volume 2

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MANUFACTURERS'
CATALOG PAGES

eem PRODUCT SECTIONS
2200-6000

See Volume 1 for:
- eem Product Sections 1100-2100
- Product Index and Directory
- Manufacturers, Sales Offices and Trade Marks Directory

20th edition

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electronic engineers master catalog

see companion
volume 1
(PAGES 1-2380/SECTIONS 1100-2100)

LOOKING FOR POWER SUPPLIES? SPECIFY ACOPIAN,

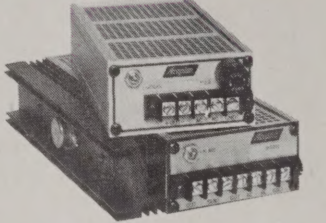
5V OR ±15V POWER FOR PCB'S

Acopian
MODEL
MINIATURE
AC to DC POWER MODULE

Mount these mini power modules, as small as 2.3" x 1.8" x 1.0", directly on printed circuit boards to save space and simplify wiring. Ratings at 5 volts from .250 to 2.5 amps; at ±15 volts from .025 to .5 amps. Short circuit protected. Prices start at $24. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

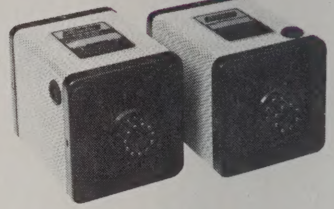
SUPPLIES THAT FIT IN THIN SPACES



Measuring only 1.68" high, Acopian narrow profile power supplies fit where many others cannot. Available in a wide range of ratings from 1 to 150 volts, to 4 amps. Regulation to ±0.005%. Tracking dual output models for op amps also available. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

SINGLE, DUAL PLUG-IN POWER



A plug-in power module can be installed in seconds. Simply plug it into a standard octal-type socket. Single output models from 1 to 200 volts. Duals combining two matched or dissimilar outputs in one case available in over 10,000 combinations. Warranty: 5 years. Shipment: 3 days.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

MULTIPLE VOLTAGES FOR PCB'S

Acopian
MODEL
DUAL OUTPUT REGULATED POWER MODULE

Simplify pc board layout with multiple output power mini's. Duals supply two isolated like or dissimilar outputs, 1 to 28 volts each. Op amp supplies provide ±12 or ±15 volts. Triples have two balanced, tracking outputs, a third for powering other circuits. Guaranteed 3-day shipment.

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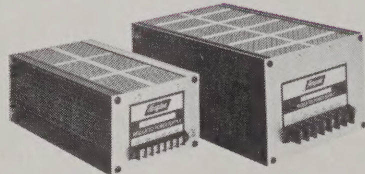
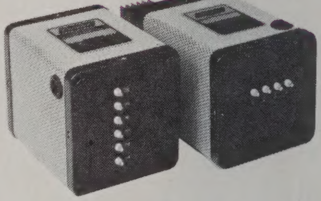
GENERAL PURPOSE POWER



Series A offers premium performance, with regulation to ±0.005%, ripple of 0.25 mv maximum and electronic current limiting. Series B supplies provide a lower-cost approach, with regulation typically ±0.1%. Ratings to 200 volts, to 32 amps. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

SOLDER TERMINAL MODULES



For applications where hard wiring is desired, Acopian offers modules with solder terminals. Included are single output models (regulated and unregulated) duals with two like or dissimilar voltages and high isolation supplies. Guaranteed 3-day shipment.

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POWER MINI'S FOR LOGIC OR OP AMPS

AC AC OUT T/C OUT
Acopian
MODEL
AC to DC POWER MODULE

Terminal strip input/output connections on these miniature power modules eliminate the need for sockets or soldering. They mount in an area only 3.5" x 2.5". Ratings: 5 volt models to 2.5 amps, ±15 volts to .5 amps. Other models from 1 to 75 volts, all with 3-day shipment guaranteed.

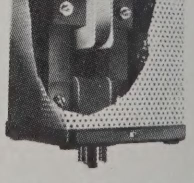
Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

MATCHED OR DISSIMILAR DUAL OUTPUT

Select the combination of matched or dissimilar outputs that you require. Hundreds of ratings available, from 1.5 to 150 volts. Outputs are isolated, and may be used in the same or opposite polarities. Acopian's 3-day shipment promise applies for any combination.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

HIGHLY ISOLATED POWER

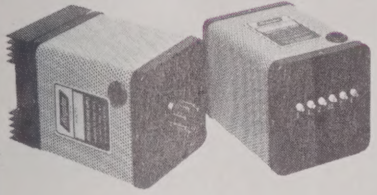


For applications requiring a power supply with unusually high isolation, such as for powering strain gage or other transducer circuits, Acopian offers models with ratings from 5 to 36 volts. Input-output isolation: 10,000 megohms minimum, 1 pF maximum. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

FAMOUS FOR 3-DAY SHIPMENTS . . . GUARANTEED

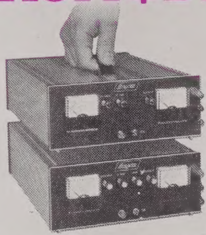
MIL-TESTED PLUG-IN POWER



MIL-tested power supplies withstand unusually severe environmental conditions. These extended-temperature plug-in modules exceed MIL specs for humidity, altitude, vibration and shock. Hundreds of single output models, thousands of dual output combinations, all guaranteed for 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

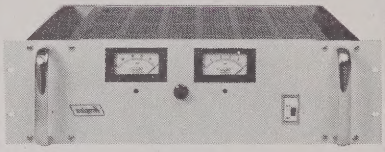
BENCHTOP POWER ...FROM $99



Reliable yet low-cost power supplies for circuit development and component evaluation. Single, dual and triple output models. Ratings from 0-7 to 0-50 volts. All have adjustable current limiting, coarse and fine voltage adjustments and two meters. They may be stacked to conserve bench space. Regulation, ± 0.01% or 2 mv. Ripple, 0.25 mv rms.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

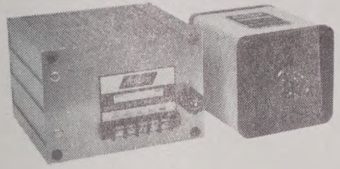
RACK MOUNT POWER ...TO 60 AMPS



Designed for mounting in standard 19" RETMA cabinet racks, these power supplies are available in 76 different output ratings from 1 to 50 volts, and from 5 to 60 amps. Regulation, ±0.05% or better; ripple, 1 mv rms or better. Options include metering and overvoltage protection. Shipment, 9 days after receipt of your order.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

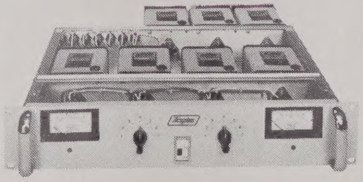
POWER FOR RELAYS AND DISPLAYS



Drive relays, lamps, small motors and similar loads with low-cost Acopian unregulated power modules. Built-in fusing protects against overloads or shorts. Series U models use terminal strip connections. Plug-in modules mount in standard octal sockets; many have adjustable outputs. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

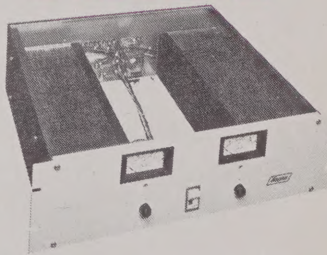
NEED A POWER SYSTEM?



Order multiple output power systems without searching through a catalog, preparing mechanical layouts, item-by-item pricing and detailed purchase requisitions. Instead, call Acopian. We'll listen to your needs, quote a firm price, and then ship your built-to-order system, fully wired and tested, in just 9 days.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

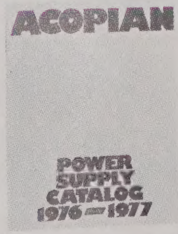
REDUNDANT POWER SYSTEMS



Output reliability is maximized by including two power modules for each voltage. If either fails, the other will continue to provide an uninterrupted output. Ratings from 3.6 to 28 volts, to 32 amps. Shipment, 9 days after receipt of your order.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

GUARANTEED 3 DAY SHIPMENT



Every power module listed in the Acopian 48-page catalog is shipped within 3 days of order. Guaranteed! Miniaturized supplies, narrow profile and plug-in modules, premium performance models, and a wide choice of other types are described in detail. Ask for your copy.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

See EEM pages 3169 to 3199, for detailed information about Acopian's broad line of power supplies and power systems.

ENGINEERING ASSOCIATES
OHIO
AUG - 8 1977
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HOW TO USE eem

eem/Electronic Engineers Master is the world's largest single collection of catalog pages from the manufacturers of electronic and electro-mechanical components, systems and equipment.

The catalog pages are divided into 43 product sections for rapid comparison and evaluation of similar products.

1. ALPHABETICAL INDEX OF MANUFACTURERS' CATALOG PAGES

To locate a particular manufacturers' catalog page by manufacturers' name, look them up in the complete alphabetical index which appears at the beginning of **Volumes 1 & 2.**

2. MANUFACTURERS' INDEX TO CATALOG PAGES BY eem PRODUCT SECTION NUMBER

To locate a particular manufacturers' catalog pages by one of the 43 product sections, look them up by section number in the complete index which appears at the beginning of **Volumes 1 & 2.**

3. PRODUCT INDEX AND DIRECTORY

The Product Index begins on **Page 1 of Volume 1.**

To locate a specific product, look in the alphabetical Product Index and Directory. Under each product heading, manufacturers are listed alphabetically. Those manufacturers with product information in the catalog are shown in **bold face** type with page numbers. For catalog information on this product, refer to the page numbers shown. Where a **bold face** listing appears with an asterisk, the product is not cataloged in this edition. Those manufacturers who have submitted data to verify that they do manufacture this product but have no further data in this edition, are shown in light face type.

NOTE:
The letter **"d"** preceding the listing indicates the product is available from distributors.

The letter **"m"** preceding the listing indicates the product is available to military specifications.

4. eem FILE SYSTEM

The **eem** File System is a method of conveniently filing manufacturers' catalogs, technical bulletins or magazine articles. It is divided into 43 product sections to coincide with the **eem** product section numbers as used in this edition. Use this index to file and locate information on specific products. In addition, in the sub-classification of **eem** products all similar products are grouped together by **eem** product section numbers. The **eem** File System begins on the green edged pages at the back of the Product Index and Directory.

5. MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

To locate a manufacturer by name, refer to the alphabetical Manufacturers, Sales Offices and Trade Marks Directory. Each listing contains complete address and phone numbers of main offices, branch offices, local representatives and local distributors.

Bold face listings indicate manufacturers who have catalog pages in this edition. Their page numbers are included. Trade marks with descriptions of the products and names of their manufacturers are combined alphabetically with manufacturers' names and are identified by (TM).

Plus . . . This important additional information:
Federal Supply Code (FSC) Number
Corporate Logos

The Manufacturers' Directory begins on the yellow pages immediately following the green edged pages of the Product Index and Directory.

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40
20
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Stanford Applied Eng.
Switchcraft
T-Bar, Inc.
Tapeswitch Corp. of America
Tech Labs
UID Electronics Div. AMF
Unimax Switch Corp.
Veetronix, Inc.

eem PRODUCT SECTION 5300

Thermocouple, Elements & Accessories 4312-4334

Carborundum Co.
Elmwood Sensors, Inc.
Fenwal Electronics
Keystone Carbon Co.
Midwest Components, Inc.
Murata Corp. of America
No. American Philips Controls
Omega Engineering, Inc.
RFL Industries, Inc.

eem PRODUCT SECTION 5400

Tools (Hand & Power)/ Soldering Supplies 4327-4333

Channellock, Inc.
Edsyn, Inc.
Hexacon Electric Co.
Technitool

eem PRODUCT SECTION 5500

Transducers 4336-4348

American Aerospace Controls, Inc.
Bell, Inc., F. W.
Bolt Beranek & Newman, Inc.
Entran Devices, Inc.
Linden Laboratories
Ohio Semitronics, Inc.

eem PRODUCT SECTION 5600

Transformers 4349-4517

Abbott Transistor Labs, Inc.
Coil Co. of America
Essex Controls
Div. Essex International, Inc.
EWC, Inc.
Freed Transformer Co., Inc.
GenRad
Hisonic, Inc.
Inductive Components, Inc.
KGS Electronics
Magnetico, Inc.
Microtran Co., Inc.
Neshaminy Transformer Co.
North Hills Electronics, Inc.
NWL Transformers
Ohmite Mfg. Co.
Perkin Elmer Corp.
Pico Electronics, Inc.
Signal Transformer Co., Inc.
Sprague Products Co.
Staco, Inc.
Sterling Transformer Corp.
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Technitrol, Inc.
Thordarson Meissner
TRW/UTC Transformers
Todd Systems
Torotel, Inc.
Torwico Electronics, Inc.
Triad-Utrad Distributor Services

eem PRODUCT SECTION 5700

Tubes & Tube Parts .. 4518-4521

Amperex Electronic Corp.
Inter-Tech Group, Inc.
Victoreen Instrument
Div. Sheller Globe

eem PRODUCT SECTION 6000

Wire/Cable/Harnesses & Accessories 4522-4722

Alpha Wire Corp.
Belden Corp. Electronic Div.
Breeze-Illinois, Inc.
Columbia Electronic Cables
Consolidated Wire & Assoc. Corp.
Daburn Electronics & Cable Corp.
Dearborn Wire & Cable Co.
Electroweave, Inc.
Essex Controls
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A C I

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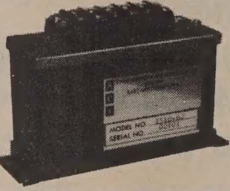
FREQUENCY TRANSDUCER MONITOR

Model 3510 (55-65 Hz)
Model 3511 (380-420 Hz)

Output: 0-1 or 0-5 VDC
Accuracy: 1%
Linearity: .05% center Freq.
Temp.: −20°C to +71°C
Size: 4½″ x 1½″ x 3″



FREQUENCY TRANSDUCER CONTROLLER

Model 3750 (55-65 Hz)
Model 3751 (380-420 Hz)

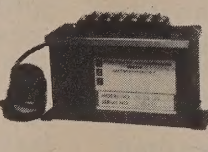
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Time Delay: Adjustable
Accuracy: 1%
Linearity: .05% center freq.
Temp.: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

D.C. CURRENT CONTROLLER

Thru-Current Ranges:

0-10 MA	0-100 MA	0-1 Amp
0-20 MA	0-200 MA	0-2 Amp
0-50 MA	0-500 MA	0-5 Amp

Model 4501 — 4502
Excitation: 28 VDC ±4 VDC
Output 1: 0-5 VDC
Output 2: Solid State or Relay Single or Hi and Lo limits (adjustable)
Accuracy: 0.5% **PASS-THRU**
Size: 4½″ x 1½″ x 3″



A.C. CURRENT MONITOR/ CONTROLLER

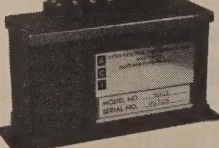
Model 4025 (60 Hz)
Model 4026 (400 Hz)

Excitation: 115 or 220 VAC
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Time Delay: Adjustable
Temp.: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

A.C. VOLTAGE TRANSDUCER MONITOR

Model 9001 (60 Hz)
Model 9002 (400 Hz)

Input: 90-140 VAC
Output: 0-1 or 0-5 VDC
Accuracy: 1%
Response: less than 0.25 Hz
Temp.: −20°C to +71°C
Size: 4½″ x 1½″ x 3″



A.C. VOLTAGE TRANSDUCER CONTROLLER

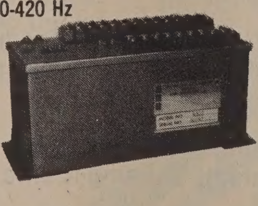
Hi and Lo Control Limits
Model 9601 (60 Hz)
Model 9602 (400 Hz)

Input: 90-140 VAC
Output 1: 0-1 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Accuracy: 1%
Response: Less than 0.25 Hz
Time Delay: Adjustable
Size: 6½″ x 1½″ x 3″

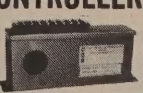
POWER LINE MONITOR/ CONTROLLER

Model 4301
1ϕ Voltage and Frequency
Model 4302 (60 Hz or 400 Hz)
3ϕ Voltage and Frequency

Voltage Band: 100-130 VAC
Freq. Band: 50-70 Hz or 380-420 Hz
Hi-Lo Limits: Adj. to any points within Band
Output Relay: SPDT or 3PDT 10 Amp
Time Delay: Adjustable 0 to 250 MSEC
Temp.: −20°C to +71°C
Size: 7½″ x 3″ x 3½″



WATTS/POWER FACTOR TRANSDUCER CONTROLLER



Model 9401-9405

Input: 90-150 & 160-250 VAC 0-500 W to 0-100 kW
Output 1: 0-1, 0-2 or 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Size: 6½″ x 1½″ x 3″

Watts Ranges:

0-500 W	0-10 kW
0-1 kW	0-20 kW
0-2 kW	0-50 kW
0-5 kW	0-100 kW

D.C. CURRENT SENSORS

Thru-Current Ranges:

0-10 MA	0-200 MA	0-5 Amp
0-20 MA	0-500 MA	
0-50 MA	0-1 Amp	
0-100 MA	0-2 Amp	

Model 6001
Excitation: 28 VDC ±4 VDC
Output: 0-5 VDC
Accuracy: 0.5% **PASS-THRU**
Response: 1 MSEC
Temp.: −20°C to +71°C
Size: 4½″ x 1½″ x 3″

Model 6002
Bi-Directional
Thru-Current Ranges:

0-10 MA	0-100 MA	0-1 Amp
0-20 MA	0-200 MA	0-2 Amp
0-50 MA	0-500 MA	0-5 Amp

Excitation: ±15 VDC
Output: 0- ±5 VDC
Accuracy: 0.5%
Response: 1 MSEC
Temp.: −20°C to +71°C
Size: 4½″ x 1½″ x 3″

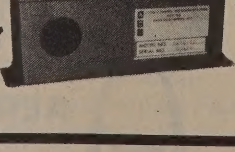
D.C. CURRENT SENSOR

Thru-Current Ranges:

0-10 MA	0-200 MA	0-5 Amp
0-20 MA	0-500 MA	0-10 Amp
0-50 MA	0-1 Amp	0-20 Amp
0-100 MA	0-2 Amp	0-50 Amp
		0-100 Amp

Model 6011
Excitation: 115 VAC ±10% 60 Hz
Output: 0-5 VDC **PASS-THRU**
Accuracy: 1%
Response: 0.5 Sec.
Temp: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

50KV → ISOLATION



SENSOR CONTROLLER

Thru-Current Ranges:

0-10 MA	0-200 MA	0-5 Amp
0-20 MA	0-500 MA	0-10 Amp
0-50 MA	0-1 Amp	0-20 Amp
0-100 MA	0-2 Amp	0-50 Amp
		0-100 Amp

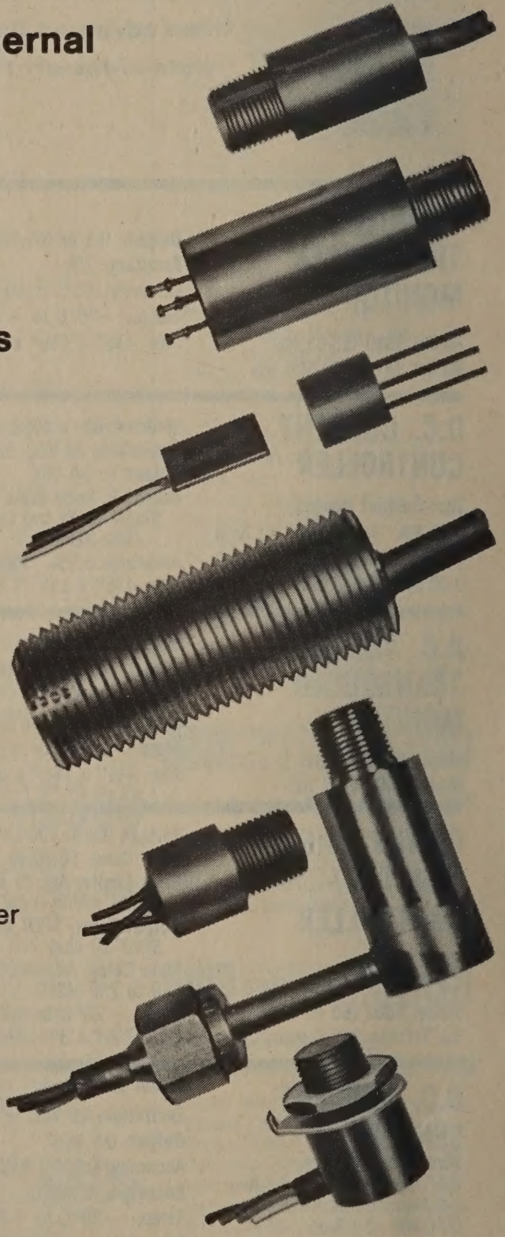
Model 4551
Excitation: 115 VAC ±10% 60 Hz
Output 1: 0-5 VDC
Output 2: Solid State or Relay adjustable Hi and Lo limits
Accuracy: 1%
Temp: −20°C to +71°C
Size: 6½″ x 1½″ x 3″

Telephone or write for individual detail sheets prices and applications assistance.

Speed-Independent Magnetic Pick-ups

Their output voltage amplitudes are totally independent of the rate of change to the external magnetic field. They provide

- **True zero speed sensing**
- **Contactless limit switches**
- **Translational and rotational velocity, direction and position sensing**
- **Counting, indexing, and timing functions**



Benefits:

- Simplify designs
- Low power consumption
- Rugged enough for engine environments
- Aerospace reliability
- Operate from logic power bus
- Freedom from EMI (no choppers or oscillators)
- Freedom from actuator mechanisms
- Can replace optical systems

Applications:

Computer peripherals—sensing of indexing marks for drive mechanisms in card readers / magnetic tape memories / paper roll drive, and character selection in printers

Transportation—wheel speed sensing (skid-controlled braking) / ignition system timing / vehicle sensing (traffic control)

Industrial — speed, position and limit sensing

Aerospace — wide applications

Other Products:

Solid state Push Button and Toggle Switches / Solid state current sensors / Hall Effect Devices / Magnetoresistors / Fluxmeters / Gaussmeters.

For information and comprehensive technical assistance, contact:

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AEROFLEX LABORATORIES INC.
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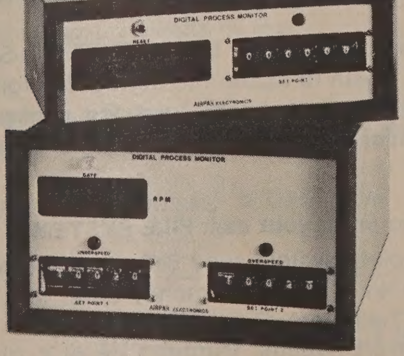

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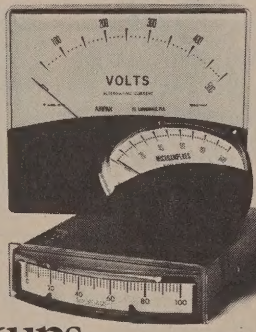

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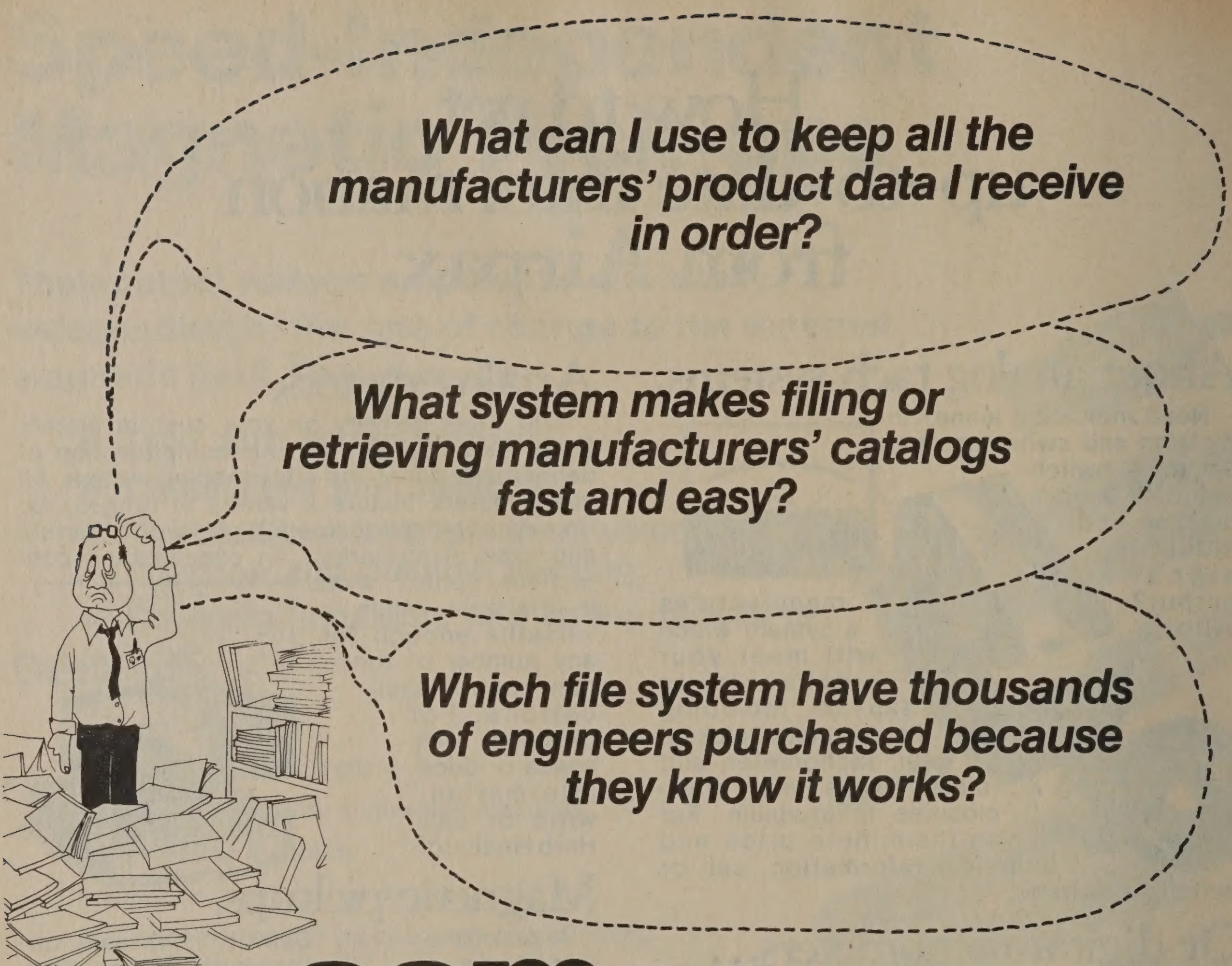
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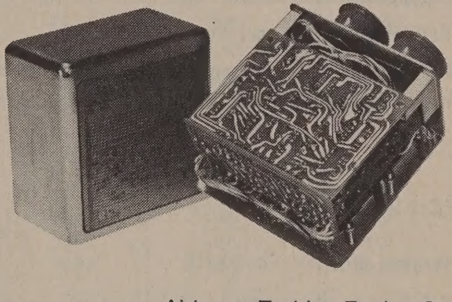

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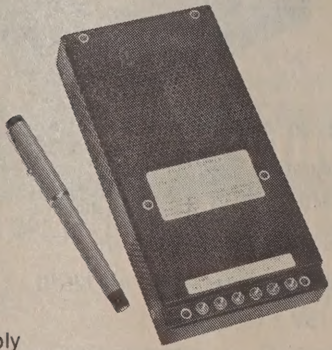
In Depth Commercial, Industrial and Aerospace Experience



Power Supply
85 Watts Output, 2.5 Watts/cu inch

POWER SUPPLIES

- Computer Grade/Mil Qualified
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- Single or Multiple Outputs
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High Precision Analog Multipliers

PRODUCT ACCURACY (MCM 1519-1) ± ½% OF ALL THEORETICAL OUTPUT VALUES OVER FULL MILITARY TEMPERATURE RANGE OF –55°C TO +125°C ZERO POINT ERROR FOR ANY INPUT COMBINATION IS ± 2MVRMS

FEATURES

- **No external trims required**
- **Distortion free AC output over entire dynamic range**
- **Linearity, product accuracy and zero point virtually unaffected by temperature**
- **All units are hermetically sealed and are not affected by external fields**
- **High analog product accuracy and wave quality allows dual multiplier assemblies to be matched within 1% of point over the specified temperature range**
- **Full four quadrant operation**
- **Package size, power supply requirements and other specs. may be altered to your exact requirements at no extra cost**

Type No.	*Product Accuracy	Operating Temperature Range
MCM 1519-1	± 0.5%	–55°C - +125°C
MCM 1519-2	± 0.5%	–25°C - +85°C
MCM 1519-3	± 0.5%	0°C - +70°C
MCM 1520-1	± 1.0%	–55°C - +125°C
MCM 1520-2	± 1.0%	–25°C - +85°C
MCM 1520-3	± 1.0%	0°C - +70°C

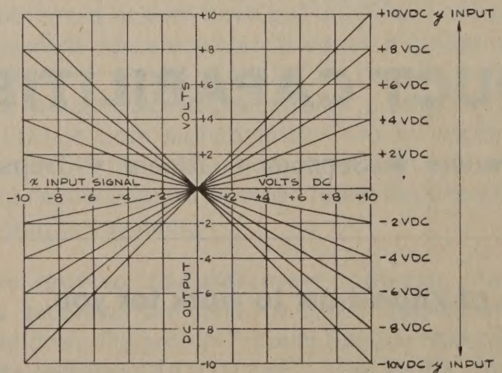
*Product accuracy is defined as the percentage error between the measured output voltage and the theoretical value of the product of the X and Y analog voltages (XY/10) at any point within the four quadrant range of the device. This specification applies over the full operating temperature range and guarantees superior accuracy at low level outputs when compared with devices specified in terms of full scale output. All accuracies are given as a % of point ± 2MVRMS (whichever is greater) in order to account for the zero point offset.

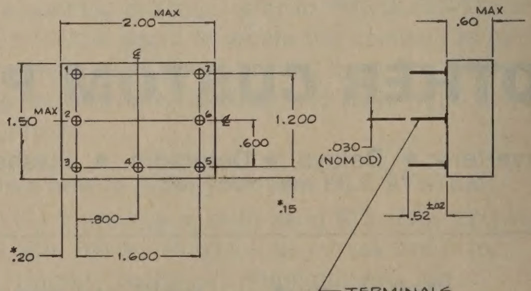
SPECIFICATIONS

- **Transfer equation:** Eo=XY/10
- **X & Y input signal ranges:** 0 to ± 10V PK
- **Maximum dynamic and static product error:** See chart for accuracy and temperature range desired
- **Maximum zero point error (X=0 Y=0 or X=± 10 Y=0 or X=0 Y=± 10):** 2MVRMS
- **Input impedance:** Both inputs 20K min.
- **Full scale output:** ± 10V peak
- **Minimum load resistance for full scale output:** 2K Ω
- **Frequency response characteristics (both inputs)**
  1% amplitude error: DC to 1200HZ (min.)
  0.5DB amplitude error: DC to 3500HZ min.
  3DB point: Approximately 10K HZ
  Roll off rate: 18DB/octave

ANALOG
MULTIPLIER
GENERAL MAGNETICS, INC.
BLOOMFIELD N.J.
TYPE NO
SER. NO

- **Output impedance:** 1 Ω
- **Short circuit duration:** 5 sec.
- **Noise level:** 5MV PK-PK at 100K HZ (approx.)
- **Operating temperature range:** See chart
- **Storage temperature range:** –55°C to +125°C
- **DC power:** ± 15V ± 1% @ 30MA





Weight: Approximately 4 oz.
Case material: High permeability nickel alloy
Terminals: Glass to metal hermatic seal pins

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GENERAL MAGNETICS • INC
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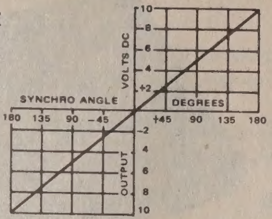
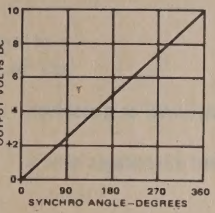
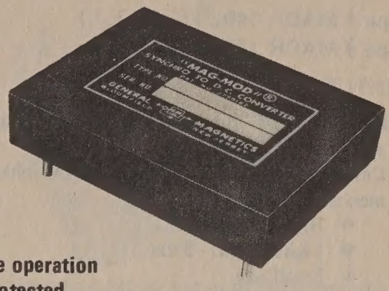
Solid State 3 Wire Synchro To Linear DC Converters...

RESPONSE CURVE
MAC 1422-1
MAC 1449-1
MAC 1458-1
MAC 1459-1



RESPONSE CURVE
MAC 1460-1
MAC 1461-1





FEATURES:

- **Develops a DC output voltage linearly proportional to a synchro angle over a ± 180° range.**
- **Completely solid state with all of the inherent advantages over a mechanical system such as:**
  - **High reliability (since there are no moving parts)**
  - **Light weight–6 ozs.**
  - **Small size**
  - **All units hermetically sealed**
- **Wide temperature range operation**
- **Output short circuit protected**
- **Three wire inputs isolated from ground**
- **Package size may be altered at no extra cost**
- **Units can be altered to accept different line to line voltages or different operating frequencies at no extra cost**
- **Not affected by reference voltage or power supply variations.**

UNIT	MAC 1422-1	MAC 1449-1	MAC 1458-1	MAC 1459-1	MAC 1460-1	MAC 1461-1
TRANSFER EQUATION	±IV/18°	±IV/18°	±IV/18°	±IV/18°	+IV/36°	+IV/36°
ACCURACY (+25°C)	½%	½%	½%	½%	½%	½%
ACCURACY (−25°C-+85°C)	1%	1%	1%	1%	1%	1%
L - L SYNCHRO INPUT (VRMS)	11.8	90	11.8	90	11.8	90
FREQUENCY (Hz)	400	400	60	60	400	400
FULL SCALE OUTPUT	±10V	±10V	±10V	±10V	+10V	+10V
OUTPUT IMPEDANCE	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω
L - L INPUT IMPEDANCE	>10K	>30K	>2K	>10K	>10K	>30K
REFERENCE VOLTAGE (VRMS)	26	115	26	115	26	115
OPERATING TEMP. °C	−25 - +85	−25 - +85	−25 - +85	−25 - +85	−25 - +85	−25 - +85
D.C. SUPPLY	±15V	±15V	±15V	±15V	±15V	±15V
D.C. SUPPLY CURRENT	±75MA	±75MA	±75MA	±75MA	±75MA	±75MA
BANDWIDTH	10Hz	10Hz	OPT.	OPT.	10Hz	10Hz
WEIGHT	6 oz.	6 oz.	6 oz.	8 oz.	6 oz.	6 oz.
SIZE	3.6x2.5x0.6	3.6x2.5x0.6	3.6x3.0x0.6	3.6x3.0x1.0	3.6x2.5x0.6	3.6x2.5x0.6

Precision AC Line Regulators...

Type # MLR-1476-1/TOTAL REGULATION 0.1% MAXIMUM

FEATURES

- Distortion free output sine wave.
- Regulation control better than one order of magnitude superior to commercial AC Voltage Regulators transformer product lines.
- No active filter or tuned resonant circuits employed.
- Regulation virtually indifferent of frequency, line amplitude, temperature or load changes.
- 1 watt output level.
- Extremely small size.
- Isolation between input and output.

SPECIFICATIONS

AC input line voltage: 26vrms ±20% at 400 Hz. ±20%.
Output: 26vrms ±1% for set point range.
Load: 0 to 40 ma.
Total regulation: ±0.1% maximum (any combination line aplitude, frequency, load).
Distortion: Less than 0.5%
Temperature Range: −55°C to +125°C
Size: 2″ x 1.8″ x 0.5″
Output Phase Angle = 0° ±0.1° over entire temperature range and ±20% frequency variations.
Weight: 1 Oz.
Case material: High permeability Nickel Alloy
Terminals: Glass to metal hermetic seal pins

Type # MLR-1476-2

FEATURES

- 0.1% total line and load regulation
- Independent of ±20% frequency fluctuation
- 6.5 watt output
- Small size
- Input and output completely isolated
- Short circuit protected

SPECIFICATIONS

- AC line voltage: 115V ±20% @ 400Hz ±20%
- Line current at full load: 95ma
- Output: 26V ±1% for set point
- Load: 0 to 250 ma
- Total regulation for line, load and frequency changes: ±0.1%
- Distortion: 2%
- Temperature Range: −55°C to +85°C
- Size: 2″ x 4.5″ x 0.9″

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GM INC

GENERAL MAGNETICS • INC
135 Bloomfield Ave., Bloomfield, New Jersey 07003 - Tel. (201) 743-2700

Solid State 4 Wire Resolver To Linear DC Converters...

GENERAL MAGNETICS INC
TYPE NO.
SER. NO.
RESOLVER TO DC CONVERTER

Type # MACR 1492 (11.8V L-L)
Type # MACR 1493 (90V L-L)

FEATURES

- Develops a DC output voltage linearly proportional to a resolver angle over a ± 180° range
- Completely solid state with all of the inherent advantages over a mechanical system such as:
  - High reliability
  - Light weight—6 ozs.
  - Small size
- All units come in hermetically sealed metal cans
- Four wire inputs isolated from ground and from each other
- Wide temperature range operation (MACR 1492-1 & MACR 1493-1)
- Economical room temperature units available (MACR 1492-2 & MACR 1493-2)
- Output short circuit protected
- Package size may be altered at no extra cost
- Units can be altered to accept different line to line voltages or different operating frequencies
- Not affected by reference voltage or power supply variations

SPECIFICATIONS

Transfer equation: ± 1V/± 18°

Accuracy:	1492-1	± 0.5% @ 25°C ± 20°C
	1493-1	± 1% @ –25°C to +85°C
	1492-2	± 0.5% @ 25°C ± 20°C
	1493-2	

Input voltage: 1492–11.8V, 400HZ 4 wire resolver input; 26V, 400 HZ reference
1493–90V, 400HZ 4 wire resolver input; 115V, 400HZ reference

Operating frequency: 400HZ ± 20%
Input impedance: 10K min.
Full scale output: ± 10V DC (± 180°)
Minimum load resistance for full scale output: 2K
Output impedance: < 1Ω
Storage temperature range: –55°C to +100°C
DC pwoer: ± 15V ± 1% @ 75ma (approximate)
Case material: High permeability nickel alloy

'Mag Mod' Micro-miniature Magnetic Modulators...

...Design Analog Computers with Micro Magnetics

Withstands High Intensity Nuclear Radiation

Circuit Isolation—DC to AC Sinusoidal Conversion and Amplification

"MAG MODS" PROVIDE FOUR QUADRANT OPERATION, extreme stability with negligible change of phase, gain and zero position over a wide temperature range. Design is simple, featherweight and rugged—with no vacuum tubes, semiconductors or moving parts to limit life.

TYPE NUMBER	IMM 987-1	IMM 821-1	IMM 847-1	IMM 1112-1
Reference Carrier Voltage and Frequency	115 V 400 Hz	3 V RMS @ 96 KHz	5 V @ 800 Hz	3.5 V RMS @ 1 MHz
Input Control Signal Range	0 to ±150 μa DC	0 to ±100 μa (DC to 1000 Hz)	0 to ±200 μa DC	0 to ±3 ma DC (DC to 200 KHz)
DC Resistance of Input DC Signal Winding	3 Inputs — 4.5 K each	150 ohms	12.5 K ohms	1000 ohms
AM Phase Reversing AC Output Range	0 to 5 V RMS @ 400 Hz	0 to 0.6 V RMS @ 96 KHz	0 to 1 V RMS @ 800 Hz	0 to 3 V RMS @ 1 MHz
Differential Gain RMS mv. AC Output/ua DC Sig. Input	33 mv RMS/μa DC	6 mv RMS/μa	5 mv RMS/μa DC	1 V RMS/ma DC
AC Output Null (Noise Level) RMS	25 mv RMS	20 mv RMS Max.	5 mv RMS	30 mv RMS
Output Impedance	1.2 K ohms	7.5 K ohms	10 K ohms	3 K ohms
External Load	25 K ohms	100 K ohms	50 K ohms	50 K ohms
Excitation (Carrier Winding) Impedance	200 K ohms	115 ohms	12 K ohms	800 ohms
Zero Point Drift over Temp. Range Referred to DC Input Terminals	±0.2 μa DC	±0.2%	±0.5 μa DC	±0.5%
Hysteresis in Percent of Max. Input DC Signal	±0.2%	±0.2%	±0.4%	±0.5%
% Harmonic Distortion in Output Wave	10%	5%	10%	3%
Temperature Range	–55°C to +80°C	0°C to +100°C	–55°C to +100°C	–55°C to +85°C
Frequency Response	DC to 100 Hz	DC to 1000 Hz	DC to 200 Hz	DC to 200 KHz
Overall Dimensions (in inches)	.550 X .750 X .550	0.562 X 0.40 X .750	13/16 X 13/16 X ½	0.4 X 0.5 X 0.6
Type of Mounting	2-56 Studs	Printed Circuit Board	Printed Circuit Board	Printed Circuit Board 1/10" Grid
Approximate Weight (in ounces)	0.3 ounce	0.12 ounce	0.2 ounce	0.1 ounce

"MAG MODS" conform to MIL-T-27A and MIL-E-5400 Specifications

The above units are but a fraction of the line of "MAG MODS" available for design applications.

There is No Substitute for Reliability

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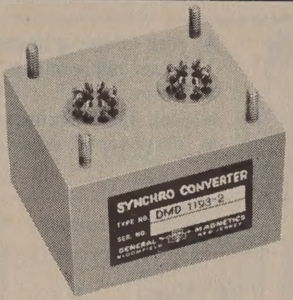
Solid State Sine-Cosine Synchro Converters...

This new encapsulated circuit converts a 3-wire synchro input to a pair of d-c outputs proportional to the sine and cosine of the synchro angle.

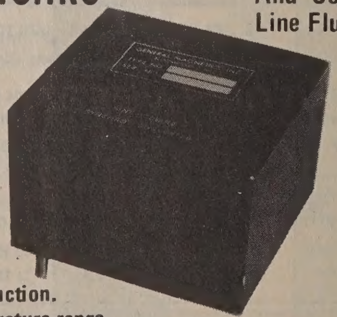
- Complete solid state construction.
- Operates over a wide temperature range.



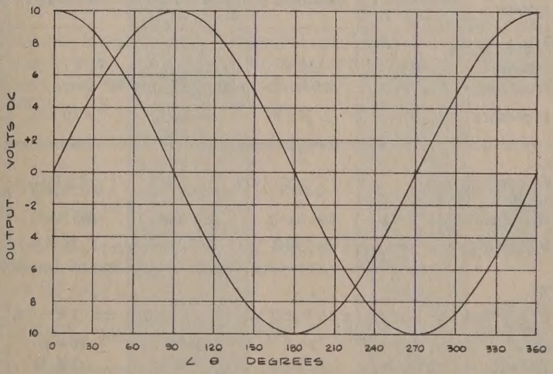
UNIT	DMD 1436-1	DMD 1430-1	DMD 1403-2	DMD 1361-6	DMD 1361-4	DMD 1193-4	DMD 1361-8	DMD 1446-1	DMD 1193-5	DMD 1193-6	DMD 1361-10	DMD 1472-2
L - L SYNCHRO INPUT (VRMS)	11.8	90	95	90	11.8	11.8	11.8	11.8	11.8	11.8	11.8	90
FREQUENCY (Hz)	400	400	60	400	400	400	400	400	400	400	400	60
FULL SCALE OUTPUT (VDC)	±10	±10	±3	±3	±3	±10	±10	±10	±10	±10	±10	±10
OUTPUT IMPEDANCE	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω	<1Ω	<10Ω	<1Ω	<1Ω	<1Ω	<1Ω
L - L INPUT IMPEDANCE	>10K	>30K	>5K	>30K	>5K	>5K	>5K	>5K	>5K	>5K	>5K	>5K
REFERENCE VOLTAGE (VRMS)	26	115	115	115	26	115	26	115	115	115	26	115
ACCURACY SIN/COS (+25°C)	±6MIN	±6MIN	±6MIN	±6MIN	±6MIN	±6MIN	±6MIN	±0.5%	±6MIN	±6MIN	±6MIN	±6MIN
FULL TEMPERATURE RANGE ACCURACY SIN/COS	±15MIN	±15MIN	±15MIN	±15MIN	±15MIN	±15MIN	±15MIN	±0.5%	±15MIN	±15MIN	±15MIN	±15MIN
D.C. SUPPLY (VDC)	±15	±15	±15	±15	±15	±15	±15	±15	±15	±15	±15	±15
D.C. SUPPLY CURRENT	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA	<30MA
BANDWIDTH	>10Hz	>10Hz	external set	>20Hz	>5Hz	>10Hz	>10Hz	>10Hz	>2Hz	>40Hz	>5Hz	external set
SIZE	1.1x3.0 x1.1	2.0x2.25 x1.4	1.1x3.0 x1.1	1.5x1.5 x0.6	1.85x0.85 x0.5	2.01x2.25 x1.4	0.85x1.85 x0.5	2x2.25 x1.4	2x2.25 x1.4	2x2.25 x1.4	2.15x1.25 x0.5	1.1x3.0 x1.1
NOTES	–	dual channel unit	–	–	–	dual channel unit	–	dual sine output	dual channel unit	dual channel unit	–	–
TEMPERATURE RANGE	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C	–40°C to +100°C

NON VARIANT SOLID-STATE SINE-COSINE SYNCHRO CONVERTER -

Type # DMD 1508-2



This New Encapsulated Circuit Converts A 3 Wire Synchro Input To A Pair Of DC Outputs Proportional To The Sine And Cosine Of The Synchro Angle Independent Of A-C Line Fluctuations



FEATURES:

- Complete solid state construction.
- Operates over a wide temperature range.
- Independent of reference line fluctuations
- Conversion accuracy–6 minutes.
- Reference and synchro inputs isolated from ground

SPECIFICATIONS

- **Accuracy:** Overall sin/cos conversion accuracy of 6 minutes. Absolute value of sine and cosine outputs accurate to 30 mv.
- **Temperature Range:** Operating –40°C to +85°C, Storage –55°C to +125°C
- **Temperature Coefficient of Accuracy:** ±10 seconds/°C on conversion accuracy, ±1 MV °/C on absolute output voltages.
- **Synchro Input (Isolated from Ground)** 90 V line to line ±5% @ 400 HZ ±5%.
- **Synchro Input Impedance:** 50 K minimum line to line
- **Reference Input (Isolated from Ground):** 115 V RMS ±5% @ 400 HZ ±5%
- **Reference Impedance:** 50 K minimum.
- **Output Variation with Reference Changes:** ±10 MV maximum for ±5% reference fluctuations.
- **DC Power:** ±15 VDC ±1% @ 60 MA
- **Output:** ±10 VDC full scale output on either channel @ 5 MA load (short circuit protected).
- **Tracking Speed:** Output within specified accuracy when the tracking speed is 20 RPM

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Solid State Magnetic Demodulators...

FEATURES

- High reference impedance resulting in very small reference power requirements
- Output as high as ±10 v. DC in present units
- Unit operation frequencies: 60 Hz to 100 KHz
- Very low DC offset null voltages (as low as 0.1% of full scale)
- Operation over wide environmental conditions
- Completely solid state—no moving parts
- Signal and reference terminals may be isolated
- Low output impedance
- Small physical size

Demodulator Type Number	DMD-903-1	DMD-931-1	DMD-1012-1	DMD-1013-1	DMD-1017-1	DMD-1023-1	DMD-1025-1	DMD-1040-1	DMD-1028-1
REFERENCE A. Voltage	120 V ±10 V	26 V	115 V	115 V	115 V	30 V-P-P	30 V	115 V	15 V
B. Frequency	60 Hertz	400 Hertz	60	400 Hertz	400 Hertz	55 Hertz	900 Hertz	400 Hertz	50 to 60 Hertz
C. Impedance	15 K	30 K	> 50 K	> 50 K	> 5 K	≈ 2.7 K	≈ 31 K	> 100 K	≈ 5.1 K
SIGNAL A. Voltage Range	0-760 mv	0-12 V	0-1 V	0-10 V	0-10 V	0-5 V	0-0.05 V	0-3.2 V	0-10 V
B. Frequency	60 Hertz	400 Hertz	60 Hertz	400 Hertz	400 Hertz	55 Hertz	900 Hertz	400 Hertz	50 to 60 Hertz
C. Impedance	10 K	> 10 K	10 K ±10%	10 K ±10%	> 10 K	> 10 K	> 3 K	> 3 K	≈ 3 K
OUTPUT A. Maximum Output	±1 V ±5%	±3.6 V ±10%	±0.5 V ±5%	±5 V ±5%	±3 V ±5%	±4 V ±5%	±0.5 V ±10%	±5 V ±5%	±10 V ±5%
B. Load	—	10 K	25 K	5 K	2 K	10 K	1 M	50 K	10 K
C. Linearity	±0.8% fs	±2% A	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs
D. Frequency Response	—	20 cps	—	—	40 Hertz	0.5 Hertz	10 Hertz	—	—
E. Ripple	8.4 mv	< 100 mv	No Filter	No Filter	< 150 mv	< 200 mv	< 10 mv	No Filter	< 400 mv
F. Null	1 mv	< 15 mv	< 10 mv	< 10 mv	< 10 mv	< 10 mv	< 1 mv	< 10 mv	< 15 mv
AMBIENT TEMP. RANGE	—40°F to +120°F	—15°C to +60°C	—30°C to +85°C	—30°C to +85°C	—30°C to +71°C	0°C to +50°C	0°C to +50°C	—30°C to +85°C	—10°C to +55°C
PHYSICAL SIZE	3 x 2⅝ x 4³⁄₁₆	2 x 2 x 0.7	1 x 1 x 2.5	1 x 1 x 2.5	1 x 1 x 2.5	0.95 x 1 x 2.5	1 x 1.7 x 0.75	1 x 1 x 2.5	1.9 x 1.25 x 2.9
TERMINAL TYPE	HP PIN	PIN	PIN	PIN	PIN	PIN	HP PIN	PIN	HP
D.C. POWER	No	No	±15 V	±15 V	28 V	±15 V	±15 V	No	±15 V

Demodulator Type Number	DMD-1034-1	DMD-1053-3	DMD-1074-1	DMD-1095-1	DMD-1104-1	DMD 1206-1	DMD 1207-1	DMD 1268-1	DMD 1377-1	DMD 1420-1
REFERENCE A. Voltage	26 V	115 V	115 V ±5%	26 V ±5%	26 V	26 V	26 V	26 V	10 V RMS ±10%	7 V RMS
B. Frequency	400 Hertz	400 Hertz	400 Hertz ±5%	400 Hertz ±5%	800 Hertz	400 Hertz	2 K Hertz	400 Hertz	60 Hertz to 2 K Hertz	100 Hertz
C. Impedance	> 8 K	> 100 K	> 100 K	> 10 K Ω	35 K	> 50 K	> 50 K	> 5 K	> 25 K	> 4 K
SIGNAL A. Voltage Range	0-5 V	0-10 V	0-50 V	0-±6.36 V	0-1 V	0-1 V	0-1 V	0-10 V	0-5 V RMS	0-7 V RMS
B. Frequency	400 Hertz	400 Hertz	400 Hertz	400 Hertz	800 Hertz	400 Hertz	2 K Hertz	400 Hertz	60 Hertz to 2 K Hertz	100 Hertz
C. Impedance	> 10 K	> 100 K	> 1 MEG	> 20 K Ω	> 50 K	> 15 K	> 15 K	> 10 K	> 50 K	> 20 K
OUTPUT A. Maximum Output	±5 V ±5%	±2.5 V ±10%	±50 V ±5%	±5.73 V ±5%	±2.0 V ±5%	1.0 V	1.0 V	±3 V ±5%	2.5 V ±5%	3 V ±5%
B. Load	10 K	10 K	100 K	10 K Ω	10 K Ω	30 K	30 K	2 K	1 Meg	1 Meg
C. Linearity	±1% fs	±1% fs	±1% fs	±1% fs	±1% fs	0.5% fs	0.5% fs	±1% fs	0.2%	0.2%
D. Frequency Response	≈ 100 Hertz	30 Hertz	80 Hertz	—	N.S.	30 Hertz	30 Hertz	40 Hertz	—	—
E. Ripple	< 450 mv	< 125 mv	< 50 mv	No Filter	< 50 mv	< 30 mv	< 10 mv	< 150 mv	No Filter	No Filter
F. Null	< 15 mv	<4 mv	< 100 mv	< 15 mv	< 10 mv	1 mv	1 mv	< 5 mv	< 2 mv	< 3 mv
AMBIENT TEMP. RANGE	0°C to +85°C	—20°C to +50°C	0°C to +65°C	—54°C to +55°C	1200 M	—55°C to +125°C	—55°C to +125°C	—30°C to +71°C	0°C to +70°C	—25°C to +40°C
PHYSICAL SIZE	0.6 x 0.9 x 1.8	1 x 1 x 2.5	2.6 x 1.95 x 2	1.200 x 1.250 x 0.500	1.350 x .600 x .650	0.95 x 1.65 x 0.1	0.95 x 1.3 x 0.1	1 x 1 x 2.5	0.9 x 1.65 x 0.6	1.25 x 1.125 x 0.8
TERMINAL TYPE	PIN	PIN	HP	PIN	PIN	PIN	PIN	PIN	PIN	PIN
D.C. POWER	±15 V	+24-32 V	±15 V ±60 V	±15 V	±15 V	±15 V	± 15 V	+28 V	±15 V DC	±15 V DC

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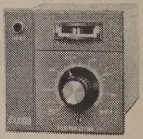
HARREL

PRECISION CONTROLS, SYSTEMS, & SENSORS

PROPORTIONAL TEMPERATURE CONTROLS

- CLOSE CONTROL: Proportional **plus automatic reset plus rate** action eliminates temperature "droop" and ensures close temperature control.
- RELIABLE: Latest integrated and hybrid circuitry ensures highest reliability and long life.
- HIGH POWER: From a few watts to 300 Kw; single phase or three phase; 115, 230, or 480 volts.
- ANY TEMPERATURE RANGE: Control either heaters or coolers from −200°C to +1100°C, using either resistance sensors or thermocouples.



¼ DIN

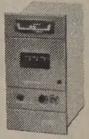
Compact plug-in instrument occupies only 4″ x 4″ panel space. Single turn or digital dial.

½ DIN

Plug-in instrument in popular ½ DIN standard metric size. Single turn or digital dial.

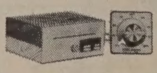
LARGE DIGITAL DIAL

Plug-in instrument with large 15/32″ high numerals easily readable from 30 ft. away. Includes front panel on-off switch, pilot light, and power output meter.



ENVIRONMENTAL EQUIPMENT CONTROLS

A complete line of controllers for temperature and humidity in environmental test equipment.

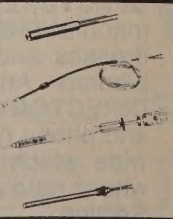


LOW COST CONTROLLERS

Performance of proportional plus automatic reset plus rate controllers at low cost. For built-in OEM applications.

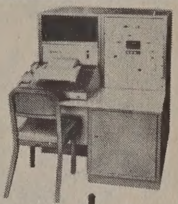
HIGH RELIABILITY MILITARY CONTROLLERS

Precision temperature control to a single selected temperature. Ideal for control of gyros, delay lines, and similar equipment. True proportional or RFI-free.



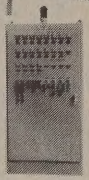
TEMPERATURE SENSORS

A complete line of temperature sensors. Patch type for surface measurement, tubular style, bayonet mount, air sensing, etc.



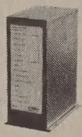
COMPUTERIZED CONTROL AND MANAGEMENT SYSTEMS

Complete digital control and management of industrial processes. Includes control of machine parameters, overall closed loop control of the process, and complete management reporting.



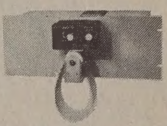
MICROPROCESSOR-BASED "DIGIPANELS"

Total control of industrial processes; includes transducers, interfaces, programming and application engineering.



COMPUTER INTERFACE/SIGNAL CONDITIONERS

A complete line of interface modules for computer control and monitoring of temperatures, pressures, RPM's, etc.



PROGRAMMERS

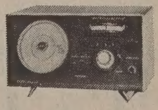
A complete line of programmers for control of temperature, pressure, etc., from a preset program.

PRESSURE CONTROLS

A complete line of pressure controls for extruders, blow molders, injection machines and similar industrial machinery.

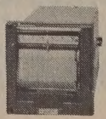
TEMPERATURE, PRESSURE OR RPM INDICATOR/ALARMS

Display temperature, pressure, or RPM in easy-to-read, ½″ high numerals. One or two process alarms for high, low, or two stage alarm.



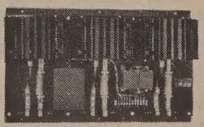
LABORATORY TEMPERATURE RECORDER

Expanded scale readout of temperature. Eleven ranges give .02% accuracy. 1, 7, and 30 hours.



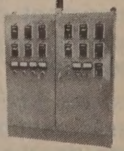
PANEL MOUNT: STRIP CHART

For continuous indication and recording of temperature and pressure at remote points.



SOLID STATE POWER UNITS

For reliable, long life control of heater power. Power to 300 Kw, single phase or three phase, 115 to 550 volts.



COMPLETE CONTROL PANELS

Complete panels for industrial processes. Includes temperature, pressure, and closed loop system controls. Computer control optional.

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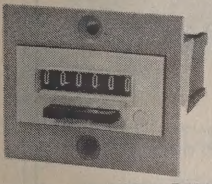
COUNTERS

ELECTROMECHANICAL COUNTERS



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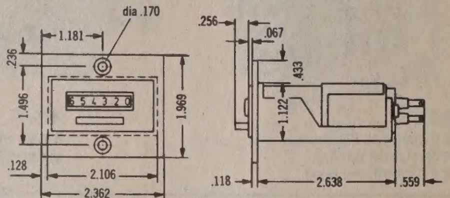
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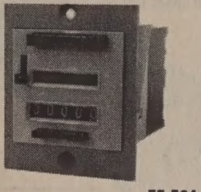
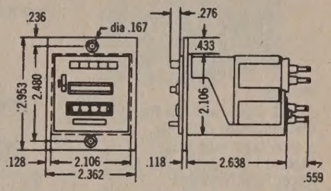
2.638
.559

CUT-OUT SIZE 2.16″ x 1.16″



FE 504


.236
dia .167
2.953
2.480
.128
2.106
2.362
.276
.433
2.106
.118
2.638
.559

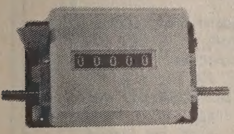
CUT-OUT SIZE 2.17″ x 2.17″

TOTALIZING

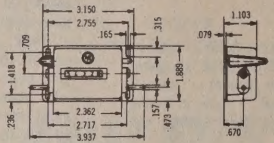
Series	No. Digits	Front Reset (Code)	Illustrated Configuration (Code)	Voltages	Speed CPS (Code)	Power W/VA	Minimum Time	
							On	Off
F 504	6 6 6, 8	PB (5) Key (4) None (0)	Basic unit, Panel frame and socket box (E)	6, 12, 24, 48, 110 DC 24, 115, 220 AC	20 (4) 10 (2)	2.2 3	25 50	25 50
PREDETERMINING† ADDING								
FE 504	3, 5	PB (5)	Basic unit, Panel frame and socket box (E)	6, 12, 24, 48, 110 DC 24, 115, 220 AC	20 (4) 10 (2)	2.2 3	25 50	25 50

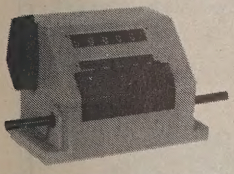
†Contact rating for predetermining counters is 30W maximum 220V maximum or 2A.

MECHANICAL COUNTERS

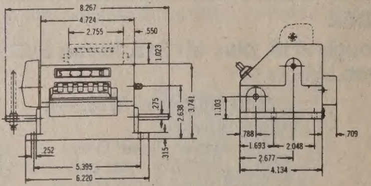


U/H/M 104


3.150
2.755
.165
.315
.709
1.418
1.889
.236
2.362
2.717
3.937
.157
.473
1.103
.079
.670



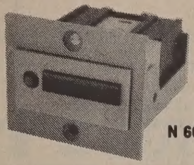
U/H/M E 280 U/H/M E 280Z


8.267
4.724
2.755
.550
1.023
.275
2.638
3.741
.252
.315
5.395
6.220
1.103
.788
1.693
2.048
2.677
4.134
.709

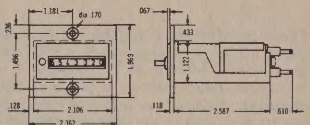
Series	No. Digits	Type Reset	Shaft Rotation	Max. Speed, RPM
TOTALIZING				
U/H/M 104	5	Lever	TC or TG	3000
PREDETERMINING* ADDING				
U/H/M E 280 U/H/M E 280Z	5 5	Lever Lever	TC or TG TC or TG	6000 6000
	E 280 has a single predetermining setting. E 280Z has two predetermining settings.			

*Contact rating for SPDT switch for predetermining counters is 30W or 220V or 2A maximum.

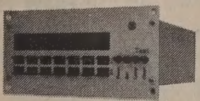
ELECTRONIC COUNTERS



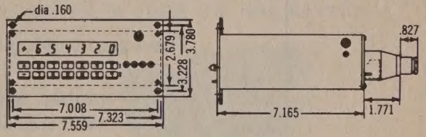
N 604


1.181
dia .170
.236
1.496
1.969
.128
2.106
2.362
.067
.433
1.122
.118
2.587
.610

CUT-OUT SIZE 2.16″ x 1.16″



NE 655

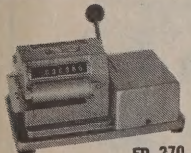

dia .160
6.5 4 3 2 0
2.679
3.780
3.228
7.008
7.323
7.559
.827
7.165
1.771

Series	No. Digits	Reset (Code)	Illustrated Configuration (Code)	Voltages	Speed CPS (Code)	Power W/VA
TOTALIZING						
N 604	7 7	PB (5) PB (7)* with battery	Basic unit, Panel frame and socket box (E)	6, 12, 24 DC 6, 12, 24 AC	1K	1.2 W
		*The N 604.77 features rechargeable built-in battery.				
PREDETERMINING* BIDIRECTIONAL						
NE 655	6 (+ – sign)	PB, Remote	Panel mount	24, 115, 220 AC	50 mech. 10K electronic	—

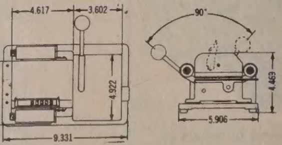
*Contact rating for SPDT switch for predetermining counters is 30W or 220V or 2A maximum.

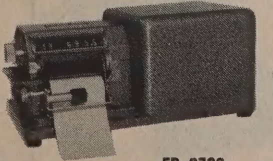
PRINTERS

ELECTROMECHANICAL (IMPULSE)

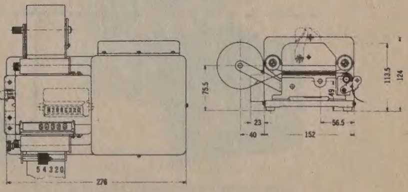


FD 270


4.617
3.602
4.645
4.922
9.331
90°
4.469
5.906



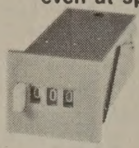
FD 272S


54320
276
75.5
49
113.5
124
23
40
56.5
152

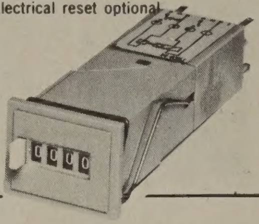
Series	No. Digits	Reset (Code)	Voltages	Speed CPS (Code)	Power	Minimum Time		Duty Cycle	Print Cycle
						On	Off		
MANUAL									
FD 270	6	None (0) After print (5)	12, 24, 110 DC 24, 110, 220 AC	5 (1) 5 (1)	14 W 20 VA	100 100	100 100	100 100	— —
AUTOMATIC									
FD 272S	6	None (0) After print (5)	12, 24, 110 DC 24, 110, 220 AC	5 (1) 5 (1)	14 W 20 VA	100 100	100 100	100 100	1-1.5 Sec.

ADDING-TOTALIZING COUNTERS

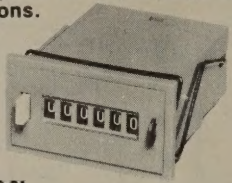
These high performance totalizing counters are designed for long life - 250 million counts - and accuracy even at speeds up to 50 counts/sec. They can be supplied for any voltage in 5 mounting styles with many options.



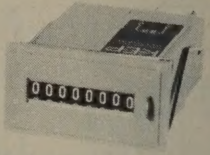
M16.21
5 or 6 Digits with PB Reset
Electric Reset Optional
5 or 6 Digit w/o Reset
Manual Lock Guard and Key
Reset Now Available



M14.23
4 digit with push button reset
Electrical reset optional



M16.21
5 or 6 digit with PB Reset
Electrical reset optional
5 or 6 digit with no reset



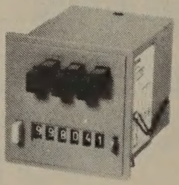
M18.20
8 digit non-reset
spring clip mount

PREDETERMINING COUNTERS

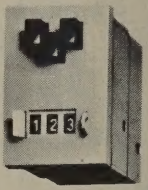
EVS13.11

EVS15.13

These two predetermining counters count down from the manually preset number to operate a built-in SPDT switch as the number wheels pass from all zeros to all 9's. Manual or optional electrical or automatic reset returns wheels to preset number and counter is ready to start again. Numbers are preset by holding in reset button, lifting locking bar and indexing up number wheels to preset position with small rod supplied or by built in pushbuttons.



MVS16.21
New 6 digit predetermining subtracting counter features large staggered buttons for easy preset . . . manual and electrical reset . . . plug-in socket box mount allows easy mating with M16 counter.



MVS13.21
New 3 digit predetermining counter. Identical functionally to 6 digit unit on left, but is narrower to take up less panel space. All mounting options available, also manual and electrical reset. Any voltage, AC or DC at speeds up to 50 counts per second.

HOW TO ORDER

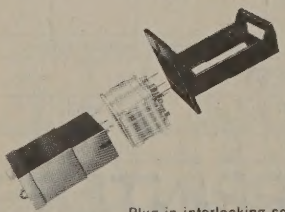
The basic catalog number i.e. M13, M14 through M18, plus MVS13,16 and EVS counters followed by:

1st Number: M16.2—
0 = Small Faceplate rear mount
1 = Large Faceplate panel mount by 2 screws
2 = Spring clip mount eliminates 2 screws

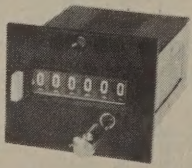
2nd Number: M16.—2
0 = No reset
1 = Manual Reset Only
2 = Electrical reset only
3 = Manual and Electrical

Followed by: Voltage required and count speed per second.

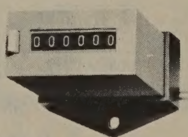
Some Optional Features



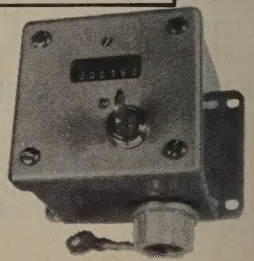
Plug-in interlocking sockets now available.



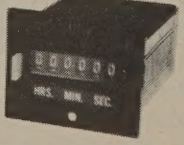
Spade key reset to prevent against unauthorized reset.



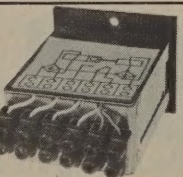
M16.61
New Surface Mounting Available for all M Seies Counters



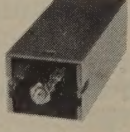
Nema 4 Water-tight & weather proof. Nema 7 explosion proof also available.



Special number wheels read out in time, money and reverse colors.



Standard insulated screw terminals on all E series counters.



Quick Disconnect terminals or solder terminals are standard on the M13 option on E series.

Transparent polycarbonate cover makes the M series water and dustproof.

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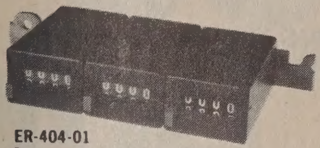
Telex: 132496
IMMEDIATE DELIVERY ON ALL ITEMS

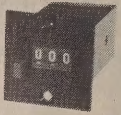
Pneumatic Counters Available

Low Cost / Moderate Performance MINIATURE COUNTERS

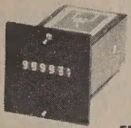
These counters serve in applications where count speeds up to 20 per second and life to 50 million are required. Electrical reset is not available.



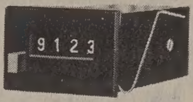
ER-404-01
Rear mounted
type ER
3 digits with reset
3 or 4 digits w/o reset



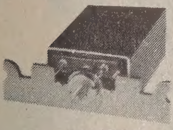
ER-313-01
3 digits with reset
3 or 4 digits w/o reset



ER-416-00
6 Digits
No Reset



ER-424-01
Frame size 4
4 Digits with Reset
5 or 6 digits w/o reset
NEW SPRING CLIP MOUNT
ALSO AVAILABLE ON 3 DIGIT MODEL



Rear View

All models at any voltage are in stock for quick delivery.

IMMEDIATE DELIVERY ON ALL ITEMS

HOW TO ORDER
ER SERIES DESIGNATION

1st DIGIT: #3 Handles 3 digits with reset - 4 digit w/o reset
#4 Handles 4 digits with reset - 5 or 6 digits w/o reset

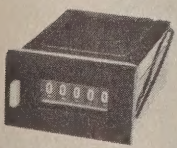
2nd DIGIT: Mounting Style
0-Stud Mount at rear
1-Panel Mount with 2 Screws
2-Spring Clip Mount - No Screws

3rd DIGIT: Number of digits required on counter
4th DIGIT: Is always 0
5th DIGIT: 0-No Reset
1-Reset

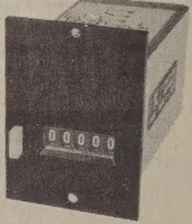
PLEASE CALL US COLLECT FOR ASSISTANCE

ADD SUBTRACT COUNTERS

These rugged units have proved extremely reliable for differential counting - they are all in stock for fast delivery.



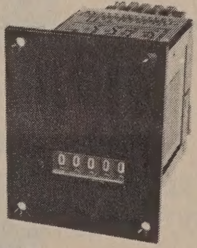
ED15.21
Available with or without manual or electric reset.
Count speed 10, 25, 40/sec.



ED25.11
Provides zero switch output with or w/o manual resets

VORWAHL
0 0 0 0 9

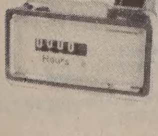
EDVS25.11
Add subtract predetermining.
Output switch point may be changed in the field.



EDA 15
Add subtract counter. Provides 10 line or BCD electrical read out.

ELAPSED TIME METERS

Accurate long life and attractive styling are features of these units.



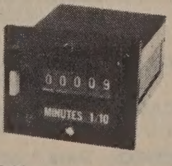
Type B2 for 110 or 220VAC. 60 HZ or 50 HZ. Attractive rear mounting. Hours only.

0 0 0 0 0
HOURS 1/10

ETH15.21
110V 60 HZ with or without electrical and manual reset.
Available in hours or minutes

0 0 0 0 0
SECONDS

EZ16.21
Stop clock reads seconds and 10ths directly from 50 or 60 HZ line.



ETMVS15.11
Predetermining Elapsed Time Counter: Operates SPDT switch as numbers pass from 00000 to 9999. AC or DC models. Hrs., Min., or Secs.

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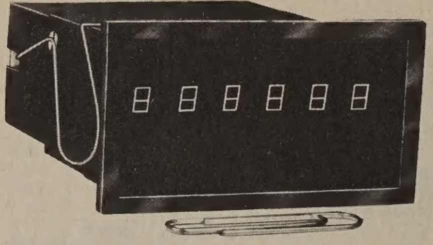
NEW!

Low Cost
ELECTRONIC COUNTERS



TWO COMPLETELY NEW LSI C/MOS TECHNOLOGIES.
24 x 48MM Case.
ADD/SUBTRACT or TOTALIZING.
BCD Output.
Logic Level Outputs.
5 Megahertz.

LOOK AT THESE FEATURES

HO7 TOTALIZER FAMILY

- 60 Micro Amp Operation
- 10 Minute Power Failure Protection Built In
- 7 Digits, .200", 4 digits, .400"
- 5 Megahertz 2 Count Speeds
- Pulse 2-30VDC
- Power 5-24VDC
- "Low Voltage" Battery Indicator
- All New Push Button Reset
- 3M Anti-Reflective Lens

LI8 ADD/SUBTRACT FAMILY

- Adds and Subtracts
- 5 Megahertz Count Speeds
- 8 Digits .200"; 4 Digits, .400"
- BCD Output
- Zero Output
- Pulse 2-30VDC
- Power 10-30VDC
- Reset to Fixed Number
- Encoder Compatable

See Product Section 2000

COUNTER DRIVERS/ENCODERS, PROXIMITY SENSORS, PHOTOELECTRIC PRESET COUNTERS/BCD INPUTS & OUTPUTS, CRYSTAL TIMERS/CLOCKS

HOW TO ORDER

HO7 2 2 H24 A 7 A

Family (HO7)
HO7-Low Current
LO-Add Only
L1-Add/Subtract

Mounting (2)
1 = Panel
2 = Spring Clip

Reset (2)
1 = Panel
2 = Remote
3 = Both

COUNT OUTPUT (H24)
C = Dry Switch Closure
H = Voltage Pulse & Voltage

Digit Size (A)
A = .200"
D = .400"

Power Supply (7)
1 = 12 vdc
2 = 24 vdc
7 = 5 vdc

Power Quality (A)
A = Regulated
B = Unregulated

LIST OF REPRESENTATIVES

City	Representative	Phone
LOS ANGELES:	Groh Associates	213-923-0963
CHICAGO:	Lincoln-Hodges	312-297-3810
SAN FRANCISCO:	Serra Associates	408-738-1117
DENVER:	Palmer Associates	303-629-0112
MINNEAPOLIS:	R. J. Sales, Inc.	612-922-1425
BOSTON:	Gilway Sales	617-935-4442
DETROIT:	Pitcher-Poulin	313-582-5450
N.Y./N.J.:	Swedelco, Inc.	914-946-1122
WASHINGTON:	H. R. Sieber Co.	301-589-9110
KANSAS CITY:	Electri-Rep	913-649-2168
CLEVELAND:	RPM Sales	216-247-3295
ATLANTA:	Electro-Mech	404-449-6337
PHILADELPHIA:	W. Reeves & Associates	215-566-6709
ROCHESTER:	Tacom Sales	716-647-3940
DALLAS:	Southland Component Sales	214-233-0603

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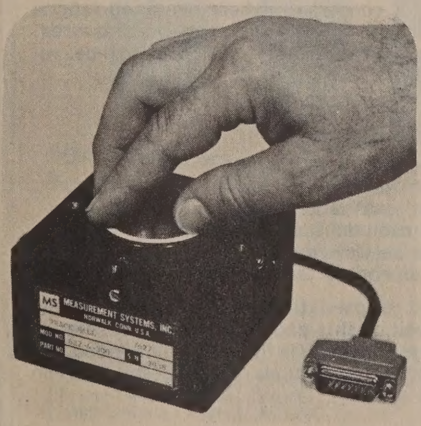
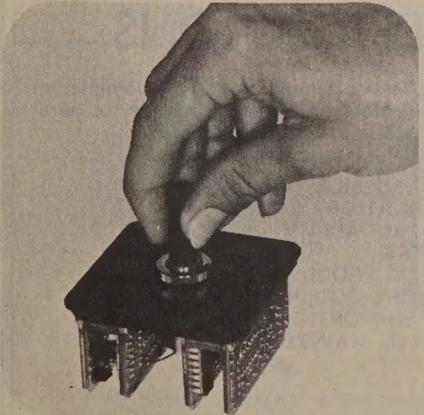
- JOYSTICKS — DISPLACEMENT • POTENTIOMETER
- JOYSTICKS — SWITCHING
- TRACKBALLS — 2, 3 or 3½ INCH SIZES • ANALOG or DIGITAL OUTPUT

Model 541
Joystick



Model 622
2-inch Trackball

Model 1505
Control Grip



Model 869
Joystick with
Pulse Rate
Output

Write or phone for the MS catalog, listing over 50 standard items.

MS MEASUREMENT SYSTEMS, INC.
523 West Avenue, Norwalk, CT 06850 • Telephone: 203/838-5561

MINELCO

A TALLEY INDUSTRIES COMPANY

Dept. EM, 135 South Main St., Thomaston, CT. 06787.
Phone: 203-283-8261 TWX: 710-475-1091

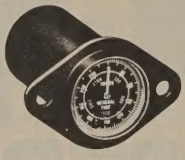
ELAPSED TIME INDICATORS & EVENTS COUNTERS

also see

- **MINELCO INDICATORS**
- **MINELCO SWITCHES**
- **MINELCO LED INDICATORS**

Miniature Elapsed Time Indicators & Events Counters

MODEL
B16C

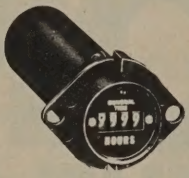


MODELS
95A & 25A

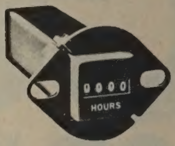
MODELS
B16F & B16G

HOURS AND TENTHS

MODELS
95C & 25C



MODELS
95B & 25B



MODEL
16C

These products conform to MIL-M-7793, special MIL specifications part numbers and cross reference data below.

FEATURES

Miniature Elapsed Time Indicators and Events Counters provide a built-in record of numbers that provide *how-long* data and *how-many* data.

Where safety is concerned, where operating fatigue exists, or component functioning must be measured, they provide the critical record — for maintenance, repair or replacement.

They —

- Anticipate breakdowns
- Predict component mortality
- Reduce "down time"
- Count the "ons" and "offs"
- Count the evolutions or revolutions
- Record the service life
- Warn of impending failure

The standard elapsed time indicators and events counters described on this page are only representative of the available special models that can be provided. Information on other capabilities will be supplied on request.

APPLICATIONS

General Time offers a complete line of subminiature elapsed time indicators and events counters for aerospace, military and industrial applications.

- SPACE EXPLORATION
- MILITARY MISSILES
- COMMUNICATIONS EQUIPMENT
- AIRCRAFT OF ALL TYPES
- COMPUTERS
- AUTOMATIC PRODUCTION MACHINERY
- LABORATORY EQUIPMENT
- GROUND SUPPORT EQUIPMENT
- PREVENTIVE MAINTENANCE SYSTEMS

WRITE OR CALL
for Complete Catalog 136B

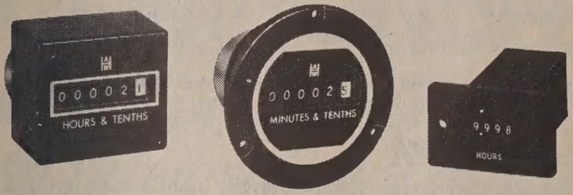
CROSS REFERENCE GUIDE

Elapsed Time Indicators

Mil. Spec. Reference	Minelco
Round Case — 28 V.D.C. Systems — Four Digit Readout	
MS17321-1	16B3CE-Y
MS17321-2	16B8CE-Y
MS17321-3	16B3A-Y
MS17321-4	16B8A-Y
MS17321-9	16B8C2-Y
Square Case — 28 V.D.C. Systems — Four Digit Readout	
MS17321-5	16C3CE
MS17321-6	16C8CE
MS17321-7	16C3A
MS17321-8	16C8A
MS17321-10	16C8C2
Round Case — 400 Hz. Systems — Four Digit Readout	
MS17322-1	95B3CE
MS17322-1A	95B3CE-50
MS17322-2	95B8CE
MS17322-2A	95B8CE-50
MS17322-3	95B3A
MS17322-3A	95B3A-50
MS17322-4	95B8A
MS17322-4A	95B8A-50
MS17322-9	95B8C2
Square Case — 400 Hz. Systems — Four Digit Readout	
MS17322-5	95C3CE
MS17322-6	95C8CE
MS17322-7	95C3A
MS17322-8	95C8A
MS17322-10	95C8C2
MS17322-5A	95C3CE-50
MS17322-6A	95C8CE-50
MS17322-7A	95C3A-50
MS17322-8A	95C8A-50
Round Case — 400 Hz. Systems — Dial Readout	
MS17323-1	95A5CE
MS17323-1A	95A5CE-50
MS17323-2	95A8CE
MS17323-2A	95A8CE-50

All MIL-SPEC items listed above immediately available from our stock.

INDICATORS AND TIMERS

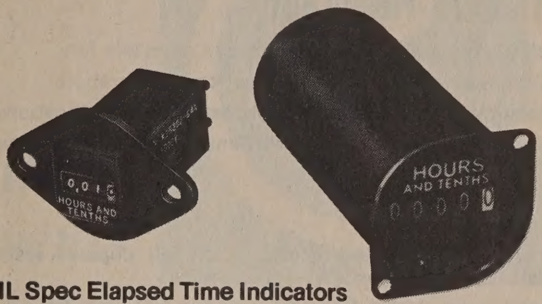


Commercial Elapsed Time Indicators

Maintain record of equipment on/off time and provide utilization time information for maintenance, billing, etc. Many different models and mounts. Up to 6 digit readouts.

Type	Series No.	Operating V ac	Styles
Standard Commercial	K42200	6-230, 50 or 60 Hz	Round and rectangular
Microminiature Commercial	K49200	115 60 or 400 Hz	End or side readout

Ask for Reference Sheets PI-125 and CI-706

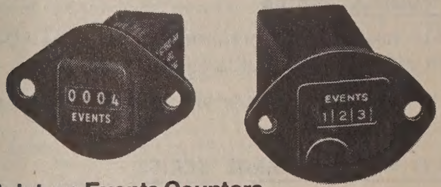


MIL Spec Elapsed Time Indicators

Conform to MIL-M-7793. In either subminiature (5-digit) or microminiature (4-digit) sizes. White numerals on black; "tenths" digit red on white. Hermetically sealed.

Type	Series No.	Operating Voltage
Subminiature	K4200 K23200 K25200	28V dc 115V ac, 60 Hz 115V ac, 400 Hz
Microminiature	K19200 (Square) K19220 (Round)	24 or 120V ac 400 Hz
	KT19700 (Square) KT19720 (Round)	24V dc

Ask for Reference Sheets MI-602 and MI-603

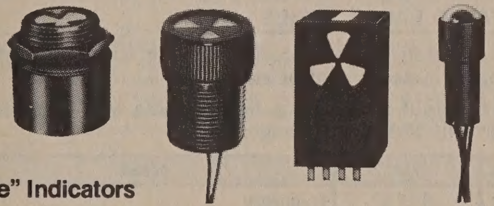


Microminiature Events Counters

Meet MIL-M-7793 environmental requirements. Up to 6 digit display, depending on model. Non-resettable and resettable types. Many standard mountings.

		Series No.		
Type	Digits	28V dc	115V 60 Hz	115V 400 Hz
Non-resettable	4	K19502	K19511	K19501
	5	K19504	K19513	K19503
	6	K19506	K19515	K19505
Resettable	3	LM19502	LM19511	LM19501
	4	LM19504	LM19513	LM19503
	5	LM19506	LM19515	LM19505

Ask for Reference Sheet MI-604

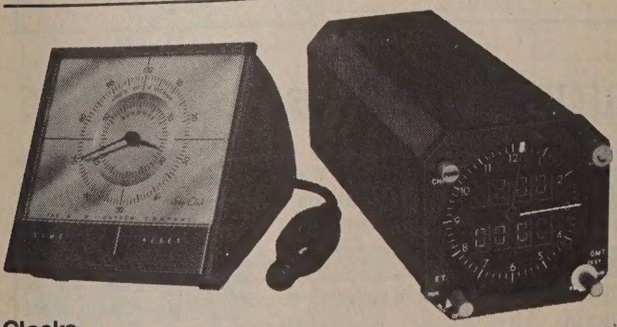


"Bite" Indicators

For monitoring circuit or system performance. Contrasting colored flag or ball appears in window to indicate fault condition. Magnetic latch retains fault condition until manually or electrically reset. Rectangular, round and ball-type units.

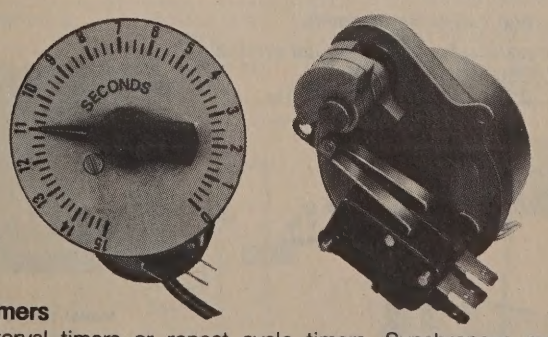
Type	Series	MIL Ref.	DC Voltage	Operating Time
Rectangular	K21500	MIL-E-5400J	17-29	50ms.
Round	K21600	MIL-M-83287	17-29	50ms.
Round-Manual Reset	L21603/01	MIL-M-83287	3-28	50ms.
Round-Electric Reset	L21603/02	MIL-M-83287	17-29	50ms.
Ball-Electric Reset	K21700		17-29	50ms.

Ask for Reference Sheets MI-605, MI-606, MI-607



Clocks

A wide range of clock devices from lab stop clocks to sophisticated electronic aircraft clock systems. Analog, digital or combination displays. Write for information.



Timers

Interval timers or repeat cycle timers. Synchronous motor driven. Stock items available. Most units U/L or CSA recognized. Write for information.

NORTH AMERICAN PHILIPS CONTROLS CORP.

Cheshire, Conn. 06410 • (203) 272-0301

CONVERTERS & INTEGRATORS

North Hills

VOLTAGE-TO-FREQUENCY

Complete line of Voltage-to-Frequency Converters for:

- A/D conversion.
- Electronic integration.
- Telemetering.
- Process control applications.

All have one-cycle response, excellent linearity down to zero frequency, low TC.

FIXED RANGE SERIES

AC-line operated models accommodate all popular system interface configurations.

0-10 volt input, 0.02% linearity, zero and full-scale trimmers.

Standard full-scale output frequencies:
2.5, 5, 10, 25, 50, 100, 250, 500 Hz
1, 2.5, 5, 10, 25, 50, 100 kHz

Series	Output
DF-11	Transformer-isolated pulses
DF-12	5 or 13 V pulses, TTL, CMOS compatible
DF-13	5 V TTL balanced line driver
DF-14	Opto-isolated uncommitted transistor
DF-15	75 ohm coax line driver
DF-16	124 ohm balanced line driver
DF-17	EIA RS-232-C interface driver

ADJUSTABLE RANGE SERIES

AC-line operated models accommodate a variety of inputs, including all process control standards.

Full-scale output frequency is field-settable with high resolution over 1 to 100,000 Hz range.

Model No.	Input	Output
DF-100	0-10 V	Frequency
DF-101	1-5 mA	Frequency
DF-102	4-20 mA	Frequency
DF-103	10-50 mA	Frequency
DF-110	−10 to +10 V	Frequency and logic output indicating polarity
DF-120	−10 to +10 V	Separate frequencies for + and − inputs

PLUG-IN MODULE SERIES

Series DF-10 plug-in modules require ±15 Vdc at 25 mA.

Input: 0-10 V

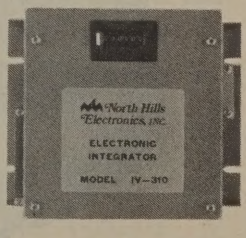
Input Impedance: > 100 MΩ

Linearity: 0.02%

Zero and full-scale trimmers

Full-scale output frequencies available:
25, 50, 100, 250, 500 Hz
1, 2.5, 5, 10, 25, 50, 100 kHz

Model DF-10
3.5 x 1.82 x 1 in.
±15 Vdc powered



Model IV-310

Model DF-12
3.5 x 8.5 x 2.3 in.
Ac-line powered

FREQUENCY-TO-VOLTAGE

Line of high-performance Frequency-to-Voltage Converters for:

- Tachometry.
- Telemetering.
- Frequency monitoring.
- Control application.

All feature ripple-free outputs and excellent linearity.

FULL-RANGE SERIES

AC-line operated models feature various input circuit options.

Output: 0-10 V

Linearity: 0.02% down to 1% of full-scale

Fast response, negligible ripple

Standard full-scale input frequencies available:
25, 50, 100, 250, 500 Hz
1, 2.5, 5, 10, 25, 50, 100 kHz

Series	Input Circuit	Input Level
FD-11	TTL balanced line driver	5 V nom.
FD-12	High impedance (> 100 KΩ)	1-100 V peak
FD-13	Opto-isolated diode	10 mA nom.

PLUG-IN MODULE SERIES

Series FD-14 has identical performance to Series FD-12, but requires an external source of ±15 Vdc power.

The unit is configured as a printed circuit plug-in module.

ULTRA-FAST NARROW RANGE SERIES

Series FT-100 Frequency Transducers cover narrow bands about power frequencies of 50, 60, and 400 Hz.

The instruments feature one-cycle response, internal crystal calibrators, and ±10 V output at 60 mA — sufficient to drive galvanometer and other types of recorders.

Model No.	Frequency Range
FT-101-1	40-60 Hz
FT-101-2	45-55 Hz
FT-102-1	50-70 Hz
FT-102-2	55-65 Hz
FT-103-1	360-440 Hz
FT-103-2	380-420 Hz

ELECTRONIC INTEGRATORS

Compute time-integral of sensor outputs; output pulses drive external or self-contained 24 V electro-mechanical totalizing counters (8 W max.). Full-scale output pulse rate field-settable with high resolution between 100 and 50,000 counts/hour.

Model No.	Input	Output
IV-100-X*	Process control currents	No count for less than min. current
IV-110	0 to 10 V	No count for −V
IV-200	−10 V to +10 V	Dual outputs for up-down counter
IV-201	−10 V to +10 V	Count ignores input polarity
IV-300	as above	Integral counter display

* 1 = 1-5 mA, 2 = 4-20 mA, 3 = 10-50 mA.

North Hills Electronics, INC. GLEN COVE, N.Y. 11542 • 516-671-5700

E-CELL (TM) COMPONENTS

First in Micro-Coulometry

- ***Timing: Seconds to Months***
- ***Integration: 1 to near ∞ events***
- ***Non-Volatile Memory***
- ***Low Cost***

① WHAT IS AN E-CELL DEVICE?

An E-CELL device is a new kind of circuit element that looks like a discrete electronic component but does the work of a complete electro-mechanical assembly. Its main functional part is a center "working" electrode, which is surrounded by an electrolyte. The unit's metallic container also serves as the second ("reservoir") electrode. Functionally, an E-CELL unit is a reversible micro-coulometer. By plating the "working" electrode, it converts electrical current-time integrals (up to several thousand milliampere-sec. into equivalent integrals of a mass of metal. Exactly one atom is transferred for each electron impressed on the E-CELL unit. Power drain is normally in the microwatt region. If the "working" electrode is then deplated at a known current, the deplating time will be proportional to the original integral. When a known mass is given as part of the initial condition (i.e. is preplated on the "working" electrode), this same process generates a precise time interval. The unit abruptly changes from a low-resistance to a high-resistance circuit element when its "working" electrode is completely deplated.

② HOW DO YOU USE AN E-CELL DEVICE?

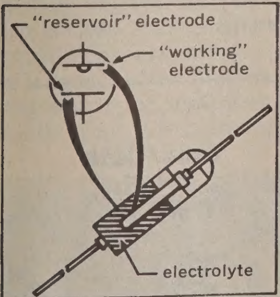
An E-CELL device has two generic functions: integration and timing. In both areas, the device is characterized by: electrical stability; small size; insensitivity to the physical environment; compatibility with the low current and voltage levels of modern circuitry; and the ability to operate over an extremely broad time domain. Compared to conventional mechanical and electro-mechanical devices which perform similar functions, an E-CELL device is much lower in cost.

For integration applications, an uncharged E-CELL unit accepts d-c, periodic, or random inputs in any waveshape — and stores the integral of these on the "working" electrode. To read out the stored value, the mass transfer process is reversed. The measured time to reach the point of the abrupt voltage swing, multiplied by the readout current, gives a precise value which represents a total count of the stimuli presented to the unit. The Model 500 EDR Digital Readout Instrument provides a convenient means of making these measurements.

Operation in the timing mode is essentially the same as that for integration. The E-CELL unit is pre-charged with a known mass of plating material. In operation, this mass is transferred to the "reservoir" electrode (container) at a constant known rate determined by the current value used. When the "working" electrode has been deplated, an abrupt voltage swing signals that the pre-set time has elapsed. This signal is normally used as a bias transition with semiconductor devices.

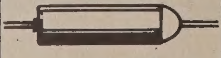
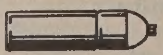
③ APPLICATIONS

The scope of applications is as broad as counting and timing functions themselves. We have a repertoire of many convenient, economical circuit designs that have been proven in actual field use. Our experienced applications specialists will help you apply E-CELL coulometric techniques to your particular problems. Representative applications: **REPETITIVE TIMING AND CONTROL** Repeat cycle timing for domestic and industrial appliances. **PULSE COUNTING AND MEMORY** Adding and subtracting pulses. Counting events for vending machines, traffic, etc. Confidential memory for security devices. **CURRENT-TIME INTEGRATION** Battery charging controls. Environmental monitoring. Data accumulation. Laboratory integration in physics, chemistry, meteorology, etc. **USE-TIME MEASUREMENT** End-of-life, elapsed time, and warranty indication. Use-accounting for office, automotive, or industrial machines. **TIMING** Ordnance, safing and arming devices. Sonobuoy scuttling. Long delays. **MIL Type 500, and Cyclic E-Cell Type 510, are also available.**



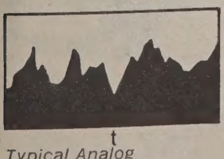
E-CELL Device and Circuit Symbol

E-CELL INTEGRATING AND TIMING COMPONENTS

Type (Actual Size)	Charge µa-hr	Application	Range Accuracy	Physical Characteristics
 Series 560	None	Integrating	10-1000 µa-hr ±2%	Single anode with axial leads. Current range up to 2000 µa. Temperature range −55°C to +71°C (See Bulletin 500 for additional information.)
	60-3000	Timing	0.1 to 3000 hr. ±2%	
 Series 550	None	Integrating	10-1000 µa-hr ±2%	Single anode, plug-in type. Current range up to 2000 µa. Temperature range −55°C to +71°C. (See Bulletin 500 for additional information.)
	60-3000	Timing	0.1 to 3000 hr. ±2%	

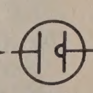
E-CELL Timing Components with other pre-charges are available on special order.

Specifications subject to change without notice.



Typical Analog Input Signal

→



E-CELL Integrator

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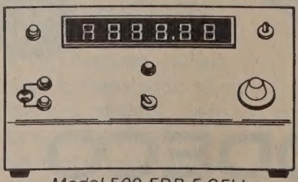
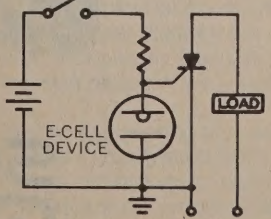
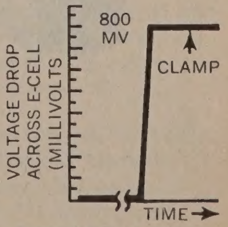


Model 500 EDR E-CELL Digital Readout Instrument



Typical circuit using E-CELL components.



Typical E-CELL device voltage rise.

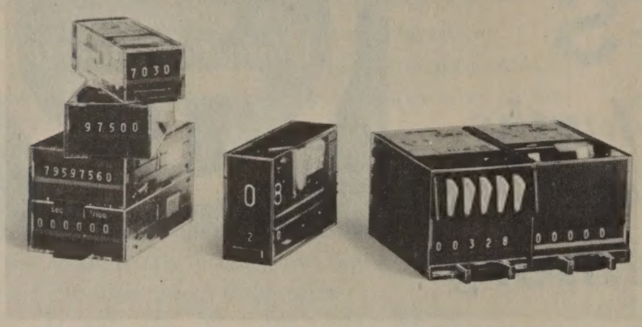
E-CELL components and instruments are protected by one or more of the following U.S. patents: 2,744,217; 3,387,288; 3,423,642; 3,423,643; 3,423,644; 3,423,648. Other U.S. and foreign patents pending.

For additional technical information and applications notes, contact:

PLESSEY ELECTRO-PRODUCTS Dept. EM subsidiary of PLESSEY INCORPORATED
3860 Centinela Ave., Los Angeles, Calif. 90066
Tel: (213) 390-3585 • TWX: 910-343-6483

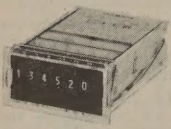
Guide to Sodeco impulse counters

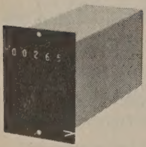
★ The Sodeco R-Series: Up to 200,000,000 counts and speeds to 60 ips

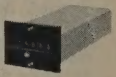


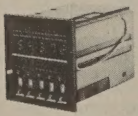
Inside their rugged, clear packages, Sodeco's new R-series impulse counters pack many times the life of any other counter on the market. The most advanced counters you can buy, they're Swiss-engineered for greater precision, quieter operation, no missed counts. Instead of all the usual rattles, vibration and wear associated with standard ratchet mechanisms, our special escapement mechanism keeps them working better longer. Compact plug-in modules with power consumption as low as 0.8W are compatible with the most advanced solid state instruments and systems. Standard ± 15% voltage tolerances and a capacity for operating with a wide variance of pulse waveforms provide a maximum safety margin. For more details on R-Series counters check the asterisked items in the application categories below.

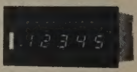
Totalizing Counters









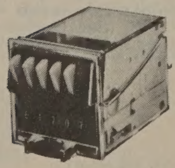


Number of Digits	Counting Speeds (ips)	Type of Reset	Typical Dimensions	Model/Style	Ask for Bulletin No.
3, 4, 5, 6, 8	10, 35, 60	None, Manual, Electric	w — 1.11″ h — 0.95″ d — 2.76″	★ RG Series	601
5, 6	10	None	w — 1.10″ h — 0.81″ d — 4.49″	EG Series	15003
3, 4, 5, 6, 7, 8,	10, 25	None, Manual	w — 1.65″ h — 1.22″ d — 4.42″	TCe Series	201
4, 5, 6	10, 25, 50	Electric	w — 1.37″ h — 2.36″ d — 4.42″	TCeF Series	201
4, 5, 6, 7	10, 25	None, Manual	w — 1.38″ h — 2.05″ d — 1.73″	TCeB Series	212
5 LED	up to 1 MHz	Manual, Electric	w — 2.83″ h — 2.83″ d — 3.94″	KE 350	KE35123
5 LED (with BCD input and readout)	up to 1 MHz	Manual, Electric	w — 2.83″ h — 1.42″ d — 3.94″	KE 250	KE35123

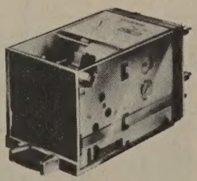
NOTE: Standard Voltages are 12, 24, 110 VDC, 110 VAC throughout. Other voltages available on request.

Other Counters

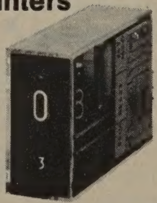
Predetermining Counters



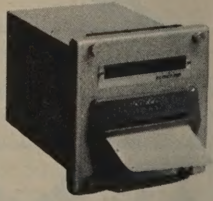
Add/Subtract Counters ★



Single Digit Counters



Time/Date & Printing Counters

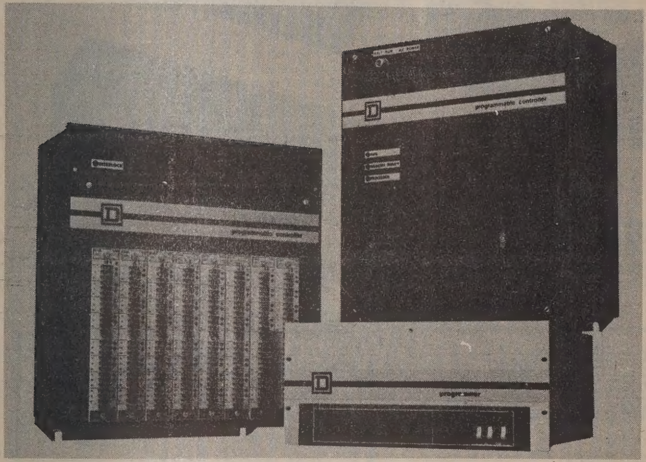


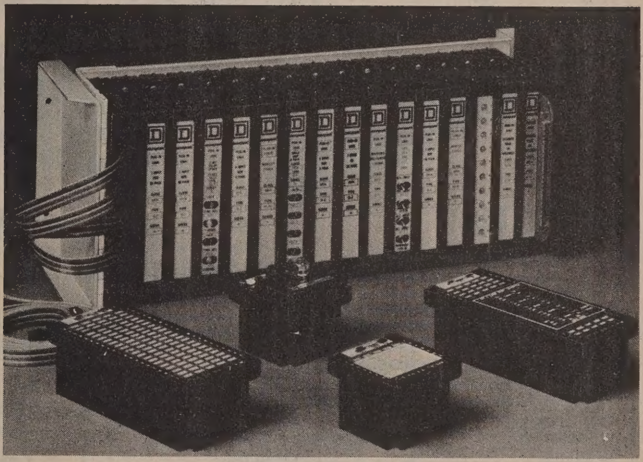
Ask for Bulletin No. 16102

SODECO
LANDIS & GYR

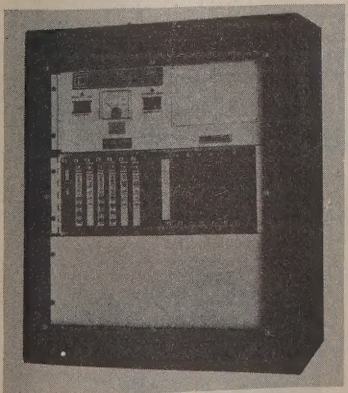
4 Westchester Plaza, Elmsford, New York 10523 • Phone: (914) 592-4400 TWX: (710) 567-1219 Telex: 137345
In Canada: 2063 Chartier Street, Dorval, Quebec H9P 1H3 • Phone: (514) 631-9069 Telex: 05-821-683

Complete control systems capability.



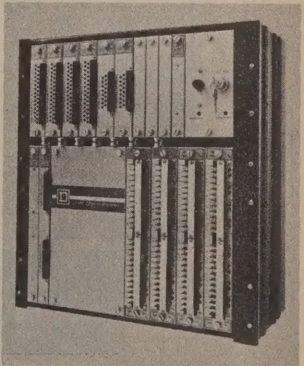


The Class 8881 Programmable Controller is designed for maximum flexibility. It can accommodate up to 2,048 inputs and outputs in increments of 16. Its memory is Read/Write core and is available from 1K to 16K words. Over 11,000 zone bits of synchronous and asynchronous shift registers and/or 991 digital timers and counters can be programmed. Arithmetic, compare, and data transfer operations are easily accomplished. Remote I/O (to 5,000 feet) and computer interfacing are also available. The controller can be programmed with either a programming box or the programming panel pictured above, allowing program entry in either ladder diagram contact configurations or Boolean Algebra. Up to 95 functions can be programmed in one rung of a ladder diagram, with the user determining series/parallel arrangement. Printed ladder diagram and Boolean statement documentation, in the language of your industry, are automatically provided by the programming equipment, as well as data logging and management reports in any format desired.



NORPAK® Demand Control is the low-cost solution to your facility's ever increasing electric bills. Reduction of the demand portion of the bill is accomplished by sensing instantaneous facility power with current transformers. Power is then limited by turning off, or shedding, certain controllable loads such as air conditioners, heaters, compressors, and so forth. Control is only taken during those brief periods when the facility power "peaks out." It is possible to reduce energy consumption by programming loads to be off line for timed intervals during peak and non-peak periods of the day. Savings due to energy reduction can be many times that of demand reduction. NORPAK demand control can be used in almost every facility from supermarkets to foundries. It should be considered whenever the electric bill exceeds $3,000/month.

NORPAK® Solid State Control is the ideal logic control in industrial environments. NORPAK logic functions are available in two forms—Encapsulated or Plug-in. Both are UL listed. The Encapsulated version is suited to environmental extremes. It withstands shock, vibration, dust and corrosive fumes. Plug-in NORPAK components are suited to less hostile atmospheres and feature the ease of plug-in maintenance. Both forms, when properly applied, are virtually immune to electrical noise.



The Ladder Diagram Processor is a small, economical programmable controller designed to replace relay or stepping switch control systems. It can accommodate up to 64 inputs and 32 outputs and has a memory capacity sufficient to handle up to 120 lines of a relay ladder diagram or schematic. Its cost is comparable to hard wired electromechanical relay systems. Light emitting diode status indicators on all inputs, outputs, relay equivalents, and lines of the ladder diagram provide continuous monitoring of the control system. Optional features such as timers, latches, shift registers, and counters are available.

For specific engineering data on Programmable Controllers, Plug-in and Encapsulated Solid State Logic or Demand Controllers, contact your nearby Square D field office. Or write Square D Company, Dept. SA-711, Milwaukee, Wisconsin 53201.

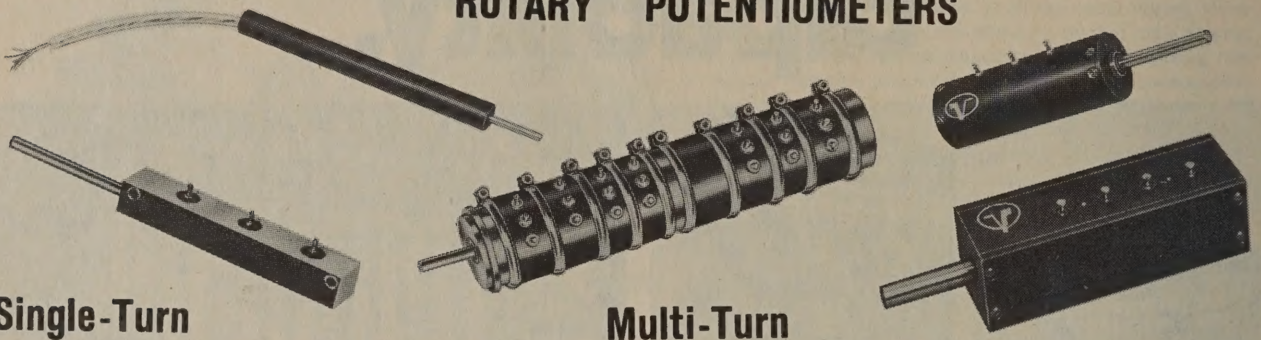
SQUARE D COMPANY

Wherever Electricity is Distributed and Controlled

VERNITECH
Division of VERNITRON CORPORATION

CIC Infinite Resolution PRECISION COMPONENTS

ROTARY POTENTIOMETERS



Single-Turn

LINEAR-FUNCTIONAL/SINE-COSINE

SPECIFICATIONS

	LINEAR	SINE-COSINE
Mechanical Rotation	360° Continuous	
Electrical Function Angle	350° Nominal	J60°
Resistance Range	0.5KΩ-2 MegΩ	500Ω-50KΩ/Quad.
Best Linearity or Conformity	.1% ÷ Inch of Dia.	.3% P-P ÷ Inch of Dia.
Resolution*	1/250,000	
Wattage	Diameter x 2 Watt(s)	
Temperature Range	−55°C to +125°C	
Taps. Maximum No.	Diameter x 6	
Starting Torque (In.—Oz.)	Diameter x .15	Diameter x .3
Life** (at 100 R.P.M.)	To 30 Million Cycles Depending on Circuitry	

Multi-Turn

LINEAR-FUNCTIONAL

SPECIFICATIONS

MULTI-TURNS			
3600° +20° −0°	3700° MIN. to 36,000°	3600° +100° −0°	3600° +110° −0°
3600° ±10°	3600° ±40°	3600° ±5°	3600° ±10°
5KΩ-250KΩ	1KΩ-125KΩ	5KΩ-500KΩ	5Ω-1MegΩ
To ±0.1%	To ±0.1%	To ±0.05%	To 0.01%
1/150,000	1/200,000	1/400,000	1/400,000
2	1	2	4
−55°C to +125°C			
1	2	1	1
0.2	1.5	1.0	2.0
To 5 Million Cycles Depending on Model and Application			
10 IN. OZ. MAX.		75 IN. OZ.	160 IN. OZ.

VERNITECH Elements — Rotary and/or Linear — Available on Order

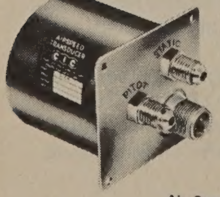
LINEAR MOTION POTENTIOMETERS

Electrical Stroke	To 60″	To 28″	To 12″	To 4″	To 1″	To 1.2″	To 1.5″	To 1.25″	To 10″
Cross Section Configuration	○	□	□	○	□	□	□		○
Resistance Range	250Ω/in. to 200KΩ/in.	150Ω/in to 200KΩ/in.		500Ω/in. to 250KΩ/in. 1		150Ω/in. to 125KΩ/in.	250Ω/in. to 125KΩ/in.	500Ω/in. to 250KΩ/in.	350Ω/in. to 250KΩ/in.
Best Linearity	0.2% ÷ Length of Electrical Stroke								
Resolution *	1/400,000								
Wattage	1 Watt per Inch of Stroke								
Temperature Range	−55° to +125°C								
Taps Maximum No.***	4	To Suit		1		To Suit	1		
Starting Force Oz. at 25°C	16	8	4	8	4		8		
Life	30 Million Strokes, Depending on Circuitry								
Shaft Misalignment Feature	Available			Not Available		Available	Not Avail.	Available	

CIC PRECISION PRESSURE TRANSDUCERS/TRANSMITTERS

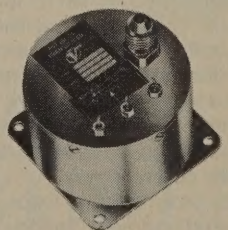
LINEAR WITH PRESSURE / ALTITUDE / AIRSPEED / FLOW / SQUARE ROOT

WEATHER-PROOF
(Available in All Models)

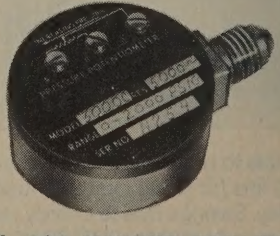


Air Speed Transducer

Pressure Range	0-10,000 PSI
Linearity	
Repeatability	To ±.05% F.S.



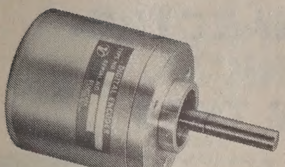
EXPLOSION-PROOF
(Available in All Models)



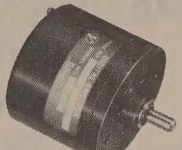
VERNITECH.
Division of VERNITRON CORPORATION

DEPT. EM, 300 MARCUS BOULEVARD
DEER PARK, LONG ISLAND, NY 11729
PHONE (516) 586-5100 TWX 510-227-6079

VERNITECH
Division of VERNITRON CORPORATION



SHAFT ENCODERS
CONTACTING AND OPTICAL
INCREMENTAL — ABSOLUTE



OPTICAL INCREMENTAL

Size	Resolution	Diameter	Length	Features (Optical)	Options
11	To 1024 Pulses	1.062	1.500	All Solid State Light Source High Reliability Industrially Designed Construction	• Sealed • Index Marker • Quadrature Output • 1X-2X-4X Multiplier • Extended Temperature Range • Non-Std. Supply Voltage • Line Drivers • Connectors • Direction Sensing
23	To 2048 Pulses	2.250	1.875		
25	To 2048 Pulses	2.500	2.500		
35	To 2500 Pulses	3.500	2.250		

OPTICAL ABSOLUTE

Size	Output Code	Counts/Turn	Least Count Angle	Features	Options
23	BCD	Up to 1000	.18°	Quadrature Output on LSB Available	• Serial Output Available • Size 30 Available With Parity Bit
30	BCD	Up to 1000	.18°		

CONTACTING ABSOLUTE

Size	Code	Counts/Turn	Revolutions for Full Count	Full Count	Features	Options
11	Gray/Binary	To 256	1 to 64	To 2^{14}	Operating Speed: To 200 RPM	• Operating Temp.: −55°C to 125°C
	BCD	To 100	1 to 100	To 9999	DTL/TTL Compatable	• Various Output Voltage Ratings
18	Gray/Binary	To 512	1 to 2048	To 2^{19}	5,000,000 Rev. — Life	• 18 and 19 Bit Total Count
23	Binary	To 256	1 to 2048	To 2^{19}	Slew Speed: 1000 RPM	• Connectors
	BCD	To 400	1 to 100	1×10^6 BCD	Output: Parallel Non-Ambiguous	
31	Gray/Binary	1024	Single Turn	To 2^{10}	All Units Contain Self-Selecting Logic	• Increasing Count — CCW Rotation

OPTICAL KIT — INCREMENTAL — INDUSTRIAL USE

Size	Resolution	Light Source	Construction	Features	Options	
Un-Housed	To 1000 Pulses	LED	Modular	Low Cost	2 Channel Output Index Channels	Squared Output Operating Voltages: 5 to 15 V.D.C.

Housed versions also available.

VERNITECH.
Division of VERNITRON CORPORATION

DEPT. EM, 300 MARCUS BOULEVARD
DEER PARK, LONG ISLAND, NY 11729
PHONE (516) 586-5100 TWX 510-227-6079

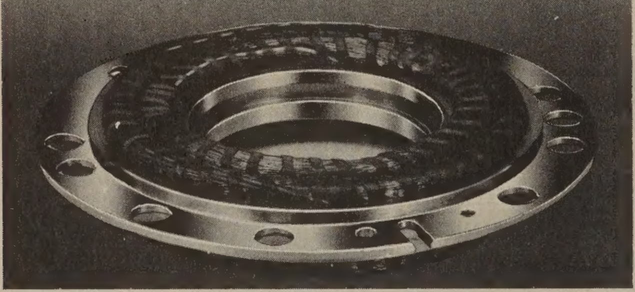
VERNITRON CONTROL COMPONENTS

a Division of Vernitron Corporation

2440 WEST CARSON STREET • TORRANCE, CALIFORNIA 90501 • (213) 328-2504, TWX: 910-349-6250

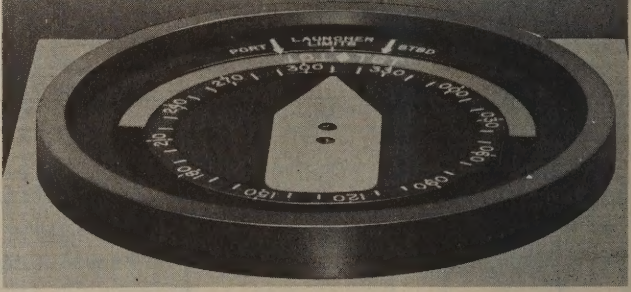
PANCAKE SYNCHROS AND RESOLVERS PROVIDE...

. . . Lower cost and higher accuracy in position sensing systems. Gimbal mounted synchros, resolvers and linear transformers are available in various configurations . . . single speed accuracies to 10 seconds . . . dual and multi-speed units with accuracies to 3 seconds. Other provisions include wide ranges of frequency, voltage, and temperature.



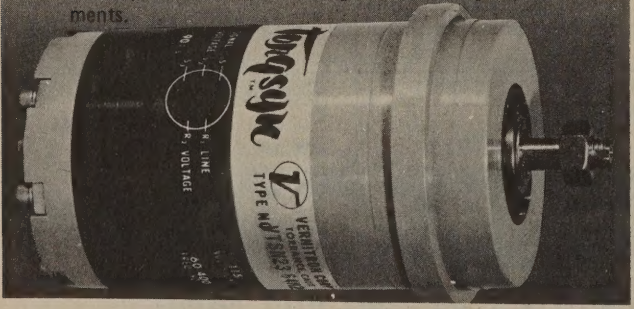
RELIABLE ELECTRO-MECHANICAL INDICATORS THAT...

. . . tell you where it's at — time after time. Simple remote readouts or complex multiple display — rudder angle, thrust direction, ship heading, target bearing, weapon system position — Vernitron can supply dependable performance under severe operating conditions. Talk to us about your electromechanical indicator requirements.



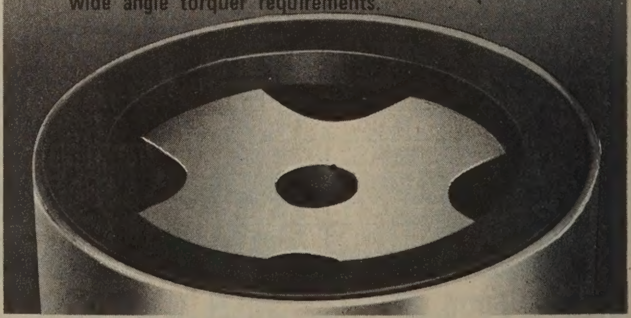
Torqsyn® REMOTE POSITIONERS ARE...

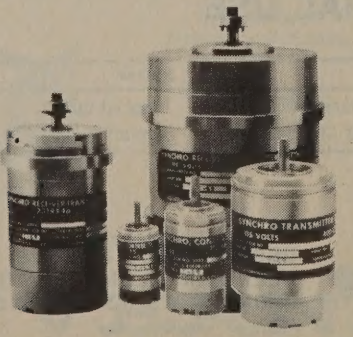
. . . completely integrated direct drive servo packages . . . no gearing required . . . compact. Operation over 50-440 Hz, most models. High input impedance . . . reliable . . . no reflected torque to driving source . . . high torque gradient . . . high inertia load capability. Available in frame sizes 11, 15, 23, and 37. Talk to us about your remote positioning and indicating requirements.



Vernitorq® WIDE ANGLE BRUSHLESS DC TORQUERS FOR...

. . . all your precise positioning, actuating, tensioning, measuring and indicating applications. Highly reliable, limited rotation, direct drive units are available frameless or housed in both two or four pole versions. Various sizes and outputs. Talk to us about your wide angle torquer requirements.





STANDARD SYNCHROS, RESOLVERS AND SELSYNS

Mil-Spec designs housed in all standard and existing frame sizes, plus Selsyn replacement type units are available with accuracies down to 20 seconds on housed synchros and resolvers. Additional features include temperature compensation, varying voltage, frequency and impedance levels.

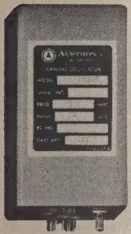
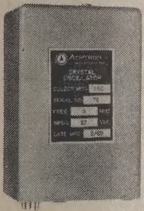
WRITE OR PHONE FOR DETAILED 20 PAGE CATALOG.

AUSTRON

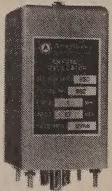
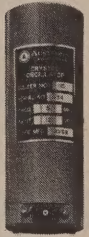
1915 KRAMER LANE
AUSTIN, TEXAS 78758
TELEPHONE (512) 836-3523

HIGH STABILITY OVEN-CONTROLLED SERIES 1100 CRYSTAL OSCILLATORS

The Sulzer Model Oscillator is a compact, rugged crystal oscillator designed for use in counters, synthesizers and communications systems.

Model	Frequency:	Aging:	Output:	Input Voltage:	Input Power:	Size:	Weight:
1150	5 MHz	5 x 10^{11}/day ultimate aging	1 vrms sine wave	12 to 27 VDC	2.5 watts operating	2⅓ x 3-3/16 x 5"	32 oz.
1120	1 MHz	1 x 10^{9}/day ultimate aging	1 vrms sine wave	12 V to 27 VDC	3 watts operating	2¼ x 2-1/8" x 4"	9 oz.
1115	5 MHz	1 x 10^{9}/day ultimate aging	1 vrms sine wave	12 to 15 VDC	150 mw @25°C typical	2" diameter x 5½ length	12 oz.
1105	1 MHz	1 x 10^{9}/day ultimate aging	TTL	+5VDC	260ma operating	1¼ x 1¾" x 3¼	7 oz.
1100	5 MHz	1 x 10^{9}/day ultimate aging	1 vrms sine wave	12 VDC to 27 VDC	2 watts operating	1¼ x 1¾" x 3¼"	7 oz.

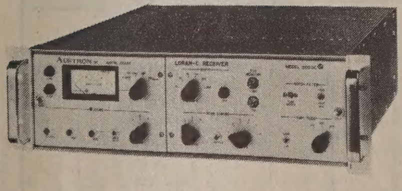
OPTIONS: Many options such as electrical tuning, special frequency, input and output voltage, pin connections and other aging rates.

NEW Lowest Phase Noise

1120S 5 MHz oscillator exhibits a SSB signal to noise ratio of 168 db/Hz at 100 Hz offset, and 176 db/Hz at 10 kHz. Corresponding Allan variance stabilities have been calculated at 3.5 x 10^{-13} for the 10 ms to 30 ms range of averaging times.

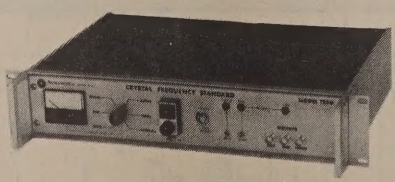
Time/frequency instruments

2000C



AUSTRON's Model 2000C Loran-C Receiver receives and phase-tracks Loran-C signals for time and frequency calibration and control, propagation study, and other purposes. When used to monitor the Loran-C groundwave, the Model 2000C permits time epoch determinations of sub-microsecond accuracy. Frequency measurements with an accuracy of one or two parts in 10^{12} are possible with one-day averaging.

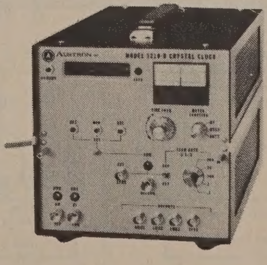
1250



The AUSTRON Model 1250 Crystal Frequency Standard generates highly stable output frequencies at 5MHz, 1 MHz, and 100 kHz. Each of these outputs has excellent waveform and spectral purity.

The Model 1250 employs an AUSTRON Model 1150 Crystal Oscillator. In Model 1150, a highly stabilized feedback amplifier is used in connection with an AGC system to maintain the crystal power at the low constant value that is necessary to attain high frequency stability.

1210D



The Model 1210D Portable Crystal Clock is a compact, self-contained, self-powered time reference providing stable time outputs at several pulse frequencies. Thus, the Model 1210D Clock can be used to transfer precise time from one geographical location to another. In additon to the pulse outputs, the Model 1210D has sinusoidal outputs at 5 MHz and 1 MHz. A time-of-day display is also provided.

SERIES 76 Oscillator 1 Hz to 300 MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE W	X	Z
Temperature Range:	−55°C to +75°C	0°C to +60°C	+15°C to +35°C
Frequency Stability:	±0.005%	±0.001%	±0.0005%

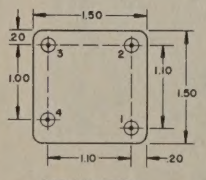
OUTPUT SPECIFICATIONS

PARAMETER	ORDERING GUIDE A	B	C
Frequency Range:	1Hz to 5MHz	1Hz to 25MHz	10MHz to 150 MHz
Supply VO:	±5VDC to ±12VDC ±5%	+5VDC ±5%	+5VDC or −5.2VDC ±5%
Current Drain:	<4MA	<18MA	<50MA
Wave Form:	Square	Square	Basically Square
Output VO:	Compatible CMOS-MOS	Compatible TTL	Compatible ECL
Tr/Tf	<100NS	<100NS	<3NS
Symmetry:	50/50 ±20%	50/50 ±20%	———
Distortion:	———	———	———
Load Resistance:	10 CMOS-MOS	10 TTL	10 TTL or ECL
Termination:	➡ 1 ➡ 4 ➡ 5 Only	➡ 1 ➡ 4 ➡ 5 Only	➡ 1 ➡ 2 ➡ 3 Only
Height: (Inches)	.62 1.5 1.5	.62 1.5 1.5	1.0 1.5 2.0
PARAMETER	**D**	**E**	**F**
Frequency Range:	150MHz to 300MHz	60Hz to 1MHz	1MHz to 300MHz
Supply VO:	+5VDC or −5.2VDC ±5%	+12VDC ±5%	+12VDC ±5%
Current Drain:	<50MA	<15MA	<50MA
Wave Form:	Basically Square	Sine	Sine
Output VO:	Compatible ECL	1VRMS ±10%	+10dbm ±3dbm
Tr/Tf	<3NS	———	———
Symmetry:	———	———	———
Distortion:	———	<5%	−25db min.
Load Resistance:	10 ECL	10K Ω	50 Ω
Termination:	➡ 1 ➡ 2 ➡ 3 Only	➡ 1 ➡ 4 ➡ 5 Only	➡ 1 ➡ 2 ➡ 3 Only
Height: (Inches)	1.5 2.0 3.0	1.5 2.0 2.0	1.5 2.0 2.5

TERMINATION

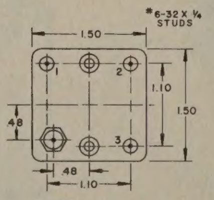
ORDERING GUIDE

1



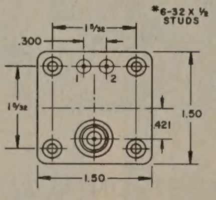
Printed Circuit Pins

2



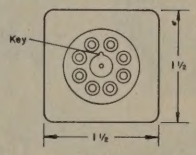
OSM Connector

3



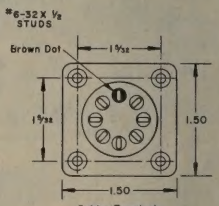
BNC Connector

4



Octal Plug

5



Solder Terminals

FILL IN BLANKS TO CONSTRUCT YOUR PART NO. — Example $\boxed{X}$ $\boxed{F}$ $\boxed{3}$

When ordering
SPECIFY
Model No.
Frequency
Supply Vo.

Freq. Stab. W, X or Z	Output Spec. A, B, C, D, E or F	Termination 1, 2, 3, 4 or 5

accutronics DEPT. EM, 628 NORTH ST., GENEVA, IL 60134, U.S.A. / (312) 232-2600
TWX: 910-237-1680 / CABLE: AKUTRONX

SERIES 77 LCVCO 1 MHz to 250 MHz

FREQUENCY STABILITY

PARAMETER	ORDERING GUIDE		
	S	T	V
Temperature Range:	−40°C to +80°C	0°C to +60°C	+15°C to +35°C
Frequency Stability:	±0.5%	±0.2%	±0.1%
Setting Accuracy:	±0.05%	±0.05%	±0.05%
△f vs Supply:	±.02% per 1% change in supply voltage		
△f vs Load:	±50PPM no load to full load		

OUTPUT SPECIFICATIONS

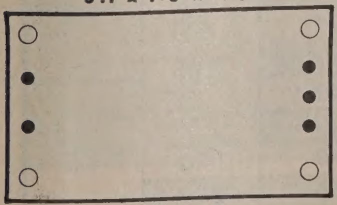
PARAMETER	ORDERING GUIDE		
	G	H	J
Frequency Range:	1MHz to 40MHz	40MHz to 250MHz	1MHz to 250MHz
Supply VO:	+12VDC ±5%	+ or −12VDC ±5%	+12VDC ±5%
Current Drain:	<30MA	<50MA	<50MA
Wave Form:	Square	Square	Sine
Output VO:	Compatible TTL	Compatible TTL or ECL	0dbm min.
Tr/Tf:	<30NS	<5NS	———
Symmetry:	50/50 ±20%	50/50 ±20%	———
Harmonics:	———	———	−20db min.
Spurious:	———	———	−60db min.
Load Resistance:	3 ea. TTL	3 ea. TTL or ECL	50Ω
Tuning Voltage:	0V ±5VDC	0V ±5VDC	0V ±5VDC
Mod. Bandwidth:	DC to 20KHZ — 3db	DC to 20KHZ — 3db	DC to 20KHZ — 3db
Size:	Option 1, 3	Option 1, 2, 3, 4	Option 2, 4
Termination:	PC Pins	PC Pins or BNC	BNC

DEVIATION/LINEARITY

PARAMETER	ORDERING GUIDE			
	6	7	8	9
Deviation:	±1%	±5%	±10%	±25%
Linearity:	±1%	±2%	±4%	±10%

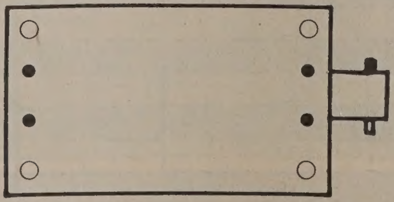
Option 1

3.1 x 1.5 x .75



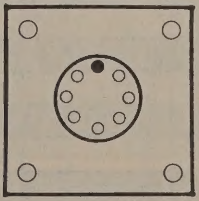
Option 2

3.56 x 1.56 x 1.50



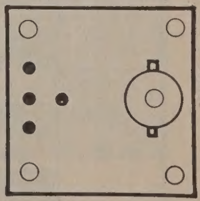
Option 3

1.5 x 1.5 x 3.5



Option 4

1.5 x 1.5 x 3.5



FILL IN BLANKS TO CONSTRUCT YOUR PART NO. — Example $\boxed{T}$ $\boxed{G}$ $\boxed{8}$ $\boxed{3}$

When ordering
↓ SPECIFY
Model No.
Frequency
Supply Vo.

☐	☐	☐	☐
Freq. Stab. **S, T or V**	**Output Spec.** **G, H or J**	**Dev./Lin.** **6, 7, 8 or 9**	**Size** **1, 2, 3, 4**

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TWX: 910-237-1680 / CABLE: AKUTRONX

accutronics oscillators

For further information call (814) 838-3571 or TWX 510-696-6886
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE/PENNSYLVANIA 16508

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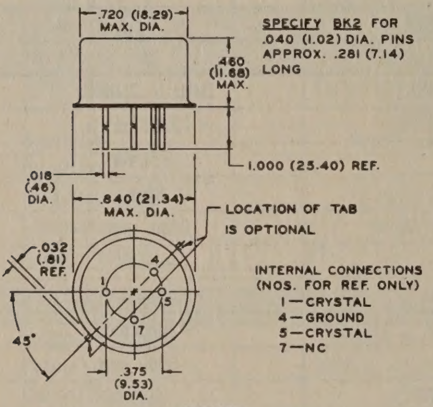
first name in frequency control

CRYSTALS

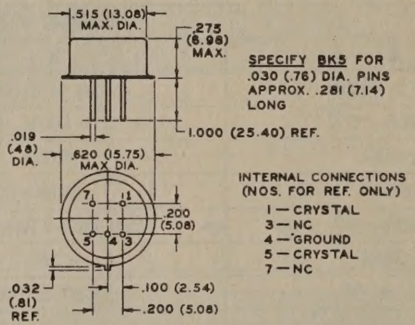
Coldweld Vacuum Sealed

Transistor Case Styles

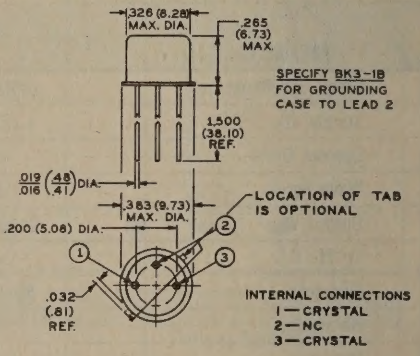
UNMATCHED PERFORMANCE DURING EXTREME SHOCK AND VIBRATION, COMBINED WITH SUPERIOR AGING AND HIGH RELIABILITY HAVE FIRMLY ESTABLISHED THIS STYLE AS FIRST CHOICE IN ADVANCED MILITARY AND SPACE SYSTEMS. EASE OF MOUNTING, FORM COMPATIBILITY AND MODERATE COST ALSO ATTRACT QUALITY COMMERCIAL USAGE.


.720 (18.29) MAX. DIA.
SPECIFY BK2 FOR .040 (1.02) DIA. PINS APPROX. .281 (7.14) LONG
.460 (11.68) MAX.
1.000 (25.40) REF.
.018 (.46) DIA.
.840 (21.34) MAX. DIA.
LOCATION OF TAB IS OPTIONAL
.032 (.81) REF.
1
4
5
7
45°
.375 (9.53) DIA.
INTERNAL CONNECTIONS (NOS. FOR REF. ONLY)
1—CRYSTAL
4—GROUND
5—CRYSTAL
7—NC

BK2W


.515 (13.08) MAX. DIA.
.275 (6.98) MAX.
SPECIFY BK5 FOR .030 (.76) DIA. PINS APPROX. .281 (7.14) LONG
1.000 (25.40) REF.
.019 (.48) DIA.
.620 (15.75) MAX DIA.
7
1
5
4
3
.200 (5.08)
.032 (.81) REF.
.100 (2.54)
.200 (5.08)
INTERNAL CONNECTIONS (NOS. FOR REF. ONLY)
1—CRYSTAL
3—NC
4—GROUND
5—CRYSTAL
7—NC

BK5W (TO-8)


.326 (8.28) MAX. DIA.
.265 (6.73) MAX.
SPECIFY BK3-1B FOR GROUNDING CASE TO LEAD 2
1.500 (38.10) REF.
.019/.016 (.48/.41) DIA.
.383 (9.73) MAX. DIA.
LOCATION OF TAB IS OPTIONAL
.200 (5.08) DIA.
①
②
③
.032 (.81) REF.
INTERNAL CONNECTIONS
1—CRYSTAL
2—NC
3—CRYSTAL

BK3 (TO-5)

BLILEY TYPE	FREQUENCY RANGE (MHz)	FREQ. TOL. (%) vs TEMP. RANGE (°C) (INCLUDES CALIBRATION AT +25°C)				MAX. SERIES RES. (Ω)	CRYSTAL CUT-AT (MODE)	TYPICAL DRIVE LEVEL (mW)
		0 TO 50	0 TO 70	−40 TO +70	−55 TO +105			
BK2W	.86 – .99	±.0015	±.002	±.0025	±.003	300	FUNDAMENTAL	1.0
	1 – 1.9					150		
	2 – 2.9					40		
	3 – 6.0					25		
BK5W	2 – 2.9					250		
	3 – 3.9					120		
	4 – 4.9					60		
	5 – 5.9					30		
	6 – 7.9					20		
	8 – 15					10		
BK3	7 – 9.9					40		0.5
	10 – 25					25		
	25 – 75					40	3RD	
	75 – 125					60	5TH	
	125 – 150					100	7TH	

	BK2W	BK3	BK5W
MIL-H-10056 HOLDER DESIGNATION	HC-40/U	HC-35/U	HC-37/U
AGING GUIDELINES: 1ST MONTH FOLLOWING YEAR	 2 PPM 1.5 PPM	 2 PPM 3 PPM	 2 PPM 2 PPM
VIBRATION	20 G FROM 10—2000 Hz		
SHOCK	150 G FOR 7 MS		

QUARTZ CRYSTALS • PACKAGED CRYSTAL OSCILLATORS • CRYSTAL FILTERS • SOLID ULTRASONIC DELAY LINES • CRYSTAL AND COMPONENT OVENS

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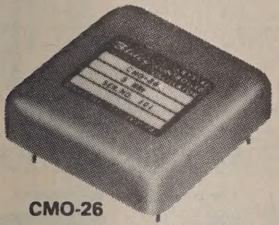
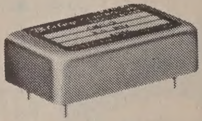
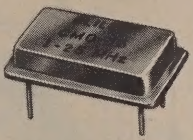
CRYSTAL OSCILLATORS

General Purpose-Clock Oscillators

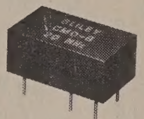
Designed with primary emphasis on Quality — Backed up by Top Technology

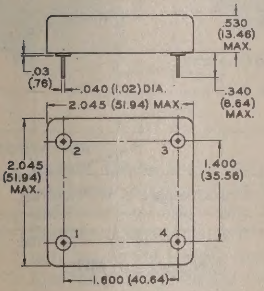

CMO-26


CMO-3

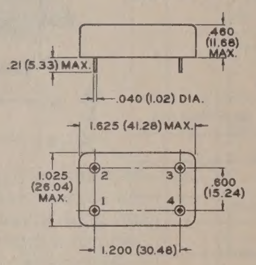

CMO-76

CMO-32C

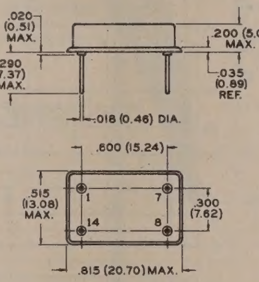

CMO-8


.530 (13.46) MAX.
.03 (.76)
.040 (1.02) DIA.
.340 (8.64) MAX.
2.045 (51.94) MAX.
2.045 (51.94) MAX.
1.400 (35.56)
1.600 (40.64)
1
2
3
4

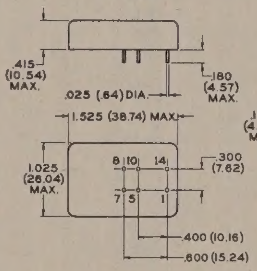
1-NEG. OSC. & RF GND.
2-VOLTAGE CONTROL OR N.C.
3- +5 Vdc
4-OUTPUT


.460 (11.68) MAX.
.21 (5.33) MAX.
.040 (1.02) DIA.
1.625 (41.28) MAX.
1.025 (26.04) MAX.
.600 (15.24)
1.200 (30.48)
1
2
3
4

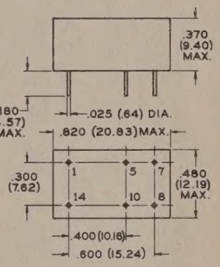
1 - NEG. OSC. & RF GND.
2 - N.C.
3 - +5 Vdc
4 - OUTPUT


.020 (0.51) MAX.
.200 (5.08) MAX.
.290 (7.37) MAX.
.035 (0.89) REF.
.018 (0.46) DIA.
.600 (15.24)
.515 (13.08) MAX.
.300 (7.62)
.815 (20.70) MAX.
1
7
14
8

1 - N.C.
7 - GND.
8 - OUTPUT
14 - +5 Vdc
(14 PIN DIP COMPATIBLE)


.415 (10.54) MAX.
.025 (.64) DIA.
.180 (4.57) MAX.
1.525 (38.74) MAX.
1.025 (26.04) MAX.
.300 (7.62)
8 10 14
7 5 1
.400 (10.16)
.600 (15.24)

1, 5, 10 - N.C.
7 - COMMON
8 - OUTPUT
14 - +5 Vdc
(14 PIN DIP COMPATIBLE)


.370 (9.40) MAX.
.180 (4.57) MAX.
.025 (.64) DIA.
.820 (20.83) MAX.
.300 (7.62)
.480 (12.19) MAX.
1 5 7
14 10 8
.400 (10.16)
.600 (15.24)

1, 5, 10 - N.C.
7 - GROUND
8 - OUTPUT
14 - +5 Vdc
(14 PIN DIP COMPATIBLE)

BLILEY TYPE	FREQUENCY RANGE	FREQ. TOL. (%) vs. TEMP. RANGE (ºC) (INCLUDES CALIBRATION AT +25ºC)				OUTPUT
		0 TO 50	0 TO 70	−20 TO +70	−40 TO +70	
CMO-26	1 Hz — 4 kHz	±.004	±.006	±.008	±.01	TTL LOGIC
	1 kHz — 50 kHz	±.003	±.005	±.007	±.009	
	50 kHz — 100 MHz	±.001	±.0012	±.0015	±.002	
	800 kHz — 150 MHz					SINE WAVE
CMO-3	20 kHz — 50 kHz	±.003	±.005	±.007	±.009	TTL LOGIC
	50 kHz — 25 MHz	±.001	±.0012	±.0015	±.002	
	3 MHz — 150 MHz					SINE WAVE
CMO-76	1 MHz — 25 MHz	—	±.01	—	—	TTL LOGIC
CMO-32C	1 MHz — 100 MHz	±.0025	±.005	±.01	—	
CMO-8	4 MHz — 100 MHz					

GENERAL SPECIFICATIONS

SUPPLY: +5 VDC
OUTPUT: TTL LOGIC "1" +2.4 V MIN., LOGIC "0" +0.4 V MAX.
SYMMETRY: 50/50 ±10%
LOAD: 10 TTL GATES
SINE WAVE (1000Ω LOAD 0.7 V RMS 800 kHz — 25 MHz
(50Ω LOAD 0.2 V RMS 1 — 150 MHz
CMOS LOGIC AVAILABLE AS A CUSTOM OPTION
FREQ. ADJUST: ELECTRICAL OR MECHANICAL AVAILABLE ON CMO 26 AS A CUSTOM OPTION
HERMETIC ENCLOSURES: CMO-26, CMO-3 AND CMO-76

QUARTZ CRYSTALS • PACKAGED CRYSTAL OSCILLATORS • CRYSTAL FILTERS • SOLID ULTRASONIC DELAY LINES • CRYSTAL AND COMPONENT OVENS

BULOVA® Crystals / 1 kHz to 185 MHz

1 kHz to 1 MHz

Cuts: JT • H (+5° Flexural) • NT
E (+5° Extensional) D • DT Bar

HOLDERS

Cuts	Frequency Range, kHz	Bulova No.	Mil No.	Seal[2]
JT	1-15	71	HC-13/U	S
	3-15	73	HC-13/U	S
	4-15	124	HC-37/U(1.5")	C
	4-15	118	HC-35/U(1.5")	C
	4-15	131	HC-41/U	C
	10-15	122	HC-37/U(.6")	C
	10-15	117	HC-35/U(.6")	C
H +5° Flexure Mode	10-90	71	HC-13/U(1")	S
	15-90	73	HC-13/U	S
	15-90	124	HC-37/U(1.5")	C
	15-90	118	HC-35/U(1.5")	C
	15-90	131	HC-41/U	C
	45-90	117	HC-35/U(1")	C
	45-90	122	HC-37/U(.6")	C
NT	8-200	71	HC-13/U	S
	15-200	73	HC-13/U	S
	20-200	124	HC-37/U(1½")	C
	20-200	118	HC-35/U(1½")	C
	20-200	131	HC-41/U	C
	45-200	117	HC-35/U(1")	C
	45-200	122	HC-37/U(.6")	C
	85-200	70	HC-6/U	S
	85-200	78	HC-33/U	S
	85-200	113	HC-36/U	C
E +5° Extensional Mode	50-300	71	HC-13/U (1.75 to 3.50)	S
	85-300	73	HC-13/U	S
	100-300	118	HC-35/U(1½)	C
	100-300	131	HC-41/U	C
	162-300	117	HC-35(1")	C
	185-300	70	HC-6/U	S
	185-300	78	HC-33/U	S
	235-300	113	HC-36/U	C
	240-300	130	HC-39/U	C
DT	80-400	90	HC-21/U	S
	150-400	70	HC-6/U	S
	150-400	78	HC-33/U	S
	200-400	113	HC-36/U	C
	200-400	130	HC-39/U	C
	325-400	116	HC-35/U(.6")	C
DT Bar	150-1000	73	HC-13/U	S
	180-1000	131	HC-41/U	C
	250-1000	122	HC-37/U(.6")	C
	285-1000	70	HC-6/U	S
	285-1000	78	HC-33/U	S
	300-1000	113	HC-36/U	C
	300-1000	130	HC-39/U	C
	440-1000	75	HC-32/U	S
	450-1000	116	HC-35/U(.6")	C
	800-1050	115	HC-35/U	C

Notes 1. *Numbers in parentheses after MIL type number indicates height or height range of modified can.*

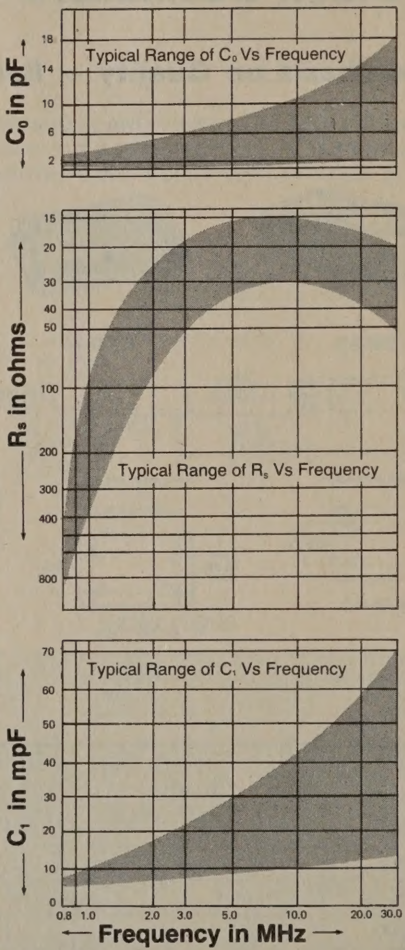
2. *Seals. "S" = solder sealed, "C" = coldweld.*

Typical Performance

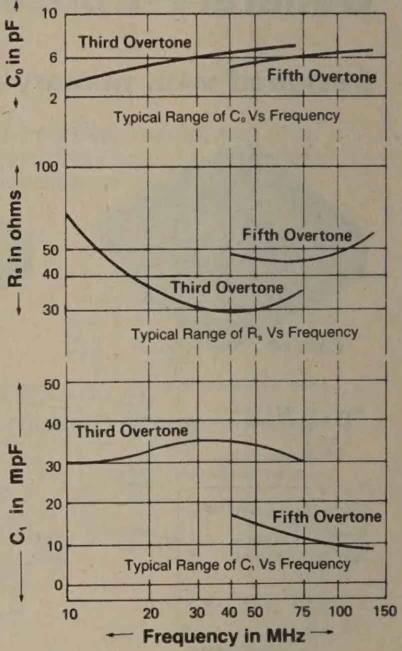
		E	DT	DT Bar	JT	H	NT
Temp. Range	-40° +85°C (MIL)	±.015%	±.01%	±.01%	±.02%	±.1%	±.01%
	-10° +60°C (Com.)	±.008%	±.005%	±.005%	±.01%	±.05%	±.005%
Drive Level	in Milliwatts	1	1	1	.1	.1	.1
Freq. Stability	P.P.M./mo.						
Coldweld		0.5	0.1	0.1	0.5	0.5	0.1
Solder Seal		2.0	1.0	1.0	2.0	1.0	1.0

ATs for Fundamental and Overtone Frequencies

FUNDAMENTAL MODE PARAMETERS
Ranges of C_0, C_1 & R_S vs. Frequency



OVERTONE MODE PARAMETERS
Ranges of C_0, C_1 & R_S vs. Frequency



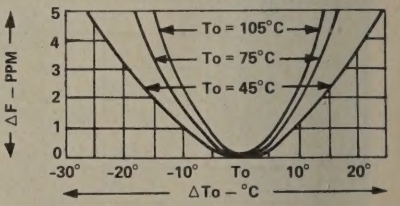
TYPICAL PERFORMANCE

Frequency tolerance: as tight as ± .002% from -55°C to +105°C, .0003% from -10°C to +60°C with reference to +25°C

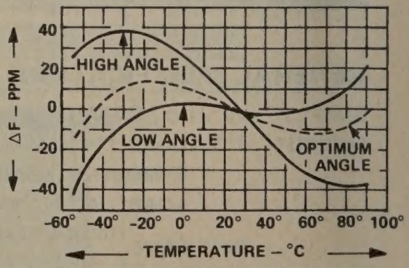
Frequency Stability: Aging, 5 parts in 10^6/30 days to 4 parts 10^8/30 depending upon package, frequency and temperature

Drive Level: 0.01mW to 10mW

AT CUT, ΔF vs. To FOR OVEN UNITS
To = Zero Temperature Coefficient Point



AT CUT, ΔF IN PPM vs. Δ°C
Coefficients, Non-ovenized Applications



AT CUT HOLDERS

BULOVA NO.	MIL NO.	SEAL[2]
70	HC-6/U	S
75	HC-32/U	S
78	HC-33/U	S
79	HC-17/U	S
80	HC-18/U	S
83	HC-25/U	S
91	HC-11A/U	S
92	—	S
95	—	S
110	HC-43/U	C
111	HC-24/U	C
112	HC-47/U	C
113	HC-36/U	C
115	HC-35/U	C
120	HC-37/U	C
121	—	C
130	HC-39/U	C
77	HC-27/U	G

BULOVA

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

FREQUENCY CONTROL
PRODUCTS

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for Full Spec Bulletin

BULOVA® Oscillators/ CRYSTAL and FORK

Crystal: PCOXOs, TCXOs and XOs

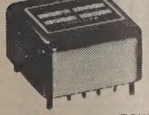
HIGH STABILITY

PCOXO

The high frequency stability of these oscillators results from housing a high precision crystal and an oscillator circuit with AGC to maintain low constant crystal drive in a stable DC proportional control oven.

	MILITARY		INDUSTRIAL	
MODEL	PCOXO-101	PCOXO-106	PCOXO-3	PCOXO-5
Frequency Range	1.0 to 10MHz	30 to 100 MHz	1.0 to 10MHz	1.0, 3.0 or 5.0MHz
Temp. Range	−55°C to +70°C	−55°C to+70°	0°C to +60°C	0°C to +60°C
Stability				
Temp. Range	±1PP10^{8}	±5PP10^{7}	4PP10^{10}/°C	2PP10^{10}/°C
Aging per day	1PP10^{9}	5PP10^{8}	5PP10^{9}	5PP10^{10}
Line Voltage ±10°	±5PP10^{9}	±5PP10^{7}	±5PP10^{9}	±5PP10^{9}
Load ±10%	±1PP10^{9}	±5PP10^{7}	±1PP10^{9}	±1PP10^{8}
Warm-up at +25°C after 1 hr.	±3PP10^{8}	±1PP10^{7}	±3PP10^{8}	±3PP10^{8}
Output	.5VRMS (min)	1 MW (Min)	1VRMS (min)	1VRMS(min)
Load	50 ohms	50 ohms	1K ohms	1K ohms
Input Voltage	+28VDC	+28VDC	+28VDC	+28VDC
Turn on Power	18W	18W	12W	12W
Power at 25°C	4.5W (Typ)	4.5W (Typ)	4.2W (Typ)	4.2W (Typ)
Size	2″ x 2″ x 4″	2″ x 2″ x 4″	2″ x 2″ x 4″	2″ x 2″ x 4″

TEMPERATURE COMPENSATED


TCXO-2
TCXO-50

TCXO-1
TCXO-100

Bulova temperature compensated crystal oscillators employ a computer selected and optimized variable capacitance diode and thermistor compensation network to maintain frequency stability over wide temperature ranges, without the use of an oven.

MODEL	TCXO-1	TCXO-2	TCXO-50	TCXO-100
Frequency Range	3MHz to 12MHz	3, 4 or 5MHz	1MHz to 12MHz	1MHz to 12MHz
Frequency Adjustment Range	±3PPM	±0.3PPM	±3PPM	±3PPM
Frequency Stability	±1PPM over Temp. Range of −40°C to +70°C	±0.2PPM over Temp. Range of −40°C to +75°C	±0.5PPM over Temp. Range of 0°C to +60°C	±2.5PPM over Temp. Range of 0°C to 60°C
Aging Rate per yr.	±1PP10^{6}	±1PP10^{6}	±1PP10^{6}	±1PP10^{6}
Power Input	12VDC ±2% at 150mw	12VDC ±5% at 50mw	12 and 5 VDC	12 and 5 VDC
Output	1VP-P into 1K ohm	125 mv RMS into 50 ohms	T^{2}L	T^{2}L
Size	2″ x 2″ x 0.5″	2″ x 2″ x 1″	2″ x 2″ x 1″	2″ x 2″ x 0.5″
Weight	3 oz.	5 oz.	5 oz.	3 oz.

COMPUTER CLOCK

XO-140
XO-14

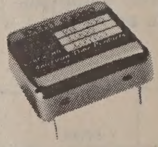
XO-304
XO-302

These computer clock oscillators feature crystal stability, printed circuit board mounting and outputs directly compatible with DTL or TTL loads. 14 pin dual in-line configuration.

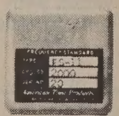
MODEL	XO-140	XO-304	XO-14	XO-302
Frequency Range	8KHz to 1MHz	4MHz to 25MHz	8KHz to 1MHz	4MHz to 25MHz
Temp. Range	−40°C to +70°C	−55°C to +85°C	0°C to +60°C	0°C to +60°C
Frequency Stability	±120PPM over Temp. Range	±50PPM over Temp. Range	±65PPM over Temp. Range	±25PPM over Temp. Range
Input Voltage	+5VDC	+5VDC	+5VDC	+5VDC
Output	Logic Zero: 0 to .4V Logic One: 2.6 to 5V	Logic Zero: 0 to .4V Logic One: 2.6 to 5V	Logic Zero: 0 to .4V Logic One: 2.6 to 5V	Logic Zero: 0 to .4V Logic One: 2.6 to 5V
Size	1″ x 2″ x .5″	.8″ x .5″ x .4″	1″ x 2″ x .5″	.8″ x .5″ x .4″

LOW FREQUENCY

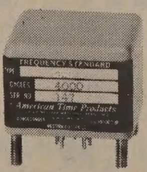
MICROPOWER



P.C. BOARD



SIMULTANEOUS MULTIPLE OUTPUTS



WIDE RANGE MODULAR

MODEL	FS 200	FS 11, FS 11-1 FS 11-F	FS 300 or FS 400	FS 32, FS 32-1 FS 32-F
Frequency, Hz	360 to 1000 Hz	400 Hz to 50 kHz	60,120,240,480 50,100,200,400	240 Hz to 100 kHz
Frequency Accuracy	up to ±.01%	up to ±..02%	up to ±.002%	up to ±.002%
Temperature Range		FOR SOME ACCURACIES AS MUCH AS −65°C to + 125°C		
Input	1.5 V DC at 6 to 20 microamps	STANDARD 28 V DC (AVAILABLE 3 to 40 V DC)		
Output	0.1 volt	SINE, SQUARE WAVE or COMPATIBLE with LOGIC		
Load	500 K ohms	10 K OHMS to 500 K OHMS or LOGIC CIRCUITRY		
Size	1-5/16″ x 1-5/16″ x 3/8″	1-1/2″ x 1-1/2″ x 3/8″	1-1/2″ x 1-1/2″ x 1-3/16″	1-1/2″ x 1-1/2″ x 1-3/16″
Weight	1 ounce	1-1/2 ounces	2-1/2 ounces	2-1/2 ounces

VERY LOW FREQUENCY

1.5 Hr/Period to 25kHz

Models:
- OA1, CMOS Compatible
- OA2, DTL & TTL Compatible
- OA3, Resistor Loading

Typical Temperature Accuracy
- 15° to 35° C, ± 0.02%
- 0° to 65° C, ± 0.1%
- −55° to 85° C, 0.2%

BULOVA FREQUENCY CONTROL PRODUCTS

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

NEED MORE INFO?
Call or Write
for Full Spec Bulletin

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

CTS KNIGHTS, INC.

SUBSIDIARY OF CTS CORPORATION. ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

CRYSTALS

SOLDER SEAL CRYSTALS 1 MHz — 180 MHz

Inexpensive solder seal crystals are ideal for applications in which long-term stabilities in the range of 5-10 ppm/year are acceptable. CTS Knights solder seal crystals are used in digital clock circuits, test and measuring instruments and commercial as well as military communications equipment. CTS Knights' test lab is government approved for qualification testing to military specification MIL-C-3098F.

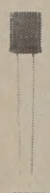
Data shown in the table and graphs applies to typical crystal designs. CTS Knights will, at no additional cost, design a crystal for your specific oscillator requirements. When ordering a crystal, the following minimal specifications must be given: 1) Frequency, 2) Calibration Tolerance at 25°C (or Oven Temperature), 3) Mode (Fundamental or Overtone), 4) Load Capacitance, 5) Holder.

CTS Knights is QPL approved on the following Military Crystal types:

CR-5A/U
CR-6A/U
CR-8A/U
CR-18A/U
CR-19A/U
CR-52A/U
CR-54A/U
CR-55A/U
CR-56A/U
CR-58A/U
CR-60A/U
CR-64/U
CR-67A/U
CR-72/U
CR-75/U
CR-76A/U
CR-77/U
CR-78A/U
CR-79/U
CR-80/U
CR-81/U
CR-82/U
CR-83/U
CR-89/U
CR-97/U
CR-106/U
CR-111/U
CR-114/U
CR-117/U
CR-124/U
CR-128/U
CR-139/U
CR-140/U
CR-141/U
CR-157/U

H3

H17


H3W

CTS Holder	Frequency Range	Calibration Tolerance @ 25°C	Stability Over Temp. Range†	Temp. Range‡	Unwanted Modes	Drive	Modes	Dimen. Outline	Approx. Price 10 pc.	Approx. Price 100 pc.
H3/H3W	2.4-4.0 MHz	±.005% through .1%	±.01%	−30 to +85°C	−6 dB min.	10 mw	Fund.	Fig. 1	Contact factory	
H3/H3W	3.3-10 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	10 mw	Fund.	Fig. 1	4.80	2.16
H3/H3W	10-25 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	5 mw	Fund.	Fig. 1	4.25	1.90
H3/H3W	17-42 MHz 43-75 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	2 mw	3rd	Fig. 1	4.10 4.60	1.80 2.20
H3/H3W	40-105 MHz 106-125 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	2 mw	5th	Fig. 1	4.85 7.15	2.20 3.20
H3/H3W	110-180 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	2 mw	7th	Fig. 1	6.80	3.00
H5/H5W	1.8-2.79 MHz 3-5 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	10 mw	Fund.	Fig. 2	10.00 6.00	4.50 2.75
H17/17W	1-2.99 MHz 3-10 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	10 mw	Fund.	Fig. 3	10.00 6.00	4.50 2.75
H17/H17W	10-18.99 MHz 19-25 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	5 mw	Fund.	Fig. 3	4.30 5.25	1.85 2.35
H17/H17W	20-51 MHz 52-60 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	2 mw	3rd	Fig. 3	4.46 5.46	2.00 2.45
H17/H17W	60-75 MHz	±.001% through .1%	±.002%	−30 to +70°C	−6 dB min.	2 mw	5th	Fig. 3	6.30	2.85

† Stability over temperature measured from frequency at 25°C.

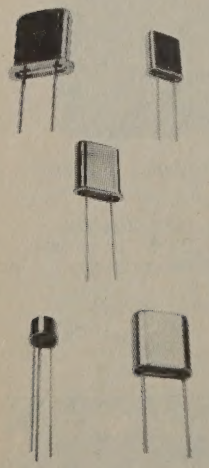
‡ Temperature ranges of −55°C to +105°C, −30°C to +60°C, 0 to 70°C and 0 to 50°C are available.

HIGH STABILITY PRECISION COLDWELD CRYSTALS 1 MHz — 150 MHz

Precision crystals are used in applications where long term aging of better than 5 ppm/year is required. The aging rate shown in the table below is after 30 days of operation at a constant temperature.

Frequency stability over temperature is tailored to customer's specific need. Frequency deviation over temperature may be held within ±5 ppm of the characteristic at curve.

Pricing varies with crystal parameter specifications. Contact CTS Knights for specific pricing.



CTS Holder	Frequency Range	Calibration Tolerance @ 25°C	Aging	Drive	Mode	Dimensional Outline
K2W	10-25 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	FUND.	FIG. 4
K2W	30-150 MHz	±10x10^{-6}	2x10^{-8}/day 3.0x10^{-6}/yr.	.1 mw	OVERTONE	FIG. 4
K3/K3W	8-25 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	FUND.	FIG. 5
K3/K3W	24-75 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	3RD	FIG. 5
K3/K3W	40-125 MHz	±10x10^{-6}	2x10^{-8}/day 3.0x10^{-6}/yr.	.1 mw	5TH	FIG. 5
K5/K5W	3-25 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	FUND.	FIG. 6
K17/K17W	1-10 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	FUND.	FIG. 7
K17/K17W	4-30 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	OVERTONE	FIG. 7
T05	10-25 MHz	±10x10^{-6}	1x10^{-8}/day 1.5x10^{-6}/yr.	.1 mw	FUND.	FIG. 8
T05	30-150 MHz	±10x10^{-6}	2x10^{-8}/day 3.0x10^{-6}/yr.	.1 mw	OVERTONE	FIG. 8
K39	1-20 MHz	±10x10^{-6}	5x10^{-8}/day 2.5x10^{-6}/yr.	2 mw	FUND.	FIG. 9

CTS KNIGHTS, INC., Dept. EM, 400E Reimann Avenue, Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

CTS KNIGHTS, INC.

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SPECIALISTS IN FREQUENCY MANAGEMENT

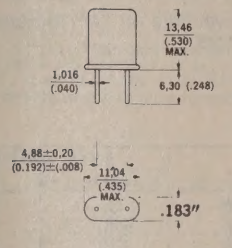
CRYSTALS

SOLDER SEAL CRYSTALS
OUTLINE DRAWINGS

Dimensions shown are maximum unless otherwise noted.

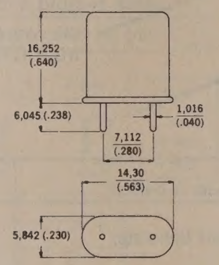
KEY = mm / (inches)

Fig. 1
H3 (HC 25/U)


13,46
(.530)
MAX.
1,016
(.040)
6,30 (.248)
4,88±0,20
(0.192)±(.008)
11,04
(.435)
MAX.
.183"

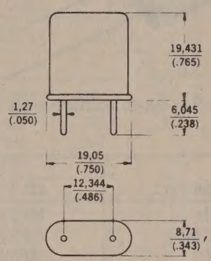
H3W (HC 18/U) 38,1 (1.5) LEADS 0,432 (.017) DIA.

Fig. 2
H5 (HC 32/U)


16,252
(.640)
6,045 (.238)
1,016
(.040)
7,112
(.280)
14,30
(.563)
5,842 (.230)

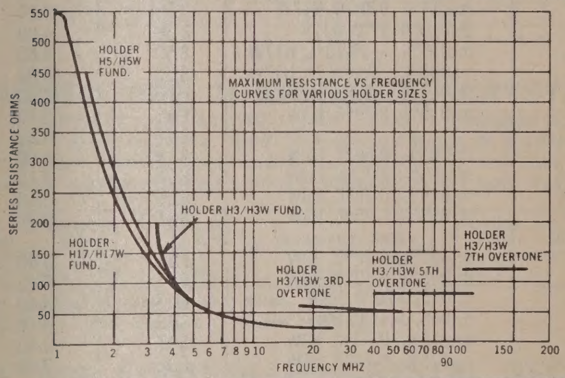
H5W 38,1 (1.5) LEADS 0,762 (.030) DIA.

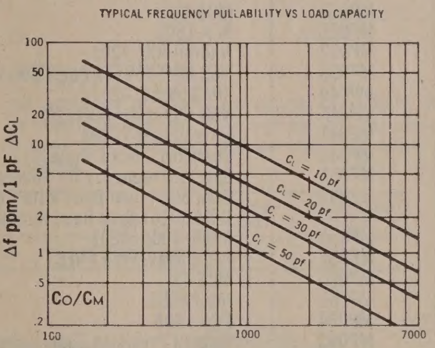
Fig. 3
H17 (HC 6/U)


19,431
(.765)
1,27
(.050)
6,045
(.238)
19,05
(.750)
12,344
(.486)
8,71
(.343)

H17W (HC 33/U) 38,1 LEADS (1.5) LEADS 0,762 DIA. (.030) DIA.

PERFORMANCE CURVES SOLDER SEAL CRYSTALS





TYPICAL Co/CM RATIOS
FUNDAMENTAL

Freq.	Co/CM
1.0 - 1.399 MHz	310
1.4 - 15 MHz	275
15 - 25 MHz	225
3RD OVERTONE	
17 - 29.999 MHz	2100
30 - 54 MHz	2250
5TH OVERTONE	
40 - 90 MHz	6500

PRECISION COLDWELD CRYSTALS
OUTLINE DRAWINGS

KEY = mm / (inches)

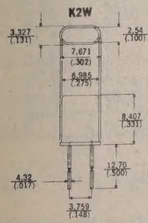

K2W
3,327
(.131)
2,54
(.100)
7,671
(.302)
6,985
(.275)
8,407
(.331)
12,70
(.500)
4,32
(.017)
3,759
(.148)

Fig. 4

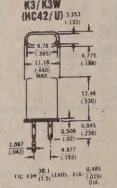

K3/K3W
(HC42/U)
13,46
(.530)
FIG K3W 38,1 (1.5) LEADS

Fig. 5

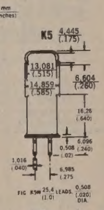

K5
4,445
(.175)
13,081
(.515)
6,604
(.260)
14,859
(.585)
16,25
(.640)
6,985
(.275)
FIG K5W 25,4 (1.0) LEADS

Fig. 6

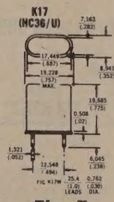

K17
(HC36/U)
7,163
(.282)
17,449
(.687)
19,228
(.757)
MAX.
19,685
(.775)
FIG H17W 25,4 (1.0) LEADS 0,762 (.030) DIA.

Fig. 7

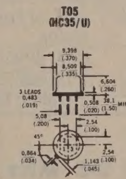

T05
(HC35/U)
3 LEADS
45°

Fig. 8

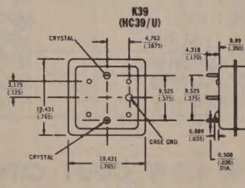
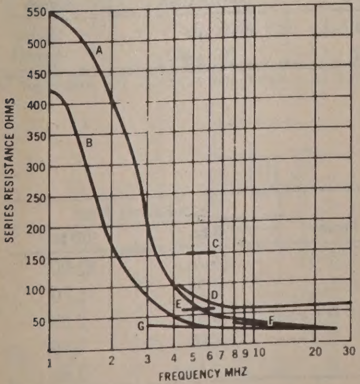
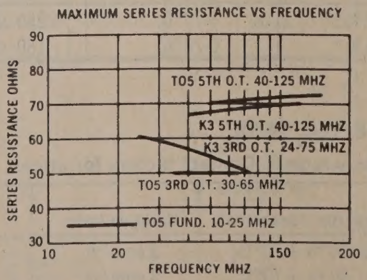

K39
(HC39/U)
CRYSTAL
CASE GRD
CRYSTAL
19,431
(.765)

Fig. 9

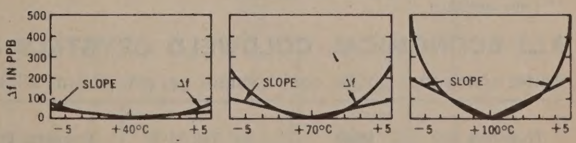
PERFORMANCE CURVES





Legend
A—K39 1-20 MHz
B—K17 1-10 MHz
C—K17 4.8-6.5 MHz
D—K17 4-30 MHz
E—K17 4.5-6.5 MHz
F—K3 8-20 MHz
G—K5 3-25 MHz

STABILITY VS. TEMPERATURE



$\frac{\Delta f}{f}$ = 3ppb/°C²ΔT² Slope = 6ppb/°CΔT

$\frac{\Delta f}{f}$ = 10ppb/°C²ΔT² Slope = 20ppb/°CΔT

$\frac{\Delta f}{f}$ = 20ppb/°C²ΔT² Slope = 40ppb/°CΔT

NOTE: Curves assume no thermal shock due to oven cycling.

CTS KNIGHTS, INC.

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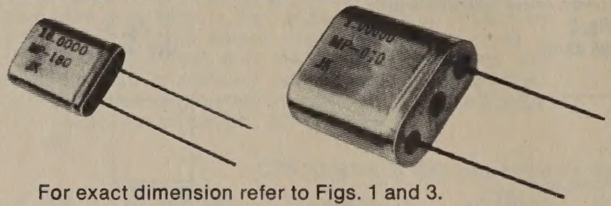
STANDARD MICROPROCESSOR CRYSTALS



For exact dimension refer to Figs. 1 and 3.

CTS Knights microprocessor crystals feature low start-up resistance. Reliability is assured by the use of mil-approved manufacturing processes. Final frequency calibration with gold and silver guarantees outstanding long-term stability.

Microprocessor crystals are available as "off the shelf" items from CTS authorized distributors.

Frequency	CTS P/N	Microprocessor or Clock IC	Specifications	Approximate Price	
				10 pcs.	100 pcs.
1.0 MHz	MP010	6800/S6860	±.02%, 0-70°C, H17W	9.80	5.50
1.8432 MHz	MP018	MC14411 Baud Rate Generator	±.02%, 0-70°C, H17W	9.80	5.50
2.0 MHz	MP020	F-8/CPU 3850	±.015%, 0-70°C, H17W	8.50	4.80
2.097152 MHz	MP021	MM5378 MM5379 Auto Clocks	±.015%, 0-70°C, H17W	8.50	4.80
2.4576 MHz	MP024	34702 Bit Rate Generator	±.015%, 0-70°C, H17W	8.50	4.80
2.667 MHz	MP026	NSC IPC-16A/5200(STE)	±.015%, 0-70°C, H17W	8.50	4.80
3.0 MHz	MP030	MCS 48	±.015, 0-70°C, H17W	8.50	4.80
3.2 MHz	MP031	RCA 1802	±.015%, −20-70°C, H17W	8.50	4.80
3.2768 MHz	MP032	Intersil ICM 7205	±.008%, −20-70°C, H17W	8.50	4.80
3.579545 MHz	MP036	NSC MM5369 (TV Color Burst)	±.015%, 0-70°C, H17W	8.50	4.80
4.0 MHz	MP040	4040/4004/4201	±.015%, 0-70°C, H3W	6.15	3.40
4.0 MHz	MP04A	NSC IPC-16A/5000(STE)		6.15	3.40
4.194304 MHz	MP041	Intersil ICM 7038A	±.007%, 0-50°C, H3W	6.15	3.40
4.91520 MHz	MP042	Standard Clock Frequency	±.015%, 0-70°C, H3W	6.15	3.40
5.0 MHz	MP05A	Special Frequency for Several MPU's	±.015%, 0-70°C, H3W	6.15	3.40
5.0688 MHz	MP050	COM 5016 Dual Baud Rate Generator COM 5016T Dual Baud Rate Generator	±.015%, 0-70°C, H3W	6.15	3.40
5.185 MHz	MP051	4040/4004/4201	±.015%, 0-70°C, H3W	6.15	3.40
5.7143 MHz	MP057	PACE (Max. Freq.) NFC	±.015%, 0-70°C, H3W	6.15	3.40
6.0 MHz	MP060	MCS 48	±.015, 0-70°C, H3W	6.15	3.40
6.144 MHz	MP061	Intel 8085	±.015, 0-70°C, H3W	6.15	3.40
6.4 MHz	MP064	RCA 1803	±.015%, 0-70°C, H3W	6.15	3.40
6.5536 MHz	MP065	Intersil Precision Timer Crystal ICM 7045	±.015%, 0-70°C, H3W	6.15	3.40
8.0 MHz	MP080	Signetics 8x300	±.015%, 0-70°C, H3W	6.15	3.40
10.0 MHz	MP100	Special Frequency for Several MPU's	±.015%, 0-70°C, H3W	4.95	2.75
18.00 MHz	MP180	8080/8008/8224	±.015%, 0-70°C, H3W	4.95	2.75
18.432 MHz	MP184	8080/8008/8224	±.015%, 0-70°C, H3W	4.95	2.75
20.0 MHz	MP200	Special Frequency for Several MPU's	±.015%, 0-70°C, H3W	4.94	2.75
22.1184 MHz	MP221	8080A	±.015%, 0-70°C, H3W	5.30	3.10
27.000 MHz	MP270	Intel 8080A Series	±.015%, 0-70°C, H3W	4.95	2.75
36.000 MHz	MP360	Intel 8080A Series	±.015%, 0-70°C, H3W	4.95	2.75
48.000 MHz	MP480	T.I. Mod. TIM9904 P.N. SNLS362	±.015%, 0-70°C, H3W	4.95	2.75

E17W LOW COST CRYSTAL 2-5 MHz

For high volume applications — Aluminum cover; epoxy hermetically sealed base. Will withstand 100 hours at 95% R.H. and 60°C. with 5 ppm max. shift. Contact factory for price.

Frequency Tolerance	Calibration Tolerance	Stability vs. Temp.	Temperature Range	Maximum R	Drive Level	Figure
2.0-2.5 MHz	±.005%	±.01%*	0-70°C.	250 Ω	10 μw**	3
2.5-5.0 MHz	±.005%	±.01%*	0-70°C.	150 Ω	10 μw**	3

* ±.1%, −40°C. to +85°C. also available.
** 5 mw maximum.

KL3 ECONOMICAL COLDWELD CRYSTALS 8-160 MHz

Better specs than solder seal crystals, yet priced only slightly higher. Contact factory for prices.

Frequency MHz	Mode	Cal. Tol. 25°C.	Frequency Drift/Op. Temperature	Maximum Aging	Figure	Approximate Price	
						10 pc.	100 pc.
8- 10	FUND.	±20 ppm	±30 ppm/-30 to +70°C.	3 ppm/yr.	5	$5.75	$2.90
10- 25	FUND.	±20 ppm	±20 ppm/-30 to +70°C.	3 ppm/yr.	5	5.25	2.70
17- 75	3rd	±20 ppm	±20 ppm/-30 to +70°C.	3 ppm/yr.	5	5.45	2.85
40-125	5th	±20 ppm	±20 ppm/-30 to +70°C.	5 ppm/yr.	5	8.00	4.00
110-160	7th	±20 ppm	±20 ppm/-30 to +70°C.	5 ppm/yr.	5	7.75	3.80

CTS KNIGHTS, INC.

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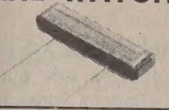
CRYSTALS/VCXO's

32.768 KHz WATCH CRYSTALS/CRYSTAL OSCILLATORS



This watch crystal design incorporates major advances in cost reduction and miniaturization. A ceramic base and epoxy hermetic seal simplify assembly and eliminate the expensive cold weld package. Superior shock performance is achieved with the aid of special conical feed-through holes in the base.

CTS Holder	Size, Max. (Inches)	Frequency	Calib. Tol. @ 25°C	Turning Point	Operating Temp. Range	Stability vs. Time	Typical Series Resistance†	Load Cap.§	Stability vs. Temp. Δf/f‡	Drive Level
Tx4	.500x.075x.140	32.768 KHz	$\pm 40 \times 10^{-6}$	27°C ±7°C	−10 to +60°C	$\pm 5 \times 10^{-6}$/yr.	20K Ohms	10-25 pF	.04 ppm/Δ°C)²	1 μW

* $\pm 30 \times 10^{-6}$ to $\pm 100 \times 10^{-6}$ tolerances available.
† Resistances shown are typical values at series resonance.
§ Load Capacity of 4-9 pf & 26-60 pf available.
‡ Δ°C with reference to turning point temperature.

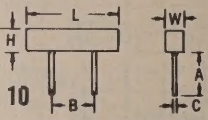
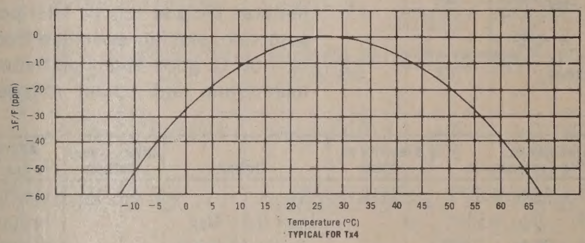


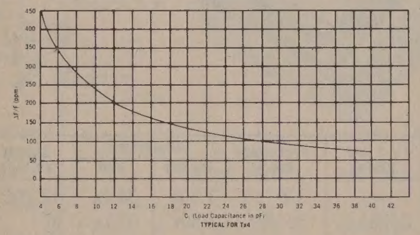
Fig. 10

TYPICAL FOR Tx4

Dim.	Inches	mm	Dim.	Inches	mm
L Max.	.500	12.700	A	.425	10,795
W Max.	.075	1,905	B	.250	6,350
H Max.	.140	3,556	C	.005	,127

Approximate Price	
10 pcs	100 pcs
4.50	2.45





TEMPERATURE COMPENSATED CRYSTALS (TCX)

The temperature compensated crystal (TCX) is designed to give good stability over a broad temperature range at a minimum of cost. Typical applications are land mobile and radio telephone equipment that require a stability of ±5 ppm over an ambient temperature range of −30°C to +60°C. The TCX is easily furnished in a variety of frequencies. Extremely low power consumption makes the TCX ideal for portable applications.

CTS Holder	Frequency Range	Calib. Tol. @ 25°C	Temperature Range	Stability vs. Temp.*	Input Voltage	Drive	Load Cap.	Dimensional Outline
H17	6-25 MHz	$\pm 10 \times 10^{-6}$	−30 to +60°C	$\pm 5 \times 10^{-6}$	+9 VDC	Less than .5 mw	32 pf	Fig. 11

Approximate Price	
10 pcs	100 pcs
22.00	17.50

* Other stabilities available. Contact factory.
† Input voltage ±5%. Regulated ±1% over temperature.

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

Voltage controlled oscillators can be supplied by CTS Knights for various stability versus temperature requirements by adding oven control or temperature compensating circuitry. Contact CTS Knights for special requirements.

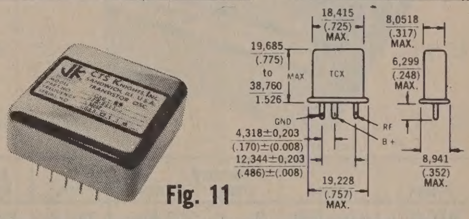

18,415
(.725)
MAX.
8,0518
(.317)
MAX.
19,685
(.775)
to
38,760
1.526
MAX
TCX
6,299
(.248)
MAX.
GND
RF
B +
4,318±0,203
(.170)±(0.008)
12,344±0,203
(.486)±(.008)
19,228
(.757)
MAX.
8,941
(.352)
MAX.

Fig. 11

Model	Frequency Range	Dimensions		Oscillator Input	Oven Input	Modulation			Stability vs. Temperature	Dimensional Outline	Approximate Price	
		Inches	mm			Input	Deviation	Linearity			10 pcs	100 pcs
JKTO-86	5-30 MHz	2.0x 2.0x.750	50,8x 50,8x19,05	12 VDC ±1	None	±3 VP.P., DC to 20 KHz	±1000 PPM	±10%	0 to +50°C $\pm 100 \times 10^{-6}$	Fig. 12	303.00	149.00
JKTO-87	10-27 MHz	2.0x 2.25x.800	50,8x 57,2x20,32	+12 & +5 VDC	+28 VDC	±3 VP.P., DC to 20 KHz	±1000 PPM	±5%	−40 to +70°C $\pm 10 \times 10^{-6}$	Fig. 13	531.00	334.00
JKTO-87	10-27 MHz	Same as Above Except Stability vs. Temperature							0 to +55°C $\pm 5 \times 10^{-6}$	Fig. 13	531.00	334.00
JKTO-100 Hybrid Design	10-25 MHz	.860x .830x.350	21,844x 21,082x8,89	12 & +5 VDC	None	±5 VP.P., DC to 10 KHz	±200 PPM	±10%	0 to +60°C $\pm 4 \times 10^{-5}$	Fig. 14	200.00	95.00

All dimensions are maximum unless otherwise noted.

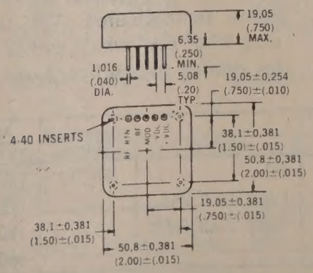

19,05
(.750)
MAX.
6,35
(.250)
MIN.
1,016
(.040)
DIA.
5,08
(.20)
TYP.
19,05±0,254
(.750)±(.010)
4-40 INSERTS
RF
MOD
VDC
38,1±0,381
(1.50)±(.015)
50,8±0,381
(2.00)±(.015)
19,05±0,381
(.750)±(.015)
38,1±0,381
(1.50)±(.015)
50,8±0,381
(2.00)±(.015)

Fig. 12
JKTO-86

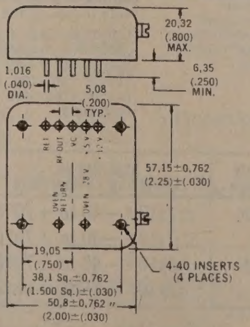

20,32
(.800)
MAX.
6,35
(.250)
MIN.
1,016
(.040)
DIA.
5,08
(.200)
TYP.
RF OUT
VC
OVEN RETURN
OVEN
57,15±0,762
(2.25)±(.030)
19,05
(.750)
38,1 Sq.±0,762
(1.500 Sq.)±(.030)
50,8±0,762
(2.00)±(.030)
4-40 INSERTS
(4 PLACES)

Fig. 13
JKTO-87

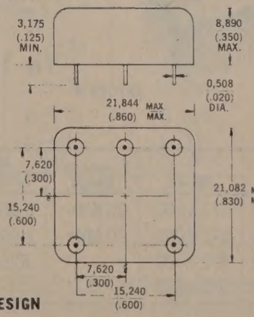

3,175
(.125)
MIN.
8,890
(.350)
MAX.
0,508
(.020)
DIA.
21,844 MAX
(.860) MAX.
7,620
(.300)
15,240
(.600)
21,082 MAX
(.830) MAX.
7,620
(.300)
15,240
(.600)

Fig. 14
JKTO-100
HYBRID DESIGN

Key: mm / inch

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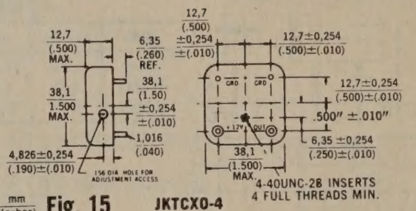
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

CRYSTAL OSCILLATORS

TEMPERATURE COMPENSATED OSCILLATORS (TCXO)

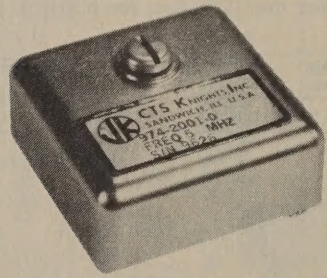
Low power requirements, high stability and excellent environmental capability characterize CTS Knights' temperature compensated crystal oscillators, CTS Knights has many years experience in developing economical TCXO designs for instrument and communications applications. Stabilities as high as ±5 x 10^{-7} over a wide temperature range are practical. CTS Knights can supply most TCXO designs with sine wave, TTL and CMOS compatible output. Special designs available. Modifications to most specifications possible. Contact CTS for feasibility.


12,7 (.500) MAX.
6,35 (.260) REF.
38,1 1.500 MAX.
38,1 (1.50) ±0,254 ±(.010)
1,016 (.040)
4,826±0,254 (.190)±(.010)
156 DIA HOLE FOR ADJUSTMENT ACCESS
12,7 (.500) ±0,254 ±(.010)
12,7±0,254 (.500)±(.010)
GRD
GRD
+12V
OUT
12,7±0,254 (.500)±(.010)
.500″ ±.010″
6,35 ±0,254 (.250)±(.010)
38,1 (1.500) MAX.
4-40UNC-2B INSERTS 4 FULL THREADS MIN.

KEY = mm/(inches) **Fig. 15** **JKTCXO-4**

JKTCXO-4. This compact temperature-compensated oscillator weighs approximately 1 ounce and is designed for mounting directly on a printed circuit board, supported by its leads. Special features include 120mw total power consumption, stability specified from −55°C to +85°C, good shock and vibration immunity and high output voltage.

Model	Series	Frequency Range	Dimensions		Supply Voltage	Stability vs. Operating Temperature	Stability vs. Time	Output	Dimensional Outline	Approx. Price	
			inches	mm						10 pcs.	100 pcs.
JKTCXO-4	—	3.2-	1.50x	38,1x	12 VDC	±2x10^{-6} −55 to +85°C	±1x10^{-6}/	TTL	Fig. 15	144.00	71.00
JKTCXO-4	Option 1	20 MHz	1.50x	38,1x	@	±5x10^{-7} 0 to +50°C	yr.	Logic 0:5 V Max.		144.00	71.00
JKTCXO-4	Option 2		.50	12,7	10 MA	±1x10^{-6} −30 to +70°C		Logic 1:2.5 V Min.		144.00	71.00



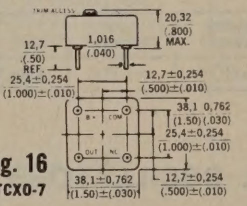
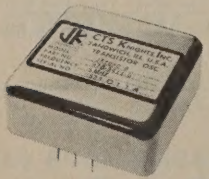

TRIM ACCESS
20,32 (.800) MAX.
12,7 (.50) REF.
1,016 (.040)
25,4±0,254 (1.000)±(.010)
12,7±0,254 (.500)±(.010)
B+
COM
OUT
NC
38,1 0,762 (1.50) (.030)
25,4±0,254 (1.000)±(.010)
38,1±0,762 (1.50)±(.030)
12,7±0,254 (.500)±(.010)

Fig. 16
JKTCXO-7

The JKTCXO-7 offers the circuit designer a stable oscillator requiring less than 120 milliwatts input power. This unit also has the advantage of being on frequency at extreme ambient temperatures. The JKTCXO-7 is particularly suited for use where space, low power consumption and being on frequency at turn on is a requisite.

Model	Series	Frequency Range	Dimensions		Supply Voltage	Stability vs. Operating Temperature	Stability vs. Time	Output	Dimensional Outline	Approx. Price	
			inches	mm						10 pcs.	100 pcs.
JKTCXO-7	974-1000	3-	1.50x	38,1x	12 VDC	±5x10^{-7} +15 to +70°C	±1x10^{-6}/	TTL	Fig. 16	144.00	70.00
JKTCXO-7	974-2000	10 MHz	1.50x	38,1x	@	±1x10^{-6} 0 to +70°C	yr.	Logic 0:5 V Max.		144.00	70.00
JKTCXO-7	974-3000		.800	20,32	10 MA	±2x10^{-6} −40 to +70°C		Logic 1:2.5 V Min.		144.00	70.00



JKTCXO-8

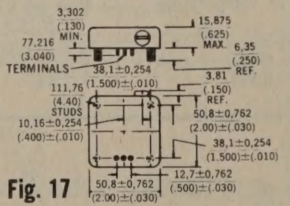

3,302 (.130) MIN.
77,216 (3.040) TERMINALS
15,875 (.625) MAX.
6,35 (.250) REF.
38,1±0,254 (1.500)±(.010)
3,81 (.150) REF.
111,76 (4.40) STUDS
10,16±0,254 (.400)±(.010)
50,8±0,762 (2.00)±(.030)
38,1±0,254 (1.500)±(.010)
12,7±0,762 (.500)±(.030)
50,8±0,762 (2.00)±(.030)

Fig. 17

TERMINATION OPTIONS FOR JKTCXO-8

Option A: 4-40 inserts are available in lieu of the 4-40 studs.

Option B: Case available with 4 .040″ dia. mounting terminals in lieu of the 4 4-40 studs and trim access centered. Connections to the oscillator are to the 4 .040″ terminals.

The JKTCXO-8 is a low cost temperature compensated oscillator designed for use as a time base for military and/or commercial equipment. Since this unit is temperature compensated, the power consumption is less than 125 milliwatts, and it is on frequency at turn on at extreme temperatures. The unit size is only 2″x2″x⅝″ which makes it attractive for printed circuit board use.

Model	Series	Frequency Range	Dimensions		Supply Voltage	Stability vs. Operating Temperature	Stability vs. Time	Output	Dimensional Outline	Approx. Price	
			inches	mm						10 pcs.	100 pcs.
JKTCXO-8	972-1000	25 KHz-	2.00x	50,8x	12 VDC	±1x10^{-6} −40 to +70°C	±1x10^{-6}/	TTL	Fig. 17	160.00	80.00
JKTCXO-8	972-2000	20 MHz	2.00x	50,8x	@	±2x10^{-6} −40 to +70°C	yr.	Logic 0:5 V Max.		145.00	70.00
JKTCXO-8	972-3000		.625	15,875	10 MA	±5x10^{-6} −40 to +70°C		Logic 1:2.5 V Min.		140.00	68.00
JKTCXO-8	972-4000					±2x10^{-6} −55 to +85°C				160.00	80.00

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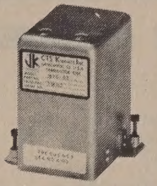
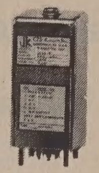
CRYSTAL OSCILLATORS

HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS

CTS Knights ovenized oscillators are available in thermostatically controlled models as well as proportional control models. A variety of design options is available to the user, including very high stability, low power, small size and sine wave or square wave (TTL or CMOS) output. Contact CTS Knights for your special requirements.



JKTO-83



JKTO-41

Model	Frequency Range	Dimensions		Oscillator Input	Oven Input	Temperature Control	Stability vs. Time†	Stability vs. Temp.	Output	Dimen. Outline
		Inches	mm							
JKTO-9	20 KHz-10 MHz	1.313‡ x1.047	33,350‡ x26,594	+28 VDC	+28 VDC/AC 20 W.	Thermostat	±1x10^{-7}/day ±1x10^{-6}/yr	−40 to +55°C ±1x10^{-6}	Sine Wave 1 V ±10% 10K Ohm Load	Fig. 18
JKTO-22	4-100 MHz	1.578x1.875 x4.422 HT	40,081x47,625 x112,32	+28 VDC	+28 VDC/AC 115 VAC 11 W.	Thermostat	±2x10^{-7}/day ±1x10^{-6}/yr	−40 to +70°C ±7.5x10^{-7}	Sine Wave 1 V RMS 5K Ohm Load	Fig. 19
JKTO-25	60 Hz-4 MHz	2.219x2.219 x4.37	56,363x56,363 x110,998	*+28 & 5	+28 VDC/AC 22 W.	Thermostat	±2.5x10^{-7}/ day ±1x10^{-6}/yr	−40 to +70°C ±7.5x10^{-7}	TTL Compatible	Fig. 20
JKTO-30	1-4 MHz	2.0x2.0x4.0	50,8x50,8x101,6	+28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}	Sine Wave 1 V RMS 500 Ohm Load	Fig. 21
JKTO-30	4-10 MHz	2.0x2.0x4.0	50,8x50,8x101,6	+12 to +28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}	Sine Wave 1 V RMS 500 Ohm Load	Fig. 21
JKTO-41	1-10 MHz	2.0x2.0x4.25	50,8x50,8x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±2x10^{-9}/day ±2.5x10^{-7}/yr	−40 to +70°C ±3x10^{-8}	Sine Wave .316 V Min. 50 Ohm Load	Fig. 22
JKTO-41	10-100 MHz	2.0x2.0x4.25	50,8x50,8x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-8}/day ±1x10^{-6}/yr	−25 to +65°C ±5x10^{-8}	Sine Wave .316 V Min. 50 Ohm Load	Fig. 22
JKTO-49	1-5 MHz	2.0x2.0x4.25	50,8x50,8x107,95	+28 VDC	+28 VDC 10 W. Max.	Double Oven Proportional	±2x10^{-9}/day ±2.5x10^{-7}/yr	−40 to +65°C ±5x10^{-9}	Sine Wave .316 V Min. 50 Ohm Load	Fig. 22
JKTO-51	1-2 MHz	1.844x2.0 x3.436	46,838x50,8 87,274	+28 VDC	+28 VDC 10 W. Max.	Proportional	±1x10^{-8}/day ±3x10^{-7}/yr	−55 to +75°C ±5x10^{-8}	Sine Wave 1 V RMS 10K Ohm Load	Fig. 23
JKTO-56	4-6 MHz	2.0x2.0x4.0	50,8x50,8x101,6	+12 VDC	+24 VDC 5 W. Max.	Proportional	±2.5x10^{-7}/yr	−10 to +60°C ±1x10^{-8}	Sine Wave .224 V Min. 50 Ohm Load	Fig. 24
					Same as Above Except		±1x10^{-6}/yr	−10 to +60°C ±5x10^{-8}		
JKTO-66	5 MHz	7x19 Panel	177,8x482,6 Panel	(115 VAC Power Supply		Double Oven Proportional	±5x10^{-10}/ day ±2x10^{-8}/yr	0 to 50°C ±2x10^{-9}	Sine Wave 1 V Min. 50 Ohm Load	Std. Rack Mtg.
JKTO-83	1-6 MHz	2.437x2 x3.187	61,899x50,8 x80,950	+30 VDC	+30 VDC 45 W. Max.	Double Oven Proportional	±1x10^{-9}/day ±2.5x10^{-7}/yr	−55 to +70°C ±1x10^{-8}	Sine Wave 1 V Min. 50 Ohm Load	Fig. 25
JKTO-88-1	1-10 MHz	2.0x2.25 x.800	50,8x57,15 x20,32	5 & 12 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-9}/day ±3x10^{-7}/yr	−25 to +65°C ±1x10^{-7}	TTL Sym. ±15% Fan Out 5	Fig. 26
JKTO-88-2	10-30 MHz	2.0x2.25 x.800	50,8x57.15 x20,32	5 & 12 VDC	+28 VDC 10 W. Max.	Proportional	±2x10^{-8}/day ±1x10^{-7}/yr	−25 to +65°C ±2x10^{-7}	TTL Sym. ±15% Fan Out 5	Fig. 26
JKTO-88-3	30-100 MHz	2.0x2.25 x.800	50,8x57.15 x20,32	12 VDC ±10%	+28 VDC 10 W. Max.	Proportional	±5x10^{-8}/day ±5x10^{-7}/yr	−25 to +65°C ±3x10^{-7}	Sine 2 mV ±3 db into 50 Ohm	Fig. 26
JKTO-110**	10 MHz	.86x.83x.75	21,8x21,1x19,1	5 VDC ±5%	5 VDC 1 W. Max.	Proportional	±4x10^{-8}/day ±1x10^{-6}/yr	0-55°C ±2x10^{-7} Max.	TTL Sym. ±15% Fan Out 2	Fig. 26A

* Must have 28 VDC oscillator and a 5 VDC binary supply

** Other frequencies available.

† At a constant temperature

APPROXIMATE PRICE

Model	JKTO-9	JKTO-22	JKTO-25	JKTO-30 (1-4 MHz)	JKTO-30 (4-10 MHz)	JKTO-41 (1-10 MHz)	JKTO-41 (10-100 MHz)	JKTO-49	JKTO-51	JKTO-56	JKTO-56	JKTO-66	JKTO-83	JKTO-88-1	JKTO-88-2	JKTO-88-3	JKTO-110
10 pcs	$172.00	$277.00	$256.00	$179.00	$185.00	$300.00	$300.00	$487.00	$283.00	$519.00	$422.00	$2500.00	$740.00	$305.00	$337.00	$359.00	$160.00
100 pcs	108.00	173.00	160.00	113.00	116.00	188.00	188.00	300.00	180.00	325.00	265.00	N/A	470.00	190.00	210.00	225.00	60.00

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SPECIALISTS IN FREQUENCY MANAGEMENT

CRYSTAL OSCILLATORS

HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS (Continued)

OUTLINE DRAWINGS

KEY = mm / (Inches)

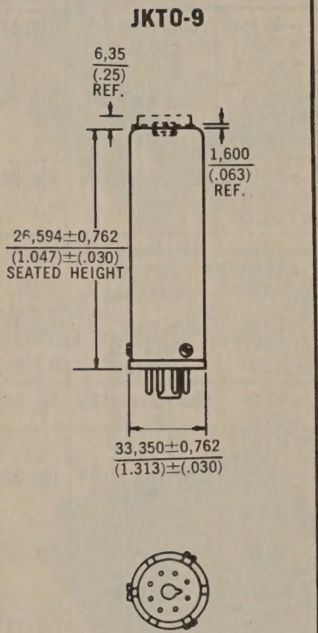

JKTO-9
6,35 (.25) REF.
1,600 (.063) REF.
26,594±0,762 (1.047)±(.030) SEATED HEIGHT
33,350±0,762 (1.313)±(.030)

Fig. 18

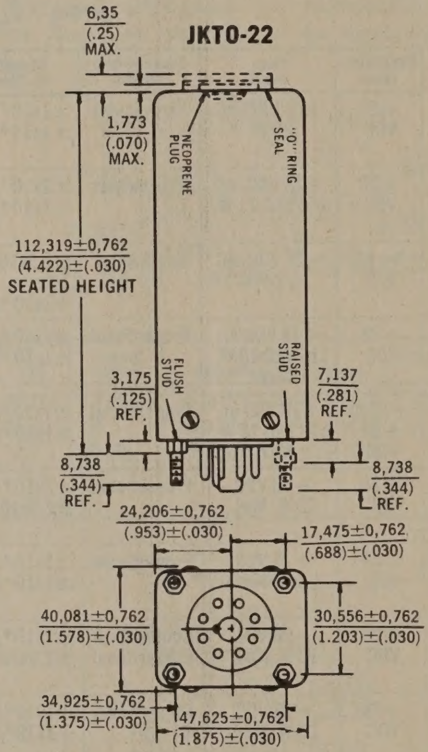

JKTO-22
6,35 (.25) MAX.
1,773 (.070) MAX.
NEOPRENE PLUG
"O" RING SEAL
112,319±0,762 (4.422)±(.030) SEATED HEIGHT
FLUSH STUD
RAISED STUD
3,175 (.125) REF.
7,137 (.281) REF.
8,738 (.344) REF.
8,738 (.344) REF.
24,206±0,762 (.953)±(.030)
17,475±0,762 (.688)±(.030)
40,081±0,762 (1.578)±(.030)
30,556±0,762 (1.203)±(.030)
34,925±0,762 (1.375)±(.030)
47,625±0,762 (1.875)±(.030)

Fig. 19

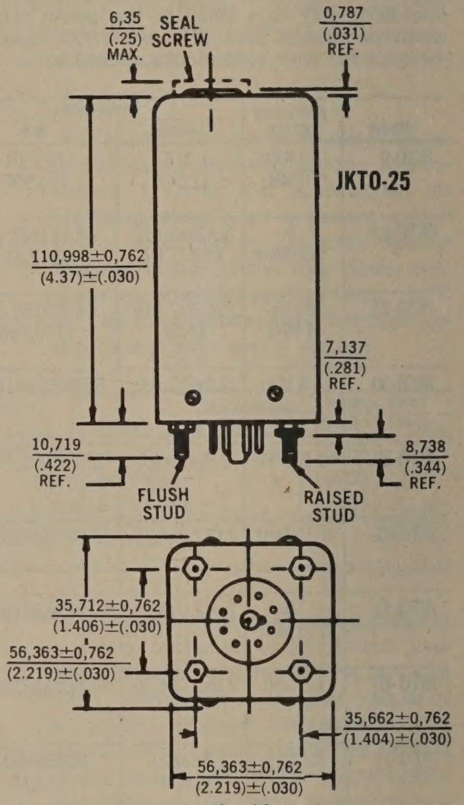
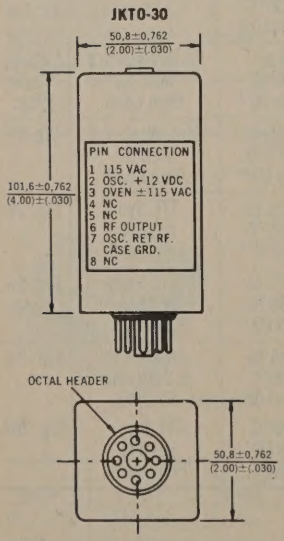

6,35 (.25) MAX.
SEAL SCREW
0,787 (.031) REF.
JKTO-25
110,998±0,762 (4.37)±(.030)
7,137 (.281) REF.
10,719 (.422) REF.
FLUSH STUD
RAISED STUD
8,738 (.344) REF.
35,712±0,762 (1.406)±(.030)
56,363±0,762 (2.219)±(.030)
35,662±0,762 (1.404)±(.030)
56,363±0,762 (2.219)±(.030)

Fig. 20


JKTO-30
50,8±0,762 (2.00)±(.030)
101,6±0,762 (4.00)±(.030)
OCTAL HEADER
50,8±0,762 (2.00)±(.030)

PIN CONNECTION
1 115 VAC
2 OSC. +12 VDC
3 OVEN ±115 VAC
4 NC
5 NC
6 RF OUTPUT
7 OSC. RET RF. CASE GRD.
8 NC

Fig. 21

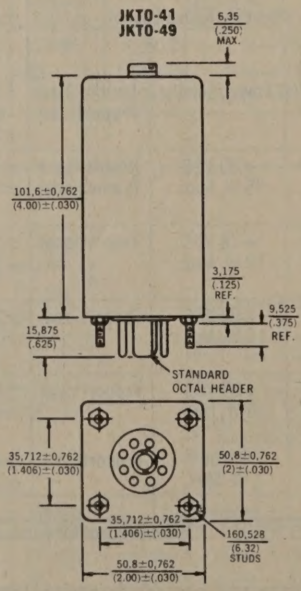

JKTO-41
JKTO-49
6,35 (.250) MAX.
101,6±0,762 (4.00)±(.030)
3,175 (.125) REF.
9,525 (.375) REF.
15,875 (.625)
STANDARD OCTAL HEADER
35,712±0,762 (1.406)±(.030)
50,8±0,762 (2)±(.030)
35,712±0,762 (1.406)±(.030)
160,528 (6.32) STUDS
50.8±0,762 (2.00)±(.030)

Fig. 22

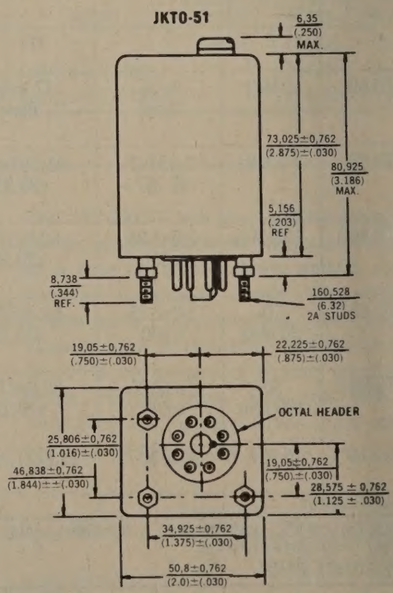

JKTO-51
6,35 (.250) MAX.
73,025±0,762 (2.875)±(.030)
80,925 (3.186) MAX.
5,156 (.203) REF
8,738 (.344) REF.
160,528 (6.32) 2A STUDS
19,05±0,762 (.750)±(.030)
22,225±0,762 (.875)±(.030)
OCTAL HEADER
25,806±0,762 (1.016)±(.030)
46,838±0,762 (1.844)±±(.030)
19,05±0,762 (.750)±(.030)
28,575 ± 0,762 (1.125 ± .030)
34,925±0,762 (1.375)±(.030)
50,8±0,762 (2.0)±(.030)

Fig. 23

CRYSTAL OSCILLATORS/ OVENS

HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS (Continued)

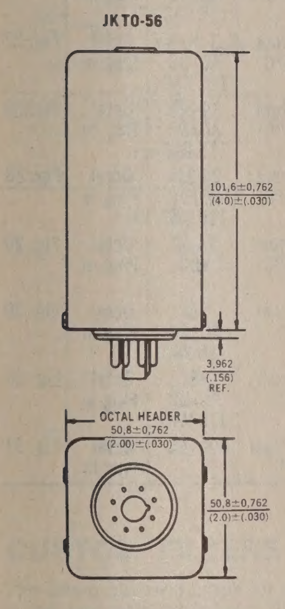

JKTO-56
101,6±0,762 (4.0)±(.030)
3,962 (.156) REF.
OCTAL HEADER
50,8±0,762 (2.00)±(.030)
50,8±0,762 (2.0)±(.030)

Fig. 24

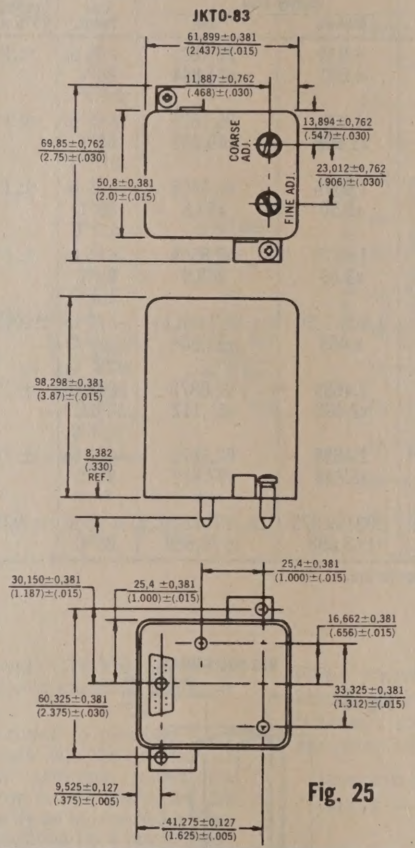

JKTO-83
61,899±0,381 (2.437)±(.015)
11,887±0,762 (.468)±(.030)
13,894±0,762 (.547)±(.030)
69,85±0,762 (2.75)±(.030)
COARSE ADJ.
23,012±0,762 (.906)±(.030)
50,8±0,381 (2.0)±(.015)
FINE ADJ.
98,298±0,381 (3.87)±(.015)
8,382 (.330) REF.
25,4±0,381 (1.000)±(.015)
30,150±0,381 (1.187)±(.015)
25,4 ±0,381 (1.000)±(.015)
16,662±0,381 (.656)±(.015)
33,325±0,381 (1.312)±(.015)
60,325±0,381 (2.375)±(.030)
9,525±0,127 (.375)±(.005)
41,275±0,127 (1.625)±(.005)

Fig. 25

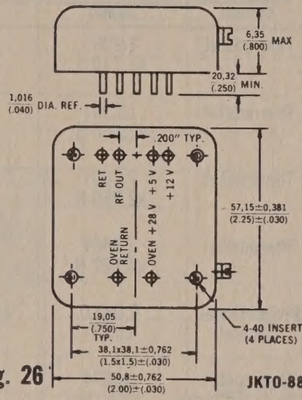

6,35 (.800) MAX
20,32 (.250) MIN.
1,016 (.040) DIA. REF.
.200" TYP.
RET
RF OUT
+5 V
+12 V
OVEN RETURN
OVEN +28 V
57,15±0,381 (2.25)±(.030)
19,05 (.750) TYP.
4-40 INSERTS (4 PLACES)
38,1x38,1±0,762 (1.5x1.5)±(.030)
50,8±0,762 (2.00)±(.030)
JKTO-88

Fig. 26

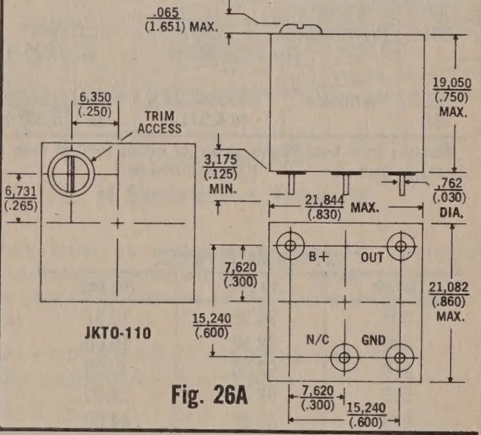

.065 (1.651) MAX.
19,050 (.750) MAX.
6,350 (.250)
TRIM ACCESS
3,175 (.125) MIN.
6,731 (.265)
.762 (.030) DIA.
21,844 (.830) MAX.
B+
OUT
7,620 (.300)
21,082 (.860) MAX.
15,240 (.600)
JKTO-110
N/C
GND
7,620 (.300)
15,240 (.600)

Fig. 26A

OVENS

Precise control and reliability are the main features of CTS Knights ovens. Snap-action thermostats known for their long life are used on every thermostat design. Hermetically sealed, double insulated thermostats are used on 115 V models and are optional on others. Contact CTS Knights for special cavity and internal component mounting requirements.

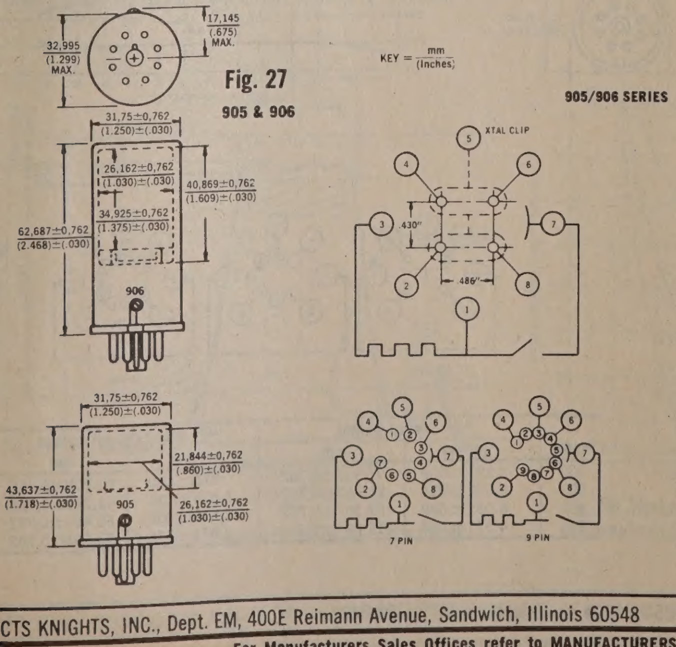

17,145 (.675) MAX.
32,995 (1.299) MAX.
31,75±0,762 (1.250)±(.030)
26,162±0,762 (1.030)±(.030)
40,869±0,762 (1.609)±(.030)
34,925±0,762 (1.375)±(.030)
62,687±0,762 (2.468)±(.030)
906
31,75±0,762 (1.250)±(.030)
21,844±0,762 (.860)±(.030)
43,637±0,762 (1.718)±(.030)
905
26,162±0,762 (1.030)±(.030)
KEY = mm / (Inches)
905/906 SERIES
XTAL CLIP
.430"
.486"
1
2
3
4
5
6
7
8
7 PIN
9 PIN

Fig. 27
905 & 906

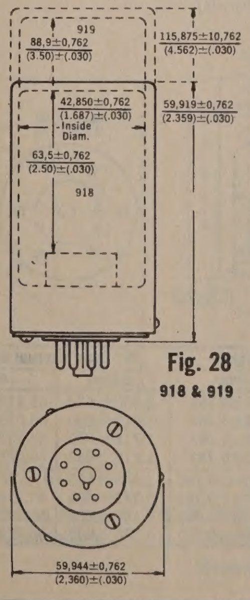
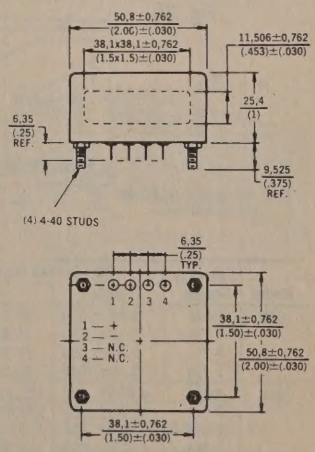

919
88,9±0,762 (3.50)±(.030)
115,875±10,762 (4.562)±(.030)
42,850±0,762 (1.687)±(.030) Inside Diam.
59,919±0,762 (2.359)±(.030)
63,5±0,762 (2.50)±(.030)
918
59,944±0,762 (2,360)±(.030)

Fig. 28
918 & 919

Fig. 29
923


50,8±0,762 (2.00)±(.030)
38,1x38,1±0,762 (1.5x1.5)±(.030)
11,506±0,762 (.453)±(.030)
25,4 (1)
6,35 (.25) REF.
9,525 (.375) REF.
(4) 4-40 STUDS
6,35 (.25) TYP.
1 2 3 4
1 — +
2 — –
3 — N.C.
4 — N.C.
38,1±0,762 (1.50)±(.030)
50,8±0,762 (2.00)±(.030)
38,1±0,762 (1.50)±(.030)

CTS KNIGHTS, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

OVENS

Series	Temperature Control	External Dimensions (Max.)		Cavity Size		Calibration Temp.	Oven Temp. Cycling @ 25°C Amb.	Max. Oven Temp. Change vs. Ambient*	Voltage	Mounting	Dimen. Outline
		inches	mm	inches	mm						
905	Thermostat	1.299‡ x1.718 H	32,995‡ 43,637 H	1.03§ x.860	26,162§ x21,844	+65 to 85°C ±2.5°C	±.1°C	1°C from −55°C	6.3 to 28V AC/DC 115 VAC	Octal Plug-in	Fig. 27
906	Thermostat	1.299‡ x2.468 H	32,995‡ 62,687 H	1.03§ x1.609	26,162§ x40,869	+65 to 85°C ±2.5°C	±.1°C	1°C from −55°C	6.3 to 28V AC/DC 115 VAC	Octal Plug-in	Fig. 27
918	Thermostat	2.360‡ x2.360 H	59,944‡ x59,944 H	1.687§ x2.50	42,850§ x63,5	+65 to 85°C ±3°C	±.1°C	2°C from −55°C	24-28V AC/DC 115 VAC	Octal Plug-in	Fig. 28
919	Thermostat	2.360‡ x4.562 H	59,944‡ x115,875 H	1.687§ x3.50	42,850§ x88,9	+65 to 85°C ±3°C	±.1°C	2°C from −55°C	24-28V AC/DC 115 VAC	Octal Plug-in	Fig. 28
923	Proportional Control	2.0x2.0 x1.0 H	50,8x50,8 x25,4	1.50 x 1.50 x.453	38,1x38,1 x11,506	+60 to 100°C ±2°C	±.015°C	.5°C from −40°C	24-32 VDC	Octal Plug-in	Fig. 29
947	Thermostat	3.187‡ x3.50 H	80,949‡ x88,9 H	2.468§ x2.406	62,687§ x61,112	+65 to 85°C ±3°C	±.1°C	2°C from 0°C	28V AC/DC 115 VAC	Octal Plug-in	Fig. 30
948	Thermostat	3.187‡ x4.875 H	80,949‡ x123,825 H	2.468§ x3.843	62,687§ x97,612	+65 to 85°C	±.1°C	2°C from 0°C	28V AC/DC 115 VAC	Octal Plug-in	Fig. 30
952/ 955	Thermostat	1.639‡x2.28 H to 4.531 H	41,631‡x57,912 H to 115,087 H	1.031§x.875 to 3.098	26,187§x22,225 to 78,689	+65 to 85°C	±.025°C	.15°C from 40°C	28 VDC	Octal Plug-in	Fig. 31

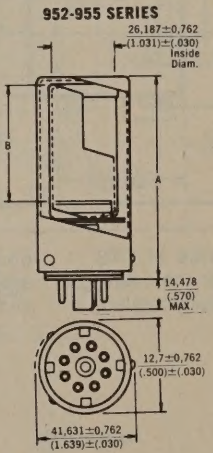
* Stability from temperature shown to within 10°C of oven temperature.

‡ Outside Diameter. § Inside Diameter.

APPROXIMATE PRICES

Model	10 pcs.	100 pcs.
905	26.00	13.57
906	28.50	16.00
918	62.00	33.00
919	62.00	33.00
923	83.00	44.00
947	79.00	42.00
948	79.00	42.00
952	77.00	41.00
955	57.00	31.00

Fig. 31


952-955 SERIES
26,187±0,762
(1.031)±(.030)
Inside Diam.
B
A
14,478
(.570)
MAX.
12,7±0,762
(.500)±(.030)
41,631±0,762
(1.639)±(.030)

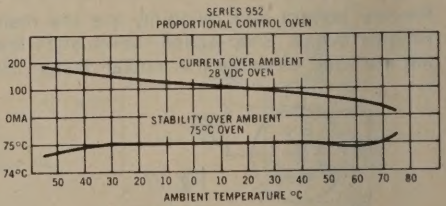
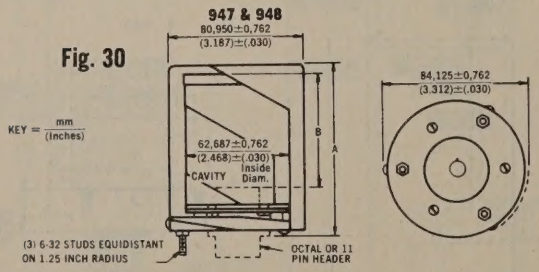
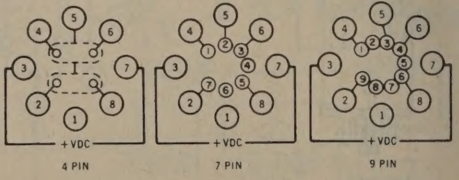


Fig. 30


947 & 948
80,950±0,762
(3.187)±(.030)
KEY = mm / (inches)
62,687±0,762
(2.468)±(.030)
Inside Diam.
CAVITY
B
A
84,125±0,762
(3.312)±(.030)
(3) 6-32 STUDS EQUIDISTANT ON 1.25 INCH RADIUS
OCTAL OR 11 PIN HEADER

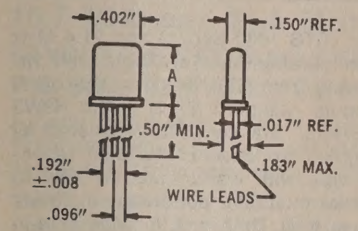

1
2
3
4
5
6
7
8
I
+VDC
4 PIN
7 PIN
9 PIN

Model	Internal Socket	"A" Seated Height		"B" Over Internal Socket	
		inches	mm	inches	mm
948	None	3.50±.030	88,9±0,762	2.406±.030	61,112±0,762
	7 Pin	3.50±.030	88,9±0,762	1.812±.030	46,025±0,762
	8 Pin	3.50±.030	88,9±0,762	1.718±.030	43,637±0,762
	9 Pin	3.50±.030	88,9±0,762	1.812±.030	46,025±0,762
948	None	4.875±.030	123,825±0,762	3.843±.030	97,612±10,762
	7 Pin	4.875±.030	123,825±0,762	3.375±.030	85,725±0,762
	8 Pin	4.875±.030	123,825±0,762	3.156±.030	80,162±0,762
	9 Pin	4.875±.030	123,825±0,762	3.375±.030	85,725±0,762

Model	"A" Seated Height		"B" Over Internal Socket	
	inches	mm	inches	mm
952	2.281±.030	57,937±0,762	.875±.030	22,225±0,762
953	3.031±.030	76,987±0,762	1.625±.030	41,275±0,762
954	4.031±.030	102,387±0,762	2.578±.030	65,481±0,762
955	4.531±.030	115,087±0,762	3.078±.030	78,181±0,762

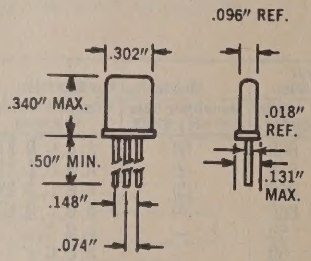
CTS KNIGHTS, INC.
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA
SPECIALISTS IN FREQUENCY MANAGEMENT

CUSTOM-BUILT FILTERS


.402"
.150" REF.
A
.50" MIN.
.017" REF.
.183" MAX.
.192" ±.008
WIRE LEADS
.096"

Holder	"A" dim.	Freq. Range
H3W3	.530" max.	7-75 MHz
H3Y3	.500" max.	7-75 MHz
H3T3	.453" max.	15-75 MHz

Fig. 32


.096" REF.
.302"
.340" MAX.
.018" REF.
.50" MIN.
.131" MAX.
.148"
.074"

K2W3 — 20-75 MHz

Fig. 33

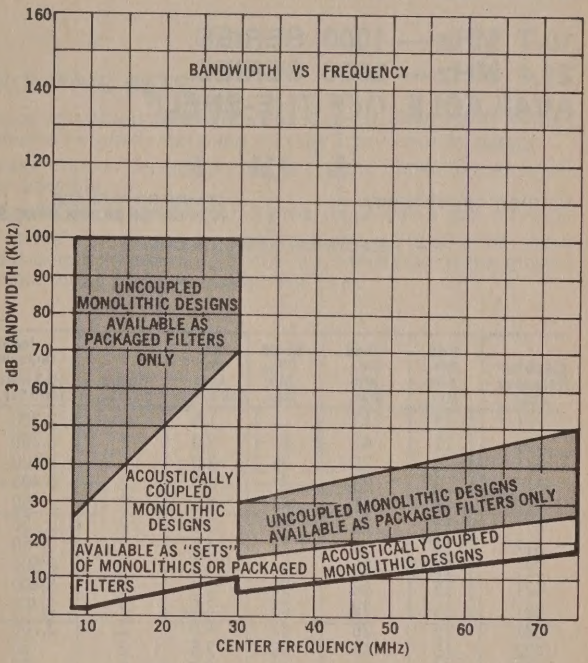


Fig. 34 Bandwidth vs. Frequency

CUSTOM FILTERS

The basic building block for all custom built CTS Knights filters is the two-pole monolithic filter available in standard package styles as shown in figures 32 and 33.

Two-pole monolithic filters can be cascaded to produce four, six and eight or more pole filter responses with the addition of coupling capacitors between two-pole sections. Using the bandwidth, impedance and shape factor charts (fig's. 34, 36 and 37) the equipment designer can specify an inexpensive filter supplied by CTS Knights to his specifications as a set of two, three, four or more "Monolithics" (coupling capacitor information will also be provided). For applications requiring plug-in packaged filters, the filter specifier may select one of the five standard CTS Knights packages (fig's. 39, 40, 41, 42, 43) or supply dimensional termination and mounting information on a package of his choice. Input/Output impedances of packaged filters may be specified at 50 ohms minimum.

Filter parameters such as insertion loss, ripple, spurious response and ultimate attenuation are not easily chartable. However, some general guidelines to specifying these values are given below:

Insertion loss — typically 1.5 dB per 2-pole section
Ripple — 1 dB minimum for most designs

Ultimate attenuation — 35 dB maximum per 2-pole section for acoustically coupled designs

Spurious attenuation — (Best attainable for most designs)	2-pole	20 dB
	4-pole	35 dB
	6-pole	45 dB
	8-pole	60 dB
	10-pole	75 dB

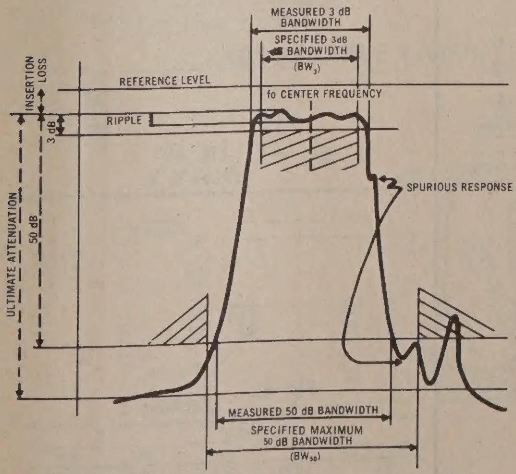

MEASURED 3 dB BANDWIDTH
SPECIFIED 3dB BANDWIDTH (BW$_3$)
INSERTION LOSS
REFERENCE LEVEL
fo CENTER FREQUENCY
RIPPLE
3 dB
SPURIOUS RESPONSE
ULTIMATE ATTENUATION
50 dB
MEASURED 50 dB BANDWIDTH
SPECIFIED MAXIMUM 50 dB BANDWIDTH (BW$_{50}$)

Fig. 35 Filter Parameters Normally Specified

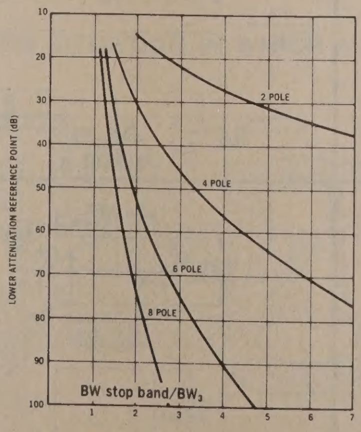
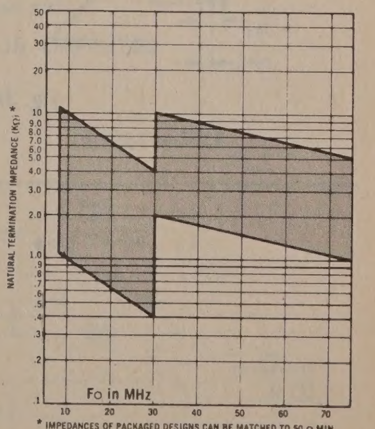


Fig. 36 Theoretical Shape Factor (Normalized to 3-dB Bandwidth)



* IMPEDANCES OF PACKAGED DESIGNS CAN BE MATCHED TO 50 Ω MIN.

Fig. 37 Natural Termination Impedance vs Frequency For Acoustically Coupled Monolithic Filters

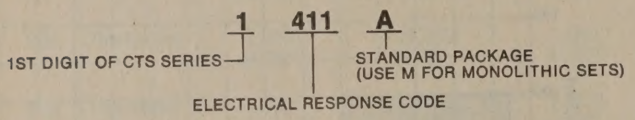
CTS KNIGHTS, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

STANDARD FILTERS

10.7 MHz — 1000 SERIES
21.4 MHz — 2000 SERIES
AVAILABLE OFF-THE-SHELF


1
411
A
1ST DIGIT OF CTS SERIES
STANDARD PACKAGE
(USE M FOR MONOLITHIC SETS)
ELECTRICAL RESPONSE CODE

Over 100 different 10.7 MHz (CTS 1000 Series) and 21.4 MHz (CTS 2000 Series) filter configurations are available with virtually OFF-THE-SHELF delivery from CTS Knights. The basic building block for CTS Knights' standard filters is the H3W3 dual resonator monolithic crystal. Standard filters ordered as "Monolithic Sets", are supplied as loose H3W3 dual resonator crystals separated by type with instructions on how to couple the crystals together for total filter performance. Filters ordered in standard packages A, B, C, D, or E provide plug-in convenience. Order from table by part number as shown below.

Electrical Response Code	3 dB BW$_3$ KHz Min.	40 dB BW$_{40}$ KHz Max.	60 dB BW$_{60}$ KHz Max.	Insertion Loss dB Max.	Ripple dB Max.	Input/Output Impedance Ω Nom.		Mechanical Configuration		Approximate 25 Piece Price			
						10.7 MHz 1000 Ser.	21.4 MHz 2000 Ser.	Monolithic Sets Set of ( ) H3W3	Standard Package Available	Series 1000		Series 2000	
										Package	Monolithic	Package	Monolithic
211	13	143	—	1.5	2	2,200	600	(1)	A, B, C, D, E1	—	$2.90	—	$4.40
411	13	41	84	2.0	2	3,200	810	(2)	A, B, C, D, E1	$17.60	5.80	$19.80	8.80
611	13	26	38	3.0	2	3,400	860	(3)	A, B, C, D, E2	20.60	8.60	24.00	13.00
811	13	23	27	4.0	2	3,400	860	(4)	A, B, C, D, E3	24.30	11.50	28.10	17.50
412	13	41	84	2.5	2	50	50	—	A, B, C	20.00	—	22.20	—
612	13	26	38	3.5	2	50	50	—	A, B, C	23.00	—	27.65	—
812	13	23	27	4.5	2	50	50	—	A, B, C	26.10	—	30.50	—
221	15	165	—	1.5	2	2,500	690	(1)	A, B, C, D, E1	—	2.90	—	4.40
421	15	46	96	2.0	2	3,400	850	(2)	A, B, C, D, E1	17.60	5.80	19.80	8.80
621	15	29	43	3.0	2	3,700	930	(3)	A, B, C, D, E2	20.60	8.60	24.00	13.15
821	15	26	31	4.0	2	3,700	930	(4)	A, B, C, D, E3	24.30	11.50	28.10	17.50
422	15	46	96	2.5	2	50	50	—	A, B, C	20.00	—	22.20	—
622	15	29	43	3.5	2	50	50	—	A, B, C	23.00	—	27.65	—
822	15	26	31	4.5	2	50	50	—	A, B, C	26.10	—	30.50	—
231	30	330	—	1.5	2	4,000	1,200	(1)	A, B, C, D, E1	—	2.90	—	4.40
431	30	90	185	2.0	2	5,600	1,800	(2)	A, B, C, D, E1	17.60	5.76	19.80	8.80
631	30	56	83	3.0	2	5,900	1,800	(3)	A, B, C, D, E2	20.60	8.60	24.00	13.10
831	30	50	60	4.0	2	5,900	2,000	(4)	A, B, C, D, E3	24.30	11.50	28.10	17.50
432	30	90	185	2.5	2	50	50	—	A, B, C	20.00	—	22.20	—
632	30	56	83	3.5	2	50	50	—	A, B, C	23.00	—	27.65	—
832	30	50	60	4.5	2	50	50	—	A, B, C	26.10	—	30.50	—
742	72	—	225	6.0	3	50	*	—	A	41.40	—	—	—
452	240	1000	—	5.0	2†	50	*	—	A	30.00	—	—	—

* Available as 1000 Series only.

† Filter designed for wide band FM use. Maximum deviation of measured phase shift from the best fit (least squares method) straight line is less than the greater of 5° or 10% of the phase value read from the straight line.

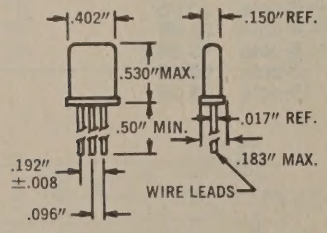

.402"
.150" REF.
.530" MAX.
.50" MIN.
.017" REF.
.183" MAX.
.192" ±.008
.096"
WIRE LEADS

Fig. 38

H3W3 — 7-75 MHz

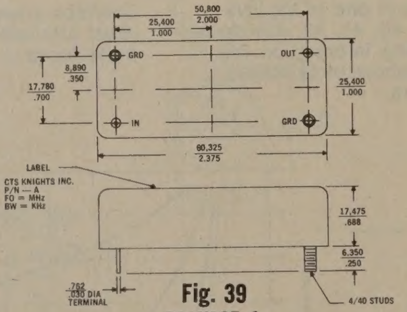

50,800
2.000
25,400
1.000
GRD
OUT
8,890
.350
17,780
.700
25,400
1.000
IN
GRD
60,325
2.375
LABEL
CTS KNIGHTS INC.
P/N — A
FO = MHz
BW = KHz
17,475
.688
6,350
.250
.762
.030 DIA
TERMINAL
4/40 STUDS

Fig. 39

PACKAGE A

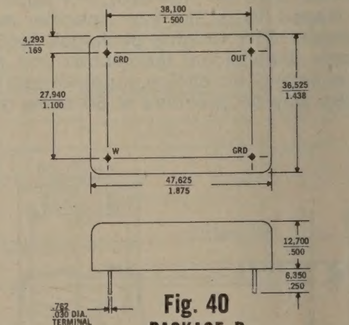

38,100
1.500
4,293
.169
GRD
OUT
27,940
1.100
36,525
1.438
W
GRD
47,625
1.875
12,700
.500
6,350
.250
.762
.030 DIA.
TERMINAL

Fig. 40

PACKAGE B

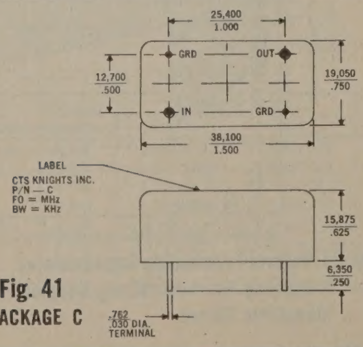

25,400
1.000
GRD
OUT
12,700
.500
19,050
.750
IN
GRD
38,100
1.500
LABEL
CTS KNIGHTS INC.
P/N — C
FO = MHz
BW = KHz
15,875
.625
6,350
.250
.762
.030 DIA.
TERMINAL

Fig. 41

PACKAGE C

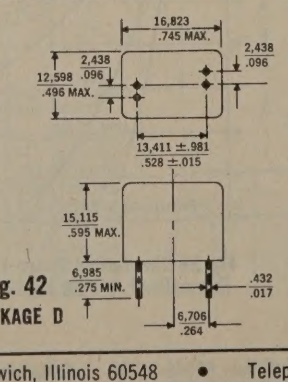

16,823
.745 MAX.
2,438
.096
2,438
.096
12,598
.496 MAX.
13,411 ±.981
.528 ±.015
15,115
.595 MAX.
6,985
.275 MIN.
.432
.017
6,706
.264

Fig. 42

PACKAGE D

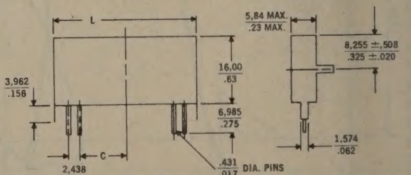

L
5,84 MAX.
.23 MAX.
8,255 ±,508
.325 ±.020
16,00
.63
3,962
.156
6,985
.275
C
2,438
.096
.431
.017
DIA. PINS
1,574
.062

Fig. 43 : PACKAGE E

Case Style	L (Max.)		C	
	In.	mm	In.	mm
E1	.890	22,606	.216	5,486
E2	1.320	33,528	.435	11,049
E3	1.750	44,450	.654	16,611

CTS KNIGHTS, INC.
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA
SPECIALISTS IN FREQUENCY MANAGEMENT

STANDARD FILTERS

10.7 MHz and 21.4 MHz

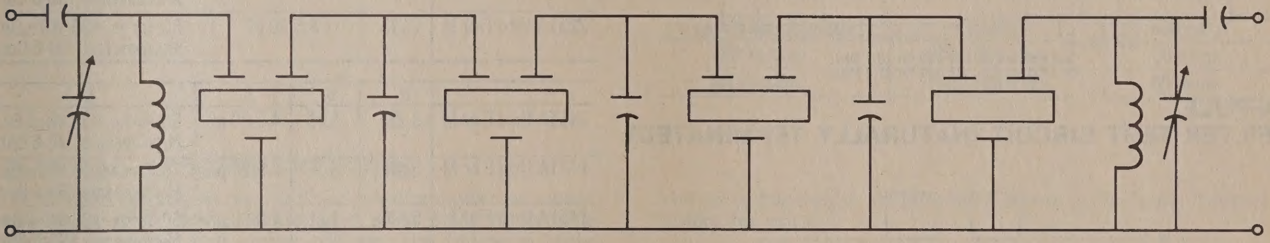
LAYOUT OF NATURALLY TERMINATED FILTERS

P.C. BOARD LAYOUT FOR FILTERS PURCHASED AS "MONOLITHIC SETS"

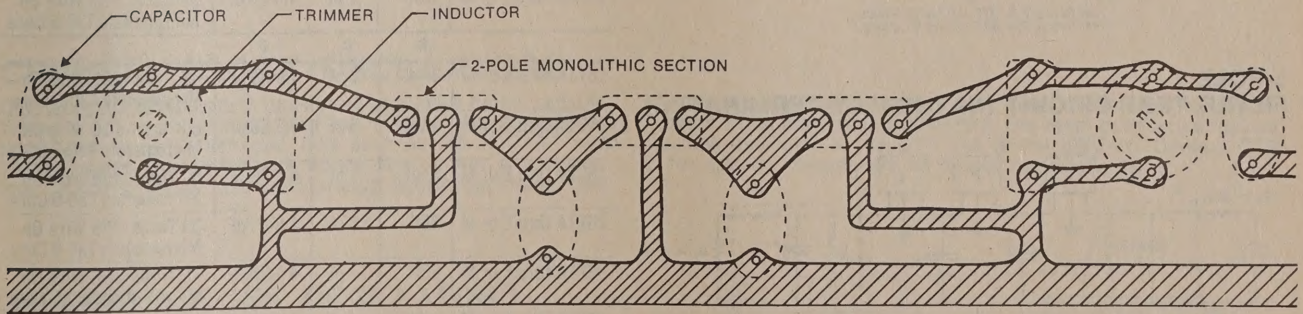
A good board layout will, 1) Maximize ultimate attenuation, 2) Minimize interstage and terminating stray capacitances and 3) Maintain acceptable levels of ripple and insertion loss.

Shown below are a circuit diagram of an 8-pole filter, plus 2 acceptable P.C. board layouts. The following points are important in board layout design:

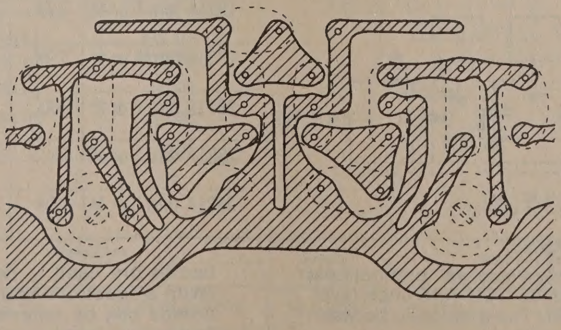
1) Separate the signal input and output as much as possible.
2) Keep interstage connections as short as practical to reduce electro magnetic coupling directly from input to output.
3) Make conductive runs to the interstage capacitors as short as possible.
4) If possible, separate each 2-pole stage with a ground strip.
5) Provide a single run ground plane and make sure that input and output trimmers and coils are connected to the ground plane through single conductive runs.



PREFERRED LAYOUT



ACCEPTABLE LAYOUT FOR SITUATION IN WHICH AREA IS CRITICAL



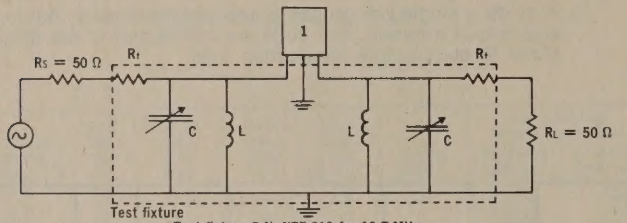
CTS KNIGHTS, INC.
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA
SPECIALISTS IN FREQUENCY MANAGEMENT

STANDARD FILTERS

TESTING STOCK FILTERS 10.7 MHz AND 21.4 MHz

Test fixtures for naturally terminated 10.7 and 21.4 MHz filters are not difficult to build; however, completely enclosed test fixtures equipped with standard BNC IN/OUT connectors, plug-in sockets (for crystals and junction capacitors) and surface access to tuning capacitors are available from CTS Knights at a nominal cost of $50.00 each. Order by part number shown with test circuit.

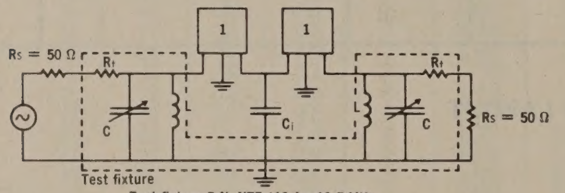
2-POLE FILTER TEST CIRCUIT (NATURALLY TERMINATED)



Test fixture P.N. NTF-210 for 10.7 MHz.
Test fixture P.N. NTF-220 for 21.4 MHz.

	Rt	C	L
1211A thru E or M	2.2K	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1221A thru E or M	2.5K	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1231A thru E or M	4.0K	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
2211A thru E or M	600	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2221A thru E or M	690	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2231A thru E or M	1.2K	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core

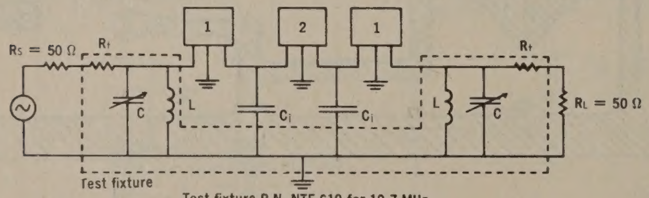
4-POLE FILTER TEST CIRCUIT (NATURALLY TERMINATED)



Test fixture P.N. NTF-410 for 10.7 MHz.
Test fixture P.N. NTF-420 for 21.4 MHz.

	Rt	Ci	C	L
1411A thru E or M	3.2K	6 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1421A thru E or M	3.4K	5 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1431A thru E or M	5.6K	1 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
2411A thru E or M	810	13 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2421A thru E or M	850	11 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2431A thru E or M	1.8K	2 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core

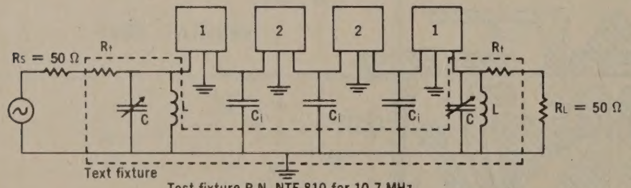
6-POLE FILTER TEST CIRCUIT (NATURALLY TERMINATED)



Test fixture P.N. NTF-610 for 10.7 MHz.
Text fixture P.N. NTF-620 for 21.4 MHz.

	Rt	Ci	C	L
1611A thru E or M	3.4K	6 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1621A thru E or M	3.7K	5 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1631A thru E or M	5.9K	1 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
2611A thru E or M	860	13 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2621A thru E or M	930	11 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2631A thru E or M	1.8K	2 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core

8-POLE FILTER TEST CIRCUIT (NATURALLY TERMINATED)



Test fixture P.N. NTF-810 for 10.7 MHz.
Test fixture P.N. NTF-820 for 21.4 MHz.

	Rt	Ci	C	L
1811A thru E or M	3.4K	6 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1821A thru E or M	3.7K	5 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
1831A thru E or M	5.9K	1 pF	4.5-20 pF	60 Turns #36 Wire On Micrometals T30-6 Core
2811A thru E or M	860	13 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2821A thru E or M	930	11 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core
2831A thru E or M	2.0K	2 pF	4.5-20 pF	30 Turns #36 Wire On Micrometals T30-6 Core

MEASURING INSERTION LOSS

1. For 50 ohm filters and other purely resistive terminations: Replace filter with a short; use this as 0 dB reference level. Remove short and replace with filter. The difference between the two signal levels is the insertion loss.
2. For naturally terminated monolithic crystal filters: In these applications the load is not purely resistive, thus the 0 dB reference signal level must first be determined by tuning the test fixture itself to maximum response with filter shorted. (With a spectrum analyzer/tracking generator, the 0 dB reference can be determined simply by switching to a broad frequency range and reading the peak response of the fixture.) The next step is to replace the short with the filter and retune for optimum bandpass characteristics. The difference between the previously determined 0 dB reference level and the peak response of the filter is the insertion loss.

CTS KNIGHTS, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

FILTERS/ CLOCK OSCILLATORS

MODEL MCF 4500
45 MHz 2-POLE CRYSTAL FILTER

SPECIFICATIONS:

Fo:	45 MHz
BW3:	18 KHz min.
BW20:	65 KHz max.
Ripple:	2 dB max.
Insertion Loss:	2 dB max.
Input & Output Impedance:	2.5K
Spurious Attenuation:	15 dB min.
Case Style:	H3W3 (Fig. 32)
Pricing:	Contact Factory

MODEL MCF 6200 LOW COST FILTER FOR AM & SSB APPLICATIONS

SPECIFICATIONS:

Center Frequency Available:	10-13 MHz
Bandwidths (3 dB):	SSB: 2.2 KHz min.-2.7 KHz max. AM: 5 KHz min.
Shape Factor:	(50 dB/3 dB): 2.0 min.
Unwanted Mode Attenuation:	60 dB min.
Ultimate Attenuation:	75 dB max.
Ripple:	1 dB typical, 2 dB max.
Insertion Loss:	SSB version: 6 dB max. AM version: 5 dB max.
Pricing:	Contact Factory

PACKAGE: Case Style C for Naturally Terminated Designs (also available A, B, D, E). Reference: Fig. 39—40—42—43. Case Style A only for 50 ohms matched design.

I/O Impedances Available	Natural Z	Matched Z
SSB Version	500-1000 ohms	50 ohms
AM Version	750-1500 ohms	50 ohms

CRYSTAL DISCRIMINATORS

CTS Knights' packaged crystal discriminations offer excellent crossover stability, low distortion and small size. We offer a variety of packages and circuit options. The following table briefly summarizes our recommended design limitations:

CTS Knights also offers monolithic dual resonator crystals to function with integrated circuit quadrature detectors such as the RCA CA3089E. These crystals are available with center frequency bandwidth limitations as shown in the table. Contact factory for price.

Center Frequency	Peak-to-Peak Bandwidth	Linearity	Center Frequency Stability	
MHz	% of Center Freq.	%	ppm	
8-25	.05 to .25	3-7	±3x10⁻⁵	−20 to 85°C

CRYSTAL CLOCK OSCILLATORS

CTS Knights' crystal clock oscillators provide a highly reliable timing function for military and commercial digital applications. The discrete packaged units such as the JKTO-77 and 78 are useful in applications where size is not a problem. The JKTO-79 series cold-weld sealed hybrid oscillators are ideal for applications where size must be reduced to a minimum while maintaining reliability. The most economical hybrid clock oscillator in the CTS line is the MXO-40. Contact CTS for special frequencies or output requirements.

DISCRETE CLOCK OSCILLATORS

Hermetically sealed metal package. Sine wave and CMOS configurations available. Operating temperature range −55°C to +125°C. Frequency to 60.0 MHz. Designed to MIL-O-55310A environmental specifications.

Model	Frequency Range	Approximate Price (In Sequence)	
		10 pcs	100 pcs
JKT077	1-4.99 MHz	$51.00	$32.00
JKT077	5-50 MHz	40.00	25.00
JKT078	50-999 kHz	64.00	40.00
JKT078	1-50 MHz	42.00	27.00

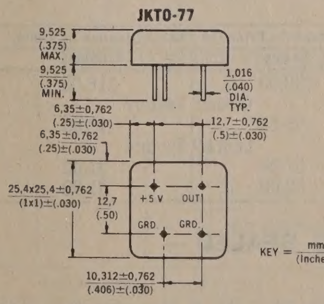


Fig. 44

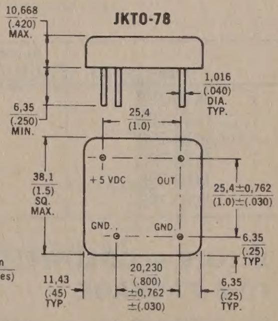


Fig. 45

Model	Frequency Range	Dimensions		Supply Voltage	Stability vs. Operating Temperature		Cal. Tol. @ 25°C	Output
		inches	mm					
JKTO-77	5-20 MHz	1.0x1.0x.375	25,4x25,4x9,525	+5 VDC	±.01%	−55 to 125°C	±50x10⁻⁶	TTL
JKTO-78	50-50,000 KHz	1.5x1.5x.420	38,1x38,1x10,668	+5 VDC	±.01%	−55 to 125°C	±50x10⁻⁶	TTL

CTS KNIGHTS, INC.

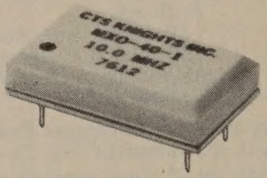
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

SPECIALISTS IN FREQUENCY MANAGEMENT

HYBRID CLOCK OSCILLATORS

HYBRID CLOCK OSCILLATORS

MXO-40 — LOW PROFILE 96% ALUMINA CERAMIC CASE — TTL COMPATIBILITY SYMMETRY TYPICALLY 48%-52%


CTS KNIGHTS INC.
MXO-40-1
10.0 MHZ
7612

OUTPUT FREQUENCY: 31.5 KHz to 26 MHz

FREQUENCY STABILITY

(Inclusive of calibration tolerance @ 25°C., operating temp. range, environmental conditions, input voltage change, aging and load change): MXO-40-1 ±.1% MXO-40-2 ±.01% MXO-40-3 ±.005% with .0025% to .0099% available upon request.

CMOS output available. Contact factory for details.

OPERATING CONDITIONS:

Supply Voltage: 5.0 V ±10%

Operating Temperature: 0 to 70°C.

Fan Out: 10 standard TTL loads

Storage Temperature: −55 to +125°C

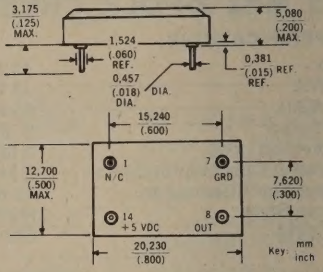

3,175
(.125)
MAX.
1,524
(.060)
REF.
0,457
(.018)
DIA.
DIA.
5,080
(.200)
MAX.
0,381
(.015) REF.
REF.
15,240
(.600)
12,700
(.500)
MAX.
1
N/C
7
GRD
14
+5 VDC
8
OUT
7,620
(.300)
20,230
(.800)
Key: mm / inch

Fig. 46

ELECTRICAL CHARACTERISTICS

	Min.	Typ.	Max.	Units
Logic 1 Level	2.5	3.8		V
Logic 0 Level		.25	.5	V
Symmetry		48-52	45-55	%
Start Up Time			2.0	MS
Short Circuit Output Current	—		100	MA
Rise Time: 8-26 MHz		3	8	NS
31.5 KHz - 8 MHz		6	15	NS
Fall Time: 8-26 MHz		3	8	NS
31.5 KHz - 8 MHz		6	15	NS

SUPPLY CURRENT

	Typ.	Max.	Units
8-26 MHz	16	30	MA
4-8 MHz	25	50	MA
2-4 MHz	35	60	MA
.5-2 MHz	45	75	MA
250-500 KHz	55	95	MA
125-250 KHz	65	105	MA
31.5-125 KHz	75	120	MA

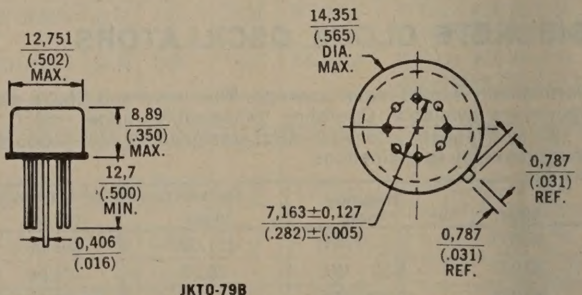
APPROXIMATE PRICE

	30 kHz-299 kHz	300 kHz-4.499 MHz	4.5 MHz-18.99 MHz	19.0 MHz-23.99 MHz
MX040-1		Contact Factory		
MX040-2				
10 pcs	32.00	31.00	14.50	16.50
100 pcs	15.00	15.00	8.00	8.50
MX040-3		Contact Factory		

Model	Approximate Price (In Same Sequence As Table) 10 pcs	 100 pcs
JKTO-79B	$30.00	$16.00
JKTO-79B	Contact Factory	
JKTO-79C	35.00	19.00
JKTO-79C	Contact Factory	
JKTO-79S	57.00	31.00
JKTO-79S	60.00	31.00

JKTO79 — COLDWELD SEALED — TO-8 PACKAGE

The JKTO-79C has an enable line and is available with complementary and dual outputs.


12,751
(.502)
MAX.
8,89
(.350)
MAX.
12,7
(.500)
MIN.
0,406
(.016)
14,351
(.565)
DIA.
MAX.
0,787
(.031)
REF.
7,163±0,127
(.282)±(.005)
0,787
(.031)
REF.

KEY = mm / (Inches)

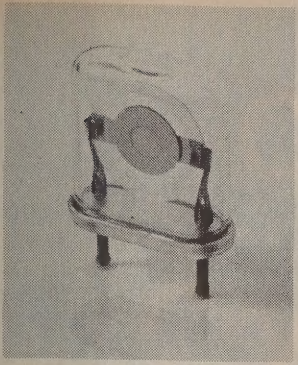
JKTO-79B
JKTO-79C
JKTO-79S

Fig. 47

Model	Frequency Range	Dimensions (Inches)	Supply Voltage	Stability vs. Operating Temperature		Cal. Tol. @ 25°C	Output
JKTO-79B	8-26 MHz	TO-8 Holder	+5 VDC	$\pm 25\times10^{-6}$	0 to 70°C	$\pm 20\times10^{-6}$	TTL
JKTO-79B	Same as above except stability:			$\pm 100\times10^{-6}$	−55 to 125°C		
JKTO-79C	.25-8 MHz	TO-8 Holder	+5 VDC	$\pm 25\times10^{-6}$	0 to 70°C	$\pm 20\times10^{-6}$	TTL
JKTO-79C	Same as above except stability:			$\pm 100\times10^{-6}$	−55 to 125°C		
JKTO-79S	8-20 MHz	TO-8 Holder	+5 VDC	$\pm 25\times10^{-6}$	0 to 70°C	$\pm 20\times10^{-6}$	SINE
JKTO-79S	Same as above except stability:			$\pm 100\times10^{-6}$	−55 to 125°C		

CTS KNIGHTS, INC., Dept. EM, 400E Reimann Avenue, Sandwich, Illinois 60548 • Telephone (815) 786-8411 • TWX 910-642-0860 Cable CTS

Add Dept. EM to address to tell them you saw it in eem



We would like to help your control your Hertz.

Colorado Crystal Corporation — providing leadership in frequency control through precision — state of the art manufacturing techniques, enabling us to provide crystal parameter control necessary for today's electronic applications.

Part No.	CK-1	CK-2	CK-3	CK-4	CK-5	CK-6	CK-7	CK-8	CK-9	CK-10	CK-11	CK-12	CK-13
Freq-MHz	3.000	4.000	5.000	10.000	10.000	25.000	25.000	50.000	50.000	100.000	125.000	150.000	200.000
Vibration Mode	fund	fund	fund	3rd	fund	fund	3rd	3rd	5th	5th	5th	7th	7th
Holder Type	glass HC/27	glass HC/27	glass HC/27	glass HC/27	metal HC/6	metal HC/18	metal HC/18	metal HC/18	metal HC/18	metal HC/18	metal HC/18	metal HC/18	metal HC/18
Drive Level-MW	0.10	0.10	0.10	0.10	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Calibrate Value-Ohms	10	10	10	22	10	10	30	40	40	51	51	60	60
Resonance	A/R 50 pF	A/R 50 pF	A/R 50 pF	A/R 28 pF	A/R 32 pF	Series	Series	Series	Series	Series	Series	Series	Series
Nominal C_o-pF	3.2	3.2	3.2	4.9	4.4	3.7	4.2	3.75	3.50	3.50	3.50	3.50	3.50
Nominal C_1-pF	.0114	.0114	.0114	.0022	.02	.016	.0018	.0015	.0005	.00045	.00042	.00027	.00025
Nominal L-Mh	247	139	89	115	12.7	2.54	22.7	6.76	20.3	5.63	3.86	4.17	2.54
Nominal R-Ohms	4.65	4.65	4.65	12	7.96	9.96	22.1	26.5	40.0	44.5	47.5	54.5	57.7
Nominal "Q"	1 Million	750K	600K	600K	100K	40K	160K	80K	160K	80K	64K	74K	55.5K
Pullability Δf-ppm**	162	162	162	29.8	275	224	24.9	21.0	7.0	6.3	5.9	3.8	3.5
Test Set	*** TS/330	*** TS/330	*** TS/330	*** TS/330	TS/330	TS/683	TS/683	TS/683	TS/683	TS/15 TS/683	TS/15	TS/15	TS/15

Operating Temperature Range = 0°C to +60°C
Temperature Coefficient = ± 10 ppm
Calibration @ +25°C = ± 10 ppm

**Δf ppm Series to AR-32 pF
***Modified

*Note: Any Anti Resonant value may be used.

$$C_1 \cong \frac{2(C_o + C_x^*)\,\Delta f}{f}$$

$$L = \frac{1}{(2\pi f)^2 C_1}$$

$$Q = \frac{1}{4\pi R \Delta f\,(C_o + C_x)}$$

Where: C_o = Total shunt capacitance of crystal unit in farads.
C_x = Equivalent load capacitance in series with crystal in series mode oscillator in farads.
R = Equivalent series arm resistance of crystal unit in ohms.
C_1 = Equivalent motional arm capacitance of crystal unit in farads.
L = Equivalent motional arm inductance of crystal unit in Henries.
Δf = Δf or difference in series resonant frequency and anti resonant frequency with C_x in series with crystal in cps.
f = Frequency in cps.

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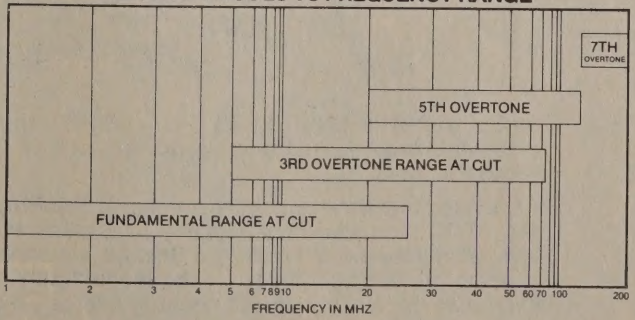

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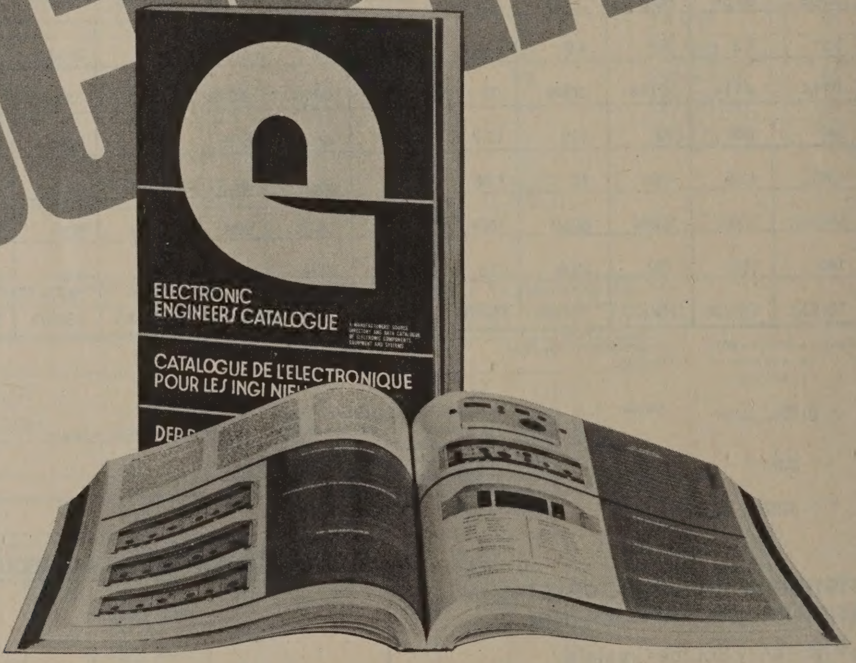

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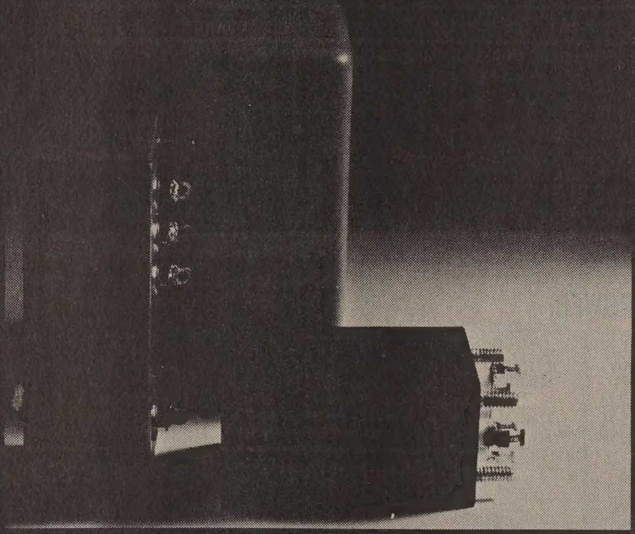

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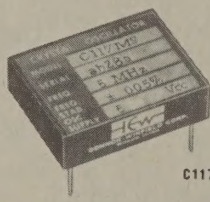
TTL SQUARE WAVE

DIP XTAL AND RC Output		Type	Model†	Freq. Tol.**	Fixed Frequencies Available	Frequency Adjust	Package	Supply Voltage	Supply Current***
Standard TTL output Duty cycle 30/70 or better, risetime and fall time ≤ 50 ns Amplitude stability ±5% with fixed supply voltage	low cost	Xtal	S14R1	E	3 MHz to 25 MHz	N.A.	3 Pin DIP 0.78″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.3″ (0.8 cm) H 0.02″ (.05 cm) Diameter Gold Plated Pins to Fit 14 Pin IC Socket	5VDC ±20%	< 1 mA to 5 mA
		Xtal	S14R5	E	8 MHz to 20 MHz	N.A.	3 Pin DIP 0.2″ (0.51 cm) H x 0.5″ (1.2 cm) W x 0.87″ (2.2 cm) L	5VDC ±20%	< 1 mA to 10 mA
CMOS or one TTL Load		Xtal	S14R4	F	32 KHz to 78 KHz	N.A.		+5VDC to 15VDC	Depending on Frequency and Supply Voltage 2 mA to 15 mA
One HNIL or two TTL load			S14R4T		8 Hz to 35 KHz		Same as S14R4 Above Except Height 0.25″ (.64 cm)		
Standard TTL output Model L14—, duty cycle 49/51-51/49 < 10 MHz, 30/70-70/30 > 10 MHz; Model D14 — duty cycle 49/51-51/49 <10 MHz, 30/70-70/30 ≥ 10 MHz; Risetime and Falltime < 50 ns; Duty cycle other models 49/51-51/49; Amplitude Stability ±5% with fixed supply voltage L14Q		Xtal	D14C	B	1 MHz to 25 MHz	N.A.	3 Pin DIP 0.8″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.3″ (0.8 cm) H Pins .017″ (.04 cm) sq.	5VDC ±5%	15 mA to 40 mA
			D14D	L					
			D14E	E					
		RC	L14Q	Q	50 Hz to 20 KHz	External (Separate) Resistance ±2% Standard	0.8″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.44″ (1.1 cm) H		20 mA to 50 mA
			L14R	W					
		Xtal	L14C	Table A Below	1 Hz to 25 MHz	Optional External (Separate) Capacitance or Inductance ±100 ppm	0.8″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.35″ (0.9 cm), 0.44″ (1.1 cm) or 0.57″ (1.45 cm) H depending on freq.		5 mA to 150 mA
			L14D		1 Hz to 60 MHz				
			L14E						
		RC	L117A	Table B	1 Hz to 20 KHz	Internal ±2% Standard	1.6″ (4.1 cm) L x 1.2″ (3.0 cm) W x 0.4″ (1.0 cm) H		20 mA to 50 mA
		Xtal	IC5A1 thru J1	Table A Below	.00005 Hz to 400 KHz	Optional ±10 ppm		5VDC ±10%	< 10 mA 150 mA
			IC5K1 thru Y1		400 KHz to 60 MHz			5VDC ±5%	5 mA to 35 mA

CMOS SQUARE WAVE (LOW POWER)

CMOS output 30/70 duty cycle, 85% of supply voltage amplitude into a 10KΩ load	low cost	Xtal	S14R2	E	3 MHz to 25 MHz	N.A.	3 Pin DIP 0.78″ (1.98 cm) L x 0.49″ (1.24 cm) W x 0.3″ (.76 cm) H 0.02 (.05 cm) Dia. Gold Plated Pins	5VDC and 15VDC	< 1 to 5 mA
CMOS output 49/51 — 51/49 duty cycle		Xtal	S14R4C	F	8 Hz to 35 KHz		Same as S14R4T Above		
 C117MS CMOS output Duty Cycle for Model C119A, B and C is 40/60, 60/40, others 51/49, 49/51		Xtal	L24R1K L24R1R L24R1M	Table A Below	< 1 Hz to 10 MHz Binary Divisions of Fundamental Frequency (Specify Between 500 Hz & 10 MHz)	N.A.	24 Pin DIP 1.25″ (3.1 cm) L x 0.8″ (2.0 cm) W x 0.43″ (1.1 cm) H 0.02″ (.05 cm) Dia. Gold Plated Pins	+5VDC to +15VDC	3 mA to 15 mA Depending on Supply Voltage
	low cost	Solid State	C130MS	Table B Right Page	24.4 Hz to 250 KHz	N.A.	1.5″ (3.8 cm) sq. x 0.5″ (1.2 cm) H .03″ (.07 cm) Dia. Gold Plated Pins		< 1 to 5 mA
			C131MS			Internal Screw Adjust ±0.2% on C131MS			
			C119A	Table B Acc. ±1 KHz	180 KHz to 550 KHz	N.A.	1.6″ (4.1 cm) L x 1.2″ (3.0 cm) W x 0.4″ (1.0 cm) H 0.03″ (.07 cm) Dia. Gold Plated Pins Other Pin Dimensions by Request		1 mA to 5 mA
			C119B	Table B Acc. ±0.1%					
			C119C	Table B		Internal Screw Adjust			
		RC	C117MS	Table B	1 Hz to 20 Hz				1 mA to 6 mA
CMOS output Duty Cycle 50/50 30/70 — 70/30 > 1.5 MHz		Xtal	C123 MSK C123 MSR	Table A Below	.0001 Hz to 10 MHz	Optional ±30 ppm for Model C121			≤ 1mA at 5VDC ≤ 5 mA at 15VDC
			C123 MSM C123 MSV		100 Hz to 10 MHz				≤ 1 mA at 5VDC ≤ 3 mA at 15VDC

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Note A: Frequency Stability ±2%, 0°C to +50°C or ±5%, −40°C to +85°C; Frequency Accuracy ±1% at a specified supply voltage.

† Use Model L14 or L84 for .023″ (.06 cm) x .016″ (.04 cm) pins. Use Model L13 or L83 for .017″ (.04 cm) square pins.

** Letter reference from charts above to combinations of frequency tolerance and temperature range listed opposite letters in Table A below.

‡ Temperature range can be shifted ±50°C within the range of −55°C to +125°C for crystal oscillators, and ±10°C for RC oscillators.

*** Supply current depends on frequency.

N.A. — not available

TABLE A (SEE CHARTS ABOVE)

Model	**	Frequency Tolerance	Temp. Range Degrees C‡
L24R1K, or C123MSK, or IC5K1	K	±.001%	+20 to +40
IC5A2, L220A, C121MSA IC5A1	A	±.002%	+20 to +40
IC5N1	N	±.0025%	+10 to +40
L24R1R, C123MSR, IC5R1	R	±.0025%	0 to +50
IC5S1	S	±.003%	0 to +50
IC5T1	T	±.003%	0 to +65
IC5U1	U	±.004%	0 to +65
IC5X1	X	±.004%	−25 to +50
	L	±.0075%	−25 to +75
L14C, L14F and L84F	—	±.001%	0 to +50
L14D, L14G and L84G	—	±.0025%	0 to +65
L24R1M or C123MSM	—	±.005%	−40 to +85

TABLE A (CONTINUED)

Model	**	Frequency Tolerance	Temp. Range Degrees C‡
IC5B2, L220B or IC5B1	B	±.005%	0 to +50
IC5Y1	Y	±.005%	−25 to +65
IC5E2, L220E IC5E1	E	±.01%	−25 to +75
IC5F1	F	±.02%	−25 to +75
IC5G1	G	±.02%	−55 to +75
IC5H1	H	±.05%	−55 to +75
IC5J1	J	±.05%	−55 to +125
L14E, L14I and L84I	—	±.005%	−25 to +75
Other Specific Combinations As Referred to in Charts Above	Q	±1%	0 to +50
	W	±0.25%	0 to +50
	Z	±0.1%	+20 to +40
C123MSV	—	±0.01%	−55 to +125

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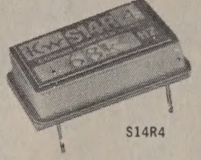
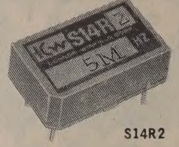
L14T

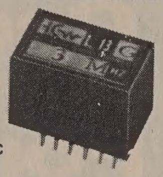


S14R4



S14R2

S16R1

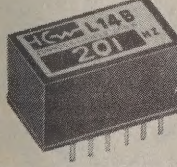


L13C

TTL PULSE

Output*		Type	Model†	Freq. Tol.**	Fixed Frequencies Available	Frequency Adjust	Package	Supply Voltage	Supply Current
Negative pulse, duration 60µs or less Amplitude 2.4Vp +1Vp −0Vp into a 2KΩ load	low cost	RC	L14A	Q	50 Hz to 25 KHz	External (Separate) Resistance ±2% Standard	0.8″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.17″ (0.43 cm) H	5VDC ±5%	1 mA to 5 mA
			L16A	W or Z			16 Pin DIP Pin 9 Omitted 0.87″ (2.2 cm) L x 0.5″ (1.2 cm) W x 0.2″ (0.5 cm) H		
	low cost		L14T	Q Accuracy +0% −2%		External (Separate) Resistance Optional	Same as L14A Above		
Negative pulse, duration 20 to 100µs Amplitude 2Vp +1Vp −0Vp into 1KΩ load (4Vp in 10KΩ) Amplitude stability ±5% with fixed supply voltage			L79A	Table B Below	1 Hz to 25 KHz	Standard Internal Screw Adjust ±2%	1.2″ (3.0 cm) L x 0.8″ (2.0 cm) W x 0.5″ (1.2 cm) H		
Negative pulse, duration 20 to 100µs Amplitude 10Vp ±2Vp into 10KΩ load Amplitude stability ±5% with fixed supply voltage		RC	L80A					12VDC ±5%	

SINEWAVE

Output*	Type	Model†	Freq. Tol.**	Fixed Frequencies Available	Frequency Adjust	Package	Supply Voltage	Supply Current
Amplitude 3V_{rms} ±1V_{rms} into a 10KΩ load (can drive 1KΩ as option) Harmonic distortion ≤ 5% Amplitude stability ±5% with fixed supply voltage  L14B	RC	L14B	Q	1 KHz to 20 KHz	External (Separate) Resistance ±2% Standard	0.8″ (2.0 cm) L x 0.5″ (1.2 cm) W x 0.57″ (1.45 cm) H	5VDC ±5%	15 mA to 50 mA
		L14N	W	1 KHz to 20 KHz				
	Xtal	L14F	Table A Left Page	100 KHz to 25 MHz	External (Separate) Capacitance or Inductance ±100 ppm			35 mA to 150 mA
		L14G		100 KHz to 60 MHz				
		L14I		100 KHz to 60 MHz				
		L84F		20 KHz to < 100 KHz		1.2″ (3.0 cm) L x 0.8″ (2.0 cm) W x 0.5″ (1.2 cm) H		35 mA to 150 mA
		L84G		20 KHz to < 100 KHz				
		L84I		20 KHz to < 100 KHz				
		IC5A2 thru J2		20 Hz to 500 KHz	Optional ±10 ppm	2″ (5.1 cm) sq. x 0.6″ (1.5 cm) H	5VDC ±10%	15 mA to 100 mA
	RC	L199B	Table B Below	50 Hz to 20 KHz	Internal Screw Adjust ±2% Standard		5VDC ±5%	20 mA to 50 mA
Amplitude 5V_{rms} ±2V_{rms} into a 10KΩ load Harmonic distortion ≤ 5% Amplitude stability ±5% with fixed supply voltage	Xtal	L220A thru J	Table A Left Page	50 Hz to 500 KHz	Optional ±10 ppm		12VDC ±10%	15 mA to 100 mA
	RC	L200B	Table B Below	50 Hz to 20 KHz	Internal Screw Adjust ±2% Standard		12VDC ±5%	10 mA to 25 mA

SINEWAVE FILTER

Input: Squarewave, ½ x supply voltage minimum pp, supply voltage maximum pp into 10KΩ	LC	L117C	Any fixed frequency from 50 Hz to 20 KHz	1.6″ (4.1 cm) L x 1.2″ (3.0 cm) W x 0.5″ (1.2 cm) H .03″ D Gold Plated Pins for PC Board Mounting	5VDC ±5%	5 mA Maximum
Output: Sinewave, T.H.D. ≤ 5%, into a 10KΩ load, 3V_{rms} ±1 for L117C, 5V_{rms} ±1V_{rms} for L118C, Amp Stability ±5%	LC	L118C			+12VDC to +15VDC ±5%	

TCXO — .03″ (.07 cm) DIAMETER GOLD-PLATED SOLDER PINS FOR C12A, B, AND C; .017″ (.04 cm) DIAMETER GOLD-PLATED SOLDER PINS FOR S16R1, R2

FLAT PACK Output*		Model	Frequency Tolerance‡	Fixed Frequencies Available	Frequency Adjust	Package	Supply Voltage	Supply Current***
TTL Square Low Power CMOS Square or Sine	Standard TTL output OR 0.6 to 9.5V_{rms} for sinewave with a 10V supply into a 600Ω to 15KΩ load Amplitude stability ±5% with fixed supply voltage.	C12A	±.000055% +25°C to +35°C	.0001 Hz to 20 MHz	Internal Screw Adjust ±30 ppm	1.75″ (4.5 cm) sq. x 0.4″ (1.0 cm) or 0.5″ (1.3 cm) H >2 kHz, >2.0″ (5.08 cm) sq. ≤ 2 KHz	5VDC ±1% for TTL OR any fixed voltage 8 to 15VDC ±1%	10 mA to 75 mA for TTL OR < 1 mA to 50 mA
		C12B	±.00015% 0° to +50°C					
		C12C	±.00025% −25°C to +65°C					
TTL Square	Standard TTL Output	S16R1	±.001% 0°C to +50°C or ±.003% −25°C to +75°C Frequency Accuracy ±.0002%	500 KHz to 6 MHz	N.A.	0.93″ (2.4 cm) L x 0.8″ (2.0 cm) W x 0.29″ (.74 cm) H S16R1 Epoxy Seal S16R2 Solder Seal	5VDC ±5%	40 mA max.
		S16R2	±.005% −55°C to +125°C Frequency Accuracy ±.0002%					

† Use Model L14 or L84 for .023″ (.06 cm) x .016″ (.04 cm) pins.
Use Model L13 or L83 for .017″ (.04 cm) square pins.

‡ Temperature range can be shifted ±50°C within the range of −55°C to +125°C for crystal oscillators, and ±10°C for RC oscillators.

N.A. — not available

* Tighter amplitude tolerance available on sinewave outputs except for frequency > 100 KHz and/or supply voltage < 10V.

** Letter reference from charts above to combinations of frequency tolerance and temperature range listed opposite letters in Table A below.

*** Supply current depends on frequency.

VCO AND VCXO

VCXO MODELS V220A, V220B, V220C AND V220D ARE AVAILABLE. VCO's ARE ALSO AVAILABLE. PLEASE CONTACT US WITH YOUR REQUIREMENTS.

TABLE B

(SEE CHARTS ABOVE)

Frequency Tolerance and Temperature Range (Specify One or More)	±.05% +15°C to +35°C	or	±0.1% +0°C to +50°C	or	±0.25% 0°C to +65°C	or	±0.5% −25°C to +65°C

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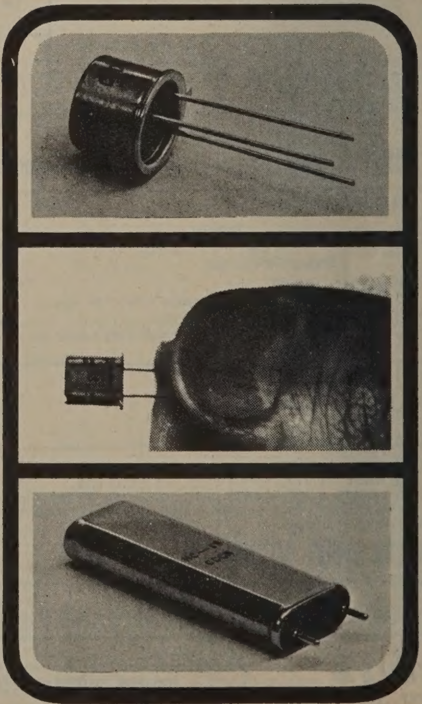

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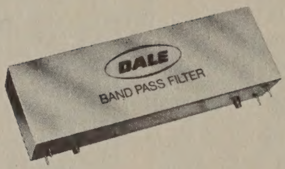
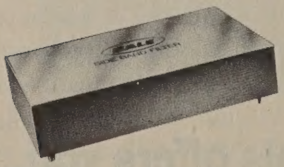


Center Frequency	Band Width	Band Width	Package	P/N
217.4 KHz	4 KHz at 3 dB	4.6 KHz at 30 dB	2.6x3.8x.64	FIL-0656
245.355 KHz	2.78 KHz at 1 dB	3.26 KHz at 60 dB	1.9x2.8x.7	FIL-0348
248 KHz	1.2 KHz at 1 dB	2.4 KHz at 60 dB	1.6x3x1.1	FIL-0861
250 KHz	6 KHz at 2 dB	12 KHz at 60 dB	1.9x2.8x.7	FIL-0498
250 KHz	440 Hz at 3 dB	2.2 KHz at 60 dB	1x3x1	FIL-0811
250 KHz	6 KHz at 1 dB	30 KHz at 60 dB	1.2x2.4x1.1	FIL-0862
254.645 KHz	2.78 KHz at 1 dB	3.26 KHz at 60 dB	1.9x2.8x.7	FIL-0347
287.600 KHz	100 Hz at 1 dB	2 KHz at 30 dB	2.6x3.8x.64	FIL-0657
340.5 KHz	800 Hz at 1 dB	4 KHz at 60 dB	2.1x3.4x.9	FIL-0670
340.5 KHz	1 KHz at 1 dB	8 KHz at 60 dB	2.1x3.4x.9	FIL-0671
340.5 KHz	300 Hz at 1 dB	2.4 KHz at 60 dB	2.1x3.4x.9	FIL-0672
340.5 KHz	120 Hz at 1 dB	1.2 KHz at 60 dB	2.1x3.4x.9	FIL-0673
455 KHz	100 Hz at 6 dB	1 KHz at 60 dB	1x2.8x1	FIL-0855
455 KHz	1 KHz at 6 dB	10 KHz at 60 dB	1x2.8x1	FIL-0854
1000 KHz	900 Hz at 3 dB	6 KHz at 60 dB	1x2.8x1.5	FIL-0629
1000 KHz	900 Hz at 3 dB	36 KHz at 45 dB	1x1.92x1.5	FIL-0627
1000 KHz	2 KHz at 3 dB	36 KHz at 45 dB	1x1.92x1.5	FIL-0628
1749.5 KHz	7.2 KHz at .4 dB	30 KHz at 60 dB	1.7x3.1x1.1	FIL-0858
1750 KHz	6 KHz at 3 dB	19 KHz at 40 dB	1.12x3.4x1	FIL-0965
2750 KHz	1 KHz at 3 dB	100 KHz at 60 dB	1x3x.6	FIL-0417

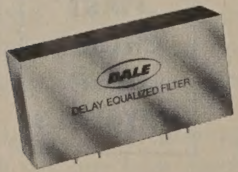
Bandpass Filters available from 16 KHz to 25 MHz.

SIDE BAND FILTERS



Carrier Frequency	Band Width	Band Width	Package	P/N
250 KHz at 40 dB	2.75 KHz at 2 dB		1x4x.8	FIL-0555
250 KHz at 40 dB	2.75 KHz at 2 dB		1x4x.8	FIL-0556
250 KHz at 60 dB	2.78 KHz at 1 dB	3.26 KHz at 60 dB	1.9x2.8x.7	FIL-0349
250 KHz at 60 dB	2.78 KHz at 1 dB	3.26 KHz at 60 dB	1.9x2.8x.7	FIL-0350
1000 KHz at 60 dB	2 KHz at 3 dB		1x4.5x1.53	FIL-0625

DELAY EQUALIZED FILTERS



Frequency	Band Width	Band Width	Package	P/N
251.675 KHz	2.85 KHz at 1 dB	3.4 KHz at 60 dB	2.6x5x1.1	FIL-0859
248.325 KHz	2.85 KHz at 1 dB	3.4 KHz at 60 dB	2.6x5x1.1	FIL-0860
258 KHz	3.2 KHz at .5 dB		2.3x4.5x.9	FIL-0986

DELAY DISTORTION

1. 425 Micro Seconds over 85% of 1 dB BW
2. 425 Micro Seconds over 85% of 1 dB BW
3. 50 Micro Seconds over 87% of .5 dB BW

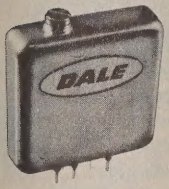
CUSTOM DESIGNS

Computer Optimized Designs in Lowpass, Highpass, Bandpass, Band Reject and Prescribed Transfer Function characteristics are available from 1 Hz to 150 MHz. Delay Equalizers for Voice, Rtty Multi-Plex. Group Filters and Super Group Filters.

DALE ELECTRONICS FREQUENCY CONTROL GROUP
930 West 23rd Street, Tempe, Arizona 85282 • Tel: 602-967-7874 • TWX: 910-950-1943

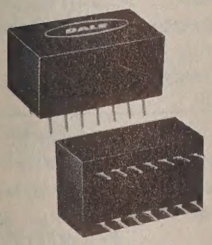
DALE® CRYSTAL OSCILLATORS

TCXO's



Frequency	Stability	Temp. Range	Output	Power Require.	Size	Type/ Part No.
3 thru 20 MHz	±1 ppM	+15 to +50°C	TTL Compatible	5 Vdc ±5% 15 mA	1.2x1.8x.65	2200-A
3 thru 20 MHz	±1 ppM	0 to +50°C	TTL Compatible	5 Vdc ±5% 15 mA	1.2x1.8x.65	2200-B
3 thru 20 MHz	±5 ppM	0 to +50°C	TTL Compatible	5 Vdc ±5% 15 mA	1.2x1.8x.65	2200-C
3 thru 20 MHz	±1 ppM	−40 to +70°C	TTL Compatible	12 Vdc ±5% 15 mA	2x2x.65	2211-A
3 thru 20 MHz	±1 ppM	−55 to +85°C	TTL Compatible	12 Vdc ±5% 15 mA	2x2x.65	2211-B
3 thru 20 MHz	±0.5 ppM	0 to +50°C	TTL Compatible	12 Vdc ±5% 15 mA	2x2x.65	2211-C
1 KHz thru 1 MHz	±1 ppM	−40 to +70°C	CMOS Compatible	12 Vdc ±5% 12 mA	2x2x.75	2230
3 thru 20 MHz	±1 ppM	−40 to +70°C	0 dbM SINE into 50 Ohms	12 Vdc ±5% 15 mA	2x2x.75	2240

CLOCK OSCILLATORS



Frequency	Stability	Temp. Range	Output	Power Require.	Size	Type/ Part No.
3.7 thru 20 MHz	±100 ppM	0 to +60°C	TTL Compatible	5 Vdc ±10% 25 mA	.5x.8x.3 14 PIN DIP	2027 Series
3.7 thru 20 MHz	±500 ppM	0 to +60°C	TTL Compatible	5 Vdc ±10% 25 mA	.5x.8x.3 14 PIN DIP	2077 Series
3.3 thru 20 MHz	±1000 ppM	0 to +60°C	TTL Compatible	5 Vdc ±10% 25 mA	.5x.8x.3 14 PIN DIP	2097 Series
500 KHz	±2.5%	0 to +60°C	TTL Compatible	5 Vdc ±10% 25 mA	.5x.8x.4 14 PIN DIP	2009
20 thru 100 MHz	±100 ppM	−55 to +85°C	TTL Compatible	5 Vdc +5% 50 mA	1.25x.65x.45	2005 Series
30 KHz thru 5 MHz	±50 ppM	0 to +60°C	TTL Compatible	5 Vdc ±10% 50 mA	1x2x.48	2004 Series

CRYSTALS

Crystals are available over a broad Frequency Range in the following Crystal Cuts and Standard Enclosure Sizes:

Cut	Enclosure Type
AT	6, 18, 36, 40, 44, 46
CT	6, 12, 36, 46
DT	6, 12, 36, 46
H	13

Cut	Enclosure Type
NT	13
SL	6, 12, 36, 46
+5E	13

DALE ELECTRONICS FREQUENCY CONTROL GROUP
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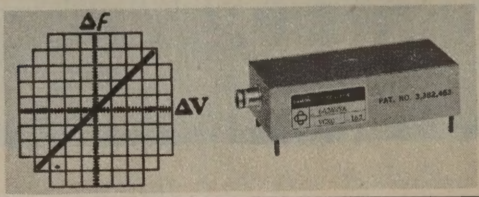
DAMON THE FORM FACTOR SPECIALISTS

VCXOs — 1 KHz to 500 MHz

Damon VCXOs provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. logic circuits is available.

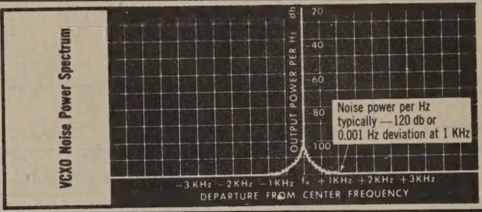


VCXO CHARACTERISTICS:

Center Frequency	1 KHz to 500 MHz
Deviation	.01% to 0.5% of Center Frequency
Linearity	1% to 5% of Peak Deviation
Frequency Stability	Determined by Peak Deviation and Operating Temp.
Modulation Rates	DC to 2 MHz

Low Noise VCXOs

Damon low noise miniaturized VCXOs are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.

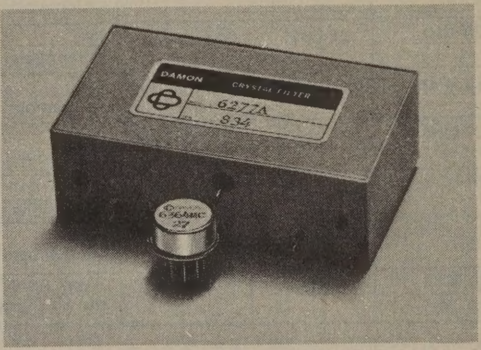


TYPICAL CHARACTERISTICS:

Center Frequency	10.000 MHz ±1 KHz
Deviation	±10 KHz
Linearity	±1%
Modulation Rate	Flat to 4 KHz
Output Power	>1 MW

Gaussian Crystal Filters

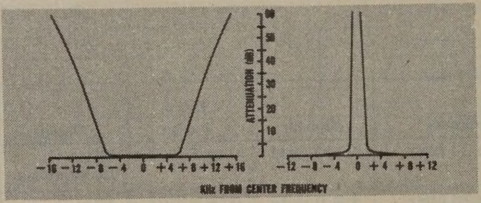
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 8 pole designs.



Center Frequency	
Conventional	10 KHz - 35 MHz
Monolithic	3 - 30 MHz
3 dB Bandwidth	100 Hz - 30 KHz
Shape Factor, 30 dB to 3 dB	3:1 to 7:1
Ringing, Pulse or Impulse	25 - 50 dB down
Phase Linearity	±2%
No. of Poles	
Conventional	2 - 8
Monolithic	2 - 4
Volume	
Conventional	1 - 6 cu. in.
Monolithic	0.016 - 0.4 cu. in.

Band-Pass/Reject Crystal Filters

A wide variety of conventional crystal filters are produced at Damon. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.

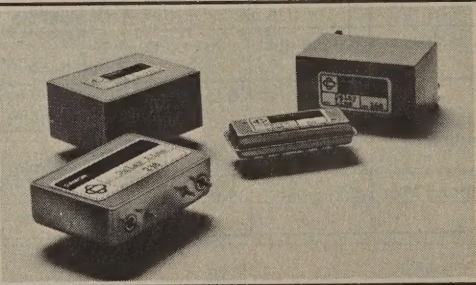


RANGE OF PARAMETERS:

Center Frequency	10 KHz - 75 MHz
Bandwidth	.01% - 3% of C.F.
Shape Factor	Down to 1.2:1
Differential Phase Shift	±2°
Group Delay Uniformity	±5%

Surface-Wave Delay Lines

With signal transfer **across** the surface instead of through the body (a state-of-the-art development), the new Surface-Wave concept results in substantially smaller packages, lower cost in production quantities and superior performance over a 20 MHz to 300 MHz range.

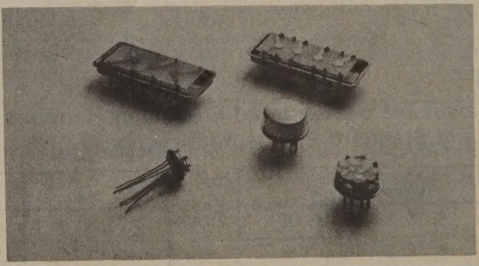


RANGE OF PARAMETERS:

Frequency Range	20 MHz - 300 MHz
Time Delay Range	0.5 - 20 Microsecs.
Bandwidth at −3 dB	3% - 30% of Center Frequency
Insertion Loss	10 - 20 dB
Spurious Responses	25 - 30 dB below Desired Response
Environment	Full Military Temp., Shock, Vibration Available
Typical Size	< 1 cu. in.

Monolithic Crystal Filters

Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



MONOLITHIC CHARACTERISTICS:

Center Frequency	2.5 - 30 MHz
3 dB Bandwidth	0.3 - 30 KHz
No. of Coupled Resonators	2 - 6
Insertion Loss	1 - 6 dB
Ripple	0.5 dB Max.
Terminations	50 Ohms to 20 Kohms
Size	TO-5, TO-8, or Flat-Pack

Write for technical bulletins.

DAMON/ELECTRONICS DIVISION

DEPT. EM, 80 WILSON WAY, WESTWOOD, MASS. 02090, TEL: (617) 449-0800

PRECISION OSCILLATORS

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DEPT. EM, HWY 95 & WEBB RD.
LAPWAI, IDAHO 83540
PHONE: (208) 843-2281
TWX: 510-776-0766

OSCILLATOR
Precision Generator
OSCILLATOR 4MHz
W.H.FERWALT, INC.
LAPWAI, IDAHO
Precision Oscillator

Precision Oscillator

IT FINALLY HAPPENED!

AFTER 15 YEARS IN THE OSCILLATOR BUSINESS, WE HAVE ACCUMULATED TOO MANY MODELS TO LIST ANY MORE

So here are a few of our capabilities:

XO^s at .001Hz to 50MHz

±.001% over +10°C to +50°C
±.003% over 0°C to +75°C (XO33)
±.007% over −40°C to +85°C (XO100)
±.01% over −55°C to +125°C (XO33A)

TCXO^s at 1Hz to 50MHz

±1PPM over 0°C to +50°C (TCXO101)
±.1PPM over 0°C to +50°C (TCXO152)
±.5PPM over 0°C to +65°C
±1PPM over −40°C to +70°C (TCXO152A)

VCXO^s at 1Hz to 85MHz

±25PPM to ±10% control at 5% linearity
±.1PPM to ±.1% stability over 0°C to +50°C
other temp. ranges within
−55°C to +125°C

VCO^s at 1Hz to 75MHz

±1% to ±60% control at 1-10% linearity
Stabilities to ±.5% over 0°C to +75°C
0 to Full Scale Frequency at
.1% linearity (VCO115)

OCXO^s at 1Hz to 30MHz

±1PP10^8 over −20°C to +55°C (PGX147)
±1PP10^7 over 0°C to +50°C (PGX50)
±5PP10^7 over −55°C to +80°C
Short term stability to 5PP10^{10} for 1 sec.
Phase noise: 146db down at 1KHz f_o
Oven voltages: 115VAC, 28VDC, others

Timer/clocks 1Sec to 12 Hours

±10% to ±.0001% over 0°C to +50°C
±10 sec/day over −30°F to +130°F
to ±5 sec/mo over +14°F to +120°F
Hours and minutes readout
Battery and AC powered
Also RC and LC oscillators

GENERAL FEATURES AVAILABLE ON MOST MODELS

Outputs: TTL, CMOS, ECL, Sinewave (1mw into 50Ω to 8V pk-pk into 10KΩ)
Power: +5VDC to +28VDC at a few mw for CMOS to 15W for oven units
Packages: Dual-in-line low profile; solder-on modules; plug-in assemblies
Aging: 2PP10^8 per day to 1PPM per year, plus others
Misc: Manual trim; gated input/output; shock & vibration; military parts

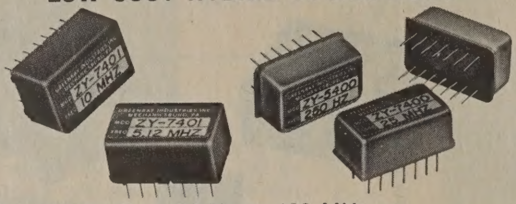
**We have in our library of circuits:
over 120 standard designs (full catalog available) and 250 special designs (individual specs available)**

If we can't come up with one to fit your needs we'll send you to our competitors.

TYPICAL DELIVERIES: off-the-shelf to 4 wks for XO^s; 6 wks for TCXO^s
PRICE RANGE: $25 to $500 (1-9 qty)

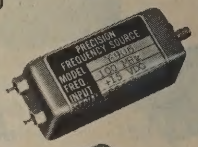
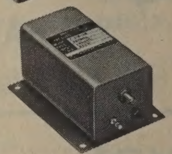
Oscillators .01 Hz to 600 MHz

LOW COST HYBRID OSCILLATORS



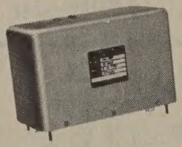
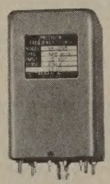
- Available from 50 Hz to 100 MHz
- Small size—typically .8 × .5 × .3″ (L-W-H) or less
- Stabilities up to $\pm 1 \times 10^{-6}$
- Outputs: To drive TTL, CMOS, ECL or sine wave
- Temperature ranges from laboratory up to −55° to +125°C
- Most units fit DIP socket
- Some units available from stock

CRYSTAL OSCILLATORS and TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

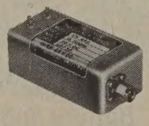



- Available from 1 Hz to 600 MHz
- Many size, mounting, and connector configuration
- Stabilities up to $\pm 5 \times 10^{-7}$
- Output levels from 1 mw to 10 watts, or outputs to direct drive TTL, CMOS or ECL logic are available
- Temperature ranges from laboratory up to −55° to +125°C
- Low phase noise designs—off-the-shelf

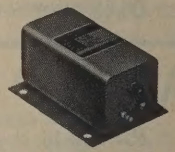
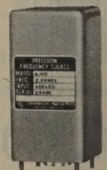
HIGH STABILITY OSCILLATORS

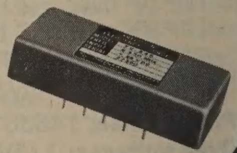
- Available from 1 Hz to 600 MHz
- Stabilities up to $\pm 5 \times 10^{-10}$
- Outputs in sine wave or to direct drive all popular logic types
- Temperature ranges from Laboratory up to −55° to +125°C
- Low single sideband phase noise versions
- Short term stabilities up to 1×10^{-12}/second
- Dual proportional oven designs available
- Many low power oven designs available
- Low aging designs



VOLTAGE CONTROLLED OSCILLATORS

- Available from 1 Hz to 600 MHz
- Voltage controlled crystal oscillators will supply frequency deviation to ±1% of center frequency
- Voltage controlled L-C and R-C oscillators will supply frequency deviation to ±30% of center frequency
- Outputs in sine wave or to direct drive all popular logic types
- Stabilities up to $\pm 1 \times 10^{-9}$
- Temperature ranges from Laboratory up to −55° to +125°C
- Excellent for phase locked loop applications.



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Mini-Oscillators
50 Hz to 100 MHz
OSCILLATORS

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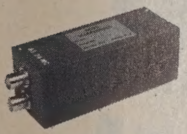
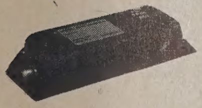
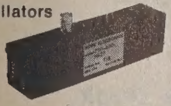
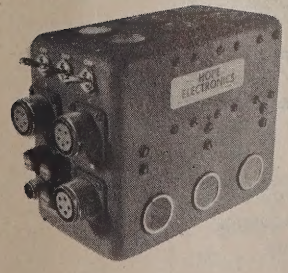
HOPE ELECTRONICS

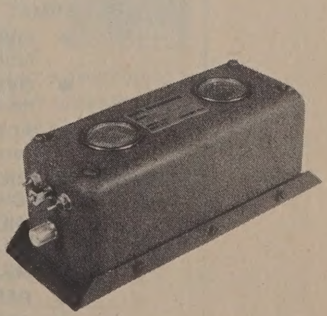
CRYSTAL OSCILLATORS AND FREQUENCY SOURCES

	Frequency Range	Tuning Range	Stability	Power Output	Tuning	Model	Price 1-24
Crystal Oscillators 	70 KHZ-99 KHZ 100 KHZ-499 KHZ 500 KHZ-849 KHZ 850 KHZ-1.499 KHZ 1.5 MHZ-59 MHZ 60 MHZ-79 MHZ 80 MHZ-139 MHZ 140 MHZ-300 MHZ	Crystal Oscillators Fixed Frequency	0.005% —20°C to +50°C	>10 mw	Center Frequency Adjust For Crystal Aging Compensation	EXO-10	$100.00 $ 95.00 $105.00 $ 90.00 $ 85.00 $ 95.00 $100.00 $110.00
	70 KHZ-599 KHZ 600 KHZ-999 KHZ 1 MHZ-10 MHZ		0.015% 0.005% —50° to +75°C	10V P-P into 1K Sine or Square Wave		XO-10V	$135.00 $125.00 $ 99.00
	1 MHZ-3 MHZ 4 MHZ-60 MHZ 61 MHZ-80 MHZ 81 MHZ-140 MHZ 141 MHZ-240 MHZ 241-MHZ-300 MHZ 301 MHZ-400 MHZ 401 MHZ-600 MHZ		0.005% —50° to +75°C	>10 mw		XO-10	$120.00 $110.00 $120.00 $130.00 $140.00 $150.00 $170.00 $190.00
	1 MHZ-60 MHZ 61.1 MHZ-120 MHZ 120.1 MHZ-180 MHZ 180.1 MHZ-240 MHZ 240.1 MHZ-400 MHZ		0.005% —50° to +75°C	>100 mw Adjustable 20 db Range >50 mw Adjustable 20 db Range		XO-100	$195.00 $205.00 $220.00 $235.00 $265.00
	1 HZ-1 KHZ 1 KHZ-100 KHZ 100 KHZ-10 MHZ		0.005% —20°C to +50°C	Square Wave 4V into 50		ICXO-4	$100.00 $ 75.00 $ 50.00
L C Oscillators 	100 KHZ-300 MHZ 200 MHZ-1000 MHZ	±25% of Center Frequency	100 ppm/°C	>10 mw	Mechanical Screw Adjustment	FTO-10A FTO-10B	$ 65.00 $ 65.00
	100 KHZ-300 MHZ 200 MHZ-1000 MHZ	±5% of Center Frequency		>100 mw		FTO-100A FTO-100B	$ 75.00 $ 75.00
Voltage Tunable Oscillators	100 KHZ-300 MHZ 200 MHZ-1000 MHZ	±10% of Center Frequency	100 ppm/°C	>10 mw	Electrical 0 to 30V	VCO-10A VCO-10B	$ 85.00 $ 85.00
	100 KHZ-300 MHZ 200 KHZ-1000 MHZ	±5% of Frequency		>50 mw		VCO-100A VCO-100B	$ 95.00 $105.00

HUNDREDS OF CUSTOM MODELS AVAILABLE

HOPE ELECTRONICS





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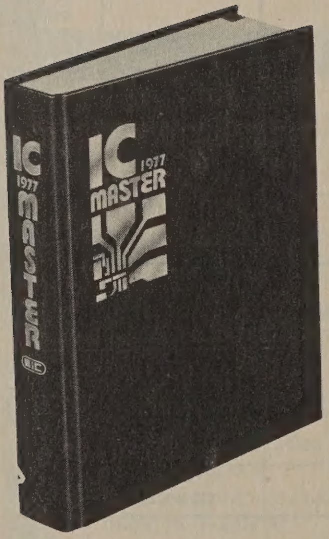
WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

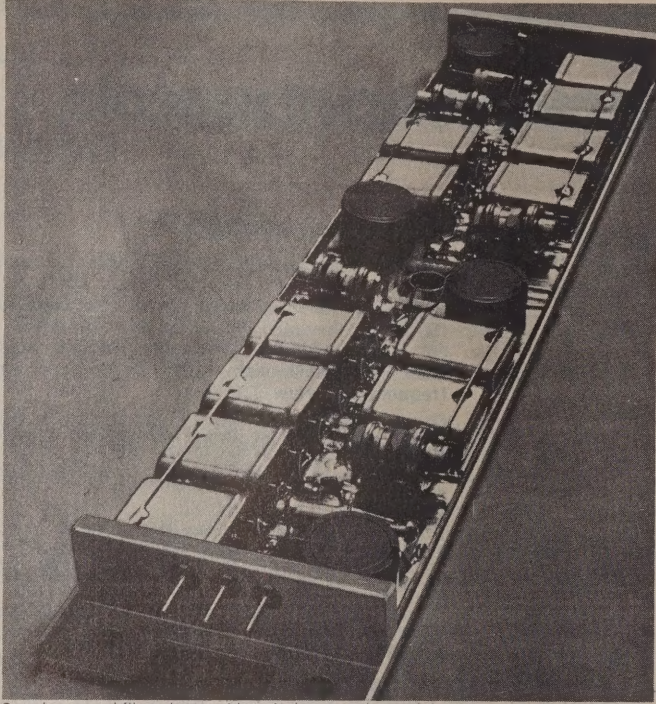
The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

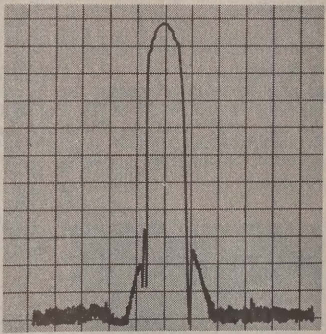
- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

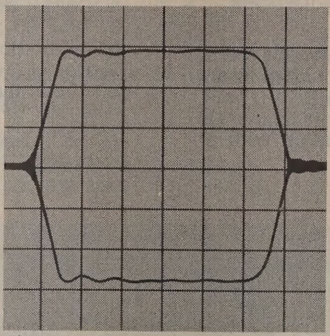
Hughes equency Control Devices



Complex crystal filter shown with typical attenuation and time response characteristics.



Frequency response



Time response

Crystal Filters

- Bandpass filters—shape factors to 1.15:1 (60 to 3dB)
- Band reject filters—shape factors to 1.5:1 (60 to 3dB)
- Upper sideband filters—shape factors to 1.11:1 (60 to 3dB)
- Lower sideband filters—shape factors to 1.11:1 (60 to 3dB)
- Gaussian (linear phase) filters—shape factors to 5:1 (60 to 3dB)
- Phase (or delay) compensated filters (to ± 1%)—shape factors to 1.15:1 (60 to 3dB)
- Frequency selection: 20 kHz to 125 MHz
- Percent bandwidth range: .005 to 5.0

Discriminators—Frequencies/ bandwidths similar to filters

TCXOs

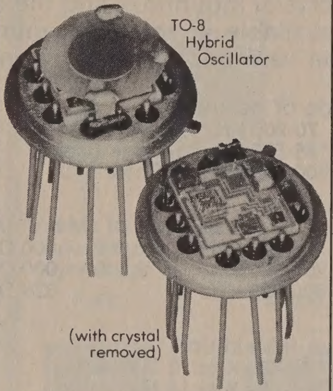
- Computer synthesized selection of components
- Small size, light weight, low power drain, instant warmup
- Frequency range: 1 Hz to 200 MHz
- Frequency stability: ± 1 ppm over −55° to +85°C or ±.1 ppm over 0° to +70°C

TC/VCXOs

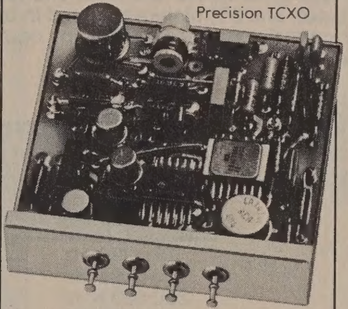
- Frequency range to 200 MHz
- Frequency deviation to ± 3000 ppm
- Deviation sensitivity to ± 250 ppm/volt, or as desired
- Linearity to ± 1% of best straight line
- Short term stability to ± 1 ppm/sec.
- Frequency stability: ± 1 ppm over −55° to 85°C or ± .1 ppm over 0° to +70°C

Hybrid Oscillators

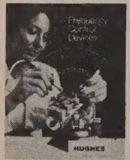
- TO-5, TO-8, E-7, DIP configurations
- TTL, CMOS compatible
- Frequency range: 1 Hz to 40 MHz
- Frequency stability: ± 40 ppm over −55° to +125°C
- Capable of meeting MIL-STD-883



Note: Input voltages from ± 5 VDC to ± 50 VDC are acceptable for all oscillators. Input power, dependent on application, can be as low as 10 mW.



All Hughes' filters, discriminators and oscillators are capable of meeting military, commercial or space-qualified environments. For more information, send for six-page frequency control device brochure describing Hughes' custom and standard product capabilities.



Hughes Aircraft Company, Communication Products Department, Microelectronic Products Division,
500 Superior Avenue, Dept. E7,
Newport Beach, California 92663.
Telephone (714) 548-0671.

HUGHES

HUGHES AIRCRAFT COMPANY
MICROELECTRONIC
PRODUCTS DIVISION

Low Frequency Crystals

70 KHz – 999 KHz

On this page we present our four most popular crystal mountings and the data for the crystals available in these mountings according to the various frequency ranges.

mode of oscillation
70-200 KHz . . . Length Shear
185-599 KHz . . . Edge Shear
600-999 KHz . . . Shear

shunt capacitance 7 pf (Maximum)
70-200 KHz . . . 10,000- 7,000 Ohms
200-500 KHz . . . 6,500-11,000 Ohms
800-999 KHz . . . 625 Ohms

drive (Maximum)
70-499 KHz 2 Milliwatts
500-999 KHz 10 Milliwatts

REMEMBER: Just any crystal and just any oscillator will not combine to produce designated spot frequencies!

DESCRIPTION AND DATA: All of these crystals are of the plated, wire mounted type. Low drift, AT-cut blanks are used in these units above 600 KHz, and low drift CT-cut, DT-cut, SL-cut, and 5°X blanks are used in units below 600 KHz. Any crystal can be supplied for operation with or without an oven.

TYPE SPECIFICATIONS

1. **General Purpose** (GP) crystals will be calibrated to within ±.02% of frequency when operated into the customers specified fundamental load capacitance only (32 pf will be used when none is specified).
   GP crystals 500-999 KHz will hold temperature tolerance of ±.005% from —30° to 60°C and ±.02% for frequencies below 500 KHz.
2. **Commercial Standard** (CS) crystals will be calibrated as noted below, as specified for operation in customers load. CS crystals will hold temperature tolerance ±.003% —30° to 60°C above 500 KHz and ±.02% below 500 KHz.
   CIRCUIT: As specified by customer. Crystals are available for all major two-way equipment and in most cases the necessary correlation data is on file. Where circuit is not specified, the crystal will be calibrated for operation into a load capacitance of 32 mmf.
   The CS series of crystal units is available to commercial or military specifications demanding tight frequency tolerance, long term stability and low frequency response.

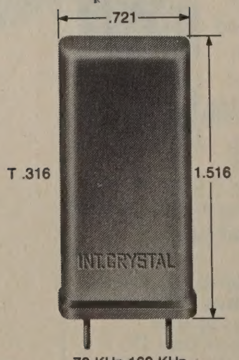
WHEN ORDERING — SPECIFY THE FOLLOWING FOR EACH CRYSTAL

- **A.** Crystal frequency
- **B.** Type GP or CS
- **C.** Calibration temperature (Room temperature or over 60°C)
- **D.** Holder (see below)
- **E.** Circuit load and correlation data.

Note: For GP specify 10, 20 or 32 pf. Do not specify equipment types in the case of GP crystals. These are made only to 10, 20 or 32 pf load. When circuit load is not specified crystals will be correlated for a 32 pf load.

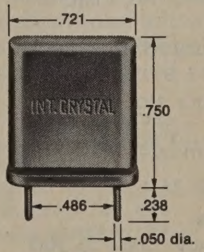
FREQUENCY	TYPE			
	GENERAL PURPOSE (1)		COMMERCIAL STANDARD (2)	
	Calibration Tolerance As Noted		Calibration Tolerance As Noted	
70- 99 KHz	.02%	$22.00	.01%	$23.50
100-199 KHz	.02%	13.90	.01%	15.90
200-599 KHz	.02%	13.90	.01%	15.90
600-849 KHz	.01%	37.50	.0025%	39.50
850-999 KHz	.01%	13.90	.0025%	15.90

F-13



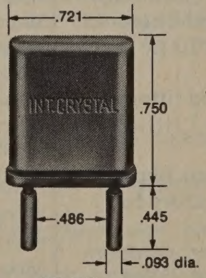
70 KHz-160 KHz
HC-13/U
(70-99 KHz 2.5" height)

F-605



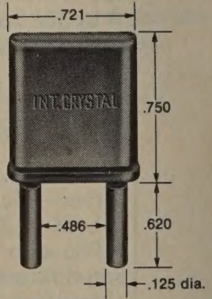
HC-6/U
T .316 max

F-609



HC-17/U
T .316 max

F-612



T .316 max

HOW TO ORDER:

MAIL: International Crystal Mfg., Inc., 10 North Lee, Oklahoma City, Okla. 73102
PHONE: Area Code 405 236-3741
WESTERN UNION TELEX: 747-147
CABLE: INCRYSTAL
BELL SYSTEM TWX: 910-831-3177

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

ICM

Medium Frequency Crystals

1 MHz — 22 MHz

FUNDAMENTAL TYPE

TYPE SPECIFICATIONS

1. **GENERAL PURPOSE** (GP) crystals will be calibrated to within ±.01% of frequency when operated into 10, 20 or 32 pf load capacitance only (32 pf will be used when none is specified.)
   GP crystals will hold temperature tolerance of ±.005% from —30° to 60°C.
2. **COMMERCIAL STANDARD** (CS) crystals will be calibrated to either .0025% or .001% as specified for operation in customer's load. CS crystal will hold temperature tolerance ±.003% —30° to 60°C.
3. A calibration tolerance of ±.001 (or special) can only be obtained when a definite circuit load capacitance and drive level are specified. Where a definite load capacitance is not specified and correlation is required from a copy of the intended circuit a tolerance of ±.01%, should be expected.
4. **HIGH ACCURACY** (HA) crystals are for use in circuits where tolerances better than ±.002% —30° to 60°C are required. Tolerances of .0005% over the range —30° to 60°C will require circuit compensation. Without compensation the range will be limited to —10° to 60°C. Compensators are not included with the crystals and tolerance is for crystals only and does not allow for any change in circuit parameters over the temperature range.

mode of oscillation
1,000-22,000 MHz Shear AT

Shunt capacitance 7 pf (max.)
7 pf (Max.)

resistance

1,000- 1,499 MHz	490 ohms
1,500- 1,999 MHz	375 ohms
2,000- 2,999 MHz	270 ohms
3,000- 3,999 MHz	150 ohms
4,000-22,000 MHz	75 to 25 ohms

drive (max.)

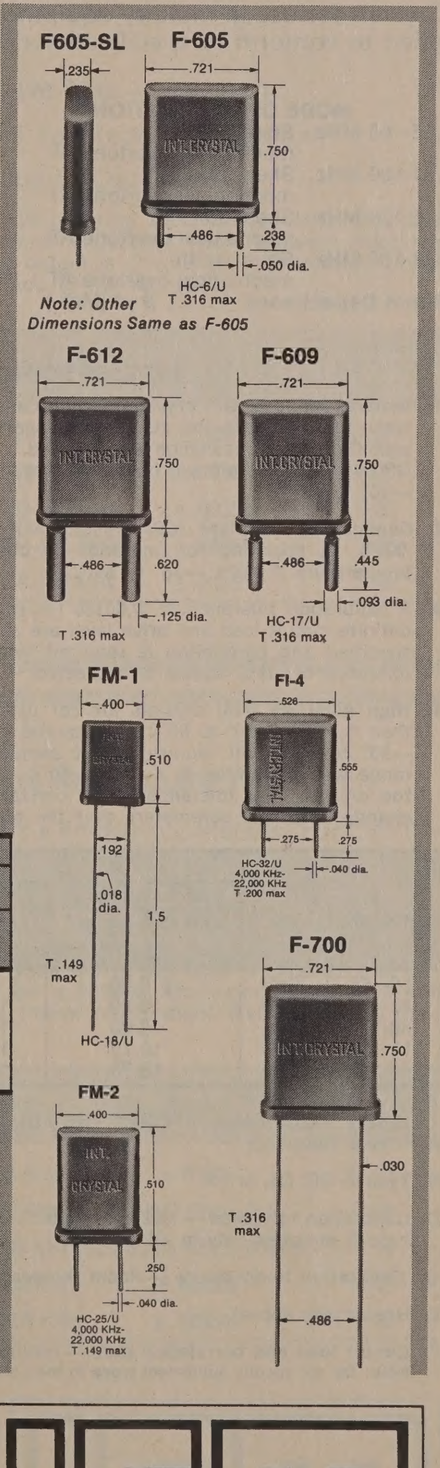
1,000- 9,999 MHz	10 milliwatts
10,000-22,000 MHz	4 milliwatts

*Available 2,000-2,999 KHz
**FM Holder Available 6,000 to 22,000 KHz

FREQUENCY	TYPE				
	GENERAL PURPOSE(1)	COMMERCIAL STANDARD(2)		HIGH ACCURACY(4)	
	Calibration Tolerance .01%	Calibration Tolerance .0025%	.001% / CS – 1 Special(3)	Temperature Tolerance —10° to +60° .002%	.0005%
1,000- 1,499 MHz	$9.00	$11.00	$13.00		
1,500- 2,999 MHz	7.00	7.90	9.00	$ 9.00*	
3,000-10,999 MHz	5.50	5.95	6.95	7.50	$10.50**
11,000-19,999 MHz	7.00	7.90	9.00	9.00	10.00
20,000-22,000 MHz	9.00	11.00	12.00	12.00	13.50

WHEN ORDERING — SPECIFY THE FOLLOWING FOR EACH CRYSTAL

- **A.** Crystal frequency
- **B.** Type — GP, CS, or HA
- **C.** Calibration tolerance — .0025% or .001% / Special (not required for GP as this type is supplied only in .01%).
- **D.** Calibration temperature (room temperature or over 60°C, 75°C, 85°C.
- **E.** Holder (see below)
- **F.** Circuit load and correlation data
  Note: For GP specify 10, 20 or 32 pf. Do not specify equipment types in the case of GP crystals. These are made only to 10, 20 or 32 pf load. When not specified crystals will be correlated for a 32 pf load.


F605-SL
.235
F-605
.721
INT.CRYSTAL
.750
.486
.238
.050 dia.
HC-6/U
T .316 max
Note: Other Dimensions Same as F-605
F-612
.721
INT.CRYSTAL
.750
.486
.620
.125 dia.
T .316 max
F-609
.721
INT.CRYSTAL
.750
.486
.445
.093 dia.
HC-17/U
T .316 max
FM-1
.400
INT. CRYSTAL
.510
.192
.018 dia.
1.5
T .149 max
HC-18/U
FI-4
.526
INT.CRYSTAL
.555
.275
.275
HC-32/U
4,000 KHz-
22,000 KHz
T .200 max
.040 dia.
F-700
.721
INT.CRYSTAL
.750
.030
T .316 max
.486
FM-2
.400
INT. CRYSTAL
.510
.250
.040 dia.
HC-25/U
4,000 KHz-
22,000 KHz
T .149 max

HOW TO ORDER:

MAIL: International Crystal Mfg., Inc., 10 North Lee, Oklahoma City, Okla. 73102
PHONE: Area Code 405 236-3741
WESTERN UNION TELEX: 747-147
CABLE: INCRYSTAL
BELL SYSTEM TWX: 910-831-3177

ICM

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

ICM

High Frequency Crystals

15 MHz — 160 MHz

Crystals for use in military equipment can be supplied to conform to specifications of MIL-C-3098E

MODE OF OSCILLATION

15- 66 MHz	Shear third mechanical overtone AT
61-100 MHz	Shear fifth mechanical overtone AT
111-139 MHz	Shear seventh mechanical overtone AT
141-160 MHz	Shear ninth mechanical overtone AT

Shunt Capacitance ...... 9 pf (Max.)

RESISTANCE ((Max.)

15- 60 MHz	40 ohms
60-110 MHz	60 ohms
110-140 MHz	80 ohms
140-160 MHz	100 ohms
Drive (Max.)	2 milliwatts

TYPE SPECIFICATIONS

1. **General Purpose** (GP) crystals will be calibrated to within ±.01% of frequency when operated into the customer's specified circuit load only. When none is specified series resonance will be used.
   GP overtone crystals will hold temperature tolerance of ±.005% from —30° to 60°C.
2. **Commercial Standard** (CS) crystals will be calibrated to either .0025% or .001% as specified for operation in customer's load. CS crystal will hold temperature ±.003% —30° to 60°C.
3. A calibration tolerance of ±.001% (or special) can only be obtained when a definite circuit load and drive level are specified. Where a definite load is not specified and correlation is required from a copy of the intended circuit a tolerance of .01% should be expected.
4. **High Accuracy** (HA) crystals are for use in circuits where tolerances better than ±.002% —30° to 60°C are required. Tolerances of .0005% over the range —30° to 60°C will require circuit compensation. Without compensation the range will be limited to —10° to 60°C. Compensators are not included with the crystals and tolerance is for crystals only and does not allow for any change in circuit parameters over the temperature range.

FREQUENCY	MHz	TYPE				
		General Purpose(1)	Commercial Standard(2)		High Accuracy (3) (4)	
		Calibration Tolerance	Calibration Tolerance	(3) CS-1	Temperature Tolerance —10° to +60°	
		.01%	.0025%	.001%/special	.002%	.0005%
15- 66	(3rd)	$ 6.00	$ 7.90	$ 8.25	†$10.50	†$12.75
61- 79	(5th)	6.90	12.00	12.25		
80-110	(5th)	9.00	15.75	16.25		
111-139	(7th)	10.75	15.75	16.25		
140-160	(9th)	15.75	18.75	19.25		

WHEN ORDERING — SPECIFY THE FOLLOWING FOR EACH CRYSTAL

A. Crystal frequency

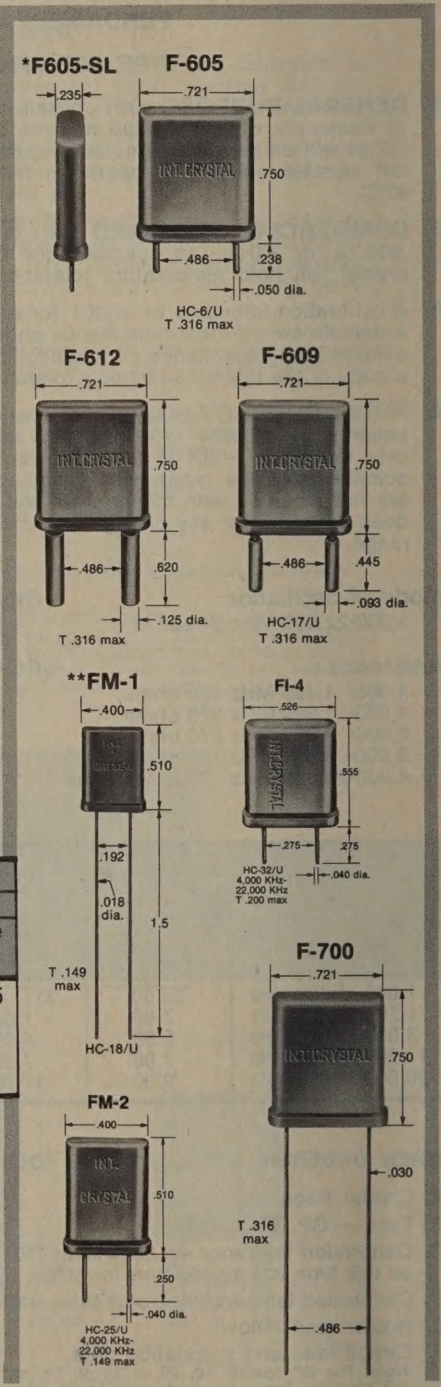
B. Type — GP, CS, or HA

C. Calibration tolerance — .0025% or .001% / Special (not required for GP as this type is supplied only in .01%)

D. Calibration temperature — Room temperature or oven 85°C

E. Holder (see above)

F. Circuit load and correlation data — normal series resonate or anti-resonate
Note: Do not specify equipment types in the case of GP crystals.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HC-18/U
FI-4
.526
INT.CRYSTAL
.555
.275
.275
HC-32/U
4,000 KHz-
22,000 KHz
T .200 max
.040 dia.
FM-2
.400
INT. CRYSTAL
.510
.250
.040 dia.
HC-25/U
4,000 KHz-
22,000 KHz
T .149 max
F-700
.721
INT.CRYSTAL
.750
.030
T .316 max
.486

*Other dimensions same as F-605
**Not supplied below 15 MHz
†Available in FM-1 and FM-2 holder only above 20 MHz

HOW TO ORDER:

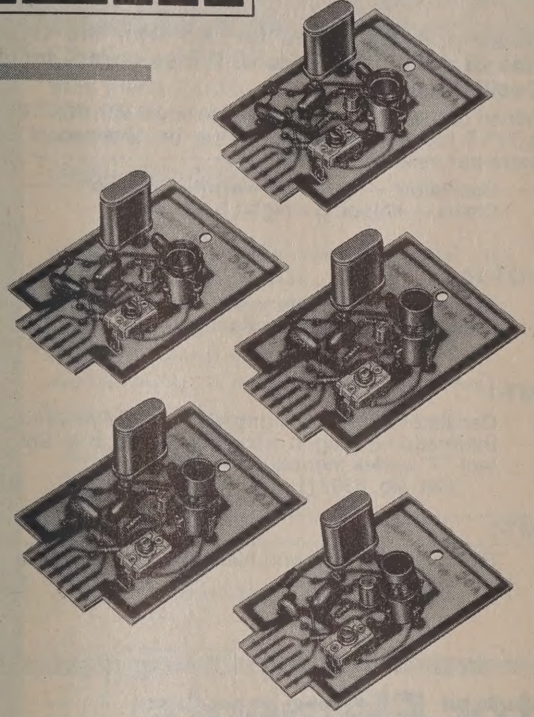
MAIL: International Crystal Mfg., Inc., 10 North Lee, Oklahoma City, Okla. 73102
PHONE: Area Code 405 236-3741
WESTERN UNION TELEX: 747-147
CABLE: INCRYSTAL
BELL SYSTEM TWX: 910-831-3177

ICM

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

Plug-in Transistor Oscillators

direct crystal control to 160 MHz

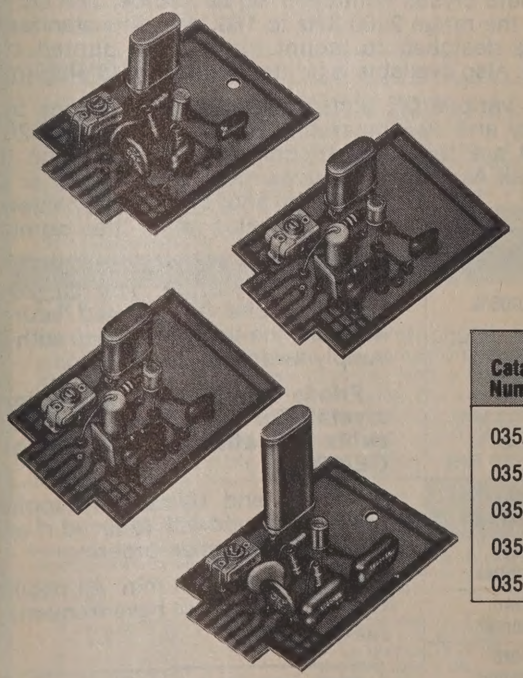


HIGH FREQUENCY (20 MHz — 160 MHz)

- Signal Generators For Receiver Alignment
- Quick-Change Plug-In Oscillators

Five transistor oscillators covering 20 MHz - 160 MHz. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min.) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

Catalog Number	Oscillator Type	Oscillator Range	Temperature Tol. −40°F to 150°F	Oscillator (Less Crystal) Price
035200	OT-124	20-40 MHz	±.0035%	$7.00
035201	OT-146	40-60 MHz	±.0035%	7.00
035202	OT-161	60-100 MHz	±.0035%	7.00
035203	OT-1140	100-140 MHz	±.0035%	7.00
035204	OT-1160	145-160 MHz	±.0035%	7.00



LOW FREQUENCY (70 KHz — 20,000 KHz)

- Band Edge Markers
- Frequency Markers For Oscilloscopes
- Portable Signal Standards
- Accessory Cases

Four transistor oscillators covering 70 KHz - 20,000 KHz. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ±.0025%. Oscillator output is 1 volt (min.) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

Catalog Number	Oscillator Type	Oscillator Range	Temperature Tol. −40°F to 150°F	Oscillator (Less Crystal) Price
035205	OT-11	70-150 KHz	±.015%	$7.00
035206	OT-12A	150-400 KHz	200-600 KHz±.01%	7.00
035207	OT-12	400-5,000 KHz	600-5,000 KHz±.0035%	7.00
035208	OT-13	2,000-12,000 KHz	±.0035%	7.00
035209	OT-14	10,000-20,000 KHz	±.0035%	7.00

HOW TO ORDER:

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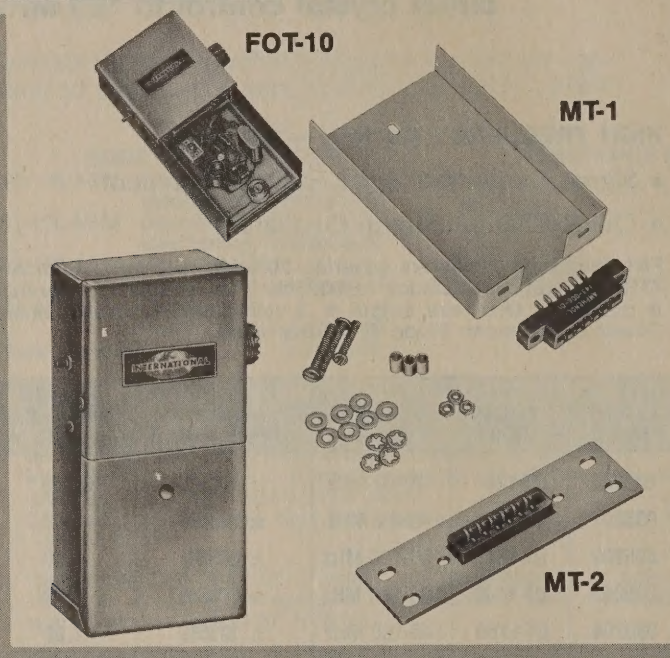
CABLE: INCRYSTAL
BELL SYSTEM TWX: 910-831-3177

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

ICM Oscillator Cases



Small portable cases for use with the OT series of plug-in oscillators. Prices do not include Oscillators.

(When oscillator and crystal are ordered with FOT-10 case a 77° F tolerance of ±.001% may be obtained at $2.00 extra per oscillator/crystal unit.

Oscillators — shipping weight: 1 lb. each
Cases — shipping weight: 3 lbs. each

FOT-10

Basic case with battery and output jack for general wider tollerance applications
Cat. No. 035210 **$14.50**

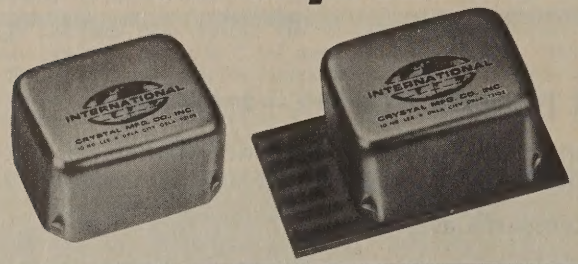
MT-1

Oscillator board mounting kit. Provides mounting for International plug-in transistor oscillators. Six contact "T" series mounting with shield.
Cat. No. 035211 **$4.95**

MT-2

Six contact socket and plate for oscillator case.
Cat. No. 035212 **$2.50**

OE Crystal Oscillator Elements



OE series of Crystal Oscillator Elements provide a complete crystal controlled signal source. The OE units cover the range 2000 KHz to 160 MHz. The standard OE unit is designed to mount direct on a printed circuit board. Also available is printed circuit board plug-in type.

The various OE units are divided into groups by frequency and by temperature stability. Models OE-20 and OE-30 are temperature-compensated units. The listed "Overall Accuracy" includes room temperature or 25° C tolerance and may be considered a maximum value rather than nominal.

All OE units are designed for 9.5 to 15 volts dc operation. The OE-20 and OE-30 require a regulated source to maintain the listed tolerance with input supply less than 12 vdc.

Prices listed include oscillator and crystal. For the plug-in type add the suffix "P" after the OE number; eg OE-1P.

OE-1, 5 and 10 can be supplied to operate at 5 vdc with reduced rf output. Specify 5 vdc when ordering.

Output −10 dbm min. All oscillators over 60 MHz do not have frequency adjust trimmers.

Catalog Number	Oscillator Element Type	2000 KHz to 60 MHz	61 MHz to 139 MHz	140 MHz to 160 MHz	Overall Accuracy	25°C Tolerance
035213	OE-1	$12.50			±.01% −30° to +60°C	±.005%
035214	OE-1		$14.50			
035215	OE-1			$17.50		
035216	OE-5	$16.00			±.002% −10° to +60°C	±.0005% 2−60MHz ±.001% 61 to 139 MHz ±.0025% 140 to 160 MHz
035217	OE-5		$19.00			
035218	OE-5			$25.00		

Catalog Number	Oscillator Element Type	3000 KHz to 20000 KHz	Overall Accuracy	25°C Tolerance
035219	OE-10	$19.00	±.0005% −10° to +60°C	Zero trimmer
035220	OE-20	$28.00	±.0005% −30° to +60°C	Zero trimmer
035221	OE-30	$48.00	±.0002% −30° to +60°C	Zero trimmer

HOW TO ORDER:

MAIL: International Crystal Mfg., Inc., 10 North Lee, Oklahoma City, Okla. 73102
PHONE: Area Code 405 236-3741
CABLE: INCRYSTAL
WESTERN UNION TELEX: 747-147
BELL SYSTEM TWX: 910-831-3177

ICM

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

MICROSONICS

SANGAMO WESTON
Schlumberger

Dept. EM / 60 Winter Street / Weymouth, MA 02188 / Tel: (617) 337-4200

STABLE TEMPERATURE COMPENSATED (TCXO) CRYSTAL OSCILLATORS

Model K1084A / 4 MHz - 21 MHz — 1.55″ x 2.1″ x .69″ — Metal Case
Model K1085A / 250 kHz - 42 MHz — 2.0″ x 2.0″ x .52″ — Metal Case
Model K1087A / 250 kHz - 21 MHz — 1.21″ x 1.75″ x .65″ — Plastic Case

GENERAL SPECIFICATIONS

Frequency Stability vs. Voltage Change: ±1 x 10^{-6} for ±10%

Frequency Stability vs. Load Change: ±1 x 10^{-6} for ±10%

Frequency Stability vs. Time: ±1 x 10^{-6}/year

Input Power, Typical: 100 mW @ 5 VDC

Low Power Version: 20 mW @ 5 VDC

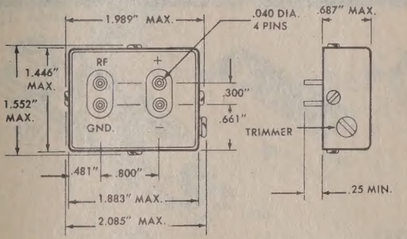
Mounting: Pins for PCB mounting with solder connections

Standard Options Available:
Input Voltages: 1, 2, 3, 4
Wave Shape: S, T
Frequency Adjust: 0, 1
Temperature Stability: A, B, C, D, E

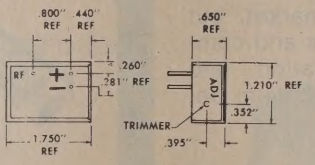
Optional Specifications		Optional Suffixes (These must be specified)			
Input Voltage:	5 VDC	1			
	9 VDC	2			
	12 VDC	3			
	15 VDC	4			
Wave Shape:					
Sine Wave:	0.7 VRMS into 1 kΩ¹		S		
Square Wave:	T^2L Drive up to 10 gates @ 1.6 mA per gate. Duty cycle 50% ±10%		T		
Frequency Adjust (±10 ppm):	Not included			0	
	Trimmer			1	
Temperature Stability:	±1 x 10^{-7} (+20°C to +30°C)				A
	±1 x 10^{-6} (0°C to +55°C)				B
	±5 x 10^{-6} (0°C to +55°C)				C
	±5 x 10^{-6} (−30°C to +85°C)				D
	±10 x 10^{-6} (−30°C to +85°C)				E

OUTLINE DETAILS

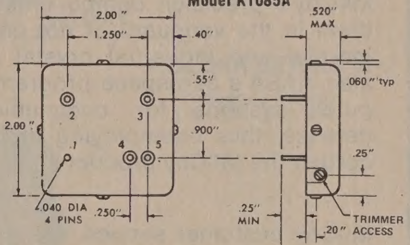
Model K1084A



Model K1087A



Model K1085A

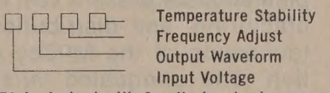


ORDERING INFORMATION

Each TCXO ordered must have a suffix code denoting input voltage, output waveform, whether frequency adjust is desired and the temperature range required. This suffix is added to the basic model number. The first suffix number denotes the input voltage; the second, a letter, denotes waveform; the third, a number, denotes frequency adjustment; and the fourth letter suffix, the stability over the temperature range. The versatility of this suffix system allows you to specify a single Oscillator from many models without poring over endless specification sheets.
The diagram shows this format more clearly.

Model No. **Suffix** **Denotes Option for**

K1087A



If for instance, Model K1087A is desired with 9 volts input, sine-wave output, frequency adjustment, and a temperature stability of ±1 x 10^{-6} from 0°C to +55°C, the Model Number is K1087A-2S1B.

CRYSTAL FILTERS

Microsonics has been manufacturing crystal filters since 1962. During that time, the company's expertise has grown by imaginative planning and a firm commitment by management to produce the best precision crystal filters available. Today, Microsonics offers customized precision designs with operating frequencies to 150 MHz in typical filter types such as bandpass, single sideband, comb sets and crystal discriminators. Production capabilities include crystal manufacturing, cold welding, automated wave soldering, high reliability assembly techniques and automated test equipment. Typical custom tailored filters previously designed and manufactured are described below.

FILTER MODEL P108C

Features a very good shape factor combined with excellent phase linearity.
Fo: 10 MHz
Bandwidth:
9.4 kHz @ 1 dB
12.5 kHz @ 15 dB
15.7 kHz @ 40 dB
Insertion Loss: 4 dB
Ripple: 1 dB
Spurious: 40 dB
Impedance: 50 ohms
Ultimate Rejection: 45 dB
Phase Linearity: ±6° max.
Size: 2.5 x 1.0 x 1.25

FILTER MODEL P961

Equalized to improve phase linearity while maintaining a 2.75 to 1, 3 dB / 60 dB shape factor.
Fo: 7.470 MHz
Bandwidth:
±2 kHz min. @ .5 dB
±3 kHz min. @ 15 dB
±6 kHz max. @ 60 dB
Insertion Loss: 3 dB
Ripple: .25 dB
Spurious: 60 dB
Impedance: 50 ohms
Ultimate Rejection: 70 dB
Phase Linearity: 8° over Fo ±2 kHz
Size: 2.1 x 1.515 x .7
Shock: 2500 G Pyrotechnic
Vibration: 100 G Sine
This filter has successfully passed all qualification tests for space satellite systems.

FILTER MODEL P408B

Demonstrates Microsonics' ability to manufacture high frequency, 42 MHz, fundamental AT cut crystals. Bandwidths of 2.5% of center frequency are possible at frequencies up to 40 MHz.
Fo: 40 MHz ±3 kHz
Bandwidth: 100 ±10 kHz
Shape Factor: 2:1
Insertion Loss: 5 dB max.
Spurious: 50 dB
Ripple: 1 dB max.
Impedance: 480 ohms
Ultimate Rejection: 60 dB
Operating Temp.: 0°C to 65°C
Size: 1.765 x .865 x .60 max.
Meets Requirements of MIL-F-18327

CRYSTAL DISCRIMINATOR MODEL D402C

A Discriminator which demonstrates exceptional bandwidth at 40 MHz with good linearity.
Fo: 40 MHz ±2.5 kHz
Bandwidth: ±80 kHz P-P
Linearity:
5° over ±25 kHz
10° over ±50 kHz
Source Impedance: 1 kHz
Load Impedance: 20 kHz
Operating Temp.: 0 to 50°C
Size: 2.1 x 1.0 x .75
Shock-Vibration MIL-STD-202
Methods 201A, 202C

McCOY ELECTRONICS COMPANY

a subsidiary of **OAK Industries Inc.**

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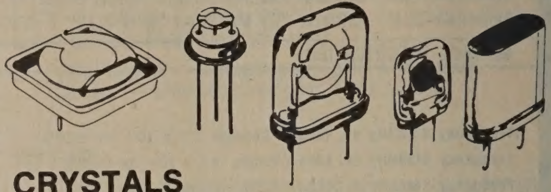
Nearly a quarter century of dedication to **Quartz Crystals, Filters,** and **Oscillators** has earned McCoy Electronics Company the foremost reputation for performance. McCoy's achievements have provided the base for extensive domestic sales representation and worldwide distribution. The versatility of design and capability in McCoy's precision components has placed them in the vanguard of not only the commercial and industrial crystal market, but also NASA's aerospace programs and computer systems for communication and defense, thus exemplifying the esteem accorded the McCoy product line.

McCoy customer service has grown in unison with the rapidly expanding McCoy technology. An additional plant facility now supplements the present vast engineering, manufacturing, and distribution capability—the foundation of the McCoy Company reputation. The unequaled versatility of custom manufacturing and resultant customer confidence are enhanced with ever increasing efficiency by our computer assisted design capability. Laboratory trial and error efforts are eliminated through the accurate analyses and directions provided by the computer.

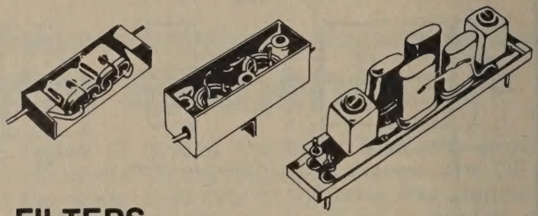
The McCoy name has been synonymous with quality in the crystal industry for more than two decades. Our catalog contains crystals, filters, and oscillators continually proven to be the ultimate in performance critique. The various components listed herein are supported by PC Board, chemical milling, and other photo-fabrication capabilities, and represent only a small cross section of products and services offered. Our many years of experience assure each customer that the industry's finest skills are at his command.

"ADVANCING CRYSTAL TECHNOLOGY FOR TWO DECADES"



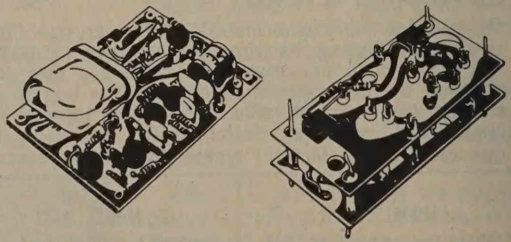
CRYSTALS

McCoy's leadership in crystal design and production permits precision blanks from 700 Hz to 250 MHz to be cut, angles controlled to within ±15", and fundamental frequencies lapped to 45 MHz. Thousands of electrode masks, permitting maximum latitude in controlling motional parameters, give range and depth to McCoy's crystal capabilities.



FILTERS

Crystal filters from 1KHz to 250MHz are designed by computer assistance to exacting specifications. Monolithic filters, with spurious mode suppression capabilities, offer an infinite variety of designs for custom application.



OSCILLATORS

The precision standard, oven, temperature compensated (TCXO) and voltage controlled (VCXO) crystal oscillators each feature a matched McCoy crystal. Coupled with the McCoy expertise in manufacturing smooth discontinuity-free crystals, these oscillators offer unequaled performance when tailored to blend with the equipment or system needs.

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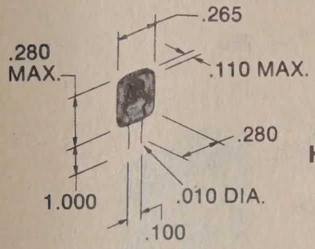
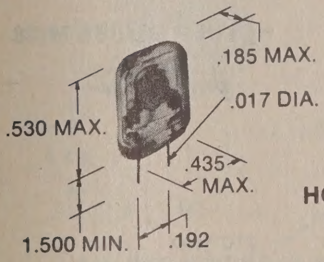
McCOY CRYSTALS

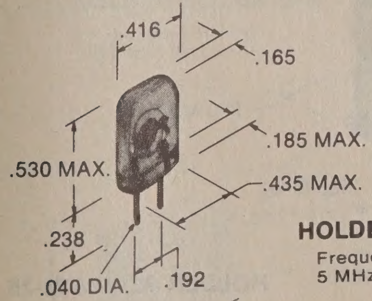
PRECISION GLASS CRYSTALS


.265
.280 MAX.
.110 MAX.
.280
1.000
.010 DIA.
.100

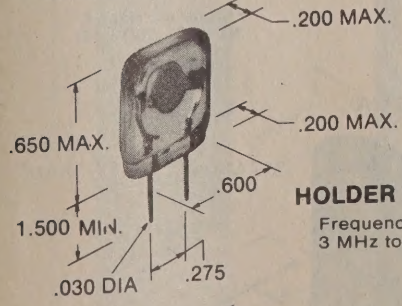
HOLDER SERIES MM
Frequency Range:
10 MHz to 250 MHz


.185 MAX.
.017 DIA.
.530 MAX.
.435 MAX.
1.500 MIN.
.192

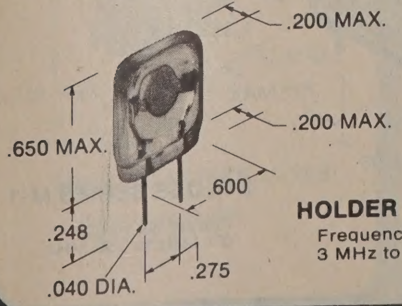
HOLDER SERIES G-20
Frequency Range:
5 MHz to 100 MHz


.416
.165
.185 MAX.
.530 MAX.
.435 MAX.
.238
.040 DIA.
.192

HOLDER SERIES G-21
Frequency Range:
5 MHz to 100 MHz

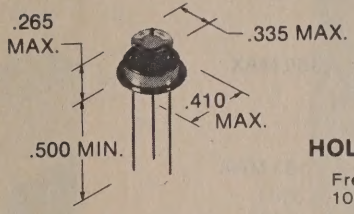

.200 MAX.
.200 MAX.
.650 MAX.
.600
1.500 MIN.
.030 DIA
.275

HOLDER SERIES G-30
Frequency Range:
3 MHz to 100 MHz

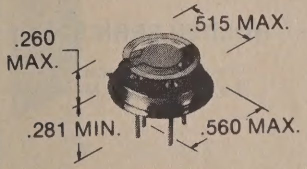

.200 MAX.
.200 MAX.
.650 MAX.
.600
.248
.040 DIA.
.275

HOLDER SERIES G-31
Frequency Range:
3 MHz to 100 MHz

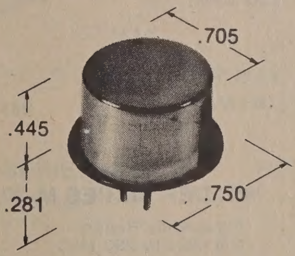
COLD WELD CRYSTALS


.265 MAX.
.335 MAX.
.410 MAX.
.500 MIN.

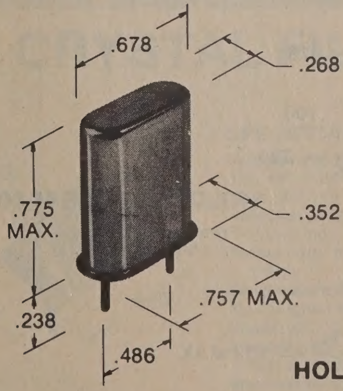
HOLDER SERIES W-6
Frequency Range:
10 MHz to 250 MHz


.515 MAX.
.260 MAX.
.281 MIN.
.560 MAX.

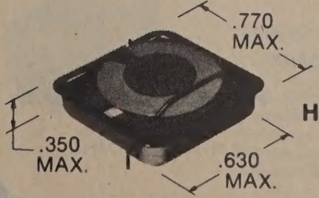
HOLDER SERIES W-7
Frequency Range:
3 MHz to 250 MHz


.705
.445
.281
.750

HOLDER SERIES W-8
Frequency Range:
0.8 MHz to 250 MHz


.678
.268
.775 MAX.
.352
.757 MAX.
.238
.486

HOLDER SERIES W-1
Frequency Range:
1 MHz to 250 MHz


.770 MAX.
.350 MAX.
.630 MAX.

HOLDER SERIES W-10
Frequency Range:
1 MHz to 250 MHz

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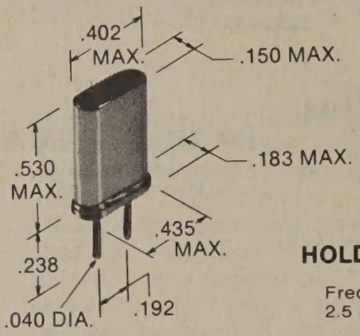
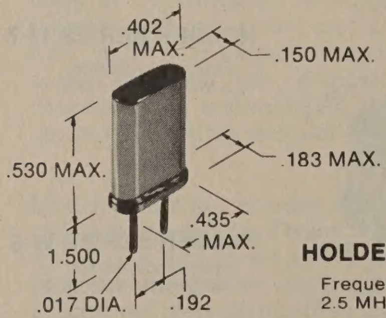
McCOY CRYSTALS

SOLDER SEAL CRYSTALS


.402 MAX.
.150 MAX.
.183 MAX.
.530 MAX.
.435 MAX.
.238
.040 DIA.
.192

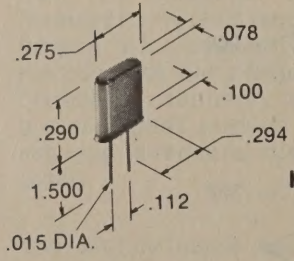
HOLDER SERIES M-21

Frequency Range:
2.5 MHz to 250 MHz


.402 MAX.
.150 MAX.
.183 MAX.
.530 MAX.
.435 MAX.
1.500
.017 DIA.
.192

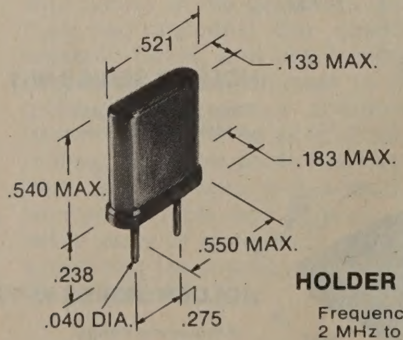
HOLDER SERIES M-20

Frequency Range:
2.5 MHz to 250 MHz


.275
.078
.100
.290
.294
1.500
.112
.015 DIA.

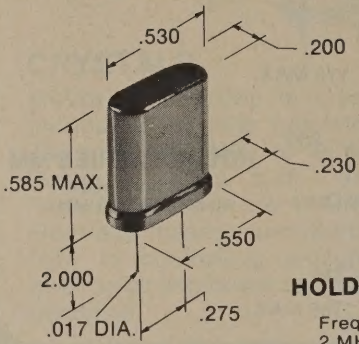
HOLDER SERIES M-60

Frequency Range:
12.5 MHz to 250 MHz


.521
.133 MAX.
.183 MAX.
.540 MAX.
.550 MAX.
.238
.040 DIA.
.275

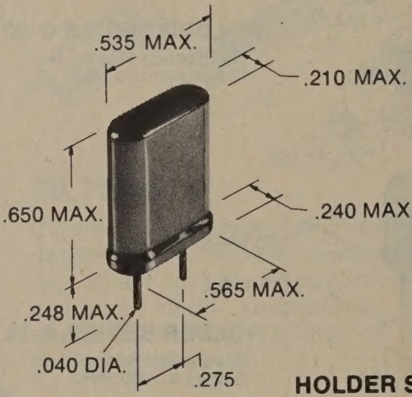
HOLDER SERIES M-41

Frequency Range:
2 MHz to 250 MHz


.530
.200
.585 MAX.
.230
.550
2.000
.017 DIA.
.275

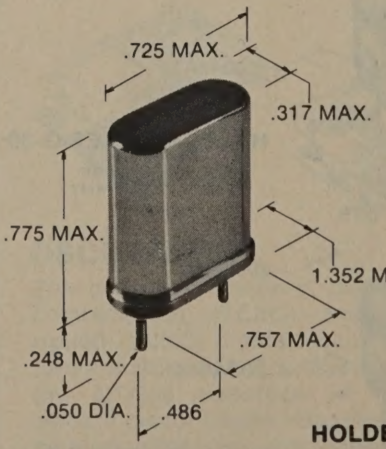
HOLDER SERIES M-28

Frequency Range:
2 MHz to 250 MHz


.535 MAX.
.210 MAX.
.650 MAX.
.240 MAX.
.565 MAX.
.248 MAX.
.040 DIA.
.275

HOLDER SERIES M-25

Frequency Range:
2 MHz to 250 MHz


.725 MAX.
.317 MAX.
.775 MAX.
1.352 MAX.
.757 MAX.
.248 MAX.
.050 DIA.
.486

HOLDER SERIES M-1

Frequency Range:
0.7 MHz to 250 MHz

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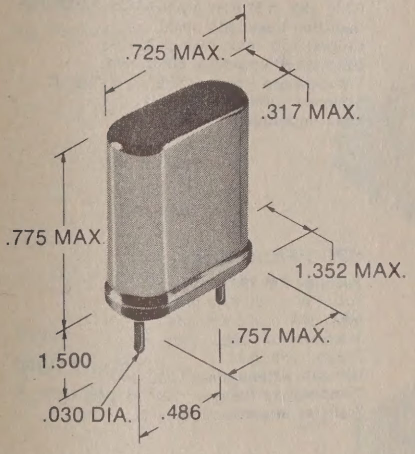
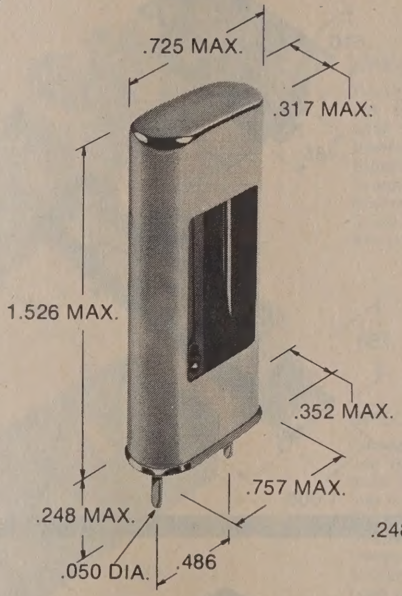
McCOY CRYSTALS

SOLDER SEAL CRYSTALS


.725 MAX.
.317 MAX.
.775 MAX.
1.352 MAX.
.757 MAX.
1.500
.030 DIA.
.486

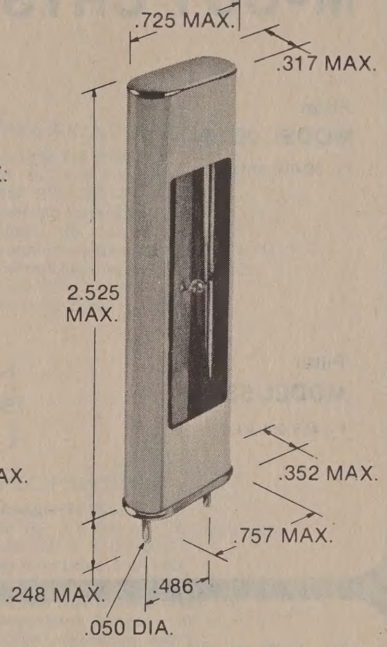
HOLDER SERIES M-4

Frequency Range:
0.7 MHz to 250 MHz


.725 MAX.
.317 MAX.
1.526 MAX.
.352 MAX.
.757 MAX.
.248 MAX.
.050 DIA.
.486

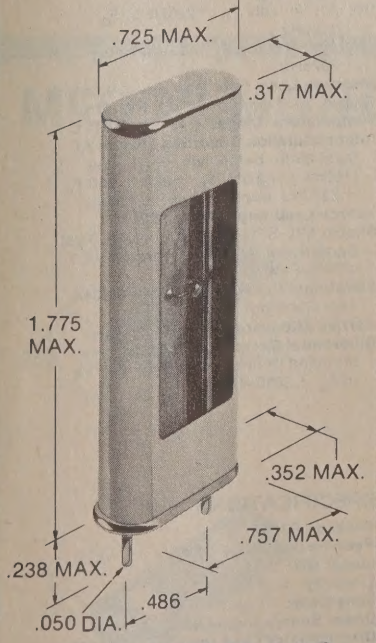
HOLDER SERIES M-22

Frequency Range:
4 Hz to 15 KHz


.725 MAX.
.317 MAX.
2.525 MAX.
.352 MAX.
.757 MAX.
.248 MAX.
.486
.050 DIA.

HOLDER SERIES M-22A

Frequency Range:
700 Hz to 1.5 KHz


.725 MAX.
.317 MAX.
1.775 MAX.
.352 MAX.
.757 MAX.
.238 MAX.
.486
.050 DIA.

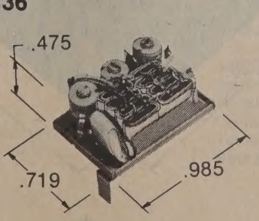
HOLDER SERIES M-22B

Frequency Range:
1.5 Hz to 4 KHz

McCOY CRYSTAL FILTERS

Filter
MODEL 80B36

F_0 57.836 MHz

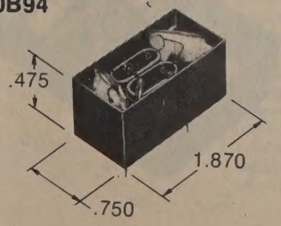


SPECIFICATIONS

Package FM 3965
3db BW ±25 KHz min.
45db BW 140 KHz max.
Insertion Loss: 6db max. @ RT, 7db over temp.
Ripple: 1db max. @ RT, 2db over temp.
Temperature Range: −54° to +100° C
Source/Load Impedance: 50 Ω
Shock: MIL-F-18327, Method I
Vibration: MIL-STD-202, Method 204B, Test Condition A
Spurious Response Attenuation:
35db min. from 58.036 to 58.236 MHz
45db min. from 10 to 57.766 MHz and 58.236 to 150 MHz

Filter
MODEL 20B94

F_0 17.000 MHz


.475
1.870
.750

SPECIFICATIONS

Package FM 2856
3db BW ±115 KHz min.
40db BW ±400 KHz max.
Insertion Loss: 4db max.
Ripple: ±1db max.
Temperature Range: −55° to +105° C
Source/Load Impedance: 50 Ω

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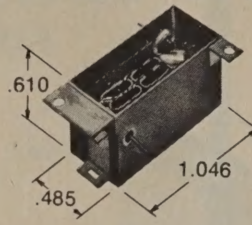
McCOY CRYSTAL FILTERS

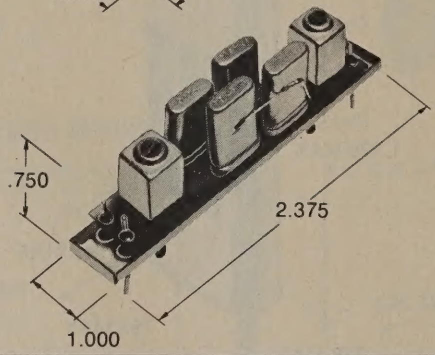
Filter
MODEL 2B164
F_o 30.000 MHz



SPECIFICATIONS

Package FM 3389
3db BW ±31.8 KHz min.
6db BW ±34.5 KHz min.
60db BW ±57 KHz max.
Insertion Loss: 3db max.
Ripple: 1db max. over ±25 KHz
Ultimate Attenuation: 60db min.
Temperature Range: −55° to +105° C
Source Impedance: 2000 Ω
Load Impedance: 50 Ω

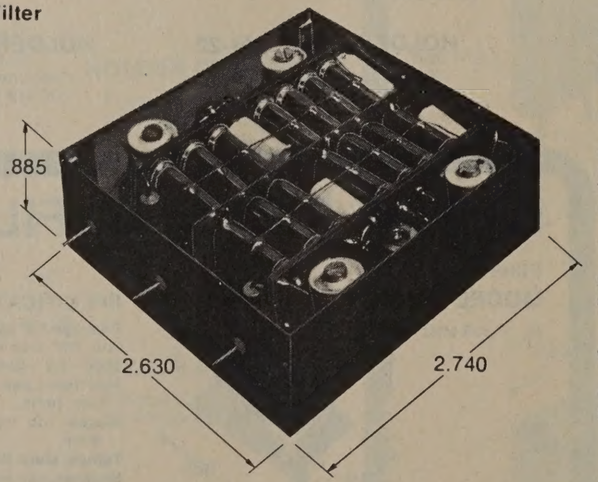
Filter
MODEL 53B20
F_o 455.000 KHz



SPECIFICATIONS

Package FM 3361
3db BW ±150 KHz min.
60db BW ±925 KHz max.
Transmission Loss: 14db max.
Ripple: 3db max.
Ultimate Attenuation: 60db min.
Temperature Range: −40° to +85° C
Transfer Impedance: 6500 Ω ±20%

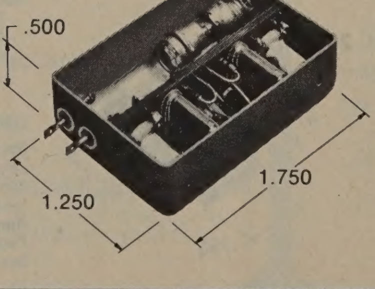
Single Sideband Filter
MODEL 20B110
F_o 1.750 MHz



SPECIFICATIONS

Package FM 2871
BW min. @ 1db F_o +295Hz to F_o +3100Hz
BW max. @ 60db F_o −125Hz to F_o +3975Hz
Insertion Loss: 5db max.
Ripple: 1db max. over 1db BW
Temperature Range: −40° to +70° C
Intermodulation Distortion Levels: At least 65db below two equal level (100mv.) signals, F_o +900Hz and F_o +2800Hz, applied simultaneously
Source/Load Impedance: 500 Ω
Shock: MIL-STD-202, Method 205, Test Conditions set forth in para 4.8.11.1 of MIL-F-39025
Vibration: MIL-STD-202, Method 204A, Test Condition A
Carrier Attenuation: @ F_o 40db min.
Differential Delay: 400 ms. max. over the band defined from F_o +800 Hz to F_o +3050 Hz

Crystal Discriminator
MODEL 6D1
F_o 11.000 MHz



SPECIFICATIONS

Package D1007
Peak-Peak BW: ±20 KHz
Linear BW: ±15 KHz
Linearity: ±3%
Sensitivity: .75 v/KHz
Driver Source Impedance: 1000 Ω
Discriminator Load Impedance: 75000 Ω
Drive Level: 3VRMS @ F_o
Temperature Range: +10° to +50° C

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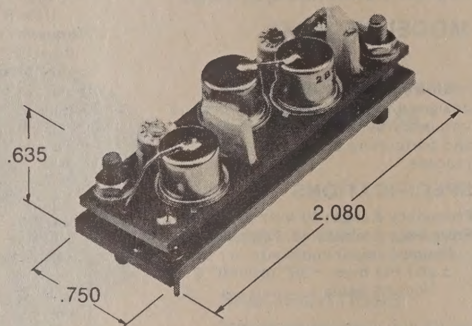
McCOY CRYSTAL FILTERS

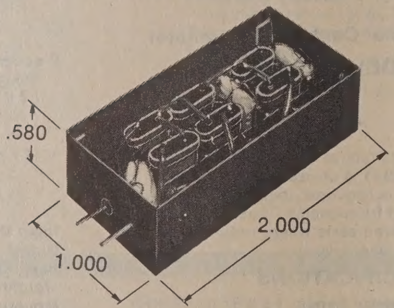
Filter
MODEL 2B308
F_o 25.500 MHz



SPECIFICATIONS

Package FM 7055
6db BW ±34.5 KHz min.
60db BW ±80 KHz max.
Insertion Loss: 5db max.
Ripple: 1db max.
Temperature Range: −55° to +71° C
Source/Load Impedance: 2700 Ω
Shock: 50G^S 11ms
Vibration: 5-500 Hz 10G^S

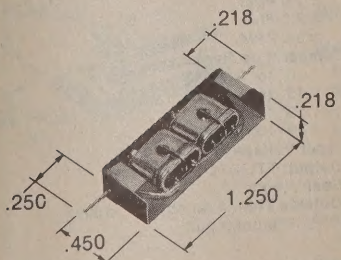
Filter
MODEL 2B91
F_o 9.000 MHz



SPECIFICATIONS

Package FM 2561
3db BW ±6 KHz min. ±7 KHz max.
60db BW 51 KHz max.
Insertion Loss: 6db max.
Ripple: 1db max.
Ultimate Attenuation: 60db min.
Temperature Range: −40° to +70° C
Source Impedance: 450 Ω
Load Impedance: 50 Ω

McCOY MONOLITHIC FILTERS

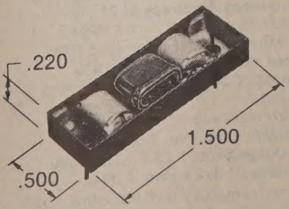


Monolithic Filter
MODEL 48Q3
F_o 11.500 MHz

Quality four pole space saver for miniaturized applications.

SPECIFICATIONS

Package FM 2885
3db BW ±10.5 KHz min.
40db BW 59 KHz max.
Insertion Loss: 2.5db max.
Ripple: 1db max.
Ultimate Attenuation: 60db min.
Temperature Range: −40° to +70° C
Source/Load Impedance: 2700 Ω



Monolithic Filters
MODELS 20Q4
1 through 16
F_o 11.000 - 15.000 MHz

Compact filter with termination matched to customer's requirement.

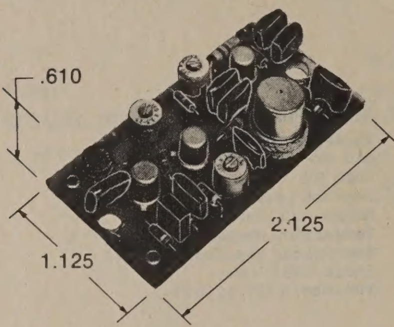
SPECIFICATIONS

Package FM 3919
3db BW ±7 KHz min.
10db BW 32 KHz max.
20db BW 50 KHz max.
Insertion Loss: 2db max.
Ripple: ±1db max.
Ultimate Attenuation: 30db min.
Temperature Range: −40° to +70° C
Source/Load Impedance: 50 Ω
Spurious Response Attenuation: 15db min.

McCOY ELECTRONICS COMPANY

a subsidiary of **OAK Industries Inc.**
MT. HOLLY SPRINGS, PA. 17065 • 717-486-3411 - TWX: 510-650-3548

McCOY CRYSTAL OSCILLATORS



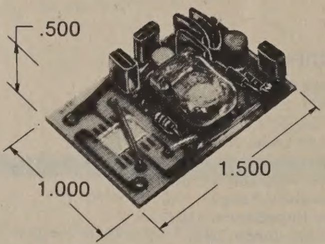
Crystal Controlled Oscillator

MODEL MC308X1

Multi-frequency crystal oscillator designed to allow the user to change frequency by inserting a new crystal and performing a simple retuning process.

SPECIFICATIONS

Frequency Range: 80 MHz to 110 MHz
Frequency Stability vs. Temperature Range (typical choices):
±20 PPM over −20° to +60° C from RT value
±50 PPM over −55° to +85° C from RT value
±100 PPM over −55° to +85° C from RT value
Frequency @ RT: Resolution of less than 1 PPM
Input Voltage: +12VDC ±2%
Input Current: 15ma. max.
Output:
7mw. min. into a 50Ω Load, sine wave, (−20° to +60° C)
5mw. min. into a 50Ω Load, sine wave, (−55° to +85° C)
Weight: 2 ounces max.
Mounting: Direct to printed circuit board using 4 wire leads
Package Volume: 1.63 cubic inches nominal
Crystal Type Used: TO-5 (McCoy Type W-6)



NOTE: Where height is critical, order MODEL MC210A1 which is the same as MC209A1 except height of .360 max.

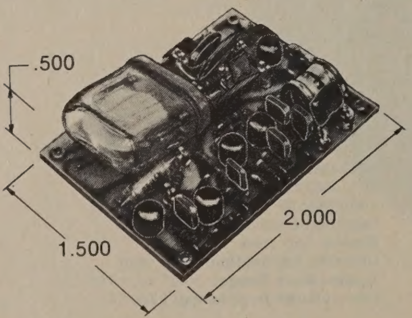
Crystal Controlled Oscillator

MODEL MC209A1

An offshoot of our MC109A1, the MC209A1 is utilized where an extra logic is required, thus obtaining lower output frequencies. It uses all MIL-approved parts where required on government work.

SPECIFICATIONS

Frequency Range: 1.8 KHz to 650 KHz
Frequency Stability vs. Temperature Range (suggested values only):
1.8 KHz to 12 KHz
±150 PPM over −55° to +105° C
± 70 PPM over 0° to +50° C
12 KHz to 650 KHz
± 50 PPM over −55° to +105° C
±100 PPM over −55° to +105° C
± 30 PPM over 0° to +50° C
Input Voltage: +5VDC ±5%
Output: Logic
Seal: Hermetic
Weight: 1.5 ounces max.
Mounting: Direct PC Mount



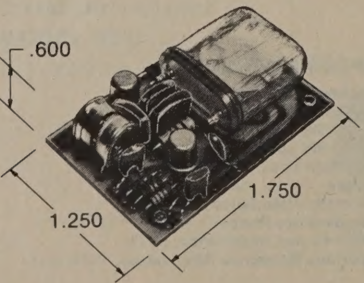
Temperature Compensated Crystal Oscillator

MODEL MC380A2

High Stabilities achieved with a single +5VDC input instead of 2 separate inputs.

SPECIFICATIONS

Frequency Range: 187.5 KHz to 25 MHz
Frequency Stability:
±0.5 PPM
±1.0 PPM
±2.0 PPM
±5.0 PPM
Temperature Range:
0° to +50° C
−10° to +70° C
−30° to +70° C
−40° to +85° C
Input Voltage: +5VDC ±1%
Output: TTL/DTL Compatible
Seal: Hermetic
Outside Trim: Available on request (5 PPM total pull)



Standard Oscillator

MODEL MC350X1

Versatile, economical crystal oscillator for PC board applications offering frequency trim adjustment and square wave output.

SPECIFICATIONS

Frequency Range: 188 KHz to 25 MHz
Frequency Stability: ±50 PPM
Temperature Range: −55° to +105° C
Frequency Accuracy at 25° C:
*Units with Trim - ±1 PPM
*Units without Trim - ±5 PPM
Input Voltage: +5VDC ±5%
Output: Compatible with TTL and DTL Logic
Seal: Hermetic
Weight: Less than 3 ounces
Package Size: 1.25 x 1.75 x .600
Volume: 1.312 cubic inches
*The frequency trim adjustment is optional and should be specified when required.

McCOY
ELECTRONICS
COMPANY

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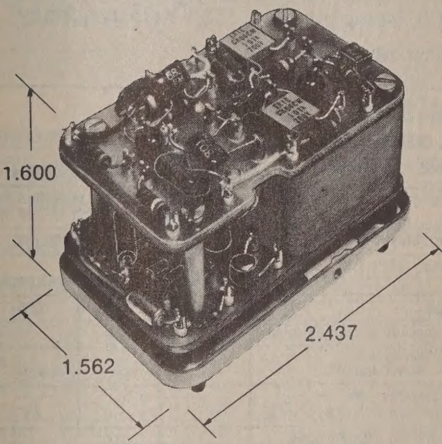
McCOY CRYSTAL OSCILLATORS



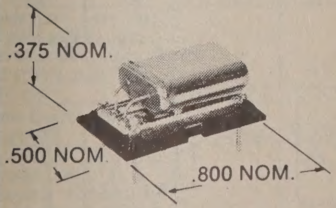
Oven Controlled Crystal Oscillator

MODEL MC645X4

Small, stable oven used where the upper ambient must be as high as +90° C.

SPECIFICATIONS

Frequency Range: 2.0 to 25 MHz
Frequency Stability: ±10 PPM over the temperature range
Temperature Range: −55° to +90° C
Input Voltage:
Oscillator: +16VDC ±5%
Oven: +18VDC to +35VDC (select value)
Output Waveshape: sine or square
Output Voltage: 4VP-P ±3db into a 10,000 Ω Load
Outside Trim: Yes, to better than 0.1 PPM of nameplate frequency
Oven Control: Proportional Type Solid State
Oven Power:
6 watts max. at −55° C turn-on and +28VDC input
3.5 watts max. steady state at −55° C and +28VDC input
Warm-up time: 10 minutes at −55° C (unit will be within frequency tolerance over the temperature range.



Miniature Dip Crystal Clock Oscillator

701/702 SERIES

SPECIFICATIONS

Size:
MC 701A1 -4 Pin Dip Plastic Pkg.
MC 702A1 -14 Pin Dip Plastic Pkg.

Pin Conn:
MC 701A1/MC 702A2 Pin #1 NC
Pin #7 GND
Pin #8 RF Output
Pin #14 +5VDC

Frequency Range:
156 KHz to 25 MHz

Frequency Stability Over Temp:
± 20 PPM, +15 °C to +34 °C
± 50 PPM, 0 °C to +70 °C
± 60 PPM, -40 °C to +85 °C
± 70 PPM, -55 °C to +105 °C

Frequency Calibration @ +25 °C:
± 25 PPM
± 10 PPM (Optional @ Prem.)

Frequency Stability vs. B+ (5.0 VDC) ± 10%:
± 2.0 PPM

Frequency Stability vs. A Load, 1 to 10 Loads:
± 2.0 PPM

Aging vs. Time:
± 5 PPM, 1st Yr. ± 3 PPM/Yr. For Subsequent Yrs.

Symmetry:
40% to 60% Typ., 35% to 65% max.

Risetime:
(.5V to 2.4V): 10 to 25 nsec Value Related to Output Frequency

Fall Time:
(2.4 to .5V): 10 to 25 nsec Value Related to Frequency

Fanout:
1 to 10 ^{2}T L Loads
(1 sink = 16.0 ma. max., 1 source = 4 ma. max.)

Output Voltage:
Logic "1": 2.4V min.
Logic "0": 0.4V max.

Input:
+5VDC. ± 10%
2.5 MHz to 25 MHz, 15 ma. typ. (25 ma. max.)
625 KHz to 2.5 MHz, 30 ma. typ. (50 ma. max.)
156 KHz to 625 KHz, 40 ma. typ. (65 ma. max.)

Features: MC701A1:
Utilizes 4 pins to facilitate mounting on PC board solder operation.

MC702A1:
Utilizes 14 Pins for mounting in 14 pin dip socket for maximum engagement under shock and vibration conditions.

MF CRYSTAL OSCILLATORS

MF GUARANTEED CRYSTAL OSCILLATORS (TCXO and XO) • 1 Hz - 20 MHz

- Improved input voltage characteristic
- Screwdriver adjustable
- Choice of 2 cases

HOW TO ORDER: For Part Number...Add case style and frequency to the Series
For example:
Series 5401, Flatpack case, 10 MHz frequency
5401 — 1 — 10 M
Series 5403, Compact case, 153.6 KHz frequency
5403 — 2 — 153.6K

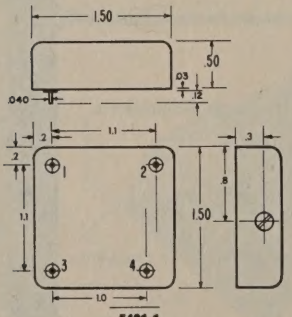
SERIES 5401

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO) • 1 Hz - 20 MHz

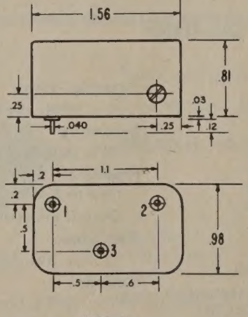
	5401-1, 2	5401-3, 4
Frequency range	As specified from 250 KHz to 20 MHz	As specified from 1 Hz to 249 KHz
Input Current, Maximum	50 ma	100 ma

	MINIMUM	TYPICAL	MAXIMUM	
Input Voltage	4.75	5.00	5.25	Volt
Frequency Screwdriver Adjustment	±5	±10		ppm
Frequency Stability with Temperature from 0 to 65°C		±0.4	±0.8	ppm
Frequency Stability with Input Voltage from 4.75 to 5.25 volts		±0.1	±0.2	ppm
Ageing, per month, after 60 days		±0.2		ppm
Output Fan Out			10	TTL loads
Symmetry, at 1.5 volts	40/60		60/40	
Rise Time, 0.8 to 2.4 volts				
1 Hz to 10 MHz		7	20	ns
Over 10 MHz to 20 MHz		2.5	5	ns
Fall Time, 2.4 to 0.8 volts				
1 Hz to 10 MHz		4	20	ns
Over 10 MHz to 20 MHz		2	5	ns

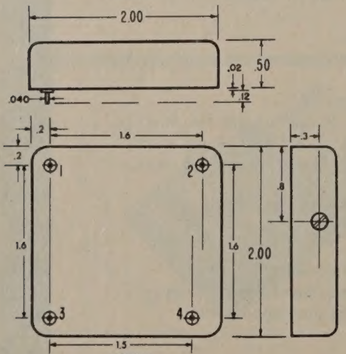
SPECIFICATIONS, SERIES 5401


1.50
.50
.03
.12
.040
.2
1.1
1.50
.3
1.0
1
2
3
4

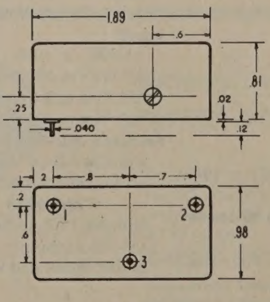
5401-1


1.56
.81
.25
.040
.03
.25
.12
.2
1.1
.5
.98
.6
1
2
3

5401-2


2.00
.02
.50
.12
.040
.2
1.6
.3
.8
1.6
2.00
1.5
1
2
3
4

5401-3


1.89
.6
.81
.25
.02
.040
.12
.2
.8
.7
.6
.98
1
2
3

5401-4

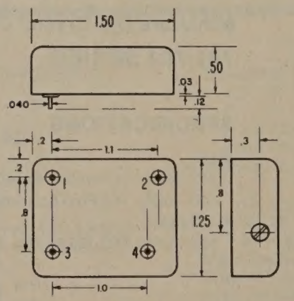
SERIES 5403

CRYSTAL OSCILLATORS (XO) • 1 Hz - 20 MHz

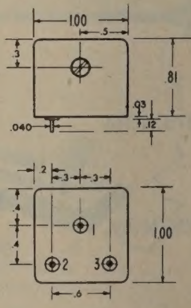
	5403-1, 2	5403-3, 4
Frequency range	As specified from 250 KHz to 20 MHz	As specified from 1 Hz to 249 KHz
Input Current, Maximum	50 ma	100 ma

	MINIMUM	TYPICAL	MAXIMUM	
Input Voltage	4.75	5.00	5.25	Volt
Frequency Screwdriver Adjustment	±5	±10		ppm
Frequency Stability with Temperature from 0 to 65°C		±7	±10	ppm
Frequency Stability with Input Voltage from 4.75 to 5.25 volts		±0.3	±1	ppm
Ageing, per month, after 60 days		±0.2		ppm
Output Fan Out			10	TTL loads
Symmetry, at 1.5 volts	40/60		60/40	
Rise Time, 0.8 to 2.4 volts				
1 Hz to 10 MHz		7	20	ns
Over 10 MHz to 20 MHz		2.5	5	ns
Fall Time, 2.4 to 0.8 volts				
1 Hz to 10 MHz		4	20	ns
Over 10 MHz to 20 MHz		2	5	ns

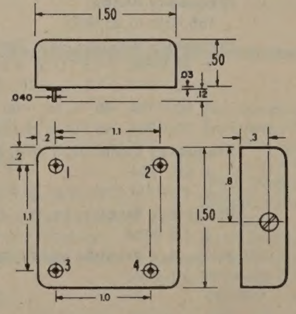
SPECIFICATIONS, SERIES 5403


1.50
.50
.03
.12
.040
.2
1.1
.8
1.25
.3
1.0
1
2
3
4

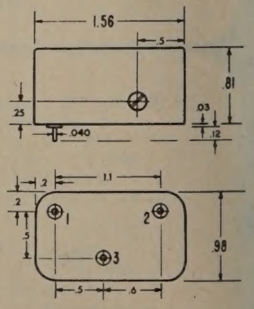
5403-1


100
.5
.3
.81
.03
.12
.040
.2
.3
.4
1.00
.6
1
2
3

5403-2


1.50
.50
.03
.12
.040
.2
1.1
.8
1.50
.3
1.0
1
2
3
4

5403-3


1.56
.5
.81
.25
.040
.03
.12
.2
1.1
.5
.98
.6
1
2
3

5403-4

AVAILABLE IN CMOS LOGIC

MF ELECTRONICS CORP.
118 EAST 25th STREET, NEW YORK, N.Y. 10010 • (212) 674-5360 • TWX: 710-581-4109

MF DIP CRYSTAL OSCILLATORS

MF GUARANTEED DIP OSCILLATORS

The Broadest line in the industry.

- Most units molded—greatly resistant to moisture and abuse.
- Units use overtone crystals from 20 MHz to 65 MHz, very stable electrically and more reliable mechanically.
- Each oscillator serialized and date coded.
- Units specified at temperatures exceeding 0 to 65°C are individually recorded 100% for frequency vs temperature-insuring compliance.
- All units guaranteed for one year to operate within specifications.

DESCRIPTION	FREQUENCY	PART NO. (substitute frequency for ...)	TOTAL ACCURACY Parts Per Million	TEMPERATURE	
Round pins, commercial.	4 to 65 MHz	5404- ...M	± 50 ppm	0 to +65°C	Fig. A
Round pins, commercial.	4 to 65 MHz	5404-1...M	± 25 ppm	0 to +65°C	
Dual DIP, commercial.	80 KHz to 4.99 MHz	5405 ...M	±200 ppm	0 to +65°C	Fig. B
Dual DIP, commercial.	80 KHz to 4.99 MHz	5405-1...M	±100 ppm	0 to +65°C	
Molded DIP, .300" high	4 to 65 MHz	5406 ...M	± 50 ppm	0 to +65°C	Fig. C
Molded DIP, .300" high	4 to 65 MHz	5406-1...M	± 25 ppm	0 to +65°C	
Molded DIP, .300" high	4 to 65 MHz	5406-2...M	± 50 ppm	−55 to +65°C	
Molded DIP, .300" high	4 to 65 MHz	5406-3...M	± 50 ppm	0 to +85°C	
Molded DIP, .300" high	4 to 65 MHz	5406-4...M	± 75 ppm	0 to +125°C	
Molded DIP, .300" high	4 to 65 MHz	5406-5...M	± 50 ppm	−55 to +85°C	
Molded DIP, .300" high	4 to 65 MHz	5406-6...M	± 75 ppm	−55 to +125°C	
Molded DIP, .300" high all dashes same as 5406, except units tunable.	4 to 65 MHz	5407 ...M	± 50 ppm	0 to +65°C	
Molded DIP, .300" high, 4 pins, lowest cost.	4 to 65 MHz	5408 ...M	±100 ppm	0 to +70°C	
Molded DIP, herm. seal, crystal and IC. Mil use.	4 to 65 MHz	5410 ...M	± 50 ppm	−55 to +85°C	
Same as above with stand-off.	4 to 65 MHz	5410S ...M	± 50 ppm	−55 to +85°C	
Molded DIP, herm. seal, crystal and IC. Mil use.	4 to 65 MHz	5411 ...M	± 75 ppm	−55 to +125°C	
Same as above with stand-off.	4 to 65 MHz	5411S ...M	± 75 ppm	−55 to +125°C	
Molded DIP, herm. seal, crystal and IC; all hi-rel parts. Additional screening available. Mil use.	4 to 65 MHz	5412 ...M	± 50 ppm	−55 to +85°C	
Same as above with stand-off.	4 to 65 MHz	5412S ...M	± 50 ppm	−55 to +85°C	
Molded DIP, herm. seal, crystal and IC; all hi-rel parts. Additional screening available. Mil use.	4 to 65 MHz	5413 ...M	± 75 ppm	−55 to +125°C	
Same as above with stand-off.	4 to 65 MHz	5413S ...M	± 75 ppm	−55 to +125°C	
Herm. seal case, herm. seal crystal and IC. Mil use.	4 to 65 MHz	5420 ...M	± 50 ppm	−55 to +85°C	Fig. D
Herm. seal case, herm. seal crystal and IC. Mil use.	4 to 65 MHz	5421 ...M	± 75 ppm	−55 to +125°C	
Herm. seal case; all hi-rel parts. Cold weld crystal. Mil use, extensive 100% screening. Most reliable part available.	4 to 65 MHz	5422 ...M	± 50 ppm	−55 to +85°C	
Herm. seal case; all hi-rel parts. Cold weld crystal. Mil use, extensive 100% screening. Most reliable part available.	4 to 65 MHz	5423 ...M	± 75 ppm	−55 to +125°C	

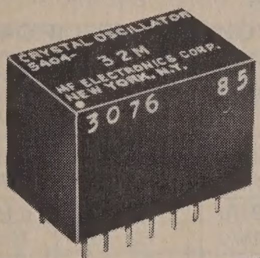


Fig. A

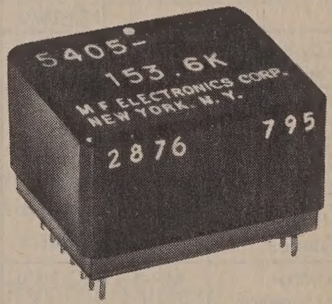


Fig. B

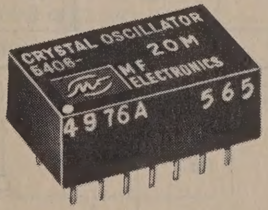


Fig. C

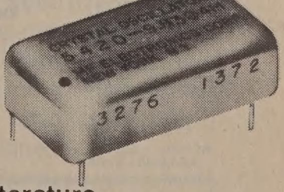


Fig. D

Telephone for complete literature.

HOW TO ORDER:

For Part Number . . . Add frequency to the Series

For example:

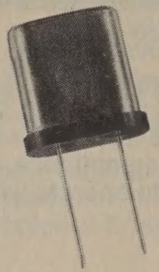
Series 5404, ±50 ppm, 0 to 65°C → **5404 - 10M** ← 10 MHz frequency

Series 5406-5, ±50 ppm, −55 to +85°C → **5406-5 - 4.096M** ← 4.096 MHz frequency

MF ELECTRONICS CORP.

118 EAST 25th STREET, NEW YORK, N.Y. 10010 • (212) 674-5360 • TWX: 710-581-4109

CRITICAL CRYSTALS come from M-tron INDUSTRIES, INC.



Commercial Crystals from 1 MHz to 100 MHz

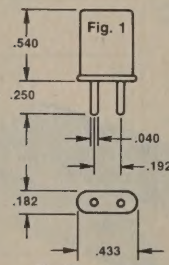
Inexpensive quartz crystals for high volume assembly applications. Widely used in circuits where long-term stabilities in the range of 5 to 10 ppm/year are acceptable. M-tron commercial crystals have typical applications in electronic clocks, TV games, color TV, microprocessors, instrumentation, avionics, CB radios, and other personal communication equipment.

GENERAL SPECIFICATIONS FOR COMMERCIAL CRYSTALS

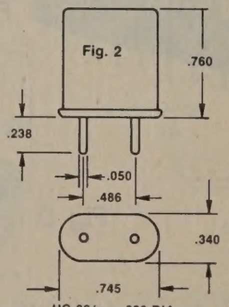
TYPICAL APPLICATION	PRODUCT TYPE	HOLDER STYLE	DIMENSIONAL OUTLINE	FREQUENCY RANGE (MHz)	CALIBRATION TOL. at 25°C (PPM)	STABILITY OVER TEMP. RANGE (PPM)	TEMP. RANGE		LOAD CAPACITY (Pf)	MAX. DRIVE LEVEL* (mW)
							−C°	+C°		
Hand-Held CB radio	CB-1	HC-25/u	Fig. 1	26.965 to 27.405	±15	±30	−20	+60	65	2.0
CB Radio	CD-1	HC-25/u HC-18/u	Fig. 1	5.0 to 60.0	±20	±30	−20	+60	32	2.0
Toy Hand-Held Radio	LP-1	HC-25/u	Fig. 1	49.830 to 49.890	±25	±50	−20	+50	65	2.0
Quartz Clocks	QC-2	HC-33 mod.	Fig. 3	4.194304 or 2.097152	±25	±50	−20	+60	15	2.0
TV Color Burst Osc.	TV-2	HC-33 mod.	Fig. 3	3.579545	±20	±30	−20	+65	18	2.0
Video Games	VG-2	HC-33 mod.	Fig. 3	3.000 to 5.000	±30	±35	−10	+65	18	2.0
Micro-processor	MP-1	HC-18/u	Fig. 1	3.579 to 28.356	±25	±35	−20	+70	18	2.0
Micro-processor	MP-2	HC-33/u	Fig. 2	1.000 to 5.000	±25	±35	−20	+70	18	2.0

**All tests performed at 0.1 mW drive level.*

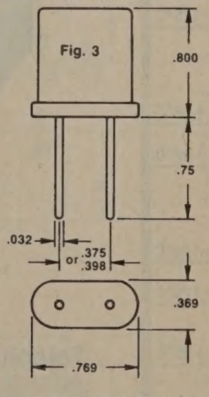
Standard Holder Styles



HC-18/u = .017 DIA. x
1.5 LONG LEADS



HC-33/u = .030 DIA. x
1.5 LONG LEADS



Custom Crystals

M-tron normally manufactures crystals to the general specifications shown here. Should your requirements vary, M-tron will provide custom crystals to your specifications. To reduce developmental time significantly, specify the following parameters when ordering custom crystals.

- Frequency in megahertz
- Mode of oscillation
- Frequency calibration tolerance @ 25°C
- Frequency deviation over the temperature range
- Operating temperature range in °C
- Maximum series resistance in ohms
- Shunt capacitance in picofarads
- Load capacity in picofarads
- Maximum drive level in milliwatts
- Holder type

M-TRON COMPONENTS DISTRIBUTION PROGRAM

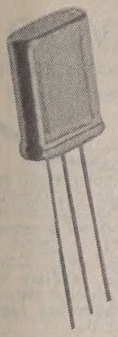
M-tron carries out an aggressive crystal marketing campaign for the electronic distributor. Crystals are available from stock 2 weeks after the receipt of an order. Non-stock items are shipped within 4 weeks. This includes all of M-tron's stocking programs which are listed at right.

In addition, an order entry system is available for distributors to request larger volumes of crystals to their own specifications. This delivery ranges from 6 to 8 weeks after receipt of an order.

M-tron currently has in stock the following crystal product lines:

- Scanner radio crystals
- Scanner radio crystal certificates
- Plug-in CB radio crystals
- Plug-in CB radio crystal certificates
- CB radio synthesizer replacement crystals
- CB radio synthesizer replacement crystal certificates
- Microprocessor crystals
- **M-tron 9** emergency delivery program

CRITICAL CRYSTALS come from M-tron INDUSTRIES, INC.



2 Pole Monolithic Filters

M-tron manufactures inexpensive 2 pole monolithic filters for high volume assembly applications. These units have normal applications in personal communications equipment, scanner radio, AM-FM-CB radio combinations and many other signal processing applications at 10.7 MHz.

Custom Monolithic Filters

M-tron builds filters to the general specifications listed below. Should your specifications vary, M-tron will custom manufacture to your exact requirements. Developmental time can be significantly reduced if the parameters listed in the chart below are specified when ordering.

CENTER FREQUENCY (MHz)	NUMBER OF POLES	BANDWIDTH AT THE −3 dB POINTS (KHz MINIMUM)	BANDWIDTH AT THE −20 dB POINTS (KHz MAXIMUM)	RIPPLE (MAX.)	SPURIOUS RESPONSE (MIN.)	INSERTION LOSS	INPUT & OUTPUT IMPEDANCE (Ω)
10.700	2	±7.5	±35.0	1 dB	15 dB	1 dB	3K
10.700	2	±3.0	±15.0	1 dB	15 dB	2 dB	1K
10.700	2	±15.0	±75.0	1 dB	15 dB	1 dB	3K

Military Crystals

M-tron is approved to build the following crystals to meet the U.S. military specifications. These applications include time base oscillators, communications equipment and other military frequency control requirements.

M-tron is QPL Approved for the following Military Crystal Types:

CR-5A/U
CR-6A/U
CR-8A/U
CR-18A/U
CR-19A/U
CR-27A/U
CR-28A/U
CR-35A/U
CR-36A/U
CR-52A/U
CR-55A/U
CR-58A/U
CR-60A/U
CR-62/U
CR-64/U
CR-65/U
CR-67A/U
CR-72/U
CR-76A/U
CR-77/U
CR-78A/U
CR-79/U
CR-81/U
CR-89/U
CR-97/U
CR-106/U
CR-117/U
CR-131/U
CR-139/U
CR-140/U
CR-142/U
CR-152/U
CR-157/U

Quality Control and Inspection

M-tron maintains a detailed Quality Control manual which is revised regularly to reflect the latest requirements for processing and testing quartz crystals. In addition to a quality audit to verify 100% production testing, an in-line quality system is employed to insure product quality. This program is in accordance with MIL-I-45208A.

Computer-Aided Design

M-tron's engineering department is ready to work with you on your new programs involving volume assembly application.

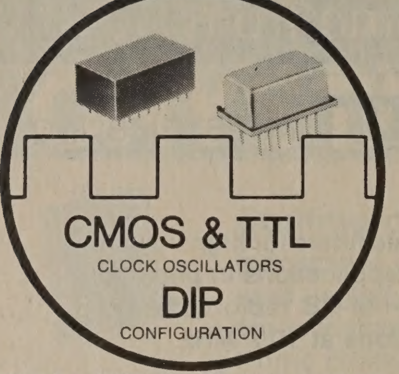
- Computer-aided design
- Excellent engineering liaison
- Samples in 3 to 4 weeks
- Consistent product design quality

Equipment Calibration is in accordance with MIL-C-45662A with frequency standards synchronized to WWVB at Fort Collins, Colorado. M-tron's ENVIRONMENTAL TESTING is performed in our government certified testing laboratory using MIL-C-3098 as the quality guideline.

Get the action YOU need from M-tron…the solid source.

Call now on our Crystal Hot Line…
(800) 843-6842 or TWX (910) 668-3603.

M-tron
INDUSTRIES, INC.
P. O. Box 630, Yankton, South Dakota 57078



Monitor has CMOS and TTL logic crystal-controlled precision clock oscillators for all your commercial, industrial, and military environment needs. Example: The 800 Series low profile TTL logic, 50Hz-40MHz, as low as $4.50 ea. in quantity! Designs per MIL-O-55310 available. OFF-THE-SHELF DELIVERY ON STANDARD FREQUENCIES.

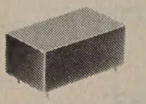
ECONOMY TTL LOGIC 50Hz-125MHz/DIP PLUG-IN

800 Series

900 Series

Input: 5VDC±10% / Output: "0" = +.4Vmax., "1" = +2.4Vmin / Current Drain: 50MA/Typ./Stability to ±30 PPM, 0°-60°C. Nominal calibration: ±50PPM @ 25°C. Full ambient units available/ Size: as small as 1"x.75"x .35"./DIP plug-in, TO-116 compatible pin pattern.

978A SERIES/3-10MHz CMOS LOGIC/14-PIN DIP

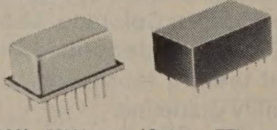


Input: 10-15VDC, 3MAmax./ Output: "0" = +.5V-max., "1" =80% of supply voltage min./ Stability: ±.005% —40° to +85°C. Nominal calibration: ±.01% @ 25°C/Std. frequencies: 4.194304MHz (1Hz binary multiple). 3.932160MHz (60Hz binary multiple), 4.096MHz (1KHz binary multiple).

870A SERIES/10Hz-10MHz CMOS LOGIC/PCB MOUNTING

Input: 10-15VDC, 10MA (<5MA for 877A)/Output: "0"=+.5V max., "1"=90% of supply voltage min. (80% for 877A, 879A)/Stability: to ±.005% 0°-60°C (—25° to +75°C for 877A, 879A), nominal calibration: ±.005%@25°C (±.01% for 877A)/ Other frequencies, stabilities to ±25PPM available on special order

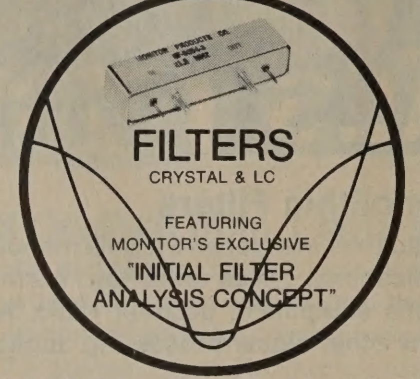
TTL LOGIC/14-PIN DIP 218KHz-20MHz


Hermetically Sealed

Input: 5VDC±10%, 50MA max./Output: TTL symmetry 60/40, +2.4V min./Rise-Fall: 20 nanosec. nominal/Load: Up to 10TTL gates (1.6MA ea.)/ Typ. stability: ±100PPM, 0°-70°C std., —55° to +125°C opt. (stabilities to ±25PPM available)/ Set tolerance: ±100PPM@+25°C (±20PPM available)/Environmental: Ref. Mil-Std-202, Mil-O-55310

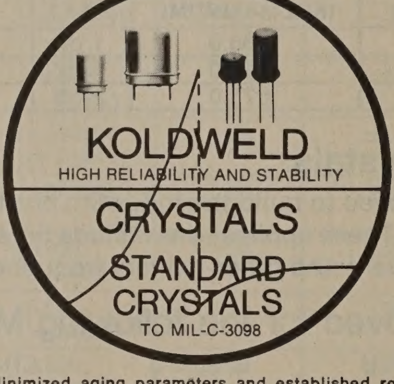
968/969 SERIES/MULTIPLE OUTPUT/TTL LOGIC/14-PIN DIP

Multiple binary related output from the same unit. 1, 2, 4, 8 and 16 MHz, Type 969. 1.25, 2.5, 5, 10, and 20 MHz, Type 968. Microprocessor clock frequencies standard/.46"x.80"x.35"h.



Among leading suppliers of LC and quartz crystal filters, Monitor will meet your Total Filter Needs, in the frequency spectrum from audio to 30MHz. No restriction to bandwidth. The "Initial Filter Analysis concept" in computerized plot and tabloid form, will assist you in optimizing your network.

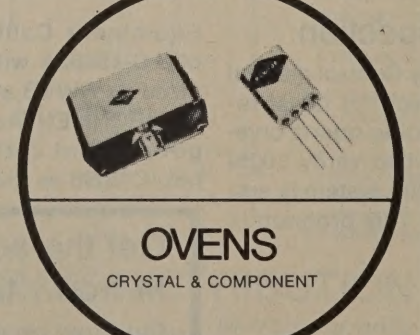
- **CCIR Filters for Multi-Channel Transmission Systems**
- **Diagnostic Filters for Dynamic Analysis**
- **Comb-Filter Sets**
- **Very Narrow Bandwith Filters**
- **Multiplex Filters**
- **Single Side Band Filters**



Minimized aging parameters and established reliability (ER) conformance are inherent in Monitor's Koldweld Crystal techniques.

The KX Types are cross referenced to standard HC-6, HC-18 and HC-13 military specification units. Monitor's KTO Series is an extension of the TO-5/TO-18 Configurations.

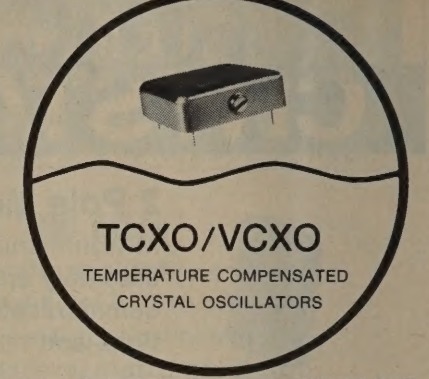
Write for our Crystal Engineering Handbook. Delivery from stock on small quantities of most standard frequencies.



Solid State Mercury 28VDC and 115VAC

Proportional Control 12VDC, 28VDC and 115VAC

Several hundred models available based on over three decades of oven design experience. Why settle for less?



Monitor Temperature Compensated Crystal Oscillators assure precise frequency control and high stability, extremely low current drain and zero warm up time. A full range of designs are available with sine wave, TTL or CMOS compatible outputs. Monitor TCXOs and TC/VCXOs are widely used in industrial, military and spacebourne environments where high density packaging, and maximum reliability are required. Ref. Mil-Std-202 and Mil-O-55310.

TCXOs, TC/VCXOs .2-20MHz

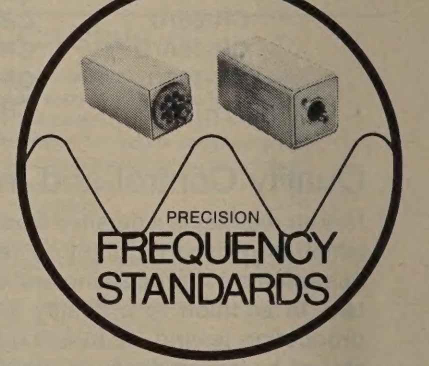
Designs available from 50Hz-50MHz. Check our stock for your needs.

E07-E42
2"x2"x.53"

E43-E78
1.5"x1.5"x.53"

E79-E90
2" dia.x.9"

Input: 5-15VDC (+15V±5% std.), 3-20MA/Outputs: TTL std. (10TTL loads), CMOS and sine wave (0 DBM min., 50 ohms)/Temp. vs. stability: ±.5PM, 0°-55°C; ±1PPM 0°-60°C; ±2PPM, —55° to +71°C; ±1PPM —20° to +70°C, other stabilities available/Aging: ±1 part in 10^{-6} per year, ±.5 parts in 10^{-7} available.



Order your precision frequency standards from Monitor. Major electronic counter and instrument manufacturers are satisfied users. Ask for our complete line of thermally stabilized standards.

Typical Specifications-Input: 115VAC or 28VDC oven, 2 watts @25°C, 6 watts turn-on; 15-30VDC oscillator, 15MA typical/Outputs: TTL compatible, sine wave and CMOS optional/Frequencies: 1, 5 and 10MHz std., other available/Aging rates up to 3 parts in 10^{-9} per day std., 1 part in 10^{-9} per day opt./Short term stability: ±5 parts in 10^{-10} per second, typ./Size: as small as 1.5"x1.5"x3.25"h.

MONITOR
PC

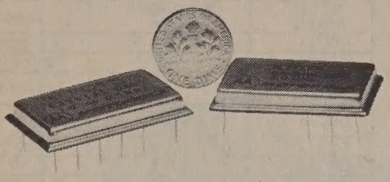
MONITOR PRODUCTS COMPANY, INC.

502 VIA DEL MONTE / OCEANSIDE, CALIFORNIA 92054 / (714) 433-4510

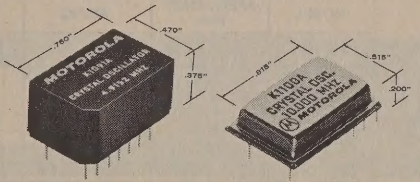
50 Years of Frequency Control Know-How

Microprocessor Clocks

Designed specifically to drive	**Intel 8080 & 8080A**	**Motorola M6800 MPU**		
MODEL	**K1117A**	**MC6870A**	**MC6871A**	**MC6871B**
Frequency	1 MHz to 2.2 MHz 2 MHz std.	250 kHz to 2.5 MHz 1 MHz std.	850 kHz to 2.5 MHz 1 MHz std.	250 kHz to 2.5 MHz 1 MHz std.
Frequency Stability (Inclusive of calibration tolerance at 25°C, operating temperature, input voltage change, load change, aging, shock, and vibration.)	±.01%	±.01%	±.01%	±.01%
Operating temp. range	0°C to 70°C	0°C to 70°C	0°C to 70°C	0°C to 70°C
Input Voltage	VDD +12V VCC + 5V VSS Gnd.	+5V	+5V	+5V
Logic Output Features	$\phi_1\phi_2$ NMOS $\phi_1\phi_2$ TTL	$\phi_1\phi_2$ NMOS ϕ_2 TTL	$\phi_1\phi_2$ NMOS ϕ_2 TTL memory clock (TTL) 2xFc (TTL)	$\phi_1\phi_2$ NMOS ϕ_2 TTL ϕ_2 TTL, (ungated) 2xFc (TTL)
Logic Input Features for clock stretching DMA, etc.	None	None	$\overline{\text{Hold}}$ 1 Memory Ready	$\overline{\text{Hold}}$ 1 $\overline{\text{Hold}}$ 2
Dimensions	1.34″L x .84″W x .200 seated height	1.34″L x .84″W x .200 seated height	1.34″L x .84″W x .200 seated height	1.34″L x .84″W x .200 seated height



Microprocessor clock models K1117A and MC6870A are designed to provide the critical two-phase, non-overlapping wave forms required by the specific microprocessor, as well as TTL outputs for VMA. Additional input and output features are added to models K1117B, MC6871A, and MC6871B to accommodate systems that use fast and slow memories, direct memory access, etc. Crystal, oscillator, NMOS drivers and necessary wave shaping circuitry are packaged by hybrid thick film IC technology into one dual-in-line module that reduces your component count and board space.



Integrated Circuit Crystal Clock Oscillators

SPECIFICATION	**K1091A**	**K1100A**	**K1114A**	**K1115A**	**K1116A**
Frequency Range:	4 MHz to 20 MHz	250 kHz to 70 MHz	250 kHz to 20 MHz		
Frequency Stability: (Inclusive of calibration tolerance at 25°C, operating temperature, input voltage change, load change, aging, shock, and vibration.)	±0.01%	±0.01%	±0.05%	±.1%	±1.0%
Temperature Range Operating: Storage:	 0°C to +70°C −55°C to +125°C	 0°C to +70°C −55°C to +125°C	 0°C to +70°C −55°C to +125°C		
Input Voltage:	+5V dc ±10%	+5V dc ±0.5V	+5V dc ±0.5V		
Input Current (typical):	60 mA	105 mA (250-1,000 kHz) 90 mA (1-4 MHz) 30 mA (4-9 MHz) 60 mA (9-30 MHz) 70 mA (30-70 MHz)	105 mA (250-1,000 kHz) 90 mA (1-4 MHz) 30 mA (4-9 MHz) 60 mA (9-30 MHz) 70 mA (30-70 MHz)		
Output: Square Wave:	TTL Compatible	TTL Compatible	TTL Compatible		
Rise & Fall Time:	10 nsec maximum	15 nsec Maximum (.25 to 9 MHz) 10 nsec Maximum (9 to 30 MHz) 5 nsec Maximum (30 to 70 MHz)	15 nsec Maximum (.25 to 9 MHz) 10 nsec Maximum (9 to 30 MHz) 5 nsec Maximum (30 to 70 MHz)		
Levels:	"0" = 0.4V, "1" = 3.0V	"0" = 0.4V, "1" = 2.4V	"0" = 0.4V, "1" = 2.4V		
Symmetry:	60/40 duty cycle worst case	60/40% at 1.4V dc level	60/40% at 1.4V dc level		
Fan Out:	1 to 10 gates, 1.6 mA/gate	1 to 10 gates, 1.6 mA/gate	1 to 10 gates, 1.6 mA/gate		
Environmental Shock:	Withstand 40 G's for 11 ms, 3 mutually perpendicular planes	1,000 G's for 0.35 ms, 1/2 sine wave, 3 shocks each plane	1,000 G's for 0.35 ms, 1/2 sine wave, 3 shocks each plane		
Vibration:	5-55 Hz, 0.06" double amplitude 15 minutes each plane	10-55 Hz, 0.060" double amplitude; 55 Hz-2 kHz, 35 G's 12 hours duration	10-55 Hz, 0.060" double amplitude; 55 Hz-2 kHz, 35 G's 12 hours duration		

MOTOROLA INC.
COMPONENT PRODUCTS DEPT.

Dept. EM, 2553 N. Edgington, Franklin Park, IL 60131
Phone: (312) 451-1000
TWX: 910-227-0799

oscillators

Ovenaire has the capabilities, experience and production techniques to meet the most exacting crystal oscillator requirements.

Contact factory for complete specifications on regular production models listed below.

HIGH STABILITY CRYSTAL OSCILLATORS

MODEL SERIES	FREQUENCY MHz	AGING	POWER @+25°C	SUPPLY VOLTAGE	OUTPUT	MAX. SIZE—MM
OSC 83	7.2 TO 13.2	1.5×10^{-6}/YR	2.2 WATTS	+28 VDC	SINE	37×48×84
OSC 78	5	2×10^{-7}/YR	0.6 WATTS	+15 VDC	TTL	65×75×114
OSC 75	10	3×10^{-8}/MO	5.5 WATTS @ −54°C	+28 VDC	TTL	37×44×90
OSC 74	7.5 TO 15	3.5×10^{-7}/YR	2.0 WATTS	+15 VDC	TTL	(A) 64×81×32 (B) 51×51×79
OSC 73-1	9 TO 15	1×10^{-6}/YR	2.0 WATTS	+15 VDC	SINE	33×79×54
OSC 73-2	2 TO 6	7.5×10^{-7}/YR	2.0 WATTS	+15 VDC	TTL	47×68×35
OSC 73-3	12 TO 25	2.5×10^{-6}/YR	2.3 WATTS	+20 VDC	SINE	36×75×41
OSC 70	22 TO 120	2.5×10^{-6}/YR	2.2 WATTS	+28 VDC	SINE	37×48×90
OSC 55	10 TO 55	1×10^{-6}/YR	1.4 WATTS	+28 VDC	SINE	33×67×19
OSC 49-3	3 OR 10	3.5×10^{-7}/YR	2.2 WATTS	+28 VDC	SINE	41×114×53
OSC 49-5	10	2.5×10^{-7}/YR	2.2 WATTS	+20 VDC	OPTIONAL	(A) 51×51×84 (B) 49×75×54
OSC 46-1	1	3×10^{-9}/DAY	85 MA	+25 VDC	SINE	75×75×93
OSC 46-2	1	3×10^{-9}/DAY	80 MA	+30 VDC	SINE	75×75×93
OSC 45	2 TO 12	1×10^{-6}/YR	1.8 WATTS	+9 VDC TO +28 VDC	TTL	(A) 43×64×33 (B) 32×44×70
OSC 29	12 TO 22	1.5×10^{-6}/YR	2.5 WATTS	+24 VDC	SINE	37×48×90
OSC 18-1	0.5 TO 2	7×10^{-9}/DAY	3.0 WATTS	+12 VDC OR +24 VDC	SINE	(A) 75×75×93 (B) 57×95×57
OSC 18-2	1	3×10^{-9}/DAY	3.0 WATTS	+12 VDC OR +24 VDC	SINE	75×75×93
OSC 18-5	1 TO 5	7×10^{-9}/DAY	3.4 WATTS	+12 VDC OR +24 VDC	SINE	75×75×93
OSC 18-6	1 OR 3	1×10^{-3}/WEEK	3.0 WATTS	+24 VDC	SINE	75×75×93
OSC 18-7	5 TO 30	3.5×10^{-6}/YR	3.0 WATTS	+24 VDC	SINE	75×75×93
TEMPERATURE STABILITIES RANGE FROM 2×10^{-8}/°C TO 1×10^{-10}/°C						

OVENIZED CRYSTAL OSCILLATORS

MODEL	FREQUENCY MHz	AGING	POWER @+25°C	SUPPLY VOLTAGE		OUTPUT	MAX. SIZE MM
				OSC	OVEN		
OSC 11-3	1	2×10^{-8}/DAY	3.5 WATTS	+12 VDC OR +24 VDC	115 VAC	SINE	38 SQ×84
OSC 11-5	1	2×10^{-8}/DAY	1.9 WATTS	+12 VDC OR +24 VDC	+12 VDC OR +24 VDC	SINE	57 SQ×93
OSC 11-7A	1 THRU 20	6×10^{-8}/DAY	4 WATTS	+12 VDC OR +24 VDC	115 VAC	SINE	38 SQ×84
OSC 11-7B	3 THRU 8	7×10^{-9}/DAY	4 WATTS	+12 VDC OR +24 VDC	115 VAC	SINE	38 SQ×84
OSC 29-1	10 TO 25	2×10^{-7}/WEEK	2.2 WATTS	22.5 VDC	+28 VDC	SINE	37×48×83
OSC 29-2	2 TO 10	5×10^{-8}/WEEK	2.7 WATTS	22.5 VDC	+28 VDC	SINE	37×48×83
OSC 32-1	2 TO 10	1×10^{-6}/YR	45 MA	+12 VDC	+24 VDC	SQUARE	51 SQ×70
OSC 44-1	2 TO 40	1×10^{-6}/YR	1.6 WATTS	+9, +12 OR +15 VDC	+15, +20, +24, +28 VDC	TTL	CHOICE OF 3 COMPACT PACKAGES
OSC 44-2	2 TO 40	1×10^{-6}/YR	1.6 WATTS	+12 VDC OR +15 VDC	+15, +20, +24, +28 VDC	SINE	
OSC 44-3	2 TO 40	1×10^{-6}/YR	1.1 WATTS	+9, +12, OR +15 VDC	+15, +20, +24, +28 VDC	TTL	CHOICE OF OCTAL PLUG OR SOLDER PIN MOUNTING 37×48×73
OSC 44-4	2 TO 40	1×10^{-6}/YR	1.1 WATTS	+12 VDC OR +15 VDC	+15, +20, +24, +28 VDC	SINE	
TEMPERATURE STABILITIES RANGE FROM 2×10^{-8}/°C TO 1×10^{-9}/°C							

PCB MOUNT CRYSTAL OSCILLATORS

MODEL SERIES	FREQUENCY MHz	AMBIENT RANGE	AMBIENT STABILITY	SUPPLY VOLTAGE	OUTPUT	SIZE—MM
OSC 51	1 to 60	0°C to +60°C	±10 PPM	+12 VDC	OPTIONAL	38.10 SQ×12.70
OSC 52	10 to 150	0°c to +60°C	±10 PPM	+12 VDC	SINE	38.10 SQ×25.40
OSC 69-2	5 to 20	−30°C to +85°C	±50 PPM	+5.0 VDC	TTL	25.40×38.10×12.70
OSC 69-3	6 to 22	−30°C to +85°C	±35 PPM	+5.0 VDC	TTL	25.40×38.10×12.70

TCXO'S

MODEL SERIES	FREQUENCY MHz	AMBIENT RANGE	AMBIENT STABILITY	AGING RATE	TRIM RANGE	MAX. SIZE (LWH) MM
OSC 20-1	10 TO 15	−30°C TO +75°C	±5 PPM	3×10^{-7}/MO	50 PPM MIN	26×15×54
OSC 20-2	10 TO 15	0°C TO +50°C	±2 PPM	3×10^{-7}/MO	50 PPM MIN	26×15×54
OSC 27-5-1	2 TO 12	0°C TO +55°C	$\pm1\times10^{-6}$	1×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	51×51×15
OSC 27-5-2	2 TO 12	0°C TO +55°C	$\pm5\times10^{-7}$	1×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	51×51×15
OSC 27-5-3	2 TO 5	0°C TO +55°C	$\pm3\times10^{-7}$	5×10^{-7}/YR	$\pm5\times10^{-6}$ MIN	51×51×15
OSC 34-2	10 TO 20	0°C TO +50°C	$\pm1\times10^{-6}$	0.75×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	45 SQ×15
OSC 35-1-1	2.5 TO 12	−5°C TO +60°C	$\pm1\times10^{-6}$	1×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	51 SQ×13
OSC 35-1-2	2.5 TO 12	−5°C TO +60°C	$\pm5\times10^{-7}$	1×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	51 SQ×13
OSC 35-1-3	2.5 TO 6	0°C TO +55°C	$\pm3\times10^{-7}$	5×10^{-7}/YR	$\pm5\times10^{-6}$ MIN	51 SQ×13
OSC 37-1-1	1 TO 5	0°C TO +55°C	$\pm2\times10^{-6}$ REF. +25°C	1×10^{-6}/YR	$\pm5\times10^{-6}$	44 SQ×19
OSC 37-2-1	5.01 TO 10	0°C TO +55°C	$\pm2\times10^{-6}$ REF. +25°C	2.5×10^{-6}/YR	$\pm8\times10^{-6}$	44 SQ×19
OSC 37-3-1	1 TO 5	−5°C TO +60°C	$\pm1\times10^{-6}$ REF. +25°C	1×10^{-6}/YR	$\pm4\times10^{-6}$	44 SQ×19
OSC 37-1-2	1 TO 5	−10°C TO +65°C	$\pm1.5\times10^{-6}$ REF. +25°C	1×10^{-6}/YR	$\pm5\times10^{-6}$	44 SQ×19
OSC 37-2-2	5.01 TO 10	−10°C TO +65°C	$\pm1.5\times10^{-6}$ REF. +25°C	2.5×10^{-6}/YR	$\pm8\times10^{-6}$	44 SQ×19
OSC 39-1	2.5 TO 12	0°C TO +60°C	$\pm1\times10^{-6}$	1×10^{-6}/YR	$\pm5\times10^{-6}$ MIN	48×37×17
OSC 40-1	4KHz TO 1MHz	0°C TO +55°C	$\pm8\times10^{-6}$	1×10^{-6}/YR	10 PPM MIN	57×51×21
OSC 61-1	7 TO 15	−10°C TO +60°C	±9 PPM	±1 PPM/YR	$\pm5\times10^{-6}$ MIN	36×27×12
OSC 67-1-1	2 TO 8	0°C TO +55°C	$\pm2\times10^{-6}$	1×10^{-6}/YR	$\pm6\times10^{-6}$ MIN	51×41×17
OSC 67-1-2	2 TO 8	0°C TO +55°C	$\pm1\times10^{-6}$	1×10^{-6}/YR	$\pm6\times10^{-6}$ MIN	51×41×17

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TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

KIDDE

Add Dept. EM to address to tell them you saw it in eem

DIP Hybrid Circuit Crystal Oscillators

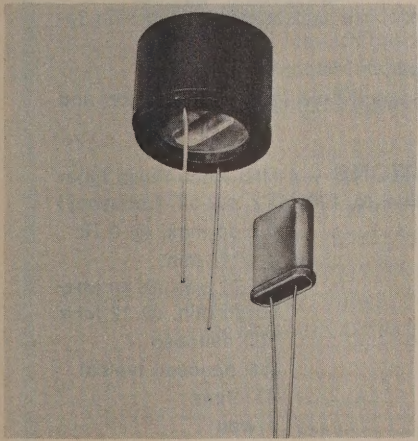
Low-cost Models DT1-121 & DT1-221 designed for digital clock applications

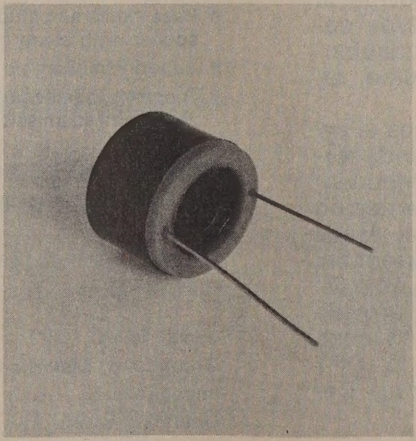
- **Frequency Range:** 20KHz to 25MHz
- **Overall Stability:** ±0.10%—Model DT1-121
±0.005%—Model DT1-221
- **Temperature Range:** 0°C to +70°C
- **Output Waveform:** Squarewave 50/50±20% to drive 10 TTL loads. 0.4V max. "0" and 2.4V min. "1" level.
- **Input Power:** Voltage +5±5%. Current 30 to 120MA depending on frequency.
- **Package:** 14 pin DIP, glass-filled nylon. Fits into standard 14-pin socket.
- **Size: (WLH):** Approx. 0.50"×0.80"×0.37".

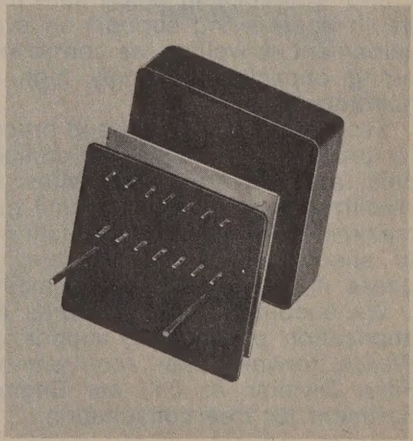
ovenaire
DTI-121
10.000 MHz

Contact factory for details on other DIP Hybrid Oscillator Models.

ovens







Miniature Crystal & Component Ovens for:

- HC-18/U, HC-25/U, HC-42/U, HC-43/U Crystals.
- TO5 & TO8 Crystal, Transistor or IC.
- 14 or 16 pin DIP IC.

State-of-the-Art PTC Proportional Control.

Low Power Consumption

Space-Saving PCB Mount

Wide range of Voltages and Temperatures

Adjustable Temperature Models Available

Single and Multiple Crystal Models.

OVENAIRE ALSO OFFERS A COMPLETE RANGE OF OVENS FOR COMMERCIAL AND MILITARY APPLICATIONS.

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KIDDE

CUSTOM FILTERS

CRYSTAL, L.C. AND ACTIVE

opt INDUSTRIES INC.

- Low Pass
- High Pass
- Band Reject
- Band Pass
- Linear Phase
- Constant Group Delay
- Constant Time Delay
- MIL-F-18327

OPT is a major supplier of active and passive custom designed filters. Our active filter capability employs the classical solutions that are augmented by unique circuit approaches. Our passive filter capability include L-C and Crystal versions. Frequencies range from low audio to 400 MHz.

OPT is at the forefront of filter engineering as a result of company sponsored research and development in addition to the technology gained through the acquisition of Burnell Company, Nytronics Filter Division; Omnitec Corporation, Filter Division; Ortho Filter Company; and Bulova Watch Company, Crystal Filter Division. Broad application experience, supported by a library of computer synthesis, analysis and optimization programs, assist in supplying the best solution to specific requirements.

OPT is unique in being able to provide in depth engineering support on prototype development as well as the controlled manufacturing capacity to supply high volume requirements.

Production equipment and processes allow for production of laminated components, toroids, and pot core assemblies. Component stabilization procedures permit guaranteeing maximum stability with operating life. Areas of specialization include delay correction, phase matching and time domain synthesis.

We encourage your inquiries and provide application engineering support at no cost. Please forward your requirements to OPT Filter Division or call our Engineering Department for free consultation.

TYPICAL EXAMPLE CUSTOM L.C. FILTER

ACCU-PULSE SERIES

P/N
opt
INDUSTRIES INC
PHILLIPSBURG, N.J.

FEATURES

- Constant time delay throughout pass band, into stop band
- Excellent step frequency discrimination characteristics
- Flat group delay
- Pass band amplitude response approximates Gaussian response with steep stop band roll-off
- Superior monotonic amplitude response
- Precisely balanced pass band pole frequency location and zeros of transmission

TYPICAL SPECIFICATIONS—4 MHz Accu-Pulse Filter (Accu-Pulse Filters available to 100 MHz cut-off frequency)

Insertion Loss	0.2 db max. @ 0 Hz
Cut-off Frequency (3 db)	4 MHz min.
Attenuation	35 db min. @ 10 MHz 60 db min. @ 12 MHz
Group Delay	100 nanosec
Group Delay Distortion	±6 nanosec typical
Impedance	75 ohms
Operating Level	1 watt
D.C. Voltage	50 vdc max.

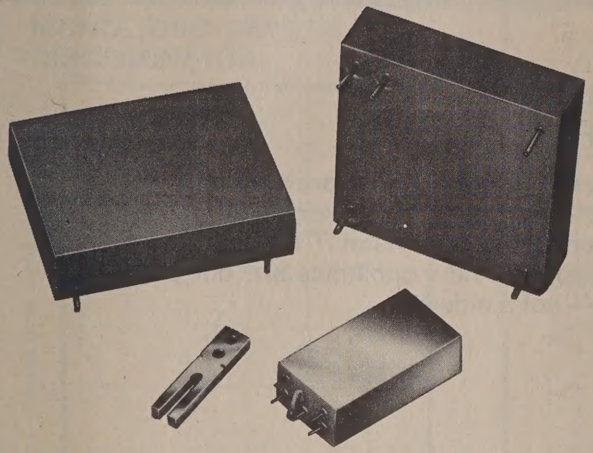
OTHER PRODUCTS

OPT Industries also manufactures custom power supplies and transformers. See our product data on these products in Section 4000 page 3290.

opt INDUSTRIES INC.

Dept. EM, 300 Red School La., Phillipsburg, NJ 08865, (201) 454-2600
TWX 510-235-2920

Call or Write For Our Facilities and Capabilities Brochure



Tuning Fork Oscillators

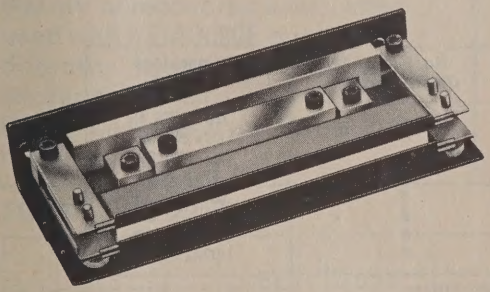
Extremely **rugged** and **reliable** hermetically-sealed frequency sources using 10 KHz to 20 KHz separately evacuated 20,000 Q Tuning Fork Resonators. C/MOS dividers used for output frequencies below 10 KHz.

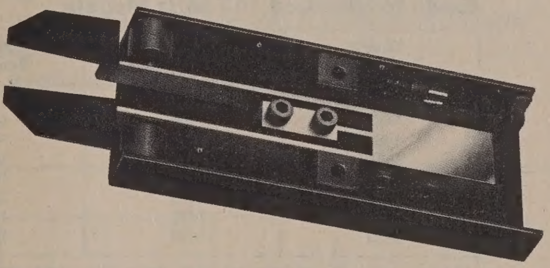
Absolute frequency accuracies from ±.05% to ±.001% over temperature ranges up to from −55°C to +105°C

Sine Wave Outputs: low distortion, constant voltage, from 60 to 10,000 Hz, DC inputs from +15V to +30V.

Logic Outputs: 1.0 to 20,000 Hz, DC inputs +5V & up

MIL quality components, low current drain designs, full MIL shock & vibration & environmental capability





Tuning Fork Light Choppers

Frequencies from 40 to 1000 Hz . . for modulating or chopping light or energy beams. May often be used to replace motor driven choppers . . offering weight and power savings plus eliminating need for lubrication.

Particular design & construction technology provides exceptional fork balance and high resistance to shock and vibration as required for most MIL applications.

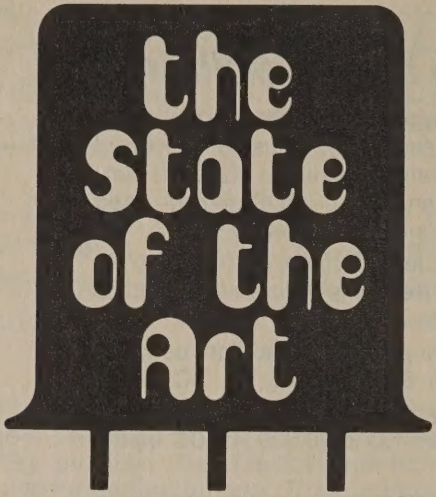
Tine ends may be fitted either with shutters, lenses, or mirrors to suit your special requirements. Drive circuits available either for slave or oscillator mode.

Philamon® products are known for their conservative ratings and performance reliability and are extensively used in major MIL programs. Our QC exceeds MIL-I-45208A and subscribes to the "intent" of MIL-Q-9858A.

For complete application information on either standard models or custom engineered units to suit your particular needs . . . phone, write, or twx . . .

Philamon® INCORPORATED

33 DUBON COURT/FARMINGDALE, NEW YORK 11735/PHONE: (516) 249-2700/TWX: 510-224-6512



MONOLITHIC CRYSTAL FILTERS

If you need crystal filters, chances are your best bet is a monolithic — for cost, for size, for performance. If you need monolithics, you need PTI — the oldest and largest supplier. And monolithics are our principal product — not a sideline.

STANDARD MODELS

For low cost, take our 10.7 MHz and 21.4 MHz integrated crystal filters. All models are available off-the-shelf. All feature tandem monolithic construction for minimum size and high stopband performance. Our 10.7's and 21.4's are available in upright, flatpack, p.c. assemblies or sets of monolithic units for assembly on your own board.

Guide to Standard 10.7 MHz Models

13 kHz Bandwidth	15 kHz Bandwidth	30 kHz Bandwidth	No. Poles (Resonators)	Dimensions WxLxH
2194F	2195F	2196F	2	.185x.432x.45
1463	1464	1465	4	.47x.59x.60
1466	1467	1468	4	.63x.89x.23
1469	1470	1471	6	.47x.59x.60
1472	1473	1474	6	.63x1.32x.23
1475	1476	1477	8	.50x.75x.60
1478	1479	1480	8	.63x1.75x.23
1433	1434	1435	8	1.02x2.39x.52

Models 1433 - 35 interchange with commonly used conventional crystal filters.
Standard European configurations are also available.

Guide to Standard 21.4 MHz Models

13kHz Bandwidth	15 kHz Bandwidth	30 kHz Bandwidth	No. Poles (Resonators)	Maximum Dimensions WxLxH (in.)
2249F	2250F	2251F	2	.185x.432x.45
1617	1618	1619	4	.47x.59x.60
1620	1621	1622	4	.63x.89x.23
1623	1624	1625	6	.47x.59x.60
1626	1627	1628	6	.63x 1.32x.23
1629	1630	1631	8	.50x.75x.60
1632	1633	1634	8	.63x 1.75x.23

PTI also offers standard models at many other popular frequencies including 5.26, 6.46, 8.0, 16.9, 20.0, 30.0, 32.0, 75 and 156 MHz.

CUSTOM MODELS

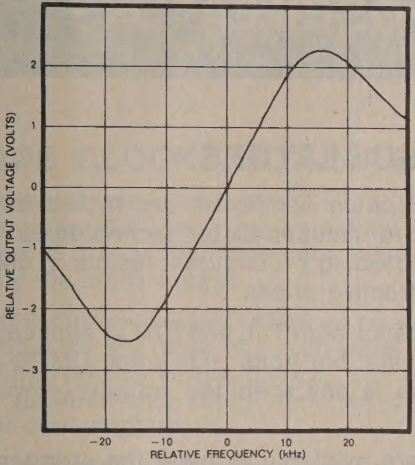
The same cost saving techniques of PTI standard integrated crystal filters can be applied to your high volume custom requirements in I-F filtering, spectrum clean-up, parametric up-conversion and front-end filtering, just to name a few. PTI engineers will work with you from start to finish to meet your specific requirements from 5 to 300 MHz. They'll be glad to discuss performance characteristics, packaging and cost. Prototypes are usually available within 4 to 6 weeks. Specification forms are yours for the asking. Write or call. If you have questions about monolithics, we've got the answers.

Piezo Technology Inc.
2400 Diversified Way
Orlando, Florida 32804
305-425-1574
TWX 810-850-4136

The standard in monolithic crystal filters

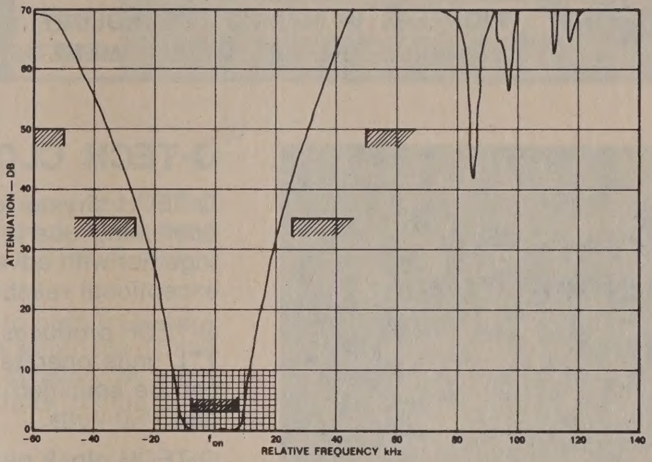
More Off The Shelf From P.T.I.

MONOLITHIC CRYSTAL DISCRIMINATOR



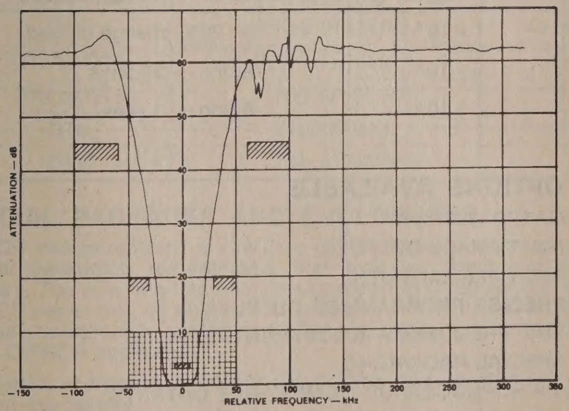
Model 2283F, at 10.7 MHz, offers 1% total harmonic distortion and 800 mV of recovered audio when used with a CA3089E quadrature detector. Model 2378F offers similar performance at 21.4 MHz. Data sheets available on request.

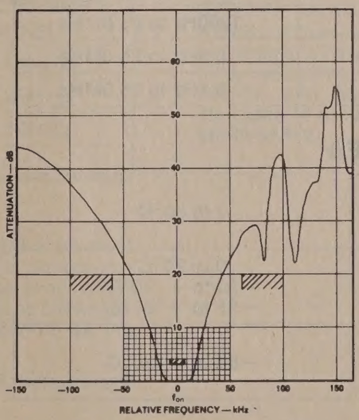
A 45 MHz SPECIAL



Our new 45 MHz Model 4371F is a 4-pole monolithic crystal filter offering maximum performance in a single HC-18 envelope. Designed for first IF use in new generation 900 MHz mobile receivers. Attenuation is 3dB max. over ± 7.5 kHz. Data sheet available on request.

FRONT-END FILTERS





These two-pole and four-pole monolithic crystal filters are designed especially for use as front-end filters for VHF low-band and high-band land mobile radios. All models are suitable for field or factory installation. They are matched to 50 ohms and fitted with phono-jacks (2-pole models) or BNC connectors (4-pole models). Two-pole models offer alternate channel rejection of 20dB min. and ultimate attenuation of 30dB. Four-pole models offer adjacent and alternate channel rejection of 20 and 45 dB (high-band) or 15 and 40 dB (low-band).

Case dimensions: l - 2.39 w - 1.02 h - 1.07

Other case styles available on special order. For OEM applications the monolithic elements can be supplied individually.

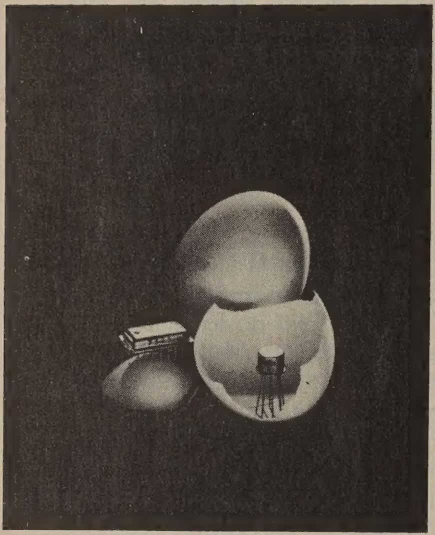
Piezo Technology Inc.
2400 Diversified Way
Orlando, Florida 32804
305-425-1574
TWX 810-850-4136

The standard in monolithic crystal filters

Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

MINIATURE / CRYSTAL CLOCK OSCILLATORS



Q-TECH CLOCK OSCILLATORS

Q-TECH Crystal controlled clock oscillators are hybrid devices combining quartz crystal and semiconductor technologies. This, together with advanced processing procedures, results in units of exceptional reliability at attractive prices.

Q-TECH produces oscillators for both TTL and CMOS applications. TTL units operate at a nominal 5.0 Volts ±.5 Volts. CMOS units can be specified to operate at any specified voltage between 5 and 15.0 Volts.

Q-TECH clock oscillators are available to meet the stringent requirements of a MIL-STD-883A, screens to Level A or Level B.

Q-TECH clock oscillators are available in 3 types: TO-5 (8 lead), TO-8 (8 or 12 lead), and DIP (14 or 16 lead). The TO-5 units covers a limited frequency range, while the TO-8 and DIP both have an extremely wide output frequency range for an extensive variety of applications. The tables below provide full details.

FREQUENCY RANGES

TO-5 (QT1)	100KHz to 30.0MHz
TO-8 (QT2, 3)	1000Hz to 25.0MHz
14 Pin DIP (QT4 & QT6)	0.1Hz to 25.0MHz
16 Pin DIP (QT5)	0.1Hz to 25.0MHz

TYPICAL TOLERANCES

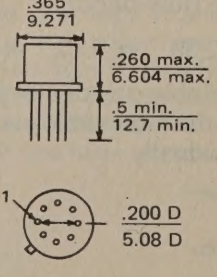
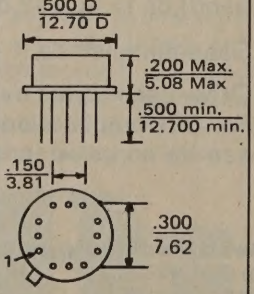
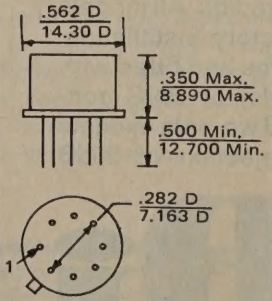
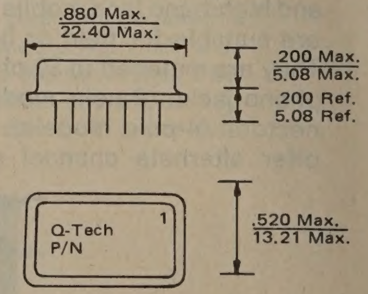
±.01% ±.005% ±.0005%	0 to 50°C
±.005% ±.0025% ±.005%	0 to 20°C −20 to + 70°C −55 to +105°C
±.003% ±.005% ±.01%	−55 to +125°C

STABILITIES AVAILABLE

2×10^{-6}	for 10% change of Vcc
1×10^{-6}	for 20% change of load
5×10^{-6}	Aging — 30 days
1×10^{-5}	Aging — 1 year

OPTIONS AVAILABLE

GATED OUTPUT
MULTIPHASE OUTPUTS
MULTIPLE OUTPUTS
PRECISE PROGRAMMED OUTPUTS
FINE FREQUENCY ADJUSTMENT
SPECIAL PACKAGING
MICROPROCESSOR COMPATIBLE OUTPUTS

	QT1	QT2	QT3	QT4 & QT6
Dimensions are in inches mm	 .365 9.271 .260 max. 6.604 max. .5 min. 12.7 min. 1 .200 D 5.08 D	 .500 D 12.70 D .200 Max. 5.08 Max .500 min. 12.700 min. .150 3.81 1 .300 7.62	 .562 D 14.30 D .350 Max. 8.890 Max. .500 Min. 12.700 Min. .282 D 7.163 D 1	 .880 Max. 22.40 Max. .200 Max. 5.08 Max. .200 Ref. 5.08 Ref. Q-Tech P/N 1 .520 Max. 13.21 Max.

2201 CARMELINA AVENUE • DEPT. EM • LOS ANGELES, CALIFORNIA 90064 • PHONE (213) 820-4921

Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

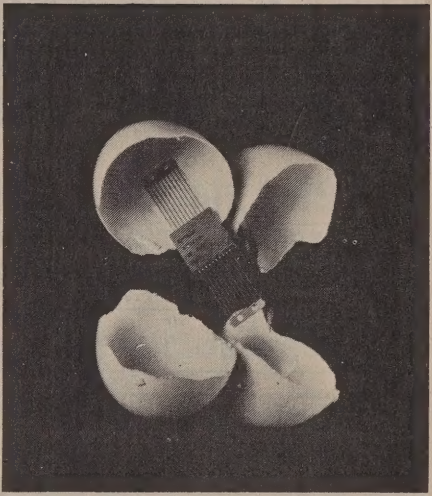
MINIATURE / CRYSTAL
CLOCK
OSCILLATORS

C-MOS CLOCK OSCILLATORS

Frequencies available in the C-MOS line of oscillators are limited presently to 10.0 MHz. This frequency limit is also related to input voltage. It is essential, therefore, when ordering a C-MOS unit to specify the input voltage.

Power requirements of C-MOS units are related to both frequency and input voltage. Most of the power is dissipated within the crystal oscillator portion of the device, and buffering, division, or other logic requirements within the unit contribute little to the total power consumption.

To accommodate low power and/or low voltage requirements for C-MOS application that are frequently encountered, two new series of oscillators are offered. These are the QT8 and the QT9. The larger diameter packages enable Q-TECH to continue to offer the stabilities of AT-cut crystals in relation to frequencies as low as 0.1 Hz and additionally, afford low power consumption and operating voltages (VDD) as low as 3-5V. Frequency ranges that may be obtained from the two packages as shown in the tabulation "FREQUENCY RANGES AVAILABLE."



FREQUENCY RANGES AVAILABLE

Package Size	C-MOS Frequency Range	TTL Frequency Range
QT1	50KHz to 10MHz	400KHz to 30MHz
QT2 or QT3	300Hz to 10MHz	1KHz to 25MHz
QT4 or QT6	.1Hz to 10MHz	.1Hz to 25MHz
QT8	.1Hz to 6MHz	.1Hz to 16MHz
QT9	.1Hz to 3MHz	—

QUALITY CONFORMANCE AND RELIABILITY ASSURANCE

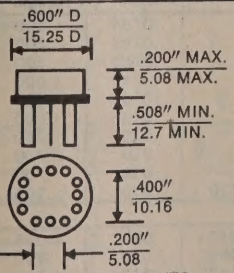
Q-Tech's facilities are qualified to Mil-I-45208 and are well equipped to perform the screening, quality conformance and reliability assurance requirements of Mil-M-38510A and Mil-Std-883. Q-Tech is fully equipped to provide hybrid oscillators under **Mil-Q-55310.**

SPECIAL PACKAGES AND ENCLOSURES

Q-TECH has introduced a new line of Flat-Pack enclosures, designed to meet special packaging requirements that may be demanded by the aerospace industry. The new line has been designated the QT20 Series, and as in all other Q-TECH series may be obtained to interface with TTL or C-MOS. These packages are fully hermetically sealed and offer the same high reliability potential as the other Q-TECH enclosures.

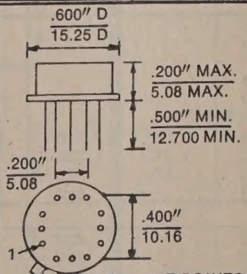
For details of frequency, output capabilities, and specific Flat Pack dimensions, consult the factory.

QT6



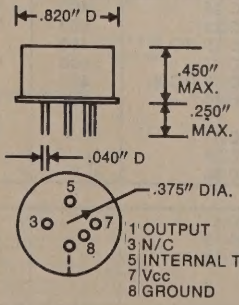
3 & 4 INTERNAL TIE POINTS
5 OUTPUT
6 GROUND
12 Vcc

QT8



3 & 10 INTERNAL TIE POINTS
5 OUTPUT
6 GROUND
12 Vcc

QT9



1 OUTPUT
3 N/C
5 INTERNAL TP
7 Vcc
8 GROUND

QT20 SERIES

See Picture Above

.50″ Leads
Sizes from ⅜″ x ½″ to square available.
Available to meet the same frequency ranges and performance levels of OTI-6 (See table)

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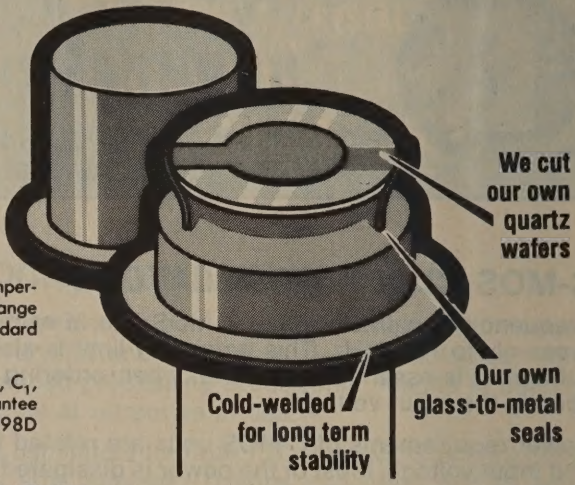
REEVES HOFFMAN

Division, Dynamics Corporation of America
400 W. North St., Carlisle, PA 17013 U.S.A.
Phone 717-243-5929 TWX: 510-650-3510


We cut our own quartz wafers
Cold-welded for long term stability
Our own glass-to-metal seals

HIGH-RELIABILITY CRYSTALS

All Reeves-Hoffman crystal units pass rigorous final inspection, including a temperature test that measures frequency and deviations in frequency over the range −55° to +125° C. All test equipment is calibrated against our in-house standard that continuously monitors Bureau of Standards' VLF transmissions.

FILTER CRYSTALS. For filter applications, crystals are available with special C_0, C_1, L_1; with temperature coefficients to your specifications; pre-aged to guarantee stability; in special designs for high shock and vibration. All units meet Mil-3098D requirements.

CRYSTAL ELEMENTS

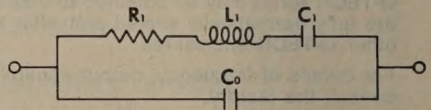
HOLDERS	FREQUENCY RANGE kHz	TYPICAL ELECTRICAL EQUIVALENT PARAMETERS Frequency kHz	R_1 ohms	L_1 H	C_1 pF	C_0 pF	Q
X–Y ELEMENT							
E-1	3.5–7.5	10	20 K	33.8 K	.0075	6.14	106 K
E-2	7.5–50	30	30 K	5.6 K	.0045	2.31	39 K
RH-13	8–50	50	30 K	2.9 K	.0033	1.85	33 K
J ELEMENT							
E-1	1.4–1.8	1	150 K	224 K	0.113	25.5	9 K
E-2	1.8–15	2	75 K	64 K	0.0996	19.3	11 K
RH-13	1.8–15	4	36 K	37 K	0.053	10	26 K
	NOTE: 1–1.8 uses	8	30 K	14 K	0.027	7.6	21.5 K
	2½″ RH-13	12	15 K	7 K	0.0248	6.8	35.5 K
N ELEMENT							
E-2	16–150	16	15 K	4,389	0.0201	12.8	31 K
RH-13	16–150	20	9 K	3,480	0.0182	11.37	48 K
RH-6	85–150	50	10 K	1,021	0.010	9.05	32 K
RH-36	90–150	90	11 K	483	0.0067	5.43	26 K
A-2	16–150	150	12 K	393	0.0028	4.59	31.5 K
A-3	50–150						
H ELEMENT							
RH-13	20–150	26.4	5 K	1,772	0.021	7.07	59 K
RH-6	90–150	38.4	4 K	1,051	0.016	6.15	61 K
E-2	20–150	66.4	3.5 K	510	0.011	4.95	63 K
E ELEMENT							
E-1	60–300	100	1.8 K	67	0.037	5.78	24 K
E-2	85–300	200	2 K	48	0.014	3.33	30 K
RH-13	85–300	300	2.5 K	39.2	0.0074	2.2	29 K
RH-6	190–300						
RH-36	190–300						
A-2	85–300						
A-3	140–300						
D ELEMENT							
RH-36	200–450	200	950	30	0.0207	9.25	41 K
RH-512	300–450	300	1.7 K	24.5	0.0114	4.98	27 K
RH-6	200–450	400	3 K	27	0.0055	2.72	23 K
E-3	250–450	450	3.5 K	31	0.004	1.60	24 K

HOLDERS	FREQUENCY RANGE kHz	TYPICAL ELECTRICAL EQUIVALENT PARAMETERS Frequency kHz	R_1 ohms	L_1 H	C_1 pF	C_0 pF	Q
C ELEMENT							
RH-36	370–600	250	500	9.6	0.004	15.2	44 K
RH-6	370–600	400	600	11.29	0.0143	5.82	46 K
RH-512	455–600	500	1 K	10.88	0.0097	3.96	39 K
E-3	455–600	600	1 K	10.07	0.0072	3.12	39 K
S ELEMENT							
RH-13	200–300	300	700	12.41	0.021	9.39	34 K
RH-36	310–800	400	700	12.5	0.012	5.4	45 K
RH-6	300–800	500	950	12.46	0.008	3.98	41 K
RH-512 & HC-18	450–1000	655	1,530	12.33	0.0047	2.69	33.5 K
E-3	330–1000						
A-5	900–1100						

HOLDERS	FREQUENCY RANGE MHz	TYPICAL ELECTRICAL EQUIVALENT PARAMETERS Frequency kHz	R_1 ohms	L_1 H	C_1 pF	C_0 pF	Q
A ELEMENT							
RH-36	1–20	500	1,500	20	.0050	2.35	44 K
RH-6	1–20	800	350	4.8	.0080	2.90	70 K
E-3	1–20	1,000	300	3.3	.0076	2.55	70 K
C	1–20	1,400	250	1.85	.0070	2.95	65 K
RH-512	5–200	3,000	65	.40	.007	2.41	128 K
RH-18	10–200	6,500	15	.02	.030	5.89	73 K
A-5	10–200	11,500	12	.01	.018	4.50	66 K
		11,514*	22	.1063	.0018	6.84	350 K
		20,769*	8	.0141	.0042	10.50	230 K
		40,374*	35	.0073	.0021	6.28	53 K

* Overtone—3

SIMPLIFIED
ELECTRICAL EQUIVALENT
OF RESONATING
QUARTZ CRYSTAL



CRYSTAL HOLDERS

(All dimensions in inches. Coldweld—max. untrimmed)

COLDWELD HOLDER	Mil Type	Diam.	Height	Length	Width	Thick.	Nominal pin dimensions Diam.	Length	Spacing
A-2	HC-35	.400	1.550				.0185	.500	.200
A-3	HC-35	.400	1.000				.0185	.500	.200
A-5	HC-35 (TO-5)	.400	.260				.0185	.500	.200
B-2	HC-37	.600	1.550				.0185	1.000	.282
B-5	HC-37 (TO-8)	.600	.260				.0185	1.000	.282
C	HC-40	.830	.350				.0185	1.000	.375
E-1			.360	2.100	.730		.020	.750	1.000
E-2	HC-41		.360	1.595	.730		.020	.750	1.000
E-3	HC-39		.360	.770	.770		.020	.750	.375
RH-36	HC-36		.810		.820	.420	.050	.206	.486
SOLDERSEAL HOLDER									
RH-6	HC-6		.775		.757	.352	.050	.238	.486
RH-13	HC-13		1.526		.757	.352	.050	.238	.486
RH-18	HC-18		.530		.435	.183	.0185	1.500	.192
RH-512			.650		.564	.234	.030	1.500	.275
RH-527			.777		.757	.245	.030	2.000	.486

Alternate pin configurations and locations are available.

REEVES HOFFMAN

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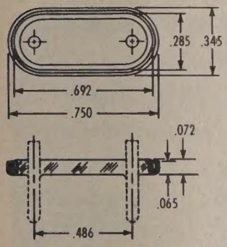
400 W. North St., Carlisle, PA 17013 U.S.A.
Phone 717-243-5929 TWX: 510-650-3510

CRYSTAL COMPONENTS

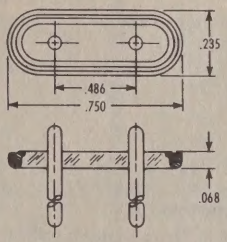
Reeves-Hoffman manufactures a complete line of crystal components with strong, reliable glass-to-metal seals. Cable, call or write for a quotation on your requirements.

SOLDERSEAL

Standard—RH-6

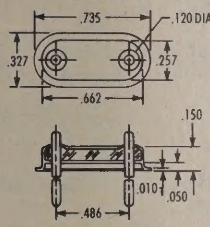

.285
.345
.692
.750
.072
.065
.486

Slimline—RH-6

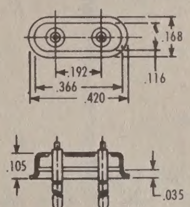

.235
.486
.750
.068

COLDWELD

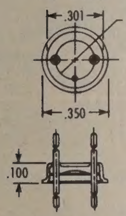
RH-36


.735
.120 DIA.
.327
.257
.662
.150
.010
.050
.486

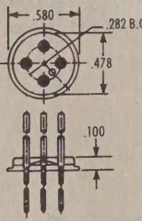
RH-18


.168
.192
.366
.420
.116
.105
.035

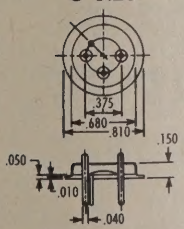
A Size


.301
.200 B.C.
.350
.100

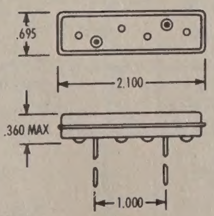
B Size


.580
.282 B.C.
.478
.100

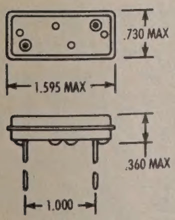
C Size


.375
.680
.810
.150
.050
.010
.040

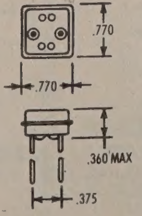
E-1


.695
2.100
.360 MAX
1.000

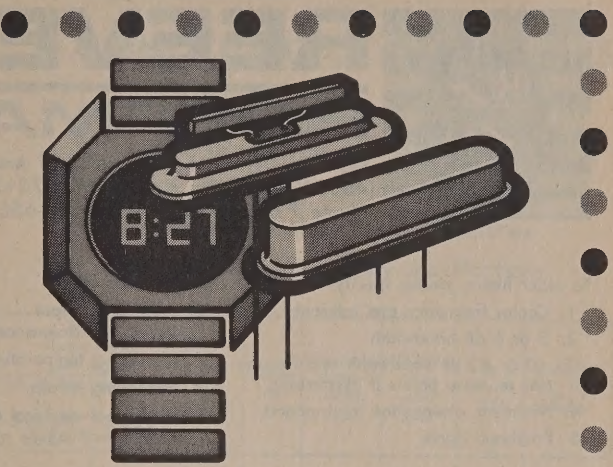
E-2


.730 MAX
1.595 MAX
.360 MAX
1.000

E-3

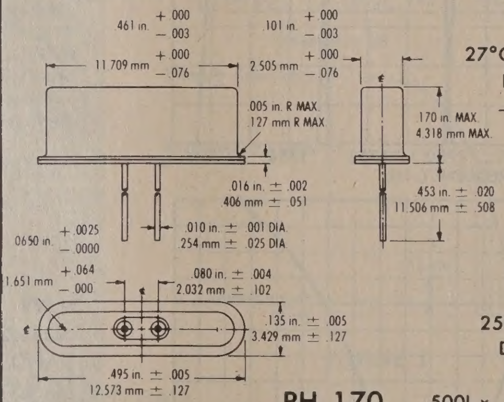

.770
.770
.360 MAX
.375

NOTE: Specific lead dimensions on request.



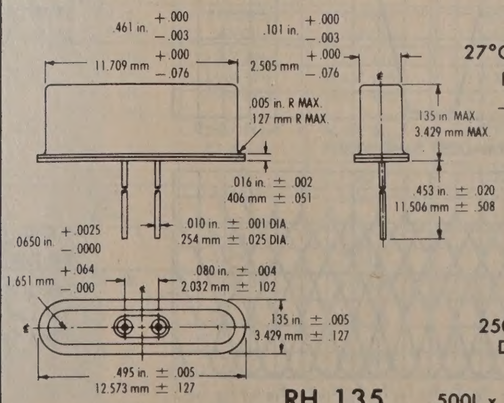
WATCH CRYSTAL PIONEERS

- ☆ Millions produced every year
- ☆ Reliable, cold-welded enclosures
- ☆ Many in chronometer quality watches
- ☆ Each individually tested


.461 in. + .000 − .003
11.709 mm + .000 − .076
.101 in. + .000 − .003
2.505 mm + .000 − .076
.005 in. R MAX
.127 mm R MAX
.170 in. MAX
4.318 mm MAX
.016 in. ± .002
.406 mm ± .051
.453 in. ± .020
11.506 mm ± .508
.0650 in. + .0025 − .0000
.010 in. ± .001 DIA
.254 mm ± .025 DIA
1.651 mm + .064 − .000
.080 in. ± .004
2.032 mm ± .102
.135 in. ± .005
3.429 mm ± .127
.495 in. ± .005
12.573 mm ± .127

RH 170

32.768 kHz	Frequency
27°C ± 5°C Typical	Turning Point
From ±.0015%	Adjustment Tolerance
−10°C + 60°C	Temperature Range
.04 ppm/°C	Coefficient
35K	Resistance, Max.
20K	Resistance, Typical
.0043 pF	Motional Capacitance
2 pF	Shunt Capacitance
35,000	Q Minimum
50,000	Q Typical
2500 G's @ .2ms Delta F ≤ 5PPM	Shock
5PPM Max.	Aging 1st Year
.500L x .135W x .170 H	Holder Dimensions


.461 in. + .000 − .003
11.709 mm + .000 − .076
.101 in. + .000 − .003
2.505 mm + .000 − .076
.005 in. R MAX.
.127 mm R MAX.
.135 in. MAX.
3.429 mm MAX
.016 in. ± .002
.406 mm ± .051
.453 in. ± .020
11.506 mm ± .508
.0650 in. + .0025 − .0000
.010 in. ± .001 DIA
.254 mm ± .025 DIA
1.651 mm + .064 − .000
.080 in. ± .004
2.032 mm ± .102
.135 in. ± .005
3.429 mm ± .127
.495 in. ± .005
12.573 mm ± .127

RH 135

32.768 kHz	Frequency
27°C ± 5°C Typical	Turning Point
From ±.0015%	Adjustment Tolerance
−10°C + 60°C	Temperature Range
.04 PPM/°C	Coefficient
35K	Resistance, Max.
20K	Resistance, Typical
.0066 pF	Motional Capacitance
2 pF	Shunt Capacitance
35,000	Q Minimum
50,000	Q Typical
2500 G's @ .2ms Delta F ≤ 5PPM	Shock
5PPM Max.	Aging 1st Year
.500L x .135W x .135H	Holder Dimensions

REEVES HOFFMAN

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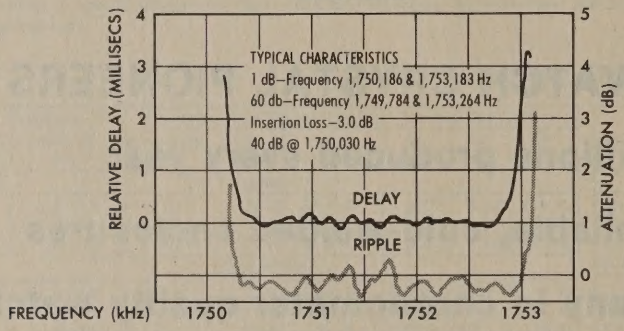
CRYSTAL FILTERS

- ★ Computer-aided design saves development time and assures optimum performance
- ★ All crystals designed and built in Reeves-Hoffman's own plant, pre-aged and temperature tested for improved stability
- ★ Packaged to meet your most exacting requirements
- ★ Modern equipment automatically measures critical parameters over the specified temperature range to assure top performance
- ★ Complete environmental testing facilities

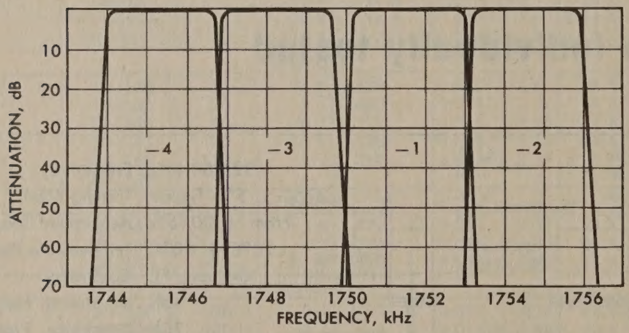
To order filters, please specify:

1. Center frequency and tolerance.
2. 3 or 6 dB bandwidth.
3. 40 or 60 dB bandwidth and frequencies at these points if asymmetric.
4. Minimum attenuation in stopband.
5. Passband ripple.
6. Insertion loss.
7. Input and output impedance (tolerance).
8. Operating temperature range.
9. Packaging details.
10. Additional electrical and environment specifications as required.



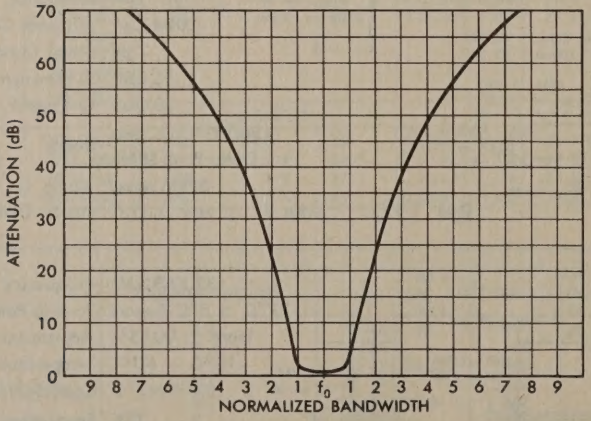
EQUALIZED DELAY FILTERS

FREQUENCY RANGE: 100 kHz–2 MHz
TYPICAL DELAY DISTORTION <200 μs
TYPICAL SHAPE FACTORS <1.2:1
IMPEDANCE LEVELS: To specifications
MEET MIL. STD. 188



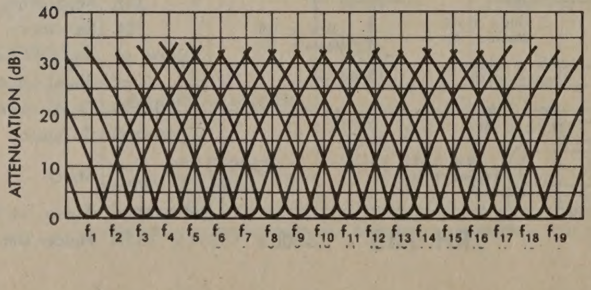
SINGLE SIDEBAND FILTERS

FREQUENCY RANGE: 10 kHz–30 MHz
SYMMETRICAL—Use for either sideband
REGULAR—Specify upper or lower
SHAPE FACTOR: From 1.1:1
TYPICAL CARRIER ATTENUATION >30 dB
Illustrated: Model F11234—4-channel SSB multiplexing.



VERY NARROW BANDWIDTH FILTERS

DESIGNS: Bessel, Butterworth, Gaussian, Chebyshev
FREQUENCY RANGE: 10 kHz–30 MHz
TYPICAL SHAPE FACTOR <6:1
IMPEDANCE LEVEL: To specifications



COMB FILTERS

FREQUENCY RANGE: 10 kHz–30 MHz
TYPICAL BANDWIDTH <0.2%
TYPICAL SHAPE FACTOR <6:1

REEVES HOFFMAN

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MONOLITHIC CRYSTAL FILTERS

- ★ Computer-aided design
- ★ Coupled, two-pole or multi-pole configurations
- ★ Custom packaging to your specifications
- ★ Complete environmental testing facilities
- ★ Conformance to all military specifications

CRYSTAL OSCILLATORS

- ★ Employing our own crystals, pre-aged for reliability
- ★ Complete environmental testing facilities
- ★ Outputs compatible with any logic family
- ★ Packaging to your specifications

HIGH-STABILITY OSCILLATORS

FREQUENCY RANGE:
100 kHz–60 MHz
TYPICAL STABILITY:
1 part in 10^8 per day to 2 parts in 10^{11} per day
OPERATING TEMPERATURE RANGE:
−55° C to +80° C
OUTPUTS:
1 volt RMS sine or to specifications
OUTPUT:
harmonics, noise & spurious—30 dB–100 dB

TEMPERATURE-COMPENSATED OSCILLATORS

FREQUENCY RANGE:
1 cps–200 MHz
TEMPERATURE RANGE:
Typical 0° C to 50° C
FREQUENCY STABILITY:
Typical, 1 part in 10^6
OUTPUT:
Sine or square wave
PACKAGING:
To specifications

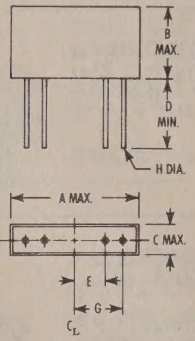
VOLTAGE-CONTROLLED OSCILLATORS

FREQUENCY RANGE:
1 kHz–200 MHz
FREQUENCY DEVIATION:
0.01%–0.5%
TYPICAL LINEARITY:
1%–5% of peak deviation
MODULATION RATE:
0 to 200 kHz

f_0 Range (MHz)	Holder	No. Resonators	Overtone (Mode)	Typical Shape Factor (See Fig 1): 20 dB BW to 3 dB BW Ratio	Typical Shape Factor (See Fig 1): 60 dB BW to 3 dB BW Ratio	Insertion Loss	Ripple (dB)	Spurious Attenuation (dB)	Ultimate Attenuation (dB)	Z in or Z out (KΩ)	3 dB BW /f_0 (%) Ratio
5 to 12 9 to 30 9 to 30	HC-6 HC-18 T05	2	Fundamental	3		1.0 to 4.0 dB	0.0 to 2.0	15	45	0.5 to 10.0	0.01 to 0.25
*5 to 12 *9 to 30 5 to 12 9 to 30	F 14765-2 F 14766-2 F 14765-1 F 14766-1	4		1.5	4.7			50	65		
5 to 12 9 to 30	F 14765-2 F 14766-2	6		1.25	2.6			60	85		
30 to 95	HC-18 T05	2	3rd Over tone	3		1.0 to 6.0 dB		10	40		0.005 to 0.05
	F 14766-1 F 14766-2*	4		1.5	4.7			50	65		
	F 14766-2	6		1.25	2.6			60	75		

* With transformer in holder.

HOLDERS All dimensions in inches.



CASE/SIZE	A	B	C	D	E ±.015	G ±.015	H ±.033
F14765-2	2.588	.995	.416	.500	.875	1.125	.030
F14765-1	1.713	.995	.416	.500	.438	.672	.030
F14766-2	1.845	.745	.250	.250	.656	.765	.017
F14766-1	1.175	.745	.250	.250	.344	.430	.017

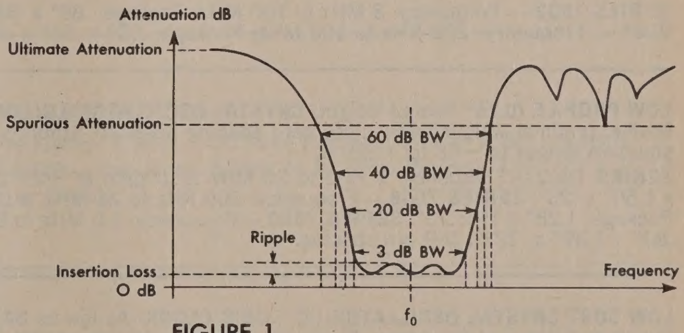


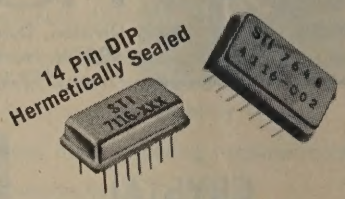
FIGURE 1

ACTUAL MEASURED DATA

BANDWIDTH	f_0 = 10.7 MHz: HC-6 2-POLE	f_0 = 10.7 MHz: F14765-1 4-POLE	f_0 = 10.7 MHz: F14765-2 6-POLE	f_0 = 10.7 MHz: HC-18 2-POLE	f_0 = 10.7 MHz: F14766-1 4-POLE	f_0 = 10.7 MHz: F14766-2 6-POLE
3 dB	13.5 kHz	13.2 kHz	13.8 kHz	15.5 kHz	12.5 kHz	15.4 kHz
6 dB	17.5 kHz	14.4 kHz	14.4 kHz	19.3 kHz	13.9 kHz	16.3 kHz
20 dB	41.1 kHz	20.4 kHz	17.1 kHz	43.1 kHz	20.0 kHz	20.1 kHz
30 dB	72.0 kHz			70.6 kHz		
40 dB		34.7 kHz	22.8 kHz	103.7 kHz	33.9 kHz	27.9 kHz
60 dB		72.4 kHz	30.7 kHz		61.0 kHz	39.3 kHz
BW_6/BW_3	1.30	1.10	1.05	1.25	1.12	1.07
BW_{20}/BW_3	3.05	1.55	1.24	2.79	1.60	1.31
BW_{30}/BW_3	5.34			4.56		
BW_{40}/BW_3		2.63	1.65	6.70	2.72	1.81
BW_{60}/BW_3		5.49	2.23		4.87	2.55
RIPPLE	0.1 dB	0.2 dB	0.7 dB	0.3 dB	0.2 dB	0.3 dB
INSERTION LOSS	0.1 dB	0.3 dB	0.4 dB	0.3 dB	0.7 dB	1.0 dB
SPURIOUS ATTENUATION	11.1 dB	50.5 dB	60 dB	35.0 dB	65.5 dB	70 dB
INPUT & OUTPUT TERMINATION	1200 ohms	1500 ohms	1500 ohms	5100 ohms	6500 ohms	6500 ohms

Spectrum Technology

Crystal Oscillator / IC Logic Clocks
Hybrid Circuit Oscillators



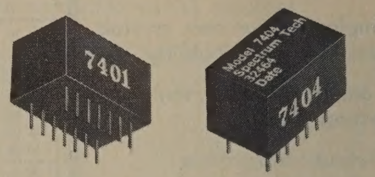
MULTIPLE OUTPUTS AVAILABLE

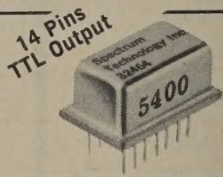
DUAL-IN-LINE LOW PROFILE CRYSTAL OSCILLATOR HYBRID CIRCUIT LOGIC CLOCK: Stability ±.005%, −55 to +105°C, ±.01% to 125°C.

SERIES 7116 — Frequency: 1 KHz to 25 MHz; 5V d-c; TTL; Package: .87″ x .50″ x .20″. **SERIES 4116** — Frequency: 2 Hz to 10 MHz, 5 to 15V d-c; CMOS; Package: .87″ x .50″ x .20″. **Available with MIL-STD-883 Level B Screening and in accordance with specified requirements of MIL-O-55310/8A.**

DUAL-IN-LINE CRYSTAL OSCILLATOR I.C., LOGIC CLOCKS:

SERIES 7401 — Frequency: 3 MHz to 50 MHz; Stability: ±.005% over 4 standard ranges up to −55 to +105°C; TTL output, +5V d-c input; Package: .80″ x .50″ x .375″; Pin 7 Com, 8 out, 14 plus. Also available 2 Com, 11 or 4 out, 5 plus. **SERIES 7404** — Frequency: 200 KHz to 25 MHz; Stability: ±.005%; Package: .80″ x .50″ x .55″. Pin 7 Com, (8 out, .8 to 25 MHz) (2 out, .4 to .8 MHz) (12 out, .2 to .4 MHz) 14 plus. **SERIES 7405** — Frequency: 200 KHz to 25 MHz; Stability: ±.005%; Package: .80″ x .50″ x .55″; Pin 2 Com, 11 or 4 out, 5 plus. **SERIES 4024** — CMOS Output DIP Oscillator; Stability: ±.005%; Package: .82″ x .50″ x .375″; Frequency: 200 Hz to 10 MHz; 14 pin.



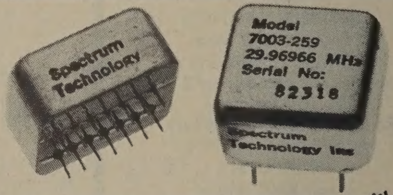


HERMETICALLY SEALED DIP CRYSTAL OSCILLATOR: Designed for applications where stability vs. temperature to ±.005% (50 ppm) is required over entire "Military" temperature range of −55 to +125°C.

SERIES 5400 — Frequency: 3 MHz to 25 MHz; Accuracy: ±.001% at +25°C; Package: .90″ x .56″ x .40″.

HIGH FREQUENCY PC OR DUAL-IN-LINE CRYSTAL OSCILLATOR I.C. LOGIC CLOCKS: Provide clocking signals for use where space is critical or power is limited. Also available with sine wave output for communications applications. PCB or DIP Mounting. Stability: ±.005% over 7 standard ranges including 0 to +70°C and −55 to +125°C. Output TTL; ECL; or sine 0.25V rms, 50 to 1000 ohm load.

SERIES 7003 — Frequency: 3 MHz to 100 MHz; Package: .88″ x .88″ x .45″. **SERIES 7004** — Frequency: 200 KHz to 100 MHz; Package: .88″ x .88″ x .50″.

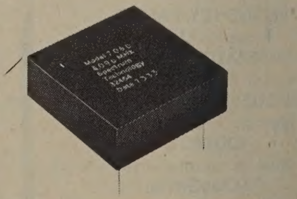


Hermetically Sealed

LOW PROFILE (0.25″ Seated Height) CRYSTAL OSCILLATOR I.C. LOGIC CLOCKS: Low Profile, minimal weight make close card spacing possible. Stability: ±.005% over 5 standard ranges to −55 to +125°C.

SERIES 7042 — Frequency: 1 KHz to 25 MHz ±10 ppm at +25°C; Package: 1.50″ x 1.50″ x .25″. **SERIES 7048** — Frequency: 200 KHz to 25 MHz ±10 ppm at +25°C; Package: 1.28″ x 1″ x .25″. **SERIES 7600** — Frequency: 1.0 MHz to 50 MHz; Package: .80″ x 1.39″ x .223″. DIP pin spacing.

LOW COST CRYSTAL OSCILLATOR I.C. LOGIC CLOCK: As low as $4.00 each depending on quantity and frequency. Eliminate oscillator design, crystal procurement, and test problems. Low power consumption. Supply +5V d-c. Drive TTL or CMOS logic. **SERIES 7060** — Frequency: 200 KHz to 50 MHz; Stability: ±.005%, 0 to +70°C; Output: Logic "0" = +0.4V max. sink 16 mA, Logic "1" = +2.4V min. source .4 mA; Package: 1.50″ x 1.50″ x .50″. **SERIES 4060** — Frequency: 200 Hz to 10 MHz; 5 to 15V d-c; Stability: to ±.005%, 0 to +70°C; Output: CMOS; Package: 1.50″ x 1.50″ x .50″.



MINIATURE DIP OVEN OSCILLATOR: New design oscillator and oven control circuit provide hybrid proportional control ovenized oscillator.

SERIES 8000 — Frequency: 3 MHz to 20 MHz; Stability: to ±1 x 10^{-7}, −40 to +70°C; Input: +28 and +15V d-c, 3.5 W at turn-on; Output: sinewave, 1V p-p, 1000 ohm load.

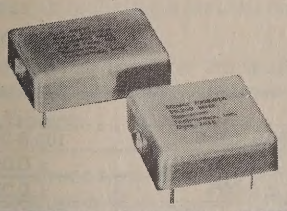
QUALITY CONTROL measures at Spectrum Technology exceed requirements of MIL-I-45208A for inspection systems and MIL-C-45662A for equipment calibration. Workmanship and soldering standards are in accordance with Requirements 5 and 9 of MIL-STD-454B. Oscillators are designed and tested to the requirements of MIL-O-55310. Hybrid oscillators are designed and produced to the requirements of MIL-O-55310 and are available screened in accordance with MIL-STD-883. FOR HIGH RELIABILITY applications, Spectrum Technology uses standard proven, conservative circuit designs and "ER" components. All soldering is in accordance with N.H.B. 5300.4 (3A). Specific sections of MIL-Q-9858A are applicable on an as required basis. Traceability of all components, and assembly and test inspection points is on a unit serialized basis. Processing specifications include special screening on crystal units as well as production screening and testing during manufacturing including high temperature burn-in. Environmental levels proven by continuing tests include 50g sine vibration, $0.2g^2$/Hz random vibration, 4000g acceleration and 1500g shock. 100% production screening tests include these plus thermal shock, temperature cycling, and leak test on an "as specified basis."

Spectrum Technology

Temperature Compensated Crystal Oscillators

For applications requiring low power and zero warm-up time. Designed for mounting on PC cards. Required supply voltage in range of 10 to 20 volts with regulation of 5 to 10%. Output TTL, CMOS, or Sine (1.0V rms, 50 to 1000 ohm load). Frequency adjustment range for 5 to 10 year aging. Stability to ±3 x 10^{-7}, 0 to +55°C; to ±1 x 10^{-6}, −20 to +65°C, −40 to +70°C, and −55 to +85°C. Other stabilities and temperature ranges available.

SERIES 7000 — Frequency: 100 KHz to 20 MHz; Package: 2″ x 2″ x .63″. **SERIES 7001** — Frequency: 10 KHz to 20 MHz; Package: 2″ x 2″ x .75″. **SERIES 7002** — Frequency: 1.0 MHz to 20 MHz; Package: 2″ x 2″ x .50″.

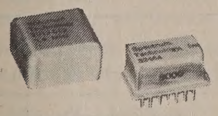


SMALLER SIZE TCXO's:

SERIES 7006 — Frequency: 1 MHz to 20 MHz; Package: 1.50″ x 1.50″ x .50″; Output: TTL, CMOS, or Sine (1.0V rms, 50 to 1000 ohm load). **SERIES 7076** — Frequency: 2.7 MHz to 20 MHz; Package: 1.25″ x 1.75″ x .50″; Output: TTL or CMOS.

CMOS TCXO's:

SERIES 4000 — Frequency: 200 Hz to 7 MHz; Package: 2″ x 2″ x .50″; Low Power: 5mA typical, 10 to 15V d-c Supply; Output: Logic "0", $0.1V_{DD}$ max.; Logic "1", $0.9V_{DD}$ min.



HYBRID AND SUBMINIATURE TCXO's:

SERIES 7013 — Frequency: 6 MHz to 20 MHz; Package: 1″ x 1″ x .50″; Output: TTL or CMOS. **SERIES 9000** — Frequency: 6 MHz to 20 MHz; Package: DIP .56″ x .90″ x .50″; Output: TTL or CMOS.

Special Custom Designs

Spectrum Technology manufactures a complete line of oscillators and timing systems, including temperature compensated crystal oscillators, crystal controlled oscillators, and integrated circuit logic clocks. Special custom-designed devices and systems include oscillator/modulator assemblies, gated oscillators, and multiple frequency oscillators.

Spectrum Technology specializes in proven reliability design devices featuring • Subminiature Size • Extremely Low Profiles • Low Power Consumption • High Stability • Output Frequencies or Pulse Rates from One Pulse Per Hour to Beyond the 100 MHz Region. Standard packages are available for PC mounting or dual-in-line circuit packaging cards.

Typical Applications for Spectrum Technology devices include: Computers, Medical Instruments, Distance Measuring Equipment, Video, Motion Picture, and Sound Recording Constant Speed Drives, Seismological Recording and Sensing Systems, Aircraft Instrument Computers, Inertial Guidance Systems, Communication Satellites, Ground Support Systems, Tracking Systems, Torpedo Control Systems, Manned Space Applications.

Spectrum Technology Inc

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TEL. (805) 964-7791 / FEDERAL SUPPLIER CODE NO. 32464

STATEK

LOW FREQUENCY
QUARTZ CRYSTALS
MODELS SX-1H & SX-1V

STATEK

FEATURES

- Low cost
- 10 kHz to 300 kHz
- Hermetically sealed TO-5 can
- 18 SX-1 stock frequencies
- Low aging

APPLICATIONS

SX-1H CRYSTAL used in series resonant oscillator circuits (two inverters)

SX-1V CRYSTAL for parallel resonant (Pierce) oscillator circuits (single inverter)

SX Crystal in TO-5 Can

SPECIFICATION SUMMARY[1]

		SX-1 SERIES			
Frequency Range (kHz)		10.0-30.0	30.0-50.0	50.0-100.0	100.0-300.0
Calibration Tolerance at 25°C	Calibration A	± 0.01%	± 0.01%	± 0.02%	± 0.02%
	Calibration B	± 0.03%	± 0.03%	± 0.05%	± 0.05%
Frequency[2] Variation (%)	0-70°C	+.0065 to −.025	+.0095 to −.03	+.013 to −.035	+.0075 to −.032
	−40 +85°C	+.008 to −.036	+.015 to −.043	+.022 to −.05	+.009 to −.044
Series Resistance (MΩ)	SX-1H	4.0-1.0	1.0-0.8	0.8-0.4	0.4-0.15
	SX-1V	0.9-0.25	0.25-0.2	0.2-0.1	0.10-0.03
Q	SX-1H	3,500-7,500	7,500-11,000	11,000-14,000	14,000-22,000
	SX-1V	17,000-32,000	32,000-42,000	42,000-58,000	58,000-70,000
Motional Capacitance fF		1.3-0.85	0.85-0.75	0.75-0.60	0.25-0.30
Maximum Drive Current (μA rms)		0.5	0.5	0.5	0.5
First Year Aging at 25°C(ppm)		10	10	10	10
Shock and Operating Vibration[3]		1000 g, 1 ms, ½ sinewave; 10 g, 10 to 1000 Hz sine sweep			
Stock Frequencies (kHz)[4]		10.0, 12.8, 15.36, 16.0, 16.384, 18.641, 19.2, 20.48, 30.72, 31.5, 32.768, 38.4, 40.96, 60.0, 76.8, 100.0, 153.6. (240.00, SX-1H only)			

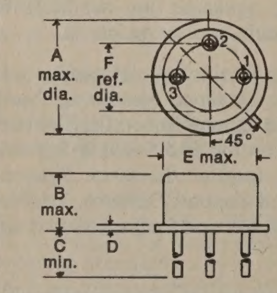
(1) Specifications are typical unless otherwise indicated. Subject to change without notice.
(2) Does not include calibration tolerance.
(3) Improved specifications available.
(4) Non-stock frequencies 10 to 300 kHz available, contact factory.

PRICING SUMMARY*

	QUANTITIES						
	1-24	25-49	50-99	100-249	250-499	500-999	1000-2499
SX-1H, Stock Frequencies, Calibration A	$ 4.30	$ 3.70	$3.20	$2.87	$2.50	$2.20	$2.00
SX-1H, Stock Frequencies, Calibration B	$ 3.70	$ 3.10	$2.79	$2.44	$2.15	$1.90	$1.70
SX-1H, Non-Stock Frequencies, Calibration A	$11.30	$ 8.00	$6.30	$4.90	$3.60	$2.85	$2.20
SX-1H, Non-Stock Frequencies, Calibration B	$ 9.60	$ 6.90	$5.40	$4.15	$3.05	$2.40	$1.87
SX-1V, Stock Frequencies, Calibration A	$ 5.40	$ 4.60	$4.00	$3.59	$3.12	$2.80	$2.50
SX-1V, Stock Frequencies, Calibration B	$ 4.30	$ 3.70	$ 3.20	$2.87	$2.50	$2.20	$2.00
SX-1V, Non-Stock Frequencies, Calibration A	$14.00	$10.00	$7.90	$6.20	$4.50	$3.50	$2.75
SX-1V, Non-Stock Frequencies, Calibration B	$11.30	$ 8.00	$6.30	$4.90	$3.60	$2.85	$2.20

*Prices subject to change without notice.

Minimum order stock frequencies, $50.00; non-stock frequency minimum order, $200.00.
Prices are significantly lower for 10,000 or more units.



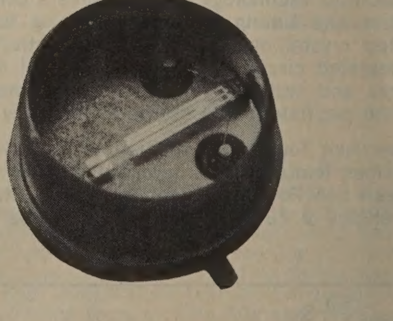
TO-5 TOP VIEW

SX-1V, SX-1H

Pin	Connection
1	Input
2	Output
3	Gnd.

Dim	Inches	Millimeters
A	0.362	9.19
B	0.185	4.70
C	0.500	12.70
D	0.029	0.74
E	0.326	8.28
F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019"; 0.48mm dia. (max.)



SX Crystal in TO-5 can with top removed.

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STATEK

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NEW

WATCH & TIME KEEPING
QUARTZ CRYSTALS
MODEL WX-6
MODEL WX-7

FEATURES
- Tuning Fork Design
- Low cost
- Laser Tuned Accuracy
- Low aging
- Small size
- High Shock Resistance

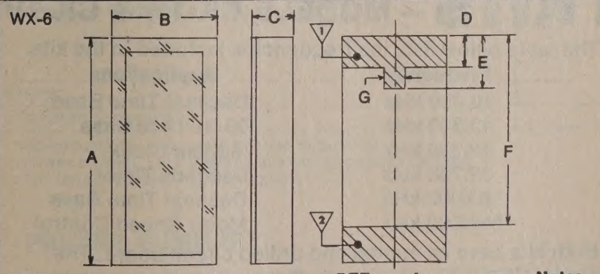
DESCRIPTION
Laser trimming of sealed tuning fork produces a very stable and high accuracy quartz watch crystal. Low cost is achieved by using semiconductor photolithographic wafer processing techniques and low cost packaging.

APPLICATIONS
Any timekeeping function from the smallest ladies watch to standard electrically powered timers.

SPECIFICATIONS*

Frequency	32.768 kHz
Frequency Tolerance, at 25°C	From ± 5 ppm
Motional Resistance, R_1	45 K ohm typical 70 K ohm maximum
Motional Capacitance, C_1	1.20 f F typical
Q (Quality factor)	90,000 typical 60,000 minimum
Shunt Capacitance, C_0	1.0 pf typical
Drive level	1 μw maximum
Turning Point, T_0	25 ± 5°C
Temperature Coefficient, K	—0.033 ppm/°C
Aging (first year, at 25°C)	3 ppm maximum
Shock (1 M drop onto hard board)	3 ppm maximum
Vibration (10g RMS, 10 to 500 Hz)	1 ppm maximum
Operating Temperature	—10 to +60°C
Storage Temperature	—20 to +70°C

*Specifications subject to change without notice. (Specifications for WX-6. Consult factory for WX-7.)



REF.	in.	mm	Notes	REF.	in.	mm	Notes
A	0.325	8.26	Max.	D	0.045	1.14	Nom.
B	0.150	3.81	Max.	E	0.075	1.91	Nom.
C	0.060	1.52	Max.	F	0.270	6.86	Nom.
				G	0.030	0.76	Nom.

Notes:

(1) Tolerance ± 0.005 in. (±0.127 mm).

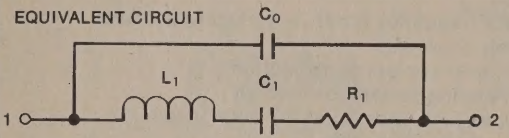
(2) ▽1 & ▽2 crystal.

(3) Connection pads are gold plated and solderable. Au or Al bondable. Pad Flush to +0.0005 in. (+0.0127 mm) above surface.

(4) Glass lid has tin seal. Package may be heated for short periods during reflow soldering. Seal area must not exceed 210°C.

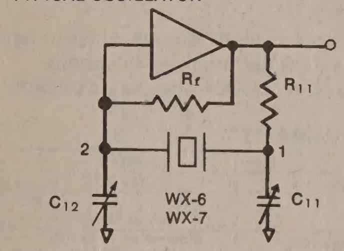
(5) Package material: white ceramic (94% alumina).

EQUIVALENT CIRCUIT



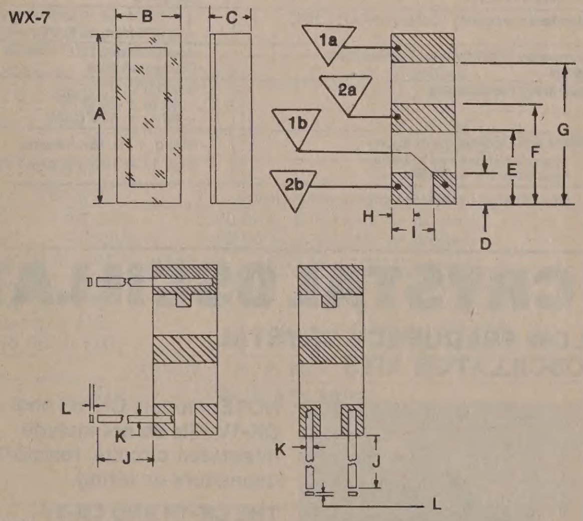
R_1 Motional Resistance
L_1 Motional Inductance
C_1 Motional Capacitance
C_0 Shunt Capacitance

TYPICAL OSCILLATOR



R_{11} = 220 K OHM
R_f = 20 M OHM
C_{11} = 30 pf
C_{12} = 15 pf

Note: Component values suggested for initial design purposes only. Values will depend upon I.C. and layout used.



REF.	in.	mm	REF.	in.	mm
A	0.260	6.60	G	0.215	5.46
B	0.094	2.39	H	0.030	0.76
C	0.060	1.52	I	0.064	1.63
D	0.045	1.14	J	0.250	6.35
E	0.110	2.79	K	0.010	0.25
F	0.150	3.81	L	0.005	0.13

Notes:

(1) 1 & 2 Crystal

(2) Connection pads are gold plated and solderable, Au or Al bondable. Pad flush to +0.0003 in. (+0.0127 mm) above surface.

(3) Glass lid has tin seal. Package may be heated for short periods during reflow soldering. Seal area must not exceed 210°C.

(4) Package material: white ceramic (94% alumina).

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LOW FREQUENCY

CRYSTAL OSCILLATORS

MODEL SQXO-2

FEATURES

- Oscillator frequency range — 10 kHz to 250 kHz
- Extremely small size
- Low milliamp current consumption
- Wide operating temperature range
- Withstands high shock and vibration levels
- CMOS and TTL compatible

DESCRIPTION

The SQXO-2 is a stable, rugged, buffered subminiature oscillator built using thick and thin film parts and the SX-1H Crystal.

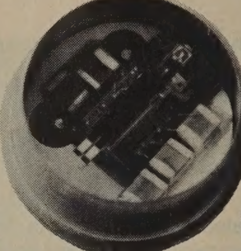
APPLICATIONS

AF standards • computer clocks • data loggers • instruments • modems • pacemakers • POS terminals • telephone equipment • timers • tone generators • ultra sonic detectors

SPECIFICATION SUMMARY*

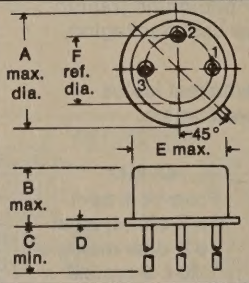
	SQXO-2
Calibration and Operating Voltage	5± 0.5 VDC
Supply Voltage Range	4 to 10 V 6v max at 100 kHz
Current (typical, at Calibration Voltage into 10 pf and 10 MΩ load)	0.50 mA at 10 kHz to 2.0 mA at 250 kHz
Frequency Ranges	10 kHz to 250 kHz
Stock Frequencies Non-stock frequencies 10 to 300 kHz available, contact factory.	10.0, 12.8, 15.36, 16.0, 16.384, 19.2, 32.768 & 100.0 kHz
Standard Frequency (Calibration A) at 25°C	± 0.01% from 10 to 50 kHz and ± 0.02% from 50 to 250 kHz
Frequency Stability over Temperature Range	Approximates SX-1 Crystal Characteristics
Operating Temperature	0 to 70°C, (C) −40 to + 85°C (I) −55 to + 125°C (M)
Shock and Operating Vibration Improved shock and vibration specifications available.	1000 g, 1 ms, ½ sinewave; 10 g, 10 to 1000 Hz sine sweep

*Specifications subject to change without notice.



SQXO-2 Oscillator in TO-5 Can

TO-5 TOP VIEW



SQXO-2

Pin	Connection
1	+ Supply
2	Output
3	Gnd.

Dim	Inches	Millimeters
A	0.362	9.19
B	0.185	4.70
C	0.500	12.70
D	0.029	0.74
E	0.326	8.28
F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019"; 0.48mm dia. (max.)

PRICING SUMMARY*

QUANTITY	SQXO-2(1) STOCK FREQ. (TO-5 CAN)	SQXO-2(1,2) NON-STOCK FREQ. (TO-5 CAN)
1- 4	$39.00	–
5-24	$29.00	$49.00
25-49	$23.50	$38.00
50-99	$23.50	$28.00
100	$19.50	$21.50

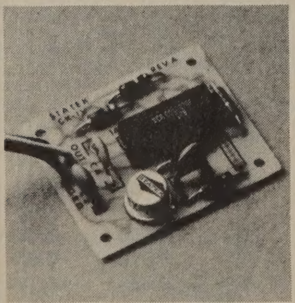
*Prices and specifications subject to change without notice.

(1) Prices shown are for Calibration A, 0 to 70°C units. Pricing for Units with different temperature and calibration ranges may be obtained from Statek.

(2) A minimum order of 5 units is required for non-stock frequency SQXO-2 oscillators.

CRYSTAL OSCILLATOR KITS — MODELS CK-1H & CK-1V

LOW FREQUENCY CRYSTAL OSCILLATOR KITS



NOTE: Models CK-1H and CK-1V Kits **do not** include integrated circuits, resistors, capacitors or wiring.

THE CK-1H AND CK-1V OSCILLATOR KITS CAN BE USED FOR:

- Oscillator breadboards
- Low volume production oscillators
- Reference oscillators for frequency correlation

DESCRIPTION

The CK-1V kit utilizes a Pierce (single inverter) oscillator circuit and contains five SX-1V crystals. The CK-1H kit utilizes a series circuit (two inverters) and contains six SX-1H crystals. The frequency calibration is ±0.01% for all frequencies except 100 kHz & 240 kHz which is ±.02%.

The table below lists the frequencies included in the kits.

Frequency	Applications
10.000 kHz	Decimal Time Base
15.360 kHz	60 Hz Time Base
19.200 kHz	Modem Clock
32.768 kHz	Seconds Timer
100.000 kHz	Decimal Time Base
240.000 kHz	Motor Speed Control

Both kits have an etched and drilled circuit board. The Model CK-1H Kit circuit uses three low cost transistors. The Model CK-1V Kit uses a CMOS 4007A Dual Complementary Pair Plus Inverter I.C.

DOCUMENTATION

The circuit documentation supplied with each kit consists of:

- Circuit schematics with a table of component values for different oscillator frequencies.
- A physical layout of the oscillator
- A parts list for various oscillator frequencies

Description of circuit operation, layout characteristics and mounting provisions are also included.

The kits are priced at $27.00 each in single quantity.

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LOW FREQUENCY

CRYSTAL OSCILLATORS REPEAT CYCLE TIMERS

LQXO-3 DQXO-3

STATEK

NEW

FEATURES

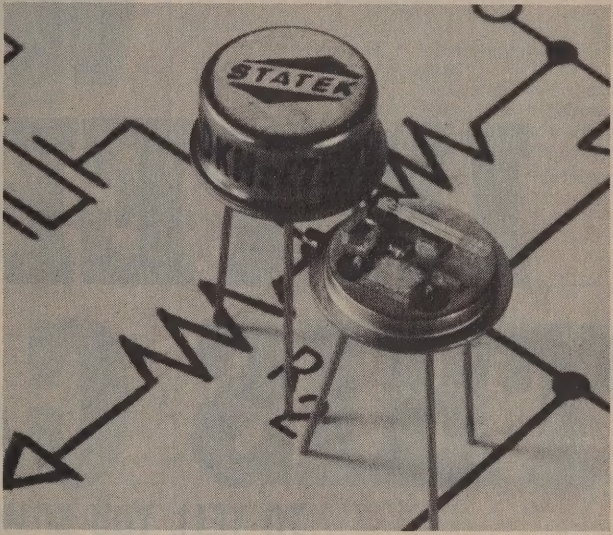
- LQ Series — 10 kHz to 300 kHz
- DQ Series — divided outputs to 1 cycle per day
- Low milliampere current
- TO-5 package
- Quartz stability
- Low aging

DESCRIPTION

The LQXO-3 is a tuning fork quartz crystal oscillator built using hybrid chip and wire construction. The DQXO-3 is an LQXO-3 with a CMOS divided output for frequencies below 10 kHz.

APPLICATIONS

The small size, moderate power consumption, high shock, CMOS drive capability of the LQXO-3 makes it suitable for instrumentation time bases, time-of-day clocks, audio standards, phase locked loop oscillators, digital circuit clocks, and industrial controllers. The longer period outputs of the DQXO-3 make it suitable for remote data timers, process controllers, long period repeat cycle timers, and tone generators.



DQXO-3

SPECIFICATION SUMMARY*

	LQXO-3	DQXO-3
Calibration Voltage	5 ±0.5 VDC	5 ±0.5 VDC
Supply Voltage Range	4 to 9 VDC	4 to 9 VDC
Current (no load)	1.5 Ma Maximum[1]	1.5 Ma Maximum[1]
Frequency Range	10 kHz to 300 kHz	10 kHz to 1Hz[2]
Stock Frequencies	10 and 100 kHz	1 Hz
Calibration Accuracy at 25°C	"A" ±0.01% (±0.02% at 50 kHz or higher) "B" ±0.03% (±0.05% at 50 kHz or higher)	
Operating Temperature	−40°C to +85°C standard; −55°C to +100°C special	
Frequency Stability −40°C to +85°C	10.0 to 30.0 kHz 30.0 to 50.0 kHz 50.0 to 100.0 kHz 100.0 to 300.0 kHz	+0.008 to −0.036% +0.015 to −0.043% +0.022 to −0.05% +0.009 to −0.044%
Shock	1000 g, 1 Ms, ½ sine	
Vibration (operating)	10 g, 10 to 1,000 Hz sine sweep	

*Specifications subject to change without notice.

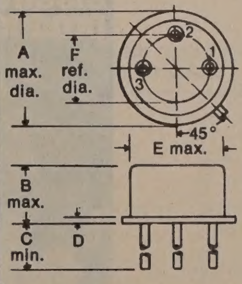
[1] Lower current, 12 V designs available; consult factory.

[2] For longer periods consult factory.

PRICING SUMMARY*

	LQXO-3		DQXO-3	
Quantity	Stock	Non-Stock	Stock	Non-Stock
1 - 4	$39.00	$49.00	$55.00	$69.00
5 - 9	29.00	38.00	40.00	53.00
10 - 99	23.50	28.00	33.00	39.00
100 - 249	19.50	21.50	22.00	30.00
250 - 499	15.50	15.50	22.00	22.00
500 - 999	12.50	12.50	18.00	18.00
1000	10.00	10.00	14.00	14.00

*"A" Calibration, −40°C to +85°C. "B" Calibration, approximately 10% lower. −55°C to +100°C approximately 10% higher. A minimum order of 4 units is required for non-stock frequencies.



TO-5 TOP VIEW

LQXO-3, DQXO-3

Pin	Connection	Dim	Inches	Millimeters
1	Output	A	0.362	9.19
2	+ Supply	B	0.185	4.70
3	Gnd.	C	0.500	12.70
		D	0.029	0.74
		E	0.326	8.28
		F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019″; 0.48mm dia. (max.)

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- **Minimum Power Required, All Solid State**
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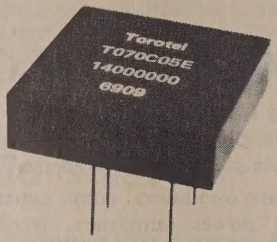
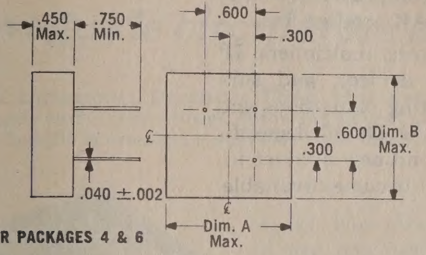
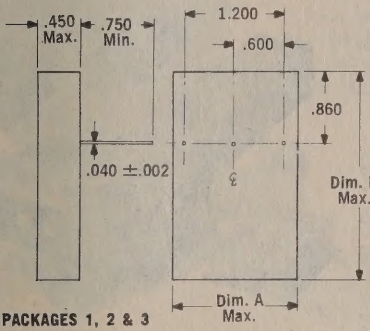




FOR PACKAGES 4 & 6



FOR PACKAGES 1, 2 & 3

POWER REQUIREMENTS

Operating Voltage .... 3.5 to 5.5 VDC
Nominal Current .... 6 ma, 0.1 MHz to 2.5 MHz
25 ma, 2.5 MHz and up
Special Order for other Operating Voltage
T^2L Logic Output:
1 = 2.4 Volts Minimum 0 = 0.4 Volts Maximum
Fanout = 5, 10 T.T.L. Loads Max.
Duty Cycle .... 50% ±10% at 1.4 Volts
Rise/Fall Time .... Measured from 0.4 to 2.4 Volts
10 nanoseconds .... 2.5 MHz and up
25 nanoseconds .... 0.1 MHz to 2.5 MHz

TOROTEL OSCILLATOR PART NUMBER

TXXX X XX X X — (Frequency)

Temp. Range in C°	No.
10°- 40°	040
0°- 50°	*050
−10°- 60°	*060
−20°- 70°	*070
−30°- 80°	ᵀ 080
−40°- 90°	ᵀ 090
−55°-105°	ᵀ 105

Freq. Tol. Over Temp. Range	No.
±10 PPM	*ᵀ A
±50 PPM	C
±100 PPM	D
±200 PPM	E
±500 PPM	F
±20 PPM	ᵀ J
±70 PPM	L

T.T.L. Output	No.
5	05
10	10

Package Type	No.
Encapsulated	E
Hermetic Seal	H

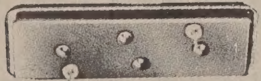
Package Size Dim. A	Package Size Dim. B	No.
1.505	3.260	1
1.505	2.510	2
1.505	1.505	3
1.505	1.505	4
1.005	1.005	6

Frequency Range	Package No.
0.1 Hz- 25 Hz	1
25 Hz-6,250 Hz	2
6,250 Hz- 100 KHz	3
100 KHz- 25 MHz	4
10 MHz- 20 MHz	6

When Ordering:
Do not mix Columns with an *
Do not mix Columns with a ᵀ

Example Order: T070D10E4-10,000,000
Torotel Oscillator, −20°C to +70°C, ±100 PPM, 10 T.T.L. Fanout, Encapsulated, Size 4, 10 MHz

QUARTZ CRYSTALS



Frequencies from 80 KHz to 125 MHz manufactured to the highest tolerances and hermetically sealed with the latest methods.

Resistance weld sealing is available **at no extra cost** in the HC-6/U, HC-18/U, HC-25/U and HC-33/U standard holders. This process uses an electrical weld to seal the crystal unit in a helium-nitrogen atmosphere. Solder balls and aging due to flux contamination are completely eliminated.

QPL-3098

In house laboratory facilities can perform testing to MIL-C-3098F. Many standard types are QPL approved and custom designs are available on request.

CRYSTAL FILTERS

Crystal filters from 10 KHz to 30 MHz are computer designed for maximum performance. Custom designs are considered a challenge. Contact Torotel's engineering staff for assistance.

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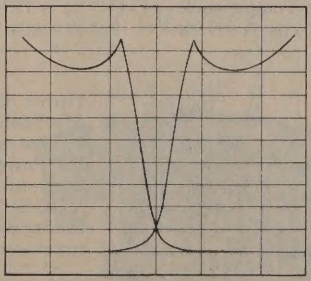

BAND PASS
BAND REJECT
LOW PASS
HIGH PASS
IN THE FREQUENCY RANGES FROM DC TO 35 MHz

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OSCILLATORS, CIRCULATORS, ISOLATORS, AMPLIFIERS, AND HYBRID COMPONENTS

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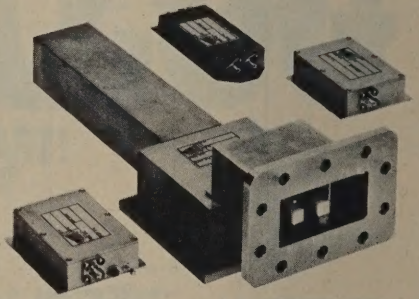
MICROWAVE SOLID STATE AMPLIFIERS



wideband

Model	Frequency Range (GHz)	Noise Figure (dB max)	Small Signal Gain (dB min)	Power Output (dBm min)
8020-1000	1.0- 2.0	3.5	25	+7
8020-1001	1.0- 2.0	3.5	40	+7
8020-1002	1.0- 2.0	3.0	25	+7
8030-1000	2.0- 4.0	4.0	25	+7
8030-1001	2.0- 4.0	4.5	25	+7
8030-1002	2.0- 4.0	6.5	40	+7
8042-1001	2.0- 6.0	7.0	25	+7
8025-1000	1.0- 4.0	4.0	25	+7
8030-1003	2.0- 4.0	3.0	25	+7
8042-1004	2.0- 6.0	5.0	25	+7
8042-1003	2.0- 7.0	5.0	22	+7
8042-1002	2.0- 8.0	5.0	20	+7
8040-1000	2.6- 5.2	6.5	25	+7
8041-1001	2.6- 5.4	6.0	25	+7
8050-1000	4.0- 8.0	6.0	25	+7
8050-1001	4.0- 8.0	5.5	25	+7
8050-1002	4.0- 8.0	7.0	25	+7
8050-1003	4.0- 8.0	6.0	40	+7
8060-1001	8.0-12.4	8.5	25	+7
8060-1000	8.0-12.4	7.5	25	+7

communications

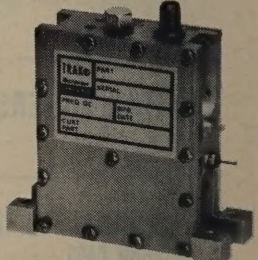
Model	Frequency Range (GHz)	Noise Figure (dB max)	Small Signal Gain (dB min)	Power Output (dBm min)
8023-1000	1.7 -2.3	3.0	25	+ 7
8040-1030	3.7 -4.2	2.6	50	+13
8040-1032	3.7 -4.2	2.0	50	+13
8040-1000	3.7 -4.2	4.5	25	+10
8054-1000	4.4 -5.0	5.0	25	+10
8051-1000	5.9 -6.4	10	25	+12
8051-1001	5.9 -6.4	10	25	+16
8063-1000	7.25-7.75	5.8	25	+10
8063-1000	7.9 -8.4	9.0	25	+10

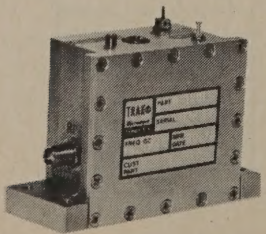
radar

Model	Frequency Range (GHz)	Noise Figure (dB max)	Small Signal Gain (dB min)	Power Output (dBm min)
8021-1000	1.25-1.35	2.2	25	+ 5
8021-1001	1.2 -1.4	2.7	25	+ 5
8031-1000	2.9 -3.1	3.5	25	+ 5
8031-1001	2.7 -2.9	3.5	25	+ 7
8052-1000	5.4 -5.9	4.5	25	+10
8061-1000	8.5 -9.6	5.5	25	+ 7

Oscillators

Fundamental Transistor Oscillators—Frequency: 2500 MHz to 5000 MHz, fc specified by customer within ±1 MHz; Tuning Range: Mechanical, ±1% min of fc; Stability Over Temperature: ±0.05% (−20°C to +77°C), ±0.1% (−54°C to +77°C); Pushing: ±0.005%/volt from DC to 3 kHz, ±0.001%/volt typical; Pulling: ±0.05% into 3.0:1 load VSWR all phases; ±0.01% typical; Output VSWR: 1.7:1 within ±300 MHz of fc; RF Power Out: +10 dbm min; Power vs. Temperature: ±3 db max, ±1 db typical; Turn-on Time: Full power within 1 second, freq. within 0.1% of fc <1 min, 5 sec typical; Harmonics: −30 db, −50 dbc typical; Spurs: −80 db; DC Power: +15 V nom. @ 40 mA max, 25 mA typical; Size: 2.75″ L × 1.0″ W × 2.5″ H; Weight: 5.0 oz max, 4.3 oz typical; Connectors: SMA-F (RF), solder pin (DC); Operating Temperature: −54°C to +77°C; Mounting: Base plate—Flange; Vibration: 25g 10-100 cps, 7g 100-200 cps; Acceleration: 12gs any axis.

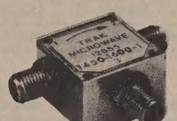




Gunn Oscillators—Center Frequency: 8 to 16 GHz (customer specified); Tuning: Mechanical, ±0.5% of center frequency; Stability: ±.05% over temperature; short term: 1 PPM/sec; Pushing: <±.002%/volt, DC to 3 kHz; Pulling: ±.01% for 3:1 load VSWR: RF Power Out: +13 dbm min to +19 dbm max; Turn-on: Full power within 1.0 sec over temperature, frequency within 0.1% of nominal frequency within 5 min; DC Power: +15 VDC @ 600 mA max, Turn-on: +15 VDC @ 700 mA max; Harmonics: >−50 dbc; Non-Harmonic Spurs: >−80 dbc; Connectors: SMA-F (RF), Solder pin feed thru (DC); Temperature: −54°C to +71°C.

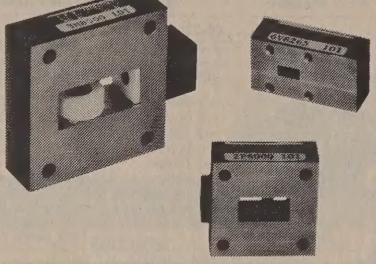
CIRCULATORS, ISOLATORS, AMPLIFIERS, SOURCES, AND HYBRID COMPONENTS

Coaxial and Drop-in circulators and isolators

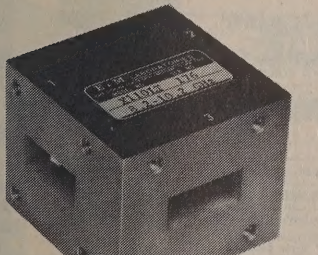


MINIATURE CIRCULATORS AND ISOLATORS *Frequency Range:* 0.5 to 18 GHz *Bandwidth:* 5% to greater than octave *Isolation:* 20 db minimum narrow band, 17 db minimum octave *Insertion Loss:* 0.3 db typical, 0.5 to 0.8 maximum *VSWR:* 1.17 typical, 1.25 maximum (narrow band) *Operating Temperature:* −54° C to +95° C (most models) *Size Range:* 1 x 1 x 0.5 inches to .375 x .375 x .375 inches nominal (narrow band) *Weight Range:* 1.8 to 0.3 ounce (narrow band) *Connectors:* SMA female *Isolator Termination:* 1 watt others optional

Waveguide circulators and isolators

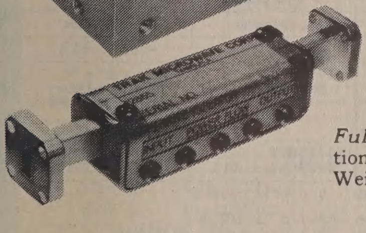


E & M Laboratories, Division of TRAK Microwave Corporation offer a complete line of waveguide and coaxial devices. Below are general specifications for the waveguide components. Specific information is available upon request.



Flange Waveguide Isolators—Frequency Range: 7.05 to 40.0 GHz; Bandwidth: 1 to 5%; Isolation: 20 db nominal; Insertion Loss: 0.5 db max; VSWR (Bilateral) 1.35:1 max.

3-Port Waveguide Circulators—Full waveguide bandwidth Wye Type. Frequency Range: 8.2 to 26.5 GHz; Isolation: 17 db nominal; Insertion Loss: 0.5 db max; VSWR: 1.3:1 max; Dimensions: 1.75 to 2.89 inch diameter, 1.57 to 2.0 inch height; Broad Bandwidth Tee Type. Frequency Range: 3.7 to 40 GHz; Isolation: 20 db nominal; Insertion Loss: 0.5 db max; VSWR: 1.3:1 max.



Full Bandwidth Waveguide Isolators—Frequency: 2.6 to 40 GHz; Isolation: 25 db nominal; Insertion Loss: 1.5 db max; VSWR (Bilateral) 1.3:1 max; Peak Power: 20 KW peak; Length: 3.75 to 14 inches; Weight: 1.5 to 14 pounds.

Hybrid Components

OSCILLATORS *Model 1016-1047 Series Specifications: Frequency Range:* 60-1200 MHz *Output Power:* 10 mW, 100 mW and 1 watt ±1.5 db into a 50 ohm load* *Frequency Set Accuracy at Room Temp:* ±0.0005% *Stability:* ±0.0025% *Temperature Range:* −54° C to +85° C *Non-harmonically Related Spurious (1MHz BW):* ≥60 dbc *Harmonics and Sub-harmonics (nominally 100 HMz 5th overtone 'tals used):* ≥30 dbc *Supply Requirements:* +15 VDC, 250 mA maximum *Size (excluding protrusions):* .69″ x .59″ x .49″ to 1.33″ x 1.33″ x .49″

*other power levels optional

COMB GENERATORS *Model 3822-1600 Specifications: Frequency Range:* 4 to 8 GHz *Comb Spacing:* 100 MHz *Power Output:* −25 dbm, ±10 db *Pulse Rise and Fall Time:* 0.2 μs maximum *Frequency Stability:* ±1.75 MHz *Non-Harmonically Related Spurious (1 MHz BW):* ≤70 dbm *Power Stability:* ±6 db *Operating Temperature:* −55° C to +71° C *Load Impedance:* 50 ohms nominal *Connector:* SMA female *Size:* 1.17″ x 0.67″ x 0.79″ *Supply Requirement:* +15 VDC at 50 mA maximum *Mounting:* Base plate

IF AMPLIFIERS *Model 8400-1000 Specifications: Frequency:* Customer specified from 20 to 150 MHz *3 db Bandwidth:* 10 MHz typical *Gain:* 70 ±3 db *Noise Figure:* 3 db maximum *AGC Range:* 60 db minimum *Input Dynamic Range (with AGC):* 80 db minimum *1 db Compression Point:* +6 dbm minimum *Power Supply:* +12 VDC @ 35 mA nominal *Temperature:* −55° C to +85° C *Input Impedance:* 50 ohms nominal *Output Impedance: IF:* 50 ohms nominal *Detector:* 1K ohms nominal (optional) *Input and Output Connectors:* SMA female *Size:* 1.16 x .66 x .49 inches

GAIN AND PHASE MATCHED IF AMPLIFIERS *Model 8400-1003 Specifications: Frequency:* 60 MHz *3 db Bandwidth:* 10 MHz minimum *Selectivity:* 20 db/octave *Band Pass Ripple:* ±0.5 db nominal *Small Signal Gain:* 60 db minimum *Small Signal Dynamic Range:* 40 db minimum at any AGC setting *AGC Range:* 50 db minimum *Noise Figure:* 3 db maximum *Gain Tracking:* ±2 db *Phase Tracking:* ±8° *Video Gain Tracking:* ±1 db (Note: IF tracking error can be cumulative with video gain error.) *Video Output Level:* 5 volts maximum across 2K ohm resistive load *IF Output Level:* +6 dbm minimum @ 1 db compression point *Input Impedance:* 50 ohms nominal *Input VSWR:* 1.15:1 maximum *Supply:* +12 VDC @ 50 mA maximum (each amplifier) *Size:* 2.27 x 1.28 x .04 inches *IF Input and Output:* 3 inches of RG 188 (connectors optional) *Supply, AGC, and Video Output Connections:* Solder terminals

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Clock Oscillators

TTL

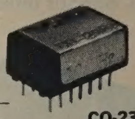
	PRINTED CIRCUIT BOARD MOUNT			DIP COMPATIBLE			
Features:	*Most economical Broadest range of frequencies & options*	*Low profile only 0.3" high*	*Small board area only 1 inch sq.*	*Consumes space of only one 14 pin DIP .35" high*	*Reduced height 14 pin DIP .28" high*	*Larger DIP package but with frequencies as low as 50 Hz*	*Lowest profile unit only .225" high*
Model:	**CO-231**	**CO-231LA (or B)**	**CO-232**	**CO-238A (or B or T)**	**CO-234A (or B)**	**CO-235**	**CO-239A (or B)**
Frequency:	1 Hz thru 100 MHz	200 KHz thru 30 MHz	3 MHz thru 30 MHz	3 MHz thru 100 MHz	4 MHz thru 25 MHz	50 Hz thru 30 MHz	4 MHz thru 100 MHz
Output:	Drives 10 TTL Loads. Logic "0": 0.4V max, sink 16 ma. Logic "1" 2.4V min, source 2 ma. (above 50 MHz drive capability decreases; at 100 MHz drives 2 Schottky TTL loads)						
Input Voltage:	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%	5 VDC ±5%
Size:	1½" x 1½" x ½" 38 x 38 x 12.7 mm	1½" x 1½" x 0.3" 38 x 38 x 7.6 mm	1" x 1" x 0.5" 25 x 25 x 12.7 mm	.5" x .8" x .35" 12.7 x 20.3 x 8.9 mm	.5" x .8" x .28" 12.7 x 20.3 x 7.1 mm	1½" x 1½" x ½" 38 x 38 x 12.7 mm	1.4" x .8" x .225" 35.6 x 20.3 x 5.7 mm
Tuning Option Available:	*YES	NO	*YES	**YES	NO	*YES	NO
	*Models with "T" suffix include tuning adjustment with nominal range of ±30 ppm below 25 MHz and 15 ppm above 25 MHz — setability is <.0001%						
Accuracy: (at 25°C)	**CO-231**: ±.001% ***CO-231T**: ±.0001%	**CO-231LA**: ±.005% **CO-231LB**: ±.001%	**CO-232**: ±.001% ***CO-232T**: ±.0001%	**CO-238A**: ±.005% **CO-238B**: ±.001% ****CO-238T**: ±.0001%	**CO-234A**: ±.005% **CO-234B**: ±.001%	**CO-235**: ±.001% ***CO-235T**: ±.0001%	**CO-239A**: ±.005% **CO-239B**: ±.001%

(**CO-238T: 3-25 MHz only)

Stability: **Standard:** 0°C to + 70°C: ±.0025%

—1 Option: —55°C to + 85°C: ±.005% (—40/+85°C for CO-231-1 <60 Hz)
—2 Option: —55°C to +125°C: ±.005% (70 MHz max for CO-238-2 & CO-239-2)
—3 Option: 0°C to + 50°C: ±.0003% (6 MHz min for CO-232, CO-238, CO-239, CO-234; 50 Hz min for CO-231; 100 Hz min for CO-235)
—4 Option: 0°C to + 50°C: ±.0001% (only for CO-231 in 12 KHz-20 MHz range)
—5 Option: 0°C to + 50°C: ±.0005% (4 MHz min for CO-232, CO-238; 100 Hz min for CO-235)
—6 Option: 0°C to + 50°C: ±.001%
—8 Option: 0°C to + 70°C: ±.01% (includes initial accuracy; do not specify A or B accuracy, or tuning with —8)
Y Option: Aging improved from 5 ppm/year typical to 1 ppm/year (only for CO-231 in 3-20 MHz range)

CO-231


CO-238

Option "C": Fully sealed metal can for 100% r.h. requirements — results in slight height increase. Not available with tuning option.

CMOS

Features:	*Most economical Broadest range of frequencies and options*	*DIP compatible Consumes space of one 14 pin DIP*	*Larger DIP package but with frequencies as low as 60 Hz*
Model:	**CO-236**	**CO-636A (or B)**	**CO-536**
Frequency:	.01 Hz thru 10 MHz	3 MHz thru 10 MHz	60 Hz thru 10 MHz
Output:	CMOS compatible	CMOS compatible	CMOS compatible
Input:	5 VDC-15 VDC for frequencies below 6 MHz; 1-2 ma typical below 2 MHz.		
Size:	1½" x 1½" x ½" 38 x 38 x 12.7 mm	.5" x .8" x .42" 12.7 x 20.3 x 10.7 mm	1½" x 1½" x ½" 38 x 38 x 12.7 mm
Tuning Option Available:	*YES	NO	*YES
	*Models with "T" suffix include tuning adjustment with setability <.0001%		
Accuracy: (at 25°C)	**CO-236**: ±.001% ***CO-236T**: ±.0001%	**CO-636A**: ±.005% **CO-636B**: ±.001%	**CO-536**: ±.001% ***CO-536T**: ±.0001%

Stability: **Standard:** 0/+ 70°C: ±.0025%

—1 Option: —40/+ 85°C: ±.005%
—2 Option: —55/+125°C: ±.005%
—3 Option: 0/+ 50°C: ±.0003% (2.5 MHz min; 6 MHz min for CO-636)
—4 Option: 0/+ 50°C: ±.0001% (only CO-236, 3-10 MHz)
—5 Option: 0/+ 50°C: ±.0005% (4 MHz min for CO-636)
—6 Option: 0/+ 50°C: ±.001%
—8 Option: 0/+ 70°C: ±.01% (includes accuracy)
—Y Option: Aging improved from 5 to 1 ppm/year (only CO-236, 3-10 MHz)

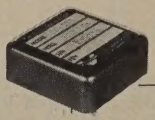
Option "C": Fully sealed metal can; results in slight height increase.

ECL

Features:	*Most economical*	*Highest frequencies*	*DIP compatible*
Model:	**CO-233ME**	**CO-233MEHA (or B)**	**CO-633A (or B)**
Frequency:	5 MHz thru 149.9 MHz	150 MHz thru 200 MHz Higher frequencies available in larger package	5 MHz thru 125 MHz
Output:	ECL compatible	ECL compatible	ECL compatible
Input Voltage:	—5.2 VDC ±5%	—5.2 VDC ±5%	—5.2 VDC ±5%
Size:	1½" x 1½" x ⅝" 38 x 38 x 16 mm	1½" x 1½" x ⅝" 38 x 38 x 16 mm	.5" x .8" x .5" 13 x 20 x 13mm
Tuning Option Available:	*YES *Tuning setable to .0001%	NO	NO
Accuracy: (at 25°C)	**CO-233ME**: ±.001% ***CO233MET**: ±.0001%	**CO-233MEHA**: ±.005% **CO-233MEHB**: ±.001%	**CO-633A**: ±.005% **CO-633B**: ±.001%

Stability: **Standard:** 0/+ 70°C: ±.0025%

**—1 Option: —55/+ 85°C: ±.005%
—2 Option: —55/+125°C: ±.005% (to 125 MHz)
—3 Option: 0/+ 50°C: ±.0003% (6 - 150 MHz)
—5 Option: 0/+ 50°C: ±.0005%
—6 Option: 0/+ 50°C: ±.001%
—8 Option: 0/+ 70°C: ±.01% (includes initial accuracy)
**—30°C lower limit above 125 MHz



Screen Tested Clock Oscillators

Each of the Clock Oscillators described above, except those with tuning, is available in a fully sealed metal can; simply add "C" to the Model No. (e.g. CO-238B-1C). For those high reliability applications requiring Screen Tested components, Vectron now offers the same Clock Oscillators:

- 100% Screen Tested as follows:
  - (A) Thermal Shock per MIL-STD-202, Method 107D, Test Condition A
  - (B) Seal Test per MIL-STD-202, Method 112B, Test Condition A
  - (C) Burn-in for 168 hours at maximum specified operating temperature
- Packaged in fully solder sealed metal housing
- Ruggedized for shock and vibration

HOW TO SPECIFY MODEL NUMBER . . .

□□□□ — □ S — □ at ▭

Basic Model
Accuracy at 25°C
Stability option
Indicates sealed, screened model
★Shock and vibration
Frequency

For example, 238A-2S-1 at 10 MHz = CO-238 Type at 10 MHz with
"A" accuracy of ±.005% at 25°C
"—2" stability of ±.005% over —55°C to +125°C
"S" for screen tested oscillator in solder sealed metal can
"—1" shock of 100g, 6 msec and vibration of 10g, to 500 Hz

★The following codes define the alternative shock and vibration specifications to which the oscillator is designed:

Code	Shock (MIL-STD-202, Meth 213B)	Vibration (MIL-STD-202)
"0"	30g, 11 msec per Test Cond J	10-55 Hz, .06" DA per Meth 201A and 5g to 500 Hz
"1"	100g, 6 msec per Test Cond C	10g to 500 Hz per Meth 204C, Cond A
"2"	100g, 6 msec per Test Cond C	20g to 2 KHz per Meth 204C, Cond D and 20 grms overall random to 2 KHz per Meth 214, Cond I-F

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166 Glover Ave. Norwalk, CT 06850
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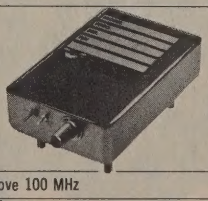
TCXOs Temperature Compensated Crystal Oscillators

	CO-251 SERIES	CO-252 SERIES	CO-254 VHF SERIES
Stability:	**CO-251:** 0/+50°C: ±1 x 10^{-6} **CO-251A:** 0/+50°C: ±5 x 10^{-7} **CO-251B:** +15/+35°C: ±2 x 10^{-7} **CO-251C:** 0/+65°C: ±1 x 10^{-6}	**CO-252-3:** 0/+50°C: ±2 x 10^{-7} **CO-252-3A:** 0/+50°C: ±1 x 10^{-7} **CO-252:** −20/+70°C: ±1 x 10^{-6} **CO-252A:** −20/+70°C: ±5 x 10^{-7} **CO-252-4:** −55/+85°C: ±5 x 10^{-6} **CO-252-4B:** −55/+85°C: ±2 x 10^{-6} **CO-252-4A:** −55/+85°C: ±1 x 10^{-6}	**CO-254-1:** 0/+50°C: ±1 x 10^{-6} **CO-254-2:** 0/+50°C: ±5 x 10^{-7} **CO-254-3:** 0/+50°C: ±2 x 10^{-7} **CO-254:** −20/+70°C: ±1 x 10^{-6} **CO-254A:** −20/+70°C: ±5 x 10^{-7} **CO-254-4:** −55/+85°C: ±5 x 10^{-6} **CO-254-4B:** −55/+85°C: ±2 x 10^{-6}
Frequency:	1, 2, 3, 4, 5 or 10 MHz standard (Any freq., 60 Hz to 20 MHz opt.)	1, 2, 3, 4, 5 or 10 MHz standard (Any freq., 60 Hz to 20 MHz opt.)	50 or 100 MHz standard (Any freq., 20 MHz to 280 MHz with freq. above 140 MHz in larger package)
Output:	TTL standard (Sine or CMOS optional)	1 vrms into 1KΩ standard (TTL, CMOS or 50Ω sine optional)	0.5 vrms into 50Ω standard (ECL or TTL optional)
Supply:	Any specified voltage in 5-32 VDC range; current as low as 4 ma for some types.		
Aging Rate:	1 x 10^{-6}/year	1 x 10^{-6}/year	2 x 10^{-6}/year
Size:	2" x 2" x ¾" (51 x 51 x 19 mm) printed circuit board mounting (Chassis mount with RF connector optional).		
Options:	• Other stability characteristics • Other mechanical configurations • Ruggedized units for high shock and vibration • Voltage frequency control (TC/VCXO)		

VCXOs Voltage Controlled Crystal Oscillators

	WIDE DEVIATION AND/OR LINEAR APPLICATIONS					NARROW DEVIATION PHASE LOCK APPLICATIONS	
Model:	CO-271V	CO-275V	CO-272V	CO-276V	CO-273V CO-274V	CO-233V	CO-231V
Frequency:	2-20 MHz	20-200 MHz (higher and lower frequencies available)	2-20 MHz	20-200 MHz	0.5-8 MHz 8-40 MHz	4-200 MHz (Higher frequencies available in larger package.)	3-20 MHz
Output:	1vrms/1KΩ	.5 vrms/50Ω (TTL, CMOS, ECL or higher level sinewave available on some models)	1vrms/1KΩ	.5 vrms/50Ω	1vrms/1KΩ .5vrms/50Ω	.5 vrms/50Ω	TTL compatible
Deviation:	±.1%	±.1% (wider and narrower deviations available)	±.1%	±.1%	±.5%	±.003%. This allows correcting to specified center frequency over 0-50°C for 5-10 years. (Wider deviations optional).	
Mod. Voltage:	±5 volts (either higher or lower sensitivity available)					0 to +6V	0 to +5V
Linearity:	±1%	±1% (For ±5% linearity, resulting in reduced cost, add "N" to Model No.)	±1%	±1%	±1%	±20% Smooth monotonic characteristic	±20%
Stability: (0-50°C)	A: ± .01% B: ±.001%	A: ± .01% B: ±.001%	±.0001% (wider temperature range optional)	±.0001%	±.025%	±.001% (wider temp. range optional)	±.001%
Oven Control:	No oven	No oven	Proportional	Proportional	No oven	No oven	No oven
Size:	2" x 2" x ¾" (51 x 51 x 19 mm)	2" x 3" x ¾" (51 x 77 x 19 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 3" x ¾" 3" x 3½" x ¾"	1½" x 1½" x ⅝" (38 x 38 x 16 mm)	1½" x 1½" x ½" (38 x 38 x 13 mm)

Sinewave Oscillators

	LOW FREQUENCY CO-281	HIGH FREQUENCY CO-282	VHF CO-233 Series	VHF HIGH POWER CO-284W
Frequency: (Configuration)	1 KHz to 3 MHz (pins for p.c. mounting)	1 MHz to 20 MHz (pins for p.c. mounting)	**CO-233:** 5-149 MHz (printed circuit board mount) **CO-233H:** 150-300 MHz (printed circuit board mount) ***CO-233W:** 5-250 MHz (chassis mount, SMA connector, solder header) ***CO-233FW:** 5-500 MHz (chassis mount, SMA connector, EMI filter cap.) *For BNC connector, replace "W" with "X". For UG1619/U connector, replace "W" with "U".	5-500 MHz *(SMA and EMI filter cap on side)
Output:	1 vrms/1K std. 0 dBm/50Ω opt.	0.5 vrms/50Ω std. 1 vrms/1K opt.	0.5 vrms/50Ω (+7 dBm) standard 1 vrms/50Ω (+13 dBm) optional Above 200 MHz, only for CO-233 FW.	1 watt/50Ω (+30 dBm) to 300 MHz 0.5 watt/50Ω (+27 dbm) > 300 MHz
Input:	+15 VDC Any supply voltage in 15-32 VDC range optional; supply less than 15 VDC subject to reduced output level	+15 VDC	+15 VDC	18-32 VDC
Accuracy: (at 25°C)	±10 ppm	±10 ppm Add "T" to model number for tuning adjustment with setability of ±1 ppm	±10 ppm	±10 ppm
Stability: 		**Standard:** 0°C to + 70°C: ±.0025% **—1** option: −55°C to + 85°C: ±.005% **—2** option: −55°C to +125°C: ±.005% **—3** option: 0°C to + 50°C: ±.0003% (N/A for CO-282 in 1-3 MHz range) **—4** option: 0°C to + 50°C: ±.0001% (only for CO-282 above 3 MHz and CO-281 any freq.) **—5** option: 0°C to + 50°C: ±.0005% **—6** option: 0°C to + 50°C: ±.001% For higher stability see TCXO and oven controlled types **Y** option: Aging improved from 5 ppm/year typical to 2 ppm/year		
Noise:	—130 dB/Hz SSB typical, 1 KHz from carrier, at frequencies below 100 MHz; 6 dB degradation per octave above 100 MHz			
Size:	2" x 2" x ¾" (51 x 51 x 19 mm)	1⅝" x 1⅝" x ½" (42 x 42 x 13 mm)	CO-233, CO-233H: 1½" x 1½" x ⅝" (38 x 38 x 16 mm) CO-233W, CO233FW: 2" x 2" x ¾" (51 x 51 x 19 mm)	2" x 3" x ¾" (51 x 76 x 19 mm)

VECTRON LABORATORIES, INC.

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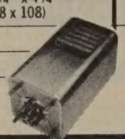
Oven Controlled Crystal Oscillators

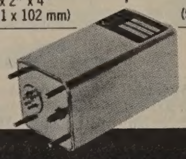
High Frequency

	HIGH STABILITY			ULTRA-STABLE	
	(Single Oven) CO-211 Series	(Single Oven) CO-200 Series	(Double Oven) CO-244V	(Single Oven) CO-206V	(Double Oven) CO-246V
Aging Rate:	**CO-211:** 1×10^{-7}/day **CO-214:** 1×10^{-8}/day **CO-215:** 5×10^{-9}/day **CO-216:** 3×10^{-9}/day **CO-217:** 1×10^{-9}/day ***CO-218:** 5×10^{-10}/day	**CO-201:** 1×10^{-8}/day **CO-202:** 5×10^{-9}/day **CO-203:** 3×10^{-9}/day **CO-204:** 1×10^{-9}/day ***CO-205:** 5×10^{-10}/day	**CO-244V:** 1×10^{-9}/day ***CO-244V-1:** 5×10^{-10}/day	**CO-206V:** 3×10^{-10}/day 5×10^{-8}/year **CO-206V-1:** 1×10^{-10}/day 3×10^{-8}/year	**CO-246V:** 3×10^{-10}/day 5×10^{-8}/year **CO-246V-1:** 1×10^{-10}/day 3×10^{-8}/year
	*(5×10^{-10}/day average; at 1, 2, 4, 5 and 10 MHz only)				
Frequency:	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			5 MHz standard (other frequencies available)	
Output:	>1 vrms into 500 ohms Logic or 50Ω output opt.	>1 vrms into 50 ohms Logic output optional	>1 vrms into 500 ohms Logic or 50Ω output opt.	>1 vrms into 50 ohms Logic output optional	
Temperature:	0/50°C: <±5×10^{-8} "—1" OPTION 0/+50°C: <±1×10^{-8} −20/+70°C: <±3×10^{-8}	0/+50°C: <±5×10^{-9} −20/+70°C: <±1×10^{-8}	0/+50°C: ±1×10^{-9}	0/+50°C: ±5×10^{-9} "—2" OPTION −20/+70°C: ±1×10^{-8}	0/+50°C: ±5×10^{-10} "—2" OPTION 0/+50°C: ±1×10^{-10}
	(Wider temperature range optional)			(Wider temperature range optional)	
Supply:	24 VDC standard (Operation from any voltage in a 5-32 VDC range optional)			24 VDC standard (Operation from any voltage in 15-32 VDC range optional)	
Power Drain:	6 watts at turn-on; 3 watts stabilized at 25°C (Units with reduced power drain available)		8 watts at turn-on; 4 watts stabilized (25°C)	6 watts at turn-on 3 watts stabilized (25°C)	11 watts at turn-on 5 watts stabilized (25°C)
Freq. Adjust.:	Screwdriver adjustment; electronic tuning (VCXO) optional			Screwdriver adjustment and electronic tuning standard	
Size:	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2¼" x 2¼" x 4¼" (58 x 58 x 108)	2¼" x 2¼" x 4¼" (58 x 58 x 108 mm)	3" x 3" x 5½" (77 x 77 x 140 mm)
Option "—5":	Oven and r.f. operates from 5VDC; output drives 10 TTL loads				
Option "D":	Same performance as CO-211 Series in 1½" x 1½" x 3" package				



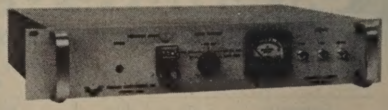
VHF

	CO-226 SERIES	CO-221 SERIES	CO-220 SERIES
Aging Rate:	**CO-226:** 1×10^{-7}/day **CO-227:** 5×10^{-8}/day **CO-228:** 3×10^{-8}/day **CO-229:** 1×10^{-8}/day	**CO-221:** 1×10^{-7}/day **CO-222:** 5×10^{-8}/day **CO-223:** 3×10^{-8}/day **CO-224:** 1×10^{-8}/day	**CO-220:** 3×10^{-9}/day **CO-220-1:** 1×10^{-9}/day (Uses Crystal below 12 MHz with internal multiplier)
Frequency:	25-200 MHz	25-400 MHz	25-200 MHz
Output:	+7 dBm/50Ω (TTL opt.)	+13 dbm/50Ω (ECL opt.)	+7 dBm/50Ω (+13 dBm opt.)
Temperature:	0-50°C: ±5×10^{-8}	0-50°C: ±5×10^{-8}	0-50°C: ±5×10^{-8}
	(higher stability and wider temperature range optional)		
Supply:	24 VDC standard	24 VDC standard	24 VDC standard
	(operation from any voltage in 15-32 VDC range optional)		
Power Drain:	6 watts at turn-on 3 watts stabilized	7 watts at turn-on 4 watts stabilized	7 watts at turn-on 4 watts stabilized
Freq. Adjust.:	Screwdriver adjust setable to 1×10^{-8} Electronic tuning (VCXO operation) optional		
Phase Noise: (Typ at 100 MHz)	−130 db/Hz 1 KHz from output	−130 db/Hz 1 KHz from output	−115 db/Hz 1 KHz from output
Size:	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)



Frequency Standards

Model:	**FS-321B**	**FS-323A**
Aging Rate:	3×10^{-10} per day at time of shipment 1×10^{-10} per day typical within 60 days "—1" OPTION 1×10^{-10} per day at time of shipment	
Frequencies:	5, 1 & 0.1 MHz	
Output Level:	1 vrms/50 ohms	
Temperature:	±5×10^{-10} over 0-50°C "—2" OPTION ±1×10^{-10} over 0-50°C	
Noise Floor:	>150 db below 5 MHz output	
Oven Control:	Double proportional	
Input Voltage:	115/230 VAC or 22-30 VDC	115/230 VAC or 22-30 VDC
Battery Life:	35 hours rechargeable	None
Size:	5¼" x 19" x 14" (13.4 x 48.3 x 35.6 cm)	3½" x 19" x 14" (8.9 x 48.3 x 35.6 cm)



About VECTRON . . .

VECTRON'S customers include virtually every major U.S. electronics manufacturer, each of the prime military and government agencies and numerous foreign users.

VECTRON oscillators are widely used for both commercial and military applications in ground, shipboard, mobile, airborne, missile and space systems.

VECTRON quality and calibration procedures are per MIL-I-45208, MIL-Q-9858A and MIL-C-45662.

VECTRON has received U.S. Government SBA Subcontractor of the Year and prime contractors Zero Defects Quality awards.

VECTRON's high volume production capability is matched with a Quick Reaction group which handles small quantity "specials" economically and expeditiously.

VECTRON's scope is solely designing and manufacturing crystal oscillators and associated instrumentation . . . specialization which assures each Vectron customer expert attention and devotion to his full and specific requirements.

NOTES

1. Many models and frequencies are available with off-the-shelf delivery.
2. When ordering a standard product, please specify model, frequency and any desired option.
3. While Vectron offers a broad line of standard products, we are equipped to handle "specials" expeditiously and economically.

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ARTRONIC INSTRUMENT COMPANY

MILITARY GRADE DELAY LINES

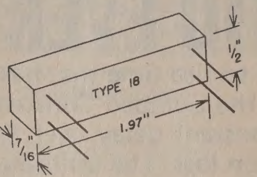
TYPE 18

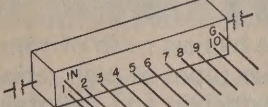
RISE TIMES

Type 18Q: 12% of delay (Table at far right)

Type 18H, 18L: 20% to 25% of delay time

Delay (μsec)	Type 18H Impedance (ohms)	Type 18L Impedance (ohms)
0.05	125	62
0.1	250	62
0.2	500	50
0.25	625	62
0.3	750	75
0.4	1000	100
0.5	1250	125
0.6	1500	150
0.7	1750	175
0.75	1875	188
0.8	2000	200
0.9	2250	225
1.0	2500	250
1.5	1875	375
2.0	2500	500
2.5	3125	625
3	1875	750
4	2500	1000
5	3125	1250
6	1500	
7	1750	
8	2000	
9	2250	
10	2500	





TYPE 18 AND TYPE 227

Delay Tolerance: 3% or 1 nsec
Thermal Coefficient of Delay: 0.005%/°C to 0.01%/°C
Test Voltage: 800 VDC
Temperature Range: −65°C to 125°C
Ordering Information: Part Numbers are given by designating first the type number and then the delay, e.g., 227-0.75. Other values of delay and impedance can also be furnished.

TYPE 227

10 Taps, equally spaced
Rise Time: 10% of total delay time
Dimensions: ½" x 3/16" x 2½" (lead face is 3/16" wide)
Leads: #22 AWG tinned solid wire, 1¼" long

Leads on end faces are spare ground leads to provide added mounting rigidity. They may be clipped off if not needed, since a third ground lead is provided on the long face.

Delay (μsec)	TYPE 18Q Impedance (ohms)	TYPE 227 Impedance (ohms)
0.01		50
0.02	50	50
0.025	50	50
0.05	50	50
0.1	100	50
0.2	100	50
0.25	100	50
0.3	200	50
0.4	200	50
0.5	200	50
0.6	200	100
0.8	200	100
1.0	200	100
1.5	500	200
2	500	200
2.5	500	250
3	1000	500
4	1000	500
5	1000	500
6	1500	1000
8	2000	1000
10	2500	1000
12	2500	1200
15	3000	1500
20	4000	2000
25		2500

OTHER STANDARD SERIES

SERIES NQ:	Untapped, 2% rise time, 3/16 x 2.1 x 6.4", 0.3 to 50 μsec.
SERIES N:	20 Taps, 4% rise time, ½ x 2 x 6.4", 0.2 to 100 μsec.
SERIES LQ:	Untapped, 4% rise time, ½ x 1.6 x 2.9", 0.2 to 20 μsec.
SERIES L:	10 Taps, 8% rise time, ½ x 1.5 x 2.9", 0.1 to 30 μsec.
SERIES W:	20 Taps, 4% rise time, 0.4 x 2.05 x 4.4", 0.2 to 60 μsec.
TYPE 228:	20-Tap 227 (22 p.c. pins ¼" long in 227 lead face).
TYPE 22:	10 Taps, 20% rise time, similar to Type 227.
TYPE 26:	10 Taps, 20% rise time, ½ x 3/16 x 1.56".
TYPE 266:	Untapped, 30% rise time, 0.38 x 0.45 x 0.7".

OTHER TYPES AND CUSTOM DESIGNS ALSO AVAILABLE

TYPE 42

20% Rise Time

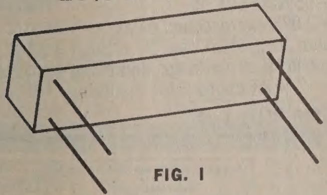


FIG. I

Dimensions: 0.3 x 0.35 x 1.4"
Delay Tolerance: ±3% ±1 nsec
Taps: Untapped
Thermal Coefficient of Delay: 0.005%/°C to 0.01%/°C
Test Voltage: 600 VDC
Temperature Range: −65°C to 125°C
Environmental: MIL-STD-202
Leads: #22 Tinned copper, 1½" long
Part Numbers: 42-T_d (μsec), e.g., 42-0.05

Total Delay (nsec)	Impedance (ohms)	Total Delay (μsec)	Impedance (ohms)
10	50	0.25	100
15	50	0.3	150
20	50	0.4	200
25	50	0.5	200
30	50	0.6	300
40	50	0.8	400
50	50	1.0	500
60	50	1.5	750
80	50	2.0	1000
100	50	2.5	1000
150	100	3.0	1250
200	100		

TYPE 56

10% Rise Time

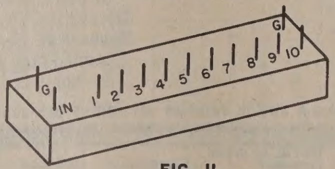


FIG. II

Dimensions: 0.35 x 0.43 x 2.5"
Delay Tolerance: ±3% ±1 nsec
Taps: 10, equally spaced
Thermal Coefficient of Delay: 0.005%/°C to 0.01%/°C
Test Voltage: 600 VDC
Temperature Range: −65°C to 125°C
Environmental: MIL-STD-202
Part Numbers: Type number followed by total delay in μsec, e.g., 56-0.08

Total Delay (nsec)	Impedance (ohms)	Total Delay (μsec)	Impedance (ohms)
10	50	0.5	200
20	50	0.6	200
25	50	0.8	200
30	50	1.0	200
40	50	1.5	500
50	50	2	500
60	50	3	500
80	50	4	1000
100	50	5	1000
200	50	6	1000
250	50	8	2000
300	50	10	2000
400	200	12	2000

TYPE 68

5% to 6% Rise Time

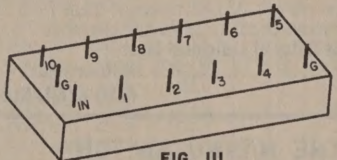


FIG. III

Dimensions: 0.4 x 0.9 x 2.9"
Delay Tolerance: ±2% ±1 nsec
Taps: 10, equally spaced (20 taps also available)
Thermal Coefficient of Delay: 0.005%/°C to 0.01%/°C
Test Voltage: 600 VDC
Temperature Range: −65°C to 125°C
Environmental: MIL-STD-202
Part Numbers: Type number followed by total delay in μsec, e.g., 68-0.02

Total Delay (nsec)	Impedance (ohms)	Total Delay (μsec)	Impedance (ohms)
20	50	1	100
30	50	1.5	200
40	100	2	200
50	50	2.5	200
60	100	3	500
80	50	4	500
100	50	5	500
200	50	6	500
250	50	8	1000
300	200	10	1000
400	200	12	1000
500	200	15	2000
600	100	20	2000
800	100	25	2000

THE ARTRONIC INSTRUMENT COMPANY

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Dept. EM, 11232 Triangle Lane, Silver Spring, Md. 20902

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
FILTERS
SECTION 2700

WRITE FOR CATALOG

SERIES "HF", "HR" & "VHR"
LUMPED CONSTANT DELAY LINES
HIGHEST $\frac{\text{TIME DELAY}}{\text{RISE TIME}}$ RATIO EVER BUILT!

These Delay Lines have the highest ratio of time delay to rise time that has ever been built in a Lumped Constant Line. Unlike other types of high ratio lines, the Lumped Constant Delay Line has a passband from D.C. to its cutoff frequency and maintains a constant delay over these frequencies. These lines are also unique in that they offer relatively low insertion loss. The units are characterized by tight time delay tolerances, low pulse distortion, excellent phase linearity and good temperature stability.

To calculate rise time in microseconds, divide the ratio into the delay. To calculate bandwidth, divide rise time in microseconds into .36. Answer will be in MHz. Attenutation range 9 to 20db.

"HF"

50/1 RATIO
Delay Range .25 to 10 microseconds.

75/1 RATIO
Delay Range .5 to 10 microseconds.

100/1 RATIO
Delay Range 1 to 10 microseconds

"HR"

100/1 RATIO
Delay Range 11 to 500 microseconds.

130/1 RATIO
Delay Range 5 to 500 microseconds.

"VHR"

150/1 RATIO
Delay Range 5 to 500 microseconds.

200/1 RATIO
Delay Range 10 to 75 microseconds.

250/1 RATIO
Delay Range 20 to 100 microseconds.

PULSE & VIDEO DELAY LINE TYPE AV-397 STOCKED

These delay lines are designed to be used with any 75 ohm system for either pulse or video delay. Although intended primarily for equalizing the delays in various lengths of coaxial cable, the line can be used wherever any delay from .025 μs. to 2.075 μs. is needed. The delay is changed by adding individual lines of various delays to give the desired total delay.

Maximum Delay: 2.075 microseconds ±3% variable in .025 microsecond steps from .025 microseconds to 2.075 microseconds.
Time Delay of Individual Lines: 1, .5, .2, .2, .1, .05, .025 microseconds.

Rise Time for Entire Line: .06 microseconds maximum.
Frequency Response: 3 db down at 5 MHz for 2.075 microseconds delay.
Distortion: 2% maximum with .2 microsecond input pulse.
Impedance: 75 ohms ±5%.
Temperature Coefficient: 50 parts/million/°C from −55°C to 105°C.
Attenuation: 7% maximum for 2.075 microsecond delay.
Mechanical: Hermetically sealed in a steel can 2" x 2½" x 5½", painted gray with black identification markings, and using 10/32 x ½ inch studs spaced on 1½" x 2" centers for mounting.

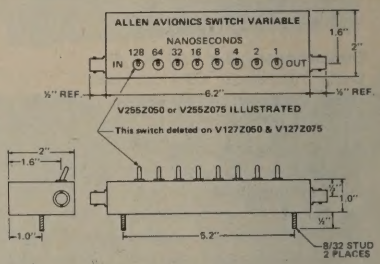
ALSO AVAILABLE: Model 75-2 — A switch variable version of the above Pulse & Video Delay Line.

"THE NANNO SWITCH"
SWITCH VARIABLE DELAY LINE

The units consist of individual delay lines each having its own switch. The time delay is changed by switching one or more individual delay lines in series with the input and output connections. The delayed output is always the summation of individual delay lines and not the result of a tapped line. This feature is an important factor in eliminating undesirable reflections in the output pulse. BNC female connectors are supplied for input and output terminations.

Part No. for 50 ohm impedance	V127Z050	V255Z050
Part No. for 75 ohm impedance	V127Z075	V255Z075
Maximum delay	127 nanosec.	255 nanosec.
Individual delay lines	1, 2, 4, 8, 16, 32, 64 nanosec.	1, 2, 4, 8, 16, 32, 64, 128 nanosec.
Rise time at maximum delay	14 nanosec.	16 nanosec.
Frequency response at maximum delay	−3 db @ 25 MHz	−3 db @ 22 MHz
Attenuation	5% maximum	8% maximum

Delay Tolerance at any Setting: 5% or 1 nanosecond, whichever is greater.
Distortion: 3% maximum with 20 nanosecond input rise time.
Temperature Coefficient: 50 parts/million/°C from −25°C to +85°C.


ALLEN AVIONICS SWITCH VARIABLE
NANOSECONDS
128 64 32 16 8 4 2 1
IN
OUT
1.6"
2"
½" REF.
6.2"
½" REF.
V255Z050 or V255Z075 ILLUSTRATED
This switch deleted on V127Z050 & V127Z075
2"
1.6"
1.0"
½"
1.0"
½"
5.2"
8/32 STUD 2 PLACES

TV LINE EQUALIZER TYPE AV-535 STOCKED

The Allen Avionic's AV-535 Equalizer is designed to compensate for losses in RG-11/U (75 ohm) cable and its equivalents. The unit is capable of equalizing 50 to 300 feet in 50 foot increments.

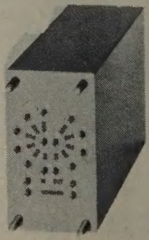
Terminals on mounting surface are so arranged to provide for simplified strapping for compensation of different cable lengths. All units are foamed and hermetically sealed in steel cans.

Size: 2 x 3½ x 5 inches (not including mounting stud length).
Mounting Centers: 1½ x 3 inches.
Stud Size: 8/32 x ½ inch long.

Impedance: 75 ohms ±2 ohms to 8 MHz.
Attenuation of Cable Plus Equalizer: 3 db.
Attenuation of equalizer alone is as shown in the following table:

Feet	0.1 MHz	2 MHz	4 MHz	8 MHz
50	2.97 db	2.86 db	2.79 db	2.67 db
100	2.93	2.68	2.53	2.27
150	2.90	2.51	2.28	1.88
200	2.86	2.35	2.03	1.52
250	2.82	2.19	1.82	1.21
300	2.78	2.02	1.58	0.86

Tolerance: ±.07 db.



OFFSET MARKING MACHINES

We manufacture a complete line of Offset Marking Machines for product identification.
They feature the LOWEST PRICES in the industry. WRITE FOR CATALOG.

ALLEN AVIONICS, INC.

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SPIRADEL®* THE MOST COMPACT

Highest Time Delay to Rise Time Ratio DISTRIBUTED DELAY LINE

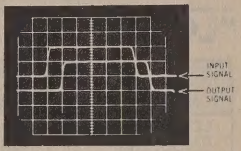
FOR IMMEDIATE DELIVERY!

SPIRADEL is a small diameter, distributed constant fixed delay line, featuring higher delay to rise time ratio and excellent pulse fidelity. Its new shape offers greater package design versatility than most other delay lines available, and the entire unit is encapsulated for maximum environmental protection.

SPIRADEL covers a delay range of 20 to 6000 nanoseconds. Any delay within this range may be selected.

Time delay to rise time ratios range up to 30 to 1. Any impedance from 50 to 1000 ohms is available. Standard delay tolerance is 5%, although tighter tolerances can be held.

SPIRADEL is designed for operation from −55°C up to +105°C. Temperature coefficient over this range is 150 parts/million/°C. Bandwidth is from DC to frequency f = .35/rise time.



TO ORDER SPECIFY PART NUMBER   STANDARD HEIGHT OF ALL UNITS: 7/16"

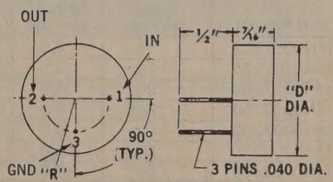
Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 50 OHMS				
SP0050Z050	50	10.0	35.0	1.60
SP0100Z050	100	13.0	26.9	2.00
SP0150Z050	150	14.0	25.0	2.50
SP0200Z050	200	16.0	21.9	2.50
SP0250Z050	250	19.0	18.4	3.25
SP0300Z050	300	21.0	16.7	3.25
SP0350Z050	350	24.0	14.5	3.25
SP0400Z050	400	27.0	12.9	3.75
SP0450Z050	450	28.0	12.5	3.75
SP0500Z050	500	29.0	12.0	3.75
IMPEDANCE 75 OHMS				
SP0025Z075	25	4.5	77.7	1.20
SP0050Z075	50	6.0	58.3	1.20
SP0100Z075	100	9.5	36.8	1.60
SP0150Z075	150	11.5	30.4	2.00
SP0200Z075	200	13.0	26.9	2.00
SP0250Z075	250	14.0	25.0	2.50
SP0300Z075	300	16.0	21.8	2.50
SP0350Z075	350	18.0	19.4	2.50
SP0400Z075	400	20.0	17.5	3.25
SP0450Z075	450	21.9	15.9	3.25
SP0500Z075	500	24.0	14.5	3.25
SP0550Z075	550	26.0	13.4	3.75
SP0600Z075	600	28.0	12.5	3.75
SP0650Z075	650	30.0	11.6	3.75
SP0700Z075	700	32.0	10.9	3.75
IMPEDANCE 100 OHMS				
SP0050Z100	50	7.3	47.9	1.20
SP0060Z100	60	7.5	46.6	1.20
SP0070Z100	70	7.7	45.4	1.20
SP0080Z100	80	8.2	42.6	1.20
SP0090Z100	90	9.1	38.4	1.20
SP0100Z100	100	10.0	35.0	1.60
SP0150Z100	150	12.5	28.0	1.60
SP0200Z100	200	14.0	25.0	2.00
SP0250Z100	250	16.0	21.8	2.00
SP0300Z100	300	18.0	19.4	2.50
SP0350Z100	350	20.0	17.5	2.50
SP0400Z100	400	22.0	15.9	2.50
SP0450Z100	450	24.5	14.2	2.50
SP0500Z100	500	27.0	12.9	3.25
SP0550Z100	550	29.5	11.8	3.25
SP0600Z100	600	31.0	11.2	3.25
SP0650Z100	650	32.5	10.7	3.25
SP0700Z100	700	34.0	10.2	3.25
SP0750Z100	750	36.0	9.7	3.75
SP0800Z100	800	38.0	9.2	3.75
SP0850Z100	850	39.5	8.8	3.75
SP0900Z100	900	41.0	8.5	3.75
SP0950Z100	950	42.5	8.3	3.75
SP1000Z100	1000	44.0	7.9	3.75

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 150 OHMS				
SP0020Z150	20	5.0	70.0	1.20
SP0030Z150	30	6.5	53.8	1.20
SP0040Z150	40	7.5	46.6	1.20
SP0050Z150	50	7.7	45.4	1.20
SP0060Z150	60	7.9	44.3	1.20
SP0070Z150	70	8.0	43.7	1.20
SP0080Z150	80	8.2	42.6	1.20
SP0090Z150	90	8.5	41.1	1.20
SP0100Z150	100	9.0	38.8	1.20
SP0150Z150	150	12.0	29.1	1.60
SP0200Z150	200	14.0	25.0	1.60
SP0250Z150	250	15.0	23.3	2.00
SP0300Z150	300	17.5	20.0	2.00
SP0350Z150	350	19.0	18.4	2.00
SP0400Z150	400	20.0	17.5	2.00
SP0450Z150	450	22.0	15.9	2.50
SP0500Z150	500	24.0	14.5	2.50
SP0550Z150	550	25.6	13.6	2.50
SP0600Z150	600	27.0	12.9	2.50
SP0650Z150	650	28.6	12.2	2.50
SP0700Z150	700	30.0	11.6	2.50
SP0750Z150	750	31.6	11.0	3.25
SP0800Z150	800	33.0	10.6	3.25
SP0850Z150	850	34.5	10.1	3.25
SP0900Z150	900	36.0	9.4	3.25
SP0950Z150	950	38.0	9.2	3.25
SP1000Z150	1000	40.0	8.7	3.25
IMPEDANCE 325 OHMS				
SP0100Z325	100	12.0	29.2	1.20
SP0150Z325	150	14.0	25.0	1.20
SP0200Z325	200	17.0	20.6	1.20
SP0250Z325	250	19.0	18.4	1.60
SP0300Z325	300	21.0	16.7	1.60
SP0350Z325	350	23.0	15.3	1.60
SP0400Z325	400	24.0	14.6	1.60
SP0450Z325	450	26.0	13.5	2.00
SP0500Z325	500	28.0	12.5	2.00
SP0550Z325	550	29.0	12.1	2.00
SP0600Z325	600	31.0	11.3	2.00
SP0650Z325	650	33.0	10.6	2.50
SP0700Z325	700	34.0	10.3	2.50
SP0750Z325	750	35.0	10.0	2.50
SP0800Z325	800	37.0	9.5	2.50
SP0850Z325	850	39.0	9.0	2.50
SP0900Z325	900	41.0	8.5	2.50
SP0950Z325	950	43.0	8.1	2.50
SP1000Z325	1000	45.0	7.8	2.50
SP1100Z325	1100	49.0	7.1	3.25
SP1200Z325	1200	52.0	6.7	3.25
SP1300Z325	1300	55.0	6.3	3.25
SP1400Z325	1400	59.0	5.9	3.25
SP1500Z325	1500	62.0	5.6	3.25

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Band-width Minimum (MHz)	Diam. Inches
IMPEDANCE 500 OHMS				
SP0300Z500	300	33.0	10.6	1.20
SP0400Z500	400	40.0	8.7	1.60
SP0500Z500	500	44.0	7.9	1.60
SP0600Z500	600	50.0	7.0	1.60
SP0700Z500	700	55.0	6.3	2.00
SP0800Z500	800	57.0	6.1	2.00
SP0900Z500	900	60.0	5.8	2.00
SP1000Z500	1000	66.0	5.3	2.00
SP1500Z500	1500	87.0	4.0	2.50
SP2000Z500	2000	110.0	3.1	2.50
SP2500Z500	2500	120.0	2.9	3.25
SP3000Z500	3000	137.0	2.5	3.25
SP3500Z500	3500	154.0	2.2	3.25
SP4000Z500	4000	165.0	2.1	3.25
IMPEDANCE 600 OHMS				
SP0400Z600	400	46.0	7.6	1.20
SP0500Z600	500	48.0	7.2	1.60
SP0600Z600	600	54.0	6.4	1.60
SP0700Z600	700	58.0	6.0	1.60
SP0800Z600	800	60.0	5.8	1.60
SP0900Z600	900	65.0	5.3	2.00
SP1000Z600	1000	70.0	5.0	2.00
SP1500Z600	1500	85.0	4.1	2.50
SP2000Z600	2000	100.0	3.5	2.50
SP2500Z600	2500	115.0	3.0	2.50
SP3000Z600	3000	125.0	2.8	3.25
SP3500Z600	3500	140.0	2.5	3.25
SP4000Z600	4000	150.0	2.3	3.25
SP4500Z600	4500	165.0	2.1	3.75
SP5000Z600	5000	170.0	2.0	3.75
SP5500Z600	5500	185.0	1.8	3.75
SP6000Z600	6000	200.0	1.7	3.75
IMPEDANCE 1000 OHMS				
SP0500Z01K	500	58.0	6.0	1.20
SP0600Z01K	600	63.0	5.5	1.20
SP0700Z01K	700	72.0	4.8	1.20
SP0800Z01K	800	80.0	4.3	1.20
SP0900Z01K	900	87.0	4.0	1.60
SP1000Z01K	1000	95.0	3.6	1.60
SP1500Z01K	1500	116.0	3.0	1.60
SP2000Z01K	2000	126.0	2.7	2.00
SP2500Z01K	2500	147.0	2.3	2.00
SP3000Z01K	3000	158.0	2.2	2.00
SP3500Z01K	3500	182.0	1.9	2.50
SP4000Z01K	4000	203.0	1.7	2.50
SP4500Z01K	4500	220.0	1.5	2.50
SP5000Z01K	5000	240.0	1.4	3.25

"TAPPED" UNITS AVAILABLE IN IMPEDANCES FROM 50 TO 325 OHMS INCLUSIVE. CALL OR WRITE FOR COMPLETE CATALOG.

"D"	"R"
1.20"	.400"
1.60"	.600"
2.00"	.800"
2.50"	1.050"
3.25"	1.425"
3.75"	1.675"



*Patented and patents applied for.

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NEW

THE ULTIMATE IN MINIATURIZATION

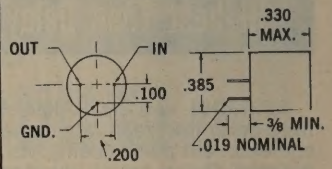
Lumped Constant, completely passive, delay lines housed in a commercial T05 package (.385 dia. x .330 high). Designed for compatibility with semiconductor and logic assemblies where space and good performance are prime considerations. Stocked in delays from 10 to 100 nanoseconds.

Delay Tolerance: ±5%.

Working Voltage: 50 volts DC.

Temp. Coefficient Over 0 to 80°C: 100 parts/million/°C.

Part No.	Time Delay (Nano-seconds)	Rise Time Max. (Nano-seconds)	Band-width (MHz)	Impe-dance (Ohms)	Atten-uation (%)
T010	10	3	120.0	100	4
T020	20	4	90.0	100	5
T030	30	6	60.0	100	6
T040	40	8	45.0	100	7
T050	50	10	36.0	100	8
T060	60	12	30.0	50	8
T070	70	14	25.7	50	9
T080	80	16	22.5	50	10
T090	90	18	20.0	50	11
T01C	100	20	18.0	50	12



"LC DIP" DUAL-IN-LINE 14 PIN TAPPED LUMPED CONSTANT DELAY LINE

TO ORDER SPECIFY PART NUMBER

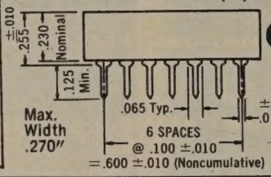
Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Bandwidth (MHz)	Impedance (Ohms)	Maximum Attenua-tion (%)	Refer to Drawing
LC010Z100B	10	2.5	144.0	100	4	1
LC020Z100A	20	4.0	90.0	100	5	1
LC025Z100A	25	5.0	72.0	100	5	1
LC030Z100A	30	6.0	60.0	100	6	1
LC040Z100A	40	8.0	45.0	100	7	1
LC050Z100A	50	10.0	36.0	100	8	1
LC100Z100A	100	20.0	18.0	100	12	1
LC150Z100A	150	30.0	12.0	100	15	1
LC200Z100A	200	40.0	9.0	100	23	1
LC250Z100A	250	50.0	7.2	100	30	1
LCL250Z050A	250	50.0	7.2	50	35	2
LCL500Z100A	500	100.0	3.6	100	35	2
LCL500Z050A	500	100.0	3.6	50	40	2
LCL750Z050A	750	150.0	2.4	50	40	2
LCL01KZ050A	1000	200.0	1.8	50	45	2

THE "LC DIP" offers the ultimate in high density packaging and tapping capabilities. These units are excellent for high frequency applications. The availability of 10 equal delay increments and the dual-in-line packaging along with its low silhouette make for compatibility with semiconductor and other assemblies where circuit board height must be held to a minimum. This makes the "LC DIP" extremely adaptable for the computer and allied industries.

Delay Tolerance:
±5% or 4 ns (whichever is greater) for delays of 250 ns or less.
±5% or 20 ns (whichever is greater) for delays of over 250 ns.

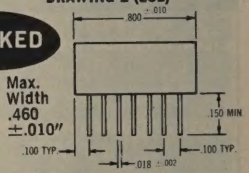
Working Voltage: 50 volts DC. **Construction:** Epoxy encapsulated.

DRAWING 1 (LC)



STOCKED

DRAWING 2 (LCL)



NOW AVAILABLE – A COMPLETE SERIES OF 20 TAPPED LUMPED CONSTANT 24 PIN DUAL-IN-LINE DELAY LINES

Available in delays from 10 nanoseconds to 1 microsecond, offering time delay to rise time ratios of 10 to 1.

DUAL-IN-LINE "MIDI" SPIRADEL®*

THE WORLD'S LOWEST COST DELAY LINE HAVING TIME DELAY TO RISE TIME GREATER THAN 5/1

"MIDI" SPIRADEL offers the same excellent pulse fidelity and phase linearity as the Standard Spiradel. Its low silhouette and dual-in-line mounting permit packaging with semiconductor and comparable components. In high volume use, the unit's low cost is competitive with all types of active devices with no sacrifice in stability and reliability. While units listed are standard-stocked, other delays and impedances are available on special order. Standard Delay Tolerance 10%. (5% on special order.)

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)
IMPEDANCE 100 OHMS Maximum Attenuation 5%			
MD005Z100	5	2.0	180.0
MD010Z100	10	2.5	144.0
MD015Z100	15	3.0	120.0
MD020Z100	20	4.0	90.0
MD025Z100	25	5.0	72.0
MD030Z100	30	6.0	60.0
MD040Z100	40	7.5	48.0
MD050Z100	50	9.0	40.0
IMPEDANCE 175 Ohms Maximum Attenuation 8%			
MD060Z175	60	11.0	32.7
MD070Z175	70	12.0	30.0
MD080Z175	80	13.0	27.7
MD090Z175	90	14.0	25.7
MD100Z175	100	15.0	24.0

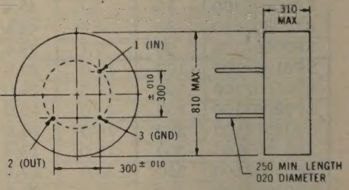
Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds) Maximum	Bandwidth Minimum (MHz)
IMPEDANCE 500 OHMS Maximum Attenuation 20%			
MD125Z500	125	25.0	14.4
MD150Z500	150	29.0	12.1
MD175Z500	175	32.0	11.3
MD200Z500	200	35.0	10.3
MD250Z500	250	40.0	9.0
IMPEDANCE 1000 OHMS Maximum Attenuation 20%			
MD300Z01K	300	60.0	6.0
MD350Z01K	350	67.0	5.4
MD400Z01K	400	74.0	4.9
MD450Z01K	450	78.0	4.6
MD500Z01K	500	81.0	4.4
MD550Z01K	550	83.0	4.3
MD600Z01K	600	85.0	4.2

TO ORDER SPECIFY PART NUMBER

STOCKED

Epoxy Encapsulated.
Temperature Coefficient:
Less than 200 PPM/°C from −55°C to +105°C.

ALLEN AVIONICS
400NS



DUAL-IN-LINE "MINI" SPIRADEL®* FOR IMMEDIATE DELIVERY!

STOCKED

*Patented and patents applied for.

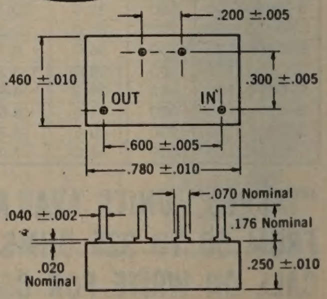
EXCELLENT PULSE FIDELITY • FLAT DELAY OVER WIDE FREQUENCY RANGE

Operation from −55°C up to +105°C. Units exhibit a change of less than 175 parts/million/°C over this temperature range. Dual-in-line mounting. Compatible with integrated circuits. Maximum attenuation for all delays: 7%.

TO ORDER SPECIFY PART NUMBER

Part Number	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN005Z125	5	2.0	125
MN010Z125	10	2.5	125
MN020Z200	20	4.0	200
MN030Z250	30	6.0	250
MN040Z300	40	8.0	300
MN050Z350	50	10.0	350
MN060Z400	60	12.0	400

Part No.	Time Delay (Nano-seconds)	Rise Time (Nano-seconds)	Impedance (Ohms)
MN070Z400	70	14.0	400
MN080Z475	80	16.0	475
MN090Z500	90	18.0	500
MN100Z500	100	20.0	500
MN125Z500	125	25.0	500
MN150Z01K	150	30.0	1000
MN175Z01K	175	35.0	1000
MN200Z01K	200	40.0	1000



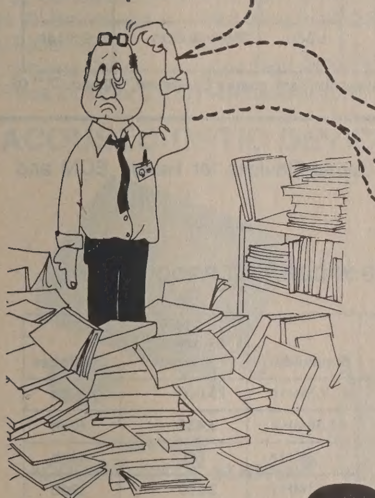
STANDARD DELAY TOLERANCE 10% (5% ON SPECIAL ORDERS)

Add Dept. EM to address to tell them you saw it in eem

What can I use to keep all the manufacturers' product data I receive in order?

What system makes filing or retrieving manufacturers' catalogs fast and easy?

Which file system have thousands of engineers purchased because they know it works?



eem FILE SYSTEM

THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

Here's how to order your eem FILE SYSTEM:

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

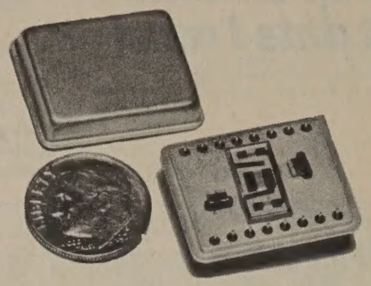
United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. • 645 Stewart Ave., Garden City, N.Y. 11530

SAW BANDPASS FILTERS .... For Satelite Communications, CATV/TV, Microwave Communications, Radar, ECM. Featuring linear phase, high rejection, low shape factor, compact size, stability, low cost.

BP150-3 SAW FILTER



Andersen's engineering staff provides quick turn around on custom designs in the 10 to 400 MHZ range. Andersen's production staff is facilitated for high volume manufacture.

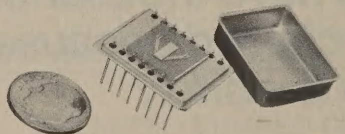
TYPICAL FILTERS IN CURRENT PRODUCTION

Small Quantities Available Stock to 30 Days.

Model	Center Frequency	Bandwidth	Amplitude Ripple	Bandwidth At Ultimate Rejection	Phase Linearity
BP22-4**	21.9MHz	400KHz@1db 550KHz@3db	±.2db	1MHz@35db	±3°@1db
VSB-1*	43.88MHz	5.25MHz@1db	±.3db	7.25MHz@45db	±4°@1db
BP66-4**	65.76MHz	400KHz@1db 550KHz@3db	±.2db	1.1MHz@45db	±1°db ±2°@3db
BP70-2**	70MHz	2MHz@1db 2.25MHz@3db	±.5db	3.5MHz@45db	±4°@1db
BP70-10*	70.7MHz	10MHz@1db 11.5MHz@3db	±.3db	15.5MHz@50db	±4°@3db
BP148-.3**	148MHz	300KHz@1db 500KHz@3db	±.5db	1.4MHz@40db	±3°@1db
BP150-3**	150MHz	3MHz@.5db 4.2MHz@3db	±.3db	8MHz@32db	±2@1db

Typical Insertion Loss 20db. Mil Spec Versions Available. Temperature Coefficient, *90 ppm/C°** 03 ppm/C°² Ref, 25°C.

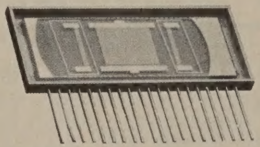
MATCHED FILTERS .... Dispersive Delay Lines and Phase Coded Devices for Radar, ECM and Communications Signal Processing.



DISPERSIVE DELAY LINES IN CURRENT PRODUCTION

Model	Type	Center Frequency	Bandwidth	Time Bandwidth Product	Sidelobes
DI 7.5-25000	IMCON	7.5MHz	2.5MHz	25,000	30db
DI 7.8-3432	IMCON	7.8MHz	1.56MHz	3,432	40db
DI 15-600	IMCON	15MHz	6MHz	600	48db
DI 22-2200	IMCON	22MHz	11MHz	2,200	39db
DS 30-250	SAW	30MHz	5MHz	250	30db
DS 60-2000	SAW	60MHz	20MHz	2,000	30db
DS 91-6500	SAW	91MHz	19MHz	650	30db
DS 240-80	SAW	240MHz	67MHz	80	30db
DS 250-256	SAW	250MHz	80MHz	256	30db

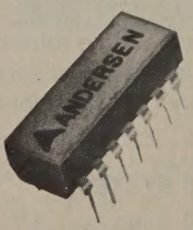
PHASE CODED DEVICES



Center frequency to 200 MHz
Bandwidth to 50 MHz
Number of chips to 127
Any specified biphase or quadriphase code

DELAY LINES .... For Commercial and Military Applications.

MINIATURE DIP

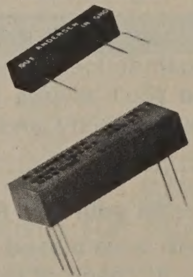


Pins 14 to 16

Delay/rise time
4 to 7
Delay 5 to 1000ns

Taps 10% of total delay

DISTRIBUTED

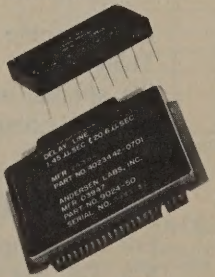


Bandwidth to 50 MHz

Delay 10ns to 1000ns

Taps Available

LUMPED CONSTANT



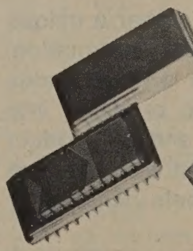
Bandwidths to 50 MHz

Delay 10ns to 3us

Taps available

Electrically variable delay available

SAW

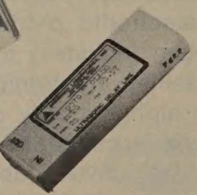


Frequency 10 MHz to 500 MHz
Bandwith to 200 MHz

Delay 100ns to 50us

Up to 60 taps

GLASS

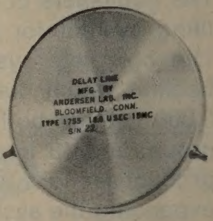


Frequency 5 to 60 MHz

Bandwidth to 30 MHz

Delay 2 to 250us

QUARTZ



Frequency 5 to 100 MHz
Bandwidth to 50 MHz
Delay 1us to 4.8ms

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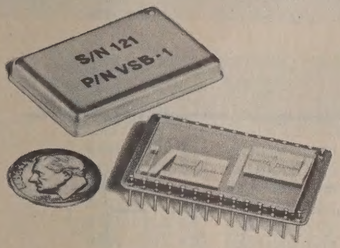
VIDEO PRODUCTS

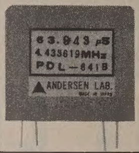
.... Luminance and Chrominance Delay Lines, Lowpass and Bandpass Filters, SAW Vestigial Sideband Filters and 1H glass delay lines for receivers, VTR's, video disc systems, cameras, exciters, and modulators.

SAW VESTIGAL SIDEBAND FILTER



Video Carrier	45.75 MHz
1 db Bandwidth	41.2 MHz to 46.5 MHz
45 db Bandwidth	39.8 MHz to 47.2 MHz
K-Factor (2T)	2%
Envelope Delay	25ns Max. (12.5T)

Filters for other TV standards available.



Luminance Distributed and LC Delay Lines

Delay 0.5 to 0.8us
Bandwidths to 4.5 MHz
Risetime 0.2 to 0.3usec

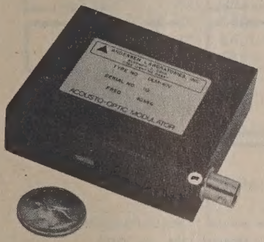
1H-DELAY LINES IN CURRENT PRODUCTION

Part No.	PDL 631 B. D. E	PDL 631F	PDL 631M	PDL 641 B. D. E	PDL 641F	*VD-1
Center frequency, MHz	3.579545	3.579545	3.575611	4.433619	4.433619	27
Delay, usec (+.005)	63.556	63.556	63.485	63.943	63.943	63.555 +10ns
-3 db min. Bandpass. MHz	2.83-4.33	2.83-4.33	2.7-4.4	3.4-5.2	3.4-5.2	14
Insertion loss, db (+3)	8	12	8	8	12	30
Max. delay drift, nsec (+20° C to + 50° C)	5	5	5	5	5	15
Triple travel, db	≥ 22	≥ 26	≥ 22	≥ 22	≥ 26	≥ 50
Other spurious, db	≥ 30	≥ 26	≥ 26	≥ 30	≥ 26	≥ 50
Operating temperature range	-20° C to +70° C	-20° C to +70° C	-20° C to +70° C	-20° C to +70° C	-20° C to +70° C	0 to 50° C

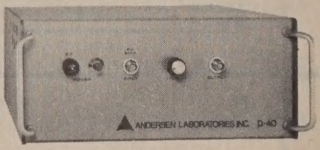
*Available ½H, 1H or 2H

ACOUSTO-OPTIC DEVICES

.... Modulators, beam deflectors, Q-Switches, Modelockers for laser recording, facsimile, non-impact printing, communications, and industrial application.



DLM-40V
ACOUSTO-OPTIC ELEMENT



D-40 DRIVER

ACOUSTO-OPTIC MODULATORS IN CURRENT PRODUCTION

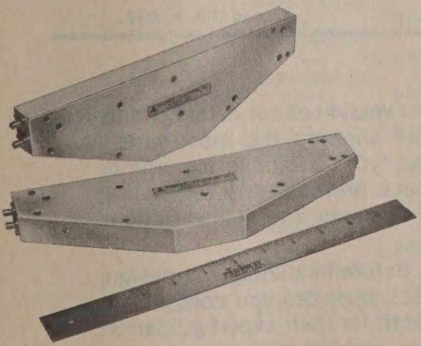
	DLM-40V	DLM-40-IR	DLM-80V	DLM-80-UV
Operating wave-length range	440-700nm	1060-1150nm	440-700nm	300-400nm
Optical trans-mission min.	96%	95%	96%	97%
Laser Polarization	random	random	random	linear-vertical
Active aperture height	2mm	1mm	.5mm	1.5mm
Acoustic center frequency	40MHz	40MHz	80MHz	80MHz
Rise time (10%-90%)	50ns	50ns	25ns	25ns
Modulation bandwidth (—3db point)	7MHz	7MHz	14MHz	14MHz
1st order deflection efficiency min.	85%	85%	85%	85%
Contrast ratio min.	1000 to 1	1000 to 1	1000 to 1	1000 to 1
RF drive power max.	2 watts	3.5 watts	2 watts	2 watts
Driver	D-40	D-40	D-80	D-80

Beam Deflectors wave length 325 to 1064 nm resolvable spots 1 to 300 acess times 300ns to 10 usec.

Q-Switches and Mode Locks for most commercial YAG lasers

SIGNAL PROCESSING SUB-SYSTEMS

.... For radar, ECM, communications, and laser recording.



PULSE COMPRESSION RECEIVERS

PULSE EXPANSION–COMPRESSION EQUIPMENT: complete sub-systems including dispersive delay lines and all necessary electronics to perform pulse expansion, pulse compression, and sidelobe suppression.

UNITY GAIN DELAY CHANNELS: complete sub-systems containing dispersive or non-dispersive delay lines with electronics as needed to satisfy specified gain, amplitude and phase requirements.

UNITY GAIN VIDEO DELAY MODULES: containing the modulation drive and recovery circuity necessary to pass base-band NTSC, SECAM and PAL video with outstanding fidelity. Available in 1H, 2H, 1/2H or custom delay time configurations. For dropout compensators, vertical aperture correctors, comb filters, video disc systems.

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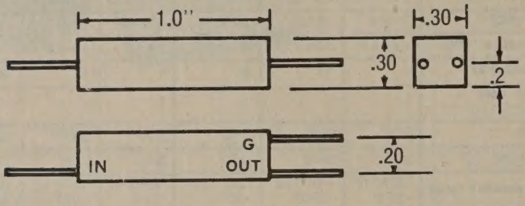
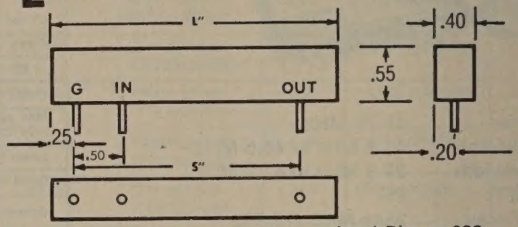
DELAY LINES

A


1.0"
.30
.30
.2
G
IN
OUT
.20

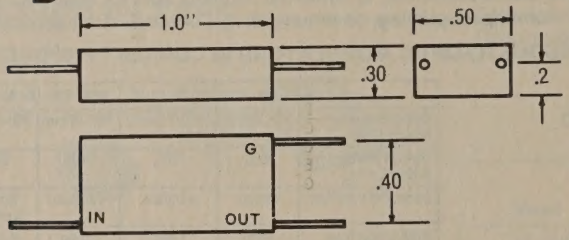
Lead Dia. = .032

E


L"
.40
.55
G
IN
OUT
.25
.50
S"
.20

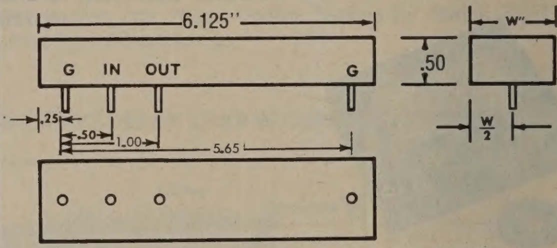
Lead Dia. = .032

B


1.0"
.50
.30
.2
G
.40
IN
OUT

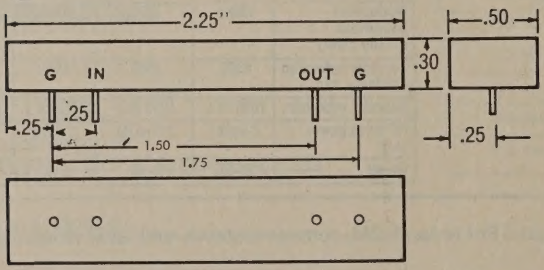
Lead Dia. = .032

F


6.125"
W"
G
IN
OUT
G
.50
.25
.50
1.00
5.65
W/2

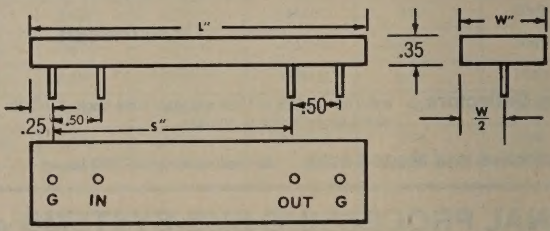
Lead Dia. = .032

C


2.25"
.50
.30
G
IN
OUT
G
.25
.25
.25
1.50
1.75

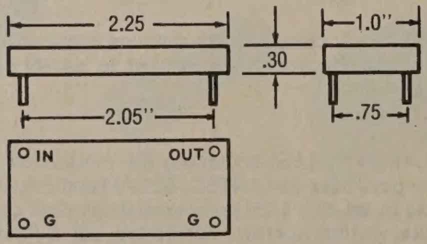
Lead Dia. = .032

G


L"
W"
.35
.25
.50
S"
.50
W/2
G
IN
OUT
G

Lead Dia. = .032

D


2.25
.30
1.0"
2.05"
.75
IN
OUT
G
G

Lead Dia. = .032

The condensed version of our catalog items are listed here showing the most widely used sizes and types available for prompt shipment. Space prohibits the full listing of the many specials and the variations available.

CAUTION: Before finalizing your design, it is highly recommended you contact our Engineering Staff for their expert guidance, founded on our vast experience and up-to-date technology — a phone call can save you valuable time and money.

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NANOSECONDS

Part Number — Impedance ±10%				DELAY TIME ±5% nsec	RISE TIME nsec 93Ω	CON-FIGU-RATION	LEAD SPACING "S" INCHES	LENGTH "L" INCHES	WIDTH "W" INCHES
93Ω	200Ω	500Ω	1000Ω						
0420-0001-93	0420-0001-02	0420-0001-05	0420-0001-10	1	4.0	A	—	1.0	.3
0420-0002-93	0420-0002-02	0420-0002-05	0420-0002-10	2	4.0	A	—	1.0	.3
0420-0003-93	0420-0003-02	0420-0003-05	0420-0003-10	3	4.0	A	—	1.0	.3
0420-0004-93	0420-0004-02	0420-0004-05	0420-0004-10	4	4.0	A	—	1.0	.3
0420-0005-93	0420-0005-02	0420-0005-05	0420-0005-10	5	4.0	A	—	1.0	.3
0420-0010-93	0420-0010-02	0420-0010-05	0420-0010-10	10	4.0	A	—	1.0	.3
0420-0015-93	0420-0015-02	0420-0015-05	0420-0015-10	15	4.0	B	—	1.0	.5
0420-0020-93	0420-0020-02	0420-0020-05	0420-0020-10	20	4.0	B	—	1.0	.5
0420-0025-93	0420-0025-02	0420-0025-05	0420-0025-10	25	5.0	C	—	2.25	.5
0420-0030-93	0420-0030-02	0420-0030-05	0420-0030-10	30	6.0	C	—	2.25	.5
0420-0035-93	0420-0035-02	0420-0035-05	0420-0035-10	35	7.0	C	—	2.25	.5
0420-0040-93	0420-0040-02	0420-0040-05	0420-0040-10	40	8.0	C	—	2.25	.5
0420-0045-93	0420-0045-02	0420-0045-05	0420-0045-10	45	9.0	C	—	2.25	.5
0420-0050-93	0420-0050-02	0420-0050-05	0420-0050-10	50	9.0	C	—	2.25	.5
0420-0055-93	0420-0055-02	0420-0055-05	0420-0055-10	55	10.0	D	—	2.25	1.0
0420-0060-93	0420-0060-02	0420-0060-05	0420-0060-10	60	10.0	D	—	2.25	1.0
0420-0065-93	0420-0065-02	0420-0065-05	0420-0065-10	65	11.0	D	—	2.25	1.0
0420-0070-93	0420-0070-02	0420-0070-05	0420-0070-10	70	12.0	D	—	2.25	1.0
0420-0075-93	0420-0075-02	0420-0075-05	0420-0075-10	75	12.0	D	—	2.25	1.0
0420-0080-93	0420-0080-02	0420-0080-05	0420-0080-10	80	13.0	D	—	2.25	1.0
0420-0085-93	0420-0085-02	0420-0085-05	0420-0085-10	85	13.0	D	—	2.25	1.0
0420-0090-93	0420-0090-02	0420-0090-05	0420-0090-10	90	14.0	D	—	2.25	1.0
0420-0095-93	0420-0095-02	0420-0095-05	0420-0095-10	95	14.0	D	—	2.25	1.0
0420-0100-93	0420-0100-02	0420-0100-05	0420-0100-10	100	15.0	D	—	2.25	1.0
0420-0125-93	—	—	—	125	15.0	G	2	3.00	.75
—	0420-0125-02	—	—	125	18.0	G	2.8	3.8	.625
—	—	0420-0125-05	0420-0125-10	125	30.0	E	1.20	1.8	.4
0420-0150-93	—	—	—	150	15.0	G	2	3.0	1.0
—	0420-0150-02	—	—	150	20.0	G	2.8	3.8	.625
—	—	0420-0150-05	0420-0150-10	150	27.0	E	1.20	1.8	.4
0420-0175-93	—	—	—	175	20.0	G	2	3.0	1.0
—	0420-0175-02	—	—	175	20.0	G	2.8	3.8	.625
—	—	0420-0175-05	0420-0175-10	175	30.0	E	1.20	1.8	.4
0420-0200-93	—	—	—	200	20.0	G	2	3.0	1.0
—	0420-0200-02	—	—	200	20.0	G	2.8	3.8	.625
—	—	0420-0200-05	0420-0200-10	200	35.0	E	1.20	1.8	.4
0420-0250-93	—	—	—	250	32.0	G	2	3.0	1.0
—	0420-0250-02	—	—	250	35.0	G	2.8	3.8	.625
—	—	0420-0250-05	0420-0250-10	250	40.0	E	1.20	1.8	.4
0420-0300-93	—	—	—	300	40.0	G	5.125	6.125	1.5
—	0420-0300-02	—	—	300	40.0	G	2.8	3.8	.925
—	—	0420-0300-05	0420-0300-10	300	45.0	E	2.20	3.0	.4
0420-0400-93	—	—	—	400	45.0	G	5.125	6.125	1.5
—	0420-0400-02	—	—	400	45.0	G	2.8	3.8	.925
—	—	0420-0400-05	0420-0400-10	400	55.0	E	2.20	3.0	.4
0420-0500-93	—	—	—	500	65.0	G	5.125	6.125	1.5
—	0420-0500-02	—	—	500	65.0	G	2.8	3.8	.925
—	—	0420-0500-05	0420-0500-10	500	70.0	E	2.20	3.0	.4
—	0420-0600-02	—	—	600	75.0	G	2.8	3.8	1.5
—	—	0420-0600-05	0420-0600-10	600	75.0	E	2.20	3.9	.4
—	0420-0700-02	—	—	700	85.0	G	5.125	6.125	.8
—	—	0420-0700-05	0420-0700-10	700	85.0	E	2.20	3.9	.4
—	0420-0800-02	—	—	800	85.0	G	5.125	6.125	.8
—	—	0420-0800-05	0420-0800-10	800	95.0	E	3.40	4.25	.4
—	0420-0900-02	—	—	900	95.0	G	5.125	6.125	.8
—	—	0420-0900-05	0420-0900-10	900	100.0	E	4.40	5.25	.4
—	0420-1000-02	—	—	1000	110.0	G	5.125	6.125	.8
—	—	0420-1000-05	0420-1000-10	1000	110.0	E	4.40	5.25	.4
—	0420-1500-02	—	—	1500	150.0	F	—	6.125	2.0
—	—	0420-1500-05	0420-1500-10	1500	150.0	F	—	6.125	.8
—	0420-2000-02	—	—	2000	200.0	F	—	6.125	2.0
—	—	0420-2000-05	0420-2000-10	2000	200.0	F	—	6.125	.8
—	0420-2500-02	—	—	2500	250.0	F	—	6.125	2.0
—	—	0420-2500-05	0420-2500-10	2500	250.0	F	—	6.125	.8
—	0420-3000-02	—	—	3000	300.0	F	—	6.125	2.0
—	—	0420-3000-05	0420-3000-10	3000	300.0	F	—	6.125	1.2
—	0420-3500-02	—	—	3500	350.0	F	—	6.125	3.0
—	—	0420-3500-05	0420-3500-10	3500	350.0	F	—	6.125	1.2
—	0420-4000-02	—	—	4000	400.0	F	—	6.125	3.0
—	—	0420-4000-05	0420-4000-10	4000	400.0	F	—	6.125	2.0
—	0420-4500-02	—	—	4500	450.0	F	—	6.125	3.0
—	—	0420-4500-05	0420-4500-10	4500	450.0	F	—	6.125	2.0
—	0420-5000-02	—	—	5000	500.0	F	—	6.125	3.0
—	—	0420-5000-05	0420-5000-10	5000	500.0	F	—	6.125	2.0

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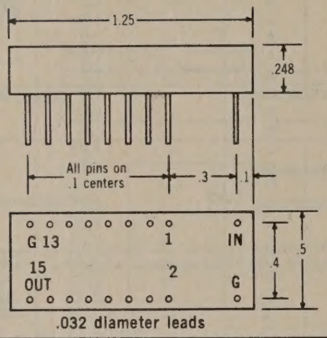
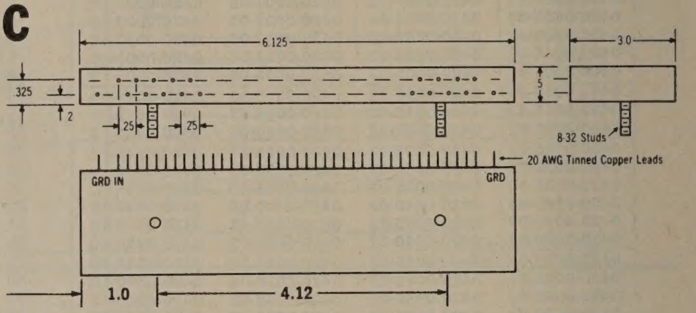
TAPPED DELAY LINES

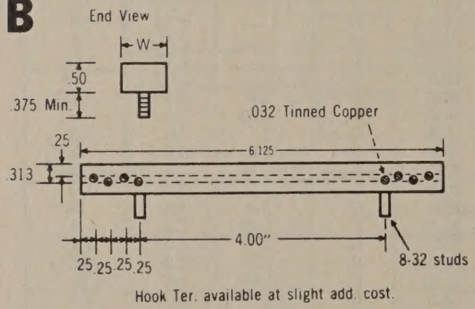
A


1.25
.248
All pins on .1 centers
.3
.1
G 13
1
IN
15 OUT
2
G
.4
.5
.032 diameter leads

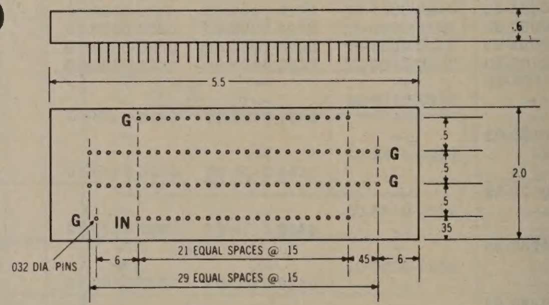
C


6.125
3.0
.325
.2
.5
.25
.25
8-32 Studs
20 AWG Tinned Copper Leads
GRD IN
GRD
1.0
4.12

B


End View
W
.50
.375 Min.
.032 Tinned Copper
.25
6.125
.313
4.00"
.25 .25 .25 .25
8-32 studs
Hook Ter. available at slight add. cost.

D


.6
5.5
G
G
G
G
IN
.5
.5
.5
.35
2.0
.032 DIA. PINS
.6
21 EQUAL SPACES @ .15
.45
.6
29 EQUAL SPACES @ .15

Part No.	Delay nsec	Tr nsec	No. of Taps	Delay/Tap nsec	Impedance	Width "	Style
0414-0155-01	15	5	15	1	100 Ω	½	A
0414-0155-02	15	5	15	1	200 Ω	½	A
0414-0155-03	15	5	15	1	500 Ω	½	A
0414-0131-01	100	15	20	5	500 Ω	.8	B
0414-0447-01	200	25	20	10	500 Ω	.8	B
0414-0448-01	300	35	20	15	500 Ω	.8	B
0414-0449-01	400	45	20	20	500 Ω	.8	B
0414-0131-02	500	55	20	25	500 Ω	.8	B
0414-0450-01	600	60	20	30	500 Ω	.8	B
0414-0451-01	700	70	20	35	500 Ω	.8	B
0414-0452-01	800	80	20	40	500 Ω	.8	B
0414-0453-01	900	90	20	45	500 Ω	.8	B
0414-0131-03	1000	100	20	50	500 Ω	.8	B
0404-0454-01	1000	30	100	10	100 Ω	2.0	D
0414-0455-01	2000	200	20	100	500 Ω	.8	B
0404-0456-01	3000	300	20	150	500 Ω	.8	B
0404-0457-01	4000	400	20	200	500 Ω	.8	B
0404-0458-01	5000	500	20	250	500 Ω	.8	B
0404-0459-01	7500	750	20	375	500 Ω	1.5	B
0404-0460-01	10,000	1000	20	500	500 Ω	1.5	B
0404-0461-01	12,500	750	25	500	500 Ω	3	C
0404-0462-01	15,000	900	30	500	500 Ω	3	C
0404-0463-01	17,500	1100	35	500	500 Ω	3	C
0404-0464-01	20,000	1200	40	500	500 Ω	3	C

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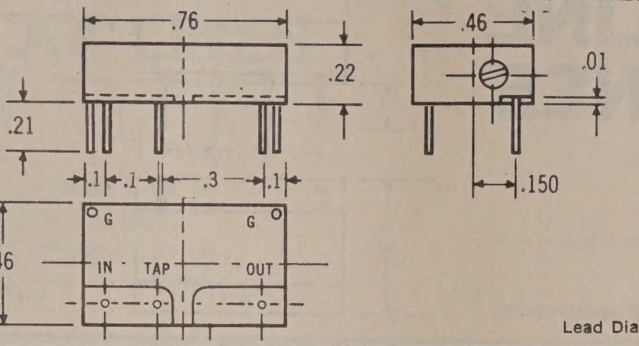
DUAL-IN-LINE VARIABLE DELAY LINES

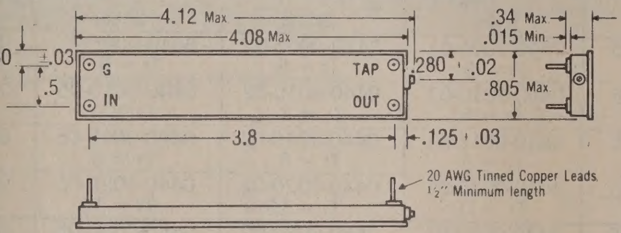
DV Series


.76
.46
.22
.01
.21
.1
.1
.3
.1
.150
.46
G
G
IN
TAP
OUT

BEL introduces the first variable delay line compatible with IC Dual-In-Line packaging featuring: • Hermetic Seal-O-Ring construction • Precious metal contacts • Resolution — MIN 2% (for high reliability performance)

Lead Dia. = .020

NV Series
PV Series

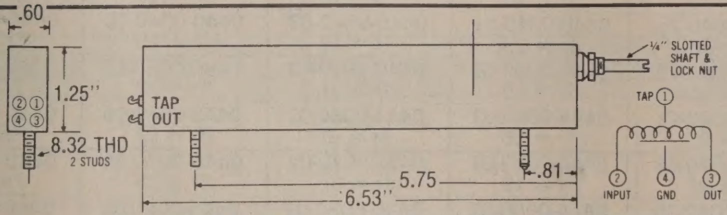

4.12 Max
4.08 Max
.34 Max
.015 Min
.150
±.03
.5
G
IN
TAP
OUT
.280
.02
.805 Max
3.8
.125
.03
20 AWG Tinned Copper Leads
½" Minimum length

VARIABLES

These precision hermetically sealed variables are available in a wide range of delays and impedances. Both may be provided with various mounting and terminal configurations to suit most applications.

NV Series in Metal Case
PV Series in Epoxy Case

CV Series
LV Series


.60
1.25"
②①
④③
8.32 THD
2 STUDS
TAP
OUT
¼" SLOTTED SHAFT & LOCK NUT
TAP ①
② INPUT
④ GND
③ OUT
5.75
.81
6.53"

VARIABLES

These precision hermetically sealed variables are available in a wide range of delays and impedances. Both may be provided with various mounting and terminal configurations to suit most applications.

Part Number	Td Range	Rise Time	Impedance ±10%	Style
0430-0040-05	0-40 nsec	15 nsec	500 Ω	NV
0430-0050-02	0-50 nsec	12 nsec	200 Ω	
0430-0150-10	0-150 nsec	55 nsec	1000 Ω	
0430-0250-05	0-250 nsec	60 nsec	500 Ω	
0430-0250-04	0-250 nsec	55 nsec	400 Ω	
0433-0040-05	0-40 nsec	10 nsec	500 Ω	PV
0433-0050-02	0-50 nsec	10 nsec	200 Ω	
0433-0150-10	0-150 nsec	45 nsec	1000 Ω	
0433-0250-05	0-250 nsec	45 nsec	500 Ω	
0433-0250-04	0-250 nsec	45 nsec	400 Ω	
0431-0450-10	0-450 nsec	70 nsec	1000 Ω	CV
0431-0500-10	0-500 nsec	75 nsec	1000 Ω	
0431-0700-05	0-700 nsec	110 nsec	500 Ω	
0431-0750-05	0-750 nsec	110 nsec	500 Ω	
0431-1000-05	0-1000 nsec	135 nsec	500 Ω	
0448-0060-50	0-60 nsec	30 nsec	50 Ω	DV
0448-0005-01	0-5 nsec	5 nsec	100 Ω	
0448-0020-02	0-20 nsec	15 nsec	200 Ω	
0448-0030-03	0-30 nsec	20 nsec	350 Ω	
0448-0040-05	0-40 nsec	25 nsec	500 Ω	
0448-0060-05	0-60 nsec	45 nsec	500 Ω	
0432-0250-01	0-250 nsec	35 nsec	100 Ω	LV

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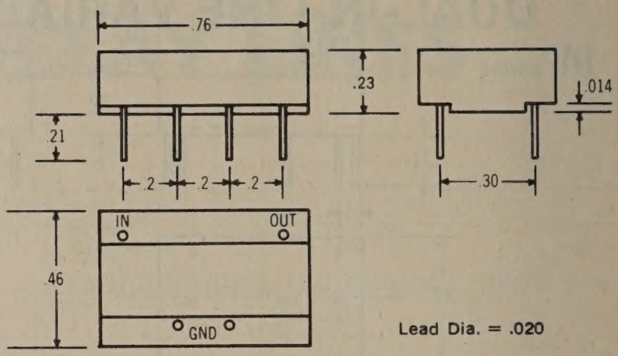
DUAL-IN-LINE DELAY LINES

- Delays from 1-1000 nanoseconds.
- Band Width to 60 mhz.
- Impedance 50 to 1000 ohms.
- Resistive Terminations if desired.
- Tapped Delay Lines available.
- Several separate lines in one case.
- Contact Bel Engineering for special applications.



Lead Dia. = .020

Time Delay nsec ±5%*	Impedance ±10%					
	50Ω	75Ω	100Ω	200Ω	500Ω	1000Ω
5	0440-0005-50 Tr = 5	0440-0005-75 Tr = 5	0440-0005-01 Tr = 5	0440-0005-02 Tr = 6	0440-0005-05 Tr = 6	0440-0005-10 Tr = 6
10	0440-0010-50 Tr = 5	0440-0010-75 Tr = 6	0440-0010-01 Tr = 6	0440-0010-02 Tr = 7	0440-0010-05 Tr = 7	0440-0010-10 Tr = 7
15	0440-0015-50 Tr = 8	0440-0015-75 Tr = 8	0440-0015-01 Tr = 8	0440-0015-02 Tr = 8	0440-0015-05 Tr = 8	0440-0015-10 Tr = 8
20	0444-0020-50 Tr = 10	0440-0020-75 Tr = 10	0440-0020-01 Tr = 10	0440-0020-02 Tr = 10	0440-0020-05 Tr = 10	0440-0020-10 Tr = 10
30	0444-0030-50 Tr = 12	0440-0030-75 Tr = 10	0440-0030-01 Tr = 10	0440-0030-02 Tr = 10	0440-0030-05 Tr = 10	0440-0030-10 Tr = 15
40	0444-0040-50 Tr = 17	0444-0040-75 Tr = 20	0440-0040-01 Tr = 13	0440-0040-02 Tr = 13	0440-0040-05 Tr = 15	0440-0040-10 Tr = 20
50	0444-0050-50 Tr = 18	0444-0050-75 Tr = 20	0440-0050-01 Tr = 15	0440-0050-02 Tr = 15	0440-0050-05 Tr = 18	0440-0050-10 Tr = 30
60	0444-0060-50 Tr = 23	0444-0060-75 Tr = 20	0444-0060-01 Tr = 18	0440-0060-02 Tr = 20	0440-0060-05 Tr = 22	0440-0060-10 Tr = 35
70	0444-0070-50 Tr = 23	0444-0070-75 Tr = 22	0444-0070-01 Tr = 19	0440-0070-02 Tr = 22	0440-0070-05 Tr = 25	0440-0070-10 Tr = 35
80	0444-0080-50 Tr = 28	0444-0080-75 Tr = 22	0444-0080-01 Tr = 19	0440-0080-02 Tr = 25	0440-0080-05 Tr = 30	0440-0080-10 Tr = 40
90	0444-0090-50 Tr = 30	0444-0090-75 Tr = 23	0444-0090-01 Tr = 20	0440-0090-02 Tr = 26	0440-0090-05 Tr = 33	0440-0090-10 Tr = 45
100	0444-0100-50 Tr = 35	0444-0100-75 Tr = 23	0444-0100-01 Tr = 20	0440-0100-02 Tr = 28	0440-0100-05 Tr = 35	0440-0100-10 Tr = 50
125	0444-0125-50 Tr = 45	0444-0125-75 Tr = 40	0444-0125-01 Tr = 22	0444-0125-02 Tr = 30	0440-0125-05 Tr = 37	0440-0125-10 Tr = 55
150	0444-0150-50 Tr = 50	0444-0150-75 Tr = 35	0444-0150-01 Tr = 27	0444-0150-02 Tr = 30	0440-0150-05 Tr = 40	0444-0150-10 Tr = 60
200	0444-0200-50 Tr = 55	0444-0200-75 Tr = 50	0444-0200-01 Tr = 37	0444-0200-02 Tr = 40	0444-0200-05 Tr = 40	0444-0200-10 Tr = 60
300			0444-0300-01 Tr = 57	0444-0300-02 Tr = 60	0444-0300-05 Tr = 55	0444-0300-10 Tr = 60
400				0444-0400-02 Tr = 60	0444-0400-05 Tr = 65	0444-0400-10 Tr = 70
500				0444-0500-02 Tr = 110	0444-0500-05 Tr = 95	0444-0500-10 Tr = 95
600				0444-0600-02 Tr = 110	0444-0600-05 Tr = 100	0444-0600-10 Tr = 125
700				0444-0700-02 Tr = 120	0444-0700-05 Tr = 110	0444-0700-10 Tr = 120
800					0444-0800-05 Tr = 120	0444-0800-10 Tr = 125
900					0444-0900-05 Tr = 135	0444-0900-10 Tr = 135
1000					0444-1000-05 Tr = 150	0444-1000-10 Tr = 150

* or 1 nsec (whichever is greater)

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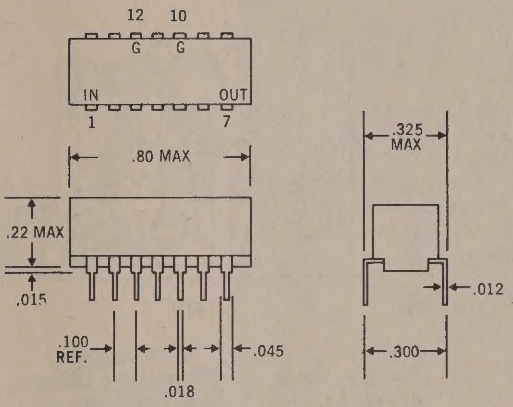
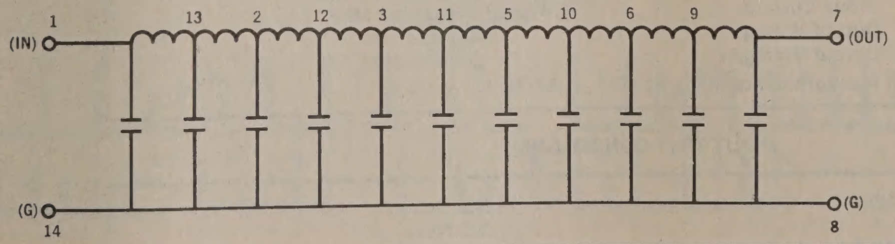
DIP DELAY LINES

- Built to conform to MIL-D-23859.
- Temperature Range −55°C to +125°C.
- Temperature Coefficient 100 ppm/°C or less.
- Will meet most stringent MIL requirements.
- Low attenuation.
- Excellent pulse fidelity.
- Compatible with TTL and other logic modes.
- Other delays available upon request.
- Contact Bel Engineering for special applications.



Time Delay nsec ±5%	Impedance ±10%					
	50Ω	75Ω	100Ω	200Ω	500Ω	1000Ω*
50	0445-0050-50 Tr = 10	0445-0050-75 Tr = 20	0445-0050-01 Tr = 10	0445-0050-02 Tr = 10	0445-0050-05 Tr = 30	0445-0050-10 Tr = 30
100	0445-0100-50 Tr = 20	0445-0100-75 Tr = 23	0445-0100-01 Tr = 20	0445-0100-02 Tr = 20	0445-0100-05 Tr = 40	0445-0100-10 Tr = 50
150	0445-0150-50 Tr = 30	0445-0150-75 Tr = 35	0445-0150-01 Tr = 25	0445-0150-02 Tr = 30	0445-0150-05 Tr = 45	0445-0150-10 Tr = 50
200	0445-0200-50 Tr = 40	0445-0200-75 Tr = 50	0445-0200-01 Tr = 35	0445-0200-02 Tr = 40	0445-0200-05 Tr = 45	0445-0200-10 Tr = 50



10 EQUALLY SPACED TAPS

CUSTOM PIN LAYOUT AVAILABLE UPON REQUEST

Total Delay nsec ±5%	Tap Delay	Distortion ± Max %	Impedance ±10%		
			50Ω	100Ω	200Ω
50	5 ±2 nsec	10	0446-0050-50 Tr = 10	0446-0050-01 Tr = 10	0446-0050-02 Tr = 10
100	10 ±3 nsec	10	0446-0100-50 Tr = 20	0446-0100-01 Tr = 20	0446-0100-02 Tr = 20
200	20 ±3 nsec	10	0446-0200-50 Tr = 40	0446-0200-01 Tr = 35	0446-0200-02 Tr = 40
250	25 ±3 nsec	10		0446-0250-01 Tr = 55	0446-0250-02 TR = 60

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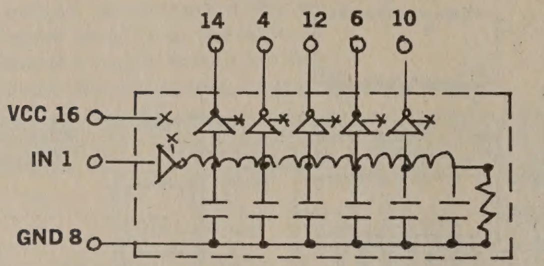
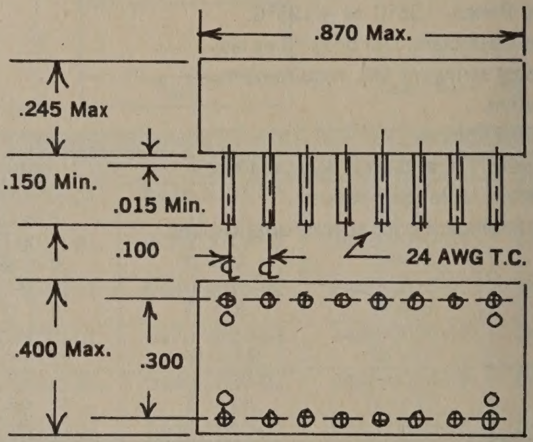
DIGITAL DELAY LINE SERIES 447

Bel Fuse Digital Delay Line Series 447 features five equally tapped delay lines with total delays of 25 to 500 nanoseconds. The lines are compatible with TTL and DTL circuits. Either Logic "1" or Logic "0" inputs are accepted. Cascading of units causes no undesirable reflections. The .870 x .400 x .260 dimensions, with standard Dip Pin-Out permits dense packaging on your circuit board. Delay tolerances for total delay is 5%. Tap tolerances are ±2nsec or 5% whichever is greater. Operating temperature is 0°-70°C. Special designs upon request.



PIN		PIN	
1	Input	6	80% Delay
14	20% Delay	10	100% Delay
4	40% Delay	8	Ground
12	60% Delay	16	Vcc



Part Number	Td (1)	Td Tap (1)	No. Taps	Tr (2)
0447-0025-01	25 Ns.	5 Ns.	5	4 Ns.
0447-0050-01	50 Ns.	10 Ns.	5	4 Ns.
0447-0100-01	100 Ns.	20 Ns.	5	4 Ns.
0447-0250-01	250 Ns.	50 Ns.	5	4 Ns.
0447-0500-01	500 Ns.	100 Ns.	5	4 Ns.

(1) Measured at 1.5 Volt Level, Leading Edge (2) Measured from 0.75V to 2.4V

Supply Voltage Vcc	4.5 to 5.5 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

All Measurements Made at VCC = 5.0 Volts @ 25°C

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Supply Current	60 ma
Pulse Width	Min. of 40% Delay

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

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The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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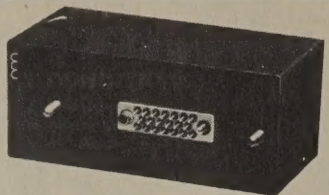
Columbia Components Delay Lines

LEADING MANUFACTURER OF

1. Video
2. Audio
3. Sonar
4. Computer
5. ATC (Air Traffic Control)
6. Video Cable Simulator
7. Millisec Delay Line
8. Programmable Adjustable Delay Line
9. Low Profile (Case height under ⅛")
10. Decade Delay Line
11. Low Temp. Coefficients Delay Lines
12. Digital Delay Line Series Compatability with TTL and DTL Circuits

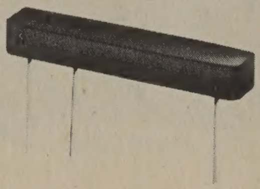
The above is only part of our design capabilities.



Q-Lines (Lumped Constant)

State-of-the-art design and packaging technology enables CCC to offer delay to rise time ratios of up to 100:1, with the smallest envelope sizes possible. Coupled with extremely low attenuation, distortion and operating temperature ranges of −55°C to +125°C make CCC Q-Lines ideal for a wide range of applications.

Write for data sheet DL-6-368

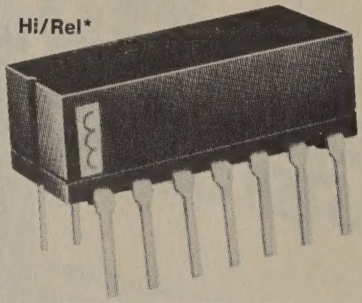


Minilines (Distributed Constant)

Economically priced delay lines featuring low profile envelopes which are ideal for printed circuit mounting and applications requiring high package density. Delays up to 2 μsec, impedances for 100 to 1,000 ohms and rise times as low as 2.5 nanoseconds are available and meet all applicable portions of MIL-D-23859A.

Write for data sheet DL-4/5-368

Hi/Rel*



DIP-TAPPED DELAY LINES

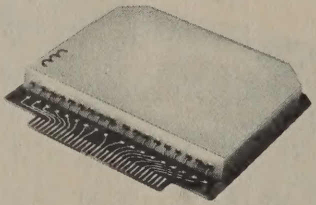
SERIES 500

- Delay: From 10 nsec to 200 nsec.
- No. Taps: 5 equally spaced taps.
- Taps Accuracy: ±5% of tap delay.
- Impedance: 50Ω, 100Ω, and 200Ω ±10%.
- Delay/Rise Time: 3/1.
- Dielectric: 50 Vdc min.
- Environment: Meets or exceeds MIL-D-23858C.
- Temperature Coefficient: 100 PPM/°C.
- Standard 14 DIP Case.

SERIES 1000

- Delay: From 10 nsec to 400 nsec.
- No. Taps: 10 equally spaced taps.
- Taps Accuracy: ±5% of tap delay.
- Impedance: 50Ω, 100Ω, and 200Ω ±10%.
- Delay/Rise Time: 5/1.
- Dielectric: 50 Vdc min.
- Environment: Meets or exceeds MIL-D-23859C.
- Temperature Coefficient: 100 PPM/°C.
- Standard 16 DIP Case.

*High Reliability: Fully MIL-SPEC quality assurance available.

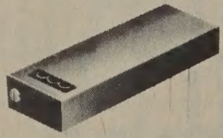


Transponder and Beacon Coder Delay Lines

Tap delay spacing of 1.45 microseconds with special tap delays designed for the various systems are available as off shelf and customer designed items. These lines have minimum volume and weight for airborne use and are normally supplied wired to printed circuit cards. These delay lines exhibit high delay accuracy and unsurpassed temperature stability — normally 10 PPM/°C.

Electrically Variable Delay Lines (E.V.D.L.)

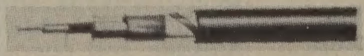
Sophisticated voltage variable devices for applications such as Aperture Phase Correction in color television signal generation. Or as a Phase Modulator where the modulating voltage is used as the device bias. CCC E.V.D.L.'s are being used at frequencies up to 50 MHz by major producers of studio broadcasting equipment.



Varilines (Mechanically Variable Delay Lines)

Columbia manufactures a wide range of precision variable delay lines encompassing delay ranges of from 0 to 20 nanoseconds, to 0 to 15 microseconds in impedance ranges of 50 to 2,000 ohms. These units can be supplied continuously variable or may be decade switched, and suitable for printed circuit applications.

Write for data sheet DL-1-368



Magnetic Core Delay Cable

Economical low-loss, high impedance delay elements for use in pulse work demanding extremely fast rise times. These delay cables can be supplied in calibrated lengths with molded-on end terminations, ready for installation or may be obtained in bulk. Delivery is usually from stock.

Write for data sheet DL-7-368

CONTACT US FOR SPECIFIC REQUIREMENTS. WE CUSTOMIZE.

COLUMBIA COMPONENTS DIVISION COMPUTER INSTRUMENTS CORP.
DEPT. EM, 100E MADISON AVENUE, HEMPSTEAD, NEW YORK 11550 / (516) 483-8200 / TWX 510-222-4189

FIXED AND TAPPED DELAY LINES

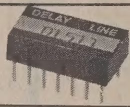
SUB-MINIATURE DUAL-IN-LINE TAPPED LUMPED CONSTANT LINES

Each line has 10 tap delays spaced at equal intervals. Attenuation less than 1 dB. Temp. Coeff. less than 50 PPM/°C. DIP configuration compatible with automatic inserting equipment. Commercial and MIL Spec. models available.

MODEL	DELAY RANGE	RISE TIME OR FREQ. RESP.	IMPEDANCE INCHES	SIZE OHMS
D1900-10	10 Nsec	2 Nsec	100	.21 x .30 x .78
D1900-20	20	3	100	.21 x .30 x .78
D1900-40	40	6	100	.21 x .30 x .78
D1900-60	60	9	100	.21 x .30 x .78
D1900-80	80	10	100	.21 x .30 x .78
D1900-100	100	20	100	.21 x .30 x .78
D8001	5	1	50	.21 x .30 x .78
D8004	10	2	100	.21 x .30 x .78
D8005	25	5	100	.21 x .30 x .78
D8007	30	6	100	.21 x .30 x .78

TAPPED DELAYS

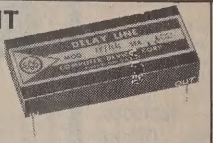
Each line provides 10 tap delays spaced at equal intervals.



D1511-1	10 Nsec	3 Nsec	100	Dual-In-Line Pin Spacing .21 x .39 x .7
D1511-2	20	6		
D1511-4	40	13		
D1511-6	60	20		
D1511-8	80	26		
D1511-10	100	33		

MINIATURE LUMPED CONSTANT

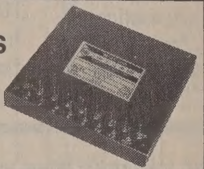
Hermetically sealed in a metal container. Delay tolerance ±5%. Temperature stability less than 50 PPM/°C, P.C. Mounting.



D647-110	50 Nsec	12 Nsec	50	.30 x 1.0 x 1.25
D647-211	100	12.5	50	.30 x 1.0 x 2.45
D647-312	250	21	50	.30 x 1.0 x 3.45
D647-323	500	42	150	.30 x 1.0 x 3.45
D647-334	750	63	500	.30 x 1.0 x 3.45
D647-115	1,000	250	50	.30 x 1.0 x 1.25
D647-236	1,450	180	500	.30 x 1.0 x 2.45
D647-327	2,900	240	150	.30 x 1.0 x 3.45
D647-338	4,350	360	500	.30 x 1.0 x 3.45

ATC TRANSPONDER AND BEACON CODING DELAY LINES

Standard 1.45 μsec tap spacings plus other special delay points are provided. Hermetically sealed steel cased, plastic encapsulated and P.C. mounted units are offered.



D1560	10.15 μsec	.33 μsec	400	.55 x 2.25 x 3.62
D1365	20.3	.5	180	.87 x 3.5 x 3.5
D1000	20.3	.5	330	.35 x 2 x 4
D120	25.0	.55	180	.75 x 5 x 4.37
D298A	25.3	.6	500	1.62 x 2.87 x 4.25
D637	20.3	.3	180	2.37 x 2.75 x 3.18
D1190	20.3	.4	400	.63 x 4 x 5
D1191	24.65	.5	500	.63 x 4 x 5
D1210	8.0	.5	500	5 x 1 x 4

VARIABLE DELAY LINES

DUAL-IN-LINE COMPATIBLE VARIABLE DELAY LINES

Sealed in plastic case. Temp. coeff. less than 50 PPM/°C. .020″ P.C. mounting pins.

V1570-1	0 - 10 Nsec	2 Nsec	100	.25 x .75 x 1.5
V1570-2	0 - 20	4	100	.25 x .75 x 1.5
V1570-3	0 - 40	8	100	.25 x .75 x 1.5
V1570-4	0 - 80	16	100	.25 x .75 x 1.5
V1570-5	0 - 160	32	200	.25 x .75 x 1.5
V1570-6	0 - 320	64	200	.25 x .75 x 1.5

MIL VERSION

Hermetically sealed in a metal case.

V1768-1	0 - 10 Nsec	2 Nsec	100	.25 x .87 x 1.6
V1768-2	0 - 20	4	100	.25 x .87 x 1.6
V1768-3	0 - 40	8	100	.25 x .87 x 1.6

MINIATURE LUMPED VARIABLE Nanosecond Range

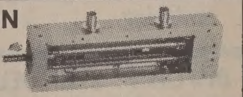
Hermetically sealed in a metal case. Lumped constant parameter. Temperature coefficient less than 50 PPM/°C. .030″ P.C. mounting pins.

DELAY LINE
MOD. V447

V447-1	0 - 55 Nsec	15 Nsec	150	.31 x 1 x 1.25
V447-2	0 - 100	30	50	.31 x 1 x 1.25
V447-3	0 - 150	25	150	.31 x 1 x 2.45
V447-4	0 - 250	30	50	.31 x 1 x 2.45
V447-5	0 - 300	30	150	.31 x 1 x 3.45
V447-6	0 - 500	60	50	.31 x 1 x 3.45

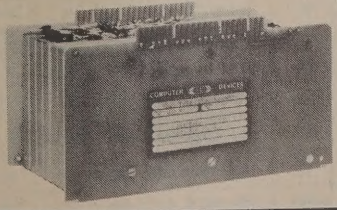
NOVEL INFINITE RESOLUTION

With input and output impedance of equal value. Voltage standing wave ratio less than ½ db to 45 MHz.



DV575-1	2 - 25 Nsec	70 MHz	200	1 x 1.25 x 5.37
DV575-2	2 - 50	70	100	1 x 1.25 x 5.37
DV575-3	2 - 50	70	200	1 x 1.25 x 5.37
DV575-4	2 - 50	70	93	1 x 1.25 x 5.37
DV575-5	2 - 25	70	50	1 x 1.25 x 5.37
DV575-6	2 - 50	70	93	1 x 1.25 x 5.37

DELAY LINE COMPUTER MEMORIES DELCOMS



THE DELAY LINE COMPUTER MEMORY (DELCOM) offers the **Lowest Price Per Bit** of any high speed memory device. Computer Devices Corp. offers convenient standard packages for all practical storage capacities from 10 bits to 20,000 bits in single delay line units as well as multi delay line units* with massive storage capacities. All Delcoms are compatible with DTL and T²L logic. Normal power requirements are +12 and −12 VDC and +5 VDC. However, Delcoms are tailored to your bit rate, delay, input-output logic and power requirements.

MANY OTHER MODELS AND SPECIALTY Delay Lines are available.
If exactly what you want is not listed, please call.

COMPUTER DEVICES CORP.
63 AUSTIN BOULEVARD COMMACK, N.Y. 11725
(516) 543-4220

military & commercial

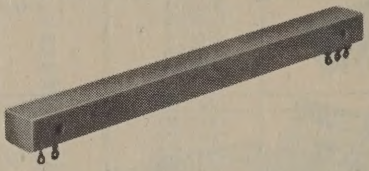
DELAY LINES

WITH OR WITHOUT CIRCUITRY

MAGNETOSTRICTIVE ★ LUMPED CONSTANT ★ ULTRASONIC ★ DISTRIBUTED CONSTANT ★ DISPERSIVE STRIP

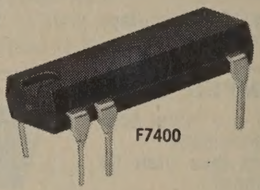
MAGNETOSTRICTIVE DELAY LINES — Fixed and variable delays to 10,000 microseconds. Fixed — FMS Series; Variable — VM Series.

FIXED MAGNETOSTRICTIVE DELAY LINE — Up to 10,000 bits of data for memory storage. Circuitry compatible with all microcircuit logic. Choice of data format: RZ, NRZ or Bipolar.

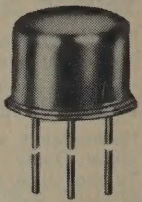


ULTRASONIC DELAY LINES — Replaces most quartz or glass lines. Offers superior performance, lower attenuation and smaller size at less cost. Frequencies to 30 MHz. Delays to 200 usec and greater.

SUBMINIATURE DELAY LINES



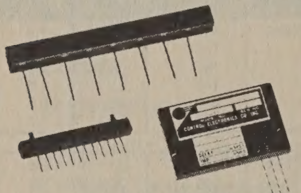
F7400



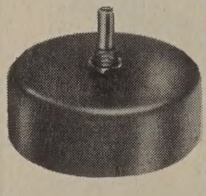
F-TO-5

TO-5 and micrologic packaged delay lines from 0.01 to 0.64 and longer delays. Ideal for timing transistors and other circuit components.

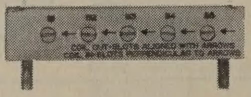
LUMPED CONSTANT DELAY LINES — Many shapes available including miniature types with pin connectors for PC Boards, connector fingers for plug-in units...multi-tapped units...terminal-ended units, etc. Delays from 0.05 usec to 500 usec for standard units. Delay to risetime ratios up to 100:1. Temperature stability to 50 ppm/C°.



COMPACT FIXED DELAY LINES FOR PC BOARDS — Extremely high density packaging. Typical Unit: 25:1 delay-to-rise-time ratio in a volume of 2 cubic inches.



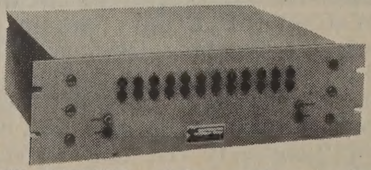
VARIABLE DELAY LINE Resolution of 1 part in 120. Delay up to 10 usec. 1″ x 3″.



UNIQUE BINARY CODED SECTIONAL DELAY LINE — Uses miniature transfer switches. Also available with terminals for remote switching.

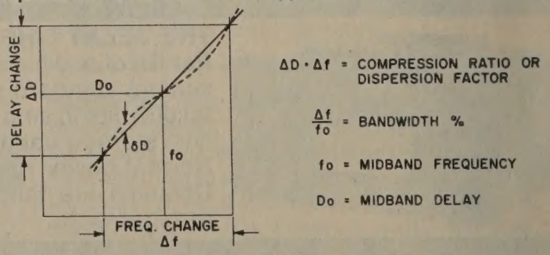
IFF MULTI-TAP DELAY LINES Standard IFF delay lines with taps every 1.45 usec. High density packaging available for airborne transponder use.

AUDIO, HIGH FREQUENCY & DISTRIBUTED CONSTANT DELAY LINES — With unusual circuits, extreme delays, high frequency application, rapid rise times, conforming waveform circuits and corrective circuits. Write for complete details.



AUDIO DELAY CABINET — Relay rack mounted cabinet houses 25 millisecond delay with taps at every ms. Units can be cascaded for longer delays.

DISPERSIVE STRIP DELAY LINES — Delay varies with frequency. A prime application is in Pulse Compression Radar Systems, eliminating large, expensive filter components. Compression ratios of 150:1, typical.



For all your Delay Line requirements, contact:

CONTROL ELECTRONICS COMPANY, INC.
153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

DATA DELAY DEVICES

253 CROOKS AVE., CLIFTON, N.J. 07011 Tel. (201) 772-1106

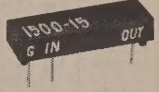
SHORT FORM CATALOG

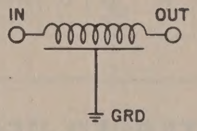
DUAL-IN-LINE DELAY LINES

PART NO.	Td (NS)	Ro (ohms)	H (INS.)	PART NO.	Td (NS)	Ro (ohms)	H (INS.)	PART NO.	Td (NS)	Ro (ohms)	H (INS.)	PART NO.	Td (NS)	Ro (ohms)	H (INS.)
1500-1	10	125	3/16	1500-7	15	240	1/8	1500-13	35	270	3/16	1500-19	30	300	1/8
1500-2	10	150		1500-8	10	250		1500-14	10	280	1/8	1500-20	40	300	↓
1500-3	15	200		1500-9	20	250		1500-15	20	280		1500-21	50	300	
1500-4	15	220		1500-10	25	250	↓	1500-16	30	280					
1500-5	25	220	↓	1500-11	15	270	3/16	1500-17	10	300					
1500-6	10	240	1/8	1500-12	25	270	↓	1500-18	20	300	↓				
1501-1	10	100	1/8	1501-16	30	250	1/8	1501-31	10	350	1/8	1501-46	60	400	3/16
1501-2	20	100		1501-17	40	250		1501-32	20	350		1501-47	70	400	
1501-3	30	100		1501-18	50	250		1501-33	30	350	↓	1501-48	80	400	
1501-4	10	150		1501-19	10	300		1501-34	40	350	3/16	1501-49	90	400	
1501-5	20	150		1501-20	20	300		1501-35	50	350		1501-50	100	400	
1501-6	30	150		1501-21	30	300		1501-36	60	350		1501-51	110	400	
1501-7	40	150		1501-22	40	300	↓	1501-37	70	350		1501-52	20	500	
1501-8	10	200		1501-23	50	300	3/16	1501-38	80	350		1501-53	30	500	
1501-9	20	200		1501-24	60	300		1501-39	90	350		1501-54	40	500	
1501-10	30	200		1501-25	70	300		1501-40	100	350	↓	1501-55	50	500	
1501-11	40	200		1501-26	80	300		1501-41	10	400	1/8	1501-56	60	500	
1501-12	50	200		1501-27	90	300		1501-42	20	400		1501-57	70	500	
1501-13	60	200		1501-28	100	300		1501-43	30	400	↓	1501-58	80	500	
1501-14	10	250		1501-29	120	300		1501-44	40	400	3/16	1501-59	90	500	↓
1501-15	20	250	↓	1501-30	140	300	↓	1501-45	50	400	↓				

SERIES 1500 & 1501

STOCKED





SPECIFICATIONS

- Taps available
- Td/Tr ≥ 3/l and 2/l series 1501 & 1500 respectively
- Withstanding voltage — 100 vdc for series 1500; 50 vdc for series 1501
- Impedance — 100 to 500 ohms
- Longer cases available for longer delays
- Cases available without studs
- #22 gauge leads, hot-tin-dip

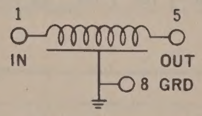
PART NO.	Td (NS)	Ro (ohm)	PART No.	Td (NS)	Ro (ohms)	PART NO.	Td (NS)	Ro (ohms)	PART NO.	Td (NS)	Ro (ohms)
1502-1	5	100	1502-15	20	200	1502-29	100	250	1502-43	40	350
1502-2	10	100	1502-16	30	200	1502-30	5	300	1502-44	50	350
1502-3	15	100	1502-17	40	200	1502-31	10	300	1502-45	80	350
1502-4	20	100	1502-18	80	200	1502-32	15	300	1502-46	100	350
1502-5	40	100	1502-19	80	200	1502-33	20	300	1502-47	10	400
1502-6	5	150	1502-20	5	250	1502-34	20	300	1502-48	20	400
1502-7	10	150	1502-21	10	250	1502-35	40	300	1502-49	30	400
1502-8	15	150	1502-22	15	250	1502-36	50	300	1502-50	40	400
1502-9	20	150	1502-23	20	250	1502-37	60	300	1502-51	10	500
1502-10	30	150	1502-24	30	250	1502-38	80	300	1502-52	20	500
1502-11	50	150	1502-25	40	250	1502-39	100	300	1502-53	30	500
1502-12	5	200	1502-26	50	250	1502-40	10	350			
1502-13	10	200	1502-27	60	250	1502-41	20	350			
1502-14	15	200	1502-28	80	250	1502-42	30	350			

SERIES 1502

STOCKED

SPECIFICATIONS

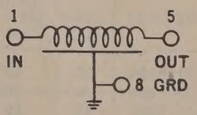
- Standard 14 lead I.C. case
- Case Height — 3/16 in.
- 50 vdc withstanding voltage
- Td/tr > 3/l
- Impedance 100 to 500 ohms
- Gold-plated leads
- Taps available



PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc. (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)
1504-20A	20	50	1.0	1504-20C	20	200	2.0	1504-300D	300	8.0	250	1504-240F	240	400	12
1504-25A	25	50	1.0	1504-40C	40	200	2.0	1504-375D	375	250	8.4	1504-320F	320	400	13
1504-30A	30	50	1.2	1504-60C	60	200	2.5	1504-500D	500	250	12.5	1504-360F	360	400	15
1504-40A	40	50	1.5	1504-80C	80	200	3.0	1504-30E	30	300	2.0	1504-480F	480	400	18
1504-45A	45	50	1.5	1504-100C	100	200	4.0	1504-60E	60	300	2.0	1504-600F	600	400	20
1504-60A	60	50	1.5	1504-120C	120	200	4.5	1504-90E	90	300	3.0	1504-800F	800	400	23
1504-75A	75	50	1.8	1504-160C	160	200	5.0	1504-120E	120	300	5.0	1504-50G	50	500	3.0
1504-100A	100	50	2.0	1504-180C	180	200	5.5	1504-150E	150	300	6.0	1504-100G	100	500	6.0
1504-10B	10	100	1.0	1504-240C	240	200	6.0	1504-180E	180	300	7.0	1504-150G	150	500	8.0
1504-20B	20	100	1.5	1504-300C	300	200	7.0	1504-240E	240	300	7.5	1504-200G	200	500	11
1504-30B	30	100	1.5	1504-400C	400	200	8.0	1504-270E	270	300	8.0	1504-250G	250	500	13
1504-40B	40	100	1.8	1504-25D	25	250	2.0	1504-360E	360	300	11.0	1504-300G	300	500	16
1504-50B	50	100	2.0	1504-50D	50	250	2.5	1504-450E	450	300	14.0	1504-400G	400	500	18
1504-60B	60	100	2.0	1504-75D	75	250	3.5	1504-600E	600	300	17.0	1504-450G	450	500	20
1504-80B	80	100	2.2	1504-100D	100	250	4.5	1504-40F	40	400	2.0	1504-600G	600	500	22
1504-90B	90	100	2.4	1504-125D	125	250	5.0	1504-80F	80	400	5.0	1504-750G	750	500	24
1504-120B	120	100	2.8	1504-150D	150	250	5.5	1504-120F	120	400	6.0	1504-1000G	1000	500	30
1504-150B	150	100	3.0	1504-200D	200	250	6.3	1504-160F	160	400	7.0				
1504-200B	200	100	4.0	1504-225D	225	250	7.0	1504-200F	200	400	8.0				

DATA DELAY DEVICES

SERIES 1504



STOCKED

SPECIFICATIONS

- Delay — (see table)
- Delay accuracy — ±5% (other tolerances on request)
- Delay Taps — Available on request
- Impedances (See table, others on request)
- Impedance Accuracy — ±10% (other tolerances on request)
- Rise Time — 20% of total time delay
- Operating voltage — 50 Vdc. Min.
- Temperature Coefficient. — 100 PPM/°C
  Environment — Meets or exceeds MIL-D-23859C.

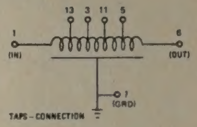
DIP-TAPPED DELAY LINES

STOCKED

PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc. (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)
1517-10A	10	50	0.6	1517-20C	20	200	1.0	1517-15E	15	300	1.0	1517-160F	160	400	6.5
1517-15A	15	50	0.6	1517-30C	30	200	1.2	1517-30E	30	300	1.0	1517-180F	180	400	7.5
1517-20A	20	50	0.7	1517-40C	40	200	1.5	1517-50E	50	300	1.5	1517-240F	240	400	9.0
1517-30A	30	50	0.7	1517-50C	50	200	2.0	1517-60E	60	300	2.5	1517-300F	300	400	10.0
1517-40A	40	50	0.9	1517-60C	60	200	2.2	1517-75E	75	300	3.0	1517-25G	25	500	1.5
1517-5B	5	100	0.5	1517-80C	80	200	2.5	1517-90E	90	300	3.5	1517-50G	50	500	3.0
1517-10B	10	100	0.7	1517-90C	90	200	2.7	1517-120E	120	300	3.7	1517-75G	75	500	4.0
1517-15B	15	100	0.7	1517-120C	120	200	3.0	1517-130E	130	300	4.0	1517-100G	100	500	5.5
1517-20B	20	100	0.9	1517-150C	150	200	3.5	1517-180E	180	300	5.5	1517-125G	125	500	6.5
1517-25B	25	100	1.0	1517-25D	25	250	1.2	1517-220E	220	300	7.0	1517-150G	150	500	8.0
1517-30B	30	100	1.0	1517-37D	37	250	1.7	1517-20F	20	400	1.0	1517-200G	200	500	9.0
1517-40B	40	100	1.1	1517-50D	50	250	2.2	1517-40F	40	400	2.5	1517-225G	225	500	10.0
1517-50B	50	100	1.2	1517-60D	60	250	2.5	1517-60F	60	400	3.0	1517-300G	300	500	11.0
1517-60B	60	100	1.4	1517-75D	75	250	2.7	1517-80F	80	400	3.5				
1517-75B	75	100	1.5	1517-100D	100	250	3.1	1517-100F	100	400	4.0				
1517-10C	10	200	1.0	1517-150D	150	250	4.0	1517-120F	120	400	6.0				

DATA DELAY DEVICES

SERIES 1517
5 TAPS



SPECIFICATIONS

- Delay accuracy – ±5% (others on request).
- No. taps – 5 Equally spaced taps.
- Taps accuracy – ±5% of tap delay.
- Impedance tolerance – ±10% (others on request).
- Rise-Time – 20% of time delay.
- Withstanding voltage – 50 Vdc. Min.
- Temperature coefficient – 100 PPM/°C.
- Environment – Meets or exceeds MIL-D-23859C.
- Overall case height – 0.280 inches.

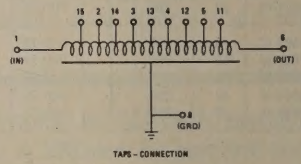
DIP-TAPPED DELAY LINES

STOCKED

PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc. (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)	PART NO.	TOTAL DELAY (NS)	Imp. (Ω)	Rdc (Ω)
1519-20A	20	50	1.0	1519-150B	150	100	3.0	1519-200D	200	250	6.3	1519-160F	160	400	7.0
1519-25A	25	50	1.0	1519-200B	200	100	4.0	1519-225D	225	250	7.0	1519-200F	200	400	8.0
1519-30A	30	50	1.2	1519-20C	20	200	2.0	1519-300D	300	250	8.0	1519-240F	240	400	12
1519-40A	40	50	1.5	1519-40C	40	200	2.0	1519-375D	375	250	8.4	1519-320F	320	400	13
1519-45A	45	50	1.5	1519-60C	60	200	2.5	1519-500D	500	250	12.5	1519-360F	360	400	15
1519-50A	50	50	1.5	1519-80C	80	200	3.0	1519-30E	30	300	2.0	1519-480F	480	400	18
1519-50A	60	50	1.5	1519-100C	100	200	4.0	1519-60E	60	300	2.0	1519-600F	600	400	20
1519-75A	75	50	1.8	1519-120C	120	200	4.5	1519-90E	90	300	3.0	1519-800F	800	400	23
1519-100A	100	50	2.0	1519-160C	160	200	5.0	1519-120E	120	300	5.0	1519-50G	50	500	3.0
1519-10B	10	100	1.0	1519-180C	180	200	5.5	1519-150E	150	300	6.0	1519-100G	100	500	6.0
1519-20B	20	100	1.5	1519-240C	240	200	6.0	1519-180E	180	300	7.0	1519-150G	150	500	8.0
1519-30B	30	100	1.5	1519-300C	300	200	7.0	1519-240E	240	300	7.5	1519-200G	200	500	11
1519-40B	40	100	1.8	1519-400C	400	200	8.0	1519-270E	270	300	8.0	1519-250G	250	500	13
1519-50B	50	100	2.0	1519-25D	25	250	2.0	1519-360E	360	300	11.0	1519-300G	300	500	16
1519-60B	60	100	2.0	1519-50D	50	250	2.5	1519-450E	450	300	14.0	1519-400G	400	500	18
1519-80B	80	100	2.2	1519-75D	75	250	3.5	1519-600E	600	300	17.0	1519-450G	450	500	20
1519-90B	90	100	2.4	1519-100D	100	250	4.5	1519-40F	40	400	2.0	1519-600G	600	500	22
1519-100B	100	100	2.6	1519-125D	125	250	5.0	1519-80F	80	400	5.0	1519-750G	750	500	24
1519-120B	120	100	2.8	1519-150D	150	250	5.5	1519-120F	120	400	6.0	1519-1000G	1000	500	30

DATA DELAY DEVICES

SERIES 1519
10 TAPS



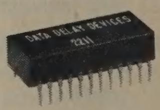
SPECIFICATIONS

- Delay accuracy – ±5% (others on request).
- No. taps – 10 Equally spaced taps.
- Taps accuracy – ±5% of tap delay.
- Impedance tolerance – ±10% (others on request).
- Rise-Time – 20% of time delay.
- Withstanding voltage – 50 Vdc. Min.
- Temperature coefficient – 100 PPM/°C.
- Environment – Meets or exceeds MIL-D-23859C.
- Overall case height – 0.280 inches.

DUAL-IN-LINE DELAY LINES

SERIES 2211

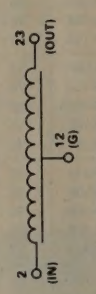
STOCKED



SPECIFICATIONS

- Standard 24 pins DIP.
- TTL and DTL compatible.
- Td/Tr = 10/1
- Delay tolerance: +5% or 1NS whichever is greater.
- Temperature coefficient: 100PPM/°C.
- Temperature range: –55°C to +125°C.
- Dielectric breakdown: 50 Vdc.
- Meets or exceeds MIL-D-23859.
- Epoxy encapsulated.

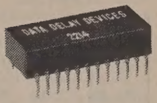
PART NO.	IMP. (Ω)	TOTAL DELAY (NS)	RISE-TIME (NS)	Rdc (Ω)	PART NO.	IMP. (Ω)	TOTAL DELAY (NS)	RISE-TIME (NS)	Rdc (Ω)	PART NO.	IMP. (Ω)	TOTAL DELAY (NS)	RISE-TIME (NS)	Rdc (Ω)
2211-50A	50	50	5	2.0	2211-120C	200	120	12	5.0	2211-600D	250	600	60	16.0
2211-60A	50	60	6	2.4	2211-200C	200	200	20	8.0	2211-750D	250	750	75	18.0
2211-80A	50	80	8	3.0	2211-300C	200	300	30	10.0	2211-200G	500	200	20	12.0
2211-100A	50	100	10	3.2	2211-400C	200	400	40	12.0	2211-300G	500	300	30	16.0
2211-150A	50	150	15	3.6	2211-500C	200	500	50	13.0	2211-400G	500	400	40	22.0
2211-50B	100	50	5	3.0	2211-600C	200	600	60	14.0	2211-500G	500	500	50	26.0
2211-60B	100	60	6	3.0	2211-50D	250	50	5	4.0	2211-600G	500	600	60	32.0
2211-80B	100	80	8	3.6	2211-100D	250	100	10	5.0	2211-800G	500	800	80	36.0
2211-100B	100	100	10	4.0	2211-150D	250	150	15	7.0	2211-1000G	500	1000	100	40.0
2211-150B	100	150	15	4.2	2211-200D	250	200	20	9.0	2211-1200G	500	1200	120	44.0
2211-200B	100	200	20	4.6	2211-250D	250	250	25	10.0	2211-1500G	500	1500	150	48.0
2211-300B	100	300	30	6.0	2211-300D	250	300	30	11.0	2211-2000G	500	2000	200	54.0
2211-40C	200	40	4	4.0	2211-400D	250	400	40	13.0					
2211-80C	200	80	8	4.0	2211-500D	250	500	50	14.0					



SCHEMATIC DIAGRAM

DUAL-IN-LINE DELAY LINES

SERIES 2214

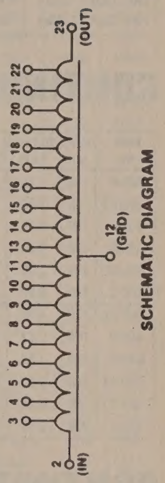


SPECIFICATIONS

- 20 Equally spaced taps.
- TTL and DTL compatible
- Td/Tr = 10/1
- Delay tolerance: ±5% or 1NS whichever is greater.
- Tap tolerance: ±5% or 1NS whichever is greater.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −55°C to +125°C.
- Dielectric breakdown: 50 Vdc.
- Meets or exceeds MIL-D-23859.
- Epoxy encapsulated.

PART NO.	IMP. (Ω)	TOTAL DELAY (NS)	TAP INCREMENT (NS)	RISE TIME (NS)	Rdc (Ω)	PART NO.	IMP. (Ω)	TOTAL DELAY (NS)	TAP INCREMENT (NS)	RISE-TIME (NS)	Rdc (Ω)
2214-50A	50	50	2.5	5	2.0	2214-800C	200	800	40	80	16.0
2214-60A	50	60	3.0	6	2.4	2214-50D	250	50	2.5	5	4.0
2214-80A	50	80	4.0	8	3.0	2214-100D	250	100	5	10	5.0
2214-100A	50	100	5.0	10	3.2	2214-150D	250	150	7.5	15	7.0
2214-150A	50	150	7.5	15	3.6	2214-200D	250	200	10	20	9.0
2214-200A	50	200	10.0	20	4.0	2214-250D	250	250	12.5	25	10.0
2214-50B	100	50	2.5	5	3.0	2214-300D	250	300	15	30	11.0
2214-60B	100	60	3.0	6	3.0	2214-400D	250	400	20	40	13.0
2214-80B	100	80	4.0	8	3.6	2214-500D	250	500	25	50	14.0
2214-100B	100	100	5	10	4.0	2214-600D	250	600	30	60	16.0
2214-150B	100	150	7.5	15	4.2	2214-800D	250	800	40	80	18.0
2214-200B	100	200	10	20	4.6	2214-1000D	250	1000	50	100	25.0
2214-300B	100	300	15	30	6.0	2214-200G	500	200	10	20	12.0
2214-400B	100	400	20	40	8.0	2214-300G	500	300	15	30	16.0
2214-40C	200	40	2	4	4.0	2214-400G	500	400	20	40	22.0
2214-80C	200	80	4	8	4.0	2214-500G	500	500	25	50	26.0
2214-120C	200	120	6	12	5.0	2214-600G	500	600	30	60	32.0
2214-200C	200	200	10	20	8.0	2214-800G	500	800	40	80	36.0
2214-300C	200	300	15	30	10.0	2214-1000G	500	1000	50	100	40.0
2214-400C	200	400	20	40	12.0	2214-1200G	500	1200	60	120	44.0
2214-500C	200	500	25	50	13.0	2214-1500G	500	1500	75	150	48.0
2214-600C	200	600	30	60	14.0	2214-2000G	500	2000	100	200	54.0

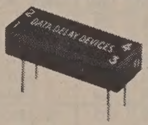
20 TAPS



TRIM-DIP DELAY LINES

STOCKED

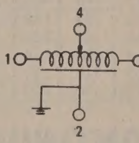
SERIES 1503



PART NO.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Tr (NS)	PART NO.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Tr (NS)	PART NO.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Tr (NS)
1503-15A	15	50	.7	3	1503-30B	30	100	2.	6	1503-60C	60	200	8	12
1503-25A	25	50	.8	5	1503-50B	50	100	3.	10	1503-100C	100	200	14	20
1503-30A	30	50	1.	6	1503-60B	60	100	4.	12	1503-20D	20	250	5	4
1503-40A	40	50	1.5	8	1503-80B	80	100	5.	16	1503-20E	20	300	5	4
1503-50A	50	50	1.7	10	1503-100B	100	100	6	20	1503-30F	30	350	8	6
1503-60A	60	50	2.	12	1503-120B	120	100	8	24	1503-25G	25	400	8	5
1503-80A	80	50	3.	16	1503-160B	160	100	10	32	1503-40H	40	500	12	8
1503-100A	100	50	3.5	20	1503-200B	200	100	14	40					
1503-15B	15	100	1.	3	1503-30C	30	200	4	6					

SPECIFICATIONS

- Continuously variable delay
- Multi-turn adjusting screw (40 turns approx.)
- Impedance (see table)
- Withstanding voltage — 50 Vdc
- Temperature Coefficient — 100 PPM/°C
- #20 gauge leads
- Resolution — .12NS approx.



MINI TRIM DELAY LINES

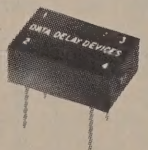
STOCKED

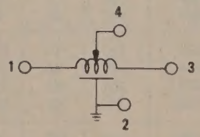
SERIES 1509

PART NO.	Td (NS)	IMPEDANCE (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

SPECIFICATIONS

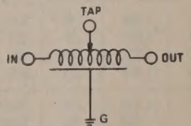
- Low cost unit
- Fits standard DIP sockets
- Continuously variable
- 20 Turns approx.
- Resolution — .15 NS
- Withstanding voltage — 100 Vdc
- Temperature coefficient — 200 PPM/°C
- #22 gauge leads





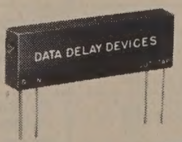
TRIM-DIP DELAY LINES

SERIES 1503J



Electrical specifications: Same as 1503,
Size: 1.75 x .565 x .275

PART NO.	Td (NS)	Imp. (Ω)	Tr (NS)	Rdc (Ω)	PART NO.	Td (NS)	Imp. (Ω)	Tr (NS)	Rdc (Ω)
1503J-150A	150	50	22	5	1503J-30E	30	300	5	7
1503J-250B	250	100	38	21	1503J-40F	40	350	6	10
1503J-130C	130	200	20	21	1503J-35G	35	400	6	10
1503J-30D	30	250	5	7	1503J-60H	60	500	9	18



STOCKED

MINI-TRIM DELAY LINES

SERIES 1509J

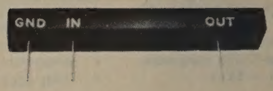
Electrical specifications: Same as 1509,
Size: 1.75 x 565 x .275

PART NO.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Tr (NS)
1509J-10B	10	100	.8	4
1509J-40C	40	200	1.5	9
1509J-40E	40	300	6.0	9
1509J-75F	75	400	12	16
1509J-80H	80	500	20	16

COMPUTER DELAY LINES

SERIES 1000

PART NO.	DELAY ± 2%	RISE TIME	RES. D.C. (Ω)	IMP. (Ω) 10%	LENGTH MAX. (IN)	PART NO.	DELAY ± 2%	RISE TIME	RES. D.C. (Ω)	IMP. (Ω) 10%	LENGTH MAX. (IN)
1000-25A	25ns	20ns	3.5	500	2	1000-400A	400ns	50ns	75	900	3
1000-50A	50ns	22ns	6	500	2	1000-450A	450ns	56ns	87	900	3
1000-100A	100ns	24ns	14	500	2	1000-500A	500ns	60ns	92	900	3
1000-125A	125ns	25ns	13.5	500	2	1000-600A	600ns	66ns	110	900	5.25
1000-200A	200ns	35ns	36	900	2	1000-700A	700ns	74ns	130	900	5.25
1000-225A	225ns	37ns	42	900	2	1000-800A	800ns	85ns	148	900	5.25
1000-250A	250ns	40ns	48	900	2	1000-900A	900ns	98ns	165	900	5.25
1000-300A	300ns	45ns	55	900	2						



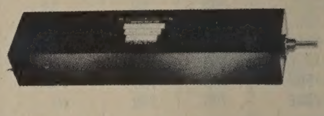
SPECIFICATIONS

TEMPERATURE RANGE: -55°C to +125°C. DISTORTION: 5% Max. DC WORKING VOLTAGE: 200 VDC. CASE EPOXY. SIZE L x .45 x .33 max.

CONTINUOUSLY VARIABLE DELAY LINES

SERIES 500

PART NO.	IMP. (Ω)	DELAY (μs)	TR (μs)	ATT. (db)	RES. (ns)	PART NO.	IMP. (Ω)	DELAY (μs)	TR (μs)	ATT. (db)	RES. (ns)
500-A	75	1.25	.12	1.5	2.5	500-F	250	0.60	.05	.5	1.0
500-A1	75	1.50	.15	1.5	3.0	500-F1	250	1.00	.10	2	1.2
500-B	100	1.00	.10	1.0	2.0	500-G	300	0.60	.06	1.2	.6
500-B1	100	1.50	.15	1.5	3.0	500-G1	300	1.25	.12	3	1.0
500-B2	100	2.00	.20	4	2	500-J	450	0.90	.09	2	.7
500-C	120	0.90	.09	1.0	2	501-A	220	0.15	.025	.25	.4
500-C1	120	1.75	.17	3	1.8	501-B	370	0.25	.040	.50	.5
500-D	150	0.62	.060	.9	1.3	501-C	400	0.35	.045	.50	.45
500-D1	150	1.50	.15	1.5	3	501-D	440	0.60	.060	.5	.6
500-D2	150	2.50	.25	9	2.0	501-E	540	0.70	.080	.6	.7
500-D3	150	2.75	.27	9	2.2	501-F	630	1.10	.10	1	.7
500-E	200	2.00	.20	6	1.6						



SPECIFICATIONS

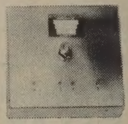
DELAY VARIATION: 0 to 10 shaft rev. ACCURACY: ± 3% or better. BANDWIDTH: f(3db)=.35/TR. IMPEDANCE TOLERANCE: ± 10% or better. OPERATING TEMPERATURE: -60°C to +125°C. TEMPERATURE COEFFICIENT: 50 PPM/°C for type 500. 170 PPM/°C for type 501. CASE: plastic. DIMENSION: 6.5 x 1.56 x 1.12 (16.5 x 3.96 x 2.85 cm). SHAFT: .25 dia. (.635 cm). MOUNTING: 2 - 6 - 32 centered on 1.56 side, spaced 6.25.

CONTINUOUSLY VARIABLE DELAY LINES

SERIES 600

PART NO.	Ro (ohms)	Td (US)	Tr (US)	RES (NS)	ATT (db)	PART NO.	Ro (ohms)	Td (US)	Tr (US)	RES (NS)	ATT (db)
601-1	50	3.50	.25	1.8	1.5	601-11	133	2.0	.15	1.6	1.0
601-2	55	1.67	.15	2.0	.8	601-12	150	.60	.06	.8	.5
601-3	66	4.00	.40	3.2	1.5	601-13	150	1.21	.09	1.8	.7
601-4	75	2.44	.18	1.8	1.2	601-14	160	2.1	.19	1.5	1.2
601-5	75	4.30	.40	3.0	1.7	601-15	186	1.41	.14	1.1	1.2
601-6	82	1.20	.10	1.5	.5	601-16	200	.87	.06	1.8	.5
601-7	95	2.82	.26	2.2	1.4	601-17	220	1.52	.13	1.3	1.1
601-8	100	1.74	.12	1.8	1.0	601-18	260	1.01	.10	1.0	1.1
601-9	110	.83	.08	1.1	.5	601-19	305	1.09	.1	.8	1.0
601-10	110	3.00	.30	2.1	1.6						

PART NO.	Ro (ohms)	Td (US)	Tr (US)	RES (NS)	ATT (db)
602-1	436	.25	.025	.2	.15
602-2	460	.31	.030	.28	.15
602-3	520	.49	.038	.33	.3
602-4	636	.59	.057	.40	.5
602-5	720	.74	.072	.55	1.0



FEATURES

- Continuously variable
- High resolution, 0.15 Ns
- Long delay, 4.3 US
- One turn delay adjustment
- Low attenuation
- High fidelity of pulse reproduction

CONTINUOUSLY VARIABLE DELAY LINES

SERIES 636

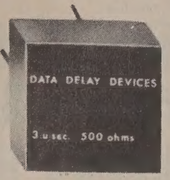
SPECIFICATIONS

- Continuously variable delay adjustment.
- Multiple shaft revolution (60 Min.).
- Delay tolerance – ± 5%
- Impedance tolerance – ± 10%
- Operating temperature – −40°C to +85°C.
- Hermetically sealed unit.
- "O" ring provided at the shaft's end.
- Meets or exceeds MIL-D-23859C.
- Miniature size.
- Maximum delay – 2.5 US.

PART NO.	DELAY (NS)	RISE-TIME (NS)	IMP. (Ω)	RES. (NS)	ATT. (db)	TC PPM/°C	DIELECTRIC WITHSTANDING VOLTAGE (DC)	PART NO.	DELAY (NS)	RISE-TIME (NS)	IMP. (Ω)	RES. (NS)	ATT. (db)	TC PPM/°C	DIELECTRIC WITHSTANDING VOLTAGE (DC)
636-100A	100	10	50	.15	2.0	50	100	636-1800B	1,800	360	100	2.8	2.8	100	40
636-200A	200	20	50	.25	2.2	50	100	636-2000B	2,000	400	100	3	3.0	100	40
636-300A	300	30	50	.3	2.4	50	100	636-2200B	2,200	440	100	3.8	3.5	100	40
636-400A	400	40	50	.4	2.7	50	100	636-2400B	2,400	480	100	4.2	3.6	100	40
636-500A	500	50	50	.45	3.0	50	100	636-2500B	2,500	500	100	5.0	4.0	100	40
636-600A	600	60	50	.5	4.5	50	100	636-100C	100	10	200	.15	.8	50	100
636-800A	800	160	50	.6	1.0	100	40	636-200C	200	20	200	.25	1.0	50	100
636-1000A	1,000	200	50	.7	1.2	100	40	636-400C	400	40	200	.4	1.5	50	100
636-1200A	1,200	240	50	.8	1.5	100	40	636-500C	500	50	200	.45	2.0	50	100
636-100B	100	10	100	.15	1.6	50	100	636-700C	700	70	200	.6	2.2	50	100
636-200B	200	20	100	.25	1.7	50	100	636-800C	800	160	200	1.2	1.6	100	40
636-300B	300	30	100	.3	1.8	50	100	636-1000C	1,000	200	200	1.3	2.0	100	40
636-400B	400	40	100	.4	2.0	50	100	636-1200C	1,200	240	200	1.8	2.2	100	40
636-500B	500	50	100	.45	2.4	50	100	636-1400C	1,400	280	200	2.0	2.4	100	40
636-600B	600	60	100	.5	2.7	50	100	636-1500C	1,500	300	200	2.5	2.6	100	40
636-700B	700	70	100	0.6	3.0	50	100	636-1600C	1,600	320	200	3.0	3.0	100	40
636-800B	800	80	100	.8	3.2	50	100	636-1800C	1,800	360	200	3.2	3.5	100	40
636-900B	900	90	100	.9	3.6	50	100	636-200E	200	40	500	1.0	.6	100	40
636-1000B	1,000	100	100	1.0	4.0	50	100	636-400E	400	80	500	1.3	1.0	100	40
636-1200B	1,200	120	100	1.2	4.5	50	100	636-500E	500	100	500	1.8	1.2	100	40
636-1400B	1,400	280	100	1.7	2.2	100	40	636-600E	600	120	500	2.5	1.3	100	40
636-1500B	1,500	300	100	1.8	2.4	100	40	636-700E	700	140	500	3.0	1.7	100	40
636-1600B	1,600	320	100	2.0	2.6	100	40								

HIGH DENSITY DELAY LINES

SERIES 100



SPECIFICATIONS

TIME DELAY: 0-35 µs DELAY ACCURACY: ± 3%. RISE TIME: 3% of time delay. IMPEDANCE: up to 4000 ohms. PHASE RESPONSE: 1% up to 3db. FREQUENCY RESPONSE: up to 10 MC. ATTENUATION: Less than 0.1 db/µs TEMPERATURE COEFFICIENT: 1000 PPM/°C.

100A $\frac{\text{DELAY}}{\text{RISE-TIME}} = 30/1$

PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)
100A-525A	5.25	075	100A-700E	7.00	400	100A-700G	7.00	600
100A-350B	3.50	100	100A-1050E	10.50	400	100A-1400G	14.00	600
100A-700B	7.00	100	100A-1400E	14.00	400	100A-2100G	21.00	600
100A-350C	3.50	150	100A-2100E	21.00	400	100A-2800G	28.00	600
100A-700C	7.00	150	100A-2800E	28.00	400	100A-3500G	35.00	600
100A-1050C	10.50	150	100A-700F	7.00	500	100A-700H	7.00	1000
100A-350D	3.50	200	100A-1050F	10.50	500	100A-1050H	10.50	1000
100A-700D	7.00	200	100A-1400F	14.00	500	100A-1400H	14.00	1000
100A-1050D	10.50	200	100A-2100F	21.00	500	100A-2100H	21.00	1000
100A-1400D	14.00	200	100A-2800F	28.00	500	100A-2800H	28.00	1000
			100A-3500F	35.00	500			

100B $\frac{\text{DELAY}}{\text{RISE-TIME}} = 20/1$

PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)
100B-300A	3.00	075	100B-400E	4.00	400	100B-2000F	20.00	500
100B-200B	2.00	100	100B-600E	6.00	400	100B-200G	2.00	600
100B-400B	4.00	100	100B-800E	8.00	400	100B-400G	4.00	600
100B-200C	2.00	150	100B-1200E	12.00	400	100B-800G	8.00	600
100B-400C	4.00	150	100B-1600E	16.00	400	100B-1200G	12.00	600
100B-600C	6.00	150	100B-200F	2.00	500	100B-1600G	16.00	600
100B-200D	2.00	200	100B-400F	4.00	500	100B-2000G	20.00	600
100B-400D	4.00	200	100B-600F	6.00	500	100B-600H	6.00	1000
100B-600D	6.00	200	100B-800F	8.00	500	100B-800H	8.00	1000
100B-800D	8.00	200	100B-1200F	12.00	500	100B-1200H	12.00	1000
100B-200E	2.00	400	100B-1600F	16.00	500	100B-1600H	16.00	1000

100C $\frac{\text{DELAY}}{\text{RISE-TIME}} = 10/1$

PART NO.	BELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)
100C-150A	1.50	075	100C-100F	1.00	500	100C-400H	4.00	1000
100C-100B	1.00	100	100C-200F	2.00	500	100C-600H	6.00	1000
100C-200B	2.00	100	100C-300F	3.00	500	100C-800H	8.00	1000
100C-100C	1.00	150	100C-400F	4.00	500	100C-030J	0.30	1500
100C-200C	2.00	150	100C-600F	6.00	500	100C-060J	0.60	1500
100C-300C	3.00	150	100C-800F	8.00	500	100C-100J	1.00	1500
100C-050D	0.50	200	100C-1000F	10.00	500	100C-200J	2.00	1500
100C-100D	1.00	200	100C-050G	0.50	600	100C-300J	3.00	1500
100C-200D	2.00	200	100C-100G	1.00	600	100C-400J	4.00	1500
100C-300D	3.00	200	100C-200G	2.00	600	100C-040K	0.40	2000
100C-400D	4.00	200	100C-400G	4.00	600	100C-080K	0.80	2000
100C-050E	0.50	400	100C-600G	6.00	600	100C-100K	1.00	2000
100C-100E	1.00	400	100C-800G	8.00	600	100C-200K	2.00	2000
100C-200E	2.00	400	100C-1000G	10.00	600	100C-300K	3.00	2000
100C-300E	3.00	400	100C-020H	0.20	1000	100C-200M	2.00	3000
100C-400E	4.00	400	100C-040H	0.40	1000	100C-200P	2.00	4000
100C-600E	6.00	400	100C-080H	0.80	1000			
100C-800E	8.00	400	100C-100H	1.00	1000			
100C-020F	0.20	500	100C-200H	2.00	1000			
100C-050F	0.50	500	100C-300H	3.00	1000			

100D $\frac{\text{DELAY}}{\text{RISE-TIME}} = 7/1$

PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)	PART NO.	DELAY (µs)	IMP (Ω)
100D-075A	0.75	075	100D-050F	0.50	500	100D-200H	2.00	1000
100D-050B	0.50	100	100D-100F	1.00	500	100D-300H	3.00	1000
100D-100B	1.00	100	100D-150F	1.50	500	100D-400H	4.00	1000
100D-050C	0.50	150	100D-200F	2.00	500	100D-015J	0.15	1500
100D-100C	1.00	150	100D-300F	3.00	500	100D-030J	0.30	1500
100D-150C	1.50	150	100D-400F	4.00	500	100D-050J	0.50	1500
100D-025D	0.25	200	100D-500F	5.00	500	100D-100J	1.00	1500
100D-050D	0.50	200	100D-025G	0.25	600	100D-150J	1.50	1500
100D-100D	1.00	200	100D-050G	0.50	600	100D-200J	2.00	1500
100D-150D	1.50	200	100D-100G	1.00	600	100D-020K	0.20	2000
100D-200D	2.00	200	100D-200G	2.00	600	100D-040K	0.40	2000
100D-025E	0.25	400	100D-300G	3.00	600	100D-050K	0.50	2000
100D-050E	0.50	400	100D-400G	4.00	600	100D-100K	1.00	2000
100D-100E	1.00	400	100D-500G	5.00	600	100D-150K	1.50	2000
100D-150E	1.50	400	100D-010H	0.10	1000	100D-100M	1.00	3000
100D-200E	2.00	400	100D-020H	0.20	1000	100D-100P	1.00	4000
100D-300E	3.00	400	100D-040H	0.40	1000			
100D-400E	4.00	400	100D-050H	0.50	1000			
100D-010F	0.10	500	100D-100H	1.00	1000			
100D-025F	0.25	500	100D-150H	1.50	1000			

AUDIO DELAY LINES

SERIES 7000

PART NO.	DELAY (µs)	RISE-TIME (µs)	BW (KHZ)	IMP (Ω)	PART NO.	DELAY (µs)	RISE-TIME (µs)	BW (KHZ)	IMP (Ω)
7000-100A	100	4	0-80	500	7000-800B	800	32	0-10	1000
7000-100B	100	4	0-80	1000	7000-1000A	1000	40	0-8	500
7000-200A	200	8	0-40	500	7000-1000B	1000	40	0-8	1000
7000-200B	200	8	0-40	1000	7000-2000A	2000	80	0-4	500
7000-400A	400	16	0-20	500	7000-2000B	2000	80	0-4	1000
7000-400B	400	16	0-20	1000	7000-4000A	4000	160	0-2	500
7000-800A	800	32	0-10	500	7000-4000B	4000	160	0-2	1000

SPECIFICATIONS

TOTAL DELAY: See table. TAP DELAY: Normal IN and OUT (100 taps can be accommodated). DELAY ACCURACY: ±3% (±½% on request). IMPEDANCE: 200 to 10,000 ohms. ±5%. ATTENUATION: 6db or better. PHASE RESPONSE: ±1% over bandwidth. TEMPERATURE RANGE: −55°C to +85°C (others on request). TEMPERATURE COEF. 100 PPM/°C (others on request). DIELECTRIC STRENGTH: 50Vdc (others on request). CASE: Hermetically sealed metal. SIZE: 5-3/4 x 3-3/16 x 2-1/2 (14.6 x 8.1 x 6.3cm) MOUNTING: (4) 10-32 studs, 1/2" long, spaced 3-1/2 x 2 (8.90 x 5.10 cm). TERMINALS: Glass-to-metal seal or press-fit type.

STEP VARIABLE DELAY LINES

SERIES 510 511 1510 1511

RISE TIME = 2% IMPEDANCE = 600 ~				RISE TIME = 2% IMPEDANCE = 1000 ~			
PART NO.	TOTAL DELAY (µs)	DELAY STEP (µs)	ATT. (db)	PART NO.	TOTAL DELAY (µs)	DELAY ISTEP (µs)	ATT. (db)
510–A	10.0	1.0	1	511–A	10.0	1.0	.6
510–B	25.0	2.5	1.5	511–B	25.0	2.5	1.0
510–C	50.0	5.0	2.0	511–C	50.0	5.0	1.5
510–D	100.00	10.0	3.5	511–D	100.0	10.0	2.5
510–E	500.00	50.0	4.0	511–E	500.0	50.0	3.0
510–F	1,000.00	100.00	4.5	511–F	1,000.00	100.0	4.0
1510–A	11.0	.1	1	1511–A	11.0	.1	.6
1510–B	110.0	1	3.5	1511–B	110.0	1	2.5
1510–C	1,100.0	10	4	1511–C	1,100.0	10	4.0
				1511–D	11,000	100	6.0

DESCRIPTION

L-C networks in tandem, with precise delay increments and low attenuation. Use as delay syntesizers for evaluation of Worst-Case design analysis; as time delay standards and Phase measuring devices. Meets Military specifications. Type 510 and 511 use a single 10 positions switch.

SPECIFICATIONS

ACCURACY: ± 2% of setting. ATTENUATION and *TIME DELAY see table. *RISE TIME: 2% of time delay or less. TEMPERATURE COEFFICIENT: ± 50 PPM/°C. DISTORTION: Less than 3% for pulse signals on most types. Essentially no harmonic distortion for sine wave signals. SIZE: 8 x 3.5 x 4.5 (20.32 x 8.89 x 11.43 cm) Max. for type 510 and 511. 16.75 x 5.25 x 5.5 (41.54 x 13.33 x 13.97 cm) Max. for type 1510 and 1511 (Rack-Mount Panel available on request).

*other can be provided on request.

DIGITAL DELAY LINES

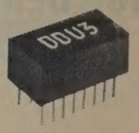
SERIES DDU-3

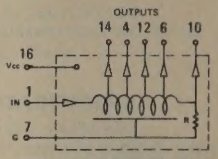
SINGLE DELAY OUTPUT (NS)		2 DELAYS OUTPUT (NS)			5 DELAYS OUTPUT (NS)					
PART NO.	DELAY@ PIN #10	PART NO.	DELAY@ PIN # 12	DELAY@ PIN # 10	PART NO.	DELAY@ PIN # 14	DELAY@ PIN # 4	DELAY@ PIN # 12	DELAY@ PIN # 6	DELAY@ PIN # 10
DDU-3-1010	10	DDU-3-2020	10	20	DDU-3-5050	10	20	30	40	50
DDU-3-1020	20	DDU-3-2040	20	40	DDU-3-5100	20	40	60	80	100
DDU-3-1030	30	DDU-3-2050	25	50	DDU-3-5150	30	60	90	120	150
DDU-3-1040	40	DDU-3-2060	30	60	DDU-3-5200	40	80	120	160	200
DDU-3-1050	50	DDU-3-2080	40	80	DDU-3-5250	50	100	150	200	250
DDU-3-1060	60	DDU-3-2100	50	100	DDU-3-5300	60	120	180	240	300
DDU-3-1080	80	DDU-3-2150	75	150	DDU-3-5400	80	160	240	320	400
DDU-3-1100	100	DDU-3-2200	100	200	DDU-3-5500	100	200	300	400	500
DDU-3-1150	150	DDU-3-2300	150	300						
DDU-3-1200	200	DDU-3-2400	200	400						
DDU-3-1300	300	DDU-3-2500	250	500						
DDU-3-1400	400									
DDU-3-1500	500									

SPECIFICATIONS

- **Delay tolerance:** ±5% or better.
- **Rise-time:** 4 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** – 0°C to 70°C standard. (– 55°C to + 125°C. on request)*
- **Supply voltage:** 4.5 to 5.5 Vdc.
- **Logic 1 input current:** 50 ua max.
- **Logic 0 input current:** –2 ma. max.
- **Logic 1 V out:** 2.5 V min.
- **Logic 0 V out:** 0.5 V max.
- **Logic 1 Fan-out:** 20/tap max.
- **Logic 0 Fan-out:** 10/tap max.
- **Power Dissipation:** 19 MW/Gate.
- **16 pin DIP case.**

***Add "M" after PART NO.**
Example DDU-3-1010M

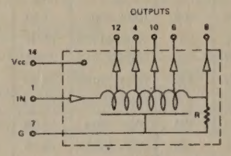




SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

SERIES DDU-4

SINGLE DELAY OUTPUT (NS)		2 DELAYS OUTPUT (NS)			5 DELAYS OUTPUT (NS)					
PART NC.	DELAY@ PIN # 8	PART NO.	DELAY@ PIN # 10	DELAY@ PIN # 8	PART NO.	DELAY@ PIN # 12	DELAY@ PIN # 4	DELAY@ PIN # 10	DELAY@ PIN # 6	DELAY@ PIN # 8
DDU-4-1010	10	DDU-4-2020	10	20	DDU-4-5050	10	20	30	40	50
DDU-4-1020	20	DDU-4-2040	20	40	DDU-4-5100	20	40	60	80	100
DDU-4-1030	30	DDU-4-2050	25	50	DDU-4-5150	30	60	90	120	150
DDU-4-1040	40	DDU-4-2060	30	60	DDU-4-5200	40	80	120	160	200
DDU-4-1050	50	DDU-4-2080	40	80	DDU-4-5250	50	100	150	200	250
DDU-4-1060	60	DDU-4-2100	50	100	DDU-4-5300	60	120	180	240	300
DDU-4-1080	80	DDU-4-2150	75	150	DDU-4-5400	80	160	240	320	400
DDU-4-1100	100	DDU-4-2200	100	200	DDU-4-5500	100	200	300	400	500
DDU-4-1150	150	DDU-4-2300	150	300						
DDU-4-1200	200	DDU-4-2400	200	400						
DDU-4-1300	300	DDU-4-2500	250	500						
DDU-4-1400	400									
DDU-4-1500	500									



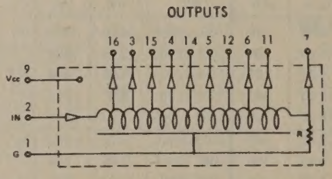
SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

DATA DELAY DEVICES
DDU-4

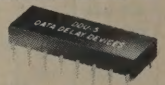
Specifications same as DDU-3 except 14 pins dip case, low profile.

SERIES DDU-5

PART NO.	TOTAL DELAY NS	DELAY PER TAP NS	PART NO.	TOTAL DELAY NS	DELAY PER TAP NS
DDU-5-10100	100	10	DDU-5-10400	400	40
DDU-5-10150	150	15	DDU-5-10500	500	50
DDU-5-10200	200	20	DDU-5-101000	1000	100
DDU-5-10250	250	25	DDU-5-101500	1500	150
DDU-5-10300	300	30	DDU-5-102000	2000	200



SCHEMATIC DIAGRAM FOR DDU-5

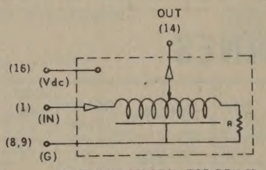


Specs. same as DDU-3
Pins spacings .6 x 1.4

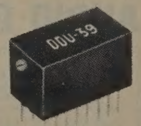
SERIES DDU-39

Continuously adjustable from 10 to 30 NS.

Specs. same as DDU-3



SCHEMATIC DIAGRAM FOR DDU-39



PROGRAMMABLE DELAY UNIT

SERIES PDU-108

TRUTH TABLE

ENABLE	C	B	A	DELAY OUT
L	L	L	L	T0
L	L	L	H	T1
L	L	H	L	T2
L	L	H	H	T3
L	H	L	L	T4
L	H	L	H	T5
L	H	H	L	T6
L	H	H	H	T7
H	Φ	Φ	Φ	L

PART NO.**	MIN.DELAY INCREMENT	TOTAL DELAY * CHANGE
PDU-108-10	10 NS	70 NS
PDU-108-20	20 NS	140 NS
PDU-108-40	40 NS	280 NS
PDU-108-50	50 NS	350 NS

TEST CONDITIONS

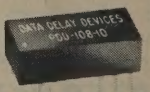
- **Input pulse-width:** ≥40% of total delay.
- **Input pulse rise-time:** ≤6 NS.
- **Input pulse voltage:** –1.5 V.
- **VEE supply voltage:** –5.2 V.
- **VEE supply current:** 56 ma. typ.
- **Operating temperature:** 25°C.

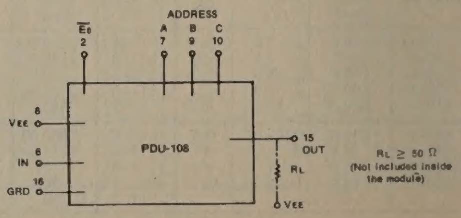
H : High L : Low Φ : Don't care
T0 : Reference or inherent delay of circuit.
T1→T7 : Multiplier of incremental delay.

* This delay value does not include the T0 delay.
** Other delay increments available on request.

SPECIFICATIONS

- **Logic 1 input voltage:** –.980 V
- **Logic 1 input current:** .22 ma.
- **Logic 0 input voltage:** –1.65 V.
- **Logic 0 input current:** –.5 ua.
- **Logic 1 output voltage:** –.96 V.
- **Logic 0 output voltage:** –1.65 V.
- **Operating temperature:** 0° to 70°C.
- **Storage temperature:** –55° to +125° C.





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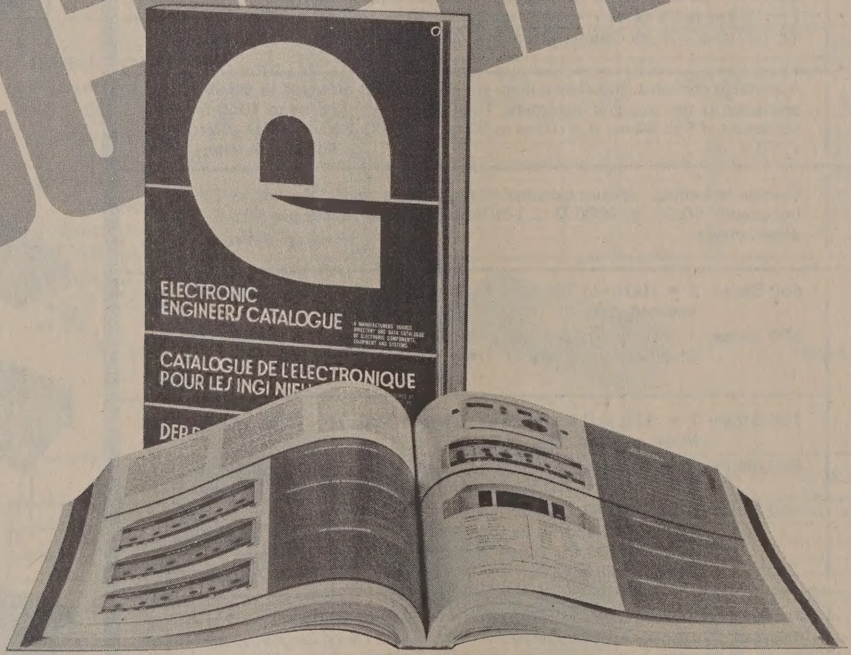
ACCEPTANCE



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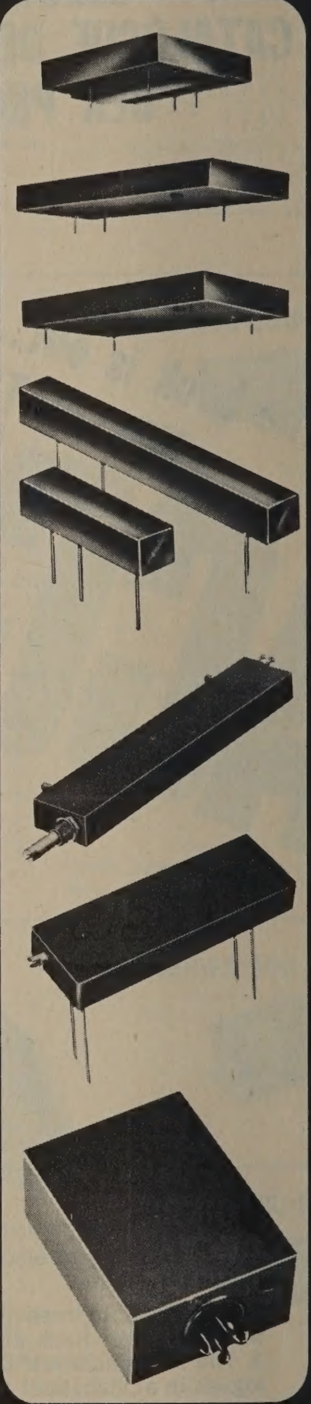
ESC The World's Leading Producer of Electromagnetic

DELAY LINES

DUAL-IN-LINE DELAY LINES	**EC Series:** From delay (T) of 5 ns and rise time (tr) of 2.5 ns to T = 25 ns and tr = 10 ns, Impedance (Z) = 200, 300, 400 or 500 Ω Size: .66 x .250 x .250 **EP Series:** From T = 20 ns to 50 ns, tr = 5 ns to 12.5 ns, Z = 200, 300, 400 or 500 Ω Size: .46 x .76 x .25 **EL Series:** From T = 50 ns to 100 ns, tr = 8.5 ns to 17 ns, Z = 200, 300, 400 or 500 Ω Size: .46 x 1.40 x .25 *Request Bulletin — ECPL* **D Series:** (Low temp. coeff. of Delay Types) From 20 ns to 100 ns, T/tr = 3.3, Z = 100 Ω or 200 Ω Size: .46 x .76 x .25 **E Series:** (Low temp coeff. of Delay) From 50 ns to 500 ns, T/tr = 6, Z = 100 Ω or 200 Ω Size: .46 x 1.4 x .25 **F Series:** (Low temp. coeff. of Delay) From 100 ns to 1000 ns, T/tr = 10, Z = 100 Ω or 200 Ω Size: 1.0 x 1.5 x .25 *Request Bulletin — DEF*
DISTRIBUTED CONSTANT DELAY LINES	Delays from 20 ns to 1100 ns, tr from less than 20 ns to 120 ns depending upon delay. Impedance from 100 to 1800 Ω. *Request Bulletin — DC*
SUB-MINIATURE NANOSEC DELAY LINES	**SM Series:** T = 10 ns to 50 ns at Z = 100 and 200 Ω; T = 100 ns to 300 ns at Z = 500 Ω T/tr = 3.5 average; Size = 1 x .32 x 32: T = 50 ns to 120 ns at Z = 100 and 200 Ω and T = 400 ns to 1200 ns at Z = 500 T/tr = 5 to 10; Size 2 x .32 x .32 *Request Bulletin-SM*
TAPPED DELAY LINES	Delays of 100 ns to 1000 ns; tapped in 10 or 20 equal increments tr = 10 ns for T = 100 ns to 55 ns for T = 1000 ns, Z from 50 Ω to 200 Ω ; Size 1 x 3 x .35 for 100 and 200 ns delay; 1.25 x 5 x .35 for longer delays. *Request Bulletin-T*
PROGRAMMABLE DELAY LINES	Adjustable constant Impedance lines with increments arranged in binary order; resolution is the smallest increment. Total delay from 125 ns to 1000 ns with resolution of 5 to 40 ns; tr = 10 ns to 80 ns; Z = 100, 200 or 500 Ω Size: .875 x 3.0 x .45 *Request Bulletin — PR*
STANDARD MIL TYPE LUMPED CONSTANT DELAY LINES	Chassis mounting, steel enclosures', delays range from 1.0 μsec to 50 μsec, Impedance 50 Ω to 2000 Ω ; T/tr from 10 to 50. Specs per MIL-D-23859 Slash sheets. *Request Bulletin — MIL*
CONTINUOUSLY VARIABLE DELAY LINES	**400 Series:** T = 100 ns to 700 ns; tr = 30 to 95 ns; Z = 100 to 1500 Ω Metal encased, Size: 6 17/32 x .66 x 1 1/4 **500 Series:** T = 1.0 to 12.0 μsec; tr = .15 to 1.9 μsec; Z = 75 to 1000 Ω Metal encased, Size: 7 1/4 x 1 x 1 5/8 *Request Bulletin-400/500* **700 Series:** T = .125 to 1.5 μsec, tr = .03 to .1 μsec, Z = 75 Ω to 1800 Ω Metal encased, Size: 4.5 x .5 x 1.51 **800 Series:** T = 10 to 280 ns; T/tr = 4 for size 2.25 x .75 x .35 and T/tr = 7 for 4 x .75 x .35, P.C.B. mounting, Epoxy enclosure. ("Trimline" TM) **900 Series:** Size: .76 x .46 x .25 for T = 5, 10 and 20 ns with T/tr = 2 to 2.5 for T = 30, 40 and 50 ns with T/tr = 3.3 Size is 1.5 x .46 x .25 Z is 200 and 300 Ω Epoxy enclosure for P.C.B. mounting. ("Mini-Trimline" TM) *Request Bulletin — 700/800/900*
HIGH DENSITY PC MOUNTING DELAY LINES	For delays of .5 μsec to 10.0 μsec with T/tr from 18 to 29 Size is 2 x 2 x .4. For delays of 15 μsec to 30 μsec with T/tr = 40 Size is 2.75 x 4.2 x .65.Z varies from 50 Ω at shorter delays to 500 Ω for longer delays. *Request Bulletin — PC*
EXTENDED DELAY/RISE TIME DELAY LINES	Delay/Rise time from 100 to 250; T = 10 μsec to 100 μsec; Z from 75 Ω to 250 Ω. Volume is 91 to 294 cu. in. depending upon T/tr. *Request Bulletin-HP*
MILLSECOND DELAY LINES	Delays from .1 msec to 5 msec; T/tr = 25, 33 and 50; Z = 500, 1000 and 2000 Ω : Volume is from 40 to 162 cu. in., hermetically sealed metal cased construction. *Request Bulletin — MS*



The lines described above represent only a small segment of our total design capability. ESC also designs and manufactures, typically . .

VIDEO	Fixed programmable and mechanically-variable delay lines for the TV broadcast industry, including video cable simulators and voltage variable delay lines.
HI-REL	Proven design, manufacturing capabilities, and facilities encompassing all quality levels dictated by MIL-I-45208 and MIL-Q-9858A.
SONAR	Delay lines used in beam forming systems. These units are manufactured to precision tolerances and are supplied in matched sets or groups.
ATC	Precision tapped delay lines for Air Traffic Control systems of all types, IFF, Beacon Systems, Tacan, Vortac, etc.

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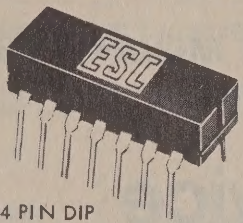
The World's Leading Producer of Electromagnetic DELAY LINES ESC

DIP DELAY LINES

SPECIFICATIONS:

- Operating Temperature: -55°C to + 125°C
- Temperature Coefficient: 50 ppm/°C max
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Conforms to applicable portions of MIL-D-23859
- Size: 1.3 lg. x .580 w. x .300 h.



14 PIN DIP

IMPEDANCE ± 10% →				50	75	93	100	200
Time Delay (nsec)± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	MODEL NO.				
10 ± 1 ns	1.7	10	1.0 ± .5		7P10	9P10	1P10	
20	3.3	10	2.0 ± .5	5P20	7P20	9P20	1P20	2P20
30	5.0	10	3.0 ± 1	5P30	7P30	9P30	1P30	2P30
40	6.5	10	4.0 ± 1	5P40	7P40	9P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	9P50	1P50	2P50
100	16	10	10 ± 1.5	5P100	7P100	9P100	1P100	2P100
150	25	10	15 ± 1.5				1P150	
200	35	10	20 ± 2				1P200	

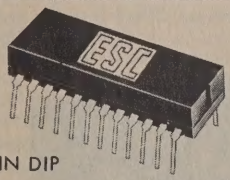
IMPEDANCE ± 10% →				300	400	500
Time Delay ± 5%	Rise Time (nsec)Max	No. of Taps	Delay per Tap ± 5%	MODEL NO.		
300	75	5	60	3P300	4P300	5P300
400	100	5	80	3P400	4P400	5P400
500	125	5	100	3P500	4P500	5P500
600	150	5	120	3P600	4P600	5P600
800	200	5	160	3P800	4P800	5P800
1000	250	5	200	3P1000	4P1000	

Low Profile (.200") available for delays up to 100 nsec. *Request Bulletin-DIP*

SPECIFICATIONS:

- Operating Temperature: -55°C to + 125°C
- Temperature Coefficient: 50 ppm/°C max
- Attenuation: 1 db max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Size: .785 lg. x .320 w. x .300 h.

IMPEDANCE ± 10% (OHMS) →				100	200
Time Delay ± 5%	Rise Time (nsec)Max	No. of Taps	Delay per Tap ± 5%	MODEL NO.	
500	42	20	25	124-5	224-5
600	50	20	30	124-6	224-6
800	67	20	40	124-8	224-8
1000	84	20	50	124-10	224-10
1200	110	20	60	124-12	224-12
1500	125	20	75	124-15	224-15
2000	170	20	100		224-20



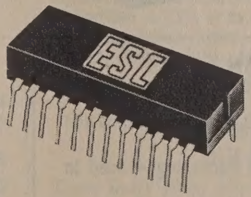
24 PIN DIP

Request Bulletin — DIP-24

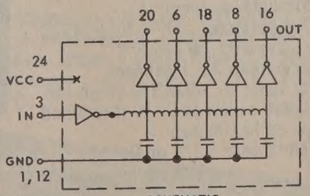
DIGITAL DELAY LINES

HIGH PERFORMANCE TAPPED TTL AND DTL COMPATIBLE IN 24 PIN PACKAGE

5 TAPS		
MODEL	Time Delay (nsec)	Delay per Tap (nsec)
5E05	50	10
5E10	100	20
5E15	150	30
5E20	200	40
5E25	250	50
5E50	500	100
5E100	1000	200



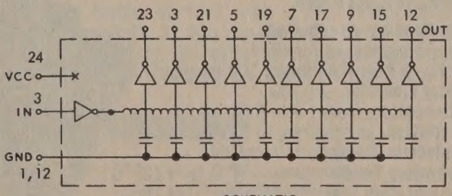
10 TAPS		
MODEL	Time Delay (nsec)	Delay per Tap (nsec)
10J10	100	10
10J15	150	15
10J20	200	20
10J25	250	25
10J30	300	30
10J50	500	50
10J100	1000	100



SCHEMATIC

SPECIFICATIONS:

- Temperature Range: -55°C to + 125°C.
- Vcc: + 4.5 to 5.5 VDC.
- Delay Tolerance: ± 2 ns or 5% whichever is greater.
- Rise Time: 4 ns typical.
- Size: 1.3 lg x .580 w. x .300 h.



SCHEMATIC

Request Bulletin DDL-24

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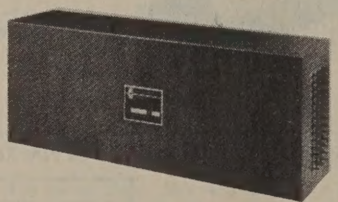
PRECISION SONAR DELAY LINES / SERIES A

The basic design of this series incorporates unsymmetrical Pierce sections with precisely controlled equalization. These sections consist of closely matched high Q inductors and precision tolerance capacitors to assure unsurpassed performance.

SPECIFICATIONS

Delay Range: from 500 μsec to 10^6 μsec ±1%
Delay Linearity: available to within ±0.05%
Bandwidth: 70 KHz maximum
Dielectric Strength: 100 VDC
Operating Temperature: −55°C to +125°C
Temperature Stability: under 50 ppm/°C



SUPER-η* DELAY LINES / SERIES H

SUPER-η LINES embody a new design principle providing the highest efficiency yet obtainable in lumped constant delay lines. Use of network synthesis techniques** rather than conventional m-derived methods result in sharply improved delay line efficiency. Compared to ordinary delay lines of the same delay-to-rise-time ratio, **Super-η** LINES use far fewer LC sections. For this reason these newly-developed lines provide such outstanding advantages as: • Greater Inherent Reliability • Smaller Package Size • Appreciable Cost Reduction

**KAPPA Technical Report #TR-101

SPECIFICATIONS

Delay Range: 0.5 μsec to 500 μsec ±5%
Delay-to-Rise-Time Ratio: as required, up to 150
Delay Linearity: ±1%
Bandwidth: 70 MHz maximum
Distortion: ±10% maximum
Dielectric Strength: as required
Operating Temperature: −55°C to +125°C
Temperature Stability: 50 ppm/°C

*η = Delay Line Efficiency = $\frac{R}{N}$

where R = Ratio of Delay-to-Rise-Time
N = Required number of LC sections

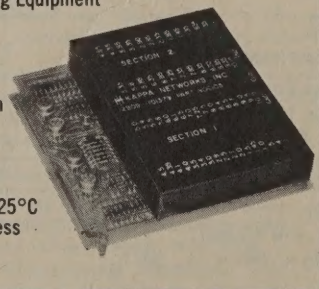
TRANSPONDER LINES / TACAN LINES DME LINES / SERIES C

Designed to meet the requirements of MIL-D-23859 and to withstand the most rigorous military environments.

• Tap Selection to Precise Tolerances • Compact Packaging • Used in Air and Ground Measuring and Signalling Equipment

SPECIFICATIONS

Tap-Spacing: as required
Tap Tolerance: as required
Delay-to-Rise-Time Ratio: 100 maximum
Delay Linearity: ±0.5%
Attenuation: from 1.5 to 6 db
Distortion: as required, to 1%
Dielectric Strength: as required
Operating Temperature: −55°C to +125°C
Temperature Stability: 50 ppm/°C or less

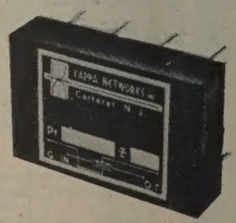


LOW DISTORTION LINES / SERIES D

Used primarily in precision instrumentation where high bandwidth and low distortion are critical considerations.

SPECIFICATIONS

Delay-to-Rise-Time Ratio: 50 maximum
Bandwidth: 50 MHz maximum
Dielectric Strength: as required
Operating Temperature: −55°C to +125°C
Temperature Stability: 50 ppm/°C
Distortion at Output: 2% maximum
Distortion at Taps: less than 5% at any tap
Distortion Limit: as low as 0.1% if required
Delay Range: up to 100μsec
Standard Tolerances: ±1% on Delays
±5% on Impedance



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165 ROOSEVELT AVENUE / CARTERET, NEW JERSEY 07008 / TEL: (201) 541-1600

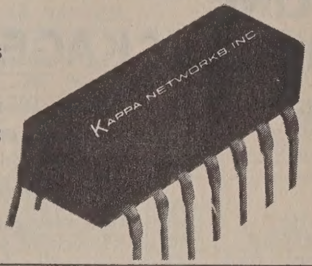
Kappa Networks, Inc. DELAY LINES

DUAL IN LINE / DELAY LINE / SERIES DP

This series widely used in computer, radar and timing applications. • Available with Tapped Delay Increments • Plug into Standard Dual-in-Line Sockets or P.C. Board • Manufactured and Tested to MIL-D-23859

SPECIFICATIONS

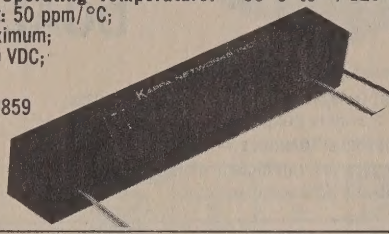
Delay Range: to 1000 nanoseconds
Distortion: 10%
Operating Temperature: –55°C to +125°C
Temperature Stability: 50 ppm/°C
Dielectric Strength: 100 VDC



MINIATURE NANOSECOND DELAY LINE / SERIES KM

This series of lumped constant design, incorporates an advanced technique of packaging, to offer high figure of merit in small volume.

SPECIFICATIONS: Operating Temperature: –55°C to +125°C; **Temperature Coefficient:** 50 ppm/°C; **Attenuation:** 0.5 db maximum; **Dielectric Strength:** 100 VDC; **Distortion (typical):** ±10%; Meets MIL-D-23859

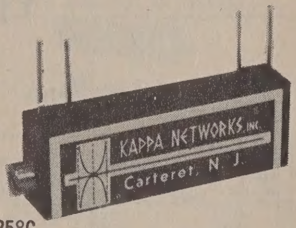


MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS / SERIES TT

This Series is the smallest of its kind and is immediately available from stock. Intermittent-free operation is assured by KAPPA's unique contact design.

SPECIFICATIONS

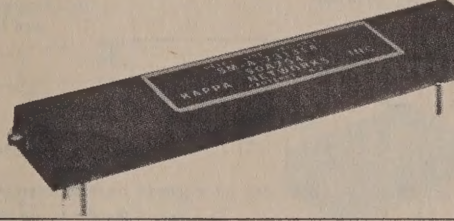
Size: ¼ cubic inch
Delay Range: up to 120 nanoseconds
Resolution: —25 nanoseconds or less
Relay-to-Rise-Time Ratio: 4/1
Bandwidth To: 70 MHz
Attenuation: .25 db maximum
Distortion: ±15% maximum
Dielectric Strength: 100 VDC
Operating Temperature: –55°C to +125°C
Temperature Stability: 200 ppm/°C



MINITRIM DELAY LINE / SERIES MT

This series available in both distributed and lumped constant design. • Ideal for P.C. Board Insertion • Wide Range of Delay • KAPPA Minitrim Delay Lines are Designed for Circuits Requiring Precise Delay Adjustments

SPECIFICATIONS: Delay Range: up to 300 nanoseconds; **Resolution:** less than 1 nanoseconds; **Attenuation:** less than .5 db; **Dielectric Strength:** as required; **Operation Temperature:** –55°C to +125°C



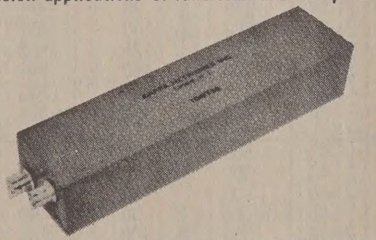
VIDEO BROADCAST DELAY LINES / SERIES BC

KAPPA Video Broadcast Delay Lines yield a greater delay-bandwidth from fewer components than conventional units, and their performance more nearly approaches constant delay at all transmitted frequencies than do conventional (m-derived) delay lines.

This performance has established their wide acceptance for use in the most demanding color television applications of American and European Systems.

SPECIFICATIONS

Delay Range: to 10 μsec
Impedance: 75 ohms ±2%
Linear Delay Bandwidth:
to 14 MHz, Delays to 1 μsec
7 MHz, Delays to 5 μsec
5 MHz, Delays to 10 μsec



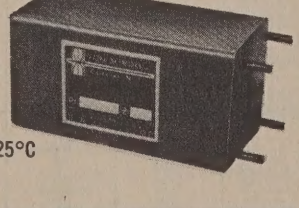
STANDARD LUMPED CONSTANT DELAY LINES / SERIES LC

Most standard KAPPA Lumped Constant Delay Lines utilize either the highly efficient Golay or unsymmetrical Pierce designs. Equalization is precisely calculated and realized, fully accounting for variations in magnetic core permeability, distributed capacity and other variables. The resulting units exhibit the specified delay linearity tolerance to frequencies beyond the 3 db passband.

SPECIFICATIONS

Delay: 50 nanoseconds to 1 second*
Impedance: 20 ohms to 50 K ohms
Delay-to-Rise-Time Ratio: 150 maximum
Delay Linearity: ±0.5%
Bandwidth: DC to 250 MHz*
Distortion: ±10% or as required
Operating Temperature: –55°C to +125°C
Temperature Stability: 50 ppm/°C

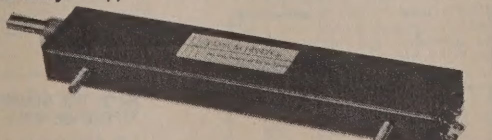
*Subject to a limit on delay X bandwidth



CONTINUOUSLY VARIABLE DELAY LINES / SERIES K

This series offer continuously variable delay lines of lumped constant design. Incorporating special contact feature for intermittent free variation.

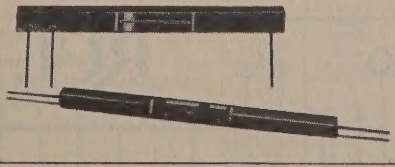
SPECIFICATIONS: Delay Range: to 2.0 μsec; **Resolutions:** 1/1000 of total delay or 1 nanosecond whichever is greater; **Delay-to-Rise-Time Ratio:** up to 10:1; **Attenuation:** under 1.5 db; **Dielectric Strength:** as required; **Operating Temperature:** –55°C to +125°C; **Temperature Coefficient Delay:** 50 ppm/°C



STANDARD DISTRIBUTED CONSTANT DELAY LINES / SERIES DC

These Delay Lines offer limited delay-rise-time ratio and small volume at lowest cost. • Available for P.C. Board Insertion • Short Delivery Cycle

SPECIFICATIONS: Delay Range: up to 3 μsec ±5%; **Delay-to-Rise-Time Ratio:** 11 maximum; **Bandwidth:** 30 MHz maximum; **Distortion:** ±5% typical, ±10% maximum; **Dielectric Strength:** as required; **Operating Temperature:** –55°C to +125°C; **Temperature Stability:** 200 ppm/°C maximum



PHONE OR WRITE FOR FREE CATALOGUE AND DATA SHEETS

DIAL TOLL-FREE 800-631-5653

KAPPA NETWORKS, INC.

165 ROOSEVELT AVENUE / CARTERET, NEW JERSEY 07008 / TEL: (201) 541-1600

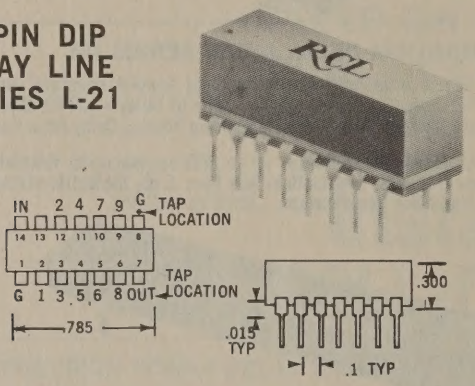
AMF
RCL Electronics

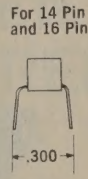
DELAY LINE DIVISION:
DEPT. EM, 195 McGREGOR STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE (603) 627-3831 • TWX 710-220-1876

DELAY LINE DUAL IN-LINE "DIP" PACKAGES

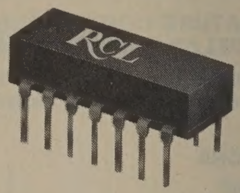
- Compatible with TTL circuits
- Total Delay Tolerance = ±5% or 1 nsec, whichever is greater
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay 70 ppm/°C ±30 ppm/°C
- Tap Interval Tolerance = ±10% or 1 nsec, whichever is greater
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50 wvdc
- Td/Tr Ratio = 5/1 (24 pin = 10/1)
- Economically priced
- Epoxy encapsulated
- Exceeds applicable portions of MIL-D-23859
- Low distortion
- Low attenuation

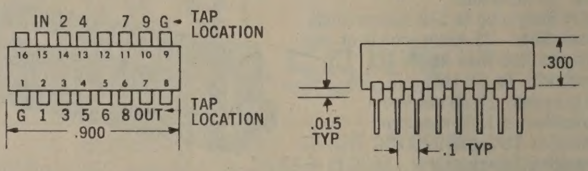
14 PIN DIP DELAY LINE SERIES L-21


RCL
IN 2 4 7 9 G TAP LOCATION
14 13 12 11 10 9 8
1 2 3 4 5 6 7
G 1 3 5 6 8 OUT TAP LOCATION
.785
.300
.015 TYP
.1 TYP


For 14 Pin and 16 Pin
.300

16 PIN DIP DELAY LINE SERIES L-22




IN 2 4 7 9 G TAP LOCATION
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
G 1 3 5 6 8 OUT TAP LOCATION
.900
.300
.015 TYP
.1 TYP

NOTE: Available in case heights of .220 or .187 for automatic machine insertion.

To order 16 Pin Series use chart below but substitute "22" for "21"

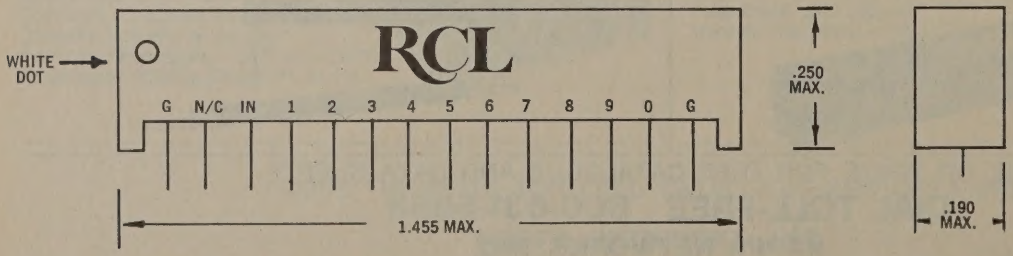
Part No.	Impedance (ohms)	Total Delay (nsec.)	Tap Intervals (nsec.)	Rise Time (nsec.)	Maximum Attenuation (db)
L-21-10	50	40	4	8	1 db
L-21-11	50	50	5	10	1 db
L-21-12	50	60	6	12	1 db
L-21-13	50	70	7	14	1 db
L-21-14	50	80	8	16	1 db
L-21-15	50	90	9	18	1 db
L-21-16	50	100	10	20	1 db
L-21-17	50	125	12.5	25	1 db
L-21-18	50	150	15	30	1 db
L-21-19	50	175	17.5	35	1 db
L-21-20	50	200	20	40	1 db
L-21-21	100	50	5	10	1 db
L-21-22	100	60	6	12	1 db
L-21-23	100	70	7	14	1 db
L-21-24	100	80	8	16	1 db
L-21-25	100	90	9	18	1 db
L-21-26	100	100	10	20	1 db
L-21-27	100	125	12.5	25	1 db
L-21-28	100	150	15	30	1 db
L-21-29	100	200	20	40	1 db
L-21-30	100	300	30	60	1 db

Part No.	Impedance (ohms)	Total Delay (nsec.)	Tap Intervals (nsec.)	Rise Time (nsec.)	Maximum Attenuation (db)
L-21-31	200	50	5	10	1 db
L-21-32	200	60	6	12	1 db
L-21-33	200	70	7	14	1 db
L-21-34	200	80	8	16	1 db
L-21-35	200	90	9	18	1 db
L-21-36	200	100	10	20	1 db
L-21-37	200	125	12.5	25	1 db
L-21-38	200	150	15	30	1 db
L-21-39	200	200	20	40	1 db
L-21-40	200	300	30	60	1 db
L-21-41	500	50	5	10	1 db
L-21-42	500	60	6	12	1 db
L-21-43	500	70	7	14	1 db
L-21-44	500	80	8	16	1 db
L-21-45	500	90	9	18	1 db
L-21-46	500	100	10	20	1 db
L-21-47	500	125	12.5	25	1 db
L-21-48	500	150	15	30	1 db
L-21-49	500	200	20	40	1 db
L-21-50	500	300	30	60	1 db

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

14 PIN SINGLE-IN-LINE DELAY LINES SERIES L-26

All Parameters in L-21 and L-22 Series Can Be Provided in L-26 Series


WHITE DOT
RCL
G N/C IN 1 2 3 4 5 6 7 8 9 0 G
1.455 MAX.
.250 MAX.
.190 MAX.

NOTE: PIN NUMBERS FOR REFERENCE ONLY.

PIN SPACING = 0.100"

AMF RCL Electronics

DELAY LINE DIVISION:

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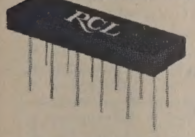
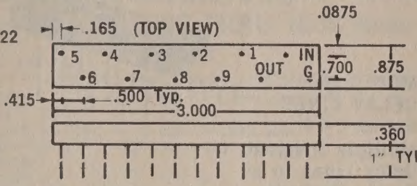
LUMPED CONSTANT DELAY LINES EPOXY ENCAPSULATED Series L-24

Lead Dia.: AWG 22



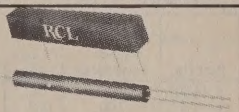


RCL Part No.	Delay nsec.*	Rise Time nsec. (max.)	Impedance Ohms (±10%)	Output Distortion % (max.)	Attenuation % (max.)	Working Voltage (max.)	External Taps
L-24-10	50	7	100	10	10	100	Every 5 nsec.
L-24-11	100	12	100	10	10	100	Every 10 nsec.
L-24-12	200	20	100	10	10	100	Every 20 nsec.
L-24-13	250	25	100	10	10	100	Every 25 nsec.
L-24-14	300	30	100	10	10	100	Every 30 nsec.
L-24-15	400	40	100	10	10	100	Every 40 nsec.
L-24-16	500	50	100	10	10	100	Every 50 nsec.

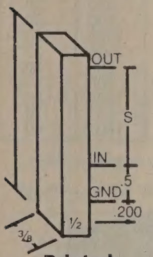
* =1 nsec or 10%, whichever is greater on total delay or taps, referred to input.

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

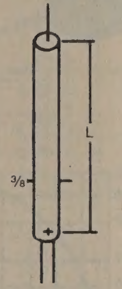
DISTRIBUTED CONSTANT DELAY LINES Series L-07 & L-08



Lead Dia.: AWG 22



Printed Board Type



Cylindrical Type

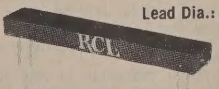
Part No. Printed Board	Part No. Cylindrical Type	Delay μsec. †	Impedance ohms‡	Rise Time μsec.	Attenuation db	Printed Board "L"	Printed Board "S"
L-07-10	L-08-10	.1	500	.055	1.5 db/μsec. or .25 db whichever is greater	2¼"	.7
L-07-11	L-08-11	.2		.075		2¼"	.7
L-07-12	L-08-12	.3		.080		2¼"	.7
L-07-13	L-08-13	.4		.085		2¾"	1.3
L-07-14	L-08-14	.5		.085		3¼"	1.7
L-07-15	L-08-15	.6		.10		3¾"	2.3
L-07-16	L-08-16	.7		.105		4"	2.5
L-07-17	L-08-17	.8		.120		4½"	2.9
L-07-18	L-08-18	.9		.125		5"	3.5
L-07-19	L-08-19	1.0		.130		5½"	3.9
L-07-20	L-08-20	1.1		.135		5¾"	4.3
L-07-21	L-08-21	1.2		.14		6¼"	4.7
L-07-22	L-08-22	.1	1000	.06	1.8 db/μsec. or .25 db whichever is greater	2¼"	.7
L-07-23	L-08-23	.2		.065		2¼"	.7
L-07-24	L-08-24	.3		.075		2¾"	1.3
L-07-25	L-08-25	.4		.085		3¼"	1.7
L-07-26	L-08-26	.5		.09		3¾"	2.3
L-07-27	L-08-27	.6		.095		4"	2.5
L-07-28	L-08-28	.7		.100		4½"	2.9
L-07-29	L-08-29	.8		.105		5"	3.5
L-07-30	L-08-30	.9		.110		5½"	3.9
L-07-31	L-08-31	1.0		.120		6"	4.5
L-07-32	L-08-32	1.1		.130		6½"	4.9
L-07-33	L-08-33	.1	1200	.06	1.8 db/μsec. or .25 db whichever is greater	2¼"	.7
L-07-34	L-08-34	.2		.075		2¼"	.7
L-07-35	L-08-35	.3		.08		2¾"	1.3
L-07-36	L-08-36	.4		.085		3¼"	1.7
L-07-37	L-08-37	.5		.09		4"	2.5
L-07-38	L-08-38	.6		.095		4½"	2.9
L-07-39	L-08-39	.7		.100		5¼"	3.7
L-07-40	L-08-40	.8		.110		5¾"	4.3
L-07-41	L-08-41	.9		.120		6½"	4.9
L-07-42	L-08-42	1.0		.130		6½"	4.9

† ±5% ‡ ±10%

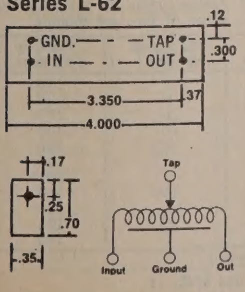
When ordering, lead length should be specified (½" nominal).

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

VARIABLE DELAY LINES — Series L-62



Lead Dia.: AWG 20



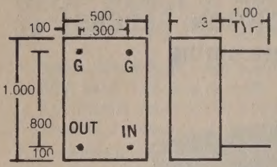
For applications which require adjustable delay time in the operating circuitry. The units are sealed against moisture and contamination. The adjusting shaft is equipped with a watertight "O" ring seal.

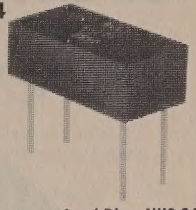
10 Turn Adjustment

RCL Part No.	Delay Range nsec.	Impedance ohms	Rise Time Max. nsec.
L-62-10	10-250	1000	40
L-62-11	10-200	200	40
L-62-12	0-300	750	60
L-62-14	5-80	300	20
L-62-15	10-250	500	60
L-62-18	10-450	500	100
L-62-19	3-100	200	15

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

MINIATURE DELAY LINES — Series L-04



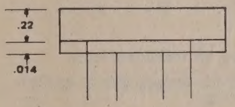


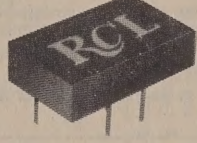
Lead Dia.: AWG 24

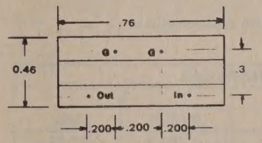
RCL Part No.	Delay nsec. (±5%)	Rise Time nsec.	Impedance ohms (±10%)	Distortion %	Attenuation %	Working Voltage (max.)
L-04-10	20	3	100	10	10	100
L-04-11	25	4	100	10	10	100
L-04-12	40	6	100	10	10	100
L-04-13	50	8	100	10	10	100
L-04-14	75	12	100	10	10	100
L-04-15	100	20	100	10	10	100

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

DIP COMPATIBLE SUBMINIATURE DELAY LINES Series L-05







TYPICAL EXAMPLES:

RCL Part No.	Delay nsec.*	Rise Time nsec.	Impedance† ohms (±10%)
L-05-00	5	2	50
L-05-01	10	4	50
L-05-02	25	10	50
L-05-03	5	2	75
L-05-04	10	4	75
L-05-05	25	10	75
L-05-06	50	20	75
L-05-07	10	4	100
L-05-08	15	6	100
L-05-09	20	8	100
L-05-10	25	10	100
L-05-11	50	20	100
L-05-12	100	46	100
L-05-13	200	80	100
L-05-14	30	16	200
L-05-15	50	20	200
L-05-16	200	80	200
L-05-17	50	20	500
L-05-18	200	80	500
L-05-19	100	46	1000
L-05-20	500	200	1000

Distortion: 10% all-encompassing

Attenuation: 10%

Working Voltage: 100V

Temperature Coefficient: 70 ppm/°C max. −55° to +125°C

Mil Spec: Meets or exceeds all applicable sections of MIL-D-23859.

In addition to the above examples of Delays, many others are available on request.

Lead Dia.: AWG 24

* ±1 nsec. or ±10%, whichever is greater.

† OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST.

VARIABLE DELAY "DUAL IN-LINES" DIP — Series L-61

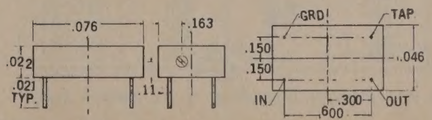
- Sealed against moisture
- Precious metal contacts
- Resolution: 2% for highest possible reliability performance

Delay lines meet applicable portion of MIL-D-23859.

TYPICAL EXAMPLES

RCL Type No.	Delay Range (Max. nsec.)	Impedance ohms (±10%)	Rise Time (nsec.)
L-61-10	.5-5	100	5
L-61-11	2-20	200	15
L-61-12	2-30	350	20
L-61-13	2-40	500	25
L-61-18	3-60	50	30

Lead Dia.: AWG 24



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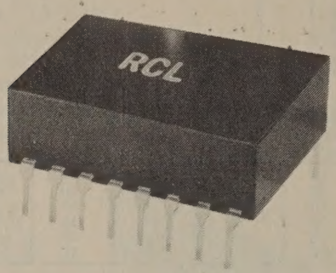
DEPT. EM, 195 McGREGOR STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE (603) 627-3831 • TWX 710-220-1876

DELAY LINE DUAL-IN-LINE "DIP" OPTION BLOCKS For Micro Programming

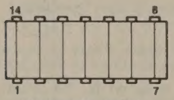


Designed to be used for bussing or micro programming, such as code conversion and rate multiplication. The units can also be used as shorting modules for test fixture compensation.

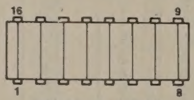
- 14 & 16 pin packages
- Custom configurations are available
- Shorting pattern may be modified by simply cutting off individual leads
- Allows shorting of multiple arrangements of pins for various circuit applications on circuit boards using a standard DIP spacing.
- May be used for bussing or micro programming, such as code conversion and rate multiplication.
- Can be used as shorting modules for test fixture compensation.

	DIMENSIONS			
	A		B	
STYLE	INCHES	MM	INCHES	MM
16 PIN DIP	.860	21.84	.700	17.78
14 PIN DIP	.760	19.30	.600	15.24

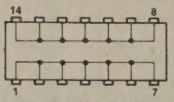
SCHEMATIC



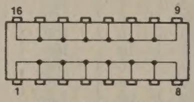
RCL Part No. L-17-01



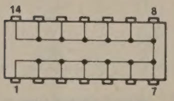
RCL Part No. L-18-01



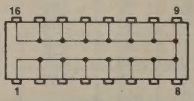
RCL Part No. L-17-02



RCL Part No. L-18-02

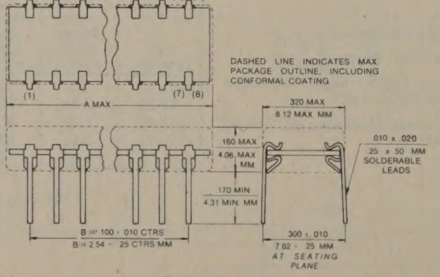


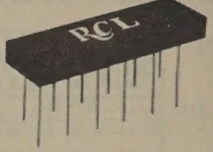
RCL Part No. L-17-03



RCL Part No. L-18-03

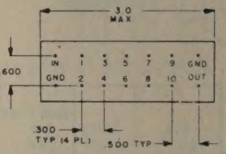
OUTLINE DRAWING


(16) (14)
(9) (8)
(1)
(7) (8)
A MAX
DASHED LINE INDICATES MAX PACKAGE OUTLINE, INCLUDING CONFORMAL COATING
320 MAX
8.12 MAX MM
.160 MAX
4.06 MAX MM
.170 MIN
4.31 MIN MM
.010 x .020
.25 x .50 MM
SOLDERABLE LEADS
B @ .100 ± .010 CTRS
B @ 2.54 ± .25 CTRS MM
.300 ± .010
7.62 ± .25 MM
AT SEATING PLANE



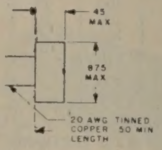
MODULAR DELAY LINES Series L-44

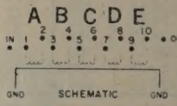
Multiple Discreet Delay Lines in a Single Package


3.0 MAX
IN 1 3 5 7 9 GND
GND 2 4 6 8 10 OUT
.600
.300 TYP (4 PL)
.500 TYP

SPECIFICATIONS:

- Operating Temperature: −55°C to +125°C
- Attenuation: 1 db
- Distortion: ±10%
- Temperature Coefficient: 100 ppm/°C
- Dielectric Strength: 100 VDC
- Delay Tolerance: ±5% or ±3 nsec, whichever is greater.
- Impedance: ±10%


.45 MAX
.875 MAX
20 AWG TINNED COPPER .50 MIN LENGTH


A B C D E
IN 1
2 3 4 5 6 7 8 9 10
OUT
GND
GND

SCHEMATIC

Part No.	Ohms Impedance	Time Delays (nsec.) A	B	C	D	E	Total	Total (nsec.) Rise Time
L-44-10	100	50	40	20	10	5	125	10
L-44-11	100	100	80	40	20	10	250	20
L-44-12	100	200	160	80	40	20	500	50
L-44-13	100	400	320	160	80	40	1000	80
L-44-14	200	50	40	20	10	5	125	10
L-44-15	200	100	80	40	20	10	250	20
L-44-16	200	200	160	80	40	20	500	50
L-44-17	200	400	320	160	80	40	1000	80
L-44-18	500	100	80	40	20	10	250	20
L-44-19	500	400	320	160	80	40	1000	80

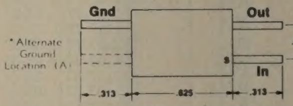
OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

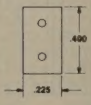
ECONOLINE DELAY LINES Series L-09

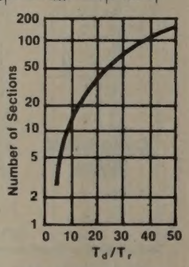
Lumped Constant, Econoline Modules are designed primarily for computer applications where large quantities of low cost time delays are required. Eleven different time delay values between 10 and 200 nanoseconds are available in this new modular form. Each module unit is a single time delay section. The required total delay and delay to rise time ratio can be obtained by simply interconnecting a number of modules. The accompanying chart shows how to select the proper module values.

Econoline Delay Line Modules are also ideal for prototypes and breadboard circuits. Single modules can be connected together on a circuit board with taps available at each connection point, if needed.

Econoline Delay Line Modules should be used in applications where pulse distortion and tolerance are not critical. They provide a convenient low cost time delay for commercial and industrial usage.


Gnd
Out
* Alternate Ground Location (A)
s
In
.200
.313
.625
.313





SELECTION CHART

The chart above can be used to determine the number of modules required to provide a desired delay and rise time.

1. Determine the delay to rise time ratio by dividing the desired time delay by the desired rise time.

2. Using the chart determine the number of sections required for this T_d/T_r.

3. Divide this number of sections by the total delay to determine the delay per section.

Total delay is the sum of the individual section delays. It can be trimmed to the desired value by selecting the proper value of the last module.

RCL Part No.	Delay nsec. (±10%)	Impedance ohms (±10%)	Attenuation db (max.)	Working Volt. (max.)
L-09-10	10	500	1	100
L-09-11	20	500	1	100
L-09-12	30	500	1	100
L-09-13	40	500	1	100
L-09-14	50	500	1	100
L-09-15	60	500	1	100
L-09-16	70	500	1	100
L-09-17	80	500	1	100
L-09-18	90	500	1	100
L-09-19	100	500	1	100
L-09-20	200	500	1	100

ORDERING INFORMATION

* For relocating ground terminal to Position A use Suffix -1

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

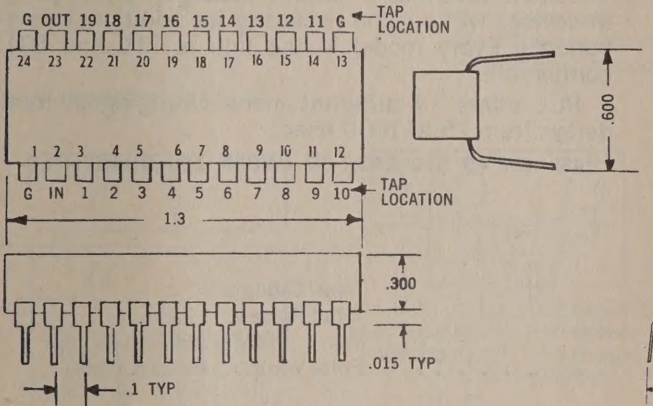
AMF

DELAY LINE DIVISION:
DEPT. EM, 195 McGREGOR STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE (603) 627-3831 • TWX 710-220-1876

RCL Electronics

24 PIN DIP DELAY LINE — Series L-23 (20 TAPS) DELAY RANGE 100 THRU 1500 Nsec

- Compatible with TTL circuits
- Total Delay Tolerance = ±5% or 1 nsec, whichever is greater
- Tap Interval Tolerance = ±10% or 1 nsec, whichever is greater
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay = 70 ppm/°C ±30 ppm/°C
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50VDC
- Low distortion
- Low attenuation
- Epoxy encapsulated
- Td/Tr Ratio = 10/1
- Exceeds applicable portions of MIL-D-23859



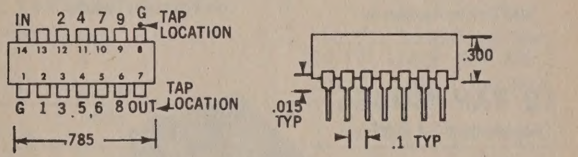
To Order 24 Pin, Series L-23, Use Chart Below

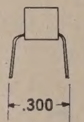
24 Pin Series L-23 Part No.	Impedance (ohms)	Total Delay (nsec.)	Tap Intervals (nsec.)	Rise Time (nsec.)	Max. Attenuation (db)
L-23-10	75	100	5	10	1 db
L-23-11	75	150	7.5	15	1 db
L-23-12	75	200	10	20	1 db
L-23-13	75	250	12.5	25	1 db
L-23-14	100	100	5	10	1 db
L-23-15	100	150	7.5	15	1 db
L-23-16	100	200	10	20	1 db
L-23-17	100	250	12.5	25	1 db
L-23-18	100	300	15	30	1 db
L-23-19	100	350	17.5	35	1 db
L-23-20	200	200	10	20	1 db
L-23-21	200	250	12.5	25	1 db
L-23-22	200	300	15	30	1 db
L-23-23	200	350	17.5	35	1 db
L-23-24	200	400	20	40	1 db
L-23-25	200	500	25	50	1 db
L-23-26	200	600	30	60	1 db
L-23-27	200	700	35	70	1 db
L-23-28	350	350	17.5	35	1 db
L-23-29	350	400	20	40	1 db
L-23-30	350	450	22.5	45	1 db
L-23-31	350	500	25	50	1 db
L-23-32	350	600	30	60	1 db
L-23-33	350	700	35	70	1 db
L-23-34	350	800	40	80	1 db
L-23-35	350	900	45	90	1 db
L-23-36	350	1000	50	100	1 db
L-23-37	350	1100	55	110	1 db
L-23-38	350	1200	60	120	1 db
L-23-39	500	500	25	50	1 db
L-23-40	500	600	30	60	1 db
L-23-41	500	700	35	70	1 db
L-23-42	500	800	40	80	1 db
L-23-43	500	900	45	90	1 db
L-23-44	500	1000	50	100	1 db
L-23-45	500	1500	75	150	1 db

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

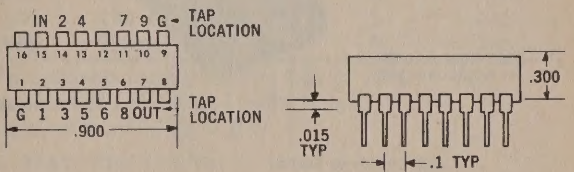
NEW! 4th GENERATION COMPATIBLE DELAY RANGE 5 THROUGH 45 Nsec 14 PIN & 16 PIN DIP — Series L-21 & L-22

- Compatible with all logic systems
- Total Delay Tolerance = ±5% or 1 nsec, whichever is greater
- Tap Interval Tolerance = ±20% or .35 nsec, whichever is greater
- Impedance Tolerance = ±10%
- Temperature Coefficient of Delay = 70 ppm/°C ±30 ppm/°C
- Operating Temperature Range = −55°C to +125°C
- Voltage Rating = 50WVDC
- Td/Tr Ratio = 5/1
- Economically priced
- Epoxy encapsulated
- Exceeds applicable portions of MIL-D-23859
- Low distortion
- Low attenuation





For 14 Pin and 16 Pin



To Order 16 Pin, Series L-22, Substitute "22" for "21"

14 Pin Series L-21 Part No.	Impedance (ohms)	Total Delay (nsec.)	Tap Intervals (nsec.)	Rise Time (nsec.)	Max. Attenuation (db)
L-21-250	50	5.0	0.50	2.5	0.5 db
L-21-251	50	7.5	0.75	3.0	0.5 db
L-21-252	50	10.0	1.00	3.5	0.5 db
L-21-253	50	12.5	1.25	4.0	0.5 db
L-21-254	50	15.0	1.50	4.5	0.5 db
L-21-255	50	17.5	1.75	5.0	0.5 db
L-21-256	50	20.0	2.00	5.5	0.5 db
L-21-257	50	25.0	2.50	6.0	0.5 db
L-21-258	50	30.0	3.00	6.5	0.5 db
L-21-259	50	35.0	3.50	7.0	0.5 db
L-21-260	75	5.0	0.50	2.5	0.75 db
L-21-261	75	7.5	0.75	3.0	0.75 db
L-21-262	75	10.0	1.00	3.5	0.75 db
L-21-263	75	12.5	1.25	4.0	0.75 db
L-21-264	75	15.0	1.50	4.5	0.75 db
L-21-265	75	17.5	1.75	5.0	0.75 db
L-21-266	75	20.0	2.00	5.5	0.75 db
L-21-267	75	25.0	2.50	6.0	0.75 db
L-21-268	75	30.0	3.00	6.5	0.75 db
L-21-269	75	35.0	3.50	7.0	0.75 db
L-21-270	100	5.0	0.50	2.5	0.75 db
L-21-271	100	7.5	0.75	3.0	0.75 db
L-21-272	100	10.0	1.00	3.5	0.75 db
L-21-273	100	12.5	1.25	4.0	0.75 db
L-21-274	100	15.0	1.50	4.5	0.75 db
L-21-275	100	17.5	1.75	5.0	0.75 db
L-21-276	100	20.0	2.00	5.5	0.75 db
L-21-277	100	25.0	2.50	6.0	0.75 db
L-21-278	100	30.0	3.00	6.5	0.75 db
L-21-279	100	35.0	3.50	7.0	0.75 db
L-21-280	100	40.0	4.00	8.0	0.75 db
L-21-281	100	45.0	4.50	9.0	0.75 db
L-21-282	200	10.0	1.00	3.5	1 db
L-21-283	200	12.5	1.25	4.0	1 db
L-21-284	200	15.0	1.50	4.5	1 db
L-21-285	200	17.5	1.75	5.0	1 db
L-21-286	200	20.0	2.00	5.5	1 db
L-21-287	200	25.0	2.50	6.0	1 db
L-21-288	200	30.0	3.00	6.5	1 db
L-21-289	200	35.0	3.50	7.0	1 db
L-21-290	200	40.0	4.00	8.0	1 db
L-21-291	200	45.0	4.50	9.0	1 db

OTHER PARAMETERS & TOLERANCES AVAILABLE ON REQUEST

AMF
RCL Electronics

DELAY LINE DIVISION:
DEPT. EM, 195 McGREGOR STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE (603) 627-3831 • TWX 710-220-1876

ACTIVE-DIGITAL DELAY MODULES (FOR TTL & DTL APPLICATIONS)

NOW RCL OFFERS DIGITAL DELAY MODULES WITH EXTENDED RANGE OF DELAYS

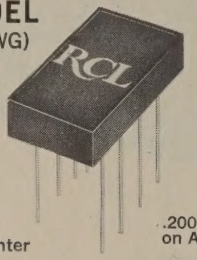
- **DDM Range Extended from 25 to 1000 nsec.**
- **TTL and DTL Compatible**
- **Extremely Low Profile (.250″ Off Board)**

SPECIFICATIONS

Rise Time (All Models)	2 nsec. Max.
Logic 1V Out (All Models)	2.4V Min.
Logic 0V Out (All Models)	0.6V Max.

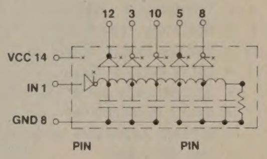
5 TAP MODEL

(All leads #24 AWG)



.300 Center-to-Center

.200 Center to Center on Adjacent Leads



RCL now adds an entirely new dimension to its regular series of Delay Line Modules. 5 TAP packages (1″L x .4″W x .250″High), 10 TAP packages (1″L x .8″W x .250″High).

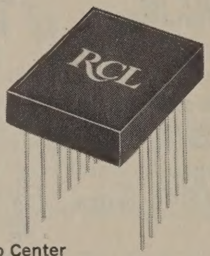
Built-in interface offers the customer direct plug-in devices without the necessity for additional components. Every model in the line is TTL and DTL compatible.

RCL offers 14 different models ranging in total delays from 25 to 1000 nsec.

AS LOW AS $10 EACH IN UNDER 100 QUANTITIES

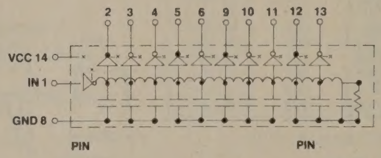
10 TAP MODEL

(All leads #24 AWG)



.100 Center to Center on Adjacent Leads

.600 Center to Center



Input Conditions
Input Pulse V . . . 3.2V
Vcc . . . 5.00V ±.25V
Pulse Width . . . 40% Td. Min.

5 TAP MODEL

RCL Style	Total Delay (ns ±5%) or ±2 nsec. whichever is greater	Delay (ns) Per Tap
L-28-00	25	5
L-28-01	50	10
L-28-02	100	20
L-28-03	150	30
L-28-04	200	40
L-28-05	250	50
L-28-06	500	100
L-28-07	1000	200

(a) Measured at 1.5V level
(b) ±10% or 2 ns, whichever is greater

Pin #	Connection
1	INPUT
3	40% TD
5	80% TD
7	GROUND
8	100% TD
10	60% TD
12	20% TD
14	Vcc

Temperature Range	0°C to 70°C
Logic "0" Drive Capabilities	10 Loads/Tap Max.
Logic "1" Drive Capabilities	20 Loads/Tap Max.
Total Delay Tolerance	±5% or ±2 ns
Tap Delay Tolerance	±10% or ±2 ns
Logic "1" Input Current	50 μA Max.
Logic "0" Input Current	−2 mA Max.

10 TAP MODEL

RCL Style	Total Delay (ns ±5%) or ±2 nsec. whichever is greater	Delay (ns) Per Tap
L-29-01	100	10
L-29-02	150	15
L-29-03	200	20
L-29-04	250	25
L-29-05	500	50
L-29-06	1000	100

(a) Measured at 1.5V level
(b) ±10% or 2 ns, whichever is greater

Pin #	Connection
1	INPUT
2	TAP #1
3	TAP #2
4	TAP #3
5	TAP #4
6	TAP #5
8	GROUND
9	TAP #6
10	TAP #7
11	TAP #8
12	TAP #9
13	TAP #10
14	Vcc

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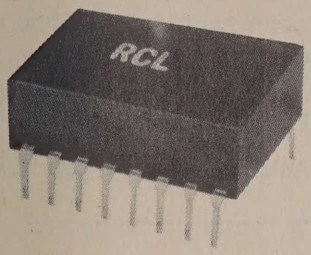
RCL Electronics

DELAY LINE DIVISION:
DEPT. EM, 195 McGREGOR STREET
MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE (603) 627-3831 • TWX 710-220-1876

"PLUG-IN" DIGITAL "DIP" DELAY MODULES



- **Fast Rise Time — Independent of Delay**
- **DTL and TTL Compatible**
- **5 Tapped Delays**

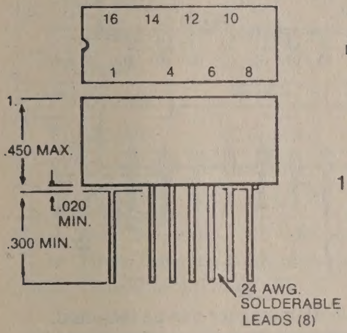
RCL "Plug-In" Digital Delay Modules provide the precise timing features of a Delay Line in a device which can be easily used with the DTL and TTL families. Considerable space savings and flexibility are achieved over the use of conventional components.

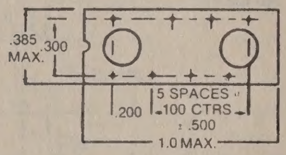
- **High Fan Out Capability**
- **50 ns, 100 ns, 250 ns Delays**
- **16 Pin Dip Pattern**
- **In Stock**

SPECIFICATIONS

Supply Voltage Vcc ...+4.75 to 5.25VDC
Logic "1" Input Current .... 50 μA Max.
Logic "0" Input Current ...... −2 mA Max.
Logic "1" V Out .... 2.4V Min.
Logic "0" V Out .... 0.4V Max.

PIN CONNECTIONS





1 Input	12 60% Delay
14 20% Delay	10 Output
4 40% Delay	8 Ground
	16 Vcc

DRIVE CAPABILITIES

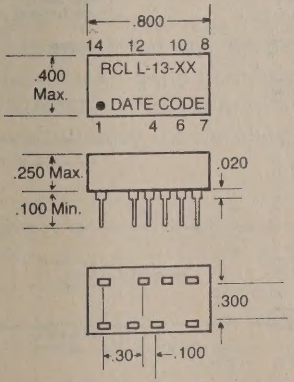
Logic "0" Output .... 10 TTL Loads/Tap Max.
(20 TTL Loads/Unit Max.)
Logic "1" Output .... 20 TTL Loads/Unit Max.

RCL No.	Delay Time (a)	Delay/Tap (b)	No/Taps	Rise Time[2]
L13-01	50 ns	10 ns	5	4 ns
L13-02	100 ns	20 ns	5	4 ns
L13-03	250 ns	50 ns	5	4 ns

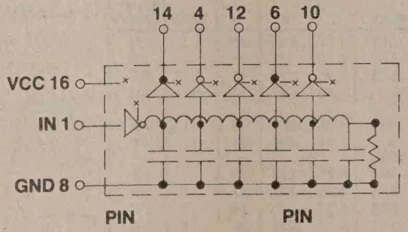
All Measurements Made at Vcc = 5.0V @ 25°C
(a) Measured at 1.5V Level, Leading Edge
(b) Measured from 0.75V to 2.4V

INPUT TEST CONDITIONS

Pulse Voltage	3.2V	Input Current	60 mA TYP
Rise Time	3 ns	Pulse Width	Min. of 40% of Delay



Connection	PIN #
INPUT	1
40% TD	4
80% TD	6
GROUND	7
OUTPUT	8
60% TD	10
20% TD	12
Vcc	14



RCL Part No.	1. Delay (TD)	Tap Delay
L-13-04	25 ns	5 ns
L-13-05	30 ns	6 ns
L-13-06	35 ns	7 ns
L-13-07	40 ns	8 ns
L-13-08	45 ns	9 ns
L-13-09	50 ns	10 ns
L-13-10	75 ns	15 ns
L-13-11	100 ns	20 ns
L-13-12	150 ns	30 ns
L-13-13	200 ns	40 ns
L-13-14	250 ns	50 ns

1. Measured at 1.5V level
2. Measured from .75V to 2.4V

All measurements at 25°C

Total Delay Tolerance .... ±5%
Tap Delay Tolerance ...... ±3 ns or ±5%
2. All Rise Times .... 4 ns Max.
Logic "0" Out .... .4V Max.
Logic "1" Out .... 2.4V Min.
All Lines Internally Terminated
10 TTL Loads Per Tap Max.
20 TTL Loads Per Unit Max.
Operating Temperature ...... 0°C to 70°C
Vcc .... 5VDC ±.25VDC
Logic "0" In ...... .8V Max., −2 mA Max.
Logic "1" In .. 2.0 to 5.5V, 50μA to 1 mA

INPUT TEST CONDITIONS

Pulse Width .... 40% TD Min.
Vcc .... 5.0VDC, 40 mA
Rise Time .... 3.0 ns
Pulse Voltage 3.2V

Technitrol, Inc.

DUAL-IN-LINE, LOW PROFILE MINIATURE LUMPED — CONSTANT DELAY LINES

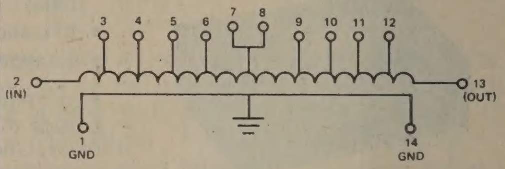
Part No.	Delay* (NS)	Rise Time (NS-Max.)	Impedance (Ohms) ±10%	Att. (% Max.)	DCR (Ohms Max.)	Tap Delay (NS-Max.)
LB10F1	20	3.1	50	2.5	1.0	2.0
LB10G1	25	3.5	50	2.5	1.0	2.5
LB10K1	50	7.5	50	3.5	1.5	5.0
LB10M1	100	17.0	50	5.5	2.5	10.0
LF10D1	10	2.2	100	1.5	1.0	1.0
LF10E1	12.5	2.5	100	1.5	1.0	1.25
LF10F1	20	3.3	100	2.0	1.5	2.0
LF10G1	25	3.7	100	2.0	1.5	2.5
LF10K1	50	8.4	100	3.0	2.5	5.0
LF10M1	100	17.0	100	5.0	5.0	10.0
LF10P1	200	38.0	100	12.0	11.5	20.0
LJ10D1	10	2.6	200	1.0	1.5	1.0
LJ10E1	12.5	2.6	200	1.0	1.5	1.25
LJ10G1	25	5.0	200	1.5	2.5	2.5
LJ10K1	80	10.0	200	2.5	5.0	5.0
LJ10M1	100	22.0	200	6.0	11.5	10.0

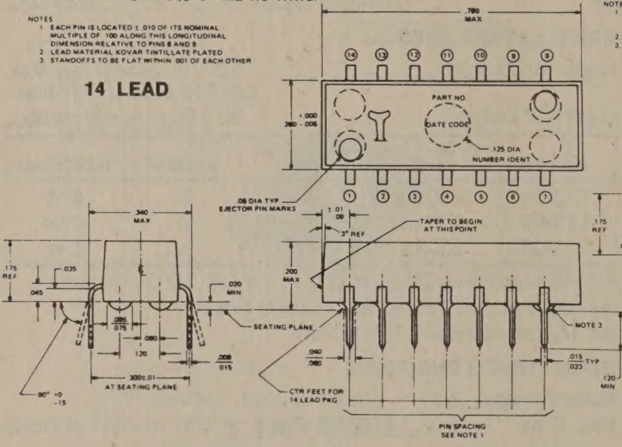
*Tolerances on T_D: ±5% or ±2 NS W.I.G.

DISTORTION: Pre-Pulse ±10% Max.
Pulse ±10% Max.

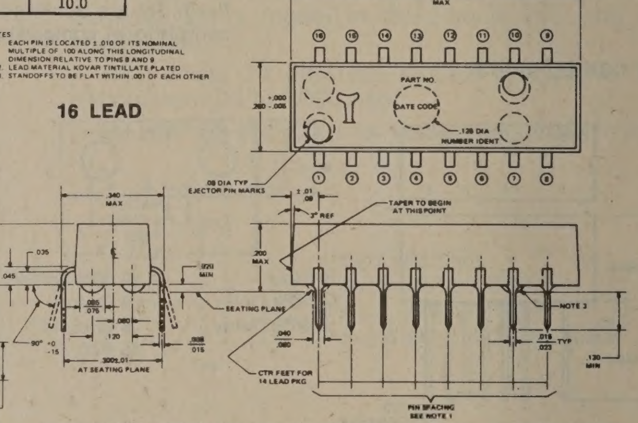
INSULATION RESISTANCE: 10K megohms at 100 VDC

HIPOT: 100 VDC


3
4
5
6
7
8
9
10
11
12
2 (IN)
13 (OUT)
1 GND
14 GND


14 LEAD
.780 MAX
PART NO.
DATE CODE
.125 DIA NUMBER IDENT
.08 DIA TYP EJECTOR PIN MARKS
.340 MAX
.175 REF
.035
.045
.020 MIN
.200 MAX
SEATING PLANE
TAPER TO BEGIN AT THIS POINT
3° REF
NOTE 3
.015 .023 TYP
.120 MIN
.040 .060
.300±.01 AT SEATING PLANE
90° +0 -15
CTR FEET FOR 14 LEAD PKG
PIN SPACING SEE NOTE 1

NOTES
1. EACH PIN IS LOCATED ± .010 OF ITS NOMINAL MULTIPLE OF .100 ALONG THIS LONGITUDINAL DIMENSION RELATIVE TO PINS 8 AND 9
2. LEAD MATERIAL KOVAR TINTILLATE PLATED
3. STANDOFFS TO BE FLAT WITHIN .001 OF EACH OTHER


16 LEAD
.880 MAX
PART NO.
DATE CODE
.125 DIA NUMBER IDENT
.08 DIA TYP EJECTOR PIN MARKS
.340 MAX
.175 REF
.035
.045
.020 MIN
.200 MAX
SEATING PLANE
TAPER TO BEGIN AT THIS POINT
3° REF
NOTE 3
.015 .023 TYP
.120 MIN
.040 .060
.300±.01 AT SEATING PLANE
90° +0 -15
CTR FEET FOR 14 LEAD PKG
PIN SPACING SEE NOTE 1

NOTES
1. EACH PIN IS LOCATED ± .010 OF ITS NOMINAL MULTIPLE OF .100 ALONG THIS LONGITUDINAL DIMENSION RELATIVE TO PINS 8 AND 9
2. LEAD MATERIAL KOVAR TINTILLATE PLATED
3. STANDOFFS TO BE FLAT WITHIN .001 OF EACH OTHER

In most 16 Lead Packages, terminating resistor can be included.
Internally-Welded Construction is used on Coils and Resistors.

STANDARD DELAY LINES

Part No.	Delay (NS)	Impedance (Ohms)	Rise Time (NS)	Taps No.	Taps Value	Case L	Case W	Case H	Case Style	Case Lead Layout
L500U801C	800±5%	50±10%	40[1]	80 —	10NS	8.00	1.19	.35	I	4-D
L500K301B	300±5%	50±5Ω	35	24 —	12.5NS	2.70	.75	.35	I	1-B
L950T102A	1000±5%	95±5Ω	60	40 —	25NS	5.80	1.25	.44	I[2]	4-B
L930A140A	14±5%	93±10%	8	Programmable 2, 4, 6, 8NS		.73	.48	.37	II	2-A
L930E101C	100±5%	93±5%	15	20 —	5NS	3.24	.865	.37	II	2-A
L930F131B	125±5%	93±10%	20	Programmable 5, 10, 20, 40, 50NS		1.54	.865	.37	II	2-D
L101K301A	300±10NS	100±5%	30	24 —	12.5NS	4.25	.875	.36	I	1-B
L101K601A	600±20NS	100±5%	60	24 —	25NS	4.25	.875	.37	I	1-B
L101E151A	156±5%	100±5%	30	24 —	6.5NS	4.25	.875	.36	I	1-B
L101K181A	180±5%	100±5%	23	24 —	7.5NS	4.25	.875	.36	I	1-B
L101K151A	156±5%	100±5%	21	24 —	6.5NS	4.25	.875	.36	I	1-B
L101D251B	250±5%	100±5%	68	10 —	25NS	3.24	.865	.37	II	3-C
L101K301C	300±10NS	100±5%	30	24 —	12.5NS	4.25	.875	.385	I[3]	1-B
L101W501A	500±5%	100±5%	30	100 —	5NS	4.51	3.00	.50	I[4]	1-G[5]
L101D501A	500±5%	100±5%	88	10 —	50NS	3.24	.865	.36	III	3-E
L101D251A	250±5%	100±5%	68	10 —	25NS	3.24	.865	.36	III	3-E
L101K501A	500±3%	100±10%	50	20 —	25NS	4.6	1.0	.30	I	1-C
L321K341A	342±20NS	320—	34	TAP #1 = 9 —	180NS 18NS	3.25	.875	.365	I	1-A
L321J181A	180±15NS	320—	20	10 —	18NS	3.25	.875	.365	I	1-A
L321K251A	250±12NS	320—	25	10 —	25NS	3.25	.875	.365	I	1-A
L331K281B	275±25NS	330±10%	27.5	11 —	25NS	3.25	.875	.312	I	1-D
L501D501A	500±5%	500±5%	90	10 —	50NS	3.24	.865	.36	III	3-E

NOTES:

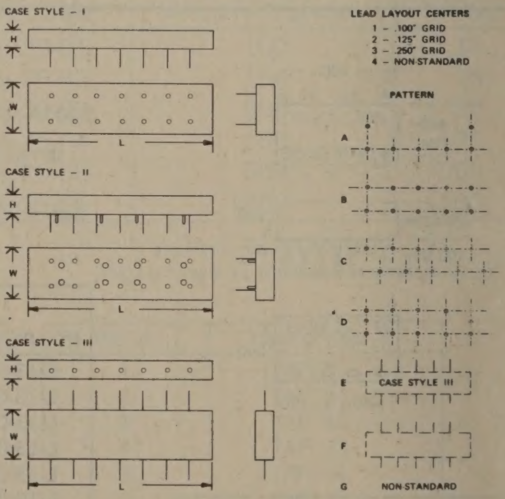
[1] Measured at 10-50% points.

[2] With — two #4-40 metal inserts.

[3] With — two #4-40 metal inserts and non-standard feet.

[4] With non-standard feet.

[5] With five rows of leads, spaced 0.5″ apart.


CASE STYLE – I
H
W
L
CASE STYLE – II
H
W
L
CASE STYLE – III
H
W
L
PATTERN
A
B
C
D
E
CASE STYLE III
F
G
NON-STANDARD

LEAD LAYOUT CENTERS
1 – .100″ GRID
2 – .125″ GRID
3 – .250″ GRID
4 – NON-STANDARD

CASE STYLES AND LEAD LAYOUT

CALL OR WRITE FOR COMPLETE CATALOG

SEE OUR TRANSFORMER PAGES IN SECTION 5600

Technitrol, Inc.

DEPT. EM 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 (215) 426-9105 TELEX 834245

Specialists in transformers and completely transfer molded, welded DIP delay lines under 3/16″ high

Technitrol, Inc.

TTL DELAY MODULES

TTL Delay Modules are designed to be used directly with super high speed TTL, standard TTL and DTL logic circuits. They provide many timing applications without any or with minimum interface.

TTL Delay Modules can be cascaded to get any combination of delay without degrading output rise time (T_R+ or T_R-). The delay to rise time ratio (T_D/T_R) of individual modules is very high (approximately 50:1) and improves with cascading modules.

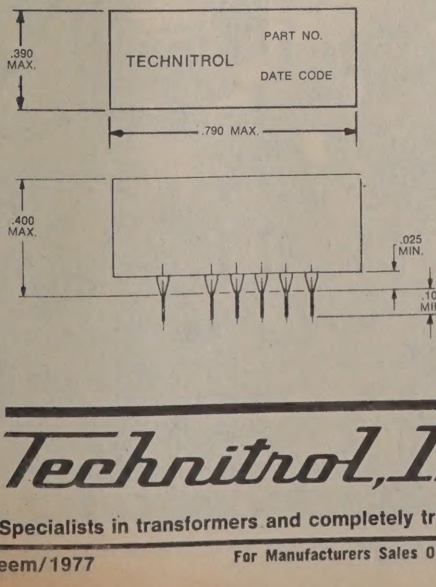
Output rise times of each module are independent of input rise times up to 50 nsec. Each module can handle input pulse widths as low as 15 nsec. (with ≤2.5 nsec. input rise times). TTL Delay Modules are encapsulated by transfer molding. They are pin compatible*with 74/54 Series TTL/SSI 14 Lead DIP Circuits.

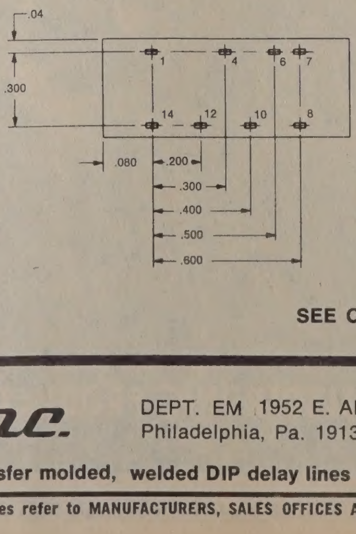
Fanout: Logic 1 — 20 Loads. Logic 0 — 10 Loads.

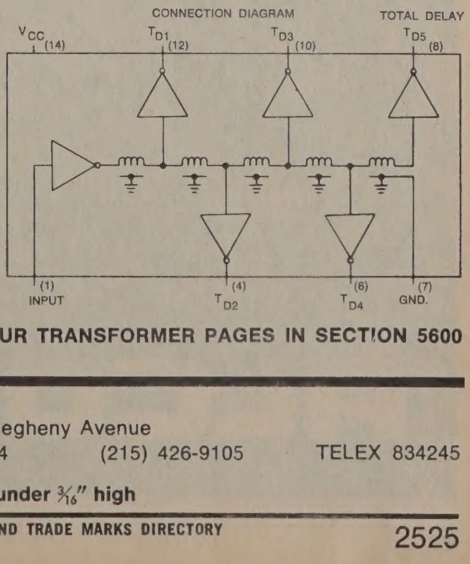
PART NO.	NANOSECONDS					ALL TAPS
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+ & T_R-
TTLDL020	10.0 ± 1.5	12.5 ± 1.5	15.0 ± 1.5	17.5 ± 1.5	20.0 ± 1.5	≤1.0 ≤1.0 nsec.
TTLDL025	5.0 ± 1.5	10.0 ± 1.5	15.0 ± 1.5	20.0 ± 1.5	25.0 ± 1.5	≤1.0 ≤1.0 nsec.
TTLDL050	10.0 ± 1.5	20.0 ± 1.5	30.0 ± 1.5	40.0 ± 2.0	50.0 ± 2.5	≤1.0 ≤1.0 nsec.
TTLDL075	15.0 ± 1.5	30.0 ± 1.5	45.0 ± 2.25	60.0 ± 3.0	75.0 ± 3.75	≤2.0 ≤2.0 nsec.
TTLDL100	20.0 ± 1.5	40.0 ± 2.0	60.0 ± 3.0	80.0 ± 4.0	100.0 ± 5.0	≤2.0 ≤2.0 nsec.
TTLDL200	40.0 ± 2.0	80.0 ± 4.0	120.0 ± 6.0	160.0 ± 8.0	200.0 ± 10.0	≤2.0 ≤5.0 nsec.
TTLDL250	50.0 ± 2.5	100.0 ± 5.0	150.0 ± 7.5	200.0 ± 10.0	250.0 ± 12.5	≤2.0 ≤5.0 nsec.
TTLDL500	100.0 ± 5.0	200.0 ± 10.0	300.0 ± 15.0	400.0 ± 20.0	500.0 ± 25.0	≤2.0 ≤9.0 nsec.

T_D — Time between +1.5 volt points on input and output voltage wave forms either low to high or high to low.
T_R — Time between +0.8 volt and +2.0 volt points on output wave form either low to high or high to low.
Delay Characteristics @ V_{CC} = 5.0V. 25°C.

All units are available in four versions:
Commercial, commercial with additional testing "MY," Military "M," and Military Hi-Rel "MX."
Commercial units use standard commercial grade IC's (plastic package), temperature range 0-70°C.
Military "M" units use military grade IC's (ceramic package) to meet MIL-STD-883 but not screened to that specification, temperature range −55°C to +120°C.
Military "MX" units use hermetically sealed IC's in a ceramic case meeting MIL-STD-883 and 38510/Mach IV program (Hi Rel. Spec.), screened and burned in. Temperature range −55°C to +125°C.
Consult factory for detailed specifications.







SEE OUR TRANSFORMER PAGES IN SECTION 5600

Technitrol, Inc.

DEPT. EM 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 (215) 426-9105 TELEX 834245

Specialists in transformers and completely transfer molded, welded DIP delay lines under 3/16" high

ALCOKNOB

HIGHEST QUALITY INSTRUMENT KNOBS WITH ANODIZED FINISH

Remember that knobs are the most visible part of your equipment. Therefore, field acceptance of your product depends largely upon its' physical appearance.

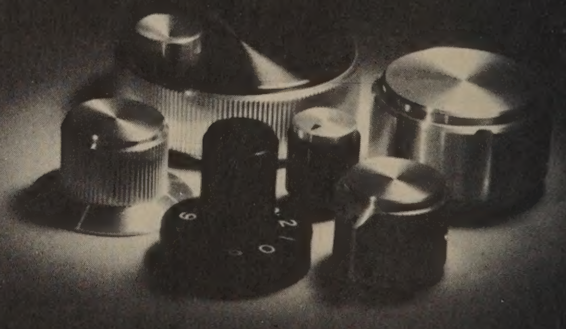
ALCO has become a leading source in the USA for anodized aluminum knobs offering a wide variety of styles in five basic diameters. These all have a durable anodized finish in either natural, black, gold or black/natural duo-tone.

Our knobs are better because they are totally machined with no compromise, even on the knurls. This offers a new dimension in appearance that is sure to enhance any panel.

All knobs illustrated in our catalog are generally available "off-the-shelf" in production quantities. However, we would be glad to quote on custom knobs either by modifying existing models or perhaps create new designs of your own choosing.

By the way, we also make a large variety of phenolic knobs, each meeting the following criterias; brass bushing, allen head set screws and a bright aluminum spin plate on black phenolic. These knobs are also stocked in quantity and fit 1/4" or 1/8" shafts.

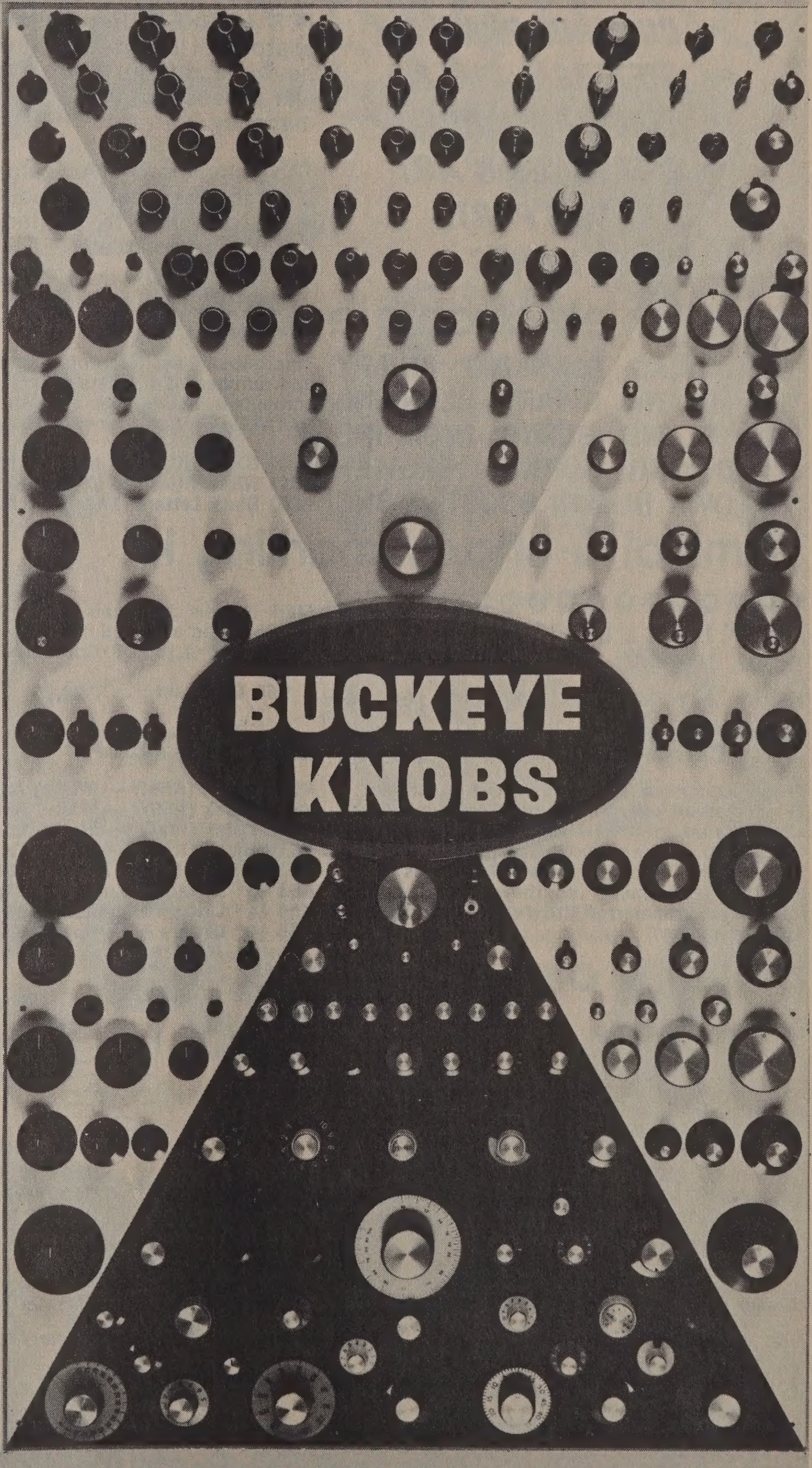
We urge you to call Customer Service at (617)-685-4371 or Telex 710 342-0552. Our salespeople know how to tend to your immediate needs. Also, don't forget to ask for our latest 24-page catalog and free sample!



ALCO® ELECTRONIC PRODUCTS, INC. NO. ANDOVER, MASS. 01845

A Subsidiary of AUGAT, INC.

Buckeye KNOBS



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STANDARD SERIES

PRESTIGE SERIES

STANDARD AND CUSTOM MODIFICATIONS

SILK SCREENING

HOT STAMPING

Buckeye Stamping also manufactures:
Cabinets, Cases, Bord-pak Racks, and modular Card Guides shown on page 1124 section 1400

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"Quality Products Since 1902"

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MARK

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- *METERS & DIALS*
- *CIRCUIT BOARDS*
- *DRAWINGS & ART*
- *CHASSIS PARTS*
- *PILOT LIGHTS*

A ballpoint pen will transfer these amazing words, letters, numbers or symbols to any clean surface! JUST RUB AND IT'S MARKED. Reproduction quality printing is clean and sharp with no background film or haze. Heat resistant adhesive is safe for diazo copies. Makes your prototypes look like production units. Coat panels with DATAKOAT for permanency.

The complete DATAK catalog lists many other kits including organic chemical symbols, schematic and logic symbols, drafting alphabets, printed circuit patterns and tapes. Also ask for the complete LETRASET catalog listing thousands of alphabet sheets.

titles for electronic equipment

BIAS BIAS BLANKING BINARY
RAL BLANK BINARY BLANKING
<ING BLEND BLEND BLOCKING
< BLOCKING BLOWER BLOWER
N BLOWN BLOWN BOOSTER BNC

This popular set for professionals has well over 2000 titles plus letters and numbers. 24 sheets cover audio, aircraft, controls, communications, computers, microwaves and other specialties. Coat transferred titles with DATAKOAT for permanency.

9581 Black Titles (24 sh.)	**$6.95**
9591 White Titles (24 sh.)	**6.95**
9601 Black Letters (12 sh.)	**3.50**
9611 White Letters (12 sh.)	**$3.50**
9621 Blk. Numbers (12 sh.)	**3.50**
9631 Wht. Numbers (12 sh.)	**3.50**

terminal & chassis marking kit

Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q
K K K K L L L L L CR CR CR CR CR
1 182 183 184 185 186 187 188 189
1 192 193 194 195 196 197 198 199

Mark chassis, terminals, circuit boards and components with this handy set. Includes all standard component ID letters and consecutive number sheets from 1 to 209. Contains 24 3″x5″ sheets.

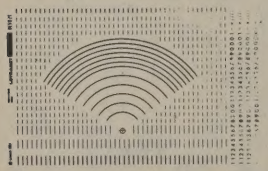
966 Black set	**$6.95**
967 White set	**$6.95**

DATAMARK titles and alphabets

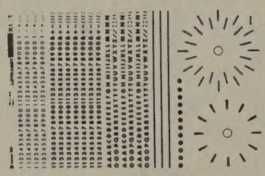
These economical sets offer DATAK quality in 12 specialized assortments of titles, symbols, alphabets and numerals. Each set of 6 sheets (3″x5″) covers one electronic specialty. Sets use the same typeface and size as "Titles for Electronic Equipment" so they make handy refills. Coat transferred titles with DATAKOAT for permanency.

K58B Black (K58W — White) Audio, TV, Hi-Fi	**$1.69**
K59B Black (K59W — White) Amateur Radio & CB	**1.69**
K60B Black (K60W — White) Experimenter, Home & Intercom	**1.69**
K61B Black (K61W — White) Test Equipment, Industry	**1.69**
K62 Marks & Switch Patterns (Black & White)	**1.69**
K63 1/8″ Letters & Numbers (Black, White & Gold)	**1.69**
K64 1/4″ Letters & Numbers (Black, White & Gold)	**1.69**
K65 1/2″ Letters & Numbers (Black, White & Gold)	**1.69**

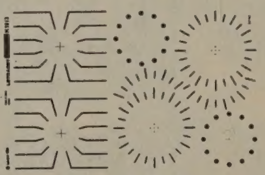
meter & dial marking kit



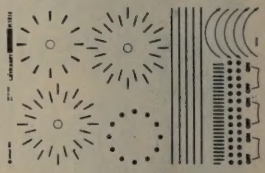
K19/1 BLK
K19/5 RED
K19/1* WHT



K19/2 BLK
K19/6 RED
K19/9 WHT



K19/3 BLK
K19/7 WHT
K19/12 RED



K19/4 BLK
K19/8, 10 WHT
K19/11 RED

Use directly on control panels and meter dial plates or as 1:1 master art. Tap switch marks are set for standard 15° and 30° detents but can be transferred at any angle for special situations. The complete set has meter arcs and graduations in black and red (white available as a refill)*. Other patterns, letters and numbers supplied in black, white and red. Protect finished panels with DATAKOAT SPRAY. Do not coat dialplates.

968 Meter & Dial Kit	**$6.95**
K19/# (color) Refill of 4 Identical Sheets	**$4.58**

DATAKOAT protective coating

High solids water-clear coating encapsulates transfers under a tough plastic film. Will not attack most plastics, lacquers or cured enamels.

04176 Brushcoat & Thinner Kit (1 oz. ea.)	**$1.49**
04177 Gloss Spray (16 fl. oz.)	**3.39**
04178 Matte Spray (16 fl. oz.)	**3.39**

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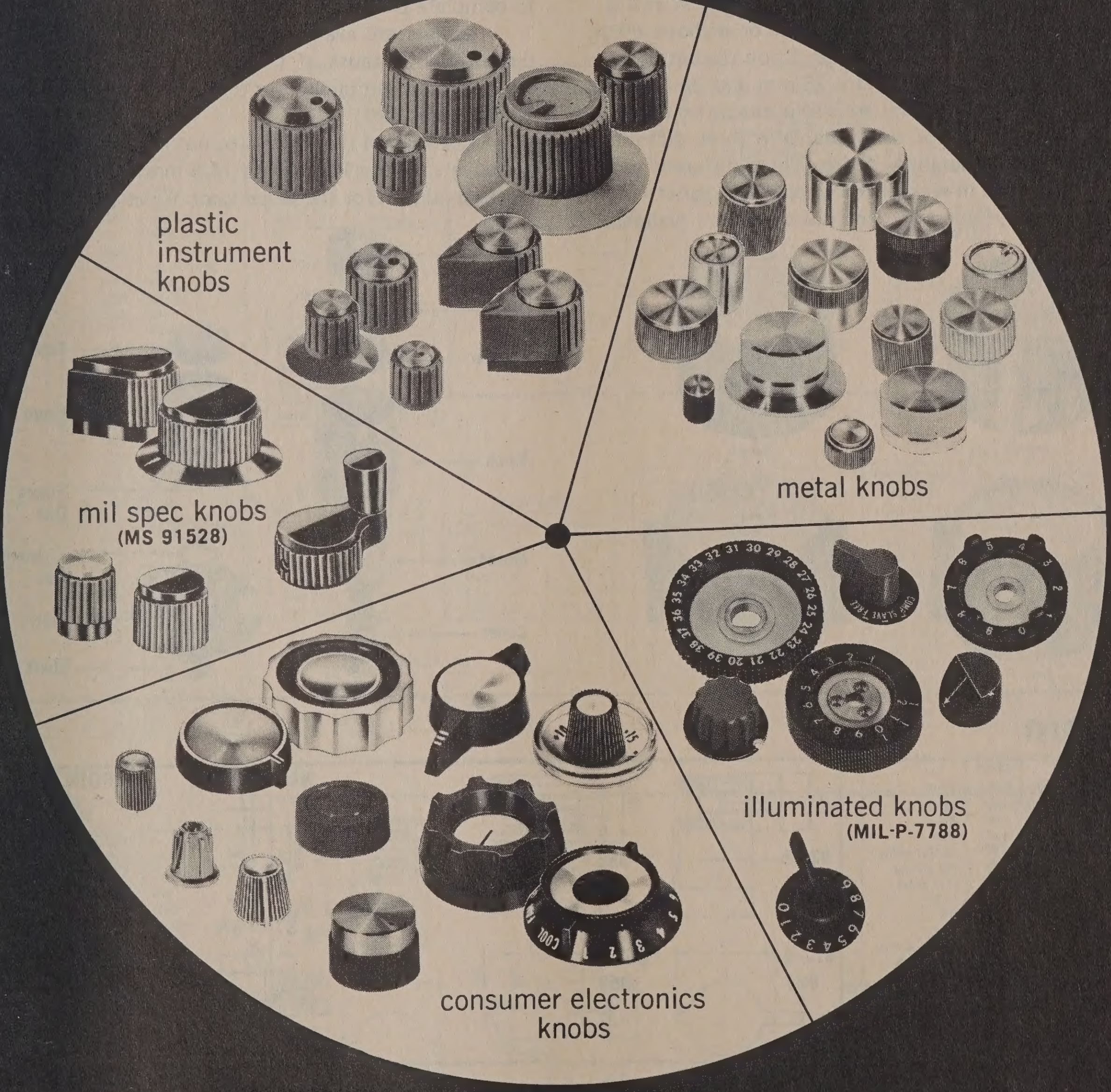
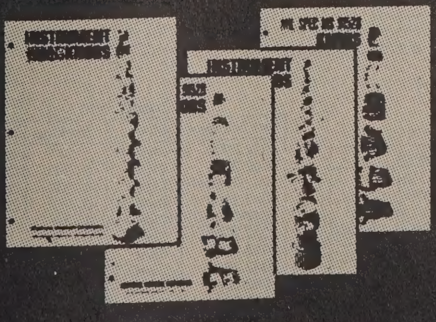

plastic instrument knobs
metal knobs
mil spec knobs
(MS 91528)
illuminated knobs
(MIL-P-7788)
consumer electronics knobs



Complete design specifications available upon request

Stock Knobs—select from thousands of different styles, materials, sizes and assembly features.

Custom Knobs—quoted and produced fast and economically to your design.

EHC

ELECTRONIC HARDWARE CORPORATION

320 Broad Hollow Rd., Farmingdale, N.Y. 11735, (516) 752-1950

Collet Knobs and Accessories

INTERLOK
ONE OF THE **PURDY** GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA. 94010 • (415) 348-5625 • TWX 910-374-2353 • TELEX 34-9373

INTERLOK offers two collet knob programs; A and C with either wide or narrow fluting, with or without wings, and with or without line markings. Knob diameters include 10-mm, 14.5-mm, 21-mm, 28-mm and 36-mm as standards. 9-mm and 45-mm are also available on order.

INTERLOK knobs are available in three different colors and with a metalized finish. Three different cap styles are available in nine different colors. A variety of pointers, stators, figure dials and nut covers are available to complete the knob assembly.

Collets are available for 1/8″, 1/4″ and metric dimensions. Because of their collet construction, the knobs can be combined into three different sized concentric knobs as well.

Covering of the tightening nut is accomplished with nut covers for the 10-mm and 14.5-mm collet knobs. A recess is built-in for the larger knob types.

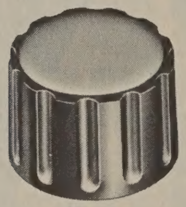


Figure A

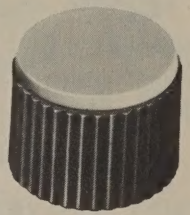


Figure C

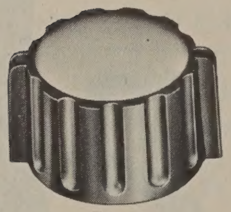


Figure B

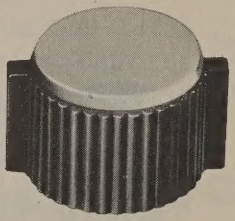
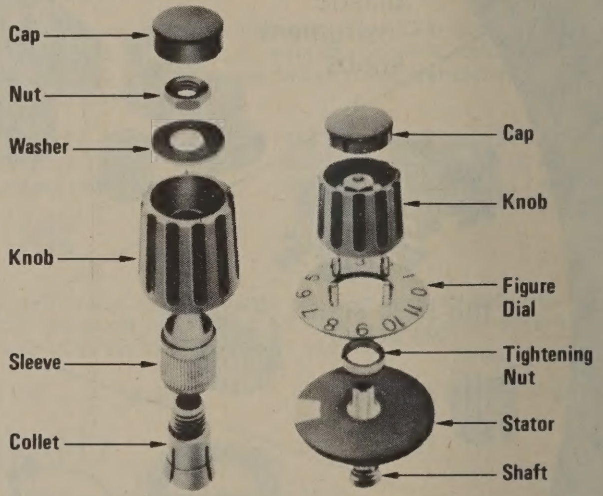
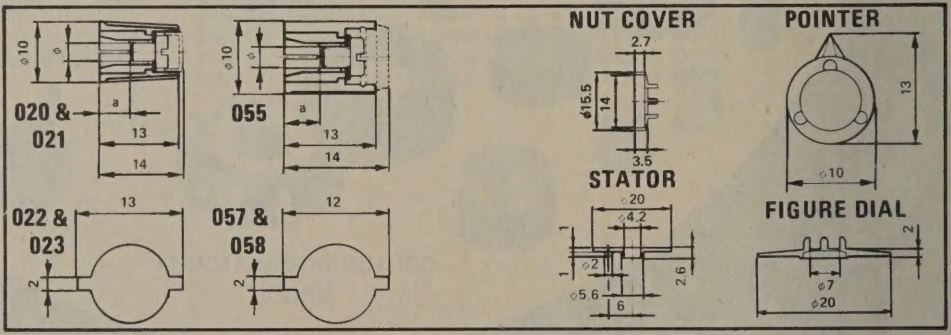


Figure D



10 mm

Part Number	Fig.	Shaft Size ϕ	Color
020-2210	A	1/8″	Lt Gy
020-2220	A	1/8″	Blk
020-2230	A	1/8″	Red
021-2210	A	1/8″	Lt Gy w/line
021-2220	A	1/8″	Blk w/line
021-2230	A	1/8″	Red w/line
022-2210	B	1/8″	Lt Gy
022-2220	B	1/8″	Blk
022-2230	B	1/8″	Red
023-2210	B	1/8″	Lt Gy w/line
023-2220	B	1/8″	Blk w/line
023-2230	B	1/8″	Red w/line
055-2200	C	1/8″	Metalized
055-2220	C	1/8″	Blk
055-2231	C	1/8″	Dk Red
057-2200	D	1/8″	Metalized
057-2220	D	1/8″	Blk
057-2231	D	1/8″	Dk Red
058-2220	D	1/8″	Blk w/line
058-2231	D	1/8″	Dk Red w/line



Dimensions are in millimeters

POINTERS

Part Number	Color
041-2110	Lt Gy
041-2120	Blk
041-2130	Red
041-2131	Dk Red
041-2141	Blu Gy

STATORS

Part Number	Color
043-2110	Gy w/Blk line
043-2220	Blk w/Wht indicator

FIGURE DIALS

Part Number	Color	Marking	Size ϕ
042-2000	Clear	–	20 mm
042-2100	Clear	0 - 11	20 mm
042-2200	Clear	1 - 12	20 mm
042-2300	Clear	0 - 9	20 mm
042-2400	Clear	1 - 10	20 mm
042-2500	Clear	0 - 5	20 mm
042-2600	Clear	1 - 6	20 mm
042-2800	Clear	–	20 mm
042-2910	Lt Gy	Pointer	20 mm
042-2913	Wht	Pointer	20 mm
042-2920	Blk	Pointer	20 mm
042-2930	Red	Pointer	20 mm
042-2931	Dk Red	Pointer	20 mm
042-2941	Blu Gy	Pointer	20 mm

NUT COVERS

Part Number	Color
044-2010	Lt Gy
044-2013	Wht
044-2020	Blk
044-2030	Red
044-2031	Dk Red
044-2041	Blu Gy
044-2110	Lt Gy w/line
044-2113	Wht w/line
044-2120	Blk w/line
044-2130	Red w/line
044-2131	Dk Red w/line
044-2141	Blu Gy w/line

CAPS
(USE ON
020-023 ONLY)

Part Number	Color
040-1010	Lt Gy
040-1020	Blk
040-1030	Red
040-1040	Blu
040-1050	Yel
040-1060	Grn

CAPS, FLAT
(USE ON
055-058 ONLY)

Part Number	Color
040-2110	Lt Gy
040-2113	Wht
040-2120	Blk
040-2131	Dk Red
040-2141	Blu Gy

CAPS, RIDGED
(USE ON 055-058 ONLY)

Part Number	Color
040-2210	Lt Gy
040-2213	Wht
040-2220	Blk
040-2231	Dk Red
040-2241	Blu Gy

Collet Knobs and Accessories

INTERLOK
ONE OF THE **PURDY** GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA. 94010 • (415) 348-5625 • TWX 910-374-2353 • TELEX 34-9373

14.5 mm

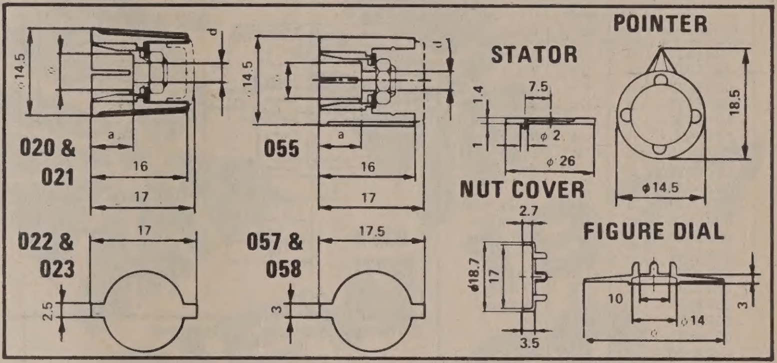
Part Number	Fig.	Shaft Size ϕ	Color
020-3210	A	1/8″	Lt Gy
020-3220	A	1/8″	Blk
020-3230	A	1/8″	Red
020-3510	A	1/4″	Lt Gy
020-3520	A	1/4″	Blk
020-3530	A	1/4″	Red
021-3210	A	1/8″	Lt Gy w/line
021-3220	A	1/8″	Blk w/line
021-3230	A	1/8″	Red w/line
021-3510	A	1/4″	Lt Gy w/line
021-3520	A	1/4″	Blk w/line
021-3530	A	1/4″	Red w/line
022-3210	B	1/8″	Lt Gy
022-3220	B	1/8″	Blk
022-3230	B	1/8″	Red
022-3510	B	1/4″	Lt Gy
022-3520	B	1/4″	Blk
022-3530	B	1/4″	Red
023-3210	B	1/8″	Lt Gy w/line
023-3220	B	1/8″	Blk w/line
023-3230	B	1/8″	Red w/line
023-3510	B	1/8″	Lt Gy w/line
023-3520	B	1/4″	Blk w/line
023-3530	B	1/4″	Red w/line
055-3200	C	1/8″	Metalized
055-3220	C	1/8″	Blk
055-3231	C	1/8″	Dk Red
055-3500	C	1/4″	Metalized
055-3520	C	1/4″	Blk
055-3531	C	1/4″	Dk Red
057-3200	D	1/8″	Metalized
057-3220	D	1/8″	Blk
057-3231	D	1/8″	Dk Red
057-3500	D	1/4″	Metalized
057-3520	D	1/4″	Blk
057-3531	D	1/4″	Dk Red
058-3220	D	1/8″	Blk w/line
058-3231	D	1/8″	Dk Red w/line
058-3520	D	1/4″	Blk w/line
058-3531	D	1/4″	Dk Red w/line

CAPS, FLAT
(USE ON
055-058 ONLY

Part Number	Color
040-3100	Metalized
040-3110	Lt Gy
040-3113	Wht
040-3120	Blk
040-3131	Dk Red
040-3141	Blu Gy

CAPS, RIDGED
(USE ON
055-058 ONLY)

Part Number	Color
040-3200	Metalized
040-3210	Lt Gy
040-3213	Wht
040-3220	Blk
040-3231	Dk Red
040-3241	Blu Gy



Dimensions are in millimeters

CAPS
(USE ON
020-023 ONLY)

Part Number	Color
040-3010	Lt Gy
040-3020	Blk
040-3030	Red
040-3040	Blu
040-3050	Yel
040-3060	Grn

POINTERS

Part Number	Color
041-3110	Lt Gy
041-3120	Blk
041-3130	Red
041-3131	Dk Red
041-3141	Blu Gy

STATORS

Part Number	Color
043-3110	Gy w/Blk line
043-3220	Blk w/Wht indicator

NUT COVERS

Part Number	Color
044-3010	Lt Gy
044-3013	Wht
044-3020	Blk
044-3030	Red
044-3031	Dk Red
044-3041	Blu Gy
044-3110	Lt Gy w/line
044-3113	Wht w/line
044-3120	Blk w/line
044-3130	Red w/line
044-3131	Dk Red w/line
044-3141	Blu Gy w/line
044-3210	Lt Gy w/line
044-3220	Blk w/line
044-3230	Red w/line

FIGURE DIALS

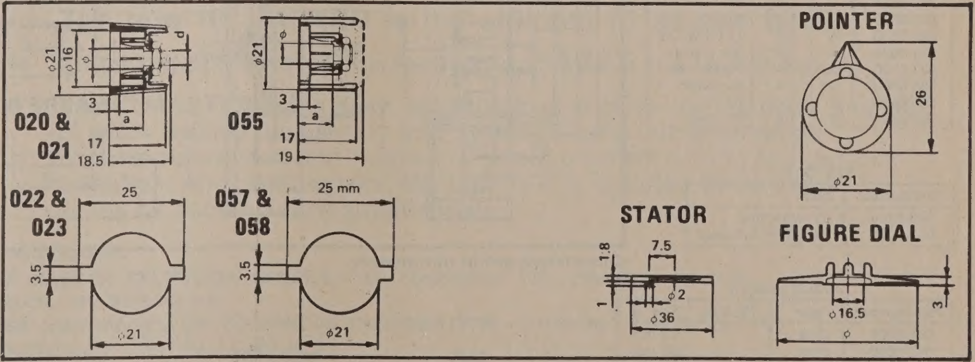
Part Number	Color	Marking	Size ϕ
042-3000	Clear	–	26 mm
042-3010	Clear	–	44 mm
042-3100	Clear	0 - 11	26 mm
042-3200	Clear	1 - 12	26 mm
042-3300	Clear	0 - 9	26 mm
042-3400	Clear	1 - 10	26 mm
042-3500	Clear	0 - 5	26 mm
042-3600	Clear	1 - 6	26 mm
042-3800	Clear	–	26 mm
042-3910	Lt Gy	Pointer	26 mm
042-3913	Wht	Pointer	26 mm
042-3920	Blk	Pointer	26 mm
042-3930	Red	Pointer	26 mm
042-3931	Dk Red	Pointer	26 mm
042-3941	Blu Gy	Pointer	26 mm

21 mm

Part Number	Fig.	Shaft Size ϕ	Color
020-4210	A	1/8″	Lt Gy
020-4220	A	1/8″	Blk
020-4230	A	1/8″	Red
020-4510	A	1/4″	Lt Gy
020-4520	A	1/4″	Blk
020-4530	A	1/4″	Red
021-4210	A	1/8″	Lt Gy w/line
021-4220	A	1/8″	Blk w/line
021-4230	A	1/8″	Red w/line
021-4510	A	1/4″	Lt Gy w/line
021-4520	A	1/4″	Blk w/line
021-4530	A	1/4″	Red w/line
022-4510	B	1/4″	Lt Gy
022-4520	B	1/4″	Blk
022-4530	B	1/4″	Red
023-4510	B	1/4″	Lt Gy w/line
023-4520	B	1/4″	Blk w/line
023-4530	B	1/4″	Red w/line
055-4220	C	1/8″	Blk
055-4231	C	1/8″	Dk Red
055-4500	C	1/4″	Metalized
055-4520	C	1/4″	Blk
055-4531	C	1/4″	Dk Red
057-4500	C	1/4″	Metalized
057-4520	D	1/4″	Blk
057-4531	D	1/4″	Dk Red
058-4520	D	1/4″	Blk w/line
058-4531	D	1/4″	Dk Red w/line

POINTERS

Part Number	Color
041-4110	Lt Gy
041-4120	Blk
041-4130	Red
041-4131	Dk Red
041-4141	Blu Gy



Dimensions are in millimeters

STATORS

Part Number	Color
043-4110	Gy w/Blk line
043-4220	Blk w/Wht indicator

FIGURE DIALS

Part Number	Color	Marking	Size ϕ
042-4000	Clear	–	36 mm
042-4010	Clear	–	44 mm
042-4020	Clear	–	53 mm
042-4030	Clear	–	63 mm
042-4100	Clear	0 - 11	36 mm
042-4200	Clear	1 - 12	36 mm
042-4700	Clear	1 - 13	36 mm
042-4800	Clear	–	36 mm
042-4910	Lt Gy	Pointer	36 mm
042-4913	Wht	Pointer	36 mm
042-4920	Blk	Pointer	36 mm
042-4930	Red	Pointer	36 mm
042-4931	Dk Red	Pointer	36 mm
042-4941	Blu Gy	Pointer	36 mm

CAPS, FLAT
(USE ON
055-058 ONLY

Part Number	Color
040-4100	Metalized
040-4110	Lt Gy
040-4113	Wht
040-4120	Blk
040-4131	Dk Red
040-4141	Blu Gy

CAPS, RIDGED
(USE ON
055-058 ONLY)

Part Number	Color
040-4200	Metalized
040-4210	Lt Gy
040-4213	Wht
040-4220	Blk
040-4231	Dk Red
040-4241	Blu Gy

CAPS (USE ON
020-023 ONLY)

Part Number	Color
040-4010	Lt Gy
040-4020	Blk
040-4030	Red
040-4040	Blu
040-4050	Yel
040-4060	Grn

Collet Knobs and Accessories

INTERLOK
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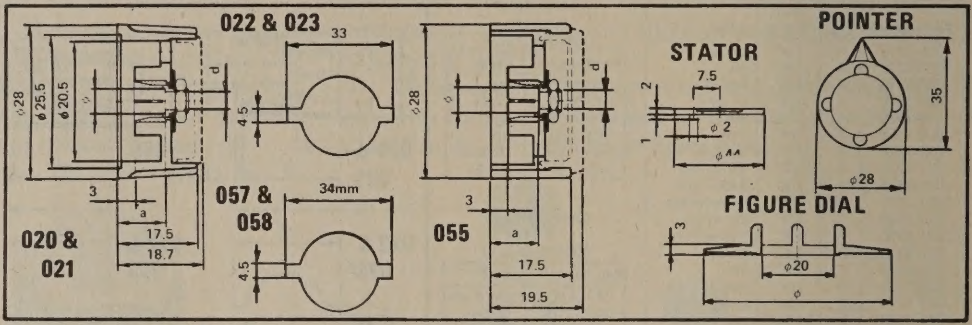
28 mm

Part Number	Fig.	Shaft Size ϕ	Color
020-5510	A	1/4″	Lt Gy
020-5520	A	1/4″	Blk
020-5530	A	1/4″	Red
021-5510	A	1/4″	Lt Gy w/line
021-5520	A	1/4″	Blk w/line
021-5530	A	1/4″	Red w/line
022-5510	B	1/4″	Lt Gy
022-5520	B	1/4″	Blk
022-5530	B	1/4″	Red
023-5510	B	1/4″	Lt Gy w/line
023-5520	B	1/4″	Blk w/line
023-5530	B	1/4″	Red w/line
055-5500	C	1/4″	Metalized
055-5520	C	1/4″	Blk
055-5531	C	1/4″	Dk Red
057-5500	D	1/4″	Metalized
057-5520	D	1/4″	Blk
057-5531	D	1/4″	Dk Red
058-5520	D	1/4″	Blk w/line
058-5531	D	1/4″	Dk Red w/line



Dimensions are in millimeters

STATORS

Part Number	Color
043-5110	Gy w/Blk line
043-5220	Blk w/Wht indicator

POINTERS

Part Number	Color
041-5110	Lt Gy
041-5120	Blk
041-5130	Red
041-5131	Dk Red
041-5141	Blu Gy

CAPS, RIDGED
(USE ON
055-058 ONLY)

Part Number	Color
040-5200	Metalized
040-5210	Lt Gy
040-5213	Wht
040-5220	Blk
040-5231	Dk Red
040-5241	Blu Gy

CAPS, FLAT
(USE ON
055-058 ONLY

Part Number	Color
040-5100	Metalized
040-5110	Lt Gy
040-5113	Wht
040-5120	Blk
040-5131	Dk Red
040-5141	Blu Gy

CAPS
(USE ON
020-023 ONLY)

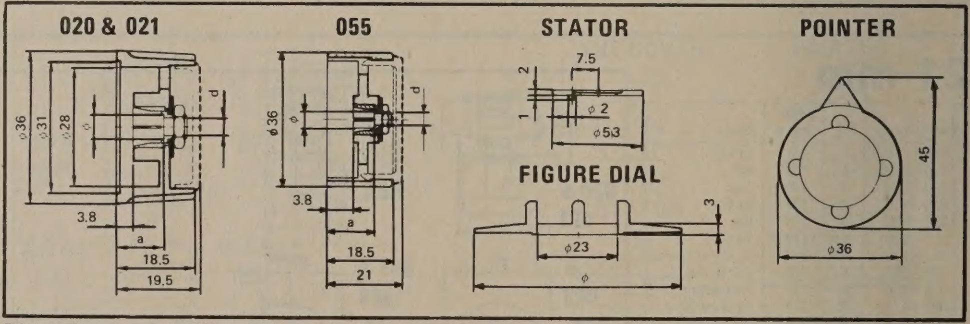
Part Number	Color
040-5010	Lt Gy
040-5020	Blk
040-5030	Red
040-5040	Blu
040-5050	Yel
040-5060	Grn

FIGURE DIALS

Part Number	Color	Marking	Size ϕ
042-5000	Clear	–	44 mm
042-5020	Clear	–	53 mm
042-5030	Clear	–	63 mm
042-5100	Clear	0 - 11	44 mm
042-5200	Clear	1 - 12	44 mm
042-5700	Clear	1 - 13	44 mm
042-5800	Clear	–	44 mm
042-5910	Ly Gy	Pointer	44 mm
042-5913	Wht	Pointer	44 mm
042-5920	Blk	Pointer	44 mm
042-5930	Red	Pointer	44 mm
042-5931	Dk Red	Pointer	44 mm
042-5941	Blu Gy	Pointer	44 mm

36 mm

Part Number	Fig.	Shaft Size ϕ	Color
020-6510	A	1/4″	Lt Gy
020-6520	A	1/4″	Blk
020-6530	A	1/4″	Red
021-6510	A	1/4″	Lt Gy w/line
021-6520	A	1/4″	Blk w/line
021-6530	A	1/4″	Red w/line
055-6500	B	1/4″	Metalized
055-6520	B	1/4″	Blk
055-6531	B	1/4″	Dk Red



Dimensions are in millimeters

STATORS

Part Number	Color
043-6110	Gy w/Blk line
043-6220	Blk w/Wht indicator

FIGURE DIALS

Part Number	Color	Marking	Size ϕ
042-6000	Clear	–	53 mm
042-6030	Clear	–	63 mm
042-6100	Clear	0 - 11	53 mm
042-6200	Clear	1 - 12	53 mm
042-6700	Clear	1 - 13	53 mm
042-6800	Clear	–	53 mm
042-6910	Lt Gy	Pointer	53 mm
042-6913	Wht	Pointer	53 mm
042-6920	Blk	Pointer	53 mm
042-6930	Red	Pointer	53 mm
042-6931	Dk Red	Pointer	53 mm
042-6941	Blu Gy	Pointer	53 mm

CAPS
(USE ON
020, 021 ONLY)

Part Number	Color
040-6010	Lt Gy
040-6020	Blk
040-6030	Red
040-6040	Blu
040-6050	Yel
040-6060	Grn

CAPS, FLAT
(USE ON
055 ONLY)

Part Number	Color
040-6100	Metalized
040-6110	Lt Gy
040-6113	Wht
040-6120	Blk
040-6131	Dk Red
040-6141	Blu Gy

CAPS, RIDGED
(USE ON
055 ONLY)

Part Number	Color
040-6200	Metalized
040-6210	Lt Gy
040-6213	Wht
040-6220	Blk
040-6231	Dk Red
040-6241	Blu Gy

POINTERS

Part Number	Color
041-6110	Lt Gy
041-6120	Blk
041-6130	Red
041-6131	Dk Red
041-6141	Blu Gy

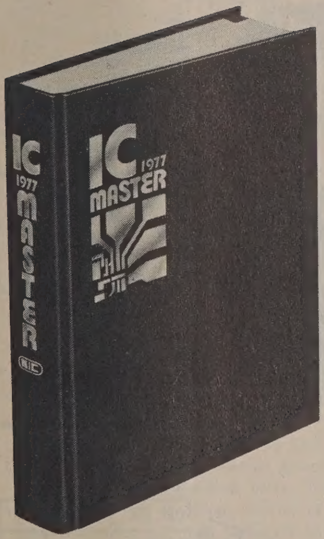
Knob Designer Kits

INTERLOK has a great idea for the packaging designer. We have a series of five designer kits that give you a complete idea of the many applications for each of our knob sizes. Each kit contains one of every item relating to that size knob.

Description	Part Number
10 mm Knob Designer Kit	070-1000
14.5 mm Knob Designer Kit	070-1450
21 mm Knob Designer Kit	070-2100
28 mm Knob Designer Kit	070-2800
36 mm Knob Designer Kit	070-3600

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 ICMASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

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- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
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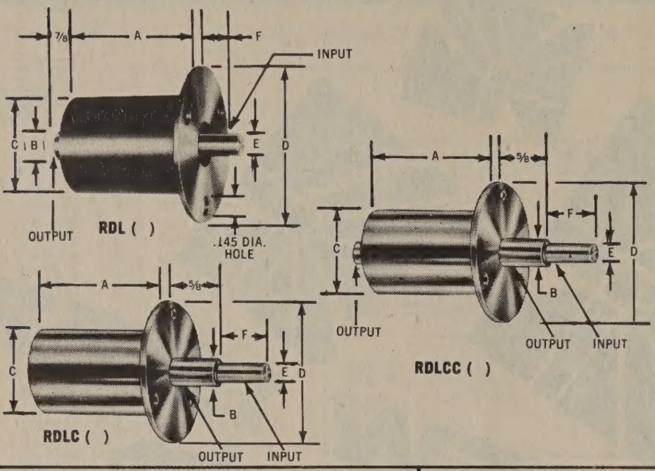
QUALITY
RELIABILITY
ECONOMY


7/8
A
F
INPUT
C
B
E
D
OUTPUT
RDL ( )
.145 DIA. HOLE
5/8
RDLCC ( )
RDLC ( )
OUTPUT
INPUT

RATIO DRIVES FOR FINE INSTRUMENT AND MACHINE CONTROLS

BALL BEARING TYPES — Compact, Durable, Exceptionally Smooth Action

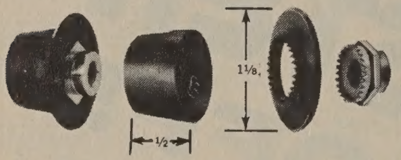
These unique ratio drives employ precision ball bearings. Used for rotary control of components in instruments, they provide unexcelled smooth motion. Ruggedly built, permanently sealed and lubricated, JAN Ratio Drives accommodate applications where miniaturization is essential.

Input and output snafts of these units operate in the SAME DIRECTION. Type "RDL" provides "in-line" input-output shafts. Type "RDLC" is supplied with **concentric** shafts whereby the output envelopes the input shaft. An added feature of Type "RDLCC" is the output shaft in the rear.

Cat. No.	Ratio	A	B O.D.	 I.D.	C	D	Input Shaft E	F	Bolt-Mtg. Dia.
RDL-1	2.6:1	1	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDL-2	7.0:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDL-3	17.0:1	1 13/16	3/8	1/4	1 1/8	1 13/16	1/4	3/4	1 15/32
RDLC-1	2.6:1	1	3/8	1/4	1 1/8	1 13/16	1/4	1 1/2	1 15/32
RDLC-2	7.0:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	1 5/64	1 15/32
RDLC-3	17.0:1	1 13/16	3/8	1/4	1 1/8	1 13/16	1/4	23/32	1 15/32
RDLCC-1	2.6:1	1 13/32	3/8	1/4	1 1/8	1 13/16	1/4	1 5/64	1 15/32
RDLCC-3	17.0:1	2 43/64	3/8	1/4	1 1/8	1 13/16	1/4	11/16	1 15/32

All Ratios are ±10%.

KNOB RATIO DRIVE



9 to 1 ratio (to dial skirt).
1:1 to potentiometer.

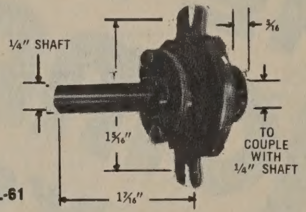
Cat. No. KRD-11
(Plain Gripping Surface)

Cat. No. KRD-12
(Knurled Gripping Surface)

Exploded view shows engineered miniature gear system, to permit precise, fine tuning of controls. As shown, 9 to 1 ratio (to dial skirt). 1:1 to potentiometer. Other ratios designed to specifications.

Brass gears; black anodized aluminum knob and dial. Available with knurled or non-knurled outside knob. Available for 1/8" shafts. 1/4" on special order.

Now! Corrosion Resistant!
IN-LINE RATIO DRIVE — 6.3:1

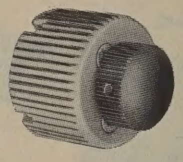

1/4" SHAFT
3/16
1 5/16"
TO COUPLE WITH 1/4" SHAFT
1 7/16"

RDL-61

Variations Available to Customers Specifications

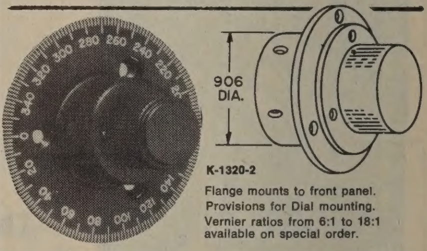
For smooth rotary control of components requiring Vernier adjustments. Suitable for use where panel space is at a premium. Durable, ruggedized ball bearing mechanism.

MACROVERNIER CONTROL KNOBS



K-1320-1

Macroposition—
1" Dia. Knob; Ratio 1:1
Vernier Position—
5/8" Dia. Knob; Ratio 10:1
Vernier ratios from 6:1 up to 18:1 available on special order.
Torque capacity factory adjusted in increments up to 6 lb.-in.



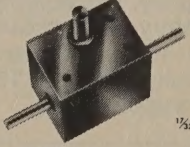
K-1320-2

Flange mounts to front panel.
Provisions for Dial mounting.
Vernier ratios from 6:1 to 18:1 available on special order.

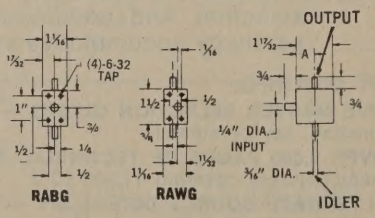
RIGHT ANGLE RATIO DRIVES — Versatile, Miniaturized, Right Angle Rotary Controls

Featuring dual output stainless steel shafts at right angles to input, these engineered drives provide ideal type instrument control. Available with matched bevel worm gears covering a wide range of ratios.

JAN's Right Angle Drives are especially useful for handling spring or gravity-loaded components since the output shaft automatically locks in any desired position yet remains free for smooth adjustment by the input shaft. Assembled in dust-proof housings, the gears are permanently pinned in place on stainless-steel shafts mounted in oilite bearings and held under constant pressure.

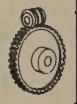


RAWG ( )
RABG ( )


1 1/16
1/32
(4)-6-32 TAP
1"
3/8
1/4
1/2
1/2
RABG
1/16
1 1/2
1/2
3/4
1 1/16
1/32
RAWG
OUTPUT
1 17/32
A
3/4
3/4
1/4" DIA. INPUT
3/16" DIA.
IDLER

BEVEL GEAR RIGHT ANGLE DRIVES

Cat. No.	Ratio	"A"
RABG-1	1:1	7/8
RABG-2	2:1	7/8
RABG-3	3:1	7/8

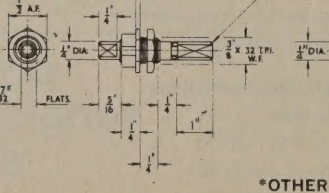


WORM GEAR RIGHT ANGLE DRIVES

Cat. No.	Ratio	"A"
RAWG-1	5.1	3/4
RAWG-2	10:1	3/4
RAWG-22	12:1	3/4
RAWG-3	20:1	3/4

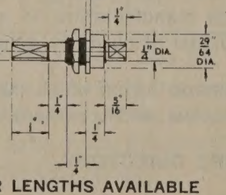
DIRECT DRIVE, REVERSE VERNIER
RDS - R 51

1:1 ratio 5:1 ratio

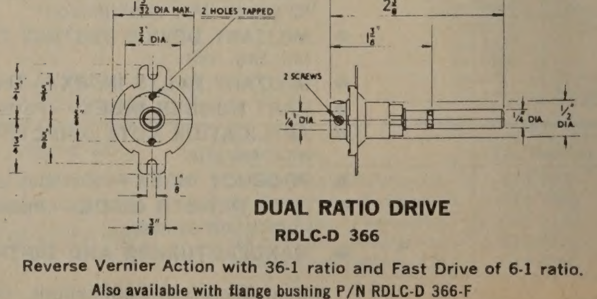

1/2 A.F.
1/16
1/64 X 45° CHAMFER BOTH ENDS
1/4
1/4 DIA.
3/8 X 32 TPI. W.F.
7/32
FLATS
5/16
1/4
1"
1/4
1/4

CONTINUOUS DRIVE
RDS 51

5:1 ratio


1/16
1/4
1/8 DIA.
1/4 DIA.
29/64 DIA.
1/4
5/16
1"
1/4

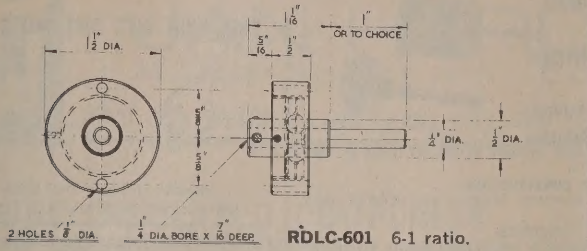
*OTHER LENGTHS AVAILABLE


1 3/32 DIA MAX.
2 HOLES TAPPED
3/4 DIA
2 SCREWS
1/4 DIA
1/4 DIA
1/2 DIA
2 3/8
1 3/8
1/8
3/8

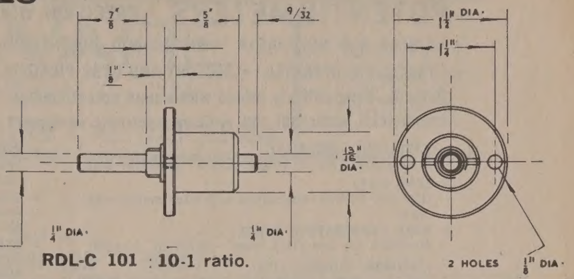
DUAL RATIO DRIVE
RDLC-D 366

Reverse Vernier Action with 36-1 ratio and Fast Drive of 6-1 ratio.
Also available with flange bushing P/N RDLC-D 366-F

RATIO DRIVES


1 1/2" DIA.
1 1/16"
1" OR TO CHOICE
5/16"
1/2"
5/8"
5/8"
1/4" DIA.
1/2" DIA.
2 HOLES 1/8" DIA.
1/4" DIA. BORE X 7/16" DEEP

RDLC-601 6-1 ratio.

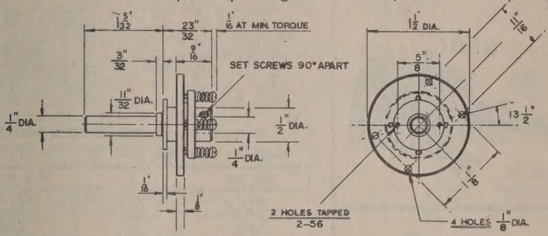

7/8"
5/8"
9/32
1/8"
13/16" DIA.
1/8" DIA.
1/4" DIA.
1 1/2" DIA.
1 1/4"
2 HOLES 1/8" DIA.

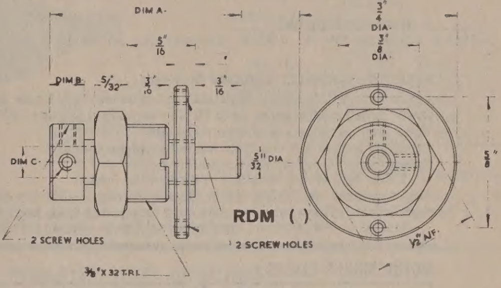
RDL-C 101 : 10-1 ratio.

ADJUSTABLE TORQUE BALL DRIVE

RDLA-601 6-1 ratio

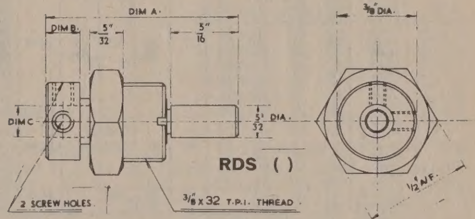
Output torque range 20 to 60 oz./inches


1 5/32"
23/32"
1/16" AT MIN. TORQUE
3/32"
9/16"
SET SCREWS 90° APART
11/32" DIA.
1/4" DIA.
1/2" DIA.
1/4" DIA.
1/16"
1 1/2" DIA.
5/8"
13 1/2°
1/16"
1/16"
2 HOLES TAPPED 2–56
4 HOLES 1/8" DIA.


DIM A
5/16"
3/4" DIA.
3/8" DIA.
DIM B
5/32
3/16"
3/16"
DIM C
5/32" DIA
5/8"
2 SCREW HOLES
2 SCREW HOLES
3/8" X 32 T.P.I.
1/2" N.F.

RDM ( )

10-1 ratio.

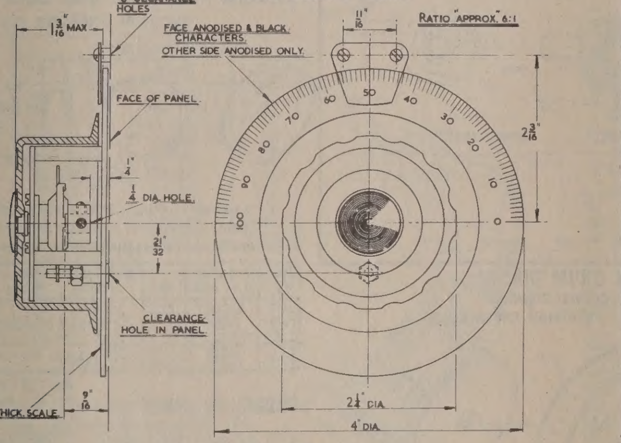

DIM A
DIM B
5/32"
5/16"
3/8" DIA.
DIM C
5/32" DIA.
2 SCREW HOLES
3/8" X 32 T.P.I. THREAD
1/2" N.F.

RDS ( )

10-1 ratio.

PART NO.	PART NO.	DIM A	DIM B	DIM C
RDS 101-1	RDM 101-1	29/32″	5/32″	5/32″
RDS 101-2	RDM 101-2	15/16″	13/64″	15/64″
RDS 101-3	RDM 101-3	15/16″	13/64″	1/4″

BALL DRIVE DIAL


6 CLEARANCE HOLES
1 3/16" MAX
FACE ANODISED & BLACK CHARACTERS.
OTHER SIDE ANODISED ONLY.
11/16"
RATIO "APPROX." 6:1
FACE OF PANEL
2 3/16"
1/4"
1/4" DIA. HOLE
21/32"
CLEARANCE HOLE IN PANEL
1/16" THICK SCALE
9/16"
2 1/4" DIA.
4" DIA.
0
10
20
30
40
50
60
70
80
90
100

DAD 600 6-1 ratio.

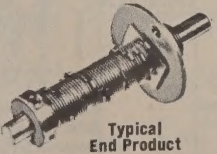
LIMIT STOP COMPONENTS

Designers can now consider the limit stop as a component to design with, such as potentiometers, capacitors, or other standard units. The simplicity of adjustment and the large number of available turns enables the stop range to be set with extreme precision. Conveniently located dual locking screws maintain settings under all conditions of shock and vibration.

LS-552 Washer

LS-554 Collar

LS-556 Stop Plate



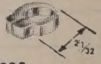
Typical End Product

Available for 1/4″ and 3/16″ Shafts

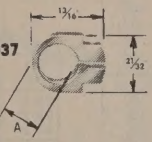
Specify — (3) for 3/16″
— (4) for 1/4″

Can be designed internally into JANSET knobs.

"NO-MAR" CLAMPS



No. 938



No. 937

Set screw does not touch shaft. Ideal for knob and gear applications. Variety of sizes available.

A Dimensions in Inches

Cat. No.	-2	-3	-4	-5	-6	-7	-8
937	1/8	3/16	1/4	5/16	3/8	13/32	7/16
938	1/8	3/16	1/4	5/16	3/8	13/32	

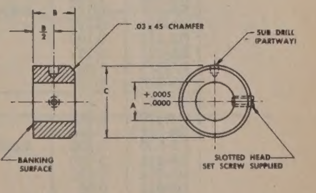
PRECISION SET SCREW COLLARS

Material: 303 Stainless Steel
Finish: Clear Passivate

5/64 to 1/2 Bores

Shaft Size	A	B	C	Set Screw	Part No.
5/64	.0779	.12	7/32	#0-80	SC7-07
3/32	.0935	.12	1/4	#0-80	SC8-09
.12	.1200	.18	5/16	#2-56	SC10-120
1/8	.1248	.18	5/16	#2-56	SC10-124
5/32	.1560	.18	5/16	#2-56	SC10-15
3/16	.1873	.22	3/8	#4-40	SC12-18
.24	.2405	.25	1/2	#6-32	SC16-240
1/4	.2498	.25	1/2	#6-32	SC16-249
5/16	.3123	.28	9/16	#6-32	SC18-31
3/8	.3748	.37	3/4	#10-32	SC24-37
1/2	.4998	.50	1	1/4-20	SC32-49

Special Collars Available on Request.


B
B/2
.03 x 45 CHAMFER
SUB DRILL (PARTWAY)
C
+.0005
−.0000
A
BANKING SURFACE
SLOTTED HEAD SET SCREW SUPPLIED

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MANUFACTURING COMPANY INC.

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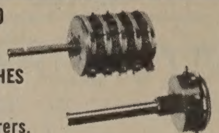
QUALITY
RELIABILITY
ECONOMY

POTENTIOMETERS / PRECISION WIRE WOUND



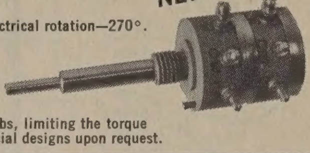
• LINEAR AND NON-LINEAR • SINGLE AND MULTI-TURN
• PENDULUM OPERATED • SECTORS AND GYRO PICKOFFS • SWITCHES

Reliable, competitively priced wire-wound potentiometers for commercial, industrial and military electronic equipment manufacturers.

- **EXCELLENT LINEARITY:** 0.03% available in single turn 5″ diameter unit.
- **LONG LIFE:** Over two million revolutions with base metal windings.
- **WIDE TEMPERATURE RANGE:** Available for operation from −55°C to +125°C.
- **MAXIMUM STORAGE LIFE:** Platinum alloy winding also insures low noise level.
- **RELIABILITY:** Welded taps for better mechanical and electrical connections.
- **HIGH RESOLUTION:** Wire as fine as 0.0003″ diameter can be used.
- **CUSTOM DESIGNS:** Fast prototype delivery on special linear or non-linear units.
- **PRECISION CONSTRUCTION:** Anodized aluminum housings and polished steel shafts.
- **ACCURATE FUNCTIONS:** Welded taps to a single turn of wire eliminates shorted sections of winding at intermediate taps.
- **RUGGEDNESS:** Meets all applicable MIL Specs.
- **LOW NOISE** Maintained over long life and extreme environments by unique wiper designs compatible with winding configurations.

RESISTOR, VARIABLE. Single and Dual gang.

NEW!

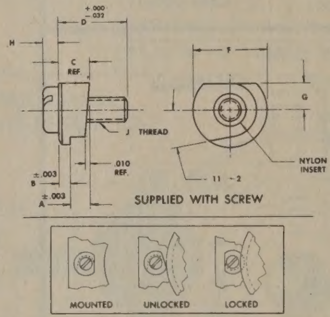


Conforms to MIL-R-12934. Resistance values as required. Linear design.
Power: 1 watt continuously, up to 70°C.; Mechanical rotation—300°; Electrical rotation—270°.
Noise level less than 1% of total resistance.
Operating torque: 4.0 to 6.0 oz. in., detent where specified.
Detent torque: 5 oz. in. above operating torque, or 6.0 to 14.0 oz. in. including unit operating torque.
Min. rotational life: 25,000 cycles. Operating Temp.: —65°C to 150°C.
Clutch Knobs: These potentiometers must be adjusted solely by clutch knobs, limiting the torque exerted on shafts beyond their rotational limits. See Jan catalog. Special designs upon request.

MOTOR MOUNT CLEATS

Type Mount	A	B	C	D	E	F	G	H	J	Part No.
Flush & Recess	.031	.040	.071	.312	.135	.390 .385	.125	.068 Max.	#4-40	SMFR3-1
Flush	.062	.040	.102	.312						SMF3-2
Flush	.062	.050	.112	.375						SMS3-3
Flush	.062	.063	.125	.375						SMS3-4
Flush	.078	.063	.141	.375						SMS3-5
Flush	.093	.040	.133	.375						SMS3-6
Flush	.093	.050	.143	.375						SMS3-7
Flush	.093	.063	.156	.375						SMF3-8
Step	.125	.050	.175	.375						SMS3-9
Step	.156	.040	.196	.375						SMS3-10
Step	.225	.063	.288	.437						SMS3-11
Flush	.250	.063	.312	.625						SMF3-12
Flush & Recess	.031	.040	.071	.250	.096	.265 .260	.091	.053 Max.	#2-56	SMFR3-20
Flush	.047	.040	.087	.250						SMF3-21
Flush	.062	.040	.102	.250						SMF3-22
Flush	.093	.040	.133	.312						SMF3-23
Step	.125	.040	.165	.312						SMS3-24
Reverse	.062	.063	.125	*	.135	.390 .385	.125	*	#4-40	SMRV3-30
Reverse	.093	.063	.156	*				*		SMRV3-31

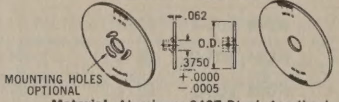
* Reverse type cleat supplied less screw.



PRECISION DISC DIALS

Clockwise and Counter Clockwise

PRECISION ENGRAVED



Material: Aluminum 24ST Black Anodized

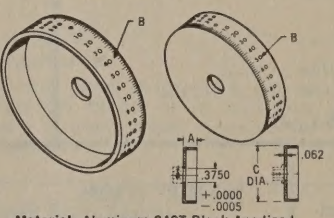
Cat. No.	Range	O. +.000 D. −.003	Steps in Degrees	Graduations
DA-01	—	1.500	—	BLANK
DA-02	0-360		2°	180
DA-03	0-100		3°-36′	100
DA-04	0-60		6°	60
DA-05	0-50		7°-12′	50
DA-06	0-25		14°-24′	25
DA-07	0-10		36°	10
DA-08	—	2.000	—	BLANK
DA-09	0-360		2°	180
DA-010	0-120		3°	120
DA-011	0-100		3°-36′	100
DA-012	0-72		5°	72
DA-013	0-60		6°	60
DA-014	0-50		7°-12′	50
DA-015	0-25		14°-24′	25
DA-016	0-10		36°	10
DA-017	—	3.000	—	BLANK
DA-018*	0-360		1°	360
DA-019*	0-360		2°	180
DA-020	0-200		1°-48′	200
DA-021	0-180		2°	180
DA-022	0-120		3°	120
DA-023*	0-100		3°-36′	100
DA-024	0-72		5°	72
DA-025	0-50		7°-12′	50
DA-026	0-10		36°	10
DA-027	—	4.000	—	BLANK
DA-028*	0-360		1°	360
DA-029*	0-360		2°	180
DA-030	0-200		1°-48′	200
DA-031	0-180		2°	180
DA-032	0-100		3°-36′	100
DA-033	0-50		7°-12′	50
DA-034	0-10		36°	10

*Available counter clockwise. To order, use prefix DC in place of DA.

PRECISION DRUM DIALS

Clockwise and Counter Clockwise

PRECISION ENGRAVED

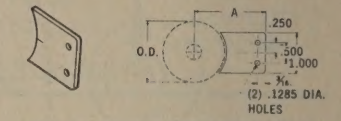


Material: Aluminum 24ST Black Anodized

Cat. No.	A	B	C	Range	Steps in Degrees
DB-1	3/8	—	.990	BLANK	—
DB-2		100		0-100	3°-36′
DB-3		180		0-360	2°
DB-4	3/8	—	1.490	BLANK	—
DB-5		60		0-60	6°
DB-6		100		0-100	3°-36′
DB-7		180		0-360	2°
DB-8	3/8	—	1.990	BLANK	—
DB-9		50		0-50	7°-12′
DB-10		25		0-25	14′-24°
DB-11		10		0-10	36°
DB-12		180		0-180	2°
DB-13		180		0-360	2°
DB-14	1/2	—	2.490	BLANK	—
DB-15		200		0-200	1°-48′
DB-16		180		0-180	2°
DB-17*		180		0-360	2°
DB-18*		360		0-360	1°
DB-19		100		0-100	3°-36′
DB-20	1/2	—	2.990	BLANK	—
DB-21		180		0-180	2°
DB-22		100		0-100	3°-36′
DB-23		10		0-10	36°
DB-24*		360		0-360	1°
DB-25*		180		0-360	2°

*Available counter clockwise. To order, use prefix DD in place of DB.

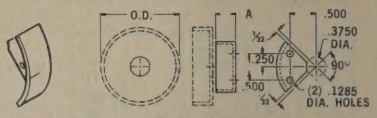
PRECISION DISC DIAL INDEX



Material: Aluminum 24ST Black Anodized
Note: Use with "DA" and "DC" Type Disc Dials

Cat. No.	A	O.D. of Dial
DG-1	1.760	1.500
DG-2	2.010	2.000
DG-3	2.510	3.000
DG-4	3.010	4.000

PRECISION DRUM DIAL INDEX

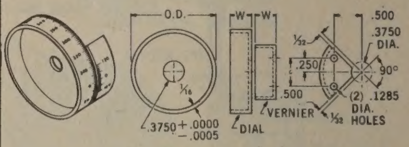


Material: Aluminum 24ST Black Anodized
Note: Use with "DB" and "DD" Type Drum Dials

Cat. No.	A	O.D. of Drum
DF-1	.375	1.490
DF-2	.375	1.990
DF-3	.500	2.490
DF-4	.500	2.999

VERNIER AND DRUM DIAL SETS

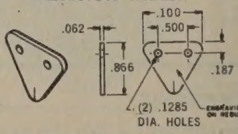
PRECISION ENGRAVED



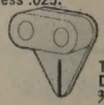
Material: Aluminum 24ST Black Anodized
Note: Special Sets Available on Request
For Additional Information See Technical Section

Cat. No.	O. +.005 D. −.005	W	Dial Graduations	Dial Range	Vernier Reading
DJ-1	1.490	.375	360° in 2° Steps	0°-360°	12′
DJ-2	1.990	.375			12′
DJ-3	2.490	.500	360° in 1° Steps		6′
DJ-4	2.990	.500			6′

PRECISION INDEX



No. 1341 POINTER, DIAL
3/8″W. x 3/8″H. x 1/8″D.
Pointer Section thickness .025.

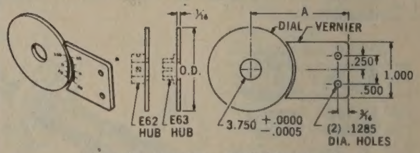


Two .078 Dia. Holes 3/16″ Apart.

Cat. No.	Material
DE-1	Clear Plexiglass
DE-2	Aluminum 24ST Black Anodized

VERNIER AND DISC DIAL SETS

PRECISION ENGRAVED



Material: Aluminum 24ST Black Anodized
Note: Special Sets Available on Request
For Additional Information See Technical Section

Cat. No.	O. +.000 D. −.005	A	Dial Graduations	Dial Range	Vernier Reading
DH-1	1.500	1.760	360° in 2° Steps	0°-360°	12′
DH-2	2.000	2.010			12′
DH-3	3.000	2.510	360° in 1° Steps		6′
DH-4	4.000	3.010			6′

We invite your inquiries for special dials and drums. Also available from stock — precision ground shafts.

JAN

JAN HARDWARE
MANUFACTURING COMPANY INC.

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QUALITY
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QUALITY
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HI-VOLTAGE INSULATED COUPLINGS U.S. PATENT NO. 2,681,387

MEETS MILITARY SPECIFICATIONS — TEMPERATURE - HUMIDITY - SHOCK - VIBRATION - FUNGUS

HI-VOLTAGE INSULATED COUPLINGS

15 KV Breakdown — 10 inch pounds torque
Series No. AK-5079 and No. AK-5164

Engineered with stainless steel shaft and precision, screwdriver tip molded-integrally with Diallyl Phthalate Material in accordance with Military Specifications. Completely shock, vibration and fungus proof, they operate with ease over an ambient temperature range of −75°C to +175°C. Supplied complete with nickel plated mounting hardware.

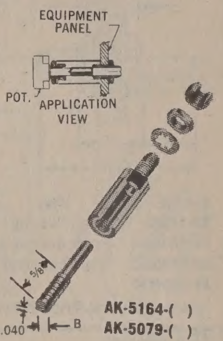
Stainless steel screwdriver tip fits all standard slotted shafts (potentiometer, etc.) without need for further machining. Ideally suited to adjust high voltage controls thus protecting operating personnel against danger. They are also used to reduce ground capacitance on other types of sensitive instrument controls.

For Commercial Instrument Applications . . .
These couplings are available in general purpose Black Bakelite.
Cat. No. 6164-(X or B)-( ) For Standard Type
Cat. No. 6079-(X or B)-( ) with Locking Type Bushing.
Dimensions are identical with 5000 Series, in chart below.

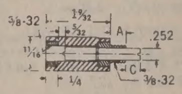
STANDARD TYPE

Cat. No.	Dimensions in Inches			
	"A"	"B"	Shaft	"C"
AK-5164-X-1	3/8	3/16	Slotted	5/16
AK-5164-B-1	3/8	1/16	Slotted	5/16
AK-5164-X-2	3/8	3/16	Slotted	15/32
AK-5164-B-2	3/8	1/16	Slotted	15/32
AK-5164-X-3	3/8	3/16	No Slot	15/16
AK-5164-B-3	3/8	1/16	No Slot	15/16
AK-5164-X-4	3/8	3/16	No Slot	1 7/16
AK-5164-B-4	3/8	1/16	No Slot	1 7/16
AK-5164-X-5	3/8	3/16	Slotted	Minus 1/16
AK-5164-B-5	3/8	1/16	Slotted	Minus 1/16
WITH LOCKING TYPE BUSHING				
AK-5079-X-1	9/16	3/16	Slotted	1/8
AK-5079-B-1	9/16	1/16	Slotted	1/8
AK-5079-X-2	9/16	3/16	Slotted	9/32
AK-5079-B-2	9/16	1/16	Slotted	9/32

Note: (3/16″) to be used with 1/8″ long shaft.
(1/16″) to be used with 1/4″ long shaft.



AK-5164-( )
AK-5079-( )



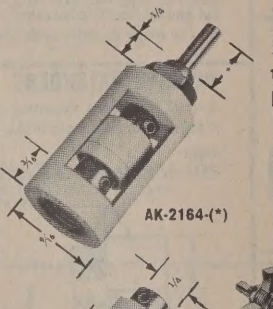
HI-VOLTAGE INSULATED COUPLINGS FOR 1/8″ SHAFTS

Cycalac material. Voltage rating: 6000 VDC.
Hubs — Brass, Nickel Plated; Shafts — St. Steel.
*Insert letter "S" or "N" followed by first two numbers of decimal equivalent, for fractional length of shaft beyond bushing.
"S" = with slot. "N" = no slot.

Typical Part Number: AK-2164-N31 =
5/16″ long shaft beyond bushing (standard), no slot. If length is 1″ use "X".

Typical Part Number: AK-2164-SX =
1″ long shaft beyond bushing, slotted.
If length exceeds 1″, use "X" and decimal equivalent for balance of number.

Typical Part Number: AK-2164-NX31 =
1 5/16″ long shaft beyond bushing, no slot.

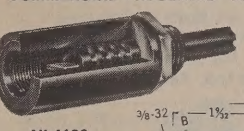


AK-2164-(*)

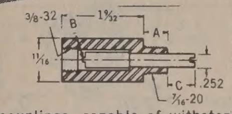
AP-1540 Center section of AK-2164-(*)

COMMERCIAL INSULATED COUPLINGS

30 KV Breakdown
10 inch pounds torque



AK-4160



STANDARD TYPE

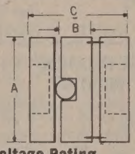
Cat. No.	Dimensions in Inches			
	"A"	"B"	Shaft	"C"
AK-4160-X-1	3/8	3/8	Slotted	1/8
AK-4160-B-1	3/8	3/16	Slotted	1/8
AK-4160-X-2	3/8	3/8	No Slot	1/2
AK-4160-B-2	3/8	3/16	No Slot	1/2

Series No. AK-4160
For TV and Industrial Applications

These handy couplings, capable of withstanding 30 KV, are made of high grade Bakelite throughout except for the stainless steel screwdriver tip molded within the drive shaft. Mounting hardware supplied.

AUTOLINEAR (INSULATED) SHAFT COUPLINGS

2.5-5 KV Breakdown Universal, Miniature, Self-aligning



Typical Part No.'s	Voltage Rating
AP-1530-34	AP-1530, 2500 V
AP-1538-22	AP-1538, 5000 V

Part No.	Dimensions in Inches			
	Dia. Hole	"A"	"B"	"C"
AP-1530-2	1/8	1/2	15/64	59/64±1/32
AP-1530-3	3/16	1/2	15/64	59/64±1/32
AP-1530-4	1/4	1/2	15/64	59/64±1/32
AP-1538-2	1/8	1/2	27/64	1 7/64±1/32
AP-1538-3	3/16	1/2	27/64	1 7/64±1/32
AP-1538-4	1/4	1/2	27/64	1 7/64±1/32

Cat. No. AP-1530 and AP-1538

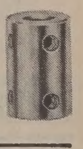
A unique series of shaft couplers that accommodate either similar or dissimilar 1/8″, 3/16″ or 1/4″ shafts. Permits offset misalignment to 1/16″ and 5° angle. Operates free of backlash. Self-extinguishing low water absorption characteristic plastic insulator between precision cast aluminum hubs. Each hub has 2 set screws for firm attachment. Alodine finish.

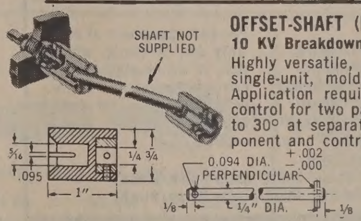
1/4″ SHAFT COUPLING EXTENDER

Cat. No. AP-1010
Nickel plated brass with 2 set screws for firm attachment to shaft. 1/2″ O.D.; 1 3/4″ overall length.
Cat. No. AP-1321
Same as above, except extends 1/4″ shaft to 1/8″ overall length 2 1/2″.

SHAFT COUPLING

Cat. No. AP-15150
A rugged, nickel plated brass coupling for joining two 1/4″ shafts. Supplied with 4 set screws for firm attachment to shafts.
Cat. No. AP-15151
Same as above, 2 set screws.





OFFSET-SHAFT (INSULATED) COUPLINGS

10 KV Breakdown ±30° Offset Cat. No. AP-15299

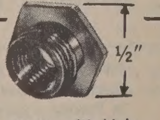
Highly versatile, durable, insulated couplings made with single-unit, molded Nylon-to-metal insert construction. Application requires two couplings — permits smooth control for two parallel shafts offset from each other up to 30° at separations greater than 3″. Secured to component and control shafts by 2 set screws.

Note: Coupling is accomplished with a 1/4″ shaft of any length (not furnished). Coupling shaft keyed to coupler by steel drive pins supplied.

AK5610
INSULATED
COUPLING

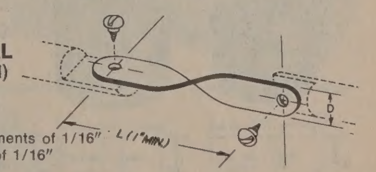
For 1/4″ shaft. Permits linear and angular misalignment up to .005″ and/or 10°
Breakdown voltage 3KV
3/4″ dia. x 5/8″ overall length.

REDUCER
INSERT
BUSHING
Cat. No.
AK771



Used as an adapter with high voltage insulated couplings to accommodate miniature (1/8″ shaft) potentiometers. External thread 3/8x32. Internal thread 1/4x32.

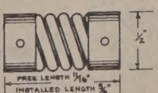
UNITWIST JAN UNIVERSAL
(shoulder screws supplied)



Specify:
1. Torque Requirement
2. Shaft Diameters (D) in increments of 1/16″
3. Distance "L" in increments of 1/16″

NEW!

SHAFT COUPLING
Cat. No. AP 1441-( )



Accommodates either similar or dissimilar 1/8″, 3/16″, or 1/4″ shafts, round or "D" flatted. Torque capacity 12 to 16 oz. in. Other drive torques and sizes available on request.

—(2) 1/8″ shaft	—(B) 1/8″ D flatted
—(3) 3/16″ shaft	—(D) 1/4″ D flatted
—(4) 1/4″ shaft	

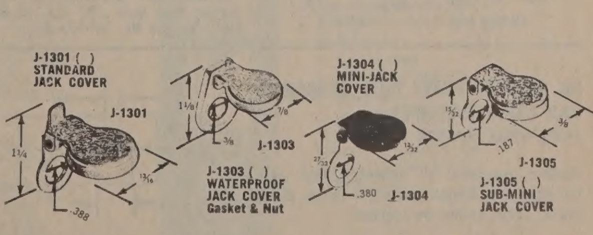
Typical Part Nos.
AP1441-24 couples 1/8″ shaft to 1/4″ shaft.
AP1441-2D couples 1/8″ shaft to 1/4″ D flatted.

JACK COVERS (TRIMMER COVERS)

These sturdy Jack Covers fit jack or panel bushings and are used to keep out dust and moisture as well as to prevent inadvertent disturbance of control settings. Outer surfaces are finished in standard colors of baked enamel.

To Order Colors Specify:
(-1) Black Wrinkle; (-2) Smooth Gray; (-3) Smooth Olive; (-4) Smooth Black. Other colors on request.

Example: Jack cover, color black wrinkle, order as J-1301 (-1)



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47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

QUALITY
RELIABILITY
ECONOMY

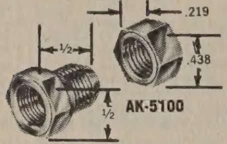
SHAFT LOCKS

Cat. No. AK-5100 thru No. AK-5107 — Split-Bushing, Collet Type Locks

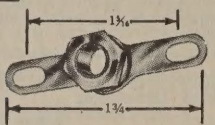
Used to securely hold the shaft of volume controls, capacitors, switches, etc. in position. Body and lock nut are brass — nickel plated. Supplied with nickel plated internal tooth lock washers, upon request.

SPLIT BUSHING TYPE — For ¼″ Shafts ⅜-32 bushing

AK-5100 Standard Lock Nut
AK-5101 Panel Mount Type
AK-5106 Knurled Shaft Lock (1″ O.D. Knurl)
AK-5107 Lock Nut (Round Head)
AK-5108 Shaft Lock, Knurled

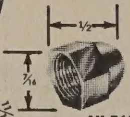


AK-5100

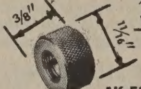


AK-5101

AK-5106



AK-5107



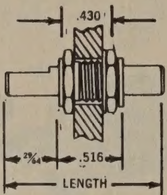
AK-5108

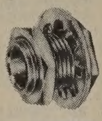
For ⅛″ thread, specify AK5109.
(¼-28 thd. ⁷⁄₃₂″ long. x ⁵⁄₁₆″ dia.)

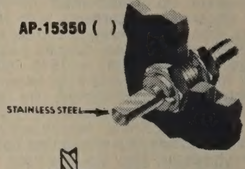
PANEL BEARING AND SHAFT ASSEMBLIES

Cat. No. AP-15350 Series

Used for rotary control of components. Passivated stainless steel shaft is ¼″ dia. with one end flattened for attaching to knob control by set screws. Supplied completely assembled with two retaining rings, jam nut with lock washer and nickel plated, brass panel bearing. Fits panels up to ³⁄₁₆″ thick; mounts in ¹³⁄₃₂″ dia. hole.



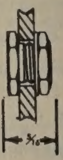

AP-15350



AP-15350 ( )

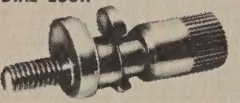
Cat. No.	Item	"L" Shaft Length
AP-15350	Panel Bearing	—
AP-15350-1	Panel Bearing &	1 ⁵⁄₁₆″
AP-15350-2	Shaft Assembly	3″
AP-15350-3		6″

Also available as Nylon Panel Bearing.



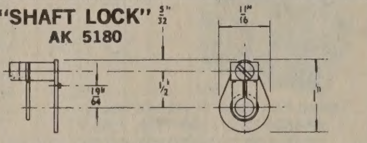
Cat. No. AK-5511 Panel Bearing Assembly
Shafts available on special order.

DIAL LOCK No. AP-1060



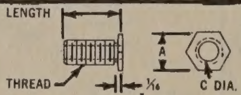
Supplied completely assembled. Securely locks dial in position. Nickel plated on brass. Knurled head. 1⅜″ overall length.

"SHAFT LOCK"
AK 5180



FITS OVER ⅜″ BUSHING FOR ¼″ SHAFT

PANEL BUSHING FOR ¼ AND ⅜ SHAFT



EXAMPLE (TO ORDER)
Pt. No. PB 61614-B=¼-28 Thd., ½ Lg. Panel Bushing-Brass w/.127 Hole.

Bushing supplied with Mtg. nut and int. tooth lockwasher.

Lgth.	A=⅜ ¼-28 Thread	A=½ ⅜-32 Thread
⅜	PB 60614	PB 80638
⁷⁄₁₆	PB 60714	PB 80738
½	PB 60814	PB 80838
⅝	PB 61014	PB 81038
¾	PB 61214	PB 81238

Thread	"C" Dia.
¼-28	.127
⅜-32	.252

Can be made to order with special nylon bearings.

NEW ITEMS! SHAFT LOCKS

One-piece; fits standard ⅜″-32 thread of shaft bushing. Friction grip holds ¼″ shaft to prevent accidental or vibrational disturbance of control settings. Adjustment for semi-permanent locking, provided. Also avail. for ⅛″ shafts.

AK-1048
Metal with plastic insert.

AK-1049
All plastic.
(Do not exceed 5 lb./in. torque to tighten).

AK-1050
Plastic with metal insert.

SHAFT KNOB LOCK

Cat. No.
AK-1057-2 (*) (⅛″ shaft)
AK-1057-4 (*) ¼″ shaft)
(Used with 71 Series Knob)
AK-1059-4 (*) (¼″ shaft)
(Used with 91 Series Knob)
*Specify "M" or "G" for matte or glossy finish.

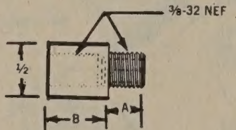
Prevents movement of controls due to shock, vibration, or accidental manual contact. Available in matte or glossy finish, for commercial or military applications.

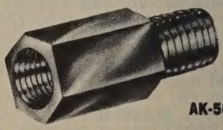
Typical Part Numbers: AK-1057-2MA = For ⅛″ Shaft/matte finish/Black
AK-1059-4GA = For ¼″ Shaft/glossy finish/Black

BUSHING EXTENDERS
Cat. No. AK-5075-1 thru AK-5075-11

Permit staggered mounting of components having ¼″ shafts, behind a panel. Useful in meeting problems of space economy. Supplied in nickel plated brass.

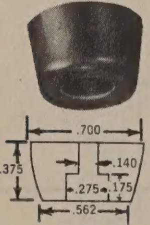
Note:
Extender AK-5075-9 is a locking (collet) type and is supplied by JAN with lock nut.



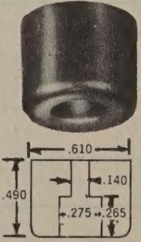

AK-5075 ( )

Dimensions in Inches

Cat. No.	"B"	"A"	Cat. No.	"B"	"A"
AK-5075-1	⅝	⅜	AK-5075-6	1⅝	¼
AK-5075-2	⅝	¼	AK-5075-7	1⁷⁄₁₆	³⁄₁₆
AK-5075-3	⅝	³⁄₁₆	AK-5075-8	1¹⁄₁₆	¼
AK-5075-4	¾	¼	AK-5075-9	¹¹⁄₁₆	½
AK-5075-5	2¼	¼	AK-5075-10	1²¹⁄₆₄	⁷⁄₁₆
			AK-5075-11	⁵⁵⁄₆₄	⁷⁄₁₆



AK-575 ( )



AK-574 ( )

CHASSIS AND CABINET BUMPERS

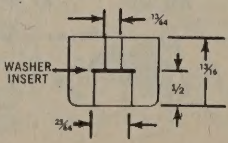
Durable, low-friction polyethylene. Guards against scuffing. Supplied in either black or russet brown, with recessed hole for screw or bolt usage.

To Order Colors: Black, specify (4); Brown, specify (7). Other colors on request.

AK-574 also available in white nylon; thru hole .187 dia., C bore ⅜″. Specify No. AK-577-8

NO. AK-576-4 HEAVY DUTY CHASSIS AND CABINET BUMPER
(WITH STEEL WASHER INSERT)

Molded neoprene. 1″ diameter, ¹³⁄₁₆″ high. Configuration similar to AK-574 above. Color: Black. Other colors on request.

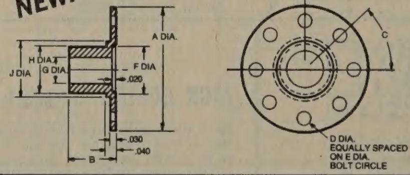


GROUND STUDS Multi-termination ground lugs.

Electrically Sound ● Easily Installed ● Space Saving

- Provides equipotential chassis termination for ground leads.
- Minimizes resistance between circuit contacts and ground point.
- Diminishes noise, pick-up and regenerative feedback.
- Eliminates the need for buss bars or stacks of lugs.
- Can be use as "Floating Ground" with proper insulation.

NEW!



Material: Brass, Half Hard
Finish: Tin Plate

Part No.	A	B	C	D	E	F	G	H	J
G 1001	¾″	⁵⁄₁₆″	30°	¹⁄₁₆″ Dia. 12 Holes	⁹⁄₁₆″	²¹⁄₆₄″	³⁄₁₆″	⁵⁄₁₆″	²³⁄₆₄″
G 5008	¾″	¼″	36°	⁵⁄₆₄″ Dia. 10 Holes	⁹⁄₁₆″	²¹⁄₆₄″	³⁄₁₆″	⁵⁄₁₆″	²³⁄₆₄″
G 7004	½″	⁹⁄₃₂″	45°	¹⁄₁₆″ Dia. 8 Holes	²⁵⁄₆₄″	¹⁷⁄₆₄″	⁵⁄₃₂″	⁷⁄₃₂″	¹⁹⁄₆₄″

JAN

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QUALITY
RELIABILITY
ECONOMY

EQUIPMENT HANDLES

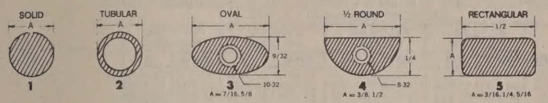
MATERIAL

- A — ALUMINUM
- B — BRASS
- S — COLD ROLLED STEEL
- SS — STAINLESS STEEL

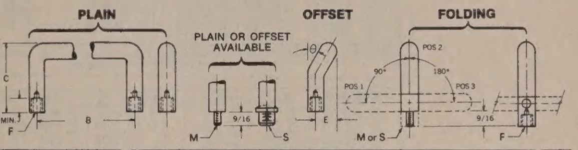
FINISH

- A — BLACK ANODIZE
- B — OPTICAL BLACK
- C — CLEAR ANODIZE
- E — SATIN ETCH
- N — NICKEL PLATE
- X — BLACK OXIDE
- P — PASSIVATE
- 0 — NO FINISH

SHAPE



TYPE



HOW TO SPECIFY

TYPE OF HANDLE

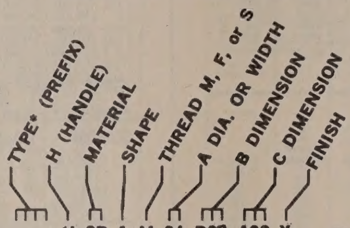
*TYPE	PREFIX	DESCRIPTION
PLAIN	NONE	———
OFFSET	ϕ, E	———
FOLDING	A	A = FREE 180°
	B	B = 2 POS., DETENT, 90°
	C	C = 3 POS., DETENT, 90°

A DIA.	3⁄16	¼	5⁄16	⅜	7⁄16	½
M, F	4-40	8-32	10-32	10-32	10-32	10-32
S	10-32	¼-28	5⁄16-24	⅜-24	⅜-24	⅜-24

RECOMMENDED CARRYING LOAD (lbs.) BASED ON HUMAN ENGINEERING FACTORS

A DIA.	¼	⅜	½	⅝	¾
JAN STD. (lbs.)	10-15	15-20	20-30	30-40	40-50
MIL STD. 1472 (lbs. max.)	15	—	20	—	40

NOTE: For special designs, identify differences from standard in ( ) after Part No.
Example: 3008 H0A 1 F 10 C09 B08 A (F = 6-32 x ¾″ deep).



DIMENSION:

θ Specify in Degrees
A, E Specify in 1⁄16 increments
C, B Specify with Letter + Fraction in 1⁄16 increments

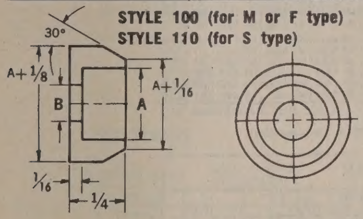
LETTER VALUE:

A thru Z = 1 thru 26. When Specifying dimension in 1⁄16 increments, use numerator of fraction for Part No. See Examples.

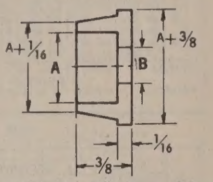
TYPICAL PART NUMBER

H 0B 1 M 04 D03 A02 X ..	Plain Handle Brass, Shape 1, Male Thd., A = ¼ O.D., B = 43⁄16, C = 1⅛, Black Oxide Finish.
3008 H 0A 1 F 10 C09 B08 A ..	30°, Offset, E = ½, Aluminum, Shape 1. Female Thd,. A = ⅝ O.D., B = 33⁄16, C = 2½, Blk. Anodized.
A H SS 2 S 08 D00 A08 P ...	Folding Handle, 180°, Free. Stainless Steel, Shape 2. A = ½ Dia., B = 4″, C = 1½, Passivate, ⅜-24 thd.

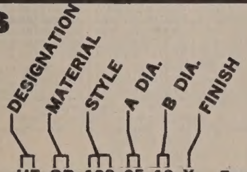
FERRULES



STYLE 100 (for M or F type)
STYLE 110 (for S type)



STYLE 200 (for M or F type)
STYLE 210 (for S type)

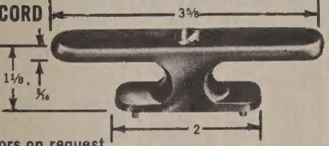


NOTES: "A" dimension is specified in 1⁄16 increments using numerator of fraction for part No.
"B" Dia. is clearance hole. For thd., see table.
For material and finish, see above.
See examples.

HF 0B 100 05 10 X	Ferrule Brass, Style 100, A = 5⁄16 Dia. B = clearance for 10-32, Black Oxide
HF 0A 200 08 10 A	Ferrule Aluminum, Style 200, A = ½ Dia. B = clearance for 10-32, Black Anodized.

Thd. Size	4-40	6-32	8-32	10-32	¼-24	⅜-24
B	04	06	08	10	25	38

HANDLE, CORD



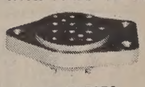
Cat. No.
H-692-1

Colors:
(-1) Grey
(-2) Black
Special colors on request.

This durable, die-cast aluminum handle is designed for use on small instrument panels. Single integral hole accepts No. 10 screw.

RELAY SOCKETS

WITH FIXED OR REMOVABLE CONTACTS!



1000 SERIES

2000 SERIES

3000 SERIES

MS No.	JAN Part No.	MS No.	JAN Part No.
MS-25322	No. 1010	MS-25456	No. 1060
MS-25324	No. 1020	MS-25458	No. 1070
MS-25326	No. 1030	MS-25460	No. 1080
MS-25328	No. 1040	MS-25462	No. 1090
MS-25330	No. 1050	MS-25464	No. 1100

NEW! FIBRE CASES —

A complete range of lightweight, high impact vulcanized Fibre Cases. Built for maximum strength and durability. Steel corners, clamps and hinges. Comfortable handles. Straps of extra heavy webbing. Water repellant finish. Ideal for motion picture film, tapes, tool cases, sample cases, electronic equipment, etc. Wide range of styles available. Special cases made to order.

JOLTA SHOCK TEST MACHINES

For Reproducible Impact-Shock Test Pulses

Four Models Engineered to Reproduce the Entire Spectrum of All Significant Impact Shock Waves

Designed for laboratory and production testing of light to medium weight components as well as complete instrumentation. Produced to meet practically all requirements of common Mil. Spec. qualification tests. Each JOLTA is electronically calibrated to certify compliance with test specifications.

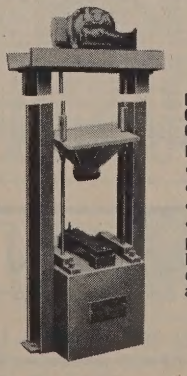
JOLTA Bench Model No. 1001 — Produced to meet JAN-S-44 and Mil-Std. 202 (202A). Standard model range 30-120G. Accessory plate springs available for test pulses to 500 G.

JOLTA Bench Model No. M-500 — Produced to meet Mil-T-12679A (Sig. C) and Mil-T-19500A. Standard model range — 200 to 1000 G at 1.0 millisecs. Alternate anvil and pad kits available to order.

JOLTA Floor Model Nos. F-3003-C1, C2, C3 — Designed for high impact shock testing for small and moderate-sized components. Precision-machined magnesium casting utilized for higher shock amplitudes. Typical tests with these units 50 to 5000 G at .2 to 11.0 millisecs. For high impact testing, accessory springs and twin anvil combinations yield impulses of 0.2 millisecs to 5000 G.

SPECIFICATIONS — JOLTA SHOCK TESTERS

Model No.	Carriage Volume	Test Weight	"G" Ranges
1001	4″x4″x5″	0-12 lbs.	25-500
M-500	3″ cube	0-2.0 lbs.	100-1000
F-3003-C-1	5″ cube	0-12 lbs.	50-1500
F-3003-C-2	5″ cube	0-4.0 lbs.	350-5000



For Production Testing, Can Be Automated for Continuous Operation

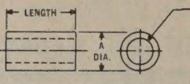
FEATURES

- Economical
- Simple to Operate
- Rugged
- Uniformly Accurate

Note:
New design allows for quick changeovers of accessories.

STANDOFFS

SPACER-THRU HOLE



Clearance Hole	Code
.091 Dia. (No. 2 Screw)	1
.116 Dia. (No. 4 Screw)	2
.141 Dia. (No. 6 Screw)	3
.171 Dia. (No. 8 Screw)	4
.194 Dia. (No. 10 Screw)	5
.219 Dia. (No. 12 Screw)	6
.257 Dia. (No. 1/4 Screw	7

Length	A=1/8	A=3/16	A=1/4	Length	A=3/16	A=1/4
1/16	SP 021	SP 031		11/16	SP 0311	SP 0411
1/8	SP 022	SP 032	SP 042	3/4	SP 0312	SP 0412
3/16	SP 023	SP 033	SP 043	7/8	SP 0314	SP 0414
1/4	SP 024	SP 034	SP 044	15/16	SP 0315	SP 0415
5/16	SP 025	SP 035	SP 045	1	SP 0316	SP 0416
3/8	SP 026	SP 036	SP 046	1 1/8		SP 0418
7/16	SP 027	SP 037	SP 047	1 1/4		SP 0420
1/2	SP 028	SP 038	SP 048	1 3/8		SP 0422
9/16	SP 029	SP 039	SP 049	1 1/2		SP 0424
5/8		SP 0310	SP 0410			

EXAMPLE (TO ORDER) Pt. No. SP 035-2-B = 3/16 Dia. x 5/16 Lg. Spacer-Brass w/.116 Clearance Hole for #4 Screw.

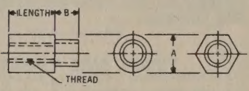
Length	A=5/16	A=3/8	A=1/2	Length	A=5/16	A=3/8	A=1/2
1/8	SP 025	SP 062	SP 082	7/8	SP 0514	SP 0614	SP 0814
3/16	SP 053	SP 063	SP 083	15/16	SP 0515	SP 0615	SP 0815
1/4	SP 054	SP 064	SP 084	1	SP 0516	SP 0616	SP 0816
5/16	SP 055	SP 065	SP 085	1 1/8	SP 0518	SP 0618	SP 0818
3/8	SP 056	SP 066	SP 086	1 1/4	SP 0520	SP 0620	SP 0820
7/16	SP 057	SP 067	SP 087	1 3/8	SP 0522	SP 0622	SP 0822
1/2	SP 058	SP 068	SP 088	1 1/2	SP 0524	SP 0624	SP 0824
9/16	SP 059	SP 069	SP 089	1 5/8		SP 0626	SP 0826
5/8	SP 0510	SP 0610	SP 0810	1 3/4		SP 0628	SP 0828
11/16	SP 0511	SP 0611	SP 0811	1 7/8		SP 0630	SP 0830
3/4	SP 0512	SP 0612	SP 0812	2		SP 0632	SP 0832

EXAMPLE (TO ORDER) Pt. No. SP 064-3-PH = 3/8 Dia. x 1/4 Lg. Spacer-Phenolic w/.141 Clearance Hole for #6 Screw.

MATERIALS B = Brass A = Aluminum SS = Stainless Steel PH = Phenolic

STANDOFF — RIVET

— HEX AND ROUND



Code	Board Thickness	Shank B
1	1/32	.075
2	1/16	.105
3	3/32	.135
4	1/8	.165
5	3/16	.230
6	1/4	.290

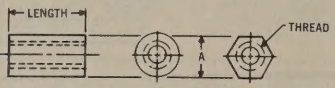
	A=1/8 Dia. 0-80 Thread		A=1/4 Dia. 2-56 Thread		A=5/16 Dia. 4-40 Thread		A=3/8 Dia. 6-32 Thread	
Length	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1/8	RR 202	RH 202	RR 4022	RH 4022	RR 5024	RH 5024	RR 6026	RH 6026
3/16	RR 203	RH 203	RR 4032	RH 4032	RR 5034	RH 5034	RR 6036	RH 6036
1/4	RR 204	RH 204	RR 4042	RH 4042	RR 5044	RH 5044	RR 6046	RH 6046
5/16	RR 205	RH 205	RR 4052	RH 4052	RR 5054	RH 5054	RR 6056	RH 6056
3/8	RR 206	RH 206	RR 4062	RH 4062	RR 5064	RH 5064	RR 6066	RH 6066
7/16	RR 207	RH 207	RR 4072	RH 4072	RR 5074	RH 5074	RR 6076	RH 6076
1/2	RR 208	RH 208	RR 4082	RH 4082	RR 5084	RH 5084	RR 6086	RH 6086
9/16	RR 209	RH 209	RR 4092	RH 4092	RR 5094	RH 5094	RR 6096	RH 6096
5/8	RR 210	RH 210	RR 4102	RH 4102	RR 5104	RH 5104	RR 6106	RH 6106
11/16	RR 211	RH 211	RR 4112	RH 4112	RR 5114	RH 5114	RR 6116	RH 6116
3/4	RR 212	RH 212	RR 4122	RH 4122	RR 5124	RH 5124	RR 6126	RH 6126
7/8	RR 214	RH 214	RR 4142	RH 4142	RR 5144	RH 5144	RR 6146	RH 6146
1	RR 216	RH 216	RR 4162	RH 4162	RR 5164	RH 5164	RR 6166	RH 6166

EXAMPLE (TO ORDER) Pt. No. RR 4052-2-B = 1/4 Dia. x 5/16 Lg. Round, Rivet Standoff-Brass w/2-56 Thread Shank = .105 for 1/16 Board.

MATERIALS R = Brass A = Aluminum SS = Stainless Steel PH = Phenolic

STANDOFF — THREADED

— HEX & ROUND



MATERIALS B = Brass A = Aluminum SS = Stainless Steel PH = Phenolic

SPECIAL SIZES AND MATERIALS/MANUFACTURED TO ORDER

	A=1/8 Dia. 0-80 Thread		A=3/16 Dia. 2-56 Thread		A=3/16 Dia. 4-40 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex
1/16	SR 201	SH 201	SR 3012	SH 3012	SR 3014	SH 3014
1/8	SR 202	SH 202	SR 3022	SH 3022	SR 3024	SH 3024
3/16	SR 203	SH 203	SR 3032	SH 3032	SR 3034	SH 3034
1/4	SR 204	SH 204	SR 3042	SH 3042	SR 3044	SH 3044
5/16	SR 205	SH 205	SR 3052	SH 3052	SR 3054	SH 3054
3/8	SR 206	SH 206	SR 3062	SH 3062	SR 3064	SH 3064
7/16	SR 207	SH 207	SR 3072	SH 3072	SR 3074	SH 3074
1/2	SR 208	SH 208	SR 3082	SH 3082	SR 3084	SH 3084
9/16	SR 209	SH 209	SR 3092	SH 3092	SR 3094	SH 3094
5/8	SR 210	SH 210	SR 3102	SH 3102	SR 3104	SH 3104
3/4	SR 212	SH 212	SR 3122	SH 3122	SR 3124	SH 3124
1			SR 3162	SH 3162	SR 3164	SH 3164

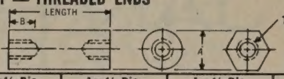
EXAMPLE (TO ORDER) Pt. No. SR 3032-A = 3/16 Dia. x 3/16 Lg. Round Standoff-Aluminum w/2-56 Threaded Hole.

	A=1/4 Dia.							
	4-40 Thread		6-32 Thread		8-32 Thread		10-32 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1/8	SR 4024	SH 4024	SR 4026	SH 4026	SR 4028	SH 4028	SR 40210	SH 40210
3/16	SR 4034	SH 4034	SR 4036	SH 4036	SR 4038	SH 4038	SR 40310	SH 40310
1/4	SR 4044	SH 4044	SR 4046	SH 4046	SR 4048	SH 4048	SR 40410	SH 40410
5/16	SR 4054	SH 4054	SR 4056	SH 4056	SR 4058	SH 4058	SR 40510	SH 40510
3/8	SR 4064	SH 4064	SR 4066	SH 4066	SR 4068	SH 4068	SR 40610	SH 40610
7/16	SR 4074	SH 4074	SR 4076	SH 4076	SR 4078	SH 4078	SR 40710	SH 40710
1/2	SR 4084	SH 4084	SR 4086	SH 4086	SR 4088	SH 4088	SR 40810	SH 40810
9/16	SR 4094	SH 4094	SR 4096	SH 4096	SR 4098	SH 4098	SR 40910	SH 40910
5/8	SR 4104	SH 4104	SR 4106	SH 4106	SR 4108	SH 4108	SR 41010	SH 41010
3/4	SR 4124	SH 4124	SR 4126	SH 4126	SR 4128	SH 4128	SR 41210	SH 41210
7/8	SR 4144	SH 4144	SR 4146	SH 4146	SR 4148	SH 4148	SR 41410	SH 41410
1	SR 4164	SH 4164	SR 4166	SH 4166	SR 4168	SH 4168	SR 41610	SH 41610

EXAMPLE (TO ORDER) Pt. No. SH 4086-B = 1/4 Dia. x 1/2 Lg. Hex Standoff-Brass w/6-32 Threaded Hole.

STANDOFF — THREADED ENDS

— HEX & ROUND



Thread	Depth B
0-80	3/16
4-40	1/4
6-32	3/8
8-32	7/16

	A=1/8 Dia. 0-80 Thread		A=1/4 Dia. 4-40 Thread		A=1/4 Dia. 6-32 Thread		A=1/4 Dia. 8-32 Thread	
Length	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1 1/16	DR 217	DH 217	DR 4174	DH 4174	DR 4176	DH 4176	DR 4178	DH 4178
1 1/8	DR 218	DH 218	DR 4184	DH 4184	DR 4186	DH 4186	DR 4188	DH 4188
1 3/16	DR 219	DH 219	DR 4194	DH 4194	DR 4196	DH 4196	DR 4198	DH 4198
1 1/4	DR 220	DH 220	DR 4204	DH 4204	DR 4206	DH 4206	DR 4208	DH 4208
1 5/16	DR 221	DH 221	DR 4214	DH 4214	DR 4216	DH 4216	DR 4218	DH 4218
1 3/8	DR 222	DH 222	DR 4224	DH 4224	DR 4226	DH 4226	DR 4228	DH 4228
1 7/16	DR 223	DH 223	DR 4234	DH 4234	DR 4236	DH 4236	DR 4238	DH 4238
1 1/2	DR 224	DH 224	DR 4244	DH 4244	DR 4246	DH 4246	DR 4248	DH 4248
2			DR 4324	DH 4324	DR 4326	DH 4326	DR 4328	DH 4328
2 1/8			DR 4344	DH 4344	DR 4346	DH 4346	DR 4348	DH 4348
2 3/4			DR 4444	DH 4444	DR 4446	DH 4446	DR 4448	DH 4448
3			DR 4484	DH 4484	DR 4486	DH 4486	DR 4488	DH 4488

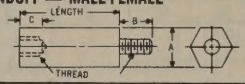
EXAMPLE (TO ORDER) Pt. No. DH 219-B = 1/8 Dia. x 1 3/16 Lg. Hex Standoff-Tapped Both Ends Brass w/o-80 x 3/16 Hole.

	A=5/16 Dia. 6-32 Thread		A=3/8 Dia. 6-32 Thread		A=3/8 Dia. 8-32 Thread		A=1/2 Dia. 8-32 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1 1/16	DR 5176	DH 5176	DR 6176	DH 6176	DR 6178	DH 6178	DR 8178	DH 8178
1 1/8	DR 5186	DH 5186	DR 6186	DH 6186	DR 6188	DH 6188	DR 8188	DH 8188
1 3/16	DR 5196	DH 5196	DR 6196	DH 6196	DR 6198	DH 6198	DR 8198	DH 8198
1 1/4	DR 5206	DH 5206	DR 6206	DH 6206	DR 6208	DH 6208	DR 8208	DH 8208
1 5/16	DR 5216	DH 5216	DR 6216	DH 6216	DR 6218	DH 6218	DR 8218	DH 8218
1 3/8	DR 5226	DH 5226	DR 6226	DH 6226	DR 6228	DH 6228	DR 8228	DH 8228
1 7/16	DR 5236	DH 5236	DR 6236	DH 6236	DR 6238	DH 6238	DR 8238	DH 8238
1 1/2	DR 5246	DH 5246	DR 6246	DH 6246	DR 6248	DH 6248	DR 8248	DH 8248
1 3/4	DR 5286	DH 5286	DR 6286	DH 6286	DR 6288	DH 6288	DR 8288	DH 8288
2	DR 5326	DH 5326	DR 6326	DH 6326	DR 6328	DH 6328	DR 8328	DH 8328
2 1/4	DR 5366	DH 5366	DR 6366	DH 5366	DR 6368	DH 6368	DR 8368	DH 8368
2 1/2	DR 5406	DH 5406	DR 6406	DH 6406	DR 6408	DH 6408	DR 8408	DH 8408
3	DR 5486	DH 5486	DR 6486	DH 6486	DR 6488	DH 6488	DR 8488	DH 8488
3 1/2	DR 5566	DH 5566	DR 6566	DH 6566	DR 6568	DH 6568	DR 8568	DH 8568
4	DR 5646	DH 5646	DR 6646	DH 6666	DR 6648	DH 6648	DR 8648	DH 8648

EXAMPLE (TO ORDER) Pt. No. DR 6186-A = 3/8 Dia. x 1 1/8 Lg. Round Standoff-Aluminum-Tapped Both Ends w/6-32 x 3/8 Thread.

MATERIALS B = Brass A = Aluminum SS = Stainless Steel PH = Phenolic

STANDOFF — MALE-FEMALE



Thread	B	C
4-40	3/16	1/4
6-32	1/4	3/8
8-32	3/8	7/16
10-32	3/8	1/2

	A=1/4 AC. Flts.				A=3/8 AC. Flts.			
Lgth.	4-40	6-32	8-32	10-32	4-40	6-32	8-32	10-32
1/4	MF 4044	MF 4046	MF 4048	MF 40410	MF 6044	MF 6046	MF 6048	MF 60410
3/8	MF 4064	MF 4066	MF 4068	MF 40610	MF 6064	MF 6066	MF 6068	MF 60610
1/2	MF 4084	MF 4086	MF 4088	MF 40810	MF 6084	MF 6086	MF 6088	MF 60810
5/8	MF 4104	MF 4106	MF 4108	MF 41010	MF 6104	MF 6106	MF 6108	MF 61010
3/4	MF 4124	MF 4126	MF 4128	MF 41210	MF 6124	MF 6126	MF 6128	MF 61210
7/8	MF 4144	MF 4146	MF 4148	MF 41410	MF 6144	MF 6146	MF 6148	MF 61410
1	MF 4164	MF 4166	MF 4168	MF 41610	MF 6164	MF 6166	MF 6168	MF 61610
1 1/8	MF 4184	MF 4186	MF 4188	MF 41810	MF 6184	MF 6186	MF 6188	MF 61810
1 1/4	MF 4204	MF 4206	MF 4208	MF 42010	MF 6204	MF 6206	MF 6208	MF 62010
1 3/8	MF 4224	MF 4226	MF 4228	MF 42210	MF 6224	MF 6226	MF 6228	MF 62210
1 1/2	MF 4244	MF 4246	MF 4248	MF 42410	MF 6244	MF 6246	MF 6248	MF 62410
1 5/8	MF 4264	MF 4266	MF 4268	MF 42610	MF 6264	MF 6266	MF 6268	MF 62610
1 3/4	MF 4284	MF 4286	MF 4288	MF 42810	MF 6284	MF 6286	MF 6288	MF 62810
2	MF 4324	MF 4326	MF 4328	MF 43210	MF 6324	MF 6326	MF 6328	MF 63210
2 1/2	MF 4404	MF 4406	MF 4408	MF 44010	MF 6404	MF 6406	MF 6408	MF 64010
3	MF 4484	MF 4486	MF 4488	MF 44810	MF 6484	MF 6486	MF 6488	MF 64810

EXAMPLE (TO ORDER) Pt. No. MF 4146-B = 1/4 AC. Flts. Standoff-Brass 6-32 Male-Female Threads.

MATERIALS B =Brass A = Aluminum SS = Stainless Steel

	A=5/16 Dia.							
	4-40 Thread		6-32 Thread		8-32 Thread		10-32 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1/8	SR 5024	SH 5024	SR 5026	SH 5026	SR 5028	SH 5028	SR 50210	SH 50210
3/16	SR 5034	SH 5034	SR 5036	SH 5036	SR 5038	SH 5038	SR 50310	SH 50310
1/4	SR 5044	SH 5044	SR 5046	SH 5046	SR 5048	SH 5048	SR 50410	SH 50410
5/16	SR 5054	SH 5054	SR 5056	SH 5056	SR 5058	SH 5058	SR 50510	SH 50510
3/8	SR 5064	SH 5064	SR 5066	SH 5066	SR 5068.	SH 5068	SR 50610	SH 50610
7/16	SR 5074	SH 5074	SR 5076	SH 5076	SR 5078	SH 5078	SR 50710	SH 50710
1/2	SR 5084	SH 5084	SR 5086	SH 5086	SR 5088	SH 5088	SR 50810	SH 50810
9/16	SR 5094	SH 5094	SR 5096	SH 5096	SR 5098	SH 5098	SR 50910	SH 50910
5/8	SR 5104	SH 5104	SR 5106	SH 5106	SR 5108	SH 5108	SR 51010	SH 51010
3/4	SR 5124	SH 5124	SR 5126	SH 5126	SR 5128	SH 5128	SR 51210	SH 51210
7/8	SR 5144	SH 5144	SR 5146	SH 5146	SR 5148	SH 5148	SR 51410	SH 51410
1	SR 5164	SH 5164	SR 5166	SH 5166	SR 5168	SH 5168	SR 51610	SH 51610

EXAMPLE (TO ORDER) Pt. No. SR 5146-PH = 5/16 Dia. x 7/8 Lg. Round Standoff-Phenolic w/6-32 Threaded Hole.

	3/8 Dia.					
	6-32 Thread		8-32 Thread		10-32 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex
1/8	SR 6026	SH 6026	SR 6028	SH 6028	SR 60210	SH 60210
3/16	SR 6036	SH 6036	SR 6038	SH 6038	SR 60310	SH 60310
1/4	SR 6046	SH 6046	SR 6048	SH 6048	SR 60410	SH 60410
5/16	SR 6056	SH 6056	SR 6058	SH 6058	SR 60510	SH 60510
3/8	SR 6066	SH 6066	SR 6068	SH 6068	SR 60610	SH 60610
7/16	SR 6076	SH 6076	SR 6078	SH 6078	SR 60710	SH 60710
1/2	SR 6086	SH 6086	SR 6088	SH 6088	SR 60810	SH 60810
9/16	SR 6096	SH 6096	SR 6098	SH 6098	SR 60910	SH 60910
5/8	SR 6106	SH 6106	SR 6108	SH 6108	SR 61010	SH 61010
3/4	SR 6126	SH 6126	SR 6128	SH 6128	SR 61210	SH 61210
7/8	SR 6146	SH 6146	SR 6148	SH 6148	SR 61410	SH 61410
1	SR 6166	SH 6166	SR 6168	SH 6168	SR 61610	SH 61610

EXAMPLE (TO ORDER) Pt. No. SH 6068-B = 3/8 Dia. x 3/8 Lg. Hex Standoff-Brass w/8-32 Threaded Hole.

	A=1/2 Dia.							
	8-32 Thread		10-32 Thread		12-24 Thread		1/4-20 Thread	
Lgth.	Round	Hex	Round	Hex	Round	Hex	Round	Hex
1/8	SR 8028	SH 8028	SR 80210	SH 80210	SR 80212	SH 80212	SR 80214	SH 80214
3/16	SR 8038	SH 8038	SR 80310	SH 80310	SR 80312	SH 80310	SR 80314	SH 80314
1/4	SR 8048	SH 8048	SR 80410	SH 80410	SR 80412	SH 80412	SR 80414	SH 80414
5/16	SR 8058	SH 8058	SR 80510	SH 80510	SR 80512	SH 80512	SR 80514	SH 80514
3/8	SR 8068	SH 8068	SR 80610	SH 80610	SR 80612	SH 80612	SR 80614	SH 80614
7/16	SR 8078	SH 8078	SR 80710	SH 80710	SR 80712	SH 80712	SR 80714	SH 80714
1/2	SR 8088	SH 8088	SR 80810	SH 80810	SR 80812	SH 80812	SR 80814	SH 80814
9/16	SR 8098	SH 8098	SR 80910	SH 80910	SR 80912	SH 80912	SR 80914	SH 80914
5/8	SR 8108	SH 8108	SR 81010	SH 81010	SR 81012	SH 81012	SR 81014	SH 81014
3/4	SR 8128	SH 8128	SR 81210	SH 81210	SR 81212	SH 81212	SR 81214	SH 81214
7/8	SR 8148	SH 8148	SR 81410	SH 81410	SR 81412	SH 81412	SR 81414	SH 81414
1	SR 8168	SH 8168	SR 81610	SH 81610	SR 81612	SH 81612	SR 81614	SH 81614

EXAMPLE (TO ORDER) Pt. No. SR 80910-A = 1/2 Dia. x 9/16 Lg. Round Standoff-Aluminum w/10-32 Threaded Hole.

SPECIAL SIZES AND MATERIALS MANUFACTURED TO ORDER

JAN

JAN HARDWARE

MANUFACTURING COMPANY INC.

47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

QUALITY
RELIABILITY
ECONOMY

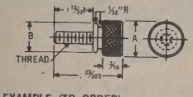
JAN

JAN HARDWARE
MANUFACTURING COMPANY INC.

47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

QUALITY
RELIABILITY
ECONOMY

THUMB SCREW

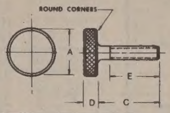


Thread	A Dia.	B Dia.	Pt. No.
6-32	⅜ 7/16 ½ ⅜	5/16 ⅜ 7/16 5/16	TS 6056 TS 7066 TS 8076 TS 6058
8-32	7/16 ½	⅜ 7/16	TS 7068 TS 8078
10-32	⅜ 7/16 ½	5/16 ⅜ 7/16	TS 60510 TS 70610 TS 80710

EXAMPLE (TO ORDER)

Pt. No. TS 6058-9 = 8-32 x 13/32 Lg. Thread, Thumb Screw- Brass.

New!



KNURLED THUMB SCREWS
Material: 303 Stainless Steel

Thread	A	C	D	E	Part No.
#4-40	¼	⅜	⅛	5/16	ST4010
	¼	½	½	7/16	ST4011
	¼	¾	½	⅝	ST4012
	⅜	⅜	⅛	5/16	ST4013
	⅜	½	⅛	7/16	ST4014
#6-32	¼	½	½	7/16	ST6015
	¼	¾	½	⅝	ST6016
	¼	1	½	13/16	ST6017
	⅜	⅜	⅛	5/16	ST6018
	⅜	½	⅛	⅜	ST6019
#8-32	¼	½	½	7/16	ST8020
	¼	¾	½	⅝	ST8021
	¼	1	½	13/16	ST8022
	⅜	⅜	⅛	5/16	ST8023
	⅜	½	⅛	⅜	ST8024
#10-24	⅜	½	3/16	7/16	ST11025
	⅜	¾	3/16	⅝	ST11026
	⅜	1	3/16	13/16	ST11027
	⅜	1¼	3/16	1	ST11028
	½	¾	3/16	⅝	ST11029
	½	1	3/16	13/16	ST11030
	½	1¼	3/16	1	ST11031
	½	1½	3/16	1¼	ST11032
	¾	¾	3/16	⅝	ST11033
	¾	1	3/16	13/16	ST11034
#10-24	¾	1¼	3/16	1	ST11035
	¾	1½	3/16	1¼	ST11036
#10-32	⅜	½	3/16	7/16	ST10037
	⅜	¾	3/16	⅝	ST10038
	¾	1	3/16	13/16	ST10039
	⅜	1¼	3/16	1	ST10040
	½	¾	3/16	⅝	ST10041
	½	1	3/16	13/16	ST10042
	½	1¼	3/16	1	ST10043
	½	1½	3/16	1¼	ST10044
	¾	¾	3/16	⅝	ST10045
	¾	1	3/16	13/16	ST10046
	¾	1¼	3/16	1	ST10047
	¾	1½	3/16	1¼	ST10048
¼-20	¾	¾	3/16	⅝	ST14049
	¾	1	3/16	13/16	ST14050
	¾	1¼	3/16	1	ST14051
	¾	1½	3/16	1¼	ST14052
	¾	2	3/16	1⅝	ST14053
	1	¾	3/16	⅝	ST14054
	1	1	3/16	13/16	ST14055
	1	1¼	3/16	1	ST14056
	1	1½	3/16	1¼	ST14057
	1	2	3/16	1⅝	ST14058

New!

SET SCREWS

SOCKET HEAD
Class 3A Thread
Stainless Steel

Screw Size	L	Part No.
#0-80	⅛ 3/16	SS-T-1 SS-T-2
#2-56	⅛ 3/16 ¼	SS-T-3 SS-T-4 SS-T-5
#4-40	⅛ 3/16 ¼	SS-T-6 SS-T-7 SS-T-8
#6-32	⅛ ¼ ⅜ ½	SS-T-9 SS-T-10 SS-T-11 SS-T-12
#8-32	¼ ⅜ ½ ⅝	SS-T-13 SS-T-14 SS-T-15 SS-T-16
#10-32	¼ ½ ¾ 1	SS-T-17 SS-T-18 SS-T-19 SS-T-20
¼-20	¼ ½ ¾ 1 1¼	SS-T-21 SS-T-22 SS-T-23 SS-T-24 SS-T-25

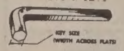
CUP POINT STAINLESS

SLOTTED HEAD
Class 2A Thread

Screw Size	L	Part No.
#0-08	⅛	SS-D-15
#0-80	3/16	SS-D-16
#2-56	⅛	SS-D-1-A
#4-40	⅛	SS-D-2-A
#6-32	⅛	SS-D-3-A

SOCKET HEAD KEYS & SETS

Material:
Steel
(Nickel Plated)

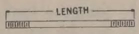


Set of Hex Socket Head Keys Containing 8 Keys from .050 to 5/32 Key Size — in case. Order SS-K-50

Screw Size	Key Size	Part No.
#2	.035	SS-K-40
#4	.050	SS-K-41
#6	1/16	SS-K-42
#8	5/64	SS-K-43
#10	3/32	SS-K-44
¼	⅛	SS-K-45
5/16	5/32	SS-K-46
⅜	3/16	SS-K-47
½	¼	SS-K-48

NEW!

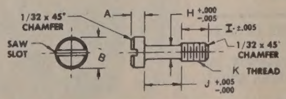
THREADED ROD
— ¼-20 THREAD — 2" EACH END



Lgth.		Lgth.		Lgth.		Lgth.		Lgth.		Lgth.	
4½	TR 1445	7	TR 1470	9½	TR 1495	12	TR 14120	14½	TR 14145	17½	TR 14175
5	TR 1450	7½	TR 1475	10	TR 14100	12½	TR 14125	15	TR 14150	18	TR 14180
5½	TR 1455	8	TR 1480	10½	TR 14105	13	TR 14130	15½	TR 14155	18½	TR 14185
6	TR 1460	8½	TR 1485	11	TR 14110	13½	TR 14135	16	TR 14160	19	TR 14190
6½	TR 1465	9	TR 1490	11½	TR 14115	14	TR 14140	16½	TR 14165	19½	TR 14195
								17	TR 14170	20	TR 14200

MATERIALS B = Brass A = Aluminum SS = Stainless Steel

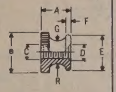
New!



CAPTIVE SCREWS
Material: 303 Stainless Steel

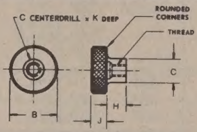
Thickness For Panel	A	B	H	I	J	K Thread	Part No.
1/16	⅛	¼	.072	.187	.281	#4-40	CS4-1
⅛	⅛	¼	.072	.187	.343		CS4-2
1/16	⅛	9/32	.086	.218	.312	#6-32	CS6-1
⅛	⅛	9/32	.086	.218	.375		CS6-2
3/16	⅛	9/32	.086	.218	.437		CS6-3
⅛	5/32	5/16	.114	.250	.406	#8-32	CS8-2
3/16	5/32	5/16	.114	.250	.468		CS8-3
¼	5/32	5/16	.114	.250	.531		CS8-4
3/16	3/16	⅜	.136	.312	.531	#10-32	CS10-3
¼	3/16	⅜	.136	.312	.593		CS10-4

THUMB NUT KNURLED



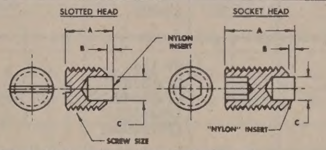
Thread	A	B Dia.	C Dia.	D Dia.	E Dia.	F	G	R Rad.	Part No.
4-36	¼	⅜	⅛	.147	5/16	3/64	7/32	3/64	KN 436
4-40	¼	⅜	⅛	.147	5/16	3/64	7/32	3/64	KN 440
6-32	¼	⅜	9/64	.169	5/16	3/64	7/32	3/64	KN 632
6-32	9/32	13/32	9/64	13/64	11/32	3/64	7/32	1/16	KN 6321
8-32	5/16	7/16	11/64	15/64	⅜	1/16	¼	1/16	KN 832
10-24	21/64	½	13/64	17/64	7/16	1/16	9/32	.070	KN 124
10-32	21/64	½	13/64	17/64	7/16	1/16	9/32	.070	KN 132
12-24	11/32	9/16	7/32	19/64	½	1/16	21/64	.070	KN 224
¼-20	⅜	⅝	17/64	21/64	9/16	1/16	23/64	5/64	KN 420

New!



KNURLED THUMB NUTS
Material: 303 Stainless Steel

Thread	B Dia.	C Dia.	H	I	J	K	Part No.
#4-40	½	⅛	¼	¼	⅛	⅛	NK4070
	½	⅛	½	¼	⅛	⅜	NK4071
	¾	⅛	¼	¼	⅛	⅛	NK4072
	¾	⅛	½	¼	⅛	⅜	NK4073
#6-32	½	#26	¼	¼	⅛	3/32	NK4074
	½	#26	½	¼	⅛	11/32	NK4075
	¾	#26	¼	¼	⅛	3/32	NK4076
	¾	#26	½	¼	⅛	11/32	NK4077
#8-32	½	—	¼	5/16	⅛	—	NK4078
	½	#15	½	5/16	⅛	¼	NK4079
	¾	—	¼	5/16	⅛	—	NK4080
	¾	#15	½	5/16	⅛	¼	NK4081
#10-24	½	—	¼	⅜	3/16	—	NK4082
	½	13/64	½	⅜	3/16	¼	NK4083
	1	—	¼	⅜	3/16	—	NK4084
	1	13/64	½	⅜	3/16	¼	NK4085
#10-32	½	—	¼	⅜	3/16	—	NK4086
	½	13/64	½	⅜	3/16	¼	NK4087
	1	—	¼	⅜	3/16	—	NK4088
	1	13/64	½	⅜	3/16	¼	NK4089
¼-20	¾	—	¼	½	¼	—	NK4090
	¾	17/64	½	½	¼	¼	NK4091
	1	—	¼	½	¼	—	NK4092
	1	17/64	½	½	¼	¼	NK4093
	1	17/64	¾	½	¼	½	NK4094



SET SCREWS
Material: Screw — Stainless Steel; Insert — Nylon Protective Tip

SLOTTED HEAD

Screw Size	A	B	C	Part No.	Screw Size	A	B	C	Part No.
#2-56	5/32	1/32	1/32	SSN-D-1	#10-24	15/64	3/64	3/32	SSN-D-5
#4-40	5/32	1/32	1/16	SSN-D-2	#10-32	15/64	3/64	3/32	SSN-D-6
#6-32	5/32	1/32	1/16	SSN-D-3	¼-20	5/16	1/16	⅛	SSN-D-7
#8-32	15/64	3/64	1/16	SSN-D-4					

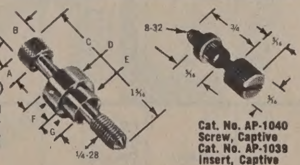
SOCKET HEAD

Screw Size	A	B	C	Part No.
#2-56	5/32	1/32	1/32	SSN-T-8
	9/32	1/32	1/32	SSN-T-24
#4-40	5/32	1/32	1/16	SSN-T-9
	9/32	1/32	1/16	SSN-T-25
	13/32	1/32	1/16	SSN-T-26
#6-32	5/32	1/32	1/16	SSN-T-10
	9/32	1/32	1/16	SSN-T-15
	17/32	1/32	1/16	SSN-T-27
#8-32	15/64	3/64	3/32	SSN-T-11
	27/64	3/64	3/32	SSN-T-16
	43/64	3/64	3/32	SSN-T-28
#10-24	15/64	3/64	3/32	SSN-T-12
	27/64	3/64	3/32	SSN-T-17
#10-32	15/64	3/64	3/32	SSN-T-13
	27/64	3/64	3/32	SSN-T-18
#10-32	43/64	3/64	3/32	SSN-T-29
¼-20	5/16	1/16	⅛	SSN-T-14
	7/16	1/16	⅛	SSN-T-19
	13/16	1/16	⅛	SSN-T-30
	1 1/16	1/16	⅛	SSN-T-31
¼-28	7/16	1/16	⅛	SSN-T-20
5/16-18	19/32	3/32	3/16	SSN-T-21
	27/32	3/32	3/16	SSN-T-32
	1 3/32	3/32	3/16	SSN-T-33
⅜-16	19/32	3/32	3/16	SSN-T-22
	27/32	3/32	3/16	SSN-T-34
	1 3/32	3/32	3/16	SSN-T-35
½-13	¾	⅛	¼	SSN-T-23
	1⅛	⅛	¼	SSN-T-36

CAPTIVE SCREW AND NUT ASSEMBLY

No. CS-711-(1)
No. CS-711-(2) (screw only)

Consists of slotted, knurled thumb screws made of corrosion resistant steel bar, and nickel-plated (on brass) panel inserts.

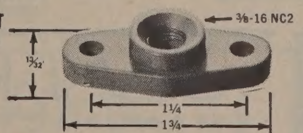


Cat. No. AP-1040
Screw, Captive
Cat. No. AP-1039
Insert, Captive

	A	B	C	D	E	F	G	J Thd.
—1	¼	⅜	1 5/16	9/16	13/32	5/16	⅜	¼-28
—2	¼	29/64	1 7/16	9/16	13/32	5/16	⅜	8-32

Cat. No. AP-1197
Screw, Captive
1/16" slotted knurled head (7/16" O.D.)
1¼" overall length; 8-32 thread.

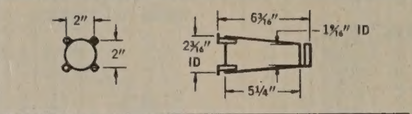
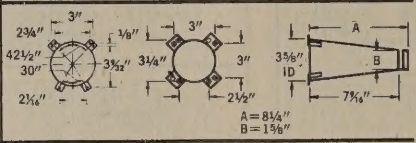
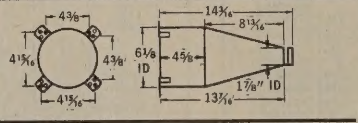
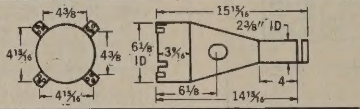
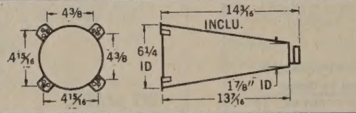
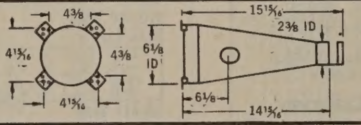
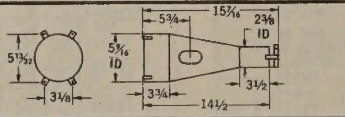
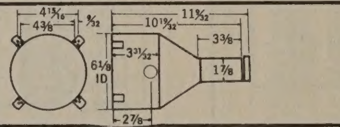
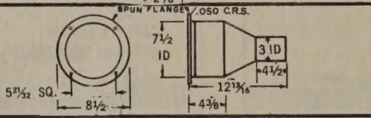
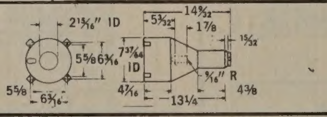
RETAINER NUT
Cat. No. R-1030



Used in conjunction with captive screw and nut assemblies. Die casting. Can be painted. Other thread sizes available upon special order.

SHIELDS

JAN's Magnetic Shields are made of MU-Metal or equal and are hydrogen annealed by a special process to assure optimum orientation of the molecular structure of the alloy for best magnetic shielding. JAN's Magnetic Shields prevent distortion and intensify modulation of the electron beam due to stray magnetic fields. In addition, the use of these shields protect personnel against the dangers of accidental tube breakage. Mounting holes are tapped for No. 6-32 screws as shown. These shields are designed to fit JAN's standard bezels as listed below. See following page for specifications on JAN's Bezel Assemblies.

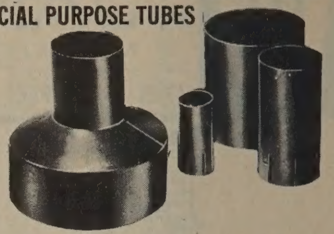
Shield Cat. No.	For Use With C.R.T. No.	Matching JAN Bezel	
S-2001 **S-2001-1**	902 2AP 2BP	CP-1110P2 CP-1120P2	 2″ 2″ 6³⁄₁₆″ 1⁵⁄₁₆″ ID 2³⁄₁₆″ ID 5¼″
S-3001 adaptable for edge-lighting graticule using S-3010 with Bezel CP-1428*	3RP 3RPA	CP-1328-P1 CP-1427-1 CP-1429-1 CP-1328-P2 CP-1427-2 CP-1429-2 CP-3430-1 CP-3430-2	 3″ 2¾″ ⅛″ 42½″ 30″ 3³⁄₃₂″ 3¼″ 2¹⁄₁₆″ 3″ 3″ 2½″ 3⅝″ ID A B 7³⁄₁₆″ A=8¼″ B=1⅝″
S-3003 **S-3003-1**	3KP 908A 3AP	CP-1328-P1 CP-1427-1 CP-1429-1	Same type as S-3001, except A=10⅛ B=2
S-3004 — 12 (less anode hole) — 22 (with anode hole) adaptable for edge-lighting graticule using S-3012 with Bezel CP-1428*	3BP 3JP 3ACP	Same as S-3003 Same as S-3005	Same type as S-3001, except A=8⅝ B=2⅜
S-3005 adaptable for edge-lighting graticule using S-3008 with Bezel CP-1428*	3WP	CP-1328-P2 CP-1427-2 CP-1429-2	Same type as S-3001, except A=10⅝ B=1⅞
S-5001	5UP	CP-1465 CP-13584-1 CP-13549-1 CP-13595-1 CP-19495-1 CP-446-11 CP-446-22	 4⅜ 4¹⁵⁄₁₆ 4⅜ 4¹⁵⁄₁₆ 14³⁄₁₆ 8¹³⁄₁₆ 6⅛ ID 4⅝ 1⅞″ ID 13⁷⁄₁₆
S-5002 adaptable for Edge-lighting	5BP 5CP 5ABP 5ADP	Same as S-5001 Same as S-5006	 4⅜ 4¹⁵⁄₁₆ 4⅜ 4¹⁵⁄₁₆ 15¹⁵⁄₁₆ 2⅜″ ID 6⅛ ID 3⁹⁄₁₆ 4 6⅛ 14¹⁵⁄₁₆
S-5003	5UP	CP-1465 CP-13584-1 CP-13549-1 CP-13595-1 CP-19495-1	 4⅜ 4¹⁵⁄₁₆ 4⅜ 4¹⁵⁄₁₆ 14³⁄₁₆ INCLU. 6¼ ID 1⅞″ ID 13⁷⁄₁₆
S-5005 adaptable for edge-lighting	5AQP 5ABP 5ADP	CP-1465-2 CP-13549-2 CP-13584-2 CP-13595-2 CP-19495-2 CP-446-11 CP-446-22	 4⅜ 4¹⁵⁄₁₆ 4⅜ 4¹⁵⁄₁₆ 15¹⁵⁄₁₆ 2⅜ ID 6⅛ ID 6⅛ 14¹⁵⁄₁₆
S-5017 adaptable for edge-lighting	5ABP 5ADP	CP-1465-2 CP-19636-2	 5¹³⁄₃₂ 3⅛ 5¾ 15⁷⁄₁₆ 2⅜ ID 5⁵⁄₁₆ ID 3½ 3¾ 14½
S-5027	5BTP	CP-19495-2	 4¹³⁄₁₆ 4⅜ ⁹⁄₃₂ 11⁵⁄₃₂ 10¹³⁄₃₂ 3⅜ 6⅛ ID 3³¹⁄₃₂ 1⅞ 2⅞
S-7001	7GP 7JP 7VP	CP-7330 CP-7445 CP-7331 CP-7550 CP-7420	 SPUN FLANGE .050 CRS. 7½ ID 3 ID 4½ 12¹³⁄₁₆ 5³¹⁄₃₂ SQ. 8½ 4⅜
S-7006	7AEP	CP-7330 CP-7445 CP-7331 CP-7550 CP-7420	 2¹³⁄₁₆″ ID 5³⁄₃₂ 14³⁄₃₂ 1⅞ 1⁵⁄₃₂ 5⅝ 6³⁄₁₆ 7³⁷⁄₆₄ ID ⁵⁄₁₆″ R 4⅜ 5⅝ 6³⁄₁₆ 4⁷⁄₁₆ 13¼

All Shields are Fabricated with Overlapped and Spot Welded Construction.

*See mounting hole arrangement illustrated with S-3001 edge-lit dimension drawing.

When ordering, be sure to specify CRT type number. Anode openings provided, where required. Shielding for EMC, RFI, and EMI now available, as bezels, shields, cushions, gaskets . . . in strip, sheet, formed, and molded.

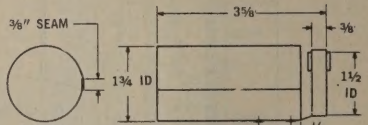
MAGNETIC SHIELDS FOR PHOTO-MULTIPLIER AND SPECIAL PURPOSE TUBES



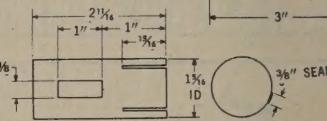
Shield	Tube
S-1091	ICP1
S-1181	929 930 5581 5653 IP39 IP40
S-1500	6291
S-1561	4440 6199 7102
S-1562	931 4471 4472 4473 6323 6328 7117

Shield	Tube
S-1562	IP21 IP22 IP28
S-1563	1EP1
S-2002	2002 6810 7264 7265 7326
S-2003	6903
S-2004	2020 4463 5819 6292 6342 6571 6655 7746 8053

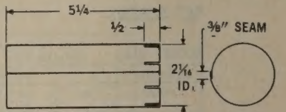
Shield	Tube
S-2005	6372
S-2007	7850
S-2008	4459 6217
S-3015	1197 6363
S-5013	1112
S-5018	1198 6364
S-7009	1238 1287


⅜″ SEAM
3⅝
⅜
1¾ ID
1½ ID
¾
¼
3″

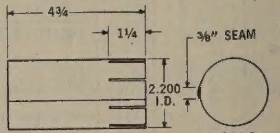
S-1561


2¹¹⁄₁₆
1″
1″
¹³⁄₁₆
⅜
1⁵⁄₁₆ ID
⅜″ SEAM

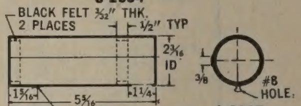
S-1562


5¼
½
⅜″ SEAM
2¹⁄₁₆ ID

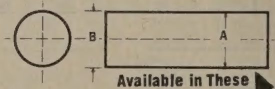
S-2002


4¾
1¼
⅜″ SEAM
2.200 I.D.

S-2004


BLACK FELT ³⁄₃₂″ THK. 2 PLACES
½″ TYP
2³⁄₁₆ ID
⅜
#8 HOLE
1⁵⁄₁₆
5⁵⁄₁₆
1¼
RIVET

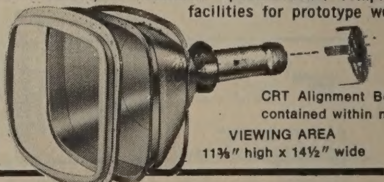
S-2007



Seamless Tubing Available in These Dimensions ▶
Can be supplied cut to your length, with holes and/or cutouts to your specifications.

A	B
1.010	1.050
.948	.998
.740	.783
.632	.663

We will design and manufacture SPECIAL Shields and Bezels, to customers specifications. Complete facilities for prototype work.



CRT Alignment Board contained within neck.
VIEWING AREA
11⅜″ high x 14½″ wide

JAN HARDWARE
MANUFACTURING COMPANY INC.
47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

QUALITY
RELIABILITY
ECONOMY

BEZELS

JAN's Bezels enhance the appearance of the instruments on which they are used. These units are functionally designed to provide OPTIMUM UTILIZATION OF THE C.R.T. SCREEN, as well as safety against tube breakage and danger to operating personnel.

JAN Bezel Assemblies are supplied with **a bezel, calibrated graticule,** (where applicable) **light filter** and **C.R.T. cushion.** Bezels are finished in a smooth dull black non-reflecting surface. These units fit JAN Mu-Metal Shields.

Edge-lit Bezels (E.L.B.A.)**

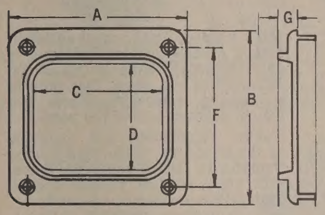
These Bezels are designed to provide edge lighting of the engraved scale-calibrated graticule by means of pilot lights.

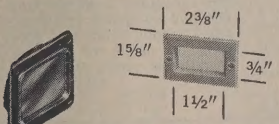
Camera Mount Bezel

These units provide an integral cast mounting flange that fits all standard 3″, 5″ and 7″ C.R.T. cameras.

				Dimensions in Inches										
				Panel Opening	A Overall Width	B Overall Ht.	C Visible Area (Bezel) Width	D Visible Area (Bezel) Ht.	E Mtg. Holes Width	F Mtg. Holes Ht.	G- Thickness (Face Only)	H- Thickness (Incl. Flange)	Visible Area (Cushion) Ht.	Visible Area (Cushion) Width
Cat. No.	C.R.T. Face	Material	Type											
BEZELS FOR 2″ C.R.T.														
CP-1110-P-2	Flat	Plastic*	Standard	2 3/16	2⅝	2⅝	1¾	1¾	2	2	5/16	7/16	1¾	1¾
BEZELS FOR 3″ C.R.T.														
CP-1220-P‡	Curved or Flat	Plastic*	Camera Mount	—	4⅞	3¼	2¾	2¼	4	2½	5/16	1 1/16	—	
CP-1328-P-1 CP-1328-P-2	Curved Flat	Plastic*	Standard	3 33/64	3¾	3¾	2⅝	2 3/16	3	3	⅜	45/64	2½	2 1/16
CP-1427-1 CP-1427-2	Curved Flat	Aluminum	Camera Mount	3 17/64	4	4	2¾ Dia.		3	3	9/16	27/32	2 25/32 Dia.	
CP-1428-1** CP-1428-2**	Curved Flat	Aluminum	Camera Mount E.L.B.A.**	3 17/64	4	4	2¾ Dia.		3	3	9/16	27/32	2 25/32 Dia.	
CP-1429-1 CP-1429-2	Curved Flat	Aluminum	Camera Mount	3 17/64	4	4	2¾ Dia.		3	3	9/16	27/32	2 25/32 Dia.	
CP-3430-1 CP-3430-2	Curved Flat	Steel	Standard	—	4 1/16 Dia.		3⅜ Dia.		3¾	3¾	1 41/64	1 41/64	2 25/32 Dia.	
BEZELS FOR 4″ C.R.T.														
CP-1533-P‡	—	Plastic*	Camera Mount	3 1/32	4 39/64	3 61/64	3	3	4	—	1 3/32	1 3/32	No Cushion	
BEZELS FOR 5″ C.R.T.														
CP-13549-1 CP-13549-2	Curved Flat	Aluminum	Standard	6.0	6¼	6¼	4⅞	3¾	4 15/16	4 15/16	17/32	1 3/32	4¼	3 3/16
CP-13584-1 CP-13584-2	Curved Flat	Aluminum	Camera Mount	6.0	6¼	6¼	4⅞	3¾	4 15/16	4 15/16	1 5/32	1 23/32	4¼	3 3/16
CP-13595-1** CP-13595-2**	Curved Flat	Aluminum	Standard E.L.B.A.**	5 7/16	6¼	6¼	4⅞	3¾	4 15/16	4 15/16	17/32	—	4¾ Dia.	
CP-1465 CP-1465-2	Curved or Flat Flat	Steel	Camera Mount	5 9/16 5 17/32	6⅜ Dia.		5 35/64 Dia.		6	6	⅞	⅞	No Cushion 4½ Dia.	
CP-19495-1** CP-19495-2**	Curved Flat	Aluminum	Camera Mount E.L.B.A.**	5 7/16	6¼	6¼	5¼ Dia.		4 15/16	4 15/16	1 5/32	—	4¾ Dia.	
CP-19636-2**	Flat	Aluminum	Camera Mount E.L.B.A.**	5⅝	5⅞	5⅞	4½ Dia.	3	4⅞	4⅞	1¼	—	4½ Dia.	
CP-446-11 CP-446-22	Flat	Steel	Camera Mount	—	6 9/16 Dia.		5 9/16 Dia.		6 5/32 6⅛	6 5/32 6⅛	1	1 19/64 1 3/16	4½ Dia.	
CP-545	Curved or Flat	Aluminum	Camera Mount	5	5 27/32	5 27/32	4 25/32 Dia.		5	5	25/32	—	—	
BEZELS FOR 7″ C.R.T.														
CP-7330-1 CP-7331-2**	Curved Flat	Aluminum	Standard E.L.B.A.**	7 13/32	7 13/16	7 13/16	6 5/16 Dia.		6 3/16	6 3/16	¾	¾	6⅜ Dia.	
CP-7375-1** CP-7375-2**	Curved Flat	Aluminum	E.L.B.A.**	7 13/32	8	8	4½	4½	6 3/16	6 3/16	1 17/32	2 29/32	1½	4½
CP-7420-1** CP-7420-2**	Curved or Flat	Aluminum	Camera Mount	7 13/32	7 13/16	7 13/16	6 15/16 Dia.		6 3/16	6 3/16	¾	1⅜	6⅜ Dia.	
CP-7550	Curved or Flat	Aluminum	Camera Mount	4 25/32	7⅜	6¼	4¾	4¾	6¼	5⅛	1 3/16	1 3/16	No Cushion	
BEZEL FOR 10″ C.R.T.														
CP-10860	Curved or Flat	Aluminum	Standard	11 1/32	12¼ Dia.		8 1/16	6¼	11½ B.O.		11/16	13/16	No Cushion	

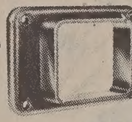
*All Plastic Bezels are furnished in shock resistant plastic, per MIL-P-3414. **Edge Lit Bezel Assemblies. ‡Rectangular C.R.T.





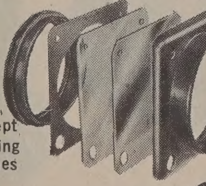
CP-1393

CP-1110P2
(with 4 mounting holes)
CP-1120P2
(same as above, but with 2 mounting holes, in diagonal corners)



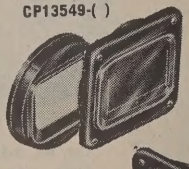
CP-1220-P

CP-1328-P-( )

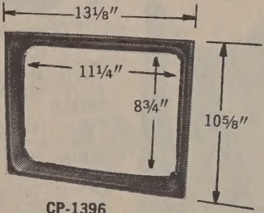


CP-1428-( )

CP-1427 } Same as 1428, except
CP-1429 } for mounting holes

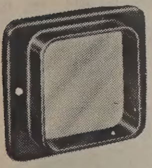


CP13549-( )

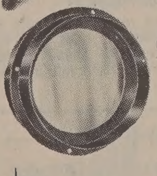


CP-1396

CP-19495-(

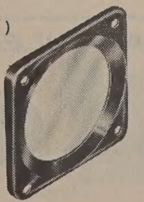


CP-1533-P

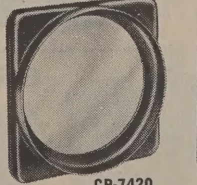


CP-1465

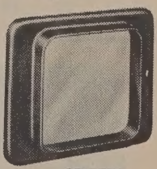
CP-13584-( )



CP-7330

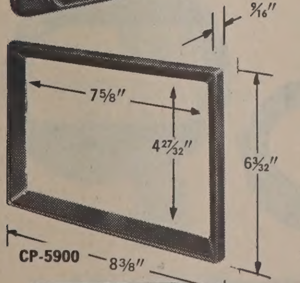


CP-7420

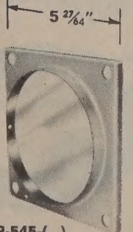


CP-7550

CP-13595-( )



CP-5900



CP-545-( )

DISTINCTIVE FEATURES

- Engineered for 2″, 3″, 4″, 5″, 7″, 8″, 10″ C.R.T.
- Maximum display area
- Precision engraved, scale-calibrated graticules; standard or to customer's specifications
- Materials and finish to "Mil Spec"
- Heavy buna-S shock cushion
- Models for edge-lighting
- Phosphor-matched light filters
- Non-reflecting matte surfaces
- Rugged camera mounts
- Models for curved and flat-faced C.R.T.

JAN

JAN HARDWARE

QUALITY
RELIABILITY
ECONOMY

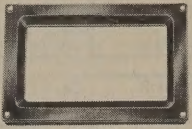
47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

ESCUTCHEON PLATES

FOR ELEGANT FRAMING OF PANEL OPENINGS

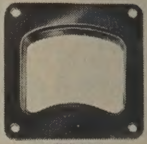
ET-120

ET-150


ET-160

EM-310

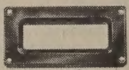
EM-320

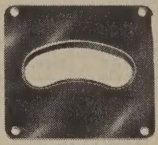

EM-325

ET-125

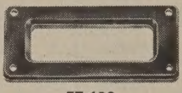
ET-165

ET-140

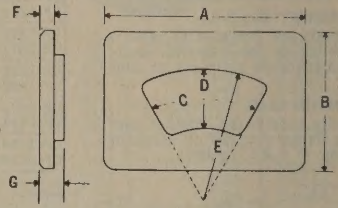

ET-155


EM-315

ET-135


ET-130

ET-145



SPECIFICATIONS — JAN ESCUTCHEONS

Escutcheon Cat. No.	A Overall Width	B Overall Height	C Window Width	D Window Height	E Effective Outer Dial Radius	Thickness F=Face Only	Thickness G=Incl. Flange	Panel Opening Width	Panel Opening Height	Mounting Holes Width	Mounting Holes Height	Type of Dial	Material
ET-128*	2 27/32	1 7/8	1 3/4	1	1 27/32	3/16	3/16	2 11/32	1 3/8	2 9/16 top 2 1/16 bottom	1 9/16	Circular	Injection Molded Tenite II, Black Matte Finish
ET-125*	3 7/8	2 15/16	2 7/8	1	3 1/4	3/16	5/16	3 1/2	1 1/2	3 1/2	1 15/16		
ET-135*	2 3/4	1 7/8	1 1/2	7/8	1 7/8	3/16	1/4	1 31/32	1 7/32	2 1/4	1 3/8		
ET-150*	3 7/8	2 5/16	2 7/8	3/4	3 1/8	3/16	5/16	3 9/32	1 7/32	3 1/2	1 15/16		
ET-165*	2 5/8	1 5/8	1 49/64	9/16	2 3/32	1/8	1/4	2 7/16	1 1/2	2 1/16	1 1/16		
ET-130*	4	1 13/16	2 3/4	13/16	—	3/16	1/4	2 13/32	1 11/32	3 1/2	1 5/16	Flexible Tape, Digital Counter, Cylinder or Drum	Injection Molded Tenite II, Black Matte Finish
ET-140*	2 1/2	1 1/2	1 1/4	5/8	—	1/8	5/16	1 17/32	1 1/32	2	1		
ET-145*	3 1/4	2 1/16	1 15/16	3/4	—	5/32	5/32	2 13/32	1 5/32	2 3/4	1 9/16		
ET-155*	2 1/2	1 3/16	1 11/16	1/2	—	5/32		2 1/32	2 9/32	2 1/4	15/16		
ET-160*	3 7/8	2 1/2	2 15/16	1 5/8	—	1/8	1/8	3	2 1/32	3 5/8	2 1/4		
EM-310	3	3	2 1/16	1 15/16	2 9/16	1/32	1/4	3 11/32	2 1/2	2 1/2	2 1/2	Helical	Soft Aluminum with Black Matte Enamel Finish
EM-315	3 1/4	3	2 1/4	5/8	2 1/16	1/32	1/8	2 15/32	1 5/64	2 3/4	2 5/8	Circular	
EM-320	3 1/4	2 3/4	2 1/4	5/8	2 1/16	1/32	1/8	2 29/64	1 3/64	2 3/4	2 1/4	Circular	
EM-325	3	3	2 1/16	1 1/2	2 5/16	1/32	1/4	2 11/32	1 61/64	2 1/2	2 1/2	Helical	

*To Order Specify: (1) frame only; (2) frame with clear window; (3) frame with clear window scribed with a center line.

JAN's molded, black, shock-resistant plastic escutcheons are available in an exceptionally wide variety of different types and sizes. They provide a pleasing window to frame dial plates mounted behind the panel.

Plastic escutcheons are available in the following ways: frame only; frame with clear windows; frame with clear window scribed with a center line.

For especially large working areas, stamped aluminum escutcheons, finished in dull black are available to meet the needs for space economy. Withstands temp. shock −65°C to +80°C. NON INFLAMMABLE.

VIEWING HOODS

Cat. No. H-465
AND/OR ADAPTER

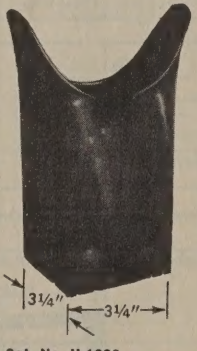
Can be used as viewing hood, on 2¾″ dia. bezels. (#1427; 1428; 1429). Also serves as adapter to permit use of face-fitting neoprene rubber viewing hoods (see above). All aluminum. Has dull black enamel finish.

Cat. No. H-689-1
(5⅝″ I.D.)

Black neoprene rubber, contour-molded, fits the shape of face. Keeps out ambient light when viewing scope.

Used with following Jan Bezels: 19636; 19495; 13584; 1465.

No. H-689-2 (4⅞″ I.D.)
Used with JAN Bezel #545

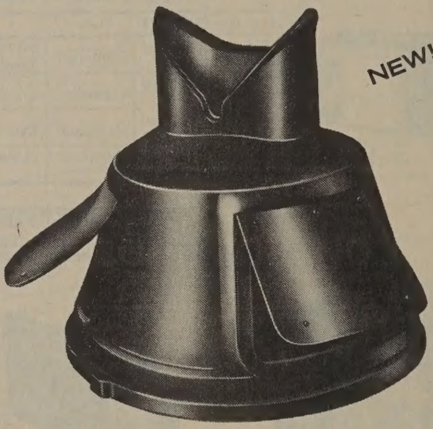


Cat. No. H-1008
TO FIT RECTANGULAR BEZELS

Black, contour molded neoprene rubber. Keeps ambient light out, when viewing scope. Fits shape of face. Can be adapted for smaller I.D.'s.

Can be used with JAN Bezel CP-1328P. Can be adapted for #1533-P

NEW!



Cat. No. H-1063

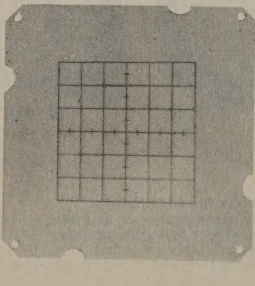
Black, contour molded neoprene rubber. Keeps ambient light out, when viewing scope. Fits shape of face. Flanges provided for hand access to PPI settings.

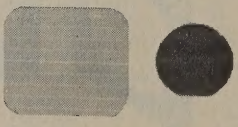
Cat. No. H-1361

Black neoprene rubber, contour-molded, fits the shape of face. Keeps out ambient light when viewing scope.

GRATICULES — FILTERS — CUSHIONS —

Assorted Sizes and Shapes

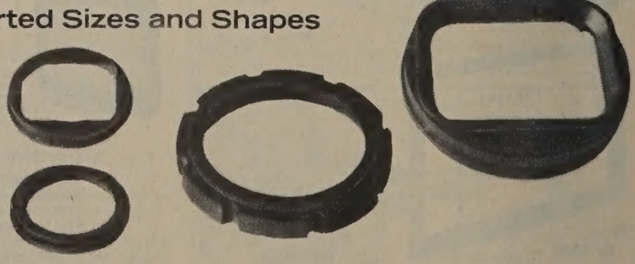




New! Non-reflective filter material.

Matte 1 side. Grey or Blue.

Other colors on special order.



JAN
JAN HARDWARE
MANUFACTURING COMPANY INC.
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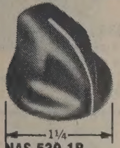
QUALITY
RELIABILITY
ECONOMY

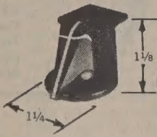
KNOBS

TRANSILLUMINATED POINTER KNOBS

K1430
For 1/8″ or 1/4″ shaft.
One set screw.
5/8″ high x 3/4″ dia.
Plastic w/metal insert.
Can be backlited.



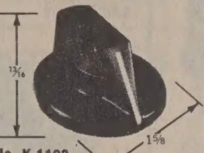
NAS 539-1B
NAS 539-1C
Similar knob also available with 1½″ dia.
Order No. 00278



USAF 61D 404 74
Cat. No. K-977

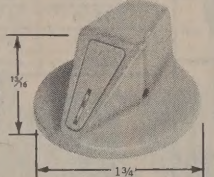
MS25165-1

MS91528

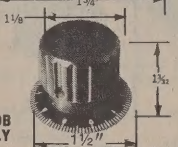


Cat. No. K-1103

Precision molded of JAN's transparent plastic material, to NAS specs, with dull finish. Transilluminated pointers permit easy reading under subdued lighting conditions. For use on instrument panels, switchboards electrical and electronic apparatus.



Cat. No. LM
USED ON LUNAR MODULES!
Precision aluminum casting. Adaptable for back lighting. With slip clutch features similar to K1375.

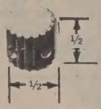


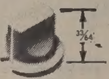
Cat. No. K-936-5
Black phenolic molded knob, with beveled aluminum skirt, black with white contrasting markings. Accurately centered brass insert, for 5/16″ shafts.
Cat. No. K-936-4
(1/4″ shaft)
Variations on shaft sizes and markings available in production quantities.

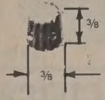
KNOB ONLY
Cat. No. K-929-5 (5/16″ shaft)
Same as above, less skirt.
Cat. No. K-929-4 (1/4″ shaft)

MINIATURE KNOBS

PLASTIC





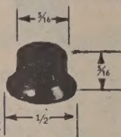


K-101295(   )
-1 w/white dot
-2 plain
For 1/8″ flatted shaft.
Can also be supplied with 1/8″ round shafts.

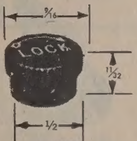
K-101294(   )
-1 11/16″ skirt dia.
-2 3/4″ skirt dia.

K-101297

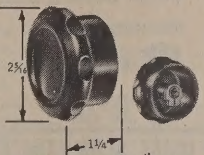
METAL



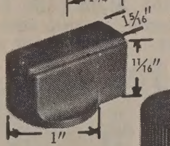
BK-1080
1/8″ flatted shaft



AK-1326
For 1/4″ shaft



TUNING KNOB
Cat. No. K-243
For 5/16″ shaft. Die cast aluminum. Made to Fed. Spec. QQ-A-591 and MIL-F-14072. Use no-mar clamp Cat. No. 937-8 for mounting (not supplied).

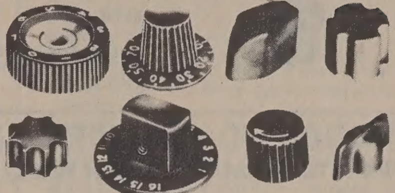


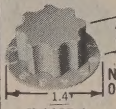
BAR KNOB For 1/4″ shaft
Cat. No. K-783
Phenolic molded knob, with metal insert. Set screw at back, for shaft attachment. Finished to specifications.
Two #3-48 tapped holes on bottom.

K1329
Knurled edge for easy turning. Twin set screws. 23/32″ high x 5/8″ dia. Available with & w/o marking.

K1428
For 1/8″ or 1/4″ shaft.
Twin set screws. 5/8″ high x 3/4″ dia. Plastic with brass insert. With or without backliting.
Can be supplied with backlited indicator line.

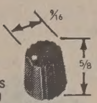
STANDARD PLASTIC KNOBS



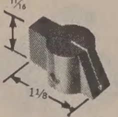


Numbers
0 thru 9

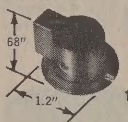
K-1105-1



1575289PC-2

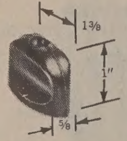


47B47299

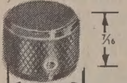


1007267-501

Knobs to satisfy almost any design or demand. Can be produced in any color or finish, either illuminated or non-illuminated. Knobs shown are only part of our stock. Let us quote on your specifications.
Knobs back lighted on special request, only. Special marking by engraving or screening, available to your specifications.



POINTER KNOB
Cat. No. K-706
Molded thermosetting phenolic. Type CFG per MIL-P-14. Designed for square shaft, providing positive action.



KNOB
Cat. No. K-897
Machined knurled edge for easy turning. Has set screw for firm attachment to 1/4″ shafts. Height 7/16″ x 9/16″ dia.

NEW!

MOLDED PLASTIC KNOBS WITH METAL INSERTS

K1280 For 13/64″ shaft. Molded plastic with metal insert 5/16″ high x 7/8″ long x 11/16″ wide.

K1334 For 1/8″ shaft. Molded plastic with metal insert. Twin set screws. 5/8″ high x 3/4″ dia. Notch: 3/32″ wide x 3/32″ deep.

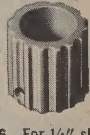
K1345 For 3/16″ shaft. Twin set screws. 3/4″ high x 7/16″ diameter.

K1349 For 5/32″ shaft with .130 across flat. Twin set screws. 11/16″ high x 3/4″ diameter.

K1354 For 5/16″ shaft with .281 across flat. Twin set screws. 45/64″ high x 3/4″ diameter.

K1331 For 3/16″ shaft. Molded plastic with metal insert. Twin set screws. 3/4″ high x 1 1/64″ dia.

K1335 For 3/32″ D flatted shaft. Molded plastic. 11/32″ high x 21/32″ dia.



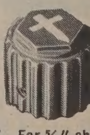
K1346 For 1/4″ shaft with .222 across flat. Twin set screws. 11/16″ high x 11/16″ diameter.

K1350 For 1/8″ shaft with .107 across D flat. Twin set screws. 7/8″ high x 7/8″ diameter.

K1355 For 5/16″ shafts. Twin set screws. 5/8″ high. Base size 17/32 x 13/32″.

K1332 For 3/16″ shaft. Molded plastic with metal insert. Twin set screws. 21/32″ high x 1⅛″ dia. Notch: 1/8″ wide x 3/16″ deep.

K1343 For 3/32″ shaft with .250 across D flat. Twin set screws. 21/32″ high x 7/8″ diameter.

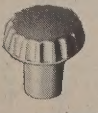


K1347 For 5/32″ shaft with .130 across flat. Twin set screws. 1/2″ high x 3/4″ diameter.

K1351 For 1/8″ round with .096 across flat. Twin set screws. 9/16″ high x 5/8″ diameter.

K1368 For 1/4″ D flatted shaft. Twin set screws. 11/16″ high x 11/16″ diameter.

K1333 For 3/16″ shaft. Molded plastic with metal insert. Twin set screws. 5/8″ high x 3/4″ dia.



K1344 For 5/32″ shaft with .130 across flat. Twin set screws. 7/8″ high x 7/8″ diameter.

K1348 For 5/32″ round or 5/32″ D flatted shaft. Twin set screws. 1/2″ high x 3/4″ diameter.

K1352 For 1/8″ shaft with .112 across flat. Twin set screws. 11/16″ high x 1/2″ diameter.

K1353 For 5/16 — 32 threaded shaft. 59/64″ high x 1/2″ diameter.

K1398/WD For 3/8″ shaft. Twin set screws. 1 1/16″ high x 2⅜″ diameter. Molded plastic with metal inserts.

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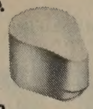
K1336
Aluminum locking knob.
15⁄32″ high, 1⁄2″ knurled O.D.
For 8-32 threaded shaft.

K1330 For 1⁄8″ shaft. Aluminum. Can be used for printed circuit boards. Gives both finger and screwdriver adjustment. 1⁄2″ high x 5⁄8″ diameter. One set screw.

K1328
For 1⁄4″ shaft.
Precision cast aluminum.
11⁄16″ high X 11⁄16″ dia.
Twin set screws.

NEW!



K1429
For 1⁄4″ shaft. One set screw and pinning hole.
15⁄32″ high x 27⁄32″ long.
Magnesium Casting.

K1434
For 1⁄4″ shaft. One set screw. 9⁄16″ high x 3⁄4″ dia. Aluminum.

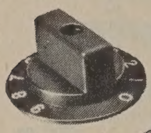
NEW!

NEW!

K1436
For 1⁄4″ shaft.
Twin set screws.
3⁄4″ high x 13⁄16″ dia.
Aluminum.

KNOBS TO MILITARY SPECIFICATIONS

One of the largest assortment of Military Knobs in the country



SMD500502

SMD500501

K1124 For 1⁄8″ shaft. 9⁄16″ high x 11⁄16″ diameter. One set screw. Aluminum die-cast.

No. K-1005
Available with or without skirt.

No. K-1020
11⁄16″ high x 9⁄16″ bas dia.

No. K-1021
11⁄16″ high x 1″ base dia.

For 1⁄4″ shaft.
Other shaft diameters on request.

MACHINED KNOBS

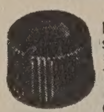
K-1006-(2)
-(3)
3⁄4″ high x 3⁄8″ dia.

K-1007-(2)
-(4)
3⁄4″ high x 3⁄4″ O.D.

SCB-41848
5⁄8″ High x 113⁄16″ Dia.

K1047 For 1⁄8″ shaft with .095 across flats. (Double D). 7⁄8″ high x 11⁄8″ diameter. Aluminum.

K1126 For 1⁄4″ Double D shaft. 15⁄32″ high x 23⁄32″ diameter. Mounts from top of knob. Aluminum die-cast.



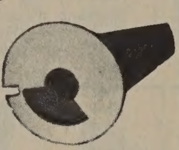
K1127 For 1⁄8″ shaft. 15⁄32″ high x 23⁄32″ diameter. Two set screws. Aluminum die-cast.

CAST ALUMINUM KNOBS

Available in black. Other colors on request. Specify shaft hole size required.

No. K-1022
Full Round Skirt
1⁄4″ hole x 11⁄32″ high x 15⁄16″ base dia.

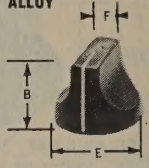
No. K-1023
Flat Back Round Skirt 1⁄4″ hole x 11⁄32″ high x 15⁄16″ base dia.
(29⁄32″ to flat back)



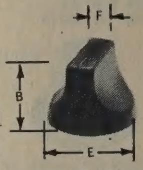
No. K-1024
With Cam Shape Cut-out 1⁄4″ hole x 11⁄32″ high x 15⁄16″ base dia.

SIGNAL CORPS DIE CAST KNOBS

ZINC ALLOY



No. K-242-1 & K-242-2



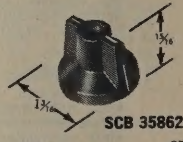
No. K-242-3

For 1⁄4″ shaft

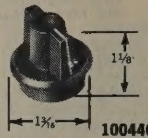
Cat. No.	B	E	F	Marking
K-242-1	3⁄4″	15⁄16″	5⁄16″	White
K-242-2	7⁄8″	11⁄8″	3⁄8″	White
K-242-3	3⁄4″	15⁄16″	5⁄16″	None

ALUMINUM

No. K-984
Dimensions as per 242-3
No markings.
Aluminum.
.257 tear drop shaft hole.
For 1⁄4″ shaft



SCB 35862-1 or 2



100446

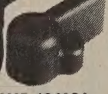
NEW!

K1432
For 5⁄16″ shaft. 11⁄4″ high x 17⁄8″ overall across wing.
Aluminum casting.
Must be pinned to shaft.

MS SIGNAL CORPS DIE-CAST ALUMINUM AND ZINC ALLOY CONTROL KNOBS

Manufactured in Accordance with Applicable Military Specifications

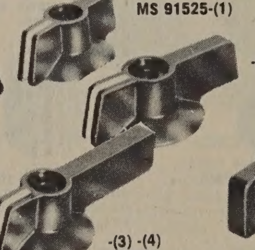
SMB 134094



SMB 134884

SMB 134171

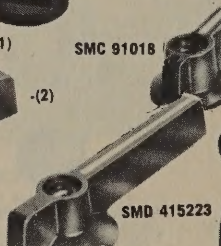
SMC 414401



MS 91525-(1)

-(2)

-(3) -(4) Longer

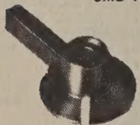


SMC 91018

SMD 415223

SMC 414393

SMC 414399

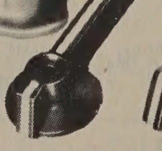


SMC 503203

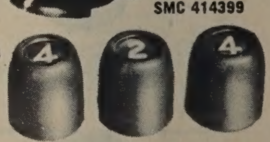
K 680-(3)

MS 91524-(1)

SMB 144319



(Many sizes available. Lengths from 13⁄16″ to 29⁄16″)



SMC 414680-1 thru 10

PARTIAL LIST OF GOVERNMENT KNOBS MANUFACTURED BY JAN

SMC 100446
SCB 104717
SMC 108874
SMC 108875
SMC 108876
SMC 108951
SMC 108952
SMB 120139
SMD 131010
SMB 134093
SMB 134094
SMB 134171
SMB 134884
SMB 134957
SMB 143975
SMB 144318
SMB 144319
SMB 144358
SMB 144517
SMB 149064
SMB 16505
SCB 16532
SMB 16552
SMB 180200A2
SMB 180288A2
SMB 180465A1
SMB 182273
SMB 249242-3
MS 25165
SCD 2593-5
SMB 283419
SMB 314747
SMB 320816
SMC 328271
SMB 336784
SMC 344847
SMC 345389
SCB 35862
SCB 35863
SMB 393998
SCB 40771
SCB 40859
SCB 40860
SMB 414393
SMC 414399
SMC 414401
SMC 414680-1 thru -10
SMD 415160
SMC 415161
SMD 415223
BUORD 416956PT2
SCB 41848
SMB 422875
SMB 424034
SMC 447052
SMC 447226
SMC 447307
SMB 456374
SMC 500407
SMC 500501
SMC 502491
NAS 539 1B
NAS 539 1C
SMB 540595-2
SMB 541048
SMC 541119
SMB 541127
SMB 541150
SMB 552131-1
SMB 552258
SMC 558544-1
SMB 601249
SMC 60125
SMB 601422
SMC 60158
SCB 60744
USAF 61D40474
SCC 614661
SCB 63251
SMB 633276
SCC 65018
SCC 65018-1
SCB 65411
SCC 65673
SCB 65884
SCB 72585
SCB 72687
NAVORD 814528
SCB 82716
SMB 902574-1
SMC 91018
MS 91522
MS 91523
MS 91525-1 thru -4
MC 91528
SMC 97250

JAN

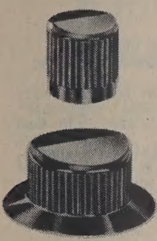
JAN HARDWARE

MANUFACTURING COMPANY INC.

47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

QUALITY
RELIABILITY
ECONOMY

SAFETY KNOBS



"PRESS-TO-TURN" KNOBS

FOR LOW TORQUE APPLICATIONS

Knobs spin freely . . . and **Must Be Pressed-In** while making changes. Developed specifically to prevent inadvertent changing of settings. For basic dimensions, see our "Deluxe Instrument Knobs" (9, 12, 17 and 22 body dia. series). When ordering, be sure to substitute prefix "T" for 9 Series and "Q" for 17 Series, as per typical part numbers.

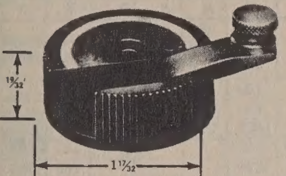
TIC4GA = .90 Dia./Press-to-Turn/Round/Dial/¼″/Glossy/Black

PRESS TO TURN

NEW!

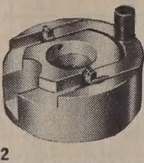
K1435
For ¼″ shaft.
One set screw.
⅞″ high x 1$\frac{1}{32}$″ dia.
Plastic with metal insert. Backlited line and arrow.

Cat. No. MS-91522-1 CRANK KNOB Retractable Spinner



Aluminum Olive Drab. For ¼″ shaft. Other colors and shaft diameters on request. 2⅝″ minimum clearance required with handle in open position.

NEW!



Cat. No. K1622
Retractable Spinner CRANK KNOB

Modified version to replace MS91522. Incorporates brake mechanism to lock control in position.

SLIP-CLUTCH KNOB with Spinners

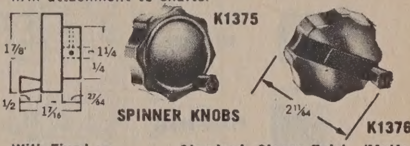
Cat. Nos. K-1375 & K-1376 (For ¼″ Shafts)

For driving devices such as variable capacitors, inductors, potentiometers, etc., the "slip-clutch"* automatically disengages and slips when the pre-determined torque has been exceeded. Knobs are fluted, and are equipped with either fixed or retractable spinner for fast turning. Backlash-free units safeguard delicate and costly instruments against careless or inadvertent cranking beyond their normal stops.

*Normally set for 3-6″ lbs. Can be modified for other requirements.

Model No. K-1376 is identical with No. K-1375 but has the additional feature of a retractable spinner. Spring loading provides positive, toggle-type action to lock spinner in either open or closed position. Model No. K-1376 is designed for use where economy of space is essential.

Cat. Nos. K-1275 & 1276 (For ¼″ shafts)
In appearance, these knobs are identical with No. K-1375 and No. K-1376 but without JAN's Slip-Clutch mechanism. Made with single-unit, molded Bakelite-to-metal-insert construction, with two set screws for firm attachment to shafts.

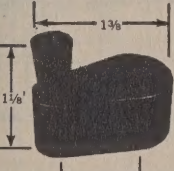


SPINNER KNOBS

With Fixed or Retractable Spinners

Standard: Glossy finish. (Matte finish avail. on special order)

Cat. No. K-1125
SPINNER KNOB
For Limited Space Applications



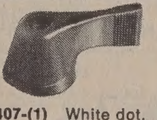
For ¼″ shaft.

Other shaft diameters on request.

Cat. No. K1358
MINIATURE SPINNER KNOB
Nylon. $\frac{19}{32}$″ High x ¾″ Wide. Spinner section diameter ⅜″. Accepts ⅛″ shaft or smaller.

Straight knurl aluminum knob. Twin set screws. For ¼″ shaft. Other sizes available. 1⅜″ dia. skirt, tapers to 1″ dia. at top. Height, 1″ Std. Torque 1 to 3 in/lbs. Available from ½ in/oz. to 48 in./oz.

Cat. No. K1357 CLUTCH KNOBS



K1408 Fits shaft $\frac{5}{16}$″ rd. x $\frac{13}{64}$″ flat. 1$\frac{29}{32}$″ long x 1$\frac{13}{16}$″ high.

K1407-(1) White dot. $\frac{9}{16}$″ high x $\frac{23}{64}$″ O.D. Shaft hole dia. .083 with .48 flat. Screwdriver slot on top.

K1407-(2) Same as above but only ½″ high, and Shaft hole dia. ⅛″ with .083 flat.

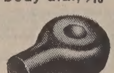
PULL TO CAGE

K1409 For $\frac{3}{16}$″ shaft. 1 set screw and 1 spot-drill hole for pinning. $\frac{11}{16}$″ high, ¾″ head dia., $\frac{7}{16}$″ shank dia. Can be supplied without marking.

K1327 For ¼″ shaft. Twin set screws. 1″ high x $\frac{11}{16}$″ body diameter. 1⅜″ overall width.

K1337 Shaft hole .260. Twin set screws. 1⅛″ long x ⅜″ high x ½″ body diameter.

K1342 Knob switch. For ¼″ D flatted shaft. 1½″ long x $\frac{7}{16}$″ high. 1″ body dia., $\frac{7}{16}$″ bar dia.

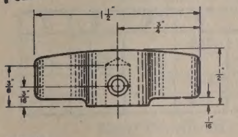


BAR-KNOB
Cat. No. K-1325

Precision cast aluminum for ¼″ shafts. Furnished with twin 8-32 set screws for shaft attachment. Provides a 1.0″ integrally cast lever arm for heavy-load switching. Finished to specifications.

51A30C82
Aluminum cast bar knob for high torque applications.

NEW!



K1431
For $\frac{7}{32}$″ shaft. ½″ x 1½″ wide.
Aluminum casting.
Must be pinned to shaft.

K1387 For $\frac{5}{32}$″ shaft hole. Twin set screws. ¼″ high x $\frac{23}{32}$″ diameter. Aluminum die-cast.

K1389 For ¼″ shaft. Twin set screws. $\frac{27}{32}$″ high x $\frac{15}{16}$″ diameter. Aluminum die-cast.

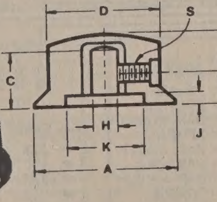
K1390 For $\frac{9}{64}$″ shaft. Two set screws. $\frac{11}{16}$″ high x $\frac{9}{16}$″ diameter. Aluminum die-cast.

K1391 For ⅛″ shaft. Twin set screws. $\frac{43}{64}$″ high x ⅝″ diameter. Aluminum die-cast, with white-filled line.

K1392 For $\frac{3}{16}$″ shaft. Two set screws. $\frac{25}{32}$″ high x $\frac{11}{16}$″ diameter. (Bar is $\frac{13}{16}$″ long). Aluminum die-cast.

K1394 For ⅛″ shaft. Two set screws. ⅞″ high x ½″ diameter. Aluminum die-cast.

INSTRUMENT KNOBS



DIMENSIONS

PART NO.				A	B	C	D	G	H	J	K	S
6	1	C	SPECIFY AS REQUIRED	¾	$\frac{7}{16}$	⅜	⅝	$\frac{7}{32}$	¼	$\frac{1}{16}$	$\frac{9}{16}$	6-32
8	1	C		1	$\frac{19}{32}$	½	$\frac{13}{16}$	$\frac{9}{32}$	¼	$\frac{3}{32}$	$\frac{11}{16}$	8-32
10	1	C		1¼	$\frac{21}{32}$	½	1	$\frac{9}{32}$	¼	$\frac{3}{32}$	$\frac{11}{16}$	8-32
13	1	C		1½	¾	$\frac{9}{16}$	1¼	$\frac{11}{32}$	¼	$\frac{5}{32}$	$\frac{31}{32}$	8-32
16	1	C		2	⅞	$\frac{21}{32}$	1⅝	$\frac{13}{32}$	¼	$\frac{3}{32}$	$\frac{13}{16}$	8-32

Body Dia.
6=⅝″
8=$\frac{13}{16}$″
10=1″
13=1¼″
16=1⅝″

Body Style
1=Round

Skirt
C=Skirt w/ Indicator Marker

(Other shaft holes to order)

Shaft Hole Dia.
2=⅛″
4=¼″
(Standard—with metal insert.
"0" preceding number means without metal insert)

Finish
G=Glossy (Standard)
M=Matte

Color
A=Black
Other Colors on Special Order

TYPICAL PART NUMBERS

81C4GB= $\frac{13}{16}$″ Dia./Round/Skirt w/indicator marker/¼″ Shaft Hole Dia./Glossy/Red
101C4MA= 1″ Dia./Round/Skirt w/indicator marker/¼″ Shaft Hole Dia./Matte/Black
101C04MA= 1″ Dia./Round/Skirt w/indicator marker/¼″ Shaft Hole Dia. without metal insert/Matte/Black

Available with Metal Tops

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QUALITY
RELIABILITY
ECONOMY

DELUXE INSTRUMENT KNOBS

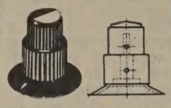
MEETS PERFORMANCE OF MIL-STD-242D (SHIPS) & MS 91528D

Molded of polycarbonate, these knobs will withstand the extreme environmental conditions of MIL-E-16400. **QPL #3926 — T.R. #J101**

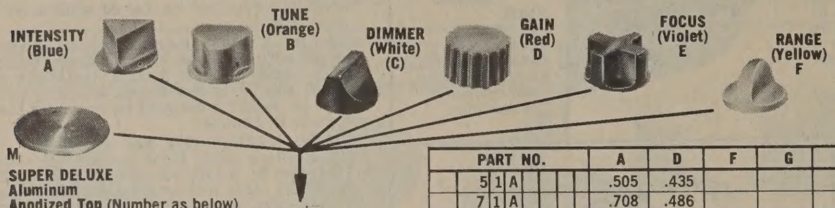
TACTILE SHAPE CONTROL CAPS

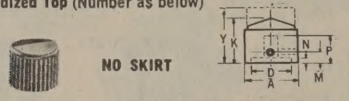
Expressly made for both visual and tactile function identification. Each Tactile Knob is produced in the standard recognizable color identified with its configuration. Available in other colors on special order. See column below for applicable tactile shape.

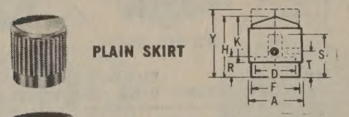
Dual Knobs for Concentric Controls
APPROVED FOR USE MIL-STD-242D & MS-91528C

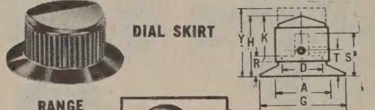


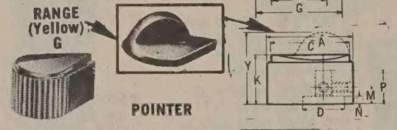
Molded of polycarbonate plastic, these "piggy-back" knobs are used with dual concentric potentiometers and in other similar applications. Meet performance of military specs above. See diagrams below for dimensions of each knob.

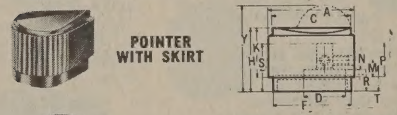


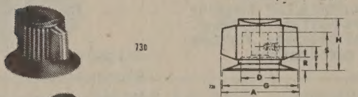


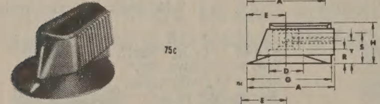


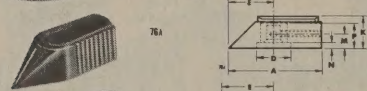


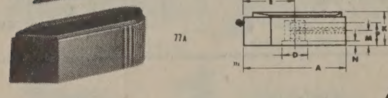












DIMENSIONS

PART NO.	A	D	F	G	H	K	M	N	P	R	S	T	Y
5 1 A	.505	.435				.509	.158	.026	.408				
7 1 A	.708	.486				.626	.187	.026	.406				.915
9 1 A	.911	.645				.798	.255	.114	.521				1.171
12 1 A	1.255	.974				.703	.260	.115	.458				1.220
17 1 A	1.755	1.465				.854	.255	.114	.521				
22 1 A	2.255	1.870				.885	.255	.114	.521				
5 1 B	.505	.435	.450		.660	.509				.181	.563	.324	
7 1 B	.708	.486	.670		.805	.626				.188	.568	.340	1.100
9 1 B	.911	.654	.826		1.027	.798				.323	.730	.484	1.399
12 1 B	1.255	.974	1.155		.870	.703				.262	.605	.427	1.399
17 1 B	1.755	1.465	1.666		1.088	.854				.338	.740	.489	
22 1 B	2.255	1.870	2.153		1.114	.885				.333	.740	.489	
5 1 C	.505	.435		.885	.660	.509				.181	.563	.324	
7 1 C	.708	.486		1.135	.805	.626				.183	.568	.340	1.100
9 1 C	.911	.645		1.510	1.027	.798				.323	.730	.484	1.399
12 1 C	1.255	.974		1.822	.870	.703				.262	.605	.427	1.399
17 1 C	1.755	1.465		2.453	1.088	.854				.333	.740	.489	
22 1 C	2.255	1.870		3.005	1.114	.885				.333	.740	.489	

SPECIFY AS REQUIRED

POINTER KNOBS

PART NO	A	D	E	F	H	K	M	N	P	R	S	T	Y
5 2 A	.750	.406	.510			.505	.158	.026	.402				
7 2 A	1.038	.486	.690			..619	.187	.026	.406				.918
9 2 A	1.344	.645	.895			.796	.255	.114	.555				1.171
5 2 B	.750	.406	.510	.669	.655	.505			.402	.177	.563	.324	
7 2 B	1.038	.486	.690	.940	.791	.619			.406	.193	.573	.364	1.100
9 2 B	1.344	.645	.895	1.251	1.051	.796			.555	.328	.796	.479	1.400

SPECIFY AS REQUIRED

PART NO.	A	D	F	G	H	K	M	N	P	R	S	T
7 3 A	1.150	.486				.610	.187	.026	.406			
7 3 B	1.150	.486	.680		.782					.183	.568	.364
7 3 D	1.150	.486		1.135	.782					.183	.568	.364

SPECIFY AS REQUIRED

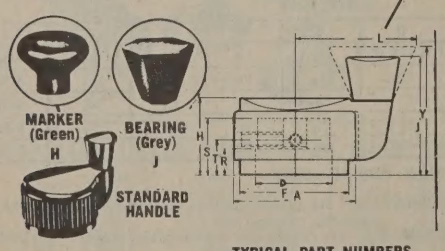
PART NO.	A	D	E	G	H	K	M	N	P	R	S	T
7 5 A	1.515	.515	.575			.645	.250	.110	.445			
7 5 C	1.720	.515	.780	1.520	.815					.266	.590	.435
7 6 A	1.855	.595	.900			.645	.250	.110	.445			
7 7 A	2.552	.562	1.290			.869	.348	.177	.739			

SPECIFY AS REQUIRED

CRANK KNOBS

PART NO.	A	D	F	H	J	L	R	S	T	Y
12 4 B	1.250	0.685	1.185	.850	1.350	1.275	.250	.605	.427	1.475
17 4 B	1.750	0.685	1.666	1.070	1.758	1.735	.320	.740	.489	1.940
22 4 B	2.250	0.685	2.185	1.095	1.782	1.970	.320	.740	.489	1.970

SPECIFY AS REQUIRED



T = STANDARD TOP (prefix not required). Use letter 'T' only when color of standard shape top is different than body color. Precede T by color code from Column 7 (BT — would mean standard shape RED top).

1 — TOP
(Color of Tactile)
O = NO TOP — Shaft Hole Drilled Thru
A = (INTENSITY - Blue)
B = (TUNE - Orange)
C = (DIMMER - White)
D = (GAIN - Red)
E = (FOCUS - Violet)
F = (RANGE - Yellow)
M = ALUM ANODIZED TOP
H = (MARKER - Green)†
J = (BEARING - Grey)†

2 — BODY DIA.
5 = .51
7 = .71
9 = .90
I = .90 Press-to-Turn*
12 = 1.25
L = 1.25 Press-to-Turn*
17 = 1.75
Q = 1.75 Press-to-Turn*
22 = 2.25
V = 2.25 Press-to-Turn*

*For Press-to-Turn Knobs see "SAFETY & SPECIAL PURPOSE KNOBS" section.

3 — BODY STYLE
1 = ROUND
2 = POINTER
3 = BAR, ROUND
4 = SPINNER
5 = BAR, SHORT
6 = BAR,LONG
7 = BAR—HIGH TORQUE

4 — SKIRT
A = NONE
B = PLAIN
C = DIAL W/POINTER
D = DIAL W/O POINTER
H = Slot

5 — SHAFT HOLE DIA.
2 = .128
3 = .190
4 = .253
5 = .312
6 = .375
7 = .268
"D" FLAT SHAFT HOLES
B = .107 (1/8")
D = .222 (1/4")

6 — FINISH
M = MATTE
G = GLOSSY

7 — COLOR
A = BLACK
B = RED
C = GREY
D = GREEN
E = YELLOW
F = PURPLE
G = BLUE
H = WHITE
J = ORANGE
K = BROWN

8 — MARKING
/WD = WHITE DOT
/FD = FLUORESCENT DOT
/PD = PHOSPHORESCENT DOT
/FA = FLUORESCENT ARROW
/PA = PHOSPHORESCENT ARROW
For no marking, leave blank

TYPICAL PART NUMBERS

91C4GA = .90 Dia./Round/Dial/1/4"/Glossy/Black.
T1C4GA = .90 Dia/Press-to-Turn/Round/Dial/1/4"/Glossy/Black.
A71B4MA = Triangle Top Blue/.72/Round/Plain/1/4"/Matte/Black.
124B4MA = 1.25 dia./Crank (Spinner)/Plain/1/4"/Matte/Black.
BT71B4MA = Standard Top Red/.72/Round/Plain/1/4"/Matte/Black.
****071B4MA** = No Top, Shaft hole drilled thru/.72/Round/Plain/1/4"/Matte/Black.

** — Specify if .127, .190, .250 hole is required for dual mounting.
NOTE: *T — Preceded by color code (BT — would mean Standard RED top).

▲**To order slip-clutch mechanism, prefix part no. with letter 'S' and add torque requirement in brackets. e.g. S 124B4MA (2 lbs.-in. ±0.5).**

FOR SPECIAL KNOBS — GIVE FULL DESCRIPTION OR SKETCH WITH ORDER.

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JAN HARDWARE | QUALITY RELIABILITY ECONOMY
MANUFACTURING COMPANY INC.
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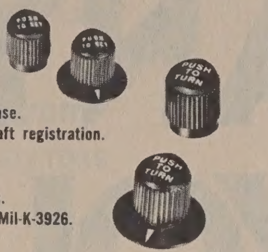
JANSET® KNOBS

U.S. Patent #4,012,966.
other Patents Pending

"PUSH-TO-SET" or "PUSH-TO-TURN"



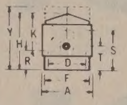
JANSET® Knobs are precision engineered and are completely integral with its mechanism totally enclosed within the knob body configuration. They protect control settings against accidental change due to shock or vibration. Only when they are depressed can the setting be altered. The knob provides infinite resolution with zero backlash such that registration to indicators (illuminated arrow, dot, cutouts etc.) is maintained throughout a full excursion. To use for existing or new designs JANSET® KNOBS REQUIRE NO MODIFICATION TO PANEL DESIGN.

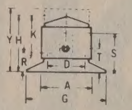
Available from ½″ to 2¼″ diameters with ring or dial skirts; with or without indicator markings. Fits all ¼″ or ⅜″ panel bushing and ⅛″ thru ¼″ shafts. (Except ½″ diameter knob which is not available for use with ¼″ shaft.)

Distinctive Features

- Knob locks automatically upon release.
- Infinite resolution with absolute shaft registration.
- Guards critical settings.
- Completely integral assembly.
- Installation same as standard knobs.
- Configuration meets MS-91528 and Mil-K-3926.

FOR TACTILE SHAPE CONTROL CAPS, SEE INFORMATION ON PRECEDING PAGE.

PLAIN SKIRT


DIAL SKIRT


PUSH-TO-SET or PUSH-TO-TURN DIMENSIONS

PART NO. (Marking, Cap: SPECIFY AS REQUIRED)	A	D	F	G	H	K	R	S	T	Y
5 1 B	.505	.435	.450		.660	.509	.181	.563	.375	
7 1 B	.708	.486	.670		.805	.626	.188	.587	.406	1.100
9 1 B	.911	.654	.826		1.027	.798	.323	.812	.603	1.399
12 1 B	1.255	.974	1.155		.870	.703	.262	.605	.603	1.399
17 1 B	1.755	1.465	1.666		1.088	.854	.338	.740	.603	
22 1 B	2.255	1.870	2.153		1.114	.885	.333	.740	.603	
5 1 C	.505	.435		.885	.660	.509	.181	.587	.400	
7 1 C	.708	.486		1.135	.805	.626	.183	.602	.431	1.100
9 1 C	.911	.645		1.510	1.027	.798	.323	.730	.603	1.399
12 1 C	1.255	.974		1.822	.870	.703	.262	.605	.603	1.399
17 1 C	1.755	1.465		2.453	1.088	.854	.333	.740	.603	
22 1 C	2.255	1.870		3.005	1.114	.885	.333	.740	.603	

SPECIFY AS REQUIRED

PREFIX
PS = PUSH-TO-SET
PT = PUSH-TO-TURN
PN = NO MARKING

TYPICAL PART NUMBERS
PS91C4GA = Marking Push-To-Set/.90 Dia./Round/Dial/¼″/Glossy/Black.
PTBT71B4MA = Marking Push-To-Turn/Standard Top Red/.72/Round/Plain/¼″/Matte/Black.

(1) CAP STYLE
(Color of Tactile)
0 = NO TOP — Shaft Hole Drilled Thru
A = (INTENSITY - Blue)
B = (TUNE - Orange)
C = (DIMMER - White)
D = (GAIN - Red)
E = (FOCUS - Violet)
F = (RANGE - Yellow)
M = ALUM ANODIZED TOP

T = STANDARD TOP (prefix not required) Use letter 'T' only when color of standard shape top is different than body color. Precede T by color code from Column 7 (BT—would mean standard shape RED top).

(2) BODY DIA.
5 = .51
7 = .71
9 = .90
12 = 1.25
17 = 1.75
22 = 2.25

(3) BODY STYLE
1 = ROUND
2 = POINTER

(4) SKIRT
B = PLAIN
C = DIAL W/POINTER
D = DIAL W/O POINTER
H = Slot

(5) SHAFT HOLE DIA.
2 = .128
3 = .190
4 = .253
5 = .312
6 = .375
7 = .268
"D" FLAT SHAFT HOLES
B = .107 (⅛″)
D = .222 (¼″)

(6) FINISH
M = MATTE
G = GLOSSY

(7) COLOR
A = BLACK
B = RED
C = GREY
D = GREEN
E = YELLOW
F = PURPLE
G = BLUE
H = WHITE
J = ORANGE
K = BROWN

(8) MARKING
/WD = WHITE DOT
/FD = FLUORESCENT DOT
/PD = PHOSPHORESCENT DOT
/FA = FLUORESCENT ARROW
/PA = PHOSPHORESCENT ARROW
For no marking, leave blank

"PUSH-TO-SET" with Overriding Clutch.

Knob can be rotated (if not pushed in) without changing shaft settings.
To specify, use part number system shown above, except use prefix PSC, PTC & PNC.
For use with other than standard top, use prefix PSCO and then specify as above.

INCREMENTAL KNOBS.

Knob locks automatically at exact point, with zero backlash. Easily provide precise setting to pre-determined positions. Equipment can now be tuned repeatedly with finite exactness to as many as 32 or as few as a single specific position.

PART NO. (Cap: SPECIFY AS REQUIRED)
EE 1 B
GG 1 B
II 1 B
LL 1 B
QQ 1 B
VV 1 B
EE 1 C
GG 1 C
II 1 C
LL 1 C
QQ 1 C
VV 1 C

SPECIFY AS REQUIRED

FOR DIMENSIONS SEE TABLE ABOVE (Columns A - Y)

(9) NO. OF INCREMENTAL POSITIONS.
SPECIFY 1 THRU 32.

(10) INCREMENT ANGLES
E = Equal Angles
N = Unequal Angles*
*Supply table of angular increments in degrees and minutes. See Table.

*SAMPLE OF TYPICAL TABLE (to be supplied)

Position	Increment Angle	Total Angle
1	0	0
2	5	5
3	4	9
4	25	34
5	266	300

(11) TOTAL ANGULAR ROTATION IN DEGREES AND MINUTES
SPECIFY 0° to 360°

FOR SPECIAL KNOBS — GIVE FULL DESCRIPTION OR SKETCH WITH ORDER.

TYPICAL PART NUMBERS
IIB4MA/WD [17E 180°] = Std. Top/.90 Dia./Round/Plain/.253 Dia. Shaft Hole/Matte/Black/White Dot/17 Incremental Positions/Equally Spaced, in 180° Rotation.
MLL1C4GB [5N 300°] = Alum. Anodized Top/1.25 Dia./Round/Dial with Pointer/.253 Dia. Shaft Hole/Glossy/Red/5 Incremental Positions/ Unequally Spaced, in 300° Rotation (See Table).

New Products!

Spin free push-to-engage knob with skirt registration.
Recommended where component shaft torque exceeds 4 oz.-in.
To specify, use prefix PTN.

Spin free push-to-engage knob with shaft friction clutch and skirt registration.
Recommended where component shaft torque is less than 4 oz.-in. and/or where minor excursions of shock and vibration are anticipated.
To specify, use prefix PTCN.

Torque knob, with shaft friction clutch.
Recommended where positive feel is desired and/or where minor excursions of shock and vibration are anticipated. *To specify, use prefix TC.*

Pull to lock knob.
Similar to push to turn series except knob must be pulled back to lock shaft. Available for spinner type knobs. *To specify, use prefix PL.*

Limit stop knob.
Up to 10 turn stops are available within the knob body, accurate within 5°. Available with or without overriding clutch. Specify/suffix (required angle 0-3600°) Precision stops available on request. *To specify, use prefix LS, LSC.*

Slip clutch knob.
Knob driving torque in detented position, 0.7 min. to 1.5 max. lb.-in. Four detented positions in 360°; functions as standard knob between limit stops. When limit stop has been reached and knob rotation continues in same direction, clutch mechanism overrides the stop without applying torque to shaft in excess of that specified.

***A note to our Customers:** If you cannot afford the space behind the panel, we can provide the function within the knob body.*

JAN HARDWARE
MANUFACTURING COMPANY INC.
47-27 36th STREET • LONG ISLAND CITY, NEW YORK 11101 • TEL: (212) 361-0800

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ECONOMY

ANY KNOB YOU NEED... WHEN YOU WANT IT

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Instrument knobs. Appliance knobs.
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Mil-spec knobs. High-style designer knobs.
Choose from thousands of stock models,
or let us quote your custom designs.
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by the dozen, or by the million.

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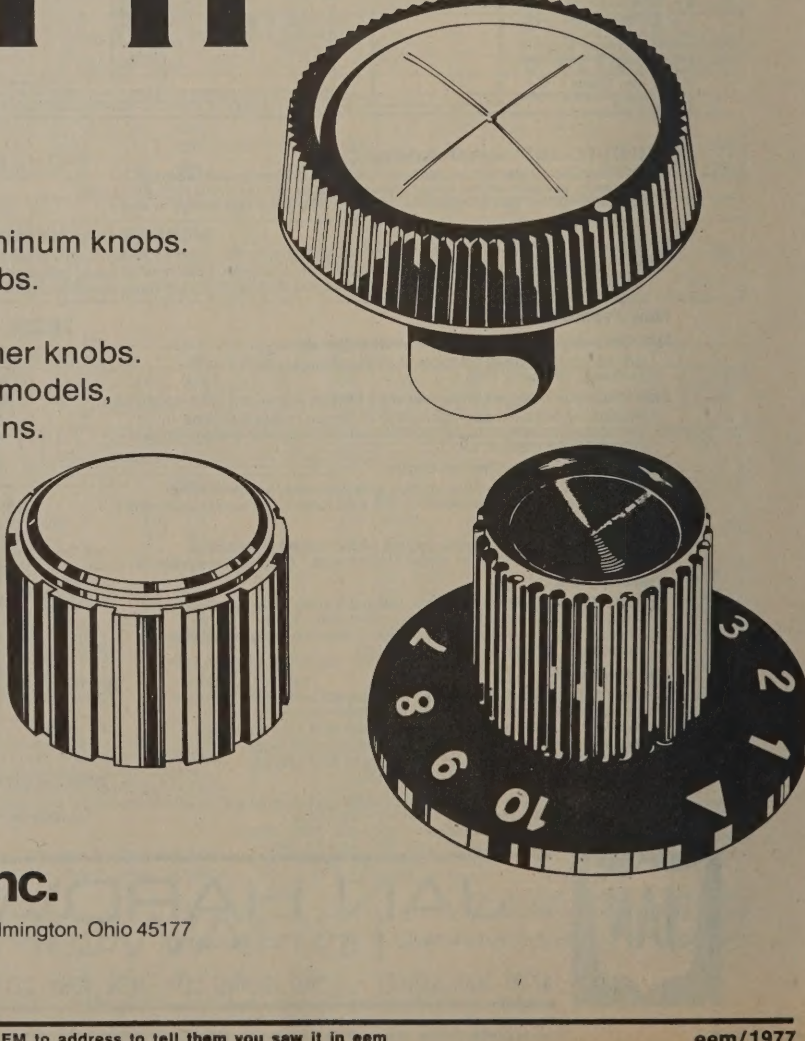
Kurz-Kasch, Inc.
Knob Division, 711 Hunter Drive, Wilmington, Ohio 45177



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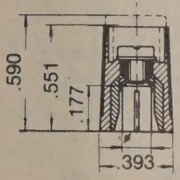
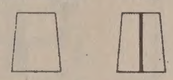
RCL Electronics

VISE GRIP COLLET KNOBS AND ACCESSORIES .400 (10mm)

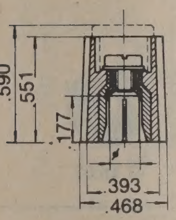
KNOBS


.590
.551
.177
.393



	STANDARD	WITH LINE
3mm	20 10 30	21 10 30
1/8"	20 10 31	21 10 31
4mm	20 10 40	21 10 40

WING KNOBS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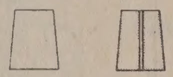
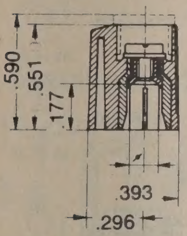
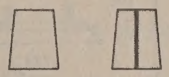
.177
.393
.468



	STANDARD	WITH LINE
3mm	22 10 30	21 10 30
1/8"	22 10 31	21 10 31
4mm	22 10 40	21 10 40

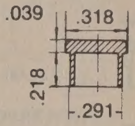
ARROW KNOBS


.590
.551
.177
.393
.296



	STANDARD	WITH LINE
3mm	18 10 30	19 10 30
1/8"	18 10 31	19 10 31
4mm	18 10 40	19 10 40

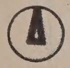
CAPS


.039
.318
.218
.291

STANDARD

30 10 00

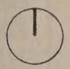
WITH ARROW



30 10 03

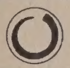
NOTE: Following Caps Not Available In Aluminum Finish:
30 10 02 30 10 03
31 10 00 31 10 04

WITH LINE



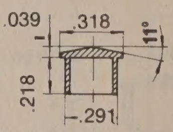
30 10 01

CURVED ARROW



30 01 02

PEAKED CAPS


.039
.318
11°
.218
.291

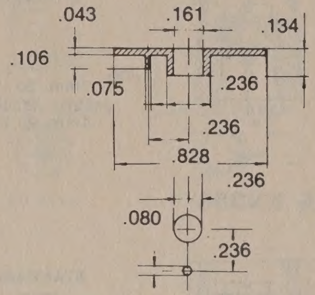
PEAKED CAP

31 10 00

WITH DOT

31 10 04

STATORS


.043
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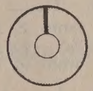
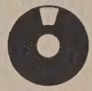
.134
.106
.075
.236
.236
.828
.236
.080
.236

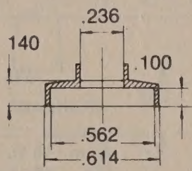


47 10 01



47 10 02

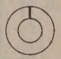
NUT COVERS


.236
140
.100
.562
.614

STANDARD

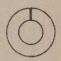
48 10 00

WITH LINE



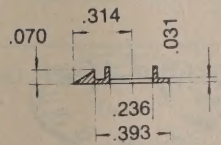
48 10 01

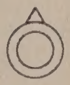
FOR WING KNOB WITH LINE MARKING



48 10 02

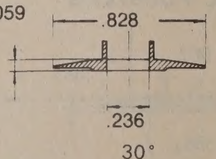
POINTERS

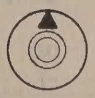

.314
.070
.031
.236
.393



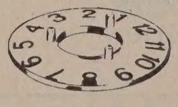
40 10 00

DIAL PLATE POINTERS



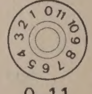


45 10 01



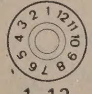
46 10 00 0

30°



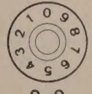
0–11
46 10 01 0

30°



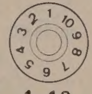
1–12
46 10 02 0

36°



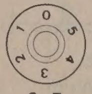
0–9
46 10 03 0

36°

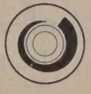


1–10
46 10 04 0

60°

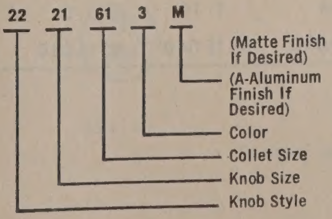


0–5
46 10 05 0



46 10 10 0

ORDERING INFORMATION FOR CONCENTRIC KNOBS


22
21
61
3
M
(Matte Finish If Desired)
(A-Aluminum Finish If Desired)
Color
Collet Size
Knob Size
Knob Style

Color
1-Gray
2-Dark Gray
3-Black
4-Red
5-Aluminum
(Matte finish not available in aluminum)

MATERIAL

With the exception of the transparent figure dials, all mouldings of the collet knob range are produced from polyamide. The transparent dials are made of luran.

Brass 58 is used for the collets, sleeves and nuts, while steel is used for the screws and washers.

TEMPERATURE STABILITY

With normal mechanical stresses: −20°C to +70°C.

For further information please contact our closest distributor, representative or RCL direct. We can also provide special types of knobs and accessories and custom color matching at the lowest price, with fastest delivery.

AMF

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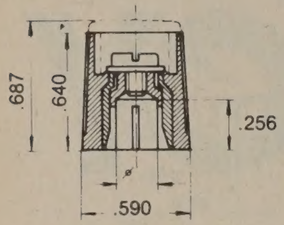
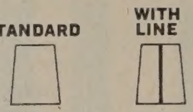
RCL Electronics

VISE GRIP COLLET KNOBS AND ACCESSORIES .593 (15mm)

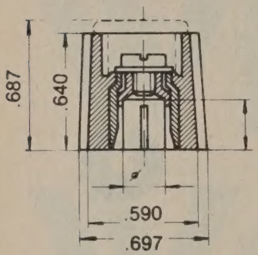
KNOBS

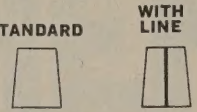

.687
.640
.256
ø
.590


STANDARD
WITH LINE

	STANDARD	WITH LINE
3mm	20 15 30	21 15 30
1/8″	20 15 31	21 15 31
4mm	20 15 40	21 15 40

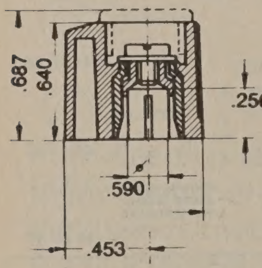
WING KNOBS

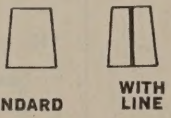

.687
.640
.256
ø
.590
.697


STANDARD
WITH LINE

	STANDARD	WITH LINE
3mm	22 15 30	23 15 30
1/8″	22 15 31	23 15 31
4mm	22 15 40	23 15 40

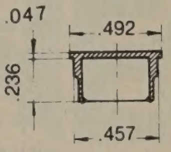
ARROW KNOBS


.687
.640
.256
ø
.590
.453


STANDARD
WITH LINE

	STANDARD	WITH LINE
3mm	18 15 30	19 15 30
1/8″	18 15 31	19 15 31
4mm	18 15 40	19 15 40

CAPS


.047
.492
.236
.457

STANDARD

30 15 00

WITH ARROW

30-15-03

WITH LINE

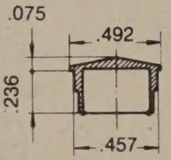
30 15 01

CURVED ARROW

30 15 02

NOTE: Following Caps Not Available In Aluminum Finish:
30 15 02 30 15 03
31 15 00 31 15 04

PEAKED CAPS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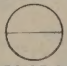
.492
.236
.457

PEAKED CAP

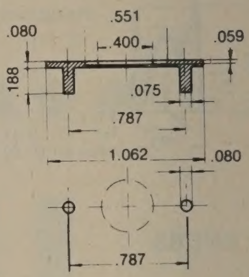


31 15 00

WITH DOT

31 15 04

STATORS


.080
.551
.400
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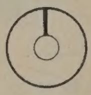
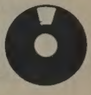
.188
.075
.787
1.062
.080
.787

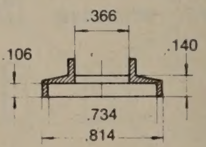


47 15 01



47 15 02

NUT COVERS


.366
.106
.140
.734
.814

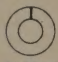
STANDARD

48 15 00

WITH LINE

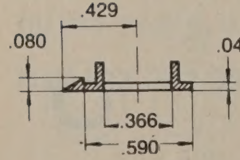
48 15 01

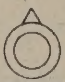
FOR WING KNOB WITH LINE MARKING



48 15 02

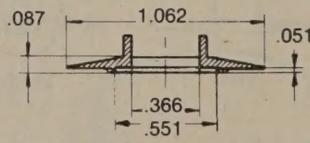
POINTERS


.429
.080
.047
.366
.590

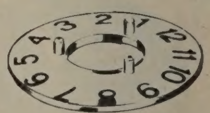


40 15 00

DIAL PLATE POINTERS

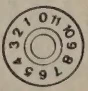

.087
1.062
.051
.366
.551

45 15 01



46 15 00 0

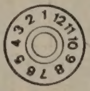
30°



0–11

46 15 01 0

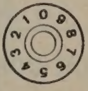
30°



1–12

46 15 02 0

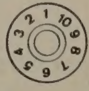
36°



0–9

46 15 03 0

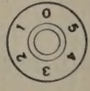
36°



1–10

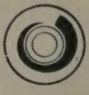
46 15 04 0

60°



0–5

46 15 05 0



46 15 10 0

PRODUCT NOTE:
For knobs used on concentric shaft components see page 2

GENERAL SALES OFFICE:
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IRVINGTON, NEW JERSEY 07111
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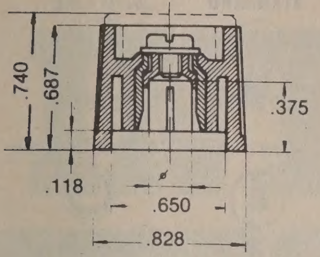
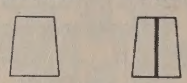
RCL Electronics

VISE GRIP COLLET KNOBS AND ACCESSORIES .820 (21mm)

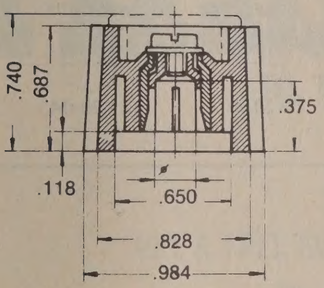
KNOBS

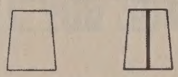

.740
.687
.375
.118
ø
.650
.828



	STANDARD	WITH LINE
3mm	20 21 30	21 21 30
1/8″	20 21 31	21 21 31
4mm	20 21 40	21 21 40

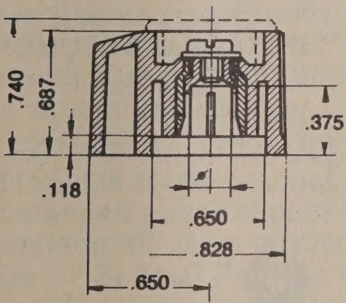
WING KNOBS

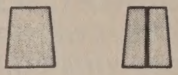

.740
.687
.375
.118
ø
.650
.828
.984



	STANDARD	WITH LINE
3mm	22 21 30	23 21 30
1/8″	22 21 31	23 21 31
4mm	22 21 40	23 21 40

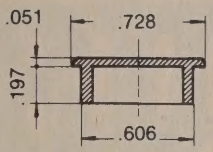
ARROW KNOBS


.740
.687
.375
.118
ø
.650
.828
.650



	STANDARD	WITH LINE
3mm	18 21 30	19 21 30
1/8″	18 21 31	19 21 31
4mm	18 21 40	19 21 40

CAPS


.051
.728
.197
.606

STANDARD

30 21 00

WITH LINE

30 21 01

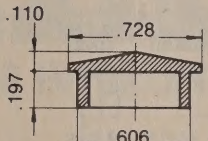
WITH ARROW

30 21 03

CURVED ARROW

30 21 02

PEAKED CAPS


.110
.728
.197
.606

PEAKED CAP

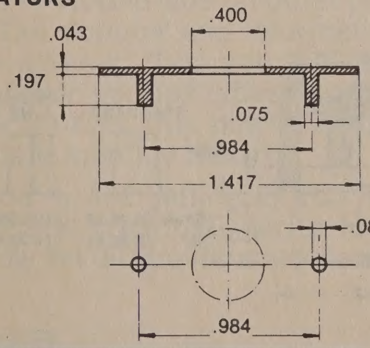
31 21 00

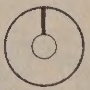
WITH DOT

31 21 04

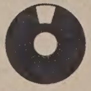
NOTE: Following Caps Not Available In Aluminum Finish:
30 21 02 30 21 03 31 21 00 31 21 04

STATORS


.400
.043
.197
.075
.984
1.417
.080
.984

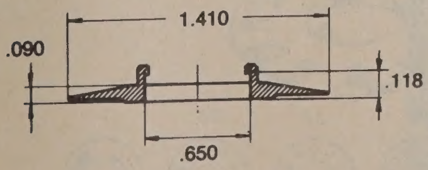


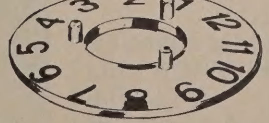
47 21 01



47 21 02

DIAL PLATE POINTERS

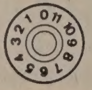

1.410
.090
.118
.650



45 21 01

46 21 000

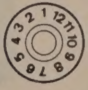
30°



0–11

46 21 010

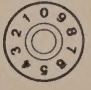
30°



1–12

46 21 020

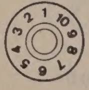
36°



0–9

46 21 030

36°



1–10

46 21 040

46 21 100

AMF

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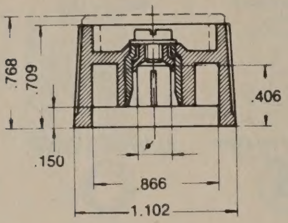
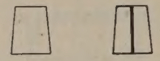
RCL Electronics

VISE GRIP COLLET KNOBS AND ACCESSORIES 1.102 (28mm)

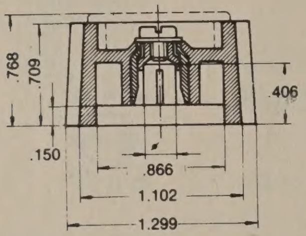
KNOBS

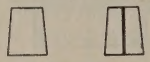

.768
.709
.406
.150
.866
1.102



	STANDARD	WITH LINE
4mm	20 28 40	21 28 40
6mm	20 28 60	21 28 60
¼"	20 28 61	21 28 61

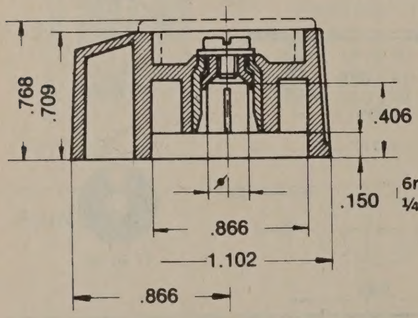
WING KNOBS

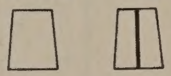

.768
.709
.406
.150
.866
1.102
1.299



	STANDARD	WITH LINE
4mm	22 28 40	23 28 40
6mm	22 28 60	23 28 60
¼"	22 28 61	23 28 61

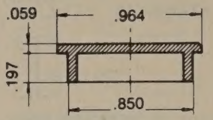
ARROW KNOBS


.768
.709
.406
.150
.866
1.102
.866



	STANDARD	WITH LINE
6mm	18 26 60	19 28 60
¼"	18 28 61	19 28 61

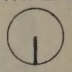
CAPS


.059
.964
.197
.850

STANDARD

30 28 00

WITH LINE

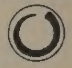


30 28 01

WITH ARROW

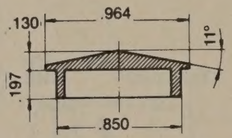
30-28-03

CURVED ARROW



30 28 02

PEAKED CAPS


.130
.964
11°
.197
.850

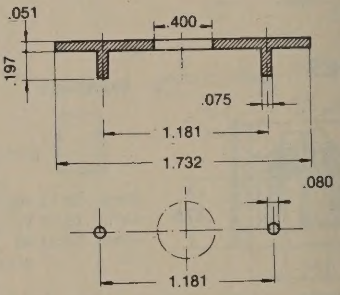
PEAKED CAP

31 28 00

WITH DOT

31-28-04

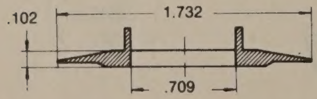
STATORS


.051
.400
.197
.075
1.181
1.732
.080
1.181

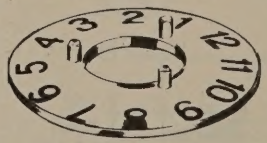
47 28 01

47 28 02

DIAL PLATE POINTERS


.102
1.732
.709

45 28 01



46 28 00 0

30°

0–11

46 28 01 0

30°

1–12

46 28 02 0

36°

0–9

46 28 03 0

36°

1–10

46 28 04 0

46 28 10 0

ALL VISE GRIP COLLET KNOBS AND ACCESSORIES ON THIS PAGE ALSO AVAILABLE IN 1.417 (36mm) SIZE.

NOTE: Following Caps Not Available In Aluminum Finish: 30-28-02 30-28-03 31-28-00 31-28-04

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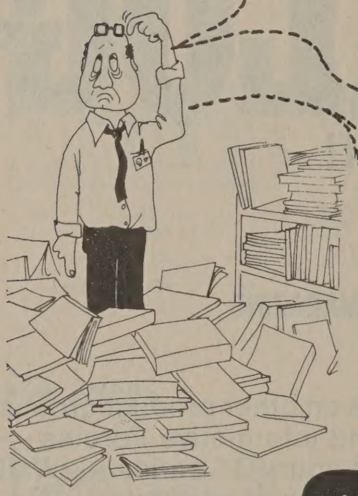

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RAYTHEON

CONTROL KNOBS

See other Raytheon Products in EEM

Opto-electronics — Section 3700
Switches — Section 5100
Test Jacks — Section 2100
Hardware — Section 2800

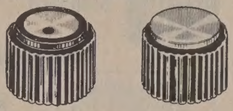
STANDARD SERIES

Raytheon Standard Series Control Knobs feature top quality and lend distinctive customer appeal to your products. All knobs have a common motif, resulting in uniform appearance regardless of function. Standard Series includes hundreds of knobs in many functional shapes, sizes and colors meeting MIL-K-3926 and MS91528. All are molded from high-impact polycarbonate with corrosion-resistant aluminum inserts for maximum strength.

DESIGNER SERIES

Give your product a fine, custom appearance with these Designer Series Knobs. Contrasting with the black bases, the aluminum caps, protected by baked-on epoxy coating, give a sunburst effect which is modern, aesthetically pleasing and implies quality. Knob bases are molded of high quality polycarbonate. Set screws, inserts same as for Standard Series. Colors or other modifications available on special order.

REGENCY SERIES



Regency Series Control Knobs offer the combination of fine quality and a custom appearance at a **modest cost,** with the choice of spun aluminum cupped caps (RS Series) or flat inlaid discs (RSF Series), protected by an epoxy coating. These knobs are particularly suited for use in industrial and instrumentation applications.

400 SERIES

To complement or contrast with the color and design of your products. The 400 Series Knobs are made of durable, high-impact acrylonitrite—butadiene—styrene (ABS) with a lusterless finish. All contain metal bushings and two set screws.

PANELRAMA SERIES

These knobs, molded of durable, high-impact acrylonitrite-butadiene-styrene (ABS), have a black matte finish capped with an epoxy-coated aluminum disk. All contain circular shaft metal inserts with two 6-32 UNC-3A set screws.

SELF-LOCKING

PUSH
TO
TURN

Designed for applications in which control settings must be maintained under conditions of shock and vibration. The setting can not be changed accidentally, since the knob must be depressed before movement. Zero backlash allows the operator infinite resolution of setting, yet prevents control shaft from rotating when released. Design is identical to Raytheon's standard line of control knobs, allowing uniformity of panel design when used in conjunction with other types.

FOR SPECIFICATIONS SEE PAGE 2562

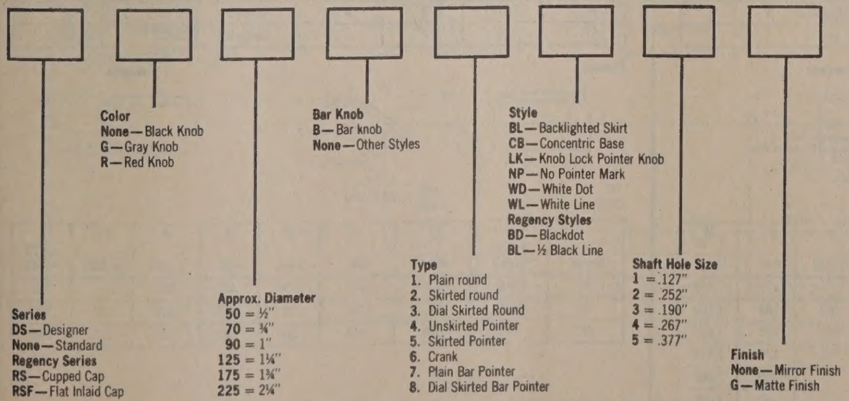
ORDERING INFORMATION

Catalog numbers published here are for stocked items. For other variations, contact factory. The derivation of the catalog numbers for each series is shown below. This does not imply that all combinations are available. Mirror finish is specified on most Standard and Designer Series Catalog numbers listed. Where matte (dull) finish is specified the suffix G is added. Note 400 and Panelrama Series have a matte finish.

Raytheon knobs are available through franchised distributor. See listing of representatives in yellow pages to call for location of your nearest distributor.

Sample knobs are available for your evaluation, write Raytheon Distributor Products Operation, Fourth Ave., Burlington, Mass. 01803, Dept. EEM.

STANDARD AND DESIGNER SERIES AND REGENCY SERIES



Series
DS—Designer
None—Standard
Regency Series
RS—Cupped Cap
RSF—Flat Inlaid Cap

Color
None—Black Knob
G—Gray Knob
R—Red Knob

Approx. Diameter
50 = ½″
70 = ¾″
90 = 1″
125 = 1¼″
175 = 1¾″
225 = 2¼″

Bar Knob
B—Bar knob
None—Other Styles

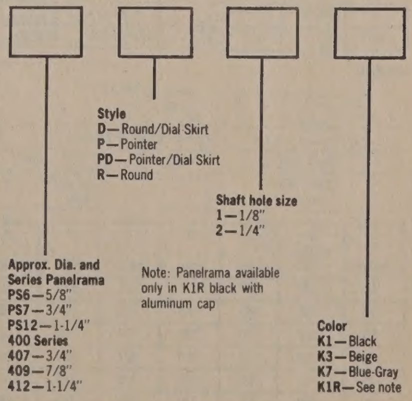
Type
1. Plain round
2. Skirted round
3. Dial Skirted Round
4. Unskirted Pointer
5. Skirted Pointer
6. Crank
7. Plain Bar Pointer
8. Dial Skirted Bar Pointer

Style
BL—Backlighted Skirt
CB—Concentric Base
LK—Knob Lock Pointer Knob
NP—No Pointer Mark
WD—White Dot
WL—White Line
Regency Styles
BD—Blackdot
BL—½ Black Line

Shaft Hole Size
1 = .127″
2 = .252″
3 = .190″
4 = .267″
5 = .377″

Finish
None—Mirror Finish
G—Matte Finish

400 AND PANELRAMA SERIES



Approx. Dia. and Series Panelrama
PS6—5/8″
PS7—3/4″
PS12—1-1/4″
400 Series
407—3/4″
409—7/8″
412—1-1/4″

Style
D—Round/Dial Skirt
P—Pointer
PD—Pointer/Dial Skirt
R—Round

Shaft hole size
1—1/8″
2—1/4″

Note: Panelrama available only in K1R black with aluminum cap

Color
K1—Black
K3—Beige
K7—Blue-Gray
K1R—See note

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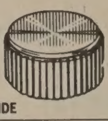
RAYTHEON CONTROL KNOBS/STANDARD AND DESIGNER SERIES

ROUND

Standard

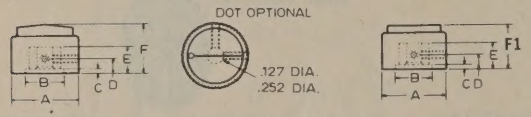


Designer

SELECTION GUIDE

Knob Dia. (Appx.)	Shaft Dia.	Knob Height (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers			
				Standard		Designer	
				Black Plain	White Dot	Black Plain	Black Dot
1/2"	1/8"	1/2"	Series 50	50-1-1	50-1WD-1	—	—
3/4"	1/8"	5/8"	Series 70	70-1-1	70-1WD-1	DS70-1-1	DS70-1BD-1
3/4"	3/16"	5/8"	Series 70	70-1-3	—	DS70-1-3	DS70-1BD-3
3/4"	1/4"	5/8"	Series 70	70-1-2	70-1WD-2	DS70-1-2	DS70-1BD-2
1"•	1/8"	3/4"	Series 90	90-1-1G	90-1WD-1G	DS90-1-1	DS90-1BD-1G
1"	3/16"	3/4"	Series 90	90-1-3	—	DS90-1-3	DS90-1BD-3
1"	1/4"	3/4"	Series 90	90-1-2	90-1WD-2	DS90-1-2	DS90-1BD-2
1-1/4"	1/4"	5/8"	Series 125	125-1-2	125-1WD-2G	DS125-1-2	—
1-3/4"	1/4"	7/8"	Series 175	175-1-2	—	—	—
2-1/4"	1/4"	7/8"	Series 225	225-1-2	—	—	—

Standard **Designer**



Series	A +.030 −.010	B min.	C min.	D max.	E min.	F ±.030	F1 ±.030
50	.500	.435	.026	.158	.405	.510	—
70	.700	.485	.026	.187	.405	.610	.590
90	.900	.640	.114	.260	.520	.790	.735
125	1.250	.750	.114	.260	.455	.700	.620
175	1.750	.750	.114	.260	.520	.850	—
225	2.250	.750	.114	.260	.520	.875	—

ROUND/ DIAL SKIRT

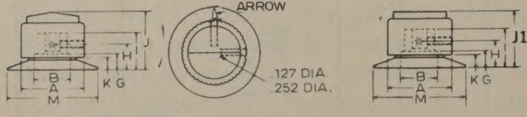
Standard

Designer

SELECTION GUIDE

Knob Dia. (Appx.)	Dial Skirt Dia. (Appx.)	Shaft Dia.	Knob Hght. (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers		
					Standard Pointer Arrow		Designer Pointer Arrow
					Black	Black Matte Back Lighted Arrow	Black
1/2"	1"	1/8"	5/8"	Series 50	50-3-1	50-3BL-1G	—
3/4"	1-1/8"	1/8"	3/4"	Series 70	70-3-1	—	DS70-3-1
3/4"	1-1/8"	1/4"	3/4"	Series 70	70-3-2	70-3BL-2G	DS70-3-2
1"	1-1/2"	1/8"	1"	Series 90	90-3-1G	—	—
1"	1-1/2"	1/4"	1"	Series 90	90-3-2	90-3BL-2G	DS90-3-2
1-1/4"	1-7/8"	1/4"	3/4"-7/8"	Series 125	125-3-2	125-3BL-2G	DS125-3-2
1-3/4"	2-1/2"	1/4"	1"	Series 175	175-3-2	175-3BL-2G	—
2-1/4"	3"	1/4"	1"	Series 225	225-3-2	—	—

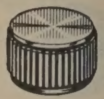
Standard **Designer**



Series	A +.030 −.010	B min.	G min.	H max.	I min.	J ±.030	J1 ±.030	K max.	M max.
50	.500	.435	.177	.325	.560	.655	—	.175	.900
70	.700	.485	.188	.369	.568	.782	.780	.187	1.150
90	.900	.640	.320	.484	.730	1.010	.980	.235	1.525
125	1.250	.750	.250	.427	.605	.850	.785	.175	1.837
175	1.750	.750	.320	.489	.740	1.070	—	.240	2.468
225	2.250	.750	.320	.489	.740	1.095	—	.240	3.020

ROUND/RING SKIRT

Standard

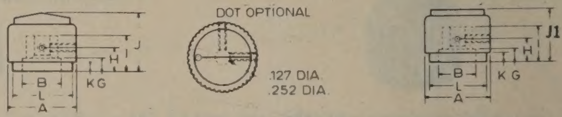


Designer

SELECTION GUIDE

Knob Dia. (Appx.)	Shaft Dia.	Knob Height (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers			
				Standard		Designer	
				Black Plain	White Dot	Black Plain	Black Dot
1/2"	1/8"	5/8"	Series 50	50-2-1	50-2WD-1	—	—
3/4"	1/8"	3/4"	Series 70	70-2-1	70-2WD-1	DS70-2-1	DS70-2BD-1
3/4"	1/4"	3/4"	Series 70	70-2-2	70-2WD-2	DS70-2-2	DS70-2BD-2
1"	1/8"	1"	Series 90	90-2-1G	—	—	—
1"	1/4"	1"	Series 90	90-2-2	90-2WD-2	DS90-2-2	DS90-2BD-2
1-1/4"	1/4"	3/4"-7/8"	Series 125	125-2-2	—	DS125-2-2	—
1-3/4"	1/4"	1"	Series 175	175-2-2	—	—	—
2-1/4"	1/4"	1"	Series 225	225-2-2	—	—	—

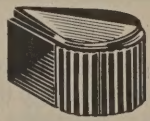
Standard **Designer**



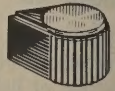
Series	A +.030 −.010	B min.	H max.	I min.	J ±.030	J1 ±.030	K max.	L max.
50	.500	.435	.325	.560	.655	—	.175	.460
70	.700	.485	.369	.568	.782	.780	.187	.680
90	.900	.640	.484	.730	1.010	.980	.235	.845
125	1.250	.750	.427	.605	.850	.785	.175	1.185
175	1.750	.750	.489	.740	1.070	—	.240	1.690
225	2.250	.750	.489	.740	1.095	—	.240	2.185

Note: Two set screws are provided.

POINTER



Standard

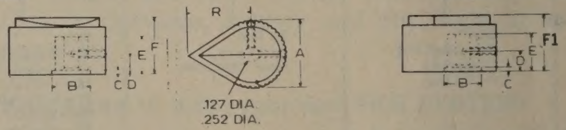


Designer

SELECTION GUIDE

Knob Dia. (Appx.)	Pointer Radius (Appx.)	Shaft Dia.	Knob Hght. (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers	
					Standard	Designer
					Black	Black
1/2"	1/2"	1/8"	1/2"	Series 50	50-4-1	—
3/4"	5/8"	1/8"	5/8"	Series 70	70-4-1	—
3/4"	5/8"	1/4"	5/8"	Series 70	70-4-2	DS70-4-2
1"	7/8"	1/8"	1"	Series 90	90-4-1G	—
1"	7/8"	1/4"	1"	Series 90	90-4-2	DS90-4-2

Standard **Designer**



Series	A +.030 −.010	B min.	C min.	D max.	E min.	F ±.030	F1 ±.030	R +.025 −.005
50	.500	.435	.026	.158	.405	.510	—	.490
70	.700	.485	.026	.187	.405	.610	.590	.680
90	.900	.640	.114	.260	.520	.790	.735	.885

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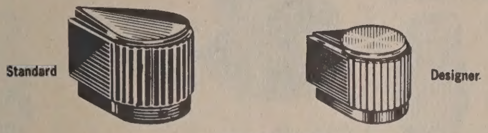
RAYTHEON CONTROL KNOBS/STANDARD & DESIGNER SERIES

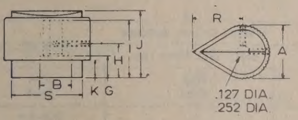
POINTER/RING SKIRT


Standard
Designer

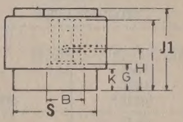
SELECTION GUIDE

Knob Dia. (Appx.)	Pointer Radius (Appx.)	Shaft Dia.	Knob Hght. (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers Standard Black	Stocked Catalog Numbers Designer Black
1/2"	1/2"	1/8"	1/2"	Series 50	50-5-1	—
3/4"	5/8"	1/8"	5/8"	Series 70	70-5-1	DS70-5-1
3/4"	5/8"	1/4"	5/8"	Series 70	70-5-2	—
1"	7/8"	1/8"	1"	Series 90	—	—
1"	7/8"	1/4"	1"	Series 90	90-5-2	DS90-5-2

Standard


J
I
H
B
S
K G
R
A
.127 DIA
.252 DIA

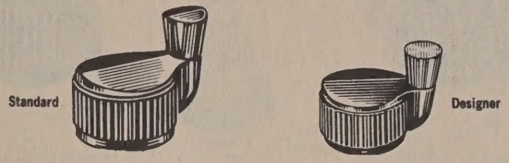
Designer



Series	A +.030 −.010	B min.	G min.	H max.	I min.	J ±.030	J1 ±.030	K max.	R +.025 −.005	S max.
50	.500	.435	.177	.325	.560	.655	—	.175	.490	.690
70	.700	.485	.188	.369	.568	.782	.765	.187	.680	1.000
90	.900	.640	.320	484	.730	1.010	.970	.235	.885	1.345

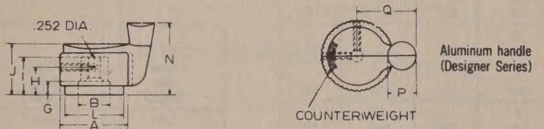
Note: Two set screws are provided.

CRANK


Standard
Designer

Knob Dia. (Appx.)	Crank Radius (Appx.)	Shaft Dia.	Crank Hght. (Appx.)	Dimension Dwg. Ref.	Stocked Catalog Numbers Standard Black	Stocked Catalog Numbers Designer Black
1-1/4"	1-1/8"	1/4"	1-3/8"	Series 125	125-6-2	DS125-6-2
1-3/4"	1-1/2"	1/4"	1-3/4"	Series 175	175-6-2	DS175-6-2G
2-1/4"	1-3/4"	1/4"	1-3/4"	Series 225	225-6-2	—

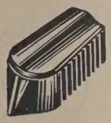
Standard and Designer

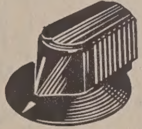

.252 DIA
N
J
I
H
G
B
L
A
Q
P
COUNTERWEIGHT
Aluminum handle
(Designer Series)

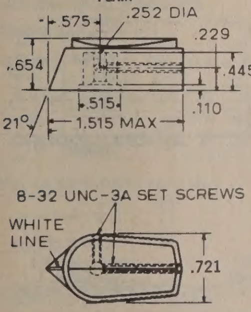
Series	A +.030 −.010	B min.	H max.	I min.	J ±.030	L max.	N ±.050	P ±.025	Q max.
125	1.250	.750	.427	.605	.850	1.185	1.350	.580	1.133
175	1.750	.750	.489	.740	1.070	1.690	1.758	.780	1.527
225	2.250	.750	.489	.740	1.095	2.185	1.782	.780	1.777

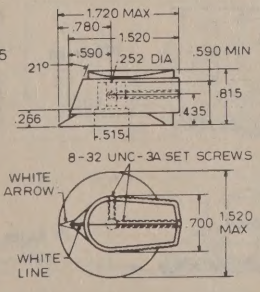
BAR POINTERS/STANDARD SERIES

1-1/2" BAR—70 SERIES

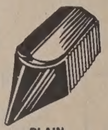

PLAIN

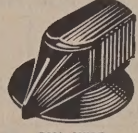

DIAL SKIRT

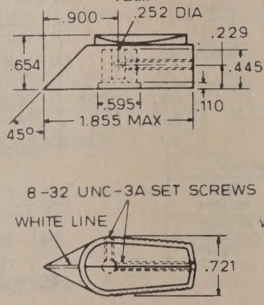

.575
.252 DIA
.229
.654
.445
.515
.110
21°
1.515 MAX
8-32 UNC-3A SET SCREWS
WHITE LINE
.721

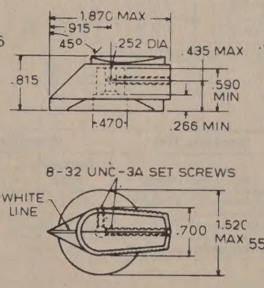

1.720 MAX
.780
1.520
.590
.252 DIA
.590 MIN
21°
.815
.435
.266
.515
8-32 UNC-3A SET SCREWS
WHITE ARROW
.700
1.520 MAX
WHITE LINE

1-7/8" BAR—90 SERIES

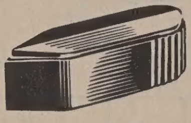

PLAIN

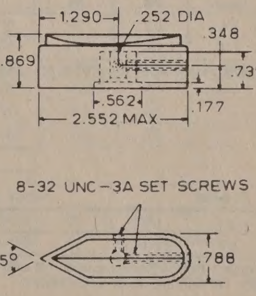

DIAL SKIRT


.900
.252 DIA
.229
.654
.445
.595
.110
1.855 MAX
45°
8-32 UNC-3A SET SCREWS
WHITE LINE
.721


1.870 MAX
.915
45°
.252 DIA
.435 MAX
.815
.590 MIN
.470
.266 MIN
8-32 UNC-3A SET SCREWS
WHITE LINE
.700
1.520 MAX

2-1/2" BAR—125 SERIES


PLAIN


1.290
.252 DIA
.348
.869
.739
.562
.177
2.552 MAX
8-32 UNC-3A SET SCREWS
55°
.788

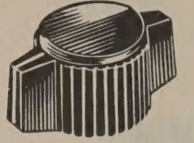
Bar Lgth. (Appx.)	Shaft Dia.	Bar Wdth. (Appx.)	Style	Stocked Catalog Numbers Plain Black	Stocked Catalog Numbers Plain With White Line Black	Stocked Catalog Numbers Plain With White Line *Gray	Stocked Catalog Numbers Dial Skirt With White Line Black	Stocked Catalog Numbers Dial Skirt With White Line Gray
1-1/2"	1/4"	3/4"	Series 70	—	70-7WL-2	G70-7WL-2G	70-8WL-2	G70-8WL-2
1-7/8"	1/4"	3/4"	Series 90	—	90-7WL-2	G90-7WL-2G	90-8WL-2	*G90-8WL-2G
2-1/2"	1/4"	3/4"	Series 125	125-7-2	—	—	—	—

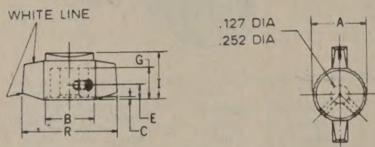
*Matte Finish

RAYTHEON CONTROL KNOBS/STANDARD & DESIGNER SERIES

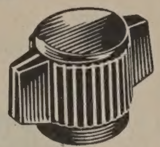
BAR KNOBS—STANDARD SERIES

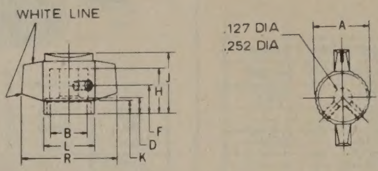
ROUND



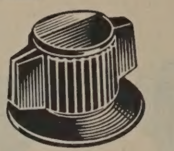

WHITE LINE
G
I
E
C
B
R
.127 DIA
.252 DIA
A

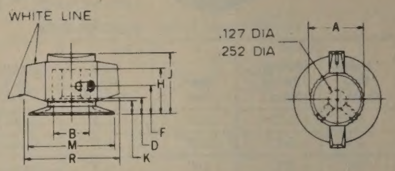
RING SKIRT




WHITE LINE
J
H
F
D
K
B
L
R
.127 DIA
.252 DIA
A

DIAL SKIRT




WHITE LINE
J
H
F
D
K
B
M
R
.127 DIA
.252 DIA
A

A +.030 −.010	.700	H min.	.568
B min.	.485	I ±.030	.610
C min.	.026	J ±.030	.782
D min.	.188	K max.	.187
E max.	.187	L max.	.680
F max.	.369	M max.	1.150
G min.	.405	R ±.025	1.150

SELECTION GUIDE

Knob Dia. (Appx.)	Bar Lgth. (Appx.)	Shaft Dia.	Knob Hght. (Appx.)	Stocked Catalog Numbers		
				Black with White Line		
				Round	Ring Skirt	Dial Skirt
3/4"	1-1/8"	1/8"	3/4"	—	—	70B-3-1
3/4"	1-1/8"	1/4"	3/4"	—	70B-2-2	70B-3-2
3/4"	1-1/8"	1/4"	5/8"	70B-1-2	—	—

SELF-LOCKING KNOBS—Standard Series

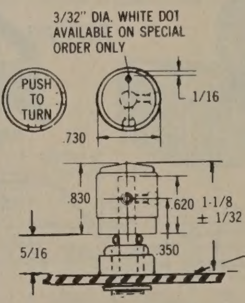
Knob must be depressed **before** shaft can be turned. Available in two styles:

PT Series: For applications where relationship between knob rotation and shaft rotation **must** be maintained. Both knob and shaft are locked until knob is depressed.

PTE Series: For applications where knob-to-shaft relationship does not need to be maintained. Knob is free to rotate while shaft is locked until knob is depressed.

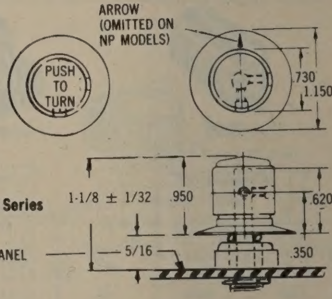
ROUND—RING SKIRT

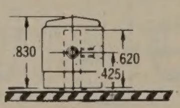
ROUND—DIAL SKIRT


3/32" DIA. WHITE DOT AVAILABLE ON SPECIAL ORDER ONLY
PUSH TO TURN
1/16
.730
.830
.620
1-1/8 ± 1/32
5/16
.350

PTE Series

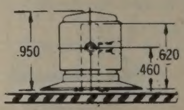
PANEL


ARROW (OMITTED ON NP MODELS)
PUSH TO TURN
.730
1.150
1-1/8 ± 1/32
.950
.620
5/16
.350



PT Series

PANEL



SELECTION GUIDE

PTE Series			Stocked Catalog Numbers			
			Round-Ring Skirt		Round-Dial Skirt	
Knob Dia. (Appx.)	Shaft Dia.	Series No.	Gray*	Black*	Gray with Arrow*	Black with Arrow*
3/4"	1/8"	70	PTEG70-2-1	PTE70-2-1	—	PTE70-3-1
3/4"	1/4"	70	PTEG70-2-2	PTE70-2-2	PTEG70-3-2	PTE70-3-2

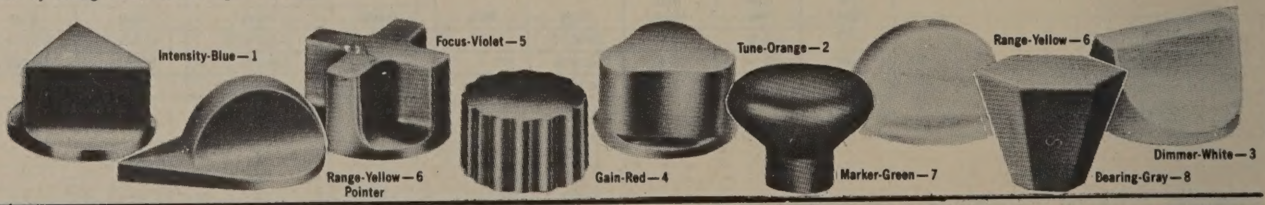
*Numbers shown are for mirror finish. Add suffix G for matte (dull) finish.

			Round-Ring Skirt	Round-Dial Skirt	
PT Series			Black*	Black with Arrow*	Black No Arrow
3/4"	1/8"	70	PT70-2-1	PT-70-3-1	PT70-3NP-1
3/4"	1/4"	70	PT70-2-2	PT70-3-2	PT70-3NP-2

*Numbers shown are for mirror finish. Add suffix G for matte (dull) finish.
Note: Two 4-40 UNC-3A set screws provided.

TACTILE KNOBS

These tactile-shaped and colored tops may be combined with all standard knobs except bar pointer. Order by adding suffix number. e.g., 70-2-2G-1


Intensity-Blue—1
Focus-Violet—5
Tune-Orange—2
Range-Yellow—6
Dimmer-White—3
Range-Yellow—6 Pointer
Gain-Red—4
Marker-Green—7
Bearing-Gray—8

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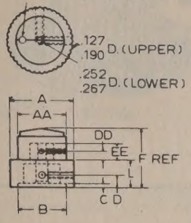
RAYTHEON CONTROL KNOBS/STANDARD & DESIGNER SERIES

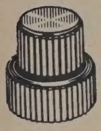
CONCENTRIC KNOBS

ROUND—ROUND

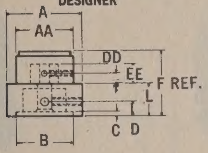
Standard

STANDARD
DOT OPTIONAL


.127
.190 D. (UPPER)
.252
.267 D. (LOWER)
A
AA
DD
EE
F REF
L
C D
B

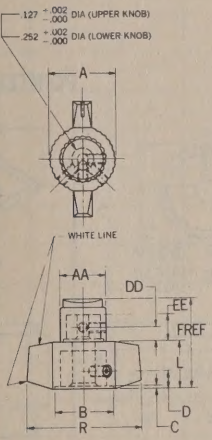

Designer

DESIGNER


A
AA
DD
EE
F REF.
L
C D
B

ROUND—ROUND BAR

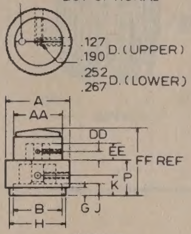
Standard


.127 +.002 −.000 DIA (UPPER KNOB)
.252 +.002 −.000 DIA (LOWER KNOB)
A
WHITE LINE
AA
DD
EE
FREF
L
B
R
D
C

ROUND—RING SKIRT

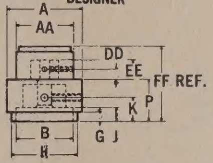
Standard

STANDARD
DOT OPTIONAL

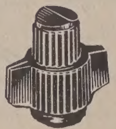

.127
.190 D. (UPPER)
.252
.267 D. (LOWER)
A
AA
DD
EE
FF REF
P
K
B
G J
H

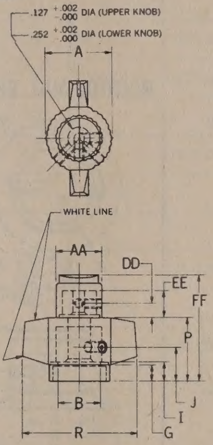
Designer

DESIGNER


A
AA
DD
EE
FF REF.
P
K
B
G J
H

ROUND—RING SKIRT BAR

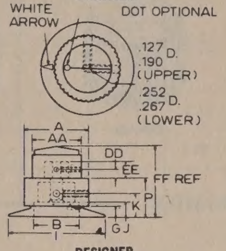

Standard


.127 +.002 −.000 DIA (UPPER KNOB)
.252 +.002 −.000 DIA (LOWER KNOB)
A
WHITE LINE
AA
DD
EE
FF
P
J
I
B
R
G

ROUND—DIAL SKIRT

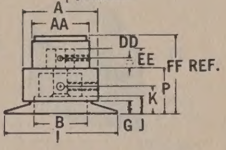
Standard

STANDARD
DOT OPTIONAL


WHITE ARROW
.127
.190 D.
(UPPER)
.252
.267 D.
(LOWER)
A
AA
DD
EE
FF REF
P
K
B
G J
I

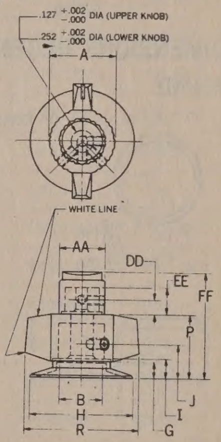
Designer

DESIGNER


A
AA
DD
EE
FF REF.
P
K
B
G J
I

ROUND—DIAL SKIRT BAR

Standard


.127 +.002 −.000 DIA (UPPER KNOB)
.252 +.002 −.000 DIA (LOWER KNOB)
A
WHITE LINE
AA
DD
EE
FF
P
J
I
B
H
R
G

DIMENSIONS FOR ALL CONCENTRICS

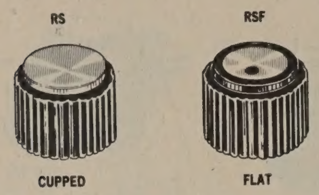
Standard and Designer Series	A +.030 −.010	AA +.030 −.010	B min.	C min.	D max.	DD max.	EE min.	F ref.	FF ref.	G max.	H max.	I max.	J max.	K max.	L ±.015	P ±.025	R ±.025
50/70	.700	.500	.485	.026	.187	.158	.405	1.065	1.255	.187	.680	1.150	.188	.369	.510	.690	1.150
70/90	.900	.700	.640	.114	.260	.187	.405	1.310	1.550	.235	.845	1.525	.320	.484	.655	.885	—
90/125	1.250	.900	.750	.114	.260	.260	.520	1.365	1.545	.175	1.185	1.837	.250	.427	.530	.700	—

SELECTION GUIDE ROUND TYPES ONLY

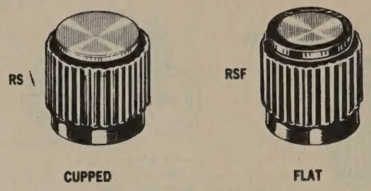
Knob Dia's. Upper/Lower (Approx.)	Shaft Dia's. Upper/Lower	Knob Color Upper/Lower	Style Series	Stocked Catalog Numbers		
				Concentric Styles		
				Round—Round	Round—Ring Skirt	Round-Dial Skirt
				Upper/Lower	Upper/Lower	Upper/Lower
STANDARD SERIES ROUND TYPES ONLY						
1/2"/3/4"	1/8"/1/4"	Black/Black	50/70	—	—	50-1-1/70-3CB-2
1/2"/3/4"	1/8"/1/4"	Black White Dot/Black	50/70	—	—	50-1WD-1/70-3CB-2
3/4"/1"	1/8"/1/4"	Black/Black	70/90	70-1-1/90-1CB-2	70-1-1/90-2CB-2	70-1-1/90-3CB-2
3/4"/1"	1/8"/1/4"	Black White Dot/Black	70/90	70-1WD-1/90-1CB-2	70-1WD-1/90-2CB-2	70-1WD-1/90-3CB-2
3/4"/1"	3/16"/.267	Black/Black	70/90	70-1-3/90-1CB-4	—	70-1-3/90-3CB-4
1"/1.25"	3/16"/1/4"	Black/Black	90/125	—	—	90-1-3/125-3CB-2
DESIGNER SERIES ROUND TYPES ONLY						
3/4"/1"	1/8"/1/4"	Alum./Black	70/90	DS70-1-1/90-1CB-2	DS70-1-1/90-2CB-2	DS70-1-1/90-3CB-2
3/4"/1"	1/8"/1/4"	Alum. Black Dot/Black	70/90	DS70-1BD-1/90-1CB-2	DS70-1BD-1/90-2CB-2	DS70-1BD-1/90-3CB-2
3/4"/1"	3/16"/.267	Alum./Black	70/90	DS70-1-3/90-1CB-4	—	DS70-1-3/90-3CB-4
3/4"/1"	3/16"/.267	Alum. Black Dot/Black	70/90	—	—	—
1"/1.25"	1/8"/1/4"	Alum. Black Dot/Black	90/125	—	—	DS90-1BD-1/125-3CB-2
1"/1.25"	3/16"/1/4"	Alum./Black	90/125	—	—	DS90-1-3/125-3CB-2
STANDARD SERIES BAR TYPES ONLY						
1/2"/3/4"	1/8"/1/4"	Black/Black White Line	50/70	50-1-1/70B-1CB-2	50-1-1/70B-2CB-2	50-1-1/70B-3CB-2

RAYTHEON CONTROL KNOBS/REGENCY SERIES

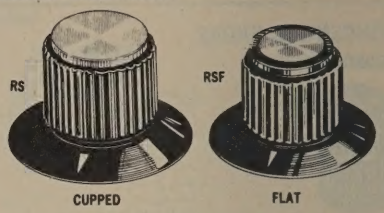
ROUND


RS
RSF
CUPPED
FLAT

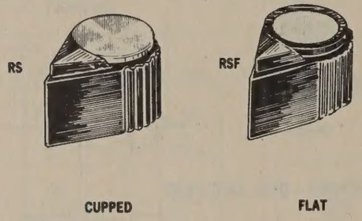
ROUND/RING SKIRT


RS
RSF
CUPPED
FLAT

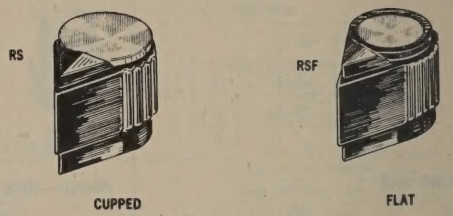
ROUND/DIAL SKIRT


RS
RSF
CUPPED
FLAT

POINTER

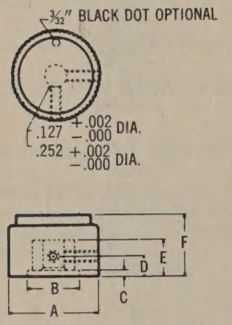

RS
RSF
CUPPED
FLAT

POINTER/RING SKIRT

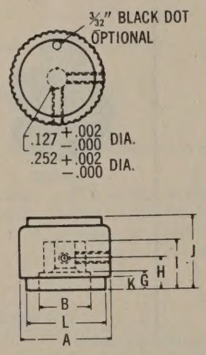

RS
RSF
CUPPED
FLAT

DIMENSIONS REGENCY SERIES

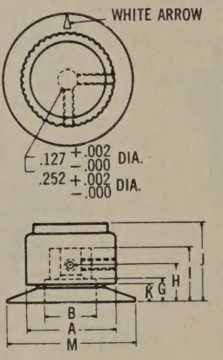
ROUND


3/32" BLACK DOT OPTIONAL
.127 +.002 −.000 DIA.
.252 +.002 −.000 DIA.
F
E
D
B
C
A

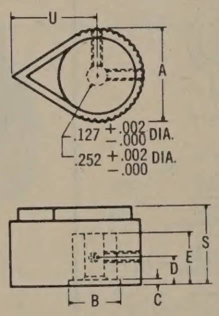
ROUND/RING SKIRT


3/32" BLACK DOT OPTIONAL
.127 +.002 −.000 DIA.
.252 +.002 −.000 DIA.
J
I
H
K G
B
L
A

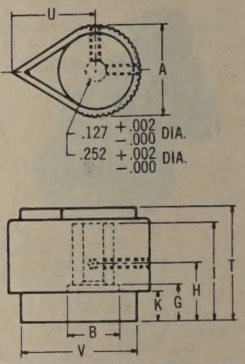
ROUND/DIAL SKIRT


WHITE ARROW
.127 +.002 −.000 DIA.
.252 +.002 −.000 DIA.
J
I
H
K G
B
A
M

POINTER


U
A
.127 +.002 −.000 DIA.
.252 +.002 −.000 DIA.
S
E
D
B
C

POINTER/RING SKIRT


U
A
.127 +.002 −.000 DIA.
.252 +.002 −.000 DIA.
T
I
H
K G
B
V

SPECIFICATIONS FOR ALL SERIES

STANDARD SERIES

A. Material and performance per MIL-K-3926
B. Dimensions per MS91528
C. Colors per FED-STD-595. Black No. 37038 (matte): 17038 (mirror). Gray No. 36231 (matt); 16231 (Mirror).
D. Moisture Resistance: 10 days, method 106 MIL-STD-202.
E. Salt Spray: 48 hours, method 101, Cond. B of MIL-STD-202.
F. Temperature: −65° to +125°C.
G. Torque: 15 pound inches with 4-40 set screws, maximum diameter ¾" 30 lb. inches with 8-32 set screw and larger diameters.
H. Set Screws: Corrosion treated steel with hex heads, cup points. Fluted socket and stainless steel types available.
J. Flammability: self extinguishing.

DESIGNER SERIES

Moisture Resistance: 10 days
Temperature: −65° to +125°C
Torque: 15 pound inches with 4-40 set screws, maximum diameter ¾", 30 lb. inches with 8-32 set screw and larger diameters.
Set Screws: Corrosion treated steel with hex heads, cup points. Fluted socket and stainless steel types available.

REGENCY SERIES

Molded parts in accordance with MIL-K-3926.
Color per FED-STD-595.
Black number 37038 (MATTE), 10738 (MIRROR).
Flammability: self extinguishing.
Set screws: per FFS200, corrosion-treated steel with hex heads and cup points.

See other Raytheon Products in EEM	
	Opto-electronics—Section 3700
	Switches—Section 5100
	Test Jacks—Section 2100
	Hardware—Section 2800

NOTES:

Standard Series

(a) Two set screws are provided:
4-40 UNC-3A on all 50 & 70 series and all 1/8" shaft models
8-32 UNC-3A on all others
(b) Custom skirt or body marking available on special order
(c) Some sizes available from stock in gray or red. Other colors on special order
(d) Reducing bushings available to reduce 1/4" shaft to 1/8" or 3/16" (RB-100=1/8") (RB-200=3/16")

Designer Series

(a) Two set screws are provided:
4-40 UNC-3A on all 70 series and 1/8" shaft models
8-32 UNC-3A on all others

400 and Panelrama Series

(a) Two set screws are provided:
4-40 UNC-3A on all 1/8" shaft models
6-32 UNC-3A on all others

Regency Series

(a) Two set screws are provided:
4-40 UNC-3A on all 1/8" shaft models
8-32 UNC-3A on 1/4" shaft models

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RAYTHEON CONTROL KNOBS/REGENCY SERIES

DIMENSIONS

Series	A +.030 −.010	B min.	C min.	D max.	E min.	F ±.030	G min.	H max.	I min.	J ±.030	K max.	L max.	M ±.050	S ±.030	T ±.030	U +.025 −.005	V max.
RS/RSF50	.500	.300	.026	.158	.405	.470	.177	.325	.560	.625	.175	.460	.900	—	—	—	—
RS/RSF70	.700	.485	.026	.187	.405	.590	.188	.369	.568	.780	.187	.680	1.150	.590	.765	.680	1.000
RS/RSF90	.900	.640	.114	.260	.520	.735	.320	.484	.730	.980	.235	.845	1.525	.735	.970	.885	1.345
RS/RSF125	1.250	.750	.114	.260	.455	.620	.250	.427	.605	.785	.175	1.185	1.837	—	—	—	—

*RS70, RS90, RSF70 and RSF90 series knobs available with 0.127 hole for 1/8" shafts at slight additional cost.

Note: Two set screws are provided:
4-40 UNC-3A on all 50 & 70 Series and 1/8" shaft models
8-32 UNC-3A on all others

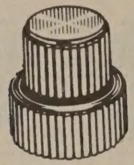
SELECTION GUIDE

STOCKED CATALOG NO.

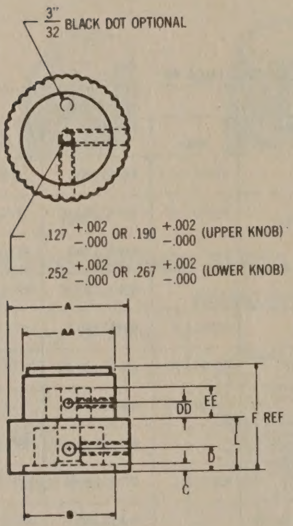
Style	Finish		Knob Dia. (Inches Approx.)	*Shaft Dia. (Inches)	Knob Height (Inches Approx.)	Dial Skirt Dia. (Inches Approx.)	Pointer Radius (Inches Approx.)	Dimension Drawing Reference	Cupped RS Series			Flat RSF Series		
	Matte	Mirror							Plain	Black Dot	Black 1/2 Line	Plain	Black Dot	Black 1/2 Line
Round	—	X	1/2	1/8	1/2	—	—	50	—	—	—	RSF50-1-1	RSF50-1BD-1	RSF50-1BL-1
	X	—	1/2	1/8	1/2	—	—	50	—	—	—	RSF50-1-1G	RSF50-1BD-1G	RSF50-1BL-1G
	—	X	3/4	1/4	5/8	—	—	70	RS70-1-2	RS70-1BD-2	—	—	RSF70-1BD-2	RSF70-1BL-2
	X	—	3/4	1/4	5/8	—	—	70	RS70-1-2G	RS70-1BD-2G	—	—	RSF70-1BD-2G	RSF70-1BL-2G
	—	X	1	1/4	3/4	—	—	90	—	—	—	RSF90-1-2	RSF90-1BD-2	RSF90-1BL-2
	X	—	1	1/4	3/4	—	—	90	—	RS90-1BD-2G	—	RSF90-1-2G	RSF90-1BD-2G	RSF90-1BL-2G
	—	X	1-1/4	1/4	5/8	—	—	125	RS125-1-2	—	—	RSF-125-1-2	RSF125-1BD-2	—
	X	—	1-1/4	1/4	5/8	—	—	125	—	—	—	—	RSF125-1BD-2G	RSF125-1BL-2G
Round with Ring Skirt	—	X	1/2	1/8	5/8	—	—	50	—	RS50-2BD-1	—	RSF50-2-1	RSF50-2BD-1	RSF125-2BL-1
	X	—	1/2	1/8	5/8	—	—	50	RS50-2-1G	—	RS50-2BL-1G	—	RSF50-2BD-1G	RSF50-2BL-1G
	—	X	3/4	1/4	3/4	—	—	70	RS70-2-2	RS70-2BD-2	—	RSF70-2-2	RSF70-2BD-2	RSF70-2BL-2
	X	—	3/4	1/4	3/4	—	—	70	RS70-2-2G	RS70-2BD-2G	RS70-2BL-2G	RS70-2-2G	RSF70-2BD-2G	RSF70-2BL-2G
	—	X	1	1/4	1	—	—	90	RS90-2-2	—	—	RSF90-2-2	RSF90-2BD-2	RSF90-2BL-2
	X	—	1	1/4	1	—	—	90	—	—	—	RSF90-2-2G	RSF90-2BD-2G	RSF90-2BL-2G
	—	X	1-1/4	1/4	3/4	—	—	125	—	—	—	—	RSF125-2BD-2	—
	X	—	1-1/4	1/4	3/4	—	—	125	—	—	—	—	RSF125-2BD-2G	RSF125-2BL-2G
Round with Dial Skirt	—	X	1/2	1/8	5/8	1	—	50	RS50-3-1	—	—	RSF-50-3-1	—	—
	X	—	1/2	1/8	5/8	1	—	50	RS50-3-1G	—	—	RSF-50-3-1	—	—
	—	X	3/4	1/4	3/4	1-1/8	—	70	RS70-3-2	—	—	—	—	—
	X	—	3/4	1/4	3/4	1-1/8	—	70	RS70-3-2G	—	—	—	—	—
	—	X	1	1/4	1	1-1/2	—	90	RS90-3-2	—	—	RSF-90-3-2	—	—
	X	—	1	1/4	1	1-1/2	—	90	RS90-3-2G	—	—	RSF-90-3-2G	—	—
Pointer	—	X	3/4	1/4	1/2	—	5/8	70	RS70-4-2	—	—	RSF-70-4-2	—	—
	X	—	3/4	1/4	1/2	—	5/8	70	RS70-4-2G	—	—	RSF-70-4-2G	—	—
	—	X	1	1/4	3/4	—	7/8	90	—	—	—	RS—90-4-2	—	—
	X	—	1	1/4	3/4	—	7/8	90	RS90-4-2G	— —	—	RSF-90-4-2G	—	—
Pointer with Ring Skirt	—	X	3/4	1/4	3/4	—	5/8	70	RS70-5-2	—	—	RSF-70-5-2	—	—
	X	—	3/4	1/4	3/4	—	5/8	70	RS70-5-2G	—	—	RSF-70-5-2G	—	—
	—	X	1	1/4	1	—	7/8	90	RS90-5-2	—	—	RSF-90-5-2	—	—
	X	—	1	1/4	1	—	7/8	90	RS90-5-2G	—	—	RSF-90-5-2G	—	—

RAYTHEON CONTROL KNOBS/REGENCY SERIES/CONCENTRIC

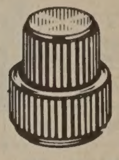
ROUND—ROUND



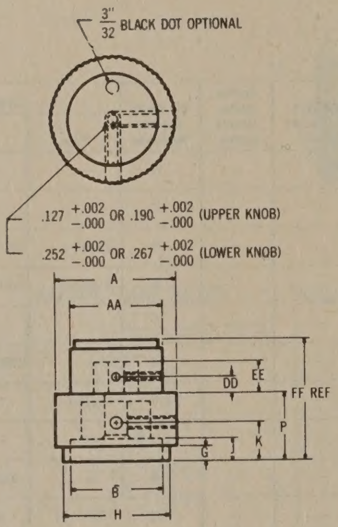
CUPPED STYLE SHOWN.


3"/32 BLACK DOT OPTIONAL
.127 +.002 −.000 OR .190 +.002 −.000 (UPPER KNOB)
.252 +.002 −.000 OR .267 +.002 −.000 (LOWER KNOB)
A
AA
DD
EE
F REF
L
D
C
B

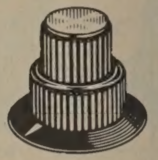
ROUND—RING SKIRT



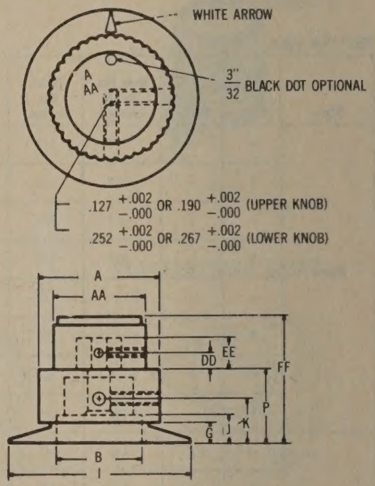
CUPPED STYLE SHOWN.


3"/32 BLACK DOT OPTIONAL
.127 +.002 −.000 OR .190 +.002 −.000 (UPPER KNOB)
.252 +.002 −.000 OR .267 +.002 −.000 (LOWER KNOB)
A
AA
DD
EE
FF REF
P
K
G
J
B
H

ROUND—DIAL SKIRT



CUPPED STYLE SHOWN.


WHITE ARROW
3"/32 BLACK DOT OPTIONAL
A
AA
.127 +.002 −.000 OR .190 +.002 −.000 (UPPER KNOB)
.252 +.002 −.000 OR .267 +.002 −.000 (LOWER KNOB)
A
AA
DD
EE
FF
P
G
J
K
B
I

EXPLANATION OF CATALOG DESIGNATIONS FOR CONCENTRIC KNOBS

Concentric knobs bear a dual designation, those at the left of the slash mark describe the upper round knob (1) the series, (2) the diameter, (3) the cap marking if any. The designations to the right of the slash mark describe for the lower concentric knob (1) the diameter, (2) the type, (3) the through shaft hole size and (4) the finish of both upper and lower knobs.

Note: Two set screws are provided:
4-40 UNC-3A on all 1/8" shaft models
8-32 UNC-3A on 1/4" shaft models

DIMENSIONS

Series	A +.030 −.010	AA +.030 −.010	B min.	C min.	D max.	DD max.	EE min.	F ref.	FF ref.	G max.	H max.	I min.	J max.	K max.	L ±.015	P ±.025
RS/RSF50/70	.700	.500	.485	.026	.187	.158	.405	.980	1.309	.187	.680	1.150	.188	.369	.510	.690
RS/RSF70/90	.900	.700	.640	.114	.260	.187	.405	1.310	1.550	.235	.845	1.525	.320	.484	.655	.885
RS/RSF90/125	1.250	.900	.750	.114	.260	.260	.520	1.365	1.545	.175	1.185	1.837	.250	.427	.530	.700

Style	Finish Upper and Lower		Knob Dia. (Inches Approx.)		Overall Height (Inches (Approx.)	Shaft Dia. (Inches)		Dial Skirt (Inches Approx.) Lower Only	Dimension Drawing Reference	STOCKED CATALOG NUMBERS					
										Cupped RS Series Upper Knob			Flat RSF Series Upper Knob		
	Matte	Mirror	Upper	Lower		Upper	Lower			Plain	Black Dot	Black 1/2 Line	Plain	Black Dot	Black 1/2 Line
Round Round	—	X	1/2	3/4	1	1/8	1/4	—	50/70	RS50/70-1-2	—	—	RSF50/70-1-2	—	—
	X	—	1/2	3/4	1	1/8	1/4	—	50/70	RS50/70-1-2G	RS50BD/70-1-2G	RS50BL/70-1-2G	RSF50/70-1-2G	RSF50BD/70-1-2G	RSF50BL/70-1-2G
	—	X	3/4	1	1-3/8	1/8	1/4	—	70/90	RS70/90-1-2	RS70BD/90-1-2	RS70BL/90-1-2	RSF70/90-1-2	RSF70BD/90-1-2	RSF70BL/90-1-2
	X	—	3/4	1	1-3/8	1/8	1—	—	70/90	RS70/90-1-2G	RS70BD/90-1-2G	RS70BL/90-1-2G	RSF70-90-1-2G	RSF70BD/90-1-2G	RSF70BL/90-1-2G
	—	X	1	1-1/4	1-3/8	1/8	1/4	—	90/125	RS90/125-1-2	RS90BD/125-1-2	RS90BL/125-1-2	RSF90/125-1-2	RSF90BD/125-1-2	RSF90BL/125-1-2
	X	—	1	1-1/4	1-3/8	1/8	1/4	—	90/125	RS90/125-1-2G	RS90BD/125-1-2G	RS90BL/125-1-2G	RSF90/125-1-2G	RSF90BD/125-1-2G	RSF90BL/125-1-2G
Round Ring Skirt	—	X	1/2	3/4	1-1/4	1/8	1/4	—	50/70	RS50/70-2-2	—	RS50BL/70-2-2	RSF50/70-2-2	RSF50BD/70-2-2	RSF50BL/70-2-2
	X	—	1/2	3/4	1-1/4	1/8	1/4	—	50/70	RS50/70-2-2G	RS50BD/70-2-2G	RS50BL/70-2-2G	RSF50/70-2-2G	RSF40BD/70-2-2G	RSF50BL/70-2-2G
	—	X	3/4	1	1-1/2	1/8	1/4	—	70/90	RS70/90-2-2	RS70BD/90-2-2	RS70BL/90-2-2	RSF70/90-2-2	RSF70BD/90-2-2	RSF70BL/90-2-2
	X	—	3/4	1	1-1/2	1/8	1/4	—	70/90	RS70/90-2-2G	RS70BD/90-2-2G	RS70BL/90-2-2G	RSF70/90-2-2G	RSF70BD/90-2-2G	RSF70BL/90-2-2G
	—	X	1	1-1/4	1-1/2	1/8	1/4	—	90/125	RS90/125-2-2	RS90BD/125-2-2	RS90BL/125-2-2	RSF90/125-2-2	RSF90BD/125-2-2	RSF90BL/125-2-2
	X	—	1	1-1/4	1-1/2	1/8	1/4	—	90/125	RS90/125-2-2G	RS90BD/125-2-2G	RS90BL/125-2-2G	RSF90/125-2-2G	RSF90BD/125-2-2G	RSF90BL/125-2-2G
Round Dial Skirt	—	X	1/2	3/4	1-3/8	1/8.	1/4	1-1/8	50/70	—	—	—	RSF50/70-3-2	RSF50BD/70-3-3	RSF50BL/70-3-2
	X	—	1/2	3/4	1-3/8	1/8	1/4	1-1/8	50/70	RS50/70-3-2G	RS50BD/70-3-2G	RS50BL/70-3-2G	RSF50/70-3-2G	RSF50BD/70-3-2G	RSF50BL/70-3-2G
	—	X	3/4	1	1-1/2	1/8	1/4	1-1/2	70/90	RS70/90-3-2	RS70BD/90-3-2	RS70BL/90-3-2	RSF70/90-3-2	RSF70BD/90-3-2	RSF70BL/90-3-2
	X	—	3/4	1	1-1/2	1/8	1/4	1-1/2	70/90	RS70/90-3-2G	RS70BD/90-3-2G	RS70BL/90-3-2G	RSF70/90-3-2G	RSF70BD/90-3-2G	RSF70BL/90-3-2G
	—	X	1	1-1/4	1-1/2	1/8	1/4	1-7/8	90/125	RS90/125-3-2	RS90BD/125-3-2	RS90BL/125-3-2	RSF90/125-3-2	RSF90BD/125-3-2	RSF90BL/125-3-2
	X	—	1	1-1/4	1-1/2	1/8	1/4	1-7/8	90/125	RS90-125-3-2G	RS90BD/125-3-2G	RS90BL/125-3-2G	RSF90/125-3-2G	RSF90BD/125-3-2G	RSF90BL/125-3-2G

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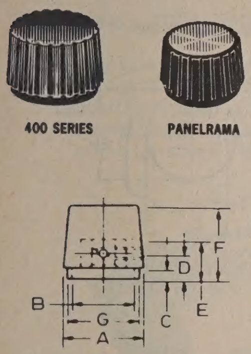
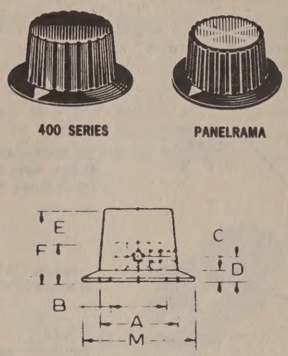
RAYTHEON CONTROL KNOBS/400 & PANELRAMA SERIES

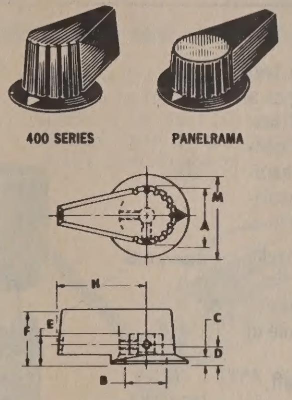
ROUND



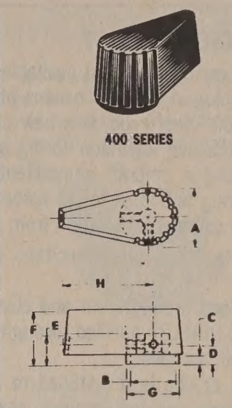
ROUND/DIAL SKIRT



POINTER/DIAL SKIRT



POINTER



DIMENSIONS 400 SERIES AND PANELRAMA

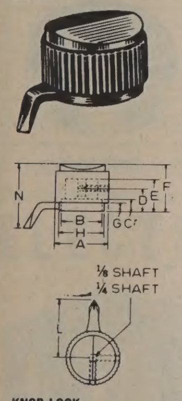
Series No.		A	B	C	D	E	F	G	H	J	K	M
400 Series	Panel Rama	+.025 −.005	min.	min.	max.	min.	±.030	max.	max.	max.	max.	max.
—	PS6	.625	.458	.120	.290	.625	.813	.558	.910	—	—	.925
407	PS7	.720	.520	.120	.290	.625	.813	.640	1.120	—	—	1.050
409	—	.875	.660	.120	.290	.625	.813	.800	1.375	1.540	.500	1.270
412	PS12	1 250	1.041	.120	.290	.625	.813	1.170	2.000	1.540	.500	1.710

SELECTION GUIDE 400 SERIES AND PANELRAMA

Knob Dia. Panel End (Appx.)	Shaft Size	Knob Hght. (Appx.)	Dial Skirt Dia. (Appx.)	Pointer Radius (Appx.)	Dimension Series Ref.	STOCKED CATALOG NUMBERS												
						Round				Round/Dial Skirt				Pointer/Dial Skirt			Pointer	
						400 Series			Panelrama	400 Series			Panelrama	400 Series		Panelrama	400 Series	
						Black	Beige	Blue Gray	Black	Black	Beige	Blue Gray	Black	Black	Beige	Black	Black	Beige
5/8"	1/4"	13/16"	1"	—	PS6	—	—	—	—	—	—	—	PS6D2K1R	—	—	—	—	—
3/4"	1/8"	13/16"	1"	—	407	407R1K1	—	—	—	407D1K1	—	—	—	—	—	—	—	—
3/4"	1/4"	13/16"	1-1/16"	1-1/8"	PS7/407	407R2K1	407R2K3	407R1K7	PS7R2K1R	407D2K1	407D2K3	407D2K7	PS7D2K1R	407PD2K1	407PD2K3	PS7PD2K1R	407P2K1	—
7/8"	1/4"	13/16"	1-1/4"	1-3/8"	409	409R2K1	409R2K3	—	—	409D2K1	409D2K3	—	—	409PD2K1	409PD2K3	—	409P2K1	—
1-1/4"	1/4"	13/16"	1-11/16"	2"	PS12/412	412R2K1	412R2K3	—	—	412D2K1	412D2K3	—	PS12DK1R	412PD2K1	—	—	412P2K1	412P2K3

KNOB LOCKS – STANDARD SERIES

POINTER



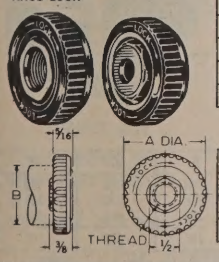
SELECTION GUIDE KNOB LOCK POINTER

Knob Dia. (Appx.)	Shaft Dia.	Dimension Dwg. Series	Stocked Catalog No.
			Knob Lock Pointer
			Black
3/4"	1/4"	70	50-1LK-2
1"	1/4"	90	90-1LK-2
1-1/4"	1/4"	125	125-1LK-2

KNOB LOCK POINTER DIMENSIONS

Series	A +.030 −.010	B min.	C min.	D max.	E min.	F ±.030	G max.	H max.	L max.	N max.
70	.700	.560	.188	.369	.568	.782	.187	.680	.812	1.154
90	.905	.640	.320	.437	.680	.958	.235	.845	.968	1.310
125	1.250	1.090	.250	.442	.605	.862	.175	1.185	1.125	1.215

KNOB LOCK



SELECTION GUIDE KNOB LOCKS

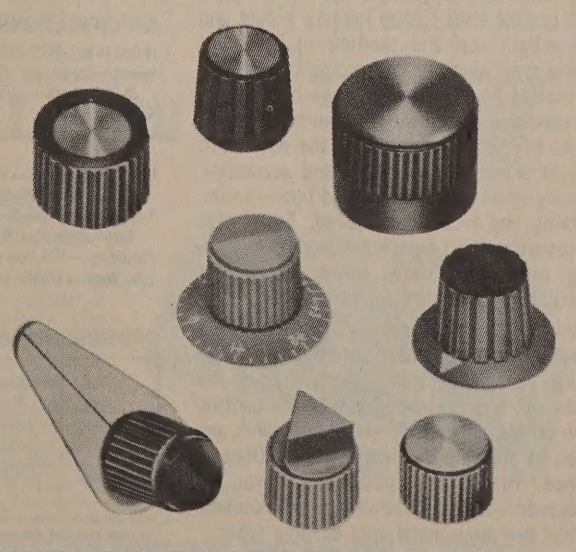
Knob Dia. (Appx.)	Thread	Dimension Series No.	Stocked Catalog Numbers	
			Knob Locks	
			Black Standard	Splash Proof
3/4"	3/8-32	70	KL701	KL703
3/4"	1/4-32	70	KL702	—
1"	3/8-32	90	KL901	KL902
1-1/4"	3/8-32	125	KL1251	KL1252

KNOB LOCK DIMENSIONS

Series	A	B
70	1	.721
90	1-5/16	.928
125	1-5/8	1.269

CUSTOM CONTROL KNOBS

Increase the sales appeal of your equipment by coordinating its front panel design. Control Knobs don't have to be just functional "add-on" accessories; you can design your knobs to enhance the appearance of panels and instruments. Our product specialist will assist you in your design efforts by selecting the exact color, size, shape and materials to fully satisfy your requirements.



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RAYTHEON

BINDING POSTS/SHAFT LOCKS

5-WAY BINDING POST

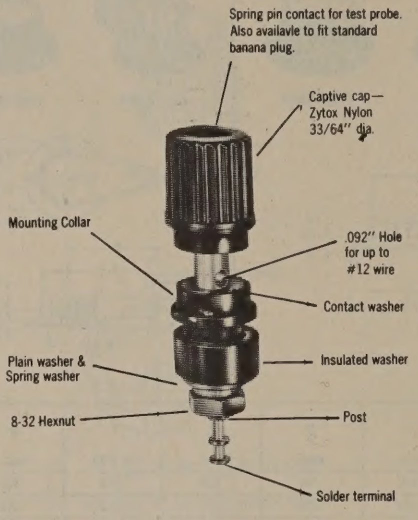
The only 5-way binding post available in two models, for plug-in of either banana plug or a standard .080″ test prod, this new unit features the exclusive Raytheon spring pin contact, providing a smooth comsistent, hard-gripping spring action. A tough nylon insulator provides complete insulation from ground.

The following types of connecitons may be made:

1. Wire looped around shaft and clamped.
2. Wire (up to #12) inserted through hole in shaft and clamped.
3. Alligator or clip lead fastened to shaft.
4. Spade lug inserted around shaft and clamped.
5. Either banana plug or .080″ test prod (depending on model used) plugged into post at the top of the fluted cap.

The solder terminal is tin plated to provide for instant soldering. A flat on one side of the nylon mounting collar permits mounting in a punched "D" hole to prevent rotation.

All metal parts are plated to withstand a 50-hour salt spray test. The unit has passed a 250-hour, 95 per cent relative humidity test at 40°C with no adverse effects.

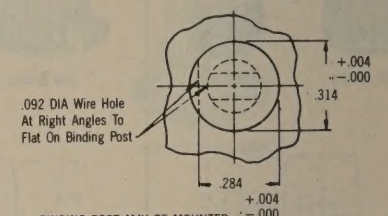

Spring pin contact for test probe. Also availavle to fit standard banana plug.
Captive cap—Zytox Nylon 33/64″ dia.
Mounting Collar
.092″ Hole for up to #12 wire
Contact washer
Insulated washer
Plain washer & Spring washer
8-32 Hexnut
Post
Solder terminal

SPECIFICATIONS

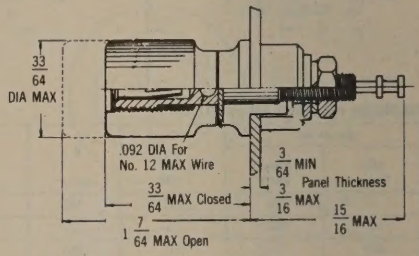
Electrical Rating: Current Capacity: 30 amperes. Operating voltage: 1000 volts RMS. Capacitance to ground: 1.9 mmf (mounted on a 1/8″ panel) with a dissipation factor of .0053 at 1000 cps.

Panel thickness range: 3/64 min. to 3/16 max.

MOUNTING HOLE DIMENSIONS


+.004
−.000
.314
.092 DIA Wire Hole At Right Angles To Flat On Binding Post
.284
+.004
−.000

BINDING POST MAY BE MOUNTED IN ROUND OR KEYED HOLE AS SHOWN


33/64 DIA MAX
.092 DIA For No. 12 MAX Wire
3/64 MIN
Panel Thickness
3/16 MAX
33/64 MAX Closed
1 7/64 MAX Open
15/16 MAX

ORDERING DATA

CATALOG NUMBERS		
Color	For .080 Test Prod	For Banana Plug
Black Red	BP-100B BP-101B	BP-105B BP106R

Other colors available on special order

SHAFT LOCKS

Raytheon Shaft Locks prevent control shafts from rotating under conditions of shock, vibration, or accidental contact. They form a dust and waterproof seal at the shaft and also at the panel surface. One-piece construction, they are simple, effective, and inexpensive.

The Shaft Lock's tapered nylon collar grips the control shaft tightly forming a dust and water-tight seal and exerting an even frictional drag which resists accidental rotation. A molded lip at the outer edge of the base compresses against the panel surface to complete the sealing function of the device. To adjust the control smoothly and accurately, merely insert a screwdriver and turn—no unlocking and relocking required. Tests have demonstrated no significant change in locking torque and water sealing even after 10,000 full on-full off cycles.

Shaft Locks mount directly to the threaded bushing found on most potentiometers and other variable controls. Simply discard the nuts and washers supplied with the control, slip on the Shaft Lock, and tighten with any type of standard 1/2 inch wrench. Once in place, the Shaft Lock need never be loosened—a distinct advantage over conventional two-piece metal split bushing types.

The Knob Lock, Model SL-110B, fits underneath the 90 Series knob and is completely out of sight. It is often a replacement for more expensive and complicated locking devices and provides the same high quality performance as the regular models.

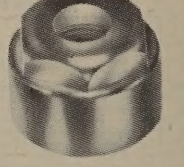
SPECIFICATIONS

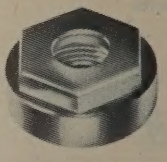
Nylon—MIL-M-20693
Insert—Brass per QQ-B-626 Nickel plated per QQ-N-290, Class I, Type V
Shock—50 g's
Vibration—5 hours at 10 to 55 cps with amplitude of 0.06″
Water Immersion—50 hours under 3 ft. head of water. Control shaft rotated every 10 hours.
Temperature Shock—Five cycles of 30 munutes at each extreme, −55°C and +85°C
Humidity—150 hours at 95% relative lhumidity 40°C
Life Wear—10,000 complete cycles

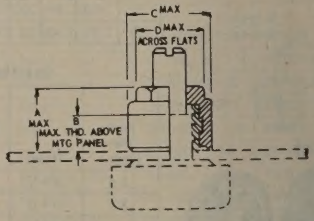
ORDERING DATA

	Catalog No.	For Shaft Size	Control Bushing Thread Size	Color
Shaft Lock Models	SL-100B SL-101R SL-105B	1/4″ 1/4″ 1/8″	3/8-32 NEF-2 3/8-32NEF-2 1/4-32 NEF-2	Black Red Black
Knob Locking Model*	SL-110B	1/4″	3/8-32 NEF-2	Black

*Use with any 90 Series, or larger, ring or dial skirted round, skirted pointer, or crank knob. See also page 11 for other knob locks.


Shaft Lock


Knob Lock


C MAX
D MAX ACROSS FLATS
A MAX
B MAX. THD. ABOVE MTG PANEL

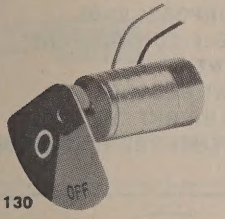
DIMENSIONS

MODEL	A	B	C	D
SL-100B SL-101R SL-105B	.480 .480 .317	.348 .348 .223	.630 .630 .455	.505 .505 .380
SL-110B	.286	.187	.630	.505

ELECTROMAGNETIC INDICATORS

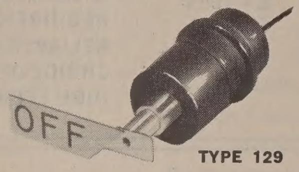
ALLARD INSTRUMENT DIV.
OF AFI

Designed for compact instrument and control panels, Allard miniature electromagnetic indicators provide positive visual signaling, are not subject to burnout, assure high readability in strong incident light. One-piece balanced rotor for dependable performance under shock and vibration. Models for momentary or latching operation, from DC or rectified AC. All models can be supplied to meet particular requirements for operating voltage, type of display and mounting, to commercial or MIL specifications.



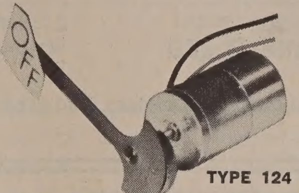
TYPE 130

Tiny indicator, totally enclosed structure. Rotation up to 60°. CW or CCW. For use with plug-on flags. Operates in any position. Case size: 7/16" O.D. x 25/32" L.



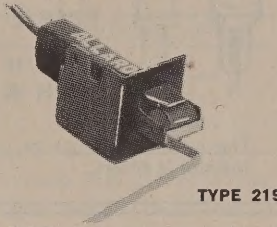
TYPE 129

Short, powerful semaphore indicator for CW or CCW rotation using demountable flag arms. Rotational anges to 60°. Works in any position. 7/16" diam. x 3/4" long.



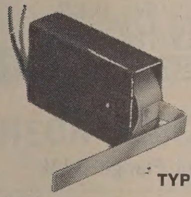
TYPE 124

Miniaturized semaphore indicator with rotation up to 60°. Available with CW or CCW rotation. For use with plug-on flags. Operates in any position. Case size: 3/8" O.D. x .575" long.



TYPE 219

Relatively inexpensive version of our highly successful instrument and panel mount indicator. Can display legends on the drum face or rotate a flag arm CW or CCW. 2 or 3 position momentary or 2 position latching operation. Indicator drum is .300" wide x .300" diam. Total length is 1⅝".

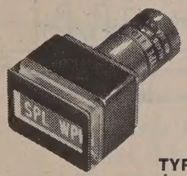


TYPE 109

2 or 3 position slim indicator for narrow locations. Can supply power to rotate a flag arm up to 60° or can display a legend directly on rotor face. CW or CCW for two position operation. .270" x .562" x 1".

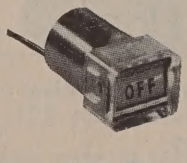
TYPE 108

Small indicator for 2- or 3-position momentary or 2-position latching (memory) indication. Prism-cut plastic lens in head can focus external light on indicator face. Colors or legends as required. 1⅛" long, 3/8" dia., 7/16" square head.



TYPE 110

Extended face indicator, permits display of complete words - or multiple symbols. For 2- or 3-position momentary, or 2-position latching indication. Plastic capped for dust and moisture protection. Length 1¾", head 1" by ¾".



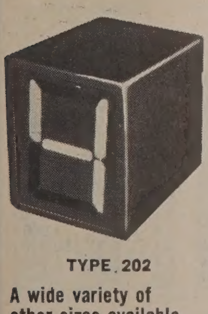
TYPE 120

Tiny broad faced indicator available with 2- or 3-position momentary or 2-position latching indication. Shows colors or legends. Head is 9/16" wide by 7/16" high. Body ½" dia. Overall length 15/16".

Types	130	129	124	219	109	108	110	120
D.C. VOLTAGES	To 28	To 40	To 40	To 40	To 40	To 90	To 50	To 40
OPERATING POWER (WATTS)	0.8	0.9	1.0	0.9	1.0	1.0	0.5	0.5
NO. OF CONNECTIONS	2	2	2	2, 3, 4	2, 3, 4	2, 3	2, 3, 4	2, 3
WEIGHT (GRAMS)	10	10.5	5	15	9.	10.6	35	9.5

ELECTROMECHANICAL READOUTS

All units illustrated are made under one or more of the following patents:
Re 24943/3,096,594
3,273,270/3,553,619



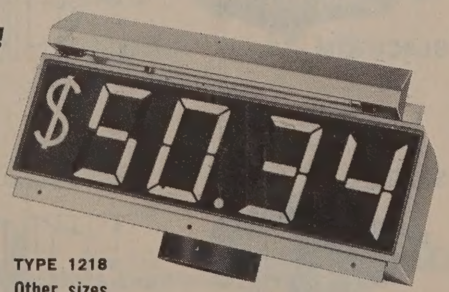
TYPE 202

A wide variety of other sizes available in single and multi-unit packages.

Compact digital indicating modules for instrument, data presentation and other display systems. Seven electromagnetic indicating segments can be operated in any desired combination by low power DC signals. Momentary or latching types. Windings available from 1 to 30 V, 1 15/16" h. x 1 7/16" w. x 2¼" d. Digit size 1½" h. x 1" w. Other digit sizes up to 4" and custom units, with as many lines as necessary, also available. Operating time less than 0.03 sec. Units also supplied with packaged encoders and decoders.

High Visibility!
Inherent Memory!

Complete readout display operating as remote repeater of cash register readings. Contains readouts, encoding matrices, pulsing and cycling circuitry and its own power supply. Use of latching (memory) type readouts makes average power consumption negligible. Packaged for all-weather, outdoor use. Uses 4 Type 218 readouts, 4" high.



TYPE 1218
Other sizes available

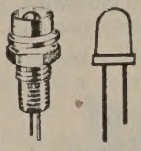
For literature or quotations on electromagnetic instruments and controls, call or write

ALLARD INSTRUMENT DIV. OF AFI
770 MAIN STREET, WESTBURY, L. I., N. Y. 11590 • (516) 334-8742

ARCOLECTRIC CORPORATION

Dept. EM, P.O. Box 348 • 11120 Chandler Blvd. • North Hollywood, California 91603
TEL: 213-985-3130 TEL: 213-877-6969 TELEX: 65-1349

REFER TO OTHER EEM PAGE FOR ARCOLECTRIC SWITCH PRODUCTS



		Typical Forward Voltage	
SL48	LED Lamp Holder		
SL48/L	Holder with LED	1.6 Volts @ 20mA	
SL48/H	Holder with **HIGH INTENSITY** LED	2.2 Volts @ 10mA	2.4 Volts @ 20mA

These indicators can be used on higher voltages if an appropriate series resistor is fitted.

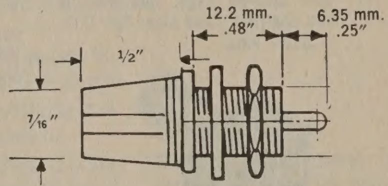
- T-1¾ DIAMETER PACKAGE
- LIGHT OUTPUT CATEGORIES
- DIFFUSED
- GENERAL PURPOSE LEADS
- IC COMPATIBLE/LOW CURRENT REQUIREMENTS
- RELIABLE AND RUGGED
- CHOICE OF 4 BRIGHT COLORS HIGH EFFICIENCY RED YELLOW GREEN

POLYCARBONATE LAMP HOLDERS

All Lamp Holders can be supplied complete with Lamps listed, for alternative Lamp types consult factory.

TRANSPARENT RED, AMBER, GREEN, BLUE and CLEAR

SL60

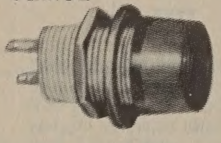


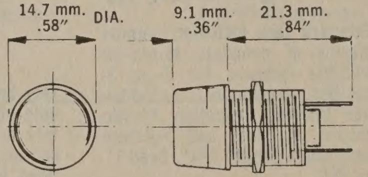
Terminals	Mounting Hole Diameter	Maximum Panel Thickness
Solder	⅜″	.34″

Midget Screw T-1¾

LES/6V	0.6W
LES/12V	0.75W
LES/28V	0.04W

SLM62



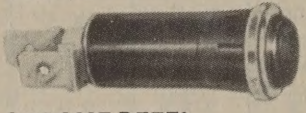


Solder	½″	.38″

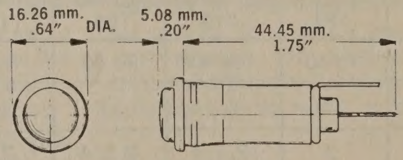
Midget Flange T-1¾

LAMP NO.	VOLTS	AMPS	HOURS	CANDLE POWER
328	6.0	.20	1,000	.63
330	14.0	.08	1,500	.50
382	14.0	.08	15,000	.30
370	18.0	.04	10,000	.15
327	28.0	.04	4,000	.34
387	28.0	.04	7,000	.30

SL67/C

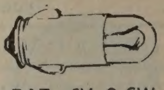


CHROME BEZEL



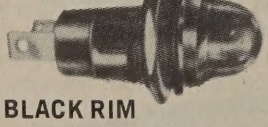
Lamp replaceable from rear only.

.250 Tab	½″ Snap in Fit	.045

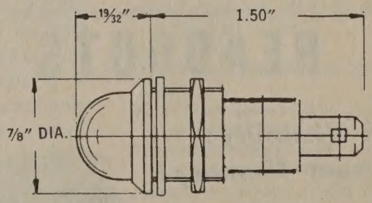


BA7	6V	0.6W
BA7	12V	2.0W
BA7	24V	1.5W

SL138/C



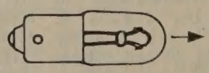
BLACK RIM



Lamp replaceable from front only.

.250 Tab	¾″	.25″

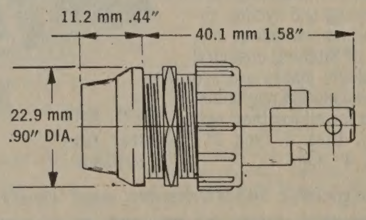
T3¼ Bulb Min. Bay. Base



LAMP NO.	VOLTS	AMPS	WATTS	C.P.	LIFE (HRS.)
49	2.0	0.06	0.12	0.04	1,000
45	3.2	0.35	1.12	0.50	3,000
47	6.3	0.15	0.95	0.52	3,000
1847	6.3	0.15	0.95	0.38	3,000
44	6.3	0.25	1.6	0.90	3,000
1866	6.3	0.25	1.6	0.65	20,000
755	6.3	0.15	0.95	0.33	50,000
1891*	14.0	0.24	3.4	2.0	500
1815*	14.0	0.20	2.8	1.4	3,000
756	14.0	0.08	1.1	0.31	50,000
1819	28.0	0.04	1.1	0.34	1,000
1829	28.0	0.07	1.9	1.0	1,000

SL392/C

CHROME BEZEL



.250 Tab	¾″	.25″

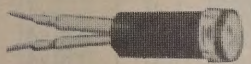
Lamp replaceable from Front or Rear

ARCOLECTRIC CORPORATION

Dept. EM, P.O. Box 348 • 11120 Chandler Blvd. • North Hollywood, California 91603
TEL: 213-985-3130 TEL: 213-877-6969 TELEX: 65-1349

REFER TO OTHER EEM PAGE FOR ARCOLECTRIC SWITCH PRODUCTS

SUB-MINIATURE INDICATORS

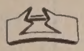


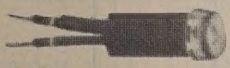
SL 44/C

VOLTAGE	CURRENT	AVERAGE LIFE
5/6 V	.04 A	10,000 hours
12/14 V	.04 A	10,000 hours
24/28 V	.025 A	1,000 hours

Built-in filament bulb. 8″ long P.V.C. covered wire leads. Polycarbonate lens: RED, GREEN, AMBER, BLUE or CLEAR. Chrome plated brass bezels Factory standard SL44/12V; others available on special order.

TINNERMAN SPEED NUTS





SL 45/C

Built-in neon tube. 8″ long P.V.C. covered wire leads. Polycarbonate lens: RED, AMBER or CLEAR only. Chrome plated brass bezels. The appropriate series resistor is built-in to one of the leads. Typical life for neons is 10,000 hours. Available in 100/120V AC/DC and 200/250V AC/DC voltage ranges. Factory standard SL45/125V; others available on special order.

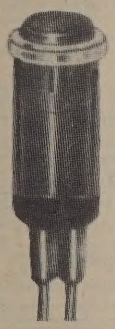
MTG. HOLE DIA. ¼″

NEON INDICATORS

All neon indicators shown below have built-in resistors designed for high-brightness 125 volt operation.

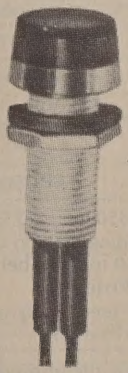
Colors: red/amber/clear. Some types can be ordered with green lens: consult factory.

SL67N/WL

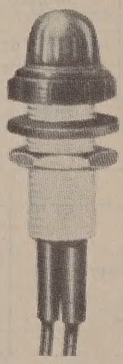


UL
recognized
component

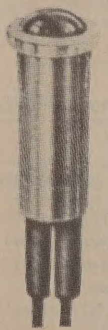
SL77



SL78



SL267/B



UL
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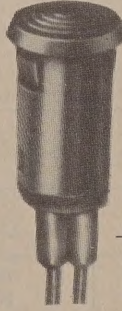
component

SL589/WL



UL
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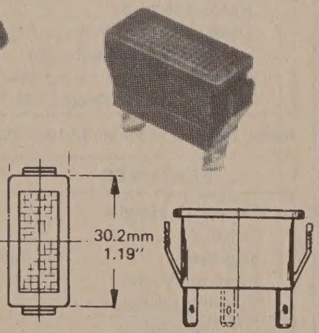
component

SL430/125V



UL
recognized
component

TERMINALS
FOR .63mm .25″
SNAP-ON
CONNECTORS

6″ PVC insulated stranded wire leads

	SL67N/WL	SL77	SL78	SL267/B	SL589/WL	SL430/125V
MOUNTING HOLE DIAMETER	½″ Snap In	.375″	.375″	.375″	½″ Snap In	1.11″ x .452″ 28.2 x 11.5 MM
MAXIMUM PANEL THICKNESS	.045″	¹¹⁄₁₆″	²¹⁄₃₂″	.035″ To .045″	.043″	.03″ To .13″
LENGTH BACK OF PANEL	1.50″	1.34″	1.25″	1.47″	1.50″	1.0″

Details of international approvals for switches and indicators on request.

BSI DVE S D UL SA SABS

BECKMAN®

SP-300 Series Displays

SPECIFICATIONS	SP-330 SERIES			SP-350 SERIES		
DC Characteristics	Minimum	Typical	Maximum	Minimum	Typical	Maximum
Display Supply Voltage (1)	160 Vdc	180 Vdc	Note 2	160 Vdc	180 Vdc	Note 2
Anode-to-Anode Differential Voltage (3)	—	—	14 Vdc	—	—	14 Vdc
Anode-to-Cathode Voltage Drop (Typical Current)	—	135 Vdc	—	—	135 Vdc	—
Cathode Current — Typical Segment (Seg. "b") (4)	70 μA	180 μA	250 μA	130 μA	330 μA	420 μA
Cathode Current — Decimal Point (4)	60 μA	135 μA	190 μA	65 μA	135 μA	190 μA
Cathode Current — Plus Sign	110 μA	290 μA	400 μA	260 μA	585 μA	820 μA
Cathode Current — Minus Sign	50 μA	135 μA	185 μA	120 μA	270 μA	380 μA
Cathode Current — Keep Alive	10 μA	50 μA	—	10 μA	50 μA	—
Power Dissipation per digit (With all segments lighted and assuming typical segment current)	—	175 mW	—	—	325 mW	—
Operating Temperature	0°C	—	70°C	0°C	—	70°C
Storage Temperature	—55°C	—	125°C	—55°C	—	125°C

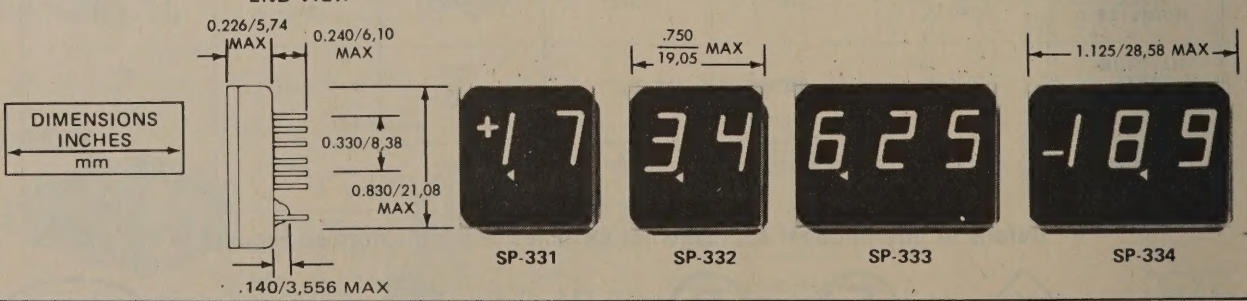
Multiplex Characteristics	SP-330 SERIES			SP-351-356 SERIES		
	Minimum	Typical	Maximum	Minimum	Typical	Maximum
Anode On Time (11)	80 μsec.	200 μsec.	—	80 μsec	200 μsec	—
Interdigit Blanking Time (12)(13)	40 μsec	55 μsec.	—	40 μsec	55 μsec	—
Refresh Period	—	—	Note 6	—	—	Note 6
Display Supply Voltage (8)	160 Vdc	180 Vdc	Note 2	160 Vdc	180 Vdc	Note 2
Anode Voltage Swing (8)	30 Vdc	45 Vdc	90 Vdc	30 Vdc	45 Vdc	90 Vdc
Cathode Voltage Swing (8)	30 Vdc (8)	50 Vdc	120 Vdc	30 Vdc (8)	50 Vdc	120 Vdc
Cathode Bias Voltage ("On" Anode to "Off" Cathode Voltage) (9)	90 Vdc	115 Vdc	120 Vdc	90 Vdc	115 Vdc	120 Vdc

Multiplex Characteristics	SP-357 and 358 Series		
	Minimum	Typical	Maximum
Anode On Time (11)	80 μsec.	400 μsec.	—
Interdigit Blanking Time (12) (13)	50 μsec.	100 μsec.	—
Refresh Period	—	—	Note 6
Display Supply Voltage (8)	160 Vdc	180 Vdc	Note 2
Anode Voltage Swing (8)	30 Vdc	45 Vdc	90 Vdc
Cathode Voltage Swing (8)	30 Vdc	50 Vdc	120 Vdc
Cathode Bias Voltage ("On" Anode to "Off" Cathode Voltage) (9)	90 Vdc	115 Vdc	120 Vdc

Notes: Refer to notes on SP-101/102 page.

FEATURES	SP-330 SERIES	SP-350 SERIES
Character Height	0.330 inch/8,38 mm	0.550 inch/13,97 mm
Color	Orange (Neon Glow)	Orange (Neon Glow)
Brightness	210 foot lamberts at typical current	210 foot lamberts at typical current
Viewing Angle	130 degrees	130 degrees
Viewing Distance	20 feet/6,10 meters	40 feet/12,20 meters
Life Expectancy	>10 years	>10 years

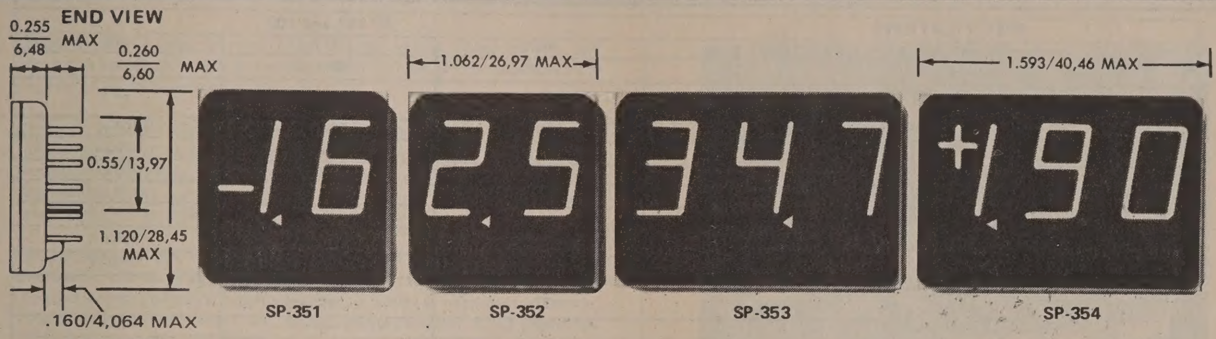
The SP-330 and SP-350 Series Displays are designed for interfacing with MOS/LSI and are recommended for use in all dc or multiplexed applications, with or without suppressed (blanked) zeros. The displays can be quickly, easily read even in direct sunlight. Continuous, "no gap" characters make the displays most attractive to users. A keep-alive cathode provides an internal ion source that reduces reionization time to less than 30 microseconds, allows zero suppression, and improves the operation of the display in dark environments and at low temperatures. Units are horizontally stackable in any combination with uniform centerline spacing.



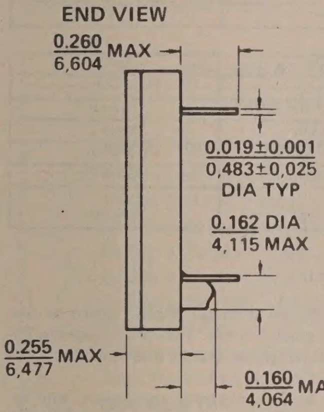
BECKMAN INSTRUMENTS, INC. INFORMATION DISPLAYS OPERATIONS
350 North Hayden Rd. P.O. Box 3579
Scottsdale, Arizona 85257 (602) 947-8371

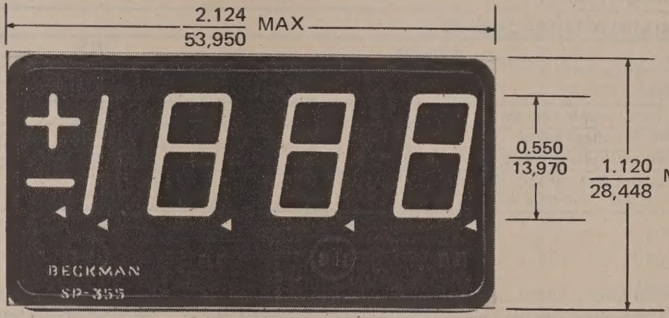
BECKMAN®

SP-300 & SP-252 Displays


END VIEW
0.255/6,48 MAX
0.260/6,60 MAX
0.55/13,97
1.120/28,45 MAX
.160/4,064 MAX
1.062/26,97 MAX
1.593/40,46 MAX

SP-351 SP-352 SP-353 SP-354


END VIEW
0.260/6,604 MAX
0.019±0.001/0,483±0,025 DIA TYP
0.162 DIA/4,115 MAX
0.255/6,477 MAX
0.160/4,064 MAX


2.124/53,950 MAX
0.550/13,970
1.120/28,448 MAX

SP-355

SP-350 displays not shown:
SP-356 — 4 digit, general application SP-357 — 3 ½ digit + colon, 12-hr. clock SP-358 — 4 digit + colon, 24-hr. clock

SPECIFICATIONS	SP-252
DC Characteristics	**Typical**
Display Supply Voltage (1)(2)	180 Vdc
Anode-to-Anode Differential Voltage	Note 10
Anode-to-Cathode Voltage Drop (1 Segment b = 330 µA)	135 Vdc
Cathode Current — Per Segment	330 µA
Cathode Current — Decimal Pt.	135 µA
Cathode Current — Keep Alive	50 µA
Power Dissipation (With All Segments Lighted @ 330 µA Typ.)	575 mW
Operating Temperature	0 – 70°C
Storage Temperature	-55 – 125°C

SPECIFICATIONS	SP-252
Multiplex Characteristics	**Typical**
Anode On Time	200 µsec
Interdigit Blanking Time(12) (1 Segment = 850 µA @ 180V)	55 µsec
Refresh Period(6)	<10 msec
Display Supply Voltage(2)	180 Vdc
Anode Voltage Swing	45 Vdc
Cathode Voltage Swing(8)	50 Vdc
Cathode Bias Voltage(9) (On "Anode to Off" Cathode Voltage)	110 Vdc

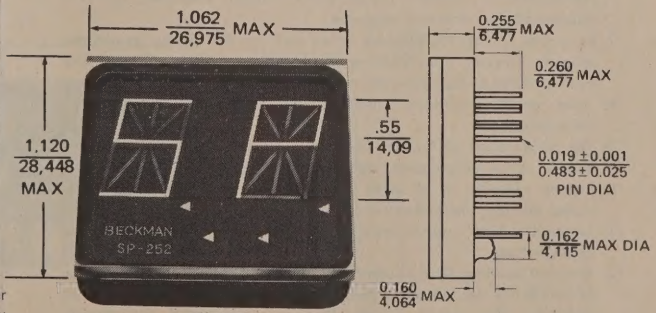
Features	SP-252
Character Height	0.55 inch/13,97mm
Color	Orange (Neon Glow)
Brightness	210 ft.-Lamberts Nom. (720 cd/m^2)
Viewing Angle	130 degrees
Viewing Distance	40 feet/12,20 meters
Life Expectancy	> 10 years

Mix-and-match versatility. Space and cost savings. That's what the new SP-252 is all about. It can be matched up with standard displays. And shows a mix of numeric and alphanumeric characters.

Specifically, the SP-252 can accommodate a set of approximately 60 characters. It can include all the letters in the alphabet, the numbers 0 to 9, plus some special symbols.

The SP-252 features a 0.55" (14.09) character height and the same character style as the Beckman SP-350 Series of numeric displays. Consequently, you can stack the SP-252 within the same series, as well as with the numeric displays, forming any desired field.

The modularity of the new SP-252 suggests a wide spectrum of applications, such as point-of-sale and terminal displays, showing status, monitoring, text and diagnostic information.


1.062/26,975 MAX
1.120/28,448 MAX
.55/14,09
0.255/6,477 MAX
0.260/6,477 MAX
0.019 ±0.001/0.483 ± 0.025 PIN DIA
0.162/4,115 MAX DIA
0.160/4,064 MAX

SP-252

END VIEW

DIMENSIONS
INCH
(mm)

BECKMAN INSTRUMENTS, INC. **INFORMATION DISPLAYS OPERATIONS**

350 North Hayden Rd. P.O. Box 3579
Scottsdale, Arizona 85257 (602) 947-8371

BECKMAN®

SP-101 and 102 Displays

SPECIFICATIONS	SP-101 and 102		
	MIN	TYP	MAX
Display Supply Voltage(1)	160 Vdc	180 Vdc	Note 2
Anode-to-Cathode Voltage Drop ('segment b = 700 μa)	—	135 Vdc	—
Cathode Current — Per Segment(3,4)	350 μa	700 μa	1000 μa
Cathode Current — Decimal Point	100 μa	200 μa	300 μa
Cathode Current — Comma (decimal point included)	200 μa	400 μa	600 μa
Cathode Current — Each Colon Segment(5)	50 μa	100 μa	150 μa
Cathode Current — Keep-Alive	15 μa	75 μa	—
Cathode Current — Plus Sign (SP-102 only)	650mA	1300mA	1900mA
Cathode Current — Minus Sign (SP-102 only)	275mA	550mA	750mA
Power Dissipation (With All Segments Lighted @ 700 μa Typical)(4)	—	725 mW	—
Operating Temperature	0°C	—	70°C
Storage Temperature	−55°C	—	125°C

MULTIPLEX CHARACTERISTICS

	MIN	TYP	MAX
Anode On Time(11,7)	80 μsec	400 μsec	—
Refresh Period	—	—	Note 6
Display Supply Voltage	160 Vdc	180 Vdc	Note 2
Anode Voltage Swing	30 Vdc	45 Vdc	90 Vdc
Cathode Voltage Swing	30 Vdc(8)	50 Vdc	120 Vdc
Cathode Bias Voltage ("ON" Anode to "OFF" Cathode Voltage)(9)	90 Vdc	110 Vdc	120 Vdc

Notes:

(Apply to SP-300, SP-252, SP-101 and SP-102 Series Displays)

1. The minimum recommended supply voltage required to ionize the display is 160 volts DC. After the display has ionized, the voltage drop is approximately 135 volts at Typical cathode current.
2. Display supply voltage (including ripple) should not exceed 200 Vdc when display is used with DD-700 or decoder/driver. Higher display supply voltages are acceptable when the drive device breakdown exceeds 80 volts DC.
3. A segment currents are ratioed to b segment.

a,d,f and g Current Ratio	1.00
c Current Ratio	1.25
e Current Ratio	1.20

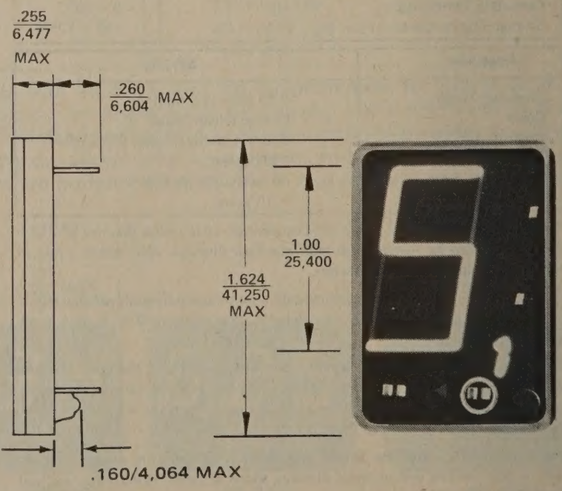
4. The minimum current is required for even segment glow. Currents up to 1.5 times the typical current may be used; however, life expectancy may be reduced by operation at excessively higher currents. For multiplexed (time shared) operation segment, currents may be increased to four times typical current with 0.25 or smaller duty cycle.
5. To ensure uniform operation of the two colon cathodes, it is recommended that each cathode have its own current limiting device (resistor or current sink). The current listed is the current required for each colon segment.
6. Keep-alive is recommended in all multiplexed applications. Three (3) milliseconds is maximum refresh period without keep-alive. Ten (10) milliseconds is typical with keep-alive.
7. No anode or cathode blanking is required for the display to perform properly, however, some blanking may be advantageous to eliminate time overlap of signals due to circuit characters.
8. Under specific conditions, Cathode Voltage Swings of as low as 10 volts are acceptable.
9. The combination of Cathode Bias Voltage and Cathode Voltage Swing must be within recommended display supply voltage.
10. Lighted cathodes on all digits with independent current limiting. For bussed cathodes (multiplexed operation), 90 volts is permissible.
11. Anode On Time assumes typical keep-alive current and typical anode supply voltage.
12. Specified blanking time assumes 520 μA typical segment current for the SP-330 Series and 900 μA typical segment current for the SP-350 Series with 180 Vdc supply voltage. Blanking requirements are strongly dependent upon the mode of multiplex operation and upon the segment current used.
13. The colons must have same blanking as any other cathode, and are only enabled during their respective digit times.

The SP-101 and 102 are planar, neon gas discharge displays similar to the Beckman SP-300 Series alphanumeric product family. They are intended to fill the need for display readability at distances greater than 40 feet/12 meters.

Both are recommended for either dc or multiplexed applications, with or without suppressed zeros. The displays can be quickly and easily read even in direct sunlight. Continuous, "no gap" characters made the displays most attractive to users.

A keep-alive cathode provides an internal ion source that reduces reionization time to less than 30 micro-seconds. This enhances dynamic response and improves multiplex, low temperature, and dark ambient performance. The units may be evenly or randomly spaced to build any display field desired.

The SP-101 contains a colon, and a comma and/or decimal points as shown below. The SP-102 has a plus and minus sign, decimal point and over range numeric one.



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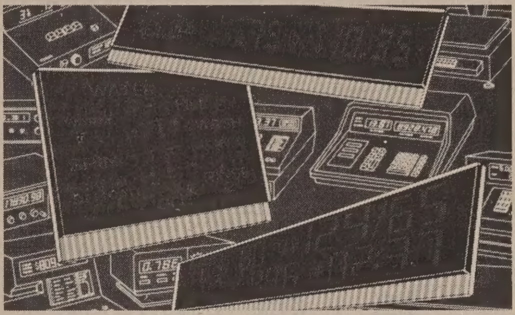
BECKMAN®

SP-400 Series Screened Image Displays

Beckman SP-400 Series Screened Image Displays let you choose the font, and the numeric style. Put together symbols, outline pictures, words, numbers in any way necessary to make your point.

Screened Image Displays offer display areas of up to 10" (254mm) by 2" (50.8mm) with characters that range from 1/4" (6,35mm) to 2" (50.8mm) in height. In other words, you're no longer limited to a certain number of digits, or even character size and style. At your direction, we will develop a display to fit your product's personality and specific requirements.

SP-400 displays can be operated Multiplexed or pulsed DC, and require, nominally, 180 Volts dc with standard drives (our own DD-700 for example). Connections can be made with flying leads, or with our edgeboard connector. The SP 421, described below, is a standard product member of the SP-400 line of custom, Screened Image Displays.



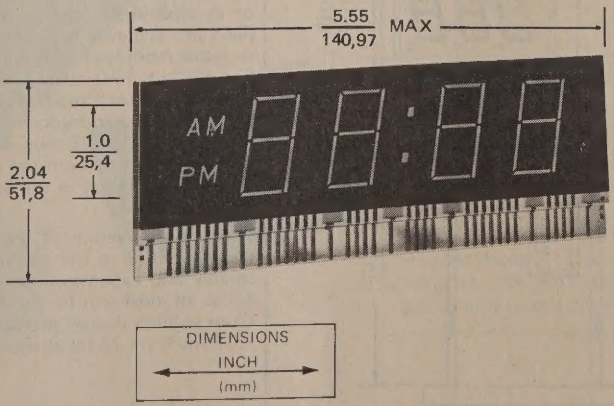
SPECIFICATIONS	SP-421		
Parameters	MIN	TYP	MAX
Anode Supply Voltage(1)	—	180 Vdc	Note 2
Anode-to-Cathode Voltage Drop(1)	—	145 Vdc	—
Anode Voltage Swing	—	50 Vdc	—
Cathode Current — Segment b(3)	2.2mA	2.7mA	3.3mA
Cathode Current — AM, PM	3.8mA	4.7mA	5.7mA
Cathode Current — Colon (both dots)	2.0mA	2.4mA	3.0mA
Cathode Current — Keep Alive	50μA	100μA	200μA
Turn on Delay	—	20μs	—
Initial Ionization Time	—	—	5s
Digit On-Time (Multiplexed)	100μs	500μs	1,000μs
Operating Temperature	0° C	—	+55°C

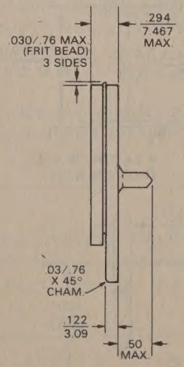
FEATURES	SP-421
Character Hieght	1.0 inch/25,4mm
Color	Orange (Neon Glow)
Brightness	150 foot lamberts (513cd/m^2) at nominal current
Viewing Angle	130 degrees
Viewing Distance	>40 feet/12,19m
Life expectancy	>10 years

Notes:

1. Cathode current (at segment b) of 2.7mA is assumed.
2. Display supply voltage (including ripple) should not exceed 200 Vdc when display is used with DD-700 Decoder/Driver. Higher display supply voltages may be used with devices having a higher breakdown voltage provided current is limited as specified.
3. The specified minimum value of current is the lowest which will produce an even glow on the reference segment, b. Derive min/typ/max values of other segment currents in proportion to segment b values as follows: segments a, d, f and g — 1.00; segment c — 1.25; and segment e — 1.20.

The SP-421 is a planar, neon-gas-discharge 12/24 hour time display designed for use in clocks whose style demands large numerals or in applications requiring readability beyond forty feet. Characters include four one-inch digits, AM and PM annunciators and colon. The SP-421 is designed to be driven by MOS/LSI chips and is recommended for use in pulsed dc or multiplexed applications.





END VIEW

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BECKMAN®

SM-800 Series Display Modules

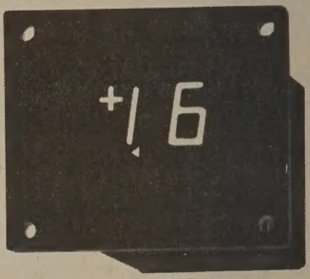
Type	Description		Electronics	Input
	Digit Positions	Digits		
SM-851	2	1-½	decoder, latch	BCD
SM-852	2	2	decoder, latch	BCD
SM-853	3	3	decoder, latch	BCD
SM-854	3	2-½	decoder, latch	BCD
SM-855	2	1-½	decoder, latch, counter	serial count
SM-856	2	2	decoder, latch, counter	serial count
SM-857	3	3	decoder, latch, counter	serial count
SM-858	3	2-½	decoder, latch, counter	serial count

MECHANICAL SPECIFICATIONS, INCH/MM

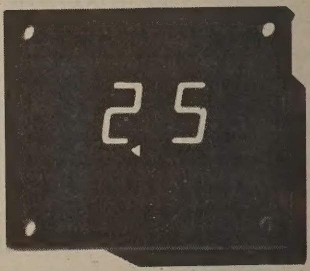
No. Digits	Body Width Dim A Nom	Bezel Width Dim B Nom	Filter Size 1.25/31,8x Dim C ± 0.015/,38	Panel Cutout Dim D	Hole Spacing Dim E +0.25/0,64 −0.000/0,00
2	1.30/33,0	1.98/50,3	1.51/38,4	1.42/36,1	1.68/42,7
3	1.83/46,5	2.51/63,8	2.04/51,8	1.94/49,3	2.21/56,1
4	2.40/61,0	3.08/78,2	2.62/66,5	2.52/64,0	2.78/70,6
5	2.93/74,4	3.61/91,7	3.15/80,0	3.05/77,5	3.31/84,1
6*	3.46/87,9	4.14/105,2	3.68/93,5	3.58/90,9	3.84/97,5
7	4.03/102,4	4.71/119,6	4.26/108,2	4.16/105,7	4.41/112,0
8**	4.56/115,8	5.24/133,1	4.79/121,7	4.69/119,1	4.94/125,5

*Assumes two each three digit displays
**Assumes two each three digit displays and one each two digit displays

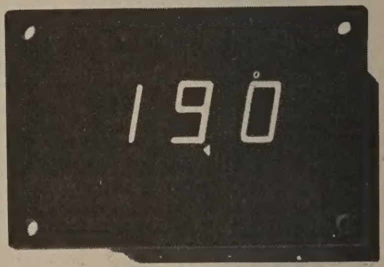
SM-851

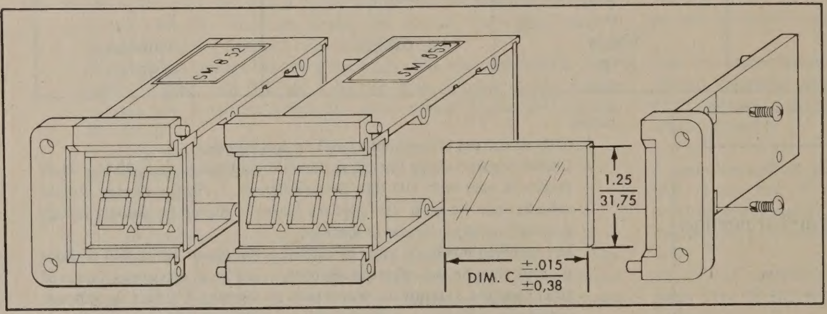


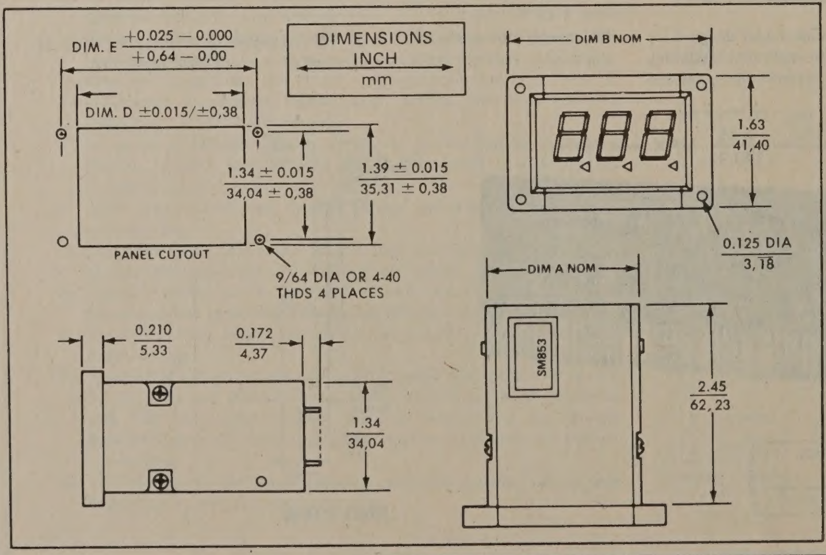
SM-852



SM-853




SM 852
SM 853
1.25
31,75
DIM. C
±.015
±0,38


DIM. E +0.025 − 0.000 / +0,64 − 0,00
DIM. D ±0.015/±0,38
DIMENSIONS
INCH
mm
1.34 ± 0.015
34,04 ± 0,38
1.39 ± 0.015
35,31 ± 0,38
PANEL CUTOUT
9/64 DIA OR 4-40 THDS 4 PLACES
DIM B NOM
1.63
41,40
0.125 DIA
3,18
DIM A NOM
SM853
2.45
62,23
0.210
5,33
0.172
4,37
1.34
34,04

The SM-800 Series modules provide the user with a modularly expandable display, complete electronics, and ready-to-mount convenience. The series is available in 1-½-, 2-, 2-½-, and 3-digit configurations that can be mounted individually or as multi-digit displays. These expanded displays are achieved by horizontally stacking two or more modules together. The maximum number of digits thus attainable is theoretically unlimited since each module contains its own drive and decode electronics. The SM-855, SM-856, SM-857 and SM-858 modules are supplied with counters in addition to the decoder/drivers and the latch provided in the SM-851, SM-852, SM-853 and SM-854.

The physical design of the package allows for easy mounting of the module(s). The ease of assembly and expansion make Beckman's SM-800 Series an ideal unit for inclusion in low and medium volume display products. Character height is 0.55 inch (14,09) for all modules.

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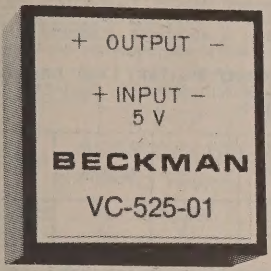
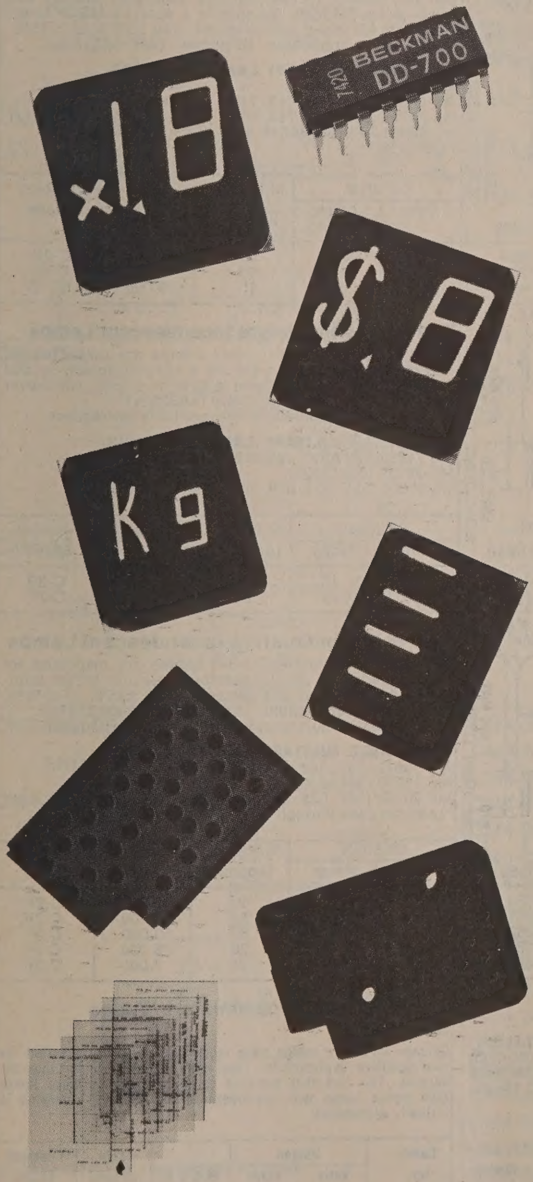
BECKMAN®

Display Accessories





Beckman provides a full line of related accessories, providing the design engineer with convenience of application and ease of implementation. These accessories include:

VC-525-01 Voltage Converters

For the display user who prefers to buy rather than build a power supply, Beckman offers economically priced dc/dc voltage converters designed specifically to operate with the Beckman Displays. These reliable voltage converters are of compact modular construction that provides an adjustable output: 170 to 210 Volts dc. 180 Volts is recommended for most dc and multiplexed applications. Unit operates from 5 Volt dc TTL/DTL logic supply.

Subassemblies

Beckman SP-300 Series Information Displays are available mounted on circuit boards. These circuit boards can be supplied in Custom configurations.

Subassemblies are available with either a lead frame or with the edge board connector. Both of these standard packages allow the user to mount the displays conveniently to a panel cutout and connect them directly into the electronic circuitry by means of standard off-the-shelf connectors. The lead frame configuration can also be connnected to the electronic circuitry by flow soldering.

Special Configurations

Beckman has the capability to design and produce displays for unique applications. Alpha readouts such as OHMS, VOLTS, AMPS, MPH, GPM and others can be combined with NUMERIC digits for special displays. You are invited to discuss your custom requirements with the local Beckman sales office.

CS-300 Connectors

Designed for use with the SP-300 Series. Units help simplify assembly; they may be attached with screws or soldered directly to a circuit board.

DD-700 Decoder/Driver with Current Regulated Outputs

This monolithic integrated circuit accepts TTL/DTL 8-4-2-1 binary coded decimal (BCD) information to direct drive the seven segment Beckman Display. A blanking input feature on the DD-700 provides unconditional blanking of all outputs while a ripple blanking feature allows suppression of unwanted leading and trailing zeros. The DD-700 has seven regulated, current programmable outputs capable of between 0.18 to 1.5 mA each. Regulation ensures constant brightness display operation under a changing supply voltage situation.

Pin Straighteners

Inexpensive pin straighteners are available for each display series. They are useful in realigning pins misaligned through handling, assuring ease of assembly.

Drafting Aids

Pin location drafting guides, Drafting Aids, are available for each display model. These handy mylar, transparent overlays provide the designer with a 4X enlargement, template like drafting guide for pin and circuit layout drawings.

BECKMAN INSTRUMENTS, INC. **INFORMATION DISPLAYS OPERATIONS**

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CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

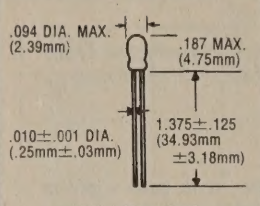
SUBMINIATURE INCANDESCENT LAMPS

T—3/4 Subminiature Incandescent Lamps

All Chicago Miniature T-3/4 Lamps are aged prior to selection for current (±10%) unless otherwise stated, and candlepower (MSCP). To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM7153AS15%). Other selection tolerances are available on request.

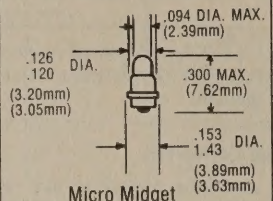
APPLICABLE MILITARY LAMP DRAWINGS
MS 90452(AS) (6803AS15, 6833AS15, 7133AS15, 7153AS15)

DESIGN		M.S.C.P.	Life	Filament
Volts	Amps (±10%)	(Approx.)	(Hours)	Shape
5.0	.060	.05	100,000	C-2R
5.0	.115	.15	40,000	C-2R


.094 DIA. MAX. (2.39mm)
.187 MAX. (4.75mm)
1.375±.125 (34.93mm ±3.18mm)
.010±.001 DIA. (.25mm±.03mm)

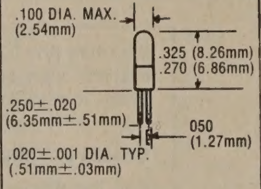
Wire Terminal

CM-6833
CM-7153


.094 DIA. MAX. (2.39mm)
.126 .120 DIA. (3.20mm) (3.05mm)
.300 MAX. (7.62mm)
.153 1.43 DIA. (3.89mm) (3.63mm)

Micro Midget Flanged Base

CM-8913
CM-8270


.100 DIA. MAX. (2.54mm)
.325 (8.26mm) .270 (6.86mm)
.250±.020 (6.35mm±.51mm)
050 (1.27mm)
.020±.001 DIA. TYP. (.51mm±.03mm)

Bi-Pin Base

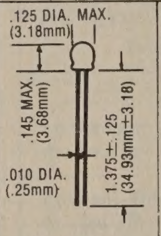
CM-7114
CM-7118

T—1 Subminiature Incandescent Lamps

All Chicago Miniature T-1 Lamps are aged prior to selection for current (±10%) unless otherwise stated, and candlepower (MSCP). To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM715AS15%).

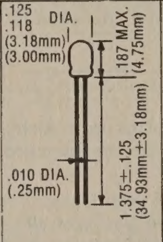
APPLICABLE MILITARY LAMP DRAWINGS
MS 3338 (6839AS25)
MS 24367 (680, 683, 713, 715)
MS 24515 (682, 685, 714, 718)
MS 90451(AS) (6802AS15, 6832AS15, 7132AS15, 7152AS15)

DESIGN		M.S.C.P.	Life	Filament
Volts	Amps (±10%)	(Approx.)	(Hours)	Shape
5.0	.060	.05	100,000	C-2R
5.0	.115	.15	40,000	C-2R
28.0	.024	.15	16,000	CC-2F


.125 DIA. MAX. (3.18mm)
.145 MAX. (3.68mm)
1.375±.125 (34.93mm±3.18)
.010 DIA. (.25mm)

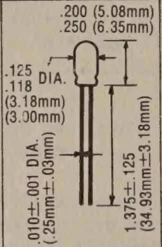
Short Wire Terminal .145 MAX.

CM-6832
CM-7152


.125 .118 DIA. (3.18mm) (3.00mm)
.187 MAX. (4.75mm)
1.375±.125 (34.93mm±3.18mm)
.010 DIA. (.25mm)

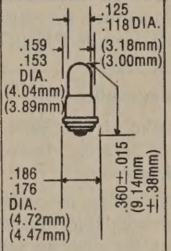
Intermediate Wire Terminal .187 MAX.

CM-6831
CM-7151


.200 (5.08mm) .250 (6.35mm)
.125 .118 DIA. (3.18mm) (3.00mm)
.010±.001 DIA. (.25mm±.03mm)
1.375±.125 (34.93mm±3.18mm)

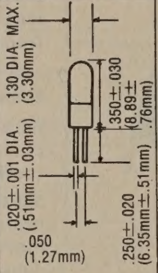
Standard Wire Terminal .250 MAX.

CM-683
CM-715
CM-6838


.125 .118 DIA. (3.18mm) (3.00mm)
.159 .153 DIA. (4.04mm) (3.89mm)
.360±.015 (9.14mm ±.38mm)
.186 .176 DIA. (4.72mm) (4.47mm)

Sub-Midget Flanged Base

CM-685
CM-718
CM-6839


.130 DIA. MAX. (3.30mm)
.350±.030 (8.89± .76mm)
.020±.001 DIA. (.51mm±.03mm)
.250±.020 (6.35mm±.51mm)
.050 (1.27mm)

Bi-Pin Base

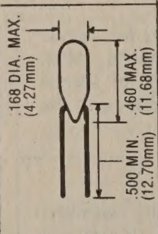
CM-7683
CM-7715
CM-7839

T—1-1/4 Subminiature Incandescent Lamps

All Chicago Miniature T-1-3/4 Lamps are inspected for current and light up. To specify a specific tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM2114AS25%). Other selection tolerances are available on request.

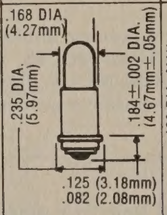
APPLICABLE MILITARY LAMP DRAWINGS
MS 25236 (323AS25, 8623AS25, 8639AS25)
MS 28135 (8627A525)
MS 51608 (325, 329, 673, 8635, 8641, 8644, 8662)

DESIGN		M.S.C.P.	Life	Filament
Volts	Amps	(Approx.)	(Hours)	Shape
3.0	.19	.25	350	C-2R
28.0	.04	.32	1,000	C-2F


.168 DIA. MAX. (4.27mm)
.460 MAX. (11.68mm)
.500 MIN. (12.70mm)

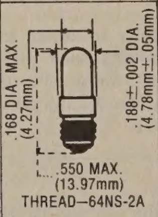
Wire Terminal

CM-324
CM-8627


.168 DIA. (4.27mm)
.235 DIA. (5.97mm)
.184±.002 DIA. (4.67mm±.05mm)
.125 (3.18mm) .082 (2.08mm)

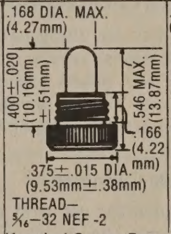
Special Midget Flanged Base

CM-8637
CM-8632


.168 DIA. MAX. (4.27mm)
.188±.002 DIA. (4.78mm±.05mm)
.550 MAX. (13.97mm)
THREAD—64NS-2A

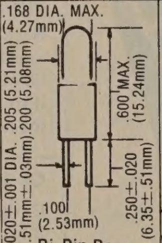
Special Screw Base

CM-325
CM-8635


.168 DIA. MAX. (4.27mm)
.400±.020 (10.16mm ±.51mm)
.546 MAX. (13.87mm)
.166 (4.22mm)
.375±.015 DIA. (9.53mm±.38mm)
THREAD— 5/16—32 NEF -2

Knurled Screw Base

CM-323
CM-8623


.168 DIA. MAX. (4.27mm)
.205 (5.21mm) .200 (5.08mm)
.600 MAX. (15.24mm)
.020±.001 DIA. (.51mm±.03mm)
.250±.020 (6.35mm±.51mm)
.100 (2.53mm)

Bi-Pin Base

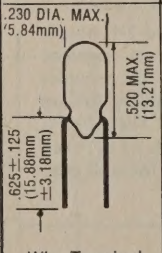
CM-7637
CM-7632

T—1-3/4 Subminiature Incandescent Lamps

All Chicago Miniature T-1-3/4 Lamps are inspected for current and light up. To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM380AS25%). Other selection tolerances are available on request.

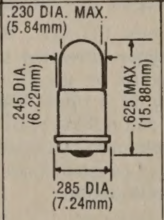
APPLICABLE MILITARY LAMP DRAWINGS
MS 15612 (335, 342, 1767, 1768, 1769)
MS 18209 (387AS25)
MS 25237 (327, 328, 330, 338, 368)
*Lamp to pass through .236″ cylinder .625″ long dia.

DESIGN		M.S.C.P.	Life	Filament
Volts	Amps	(Approx.)	(Hours)	Shape
6.0	.20	.60	1,000	C-2R
6.3	.20	.40	50,000	C-2R
14.0	.08	.30	50,000	C-2F
28.0	.04	.30	25,000	C-2F
28.0	.04	.34	7,000	C-2F


.230 DIA. MAX. (5.84mm)
.520 MAX. (13.21mm)
.625±.125 (15.88mm ±3.18mm)

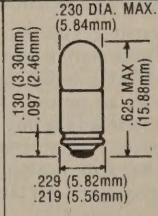
Wire Terminal

CM-1784
CM-2181
CM-2182
CM-2187
CM-1764


.230 DIA. MAX. (5.84mm)
.245 DIA. (6.22mm)
.625 MAX. (15.88mm)
.285 DIA. (7.24mm)

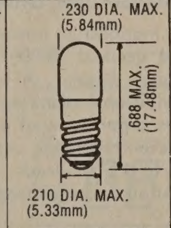
Midget Flanged Base

CM-328
CM-381
CM-382
CM-387
CM-327


.230 DIA. MAX. (5.84mm)
.130 (3.30mm) .097 (2.46mm)
.625 MAX (15.88mm)
.229 (5.82mm) .219 (5.56mm)

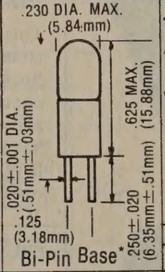
Midget Grooved Base

CM-337
CM-379
CM-386
CM-388
CM-334


.230 DIA. MAX. (5.84mm)
.688 MAX. (17.48mm)
.210 DIA. MAX. (5.33mm)

Midget Screw Base

CM-1768
CM-378
CM-8362
CM-399
CM-335


.230 DIA. MAX. (5.84mm)
.625 MAX. (15.88mm)
.020±.001 DIA. (.51mm±.03mm)
.250±.020 (6.35mm±.51mm)
.125 (3.18mm)

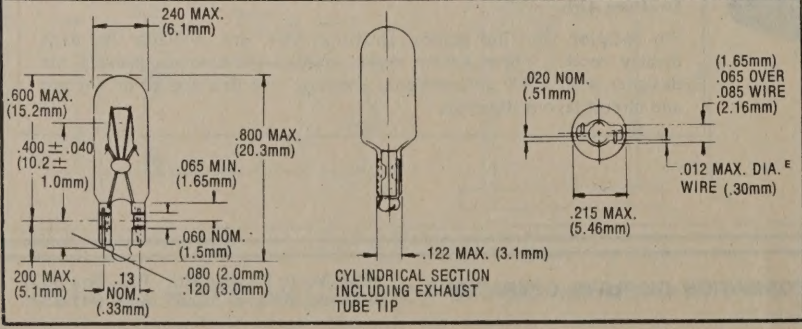
Bi-Pin Base*

CM-7328
CM-7381
CM-7382
CM-7387
CM-7327

T—1-3/4 (6mm) Subminiature Wedge Base Lamps

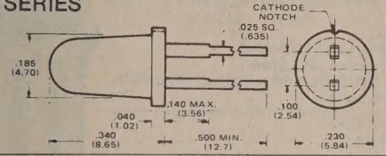
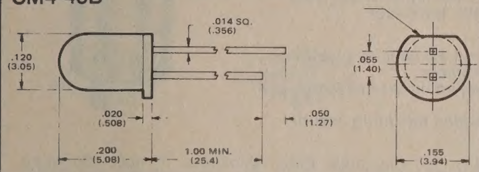
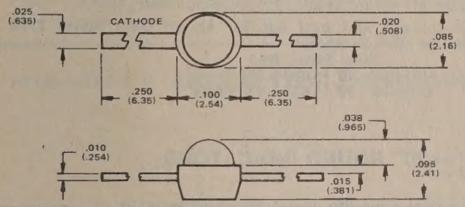
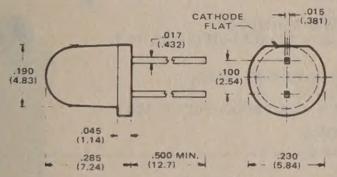
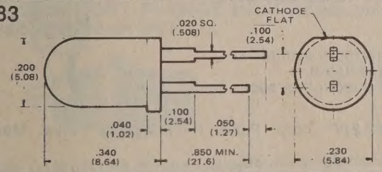
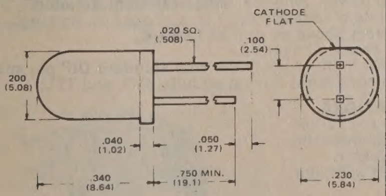
Chicago Miniature wedge base lamps are particularly suited for cost-sensitive applications. They can be designed for low-cost sockets. The fact that there is no metal base to these lamps also means lamps will not freeze in the sockets, corrosion is virtually eliminated.

Lamp No.	Design Volts	Amps	M.S.C.P.	Life (Hours)	Filament Shape
CM-37	14.0	.09	.50	1,500	C-2F
CM-73	14.0	.08	.30	15,000	C-2F
CM-84	6.3	.04	.03	10,000	C-2R
CM-85	28.0	.04	.30	7,000	C-2F
CM-86	6.3	.20	.40	20,000	C-2F


240 MAX. (6.1mm)
.600 MAX. (15.2mm)
.400±.040 (10.2± 1.0mm)
.800 MAX. (20.3mm)
.065 MIN. (1.65mm)
.060 NOM. (1.5mm)
200 MAX. (5.1mm)
.13 NOM. (.33mm)
.080 (2.0mm) .120 (3.0mm)
.122 MAX. (3.1mm)
CYLINDRICAL SECTION INCLUDING EXHAUST TUBE TIP
.020 NOM. (.51mm)
(1.65mm) .065 OVER .085 WIRE (2.16mm)
.012 MAX. DIA. WIRE (.30mm)
.215 MAX. (5.46mm)

SOLID STATE LAMPS

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

SERIES	DEVICE NO.	LENS			LIGHT COLOR	LUMIUOUS INTENSITY, TYPICAL, @ 'F = 20 mA, mcd	VIEWING ANGLE, TYPICAL
		SHAPE	TINT	DIFFUSION			
CM4-20 SERIES  CATHODE NOTCH .025 SQ. (.635) .185 (4.70) .140 MAX. (3.56) .100 (2.54) .040 (1.02) .340 (8.65) .500 MIN. (12.7) .230 (5.84)	CM4-20	Tapered	Clear	Transparent	Red	2.0	90°
	CM4-21	Tapered	Clear	Diffused	Red	1.6	90°
	CM4-22	Tapered	Red	Transparent	Red	1.6	90°
	CM4-23	Tapered	Red	Diffused	Red	.4	180°
	CM4-24	Tapered	Red	Diffused	Red	3.0	60°
	CM4-25	Tapered	Red	Diffused	Red	1.6	90°
CM4-43B  .014 SQ. (.356) .120 (3.05) .055 (1.40) .020 (.508) .050 (1.27) .200 (5.08) 1.00 MIN. (25.4) .155 (3.94)	CM4-43B	Cylindrical	Red	Diffused	Red	1.0	90°
	CM4-244B	Cylindrical	Red	Diffused	Red	5.0	90°
	CM4-344B	Cylindrical	Green	Diffused	Green	1.0	90°
	CM4-444B	Cylindrical	Orange	Diffused	Orange	5.0	90°
	CM4-544B	Cylindrical	Yellow	Diffused	Yellow	4.0	90°
CM4-50 SERIES  .025 (.635) CATHODE .020 (.508) .085 (2.16) .250 (6.35) .100 (2.54) .250 (6.35) .038 (.965) .010 (.254) .096 (2.41) .015 (.381)	CM4-50	(Axial Lead)	Clear	Transparent	Red	1.4	90°
	CM4-53	(Axial Lead)	Red	Diffused	Red	1.0	80°
CM4-73A  CATHODE FLAT .015 (.381) .017 (.432) .190 (4.83) .100 (2.54) .045 (1.14) .285 (7.24) .500 MIN. (12.7) .230 (5.84)	CM4-73A	Cylindrical	Red	Diffused	Red	2.0	70°
CM4-83  CATHODE FLAT .020 SQ. (.508) .100 (2.54) .200 (5.08) .100 (2.54) .040 (1.02) .050 (1.27) .340 (8.64) .850 MIN. (21.6) .230 (5.84)	CM4-83	Cylindrical	Red	Diffused	Red	2.0+	24°
	CM4-83-2	Cylindrical	Red	Diffused	Red	3.0+	24°
	CM4-83-3	Cylindrical	Red	Diffused	Red	4.0+	24°
						+ @ IF = 10 mA	
CM4-80B SERIES AND CM4-X80B SERIES  CATHODE FLAT .020 SQ. (.508) .100 (2.54) 200 (5.08) .040 (1.02) .050 (1.27) .340 (8.64) .750 MIN. (19.1) .230 (5.84)	CM4-80B	Cylindrical	Clear	Transparent	Red	2.0	50°
	CM4-81B	Cylindrical	Clear	Diffused	Red	1.6	72°
	CM4-82B	Cylindrical	Red	Transparent	Red	2.0	50°
	CM4-84B	Cylindrical	Red	Diffused	Red	1.6	80°
	CM4-85B	Cylindrical	Red	Diffused	Red	.8	110°
	CM4-86B	Cylindrical	Red	Diffused	Red	.6	150°
	CM4-282B	Cylindrical	Red	Transparent	Red	40.0	28°
	CM4-283B	Cylindrical	Red	Diffused	Red	8.0	24°
	CM4-284B	Cylindrical	Red	Diffused	Red	4.0	65°
	CM4-382B	Cylindrical	Green	Transparent	Green	15.0	28°
	CM4-383B	Cylindrical	Green	Diffused	Green	3.0	24°
	CM4-384B	Cylindrical	Green	Diffused	Green	1.5	65°
	CM4-482B	Cylindrical	Orange	Transparent	Orange	40.0	28°
	CM4-483B	Cylindrical	Orange	Diffused	Orange	8.0	24°
	CM4-484B	Cylindrical	Orange	Diffused	Orange	4.0	65°
	CM4-582B	Cylindrical	Yellow	Transparent	Yellow	45.0	28°
	CM4-583B	Cylindrical	Yellow	Diffused	Yellow	10.0	24°
DIMENSIONS IN INCHES (MM)	CM4-584B	Cylindrical	Yellow	Diffused	Yellow	6.0	65°

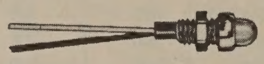
TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

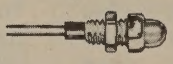
or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

LED INDICATOR LIGHTS

LED ASTROLITES


With Wire Leads
6039-004-304


With Wire Termin:
6039-005-304

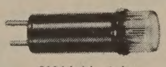
Chicago Miniature/Drake's high brightness LED lamps may be operated directly from low-level logic circuitry which makes them ideal for computer, numerical control, medical instruments and other sophisticated applications. Available in green, red and amber. Long life expectancy (years). Bright light can be seen from across average room. Overall size—17/64" dia.; 6" leads; other lead lengths on special order.

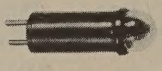
Mtg. hole dia. — .193"; max. panel thk. 3/16"; centers 11/32"; LED COLORS: green, red and yellow.

ELECTRICAL (25°C): Forward voltage: 2.1 VDC — Red. 2.6 VDC — Green & Yellow. Reverse voltage: 4.0 DC max. Forward current: (If) 15mA — Red. 40mA — Green & Amber. Power dissipation: 225 mw. max. Luminous intensity: Red @ 15mA=2.4 MCD. Green & Amber @ 40mA=4.5 MCD.

CM/Drake No.	Lens Dia.	Bezel Dia.	Projection	
			Front	Rear
6039-005-304	13/64"	17/64"	17/64"	13/32"
6039-004-304	13/64"	17/64"	17/64"	13/32"

LED CARTRIDGE CM44 SERIES

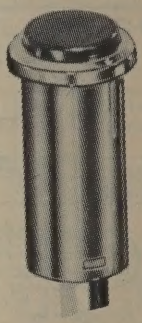

CM44-11 style


CM44-21 style

Now available, two transparent cap-styled LED cartridges, interchangeable with MIL-L-3661 cartridges operating on DC. Internal fresnel ring pattern on round or short cylindrical caps provide optimum 180° visibility for these high brightness long life LEDs. Solid state reliability and IC compatibility are advanced operating features. Built-in resistor; polarized stainless steel pins — anode is marked "A"; cathode pin is "B". LED colors: red (GaAsP type), amber and green (GaP type). Blk. anodized alum. housing; nylon insulator same size as incandescent cartridges. Standard voltages range from 1.6V to 28V; other voltages available upon request.

CM/Drake No.	DC Operating Characteristics			LED & LENS COLORS
	Rated Volts	Current mA	Operating Volts DC	
CM44-11-0021	5	20	2.5 — 7	Red
CM44-11-0123	5	20	2.5 — 7	Amber
CM44-21-0212	5	20	2.5 — 7	Green
CM44-21-0101	28	20	10 — 30	Red

"ULTRALITE"—.40" ROUND INDICATOR



FEATURES
- Unequaled brightness and spot size—up to 13 mcd with .40 in. diameter spot.
- Wide effective field of indication—up to 140°.
- Solid State—low power, long life, shock resistant, reliable.
- Push-in mounting.
- Current limiting resistors included.
- Available in red, amber and green.
- Choice of 6-inch leads or solder/faston terminals.
- Appealing chrome bezel.

TYPICAL APPLICATIONS
- Front panel indicator.
- Low power circuits.
- High shock and vibration environments.
- Extremely long life indication.

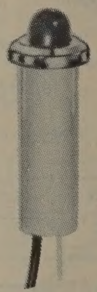
OPTIONS
- Other voltages and currents available.
- A.C. versions available.
- Legends hot stamped on face of lens.
- Clear lens.
- Speed nuts for added mounting security.

MECHANICAL
Mounting: Mounts in ½" dia. hole. Panel thickness 1" max. Mounting centers ⅝" min.
Polarity: White lead indicates cathode; (+) on base indicates anode.
Materials: Body Material: Nylon; Leads: 22 GA. topcoated.

Same Voltage and Current and part number as on Data Sheet 7703 but the "4" changes to "3." Example:

Wire Term. Red
Ultralite .40 = 6340-302-505R
Ultralite .30 = 6330-302-505R

"ULTRALITES"—.20" ROUND INDICATORS



FEATURES
- Solid State—low power, long life, shock resistant, reliable.
- Push-in mounting.
- Current limiting resistors included.
- Available in standard red and hi-efficiency red, yellow, and green.
- Standard with 6-inch insulated leads.
- Appealing chrome bezel.
- Wide effective field of indication—up to 160°.

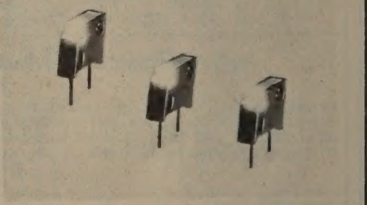
TYPICAL APPLICATIONS
- Front panel indicator.
- Low power circuits.
- High shock and vibration environments.
- Extremely long life indication.

OPTIONS
- Other voltage and currents available.
- Other lead lengths available.
- Speed nuts for added mounting security.

MECHANICAL
Mounting: Mounts in .277" hole. Panel thickness ¾" max. Mounting centers ⅜" min.
Polarity: White lead indicates cathode.
Materials: Body Material Nylon; Leads tinned, 24 GA., stranded.

STATUS/FAULT INDICATOR

FEATURES
- Solid State—low power, long life, shock resistant, reliable.
- Wide effective field of indication.
- Readily visible from **above** as well as **forward.**
- Current limiting resistor included.
- Pin Spacing—.300 inch—compatible with standard DIP pin spacing.
- Compatible with solid state driving circuits, DTL and TTL.



TYPICAL APPLICATIONS
- PC board status indication.
- Back panel status indication.
- Circuit fault indicator.
- DIP switch status indicator.

OPTIONS
- Other voltages and currents available.

MECHANICAL
Leads: Tinned copper base alloy.
Body: Polycarbonate.
Mounting Centers: .100"

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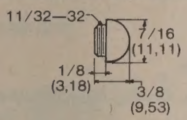
or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

INDICATOR LIGHTS

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

121A—SERIES LENS CAPS FOR 5120-SERIES TINYLITE INDICATORS

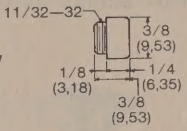
TRANSLUCENT DOME LENSES



121A-204	Red
121A-204	Yellow
121A-204	White
121A-207	Green

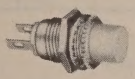
TRANSLUCENT CYLINDRICAL LENSES

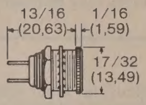
121A-604	Red
121A-604	Yellow
121A-604	White
121A-607	Green



Red, Yellow and White Lenses Are Nylon.
Green Lenses Are Polycarbonate.

5120—SERIES TINYLITES





TINYLITES Are Supplied with Choice of Three Low Voltage Incandescent Lamps Installed, 7 Volts, 14 Volts or 28 Volts. Applications Include Alarm Systems, Medical Equipment, Control and Instrument Panels.

Housing: Nickel Plated Brass
Hardware: Zinc Plated Steel
Insulation: Glass Filled Nylon
Current-carrying Parts Are All Nonferrous Metals
Terminals: Solder Dipped Brass
Mounting Hole: 7/16″ Dia.; Max Panel Thickness: 1/4″

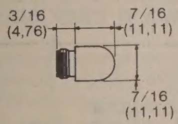
HOW TO ORDER

51xx — 022 — xxx (Specify Color)
26 for 7.0V, .065 Amp Lamp
27 for 14.0V, .065 Amp Lamp
28 for 28.0V .040 Amp Lamp
Use Last Three Digits from 121A Series Lens Caps

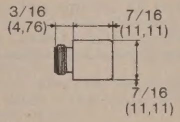
Example: 5127-022-607 Green is a Tinylite with a 14.0 Volt Lamp installed and having a Green Cylindrical Lens Cap.

To order body only (including Lamp) omit last three digits.

131A—SERIES LENS CAPS FOR 5131-038 MIDGET FLANGE INDICATORS



Part No.	QPL Recog. as
131A-304 Red	**LC12RT2**
131A-304 Green	**LC12GT2**
131A-304 Yellow	**LC12YT2**

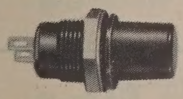


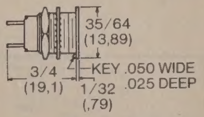
Part No.	QPL Recog. as
131A-604 Red	**LC29RT2**
131A-604 Green	**LC29GT2**
131A-604 Yellow	**LC29YT2**

Built to conform to MIL-L-3661B
Lens: Butyrate
Lens Shank: Nickel Plated Brass

5131-038 MIDGET FLANGE INDICATOR

QPL RECOGNIZED AS LH73/1





Accepts T-1¾ Midget Flange Lamps

These Indicators Are for Military and Commercial Applications.
Built to Conform to MIL-L-3661B

Housing: Black Anodized Aluminum
Hardware: Cadmium Plus Cronak Over Steel
Insulation: Fiberglass Base Thermoplastic Liner
Current-carrying Parts: Nonferrous Metal Except Center Contact Spring Which Is Stainless Steel
Mounting Hole: 15/32″
Max. Panel Thickness: 3/32″

HOW TO ORDER

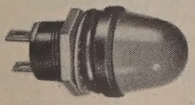
5131-038-xxx (Specify Color)
Last Three Digits from 131A-Series Lens Caps

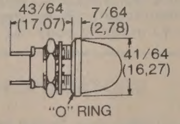
Example: "5131-038-304 Yellow" is a midget flange indicator with a 131A-304 yellow dome style lens cap installed.

Body only 5131-038 less lens

5139-038 MILITARY WATERPROOF MIDGET FLANGE INDICATOR

QPL RECOGNIZED AS LH89/1 AND LC35 - T2





Accepts T-1¾ Midget Flange Lamp

Built to Conform to MIIL-L-3661B, These Indicators Have Neoprene "O" Rings for Waterproofing on Both Lens and Body.

Housing: Black Anodized Aluminum
Hardware: Cadmium Plus Cronak Over Steel
Insulation: Fiberglass Base, Thermoplastic Liner
Current-carrying Parts: Nonferrous Metal Except Center Contact Spring Which Is Stainless Steel
Lens: Butyrate
Lens Shank: Nickel Plated Brass
Mounting Hole: 15/32″
Max. Panel Thickness: 3/16″

HOW TO ORDER

Body and Lens	Lens Only	Mil. No. of Lens
5139-038-404 Red	**139A-404** Red	**LC35RT2**
5139-038-404 Green	**139A-404** Green	**LC35GT2**
5139-038-404 Yellow	**139A-404** Yellow	**LC35YT2**

Body Only: 5139-038 Less Lens
MIL No. of Body Only LH89/1

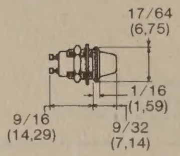
TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

INDICATOR LIGHTS

5160—SERIES GEMLITES



Accepts T-1 Submidget Flange Lamp

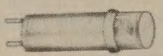
GEMLITES Are a High Quality, Reliable Indicator Used in Military and Commercial Applications Where Size and Ease of Lamp Replacement Are Prime Considerations.

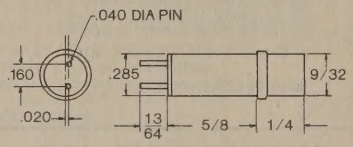
Available in Red, Green, Amber and White
Housing: Black Nickel Plated Brass
Hex Nut: Brass
Lockwasher: Bronze
Terminations: Brass Turret Lugs Gold Plated Center Contact. Silver Plated Shell Contact
Lens: Translucent Butyrate, Red, Green, Amber and White
Mounting Hole: 5⁄16″ diameter
Max. Panel Thickness: 7⁄32″

HOW TO ORDER

Part Number: 5160-458-604 (Specify Color)
Body Only Number: 5160-458
Lens Only Number: 160A-604 (Specify Color)

CARTRIDGE INDICATOR LAMPS



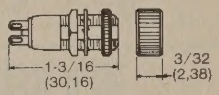


- Long life
- Built to meet MIL-L-3661
- High temperature polycarbonate lenses
- Three voltages: 6.3V; 14.0V; 28.0V
- Three colors: red, green and amber
- Hi Rel Look—Used on military and commercial instruments and in panels.

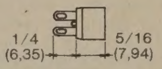
Housing: Clear Anodized Aluminum
Pins: Stainless Steel
Insulator: Nylon, Glass Filled
Lens: Translucent Polycarbonate

Volts	Amps	MSCP (Approx.)	Life	Color	Part Number
6.3V	.040	.02	50,000 HR	Red	**CML640271**
6.3V	.040	.02	50,000 HR	Green	**CML640272**
6.3V	.040	.02	50,000 HR	Amber	**CML640273**
14.0V	.080	.3	50,000 HR	Red	**CML640281**
14.0V	.080	.3	50,000 HR	Green	**CML640282**
14.0V	.080	.3	50,000 HR	Amber	**CML640283**
28.0V	.040	.2	50,000 HR	Red	**CML640401**
28.0V	.040	.2	50,000 HR	Green	**CML640402**
28.0V	.040	.2	50,000 HR	Amber	**CML640403**

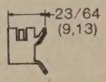
CARTRIDGE HARDWARE



CML 10204-1 CARTRIDGE HOLDER
FOR CML SERIES CARTRIDGE LAMPS
Body, Facing Nut and Collar: Black Anodized Aluminum
Lockwasher and Hex Nut: Cadmium Plated Steel
Solder Lugs: Cadmium Plated Spring Brass
Insulation: Phenolic
Mounting Hole: 3⁄8″ dia.
Max. Panel Thickness: 7⁄32″

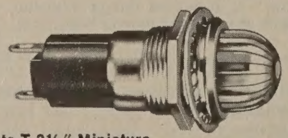


CM 21-3 CONNECTOR
Low Cost Connector Mates with Cartridge Lamps.
Body: Phenolic
Solder Lugs: Cadmium Plated Spring Brass



CML 10380 MOUNTING CLIP
Low Cost Clip for Mounting Cartridge Lamps Directly into Panels. Squeez Tabs and Push Over Back of Cartridge.
Material: Spring Tempered Steel Black Rust Preventative Finish.

5201—SERIES DELUXE INDICATOR

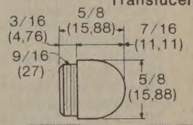


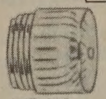
Accepts T-3¼″ Miniature Bayonet Lamp.
DELUXE INDICATOR: Chrome Bezel for Quality Appearance. U.L. and CSA Listed.
Use with 25 P-Series Lenses.
Mounting Bushing: Chrome Plated Brass
Housing: Molded Phenolic

25P LENSES FOR 5201 & 5100 SERIES

25P-326
Transparent

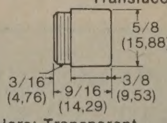
25P-306
Transparent
25P-307
Translucent



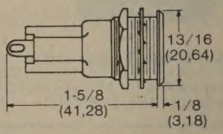


25P-626
Transparent

25P-606
Transparent
25P-607
Translucent



Colors: Transparent, Amber, or Clear.
Translucent is Red, Green, Yellow, or White.
Specify Color.



Terminals: Brass
Hardware: Zinc Plated Steel
Mounting Hole: 11⁄16″
Max. Panel Thicknes: 13⁄32″

HOW TO ORDER

5201 — xxx — xxx (Specify Color)

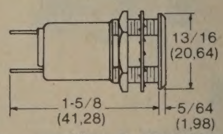
222 for Incandescent Lamps
*232 for B2A Neon Lamp
*242 for B1A Neon Lamp
*For 125V Operation

Use Last Three Digits from 25P-Series Lens Caps

Example: "5201-232-326 Amber" is part number for Deluxe Indicator requiring B2A Lamp and with Amber Fluted Dome Lens.
Units requiring B2A Lamps have built-in 22K ohm resistor.
Units requiring B1A Lamps have built-in 100K ohm resistor.
When ordering body only, omit last three digits.

5100—SERIES STANDARD INDICATOR

Accepts T-3¼ Miniature Bayonet Lamp
STANDARD INDICATOR: Attractive Nickel Plated Bezel. U.L. and CSA Listed.
Use with 25 P-Series Lenses.
Housing: Glass Filled Polyester
Bezel: Nickel Plated Steel
Terminals: Brass



Hardware: Zinc Plated Steel
Mounting Hole: 11⁄16″
Max. Panel Thickness: 13⁄32″

HOW TO ORDER

5100 — xxx — xxx (Specify Color Here)

822 for Incandescent Lamps
*832 for B2A Neon Lamps
*842 for B1A Neon Lamps
*For 125V Operation

Use Last Three Digits from 25P Series Lens Caps

Example: 5100-822-607 red is part number for standard indicator requiring an incandescent lamp and having a 25P-607 Red Lens.
Units requiring B2A Lamps have built-in 22K ohm resistors.
Units requiring B1A Lamps have built-in 100K ohm resistors.
When ordering body only, omit last three digits.

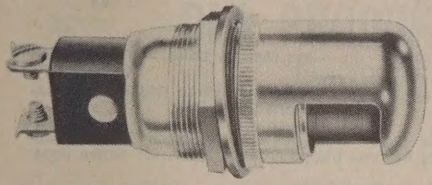
INDICATOR LIGHTS

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

900—SERIES INSTRUMENT LITES

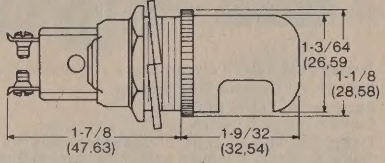
THE 900-SERIES INSTRUMENT LITES PROVIDE LOCALIZED LIGHT FOR ILLUMINATION OF PANELS, SWITCHES, METERS AND LEGEND PLATES

900-006

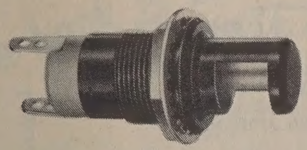


Accepts Both S-6 and C-7 Candelabra Screw Base Lamps

Hood and Face Nut: Chrome Plated Brass
Mounting Bushing: Nickel Plated Brass
Hardware: Cadmium and Cronak Plated Steel
Contacts, Terminals and Screws: Nonferrous Metal
Mounting Hole: 1″
Max. Panel Thickness: ½″
Max. Electrical Ratings: 250V, 1A, 75W
Insulation: Phenolic

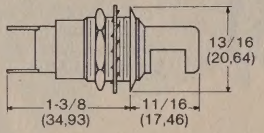


900-200

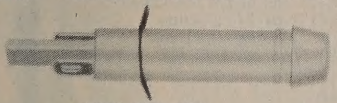


Accepts T-3¼ Miniature Bayonet Lamps

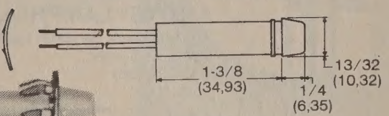
Screw-in Hood
Hood: Aluminum Black Outside, Clear Anodized Inside
Mounting Bushing: Black Anodized Aluminum
Current-carrying Parts: Nonferrous Metals
Hardware: Cadmium and Cronak Plated Over Steel
Insulation: Phenolic, Volcoid and Nylon
Mounting Hole: 11/16″
Max. Panel Thickness: 13/32″
Max. Electrical Ratings: 120V, 3W



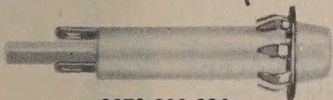
6063—SERIES, 6073—SERIES AND 6243—SERIES NEON GLOWLITES



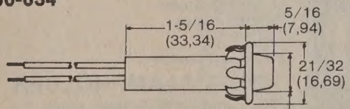
6063-000-634



6003-001-634



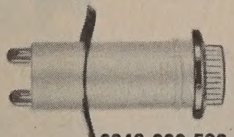
6073-000-634



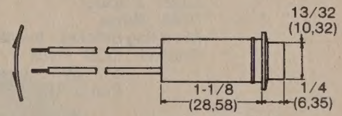
6073-001-634

U.L. and CSA Recognized. All GLOWLITES Have High Bright C2A Neon Lamps with Built-in 30K Resistor. Life Over 5000 Hours. Available with 10-inch Wire Leads or Quick Connect Terminals (accepts 3/16 x .020 female terminal). Designed for 125V Operation
Insulation: Vulcoid
Quick Connect Terminals: Brass Solder Dipped
Wire Leads: Black #22 Bonded Wire with 105°C PVC Insulation .031 Thk.
Body and Lens: Nylon
Available in Red, Amber and White*
*6243-Series Available in Clear Instead of White

Part No.	Mounting Hole Size	Max. Pnl. Thickness	Termination
6063-000-634 (Specify Color)	⅜″	15/16″	Solder Lug
6063-001-634 (Specify Color)	⅜″	15/16″	Wire Lead
6073-000-634 (Specify Color)	½″	5/64″	Solder Lug
6073-001-634 (Specify Color)	½″	5/64″	Wire Lead
6243-000-596 (Specify Color)	½″	¾″	Solder Lug
6243-001-596 (Specify Color)	½″	¾″	Wire Lead



6243-000-596

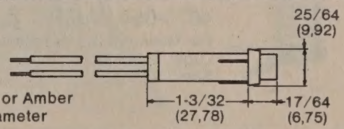


6243-001-596

6380—SERIES SLENDER GLOW INCANDESCENT INDICATORS

Available in 3 Voltages (6.3V, 14V, and 28V) and in Three Colors (Red, Green and Amber). 10-inch Black Leads, #22 GA. Bonded with .031″ of 105°C PC Insulation.

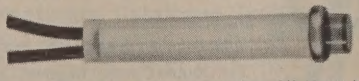
Housing: White Nylon
Bezel: Bright Stainless Steel
Lens: Translucent Polycarbonate Red, Green or Amber
Mounting Hole: .312/.314″ Diameter



Part Number	Voltage	Current	Life
6386-001-607 (Specify Color)	6.3V	.20A	50,000 Hr.
6387-001-607 (Specify Color)	14.0V	.08A	50,000 Hr.
6388-001-607 (Specify Color)	28.0V	.04A	25,000 Hr.

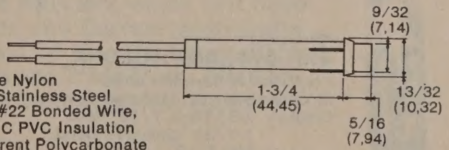
6483—SERIES SLENDER GLOW NEON INDICATORS

6483-401-603 Red
6483-401-603 Yellow
6483-401-603 Clear



Units Are U.L. and CSA Recognized for 125V Operation. All Have High Bright C2A Neon Lamp with 33K-Series Resistor. 25,000 Hour Life. 10-inch Black Leads, #22 GA. Bonded with .031-inch 105°C PVC Insulation.

Housing: White Nylon
Bezel: Bright Stainless Steel
Leads: Black #22 Bonded Wire, .031″ of 105°C PVC Insulation
Lens: Transparent Polycarbonate
Mounting Hole: .312/.314″ Diameter



TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

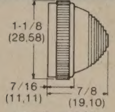
INDICATORS & LAMPHOLDERS

5796—SERIES TITELITE INDICATORS

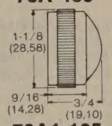
Transparent Lens Polycarbonate w/Frosted Back.
Lens Bezel Chrome Plated Brass.
Accepts S-6 Screw or Double Contact Bayonet Lamps

TITELITES Have Large 1" Diameter Lens for Distance and Off-Angle Visibility. Units Supplied with 2 Neoprene Gaskets to Seal Out Oil and Water. All Units Are U.L. and CSA Listed for Up to 75W Operation.

78A SERIES LENS CAPS

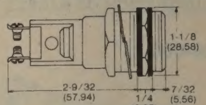


78A-435



78A1-105

Housing: Phenolic
Mounting Bushing: Nickel Plated Brass
Hardware: Cadmium and Cronak Plated Steel. Face Nut Chrome Plated Brass
Gaskets: Neoprene
Terminals: Brass with Brass Screws
Mounting Hole: 1"
Max. Panel Thickness: ⅜"



HOW TO ORDER

5796 — xxx — xxx (Specify Color) — Red, Green, Yellow

393 for Double Contact Bayonet Lamp
523 for Candelabra Screw Lamp

Use Last Three Digits from 78A-Series Lens Caps

Example: 5796-393-435 Green is a Titelite that accepts S-6-type Double Contact Bayonet Lamps and has a 78A-435 Green Lens.

To order body only omit last three digits.

LAMPHOLDERS

PHOTOS 3/4 ACTUAL SIZE

4772-001 LAMPHOLDER

For T-1-3/4 Wedge Base Lamps
Lugs: 2 Solder
Housing: Nylon
Spacing: 13/64"

4672-001 LAMPHOLDER

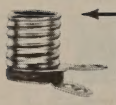
For T-3-1/4 Wedge Base Lamps
Lugs: 2 Solder
Housing: Nylon
Spacing: 3/8"

4060-014 LAMPHOLDER

For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass
Mounting Bracket: Insulated from shell
Bracket: .033 Thick, 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32"

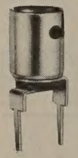
4060-314 LAMPHOLDER

For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass
Mounting Bracket: Insulated from shell
Bracket: .033" Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32"



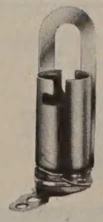
4070-054 LAMPHOLDER

For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass



4099-017 LAMPHOLDER

For Miniature Bayonet Lamps
For Mounting in P.C. Boards
.062 Dia. Hole .400 Spacing



4151-014 LAMPHOLDER

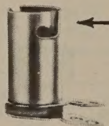
For Miniature Bayonet Lamps
Mounting Bracket: Insulated from shell
Bracket: .033 Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32".

4151-314 LAMPHOLDER

For Miniature Bayonet Lamps
Mounting Bracket: Insulated from shell
Bracket: .033" Thick., 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32".

4157-314 LAMPHOLDER

For Miniature Bayonet Lamps
Leads: 10" Blk., #22 105° PVC
Mounting Bracket: Insulated from shell
Housing: Nylon over plated steel shell
Bracket: .033 Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 23/32"

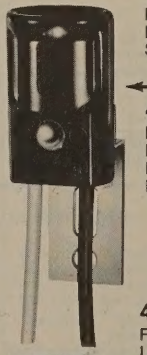


4160-051 LAMPHOLDER

For Miniature Bayonet Lamps
Lugs: 2 Solder
Shell: Steel

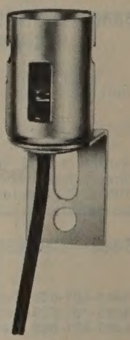
4311-052 LAMPHOLDER

For Candelabra Screw Lamps
Lugs: 2 Solder
Shell: Brass



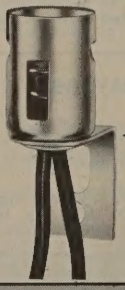
4327-312 LAMPHOLDER

For Candelabra Screw Lamps
Leads: 10 inch Blk., #18, 105°C PVC
Mounting Bracket: Insulated from shell
Bracket: .033" Thick, 5/8" Wide
1" Long after bend
Hole .170" Dia.
Slot .170" x .420"



4345-312 LAMPHOLDER

For Single Contact Bayonet Lamps
Leads: 10" Blk., #18, 60°V PVC
Bracket: .033" Thick, 5/8" Wide,
7/8" Long after bend.
Hole .170" Dia.
Slot .170" x .420"



4365-312 LAMPHOLDER

For Double Contact Bayonet Lamps
Leads: 10" Blk., #18, 105°C PVC
Bracket: .033" Thick, 5/8" Wide
7/8" Long after bend
Hole .170" Dia.
Slot .170" x .420"

TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

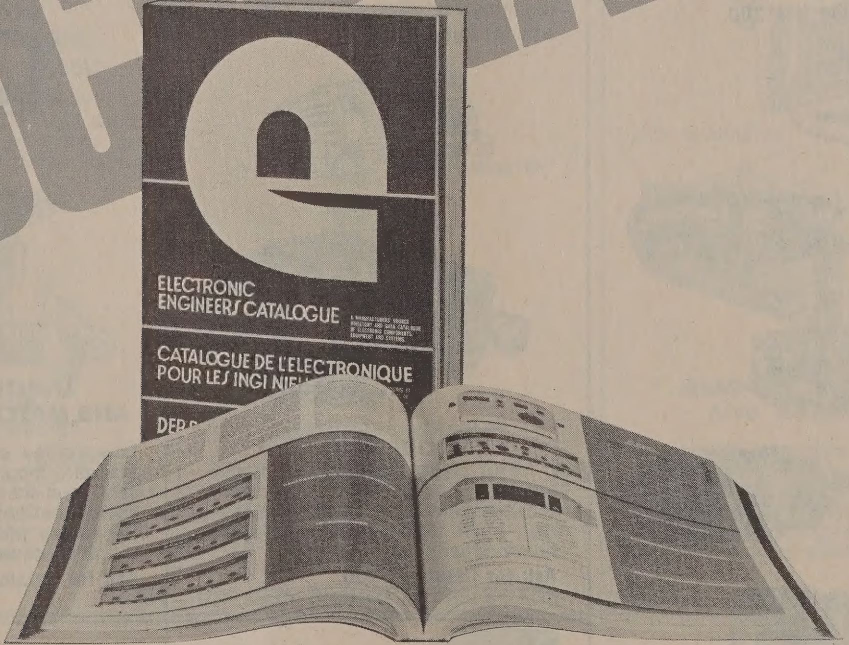
or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

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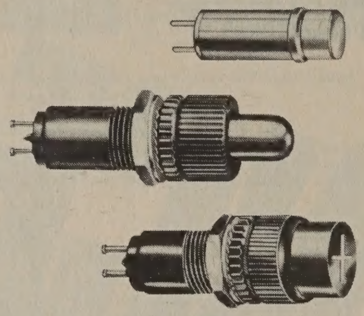
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

1,500,000 VISUAL INDICATORS

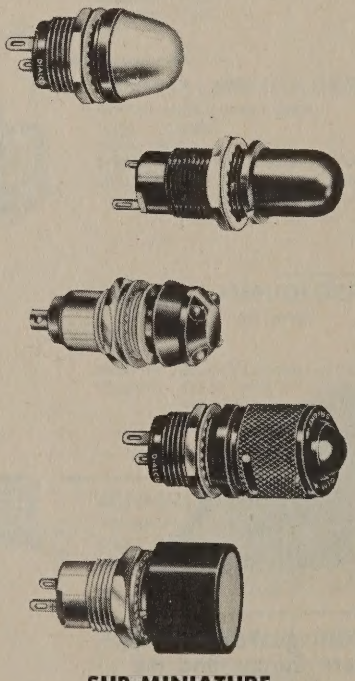
INDICATOR LIGHTS, ILLUMINATED SWITCHES, READOUT DISPLAYS



ULTRA-MINIATURE INDICATORS

Meet requirements of MIL-L-3661B. Incandescent, neon and LED. Mount in 3/8″ clearance hole.

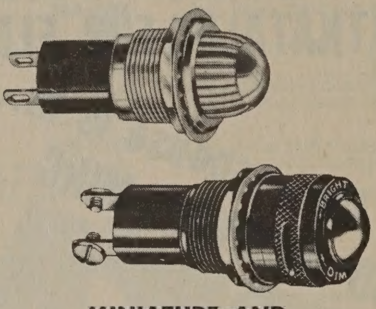
Ask for Catalog UM1200.



SUB-MINIATURE INDICATORS

Incandescent and neon. Mount in 13/32″ to 17/32″ clearance holes. Meet or exceed environmental requirements of MIL-L-6723 and MIL-L-3661B.

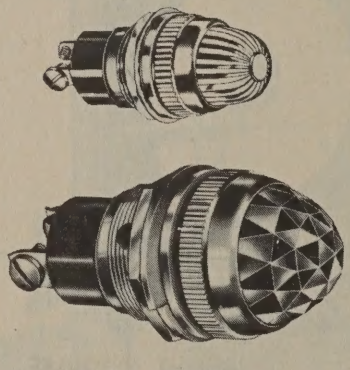
Ask for Catalogs L-157, L-158, L-178.



MINIATURE AND LARGE INDICATORS

Incandescent and neon. Miniature units mount in 9/16″ or 11/16″ clearance holes, large units in 1″ or 1 3/16″ hole. Wide choice of cap shapes and colors, also caps with mechanical dimming feature.

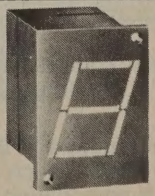
Ask for Catalog L-161.



OIL-TIGHT INDICATORS

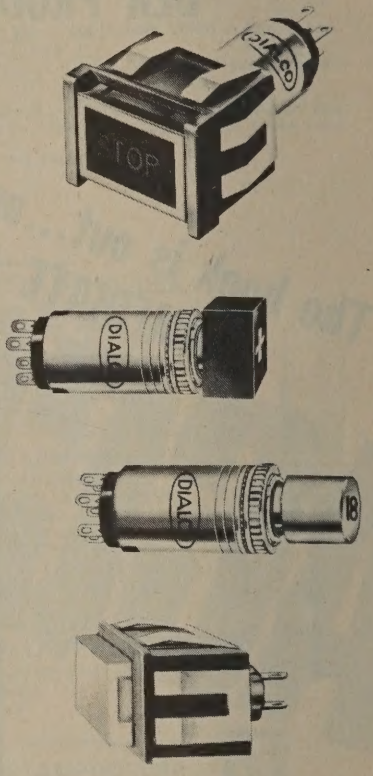
Incandescent and neon. Mount in 11/16″, 1″ or 1 3/16″ clearance holes. For heavy duty.

Ask for Catalog L-200.



SINGLE-PLANE READOUTS

Incandescent and neon — 5 to 170 volts. 3/4″ or 1″ characters. Display 10 numbers and 10 letters. Compatible caption models.



LIGHTED SWITCHES AND MATCHING INDICATORS

Low-profile snap-in switches and standard mounting switches. Momentary non-snap, snap or alternate switch actions. Ratings up to 5 A. Cap sizes include 1/2″ 5/8″ and 3/4″ round or square; 3/4″ x 1″ rectangle.

Ask for Catalog L-210.

DIALIGHT
INDICATOR LIGHT SELECTOR GUIDE
INCANDESCENT • NEON • LED

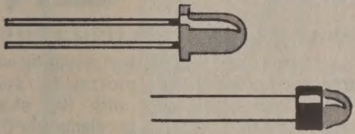
Send for FREE Indicator Light Product Selector Guide Catalog SG730.

DIALIGHT
A NORTH AMERICAN PHILIPS COMPANY

203 HARRISON PLACE, BROOKLYN, N.Y. 11237 • AREA CODE (212) 497-7600

TO CHOOSE FROM DIALCO®

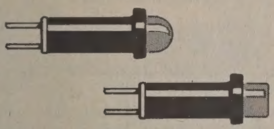
. . . AND INDUSTRY'S BROADEST LINE OF LED DISPLAY DEVICES



DIODE-LITE™ LIGHT SOURCES

RED • GREEN • YELLOW

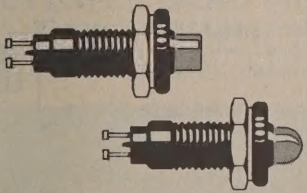
Diffusing particles in plastic encapsulant provide large, soft light source for panel light, status indicator and A/N display applications.



INDICATOR LIGHT CARTRIDGES

RED • GREEN • YELLOW

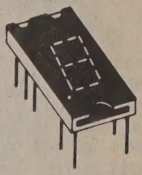
IC-compatible ultra-miniature cartridges with DIODE-LITE light source are interchangeable with incandescent types using DC power source.



INDICATOR LIGHT ASSEMBLIES

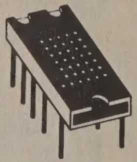
RED • GREEN • YELLOW

Cartridge with DIODE-LITE in housing with mounting hardware ready for installation. Interchangeable with DIALCO ultra-miniature incandescent types.

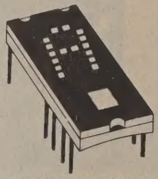


.270″ CHARACTER

PLUS-MINUS ONE, .270″ CHARACTER



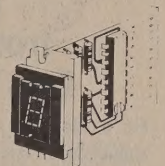
ALPHA-NUMERIC .300″ CHARACTER



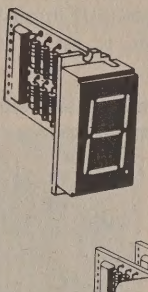
.270″ HEXADECIMAL

READOUT MODULES

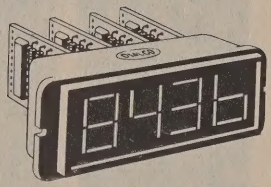
Character heights from .270″ to .625″. Dot, dot matrix and segmented formats for both numeric and full alpha-numeric displays. Wide angle (140°) viewing. IC compatible.



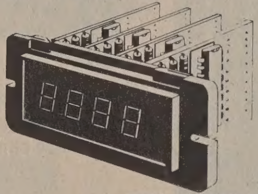
.270″ CHARACTER



.625″ CHARACTER



.625″ CHARACTER



.270″ or .300″ CHARACTERS

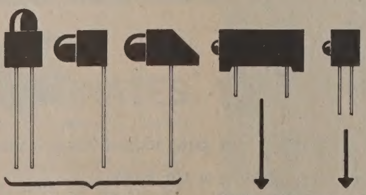
READOUT PACKAGES AND ASSEMBLIES

Single-digit packages in character heights from .270″ to .625″ include decoder/driver and resistors mounted on PC board. Bezel assemblies ready for panel mounting available with up to 10 display packages.

ASK FOR LED PRODUCT SELECTOR GUIDE

LED LOGIC-STATE FAULT INDICATORS

RED • GREEN • YELLOW



Series 550 Series 547 Series 555

550 series indicators, with/without built-in series resistors. For use as electronic circuit fault finders, as indicators or in binary data displays.

547 series indicators, with built-in series resistor, permit dense packaging — 10 units to the inch. Pin spacing is compatible with DIP sockets.

555 series indicators have built-in series resistor, are IC compatible, and can be p-c board mounted 10 units to the inch.

DIALIGHT

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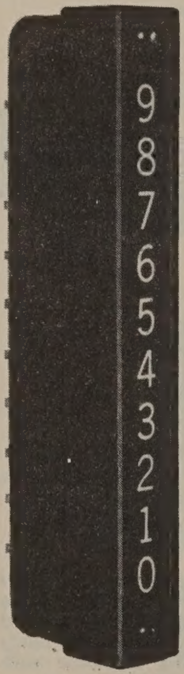
d² display devices

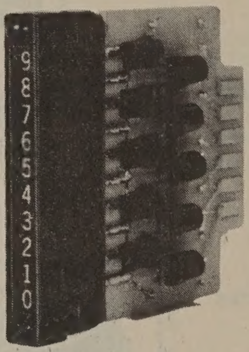
DIGISTRIP front relampable DIGITAL DISPLAYS

For a wide range of console and instrument display applications. Can be mounted horizontally or vertically, directly on p.c. boards, or ganged for high-density readout.

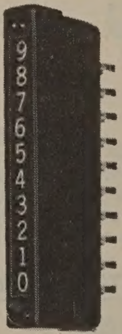
All Digistrip models are available with standard 0-9 legend, or with custom read-out information.



Digistrip II
3″ legend area.



Digistrip I with high-gain transistor drivers on integral printed circuit board.



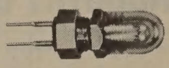
Digistrip I
1½″ legend area.

MINIATURE T-1 INDICATOR LIGHTS

Designed to provide the brightest light in the least space.
Available off-the-shelf, or designed to your application.

QUICK-LENS

Front-relampable miniature indicator light with built in light reflector for maximum brightness, even in high ambient light.

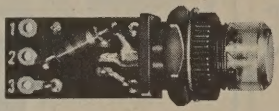


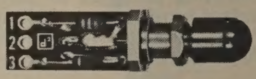
MINI-LENS

Front relampable, micro-miniature indicator light, featuring minimum panel spacing. Can be RFI shielded. Threaded body can mount directly to panel.

FLUSH-LENS

For panel mounting without protrusion. Available with RFI shield. Unit is relampable from rear of panel. No solder connections required.

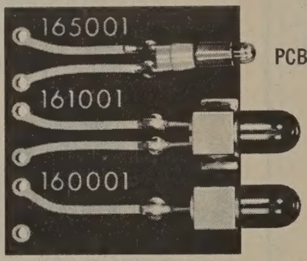




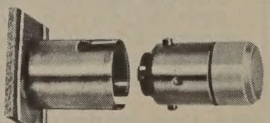
TRANS-LENS **TDML**

Each front relampable, with high-gain transistor driver on compact, integral p.c. board. Minimum depth behind panel. Both available in "bare board" configuration for customer to install own components. Trans-Lens is transistor-driven version of Quick-Lens; TDML is transistor-driven version of Mini-Lens.

P.C. BOARD INDICATORS

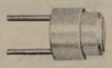


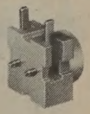
ADAPTER LENS AND SOCKET



Midget T-1¾ flanged base lamp adaptor used with T-3¼ printed circuit mounted socket. Furnished with or without integral color filter.

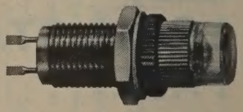
T-1 UNBASED





------------------ T-1¾ BI-PIN ------------------

Basic sockets for custom designed lamp holders or p.c. board mounting used as lighting chassis for back lighted display.
Also available in side mounting.



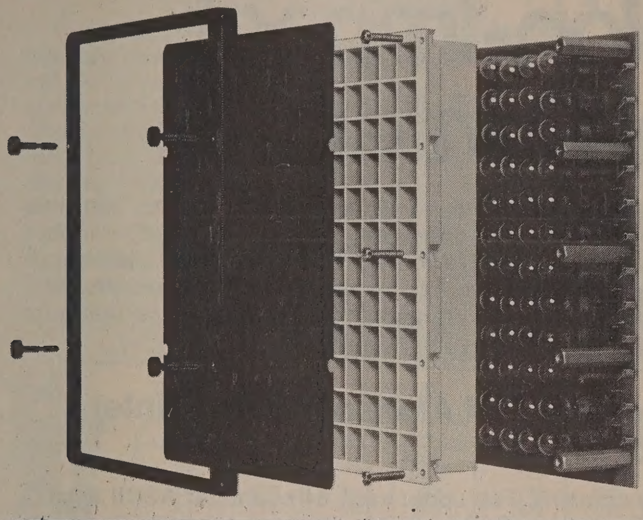
TWIST-LENS

Quick-change lens, available in clear or colors. Waterproof and RFI shielded units available. Uses T-1¾ Bi-Pin base lamp for high brightness.

All illustrations are actual size

d² display devices, inc

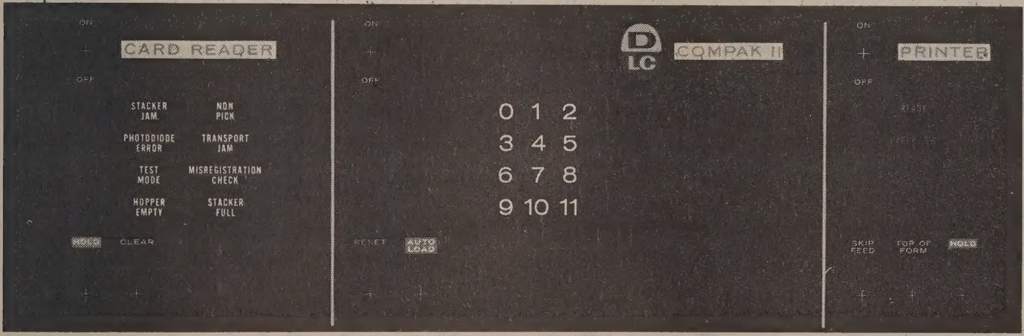
mailing address: **p. o. box 667 encinitas, california 92024**
plant location: **second and E streets (714) 753-0113**



panels and laminates d²

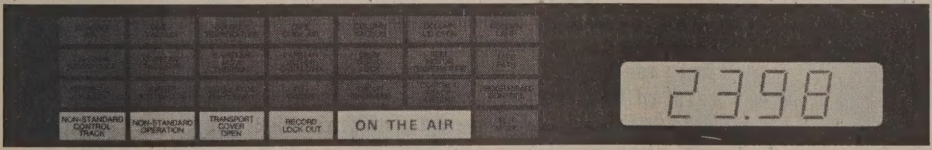
BACK LIGHTED PANELS

Exploded view shows a typical backlighted panel application with printed circuit board lighting chassis containing lamps and sockets, light baffle (eggcrate) to divide message areas, and legend screen with front bezel. Application shown is relampable from front of panel. Rear relamping is also available.


ON
CARD READER
OFF
STACKER JAM
NON PICK
PHOTODIODE ERROR
TRANSPORT JAM
TEST MODE
MISREGISTRATION CHECK
HOPPER EMPTY
STACKER FULL
HOLD
CLEAR
ON
OFF
DLC
COMPAK II
0 1 2
3 4 5
6 7 8
9 10 11
RESET
AUTO LOAD
ON
PRINTER
OFF
SKIP FEED
TOP OF FORM
HOLD

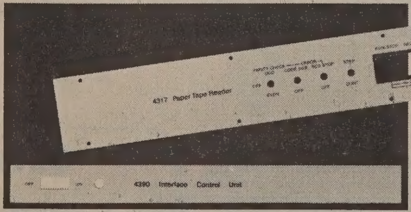
POLYESTER DEAD FRONT LAMINATES

Used in conjunction with backlighted panels, or provided separately, are DF991 legend screen laminates. Except for permanently visible graphics that may be desired all nomenclature is invisible until backlighted. Standard background is black, but colored dead front laminates are also available. .010″ and double .010″ thickness are used.


NON-STANDARD CONTROL TRACK
NON-STANDARD OPERATION
TRANSPORT COVER OPEN
RECORD LOCK OUT
ON THE AIR
23.98

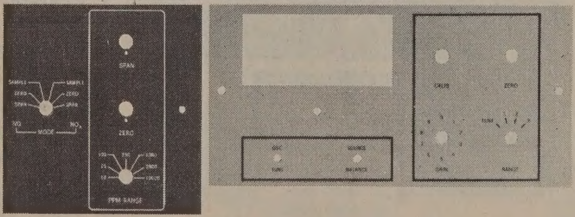
POLYCARBONATE AND ACRYLIC LAMINATES

Offered in dead front as noted above for polyester laminates. Thickness ranges from .020″ to .250″. Used for LED devices as well as incandescent lamps. All laminates are provided with or without pressure sensitive adhesive backing, depending upon application. All laminates feature color matching to FED STD 595, Pantone, or customer supplied color chips.


4317 Paper Tape Reader
4380 Interface Control Unit

NON-ILLUMINATED LAMINATES

Supplied on .010″ adhesive backed polyester film non-illuminated laminates are used to replace conventional painting and printing of metal panels. Screen printing of graphics is sub-surface to protect markings from being scratched off. Holes for switches, knobs, etc. are steel rule die cut. Background color is matched to customer requirements.


SPAN
ZERO
MODE
PPM RANGE
CALIB
ZERO
RANGE

Write for detailed specification sheets

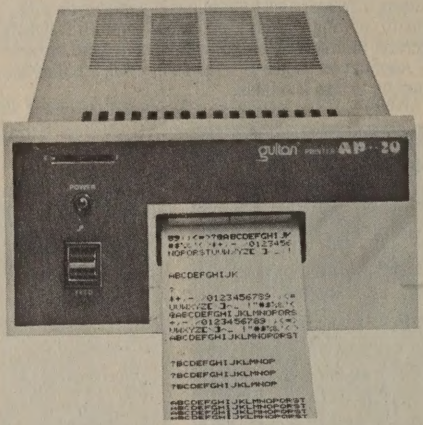
d²

display devices, inc

mailing address: **p. o. box 667 encinitas, california 92024**
plant location: **second and E streets (714) 753-0113**

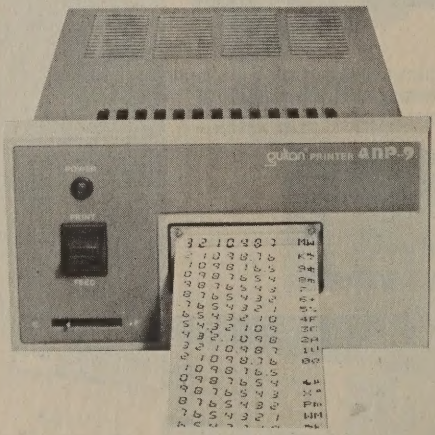
Gulton's Non-Impact Thermal Printers

Printers don't have to use complex clicking and banging mechanical devices as their print mechanisms. Gulton proves it with a line of printers that provides totally quiet operation. With the Gulton non-impact thermal technique, only one moving part is required, the tape drive motor. The tape glides silently beneath the thermal print head at up to 4 line/sec. print rate to produce clear, readable characters. Three basic printer models are yours to choose from — each with distinctive characteristics that sets it apart from any other printer.



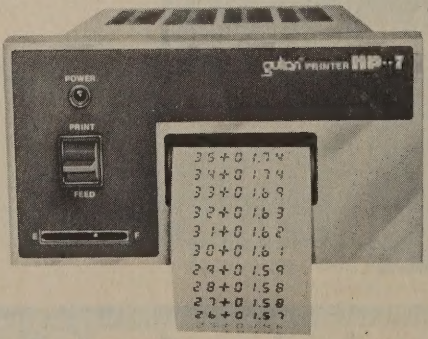
20 Column Full Alphanumeric Printer AP-20

Twenty columns. Full upper case 64 character ASCII subset. Panel mounting. Quiet reliable thermal printing. Complete with all electronics including power supply. Simple parallel interface. Print rate is 2.5 lines/second. **The most significant advance in printers yet!**



Seven Column Numeric Printer With Data Identification ANP-9

Seven columns of numbers with left hand decimal point in each column, or six with a plus/minus sign . . . and two columns of data identification numbers, letters and symbols. Eliminates transcription errors and unidentified numbers. Data identification characters can be specified to the left or right of the number columns. A standard 32 character set of data identification characters is provided. However, any special characters that can be formed by a 5 x 7 dot matrix are available.



Seven Column Numeric Printer NP-7

Seven columns of printing. Four print head styles to choose from: either seven columns of numbers, or six columns of numbers with plus/minus sign in first, second or third column. Character type is standard seven segment with left hand decimal point in each column. Panel mounting configuration. Fast, simple tape loading. Complete with electronics for easy interface to all popular digital panel meters.

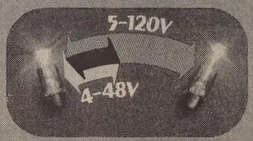
gulton®

Measurement & Control Systems Division
Gulton Industries Inc., East Greenwich, Rhode Island 02818
401-884-6800 • TWX 710-387-1500

THE SYLVANIA Mix 'n Match SYSTEM EXPLAINED

Sylvania Mix 'n Match. The only system that offers you the universal parts flexibility built around two series of T-2 slide base lamps. The first is our Pilot Lamp series spanning 5 to 120 volts. The second is our Indicator Lamp series from 4 to 48 volts.

All the lamps in each series are physically identical. So sockets and lenses are fully compatible.

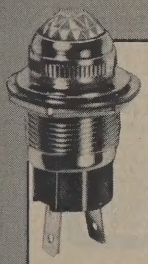


And in a number of instances, lenses and caps are even interchangeable between series.

As you can see, our system is calculated to make life a lot easier for everyone.

From the guy who builds the prototypes, to the guy who does the purchasing, to the guy who controls production inventory.

UNIVERSAL PILOT LAMP HOUSING


Actual Size

TRANSLUCENT LENSES

Qty.	Ea.
1	$.83
10	.497
100	.417
500	.338

Color	Ordering Number
Red	30200
Green	30212
Blue	30213
Yellow	30214

JEWELED LENSES

Qty.	Ea.
1	$.79
10	.476
100	.400
500	.324

Color	Ordering Number
Red	30100
Green	30102
Blue	30103
Amber	30106

TRANSPARENT LENSES

Qty.	Ea.
1	$.45
10	.268
100	.225
500	.182

Color	Ordering Number
Red	30110
Green	30112
Blue	30113
Amber	30111
Yellow	30114
Clear	30116

FLUTED LENSES

Qty.	Ea.
1	$.40
10	.238
100	.200
500	.162

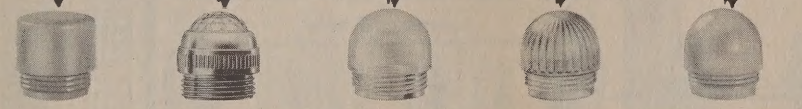
Color	Ordering Number
Red	30120
Green	30122
Blue	30124
Amber	30126
Clear	30125

TRANSLUCENT LENSES

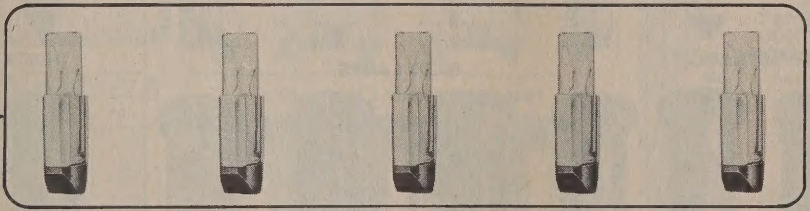
Qty.	Ea.
1	$.45
10	.268
100	.225
500	.182

Color	Ordering Number
Red	30130
Green	30132
Yellow	30131
White	30133

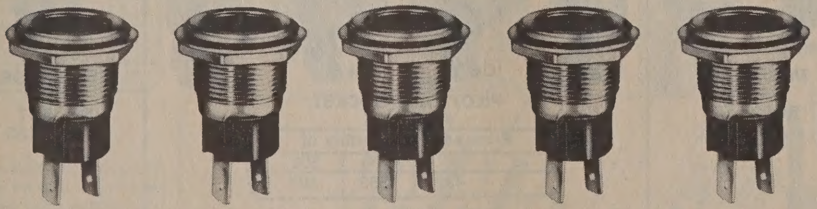
Choose your lens & color…



add a T-2 Pilot Lamp…



and insert into socket



PILOT LAMP SOCKET
P/N 30099

Price each in quantity of			
1	10	100	500
$1.84	$1.103	$.926	$.750

PILOT LAMPS

LAMP NUMBER	DESIGN VOLTS	DESIGN AMPERES	DESIGN WATTS	FILAMENT	M.S.C.D.	AVERAGE END FOOT CANDLES	RATED AVERAGE LIFE (HOURS)	Price each in quantity of 1	10	100	500
5SLB	5.0	.120	.60	C-2V	—	1,600	2,500	$1.26	$.757	$.636	$.515
6PSB	6.0	.140	.80	C-2F	.12	500	20,000	1.26	.757	.636	.515
6SLB	6.0	.144	.60	C-2V	—	1,700	2,500	1.26	.757	.636	.515
12PSB	12.0	.170	2.0	C-2F	.35	2,000	12,000	1.26	.757	.636	.515
24PSB	24.0	.073	1.7	C-2F	.50	3,000	10,000	1.26	.757	.636	.515
28PSB	28.0	.040	1.1	C-2F	.29	1,600	5,000	1.26	.757	.636	.515
48PSB	48.0	.053	2.5	C-7A	.70	1,800	7,500	1.26	.757	.636	.515
60PSB	60.0	.050	3.0	C-7A	.73	2,600	7,500	1.44	.864	.726	.588
120PSB	120.0	.025	3.0	CC-7A	.36	1,200	10,000	1.44	.864	.726	.588

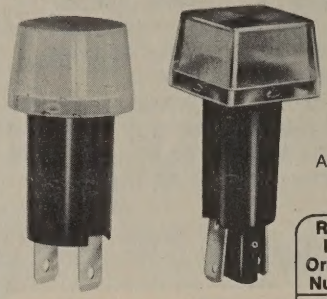
GTE SYLVANIA

West Main Street, Hillsboro, N.H. 03244
(603) 464-5533 • TWX 710 366-0387

PANEL LAMP ASSEMBLIES

Mix 'n Match

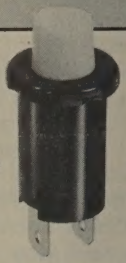
SINGLE SOCKET ASSEMBLIES



Actual Size

Round Lens Ordering Number	Color	Square Lens Ordering Number
30160	Red	30170
30161	Clear	30171
30162	Amber	30172
30163	White	30173
30164	Green	30174
30165	Blue	30175

Price each in quantity of			
1	10	100	500
.32	.194	.163	.132



Actual Size

PYREX END CAPS[1]

Price each in quantity of			
1	10	100	500
.25	.148	.125	.101

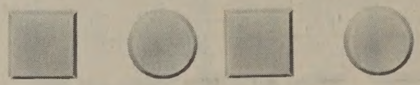
Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Pearl White	38006
Green	38004
Blue	38005
Orange	38007

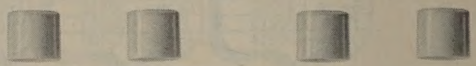
PYREX END CAPS[2]

Price each in quantity of			
1	10	100	500
.29	.173	.146	.118

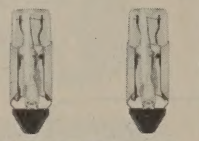
Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

Choose a cap or lens...

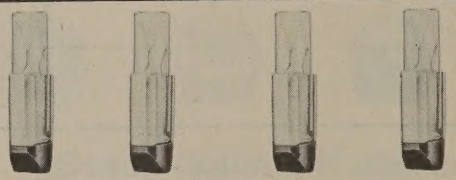




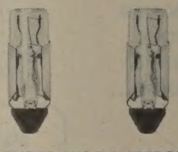
add a T-2 Slide Base Lamp...



INDICATOR LAMPS[3]

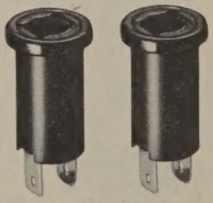


PILOT LAMPS

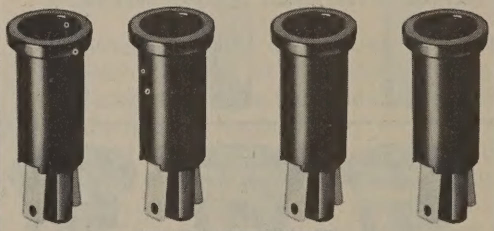


INDICATOR LAMPS[3]

and insert into socket of your choice



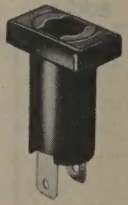
INDICATOR LAMP SOCKETS
P/N 30153



PILOT LAMP SOCKET
P/N 30152

Price each in quantity of			
1	10	100	500
.72	.432	.363	.294

INDICATOR LAMP SOCKET
P/N 30153



INDICATOR LAMP SOCKET
P/N 30151

INDICATOR LAMP SOCKETS

	Price each in quantity of			
	1	10	100	500
P/N 30151	.47	.284	.238	.193
P/N 30153	.47	.284	.238	.193

PILOT LAMPS

LAMP NUMBER	DESIGN VOLTS	DESIGN AMPERES	DESIGN WATTS	FILAMENT	M.S.C.D.	AVERAGE END FOOT CANDLES	RATED AVERAGE LIFE (HOURS)	Price each in quantity of 1	10	100	500
5SLB	5.0	.120	.60	C-2V	—	1,600	2,500	$1.26	$.757	$.636	$.515
6PSB	6.0	.140	.80	C-2F	.12	500	20,000	1.26	.757	.636	.515
6SLB	6.0	.144	.60	C-2V	—	1,700	2,500	1.26	.757	.636	.515
12PSB	12.0	.170	2.0	C-2F	.35	2,000	12,000	1.26	.757	.636	.515
24PSB	24.0	.073	1.7	C-2F	.50	3,000	10,000	1.26	.757	.636	.515
28PSB	28.0	.040	1.1	C-2F	.29	1,600	5,000	1.26	.757	.636	.515
48PSB	48.0	.053	2.5	C-7A	.70	1,800	7,500	1.26	.757	.636	.515
60PSB	60.0	.050	3.0	C-7A	.73	2,600	7,500	1.44	.864	.726	.588
120PSB	120.0	.025	3.0	CC-7A	.36	1,200	10,000	1.44	.864	.726	.588

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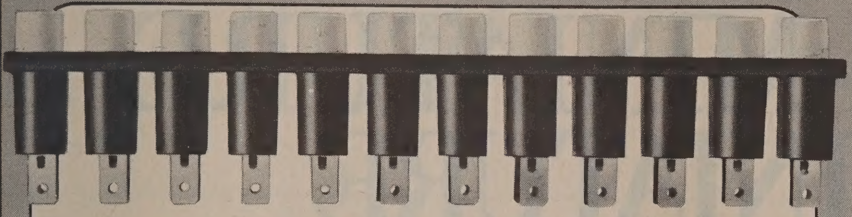
[3] See opposite page for electrical data and pricing of indicator lamps.

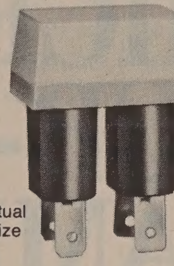
GTE SYLVANIA

STRIP SOCKET ASSEMBLIES

Mix 'n Match

TWIN LIGHT ASSEMBLIES





PROFAX END CAPS[1]

Price each in quantity of			
1	10	100	500
.25	.148	.125	.101

Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Pearl White	38006
Green	38004
Blue	38005
Orange	38007

PYREX END CAPS[2]

Price each in quantity of			
1	10	100	500
.29	.173	.146	.118

Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

TWIN LIGHT LENSES

Price each in quantity of	
1	$.79
10	.476
100	.400
500	.324

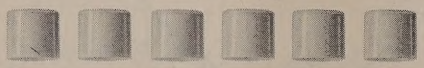
No.	Color
30180	Red
30182	Amber
30183	White
30184	Green
30185	Blue

INDICATOR LAMP STRIP SOCKETS

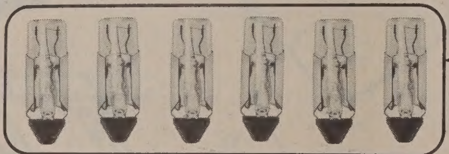
	½" CENTERS		¾" CENTERS	
No. Skts.	Common Ground	Individual Contacts	Common Ground	Individual Contacts
2	31301	31311	31321	31337
3	31302	31312	31322	31338
4	31303	31313	31323	31334
5	31304	31314	31324	31339
6	31305	31315	31325	31333
7	31306	31316	31326	31340
8	31307	31317	31327	31341
9	31308	31318	31328	31342
10	31309	31319	31329	31343
11	31310	31320	31330	31344
12	31250	33250	31275	33275

	Price each in quantity of			
No. Skts.	1	10	100	500
2	$1.77	$1.060	$ .890	$ .721
3	2.63	1.579	1.326	1.074
4	3.50	2.096	1.761	1.426
5	4.36	2.615	2.197	1.779
6	5.23	3.134	2.633	2.132
7	6.09	3.653	3.069	2.485
8	6.96	4.172	3.505	2.838
9	7.82	4.691	3.941	3.191
10	8.69	5.210	4.377	3.544
11	9.56	5.729	4.813	3.897
12	5.45	3.265	2.743	2.221

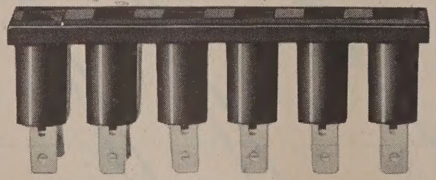
Choose end caps



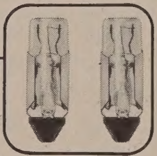
add T-2 Lamps



and insert Lamp into socket

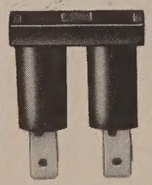


INDICATOR LAMPS



TWIN LIGHT SOCKETS

No.	Description
31351	Both Sides Common (2 contacts)
31352	One Side Common (3 contacts)
31353	Individual Contacts (4 contacts)



Price each in quantity of			
1	10	100	500
$1.83	$1.055	$.880	$.705

INDICATOR LAMPS

LAMP NUMBER	DESIGN VOLTS	DESIGN AMPERES	DESIGN WATTS	FILAMENT	M.S.C.D.	AVERAGE END FOOT-CANDLES	RATED AVERAGE LIFE (HOURS)	Price each in quantity of 1	10	100	500
4ESB	4.0	.040	.16	C-6	.03	200	10,000	$1.35	$.807	$.678	$.549
5ESB	5.0	.040	.20	C-6	.04	225	8,000	1.35	.807	.678	.549
6ESB	6.0	.040	.24	C-2V	.025	250	10,000	1.23	.735	.618	.500
53B	6.0	.240	1.44	C-2V	.24	2,000	5,000	1.13	.676	.568	.460
10ASB	10.0	.010	.10	C-2F	.001	*	50,000	1.50	.901	.757	.613
10CSB	10.0	.017	.17	C-2V	.01	60	20,000	1.37	.822	.690	.559
10ESB	10.0	.040	.40	C-2V	.07	450	10,000	1.24	.741	.622	.504
12ESB	12.0	.040	.48	C-2V	.09	650	10,000	1.24	.741	.622	.504
14FSB	14.0	.080	1.12	C-2F	.50	4,000	500	1.36	.813	.683	.553
16CSB	16.0	.017	.27	C-2F	.016	80	15,000	1.36	.813	.683	.553
16ESB	16.0	.040	.64	C-2F	.17	800	7,500	1.24	.741	.622	.504
18ESB	18.0	.040	.72	C-2F	.14	850	5,000	1.24	.741	.622	.504
24CSB	24.0	.017	.42	C-2F	.02	100	15,000	1.36	.813	.683	.553
24ESB	24.0	.040	.96	C-2F	.12	850	8,000	1.26	.757	.636	.515
28ESB	28.0	.040	1.12	C-2F	.25	1,500	6,000	1.26	.757	.636	.515
48ESB	48.0	.040	1.92	CC-2F	.44	3,000	5,000	1.44	.864	.726	.588

Dimensional drawings and listings of hundreds of other miniature lamps will be found in our four color catalog #301 available on request.

GTE Sylvania
Miniature Lighting Products
West Main Street
Hillsboro, N.H. 03244
Tel: 603-464-5533

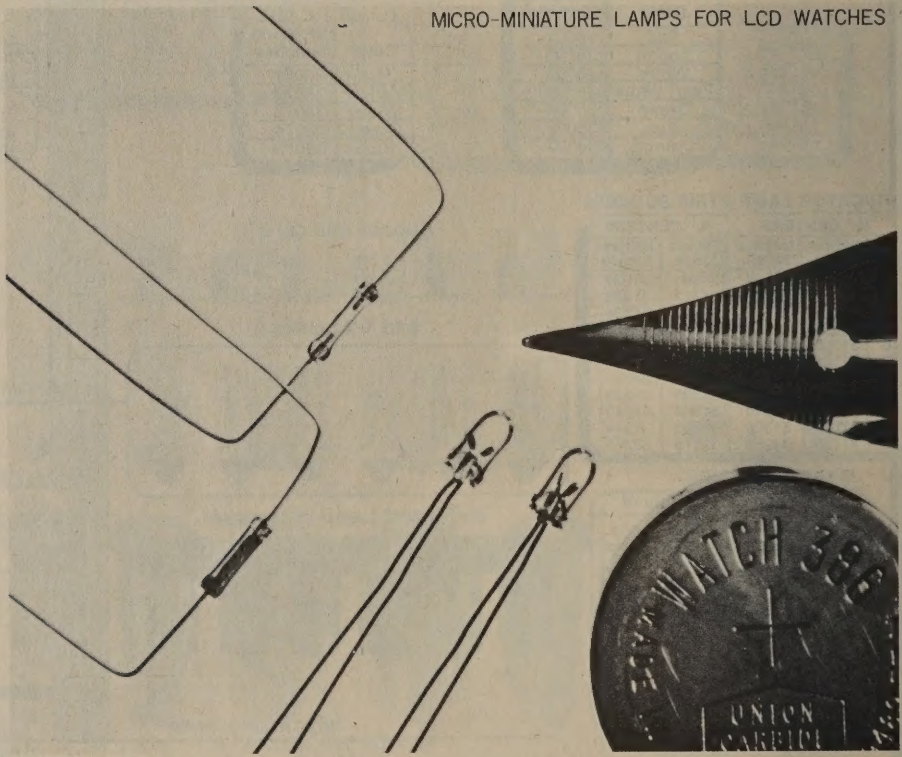
---

[1] Profax caps are press fit to lamp. Cannot be used with lamps rated over 1.1 watts.

[2] Pyrex caps must be cemented to bulb with a translucent silicone rubber adhesive.

GTE SYLVANIA

HAMAI'S MICRO-MINIATURE SUB-MINIATURE LAMPS


MICRO-MINIATURE LAMPS FOR LCD WATCHES

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your nearest HAMAI distributor.

EAST : Mura Corporation
50 South Service Road
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MIDWEST : Sakata U.S.A. Corporation
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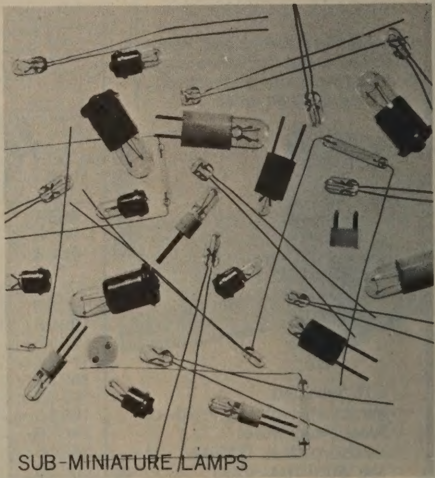
EIK Grove Village, 111. 60007
Phone(312)593-3211 Telex:230-280534

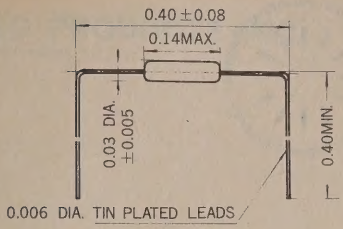
WEST : Sakata U.S.A. Corporation
La Branch
Room No.425
510 West 6th Street
Los Angels, Calif. 90014
Phone(213)622-4977 Telex:230-698131


SUB-MINIATURE LAMPS

Specialist of Micro-Miniature Lamps, Sub-miniature Lamps & Lens-End Lamps.

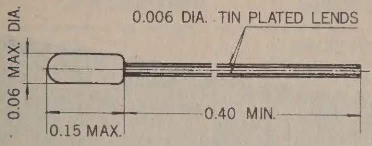
Guarantees Supreme Quality
ROYAL

HAMAI ELECTRIC LAMP CO., LTD.
9-26, Kasuga, 1-chome, Bunkyo-ku, Tokyo 112
Phone:Tokvo(03)813-8811 Cable:HAMAIELEC Telex:272-2408


0.40±0.08
0.14MAX.
0.03 DIA. ±0.005
0.40MIN.
0.006 DIA. TIN PLATED LEADS

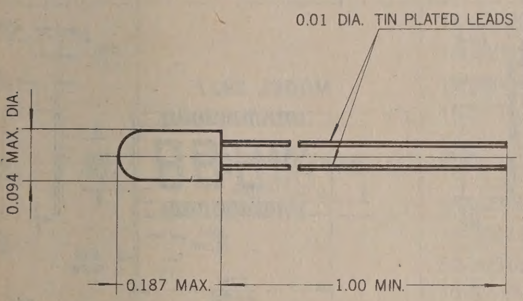
	LAMP NO.	DESIGN		MSCP	LIFE (HOURS)
		VOLTS	AMPS		
T-1/4	AXL−11	1.3	0.013 MAX.	0.002 MIN.	20 MIN.
	AXL− 4	1.55	0.010 MAX.	0.002 MIN.	20 MIN.
	AXL− 1	1.55	0.013 MAX.	0.0027 MIN.	40 MIN.
	AXL− 7	1.55	0.018 MAX.	0.005 MIN.	40 MIN.

Designed for LCD watches, having a high light output and low current.

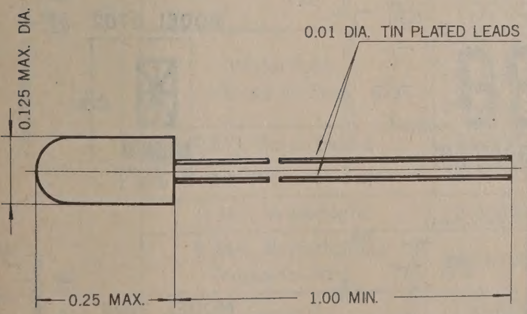

0.006 DIA. TIN PLATED LENDS
0.06 MAX. DIA.
0.15 MAX.
0.40 MIN.

	LAMP NO.	DESIGN		MSCP	LIFE (HOURS)
		VOLTS	AMPS		
T-1/2	H−0133	1.55	0.013 MAX.	0.0027 MIN.	40 MIN.
	H−0135	1.55	0.015 MAX.	0.0024 MIN.	20 MIN.
	H−0134	1.55	0.018 MAX.	0.005 MIN.	40 MIN.

Designed for LCD watches, having a high light output and low current.


0.01 DIA. TIN PLATED LEADS
0.094 MAX. DIA.
0.187 MAX.
1.00 MIN.

	LAMP NO.	DESIGN		MSCP (±25%)	AVERAGE LIFE (HOURS)
		VOLTS	AMPS (±10%)		
T-3/4	H−0243	1.5	0.015±20%	0.002 NOM.	5,000
	H−0252	3.0	0.010±20%	0.001 NOM.	16,000
	H−0253	3.0	0.060	0.03	50,000
	H−0256	5.0	0.015	0.01 NOM.	5,000
	H−0265	5.0	0.021	0.03	5,000
	6833	5.0	0.060	0.05	60,000
	7133	5.0	0.075	0.09	25,000
	7153	5.0	0.115	0.15	40,000


0.01 DIA. TIN PLATED LEADS
0.125 MAX. DIA.
0.25 MAX.
1.00 MIN.

Available with flange base and bi-pin base

	LAMP NO.	DESIGN		MSCP (±25%)	AVERAGE LIFE (HOURS)
		VOLTS	AMPS (±10%)		
T-1	H−0301	1.5	0.015±20%	0.001 NOM.	10,000
	H−0303	3.0	0.008±20%	0.001 NOM.	16,000
	7207	3.0	0.060	0.03	60,000
	7209	5.0	0.015±20%	0.01 NOM.	5,000
	6022	5.0	0.021	0.03	5,000
	680	5.0	0.060	0.03	60,000
	683	5.0	0.060	0.05	60,000
	713	5.0	0.075	0.09	25,000
	715	5.0	0.115	0.15	40,000
	7218	10.0	0.027	0.08	5,000
	7219	12.0	0.060	0.15	16,000
	7220	18.0	0.026	0.13	5,000
	6838	28.0	0.024	0.15	7,000

A complete catalog is available on request

Guarantees Supreme Quality

ROYAL

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9-26, Kasuga, 1-chome, Bunkyo-ku, Tokyo 112
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HAMLIN INC

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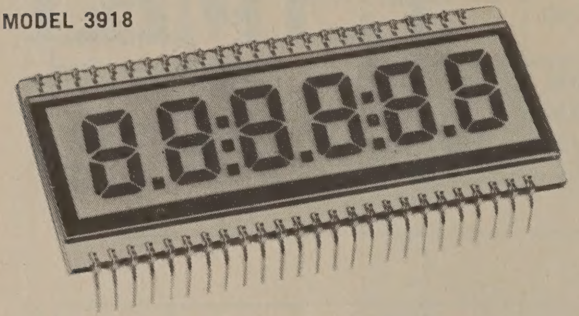
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

LIQUID CRYSTAL DISPLAYS

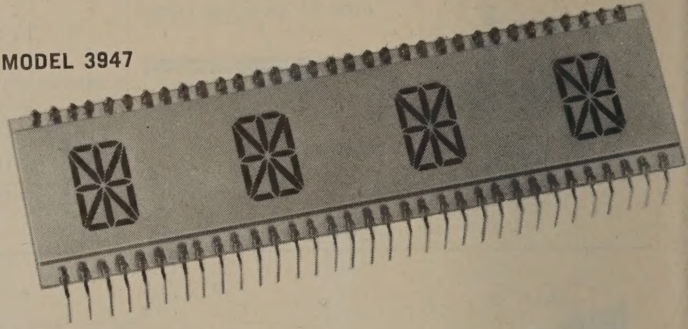
Hamlin field effect LCD's are available in Dual in-line or edge board connector packaging. Digits may be black or clear with a choice of transmissive, transflective or reflective background. Thermoplastic bonding provides maximum seal integrity.

Complete design/production services are available to provide custom displays with special format, electrical or environmental requirements. Contact our applications engineering department directly or through your nearest Hamlin sales representative.

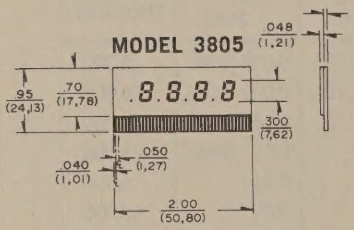
MODEL 3918



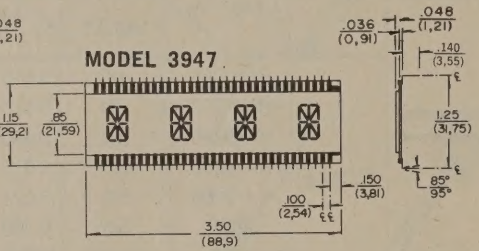
MODEL 3947



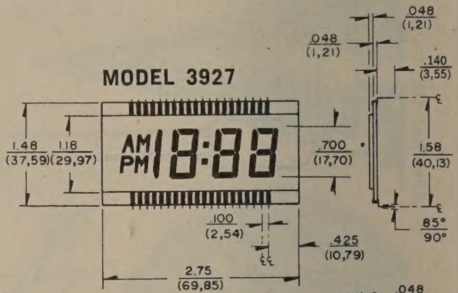
MODEL 3805


.048 (1,21)
.048 (1,21)
.95 (24,13)
.70 (17,78)
.300 (7,62)
.050 (1,27)
.040 (1,01)
2.00 (50,80)

MODEL 3947


.036 (0,91)
.048 (1,21)
.140 (3,55)
1.15 (29,21)
.85 (21,59)
1.25 (31,75)
85° 95°
.100 (2,54)
.150 (3,81)
3.50 (88,9)

MODEL 3927


.048 (1,21)
.048 (1,21)
.140 (3,55)
1.48 (37,59)
1.18 (29,97)
AM PM
.700 (17,70)
1.58 (40,13)
.100 (2,54)
.425 (10,79)
85° 90°
2.75 (69,85)

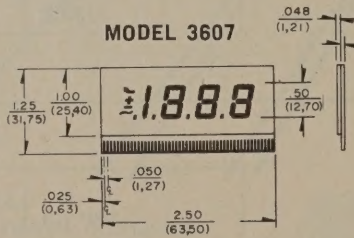
PERFORMANCE SPECIFICATIONS

Characteristic Unless otherwise specified TA = +25°C and test voltage is typical		Min.	Typ.	Max.	Units
Operating Voltage		4	5	17	Vrms
DC Drive component allowable			25		mV
Operating frequency range*		30	32	100	Hz
Current (all segments ON)			30		µA
Capacitance (all segments ON)			1300		pF
DC resistance (all segments ON)			25		MΩ
Visual threshold	10% ON 25°C		1.9		Vpeak
	0°C		2.3		Vpeak
	90% ON 25°C		2.7		Vpeak
	0°C		3.1		Vpeak
Response time					
Segment ON (TA = +25°C)			75		ms
Segment OFF (TA = +25°C)			150		ms
Segment ON (TA = 0°C)			150		ms
Segment OFF (TA = 0°C)			600		ms
Contrast ratio			20:1		
Operating temperature range		−10		+60	°C
Storage temperature range†		−20		+65	°C
Expected life			50,000		hours

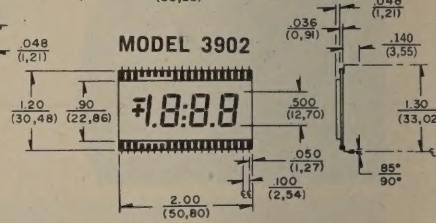
* Recommended; flicker may occur below 30 Hz, power consumption increases above 100 Hz.

† 40% relative humidity.

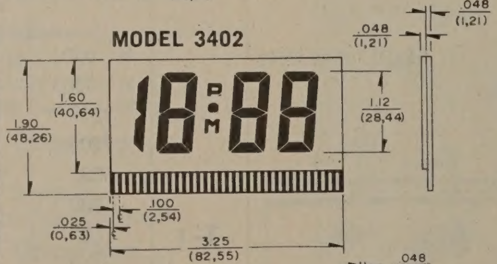
MODEL 3607


.048 (1,21)
.048 (1,21)
1.25 (31,75)
1.00 (25,40)
.50 (12,70)
.050 (1,27)
.025 (0,63)
2.50 (63,50)

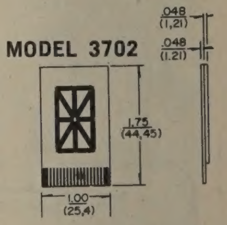
MODEL 3902


.036 (0,91)
.048 (1,21)
.140 (3,55)
1.20 (30,48)
.90 (22,86)
.500 (12,70)
1.30 (33,02)
.050 (1,27)
.100 (2,54)
85° 90°
2.00 (50,80)

MODEL 3402


.048 (1,21)
.048 (1,21)
1.60 (40,64)
1.90 (48,26)
1.12 (28,44)
P M
.100 (2,54)
.025 (0,63)
3.25 (82,55)

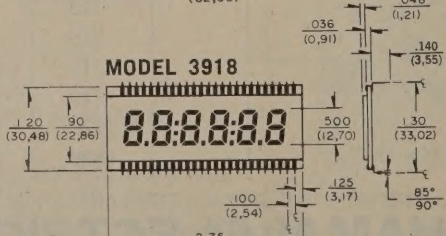
MODEL 3702


.048 (1,21)
.048 (1,21)
1.75 (44,45)
1.00 (25,4)

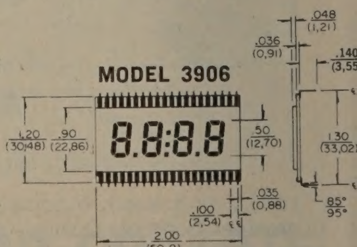
ORDERING/PRICING INFORMATION

Display No.	List 1-10	Connector No.	List 1-10
3805-312	$18.00	3152-200	$3.90
3947-312	40.00	DIP	4.00
3927-312	35.00	DIP	—
3607-312	21.80	3152-250	4.30
3902-312	30.00	DIP	—
3402-312	26.95	3112-325	3.40
3702-312	16.45	3152-400	5.50
3918-312	34.00	DIP	—
3906-312	30.00	DIP	—

MODEL 3918


.036 (0,91)
.048 (1,21)
.140 (3,55)
1.20 (30,48)
.90 (22,86)
.500 (12,70)
1.30 (33,02)
.125 (3,17)
85° 90°
.100 (2,54)
2.75 (69,85)

MODEL 3906


.036 (0,91)
.048 (1,21)
.140 (3,55)
1.20 (30,48)
.90 (22,86)
.50 (12,70)
1.30 (33,02)
.100 (2,54)
.035 (0,88)
85° 95°
2.00 (50,8)

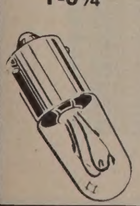
NOTE: To specify viewing mode, add following suffix numbers:

210 Transmissive clear on black
312 Transflective black on silver
313 Reflective black on silver

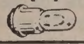
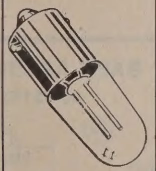
ILLUMINATED PRODUCTS INC.
A Subsidiary of Oak Industries Inc.
2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

INDICATOR SELECTION GUIDE

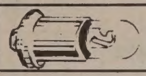
INCANDESCENT

SIZE	DESCRIPTION	SERIES	PAGE NO.
T-1	General Purpose, Sub-Miniature	99-33180	2
		99-33081	3
		99-33080	3
		99-36980	4
		99-36981	4
		99-36982	4
	Sub-Miniature, E.M.I. Suppressed	98-36980	4
		98-36981	4
		98-36982	4
	Sub-Miniature, Watertight	95-33180	4
T-1¾	General Purpose, Miniature	14-33880	5
		14-33881	5
		14-33882	5
		14-34080	6
		14-35180	6
		14-36380	7
		14-30380	7
		14-30080	8
		59-52380	9
		59-52480	9
		11-33480	10
	General Purpose, Miniature, Press-to-Test	59-52280	9
		03-90980	10
		03-91080	11
		01-91180	12
	Watertight	15-30083	12
		15-35182	13
		15-35183	13
		11-35182	13
	Watertight, Press-to-Test	05-91182	14
		05-90880	14
		05-90881	14
	E.M.I. Suppressed	18-36880	15
	E.M.I., Press-to-Test	08-83281	15
	E.M.I., Watertight	18-36680	16
	E.M.I., Watertight, Press-to-Test	08-83283	16
T-3¼ 	General Purpose	13-VM305	17
		13-VM309	17
	General Purpose, Press-to-Test	04-VM905	17
		04-VM906	17
		02-91180	18
	Watertight, Press-to-Test	06-91182	18
	E.M.I. Suppressed	18-83680	19

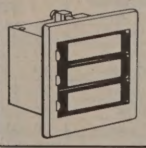
NEON

SIZE	DESCRIPTION	SERIES	PAGE NO.
T-1 	Sub-Miniature	99-33080	3
		99-33081	3
T-2	General Purpose, Miniature	22-35380	19
		31-36180	21
		31-36280	21
		33-36181	20
		33-36281	20
		33-30880	20
		33-30881	20
	Watertight	31-36680	21
		31-36681	21
	E.M.I. Watertight	38-36680	16
		38-36681	16
	E.M.I. Suppressed	38-36180	22
		38-36280	22
		38-36480	22
		38-36481	22
T-3¼ 	E.M.I. Suppressed	38-83681	23
		38-83682	23

LIGHT EMITTING DIODE (L.E.D.)

SIZE	DESCRIPTION	SERIES	PAGE NO.
	General Purpose, Miniature	QT/D300	23
		14-35380	23

RECTANGULAR MISSILITES

	DESCRIPTION	PAGES
	Dual lamp word warning indicators	24-31

* UL Recognized

☐ MILITARY APPROVED, See Pages 32 and 33

Indicators

INDICATOR LIGHTS

This Indicator Light section of the catalog has been compiled to provide the necessary specification information as concisely as possible, so the design or packaging engineer may readily select the unit which best meets his needs. In particular, the Indicator Selection Guide presents a speedy method of narrowing down the total number of indicators in this catalog to a small group for more detailed consideration.

As more and more indicators became available, the old system of requiring the customer to construct his own part number became more and more cumbersome. In this catalog, for the first time, complete assembly part numbers are tabulated for each indicator/cap combination. Very simple substitutions in these numbers allow changes in color, substitution of translucent for transparent lenses, etc. As in the past, the desired lamp number is added as a suffix to the part number. This new method in no way represents a change in the previous numbering system; it is only a faster method for determining the proper number.

These panel indicators embody the best of military and commercial materials and performance features. Materials, finishes, and workmanship, are more than adequate for conformance to Military, Federal, or industry specifications. In particular, pages 32 and 33 presents a cross reference listing of IPI indicators which are on the MIL-L-3661B Qualified Products List, and also those which may be ordered against MS (Military Standard) designations.

Because of the wide variety of items in the Illuminated Products Indicator Light line, it is possible in most cases to select a standard, off-the-shelf unit to meet a precise requirement. Innumerable variations can also be furnished, such as caps in special color combinations, lettered to meet your needs, either hot stamped, or engraved and filled.

The Illuminated Products sales staff is always at your service whenever additional information or assistance is required.

sub-miniature

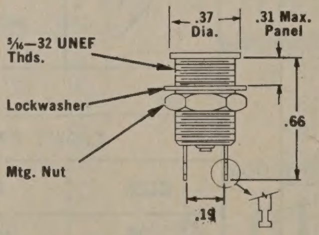
99-33180 SERIES

Notes:

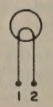
1. **Material and Finishes:** Mounting tube, black glass filled nylon per MIL-M-19887. Mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1 sub-midget flange base. See lamp selection guide. Choose from Group M.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .328 + .015 — .000 diameter.
5. **Weight:** Approx. .12 oz less lamp.

BASE ASSEMBLY

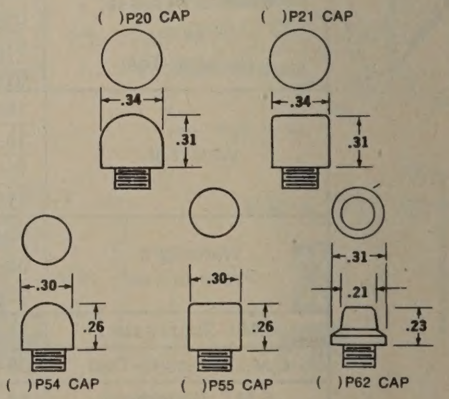
99-33180



SCHEMATIC



CAP STYLES



Complete Assembly Part Numbers (Less Lamp)

Transparent Lens Colors	( )P20 Cap	( )P21 Cap	( )P54 Cap	( )P55 Cap	( )P62 Cap
Clear*	99-33180-5P20	99-33180-5P21	99-33180-5P54	99-33180-5P55	99-33180-5P62
Red	99-33180-6P20	99-33180-6P21	99-33180-6P54	99-33180-6P55	99-33180-6P62
Green	99-33180-7P20	99-33180-7P21	99-33180-7P54	99-33180-7P55	99-33180-7P62
Amber	99-33180-8P20	99-33180-8P21	99-33180-8P54	99-33180-8P55	99-33180-8P62
Blue	99-33180-11P20	99-33180-11P21	99-33180-11P54	99-33180-11P55	99-33180-11P62
Yellow	99-33180-12P20	99-33180-12P21	99-33180-12P54	99-33180-12P55	99-33180-12P62
Orange	99-33180-16P20	99-33180-16P21	99-33180-16P54	99-33180-16P55	99-33180-16P62
Lunar	99-33180-17P20	99-33180-17P21	99-33180-17P54	99-33180-17P55	99-33180-17P62

Translucent colors: Add "TL" as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

Indicators

sub-miniature "little QT"

99-33080 SERIES
99-33081 SERIES

Notes:

1. **Materials and Finishes:** Housing and lamp base, gray glass filled nylon. Terminals, beryllium copper, gold flashed. Retainer clip, stainless steel.

2. **Lens Cap:** High impact resistant plastic per L-P-393. (polycarbonate)

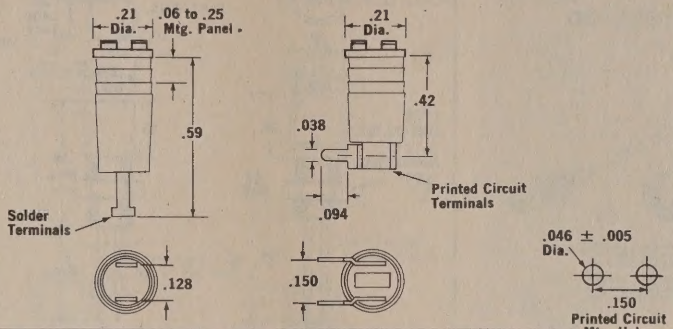
3. **Lamp:** Assembly accepts IPI based T-1 lamp, see lamp selection below. Lamp is replaced by removing snap-on cap.

4. **Mounting:** Two types optional.

A. Press-in; Assembly press fits into .189 dia. hole. No mounting hardware required.

B. Retainer clip; For mounting assembly into .200 ±.005 dia. hole or panels less than .06 thick. Order clip 067003000 separately.

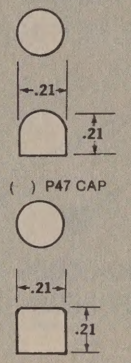
BASE ASSEMBLY 99-33080 — BASE ASSEMBLY 99-33081



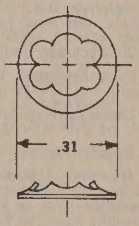
Complete Assembly Part Numbers (Less Lamp) **		
Transparent Lens Colors	( )P46 Cap	( )P47 Cap
Clear*	99-33080- 5P46	99-33080- 5P47
Red	99-33080- 6P46	99-33080- 6P47
Green	99-33080- 7P46	99-33080- 7P47
Amber	99-33080- 8P46	99-33080- 8P47
Blue	99-33080-11P46	99-33080-11P47
Yellow	99-33080-12P46	99-33080-12P47
Orange	99-33080-16P46	99-33080-16P47
Lunar	99-33080-17P46	99-33080-17P47

Translucent colors: add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Indicates color designation.
For printed circuit terminals change 99-33080 to 99-33081
**To order with lamp installed, add Lamp Number No. as suffix to Part No.
Example: 99-33080-5P46-001

CAP STYLES



SCHEMATIC



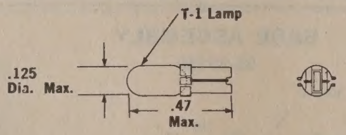
Optional Mtg. Clip 067003000 (Order Separately)

"little QT" lamps

Notes:

1. **Lamp Bases** are color coded for operating voltage as follows:

Blue	1.5 volts
Yellow	3.0 volts
Black	5.0 volts
Green	10.0 volts
Gray	12.0 volts
Purple	14.0 volts
White	18.0 volts
Red	28.0 volts
Brown	115.0 volts AC



Little QT™ Lamp Selection					
Lamp No.	Volts	Amps	MSCP	Average Life (Hrs.)	ANSI No. (Ref.)
001	1.5	.010	.002	10,000	7200
002	1.5	.015	.01	10,000	7201
003	1.5	.060	.02	50,000+	7202
004	1.5	.075	.03	16,000+	7203
005	3.0	.060	.03	100,000	7207
006	3.0	.120	.15	16,000	7208
007	**3.0**	**.008**	**.01**	**16,000**	**7204**
008	**5.0**	**.015**	**.02**	**10,000**	**7209**
009	**5.0**	**.060**	**.05**	**100,000**	**683**
010	5.0	.075	.09	25,000	713
012	5.0	.115	.20	5,000	7213
013	**5.0**	**.060**	**.03**	**100,000**	**680**
014	5.0	.115	.19	10,000	7215
015	5.0	.125	.25	5,000	7216
024	**5.0**	**.115**	**.15**	**40,000**	**715**
025	5.0	.060	.15	6,500	6150
016	**10.0**	**.027**	**.10**	**10,000**	**7218**
017	**12.0**	**.060**	**.15**	**16,000+**	**7219**
027	**14.0**	.040	.15	16,000	23
018	**18.0**	**.026**	**.15**	**10,000**	**7220**
022	**28.0**	**.024**	**.15**	**16,000+**	**6838**

Bold face type indicates most popular lamps generally available directly from stock.

To Order Lamps Separately Specify 100057 ( )
Lamp No. From Tabulation
Example: 100057001

ILLUMINATED PRODUCTS INC.

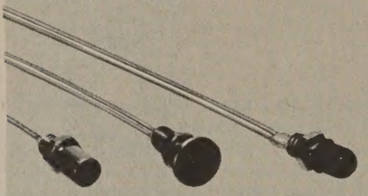
A Subsidiary of Oak Industries Inc.

2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

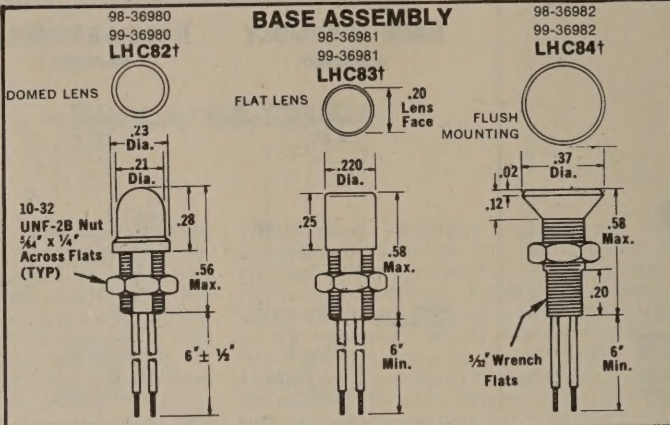
OAK

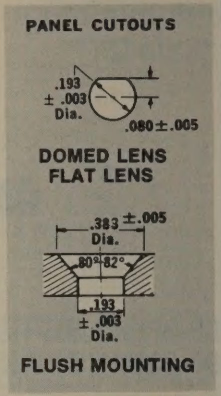
Indicators

sub-miniature, optional E.M.I. suppression



98-36980 SERIES
99-36980 SERIES


BASE ASSEMBLY
98-36980
99-36980
LHC82†
DOMED LENS
.23 Dia.
.21 Dia.
10-32 UNF-2B Nut
5/64" x 1/4" Across Flats (TYP)
.28
.56 Max.
6" ± 1/2"
98-36981
99-36981
LHC83†
FLAT LENS
.20 Lens Face
.220 Dia.
.25
.58 Max.
6" Min.
98-36982
99-36982
LHC84†
FLUSH MOUNTING
.02
.37 Dia.
.12
.58 Max.
.20
5/32" Wrench Flats
6" Min.


PANEL CUTOUTS
.193 ± .003 Dia.
.080 ± .005
DOMED LENS
FLAT LENS
.383 ± .005 Dia.
80°-82°
.193 ± .003 Dia.
FLUSH MOUNTING

Complete Assembly Part Numbers (Includes Lamp)						
	E.M.I. Suppressed			Not E.M.I. Suppressed		
Transparent Lens Colors	Domed Lens	Flat Lens	Flush Mounting	Domed Lens	Flat Lens	Flush Mounting
Clear°	98-36980-5	98-36981-5	98-36982-5	99-36980-5	99-36981-5	99-36982-5
Red	98-36980-6	98-36981-6	98-36982-6	99-36980-6	99-36981-6	99-36982-6
Green	98-36980-7	98-36981-7	98-36982-7	99-36980-7	99-36981-7	99-36982-7
Amber	98-36980-8	98-36981-8	98-36982-8	99-36980-8	99-36981-8	99-36982-8
Blue	98-36980-11	98-36981-11	98-36982-11	99-36980-11	99-36981-11	99-36982-11
Yellow	98-36980-12	98-36981-12	98-36982-12	99-36980-12	99-36981-12	99-36982-12
Orange	98-36980-16	98-36981-16	98-36982-16	99-36980-16	99-36981-16	99-36982-16
Lunar	98-36980-17	98-36981-17	98-36982-17	99-36980-17	99-36981-17	99-36982-17

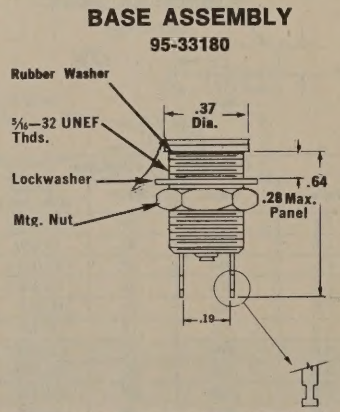
Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661.
See pages 32 and 33 for complete listing of military type designations.
°White if translucent color specified.

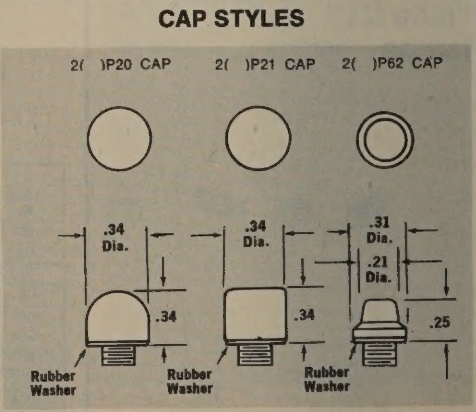
Notes:

1. **Materials and Finishes:** Mounting tube and nut are stainless steel, passivated per MIL-S-5002. Wire leads #26 GA silver coated, stranded copper with TFE-flurocarbon insulation.
2. **Lens Assembly:** Lens is high impact-resistant plastic per L-P-393 (polycarbonate).
3. **Lamp:** (non-replaceable) MS 24367-683 subminiature T-1 with 5.0V @ .060 AMP rating.
4. **Weight:** Approx. 0.005 lbs. maximum.
5. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. E.M.I. suppressed assemblies require paint free area on back side of mounting hole for E.M.I. conductivity.

sub-miniature, watertight

95-33180 SERIES

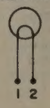

BASE ASSEMBLY
95-33180
Rubber Washer
5/16—32 UNEF Thds.
.37 Dia.
Lockwasher
.64
.28 Max. Panel
Mtg. Nut
.19


CAP STYLES
2( )P20 CAP
2( )P21 CAP
2( )P62 CAP
.34 Dia.
.34
Rubber Washer
.34 Dia.
.34
Rubber Washer
.31 Dia.
.21 Dia.
.25
Rubber Washer

Complete Assembly Part Number (Less Lamp)			
Transparent Lens Colors	2( )P20 Cap	2( )P21 Cap	2( )P62 Cap
Clear*	95-33180- 25P20	95-33180- 25P21	95-33180- 25P62
Red	95-33180- 26P20	95-33180- 26P21	95-33180- 26P62
Green	95-33180- 27P20	95-33180- 27P21	95-33180- 27P62
Amber	95-33180- 28P20	95-33180- 28P21	95-33180- 28P62
Blue	95-33180-211P20	95-33180-211P21	95-33180-211P62
Yellow	95-33180-212P20	95-33180-212P21	95-33180-212P62
Orange	95-33180-216P20	95-33180-216P21	95-33180-216P62
Lunar	95-33180-217P20	95-33180-217P21	95-33180-217P62

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



NOTES:

1. **Material and Finishes:** Mounting tube, black glass filled nylon per MIL-M-19887. Mtg. nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.
3. **Lamp:** T-1 sub-midget flange base. See lamp selection guide. Choose from Group M.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .328 + .015 —.000 diameter.

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Tel: (714) 540-9471 TWX: 910-595-1504

Indicators

miniature "big QT"

14-33880 SERIES
14-33881 SERIES
14-33882 SERIES

Notes:

1. Materials and Finishes: Housing and lamp base, gray glass filled nylon. Terminals, beryllium copper, gold flashed. Retainer clip, spring steel.

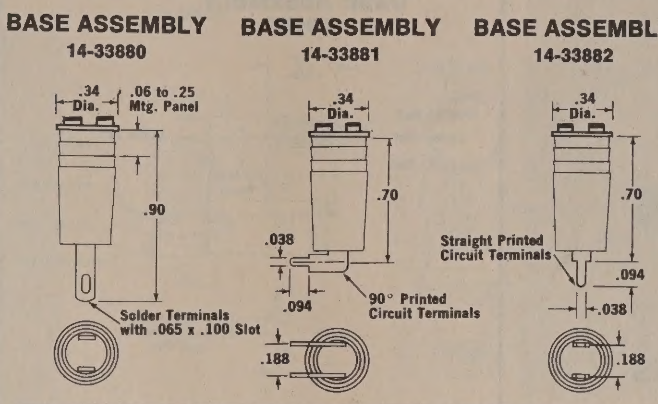
2. Lens Cap: High impact resistant plastic per L-P-393. (polycarbonate)

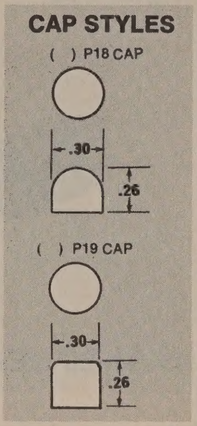
3. Lamp: Assembly accepts IPI based T-1¾ lamp, see lamp selection below. Lamp is replaced by removing snap-on cap.

4. Mounting: Two types optional.

A. Press-in; Assembly press fits into .281 dia. hole. No mounting hardware required.

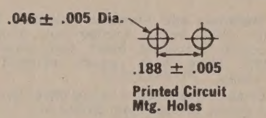
B. Retainer clip; For mounting assembly into .200 ±.005 dia. hole or panels less than .06 thick. Order clip 067003000 separately.

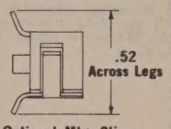

BASE ASSEMBLY 14-33880
BASE ASSEMBLY 14-33881
BASE ASSEMBLY 14-33882
.34 Dia.
.06 to .25 Mtg. Panel
.90
Solder Terminals with .065 x .100 Slot
.34 Dia.
.70
.038
.094
90° Printed Circuit Terminals
.188
.34 Dia.
.70
Straight Printed Circuit Terminals
.094
.038
.188


CAP STYLES
( ) P18 CAP
.30
.26
( ) P19 CAP
.30
.26

Complete Assembly Part Numbers (Less Lamp)**		
Transparent Lens Colors	( )P18 Cap	( )P19 Cap
Clear*	14-33880- 5P18	14-33880- 5P19
Red	14-33880- 6P18	14-33880- 6P19
Green	14-33880- 7P18	14-33880- 7P19
Amber	14-33880- 8P18	14-33880- 8P19
Blue	14-33880-11P18	14-33880-11P19
Yellow	14-33880-12P18	14-33880-12P19
Orange	14-33880-16P18	14-33880-16P19
Lunar	14-33880-17P18	14-33880-17P19

Translucent colors: add "TL" as suffix to Part No.
*White if translucent colors specified.
( ) Indicates color designation.
For printed circuit terminals change 14-33880 to 14-33881 or 14-33882
**To order with lamp installed, add Lamp No. as suffix to Part No. Example: 14-33880-5P18-101


.046 ± .005 Dia.
.188 ± .005
Printed Circuit Mtg. Holes


.52 Across Legs

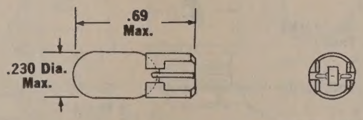
Optional Mtg. Clip 067004000 (Order Separately)

"big QT" lamps

Notes:

1. Lamp Bases are color coded for operating voltage as follows:

5.0 volts	Black
6.0 volts	Orange
6.3 volts	Dark Green
10.0 volts	Green
14.0 volts	Purple
28.0 volts	Red


.69 Max.
.230 Dia. Max.

To Order Lamps Separately
Specify 100057 ( )
Lamp No. From Tabulation

Big QT™ Lamp Selection					
Lamp No.	Volts	Amps	MSCP	Average Life (Hrs.)	ANSI No. (Ref.)
101	5.0	.066	.11	7,000	1739
102	6.0	.040	.032	10,000	1730
103	6.0	.200	.60	3,000	1784
104	6.3	.075	.230	500	1739
105	6.3	.200	.570	5,000	2112
106	10.0	.014	.004	10,000	1869
107	14.0	.080	.520	2,500	1705
108	14.0	.080	.300	50,000	2182
109	28.0	.040	.340	5,000	1764
110	28.0	.040	.300	25,000	2187

A neon lamp version of this indicator is also available.

Example: 100057101

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OAK

Indicators

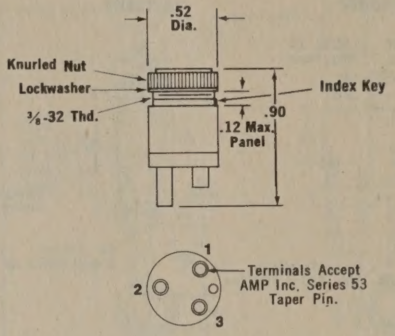
miniature

14-34080 SERIES

Notes:

1. **Materials and Finishes:** Mounting tube, molded glass filled nylon, knurled nut, aluminum, black anodized. Terminals, brass, gold plated per MIL-G-54204. Caps, high impact resistant plastic per L-P-349a.
2. **Lamp:** T-1¾ Midget flange base. See Lamp selection guide. Choose from Group A.
3. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Knurled nut fits No. 20 Gulmite wrench (Bergander Mfg. Co., Skokie, Illinois).

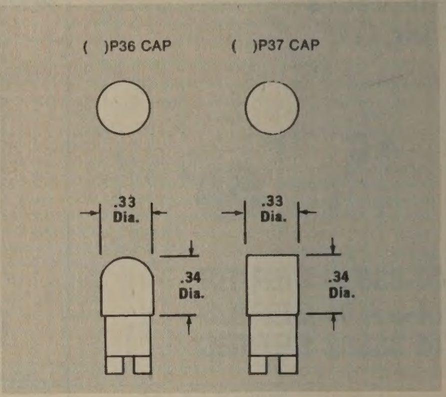
BASE ASSEMBLY
14-34080


.52 Dia.
Knurled Nut
Lockwasher
⅜-32 Thd.
Index Key
.90
.12 Max. Panel
1
2
3
Terminals Accept AMP Inc. Series 53 Taper Pin.

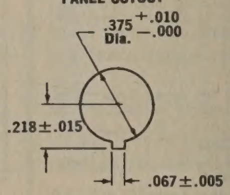
Complete Assembly Part Numbers (Less Lamp)		
Transparent Lens Colors	( )P36 Cap	( )P37 Cap
Clear*	14-34080-5P36	14-34080-5P37
Red	14-34080-6P36	14-34080-6P37
Green	14-34080-7P36	14-34080-7P37
Amber	14-34080-8P36	14-34080-8P37
Blue	14-34080-11P36	14-34080-11P37
Yellow	14-34080-12P36	14-34080-12P37
Orange	14-34080-16P36	14-34080-16P37
Lunar	14-34080-17P36	14-34080-17P37

Translucent colors: add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

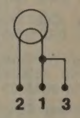
CAP STYLES


( )P36 CAP
( )P37 CAP
.33 Dia.
.34 Dia.
.33 Dia.
.34 Dia.

PANEL CUTOUT


.375 +.010 −.000 Dia.
.218±.015
.067±.005

SCHEMATIC



---

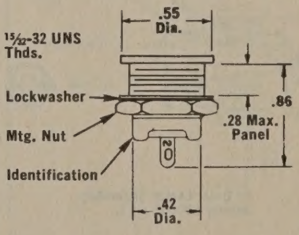
miniature

14-35180 SERIES

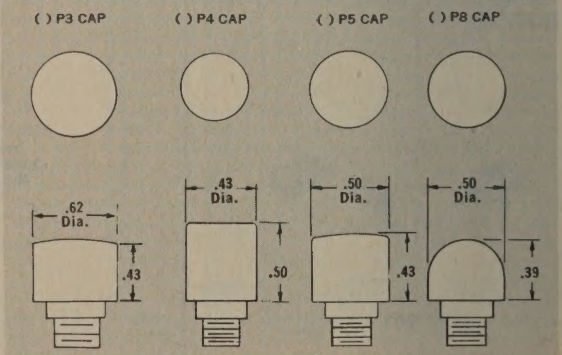
Notes:

1. **Materials and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .2 oz. less lamp.

BASE ASSEMBLY
14-35180


.55 Dia.
15/32-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.86
.28 Max. Panel
.42 Dia.

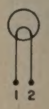
CAP STYLES


( ) P3 CAP
( ) P4 CAP
( ) P5 CAP
( ) P8 CAP
.62 Dia.
.43
.43 Dia.
.50
.50 Dia.
.43
.50 Dia.
.39

Complete Assembly Part Numbers (Less Lamp)				
Transparent Lens Colors	( )P3 Cap	( )P4 Cap	( )P5 Cap	( )P8 Cap
Clear*	14-35180-5P3	14-35180-5P4	14-35180-5P5	14-35180-5P8
Red	14-35180-6P3	14-35180-6P4	14-35180-6P5	14-35180-6P8
Green	14-35180-7P3	14-35180-7P4	14-35180-7P5	14-35180-7P8
Amber	14-35180-8P3	14-35180-8P4	14-35180-8P5	14-35180-8P8
Blue	14-35180-11P3	14-35180-11P4	14-35180-11P5	14-35180-11P8
Yellow	14-35180-12P3	14-35180-12P4	14-35180-12P5	14-35180-12P8
Orange	14-35180-16P3	14-35180-16P4	14-35180-16P5	14-35180-16P8
Lunar	14-35180-17P3	14-35180-17P4	14-35180-17P5	14-35180-17P8

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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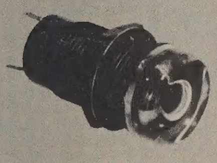
Indicators

miniature

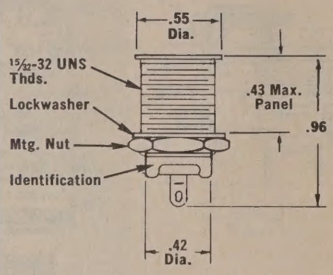


14-36380 SERIES

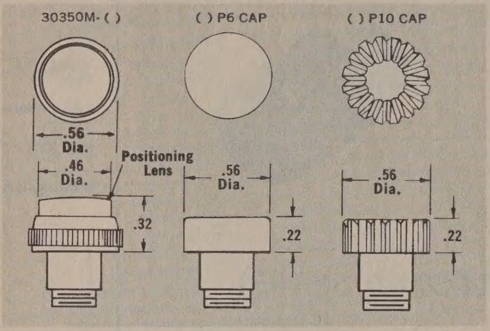
Notes:

1. **Material and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder is brass, bright nickel plate.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .2 oz. less lamp.

BASE ASSEMBLY
14-36380


.55
Dia.
15/32-32 UNS
Thds.
Lockwasher
Mtg. Nut
Identification
.43 Max.
Panel
.96
.42
Dia.

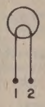
CAP STYLES


30350M-( )
( ) P6 CAP
( ) P10 CAP
.56
Dia.
.46
Dia.
Positioning
Lens
.32
.56
Dia.
.22
.56
Dia.
.22

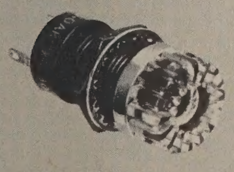
Complete Assembly Part Numbers (Less Lamp)			
Transparent Lens Colors	30350M-( ) Cap	( )P6 Cap	( )P10 Cap
Clear*	14-36380-5	14-36380-5P6	14-36380-5P10
Red	14-36380-6	14-36380-6P6	14-36380-6P10
Green	14-36380-7	14-36380-7P6	14-36380-7P10
Amber	14-36380-8	14-36380-8P6	14-36380-8P10
Blue	14-36380-11	14-36380-11P6	14-36380-11P10
Yellow	14-36380-12	14-36380-12P6	14-36380-12P10
Orange	14-36380-16	14-36380-16P6	14-36380-16P10
Lunar	14-36380-17	14-36380-17P6	14-36380-17P10

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



miniature

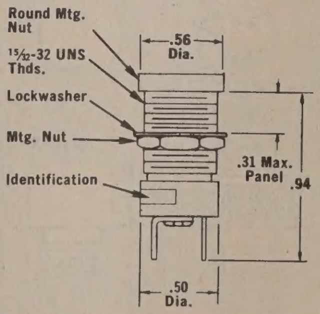


14-30380 SERIES

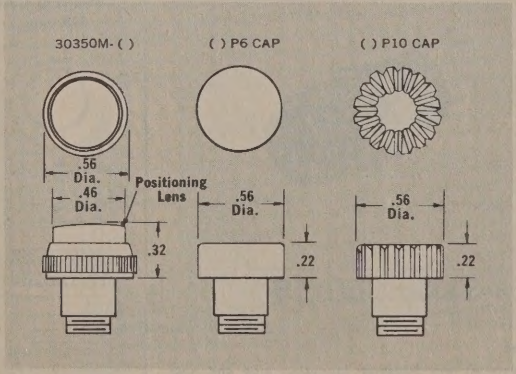
Notes:

1. **Material and Finishes:** Mounting tube and rear nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Round front mtg. nut, brass, bright nickel plate.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder is brass, bright nickel finish.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:**
Approx. .4 oz less lamp with 30350M-( ) cap.
.3 oz less lamp with P6 or P10 cap.

BASE ASSEMBLY
14-30380


Round Mtg.
Nut
.56
Dia.
15/32-32 UNS
Thds.
Lockwasher
Mtg. Nut
Identification
.31 Max.
Panel
.94
.50
Dia.

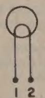
CAP STYLES


30350M-( )
( ) P6 CAP
( ) P10 CAP
.56
Dia.
.46
Dia.
Positioning
Lens
.32
.56
Dia.
.22
.56
Dia.
.22

Complete Assembly Part Numbers (Less Lamp)			
Transparent Lens Colors	30350M-( ) Cap	( )P6 Cap	( )P10 Cap
Clear*	14-30380-5	14-30380-5P6	14-30380-5P10
Red	14-30380-6	14-30380-6P6	14-30380-6P10
Green	14-30380-7	14-30380-7P6	14-30380-7P10
Amber	14-30380-8	14-30380-8P6	14-30380-8P10
Blue	14-30380-11	14-30380-11P6	14-30380-11P10
Yellow	14-30380-12	14-30380-12P6	14-30380-12P10
Orange	14-30380-16	14-30380-16P6	14-30380-16P10
Lunar	14-30380-17	14-30380-17P6	14-30380-17P10

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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OAK

Indicators

miniature

14-30080 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

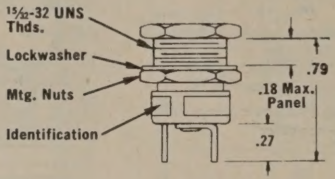
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

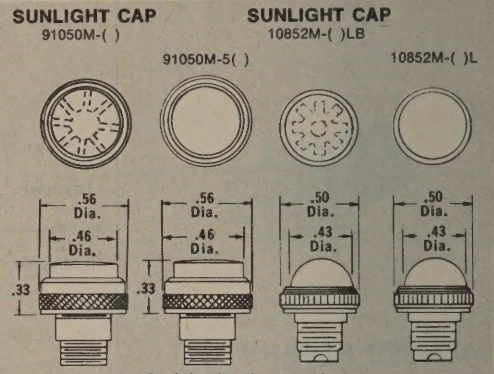
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

5. **Weight:** Approx. .27 oz less lamp.

BASE ASSEMBLY
14-30080



CAP STYLES

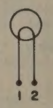


See below for other cap styles.

Complete Assembly Part Numbers (Less Lamp)				
Transparent Lens Colors	91050M-( ) Sunlight Cap	91050M-5( ) Cap	10852M-( )LB Sunlight Cap	10852M-( )L Cap
Clear*	14-30080-55LB	14-30080-55L	14-30080-5LB	14-30080-5L
Red	14-30080-56LB	14-30080-56L	14-30080-6LB	14-30080-6L
Green	14-30080-57LB	14-30080-57L	14-30080-7LB	14-30080-7L
Amber	14-30080-58LB	14-30080-58L	14-30080-8LB	14-30080-8L
Blue	14-30080-511LB	14-30080-511L	14-30080-11LB	14-30080-11L
Yellow	14-30080-512LB	14-30080-512L	14-30080-12LB	14-30080-12L
Lunar	14-30080-517LB	14-30080-517L	14-30080-17LB	14-30080-17L

Translucent colors: Add "TL" as suffix to Part No., not recommended for sunlight caps.
Frosted lens: For 10852M caps only — add "EF" (externally frosted) or "IF" (internally frosted) as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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miniature

14-30080 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

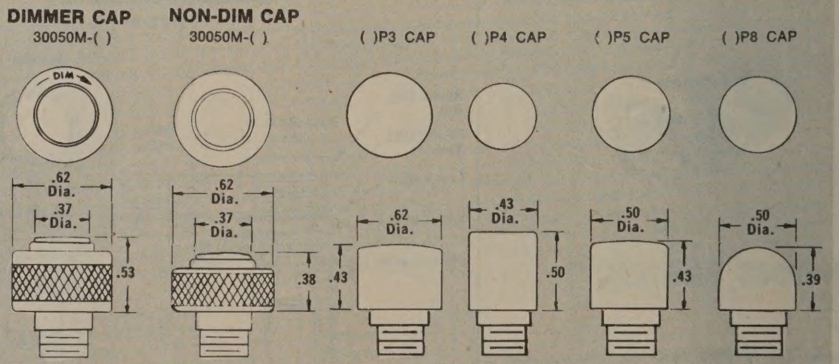
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

5. **Weight:** Approx. .45 oz. less lamp (Dim type)
.25 oz. less lamp (Non-dim)

CAP STYLES

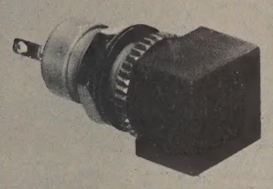


Complete Assembly Part Numbers (Less Lamp)						
Transparent Lens Colors	30050M-( ) Dimmer Cap	30050M-( ) Non-Dim Cap	( )P3 Cap	( )P4 Cap	( )P5 Cap	( )P8 Cap
Clear*	14-30080-1	14-30080-5	14-30080-5P3	14-30080-5P4	14-30080-5P5	14-30080-5P8
Red	14-30080-2	14-30080-6	14-30080-6P3	14-30080-6P4	14-30080-6P5	14-30080-6P8
Green	14-30080-3	14-30080-7	14-30080-7P3	14-30080-7P4	14-30080-7P5	14-30080-7P8
Amber	14-30080-4	14-30080-8	14-30080-8P3	14-30080-8P4	14-30080-8P5	14-30080-8P8
Blue	14-30080-10	14-30080-11	14-30080-11P3	14-30080-11P4	14-30080-11P5	14-30080-11P8
Yellow	14-30080-14	14-30080-12	14-30080-12P3	14-30080-12P4	14-30080-12P5	14-30080-12P8
Orange	——	14-30080-16	14-30080-16P3	14-30080-16P4	14-30080-16P5	14-30080-16P8
Lunar	——	14-30080-17	14-30080-17P3	14-30080-17P4	14-30080-17P5	14-30080-17P8

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

Indicators

miniature, optional press-to-test

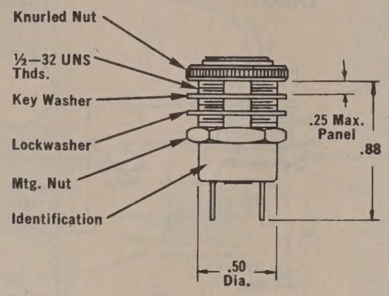


59-52280 SERIES
59-52380 SERIES

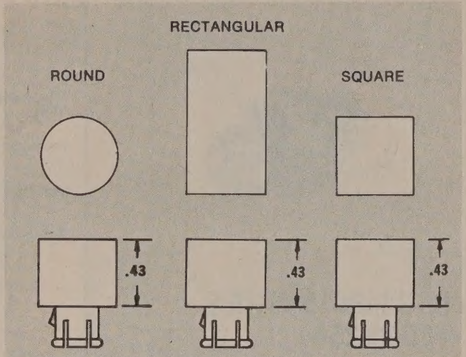
Notes:

1. **Material and Finishes:** Mounting tube and knurled nut, clear anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Mfg. nut and key washer, brass, nickel plate.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Friction fit lens caps are rotatable or keyed.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole, see drawing to right.
5. **Weight:** Approx. .5 oz, less lamp.

BASE ASSEMBLY
59-52280 (Press-to-test)
59-52380

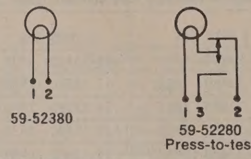

Knurled Nut
½—32 UNS Thds.
Key Washer
Lockwasher
Mtg. Nut
Identification
.25 Max. Panel
.88
.50 Dia.

CAP STYLES

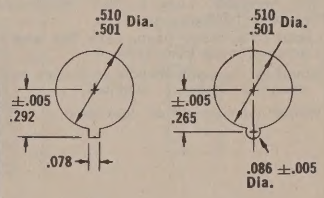

RECTANGULAR
ROUND
SQUARE
.43
.43
.43

See IPI Pages 9 and 10 in Section 5100 for cap size, styles and part numbers.

SCHEMATICS


1 2
59-52380
1 3 2
59-52280
Press-to-test

PANEL CUTOUTS

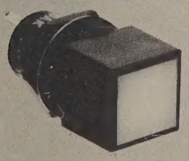

.510 / .501 Dia.
±.005
.292
.078
.510 / .501 Dia.
±.005
.265
.086 ±.005 Dia.

Complete Assembly Part Numbers

To order complete assembly specify:

59-52380 - ( ) - ( )
- **Lamp** (See Pg. 34)
- **Cap assy P/N** (See IPI Pgs. 9 & 10 in Section 5100)
- **Base assy: P/N 59-52280 (Press-to-Test)**
  P/N 59-52380

miniature

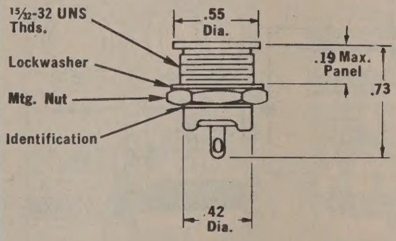


59-52480 SERIES

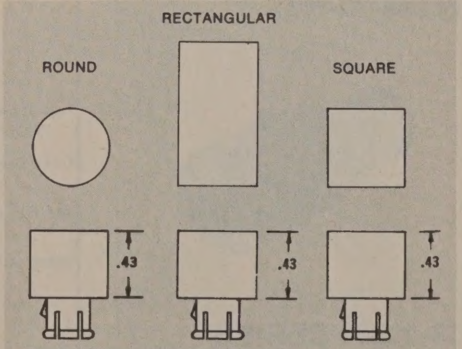
Notes:

1. **Materials and Finishes:** Mounting tube and hex nut, aluminum, black anodized per MIL-A-8625. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Friction fit lens caps are rotatable or keyed.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .2 oz. less lamp.

BASE ASSEMBLY
59-52480

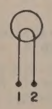

$^{15}/_{32}$-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.55 Dia.
.19 Max. Panel
.73
.42 Dia.

CAP STYLES


RECTANGULAR
ROUND
SQUARE
.43
.43
.43

See IPI Pages 9 and 10 in Section 5100 for cap size, styles and part numbers.

SCHEMATIC



Complete Assembly Part Numbers

To Order Complete Assembly Specify:

59-52480-( ) - ( )
- Lamp (See Pg. 34)
- Cap Assembly (See IPI Pgs. 9 & 10 in Section 5100)
- Base Assembly

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Indicators

miniature

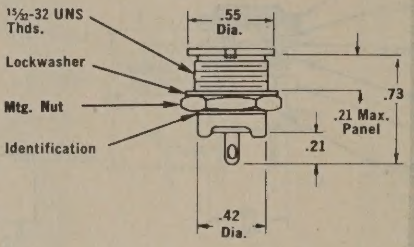
11-33480 SERIES (MS25256)

NOTES:

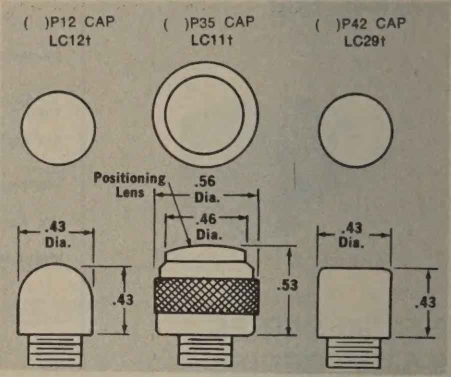
1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.
5. **Weight:** Approx. .20 oz. less lamp.

BASE ASSEMBLY

11-33480
LH73/1†


15/32-32 UNS Thds.
.55 Dia.
Lockwasher
Mtg. Nut
Identification
.73
.21 Max. Panel
.21
.42 Dia.

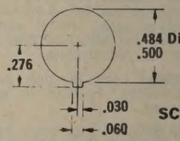
CAP STYLES


( )P12 CAP
LC12†
( )P35 CAP
LC11†
( )P42 CAP
LC29†
Positioning Lens
.56 Dia.
.46 Dia.
.43 Dia.
.43
.53
.43 Dia.
.43

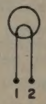
Complete Assembly Part Numbers (Less Lamp)			
Transparent Lens Colors	( )P12 Cap	( )P35 Cap	( )P42 Cap
Clear*	11-33480- 5P12	11-33480- 5P35	11-33480- 5P42
Red	11-33480- 6P12	11-33480- 6P35	11-33480- 6P42
Green	11-33480- 7P12	11-33480- 7P35	11-33480- 7P42
Amber	11-33480- 8P12	11-33480- 8P35	11-33480- 8P42
Blue	11-33480-11P12	11-33480-11P35	11-33480-11P42
Yellow	11-33480-12P12	11-33480-12P35	11-33480-16P42
Orange	11-33480-16P12	11-33480-16P35	11-33480-12P42
Lunar	11-33480-17P12	11-33480-17P35	11-33480-17P42

Translucent colors: Add "TL" as suffix to Part No.
†Assembly conforms to requirements of MIL-L-3661 and MS25256 See Pages 32 and 33 for complete listing of MS Part Numbers and Type Designations.
*White if translucent color specified.
( ) Designates color selection.

PANEL CUTOUT


.484 Dia.
.500
.276
.030
.060

SCHEMATIC



---

miniature, press-to-test

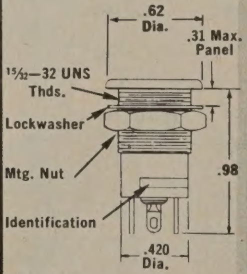
03-90980 SERIES

Notes:

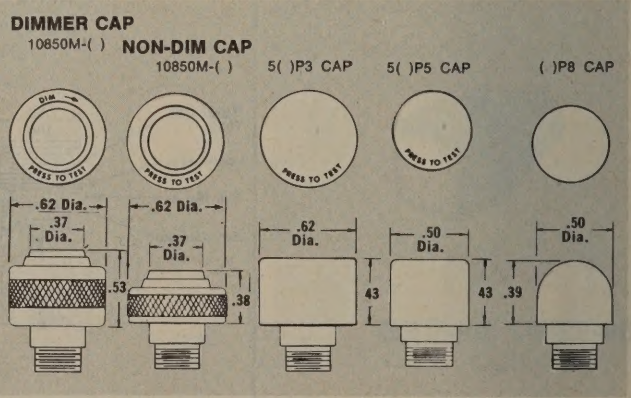
1. **Material and Finishes:** Moulded glass filled nylon mounting tube. Mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .9 oz. less lamp.

BASE ASSEMBLY

03-90980


.62 Dia.
.31 Max. Panel
15/32—32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.98
.420 Dia.

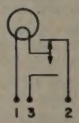
CAP STYLES


DIMMER CAP
10850M-( )
NON-DIM CAP
10850M-( )
5( )P3 CAP
5( )P5 CAP
( )P8 CAP
DIM
PRESS TO TEST
PRESS TO TEST
PRESS TO TEST
PRESS TO TEST
.62 Dia.
.37 Dia.
.53
.62 Dia.
.37 Dia.
.38
.62 Dia.
43
.50 Dia.
43
.39
.50 Dia.

Complete Assembly Part Numbers (Less Lamp)					
Transparent Lens Colors	10850M-( ) Dimmer Cap	10850M-( ) Non-Dim Cap	5( )P3 Cap	5( )P5 Cap	( )P8 Cap
Clear:	03-90980-1	03-90980-5	03-90980-55P3	03-90980-55P5	03-90980-5P8
Red	03-90980-2	03-90980-6	03-90980-56P3	03-90980-56P5	03-90980-6P8
Green	03-90980-3	03-90980-7	03-90980-57P3	03-90980-57P5	03-90980-7P8
Amber	03-90980-4	03-90980-8	03-90980-58P3	03-90980-58P5	03-90980-8P8
Blue	03-90980-10	03-90980-11	03-90980-511P3	03-90980-511P5	03-90980-11P8
Yellow	03-90980-14	03-90980-12	03-90980-512P3	03-90980-512P5	03-90980-12P8
Orange	——	03-90980-16	03-90980-516P3	03-90980-516P5	03-90980-16P8
Lunar	——	03-90980-17	03-90980-517P3	03-90980-517P5	03-90980-17P8

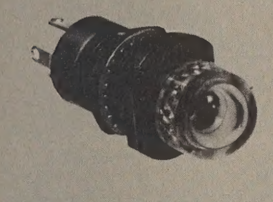
Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



Indicators

miniature, press-to-test

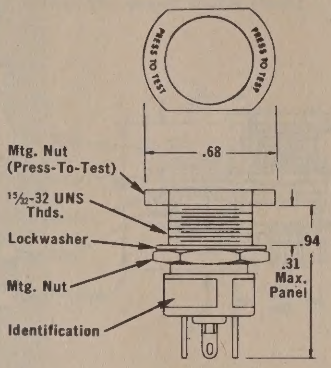


03-91080 SERIES

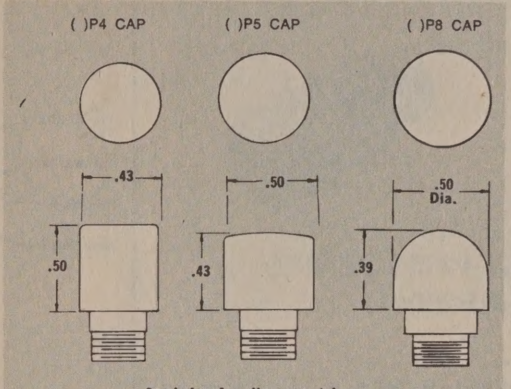
Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .4 oz less lamp.

BASE ASSEMBLY
03-91080



CAP STYLES

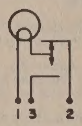


See below for other cap styles

Complete Assembly Part Number (Less Lamp)			
Transparent Lens Colors	( )P4 Cap	( )P5 Cap	( )P8 Cap
Clear*	03-91080-5P4	03-91080-5P5	03-91080-5P8
Red	03-91080-6P4	03-91080-6P5	03-91080-6P8
Green	03-91080-7P4	03-91080-7P5	03-91080-7P8
Amber	03-91080-8P4	03-91080-8P5	03-91080-8P8
Blue	03-91080-11P4	03-91080-11P5	03-91080-11P8
Yellow	03-91080-12P4	03-91080-12P5	03-91080-12P8
Orange	03-91080-16P4	03-91080-16P5	03-91080-16P8
Lunar	03-91080-17P4	03-91080-17P5	03-91080-17P8

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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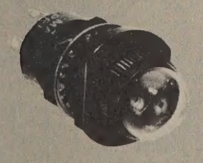
miniature, press-to-test

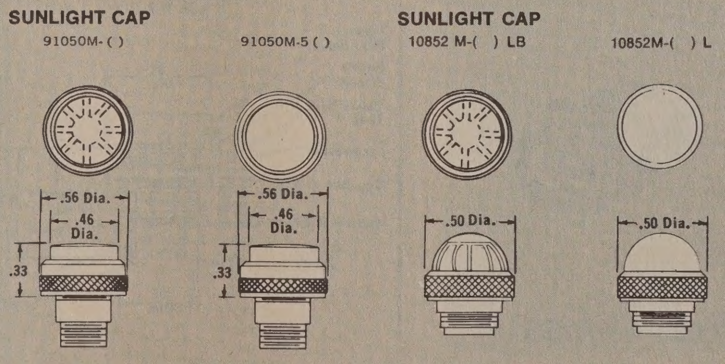


03-91080 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .4 oz less lamp.

CAP STYLES



Complete Assembly Part Number (Less Lamp)				
Transparent Lens Colors	91050M-( ) Sunlight Cap	91050M-5( ) Cap	10852M-( )LB Sunlight Cap	10852M-( )L Cap
Clear*	03-91080-5	03-91080-55	03-91080-5LB	03-91080-5L
Red	03-91080-6	03-91080-56	03-91080-6LB	03-91080-6L
Green	03-91080-7	03-91080-57	03-91080-7LB	03-91080-7L
Amber	03-91080-8	03-91080-58	03-91080-8LB	03-91080-8L
Blue	03-91080-11	03-91080-511	03-91080-11LB	03-91080-11L
Yellow	03-91080-12	03-91080-512	03-91080-12LB	03-91080-12L
Lunar	03-91080-17	03-91080-517	03-91080-17LB	03-91080-17L

Translucent Colors: Add "TL" as suffix to Part No., not recommended for sunlight caps
Frosted Lens: For 10852M caps only—Add "EF" (externally frosted) or "IF" (internally frosted) as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

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Indicators

miniature, press-to-test

01-91180 SERIES (MS25041)

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

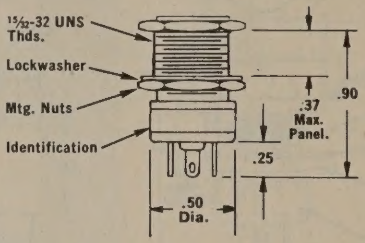
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

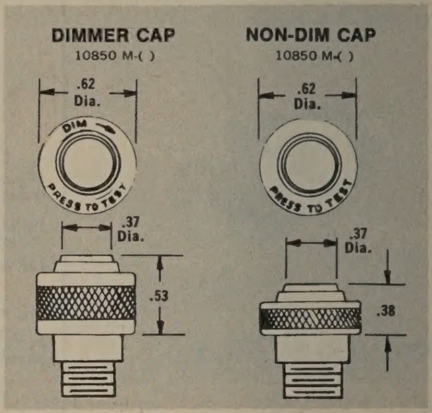
5. **Identification:** The part will be identified with MS P/N and base assembly number.

6. **Weight:** Approx. .5 oz less lamp.

BASE ASSEMBLY
01-91180


$^{15}\!/_{32}$-32 UNS Thds.
Lockwasher
Mtg. Nuts
Identification
.90
.37 Max. Panel.
.25
.50 Dia.

CAP STYLES

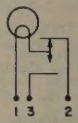

DIMMER CAP
10850 M-( )
NON-DIM CAP
10850 M-( )
.62 Dia.
.62 Dia.
DIM
PRESS TO TEST
PRESS TO TEST
.37 Dia.
.37 Dia.
.53
.38

Complete Assembly Part Numbers (Less Lamp)

Transparent Lens Colors	10850M-( ) Dimmer Cap		10850M-( ) Non Dim Cap	
	Part No.	MS Part No.	Part No.	MS Part No.
Clear°	01-91180-1	MS25041-1	01-91180-5	MS25041-5
Red	01-91180-2	MS25041-2	01-91180-6	MS25041-6
Green	01-91180-3	MS25041-3	01-91180-7	MS25041-7
Amber	01-91180-4	MS25041-4	01-91180-8	MS25041-8
Blue	01-91180-10	MS25041-10	01-91180-11	MS25041-11
Yellow	01-91180-14	—	01-91180-12	—
Lunar	—	—	01-91180-17	—

Translucent colors: Add ‘‘TL’’ as suffix to Part No.
( ) Designates color selection.
°White if translucent color specified

SCHEMATIC



---

miniature, watertight

15-30083 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel, Terminals, brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.

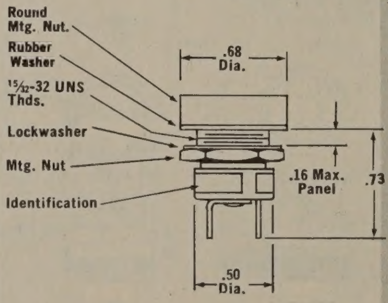
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from. Group A.

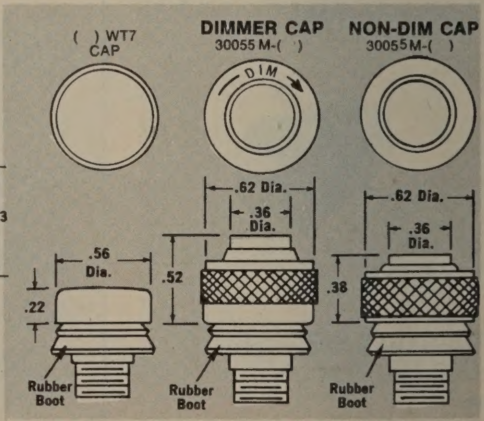
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

5. **Weight:** Approx. .3 oz. less lamp.

BASE ASSEMBLY
15-30083


Round Mtg. Nut.
Rubber Washer
$^{15}\!/_{32}$-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.68 Dia.
.16 Max. Panel
.73
.50 Dia.

CAP STYLES

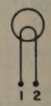

( ) WT7 CAP
DIMMER CAP
30055 M-( )
NON-DIM CAP
30055 M-( )
DIM
.62 Dia.
.62 Dia.
.36 Dia.
.36 Dia.
.56 Dia.
.22
.52
.38
Rubber Boot
Rubber Boot
Rubber Boot

Complete Assembly Part Numbers (Less Lamp)

Transparent Lens Colors	( )WT7 Cap	30055M-( ) Dimmer Cap	30055M-( ) Non-Dim Cap
Clear°	15-30083-5WT7	15-30083-1	15-30083-5
Red	15-30083-6WT7	15-30083-2	15-30083-6
Green	15-30083-7WT7	15-30083-3	15-30083-7
Amber	15-30083-8WT7	15-30083-4	15-30083-8
Blue	15-30083-11WT7	15-30083-10	15-30083-11
Yellow	15-30083-12WT7	15-30083-14	15-30083-12
Orange	15-30083-16WT7	—	15-30083-16
Lunar	15-30083-17WT7	—	15-30083-17

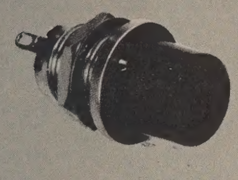
Translucent colors: Add ‘‘TL’’ as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



Indicators

miniature, watertight and oiltight



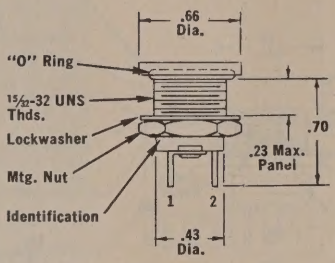
15-35182 SERIES
15-35183 SERIES

Notes:

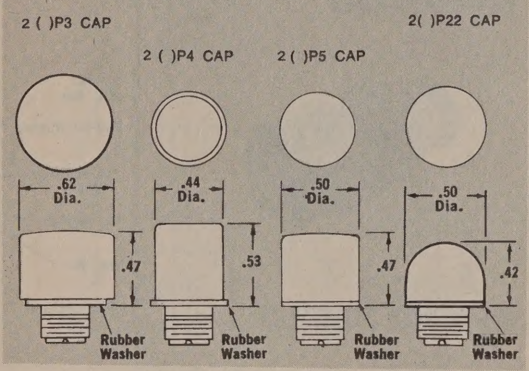
1. **Material and Finishes:** Mounting tubes are aluminum, black anodized per MIL-A-8625A or brass, bright nickel finish per QQ-N-290. Mtg. nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plated. Terminals, brass, tin plated per MIL-T-10727A. "O" ring, and rubber washers, neoprene.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter. "O" ring supplied with base assembly.
5. **Weight:** Approx. .3 oz. less lamp.

BASE ASSEMBLY

15-35182 Black Anodized Finish
15-35183 Bright Nickel Finish


.66 Dia.
"O" Ring
15/32-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.70
.23 Max. Panel
1
2
.43 Dia.

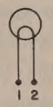
CAP STYLES


2 ( )P3 CAP
2 ( )P4 CAP
2 ( )P5 CAP
2( )P22 CAP
.62 Dia.
.44 Dia.
.50 Dia.
.50 Dia.
.47
.53
.47
.42
Rubber Washer
Rubber Washer
Rubber Washer
Rubber Washer

Complete Assembly Part Numbers (Less Lamp)				
Transparent Lens Colors	2( )P3 Cap	2( )P4 Cap	2( )P5 Cap	2( )P22 Cap
Clear*	15-35182-25P3	15-35182-25P4	15-35182-25P5	15-35182-25P22
Red	15-35182-26P3	15-35182-26P4	15-35182-26P5	15-35182-26P22
Green	15-35182-27P3	15-35182-27P4	15-35182-27P5	15-35182-27P22
Amber	15-35182-28P3	15-35182-28P4	15-35182-28P5	15-35182-28P22
Blue	15-35182-211P3	15-35182-211P4	15-35182-211P5	15-35182-211P22
Yellow	15-35182-212P3	15-35182-212P4	15-35182-212P5	15-35182-212P22
Orange	15-35182-216P3	15-35182-216P4	15-35182-216P5	15-35182-216P22
Lunar	15-35182-217P3	15-35182-217P4	15-35182-217P5	15-35182-217P22

To order assembly with bright nickel finish change 15-35182 to 15-35183.
Translucent Colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



---

miniature, watertight

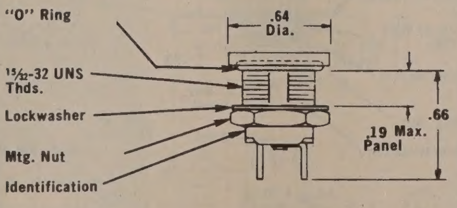
11-35182 SERIES

Notes:

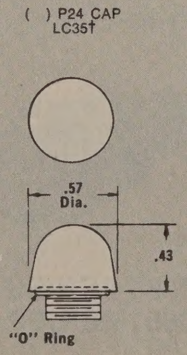
1. **Material and Finishes:** Mounting tube aluminum, black anodized per MIL-A-8625A. Mounting nut, steel cad plate per QQ-P-416. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass tin plated per MIL-T-1072A. "O"-ring silicone rubber.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.
5. **Weight:** Approx. .3 oz. less lamp.

BASE ASSEMBLY

11-35182
LH 89/1†


"O" Ring
.64 Dia.
15/32-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.66
.19 Max. Panel

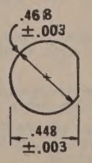
CAP STYLES


( ) P24 CAP
LC35†
.57 Dia.
.43
"O" Ring

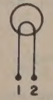
Complete Assembly Part Numbers (Less Lamp)	
Transparent Lens Colors	( )P24 Cap
Clear*	11-35182-5P24
Red	11-35182-6P24
Green	11-35182-7P24
Amber	11-35182-8P24
Blue	11-35182-11P24
Yellow	11-35182-12P24
Orange	11-35182-16P24
Lunar	11-35182-17P24

Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661. See pages 32 and 33 for complete listing of military type designations.
*White if translucent color specified.
( ) Designates color selection.

PANEL CUTOUT


.468 ±.003
.448 ±.003

SCHEMATIC



ILLUMINATED PRODUCTS INC.

A Subsidiary of Oak Industries Inc.

2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

Indicators

miniature, watertight, press-to-test

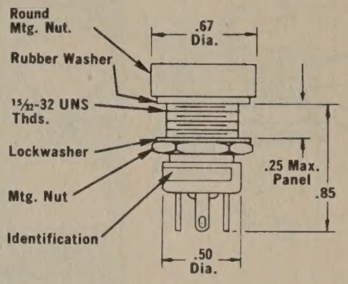
05-91182 SERIES

Notes:

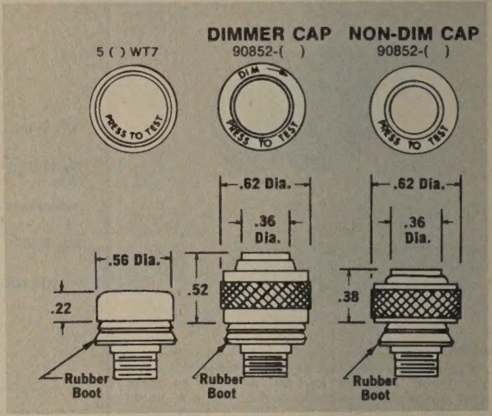
1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass. Tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .44 oz. less lamp.

BASE ASSEMBLY

05-91182


Round Mtg. Nut.
.67 Dia.
Rubber Washer
15/32-32 UNS Thds.
Lockwasher
.25 Max. Panel
.85
Mtg. Nut
Identification
.50 Dia.

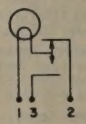
CAP STYLES


DIMMER CAP
90852-( )
NON-DIM CAP
90852-( )
5 ( ) WT7
DIM
PRESS TO TEST
PRESS TO TEST
PRESS TO TEST
.62 Dia.
.36 Dia.
.62 Dia.
.36 Dia.
.56 Dia.
.22
.52
.38
Rubber Boot
Rubber Boot
Rubber Boot

Complete Assembly Part Numbers (Less Lamp)			
Transparent Lens Colors	5( )WT7 Cap	90852-( ) Dimmer Cap	90852-( ) Non-Dim Cap
Clear°	05-91182-55WT7	05-91182-1	05-91182-5
Red	05-91182-56WT7	05-91182-2	05-91182-6
Green	05-91182-57WT7	05-91182-3	05-91182-7
Amber	05-91182-58WT7	05-91182-4	05-91182-8
Blue	05-91182-511WT7	05-91182-10	05-91198-11
Yellow	05-91182-512WT7	05-91182-14	05-91182-12
Orange	05-91182-516WT7	——	05-91182-16
Lunar	05-91182-517WT7	——	05-91182-17

Translucent colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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miniature, watertight, press-to-test

PRESS TO TEST

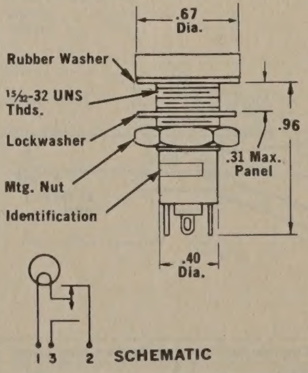
05-90880 SERIES
05-90881 SERIES

Notes:

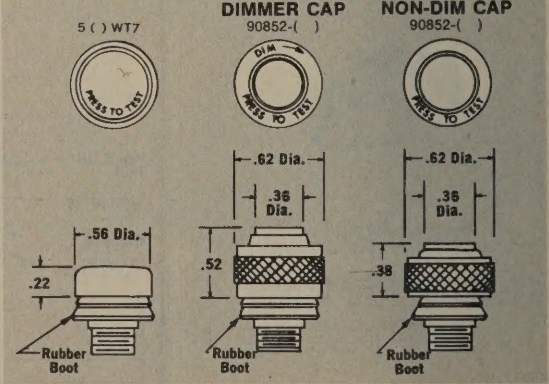
1. **Material and Finishes:** Molded glass filled nylon mounting tube. Nut is aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended hole .500 ± .015 diameter.
5. **Weight:** Approx. .3 oz less lamp.

BASE ASSEMBLY

05-90880 (Terminals potted)
05-90881 (Terminals not potted)


.67 Dia.
Rubber Washer
15/32-32 UNS Thds.
Lockwasher
.96
.31 Max. Panel
Mtg. Nut
Identification
.40 Dia.
1
3
2
SCHEMATIC

CAP STYLES


DIMMER CAP
90852-( )
NON-DIM CAP
90852-( )
5 ( ) WT7
DIM
PRESS TO TEST
PRESS TO TEST
PRESS TO TEST
.62 Dia.
.36 Dia.
.62 Dia.
.36 Dia.
.56 Dia.
.22
.52
.38
Rubber Boot
Rubber Boot
Rubber Boot

Complete Assembly Part Numbers (Less Lamp)						
Transparent Lens Colors	05-90880 (Terminals Potted)			05-90881 (Terminals Not Potted)		
	5( )WT7 Cap	90852-( ) Dimmer Cap	90852-( ) Non-Dim Cap	5( )WT7 Cap	90852-( ) Dimmer Cap	90852-( ) Non-Dim Cap
Clear°	05-90880-55WT7	05-90880-1	05-90880-5	05-90881-55WT7	05-90881-1	05-90881-5
Red	05-90880-56WT7	05-90880-2	05-90880-6	05-90881-56WT7	05-90881-2	05-90881-6
Green	05-90880-57WT7	05-90880-3	05-90880-7	05-90881-57WT7	05-90881-3	05-90881-7
Amber	05-90880-58WT7	05-90880-4	05-90880-8	05-90881-58WT7	05-90881-4	05-90881-8
Blue	05-90880-511WT7	05-90880-10	05-90880-11	05-90881-511WT7	05-90881-10	05-90881-11
Yellow	05-90880-512WT7	05-90880-14	05-90880-12	05-90881-512WT7	05-90881-14	05-90881-12
Orange	05-90880-516WT7	——	05-90880-16	05-90881-516WT7	——	05-90881-16
Lunar	05-90880-517WT7	——	05-90880-17	05-90881-517WT7	——	05-90881-17

Translucent colors: Add "TL" suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

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A Subsidiary of Oak Industries Inc.

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Tel: (714) 540-9471 TWX: 910-595-1504

OAK

Indicators

miniature, E. M. I. suppressed press-to-test

08-83281 SERIES

Notes:

1. Material and Finishes: Lens holder and front mounting nut is black anodized per MIL-A-8625A. Mounting tube & rear Mtg. nut, is bright nickel plated per QQ-N-290. Lockwasher is stainless steel. Terminals brass, gold plated per MIL-G-45204.

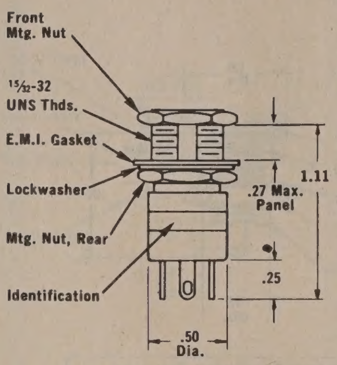
2. Cap Assembly: Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

3. Lamp: T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

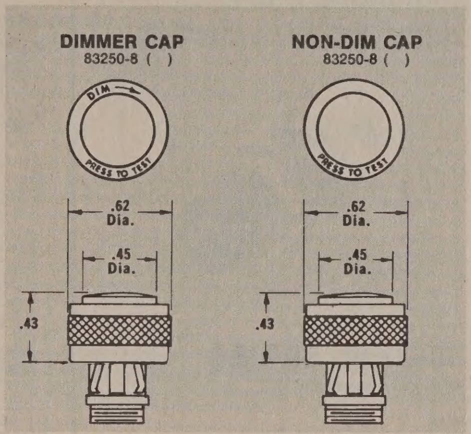
4. Mounting: Assembly mounts from rear of panel. All mounting hardware supplied. Flat on Mtg. tube provides for keyed installation.

5. Weight: Approx. .5 oz less lamp.

BASE ASSEMBLY
08-83281


Front Mtg. Nut
15/32-32 UNS Thds.
E.M.I. Gasket
Lockwasher
Mtg. Nut, Rear
Identification
1.11
.27 Max. Panel
.25
.50 Dia.

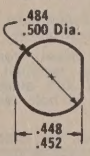
CAP STYLES


DIMMER CAP
83250-8 ( )
NON-DIM CAP
83250-8 ( )
DIM
PRESS TO TEST
PRESS TO TEST
.62 Dia.
.45 Dia.
.43
.62 Dia.
.45 Dia.
.43

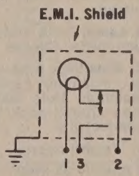
Complete Assembly Part Numbers (Less Lamp)		
Transparent Lens Colors	83250-8( ) Dimmer Cap	83250-8( ) Non-Dim Cap
Clear*	08-83281-81	08-83281-85
Red	08-83281-82	08-83281-86
Green	08-83281-83	08-83281-87
Amber	08-83281-84	08-83281-88
Blue	08-83281-810	08-83281-811
Yellow	08-83281-814	08-83281-812
Orange	——	08-83281-816
Lunar	——	08-83281-817

Translucent Colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

PANEL CUTOUT

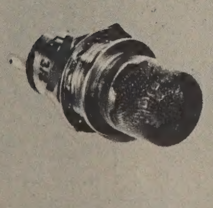

.484
.500 Dia.
.448
.452

SCHEMATIC


E.M.I. Shield
1
3
2

---

miniature, E. M. I. suppressed



18-36880 SERIES

Notes:

1. Material and Finishes: Mounting tube and exposed hardware, brass, bright nickel plate per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

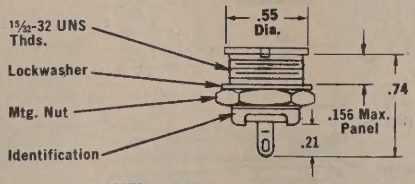
2. Cap Assembly: Lens is high impact-resistant plastic per L-P-349a.

3. Lamp: T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

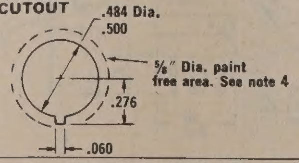
4. Mounting: Assembly mounts from front of panel. All mounting hardware supplied. E.M.I. suppressed assemblies require paint free area on back side of mounting hole for E.M.I. conductivity.

5. Weight: Approx. .35 oz less lamp.

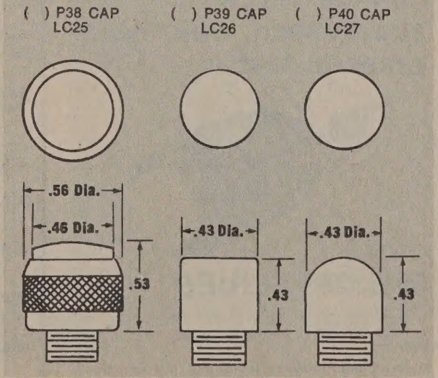
BASE ASSEMBLY
18-36880
LH73/2†


15/32-32 UNS Thds.
Lockwasher
Mtg. Nut
Identification
.55 Dia.
.74
.156 Max. Panel
.21

PANEL CUTOUT


.484 Dia.
.500
⅝" Dia. paint free area. See note 4
.276
.060

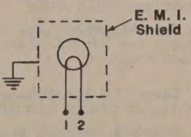
CAP STYLES


( ) P38 CAP
LC25
( ) P39 CAP
LC26
( ) P40 CAP
LC27
.56 Dia.
.46 Dia.
.53
.43 Dia.
.43
.43 Dia.
.43

Complete Assembly Part Numbers (Less Lamp)			
Transparent Lens Colors	( )P38 Cap	( )P39 Cap	( )P40 Cap
Clear*	18-36880-5P38	18-36880-5P39	18-36880-5P40
Red	18-36880-6P38	18-36880-6P39	18-36880-6P40
Green	18-36880-7P38	18-36880-7P39	18-36880-7P40
Amber	18-36880-8P38	18-36880-8P39	18-36880-8P40
Blue	18-36880-11P38	18-36880-11P39	18-36880-11P40
Yellow	18-36880-12P38	18-36880-12P39	18-36880-12P40
Orange	18-36880-16P38	18-36880-16P39	18-36880-16P40
Lunar	18-36880-17P38	18-36880-17P39	18-36880-17P40

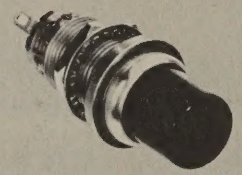
Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661 See pages 32 and 33 for complete listing of military type designations.
*White if translucent colors specified.
( ) Designates color selection.

SCHEMATIC


E. M. I. Shield
1
2

Indicators

miniature, E.M.I. suppressed, watertight



18-36680 SERIES

Neon version available†

Notes:

1. **Material and Finishes:** Mounting tube and mtg. nut brass, bright nickel finish. Lockwasher stainless steel or steel nickel plate. Terminals, brass, tin plated per MIL-T-10727A. "O"-ring, silicone rubber.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders, brass, bright nickel plated.

3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

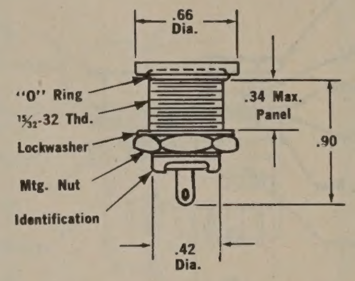
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended Mounting Hole 500 ± .015 diameter. Paint free area around back side of hole required for E.M.I. conductivity.

5. **Weight:** Approx. .35 oz. less lamp.

† Specify 38-36681—( ) for 27 KΩ internal resistor (C9A neon lamp) or 38-36680 - ( ) for 68 KΩ internal resistor (C7A neon lamp).
Neon Lamp (C7A or C9A) must be specified when ordering.

BASE ASSEMBLY

18-36680

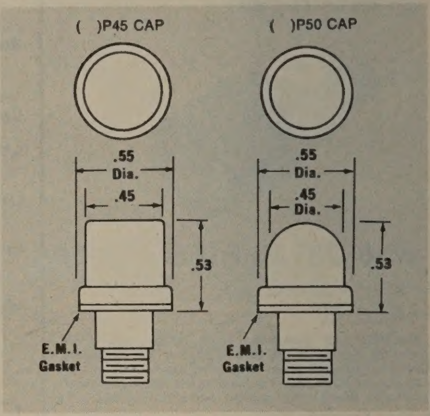

.66 Dia.
"O" Ring
¹⁵⁄₃₂-32 Thd.
Lockwasher
Mtg. Nut
Identification
.34 Max. Panel
.90
.42 Dia.

Transparent Lens Colors	( )P45 Cap	( )P50 Cap
Clear*	18-36680-5P45	18-36680-5P50
Red	18-36680-6P45	18-36680-6P50
Green	18-36680-7P45	18-36680-7P50
Amber	18-36680-8P45	18-36680-8P50
Blue	18-36680-11P45	18-36680-11P50
Yellow	18-36680-12P45	18-36680-12P50
Orange	18-36680-16P45	18-36680-16P50
Lunar	18-36680-17P45	18-36680-17P50

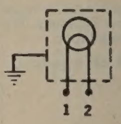
Complete Assembly Part Numbers (Less Lamp)

*White if translucent color specified.
Translucent colors: add "TL" as suffix to Part No.
( ) Designates color selection.

CAP STYLES


( )P45 CAP
( )P50 CAP
.55 Dia.
.45
.53
E.M.I. Gasket
.55 Dia.
.45 Dia.
.53
E.M.I. Gasket

SCHEMATIC



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miniature, E. M. I. suppressed, watertight press-to-test

08-83283 SERIES

Notes:

1. **Material and Finishes:** Round mtg. nut is aluminum, black anodized per MIL-A-8625A. Mtg. tube and Mtg. nut, bright nickel plated per QQ-N-290. Lockwasher is steel, nickel plated. Rubber boot and washer, silicone rubber. Terminals, brass, gold plated per MIL-G-45204.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

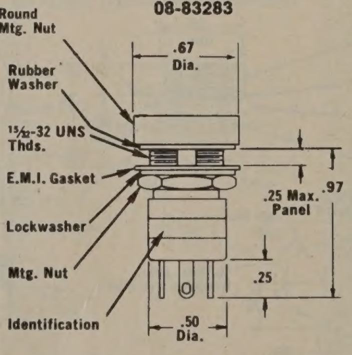
3. **Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Flat on Mtg. tube provides for keyed installation.

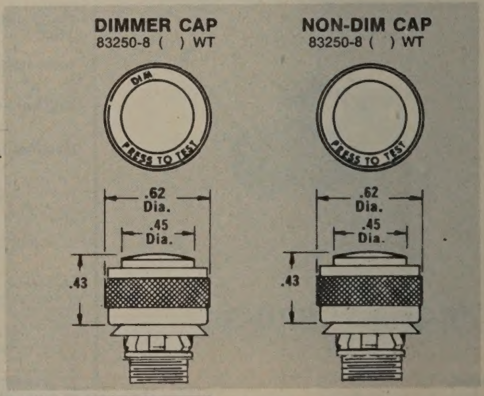
5. **Weight:** Approx. .6 oz. less lamp.

BASE ASSEMBLY

08-83283


Round Mtg. Nut
.67 Dia.
Rubber Washer
¹⁵⁄₃₂-32 UNS Thds.
E.M.I. Gasket
.25 Max. Panel
.97
Lockwasher
Mtg. Nut
.25
Identification
.50 Dia.

CAP STYLES

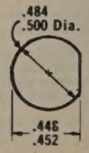

DIMMER CAP
83250-8 ( ) WT
NON-DIM CAP
83250-8 ( ) WT
DIM
PRESS TO TEST
PRESS TO TEST
.62 Dia.
.45 Dia.
.43
.62 Dia.
.45 Dia.
.43

Transparent Lens Colors	83250-8( )WT Dimmer Cap	83250-8( )WT Non-Dim Cap
Clear*	08-83283-81	08-83283-85
Red	08-83283-82	08-83283-86
Green	08-83283-83	08-83283-87
Amber	08-83283-84	08-83283-88
Blue	08-83283-810	08-83283-811
Yellow	08-83283-814	08-83283-812
Orange	——	08-83283-816
Lunar	——	08-83283-817

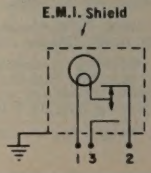
Complete Assembly Part Numbers (Less Lamp)

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

PANEL CUTOUT


.484
.500 Dia.
.446
.452

SCHEMATIC


E.M.I. Shield
1 3 2

ILLUMINATED PRODUCTS INC.
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Tel: (714) 540-9471 TWX: 910-595-1504

OAK
Indicators

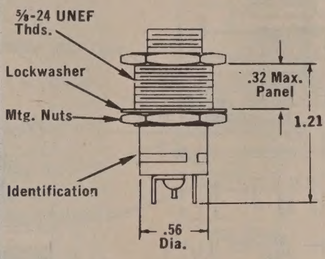
general purpose

13-VM 305 SERIES
13-VM 309 SERIES

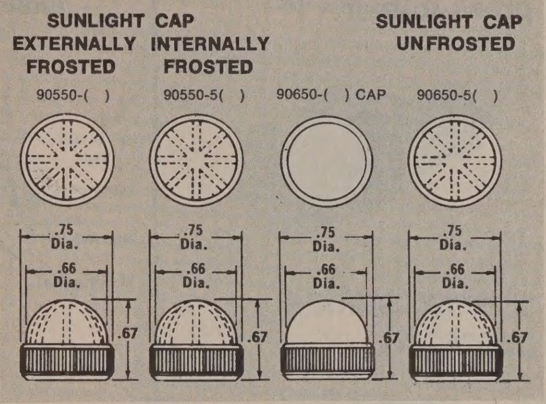
NOTES:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic (nylon). Standard colors are semi-diffusing.
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.

BASE ASSEMBLY
13-30080S


⅝-24 UNEF Thds.
Lockwasher
Mtg. Nuts
Identification
.32 Max. Panel
1.21
.56 Dia.

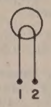
CAP STYLES


SUNLIGHT CAP
EXTERNALLY FROSTED
INTERNALLY FROSTED
SUNLIGHT CAP UNFROSTED
90550-( )
90550-5( )
90650-( ) CAP
90650-5( )
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67

Complete Assembly Part Number (Less Lamp)				
Semi-Diffusing Lens Colors	90550 - ( ) Sunlight Cap	90550 - 5( ) Sunlight Cap	90650 - ( ) Cap	90650 - 5( ) Sunlight Cap
Lunar	13-VM309- 5	13-VM309- 55	13-VM305- 5	13-VM305- 55
Red	13-VM309- 6	13-VM309- 56	13-VM305- 6	13-VM305- 56
Green	13-VM309- 7	13-VM309- 57	13-VM305- 7	13-VM305- 57
Amber	13-VM309- 8	13-VM309- 58	13-VM305- 8	13-VM305- 58
Blue	13-VM309-11	13-VM309-511	13-VM305-11	13-VM305-511

( ) Designates color selection.

SCHEMATIC



general purpose, press-to-test

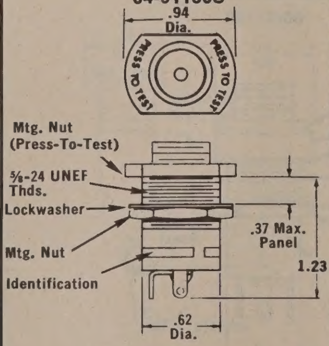
PRESS TO TEST
PRESS

04-VM905 SERIES
04-VM906 SERIES

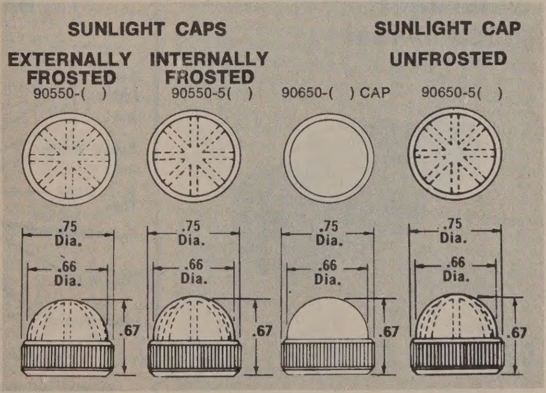
NOTES:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic (nylon). Standard colors are semi-diffusing.
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.
5. **Weight:** Approx. .55 oz. less lamp.

BASE ASSEMBLY
04-91180S


.94 Dia.
PRESS TO TEST
PRESS TO TEST
Mtg. Nut (Press-To-Test)
⅝-24 UNEF Thds.
Lockwasher
Mtg. Nut
Identification
.37 Max. Panel
1.23
.62 Dia.

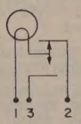
CAP STYLES


SUNLIGHT CAPS
EXTERNALLY FROSTED
INTERNALLY FROSTED
SUNLIGHT CAP UNFROSTED
90550-( )
90550-5( )
90650-( ) CAP
90650-5( )
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67
.75 Dia.
.66 Dia.
.67

Complete Assembly Part Number (Less Lamp)				
Semi-Diffusing Lens Colors	90550 - ( ) Sunlight Cap	90550 - 5( ) Sunlight Cap	90650 - ( ) Cap	90650 - 5( ) Sunlight Cap
Lunar	04-VM905- 5	04-VM905- 55	04-VM906- 5	04-VM906- 55
Red	04-VM905- 6	04-VM905- 56	04-VM906- 6	04-VM906- 56
Green	04-VM905- 7	04-VM905- 57	04-VM906- 7	04-VM906- 57
Amber	04-VM905- 8	04-VM905- 58	04-VM906- 8	04-VM906- 58
Blue	04-VM905-11	04-VM905-511	04-VM906-11	04-VM906-511

( ) Designates color selection.

SCHEMATIC



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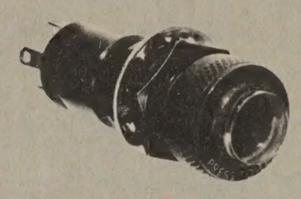
OAK

Indicators

press-to-test



02-91180 SERIES (MS25331)

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

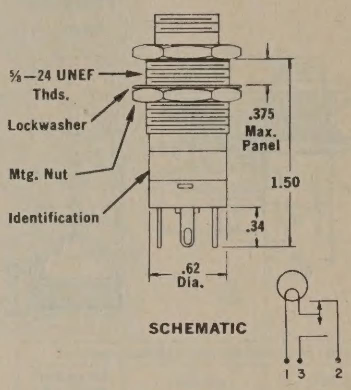
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.

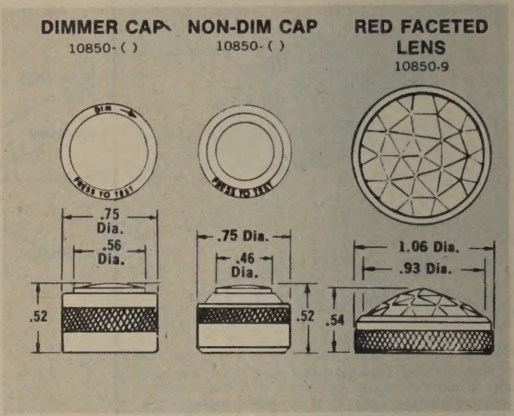
5. **Identification:** The part will be identified with MS P/N and base assembly number.

6. **Weight:** Approx. .8 oz less lamp.

BASE ASSEMBLY
02-91180


⅝—24 UNEF Thds.
Lockwasher
Mtg. Nut
Identification
.375 Max. Panel
1.50
.34
.62 Dia.
SCHEMATIC
1 3 2

CAP STYLES


DIMMER CAP
10850-( )
NON-DIM CAP
10850-( )
RED FACETED LENS
10850-9
DIM
PRESS TO TEST
.75 Dia.
.56 Dia.
.52
.75 Dia.
.46 Dia.
.52
1.06 Dia.
.93 Dia.
.54

Complete Assembly Part Numbers (Less Lamp)						
Transparent Lens Colors	10850-( ) Dimmer Cap		10850-( ) Non-Dim Cap		10850-9 Faceted Lens	
	Part No.	MS Part No.	Part No.	MS Part No.	Part No.	MS Part No.
Clear*	02-91180-1	MS25331-1	02-91180-5	MS25331-5	—	—
Red	02-91180-2	MS25331-2	02-91180-6	MS25331-6	02-91180-9	MS25331-9
Green	02-91180-3	MS25331-3	02-91180-7	MS25331-7	—	—
Amber	02-91180-4	MS25331-4	02-91180-8	MS25331-8	—	—
Blue	02-91180-10	—	02-91180-11	—	—	—
Yellow	02-91180-14	—	02-91180-12	—	—	—
Lunar	—	—	02-91180-17	—	—	—

Translucent colors: Add "TL" as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

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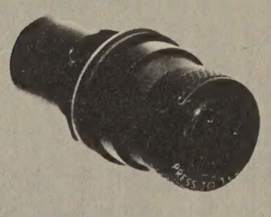
watertight, press-to-test



06-91182 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.

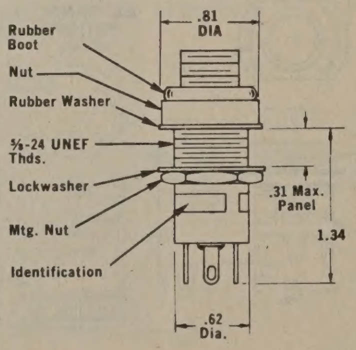
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

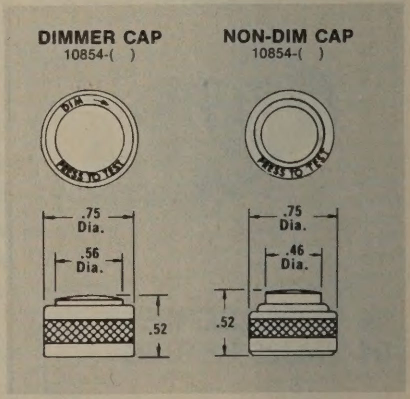
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.

5. **Weight:** Approx. .85 oz less lamp.

BASE ASSEMBLY
06-91182


.81 DIA
Rubber Boot
Nut
Rubber Washer
⅝-24 UNEF Thds.
Lockwasher
Mtg. Nut
Identification
.31 Max. Panel
1.34
.62 Dia.

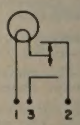
CAP STYLES


DIMMER CAP
10854-( )
NON-DIM CAP
10854-( )
DIM
PRESS TO TEST
.75 Dia.
.56 Dia.
.52
.75 Dia.
.46 Dia.
.52

Complete Assembly Part Numbers (Less Lamp)		
Transparent Lens Colors	10854-( ) Dimmer Cap	10854-( ) Non-Dim Cap
Clear*	06-91182-1	06-91182-5
Red	06-91182-2	06-91182-6
Green	06-91182-3	06-91182-7
Amber	06-91182-4	06-91182-8
Blue	06-91182-10	06-91182-11
Yellow	06-91182-14	06-91182-12
Orange	——	06-91182-16
Lunar	——	06-91182-17

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC



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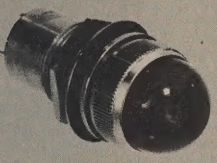
OAK

Indicators

E.M.I. suppressed



18-83680 SERIES

Notes:

1. **Materials and Finishes:** Mounting tube and nut, bright nickel finish per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder brass, bright nickel finish.

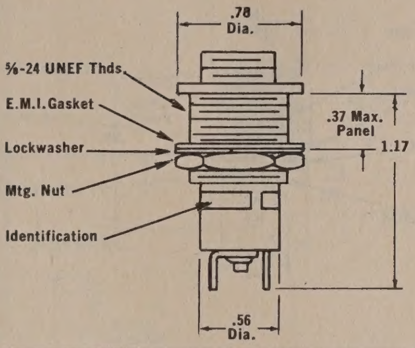
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter with paint free area around back side of hole for E.M.I. conductivity.

5. **Weight:** Approx. 1 oz. less lamp.

BASE ASSEMBLY

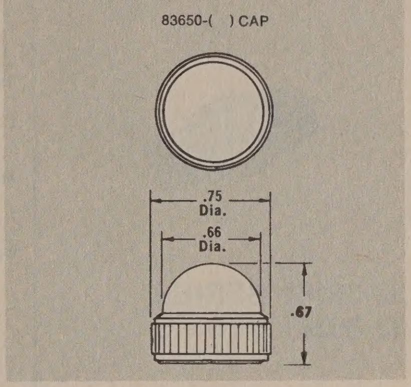
18-83680



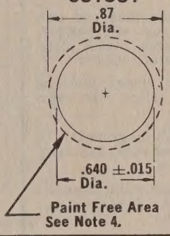
Complete Assembly Part Numbers (Less Lamp)	
Transparent Lens Colors	83650-( ) Cap
Clear*	18-83680-5
Red	18-83680-6
Green	18-83680-7
Amber	18-83680-8
Blue	18-83680-11
Yellow	18-83680-12
Orange	18-83680-16
Lunar	18-83680-17

Translucent colors: Add ''TL'' as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

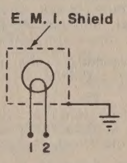
CAP STYLES



PANEL CUTOUT



SCHEMATIC



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miniature, neon

22-35380 SERIES

Notes:

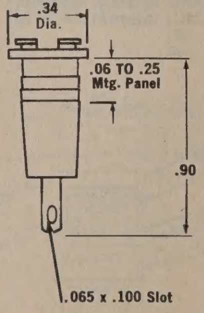
1. **Materials and Finishes:** Housing is black glass filled nylon. Terminals, beryllium copper, plated for solderability. Retainer clip, spring steel.

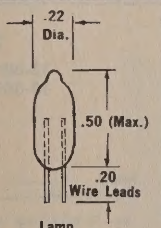
2. **Lens Cap:** High impact resistant plastic per L-P-393 (polycarbonate). Standard colors are transparent. 6( )P58 cap designed with internal micro grooves to optimize neon illumination.

3. **Lamp:** 211 (std.) or 212 (high brightness) T-2 neon lamp furnished with each assembly. Lamp is replaceable from front of panel.

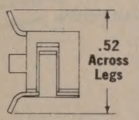
4. **Mounting:** Two types optional
A) Press-in; assembly press fits into .281 diameter hole. No mounting hardware required.
B) Retainer clip; for mounting into .296 ±.015 hole or panels less than .06 thick. Order retainer clip separately.

5. **Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 or equiv.



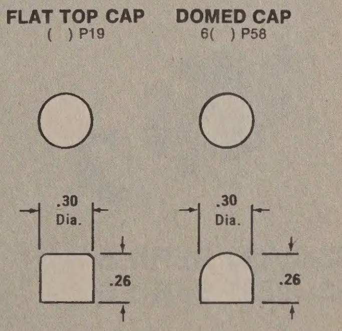


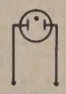
Lamp Outline Dimensions



Optional Retainer
06700400
(Order Separately)

CAP STYLES





SCHEMATIC

Complete Assembly Part Numbers (Includes Lamp)			
Lamp	Transparent Lens Colors	( )P19 Cap	6( )P58 Cap
211	Clear	22-35380-5P19-211	22-35380-65P58-211
	Red	22-35380-6P19-211	22-35380-66P58-211
	Amber	22-35380-8P19-211	22-35380-68P58-211
	Lunar	22-35380-17P19-211	22-35380-617P58-211
212	Clear	22-35380-5P19-212	22-35380-65P58-212
	Red	22-35380-6P19-212	22-35380-66P58-212
	Amber	22-35380-8P19-212	22-35380-68P58-212
	Lunar	22-35380-17P19-212	22-35380-617P58-212

Translucent colors not recommended.
( ) Designates color selection.

Lamp Selection Guide			
Lamp	ANSI No.	Starting Voltage	*Recommended Series Resistor
211	A1B	65 VAC 95 VDC	68KΩ
212	A1C	95 VAC	27KΩ

*Series Resistor not supplied, must be connected externally.

ILLUMINATED PRODUCTS INC.

A Subsidiary of Oak Industries Inc.

2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

OAK

Indicators

miniature, neon

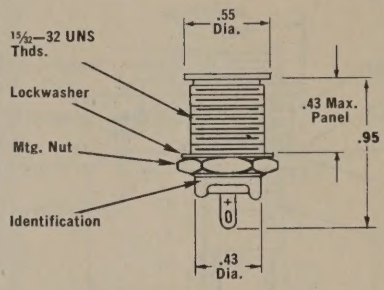
33-36181 SERIES
33-36281 SERIES

NOTES:

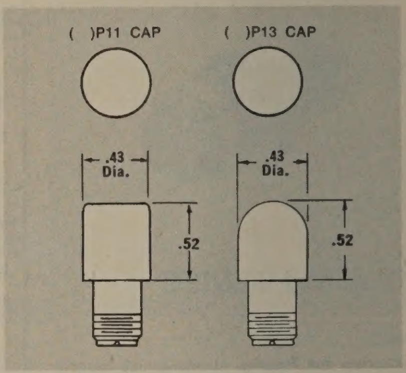
1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.
3. **Lamp:** C7A (std.) or C9A (high brightness) T2 neon lamp supplied with each assembly. See lamp guide for electrical characteristics.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .3 oz. less lamp.

BASE ASSEMBLY

33-36181 (Internal Resistor 68KΩ)
33-36281 (Internal Resistor 27KΩ)



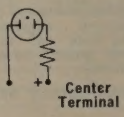
CAP STYLES



Complete Assembly Part Number (Includes Lamp)			
LAMP	Transparent Lens Colors	( )P11 Cap	( )P13 Cap
C7A	Clear	33-36181- 5P11-C7A	33-36181- 5P13-C7A
	Red	33-36181- 6P11-C7A	33-36181- 6P13-C7A
	Amber	33-36181- 8P11-C7A	33-36181- 8P13-C7A
	Lunar	33-36181-17P11-C7A	33-36181-17P13-C7A
C9A	Clear	33-36281- 5P11-C9A	33-36281- 5P13-C9A
	Red	33-36281- 6P11-C9A	33-36281- 6P13-C9A
	Amber	33-36281- 8P11-C9A	33-36281- 8P13-C9A
	Lunar	33-36281-17P11-C9A	33-36281-17P13-C9A

Translucent colors: Not recommended.
( ) Designates color selection.

SCHEMATIC



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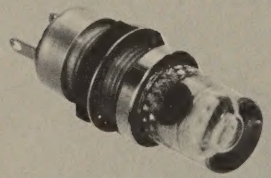
miniature, neon



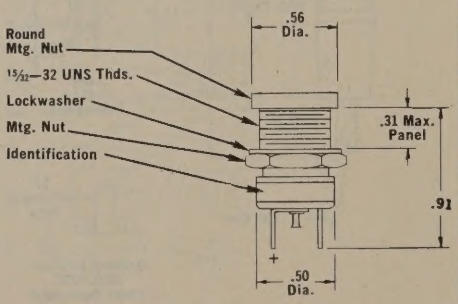
33-30880 SERIES
33-30881 SERIES

Notes:

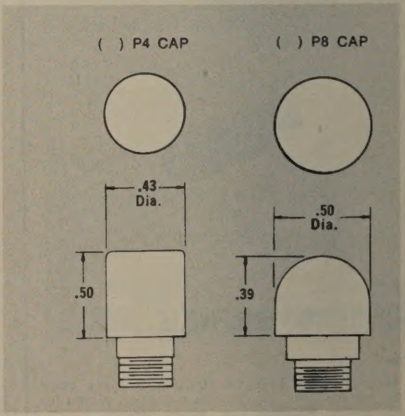
1. **Material and Finishes:** Mounting tube gold anodized, rear mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Round front mtg. nut, bright nickel plate.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.
3. **Lamp:** A1G (std.) or A1H (high brightness) T2 neon is furnished with each assembly. See lamp guide for electrical characteristics.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.
5. **Weight:** Approx. .35 oz. less lamp.

BASE ASSEMBLY

33-30880 (27KΩ Internal Resistor)
33-30881 (68KΩ Internal Resistor)



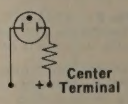
CAP STYLES



Complete Assembly Part Numbers (Includes Lamp)			
Lamp	Transparent Lens Color	( )P4 Cap	( )P8 Cap
A1H	Clear	33-30880-5P4-A1H	33-30880-5P8-A1H
	Red	33-30880-6P4-A1H	33-30880-6P8-A1H
	Amber	33-30880-8P4-A1H	33-30880-8P8-A1H
	Lunar	33-30880-17P4-A1H	33-30880-17P8-A1H
A1G	Clear	33-30881-5P4-A1G	33-30881-5P8-A1G
	Red	33-30881-6P4-A1G	33-30881-6P8-A1G
	Amber	33-30881-8P4-A1G	33-30881-8P8-A1G
	Lunar	33-30881-17P4-A1G	33-30881-17P8-A1G

Translucent colors: Not recommended.
( ) Designates color selection.

SCHEMATIC



ILLUMINATED PRODUCTS INC.

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Indicators

miniature, neon

31-36180 SERIES
31-36280 SERIES
(MS 25257)

Notes:

1. **Material, and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

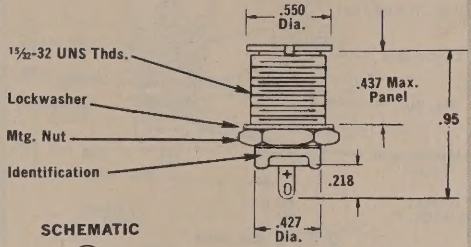
3. **Lamp:** C7A (STD.) or C9A (high brightness) T2 neon lamp furnished with each assembly. See lamp guide for electrical characteristics.

4. **Mounting:** Assembly mounts from,rear of panel. All mounting hardware supplied.

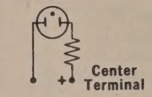
5. **Weight:** Approx. .3 oz. less lamp.

BASE ASSEMBLY

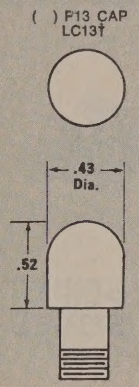
31-36180 (62KΩ Internal Resistor) LH74/1†
31-36280 (27KΩ Internal Resistor) LH 74/2†



SCHEMATIC



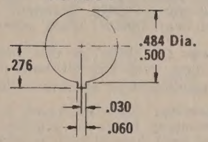
CAP STYLES



Complete Assembly Part Number (Includes Lamp)		
Lamp	**Transparent Lens Colors**	**( )P13 Cap**
C7A	Clear	31-36180-5P13-C7A
	Red	31-36180-6P13-C7A
	Amber	31-36180-8P13-C7A
	Lunar	31-36180-17P13-C7A
C9A	Clear	31-36280-5P13-C9A
	Red	31-36280-6P13-C9A
	Amber	31-36280-8P13-C9A
	Lunar	31-36280-17P13-C9A

Translucent colors: Not recommended.
† Assembly conforms to requirements of MS25257 and MIL-L-3661. See pages 32 and 33 for complete listing of military Part Numbers and type designations.
( ) Designates color selection.

PANEL CUTOUT



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miniature, neon watertight

31-36680 SERIES
31-36681 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A, "O"-ring, silicone rubber.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

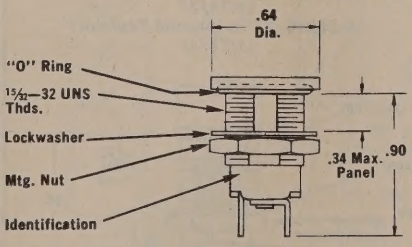
3. **Lamp:** C7A (STD.) or C9A (high brightness) T2 neon lamp furnished with each assembly. See lamp guide for electrical characteristics.

4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.

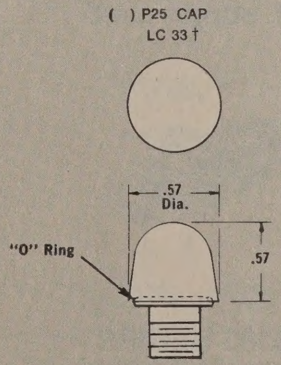
5. **Weight:** Approx. .3 oz less lamp.

BASE ASSEMBLY

31-36680 (62KΩ) LH88/1†
31-36681 (27KΩ) LH88/2†



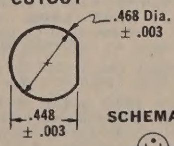
CAP STYLES



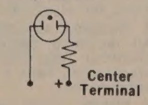
Complete Assembly Part Numbers (Includes Lamp)		
Lamp	**Transparent Lens Colors**	**( )P25 Cap**
C7A	Clear	31-36680-5P25-C7A
	Red	31-36680-6P25-C7A
	Amber	31-36680-8P25-C7A
	Lunar	31-36680-17P25-C7A
C9A	Clear	31-36681-5P25-C9A
	Red	31-36681-6P25-C9A
	Amber	31-36681-8P25-C9A
	Lunar	31-36681-17P25-C9A

Translucent colors: Not recommended.
† Assembly conforms to requirements of MIL-L-3661. See pages 32 and 33 for complete listing of military type designations.
( ) Designates color selection.

PANEL CUTOUT



SCHEMATIC



ILLUMINATED PRODUCTS INC.
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2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
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OAK

Indicators

miniature, neon, E.M.I. suppressed

38-36480 SERIES
38-36481 SERIES

Notes:

1. **Material and Finishes:** Mounting tube and exposed hardware, bright nickel finish. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent. Lens holder bright nickel plated.

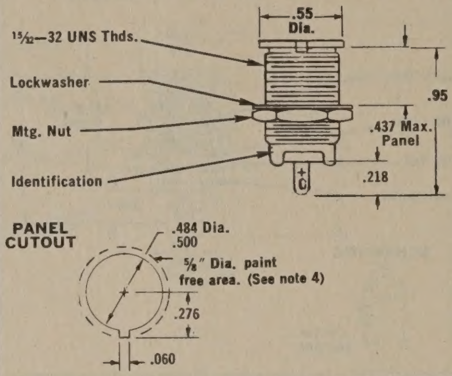
3. **Lamp:** C7A (Std.) or C9A (High brightness) T2 neon lamp furnished with each assembly. See lamp guide for electrical characteristics.

4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Paint free area around back side of hole required for E.M.I. conductivity.

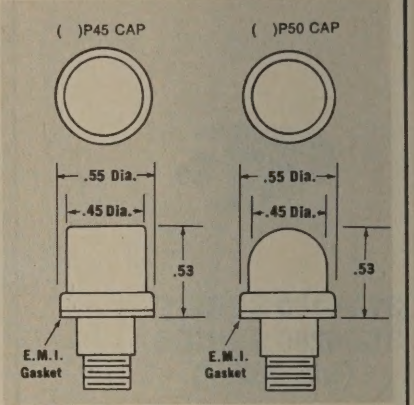
5. **Weight:** Approx. .5 oz. less lamp.

BASE ASSEMBLY

38-36480 (62 K Ω Internal Resistor)
38-36481 (27 K Ω Internal Resistor)


.55 Dia.
15/32—32 UNS Thds.
Lockwasher
.95
Mtg. Nut
.437 Max. Panel
Identification
.218
PANEL CUTOUT
.484 Dia.
.500
5/8" Dia. paint free area. (See note 4)
.276
.060

CAP STYLES

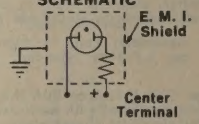

( )P45 CAP
( )P50 CAP
.55 Dia.
.45 Dia.
.53
E.M.I. Gasket
.55 Dia.
.45 Dia.
.53
E.M.I. Gasket

Lamp	Transparent Lens Colors	( )P45 Cap	( )P50 Cap
C7A	Clear	38-36480-5P45-C7A	38-36480-5P50-C7A
	Red	38-36480-6P45-C7A	38-36480-6P50-C7A
	Amber	38-36480-8P45-C7A	38-36480-8P50-C7A
	Lunar	38-36480-17P45-C7A	38-36480-17P50-C7A
C9A	Clear	38-36481-5P45-C9A	38-36481-5P50-C9A
	Red	38-36481-6P45-C9A	38-36481-6P50-C9A
	Amber	38-36481-8P45-C9A	38-36481-8P50-C9A
	Lunar	38-36481-17P45-C9A	38-36481-17P50-C9A

Complete Assembly Part Numbers (Includes Lamp)

Translucent colors: Not recommended.
( ) Designates color selection.

SCHEMATIC


E. M. I. Shield
Center Terminal

---

miniature, neon E.M.I. suppressed

38-36180 SERIES
38-36280 SERIES

NOTES:

1. **Material and Finishes:** Mounting tube and nuts are brass, nickel plated per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

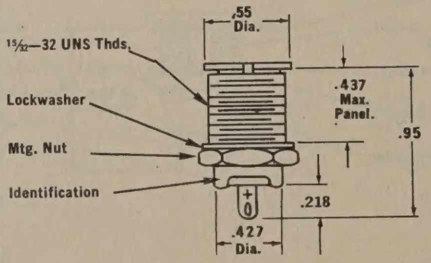
3. **Lamp:** C7A (std.) or C9A (high brightness) T2 neon lamp supplied with each assembly. See lamp guide for electrical characteristics.

4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended Mounting Hole 500 ± .015 diameter. Paint free area around back side of hole required for E.M.I. conductivity.

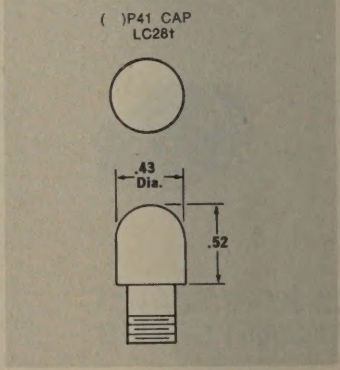
5. **Weight:** .30 oz. less lamp.

BASE ASSEMBLY

38-36180 (62KΩ Internal Resistor)
LH74/3†
38-36280 (27KΩ Internal Resistor)
LH74/4†


.55 Dia.
15/32—32 UNS Thds.
Lockwasher
.437 Max. Panel.
.95
Mtg. Nut
Identification
.218
.427 Dia.

CAP STYLES

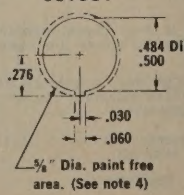

( )P41 CAP
LC28†
.43 Dia.
.52

LAMP	Transparent Lens Colors	( )P41 Cap
C7A	Clear	38-36180- 5P41-C7A
	Red	38-36180- 6P41-C7A
	Amber	38-36180- 8P41-C7A
	Lunar	38-36180-17P41-C7A
C9A	Clear	38-36280- 5P41-C9A
	Red	38-36280- 6P41-C9A
	Amber	38-36280- 8P41-C9A
	Lunar	38-36280-17P41-C9A

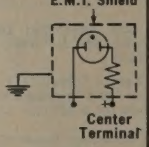
Complete Assembly Part Number (Includes Lamp)

Translucent colors: Not Recommended.
†Assembly conforms to requirements of MIL-L-3661
See Pages 32 & 33 for complete listing of military type designations.
( ) Designates color selection.

PANEL CUTOUT


.484 Dia.
.500
.276
.030
.060
5/8" Dia. paint free area. (See note 4)

SCHEMATIC


E.M.I. Shield
Center Terminal

Indicators

neon, E. M. I. suppressed

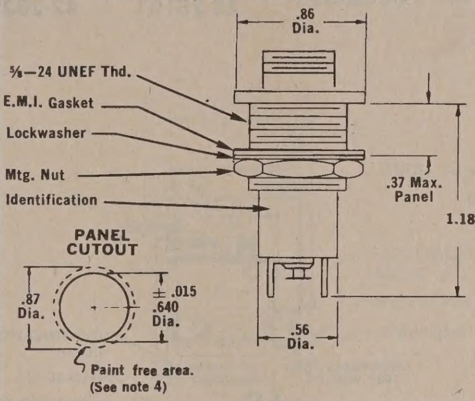
38-83681 SERIES
38-83682 SERIES

Notes:

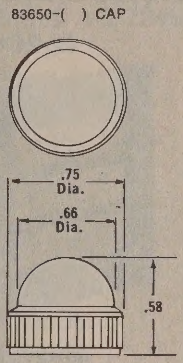
1. **Material and Finishes:** Mounting tube and nut, bright nickel finish per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact resistant plastic per L-P-349a. Standard colors are transparent. Lens holder, bright nickel finish per QQ-N-290
3. **Lamp:** NE51 (standard) or NE51H (high brightness) T-3¼ neon is furnished with each assembly. See lamp guide for electrical characteristics.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter, with paint free area around back side of hole for E.M.I. conductivity.
5. **Weight:** Approx. 1 oz.

BASE ASSEMBLY

38-83681 (27K Ω Internal Resistor)
38-83682 (100KΩ Internal Resistor)


.86 Dia.
⅝—24 UNEF Thd.
E.M.I. Gasket
Lockwasher
Mtg. Nut
Identification
.37 Max. Panel
1.18
PANEL CUTOUT
.87 Dia.
± .015
.640 Dia.
.56 Dia.
Paint free area. (See note 4)

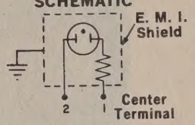
CAP STYLES


83650-( ) CAP
.75 Dia.
.66 Dia.
.58

Complete Assembly Part Numbers (Includes Lamp)		
Lamp	Transparent Lens Colors	83650-( ) Cap
NE51H	Clear	38-83681-5-NE51H
	Red	38-83681-6-NE51H
	Amber	38-83681-8-NE51H
	Lunar	38-83681-17-NE51H
NE51	Clear	38-83682-5-NE51
	Red	38-83682-6-NE51
	Amber	38-83682-8-NE51
	Lunar	38-83682-17-NE51

Translucent colors: Not recommended.
( ) Designates color selection.

SCHEMATIC


E. M. I. Shield
2
Center Terminal

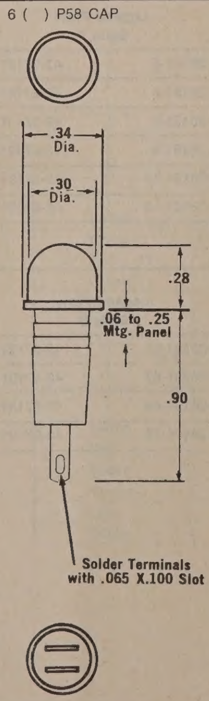
---

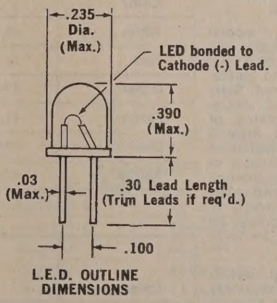
miniature, L.E.D. indicator

QT/D300
14-35380 SERIES

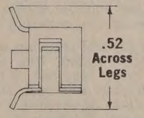
Notes:

1. **Materials and Finishes:** Housing, molded glass filled nylon. (Black). Terminals, beryllium copper. Retainer clip, spring steel.
2. **Lens Cap:** High impact resistant plastic per L-P-393, (polycarbonate).
3. **Mounting:** Two types optional:
   A. Press-In: Assembly press fits into .281 diameter hole. No mounting hardware required.
   B. Retainer Clip: For mounting assembly into .296 ± .015 dia. hole or panels less than .06 thick. Order clip 067004000 separately.
4. **Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 or equiv.
5. **Lamp:**
   A. QT/D300 assembly supplied with L.E.D. as described.
   B. 14-35380 assembly does not include L.E.D. Assembly will accept any L.E.D. conforming to outline shown.


6 ( ) P58 CAP
.34 Dia.
.30 Dia.
.28
.06 to .25 Mtg. Panel
.90
Solder Terminals with .065 X.100 Slot

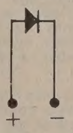

.235 Dia. (Max.)
LED bonded to Cathode (-) Lead.
.390 (Max.)
.03 (Max.)
.30 Lead Length (Trim Leads if req'd.)
.100

L.E.D. OUTLINE DIMENSIONS


.52 Across Legs

Optional Mtg. Clip
067004000

SCHEMATIC



(+) Anode Terminal, Gold Plated
(—) Cathode Terminal, Tin Plated

QT/D300
Light Source: Gallium arsenide phosphide light emitting diode. (L.E.D.)

Characteristics: Forward current; 50 milliamps maximum.
Forward voltage; 1.6 to 2.0 at 20 milliamps.
Reverse breakdown; 3 volts minimum.
Wavelength; 655 ±15 nanometers. (Red)

Appearance: Lens cap design optimized to provide high legibility under all indoor lighting conditions, over 170° viewing angle.

Complete Assembly Part Numbers		
Transparent Lens Colors	Includes L.E.D.	Less L.E.D.
Clear	———	14-35380-65P58
Red	QT/D300*	14-35380-66P58
Green	———	14-35380-67P58
Amber	———	14-35380-68P58

( ) Designates color selection.
*Also available with flat, red translucent cap as QT/D301.

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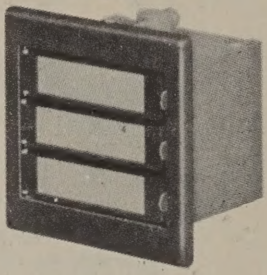
OAK

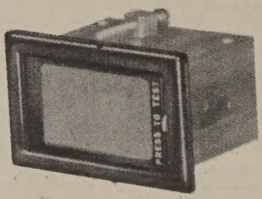
MISSILITE Assembly

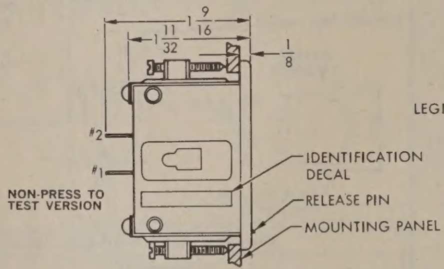
42-26191 42-26291 42-27191 42-27291

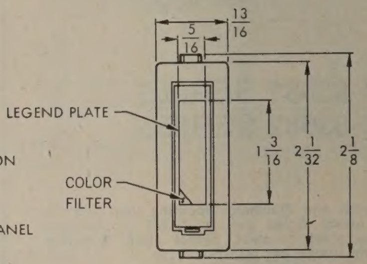
42-26191

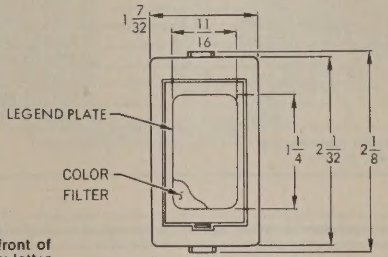


42-27291

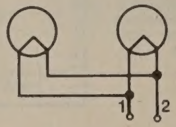




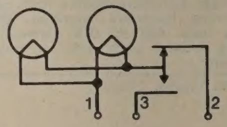




NON PRESS-TO-TEST
42-26191/42-27191



"PRESS-TO-TEST"
42-26291/42-27291



Description: Dual lamp lighted legend indicator assembly.

SPECIFICATIONS

LEGEND: Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 31.

LAMPS: Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 34, and ordering instructions.

OPTIONS: If vertical stacking is desirable, a second dash number is added. This number indicates the number of units required. Example: 42-26291-6-8 designates 8 units with red, Style A legend plates or 42-26291-66-4, designates 4 units with red, Style B legend plates. Example 2: 42-27291-6-3, designates 3 units with red, Style A legend plates; or 42-27291-66-4, designates 4 units with red, Style B legend plates. Refer to page 29 for dimensions of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cutout dimensions.

Note: If a second dash number does not appear on the part number, a single unit will be furnished.

MOUNTING: Single units are furnished with universal mounting brackets which enables the assembly to be secured at either top and bottom or at each side. Unless otherwise specified, multiple units will be supplied with mounting brackets at top and bottom only.

PANEL CUTOUTS: For panel cutout dimensions refer to page 29.

WEIGHT: Approximately 1.7 oz., less lamps per single unit.

Color	Legend Plate Style A		Legend Plate Style A "Press to Test"	
White	42-26191-5	42-27191-5	42-26291-5	42-27291-5
Red	42-26191-6	42-27191-6	42-26291-6	42-27291-6
Green	42-26191-7	42-27191-7	42-26291-7	42-27291-7
Amber	42-26191-8	42-27191-8	42-26291-8	42-27291-8
Blue	42-26191-11	42-27191-11	42-26291-11	42-27291-11
Yellow	42-26191-12	42-27191-12	42-26291-12	42-27291-12

Color	Legend Plate Style B		Legend Plate Style B "Press to Test"	
Red	42-26191-66	42-27191-66	42-26291-66	42-27291-66
Green	42-26191-67	42-27191-67	42-26291-67	42-27291-67
Amber	42-26191-68	42-27191-68	42-26291-68	42-27291-68
Blue	42-26191-69	42-27191-69	42-26291-69	42-27291-69

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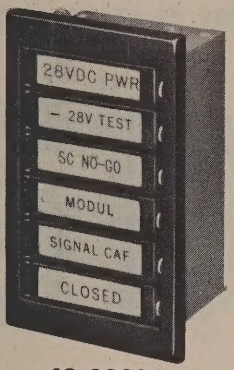
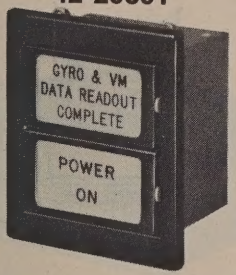
OAK

MISSILITE Assembly

42-29191


28VDC PWR
— 28V TEST
SC NO-GO
MODUL
SIGNAL CAF
CLOSED

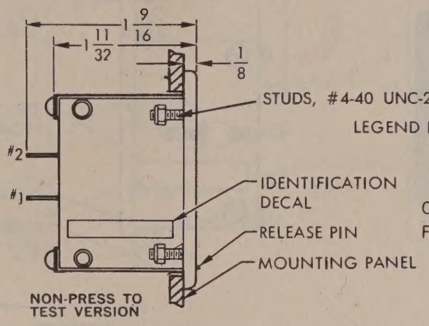
42-29391

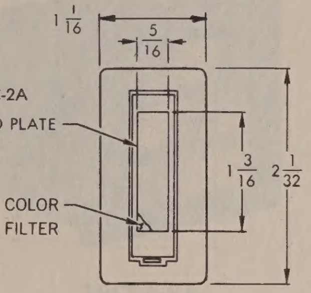

GYRO & VM
DATA READOUT
COMPLETE
POWER
ON

Listed and Qualified under MIL-I-3661B as 41-29193 (LHC81/1 thru /10) and 41-29293 (LHC81/11 thru /20). — difference, legend plates not furnished.
See pages 32 and 33 for complete listing of military type designations.

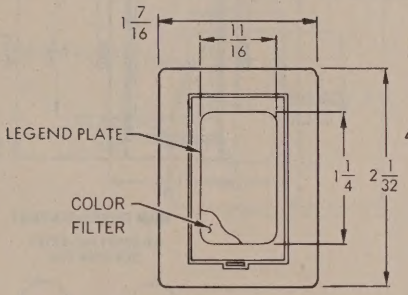
Description: Dual lamp lighted legend indicator assembly secured to panel by integral threaded studs and elastic stop nuts.

42-29191 42-29291 42-29391 42-29491


$1\frac{9}{16}$
$1\frac{11}{32}$
$\frac{1}{8}$
STUDS, #4-40 UNC-2A
#2
#1
IDENTIFICATION DECAL
RELEASE PIN
MOUNTING PANEL
NON-PRESS TO TEST VERSION


$1\frac{1}{16}$
$\frac{5}{16}$
LEGEND PLATE
COLOR FILTER
$1\frac{3}{16}$
$2\frac{1}{32}$

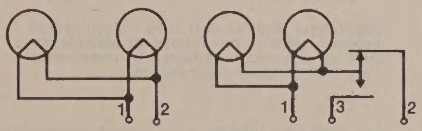
42-29191
42-29291


$1\frac{7}{16}$
$\frac{11}{16}$
LEGEND PLATE
COLOR FILTER
$1\frac{1}{4}$
$2\frac{1}{32}$

42-29391
42-29481

NON PRESS-TO-TEST
41-29193/42-29191/42-29391
SCHEMATIC

"PRESS-TO-TEST"
41-29293/42-29291/42-29491
SCHEMATIC



SPECIFICATIONS:

LEGEND: Legend Plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 31.

LAMPS: Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 34, and ordering instructions.

OPTIONS: If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 41-29191-6-8, designates 8 units with Red, style A Legend Plates: or 42-29191-56-4, designates 4 units with Red, style B Legend Plates. Refer to page 29 for dimensions of single or stacked assemblies. 42-29391 and 42-29491 available with up to 5 units in vertical array.

NOTE: If a second dash number does not appear on the part number, a single unit will be furnished.

MOUNTING: Units are stud mounted top and bottom.

PANEL CUTOUTS: For panel cutout dimensions refer to page 29.

WEIGHT: Approximately 1.2 oz. less lamps per single unit.

Color	Legend Plate Style "A"		Legend Plate Style "A" Press to Test	
White	42-29191-5	42-29391-5	42-29291-5	42-29491-5
Red	42-29191-6	42-29391-6	42-29291-6	42-29491-6
Green	42-29191-7	42-29391-7	42-29291-7	42-29491-7
Amber	42-29191-8	42-29391-8	42-29291-8	42-29491-8
Blue	42-29191-11	42-29391-11	42-29291-11	42-29491-11
Yellow	42-29191-12	42-29391-12	42-29291-12	42-29491-12

Color	Legend Plate Style "B"		Legend Plate Style "B" Press to Test	
Red	42-29191-56	42-29391-56	42-29291-56	42-29491-56
Green	42-29191-57	42-29391-57	42-29291-57	42-29491-57
Amber	42-29191-58	42-29391-58	42-29291-58	42-29491-58
Blue	42-29191-59	42-29391-59	42-29291-59	42-29491-59
White	42-29191-60	42-29391-60	42-29291-60	42-29491-60

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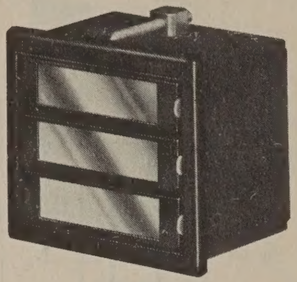
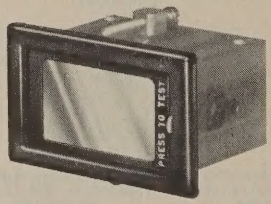
MISSILITE Assembly

42-46191

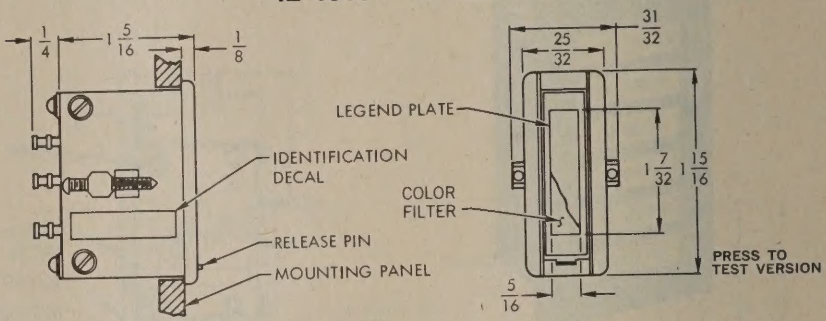


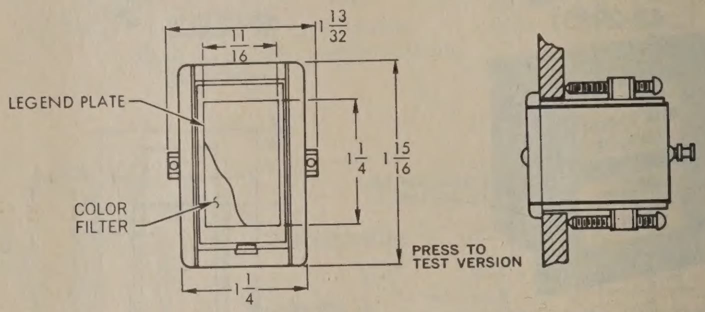
42-47291



Description: Modular dual lamp lighted legend indicator: permits the buildup of multiple assemblies in vertical, horizontal or combination arrays, from standard components.

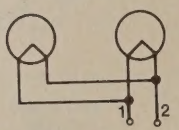
42-46191 42-46291 42-47191 42-47291





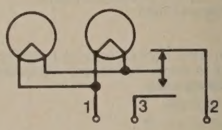
NON PRESS-TO-TEST

42-46191/42-47191 SCHEMATIC



"PRESS-TO-TEST"

42-46291/42-47291 SCHEMATIC



SPECIFICATIONS

LEGEND: Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 31.

LAMPS: Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 34, and ordering instructions.

OPTIONS: If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 42-47291-6-3, designates 3 units with red, Style A legend plates or 42-47291-66-4, designates 4 units with red, style B Legend Plates. Refer to page 29 for dimensions of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cut out dimensions.
Note: If a second dash number does not appear on the part number, a single unit will be furnished.

MOUNTING: Single and multiple units are furnished with mounting brackets at top and bottom.

PANEL CUTOUTS: For panel cutout dimensions refer to page 29.

WEIGHT: Approximately 1.6 oz., less lamps per single unit.

Color	Legend Plate Style A		Legend Plate Style A "Press to Test"	
White	42-46191-5	42-47191-5	42-46291-5	42-47291-5
Red	42-46191-6	42-47191-6	42-46291-6	42-47291-6
Green	42-46191-7	42-47191-7	42-46291-7	42-47291-7
Amber	42-46191-8	42-47191-8	42-46291-8	42-47291-8
Blue	42-46191-11	42-47191-11	42-46291-11	42-47291-11
Yellow	42-46191-12	42-47191-12	42-46291-12	42-47291-12

Color	Legend Plate Style B		Legend Plate Style B "Press to Test"	
Red	42-46191-66	42-47191-66	42-46291-66	42-47291-66
Green	42-46191-67	42-47191-67	42-46291-67	42-47291-67
Amber	42-46191-68	42-47191-68	42-46291-68	42-47291-68
Blue	42-46191-69	42-47191-69	42-46291-69	42-47291-69

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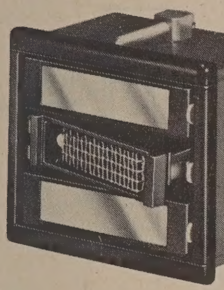
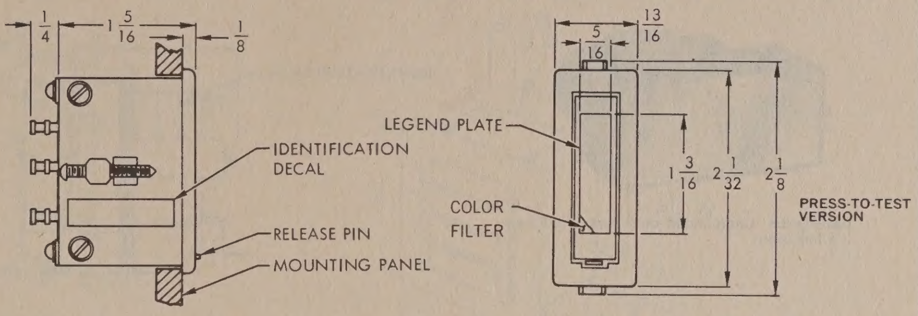
OAK

MISSILITE Assembly R.F.I. SHIELDED

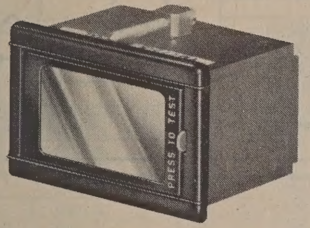
48-47691

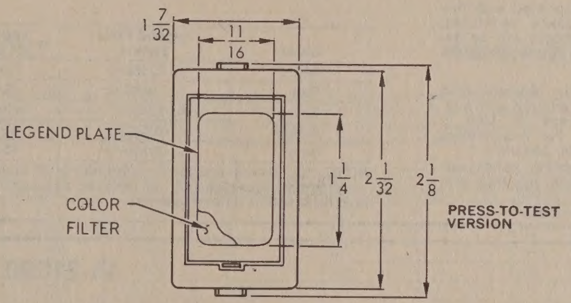


48-47691 48-47891 48-47791 48-47991



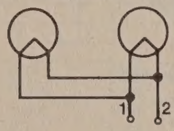
48-47991



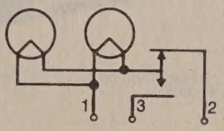


Description: Recommended for use where it is desired to exclude extraneous radio frequency radiations from the system or where internally generated RFI must be confined to the originating apparatus.

NON PRESS-TO-TEST
48-47691/48-47791
SCHEMATIC



"PRESS-TO-TEST"
48-47891/48-47991
SCHEMATIC



SPECIFICATIONS

LEGEND: Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 31.

LAMPS: Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 34, and ordering instructions.

OPTIONS: If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 48-47691-6-3, designates 3 units with red, Style A legend plates; or 48-47691-66-4, designates 4 units with red, Style B Legend Plates. Refer to page 29 for dimensions of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cutout dimensions.
Note: If a second dash number does not appear on the part number, a single unit will be furnished.

MOUNTING: Single units are furnished with universal mounting brackets which enables the assembly to be secured at either top and bottom or at each side. Unless otherwise specified, multiple units will be supplied with mounting brackets at top and bottom only.

PANEL CUTOUTS: For panel cutout dimensions refer to page 29.

WEIGHT: Approximately 1.8 oz., less lamps per single unit.

Color	Legend Plate Style A		Legend Plate Style A "Press to Test"	
White	48-47691-5	48-47791-5	48-47891-5	48-47991-5
Red	48-47691-6	48-47791-6	48-47891-6	48-47991-6
Green	48-47691-7	48-47791-7	48-47891-7	48-47991-7
Amber	48-47691-8	48-47791-8	48-47891-8	48-47991-8
Blue	48-47691-11	48-47791-11	48-47891-11	48-47991-11
Yellow	48-47691-12	48-47791-12	48-47891-12	48-47991-12

Color	Legend Plate Style B		Legend Plate Style B "Press to Test"	
Red	48-47691-66	48-47791-66	48-47891-66	48-47991-66
Green	48-47691-67	48-47791-67	48-47891-67	48-47991-67
Amber	48-47691-68	48-47791-68	48-47891-68	48-47991-68
Blue	48-47691-69	48-47791-69	48-47891-69	48-47991-69

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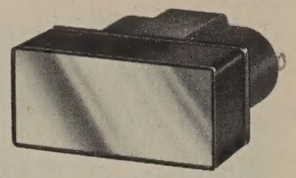
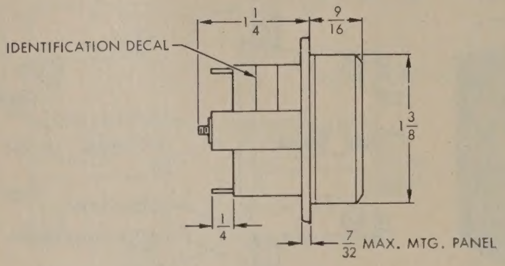
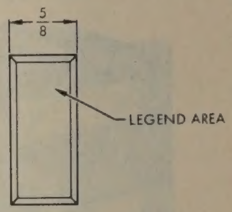
MISSILITE Assembly

43-20580



Description: Ungrounded dual lamp word warning indicator.


1 1/4
9/16
IDENTIFICATION DECAL
1 3/8
1/4
7/32 MAX. MTG. PANEL


5/8
LEGEND AREA

SPECIFICATIONS:

LEGEND: Legend area may be imprinted with any letter or numeral combination, space permitting. When necessary, special part numbers will be assigned for customer identification. For legend plate style and color refer to page 31.

LAMPS: Not supplied with assembly. Specify when ordering if desired. Two lamps required per unit. Consult lamp selection guide page 34. Unit is relampable from front of panel. For independent lamp illumination, specify 43-20880 Missilite.

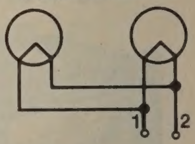
MOUNTING: See below for mounting panel cut-out information. Mounting hardware supplied with assembly.

WEIGHT: Approximately 1.0 less lamp.

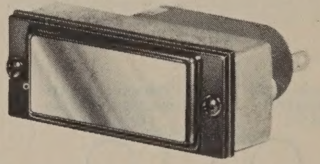
Color	Legend Plate Style A	Legend Plate Style B
White	43-20580-5	None
Red	43-20580-6	43-20580-56
Green	43-20580-7	43-20580-57
Amber	43-20580-8	43-20580-58
Blue	43-20580-11	43-20580-59

NOTE: To prevent accidental interchange of legends in multiple installations, lens caps will be indexed to proper base when this feature is specified by customer.

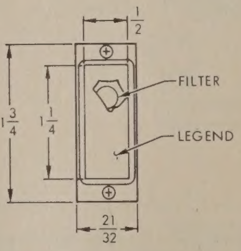
43-20580 SCHEMATIC

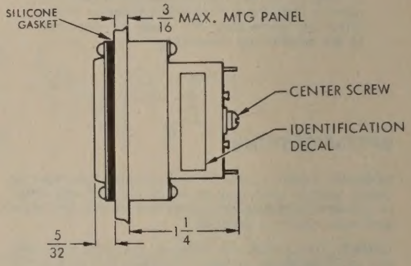


45-21090



Description: Splash-proof, word warning indicator.


1/2
FILTER
LEGEND
1 3/4
1 1/4
21/32


SILICONE GASKET
3/16 MAX. MTG PANEL
CENTER SCREW
IDENTIFICATION DECAL
5/32
1 1/4

SPECIFICATIONS:

LEGEND: Legend area may be imprinted with any letter or numeral combination, space permitting. When necessary, special part numbers will be assigned for customer identification. For legend plate style and color refer to page 31.

LAMPS: Not supplied with assembly. Specify when ordering if desired. Two lamps required per unit. Consult lamp selection guide page . Relamping screw at bottom of base. For independent lamp illumination, specify 45-20990 Missilite.

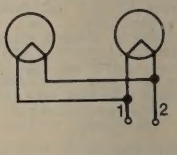
MOUNTING: See below for mounting panel cut-out information. Mounting hardware supplied with assembly.

WEIGHT: Approximately .8 oz., less lamps.

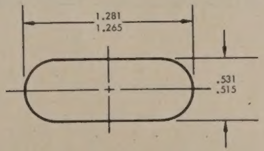
SPECIAL APPLICATIONS: Unit is splash-proof when installed in panel and is designed to meet most military and commercial applications.

Color	Legend Plate Style A	Legend Plate Style B
White	45-21090-5	None
Red	45-21090-6	45-21090-56
Green	45-21090-7	45-21090-57
Amber	45-21090-8	45-21090-58
Blue	45-21090-11	45-21090-59
Yellow	45-21090-12	None

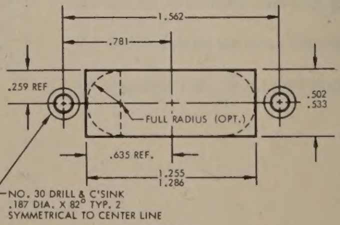
43-21090 SCHEMATIC



MOUNTING PANEL CUT-OUT DIMENSIONS


1.281
1.265
.531
.515

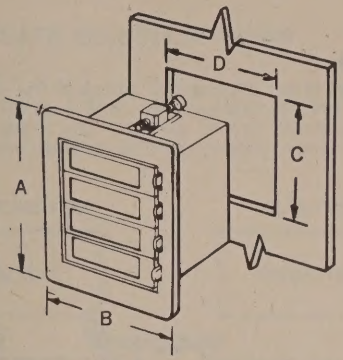
43-20580


1.562
.781
.259 REF
.502
.533
FULL RADIUS (OPT.)
.635 REF.
1.255
1.286
NO. 30 DRILL & C'SINK
.187 DIA. X 82° TYP. 2
SYMMETRICAL TO CENTER LINE

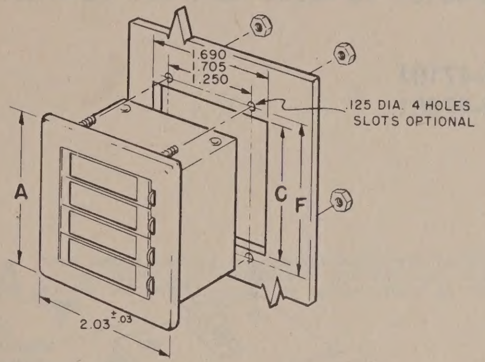
45-21090

MISSILITE Assembly

MOUNTING PANEL CUT-OUT DIMENSIONS



KEY-BLOCK MOUNT



STUD MOUNT

For other information on configurations not illustrated, contact our Sales Department and appropriate ordering data will be furnished. Our Engineering Department will prepare and maintain a specification control drawing describing your exact requirement. Drawings will be submitted for approval prior to production of parts.

No. of Units In Vertical Array		1 Unit	2 Unit	3 Unit	4 Unit	5 Unit	6 Unit	7 Unit	8 Unit	9 Unit	10 Unit	Tolerance
42-26191	Dim. A	.812	1.218	1.937	2.390	X	3.265	X	4.140	X	5.031	±.03
42-26291	Dim. B	2.031	2.031	2.031	2.031	X	2.031	X	2.031	X	2.031	±.03
	Dim. C	.618	1.061	1.499	1.940	X	2.820	X	3.700	X	4.580	±.015
	Dim. D	1.795	1.705	1.705	1.705	X	1.705	X	1.705	X	1.705	∓.015
42-27191	Dim. A	1.218	2.390	3.265	4.140	5.031	X	X	X	X	X	±.03
42-27291	Dim. B	2.031	2.031	2.031	2.031	2.031	X	X	X	X	X	±.03
	Dim. C	1.061	1.940	2.820	3.700	4.580	X	X	X	X	X	±.015
	Dim. D	1.795	1.705	1.705	1.705	1.705	X	X	X	X	X	±.015
42-29191	Dim. A	1.063	1.504	1.944	2.384	2.824	3.264	3.704	4.144	5.584	5.024	±.010
42-29291	Dim. C	.540	.970	1.410	1.850	2.296	2.733	3.174	3.617	4.060	4.500	±.010
	Dim. F	.796	1.226	1.666	2.106	2.554	2.989	3.430	3.873	4.316	4.758	±.010
42-29391	Dim. A	1.504	2.384	3.264	4.144	5.024	X	X	X	X	X	±.010
42-29491	Dim. C	.970	1.850	2.733	3.617	4.500	X	X	X	X	X	±.010
	Dim. F	1.226	2.106	2.989	3.873	4.758	X	X	X	X	X	±.010
42-46191	Dim. A	.789	1.232	1.672	2.112	2.552	2.992	3.432	3.875	4.312	4.752	±.015
42-46291	Dim. B	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950	±.015
48-47691	Dim. C	.650	1.093	1.531	1.972	2.412	2.852	3.292	3.732	4.172	4.612	±.015
48-47891	Dim. D	1.795	1.795	1.795	1.795	1.795	1.795	1.795	1.795	1.795	1.795	±.015
42-47191	Dim. A	1.232	2.112	2.992	3.875	4.752	X	X	X	X	X	±.015
42-47291	Dim. B	1.950	1.950	1.950	1.950	1.950	X	X	X	X	X	±.015
48-47791	Dim. C	1.092	1.972	2.852	3.732	4.612	X	X	X	X	X	±.015
48-47991	Dim. D	1.795	1.795	1.795	1.795	1.795	X	X	X	X	X	±.015

BASIC DATA

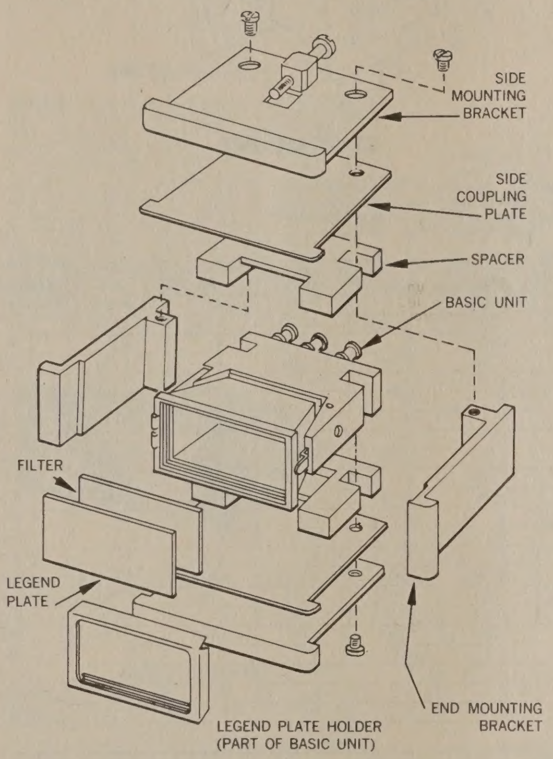
(MISSILITE MATERIAL STANDARDS)

PART	MATERIAL	FINISH OR MATERIAL SPECIFICATIONS	
Base Shell	Phenolic Resin	Black	MIL-M-14F
Lamp Housing	Phenolic Resin	Black	MIL-M-14F
Mounting Brackets	Aluminum	Black Anodized	MIL-A-8625
Mounting Plates	Aluminum	Black Anodized	MIL-A-8625
Escutcheon Plates	Aluminum	Black Anodized	MIL-A-8625
Legend Holders	Aluminum	Black Anodized	MIL-A-8625
Legend Plates	Butyrate Plastic	—	L-P-349
Filters	Silicone Rubber	—	MIL-R-5847
	Butyrate Plastic	—	L-P-349
R.F.I. Screen	Monel Wire	—	QQ-N-281
Gaskets	Silicone Rubber	—	MIL-R-5847
Key-block Assemblies	Brass	Cadmium Plated	QQ-P-416
Terminal (Solder)	Brass	Tin Plated	MIL-T-10727
Terminal (Screw)	Brass	Nickel Plated	QQ-N-290
Terminal (Turret)	Brass	Tin Plated	MIL-T-10727
Lamp Contacts	Brass	Nickel Plated	QQ-N-290

MISSILITE PARTS BREAKDOWN

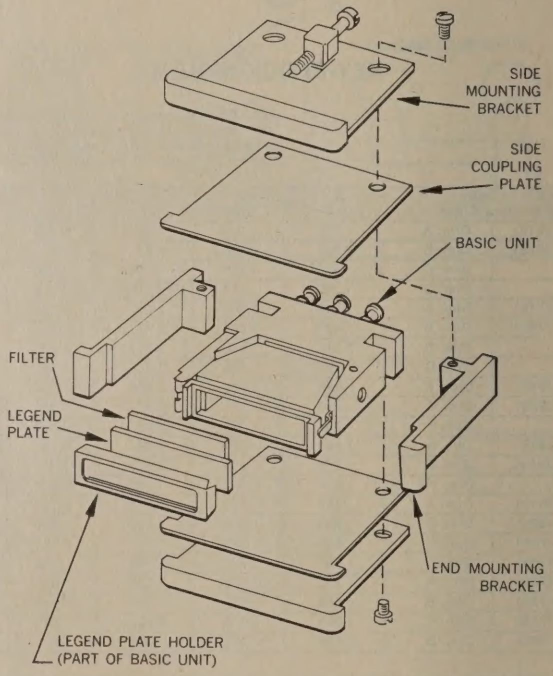
42-46191 42-46291 42-47191 42-47291

42-47191
42-47291


SIDE MOUNTING BRACKET
SIDE COUPLING PLATE
SPACER
BASIC UNIT
FILTER
LEGEND PLATE
END MOUNTING BRACKET
LEGEND PLATE HOLDER (PART OF BASIC UNIT)

Side Mounting Bracket—042005003
Side Coupling Plate—048016011
Spacer—050007001
Basic Unit—42-47190 or 42-47290
Filter—27203
Legend Plate—27201
Keyblock Assembly—100056001
Legend Plate Holder
(Part of Basic Unit)

42-46191
42-46291


SIDE MOUNTING BRACKET
SIDE COUPLING PLATE
BASIC UNIT
FILTER
LEGEND PLATE
END MOUNTING BRACKET
LEGEND PLATE HOLDER (PART OF BASIC UNIT)

Side Mounting Bracket—042005003
Side Coupling Plate—048016011
Basic Unit—42-46190 or 42-46290
Filter—46103
Legend Plate—46101
Legend Plate Holder
(Part of Basic Unit)
Key Block Assembly—100056002

MISSILITE Assembly

BEST FOR YOUR APPLICATIONS IPI INDICATOR LIGHTS

LEGEND PLATE SELECTION GUIDE

Part numbers are included for specific assemblies having legend plate Styles A & B. Part numbers are available upon request for assemblies requiring legend styles and colors other than those listed on Missilite catalog pages.

UNLIGHTED	LIGHTED			
INVERTER OFF	INVERTER OFF	SOLID COLOR	LEGEND PLATE STYLE **A**	Visible opaque markings on translucent background. Standard markings will be black characters on white and yellow backgrounds, and white characters on backgrounds of all other colors.
POWER ON	POWER ON		LEGEND PLATE STYLE **B**	Visible black opaque markings on white translucent background. When lighted, the background changes to desired color.
	STOP	HIDDEN MARKINGS—LIGHTED BACKGROUND	LEGEND PLATE STYLE **C**	When unlighted, markings are obscured for minimum visibility. When lighted, the markings appear black against a lighted background of desired color.
	FUEL TANK 95% FULL	HIDDEN MARKINGS—OPAQUE BACKGROUND	LEGEND PLATE STYLE **D**	When unlighted, markings are obscured for minimum visibility. When lighted, the markings appear in the desired color, the background remains opaque.
DENSE	DENSE	SEMI-HIDDEN MARKINGS	LEGEND PLATE STYLE **E**	When unlighted, the markings are semi-visible on an opaque background. When lighted, the characters are clearly visible in desired color, background remains opaque.
TAKEOFF	TAKEOFF	SEMI-HIDDEN MARKINGS	LEGEND PLATE STYLE **F**	Semi-visible markings on background of color specified. When lighted opaque markings are sharply outlined.

HOW TO ORDER IPI MISSILITES

Simply write or call the IPI representative in your area or the factory.

The following information must be included on the purchase order:

Specify the IPI part number with appropriate dash number (see individual pages).

Specify color and style of legend if requirements are for other than those parts listed herein.

Specify the desired legend plate markings. THE LEGEND PLATE WILL BE MARKED EXACTLY THE WAY IT APPEARS ON THE CUSTOMER'S DRAWING OR PURCHASE ORDER.

Specify lamp number in accordance with the lamp selection guide on page 34. Use lamp number as a suffix dash number to unit reference. Example: 42-26291-6-327.

Specify any requirements that deviate from standard i.e., side mounting for 42-46191 series, horizontal stacks of 42-47291, etc.

IPI will prepare individual customer specification control drawings for special configurations not covered by catalog part number.

These will be distinguished by a three digit dash number affixed to basic part number. Example: 42-26291-147.

CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

SPECIFICATION	TYPE DESIGNATION	IPI PART NUMBER	PG.
MIL-L-3661/5	LH 73/1	11-33480	10
	LH 73/2	18-36880	15
MIL-3661/6	LH 74/1	31-36180	21
	LH 74/2	31-36280	21
	LH 74/3	38-36180	22
	LH 74/4	38-36280	22
MIL-L-3661/11	LC 11 RN 2	6 P 35	10
	↑ GN 2	7 P 35	
	YN 2	8 P 35	
	CN 2	5 P 35	
	RT 2	6 P 35 TL	
	GT 2	7 P 35 TL	
	YT 2	12 P 35 TL	
	WT 2	5 P 35 TL	
	GD 2	7 P 35 IF	
	RD 2	6 P 35 IF	
	RB 2	46 P 35	
	GB 2	47 P 35	
	↓ YB 2	412 P 35	
	LC 11 WB 2	45 P 35	
MIL-L-3661/12	LC 12 RN 2	6 P 12	10
	↑ GN 2	7 P 12	
	YN 2	8 P 12	
	CN 2	5 P 12	
	RT 2	6 P 12 TL	
	GT 2	7 P 12 TL	
	↓ WT 2	5 P 12 TL	
	LC 12 YT 2	12 P 12 TL	
MIL-L-3661/13	LC 13 RN 2	6 P 13	21
	YN 2	8 P 13	
	WT 2	17 P 13	
	↓ CN 2	5 P 13	
	LC 13 GT 2	7 P 13 TL	

CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

SPECIFICATION	TYPE DESIGNATION	IPI PART NUMBER	PG.
MIL-L-3661/25	LC 25 RN 2	6 P 38	15
	↑ GN 2	7 P 38	
	YN 2	8 P 38	
	CN 2	5 P 38	
	RT 2	6 P 38 TL	
	GT 2	7 P 38 TL	
	↓ YT 2	12 P 38 TL	
	LC 25 WT 2	5 P 38 TL	
MIL-L-3661/26	LC 26 GN 2	7 P 39	15
	↑ GT 2	7 P 39 TL	
	RN 2	6 P 39	
	RT 2	6 P 39 TL	
	WT 2	5 P 39 TL	
	YN 2	8 P 39	
	↓ YT 2	12 P 39 TL	
	LC 26 CN 2	5 P 39	
MIL-L-3661/27	LC 27 RN 2	6 P 40	15
	↑ YN 2	8 P 40	
	CN 2	5 P 40	
	RT 2	6 P 40 TL	
	GT 2	7 P 40 TL	
	YT 2	12 P 40 TL	
	↓ WT 2	5 P 40 TL	
	LC 27 GN 2	7 P 40	
MIL-L-3661/28	LC 28 RN 2	6 P 41	22
	↑ YN 2	8 P 41	
	↓ WT 2	17 P 41	
	LC 28 CN 2	5 P 41	
MIL-L-3661/29	LC 29 CN 2	5 P 42	10
	↑ GN 2	7 P 42	
	GT 2	7 P 42 TL	
	RN 2	6 P 42	
	RT 2	6 P 42 TL	
	WT 2	5 P 42 TL	
	↓ YN 2	8 P 42	
	LC 29 YT 2	12 P 42 TL	
MIL-L-3661/33	LC 33 RN 2	6 P 25	21
	↑ YN 2	8 P 25	
	↓ WT 2	17 P 25	
	LC 33 CN 2	5 P 25	
MIL-L-3661/34	LC 34 EN 2/DO 2	80250-11	*
	↑ CN 2/DO 2	↑ -12	
	EN 2/EN 2	-13	
	CN 2/EN 2	-14	
	↓ EN 2/S02	↓ -15	
	LC 34 CN 2/S02	80250-16	
MIL-L-3661/35	LC 35 RN 2	6 P 24	13
	↑ GN 2	7 P 24	
	YN 2	8 P 24	
	CN 2	5 P 24	
	GT 2	7 P 24 TL	
	YT 2	12 P 24 TL	
	↓ RT 2	6 P 24 TL	
	LC 35 WT 2	5 P 24 TL	

*Not shown in this catalog. Please contact Illuminated Products for details.

ILLUMINATED PRODUCTS INC.

2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

SPECIFICATION	TYPE DESIGNATION	IPI PART NUMBER	PG.
MIL-L-3661/39	LHC 81/1	41-29193-1	25
	/2	-2	
	/3	-3	
	/4	-4	
	/5	-5	
	/6	-6	
	/7	-7	
	/8	-8	
	/9	-9	
	LHC 81/10	41-29193-10	
	LHC 81/11	41-29293-1	25
	/12	-2	
	/13	-3	
	/14	-4	
	/15	PRESS -5	
	/16	TO TEST -6	
	/17	-7	
	/18	-8	
	/19	-9	
	LHC 81/20	41-29293-10	
MIL-L-3661/40	LHC 82/1 WT 2	99-36980- 5 TL	4
	/1 RT 2	- 6 TL	
	/1 GT 2	- 7 TL	
	LHC 82/1 YT 2	99-36980-12 TL	
	LHC 82/2 YT 2	98-36980-12 TL	4
	/2 WT 2	- 5 TL	
	/2 RT 2	- 6 TL	
	LHC 82/2 GT 2	98-36980- 7 TL	
MIL-3661/41	LHC 83/1 WT 2	99-36981- 5 TL	4
	/1 RT 2	- 6 TL	
	/1 GT 2	- 7 TL	
	LHC 83/1 YT 2	99-36981-12 TL	
	LHC 83/2 WT 2	98-36981- 5 TL	4
	/2 RT 2	- 6 TL	
	/2 GT 2	- 7 TL	
	LHC 83/2 YT 2	98-36981-12 TL	
MIL-L-3661/42	LHC 84/1 WT 2	99-36982- 5 TL	4
	/1 RT 2	- 6 TL	
	/1 GT 2	- 7 TL	
	LHC 84/1 YT 2	99-36982-12 TL	
	LHC 84/2 YT 2	98-36982-12 TL	4
	/2 WT 2	- 5 TL	
	/2 RT 2	- 6 TL	
	LHC 84/2 GT 2	98-36982- 7 TL	
MIL-L-3661/46	LH 88/1	31-36680	21
	LH 88/2	31-36681	21
MIL-L-3661/47	LH 89/1	11-35182	4
MIL-L-3661/51	LH 92/1	91-80280	*

CROSS REFERENCE TO "MS" NUMBERS

MILITARY STANDARD	IPI PART NUMBER	PG.
MS 25010 A 11 A	91-80080-11	*
12 A	-12	
13 A	-13	
14 A	-14	
15 A	-15	
MS 25010 A 16 A	91-80080-16	
MS 25010 B*11 A	91-80180-11	*
12 A	-12	
13 A	-13	
14 A	-14	
15 A	-15	
MS 25010 B 16 A	91-80180-16	
MS 25010 C*11 B	91-80280-11	*
12 B	-12	
13 B	-13	
14 B	-14	
15 B	-15	
MS 25010 C 16 B	91-80280-16	
Canceled after 5 Feb. 1971. Superseded by LH 92/1 LC 34.		
MS 25041- 1	01-91180- 1	12
- 2	- 2	
- 3	- 3	
- 4	- 4	
- 5	- 5	
- 6	- 6	
- 7	- 7	
- 8	- 8	
-10	-10	
MS 25041-11	01-91180-11	
MS 25256- 2	11-33480- 8 P 12	10
- 4	- 7 P 12	
- 6	- 6 P 12	
- 8	- 5 P 12	
-10	- 5 P 12TL	
MS 25256-12	11-33480-11 P 12	
Canceled after 26 May 1969. Superseded by LH 73/1 LC 12.		
MS 25257- 1	31-36180-8 P 13-NE 2 D	21
- 2	-8 P 13	
- 3	-6 P 13-NE 2 D	
- 4	-6 P 13	
- 5	-5 P 13-NE 2 D	
MS 25257- 6	31-36180-5 P 13	
Canceled after 4 June 1970. Superseded by LH 74/1 LC 13.		
MS 25331- 1	02-91180-1	18
- 2	-2	
- 3	-3	
- 4	-4	
- 5	-5	
- 6	-6	
- 7	-7	
- 8	-8	
MS 25331- 9	02-91180-9	

*Not shown in this catalog. Please contact Illuminated Products for details.

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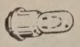
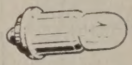
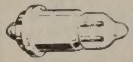
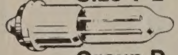
LAMP SELECTION GUIDE

INCANDESCENT TYPE

	LAMP NO.	RATED VOLTAGE	AMPERAGE	APPROX. CANDLEPOWER	AVERAGE LIFE (Hrs.)	NOTES
Size T-1 Sub-midget Flange Base  **Group M**	682	5.0	.060	.03	100,000	MS24515-682
	685	5.0	.060	.05	100,000	MS24515-685
	718	5.0	.115	.15	40,000	MS24515-718
	6839	28.0	.024	.13	16,000	MS3338-6839
Size T-1¾ Midget Flange Base  **Group A**	331	1.35	.06	.01	500	
	268	2.5	.35	.21	10,000	
	338	2.7	.06	.04	6,000	MS25237-338
	345	6.0	.04	.03	10,000	
	328	6.0	.20	.34 @ 5 V	1,000	MS25237-328
	380	6.3	.04	.02	50,000	
	350	6.3	.15	.45	3,000	
	349	6.3	.20	.55	3,000	
	381	6.3	.20	.40	50,000	
	344	10.0	.014	.004	10,000	
	367X	10.0	.04	.08	5,000	
	330	14.0	.08	.50	750	MS25237-330
	370	18.0	.04	.15	1,000	
	327	28.0	.04	.34	1,000	MS25237-327
	387	28.0	.04	.30	25,000	MS18209-387
Size T-3¼ Miniature Bayonet Base Single Contact **Group B**	316	6.0	.70	3.4	500	MS25231-316
	44	6.3	.25	.9	3,000	
	47	6.3	.15	.52	3,000	
	1816	13.0	.33	3.0	1,000	
	1815	14.0	.20	1.4	3,000	
	313	28.0	.17	3.0	500	MS25231-313
	1819	28.0	.04	.34	1,000	MS25231-1819
	1829	28.0	.075	1.0	1,000	MS25231-1829
	1835	55.0	.05	1.1	10,000	

NEON GLOW TYPE

	LAMP NO.	RATED VOLTAGE	STARTING VOLTAGE	RECOMMENDED SERIES RESISTOR	NOTES
Size T-2  **Group C**	A1G	105-125 AC OR DC	65 VAC 95 VDC	68KΩ	
	A1H (High Brightness)	105-120 VAC 150 VDC	95 VAC	27KΩ	
Size T-2  **Group D**	C7A	105-125 AC OR DC	65 VAC 90 VDC	68KΩ	MS25252-C7A
	C9A (High Brightness)	105-125 AC OR DC	105 VAC	27KΩ	MS25252-C9A
Size T-3¼ **Group E**	NE51	105-125 AC OR DC	65 VAC 90 VDC	100KΩ	
	NE51H (High Brightness)	105-125 AC OR DC	105 VAC	27KΩ	

Notes:

1. Candlepower values indicated are approximate initial mean spherical candlepower at rated voltage.
2. Service conditions such as voltage surges, temperature, shock, and vibration may contribute to a shorter average life.

CROSS REFERENCE INDEX

IPI Lamp Numbers to Industry Lamp Numbers

IPI No.	Ind. No.	IPI No.	Ind. No.	IPI No.	Ind. No.	IPI No.	Ind. No.	IPI No.	Ind. No.
1	7100	81	7202	228	—	330	—	466	—
2	7200	83	—	229	6150	331	2128	467	7248
3	7101	84	7231	230	6180	332	7259	468	—
4	7201	85	7240	238	—	333	3229	472	—
8	7209	86	7241	239	8587	334	—	473	—
9	6833	87	7228	240	8913	335	7260	474	—
11	683	88	7227	241	8828	336	7261	475	—
12	7133	96	7105	242	8270	339	—	476	—
14	713	97	7107	243	—	340	7022	477	—
16	715	98	7108	244	—	341	7263	478	—
16-39	—	99	7223	245	—	342	—	556	—
17	7153	100	7224	246	—	343	7680	557	—
18	7102	105	7104	247	—	344	7683	558	—
20	7213	108	7106	248	—	345	7265	559	—
21	7225	110	7206	253	253	346	—	560	—
22	7226	111	7092	253X	253X	347	7714	563	—
24	7233	116	7211	253-1	261	348	7266	693	—
25	685	117	7235	255	—	349	7715	694	—
26	714	138	7205	256	—	352	—	695	—
27	718	139	7210	262	7122	355	—	697	6152
28	7237	140	7109	263	8022	356	7267	700	6212
29	682	147	7229	266	—	358	—	701	8175
30	6803	155	—	267	—	359	7268	729	2140
32	680	156	7093	273	679	360	—	730	2124
33	7152	157	7097	279	—	361	—	731	2136
34	8666	160	7234	282	3810	362	8095	732	252
39	7215	161	7230	283	7810	366	—	733	—
40	—	172	—	285	3811	367	8111	734	—
44	7238	173	7090	286	7811	368	8112	739	—
45	7216	174	7094	288	—	369	8098	770	—
46	7239	175	—	289	—	371	—	771	—
57	6802	176	7096	290	—	382	—	772	—
58	6832	186	—	292	—	383	—	773	—
59	7132	189	2	293	—	384	8097	774	—
60	7212	201	—	296	—	385	—	775	—
62	6838	203	8711	297	—	386	—	776	—
63	7232	209	—	299	7113	388	—	803	—
64	6839	210	6022	303	7116	389	8099	804	—
66	7219	211	—	305	8383	390	—	819	—
70	7214	213	—	310	7123	391	—	821	—
71	32	218	—	315	3225	393	7839	822	—
72	7207	219	—	316	7254	405	7118	823	—
73	7203	220	—	319	—	450	—	824	—
74	7218	224	—	320	8102	455	7112	869	—
75	7220	225	—	321	7255	456	7114	870	—
76	7208	226	—	326	—	457	7117	871	—
80	7204	227	—	329	7257	458	7119	872	—

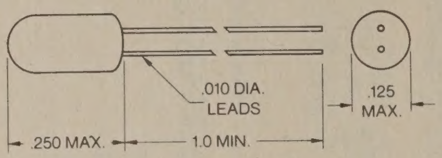
Industry Lamp Numbers to IPI Lamp Numbers

Industry No.	IPI No.	Industry No.	IPI No.	Industry No.	IPI No.	Industry No.	IPI No.	Industry No.	IPI No.	Industry No.	IPI No.
2	189	6022	210	7106	108	7206	110	7232	63	7714	347
32	71	6150	229	7107	97	7207	72	7233	24	7715	349
252	732	6152	697	7108	98	7208	76	7234	160	7810	283
253	253	6180	230	7109	140	7209	8	7235	117	7811	286
253X	253X	6212	700	7112	455	7210	139	7237	28	7839	393
261	253-	6802	57	7113	299	7211	116	7238	44	8022	263
679	273	6803	30	7114	456	7212	60	7239	46	8095	362
680	32	6832	58	7116	303	7213	20	7240	85	8097	384
682	29	6833	9	7117	457	7214	70	7241	86	8098	369
683	11	6838	62	7118	405	7215	39	7248	467	8099	389
685	25	6839	64	7119	458	7216	45	7254	316	8102	320
713	14	7022	340	7122	262	7218	74	7255	321	8111	367
714	26	7090	173	7123	310	7219	66	7257	329	8112	368
715	16	7092	111	7132	59	7220	75	7259	332	8175	701
718	27	7093	156	7133	12	7223	99	7260	335	8270	242
2124	730	7094	174	7152	33	7224	100	7261	336	8383	305
2128	331	7096	176	7153	17	7225	21	7263	341	8587	239
2136	731	7097	157	7200	2	7226	22	7265	345	8666	34
2140	729	7100	1	7201	4	7227	88	7266	348	8711	203
3225	315	7101	3	7202	81	7228	87	7267	356	8828	241
3229	333	7102	18	7203	73	7229	147	7268	359	8913	240
3810	282	7104	105	7204	80	7230	161	7680	343		
3811	285	7105	96	7205	138	7231	84	7683	344		

Note: Consult factory for lamps listed but not shown in catalog.

INCANDESCENT LAMPS

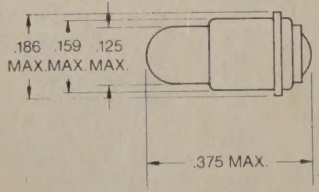
T-1 Unsupported Unbased



Part Numbers					
IPI No.	**Industry No.**	**Volts**	**Amps** (±10%)	**MSCP**	**Life** (hrs.)
2	7200	1.5	0.010**	0.002	10,000
4	7201	1.5	0.015	0.003	10,000
203	8711	2.5	0.320	0.210	10,000
331	2128	3.0	0.125***	0.005	10,000
138	7205	3.0	0.015	0.010	5,000
110	7206	3.0	0.225	0.015	10,000
83	—	3.0	0.040	0.027	10,000
72	7207	3.0	0.060	0.030	100,000
76	7208	3.0	0.120	0.150	16,000
472	—	5.0	0.020	0.020	50,000
210	6022	5.0	0.020	0.034	10,000
225	—	5.0	0.040	0.100	2,500
32*	680	5.0	0.060	0.030	100,000
11*	683	5.0	0.060	0.050	100,000
229	6150	5.0	0.060	0.150	6,500
246	—	5.0	0.060	0.150	6,500
14*	713	5.0	0.075	0.090	25,000
116	7211	5.0	0.080	0.150	5,000
16*	715	5.0	0.115	0.150	40,000
16-39	—	5.0	0.115	0.170	40,000
39	7215	5.0	0.115	0.190	10,000
20	7213	5.0	0.115	0.200	5,000
70	7214	5.0	0.115	0.220	5,000
244	—	5.0	0.115	0.250	5,000
45	7216	5.0	0.125	0.250	5,000

*MS-24367 **±15% ***±20%

T-1 Unsupported Flange Base



Part Numbers					
IPI No.	**Industry No.**	**Volts**	**Amps** (±10%)	**MSCP**	**Life** (hrs.)
320	8102	1.5	0.075	0.027	16,000
147	7229	3.0	0.015	0.009	5,000
84	7231	3.0	0.060	0.030	100,000
473	—	5.0	0.020	0.018	50,000
263	8022	5.0	0.020	0.034	10,000
226	—	5.0	0.040	0.090	10,000
29*	682	5.0	0.060	0.030	100,000
25*	685	5.0	0.060	0.050	100,000
247	—	5.0	0.060	0.130	6,500
26*	714	5.0	0.075	0.090	25,000
27*	718	5.0	0.115	0.150	40,000
28	7237	5.0	0.115	0.180	5,000
245	—	5.0	0.115	0.230	5,000
46	7239	5.0	0.125	0.220	5,000

*MS-24515

Note: To order lamps, prefix the IPI part number with LA— (example LA330)

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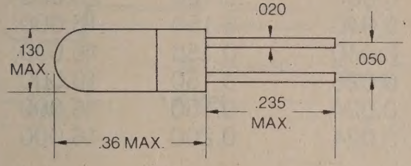
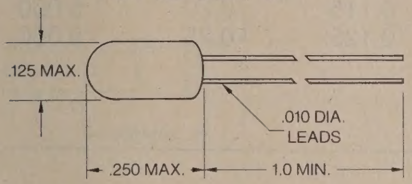
INCANDESCENT LAMPS

T-1 Unsupported Bi-Pin



Part Number					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
319	—	1.5	0.060	0.015	100,000
334	—	3.0	0.0225	0.015	10,000
366	—	3.0	0.040	0.027	10,000
336	7261	3.0	0.120	0.150	16,000
693	—	5.0	0.020	0.020	50,000
342	—	5.0	0.040	0.100	10,000
346	—	5.0	0.060	0.150	6,500
347	7714	5.0	0.075	0.090	25,000
349	7715	5.0	0.115	0.150	40,000
352	—	5.0	0.115	0.190	10,000
358	—	5.0	0.115	0.220	5,000

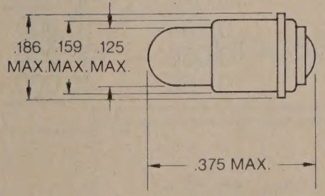
T-1 Supported Unbased



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
80	7204	3.0	0.008*	0.001	16,000
8	7209	5.0	0.015	0.015	10,000
139	7210	5.0	0.030	0.030	16,000
255	—	10.0	0.015	0.020	16,000
74	7218	10.0	0.027	0.100	10,000
209	—	12.0	0.030	0.100	25,000
227	—	12.0	0.040	0.150	16,000
66	7219	12.0	0.060	0.150	16,000
266	—	13.0	0.040	0.190	16,000
248	—	14.0	0.040	0.150	16,000
367	8111	14.0	0.065	0.150	16,000
75	7220	18.0	0.026	0.150	10,000
62	6838	28.0	0.024	0.150	16,000
267	—	28.0	0.024	0.200	16,000

*±18.75%

T-1 Supported Flange Base



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
24	7233	5.0	0.015	0.013	10,000
160	7234	5.0	0.030	0.030	16,000
85	7240	10.0	0.027	0.100	10,000
243	—	12.0	0.030	0.090	25,000
71	32	12.0	0.060	0.130	16,000
368	8112	14.0	0.065	0.150	16,000
86	7241	18.0	0.026	0.150	10,000
64*	6839	28.0	0.024	0.130	16,000

*MS-3338

Note: To order lamps, prefix the IPI part number with LA— (example LA330).

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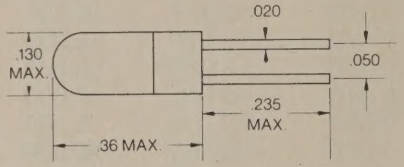
INCANDESCENT LAMPS

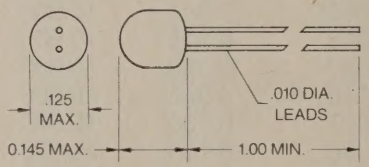
T-1 Supported Bi-Pin



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
330	—	3.0	0.008*	0.001	16,000
361	—	10.0	0.015	0.020	16,000
382	—	12.0	0.030	0.100	25,000
383	—	12.0	0.040	0.150	16,000
388	—	14.0	0.040	0.150	16,000
389	8099	18.0	0.026	0.150	10,000
393	7839	28.0	0.024	0.150	16,000
391	—	28.0	0.024	0.200	16,000

*±18.75%

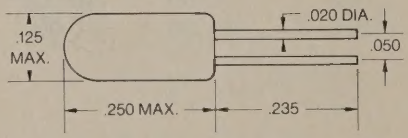
T-1 Reduced Length 0.145" MOL Unbased



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
57**	6802	5.0	0.060	0.03	100,000
58**	6832	5.0	0.060	0.05	100,000
697	6152	5.0	0.060	0.15	6,500
59**	7132	5.0	0.075	0.09	25,000
700	6212	5.0	0.080	0.15	5,000
33**	7152	5.0	0.115	0.15	40,000
60	7212	5.0	0.115	0.20	5,000
701	8175	5.0	0.125	0.25	5,000

**MS-90451

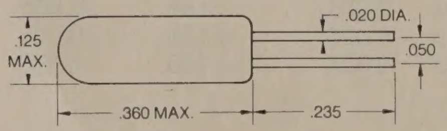
T-1 Integral Bi-Pin Short Length



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
773	—	5.0	0.02	0.020	50,000
774	—	5.0	0.02	0.034	10,000
775	—	5.0	0.06	0.050	100,000
776	—	5.0	0.06	0.100	20,000
824	—	5.0	0.115	0.150	40,000

*Special IPI design for minimum space applications

T-1 Integral Bi-Pin Standard Length



Part Numbers					
IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
871	—	5.0	0.020	0.020	50,000
872	—	5.0	0.020	0.034	10,000
869	—	5.0	0.060	0.050	100,000
870	—	5.0	0.115	0.150	40,000

*Interchangeable with conventional bi-pin lamps

Note: To order lamps, prefix the IPI part number with LA— (example LA330).

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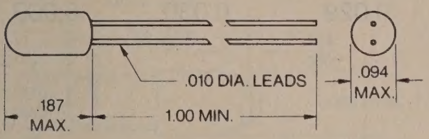
INCANDESCENT LAMPS

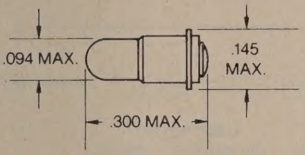
T-3/4 Unbased



Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
1	7100	1.5	0.010**	0.002	10,000
3	7101	1.5	0.015	0.003	10,000
201	—	1.5	0.060	0.015	100,000
739 •	—	2.0	0.040	0.020	10,000
213	—	5.0	0.020	0.020	50,000
189	2	5.0	0.020	0.034	10,000
803†	—	5.0	0.025	0.030	5,000
30*	6803	5.0	0.060	0.030	100,000
9*	6833	5.0	0.060	0.050	100,000
12*	7133	5.0	0.075	0.090	25,000
34	8666	5.0	0.080	0.150	6,000
17*	7153	5.0	0.115	0.150	40,000
18	7102	5.0	0.115	0.200	5,000

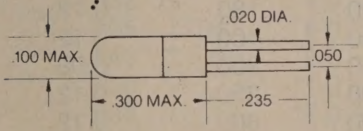
*MS-90452 (AS) **±15% †Rated for DC operation

T-3/4 Flange Base



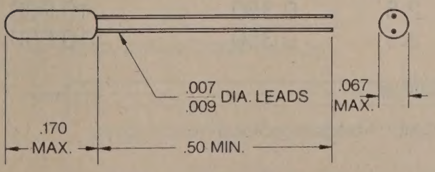
Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
733	—	2.0	0.040	0.018	10,000
292	—	5.0	0.020	0.018	50,000
239	8587	5.0	0.060	0.027	100,000
241	8828	5.0	0.075	0.080	25,000
242	8270	5.0	0.115	0.130	40,000

T-3/4 Bi-Pin



Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
290	—	1.5	0.060	0.015	50,000
293	—	5.0	0.020	0.018	50,000
455	7112	5.0	0.020	0.032	6,000
297	—	5.0	0.024	0.039	1,000
804	—	5.0	0.025	0.029	5,000
456	7114	5.0	0.060	0.049	100,000
457	7117	5.0	0.080	0.150	6,000
405	7118	5.0	0.115	0.150	40,000

T-1/2 Unbased



Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
174	7094	1.5	0.015	0.002	10,000
175	—	1.5	0.051	0.020	5,000
186	—	2.5	0.045	0.050	1,000
176	7096	3.0	0.029	0.030	5,000
157	7097	5.0	0.020	0.034	5,000

Note: To order lamps, prefix the IPI part number with LA— (example LA330).

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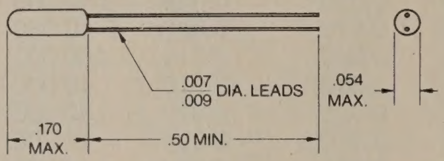
INCANDESCENT LAMPS

T-3/8 Unbased


.007
.009 DIA. LEADS
.054
MAX.
.170
MAX.
.50 MIN.

Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	MSCP	Life (hrs.)
173	7090	1.5	0.015	0.002	10,000
155	—	1.5	0.051	0.020	1,000
156	7093	3.0	0.029	0.030	5,000

TL Lensed Assemblies

FIG. 1

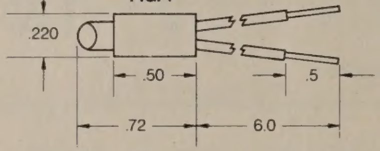
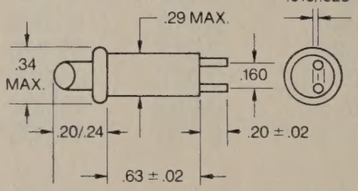

.220
.50
.5
.72
6.0

FIG. 2


.015/.025
.29 MAX.
.34
MAX.
.160
.20/.24
.20 ± .02
.63 ± .02

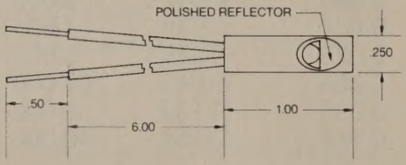
Part Numbers IPI No.	Fig. No.	Volts	Amps (±10%)	Life (hrs.)	Spot Intensity**
474***	1	2	0.180	12,000	220
474	1	2.5	0.200	1,000	500
477	1	2.5	0.350	10,000	1,000†
478	2	2.5	0.350	10,000	800
475***	1	5	0.180	10,000	500
475	1	6	0.200	1,000	1,000

**Foot-Candles ***Derated

Note; Min. spot dia. is .12 measured at .6 in. from tip of lamp.

†0.006" Min. Dia. Spot

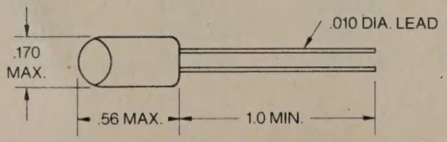
RL Projection Lensed Assemblies


POLISHED REFLECTOR
.250
.50
1.00
6.00

IPI Part No.	Volts	Amps (±10%)	Life (hrs.)	Spot Intensity**	Spot Dia. (in., min.)
556***	2	0.180	12,000	180	0.12
556	2.5	0.200	1,000	400	0.12
560	2.5	0.350	10,000	800	0.08
557***	5	0.180	10,000	350	0.12
557	6	0.200	1,000	800	0.12

**Foot-Candles ***Derated

TL Lensed Unbased


.010 DIA. LEAD
.170
MAX.
.56 MAX.
1.0 MIN.

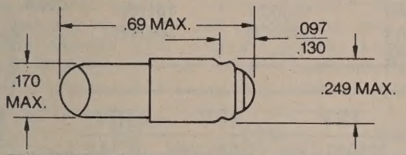
Part Numbers IPI No.	Industry No.	Volts	Amps (±10%)	Life (hrs.)
729	2140	2.5	0.350	10,000
731	2136	2.5	0.350	10,000
730	2124	2.5	0.350	10,000

Note: To order lamps, prefix the IPI part number with LA— (example LA330).

ILLUMINATED PRODUCTS INC. 2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

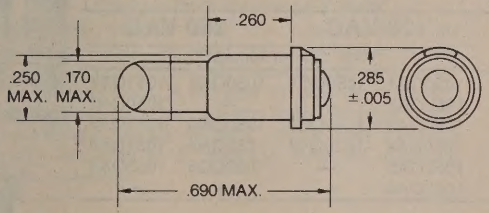
INCANDESCENT LAMPS

TL... Lensed Groove Base



Part Numbers				
IPI No.	Industry No.	Volts	Amps (±10%)	Life (hrs.)
253	253	2.5	0.350	10,000
253-X	253-X	2.5	0.350	10,000
253-1	261	2.5	0.350	10,000

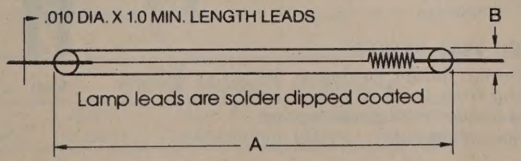
TL... Lensed Flange Base



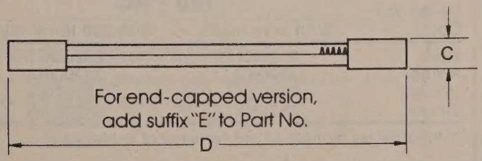
Part Numbers				
IPI No.	Industry No.	Volts	Amps (±10%)	Life (hrs.)
732	252	2.5	0.350	10,000

.... Line Filament

Part Numbers										
IPI No.	Industry No.	Volts	Amps (±10%)	Filam. Temp. (°K)	Life (hrs.)	Min. Hot Lgth.	A	B	C	D
111	7092	2.5	0.045	2150	1,000	.37	.88	.052	—	—
218	—	3.0	0.400	1910	25,000	1.00	2.00	.160	.190	2.20
219	—	3.7	0.120	2380	1,000	.62	1.30	.094	.125	1.40
468	—	5.0	0.480	2100	20,000	1.50	2.25	.160	.190	2.40
563	—	6.0	0.110	1980	25,000	1.40	2.00	.094	.125	2.10
105	7104	6.0	0.120	2160	5,000	1.00	1.70	.094	.125	1.80
140	7109	6.0	0.400	2320	2,000	1.25	2.15	.160	.190	2.30
220	—	11.0	0.400	2080	20,000	3.00	4.50	.160	.190	4.70
288	—	12.0	0.140	1910	25,000	3.70	4.44	.094	.125	4.56
211	—	14.0	0.500	2240	5,000	3.30	4.50	.160	.190	4.70
97	7107	18.0	0.120	1990	25,000	3.50	4.50	.094	.125	4.60
108	7106	20.0	0.120	1990	25,000	4.00	5.00	.094	.125	5.10
450	—	29.0	0.120	1990	25,000	6.50	7.50	.094	.125	7.60
40	—	30.0	0.335	2100	20,000	9.00	10.40	.160	.190	10.60
279	—	32.0	0.180	2380	1,000	6.50	7.70	.160	.190	8.00
98	7108	36.0	0.120	1990	25,000	7.50	8.80	.094	.125	8.90
99	7223	38.0	0.200	2160	5,000	9.00	10.50	.125	.160	10.65
100	7224	48.0	0.200	2130	5,000	11.50	12.90	.125	.160	13.10



Lamp leads are solder dipped coated



For end-capped version, add suffix "E" to Part No.

Note: To order lamps, prefix the IPI part number with LA— (example LA330).

IDI Pilot and Indicator Lights—

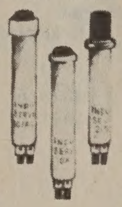
—Improve product and application appearance—Complement and highlight your design—Rugged, engineered for long operating life—Tamper-proof housings—Mount quickly, securely—UL recognized, CSA approved* (125V and 250V models).

GLO-DOT MINIATURE NEON PILOT LIGHTS WITH WIRE LEADS

Lens Color	120 VAC		
Red	2110A1	2120A1	2150A1
Clear	2110A2	—	—
Amber	2110A3	2120A3	3150A3
White	2110A4	2120A4	2150A4
Green	2112A5	—	2152A5

Mounting Hole: 5/16″ diameter. Voltage: 105-125 VAC

*UL File No. E20325. Canadian Standards Association approval No. 13346.


2110A 2150A

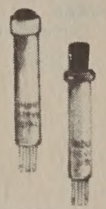
2120A

GLO-DOT MINIATURE NEON PILOT LIGHT WITH .187 TERMINALS**

Lens Color	120 VAC	
Red	2110QA1	2154QA1
Clear	2110QA2	—
Amber	2110QA3	2150QA3
White	2110QA4	2150QA4
Green	2110QA5	2150QA5

Mounting Hole: 5/16″ diameter. Voltage: 105-125 VAC

**All terminal models tinned for ease of soldering.


2110QA

2150QA

GLO-DOT SERIES 2990P

One-piece lens-body 6, 12 and 28 volt incandescent pilot lights with plug bezel and low profile lens.

Stock Models Available

Lens Color	6V	12V	28V
Red	2990P1-6V	2990P1-12V	2990P1-28V
Amber	2990P3-6V	2990P3-12V	2990P3-28V
White	2990P4-6V	2990P4-12V	2990P4-28V
Green	2990P5-6V	2990P5-12V	2990P5-28V
Blue	2990P6-6V	2990P6-12V	2990P6-28V
Yellow	2990P7-6V	2990P7-12V	2990P7-28V

Mounting Hole: ½″ diameter in 1/32″ to 3/32″ thick panels.

GLO-DOT SERIES 2990D

One-piece lens-body 6, 12 and 28 volt incandescent pilot lights.

Stock Models Available

Lens Color	6V	12V	28V
Red	2990D1-6V	2990D1-12V	2990D1-28V
Amber	2990D3-6V	2990D3-12V	2990D3-28V
White	2990D4-6V	2990D4-12V	2990D4-28V
Green	2990D5-6V	2990D5-12V	2990D5-28V
Blue	2990D6-6V	2990D6-12V	2990D6-28V
Yellow	2990D7-6V	2990D7-12V	2990D7-28V

Mounting Hole: 5/16″ diameter.

OMNI-GLOW SERIES 2600

Versatile general purpose neon pilot lights. Mounting hole: ⅞″ diameter. Voltage: 105-125 VAC.

SERIES 2620K

Lens Color	120 VAC With wire leads	120 VAC With 250 terminals**
Red	2620K1	2620QK1
Amber	2620K3	2620QK3
White	2620K4	2620QK4
Green	2622K5	2622QK5

**All terminal models tinned for ease of soldering.

2620K

2620QK

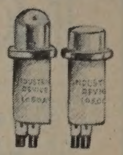
OMNI-GLOW

Versatile general purpose neon and incandescent pilot lights. Mounting hole: ½″ diameter.

Lens Color	120 VAC With wire leads		
Red	1050A1	1050C1	1050N1
Clear	1050A2	—	—
Amber	1050A3	1050C3	1050N3
White	1050A4	1050C4	1050N4
Green	1052A5	1052C5	1052N5
Blue	1052A6	—	—

Lens Color	6V	12V	28V	250V
Red	1090A1-6V	1090A1-12V	1090A1-28V	1051A1
Clear	—	—	—	1051A2
Amber	1090A3-6V	1090A3-12V	1090A3-28V	1051A3
White	1090A4-6V	1090A4-12V	1090A4-28V	1051A4
Green	1090A5-6V	1090A5-12V	1090A5-28V	—
Blue	1090A6-6V	1090A6-12V	1090A6-28V	—

Lens Color	120 VAC With 127 terminals**			250 VAC
Red	1050QA1	1050QC1	1050QN1	1051QA1
Clear	1050QA2	—	—	1050QA2
Amber	1050QA3	1050QC3	1050QN3	1051QA3
White	1050QA4	1050QV4	1050QN4	1051QA4
Green	1052QA5	—	1052QC5	1053QA5
Blue	1052QA6	—	—	—


1050A 1050C
1051A
1090A

1050N

1050QC

1050QA

1050QN

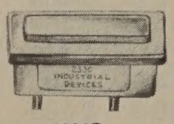
LINE-O-LITE

Will snap-fit into panels .055-.070″ thick without speednut, other thicknesses with speednut. Mounting hole: 19/32″ x .395/.400″. Voltage: 105-125 VAC.

SERIES 2330D

Lens Color	120 VAC With wire leads	120 VAC With 250 terminals**
Red	2330D1	2330QD1
Amber	2330D3	2330QD3
White	2330D4	2330QD4
Green	2332D5	2332QD5

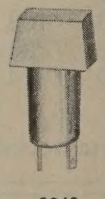
**All terminal models tinned for ease of soldering.


2330D

2330QD

MINI-SLIDE PILOT LIGHT ASSEMBLIES

Model 3040 Series—Model 3060 Series—Two lens shapes, round and square; for either model series.—Sockets for "Pilot" lamps including 120 volt lamp and "indicator" lamps.


3040

3060

MODEL 2800 SERIES

—Screw-in design for easy relamping from front of panel. —Unique torque-limiting, self-locking nylon mounting nut.

INDUSTRIAL DEVICES, INC.

The Bright Spot for Your Product

Red, Green or Yellow Emitting Diodes

New! Super Bright LEDs —

Light on your budget, heavy on performance SOLID STATE GLO-DOT 2191U SERIES HEMISPHERICAL LENS — Red, Green or Yellow

Approximately 100,000 hour life. Low voltage, low power drain — ideal for solid state and battery operations. Built-in current-limiting resistor and rectifier diode permit unit use in AC and DC applications, and protect against damage from incorrect polarity connection. Highly reliable, shock and vibration resistant. Requires 5/16″ diameter hole for mounting (speednut supplied).

Lens Color	6V	12V	24V
Red	2191U1-6V	2191U1-24V	2191U1-28V
Green	2191U5-6V	2191U5-12V	2191U5-28V
Yellow	2191U7-6V	2191U7-12V	2191U7-28V

SOLID STATE GLO-DOT 2191L SERIES FLAT TOP LENS — Red, Green or Yellow

Approximately 100,000 hour life. Low voltage, low power drain — ideal for solid state and battery operations. Built-in current limiting resistor and rectifier diode permit unit uses in AC and DC applications, and protect against possible damage from incorrect polarity connection. Highly reliable, shock and vibration resistant. Requires 5/16″ diameter hole for mounting (speednut supplied).

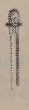
Lens Color	6V	12V	24V
Red	2191L1-6V	2191L1-12V	2191L1-28V
Green	2191L5-6V	2191L5-12V	2191L5-28V
Yellow	2191L7-6V	2191L7-12V	2191L7-28V

SOLID STATE 4304H HIGH DOME LED SERIES — Red, Green or Yellow

Each unit is packaged with one black panel mounting clip. *Wiring and installation instructions are furnished with each unit. Mount in 17/64″ diameter hole.

Lens Color	Stock Models Available	
Red	4304H1	From 3V up depending on current-limiting resistor you use
Green	4304H5	
Yellow	4304H7	

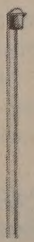
SOLID STATE 4302M SUBMINIATURE DOME LED SERIES — Red, Green



Each unit is packaged with one black panel mounting clip. *Wiring and installation instructions are furnished with each unit.

Lens Color	Stock Models Available	
Red	4303M1	From 3V up depending on current-limiting resistor you use
Green	4302M5	

SOLID STATE MICRO-MINIATURE LED 4301T SERIES — Red, Green



For circuit applications where space is limited. *Wiring and installation instructions are furnished with each unit.

Lens Color	Stock Models Available	
Red	4300T1	From 3V up depending on current-limiting resistor you use
Green	4300T1	

SOLID STATE MINIATURE LED 4303F SERIES — Red, Green, Yellow

For circuit applications where space is limited. *Wiring and installation instructions are furnished with each unit.

Lens Color	Stock Models Available	
Red	430F1	From 3V up depending on current-limiting resistor you use
Green	4303F5	
Yellow	4303F7	

MINI DOT SERIES 4790J — 6, 12, 28V Incandescents and 4730J 120V Neons

Decorator appearance enhances the front panel of your equipment. MINI DOT is mounted by pushing lens through panel opening and then locking body to the lens behind the panel, affording a secure and tamper-proof indicator light. Mounting hole 0.177/0.182″ or #16 drill.

Stock Models Available

Lens Color	Incandescents 6V	Incandescents 12V	Incandescents 28V	Neon 120V
Red	4790J1-6V	4790J1-12V	4790J1-28V	4730J1-120V
Amber	4790J3-6V	4790J3-12V	4790J3-28V	4730J3-120V
White	4790J4-6V	4790J4-12V	4790J4-28V	4730J4-120V
Green	4790J5-6V	4790J5-12V	4790J5-28V	3730J5-120V
Blue	4790J6-6V	4790J6-12V	4790J6-28V	—
Yellow	4790J7-6V	4790J7-12V	4790J7-28V	—

Sub Miniature Wedge Base Pilot Light Assemblies

TINY-MITE SUBMINIATURE WEDGE BASE SERIES B4610A

Replaceable lamp 6, 12 and 28 volt incandescent pilot lights.

Stock Models Available

Lens Color	6V	12V	28V
Red	4610A1-6V	4610A1-12V	4610A1-28V
Amber	4610A3-6V	4610A3-12V	4610A3-28V
White	4610A4-6V	4610A4-12V	4610A4-28V
Green	4610A5-6V	4610A5-12V	4610A5-28V
Blue	4610A6-6V	4610A6-12V	4610A6-28V
Yellow	4610A7-6V	4610A7-12V	4610A7-28V

Mounting hole ⅛″ diameter, 110 quick connect terminals tinned brass.

TINY-MITE SUBMINIATURE WEDGE BASE SERIES B4610B

4610B

Replaceable lamp 6, 12 and 28 volt incandescent pilot lights.

Stock Models Available

Lens Color	6V	12V	28V
Red	4610B1-6V	4610B1-12V	4610B1-28V
Amber	4610B3-6V	4610B3-12V	4610B3-28V
White	4610B4-6V	4610B4-12V	4610B4-28V
Green	4610B5-6V	4610B5-12V	4610B5-28V
Blue	4610B6-6V	4610B6-12V	4610B6-28V
Yellow	4610B7-6V	4610B7-12V	4610B7-28V

Mounting hole ⅜″ diameter, 110 quick connect terminals tinned brass.

FOR YOUR SPECIAL REQUIREMENTS

IDI is fully equipped to manufacture any special or non-standard indicator lights and associated components to your tightest specs and furnish fast delivery. Have a problem? Get in touch.

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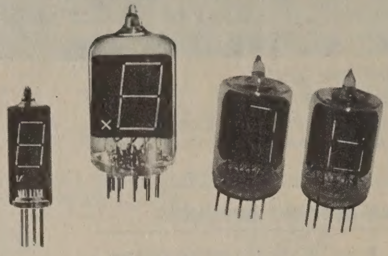
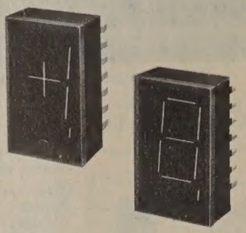
The world's broadest line . . .

IEE • APOLLO INCANDESCENT TUBE DISPLAYS



.4", .47" or .6" high, 7-segment characters with ±1 and decimal point options.

IEE • AURORA INCANDESCENT FLATPACK DISPLAYS



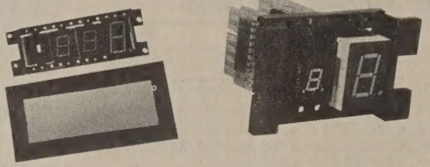
.47" or .61" high, 7-segment characters and ± overflow 1 with decimal points.

IEE • IRIS STATUS INDICATOR

IEE 2 3
4 GO READY
INSTR PANEL CYCLE
NO GO
STAND BY
HIGH TEMP
NO 3 FULL
STOP

Illuminate individual, combination, or all 12 message areas.

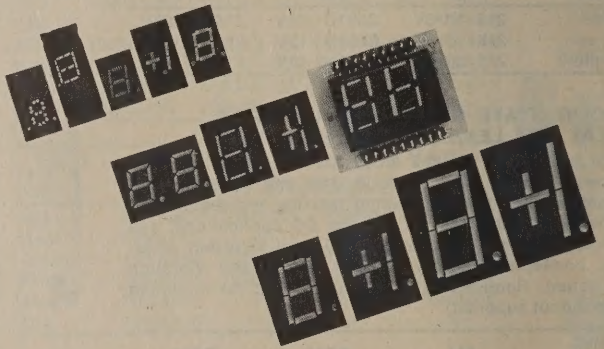
IEE • ATLAS DISPLAY MOUNTING HARDWARE AND DECODER/DRIVER



Mounting Hardware accommodates all standard, DIP-packaged LED and other planar displays.

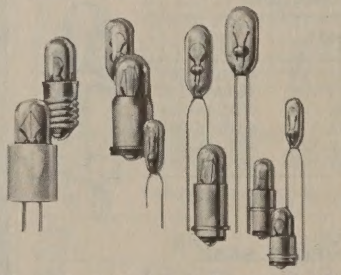
Decoder/Driver is designed to be integrally mounted onto the back of IEE-ATLAS Mounting Hardware

IEE • HERCULES LED DISPLAYS



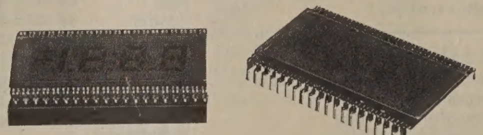
Numeric, ±1, hexadecimal or alphanumeric format; 7-segment and 5 x 7 dot matrix red characters from .270" to 1 inch high.

IEE • ELECTRA SUBMINIATURE LAMPS



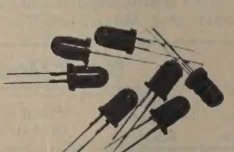
All standard sizes T-¾ through T-1¾; choice of all base configurations

IEE • POLARIS LIQUID CRYSTAL DISPLAYS



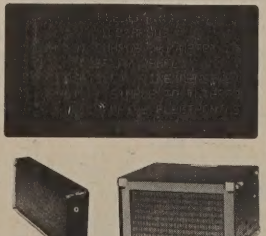
Choice of reflective (ambient lighting) or transmissive (backlighting) types, DIP-packaging style.

IEE • HERCULES/ ELECTRA LED INDICATORS



Choice of red, yellow or green diffused light, T-1 or T-1¾ sizes.

IEE • ARGUS ALPHANUMERIC DISPLAY SUBSYSTEMS



32, 64, 128 or 256 characters per panel; orange or green, fourteen different configurations, a compact, readable alternative to a CRT.

IEE
the Olympus of displays

IEE • TITAN PROJECTION DISPLAYS

FILL TANK #2
A ON 4
5
8

Capable of displaying any image, color and message which is reproducible on film; 14 different models from .34" through 3.375" message areas.

INDUSTRIAL ELECTRONIC ENGINEERS, INC., 7740 Lemona Ave., Van Nuys, California 91405 • Telephone: (213) 787-0311 • TWX 910-495-1707

FOR FURTHER INFORMATION, REQUEST DATA BY PRODUCT NAME

NUMERIC READOUTS

"LINKS BETWEEN MAN AND MACHINE"

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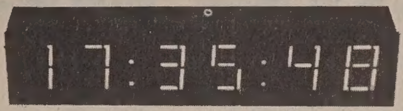
46-10 104th STREET • CORONA, N. Y. 11368

212 / 476-1287

See our Programming and Switching Products in Section 5100.

— FEATURING —

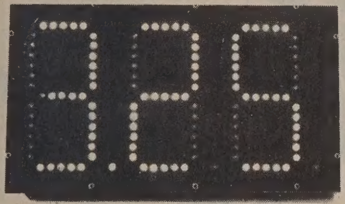
- Ready to mount into panel cutout
- Servicing from front without tools
- Supplied in attractive assemblies with bezel
- Includes anti-glare "Black-Out" panel & color filter
- Snap-in logic boards available with memory option
- All wear parts (lamps and logic) socket mounted
- Plus minus signs, colons, decimal, message modules optional



Series 68031

6 DIGIT CLOCK DISPLAY SHOWN

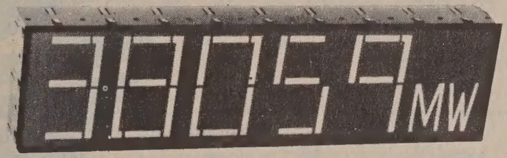
1.0" Characters — Viewing to 30 Ft.



Series 68036 & OD68036

3 DIGIT UNIT SHOWN

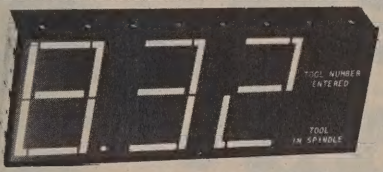
Indoor/Outdoor — Viewing to 150 Ft.



Series 68032

5 DIGIT MEGAWATT DISPLAY SHOWN

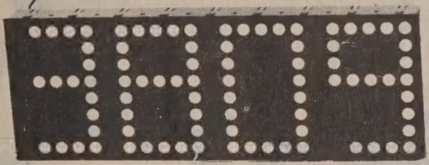
2.0" Characters — Viewing to 60 Ft.


TOOL NUMBER ENTERED
TOOL IN SPINDLE

Series 68033

3 DIGIT N. C. TOOL DISPLAY SHOWN

2.7" Characters — Viewing to 80 Ft.



FOR OUTDOOR VIEWING

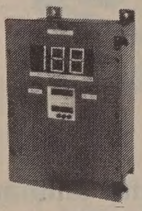
4 DIGIT UNIT SHOWN

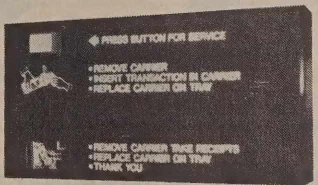
Series OD68032/33

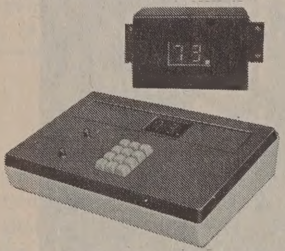
2.1"/2.9" Characters — Viewing to 60/80 Ft.

SPECIAL SYSTEMS

We have supplied various hardware designed to meet special customer needs, including keyboard entry displays, up/down counters, hi-threshold interfaces, pre-determining counters, display/control systems and special enclosures. Call us to discuss your requirements.




PRESS BUTTON FOR SERVICE
•REMOVE CARRIER
•INSERT TRANSACTION IN CARRIER
•REPLACE CARRIER ON TRAY
•REMOVE CARRIER TAKE RECEIPTS
•REPLACE CARRIER ON TRAY
•THANK YOU

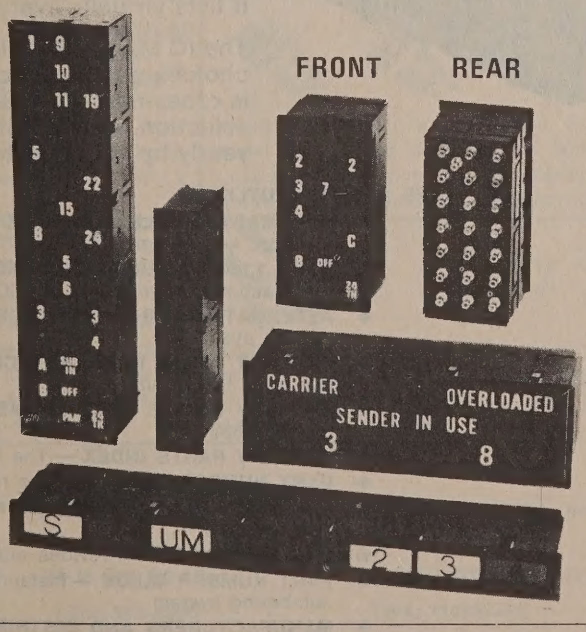


LIGHTED INDICATORS
STATUS DISPLAYS
BACK-LIGHTED/DEAD FRONT PANELS
ANNUNCIATORS

SERIES 68011, 68012, 68013 AND 68014

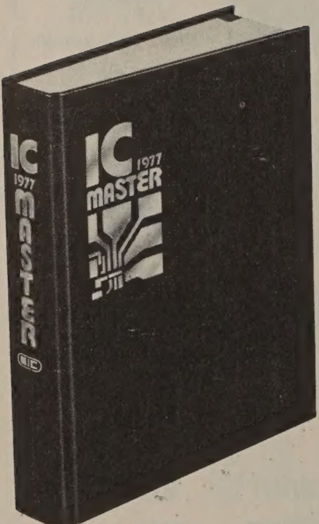
Any group of messages/symbols can be displayed in any combination of colors • Front panel graphics are back lighted using Std. MFB T 1¾" lamps • Basic message module sizes: 3/8" Sq, 3/8" x 3/4", 3/8" x 1-1/8", 3/8" x 1-1/2" or multiples of these • Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout • Common ground reduces installation time • Servicing can be done from the front • Lamp drivers and special logic available.

74000 SERIES BACKLIGHTED/DEAD FRONT PANEL ASSEMBLIES are available to meet a wide variety of medium to large size display applications. These are supplied to meet customer specifications.


FRONT
REAR
CARRIER
SENDER IN USE
OVERLOADED
3
8
S
UM
2
3

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

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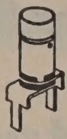
LEECRAFT

INDICATOR LIGHTS • LAMPHOLDERS • SWITCHES

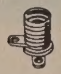
NEON — INCANDESCENT — LED

MIDGET GROOVED 25-00 SERIES



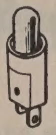
Solder Terminals, wire leads, or P/C mounting.

MIDGET SCREW 16-00 Series



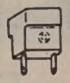
Solder terminals, wire leads, or P/C mounting.

SUB-MINIATURE WEDGE BASE 53-00 Series



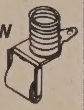
For T1 3/4 Lamps
Solder terminals, wire leads or P/C mounting.

MINIATURE WEDGE BASE 23-00 Series



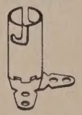
For T-3 1/4 Lamps
Solder terminals, wire leads or P/C mounting.

MINIATURE SCREW 5-00 Series CANDELABRA SCREW 6-00 Series



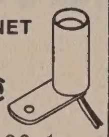
Solder terminals or P/C mounting.

MINIATURE BAYONET 7-00 Series



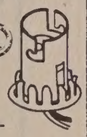
Solder terminals or P/C mounting.

MINIATURE BAYONET 2-00 Series 3-00 Series



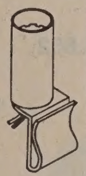
Wire leads. (2-00-1 Series-grounded)

CANDELABRA BAYONET DOUBLE CONTACT 57 and 12 Series SINGLE CONTACT 11 and 10 Series



Tab or solder terminals, wire leads.

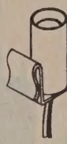
CANDELABRA SCREW 4-00 Series



Wire leads.

18-00 Series
Solder terminals.

INTERMEDIATE SCREW 14-00 Series



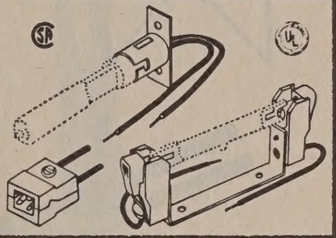
Wire leads.

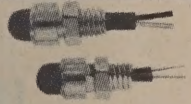
8-00 Series
Solder terminals.

QUARTZ IODINE

2600 Series for Double Ended Quartz type lamps. 2200 Series for double contact Quartz lamps. Metal tabs or wire leads.

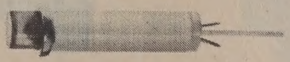
21 Series for T2 1/4 Quartz Halogen wedge base lamps.





LED SERIES L58

High brightness LED's, micro size. Unaffected by shock and vibration. Wide viewing angle. Red, green, yellow. Square Bezel available. Mounting hole .191".

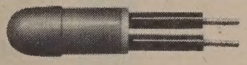


LED SERIES L 45

High brightness LED's. Available with internal dropping resistor and a variety of lens/Bezels. 5/16" mounting hole.

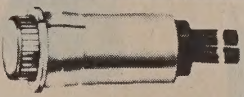
TINEON SERIES 36

Long life neon or incandescent lamps. Press fit into 5/16" hole. Built-in resistor. A variety of lens/bezels.



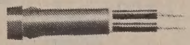
WATER PROOF SERIES 56

Available 6-14-28 Volts incandescent. Also for 115 or 220 Volts with external resistor. One piece Lexan construction in all colors. Mounts in 5/16" hole.



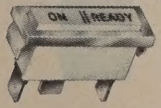
SNAPLITE SERIES 32

Available in full range of voltages. Lamps and terminations. Flush, square, High Hat lenses and bezels. Snap fits 1/2" hole.



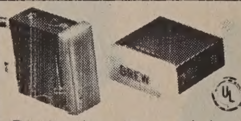
TINEON SERIES 65

Ultra compact for minimum back panel projection. Stranded leads or tab terminals. Built in resistor for neon lamp. Mounting ears for snap fit in 5/16" hole.



RECTANGULAR INDICATOR SERIES 31D

Dual message indicator with neon or incandescent lamps. All lens colors. Chrome or plastic bezel available. Snap fit in 1.281" x .395" hole.



RECTANGULAR TRIM-LINE SERIES 4800

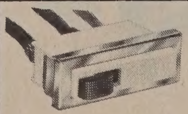
Distinctive tapered lens enhances front panel styling. One piece hi-impact plastic construction snaps securely in .325" x .860" hole.

MIDGET SCREW SERIES 49

Available with flat or dome lens. Front panel replaceable incandescent lamps. Lens available in all colors with or without hot stamped legend. 7/16" mounting hole.

ROCK-A-LITE SERIES 7100

Lighted rocker switch and indicator combination. Available in low and line voltage. Contacts rated at 15 Amps 125V AC. All colors. 1.281" x .395" mounting hole.



SLIDELITE SERIES 51

Lighted slide switch and indicator combination. Available in low and line voltages. Contacts rated at 6 Amps., 125V AC. 1.281" x .395" mounting hole.

LIGHTING GUIDE
PRODUCT LIGHTING GUIDE
LEECRAFT
INDICATOR LIGHTS

WRITE
FOR
CATALOG

LEECRAFT MANUFACTURING CO., INC.
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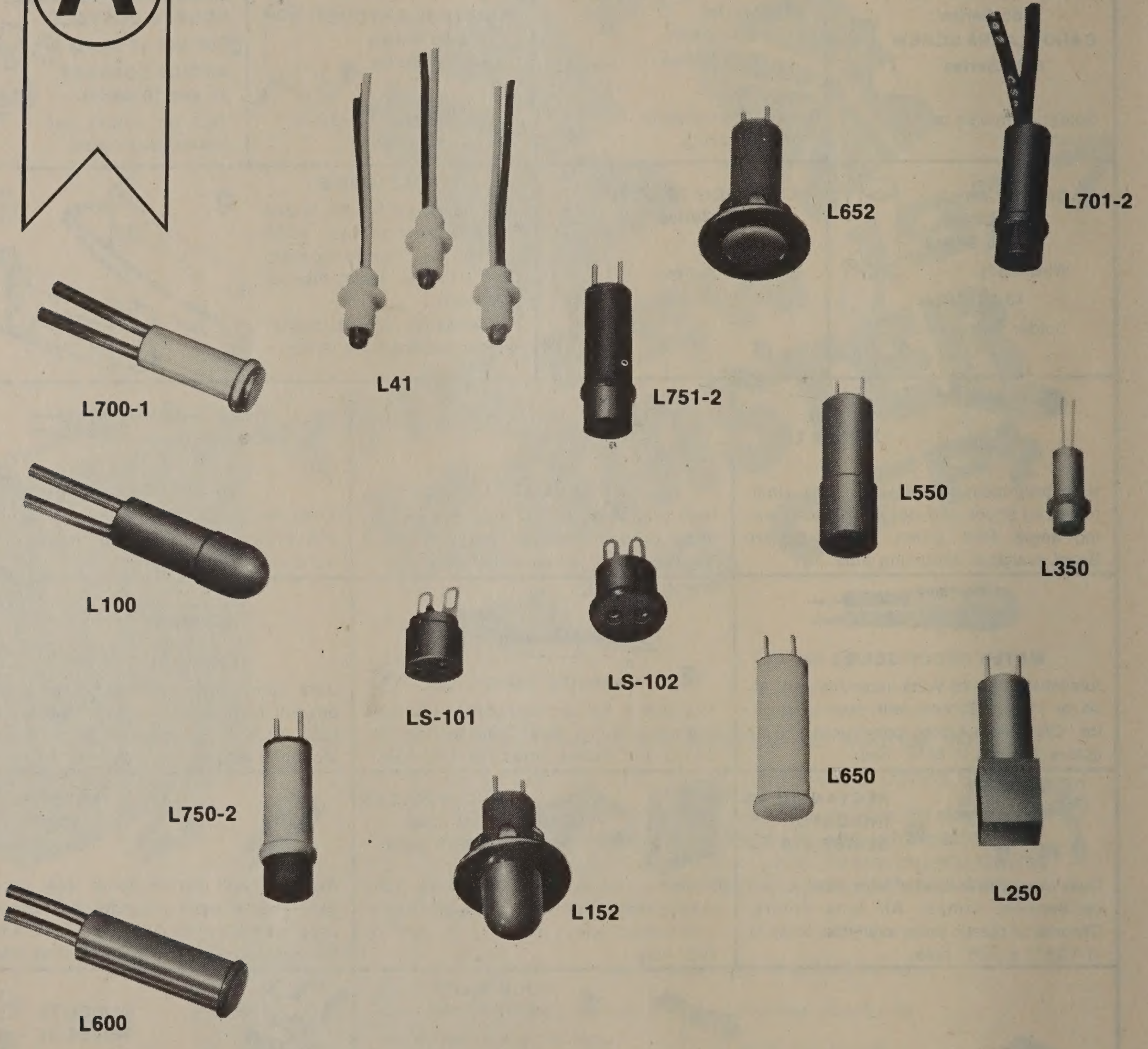
(212) 392-8800 TWX: 710822897

Award-Winning Indicator Lights


L41
L652
L701-2
L700-1
L751-2
L550
L100
L350
LS-102
LS-101
L750-2
L650
L250
L152
L600

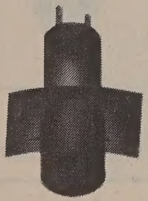
- Custom styling for maximum product identification
- Simplified mounting
- Long, reliable equipment life built in
- Variety of voltages and currents
- Brilliant, exciting colors
- LED, incandescent and neon bulbs
- Customized samples on request
- Backed by years of experience
- Competitive prices
- Customized terminations
- Sub-miniature lights available

Customized For You In Seven Days!

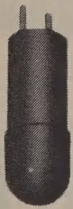
L300

L552

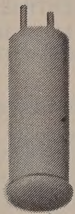
L200


L550

L500


L150

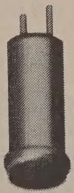
LS-101



L252

L650

LS-102


L750-1

L190

Let's get together and discuss your needs! Today, contact...

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WILBRECHT ELECTRONICS

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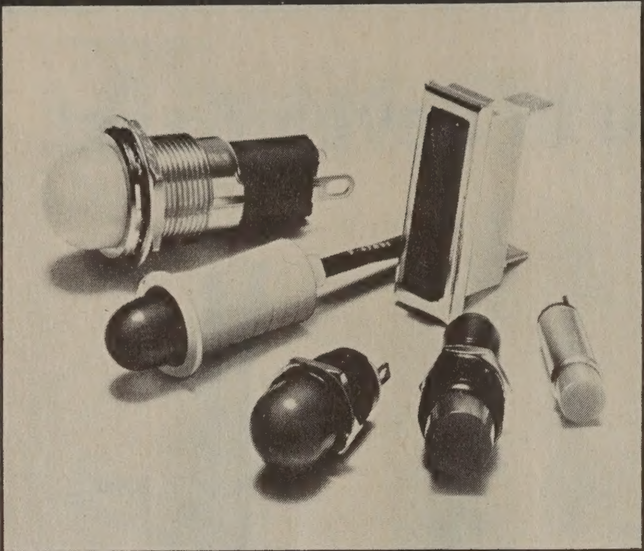
LITTELITES

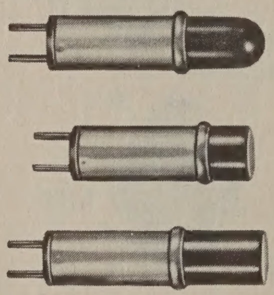
INDICATOR LIGHTS. . .



- **Broad line** . . . Littelites include Cartridge Lamps and Lampholders, Subminiature Lampholders, Miniature Lampholders, and Snap-Mount Plastic Lites . . . we offer a wider selection among these four product groups than any other single manufacturer.
- **UL/CSA** . . . All Littelites are UL Recognized or Listed and CSA Certified. New tools and molds assure you of the finest quality lights on the market today.
- **Fast** turn-around on large volume orders.
- **Off-the-shelf** availability from a nationwide network of Littelites distributors.
- **Special** requirements? Just give us a call (312) 824-1188.

CARTRIDGE LAMPS/LAMPHOLDERS

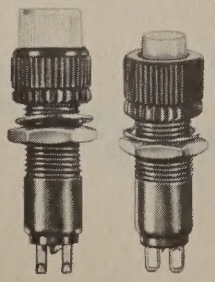
SEND FOR CATALOG LL-C574



UL RECOGNIZED
CSA CERTIFIED
MEET MIL-L-3661 REQUIREMENTS

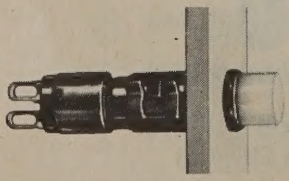
Cartridge Lamps

Incandescent, neon, or solid state. Solid state units supplied with green, red, yellow, or amber LEDs. All cartridge lamps offer a wide choice of lens styles and colors. Mate with cartridge lampholders shown below.



Cartridge Lampholders

Designed for rear mounting into 3/8" clearance hole. Turret pin, solder lug, or solder cup terminals. Available with flat for "D" hole mounting. Supplied separately or as complete assembly, which includes lens cap (smooth or fluted) or lens collar (.284" or .230" wide).

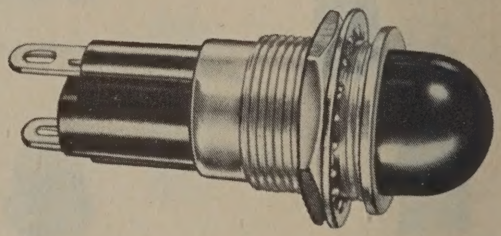


Clips and Sockets

Provides inexpensive means of mounting cartridge lamps directly to the panel. Solder lug or solder cup terminals. Clip secures cartridge lamp in 9/32" mounting hole.

MINIATURE LAMPHOLDERS

SEND FOR CATALOG LL-M574



- For front mounting into 11/16" clearance hole.
- Accommodate T3-1/4 or T2 bayonet based incandescent lamps and T3-1/4 bayonet based neon lamps.
- Screw or solder lug terminals
- Drip proof and "D" hole mounting available.
- Neon lampholders feature built-in resistor.
- Six basic lens styles available in wide choice of colors.
- **UL Listed, CSA Certified** (Solder Lug Terminals)

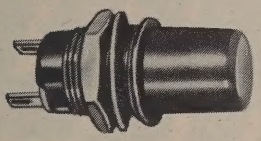
  UL Recognized, CSA Certified (Screw Type Terminals)

. . . FROM LITTELFUSE

SUBMINIATURE LAMPHOLDERS

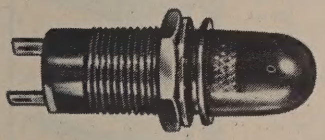
SEND FOR CATALOG LL-S574

Subminiature lampholders accommodate T1-3/4 incandescent or T2 neon midget flanged base lamps. All lampholders allow easy installation and replacement of the lamp and lens from the panel front. **UL Recognized. CSA Certified.**



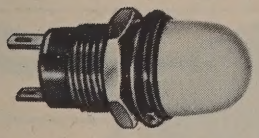
920 Series

For front mounting into 15/32" clearance hole. Accept a T1-3/4 incandescent midget flanged base lamp (1.35-28V). Choice of four different lens styles. Meet requirements of MIL-L-3661.



921 Series

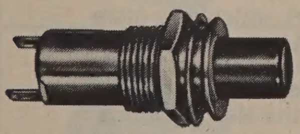
Front mounting into 15/32" clearance hole. Accommodate replaceable T2 neon midget flanged base lamps (C7A—105-125V AC-DC or C9A—110-125VAC). Built-in resistor limits lamp current. Meet requirements of MIL-L-3661.



922 Series

Three different mounting configurations: **922 Series**—front mount—15/32" clearance hole; **923 Series**—front mount—17/32" clearance hole; **924 Series**—front or rear mount—15/32" clearance hole.

Accept a T1-3/4 incandescent midget flanged base lamp (1.35-28V). Choice of four lens styles.



925, 926, 927 Series

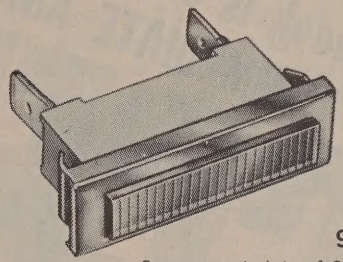
Three different mounting configurations: **925 & 926 Series**—rear mount—3/8" hole; **927 Series**—front mount—15/32" hole.

Accommodate either T1-3/4 incandescent or T2 neon midget flanged base lamps. Three different lens styles in smooth face or fresnel. Lampholders and lenses can be furnished with gaskets for drip proof applications.

SNAP-MOUNT PLASTIC LITES

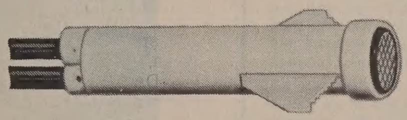
SEND FOR CATALOG LL-P574

Designed to snap into mounting hole without the use of auxiliary hardware. The 970 and 980 Series feature a pair of flex arms which ensure positive retention and protection against shock and vibration. **UL Listed. CSA Certified:** All units with wire leads.
UL Recognized. CSA Certified: Units with Q.C. Terminals.



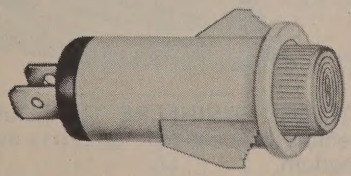
960 Series

Snap-mount into 1.281" x .395" mounting hole. Available with neon (125-250V) or incandescent (6-28V) lamps. Can be supplied with 6" wire leads, 1/4" or 3/16" Q.C. terminals. Choice of fluted or smooth face lens.



970 Series

Snap-mount into .312/.318" diameter hole. Available with neon (125-250V), incandescent (6-28V) or solid state (1.8-28V) lamps. Solid state units supplied with red, yellow, amber, or green LEDs. Terminations include 6" wire leads or .125" Q.C. terminals. Choice of eight lens styles.



980 Series

Snap-mount into .500/.510" diameter hole. Available with neon (125-250V) or incandescent (6-28V) lamps. 6" wire leads or .187" Q.C. terminals. Fresnel lenses in six different styles.

LITTELFUSE
SUBSIDIARY OF TRACOR

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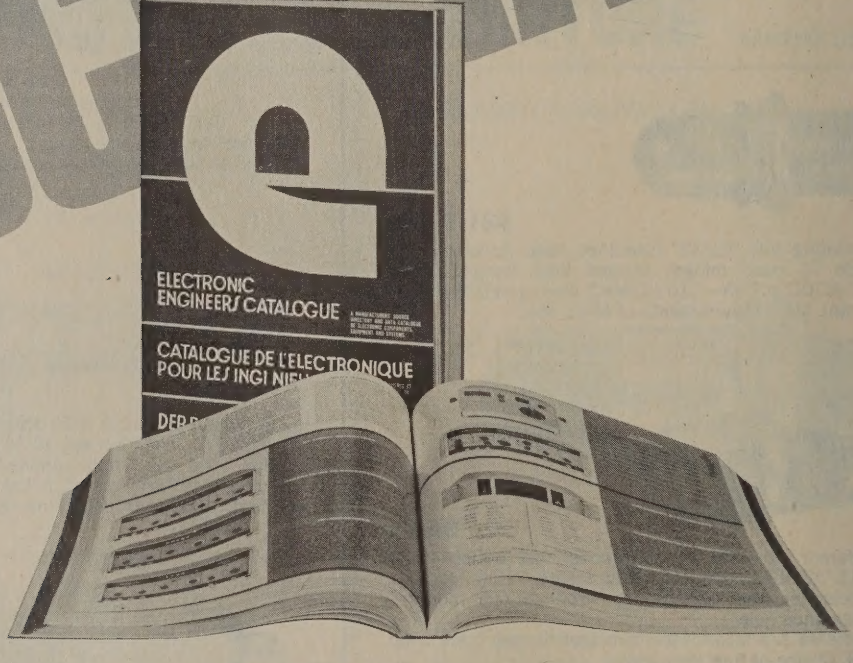
ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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MINELCO
A TALLEY INDUSTRIES COMPANY
Dept. EM, 135 South Main St., Thomaston, CT. 06787.
Phone: 203-283-8261 TWX: 710-475-1091

INDICATORS

also see

- MINELCO SWITCHES
- MINELCO ELAPSED TIME INDICATORS
- MINELCO LED INDICATORS

Miniature BITE* Indicators

*Built In Test Equipment

BALL INDICATORS

(see Page 3 for Dome Lens suitable for all Indicators below except BHGM)

Minelco Ball Indicators are electro-magnetic displays; electrical pulse to unit rotates two-color ball to display the opposite color. Magnetic latching models retain color after pulse is removed. Self-restoring models change back to Power-Off or unenergized display color when power is removed. Model BHGM resets by push button. Ideal for use as fault location and Power-Off applications.

—Front panel, rear panel, sleeve, threaded mountings available. Mounting hardware provided.

—No filaments, springs, hinges or bearings. When used within limits, will not burn out. Power drain negligible.

—*Display colors:* red, white, black, orange, blue, green, or yellow.

—*Standard coil voltages:* 1.5, 3, 5, 6, 12, 24, 28.

—*Operating temperature range:* -65°C to +125°C.

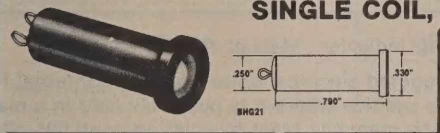
—Withstand over 30 G's vibration, 100 G's shock, and retain accurate display.

—Sleeve mounting tool, T-21, and external magnetic reset tool, RT22, available: consult factory for details.

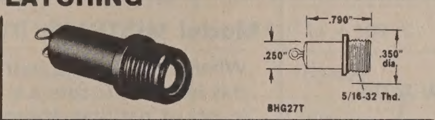
—*Special modifications available:* radiused dome lens, edge-lit lens, non-glare glass, O-Ring panel seal, square case, RFI shielding, lead wire terminals. For more information, contact sales representative or factory.

†indicates models meet MIL-I-81663/1 and MIL-I-83287/3

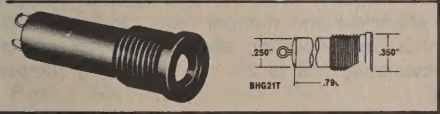
SINGLE COIL, LATCHING



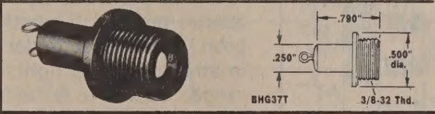
BHG21



BHG27T



BHG21T



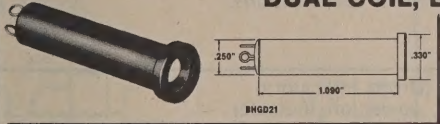
BHG37T

BHG21 Front Panel Sleeve mount
BHG21T Front panel; 5/16''-32 thread
BHG27T Rear panel; 5/16''-32 thread
BHG37T Rear panel; 3/8''-32 thread

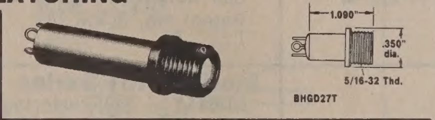
Electrically SET by applying a 20 millisecond pulse to coil; electrically RESET by reversing polarity to coil. Retains reading in either mode magnetically with no power required. May be manually reset with RT-22 reset tool.
See Bulletin B-11B for specifications.

† Patent No. 3,425,055

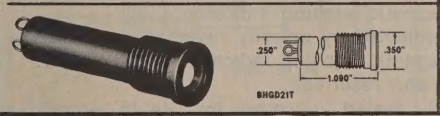
DUAL COIL, LATCHING



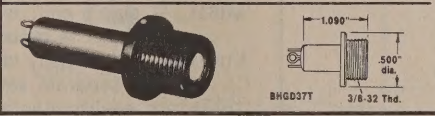
BHGD21



BHGD27T



BHGD21T



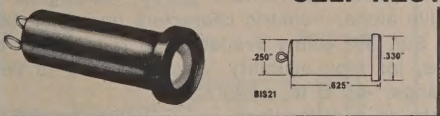
BHGD37T

BHGD21 Front Panel Sleeve mount
BHGD21T Front panel; 5/16''-32 thread
BHGD27T Rear panel; 5/16''-32 thread
BHGD37T Rear panel; 3/8''-32 thread

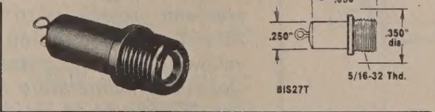
Two discreet coils provide for SET and RESET. By far the most popular of FAULT indicators. Retains reading in either mode magnetically with no power required. May be manually reset with RT-22 reset tool.
See Bulletin B-11B for specifications.

Patent No. 3,425,055
†

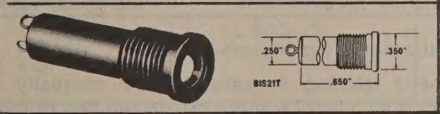
SELF RESTORING



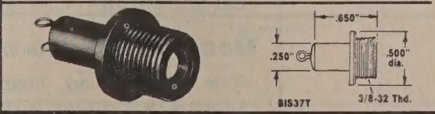
BIS21



BIS27T



BIS21T



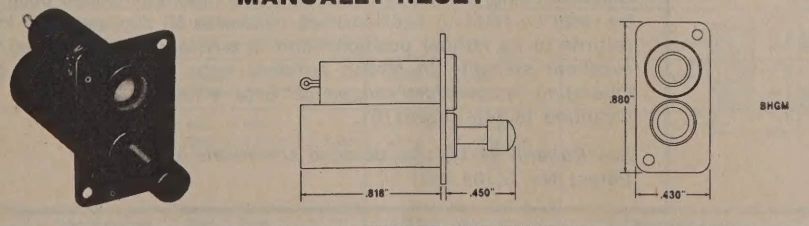
BIS37T

BIS21 Front Panel Sleeve mount
BIS21T Front panel; 5/16''-32 thread
BIS27T Rear panel; 5/16''-32 thread
BIS37T Rear panel; 3/8''-32 thread

Ideal for use as Power-Off indicators. Small, reliable, the BIS display ball is magnetically biased to return and magnetically latch to its unenergized color when power to the system it is monitoring fails.
See Bulletin B-12B for specifications.

Patent No. 3,487,403

MANUALLY RESET



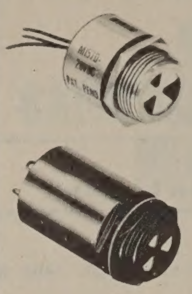
BHGM

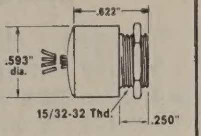
BHGM

Single coil BHGM display is electrically SET to display Fault. Unit may be manually RESET by depressing push button, releasing reverse magnetic polarity to display ball. No electrical switching or mechanical interlocking required for RESET.
See Bulletin B-13B for specifications.

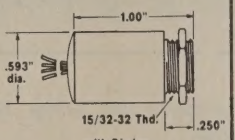
Patent No. 3,425,055

Minelco Miniature BITE Indicators





without Diodes



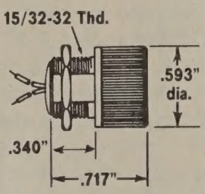
with Diodes

Model MI57D (Dual coil. Electrical reset.)

An internal-flag indicator requiring only pulse power to change color. No-Fault display can be ordered all white or all black. 25 ms pulse changes flag position to show segmented Fault color. Retains display after pulse by magnetically latching in position with no further power requirement. Reset is electrical. Features low power drain, positive indication, excellent visibility, high sensitivity, and fast response. Unit sealed and impervious to humidity, dust and salt spray. *Standard display colors:* black, white and red. Available in 6 to 28v dc. *Operating temperature range:* -65°C to +125°C. Available with or without arc suppression and/or steering diodes. Qualified to Mil-I-83287/02.

See Bulletin M-11A for detailed specifications.

Patent No. 3,406,388



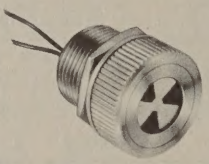
Model MI51LP (Low power. Manual reset.)

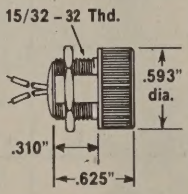
A manually resettable magnetic latching indicator requiring only 50 milliwatts pulse power to operate. Ideal for direct interface with TTL logic. Indicator displays red or white color upon application of a pulse width of 25 milliseconds. Display magnetically latches and holds pulse color until knurled knob is rotated 60 degrees clockwise, resetting indicator to all-black display color. Available in 1.5 to 28v dc. *Operating temperature range:* -65°C to +125°C.

Qualified to Mil-I-83287/04.

See Bulletin M-12B for detailed specifications.

Patent No. 3,465,333



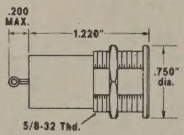


Model MI51SMS (Flag indicator. Manual reset.)

When a fault occurs, a triggered electrical pulse causes the internal flag of this indicator to rotate to a position where it is positively held in a magnetic-locked position. It can be manually reset by rotating knob 60°. Can be special ordered for both electrical and manual reset. Indicator provides positive indication under shock and vibration, and offers excellent visibility in strong incident light. Available in 6 to 28v dc. *Operating temperature range:* -65°C to +125°C.

See Bulletin M-13 for detailed specifications.

Patent No. 3,406,388

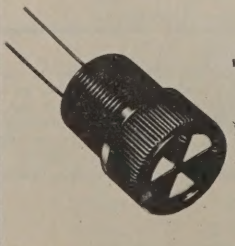


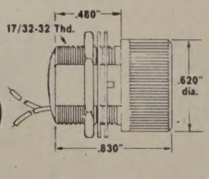
Model MI61 Series (Drum Indicators)

MI61M — self-restoring, power off indicator.
MI61L — single coil, magnetic latching indicator.
Reset is accomplished by polarity reversal.
MI61LD — dual coil, magnetic latching indicator.
Separate set and reset coil.

These are environmentally sealed indicators for use in aircraft, avionic instrumentation, and control panel applications. Large, rectangular drum area can provide up to five alpha, numeric characters on either SET or RESET. Day-Glo or Mil. Std. 595 colors available are red, white, black, yellow, green and orange, for high visibility. Available in 3 to 28v dc. *Operating temperature range:* -65°C to +125°C.

See Bulletin M-14 for detailed specifications. Patent No. 3,634,857





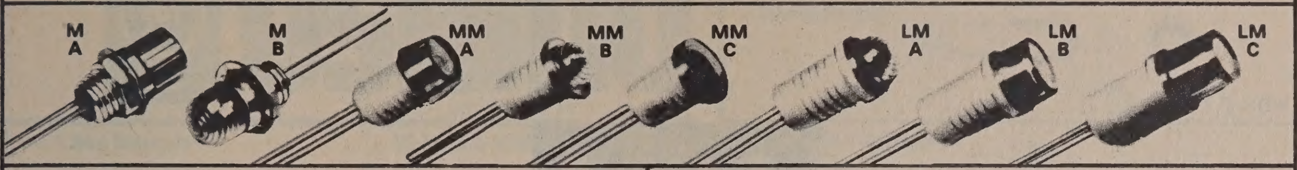
Model MI61S (Manual reset. Flag Indicator)

This internal flag, magnetic latching indicator can be manually reset. When a fault occurs, a triggered electrical pulse causes the flag to rotate to a position where it is positively held in a magnetic-locked position. It may be reset by rotating knurled knob clockwise 60 degrees. The knob spring returns to its normal position. Unit is environmentally sealed and offers excellent visibility in strong ambient light. Available in 3 to 28v dc. *Operating temperature range:* -65°C to +125°C. Qualified to Mil-I-83287/01.

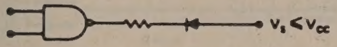
See Bulletin M-17A for detailed specifications.

Patent No. 3,704,462

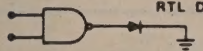
Minelco MIN-Lites LED INDICATORS

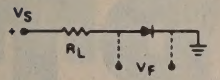

M
A
M
B
MM
A
MM
B
MM
C
LM
A
LM
B
LM
C

DTL & TTL DRIVE CIRCUITS



RTL DRIVE CIRCUIT





$R_L = (V_S - V_F)/I_F$
CHOOSE I_F FOR
DESIRED BRIGHTNESS

DC OPERATION

Include diode only if transient voltages present exceed V_R specified.

AC OPERATION

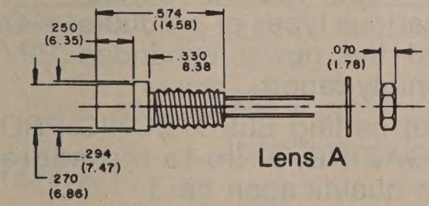
Diode required. Total circuit current doubled as it consumes the same current as LED.

Voltage (V)	Value of RL 20mA	Value of RL 40mA
5	180Ω	100Ω
6	220Ω	120Ω
10	470Ω	220Ω
12	680Ω	270Ω
14	820Ω	390Ω
18	1KΩ	470Ω
24	1.5KΩ	680Ω
30	1.8KΩ	820Ω

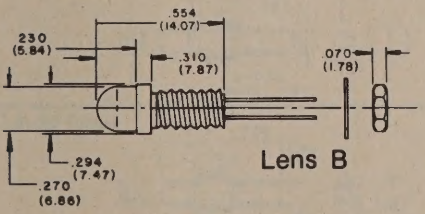
Typical values of R are specified for 20mA and 40mA total circuit current. Diode and Resistor shown are not supplied.

LEDs (Gallium Phosphide)	Types M	Type MM	Type LM
Forward Volts	R=2.1V, G/Y=2.6V	R=2.1V, G/Y=2.6V	2V (RG) 1.9V (YA)
Reverse Current V_R=4V	1µA	1µA	
Reverse Current V_R=3V			1µA (10µA Max.)
Capacitance V=0, 1MHz	R=100pf, G/Y=50pf	R=100pf, G/Y=50pf	100pf
Temperature Range	-50°C to +100°C	-55°C to +100°C	-20°C to +100°C
Max. Dis. @ 25°C	225mW	150mW	85mW(R) 112mW(GYA)
Cont. Forward Current	80mA	50mA	80mA(R) 50mA(GYA)
Peak Reverse Voltage	4V	4V	5V
Peak Pulse Current (1µS, 1%)	1A	1A	1A

M LEDS


.574
(14.58)
250
(6.35)
.330
8.38
.070
(1.78)
.294
(7.47)
.270
(6.86)

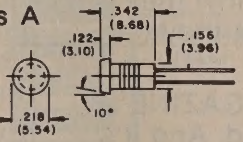
Lens A


.554
(14.07)
230
(5.84)
.310
(7.87)
.070
(1.78)
.294
(7.47)
.270
(6.86)

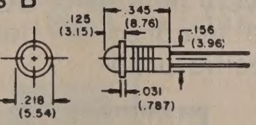
Lens B

MM LEDS

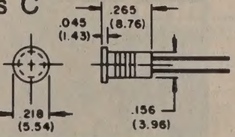
Lens A


.342
(8.68)
.122
(3.10)
.156
(3.96)
10°
.218
(5.54)

Lens B

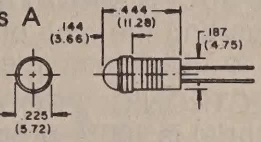

.345
(8.76)
.125
(3.15)
.156
(3.96)
.218
(5.54)
.031
(.787)

Lens C

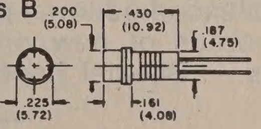

.265
(8.76)
.045
(1.43)
.218
(5.54)
.156
(3.96)

LM LEDS

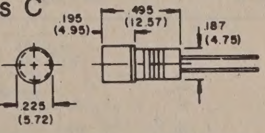
Lens A


.444
(11.28)
.144
(3.66)
.187
(4.75)
.225
(5.72)

Lens B


.200
(5.08)
.430
(10.92)
.187
(4.75)
.225
(5.72)
.161
(4.08)

Lens C


.495
(12.57)
.195
(4.95)
.187
(4.75)
.225
(5.72)

PHYSICAL CHARACTERISTICS

Series	Body Material	Color Intensity@10mA (MCD - Millicandelas)	Lens	Mounting	Terminal Style
MM	Polycarbonate	Red 1.1 mcd Green/Amber 2.5 mcd	5.55 mm dia. Viewing Angle: 75°	Push fit	1'' standard gold plated leads
LM	Nylon	Red .8 mcd Green/Amber 1.5 mcd	A - 4.4 mm dia. B/C - 5.1 mm dia. Viewing Angle: A/B 75° C 45°	Push fit	1'' standard gold plated leads
M	Nickle Plated Brass	Red 2 mcd Green/Amber 4.5 mcd	6.8 mm dia. Viewing Angle: 75°	Secured by nut	1'' standard gold plated leads

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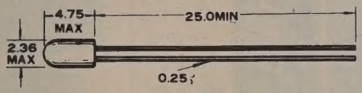
OSHINO

unit in m/m

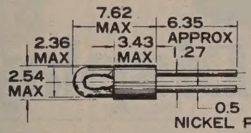
SUBMINIATURE LAMP BULBS

1. T-3/4 Wire Terminals US Mil. Std MS90452


4.75 MAX
25.0MIN
2.36 MAX
0.25φ

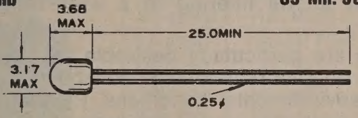
1.5-5V

2. T-3/4 Bi-Pin


7.62 MAX
6.35 APPROX
2.36 MAX
3.43 MAX
1.27
2.54 MAX
0.5 NICKEL PIN

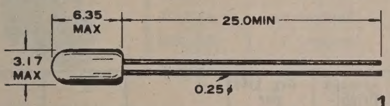
1.5-5V

3. T-1 Short Bulb US Mil. Std. MS90451


3.68 MAX
25.0MIN
3.17 MAX
0.25φ

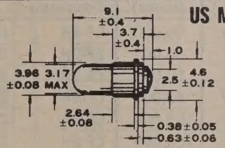
1.5-5V

4. T-1 Wire Terminals US Mil. Std. MS24367


6.35 MAX
25.0MIN
3.17 MAX
0.25φ

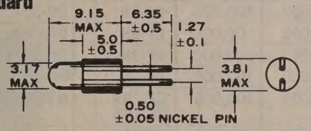
1.5-28V

5. T-1 Sub-Midget Flanged Base (SM4s/4) US Mil. Std. MS24515 MS3338


9.1 ±0.4
3.7 ±0.4
1.0
4.6
2.5 ±0.12
3.96 ±0.08
3.17 MAX
2.64 ±0.08
0.38±0.05
0.63±0.08

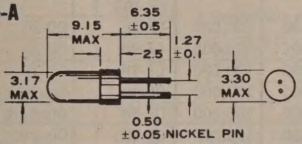
1.5-28V

6. T-1 Bi-Pin Standard


9.15 MAX
6.35 ±0.5
1.27 ±0.1
5.0 ±0.5
3.17 MAX
3.81 MAX
0.50 ±0.05 NICKEL PIN

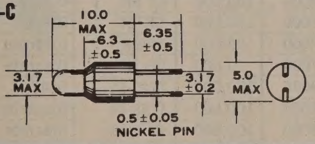
1.5-28V

7. T-1 Bi-Pin Type-A


6.35 ±0.5
9.15 MAX
1.27 ±0.1
2.5
3.17 MAX
3.30 MAX
0.50 ±0.05 NICKEL PIN

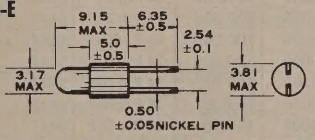
1.5-28V

8. T-1 Bi-Pin Type-C


10.0 MAX
6.3 ±0.5
6.35 ±0.5
3.17 MAX
3.17 ±0.2
5.0 MAX
0.5±0.05 NICKEL PIN

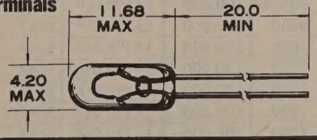
1.5-28V

9. T-1 Bi-Pin Type-E


9.15 MAX
6.35 ±0.5
5.0 ±0.5
2.54 ±0.1
3.17 MAX
3.81 MAX
0.50 ±0.05NICKEL PIN

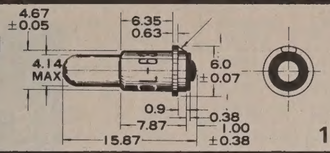
1.5-28V

10. T-1 1/4 Wire Terminals


11.68 MAX
20.0 MIN
4.20 MAX

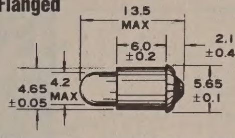
1.5-60V

11. T-1 1/4 Special Flarged


4.67 ±0.05
6.35
0.63
4.14 MAX
6.0 ±0.07
0.9
0.38
7.87
1.00
15.87
±0.38

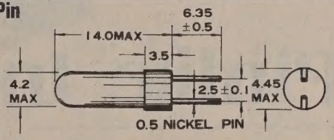
1.5-60V

12. T-1 1/4 Special Flanged (SM5s/8)


13.5 MAX
6.0 ±0.2
2.1 ±0.4
4.65 ±0.05
4.2 MAX
5.65 ±0.1

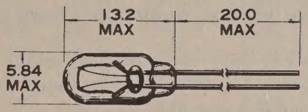
1.5-60V

13. T-1 1/4 Bi-Pin


6.35 ±0.5
14.0MAX
3.5
4.2 MAX
2.5±0.1
4.45 MAX
0.5 NICKEL PIN

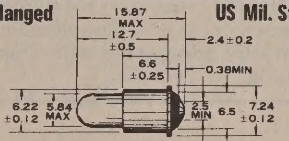
1.5-60V

14. T-1 3/4 Wire Terminals


13.2 MAX
20.0 MAX
5.84 MAX

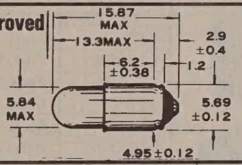
1.5-60V

15. T-1 3/4 Midget Flanged (MF6s/8) US Mil. Std. MS25237 JIS C7522


15.87 MAX
12.7 ±0.5
2.4±0.2
6.6 ±0.25
0.38MIN
6.22 ±0.12
5.84 MAX
2.5 MIN
6.5
7.24 ±0.12

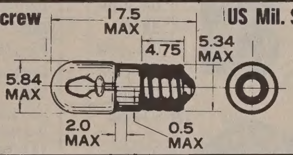
1.5-60V

16. T-1 3/4 Midget Groved (MG6s/9)


15.87 MAX
13.3MAX
2.9 ±0.4
6.2 ±0.38
1.2
5.84 MAX
5.69 ±0.12
4.95±0.12

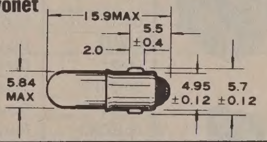
1.5-60V

17. T-1 3/4 Midget Screw (E-5) US Mil. Std. MS15612


17.5 MAX
4.75
5.34 MAX
5.84 MAX
2.0 MAX
0.5 MAX

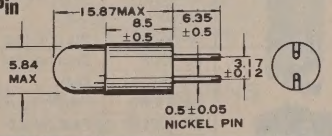
1.5-60V

18. T-1 3/4 Midget Bayonet (BA5s)


15.9MAX
5.5 ±0.4
2.0
5.84 MAX
4.95 ±0.12
5.7 ±0.12

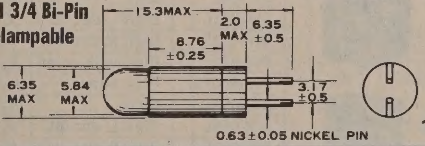
1.5-60V

19. T-1 3/4 Bi-Pin


15.87MAX
8.5 ±0.5
6.35 ±0.5
5.84 MAX
3.17 ±0.12
0.5±0.05 NICKEL PIN

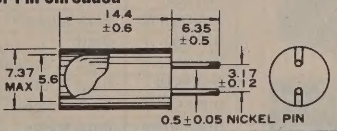
1.5-60V

20. T-1 3/4 Bi-Pin Relampable


15.3MAX
2.0 MAX
6.35 ±0.5
8.76 ±0.25
6.35 MAX
5.84 MAX
3.17 ±0.5
0.63±0.05 NICKEL PIN

1.5-60V

21. T-1 3/4 Bi-Pin Shrouded


14.4 ±0.6
6.35 ±0.5
7.37 MAX
5.6
3.17 ±0.12
0.5±0.05 NICKEL PIN

1.5-28V

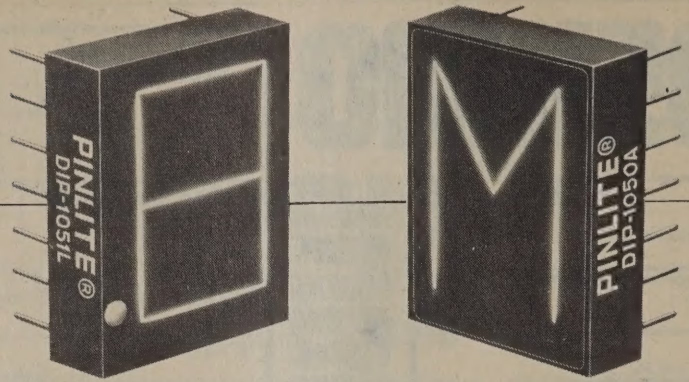
OSHINO ELECTRIC LAMP WORKS, LTD.

Shinagawa, Tokyo, Japan.

• Ask informations to:

WAMCO TECHNICAL SALES, INC.

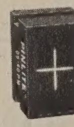
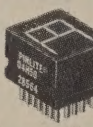
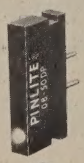
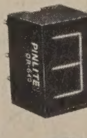
705 W. 16th Street, Costa Mesa, California 92627
TEL: (714) 833-9361 TELEX: 678459



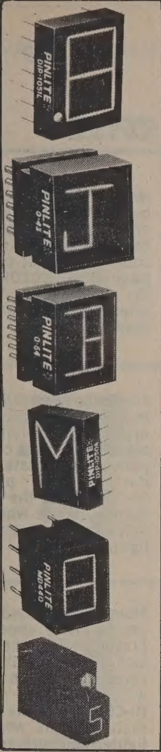
Pinlite® Incandescent Displays

- Directly-viewed incandescent design makes Pinlite displays ideal for high ambient light situations.
- Simple voltage reduction allows dimming for night use.
- High contrast ratio insures clear character definitions in a 10,000 ft.-candle incident light condition.
- 120° viewing angle.
- Patented cross-over filament arrangement eliminates "open corners" characteristic of other display types.
- Directly compatible with standard TTL driving networks.
- Easily multiplexed.
- "White" light allows filtering to a wide range of colors.

Pinlite displays are particularly desirable for applications requiring brightness and high reliability over a wide range of environmental conditions. Popular uses include aircraft cockpits, marine navigation, computer peripheral equipment, taxi meters and gas pump readouts.

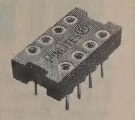





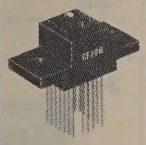
Part No.	Description	Character Height	Dimensions H (Inches)	Dimensions W (Inches)	Dimensions D (Inches)	Voltage	Current per Segment (mA)	Average Brightness (Ft.-Lmbrts.)	Avg. Life per Segment (Hours)	Mating Connector	Decoder Driver	List Price
03-15	Digit	3/16"	.305	.225	.312	1.5	8±1	700	50,000	CF-9H	DD-20	$27.00
03-15PM	Plus/Minus	3/16"	.305	.225	.312	1.5	8±1	700	50,000	CF-9H	Discrete	27.00
03-15DP	Decimal Point	N.A.	.305	.075	.312	1.5	7.5	700	50,000	CF-3H	Discrete	19.00
03-30	Digit	3/16"	.305	.225	.312	3	14±2	7000	50,000	CF-9H	DD-20	27.00
04-30	Digit	1/4"	.375	.275	.312	3	8±1	1400	100,000	CF-9H	DD-20	21.00
04-30PM	Plus/Minus	5/32"	.375	.275	.312	3	8±1	1400	100,000	CF-9H	Discrete	21.00
04-30DP	Decimal Point	N.A.	.375	.075	.312	3	9±1	1400	100,000	CF-3H	Discrete	15.00
04-40	Digit	1/4"	.375	.275	.312	4	12±2	9000	100,000	CF-9H	DD-20	21.00
04-40PM	Plus/Minus	5/32"	.375	.275	.312	4	12±2	9000	100,000	CF-9H	Discrete	21.00
04-40DP	Decimal Point	N.A.	.375	.075	.312	4	10.5±1	9000	100,000	CF-3H	Discrete	15.00
04-50	Digit	1/4"	.375	.275	.312	5	12±2	9000	100,000	CF-9H	DD-20	21.00
04-H50	Hexadecimal 9 Segment	1/4"	.375	.465	.312	5	18±2	9000	100,000	CF-10H CF-10D	N.A.	17.25
04-N50	1½ Digit 9 Segment	1/4"	.375	.465	.312	5	18±2	9000	100,000	CF-10H CF-10D	N.A.	17.25
06-30	Digit	5/16"	.468	.306	.312	3	8±1	1400	100,000	CF-9H	DD-20	16.00
06-40	Digit	5/16"	.468	.306	.312	4	17±2	9000	100,000	CF-9H	DD-20	16.00
06-50	Digit	5/16"	.468	.306	.312	5	18±2	9000	100,000	CF-9H	DD-20	16.00
06-50PM	Plus/Minus	5/32"	.468	.306	.312	5	18±2	9000	100,000	CF-9H	Discrete	16.00
06-50DP	Decimal Point	N.A.	.465	.100	.312	5	17±2	9000	100,000	CF-3H	Discrete	11.00
06-50NS	North/South	5/16"	.468	.306	.312	5	18±2	9000	100,000	CF-9H	Discrete	18.00
06-50EW	East/West	5/16"	.468	.306	.312	5	18±2	9000	100,000	CF-9H	Discrete	18.00
08-50	Digit	29/64"	.625	.425	.312	5	17±2	7000	100,000	CF-9H	DD-20	18.00
08-50PM	Plus/Minus	1/4"	.625	.425	.312	5	17±2	7000	100,000	CF-9H	Discrete	18.00
08-50DP	Decimal Point	N.A.	.625	.100	.312	5	17±2	7000	10,000	CF-3H	Discrete	13.00
DR-650	Digit	5/16"	.468	.306	.302	5	18±2	9000	100,000	CM5-11	5447	12.25
DR-650NS	North/South	5/16"	.468	.306	.302	5	18±2	9000	100,000	CM5-11	Discrete	18.00
DR-650EW	East/West	5/16"	.468	.306	.302	5	18±2	9000	100,000	CM5-11	Discrete	18.00
DIP-640	Digit	5/16"	.740	.400	.270	4	17±2	9000	100,000	14 Pin DIP	5447	9.00
DIP-641L	Digit L. dec. pt.	5/16"	.740	.400	.270	4	17±2	9000	100,000	14 Pin DIP	5447	10.50
DIP-641R	Digit R. dec. pt.	5/16"	.740	.400	.270	4	17±2	9000	100,000	14 Pin DIP	5447	10.50
DIP-642	Digit with colon	5/16"	.740	.400	.270	4	17±2	9000	100,000	14 Pin DIP	5447	12.00
DIP-640PM	Plus/Minus	5/32"	.740	.400	.270	4	17±2	9000	100,000	14 Pin DIP	5447	9.00
DIP-650	Digit	5/16"	.740	.400	.270	5	18±2	9000	100,000	14 Pin DIP	5447	9.00
DIP-651L	Digit L. dec. pt.	5/16"	.740	.400	.270	5	18±2	9000	100,000	14 Pin DIP	5447	10.50
DIP-651R	Digit R. dec. pt.	5/16"	.740	.400	.270	5	18±2	9000	100,000	14 Pin DIP	5447	10.50
DIP-652	Digit with colon	5/16"	.740	.400	.270	5	18±2	9000	100,000	14 Pin DIP	5447	12.00
DIP-650PM	Plus/Minus	5/32"	.740	.400	.270	5	18±2	9000	100,000	14 Pin DIP	5447	9.00
DIP-850	Digit	29/64"	.700	.500	.270	5	17±2	7000	100,000	14 Pin DIP	5447	9.00
DIP-851L	Digit L. dec. pt	29/64"	.700	.500	.270	5	17±2	7000	100,000	14 Pin DIP	5447	10.50
DIP-851R	Digit R. dec. pt.	29/64"	.700	.500	.270	5	17±2	7000	100,000	14 Pin DIP	5447	10.50
DIP-852	Digit, colon	29/64"	.700	.500	.270	5	17±2	7000	100,000	14 Pin DIP	5447	12.00
DIP-850PM	Plus/Minus	1/4"	.700	.500	.270	5	17±2	7000	100,000	14 Pin DIP	5447	9.00
DIP-1050	Digit	5/8"	.970	.760	.320	5	17±2	6000	100,000	14 Pin DIP	5447	9.00
DIP-1051L	Digit L. dec. pt.	5/8"	.970	.760	.320	5	17±2	6000	100,000	14 Pin DIP	5447	10.50
DIP-1051R	Digit R. dec. pt.	5/8"	.970	.760	.320	5	17±2	6000	100,000	14 Pin DIP	5447	10.50
DIP-1052	Digit, colon	5/8"	.970	.760	.320	5	17±2	6000	100,000	14 Pin DIP	5447	12.00
DIP-1050PM-1	Plus/Minus "1"	5/16"/ 5/8"	.970	.760	.320	5	17±2	6000	100,000	14 Pin DIP	Discrete	9.00



Part No.	Description	Character Height	Dimensions H	W	D	Voltage	Current per Segment (mA)	Average Brightness (Ft.-Lmbrts.)	Avg. Life per Segment (Hours)	Mating Connector	Decoder Driver	List Price
			(Inches)									
0-43	16 Segment	¼″	.375	.335	.312	3	8±1	1400	100,000	CF-20H	PLAND-76	35.00
0-44	16 Segment	¼″	.375	.335	.312	4	12±2	9000	100,000	CF-20H	PLAND-76	35.00
0-45	16 Segment	¼″	.375	.335	.312	5	12±2	9000	100,000	CF-20H	PLAND-76	35.00
0-63	16 Segment	5/16″	.465	.375	.312	3	8±1	1400	100,000	CF-20H	PLAND-76	33.00
0-64	16 Segment	5/16″	.465	.375	.312	4	17±2	9000	100,000	CF-20H	PLAND-76	33.00
0-65	16 Segment	5/16″	.465	.375	.312	5	18±2	9000	100,000	CF-20H	PLAND-76	33.00
DIP-1050A	16 Segment	⅝″	.970	.760	.320	5	17±2	6000	100,000	24 Pin DIP	PLAND-76	25.00
MD-440	Digit	¼″	.375	.275	.312	4	12±2	9000	100,000	MDC-4	5447	13.00
MD-440DP	Decimal Point	N.A.	.375	.075	.312	4	10.5±1	9000	100,000	MDC-4	Discrete	9.00
MD-440PM	Plus/Minus	5/32″	.375	.275	.312	4	12±2	9000	100,000	MDC-4	Discrete	13.00
MD-450	Digit	¼″	.375	.275	.312	5	12±2	9000	100,000	MDC-4	5447	13.00
MD-450PM	Plus/Minus	5/16″	.375	.275	.312	5	12±2	9000	100,000	MDC-4	Discrete	13.00
MD-4H50	Hexadecimal	¼″	.375	.465	.312	5	18±2	9000	100,000	N.A.	N.A.	19.75
MD-4N50	1½ Digit	¼″	.375	.465	.312	5	18±2	9000	100,000	N.A.	N.A.	19.75
MD-640	Digit	5/16″	.468	.306	.312	4	17±2	9000	100,000	MDC-4	5447	11.00
MD-640PM	Plus/Minus	5/32″	.468	.306	.312	4	17±2	9000	100,000	MDC-4	Discrete	11.00
MD-640DP	Decimal Point	N.A.	.465	.100	.312	4	14±2	9000	100,000	MDC-4	5447	8.00
MD-650	Digit	5/16″	.468	.306	.312	5	18±2	9000	100,000	MDC-4	5447	11.00
MD-650PM	Plus/Minus	5/32″	.468	.306	.312	5	18±2	9000	100,000	MDC-4	Discrete	11.00
MD-650DP	Decimal Point	N.A.	.465	.100	.312	5	17±2	9000	100,000	MDC-4	Discrete	8.00
MD-640XY	"X" "Y"	5/16″	.468	.306	.312	4	17±2	9000	100,000	MDC-4	Discrete	11.00
MD-640LR	Left/Right	5/16″	.468	.306	.312	4	17±2	9000	100,000	MDC-4	Discrete	11.00
MDD-640	Digit	5/16″	.765	.306	.900	4	17±2	9000	100,000	N.A.	5447	20.45
MDD-650	Digit	5/16″	.765	.306	.900	5	18±2	9000	100,000	N.A.	5447	20.45
MDD-63	16 Segment	5/16″	.765	.375	.900	3	8±1	1400	100,000	N.A.	PLAND-76	40.50
MDD-64	16 Segment	5/16″	.765	.375	.900	4	17±2	9000	100,000	N.A.	PLAND-76	40.50
MDD-65	16 Segment	5/16″	.765	.375	.900	5	18±2	9000	100,000	N.A.	PLAND-76	40.50
MDD-450	Digit	¼″	.665	.275	.900	5	12±2	9000	100,000	N.A.	5447	21.95

CONNECTORS



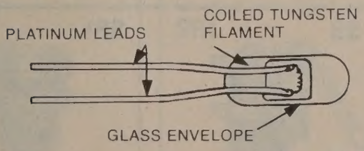


Part Number	Description	Dimensions H	W	D	List Price
		(Inches)			
CF-3H	For all "0" series decimal points, colons.	.700	.094	.385	$ 3.50
CF-9D	Connector with multiplex isolation diodes for "0" series 7-segment displays.	.562	.208	1.000	10.90
CF-9H	For all "0" series 7-segment, PM, EW, NS	.780	.208	.385	3.50
CF-10D	Connector with multiplex isolation diodes for 1½ digit and hexadecimal displays.	.625	.440	1.000	Consult Factory
CF-10H	Connector for 04N series 1½ digit displays and 04H series hexadecimal displays.	.875	.390	.385	Consult Factory
CF-20H	For 0-43, 0-44, 0-45, 0-63, 0-64, and 0-65 displays.	.875	.334	.385	10.00
CF-204D	Connector with multiplex isolation diodes for 0-43, 0-44, and 0-45 displays.	.625	.334	1.000	17.55
CF-206D	Connector with multiplex isolation diodes for 0-63, 0-64, and 0-65 displays.	.625	.334	1.000	17.55
MDC-4	For all Mini/DIP styles except decimal point.	.525	.295	.155	1.40

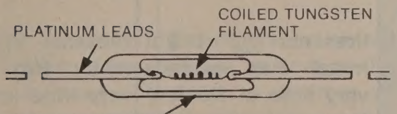
DECODER/DRIVERS

DD-20	BCD to 7-segment decoder/driver and connector for "0" series.	.875	.225	1.000	$39.00
DDL-20	BCD to 7-segment decoder/driver and connector with memory for "0" series.	.875	.225	1.500	49.00
PLAND-76	ASCII to 16-segment decoder/driver.	1.360	.960	.450	59.00

MICRO MINIATURE LAMPS



LENS LAMP



AXIAL

PINLITE® LAMP SPECIFICATIONS

L = Lens   Axial = No Prefix

Model	Voltage	Current mA	Dimensions L	Dia.	Light Output in Millilumens	Resistance Cold	Hot	Life Hours	List Price
			(Inches)						
L12-12	1.25	12±2	.080 (2.03)	.030 (0.76)	45	13	104	1000	$5.50
L15-30	1.5	30±4	.080 (2.03)	.030 (0.76)	160	5.5	50	1000	5.50
L15-45	1.5	45±5	.080 (2.03)	.030 (0.76)	220	4	33	1000	5.50
15-15	1.5	15±2	.070 (1.78)	.015 (0.38)	60	11	100	800	5.50
30-30	3	30±3	.125 (3.18)	.030 (0.76)	250	10	100	1000	5.50
60-20	6	20±3	.250 (6.36)	.040 (1.02)	400	30	300	2000	5.50

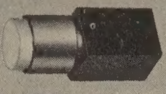
REFAC electronics corporation
DEPT. EM, P.O. BOX 809, WINSTED, CT 06098 (203) 379-2731

THE SLOAN COMPANY

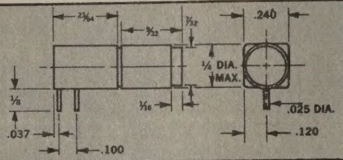
7704 SAN FERNANDO ROAD BOX 367

SERIES / DRAWINGS

101

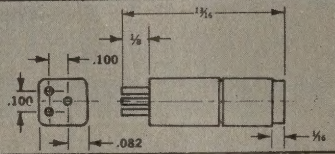


LENS BAYONET TYPE
LENS STYLES AVAIL. — DS, DSC, Q, QB

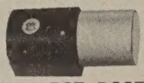

23/64
9/32
7/32
.240
1/4 DIA. MAX.
1/8
1/16
.025 DIA.
.037
.100
.120

111

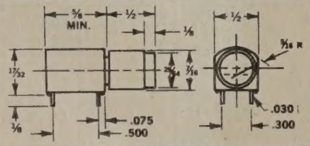
LENS BAYONET TYPE
SAME AS 101


1 3/16
1/8
.100
.100
.082
1/16

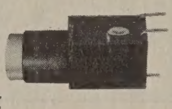
864



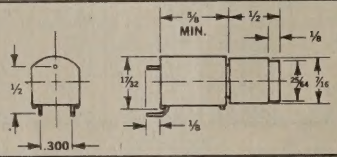
LENS
BAYONET TYPE
LENS STYLES AVAIL. — DS7, DSC7, Q7, QB7
THE SUFFIX (7) IS PERTINENT TO 864 OR 874 SERIES ONLY


5/8 MIN.
1/2
1/8
1/2
5/16 R
17/32
25/64
7/16
1/8
.075
.500
.030
.300

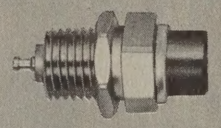
874



LENS
BAYONET TYPE
SAME AS 864


5/8 MIN.
1/2
1/8
1/2
17/32
25/64
7/16
1/8
.300

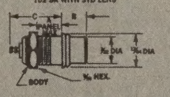
102



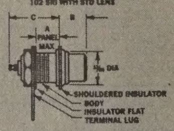
AVAILABLE IN
ALL BODY STYLES

LENS STYLES AVAIL. — STD, DSC, QB, DS, Q

102 SR WITH STD LENS

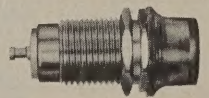

C
A
PANEL MAX
B
7/32 DIA
13/64 DIA
BODY
5/16 HEX

102 SRI WITH STD LENS


C
B
A
PANEL MAX
13/64 DIA
SHOULDERED INSULATOR
BODY
INSULATOR FLAT
TERMINAL LUG

BODY	A	B	C
S	13/64	9/32	13/32
SI	5/32	5/16	3/8
SS	1/4	15/64	7/16
SSI	13/64	17/64	13/32
SK	17/64	15/64	15/32
SKI	7/32	1/4	7/16
SR	9/32	13/64	15/32
SRI	15/64	15/64	29/64

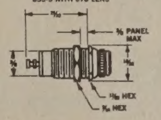
855



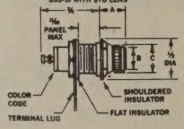
BODY STYLES
AVAILABLE S OR SI

LENS STYLES AVAIL. — STD, DS, DSC, Q, QB, D, M, SE

855-S WITH STD LENS

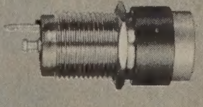

7/16
3/8 PANEL MAX
11/16 HEX
5/16 HEX

855-SI WITH STD LENS

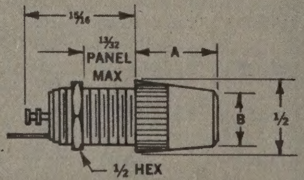

5/8
A
5/16 PANEL MAX
B
C
1/2 DIA
COLOR CODE
TERMINAL LUG
SHOULDERED INSULATOR
FLAT INSULATOR

	A		B	C
LENS STLYE	S	SI		
STD	19/64	21/64	17/64	3/8
D	5/16	11/32	3/8	1/2
DS,DSC,Q,QB	21/64	23/64	3/8	7/16
M	21/32	11/16	3/8	1/2
SE	3/16	3/16		1/2

856



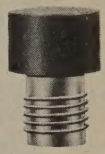
AVAILABLE IN BODY
STYLE S ONLY
(2 TERMINAL BODY ONLY)
LENS STYLES AVAIL. — M, Q, DS, MB, QB, DSC


15/16
13/32 PANEL MAX
A
B
1/2
1/2 HEX

LENS STYLE	A	B
M,MB	5/8	3/8
DS,DSC,Q,QB	3/8	15/32

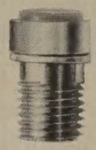
LENS STYLE

DS



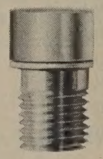
Matte black anodized bezel prevents sidelight emission. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored lighted.

Q



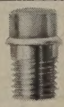
Aluminum anodized bezel (matte silver appearing) allows 180° visibility, blends with light colored panels; contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

DSC



Aluminum anodized bezel (matte silver appearing) prevents sidelight emission. Blends with light colored panels, contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

STD



Flat, slightly projected lens gives 180° visibility.

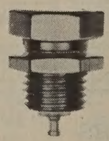
Lens differs on 855 — see drawing.

SE

Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space. Can be relamped with gloved hands.

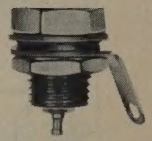
BODY TYPES

S



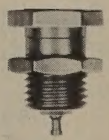
Presents bright metal Hex extending in front of the panel or in front of the shoulder washer on the SI model.

SI



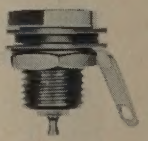
Presents bright metal Hex extending in front of the panel or in front of the shoulder washer.

SS



Presents 5/16" bright metal Hex extends very little in front of the panel or in front of the shoulder washer on the SSI model.

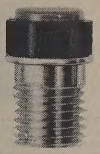
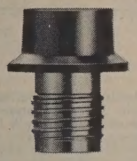
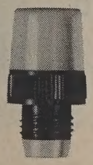
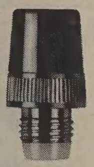
SSI



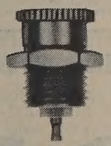
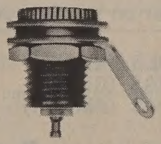
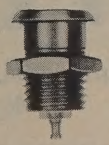
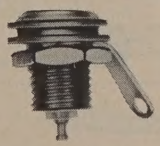
Presents 5/16" bright metal Hex extends very little in front of the panel or in front of the shoulder washer.

SUN VALLEY, CALIFORNIA 91353 PHONE: (213) 875-1123 TWX: 910-498-2250

LENS STYLE

QB		Matte black anodized bezel. Allows 180° visibility. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.
D		Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication. BI-COLOR has the added feature, white when unlighted and colored when lighted.
MB		Offers the same features as Type M. Black metal trim. Both accommodate T-1¾ based lamp or T-2 based neon lamp (NE2J or AIH types).
M		Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility.

BODY TYPES

SK  Presents small knurled flange in front of the panel or in front of the shoulder washer on the SKI model.	**SKI**  Presents small knurled flange in front of the panel or in front of the shoulder washer.
SR  Presents a small flange in front of the panel or in front of the shoulder washer on the SRI model.	**SRI**  Presents a small flange in front of the panel or in front of the shoulder washer.

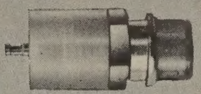
LENS COLOR	LAMP TYPE	HOW TO ORDER
TRANSPARENT RL — Red *BL — Blue *GL — Green AL — Amber CL — Clear TRANSLUCENT RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber *Not recommended for use with neon lamps.	T-1 INCANDESCENT OR T-1 BASED LED	EXAMPLE: 101 RL Model No. Lens Color DSC T-1 Based Lamp Lens Style Lamp Type
TRANSPARENT RL — Red *BL — Blue *GL — Green AL — Amber CL — Clear TRANSLUCENT RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber *Not recommended for use with neon lamps.	T-1¾ OR T-2 INCANDESCENT OR T-1¾ BASED LED	EXAMPLE: 864 RL Model No. Lens Color DSC T-1¾ Based Lamp Lens Style Lamp Type
GENERAL PURPOSE LENS MATERIAL (Translucent except M lens) R — Red W — White B — Blue G — Green A — Amber *C — Clear LEXAN LENS MATERIAL (Transparent) RL — Red BL — Blue GL — Green AL — Amber CL — Clear (Translucent) RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber	T-1 INCANDESCENT OR T-1 BASED LED	EXAMPLE: 102SI AL Body Type Lens Color DSC T-1 BASED LAMP Lens Style Lamp Type
GENERAL PURPOSE (Translucent R — Red W — White B — Blue G — Green A — Amber LEXAN LENS MATERIAL (Transparent) RL — Red BL — Blue GL — Green AL — Amber CL — Clear (Translucent) RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber	T-1¾ INCANDESCENT OR T-1¾ BASED LED	EXAMPLE: 855SI G 5 Body Type Lens Color Color Coding D BI-COLOR BASED LAMP Lens Style Lamp Type
M and MB LENS TRANSPARENT EXCEPT FOR WHITE R — Red W — White *B — Blue *G — Green A — Amber C — Clear ALL LENSES EXCEPT M AND MB TRANSPARENT RL — Red *BL — Blue *GL — Green AL — Amber CL — Clear TRANSLUCENT RLUC - Red WLUC White *BLUC - Blue *GLUC - Green ALUC - Amber *Not recommended for use with neon lamps	T1¾ AND T2 INCANDESCENT OR T-1¾ BASED LED	EXAMPLE: 856 RLUC MODEL NO. LENS COLOR T-1¾ or T-2 BASED LAMP LAMP TYPE

THE SLOAN COMPANY

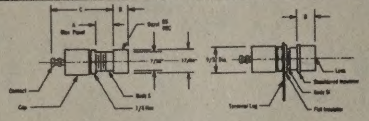
7704 SAN FERNANDO ROAD BOX 367

SERIES / DRAWINGS

107

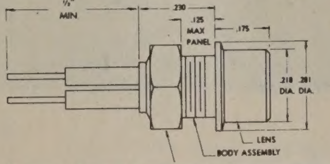


REAR RELAMPABLE
LENS STYLES AVAILABLE — STD DS DSC Q QB

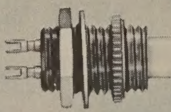

C
B
A
Max Panel
Contact
Cap
Body S
1/4 Hex
7/32"
17/32"
9/32 Dia.
B
Lens
Terminal Lug
Flat Insulator

105

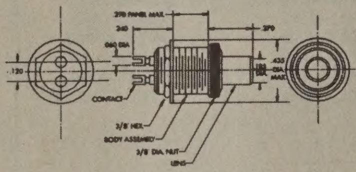
FIXED
LENS STYLES AVAILABLE — STD DS DSC Q QB


½" MIN
.230
.125 MAX PANEL
.175
.218 DIA.
.281 DIA.
LENS
BODY ASSEMBLY

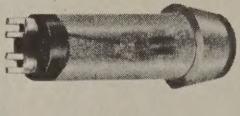
106



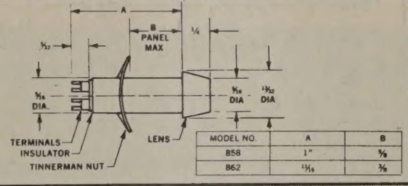
FIXED


.270 PANEL MAX
.240
.270
.060 DIA
.120
.435 DIA MAX
CONTACT
3/8 HEX
BODY ASSEMBLY
3/8 DIA NUT
LENS

858
862

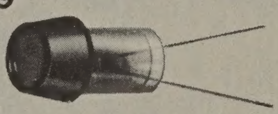


FIXED

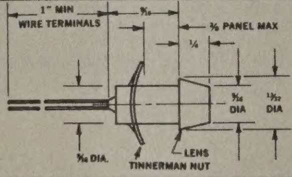

A
B PANEL MAX
¼
3/32
5/16 DIA.
9/16 DIA
13/32 DIA
TERMINALS
INSULATOR
TINNERMAN NUT
LENS

MODEL NO.	A	B
858	1"	⅝
862	1 1/16	⅜

859

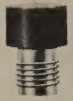


FIXED


1" MIN WIRE TERMINALS
9/16
⅜ PANEL MAX
¼
9/16 DIA
13/32 DIA
5/16 DIA.
LENS
TINNERMAN NUT

LENS STYLE

DS



Matte black anodized bezel prevents sidelight emission. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored lighted.

Q

Aluminum anodized bezel (matte silver appearing) allows 180° visibility, blends with light colored panels; contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

DSC

Aluminum anodized bezel (matte silver appearing) prevents sidelight emission. Blends with light colored panels, contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

QB

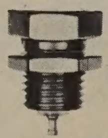
Matte black anodized bezel. Allows 180° visibility. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

STD

Flat, slightly projected lens gives 180° visibility.

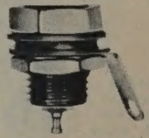
BODY STYLES

S



Presents bright metal Hex extending in front of the panel or in front of the shoulder washer on the SI model.

SI

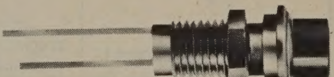


Presents bright metal Hex extending in front of the panel or in front of the shoulder washer.

FIXED (NON-RELAMPABLE) LED SERIES
LED: T-1 SIZE

- Lens Shape: Domed or Flat.
- Lens Colors: Red, Green, Amber, White and Clear in either transparent or translucent material.
  All lenses available with or without Fresnel rings.
- Mounting Hole — ¼" — Round or "D" hole. Center to Center Mtg. 5/16"
- Wire Wrap Terminals (will accept standard connector) and solderable.
- Available up to 18 VDC with built-in resistor.

2L5 (RED)
2G5 (GREEN)
2A5 (AMBER)



LENS STYLE

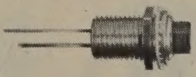
DOME

FLAT

FIXED (NON-RELAMPABLE) LED SERIES
LED: T-1¾ SIZE

- LED Shape: Domed of Flat.
- Lens Colors: LED: Red, Green, Amber, White and Clear.
  Incandescent: Red, Green, Amber, White, Clear or Blue.
  All lenses available with or without Fresnel rings in either transparent or transluscent material.
- Mounting Hole — 5/16" — Round or "D" hole. Center to Center Mtg. 7/16".
- Wire Wrap Terminals (will accept standard connector) and solderable.
- Available up to 50 VDC with built-in resistor.
- AC available up to 120 Volt with built-in resistor and diode.
- Standard indicators furnished with Hi-Brite LEDs **(up to 50 Mcd).**
  Other LEDs can be furnished upon request.

3R5 (RED)
3G5 (GREEN)
3A5 (AMBER)

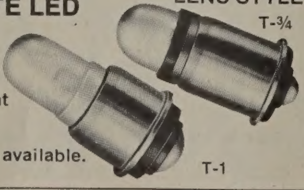


LENS STYLE

DOME

FLAT

T-1 FLANGED BASED HI-BRITE LED AND T-1¾ FLANGED BASED HI-BRITE LED

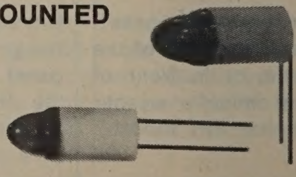

LENS STYLE
T-¾
T-1

- Used as a replacement for incandescent lamps.
  Available in Red, Green and Amber.
- Various voltages and operating current available.
  Light intensities up to 50 Mcd.

BI-PIN OR P/C MOUNTED HIGH BRITE LED

T-1¾ SIZE

VOLTAGES UP TO 28 VOLTS

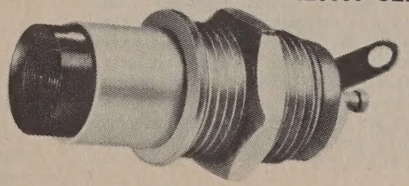


SUN VALLEY, CALIFORNIA 91353 PHONE: (213) 875-1123 TWX: 910-498-2250

LENS COLOR	LAMP TYPE	HOW TO ORDER
General Purpose Lens Materials (Translucent) R — Red W — White B — Blue G — Green A — Amber Lexan Lens Materials (Transparent) RL — Red BL — Blue GL — Green AL — Amber CL — Clear (Translucent) RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber	T-1 BASED LAMP INCANDESCENT OR T-1 BASED LED	EXAMPLE 107 → Body Type RLUC → Lens Color DS → Lens Style Based Lamp → Lamp Type
General Purpose Lens Materials (Translucent) R — Red W — White B — Blue G — Green A — Amber Lexan Lens Materials (Transparent) RL — Red BL — Blue GL — Green AL — Amber CL — Clear (Translucent) RLUC — Red WLUC — White BLUC — Blue GLUC — Green ALUC — Amber	T-1 UNBASED LAMP MIL SPEC OR COMM.	105S - R - MIL. or COMM. Model No. Lens Color Mil. Spec. or Commercial Bulbs
R — Red W — White *B — Blue *G — Green A — Amber *Not recommended for use with neon lamps.	T-1 UNBASED LAMP MIL SPEC OR COMM.	106S - R - MIL. or COMM. Model No. Lens Color Mil. Spec. or Commercial Bulbs
R — Red W — White *B — Blue *G — Green A — Amber C — Clear *Not recommended for use with neon lamps.	T-1, T-1¾ OR T-2 UNBASED INCANDESCENT OR NEON LAMP	858 → Model No. C → Lens Color AIB → Lamp Type 220K → *Resistor
R — Red W — White *B — Blue *G — Green A — Amber C — Clear *Not recommended for use with neon lamps.	T-1, T-1¾ OR T-2 UNBASED INCANDESCENT OR NEON LAMP	859 → Model No. C → Lens Color AIB → Lamp Type 220K → *Resistor

SERIES 121000 AND 123000
TWO TERMINAL, FRONT RELAMPABLE

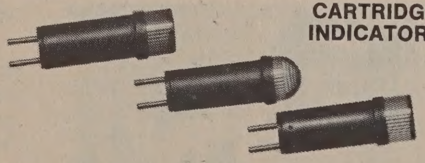
121000 SERIES
123000 SERIES



- Designed to use T-1 size flange based incandescent or LED light sources.
- 9/32″ Diam. Mtg. Hole (Series 121000). Center to Center spacing 3/8″.
- 5/16″ Diam. Mtg. Hole (Series 123000). Center to Center spacing 1/2″.
- Three lens styles available for either series in translucent or transparent material, plain or with fresnel rings.
- A variety of lens colors available.
- Terminals accept two (2) #22 AWG wires each and are isolated from case and panel.
- Body and lens bezels can be furnished in black or clear anodized finish.
- Hot stamping of lenses can be furnished upon request.
- Both Series are available in waterproof versions.
- RFI shielding can be provided on both Series.

SLOAN CARTRIDGE INDICATORS

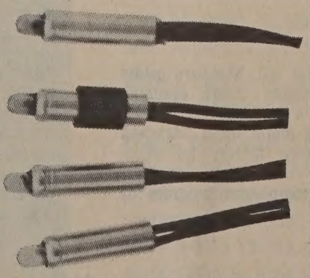
CARTRIDGE INDICATORS



- Designed to provide low cost, front panel light indication with a variety of light sources and multi-optional mounting features.
- Extremely rugged in construction, Sloan Cartridge units consist of an aluminum body incorporating Solid State, Incandescent or Neon light sources. Termination is by .040 diam. stainless steel pins.
- Lens styles are flat or domed in transparent or translucent material. All lenses incorporate Fresnel rings for maximum distribution of light output. A wide variety of lens colors are available.

New

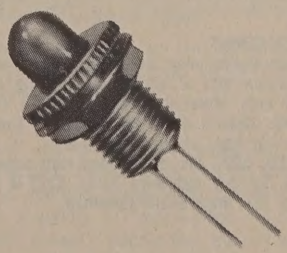
5L3 SERIES (T-1 LED)



- Red, Green or Amber
- 1/8″ body diameter
- No lens required
- Non relampable
- Termination by color coded wire leads
- Voltages up to 14 VDC

New

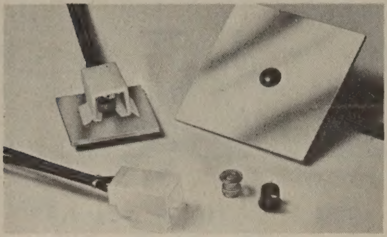
1L3 SERIES (T-1¾ HI-BRITE LED)



- Red, Green or Amber
- 1/4″diam threaded metal body
- No lens required
- Non-relampable
- Voltages up to 14 VDC

SoLiCo *PILOT AND INDICATOR LIGHTS*

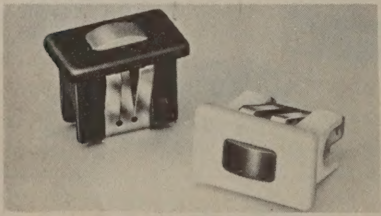
A COMPLETE RANGE OF MULTI-FUNCTION INDICATOR LIGHTS



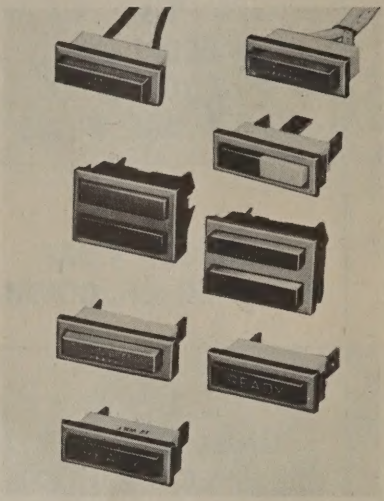
1K14 SERIES
Rear mounts in panel not more than .085" thick. Mounting hole .310" — .320"
LAMP: High brightness neon is standard with complete range of attached resistors available. Miniature incandescent in T-1¾ size available in range of 1.3 volt thru 28 volt.
COLORS: Lens colors are available in complete spectrum both in transparent and translucent material.
Recognized under the component program of U/L and CSA approved.

SoLiCo 110V
SoLiCo 28V

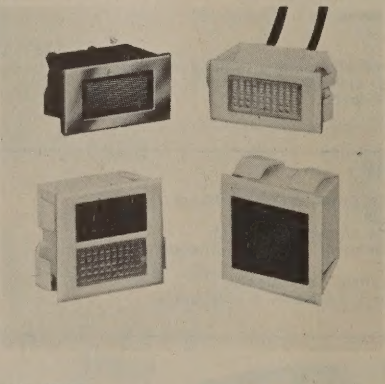
3L SERIES (with built-in resistor)
3S SERIES (resistor in lead)
These compact lights snapfit in a 5/16" hole. No additional hardware is necessary. Extended portion is .350 diameter by .110 inch high, while body length below shoulder is 1.420" long on 3L and .940" long on 3S.
Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.
LENS: F4 and F5* lens is offered in a variety of colors and available in nylon or lexan. Decorative bezel with various finishes upon request. Chrome is standard.
BODY COLORS: White is standard although body can be molded in any color.
LEADS: Same as 5S.



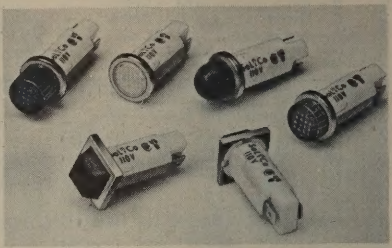
S222 SERIES
These lights snap securely without additional hardware into a rectangular opening 1.200 by .640 inch. Material thickness .045 to .065 inch.
LENS: Choice of colors available (nylon and acrylic). Red, white, amber, clear.
LEADS: S222 Series provided with screw terminals, S222-A with wire leads. S222-B provided with .250 male spade terminals.



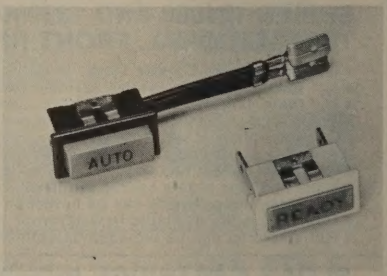
"R" SERIES
These rectangular lights snap in securely (without additional hardware) into 1.312 or 1.280 by .375 inch opening. Material thickness range .030/.080 inch. 2R requires 1.280" by .812 inch mounting hole.
Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate built-in resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.
LENS: Ideal for vertical or horizontal hot stamp legends. These 1.150 by .250 inch lenses are offered in a variety of colors (nylon or lexan). Split lens variations also available (2R and 4R Series).
BEZEL: Decorative bezel in various finishes available (black, bright brass, etc.) Chrome plate is standard.
LEADS: Same as M SERIES.



"L" SERIES
Molded from DuPont Zytel 101. Standard colors are black or white, custom colors available upon request.
Optional: When ordering metal bezel, stainless steel is standard. Consult factory for other finishes.
Recognized under the component program of U/L and CSA approved.



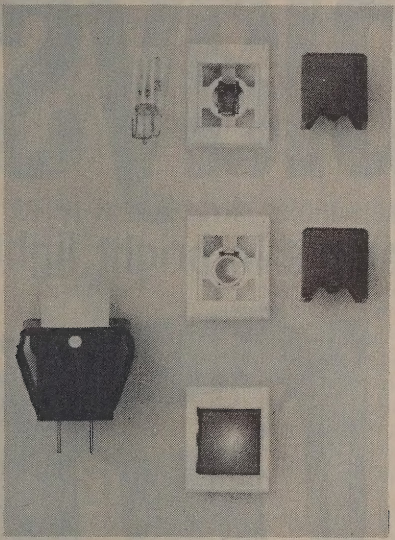
5T SERIES
HOUSING: Zytel 101, White is standard. However, Black, Red and other colors are available. Fits in ½" mounting hole (snap fit).
RATING: Same as 5S — 5L SERIES
LAMP: High brightness neon is standard with complete range of attached resistors available. Miniature incandescent in T-1¾ size available in range of 1.3 volt thru 28 volt.
LENS: Various styles with internal facets for maximum light refraction. Available in Lexan and Nylon.
COLORS: Lens colors are available in complete spectrum both in transparent and translucent material.
BEZEL: Optional, available in chrome or other finishes. Square or round depending on lens style.



"M" SERIES
These compact units snap securely without additional hardware into .940 by .440 inch opening. Material thickness .031" — .093".
LENS: M Series with "H" lens features a .855 by .315 inch lens face — .170" high offering excellent raised lighting characteristics with a choice of colors. (Imprinting available).
M Series with "F" lens affords a full .860 by .315 inch lighting face ideal for hot stamping legends, even two lines if desired.
BODY COLORS: white or black available.
LEADS: Black plastic 105°C leads 6" long ends stripped ½" and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be provided with a variety of terminations — ring, female flag, etc. M series can be supplied with .250" or .187" male spades.

SORENSON LIGHTED CONTROLS, INC. 530 Oakwood Avenue, West Hartford, Ct. 06110

SoLiCo PILOT AND INDICATOR LIGHTS



1000 SERIES FEATURES REPLACEABLE LAMP

Snap-out lens and wedge base lamp (6-28 volt range) permits relamping from front of panel without tools.

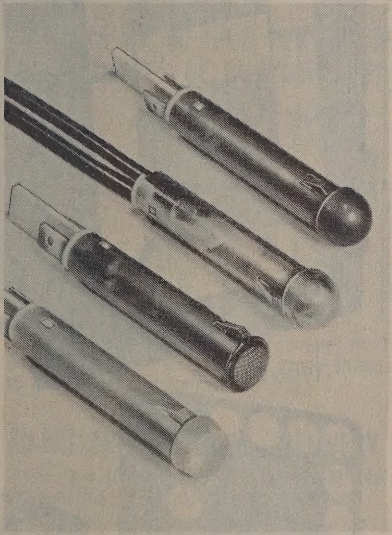
MOUNTING INFORMATION: Unit has self-locking ears; snaps into conventional .515″ x .625″ hole in panel .02″ to .156″ thick. Measures .750″ behind panel.

RATING: 6-28 volt and 125-250 volt. Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved.

LENS: Full range of colors. .430″ x .460″ x .300″ high.

HOUSING: DuPont Zytel 101 available in white, red or black.

TERMINATION: Solder Lugs.



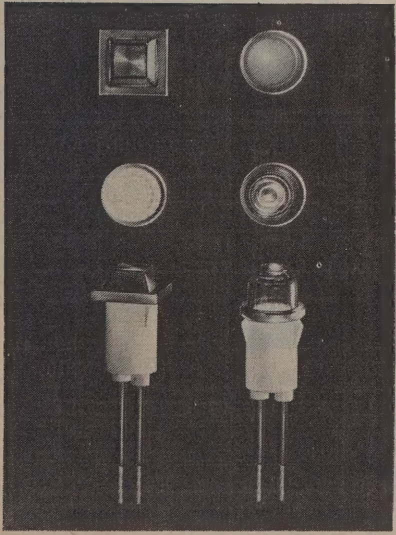
3W AND 3T SERIES

MOUNTING INFORMATION: Snap-in feature with self-locking ears. Fast assembly, no additional hardware necessary.

BODY COLORS: Lens and body one piece design. Available in all colors.

TERMINATION: 6″ wire leads standard on 3W, .187″ male tabs on 3T.

LENS: 3 configurations: dome, semi-dome, cylindrical flat top.



5S AND 5L SERIES

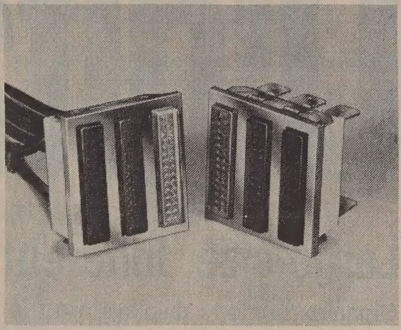
These stylish round body lights with chrome plated bezel mount into ½″ hole and are secured by self-locking "barbs." The overall body length below the bezel is .900″ on the 5S and 1.120″ on the 5L.

Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.

LENS: A choice of lens styles and colors available. Nylon or Lexan material.

BEZEL: Decorative bezels in various finishes available (chrome plated is standard).

LEADS: Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and color leads can readily be supplied. In addition, these leads can be provided with a variety of terminals, ring, female quick connect, male spade, etc.



RT SERIES

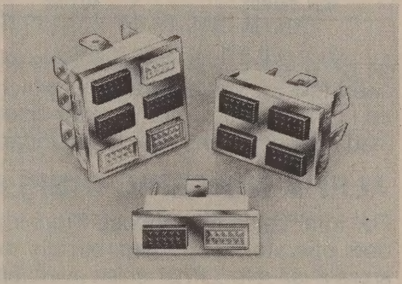
MOUNTING INFORMATION: These multiple function lights snap-fit into a 1.28″ x 1.234″ mounting hole in panels from .09″ to .30″ thick. No additional hardware is necessary.

RATING: Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved at 125-250 volts.

LENS: Ideal for vertical or horizontal hot stamp legends. These 1.150″ x .250″ lenses are offered in a variety of colors (nylon or lexan).

BEZEL: Decorative bezel in various finishes available (black, bright brass, etc.). Chrome plate is standard.

LEADS: Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be supplied with a variety of terminations — ring, female quick connect, female flag, etc., or with .250″ male spades attached to the body.



SR, 4R AND 6R SERIES

MOUNTING INFORMATION: These multiple function lights snap-fit into panels from .09″ to .30″ thick. No additional hardware is necessary.

RATING: Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved at 125-250 volts.

LENS: Ideal for vertical or horizontal hot stamp legends. .485″ x .250″ lenses are offered in a variety of colors (nylon or lexan).

BEZEL: Decorative bezel in various finishes available (black, bright brass, etc.). Chrome plate is standard.

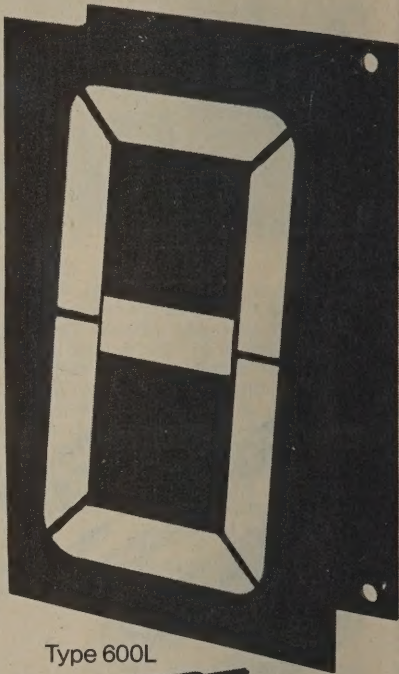
LEADS: Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be supplied with a variety of terminations — ring, female quick connect, female flag, etc., or with .250″ male spades attached to the body.

Signalex™

Digital Displays

Large size. Inherent memory. Long lasting. Legible in bright light.

Signalex numeric displays are the simple solution to problem display requirements. Actuated electromagnetically, they are virtually maintenance-free, last almost indefinitely. No power required except when numbers are being changed. And the big, bold, light-reflecting characters (up to 12" high) can be seen under any ambients...even bright sunlight, or in the dark when illuminated. Standard colors are white on black, with customized colors on special order.



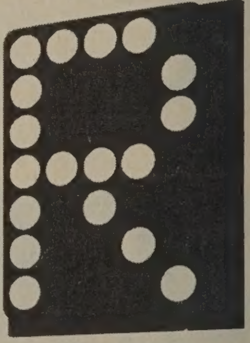
Type 600L

NUMERIC DISPLAYS

DISPLAY SIZE	1½"	4"	6"	9"	12"
SIGNALEX MODEL	150L	400L	600L	900L	1200L
Character Size H x W	1-9/16" x 15/16"	4-1/16" x 2-5/16"	6-1/16" x 3-9/16"	9" x 6"	12" x 8"
Vane Width	5/32"	7/16"	11/16"	1-1/8"	1-1/2"
Frame Size H x W	1-7/8" x 1-5/16"	5" x 3-1/4"	7-1/4" x 5-1/4"	11" x 8-1/4"	14" x 11"
Min. Pulse Length	30 ms	50 ms	90 ms	150 ms	190 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.1 W	2.0 W	2.5 W
Max. Viewing	40 Feet	100 Feet	250 Feet	500 Feet	800 Feet

U.S. Patent No. 3,886,545; other patents pending.

All sizes are 7 segment readouts with bi-stable magnetic circuits that are pulse operated. Except for the 150L, which has 3 terminal pins per segment for connection to PC boards, all the other sizes are customarily supplied with three 8 inch leads per segment. 12v. DC standard. Other voltages on special order.



Type 1235L

ALPHA-NUMERIC DISPLAYS

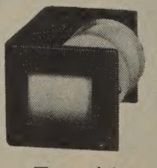
For total versatility choose Signalex dot matrix displays. Thirty-five bright white dots operate electromagnetically to display any letter or number. Big 9" and 12" sizes available. Other sizes available on special order. (Pat. Pending)

2-STATE INDICATORS

Type A1 is a single window model. Strips may be ordered with as many windows as required. Each window has two alternating display faces. The signal, letter or number at each display position snaps into view with an electric pulse and remains until a pulse activates alternate circuit. Available in multiple segments. The segments are bi-stable magnetic circuits and pulse operated. 12 v. DC and white-on-black are standard. Custom voltages and colors available.

Window size • 3/8" H x 1/2" W	Window to Window Spacing • 3/4"	No. Connections • 3/window
Pulse Length, Min. 30 ms either display	Pulse Power Required • 1.1 watts	

U.S. Patent No. 3,936,818



Type A1

Type A6

Note:
In addition to standard models, economical Signalex display devices can be modified to your requirements.

The Staver Company, Inc.
47 N. Saxon Ave., Bay Shore, N.Y. 11706 (516) 666-8000
TWX 510-227-6142

SIGNALEX

AD-MU AD-VANCE MAGNETICS SHIELDING

MAGNETIC SHIELD COSTS REDUCED

Ad-Vance Magnetics, Inc. already owns tooling for just about every type of magnetic shield used during the past 20 years. Such existing tooling could cut your shielding costs substantially. Or, our Magnetic Shielding Specialists will design and fabricate an AD-MU shield to your precise performance requirements.

AD-MU FOILS PROVIDE ECONOMICAL SHIELDING

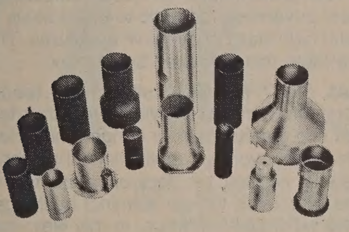
1. Cut and contour in minutes to exact desired shape.
2. Can eliminate costs of designing and manufacturing pre-fabricated shields in many instances.
3. Excellent for hard-to-get-at places.
4. Ideal for experimental applications to quickly determine exact amount of shielding required.
5. Useful in many production applications. Permit placing magnetically reacting components closer, compacting assemblies.

Heat treated; ready for instant use. Delivery from stock.

Widths: 4″, 15″.

Thicknesses: For AD-MU-78, .002″ (4″ width only), .004″, .006″, .010″. For AD-MU-00, .004″ only.

AD-MU-78 OR 80 HIGH PERMEABILITY SHIELDS FIT 334 TYPES OF PHOTOMULTIPLIER TUBES



For your special application or specific magnetic environment, our engineers can either modify a stock shield or custom design a shield to your exact requirement.

AD-MU SHEET STOCK — DELIVERY FROM STOCK

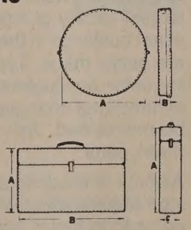
Order Low (AD-MU-00), Medium (AD-MU-48), and/or High (AD-MU-80) Permeability Stock as Required.

For the convenience of those preferring to design and manufacture magnetic shields in-house. Easy to work: bend, stamp, draw, finish, etc. on ordinary sheet metal working equipment. SHIELDS MUST BE HEAT TREATED before finishing by plating, MIL spec painting, etc.

Sheet dimensions: 30″ x 120″.

Thicknesses: .014″, .020″, .025″, .031″, .040″, .050″ and .062″.

STURDY AD-MU TAPE DATA PROTECTORS



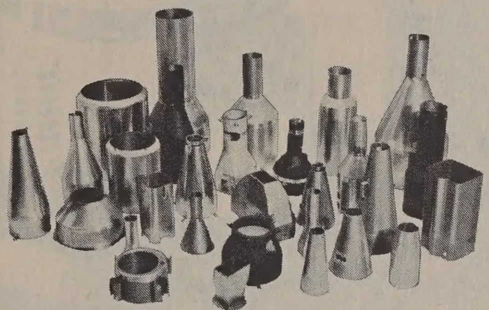
1. Assure fidelity by keeping vital recorded data on magnetic tapes free from distortions caused by unforeseen external magnetic fields.
2. Minimize erasure accidents during safekeeping or transport.
3. Deter the covert saboteur or vandal.
4. Invaluable insurance against possible expensive or irreplaceable losses.

AD-MU CRT SHIELDS

Eliminate the reactive effects of external magnetic fields on the electron beam. Contact our Engineering Department for help in designing and manufacturing the best shield for your application.

Ad-Vance Magnetics, the Problem Solving Magnetic Shielding Specialists, is the industry's largest, oldest and most experienced firm specializing in magnetic shielding. Our shielding is everywhere: off-planet in spacecraft and satellites, and planet-wide in exacting industrial, military, laboratory and consumer applications.

AD-MU CUSTOM FABRICATED SHIELDS FOR COMPONENTS AND SYSTEMS



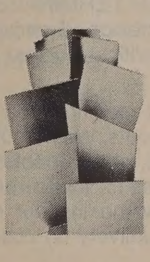
From the simplest component to the most complex system, Ad-Vance Magnetics can design and make the shields you need . . . for magnetic isolation test chambers, for low field research, magnetic shielding components required in systems (such as CRTs), transformers, motors, tachometers, reed relays and computers, dewars for cryogenic or geophysical research, video cameras, scan converters, etc.

COMPLETE FACILITIES IN 2 LARGE MODERN PLANTS

Up-to-date equipment for all types of metal forming, heliarc and spot welding, processing control of heat treating and finishing . . . complete in-house tool room . . . in-house quality control . . . experienced engineering and design services unequalled in the industry.

PHYSICAL CHARACTERISTICS OF AD-MU ALLOYS

(FORMING QUALITY — NOT ANNEALED)



	AD-MU-80	AD-MU-78	AD-MU-48	AD-MU-00
density (grams/cm^3)	8.74	8.21	8.20	7.80
coefficient of expansion per degree C (20°/100°)	12.30 x 10^{-6}	12.42 x 10^{-6}	9.38 x 10^{-6}	13.10 x 10^{-6}
tensile, strength (lbs/in^2 x 10^3)	99.0	85.0	73.0	45.0
yield point (lbs/in^2 x 10^3)	35.0	32.5	29.5	28.0
hardness (rockwell B)	65/80	65/75	65/75	20/40
modulus of elasticity (lbs/in^2 x 10^6)	32.0	30.0	24.0	29.5
melting point degrees C	1450	1470	1425	1525
shear point (x 10^3 psi)	—	42.75	—	35.00
elongation (% in 2″ section)	32	35	33	—

AD-MU ALLOYS PROTECT PERMANENTLY

• Will not saturate when properly used • No excessive loss of permeability from shock • Relatively stable permeability characteristics after final anneal, avoiding the expense and inconvenience of regularly repeated annealings • Minimum retentivity for any alloy of a given permeability.

Ad-Vance engineers are magnetic shielding specialists. Contact our Engineering Department for help with your current magnetic shielding problems. Request Ad-Vance's complete 44-page catalog featuring advanced shielding techniques and components.

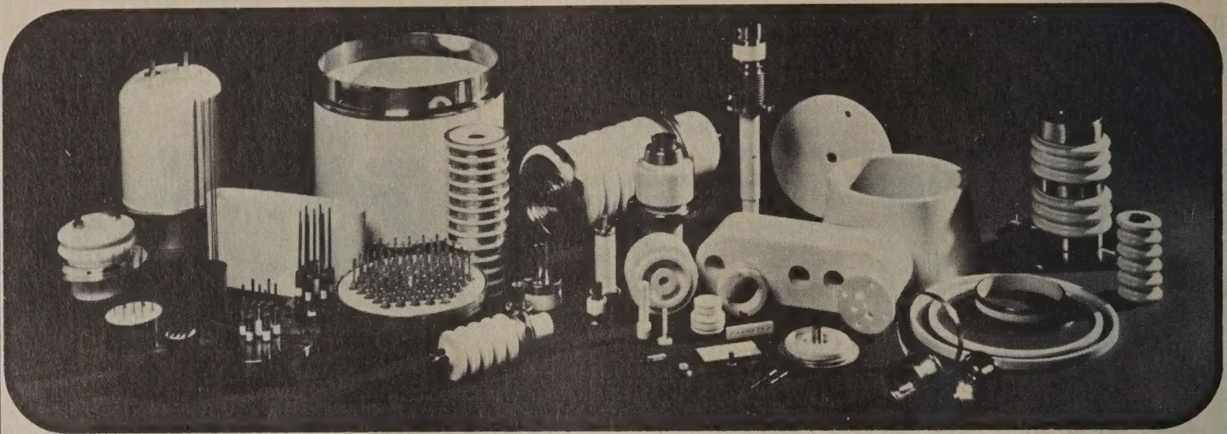
AD-VANCE MAGNETICS, INC., 226 E. SEVENTH ST. / ROCHESTER, IND. 46975 / (219) 223-3158 / TWX 810-290-0294

ALBEROX ... *For outstanding performance in high temperature, hermetic terminals.*

We're SPECIALISTS in brazing METAL parts to high alumina CERAMICS for demanding HIGH TEMPERATURE, HERMETIC applications.

CUSTOM HERMETIC CONNECTORS Multipin hermetic connectors for demanding vacuum and space applications requiring 400°C. bakeout — conditions where glass connectors won't stand up — are being produced in a variety of configurations. To save cost, Alberox can also provide connector sub-assemblies such as pin decks to be brazed or welded into shells or flanges by the customer.

MINIATURE TUBE AND PIN SEALS Many high temperature applications require insulated pin or tube feedthrus. These are available with weldable or brazeable metal parts, and can be added to covers or flanges, etc. All Alberox feedthrus are suitable for cryogenic environments.



Since 1961, we have designed and produced a wide variety of seals for custom applications in diverse components such as . . .

- VACUUM FEEDTHRU TERMINALS
- CERAMIC ELECTRON TUBE AND VACUUM SWITCH ENVELOPES
- NUCLEAR REACTOR PENETRATOR FEEDTHRU TERMINALS and INSULATORS
- SQUIBB and DETONATOR CONNECTORS
- POWER SEMICONDUCTOR HOUSINGS
- SPACE FLIGHT HERMETIC CONNECTORS
- JET ENGINE THERMOCOUPLE COMPONENTS
- HIGH PRESSURE OIL WELL LOGGING FEEDTHRUS
- CAPACITORS and TRANSFORMER TERMINALS

In addition to the above, Alberox has designed and produced state-of-the-art components for critical nuclear devices.

The Alberox plant was designed and built specifically for the efficient production of ceramic-to-metal seals. We manufacture our own A-950 high alumina ceramic, which enables us to optimize on the best metalizing process for this ceramic; thus we can provide superior seals. By making our own ceramic, our customers benefit by fast delivery on custom designs.

Another important feature of Alberox is that all of the plating requirements are met "in-house", including nickel, gold, copper, silver, bright tin and solder plating!

We have several types of BRAZING FURNACES for brazing ceramic-to-metal and metal-to-metal parts in HIGH VACUUM, or HYDROGEN, ARGON or any other specified atmosphere! The standard operating procedure is to custom program the brazing cycle, taking into account the ceramic, the types of metals, braze materials and the atmosphere.

Alberox exercises complete control, from the design stage right through all manufacturing operations — to meet or exceed the highest quality standards and maintain the fastest delivery in the industry. Products made by Alberox are assured to outperform all design parameters set for them!

HIGH PRESSURE FEEDTHRUS *Alberox A-950 Alumina* has extraordinarily high compressive strength (350,000 psi). By using this strength to its best advantage, ceramic-to-metal seals can be produced to withstand high static or dynamic pressures. Thousands of these seals have been manufactured by Alberox.

MULTITERMINAL FEEDTHRUS Multiterminal feedthrus differ from multipin connectors in that individual feedthru terminals are brazed or welded into a metal deck or flange. These feedthrus are generally used for higher voltage applications than can be accommodated by a regular ceramic pin deck or connector. Alberox has an extensive line of catalog tubular terminal bushings which are often used for the individual feedthrus. In this way, custom multiterminal feedthrus can be delivered quickly.

POWER FEEDTHRUS Copper, or just about any other type of metal, from ⅛ inch to over 1 inch in diameter can be provided in power feedthrus. Modifications of our standard catalog tubular and fluted terminal bushings are often perfectly suited, and custom ceramic-to-metal seal designs can be easily accommodated. Weldable or brazeable flanges also can be added to the feedthrus to allow easy installation on existing flanges or bulkheads.

INSULATORS AND STANDOFFS Insulators and standoffs can be supplied in tubular or fluted shapes, bare or glazed, with or without metal adapters or studs. Alberox manufactures plain ceramic parts for use as spacers, insulators, supports, isolators, decks, or washers. Metalized and glazed cylinders are also available for envelopes of high power electron tubes such as Thyratrons or for vacuum switches.

CATALOG HIGH VOLTAGE BUSHINGS Alberox stocks the largest variety of high voltage tubular and fluted high alumina terminal bushings in the industry. Modifications to these catalog items are easily made. Typical modifications are: special studs, brazed-in-center conductors, different metal parts, finishes and ceramic dimensional changes. Fast delivery at reasonable prices can still be maintained. Ask for Catalog #472 which illustrates details of these parts.

Alberox is ready to assist you with your ceramic-to-metal seal design requirements. When you need FAST DELIVERY of SUPERB ceramic-to-metal seals, at realistic prices — contact ALBEROX.

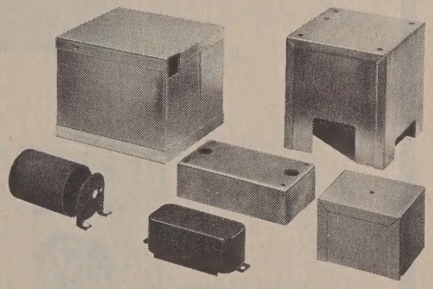
ALBEROX CORPORATION
Industrial Park
New Bedford, Massachusetts 02745
Phone 617-995-1725

Big shielding problem?

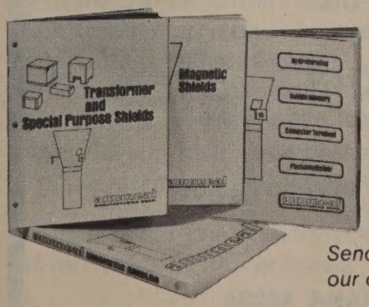
How's this for size?

This magnetic shield was built by Amuneal for a critical military radar application. Even though the shield is pretty large, it's the size of the *problem* that we're talking about. The specifications called for extremely tight dimensional tolerances and the most stringent electrical performance characteristics we have ever encountered. All this, plus the fact that we had only six weeks to design it, determine the best method of fabrication, tool up, build it, perform complete analytical testing, and deliver. This is just one example of Amuneal's performance in designing and manufacturing magnetic shields to meet all kinds of tough specifications. If you have a shielding problem, big or little, talk it over with us. A phone call is all it takes.

Cathode Ray Tube Shields
Photomultiplier Tube Shields
Printed Circuit Shields
Transformer Shields
Computer Terminal Shields
Power Supply Shields
Bubble Memory Shields
Motor Shields
Shielded Test Chambers
Storage Tube Shields
Special Application Shields
Wrap-around Foil Shielding

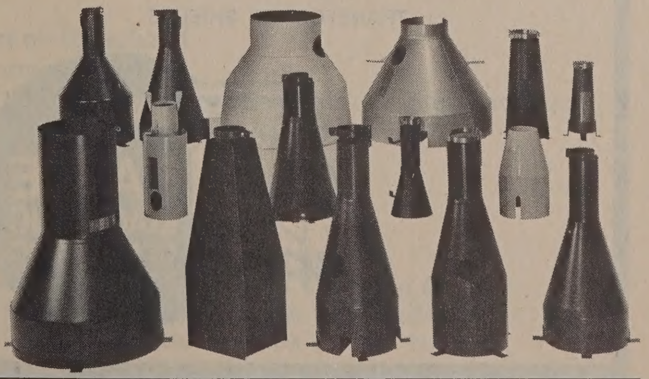


In-house Hydroforming and Hydrogen Annealing
Design & Prototype Assistance
Complete Tool & Die Making



Send for your free copy of our complete facilities catalog.

Shields for Magnetic-Sensitive Tubes and Components



amuneal
MANUFACTURING CORP.
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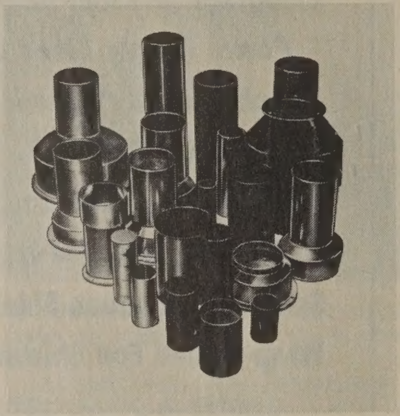
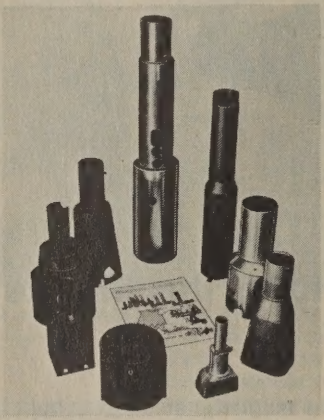
Magnetic Shielding by Eagle

Call us whenever you have a problem in magnetic shielding. With a 29-year background in shield design and production, we can probably help you save time, money and headaches.

Custom Shields • Standard Shields • Sheet • Foil • Design Engineering • Fabrication • Heat Treating • Testing • Finishing


PHOTOMULTIPLIER TUBE SHIELDS


CATHODE RAY TUBE SHIELDS

SHIELDS FOR MEDICAL INSTRUMENTS

Magnetic Shielding
EAGLE
SHIELDS • SHEET • FOIL
TRANSFORMER SHIELDS

Sheet and Foil for Every Need

Eagle "AAA" High permeability against low level fields
Eagle "A" Low permeability against high level fields

SHEET

For forming, bending, drawing

Eagle "AAA"
Dimensions: 30″ x 120″
Thickness: .014, .020, .025, .030, .040, .050 and .062

Eagle "A"
Dimensions: 36″ x 96″
Thickness: .014, .020, .025, .030, .050 and .062

FOIL

Plain or with adhesive backing

Eagle "AAA"
Width: To 15″
Thickness: .004, .006 and .010

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INDIANAPOLIS, INDIANA

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INDIANAPOLIS, INDIANA 46224
PHONE (317) 297-1030

John L. Coddington, President

Ferrite Cores for the Electronics Industry.

FAIR-RITE

Where innovation is an everyday event.

The better-known characteristics of ferrites have been exploited for three decades: high permeability, low losses at high frequencies, high volume resistivity; reasonable cost....

IF transformers; antennas; high frequency, high Q inductors; high voltage transformers; deflection components; TV balun transformers and a host of other devices have been designed around ferrite cores.

Yet the lesser-known properties of ferrites offer the potential for still more innovative applications.

Want to know about the solutions our ferrite cores can offer?

Ask for our application notes on the wide variety of shield beads we produce, and see how the uncommon attenuation characteristics of ferrites can help solve EMI/RFI suppression problems.

Ask for our notes on broadband matching transformers, and discover how 98% efficiency can be achieved in handling kilowatts of power.

Investigate the use of ferrite toroids and beads in high frequency linear amplifiers, and shrink the size and voltage requirements for output stages of HF transmitters.

Switch-mode power supplies; saturable reactors... let us help you innovate. Write, phone or TWX us.

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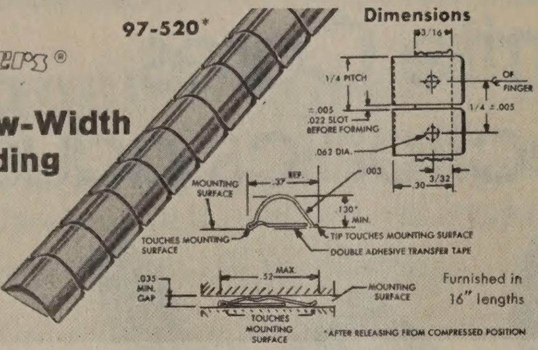
Factory & Midwest Sales Office: Palestine, Illinois 62451 · 618-586-2556 TWX 510-525-1712
Foreign Affiliate: Numex, S. A., APDO 16-010, Mexico 16, D. F. Mexico

Sticky Fingers®

New Narrow-Width High Shielding Finger Contact Strips


97-520*
Dimensions
3/16
1/4 PITCH
OF FINGER
±.005
.022 SLOT BEFORE FORMING
1/4 ±.005
.062 DIA.
.003
30
3/32
MOUNTING SURFACE
.37
REF.
.130" MIN.
TOUCHES MOUNTING SURFACE
TIP TOUCHES MOUNTING SURFACE
DOUBLE ADHESIVE TRANSFER TAPE
.035 MIN. GAP
.52 MAX.
MOUNTING SURFACE
TOUCHES MOUNTING SURFACE
*AFTER RELEASING FROM COMPRESSED POSITION

Furnished in 16" lengths

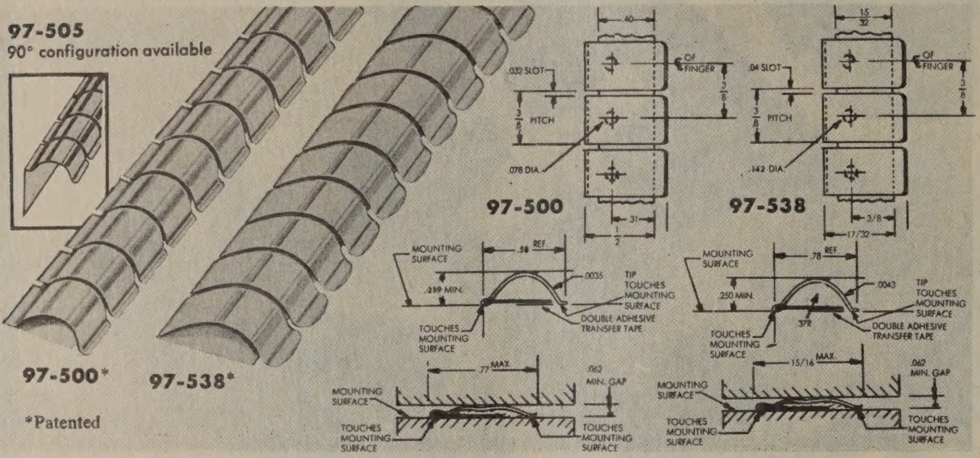
*Patented

A smaller size Sticky-Fingers beryllium copper contact strip, providing high RFI/EMI shielding effectiveness in less space.

Series 97-520* measures just 3/8" wide, and 1/2" at maximum deflection. Yet, it provides shielding effectiveness greater than 92 dB at 1 MHz magnetic and 92 dB at 10 GHz plane wave, and has a dynamic range of 0.10".

It is ideal as an all-purpose contact strip for metal cabinets and electronic enclosures where space is critical. Series 97-520 is especially recommended where variations exist in the space to be shielded and in applica-

97-505
90° configuration available


40
.032 SLOT
OF FINGER
3/8
3/8 PITCH
.078 DIA.
31
1/2
97-500
15/32
.04 SLOT
OF FINGER
3/8
3/8 PITCH
.142 DIA.
3/8
17/32
97-538
MOUNTING SURFACE
.58 REF.
.0035
TIP TOUCHES MOUNTING SURFACE
.239 MIN.
TOUCHES MOUNTING SURFACE
DOUBLE ADHESIVE TRANSFER TAPE
.77 MAX.
.062 MIN. GAP
MOUNTING SURFACE
.78 REF.
.0043
.250 MIN.
37R
15/16 MAX.

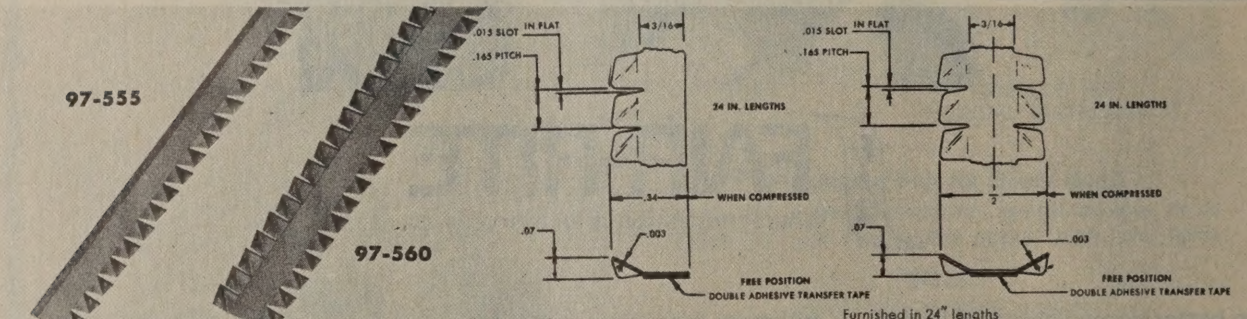
97-500* **97-538***

*Patented

Sticky Fingers®

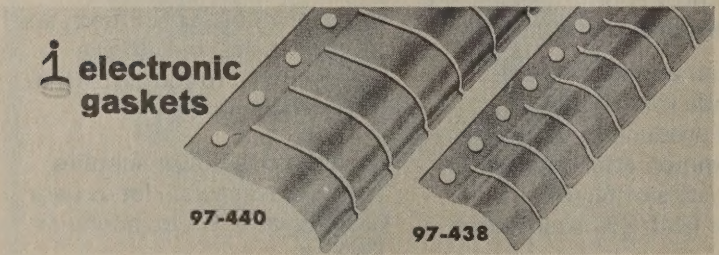
—a New Concept in Instant RFI/EMI Shielding

High-performance beryllium copper finger contact strips . . . each with its own self-adhesive backing . . . provide an extremely tight, instant bond. To install, simply peel off the protective paper backing . . . place strip into position . . . and press down firmly. Seals instantly to shield against RFI/EMI interference in all types of metal cabinets and electronic enclosures.
The adhesive strengthens as it cures with age. Moreover, the


97-555
97-560
.015 SLOT
IN FLAT
.165 PITCH
3/16
24 IN. LENGTHS
.34
WHEN COMPRESSED
.07
.003
FREE POSITION
DOUBLE ADHESIVE TRANSFER TAPE
1/2

Furnished in 24" lengths

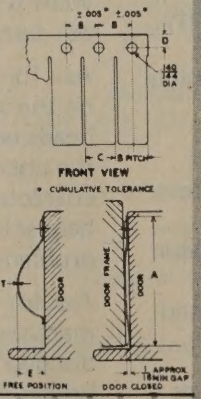
electronic gaskets


97-440
97-438

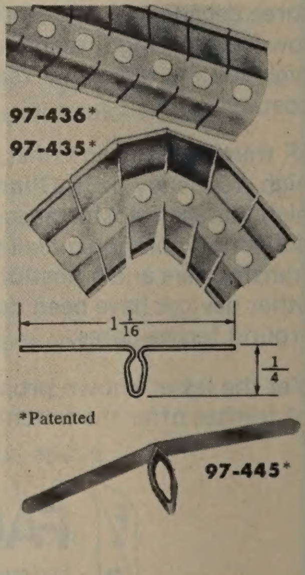
These standard beryllium copper contact strips offer ideal RFI/EMI shielding of doors and movable components in electronic screen rooms, trailers, computers and communication equipment.

They have been scientifically designed for wiping closures, but are also useable in compression. Moreover, these contact strips feature extremely good endurance life as well as a high dynamic range. In tests, attenuation up to 100 dB has been measured at 400 MHz and 10 GHz. Fastening of strip is usually accomplished using screws or rivets. Soldering is optional.

For pricing, please advise catalog number, total footage and surface finish required.


±.005* ±.005*
B
B
D
.140/.144 DIA
C
B PITCH
FRONT VIEW
* CUMULATIVE TOLERANCE
T
DOOR
DOOR FRAME
DOOR
A
E
FREE POSITION
1/16 APPROX. MIN GAP
DOOR CLOSED

CAT. NO.	A	B	C	D	E	T
97 - 438	1 9/32	3/8	.335	5/32	1/4	.005
97 - 440	1.90	1/2	.460	3/16	13/32	.007


97-436*
97-435*
1 1/16
1/4
97-445*

*Patented

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INSTRUMENT SPECIALTIES COMPANY, INC.
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tions that require high shielding effectiveness despite frequent opening and closing of the cabinet.

Series 97-520 when tested per Military Standard MIL-STD-285 for electromagnetic shielding, showed superior performance under increased compression. It is supplied in standard 16" lengths, and in a variety of surface finishes.

*Patented

Typical Performance Capabilities*

*An independent testing laboratory has indicated the following performance:

Frequency	Field	Shielding Effectiveness (Fully Deflected) 97-520 at .045" Gap	97-520 at .090" Gap
14 kHz	Magnetic	63dB	38dB
200 kHz		81	57
1 MHz		>92	>92
1 MHz	Electric	>126	>126
18 MHz		>120	>120
400 MHz	Plane Wave	118	111
1 GHz		78	100
10 GHz		92	82

Approx. Pressure Required in Pounds/Linear Foot

	97-520
Deflected to .090" height	26 lbs./ft.
.060" height	37 lbs./ft.

Standard finishes available

Add proper suffix to catalog number

-A	-Bright (stock)	-G	-Gold
-SnPb	-Tin Lead	-S	-Silver
-CdC	-Cadmium Plate plus Chromate		

Other finishes available on special order.

geometry of the strip design, continually compressed, further assists in strengthening the bond. Soldering or mechanical fastenings are completely eliminated. Shielding effectiveness of 97-500 has been proved greater than 46 dB at 14 kHz magnetic and 108 dB at 10 GHz plane wave.

STICKY FINGERS are unaffected in temperature ranges from —65 F. to 225 F. The adhesive meets salt spray, shock and humidity cycle tests, and complies with MIL-D-8634, MIL-N-25076 and MIL-P-19834A.

Furnished in approximately 24" lengths, cut to the center of nearest slot.

Typical Performance Capabilities

Frequency	Field	Shielding Effectiveness At 1/16" Gap 97-500	At 1/8" Gap 97-500
60 Hz	Magnetic	12dB	–
400 Hz		14	–
14 kHz		46	38dB
200 kHz		70	63
1 MHz		≥90	≥90
1 MHz	Electric	≥120dB	≥120dB
18 MHz		≥145	≥145
400 MHz	Plane Wave	117	109
1 GHz		104	100
10 GHz		≥108	100

Approx. Pressure Required in Pounds/Linear Foot

At 1/16" Gap: 36 lb/ft

At 1/8" Gap: 16 lb/ft

sticky fingers

Twist Series

Self-adhesive beryllium copper contact strips with scientific twist design offer narrower-than-ever electronic gaskets for general shielding applications where space is at a premium.

Series 97-555 single edge contact strip measures only ⅜" wide, yet shielding effectiveness is 71 dB at 14 kHz magnetic and 102 dB at 10 GHz plane wave. Ideal for all types of panels or electronic enclosures.

Series 97-560 strips for cabinets with panel-divider bars. Unique double edge design, ½" wide, permits panels to be easily removed and replaced without damage to the installed strip.

Typical Performance Capabilities

Frequency	Field	Shielding Effectiveness (Fully Deflected) 97-555	97-560
14 kHz	Magnetic	71dB	≥75dB
200 kHz		96	≥97
1 MHz	Electric	≥120	≥120
18 MHz		≥120	≥120
400 MHz	Plane Wave	≥115	≥115
1 GHz		≥106	≥106
10 GHz		102	≥126

Approx. Pressure Required in Pounds/Linear Foot

	97-555	97-560
Deflected to .030" height	30 lbs./ft.	48 lbs./ft.
.015" height	67 lbs./ft.	72 lbs./ft.

Balanced Finger Strips offer 90° corners and quick spring clip fastening.

When contact strips are required for rectangular openings or structural joints, they can be quickly and easily installed in field or factory.

Matching 90° corners provide a perfect fit and spring clips hold the strips firmly in place. (No special tools or soldering required.) Result: More simplified design and construction of cabinets and enclosures.

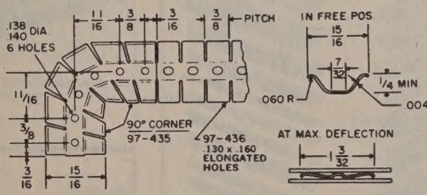
These strips feature a mechanically balanced design to provide high dynamic range, long endurance life and multiple lines of contact under relatively light pressure. Attenuation of more than 100 dB at 200 kHz, 400 MHz and 10 GHz has been measured for a single, rectangular enclosure using Series 97-436 gaskets.

Spring Clip Fastener

Designed for use with Series 97-436 and Series 97-435 finger strips. Permits full strip compression, yet is easily installed without special tools. Fastener also permits temporary lifting of gaskets for cleaning of contact surfaces.

Advise Catalog number, total footage, and surface finish for pricing.

cat. no.	max. length*	finish*
97-436-A	35 ft.	Bright
97-436-S	25 ft.	Silver Plated .0002" ± .0001
97-436-G	25 ft.	Gold Plated .000050" min.



prefabricated 90° corners	cat. no.	finish*
(advise number of corners needed.)	97-435-A 97-435-S 97-435-G	Bright Silver Plated .0002" ± .0001 Gold Plated .000050" min.
spring clip fastener	**cat. no.**	**finish***
packaged in lots of 100, 200, 500, or 1000 (advise total quantity needed.)	97-445-A 97-445-S 97-445-G	Bright Silver Plated .0002" ± .0001 Gold Plated .000050" min.

*Specified lengths and other finishes to order

finger contact strips

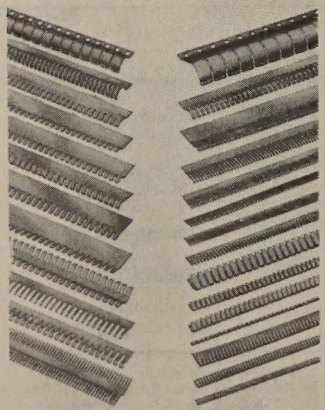
of MICRO-PROCESSED ***beryllium copper, alloy 25***

for grounding and shielding in high-frequency equipment . . . for forming large-diameter contact rings

A wide variety of beryllium copper finger contact strips provides engineers and designers with flexibility in the solution of grounding and shielding problems. Various lengths, widths, contours and hole locations are possible for many of the standard catalog items shown here.

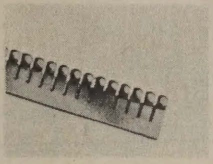
Engineering Design Kit Available

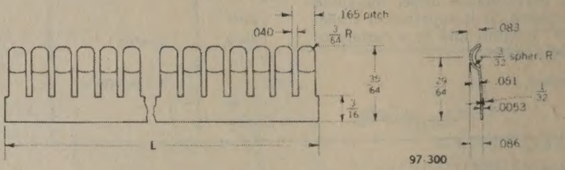
An Engineering Design Kit is available to permit the engineer the utmost latitude in his search for the exact strip configuration to effectively meet his needs. Each assortment contains at least 34 items.



Order assortment by Number 97-272. Price: $25.00

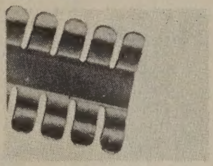
figure A

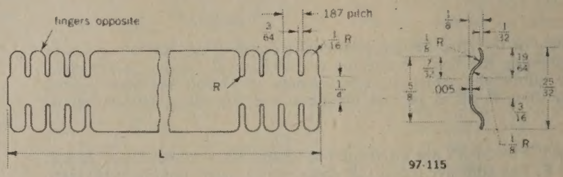



165 pitch
040
$\frac{3}{64}$ R
$\frac{35}{64}$
$\frac{3}{16}$
L
083
$\frac{3}{32}$ spher. R
$\frac{29}{64}$
061
$\frac{1}{32}$
0053
086
97-300

CONTIPS available

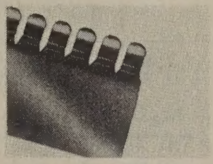
figure B

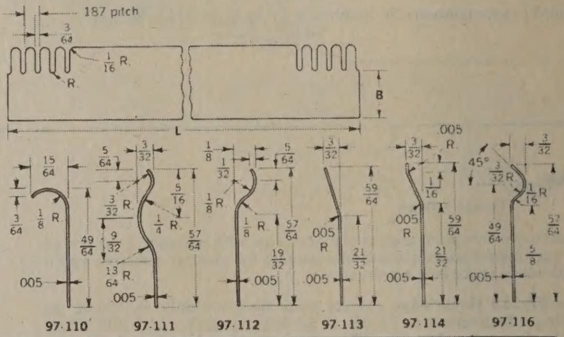



fingers opposite
187 pitch
$\frac{3}{64}$
$\frac{1}{16}$ R
R
$\frac{1}{4}$
L
$\frac{1}{8}$ R
$\frac{1}{32}$
$\frac{19}{64}$
$\frac{25}{32}$
$\frac{5}{8}$
005
$\frac{3}{16}$
97-115

CONTIPS available

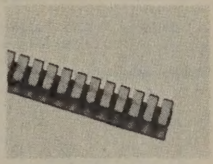
figure C

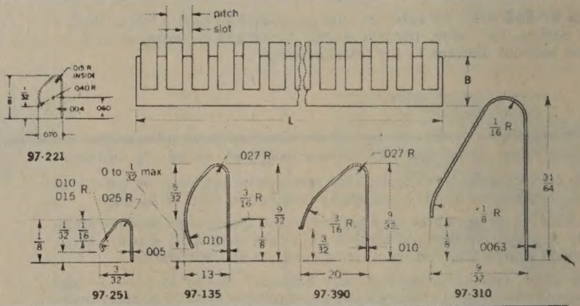



187 pitch
$\frac{3}{64}$
$\frac{1}{16}$ R
R
B
L
97-110
97-111
97-112
97-113
97-114
97-116

CONTIPS available on 97-111, 97-112, 97-114 and 97-116 only

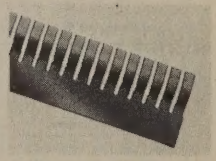
figure D

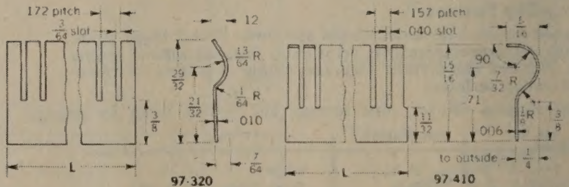



pitch
slot
B
L
97-221
0 to $\frac{1}{32}$ max
027 R
025 R
010
015 R
005
13
20
0063
97-251
97-135
97-390
97-310

not available with CONTIPS

figure E

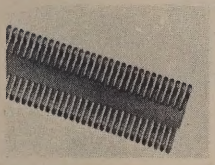



172 pitch
$\frac{3}{64}$ slot
L
12
$\frac{13}{64}$ R
$\frac{29}{32}$
$\frac{21}{32}$
$\frac{1}{64}$ R
010
$\frac{7}{64}$
97-320
157 pitch
040 slot
90°
71°
006
to outside $\frac{1}{4}$
97-410

CONTIPS available

precision springs of beryllium copper

figure F



CONTIPS available

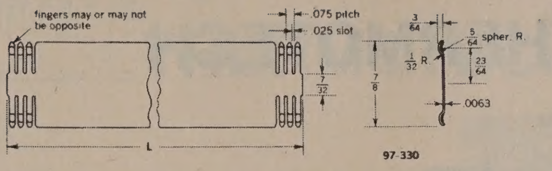
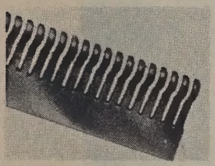

fingers may or may not be opposite
.075 pitch
.025 slot
7/32
7/8
L
3/64
5/64 spher. R.
1/32 R.
23/64
.0063
97-330

figure G



CONTIPS available

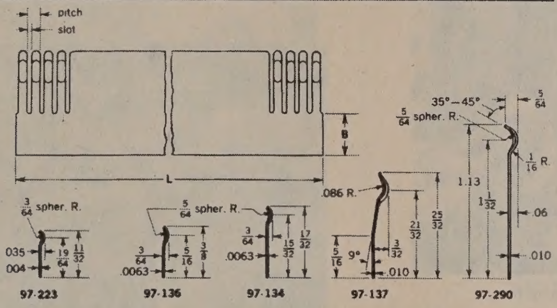
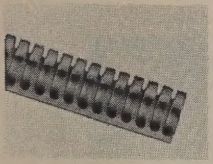

pitch
slot
B
L
35°—45°
5/64 spher. R.
5/64
1/16 R.
.086 R.
1.13
1 1/32
.06
3/64 spher. R.
5/64 spher. R.
.035
.004
19/64
11/32
3/64
5/16
3/8
.0063
3/64
15/32
17/32
.0063
5/16
9°
3/32
21/32
25/32
.010
.010
97-223
97-136
97-134
97-137
97-290

figure H



CONTIPS available

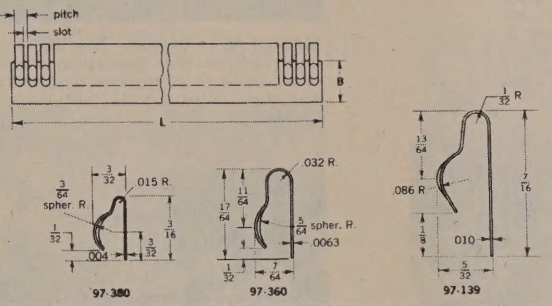

pitch
slot
B
L
1/32 R
3/64 spher. R
3/32
.015 R.
1/32
3/16
3/32
.004
.032 R.
11/64
17/64
5/64 spher. R.
.0063
1/32
7/64
13/64
.086 R
7/16
1/8
.010
5/32
97-380
97-360
97-139

figure I

not available with CONTIPS

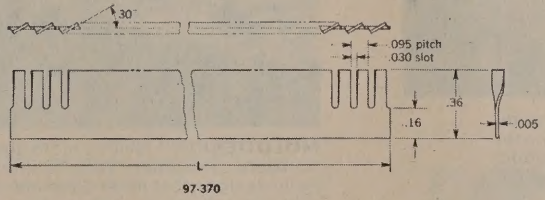
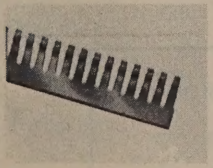
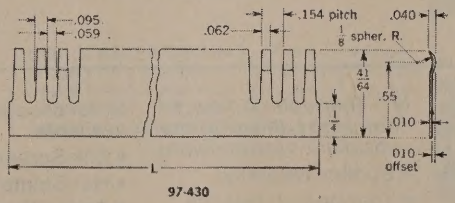

30°
.095 pitch
.030 slot
.36
.16
.005
L
97-370

figure J



CONTIPS available


.095
.059
.062
.154 pitch
.040
1/8 spher. R.
41/64
.55
1/4
.010
.010 offset
L
97-430

dimensions in inches

catalog number	fig-ure	pitch	slot	B	stock length L■	wt. per 1000 in., lb
97-110	C	.187	.047	⅝	16	1.3
97-111	C	.187	.047	⅝	16	1.3
97-112	C	.187	.047	⅝	16	1.3
97-113	C	.187	.047	⅝	16	1.3
97-114	C	.187	.047	⅝	16	1.3
97-115	B	.187	.047		16	1.1
97-116	C	.187	.047	41⁄64	16	1.3
97-134	G	.075	.025	7⁄32	16	.9
97-135	D	.134	.040	15⁄64	16	1.4
97-136	G	.075	.025	1⁄16	16	.6
97-137	G	.094	.031	5⁄16	16	2.0
97-139	H	.094	.031	5⁄16	16	2.0
97-221	D	.060	.020	3⁄32	12	.3
97-223	G	.060	.020	⅛	16	.35
97-251	D	.127	.050	3⁄32	12	.3
97-290	G	.075	.025	11⁄16	16	3.0
97-300	A	.165	.040	3⁄16	16	.8
97-310	D	.187	.062	⅜	16	1.4
97-320	E	.172	.047	⅜	16	2.4
97-330	F	.075	.025		16	1.3
97-360	H	.075	.025	7⁄32	16	.9
97-370	I	.095	.030	.16	16	.43
97-380	H	.060	.020	⅛	16	.35
97-390	D	.134	.040	15⁄64	16	1.4
97-410	E	.157	.040	11⁄32	16	1.8
97-430	J	.154	.059	¼	16	1.4

■ **lengths:** Stock lengths supplied unless shorter lengths are specified . . . cut to nearest slot. Specified lengths may have partial fingers removed.

widths: Other widths and special contours available to order.

standard finishes

	add suffix to catalog number
as heat-treated user to apply finish	—H
bright finish for welding, soldering	—A
silver plated .0002 (±.0001) inch thick	—S
gold plated .000050 in. min.	—G

other finishes to specification

CONTIPS

localized deposits of silver or gold (see page 8)

	add suffix to catalog number
SILVER CONTIPS only	—K
SILVER CONTIPS plus silver plating	—KS
GOLD CONTIPS only	—GK
GOLD CONTIPS plus gold plating	—GKG

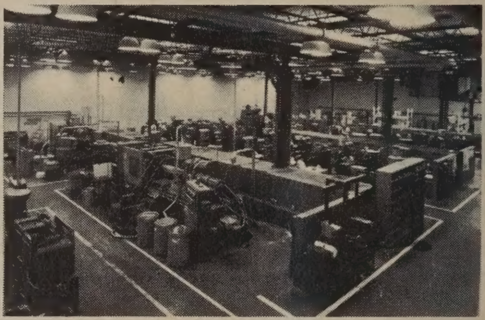
Write for Free Catalog Today!

INSTRUMENT SPECIALTIES COMPANY, INC.

276 Bergen Boulevard, Little Falls, N.J. 07424
Phone: 201-256-3500 TWX: 710-988-5732

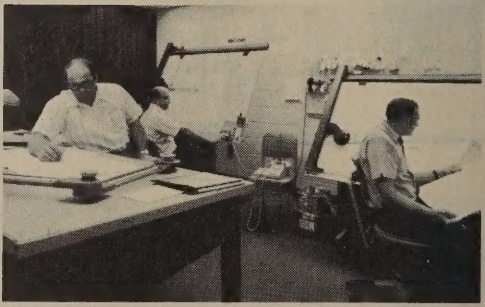
People make the big difference at ITT THERMOTECH

QUALITY CONTROL—Constant attention and adherence to strict quality control assures consistent part characteristics from run to re-run, press to press and within each lot.



MANUFACTURING—Over 200 injection, compression and transfer presses, from one ounce to 25 ounces and as large as 450 tons, offer a wide latitude for short and long runs.

COMPUTER FACILITIES—In-plant computer facilities are used for work order analysis, raw material control and production scheduling to insure fast, on time delivery of orders.



MOLD DESIGN—Skilled mold designers translate customer specifications into mold designs that meet customer's exact part cost, tolerances and quality requirements.

ITT THERMOTECH—The Full Service Molder—For a quarter of a century ITT Thermotech has served the nation's industrial and military markets with high quality custom and stock precision moldings. Employing close to 500 employees, Thermotech offers customers complete molding facilities for thermoplastic, thermoset and fluorocarbons plus secondary operations.

All tool room, manufacturing and inspection facilities have been approved by government agencies.

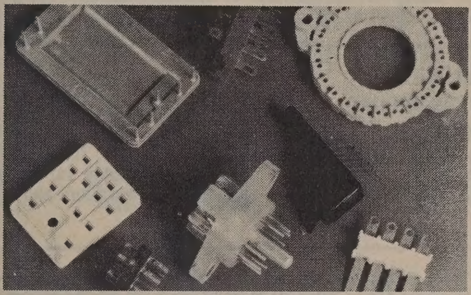
ITT Thermotech now encompasses these former subsidiaries and divisions:

- Booker Wallestad
- Thermotech Plastics
- Florida Division
- Wilcox Products
- Thermotech Coil Forms and Components

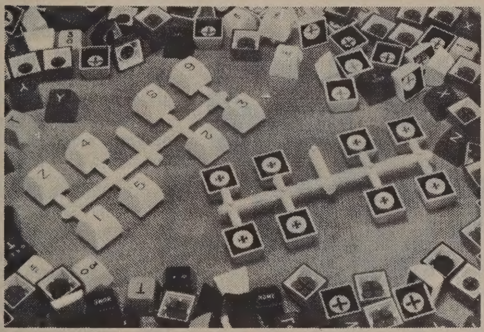
Other secondary services available:

- Silk Screening
- Hot Stamping
- Secondary Finishing
- Heat Sealing
- Sonic Welding
- Mold Maintenance

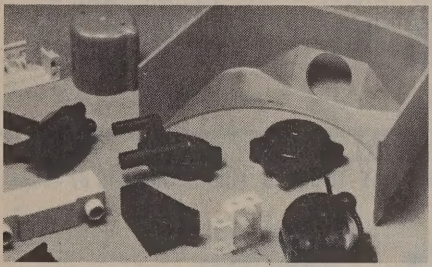
Precision makes the big difference at ITT THERMOTECH



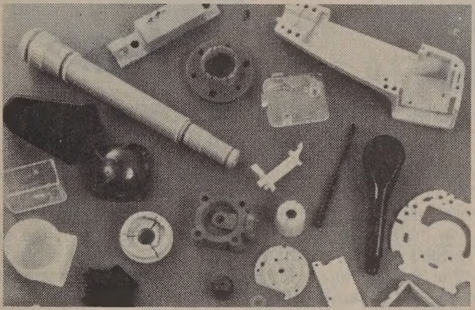
INSERTS—Highly automated equipment in both primary and secondary operations produce low-cost, precision parts with inserts for electrical/electronic components.



TWO COLOR KEYTOPS—An extensive library of stock and custom designed legends are available to meet all but the most unusual of alphanumeric and conventional control keytop needs.

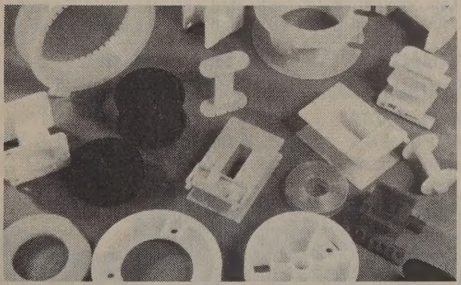


CASES AND HOUSING—Miniature or large cases and housings of thermoset, thermoplastic or fluorocarbons materials with a wide variety of characteristics and configurations are available in both short and long runs.



INTRICATE PARTS—Intricate configurations and shapes in a wide variety of plastics are commonplace challenges to design and production personnel.

COILS AND BOBBINS—Years of experience bring superior technical know-how to the design and manufacture of simple or intricate shapes and sizes, thin or heavy walled coil forms and bobbins.



ITT THERMOTECH

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Florida Division: 3200 Tyrone Blvd.,/St. Petersburg, Fla. 33710/(813) 347-2191

The INTER-TECHNICAL Group, Inc.

UNITED STATES AGENCY OF THE TELCON METALS GROUP OF COMPANIES

P. O. BOX 23
IRVINGTON, N. Y. 10533
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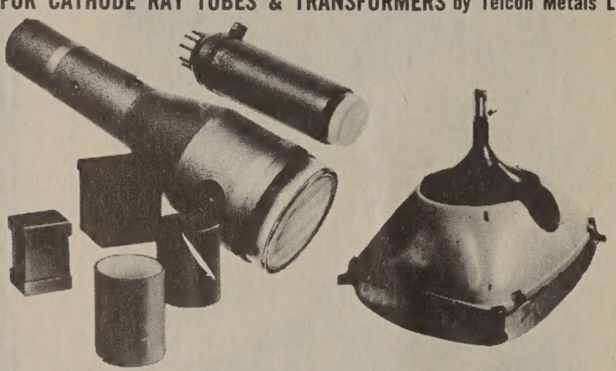
TWX: 710-564-0802

TELCON METALS LTD. is one of the largest manufacturers of nickel-iron and cobalt alloys for magnetic applications. Their fully integrated facilities provide raw materials and fabricated components covering the whole range of commonly used soft magnetic materials.

SOFT MAGNETIC ALLOYS SUPPLIED IN STRIP—ROD—BAR—WIRE—FOIL

NICKEL-IRON	COBALT-IRON	THERMOSTATIC BIMETALS
76% Nickel 50% Nickel 36% Nickel	PERMENDUR 49 PERMENDUR 24 SUPERMENDUR	We offer a complete selection of Telcon thermostatic bimetals for various temperature ranges and environments. Their varied mechanical properties, hardnesses, thermal activities, and thermal and electrical conductivities make it easy for the user to select the right one for his particular requirements. Available in thicknesses from .004″ to .125″ and widths as small as 1/16″ in coils and flat lengths.

MAGNETIC SHIELDS UP TO 30″ DIAMETER FOR CATHODE RAY TUBES & TRANSFORMERS by Telcon Metals Ltd.



MELTING, ROLLING, FABRICATING, ANNEALING FROM START TO FINISH IN ONE FACILITY

Telcon Metals, Ltd., has its own in-plant facilities to handle every phase of the magnetic shield manufacturing process from start to finish. This means 100% Telcon supervision all the way — from the melting and rolling of the raw material to the fabrication and annealing of the magnetic shield. Telcon's total production method is based on a century of experience in the manufacture of alloys. All these factors are your assurance that you get a sensibly priced, high quality product.

A NEW CONCEPT IN MAGNETIC SHIELD CONSTRUCTION

Specially developed for quantity production of high efficiency complex shields, new TELFORM construction utilizes precision drawn segments to drastically reduce welded seams. The result is extra close fitting shields with improved shielding characteristics. This new technique is applicable for CRT tubes up to approximately 20″ long. No premium charge even though dimensions, finish and appearance are far more uniform throughout batches than conventionally fabricated shields. Rapid delivery after initial tooling. Available in 80%, 50% and 36% nickel-iron alloys.

Extremely Competitive Prices on Custom Shields.
Send for Illustrated Catalog and Ask for a Quotation.

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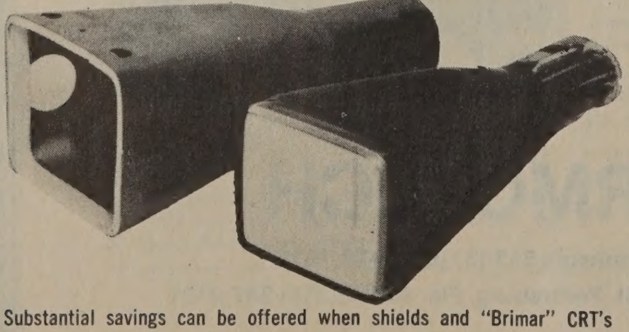
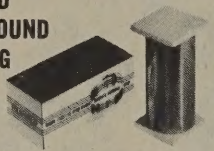
- High Permeability Strip, Rod & Wire for Component Manufacturing
- Glass to Metal Seal Alloys



Substantial savings can be offered when shields and "Brimar" CRT's are purchased as assemblies.

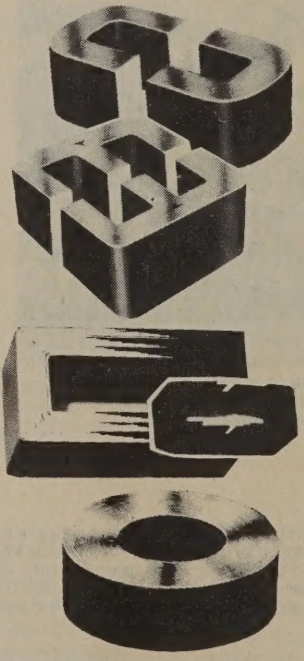
TELSHIELD WRAP-AROUND SHIELDING FOIL



Shield components efficiently, simply, from unwanted signals with easy-to-use Telshield. Available in 0.001 in.-0.010 in. thickness tape, in widths of 3/32 in-6 in. Special handy packs for laboratory and R & D use.

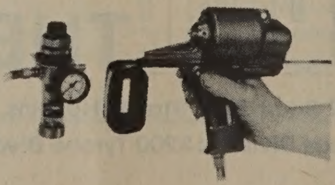
ALL ALLOYS AVAILABLE AS COMPONENTS FABRICATED IN HOUSE.

E, C AND TOROIDAL TAPE WOUND CORES BY TELCON MAGNETIC CORES, LTD.



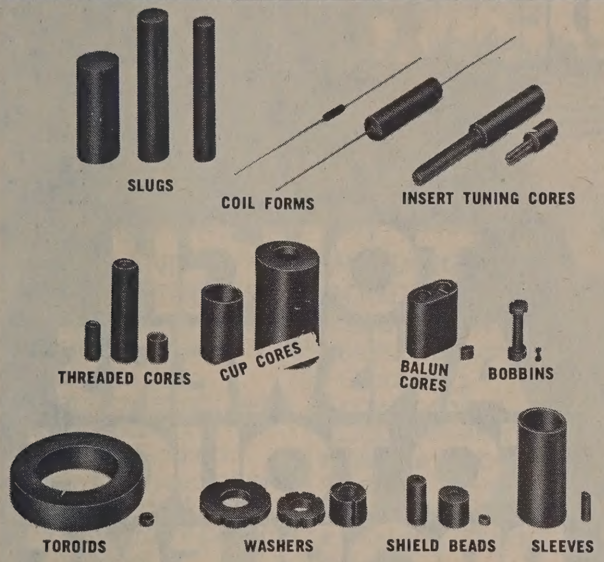
- Grain oriented Silicon Steel Cores.
- Made to EIA Spec. RS217 and trade specifications by our British assosiate TELCON MAGNETIC CORES LTD. . . . one of the largest manufacturers of grain oriented silicon steel components.
- Available in all American standard or special sizes to American core numbers. Popular types available from New York warehouse for immediate delivery.
- Sold at prices that help you solve your constantly rising cost level problem.
- Produced by one of the largest manufacturing facilities in the world.
- Now, also available, LL distributed gap cores for small transformers where temperature and/or gap VA may be problems. Can replace 4 to 6 mil cut cores, 6 mil laminations, and sometimes Ni-Fe laminations.
- Toroidal cores available in 2, 4, 6 and 12/13 mil tape thickness. Cores can be supplied impregnated or edge bonded for improved rigidity. Also available gapped or cut.

"C" CORE COMPRESSED AIR BANDING TOOL by TELMAG



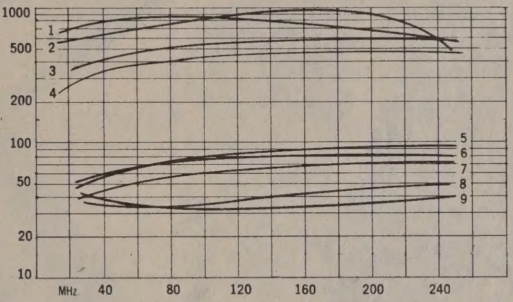
Manufacturing rejects caused by variations in banding of "C" transformer cores can now be eliminated. The new "C" core Compressed Air Banding Tool provides consistent banding stresses in assembly-line operation. By making cores useful which were formerly rejected, the tool soon pays for itself.

K KRYSTINEL FERRITE CORES



SHIELD BEADS (Partial Listing)

Dimensions (Inches)				Material	K-430	K-405	K-810	K-480	K-945
				Prefix	E49	E03	E31	E41	E50
HT.	O.D.	I.D.	ADD PREFIX HERE	Base No.	A (nh/N²) ± 20%				
.050	.138	.051		1F3Y-1G0	70	95	180	218	642
.128	.138	.051		3N3Y-1G0	181	244	460	561	1650
.128	.138	.062		3N3Y-1S0	137	185	350	425	1250
.125	.163	.062		3K4N-1S0	168	226	429	521	1530
.250	.163	.062		754N-1S0	337	453	858	1024	3060
.125	.190	.090		3K5F-2K0	130	175	331	400	1180
.250	.190	.090		755F-2K0	260	351	664	800	2370
.250	.200	.062		755Q-1S0	406	546	1034	1250	3690



1: WC41-B96R-25. **2:** WC49-B96R-25. **3:** WC41-B96R-15. **4:** WC49-B96R-15. **5:** E03-755Q-1S0, 1 turn. **6:** E41-755Q-1S0, 1 turn. **7:** E49-755Q-1S0, 1 turn. **8:** E46-755Q-1S0, 1 turn. **9:** E31-755Q-1S0, 1 turn.

WOUND CHOKE (6 HOLE BEAD)

Part Number	Dimensions			No. of Turns	No. of Windings	Impedance @ Freq.	
	L	O.D.	Lead			Min.Ω	MHz
WC41-B96R-15	.394	.236	1.562	1½	1	300	120
WC49-B96R-15	.394	.236	1.562	1½	1	400	240
WC41-B96R-25	.394	.236	1.562	2½	1	600	50
WC49-B96R-25	.394	.236	1.562	2½	1	700	180

LINEAR FERRITE CORES

Krystinel manufactures a complete line of standard and custom made ferrites. We maintain a large inventory of standard sizes and shapes as detailed in our catalog. Additionally, special ferrites can be made to your electrical and mechanical specifications if our standard parts do not satisfy your requirements.

Copies of our catalog, as well as samples and technical information, may be obtained by contacting us at our Port Chester office.

Please write to request information on our newly developed K-950 Series of ferrite materials which have been designed especially for pulse applications.

KRYSTINEL FERRITE MAGNETIC CHARACTERISTICS — MATERIALS

Characteristic	Unit	Symbol	K-505	K-502	K-401-1	K-420	K-430	K-405	K-204	K-810	K-480	K-820	K-915	K-945	K-940	K-960
Initial Permeability		μi	15	40	120	200	275	370	375	700	850	1500	1500	2700	4400	6000
Maximum Permeability		μMax.	40	100	300	750	1500	1200	700	1900	2500	2600	2500	4000	6300	7500
Coercive Force	Oersted	Hc	23	5.0	2.5	1.5	0.5	0.6	0.8	0.3	0.35	0.3	0.4	0.17	0.11	0.10
Saturation Flux Density	Gauss	Bsat	2200	2000	2800	2200	2100	3100	2700	3200	2800	4200	4750	4000	4000	3900
(@ H Oersted)		(H)	(20)	(20)	(20)	(12)	(8)	(15)	(10)	(5)	(4)	(6)	(7)	(5)	(2.5)	(2)
Residual Flux Density	Gauss	Br	1350	700	1600	1250	1200	2100	1100	1200	1400	1600	1750	950	920	750
Curie Temperature	°C	Tc	500	450	400	275	150	325	200	175	140	180	220	150	150	150
Volume Resistivity	Ohm-Cm	ρ	$2x10^4$	$1x10^6$	$1x10^7$	$1x10^6$	$1x10^8$	$1x10^8$	$3x10^3$	$4x10^1$	$5x10^6$	$5x10^1$	$1x10^2$	2x10	$2x10^1$	$2x10^1$
Temperature Change of Initial Permeability (0°C to 60°C)	%	$\frac{\triangle L \times 100}{L\ @\ 25°C}$	±5	±5	±6	±3	±12	±20	±8	±8	±10	±10	±10	±15	±15	±25
Loss Factor $X10^{-6}$		$\frac{\text{Tan. } \delta}{\mu i}$	325	60	20	50	20	30	12.5	27.0	25.0	6.0	4.0	10.0	10.0	9.0
@ Frequency	MHz		100	10	1	1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1

NOTES: 1. Normal tolerance of μi is ±20%. Permeability values vary with size of toroids used. A*l* values listed in the toroid section (Group L) reflect this variation. 2. For extended temperature ranges or tighter temperature coefficients of permeability, contact Krystinel Engineering Dept. 3. Loss data include both coil and core losses as read on a one inch dia. toroid for K-505, K-502, K-401-1, K-405 and K-204; and one half inch dia. toroid for K-810, K-915, K-925, K-940 and K-960. 4. Hysteresis loop data were taken using a D.C. balistic galvanometer @ 25°C.

BELOW IS A PARTIAL LISTING OF OUR TOROID LINE

MATERIALS

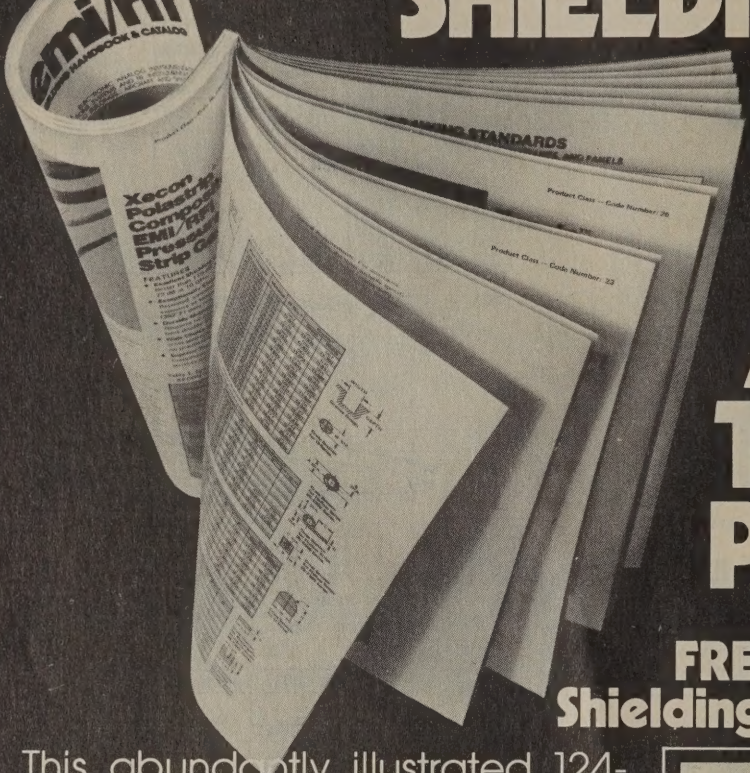
Dimensions (Inches)				Part No.	K-505	K-502	K-401-1	K-405	K-810	K-915	K-945	K-940	K-960	Cross Sectional Area Cm²	Magnetic Path Length Cm
				Prefix	L11	L10	L01	L03	L31	L27	L50	L38	L35		
O.D.	I.D.	HT.	Add Prefix Here	Base No.				A_L (nh/N²) ±20%							
.100	.070	.050		2V20-1F	1.4	4.0	10.0	33	62	152	245	393	536	.0048	.678
.138	.070	.050		3Y20-1F	2.7	7.5	19.0	61	116	282	465	730	994	.0109	.829
.155	.087	.050		4F2H-1F	2.3	6.4	16.0	53	99	242	395	626	854	.0109	.965
.190	.090	.050		5F2K-1F	2.9	8.0	21.1	67	127	272	500	798	1088	.0161	1.116
.230	.120	.060		6K3F-1Q	3.0	8.6	22.0	71	134	287	535	843	1150	.0213	1.396
.300	.125	.125		8K3K-3K	8.4	24.0	57.0	182	366	732	1500	1933	—	.0705	1.695
.375	.187	.125		AQ5C-3K	6.8	19.0	46.0	148	297	595	1200	1570	—	.0758	2.241
.500	.287	.250		EA87-75	11.0	31.0	76.0	240	480	960	1900	2542	—	.1717	3.138
.820	.500	.250		NFEA-75	9.8	28.0	68.0	215	430	860	1700	2278	—	.258	5.264

EXAMPLE: For K-502 toroid (.155 OD x .087 ID x .050 Ht.,) part number is L10-4F2H-1F

KRYSTINEL

KRYSTINEL CORPORATION
FOX ISLAND ROAD / PORT CHESTER, NEW YORK 10573
(914) 937-5252 / TWX 710-569-1604

EMI/RFI SHIELDING


emi/rfi
Xecon Polastrip Compo EMI/RFI Press Strip G
STANDARDS
Product Class — Code Number: 26
Product Class — Code Number: 23

TOUGH ANSWERS TO TOUGH PROBLEMS

FREE...New EMI/RFI Shielding Handbook & Catalog

This abundantly illustrated 124-page handbook presents...a thorough treatment of electromagnetic shielding...practical applications of shielding techniques...a complete guide to EMI/RFI gasket design...a glossary of EMI/RFI terms...and a catalog of products. Edited by the Metex Electronic Shielding Group, leading manufacturer of EMI/RFI shielding materials, components, subsystems. Phone, wire or write us on company letterhead to request your free copy of this new handbook, or to obtain more information on our other free technical services.

emi/rfi
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PLUS
Three more technical services

1 FREE Videotape Presentations
See and hear practical solutions to the problems associated with EMI/RFI shielding.

2 FREE Shielding Seminars
For small groups. Interface with EMI/RFI gasketing experts. Presentations oriented to the group interest. Color slides...videotapes...samples... question-and-answer sessions.

3 FREE Applications Engineering
Get concise, meaningful, technical assistance...technical briefs...personal consultation.

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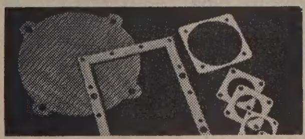
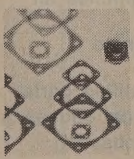
EMI/RFI shielding materials...components... sub-systems

The beginning of any answer to your EMI/RFI problems is right here.

GASKETS AND GASKET MATERIALS

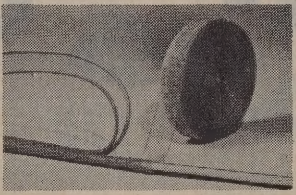
- Strip Gasketing...with and without environmental seal
- Sheet Gasketing...with pressure seal
- Standard Gaskets...including connector and waveguide gaskets...environmental or pressure seal optional
- Custom Gaskets...designed and factory-fabricated to customer specifications

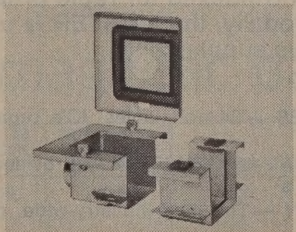
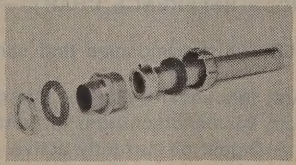




SHIELDING AND CONDUCTIVE COMPONENTS

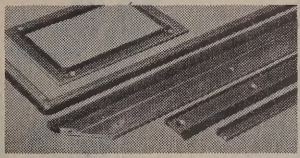
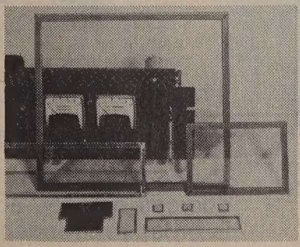
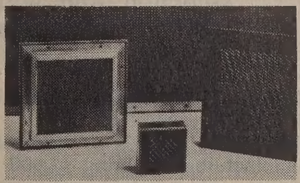
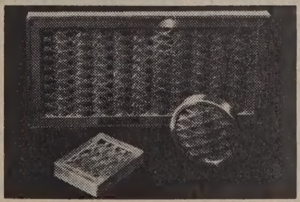
- Static Discharge Buttons
- Grounding Components
- Cable Shielding Tapes
- Flexible Cable-Shielding Covers
- Shielded Raceways
- Shielded Conduit Fittings



SHIELDING FRAMES AND ASSEMBLIES

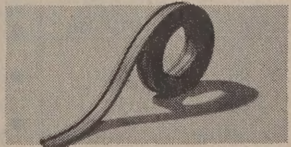
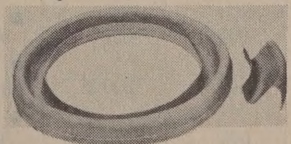
- Shielded Frames...ready-to-mount...pressure or weather seal optional
- Custom-Fabricated Frame Lengths...ready for customer assembly
- Bulk Frame-Strip Gasketing
- Shielded Windows...ready to install...custom-fabricated
- Shielded Ventilating Panels
- Shielded Air Filters

CONDUCTIVE-ELASTOMER EMI/RFI XECON® GASKETS AND COMPOUNDS*

- Composite EMI/Pressure-Seal Gasketing...7 durometer ratings...sheets, strips, custom die-cut gaskets, molded gaskets
- Armored Xecon™ High-Tensile-Strength Gasketing
- Vulcanized Xecon™ Pressure-Seal Gaskets
- O-Ring Gaskets for Waveguides
- Standard Connector Gaskets
- Conductive Adhesive
- Conductive Compounds...for EMI/RFI shield coating, caulking, cementing

*Xecon gasketing compounds are homogenous conductive elastomers consisting of high-grade silicone in which are suspended microscopic silver-coated glass particles that provide the conductive path through the gasket.

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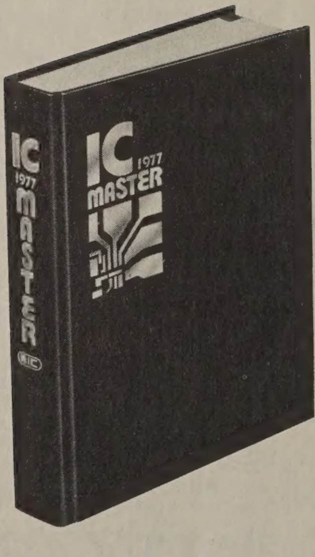
WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
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- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

CO-NETIC & NETIC EMI shielding material

MAGNETIC SHIELD DIVISION

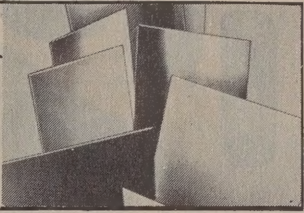
MAGNETIC SHIELD DIV. CO-NETIC NETIC PERFECTION MICA CO.

A complete stock of CO-NETIC (high permeability) and NETIC (high saturation) shielding alloys is available in foil and sheet form. Our engineering department will gladly assist you in the development of shield designs to meet your prototype or production requirements.

Perfection Mica Company
750 North Thomas Drive
Bensenville, Illinois 60106
(312) 766-7800 TWX (910) 256-4815

sheet stock: (standard—30″ x 120″) Shipped immediately from stock.

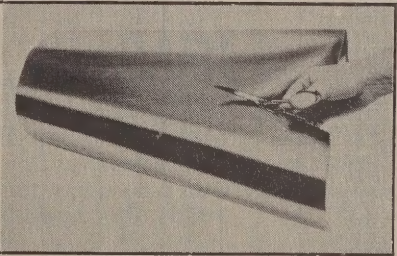
STD. THK. (Inch)	NETIC S3-6 ALLOY SHEET	CO-NETIC AA STRESS ANNEALED	CO-NETIC AA PERFECTION ANNEALED
.014 .020 .025 .030 .040 .050 .062	High saturation capability. .040 NETIC not stocked. Also stock .095″	High permeability characteristics. Stress annealed for ease of fabrication. Must be final annealed for maximum attenuation characteristics. Also stocked in .100″.	High permeability characteristics. Perfection Annealed material has been fully hydrogen annealed for optimum magnetic properties. No further annealing after fabrication is necessary if severe forming is avoided.



foil stock: (standard coils—50 and 100 linear ft.)

STD. THK. (Inch)	NETIC PERFECTION ANNEALED WIDTH (Inch)	CO-NETIC PERFECTION ANNEALED WIDTH (Inch)
.002	—	4
.004	4	4
.004	15	15
.006	—	4
.006	—	15
.010	—	4
.010	—	15

Standard foils shipped immediately from stock. All sizes available with double-faced pressure sensitive tape and release coated liner. Foils can be slit to a minimum width of ¼″, with or without backing. Width tolerance ±.010. Backed and slit foils shipped one week after receipt of order. All foil is Perfection Annealed for maximum attenuation.



physical & magnetic data:

	CO-NETIC AA PERFECTION ANNEALED	CO-NETIC AA STRESS ANNEALED	NETIC S3-6
Specific Gravity	8.58	8.58	7.85
Coefficient of expansion per °C x 10^{-6}	12.5	12.5	11.7
Tensile strength in PSI x 10^3	64	90	50
Yield strength PSI x 10^3	18.5	38	38
Hardness, Rockwell B	50±5	70±5	50±5
Elongation in 2 inches, percent	27	35	30
Melting point (°F)	2680	2680	2760
Thermal conductivity (cal/sec/cm^2/cm/°C) at 20°C	.138	.138	.118
Curie Temp.	750°F	750°F*	770°F

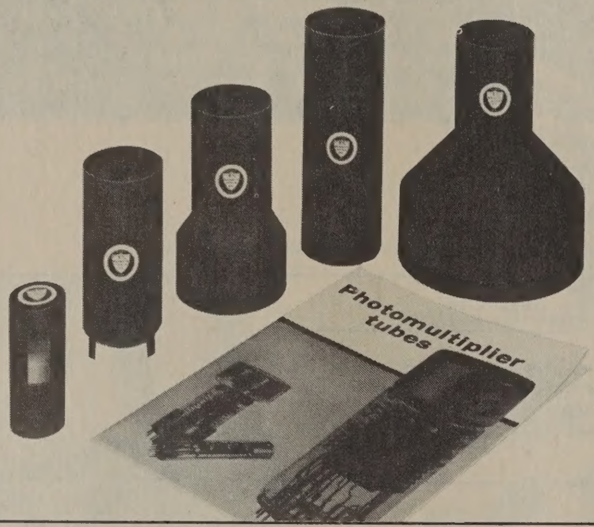
	CO-NETIC AA PERFECTION ANNEALED	CO-NETIC AA STRESS ANNEALED	NETIC S3-6
Electrical Resistivity ohms/cir mil foot	337	337	60
Microhm centimeters	56	56	10
Thickness tolerance	±10%	±10%	±10%
Saturation Induction (Gauss)	7500	7500*	21,400
Initial Permeability	25,000	25,000*	200
Permeability at 200 gauss	135,000	135,000*	800
Maximum Permeability	500,000	500,000*	5000
Induction at μmax.	3000	3000*	8000
Coercive force, H_c, oersteds	.004-.01	.004-.01*	1.0

* Magnetic Properties after Hydrogen Anneal.

photomultiplier tube shields...

MAGNETIC SHIELD DIVISION

Precision shields shipped from stock for 90% of photomultiplier tubes.



Perfection Mica Company
750 North Thomas Drive
Bensenville, Illinois 60106
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CO-NETIC magnetic shields improve the amplification characteristics of photomultiplier tubes by providing significant attenuation of magnetic fields. Effective shielding is ensured over a wide range of field intensities. When grounded, the shields provide protection against electrostatic interference.

CO-NETIC shields are highly resistant to shock and vibration. The shields have minimal retentivity and do not require periodic re-annealing.

Custom engineered shields are available in any quantity. Call for design assistance or send print for prompt quotation.

SHIELDED DIMENSIONS

Part No.	Drawing	A	B	C	D	E	F	G	Notes
06P25	1	5/8	2 1/2						
07P13V1	2	3/4	1 3/8		13/16	1/2	1/4		a
10P25	1	1	2 1/2						
10P40	1	1	4						
11P42X18	5	1 1/8	4 1/4	1 7/8	2 15/16	1 5/16	1/4		d
12P31V1	2	1 1/4	3 1/8		1 11/16	1 1/8	5/8		a
12P35	1	1 1/4	3 1/2						
12P45	1	1 1/4	4 1/2						
13P23V1	2	1 3/8	2 3/8		1 1/4	1 1/8	5/8		a
13P28V1	2	1 3/8	2 13/16		1 9/16	1 1/8	5/8		a
13P32V1	2	1 3/8	3 1/4		1 15/16	1 1/8	5/8		a
13P52V1	2	1 3/8	5 1/4		3 15/16	1 1/8	5/8		a
15P27	1	1 1/2	2 3/4						
15P40	1	1 1/2	4						
15P50	1	1 1/2	5						
17P30	1	1 3/4	3						
17P33V1	2	1 3/4	3 3/8		2 11/16	7/8	3/4		a
17P45	1	1 3/4	4 1/2						
17P53V1	4	1 3/4	5 3/8		2 3/4	2 5/8	1/4	2 1/16	b
20P50	1	2	5						
21P45V1	3	2 3/16	4 1/2		1/2	1/2	1/4		c
21P55V1	3	2 3/16	5 1/2		1/2	1/2	1/4		c
22P40	1	2 1/4	4						
22P50	1	2 1/4	5						
22P60	1	2 1/4	6						
22P70	1	2 1/4	7						
23P55X32	6	2 3/8	5 9/16		3 3/8	11/16		1 1/2	
23P61X37	6	2 3/8	6 1/8	3 3/4	1/4	3 3/4		2 1/8	
23P68X57	6	2 3/8	6 7/8	5 3/4	3	1 7/8		2	
23P101X57	6	2 3/8	10 1/8	5 3/4	1/2	2 3/4		6 7/8	
25P40	1	2 1/2	4						
25P50	1	2 1/2	5						
25P60	1	2 1/2	6						
25P70	1	2 1/2	7						
27P73V1	2	2 3/4	7 3/8		3 5/8	4 3/8	3		a
30P67X57	6	3	6 3/4	5 3/4	3 1/4	1 1/2		2	
32P80	1	3 1/4	8						
32P100X55	6	3 1/4	10	5 1/2	3 1/2	1		5 1/2	
35P70	1	3 1/2	7						

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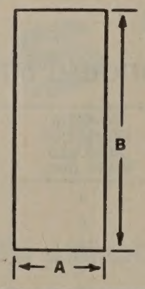

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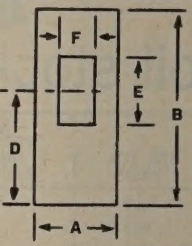

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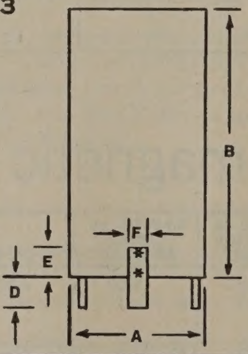

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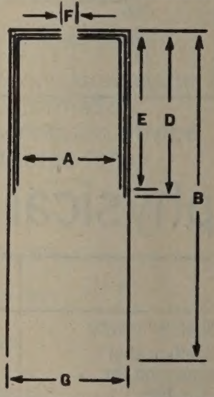


NOTES:

Unless otherwise noted:

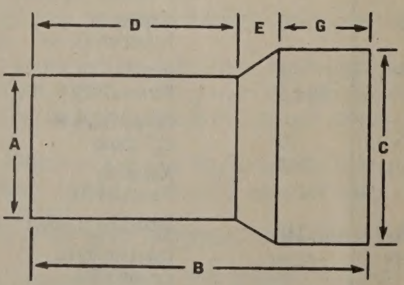
Dimensions — All ID

Material — .040″ Thick Co-Netic AA

Finish — Black baked enamel; texture outside, flat inside.

- **a** — Upper end closed.
- **b** — Dimensions D & E are measured from the outside of the outer shell. Dimension G is the maximum OD. Material — Three layers, separable; outer .049 Netic S3-6, two inner .031 Co-Netic AA Finish — Netic S3-6, black oxide; Co-Netic AA, none.
- **c** — Has three tabs, spaced 120° apart, to grip the metal collar of the PM tube.
- **d** — Material — .031″ Co-Netic AA.

6



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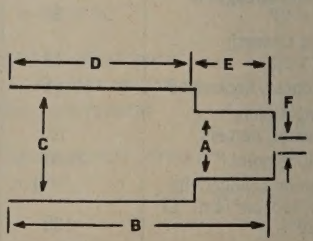

complete magnetic shielding accessories & mica

MAGNETIC SHIELD DIVISION

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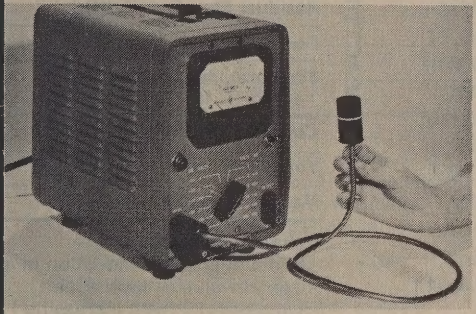
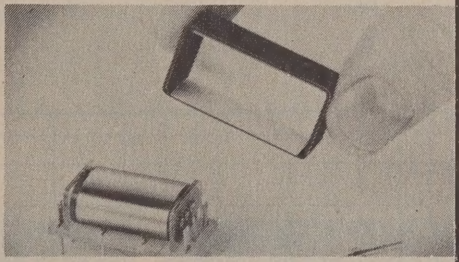


LAB KITS & PROBES

Lab Kit contains assorted CO-NETIC and NETIC shielding materials, double-faced pressure sensitive tape for shield construction and 20 millivolts/gauss A.C. magnetic pickup probe .... all for	$99.50
Probe only, 20 mV/gauss	$49.50
Ultra sensitive probe only, 60 mV/gauss	$79.50

COMPONENT SHIELDS

Standard enclosures for transformers, CRT's, small motors, relays and reed switches are available from stock. Magnetic Shield Division is also the preferred source for custom shields to your specifications. Extensive standard and special tooling provide fast shipment. Call for design assistance or send print for prompt quotation.

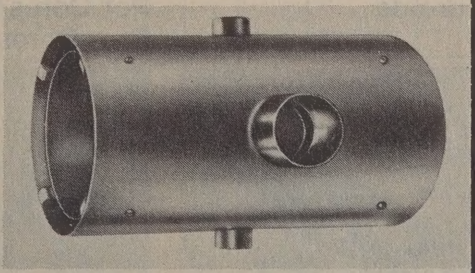


INTER-8 WEAVE CABLE

Our patented, woven configuration of four signal leads provides superior attenuation over a twisted pair. Attenuation improvement of unshielded INTER-8 WEAVE cable is −20 db for radiation and −12 db for pickup. An additional −20 db is obtained with our braided CO-NETIC jacket. Available in solid/plain or multiple/tinned AWG 24 wire.

ZERO GAUSS CHAMBERS

Zero gauss chambers provide the ultimate in magnetic shielding. Magnetic Shield Division's general-purpose zero gauss chamber offers a significant reduction in both static and time varying fields found in laboratory and research environments. Degaussing coils can be furnished, and a Helmholtz coil system can be incorporated to generate known fields. Three concentrically spaced CO-NETIC chambers with closed ends and removable covers are provided. Placement of openings is optional. Attenuation in excess of −60 db is typical.



MICA INSULATORS

Available in sheet, wafer, flakes and ground form. Clear, natural and built-up sheet stock thicknesses from .002″ to .062″. Save tooling expense on a wide variety of fabricated parts, including semi-conductor insulators in .002″ to .003″ thickness with .002″ hole tolerances. Excellent heat resistance and high dielectric strength provide improved breakdown protection and increased efficiency of electronic components.

Stackpole CERAMAG® Ferrites:

Stackpole has pioneered since 1947 in the large-scale production of soft ferrite components—products that have set the standard for uniformity and dependability in the electronics industry.

CERAMAG is Stackpole's trademark for its family of soft spinel ferrite compositions. Each material is usable over a portion of the frequency range of 1 kHz to over 200 MHz.

The large selection of CERAMAG materials and tooling that Stackpole offers makes possible new designs heretofore impractical or impossible.

As each CERAMAG material has a unique set of characteristics, the design engineer should carefully choose the precise ferrite needed to achieve an optimum system design.

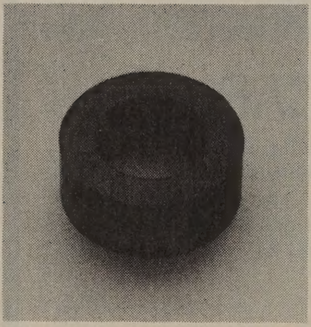
Our expertise lies in designing the best core material and providing it in a usable configuration at the most reasonable cost. We will work with your design engineer and support him with our expertise.

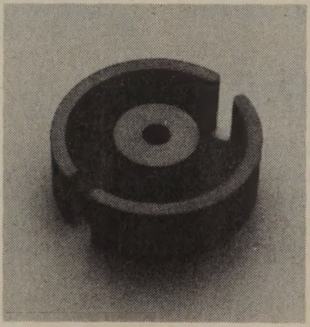
For information on The Right Ferrites, write for Bulletin 59-103, to: Stackpole Carbon Company, Electronic Components Division, St. Marys, Pa. 15857. Telephone: (814) 781-1234. TWX: 510-693-4511.

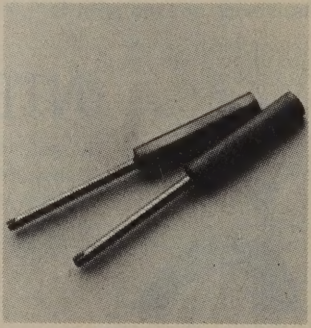
	MATERIAL GENERIC TYPE
CHARACTERISTICS	**Initial Permeability (μ_o)**
	Saturation Flux Density (B_s)
	(@ H oersteds)
	Residual Flux Density (B_r)
	Coercive Force (H)
	Temperature Coefficient of μ_o (25°C to 100°C) (T.C.)
	Curie Temperature (T_c)
	Volume Resistivity @ 25°C (ρ)
	Max. Usable Frequency (F)

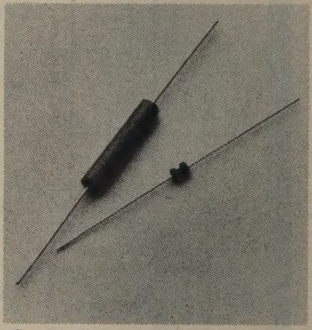
Saturation Induction, B_s— Maximum possible induction in a material; value is approached asymptotically (with increasing H) by the normal magnetization curve and the hysteresis loop.

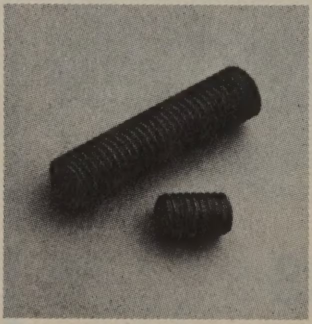
Coercive Force, H_c— The demagnetizing force necessary to reduce the Residual Induction to zero.

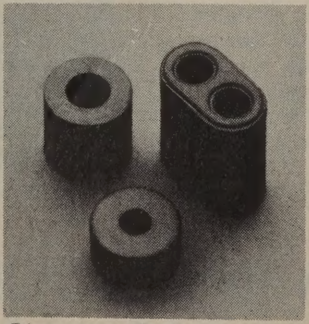

Toroids

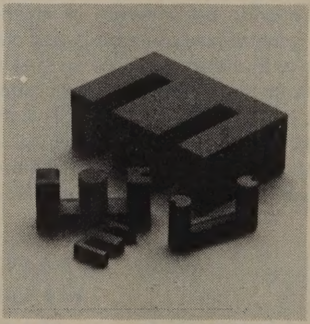

Pot Cores/ Cup Cores


Insert Cores


Coil Forms and Bobbins


Thread Cores


Sleeves, Baluns, and Beads


U Cores, E and EC Cores, and I Bars

Deflection-Yoke Cores

The Right Ferrites

C/5N	C/7B	C/7D	C/9	C/11	C/12	C/14	C/14A	C/24	C/24B	C/25 Series	C/26	C/27A	C/28
NiZn	NiZn	NiZn	NiZn	NiZn	NiZn	NiZn	NiZn	MnZn	MnZn	MnZn	MnZn	MnZn	MnZn
500	450	850	190	125	35	12.5	7.5	2500	2000	500 to 1250	2000	1000	1500
2500	2600	3200	3000	2550	2400	2100		4500	5100	NA	3800	4200	3900
(9.0)	(9.0)	(9.0)	(18.0)	(18.0)	(9.0)	(100.0)		(9.0)	(9.0)		(9.0)	(9.0)	(4.0)
1400	1650	1800	1980	1420	750	1600		1700	2500	NA	1200	1700	1700
0.85	0.48	0.25	2.0	2.8	4.7	21.0		0.25	0.25	NA	0.25	0.40	0.36
+0.2	+0.9	+0.9	+0.22	+0.02	+0.08	+0.36		−0.18	NA		+0.15	+0.15	
200	160	140	210	385	450	510		205	230	195 to 290	170	200	170
1.0×10^3	1.0×10^6	1.4×10^5	1.0×10^{11}	2.0×10^7	3.0×10^7	5.0×10^9		1.0×10^2	5.0×10^1	1.0×10^1	2.0×10^2	2.0×10^3	1.0×10^3
1.0	1.0	1.0	2.0	5.0	50.0	100.0	400.0	0.5	0.5	2.0	0.5	1.0	0.5

Residual Induction, B_r—
The magnetic induction corresponding to zero magnetizing force in a magnetic material which is in a symmetrically, cyclically magnetized condition.

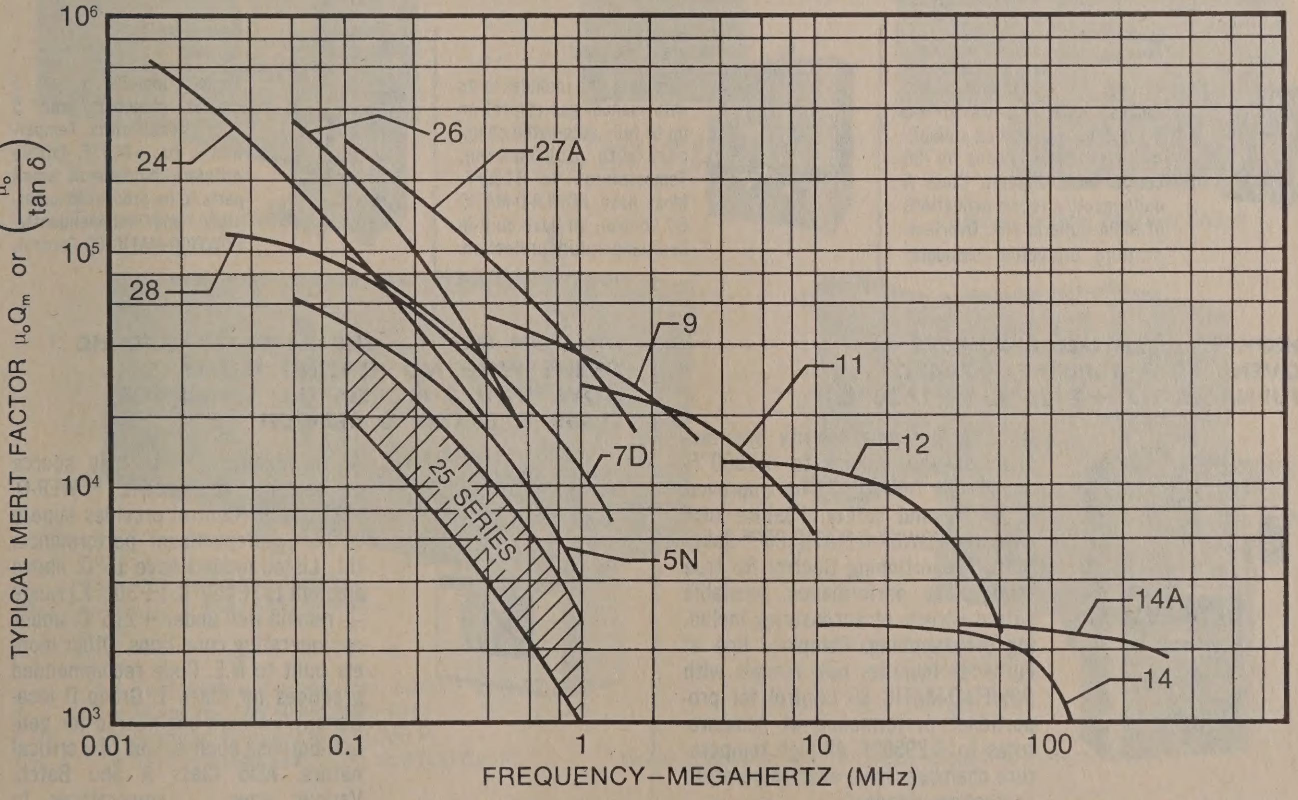
Temperature Coefficient of Initial Permeability, T.C.—
The relative change of initial permeability per degree centigrade, in percent.

Curie Temperature, T_c—
Stackpole Carbon Company defines Curie Temperature as that temperature, in degrees centigrade, at which the μ_o of a material becomes 1/10 the maximum value of μ_o.

Volume Resistivity, ρ—
The resistance of a one-cm cube of material.

General Tolerances on Characteristics
These will vary depending upon configuration and application.

μ_o	±20%
μ_m, B_s, B_r, H_c	±25%
T.C.	±50%
T_c, ρ, D.F., K	Typical
B_u	+15%



CERAMAG is a family of materials capable of operating over the frequency range of 1k Hz to over 200 MHz.

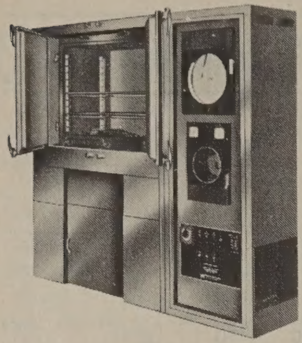
The $\mu_o Q_m$ product may be regarded as a figure of merit for a given ferrite, since it provides a measure of the useful frequency response. Q_m is the material quality factor, and μ_o is the toroidal initial permeability.

The section of the $\mu_o Q_m$ curve shown indicates the most suitable area of operation for each material in the ungapped (toroid) configuration.

STACKPOLE®

BLUE M

TEMPERATURE CONTROLLED EQUIPMENT FOR CRITICAL RESEARCH/PRODUCTION WORK



FULL-RANGE TEMP./HUMIDITY CHAMBERS

Maximum capability cabinets to perform all current MIL humidity tests. Dual wet and dry bulb POWER-O-MATIC 60® Proportioning Control Systems assure absolute stability and reliability. Horizontal mechanical convection units feature programming, separate monitoring recorder, and built-in overtemperature protection. Range: −18°C. to +93°C. (±½°C.). Meets MIL-202D, Method 106C, Step 7A; automatically performs −10°C. dip without changing cams. Maintains R.H. ±½%. Chamber sizes: 5.8, 11, 27 and 64 cu. ft.

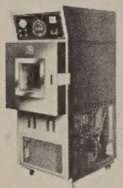
ALSO . . .

Full-Range Single Steady State Chambers

HUMID-FLOW™ Air-Cooled Chambers

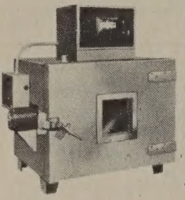
New −40°C. Extended Range Cabinets

New +150°C. Steady State Cabinets



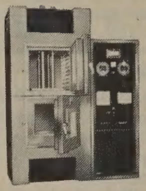
VERSA-RANGE® REFRIGERATED TEST CHAMBERS

Two versatile ranges: −100°F. to +400°F. and −40°F. to +200°F. Five chamber sizes — 3 to 64 cu. ft. Patented POWER-O-MATIC 60 Control for incomparably reliable performance. Also −40°F., −120°F. chest type units. Overtemperature protection.



STABIL-THERM® LN$_2$ CHAMBERS

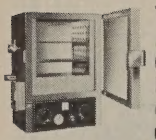
Front or top opening models. −185°C. to +200°C. with solid-state instrumentation. Similar units with CO$_2$ as coolant have −73°C. to +300°C. range. Quality construction throughout, including overtemperature protection.



THERMAL SHOCK TEST CHAMBERS

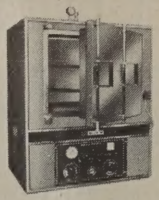
Dual Cabinets for MIL-STD-202 and 883; Versa-Whirl Baths for MIL-STD. 883, Method 1011, Conditions A to F. Latter available as an integrated, automated facility.

TYPICAL EXAMPLES OF AMERICA'S FINEST, MOST COMPLETE LINES OF OVENS AND FURNACES



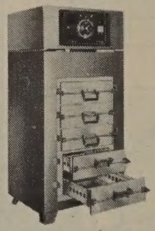
LIFE-TEST OVENS

Variety of types, sizes and ranges. POWER-O-MATIC 60 Control for unequalled reliability. Also Batch Ovens to 96 cu. ft. including new Class A units meeting recommendations of NFPA Bulletin 86A. Overtemperature protection standard.



INERT GAS OVENS

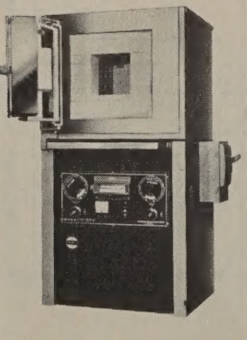
Complete line includes units with manual gas control on up to fully automated chambers with programming. Temperatures to 1100°F. Most have POWER-O-MATIC 60 Control; all have built-in overtemperature protection.



DRAWER OVENS

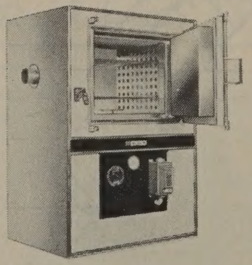
Models include 3 and 5 drawer chambers and 5 door, 5 shelf units. Temperatures to +600°F. Enable different batches of small parts to be processed separately and independently. POWER-O-MATIC 60 Control.

HIGH TEMPERATURE CHAMBERS — OVENS TO +1300°F. (+704°C.) . . . FURNACES TO +2950°F. (+1620°C.)



Ultra-Temp Ovens, gravity and mechanical, with ranges to +1300°F. Completely redesigned for improved efficiency and safety. Feature new patented POWER-O-MATIC 80™ Solid-State Proportioning Control for true straight-line performance. Available with a variety of accessories including programming. Complete line of Furnaces includes new models with POWER-O-MATIC 80 Control for proportional performance at temperatures to +2950°F. All high temperature chambers have overtemperature protection standard.

FRICTION-AIRE™ — THE PATENTED ELECTRIC OVENS WITH NO HEATING ELEMENTS . . . NOW WITH 3 MODELS U.L. LISTED FOR CLASS 1, GROUP D SERVICE!



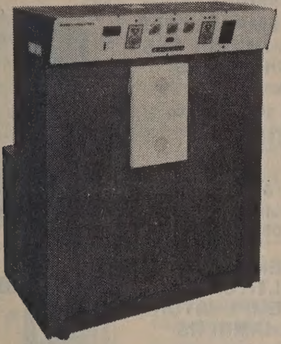
Air turbulence is the only source of heat . . . non-electric POWER-O-MATIC 90™ Control provides superb ±0.5°C. proportional performance. U.L. Listed models have 15°C. above ambient to +150°C. (+302°F.) range — remain well under +215°C. under any operating conditions. Other models built to N.E. Code recommended practices for Class 1, Group D locations . . . others engineered for general-purpose applications of a critical nature. Also Class A and Batch. Various sizes . . . temperatures to +260°C. (+500°F.). You can't buy a safer chamber!

FOR FULL DETAILS ON THESE PRODUCTS AND FOR INFORMATION ON OUR COMPLETE CONTROLLED TEMPERATURE CAPABILITY, WRITE:

BLUE M

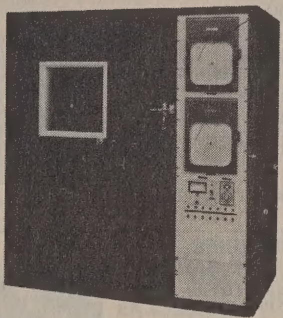
BLUE M EQUIPMENT, A Sales & Service Branch of Blue M Electric Company
Corporate Headquarters: BLUE ISLAND, ILLINOIS 60406

Environmental Simulation Equipment

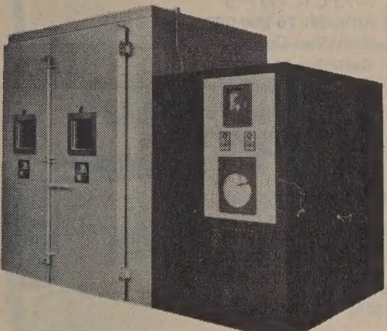


Rotating Drum Thermal Shock

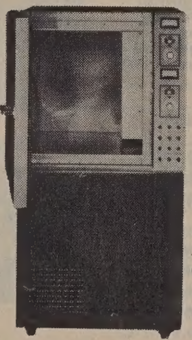
Bench Top
High/Low Temperature



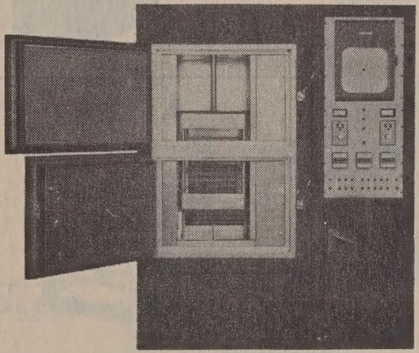
High/Low Temperature
and Humidity
(10-64 Cu. Ft.)



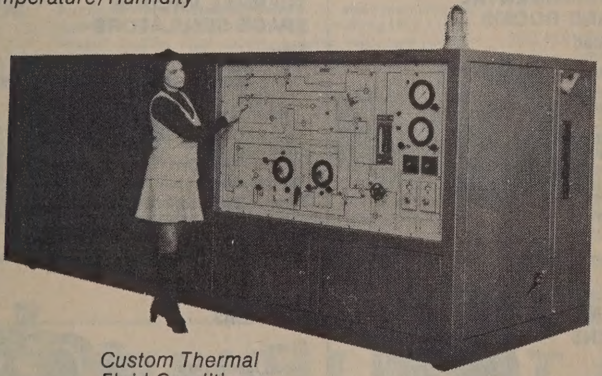
Prefabricated
Walk-In
Temperature/Humidity



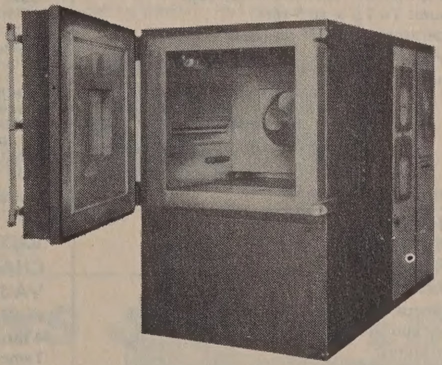
High/Low Temperature
and Humidity (5 Cu. Ft.)



Vertical Elevator Thermal Shock



Custom Thermal
Fluid Conditioner



Temperature/Altitude
(300,000 Ft.)

- Temperature ranges from —300°F to +1200°F
- Humidity: 5% RH to 95% RH
- Altitude: Ambient to 300,000 Ft.
- Test volumes: 0.4 Cu. Ft. to 5,000 Cu. Ft.

Write for catalog with prices or telephone collect

RANSCO INDUSTRIES

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Tenney
ENGINEERING, INC.

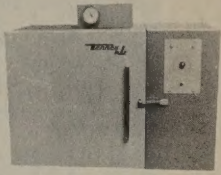
ENVIRONMENTAL TEST EQUIPMENT

Oldest and largest manufacturer of Environmental Equipment

109 Springfield Rd., Union, New Jersey 07083 • (201) 686-7870 • (212) 962-0332

BENCH TOP TEMPERATURE CHAMBERS

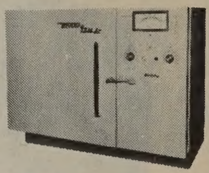
Work space:
1½ & 5 cubic feet.
Temperatures:
−112°F to +350°F
±¼°F
(−80°C to +177°C)



Bulletins 108 and 123.

BENCH MODEL TEMPERATURE-HUMIDITY CHAMBERS

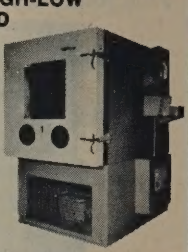
Work space:
3 & 5 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +93°C)
Humidity capabilities:
20% RH to 98% RH.



Bulletins 101 and 123.

TENNEY SERIES HIGH-LOW TEMPERATURE AND TEMPERATURE HUMIDITY TEST CHAMBERS

Work Space:
5 cubic feet to
64 cubic feet.
Temperatures:
−112°F to +350°F.
(−80°C to +177°C)



Bulletins 103, 104, 106, 126 and 127.

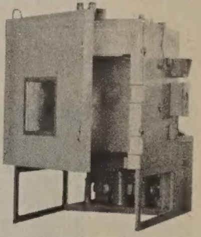
TH & T SERIES MODERATE RANGE TEMPERATURE-HUMIDITY CHAMBERS

10 cubic feet thru
65 cubic feet.
Temperatures:
Low to 0°F (−17°C)
High to 200°F (+93°C)
Humidity:
optional

Bulletins 109 and 111.

MIL-STD-781 AGREE TEMPERATURE-VIBRATION CHAMBERS

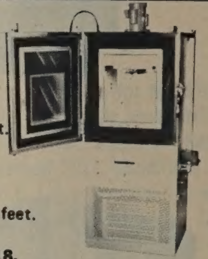
Sizes:
Available in sizes for mating with vibrator units having table tops from 2 square feet to 40 square feet.



Bulletin 105.

TENNEYZPHERE ALTITUDE-TEMPERATURE CHAMBERS

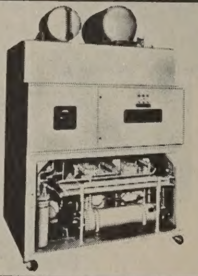
Work space: 5 cubic feet thru 64 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +177°C)
Altitude: To 200,000 feet.
Humidity: Optional



Bulletins 117 and 118.

KOLD-PAK PACKAGED REFRIGERATION SYSTEMS

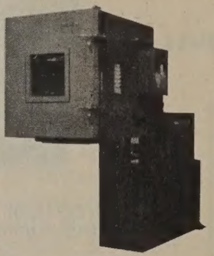
Temperatures:
Low to −100°F
(−73°C)
High to +250°F
(+121°C)



Bulletin 114.

VIBRATION TEMPERATURE CHAMBERS

Sizes: Standard from
5 cubic feet
to 64 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +177°C)
Humidity: Optional



Bulletin 102.

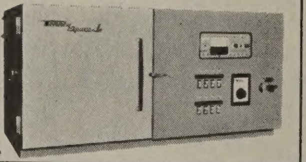
MULTI-RANGE PRECISION TEMPERATURE BATHS

Work space:
One gallon &
9 gallon.
Temperatures:
−100°F to +248°F
(−73°C to +120°C)

Bulletins 107 and 125.

SPACE JR. THERMAL VACUUM SPACE SIMULATORS

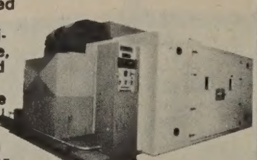
Work space: 14" diameter x 12" deep
Vacuum: To 7.5 x 10^{-8} torr.
Temperatures: −100°F to +350°F
(−73°C to
+177°C)



Bulletin 112.

WALK-IN ENVIRONMENTAL CHAMBERS AND ROOMS

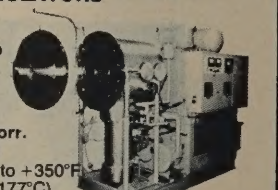
Used for controlled environmental parameters of altitude, temperature, rain, humidity and other conditions. Available as single piece unitized or semi-unitized packages. Also, in modular panels for field construction.



Bulletins 113

THERMAL VACUUM SPACE SIMULATORS

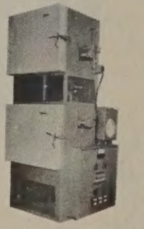
Sizes:
Standard,
1½ feet to
6 feet
diameters.
Vacuum
capability:
To 1 x 10^{-9} torr.
Temperatures:
From −320°F to +350°F
(−196°C to +177°C)



Bulletin 120.

MECHANICALLY REFRIGERATED THERMAL SHOCK CHAMBERS

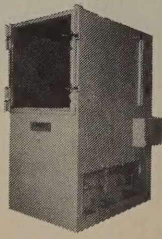
Work Space:
3, 5 & 8 cubic feet
Temperatures:
Top compartment
to +350°F (+177°C)
Lower compartment
to −100°F (−73°C)
Center compartment
ambient optional.



Bulletin 121.

VACUUM CHAMBERS AND VACUUM OVENS

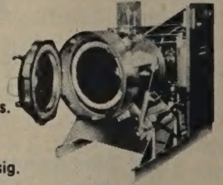
Work space:
4 thru 27 cubic feet.
Temperatures:
To +300°F (+150°C)
Vacuum:
To 148 microns
(200,000 feet)



Bulletin 110.

AUTOCLAVE SYSTEMS

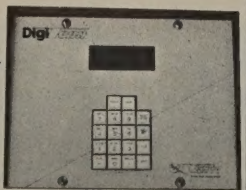
Sizes:
Small laboratory
models to large
production units.
Temperatures:
+500°F (260°C)
Pressure: to 1000 psig.
Vacuum : Optional



Bulletin 122.

DIGITENN

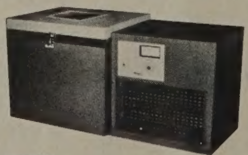
Microprocessor based programmer for new and existing chambers.



Bulletin 131

TENNEY SUB-ARCTIC INDUSTRIAL CABINETS AND COLD STORAGE CHESTS

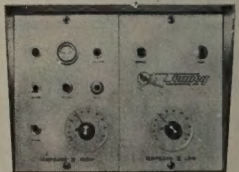
Work space:
6 thru
12 cubic feet.
Temperature ranges:
Low to −120°F)
(−84°C)
High to +350°F (+177°C)



Bulletin 115.

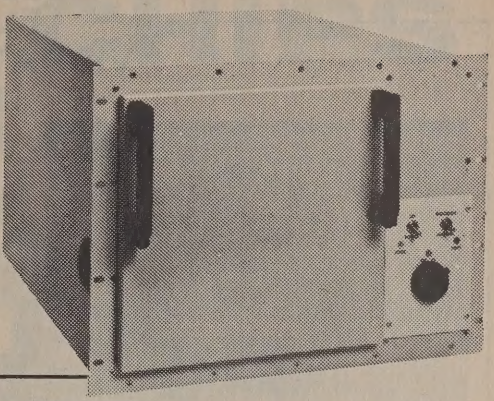
TEMPGARD® II ALARMS

Hi only or
Hi Low
Temperatures:
−125°F to
+425°F
(−87°C to
+218°C)



Bulletin 124.

TEMPERATURE CHAMBERS EXPENDABLE GAS COOLED



Resettable to .02°—No RFI—No overshoot. No triple point problems (valve freeze ups) with 300 psi CO_2.* Low gradients—Low energy & coolant consumption—Staged heating. Utmost reliability, efficiency and convenience. Programable. Controller—Sigma's Model C Precision, described below. Range: Standard -75° to 199°C, extendable on order.

PARTIAL LIST OF STANDARD MODELS

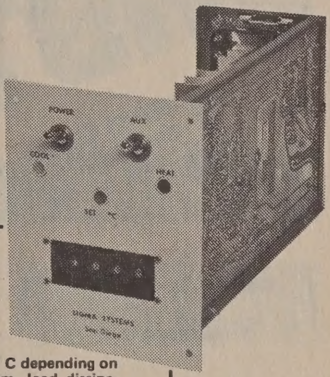
Model	Volume liters	Cm. dims. H x W x D	Volume Cubic feet	Inch dims. H x W x D	Door	Type of chamber
18	18	27x25.4x26x4	.64	10.63x10.0x10.4	Pull out	Portable
18R	18	27x25.4x26.4	.64	10.63x10.0x10.4	Pull out	Rack mount
26	26	27x36.8x26.4	.92	10.63x14.5x10.4	Pull out	Bench–45 cm. wide
52	52	63.5x26.7x30.7	1.83	25.13x10.5x12.08	Hinged	Adjustable shelves
100	100	63.5x52.0x30.7	3.50	25.13x20.5x12.08	Hinged	Bench - shallow
170	170	63.5x52.0x51	5.96	25.13x20.5x20.08	Hinged	Bench - deep
600	600	88x89x76.5	21.1	34.6x35.0x30.12	Hinged	Floor

ASK FOR DETAILED SPECIFICATIONS AND CHAMBER SELECTION GUIDE

When the optional N/C "Manual Program" switch is not requested, an auxilliary switch and circuit is provided to power an interior light, AC jack, etc. (customer installed). All chambers have a 38 mm. (1.5 inch) port in lower left side.

***All low pressure CO_2 chambers equipped with Sigma's special valve (Patent applied for).**

CHAMBER CONTROLLERS FOR RETROFIT



An economical cure for problems of reliability or temperature drift & inaccuracy in older chambers. Worthwhile provided the chamber has acceptable air flow dynamics, insulation, door seals and response characteristics.

MODEL C PRECISION TEMPERATURE CONTROLLER SPECIFICATIONS & OPTIONS

(SUPPLIED ON ALL SIGMA CHAMBERS UNLESS OTHERWISE SPECIFIED)

TYPE: Automatic mode selecting, solid state, electronic chopper stabilized, time proportioning, zero switching (R.F.I. free) integral cycling, opto coupler isolated, with lead proportional lag damping and provision for two stage heating.

AMBIENT TEMPERATURE COMPENSATION: ±.01% (±.0001°C/°C) nominal.

TEMPERATURE EFFECT DUE TO LINE VOLTAGE INSTABILITY: Internal regulated power supplies render this negligible (not measurable) for voltage excursions of ± 20%.

TEMPERATURE ACCURACY (ABSOLUTE) AT SENSOR: ± .7°C at -78.89 C; ± .5°C at 260°C and as affected by ± .25% linearity of set point pot between these points. Linearity to ± .05% is available as an option.

DEAD BAND: .04°C Nominal (Dependent on gain setting).

SET POINT STABILITY: Typically ± .01° to .02° C depending on chamber size, circulation, cooling medium, load dissipation, etc.

STAGE HEATING (PROPORTIONAL BAND): Full on cooling to full power, .15°C (gain dependent).

POWER HANDLING CAPABILITY, STANDARD: 30 amps at 240 volts (7.2 Kilowatts). Optionally to 900 amps at 600 volts (higher powers made to specifications).

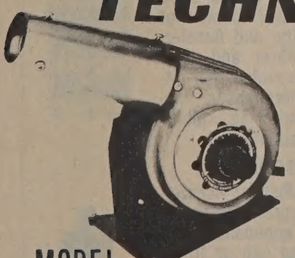
STABILIZATION TIME: Nominally 30 to 60 seconds after reaching proportional band depending on chamber characteristics.

NULL INDICATION BAND: ± .7°C nominal.

PROGRAMABILITY: Optional—No Charge.

AVAILABLE WITH VERNIER DIAL FOR ADJUSTMENT TO .02°

TECHNICAL HEAT GUNS & BLOWERS



Continuous stepless adjustability; Ambient to 900°F with locking dial for quality controlled processing. Durable, dependable. Sigma's heat guns eliminate the need for operator skill. Give the correct temperature for any requirement—Locked in. They are easily calibrated and certified for specific applications.

NO NOZZLE DEFLECTORS NEEDED. The air is mixed to acceptable temperature uniformity in the gun by a specially designed nozzle (patented). The standard heat source of hundreds of manufacturers & laboratories.

MODEL ER900

$99.50

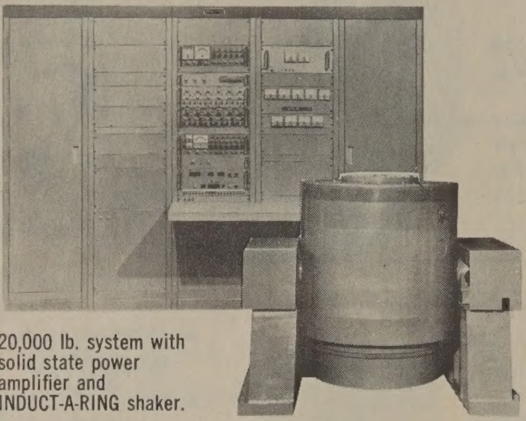
MODEL B900

$130.00

SIGMA SYSTEMS CORPORATION (FORMERLY DELTA DESIGN ENGINEERS, INC.)

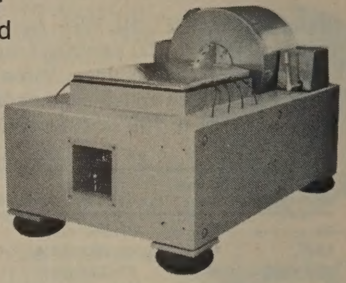
3163 Adams Avenue San Diego, CA 92116 Area Code (714) 283-3193

ELECTRODYNAMIC VIBRATION TEST SYSTEMS



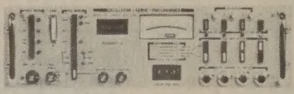
20,000 lb. system with solid state power amplifier and INDUCT-A-RING shaker.

- 50 to 36,000 lb. force systems for sine and random vibration
- Systems powered by solid state amplifiers to 256 kVA
- INDUCT-A-RING shakers for unmatched performance and reliability
- Control instruments for MIL-STD-810 testing
- Multiple shaker systems
- 6 inch stroke electrodynamic force generators
- PERMALINE Slip Table on combined seismic base



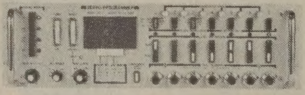
Shaker and slip table on PERMALINE combined seismic base.

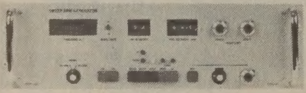
CONTROL INSTRUMENTATION



BASIC SINE CONTROL

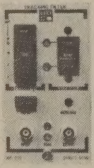
The OSP-4 is our most economical, compact sine control system. Provides sine sweep and servo control for test programs of up to four levels. Input charge amplifier is standard.





DELUXE SINE CONTROL

The OSC-1S and SPA-7 comprise our most comprehensive sine control system. Sine sweep and programmable servo control are provided for tests of up to seven levels. Both frequency and vibration level are digitally displayed. Sweep rate and test duration may be preselected to provide automatic shutdown. Automatic or manual modes for selecting crossover frequencies are provided. Input charge amplifier is standard.

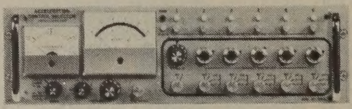


TRACKING FILTER

Model TF22 Tracking Filter features fixed or constant 10% bandwidth which varies between 2 and 200 Hz. Log DC output is standard. Modular construction allows six channels per 19″ rack.

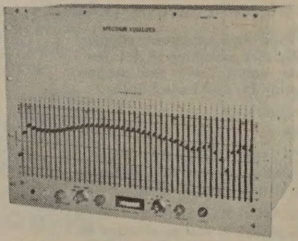
SIGNAL AVERAGER

Model MAC-8 Averaging Control features eight individually selectable data channels for control to the average signal level. Can be used for sine or random testing.



SIGNAL SELECTOR

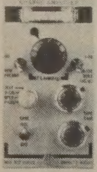
Model ACS-6 automatically selects the highest (or lowest) acceleration input. Accepts six sine acceleration signals, and gates to the output whichever signal reaches its preset limit.



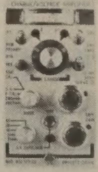
SPECTRUM EQUALIZER

Model E109B Spectrum Equalizer features 45 active, four-pole filters with individual gain controls. Convenient equalization can be performed using this unit in conjunction with tracking filter analyzer or real time analyzer.

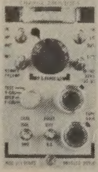
SIGNAL CONDITIONERS



Model D22PM Basic Charge Amp



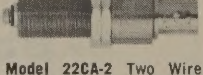
Model D22PMH Differential Charge Input Switchable Filters



Model D22PMR Charge/Strain Gage Amp

Model D22PMB Bridge Conditioner

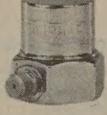
Model 1610M Vibration Monitor provides readout of acceleration, velocity or displacement on 1% log scale meter.



Model 22CA-2 Two Wire Remote Charge Preamp. Operates with any Model 22 instrument.

Model 11PA-2 Two Wire Remote Voltage Preamp. Operates with any Model 22 instrument.

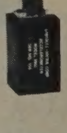
The D22 Series Signal Conditioners are offered for use with piezoelectric and strain gage transducers. Integrated circuit design provides superior low noise characteristics in a rugged modular construction. Units shown here are only a few examples of a complete family of signal conditioners that permit a wide variety of dynamic and static measurements.



A full line of piezoelectric accelerometers are offered for general purpose vibration testing and for many special applications.

INDUSTRIAL VIBRATION MONITORS

The Series 800 Vibration Alarm Module is used with the Series 8800 Industrial Accelerometer to monitor Displacement, Velocity, and Acceleration. Adjustable alarm and time delay circuits are provided, permitting low cost, comprehensive machinery health monitoring. Multi-channel systems available.



INDUSTRIAL ACCELEROMETERS

The Series 8800 Industrial Accelerometer features integral electronics giving low output impedance, and rugged cable. Bearing cap or frame mounted accelerometer technique utilizes the total vibration spectrum, compared to limited response of proximity probes or velocity pickups.

UDCO

UNHOLTZ-DICKIE CORPORATION
DEPT. EM, 3000 WHITNEY AVE. / HAMDEN, CONN. 06518
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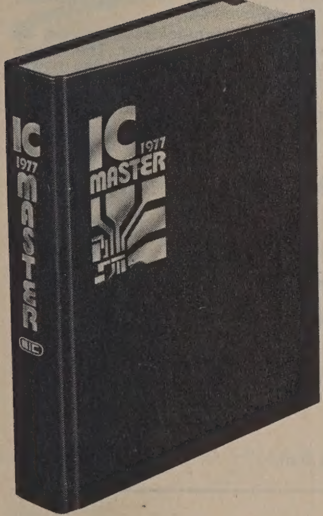

The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

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- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
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BORG WARNER

Borg-Warner Thermoelectrics

DEPARTMENT OF BORG-WARNER CORPORATION WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018, PHONE 312/827-3131

THERMOELECTRIC COOLERS

INTRODUCTION TO THERMOELECTRIC PRODUCTS

Thermoelectric cooling units have many unique advantages over other types of coolers in their application area.

SIZE

They can be tailored to fit the application by easy addition or subtraction of modules to fill the need accurately and avoid waste.

POWER INPUT

Due to tailored modular construction, power requirements can be reduced to a minimum. Power is provided through a single pair of leads.

RELIABILITY

There are no parts that wear or clog, and no delicate moving parts. Gases, corrosive liquids or chemicals that will leak or dissipate with age are also eliminated. These features result in greatly reduced maintenance requirements.

LOGISTICS

There are no requirements at the load for pumping refrigerant or for a source of coolant such as liquid nitrogen to be added during operation of the system.

REMOTE CONTROL

The unit and heat sink are required in the cooling area; the power supply and most other control equipment can be mounted and operated remotely.

COOLING RANGE

Thermoelectric coolers are capable of operating from any heat-sink temperature from +100°C to −100°C.

TEMPERATURE CONTROL

Simple electronic control schemes allow control within a fraction of a degree of desired load temperatures above or below ambient.

HEAT SINKS

The design of the heat sink or heat exchanger is a very important aspect of a good thermoelectric system.

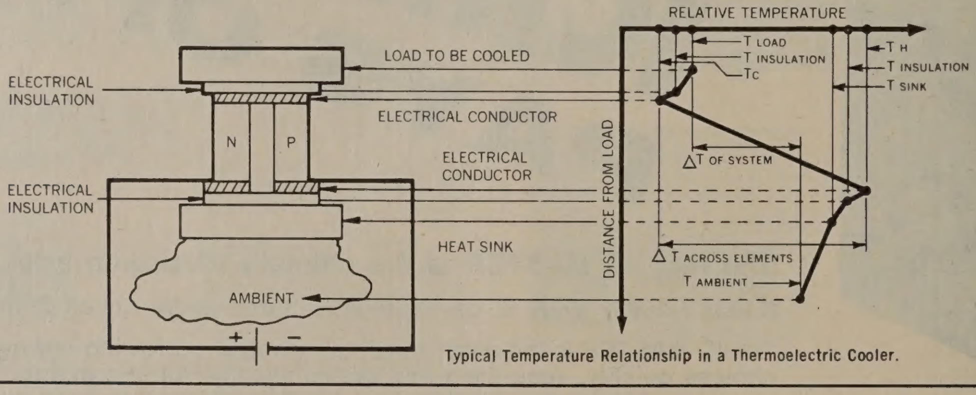
The figure below illustrates the steady-state temperature profile across a typical thermoelectric device from the load side to the ambient.

The total steady-state heat which must be rejected by the heat sink to the ambient may be expressed as follows:

heat rejected (Q_s) = heat absorbed from load (Q_e) + power input (V•I) + heat leakage (Q_l)

If the heat sink is not capable of rejecting the required Q_s from a given system, the temperature of the entire system will rise and the load temperature will increase. If the thermoelectric current is increased to maintain the load temperature, the COP tends to decrease. Thus, a good heat sink contributes to improved COP.

Energy may be transferred to or from the thermoelectric system by three basic modes: conduction, convection, and radiation. The values Q_e and Q_l may easily be estimated; their total along with the power input gives Q_s, the energy the hot-junction must dissipate.



Typical Temperature Relationship in a Thermoelectric Cooler.

TIME TO COOL OR HEAT VARIOUS MATERIALS

The figure below shows the heat transfer required to cool or heat a given weight of known material in one hour without a change of state. When a change of state occurs (freezing, melting or vaporizing) the additional heating or cooling capacity required can be estimated by multiplying the weight of the given material by the appropriate latent heat. The equation plotted in the Figure at the right is:

$$Q \ \Delta t = m \ C_p \ \Delta T \qquad (2)$$

- ΔT — required temperature change (°F)
- C_p — average specific heat (BTU/lb-°F)
- m — weight of material (lbs)
- Δt — time interval
- Q — heat removed or supplied (BTU/hr)

Using this formula, it is easy to design a photographic bath for processing film rapidly. The bath consists of 2 lbs of water in a 1 lb stainless steel container. The bath must be cooled from 110°F to 60°F in 1 hour. How much heat must be removed?

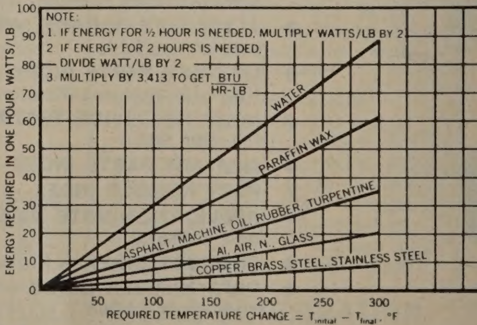
The temperature change is (110-60) = 50°F.

Enter Figure below on the horizontal axis at 50°F. Move vertically to the stainless steel and water curves and read on the vertical axis:

15 watts/lb × 2 lbs of water = 30 watts
1.6 watts/lb × 1 lb of stainless = 1.6 watts

Thus, for 1 hr, 31.6 watts are required.

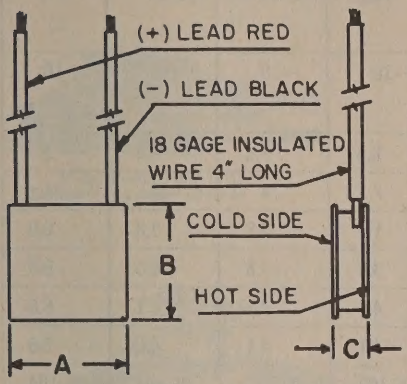
The time provided by this graph is based on a constant heat transfer during the one hour period. Actually, a thermoelectric cooler would not pump heat at a constant level due to change in ΔT and this should be taken into account in a design. An effective heat pumping capacity of a thermoelectric cooler can be estimated as the heat pumping capacity at a temperature difference equal to one-half of the final operating ΔT (usually, initial ΔT = 0). Borg-Warner can provide assistance in more accurate transient design.

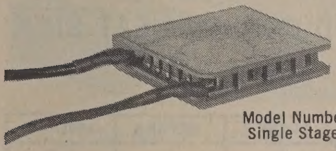


Energy to be Added or Removed Thermoelectrically in One Hour for Various Materials.

STANDARD THERMOELECTRIC DEVICES

SINGLE STAGE MODULE SPECIFICATION CHART — T_H 27°C IN VACUUM

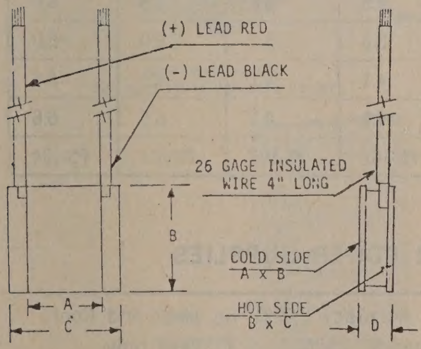




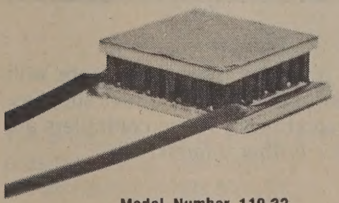
Model Number 920-31
Single Stage Module

MODULE NUMBER	MAX ΔT Qc = 0 ΔT - °C	MAX Qc ΔT = 0 Qc - WATTS	MAX CURRENT AMPS	MAX VOLTAGE VOLTS	DIM. A	DIM. B	DIM. C
920-3	66	1.8	8.5	0.34	0.29	0.57	0.22
920-7	66	4.3	8.5	0.80	0.57	0.57	0.22
920-11	66	6.7	8.5	1.24	0.57	0.85	0.22
920-15	66	9.2	8.5	1.70	0.57	1.20	0.22
920-31	66	19.0	8.5	3.50	1.20	1.20	0.22
930-3	66	0.8	3.7	0.36	0.20	0.38	0.21
930-7	66	1.8	3.7	0.84	0.38	0.38	0.21
930-11	66	2.9	3.7	1.30	0.38	0.57	0.21
930-17	66	4.5	3.7	2.00	0.57	0.57	0.21
930-35	66	9.4	3.7	4.20	0.57	1.20	0.21
930-71	66	19.0	3.7	8.50	1.20	1.20	0.21
940-3	66	2.9	14.0	0.34	0.29	0.57	0.18
940-7	66	6.8	14.0	0.80	0.57	0.57	0.18
940-11	66	10.6	14.0	1.24	0.57	0.85	0.18
940-15	66	14.5	14.0	1.70	0.57	1.20	0.18
940-31	66	30.0	14.0	3.50	1.20	1.20	0.18
950-3	66	1.3	6.0	0.36	0.20	0.38	0.17
950-7	66	3.0	6.0	0.84	0.38	0.38	0.17
950-11	66	4.6	6.0	1.30	0.38	0.57	0.17
950-17	66	7.2	6.0	2.00	0.57	0.57	0.17
950-35	66	14.8	6.0	4.20	0.57	1.20	0.17
950-71	66	30.0	6.0	8.50	1.20	1.20	0.17

MINI MODULE SPECIFICATION CHART—T_H 27°C IN VACUUM



MINI MODULE NUMBER	MAX ΔT Qc = 0 ΔT - °C	MAX Qc ΔT = 0 Qc - WATTS	MAX CURRENT AMPS	MAX VOLTAGE VOLTS	DIM. A	DIM. B	DIM C	DIM. D
110-4	64	0.24	1.1	0.5	0.08	0.16	0.14	0.13
110-8	64	0.49	1.1	1.0	0.16	0.16	0.22	0.13
110-12	64	0.73	1.1	1.5	0.16	0.24	0.22	0.13
110-18	64	1.10	1.1	2.2	0.24	0.24	0.30	0.13
110-32	64	1.95	1.1	4.0	0.32	0.32	0.38	0.13
120-4	64	0.30	1.4	0.5	0.08	0.16	0.14	0.12
120-8	64	0.61	1.4	1.0	0.16	0.16	0.22	0.12
120-12	64	0.92	1.4	1.5	0.16	0.24	0.22	0.12
120-18	64	1.35	1.4	2.2	0.24	0.24	0.30	0.12
120-32	64	2.40	1.4	4.0	0.32	0.32	0.38	0.12
130-4	64	0.42	1.9	0.5	0.09	0.18	0.15	0.12
130-8	64	0.84	1.9	1.0	0.18	0.18	0.24	0.12
130-12	64	1.25	1.9	1.5	0.18	0.27	0.24	0.12
130-18	64	1.90	1.9	2.2	0.27	0.27	0.33	0.12
130-32	64	3.35	1.9	4.0	0.36	0.36	0.42	0.12



Model Number 110-32
Mini Module

Standard coolers will withstand ambient temperatures of 110°C. Special coolers are available at premium prices that will withstand ambient temperatures of 160°C. For high temperature applications consult the factory.

BORG WARNER

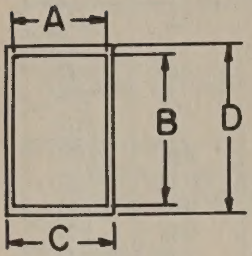
Borg-Warner Thermoelectrics

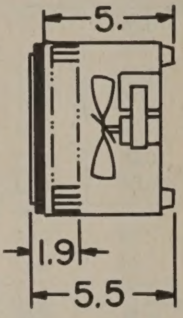
DEPARTMENT OF BORG-WARNER CORPORATION WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018 • PHONE (312) 827-3131

THERMOELECTRIC HEAT PUMPS

BORG WARNER

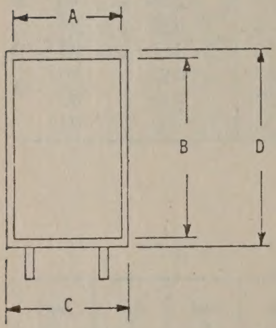
HEAT PUMP SPECIFICATION CHART T_H 77°F IN DRY AIR — AIR COOLED HEAT SINK

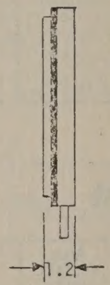




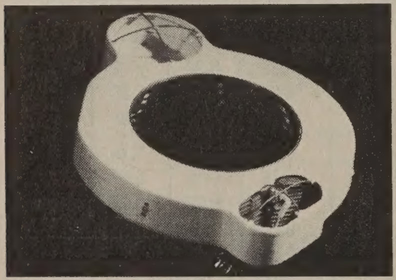
HEAT PUMP NUMBER	930AHP-1	920AHP-2	920AHP-4	930AHP-6	930AHP-9
MAX HEAT PUMPING WITH COLD PLATE SUPPRESSED TO 77°F AMBIENT (WATTS))	15	30	50	80	120
MIN. COLD PLATE TEMPERATURE OPERATING IN 77°F AMBIENT (°F)	−10	−10	−10	−10	−10
INPUT POWER AMPS	3.6	8.3	7.3	6.4	9.7
INPUT POWER VOLTS	9	7	14	24	24
DIMENSION A	1.5	1.5	3.8	3.8	6.0
DIMENSION B	2.0	3.8	3.8	6.0	6.0
DIMENSION C	4.1	4.1	4.1	4.1	6.6
DIMENSION D	4.1	4.1	4.1	6.6	6.6
POWER SUPPLY REQUIRED	PS-101	PS-102	PS-103	PS-104	PS-104

HEAT PUMP SPECIFICATION CHART T_H 77°F IN DRY AIR — LIQUID COOLED HEAT SINK

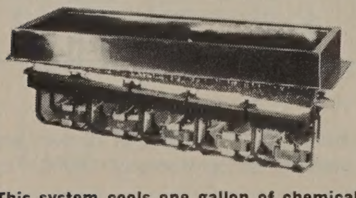




HEAT PUMP NUMBER	950LHP-1	940LHP-2	940LHP-4	950LHP-6	950LHP-9
MAX HEAT PUMPING WITH COLD PLATE SUPPRESSED TO 77°F AMBIENT (WATTS))	20	50	90	125	190
MIN. COLD PLATE TEMPERATURE OPERATING IN 77°F AMBIENT (°F)	−20	−20	−20	−20	−20
INPUT POWER AMPS	6	14	12	10	15
INPUT POWER VOLTS	9	7	14	24	24
DIMENSION A	1.5	1.5	3.8	3.8	6.0
DIMENSION B	2.0	3.8	3.8	6.0	6.0
DIMENSION C	4.1	4.1	4.1	4.1	6.6
DIMENSION D	4.1	4.1	4.1	6.6	6.6
POWER SUPPLY REQUIRED	PS-101	PS-102	PS-103	PS-104	PS-104



Ring type cooler to stabilize the inertial navigation system at 40°C and pump 280 watts with an input power of 338 watts.



This system cools one gallon of chemical solution to 40°F below ambient with 850 watts of input power. Load capability 450 watts at 0 ΔT.

TEMPERATURE CONTROLLERS FOR POWER SUPPLIES

TC-101	Set Point Relay Controlled Accuracy ±3°C	Heat and Cool
TC-102	Set Point Proportional Accuracy ±1°C	Cool only
TC-104	Set Point Proportional Accuracy ±1°C	Heat and Cool

Other Borg-Warner Thermoelectric Heat Pumps are available that will operate with larger or smaller heat pumping capacities and current input voltage. Power supplies, on/off temperature controllers with set point, and proportional reverse controllers are available to fit these pumps. Please contact factory for further information.

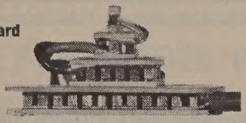
BORG WARNER

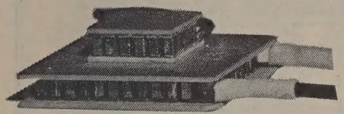
Borg-Warner Thermoelectrics

DEPARTMENT OF BORG-WARNER CORPORATION WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018 • PHONE (312) 827-3131

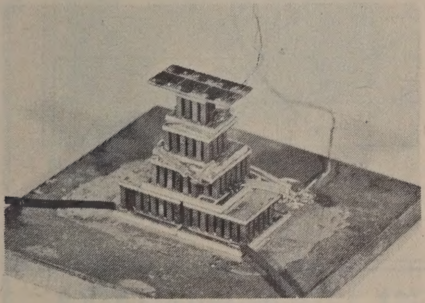
CASCADED THERMOELECTRIC COOLERS

Model Number 954-70-16-4-1 Standard Four Stage Cascade





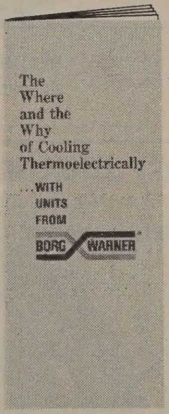
Model Number 932-70-17 Standard Two Stage Cascade



High Performance Two Watt 193°K Cascaded Cooler

High Performance Ten Watt 170°K Cascaded Cooler

Write on company letterhead for your free copy



The Where and the Why of Cooling Thermoelectrically

...WITH UNITS FROM

The principles, applications, and design possibilities of thermoelectric cooling are discussed in this booklet.

STANDARD

2 - 5 Stages
From T_H 27°C
To T_C 180°K

Over 7000 Optimized Cascade Designs Using Partial Standard Borg-Warner Thermoelectric Modules.

- Customer Design at Standard Cooler Prices
- Lowest Price Per Watt of Heat Pumped
- Quick Delivery, Usually one Week ARO

HIGH PERFORMANCE

2 - 14 Stages
From T_H 27°C
To T_C 130°K

Individual Computer Aided Cascade Design Using Standard or High Performance Thermoelectronic Materials.

- Higest Heat Pumping Capability
- Lowest Temperatures
- Lowest Power Input

FOR RAPID QUOTATIONS CALL THE FACTORY

Specify: Q_C — Active Heat Load to be Pumped
T_H — Ambient or Hot Side Temperature
T_C — Cold Side Temperature Required
V — Operating Voltage Desired
P — Maximum Power Available
Environment — Vacuum or Dry Air
Size Requirements

Cascaded Thermoelectric Coolers are available at premium prices that will withstand ambients or bake-out temperatures of 150°C.

CUSTOM DESIGN

Engineering back-up is available for designs to meet customer specifications.

APPLICATION OF THERMOELECTRIC PRODUCTS

Cold traps for vacuum chambers
Crystals
Discrete silicon components
Inertial guidance systems
Infrared detectors
Integrated circuits
Lasers
Masers
Nuclear radiation detectors
Parametric amplifiers
Constant temperature chambers
Environment chambers
Integrated circuit test chembers
Temperature baths
Display cabinets
Ice cube makers
Photo developing solution coolers
Photomultiplier tubes
Vidicon tubes
Cold probes
Dew point hygrometers
Microscope cold plates
Mobile drug coolers
Surgical instrument-coolers
Test tube coolers

BORG WARNER

Borg-Warner Thermoelectrics

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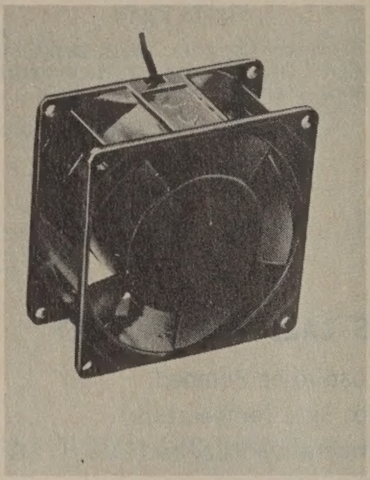
Telephone (312) 325-9380 / TWX 910-226-0424

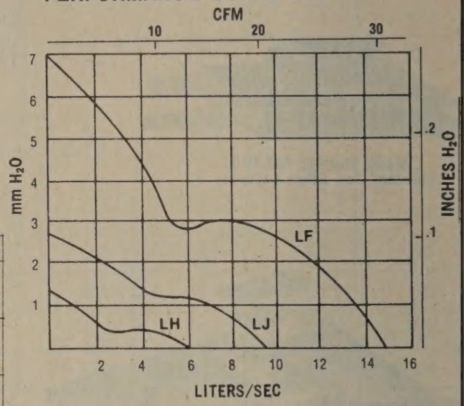
AXIAL FAN MODEL 126



- Popular 3⅛ x 1½ inch size
- 2¹³⁄₁₆ inch mounting centers
- 22 CFM at .1 inch of water, 32 CFM at Free Flow
- 50% quieter than competitive fans
- U.L. recognized file 64887
- Reduced flow versions for very quiet applications
- Sleeve or ball bearing

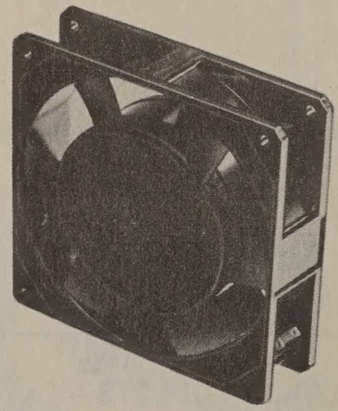
Part Number	Volt	Current	Delivery
760-126LH- 2182-11115	115	45 ma	13 CFM
2181-11220	220	32 ma	
760-126LJ- 2182-11115	115	50 ma	20 CFM
2181-11220	220	35 ma	
760-126LF- 2182-11115	115	100 ma	30 CFM
2181-11220	220	50 ma	

PERFORMANCE CURVE 126



60 Hz PERFORMANCE

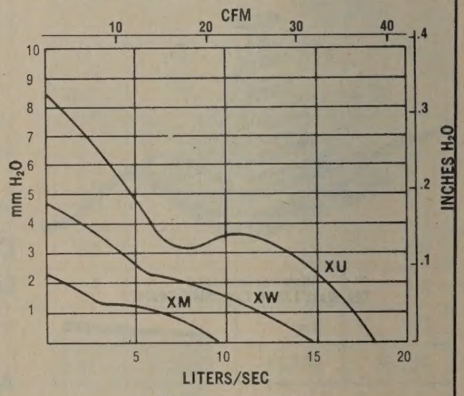
AXIAL FAN MODEL 99



- 3⅝ x 1 inch thin size
- 3¼ inch mounting centers
- 31 CFM at .1 inch of water, 41 CFM at Free Flow
- U.L. recognized File 64887
- Reduced flow versions for very quiet applications

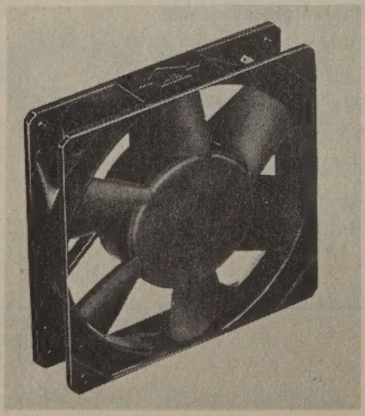
Part Number	Volt	Current	Delivery
760-99XM- 182-11115	115	60 ma	21 CFM
181-11220	220	35 ma	
760-99XW- 182-11115	115	65 ma	32 CFM
181-11220	220	40 ma	
760-99XU- 182-11115	115	105 ma	41 CFM
181-11220	220	60 ma	

PERFORMANCE CURVE 99



60 Hz PERFORMANCE

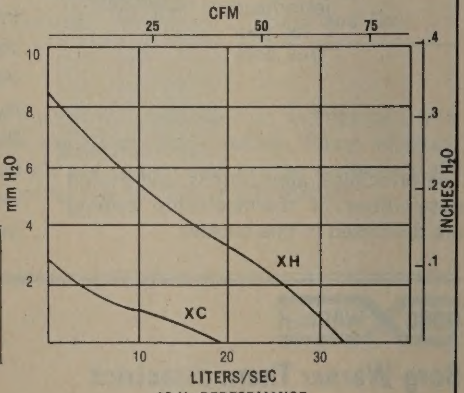
AXIAL FAN MODEL 98



- 4⅝ x 1 inch thin size
- 4⅛ inch mounting centers
- 50 CFM at .1 inch of water, 73 CFM Free Flow
- Fits where 1½ inch thick fans won't
- U.L. recognized 64887
- Reduced flow version for very quiet applications

Part Number	Volt	Current	Delivery
760-98XC- 182-11115	115	100 ma	38 CFM
181-11220	220	60 ma	
760-98XH- 182-11115	115	110 ma	73 CFM
181-11220	220	60 ma	

PERFORMANCE CURVE 98



60 Hz PERFORMANCE

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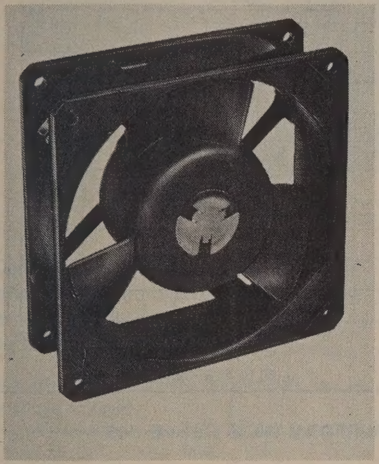
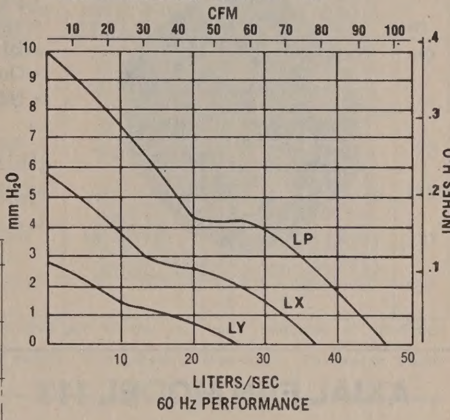
AXIAL FAN MODEL 133



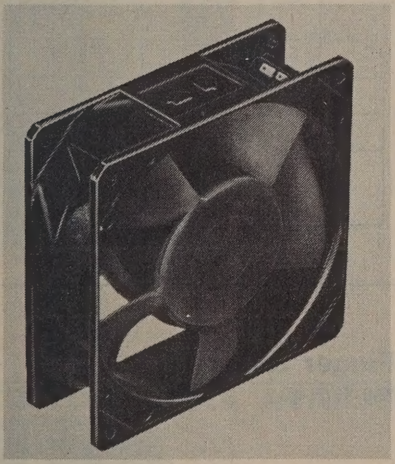
- Popular 4⅝ x 1½ inch size
- 4⅛ inch mounting centers
- 60 CFM at .15 inch of water, 100 CFM Free Flow
- 50% more air at typical working pressures
- At least 5 decibels quieter at typical working pressures
- U.L. recognized file 64887
- Reduced flow versions for very quiet applications
- Sleeve or ball bearing

Part Number		Volt	Current	Delivery
133LY-	2182	115	125 ma	52 CFM
	2181	220	65 ma	
133LX-	2182	115	140 ma	77 CFM
	2181	220	75 ma	
133LP-	2182	115	150 ma	100 CFM
	2181	220	80 ma	

PERFORMANCE CURVE 133



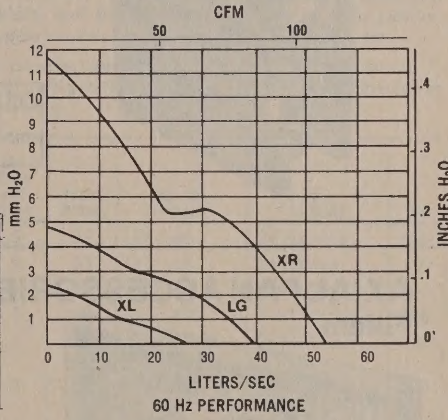
AXIAL FAN MODEL 125



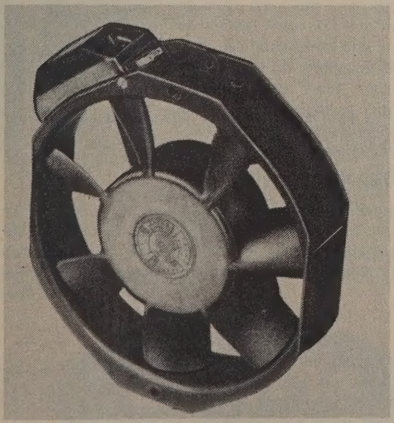
- 4⅝ x 1½ inch size
- 4⅛ inch mounting centers
- 85 CFM at .15 inch of water, 115 CFM Free Flow
- Industry's most powerful 4⅝ inch fan
- U.L. recognized file 64887
- Reduced flow version for quiet applications
- Sleeve or ball bearing

Part Number		Volt	Current	Delivery
	182-11115	115	115 ma	57 CFM
760-125XL-	181-11220	220	60 ma	
	182-11115	115	160 ma	83 CFM
760-125LG-	181-11220	220	85 ma	
	2182-11115	115	180 ma	115 CFM
760-125XR-	2181-11220	220	100 ma	

PERFORMANCE CURVE 125



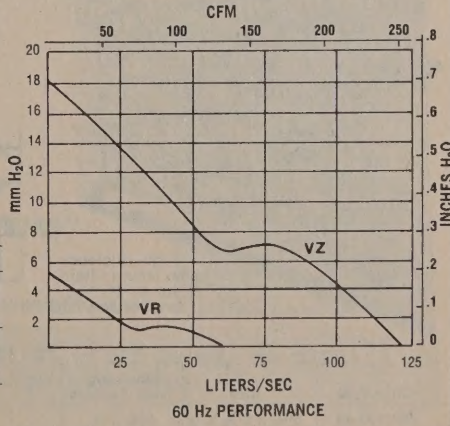
AXIAL FAN MODEL 120



- 6¾ x 6 x 1½ inch thin size
- 6⅜ inch mounting centers
- 163 CFM at .25 inch of water, 260 CFM Free Flow
- Can replace up to four 4⅝ inch fans
- Quieter than competitive 2 inch thick fans
- U.L. recognized file 64887
- Reduced flow version for even quieter operation

Part Number		Volt	Current	Delivery
	282-11115	115	150 ma	127 CFM
760-120VR-	281-11220	220	70 ma	
	282-11115	115	350 ma	260 CFM
760-120VZ-	281-11220	220	195 ma	

PERFORMANCE CURVE 120



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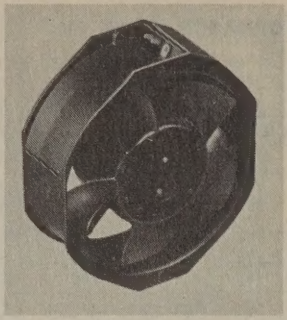
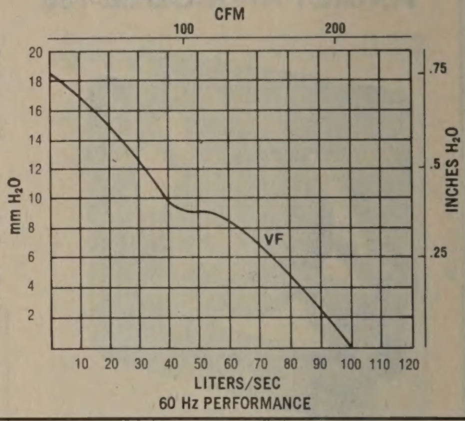
AXIAL FAN MODEL 122



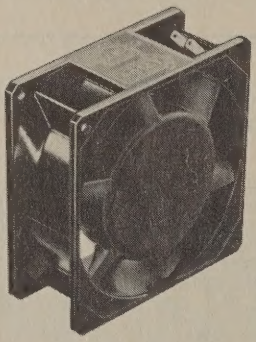
- 6¾ x 6 x 2 inch size
- 6⅜ inch mounting centers
- 150 CFM at .25 inch of water, 215 CFM Free Flow
- Quieter than competitive fans
- U.L. recognized file 64887

Part Number	Volt	Current	Delivery
760-122VF- 582-11115	115	500 ma	215 CFM
581-11220	220	260 ma	

PERFORMANCE CURVE 122



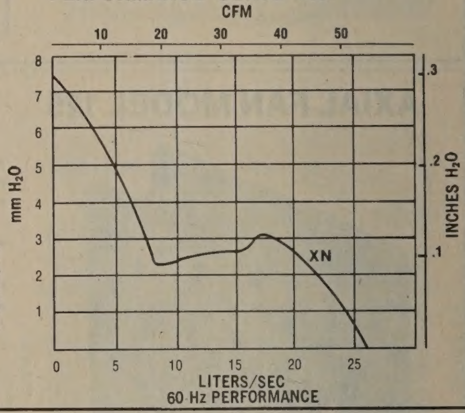
AXIAL FAN MODEL 113



- 3⅝ x 1½ inch size
- 3.248 inch mounting centers
- 40 CFM at .1 inch of water, 53 CFM Free Flow
- Convenient intermediate size
- U.L. recognized file 64887
- Sleeve or ball bearing

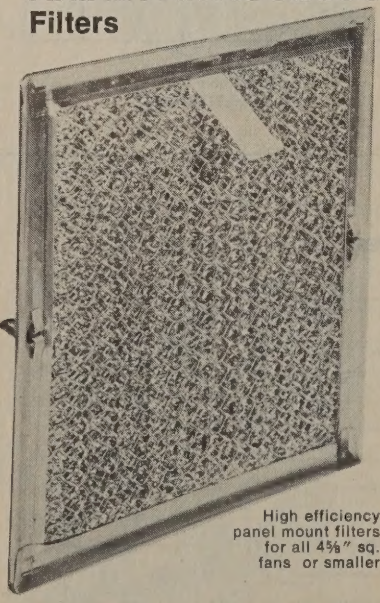
Part Number	Volt	Current	Delivery
760-113XN- 2182-11115	115	135 ma	53 CFM
2181-11220	220	70 ma	

PERFORMANCE CURVE 113



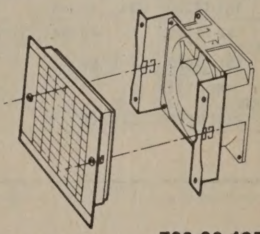
AXIAL FAN ACCESSORIES

Filters



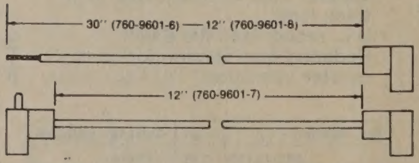
High efficiency panel mount filters for all 4⅝″ sq. fans or smaller

Filter P/N	Size	Mounting Hole Centers
760-100-45	5¹¹⁄₁₆ x 5¹¹⁄₁₆ x ¼	5³⁄₁₆±¹⁄₁₆



760-96-125

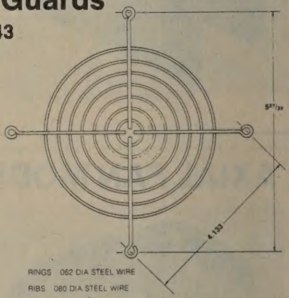
For all 4½ inch square fans; prevents coarse materials from entering unit. Filter mounts easily to the body of the fan by use of attached spring clips. Wire mesh screen is held in place by a pair of quick-release screws.



UL approved #18GA wire molded terminal ⅜ inch end stripped.
760-9601-6 — 30″ long
760-9601-7 — 12″ jumper for multiple connection
760-9601-8 — 12″ long

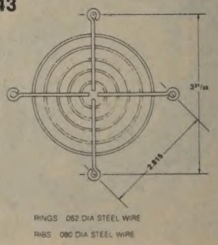
Finger Guards

760-9601-43



Fits all 4½ inch square fans. Meets UL spacing requirements.
Bright zinc finish over steel wire.

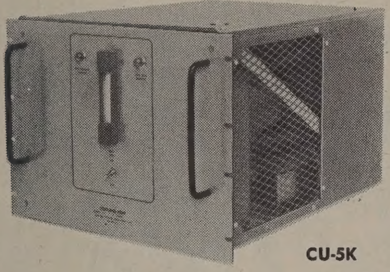
760-12601-43



Fits all 3⅛ inch square fans. Meets UL spacing requirements.
Bright zinc finish over steel wire.

COOLING UNITS
HEAT EXCHANGE-REFRIGERATING

Electro
IMPULSE, INC.


CU-5K

Heat exchange cooling units are useful whenever it is desirable to prevent runaway heat conditions. Heat is absorbed by a circulating coolant liquid, then exhausted into the ambient by forced air passing through a radiator.

Use this series when coolant temperature can be allowed to rise above ambient.

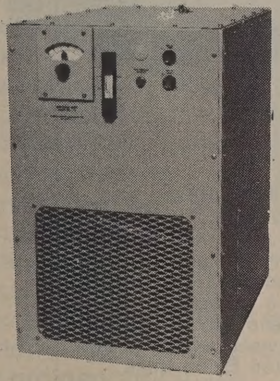
CU SERIES
WATER TO AIR HEAT EXCHANGERS

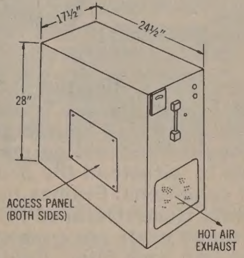
Model	Cap Watts (BTU/Hr)	(1) Temp. Rise (Water)	Coolant Flow	Max. Press.	Std. Op Volt	Size LxWxH	Wt.
CU-500	500 (1700 BTU)	10/500 w	.5	30	115-1-60	10x14x20	60
CU-5000	5000 (17,000 BTU)	5/KW	1	50	115-1-60	23x17⁷⁄₁₆x14	75
CU-10,000	10,000 (34100)	4/KW	2	50	115-1-60	22x17½x18	95
CU-20K	20,000 (68,000 BTU)	1.25/KW	5	60	208/230 1-60	33½x21½x30	175
CU-50K	50,000 (170,000 BTU)	0.5/KW	12	60	208/230-3-60	40x40x40	250
CU-100K	100,000 (341,000 BTU)	0.3/KW	20	60	208/230-3-60	64x96x68	400

(1) Measured coolant rise above ambient per °F per unit watts indicated at rated flow using water.

Optional Equipment Available: Flow switch, Thermometers, Thermostat, Flowmeter, Heater and Water De-ionizer.

RU SERIES


RU-75



Models from this series are required when coolant temperatures must be below ambient. Using refrigeration, they can provide temperatures to 0 degrees C and below, while removing up to 11,000 watts of heat.

These units are ideal for remote applications. Coolant temperatures are low, flow rate is steady, and the final heat sink can be in a location which will not cause overloading of air-conditioning equipment.

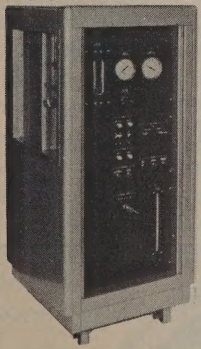
Special options can provide temperature control of ±0.15 degree F, while combinations of refrigeration and heating can hold temperatures at any point above ambient.

Model	Amb. 70°F Capacity Watts Water @ 65°F	Amb.90°F Capacity Watts Water @ 65°F	(1) Coolant Flow	Max. Press.	Std. Op Voltage	Size LxWxH	Wt.
RU-6	370	325	.5	30	115-1-60	24½x14x11	120
RU-12.5	900	780	.5	35	115-1-60	34x18x14	150
RU-25	1180	1050	1	50	115-1-60	23x13½x22	200
RU-50	1780	1560	1	50	115-1-60	17x17x15½	220
RU-75	2600	2300	1	50	115-1-60	24⅝x17¾x28¼	230
RU-100	3350	2900	3	60	208/220-1-60	24⅝x17¾x28¼	230
RU-200	4630	4130	3	60	208/220-1-60	26⅛x18¾x36¾	240
RU-300	7100	6100	4	60	208/230-3-60	32x18x36	300
RU-400	11,000	9000	5	60	208/230-3-60	32½x18x36⅜	390

(1) Recommended min. flows — other flow rates available.

Optional Equipment Available: Thermometer, Thermostat, Flow Meter, Heater.

CUSTOM UNITS AVAILABLE



If your cooling requirements are not satisfied by any of our standard units, we invite you to contact us for a quotation on a special unit. We can provide units for almost any cooling requirement. Military units are our specialty. The unit shown at the left is a Military heat exchanger designed to circulate and cool Monsanto coolanol 25. For qualification, it underwent rigorous environmental testing. We have in-house facilities and test chambers for vibration, temperature, humidity, altitude, etc. Ground support units to circulate and cool water in accordance with MIL-W-21965 are also available. Our quality control system conforms to MIL-I-45208A and MIL-Q-9858A.

REQUEST FREE APPLICATION BULLETIN #696: "CLOSED LOOP COOLING SYSTEMS"

Electro
IMPULSE, INC.
CLOSED LOOP COOLING SYSTEMS

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Electro
IMPULSE, INC.

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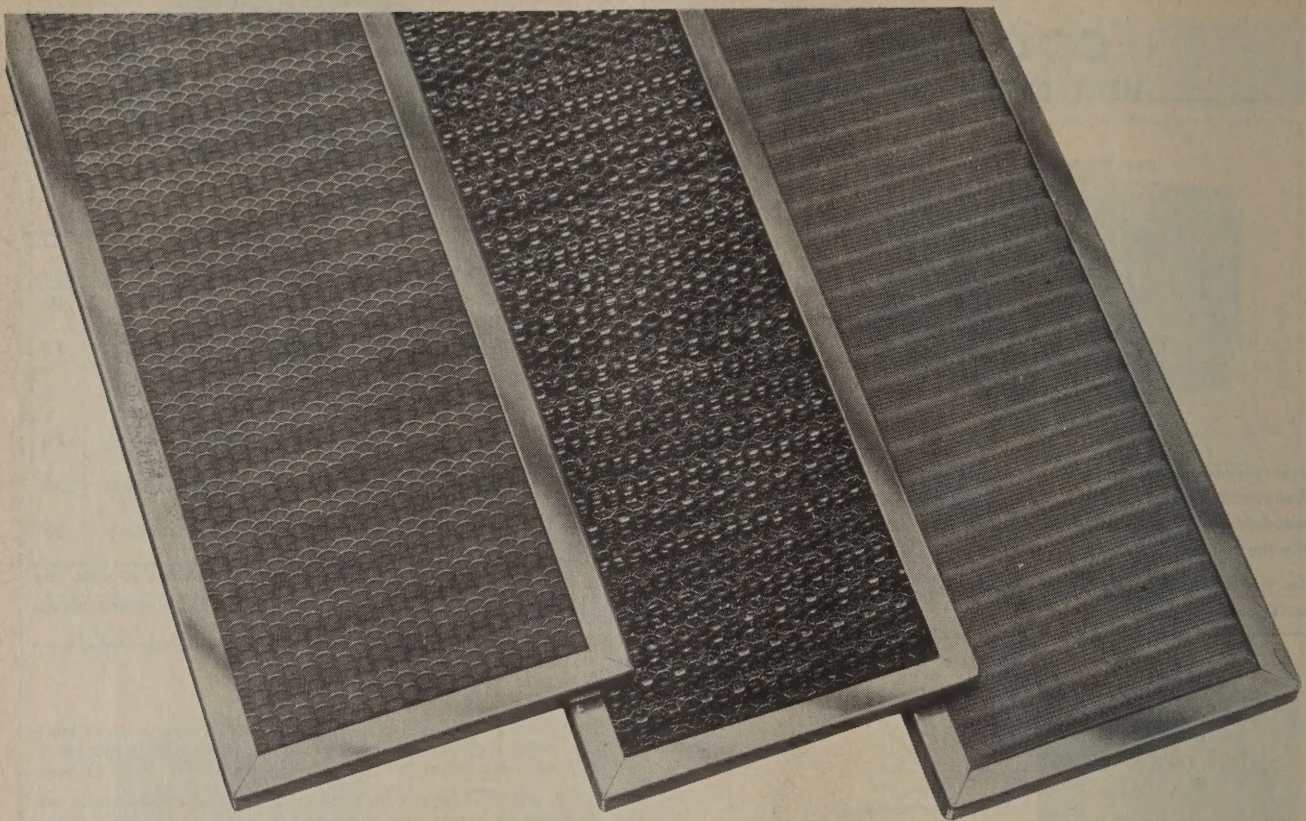
TELEPHONE: (201) 741-0404

SEE OUR OTHER PRODUCTS ON PAGE 2835

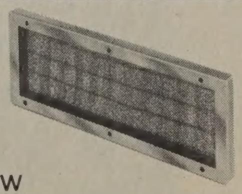


EVANS air filters

for Electronic Cabinet Application

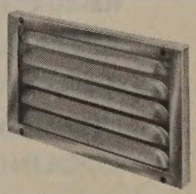
. . . used on Computers . . . Card Readers . . . Tape Transports . . . Transceivers . . . Power Supply Units . . . both large and small cabinetry. Evans Air filters are permanent. Rigid. Aluminum. Made to withstand the brutal abuse of military field conditions. Frames have mitered corners for smooth, close tolerance fit. Die cut, expanded aluminum grids are criss crossed and precision fitted into each filter. Patented Brillo Lock design gives more air delivery with positive cleaning results.

Tolerance:	± 1/32″
Velocity:	200 to 900 FPM
Efficiency:	75% AFI Test
Finishes:	Available in chemical film finish to meet requirements of MIL-C-5541 . . . MIL-F-14072 . . . MIL-A-8625
Sizes:	Filter of 1/2″ or 3/4″ dimension. Made to a maximum area 400 sq. inches . . . with maximum length 25″ on one side without special bracing. For complete information write or call.



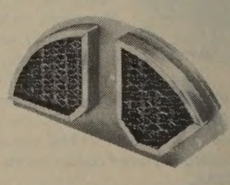
LOW
RESISTANCE FILTER

Special serts permit fastening solidly to blower unit. Made for air drop equipment.



LOUVERED FILTERS

For outside application. Louvers protect filter media from water, ice, snow.

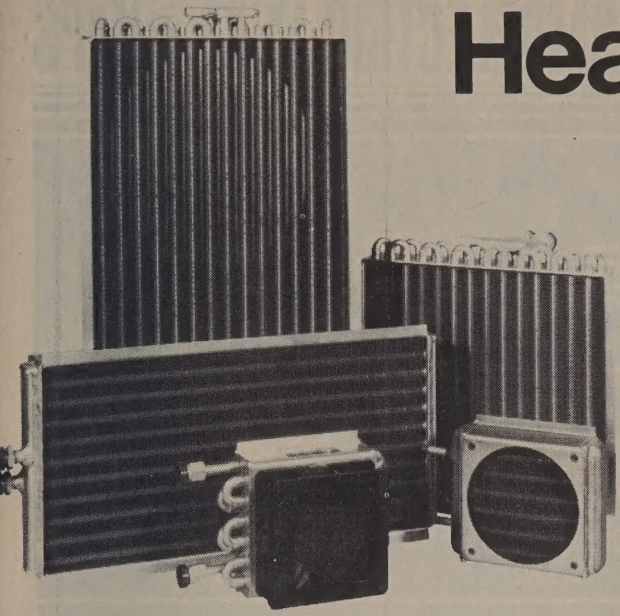


HEAVY DUTY UNIT

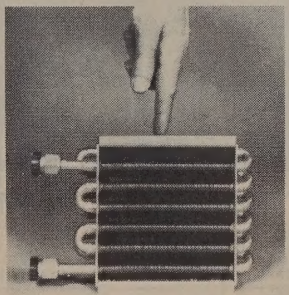
For rugged military use. Extra rigid frame made from .063 aluminum.

The George Evans Corporation

121-37th Street, Moline, Illinois 61265
Phone 309/762-9456



Heat exchangers that fit where others won't.

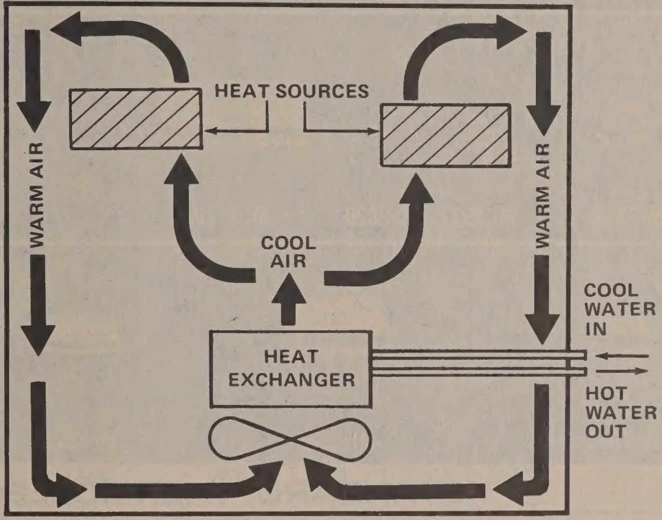


Compact Lytron heat exchangers fit tight spaces...pump heat out, efficiently.
Solve heat buildup problems with these compact, space-saving Lytron heat exchangers. Choose from 24 standard models, aluminum or copper. Exclusive INNER-FIN® construction increases internal cooling surface and saves up to 50% of ordinary coil space.

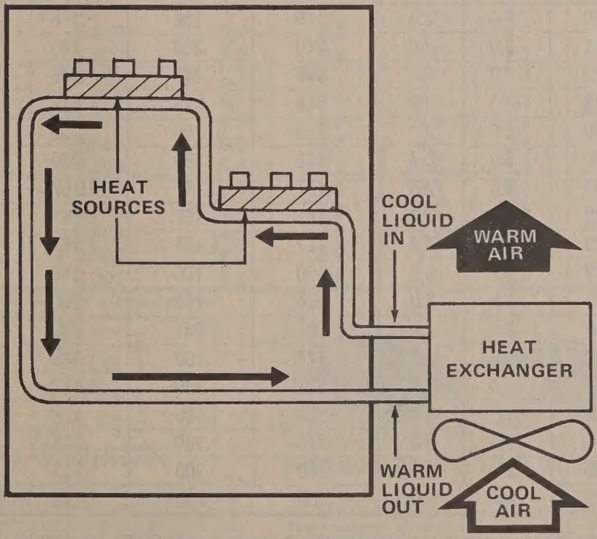
Ideal for cooling electronic cabinets, lasers, machine tools, computer systems, X-ray machines, space vehicles, airborne and mobile equipment...and a variety of electronic or mechanical equipment where unwanted heat builds up in tight quarters.

Compact Lytron heat exchangers—they fit where others won't. Special designs for special problems also available. As well as applications engineering assistance.

For compact size, minimum weight, proven reliability, prompt service and delivery at low cost, contact Lytron Incorporated, 2 Dragon Court, Woburn, Massachusetts 01801.
Phone: (617) 933-7300.


HEAT SOURCES
WARM AIR
WARM AIR
COOL AIR
HEAT EXCHANGER
COOL WATER IN
HOT WATER OUT

APPLICATION 1: REMOVING HEAT FROM COOLING AIR


HEAT SOURCES
COOL LIQUID IN
WARM AIR
HEAT EXCHANGER
WARM LIQUID OUT
COOL AIR

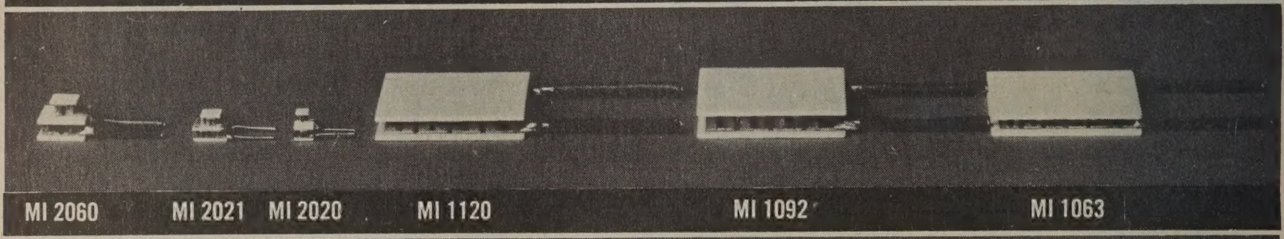
APPLICATION 2: REMOVING HEAT FROM COOLING LIQUID

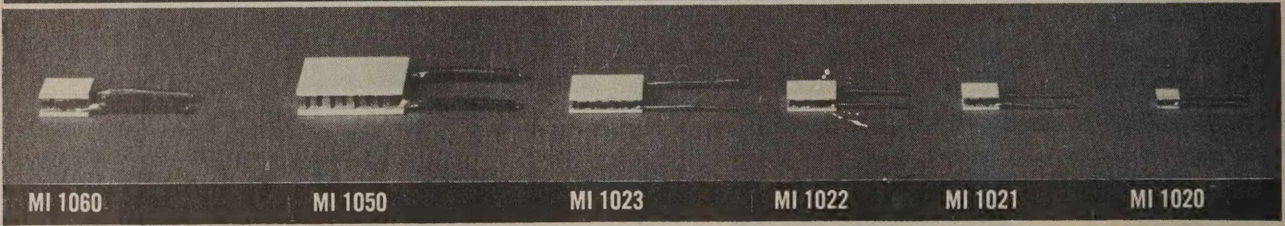
LYTRON
INCORPORATED

marlow industries incorporated
1021 S. JUPITER ROAD • GARLAND, TEXAS 75042

THERMOELECTRIC HEAT PUMPS

MI 6030
MI 6020
MI 4012
MI 4000
MI 3040
MI 3026





STANDARD THERMOELECTRIC HEAT PUMPS

MODEL	Imax (amps)	Vc @ Imax (volts)	TOP CERAMIC L (inches)	TOP CERAMIC W (inches)	BOTTOM CERAMIC L (inches)	BOTTOM CERAMIC W (inches)	HEIGHT H (inches)	Tc max VACUUM (10-6 Torr)	Tc max DRY NITROGEN (14.7 psia)	HEAT PUMP CAPACITY (mw/°C)
MI 1020	2.0	0.8	.156	.156	.156	.156	.113	−40	−33	17
MI 1021	2.0	2.0	.260	.260	.260	.260	.113	−41	−35	39
MI 1022	2.0	3.6	.346	.346	.346	.346	.113	−41	−35	73
MI 1023	2.0	8.2	.518	.518	.518	.518	.113	−41	−35	164
MI 1050	5.0	3.7	.750	.750	.750	.750	.178	−41	−34	218
MI 1060	6.0	0.7	.380	.380	.380	.380	.165	−41	−33	55
MI 1063	6.0	7.5	1.167	1.167	1.167	1.167	.165	−41	−34	546
MI 1092	9.0	3.4	1.167	1.167	1.167	1.167	.212	−40	−33	350
MI 1120	12.0	3.4	1.167	1.167	1.167	1.167	.195	−41	−34	450
MI 2020	1.7	0.9	.100	.100	.156	.156	.200	−70	−56	4
MI 2021	1.5	2.0	.156	.156	.260	.260	.200	−64	−55	11
MI 2060	5.5	0.8	.207	.207	.380	.380	.294	−70	−54	12
MI 3026	1.2	2.9	.174	.160	.346	.346	.285	−84	−62	6
MI 3040	4.0	6.5	.511	.339	1.113	.855	.421	−80	−68	54
MI 4000	0.5	6.0	.314	.160	.678	.522	.405	−85	−50	4
MI 4012	1.0	6.0	.314	.160	.678	.522	.405	−88	−60	8
MI 6020	1.7	6.0	.200	.200	1.113	.855	1.012	−100	−33	3
MI 6030	3.7	6.0	.200	.200	1.113	.855	.802	−105	−56	5

Thermoelectric heat pumps are now being used in industrial and military equipment that requires small, efficient, vibration free, cooling systems. Marlow Industries Standard heat pumps are available from stock for off-the-shelf delivery. The smaller heat pumps can be mounted on TO-37 or TO-8 headers. The larger modules can be mounted to a Flat Plate for ease of installation into a system. Related products such as temperature controllers/power supplies, and heat sinks are also available.

To assist you in selecting a thermoelectric heat pump for your next requirement, write for our "Guide To Thermoelectric Heat Pumps."

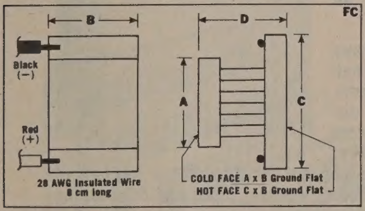
marlow industries
incorporated 1021 S. Jupiter Road • Garland, Texas 75042 • (214) 494-2521 • TWX 910-860-5161

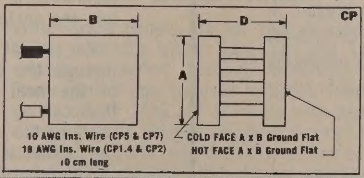
MELCOR SOLID STATE COOLING WITH THERMOELECTRICS

THERMOELECTRIC (PELTIER) HEAT PUMP MODULE SPECIFICATIONS

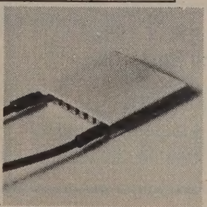
CATALOG NUMBER	I MAX. AMPS	Q MAX. WATTS (HOT FACE Th = 27°C)	V MAX. VOLTS (HOT FACE Th = 27°C)	ΔT MAX. °C (HOT FACE Th = 27°C)	MULTIPLIER Q & V	DIMENSIONS MM A	DIMENSIONS MM B	DIMENSIONS MM C	DIMENSIONS MM D	WEIGHT GMS
CP Series										
CP 1.4- 3-10L	3,6	0,8	0,36	70,0	0,04	5,0	10,0		4,8	0,6
CP 1.4- 7-10L	3,6	1,9	0,85	70,0	0,10	10,0	10,0		4,8	1,4
CP 1.4-11-10L	3,6	2,9	1,33	70,0	0,15	10,0	15,0		4,8	2,2
CP 1.4-17-10L	3,6	4,6	2,06	70,0	0,24	15,0	15,0		4,8	3,4
CP 1.4-35-10L	3,6	9,4	4,24	70,0	0,49	15,0	30,0		4,8	7,0
CP 1.4-71-10L	3,6	19,0	8,60	70,0	1,00	30,0	30,0		4,8	14,2
CP 1.4- 3-06L	6,0	1,3	0,36	67,5	0,04	5,0	10,0		3,8	0,5
CP 1.4- 7-06L	6,0	3,0	0,85	67,5	0,10	10,0	10,0		3,8	1,2
CP 1.4-11-06L	6,0	4,6	1,33	67,5	0,15	10,0	15,0		3,8	1,8
CP 1.4-17-06L	6,0	7,2	2,06	67,5	0,24	15,0	15,0		3,8	2,9
CP 1.4-35-06L	6,0	14,8	4,24	67,5	0,49	15,0	30,0		3,8	6,0
CP 1.4-71-06L	6,0	30,0	8,60	67,5	1,00	30,0	30,0		3,8	12,2
CP 2 - 3-10L	8,5	1,8	0,36	70,0	0.10	8,0	15,0		5,7	1,9
CP 2 - 7-10L	8,5	4,3	0,85	70,0	0,23	15,0	15,0		5,7	4,3
CP 2 -11-10L	8,5	7,7	1,33	70,0	0,35	15,0	23,0		5,7	6,5
CP 2 -15-10L	8,5	9,2	1,81	70,0	0,48	15,0	30,0		5,7	8,9
CP 2 -31-10L	8,5	19,0	3,75	70,0	1,00	30,0	30,0		5,7	18,5
CP 2 - 3-06L	14,0	2,9	0,36	67,5	0,10	8,0	15,0		4,7	1,6
CP 2 - 7-06L	14,0	6,8	0,85	67,5	0,23	15,0	15,0		4,7	3,6
CP 2 -11-06L	14,0	10,6	1,33	67,5	0,35	15,0	23,0		4,7	5,5
CP 2 -15-06L	14,0	14,5	1,81	67,5	0,48	15,0	30,0		4,7	7,5
CP 2 -31-06L	14,0	30,0	3,75	67,5	1,00	30,0	30,0		4,7	15,7
CP 5 -31-10L	36,0	81,0	3,75	70,0	1,00	55,0	55,0		7,1	107,0
CP 5 -31-06L	60,0	130,0	3,75	67,5	1,00	55,0	55,0		6,1	93,5
CP 7 -17-10L	70,0	87,0	2,06	70,0	1,00	55,5	55,5		7,1	104,0
CP 7 -17-06L	115,0	135,0	2,06	67,5	1,00	55,0	55,0		6,1	91,5
FC Series										
FC 0.6- 4-06L	1,1	0,30	0,48	67,5	0,125	2,1	4,1	4,1	2,7	All weights below 0.7 g
FC 0.6- 8-06L	1,1	0,60	0,97	67,5	0,250	4,1	4,1	6,2	2,7	
FC 0.6-12-06L	1,1	0,90	1,46	67,5	0,375	4,1	6,2	6,2	2,7	
FC 0.6-18-06L	1,1	1,35	2,18	67,5	0,562	6,2	6,2	8,2	2,7	
FC 0.6-32-06L	1,1	2,40	3,88	67,5	1,000	8,2	8,2	10,3	2,7	
FC 0.6- 4-05L	1,4	0,38	0,48	67,5	0,125	2,1	4,1	4,1	2,4	All weights below 0.7 g
FC 0.6- 8-05L	1,4	0,75	0,97	67,5	0,250	4,1	4,1	6,2	2,4	
FC 0.6-12-05L	1,4	1,13	1,46	67,5	0,375	4,1	6,2	6,2	2,4	
FC 0.6-18-05L	1,4	1,69	2,18	67,5	0,562	6,2	6,2	8,2	2,4	
FC 0.6-32-05L	1,4	3,00	3,88	67,5	1,000	8,2	8,2	10,3	2,4	
FC 0.7- 4-05L	1,9	0,52	0,48	67,5	0,125	2,3	4,6	4,6	2,4	All weights below 0.7 g
FC 0.7- 8-05L	1,9	1,04	0,97	67,5	0,250	4,6	4,6	6,9	2,4	
FC 0.7-12-05L	1,9	1,56	1,46	67,5	0,375	4,6	6,9	6,9	2,4	
FC 0.7-18-05L	1,9	2,34	2,18	67,5	0,562	6,9	6,9	9,2	2,4	
FC 0.7-32-05L	1,9	4,16	3,88	67,5	1,000	9,2	9,2	11,5	2,4	

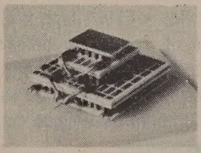
FC 0.6 - 4 - 06 = 0.6 mm x 0.6 mm element cross section — 4 thermocouples — .060″ element height

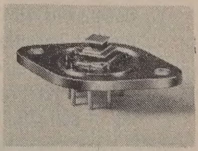

FC
B
D
Black (−)
Red (+)
A
C
28 AWG Insulated Wire 8 cm long
COLD FACE A x B Ground Flat
HOT FACE C x B Ground Flat


CP
B
D
A
10 AWG Ins. Wire (CP5 & CP7)
18 AWG Ins. Wire (CP1.4 & CP2)
10 cm long
COLD FACE A x B Ground Flat
HOT FACE A x B Ground Flat

Oriented polycrystalline thermoelectric elements, ceramic faced. Temperature range −150°C to +110°C. For solder interfacing (hot side), specify type TL. Non-ceramic series MC (not tabulated) available in 15, 30, and 60 amperes. Most sizes available from stock. Special modules, assemblies and multi-stage cascades available on special order. Complete catalog available on request.







THERMOELECTRIC HEAT PUMPS

Multi-stage cascades (2 and 3 stage pictured) available in standard and custom configurations. Temperature differentials to 105°C (4 stage). Beryllia ceramic construction with solder interfacing between stages.

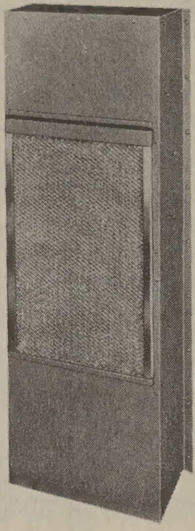
Complete line of single stage modules available in 56 models from 2.1 mm x 4.1 mm (67°C max ΔT, 0.30 watts heat pumped, 1.1 amps, 0.48 volts max) to 55 mm x 55 mm (67°C max ΔT, 135 watts heat pumped, 115 amps, 2.1 volts max).

Modules, cascades, assemblies supplied in O.E.M. quantities.

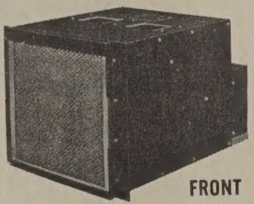
MELCOR

Materials Electronic Products Corporation
990 SPRUCE STREET • TRENTON, NEW JERSEY 08648 U.S.A.
Telephone (609) 393-4178 Telex 843314

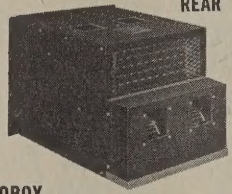
AIR CONDITIONERS • HEAT EXCHANGERS • HEAT PIPES



SLIMBOY



FRONT



REAR

LOBOY

AIR CONDITIONERS

- FOR COMPUTER-CONTROLLED MACHINE TOOL SYSTEMS
- ELECTRONICS
- COMPUTERS
- 6000 TO 10,000 BTU

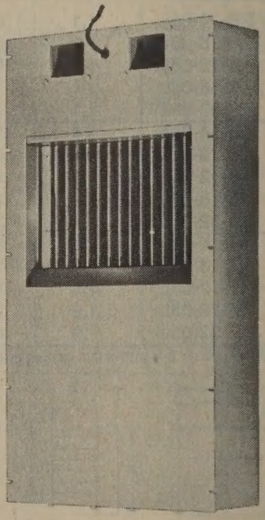
SLIMBOY — For longer life and greater reliability for solid state components and controls packaged door-mounted or rack-mounted units in 115 or 220 volts. Easy to install. Dimensions 19″ wide x 51¼″ high x 17″ deep. Sealed to prevent induction of ambient or polluted air. Centrifugal blowers deliver cool air at high velocity to heat producing components. Pressure-sensing by-pass valve prevents freezing of coil. 20,000 hours continuous duty assured.

LOBOY — All the performance characteristics of the SLIMBOY in a compact 6000 BTU package, 19″ x 15$\frac{23}{32}$″ high x 25$\frac{1}{16}$″ deep. Operates on 115 volts, 60 Hz; 135 lbs; draws 12 amps.

HEAT EXCHANGERS

These water-cooled heat exchangers are designed for mounting in the front panel of a 19″ electronic cabinet and for removing the heat from the air being recirculated within the cabinet. The system does not use room ambient air nor does it exhaust warm inside cabinet air into the atmosphere. An interior cabinet temperature of 80°F (max.) with a 1 KW heat dissipation can be maintained. The unit employs 66°F to 70°F chilled inlet water.

Substantially more cooling may be obtained by using refrigerated water or direct expansion of a refrigerant.



HEAT PIPE HEAT EXCHANGERS

The business end of these McLean cooling systems consists of a bank of heat pipes and two dual centrifugal blowers. A highly efficient method of cooling and recirculating electronic cabinet air without introducing ambient, contaminated, or polluted air into the enclosure.

Hot cabinet air is drawn through the bottom half of the heat pipe bank, thus cooling it, and discharging this cool air into the cabinet at 350 CFM at 0″ SP. A blower draws ambient air through the top half of the heat pipe bank, cooling the heat pipes and discharging heated air into the atmosphere.

A stable interior temperature 16°F above ambient is maintained. The unit mounts on the door or mounting rails of the rack and does not take up interior space.

Send for Catalog

Complete engineering specs on a broad line of cooling equipment for electronics.

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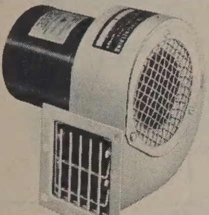
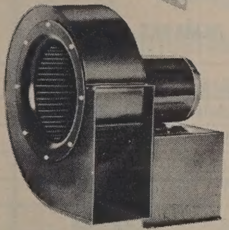
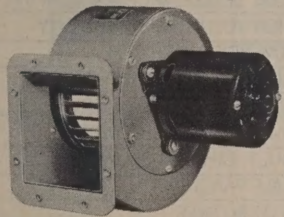
ENGINEERING LABORATORIES
Dept. EM, Princeton Junction, NJ 08550
(609) 799-0100 • Telex 84-3422

McLEAN
ENGINEERING MIDWEST
Dept. EM, 9560 Eighty-Fifth Ave. N.
Maple Grove, MN 55369 • (612) 425-4747

SINGLE & DUAL CENTRIFUGAL BLOWERS FILTER GRILLE PANELS





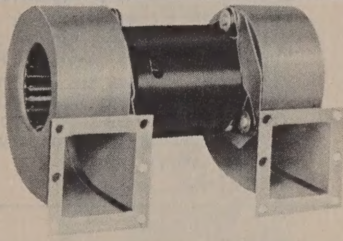


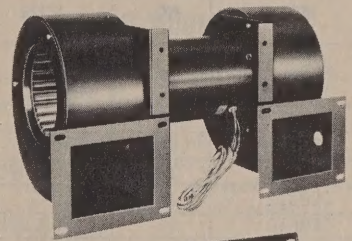
SINGLE CENTRIFUGAL BLOWERS—McLean does have a large selection of single centrifugal blowers engineered to meet a wide variety of CFM output and pressure characteristics. Inlet duct flanges, exhaust outlet flanges and protective screens are available. CW and CCW rotations can be supplied. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motor and wheels are balanced to precision tolerances assuring vibration-free operation. All motors are UL approved. These blowers may be operated in any shaft position.

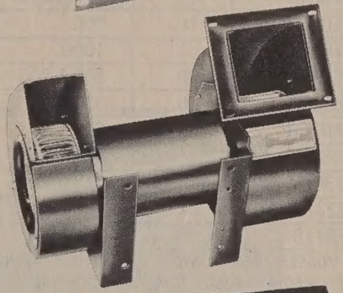
CFM output ranges from 50 to 2000 CFM with static pressures from 0″ to 3.0″ SP. Motors can be supplied for any AC frequency or power.

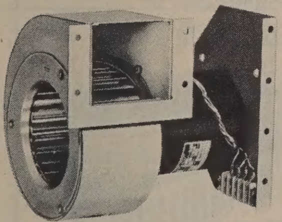
DUAL CENTRIFUGAL BLOWERS—There is an extensive variety of McLean Dual Centrifugal Blowers offering a wide choice of static pressure and output characteristics. Wheel diameters range from 3″ to 12″. Motors can be supplied for any AC frequency or power, single or three phase. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motors and wheels are balanced to precision tolerances assuring vibration-free operation. All motors are UL approved.

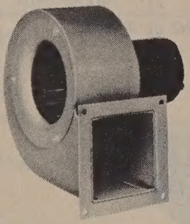
Exhaust outlet flanges, inlet duct flanges, protective screens and various types of mounting flanges and supports are available.

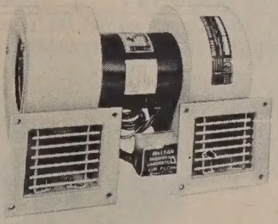


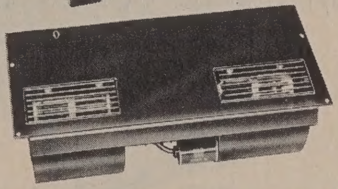




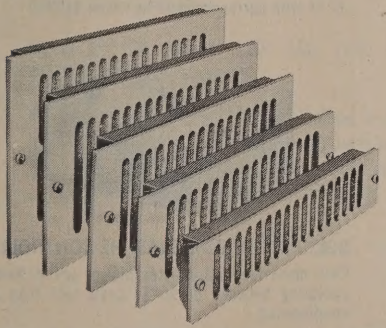




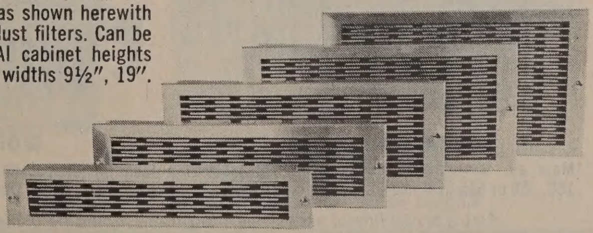




FILTER GRILLE PANELS



Filter Grille Panels are for use in electronic cabinets where louvered area is needed to permit adequate ventilation. These panels may be used as an air inlet or air outlet. They are available with two different grille designs as shown herewith and are complete with dust filters. Can be supplied in standard EAI cabinet heights from 3½″ x 10½″ and widths 9½″, 19″. 24″ and 30″.



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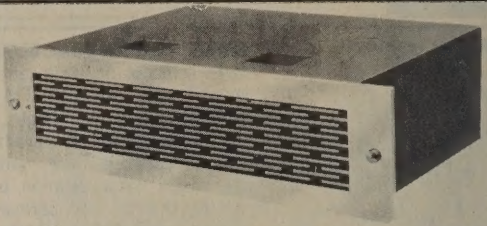
PACKAGED COOLING EQUIPMENT

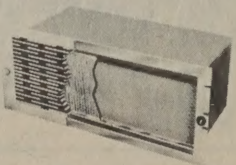
RACK–MOUNTED BLOWERS

Over 100 models available in any panel width. Heights from 3½" to 12¼". Airflows to 1000 CFM. Pressurize systems with cool, filtered air. Prevent dust from entering systems. Standard EIA notching. Quick, easy mounting. No cutting. No filing. Also Packaged Fans for pressurizing or evacuating. Four sizes. Airflows from 275 to 120 CFM. All units available to Commercial, Military or EMI Shielded Specifications.



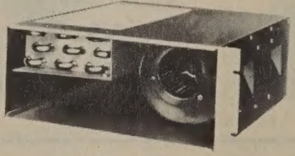
MODEL	NO	CFM	PANEL* HEIGHTS	MOTOR**		REMARKS
				RPM	AMPS OR WATTS	
2EB300	12	150	3½ & 5¼	2900	70W	FOR LIMITED SPACE
2EB3500	12	290	3½ & 5¼	3200	175W	HIGH PRESSURE-LIMITED SPACE
2EB408	16	300	5¼ & 7	1500	60W	QUIET OPERATION
2EB412	16	350	5¼ & 7	3000	200W	HIGH PRESSURE & VELOCITY
2EB508	16	325 & 475	7 & 8¾	1250-1600	0.8/0.6 amps	DUAL SPEED-LOW VELOCITY
2EB512	16	500	7 & 8¾	1700	130W	LARGE VOL. HIGH VELOCITY
2EB610	16	450 & 750	8¾ & 10½	1100-1500	1.6-1.3amps	DUAL SPEED-LARGE VOL.-LOW VEL.
2EB612	16	800	8¾ & 10½	1650	220W	HIGH VOLUME-HIGH VELOCITY
1EB800G	1	1000	10½	1100	240W	LOW NOISE-HIGH CFM
2EB412	20	500 & 700	5¼-7-8¾	3000	200W	SIDE DISCHARGE DUCT BLOWER
P1E350	6	350 or 675	5¼	3000	200W	PONTOON BASE BLOWER
4EB300	2	250	5¼ X 14⅝D	Two 3100	80W	MULTI-EXHAUST BLOWER
4EB424	2	450	7 X 19½D	Two 1700	70W	MULTI-EXHAUST BLOWER
ID300M	4	75	5¼	3000	40W	HALF PANEL WIDTH
IE2200	1	150	3½	3150	80W	SLOT BLOWER
IEB710	9	180 to 515	1¾-3½-5¼-7	1600	900W	SIDEWINDER

*ALL MODELS ARE 19" WIDTH EXCEPT ID300M (HALF PANEL) **ALL MOTORS ARE 115V 50/60 NZ UL APPROVED
UNITS ALSO AVAILABLE TO OTHER RACK WIDTHS AND FOR RECESSED INSTALLATION



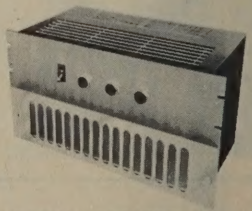
EMI—SHIELDED UNITS

All packaged blowers available with an EMI shield and wave guide media built into the airstream. Cuts signal leakage inward or outward.



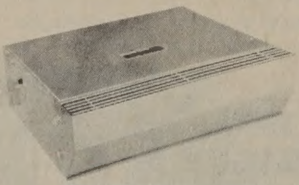
HEAT EXCHANGERS

Maintain cabinet temperature at 80°F maximum with 1 KW heat dissipation. Air recirculates in rack and is cooled by exchanger in blower case.



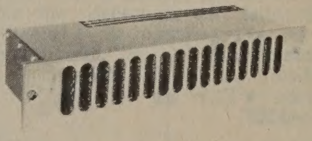
HEATER—COOLERS

For unheated field installations. Maintains an even 65°F with surrounding air as low as 10°F.



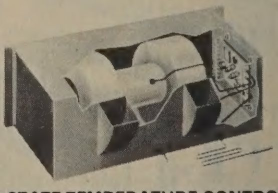
SIDEWINDER BLOWERS

More air. More pressure. Less space. Delivers 180, 350 or 515 CFM in a 17" wide airstream.



SLOT BLOWERS

Ideal for jam-packed circuitry. Delivers 150 CFM from a 3½" panel. Quiet.



SOLID STATE TEMPERATURE CONTROLLERS

Cuts noise level. Modulates blower speed. Keeps operating between 80-90°F. Costs less than air conditioning.

Also a broad line of accessory equipment including grilles, controls, etc.

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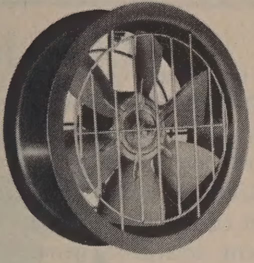
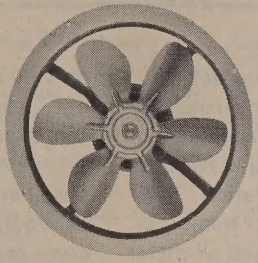
FANS—Venturi, Orifice, Panel, Reversible

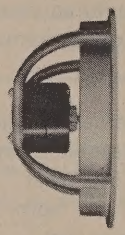


VENTURI-MOUNTED

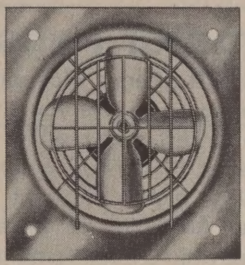
MODEL 1VB80 Push or pull airflow. 420 cfm. Mounts easily on top, bottom, or side. Black anodized aluminum 3⅞″ deep, 1600 rpm, 60 watt, 115 volt, 50/60 Hz, shaded pole, stainless steel shaft, double-shielded ball bearings, permanent lube.



ORIFICE-MOUNTED



SERIES 1NB65-80 Push or pull airflow. 275,300, or 395 cfm. Dimensions 4″ x 8½″ or 4¾″ x 10¼″. Strong, light axial flow aluminum for maximum pressure. Mounts top, bottom, or side. Quiet, vibrationless. 115 volts, 50/60 Hz, 1600 rpm or 3000 rpm.



PANEL-MOUNTED

SERIES 1PB65 Low cost, long life, ready-to-mount, shaft in any position: Easy to install. Propeller side and motor side protected with heavy wire guards. 280 cfm, 3100 rpm, 70 watt, 115 volt, 50/60 Hz, permanent lube. 10″ square panel on 9″ centers, 4 23/32″ deep.

REVERSIBLE FILTER BOX PROPELLER FANS

Mechanically reversible. Wide range of airflows. Flexible mounting. Efficient, versatile, compact.

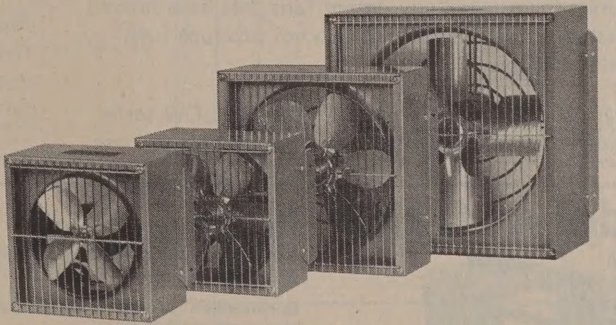
Model 1RB65 delivers 275 cfm, 3100 rpm 4½″ deep x 8⅞″ square

Model 1RB80 delivers 450 cfm, 1650 rpm 4½″ deep x 8⅞″ square

Model 1RB100 delivers 725 cfm, 1600 rpm 4½″ deep x 12⅛″ square

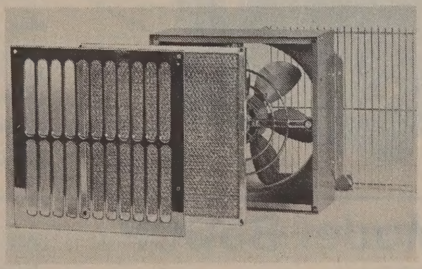
Model 1RB120 delivers 1200 cfm, 1450 rpm 4½″ deep x 15⅛″ square

Model LA120 Back Draft Damper is used in conjunction with Model 1RB120. Louvers automatically open when power is applied and close when power is off. May be used in horizontal or vertical positions.



MODEL 1RB65 MODEL 1RB80 MODEL 1RB100 MODEL 1RB120

MODEL LA120



EXTRA EQUIPMENT: STAINLESS STEEL GRILLE, PERMANENT WASHABLE FILTER, HEAVY GAUGE PROPELLER GUARD

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Pentaflow™ Premium Grade Fans

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Pamotor Fans

PAMOTOR offers a wide selection of cooling devices, each designed to give you a maximum performance at minimum cost. As a result of many years of engineering excellence, PAMOTOR fans have earned a reputation for reliability, high quality and low-noise operation. The unique PAMOTOR design has been awarded numerous patents, which, when combined with its rugged all-metal construction, is ounce-for-ounce the best investment for your cooling dollar. PAMOTOR fans are designed to outlast the equipment they cool.

All PAMOTOR fans are warranted to be free of defects in materials and workmanship for a period of one year. The PAMOTOR PENTAFLOW™ premium grade series are warranted for five years.

PAMOTOR fans are ideal for EDP systems and peripheral equipment, electronic test equipment, medical equipment, broadcast equipment, high-power lamps, color processing equipment, emergency generators, color TV/hi-fi amplifiers, electrical controls, telephone equipment, vending machines, airborne equipment, mobile radio equipment, shipboard computers and communications systems.

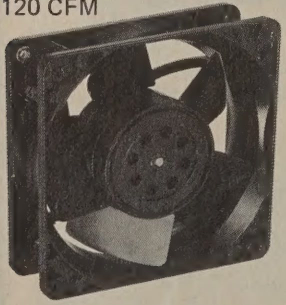
Perhaps the two most important fields of applications for PENTAFLOW fans are: (1) in limited-production deluxe equipment, in professional-grade instrumentation, in few-of-a-kind, custom-designed and permanently-installed systems requiring optimum performance and absolute dependability for many years; (2) as field replacements or retrofit units for original-equipment fans that have proved to be unreliable, are too noisy, or do not produce sufficient cooling airflow.

Every model in the premium PENTAFLOW series incorporates the seven basic points of superiority that are so designed into all standard PAMOTOR fans: lightweight, durable all-metal construction . . . high reliability . . . low noise level . . . low operation temperature . . . optimized shape factor . . . minimum electromagnetic field . . . low true cost.

In addition, PENTAFLOW models possess other important proprietary design features for extended long life, optimized performance, and highest reliability; accordingly, they carry a full 5-year warranty against defects in materials and workmanship.

Model 4600XP

120 CFM



Size: 4½" Square x 1½" Deep

Advantages: Extra high airflow at maximum back pressures.

Construction: All-metal, shaded-pole motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

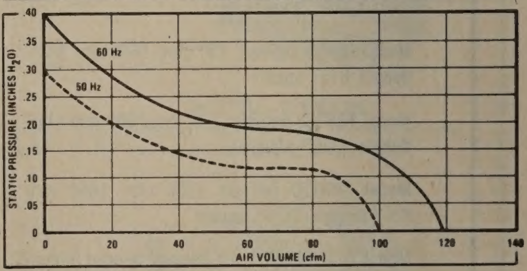
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504, 5505.

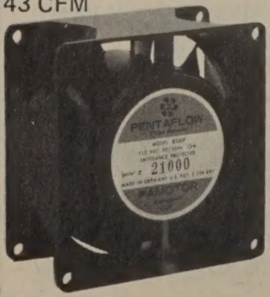
Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
4600XP	X		115	50/60	18 W	120	3100	18	46	34



Model 8500P

43 CFM



Size: 3-1/8" Square x 1½" Deep

Advantages: Compact, high airflow, low noise.

Construction: All-metal, shaded-pole motor, 12" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

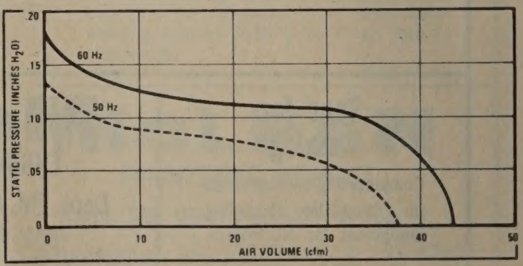
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5508.

Fan Drawing: See figure 7, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
8500P	X		115	50/60	13 W	43	3200	18	38	22.3



Induction Fans

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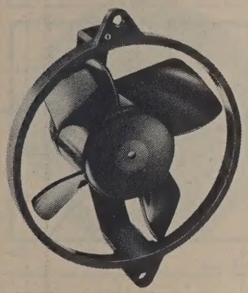
Model 900

34 CFM (variable)



Size: 3-1/8" Diameter x 1½" Deep

Advantages: Ultra compact - little mounting space required, very quiet, variable airflow, extremely low stray field, axial and radial air entry.

Construction: Special polyamid, induction motor, 6" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

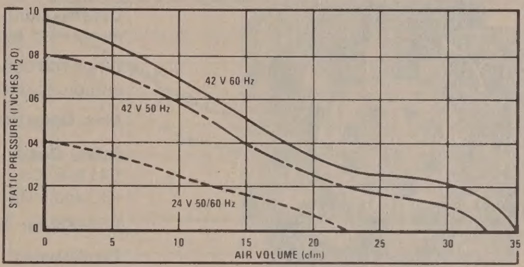
Max. Operating Temp.: +55° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Capacitor Required: 5.6 mfd.

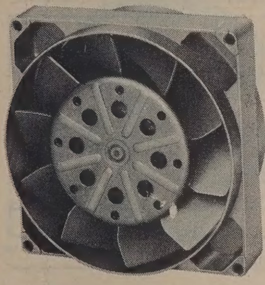
Fan Drawing: See figure 9, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
900	X		24 - 42	50/60	2 - 3 W	34	1700	4	22	16.8



Model 1300

120 CFM



Size: 4½" Square x 2" Deep

Advantages: Compact, stable airflow and back pressures, ideal for tube mounting.

Construction: All-metal, induction motor, 3" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

Max. Operating Temp.: +55° C.

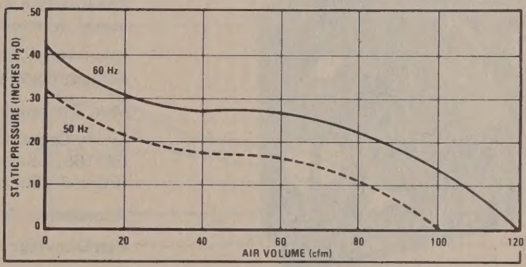
Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5507

Capacitor Required: 2 mfd

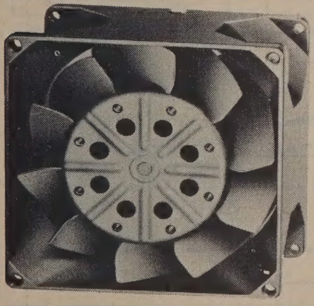
Fan Drawing: See figure 10, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
1300	X		230	50/60	25 W	120	3400	42	52	37.6



Model 2110

125 CFM



Size: 4½" Square x 2" Deep

Advantages: 400 Hz operation, high airflow, maximum back pressures.

Construction: All-metal, induction motor, 6" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

Max. Operating Temp.: +55° C.

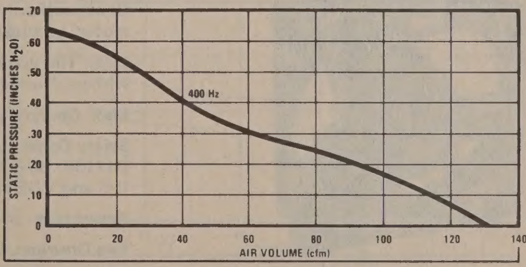
Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504.

Capacitor Required: .5 mfd.

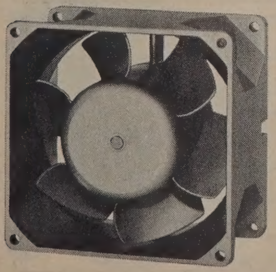
Fan Drawing: See figure 1, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
2110		X	115	400	30 W	125	3720	32	61	44.9



3000 Series

65 CFM



Size: 3½" Square x 2"

Advantages: Highest airflow for size, low noise.

Construction: All-metal, induction motor, 6" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

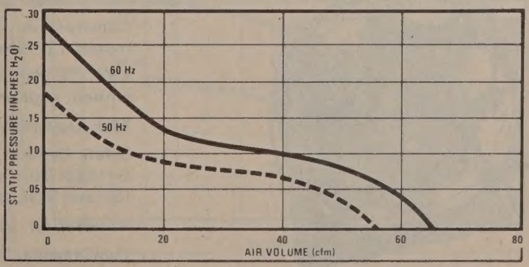
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Capacitor Required: 4 mfd.

Fan Drawing: See figure 11, page 15

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
3000	X		115	50/60	15 W	65	3180	19	46	29.3
3050U	X		230	50/60	15 W	65	3150	19	46	29.3



Shaded Pole Fans

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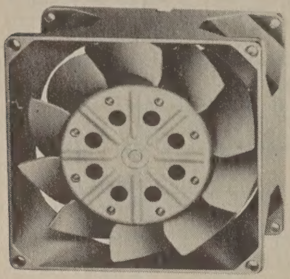
2500 Series
115 CFM



Size: 4½" Square x 2" Deep

Advantages: Powerful, concentrated air stream, high cooling capacity.

Construction: All-metal, shaded-pole motor, 12" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

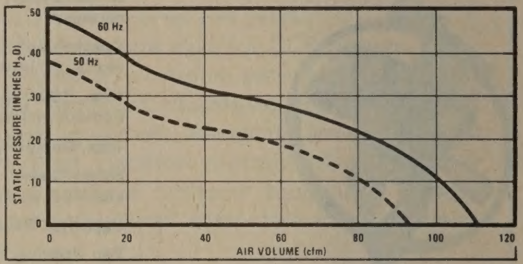
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

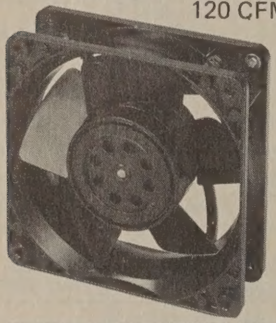
Accessories: 5501, 5502, 5503, 5504.

Fan Drawing: See figure 1, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
2500S	X		115	50/60	27 W	115	3300	32	53	37.5
2550S	X		230	50/60	27 W	115	3300	32	53	37.5



4600X Series
120 CFM



Size: 4½" Square x 1½" Deep

Advantages: Extra high airflow at maximum back pressures.

Construction: All-metal, shaded-pole motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

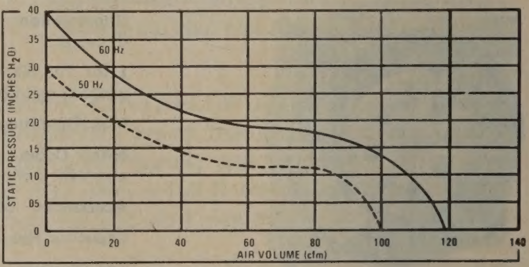
Max. Operating Temp.: +55° C (*+85° C).

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

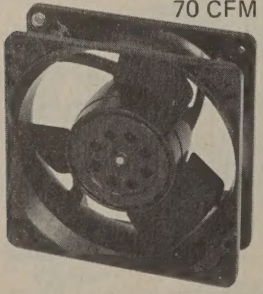
Accessories: 5501, 5502, 5503, 5504, 5505.

Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
4600X	X		115	50/60	18 W	120	3100	18	46	34
4606X*		X	115	50/60	18 W	120	3100	18	47	35
4650X	X		230	50/60	18 W	120	3100	18	46	34
4656X*		X	230	50/60	18 W	120	3100	18	47	35



Model 4800X
70 CFM



Size: 4½" Square x 1½" Deep

Advantages: The quietest of fans in this size.

Construction: All-metal, shaded-pole motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

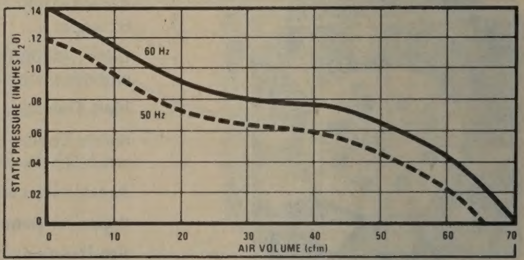
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

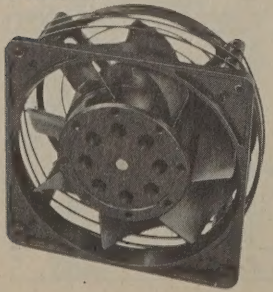
Accessories: 5501, 5502, 5503, 5504, 5505.

Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
4800X	X		115	50/60	10 W	70	1900	18	32	21



5500 Series
140 CFM



Size: 4½" Square x 2" Deep

Advantages: Axial and radial air entry for use in high density cooling applications, built-in finger guard.

Construction: All-metal, shaded-pole motor, 12" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

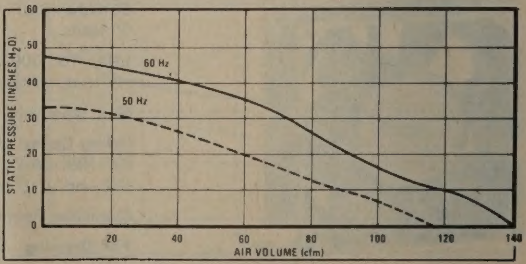
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504.

Fan Drawing: See figure 4, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
5500S	X		115	50/60	40 W	140	3300	35	50	37
5550S	X		230	50/60	38 W	140	3300	35	50	37



Shaded Pole Fans

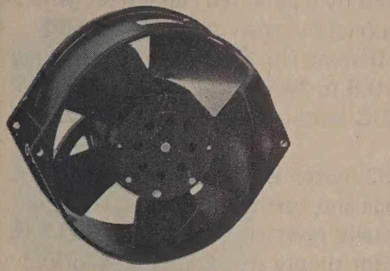
PAMOTOR

ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA. 94010 • (415) 347-1203 • TWX 910-374-2353 • TELEX 34-9373

7600 Series

250 CFM



Size: 6″ Diameter x 2″ Deep

Advantages: High airflow, excellent back pressures.

Construction: All-metal, shaded-pole motor, 12″ leads.

Life: 100,000 hours continuous at 25° C without maintenance.

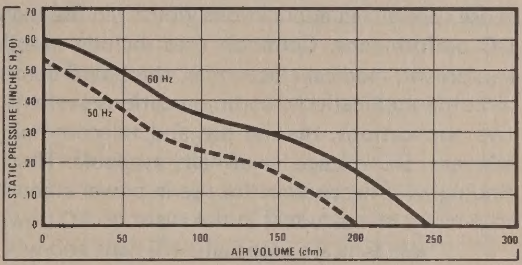
Max. Operating Temp.: +55° C (*+85° C).

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5506.

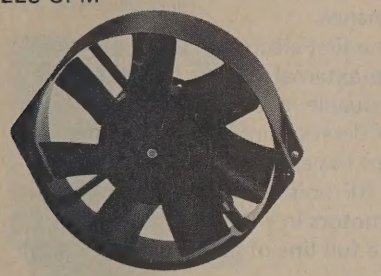
Fan Drawing: See figure 5, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
7600S	X		115	50/60	38 W	250	3200	38	54	40
7606*		X	115	50/60	38 W	250	3200	38	54	41
7650S	X		230	50/60	38 W	250	3200	38	54	40
7656*		X	230	50/60	38 W	250	3200	38	54	41



7900 Series

225 CFM



Size: 6″ Diameter x 1½″ Deep

Advantages: Minimum depth, high airflow, low noise in operating modes.

Construction: All-metal, shaded-pole motor, 12″ leads.

Life: 100,000 hours continuous at 25° C without maintenance.

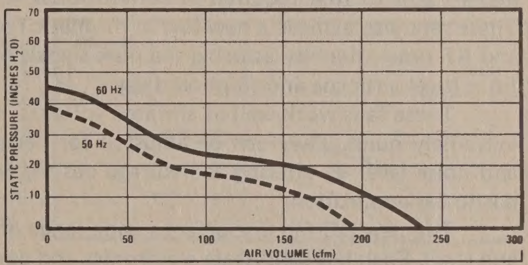
Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5506.

Fan Drawing: See figure 6, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dR (SIL)
7900S	X		115	50/60	41 W	225	2900	27	58	47
7950S	X		230	50/60	40.5 W	225	2900	27	58	47



8500 Series

43 CFM

SYSTEM PAPST
MODEL 8500
PAMOTOR
SAN FRANCISCO USA

Size: 3-1/8″ Square x 1½″ Deep

Advantages: Compact, high airflow, low noise.

Construction: All-metal, shaded-pole motor, 12″ leads.

Life: 100,000 hours continuous at 25° C without maintenance.

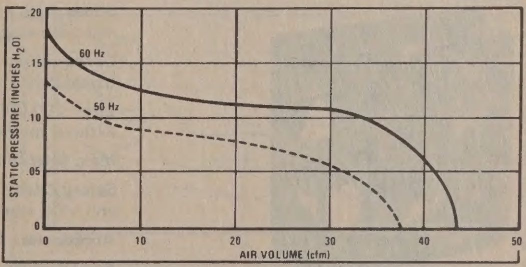
Max. Operating Temp.: +55° C (*+85° C).

Safety Codes: UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Accessories: 5508.

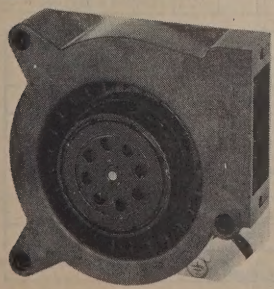
Fan Drawing: See figure 7, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
8500C	X		115	50/60	13 W	43	3200	18	38	22.3
8506*		X	115	50/60	13 W	43	3200	18	39	23
8550C	X		230	50/60	13 W	43	3200	18	38	22.3
8556*		X	230	50/60	13 W	43	3200	18	39	23



RL90-18 Series

29 CFM



Size: 4-3/4″ Square x 1½″ Deep

Advantages: High concentrated airflow at maximum pressures, low acoustical disturbance, perfect for spot cooling.

Construction: Makrolon housing, ultramid wheel, shaded-pole motor, 12″ leads.

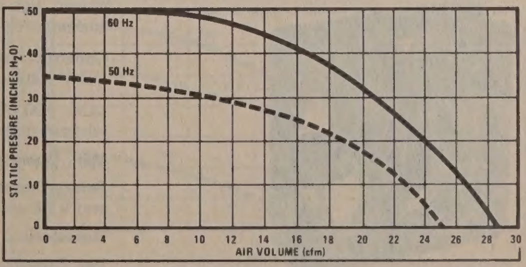
Life: 100,000 hours continuous at 25° C without maintenance.

Max. Operating Temp.: +55° C.

Safety Codes: UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.

Fan Drawing: See figure 8, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (ac)	Frequency (Hz)	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
RL90-18/00	X		115	50/60	21 W	29	2700	23	57	42.7
RL90-18/50	X		230	50/60	19 W	29	2600	23	57	42.7



DC Fans

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA. 94010 • (415) 347-1203 • TWX 910-374-2353 • TELEX 34-9373

PAMOTOR has an all new series of self-contained solid state brushless DC fans for you to choose from. Through their new design, these fans have been engineered to tackle those specialized applications which require highly reliable DC performance. Common uses include mobile radio equipment, medical electronics, shipboard computers, airborne applications, communications systems, automotive applications, marine use and telecommunications; wherever DC voltage is normally available. They are also finding wide acceptance for use in power stand-by modes to prevent memory loss in the event of AC power failure.

These fans are especially efficient and will outperform any similar sized fans at normal operating back pressure. Typically, they offer greater air volume (cfm), reduced noise levels and reduced power drain. For example, the power drain at maximum back pressure is approximately 20% of that required in conventional AC units. These fans also achieve a new low in magnetic radiation and RF noise, thereby assuring the pure signals necessary for critical airborne and shipboard use.

These fans work well at all rated voltages, and are extremely quiet. They can be adjusted for performance and noise level by altering the voltage desired for your particular application.

The new DC fan line offers a wide range of models and sizes. Each has solid state electronics and conforms to UL, CSA, IEC and VDE standards. They feature a single phase brushless motor with all electronics mounted on a PC card within the motor frame. Drive amplifiers for the motor are controlled by a patented Hall-effect generator circuit which is coupled by small pole pieces to the motor's field magnet (Patent No. 3-873-897). Available voltage ranges include 9.5 to 14 VDC (12 VDC nominal), 19 to 28 VDC (24 VDC nominal), and 38 to 56 VDC (48 VDC nominal).

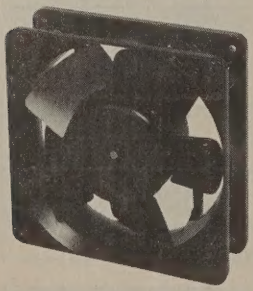
The brushless DC motor is polarity protected to avoid accidental damage and costly down time. If the input polarity is accidentally reversed, integral diodes block all circuits and the motor simply stops. Even in a locked rotor condition, the motor goes into a neutral state to avoid damage. Precision high temperature ball bearings and high temperature lubricants help to achieve a life expectancy of 100,000 hours of continuous operation at 25° C without maintenance.

These fans are the first electronic DC cooling fans that do not require an external voltage inverter. This means that you save valuable mounting space and weight because the only consideration in mounting is the fan itself. This new concept has eliminated many of the inherent reliability and RF noise problems generally associated with using AC motors in a DC environment.

PAMOTOR has a full line of accessory items available for their fans.

Model 4112X

122 CFM (variable)



Size: 4½" Square x 1½" Deep

Advantages: Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.

Construction: All-metal, brushless electronic motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

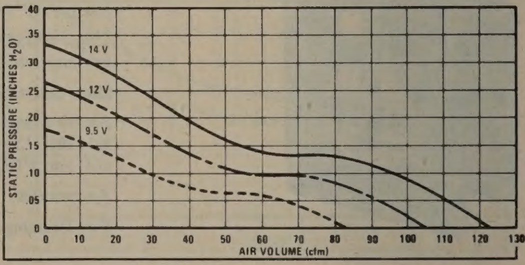
Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504, 5505.

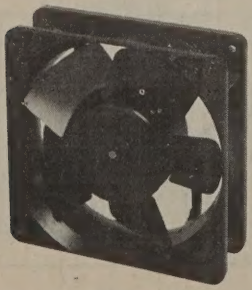
Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
4112X		X	9.5 - 14 12 Nominal	330 mA	4 W	106	2775	21	44	32.9



Model 4124X

122 CFM (variable)



Size: 4½" Square x 1½" Deep

Advantages: Solid state integral electronics no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.

Construction: All-metal, brushless electronic motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

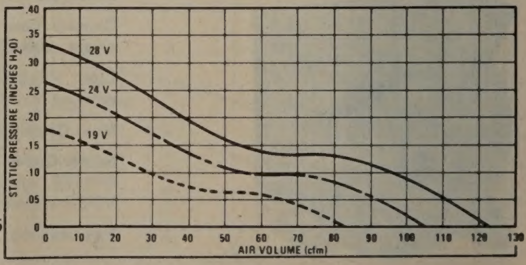
Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504, 5505

Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level	
									dB (A)	dB (SIL)
4124X		X	19 - 28 24 Nominal	170 mA	4.1 W	106	2775	21	44	32.9



DC Fans

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

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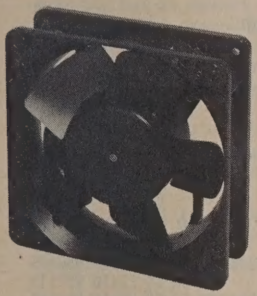
Model 4148X

122 CFM (variable)



Size: 4½" Square x 1½" Deep

Advantages: Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.

Construction: All-metal, brushless electronic motor, terminal block.

Life: 100,000 hours continuous at 25° C without maintenance.

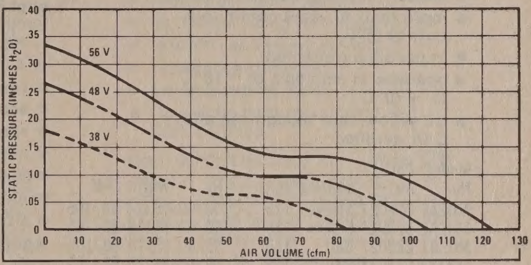
Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5501, 5502, 5503, 5504, 5505.

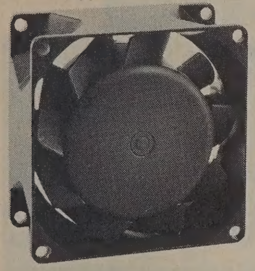
Fan Drawing: See figure 2, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
4148X		X	38 - 56 48 Nominal	85 mA	4.1 W	106	2775	21	44	32.9



Model 8112

41 CFM (variable)



Size: 3-1/8" Square x 1½" Deep

Advantages: Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.

Construction: All-metal, brushless electronic motor, 12" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

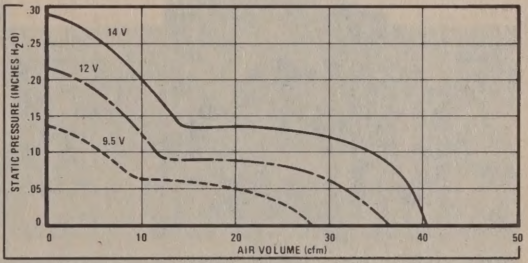
Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5508.

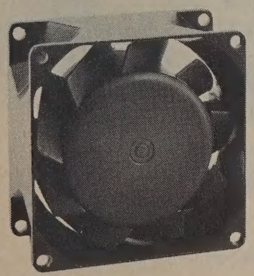
Fan Drawing: See figure 7, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
8112		X	9.5 - 14 12 Nominal	230 mA	4 W	37	3225	19	37	27.9



Model 8124

41 CFM (variable)



Size: 3-1/8" Square x 1½" Deep

Advantages: Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.

Construction: All-metal, brushless electronic motor, 12" leads.

Life: 100,000 hours continuous at 25° C without maintenance.

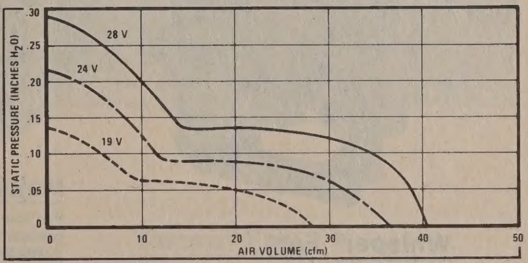
Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Accessories: 5508.

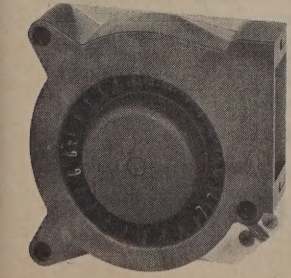
Fan Drawing: See figure 7, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
8124		X	19 - 28 24 Nominal	115 mA	2.8 W	37	3225	19	37	27.9



RL90-18/24

31 CFM (variable)



Size: 4-3/4" Square x 1½" Deep

Advantages: Solid state integral electronics, no external inverter required, low input power, high concentrated variable airflow, locked rotor and polarity protected.

Construction: Makrolon housing, ultramid wheel, brushless electronic motor, 12" leads.

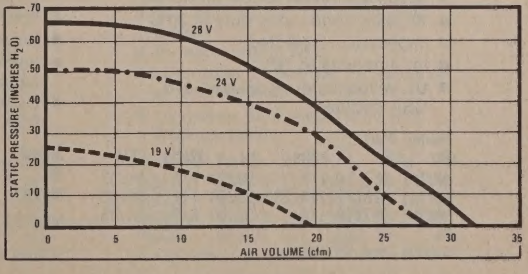
Life: 100,000 hours continuous at 25° C without maintenance.

Max. Operating Temp.: +80° C.

Safety Codes: Conforms to UL, CSA, IEC and VDE standards.

Fan Drawing: See figure 8, page 15.

Model Number	Sintered Iron Sleeve	Ball Bearing	Voltage (dc)	Input Current	Input Power	Airflow (cfm)	Speed (rpm)	Weight (ounces)	Noise Level dB (A)	Noise Level dB (SIL)
RL90-18/24		X	19 - 28 24 Nominal	235 mA	5 W	28	2500	22	56	44.9



Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

Muffin® Fan

The dependable, low cost, largest selling fan for commercial cooling applications.

- 105 cfm free air delivery
- 4.71″ sq. x 1.50″ depth
- weight 17 oz.
- acoustical rating as low as NC-43
- more than 10 years continuous duty at 20°C
- impedance protected
- operates in ambients of −18°C to +70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Bearing	Volts	Hz	Watts	CFM
MU2A1	028021	Sleeve	115	50/60	15/14	88/105
MU2A2	028022	Sleeve	115	50/60	15/14	88/105
MU2B1	028027	Ball	115	50/60	15/14	88/105
MU2B2	028028	Ball	115	50/60	15/14	88/105
MU3A1	028023	Sleeve	220/230	50/60	15/14	88/105
MU3A2	028024	Sleeve	220/230	50/60	15/14	88/105
MU3B1	028029	Ball	220/230	50/60	15/14	88/105
MU3B2	028030	Ball	220/230	50/60	15/14	88/105

Catalog Sheet COM 040

Sentinel® Fan

An especially rugged fan for severe application conditions, including temperature and shock.

- 105 cfm free air delivery
- 4.71″ sq. x 1.50″ depth
- weight 16 oz.
- acoustical rating as low as NC-43
- stainless steel ball bearings
- impedance protected
- for ambients to 100°C
- meets MIL E-4970A
- UL yellow card recognized

Model No.	Part No.	Volts	Hz	Watts	CFM
S747	020138	115	50/60	14	105
S756	020146	230	50/60	14	105

Catalog Sheet COM 060

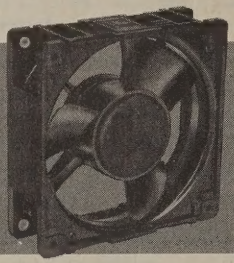
Centaur® Fan

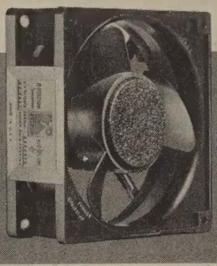
The highest performance in air and pressure delivery for a fan of its size.

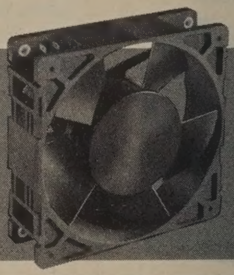
- 115 cfm free air delivery
- 4.69″ square x 1.53″ depth
- weight 19 oz.
- rugged die cast aluminum housing
- acoustical rating as low as NC-47
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Bearings	Volts	Hz	Watts	CFM
CR2A1	028076	Sleeve	115	50/60	23/16	95/115
CR52A1	028082	Sleeve	220/208-230	50/60	23/16	95/115
CR2B1	027079	Ball	115	50/60	23/16	95/115
CR52B1	028085	Ball	220/208-230	50/60	23/16	95/115
CR9A5	028162	Sleeve	115/230	50/60	23/16	95/115

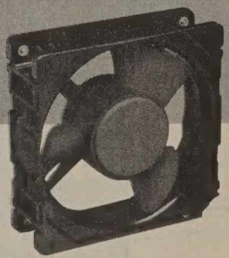
Catalog Sheet COM 070

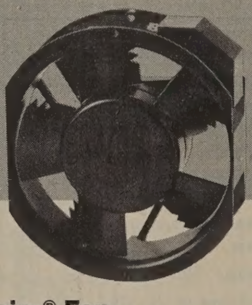


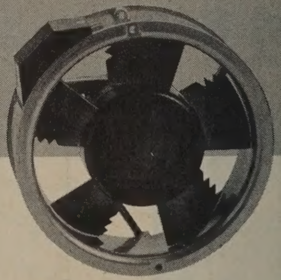




FOR COMMERCIAL APPLICATIONS







Whisper® Fan

The quiet one—for efficient cooling where low acoustical disturbance is a must.

- 52 to 75 cfm free air delivery
- 4.71″ sq. x 1.50″ depth
- weight 17 oz.
- acoustical rating as low as NC-26
- 10 years continuous duty at 20°C
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Volts	Hz	Watts	CFM
WR2A1	027117	115	50/60	7/7	51/52
WR3A1	028171	220/230	50/60	11/11	56/65
WR2H1	027119	115	50/60	8/7	64/75

Catalog Sheet COM 050

Major® Fan

For low cost, low noise, high pressure/volume cooling in the tightest of spaces.

- 240 cfm free air delivery
- 6.75″ x 5.92″ x 2.00″ depth
- weight: 1.84 lbs.
- acoustical rating as low as NC-53
- all metal one piece housing
- long life ball bearings
- thermally protected
- for ambients to 70°C
- permanent split capacitor motor, capacitor provided
- UL yellow card recognized and CSA certified

Model No.	Part No.	Volts	Hz	Watts	CFM
MR2B3	028245	115	50/60	40/39	200/240
MR77B3	028309	220/240 208/230	50/60	33/35	200/240

Catalog Sheet COM 080

Patriot® Fan

Quiet high pressure performance in a compact rugged fan.

- 240 cfm free air delivery
- 6.75″ dia. x 2″ depth
- weight: 1.84 lbs.
- acoustical rating as low as NC-47
- all-metal one-piece housing
- long life ball bearings
- permanent split capacitor motor, capacitor provided
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Volts	Hz	Watts	CFM
PT2B3	028154	115	50/60	40/39	200/240
PT77B3	028250	220/240 208/230	50/60	33/35	200/240

Catalog Sheet COM 083

Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

Biscuit® Blower

The only air moving device that fits inside a 1¾″ rack panel mounted instrument.

- 25 cfm free air delivery
- high pressure capability
- built around famous Muffin fan features
- 4.75″ square x 1.56″ depth
- weight 19 oz.
- acoustical rating as low as NC-42
- for ambients to 72°C
- UL yellow card recognized

Model No.	Part No.	Volts	Hz	Watts	CFM
BT2A1	025447	115	50/60	16	25
BT3A1	025449	230	50/60	17	25

Catalog Sheet COM 130

Sprite® Fan

A smaller size fan that delivers relatively high pressures at close-to-maximum air delivery.

- 35 cfm free air delivery
- 3.14″ sq. x 1.64″ depth
- acoustical rating as low as NC-28
- weight: 18 oz.
- for ambients to 70°C
- UL yellow card recognized and CSA certified
- leadwire and terminal models

Model No.*	Part No.	Volts	Hz	Watts	CFM
SU2A1	028267	115	50/60	13/11	29/35
SU3A1	028269	220/230	50/60	13/11	29/35
SU2E1	028275	115	50/60	7/6	23/27
SU3E1	028276	220/230	50/60	11/10	22/27
SU2C1	028270	115	50/60	5/5	19/21

*Leadwire model. Terminal models also available.

Catalog Sheet COM 030

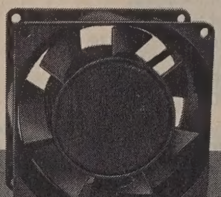
Lyric® Fan

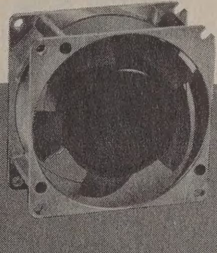
Thinness and low noise level are features that make this small fan the ideal choice for computer terminals.

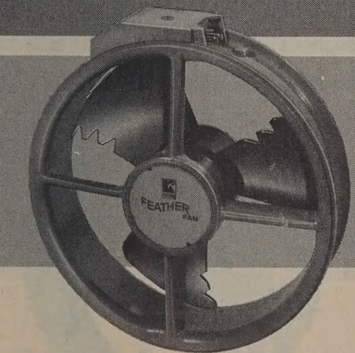
- 31 cfm free air delivery
- 3.14″ sq. x 1.38″ depth
- weight: 15 oz.
- rugged all-metal housing
- acoustical rating as low as NC-35
- leadwire and terminal models
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

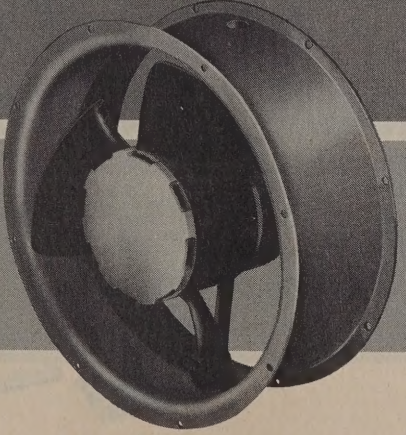
Model No.*	Part No.	Volts	Hz	Watts	CFM
LY2A1	028172	115	50/60	8.5	31
LY3A1	028173	230	50/60	8.5	31
LY2E1	028176	115	50/60	8.5	31
LY3E1	028177	230	50/60	8.5	31

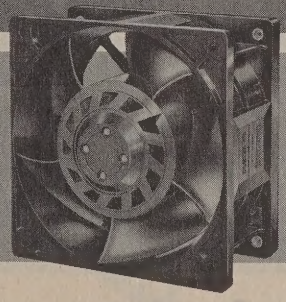
*Leadwire model. Terminal models also available.











Feather® Fan

High volume air performance where space is severely limited, particularly in depth.

- 270 cfm free air delivery
- 7″ dia. x 2.47″ depth
- weight 1.5 lbs.
- exclusive new Feathered Edge™ (pat. pend.) blade is extra quiet at free delivery; NC-48
- permanently lubricated ball bearings
- multi-slot split capacitor motor, capacitor provided
- for ambients to 65°C
- UL yellow card recognized

Model No.	Part No.	Volts	Hz	Watts	CFM	Thermal Protector
FF103	026161	115	50/60	20	270	No
FF113	026165	115	50/60	20	270	Yes
FF203	026162	230	50/60	20	270	No
FF213	026166	230	50/60	20	270	Yes

Catalog Sheet COM 090

Caravel® Fan

Maximum air volume, from a narrow fan, for flushing large racks and cabinets.

- 590 cfm free air delivery
- 10″ dia. x 3.5″ depth
- weight 4.4 lbs.
- ball bearing thermally protected slow speed motor
- acoustical rating as low as NC-45
- for ambients to 60°C
- UL yellow card recognized and CSA certified
- exclusive new Feathered Edge™ (pat. pend.) blade for low noise level operation

Model No.*	Part No.	Volts	Hz	Watts	CFM
CL2L2	020188	115	50/60	61	590
CL2T2	020189	115	50/60	61	590
CL3L2	020190	230	50/60	61	590
CL3T2	020191	230	50/60	61	590

*T = with terminals, L = with leads

Catalog Sheet COM 110

Tarzan® Fan

High air volume and pressure combined, for tightly packed cabinets and chassis.

- 340 cfm free air delivery
- 6.91″ square x 4.34″ depth
- weight 5 lbs.
- acoustical rating as low as NC-57
- ball bearing thermally protected motor
- for ambients to 55°C
- centrifugal blower performance in a compact axial flow fan
- UL yellow card recognized and CSA certified

Model No.*	Part No.	Volts	Hz	Watts	CFM
TN3A2	020174	115	50/60	85	340
TN3C2	020169	115	50/60	85	340
TN3A3	020172	230	50/60	85	340
TN3C3	020177	230	50/60	85	340

*A = terminals, C = leads

Catalog Sheet COM 120

Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

Wafer Fan

1″ thickness and low noise level for cooling applications in tight spots in equipment used near operators.

- 37 cfm free air delivery
- 3.63″ sq. x 1″ depth
- weight: 10 oz.
- acoustical rating as low as NC-41
- all metal one piece housing
- impedance protected
- for ambients to 55°C
- UL yellow card recognized

Model No.	Part No.	Bearing	Volts	Hz	Watts	CFM
WA2E79	028196	Ball	115	50/60	14/12	37
WA2F79	028334	Sleeve	115	50/60	14/12	37
WA2E77	028200	Ball	208-240	50/60	13/11	37
WA2F77	028392	Sleeve	208-240	50/60	13/11	37

Mohawk™ Fan

Highest air flow, quietest performance for 5¼″ rack mounted equipment.

- 127 cfm free air delivery
- 5.06″ sq. x 1.53″ depth
- weight: 22 oz.
- all metal housing
- exclusive Feathered Edge™ blade for low noise level operation, as low as NC-45
- slow speed 100 cfm model for noise levels as low as NC-42
- noise attenuator accessory provides even further noise reduction of 5 dB
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Volts	Hz
MW2A1	028178	115	50/60
MW3A1	028179	230	50/60
MW2C1	028180	115	50/60
MW3C1	028181	230	50/60

Spartan Fan

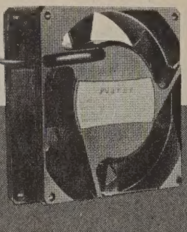
The MIL SPEC version of the famous MUFFIN

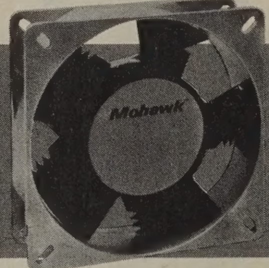
- 113 cfm free air delivery (132 cfm for 400 Hz model)
- unusually high pressure characteristics (up to .5″ hg)
- dimensionally interchangeable with Muffin fan (4.68″ square x 1.50″)
- Double shielded stainless steel ball bearings
- lubricated for life
- highly efficient multi-slot motor
- withstands ambients from −60°F (−54°C) to +212°F (+100°C)
- venturi, spiders, and hub are single aluminum casting for shock and vibration resistance
- meets all applicable mil specs for ground and shipboard

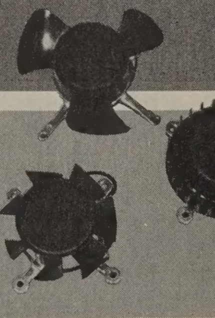
Motor Series	Volts	Hz	Watts	CFM
682YS	115	50/60	13	113
810DS	115	400	13	132

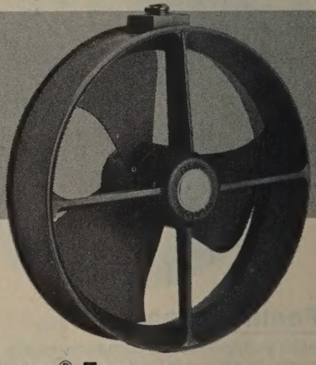
Type SL with leads, Type ST with terminals

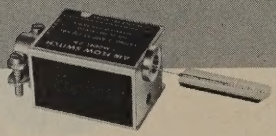
Catalog Sheet MIL 070











Scout™ Fan

Versatile, compact line of fans for applications demanding tightest packaging. Available with 3 impeller options, for use with customer designed air passages.

- 25 to 105 cfm free air delivery
- 1.6″ depth, impeller dia. 2.93″ to 4.19″
- weight: 12 oz.
- famous Muffin® motor reliability
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Model No.	Part No.	Volts	Hz	Impeller	Watts	CFM*
KM2AF	028118	115	50/60	Muffin	14	105
KM3AF	028121	230	50/60	Muffin	14	105
KM2CF	028122	115	50/60	Whisper	6	35
KS2AC	028129	115	50/60	Sprite	11	35
KS3AC	028130	230	50/60	Sprite	11	35
KS2CC	028194	115	50/60	Sprite	5	21
KB2AC	028131	115	50/60	Biscuit	16	25
KB3AC	028132	230	50/60	Biscuit	17	25

*Free delivery airflow when used in a recommended housing.

Airflow Interlock Switches

Model 2A Airflow Switch detects loss of airflow to protect equipment.

- rated at 5 amps 250 VDC
- SPDT actuation
- interchangeable vanes available for 8 sensitivity ranges
- mounts to round or flat duct with single screw

Determinator Kit available with complete set of 8 vanes and Model 2A Switch in plastic box.

Catalog Sheet MIS 010

Saucer® Fan

High volume and high pressure both, from a minimum of fan space.

- 275 cfm free air delivery
- generates pressures up to .5″ H_2O
- driving motor entirely within hub for minimum depth - 2.50″, dia. 7″
- pre-lubricated stainless steel ball bearings
- for ambients from −60°F (−54°C) to +257°F (+125°C)
- clamping rings at venturi ends for easy mounting
- meets all applicable military specifications

Motor Series	Volts	Hz	Watts	CFM
340ZS	115	50/60	25	275

Catalog Sheet MIL 080

Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

Aximax® - 1, 2, & 3

Family of miniature, high-performance air movers for air-borne and other critical space/weight/performance applications.

- free air delivery from 11 cfm to 160 cfm
- optional Altivar® motors automatically increase speed with altitude
- life expectancies from 10,000 hours up at 72°C
- withstand ambients up to 257°F (125°C)
- sizes: 1½″ x 1½″, 2″ x 1½″, and 3″ x 2 5/16″
- weight 4 oz., 4½ oz., and 14 oz. respectively
- meet all applicable military specifications

Models for 115 VAC, 1 phase, 400 Hz; 200 VAC, 3 phase, 400 Hz; and 115 VAC 1 phase, 60 Hz (except Aximax 1)

Catalog Sheets MIL 020, 030, 040

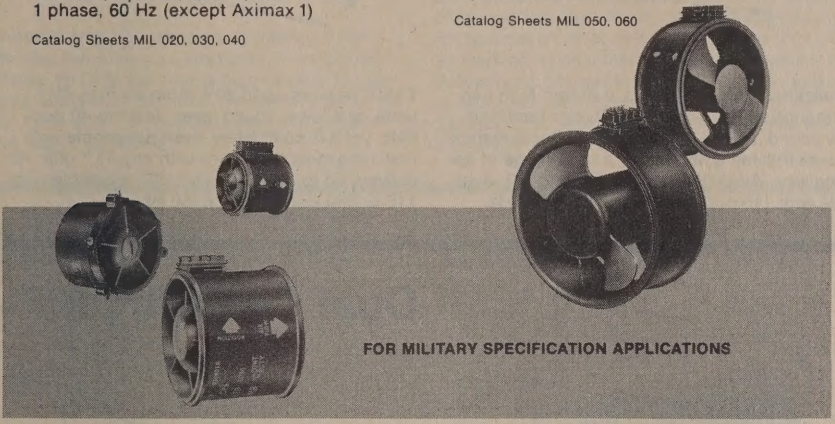
Propimax® 2, 3, & 3B

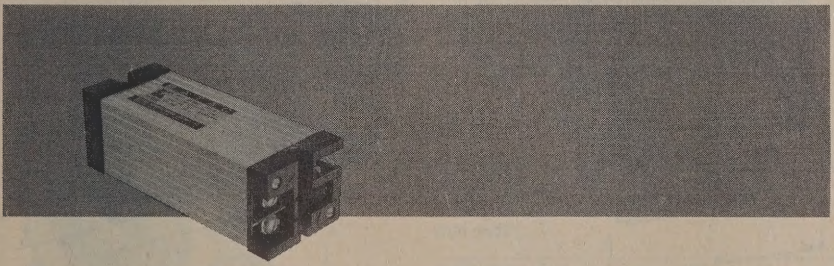
Large-volume and high-pressure air movers for airborne equipment.

- free air delivery from 22 cfm to 225 cfm
- offer pressures as high as 7″ H_2O at cut-off
- optional Altivar® motors automatically increase speed with altitude
- life expectancies of 10,000 hours at 14.7 psia and 72°C
- withstand ambients up to 257°F (125°C)
- size/weight: 3½″ x 1½″ and 6.5 oz. for Propimax 2 3¾″ x 2″ and 16 oz. for Propimax 3 and 3B
- meet all applicable military specifications

Models for 115 VAC, 1 phase, 400 Hz; 200 VAC, 3 phase, 400 Hz; 115 VAC, 1 phase, 60 Hz

Catalog Sheets MIL 050, 060

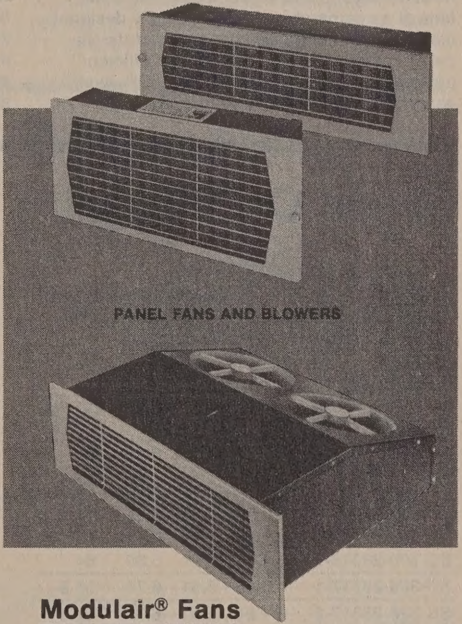




Batac®

Solid state inverters and converters that allow use of Rotron air movers with DC and non-standard power sources.

- enclosed in solder sealed or resin-filled cases
- compact sizes: from 1.29″ x .97″ x 1.09″ to 2½″ x 3½″ x 5 1/16″
- for ambients −40°C to +71°C
- allows Rotron fan reliability from DC power sources
- available with protection for accidental reversal of input voltage
- every design tailored to a specific fan load



Modulair® Fans

Special air moving packages incorporate proven Rotron fans to maximize air flow and simplify installation.

- fit standard 19″ relay racks and cabinets
- incorporate washable filters, and grilles for attractive appearance

MB-9100

- uses three Muffin Fans to provide 240 cfm free air delivery
- 5¼″ high, 19″ wide, 3½″ deep

MB-9200

- uses two Feather Fans to provide 400 cfm free air delivery
- 8¾″ high, 19″ wide, 3½″ deep

MB-5100

- uses two Feather Fans to provide 400 cfm
- special angle allows base mounting, minimizes eddying
- 5¼″ high, 19″ wide, 13 21/32″ deep, 13 lbs.

Catalog Sheets CAB 020, 030

21923

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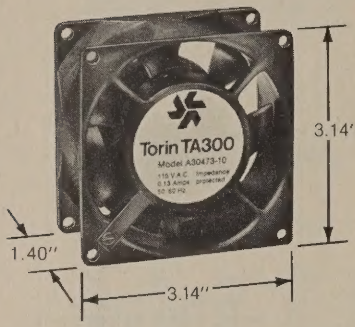
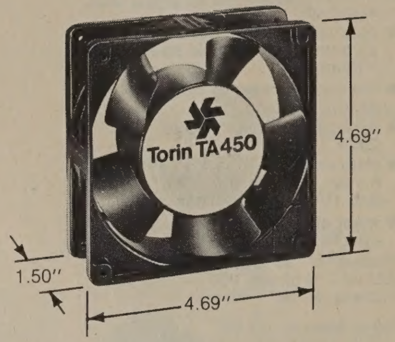
TA300



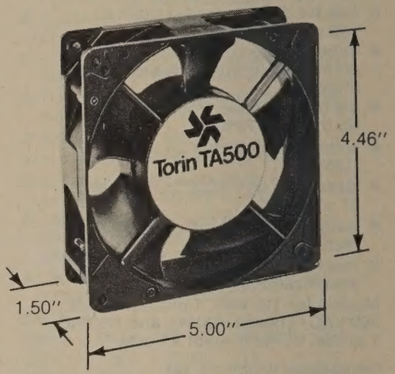
TA300 offers strong performance with lower noise levels and less power input than other fans of a comparable size. A specially designed motor and improved aerodynamics of the impeller combine to make this a most efficient package. Air delivery 36 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

TA450



Available in two versions, a standard high performance series, and an "S" series featuring low sound, as low as 32 decibels. Performance makes this fan a natural for a wide range of applications. Air delivery 106 CFM at 0″ SP. Available with 115 or 230 volt motors, 50/60 Hz.

TA500



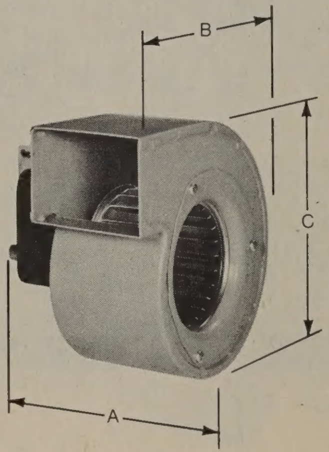
TA500 delivers up to 20% more air than 4½″ units, at a lower sound level, down to 40 decibels, yet it is completely interchangeable with matching mounting holes with any 4½″ unit. Air delivery up to 126 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

Single Centrifugal

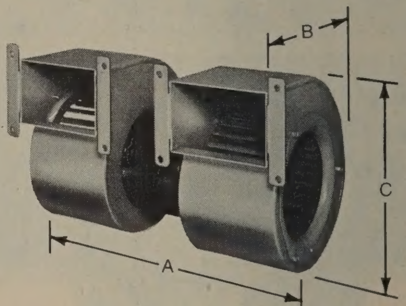
Largest selection of any maker. All motors have Class A insulation, ball bearings, thermal overload protection.

Specifications

Unit	A	B	C	CFM at 0″ SP
SC 216-28316-1	3.40	4.69	5.39	29
SC 216-28316-2	4.34	4.69	5.39	44.5
SC 300-28316-3	3.88	4.69	5.39	41.5
SC 300-28316-4	4.84	4.69	5.39	61
SC 300-28316-5	4.84	4.69	5.39	64
SC 326-28317-1	3.88	5.91	6.79	68.5
SC 326-28317-2	4.84	5.91	6.79	102.5
SC 326-28962	6.33	6.44	6.85	120
SC 400-28963	8.31	6.14	6.85	235
SC 400-28964	8.81	7.17	7.68	239
SC 416-28965	7.82	7.17	7.68	159
SC 424-28966	8.35	7.17	7.68	285
SC 424-28967	8.32	7.83	8.52	190
Small snap lock housing style				
SC 116-28323-1	2.87	3.19	3.73	5.6
SC 200-29323-2	2.87	3.19	3.73	12.6
Plastic housing & wheel				
SC 306-28361	6.00	5.44	5.83	98



Dual Centrifugal



Heavy duty construction.

Specifications

Unit	A	B	C	CFM at 0″ SP
SC 326-29039	10.31	6.40	6.78	296
SC 400-29042	11.06	6.40	6.78	415
SC 408-29040	14.00	7.13	7.61	582
SC 408-29041	11.25	7.13	7.61	270
SC 416-29044	11.69	7.13	7.61	475
SC 500-29045	12.12	7.13	7.61	385
SC 508-29046	13.78	7.79	8.45	460
SC 610-29047	14.75	9.76	10.64	655

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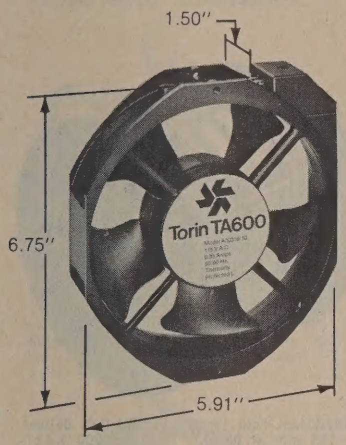
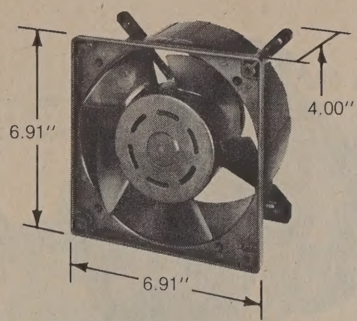
TA600



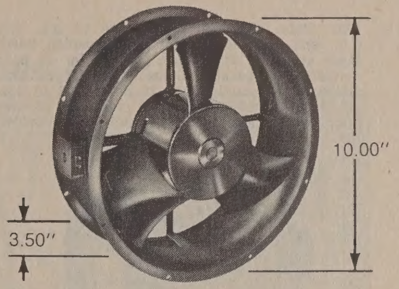
TA600 is only 1½ inches thick, making it the thinnest fan of its size produced in the United States. Its CFM per watt is high relative to other units of these dimensions. Air delivery up to 251 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

TA700



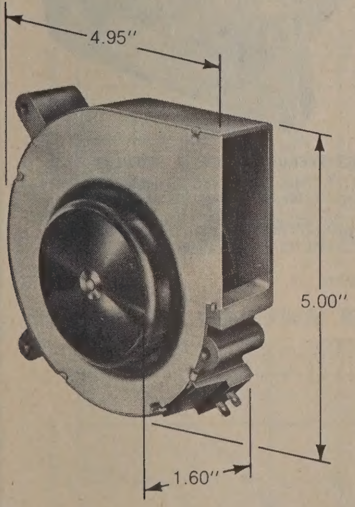
The TA700 is a tube-axial unit developed to produce greater air delivery than any other blower of its size and type. It was designed specifically for applications that demand a large volume of air working against moderate static pressure. It outperforms competitive units in air flow, power consumption and quietness of operation. Air delivery up to 380 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

TA1000



TA1000 tube axial has the lowest power and noise for equivalent air delivery of any unit of its type. TA1000 is especially effective in applications where a large volume of air is required, and where moderate system resistance exists. Examples would be cabinet flushing of relay rack and communications packages and printed circuit card chassis in computers. Air delivery up to 530 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

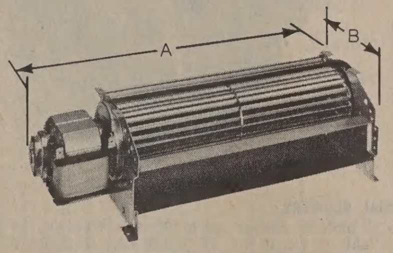
SC382—Pancake Centrifugal



SC382-2966 features an extremely thin profile, 1⅝″ deep. Its housing is all metal in construction, and the impeller is polysulfone plastic. The integral motor has a proven bearing design presently in use on most sleeve bearing motors.

The SC382 produces high velocity air at good static pressure. Air delivery 26 CFM at 0″ SP. 115 volt motor, 50/60 Hz.

Transverse Flow

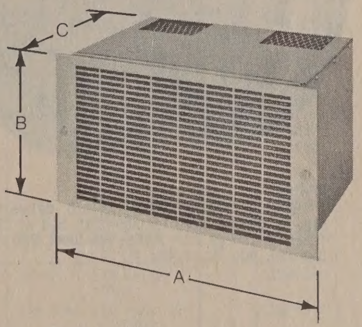


Transverse Flow Blowers utilize the entire width of the impeller blades, they take air in across the entire width of impeller and discharge it at that width.

Specifications

Unit	A	B	CFM at 0″ SP
SEL 236-28206	7.29	4.33	53
SEL 236-28207	10.15	4.33	68
SEL 236-28208	10.35	4.33	73
SEL 236-28309	12.87	4.33	82.5
SEL 236-28310	12.97	4.33	111
SEL 236-28211	23.62	4.57	171
SEL 236-28213	10.12	3.78	81
SEL 236-28214	10.12	3.78	74
Double unit, motor in center			
SEL 236-2812	24.00	4.57	165

Cabinet Blower



Specifications

Unit	A	B	C	CFM at 0″ SP
CB 700-29416-1	19.00	9.00	7.00	218
CB 700-29416-2	19.00	9.00	7.00	315
CB 875-29471-1	19.00	10.25	8.75	360
CB 875-29471-2	19.00	10.25	8.75	180
CB 875-29471-3	19.00	10.25	8.75	325
CB 875-29471-4	19.00	10.25	8.75	250
CB 875-29471-5	19.00	10.25	8.75	290
CB 1050-24472-2	19.00	12.00	10.50	500

Torin Corporation Torrington, Connecticut 06790 (203) 482-4422

Torin Corporation **United States:** Torrington, Connecticut, Van Nuys, California; **Canada:** Oakville, Ontario; **England:** Swindon, Wiltshire; **Belgium:** Nivelles; **Australia:** Sydney; **Spain:** Alcalá de Henares; **Brazil:** São José dos Campos.

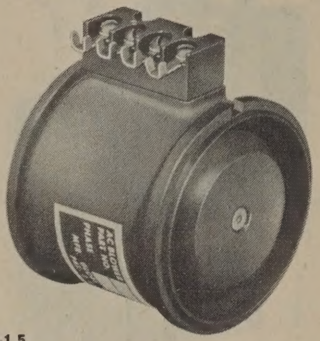
TRW GLOBE MOTORS

FANS AND BLOWERS

TRW Globe offers a wide range of a.c. and d.c. fans and blowers for every cooling need. Many standard models are stocked for 48 hour delivery. And because Globe is the largest precision motor source, we can move fast to provide engineered specials in prototype or production quantities. Check your needs below. Hundreds of other units are available.

VAX-1

1⅛″ VANEAXIAL A.C. or D.C. VAX-1-AC delivers 10 cfm @ .6″ H_2O. 26 v.a.c., single phase, 400 Hz. 1.5 oz. VAX-1-DC delivers 8.5 cfm @ .5″ H_2O. 26 v.d.c. 1.4 oz.

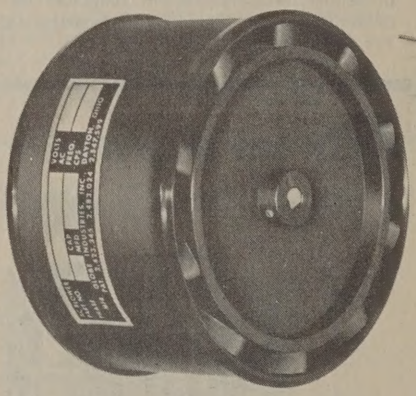


VAX-1.5

1¾″ VANEAXIAL A.C. or D.C. VAX-1.5-AC delivers 12.0 cfm @ 1.9″ H_2O. 115 v.a.c., single phase, 400 Hz. 4.0 oz. VAX-1.5-DC delivers 15 cfm @ 1.3″ H_2O. 27 or 50 v.d.c. 5.0 oz.

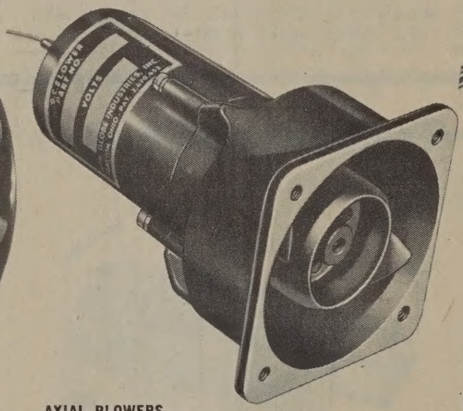
VAX-3

3″ VANEAXIAL. Four types A.C. and D.C. deliver 85 to 165 cfm at 0″ H_2O. 115 and 200 v.a.c.; 12 and 28 v.d.c. 14 to 17 oz.



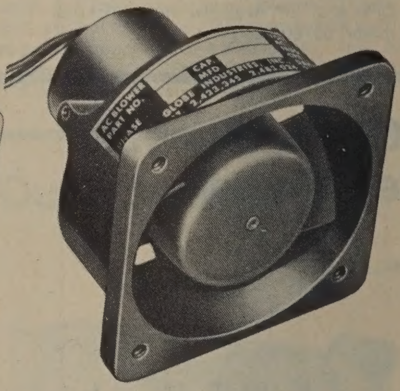
VAX-4-FC

4″ HIGH ALTITUDE VANEAXIAL A.C. delivers 170 cfm @ 0″ H_2O, 140 cfm @ 2.1″ H_2O at 25,000 ft. or 95 cfm @ 2.5″ H_2O at sea level. 200 v.a.c., 3-phase, 400 Hz. 2 lbs.



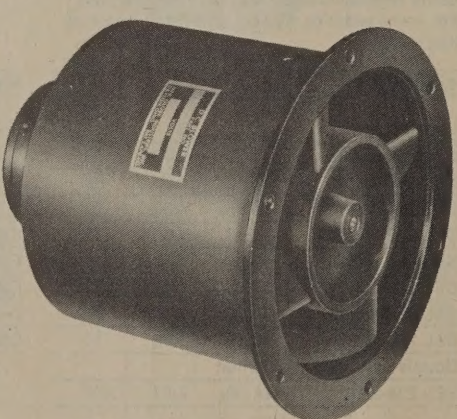
AXIAL BLOWERS

Axial blowers deliver up to 62 cfm free air, available in a.c. or d.c. 27 to 200 v.a.c. 1, 2 or 3-phase, 60 and 400 Hz. 4 to 70 v.d.c. 5 to 9½ oz.



VARIABLE FREQUENCY FANS & BLOWERS

Consist of Type MC or SC variable frequency motors powering a wide range of axial or centrifugal blowers and fans. Max. output 85 cfm @ 0″ H_2O. 27 to 200 v.a.c., 1, 2 and 3-phase, 320 to 1,200 Hz. 2.7 to 10 oz.



VAX-4.5-GR

4½″ VANEAXIAL A.C./D.C. delivers 315 cfm @ 0″ H_2O or 220 cfm @ 1.75″ H_2O. UNIVERSAL 115 v.a.c., single phase, 60 Hz. or 115 v.d.c. 4½ lbs.

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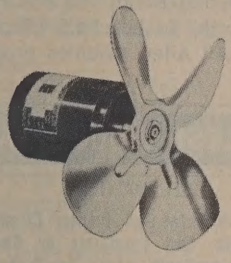
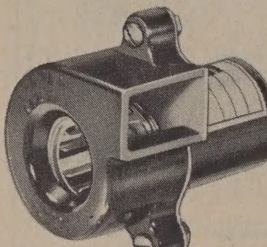
TRW GLOBE MOTORS

FANS AND BLOWERS



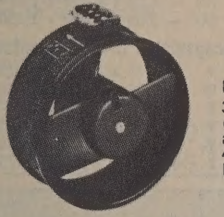
OPEN FANS

Fans deliver up to 195 cfm @ 0″ H_2O, a.c., d.c. or a.c./d.c. 4 to 120 v.d.c. 200 v.a.c., 1, 2 or 3-phase, 60 and 400 Hz. 2.3 oz. min.



CENTRIFUGAL BLOWERS

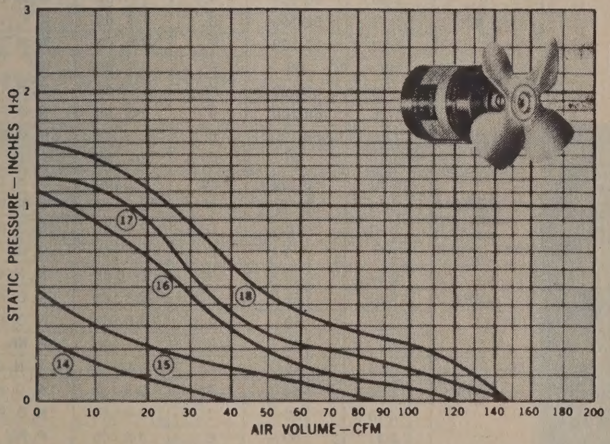
1″ to 2½″ RH or LH scroll models, a.c. or d.c., round or rectangular outlet, produce up to 50 cfm free air. 115 to 200 v.a.c., 60 and 400 Hz. D.C. versions 27 v.d.c. 4 to 18 oz.



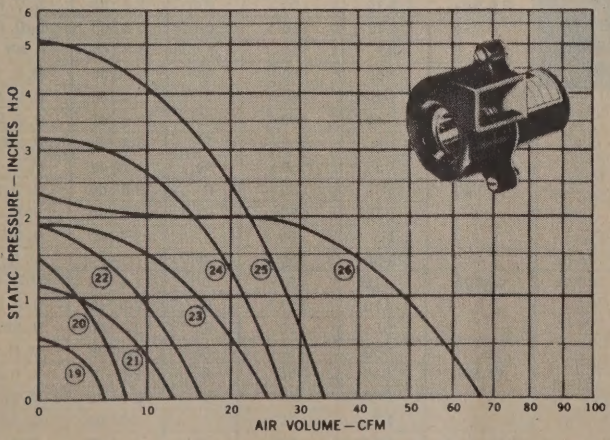
PAX-3

3¼″ PROPAXIAL A.C. delivers 120 cfm @ 0″ H_2O with Type MCS 2 pole motor, and 62 cfm @ 0″ H_2O with Type MCS 4 pole motor. 200 v.a.c., 3-phase, 400 Hz. D.C. versions available.

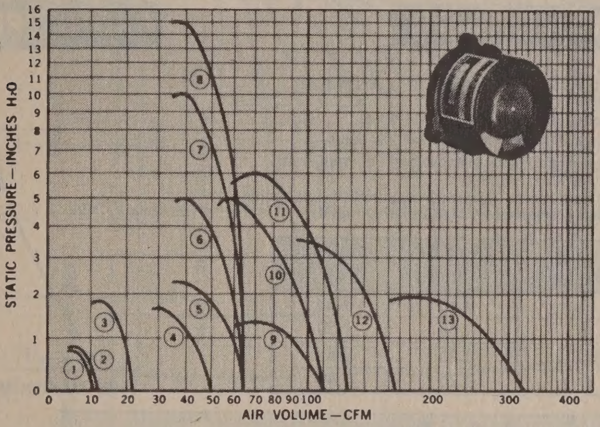
A.C. AND D.C. FANS



A.C. AND D.C. CENTRIFUGAL BLOWERS



A.C. AND D.C. VANEAXIAL BLOWERS



A.C. AND D.C. VANEAXIAL BLOWERS

Curve No.	Type	Dia.	Weight	Power Source	Phase	Part No.
1	VAX-1-DC	1⅛″	1.4 oz.	26 v.d.c.		19A1040
2	VAX-1-AC	1⅛″	1.5 oz.	26 v.a.c., 400 Hz	1	19A1173
3	VAX-1.5-AC	1¾″	4.2 oz.	115 v.a.c., 400 Hz	1	19A1233
4	VAX-2-MM*	2″	5 oz.	26 v.d.c.		19A907
5	VAX-2-MC*	2″	5 oz.	200 v.a.c., 400 Hz	3	19A774
6	STAX-3-FC	3″, 1 stage	48 oz.	200 v.a.c., 400 Hz	3	19A920
7	STAX-3-FC	3″, 2 stage	28.6 oz.	200 v.a.c., 400 Hz	3	19A921
8	STAX-3-FC	3″, 3 stage	29 oz.	200 v.a.c., 400 Hz	3	19A922
9	VAX-3-BD	3″	16 oz.	28 v.d.c.		19A827
	VAX-3-GN	3″	16 oz.	115 v.d.c., or 115 v.a.c., 60 Hz	1	19A908
10	VAX-4-FC	4″	2 lbs.	200 v.a.c., 400 Hz	3	19A1348
11	VAX-4.5-LC	4¹¹⁄₁₆″	5½ lbs.	200 v.a.c., 400 Hz	3	19A1350
12	VAX-3-FC	3″	14 oz.	115 v.a.c., 400 Hz	3	19A798
13	VAX-4.5-GR	4¾″	4½ lbs.	115 v.d.c., or 115 v.a.c., 60 Hz	1	19A832

*Pictured in above chart.

A.C., D.C. FANS AND CENTRIFUGAL BLOWERS

Curve No.	Type	Dia.	Power Source	Phase	Part No.
14	FC	3″ fan	115 v.a.c., 60 Hz	1	19A643
15	MC	4″ fan	115 v.a.c., 60 Hz	1	19A552
15	FC	4″ fan	115 v.a.c., 60 Hz	1	19A644
16	FC	4½″ fan	115 v.a.c., 60 Hz	1	19A645
17	FC	5½″ fan	115 v.a.c., 60 Hz	1	19A647
18	FC	5″ fan	115 v.a.c., 60 Hz	1	19A646
19	SS	1″ blower	27 v.d.c.		19A566
20	SC	1″ blower	115 v.a.c., 400 Hz	1	19A565
21	MM	1½″ blower	27 v.d.c.		19A1860
22	MC	2″ blower	115 v.a.c., 400 Hz	1	19A518
23	LL	2″ blower	27 v.d.c.		19A1852
24	MC	2½″ blower	115 v.a.c., 400 Hz	1	19A532
25	FC	2″ blower	115 v.a.c., 400 Hz	3	19A725
26	YC	1½″ blower	115 v.a.c., 60 Hz	1	19A1185

Air volume varies with direction of air flow and type of enclosure.

TRW GLOBE MOTORS, an Electronic Components Division of TRW INC. 2275 STANLEY AVE. DAYTON, OHIO 45404 (513) 228-3171

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT L-C FILTERS

Allen Avionics is staffed and organized to provide precision L-C Filters and Delay Lines with fast delivery. Your most difficult engineering problems are solved by our high level engineering staff in conjunction with sophisticated computer programs, enabling rapid filter design determination.

Allen Avionics computer designs are generated for the four basic filter types: Lowpass, Highpass, Bandpass, and Bandstop. These are built-in Butterworth, Tchebycheff, Elliptical, Gaussian, and Bessel functions. All Allen Avionics products are manufactured in the U.S.A.

BANDPASS

PROTOTYPES OFTEN DELIVERED IN LESS THAN 3 DAYS

Types: Butterworth, Tchebycheff, and Elliptic Function.

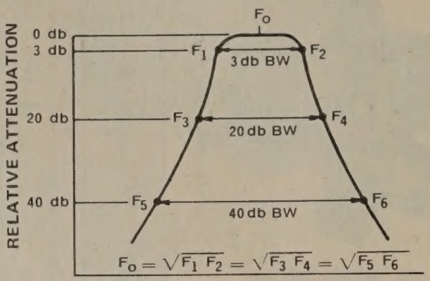
Frequency Range: 400 Hz to 30 MHz.

Impedance Range: 50 ohms to 10K ohms.

Construction: Epoxy encapsulated or sealed in metal can.

Order any center frequency required. Interpolation between frequencies listed below is valid.

Shape Factor	20 db BW / 3 db BW	40 db BW / 3 db BW
Ao	3.65	7.85
B	1.60	2.50
C	1.45	1.85
E	1.20	1.45



1 db MAXIMUM RIPPLE

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250
P — 6.00 x 1.500 x 1.250
Q — 7.00 x 1.500 x 1.250
NN — 4.00 x 4.000 x 1.250
OO — 5.00 x 4.000 x 1.250

Encapsulated in Epoxy Container:

V — 1.75 x 1.750 x .875
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Y_1 — 4.00 x 2.000 x 1.250
Z — 4.50 x 2.500 x 1.375

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
400 Hz	1-10	1K-10K	Ao	2-8 db	Y_1
1 kHz	1-20	1K-10K	Ao	2-8 db	Y, Y_1
	1-8	1K-10K	B	4-8 db	Z
5 kHz	1-25	500-10K	Ao	1-8 db	X, Y, Y_1
	1-10	500-10K	B	2-8 db	Y_1, Z
	1-5	1K	C	3-8 db	Z
10 kHz	1-50	100-1K	Ao	1-8 db	X, Y, Y_1
	1-25	100-10K	B	2-8 db	Y, Y_1, Z
	1-20	100-500	C	3-8 db	Y_1, Z
	1-5	500	E	4-8 db	Z
25 kHz	1-50	100-10K	Ao	1-8 db	W, X, Y
	1-40	100-5K	B	2-8 db	X, Y, Y_1
	1-25	100-500	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
50 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-40	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-5	100-500	E	4-8 db	Z
75 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-30	100-500	B	2-8 db	X, Y, Y_1
	1-25	100-250	C	3-8 db	Y_1, Z
	1-6	50-200	E	4-8 db	Z
100 kHz	1-50	100-5K	Ao	1-8 db	W, X, Y
	1-35	50-150	B	2-8 db	X, Y, Y_1
	1-25	50-100	C	3-8 db	Y_1, Z
	1-8	50-100	E	4-8 db	Z
200 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-50K	B	2-7 db	W, X, Y
	1-25	50-100	C	3-7 db	X, Y, Y_1
	1-8	50-100	E	4-7 db	Y_1, Z
300 kHz	1-50	50-5K	Ao	1-7 db	V, W, X
	1-25	50-5K	B	2-7 db	W, X, Y
	1-15	50-100	C	3-7 db	Y, Y_1
	1-6	50-100	E	4-7 db	Z
400 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	1-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	Y_1, Z
	1-6	50-100	E	4-8 db	Z
500 kHz	1-50	50-5K	Ao	1-8 db	V, W, X
	10-25	50-5K	B	2-8 db	W, X, Y
	1-12	50-100	C	3-8 db	X, Y, Y_1
	1-5	50-100	E	4-8 db	Y, Z
750 kHz	1-50	50-2K	Ao	1-10 db	W, X, Y
	1-25	50-5K	B	2-8 db	X, Y, Y_1
	1-10	50-2K	C	3-8 db	Y, Y_1
	1-3	50-100	E	4-8 db	Y_1, Z

CALL OR WRITE FOR OUR COMPLETE FILTER CATALOG

Our Engineering Staff will be happy to help you with your design problems.

Center Frequency (Fo)	Q Range Fo / 3 db BW	Impedance Range (Ohms)	Shape Factor	Insertion Loss	Size
1 MHz	1-50	50-100	Ao	1-10 db	W, X, Y
	1-25	50-100	B	2-8 db	X, Y, N
	1-10	50-100	C	3-8 db	M, N. O
	1-5	50	E	3-8 db	NN
2 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-25	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
3 MHz	1-50	50-100	Ao	1-10 db	M, N, O
	1-20	50-100	B	2-8 db	N, O, P
	1-10	50-100	C	3-8 db	N, O, P
	1-5	50	E	3-8 db	P, NN
4 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
7.5 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	3-8 db	N, O, P
	1-3	50	E	3-8 db	P, NN
10 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-20	50	B	2-8 db	N, O, P
	1-12	50	C	3-8 db	O, P, Q
	1-6	50	E	3-8 db	Q, NN, OO
15 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-8 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-3	50	E	3-7 db	Q, NN, OO
20 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	O, P, Q
	1-5	50	E	3-7 db	Q, NN, OO
25 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-15	50	B	2-6 db	N, O, P
	1-10	50	C	2-6 db	Q, NN
	1-3	50	E	3-7 db	Q, NN, OO
30 MHz	1-50	50	Ao	1-10 db	M, N, O
	1-12	50	B	2-6 db	N, O, P
	1-6	50	C	3-7 db	P, Q, NN
	1-3	50	E	3-7 db	Q, NN, OO

ALLEN AVIONICS, INC.

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SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

CUSTOM-BUILT L-C FILTERS LINEAR PHASE LOWPASS

LINEAR PHASE LOWPASS FILTERS

Types:
Bessel, Gaussian, Equal Phase Ripple and Transitional (Gaussian to 6 db).

Frequency Range:
400Hz to 50MHz.

Impedance Range:
50 ohms to 20K ohms.

Low Delay and Phase Distortion in Passband.

Very Low Pulse Distortion (Low Overshoot).

Construction:
Epoxy encapsulated or sealed in metal can.

DELIVERY: PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 3 DAYS

The lowpass filters listed below are typical units that we build. We do manufacture linear phase lowpass filters with any cut-off frequency between 1KHz and 50MHz.

SIZE (INCHES)

Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:

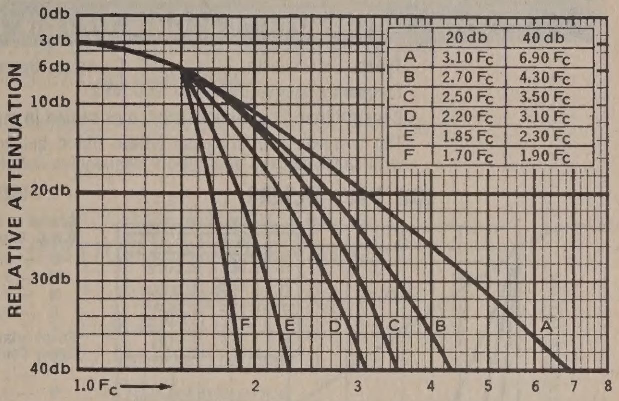
K — 1.50 x 1.000 x .800
L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250

Encapsulated in Epoxy Container:

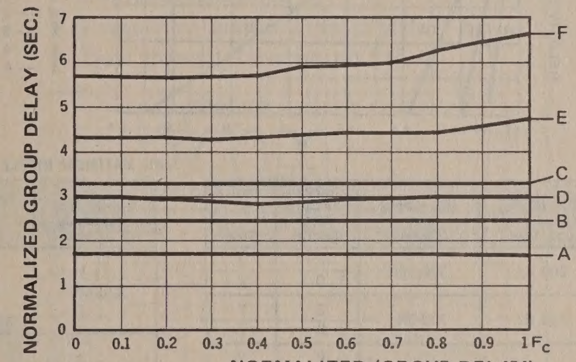
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

The graph at right illustrates ideal delay characteristics.
Consult table below for typical realizable values.

Shape Factor	Max. Phase Distortion	Maximum Overshoot	Typical Delay Variation
A	±2°	1.5%	3%
B	±2°	1.5%	3%
C	±2°	1.5%	3%
D	±3°	3%	8%
E	±7°	6%	13%
F	±12°	9%	17%



	20 db	40 db
A	3.10 Fc	6.90 Fc
B	2.70 Fc	4.30 Fc
C	2.50 Fc	3.50 Fc
D	2.20 Fc	3.10 Fc
E	1.85 Fc	2.30 Fc
F	1.70 Fc	1.90 Fc



$$\text{GROUP DELAY} = \frac{\text{NORMALIZED (GROUP DELAY)}}{2\pi F_c \text{ (Hz)}}$$

½ db MAXIMUM RIPPLE — 1 db MAXIMUM INSERTION LOSS

Cut-Off (F_c) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size Range
1KHz	500-10K	A	X
	500-10K	B	Y, Z
	500-10K	C	Z
	500-10K	D	Y
	500-10K	E	Y, Z
	500-10K	F	Z
5KHz	50-20K	A	X
	50-20K	B	Y, Z
	50-15K	C	Y, Z
	50-20K	D	Y
	50-20K	E	Y, Z
	50-10K	F	Z
10KHz	50-10K	A	W, X
	50-10K	B	X, Y
	50-10K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	Y, Z
50KHz	50-10K	A	W, X
	50-10K	B	X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X, Y
	50-10K	F	X, Y
100KHz	50-10K	A	U, W
	50-5K	B	W, X
	50-5K	C	X, Y
	50-10K	D	W, X
	50-10K	E	X
	50-10K	F	X, Y
500KHz	50-3K	A	U, W
	50-3K	B	W
	50-1K	C	W, X
	50-5K	D	W
	50-5K	E	W, X
	50-5K	F	X, Y
750KHz	50-2.5K	A	U, W
	50-2.5K	B	W, X
	50-1K	C	X, Y
	50-5K	D	U, W
	50-5K	E	W, X
	50-5K	F	X
1MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	X
2MHz	50-500	A	L
	50-500	B	M
	50-500	C	M
	50-500	D	W
	50-500	E	W, X
	50-500	F	W, X
5MHz	50-500	A	L
	50-500	B	M
	50-200	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M
7.5MHz	50-500	A	K
	50-250	B	L
	50-100	C	M
	50-500	D	L
	50-500	E	M
	50-500	F	M
10MHz	50-100	A	K
	50-100	B	L
	50-100	C	M
	50-100	D	L
	50-100	E	M
	50-100	F	M
20MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
30MHz	50-100	A	K
	50-100	B	L
	50-100	D	L
	50-100	E	M
	50-100	F	N
40MHz	50	A	K
	50	B	L
	50	D	L
	50	E	M
	50	F	M
50MHz	50	A	K
	50	D	L
	50	E	M
	50	F	M

SHARP DELAY EQUALIZED LOWPASS FILTERS

By the utilization of delay equalization techniques, Allen Avionics now designs and manufactures a complete line of sharper cut-off, flat delay lowpass filters than shown above. We offer these with 40db to 3db ratios as small as 1.22 and delay distortion of less than 10%.

ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: (516) 248-8080 OR (516) 747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

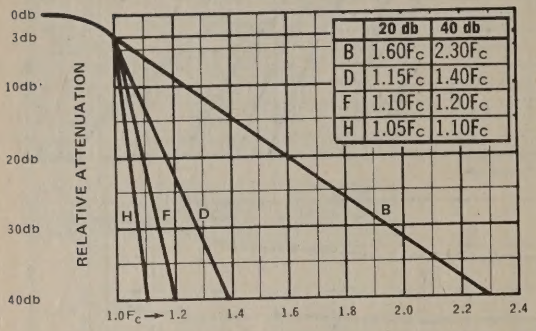
CUSTOM-BUILT LOWPASS & HIGHPASS L-C FILTERS

PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 3 DAYS

Types: Butterworth, Tchebycheff, Gaussian, Bessel and Elliptic Function.
Frequency Range: 200 Hz to 200 MHz.
Construction: Epoxy encapsulated or sealed in metal can.

The Lowpass and Highpass Filters listed below are typical units that we build. We do manufacture units with shape factors and cut-off frequencies in-between those listed.

LOW PASS FILTERS



SIZE (INCHES)

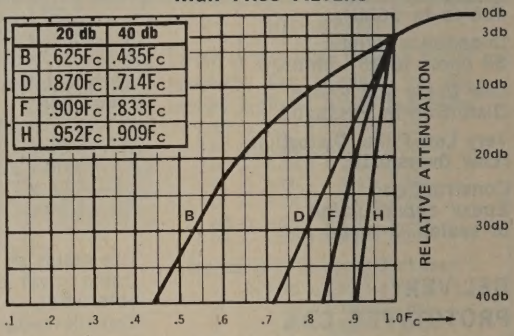
Sealed in Metal Can with B.N.C. Connectors:

L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250

Encapsulated in Epoxy Container:

S — 1.25 x .875 x .625
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

HIGH PASS FILTERS



1 db MAXIMUM RIPPLE — 2 db MAXIMUM INSERTION LOSS

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
200 Hz	500-1500	B	Z
		D	Z
400 Hz	500-3K	B	Y
		D	Z
1 kHz	500-10K	B	Y
		D	Z
		F	Z
2.5 kHz	500-20K	B	Y
		D	Z
		F	Z
5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
7.5 kHz	50-20K	B	Y
		D	Z
	150-20K	F	Z
10 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
25 kHz	50-10K	B	X
		D	Z
	150-10K	F	Z
50 kHz	50-10K	B	X
		D	Z
	150-10K	F	Y
		H	Z
75 kHz	50-10K	B	W
		D	Y
	150-10K	F	Y
		H	Z
100 kHz	50-10K	B	W
		D	Y
		F	Y
		H	Z
200 kHz	50-10K	B	U
		D	W
	50-5K	F	Y
		H	Z
300 kHz	50-5K	B	U
		D	W
	50-5K	F	Y
		H	Z

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
400 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
500 kHz	50-5K	B	U
		D	W
		F	Y
		H	Z
600 kHz	50-2.5K	B	U
		D	W
	50-2K	F	Y
		H	Z
700 kHz	50-2.5K	B	U
		D	W
	50-2.0K	F	Y
		H	Z
800 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Z
900 kHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	Y
1 MHz	50-1.5K	B	U
		D	W
	50-1.0K	F	X
		H	O
2 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
3 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
4 MHz	50-250	B	U
		D	W
	50-200	F	X
		H	O
5 MHz	50-250	B	S
		D	W
	50-100	F	X
		H	O
6 MHz	50-100	B	S
		D	U
		F	X
		H	O

Cut-Off (Fc) Frequency 3 db Max.	Impedance Range (Ohms)	Shape Factor (See Graph)	Size
7 MHz	50-100	B	S
		D	U
		F	M
		H	O
8 MHz	50-100	B	S
		D	U
		F	M
		H	O
9 MHz	50-100	B	S
		D	U
		F	M
		H	N
10 MHz	50-100	B	S
		D	S
		F	M
		H	N
15 MHz	50-100	B	S
		D	S
		F	M
		H	N
20 MHz	50-100	B	S
		D	S
	50	F	M
		H	N
25 MHz	50	B	S
		D	S
		F	M
		H	N
30 MHz	50	B	S
		D	S
		F	M
35 MHz	50	B	L
		D	M
		F	M
40 MHz	50	B	L
		D	M
		F	M
50 MHz	50	B	L
		D	M
		F	N
75 MHz	50	B	M
		D	N
* 100 MHz to 400 MHz	50	B	M

* Lowpass only.

Active Electronic Filters

Analyze your requirements with our variable frequency instruments and select our low cost fixed frequency modules accordingly.

Applications: Communication, Data Transmission, Control, Vibration testing, Biomedicine, Military Engineering.

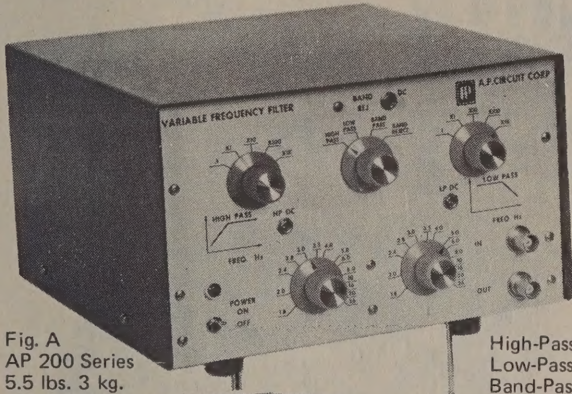
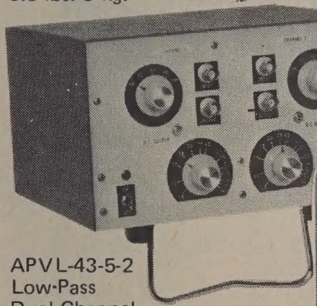

VARIABLE FREQUENCY FILTER
A.P. CIRCUIT CORP
HIGH PASS
LOW PASS
POWER ON OFF
IN
OUT

Fig. A
AP 200 Series
5.5 lbs. 3 kg.

High-Pass
Low-Pass
Band-Pass
Band-Reject



APVL-43-5-2
Low-Pass
Dual Channel

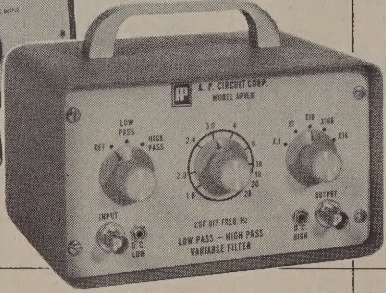

A. P. CIRCUIT CORP.
MODEL APVLH
LOW PASS
HIGH PASS
INPUT
OUTPUT
CUT OFF FREQ. Hz
LOW PASS — HIGH PASS
VARIABLE FILTER

Fig. B
APV 40 SERIES

VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 microvolt R.M.S.)
- High Input, Low Output impedance
- O Db insertion Loss
- 24 Db/Octave slope
- Frequency range 0.01 Hz-5 MHz
- Dual channel Rack mount Fig. C

Model	FUNCTION Low Pass	 High Pass	 Band Pass	 Band Reject	Tuning Range	Fig.
APVL-43-5	✓				0.02Hz–2KHz	B
APVL-44-5	✓				0.2Hz–20KHz	B
APVL-45-5	✓				2.0Hz–200KHz	B
APVH-43-5		✓			0.02Hz–2KHz	B
APVH-44-5		✓			0.2Hz–20KHz	B
AP255-5	✓	✓	✓	✓	0.2Hz–20 KHz	A
AP260-5	✓	✓	✓	✓	0.1Hz–10KHz	A
AP265-5	✓	✓	✓	✓	0.02Hz–2KHz	A
AP280-5	✓	✓	✓	✓	2.0Hz–200KHz	A
AP220-5	✓	✓	✓	✓	20Hz–2MHz	A
AP 301			✓		0.1–10KHz	B
AP 401			✓	✓	0.1–10KHz	B

FREQUENCY MODULES

FIXED FREQUENCIES · EXTERNALLY TUNEABLE
DUAL IN LINE CONSTRUCTION

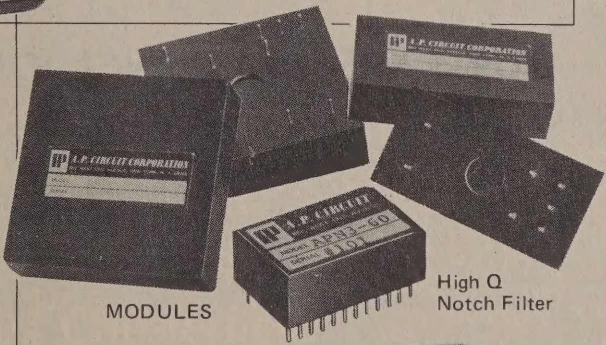
Feature Low Noise, High Input, Low Output impedance. O insertion Loss.

* Low-Pass * High-Pass * Band-Pass	STD. FREQUENCIES: 0.01 Hz–200,000 Hz 4 pole 24 Db/Octave or 8 pole 48 Db/Octave

* **High Q Band reject including 60 Hz noise elimination filter**

Signal Conditioning Units assembled to customer specifications.

For a complete catalog and additional information write to Dept. P.


A. P. CIRCUIT CORPORATION
A.P. CIRCUIT
APN3-60

MODULES

High Q
Notch Filter

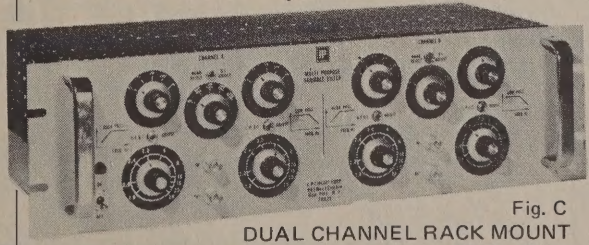


Fig. C
DUAL CHANNEL RACK MOUNT
12 lbs. 6 kg.

A.P. CIRCUIT CORPORATION

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Must You Meet MIL-STD 461?

Here's where EXPERIENCE counts!

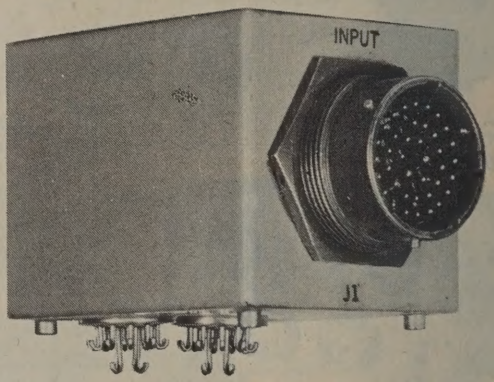
AXEL computer-aided designed filters will enable your system to meet the exacting requirements of MIL-STD 461 and MIL-F-15733.

Initial system analysis is our specialty.

AXEL ELECTRONICS is a highly experienced organization specializing in the design and production of standard and custom built filters.

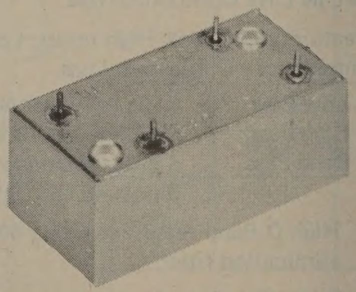
We offer a complete line of high quality, long life, high performance filters from low signal level devices to very high power line filters including special multi-circuit packages.

A total filter design service is available backed by a complete QC monitored manufacturing facility to meet your most stringent requirements.



OUR EXPERIENCE INCLUDES:

- Active and Passive Electric Wave Filters (MIL-F-18327)
- Low Pass - High Pass - Band Pass - Band Reject Filters
- Constant Delay Filters
- Delay Equalizers
- Signal Line Filters
- Transmission Line Filters



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Axel

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LOW PASS, HIGH PASS, BAND PASS, BAND STOP, EQUALIZERS, WEIGHTING, ROOFING filters

From 1.0 Hz to 1000 MHz, designed to commercial or Mil Specs. Our competent staff of filter engineers has made us a top rated supplier in the Instrumentation, Communications, Telemetering, Telephony and Computer fields.

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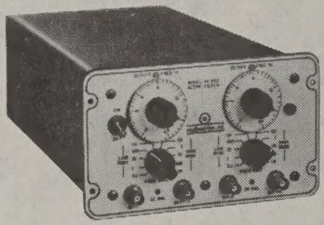
COMSTRON·SEG MULTIMETRICS DIVISION ACTIVE FILTERS

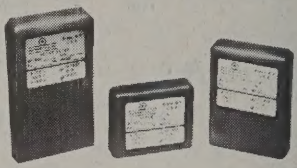
TUNABLE & FIXED 0.001Hz to 2MHz

- Top performance and versatility
- Individual channels are independent High or Low Pass Butterworth Filters
- Interconnected channels are Band Pass, Band Reject or have sharpened attenuation slopes
- Selectable Time Domain response for optimum transient (pulse) behavior
- All units rack mountable
- Quick delivery!

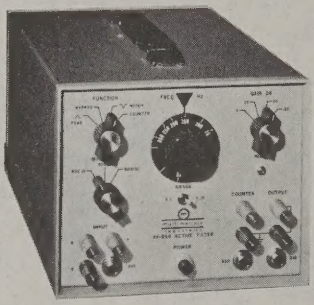


SERIES AF-100, AF-200

20Hz to 2MHz, 0.2Hz to 20kHz; tunable; ruggedly built, low cost package. Designed for a wide range of applications.

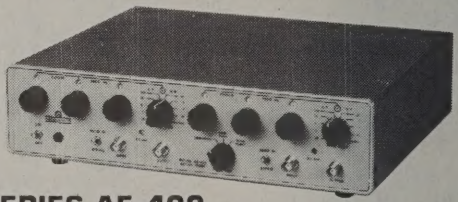


Fixed frequency, mini-sized modules. Low, high, band pass, band reject and notch functions, Butterworth, Chebyschev and elliptic responses. Frequencies from 0.001Hz to 100kHz. Other frequencies, response characteristics and pole configurations available.



SERIES AF-850A

35Hz to 3500Hz; ±1% accuracy; tunable; ideal for notched noise measurements and waveform analysis. Fully compatible with telephone channel transmission measuring techniques and equipment.



SERIES AF-400

0.001Hz to 99.9kHz; digital switch tuning; superb accuracy and stability. 115/230VAC or battery operated.

MODEL	AF-110	AF-120	AF-210	AF-220	AF-410	AF-420	AF-410L	AF-420L	AF-850A
FREQ. RANGE, Hz	20 to 2M		0.2 to 20K		0.01 to 99.9K		0.001 to 9.99K		35 to 3.5K
ACCURACY	±5%		±5%		±2%		±2%		±1%
CHANNELS	1	2	1	2	1	2	1	2	1
TUNING	CONTINUOUS				DIGITAL SWITCH				CONTINUOUS
SLOPE, db/Octave	24 (48 – 2 CHANNELS IN SERIES)								N/A
FUNCTIONS	HP, LP	HP, LP BP, BR	HP, LP	HP, LP BP, BR	HP, LP BYPASS	HP, LP BP, BR BYPASS	HP, LP BYPASS	HP, LP BP, BR BYPASS	BP, BR, BYPASS, GAIN

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- Low Pass
- Band Pass
- Band Reject
- Matched
- Delay Equalized
- Amplitude Equalized
- Time Domain
- FDM
- Optimum
- Thompson
- Butterworth
- Chebyschev
- Cauer
- Bessel
- Elliptic
- Legendre
- Channel Simulation

SEG ELECTRONICS
Fo-1900 HZ
BP-1100 R-600 Λ

COMSTRON•SEG's on-time delivery of "impossible" filters, from engineering conception to mathematical synthesis, through quality oriented production, satisfies our most demanding customers.

Whatever your needs . . . from spectral shaping and phase correction to time-domain synthesis . . . you can rely on the filter experts at COMSTRON • SEG. Computer-optimized custom designs from DC to 120MHz with sharp roll offs or phase correction or narrow bandwidths, all in production quantities with competitive pricing. NAME IT AND COMSTRON•SEG WILL DELIVER IT ON SCHEDULE!

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corcom

RFI Power Line Filters

S, V & W SERIES* These filters combine line-to-ground RFI filters with additional circuitry to reduce low frequency line-to-line noise. They are designed to protect equipment from malfunctions due to conducted line interference coming into the equipment from the line (susceptibility). They also provide needed noise suppression to allow most equipment to meet VDE, CISPR and CSA specifications for conducted emission. They are particularly effective when applied in equipment using switching type power supplies, SCR and T²L circuits.

H SERIES* These filters are designed for use in health care equipment and are recognized under UL 544 specification. Model 6H1 is suited for patient care equipment. Models 6H4 & 6H9 are suited for non-patient equipment (equipment that is intended for use where contact with the patient is unlikely).

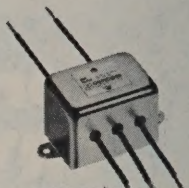
B SERIES* These filters are general purpose types—effectively providing RFI control of line to ground noise in a small size at lowest cost. They are available in a broad selection of current ratings and termination styles.

EF SERIES* Now VDE approved. These filters incorporate the special IEC (International Electrotechnical Commission) power line connector. This connector has 4 mm minimum pin spacing and complies with all current and proposed requirements for use with industrial and test equipment in the European market where a detachable power cord is part of the equipment design. The EF series features extremely low leakage current; meets IEC, BSI, VDE, CSA and ASA requirements for data processing equipment. Minimum insertion loss 2.0 MHz to 5.0 MHz 50 DB.

K SERIES* These filters are similar to the B Series but have the added feature of being extremely effective in the control of line to line as well as line to ground RFI interference. The K Series is particularly suited where pulsed, continuous and/or intermittent RFI interference is present and should be used where line to line interference protection is required.

R SERIES* These filters are dual T section RFI powerline filters and provide premium performance at moderate cost. They are well suited for low impedance loads where noisy RFI environments are present. At frequencies as low as 150 KHz, the R Series has an insertion loss as high as 45 DB. They control pulsed, continuous and/or intermittent interference. The R Series provides extremely low leakage current without deterioration of insertion loss characteristics.

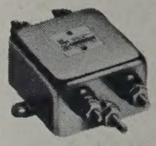
CASE STYLE
B1, K1, H1



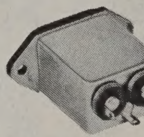
CASE STYLE
B3, K3

CASE STYLE
B4, K4

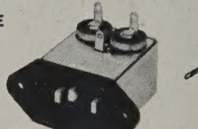
CASE STYLE
B5, K5



CASE STYLE
B6, K6



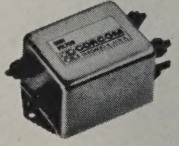
CASE STYLE
E1, H4



CASE STYLE
E2, H9

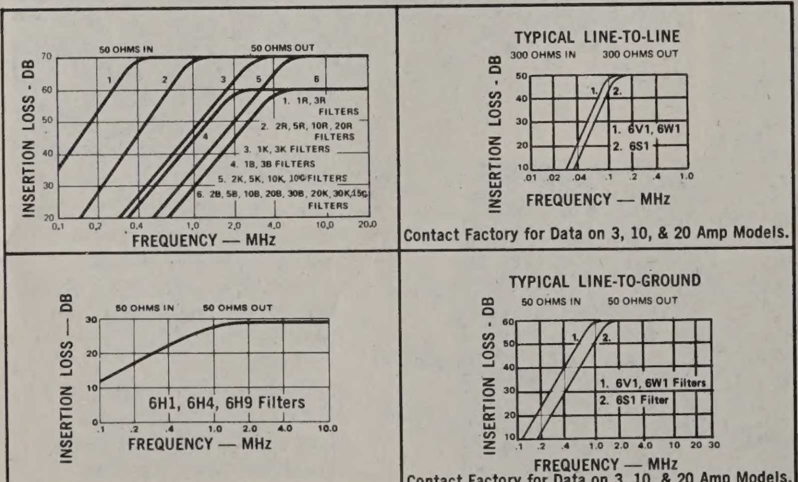
CASE STYLE
R1, S1, V1, W1

CASE STYLE R3



CASE STYLE R6

TYPICAL INSERTION LOSS VS FREQUENCY TEST PER MIL STD. 220

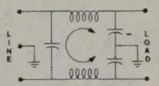


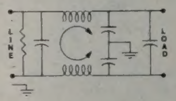
Contact Factory for Data on 3, 10, & 20 Amp Models.

Contact Factory for Data on 3, 10, & 20 Amp Models.

FILTER ELECTRICAL SCHEMATICS

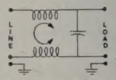
B SERIES
EF SERIES
J SERIES

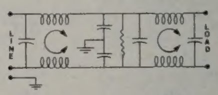




K SERIES

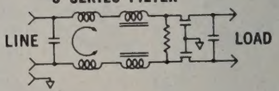
H SERIES



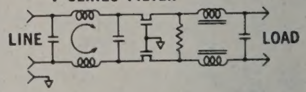


R SERIES

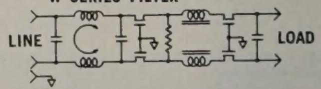
S SERIES FILTER



V SERIES FILTER



W SERIES FILTER



Specifications	B, K Series	EF, J Series	R Series	H Series	S, V, W Series
Rated Voltage	115/250 VAC	115/250 VAC	115/250 VAC	115/250 VAC	115/250 VAC
Maximum Leakage Current, Each Line to Ground @ 115 VAC 60 Hz	.5 mA	.25 mA	.5 mA	2 μA	Less than 1.5 mA**
Operating Frequency	50-400 Hz	50-400 Hz	50-400 Hz	50-400 Hz	50-60 Hz
High Pot Test	2250 VDC	2250 VDC	2250 VDC	2500 VAC	2250 VDC

*115 VAC ONLY **@ 250 V, 60 Hz

corcom

DEPT. EM, 2635 NORTH KILDARE AVENUE
CHICAGO, ILLINOIS 60639
(312) 384-7400 • TWX 910-221-5308

*** THESE FILTERS ARE RECOGNIZED UNDER THE COMPONENTS PROGRAM OF UNDERWRITERS LABORATORIES INC.**

corcom

RFI Power Line Filters

SERIES B FILTERS*
GENERAL PURPOSE TYPE WITH TWO "L" SECTIONS

Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
1B1	B1	2.50 x 2.02 x .63	1	$7.35
1B3	B3	2.50 x .94 x .63	1	7.65
1B4	B4	2.00 x 2.42 x .75	1	8.50
1B5	B5	2.00 x 1.88 x .75	1	8.61
2B1	B1	2.50 x 2.02 x .63	2	6.70
2B3	B3	2.50 x .94 x .63	2	6.81
2B4	B4	2.00 x 2.42 x .75	2	7.68
2B5	B5	2.00 x 1.88 x .75	2	7.79
3B1	B1	2.50 x 2.39 x .75	3	7.68
3B3	B3	2.50 x 1.31 x .75	3	8.06
3B4	B4	2.00 x 2.67 x .75	3	8.77
3B5	B5	2.00 x 2.13 x .75	3	8.92
5B1	B1	2.50 x 2.39 x .75	5	6.81
5B3	B3	2.50 x 1.31 x .75	5	7.24
5B4	B4	2.00 x 2.67 x .75	5	7.95
5B5	B5	2.00 x 2.13 x .75	5	8.06
10B1	B1	2.50 x 2.39 x 1.13	10	7.52
10B3	B3	2.50 x 1.31 x 1.13	10	7.79
10B4	B4	2.00 x 2.67 x 1.13	10	8.61
10B5	B5	2.00 x 2.13 x 1.13	10	8.77
10B6	B6	2.50 x 2.63 x 1.13	10	9.00
20B1	B1	2.78 x 3.14 x 1.125	20	12.37
20B6	B6	2.75 x 3.38 x 1.13	20	13.89
30B6	B6	4.13 x 5.25 x 1.50	30	24.75

SERIES EF FILTERS*
INTERNATIONAL TYPE WITH IEC CONNECTOR — VDE APPROVED

Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
1EF1	E1	1.97 x 1.97 x .79	1	$9.79
3EF1	E1	1.97 x 1.97 x .79	3	9.79
6EF1	E1	1.97 x 1.97 x .79	6	9.24
1EF2	E2	1.97 x 1.55 x 1.31	1	9.24
3EF2	E2	1.97 x 1.55 x 1.31	3	8.69
6EF2	E2	1.97 x 1.55 x 1.31	6	8.69

SERIES H FILTERS*
LOW LEAKAGE CURRENT FILTERS FOR HEALTH CARE EQUIPMENT—UL 544

Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
6H1	H1	2.50 x 2.01 x .62	6	$7.83
6H4	H4	1.97 x 1.97 x .79	6	10.94
6H9	H9	1.97 x 1.55 x 1.31	6	10.94

SERIES K FILTERS*
FOR LINE TO LINE & LINE TO GROUND NOISE SUPPRESSION

Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
1K1	K1	2.78 x 2.89 x .88	1	$8.61
1K3	K3	2.78 x 1.81 x .88	1	8.85
1K4	K4	2.00 x 2.67 x .88	1	9.56
1K5	K5	2.00 x 2.13 x .88	1	9.66
2K1	K1	2.78 x 2.89 x .88	2	8.01
2K3	K3	2.78 x 1.81 x .88	2	8.14
2K4	K4	2.00 x 2.67 x .88	2	8.84
2K5	K5	2.00 x 2.13 x .88	2	8.95
3K1	K1	2.78 x 2.89 x 1.13	3	8.84
3K3	K3	2.78 x 1.81 x 1.13	3	9.19
3K4	K4	2.00 x 2.67 x 1.13	3	9.79
3K5	K5	2.00 x 2.13 x 1.13	3	9.90
5K1	K1	2.78 x 2.89 x 1.13	5	8.14
5K3	K3	2.78 x 1.81 x 1.13	5	8.49
5K4	K4	2.00 x 2.67 x 1.13	5	9.08
5K5	K5	2.00 x 2.13 x 1.13	5	9.19
10K1	K1	2.78 x 3.14 x 1.13	10	8.72
10K3	K3	2.78 x 2.06 x 1.13	10	8.95
10K6	K6	2.75 x 3.38 x 1.13	10	9.96
20K1	K1	2.50 x 3.14 x 1.50	20	13.24
20K6	K6	3.32 x 3.38 x 1.50	20	15.05
30K6	K6	4.12 x 5.26 x 1.50	30	26.31

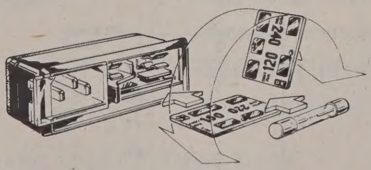
SERIES R FILTERS*
FOR PREMIUM PERFORMANCE WITH TWO "T" SECTIONS

Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
1R1	R1	3.14 x 1.75 x 1.13	1	$13.12
1R3	R3	2.06 x 1.75 x 1.13	1	13.92
2R1	R1	3.14 x 1.75 x 1.13	2	12.94
2R3	R3	2.06 x 1.75 x 1.13	2	13.07
3R1	R1	3.64 x 2.00 x 1.13	3	13.92
3R3	R3	2.56 x 2.00 x 1.13	3	14.33
5R1	R1	3.64 x 2.00 x 1.13	5	13.07
5R3	R3	2.56 x 2.00 x 1.13	5	13.48
10R1	R1	3.64 x 2.00 x 1.50	10	13.78
10R3	R3	2.56 x 2.00 x 1.50	10	14.05
10R6	R6	3.82 x 2.00 x 1.50	10	15.24
20R1	R1	5.01 x 3.32 x 1.50	20	28.75
20R6	R6	5.25 x 3.32 x 1.50	20	30.20

SERIES S, V & W FILTERS*
FOR EQUIPMENT USING SWITCHING TYPE POWER SUPPLIES

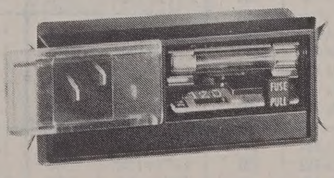
Model No.	Case Style	Size L x W x H (Inches)	Maximum Line Current (Amps)	Unit Price
3S1	S1	3.13 x 1.75 x 1.13	3	$12.83
6S1	S1	3.62 x 2.00 x 1.50	6	11.99
10S1	S1	3.62 x 2.00 x 1.50	10	12.71
20S1	S1	5.01 x 3.31 x 1.50	20	28.68
3V1	V1	3.13 x 1.75 x 1.13	3	$14.04
6V1	V1	3.62 x 2.00 x 1.50	6	13.20
10V1	V1	3.62 x 2.00 x 1.50	10	13.92
20V1	V1	5.01 x 3.31 x 1.50	20	29.89
3W1	W1	3.13 x 1.75 x 1.13	3	$15.25
6W1	W1	3.62 x 2.00 x 1.50	6	14.25
10W1	W1	3.62 x 2.00 x 1.50	10	15.13
20W1	W1	5.01 x 3.31 x 1.50	20	31.10

THE VS & F VOLTAGE SELECTING & FUSED CONNECTOR



Available to the industry for the first time in one unit a voltage selector switch, a connector and a fuse. The VS & F allows equipment to operate anywhere in the world. FOUR OPERATING VOLTAGES — The VS & F and a simple transformer modification allows the equipment to operate at 100, 120, 220 or 240 volts 50-400 Hz. Voltage selection is made with a unique voltage selector card. EASY INSTALLATION — Only one rectangular cut-out is required for easy snap in mounting. BUILT-IN SAFETY — The fuse and voltage selector card are enclosed behind a see-thru cover which cannot be moved until the power cord is removed from the equipment. UL & IEC — The VS & F has an IEC approved connector, UL SE-01 fire retardant polyester housing and complies with UL and IEC requirements. RFI FILTER — Available with RFI filter (see EF Series specifications for electrical data.) Minimum insertion loss at .5 MHz is 24 DB, at 2.0 MHz to 5.0 MHz 50 DB.

Model 6J1 (unfiltered style) .... $ 5.95 List Price
Model 6J4 (filtered style) .... $10.95 List Price



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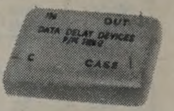
*** THESE FILTERS ARE RECOGNIZED UNDER THE COMPONENTS PROGRAM OF UNDERWRITERS LABORATORIES INC.**

DATA DELAY DEVICES
253 CROOKS AVE., CLIFTON, N.J. 07011 Tel. (201) 772-1106

SHORT FORM CATALOG

LOW PROFILE FILTERS

SERIES 1100



CASE Metal flat case to reduce hum pick-up.

PINS Straight pins for PC mounting.

MIL SPECS These filters meet MIL-F-18327C specs. Grade 6, Class R, Life X.

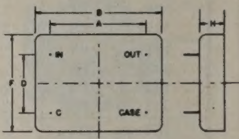
NOTE Filters with other requirements than shown can be supplied. Our technical staff is ready to give you prompt service.

LOW-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1101-1	10K	DC to 460Hz	600Hz	40db above 750Hz	1
1101-2	600	DC to 3KHz	3.4KHz	40db above 4.2KHz	1
1101-3	10K	DC to 4.4KHz	5KHz	43db above 6.3KHz	2
1101-4	1K	DC to 9KHz	10KHz	43db above 12.8KHz	1
1101-5	600	DC to 15KHz	18KHz	43db above 23KHz	1
1101-6	600	DC to 43KHz	50KHz	43db above 64KHz	2

BROAD BAND-PASS

PART NO.	Imp. IN/OUT	PASS-BAND	STOP-BAND (36db) BELOW	STOP-BAND (36db) ABOVE	CASE NO.
1103-1	10K	1KHz to 2KHz	0.5KHz	4KHz	3
1103-2	10K	2KHz to 4KHz	1KHz	8KHz	3
1103-3	10K	4KHz to 8KHz	2KHz	16KHz	3
1103-4	10K	10KHz to 20KHz	5KHz	40KHz	4



HIGH-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1102-1	10K	300Hz & above	200Hz	40db below 140Hz	1
1102-2	10K	600Hz & above	400Hz	40db below 280Hz	1
1102-3	10K	1.2KHz & above	800Hz	40db below 560Hz	1
1102-4	10K	3KHz & above	2KHz	40db below 1.4KHz	2
1102-5	10K	6KHz & above	4KHz	40db below 2.8KHz	2

CASE DIMENSIONS

CASE NO.	A IN.	A M.M.	B IN.	B M.M.	D IN.	D M.M.	F IN.	F M.M.	H IN.	H M.M.
1	1.4	35.56	1.875	47.63	1.4	35.56	2.0	50.8	0.5	12.70
2	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.375	9.53
3	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.5	12.70
4	0.8	20.32	1.25	31.75	1.0	25.4	1.75	44.45	0.375	9.53

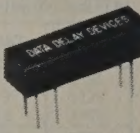
ACTIVE FILTERS

LOW PASS 24 db/OCT.	HIGH- PASS 24 db/OCT.	BAND-PASS 24 db/OCT.	BAND- REJECT 24 db/OCT.
32 BU24X-10	34 BU24X-10	46 BU24Y-10-100	63 BU24Y-10-100
32 BU24X-100	34 BU24X-100	46 BU24Y-100-1000	63 BU24Y-100-1000
32 BU24X-1000	34 BU24X-1000	46 BU24Y-1000-10,000	63 BU24Y-1000-10,000
32 BU24X-10,000	34 BU24X-10,000	46 BU24Y-10,000-15,000	63 BU24Y-10,000-15,000
32 BU24X-20,000	34 BU24X-20,000	46 BU24Y-15,000-20,000	63 BU24Y-15,000-20,000

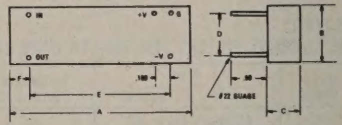
TO ORDER OTHER ACTIVE FILTERS NOT LISTED ON ABOVE TABLE USE THE FOLLOWING PROCEDURE:

PART NO. 32	BU	24	X	01000-00000
32-LOW PASS 34-HIGH PASS 46-BAND PASS 63-BAND REJECT	BU-BUTTERWORTH BE-BESSEL CH-TCHEBYSHEV	12-12 db/OCT. 24-24 db/OCT. 36-36 db/OCT. 48-48 db/OCT.	X = Case #1 Y = Case #2	CUT-OFF FREQUENCIES in HZ

SPECIFICATIONS



- **Transfer characteristics** – Butterworth, Bessel, Tchebyshev.
- **Gain in pass-band** – 0 db ±.2db
- **Cut-off frequency accuracy** – ±2% @ – 3 db
- **Maximum input voltage** – 10 volts peak.
- **Supply voltage** – ±15 volts min., ±18 volts max.
- **DC drift** – 20uV/°C typical.
- **Temperature range** – 0°C to 70°C (standard), -55°C to 125°C (on request).
- **Temperature/Coefficient** – .03%/°C. better on request.
- **Power consumption** – 400 MW Max.

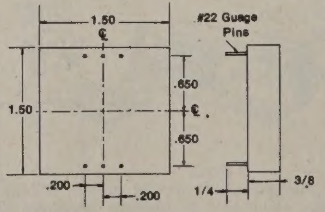


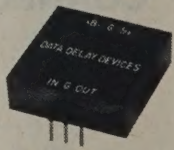
Case No.	Dimensions (inches) A	B	C	D	E	F	Highest Skirt Att. (db/oct.) (LP) & (HP)	(BP) & (BR)
1	1.25	.40	.34	.300	.700	.225	24	12
2	2.00	1.00	.50	.600	1.100	.50	48	24

TONE ACTIVE FILTERS

SERIES TAF-24

PART NO.	fc(Hz)	PART NO.	fc(Hz)	PART NO.	fc(Hz)
TAF24-360	360	TAF24-1260	1260	TAF24-2280	2280
TAF24-420	420	TAF24-1320	1320	TAF24-2340	2340
TAF24-480	480	TAF24-1336	1336	TAF24-2400	2400
TAF24-540	540	TAF24-1380	1380	TAF24-2460	2460
TAF24-600	600	TAF24-1440	1440	TAF24-2520	2520
TAF24-660	660	TAF24-1477	1477	TAF24-2580	2580
TAF24-697	697	TAF24-1500	1500	TAF24-2640	2640
TAF24-720	720	TAF24-1560	1560	TAF24-2700	2700
TAF24 770	770	TAF24-1620	1620	TAF24-2760	2760
TAF24-780	780	TAF24-1633	1633	TAF24-2820	2820
TAF24-840	840	TAF24-1680	1680	TAF24-2880	2880
TAF24-852	852	TAF24-1740	1740	TAF24-2940	2940
TAF24-900	900	TAF24-1800	1800	TAF24-3000	3000
TAF24-941	941	TAF24-1860	1860	TAF24-3060	3060
TAF24-960	960	TAF24-1920	1920	TAF24-3120	3120
TAF24-1020	1020	TAF24-1980	1980	TAF24-3180	3180
TAF24-1080	1080	TAF24-2040	2040	TAF24-3240	3240
TAF24-1140	1140	TAF24-2100	2100	TAF24-3300	3300
TAF24-1200	1200	TAF24-2160	2160	TAF24-3360	3360
TAF24-1209	1209	TAF24-2220	2220		





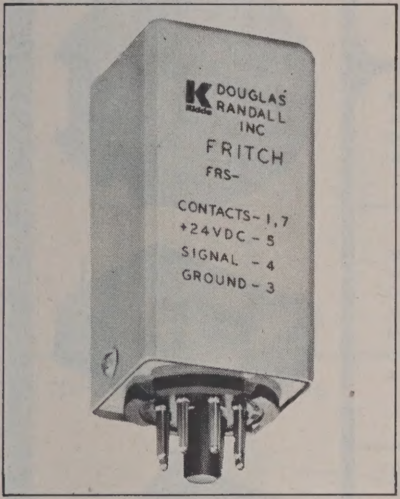
SPECIFICATIONS

- **Center frequency** – See table below (others on request).
- **Bandwidth (3db)** – ±1.5% to ±3% of fc.
- **Bandwidth (20db)** – ±10.5% of fc.
- **Gain** – 10db ±1db.
- **Gain variation** – ±.4db from 0°c. to 70°c.
- **Input impedance** – 10 K (Ω)
- **Output load** – ≥ 600 (Ω).
- **Temperature range** – -0°c to 70°c.
- **Power supply** – ±15 Vdc.

Douglas Randall TONE CONTROLS KIDDE

DIVISION OF WALTER KIDDE & COMPANY, INC. • 6 PAWCATUCK AVE., PAWCATUCK, CONN. 02891 • (203) 599-1750

FRITCH® — Frequency Responsive Switch



The FRITCH® is a sensitive, rapid tone detector combining solid state circuitry with a Reed Relay output. Two basic types are made:

- Type I — Used where only one frequency is present.
- Type II — Used where several frequencies are present.

DOUBLE TONE FRITCHes detect two frequencies. They are prefiltered to operate in the presence of several frequencies and can incorporate optional time delays to minimize the effect of spurious signals. They are ideal for detecting touch tone pairs over telephone lines.

Specifications

FREQUENCY RANGE: 7 Hz to 100 KHz.

BANDWIDTH: Must Operate: ±2% fo. May Operate ±5% fo.

NORMAL CHANNEL SPACING: 11%.

INPUT SIGNAL LEVEL: 5 VRMS, 1 VRMS or 0.7 VRMS (odbm). Special to .050 V.

INPUT IMPEDANCE: 25,000 ohms typical.

RESPONSE TIME: To 75 pulses per second depending on frequency.

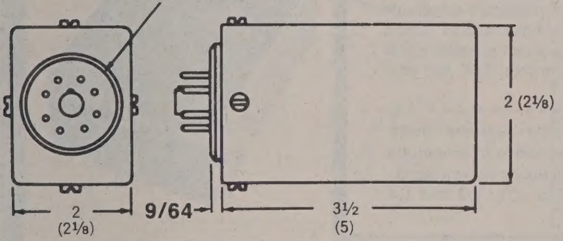
DC POWER INPUT: 12 V or 24 VDC ±10% (other voltages available).

OUTPUT CONTACTS: Form 1A, 2A, 1B, 2B, 1C or 1A1B. Solid state output optional.

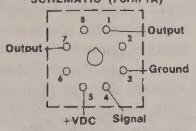
CONTACT RATING: Form A or B — 10 W, 0.5 A or 250 VDC Max. Form C — 3 W, 0.25 A or 28 VDC Max.

ENVIRONMENTAL LIMITS: Shock: 50 g; Vibration: 35 g; Temperature: −0°C to +50°C.

STANDARD OCTAL TUBE BASE



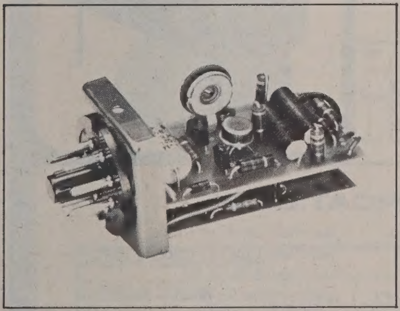
SCHEMATIC (Form 1A)



DIMENSIONS IN PARENTHESIS ( ) ARE FOR DOUBLE TONE FRITCH

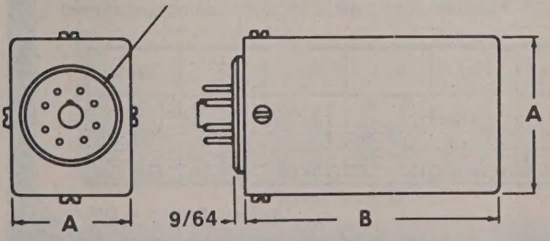
® Registered trademark of Douglas Randall Frequency Responsive switch. (Patent 3584275)

Oscillators



Douglas Randall Oscillators are solid state RC devices. The oscillator circuit operates continuously. The output stage is gated to a low impedance driver circuit, insuring extremely rapid signal response and freedom from frequency shift due to keying. Keying is accomplished by connecting the proper terminal to the power supply common (see schematic). The oscillators have reverse polarity protection incorporated in the unit to protect them if improperly connected. Single, double and triple tone versions are available in standard octal plug housings. They are also available for P.C. Mounting.

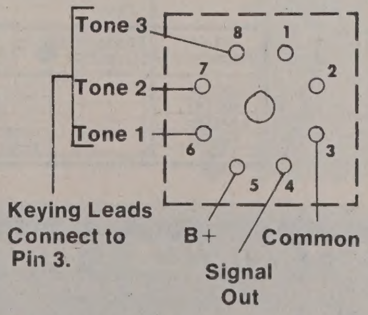
STANDARD OCTAL TUBE BASE



Dimension
Single Tone
A — 1½
B — 2¾

Double
or Triple Tone
A — 2
B — 3½

SCHEMATIC



Specifications

DC POWER INPUT: 12 V or 24 VDC ±10% (other voltages available).

LOAD IMPEDANCE: 600 ohms.

OUTPUT SIGNAL: Standard, 1 V RMS.

DISTORTION: 1%.

RESPONSE TIME: 50 Microseconds.

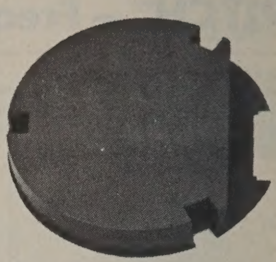
DECAY TIME: 50 Microseconds.

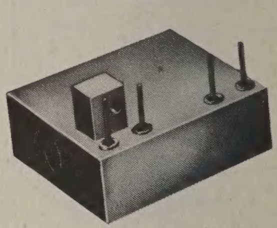
FREQUENCY RANGE: ±1%: 0°C to 40°C. ±1.5%: −20° to +65°.

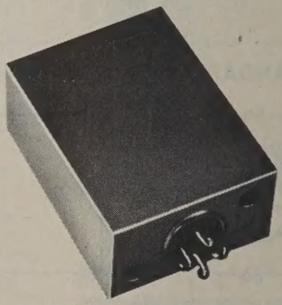
ESC LC FILTERS

DC to 100 Mhz

- Low Pass
- Band Reject
- RC
- Phase Matched
- High Rel
- High Pass
- Wideband
- Linear Phase
- Attenuation Matched
- Comb
- Band Pass
- Audio
- Constant Group Delay
- Low Transient Response
- Attenuation Equalizers



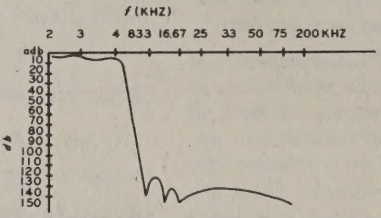




SONAR FILTERS IN PHASE AND AMPLITUDE MATCHED SETS

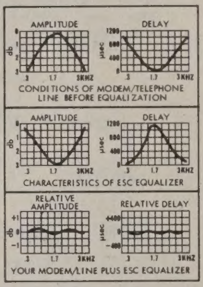
Linear phase bandpass and lowpass filters, with phase and amplitude matched passbands. Matching can be accomplished for any number of channels; generally three filters made a set, but as many as 900 have been phase and amplitude matched. ESC produces filters for Sonobuoys and audio comb analyzers.

HIGH ATTENUATION 140 db AIRCRAFT RADIO LOW PASS FILTERS



ESC is the leading manufacturer of high attenuation filters. These filters provide more than 140 db attenuation of harmonic frequencies in the audio band and have controlled minimum phase shift. Size is only 1.2 x 1.0 x .58.

ESC EQUALIZERS



ESC produces custom designed equalizers for group delay and amplitude distortion. In particular, ESC produces custom designed compromise equalizers for modem manufacturers to correct for transmission line and modem produced amplitude and phase (delay) distortion. Equalization allows modem sets to be used at highest possible rates with minimum distortion. Contact ESC for your specific requirement.

ESC TELEPHONE LINE SIMULATORS

They provide voice-band data systems users with nominal worst case conditions of amplitude and envelope delay of Bell Telephone voice bandwidth data channel 3002 and C1, C2 and C4 conditioning.

FILTERS FOR THE TELEPHONE INDUSTRY

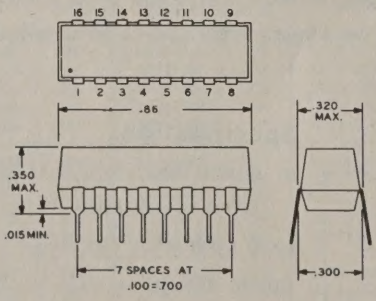
ESC has a full line of 1010 Hz Band reject filters. Low profile versions for standard telephone testing production equipment. Available in 600 Ω and 900 Ω balanced and unbalanced versions to "Western Electric" specifications.

2600 Hz Band reject filters available to standard "Bell" specifications or in miniaturized version with height approximately ½". Low cost for standard "SF" Signalling equipment.

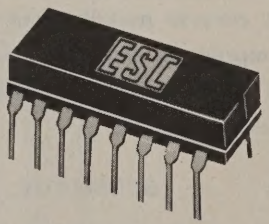
ULTRA SHARP HIGH SPEED DATA MODEM FILTERS

ESC produces a series of lowpass, bandpass and band suppression filters in 60 Khz to 108 Khz range for use in high speed (150 Kbps) data modems. Filters have very sharp attenuation characteristics, low group delay distortion and more than 60 db intermodulation distortion and are made in compact sizes for PC board capability.

DIP LOW PASS FILTER SERIES



PIN 1 — IN
PIN 8 — OUT
PINS 9 & 16 — GND



SPECIFICATIONS:

- Insertion Loss: less than .5 db at .1 Fc
- Ripple: less than 1 db in Passband to Fc
- Attenuation: less than 3 db to Fc
  greater than 50 db at 3 Fc
- Operating Temp: − 55°C to + 125°C
- Built to conform to applicable portions of MIL-F-18327
- Mounting: Standard 16 Pin configuration
- For other filter types in DIP configuration contact plant

CUT-OFF FREQUENCY Fc	IMPEDANCE Z IN/OUT ➡	75 Ω	100 Ω	200 Ω	250 Ω	500 Ω	1000 Ω
200 KHz				2 DIP-200	2 DIP-250	2 DIP-500	2 DIP-1000
400 KHz			4 DIP-100	4 DIP-200	4 DIP-250	4 DIP-500	4 DIP-1000
500 KHz			5 DIP-100	5 DIP-200	5 DIP-250	5 DIP-500	5 DIP-1000
800 KHz		8 DIP-75	8 DIP-100	8 DIP-200	8 DIP-250	8 DIP-500	8 DIP-1000
1 MHz		10 DIP-75	10 DIP-100	10 DIP-200	10 DIP-250	10 DIP-500	10 DIP-1000

Request Bulletin — DIP-F

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD ● PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 ● TWX 710-991-9780

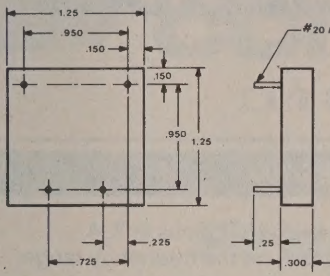
TOLL FREE
800-631-0853
(except N.J.)

LC FILTERS

DC to 100 Mhz

ESC

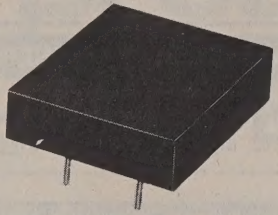
130 DB/OCTAVE MINIATURIZED FL LOW PASS FILTERS



SPECIFICATIONS:

- Insertion Loss:.................. Less than 1 db at .1 f_c
- Ripple:......................... Less than 1 db in Pass Band
- Roll-off:...................... 130 db per octave or better
- Minimum stop band attenuation:.. 45 db
- Operating Temp. Range: .... $-55^{\circ}C$ to $+125^{\circ}C$
- Construction: .... Epoxy - DAP molded construction
- Built to conform to applicable portions of MIL-F-18327

Request Bulletin — FL

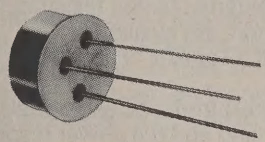


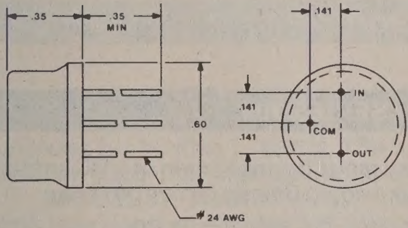
STANDARD TYPES:

Cut-off Frequency (Khz)	Impedance (ohms) 600	1000	2000	3000	5000
3.0	FL3-6	FL3-10	FL3-20	FL3-30	
4.0	FL4-6	FL4-10	FL4-20	FL4-30	
5.0	FL5-6	FL5-10	FL5-20	FL5-30	FL5-50
8.0	FL8-6	FL8-10	FL8-20	FL8-30	FL8-50
10.0	FL10-6	FL10-10	FL10-20	FL10-30	FL10-50

Other designs available upon request

TO-8 LOW PASS FILTERS





Request Bulletin-TO-8

SPECIFICATIONS:

- Insertion Loss: .... Less than .5 db at .1 f_c
- Ripple: .... Less than .5 db Peak to Peak in pass-band.
- Attenuation:.................. Series M: 12 db/octave roll-off from 3 db point.
  Series P: 18 db/octave roll-off from 3 db point.
- Operating Temp. Range: ...... Military: $-55^{\circ}C$ to $+125^{\circ}C$. Conforms to applicable portions of MIL-F-18327.
  Commercial: 0° to $+70^{\circ}C$.
- Mounting: .... Standard TO-8 -- see diagram.

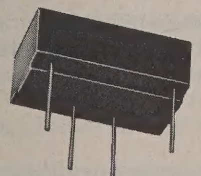
STANDARD TYPES:

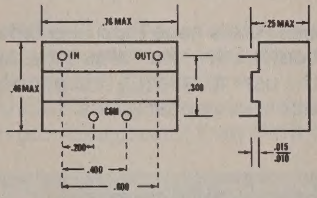
SERIES M (12 db/octave) Impedance (ohms) 600	1000	2000	3000	5000	Cut-off Frequency (Khz)	SERIES P (18 db/octave) Impedance (ohms) 600	1000	2000	3000	5000
	M2-10*	M2-20			2.0		P2-10*	P2-20*		
M3-6*	M3-10	M3-20			3.0	P3-6*	P3-10*	P3-20		
M5-6	M5-10	M5-20	M5-30		5.0	P5-6*	P5-10	P5-20	P5-30	
M8-6	M8-10	M8-20	M8-30	M8-50	8.0	P8-6	P8-10	P8-20	P8-30	
M10-6	M10-10	M10-20	M10-30	M10-50	10.0	P10-6	P10-10	P10-20	P10-30	P10-50

Other designs available upon request

* Not available to MIL specs.

ESC DUAL-IN-LINE DIF® FILTERS





Five series of filters, three lowpass and two highpass. As example DIF-L39 lowpass series is listed below. Also available is linear phase series DIF-LP, lowpass series DIF-L20, highpass series DIF-H20 and DIF-H39. Full specifications for attenuation and typical characteristics such as phase shift, group delay and pulse response are presented in catalog. A bandpass filter can be formed by tandem connection of a lowpass and highpass (minimum bandwidth is one octave).

SPECIFICATIONS:

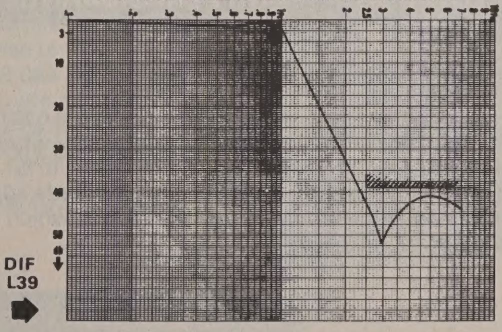
INSERTION LOSS	**<.5 db at .1Fc**
RIPPLE	**<±1 db in Passband (to Fc)**
ATTENUATION	**<3 db to Fc** **>39 db at 2.5 Fc & higher frequencies**

DIF-L39 SERIES STANDARD PART NUMBERS

CUTOFF FREQUENCY Fc / IMPEDANCE Z IN/OUT	50Ω	100Ω	200Ω	500Ω	1000Ω	2000Ω	5000Ω
1KHz				DIF-L39-31	DIF-L39-41		
2				DIF-L39-32			
2.5			DIF-L39-21		DIF-L39-42	DIF-L39-50	
5		DIF-L39-11	DIF-L39-22	DIF-L39-33	DIF-L39-43	DIF-L39-51	DIF-L39-57
10KHz	DIF-L39-1	DIF-L39-12		DIF-L39-34	DIF-L39-44		DIF-L39-58
12.5			DIF-L39-23			DIF-L39-52	
20	DIF-L39-2			DIF-L39-35			DIF-L39-59
25		DIF-L39-13	DIF-L39-24		DIF-L39-45	DIF-L39-53	
50	DIF-L39-3	DIF-L39-14	DIF-L39-25	DIF-L39-36	DIF-L39-46	DIF-L39-54	DIF-L39-60
100KHz	DIF-L39-4	DIF-L39-15		DIF-L39-37	DIF-L39-47		DIF-L39-61
125			DIF-L39-26			DIF-L39-55	
200	DIF-L39-5			DIF-L39-38			
250		DIF-L39-16	DIF-L39-27		DIF-L39-48	DIF-L39-56	
500	DIF-L39-6	DIF-L39-17	DIF-L39-28	DIF-L39-39	DIF-L39-49		
1MHz	DIF-L39-7	DIF-L39-18		DIF-L39-40			

Request Bulletin — DIF

DIF-L39 NORMALIZED ATTENUATION CHARACTERISTIC



ESC ELECTRONICS CORPORATION

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PHONE: (201) 947-0400 • TWX 710-991-9780

TOLL FREE
800-631-0853
(except N.J.)

Frequency Devices INC.

active filters AND sinewave oscillators

FROM Frequency Devices INC.

FIXED FREQUENCY ACTIVE FILTERS - SERIES 700

700 SERIES Active Filters offer Bessel, Butterworth, and Tchebyscheff transfer functions in 2, 4, 6, and 8-pole designs. Lowpass, highpass, bandpass, and band reject with f_o and f_c on the frequency range from 0.001 Hz to 20 kHz.

RESISTIVE TUNEABLE ACTIVE FILTERS - SERIES 730, 740, 760, 770, 780

730 & 740 SERIES are 2, 4, and 6-pole lowpass filters with externally tuneable cutoff frequencies up to 50kHz. Various models are tuneable over 200:1 or 500:1 frequency ranges via external tuning resistors. Bessel and Butterworth response characteristics which pass signals from DC to f_c are available.

760 SERIES BANDPASS: Two pole-pair Butterworth characteristics with Q of 5 or 10 and 1000:1 tuning. Various models cover the range 0.05Hz to 20kHz.

770 SERIES are 2, and 4-pole highpass filters with externally tuneable cutoff frequencies. Models are available with f_c from 0.02Hz to 20kHz. All models feature 1000:1 frequency tuning and full power response to 50kHz.

780 SERIES BANDPASS/BAND REJECT: Provides adjustable Q of 0.5 to 100 with 1000:1 tuning. Notch depth is 50 to 60dB and is trimmable to 60 to 80dB.

VOLTAGE TUNEABLE ACTIVE FILTERS - SERIES 300

300 SERIES 2-pole active filters are tuneable over a 20:1 frequency range by application of a DC control voltage. Simultaneous lowpass, highpass, and bandpass outputs are provided. Gain or Q may be varied with a single resistor.

PROGRAMMABLE FILTERS - 744, 745 Series & FC 102, FC 103

744 & 745 SERIES Butterworth and Bessel Lowpass Filters have BCD and Binary programmable corner frequencies and 500:1 and 1000:1 tuning ranges. Five models cover the frequency range from 0.1Hz to 50kHz.

FC102: The almost instrument filter card permits the user to select f_c via pencil point switches. It is an excellent choice for breadboard and laboratory applications.

FC103: Digitally controllable lowpass filters.

SINEWAVE OSCILLATORS LOW COST — HIGH PERFORMANCE — LOW DISTORTION

400 SERIES FIXED FREQUENCY - 440 SERIES TUNEABLE

Modular fixed frequency and tuneable oscillators feature low distortion quadrature (90°±.1°) buffered outputs. Fixed frequency models are available from 1Hz to 20kHz (externally adjustable ±10%). Tuneable models have frequency tuning range of 1000:1 and amplitude adjustable from 2.5 to 20V p-p.

Amplitude control modules 664/665 which maintain amplitude stability to 100ppm are also available.

Frequency Devices INC.

450 SERIES - COMPACT - LOW COST

THE 450 SERIES features 0.1dB amplitude stability, 0.1% distortion, 1 to 20V p-p adjustable, 100Hz to 10kHz range, 1% accuracy (adj. ±5%) and 0.02%/°C stability.

Frequency Devices, Inc., Dept. EM, 25 Locust St., Haverhill, MA 01830 (617) 374-0761 TWX 710-347-0314

tone detectors AND communications products

FROM

Frequency Devices INC.

TONE DETECTORS FOR TOUCH TONE* APPLICATIONS

MODEL 550-1 [LOW GROUP] & MODEL 550-2 [HIGH GROUP] TONE DETECTOR MODULES
The Model 550-1 and Model 550-2 Tone Detector Modules are complete, easy to use, adjustment free, high performance tone detector modules. They detect standard Bell System Touch Tones* with relative amplitudes of 15dB and absolute amplitudes in the range from -30dBm to 0dBm. Detection and hold times have been set for non-ambiguous detection of 40ms on and 40ms off tone bursts. Outputs may be interfaced with CMOS or T^2L logic.

TONE ENCODERS FOR TOUCH TONE* APPLICATIONS

MODEL 510 TOUCH TONE* ENCODER is a complete T^2L Compatible Touch Tone* Encoder in a 2.4 cu. in. low profile (0.4″) module. Specifications include: Low distortion outputs (<1%) - Touch Tone* frequencies (±1%) (Osc 1 - 697Hz, 770Hz, 852Hz, 941Hz Osc. 2 - 1209Hz, 1336Hz, 1477Hz , 1633Hz). Gating isolation 60dB - 10Ω impedance output.

MODEL 511 TOUCH TONE* ENCODER is a complete T^2L Compatible Dual Tone Encoder having high tone signal amplitudes 3dB greater than the low tones.

FSK MODEM FILTERS — 530 SERIES

530 SERIES MODEM FILTERS are dual frequency 1170/2125 Hz bandpass filters. Their center frequencies can be selected by externally grounding a control input. Transistor switching can be used to originate and answer type modem applications.

Model 530 is a TRANSMIT filter with greater than 30dB of adjacent channel rejection and Model 531 is a RECEIVE filter which provides greater than 60dB of adjacent channel rejection.

WEIGHTING FILTERS — 580 SERIES

581 SERIES C-MESSAGE WEIGHTING FILTERS provide a frequency response characteristic which simulates the perceived response of the human ear to telephone noise.

585 SERIES NARROW BAND NOTCH FILTERS eliminate test or holding tones that interfere with the accuracy of noise measurements in telephone message circuits. Models 585-1 and 585-2 have −3dB and −50dB bandwidths that conform with Bell System specifications.

When a 581 is used in conjunction with a 585 they provide what is commonly called a "C-Notch" filter.

FREQUENCY DEVICES INC. ALSO CARRIES A BROAD LINE OF ACTIVE FIXED FREQUENCY, TUNEABLE AND PROGRAMMABLE FILTERS AND SINEWAVE OSCILLATORS.

*Registered trademark of AT&T.

Frequency Devices, Inc., Dept. EM, 25 Locust St., Haverhill, MA 01830 (617) 374-0761 TWX 710-347-0314

FEI Frequency Electronics, inc.

3 Delaware Dr., New Hyde Park, N.Y. 11040 (516) 328-0100.

Timekeeper for Outer Space . . .
Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

INSTRUMENTS

- DISCIPLINED TIME FREQUENCY STANDARDS
- HIGH STABILITY FREQUENCY STANDARDS
- FREQUENCY STANDARD CARRYING CASES
- DIGITAL PHASE COMPARATORS
- FREQUENCY ERROR ANALYZERS
- DISTRIBUTION AMPLIFIERS
- VIDEO DISTRIBUTION AMPLIFIERS
- RF SWITCHOVERS
- PASSIVE COMBINERS
- DIGITAL CLOCKS
- C/KT RATIOMETERS
- MICROWAVE FREQUENCY MULTIPLIERS
- IF NOISE GENERATORS
- HIGH FREQUENCY AMPLIFIERS
- UHF DOWN-CONVERTERS
- UHF UP-CONVERTERS

SYSTEMS

- TIME & FREQUENCY CONTROL SYSTEMS
- UHF SYNTHESIZERS
- FREQUENCY GENERATORS
- COHERENT MICROWAVE SYNTHESIZERS
- RF SWITCHING SYSTEMS

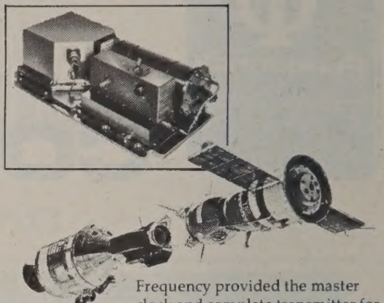
CRYSTAL FILTERS AND DISCRIMINATORS

- NARROW BAND CRYSTAL FILTERS
- INTERMEDIATE WIDE BAND CRYSTAL FILTERS
- BAND REJECT CRYSTAL FILTERS
- SINGLE SIDE BAND CRYSTAL FILTERS
- DISCRIMINATORS

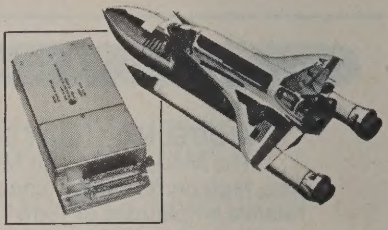
OSCILLATORS

- OVENIZED CRYSTAL OSCILLATORS
- OVENIZED VOLTAGE CONTROLLED CRYSTAL OSCILLATORS
- TEMPERATURE COMPENSATED VOLTAGE CONTROLLED CRYSTAL OSCILLATORS
- TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS
- NON-OVENIZED CRYSTAL OSCILLATORS
- LC VOLTAGE CONTROLLED OSCILLATORS
- PRECISION LOW POWER OSCILLATORS
- HIGH STABILITY PROPORTIONAL OVENS
- CUSTOM ENGINEERED OSCILLATORS

LOW PHASE-NOISE FREQUENCY SOURCES TO 10 GHz

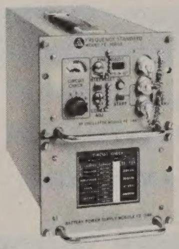


Frequency provided the master clock and complete transmitter for an important Apollo-Soyuz experiment.



Scheduled for launch during 1979, NASA's Space Shuttle is designed to become America's manned reusable space transportation system. Frequency has delivered Oscillators for the Master Timing Unit Redundant Clock for the Space Shuttle Orbiter, built by Rockwell International Corporation's Space Division.

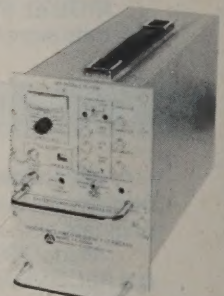
INSTRUMENTS



IMPROVED FREQUENCY STANDARD

HIGH STABILITY FREQUENCY STANDARD

DISTRIBUTION AMPLIFIER

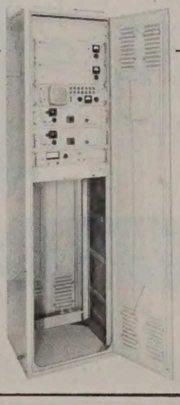


DISCIPLINED TIME FREQUENCY STANDARD

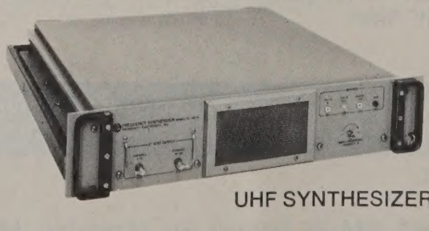
HIGH LEVEL IF NOISE GENERATOR

UHF DOWN-CONVERTER

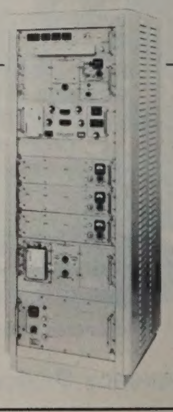
SYSTEMS



FREQUENCY STABILIZATION EQUIPMENT



UHF SYNTHESIZER



FREQUENCY-TIME STANDARD SET

type spacecraft.

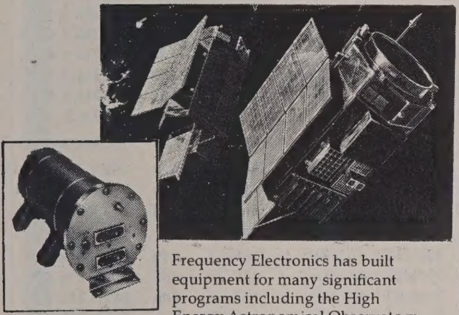
The NTS-1 crystal clock, built by Frequency Electronics, Inc., is still functioning very well, according to Easton. It has exhibited a long-term stability of about one part in 10^{11}, Easton said.

This corresponds to an error of 800′ in measuring range to the satellite if a crystal

—From "Frequency Standard Orbital Test Set," by Philip J. Klass in "Aviation Week & Space Technology" magazine, Oct. 11, 1976.

Roger Easton is Branch Head of Naval Research Laboratory's space applications.

The Navigation Technology Satellite—NTS-1—built by NRL, was launched on July 14, 1974.



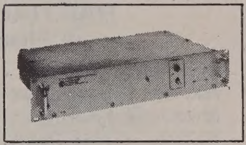
Frequency Electronics has built equipment for many significant programs including the High Energy Astronomical Observatory (HEAO) Satellite.

FEI Frequency Electronics, inc. 3 Delaware Dr., New Hyde Park, N.Y. 11040 (516) 328-0100.

Broad Band Modular Switching Systems

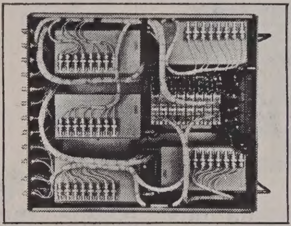
Complete systems with power supplies, digital interface converters, I/O equipment, control panels, and various other functions are available. FEI switching systems are presently being used in: Satellite Automatic Checkout Equipment, High-Speed PCB Testers, Direction Finders, Antenna Distribution Systems, Video Distribution Systems.

Scanners & Controllers



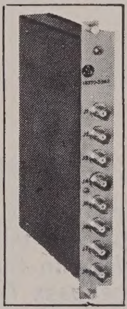
FE 7801
DIGITAL INTERFACE UNIT

Solid-State Matrices



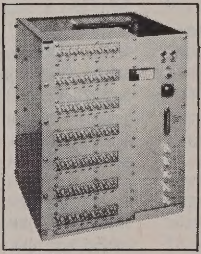
FE 7650A
8×50 MATRIX

Reed Switches

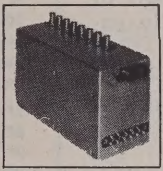


FE 7735A
1×8 SWITCH

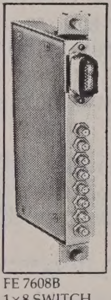
Reed Relay Matrices



FE 7750A
5×56 MATRIX

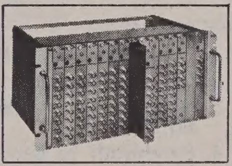


FE 7758A
7×8 MATRIX



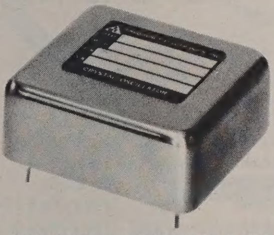
FE 7608B
1×8 SWITCH

Solid-State Switches

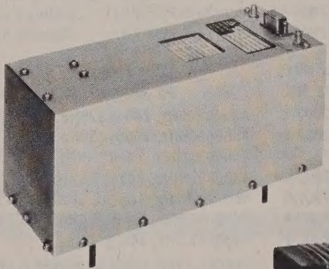


FE 7642D
4×92 SWITCH

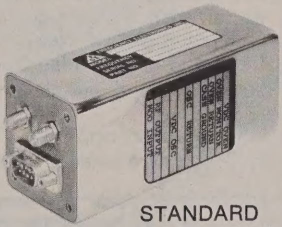
OSCILLATORS



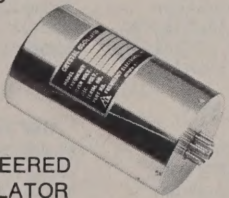
VOLTAGE CONTROLLED
CRYSTAL OSCILLATOR



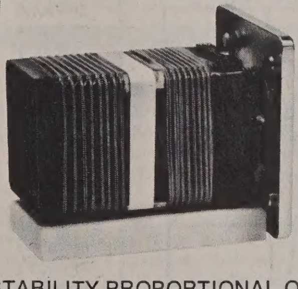
SATELLITE
CRYSTAL
OSCILLATOR



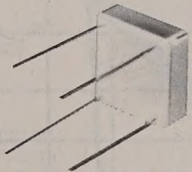
STANDARD
OSCILLATOR



CUSTOM ENGINEERED
OSCILLATOR



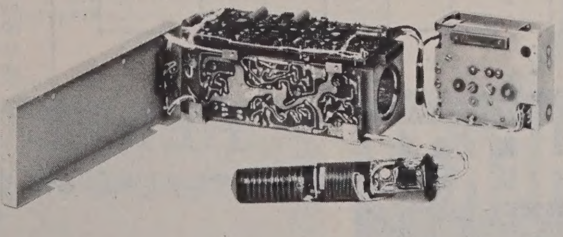
HIGH STABILITY PROPORTIONAL OVEN



STANDARD
OSCILLATOR

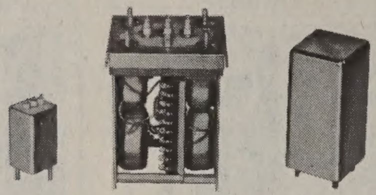
CRYSTAL FILTERS AND DISCRIMINATORS

HIGH RELIABILITY PRODUCTS



HERTZ FILTERS

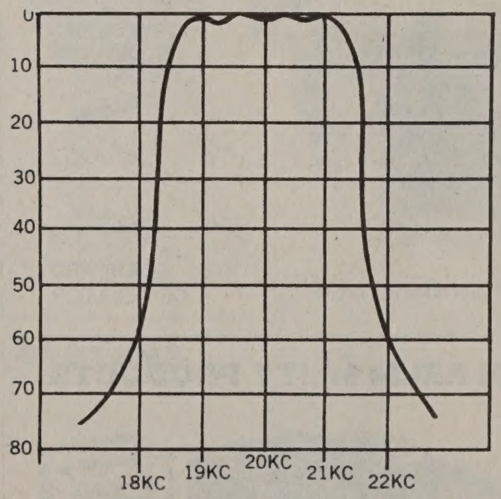
BAND PASS FILTERS CUSTOM DESIGNED TO FILL YOUR NEEDS



Hertz Filter Corporations' engineering department is made up entirely of specialists in the field of custom design of band pass filters. They are all fully experienced and prepared to help you solve your filter problems. Call or write Hertz for reliable service and prompt delivery.

FEATURES

1. Filters, Band Pass, Passive
2. Center Frequencies — 50 Hz to 50 Meg Hz
3. Shape factors — better than 2.0 for ratios of 60 db to 3 db
4. Bandwidth to center frequency ratio — up to 10%
5. Phase linearity — within 10° through passband
6. Low passband insertion loss
7. Better than 80 db attenuation 50% above and below center frequency
8. Input and output impedances as required
9. Low input and output impedances in stop band
10. Low passband ripple
11. L, C, and R elements only



PARTIAL LIST OF HERTZ FILTERS

(all filters in accordance with MIL-F-18327)

BAND PASS PART NO.	PASS BAND	STOP BAND	Z_o	I.L.@CF	SIZE
BP-7907-1	3db(150-300)Hz	60db(50-850)Hz	600	1db	2 x 2¼ x 4
BP-7907-2	3db(300-900)Hz	60db(110-1700)Hz	600	1db	2 x 2¼ x 4
BP-7907-3	3db(600-1200)Hz	60db(210-3400)Hz	600	1db	2 x 2¼ x 4
BP-7907-4	3db(1.2-2.4)KHz	60db(.43-6.8)KHz	600	1db	2 x 2¼ x 4
BP-7907-5	3db(2.4-4.8)KHz	60db(.85-13.5)KHz	600	1db	2 x 2¼ x 4
BP-7907-6	3db(4.8-9.6)KHz	60db(1.7-27)KHz	600	1db	2 x 2¼ x 4
BP-7907-7	3db(8.9-11.2)KHz	60db(3.1-32)KHz	600	1db	2 x 2 x 3
BP-7996-1	3db(825-1,175)Hz	40db(650-1,350)Hz	30K	3db	1 x 2¼ x 4½
BP-8004-10	3db(8-26)KHz	30db(4-30)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-11	3db(19.5-33.5)KHz	30db(16.5-36.5)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-12	3db(26.25-40.25)KHz	30db(23.25-43.25)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-8004-13	3db(32.6-52.6)KHz	30db(27.6-57.6)KHz	10K/2K	2db	1⅜ x 1⅝ x 2¾
BP-7897-1	3db(37.5-40.5)KHz	30db(34.5-43.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-2	3db(40.5-43.5)KHz	30db(37.5-46.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-3	3db(43.5-46.5)KHz	30db(40.5-49.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-4	3db(46.5-49.5)KHz	30db(43.5-52.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-5	3db(49.5-52.5)KHz	30db(46.5-55.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-6	3db(52.5-55.5)KHz	30db(49.5-58.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-7	3db(55.5-58.5)KHz	30db(52.5-61.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-8	3db(58.5-61.5)KHz	30db(55.5-64.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-9	3db(61.5-64.5)KHz	30db(58.5-67.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-10	3db(64.5-67.5)KHz	30db(61.5-70.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-11	3db(67.5-70.5)KHz	30db(64.5-73.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-12	3db(70.5-73.5)KHz	30db(67.5-76.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-13	3db(73.5-76.5)KHz	30db(70.5-79.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-14	3db(76.5-79.5)KHz	30db(73.5-82.5)KHz	10K/1K	4db	1¼ x 1¼ x 2
BP-7897-15	3db(79.5-82.5)KHz	30db(76.5-85.5)KHz	10K/1K	4db	1¼ x 1¼ x 2

LOW PASS PART NO.	PASS BAND	STOP BAND	Z_o	SIZE
LP-7907-1	4db@300Hz, 1db@225Hz	60db@850Hz	600	2 x 2 x 3
LP-7907-2	4db@600Hz, 1db@450Hz	60db@1700Hz	600	2 x 2 x 3
LP-7907-3	4db@1.2KHz, 1db@.9KHz	60db@3.4KHz	600	2 x 2 x 3
LP-7907-4	4db@2.4KHz, 1db@1.8KHz	60db@6.8KHz	600	2 x 2 x 3
LP-7907-5	4db@4.8KHz, 1db@3.6KHz	60db@13.5KHz	600	2 x 2 x 3
LP-7907-6	4db@9.6KHz, 1db@7.2KHz	60db@27KHz	600	2 x 2 x 3
LP-7907-7	4db@11.2Hz, 1db@10KHz	60db@32KHz	600	1⅜ x 1⅝ x 2¾
LP-7996-1	5db@1,175Hz, 2db@1,000Hz	40db@650Hz	30K	1⅜ x 1⅝ x 2¾
LP-8004 10	5db@26KHz, 1db@17KHz	30db@30KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-11	5db@33.5KHz, 1db@26.5KHz	30db@36.5KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-12	5db@40.25KHz, 1db@33.25KHz	30db@43.25KHz	10K/2K	1¼ x 1¼ x 2
LP-8004-13	5db@52.6KHz, 1db@42.6KHz	30db@57.6KHz	10K/2K	1¼ x 1¼ x 2

PART NO. HIGH PASS	PASS BAND	STOP BAND	Z_o	SIZE
HP-7907-1	4db@150Hz, 1db@225Hz	60db@50Hz	600	2 x 2 x 3
HP-7907-2	4db@300Hz, 1db@450Hz	60db@110Hz	600	2 x 2 x 3
HP-7907-3	4db@600Hz, 1db@900Hz	60db@210Hz	600	2 x 2 x 3
HP-7907-4	4db@1.2KHz, 1db@1.8KHz	60db@.43KHz	600	2 x 2 x 3
HP-7907-5	4db@2.4Hz, 1db@3.6KHz	60db@.85KHz	600	2 x 2 x 3
HP-7907-6	4db@4.8Hz, 1db@7.2KHz	60db@1.7KHz	600	2 x 2 x 3
HP-7907-7	4db@8.9KHz, 1db@10KHz	60db@3.1KHz	600	1⅜ x 1⅝ x 2¾
HP-7996-1	5db@825Hz, 2db@1,000Hz	40db@1,350Hz	30K	1⅜ x 1⅝ x 2¾
HP-8004-10	5db@8KHz, 1db@17KHz	30db@4KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-11	5db@19.5KHz, 1db@26.5KHz	30db@16.5KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-12	5db@26.25KHz, 1db@33.25KHz	30db@23.25KHz	10K/2K	1¼ x 1¼ x 2
HP-8004-13	5db@32.6KHz, 1db@42.6KHz	30db@27.6KHz	10K/2K	1¼ x 1¼ x 2

HERTZ

HERTZ FILTER CORPORATION
3 AERIAL WAY • SYOSSET, NEW YORK 11791
TELEPHONE (516) 822-4770

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WORLD'S LEADER IN EMI/RFI FILTERS

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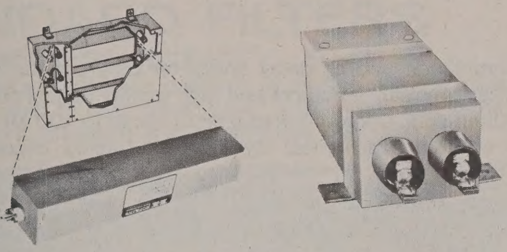
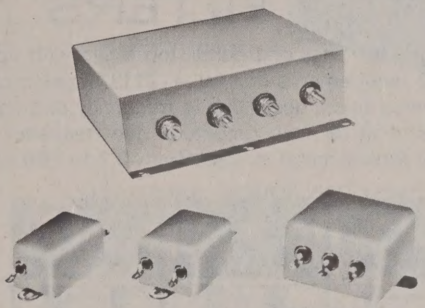
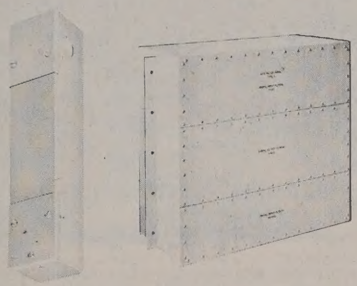
HEAVY DUTY POWER LINE FILTERS



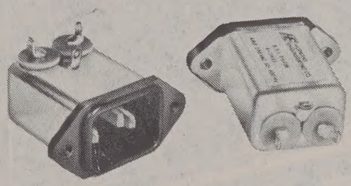
DATA PROCESSING FILTERS



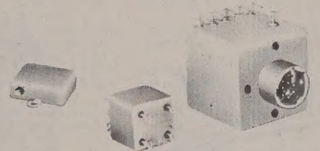
COMMUNICATION FILTERS



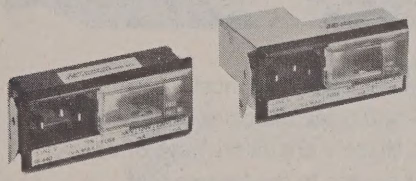
UNIVERSAL RFI/EMI FILTER



CUSTOM FILTERS



FILTERED FUSE CONNECTOR MODULE



ENGINEERING CATALOGUE AVAILABLE UPON REQUEST

FACILITIES CAPABILITY

Hopkins Engineering Company is a leading manufacturer of RFI/EMI filters. It was founded in 1945 and offers engineering design and manufacturing expertise in solving electromagnetic interference problems.

MANUFACTURING

A wide variety of filter designs are manufactured in our modern fully equipped 30,000 square foot factory. Quality is built into every Hopkins filter by skilled production personnel and an efficient prototype department offers prompt delivery of new designs. Hopkins has manufactured products to the most exacting military programs for over 25 years.

ENGINEERING

Hopkins' engineers have developed thousands of filter designs to meet a variety of military and industrial RFI/EMI suppression requirements. This versatility coupled with the latest filter design techniques and use of computer assisted design programs allows our engineers to develop filters of optimized circuitry, performance, reliability, and cost.

QUALITY ASSURANCE

A policy of rigid quality control practices are employed. Quality materials and high workmanship standards insures a product that meets or exceeds specification requirements. Our quality assurance department maintains established procedures to control the quality and reliability objectives of the customer and Hopkins Engineering Company.

hisonic inc.

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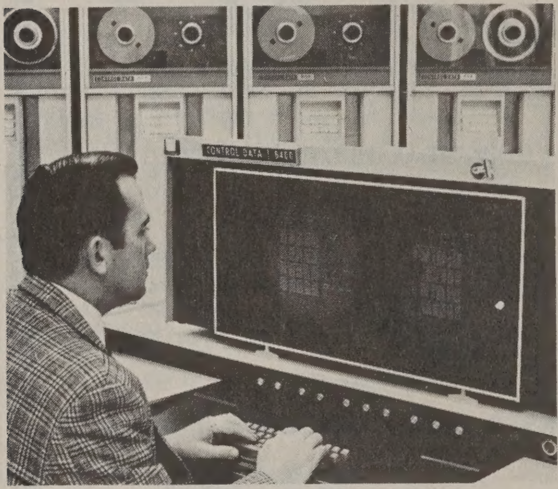
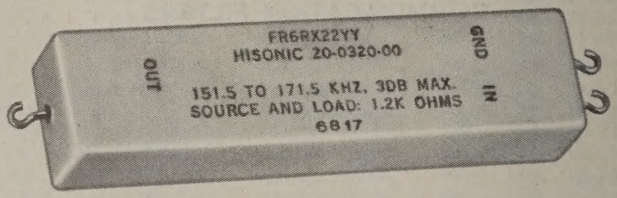
PHONE: 913-782-0012
TELEX: 4-2562

CUSTOM FILTERS

Low, band or high pass and band stop filters with optimum amplitude and/or delay characteristics can be supplied to your special requirements and MIL-F-18327 Construction utilizes precision inductors and high quality capacitors of special films or silvered mica, according to frequency and space requirements. Operating frequencies range to 100 MHZ. Temperature stabilization for both amplitude and frequency can be effected. Mechanical styles may be epoxy encapsulated or hermetically sealed metal in sizes from 0.2 to 200 cu. in.



To keep pace with the most sophisticated technologies of network design, Hisonic engineers have direct in-plant access to the tremendous capabilities of large late-generation computers. The Hisonic staff includes specialists with up to 25 years experience in precision inductor and filter network design. It also includes advanced mathematicians with backgrounds of program development, who are able to achieve design excellence not otherwise attainable.



EXAMPLE CUSTOM FILTERS

BAND PASS

P/N		Pass Band db @ BW	Stop Band db @ BW	Impedance	Size
20-0340-xx	Series: f_0 8-7.5KHZ	.15@1.0f_0	25@1.75f	2.7K/2.7K	1.3x3.0x1.0H
20-0450-xx	Series: f_0 4.5-7.1KHZ	4.0@98HZ	26@258HZ	600/600	1.5x3.6x1.0H
20-0521-12	f_0 9960HZ:IL .4db	1.0@1460HZ	35@4000HZ	2K/500	2.5x2.5x.7H
20-0501-10	f_0 30KHZ:IL .5db	.25@20KHZ	40@ +30KHZ −24.7KHZ	4.7K/4.7K	1.4x2.0x.6H
20-0481-11	f_0 40KHZ:IL .5db	3.0@24KHZ	30@ +50KHZ −27KHZ	4.7K/4.7K	1.1x1.9x.6H
20-0177-10	f_0 142KHZ:IL 20db	3.0@3.0KHZ	70@20KHZ	5K/470	1.8x2.0x.9H
20-0299-10	f_0 155KHZ:IL 3db	1.2@56.6KHZ	40@ +120KHZ −80KHZ	1K/1K	1.3x1.4x.8H
20-0410-xx	Series: f_0 200-500KHZ	3.0@.10f	60@.85f	1K/1K	1.3x2.8x1.1H
20-0466-10	f_0 5.5MHZ:IL 4db	.5@40KHZ	40@980KHZ 65@1980KHZ	600/600	1.0x2.3x.7H
20-0527-10	f_0 10MHZ:IL 5db	.3@320KHZ	45@4.0MHZ	600/600	1.3x1.8x.9H
20-0459-10	f_0 11.8MHZ:IL 4db	2.0@1.0MHZ	50@ +1.0MHZ −1.6MHZ	50/50	.6x3.2x1.0H
20-0539-10	f_0 30MHZ:IL 8db	.3@ 64MHZ	20@3.2MHZ 30@6.2MHZ	500/500	1.4x2.0x.6H

LOW & HIGH-PASS & BAND SUPPRESSION

P/N	Description	db @ Abs.Freq.			Size
20-0212-10	200HZ Low Pass	3@185HZ	60@430HZ	1K/1K	1.0x1.7x1.5H
20-0388-xx	IRIG TELEM. VCO LP f Range 4-70KHZ	1@1.07f	20@1.8f 36@2.8f	Source 18K Load 47K	.5x.8x.8H
20-0350-10	High Atten. LP	3@500HZ	105@1000HZ	1K/100K	.6x3.5x1.0H
20-0519-10	Voice Low Pass	5@2500HZ	40@4000HZ	600/600	1.3x1.8x.9H
20-0342-10	Voice Low Pass	1@3000HZ	40@3400HZ	600/600	1.5x4.0x1.1H
20-0475-10	Voice Low Pass	3@3500HZ	40@4500HZ	600/600	2.0x2.0x.5H
20-0414-10	Low Pass	.4@24.5KHZ	61@40KHZ	1K/1K	1.0x2.0x.5H
20-0399-10	Low Pass	.25@25KHZ	65@50KHZ	10K/10K	1.0x1.0x1.1H
20-0280-01	Instrumentation LP	3@500KHZ	18/Octave	75/75	1.3x1.3x1.0H
-02	W/BNC Connectors	3@1.2MHZ	18/Octave	75/75	1.3x1.3x1.0H
20-0529-10	Video Range LP	1@4MHZ	40@5.5MHZ	200/200	1.3x2.0x.5H
20-0489-10	300HZ High Pass	3@300HZ	20@250HZ	200/6K	1.0x1.5x.5H
20-0473-00	Balanced High Pass	.5@1400HZ	50@750HZ	600/600	Field Test Case
20-0325-10	Speech + Tone Suppress	3@1.0&1.6KHZ	40@1.2-1.3KHZ	600/600	2.8x3.0x1.0H
20-0460-10	Band Suppression	.3@552&667KHZ	50@605-609KHZ	75/75	1.4x2.0x2.0H
20-0159-11	Band Suppression	.3@7.4&9.8MHZ	50@8.47-8.56MHZ	75/75	1.4x2.0x2.0H

DUAL FUNCTION FILTERS & SPECIAL NETWORKS

P/N	Description	Characteristics	Impedance	Size
20-0488-13	Isolated LPF &Video range XFMR	.6db@1.5MHZ.14db@2.5MHZ 3db .1 to 5 MHZ	200/200 200/200	.8x.8x.4H
20-0343-10	Common input voice LP & Signal BP Filter	1db@3KHZ.35db@3.4KHZ f 3.4KHZ.6db@150HZ BW	600/600 Com/50K	2.5x4.0x1.1H
20-0232-10	Common input Voice LP & Signal BP Filter	1db@3.4KHZ.35db@3.8KHZ f 3.8KHZ.2db@20HZ BW	600/600 Com/50K	2.5x4.0x1.1H
20-0486-10	90/150HZ Glide/Slope Dual BP Filter	.25db@85−95HZ.20DB@50&150HZ .25db@142−158HZ.20DB@90&250HZ	1K/10K Com/10K	2.3x2.4x1.7H
20-0405-10	Isolated Dual Dis-symetrical BP Filter	3db2.1−2.5KHZ.30db@3.7KHZ 3db3.7−4.1KHZ.30db@2.8KHZ	1K/10K 1K/10K	1.6x1.9x.8H
20-0217-10	Common Input. Dual Narrow BP Filter	f 269KHZ.55db@63KHZ BW f 331KHZ.55db@75KHZ BW	1K/10K Com/10K	2.0x4.0x.7H
20-0463-11	Twin Tee RC Network	56db min @ 130 HZ	82/5M	1.6x1.6x.6H
20-0463-12	Twin Tee RC Network	56db min @ 140 HZ	82/5M	1.6x1.6x.6H
20-0412-11	Audio Delay Equalizer	90 us correction @ 2KHZ.Bal.Imp	600/600	.9x1.3x1.0H
20-0478-10	Phase Shift Network	160±5 degrees 3−90KHZ	50/2K/2K	1.4x2.3x1.4H

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OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

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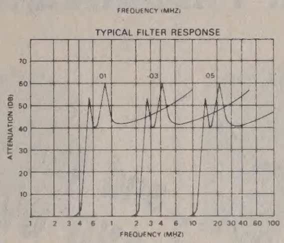
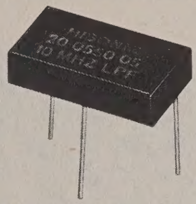
STANDARD FILTERS

FOR HIGHEST SELECTIVITY

Standard filters are computer designed by modern network methods for minimum stop to pass band ratios. Applications are those requiring optimum utilization of frequency spectrum.

Technicians adjust critical response of special band pass filters utilizing adjustable ferrite core inductors. Modern precision test equipment is employed in association with MIL I 45208 Quality Control procedures.





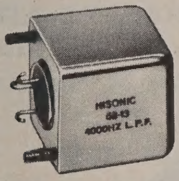
.72″ x .40″ x .23 encapsulated.

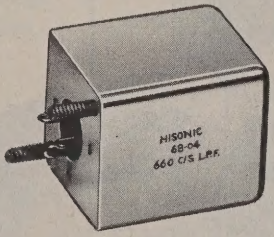
MINIATURE SERIES 550 LOW PASS

ELECTRICAL SPECIFICATIONS

- IMPEDANCE: 100 ohms standard.
- INSERTION LOSS: .5db max. at .1Fc.
- RESPONSE:
  3DB max. at Fc
  40DB min. at 1.5 Fc
- SIGNAL LEVEL: Max. power in mw = 10
- OTHER IMPEDANCES AND FREQUENCIES: Write for data sheet.
- TEMPERATURE RANGE: −55 to +105°C
- STANDARD CUTOFF FREQUENCIES:

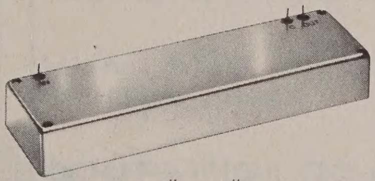
Fc (MHZ)	HISONIC PART NUMBER
.40	20-0550-01
1.0	20-0550-02
2.0	20-0550-03
5.0	20-0550-04
10.0	20-0550-05
20.0	20-0550-06





SERIES 68 LOW PASS

SPECIFICATIONS:	fc cps	Part No.
Relative Attenuation		
3 db ± .5 @ fc		
20 db min @ 1.3 fc	330	68-01
40 db min @ 1.5 fc	450	68-02
	600	68-03
Insertion loss—1 db max	660	68-04
	790	68-05
Terminations	900	68-06
Input—10K ohms	1050	68-07
Output—10K ohms	1200	68-08
	1600	68-09
Physical Specifications	2100	68-10
Case Hermetically Sealed Steel	3000	68-11
Size (330 to 900 cps)	3300	68-12
1.26″x1.26″x1.5″ High	4000	68-13
Mounting: two 6-32 studs	4500	68-14
spaced 1.25″	5250	68-15
Size (1050 to 13000 cps)	6000	68-16
1″x1″x1″ High	8000	68-17
Mounting: two 4-40 studs	10500	68-18
spaced 1″	11500	68-19
Terminals—3 solder type	13000	68-20



5.62″ x 1.75″ x .80 metal cased.

SERIES 430 FSK TONE CHANNEL BAND PASS

(170HZ spacing)

SPECIFICATIONS:	Freq.	Receiver No.	Trans. No.
Relative Attenuation			
(Receive Filters)	425	430-01	430-21
3 db max at ± 42.5 cps	595	430-02	430-22
20 db min at ± 85 cps	765	430-03	430-23
38 db min at ± 128 cps	935	430-04	430-24
(Transmit Filters)	1105	430-05	430-25
3 db max at ± 42.5 cps	1275	430-06	430-26
15 db min at ± 85 cps	1445	430-07	430-27
30 db min at ± 128 cps	1615	430-08	430-28
	1785	430-09	430-29
Insertion Loss—6 db max	1955	430-10	430-30
	2125	430-11	430-31
Terminations	2295	430-12	430-32
Input: 600 ohms	2465	430-13	430-33
(inputs all channels may	2635	430-14	430-34
be operated in parallel)	2805	430-15	430-35
Output: Receive 50K ohms	2975	430-16	430-36
Transmit 600 ohms	3145	430-17	430-37
	3315	430-18	430-38

In addition to series listed, other tone channel series with spacings from 85 to 500 c/s are available.

hisonic inc.

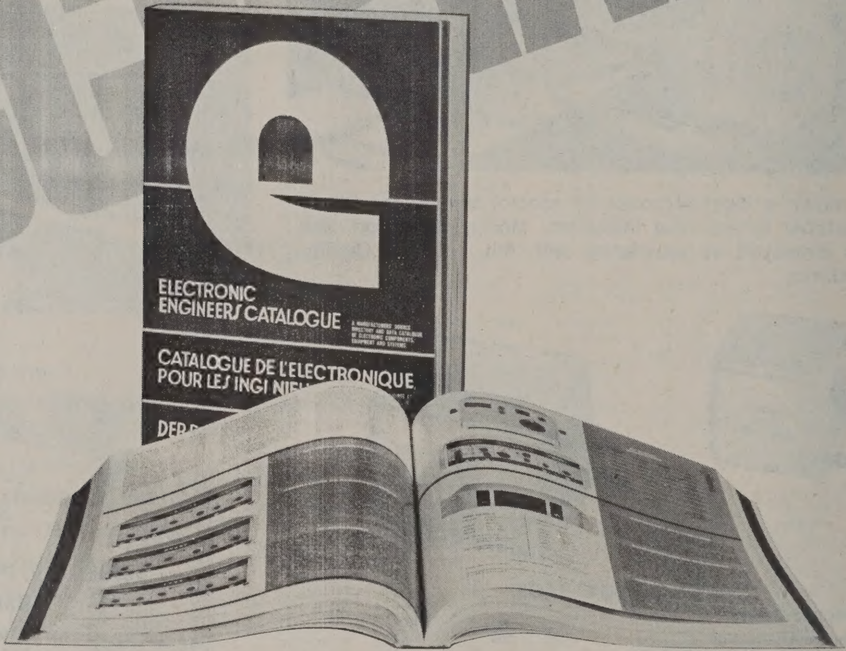
OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

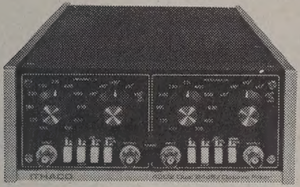
The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe and the United Kingdom. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

ITHACO

THE PREDICTABLE FILTERS

MODEL 4302 LABORATORY DUAL FILTER



ACCURACY/PHASE MATCH: ±3% of setting/±6°

FREQUENCY RANGE: 10 Hz – 1 MHz

ATTENUATION: 24 dB/octave all modes; 48 dB/octave series hi-or lo-pass, > 100 dB max attenuation

CHARACTERISTICS: selectable Butterworth or Bessel

HUM AND NOISE: <75μV rms X1 gain; <10μV rms X10 gain

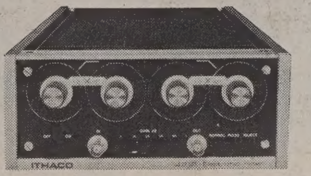
COUPLING: selectable AC or DC

GAIN: selectable X1 or X10 for each section

LOW DISTORTION: <.005% at 1 kHz X10 gain

LOW COST: $655

4210 SERIES CALIBRATED LAB FILTERS



ACCURACY/PHASE MATCH: ±1% of setting/±2°

FREQUENCY RANGE: .01 Hz – 1MHz in 3 models

ATTENUATION: 24 dB/octave all modes; >100 dB max.

CHARACTERISTICS: selectable Butterworth or Bessel

HUM AND NOISE: <70 μV rms

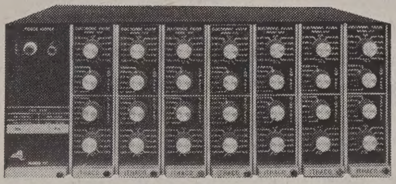
COUPLING: DC in lo-pass; AC all other modes

GAIN: optional selectable 0/10/20/30/40 dB

BATTERY POWER: available as option

THREE MODELS TO CHOOSE FROM AT $995

4110-SERIES MULTI CHANNEL FILTERS



ACCURACY/PHASE MATCH: ±1% of setting/±2°

FREQUENCY RANGE: ±.01 Hz – 1 MHz in 3 models

ATTENUATION: 24 dB/octave all modes; >90 dB max.

CHARACTERISTICS: Butterworth only

HUM AND NOISE: <70 μV rms

COUPLING: DC in lo-pass; AC all other modes

BANDPASS: characteristics completely predictable and repeatable ±1%/±0.1 dB all settings

THREE MODELS TO CHOOSE FROM, $820 to $870

ITHACO

735 W CLINTON ST ITHACA NEW YORK 14850
PHONE 607-272-7640 TWX 510-255-9307

'78
THE MASTER CATALOG
'77
'78
THE ELECTRONIC DISTRIBUTORS MASTER CATALOG
FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

YESTERDAY'S RADIO MASTER IS TODAY'S

ELECTRONIC DISTRIBUTORS MASTER CATALOG

Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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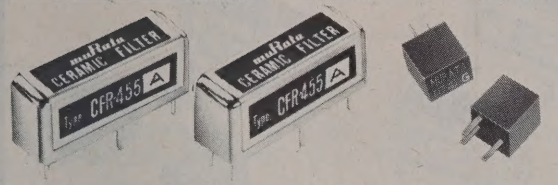
muRata
CORPORATION
OF AMERICA

CERAMIC LADDER-TYPE FILTERS

1148 FRANKLIN ROAD S.E., MARIETTA, GEORGIA 30067 • TEL: (404) 422-9777 • TELEX: 54-2329 • TWX: 810-763-4723


muRata CERAMIC FILTER
Type CFR455 A
muRata CERAMIC FILTER
Type CFR455 A

Murata ceramic ladder filters provide their oustanding performance and selectivity through the use of a piezoelectric effect on leadziroconate—titanate ceramics. Each filter consists of multiple ceramic elements coupled electrically in a ladder network. The various filters listed below differ only in selectivity characteristics and size, both of which depend upon the number of ceramic elements utilized in each type. Complete technical data is available from Murata Corporation of America.

CFS-455
455 KHz PRECISION CERAMIC FILTERS
FOR COMMUNICATIONS RECEIVERS

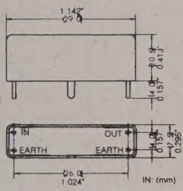
DIMENSIONS

Terminal Location: (viewed from bottom, tab down)

Input: Upper Left

Output: Upper Right

Earth: Lower Left and Right


1.142"
(29.0)
(10.5)
0.413"
(4.0)
0.157"
IN
OUT
EARTH
EARTH
(4.0)
0.157"
(7.5)
0.295"
(26.0)
1.024"
IN: (mm)

SPECIFICATIONS

Model	Center Frequency (KHz)	3 dB Band Width (KHz) Min.	6 dB Band Width (KHz) Min.	70 dB Band Width (KHz) Min.	Insertion Loss (dB) Max.	Input & Output Imped. (Ω)	Temperature Range (°C)
CFS-455 A	455	±13	±17.5	±30	6	1500	−20 to +80
CFS-455 B	455	±10	±15	±25	6	1500	
CFS-455 C	455	± 9	±13	±23	6	1500	
CFS-455 D	455	± 7	±10	±20	6	1500	
CFS-455 E	455	± 5.5	± 8	±15	8	1500	
CFS-455 F	455	± 4.2	± 6	±12	8	2000	
CFS-455 G	455	—	± 4	± 9	8	2000	
CFS-455 H	455	—	± 3	± 7.5	9	2000	
CFS-455 I	455	—	± 2	± 5	10	2000	
CFS-455 J	455	—	± 1.5	± 4.5	10	2000	

CFR-455
455 KHz STANDARD CERAMIC FILTERS
FOR COMMUNICATIONS RECEIVERS

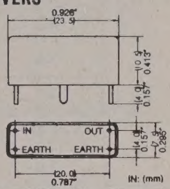
DIMENSIONS

Terminal Location: (viewed from bottom, tab down)

Input: Upper Left

Output: Upper Right

Earth: Lower Left and Right


0.926"
(23.5)
(10.5)
0.413"
(4.0)
0.157"
IN
OUT
EARTH
EARTH
0.157"
(7.5)
0.295"
(20.0)
0.787"
IN: (mm)

SPECIFICATIONS

Model	Center Frequency (KHz)	3 dB Band Width (KHz) Min.	6 dB Band Width (KHz) Min.	60 dB Band Width (KHz) Min.	Spurious (dB) Min.	Insertion Loss (dB) Max.	Input & Output Imped. (Ω)	Temp. Range (°C)
CFR-455 A	455	±13	±17.5	±30	45	6	1000	−20 to +80
CFR-455 B	455	±10	±15	±25	45	6	1000	
CFR-455 C	455	± 9	±13	±23	45	6	1000	
CFR-455 D	455	± 7	±10	±20	45	6	1500	
CFR-455 E	455	± 5.5	± 8	±16	40	8	1500	
CFR-455 F	455	± 4.2	± 6	±12	40	8	2000	
CFR-455 G	455	—	± 4	±10	40	8	2000	
CFR-455 H	455	—	± 3	± 7.5	40	9	2000	
CFR-455 I	455	—	± 2	± 5	40	10	2000	

CFM-455
455 KHz ECONOMY CERAMIC FILTERS
FOR COMMUNICATIONS RECEIVERS

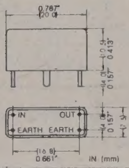
DIMENSIONS

Terminal Location: (viewed from bottom, tab down)

Input: Upper Left

Output: Upper Right

Earth: Lower Left and Right

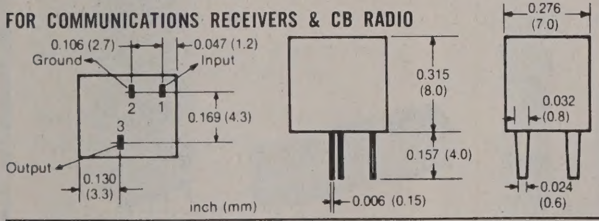

0.787"
(20.0)
0.413"
0.157"
IN
OUT
EARTH
EARTH
0.157"
(16.8)
0.661"
IN: (mm)

SPECIFICATIONS

Model	Center Frequency (KHz)	3 dB Band Width (KHz) Min.	6 dB Band Width (KHz) Min.	50 dB Band Width (KHz) Min.	Spurious (dB) Min.	Insertion Loss (dB) Max.	Input & Output Imped. (Ω)	Temp. Range (°C)
CFM-455 A	455	±13	±17.5	±30	40	4.5	1000	−20 to +80
CFM-455 B	455	±10	±15	±25	40	4.5	1000	
CFM-455 C	455	± 9	±13	±23	40	4.5	1000	
CFM-455 D	455	± 7	±10	±20	40	4.5	1500	
CFM-455 E	455	± 5.5	± 8	±16	35	6.0	1500	
CFM-455 F	455	± 4.2	± 6	±12	30	6.0	2000	
CFM-455 G	455	—	± 4	±10	30	6.0	2000	
CFM-455 H	455	—	± 3	± 7.5	30	7.5	2000	

CFU-455
455 KHz CERAMIC FILTERS
FOR COMMUNICATIONS RECEIVERS & CB RADIO

DIMENSIONS


0.106 (2.7)
0.047 (1.2)
Ground
Input
2
1
3
0.169 (4.3)
Output
0.130 (3.3)
inch (mm)
0.315 (8.0)
0.157 (4.0)
0.006 (0.15)
0.276 (7.0)
0.032 (0.8)
0.024 (0.6)

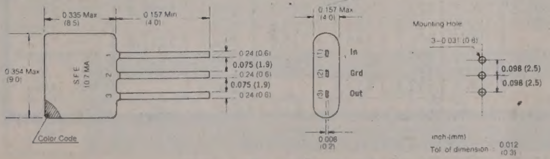
SPECIFICATIONS

Model	Center Frequency (KHz)	6 dB Band Width (KHz) Min.	40 dB Band Width (KHz) Min.	Insertion Loss (dB) Max.	Stop Band Attenu-ation (dB) Min.*	Input & Output Imped. (Ω)
CFU-455 B2	455 ±2	±15	±30	4	27	1500
CFU-455 C2	455 ±2	±12.5	±24	4	27	1500
CFU-455 D2	455 ±1.5	±10	±20	4	27	1500
CFU-455 E2	455 ±1.5	± 7.5	±15	6	27	1500
CFU-455 F2	455 ±1.5	± 6	±12.5	6	27	2500
CFU-455 G2	455 ±1	± 4.5	±10	6	25	2000
CFU-455 H2	455 ±1	± 3	± 9	6	25	2000
CFU-455 I2	455 ±1	± 2	± 6	6	25	2000

* Stop band attenuation is specified at 455 KHz, ±100 Hz.

SFE-10.7MA5 10.7 MHz CERAMIC FILTERS
FOR FM AND COMMUNICATIONS RECEIVERS

DIMENSIONS


0.335 Max (8.5)
0.157 Min (4.0)
0.354 Max (9.0)
SFE 10.7 MA
1
2
3
0.24 (0.6)
0.075 (1.9)
0.24 (0.6)
0.075 (1.9)
0.24 (0.6)
Color Code
0.157 Max (4.0)
(1)
(2)
(3)
In
Grd
Out
0.008 (0.2)
Mounting Hole
3−0.031 (0.8)
0.098 (2.5)
0.098 (2.5)
inch (mm)
Tol. of dimension: 0.012 (0.3)

SPECIFICATIONS

Center Frequency (center of 3 dB points):

D	10.64 ±0.03 MHz (Black)	C	10.73 ±0.03 MHz (Orange)
B	10.67 ±0.03 MHz (Blue)	E	10.76 ±0.03 MHz (White)
A	10.70 ±0.03 MHz (Red)		

The frequency of the production lots is dispersed between 10.64 ±0.03 MHz and 10.76 ±0.03 MHz. The filters are supplied in five respective groups, each group color coded and supplied as outlined above. Orders for only certain groups are unacceptable.

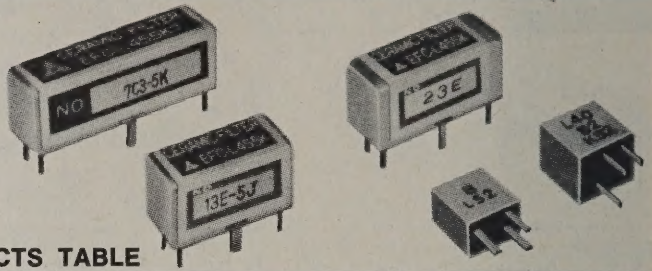
3 dB Band Width:	280 ±50 KHz
20 dB Band Width:	650 KHz Max.
Insertion Loss:	6 dB Max.
Spurious Response between 9-12 MHz:	30 dB Min.
Temperature Coefficient of Center Frequency:	$0 < \frac{f(max) - f(min)}{f(20°C) \times 100°C} \times 10^6$ less than 120ppm/°C
Temperature Range:	−20° to +80°C
Input and Output Impedance:	330 ohms

Panasonic

CERAMIC LADDER FILTERS

FEATURES

- High selectivity
- Low impedance and insertion loss
- Small in size and lightweight



STANDARD AND SEMI-STANDARD PRODUCTS TABLE

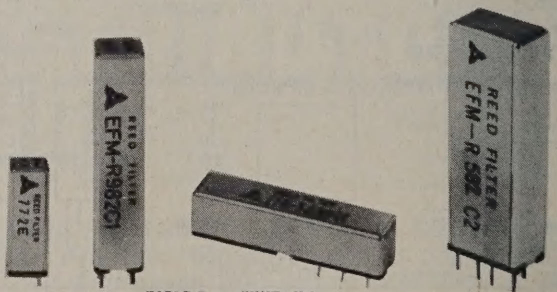
Type No.	Part No.		*1 Center Frequency (kHz)	Band Width (kHz)			*2 Spurious Response (dB/min.)	Ripple (dB/max.)	Insertion Loss (dB/max.)	Impedance (kΩ)
	Standard Products	Semi-Standard Products		@ −6 dB (min.)	(max.)					
Type 30	EFC-L455K30A		455	± 2.2	@ Pole	± 8.0	12	0	4.0	2.0
	EFC-L455K30B			± 4.0		±11.0		0	4.0	2.0
	EFC-L455K30C			± 6.0		±15.0		0	4.0	2.0
	EFC-L455K30D			± 7.5		±21.0		0	4.0	2.0
	EFC-L455K30E			±10.0		±23.0		0	3.0	2.0
Type 40	EFC-L455K40A		455	± 2.2	@ −40 dB	± 6.0	27	0	6.0	2.0
	EFC-L455K40B			± 4.0		± 9.0		1.0	6.0	2.0
	EFC-L455K40C			± 6.0		±13.0		1.0	6.0	2.0
	EFC-L455K40D			± 7.5		±15.0		1.0	6.0	2.0
	EFC-L455K40E			±10.0		±20.0		1.5	4.0	2.0
Types 11 and 21	EFC-L455K11A	EFC-L455K21A	455	± 2.2	@ −70 dB	± 5.0	80	3.0	8.0	2.0
	EFC-L455K11B	EFC-L455K21B		± 4.0		± 8.0		3.0	8.0	2.0
	EFC-L455K11C	EFC-L455K21C		± 6.0		±12.0		3.0	6.0	2.0
	EFC-L455K11D	EFC-L455K21D		± 7.5		±14.0		3.0	6.0	1.5
	EFC-L455K11E	EFC-L455K21E		±10.0		±20.0		3.0	4.5	1.5
Types 12, 22 and 7	EFC-L455K12A	EFC-L455K22A EFC-L455K7A	455	± 2.2	@ −70 dB	± 5.0	70	3.0	8.0	2.0
	EFC-L455K12B	EFC-L455K22B EFC-L455K7B		± 4.0		± 8.0		3.0	8.0	2.0
	EFC-D455K12C	EFC-L455K22C EFC-L455K7C		± 6.0		±12.0		3.0	6.0	2.0
	EFC-L455K12D	EFC-L455K22D EFC-L4557D		± 7.5		±14.0		3.0	6.0	1.5
	EFC-L455K12E	EFC-L455K22E EFC-L455K7E		±10.0		±20.0		3.0	4.5	1.5
Types 13 and 23	EFC-L455K13A	EFC-L455K23A	455	± 2.2	@ −50 dB	± 5.0	40	3.0	6.0	2.0
	EFC-L455K13B	EFC-L455K23B		± 4.0		± 8.0		3.0	6.0	2.0
	EFC-L455K13C	EFC-L455K23C		± 6.0		±12.0		3.0	6.0	2.0
	EFC-L455K13D	EFC-L455K23D		± 7.5		±14.0		3.0	6.0	1.5
	EFC-L455K13E	EFC-L455K23E		±10.0		±20.0		3.0	4.5	1.5
Types 14 and 24	EFC-L455K14A	EFC-L455K24A	455	± 2.2	@ −40 dB	± 5.0	30	3.0	6.0	2.0
	EFC-L455K14B	EFC-L455K24B		± 4.0		± 8.0		3.0	6.0	2.0
	EFC-L455K14C	EFC-L455K24C		± 6.0		±12.0		3.0	6.0	2.0
	EFC-L455K14D	EFC-L455K24D		± 7.5		±14.0		3.0	6.0	1.5
	EFC-L455K14E	EFC-L455K24E		±10.0		±20.0		3.0	4.5	1.5

NOTE: 1. Standard units are more recommendable than semi-standard ones from the viewpoints of space and price.
2. *1: Tolerance of center frequency A•B: ±1.0kHz, C•D•E: ±1.5kHz *2: In the range of the center frequency ±100kHz

HIGH Q AND HIGH SELECTIVITY REED FILTERS

FEATURES

- High Q and High Selectivity — The selectivity does not decrease even in case of high center frequency, permitting use of many signal frequency channels within a limited frequency range.
- Excellent Durability Against Vibration and Shock — Because the change of its characteristics caused by vibration or shock is very limited, it is suitable for pocketable wireless apparatus.
- Superior Stability Against Aging — The reed filter provides an extremely high degree of reliability, unlike conventional reed selectors with contact points, due to piezoelectric ceramic employed as an electromechanical conversion element.
- Small Size and Lightweight — With its compactness, it is recommendable for use in small communication equipment.



STANDARD FREQUENCY TABLE

TABLE A — (UNIT: Hz)

382.5	502.5	652.5		937.5	1087.5	1222.5	1372.5	1507.5	1657.5	1807.5
397.5	517.5	667.5	802.5	952.5		1237.5	1387.5	1522.5	1672.5	1822.5
	532.5	682.5	817.5	967.5	1102.5	1252.5		1537.5	1687.5	1837.5
412.5	547.5	697.5	832.5	982.5	1117.5	1267.5	1402.5	1552.5		1852.5
427.5	562.5		847.5	997.5	1132.5	1282.5	1417.5	1567.5	1702.5	1867.5
442.5	577.5	712.5	862.5		1147.5	1297.5	1432.5	1582.5	1717.5	1882.5
457.5	592.5	727.5	877.5	1012.5	1162.5		1447.5	1597.5	1732.5	1897.5
472.5		742.5	892.5	1027.5	1177.5	1312.5	1462.5		1747.5	
487.5	607.5	757.5		1042.5	1192.5	1327.5	1477.5	1612.5	1762.5	1912.5
	622.5	772.5	907.5	1057.5		1342.5	1492.5	1627.5	1777.5	
	637.5	787.5	922.5	1072.5	1207.5	1357.5		1642.5	1792.5	

TABLE B — (UNIT: Hz)

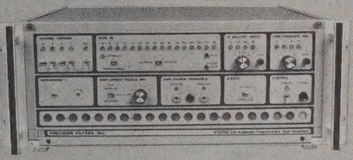
288.5	378.6	496.8	634.5	810.2	1034.7	1321.2
296.5	389.0		651.9	832.5	1063.2	1357.6
	399.8	510.5	669.9	855.5	1092.4	1395.0
304.7		524.6	688.3	879.0	1122.5	1433.4
313.0	410.8	539.0			1153.4	
321.7	422.1	553.9	707.3	903.2	1185.2	
330.5	433.7	569.1	726.8	928.1		
339.6	445.7	584.8	746.8	953.7	1217.8	
349.0	457.9		767.4	979.9	1251.4	
358.6	470.5	600.9	788.5		1285.8	
368.5	483.5	617.4		1006.9		

Panasonic / MATSUSHITA ELECTRIC CORPORATION OF AMERICA / INDUSTRIAL DIVISION
DEPT. EM, ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000
OUR TECHNOLOGY IS ALL AROUND YOU

# PRECISION FILTERS, Inc.
for
PROGRAMMABLE INSTRUMENTS

SYSTEM 216
PROGRAMMABLE-AUTOMATIC GAIN-RANGING AMPLIFIERS

In this 16-channel amplifier system each amplifier maintains its output to a level suitable for recording on magnetic tape while the status of all amplifiers is recorded on a separate tape track. During playback, one channel is displayed while all channels are read out, bit parallel, byte serial. The system consists of a 7" main-frame, a plug-in control card, and up to 16 plug-in amplifiers.



- **AUTOMATIC GAIN RANGING**
- **PROGRAMMABLE GAIN, LFRO, MODE, & TC**
- **GAIN: -12 dB to +78 dB**
- **LOW-NOISE DIFF. INPUT**
- **OVERLOAD DETECTORS**
- **PLUG-IN HIGH FREQ. ROLLOFF**
- **COMPUTER INTERFACES**
- **BANDWIDTH: 1 Hz-500 kHz**
- **1° PHASE ACCURACY**

PLUG-IN CONTROL MODULES

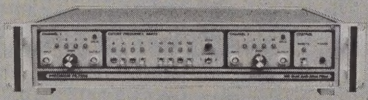
216-C-01	IEEE Bus (HP-IB)
216-C-02	Interface for TTY
216-C-03	Interface for Minicomputer's Buffered I/O
216-C-04	Manual Only
216-C-05	MUX/DEMUX and Interface for Computer

AMPLIFIER SPECIFICATIONS

INPUT	10 M ohm Differential
CMRR	90 dB, 50 Hz-400 Hz
GAIN	-12 dB to + 78 dB in 6 dB steps
LFRO	1, 10, 100, 1 k Hz (6 dB/octave)
HFRO	Plug-In Low-Pass Filter (12 dB/octave)
NOISE	5µV rms in 100 kHz BW

MODEL 602
DUAL-CHANNEL FILTER HP-LP-BP-BR

This two-channel filter has programmable gain & cutoff frequency and direct readout of channel overload. It is housed in a 3½" high rack-mounting cabinet and contains a control card to interface a mini-computer. Precisely controlled low-pass, high-pass or time-delay (linear-phase) filters are available which cover four decades of cutoff frequencies in the range .01 Hz to 150 kHz.



- **1° PHASE ACCURACY**
- **HP-LP-BP-BR**
- **-80 dB at 2 F_c**
- **ELLIPTIC FILTERS**
- **LINEAR-PHASE FILTERS**
- **PROGRAMMABLE GAIN & CUTOFF FREQUENCY**
- **OVERLOAD DETECTORS**
- **COMPUTER INTERFACES: IEEE, TTY, BUFFERED I/O**

CONTROL OPTIONS

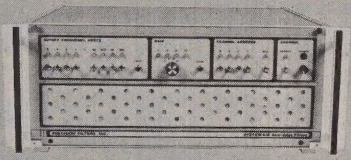
602-C-01	IEEE Bus (HP-IB)
602-C-02	Interface for TTY
602-C-03	Interface for Mini-computer's Buffered I/O
602-C-04	Manual Only

FILTERS

602-01-XXX	10 Hz - 150 kHz
602-02-XXX	1 Hz - 15 kHz
602-03-XXX	.1 Hz - 1.5 kHz
602-04-XXX	.01 Hz - 150 Hz
602-XX-LP1	6 pole, 6 zero LP
602-XX-HP1	6 pole, 6 zero HP
602-XX-TD1	6 pole, 4 zero TD

SYSTEM 616
MULTI-CHANNEL PROGRAMMABLE FILTERS

This 16-channel filter system with programmable gain and cutoff frequency consists of a 7" high rack-mounting main frame with power, connections, and controls for all channels; a plug-in control module for interfacing a minicomputer; and up to 16 plug-in filters. Precisely controlled low-pass, high-pass and time-delay (linear-phase) filters are available which cover four decades of cutoff frequencies in the range .01 Hz - 150 kHz.



- **1° PHASE ACCURACY**
- **HP-LP-BP-BR**
- **-80 dB at 2 F_c**
- **-90 dB at 1.56 F_c**
- **ELLIPTIC FILTERS**
- **LINEAR-PHASE FILTERS**
- **PROGRAMMABLE GAIN & CUTOFF FREQUENCIES**
- **COMPUTER INTERFACES: IEEE, TTY, BUFFERED I/O**

PLUG-IN CONTROL MODULES

616-C-01	IEEE Bus (HP-IB)
616-C-02	Interface for TTY
616-C-03	Interface for Mini-computer's Buffered I/O
616-C-04	Manual Only

PLUG-IN FILTER MODULES

616-01-XXX	10 Hz - 150 kHz
616-02-XXX	1 Hz - 15 kHz
616-03-XXX	.1 Hz - 1.5 kHz
616-04-XXX	.01 Hz - 150 Hz
616-XX-LP1	6 pole, 6 zero LP
616-XX-LP2	12 pole, 12 zero LP
616-XX-HP1	6 pole, 6 zero HP
616-XX-TD1	6 pole, 4 zero TD

PRECISION FILTERS 303 W. Lincoln St., Ithaca, N.Y. 14850 Tel. (607) 277-3550

OUR NEW 1977 CATALOG LISTS OVER 550 MILITARY AND UL LISTED RFI/EMC FILTER TYPES.

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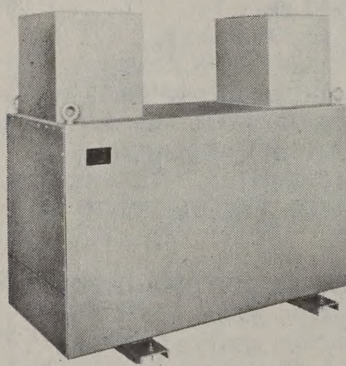
...the nation's leading filter supplier offers a complete range of RFI/EMC filters...

RFI offers the most complete range of products in the industry. Sophisticated, complex, multi-circuit filter assemblies, or simple feedthru capacitors—we make them all.

These are just a few of the more than 10,000 different filter designs by RF INTERONICS for specific customer requirements. For detailed information concerning standard and custom-engineered parts contact our sales department.

Multi-circuit filter packages

Designed to provide the equipment manufacturer with the most economical package from the standpoint of size, weight, and cost. Packages can include the input power connector and considerably simplify equipment construction and wiring.

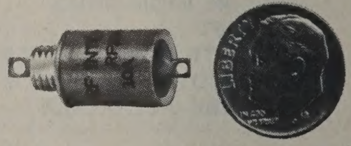


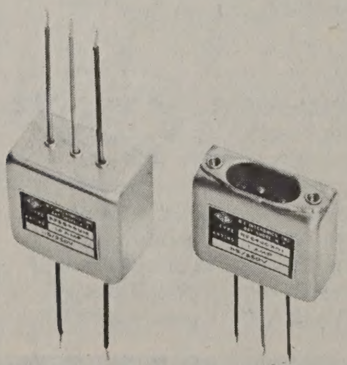
High Power Filter Units

Current and voltage ratings up to 2000 amperes and 20,000 volts. Designed to provide the performance required by high powered ground installations, such as computer facilities, shielded test laboratories, radar installations and similar, high performance applications.

Cylindrical filters to Mil-F-15733E

RF Interonics has more QPL listed parts than any other supplier in the industry — Now qualified on more than 180 different filters, including subminiature "MICRO-FILTER®" units corresponding to military styles FL10, 11, 12, 13 14 and 15, and standard cylindrical types, covered by requirements for styles FL22, 24, 81, 82, 83 and 84 of the military specification.



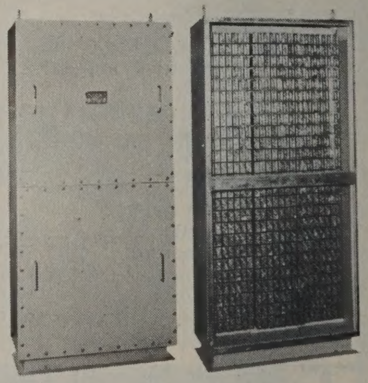


UL Listed Parts

RFI's line of filters includes parts recognized under the components listing program of Underwriters' Laboratories, Inc. These filters are designed for use in Data Processing Equipment, and similar applications.

Communications and Signal Line Filters

RF Interonics manufactures a wide range of filters with various pass band and impedance characteristics, suitable for use in communication, signal or telephone line applications. Filters are available as single or dual circuit units, or in multi-circuit shielded cabinets.



RF INTERONICS

100-E Pine Aire Drive, Bay Shore, Long Island, New York 11706 / (516) 231-6400 / TWX 510-227-6233

These precision analog filters enjoy a worldwide reputation for accuracy, stability, and wide-range flexibility. Highly price-competitive, they have become the first choice of the electronics industry for a broad spectrum of applications, including: anti-aliasing; band limiting in data-acquisition systems; signal-to-noise enhancement in low-level measurements and communications; signal reconstruction (smoothing) in A/D/A and digital-communications systems; and hundreds of test and development-laboratory uses.

Models 432 and 442
Budget Variable Analog Filters

- Two Independent Channels usable in Series, in Parallel, or Separately
- 24dB Rolloff/Octave/Channel
- Cutoff Frequency Ranges: 1Hz-110KHz (Model 432), 10Hz-1.1MHz (Model 442)
- Cutoff Frequency Accuracy: ±5%
- Resolutions: 1Hz to 10KHz (2 digits)
- High Pass, Low Pass, Band Pass, and Band Reject Functions
- 0dB/20dB Gain
- Flat Amplitude (Butterworth) and Flat Delay (Linear Phase) Responses
- Impedances: 1 Megohm Input, 50 Ohms Output
- 80dB Dynamic Range

Models 452 and 852 Dual Hi/Lo Variable Analog Filters

- Two Independent Channels usable in Series, in Parallel, or Separately
- Rolloff: 24dB/Octave (Model 452) or 48dB/Octave (Model 852)
- Cutoff Frequency Ranges: 0.1Hz to 111KHz; Option -01: 0.01Hz to 111KHz
- Cutoff Frequency Accuracy: ±2%
- Resolution: 0.01 to 100Hz (3 digits)
- High Pass, Low Pass, Band Pass, and Band Reject Functions
- Near-Ideal Flat Amplitude (Butterworth) and Flat Delay (Linear Phase) Responses
- 0dB/20dB Gain
- Impedances: Input 1 Megohm, Output 50 Ohms
- Dynamic Range: 90dB
- Negligible Noise and Drift.

System 816 Computer-Compatible Multi-channel Filter System

- Up to 16 Independent Channels
- Local, Remote, and On-card Programming; High Pass, Low Pass, Band Pass, and Band Reject Functions
- Cutoff Frequency Range: 0.1Hz to 150KHz
- Cutoff Frequency Accuracy: ±2%
- Butterworth and Bessel Responses
- 60 Cutoff Frequencies per 4-decade plug-in card
- 48dB/Octave Rolloff (96dB/Octave with 2 channels cascaded)
- Impedances: 1 Megohm Input, 50 Ohms Output
- Programming Delay 3msec (plus filter settling time)
- Negligible Insertion Loss
- Dynamic Range: 80dB

FILTERS for SIGNAL PROCESSING

ROCKLAND
ROCKLAND SYSTEMS CORPORATION
ROCKLAND
SYSTEM 816
MODEL 852 DUAL FILTER
ROCKLAND

ADVANCED SIGNAL TECHNOLOGY

ROCKLAND

SYNTHESIS • PROCESSING • ANALYSIS

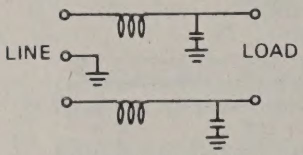
Our Second Decade of Leadership

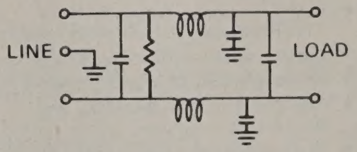
Rockland Systems Corporation, 230 W. Nyack Road, West Nyack, N.Y. 10994, (914) 623-6666, TWX 710-575-2631

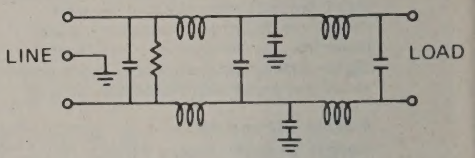
Rtron RFI/EMI FILTERS

For Data Processing, Industrial Controls, and Instrumentation Applications. Meets U.L. and C.S.A. requirements. Low Leakage without sacrificing Insertion Loss. Excellent Quality at Low Cost.

VOLTAGE RATING 115/250







RNF L SERIES

1 AMP FILTERS

Part No.	STYLE	A	B	C	D	E	F
RNF-1L1	1	1.750	.875	.625	2.125	2.500	.625
RNF-1L2	2	1.750	.875	.625	2.125	2.500	.625
RNF-1L3	3	1.750	.875	.625	2.125	2.500	–
RNF-1L4	4	1.750	.875	.625	2.125	2.500	.500
RNF-1L5	5	1.750	.875	.625	2.125	2.500	.500
RNF-1L6	6	2.000	1.750	.750	1.500	–	.625
RNF-1L7	7	2.000	1.750	.750	1.500	–	–

2 AMP FILTERS

RNF-2L1	1	1.750	.875	.625	2.125	2.500	.625
RNF-2L2	2	1.750	.875	.625	2.125	2.500	.625
RNF-2L3	3	1.750	.875	.625	2.125	2.500	–
RNF-2L4	4	1.750	.875	.625	2.125	2.500	.500
RNF-2L5	5	1.750	.875	.625	2.125	2.500	.500
RNF-2L6	6	2.000	1.750	.750	1.500	–	.625
RNF-2L7	7	2.000	1.750	.750	1.500	–	–

3 AMP FILTERS

RNF-3L1	1	1.750	1.250	.750	2.125	2.500	.625
RNF-3L2	2	1.750	1.250	.750	2.125	2.500	.625
RNF-3L3	3	1.750	1.250	.750	2.125	2.500	–
RNF-3L4	4	1.750	1.250	.750	2.125	2.500	.500
RNF-3L5	5	1.750	1.250	.750	2.125	2.500	.500
RNF-3L6	6	2.000	2.000	.750	1.500	–	.625
RNF-3L7	7	2.000	2.000	.750	1.500	–	–

5 AMP FILTERS

RNF-5L1	1	1.750	1.250	.750	2.125	2.500	.625
RNF-5L2	2	1.750	1.250	.750	2.125	2.500	.625
RNF-5L3	3	1.750	1.250	.750	2.125	2.500	–
RNF-5L4	4	1.750	1.250	.750	2.125	2.500	.500
RNF-5L5	5	1.750	1.250	.750	2.125	2.500	.500
RNF-5L6	6	2.000	2.000	.750	1.500	–	.625
RNF-5L7	7	2.000	2.000	.750	1.500	–	–

10 AMP FILTERS

RNF-10L1	1	1.750	1.250	1.125	2.125	2.500	.625
RNF-10L2	2	1.750	1.250	1.125	2.125	2.500	.625
RNF-10L3	3	1.750	1.250	1.125	2.125	2.500	–
RNF-10L4	4	1.750	1.250	1.125	2.125	2.500	.500
RNF-10L5	5	1.750	1.250	1.125	2.125	2.500	.500
RNF-10L6	6	2.000	2.000	1.125	1.500	–	.625
RNF-10L7	7	2.000	2.000	1.125	1.500		–
RNF-10L8	8	1.750	1.250	1.125	2.125	2.500	.625

20 AMP FILTERS

RNF-20L8	8	2.000	2.000	1.125	2.375	2.781	.625

30 AMP FILTERS

RNF-30L10	10	3.875	3.312	1.500	3.750	4.125	.625

RNF P SERIES

1 AMP FILTERS

Part No.	STYLE	A	B	C	D	E	F
RNF-1P1	1	2.000	1.750	.875	2.375	2.781	.625
RNF-1P2	2	2.000	1.750	.875	2.375	2.781	.625
RNF-1P3	3	2.000	1.750	.875	2.375	2.781	–
RNF-1P4	4	2.000	1.750	.875	2.375	2.781	.500
RNF-1P5	5	2.000	1.750	.875	2.375	2.781	.500
RNF-1P6	6	2.000	2.000	.875	1.500	–	.625
RNF-1P7	7	2.000	2.000	.875	1.500	–	–

2 AMP FILTERS

RNF-2P1	1	2.000	1.750	.875	2.375	2.781	.625
RNF-2P2	2	2.000	1.750	.875	2.375	2.781	.625
RNF-2P3	3	2.000	1.750	.875	2.375	2.781	–
RNF-2P4	4	2.000	1.750	.875	2.375	2.781	.500
RNF-2P5	5	2.000	1.750	.875	2.375	2.781	.500
RNF-2P6	6	2.000	2.000	.875	1.500	–	.625
RNF-2P7	7	2.000	2.000	.875	1.500	–	–

3 AMP FILTERS

RNF-3P1	1	2.000	1.750	1.125	2.375	2.781	.625
RNF-3P2	2	2.000	1.750	1.125	2.375	2.781	.625
RNF-3P3	3	2.000	1.750	1.125	2.375	2.781	–
RNF-3P4	4	2.000	1.750	1.125	2.375	2.781	.500
RNF-3P5	5	2.000	1.750	1.125	2.375	2.781	.500
RNF-3P6	6	2.000	2.000	1.125	1.500	–	.625
RNF-3P7	7	2.000	2.000	1.125	1.500	–	–

5 AMP FILTERS

RNF-5P1	1	2.000	1.750	1.125	2.375	2.781	.625
RNF-5P2	2	2.000	1.750	1.125	2.375	2.781	.625
RNF-5P3	3	2.000	1.750	1.125	2.375	2.781	–
RNF-5P4	4	2.000	1.750	1.125	2.375	2.781	.500
RNF-5P5	5	2.000	1.750	1.125	2.375	2.781	.500
RNF-5P6	6	2.000	2.000	1.125	1.500	–	.625
RNF-5P7	7	2.000	2.000	1.125	1.500	–	–

10 AMP FILTERS

RNF-10P1	1	2.000	2.000	1.125	2.375	2.781	.625
RNF-10P2	2	2.000	2.000	1.125	2.375	2.781	.625
RNF-10P3	3	2.000	2.000	1.125	2.375	2.781	–
RNF-10P4	4	2.000	2.000	1.125	2.375	2.781	.500
RNF-10P5	5	2.000	2.000	1.125	2.375	2.781	.500
RNF-10P8	8	2.000	2.000	1.125	2.375	2.781	.625

20 AMP FILTERS

RNF-20P9	9	2.500	2.000	1.500	2.940	3.312	.625

30 AMP FILTERS

RNF-30P10	10	3.875	3.312	1.500	3.750	4.125	.625

RNF T SERIES

1 AMP FILTERS

Part No.	STYLE	A	B	C	D	E	F
RNF-1TII	11	2.000	1.750	1.125	2.375	2.781	.625
RNF-1T12	12	2.000	1.750	1.125	2.375	2.781	.625
RNF-1T13	13	2.000	1.750	1.125	2.375	2.781	
RNF-1T14	14	2.000	1.750	1.125	2.375	2.781	500
RNF-1T15	15	2.000	1.750	1.125	2.375	2.781	500

2 AMP FILTERS

RNF-2T11	11	2.000	1.750	1.125	2.375	2.781	.625
RNF-2T12	12	2.000	1.750	1.125	2.375	2.781	.625
RNF-2T13	13	2.000	1.750	1.125	2.375	2.781	
RNF-2T14	14	2.000	1.750	1.125	2.375	2.781	.500
RNF-2T15	15	2.000	1.750	1.125	2.375	2.781	.500

3 AMP FILTERS

RNF-3T11	11	2.500	2.000	1.125	2.940	3.312	.625
RNF-3T12	12	2.500	2.000	1.125	2.940	3.312	.625
RNF-3T13	13	2.500	2.000	1.125	2.940	3.312	–
RNF-3T14	14	2.500	2.000	1.125	2.940	3.312	.500
RNF-3T15	15	2.500	2.000	1.125	2.940	3.312	.500

5 AMP FILTERS

RNF-5T11	11	2.500	2.000	1.125	2.940	3.312	.625
RNF-5T12	12	2.500	2.000	1.125	2.940	3.312	.625
RNF-5T13	13	2.500	2.000	1.125	2.940	3.312	–
RNF-5T14	14	2.500	2.000	1.125	2.940	3.312	.500
RNF-5T15	15	2.500	2.000	1.125	2.940	3.312	.500

10 AMP FILTERS

RNF-10T11	11	2.500	2.000	1.500	2.940	3.312	.625
RNF-10T12	12	2.500	2.000	1.500	2.940	3.312	.625
RNF-10T13	13	2.500	2.000	1.500	2.940	3.312	
RNF-10T14	14	2.500	2.000	1.500	2.940	3.312	.500
RNF-10T15	15	2.500	2.000	1.500	2.940	3.312	.500
RNF-10T16	16	2.500	2.000	1.500	2.940	3.312	.625

20 AMP FILTERS

RNF-20T10	10	3.875	3.312	1.500	3.750	4.125	.625

30 AMP FILTERS

RNF-30T10	10	5.500	3.312	1.750	3.750	4.125	.625

ELECTRICAL SPECIFICATIONS

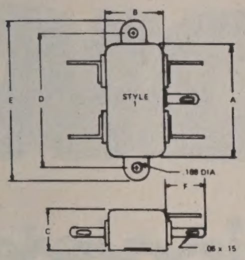
Maximum leakage current, each,
line to ground. @ 115 VAC-60Hz .... 0.5 MA
@ 250 VAC-60Hz .... 1.0 MA
Test Voltage ....2100 VDC
Frequency .... 50 - 400 Hz
Voltage ....115/250 VAC

TYPICAL INSERTION LOSS
Mil. STD. 220

Rtron corporation *P.O. Box 743 Skokie, Illinois 60076 312 • 679-7180*

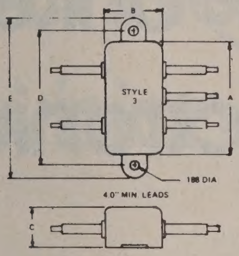
Rtron RFI/EMI FILTERS

Case Style 1 & 2

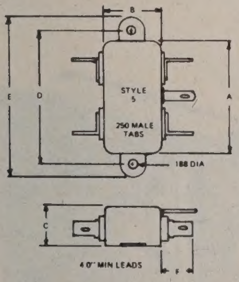

B
E
D
A
STYLE 1
188 DIA
F
C
.08 x .15

Style 2 same as 1 except load side has lead wires instead of solder lugs.

Case Style 3

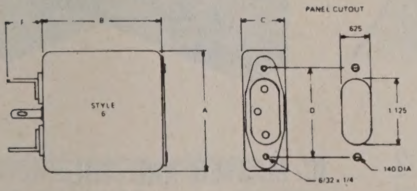

B
E
D
STYLE 3
A
188 DIA
4.0" MIN LEADS
C

Case Style 4 & 5


B
E
D
STYLE 5
250 MALE TABS
A
188 DIA
C
4.0" MIN LEADS
F

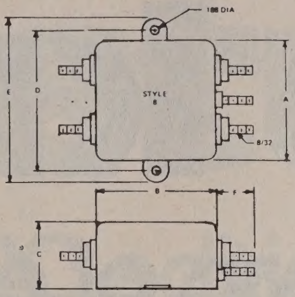
Style 4 same as 5 except load side has lead wires instead of quick disconnects.

Case Style 6 & 7


PANEL CUTOUT
F
B
C
.625
STYLE 6
A
D
1.125
140 DIA
6/32 x 1/4

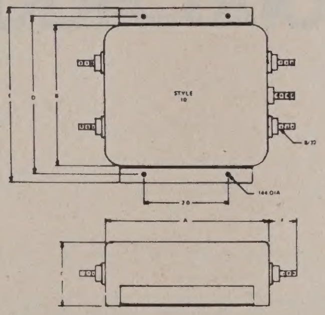
Style 7 same as 6 except load side has lead wires instead of solder lugs.

Case Style 8 & 9

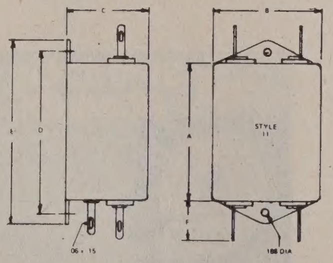

188 DIA
E
D
STYLE 8
A
8/32
B
F
G
C

Style 9 same as 8 except has triangular mounting tabs.

Case Style 10

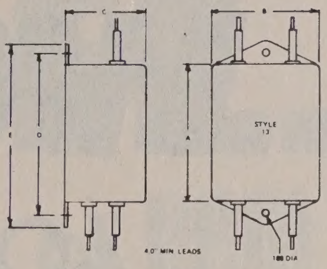

E
D
B
STYLE 10
8/32
2.0
144 DIA
A
F
C

Case Style 11 & 12

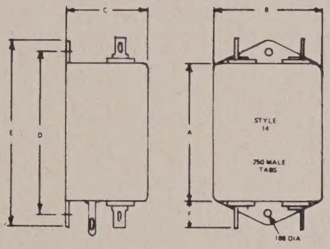

C
B
E
D
A
STYLE 11
F
.06 x .15
188 DIA

Style 12 same as 11 except has lead wires instead of solder lugs.

Case Style 13

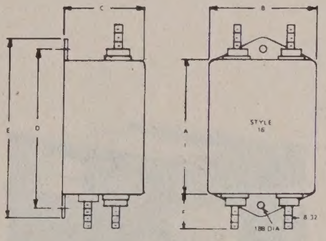

C
B
E
D
A
STYLE 13
4.0" MIN LEADS
188 DIA

Case Style 14 & 15


C
B
E
D
A
STYLE 14
250 MALE TABS
F
188 DIA

Style 15 same as 14 except has lead wires on load side instead of quick disconnects.

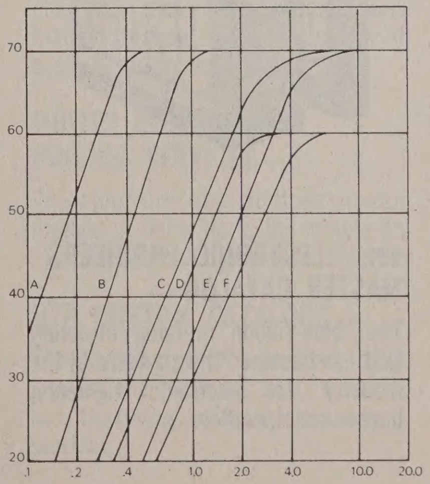
Case Style 16


C
B
E
D
A
STYLE 16
F
8-32
188 DIA

TYPICAL INSERTION LOSS
Mil. STD. 220

Curve	Filter
A	1T, 3T*
B	2T, 5T, 10T, 20T, 30T
C	1P, 3P
D	1L, 3L
E	2P, 5P, 10P
F	2L, 5L, 10L, 20L, 30L, 20P, 30P

Example:
1T . . . 1 represents "current," T represents "series"



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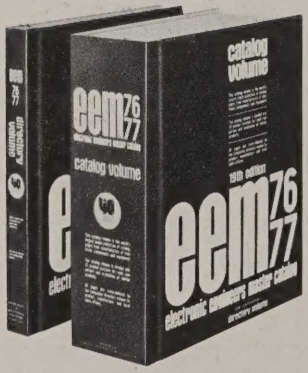
United Electronics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19th edition
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directory volume

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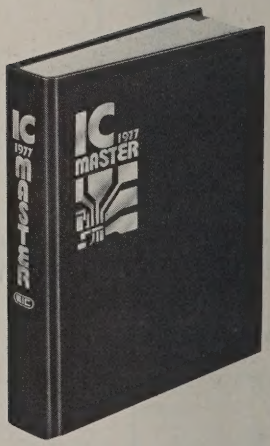
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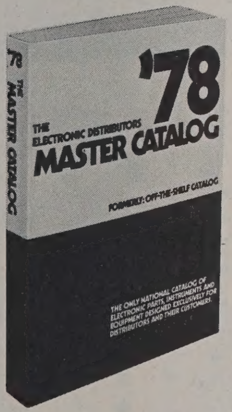
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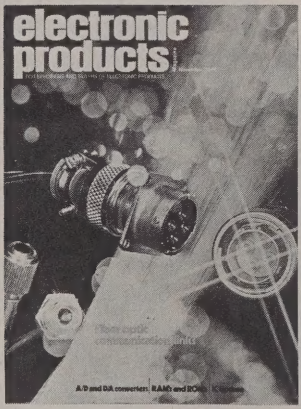
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As the problem is pinpointed, Spectrum Control has the total facilities to affect satisfactory, economical solution. Corrective action may involve circuit changes, packaging changes . . . or require EMI Filters, gaskets, metal shields or other types of hardware. Whatever is required, Spectrum Control is equipped with qualified personnel, plant facilities and a broad range of reasonably priced components to help resolve your EMI/EMC problems.

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A rapidly increasing number of industrial and consumer products, equipment and systems are potential sources of electromagnetic interference. Spectrum Control specializes in air navigation and avionics, microwave ovens, control circuits, power supplies, electrical instruments, electric motor noise suppression . . . just about any application where EMI impairs optimum performance.

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MIL-I-26600
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FCC-Part 18

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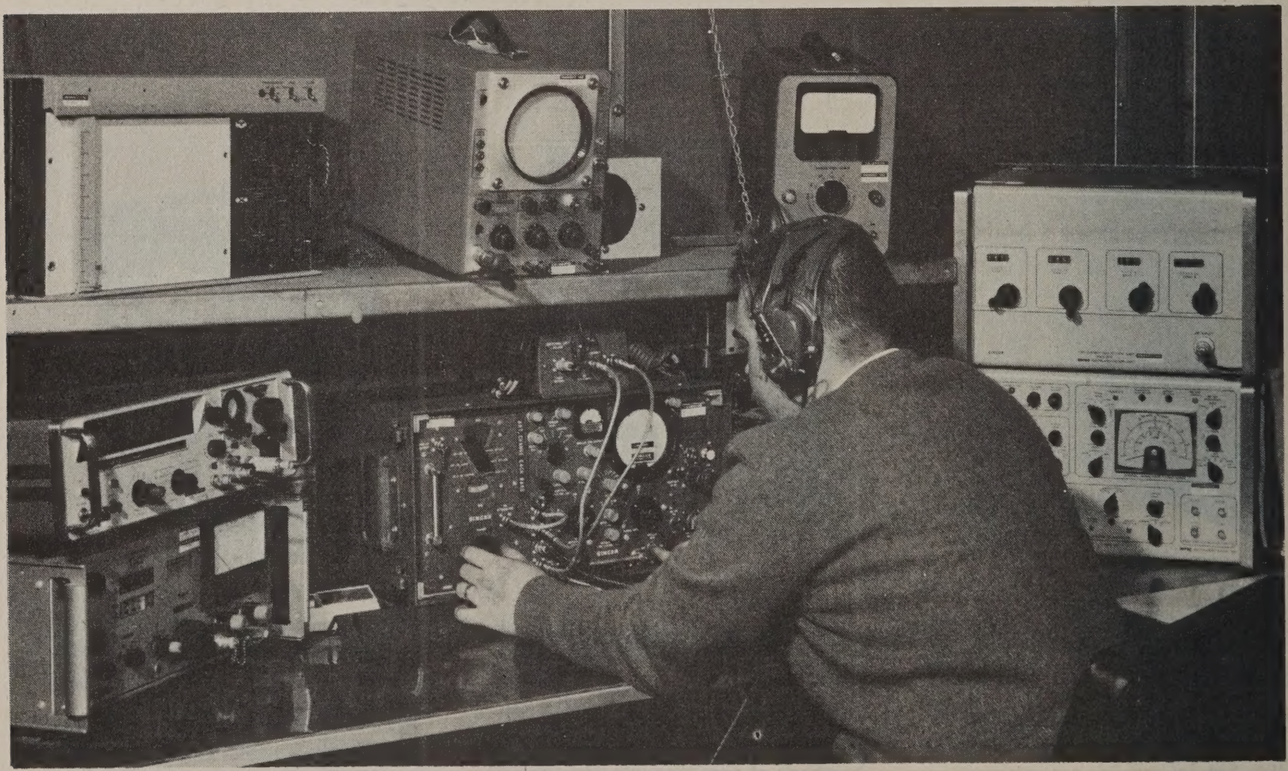

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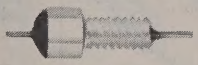
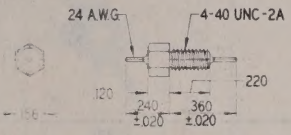
EMI/RFI SUPPRESSION FILTERS

**THREAD BUSHING
RESIN SEAL**



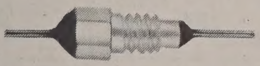

24 A.W.G.
4-40 UNC-2A
.220
.120
.240 ±.020
.360 ±.020
.156

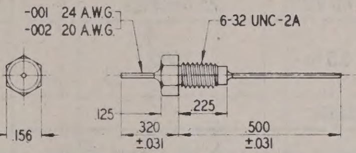
TOL. ± .015

TEST SPECIFICATION: SCI 51000

Spectrum Control N°	Rated I_{DC}	Working Volts		DCR Max.	Refer Cap - - - -	Insertion Loss DB					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-729-303	10 amps	200 VDC	100 VDC	.01	.0015 MFD	—	5	42	50	65	65
51-729-304	10 amps	200 VDC	100 VDC	.01	.022 MFD	7	27	43	45	55	55
51-729-305	10 amps	200 VDC	200 VDC	.01	.0045 MFD	—	14	55	60	60	60

TOL. ± .015

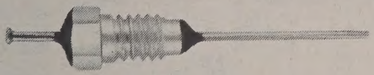


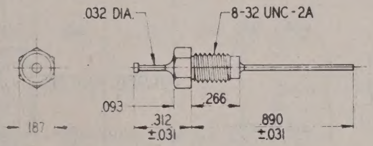

-001 24 A.W.G.
-002 20 A.W.G.
6-32 UNC-2A
.225
.125
.320 ±.031
.500 ±.031
.156

TEST SPECIFICATION: SCI 51000

Spectrum Control N°	Rated I_{DC}	Working Volts		DCR Max.	Refer Cap - - - -	Insertion Loss DB					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-726-001	3 amps	200 VDC	100 VDC	.01	.001 MFD	—	3	40	50	70	70
51-726-002	10 amps	200 VDC	100 VDC	.01	.022 MFD	7	27	43	45	55	55
51-726-008	10 amps	100 VDC	50 VDC	.01	.0055 MFD	—	16	60	70	70	70

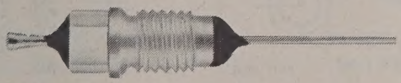
TOL. ± .015

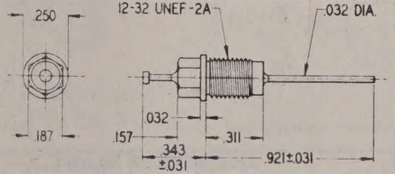



.032 DIA.
8-32 UNC-2A
.093
.266
.312 ±.031
.890 ±.031
.187

TEST SPECIFICATION: SCI 51000

Spectrum Control N°	Rated I_{DC}	Working Volts		DCR Max.	Refer Cap - - - -	Insertion Loss DB					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-712-001	10 amps	200 VDC	100 VDC	.01	.0015 MFD	—	5	42	50	70	70
51-712-003	10 amps	200 VDC	100 VDC	.01	.022 MFD	7	27	43	45	70	70
51-712-017	10 amps	200 VDC	100 VDC	.01	.0055 MFD	—	11	50	55	70	70




.250
12-32 UNEF-2A
.032 DIA.
.032
.187
.157
.311
.343 ±.031
.921±.031

TOL. ± .015

TEST SPECIFICATION: SCI 51000

Spectrum Control N°	Rated I_{DC}	Working Volts		DCR Max.	Refer Cap - - - -	Insertion Loss DB						
		+85°C	+125°C			100 KHz	1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
51-714-001	10 amps	350 VDC	200 VDC	.01	.0015	—	—	5	45	50	70	70
51-714-002	10 amps	200 VDC	100 VDC	.01	.0050	—	5	20	60	60	70	70
51-714-007	10 amps	200 VDC	100 VDC	.01	.05	—	10	30	50	60	70	70

SPECTRUM CONTROL

SPECTRUM CONTROL INC.

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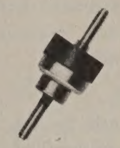
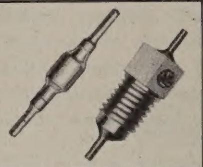
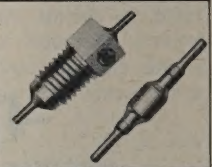
THREAD BUSHING

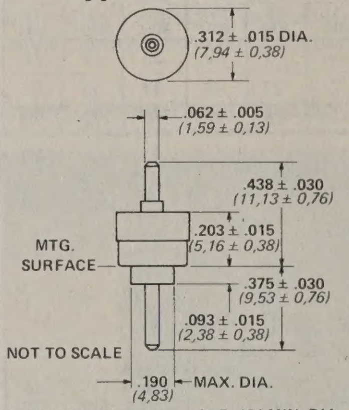


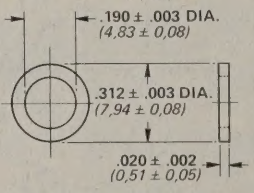
Specifications	Type FCS-C	Type SMFB-A4	Type SMFO-1 Type SMFB-A1	Type SMFB-A2 Type SMFO-2
Attenuation See explanation below table.	25 dB @ 25°C 20 dB @ 85°C	50 dB @ 25°C 45 dB @ 125°C	35 dB @ 25°C 35 dB @ 125°C	60 dB @ 25°C 50 dB @ 85°C
Operating Temperature Range	−55°C to +85°C	−55°C to +125°C	−55°C to +125°C	−55°C to +85°C
DC Working Voltage Includes summation of the DC and lower level AC peak voltages.	500 Volts	500 Volts	200 Volts	200 Volts
Feed-Thru Current DC and/or low frequency AC RMS.	25 Amperes	10 Amperes	10 Amperes	10 Amperes
Capacitance (pF) Minimum values at 25°C, 0.5 to 2.5 volts RMS, at 1 KHz.	1000	2500	1300	5500
Feed-Thru Terminal Resistance	0.01 Ohm Maximum			

Attenuation: Minimum attenuation values from 100 MHz to 10 GHz, when measured with an input 50 ohm series resistor (except FCS-C which is determined without 50 ohm series resistor), and at 0 volts DC and 0 amperes DC.

Type FCS-C

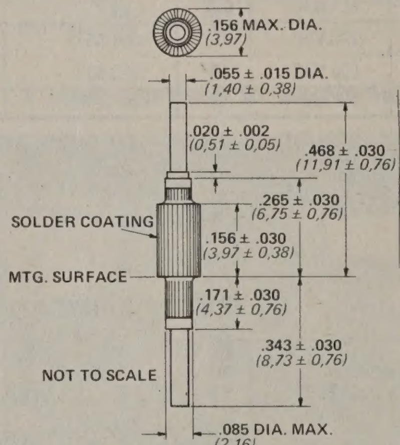

.312 ± .015 DIA.
(7,94 ± 0,38)
.062 ± .005
(1,59 ± 0,13)
.438 ± .030
(11,13 ± 0,76)
.203 ± .015
(5,16 ± 0,38)
MTG. SURFACE
.375 ± .030
(9,53 ± 0,76)
.093 ± .015
(2,38 ± 0,38)
NOT TO SCALE
.190 MAX. DIA.
(4,83)

RECOMMENDED MTG. HOLE .191 MIN. DIA. (4,85)

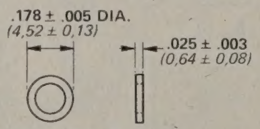

.190 ± .003 DIA.
(4,83 ± 0,08)
.312 ± .003 DIA.
(7,94 ± 0,08)
.020 ± .002
(0,51 ± 0,05)

SOLDER WASHER M-6447

Types SMFO-1, SMFO-2

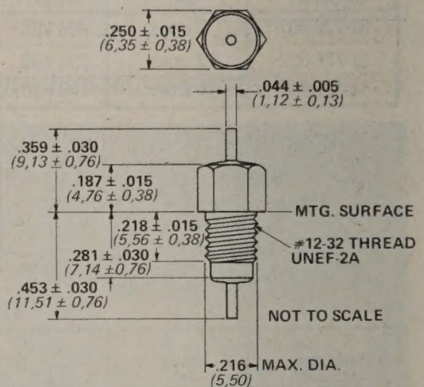

.156 MAX. DIA.
(3,97)
.055 ± .015 DIA.
(1,40 ± 0,38)
.020 ± .002
(0,51 ± 0,05)
.468 ± .030
(11,91 ± 0,76)
.265 ± .030
(6,75 ± 0,76)
SOLDER COATING
.156 ± .030
(3,97 ± 0,38)
MTG. SURFACE
.171 ± .030
(4,37 ± 0,76)
.343 ± .030
(8,73 ± 0,76)
NOT TO SCALE
.085 DIA. MAX.
(2,16)

RECOMMENDED MTG. HOLE .093 DIA. (2,38)

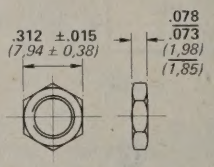

.178 ± .005 DIA.
(4,52 ± 0,13)
.025 ± .003
(0,64 ± 0,08)

SOLDER WASHER M-6446

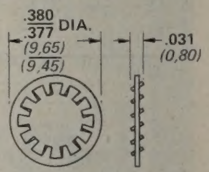
Types SMFB-A1, SMFB-A2, SMFB-A4


.250 ± .015
(6,35 ± 0,38)
.044 ± .005
(1,12 ± 0,13)
.359 ± .030
(9,13 ± 0,76)
.187 ± .015
(4,76 ± 0,38)
MTG. SURFACE
.218 ± .015
(5,56 ± 0,38)
#12-32 THREAD
UNEF-2A
.281 ± .030
(7,14 ±0,76)
.453 ± .030
(11,51 ± 0,76)
NOT TO SCALE
.216 MAX. DIA.
(5,50)

RECOMMENDED MTG. HOLE .228 DIA. (5,79)


.312 ±.015
(7,94 ± 0,38)
.078
.073
(1,98)
(1,85)

NUT M-6377


.380
.377 DIA.
(9,65)
(9,45)
.031
(0,80)

LOCK WASHER M-6351

Allen Bradley Type Number	Spectrum Control Inventory Code Number
FCS-C	51-722-001 51-722-022 with solder mounting washer
SMFB-A1	51-719-022 with nut and lockwasher
SMFB-A2	51-719-021 with nut and lockwasher
SMFB-A4	51-719-011 with nut and lockwasher
SMFO-1	51-723-303 51-723-304 with solder mounting washer
SMFO-2	51-723-301 51-723-302 with solder mounting washer

SPECTRUM ACQUIRES ALLEN BRADLEY LINE

In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

SPECTRUM CONTROL INC.

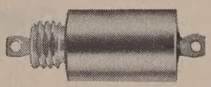
152 EAST MAIN STREET, FAIRVIEW, PA. 16415
PHONE (814) 474-5593

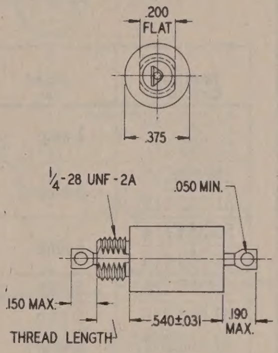
EMI/RFI SUPPRESSION FILTERS

HERMETIC SEAL

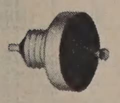
50VDC +85°C L SECTION 28VDC +125°C

Spectrum Control N°	A Thread Length	Inductor Location	Rated Current	DCR Max.	Insertion Loss DB					
					30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-353-007	.187	THREAD	60 ma.	70	44	70	70	70	70	70
51-353-086	.312	END								
51-353-094	.187	TOP								
51-353-102	.312	END								
51-353-006	.187	THREAD	150 ma.	12	24	52	64	70	70	70
51-353-087	.312	END								
51-353-095	.187	TOP								
51-353-103	.312	END								
51-353-005	.187	THREAD	250 ma.	4	18	42	56	70	70	70
51-353-088	.312	END								
51-353-096	.187	TOP								
51-353-104	.312	END								
51-353-004	.187	THREAD	300 ma.	2.3	16	35	44	62	70	70
51-353-089	.312	END								
51-353-097	.187	TOP								
51-353-105	.312	END								
51-353-003	.187	THREAD	450 ma.	1.2	15	31	37	55	70	70
51-353-090	.312	END								
51-353-098	.187	TOP								
51-353-106	.312	END								
51-353-276	.187	THREAD	1 amp.	.25	15	33	44	70	70	70
51-353-091	.312	END								
51-353-099	.187	TOP								
51-353-107	.312	END								
51-353-277	.187	THREAD	5 amps	.015	15	28	33	46	70	70
51-353-092	.312	END								
51-353-100	.187	TOP								
51-353-108	.312	END								
51-353-001	.187	THREAD	10 amps	.01	15	28	33	44	64	70
51-353-093	.312	END								
51-353-101	.187	TOP								
51-353-109	.312	END								

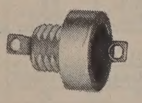



.200
FLAT
.375
¼-28 UNF-2A
.050 MIN.
.150 MAX.
THREAD LENGTH
.540±.031
.190
MAX.

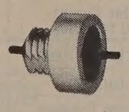
100VDC +85°C L SECTIONS 125VAC +125°C



51-717 Style
See Fig. 1



51-359 Style
See Fig. 2



51-344 Style
See Fig. 3

Spectrum Control N°	Rated Idc	Working Volts		DCR Max.	Refer Cap - - - -	Insertion Loss DB					
		+85°C	+125°C			30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-717-001	15 amps	100 VDC	50 VDC	.01	1.4 MFD	15	28	33	44	60	70
51-717-007	15 amps	125 VAC	125 VAC	.01	.015 ±20%	—	—	—	10	30	70
51-359-001	15 amps	100 VDC	50 VDC	.01	1.4 MFD	15	28	33	44	60	70
51-359-007	15 amps	125 VAC	125 VAC	.01	.015 ±20%	—	—	—	10	30	70
51-344-006	15 amps	100 VDC	50 VDC	.01	1.4 MFD	15	28	33	44	60	70

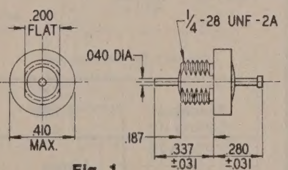

.200
FLAT
.040 DIA.
¼-28 UNF-2A
.410
MAX.
.187
.337
±.031
.280
±.031

Fig. 1

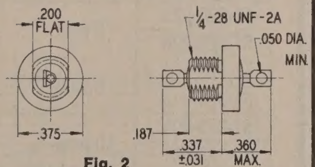

.200
FLAT
¼-28 UNF-2A
.050 DIA.
MIN.
.375
.187
.337
±.031
.360
MAX.

Fig. 2

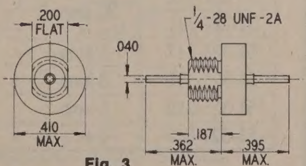

.200
FLAT
¼-28 UNF-2A
.040
.410
MAX.
.187
.362
MAX.
.395
MAX.

Fig. 3

SPECTRUM CONTROL

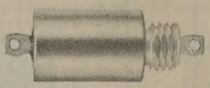
SPECTRUM CONTROL INC.

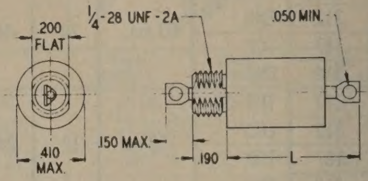
152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

EMI/RFI SUPPRESSION FILTERS

SPECTRUM CONTROL

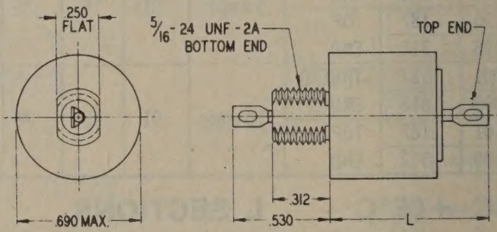
125VAC +125°C L, Pi, T 0-400 HERTZ





Spectrum Control N°	Rated IDC	Filter Circuit and Inductor	Length L +.015 −.090	DCR Max.	Insertion Loss DB 75 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-353-110	1 amp L	Inductor Top	.728	.25	8	17	29	50	70	70
51-353-111		Inductor Bottom								
51-353-112	3 amp L	Inductor Top	.728	.05	8	13	20	35	70	70
51-353-113		Inductor Bottom								
51-353-114	5 amp L	Inductor Top	.728	.015	8	12	20	30	62	70
51-353-115		Inductor Bottom								
51-353-315	.5 amp	Pi	.778	.6	15	33	50	80	80	80
51-353-316	1 amp	Pi	.778	.25	—	20	40	70	80	80
51-353-317	3 amp	Pi	.778	.05	—	—	20	55	80	80
51-351-601	2 amp	T	1.164	—	5	11	18	33	70	70

240VAC +125°C L, Pi, T 0-400 HERTZ



Spectrum Control N°	Rated IDC	Filter Circuit and Inductor	Length "L"	DCR Max.	Insertion Loss DB 50 KHz	100 KHz	150 KHz	1 MHz	10 MHz	1 GHz
51-320-023	1 amp	Inductor Bottom	1.006	.21	13	24	30	60	70	70
51-320-024		Inductor Top								
51-320-025	3 amp	Inductor Bottom	1.006	.03	9	14	19	45	70	70
51-320-026		Inductor Top								
51-320-027	5 amp	Inductor Bottom	1.006	.007	9	14	19	37	70	70
51-320-028		Inductor Top								
51-323-005	10 amp	Inductor Bottom	1.006	.0075	5	10	14	30	53	70
51-323-001		Inductor Top								
51-322-012	20 amp	Inductor Bottom	1.738	.0075	4	6	19	35	55	70
51-322-001		Inductor Top								
51-321-317	1 amp	Pi	1.320	.21	23	43	53	80	80	80
51-321-318	3 amp	Pi	1.320	.03	—	15	31	80	80	80
51-321-319	5 amp	Pi	1.320	.02	—	—	17	75	80	80
51-321-612	4 amp	T	1.320	.0013	8	14	18	40	70	70

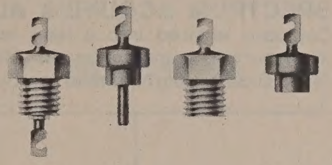
SPECTRUM CONTROL INC.

152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

FEED-THRU CERAMIC CAPACITORS

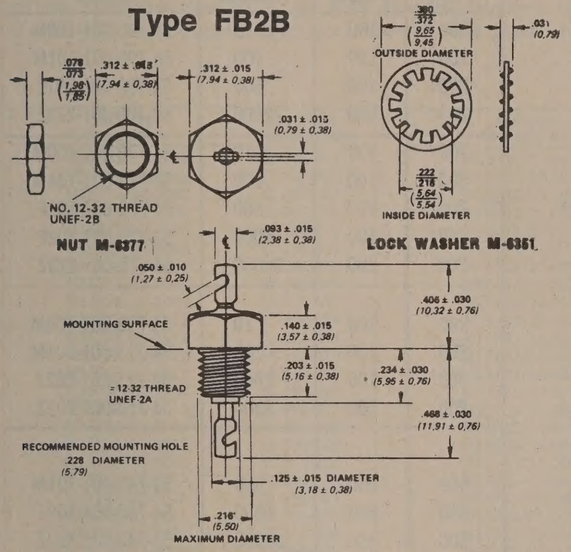
500VDC −55°C to +85°C

SPECTRUM ACQUIRES ALLEN BRADLEY LINE

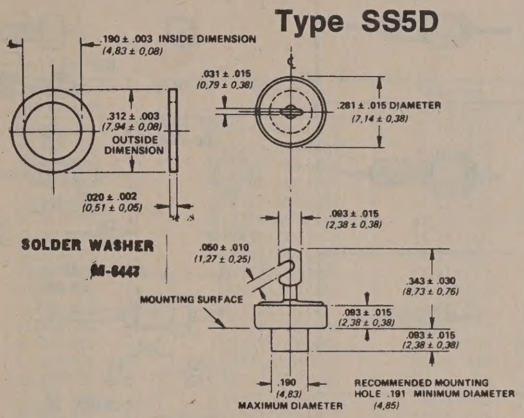


In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

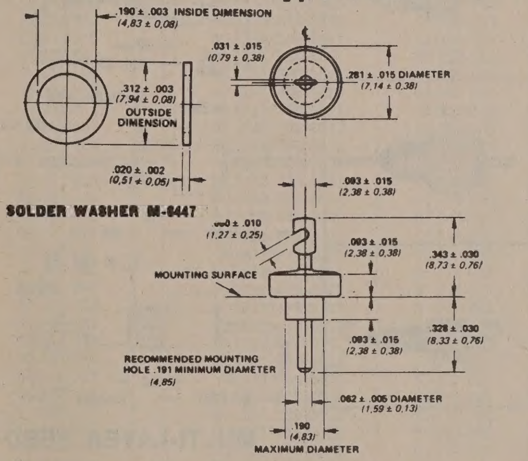
Type FB2B


.380
.372
(9,65)
(9,45)
OUTSIDE DIAMETER
.031
(0,79)
.078
.073
(1,98)
(1,85)
.312 ± .015
(7,94 ± 0,38)
.312 ± .015
(7,94 ± 0,38)
.031 ± .015
(0,79 ± 0,38)
.222
.218
(5,64)
(5,54)
INSIDE DIAMETER
NO. 12-32 THREAD UNEF-2B
NUT M-6377
LOCK WASHER M-6351
.093 ± .015
(2,38 ± 0,38)
.050 ± .010
(1,27 ± 0,25)
.406 ± .030
(10,32 ± 0,76)
MOUNTING SURFACE
.140 ± .015
(3,57 ± 0,38)
.203 ± .015
(5,16 ± 0,38)
.234 ± .030
(5,95 ± 0,76)
12-32 THREAD UNEF-2A
.468 ± .030
(11,91 ± 0,76)
RECOMMENDED MOUNTING HOLE .228 DIAMETER (5,79)
.125 ± .015 DIAMETER
(3,18 ± 0,38)
.216
(5,50)
MAXIMUM DIAMETER

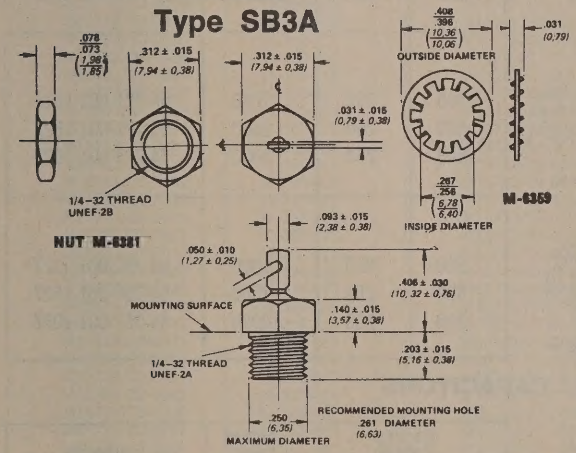
Type SS5D


.190 ± .003 INSIDE DIMENSION
(4,83 ± 0,08)
.031 ± .015
(0,79 ± 0,38)
.281 ± .015 DIAMETER
(7,14 ± 0,38)
.312 ± .003
(7,94 ± 0,08)
OUTSIDE DIMENSION
.020 ± .002
(0,51 ± 0,05)
SOLDER WASHER M-6447
.093 ± .015
(2,38 ± 0,38)
.050 ± .010
(1,27 ± 0,25)
.343 ± .030
(8,73 ± 0,76)
MOUNTING SURFACE
.093 ± .015
(2,38 ± 0,38)
.093 ± .015
(2,38 ± 0,38)
.190
(4,83)
MAXIMUM DIAMETER
RECOMMENDED MOUNTING HOLE .191 MINIMUM DIAMETER (4,85)

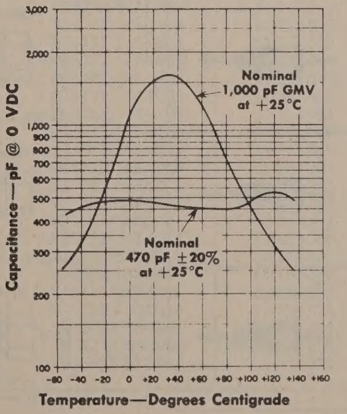
Type FA5C


.190 ± .003 INSIDE DIMENSION
(4,83 ± 0,08)
.031 ± .015
(0,79 ± 0,38)
.281 ± .015 DIAMETER
(7,14 ± 0,38)
.312 ± .003
(7,94 ± 0,08)
OUTSIDE DIMENSION
.020 ± .002
(0,51 ± 0,05)
SOLDER WASHER M-6447
.093 ± .015
(2,38 ± 0,38)
.050 ± .010
(1,27 ± 0,25)
.093 ± .015
(2,38 ± 0,38)
.343 ± .030
(8,73 ± 0,76)
MOUNTING SURFACE
.328 ± .030
(8,33 ± 0,76)
.093 ± .015
(2,38 ± 0,38)
RECOMMENDED MOUNTING HOLE .191 MINIMUM DIAMETER (4,85)
.062 ± .005 DIAMETER
(1,59 ± 0,13)
.190
(4,83)
MAXIMUM DIAMETER

Type SB3A


.408
.396
(10,36)
(10,06)
OUTSIDE DIAMETER
.031
(0,79)
.078
.073
(1,98)
(1,85)
.312 ± .015
(7,94 ± 0,38)
.312 ± .015
(7,94 ± 0,38)
.031 ± .015
(0,79 ± 0,38)
1/4–32 THREAD UNEF-2B
NUT M-6381
.267
.256
(6,78)
(6,40)
INSIDE DIAMETER
M-6359
.093 ± .015
(2,38 ± 0,38)
.050 ± .010
(1,27 ± 0,25)
.406 ± .030
(10, 32 ± 0,76)
MOUNTING SURFACE
.140 ± .015
(3,57 ± 0,38)
.203 ± .015
(5,16 ± 0,38)
1/4–32 THREAD UNEF-2A
RECOMMENDED MOUNTING HOLE .261 DIAMETER (6,63)
.250
(6,35)
MAXIMUM DIAMETER

Spectrum Control P/N	Allen Bradley P/N	Tolerance %	Capacitance pf	Hardware Supplied
54-794-002-101M	FA5C-1012	20	100	M6447 Solder Preform
54-794-002-471M	FA5C-4712	20	470	
54-794-002-102P	FA5C-102W	GMV	1000	
54-804-002-101M	FB2B-1012	20	100	Nut M6377 Washer M6351
54-804-002-471M	FB2B-4712	20	470	
54-804-002-102P	FB2B-102W	GMV	1000	
54-803-004-101M	SS5D-1012	20	100	M6474 Solder Preform
54-803-004-471M	SS5D-4712	20	470	
54-803-004-102P	SS5D-102W	GMV	1000	
54-807-002-101M	SB3A-1012	20	100	Nut M6381 Washer M6359
54-807-002-471M	SB3A-4712	20	470	
54-807-002-102P	SB3A-102W	GMV	1000	



SPECTRUM CONTROL

SPECTRUM CONTROL INC.

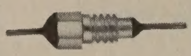
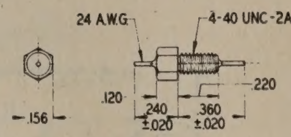
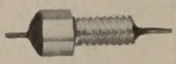
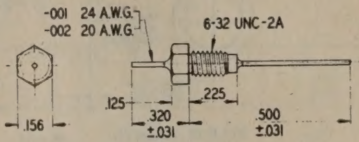
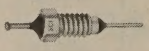
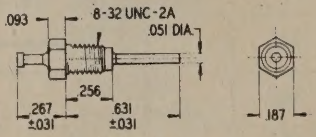
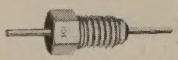
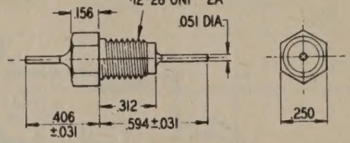
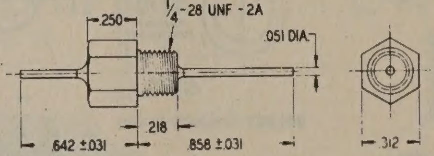
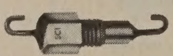
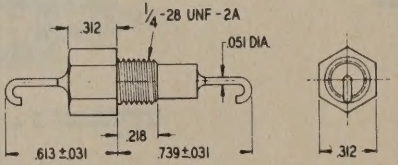
152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

FEED-THRU CERAMIC CAPACITORS

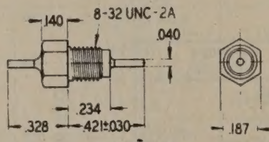
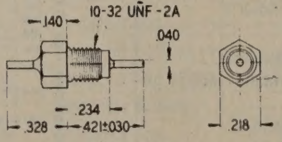
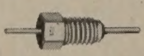
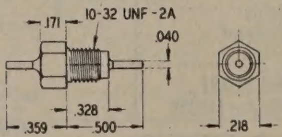
RESIN SEAL

SPECTRUM CONTROL

SPECTRUM ACQUIRES ALLEN BRADLEY LINE In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

		Working Voltage		Catalog Values Picofarad	Ordering Number
		+85°C	+125°C		
	 24 A.W.G. 4-40 UNC-2A .220 .120 .156 .240 ±.020 .360 ±.020	200	100	10	54-790-001-100M
		200	100	100	54-790-001-101M
		200	100	500	54-790-001-501Z
		200	100	22000	54-790-001-223Z
	 -001 24 A.W.G. -002 20 A.W.G. 6-32 UNC-2A .125 .225 .156 .320 ±.031 .500 ±.031	200	100	10	54-779-001-100M
		200	100	100	54-779-001-101M
		200	100	500	54-779-001-501P
		200	100	1000	54-779-001-102P
		200	100	22000	54-779-001-223Z
	 .093 8-32 UNC-2A .051 DIA. .256 .267 ±.031 .631 ±.031 .187	200	100	10	54-713-001-100M
		200	100	100	54-713-001-101M
		200	100	1000	54-713-001-102Z
		200	100	3000	54-713-001-302Z
	 12-28 UNF-2A .156 .051 DIA. .312 .406 ±.031 .594±.031 .250	500	250	500	54-743-001-501M
		500	250	1000	54-743-001-102Z
		500	250	39000	54-743-001-393Z
	 .250 1/4-28 UNF-2A .051 DIA. .218 .642 ±.031 .858 ±.031 .312	500	250	1000	54-721-001-102Z
		500	250	1500	54-721-001-152Z
		500	250	3000	54-721-001-302Z
	 .312 1/4-28 UNF-2A .051 DIA. .218 .613 ±.031 .739±.031 .312	500	250	1000	54-752-001-102Z
		500	250	1500	54-752-001-152Z
		500	250	10000	54-752-001-103Z

MULTI-LAYER FEED-THRU CAPACITORS

		Working Voltage		Catalog Values Picofarad	Ordering Number
		+85°C	+125°C		
	 .140 8-32 UNC-2A .040 .234 .328 .421±.030 .187	100	100	50000	54-785-005-503P
	 .140 10-32 UNF-2A .040 .234 .328 .421±.030 .218	50	50	.3 MFD	54-786-013-304Z
	 .171 10-32 UNF-2A .040 .328 .359 .500 .218	50	50	.5 MFD	54-786-021-504Z
		50	50	1.0 MFD	54-786-014-105Z

SPECTRUM CONTROL INC.

152 EAST MAIN STREET, FAIRVIEW, PA. 16415

PHONE (814) 474-5593

EMI/RFI SUPPRESSION FILTERS

MIL-F-15733

Listed below are the decodings from Mil-F-15733 to Spectrum part number. These filters can be ordered by the Spectrum or Mil number. A copy of this Mil specification and the slash sheets are available through normal channels at Naval Publications, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. Spectrum Control is QPL'd on all dash numbers under slash sheets shown and will become qualified under all new slash sheets.

Military Designation	Spectrum Part Number
M15733/23-0001	51-390-001
M15733/23-0002	51-390-002
M15733/23-0003	51-390-003
M15733/23-0004	51-390-004
M15733/23-0005	51-353-316
M15733/23-0006	51-353-317
M15733/23-0007	51-390-005
M15733/23-0008	51-390-006
M15733/23-0009	51-390-007
M15733/23-0010	51-390-008
M15733/23-0011	51-353-318
M15733/23-0012	51-353-319
M15733/23-0013	51-390-009
M15733/23-0014	51-390-010
M15733/23-0015	51-390-011
M15733/23-0016	51-390-012
M15733/23-0017	51-353-320
M15733/23-0018	51-353-321
M15733/23-0019	51-390-013
M15733/23-0020	51-390-014
M15733/23-0021	51-390-015
M15733/23-0022	51-390-016
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M15733/23-0024	51-353-323
M15733/23-0025	51-390-017
M15733/23-0026	51-390-018
M15733/23-0027	51-390-019
M15733/23-0028	51-390-020
M15733/23-0029	51-353-324
M15733/23-0030	51-353-325
M15733/23-0031	51-390-021
M15733/23-0032	51-390-022
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M15733/23-0040	51-390-028
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M15733/23-0058	51-390-040
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M15733/24-0004	51-385-026
M15733/24-0005	51-353-066
M15733/24-0006	51-353-067
M15733/24-0007	51-385-027
M15733/24-0008	51-385-028
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M15733/24-0018	51-385-030
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M15733/25-0012	51-382-604
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M15733/27-0017	51-321-607
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M15733/27-0019	51-320-019
M15733/27-0020	51-320-020
M15733/27-0021	51-323-315
M15733/27-0022	51-321-315
M15733/27-0023	51-321-609
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M15733/28B-0002	51-712-028
M15733/32-0001	52-304-006
M15733/33-0001	51-707-006
M15733/33-0002	51-707-007
M15733/34B-0001	51-322-016
M15733/34B-0002	51-322-017
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M15733/34B-0004	51-321-328
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M15733/34B-0008	51-353-208
M15733/34B-0009	51-321-334
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M15733/38A-0001	51-343-018
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M15733/43A-0002	51-719-024
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M15733/54B-0013	51-353-359
M15733/54B-0014	51-353-360
M15733/54B-0015	51-353-227
M15733/54B-0016	51-353-228
M15733/56-0001	51-431-804
M15733/56-0002	51-431-805
M15733/57-0001	51-353-226

SPECTRUM CONTROL

SPECTRUM CONTROL INC.

152 EAST MAIN STREET, FAIRVIEW, PA. 16415
PHONE (814) 474-5593

STERLING
TRANSFORMER

STANDARD INTERSTAGE AND LINE TRANSISTOR AND TUBE APPLICATIONS *filters*

Hermetically Sealed — Manufactured to MIL-F-18327B Available in Other Frequencies

LOW PASS

INTERSTAGE

LI units have a loss of approximately 3 db at cutoff frequency, and an attenuation of 35 db at 1.5 cutoff frequency. Input and output 10,000 ohms. LI units are MIL type FR4RX11YY.

Part No.	Frequency	Case Size	Net Price
LI-60	60 cps	A	$79.20
LI-100	100 cps	A	79.20
LI-200	200 cps	B	79.20
LI-400	400 cps	B	79.20
LI-500	500 cps	B	79.20
LI-800	800 cps	B	79.20
LI-1,000	1,000 cps	B	79.20
LI-1,500	1,500 cps	B	79.20
LI-2,000	2,000 cps	B	79.20
LI-2,500	2,500 cps	B	79.20
LI-3,000	3,000 cps	B	79.20
LI-4,000	4,000 cps	B	79.20
LI-5,000	5,000 cps	B	79.20
LI-10,000	10,000 cps	B	79.20

LINE

LL units have a loss of approximately 3 db at cutoff frequency, and an attenuation of 35 db at 1.5 cutoff frequency. Input and output 500/600 ohms. LL units are MIL type FR4RX11YY.

Part No.	Frequency	Case Size	Net Price
LL-600	600 cps	A	$79.20
LL-1,000	1,000 cps	A	79.20
LL-1,500	1,500 cps	A	79.20
LL-2,000	2,000 cps	A	79.20
LL-2,500	2,500 cps	A	79.20
LL-4,000	4,000 cps	A	79.20
LL-8,000	8,000 cps	A	79.20
LL-10,000	10,000 cps	A	79.20
LL-12,000	12,000 cps	A	79.20

HIGH PASS

INTERSTAGE

HI units have a loss of less than 6 db at cutoff frequency, and an attenuation of 35 db at .67 cutoff frequency. Input and output 10,000 ohms. HI units are MIL type FR4RX33YY.

Part No.	Frequency	Case Size	Net Price
HI-100	100 cps	A	$79.20
HI-200	200 cps	A	79.20
HI-300	300 cps	A	79.20
HI-400	400 cps	A	79.20
HI-500	500 cps	A	79.20
HI-800	800 cps	A	79.20
HI-1,000	1,000 cps	A	79.20
HI-2,000	2,000 cps	A	79.20
HI-3,000	3,000 cps	A	79.20

LINE

HL units have a loss of less than 6 db at cutoff frequency, and an attenuation of 35 db at .67 cutoff frequency. Input and output 500/600 ohms. HL units are MIL type FR4RX33YY.

Part No.	Frequency	Case Size	Net Price
HL-200	200 cps	A	$88.00
HL-300	300 cps	A	88.00
HL-500	500 cps	A	88.00
HL-1,000	1,000 cps	A	88.00

FOR WIDE BAND PASS FILTERS THE LI & HI OR LL & HL MAY BE CONNECTED IN SERIES.

BAND PASS

INTERSTAGE

BI units have 2:1 voltage gain. They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 10,000 ohms, output to grid. BI units are MIL type FR4RX22YY.

Part No.	Frequency	Case Size	Net Price
BI-50	50 cps	A	$79.20
BI-60	60 cps	A	79.20
BI-100	100 cps	A	79.20
BI-120	120 cps	B	79.20
BI-200	200 cps	B	79.20
BI-240	240 cps	B	79.20
BI-400	400 cps	B	79.20
BI-500	500 cps	B	79.20
BI-750	750 cps	B	79.20
BI-800	800 cps	B	79.20
BI-1,000	1,000 cps	B	79.20
BI-1,500	1,500 cps	B	79.20
BI-2,000	2,000 cps	B	79.20
BI-3,000	3,000 cps	B	79.20
BI-4,000	4,000 cps	B	79.20
BI-5,000	5,000 cps	B	79.20
BI-10,000	10,000 cps	B	79.20

LINE

BL units have 9:1 voltage gain. They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 500/600 ohms, output to grid. BL units are MIL type FR4RX22YY.

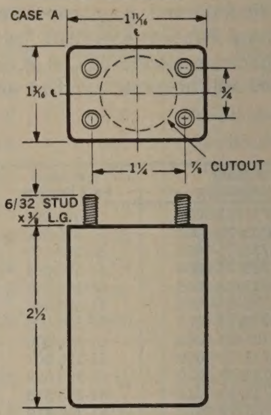
Part No.	Frequency	Case Size	Net Price
BL-400	400 cps	B	$79.20
BL-1,000	1,000 cps	B	79.20

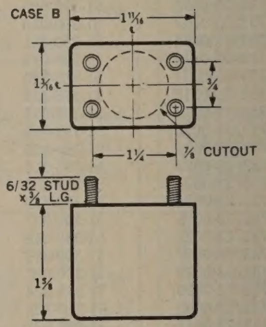
TRANSISTOR INTERSTAGE

They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 10,000 ohms, output 10,000 ohms. BIT units are MIL type FR4RX22YY.

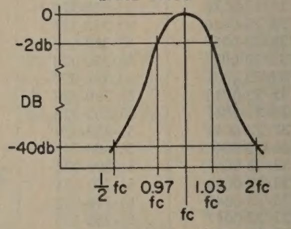
Part No.	Frequency	Case Size	Net Price
BIT-60	60 cps	A	$88.00
BIT-100	100 cps	A	88.00
BIT-120	120 cps	B	88.00

CASE DETAIL

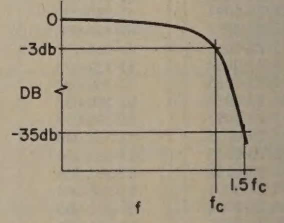




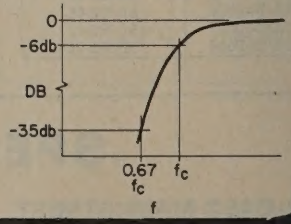
BAND PASS



LOW PASS



HIGH PASS



STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

SHORT FORM CATALOG
LG 66
February 1977
Supersedes LG 63

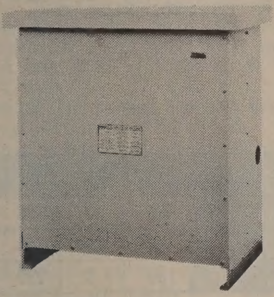
TOPAZ SOLUTIONS TO POWER PROBLEMS
ELECTRONICS

3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

ULTRA-ISOLATION NOISE-SUPPRESSION TRANSFORMERS

125 VA to 130 kVA

PROTECT SENSITIVE EQUIPMENT FROM POWER LINE NOISE



ENCASED TYPE, available in 75 to 130 kVA ratings, three-phase

Featuring:

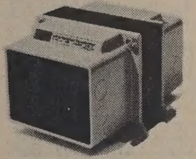
- **Clean, Noise-Free Power Output**
- **Unique Triple Box Shielded Design**
- **Low Coupling Capacitance**
- **Guaranteed Performance**
- **Topaz Quality**

Many of today's electronic equipment and systems are sensitive to line voltage transients and spikes caused by utility feeder switching, lightning, air conditioning and other sources of noise. Topaz Ultra-Isolation Transformers prevent these transients from reaching sensitive equipment. A unique box shielding technique reduces capacitive coupling from primary to secondary to less than 0.0005 picofarads. This low capacitive coupling provides a common-mode noise rejection ratio of over ten million to one.

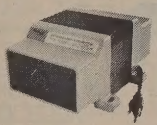
A full line of single-phase and three-phase models is available from 125 VA to 130 kVA. Topaz Ultra-Isolation Transformers may be used alone or in conjunction with Topaz AC Line Regulators.

TYPICAL EQUIPMENT AND SYSTEMS USING TOPAZ ULTRA-ISOLATION TRANSFORMERS

- Computers and Computer Peripherals
- Instrumentation
- Process Control
- Digital Communications
- Telemetry
- Audio and Video Recording



ENDBELL TYPE, available in ratings from 125 VA through 5 kVA single phase



LINE CORD/RECEPTACLE TYPE, available in ratings from 125 VA through 2.4 kVA

APPLICATIONS

- Isolating sensitive equipment from noisy power lines
- Isolating noisy equipment from sensitive equipment sharing the same power line
- Minimizing common-mode noise
- Minimizing transverse-mode noise resulting from common-mode noise at the input
- Complete electrostatic shielding

STANDARD ULTRA-ISOLATION TRANSFORMERS

SINGLE-PHASE MODELS—All Topaz standard endbell type and encased type Ultra-Isolation Transformers are manufactured with dual-voltage primary and secondary windings and are rated for operation at either 50 or 60 Hz. For maximum versatility, the dual-voltage windings permit hookup in any combination of the listed voltages—one to one, step-up or step-down. Single-phase transformers are available in three styles:

TERMINAL STYLE: Available in all power ratings. Transformers are supplied with terminals or lugs for direct-wired installations. Wiring instructions are included with each transformer.

LINE CORD/RECEPTACLE STYLE: Available on models with power ratings through 2.5 kVA. Transformers are supplied prewired in a 120 V-120 V configuration. There is a plug on the six foot input line cord and a standard 120V receptacle on the secondary.

125 VA through 500 VA models have a NEMA 5-15P plug attached to the input cord and a NEMA 5-15R output receptacle.

1 kVA models have a NEMA 5-15P input plug and a duplex NEMA 5-15R output receptacle.

2.4 kVA models are limited to 20 amperes input and have a NEMA L5.20P twist lock input plug and a duplex NEMA 5-15R output receptacle.

THREE-PHASE MODELS— Standards models are available prewired for specified operating voltages.

NON-STANDARD ULTRA-ISOLATION TRANSFORMERS—The following list includes all standard transformers. Transformers can be designed and manufactured to suit a full range of special requirements. Please contact Topaz for additional information.

Typical Specifications: Standard 50/60 Hz Single-Phase Models

Common-Mode Noise Attenuation: .005 pF—126 dB; .001 pF—140 dB; .0005 pF—146 dB

DC Isolation: 1000 megohms winding-to-winding and winding-to-ground

Dielectric Strength: 1000 VAC minimum

Electromagnetic Noise: Less than 0.11 Gauss (20 dB) at 18″ distance

Operating Voltages: To 110% of nominal

Operating Frequency: 50/60 Hz

Other Models Available: 400 Hz

POWER RATING	PRIMARY VAC (Nominal)	SECONDARY VAC (Nominal)	FREQ. Hz	PART NUMBERS TERMINAL STYLE EFFECTIVE COUPLING CAPACITANCE .005 pF	.001 pF	.0005 pF	LINE CORD/RECEPTACLE STYLE EFFECTIVE COUPLING CAPACITANCE .005 pF	.001 pF	.0005 pF	% Reg.**	DIMENSIONS (inches/centimeters) H in. cm.	W in. cm.	D in. cm.	MW in. cm.	MD in. cm.	APPROX. WEIGHT (lbs/kg)
SINGLE-PHASE MODELS																
125 VA	120/240	120/240	50/60	91091-11	91091-21	91091-31	91091-12	91091-22	91091-32	3	4.4/11	7.0/18	7.9/20	6.2/16	2.6/7	11.5/5
250 VA	120/240	120/240	50/60	91092-11	91092-21	91092-31	91092-12	91092-22	91092-32	3	4.4/11	7.0/18	8.2/21	6.2/16	3.0/8	14.0/6
500 VA	120/240	120/240	50/60	91095-11	91095-21	91095-31	91095-12	91095-22	91095-32	3	4.4/11	7.0/18	9.4/24	6.2/16	4.0/10	20.5/9
1 kVA	120/240	120/240	50/60	91001-11	91001-21	91001-31	91001-12	91001-22	91001-32	3	6.3/16	8.4/21	10.0/25	7.2/18	3.5/9	38.0/17
△2.5 kVA	120/240	120/240	50/60	91002-11	91002-21	91002-31	91002-12	91002-22	91002-32	3.5	6.3/16	8.4/21	11.8/30	7.2/18	5.2/13	57.5/26
5 kVA	120/240	120/240	50/60	91005-11	91005-21	91005-31				3	6.3/16	8.4/21	14.2/36	7.2/18	5.2/13	90.5/41
5 kVA	240/480	120/240	50/60	91105-11	91105-21	91105-31				3	6.3/16	8.4/21	14.2/36	7.2/18	6.0/15	90.5/41
10 kVA	240/480	120/240	50/60	93110-11	93110-21	93110-31				4	22.8/58	15.1/38	14.1/36			222/101
15 kVA	240/480	120/240	50/60	93115-11	93115-21	93115-31				4	22.8/58	15.1/38	14.1/36			269/122
20 kVA	240/480	120/240	50/60	93120-11	93120-21	93120-31				3	22.8/58	15.1/38	14.1/36			332/151
THREE-PHASE MODELS																
3 kVA	208Y/120	208Y/120	50/60	91403-11	91403-21	91403-31				3	7.8/20	34.6/88	10.0/25	33.1/84	3.8/10	139/63
3 kVA	240	208Y/120	50/60	91503-11	91503-21	91503-31				3	7.8/20	34.6/88	10.0/25	33.1/84	3.8/10	139/63
7.5 kVA	208Y/120	208Y/120	50/60	91407-11	91407-21	91407-31				3.5	7.8/20	34.6/88	11.8/30	33.1/84	5.5/14	198/90
7.5 kVA	240	208Y/120	50/60	91507-11	91507-21	91507-31				3.5	7.8/20	34.6/88	11.8/30	33.1/84	5.5/14	198/90
15 kVA	208Y/120	208Y/120	50/60	91415-11	91415-21	91415-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
15 kVA	240	208Y/120	50/60	91515-11	91515-21	91515-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
15 kVA	480	208Y/120	50/60	91615-11	91615-21	91615-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
30 kVA	208Y/120	208Y/120	50/60	93430-11	93430-21	93430-31				4	23.8/60	53.0/135	14.1/36			766/347
30 kVA	240	208Y/120	50/60	93530-11	93530-21	93530-31				4	23.8/60	53.0/135	14.1/36			766/347
30 kVA	480	208Y/120	50/60	93630-11	93630-21	93630-31				4	23.8/60	53.0/135	14.1/36			766/347
45 kVA	208Y/120	208Y/120	50/60	93445-11	93445-21	93445-31				4	23.8/60	53.0/135	14.1/36			928/421
45 kVA	240	208Y/120	50/60	93545-11	93545-21	93545-31				4	23.8/60	53.0/135	14.1/36			928/421
45 kVA	480	208Y/120	50/60	93645-11	93645-21	93645-31				4	23.8/60	53.0/135	14.1/36			928/421
75 kVA	208	208Y/120	60	94775-11	94775-21	94775-31				2	47.0/119	42.0/107	28.0/71			1160/526
75 kVA	240	208Y/120	60	94575-11	94575-21	94575-31				2	47.0/119	42.0/107	28.0/71			1160/526
75 kVA	480	208Y/120	60	94675-11	94675-21	94675-31				2	47.0/119	42.0/107	28.0/71			1160/526
100 kVA	208	208Y/120	60	94780-11	94780-21	94780-31				2	47.0/119	42.0/107	28.0/71			1469/666
100 kVA	240	208Y/120	60	94580-11	94580-21	94580-31				2	47.0/119	42.0/107	28.0/71			1469/666
100 kVA	480	208Y/120	60	94680-11	94680-21	94680-31				2	47.0/119	42.0/107	28.0/71			1469/666
130 kVA	208	208Y/120	60	94785-11	94785-21	94785-31				2	47.0/119	42.0/107	28.0/71			1820/826
130 kVA	240	208Y/120	60	94585-11	94585-21	94585-31				2	47.0/119	42.0/107	28.0/71			1820/826
130 kVA	480	208Y/120	60	94685-11	94685-21	94685-31				2	47.0/119	42.0/107	28.0/71			1820/826

**Regulation is specified in percent voltage change from no load to full resistive load.
△ Line Cord/Receptacle Type Rated 20A Maximum (2.4 kVA)

Printed in U.S.A.

TRW UTC TRANSFORMERS

INDUCTORS

ULTRAMINIATURE HIGH Q INDUCTORS MINIDUCTOR SERIES

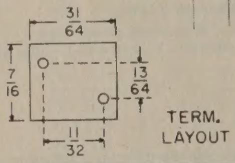
PACKAGING Hermetically sealed. MS, MM, MH, MW, epoxy molded symmetrical toroids. ML, hipermalloy shield cased, hum reducing laminated inductor. MO, epoxy molded hum reducing laminated inductor. All have straight pin terminals for printed circuit applications.

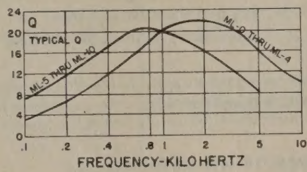
TERMINALS Per MIL-STD-1276.
MIL SPECS To complete MIL-T-27D Specs. Mil Type TF5R20ZZ.

Type No.	Tolerance Inductance at 25°C	Test Frequency	Test Level RMS V	Max. L Variation −55°C to +105°C
ML-0 thru 4	±3%	1 kHz	1.0	Within 2%
ML-5 thru 10	±3%	400 Hz	1.0	±2%
MO-.1 thru 1	±2%	1 kHz	1.0	+1% −2%
MO-2 thru 100	±2%	400 Hz	1.0	+1% −3%
MS	±2%	1 kHz	0.1	±2%
MM	±2%	1 kHz	0.1	±2%
MH	±2%	1 kHz	0.1	±1%
MW	±1%	1 kHz	1.0	±1%

LAMINATED TYPES ML SERIES

ML CASE
7/16″ x 31/64″ x 9/16″ high
Weight .2 oz.
TERM. Type D
gold-plated Dumet
.025″ Dia. x 1″ long

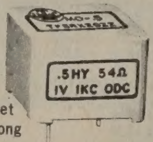


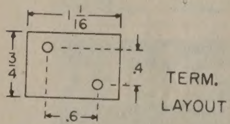


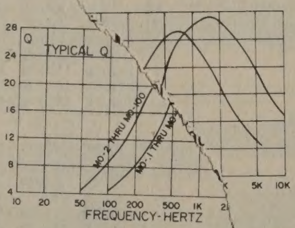
Type No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%	Type No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
ML-0	.15	12	33	ML-6	4.0	.7	340
ML-1	.25	9	55	ML-7	6.0	.6	530
ML-2	.4	7	90	ML-8	10	.5	850
ML-3	7	5	135	ML-9	25	.3	2300
ML-4	1.4	3	210	ML-10	60	.2	5160
ML-5	2.5	1	21				

MO SERIES

MO CASE
3/4″ x 1 1/16″ x 13/16″ high Weight 1 oz.
TERM. Tinned Dumet
.040″ Dia. x 5/32″ long







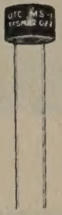
Type No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%	Type No.	Ind. Hy (0 DC)	ma DC Max.	DC ±20
MO-.1	.1	55	14	MO-5	5	5	340
MO-.15	.15	45	22	MO-7.5	7.5	4.5	517
MO-.3	.3	28	34	MO-20	20	2.7	1310
MO-.5	.5	23	54	MO-50	50	1.4	3180
MO-1	1	16	130	MO-100	100	1.1	8550
MO-2	2	8	130				

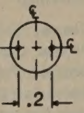
TOROIDAL TYPES

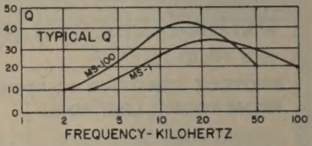
MS SERIES

MS CASE
.35″ Dia. x .23 high
Weight 1.3 Gm.

TERM. Type D
gold-plated Dumet
.025″ Dia. x 1 1/4″ long







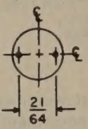
Type No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.	Type No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MS-1	1	60	1.4	MS-25	25	13	38
MS-5	5	28	7	MS-50	50	9	75
MS-10	10	20	11	MS-100	100	6	132

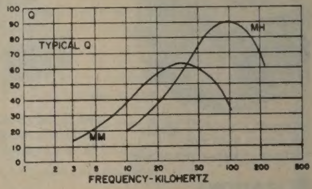
MM SERIES / MH SERIES

MM / MH CASE
7/16″ Dia. x 1/4″ high
Weight .07 oz.

TERM. Type D
gold-plated Dumet
.025″ Dia. x 1 1/4″ long

UTC
MH-2
1.5 MHY





MM SERIES

Type No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MM1	3	50	4.8
MM-2	5	40	8.0
MM-3	8	30	13
MM-4	12.5	25	19
MM-5	20	20	31
MM-6	30	16	47
MM-7	60	11	94
MM-8	120	8	186

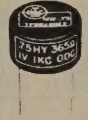
MH SERIES

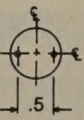
Type No.	Ind. mHy (0 DC)	ma DC Max.	DCRΩ Max.
MH-1	.6	90	1.9
MH-2	1.5	57	4.9
MH-3	2.5	44	8.2
MH-4	6	28	19
MH-5	10	22	32
MH-6	15	18	49
MH-7	25	14	82
MH-8	40	11	130

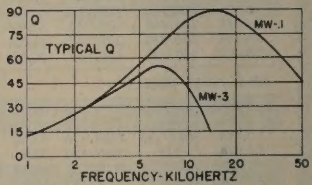
MW SERIES

MW CASE
23/32″ Dia. x 13/32″ high
Weight .25 oz.

TERM. Type N-2
gold-plated nickel
.040″ Dia. x 3/8″ long







Type No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%	Type No.	Ind. Hy (0 DC)	ma DC Max.	DCRΩ ±20%
MW-.05	.05	25	27	MW-1	1.0	6	500
MW-.10	.10	18	51	MW-1.2	1.2	5	560
MW-.25	.25	11	136	MW-2	2	4	870
MW-.5	.5	8	243	MW-3	3	3.5	1340
MW-.75	.75	7	355	MW-5	5	3	2500

TRW/UTC TRANSFORMERS • 150 VARICK STREET, NEW YO RK, N.Y. 10013 • TELEPHONE: (212) 255-3500 • TWX: 710-581-2722

TRW UTC TRANSFORMERS FILTERS

UTC "FLATS"* ELECTRIC WAVE FILTERS

DESIGNED, MANUFACTURED AND SUCCESSFULLY TESTED TO COMPLETE MIL-F-18327 SPECIFICATIONS

These filters meet today's need for flat component configurations, have excellent attenuation characteristics and are ruggedized to Grade 6, MIL-F-18327. Straight pin terminals and flat construction make these units ideally suited for printed circuit applications. These filters are hermetically sealed in flat metal cases shielded to reduce hum pickup. FP-A Case: 2″ x 2″ x ½″ h., 2.5 oz. FP-B Case: 2″ x 1½″ x ⅜″ h., 2 oz. FP-C Case: 2″ x 1½″ x ½″ h., 2.2 oz.

FHH-200: Flat package high pass filter, source and load 10K ohms. Units are within 1 db up to 300 Hz 3 db ±1 db at 200 Hz, and have an attenuation of at least 40 db at frequencies below 140 Hz. FP-A Case. Mil Type: FR6RX33YY1.

FLH-600: Flat package low pass filter, source and load 10K ohms. Units are within 1 db from DC to 450 Hz, 3 db ±1 db at 600 Hz, and have an attenuation of at least 40 db at frequencies above 800 Hz. FP-A Case. Mil Type: FR6RX11YY1.

FLH-5000: Flat package low pass filter, source and load 10K ohms. Units are within 1 db from DC to 4.2 kHz, 3 db ±1 db at 5 kHz, and have an attenuation of at least 43 db at frequencies above 6400 Hz. FP-B Case. Mil Type: FR6RX11YY1.

FLL-3500: Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 3 kHz, 3 db ±1 db at 3500 Hz, and have an attenuation of at least 40 db at frequencies above 4500 Hz. FP-A Case. Mil Type: FR6RX33YY1.

FLL-18000: Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 15 kHz, 3 db ±1 db at 18 kHz, and have an attenuation of at least 43 db at frequencies above 23 kHz. FP-A Case. Mil Type: FR6RX11YY1.

FLL-50000: Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 42 kHz, 3 db ±1 db at 50 kHz, and have an attenuation of at least 43 db above 64 kHz. FP-B Case. Mil Type: FR6RX11YY1.

FBH-1: Flat package Broad Band Pass Filter has a source and load of 10K ohms. Units are within 3 db from 1 kHz to 2 kHz, and have an attenuation of at least 36 db at frequencies below 500 cps and above 4 kHz. FP-C Case. Mil Type FR6RX22YY1.

FBH-10: Same as FBH-1, except less than 3 db from 10 kHz to 20 kHz, attenuation of at least 36 db below 5 kHz and above 40 kHz.

INTERSTAGE AND LINE FILTERS

Available in stock frequencies listed below (numerical part of type—number is center frequency in Hz on band pass or cutoff frequency in Hz on low and high pass filters). Compact shielded cases hermetically sealed to MIL-F-18327 specs. BMI, LMI, BML Cases: 1³⁄₁₆″ x 1¹¹⁄₁₆″ x 1⅝″ h.; wt., 6 oz. HMI, HML, LML Cases: 1³⁄₁₆″ x 1¹¹⁄₁₆″ x 2½″ h.; wt., 9 oz. The BMI filters are band pass interstage units designed to operate between 10,000 ohms and a grid. They provide a gain of 2 at center frequency. BTI units are same as BMI, but 10,000 ohms output. BML band pass filters, similarly, work into a grid, but have an input impedance of 500/600 ohms. They provide a gain of 9.

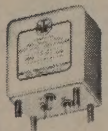
HMI filters are high pass interstage units.

LMI filters are low pass interstage units.

HML filters are high pass with input and output impedance of 500/600 ohms.

LML filters are low pass filters with input and output impedance of 500/600 ohms.

BM & LM Series



HM Series

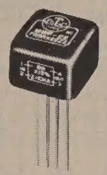
UTC Type	UTC Type	UTC Type	UTC Type	UTC Type
BMI-30	BMI-1000	HMI-100	LMI-50	LMI-5000
BMI-50		HMI-200	LMI-100	LMI-10000
BMI-60		HMI-300	LMI-150	LML-500
BMI-90		HMI-400	LMI-200	LML-1000
BMI-100		HMI-500	LMI-400	LML-1500
BMI-120		HMI-800	LMI-500	LML-2000
BMI-150		HMI-1000	LMI-800	LML-2500
BMI-200	BML-400	HMI-2000	LMI-1000	LML-3000
BMI-240	BML-1000	HMI-3000	LMI-1500	LML-4000
BMI-300		HML-40	LMI-2000	LML-8000
BMI-400	BTI-60	HML-200	LMI-2500	LML-10000
BMI-500	BTI-100	HML-300	LMI-3000	LML-12000
BMI-750	BTI-120	HML-500	LMI-4000	
BMI-800	HMI-50	HML-1000		

MNF/MWF BAND PASS TELE-MINIFILTER

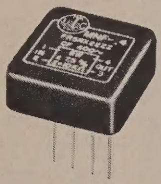
Both MNF and MWF types are designed for 10K source and load impedance. Low profile and pin terminals make these filters ideally suited for printed circuit applications. Mil-F-18327 Type FR7RX22ZZ1

MNF filters are down less than:
3 db. at ±7.5% of Center Frequency.
15 db. min at ±25% of Center Frequency.
Attenuation is greater than 40 db. beyond 1.75 x Center Frequency and .58 x Center Frequency.

MWF filters are down less than:
3 db. at ±15% of Center Frequency.
15 db. min. at ±50% of Center Frequency.
Attenuation is greater than 40 db. beyond 2.5 x Center Frequency and .4 x Center Frequency.



MNF-4 thru MNF-5.4
1³⁄₁₆″ sq. x ½″ high
Weight 1 oz.



MNF-7.35 thru MWF-70
²³⁄₃₂″ sq. x ½″ high
Weight ⅓ oz.

UTC Type	Center Frequency kHz	Band Width± (%)
MNF-.4	.4	7½
MNF-.56	.56	7½
MNF-.73	.73	7½
MNF-.96	.96	7½
MNF-1.3	1.3	7½
MNF-1.7	1.7	7½
MNF-2.3	2.3	7½
MNF-3.0	3.0	7½
MNF-3.9	3.9	7½
MNF-5.4	5.4	7½
MNF-7.35	7.35	7½
MNF-10.5	10.5	7½
MNF-14.5	14.5	7½
MNF-22	22	7½
MNF-30	30	7½
MNF-40	40	7½
MNF-52.5	52.5	7½
MNF-70	70	7½
MWF-22	22	15
MWF-30	30	15
MWF-40	40	15
MWF-52.5	52.5	15
MWF-70	70	15

MINIFILTERS*

These units provide almost the same characteristics as the standard interstage units listed at the bottom left, although extremely miniaturized. Hermetically sealed to MIL-F-18327 specs. B Type Case: ¾″ x ¾″ x 1⅛″ h.; wt., 1 oz. H and L Cases: 1″ x 1″ x 1⅜″h; wt., 2¼ oz. Center frequency in Hz on band pass or cutoff frequency in Hz on low and high pass filters is indicated by type numbers."

BPM units (BAND PASS) have 2:1 gain. Attenuation is approximately 2 db ±3% from center frequency, and 35 db per octave as shown. source; 10,000 ohms, output to grid, tapped for 10,000 ohms.

BPM units (band pass) have a 2:1 gain grid output. Attenuation is less than 2 db ±3% from center frequency and 35 db per octave. Source 10,000 ohms, output to grid, tapped for 10,000 ohms. Can be connected for band reject response."

Source and load 10,000 ohms.

LPM units (LOW PASS) are down less than 6 db at cutoff frequency, and more than 30 db at 1.5 cutoff frequency, 40 db at 1.65 cutoff frequency. Source and load 10,000 ohms.

BPM

HPM & LPM

UTC Type	UTC Type	UTC Type
BPH-50000	BPM-2500	HPM-4000
BPH-100000	BPM-3000	LPM-200
BPM-400	BPM-3200	LPM-300
BPM-440	BPM-4000	LPM-500
BPM-500	BPM-4800	LPM-1000
BPM-600	BPM-5000	LPM-1500
	BPM-6000	LPM-2000
BPM-800		LPM-3000
BPM-1000	BPM-8000	LPM-5000
BPM-1200	BPM-10000	LPM-6000
BPM-1500	BPM-20000	LPM-8000
BPM-1600	HPM-500	LPM-10000
	HPM-1000	LPM-15000
BPM-2000	HPM-1500	

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TRW UTC TRANSFORMERS FILTERS & INDUCTORS

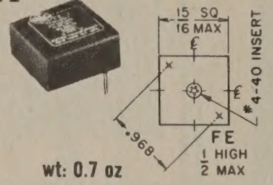
FE, FI MINIATURE INDUCTORS

DESIGNED, MANUFACTURED AND TESTED TO COMPLETE MIL-T-27

SPECIFICATIONS

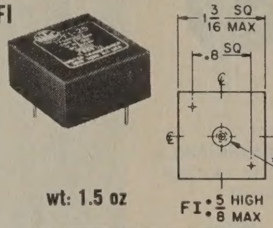
FE, FI miniature inductors are ideal for transistor and printed circuit applications, having both pin terminals and a molded flat construction. These units are symmetrical toroids providing maximum Q in minimum size. The FE and FI inductors are adjusted at 1V, 1 kHz. All units are adjusted to a tolerance of ±1%. The maDC max. shown is for approximately 5% drop in inductance. The temperature stability is unequalled from −55°C to +100°C. For AC level limitations, a general rule of thumb would be to consider the maximum AC current approximately equal to the maximum DC current rating. All units Mil Type: TF5R20ZZ.

FE

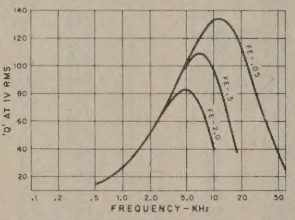


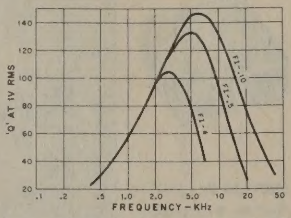
wt: 0.7 oz

FI



wt: 1.5 oz



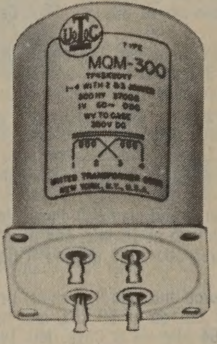


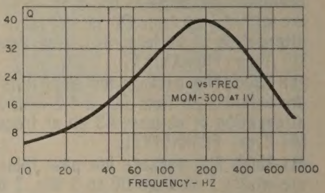
Type No.	Ind. Hy (0 DC)	maDC Max.	DCRΩ Max.
FE-.01	.0100	70	2.5
FE-.02	.0200	50	5.1
FE .05	.0500	30	12
FE-.1	.100	22	22
FE-.5	.500	10	122
FE-1	1.00	7	250
FE-2	2.00	5	500

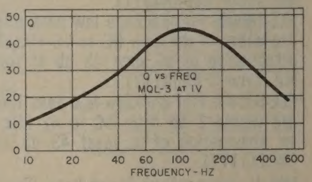
Type No.	Ind. Hy (0 DC)	maDC Max.	DCRΩ Max.
FI-.04	.0400	50	4.3
FI-.1	.100	30	11
FI-.25	.250	20	27
FI-.5	.500	14	60
FI-1	1.00	10	110
FI-4	4.00	5	430

LOW FREQUENCY HIGH Q COILS MQM — MQL

Designed for High Q at low frequencies, structure provides excellent stability. Inductance values to 2% tolerance at 1V, 60 Hz Inductance Variation MQM −55°C to +130°C less than ±2%, MQL −55°C to 105°C less than 3%. Transformer, parallel, series or center tapped connections are permitted due to dual windings to 4 terminals. MQM Mil Type TF4SOYY 1$\frac{5}{16}$ diam., 1⅝ h, Mounting 1⅛ sq., cutout 1 diam., wt. 5 oz. MQL Mil Type TF4R20YY 1$\frac{13}{16}$ dia., 2½ h, Mounting 1½ sq., cutout 1½ diam., wt. 1 lb.







Type No.	Series Henries (0 DC)	Parallel Henries (0 DC)	Series DCRΩ ±20%
MQM-2	2	.5	21
MQM-16	16	4	143
MQM-40	40	10	368
MQM-300	300	75	3700
MQM-600	600	150	5720

Type No.	Series Henries (0 DC)	Parallel Henries (0 DC)	Series DCRΩ ±20%
MQL-0	1	.25	5
MQL-1	10	2.5	50
MQL-2	20	5	82
MQL-3	200	50	820
MQL-4	400	100	2100
MQL-5	2500	625	13K
(For 60 Hz and lower)			

VARIDUCTORS

These variable inductors are ideal for use in tuned circuits, equalizers, oscillators, etc.

HVC, TVC VARIABLE INDUCTORS

PACKAGING — Hermetically sealed. Metal encased. Inductance variation controlled by adjustment screw on top of case. Range is covered in 900° rotation. Setting is positive. TVC is tapped version of HVC, with taps at 30% and 50% of total turns.

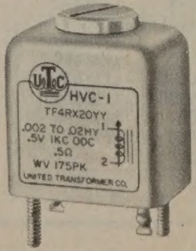
RANGE — HVC, TVC +200% −70% of nominal value.

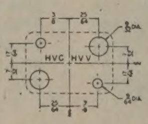
TEMPERATURE STABILITY — At mean inductance, from −55°C to +105°C. HVC & TVC: ±1.5%.

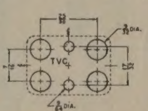
MIL TYPE TF4R20YY Size — 1⅛ x $\frac{25}{32}$ x 1$\frac{9}{32}$ h, Wt. 2 oz.

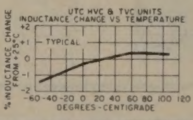
Type No.	Tapped Type No.	Min. Hys.	Mean Hys.	Max. Hys.	maDC	DCRΩ +20%
HVC-1	TVC-1	.002	.006	.02	100	.5
HVC-2	TVC-2	.005	.015	.05	60	1.4
HVC-3	TVC-3	.011	.040	.11	40	3.6
HVC-4	TVC-4	.03	.1	.3	30	8.6
HVC-5	TVC-5	.07	.25	.7	20	22
HVC-6	TVC-6	.2	6	2	15	55
HVC-7	TVC-7	.5	1.5	5	10	141
HVC-8	TVC-8	1.1	4	11	7	360
HVC-9	TVC-9	3	10	30	5	950
HVC-10	TVC-10	7	25	70	3.5	2220
HVC-11	TVC-11	20	60	200	2	5550
HVC-12	TVC-12	50	150	500	1.5	15.6K

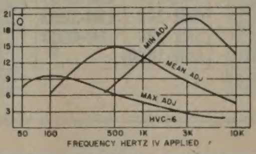
Choosing Type No.: If frequency is above 100 Hz, use type providing required inductance between mean and min. values.

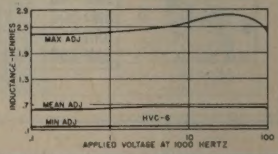












SR POWER INDUCTORS

SR power inductors are a new development, optimizing saturation characteristics with temperature rise. By special design, TRW/UTC has achieved higher LI^2 capability with lower DCR for a given size. Another way to see this improvement is to realize that these units produce less drop in inductance with DC for their size than comparable available units. See the curves below for typical capability in each size.

These inductors have low losses in the 3 to 100 kHz frequency range, making them ideal for switching regulator and AC filter choke applications.

The type numbers correspond to their inductance values in microhenries, which are measured at 1 V, 10 kHz, 0 DC with an inductance tolerance of +15%, −5%. Current listings I_1 are for approximately 10% drop in inductance with a typical 20°C temperature rise, and listings I_2 are for a 20% drop in inductance with a typical 40°C temperature rise.

Values of inductance other than listed in an existing size are available. Part number would be:

SR (A, B, or C)—(inductance in microhy at 0 DC)

Single-winding construction is assumed unless otherwise specified.

USE OF CURVES

EXAMPLE 1 Select an inductor to meet a requirement of 200 μhy at 3 amps with a maximum temperature rise of 20°C.

First, calculate LI^2, where L is in microhenries and I is in amperes. $LI^2 = 200 \times 3 \times 3 = 1800$.

Study the curves below to find the smallest coil that has a temperature rise less than 25°C. For $LI^2 = 1800$, SRA ≈ 30°C, which is too high for this requirement. However, the SRB curve shows an acceptable heat rise of 15°C and 92% of initial inductance at $LI^2 = 1800$. To meet the requirement of 200 μhy at 3 amps, inductance at 0 DC $\approx \frac{200}{.92} = 217$. Look in the itemized listing for an appropriate coil. Select SRB-220. Recalculate $LI^2 = 220 \times 3 \times 3 = 1950$. Check the curve to verify that the heat rise is still under 20°C for the new value of LI^2.

EXAMPLE 2 Select an inductor to meet a requirement of 750μhy minimum at 0 DC, with a maximum change in inductance of 15% at 1 amp and 25% at 1.5 amp. Looking at the itemized listing, select SRA-800. Calculate LI^2 as in Example 1. For 1 amp, $LI^2 = 800$; for 1.5 amp, $LI^2 = 1800$.

Check the SRA curve for the drop in inductance. It is less than 10% at 1 amp, and less than 20% at 1.5 amp, which is acceptable.

		DIA.			DIA.	DIA.	DIA.	±.010	±.010	±.010	C'BORE
FIG.	TYPE	A	B	C	D	E	F	G	H	J	K
1	SRA	7/8	7/16	1/4	5/32	.073	9/32	.400	.200	—	.082
2	SRA	7/8	7/16	1/4	5/32	.073	9/32	.400	.200	.200	.082
1	SRB	1 3/16	9/16	1/4	5/32	.073	9/32	.600	.300	—	.082
2	SRB	1 3/16	9/16	1/4	5/32	.073	9/32	.600	.300	.400	.082
1	SRC	1 3/8	3/4	1/4	5/32	.073	9/32	.800	.300	—	.082
2	SRC	1 3/8	3/4	1/4	5/32	.073	9/32	.800	.300	.400	.082

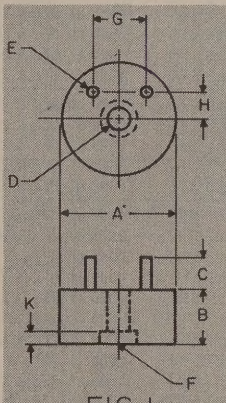


FIG. 1

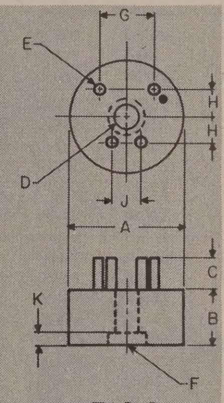


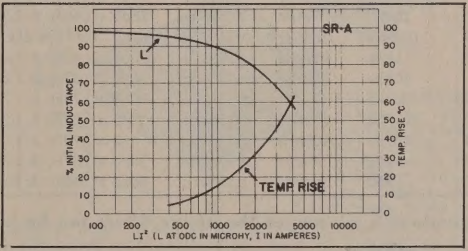
FIG. 2

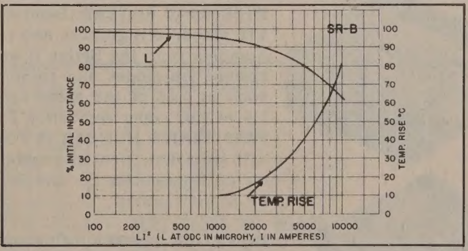
Type No.	Microhy (0 DC) L	Amps I_1	Amps I_2	Ohms Max DCR	No. of Windings	Case
SRA-1250	1250	.8	1.2	.7	1	Fig. 1
SRA-800	800	1	1.5	.45	1	Fig. 1
SRA-500	500	1.2	1.8	.3	1	Fig. 1
SRA-350	350	1.5	2.2	.2	1	Fig. 1
*SRA-200	200 50	2 4	3 6	.12 .03	2	Fig. 2
*SRA-88	88 22	3 6	4.5 9	.052 .013	2	Fig. 2
*SRA-32	32 8	5 10	7.5 15	.02 .005	2	Fig. 2

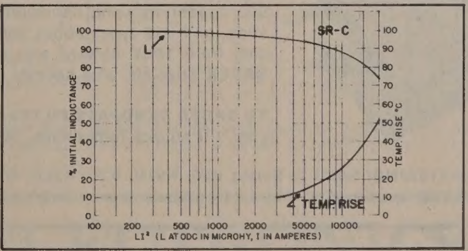
Type No.	Microhy (0 DC) L	Amps I_1	Amps I_2	Ohms Max DCR	No. of Windings	Case
SRB-3000	3000	.8	1.2	1.2	1	Fig. 1
SRB-2000	2000	1	1.5	.8	1	Fig. 1
SRB-1200	1200	1.25	1.88	.5	1	Fig. 1
SRB-780	780	1.6	2.4	.3	1	Fig. 1
SRB-520	520	2	3	.2	1	Fig. 1
SRB-320	320	2.5	3.75	.13	1	Fig. 1
*SRB-220	220 55	3 6	4.5 9	.08 .02	2	Fig. 2
*SRB-120	120 30	4 8	6 12	.05 .013	2	Fig. 2
*SRB-80	80 20	5 10	7.5 15	.032 .008	2	Fig. 2

Type No.	Microhy (0 DC) L	Amps I_1	Amps I_2	Ohms Max DCR	No. of Windings	Case
SRC-10000	10000	.84	1.1	2.1	1	Fig. 1
SRC-6400	6400	1	1.35	1.4	1	Fig. 1
SRC-2500	2500	1.6	2.2	.55	1	Fig. 1
SRC-1600	1600	2.1	2.8	.34	1	Fig. 1
SRC-1000	1000	2.6	3.5	.21	1	Fig. 1
*SRC-640	640 160	3.3 6.6	4.5 9	.13 .033	2	Fig. 2
*SRC-400	400 100	4 8	5.4 10.8	.088 .022	2	Fig. 2
*SRC-240	240 60	5 10	6.8 13.6	.056 .014	2	Fig. 2

*Two identical windings brought out to four terminals permit series, parallel, center tapped or transformer connections.







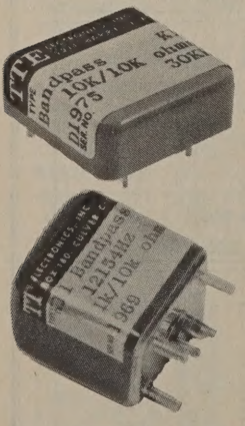
TTE *miniature* FILTERS

THESE PAGES CATALOG OVER 1,000,000 STANDARD FILTER TYPES — SPECIFY ANY COMBINATION OF FREQUENCY, SOURCE AND LOAD OHMS WITHIN THE MIN-MAX RANGES. ONE WEEK PROTOTYPE SHIPMENTS.

BANDPASS FILTERS FOR ANY CENTER FREQUENCY FROM 30Hz (SPECIALS FROM 10Hz UPWARD)

Series	Fc Center Freq. Range Min.	Max.	Bandwidth @ −3db	Stopband Attenuation	Source, Ohms Min.	Max.	Load, Ohms Min.	Max.	Case No.
K10	500Hz	9.9KHz	±1%Fc	30db at .92Fc & 1.1Fc & 40db at .86Fc & 1.2Fc	1K	500K	1K	500K	4
K10A	10KHz	100MHz	±1%Fc		50	10K	50	10K	3 or 11
K11B	500Hz	9.9KHz	±1%Fc	30db at .94Fc & 1.06Fc & 40db at .93Fc & 1.1Fc	1K	500K	1K	500K	4
K11E	10KHz	99KHz	±1%Fc		1K	10K	1K	10K	3 or 13
K11G	100KHz	100MHz	±1%Fc		50	1K	50	1K	12
K12A	500Hz	9.9KHz	±2%Fc	30db at .92Fc & 1.1Fc	1K	10K	1K	10K	4
K12C	10KHz	100MHz	±2%Fc	30db at .92Fc & 1.1Fc	50	10K	50	10K	3 or 12
K13	30Hz	99Hz	±5%Fc	60db at .5Fc & 2Fc	1K	500K	1K	500K	5
K14A	100Hz	100KHz	±5%Fc	40db at .5Fc & 2Fc	500	10K	100	1 meg	3
K14B	300Hz	999Hz	±5%Fc	35db at .5Fc & 2Fc	700	15K	700	15K	11
K14C	1KHz	99KHz	±5%Fc	43db at .5Fc & 2Fc	1K	1K	1K	10K	10
K14D	100KHz	100MHz	±5%Fc	43db at .5Fc & 2Fc	50	100	50	100	10
K17	100Hz	10KHz	±5%Fc	60db at .5Fc & 2Fc	500	10K	100	1 Meg	4
K17D	300Hz	3KHz	±5%Fc	50db at .5Fc & 2Fc	500	15K	500	30K	12
K17E	3KHz	99KHz	±5%Fc	50db at .5Fc & 2Fc	100	50K	100	100K	11
K17C	100KHz	100MHz	±5%Fc	60db at .5Fc & 2Fc	50	300	50	300	11
K18	10KHz	100KHz	±5%Fc	60db at .5Fc & 2Fc	100	100K	100	500K	3
K20	100Hz	3.9KHz	±7.5%Fc	40db at .57Fc & 1.75Fc	500	10K	500	10K	4
K20C	250Hz	99KHz	±7.5%Fc	35db at .5Fc & 2Fc	1K	10K	1K	10K	11
K20D	100KHz	100MHz	±7.5%Fc	40db at .67Fc & 1.5Fc	50	300	50	300	11
K21B	1KHz	100KHz	±7.5%Fc	40db at .6Fc & 1.67Fc	500	10K	500	10K	3
Q20	10KHz	99KHz	±7.5%Fc	40db at .7Fc & 1.4Fc	600	10K	600	10K	4 or 13
Q21	10KHz	99KHz	±7.5%Fc	60db at .75Fc & 1.3Fc	600	10K	600	10K	5 or 16
Q20A	100KHz	999KHz	±7.5%Fc	40db at .7Fc & 1.4Fc	50	1K	50	1K	13
Q21A	100KHz	999KHz	±7.5%Fc	60db at .75Fc & 1.3Fc	50	1K	50	1K	15
Q20B	1MHz	50MHz	±7.5%Fc	40db at .7Fc & 1.4Fc	50	75	50	75	12
Q21B	1MHz	50MHz	±7.5%Fc	60db at .75Fc & 1.3Fc	50	75	50	75	15
K30	100Hz	3.9KHz	±15%Fc	40db at .4Fc & 2.5Fc	500	10K	500	10K	4
K30C	150Hz	99KHz	±15%Fc	25db at .45Fc & 2.2Fc	1K	10K	1K	10K	11
K30D	100KHz	100MHz	±15%Fc	40db at .5Fc & 2Fc	50	300	50	300	11
K31B	1KHz	100KHz	±15%Fc	40db at .45Fc & 2.2Fc	500	10K	500	10K	3
Q30	10KHz	99KHz	±15%Fc	30db at .67Fc & 1.37Fc	600	10K	600	10K	4 or 13
Q31	10KHz	99KHz	±15%Fc	50db at .73Fc & 1.31Fc	600	10K	600	10K	5 or 16
Q30A	100KHz	999KHz	±15%Fc	30db at .67Fc & 1.37Fc	50	1K	50	1K	13
Q31A	100KHz	999KHz	±15%Fc	50db at .73Fc & 1.31Fc	50	1K	50	1K	15
Q30B	1MHz	50MHz	±15%Fc	30db at .67Fc & 1.37Fc	50	75	50	75	12
Q31B	1MHz	50MHz	±15%Fc	50db at .73Fc & 1.31Fc	50	75	50	75	15

The bandwidth for any of the above filters can be increased or decreased to specification.



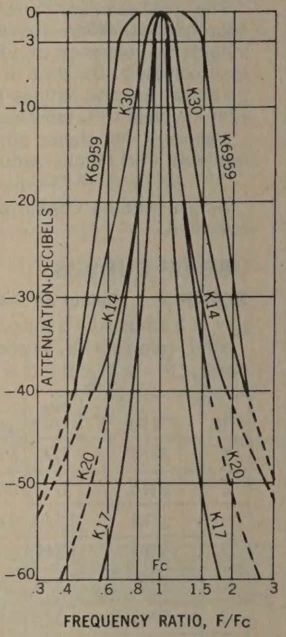
WIDE BAND FILTERS: Bandwidths of ±16% or greater can be obtained by ordering TTE standard High pass and Low pass filter sections as a composite network. Select numbers from the Series H and J listings on the next page which give the desired attenuation slopes and combine these numbers. For example to obtain a slope of 40db at 0.65 of the lower frequency cut-off, F_{c1}, (High pass section) and 40db at 1.6 of the upper frequency cut-off, F_{c2}, (Low pass section) use H6959. **THE HIGH PASS SERIES NUMBER IS FIRST, FOLLOWED BY THE LOW PASS NUMBER.** Types with dissymmetrical attenuation slopes can be combined. Also specify the 3db down cut-off frequencies F_{c1} and F_{c2} and impedance. The price is the sum of the HP and LP section prices.

INSERTION LOSSES for bandpass types between equal terminations are from 0.5 to 6db depending upon bandwidth, frequency and size. K10 and K11 types have about 10db, and K12 types about 5db flat loss. **SPECIALS** are available for center frequencies from 10Hz upward and 40db to 3db bandwidth ratios as sharp as 1.2:1. **TO ORDER** Specials, also specify (5) bandwidth and (6) stop band attenuation required.

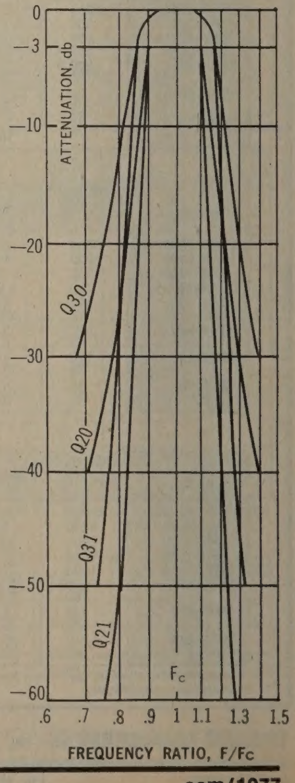
TO ORDER BANDPASS FILTERS — Specify (1) TTE Series No., (2) minus 3db frequencies, (3) source impedance, (4) load impedance. **PRICES $39 to $174.**

TELEMETERING: Refer to Series K20, K21B, K30, K31B, Q20, Q21, Q30 or Q31.
TO ORDER specify IRIG Channel number, source and load impedances.

TYPICAL RESPONSE CURVES
FOR TYPE K BANDPASS FILTERS



TYPICAL RESPONSE CURVES
FOR TYPE Q BANDPASS FILTERS



TT ELECTRONICS
2214 SO. BARRY AVE.
LOS ANGELES, CA 90064
(213) 478-8224

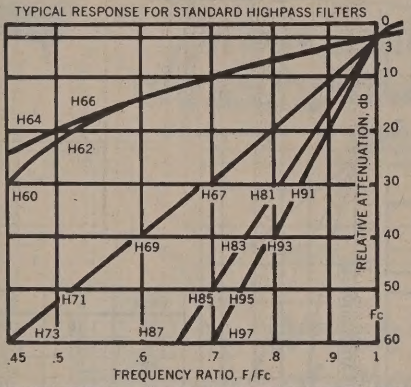
TTE *miniature* FILTERS

HIGH PASS

STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100MHz

Series	Min. Attn. db	Cut-off Ratio F/Fc
H60E	30	.45
H62E	40	.35
H64E	50	.25
H66E	60	.15
H67E	30	.70
H69E	40	.60
H71E	50	.52
H73E	60	.45
H81E	30	.81
H83E	40	.75
H85E	50	.70
H87E	60	.65
H91E	30	.85
H93E	40	.80
H95E	50	.75
H97E	60	.70

TYPICAL RESPONSE CURVE



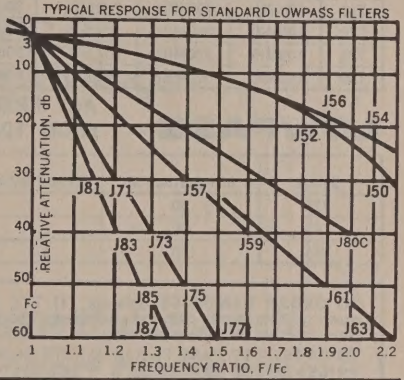
TO ORDER specify (1) TTE Series No., (2) minus 3db freq., (3) impedance. (4) Case No. **SPECIALS** are available for cut-off frequencies down to 40Hz and above 100MHz. **PRICES** $29 to $80.

LOW PASS

STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100MHz (*And from 10Hz to 74Hz)

Series	Min. Attn. db	Cut-off Ratio F/Fc
J50E	30	2.2
J52E	40	3.0
J54E	50	4.0
J56E	60	5.5
J57E	30	1.4
J59E	40	1.6
J61E	50	1.9
J63E	60	2.2
J71E	30	1.2
J73E	40	1.3
J75E	50	1.4
J77E	60	1.5
J81E	30	1.15
J83E	40	1.20
J85E	50	1.27
J87E	60	1.35
*J80E	40	2.0

TYPICAL RESPONSE CURVE



TO ORDER specify (1) TTE Series No., (2) minus 3db freq., (3) impedance. (4) Case No. **SPECIALS** are available for cut-off frequencies down to 3Hz and above 100MHz. **PRICES** $29 to $80.

CASE SIZES FOR HIGHPASS AND LOWPASS FILTERS

	STANDARD CHASSIS TYPE				FLAT PC BOARD TYPE							
Series No.	2	3	4	5	9	10	11	12	13	15	16	17
H60E-H66E J50E-J56E	500Hz to 100KHz	100Hz to 200KHz	75Hz to 100Hz		200Hz to 500Hz	500Hz to 100MHz						
H67E-H73E J57E-J63E	50KHz to 100KHz	1KHz to 50KHz	75Hz to 1KHz				2KHz to 100MHz	200Hz to 2KHz	100Hz to 200Hz			
H81E-H87E J71E-J77E		5KHz to 100KHz	1KHz to 5KHz	100Hz to 1KHz			2.5KHz to 100MHz	500Hz to 2.5KHz			200Hz to 500Hz	100Hz to 200Hz
H91E-H97E J81E-J87E		5KHz to 100KHz	1KHz to 5KHz	100Hz to 1KHz				2.5KHz to 100MHz		500Hz to 2.5KHz		200Hz to 500Hz
J80E				10Hz to 74Hz								

TT ELECTRONICS, INC.
Bandpass
12154Hz
1K/10K ohm
1969
TTE
TYPE
Bandpass
10K/10K ohms
30K
D1975
SER. NO.

SOURCE AND LOAD impedances are equal and resistive for standard HP and LP filters. The insertion loss is less than 015db for ±10% matching. Typical Passband flatness within ±0.2db.

SPECIALS for other impedance and unequal terminations are available. Units with cut-off ratios as sharp as 1.06 (0.94 Highpass) are available.

IMPEDANCE GUIDE — HIGH PASS AND LOW PASS TYPES

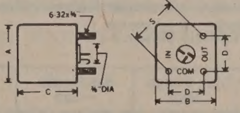
Fc −3db 10Hz 50Hz 100Hz 500Hz 5KHz 10KHz 100KHz 500KHz 1MHz 5MHz 100MHz

Z MIN	Ω	10K	10K	5K	1K	500	100	50	50	50	50
Z MAX	Ω	15K	39K	39K	39K	20K	3K	3K	1K	300	75

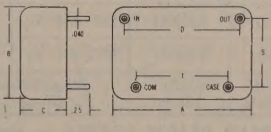
CASE DIMENSIONS & MOUNTING INFORMATION FOR ALL FILTERS

	STANDARD CHASSIS TYPE				FLAT PC BOARD TYPE								
Case	2	3	4	5	9	10	11	12	13	15	16	17	Case
A	1.19	1.31	1.63	1.94	1.27	1.27	1.88	2.0	2.0	2.96	2.96	2.96	A
B	1.19	1.31	1.63	1.81	1.27	1.27	1.44	2.0	2.0	1.93	1.93	1.93	B
C	1.25	1.75	2.38	2.44	1.0	.5	.5	.5	.75	.5	.75	1.25	C
D	.75	—	1.19	1.38/ 1.25	.9	.9	1.5	1.5	1.5	2.4	2.4	2.4	D
S	—	1.25	—	—	.9	.9	1.0	1.5	1.5	1.4	1.4	1.4	S
Mtg.	(4)	(2) 6-32 x ⅜" STUDS	(4)	(4)	.6	.6	1.0	1.0	1.0	2.0	2.0	2.0	T
					PRINTED CIRCUIT BOARD PINS								Mtg.

CHASSIS MOUNT TYPE



FLAT CASES PC BOARD TYPE



FROM 500KHz UPWARD FLAT CASE "COM" IS CONNECTED TO CASE.

BNC AND SMA CONNECTIONS ARE AVAILABLE

NOTES: TTE Filters are epoxy encased within hermetically sealed steel cases. The case finish is copper plate per MIL-C-14550 under fused tin per MIL-T-10727A. The maximum power output without de-tuning is 10 to 20 milliwatts for most low frequency types. K10 and K12 types are tested at 100mV and B83 types at .77V output for all imped. levels. Terminations are regarded as resistive unless otherwise specified.

TTE COVERS THE RANGE—
VLF-LF-MF-HF-VHF-UHF
LC — CRYSTAL — POWER NETWORKS

TT ELECTRONICS
INC. 2214 SO. BARRY AVE. / LOS ANGELES, CA 90064 / (213) 478-8224

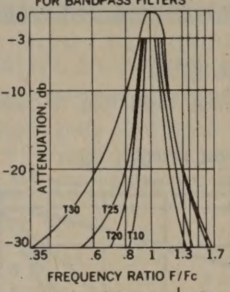
TTE *miniature* FILTERS

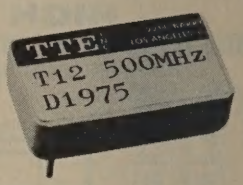
VHF-UHF

BANDPASS — ANY FREQUENCY FROM 100MHz TO 300MHz

Series	F_c Center Freq. Range Min.	Max.	Bandwidth @ 3db	Stopband Attenuation	Source & Load Ohms	Case No.
T10	100MHz	299MHz	±1% F_c	30db at .8F_c & 1.35F_c	50	36
T14	100MHz	299MHz	±2% F_c	30db at .79F_c & 1.36F_c	50	36
T20	100MHz	300MHz	±5% F_c	30db at .71F_c & 1.47F_c	50	33
T25	100MHz	300MHz	±7.5% F_c	30db at .45F_c & 1.62F_c	50	33
T30	100MHz	300MHz	±10% F_c	30db at .35F_c & 1.65F_c	50	33

TYPICAL RESPONSE CURVES FOR BANDPASS FILTERS

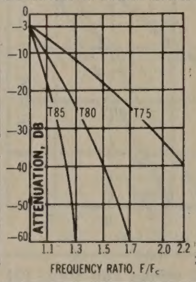


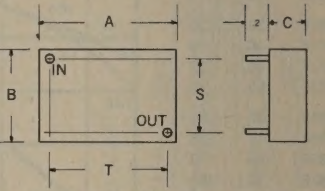


LOWPASS — ANY FREQUENCY FROM 10MHz TO 500MHz

Series	Attenuation, db	Cut-off Ratio	Source & Load Ohms	Case No.
T75	40	2.2	50	33
T80	60	1.7	50	42
T85	60	1.3	50	44

TYPICAL RESPONSE FOR STANDARD LOWPASS FILTERS





Case	A	B	C	S	T
33	1.16	.66	.38	.38	.8
36	1.6	1.0	.5	.65	1.3
42	2.2	.74	.38	.44	1.9
44	3.0	.75	.38	.44	2.7

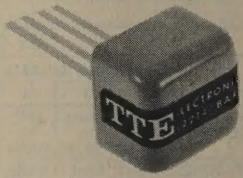
TO ORDER BANDPASS Specify (1) TTE Series Number, (2) Center Frequency, (3) Minus 3db frequencies. The approximate price is $59. Other Bandwidths may be specified.

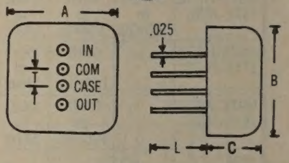
TO ORDER LOWPASS Specify (1) TTE Series Number, (2) Cutoff frequency. **PRICES** $47 to $110.

SUBMINIATURE

BANDPASS FILTERS FOR ANY FREQUENCY FROM 300Hz TO 10MHz

Series	F_c Center Freq. Range Min.	Max.	Bandwidth @ −3db Max.	Stopband Attenuation	Source Ohms Min.	Max.	Load Ohms Min.	Max.	Case No.
S10	300Hz	1KHz	±7.5% F_c	40db at .55F_c & 1.8F_c	10k	10k	10k	10k	31
S11	1KHz	5KHz	±7.5% F_c	40db at .55F_c & 1.8F_c	1k	10k	1k	10k	31
S12	5KHz	50KHz	±7.5% F_c	40db at .58F_c & 1.75F_c	1k	1k	1k	1k	30 or 31
S13A	50KHz	1MHz	±7.5% F_c	40db at .58F_c & 1.75F_c	500	1k	500	1k	30 or 31
S14A	1MHz	10MHz	±7.5% F_c	40db at .58F_c & 1.75F_c	50	500	50	500	31
S20	300Hz	1KHz	±15% F_c	40db at .4F_c & 2.5F_c	10k	10k	10k	10k	31
S21	1KHz	5KHz	±15% F_c	40db at .4F_c & 2.5F_c	1k	10k	1k	10k	31
S22A	5KHz	50KHz	±15% F_c	40db at .4F_c & 2.5F_c	1k	10k	1k	10k	30 or 31
S23A	50KHz	1MHz	±15% F_c	40db at .4F_c & 2.5F_c	500	1k	500	1k	30 or 31
S24	1MHz	10MHz	±15% F_c	40db at .4F_c & 2.5F_c	50	500	50	500	31





*LOWPASS FILTERS

Series	Min. Attn. db	Cut-off Ratio F/FC
S60	30	1.41
S61	40	1.67
S62	50	1.96
S63	60	2.45

*HIGHPASS FILTERS

Series	Min. Attn. db	Cut-off Ratio F/FC
S40	30	.7
S41	40	.59
S42	50	.51
S43	60	.4

*FOR FREQUENCIES FROM 5KHz TO 10MHz

TO ORDER BANDPASS Specify (1) TTE Series Number, (2) Center Frequency, (3) Source and load impedance. The approximate price is $74.

IMPEDANCE GUIDE: Standard impedances for HP and LP types are 1k to 10k (5 to 10KHz) 300 ohms to 1k (10 to 100KHz) 50 ohms to 1k (100 to 500KHz) 50 to 300 ohms (0.5 to 1MHz) 50 to 75 ohms (1MHz to 10MHz).

TO ORDER HP and LP specify (1) TT series number, (2) cut-off frequency, (3) source and load impedance. The approximate price is $63 each.

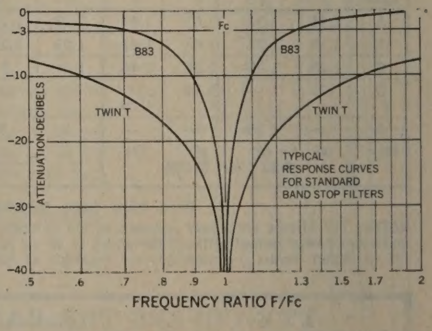
Case	A	B	C	T	L
30	.75	.75	.5	.1	1.0
31	1.19	1.19	.5	.2	1.0

PC PIN MOUNTING

BAND REJECT STANDARD FILTERS FOR ANY CENTER FREQUENCY FROM 10Hz TO 10MHz

Series	F_c, Center Freq. Range Min.	Max.	Bandwidth −3db	Attenuation	Impedance Ohms Min.	Max.	Circuit	Case No.
B83	10Hz	1MHz	.77F_c & 1.3F_c	50db Notch	50	1 Meg.	L-C	4
D	10Hz	100KHz	.25F_c & 4 F_c	50db Notch	SEE ORDERING INSTRUCTIONS BELOW		Twin-T	2
F	10Hz	100KHz	.25F_c & 4 F_c	60db Notch			Twin-T	2
R20 R30	100Hz 4KHz	3999Hz 10MHz	$BW_{3db}/BW_{40db} \leq 5$ For $BW_{40db} \geq 10\% F_c$		10K 50	50K 10K	L-C L-C	4 or 13 4 or 13

TO ORDER BAND REJECT FILTERS — Specify (1) TTE Series No. or Letter, (2) center frequency, (3) source impedance, (4) load impedance. For Series R20 and R30 specify 40db bandwidth. Twin-T prices and cases apply to all filters using capacitor values from 0.1 MFD to 500 pF. $C = 1/8.85FHz\ (R_{source}R_{load})^{1/2}$. C is in farads. Filters with null frequencies as low as 1Hz are available. Terminations are regarded as resistive unless otherwise specified. **PRICES** $19 to $64.



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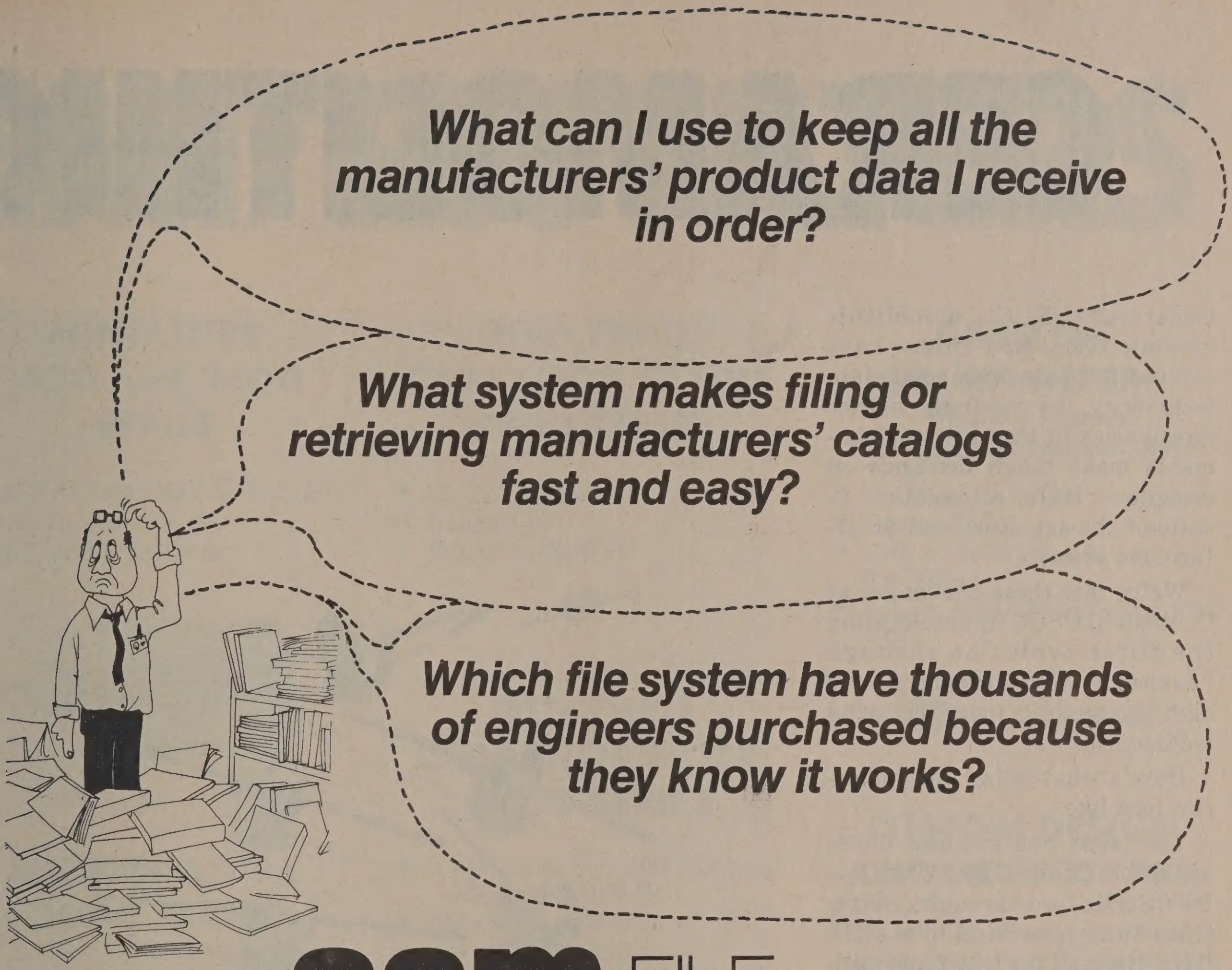
What can I use to keep all the manufacturers' product data I receive in order?
What system makes filing or retrieving manufacturers' catalogs fast and easy?
Which file system have thousands of engineers purchased because they know it works?

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THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

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Here's how to order your eem FILE SYSTEM:

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645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

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CERAMOLITHIC®

Centralab/USCC's monolithic ceramic EMI/RFI filters have evolved in phase with solid state technology. Increasingly higher frequencies in tiny LSI environments make tough demands on designers: better attenuation, in state-of-the-art sizes and at affordable prices.

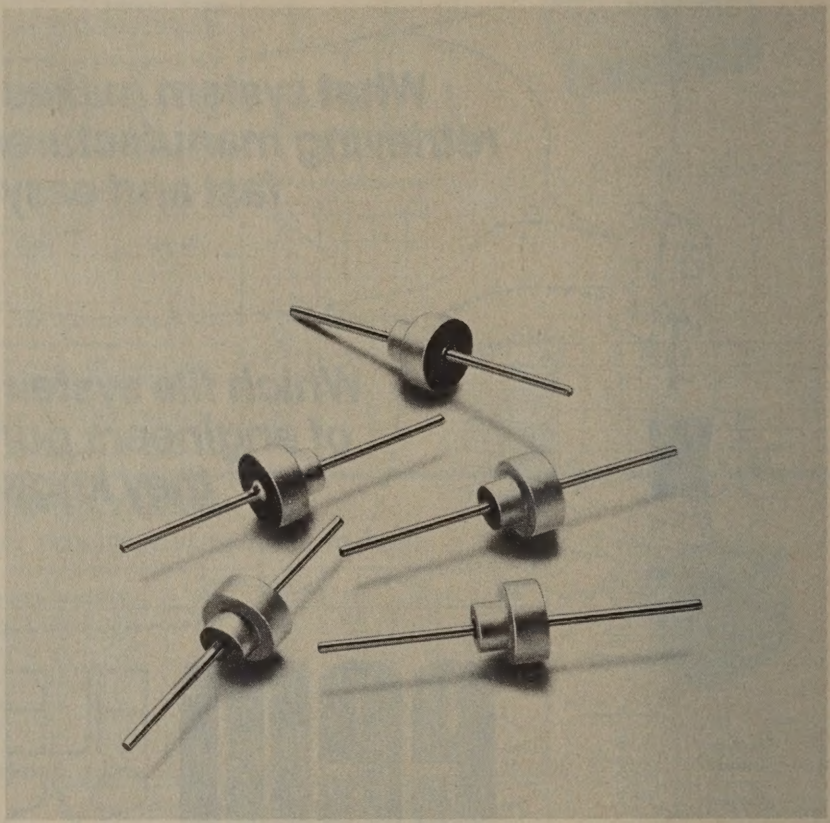
We've met these challenges at Centralab/USCC by accelerating the filter evolution through research in dielectrics and high-productivity manufacturing techniques.

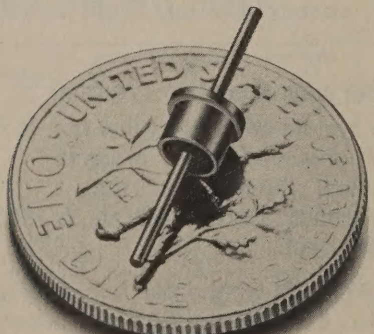
Here's what today and tomorrow look like.

The latest and smallest filters available from CRL/USCC — 9900 Series feed-throughs. Better than 70db insertion loss at 10 GHz. Used all the way from medical electronics to CATV.

MIL-STD-461 filters — the smallest ever offered for this use. For any relatively low source and load impedance job, the highest insertion loss at low frequencies.

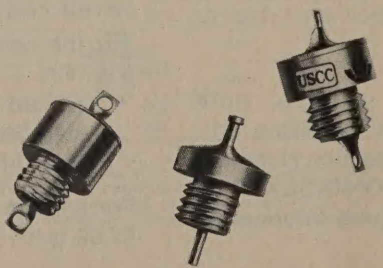
Also tomorrow's filters today— CASELESS. CRL/USCC now offers another step in CERAMOLITHIC® technology — a dielectric that serves as its own outer case — with obvious economics.





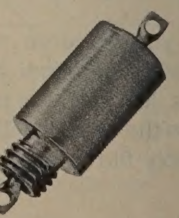
"BUTTON" SERIES

- Epoxy or hermetically sealed;
- 50, 100, 200, 300 VDC and 115 VAC 0-400 Hz;
- 15 amps DC; L section
- .187″ or .312″ thread lengths



MINIATURE 1000 and 2000 SERIES

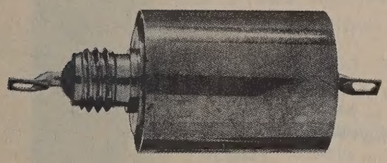
- 50, 100, 200, 300 VDC and 115 VAC 0-400 Hz;
- .06 to 10 amps DC; Pi, L and T sections;
- .187″ or .312″ thread lengths



EMI/RFI FILTERS

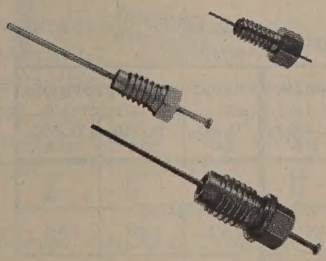
MINIATURE 1400 and 2400 SERIES

- 125 VAC and 230 VAC 0-40 Hz;
- .1 to 10 amps DC;
- Pi, L and T sections



SUBMINIATURE 3000 SERIES

- 3112: 100 VDC; 10 amps; L section
- 3223: 200 VDC; 10 amps; Pi section
- 3300: 50, 100 and 200 VDC; 10 amps;
- Pi and Multi-sections
- 3500: 100, 200 and 500 VDC; 25 amps; Pi section

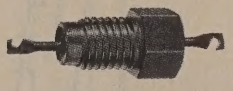


FEED-THRU CAPACITOR FILTERS 9900 SERIES

- 50, 100, 200 WVDC
- 10 amps DC
- 100 pF to 5000 pF

FEED-THRU CAPACITOR FILTER 9000 SERIES

- 50, 100, 200, 300, 500 VDC and 115 VAC 0-400 Hz;
- 10 and 25 amps DC;
- 100 pF to 1.5 Mfd.



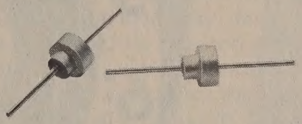
MIL-STD-461 FILTER MIL-F-15733*

- Designed for MIL-STD-461 applications;
- 50, 100, 300 VDC and 115 VAC 0-400 Hz;
- .1 to 10 amps DC;
- 5 element inductor fed.

CASELESS EMI/RFI FILTERS

UF and US Series Feed-Thru and Standoff Styles

- 50, 100, 200 WVDC
- 5 amps DC
- 1000 to 5000 pF; 0.01 to 0.05 Mfd.
- Square lead available for wire wrap.



CUSTOM DESIGN AND PROTOTYPES.

CRL/USCC offers you complete custom design assistance for non-standard filters, including prototype manufacturing and testing services. Call (213) 240-4880 for applications engineering support, or write for your EMI/RFI filters catalog.

*Under qualification.

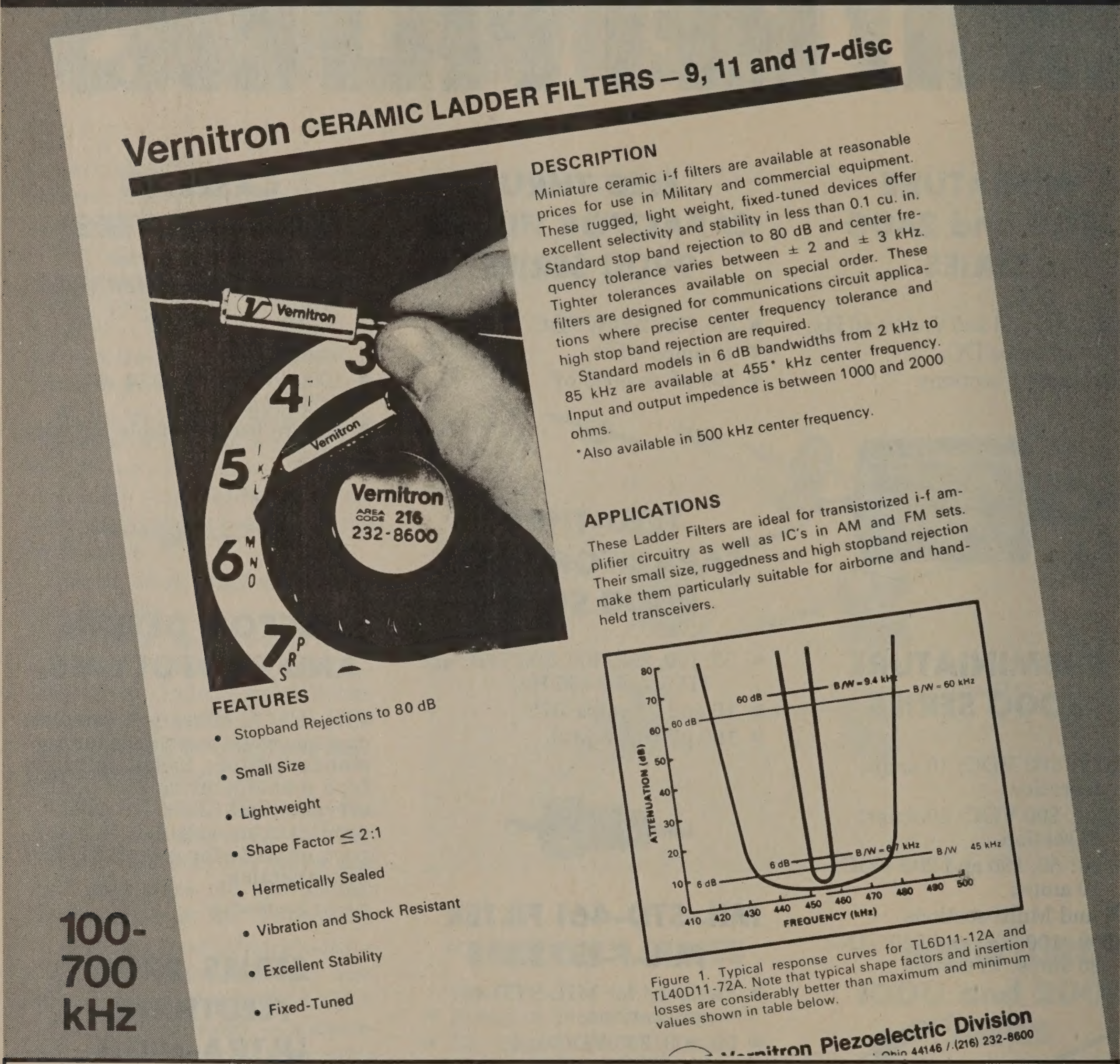
SERIES 2700 FEEDTHRU/ ULTRA-HIGH RELIABILITY FILTER

The Series 2700 Feedthru/ultra-high reliability filter is a totally new concept in filtering, offering almost unlimited reliability where maintenance-free systems are mandatory. This new concept is based on utilizing a redundant capacitor system by using two capacitors in series, so that a failed capacitor results in improved filtering.

CENTRALAB / USCC Electronics • GLOBE-UNION INC.
4561 Colorado Boulevard • Los Angeles, Ca. 90039 • (213) 240-4880

*Under qualification.

from **Vernitron** (the ceramic filters people)



Vernitron CERAMIC LADDER FILTERS — 9, 11 and 17-disc

DESCRIPTION

Miniature ceramic i-f filters are available at reasonable prices for use in Military and commercial equipment. These rugged, light weight, fixed-tuned devices offer excellent selectivity and stability in less than 0.1 cu. in. Standard stop band rejection to 80 dB and center frequency tolerance varies between ± 2 and ± 3 kHz. Tighter tolerances available on special order. These filters are designed for communications circuit applications where precise center frequency tolerance and high stop band rejection are required.

Standard models in 6 dB bandwidths from 2 kHz to 85 kHz are available at 455* kHz center frequency. Input and output impedence is between 1000 and 2000 ohms.

*Also available in 500 kHz center frequency.

APPLICATIONS

These Ladder Filters are ideal for transistorized i-f amplifier circuitry as well as IC's in AM and FM sets. Their small size, ruggedness and high stopband rejection make them particularly suitable for airborne and hand-held transceivers.

FEATURES

- Stopband Rejections to 80 dB
- Small Size
- Lightweight
- Shape Factor ≤ 2:1
- Hermetically Sealed
- Vibration and Shock Resistant
- Excellent Stability
- Fixed-Tuned

Figure 1. Typical response curves for TL6D11-12A and TL40D11-72A. Note that typical shape factors and insertion losses are considerably better than maximum and minimum values shown in table below.

Vernitron
3
4
5 J K L
6 M N O
7 P R S
Vernitron
AREA CODE 216
232-8600
80
70
60
50
40
30
20
10
0
ATTENUATION (dB)
60 dB
B/W = 9.4 kHz
B/W = 60 kHz
60 dB
6 dB
B/W = 6.7 kHz
B/W 45 kHz
6 dB
410
420
430
440
450
460
470
480
490
500
FREQUENCY (kHz)
Vernitron Piezoelectric Division
Ohio 44146 / (216) 232-8600

100-700 kHz

GENERAL SPECIFICATIONS

Center Frequency 455 or 500 kHz (capability from 100-700 kHz)

Stopband Rejection 9-disc — 50 dB; 11-disc — 60 dB; 17-disc — 80 dB

Stability +0.2%/5 yrs; within ±0.2%/ —40° to +85° C.

Ripple Bandwidth Dependent, 1 to 3dB

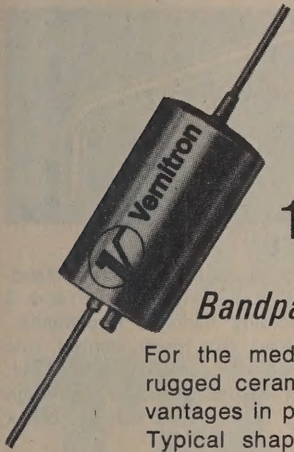
Operating Range —40° to +85° C.

Environmental Meets MIL Std. 202B

	9-DISC — 50 dB STOPBAND			11-DISC — 60 dB STOPBAND			17-DISC — 80 dB STOPBAND		
TYPICAL MODELS	TL-10D9 20A	TL-16D9 32A	TL-20D9 38A	TL-6D11 12A	TL-16D11 32A	TL-30D11 57A	TL-2D 5A	TL-16D 25A	TL-30D 45A
BANDWIDTH/6dB @27°C /60dB	10 20	16 32	20 38	6 12	16 32	30 57	5 5	16 25	30 45
SHAPE FACTOR	2.0:1	2.0:1	1.9:1	2.0:1	2.0:1	1.9:1	2.5:1	1.6:1	1.5:1
INSERTION LOSS (dB)	4	5	5	6	5	5	10	5	5
IN/OUT IMPEDANCE (OHMS)	2000	1000	1000	2000	1000	1000	2500	1500	1200

Vernitron Piezoelectric Division
232 Forbes Road / Bedford, Ohio 44146 / (216) 232-8600

from **Vernitron** (the ceramic filters people)



LADDER FILTERS

Series LTL

100 to 270 kHz

Bandpass capabilities 1 to 10%

For the medium-frequency range, these rugged ceramic bandpass filters offer advantages in price and size over LC filters. Typical shape factors of 2.0 to 1 are achieved in this unique ladder design.

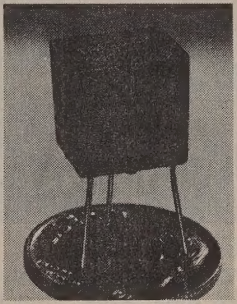
Ideal for navigation and instrumentation applications.

Any Operating Frequency Between 100 kHz and 270 kHz.

SEND FOR BULLETIN 94043

Ceramic Filter
VTL 455A

455 kHz



LOW-COST MINIATURES

For today's compact COMM receivers

VTL Ladder Filters

For OEM or service replacement without board modification in transceivers, receivers, pagers or scanners. Stopband to 60 db. No transformer required. Encapsulated. Mates with IC circuitry.

BULLETIN 94042

TAF Series

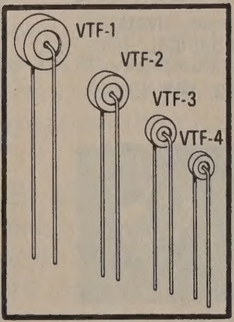
Compact, encapsulated 3-resonator filter gives close to 50 db rejection and greatest design flexibility. Designed for volume assembly, flow-soldering. IC compatible.

BULLETIN 94039

RESONATORS FOR OSCILLATOR CONTROL

Series VTF

175 to 600 kHz



Series VTF-1/175-249 kHz

Series VTF-2/250-346 kHz

Series VTF-3/347-435 kHz

Series VTF-4/436-600 kHz

Applications: Digital clock generators, oscillator elements, frequency-selective bypass elements, coupling elements, bandpass filters, notch filters, data transmission.

GENERAL SPECIFICATIONS

Resonant Frequency Tolerance	1.0% to 2.0% dependent on frequency
Temperature Stability	0.2% of resonant frequency
Operating Range	—20°C to +60°C.
Resonant Impedance	Less than 20 ohms

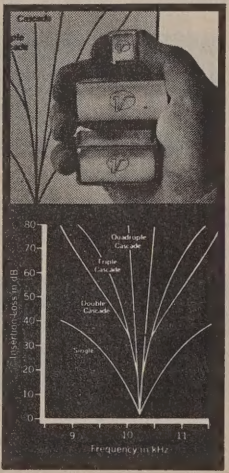
SEND FOR BULLETIN 94044

f_o–7.5 to 50 kHz

Designed for Omega Applications

LOW FREQUENCY FILTERS (LF)

Single Resonator
2, 3 or 4 Resonator
Cascades



High-performance miniature for LF communications or Omega systems—featuring selection of any f_o from 7.5 to 50 kHz. Single-resonator units have rejection to greater than 40 dB; cascaded units to above 90 dB. Standard Omega models at 10.2, 11.33 and 13.0 kHz, available in commercial or hermetically-sealed militarized versions.

FEATURES

- **Any f_o Between 7.5 and 50 kHz**
- **Phase Stability <1.5° Over 60 dB Range**
- **Temp. Stability Within 0.2%**
- **Low Insertion Loss**
- **Passive—No External Power Req'd**
- **Fixed-tuned**

APPLICATIONS

Low frequency receivers, specifically Omega series; selective calling, underwater sound, command-destruct; air or maritime navigation receivers.

Write for Data Sheet 94037

Vernitron Piezoelectric Division
232 Forbes Road / Bedford, Ohio 44146 / (216) 232-8600

AMATOM ELECTRONIC HARDWARE

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Manufacturer of Standard Hardware for the Electric and Electronic Industries

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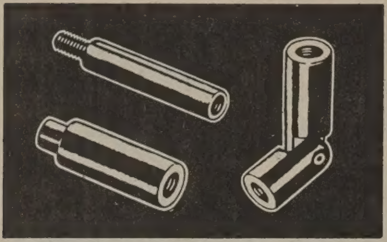
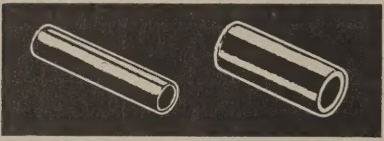


STANDOFFS

POST TYPE: Brass, Aluminum, Stainless Steel, Nylon, Phenolic, Tenite. 1/8 through 5/8 round, hex, square. **SWAGE TYPE:** Brass, Aluminum, Stainless Steel. 1/8 through 3/8 round or hex. Lengths: 1/8 through 2". **MALE–FEMALE:** Brass, Aluminum, Stainless Steel, Nylon. 3/16 through 3/8 round or hex. Lengths: 1/4 through 6". **HINGED:** Brass, Aluminum, Stainless Steel. 3/16 through 3/8 round. Lengths: 3/4 through 2".

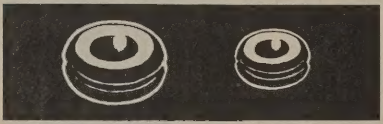


SPACERS

Brass, Aluminum, Stainless Steel, Nylon, Phenolic, Tenite. 1/8 through 1/2 OD; various ID. Lengths: up to 2".

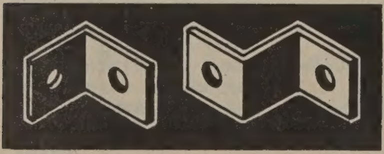
BUMPERS

Available types: machine screw, wood screw, knurled drive, recess and adhesive backed.



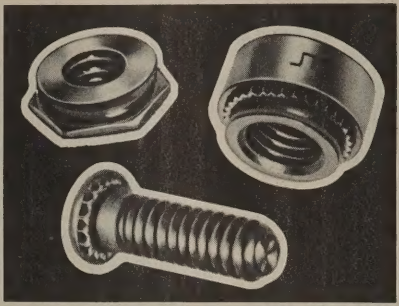
GROMMETS

Available in AN-MS and standard commercial line. 11/32 through 1-5/8 OD, 1/8 through 7/8 ID.



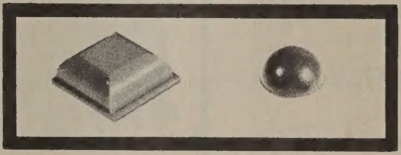
BRACKETS

"L" and "Z" brackets available with various combinations of holes – tapped or untapped.



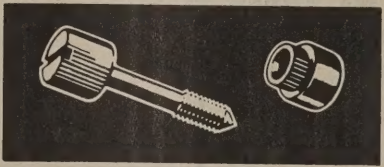
SELF CLINCH FASTENERS

■ Provide strong, load bearing threads in light gauge metal ■ Resist push out, pull out and torque out ■ Fast, easy, economical assembly with any standard mechanical, hydraulic or pneumatic press ■ In most popular sizes from 2-56 up ■



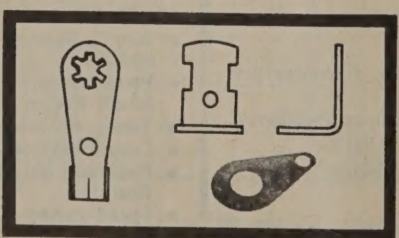
ADHESIVE BACKED POLYURETHANE BUMPERS

No costly screws, rivets or time-consuming mechanical fastener operation. Just "bump-it-on." High tack adhesive grabs immediately.



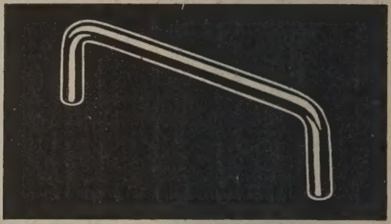
CAPTIVE PANEL HARDWARE

SCREWS: Brass and Stainless Steel. 7 types available with head diameters 1/8 through 3/4. Lengths: 1/4 through 2". Threads: 4-40 through 5/16-18. **RETAINERS:** Brass and Stainless Steel. 7 types available,



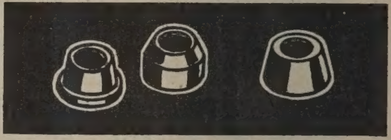
SOLDER LUGS

Wide variety of lugs, terminals, wire clips, brackets, jumpers etc.



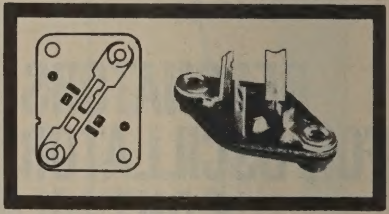
HANDLES

29 different styles available from standard round bow handles to 2 and 3 position folding handles. Rectangular, oval, extruded, tape insert, slanted, zinc die cast, circuit board, offset etc. External or internal threads. 1/8 through 3/8 round, 7/16 x 9/32 through 5/8 x 3/8 oval.



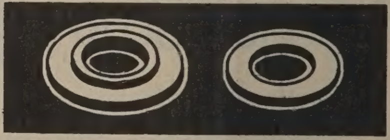
FERRULES

5 different styles available for 1/8 to 1/2 diameter handles in brass, aluminum and stainless steel.



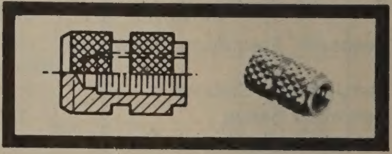
TRANSISTOR SOCKETS

Phenolic or Nylon sockets for TO-3 and TO-66 cases.



INSULATING WASHERS

Flat washers, Shoulder washers: Fibre, Nylon, Phenolic, Teflon, Tenite etc.



INSERTS

Brass or Stainless Steel inserts designed to provide metal threads in plastic materials. Available as a standard part in two lengths.

Full Line Catalog Available on Request

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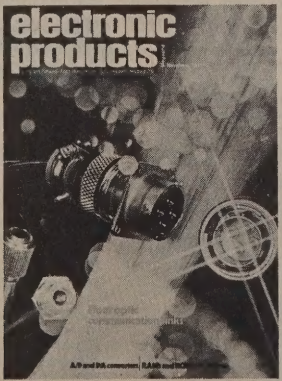

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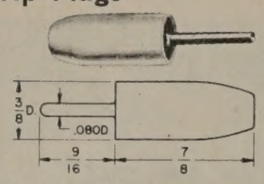
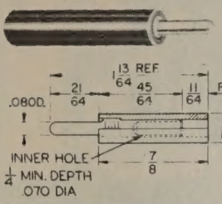
JOHNSON®

E. F. JOHNSON COMPANY, WASECA, MINNESOTA 56093

Hardware

Tip Plugs





Solderless Tip Plug

Completely insulated, molded sleeve. Recessed metal head prevents exposure of metal surfaces when engaged in any standard tip jack. All metal parts are nickel-plated brass. Designed for solderless connection of up to 16 gauge stranded wire. Fits all stand. tip jacks. Cur. Rating: 10A.

Cat. No. 105-0300-001

(See color chart under Tip Jacks)

Sub-miniature Tip Plug

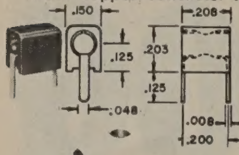
For use with miniature jack, .080″ dia. tip. Nickel-plated machined brass body, solder type lead connection.

Cat. No. 105-0770-001

(See color chart under Tip Jacks)

Printed Circuit Connectors

The sub-miniature Tip Jacks and Tip Plugs described below are rated at 5 amps maximum current capacity. Operating voltage is 1500 volts RMS at sea-level and 330 volts RMS at 50,000 feet. Contact resistance is less than 2 milliohms; capacitance between two adjacent jacks less than one pF at 1 MHz. Body material is made of tough, low-loss polyamide per MIL-M-20693A; able to stand extremely hard usage. Tip Plugs have a one-piece machined contact. Jacks equipped with beryllium copper contacts. Jack contacts and terminals are silver-plated.

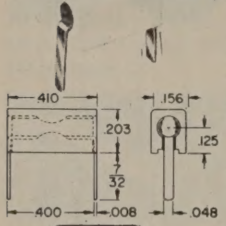


New Horizontal Jack

New design accepts 0.080″ diameter tip plug in either end. Silver-plated and Iridited beryllium-copper formed contacts. Two terminals. Approx. one-half size of standard Tip Jack.

Cat. No. 105-1100-001

(See color chart under Tip Jacks)



Horizontal Jack

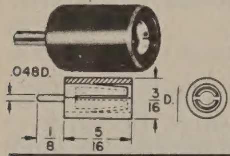
(U.S. Patent No. 3,208,027)

Unique design accepts .080″ diameter tip plug in either end, or from top or bottom! Silver-plated beryllium copper formed contact. Two terminals.

Note: Available as a special in production quantities without cross hole.

Cat. No. 105-0750-001

(See color chart under Tip Jacks)



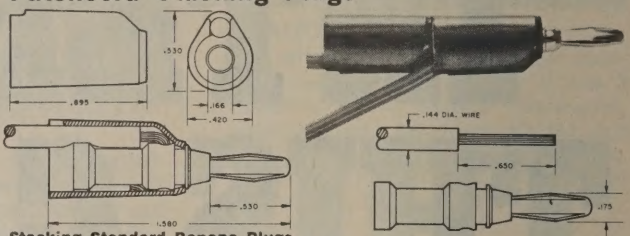
Vertical Jack

Mounts through single .052″ hole, requires minimum mounting area. Silver-plated, machined beryllium copper contact.

Cat. No. 105-0850-001

(See color chart under Tip Jacks)

Patchcord Stacking Plugs

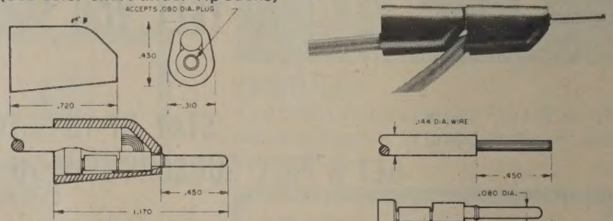


Stacking Standard Banana Plugs

Current Rating: 15 amps. Assembly with special tool and fixture is recommended. 6 colors.

Cat. No. 108-1080-001

(See color chart under Tip Jacks)



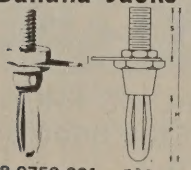
Stacking .080″ Standard Tip Plugs

Current Rating: 10 amps.

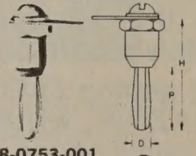
Cat. No. 105-1200-001 (See color chart under Tip Jacks)

Engineering Kits available containing material to assemble 30 patchcords in six colors from E. F. Johnson Company.

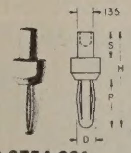
Banana Jacks and Plugs



108-0750-001 A



108-0753-001 B



108-0754-001 C

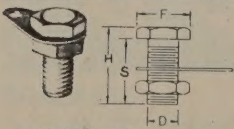
Standard Banana Plugs

This group of standard banana plugs has accurately machined brass studs which extend the full length of the plugs, providing extra strength. Springs are nickel-silver — highly resistant to corrosion. Bodies and hardware .0001 nickel-plated. All banana plugs listed below are available with beryllium copper springs and nickel, cadmium, or silver plating, when desired. A wide selection of miniature solder-type plugs is also available on special order — however, quantities in special platings or plugs should be sufficiently large for economical production runs. Solder terminal and nut or screw furnished.

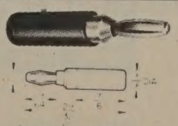
Cat. No.	Dwg.	S	P	D	H	Thread
108-0750-001	A	3/8″	17/32″	.175″	1 1/8″	6-32
108-0750-002	A	3/4″	17/32″	.175″	1 1/2″	6-32
108-0753-001	B	—	17/32″	.175″	15/16″	6-32

This banana plug is similar to standard types listed above, except it is designed for riveting. Springs are beryllium copper, cadmium-plated.

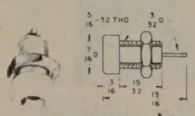
Cat. No.	Dwg.	S	P	D	H	Thread
108-0754-001	C	7/32″	13/32″	.155″	13/16″	—



108-0740-001



108-1000-001



108-0900-001

Miniature Banana Plugs

Extremely small insulated banana plugs with precision machined phosphor bronze body, nickel-plated. One-piece springs are beryllium copper, nickel-plated, .120″ dia. Polyamide sleeve. Current Rating: 5 amps.

Cat. No. 108-1000-001 (6 colors — see chart)

Standard Banana Jacks

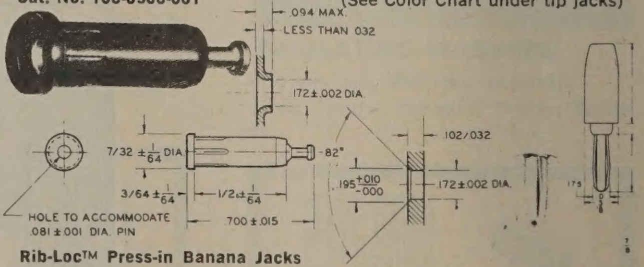
High quality, machined brass banana jack. Nickel-plated. Furnished complete with solder terminal and nut.

Cat. No.	F	D	S	H	Hole Dia.	Thread
108-0740-001	3/8″	1/4″	17/32″	5/8″	.166″	1/4″-28

Banana Jack

Completely insulated molded body with cadmium-plated insert. Accommodates banana plugs of nominal .175″ diameter. Voltage Breakdown: 10,000 volts DC. Capacity to 1/16″ Panel: 2.4 mmf nominal. Mounts in 21/64″ diameter circular, "D," or double flat hole (1/4″ across flats). Single nut furnished for mounting — no other mounting hardware needed.

Cat. No. 108-0900-001 (See Color Chart under tip jacks)



Rib-Loc™ Press-in Banana Jacks

Johnson Rib-Loc design permits substantial production line savings—no mounting hardware to handle and assemble. Rib-Loc banana jacks install by pressing into proper size chassis hole. Accept .120″ tip plug in recessed contact. Silver-plated brass contact. Brass solder terminal silver-plated and Iridited for good solderability. Insulating body molded of low-loss polyamide. Current Rating: 10 amps. Peak Withstanding Voltage: 5,000 volts. Capacity to 1/8″ Panel: 1.5 pf nominal.

Cat. No. 108-1100-001 (6 colors — see chart)

Solderless Banana Plugs

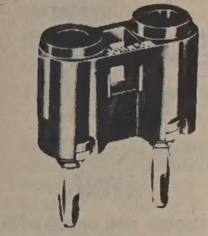
Compact, high voltage insulated plug for a wide variety of applications. Designed for fast, solderless connection of up to 16 gauge stranded wire. Body and pin are constructed of one-piece, nickel-plated brass with high grade nickel-silver springs. Sleeve is molded. Cur. Rating: 15A.

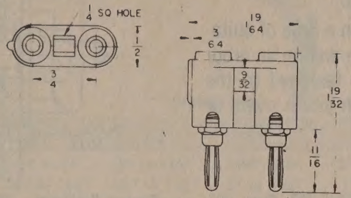
Cat. No. 108-0300-001 (See Color Chart under tip jacks)

JOHNSON®

E. F. JOHNSON COMPANY, WASECA, MINNESOTA 56093

Hardware

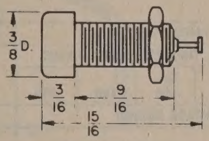




Dual Banana Plugs

Extremely versatile dual banana plug for solderless connection. Molded body incorporates polarity indication and strain relief hole for wire leads. Springs are high quality nickel-silver — bodies are nickel plated. Accurately machined brass studs extend full length of pins for extra strength. Voltage Breakdown: 10,000 volts DC. Capacity Plug to Plug: 1.3 pf. Current Rating: 15 amps.

Cat. No. 108-0200-001 (solderless) (See color chart under tip jacks)

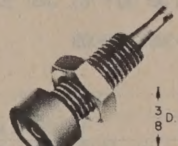


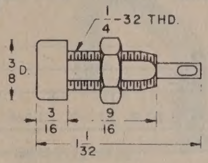
Deluxe Tip Jack

(U.S. Patent No. 2,704,357)

Molded body with recessed closed entry design contact. Silver-plated beryllium copper contact spring. Brass solder terminal is hot tin dipped. Current Rating: 10 amps. Voltage Breakdown: 11,000 VDC. Capacity to ⅛″ Panel: 2.0 pf. ¼″-32 nut furnished.

Cat. No. 105-0600-001
(See color chart below)

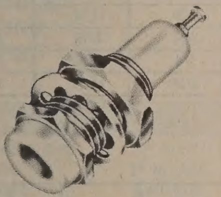


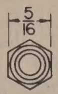


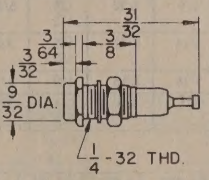
Standard Tip Jack

Molded body with recessed, cadmium-plated formed phosphor bronze contact. Current Rating: 10 amps. Voltage Breakdown: 9,000 volts DC. Capacity to ⅛″ Panels: 2.0 mmf. ¼″-32 nut furnished.

Cat. No. 105-0800-001
(See color chart below)





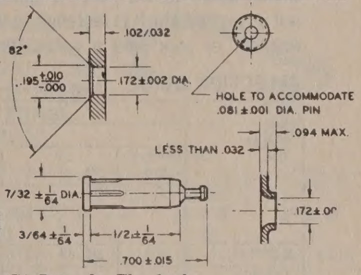


Metal-Clad Tip Jacks — Military

High reliability tip jack for military use or demanding industrial applications. Highest quality materials — withstand severe environmental temperature, vibration and salt spray conditions. Complies with MIL-C-39024/10. Closed entry contact design prohibits entry of tip plug .085″ or larger — prevents accidental contact damage by careless probe insertion. Heavy nickel-plated brass jacket. Gold-plated beryllium copper contact spring greatly exceeds minimum insertion/withdrawal cycle requirements. Current Rating: 5 amps. Voltage Breakdown: 8,000 volts DC. Capacity to ⅛″ Panel: 3.8 pf. ¼″-32 nut and lock washer furnished. Terminal Style: "A" (Terminal Style "C" available on special order in production quantities.) Brass solder term. in gold-plated.

Cat. No. 105-0200-200

Mil. Std. No.		E.F. Johnson No.
MIL-C-39024/10-01	White	105-0201-200
MIL-C-39024/10-02	Red	105-0202-200
MIL-C-39024/10-03	Black	105-0203-200
MIL-C-39024/10-04	Brown	105-0208-200
MIL-C-39024/10-05	Green	105-0204-200
MIL-C-39024/10-06	Orange	105-0206-200
MIL-C-39024/10-07	Blue	105-0210-200
MIL-C-39024/10-08	Yellow	105-0207-200
MIL-C-39024/10-09	Gray	105-0213-200
MIL-C-39024/10-10	Violet	105-0212-200



Rib-Loc™ Press-in Tip Jacks

Johnson Rib-Loc design permits substantial production line savings — no mounting hardware to handle and assemble. Rib-Loc tip jacks install by pressing into proper size chassis hole. Accept .080″ tip plug in recessed, closed-entry type contact that rejects plugs .085″ or larger to prevent accidental contact damage. Silver-plated beryllium copper contact spring. Brass solder terminal silver-plated and iridited for good solderability. Insulating body molded of low-loss polyamide. Current Rating: 10 amps. Voltage Breakdown: 5,000 volts DC. Capacity to ⅛″ Panel: 1.4 pf nominal.

Cat. No. 105-1040-001
(See color chart below)

Color Chart

NOTE: Connectors, unless otherwise specified, are available in 6 molded colors to Federal Standard 595. Other colors listed are available as specials. Catalog number for color desired is determined by adding color numbers on chart below to 6th and 7th digits of catalog number listed for series. EXAMPLE: 105-0800-001 in Violet, add color number for Violet (12) to 6th and 7th digits of series number, and order 105-0812-001. To order 105-1040-001 in Violet, add 12 to 6th and 7th digits of series number and order 105-1052-001.

Color	No.	Color	No.
White*	01	Yellow*	07
Red*	02	Brown	08
Black*	03	Blue*	10
Green*	04	Violet	12
Orange	06	Grey	13

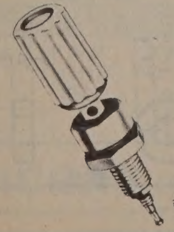
*Indicates colors available from stock. Other colors listed are, for some items, available as specials.

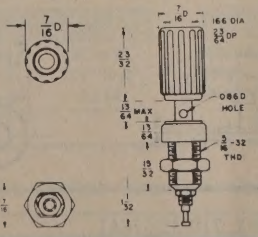
Binding Posts

Compact, insulated, pre-assembled binding posts with molded body and silver-plated shank. Fluted thumb nut self-captivated. Connection made at solder stud, or lug may be slipped over threaded portion and secured with a nut. Single tip plug fits hole in top of miniature binding post; banana plug accepted by two larger binding posts. Insulation resistance greater than 200 meg. after MIL-T-5422B humidity test. (U.S. Patent No. 2,806,999.)

New miniature binding post designed for compact test equipment applications. Rated at 15 amps thumb nut to terminal, 5 amps tip jack to terminal. Voltage Breakdown: 5,000 volts DC. Capacitance to ⅛″ panel; 3 pf. Mounts in ¹⁷⁄₆₄″ diameter circular hole; "D" or double flat hole — .219″ across flats. Equipped with single ¼″-32 nut for fast mounting — no time-consuming spacers or mounting hardware required. No. 111-0200 accepts .080″ dia. pin probe. No. 111-0400 accepts .120″ dia. banana plug. Avail. in 6 Colors: white, red, black, green, yellow, blue.

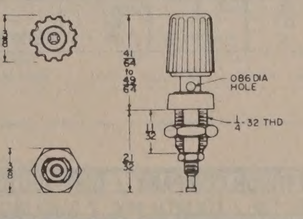
Cat. No. 111-0200-001 **Cat. No. 111-0400-001**





Rated at 15 amps. Current carrying capacity. Voltage Breakdown: 8,000 volts DC. Capacitance to ⅛″ panel: 3.3 pf. Mounts in ²³⁄₆₄″ diameter circular hole; "D" or double flat hole — ¼″ across flats. Single ⁵⁄₁₆″-32 mounting nut furnished — no other hardware required.

Cat. No. 111-0100-001 (10 colors available — see color chart)



RAYTHEON CAPTIVE HARDWARE

See other Raytheon Products in EEM

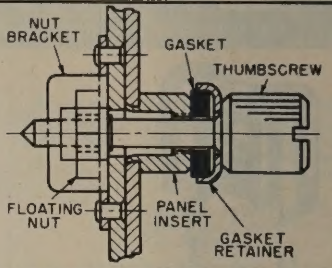
Opto-electronics—Section 3700
Switches—Section 5100
Knobs—Section 2400
Test Jacks—Section 2100

CAPTIVE HARDWARE

Raytheon captive hardware was designed to fill the need for a standard line of stainless steel fastening hardware which would meet government specifications. MIL-E-16400 (ships) and when painted or dull—MIL-E-5400 and MIL-P-11268 (sig C).

Available in a variety of sizes to handle almost any requirement, the complete captive assembly consists of a slotted-head thumb screw, an insert bushing for securing the thumb screw to the panel, a captive floating nut assembly which is fastened to the chassis member or rack, and a gasket retainer and rubber gasket for use when a dust proof, splash proof seal is required.

The panel insert is secured in a hole of suitable dimensions by flaring the end on an arbor press. The nut assembly is fastened to the chassis member or rack with either rivets or mounting hardware.



MATERIALS

Screw—303 stainless steel per QQ-S-763, Class 303, Cond. A passivated per MIL-F-14072
Insert—302 stainless steel per QQ-S-763, Class 302, Cond. A
Gasket—Rubber per MIL-R-3065, RN500B
Gasket Retainfer—302 stainless steel per QQ-S-766, Class 302
Nut Bracket Assembly—Cold rolled steel bracket per QQ-S-692, MIL-B-12128A. Cadmium plated per QQ-P-416, Type II, Class I with iridescent chromate film.

SELECTION GUIDE (Select thread size and read across)

THREAD SIZE	CAPTIVE SCREW										PANEL INSERT					NUT/RETAINER/GASKET		
	SCREW LENGTH, INCHES										NOMINAL MATL. THICKNESS RANGE, INCHES							
	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	2	.048-.072	.074-.109	.119-.156	.188	.250			
	CATALOG NUMBER										CATALOG NUMBER					CATALOG NUMBER		
	PREFIX CS—										PREFIX PIN—					NUT ASSY	RETAINER	GASKET
8-32NC-2	100	101	102	103							100	101	102	103		NB100	GSR118	GS103
10-24NC-2 10-32NF-2		120	111 121	112 122							110 120	111 121	112 122	113 123	114 124	NB101 NB102	GSR115	GS100
1/4-20NC-2			130	131	132	133	134	135			130	131	132	133	134	NB103	GSR116	GS101
5/16-18NC-2								142	143	144	140	141	142	143	144	NB104	GSR117	GS102

DIMENSIONAL DATA

CAPTIVE SCREW

Catalog No. CS—	Thread Size	A	B	C	D	E	F	G NOM	KNURL PITCH
100/103	8-32NC	5/16	3/64	5/64	1/4	3/32	.125 .115	5/16	40
110/112 120/122	10-24NC-2 10-32NF-2	7/16	1/16	3/32	1/14	5/32	.135 .125	3/8	30
130/136	1/4-20NC-2	9/16	5/64	3/32	5/16	3/16	.180	1/2	30
140/144	5/16-18NC-2	11/16	3/32	1/8	3/8	1/4	.235 .225	5/8	20

GASKET

CATALOG NUMBER	A ±1/32	B ±1/32	C ±1/32
GS103	5/32	11/32	1/8
GS100	3/16	7/16	3/16
GS101	1/4	9/16	3/16
GS102	5/16	11/16	3/16

CAPTIVE NUT ASSEMBLY

Nut Assy. Cat. No.	Thread Size	+0 −1/64 A	±.002 B	±.008 C	REF MAX D	±.008 E	±1/64 F	+.003 −.000 G	+.015 −.000 H	+1/64 −0 J	+1/64 −0 K	±.005 L
NB100	8-32NC-2	1-3/32	.796	.312	.263	.209	15/32	.128	.199	9/32	1/4	.030
NB101	10-24NC-2	1-1/4	.937	.312	.305	.254	5/8	.128	.223	19/64	17/64	.048
NB102	10-32NF-2	1-1/4	.937	.312	.305	.254	5/8	.128	.223	19/64	17/64	.048
NB103	1/4-20NC-2	1-3/8	1.062	.375	.350	.279	3/4	.128	.343	27/64	5/16	.060
NB104	5/16-18NC-2	1-9/16	1.250	.500	.437	.329	7/8	.161	.361	7/16	7/16	.060

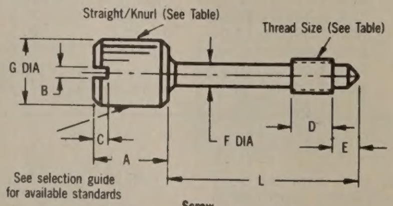
Nut entirely captive. Bracket and nut supplied as one unit.

RETAINER

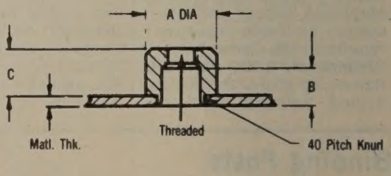
CATALOG NUMBER	A +1/64 −0	B ±1/64
GSR118	11/32	11/64
GSR115	7/16	7/32
GSR116	9/16	9/32
GSR117	11/16	11/32

INSERT

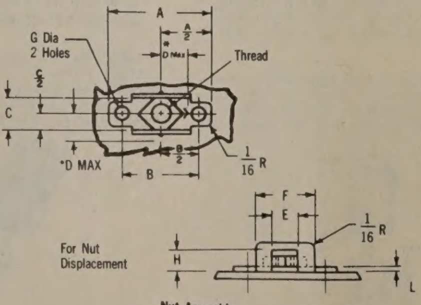
Cat. No. PIN—	A NOM	B MIN	C ±.020	Thread Size
100	5/16	3/16	.262	8-32NC-2
101			.232	
102			.187	
103			.124	
110	3/8	7/32	.325	10-24NC-2
111			.295	
112			.250	
113			.187	
114			.125	
120	3/8	7/32	.325	10-32NF-2
121			.295	
122			.250	
123			.187	
124			.125	
130	1/2	9/32	.387	1/4-20NC-2
131			.357	
132			.312	
133			.249	
134			.187	
140	5/8	11/32	.450	5/16-18NC-2
141			.420	
142			.375	


Straight/Knurl (See Table)
Thread Size (See Table)
G DIA
B
C
A
F DIA
D
E
L
See selection guide for available standards

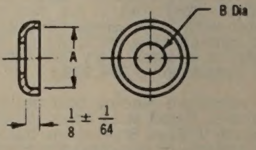
Screw



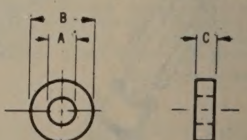
Insert



Nut Assembly



Gasket Retainer



Gasket

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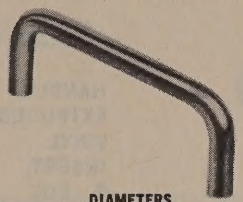
PANEL AND RACK HANDLES

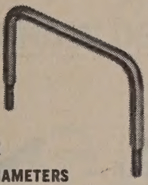
HANDLE, ROUND, INTERNAL THREAD



DIAMETERS

	⅛″	5/32″	3/16″	¼″	5/16″	⅜″	½″
Mounting ℄-℄	¾″ to 3″	1″ to 3″	1″ to 5¼″	1⅛″ to 8″	2″ to 12″	2″ to 12″	4″ to 10″
Height	½″ to 2″	¾″ to 1¼″	⅝″ to 1½″	1″ to 4½″	1″ to 5″	1 5/16″ to 4″	2″ to 3″
Threads	2-56	4-40	4-40, 6-32	6-32, 8-32	8-32, 10-32	10-32, ¼-20	¼-20, 5/16-18

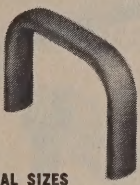
HANDLE, ROUND, EXTERNAL THREAD — WITH SHOULDER



DIAMETERS

	3/16″	¼″	5/16″
Mounting ℄-℄	2″ to 6″	2″ to 6″	2″ to 9″
Height	1″ to 2″	1″ to 2″	1 13/16″ to 2¼″
Threads	4-40, 6-32	8-32, 10-32	10-32, ¼-20

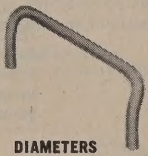
HANDLE, OVAL, INTERNAL THREAD



MATERIAL SIZES

	9/32″ x 7/16″	9/32″ x ⅝″	⅜″ x ⅝″
Mounting ℄-℄	2½″ to 12″	2½″ to 12″	2½″ to 12″
Height	1 9/32″ to 4″	1 9/32″ to 4″	1 9/32″ x 3″
Threads	10-24, 10-32	10-24, 10-32	10-24, 10-32

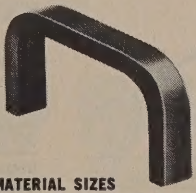
HANDLE, ROUND, OFFSET



DIAMETERS

	3/16″	¼″	5/16″	⅜″
Mounting ℄-℄	2″ to 6″	2″ to 6″	2″ to 10″	3″ to 10″
Height	1″ to 1½″	1″ to 2″	1 5/16″ to 1½″	1¾″ to 2½″
Threads	4-40, 6-32	6-32, 8-32	8-32, 10-32	8-32, 10-32

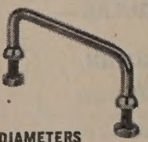
HANDLE, RECTANGULAR, INTERNAL THREAD



MATERIAL SIZES

	3/16″ x ½″	¼″ x ½″	5/16″ x ½″	¼″ x ⅝″	¼″ x 1″
Mounting ℄-℄	2″ to 10″	2″ to 10″	2″ to 10″	2″ to 10″	2″ to 10″
Height	1½″ to 2″	1½″ to 2″	1″ to 2″	1″ to 4″	1″ to 4″
Threads	4-40, 6-32	6-32, 8-32	8-32, 10-32	6-32, 8-32	6-32, 8-32

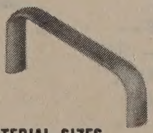
HANDLE, ROUND, EXTERNAL THREAD — NO SHOUDLER



DIAMETERS

	3/16″	¼″	5/16″
Mounting ℄-℄	3″ to 6″	3″ to 8″	3″ to 9″
Height	1½″ to 2″	1½″ to 2″	1½″ to 2″
Threads	12-28	¼-20	5/16-18

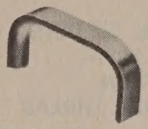
HANDLE, OVAL — SLANTED, INTERNAL THREAD



MATERIAL SIZES

	7/16″ x 9/32″	⅝″ x 9/32″	⅝″ x ⅜″
Mounting ℄-℄	3″ to 10″	3″ to 10″	3″ to 10″
Height	1½″ x 2″	1½″ x 2″	1½″ x 2″
Threads	10-24, 10-32	10-24, 10-32	10-24, 10-32

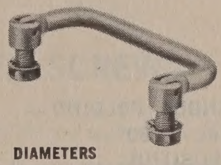
HANDLE, HALF ROUND, INTERNAL THREAD



MATERIAL SIZE

	5/16″ x ⅝″
Mounting ℄-℄	3″ to 9″
Height	1 9/32″ to 2″
Threads	10-24, 10-32

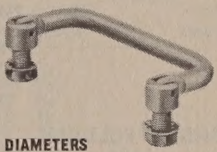
HANDLE, FOLDING — ROUND — 90° FREE FALL, EXTERNAL THREAD



DIAMETERS

	¼″	5/16″	⅜″
Mounting ℄-℄	3″ to 9″	3″ to 9″	3″ to 9″
Height	1.46	1.62	1.81
Threads	¼-28, 5/16-24	5/16-24, ⅜-24	5/16-24, ⅜-24

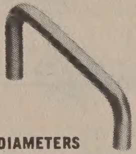
HANDLE, FOLDING — ROUND — 90° 2 POSITION, EXTERNAL THREAD



DIAMETERS

	5/16″	⅜″
Mounting ℄-℄	4″ to 9″	4″ to 9″
Height	1.845	1⅝″ to 2⅜″
Threads	5/16-24, ⅜-24	5/16-24, ⅜-24

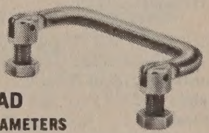
HANDLE, ROUND — SLANTED, INTERNAL THREAD



DIAMETERS

	5/16″	⅜″
Mounting ℄-℄	3″ to 7″	3″ to 7″
Height	1½″ to 2″	1½″ to 2″
Threads	8-32, 10-32	8-32, 10-32

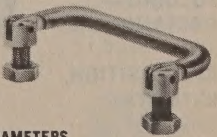
HANDLE, FOLDING — ROUND — 180° ALL POSITION, EXTERNAL THREAD



DIAMETERS

	¼″	5/16″	⅜″
Mounting ℄-℄	3″ to 9″	3″ to 9″	3″ to 9″
Height	1.46	1.62	1.81
Threads	¼-28, 5/16-24	5/16-24, ⅜-24	5/16-24, ⅜-24

HANDLE, FOLDING — ROUND — 180° 3 POSITION, EXTERNAL THREAD



DIAMETERS

	¼″	5/16″	⅜″
Mounting ℄-℄	4″ to 8″	4″ to 8″	4″ to 8″
Height	1 7/16″	1 7/16″	1 13/16″
Threads	¼-28, 5/16-24	¼-28, 5/16-24	5/16-24, ⅜-24

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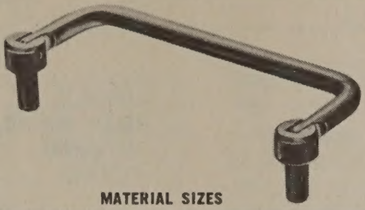
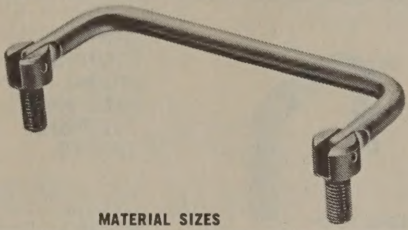
PANEL AND RACK HANDLES



HANDLE, FOLDING — OVAL — 90° — 2 POSITION, EXTERNAL THREAD

MATERIAL SIZES

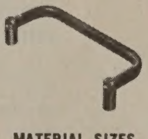
	7/16" x 9/32"	1/2" x 1/4"	5/8" x 9/32"	5/8" x 3/8"
Mounting ℄-℄	3" to 8"	3" to 8"	3" to 8"	3" to 8"
Height	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"
Threads	5/16-24, 3/8-24	5/16-24, 3/8-24	5/16-24, 3/8-24	5/16-24, 3/8-24



HANDLE, FOLDING — OVAL — 180° — 3 POSITION, EXTERNAL THREAD

MATERIAL SIZES

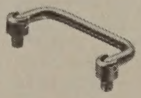
	7/16" x 9/32"	1/2" x 1/4"	5/8" x 9/32"	5/8" x 3/8"
Mounting ℄-℄	3" to 8"	3" to 8"	3" to 8"	3" to 8"
Height	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"	1 11/16" to 2 1/8"
Threads	5/16-24, 3/8-24	5/16-24, 3/8-24	5/16-24, 3/8-24	5/16-24, 3/8-24



HANDLE, FOLDING — OVAL — 180° — ALL POSITION, INTERNAL THREAD

MATERIAL SIZES

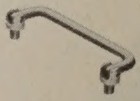
	7/16" x 9/32"	1/2" x 1/4"	5/8" x 9/32"	5/8" x 3/8"
Mounting ℄-℄	2" to 8"	2" to 8"	2" to 8"	2" to 8"
Height	2" to 3"	2" to 3"	2" to 3"	2" to 3"
Threads	8-32, 10-32	8-32, 10-32	8-32, 10-32	8-32, 10-32



HANDLE, FOLDING — ROUND — 90° FREE FALL, EXTERNAL THREAD

DIAMETERS

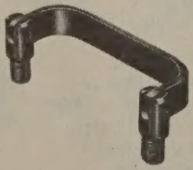
	5/16"	3/8"
Mounting ℄-℄	3" to 6"	3" to 6"
Height	1 17/32" to 1 13/16"	1 17/32" to 1.85
Threads	5/16-24, 3/8-24	5/16-24, 3/8-24



HANDLE, FOLDING — ROUND — 180° FREE FALL, EXTERNAL THREAD

DIAMETERS

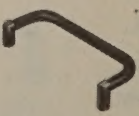
	5/16"	3/8"
Mounting ℄-℄	3" to 6"	3" to 6"
Height	1 17/32" to 1.85	1 17/32" to 1.85
Threads	5/16-24, 3/8-24	5/16-24, 3/8-24



HANDLE, FOLDING — RECTANGULAR — 180° ALL POSITION, EXTERNAL THREAD

MATERIAL SIZE

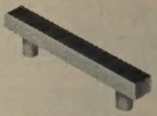
	1/2" x 5/16"
Mounting ℄-℄	3" to 10"
Height	1 1/2" to 2 1/2"
Threads	5/16"-24, 3/8"-24



HANDLE, FOLDING — ROUND — 90° FREE FALL, INTERNAL THREAD

DIAMETERS

	5/16"	3/8"
Mounting ℄-℄	3-7	3-7
Height	2	2
Threads	8-32, 10-32	8-32, 10-32

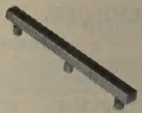


HANDLE, EXTRUDED — VINYL INSERT, 2 LEGS

Black Vinyl Insert is standard. Other colors or wood grain vinyl available upon special order.

MATERIAL SIZE

5/16" x 1/2"	Material Cross Section
Overall Length	2 7/8"-5 7/8"
Mounting ℄-℄	2"-5"
Height	1 1/16"-1 1/2"
Threads	8-32, 10-32

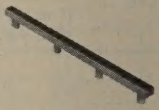


HANDLE, EXTRUDED — VINYL INSERT, 3 LEGS

Black Vinyl Insert is standard. Other colors or wood grain vinyl available upon special order.

MATERIAL SIZE

5/16" x 1/2"	Material Cross Section
Overall Length	6 3/8"-12 1/8"
Mounting ℄-℄	5 1/2"-11 1/4"
Height	1 1/16"-1 1/2"
Threads	8-32, 10-32

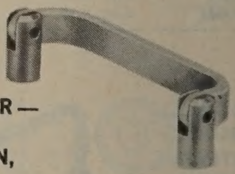


HANDLE, EXTRUDED — VINYL INSERT, 4 LEGS

Black Vinyl Insert is standard. Other colors or wood grain vinyl available upon special order.

MATERIAL SIZE

5/16" x 1/2"	Material Cross Section
Overall Length	12 7/8"-15 5/8"
Mounting ℄-℄	12"-14 3/4"
Height	1 1/16"-1 1/2"
Threads	8-32, 10-32



HANDLE, FOLDING — RECTANGULAR — 180° ALL POSITION, INTERNAL THREAD

DIAMETER

	1/2" x 5/16"
Mounting ℄-℄	3" to 10"
Height	1 1/2" to 2 1/2"
Threads	8-32, 10-32

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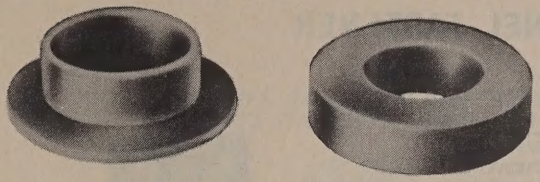
CAPTIVE PANEL HARDWARE

INSULATING WASHERS



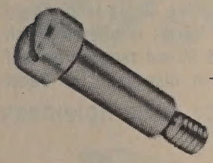
Barrel machined to ±.005 assuring precision fit to mating hole.
Edge chamfered to permit smooth entry.
I.D. reamed to +.005/−.000 conforming to screw tolerances.

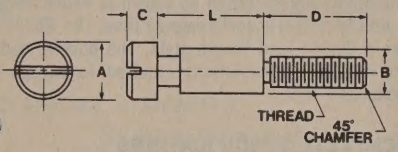
MATERIALS SPECIFICATION

Nylon	Mil-P-17091B Type 1
Teflon®[1]	Mil-P-19468A
Glass Filled Lexan®[2]	LP-393A
Phenolic	Mil-P-15035, FBI

1. E. I. Dupont de Nemours 2. General Electric

SLOTTED SHOULDER SCREWS





APPLICABLE TOLERANCES

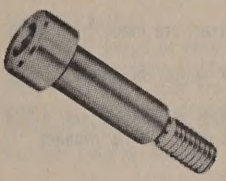
"B" +.000
−.001
"C" ±.005
"L" +.002
−.000

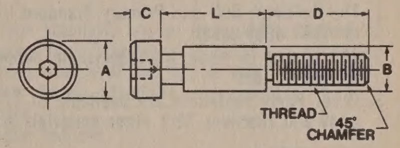
APPLICABLE SPECIFICATIONS

Stainless Steel — Mil-S-764, Cond. A (303)
Per Mil-W-52263C
Passivate — Per Mil-F-14072-E-300
Threads — Class 2A per handbook H.28, Part 1

Available in Type 303 Stainless Steel.
Other materials avialable on special order.

BROACHED SHOULDER SCREWS





APPLICABLE TOLERANCES

"B" +.000
−.001
"C" ±.005
"L" +.002
−.000

BROACH INFORMATION

4-40	5/64
6-32	3/32
8-32	3/32
0-24	3/32
0-32	3/32
1/4-20	5/32
5/16-18	3/16
3/8-16	1/4

Available in Type 303 Stainless Steel.
Other materials available on special order.

CAPTIVE PANEL SCREWS

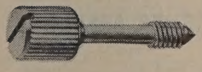
Captive Panel Screws are available in the following materials:

- Brass
- Aluminum
- Carbon Steel
- Stainless Steel

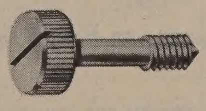
Series 4300 Captive Panel Screws

Decorative Panel Washer

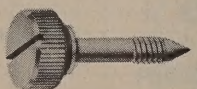
Series 4400 Captive Panel Screws



Series 4000 Captive Panel Screws

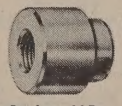


Series 4100 Captive Panel Screws



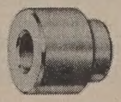
Series 4200 Captive Panel Screws

Series 40R Retainer, Captive Screw

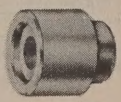


Series 41R Retainer, Captive Screw

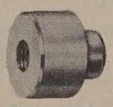
Series 42R Retainer, Captive Screw



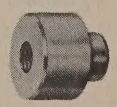
Series 43R Retainer, Captive Screw



Series 44R Retainer, Captive Screw



Series 45R Retainer, Captive Screw



Series 46R Retainer, Captive Screw

METALS & PLASTICS SELECTION

Materials	Specifications
Brass	QQ-B-626b, Comp 22, ½ Hard
Aluminum	QQ-A-255/3b (2011-T3)
Stainless Steel	QQ-S-764, Cond. A (303) per Mil-W-52263c
Carbon Steel	QQ-S-634 — QQ-S-633 — QQ-S-637

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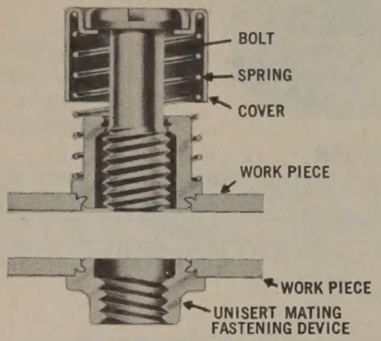
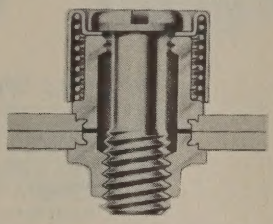
CAPTIVE PANEL HARDWARE

SERIES P PANEL FASTENER


BOLT
SPRING
COVER
WORK PIECE
WORK PIECE
UNISERT MATING FASTENING DEVICE

INSTALLED AND UNLOCKED



INSTALLED AND LOCKED

DESIGN FLEXIBILITY IN CONCEPT

The design principle of the P-Series Panel Fastener permits adaptability to single or multiple lead threads as well as to a variety of materials and their combinations.

MATERIALS

1. The Retainer, Bolt and Primary Standard Unisert are made from 4130 or 4140 alloy steel.
2. The Spring is made from beryllium copper while the cover is 302 stainless steel.
3. Other Panel Fasteners are available in 17-4PH stainless steel, A-286 alloy and titanium. Still other materials are available on request.

HEAT TREAT

Alloy steel configuration — 160,000-180,000 psi tensile.

FINISH

1. Alloy steel configuration — cadmium plated.
2. Other finishes are available on request.

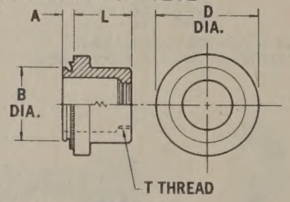
THREADS

The P5282 configuration as shown is available in the single lead thread style. To reduce panel removal time, the P6292 series is offered which has a double lead thread style. The double lead thread reduces by half the number of revolutions required to engage or disengage the Panel Fastener's bolt.

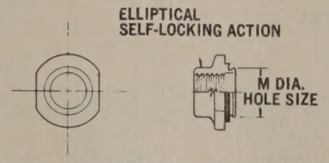
COMPLETE SPECIFICATIONS

1. The above dimensions are for the P5282 configuration and should be considered for reference only, subject to change without notice.
2. For complete dimensions, specifications and how-to-order data, refer to UNICORP Standards pages: P5282 for the alloy steel, single lead thread Panel Fastener and P12 for the primary standard Unisert.

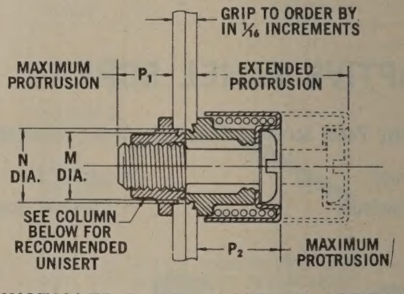
SPECIFICATIONS P5282


A
L
D DIA.
B DIA.
T THREAD

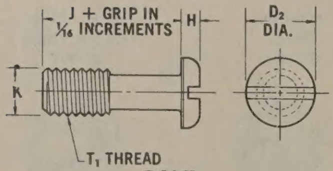
RETAINER


ELLIPTICAL SELF-LOCKING ACTION
M DIA. HOLE SIZE

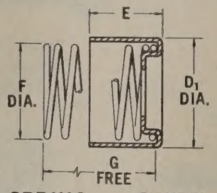
TYPICAL UNISERT CONFIGURATION


GRIP TO ORDER BY 1/16 INCREMENTS
MAXIMUM PROTRUSION
P_1
EXTENDED PROTRUSION
N DIA.
M DIA.
SEE COLUMN BELOW FOR RECOMMENDED UNISERT
P_2
MAXIMUM PROTRUSION

INSTALLED PANEL FASTENER ASSEMBLY


J + GRIP IN 1/16 INCREMENTS
H
D_2 DIA.
K
T_1 THREAD

BOLT


E
F DIA.
D_1 DIA.
G FREE

SPRING COVER (OPTIONAL)

PANEL FASTENER ASSEMBLY FIRST DASH NUMBER	RETAINER					SPRING & COVER				BOLT				
	A MAX.	B DIA. MAX.	D DIA. MAX.	L MAX.	T THREAD	D_1 DIA. MAX.	E	F DIA.	G FREE	D_2 DIA. MAX.	H MAX.	J	K (REF.)	T_1 THREAD
P5282SN-440	.030	.217	.310	.242	4-40NC-3B	.370	.303	.270	1	.180	.055	.430	.112	4-40NC-3A
P5282SN-632	.030	.217	.310	.242	6-32NC-3B	.390	.303	.270	1	.215	.066	.430	.138	6-32NC-3A
P5282SN-832	.039	.249	.330	.239	8-32NC-3B	.390	.298	.300	1	.230	.075	.430	.164	8-32NC-3A
P5282SN-1032	.039	.280	.375	.239	10-32NF-3B	.420	.278	.344	1	.275	.075	.430	.190	10-32NF-3A
P5282SN-428	.050	.374	.460	.283	¼-28UNF-3B	.505	.344	.432	1	.360	.080	.507	.250	¼-28UNF-3A

PANEL FASTENER ASSEMBLY FIRST DASH NUMBER	INSTALLED PANEL FASTENER ASSEMBLY					
	PROTRUSION		M DIA. RECOMMENDED HOLE SIZE FOR UNISERT	N DIA. RECOMMENDED HOLE SIZE FOR RETAINER	RECOMMENDED UNISERT PART NUMBER	INSTALLATION LOAD (LBS.) 7075-T6 ALUM.
	P_1 MAX.	P_2 MAX.				
P5282SN-440	.257	.327	.175 .172	.221 .218	P12-440	2000
P5282SN-632	.257	.332	.194 .191	.221 .218	P12-632	2000
P5282SN-832	.261	.329	.224 .221	.253 .250	P12-832	3000
P5282SN-1032	.261	.329	.253 .250	.284 .281	P12-1032	4000
P5282SN-428	.294	.379	.347 .344	.378 .375	P12-428	5800

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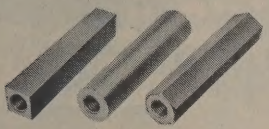
THREADED AND UNTHREADED STANDOFFS

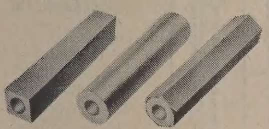
STANDOFFS AND SPACERS

STANDOFFS, THREADED



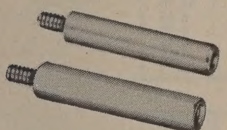
⅛″ Standoffs, Threaded
5/32″ Standoffs, Threaded
3/16″ Standoffs, Threaded
¼″ Standoffs, Threaded
5/16″ Standoffs, Threaded
⅜″ Standoffs, Threaded
½″ Standoffs, Threaded
⅝″ Standoffs, Threaded

SPACERS, UNTHREADED STANDOFFS



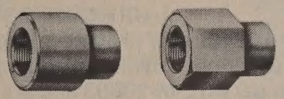
⅛″ Spacers, Unthreaded Standoffs
3/16″ Spacers, Unthreaded Standoffs
¼″ Spacers, Unthreaded Standoffs
5/16″ Spacers, Unthreaded Standoffs
⅜″ Spacers, Unthreaded Standoffs
½″ Spacers, Unthreaded Standoffs
⅝″ Spacers, Unthreaded Standoffs

PRECISION MALE TO FEMALE STANDOFFS



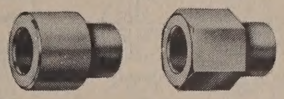
⅛″ D. Male to Female Standoffs
5/32″ D. Male to Female Standoffs
3/16″ D. Male to Female Standoffs
¼″ D. Male to Female Standoffs
5/16″ D. Male to Female Standoffs
⅜″ D. Male to Female Standoffs

STANDOFFS, SWAGE AND RIVET TYPE
THREADED STANDOFFS, SWAGE/RIVET



⅛″ Threaded Standoffs
5/32″ Threaded Standoffs
3/16″ Threaded Standoffs
¼″ Threaded Standoffs
5/16″ Threaded Standoffs
⅜″ Threaded Standoffs

UNTHREADED STANDOFFS, SWAGE/RIVET



⅛″ Unthreaded Standoffs
5/32″ Unthreaded Standoffs
3/16″ Unthreaded Standoffs
¼″ Unthreaded Standoffs
5/16″ Unthreaded Standoffs
⅜″ Unthreaded Standoffs

ADVANTAGES

UNICORP'S swage or rivet type standoffs are an inexpensive method of spacing or mounting electronic circuit boards and electronic components. After installation they are permanently affixed to the board and further assembly becomes simplified. These standoffs are available in both threaded and unthreaded types.
Full line catalog available upon request.

METALS AND PLASTICS SELECTION

Materials	Material Shape ○	□	⬡	Specifications
Brass	●	●	●	QQ-B-626, Comp. 22, ½ Hard
Aluminum	●	●	●	QQ-A-225a, Comp. 2, T-3
Stainless Steel	●	●	●	QQ-S-763, Class 303, Cond. A
Carbon Steel	●	●	●	QQ-S-633, Class 2
Laminated Phenolic	●			MIL-P-15035, Type FBI
Teflon®	●	●	●	MIL-P-14078
Nylon	●	●	●	MIL-P-17091B, Grade 101
10% Glass Filled LEXAN®	●			MIL-P-81390

PLATING AND FINISH SELECTION

Standard Finishes	Brass	Aluminum	Stainless Steel	Carbon Steel	Applicable Specifications
Anodize (Sulphuric) Dichromate Seal, Yel./Grn.		●			Mil-A-8625A-Type 2
Anodize (Sulphuric) Hot Water Seal, Clear		●			Mil-A-8625A-Type 2
Anodize (Chromic) Hot Water Seal, Dark Gray		●			Mil-A-8625A-Type 1
Anodize — Black		●			Mil-A-8625A-Black
Anodize — Black, High Lustre		●			Mil-A-8625A-Black High Lustre
Cadmium Plate, Clear Chromate	●			●	QQ-P-416, Class 2
Cadmium Plate, Commercial	●			●	
Cadmium Plate, Gold Chromate	●			●	QQ-P-416, Class 2, Type 2
Nickel Plate	●			●	QQ-N-290, Class 1, Type V1 KC
Chromium Plate (Bright)	●			●	QQ-C-320, Class 1, Type 1
Chromium Plate, Eingineering	●			●	QQ-C-320, Class 2
Chromium Plate (Satin Finish)	●			●	QQ-320, Class 1, Type 11
Chromium Plate (Polished) per Mil-QQ-C-320, over Nickel per Mil-QQ-N-290	●			●	
Passivate			●		Mil-F-14072-E300
Bright Dip	●	●			
Iridiate, Clear		●			Mil-C-5541
Iridite, Gold #14		●			#14 Mil-C-5541
Alodine 1200		●			
Black Oxide, Brass	●				Mil-F-495
Black Oxide, Stainless Steel			●		Mil-C-1392A, Class 3
Zinc Plate .0002 Thick	●			●	QQ-Z-325a, Type 1, Class 3
Zinc Plate .0002 Thick, Yellow/Green Chromate	●			●	QQ-Z-325a, Type 1, Class 3
No Finish					
Hot Tin Dip	●				Mil-T-10727, Type 2
Silver Plate	●				QQ-S-365 0.0002-0.0003
Electro Tin Plate	●				Mil-T-10727, Type 1

● Applicable Finish — Material

PRECISION STANDOFFS — THREADED AND UNTHREADED

UNICORP has arranged this Catalog to assist Engineers, Designers and Buyers select the correct part for all applications without resorting to a "Special Order".

UNICORP delivers these components to your plant inspected, plated and ready for installation.

UNICORP maintains stock in lengths of 1/64 of an inch increments.

SHAPES: Round, Square, Hex.

DIAMETERS: ⅛″ — 5/32″ — 3/16″ — ¼″ — 5/16″ — ⅜″ — ½″ — ⅝″.

MATERIALS: Brass, Aluminum, Stainless Steel, Carbon Steel, Nylon, Teflon, Linen Base Phenolic, 10% Glass Filled Lexan.

THREADS: External — Class UNC-2A; Internal — Class UNC-2B.

FINISHES: Refer to chart at left.

TOLERANCES: Length: Up to 4″ .005; 4″ to 6″ .008; Over 6″ .010.

Diameter: Standard commercial bar stock tolerances.

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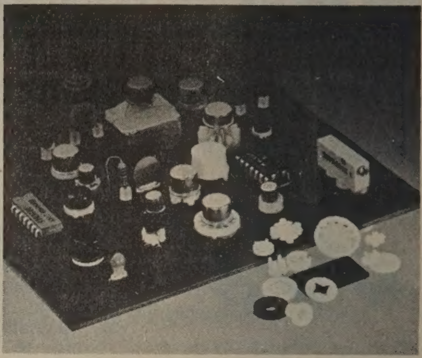
waldom / Bivar PERM-O-PAD®

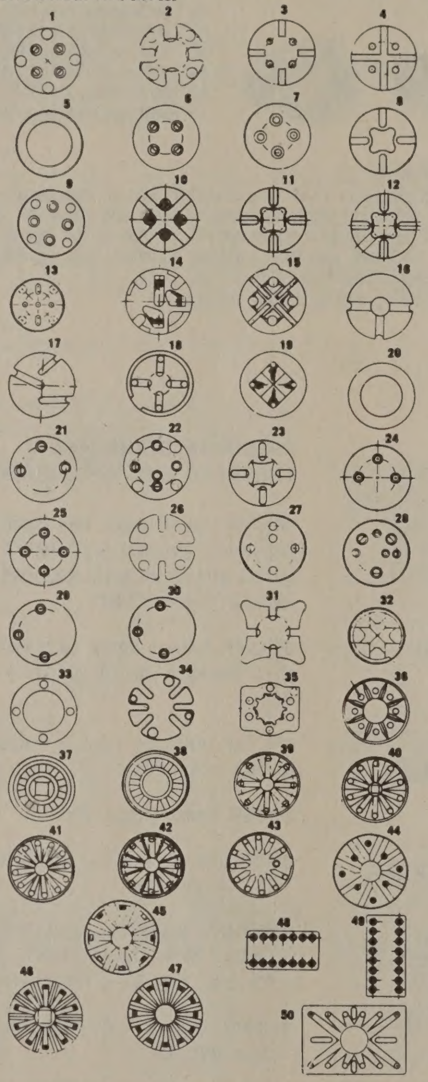
(MFG. BY BIVAR INC.)

- IMPROVE RELIABILITY
- REDUCE PRODUCTION COSTS
- NYLON PER MIL-M-20693

FOR . . . PROTECTING, LOCATING, FIXTURING, SPACING, MOUNTING & REINFORCING . . . TRANSISTORS, INTEGRATED CIRCUITS & OTHER PRINTED CIRCUIT COMPONENTS.



PERMANENT MOUNTING SPACERS give protective support, shock mounting, added insulation, greater heat dissipation, cleanliness and improve neatness. PERM-O-PADs are molded from Nylon per MIL-M-20693 and are available from stock in a multitude of configurations. There are many unique designs to choose from in these economical mounts.



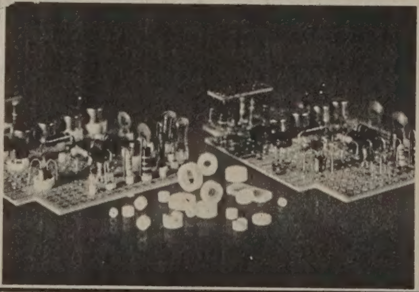
Part No.	Fig.	O.D.	Thickness	Spacing of Leads		100-499 Per C
				Entry	Exit	
100-095	1	.200	.095	.100	.100	$6.45
101-096	2	.200	.096	.100	.100	6.45
102-125	3	.250	.125	.100	.100	6.45
111-125	4	.250	.125	.100	.100	6.45
103-080	5	.225	.080	.100	.100	6.45
104-060	6	.200	.060	.100	.100	6.45
105-021	7	.250	.021	.100	.100	6.45
106-045	8	.270	.045	.100	.100	6.45
107-180	9	.200	.180	.100	.100	6.45
108-021	10	.225	.021	.100	.100	6.45
109-045	11	.200	.045	.100	.100	6.45
110-030	12	.200	.030	.100	.100	6.45
112-040	13	.230	.040	.100	.100	6.45
200-170	14	.225	.170	.100	.200	$6.45
201-150	15	.310	.150	.100	.200	6.45
202-150	16	.250	.150	.100	.200	6.45
203-150	17	.250	.150	.100	.200	6.45
204-125	18	.270	.125	.100	.200	6.45
205-085	19	.225	.085	.100	.150	6.45
500-080	20	.365	.080	.200	.200	$6.45
501-075	21	.345	.075	.200	.200	6.45
502-120	22	.345	.120	.200	.200	6.45
503-075	23	.345	.075	.200	.200	6.45
504-038	24	.345	.038	.200	.200	6.45
511-038	25	.345	.038	.200	.200	6.45
505-120	26	.350	.120	.200	.200	6.45
506-038	27	.350	.038	.200	.200	6.45
507-100	28	.340	.100	.200	.200	6.45
508-075	29	.281	.075	.200	.200	6.45
510-110	30	.281	.110	.200	.200	6.45
509-060	31	.312	.060	.200	.200	6.45
512-115	32	.230	.115	.200	.200	6.45

Part No.	Fig.	No. of Leads	O.D.	Thickness	Spacing of Leads		100-499 Per C
					Entry	Exit	
600-080	33	—	.365	.080	.200/.230	.200/.230	$6.45
601-120	34	6	.350	.120	.200/.230	.200/.230	7.80
608-090	35	10	.390	.090	.200/.230	.200/.230	7.80
605-085	36	8	.370	.085	.200/.230	.200/.230	7.80
606-075	37	10	.370	.075	.200/.230	.200/.230	7.80
607-075	38	12	.370	.075	.200/.230	.200/.230	7.80
700-130	39	8	.500	.130	.200/.230	.400	$11.00
701-130	40	10	.500	.130	.200/.230	.400	11.00
702-130	41	12	.500	.130	.200/.230	.400	11.00
707-120	42	8	.450	.120	.200/.230	.400	11.00
708-275	43	12	.500	.275	.200/.230	.400	13.60
703-250	44	8	.500	.250	.200/.230	.400	13.60
704-250	45	8	.500	.250	.200/.230	.400	13.60
705-250	46	10	.500	.250	.200/.230	.400	13.60
706-250	47	12	.500	.250	.200/.230	.400	13.60

Width

814-060	48	14	.450	.060	.100	.100	$11.00
814-080	48	14	.450	.080	.100	.100	11.00
814-100	48	14	.450	.100	.100	.100	11.00
816-060	49	16	.450	.060	.100	.100	11.00
816-080	49	16	.450	.080	.100	.100	11.00
816-100	49	16	.450	.100	.100	.100	11.00
808-187	50	8	.385	.187	.200/.230	DIP	11.00
810-187	50	10	.385	.187	.200/.230	DIP	11.00
812-187	50	12	.385	.187	.200/.230	DIP	11.00

DISS-O-PAD®



- EVEN, ACCURATE POSITIONING
- REDUCE REJECTS & REWORK
- REDUCE LABOR COSTS
- STANDARD SHAPES TO FIT ALMOST ANY COMPONENT

SIMPLE AND EASY TO USE . . . WASH AWAY IN WARM OR HOT RUNNING WATER . . . NO RESIDUE.

WASH AWAY SPACERS provide accurate, uniform component spacing above PCB surfaces, protect components throughout the soldering cycle, then **WASH AWAY** completely in **WARM** or **HOT RUNNING WATER**, without a trace of residue. Over 400 sizes are available from stock. Low cost, versatile DISS-O-PADs substantially reduce rejects, inspection and rework costs.

WALDOM ELECTRONICS, INC. 4625 WEST 53rd STREET, CHICAGO, ILLINOIS 60632 (312) 585-1212

waldom / Bivar

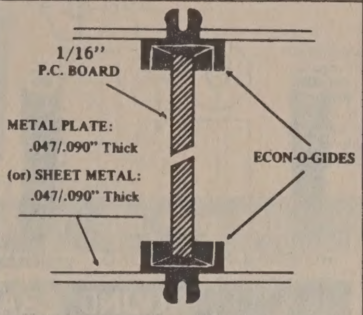
(MFG. BY BIVAR INC.)

SNAP-IN CARD GUIDES

ECON O GIDE®

- Rigid reinforced nylon
- 24 Standard lengths, 2½″ thru 14″ in ½″ increments
- Fast, easy installation
- Economical

SNAP-IN CARD GUIDES, available from stock in 24 Standard lengths, ECON-O-GIDEs provide a wide choice to meet your most challenging design needs. Molded from Reinforced Nylon for strength and rigidity, these inexpensive guides snap into sheet metal with minimum effort and maximum retention. Samples are immediately available upon your request.


1/16″
P.C. BOARD
METAL PLATE:
.047/.090″ Thick
(or) SHEET METAL:
.047/.090″ Thick
ECON-O-GIDES

Typical installation of ECON-O-GIDEs

SPECIFICATIONS

Material: Reinforced nylon, black.

Drawing Tolerances:

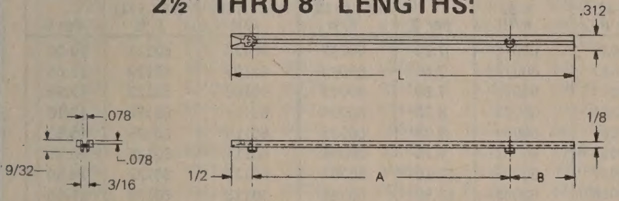
Overall Length "L"	±1/16
Fractions	±1/64
.X	±1/64
.XX	.010
.XXX	.005

All dimensions in inches. Code Ident. No. 32559

MOUNTING INFORMATION

SNAP-IN metal plates, .047/.090″ thick.
Hole Size:
.172″ dia., +.003, −.001 (11/64″ drill).

2½″ THRU 8″ LENGTHS:


.312
L
.078
.078
9/32
3/16
1/8
1/2
A
B

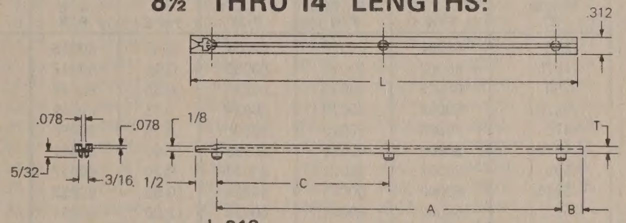
±.010

NET PRICE EACH

Part No.	L	A	B	1-49
E-250	2.5	1-33/64	0.5	$.33
E-300	3.0	1-33/64	1.0	
E-350	3.5	1-33/64	1.5	
E-400	4.0	3-1/64	.5	.35
E-450	4.5	3-1/64	1.0	
E-500	5.0	3-1/64	1.5	
E-550	5.5	3-1/64	2.0	
E-600	6.0	5-1/64	0.5	.38
E-650	6.5	5-1/64	1.0	
E-700	7.0	6-1/32	0.5	.48
E-750	7.5	6-1/32	1.0	
E-800	8.0	6-1/32	1.5	

Write for quotations on quantities above 5000.

8½″ THRU 14″ LENGTHS:


.312
L
.078
.078
1/8
T
5/32
3/16
1/2
C
A
B

±.010

NET PRICE EACH

Part No.	L	A	B	C	T	1-49
E-850	8.5	7-17/32	.5	3-49/64	.141	$.55
E-900	9.0	7-17/32	1.0	3-49/64	.141	
E-950	9.5	7-17/32	1.5	3-49/64	.141	
E-1000	10.0	9-1/32	.5	4-33/64	.141	.65
E-1050	10.5	9-1/32	1.0	4-33/64	.141	
E-1100	11.0	9-1/32	1.5	4-33/64	.141	
E-1150	11.5	10-35/64	.5	5-17/64	.156	.78
E-1200	12.0	10-35/64	1.0	5-17/64	.156	
E-1250	12.5	10-35/64	1.5	5-17/64	.156	
E-1300	13.0	12-3/64	.5	6-1/64	.156	.88
E-1350	13.5	12-3/64	1.0	6-1/64	.156	
E-1400	14.0	12-3/64	1.5	6-1/64	.156	

Write for quotations on quantities above 5000.

NOTE: Slotting or elongating of 2nd and 3rd mounting holes is recommended to allow for length variations in molding.

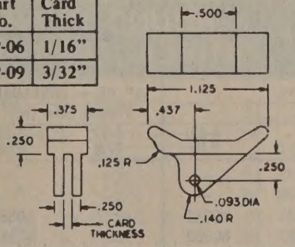
PC CARD EJECTORS

With these convenient snap-in card guides, your board stacking or rack mounting options are greatly increased. Guides may be located to desired spacing; they add extra insulation between boards and rack or cabinet enclosures. For computers/systems, instrumentation and industrial applications. Constructed of rigid, reinforced nylon, black. Std. lengths, 2½″ thru 14″ in ½″ increments. Mounting: Snap-in metal plates, .047/.090″ thick. Hole size, .172″ dia.

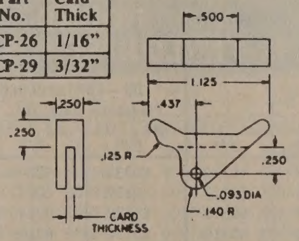
Net Price Each (Includes Mounting Pins)

Part No.	Card Thick.	1-49
CP-06 CP-26 CP-36	1/16″	$.39
CP-09 CP-29 CP-39	3/32″	.40
LP-06 LP-36	1/16″	.44

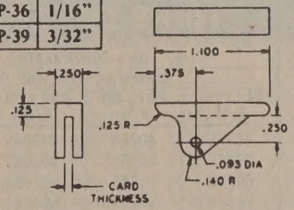
Part No.	Card Thick
CP-06	1/16″
CP-09	3/32″


.500
1.125
.375
.437
.250
.125 R
.250
.093 DIA
.250
.140 R
CARD THICKNESS

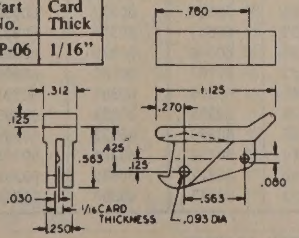
Part No.	Card Thick
CP-26	1/16″
CP-29	3/32″


.500
1.125
.250
.437
.250
.125 R
.250
.093 DIA
.140 R
CARD THICKNESS

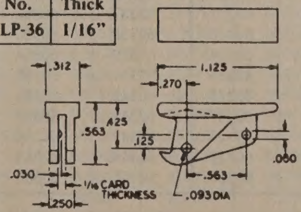
Part No.	Card Thick
CP-36	1/16″
CP-39	3/32″


1.100
.250
.375
.125
.125 R
.250
.093 DIA
.140 R
CARD THICKNESS

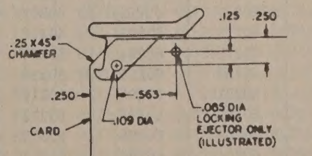
Part No.	Card Thick
LP-06	1/16″


.780
.312
1.125
.270
.125
.425
.563
.125
.060
.030
1/16 CARD THICKNESS
.563
.093 DIA
.250

Part No.	Card Thick
LP-36	1/16″

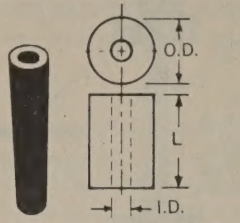

.312
1.125
.270
.425
.563
.125
.060
.030
1/16 CARD THICKNESS
.563
.093 DIA
.250

CARD MOUNTING DIMENSIONS

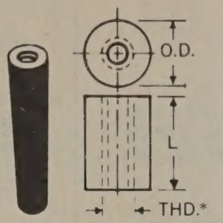

.125
.250
.25 X45° CHAMFER
.250
.563
CARD
.109 DIA
.085 DIA LOCKING EJECTOR ONLY (ILLUSTRATED)

NOTE: 2 Ejectors, mounted on opposing corners, are recommended for cards where width is greater than length.

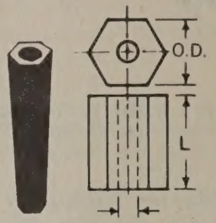
waldom spacers



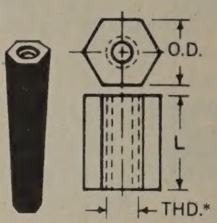
ROUND UNTHREADED



ROUND THREADED



HEX UNTHREADED



HEX THREADED

*On threaded spacers 3/4" and longer, tap is 3/8" from each end, and not continually throughout.

ROUND BRASS SPACERS CADMIUM PLATED - Std. Pkg. 100

	¼" OD — UNTHREADED					¼" OD — THREADED				⅜" OD — UNTHREADED		
	Clearance Hole (ID)					Thread Size (ID)				Clearance Hole (ID)		
Length "L"	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C
.125	60001	60016	60031	5.60	60046	60061	60076	7.25	60091	60106	60121	10.00
.1875	60002	60017	60032	6.05	60047	60062	60077	7.50	60092	60107	60122	11.65
.250	60003	60018	60033	6.85	60048	60063	60078	7.80	60093	60108	60123	12.25
.3125	60004	60019	60034	7.75	60049	60064	60079	8.30	60094	60109	60124	13.10
.375	60005	60020	60035	8.25	60050	60065	60080	9.30	60095	60110	60125	15.55
.4375	60006	60021	60036	9.00	60051	60066	60081	9.75	60096	60111	60126	16.55
.500	60007	60022	60037	9.20	60052	60067	60082	12.10	60097	60112	60127	16.90
.5625	60008	60023	60038	10.50	60053	60068	60083	12.90	60098	60113	60128	21.35
.625	60009	60024	60039	11.00	60054	60069	60084	13.40	60099	60114	60129	20.30
.6875	60010	60025	60040	13.75	60055	60070	60085	17.40	60100	60115	60130	22.85
.750	60011	60026	60041	14.20	60056	60071	60086	17.65	60101	60116	60131	20.20
.8125	60012	60027	60042	14.70	60057	60072	60087	17.80	60102	60117	60132	23.60
.875	60013	60028	60043	16.00	60058	60073	60088	18.70	60103	60118	60133	26.80
.9375	60014	60029	60044	16.50	60059	60074	60089	19.25	60104	60119	60134	27.60
1.000	60015	60030	60045	18.25	60060	60075	60090	20.50	60105	60120	60135	28.70

HEX BRASS SPACERS CADMIUM PLATED - Std.Pkg.100

	¼" HEX — UNTHREADED					¼" HEX THREADED				⅜" HEX — UNTHREADED		
	Clearance Hole (ID)					Thread Size (ID)				Clearance Hole (ID)		
Length "L"	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C
.125	60136	60151	60166	6.25	60181	60196	60211	7.35	60226	60241	60256	10.20
.1875	60137	60152	60167	6.65	60182	60197	60212	7.85	60227	60242	60257	11.65
.250	60138	60153	60168	7.35	60183	60198	60213	8.50	60228	60243	60258	12.65
.3125	60139	60154	60169	8.70	60184	60199	60214	9.20	60229	60244	60259	14.50
.375	60140	60155	60170	9.00	60185	60200	60215	10.35	60230	60245	60260	15.85
.4375	60141	60156	60171	9.30	60186	60201	60216	11.15	60231	60246	60261	19.40
.500	60142	60157	60172	9.60	60187	60202	60217	12.15	60232	60247	60262	20.00
.5625	60143	60158	60173	10.55	60188	60203	60218	14.20	60233	60248	60263	21.00
.625	60144	60159	60174	11.15	60189	60204	60219	17.00	60234	60249	60264	23.20
.6875	60145	60160	60175	13.90	60190	60205	60220	17.90	60235	60250	60265	23.60
.750	60146	60161	60176	14.20	60191	60206	60221	18.90	60236	60251	60266	24.60
.8125	60147	60162	60177	15.35	60192	60207	60222	19.60	60237	60252	60267	25.80
.875	60148	60163	60178	17.15	60193	60208	60223	19.90	60238	60253	60268	29.00
.9375	60149	60164	60179	18.60	60194	60209	60224	20.85	60239	60254	60269	29.40
1.000	60150	60165	60180	19.60	60195	60210	60225	22.50	60240	60255	60270	32.00

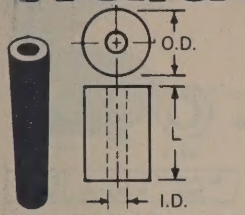
ROUND FIBRE SPACERS — ROUND NYLON SPACERS — ROUND PHENOLIC THREADED SPACERS

	¼" OD — UNTHREADED					¼" OD — UNTHREADED				¼" OD — THREADED		
	Clearance Hole (ID)					Clearance Hole (ID)				Thread Size (ID)		
Length "L"	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C
.125	60271	60286	60301	5.10	60316	60331	60346	3.25	—	—	—	—
.1875	60272	60287	60302	5.65	60317	60332	60347	3.70	—	—	—	—
.250	60273	60288	60303	6.15	60318	60333	60348	4.20	60361	60374	60387	9.20
.3125	60274	60289	60304	6.95	60319	60334	60349	4.80	60362	60375	60388	10.20
.375	60275	60290	60305	7.65	60320	60335	60350	5.40	60363	60376	60389	11.65
.4375	60276	60291	60306	8.35	60321	60336	60351	5.85	60364	60377	60390	12.15
.500	60277	60292	60307	9.00	60322	60337	60352	6.35	60365	60378	60391	13.10
.5625	60278	60293	60308	10.00	60323	60338	60353	6.85	60366	60379	60392	13.70
.625	60279	60294	60309	10.40	60324	60339	60354	7.35	60367	60380	60393	14.70
.6875	60280	60295	60310	11.45	60325	60340	60355	7.85	60368	60381	60394	16.35
.750	60281	60296	60311	12.35	60326	60341	60356	8.20	60369	60382	60395	17.35
.8125	60282	60297	60312	13.50	60327	60342	60357	8.60	60370	60383	60396	18.00
.875	60283	60298	60313	14.20	60328	60343	60358	9.10	60371	60384	60397	19.00
.9375	60284	60299	60314	14.90	60329	60344	60359	9.50	60372	60385	60398	19.60
1.000	60285	60300	60315	15.20	60330	60345	60360	9.80	60373	60386	60399	20.60

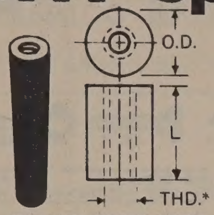
SAMPLES, OR PRICES FOR LARGER QUANTITIES AVAILABLE UPON REQUEST

WALDOM ELECTRONICS, INC. 4625 WEST 53rd STREET, CHICAGO, ILLINOIS 60632 (312) 585-1212

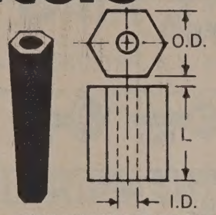
waldom spacers



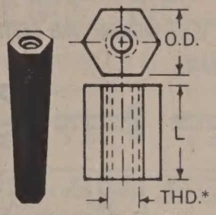
ROUND UNTHREADED



ROUND THREADED



HEX UNTHREADED



HEX THREADED

*On threaded spacers 3/4" and longer, tap is 3/8" from each end, and not continually throughout.

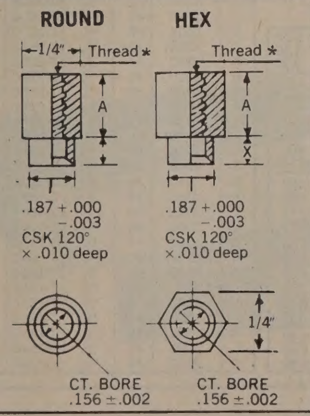
ROUND ALUMINUM SPACERS - Irridite 14-2 per MIL-C-5541 - Std. Pkg. 100

	1/4" OD — UNTHREADED				5/16" OD		1/4" OD — THREADED				5/16" OD	
	Clearance Hole (ID)				Clearance Hole (ID)		Thread Size (ID)				Thread Size (ID)	
Length "L"	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	#10 (.200) P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C	10-32 P/N	Per C
.125	60400	60418	60436	4.90	60454	6.85	60472	60488	60504	5.90	60520	7.85
.250	60401	60419	60437	5.90	60455	7.85	60473	60489	60505	6.85	60521	8.80
.375	60402	60420	60438	6.85	60456	8.80	60474	60490	60506	7.85	60522	9.80
.500	60403	60421	60439	7.85	60457	9.80	60475	60491	60507	8.80	60523	10.80
.625	60404	60422	60440	8.80	60458	10.75	60476	60492	60508	9.80	60524	11.75
.750	60405	60423	60441	9.80	60459	11.75	60477	60493	60509	10.80	60525	12.75
.875	60406	60424	60442	10.75	60460	12.75	60478	60494	60510	11.75	60526	13.70
1.000	60407	60425	60443	11.75	60461	13.70	60479	60495	60511	13.70	60527	14.70
1.250	60408	60426	60444	12.75	60462	14.70	60480	60496	60512	15.65	60528	15.65
1.500	60409	60427	60445	23.50	60463	26.45	60481	60497	60513	17.65	60529	17.65
1.750	60410	60428	60446	24.50	60464	27.45	60482	60498	60514	19.60	60530	19.60
2.000	60411	60429	60447	25.50	60465	28.40	60483	60499	60515	21.55	60531	21.55
2.50	60412	60430	60448	26.45	60466	29.40	60484	60500	60516	23.50	60532	23.50
3.00	60413	60431	60449	27.45	60467	30.40	60485	60501	60517	25.50	60533	25.50
3.50	60414	60432	60450	31.35	60468	31.35	60486	60502	60518	27.45	60534	27.45
4.00	60415	60433	60451	36.25	60469	32.35	60487	60503	60519	35.30	60535	29.40
5.00	60416	60434	60452	37.25	60470	33.30	—	—	—	—	—	—
6.00	60417	60435	60453	47.00	60471	34.30	—	—	—	—	—	—

HEX ALUMINUM SPACERS - Irridite 14-2 per MIL-C-5541 - Std. Pkg. 100

	1/4" HEX — UNTHREADED				5/16" HEX		1/4" HEX THREADED				5/16" HEX	
	Clearance Hole (ID)				Clearance Hole (ID)		Thread Size (ID)				Thread Size (ID)	
Length "L"	#4 (.115) P/N	#6 (.140) P/N	#8 (.171) P/N	Per C	#10 (.200) P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C	10-32 P/N	Per C
.125	60536	60548	60560	5.90	60572	8.80	60584	60600	60616	6.85	60632	9.80
.250	60537	60549	60561	6.85	60573	9.80	60585	60601	60617	7.85	60633	10.80
.375	60538	60550	60562	7.85	60574	10.80	60586	60602	60618	8.80	60634	11.75
.500	60539	60551	60563	8.80	60575	11.75	60587	60603	60619	9.80	60635	12.75
.625	60540	60552	60564	9.80	60576	12.75	60588	60604	60620	10.80	60636	13.70
.750	60541	60553	60565	10.80	60577	13.70	60589	60605	60621	11.75	60637	14.70
.875	60542	60554	60566	11.75	60578	14.70	60590	60606	60622	12.75	60638	15.70
1.000	60543	60555	60567	12.75	60579	15.70	60591	60607	60623	13.70	60639	16.65
1.250	60544	60556	60568	23.50	60580	26.45	60592	60608	60624	15.70	60640	18.60
1.500	60545	60557	60569	24.50	60581	27.45	60593	60609	60625	17.65	60641	20.60
1.750	60546	60558	60570	25.50	60582	28.40	60594	60610	60626	19.60	60642	22.55
2.00	60547	60559	60571	26.45	60583	29.40	60595	60611	60627	21.55	60643	24.50
2.50	—	—	—	—	—	—	60596	60612	60628	23.50	60644	26.45
3.00	—	—	—	—	—	—	60597	60613	60629	25.50	60645	28.40
3.50	—	—	—	—	—	—	60598	60614	60630	27.45	60646	30.40
4.00	—	—	—	—	—	—	60599	60615	60631	34.30	60647	32.35

THREADED SWAGE STANDOFFS - Brass Nickel Plated


ROUND
HEX
1/4"
Thread *
Thread *
A
A
X
.187 +.000 −.003 CSK 120° × .010 deep
.187 +.000 −.003 CSK 120° × .010 deep
1/4"
CT. BORE .156 ±.002
CT. BORE .156 ±.002

Length		ROUND THREADED				HEX THREADED			
A	X	4-40 P/N	6-32 P/N	8-32 P/N	Per C	4-40 P/N	6-32 P/N	8-32 P/N	Per C
1/4	.105	60648	60666	60684	10.20	60702	60720	60738	10.80
1/4	.135	60649	60667	60685	10.20	60703	60721	60739	10.80
1/4	.165	60650	60668	60686	10.20	60704	60722	60740	10.80
3/8	.105	60651	60669	60687	11.75	60705	60723	60741	12.40
3/8	.135	60652	60670	60688	11.75	60706	60724	60742	12.40
3/8	.165	60653	60671	60689	11.75	60707	60725	60743	12.40
1/2	.105	60654	60672	60690	14.40	60708	60726	60744	15.10
1/2	.135	60655	60673	60691	14.30	60709	60727	60745	15.10
1/2	.175	60656	60674	60692	14.30	60710	60728	60746	15.10
5/8	.105	60657	60675	60693	15.10	60711	60729	60747	15.70
5/8	.135	60658	60676	60694	15.10	60712	60730	60748	15.70
5/8	.165	60659	60677	60695	15.10	60713	60731	60749	15.70
3/4	.105	60660	60678	60696	16.65	60714	60732	60750	17.35
3/4	.135	60661	60679	60697	16.65	60715	60733	60751	17.35
3/4	.165	60662	60680	60698	16.65	60716	60734	60752	17.35
1"	.105	60663	60681	60699	21.60	60717	60735	60753	22.25
1"	.135	60664	60682	60700	21.60	60718	60736	60754	22.25
1"	.165	60665	60683	60701	21.60	60719	60737	60755	22.25

SAMPLES, OR PRICES FOR LARGER QUANTITIES AVAILABLE UPON REQUEST

WALDOM ELECTRONICS, INC. 4625 WEST 53rd STREET, CHICAGO, ILLINOIS 60632 (312) 585-1212

waldom HARDWARE AND FASTENING DEVICES

PACKAGED HARDWARE

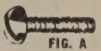


FIG. A

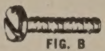


FIG. B

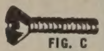


FIG. C

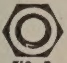


FIG. D

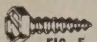


FIG. E

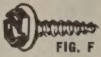


FIG. F

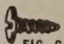


FIG. G

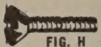


FIG. H

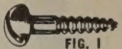


FIG. I

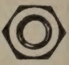


FIG. J

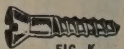


FIG. K

ROUND HEAD STEEL FIG. A MACHINE SCREWS — Nickel Plated

Screw Size Inch	Part No.	Per Pkg. of 100
2-56 x ⅛	F-579-C	2.20
2-56 x ¼	F-461-C	2.30
2-56 x ½	F-462-C	2.40
2-56 x ¾	F-463-C	2.60
3-48 x ¾	F-464-C	2.50
4-36 x ¼	F-465-C	2.20
4-36 x ⅜	F-466-C	2.40
4-36 x ½	F-467-C	2.60
4-36 x ⅝	F-580-C	2.70
4-36 x ¾	F-468-C	2.80
4-40 x ¼	F-469-C	2.30
4-40 x ⅜	F-581-C	2.40
4-40 x ½	F-470-C	2.60
4-40 x ⅝	F-582-C	2.70
4-40 x ¾	F-471-C	2.80
6-32 x ¼	F-472-C	2.30
6-32 x ⅜	F-583-C	2.35
6-32 x ½	F-473-C	2.40
6-32 x ⅝	F-584-C	2.60
6-32 x ¾	F-474-C	2.70
6-32 x 1	F-475-C	2.80
6-32 x 1¼	F-476-C	3.20
6-32 x 2	F-477-C	5.20
8-32 x ¼	F-478-C	2.60
8-32 x ⅜	F-479-C	2.80
8-32 x ½	F-480-C	2.80
8-32 x ⅝	F-585-C	2.80
8-32 x ¾	F-481-C	3.00
8-32 x 1	F-482-C	3.20
8-32 x 1¼	F-483-C	3.40
10-32 x ½	F-484-C	3.00
10-32 x ⅝	F-586-C	3.20
10-32 x ¾	F-485-C	3.30
10-32 x 1	F-486-C	3.40
10-32 x 1½	F-487-C	4.40

BINDER HEAD STEEL FIG. B MACHINE SCREWS — Nickel Plated

Screw Size Inch	Part No.	Per Pkg. of 100
2-56 x ⅛	F-591-C	2.20
2-56 x ¼	F-592-C	2.30
2-56 x ½	F-593-C	2.40
2-56 x ⅝	F-594-C	2.45
4-40 x ¼	F-020-C	2.30
4-40 x ½	F-021-C	2.60
4-40 x ¾	F-022-C	2.80
6-32 x 1/16	F-502-C	2.20
6-32 x ¼	F-503-C	2.30
6-32 x ⅜	F-504-C	2.35
6-32 x ½	F-014-C	2.40
6-32 x ⅝	F-621-C	2.60
6-32 x ¾	F-015-C	2.70
8-32 x ¼	F-023-C	2.60
8-32 x 5/16	F-505-C	2.70
8-32 x ⅜	F-024-C	2.75
8-32 x ½	F-025-C	2.80
8-32 x ¾	F-026-C	3.00
10-32 x ½	F-577-C	3.00
10-32 x ¾	F-578-C	3.30

FLAT HEAD STEEL FIG. C MACHINE SCREWS — Nickel Plated

Screw Size Inch	Part No.	Per Pkg. of 100
4-40 x ¼	F-622-C	2.30
4-40 x ⅜	F-623-C	2.40
4-40 x ½	F-624-C	2.60
6-32 x ¼	F-625-C	2.30
6-32 x ⅜	F-626-C	2.35
6-32 x ½	F-627-C	2.40
6-32 x ¾	F-628-C	2.70
8-32 x ⅜	F-629-C	2.75
8-32 x ½	F-630-C	2.80
8-32 x ¾	F-631-C	3.00
10-32 x ½	F-632-C	3.00

HEX STEEL NUTS — Nickel Plated FIG. D

Screw Size Inch Thrd. Width Thk.	Part No.	Per Pkg. of 100
2-56 x 3/16 x 1/16	F-554-C	1.80
3-48 x 3/16 x 1/16	F-555-C	2.00
4-36 x ¼ x 3/32	F-556-C	2.05
4-40 x ¼ x 3/32	F-557-C	2.10
6-32 x ¼ x 3/32	F-559-C	2.20
6-32 x 5/16 x 7/64	F-560-C	2.30
8-32 x ¼ x 3/32	F-561-C	2.30
8-32 x 5/16 x 7/64	F-562-C	2.30
10-32 x ⅜ x ⅛	F-563-C	2.40
12-24 x 7/16 x 5/32	F-619-C	3.40
¼-20 x 7/16 x 3/16	F-564-C	3.70

SLOTTED HEX HEAD SHEET METAL SCREWS (Type A) — Nickel Plated FIG. E

Screw Size Inch	Part No.	Per Pkg. of 100
4 x ⅜	F-016-C	2.35
4 x ½	F-523-C	2.75
6 x ¼	F-524-C	2.80
6 x ⅜	F-525-C	2.90
6 x ½	F-526-C	3.00
6 x ⅝	F-595-C	3.10
6 x ¾	F-527-C	3.20
8 x ¼	F-528-C	2.80
8 x ⅜	F-529-C	2.90
8 x ½	F-530-C	3.00
8 x ⅝	F-017-C	3.10
8 x 1	F-531-C	3.20
10 x ⅜	F-532-C	3.20
10 x ½	F-533-C	3.30
10 x ¾	F-534-C	3.40

HEX WASHER HEAD — SLOTTED SHEET METAL SCREWS FIG. F (Type A) Steel-Indented; Nickel Plated

Screw Size Inch	Part No.	Per Pkg. of 100
6 x ¼	F-056-C	3.20
6 x ⅜	F-057-C	3.40
6 x ½	F-050-C	3.50
6 x ⅝	F-058-C	3.60
6 x ¾	F-054-C	3.70
8 x ¼	F-051-C	3.20
8 x ⅜	F-052-C	3.40
8 x ½	F-053-C	3.50
8 x ⅝	F-055-C	3.60
8 x ¾	F-059-C	3.70

PAN HEAD SHEET METAL SCREWS (Type A) — Nickel Plated FIG. G

Screw Size Inch	Part No.	Per Pkg. of 100
4 x ½	F-596-C	2.40
6 x ¼	F-033-C	2.40
6 x ⅜	F-597-C	2.50
6 x ½	F-034-C	2.60
6 x ¾	F-035-C	2.70
8 x ¼	F-036-C	2.50
8 x ⅜	F-598-C	2.60
8 x ½	F-037-C	2.70
8 x 1	F-038-C	3.20

OVAL HEAD STEEL FIG. H MACHINE SCREWS — Nickel Plated

Screw Size Inch	Part No.	Per Pkg. of 100
6-32 x ½	F-506-C	2.40
6-32 x ¾	F-507-C	2.70
8-32 x ¾	F-508-C	3.00
10-32 x ½	F-509-C	3.00
10-32 x ¾	F-510-C	3.30

ROUND HEAD STEEL WOOD SCREWS — Nickel Plated FIG. I

Screw Size Inch	Part No.	Per Pkg. of 100
4 x ½	F-514-C	2.80
4 x ¾	F-515-C	3.20
6 x ¾	F-516-C	3.30
6 x 1	F-517-C	3.40
8 x ¾	F-518-C	3.60
8 x 1	F-047-C	3.80
8 x 1¼	F-519-C	4.00
10 x 1½	F-520-C	4.80
12 x 1½	F-521-C	5.80
14 x 1¾	F-522-C	8.00

VOLUME CONTROL & TOGGLE SWITCH MOUNTING NUTS — Nickel Plated

(For Volume Control) FIG. J

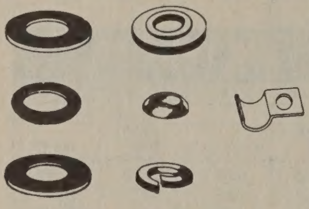
Screw Size Inch	Part No.	Per Pkg. of 100
⅜-32 x ½ x 3/32	F-565-C	5.60

(For Toggle Switch)

Screw Size Inch	Part No.	Per Pkg. of 100
15/32-32 x 9/16 x 5/64	F-566-C	4.80
.475-32 x 19/32 x 1/16	F-567-C	5.20

FLAT HEAD STEEL WOOD SCREWS — Nickel Plated FIG. K

Screw Size Inch	Part No.	Per Pkg. of 100
8 x ½	F-027-C	3.60
8 x 1	F-048-C	3.80
8 x 1¼	F-032-C	4.00
10 x 1½	F-044-C	4.80



FLAT STEEL WASHERS — Nickel Plated

Screw Size	I.D. In.	O.D. In.	Thk. In.	Part No.	Per Pkg.
2	.092	7/32	.018	MW-400-C	.80
4	.125	9/32	.025	MW-401-C	.85
6	.150	⅜	.032	MW-402-C	.90
8	.170	⅜	.032	MW-403-C	.95
10	.204	7/16	.032	MW-404-C	1.05
¼	.281	⅝	.050	MW-408-C	2.00
⅜	.392	11/16	.050	MW-410-C	2.40

FLAT FIBER WASHERS

Screw Size	I.D. In.	O.D. In.	Thk. In.	Part No.	Per Pkg.
4	.120	¼	1/32	FW-374-C	1.00
6	.145	¼	1/32	FW-375-C	1.00
8	3/16	⅜	1/32	FW-376-C	1.00
10	.192	⅜	1/32	FW-377-C	1.10
¼	.255	½	1/32	FW-378-C	1.30
⅜	⅜	⅝	1/32	FW-379-C	1.40
7/16	.440	¾	1/32	FW-380-C	2.65

EXTRUDED FIBER WASHERS

Screw Size	I.D. In.	O.D. In.	Thk. In.	Part No.	Per Pkg.
4	⅛	9/32	5/64	FW-384-C	2.50
6	9/64	5/16	5/64	FW-385-C	2.65
8	11/64	⅜	3/32	FW-386-C	2.80
10	13/64	7/16	3/32	FW-387-C	2.90
¼	.256	½	3/32	FW-388-C	3.20
⅜	.375	⅝	3/32	FW-389-C	3.50

STEEL CUP WASHERS — Nickel Plated

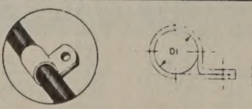
Screw Size	I.D. In.	O.D. In.	Thk. In.	Part No.	Per Pkg.
6				CW-6-C	.90
8				CW-8-C	1.05
10				CW-10-C	1.40

STEEL SPLIT LOCK WASHERS — Zinc Plated

Screw Size	I.D. In.	O.D. In.	Thk. In.	Part No.	Per Pkg.
#4 Screw				MW-411-C	1.00
#6 Screw				MW-412-C	1.05
#8 Screw				MW-413-C	1.10
#10 Screw				MW-414-C	1.15
#¼ Screw				MW-415-C	1.20

METAL CABLE CLAMPS — Cadmium Plated

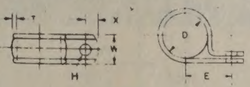
Mtl. In.	Ht. In.	W. In.	Wire Hold Area	Part No.	Per Pkg.
.020B	7/16	¼	3/32	C-201-S	2.05
.032S	⅝	⅜	10/64	C-202-C	2.35
.032S	11/16	⅜	1/4	C-203-C	2.40
.032S	15/16	⅜	10/32	C-204-C	2.70



NYLON CABLE CLAMPS

D	D₁ Inch.	E	Blue Line—Pkg. of 100 or as shown ( )	
			Part No.	Per Pkg.
⅛	.125	.310	CCN-31-C	3.05
3/16	.188	.373	CCN-32-C	3.25
¼	.250	.407	CCN-33-C	3.35
5/16	.313	.448	CCN-34-C	3.80
⅜	.375	.479	CCN-35-P (50)	2.00
7/16	.438	.510	CCN-36-P (50)	2.05
½	.500	.542	CCN-37-P (50)	2.10
9/16	.563	.623	CCN-38-P (25)	1.60
⅝	.625	.638	CCN-39-P (25)	1.60
11/16	.688	.752	CCN-40-P (20)	1.40
¾	.750	.783	CCN-41-P (20)	1.45
⅞	.875	.845	CCN-42-P (20)	1.60
1	1.000	.908	CCN-43-P (15)	1.50

Width: Up to CCN-37, ⅜″. All others are ½″. ⅜″ width have .167″ mounting hole, ½″ width have 13/64″ mounting hole. ⅜″ width are .040″ thickness, ½″ width are .060″ thickness.



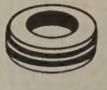
BUTYRATE CABLE CLAMPS

D	D₁ Inch.	E	Blue Line—Pkg. of 100 or as shown ( )	
			Part No.	Per Pkg.
⅛	.115	.310	CCB-1-C	3.90
3/16	.172	.373	CCB-2-C	3.95
¼	.234	.407	CCB-3-C	4.40
5/16	.297	.448	CCB-4-P (50)	2.25
⅜	.359	.479	CCB-5-P (50)	2.40
7/16	.422	.510	CCB-6-P (40)	2.00
½	.484	.542	CCB-7-P (40)	2.05
9/16	.547	.623	CCB-8-P (30)	1.65
⅝	.609	.654	CCB-9-P (25)	2.00
11/16	.672	.752	CCB-10-P (20)	1.35
¾	.734	.783	CCB-11-P (20)	1.40
⅞	.859	.845	CCB-12-P (20)	1.45
1	.934	.908	CCB-13-P (15)	1.30
1¼	1.227	1.062	CCB-15-P (10)	1.15
1½	1.102	.970	CCB-14-P (15)	1.45

Thickness: .060″. Width: ½″. Mounting hole: 13/64″, 7/32″ from end of clamp.

VINYL GROMMETS

- Exceptional Aging Qualities
- High Dielectric Properties
- Oil Resistant
- Durometer Hardness 45 1045
- Cost Less Than Rubber
- Will Not Stain Most Surfaces



A	B	C	D	E	Part No.	Per Pkg. of 100
⅛	1/16	11/32	3/16	¼	G-401-C	2.35
3/16	1/16	7/16	7/32	5/16	G-402-C	2.75
¼	1/16	9/16	¼	⅜	G-403-C	3.10
5/16	1/16	⅝	¼	7/16	G-404-C	3.20
⅜	1/16	⅝	¼	½	G-405-C	3.30
½	1/16	13/16	9/32	⅝	G-406-P*	2.50
⅝	1/16	1⅛	9/32	⅞	G-407-P†	1.90

*(50) †(25)

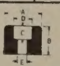
These grommets were tested by Underwiters Laboratories in a circulating air oven at 212°F for seven days with no visible change.

RUBBER GROMMETS

A	B	C	D	E	Part No.	Per Pkg. of 100
⅛	1/16	11/32	3/16	¼	G-300-C	3.05
5/16	1/16	9/16	3/16	15/32	G-301-C	4.30
⅜	1/16	11/32	9/32	½	G-302-P*	2.80
3/16	1/16	7/16	7/32	5/16	G-305-C	3.20
7/16	3/64	¾	¼	19/32	G-307-P*	3.05
11/32	1/16	⅝	5/16	15/32	G-309-C	4.25
⅝	1/16	1⅛	5/16	⅞	G-311-C†	3.15

*(50) †(25)

RUBBER BUMPERS — Recessed Screw Type



For mounting on all types of Electronic Equipment. Prevents vibration and protects surfaces under equipment from being marred.

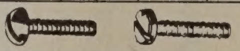
A	B	C	D	E	Part No.	Per Pkg. of 100
½	¼	5/32	¼	⅛	B-321-C	4.20
¾	¼	⅛	¼	⅛	B-322-P*	2.10
⅝	⅜	7/32	¼	⅛	B-323-P*	2.15
¾	⅜	7/32	¼	⅛	B-324-P*	2.20

*(25)

Button Type

A	B	C	D	E	Part No.	Per Pkg. of 100
⅜	⅜	17/64	3/16	.040	B-361-C	5.00
½	7/16	11/32	¼	.040	B-362-C	5.30
⅝	9/16	15/32	5/16	.040	B-363-P*	2.30

*(25)



NYLON SCREWS — Round Head & Binder Head

Description Inch.	Round Head Part No.	Binder Head Part No.	Pkg. of 100
2-56 x ¼	FN-800-C	FN-815-C	5.60
2-56 x ½	FN-801-C	FN-816-C	5.60
4-40 x ¼	FN-802-C	FN-817-C	5.60
4-40 x ½	FN-803-C	FN-818-C	5.60
4-40 x ¾	FN-804-C	FN-819-C	6.00
6-32 x ¼	FN-805-C	FN-820-C	6.00
6-32 x ⅜	FN-806-C	FN-821-C	6.00
6-32 x ½	FN-807-C	FN-822-C	6.00
6-32 x ⅝	FN-808-C	FN-823-C	6.20
6-32 x ¾	FN-809-C	FN-824-C	6.20
8-32 x ⅜	FN-810-C	FN-825-C	6.20
8-32 x ½	FN-811-C	FN-826-C	6.20
8-32 x ¾	FN-812-C	FN-827-C	6.40
10-32 x ½	FN-813-C	FN-828-C	6.40
10-32 x 1	FN-814-C	FN-829-C	6.80

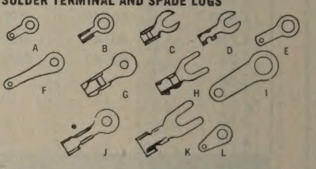
NYLON FLAT WASHERS

Part No.	I.D.	O.D.	Thickness	Pkg. of 100
NW-875-C	#4 (.120)	9/32	.050	1.50
NW-876-C	#6 (.150)	5/16	.050	1.50
NW-877-C	#8 (.170)	⅜	.060	2.00
NW-878-C	#10 (.195)	7/16	.060	2.40

NYLON HEX NUTS

Description Inch.	Part No.	Pkg. of 100
2-56	FN-853-C	5.50
4-40	FN-854-C	5.60
6-32	FN-855-C	5.70
8-32	FN-856-C	5.80
10-32	FN-857-C	6.00

SOLDER TERMINAL AND SPADE LUGS



Supplied with hot-tin dipping in brass (B), or copper (C) as specified in Material column.

Fig.	Material Thickness	Hole Size	Length In.	Part No.	Per Pkg. of 100
A	.015C	#2	21/64	T-251-C	1.90
A	.020B	#6	½	T-151-C	1.90
A	.020B	#8	13/16	T-152-C	2.70
A	.020B	#10	13/16	T-153-C	2.80
B	.020C	#4	9/16	T-226-C	2.40
B	.032C	#6	½	T-156-C	2.80
B	.020B	#8	21/32	T-227-C	5.20
B	.020B	#10	21/32	T-228-C	4.40
C	.020B	#8	41/64	T-157-C	2.65
D	.020B	#6	21/32	T-158-C	2.65
D	.020B	#8	21/32	T-159-C	2.75
D	.020B	#10	47/64	T-225-C	3.60
E	.015B	#8	47/64	T-162-C	3.40
F	.025B	#6	1	T-163-C	3.05
F	.025B	#8	1	T-164-C	3.05
G	.020C	#6	15/16	T-166-C	4.55
G	.020C	#8	15/16	T-167-C	5.20
G	.020C	#10	15/16	T-168-C	5.20
H	.020B	3/16″	25/32	T-170-C	3.60
I	.020B	#10	1 5/32	T-173-C	6.40
J	.032B	#8	15/16	T-187-C	6.40
J	.032B	#10	15/16	T-188-C	9.20
K	.032B	#8	1	T-193-C	2.10
L	.020B	#6	9/16	T-154-C	2.10
L	.015C	#8	17/32	T-224-C	2.80

ANALOG DIGITAL DATA SYSTEMS, INC.

DEPT. EM, P.O. BOX 9209 • ROCHESTER, N.Y. 14625 • PHONE (716) 334-9649

DATA ACQUISITION SYSTEMS

A. D. DATA SYSTEMS OFFERS A LOW COST APPROACH TO DATALOGGING THROUGH THE SERIES 14 & 15 MAINFRAMES WITH A WIDE RANGE OF EXPANSIONS AND OPTIONS. YOU CAN CHOOSE THE UNIT TO MEET YOUR EXACT REQUIREMENT WITH MINIMUM COST, HIGHER RELIABILITY AND SMALLER SIZE; AND STILL RETAIN FLEXIBILITY FOR FUTURE EXPANSION.

DATALOGGERS SERIES 14 & 15

ARE AVAILABLE WITH THE FOLLOWING FEATURES:

- Multiplexing from 10 to 1000 analog inputs.
- Expandable in 10 channel modules.
- Two wire differential input with high common mode rejection.
- Voltage measurements, autoranging, and thermocouple measurements.
- Digital clock in Days, Hours and Minutes.
- Scan interval selection.
- Visual display of time, channel and data.
- Printer output.
- Teletype 20 ma. neutral line output.
- RS232-C compatible output.
- IEEE 488 compatible interface.
- Remote keyboard control.

SERIES 14 DATALOGGERS

For voltage measurements only with autoranging thru ±.1999v, ±1.999v and ±19.99v with common mode rejection of 70db at 60Hz and common mode voltage ±100v. Multiplexing speeds up to 30 readings/second.

MODEL 14P

Basic unit has output of channel number and data on 9 column printer with speed of 3 readings/second.

Digital clock option available with interval selection and printout on 9 additional columns.

MODEL 14TY

Output is available with either TTY or RS232 compatibility for driving Teletypes, Terminals, Tape Cassettes on Modules making this unit ideal for data collection at remote locations.

Options include digital clocks, remote control by keyboard or teletype and parallel output onto paper tape or magnetic tape.

Speeds can be set to 110, 300, 1200 and 2400 baud.

SERIES 15 DATALOGGERS

This series of dataloggers has all the features of the 14TY but can be used for both voltage and temperature measurements, with linearization, reference junction compensation and open thermocouple indication.

Datalogging speed is one channel/second with dual slope integration and input filtering.

MODEL 15TS

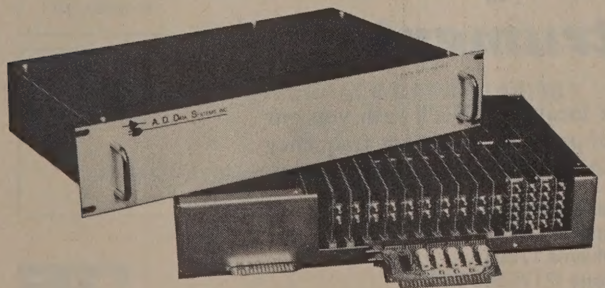
This basic datalogger is designed to measure temperatures using any one type of thermocouple input.

MODEL 15TP

This is a programmable datalogger which has a selection of any 4 types of thermocouples or 3 thermocouples and voltage.

SWITCHING SYSTEMS

A. D. DATA SYSTEMS OFFER A SERIES OF SWITCHING UNITS USING REED RELAYS FOR ALL TYPES OF SWITCHING FUNCTIONS. UNITS ARE AVAILABLE WITH MANUAL; COMPUTER I/O BUS; IEEE 488 INTERFACE BUS; OR RS232 SERIAL CONTROL. INTERNAL MEMORY OR LATCHING OF SWITCH SELECTION DATA REQUIRE ONLY MOMENTARY LOGIC LEVELS FROM COMPUTER CONTROL BUS.



SERIES 56 COAXIAL MATRIX

SERIES 12 MULTIPLEXERS

Available with 10 to 10,000 channels, expandable in 10 channel modules with 1, 2, 3 or 4 poles per channel. Basic unit has sequential or individual channel selection from remote or local control. Standard switching modules include isothermal, high common mode, switch guard and flying capacitor type switching.

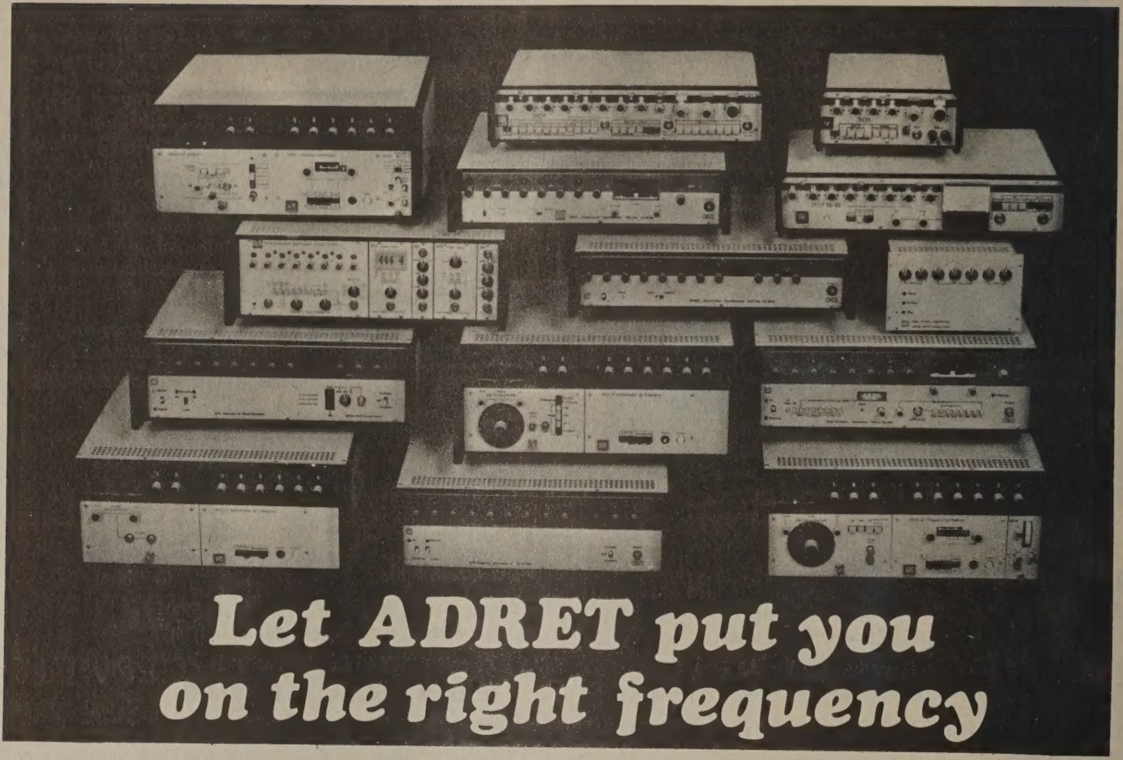
SERIES 56 COAXIAL MATRIX

Manual or Computer Controlled Switching of several inputs to several outputs by selection of individual latched crosspoints. Designed specifically for very high frequency signals with 50 ohm characteristic impedance for distortionless switching and low crosstalk.

Basic unit is 10 X 10 matrix, expandable to any size required.

SERIES 35 MATRICES

MANUAL OR COMPUTER CONTROLLED routing of signals in any input to any output format. Basic unit has controls for up to 1000 crosspoints, and matrix can be built up in required configuration by plug in modules of 10 or 20 crosspoints. The modules are available with either single pole or two pole switches configured for use as multiplexers, matrices or individual sets of contacts.



It's never easy to pick the right frequency synthesizer when you have to pore through a thick catalog of all kinds of instruments to make your choice.

Adret makes it easy. Frequency generators are our only business and you'll find more synthesizers in our new catalog than anywhere else. You're sure to find an Adret synthesizer that meets your needs at a very competitive price.

You see, we've been frequency-synthesizer specialists for 10 years now. You get a choice of 15 synthesizers in our 1977 catalog, not counting specials and OEM versions. The frequencies run as low as 0.01 Hz and as high as 600 MHz. But since we offer so many models, you don't end up paying for spectrum and features you don't need.

You get the most for your instrument dollar.

let ADRET guide you to the right instrument

Call us, or our representative in your local area. We'll rush you our new 1977 catalog. It gives you a lot of practical tips about frequency measurements as well as the details on our hardware.

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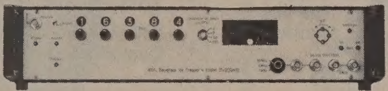
let ADRET guide you to the right instrument

STANDARD RECEIVER



4101

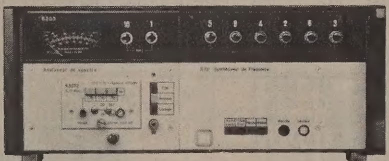
15 kHz/200 kHz with 20 Hz resolution. High stability built-in crystal pilot. **Reference frequencies availables :** 1 MHz, 5 MHz, 10 MHz.

FREQUENCY ERROR MULTIPLIER

4110

Input frequencies : any submultiple of 10 MHz down to 1 MHz. **Frequency error multiplied** by 10^n (n : 1 to 4) **ΔF/F measurement** with 10^{-12} resolution. Outputs : BCD coded and analog, digital display.

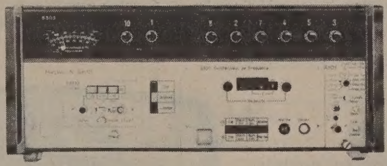
SELECTIVE dB METER



6101 + 6303

Analysis filter : 10 Hz or 100 Hz at – 3 dB.
Dynamic range : 120 dB. **Sensibility** : 0.1 µV measurement display on galvanometer.

SPECTRUM ANALYSER



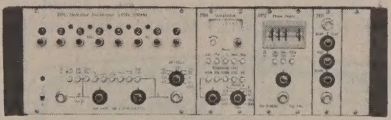
6100 + 6303

Same characteristics as for 6101 + 6303 plus **Deviation** ± 200 Hz to ± 100 kHz from the carrier. **XY output** for recorder.

IEEE 488 BUS INTERFACE CAPABILITIES WITH INTERFACE 414 ASCII/PARALLEL BCD

MODULAR SIGNAL GENERATOR

0.01 Hz/ 200 kHz

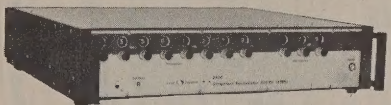


3100

Resolution 0.01 Hz. **Phase shifting** from 0° to 359.9° (resolution 0.1°)
Sweep with markers, **programmable attenuator.**

FREQUENCY AND LEVEL GENERATOR

300 Hz/
14 MHz

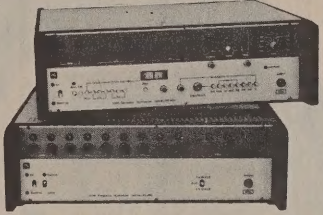


2400

Resolution : 1 Hz, **offset frequency** : Fo + 20 MHz
Output impedance 50/75 Ω and < 3 Ω **Programmable output level,** + 20 dB to – 80 dB **Level regulation,** ± 0.01 dB (resolution 0.1 dB).

GENERATOR SYNTHESIZER / FREQUENCY SYNTHESIZER

300 Hz to 60 MHz

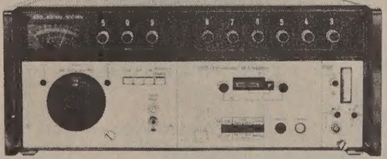


3300/3310

3300 : **AM/FM** modulation, **Search** function
3310 : **Frequency** and **level** programming

PLUG-IN MULTIFUNCTION GENERATOR

400 kHz/
600 MHz



6100 + 6315

AM-FM-PM modulations Frequency Search : ± 1 Hz to ± 1 MHz **Output level** : 1 V to 0.1 µV
Auxiliary plug-ins : Sweep with markers, 0.01 Hz resolution, internal modulating signals.

SPECIAL PRODUCTIONS MADE UNDER CUSTOMER'S REQUIREMENTS

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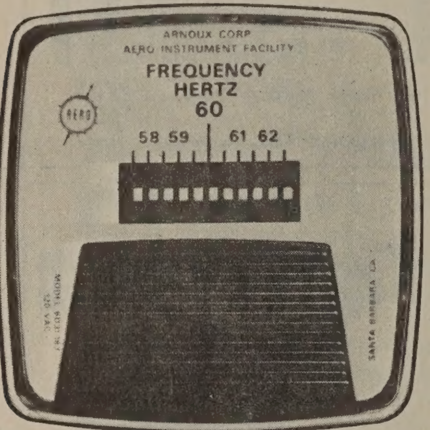
FREQUENCY METERS

OVER 25 YEARS OF CONTINUOUS PRODUCTION

VIBRATING REED METERS

The AERO Instrument Facility of Arnoux Corporation produces over 1000 different types and styles of Vibrating Reed Frequency Meters, with a proved history of usage spanning over 25 years. Unsurpassed for high performance and quality construction, all AERO Frequency Meters provide the inherent advantages of great accuracy (with 0.3% at 72°F, and within 0.1% on special order); long term stability (±75 ppm per degree F. from -60° to +180°); low power consumption; self-checking characteristics; high reliability; and extreme ruggedness. No adjustments are ever required on Vibrating Reed Frequency Meters. AERO meters are available with . . . . .

- **1.5 inch to 3.5 inch Round Cases**
- **Bakelite and Metal Construction**
- **Hermetic Sealing**
- **1 Reed to 11 Reeds**
- **Center Frequencies from 20 Hz to 400 Hz**
- **Voltages from 24 Vrms to 220 Vrms**
- **Running Time Indicators**
- **Combination Meters**

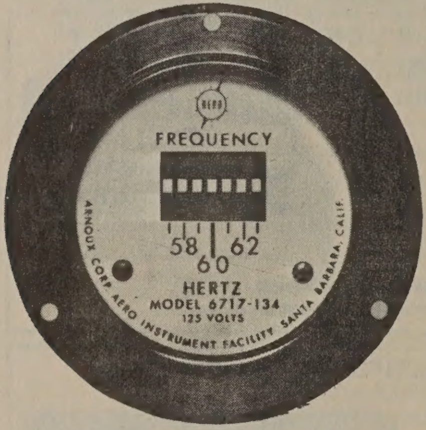


3.5 Inch Full View Meters

MODEL* NO.	CENTER FREQUENCY	FREQUENCY RANGE	NUMBER OF REEDS	REED INTERVAL	PRICE PER UNIT 1-24	25-49	50-99
2810.183	[50 Hz 60 Hz	48 to 52 Hz 58 to 62 Hz]	10	1 Cycle	$40.93	$27.42	$22.52
4059-183	400 Hz	380 to 420 Hz	9	5 Cycles	46.32	31.03	25.48
5D31-183	50 Hz	47.5 to 52.5 Hz	11	½ Cycle	40.73	27.29	22.41
5717-183	50 Hz	47 to 53 Hz	7	1 Cycle	38.01	25.47	20.90
6D31-183	60 Hz	57.5 to 62.5 Hz	11	½ Cycle	40.73	27.29	22.41
6511-183	60 Hz	55 to 65 Hz	11	1 Cycle	40.73	27.29	22.41
6717-183	60 Hz	57 to 63 Hz	7	1 Cycle	38.01	25.47	20.90
6815-183	60 Hz	58 to 62 Hz	5	1 Cycle	35.81	23.99	19.69

Mounting Data. Three equally-spaced mounting studs (No. 8-32) are permanently affixed to rear of meter face panel, on 3.16" diameter (single studs at top center). Meter case requires 2.18" diameter hole. Total depth from rear of face panel is 2.50", including two No. 10-32 electrical connection studs. Meter face panel is 3.50" square and approximately 0.4" deep.

*Model numbers specify non-hermetically sealed metal cases; 0.3% accuracy; standard voltage of 117 Vrms; and input resistance of 10,000 ohms.



3.5 Inch Round Meters

MODEL* NO.	CENTER FREQUENCY	FREQUENCY RANGE	NUMBER OF REEDS	REED INTERVAL	PRICE PER UNIT 1-24	25-49	50-99
2810-134	[50 Hz 60 Hz	48 to 52 Hz 58 to 62 Hz]	10	1 Cycle	$36.94	$24.75	$20.32
4059-134	400 Hz	380 to 420 Hz	9	5 Cycles	42.33	28.36	23.28
5D31-134	50 Hz	47.5 to 52.5 Hz	11	½ Cycle	36.74	24.62	20.21
5717-134	50 Hz	47 to 53 Hz	7	1 Cycle	34.01	22.79	18.71
6D31-134	60 Hz	57.5 to 62.5 Hz	11	½ Cycle	36.74	24.62	20.21
6511-134	60 Hz	55 to 65 Hz	11	1 Cycle	36.74	24.62	20.21
6717-134	60 Hz	57 to 63 Hz	7	1 Cycle	34.01	22.79	18.71
6815-134	60 Hz	58 to 62 Hz	5	1 Cycle	31.81	21.32	17.50

Mounting Data. Three equally-spaced mounting holes are through meter face panel on 3.16" diameter (single hole at top center). Holes accept No. 8-32 mounting hardware (supplied). Meter case requires 2.69" diameter hole. Total depth from rear of face panel is 2.31", including two No. 6-32 electrical connection studs. Meter face panel is 3.50" diameter and approximately 0.2" deep.

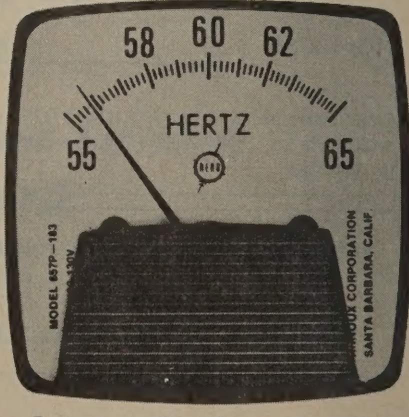
*Model numbers specify non-hermetically sealed bakelite cases; 0.3% accuracy; standard voltage of 117 Vrms; and input resistance of 10,000 ohms.

POINTER TYPE METERS

AERO's new line of Pointer-Type Meters feature advanced microminiature circuits for performing frequency-to-DC conversion with remarkable linearity and stability. These circuit innovations have now made pointer-type meters both economical and practical for production. Pointer-Type Meters are presently available in three frequency ranges, with accuracy and stability as great as 0.3 Hz in the 45 to 65 Hz ranges. The input voltage for all units is 115 ±15Vac, with power consumption approximately 2 watts. Operating temperature range is 0° to 150°F.

MODEL NO.	FREQUENCY RANGE	ACCURACY & STABILITY	PRICE PER UNIT 1-24	25-49	50-99
557P-183	45-55 Hz	0.3 Hz	$64.56	$46.81	$40.34
657P-183	55-65 Hz	0.3 Hz	64.56	46.81	40.34
407P-183	380-420 Hz	2.0 Hz	64.56	46.81	40.34
257P-183	45-65 Hz	0.3 Hz	64.56	46.81	40.34

Mounting Data
(Same as for 3.5 Inch Full View Meters. See above.)



All prices are net, FOB Factory, 10/31/76, subject to change.

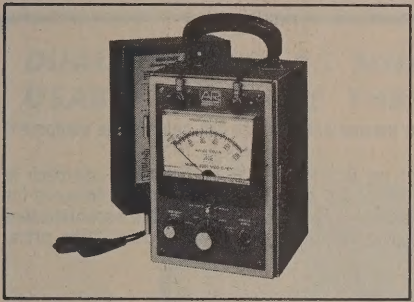
Larger quantity prices on request.

Write for Our Catalog for Complete Data on Other Models and Styles of Aero Frequency Meters

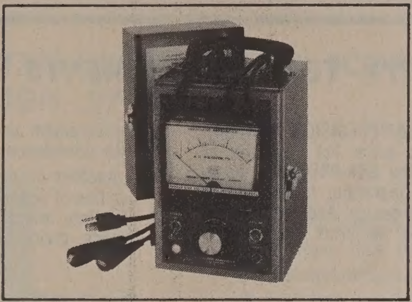
AERO INSTRUMENT FACILITY OF ARNOUX *CORPORATION*

35 ANACAPA STREET
SANTA BARBARA, CALIFORNIA 93101
PHONE (805) 963-3476

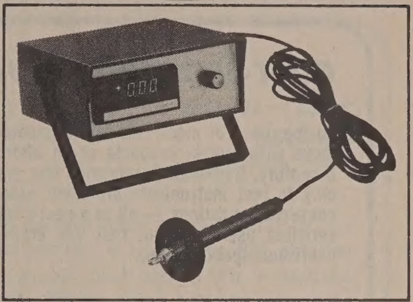
INSULATION TESTING EQUIPMENT for electronic equipment and systems



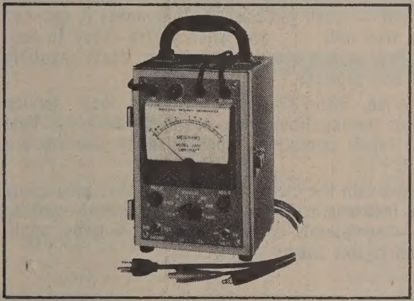
Meg-Chek® Megohmmeters for testing insulation resistance of motors, transformers, cables and generators. Models: 500V and 1000V DC.



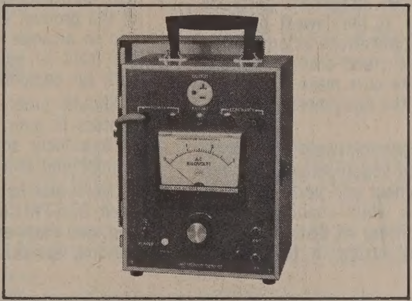
3KV AC Hypot for production line testing to meet UL and CSA approval.



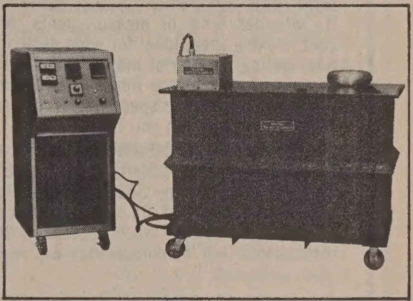
Kilovoltmeter for checking calibration of high voltage testers as specified by UL. Digital readout, compact, very portable.



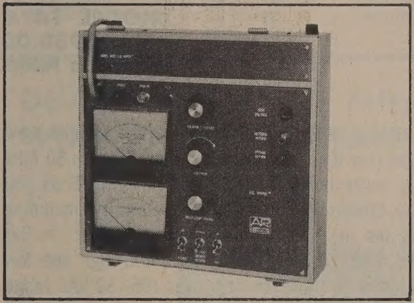
Vibrotest for resistance testing of printed circuits, transistors, cables and motors to 10 million megohm range.



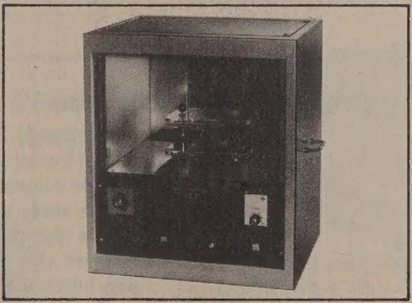
Automatic Hypot/Ground Continuity Tester for UL and CSA approval testing of production line items.



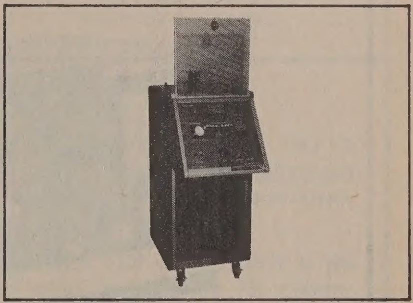
Series Resonant Test Sets for testing highly capacitive electrical insulation systems.



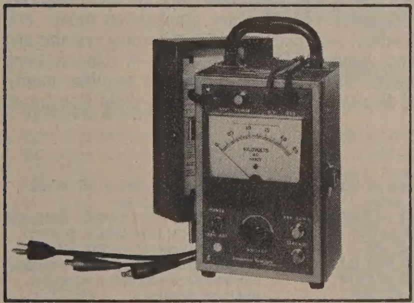
4KV AC Hypot for nondestructive testing. Has both current and volt meters.



Materials Testing Hypot for breakdown and dielectric strength tests to meet ASTM specifications. Has digital readout.

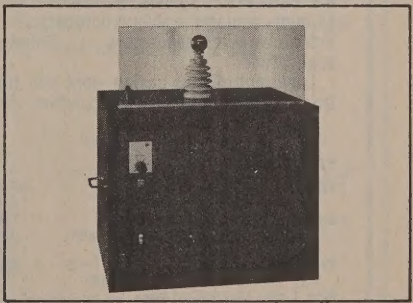


Corona Detection Equipment for detecting partial discharges in electrical insulation systems. Models: 10KV and up.



AC Hypot Jr. for testing small appliances, motors, tools. Models: limited current to 10KV.

Arc Resistance Tester for meeting ASTM and federal LP tests of resistance of solid electrical insulation materials to action of an arc close to the surface.



Bench-style AC Hypots for dielectric strength tests of rotating machinery, switchgear, cables, transformers. Also mobile models from 10 to 35KV. Console models: 300 KV at 250 KVA.

For full-line information request Catalog SFC

Associated Research, inc.

6125 WEST HOWARD STREET, CHICAGO, IL 60648
PHONE 312/647-7850

Sales representatives in principal cities 708

B+K PRECISION DYNASCAN CORPORATION

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COST-EFFECTIVE, QUALITY TEST INSTRUMENTS

To the users of electronic test equipment, B&K-PRECISION is synonymous with quality products at an affordable price. For a quarter of a century, Dynascan Corporation has given the B&K-PRECISION name only to test instruments providing ease of operation, reliability and conservative ratings — all in a cost-effective design. And consistently satisfied users confirm that the entire line performs well beyond published specifications.

DESIGNED AND ENGINEERED FOR USER REQUIREMENTS

B&K-PRECISION conceives, designs and engineers test instruments to fulfill user requirements. Each B&K-PRECISION instrument performs its intended tests or measurements reliably at the lowest possible cost, making them ideal for such dedicated applications as production line testing, industrial maintenance and repair, and other situations involving known usage limits. Instruments like ours make it possible for you to avoid over-specifying. You buy all the equipment you need, but never more than you need.

Because B&K-PRECISION instruments are conservatively rated, their actual performance usually exceeds published specifications. You are thus assured that any B&K-PRECISION instrument will perform accurately and reliably at its rated specifications while enabling you to exceed those ratings when necessary. In addition, all B&K-PRECISION instruments are human-engineered, reducing errors in testing and measurement so even inexperienced users can operate the equipment with confidence.

Another example of the B&K-PRECISION cost-effective approach is our line of accessory items. Our probes, in particular, are designed for complete interchangeability with those of leading ultra-sophisticated brands, giving you compatible performance at about half the price.

B&K-PRECISION . . . LOCALLY STOCKED, LOCALLY SERVICED

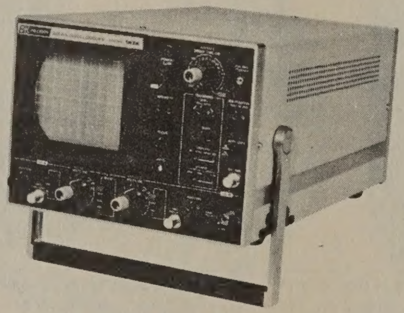
Your local electronic distributor carries the full line of B&K-PRECISION test instruments, and he can provide you with off-the-shelf delivery of the product you need — when you need it. This makes it easy for you to arrange for a trial unit . . . and when you're ready to buy, it's from an established source, one your company deals regularly with for components and supplies.

Should problems arise, B&K-PRECISION maintains local service centers in every major metropolitan area. Again, because you deal with a local source, repair operations, though rarely needed, are prompt and courteous.

You'll also be pleased with the instruction manuals that accompany each B&K-PRECISION instrument. These manuals — clearly written and well-illustrated — completely cover the test procedures, applications, operation and circuit theory of the unit.

DUAL-TRACE 5" 30 MHz TRIGGERED SWEEP SCOPE . . . LOWEST PRICE 30 MHz SCOPE WITH SIGNAL DELAY

MODEL 1474
$930.00
INCLUDING PROBES



FEATURES

• Rise time 11.7 nS or less • Built-in signal delay line permits view of high frequency pulse rise time • Triggers on signals up to 50 MHz • Mode automatically shifts between CHOP and ALTERNATE as you change sweep time • Checks most digital logic circuitry, including ECL • High accuracy ten position vertical input attenuator • Flat response with smooth rolloff past 30 MHz • Built-in high and low pass filters • Maintains calibration accuracy over 105-130 VAC range • 20 calibrated sweeps — 0.2 μS/cm-0.5 S/cm.

APPLICATIONS

Microprocessors system development . . . Analysis and troubleshooting of mini-computer and microprocessors . . . Computer terminals . . . Video character generators . . . Video games . . . Broadcast studio application.

Logic and digital design work and troubleshooting, including electronic organs, counters, calculators, phase-locked-loops, DMM's and synthesizers . . . Check the divider network of any system using TTL, DTL, RTL and most ECL logic . . . Measure propagation delays and phase shifts . . . Troubleshoot and maintain video recording systems and equipment . . . Set sync, video and color burst levels in video systems with extreme accuracy . . . Use A-B mode to compare amplifier input/output waveforms and display algebraic difference as distortion curve.

SPECIFICATIONS

VERTICAL AMPLIFIER (Channel A and Channel B.)
Deflection Factor: 5 mV/cm to 5 V/cm, ±3% in 10 ranges, each with fine adjustment.
Freq. Response: DC, DC-30 MHz (−3 dB); AC, 10 Hz-30 MHz (−3 dB).
Rise Time: 11.7 nS or less.
Overshoot: 3% or less.
Input Impedance: 1 MΩ ±2%, 22 pF (±3;F)
Tilt: Less than 5%.
Maximum Input Voltage: 300V DC + AC peak or 600V p-p.
Operating Modes: CH-A, CH-B, Dual, Add.
ALT 0.2 μS/cm-0.5 mS/cm.
CHOP 1 mS/cm-0.5 S/cm.
Chop Frequency: 200 kHz ±20%.
Signal Delay: Fixed.
CH B Polarity: NORM; INV.

SWEEP SYSTEM (Common to Channel A and Channel B.)
Type: Automatic and triggered
(NORM) Mode (X-Y operation) CH A = Y, CH B = X.
Sweep Time: 0.2 μS/cm-0.5 S/cm ±3% in 20 calibrated steps in a 1-2-5 sequence with vernier adjustment.
Horizontal Position Control: Pull for 5X magnification.
Sweep Magnification: x5 (five times) ±5%.
Linearity: 3% or better.

TRIGGERING
Source: INT CH-A, CH-B and EXT; X1 and X.1.
Slope: Positive or negative, continuously variable level control; pull for AUTO.
Range: INT DC-5 MHz, .3 cm or less. 5 MHz-30 MHz, 1 cm or less.
EXT DC-10 MHz, 100 mV p-p or better.
DC-30 MHz, 500 mV p-p or better.
Coupling: AC, DC, LF reject, HF reject. (AC) 30 Hz — 30 MHz (LF reject) signals below 10 kHz are attenuated. (HF reject) signals higher than 30 kHz are attenuated.
Non-Distorted Maximum Amplitude: More than 40 mm at 30 MHz; more than 80 mm at 10 MHz.

HORIZONTAL AMPLIFIER (Input through Channel B vertical input).
Deflection Factor: 5 mV/cm to 5 V/cm, ±5%, in ten ranges, each with fine adjustment.
Freq. Response: DC-1 MHz (−3 dB).
Input Impedance: 1 megohm (nominal), shunted by 22 pF (±3 pF).
Input Protection: 300 V DC + AC peak, or 600 V p-p.
X-Y Operation: With SWEEP TIME/CM switch in CH.B position, the CH.B input becomes the X input (horizontal) and the CH.B position control becomes the horizontal position control.

OTHER SPECIFICATIONS
Calibration: 0.5V p-p ±1% (squarewave at 1 kHz ±10%).
Intensity Modulation: More than +5V. DC-5 MHz.
Probes: Two PR-36 probes supplied.
Power Requirements: 115/230VAC, 50/60 Hz, 25 W.
Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").
Weight: 8.8 kg. (19.6 lbs.).

B+K PRECISION DYNASCAN CORPORATION / OSCILLOSCOPES

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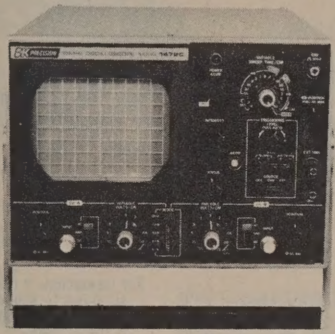
DUAL-TRACE 5" 15 MHz TRIGGERED SWEEP SCOPE USABLE RESPONSE THROUGH 27 MHz

MODEL 1472C
$660.00
INCLUDING PROBES



FEATURES

• Mode automatically shifts between CHOP and ALTERNATE as you change sweep time for fast set up • Bright Blue P31 phosphor • Flat in-band response with smooth rolloff past 15 MHz • Maintains calibration accuracy over 105-130 VAC range • Check most digital logic circuitry, including CMOS • Front-panel X-Y operation using matched vertical amps • Algebraic addition and subtraction • Differential input capability • 19 calibrated sweeps — .5 μsec/cm to .5 sec/cm • Sweep to .1 μsec/cm with 5x; 1.5 sec/cm with uncalibrated vernier • Monitor CB AM and SSB • Adjust color video to close tolerances in TV broadcast studies • TV sync separators.

SPECIFICATIONS

VERTICAL AMPLIFIER

Deflection Factor: 0.01 V/cm to 20V/cm, ±5%, in 11 ranges, each with fine adjustment.

Frequency Response: DC, DC-15 MHz (−3 dB); AC, 2 Hz-15 MHz (−3 dB).

Risetime: 24 nsec.

Input Impedance: 1 megohm (approx.) shunted by 27 pF (±3 pF).

Maximum Input Voltage: 300V, DC + AC peak or 600V p-p.

Operating Modes: Channel A only; Channel B only; Dual Trace (A and B) — trace automatically chopped at all sweep times of 1 msec/cm and slower, alternate mode automatically selected for all faster sweep times; A + B (single-trace algebraic sum of Channels A and B); A-B (single-trace algebraic difference of Channels A-B).

SWEEP

Auto and triggered. 0.5 μsec/cm to 0.5 sec/cm in 19 overlapping ranges.

Sweep Magnification: 5x at all speeds.

TRIGGERING

Source: CH A and CH B, 1cm deflection minimum. EXT, 1V p-p sensitivity.

Slope: Positive and negative, continuously variable level control; pull for AUTO.

Range: 20 Hz guaranteed (minimum 1cm deflection as measured on CRT); 20 Hz-27 MHz typical.

TV Sync: Vertical and horizontal sync separator.

Low Pass Filters: TV sync separators function as 100 Hz-3 kHz (TV-V) and 100 Hz-1 MHz (TV-H) filters.

HORIZONTAL AMPLIFIER

(Input through Channel B vertical input).

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, in 11 ranges, each with fine adjustment.

Frequency Response: DC-1 MHz (−3 dB).

Input Protection: 300V, DC + AC peak, or 600V p-p.

OTHER

Calibration Voltage: 1 kHz square wave.

Intensity (Z-Axis) Modulation: 30V p-p minimum.

Probes: Two PR-34's supplied.

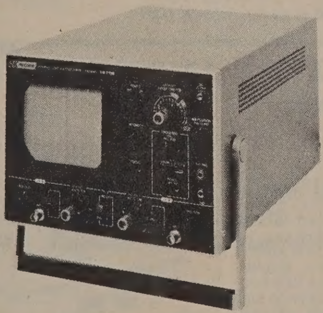
Power Required: 115/230 VAC, 50/60 Hz, 23W; CSA-approved three-wire line cord.

Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Weight: 8.8 kg. (19.6 lbs.).

DUAL-TRACE 5" 10 MHz TRIGGERED SWEEP SCOPE WITH TTL COMPATIBLE Z AXIS

MODEL 1471B
$570.00
INCLUDING PROBES



FEATURES

• Mode automatically shifts between CHOP and ALTERNATE as you change sweep time for fast set-up • Bright blue P31 phosphor • 18 calibrated sweeps — 1 μsec/cm to .5 sec/cm • Sweep to 200 nsec/cm with 5X magnification • Maintains calibration accuracy over 105-130 VAC range • Front panel X-Y operation using matched vertical amps • Input grounding switches • TV sync separators • Check most digital logic circuitry including CMOS • Character display applications using TTL Z-axis intensity modulation.

SPECIFICATIONS

VERTICAL AMPLIFIER

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, in 11 ranges.

Frequency Response: DC, DC-10 MHz (−3 dB); AC, 10 Hz-10 MHz (−3 dB).

Risetime: 35 nsec.

Overshoot: 3% or less at 100 kHz.

Input Impedance: 1 megohm (approx.) shunted by 25 pF (±3 pF).

Tilt: Less than 5%.

Maximum Input Voltage: 300V, DC + AC peak or 600V p-p.

Operating Modes: Channel A only; Channel B only; Channels A and B (dual).

Dual Trace: Trace automatically chopped at all sweep times of 1 msec/cm and slower, alternate mode automatically selected for all faster sweep times.

Chop Frequency: 200 kHz approx.

Channel Separation: Better than 60 dB at 1 kHz.

SWEEP SYSTEM

(Common to Chan. A and Chan. B.)

Type: Automatic and triggered; in automatic mode, sweep is obtained without input signal.

Sweep Time: 1 μsec/cm to 0.5 sec/cm (±5%) in 18 ranges, in 1-2-5 sequence.

Sweep Magnification: 5x at all speeds for maximum sweep speed of 200 nsec/cm.

Linearity: 3% or less.

TRIGGERING

Source: CH A and CH B; triggers at or less than 1 cm deflection. EXT 1V p-p sensitivity.

Slope: Positive and negative, continuously variable level control; pull for AUTO.

Range: 20 Hz to 10 MHz min. (at or less than 1 cm deflection); triggers to 15 MHz.

TV Sync: Vertical and horizontal sync separator circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing. TV-H (line) and TV-V (frame) sync switched automatically by SWEEP TIME/CM switch. TV-V, 0.5 sec/cm to 0.1 msec/cm. TV-H, 50 μsec/cm to 1 μsec/cm.

Low Pass Filters: The TV sync separator circuits also function as 100 Hz-3 kHz (TV-V) and 100 Hz-1 MHz (TV-H) filters.

HORIZONTAL AMPLIFIER

(Input through Chan. B vertical input.)

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, 11 ranges.

Frequency Response: DC-1 MHz (−3 dB).

Input Impedance: 1 megohm (nom.) shunted by 25 pF (±3 pF).

Input Protection: 300V, DC + AC peak, or 600V p-p.

X-Y Operation: With SWEEP TIME/CM switch in CH B position, the CH B input becomes the X input (horizontal) and the CH B position control becomes the horizontal position control.

OTHER SPECIFICATIONS

Calibration Voltage: Line frequency square wave, 1V p-p (±5%).

Intensity (Z-Axis) Modulation: 5V p-p nominal; 470K nominal input resistance.

Probes: Two PR-31's supplied.

Power Required: 115/230V, 50/60 Hz, 20W; CSA-approved three-wire line cord.

Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Weight: 8.8 kg. (19.6 lbs.).

B+K PRECISION DYNASCAN CORPORATION / OSCILLOSCOPES

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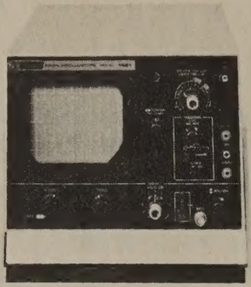
10 MHz TRIGGERED SWEEP 5" OSCILLOSCOPE

MODEL 1461
$470.00
INCLUDING PROBE



FEATURES

• 18 sweep range selections • DC-10 mV/cm sensitivity • Fully regulated . . . Calibration is accurate from 105-130V line • Automatic selection of horizontal or vertical TV signals • Built-in calibration signal • Triggered and automatic sweep • Built-in TV vertical and horizontal sync separation circuits.

This is one scope that's equally at home in an R&D lab or on a technician's bench. Top styling and performance form a blend uncommon in this price category.

The Model 1461 offers all the advantages of triggered sweep with automatic sync plus very high 10 mV/cm sensitivity. The eleven-position vertical attenuator is conveniently calibrated in 1/2/5 step sequence.

SPECIFICATIONS

VERTICAL AMPLIFIER
Sensitivity: 10 mV/cm-20 V/cm ±5%, divided into 11 calibrated ranges, each with fine adjustment.
Frequency Response: DC, DC-10 MHz (3 dB); AC, 2 Hz-10 MHz (−3 dB).
Risetime: 35 nsec.
Overshoot and Ringing: 3% or less at 100 kHz square wave display.
Input Impedance: 1 megohm shunted by 22 pF (±3 pF).
Maximum Input Voltage: 300 VDC plus AC peak, or 600V p-p.

SWEEP
Sweep System: Automatic and triggered.
Sweep Time: 1 μsec/cm-.5 sec/cm, ±5%, divided into 18 calibrated ranges (1/2/5 step sequence), each with fine adjustment.
MAGNIFICATION: 5x at all speeds; increases maximum sweep to .2 μsec/cm.
Linearity: 5 sec/cm-2 μsec/cm ranges 3% or less; 1 μsec/cm 5% or less.

TRIGGERING
Source: Internal and external.
Slope: Positive or negative, continuously variable level control (pull for automatic triggering).
Range: 20 Hz-10 MHz (minimum 1.0 cm deflection on CRT screen).
TV SYNC: Vertical and horizontal sync separator circuit provided so that any portion of complex TV waveform can be synchronized and expanded for viewing. TV sync polarity is selected by Sync switch. TVH (line) and TVV (frame) sync switched automatically by SWEEP TIME/CM switch.
TVV (FRAME) = 0.5 sec/cm to 0.1 msec/cm.
TVH (LINE) = 50 μsec/cm to 1 μsec/cm.

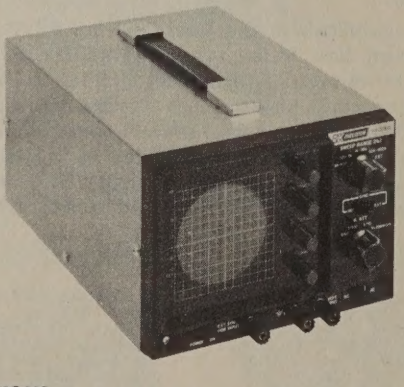
HORIZONTAL AMPLIFIER
Sensitivity: 100 mV/cm.
Response: DC-800 kHz (−3 dB) 100.
Input Impedance: 100k ohms (nominal), shunted by 40 pF.
Maximum Input Voltage: 300V (DC + AC Peak) or 600V p-p.

X-Y Operation: Y (vertical) signal supplied to scope INPUT jack; X (horizontal) signal supplied to H INPUT jack.
1V p-p square wave (±5%) at line frequency.
Intensity Modulation: 0-5V p-p (TTL logic-compatible). High logic-increases brightness; low logic-decreases brightness.
Input Resistance: 10 kΩ (nominal).
Power Requirements: 117 or 230 VAC, ±10%, 50/60 Hz, 20 watts. (3-wire line cord, CSA approved for oscilloscopes.) Calibration accuracy applies over full input voltage range.
Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").
Net Weight: 8 kg (17.3 lbs.).

PROBE (included)
Model No.: PR-31.
Attenuation: Combination 10:1 and direct.
Input Impedances: 10:1-10 megohms, 18 pF.
Connector: BNC.
Tip: Spring-loaded, hook-on tip.

3" SOLID STATE PORTABLE OSCILLOSCOPE

MODEL 1403A
$219.00



FEATURES

DC to 5 MHz bandwidth, with direct-deflection input for waveforms to 450 MHz • Sharp, bright trace • DC amplifiers on both axes • New high-brightness CRT • All solid state • Weighs only 8.4 lbs.

APPLICATIONS

The 1403A is ideal for many monitoring applications, freeing more expensive scopes from "menial" monitoring tasks. Just set the controls for the waveform being monitored and leave the rest to your tester. She'll appreciate the 1403A's sharp trace and stability. The 1403A takes up very little space on production line, classroom lab table or bench; its sturdy construction, bright display and portability make it ideal for use anywhere. This rugged "miniscope" has DC to 5 MHz bandwidth, DC amplifiers on both vertical and horizontal axes and direct-deflection terminals for waveforms up to 450 MHz. Model 1403A is completely solid state (except CRT), weighs just 8.4 lbs. and has a three-wire grounded AC cord. With test leads. Use optional PR-21 probe; all other probes with UHF to double-banana connector adapter.

SPECIFICATIONS

VERTICAL AMPLIFIER
Sensitivity: 10 mV/div or better.
Response: DC, DC 5 MHz (−3 dB); AC, 2 Hz-5 MHz (−3 dB).
Overshoot: 5% or less.
Maximum Input: 600V peak-to-peak.
Input Impedance: 1 meg shunted by 30 pF.
Attenuator: 1, 1/10, 1/100 multiplier, ±5%.
Gain Control Range: Continuously variable range greater than 22 dB.

HORIZONTAL AMPLIFIER
Sensitivity: 300 mV/div or better.
Response: DC-250 kHz.
Input Impedance: 1 meg shunted by 30 pF.

SWEEP SYSTEM
Type: Recurrent.
Time Base Ranges: 10-100 Hz, 100-1000 Hz, 1-10 kHz, 10-100 kHz; continuously variable between ranges.
Sweep Linearity: ±5%.
Synchronization: Internal, negative.
Signal Required for Sync: (Internal) More than 1 division deflection on screen of CRT. (External) More than 2V p-p.

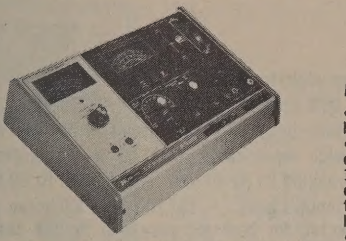
GENERAL
Intensity Modulation: 25V peak-to-peak.
Power Requirements: 117/234 VAC, 50-60 Hz, 15W; three-wire grounded line cord.
Accessories Included: Leads, spare fuse, instructions.
Size (HxWxD): 15 x 19 x 30 cm (6 x 7.25 x 12").
Net Weight: 3.8 kg. (8.4 lbs.).

B+K PRECISION DYNASCAN CORPORATION / **TRANSISTOR TESTERS**

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

LAB QUALITY SEMICONDUCTOR TESTER

MODEL 530
$295.00



FEATURES

- Measures transistor beta or FET gm
- Measures transistor cut-off frequency up to 1500 MHz
- Non-destructive testing of transistor and diode breakdown voltages
- Measures I_{CES} and I_{DSS}
- Fast testing of transistors, FET's, and SCR's — in or out-of-circuit
- Base diagrams are not required
- No biasing information required
- Identifies all leads of transistors and SCR's
- Automatic identification of PNP/NPN types and N or P channel FET's.

SPECIFICATIONS

IN-CIRCUIT TESTS
Good/Bad Test: For bipolar transistors, FET's and SCR's.
Identifies: All leads of bipolar transistors and SCR's, and gate lead of FET's. Also identifies device polarity by automatically indicating PNP, NPN, and P or N channel FET's.

OUT-OF-CIRCUIT TESTS
Measures: Transistor beta, gm, f_t, I_{CES}, I_{DSS}, BV_{CES}, and PIV.
Transistor Beta: Two I_C ranges (low power, 20-600; high power, 20-200).
gm OF FET's
f_t: Three ranges (1-100 MHz; 50-750 MHz; 750-1500 MHz). I_{CES} and I_{DSS}: From .5 μA to 5 mA. BV_{CES} of transistors and PIV of diodes at 10V (5 mA max.) or variable 10-100V (100 μA max.).
Accuracy: Within 10% for β, gm, and f_t tests.

INDICATORS
Audible tone for GOOD indication. Front panel switch provides tone defeat. LED Lamps identify device polarity, including NPN, PNP, or N or P channel FET's. Panel Indicator and Test Switch identifies all leads of transistors and SCR's and base lead of FET's.
Jacks and test leads are color coded.
Meters indicate other device parameters.

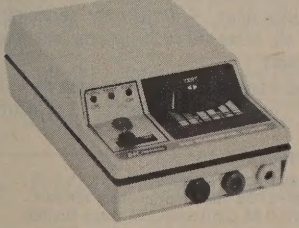
APPLIED TEST CURRENTS
Collector: 125 mA at 4% duty cycle.
Base: 250 mA at 4% duty cycle (HI drive); 1 mA at 4% duty cycle (low drive).
Test Repetition Rate: 10 per second.
Voltage for Leakage Test: Variable from 10-100 VDC.
High-power beta and gm Tests: Special 300 μS, 1% duty cycle current pulses enable testing at 2 amps without over-dissipation of device under test. Maximum beta (200) and maximum gm (400 millimhos) correspond to test current of 2 amps.

LIMITING IN-CIRCUIT SHUNT VALUES FOR IN-CIRCUIT GOOD/BAD TEST
Resistance: Down to 10Ω (HI drive). Down to 1.5 kΩ (LO drive).
Capacitance: Up to 15 μF (HI drive). Up to 0.3 μF (LO drive).

GENERAL
Color-coded Mini-lock clips for hands-free operation. Detailed instruction manual. Optional FP-5 Dynaflex three-lead, one-hand probe for easy in-circuit testing.
Power Required: 105-125 VAC, 60 Hz, 10 watts.
Size (HxWxD): 18 x 33 x 9 cm (7 x 13 x 3½").
Net Weight: 2.3 kg (5 lbs.).

PORTABLE INDUSTRIAL TESTER

MODEL 510
$90.00



FEATURES

- Fast GO/NO-GO in-circuit transistor testing
- Fast and thorough GOOD/BAD out-of-circuit testing
- Tests FET's and SCR's in-circuit or out-of-circuit
- Connect any test clip to any component lead
- Gives positive emitter-base-collector identification in LO drive — positive base identification in HI drive
- Light-Emitting Diodes indicate NPN-OK or PNP-OK
- Pocket-size — over 100 hours of testing from single set of "AA" cells
- Digital stability — no adjustments; nothing to go out of calibration.

SPECIFICATIONS

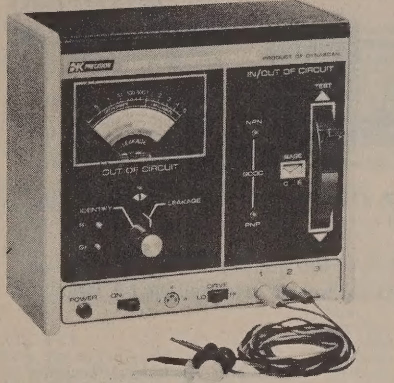
IN/OUT-OF-CIRCUIT TESTS
GOOD/BAD test for transistors, FET's and SCR's.
Identifies transistors as NPN or PNP.
FET as N-channel or P-channel.
Identifies FET gate lead.
Identifies all leads of transistors in LO drive; base lead in HI drive.
Identifies all leads of SCR.

APPLIED TEST CURRENTS
Base Drive: 250 mA (HI) or 1 mA (LO) at 2% duty cycle.
Collector Drive: 125 mA at 2% duty cycle.
Test Repetition Rate: 5 Hz.

IN-CIRCUIT SHUNT LIMITS FOR VALID GOOD/BAD TEST:
Resistance: Down to 10 ohms with HI drive; down to 1.5K ohms with LO drive.
Capacitance: Up to 25 μF with HI drive; up to .3 μF with LO drive.
Power Requirements: 6 VDC from four "AA" cells, not supplied. Standby current, 4 mA; average testing current, 12 mA.
Accessories: Carrying Case and test leads supplied. Model FP-5 Dynaflex Probe (optional) may be used in place of test leads.
Size (HxWxD): 4.4 x 9.5 x 6.6 cm (1.75 x 3.75 x 6.6").
Weight: 450g (1 lb.).

INDUSTRIAL TRANSISTOR TESTER

MODEL 520B
$160.00



FEATURES

- Now with HI/LO drive
- Works in-circuit when others won't
- Identifies all three transistor leads
- Random lead connection
- Audibly and visually indicates GOOD transistor
- Automatic NPN/PNP determination
- Positive Si/Ge identification
- Tests diodes, SCR's, FET's, and Darlingtons.

SPECIFICATIONS

IN-CIRCUIT TESTS
Good/Bad Test: For PNP and NPN transistors. FET's and SCR's.
Identifies: NPN or PNP.

OUT-OF-CIRCUIT TESTS
Good/Bad Test: For PNP and NPN transistors. FET's, SCR's, leakage and loss.
Identifies: NPN or PNP; silicon or germanium transistors.
Measures: Reverse leakage from 0.1 μA to 5 mA.
AUTOMATIC INDICATORS — Audible Tone for GOOD indication. LED Lamps identify NPN or PNP devices and Ge or Si types. Test Switch automatically identifies base or gate lead for good transistors or FET's.
Meter Scales: Readable from 0.1 μA to 5 mA for Ice leakage; calibrated for silicon and germanium power and signal transistor leakage limits.

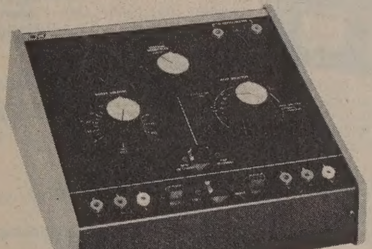
APPLIED TEST CURRENTS
Collector: 250 mA at 5% duty cycle.
Base: 125 mA at 5% duty cycle.
Test Repetition Rate: 10 per second.
Leakage Test Reverse Voltage: 2.0V.

LIMITING IN-CIRCUIT BASE-EMITTER SHUNT VALUES FOR VALID TESTS
Resistance: Greater than 10 ohms.
Capacitance: Less than 15 μF.

GENERAL
Accessories: Color-coded test leads with Mini-Lock clips; detailed instruction manual; optional FP-5 Dynaflex™ three-lead, one-hand probe for easy in-circuit testing available.
Power Required: 105-125 VAC, 50-60 Hz; also available for 230 VAC, 50-60 Hz.
Size (HxWxD): 20 x 17 x 8.9 cm (8 x 7 x 3.5").
Net Weight: 2.27 kg (5 lb.).

SEMICONDUCTOR CURVE TRACER

MODEL 501A
$182.00



FEATURES

- Display characteristic curves for all semiconductor devices on your scope
- Built-in current limiting protects devices under test
- Pinpoint bad devices in-circuit
- Measure breakdown voltage non-destructively
- Identify unknown devices.

SPECIFICATIONS

COLLECTOR SWEEP
Range: 0-100 VDC peak at 100 mA maximum.
Polarity: NPN (N-Channel) or PNP (P-Channel).
Current Limiting: Automatic at approximately 130% of full scale for each vertical attenuator range.

STEP GENERATOR
11 Current Ranges: 1, 2, 5, 10, 20, 50 μA per step; .1, .2, .5, 1, 2 mA per step; ±3% constant-current steps.
5 Voltage Ranges: .05, .1, .2, .5, 1V per step, ±4%; source resistance, 1K.
Number of Steps: Six, continuous display.
Step Polarity: Same as Collector Sweep (NPN or PNP); inverted in VOLTS/STEP positions.

CALIBRATION
Source: ±.05 to 5V p-p, ±3% accuracy.
Attenuator Range: 1, 2, 5, 10 mA per division vertically, ±3%.

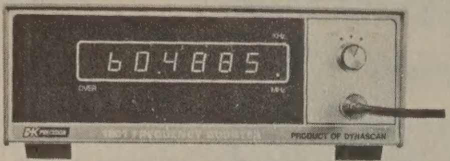
GENERAL
Sockets: Two TO-5 type transistor sockets (right and left) with each pin (three per socket) paralleled by a banana jack for external cables. Slide switch selects right or left socket.
Output Terminals: Banana jacks for vertical, horizontal and ground outputs to oscilloscope.
Accessories Included: Cables to scope, mylar 10 x 10-division graticule, detailed instruction manual and FP-5 probe.
Power Requirements: 105-125 VAC, 50-60 Hz; also available for 230 VAC, 60 Hz. With three-wire cord.
Size (HxWxD): 10.2 x 25 x 24 cm (4 x 10 x 9.5").
Net Weight: 1.35 kg (3 lbs.).

B+K PRECISION DYNASCAN CORPORATION / **FREQUENCY COUNTER POWER SUPPLIES**

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

40 MHz AUTORANGING COUNTER

MODEL 1801
$200.00



DISPLAY OF 60 MHZ TYPICAL FREQUENCY UPPER LIMIT

FEATURES

- Automatic ranging 20 Hz-40 MHz guaranteed • 1 Hz resolution
- Six-digit solid-state readout with discrete reliable TTL logic.
- Suppression of leading digit for extra resolution above 1 MHz on 1 sec gate time • 10 MHz crystal time base for stability • User-convertible to external time base • Three automatic decimal point positions • Accepts wide input range with no level adjustment normally needed • Autoranging 20 Hz-40 MHz (typically 10 Hz-60 MHz, but may require larger input signal) • 10, 100 or 1000 msec gate times automatically selected for best accuracy and fastest reading • One simple trimmer for time base adjustment (when needed).

MODEL PR-25 PROBE

10:1 and 1:1 compensated counter probe (optional)

SPECIFICATIONS

FREQUENCY

Range: 20 Hz-40 MHz guaranteed; 10 Hz to over 60 MHz typical.

Auto Gate Time: 10 msec or 100 msec (MHz reading) or 1 sec (kHz reading), chosen automatically.

Manual Gate Time: 1 sec (kHz reading, 1 Hz resolution).

Accuracy: ± time base accuracy, ±1 count.

Resolution: 1 Hz.

Display: Input signal frequency, automatically positioned decimal point. Units (kHz, MHz) displayed on front by illuminated indicator.

INPUT CHARACTERISTICS

Impedance: 1 meg/25 pF.

Sine Wave Sensitivity: 30 mV RMS (guaranteed); 15 mV RMS (typical); 20 Hz-40 MHz.

Max. Input (peak AC + DC): 200V to 500 Hz; linearity derated to 100V at 1 kHz; 100V, 1 kHz-5 MHz; linearly derated to 50V at 40 MHz.

INTERNAL TIME BASE CHARACTERISTICS

(Ref. 25°C after 30 min. warmup)

Type: 10 MHz. Xtal oscillator.

Setability: ±0.1 PPM (±1 Hz).

Line Voltage Stability: Better than 1 PPM for ±10% line variation.

Temperature Stability: Better than ±0.001% (i.e., ±10 PPM), 0-50°C.

Max. Aging Rate: 10 PPM/year.

DISPLAY CHARACTERISTICS

Visual: 6 digits with overflow, kHz and MHz indicators.

Overflow: Flashing light.

Display Refresh Interval: Fixed; 200 msec plus gate interval.

GENERAL

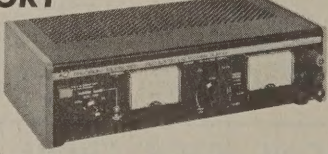
Power Requirements: 105-130V, 60 Hz, 25W max.

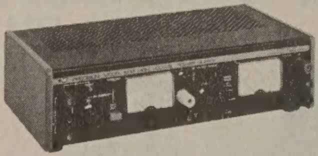
Size (HxWxD): 8.3 x 22 x 26 cm (3.3 x 8.7 x 10.5").

Weight: 2.5 kg (5.5 lbs.).

LABORATORY POWER SUPPLIES

MODEL 1601
$225.00
MODEL 1602
$250.00





FEATURES 1601

- Isolated 0-50 VDC, continuously variable; 02A in four ranges
- Fully automatic shutdown, adjustable current limit • Perfect for solid state servicing.

FEATURES 1602

- 0-400 VDC, 0-200 mA, continuously variable • 0 to −100 VDC, 0-2 mA and 12.6/6.3 VAC at 3.5A
- Fully automatic shutdown, adjustable current limit.

SPECIFICATIONS

1601

Input Voltage: 105-125 VAC, 60 Hz.
Output Voltage: 0-50 VDC, continuously variable; two ranges, 0-25 and 0-50 VDC.
Output Current: 02A in four ranges — 0-50 mA, 0-0.2A, 0-0.5A, 0-2A.
Load Regulation: Minimum, 0.05%; maximum, 0.1%; typical, 0.07%.
Line Regulation: 0.02% typical from 105 to 125 VAC with output of 50 VDC and 2A.
Ripple: 5 mV peak-to-peak.
Temperature Coefficient: .012% of output voltage per °C.
Size (HxWxD): 9.8 x 35 x 25 cm (3.88 x 14.13 x 10").
Net Weight: 5 kg (11 lbs.). Complete with leads and instruction manual.

1602

Input Voltage: 105-125 VAC, 60 Hz.

400 VDC SUPPLY
Output Voltage: 0-400 VDC, continuously variable.
Output Current: 0-200 mA.
Load Regulation: 0.1%.
Line Regulation: 0.1% for 105-125 VAC line.
Noise and Ripple: Less than 10 mV peak-to-peak.
Protection: 0-200 mA adjustable shutdown.

BIAS SUPPLY (100 VDC)
Output Voltage: 0 to −100 VDC continuously variable, floating.
Output Current: 0-2 mA.
Load Regulation: 1%.
Line Regulation: 1%.
Noise and Ripple: Less than 10 mV peak-to-peak.
Protection: Current-limiting resistance.

12.6 AND 6.3 VAC (NON-ADJUSTABLE)
Output Voltage: 12.6 or 6.3 VAC ±5% no-load, floating.
Output Current: 3.5A continuous.
Protection: Thermal circuit breaker on front panel.
Size (HxWxD): 9.8 x 35 x 25 cm (3.88 x 14.13 x 10").
Net Weight: 5 kg (11 lbs.).

MOBILE EQUIPMENT POWER SUPPLY

MODEL 1640
$100.00

FEATURES

- Regulated adjustable output from 11-15 VDC, 0-3A • Fully automatic overload protection, manual reset, 5A surge limit • Perfect for servicing CB radios and all other 12 volt mobile equipment.

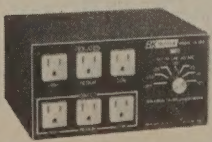
APPLICATIONS

Citizens Band transceivers . . . Auto tape decks . . . Auto radios . . . FM converters . . . Electronic ignitions.

SPECIFICATIONS

Input Voltage: 117 VAC, 60 Hz.
Output Voltage: 11-15 VDC, continuously variable.
Output Current: 0-3A continuous, 5A surge limited.
Meter: Voltmeter-ammeter, pivot and jewel movement (illuminated). Metering function selected by switch.
Overload Indicator: LED glows after overload; turns off when overload is cleared.
Ripple: Less than 8 mV RMS; 0-3A.
Load Regulation: Less than 0.8% voltage change from 0-3A, 11V to 15V.
Line Regulation: Less than 0.8% voltage change at 3A output ±10% line variation.
Short Circuit Protection: Voltage shutdown, manual reset. Surge current limited to 5A maximum.
Size: (HxWxD): 7.8 x 25 x 22 cm (3$\frac{1}{16}$ x 10 x 8½").
Weight: 3.6 kg (8 lbs.).

NEW ISOLATION AND AUTOTRANSFORMER



MODEL TR-100: $55.00

FEATURES

The TR-100 is a versatile isolation and autotransformer, designed for use in industry, shops or schools. Three isolated outlets permit safe testing of transformerless equipment. The TR-100 can also be used to vary the input line voltage applied to an electrical device under test.

SPECIFICATIONS

Switchable input line volts from 105 to 130 volts, three wire cord. Output receptacles provided for Low—105V, Medium—115, and High—120V. **Load ratings:** Isolated: 400 VA Continuous, 450 VA intermittent, Direct: 500/750 VA; Primary to secondary current leakage less than 0.1 mA—meets ANSI spec C101.1, 1971 for leakage. CSA approved. **Size** (HWD): 11.25 x 20.6 x 17.5 cm (4.5 x 8.25 x 7"). **Weight:** 5.4 kg (12 lbs.).

B+K PRECISION DYNASCAN CORPORATION / **DIGITAL MULTIMETERS**

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

NEW 3½ DIGIT PORTABLE DMM

MODEL 2800
$99.95

FEATURES

• Reliable—fully overload protected • 3½ digit easy to read LED display • Completely portable —use it anywhere! • Auto zeroing • High/Low-power ohms for in-circuit accuracy • 1 mV, 1 μA, 0.1 ohm resolution • 10 meg input impedance, industry standard • Excellent temperature coefficient • Typical DC accuracy 1%.

Combines the features of our most popular DMM with a new 3½ digit readout capability. Other new features include an auto-zero circuit and improved overload protection. The 2800 features 22 scales that range as high as 1000 volts, DC or AC. Resolution is to 1 mV, 1 μA or 0.1 ohm. Input impedance is 10 megohms.

The 2800 has 100% overrange reading capability. This allows you to read 1999 on a scale normally limited to a maximum reading of 1000.

Alternating high-/low-power ohms ranges permit analysis of solid-state circuitry without biasing semiconductor junctions. Typical accuracy is ±19° on DC and ±1.5% AC.

ACCESSORIES FOR 280, 2800, 2810

Model BC-28: $8.00. AC adapter/battery charger; **Model BP-28: $20.** Rechargeable batteries; **Model ES-10: $20.** 10 amp current shunt; **Model LC-28: $6.00.** Carrying case; **Model MS-28: $3.00.** Wire tilt stand; **Model PR-21: $10.00.** Isolation/direct probe; **Model PR-23: $15.00.** RF demodulator probe; **Model PR-28: $24.00.** High-voltage probe.

SPECIFICATIONS

AC-DC VOLTAGE
Ranges: ±0-1V, 100V, 1000 V.
Input Impedance: 10 megohms.
Circuit Protection: ±1000 VDC or AC RMS, all ranges.
Polarity Indication: Automatic.
Response: 50-400 Hz.

DC AND AC CURRENT
Ranges: 0-1 mA, 10 mA, 100 mA, 1000 mA.
Circuit Protection: Diodes and externally accessible fuse.

RESISTANCE
Ranges: 0-100Ω, 1kΩ, 10kΩ, 10MΩ. Alternate ranges are Hi and Lo power.
Protection: No component failure other than a fuse will result with application of +100 VDC or −450 VDC or 300 VAC RMS to input.

ACCURACY
Note: For all ranges add ±1 L.S.D.
DC Volts: ±1% of reading, ±0.25% of f.s. three lowest ranges; ±1.5% of reading, ±0.25% of f.s. 1000V range.
DC Current: ±2.0% of reading, ±.5% of f.s. range, 1 mA, 10 mA, 100 mA ranges, ±2.5% of f.s., ±.5% of f.s., 1A range.
AC Volts: ±1.5% of reading, ±.5% of f.s., 1V, 10V, 100V ranges. ±2.5% of reading, ±.5% of f.s., 1000V ranges.
AC Current: ±2.0% of reading, ±.5% of f.s., 1 mA, 10 mA, 100 mA ranges. ±3.0% of reading, ±.5% of f.s., 1A range.
Resistance: ±1.5% of reading, ±.5% of f.s., ±1 LSD, 1000Ω, 1kΩ 10kΩ, 100kΩ and 1mΩ ranges. ±2% of reading, ±.5% of f.s., ±1 LSD, 10MΩ range.

GENERAL
Readout: 3½ digits, 3″ LED.
Overrange Indication: Display flashes 1999.
Operating Temperature Range: +15°C to +35°C; usable range at reduced accuracy: 0°C to 50°C.
Includes: 2 test leads, manual, spare fuse.
Power: Four "C" size batteries—Ni-Cad, alkaline or carbon-zinc, with provision for AC adapter/charger (Batteries and AC adapter/charger not supplied).
Battery Life: Better than 40 hours of continuous use with alkaline batteries.
Size (HWD): 16 x 11 x 5 cm (6.4 x 4.4 x 2″)
Weight: 907g. (2 lbs.).

NEW 3½ DIGIT DMM WITH .5% ACCURACY

MODEL 2810
$119.95

FEATURES

• 3½ digit easy to read LED display • 0.5% DC accuracy with autozeroing • 100 mV, .01Ω resolution • 10 ohm range and control to zero lead resistance • Selectable High-Low-power ohms on four ranges • Completely overload protected on all 29 ranges • 100% overrange reading to 2000 counts full scale • Protected against RF interference • Completely portable.

THE MOST VERSATILE DIGITAL VOM WE'VE EVER OFFERED

While retaining the convenience of our popular user-oriented panel layout, we've designed into the B&K-PRECISION Model 2810 a combination of features uncommon in a portable digital VOM. Typical DC accuracy is 0.5% with a 3½ digit display. Auto-zeroing on all but the 10Ω range minimizes set-up time, while the 100% overranging capability reduces the need for frequent range changes.

The 10Ω range, with its .01Ω resolution, is ideal for locating a shorted winding in a transformer, motor or coil.

The high-/low-power ohms switch permits resistance measurements in solid-state circuitry without biasing semiconductor junctions. Unlike many electronic voltmeters, the 2810 can also be used in R-F energy fields. This includes use near business band, CB and amateur radio transmitters.

Like other B&K-PRECISION instruments, the 2810 is well protected against overloads.

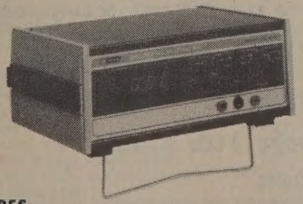
SPECIFICATIONS

AC-DC VOLTAGE
Ranges: ±100.0 mV, 1V, 10V, 100V, 1000V.
Input Impedance: 10 megohms.
Circuit Protection: ±1500 VDC or AC peak, all ranges.
Polarity Indication: Automatic.
Frequency Response: 50-1000 Hz; 50-400 Hz, 1000V range.
Protection: ±1500 VDC or AC peak, all ranges (50 Hz-1 kHz).
DC AND AC CURRENT
Ranges: 1 mA, 10 mA, 100 mA, 1000 mA.
Circuit Protection: Diodes and externally accessible fuse, all ranges.
Nominal Voltage Drop (full scale): 200 mV; 750 mV on 1 amp range.
AC Frequency Response: 50-400 Hz..
Overrange: 100% to 1999.
RESISTANCE
Ranges: 10Ω, 100Ω, 1kΩ, 100kΩ, 10MΩ.
Protection: No component failure other than a fuse will result with application of +100 VDC or −450 DC or 300 VAC RMS to input.
ACCURACY
Note: For all ranges add ±1 L.S.D.
DC Volts: ±0.5% of reading, ±0.1% of f.s., 1V, 10V, 100V ranges; ±1.0% of reading, ±0.2% of f.s., 100 mV, 1000V ranges.
DC Current: ±1% of reading, ±0.5% of f.s., 1 mA, 10 mA, 100 mA ranges; 1.5% of reading, ±0.5% of f.s., 1000 mA range.
AC Volts: ±1.0% of reading, ±0.25% of f.s., 1V, 10V, 100V ranges; ±1.0% of readings, ±0.5% of f.s., 100 mV range; ±2.0% of reading, ±0.5% of f.s., 1000V range.
AC Current: ±1.5% of reading, ±0.5% of f.s., 1 mA, 10 mA, 100 mA ranges; ±2.0% of reading, ±0.5% of f.s., 1000 mA range.
Resistance: ±1.0% of reading, ±0.25% of f.s., 1kΩ, 10kΩ, 100kΩ, and 1000kΩ ranges in High-Ω; ±1.5% of reading, ±0.5% of f.s., 10Ω, 100Ω, 1kΩ, 10kΩ, 1000kΩ ranges in low-Ω 1.5% of reading, ±0.5% of f.s., 10MΩ range.

GENERAL
Readout: 3½ digits, .3″ LED.
Overrange Indication: Display flashes 1999.
Operating Temperature Range: +15°C to +35°C; usable range at reduced accuracy: 0°C to 50°C.
Power: Four "C" size batteries—Ni-Cad, alkaline or carbon-zinc, with provision for AC adapter/charger (Batteries and AC adapter/charger not supplied).
Battery Life: Better than 40 hours of continuous use with alkaline batteries.
Size (HWD): 16 x 11 x 5 cm (6.4 x 4.4 x 2″).
Weight: 907 g. (2 lbs.).

3½ DIGIT PORTABLE MULTIPLIER

MODEL 283
$170.00



FEATURES

• High intensity, reliability 3½ digit LED display for maximum readability • Selectable HI/LO ohms function allows in-circuit resistance measurement without forward biasing semiconductor junctions • Universal AC power supply • Easily installed optional battery pack • Large, bright non-blinking 7-segment digits • DC accuracy, 0.5% • Automatic polarity • Full overload protection on all ranges • 1 mV resolution.

OPTIONAL ACCESSORIES

Model BP-83: $50.00. Rechargeable Battery Pack: Permits 8 hours of continuous use on one overnight recharging. **Model PR-21: $10.00.** Isolation/Direct Probe. **Model LC-83: $15.00.** Handsome leatherette case. **Model PR-23: $15.00.** Demodulator Probe. **Model PR-28: $24.00.** High Voltage Multiplier Probe (increases the voltmeter range to 40,000 VDC).

SPECIFICATIONS

DC VOLTAGE (Auto Polarity)
Ranges: ±1.000, 10,00, 100.0 1000V.
Maximum DC Input: 1500 VDC or DC plus AC peak.
Accuracy: 1, 10 100V range ±.5% of reading ±1 LSD, 1000V ranges, ±1% of reading, ±1 LSD.
Polarity: Automatic.

AC VOLTAGE
Ranges: ±0-1.000, 10.00, 100.0, 1000 RMS.
Maximum AC Input: 1500V peak or 1500 VDC plus AC peak.
Accuracy and Response: 1V, 10V, 100V range, ±1% of reading, ±1 LSD, 40-400 Hz; 1000 V range, ±1.5% of reading, ±1 LSD, 40-400 Hz.

AC-DC CURRENT
Ranges: 0-1.000, 10.00, 100.0, 1000 mA.
DC Accuracy: 1, 10, 100 mA ranges, ±1% of reading; ±1 LSD. 1000 mA range, ±1.5% of reading, ±1 LSD.
AC Accuracy: 1, 10, 100 mA ranges, ±1.5% of reading, ±1 LSD. 1000 mA range, ±2% of reading, ±1 LSD.

Frequency Response: 40-400 Hz.

RESISTANCE
Ranges: 0-100.0Ω; 1.000k, 10.00k, 100.0kΩ ; 1.000, 10.0MΩ.
Accuracy: 1k to 1000k ranges in Hi ohms, ±1% of reading, ±1 LSD. 10MΩ range, and five lowest ranges in low ohms, ±2% of reading, ±1 LSD.

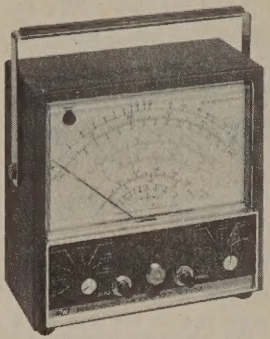
GENERAL
Display: 3½ digit, .41″ LED.
Accuracy Temperature Coefficient (15°C to 35°C): ± .025% of reading/°C on DCV ranges; ±.05%/°C, all other ranges.
Input Impedance: 10MΩ.
Overrange: 100%.
Overload Protection: Protected up to 1000V on ohms ranges; to 3A on current shunts; to 1500V on voltage ranges.
Power: 105-125 VAC, 50/60 Hz; 230 VAC, 50/60 Hz, with 3-wire grounded detachable AC line cord and test leads.
Size (WxDxH): 23 x 18 x 19 cm (9 x 7 x 3.5″).
Weight: 2.7 kg. (3 lbs.).

B+K PRECISION DYNASCAN CORPORATION / VACUUM TUBE VOLTMETER MULTIMETERS

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

VACUUM TUBE VOLTMETER

MODEL 177
$130.00



FEATURES

• Internal DC power supply for ohms ranges — no battery needed • 37 ranges, including dB and zero center scales.

The 177 includes the PR-43 DC/AC/Ohms probe with switch and ground lead. Low AC ranges have special calibrations. Features easy-to-read 7″ mirrored scale, DC polarity switch and 1% precision resistors in all critical circuits. See other meter probes on page 1497.

SPECIFICATIONS

DC Volts: 0-.5, 1.5, 5, 15, 50, 150, 500, 1500.

AC Volts: RMS, 0-1.5, 5, 15, 50, 150, 500, 1500; peak-to-peak, 4, 14, 40, 140, 400, 1400, 4000; frequency response, ±1 dB, 40 Hz-3 MHz (600 ohm source, 5V range).

Resistance: 0-1K, 10K, 100K; 0-1, 10, 100, 1000 meg; 10 ohms center scale.

Input Resistance: 11 megs (1 meg in probe).

Accuracy: DC, ±3% F.S.; AC, ±5% F.S.

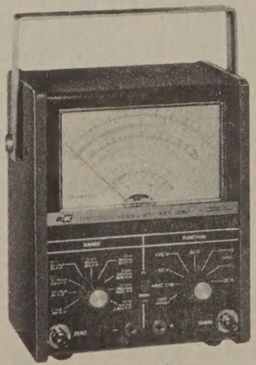
Power Required: 105-125 VAC, 50-60 Hz.

Size (HxWxD): 18 x 18 x 9 cm (7.1 x 7.25 x 3.6″).

Net Weight: 2.7 kg (6 lbs.).

SOLID STATE ELECTRONIC MULTI-METER WITH HIGH-LOW POWER OHMS

MODEL 277
FET METER
$120.00



FEATURES

• High and lower-power ohms ranges for transistor circuit test • 1 μA full scale current range for semiconductor leakage tests • 15 meg input impedance • FET input • 25 ranges; overload protected • Checks its own batteries

SPECIFICATIONS

Multipliers: 1% precision type, frequency-compensated.

Meter: 4.5″; 50 μA movement, mirrored scale.

Protection: Meter and FET input fully overload protected; current and resistance circuits overload protected by fuse.

DC Volts: 0-.1, .3, 1, 3, 10, 30, 100, 300, 1000; zero-center capability on all ranges; accuracy, ±2% F.S.; input resistance, 15 megs.

AC Volts: RMS, 0-.1, .3, 1, 3, 10, 30, 100, 300, 1000; peak-to-peak, 0-.28, .88, 2.8, 8.8, 28, 88, 280, 880, 2800; accuracy, ±3% F.S.; input impedance, 10 megs shunted by 100 pF; frequency response, flat, 50 Hz-150 kHz.

DC Current: 0-1, 10, 100 μA; 0-1, 10, 30, 100, 300, 1000 mA; accuracy, ±3% F.S.

Resistance: Rx1, x10, x100, x1K, x100K, x1 meg, switch-selectable for either .068 or 1.5 test volts; 10 ohms center-scale.

Decibels: 9 ranges from −20 to +60 dB; accuracy, ±3% F.S. (0 dB = 1 mW into 600 ohms).

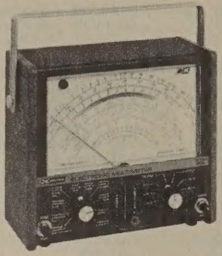
Power Required: One 9V type 2V6 battery and one 1.5V "D" cell.

Size (HxWxD): 18 x 14.5 x 9.1 cm (7.25 x 5.8 x 3.6″).

Net Weight: 907g (2 lbs.).

SOLID STATE ELECTRONIC MULTI-METER WITH HIGH-LOW POWER OHMS

MODEL 290
FET METER
$165.00



FEATURES

• 75 ranges; ±1.5% VDC accuracy • High and low-power ohms ranges • 15 meg FET input • Fully overload protected • 50 mV AC and DC full scale • 50 μA full scale current range • Rx0.1 ohm range with 1 ohm scale.

SPECIFICATIONS

DC VOLTS

10 Ranges: 0-50, 150, 500 mV; 1.5, 5, 15, 50, 150, 500, 1500V.

Accuracy: ±1.5% F.S.

Input Resistance: 15 megs, including 100K in PR-21 probe.

AC Rejection: Greater than 46 dB at 60 Hz.

AC VOLTS

10 RMS Ranges: 0-50, 150, 500 mV; 1.5, 5, 15, 50, 150, 500, 1500V.

Peak-to-Peak Ranges: 0-140, 440 mV; 1.4, 4.4, 14, 140, 440, 1400, 4400V.

Accuracy: ±3% F.S. at 60 Hz; ±5% on 500V and 1500V ranges.

Input Impedance: 15 megs shunted by 41 pF at input jacks.

Frequency Response: 50 mV-150V ranges, ±0.5 dB, 20 Hz-500 kHz; ±3 dB, 5 Hz-750 kHz.

DC CURRENT

10 Ranges: 0-50, 150, 500 μA; 1.5, 5, 15, 50, 150, 500 mA; 1.5A.

Accuracy: ±3% F.S., except ±4% on 1.5A range.

Internal Voltage Drop: At input terminals, 50 mV on 50 mA range.

AC CURRENT

10 Ranges: 0-50, 150, 500 μA; 1.5, 5, 15, 50, 150, 500 mA; 1.5A.

Accuracy: ±4% F.S. at 60 Hz; ±5% on 50 μA and 1.5A ranges.

Frequency Response: ±0.5 dB, 20 Hz-5 kHz; ±3 dB, 7 Hz-16 kHz.

Internal Voltage Drop: At input terminals, 50 mV to 50 mA range.

RESISTANCE

8 Low-Power Ranges (33 mV source): Rx0.1, Rx1, Rx10, Rx100, Rx1K, Rx10K, Rx100K, Rx1 meg.

Center Scale Reading: 1 ohm, Rx0.1; 10 ohms, Rx1 range.

Accuracy: ±3° of arc.

DECIBELS

10 Ranges: −40 to +66 dB.

Accuracy: ±3% F.S. (0 dB = 1 mW across 600 ohms).

GENERAL

Meter: 7″, with 6.63″ scale arc length; 100 μA movement, ±2%, 100°; mirrored scale.

Protection: Meter and FET input protected against overloads. Circuit overload protection by diodes and fuse; spark gaps for high voltage protection.

Power Required: 105-124 VAC, 50-60 Hz; also available for 240 VAC, 50/60 Hz. 3.9W; three-wire grounded cord.

Size (HxWxD): 18 x 20 x 9 cm (7.25 x 8 x 3.6″).

Net Weight: 1.96 kg (4.25 lbs.).

NEW COMPACT VOMs

MODEL 115: $37.50

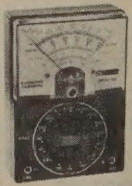
FEATURES

Unusual features include a 5 ohm mid-scale range for checking windings; and four DC current ranges to allow checks of thermocouples and oil burner controls. DC and AC voltage measurement extends to 1200 volts.

Test leads, and instructions are included; carrying case is optional. HV-12 high-voltage probe adapter is also optional and extends the 115 to 12k VDC.

SPECIFICATIONS

DC Volts: 0-60, 300, 1200 mV; 0-3, 12, 60, 300, 1200V. DC Current: 0-0.03, 0.06; 60, 600 mA. DC Accuracy: ±3% full scale. AC Volts: 0-6, 30, 60, 300, 600, 1200. ±4% full scale. Resistance: 0-500, 50k, 500k, 5MΩ. Meter: 30,000 Ω/VDC; 15,000 Ω/VAC. Battery: 1.5V "AA" battery; 15V W-10 battery. Size (HWD): 10.2 x 15 x 4.4 cm (6 x 4 x 1.75″). Weight: .45 kg (.5 lb.).



MODEL 110: $24.50

FEATURES

The 110's 10Ω mid-scale range allows accurate testing of coil and motor windings. Leakage resistances up to one megohm can also be measured.

Test leads and detailed instructions included; LC-10 case is optional.

SPECIFICATIONS

DC volts: 0-2.5, 10, 50, 250, 1000V. DC Current: 0.05, (250 mV), 25, 250 mA. DC Accuracy: ±3% full scale. AC Volts: 0-10, 50, 250, 500, 1000. AC Accuracy: ±4% full scale. Resistance: 0-1k, 100k, 1M. Meter: 20,000/VDC; 10,000/VAC. Battery: 1.5V "AA" battery. Size (HWD): (5 x 3.5 x 1.5″). Weight: .35 kg (.4 lb.).

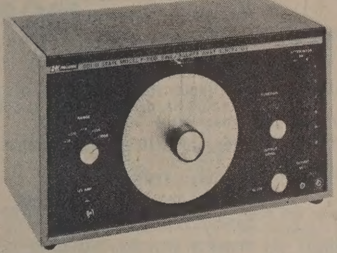
B+K PRECISION **DYNASCAN CORPORATION** / **SIGNAL GENERATORS**

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

SINE/SQUARE WAVE GENERATOR

MODEL E310B

$164.00



FEATURES

• Extended Frequency Range — Sine: 20 Hz to 2 MHz; Square: 20 Hz to 300 kHz • Constant-voltage output over each band and band-to-band • 56 dB step attenuation.

The industry standard for years! All solid-state circuitry uses FET's in oscillator, silicon transistors and zener-regulated power supply. Fully shielded — will not radiate to other equipment. Large, easy-to-read 5″ vernier dial scale for accurate repeatability. Handsome case and panel for professional appearance. Rugged enough to withstand continuous use in laboratories, schools and service shops.

SPECIFICATIONS

Sine Wave Frequency: 20 Hz to 2.0 MHz in five decade ranges.
Output: 8 VRMS into hi-Z loads; 0-7 VRMS into 600Ω; ±2 dB.
Distortion: 0.25% typical; 0.5% maximum (100 Hz to 2 MHz); 1% maximum below 100 Hz.
Square Wave Frequency Range: 20 Hz to 200 kHz in four decade ranges.
Rise Time: Less than 100 nsec at 20 kHz.
Symmetry: Balanced within 5% or less.
Frequency Calibration Accuracy: ±3%, 20 Hz to 2 MHz.
Attenuators (both sine and square wave): Six switches for a total of 56 dB; accuracy, ±5% when terminated in a 600Ω load. Continuously variable control adjusts output from maximum set by switches down to less than 0.25 mV.
Power Requirements: 100-130 VAC, 50-60 Hz; 15W. Also available for 117/234 VAC, 50-60 Hz.
Size (HxWxD): 18 x 32 x 20 cm (7.25 x 12.75 x 8″).
Net Weight: 4.3 kg (9.5 lbs.).

SOLID STATE RF SIGNAL GENERATOR

MODEL E200D

$250.00

FEATURES

• 100 kHz to 216 MHz in 5 bands • Completely shielded RF output w/modulation percent metering and variable monitored attenuation usable to less than 1 μV • Built-in 100 kHz and 1 MHz crystal calibration system • Easy-setting 2-color 5″ anti-backlash vernier dial.

Features 100% silicon transistor circuitry and zener-regulated power supply for accuracy, stability and long life. Double shielding eliminates spurious radiation even at outputs of 1 μV. Internal crystal calibrator has accuracy of better than 0.1%. Has 200 μA d'Arsonval meter for accurate monitoring and setting of RF carrier and modulation levels.

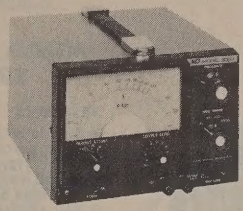
SPECIFICATIONS

Frequency Range: 100 kHz-54 MHz in 5 bands; 54/216 MHz on harmonics.
Accuracy: ±1.5% of highest frequency on any range used; better than 0.1% obtainable with crystal calibrator.
Output (calibrated into 50Ω load): 100,000 μV maximum.
Output Level Calibration Accuracy: ±1 dB to 54 MHz.
Attenuation: 6 individually shielded step attenuators with total attenuation capability of −96 dB. Outputs as low as 106 dB below 100,000 μV can be obtained with fine output level control and calibrated meter, which provides variable −10 dB to +2 dB output level indication (0 dB = 100,000 μV into 50Ω).
Modulation: 400 Hz, nominal. External sensitivity; 1 VRMS for 50% modulation.
Crystal Calibrator: 1 MHz ±.05% crystal oscillator. Built-in detector, amplifier and speaker provided for calibration.
Crystal Calibrator: 1 MHz ±.05% crystal oscillator. Built-in detector, amplifier and speaker provided for calibration.
Power Requirements: 110-130 VAC, 50-60 Hz; 6W. Also available for 234 VAC, 50-60 Hz. Three-wire grounded line cord.
Size (HxWxD): 18 x 32 x 20 cm (7.25 x 12.75 x 8″).
Net Weight: 4.5 kg (10 lbs.).

SINE/SQUARE WAVE GENERATOR

MODEL 3050

$144.00



FEATURES

• Sine/square waves, 20 Hz-200 kHz • Synchronizing input terminal • High stability, even with line voltage changes • 10 VRMS output, 0-40 dB attenuation • Each band position uses entire scale • Tests ultrasonic controls

This versatile audio frequency generator, based on the Wien bridge oscillator circuit, provides sine wave output voltage of 10 VRMS over its entire frequency range of 20 Hz to 200 kHz. WAVE FORM switch allows easy selection of either sine or square waves. An ideal signal source for phase and time measurements and for characteristic measurements using square waves, as well as a low-distortion signal source for audio frequency measurements.

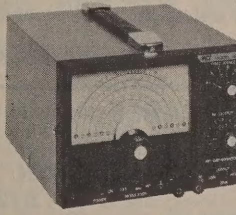
SPECIFICATIONS

Frequency Range (sine and square wave): 20 Hz-200 kHz in four decades.
Accuracy: ±(3% +2 Hz).
Sine Wave Output Voltage: 10 VRMS, ±10% at 1 kHz.
Output vs. Frequency Characteristics (referred to 1 kHz level): ±1 dB or better from 20 Hz to 200 kHz.
Distortion: 0.5% or less, 50 Hz-100 kHz; 1% or less, 20 Hz-200 kHz.
Square Wave Output Voltage: 10V p-p or more.
Tilt: 10% or less at 20 Hz.
Rise and Fall Times: 500 nsec or less.
Overshoot: 3% or less.
Symmetry: Within ±5% measured at 1 kHz with maximum output.
Output (sine and square wave): 0/20/40 dB step attenuator plus continuously variable OUTPUT vernier control that adjusts output from zero to maximum selected by step attenuator. Approx. 600Ω output impedance.
External Synchronization: Range, typically 1.5%V; 3 VRMS maximum input. Input impedance approximately 20,000Ω.
Stability with ±10% Line Voltage Variation: Less than ±0.5% frequency drift; less than ±0.5 dB output level variation.
Power Requirements: 117 VAC, 50-60 Hz; also available for 230 VAC; 30W.
Size (HxWxD): 15 x 19 x 24 cm (6 x 7.75 x 9.6″).
Net Weight: 2.8 kg (6.25 lbs.).
Accessories: Complete with one red and one black test lead, each terminated in insulated alligator clip and banana plug; spare fuse.

SOLID STATE RF SIGNAL GENERATOR

MODEL 2050

$120.00



FEATURES

• 100 kHz to 30 MHz in 6 bands, with 1.5% accuracy • 3 Outputs: RF, modulated RF (400 Hz) and externally modulated RF • Positive anti-backlash dial drive • Zener-regulated power supply • 100% solid state • FET's for stability.

Rugged, versatile, accurate RF signal generator is built to withstand the rigors of continuous industrial use, yet it's compact and lightweight — weighs only 5 lbs. Zener-regulated power supply is internally fuse-protected. Isolated RF output gives maximum protection against external voltage sources.

SPECIFICATIONS

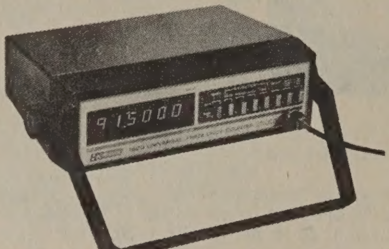
Frequency Ranges: 100 kHz to 30 MHz on 6 fundamental bands.
Accuracy: 1.5% of dial setting.
Output: 0.1 VRMS or better (20°C).
Attenuator: Combination HIGH-LOW switch, plus continuously variable RF OUTPUT control for approximately 20 dB change.
Modulation, Internal: 400 Hz; 40%, ±5%.
Modulation, External: 40 Hz to 10 kHz; modulating voltage input, 1.5 VRMS for 40% or better modulation.
Operating Temp. Range: 0-50°C.
Power Requirements: 117 VAC (also available for 230 VAC) 50-60 Hz; 2.8W. 3-wire grounded line cord.
Size: (HxWxD): 15 x 19 x 25 cm (6.1 x 7.5 x 9.75″).
Net Weight: 2.2 kg (5 lbs.).
Accessories: Supplied with shielded leads with insulated clip and banana plug; detailed instruction manual.

B+K PRECISION DYNASCAN CORPORATION

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

NEW 80 MHz COUNTER WITH PERIOD MODE

MODEL 1820
$260.00



FEATURES

• 5 Hz to 80 MHz reading guaranteed—100 MHz typical • Period measurements from 5 Hz to 1 MHz • Period average, auto and manual positions • One PPM resolution • Totalizes to 999999 plus overflow • Elapsed time measurements from .01 to 9999.99 seconds plus overflow • One-megohm input resistance • Bright .43″ high LED readouts.

For frequency measurements, the 1820 reads to a typical top frequency of 100 MHz and reads signals as low as 5 Hz. By the using the period mode, accurate resolution of a 5 Hz signal is to 1 Hz. The 1820 is fully autoranging, with automatic decimal point position and MHz/kHz readout.

In the accumulate mode, "event counts" are displayed by totalizing pulses counted, up to 999.999. The 1820 also counts from .01 to 9999.99 seconds (2.777 hours) plus overrange.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Range: 5 Hz to 80 MHz.

Gate Time Auto: 10 ms (MHz reading) and 100 ms and 1 sec. (kHz reading).

Gate Time Manual: 1 sec. (kHz reading—1 Hz resolution).

Accuracy: ±t.b. accuracy ±1 count.

Resolution: ±0.0001% (i.e. 1 PPM of a 6 digit scale).

PERIOD CHARACTERISTICS

Range: 5 Hz to 1 MHz.

Period Average Auto: 1 period average (ms), 10 and 100 period average (μs).

Period Average Manual: 100 period average (μs reading with 1 ns resolution).

TOTALIZE CHARACTERISTICS

Range: 5 Hz to 80 MHz.

Capacity: 0 to 999999 plus overflow.

ELAPSED TIME

Range: .01 to 9999.99 sec. plus overrange.

INPUT CHARACTERISTICS

Impedance: 1 Megohm, 25 pF.

Sensiitvity: 30 mV RMS, 5 Hz to 40 MHz; 50 mV maximum at 80 MHz.

Max. Input: 200V (peak AC + DC) DC to 500 Hz, derate linearly to 30V (peak AC + DC) at 80 MHz.

Attenuator: X10 switch selectable.

INTERNAL TIME BASE (25°C)

Type: 10 MHz Crystal Oscillator.

Setability: ±1 PPM (±1 Hz).

Stability: Less than ±0.001% (i.e. ±10 PPM) from 0°C to 50°C ambient.

Display: 6 digits .43″ high with overflow, kHz/μs, MHz/ms indicator, and leading zero blanking.

GENERAL

Power: 105V to 130V and 212 to 258V, 50/60 Hz.

Size (HWD): 8.1 x 29 x 19 cm. (3.25 x 11.6 x 7.50″).

Weight: 2.55 kg (5 lbs.).

NEW 520 MHz FREQUENCY COUNTER

MODEL 1850
$450.00

FEATURES

• 5 Hz to 520 MHz reading guaranteed • Gate time from 10 ms to 10 seconds • Full period measurement capability • 50 mV input sensitivity at 520 MHz • Operates from 115 or 230 VAC, or 12 VDC • Well protected input circuitry • Temperature compensated crystal oscillator (TCXO).

For engineers and technicians requiring accurate frequency measurement extending into the UHF range, the new Model 1850 will seem "made to order." The prescaled range covers 10 to 520 MHz while the normal range is from 5 Hz to 60 MHz. Autoranging is featured on both. Gate times from 10 ms to 10 seconds are automatically selected in the prescale mode, and 10 ms to 1 second in normal. For manual gate time selection, 1 second operation in normal and 10 seconds in prescale are selectable.

A high-accuracy TCXO (temperature compensated crystal oscillator) time base is standard.

For accurate very low-frequency measurements, the 1850 has period measurement capability, covering 5 Hz to 1 MHz.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Range: Normal—5 Hz to 60 MHz.

Prescale: 10 MHz to 520 MHz; Function switch selects kHz or AUTO display reading.

Gate Time Auto: Normal—10 ms, 100 ms and 1 sec.

Prescale: 10 ms and 100 ms, 10 sec.

Gate Time Manual: Normal—1 sec.

Prescale: 10 sec.

Accuracy: ±t.b. accuracy ±1 count.

Resolution: ±0.0001% (i.e. 1 PPM of a 6 digit scale).

PERIOD CHARACTERISTICS

(Normal input only)

Range: 5 Hz to 1 MHz.

Period Average Auto: 1 period average (ms), 10 and 100 period average (μs).

Period Average Manual: 100 period average (μs reading with 1 ns resolution).

INPUT CHARACTERISTICS

Impedance: Normal—1 Megohm, 25 pF.

Prescale: 50Ω with less than 2V RMS input.

SENSITIVITY

Normal: 30 mV. 5 Hz to 40 MHz; 50 mV maximum at 60 MHz (5 Hz to 1 MHz in period)

Prescale: 50 mV RMS, 10 MHz to 520 MHz with 50Ω.

MAX. INPUT

Normal: 200V (peak AC + DC) DC to 500 Hz, derating linearly to 30V (peak AC + DC) at 60 MHz.

Prescale: 5V RMS, 10 MHz to 520 MHz.*

INTERNAL TIME BASE (25°C)

Type: TCXO (Temperature Compensated Crystal Oscillator) 10 MHz.

Stability: ±1 PPM max. 0°C to 50°C ambient.

Output: 10 MHz TTL level (rear panel BNC jack).

Display: 6 digits .43″ high with overfiow kHz/μs, MHz/ms indicator and leading zero blanking.

GENERAL

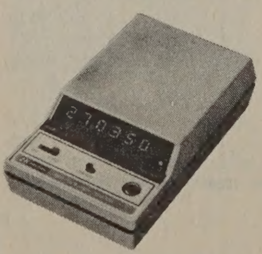
Power: 105 to 130V, and 212 to 258V, 50/60 Hz, 11 to 16 VDC Automotive battery with accessory power cable (provided with unit).

Size (HWD): 8.1 x 29 x 19 cm (3.25 x 11.6 x 7.50″).

Weight: 2.55 kg (5 lbs.).

NEW 30 MHz PORTABLE FREQUENCY COUNTER

MODEL 1827
$120.00



FEATURES

• 30 MHz reading guaranteed, 50 MHz typical—COVERS ALL 40 CB CHANNELS • Full 6-digit display with range switch allows 8-digit accuracy • 1 Hz resolution —even at 30 MHz and beyond • Completely portable for use anywhere • Exclusive battery saver features auto-shutoff of display to reduce battery drain • Operates on AA size batteries, AC with optional charger/adapter or 12 VDC with optional power cord/adapter • Complete range of optional accessories for unequaled versatility • Easy to use.

The B&K-PRECISION Model 1827 is a significant breakthrough in instrument technology. For the first time ever, a portable frequency counter is available that combines true versatility with a very low price. Not much larger than a pocket calculator, the 1827 offers such features as full six-digit display and guaranteed operation to 30 MHz with 1 Hz resolution.

Full autoranging provides direct frequency readout of the six most significant digits, or switch to the "1 second" position for 1 Hz resolution. Decimal point position and MHz/kHz indication are both automatic.

Battery saver feature electronically shuts off power to the LED display after 15 seconds of operation. DISPLAY button instantly restores the display for another 15 seconds. When on external power, DC or AC, the display remains on continuously. The 1827 can be powered from either an external 6.7 to 9.7 volts, 12 volts DC (for mobile operation) or 115 VAC with appropriate accessories.

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Range: 100 Hz to 30 Hz (guaranteed); 50 MHz typical. Function switch selects kHz or AUTO display reading.

Gate Time: (Auto) 10 ms, 100 ms or 1 sec. (kHz reading). (Manual) 1 sec (kHz reading, 1 Hz resolution).

Accuracy: ±1 count.

Resolution: 1 PPM of a 6 digit scale.

INPUT CHARACTERISTICS

Impedance: 10kΩ min.

Sensitivity: 100 mV RMS: 200 kHz—30 MHz 200 mV RMS; 100 Hz—200 kHz.

Max. Input: 200V (peak AC + DC) to 500 Hz; derate linearly to 25V (peak AC + DC) at 30 MHz.

TIME BASE (25°C)

Type: 4.0 MHz Crystal Oscillator.

Setability: ±0.25 PPM (±1 Hz).

Temp. Stability: Better than ±0.001% (i.e. ±10 PPM) from 0-50°C ambient.

Display: Six .3″ high LED digits with over-flow, LED kHz and MHz indicators and anti-glare window.

GENERAL

Power: 6 to 9V ("AA battery operation) or 6.7 to 9.7 VDC at external power jack.

Battery Life: Eight hours min. for normal usage pattern.

Battery Charging Time: 14-16 hours. Batteries are not required when operated on external power.

Size (HWD): 4 x 9.5 x 17 cm (1.75 x 3.75 x 6.6″).

Weight: Less than 0.45 kg (1 lb.) with batteries.

ACCESSORIES

Model SA-12: Automotive power cord. Plugs in to the cigarette lighter. BP-27 Battery Pack. CC-52 Cable. Allows operation on externål 6.7 to 9.7 volts DC.

Model BP-27: Rechargeable Battery Pack.

Model BC-27: Charger/AC Adapter.

Model SA-10: SA-10 R-F Signal Tap. Rated at 100 watts.

Model LC-18: Carrying Case.

Model MB-27: Mounting Bracket.

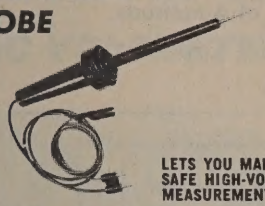
Model SA-27: Pick-Up Antenna.

B+K PRECISION DYNASCAN CORPORATION / PROBES AND CABLES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

HIGH-VOLTAGE MULTIPLIER PROBE

MODEL PR-28
$24.00



LETS YOU MAKE SAFE HIGH-VOLTAGE MEASUREMENTS

FEATURES

• Extends voltmeter range to rated 40,000 VDC • Accurate to ±2% • Safe one-hand testing • Use with any high-impedance voltmeter (10 megohm input or greater)

Th PR-28 lets you read voltages beyond the range of your present voltmeter. In the safest one-hand-in-the-pocket manner, the shape of the handle and the long probe tip allow you to keep a safe distance from voltages to 40 kVDC.

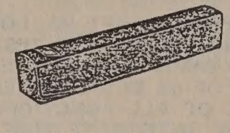
The PR-28 can be used to measure high-voltage power supplies in industry as well as in TV repair applications. When used with a good meter, the PR-28 is useful in other applications, including maintenance and repair of electrostatic precipitators, monitor oscilloscopes, x-ray machines and numerous computer-related equipment applications using high-voltage cathode-ray tubes.

The PR-28 can be used with B&K-PRECISION Models 277, 280, 281, 282, 283, 290, 2800 and 2810 or with any other constant-impedance voltmeter to extend its range to 40k VDC.

SPECIFICATIONS

Voltage Range: Usable to 40 kVDC and 20 kVAC (60 Hz); multiplies instrument range by 1000 (e.g., 40V becomes 40,000V); may be used with any instrument having a constant impedance of 10 megohms or greater.
Impedance: 600 ohms nominal.
Accuracy: ±2%, plus instrument accuracy.
Calibration: Internal; factory calibrated at 25 kV.
Frequency Range: DC-80 Hz; 20 kVAC max. at 60 Hz.
Size: (HxDia.xCord) 35.56 x 5.72 x 76.2 cm (14 x 2.25 x 30″).
Weight: 199g. (7 oz.).

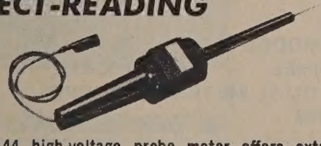
MODEL LC-32 CARRYING CASE
$12.00



Use this optional vinyl case to carry your PR-28 or HV-40 safely to any job.

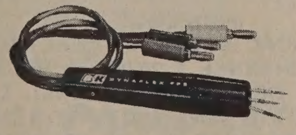
HIGH-VOLTAGE 40kVDC PROBES DIRECT-READING

MODEL HV-44
$35.00



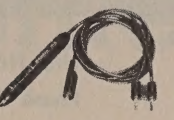
The HV-44 high-voltage probe meter offers extreme reliability and user safety. Voltage measurements up to 40,000 volts are performed accurately and quickly. The HV-44 is factory calibrated at 25 kV and should never need recalibration. Accuracy at 25 kV is ±2% and ±3% at full scale. The core magnet type meter is unaffected by common outside magnet fields and is highly shock resistant. The probe body is molded of high-impact ABS plastic for maximum insulation and lightest weight. The HV-44 will hold-up under the most active field service conditions, preventing down time and possible lost business. Supplied with two interchangeable tips: one conventional round needle type and one specially designed flat spring type for easy access to CRT anode. Model LC-32 vinyl carrying case is optional.

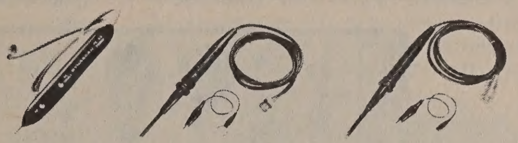
FP-5 "DYNA-FLEX" PROBE



Model FP-5 "Dynaflex Probe: $15.00. Positive contact is assured by spring-loaded needle-sharp tips. Spacing of 3 tips, adjustable with one hand, from 1/32″ to 5/8″. Each tip is colored-coded for fast easy identification. Can be used to make temporary component substitutions on PC boards. For use with Model 501A Curve Tester, Model 520, Model 520B, Model 530 or Model 162 Transistor Tester, or with any VTVM, or VOM having banana jacks.

OSCILLOSCOPE PROBES





Model PR-23 RF Detector/Demodulator Probe: $15.00. The B&K Model PR-23 is an all purpose detector/demodulator probe usable with any electronic voltmeter (both analog and digital) or oscilloscope Models 1403, 1431, 1440, 1460, 1465, 1470, and 1472. Typical Freq. Res. ±2 dB 15 kHz to 125 MHz, within 6 dB at 250 MHz. With UHF connector; banana plug adapter required for use with meters, 1403 and 1403A.

Model PR-30 Combination 10:1/Direct Probe: $25.00. Input Impedance: Low-capacity, 10:1, 10 megohms/12 pF; direct, 1 megohm/120 pF. With spring-loaded clip-tip and UHF connector. For B&K-PRECISION Models 1431, 1440, 1460, 1465, and 1470.

Model PR-31 Combination 10:1/Direct Probe: $25.00. Input Impedance: Low-capacity, 10:1, 10 megohms/12 pF; direct 1 megohm/120 pF. With spring-loaded clip-on probe tip and BNC connector. Required for B&K-PRECISION Models 1461, 1471, 1471B, and 1472C.

Model PR-34 10:1/Direct Low-Capacitance Probe: $30.00. Designed to prevent ringing when used with extended bandwidth oscilloscopes such as the B&K-PRECISION Model 1472. Input Impedance: 10:1, 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Max Input Voltage: 500 Vp-p. With spring-loaded clip-on tip and UHF connector.

Model PR-35 10:1/Direct Low-Capacitance Probe: $30.00. Designed for use with 15 MHz bandwidth oscilloscopes. Input Impedance: 10:1, 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Max. Input Voltage: 500 Vp-p. With spring-loaded clip-on tip and BNC connector. Can be used with B&K-PRECISION Models 1471, 1471B, and 1472C.

Model PR-36 10:1/Direct Low-Capacitance Probe: $35.00. Designed for oscilloscopes with bandwidth extending beyond 30 MHz. Required for B&K-PRECISION Model 1474. Input Impedance: 10:1, 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Input Voltage: 500 Vp-p. With spring-loaded clip-on tip and BNC connector. Can also be used with B&K-PRECISION Models 1471, 1471B, and 1472C.

Model PR-37 Deluxe 10:1 direct probe: $40.00. Designed for oscilloscopes and frequency counters to 100 MHz. Includes spring-loaded retractable tip cover, insulating tip, BNC tip, IC tip and compensation capacitor adjustment tool. Has BNC connector.

METER PROBES AND CABLES

Model AV-1A RF Probe: $13.50. Extends frequency range to 250 MHz. For use with Model 177 VTVM.

Model AV-2A High-Voltage Probe: $19.50. Extends DC voltage range to 50,000 VDC. For use with Model 177 VTVM. (See page 7 for other high voltage probes.)

Model PR-21 Isolation/Direct Probe: $10.00. For Models 277, 280, 281, 282, 283, 290, and 1403. Prevents capacitive loading and RF interference when measuring DC in RF circuits. Has switchable 100K ohm isolating resistor. Terminated in molded double banana plug.

Model PR-25 10:1 and 1:1 Compensated Counter Probe: $15.00. Reduce possibility of double counts when measuring square waves or digital steps, with Model 1801. Direct impedance 1 meg, shunted by 110 pF; 10:1 impedance 10 meg, shunted by 10 pF. Frequency Response: 20 Hz to 60 MHz. BNC connector.

Model PR-43 DC/AC/Ohms Probe: $9.00. Exact replacement for test probe supplied with B&K-PRECISION Model 177 VTVM's.

Model PR-151 Demodulator Probe: $13.50. Use for viewing RF and IF modulation waveforms on B&K-PRECISION scopes, and exact replacement for probe furnished with Model 415 Alignment Generator.

Model TP-41 Terminated RF Cable: $12.00. Exact replacement for cable furnished with B&K-PRECISION Model 415 Alignment Generator. With selectable terminations of 75 or 300 ohms.

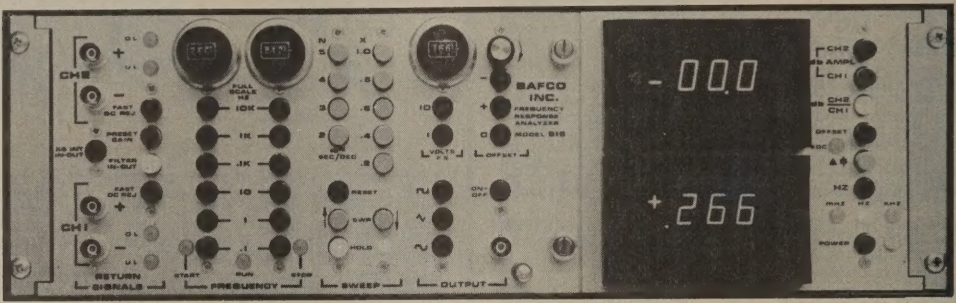
INSTRUMENT CONNECTING CABLES

Model CC-41: $7.50. 36″ RG/58U with a BNC connector on each end.
Model CC-42: $6.50. 36″ RG/58U with BNC connector and UHF connector (PL-259).
Model CC-43: $6.50. 36″ RG/58U with BNC connector and banana plugs.
Model CC-44: $6.50. 36″ RG/58U with BNC connector and coaxial microphone connector.
Model CC-45: $8.00. 36″ RG/58U with BNC connector and Type N connector.
Model CC-46: $6.00. 36″ RG/58U with UHF connector (PL-259) on each end.
Model CC-47: $3.00. 36″ zip cord with spade lugs and cigarette lighter plug.
Model CC-48: $5.00. 36″ audio coax with 1/4″ phone plug and dual banana plug.
Model CC-49: $4.00. 36″ audio coax with phono plug to dual banana plugs.
Model CC-50: $4.00. 36″ audio coax with 3.5 mm mini-phone plug to dual banana plug.
Model CC-51: $6.00. 36″ audio coax with RCA phono plug to alligator clips.

A COMPLETE LINE OF FREQUENCY RESPONSE ANALYZERS

WITH

High Noise & Harmonic Rejection (Fourier Analysis). Direct Readout of Amplitude, Phase Shift, Frequency, AMP. Ratio (db). Fast, Simple Operation. Low Cost, Portable. Calibrated, Low Distortion Test Signal with D.C. Offset.

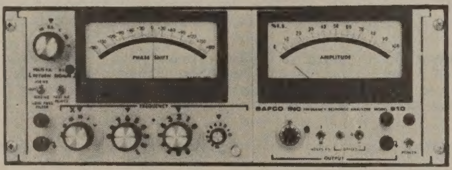

CH2
CH1
RETURN SIGNALS
FREQUENCY
SWEEP
OUTPUT
START
RUN
STOP
RESET
HOLD
BAFCO INC. FREQUENCY RESPONSE ANALYZER MODEL 916
-00.0
+.266
POWER

MODEL 916
UNIVERSAL TWO CHANNEL SWEEP F.R.A.

916 - .005 Hz to 10,000 Hz • 916M - .01 Hz to 20,000 Hz • 916H - .025 Hz to 50,000 Hz

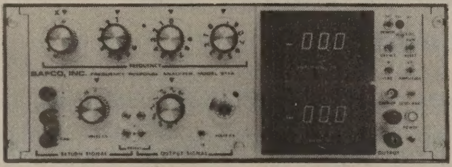
- DISPLAYS & PLOTS AMP. RATIO (db) & PHASE SHIFT VS. LOG FREQUENCY
- OPEN LOOP RESULTS FROM CLOSED LOOP TESTS
- AUTOMATIC GAIN CONTROL – 80 db DYNAMIC RANGE IN EACH CHANNEL
- CONTINUOUS SWEEP OVER ANY PORTION OF 6½ DECADE FREQUENCY RANGE
- DIRECT OPERATOR CONTROL OF ALL FUNCTIONS – SWEEP SPEED, SWEEP SENSE, INTEGRATE TIME
- HIGH NOISE & HARMONIC REJECTION – FOURIER INTEGRAL ANALYSIS
- OPTIONS: CARRIER, AMPLITUDE SERVO, MECHANICAL IMPEDANCE

● REMOTE PROGRAMMING – MODEL 920 ●


PHASE SHIFT
AMPLITUDE
FREQUENCY
BAFCO INC
OUTPUT

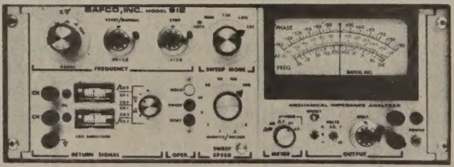
MODEL 910-B

SINGLE CHANNEL – 0.1-20,000 Hz
LOW COST – DUAL METER – CONTINUOUS READING


BAFCO, INC.
-00.0
-00.0
RETURN SIGNAL
OUTPUT SIGNAL

MODEL 911A-2D

SINGLE CHANNEL – .01 -10,000 Hz
DUAL DIGITAL READOUTS – AMPLITUDE RATIO (DB) & PHASE SHIFT


BAFCO,INC. MODEL 912
FREQUENCY
PHASE
FREQ
MECHANICAL IMPEDANCE ANALYZER
RETURN SIGNAL
OUTPUT

MODEL 912

MECHANICAL IMPEDANCE ANALYZER – TWO CHANNEL 1.-20,000 Hz. A.G.C. OVER 60 DB IN EACH CHANNEL. DIRECT PLOT OF AMPLITUDE RATIO (DB) AND PHASE SHIFT VS. LOG FREQUENCY. ARTIFICIAL INTEGRATION.

BAFCO, INC. welcomes your inquiry, and is pleased to assist you in selecting the model analyzer best suited to your frequency response measurement needs. Send for complete catalog of all models.

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WARMINSTER, PENNSYLVANIA 18974
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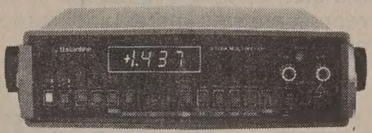
Ballantine Instruments and Measuring Equipment

AC VOLTMETERS and MULTIMETERS

Model 3630A

- **AC Voltmeters Digital and Analog.** True RMS, Average and Peak Responding. Sensitivities from 100 uV to 1 kV full scale. Bandwidths from 0.1 Hz to 1 GHz. 19,999 counts. AC/DC coupled models. Resolution to 1 uV; Accuracy to 0.01%. Linear and log voltage and dB indication. Floating inputs/battery and line powered. IEEE 488 Adaptable Models.

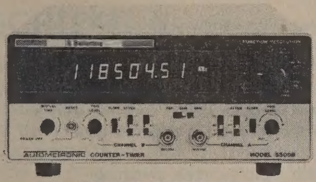
- **Portable Digital Multimeters, RMS Responding.** 1999 counts. 6 functions. 30 ranges from 100 uV to 1200 V ac and dc; 100 nA to 1.999 A ac and dc; 100 milliohms to 19.99 megohms. Accuracy to 0.05%.


Model 3028A

REQUEST CATALOG "VV"

Over 25 Commercial, Industrial and Military Models to Fit Your Application.

FREQUENCY COUNTERS and COUNTER-TIMERS


Model 5500B-08

- **Intelligent Universal Counter Timers.** Model 5500B: DC to 110 MHz, 8 digits, automatic resolution, ATE oriented. IEEE 488 Adapter.

  Model 5500B-Opt. 35: to 1 GHz.
- **Communications Counters** Sensitivities to 15 mV.

Model 5725B: Low cost, 6 digit, 225 MHz for field, CB, and general usage.

Model 5760A: 600 MHz, 8 digit, line/battery, operated. TCXO and proportional oven clock positions.

Model 5755A: 512 MHz economy, 6 digits.

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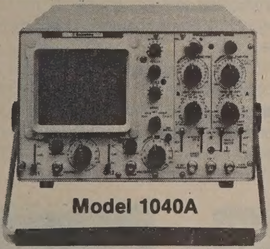

Model 1040A

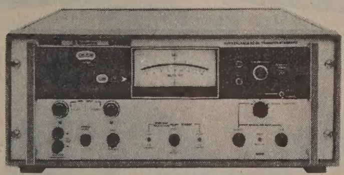
PORTABLE OSCILLOSCOPES/DUAL CHANNEL

- **10MHz/20MHz/40MHz Models.** Sensitivities to 50 uV/cm; mixed and delayed sweeps to 20 ns/cm. Field/bench capability. Rugged. Reliable.

- **Oscilloscope Calibrators**
- **Time Mark Generators**
- **Transient Recorders**

REQUEST CATALOG "OO"

AC CALIBRATION STANDARDS and THERMAL TRANSFER DEVICES


Model 1600A

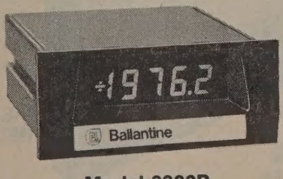
- **Automatic AC/DC Transfer Standard.** DC to 100 MHz. 0.25 V to 1200 V.
- **Coaxial Thermal Converters to 1 GHz.** 0.1 V to 135 V.
- **Micropotentiometers to 900 MHz.** 17 uV to 1.4 V.

- **AC/DC Voltage Calibrators.** Accuracy to 100 ppm . . . Resolution and repeatability to 20 ppm. Ranges from 17 uV to 1 kV.

REQUEST CATALOG "SS"

All fully NBS traceable and certifiable. Complete capability for traceable voltage and current and power metrology measurements.

DIGITAL PANEL METERS


Model 8300B

28 Voltage and Current Models. 4½, 3½, 2½ digits. Superior long time stability. Accuracies to + (0.01% rdg + 0.01% fs).

Longtime reliability — 3 year LCD display warranty.

Jumbo 0.7" high characters. High contrast illuminated white on black displays and daylight-viewing power-saving reflective displays.

8300B Series — 20 mV to 1000 V; 2 uA to 2A; less than 1 W power consumption.

8300E Series Engineering Units — Readout in actual units of measurement as specified.

REQUEST CATALOG "MM"

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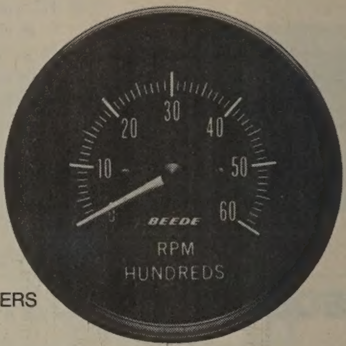
Beede Custom Panel Meters

Beede, world's largest manufacturer of custom meters for monitoring and control of variables, maintains large inventories of meter components to provide customers with low-cost customizing capabilities. Beede products are available in the U.S., Canada and Europe through company representatives, meter modification centers and from the manufacturer.


10
20
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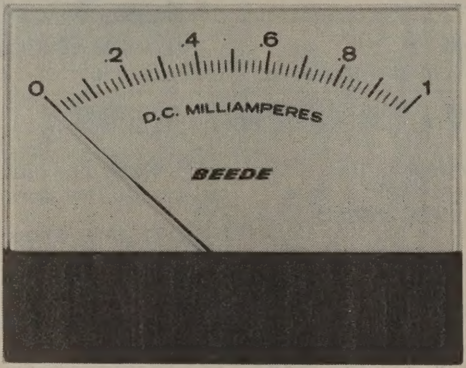
40
50
60
BEEDE
RPM
HUNDREDS

TACHOMETERS


0
.2
.4
.6
.8
1
D.C. MILLIAMPERES
BEEDE

PANEL METERS

Panel Meters. Wide variety of styles and features to meet your needs. Tracking accuracies to 1% or ½% available.

250° Meters. Variety of case styles and sizes.

Meter Relays. Precision optical controller with output indication and wide choice of unique functional options.

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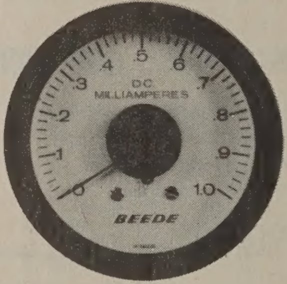
Tachometers. For a broad range of high shock and vibration applications.

Meter Movements. Six types of D'Arsonval movements in selection of Beede case styles or customer's case.


D.C. MILLIAMPERES
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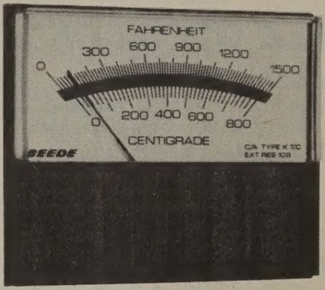
FAHRENHEIT
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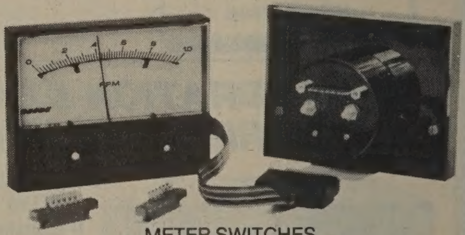
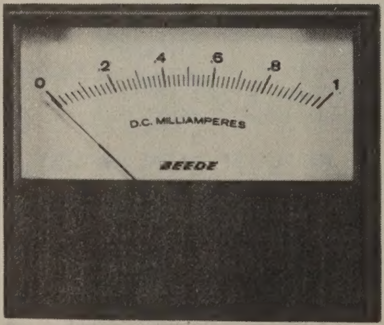
PYROMETERS



METER SWITCHES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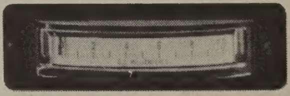

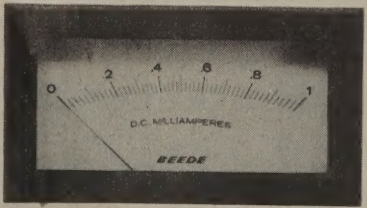
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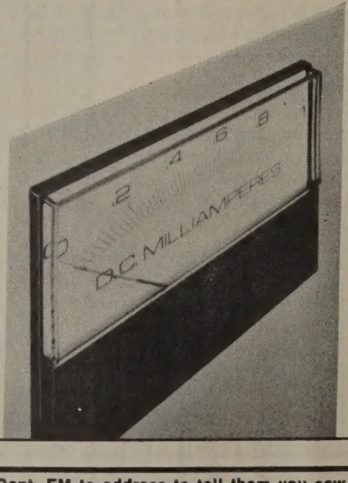
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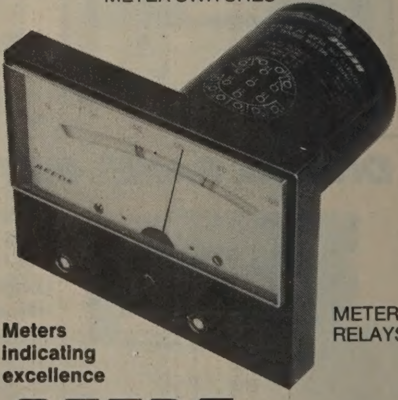

METER RELAYS

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DIGITAL CURRENT METER

DESCRIPTION

The Bell model 1776 digital current meter provides a revolution in metrology via its ability to accurately measure ac, dc, (and ac on dc) current with **non-contact clamp-on probes.** No longer is it necessary to break the circuit to make a current measurement. This time saving feature is extremely helpful in the troubleshooting, repair and design fields. Now it's possible to obtain current measurements more easily and safely than voltage measurement with complete isolation from the bus.

The Bell model 1776 digital current meter introduces virtually no resistance on dc readings and extremely small impedance on ac readings. In this way, measurements can be made with a minimum of disturbance in the measured circuit.

The unique circuit design coupled with the digital readout provides a wide dynamic range of measurements with excellent resolution. A peak reading capability is standard. This function permits you to read and hold the reading of the peak current appearing on the measured conductor. The 1776 is designed for portable operation with internal rechargeable batteries and for 115/230 Vac, 50-60Hz line operation.

PROBES

There are three **clamp-on probes** available for the Bell 1776 digital current meter. Each probe is designed for a distinct full scale range. These ranges are 1000 amperes, 100 amperes, and 10 amperes. The probes are self calibrating and are interchangeable on any 1776 digital current meter. The probes have a 100% overrange capability with reduced accuracy.

Unique probe configurations are available on a special order basis.

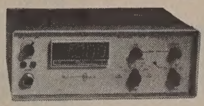
SPECIFICATIONS

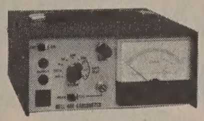
Current Ranges (with applicable probe)	1000 amperes, F.S. 100 amperes, F.S. 10 amperes, F.S.
Accuracy D.C. A.C. (Sinusoidal) Peak Detection (D.C. accuracy)	 ±1.0%, F.S. ±1.0%, F.S. ±2.0%, F.S.
Frequency Response	D.C. to 5 kHz
Power Requirements	115/230 Vac, 50/60Hz and internal rechargeable Nicad batteries, with built-in trickle charge circuitry

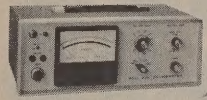
ORDERING INFORMATION

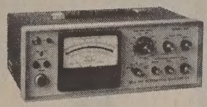
Contact F. W. Bell, Inc. for application assistance. Product assistance and technical literature are available. If standard models are not available, F. W. Bell, Inc. can design for your special electrical and physical requirements.

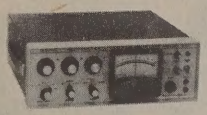
HALL EFFECT GAUSSMETERS











DESCRIPTION

Bell Gaussmeters are high quality instruments designed to accurately measure magnetic flux density. Twenty-eight models and one-hundred ten standard field probes meet the demanding requirements of most application.

Bell Gaussmeters provide four magnetic field measurement modes. They provide direct measurement of absolute magnetic field density, differential measurement of the difference in magnetic field density at two probe locations, incremental field measurements using an expanded scale, and summation measurements.

There are **110 standard probe models** for each gaussmeter model. Each probe is a precision solid-state magnetic field sensor built into a rugged package for accurate, repeatable, stable, field measurements. Models are available for transverse, axial, differential, two-axis, and three-axis measurements with a variety of field ranges, field sensitivities, and physical configurations for each.

SPECIFICATIONS

Gaussmeter model	ranges FS	accuracy	DC output voltage FS
811 digital	10 to 100,000 G	± 0.1% to 100 kg	1 Volt
810 field monitor	10 to 100,000 G	± 0.1% to 100 kg	1 Volt
660 digital	1 to 100,000 G	± 0.1% to 10 kg ± 0.3% to 30 kg	1 Volt
640 incremental	0.1 to 30,000 G	± 0.25% FS	1 Volt 5 Volts
620 precalibrated	0.1 to 30,000 G	± 0.25% FS	1 Volt
615 digital	10 to 100,000 G	± 0.5%	100 mV BCD
610 self-calibrated	1 to 100,000 G	± 0.5%	100 mV
600 general purpose	100 to 30,000 G	± 4% to 30 kg	1 Volt

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ELECTRONIC ENGINEERS CATALOGUE
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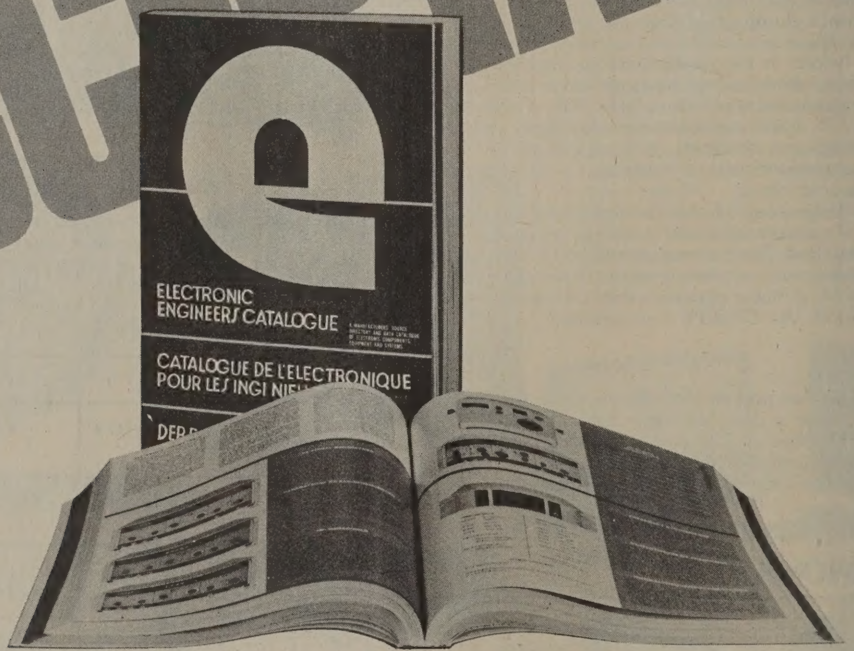
IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe and the United Kingdom. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

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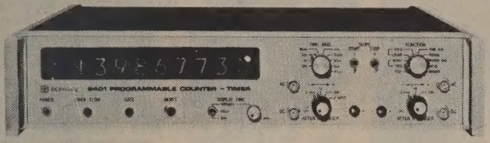
FREQUENCY COUNTERS — SEMICONDUCTOR TESTERS PRINTERS — LINE NOISE GENERATORS



PROGRAMMABLE COUNTER-TIMER Model 6401

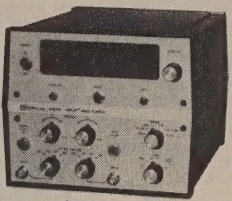
Actually two counters in one, the Model 6401 allows frequency ratio and time interval measurements between 2 signal sources. It features field-replaceable ICs, trigger point monitor lamps and burst frequence measurements. A choice of 3 standard oscillators is offered, with the "O" oscillator standard, and the "L" and "N" oscillators optional. Priced from **$1,975.00.**

INDUSTRIAL COUNTERS AND CONTROLLERS Models 6220A, 6235B and 6240B

Model 6220A is a dual preset controller which is ideal for programming external functions at two separate predetermined count lines. Model 6235B is a direct-count laboratory 5MHz IC counter for industrial use. Auxiliary input-output connector provides external control for remote synchronization. Model 6240B is a direct-count 10MHz 2-channel laboratory IC counter-timer. Measures frequency (0 to 10MHz) period and time interval plus ratio and stability.

$1,205

$1,205



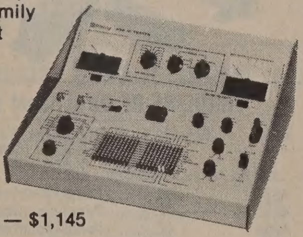
$1,205

DIGITAL / LINEAR IC TESTERS MODELS 998, 999 and 999-D

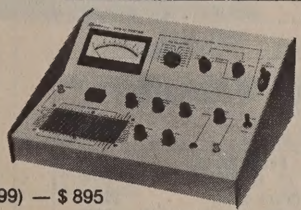
Model 998 is a precision linear IC tester which checks all important DC parameters including offset voltage and range, input and bias current, open loop gain, power dissipation and other voltage and current measurements.

Model 999 is a digital IC tester which checks RTL, RCTL, DTL, modified DTL, TTL, LPDTL, CML and ECLIC's for all important DC parameters. It accepts most types of digital IC packages.

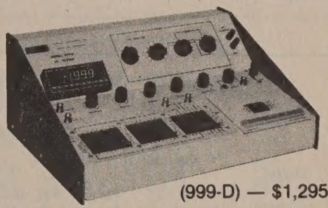
Model 999-D is a 24-pin digital IC tester which also tests CMOS. Featuring a digital readout and a 24-pin selector, it checks the entire IC family plus input threshold levels, output currents, truth tables, noise immunity and much more!



(998) — $1,145



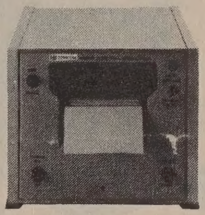
(999) — $ 895



(999-D) — $1,295

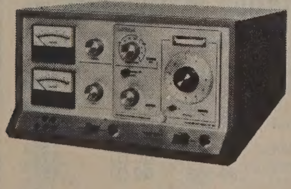
DIGITAL PRINTER MODEL 1454

21-column digital printer accepts data in BCD or ten live decimal codes. It features flexible input format, BCD column expansion capability, portability and decimal point, column suppression, and red/black print control. Input levels can be specified at IC levels or transistor levels. Replacement IC is socket-connected and instantly changeable. Priced from **$1,380.00.**



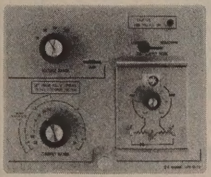
LINE NOISE GENERATOR — Models 3020 and 3021

These instruments offer a controlled method of generating line noise. Inexpensive, they serve a dual purpose: generating a controlled line transient similar to rectifier or SCR noise on the AC line, as well as measuring line noise up to one kilowatt peak. They also generate noise pulses to simulate power line interference up to 10 kilowatt peak power. Noise amplitude and phase position are continuously adjustable from 0 to 600 volts. Pulse rise time is 0.5 microsecond or better. A sweep mode is provided for scanning the noise pulse over the full 360° of line cycle. Model 3020 is priced at $1,195. Model 3021, which has a special variable pulse rate control, is priced at $1,295.



SEMICONDUCTOR TEST SET Model 70

Plug-in test modules provide the low-cost Model 70 with the scope and capabilities of a much more expensive test system. The basic unit contains power supplies and metering circuitry for settingup bias conditions. Interchangeable modules slide into and connect with the chassis. $1,073.00.

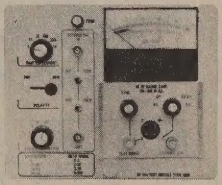


TEST MODULE 10-CD

Employs two plug-ins to test module — one for leakage measurement and breakdown voltage to 1000V, and the other for extreme low-leakage measurement. $1,073.

TEST MODULE 10-RF-1

Gives direct read-out of hfe from 3 MHz to 30 MHz. Accuracy is + 10% maximum error. $1,045.00.



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2700 DuPont Drive, Irvine, CA 92715 (714) 833-3300 TWX No. 910-595-2552

BIRD

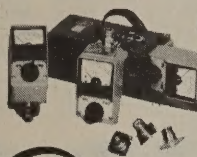
Quality Instruments For RF Power Measurement

50 ohms nominal

Insertion instruments for measuring and monitoring incident and reflected power in coaxial transmission lines with ±5% of full scale accuracy. Insertion VSWR is less than 1.05. Net power under any load condition is the difference between incident and reflected power readings, which also yield load VSWR from a nomograph. 4311 and 4314 THRULINE Peak and CW Wattmeters also measure power of pulsed RF systems such as air navigational aids, telemetry, radar, etc. from 0.4 microsecond pulse width (±8% accuracy).

4371 Digital Multirange Broadband Wattmeter, self-contained elements. (Analog Version: Model 4370)

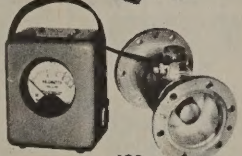
Direct reading instruments for absorbing and measuring RF power. The load section of the TERMALINE Wattmeter serves as a dummy load. The indicating meter is calibrated to read RF power directly in watts with ±5% of full scale accuracy (to 500MHz).



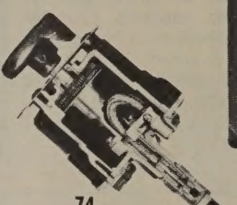
4111-14

6254

6154



460



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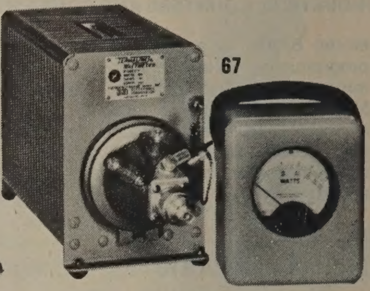
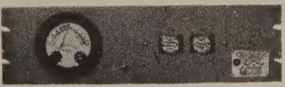
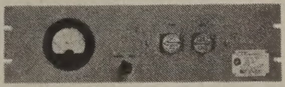
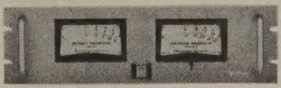




3122 VSWR + Wattmeter



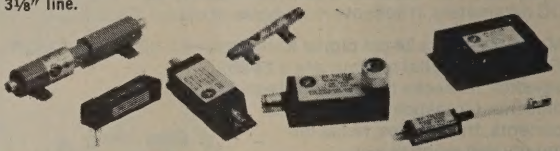
4521 Panel-mounted "43" type



3127 3128

COAXIAL RF FILTERS

Custom engineered or field-proven designs. High rejection attenuation filters available with Low-pass cut-off from 16 to 2700MHz (about fifty designs of 400MHz). Hi-pass cut-off frequencies from 30 to 1000MHz, Band-pass as narrow as 5% of center frequency. Sizes from ¼ cubic inches, with subminiature connectors, to 3⅛" line.



THRULINE® RF Directional Wattmeters

Model	Connectors	PLUG-IN ELEMENTS Frequency (MHz)	PLUG-IN ELEMENTS Power Ranges (Watts)	U.S. Price
43	QC (1)	For CW, FM, and TV (black level)		$120
4311 (Battery)	QC (1)	For Peak, Pulse, SSB, AM, TV, CW, and FM		395
4314 (AC/DC)	QC (1)	For Peak, Pulse, SSB, AM, TV, CW, and FM		450
Order one or more elements with your Thruline Wattmeter to suit your frequency and power ranges.		2-30	50, 100, 250, 500, 1000, 2500, 5000	42 each
		25-60, 50-125, 100-250, 200-500, 400-1000	5, 10, 25, 50, 100, 250, 500, 1000	36 each
		Elements, Milliwatt (100, 250, 500) narrow band		$75
		Elements, low power (1, 2.5W) narrow band		50
		Elements, 950-1260MHz (1, 2.5, 5, 10, 25, etc. to 5000W)		75
		Elements, high frequency to 2300MHz (1, 2.5, 5, 10, 25W)		75
		Elements, peak only to 10kW, 25-1000MHz in five bands		75
		CC-1 Cowhide Carrying Case for 43, 4311		25
		EC-1 Element Case for 12 spares		16
4274		Directional Coupler Elements, BNC/F RF Output:		
		—40dB 50-100MHz, 1000W max.		55
		—40db 75-150MHz, 1000W max.		55
		—40dB 125-250MHz, 1000W max.		55
		—40dB 225-450MHz, 1000W max.		55
		—35dB 400-800MHz, 500W max.		55
		—30dB 750-1250MHz, 100W max.		55
4274-025		Non-directional RF Sampler 25-1000MHz: —50dB, 500W max.		36
4330	QC (1)	Milliwatt version of Model 43 (200/800mW)		150
		Elements (4330) 60-2300MHz in narrow bands, 60-950/950-2300		60/80
4370	QC (1)	25-520MHz	1-500W	595
4371	QC (1)	25-520MHz	1-1000W	995
4111	UHF, N, BNC	25-175MHz Mini-Monitor® Pocket Meter	150/15W	149
4112	N, UHF, BNC	2- 30MHz Mini-Monitor® Pocket Meter	200/20W	149
4113	N, UHF, BNC	2- 30MHz Mini-Monitor® Pocket Meter	1000/100W	149
4114	N, UHF, BNC	400-512MHz Mini-Monitor® Pocket Meter	50/5W	149
4115	N, UHF, BNC	100-225MHz Mini-Monitor® Pocket Meter	50/5W	149
4118	N, UHF, BNC	400-512MHz Mini-Monitor® Pocket Meter	150/15W	149
4712	1⅝ EIA Fl.	Rigid Line Wattmeter		225
		Elements (4712) Choices from 25W-25kW 2-1000MHz		50
460	3⅛ EIA Fl.	Rigid Line Wattmeter		$260
4805	3⅛ Unfl.	Rigid Line Wattmeter		185
		Elements (460, 4805) Choices from 1-100kW, 2-1000MHz		50

THRULINE RF Directional Wattmeters (Cont'd)

4902	6⅛ EIA Fl.	Rigid Line Wattmeter	630
		Elements (4902) Choices from 2.5-250kW, 2-1000MHz	50
4521	QC (1)	Panel-mounted one meter — one socket	125
4522	QC (1)	Panel-mounted, one meter — two sockets	185
4526	QC (1)	Panel-mounted, two meters — two sockets	235
3122	QC (1)	Special meter: simultaneous forward: reflected power and VSWR, panel mtd. two sockets	350
4342	QC (1)	Portable version of 3122	350
		These five models use Elements listed for Model 43	
4320/21		Amplifiers for adding PEAK READ to CW Thrulines	285

WATTCHER® RF Power Monitor/Alarm

Model		U.S. Price
3127/28	Fwd/refl. Wattmeter. Has alarm or Xmitter shut-off with high VSWR. Requires Line Section, Elements, etc. Choices from 0.45 to 2300MHz, 1W to 250kW.	$525

TERMALINE® RF Absorption Wattmeters

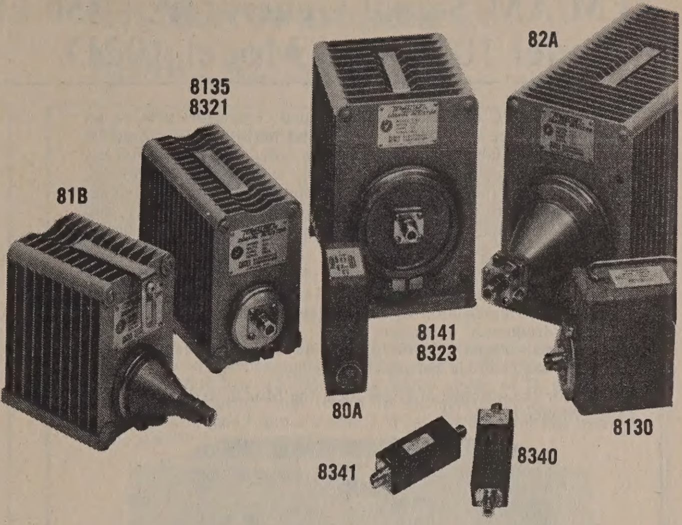
Model	Power Scales	Freq. (MHz)	Connector	U.S. Price
6254	25, 50, 100, 250, 500mW, 1 or 2W	30-500	BNC/F	$190
†611	0-15/60W also see 6156	30-500	N/F	250
6104	0-2/6/20/60W	25-512	N/F	249
6154	0-5/15/50/150W	25-1000	N/F	275
6156	0-5/15/50/150W	25-512	N/F	249
†67	0-25/100/500W	30-500	QC (1)	410
694	0-1000W	2-30	QC (1)	525
6835	0-120/600/1200W	30-500	QC (1)	650
Water-cooled:				
†67C	0-100/500/2500W	30-500	QC (1)	525

† Special calibration 500-1000MHz available at time of order. 25

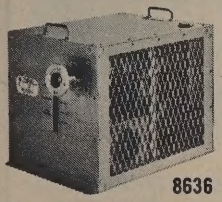
COAXWITCH® Coaxial Selector Switches

Model	Function	U.S. Price	Model	Function	U.S. Price
7422	1P2T	$125	718	1P8T	$150
7441	1P3T	125	7181	1P10T	160
7431	1P4T	125	72-2	2P2T	125
74	1P6T	140	72-R	2P-Rev	125

8160
8164
8166
80M
8010
80BNCM
8080
8053



TERMALINE RF Coaxial Load Resistors for accurate, non-radiating termination of 50-ohm RF coaxial transmission lines are designed for use in permanent installations, development testing and trouble shooting of transmitters, intermediate components, power tubes, and accessories.



8636

No external water supply is needed for the new 10kW Self-Cooling MODULOAD® RF Load Resistor Module. In a scant three cubic feet of space, the integral heat-exchanger permits continuous 10kW dissipation in 5° to 45° ambients (−20°C to +20°C with anti-freeze).

QC-TYPE CONNECTORS (Quick Change): Adaptable to particular TERMALINE, THRULINE, and TENULINE units, these connectors may be quickly changed in the field. Connector types available are: Female or male BNC, TNC, N, C, SC, HN, LC, UHF, LT, 7/8″, and 1⅝″ EIA Flanged.

Normally supplied: (1) Female N, (2) Female LC, (3) Male N.

OTHER BIRD INSTRUMENTS: THRULINE® RF DIRECTIONAL POWER SENSORS • SENTRILINE® FILTER-COUPLERS • COAXIAL RF FILTERS • NEW: VSWR/WATTMETERS.

Prices are subject to changes without notice. F.O.B. Cleveland, Ohio.

Standard Units: Stock to 12 weeks delivery

TERMALINE® RF Coaxial Load Resistors

Air Cooled, Dry Dielectric

Model	Power	Freq.	VSWR @ 1GHz	Connector	U.S. Price
8010, 8011	2W	0-4GHz	1.04	N/F, N/M	$29
8015, 8016	2W	0-4GHz	1.04	TNC/M, TNC/F	29
80F, 80M	5W	0-4GHz	1.1	N/F, N/M	32
80CF, 80CM	5W	0-4GHz	1.1	C/F, C/M	35
80 BNC/F, -/M	5W	0-4GHz	1.1	BNC/F, BNC/M	35
8052, 8053	10W	0-4GHz	1.1	N/F, N/M	38
8080	25W	0-3.5GHz	1.1	QC (3)	47
8085	50W	0-3.5GHz	1.1	QC (3)	75
8071 Miniload®	100W*	0-2GHz	1.1	SMA/F	125
8160	100W	0-2.5GHz	1.1	QC (3)	150
8164	100W	0-2.5GHz	1.1	QC (1)	125
8166	150W	0-2.5GHz	1.1	QC (1)	150
8072 Miniload®	300W*	0-2.5GHz	1.1	SQC (1)	140

* When bolted to heat sink.

Air Cooled, Liquid Dielectric

Model	Power	Freq.	VSWR @ 1GHz	Connector	U.S. Price
80A	20W	0-3.5GHz	1.1	N/F	50
8130	50W	0-4GHz	1.1	QC (1)	60
81B	80W	0-4GHz	1.1	N/F	100
8135	150W	0-4GHz	1.1	QC (1)	85
8141	250W	0-2.5GHz	1.1	QC (1)	125
8201	500W	0-2.5GHz	1.1	QC (1)	175
82A	500W	0-3.5GHz	1.1	QC (1)	200
8401	600W	0-3GHz	1.1	QC (1)	195
8251	1000W	0-2.5GHz	1.1	QC (2)	325
8833	1000W	0-2.5GHz	1.1	QC (2)	400
8890**	2500W	0-1.5GHz	1.1	QC (2)	545
8891**	2500W	0-1.5GHz	1.1	3⅛ EIA Fl.	545
8892**	2500W	0-1.5GHz	1.1	1⅝ EIA Fl.	545
8898-510	7500W	0-1.5GHz	1.1	3⅛ Unfl.	1025
** BA-88 Blower for doubling power (intermittent duty).					300
** Overtemperature Thermoswitch.					38.50

MODULOAD® Self-Cooled Load Systems

Model	Power	Freq.	VSWR @ 1GHz	Connector	U.S. Price
8632	10kW	0-1.4GHz	1.1	3⅛ EIA Fl.	2600
8641/2	20kW	0-1.3GHz	1.1	3⅛ EIA Fl.	3600
8651/2	40kW	0-1.3GHz	1.1	3⅛ EIA Fl.	5500

TERMALINE RF Coaxial Load Resistors (Cont'd)

Water Cooled, Air Dielectric

8710	1kW	0-3.5GHz	1.1	N/M or F	$210
8720	5kW	0-2GHz	1.1	1⅝ EIA Fl.	350
8736	10kW	0-1.4GHz	1.1	1⅝ EIA Fl.	950
8742/8542	15kW	0-1.5GHz	1.1	3⅛ EIA Fl.	1400
8752/8552	25kW	0-1.5GHz	1.1	3⅛ EIA Fl.	2000
8762/8562	50kW	0-1.5GHz	1.1	3⅛ EIA Fl.	2600
6770 Dolly for mounting 10kW to 50kW Loads.					225

TENULINE® Attenuators

Model	Power	Freq.	VSWR	Atten.	Connector	U.S. Price
8340-060, -100, -200	25W	0-500MHz to 1000MHz	1.1 1.15	6dB 10, 20dB	QC (1) in, (1) out	$125
8341-060, -100, -200	40W*	0-500MHz to 1000MHz	1.1 1.15	6dB 10, 20dB	QC (1) in, (1) out	140
8343-060, -100, -200	100W	0-500MHz to 1000MHz	1.1 1.15	6dB 10, 20dB	QC (1) in, (1) out	250
8321	50W	0-500MHz	1.1	30dB	QC (1) in, (1) out	200
8323	100W	0-500MHz	1.1	30dB	QC (1) in, (1) out	250
8322	200W	0-500MHz	1.1	30dB	QC (1) in, (1) out	300
8325	500W	0-500MHz	1.1	30dB	QC (1) in, (1) out	450
8327**	1000W	0-500MHz	1.1	30dB	QC (2) in, (1) out	575
8329**	2000W	0-500MHz	1.1	30dB	QC (2) in, (1) out	675
BA-88 Blower for 4000W int. duty (8329).					—	300

* When bolted to heat sink. ** Overtemperature Thermoswitch. 38.50

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800 OLDE HICKORY RD.
LANCASTER, PENN. 17601
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WESTERN REGION
1188 EAST OJAI AVE.
OJAI, CALIF. 93023
PHONE (805) 646-7255

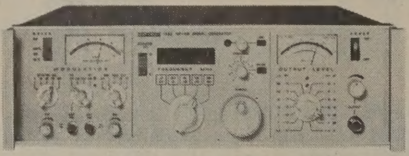
BIRD
Electronic Corporation
30303 Aurora Road, Cleveland (Solon) Ohio 44139
Phone: (216) 248-1200 • TWX: 810-427-2687
Cable: BIRDELEC

FM/AM Signal Generators—450 kHz to 520 MHz
Model 102C and Model 102D

The Model 102C and Model 102D Signal Generators provide an optimum balance of design features and performance characteristics at a reasonable price. They have a broad range of usefulness for measurements in the mobile radio, entertainment, avionics, telemetry, aerospace, components, communications, and educational fields. Both models exhibit the low noise, high stability, and excellent shielding characteristics particularly necessary for narrow band receiver measurements.

Synthesizer stability is provided by the Model 102D. Here the output frequency may be phase locked to either a stable internal temperature compensated crystal oscillator or an external standard reference frequency. A unique feature allows display of the true locked output frequency with full 100 Hz resolution even when the vernier is used to tune between lock points.

Except for the absence of phase-lock, the Model 102C is identical to the Model 102D.



SPECIFICATIONS

FREQUENCY

Ranges: 0.45-32.5, 32.5-65, 65-130, 130-260, 260-520 MHz
Accuracy: 102D, ±(100 Hz + 1 ppm); 102C, ±(100 Hz + 5 ppm)
Stability: 102D locked, bands 2-5, < 0.05 ppm/hr. after 4 hr.
band 1, < 100 Hz/hr.
102C, 102D unlocked, bands 2-5, < 4 ppm/10 min. after 4 hr.
band 1, < 1.5 kHz/10 min.
Residual FM: bands 2-5, < 0.2 ppm peak (20 Hz-15 kHz BW)
band 1, < 15 Hz peak
Display: six digit LED, resolution 100 Hz, 1 kHz, and 10 kHz

RF OUTPUT

Power Level: −130 to 13 dBm (0.07 µV−1 V into 50 Ω)
Attenuator: 13 steps, 10 dB/step, plus variable 13 dB
Accuracy: ±2 dB max.
Leveling: ±0.5 dB
SSB Noise Floor: 135 dB/Hz typical
Spurious Output: > 30 dB down (> 25 dB below 5 MHz)
Impedance: 50 Ω; VSWR < 1.5:1

FREQUENCY MODULATION

Deviation: 0 to 300 kHz in 5 ranges
Accuracy: ±10% fs, 20 Hz-200 kHz
Bandwidth: 102D locked, 50 Hz-200 kHz
102C, 102D unlocked, dc-200 kHz
Distortion: At 100 kHz deviation; band 5, 0.15%; band 4, 0.25%; band 3, 0.5%; bands 1 and 2, 1.0%

AMPLITUDE MODULATION

Percent: 0-100
Calibrated Ranges: 30%, 100%
Bandwidth: dc−20 kHz
Distortion (1 kHz rate): < 1% THD at 30%, < 2% at 70%, < 3% at 90%

INTERNAL MODULATION

Frequencies: 400 Hz, 1, 3, 10, 19 kHz
Accuracy: ±3%
Distortion: < 0.25% THD

MAJOR OPTIONS:

Ext. clock input, special modulation frequencies, NAV/COM version, fused rf output, accessory frequency doubler

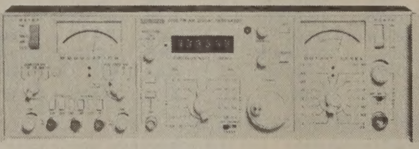
FM/AM Signal Generators - 125 kHz to 175 MHz
Model 103A and Model 103B

The Model 103A and Model 103B Signal Generators cover important applications in the design, production, and maintenance of receivers and systems in the entertainment and communication fields. Identical except for the addition of phase-lock in the 103B, these generators have a carrier frequency range from 125 kHz to 175 MHz displayed on a 6-digit LED readout with selectable resolution down to 1 Hz, below 16 MHz, and 10 Hz above 16 MHz.

This display is also available to count external signals from 5 Hz to 175 MHz with the same resolution and 100 mV sensitivity. A ± 1 ppm time base TXCO is standard.

Five sweep modes are supplied as standard with center frequencies of 262 kHz and 455 kHz and sweep widths of ±30 kHz, 1.2 MHz ±100 kHz, 10.7 MHz ±1 MHz, and 98 MHz ±10 MHz. Other sweep ranges may be substituted on special order. The sweep center frequency as well as the frequency of a variable marker can be read on the digital frequency display.

RF outputs in either the sweep or generator mode are leveled, monitored, and adjustable from −130 dBm to +13 dBm (+23 dBm in a high level position) by a 13-step 10 dB attenuator plus a variable 13 dB panel control.



SPECIFICATIONS

FREQUENCY

Range: 0.125 to 175 MHz in 11 bands
Accuracy: Resolution ± 1 ppm
Stability: 10 ppm/10 min. after 2 hr., unlocked (103A or 103B)
0.05 ppm/hr. after 4 hr., phase-locked (103B only)
Residual FM: < 0.2 ppm peak (20 Hz-15 kHz BW)

RF OUTPUT

Power Level: −130 dBm to +23 dBm (0.07 µV-3V into 50 Ω)
Attenuator: 13 steps, 10 dB/step, plus variable 13 dB, plus 10 dB high level
Accuracy: ±2 dB max.
Leveling: ±0.5 dB max.
SSB noise Floor: 135 dB/Hz
Spurious Output: > 30 dB down
Impedance: 50 Ω; VSWR < 1.3

FREQUENCY MODULATION

Deviation: 0-300 kHz, 32-175 MHz; 0-100 kHz, 8-32 MHz
Accuracy: ±7% fs
Bandwidth: dc-200 kHz (50 Hz-200 kHz, phase-locked, 103B only)
Distortion: 0.15% at 75 kHz, 64-138 MHz
Stereo Separation: > 43 dB, 50 Hz-15 kHz rates, 64-138 MHz

AMPLITUDE MODULATION

Percent: 0-100; 30% and 100% fs
Accuracy: ±(2% + 3% of reading) to 80% AM at 1 kHz
Bandwidth: dc −20 kHz above 1 MHz
Distortion: < 1% THD at 30%, 1 kHz rate

INTERNAL MODULATION

Frequencies: 400 Hz, 1, 3, 10, 19 kHz, plus 35 Hz ramp
Distortion: < 0.2% THD

FREQUENCY SWEEP

Standard Ranges: 262 kHz ±30 kHz, 455 kHz ±30 kHz, 1.2 MHz ±100 kHz, 10.7 MHz ±1 MHz, 98 MHz ±10 MHz
Output: Same power level, attenuation, accuracy, and leveling as rf output
Display: Center frequency and adjustable marker displayed on 6-digit LED readout

EXTERNAL COUNTER

Frequency Range: 5 Hz-175 MHz
Sensitivity: > 100 mV
Resolution: 1 Hz to 16 MHz; 10 Hz to 175 MHz
Reference Accuracy: < ±1 ppm, 15-35°C

MAJOR OPTIONS

Special modulation frequencies, special sweep ranges, fused rf output, FM down to 4 MHz.

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RF Millivoltmeters
Model 92 Series

Available in four versions, these rf millivoltmeters offer the best choice for sensitive, wide-band, accurate rf voltage measurements.

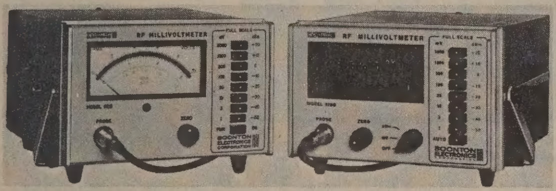
a) Model 92B, a programmable analog version, has a large mirrored-scale meter with linear 0-3 and 0-10 voltage ranges, a dBm scale (1 mW into 50Ω) and dc output.

b) Model 92BB is identical to Model 92B but with the addition of internal rechargable batteries.

c) Model 92BD, a programmable LED digital version, has 4 digit display, serial BCD data outputs, dc output, optional dBm display (0.01 dB resolution) and autoranging.

d) Model 92C, a low-cost analog version, saves by eliminating programming and dc output, by making the most sensitive range 3 mV fs, and by working to a more modest accuracy specification.

All models are supplied with rf probe, 50 Ω BNC adapter and probe tip. Many optional accessories extend their capability for other measurements.



SPECIFICATIONS

Analog Model 92B

Voltage Range: 200 μV to 3 V (300 V up to 700 MHz with divider). Useful indications down to 100 μV.
Frequency Range: 10 kHz to 1.2 GHz.
Basic Accuracy: ±(1% rdg + 1% fs).
Indicator: 4½" taut-band meter; scales 0-3, 0-10 and dBm.
Remote Control: All functions and ranges commanded by TTL inputs.
DC Output: 10 V fs.
Options: Many scale variations, other dB references, rear input.

Analog Battery Model 92BB

Specifications same as 92B. Sealed lead-acid rechargable 6 hour battery.

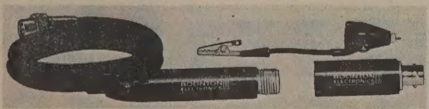
Digital Model 92BD

Voltage Range: 200 μV to 3 V (300 V up to 700 MHz with divider).
Frequency Range: 10 kHz to 1.2 GHz.
Basic Accuracy: ±(1% rdg + 1% fs).
Display: 4 digit LED, reads 1000 fs for "10" ranges and 3000 fs for "3" ranges. Small analog meter to right of display is scaled in dBm.
Data Outputs: BCD (serial) digits, binary coded range information. Overrange, underrange, encode complete.
Remote Control: All functions and ranges commanded with TTL inputs.
DC Output: 10 V fs.
Options: Autoranging, digital dBm readout (0.01 dB resolution), other dB references, rear input, BCD serial/parallel converter

Model 92C

Voltage Range: 500 μV to 3 V (300 V up to 700 MHz with divider).
Frequency Range: 10 kHz to 1.2 GHz.
Basic Accuracy: ±(1% rdg + 2% fs).
Indicator: 4½" taut-band meter; scales, 0-3, 0-10 and dBm.

FURNISHED ACCESSORIES



RF Probe with low noise cable and connector	91-12F
50 Ω BNC Adapter; 1 kHz to 600 MHz	91-8B*
Removable Probe Tip with grounding clip lead	91-13B

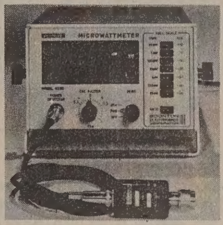
RF Microwattmeters
Model 42 Series

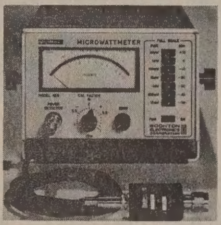
STANDARD VERSIONS

Virtually drift-free, these sensitive power meters cover a dynamic range of 70 dBm from 1 nW to 10 mW (−60 to +10 dBm.) Overload tolerance is 0.3 W cw. Three 50 Ω power detectors offer a choice of frequency range. All start at a low 200 kHz covering up to as high as 18 GHz. A 75 Ω detector is available for CATV applications. The analog models (line or battery) are scaled in power and dBm. The digital model gives 3½ digit resolution for power and 4 digit resolution (0.01 dB) for the optional dBm display.

HIGHER POWER VERSIONS

Specifically designed to use higher power detectors, these power meters cover a power range of 10 dB higher than the standard models and provide low VSWR. The dynamic range of 70 dB covers power measurements from 10 nW to 100 mW (−50 to +20 dBm.) Overload tolerance is greater than 2 W cw. All features and options of the standard models apply.





SPECIFICATIONS (Standard Versions)

Order with one of the following detectors:

41-4A: 50 Ω, 200 kHz-7 GHz
41-4B: 50 Ω, 200 kHz-12.4 GHz
41-4C: 75 Ω, 200 kHz-1 GHz
41-4E: 50 Ω, 200 kHz-18 GHz

Digital Model 42BD

Power Range: 10 nW fs to 10 mW fs.
Frequency Range: 200 kHz to 18 GHz.
Accuracy: Overall, instrument and detector. ±(0.2 dB + 1 digit) to ±(0.8 dB + 1 digit) depending on power range and frequency.
Stability: <1 nanowatt/hour at 25°C
Temperature Effect: 0.007 dB/ °C typ.
Indicator: 3½ digit LED display for power, 4 digit for dBm option.
Data Outputs: BCD (serial) digits, binary coded range, overrange, underrange, encode complete, TTL.
Remote Control: Input range, encode hold and trigger, manual disable, dBm and autorange commanded by TTL inputs.
DC Output: 10 V fs proportional to power.
Major Options: Autoranging, dBm display, BCD serial/parallel converter.

Analog Model 42B

Power Range: 10 nW fs to 10 mW fs.
Frequency Range: 200 kHz to 18 GHz.
Accuracy: Overall instrument and detector. ±(0.2 dB + 0.5% fs) to ±(0.8 dB + 1.0% fs) depending on power range and frequency.
Stability: <1 nanowatt/hour at 25°C
Temperature Effect: 0.007 dB/°C typ.
Indicator: 4½ inch taut band meter calibrated power and dBm.
Remote Control: Input range and manual disable commanded by TTL inputs.
DC Output: 10 V fs proportional to power.
Major Options: Meter scale and dc output linear with dBm. Rear input.

Analog Battery Model 42BB

Specifications same as 42B. Sealed lead-acid rechargeable 6 hour battery.

SPECIFICATIONS (Higher Power Versions)

Order with one of the following detectors:

41-5B: 50 Ω, 200 kHz-12.4 GHz
41-5E: 50 Ω, 200 kHz-18 GHz

Models: 42C Analog, 42CB Analog – Battery, 42CD Digital.
Power Range: 100 nW fs to 100 mW fs.
VSWR: <1.07 at 200 kHz, <1.28 at 18 GHz.
Stability: drift <10 nW/hour at 25°C.

ALL OTHER SPECIFICATIONS ARE THE SAME AS THE STANDARD VERSIONS.

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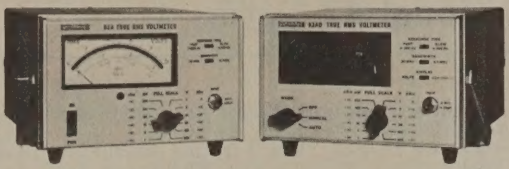
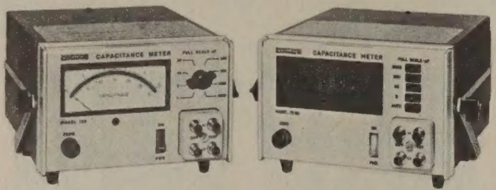


RMS Voltmeters—93 Series

True rms responding programmable voltmeters with full-scale ranges from 1 mV to 300 V and a frequency range from 10 Hz to 20 MHz. Available in either analog (93A) or digital (93AD) versions. Model 93AD can be ordered with autoranging and dB display with 0.01 dB resolution.



1 MHz Capacitance Meters—72 Series

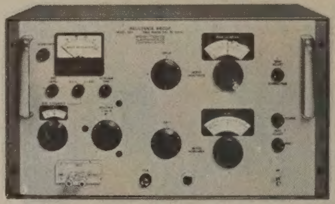
Models 72B and 72BD provide accurate three-terminal capacitance measurements at 1 MHz with 15 mV test level. Analog version has full-scale ranges from 1 to 3000 pF, digital from 2 to 2000 pF with BCD outputs. Fast responding dc output, bias input, and remote ranging are standard on either instrument.

1 MHz Inductance Meters—62 Series

The Model 62 Inductance Meters provide fast, accurate, two-terminal, series inductance measurements at 1 MHz with low test currents. Both the analog 62A with full-scale ranges from 1 to 3000 μH, and the digital 62AD with ranges from 2 to 2000 μH have a linear, high-speed dc analog output.

Capacitance Bridges

Capacitance bridges covering measurements from 0 to 1000 pF are available as the 5 kHz to 500 kHz Model 75C, and the 1 MHz Model 75D. All have conductance ranges from 0 to 1000 μS and adjustable test signals as low as 1 mV.



Inductance Bridges

Three unique Model 63 Inductance Bridges provide direct-reading measurements of series inductance and series resistance. Model 63H covers 0.2 nH to 110 mH at 5-500 kHz, 63M from 2 nH to 1.1 H at 1-100 kHz, and 63L from 20 nH to 11 H at 0.4 to 40 kHz.

Admittance Bridge

Model 33 RF Admittance Bridges measure two-terminal parallel capacitance to 150 pF and conductance to 25 mS at 1, 5, 10, 20, 50, and 100 MHz. Good resolution of conductance makes loss measurements possible on many high-Q diodes, varactors, and capacitors. Internal and external dc bias is standard.

Automatic 1 MHz Capacitance Bridge
Model 76A

The Model 76A combines established precision bridge techniques with an automatic balancing system and internal computing facilities. It makes fully automatic, triggered or free running, 1 MHz parallel capacitance and conductance measurements with test levels of from 5 to 200 mV rms. Independent range selection or autoranging for both capacitance and loss is made using the convenient front-panel push-button controls. Annunciators show the range or mode in use.

The bridge will compute and display on command the equivalent series capacitance, series resistance, dissipation (tan δ), or Q of the test. In addition, any capacitance measurement can be displayed as a deviation in capacitance or a percentage deviation versus a previously entered and stored value.

The push button controls have a secondary function when the "entry" mode is selected. In this mode they may be used to program numbers which appear in the right hand display. These numbers may be entered into storage as a reference capacitance value for deviation measurements or entered to set a dc bias voltage on the optional internal supply.

A unique "corrected zero" feature of the 76A supplements the front panel coarse and fine C & G zero controls. In this mode the zero offsets of every combination of C & G range are automatically measured and stored for correction of subsequent readings.

Measurements may be made at the front panel test inputs or at the end of shielded test leads. When "remote test point" is selected a stored program is used to calculate and correct for each measurement made through the 30 inch test cables supplied.

Versatile remote control input and data output options are available, including the IEEE 488-1975 interface bus.

SPECIFICATIONS

Capacitance: 0-2000 pF in 4 ranges;
0-1.9999 pF, 0-19.999 pF, 0-199.99 pF, 0-1999.9 pF

Basic Capacitance Accuracy: ±(0.1% rdg + 1 digit).

Conductance: 0-2000 μS in 4 ranges;
0-1.999 μS, 0-19.99 μS, 0-199.9 μS, 0-1999 μS

Basic Conductance Accuracy: ±(2% rdg + 1 digit).

Test Frequency: 1 MHz.

Test Level: 5-200 mV, adjustable.

Test Time: <100 ms, C >2 pF and G >2 μS.
<500 ms, C <2 pF or G <2 μS.

Display: Dual digital readout, decimal points, units, modes, active ranges.

Display Modes: C_p, C_s, ΔC, $\Delta\%$, G, R_p, R_s, D (tan δ), Q.

Autoranging: Standard.

Trigger Modes: Continuous (1 per sec), manual, external.

DC Bias: External input, ±200 V, 30 mA fused.

Supplied Accessories: Universal test fixture with 30" input cables.

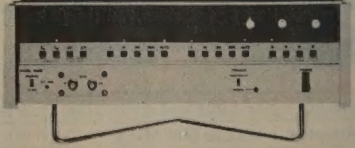
OPTIONS

Data Outputs/Remote Control Inputs: Three mutually exclusive interface options are available.

1. Parallel BCD outputs, TTL, isolated.
2. BCD Serial by bit, TTL, isolated.
3. IEEE 488-1975 Interface Bus.

Internal DC Bias Supply: Programmable from panel push buttons or remote input.

Range: 0-200 V unipolar, 5 mA max.
Resolution: 5 mV up to 20 V, 50 mV above 20 V.



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Aiken Industries
California Instruments
Division

California Instruments was the originator of the digital multimeter which incorporates a frequency counting function, and of the 7-channel oscilloscope for monitoring multi-track analog tape recording. Other products include Digital Panel Meters, AC power sources and line correctors.

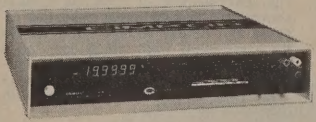
CIMRON DIGITAL MULTIMETERS, MULTIMETER/COUNTERS

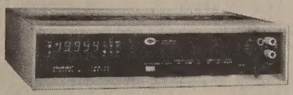
All Cimron digital multimeters and multimeter/counters employ automatic zeroing and full input protection circuitry. All of the units are rack mountable and can be supplied with a high voltage probe to 30 KV and an R.F. probe to 1 GHz.

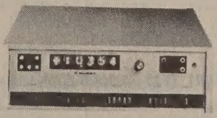
MODEL NUMBERS	DMM 50	DMM 51	DMM 52	DMM 40	DMM 42	DSM 44	6653A	DMC 45
Number of Digits	5½	5½	5½	4½	4½	4½	4½	4¾
Overrange %	20	20	100	100	100	100	10	300
Readings/Sec.	20	3⅓	7½-15	4	2½	20-30	1000	2
Range Change	Auto/Man/Rem	Auto/Man	Auto/Man/Rem	Auto/Man	Auto/Man/Rem	Auto/Man/Rem	Auto/Man/Rem	Man
FREQUENCY	—	—	—	—	—	—	—	Std
Ranges (6)	—	—	—	—	—	—	—	100 Hz-20 mHz
Sensitivity	—	—	—	—	—	—	—	.01 Hz
DC VOLTS	Std	Std	Std	Std	Std	Std	Std	Std
Ranges	5	5	5	5	6	5	6	5
Sensitivity	1 μV	1 μV	1 μV	10 μV	1 μV	10 μV	1 μV	10 μV
Accuracy	.002% Rdg	.002% Rdg	.001% Rdg	.01% Rdg	.01% Rdg	.01% Rdg	.01% Rdg	.01% Rdg
AC VOLTS — Averaging	Opt	Opt	Opt	Std	Opt	Opt	Opt	Std
AC Volts — RMS	Opt	Opt	Opt	—	Opt	Opt	Opt	—
Ranges	4	4	4	5	4	4	4	5
Sensitivity	10 μV	10 μV	10 μV	10 μV	100 μV	100 μV	100 μV	10 μV
Accuracy	.05% Rdg	.05% Rdg	.05% Rdg	.1% Rdg	.1% Rdg	.1% Rdg	.1% Rdg	.1% Rdg
RESISTANCE	Opt	Opt	Std	Std	Opt	Opt	Opt	Std
Ranges	6	6	6	6	9	7	5	6
Sensitivity	1 mOhm	1 mOhm	1 mOhm	.01 Ohm	.1 mOhm	1 mOhm	.1 Ohm	.01 Ohm
Accuracy	.003% Rdg	.003% Rdg	.002% Rdg	.05% Rdg	.01% Rdg	.02% Rdg	.01% Rdg	.02% Rdg
RATIO DC/DC 3-Wire	Std	Std	—	—	—	Std	Std	—
Ratio DC/DC 4-Wire	—	Opt	Opt	—	—	Opt	—	—
Ranges	—	5	5	—	—	5	6	—
AC/AC Ratio	—	—	—	—	—	Opt	—	—
Sensitivity	—	—	—	—	—	10 μV	—	—
Ratio AC/DC	—	—	—	—	—	Opt	Opt	—
Current AC and DC	Opt	Opt	Opt	Std	Opt	Opt	Opt	Std
Ranges	5	5	5	2	6	6	6	5
Data Output	Opt	Opt	Opt	Opt	Std	Opt	Opt	Opt
Remote Control	Opt	—	Opt	—	Std	Opt	Opt	—
Battery Operation	—	—	—	Opt	—	—	—	Opt

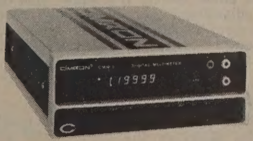
Specifications Subject to Change Without Notice

DMM 50

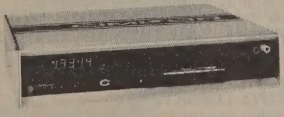

DMM 52

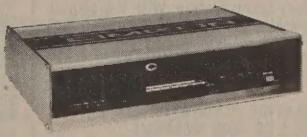

DMM 42


6653A


DMM 51

DMM 40


DSM 44


DMC 45

CALIFORNIA INSTRUMENTS COMPANY

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Representatives in principal cities throughout the world.

CABLEMASTER®

A VERSATILE LINE OF COMPACT INSTRUMENTS FOR AUTOMATIC TESTING OF ELECTRICAL CABLE ASSEMBLIES, CONNECTORS AND HARNESSES

Cablemaster 400-C

A field proven 400 circuit tester for in-plant use.

The Cablemaster Model 400-C is a 400 point tester which measures continuity, insulation resistance and dielectric strength quickly — accurately — economically. It is ideal for use in receiving inspection, production, quality control, laboratories, field maintenance, operational sites and in a wide range of applications where complete and reliable cable or connector testing is desired with one compact unit. The Model 400-C is designed to provide maximum convenience and versatility. It is equipped with a mobile carrier to permit easy movement to any location. The unit can be removed from the carrier if desired. The 400-C sequences thru the 400 points at a rate of up to 120 steps per minute checking each point for the parameter under test.

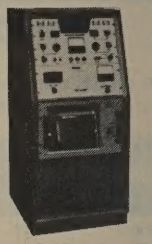
Cablemaster 400-S

For shipboard and aircraft cable checkout where terminations may be hundreds of feet apart.

The Model 400-S Cablemaster is a high speed, sequential wire analyzer designed primarily for shipboard and aircraft checkout. The unit incorporates all of the features of the Model 400-C with the added capability of convenient testing of long installed cables where the terminations may be hundreds of feet apart. The 400-S consists of a main console mounted on a mobile carrier and two extension units. Control cables (up to 250 feet long) connect the extension units to the main console. An additional feature allows automatic scanning of test points to locate crossed wires when an open is indicated. This feature permits a wire list to be generated with the aid of the optional printer.

Cablemaster 1200-C

Field expandable from 400 circuits to 1200 circuits.



The Model 1200-C Cablemaster (shown above with optional printer and low ohm analyzer) incorporates all of the features of the Model 400-C and functions identically except that it has the capability to test up to 1200 points. To accommodate the additional number of output modules it is mounted in a mobile console. When accessories such as a printer, low ohm analyzer, etc. are incorporated they are mounted within the same console. The 1200-C is modular in design and construction. This permits the unit to be obtained with fewer than the maximum 1200 test points but having the capability of being expanded to 1200 test points in the field by simply adding output modules obtained from the factory.

SPECIFICATIONS

	400-C	400-S	1200-C
Test Capacity (Maximum) Insulation Resistance: Hipot: Continuity:	400 circuits 400 circuits 200 circuits	200 circuits 200 circuits 200 circuits	1200 circuits 1200 circuits 600 circuits
Test Ranges Insulation Resistance: Hipot: Continuity: Resistance Current	1 to 5000 megohms 0 to 3000 volts ac or dc 0.5 to 59 ohms 0.5 to 3 amps	1 to 5000 megohms 0 to 3000 volts ac or dc 0.5 to 59 ohms 0.5 to 3 amps	1 to 5000 megohms 0 to 3000 volts ac or dc 0.5 to 59 ohms 0.5 to 3 amps
Hipot Dwell Time:	0.5 to 180 seconds	0.5 to 180 seconds	0.5 to 180 seconds
Max Test Rate:	120 tests per minute	120 tests per minute	120 tests per minute
Input Power:	110-125 volts ac* 50-60 Hz	110-125 volts ac* 50-60 Hz	110-125 volts ac* 50-60 Hz
Weight:	165 pounds	Main Unit: 150 pounds Extension Units: 42 lbs. each	250 pounds
Cabinet Dimensions:	21 x 13½ x 18½ inches	21 x 13½ x 18½ inches (plus 2 extension units at 9 x 16 x 14½ inches)	49 x 22 x 27 inches
*220 volt unit available			

CHECK THESE OUTSTANDING FEATURES

EASE OF OPERATION

Simplified operating procedures permit the Cablemaster to be operated by non-technical personnel. Controls are conveniently located and are arranged to provide efficient operation. Test results are displayed on a digital readout to reduce errors. When a fault is located the test sequence automatically stops and an alarm is sounded to alert the operator. Testing can be continued at the operator's discretion.

PERMANENT TEST RECORD (Optional)

The Cablemaster is available with an optional printer to provide a complete and permanent record of each test. The type of test, circuit tested, and test results are recorded on a continuous paper tape. Failures are printed in red for easy identification. With the printer in operation the Cablemaster will not stop when a fault is located, but will record the fault and proceed with the test.

INSULATION RESISTANCE RANGE FROM 1 TO 5000 MEGOHMS

The Cablemaster automatically checks each conductor against all others to determine insulation resistance under any impressed voltage between 20 and 1000 vdc. Use of plug-in resistance standards and a front panel control allows rapid change from one acceptance level to another.

DIELECTRIC STRENGTH (HIPOT) RANGE FROM 0 TO 3000 VOLTS AC OR DC

The Cablemaster automatically checks each conductor against all others for shorts and leakage. Any test voltage up to 3000 vac or vdc can be selected by the operator. The voltage range is continuously variable and is monitored on the precision meter provided on the front panel. Hipot dwell time can be set for any period up to three minutes.

CONTINUITY RESISTANCE RANGE FROM 0.5 to 59 OHMS — 0.5 to 3 AMPERES

Termination-to-termination continuity on a maximum of 600 simple or complex circuits is quickly accomplished in one test setup. Resistance test level is selected with convenient digital switches.

SIMPLIFIED TESTING CAPABILITY FOR MULTIPLE CONDUCTORS

A unique programming circuit permits testing of multiple and simple circuits mixed in any sequence. No special programming is required and setup time is greatly reduced.

CHECK THESE VERSATILE ACCESSORIES

804W LOW OHM ANALYZER

This feature permits close tolerance readings in low ohms for testing of resistance in connectors and jumper cables by providing a high speed, sequential low ohm measurement test capability to the Models 400-C and 1200-C Cablemaster. Precise resistance from .001 to 0.5 ohm can be measured. The unit supplies a constant current source to the part under test and records the actual voltage drop across the component from which resistance of the component is calculated. A permanent record of each test position is printed out on a printer supplied with this feature.

PRINTER

The Cablemaster is available with an optional printer to provide a complete and permanent record of each test. The printout includes the type of test, the circuit test number and test results including the millivolt drop for the low ohm test. Failures are printed in red for easy identification.

RISE TIME CONTROL

This feature permits application of high voltage with a rise time range of 500 volts per second to avoid spikes due to sudden application of high voltage. (A fall time control is also available).

COMPENSATION PANEL

An auxiliary panel can be added to all models of the Cablemaster to null out the capacitive leakage effects of the test specimen. An A.C. current meter on the panel precisely measures the leakage. A Range Select switch allows two scale settings for the A.C. current meter: 2 Ma or 20 Ma full scale. Two additional switches on the front panel enable the operator to dial in compensating capacitance. The range of the compensating capacitance is from .001 to .059 microfarad.

MEGOHMMETER PANEL

A Megohmmeter Panel can be added to Model 400-C and 1200-C Cablemasters to give discrete insulation resistance reading from 0.5 to 20K megohms with a panel meter. The meter also has an adjustment set point for low limit reject capabilities. The range of the output is in 5 steps, midscale 1, 10, 100, 1000, or 10,000 megohms.

AC MONITOR PANEL

Discreet reading of hipot current can be added to the Cablemaster by the addition of an AC Monitor Panel. The unit contains a current meter with a variable trip level set point for monitoring current thru the hipot circuit.

CHATSWORTH DATA CORPORATION

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unique instrumentation

Model 255

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True RMS/1%/ d-c to 500 kHz/Waveshape Independent

5.000A/500.0mA/50.00mA/5.000mA and 20.00V/200.0V/1000V Twenty-four power combinations between 10.00 mW and 5000 W. Power factor for "sinusoidal-like" waveshapes. BCD outputs. Remote programming of functions. Price $985.00

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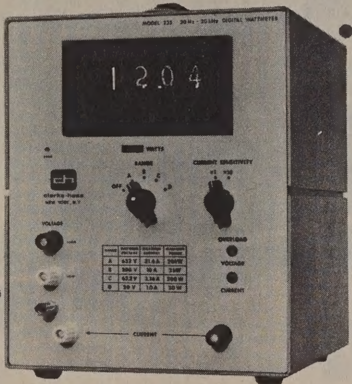

Model 235

WIDEBAND WATTMETER

20Hz – 20 kHz; 2W – 20kW. Full scale up to 31 A/630 V. down to 100 mA/ 20 V. Accuracy 1%, any connection. Power Factors 0-1. Easy to connect and to read. BCD output available. Various range combinations available: 6 to 600 V, 10 mA to 31 Amperes.
Price $2495.00

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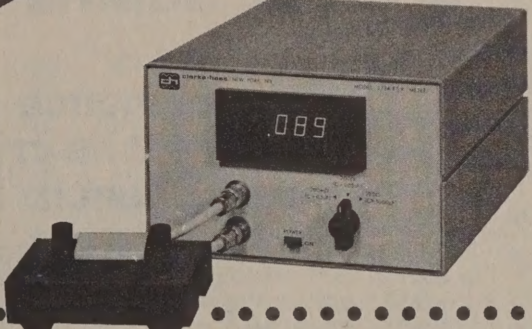
Model 273A

DIGITAL ESR METER

The industry standard for 100 kHz ESR measurements. The Model 273A measures Equivalent Series Resistance values from 0.1 milliohm to 20 ohms. Handles any type of capacitance with values from 5,000 pF up to 1 farad. In use by the world's leading capacitor users. The Model 273A allows production line monitoring in capacitor manufacture and 100% incoming inspection for capacitor users with critical loss requirements. BCD outputs standard. Price $820.00

Model 273A also measures internal impedance of *Batteries*, contact resistance of *Relays*, and the effective loss term in *Networks*.



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function generators

All function generators with sine, square, and triangular waveshapes, Tone Burst, Phase Lock Synchronization, Wide Range low distortion VCF and/or FM. All extend down to 1 mHz with "Low Frequency Expand Switch". All generators have sine wave distortions below 46 dB and extremely flat sine wave amplitude vs frequency characteristics. Most units sweep to twice the upper dial frequency. All generators have 50 ohm output, 60 dB of output range.

Model 743

TONE BURST, PHASE LOCK SYNC.

Dial Controlled 1 Hz to 2 MHz. Low distortion FM or VCG. Price $385.00

Model 748

DIAL CONTROLLED 1 Hz to 2 MHz.

High quality, low distortion AM or suppressed carrier modulation or detection. Price $535.00

Model 744

TONE BURST, PHASE LOCK SYNC.

Dial Controlled 3 Hz to 3 MHz. Balanced 600 ohm output. Price $415.00

Model 750

DIAL CONTROLLED 1 Hz to 2 MHz.

Internal ramp generator with sweep times from 1 msec to 200 seconds.
Price $495.00

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Now you can have the precision and versatility of a synthesizer at the price of an ordinary oscillator.

Here's the synthesizer that gives you full 5+ digit crystal accuracy (no accuracy stealing verniers), clean signals, automatic leveling, and high output power.

The new 1013 is the only synthesizer using COMSTRON's Direct Programming Differential Synthesis Technique (Patent No. 3,895,311) that gives uncompromising precision and high speed programmability. It all adds up to a cost-performance breakthrough with unmatched reliability and data handling capability...your guarantee of performance with integrity.

SPECIFICATIONS

Range

Frequency Range:
0.1Hz to 13MHz in 5 ranges

Accuracy

Frequency Accuracy:
Full 5+ digits, ±0.001% of setting for 6 months, 0°C to 55°C

Frequency Stability:
Full 5+ digits, long term is ± 10 ppm of setting per year at ambient

Purity

Phase Noise:
Signal to phase noise (integrated), Greater than 40dB in a 30kHz band excluding ± 1Hz, centered on carrier 10MHz range, greater than 60dB, 1MHz range and below

Harmonic Distortion:
−40dB 1 MHz to 13MHz
−50dB 0.1Hz to 1MHz

Spurious:
Greater than 60dB below selected output level or less than −110dBm/50 ohm, whichever is greater

Amplitude:
Maximum 6Vrms open circuit
3Vrms (+23dBm) into 50 ohms

Output Impedance:
50 ohms

Amplitude Control:
Attenuator: +20 to −30dB in 10dB steps
Continuous control: +3 to −15dB
Meter indication in volts and dBm

Square Wave Output:
Positive going square wave TTL compatible

Options

Option 001: Programming—Parallel BCD
Option 002: Programmable Attenuator
Option 003: ASCII, Standard 488 Interface
Option 004: Ultra Stable Reference Oscillator
Option 005: External Reference
Option 006: 75 ohm Impedance

Comstron-Seg

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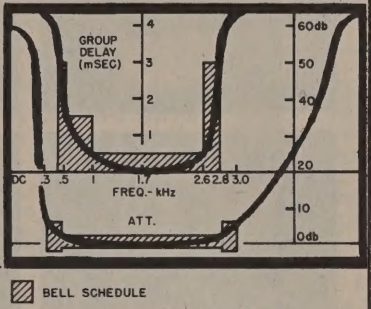
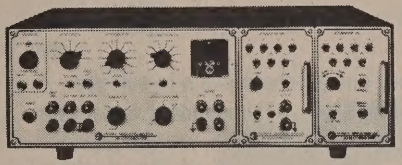
COMSTRON·SEG TELEPHONE CHANNEL TEST AND SIMULATION EQUIPMENT

STANDARD TELEPHONE DATA LINE SIMULATORS

- Simulates nominal worst case attenuation and delay per Bell, CCITT, and DCS Schedules.
- Simulates 3002, C1, C2, C4, and DCS-S1, S2, S3.
- Also available; C-Message Weighting, A Weighting, 3kHz Flat, and Tone Notches.



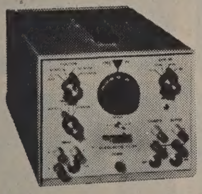
PHASE JITTER SIMULATOR



FA-1564 A

- Simulates normally encountered active telephone channel impairments such as phase jitter, phase hits, harmonic distortion, broadband and impulse noise and frequency translation
- Simulates phase jitter; 0 to 45° peak-to-peak; jitter frequencies, 20 to 300Hz
- Use for developing, testing and evaluating data-com equipment

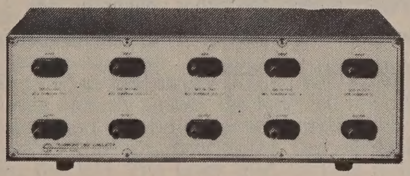
TUNABLE BAND PASS AND BAND REJECT FILTER



AF-850A

- Telephone channel filter tunable from 35Hz to 3500Hz
- Use for notched noise measurements and waveform analysis; 3.5Hz and 35Hz bandwidth
- Fully compatible with telephone channel transmission measuring techniques and equipment
- 0dB, 10dB, 20dB, 30dB gain and by-pass functions
- Generates reference signal at Fc of notch and bandpass

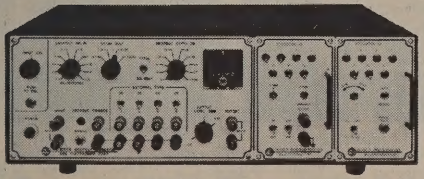
TELEPHONE DATA LINE SIMULATOR



Model LSCC-( )

- Contains up to 5 data line simulators
- Industry standard telephone line simulator
- Simulates nominal worst case attenuation and delay, per Bell, CCITT, and DCS schedules
- Simulates 3002, C1, C2, C4 and DCS-S3
- Controlled out-cf-band characteristics
- Also available: C-Message Weighting, F1A Weighting, Telephoto 1 and 2, etc.

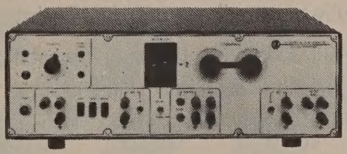
DROPOUT SIMULATOR



FA-1955 A

- Simulates data-channel dropout; adjustable duration from 1 ms to 10 seconds and depth from —3dB to greater than —50dB
- Simulates additive broadband and impulse noise, SFI tones and out-of-band signals
- Operates in band limited mode, with SEG Telephone Data Line Simulators, or in broadband metallic mode

DIGITAL DELAY (ECHO) GENERATOR



FA-1755

- Simulates data channel delay and/or echo
- Delay to 100 ms* in 1 ms steps
- Stores 99 ms* of transient input data and continuously regenerates it for analysis or utilization as additional channel impairment
- Bandwidth 200Hz to 3.4kHz delay-corrected to 50usec
- Echo adjustable to 49dB in 1dB steps

*Up to 2 seconds available

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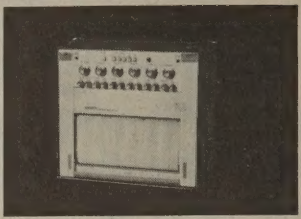
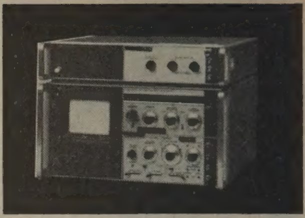
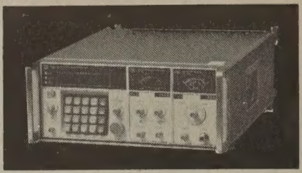
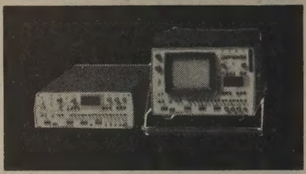
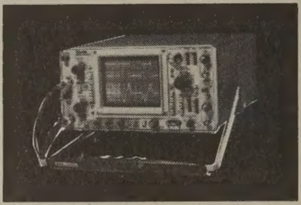

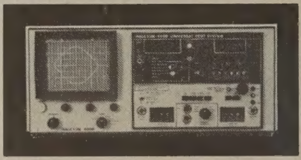
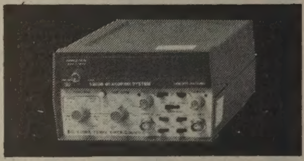
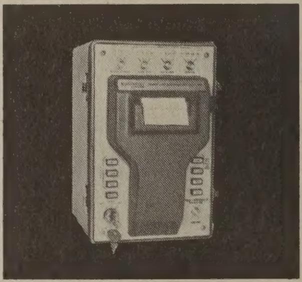
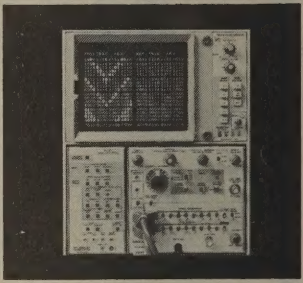
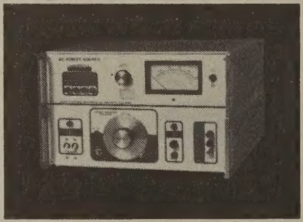
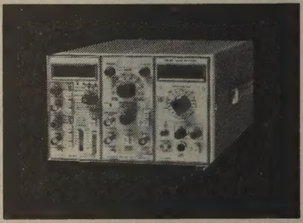

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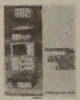

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How they work — The patented Curtis Ampere Hour Meter is basically a mercury microcoulometer fabricated from precision bore, glass capillary tubing filled with two columns of mercury separated by a small electrolyte gap. Application of pure or pulsed DC signals to electrodes inserted in the mercury causes mercury at the anode to be electrochemically transferred across the gap to the cathode at a time rate proportional to the current. The gap moves along the tube length as a function of the current-time integral. A constant-current supply provides a precision timing device.

TYPICAL APPLICATIONS

Warranty — Low-cost meters for warranty of equipment based on both actual usage, and calendar period.

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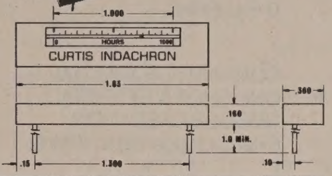
ANALOG COUNTERS

When operated by well defined pulses such as digital logic signals, any Curtis INDACHRON™ can be calibrated to provide direct indication of accumulated number of pulses with virtually any full scale reading. They can be used to count the number of lines, copies, characters, or other operating functions of computer peripherals, office or communication equipment.

L Series Curtis Indachron™

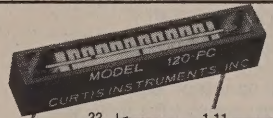
Used on OEM equipment as a very low-cost means of validating warranties and for P.M. scheduling. Under $2.00 each in production quantities. AC and DC Models. Various time scales and electrical ratings. Can be mounted on printed circuit cards or direct to chassis with adhesive strips.

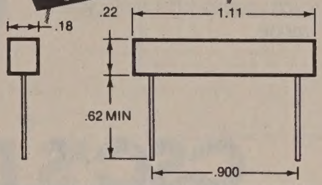
0
HOURS
2000
CURTIS INDACHRON



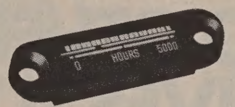
120-PC Series

Radial leads for installation directly on printed circuit cards for "mean-time-to-failure" or preventative maintenance scheduling. Can be instrumented from available DC voltages for any time scale by use of series resistor. Full scale of .65 inches = 4.16 milliamp-hours.





620 PC, 620N Series, MIL Type

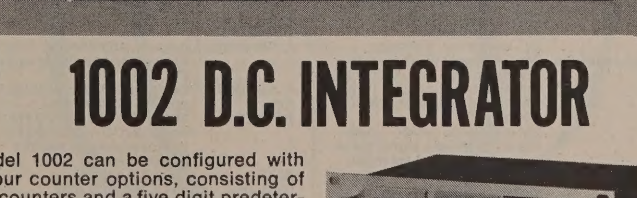


The Curtis MIL type analog timers are made in two configurations. The 620N Series meet MS90386, and are now available in 5V and 15V, as well as 28V DC and 115V AC models. The 5V and 15V units directly answer the long felt need for an elapsed time meter than can be powered **directly** from voltages available within the box, precluding the necessity of special wiring for the ETI. The units also provide dramatic economies over the older electromechanical types. The 28V DC version provides for internal regulation over the complete aircraft power range, and the 115V AC device is truly insensitive to variation in line frequency.

The 620 PC Series meets the MS-3311 (AS) and was specifically designed for repairable modules and subassemblies, is very low cost and installs directly on PC boards.

CP-3 Series

New low cost monitor for P/M scheduling and other applications requiring a simple means of reset to zero in the field. AC or DC. Scales for any type of scheduling.



Meter after a period of operation (800 hours).

1 Cover removed. Dot is at second guideline from right.

2 Scale "0" is set to second guideline from left.

3 Cover is reversed 180° and reinstalled. Meter is now at "0" for next period of operation.

1002 D.C. INTEGRATOR

The Curtis Model 1002 Integrator is a highly reliable, precision integration and control system for ampere hour applications in battery, solar energy and process control including the plating processes involving precious metals such as gold and silver. The 1002 maintains a guaranteed accuracy of ±1.0% over the full specified current or voltage range. Available in A.C. and D.C. powered models.

The Model 1002 can be configured with any of four counter options, consisting of six digit counters and a five digit predetermined counter. Single channel models are available in a half rack or full rack package and dual channel models are enclosed in a full rack package.

A related Integrator, the Model 1003, is available for bipolar D.C. integration.

Write for full specifications.

THE LOGICAL CHOICE: Third in a series

SYMMETRICAL AND UNSYMMETRICAL PULSES 0.5Hz-5MHz.

CONTINUOUS, MANUAL ONE-SHOT & EXTERNAL TRIGGER OPERATION
External triggering to 10MHz

INDEPENDENTLY-CONTROLLABLE PULSE WIDTH & SPACING
100 nanosec-1 sec in 7 overlapping ranges 10^7:1 duty cycle range

POWER ON
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DESIGN MATE 4
PULSE GENERATOR
AMPLITUDE
PULSE WIDTH
PULSE SPACING
GATE/TRIG
MODE
TRIG GATE
RUN
ONE SHOT
WIDTH VERNIER
SPACING VERNIER
X1 X10
ONE SHOT
CONTINENTAL SPECIALTIES CORPORATION, NEW HAVEN, CONN.

INDEPENDENT CMOS AND TTL OUTPUTS Fan-out to 40 TTL loads

SYNCHRONOUS OUTPUT GATING

100mV-10V POSITIVE OUTPUT Less than 30 nanosec rise/fall times

CSC'S DESIGN-MATE™ 4: $124.95. NO OTHER DIGITAL PULSE GENERATOR GIVES YOU SO MUCH, FOR SO LITTLE.

Sounds hard to believe . . . but even a brief look at Design-Mate 4's specifications proves CSC's engineers have done it again. Whatever your application—whether you're looking for precision, flexibility or just plain economy—this compact source of fast, clean digital pulses offers the performance you need . . . at a price that discourages procrastination.

Use it as a clock source, delayed pulse generator, synchronous clock, manual system stepper, pulse stretcher, clock burst generator or in dozens of other applications. Use it alone or in tandem with other DM-4's for gated control. The wide range of controls and multiple outputs give you enormous versatility . . . plus compatibility with all major logic families, for research, design, development, quality control, production testing, maintenance, troubleshooting . . . you name it.

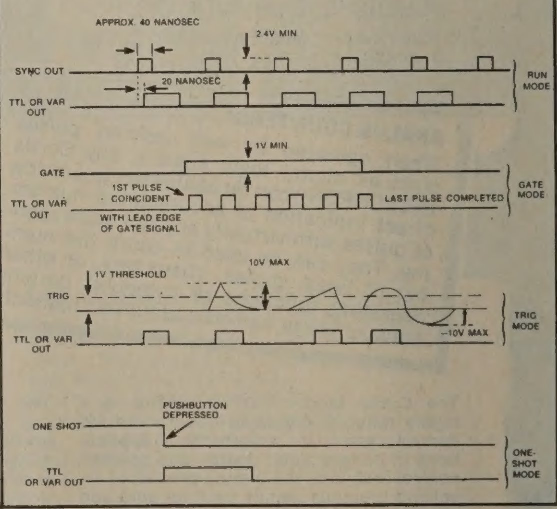
Now, read the specs that follow . . . and check the price again. Or better yet, try DM-4 for yourself at your local CSC distributor. Once you do, we think you'll find it's as hard to do without as it is easy to own.

For more information about CSC's other fine products, and a list of distributors, please call or write.

DM-4 SPECIFICATIONS

Frequency Range:	0.5 Hz to 5 MHz
Pulse Width and Spacing Controls:	100 nanosec to 1 sec. in 7 overlapping decade ranges. A single-turn vernier control provides continuous adjustment between ranges.
Duty Cycle:	10^7-to 1 Range: adjustable over entire pulse width/spacing range, 100 nanosec "ON" 1 sec "OFF" to 1 sec "ON" and 100 nanosec "OFF".
Operating Modes:	
RUN	0.5 Hz to 5 MHz as per width/spacing and amplitude control settings.
TRIG	DC to approx. 10 MHz.
Input requirements:	Sine waves 2 VP-P; pulses 1 V peak, >40 nanosec wide; maximum input ±10 V. (Input Impedance: Approx. 10KΩDC coupled.)
GATE	Synchronous gating. Leading edge of gate signal turns generator "ON". Last pulse is completed, even if gate ends during pulse.
Input requirements:	Same as "TRIG" Mode.

ONE-SHOT	Pushbutton for single pulse. Output pulse occurs each time push-button is pressed.
OUTPUTS:	
VAR OUT	
Amplitude	0.1-10 V positive
Rise/fall time	Less than 30 nanosec
Impedance	400Ωmax.
TTL OUT	
Fan-out	40 TTL Loads
Sink	160 milliamps—0.8 V max.
Rise/fall time	Less than 20 nanosec
SYNC OUT	
Pulse width	Approx. 40 nanosec. Other sync pulse spec's same as TTL out.
Pulse lead time	Sync pulse leads outputs by approx. 20 nanosec.
POWER	117 VAC±10%, 50/60 Hz, 5 watts (220 VAC, 50/60 Hz also available, at slightly higher cost.)
SIZE (WxLxH)	7.5 x 6.5 x 3.25" 191 x 165 x 83 mm
WEIGHT	2 lbs. (0.91 Kg)


APPROX. 40 NANOSEC
2.4V MIN
SYNC OUT
20 NANOSEC
TTL OR VAR OUT
RUN MODE
1V MIN
GATE
1ST PULSE COINCIDENT WITH LEAD EDGE OF GATE SIGNAL
TTL OR VAR OUT
LAST PULSE COMPLETED
GATE MODE
10V MAX
1V THRESHOLD
TRIG
TTL OR VAR OUT
−10V MAX
TRIG MODE
PUSHBUTTON DEPRESSED
ONE SHOT
TTL OR VAR OUT
ONE-SHOT MODE

CONTINENTAL SPECIALTIES CORPORATION
CSC
EASY DOES IT

44 Kendall Street, Box 1942 New Haven, CT 06509 • 203-624-3103 TWX: 710-465-1227
West Coast office: Box 7809, San Francisco, CA 94119 • 415-421-8872 TWX: 910-372-7992

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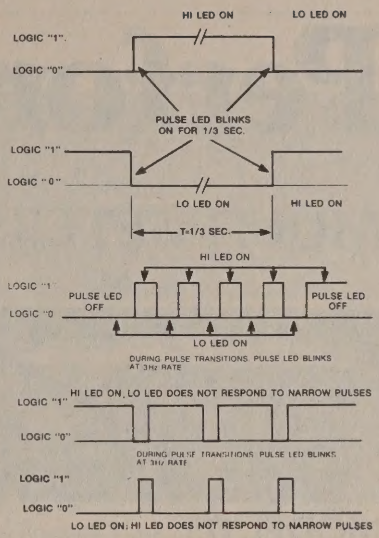
THE LOGICAL CHOICE—First in a series

Logic Probe 1 is a compact, enormously versatile design, test and troubleshooting tool for all types of digital applications. By simply connecting the clip leads to the circuit's power supply, setting a switch to the proper logic family and touching the probe tip to the node under test, you get an instant picture of circuit conditions.

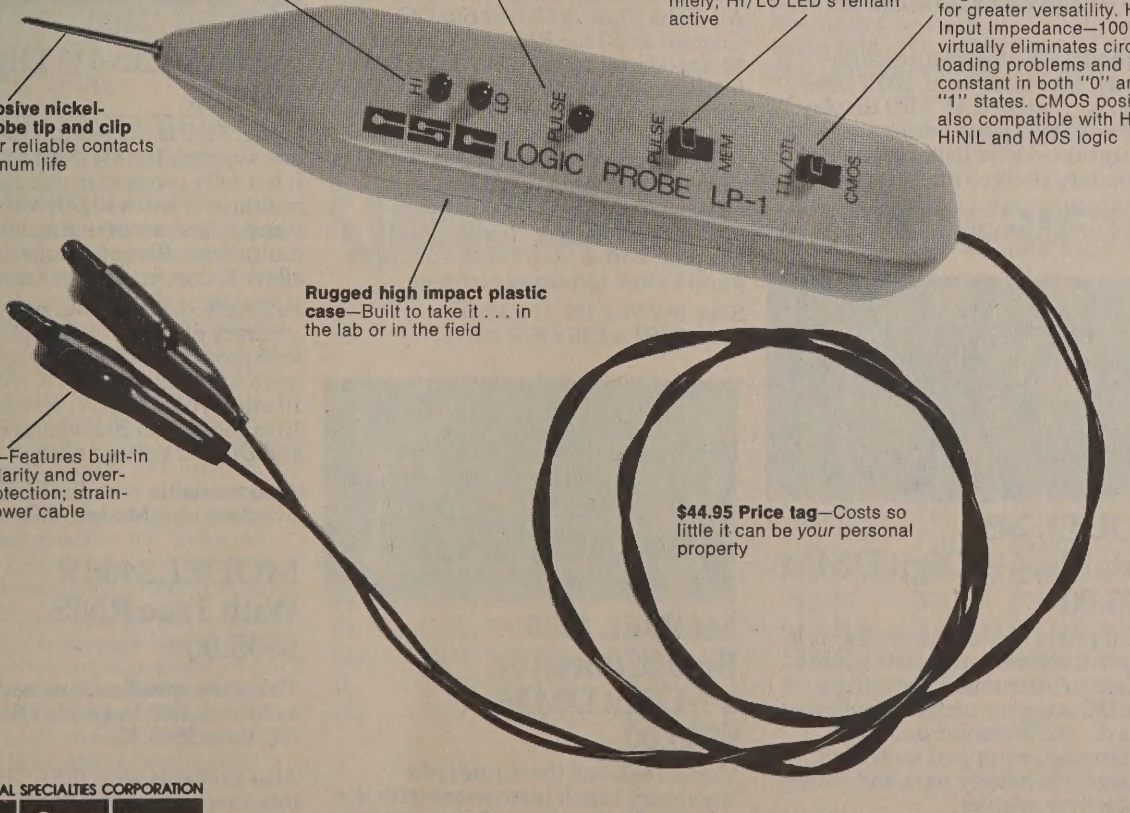
LP-1's unique circuitry—which combines the functions of level detector, pulse detector, pulse stretcher and memory—makes one-shot, low-rep-rate, narrow pulses—nearly impossible to see, even with a fast scope—easily detectable and visible. HI LED indicates logic "1", LO LED, logic "0", and all pulse transitions—positive *and* negative as narrow as 50 nanoseconds—are stretched to ⅓ second and displayed on the PULSE LED. By setting the PULSE/MEMORY switch to MEMORY, single-shot events as well as low-rep-rate events can be stored indefinitely.

While high-frequency (5-10MHz) signals cause the "pulse" LED to blink at a 3Hz rate, there is an additional indication with unsymmetrical pulses: with duty cycles of less than 30%, the LO LED will light, while duty cycles over 70% will light the HI LED.

In all modes, high input impedance (100K) virtually eliminates loading problems, and impedance is constant for all states. LP-1 also features over-voltage and reverse-polarity protection. Housed in a rugged, high-impact plastic case with strain-relieved power cables, it's built to provide reliable day-in, day-out service for years to come.


HI LED ON
LO LED ON
LOGIC "1"
LOGIC "0"
PULSE LED BLINKS ON FOR 1/3 SEC.
LOGIC "1"
LOGIC "0"
LO LED ON
HI LED ON
T=1/3 SEC.
HI LED ON
LOGIC "1"
LOGIC "0"
PULSE LED OFF
PULSE LED OFF
LO LED ON
DURING PULSE TRANSITIONS PULSE LED BLINKS AT 3Hz RATE
HI LED ON, LO LED DOES NOT RESPOND TO NARROW PULSES
LOGIC "1"
LOGIC "0"
DURING PULSE TRANSITIONS PULSE LED BLINKS AT 3Hz RATE
LOGIC "1"
LOGIC "0"
LO LED ON; HI LED DOES NOT RESPOND TO NARROW PULSES

CSC'S MULTI-FAMILY LOGIC PROBE 1. AT $44.95, IT DIGS UP A LOT OF INFORMATION WITHOUT BURYING YOUR BUDGET.


HI
LO
PULSE
CSC LOGIC PROBE LP-1
PULSE
MEM
TTL/DTL
CMOS

PULSE LED—Lets you know what's going on—and off. Indicates positive *and* negative pulse and level transitions. LP-1 stretches pulses as narrow as 50 nanoseconds to full ⅓ sec. (3Hz pulse rate)

PULSE/MEMORY Switch—PULSE position detects and stretches pulses as narrow as 50 nanoseconds to ⅓ sec. Switch to MEMORY and it stores single shot and low-rep-rate events indefinitely; HI/LO LED's remain active

HI/LO LED's—Display level (HI-logic "1", LO-logic "0") of signal activity at node under test

Logic Family Switch—TTL/DTL or CMOS matches Logic "1" and "0" levels, for greater versatility. High Input Impedance—100K virtually eliminates circuit loading problems and is constant in both "0" and "1" states. CMOS position also compatible with HTL, HiNIL and MOS logic

Non-corrosive nickel-plated probe tip and clip leads—For reliable contacts and maximum life

Rugged high impact plastic case—Built to take it . . . in the lab or in the field

Protected—Features built-in reverse polarity and over-voltage protection; strain-relieved power cable

$44.95 Price tag—Costs so little it can be *your* personal property

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Performance & Value.

MULTIMETERS

DATA PRECISION

MODEL 175
Portable, 3½ Digit DMM
$189.00

With a basic DC accuracy of ±0.1% input ±1 l.s.d., guaranteed for a full year, and 100μV resolution, the Model 175 is unsurpassed for accuracy and sensitivity. Battery and line operated and truly portable, it measures: DC Volts from ±100μV to ±1000V; AC Volts from 100μV to 500V (30Hz to 50kHz); DC Current from ±0.1μA to ±2A; AC Current from 0.1μA to 2A (30Hz to 50kHz); Resistance from 100mΩ to 20MΩ in two modes (HI excitation 2.5V and LO excitation 300mV).

The Model 175 also features auto-polarity, automatic zero, 100% overrange, big, bright 0.43" LED display and comes equipped with both rechargeable NiCd battery module and battery charger/line adaptor.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm

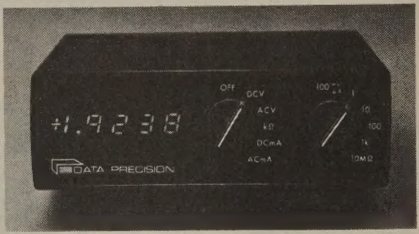
DATA PRECISION

MODEL 245
Portable, 4½ Digit DMM
$295.00

Ideal for field use, the Model 245 is a rugged, truly miniature, lab-quality, 5-function instrument featuring a basic DC accuracy of ±0.05% of input ±1 l.s.d., .005% resolution, 100% overranging, equipped with both rechargeable battery pack and battery charger/line adapter.

Model 245 measures ACV (100μV to 500V RMS), DCV ±100μV to 1000V, Resistance 100 milliohms to 20 Megohms, AC and DC current 1 microamp to 2 Amps. AC voltage/current response, 30Hz to 50kHz.

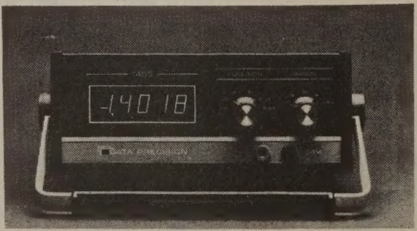
Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm



MODEL 248
Portable, 4½ Digit DMM With True RMS Measurement
$345.00

This high-resolution instrument measures Resistance 100mΩ to 20MΩ, DC Volts ±10μV to ±1kV, True RMS AC Volts 10μV to 500V, both DC Current and True RMS AC Current 10 nanoAmps to 2A. The Model 248 features sensitivity of 10μV. Basic DC accuracy is ±0.05% of input ±1 l.s.d., guaranteed for a full year, 100% overrange, overload protection, large LED display, and comes complete with both rechargeable NiCd battery module and battery charger/line adaptor, with 6 hours of in-spec operation before requiring recharge.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm



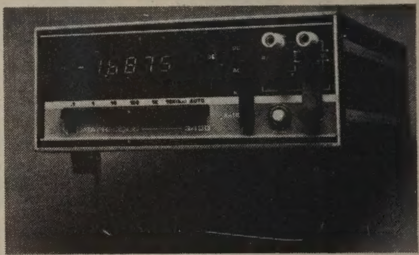
MODEL 1455
Bench/Portable 4½ Digit DMM
$355.00

Model 1455—all the virtues of a laboratory bench instrument with the added benefits of complete portability. A five-function multimeter featuring ½" high display, and 100% overranging, Model 1455 measures 100μV to 1000VDC, 100μV to 500 VAC; resistance 100 milliohms to 20 Megohms; AC and DC current, 1 microamp to 2 Amps. AC response, 30Hz to 50kHz.

Basic DC accuracy is ±0.02% of input ±1 l.s.d. for 6 months. Internal NiCd battery module and line cord recharger included.

MODEL 1450
4½ Digit DMM
$325.00

The same specifications and features as the Model 1455, line operation only.



MODEL 3400
System/Lab 4½ Digit
$795.00

Model 3400 is the world's most accurate systems/lab 4½ digit multimeter. It is a fully programmable system multimeter and a highly versatile stand-alone, autoranging laboratory multimeter. Remote triggering will allow 12 conversions per second.

Full 100% overranging, basic DCV accuracy of ±0.007% of input ±1 l.s.d. for 6 months, measures from ±10 microvolts to ±1,000 VDC, ACV from 10 microvolts to 750V, resistance from 10 milliohms to 20 Megohms, AC/DC and DC/DC voltage ratio.

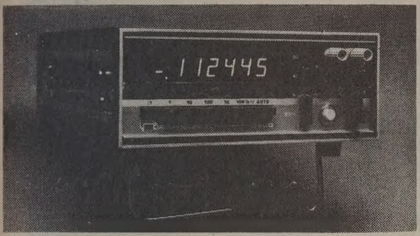
Also available with IEEE STD 488 interface unit Model 3410.

MODEL 3400 R
With True RMS
$895.00

The same specifications and features as Model 3400 but with TRUE RMS AC Volts $895.00.

Also available with IEEE STD 488 interface unit Model 3410.

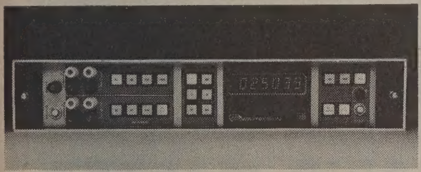
COUNTERS



MODEL 3500
5½ Digit Precision DMM
$995.00

The Model 3500 is a full function, autoranging DMM with 6 month basic accuracy of ±0.007% of input.±0.001% f.s. ±1l.s.d. Remote ranging and trigger, 20% overrange and ½ inch planor display.

- DCV ±1 μV to ±1000 volts. AC 1μV to 700 volts. 30Hz to 100 kHz.
- Resistance 1 milliohm to 12 Megohms.
- 1000 MΩ Input Impedance through 10 VDC. 2 and 4 wire Ratiohmic™ Resistance Method. DC/DC and AC/DC Ratio, BCD output and voltage ratio are included at no extra cost.



MODEL 7500
5½ Digit Programmable Systems Multimeter
$2995.00 Basic Price

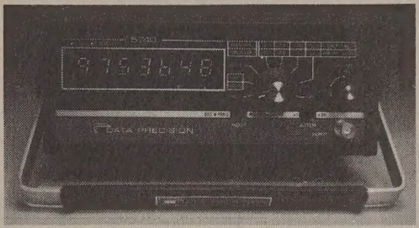
Model 7500 is a 5½ digit multi-speed instrument that will perform a full conversion *1000 times per second!* It's completely programmable in function, range, mode, timing, and conversion speeds. DCV accuracy is ±0.007% of input ±0.001% range ±1 l.s.d. for 6 months; sensitivity is rated at 1μV and 1mΩ; DCV and ACV measurement from 1μV to 1000V. A true universal ratiometer, Model 7500 enables the user to choose both the numerator and denominator independently, and every measurement—DC Volts, AC Volts, and Resistance—can be made on a ratio basis to any other if desired.

Model 7500 provides for full incorporation into any computer-based, high-speed, multi-channel automatic test or data acquisition system. In addition, a broad range of standard options, including built-in microprocessor-controlled IEEE 488 BUS or RS232/TTY Output.

MODEL 585
Portable, 250 MHz, 8 Digit Frequency Counter
$345.00

A completely portable—battery and line operated—8 digit frequency counter, it will measure frequency from 10Hz to 250MHz, always reading directly in MHz, with correctly positioned decimal point. Resolution 0.1Hz. It also has an excellent sinewave sensitivity (10m VRMS to 50MHz, 50m VRMS to 250MHz). Other features: dual Input Impedance (50Ω/1MΩ), an Attenuator, 3 gate times and bright 0.3" LED display for optimum reliability. Includes NiCD Module, Charger, and Carrying Case. Optional antenna and other accessories.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm.



MODEL 5740
100MHz, 7 Digit Multifunction Counter
$295.00

The Model 5740 measures Frequency, Period, Period Average, Total Events and Elapsed Time.

The Model 5740 measures: Sinewaves, Square Waves, Pulses, Pulse Pairs, Complex Waves • Frequency: 5 Hz to 100 MHz; 10 ms/100 ms/1 sec./10 sec. gate times, resolution to 0.1 Hz
- Period: ½ microsecond to 0.2 sec.
- Period Average: 10, 100 and 1000 periods • Total Events: 0 to 9,999,999 (unlimited with "overflow" indicator)
- Elapsed Time: 0 to 99,999.99 sec. (27.8 hrs) • Sensitivity to 10mV.

For complete information on these and other Data Precision instruments or a demonstration, contact your local Data Precision representative or Data Precision Corporation, Audubon Road, Wakefield, MA. 01880 USA (617) 246-1600. TELEX (0650) 949341.

All instruments under $500. available from stock at local representatives.

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...years ahead

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The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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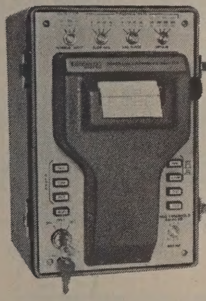
DRANETZ

ENGINEERING LABORATORIES INCORPORATED

DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

SERIES 606

POWER LINE DISTURBANCE ANALYZER/RECORDER



- For 115/230/460 V rms, 1 and 3 phase systems.
- Monitors, classifies, times and prints out line disturbances.
- Immediate and day-end printouts.
- Operates on command or disturbance — no wasted paper.
- For portable or permanent installation.
- 4 hour internal carry over power.

The 606 is designed specifically for monitoring power lines connected to computers, process control systems, hospital equipment and data communications devices, which are particularly susceptible to line transients, level changes or other disturbances. Using a digital microprocessor, the 606 classifies each disturbance into IMPULSE, CYCLE-TO-CYCLE CHANGE or SLOW RMS CHANGE. When preset thresholds are exceeded, the instrument prints out time, classification, magnitude, duration and channel designation. Data is also accumulated for overflow and day-end printout. The instrument is designed for unattended monitoring in a permanent installation or for temporary use at more than one site.

SPECIFICATIONS

Input Voltage Ranges: 115, 230, 460 V rms ±50%, all transformer isolated, Zin > 100 kΩ

Number of Inputs: Model 606-1, 1 input; Model 606-3, 3 inputs (3φ or separate circuits)

Test Modes:

AVG+ or AVG−: Increase or decrease in steady state rms, averaged over 10 sec

SURGE or SAG: Increase or decrease in cycle-to-cycle rms value

IMPULSE: 0-peak value of impulse (excluding line voltage waveform) having duration 0.5-800 μsec

ACCUMULATED COUNT: Summation of disturbance data in memory (includes time, HI AVERAGE, LO AVERAGE, HI SURGE and number of HITS, LO SAG and number of HITS, HI IMPULSE and number of HITS)

Printing Modes:

AVG+ or AVG−: Prints time, AVG+ or AVG−, rms VALUE, CHAN., when exceeding threshold of 3, 5, 10, 15 V rms*

SURGE or SAG: Prints time, SURGE or SAG, rms VALUE, CHAN. and duration (cycles) when exceeding threshold of 3, 5, 10, 15 V rms*

IMPULSE: Prints time, IMPULSE, 0-pk VALUE (excluding line voltage) and CHAN, when exceeding 0-pk threshold of 50, 100, 200, 400 V

SUPPLY DOWN or UP: Prints POWER OFF or POWER ON and TIME

STORED DISTURBANCES: Stores data on disturbances during printing. Prints out when printer clears

ACCUMULATED COUNT (Short Term): Overflow of data entering printer. Prints out automatically

DAILY ACCUMULATED COUNT: End-of-day print out. Prints number of day and ACCUMULATED COUNT

TEST: Prints time and ACCUMULATED COUNT

RESET: Prints time and ACCUMULATED COUNT, resets memory

PRINT OFF: Prints PRINT OFF and TIME, disables printer, all data goes into accumulator for delayed summary printout

Accuracy:

AVG+ or AVG−: At 60 Hz (sine wave signal), ±1% of reading ±1% of nominal input

SURGE or SAG: At 60 Hz (sine wave signal), ±1% of reading ±1% of nominal input

IMPULSE: ±5% of reading ±1% of maximum impulse calibrated with a positive going, 10 μsec, half sinewave impulse. 6 dB bandwidth with half sinewave impulses: 800 μsec to 0.5 μsec

Clock: Indicates real time in hours, minutes, seconds, crystal controlled. During power off, operates on internal batteries (4 hours). Clock resets from front panel buttons

Printer: 18 character, alpha-numeric, thermal, paper 2¼″ wide, prints 1 line/sec

Supply Power: 90 to 140 V rms, 45-450 Hz, 1φ, 1.0 A maximum (also DC operation 120-170 V maximum).

Case: Portable, removable cover with carrying handle.

Size (with cover): 11″ H x 7″ W x 9½″ D; shipping 11″ x 14″ x 18″.

Weight: 16 lbs. (7 kg.); shipping 24 lbs. (11 kg.).

Options: Opt. 101 (606-3 only), freq. disturbances; Opt. 102, 115/230 V supply power (switch selectable), 45-65 Hz; Opt. 103 (606-3, Opt. 101 only), monitors 400 Hz power lines; Opt. 104, external event indication; MR15 Rack Mount Series, 19″ rack plate and dust cover.

Model K103 Test Kit: Includes disturbance generator designed to verify operation of Series 606. Also includes a card puller, an extender card, and a set of programmed memories for assisting in calibration and troubleshooting.

Model 910 Uninterruptible Power Supply: For complete operation of 606 during power shutdown up to 2 hours. Fully protected from impulses to 1600 Volts, sags and surges of 50%, and total power interruptions.

Input (under normal conditions): 115/230 V rms nominal (switch selectable), 45-65 Hz, 1φ, 1.0 A maximum.

Output: 120 to 170 Volts, DC, 1.0 A.

Recharging Time: 18 hours.

Size: Portable carrying case same size as 606.

Weight: 35 pounds (16 kg.).

*These values for 115 V input; multiply by x2 or x4 for 230 V rms or 460 V rms.

FOR FULL INFORMATION WRITE FOR BULLETIN 606

SERIES 616

DC-AC VOLTAGE DISTURBANCE ANALYZER

- Isolated inputs for simultaneously monitoring AC and DC voltages.
- High sensitivity for detecting disturbances in DC voltage
- Perfect for pinpointing the effects of AC input line disturbances on the DC outputs of power supplies in computers, digital communications equipment, and medical instrumentation.

The Series 616 is a highly portable easy-to-connect analyzer for recording voltage disturbances on three channels: one AC channel (40-350 VRMS, 45-65 Hz) and two DC channels (4-50 VDC, independent of polarity). As in the Series 606 (described above), IMPULSES, SAGS and SURGES, and SLOW AVERAGE variations are conveniently recorded, when they occur, in an easy-to-interpret alphanumeric printout. The Series 616, with considerably higher disturbance sensitivity on the DC channels, than the 606, is specially adapted for a wide range of DC monitoring applications. Two models, the Model 616A and the Model 616B, are available for voltage ranges of 4 to 25 VDC or 8 to 50 VDC.

FOR FULL INFORMATION WRITE FOR BULLETIN 616

SEE PAGE 2831 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

SEE PAGE 2831 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

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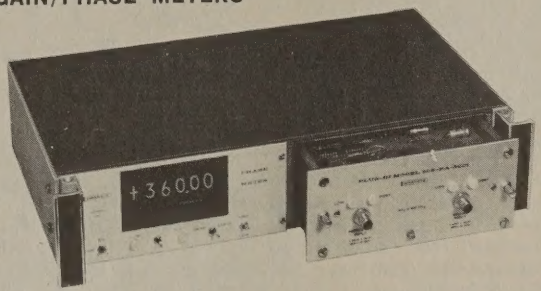
SERIES 305

SUPER PERFORMANCE PHASEMETERS AND GAIN/PHASE METERS*



305 Series Phasemeters provide the highest available accuracy, along with many operational features. Designed for the calibration laboratory, the design engineer's bench, the production line and automatic test systems, the 305 is the most widely accepted phasemeter in industrial, and governmental organizations. **

FEATURES

- No hands 86 dB dynamic range
- Automatic or programmable operation and calibration
- Highest accuracy — to 0.03°
- Repeatability better than 0.01°
- Rejects harmonics and noise
- Wide frequency range — 1 Hz to 11 MHz

FLEXIBILITY THROUGH PLUG-IN CONCEPT

The plug-in concept of the 305 offers a wide selection of characteristics. Three standard mainframes and nine plug-ins are complemented by a variety of options, such as programmability, high speed and autocalibration. Special modifications are also available. In addition, modular construction throughout provides maintainability at both component and P.C. card levels for ease and speed of servicing.

WIDE FREQUENCY RANGE

The basic mainframe provides a direct frequency coverage of 2 Hz to 700 kHz with high accuracy. By the use of frequency converting plug-ins such as the 305-PA-3005, standard units can handle frequencies up to 11 MHz. Special units can be provided for higher frequency.

NO HANDS OPERATION

The Series 305 Phasemeters require no controls or adjustments by the operator. These units are also equipped with several significant automatic features. These include automatic selection of angle range, automatic sensing of leading or lagging angle, automatic selection of the output time constants, and automatic setting of AC gains.

HIGHEST ACCURACY

Accuracy to better than ±0.03° is attained with precision mainframes and carefully designed plug-ins. Mainframes exhibit precise zero crossing detection, angle-to-DC conversion linearity to approximately ±0.01° and outstanding DC stability. Plug-ins are designed for accurate conversion of sine wave (also square wave) inputs to square waves through carefully controlled amplifier circuitry, use of gain autoranging, and harmonic filters where necessary.

INSENSITIVITY TO INPUT LEVEL

Series 305 plug-ins are available with a guaranteed accuracy of better than ±0.05° even with independent input level variations of 60 dB. Typical accuracy can approach ±0.03° as shown on the following page.

NON-AMBIGUOUS ANGLE READINGS

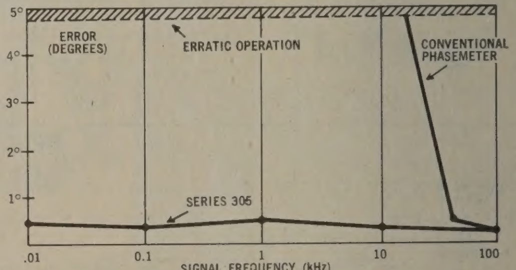
Two phase angle ranges in the 305 eliminate the ambiguity or "dead zone" error inherent in all other phasemeters (usually at 0°/360° or −180°/+180°). An automatic system switches to the 0°/360° range for angles near 180° and to the −180°/+180° range for angles near 0°. Unique guard bands prevent dead zones near switching points.

REPEATABILITY, STABILITY, AUTOCALIBRATE

Repeatability of the 305 is better than ±0.005°; temperature coefficient is ±0.001°/°C; and DC output drift is better than ±0.05° over any 30 day period. The autocalibrate feature eliminates virtually all DC errors in digital panel readout and BCD rear panel outputs.

NOISE IMMUNITY

Unique patented circuitry minimizes noise errors and makes possible accurate phase measurements under noise levels where other phasemeters become completely useless. The accompanying curve compares the phase error of the model 305 with that of a conventional phasemeter with broad band noise in both channels.



PHASE READING ERROR VS SIGNAL FREQ.
FOR GAUSSIAN NOISE (FLAT TO 5 MHz)
IN BOTH CHANNELS FOR S/N =10

PROGRAMMABLE OPERATION

Standard mainframes are provided with rear connections for overriding the automatic time constant and angle range selectors by relay contact closures. Options are provided for control by DTL and TTL logic.

DIGITAL READOUT

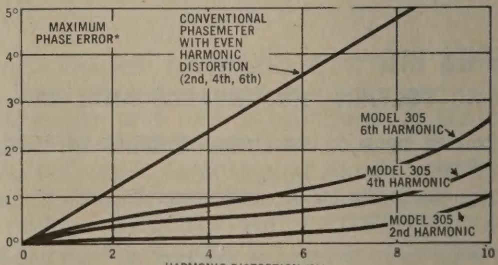
In addition to analog DC output, standard mainframes are available with up to 5 digit panel readouts (i.e., 0.00° to ±180.00° and 0.00° to +360.00°) and BCD outputs for each digit. Autocalibrate feature eliminates virtually all meter drift and scaling errors.

RAPID PHASE NULLING

For production testing of filters and other networks, an additional analog deviation-panel meter (305D) provides an easy means of adjusting a test angle to any accurate value. Presetting can be done in seconds without any other equipment. The precision digital panel meter monitors actual test angle continuously.

ABILITY TO REDUCE HARMONICS

The 305 is designed to reduce significantly the errors due to even harmonic distortion without the use of filters. The accompanying curve compares the error due to even harmonic distortion (maximized for worst case harmonic angle) on conventional phasemeters and on the model 305. (Odd harmonics in-phase with fundamental contribute no error.)



COMPARISON OF ERRORS DUE TO EVEN HARMONIC DISTORTION
(* For worst case phase relationship between harmonic and fundamental)

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*Manufactured under U.S. Pat. No. 3,725,781

**For extensive application information, write for availability of "Applications Handbook of Precision Phase Measurement."

DRANETZ

ENGINEERING LABORATORIES INCORPORATED

DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

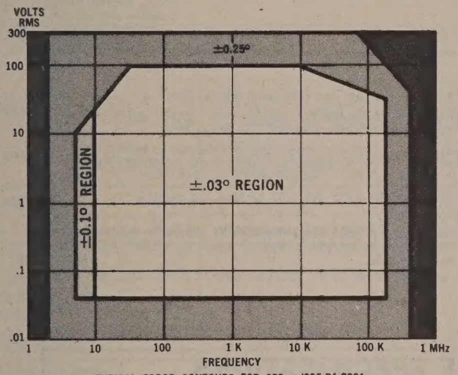
SERIES 305

SUPER PERFORMANCE PLUG-INS

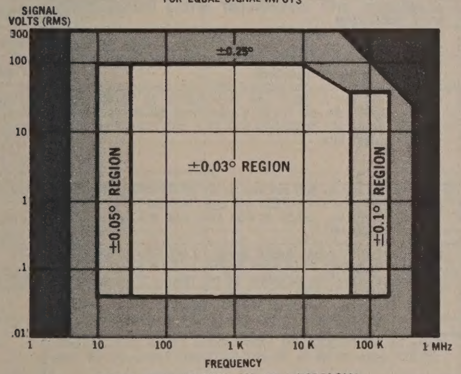
The variety of plug-ins available provides unlimited flexibility for the Series 305 Phasemeters in meeting many phase measurement problems. In addition to an expanding line of standard plug-ins, custom units can be designed for special needs.

305-PA-3001 AUTORANGING PLUG-IN

This plug-in features high accuracy over a broad range of input levels and frequencies. Autoranging of gain in each channel assures high accuracy (±0.05° guaranteed) over a dynamic range of 60 dB (50 mV to 50 V rms) for independent levels of inputs, with a useful range of 90 dB (10 mV to 300 V rms). This plug-in covers the range from 2 Hz to 700 kHz, with its highest accuracy in the 50 Hz to 50 kHz range. The curves shown illustrate typical accuracies as a function of level and frequency. The 305-PA-3001 also features compatibility with Tektronix probes and includes front panel lamps to indicate when either input signal is below 50 mV or above 50 V rms.



TYPICAL ERROR CONTOURS FOR 305 w/305-PA-3001 FOR EQUAL SIGNAL INPUTS



TYPICAL ERROR CONTOURS FOR 305 w/305-PA-3001 FOR UNEQUAL INPUTS — REF. 0.3 VOLTS RMS

While the above accuracies apply to sine wave inputs, this instrument can also be used for square wave and amplitude modulated signals.

305-PA-3002 SINGLE RANGE PLUG-IN

The 305-PA-3002 is similar to the model 305-PA-3001 except that it does not include autoranging or limit indicator lamps. For sine wave inputs the standard unit is designed for guaranteed ±0.05° accuracy (typically ±0.03°) over independent signal levels of 50 mV to 500 mV rms, with a slight reduction in accuracy from 10 mV to 3 V rms. Other level ranges can be supplied on special order; Tektronix probes can be used for high input levels. This plug-in is useful for sine wave, square wave and amplitude modulated signals.

305-PA-3005 HIGH FREQUENCY PLUG-IN

This high frequency plug-in is designed for high accuracy to 11 MHz. Using a self tracking oscillator, the input signals are converted to 40 kHz for precision measurement by the mainframe. Input attenuators (50 ohms) are provided with 10 dB steps, to cover a range of 1 mV to 3 V rms in either channel. Front panel lamps indicate when input levels are out of range or when level controls are improperly set. The self tracking oscillator can be controlled by channel A signal or by a third independent signal.

305-PA-3007 PROGRAMMABLE AND AUTORANGING PLUG-IN

This programmable plug-in features all of the characteristics of the model 305-PA-3001. In addition it includes increased input gain to achieve operation down to 1 mV rms. The unit can be operated either in an automatic or programmable mode. Without rear connections, the plug-in operates automatically as a 305-PA-3001; however, by utilizing rear connectors, the internal autoranging can be overridden and additional internal gain can also be inserted. Programming is available by DTL and TTL logic.

305-PA-3008 SINGLE FREQUENCY PLUG-IN

The 305-PA-3008 is a special purpose plug-in designed for precision calibration of 50 Hz, 60 Hz and 400 Hz power line equipment such as wattmeters, phase detectors and watt hour meters. This instrument can measure phase difference between two voltages, two currents or between a voltage and a current. The unit covers a voltage range of 25 V to 250 V rms and a current range of 0.1 to 5 A rms. The basic plug-in covers the frequency range of 50 Hz to 500 Hz. Plug-in filters, available for 50 Hz, 60 Hz and 400 Hz, assure reduction of second harmonic by at least 40 dB and higher harmonics by at least 50 dB. A front panel zero control provides adjustment for high accuracy (±0.1°) at any single frequency.

305-PA-3009 WIDE BAND NETWORK ANALYZER PLUG-IN (GAIN/PHASE/AMPLITUDE)

This plug-in measures the voltage amplitude of each signal input (in volts or dBV, selectable by operator), the phase difference between inputs, and the amplitude ratio of inputs. Featuring autoranging of gain in both channels, it requires no manual setting of gains for any measurement. Simultaneous DC outputs on mainframe are proportional to all four fuctions. A front panel switch selects the measuring mode for digital panel readout — channel A voltage, channel B voltage, phase difference, or amplitude ratio. Lamps on the front panel of the plug-in indicate the proper decade multiplier. The 305-PA-3009A is designed for extending the low frequency range.

305-PA-3010 SPECIAL PURPOSE PLUG-IN

This plug-in is typical of special purpose plug-ins which can be supplied to meet unique problems. Having high input impedance, it is equipped with closely matched low pass filters to pass 125 Hz signals while rejecting 400 Hz signals, solving problems in many types of servo control systems. Similar units can be readily designed for other special voltage and frequency applications.

305-PA-3015 PROGRAMMABLE PLUG-IN

Intended for use in automatic test systems, this plug-in has two selectable filters for harmonic rejection and selectable gains to handle inputs from 50 mV to 50 V rms. Filter (or filter out) selection as well as gain switching is accomplished by contact closures across terminals on the rear of the main frame.

PRECISION TRANSFORMER ISOLATION NETWORKS

Dranetz TR 3100 series networks are available for input voltage isolation with minimum phase error and flat gain response. For use with balanced or signal ended sources, these units are equipped with internal preamplifiers to produce outputs in the 30 mV to 3 V rms range (for use with 305 Series Phasemeters) for input levels from 50 mV to 500 V rms. These transformer units are packaged for direct plug-in into the input BNC's of the phasemeter, and draw B+ power from the front panel accessory connector of the phasemeter plug-in. Size: 2¾" x 2¾" x 2". Input: banana jack. Output: BNC.

Model TR___	Zin	Com. Mode Rej: >60 dB for frequency	Range for ±0.1° typical shift	Range for ±0.3° typical shift	Gain ±2%
3101	1 megΩ 70 pF	Below 1 kHz	20-400 V rms 50 Hz-20 kHz	5-400 V rms 10 Hz-25 kHz	x 0.01
3102	100 kΩ 70 pF	Below 10 kHz	2-40 V rms 50 Hz-20 kHz	0.5-40 V rms 10 Hz-25 kHz	x 0.1
3103	10 kΩ 70 pF	Below 25 kHz	0.2-4 V rms 50 Hz-20 kHz	0.05-4 V rms 10 Hz-25 kHz	x 1.0

SEE PAGE 2831 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

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SERIES 305

SUPER PERFORMANCE PHASEMETERS

MAINFRAME SPECIFICATIONS

Frequency Range: 2 Hz to 11 MHz (see plug-in data)

Angle Ranges: 0.00° to ±180.00° or 0.00° to +360.00° manually or automatically selected. End-of-range measurement errors are prevented by 15° automatic guard zones.

Analog Output

Range: −1.8000 to +3.6000 Vdc corresponding to measured angle; 10.0 mVdc per degree

Accuracy: See plug-in specifications

Output Impedance: 100 ohms

DC Resolution: Infinite

Linearity: Approx. ±0.01°

Repeatability: Better than ±0.005°

Time Constants: Automatically selected; 10 ms for frequency >5 kHz, 50 ms >500 Hz, 350 ms >50 Hz, 700 ms >2 Hz (Note: 4.6 time constants to respond to better than 99% of step change).

Warm-up Drift: Approx. 0.05° after first minute.

Long Term Drift: Typically less than ±0.05° per month

Temp. Coefficient: Approx. ±0.001°/°C

Recommended Output Devices: Recorders, DVM's, A-D Converters, Printers

Self Check: Front panel switches; dc outputs correspond to −180.00°, 0.00°, +180.00° and +360.00°

Error Rejection: False triggers due to high frequency noise are locked out for signal to noise ratios better than 10:1. Errors and fluctuations due to waveform dissymmetry or low frequency noise reduced by at least 10 to 1.

Harmonic Rejection: Worst case errors due to even harmonic distortion reduced by approximately 5:1 without filters. Odd harmonics in-phase with fundamental contribute no error.

Operator Adjustments: None.

Operating Temp. Range: 0° to +50°C

Grounding: Independent grounds for signal, chassis, and power line. (For safety, chassis and power line grounds connected at factory.)

Remote Programmability (standard on all mainframes): By rear connector pins. Override by contact closure of automatic time constant selection and angle range. Factory installed wiring from rear connector to plug-in for use with programmable plug-ins.

Modular Construction: Circuits on removable plug-in cards, extenders supplied for ease in servicing.

Size: 3½″ high, 16″ deep, 19″ rack/portable package; shipping 22½″ x 22½″ x 6½″.

Weight: 20 lbs. (9 kg.); shipping 30 lbs. (14 kg.).

Power: 115/230 V, 50-400 Hz, <0.75 A (specify voltage and frequency when ordering).

Plug-In Accommodation: Accepts 305-PA-( ) plug-ins. Mainframes and plug-ins are interchangeable.

ANGLE PRESENTATION

	Model 305	Model 305B	Model 305C	Model 305D
DIGITAL				
Display	None	4 digit plus sign	5 digit plus sign	
Angle Ranges	Not Applicable	0.0° to ±180.0° and 0.0° to +360.0°	0.00° to ±180.00° and 0.00° to +360.00°	
Resolution	NA	0.1°	0.01°	
BCD Output	None	BCD coded (1248), 4 lines per digit plus polarity line; TTL/DTL compatible (<0.8 V to > +2.4 V dc). Read and hold on command, and data ready features available on rear connector.		
Warm-up Time	NA	30 minutes (1 minute with option 107)		
Zero & FS Controls	NA	Front panel for FS & 0 (no adjustments with option 107)		
ANALOG				
DC Output	10.0 mV/°; 0.0000 V to 3.6000 V and −1.8000 V to +1.8000 V corresponding to 0.00° to 360.00° and −180.00° to +180.00°; infinite resolution.			
DC Offset	None			Continuously adjustable angle offset. Analog panel meter and DC output indicate deviation from offset.

OPTIONS

#101 Rear connectors for signal and reference inputs, BNC(4)

#102 Full mainframe programmability; includes self check, angle range and time constant selection, DTL and TTL compatible.

#103 High speed analog output response. Time to respond to within 99% of step change: 1 ms for frequency >5 kHz, 10 ms >500 Hz, 100 ms >50 Hz, 1 second >5 Hz. (Temp. stability ±0.01°/°C)

(Opt. 103 not available with Opt. 107 or Mod. 14 below.)

#105 Remote zero control.

#107 Automatic calibration checks and automatically readjusts digital readout and BCD output circuits to reduce readout errors to ±0.02°. This option available only on 305C.

Mod. 14 Higher accuracy below 12 Hz. Available only on 305B, 305C, and 305D.

COMBINED PLUG-IN AND MAINFRAME SPECIFICATIONS

MODEL	FREQUENCY RANGE	INPUT LEVELS (independent)	INPUT Z	ACCURACY(2) WITH INDEPENDENT LEVELS UNLESS OTHERWISE INDICATED Analog output accuracy: As specified below. Digital phase accuracv: For model 305C, same as analog accuracy. For model 305B, add ±0.15° digital readout error to analog accuracy specified.
305-PA-3001 Auto Ranging Plug-in	2 Hz to 700 kHz	10 mV to 300 V rms up to 10 kHz and to 50 V rms up to 700 kHz; can be extended to 40 kV rms with Tektronix probes. Each channel has automatic gain ranging, and lamps which indicate when level is below 50 mV and above 50 V rms.	1 megohm shunted with 40 pF	±0.05°, 50 mV to 50 V rms from 50 Hz to 50 kHz; typically ±0.03°, 50 mV to 50 V rms from 50 Hz to 50 kHz, ±0.05° to 10 Hz, ±0.1° to 250 kHz, and ±0.25° at other levels to 500 kHz.
305-PA-3002 Single Range Plug-in	2 Hz to 700 kHz	10 mV to 3 V rms(1); can be extended to 3 kV rms with Tektronix probes. Other ranges available on request.	1 megohm shunted with 40 pF	±0.05°, 50 mV to 500 mV rms from 50 Hz to 50 kHz; typically ±0.03°, 50 mV to 500 mV rms from 50 Hz to 50 kHz, ±0.05° to 10 Hz, ±0.1° to 250 kHz, and ±0.25° at other levels to 500 kHz.
305-PA-3005 High Frequency Plug-in	200 kHz to 11 MHz	1 mV to 3 V rms; manual level controls in 10 dB steps. Lamps indicate when inputs are out of range or when level controls are improperly set.	50 ohms	Broadband with equal inputs above 10 mV rms: ±0.4° from 200 kHz to 4 MHz; ±1° from 4 MHz to 11 MHz. With independent levels above 10 mV rms: ±1° up to 4 MHz and ±2° up to 11 MHz. Single frequency — above 10 mV rms: ±0.3° at any frequency from 200 kHz to 11 MHz at any fixed levels.
305-PA-3007 Programmable and Auto-Ranging Plug-in	2 Hz to 700 kHz	Autoranging: similar to levels of 305-PA-3001. Programmable: overrides autoranging; extends low levels to 1 mV rms; DTL, TTL logic; program connector in rear of mainframe.	1 megohm shunted with 40 pF	Same as 305-PA-3001 for levels above 10 mV rms; typically ±0.35° from 50 Hz to 50 kHz for levels below 10 mV rms.
305-PA-3008 Power Freq. Plug-in	50-500 Hz without filters. 50 Hz, 60 Hz and 400 Hz L.P. filters available(3)	25 V to 250 V rms; 0.1 A to 5 A rms. Inputs are transformer isolated.	100 k ohm (voltage) 0.02 Ω max. (current)	At any single frequency, with filter set: ±0.1°, 25 V to 250 V rms, or 0.1 A to 5 A rms.
305-PA-3009 Network Analyzer (Gain/Phase/Amplitude)	5 Hz to 700 kHz (Note: 305-PA-3009A operates to 1 Hz with 305 mod. 14)	10 mV to 40 V rms. Each channel has automatic gain ranging. Direct reading of phase angle, amplitude ratio and level of each input. Compatible with Tektronix probes.	1 megohm shunted with 40 pF	Phase: ±0.1° from 40 mV to 40 V rms from 50 Hz to 50 kHz; typically ±0.25° at all other levels from 5 Hz to 500 kHz. Voltage Amplitude: above 40 mV (channel A or B): ±2% reading ±0.03% FS, 50 Hz to 50 kHz; ±5% reading ±0.03% FS, 100 kHz to 500 kHz.(5) Ratio: ±0.5 dB, 50 Hz to 50 kHz; ±1 dB, 50 kHz to 500 kHz.(5)
305-PA-3010 Special Purpose Plug-in (with filter)	For use at 125 ±10 Hz; matched filters in both channels reject higher frequencies	500 mV to 5 V rms. Other ranges available on request.	1 megonm shunted with 40 pF	±0.1°, 500 mV to 5V rms; ±0.25°, 100 mV to 500 mV rms.
305-PA-3015 Selectable Filter Plug-in	5 Hz to 500 kHz without filters; uses 2 of type 305-PA-3008-( ) filters (3); filter selection programmable	Ranges of 50-500 mV rms, 0.5 to 5 V rms, and 5-50 V rms selectable by remote contact closures.	1 megohm shunted with 40 pF	With filters, ±0.1° at fixed frequencies over all levels; without filters ±0.1° from 50 Hz to 50 kHz at all levels (typically ±0.03°), typically ±.25°, 5 Hz to 500 kHz.

(1) Can be provided for other voltage levels.

(2) For sinusoidal signal; can be used for square wave inputs over limited frequency range; can be used for amplitude modulated signals up to 97% modulation, depending upon model, level and frequency.

(3) 50 Hz filter, P/N 305-PA-3008-50; 60 Hz filter, P/N 305-PA-3008-60; 400 Hz filter, P/N 305-PA-3008-400. (Other frequencies available on request.)

(4) Available for use with 305-PA-3001, -3002, -3007 and -3010. Specify when ordering plug-in.

(5) For higher accuracy below 50 Hz, specify Model 305-PA-3009A.

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SERIES 331

HIGH ACCURACY ECONOMY PHASEMETERS

PHASE METER
DRANETZ
REFERENCE
CALIBRATE
DEGREES

- Accuracy to 0.05°, resolution to 0.01°
- Frequency range 2 Hz to 500 kHz
- Analog output and 4 or 5 digit panel readouts
- Input 0.05 to 220 V rms
- Accepts sine, square and other waveforms in either channel

The Dranetz 331 Series Phasemeters feature high accuracy over a broad amplitude and frequency range. Front panel controls (equipped with LO/HI indicators) are used to select proper voltage ranges, as well as to check and adjust calibration. The 331 incorporates several of the important features of the Superperformance 305 Series, including elimination of 0°/360° ambiguity and reduction of sensitivity to noise and even harmonics. The 331 is designed for calibrating equipment, for testing subassemblies and for general laboratory work.

SPECIFICATIONS

CHARACTERISTICS	331B	331C
Frequency Range:	2 Hz to 500 kHz	
Accuracy: Sine Wave:	±0.1° ±1 digit from 50 Hz to 50 kHz, add ±0.2° per 100 kHz above 100 kHz and ±0.2° ±1 digit at 5 Hz.	±0.05° from 50 Hz to 50 kHz; ±0.2° from 10 Hz to 100 kHz; add ±0.2° per 100 kHz above 100 kHz.
Square Wave:	±0.1° ±1 digit from 10 Hz to 20 kHz; ±.5° per 100 kHz above 20 kHz	±0.05° from 10 Hz to 5 kHz; ±0.1° to 20 kHz; ±0.5° per 100 kHz above 20 kHz.
Angle Ranges:	000.0° to 360.0° or −180.0° to +180.0° automatic or selectable.	
Display:	Beckman (Sperry) 0.6″ 4 digit for ranges above.	Beckman (Sperry) 0.6″ 5 digit for ranges above.
Drift (30 day period): Sine Wave: Square Wave: DC Drift:	 None None 0.1°	
Repeatability (DC):	Better than 0.1°.	Better than 0.01° after readjusting 0 and FS.
Temperature Coefficient:	0.01°/°C independent of other conditions.	
Input Signal Amplitudes:	0.05 to 220 Volts rms in 3 ranges (0.05-0.5, 0.4-5, 4-220; can be extended with Tektronix probes.	
Input Impedance:	1 megohm shunted by 50 pF nominal	
Response Time:	700 milliseconds	
Maximum DC Component:	±200 volts; can be extended with probes	
Analog Output:	0.0000 to 3.600 V and −1.8000 to +1.8000 V DC, +10.00 mV DC/degree phase; output impedance less than 100 ohms.	
Ambient Temperature	0°C to 45°C	
Panel Controls and Adjustments:	3 range input level pushbuttons each channel; read-hold; power; 0° cal and 360° cal adjustments.	
Connectors:	BNC, both input channels, rear and front; PC rear for analog output.	
Power Requirements:	105-125 or 210-250 volts, 50/60 Hz, 70 watts.	
Dimensions:	3½″ high x 16″ deep, 19″ rack/portable package; 22½″ x 22½″ x 6½″ shipping; 18 lbs. (7 kg) net wt., 25 lbs. (10 kg) shipping.	
Option:	None	#101: BCD output, TTL/DTL, 8421

FOR FULL INFORMATION WRITE FOR BULLETIN 331

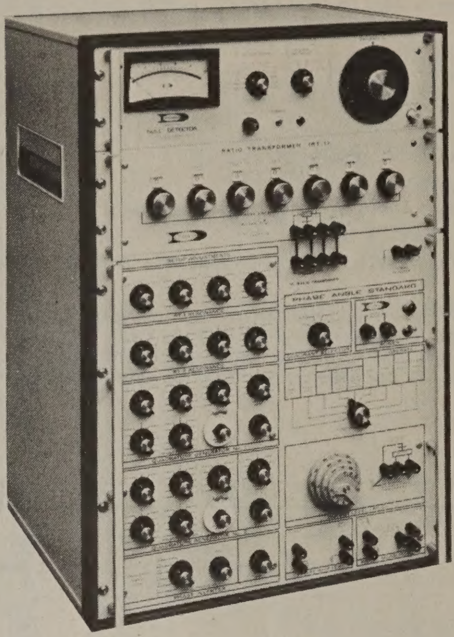
FREE TECHNICAL ARTICLES

Prepared by the Engineering Department of Dranetz Engineering Laboratories

TM-102, 081	Measurement of Power Factor in Single-Phase and Three-Phase Systems Using Phasemeter Techniques (17 page technical paper).
TP-102, 980	Phasemeter Specs Can Fool You (6 page reprint from **Electronic Design**, November 22, 1975).
TP-102, 981	Application Notes for Sampling Log Voltmeter (10 page technical paper).
TP-102, 982	Analysis of Electroacoustic Transducers by Differential Admittance Techniques (5 page reprint from **Journal of Acoustical Society of America**, August, 1966).
TP-102, 983	Recording Impedance & Admittance of Transducers under High Power (6 page reprint from **Electronic Products**, May, 1965).
TP-102, 984	Applications Handbook of Precision Phase Measurement (28 page publication).
TP-102, 985	Advantages of Phase-Angle Measurement by Digital Techniques (7 page technical paper).
TP-102, 986	Power Line Monitoring & Transient Analysis — presented at Powercon 2 (19 page technical paper).
TP-102, 987	Power Monitoring — It Can Help Cure Your Repair/Replacement Problems (2 page reprint from **Maintenance Engineering**, January, 1976).
TP-102,988	Tracking Down and Identifying Power Line Aberrations (4 page reprint from **Mini-Micro Systems**, July, 1976).
TP-102, 989	Incoming Inspection for AC Power (6 page reprint from **Design News**, December 20, 1976).
TP-102,991	When & How to Automate Phase Instrumentation (13 page technical paper).
TP-102, 992	Trip-point Testing of Overcurrent, Overvoltage, and Impedance Relays (4 page technical paper).

THESE ARTICLES ARE AVAILABLE UPON REQUEST

DYTRONICS



The first authentic Primary Phase Angle Standard for industry

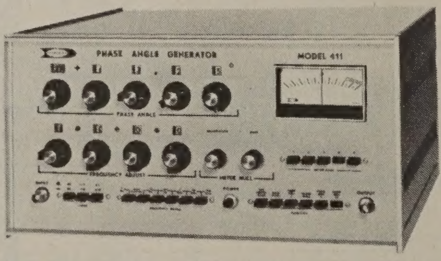
MODEL 311/RT-1/717S PRIMARY PHASE ANGLE STANDARD

- 0.015° Accuracy
- Self-Calibrating
- Maximum 125 Volt Output
- Shift or Measure Phase Angle
- Frequency Range 30Hz to 10,000Hz
- 12 Microdegrees Resolution

Dytronics offers an array of instrumentation for the measurement and generation of phase angle. This successful and advanced measurement technique pioneered by Dytronics is recognized as the finest throughout the world. See our catalog for complete information or contact Dytronics Company Inc. 4800 Evanswood Drive, Columbus, Ohio 43229, Telephone (614) 885-3303.

Model Number	Frequency Range	Accuracy	Measure Phase?	Shift Phase?	0° to 360° Coverage without Ambiguity?
302	1 Hz-100 kHz	±0.5°	Yes	Yes	Yes
311/Rt-1/717S	30 Hz-10 kHz	±0.015°	Yes	Yes	Yes
312	4 kHz-500 kHz	±0.02°	Yes	Yes	Yes
342	400 Hz	±0.1°	Yes	Yes	Yes
402	400 Hz	±0.01°	No	Yes	No
411	1 Hz-100 kHz	±0.1°	No	Yes	Yes
412	.01 Hz-1 kHz	±0.1°	No	Yes	Yes

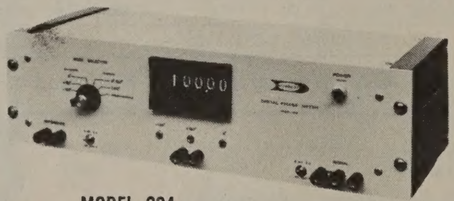
SEE OUR CATALOG FOR A COMPLETE LIST OF MODELS AND SPECIFICATIONS.



MODEL 411
PHASE SHIFTER/GENERATOR

Model 224 "hands-off" Digital Phase Meter

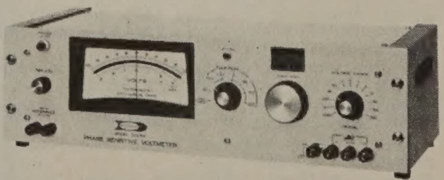
Hands-Off Phase Angle Measurements using new **"Linear Mode Concept"** 0.1° Accuracy 0.01° Resolution



MODEL 224

Model Number	Frequency Range	Accuracy	Internal Filters	Outputs	0° to 360° Coverage without Ambiguity?
222	20 Hz-100 kHz	±0.1°	No	DC	Yes
224	20 Hz-100 kHz	±0.1°	No	DC-BCD	Yes
244/RS	400 Hz	±1.0°	Yes	DC	Yes
250B	4 Frequency	±1.0°	Yes	DC	Yes

SEE OUR CATALOG FOR A COMPLETE LIST OF MODELS AND SPECIFICATIONS

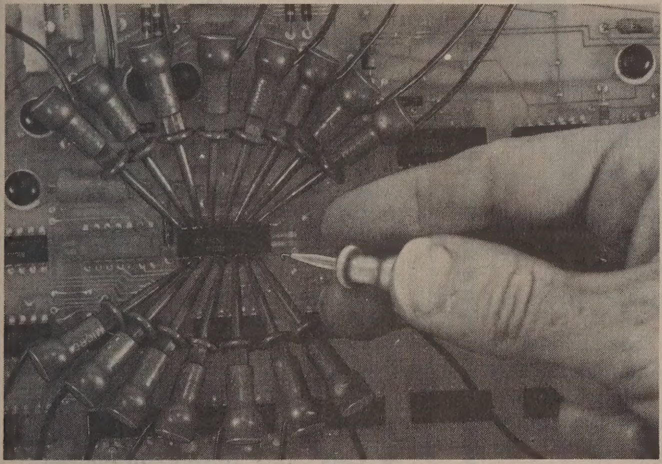


MODEL 244/RS
PHASE SENSITIVE VOLTMETER

DYTRONICS COMPANY, INC.
4800 EVANSWOOD DRIVE, COLUMBUS, OHIO 43229
Telephone (614) 885-3303

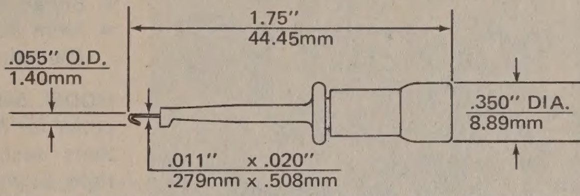
E-Z-HOOK® . . .THE BETTER MADE TROUBLE SHOOTERS

Quality engineered through precision tooling and the best selection of materials—Beryllium Copper, Nickel Silver or Stainless Steel with Gold or Nickel Plating. Non-conducting Parts made of Durable Heat and Chemical Resistant Nylon. Uniquely designed to give maximum holding power without damage to components, true readings through a single contact point, and maximum insulation in a minimum of space. Each size hook is available in the 10 standard RETMA colors, and by interchanging the plungers and bodies, 99 different color combinations can be created. Each size hook is available individually, or preconnected to a wide variety of test lead and coaxial interface connectors. An ever increasing range of applications throughout industry make E-Z-Hook products the most sought after test aids available. Truly, THE IMPOSSIBLE HOOKERS!



MICRO HOOK XM

The XM Micro Hook was designed for difficult IC test connections It's lightweight (less than 1 gram) and Finger-eze Hypo Action let you connect direct to delicate wires where weight and leverage may damage component. One-Piece Beryllium Copper, Gold-Plated Hook and Conductor. Stainless Steel Compression Coil Spring exerts about 8 oz./227gm of contact pressure. As with all E-Z-Hook Connectors, the XM Micro Hook Model is completely field serviceable.

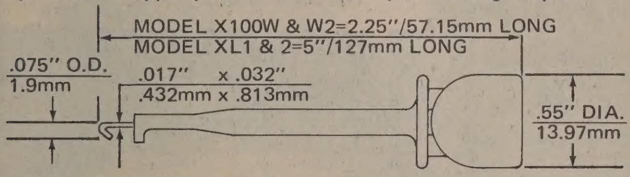


MODEL XM SHOWN ACTUAL SIZE WITH HOOK EXTENDED

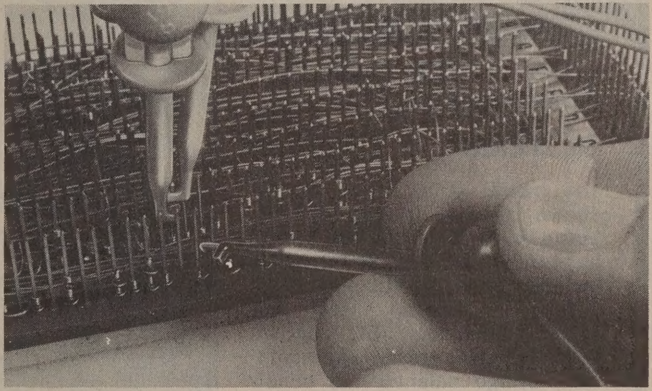
MINI HOOK X100W OR X100W2 AND XL1 OR XL2

The X100W & W2 (2.25''/57.15mm long) and XL1 &2 (5''/127mm long) Mini Hooks combine proven construction, miniature size and Finger-eze Hypo Action to permit direct hook-ups to components. One-Piece Beryllium Copper, Gold-Plated Conductor and Hook. The Stainless Steel Coil Spring exerts 16 oz./454gm of contact pressure.

MODELS X100W & XL1	**MODELS X100W2 & XL2**
.040''/1.016mm square hole tip for wire wrapped pins.	.065''/1.65mm x .040/1.016mm hole tip for rectangular pins.

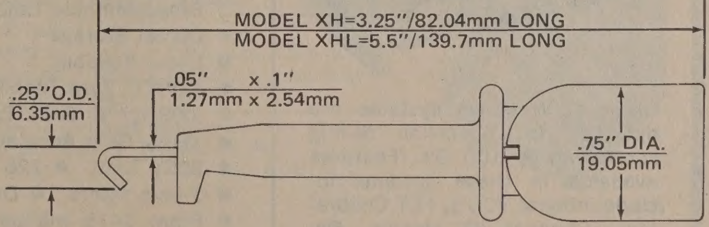

MODEL X100W & W2=2.25''/57.15mm LONG
MODEL XL1 & 2=5''/127mm LONG
.075'' O.D.
1.9mm
.017'' x .032''
.432mm x .813mm
.55'' DIA.
13.97mm

MODEL X100W SHOWN ACTUAL SIZE WITH HOOK EXTENDED



MACRO HOOK XH AND XHL

The XH (3.25''/82.04mm long) and XHL (5.5''/139.7mm long) Macro Hooks will span terminals up to .125''/3.175mm in diameter. The One-Piece Nickel Silver Conductor and Hook is equivalent in surface area to No.14AWG wire (.064''/1.65mm Dia.) The Stainless Steel Coil Spring exerts approximately 40 oz./1134gm of contact pressure, Heavily insulated to a single contact point.



MODEL XH SHOWN ACTUAL SIZE WITH HOOK EXTENDED

For Complete Information on the Full-Line Source for All Your Test Connection Needs, Send for Latest Catalog and Price List

E-Z-HOOK®

P. O. BOX 450, ARCADIA, CALIFORNIA 91006
PHONE: (213) 446-6175 TWX 910 582 1614

Ectron
CORPORATION

- Differential DC Amplifiers
- Strain Gage Signal Conditioners
- Thermocouple Signal Conditioners
- Signal Conditioning Systems
- Data Acquisition Systems
- Thermocouple/MV Calibrators

MODEL 314

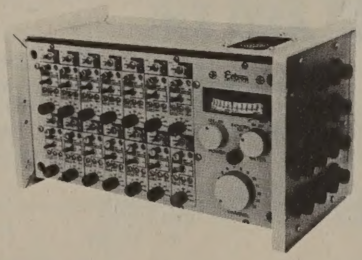
Miniature airborne amplifier occupies less than one cubic inch. Contains differential amplifier, strain gage excitation and power supply to operate from 28V dc. 20 kHz Bandwidth. Price $450. (Bulletin 2007)

400 ENVIRONMENTAL SERIES

- 100G Shock
- −25 to +71°C
- 0.5 μV/°C Stability
- Thermal Shock Resistant
- Bridge Excitation and Balance
- Thermocouple Conditioning
- RFI protection
- 120 dB CMR • 100V CMV
- Rack or Stud Mounting
- 12 or 28 V dc Power • 8 oz's.
- From $330 (Bulletin 2001A)

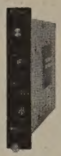
4000 SERIES, SIGNAL CONDITIONING SYSTEMS

The typical 4000 series system shown below is designed for Airborne or Vehicular service involving moderately high G forces. It includes 14 stable 400 series amplifiers, a monitor meter and monitor selection switch, individual CAL switches, bridge excitation, bridge balance and conditioning.



Other 4000 series systems are designed for operation during shocks up to 100 G's. Features available in these systems include integral VCO's, FET Calibration, Channel ID signals, Rechargeable Battery Pack and others. (See Bulletin 2001A)

500 ECONOMY SERIES



- 1μV/°C
- 114 dB CMR
- Gains X.01 to X2500
- 16 Amps per 3.5" high rack
- 80 kHz bandwidth
- Filtered output
- 10 ma, 100 ma, dual outputs
- Bridge Bal., Completion, CAL
- From $155 (Bulletin 2004A or B)

MODEL 540 — Four-channel amplifier for multi-channel data systems such as Model 6000 at right. From $400 (Bulletin 2004B)

600 INDUSTRIAL SERIES

- Strain Gage Conditioning
- Thermocouple Conditioning
- Thermocouple Linearization
- Reference Junctions
- Multifunction Amplifiers
- Bridge Excitation and Bipolar Cal.
- Expanded Scale Operation
- .2μV/°C Zero Stability
- 120 dB CMR and 300V CMV
- 12V dc, 28V dc or 115V ac power
- From $255 (Bulletin 2005)

700 WIDEBAND SERIES

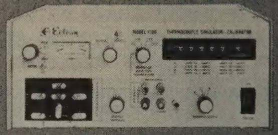
- 100 kHz Bandwidth
- Manual or Programmable Gain
- Digital Storage
- Local Readout
- 1μV/°C Zero Stability
- .003%/°C Gain T.C.
- .01% Gain Accuracy
- 300V CMV • 126 dB CMR
- 3-pole filters • Dual outputs
- From $415 manual gain
- From $775 programmable gain (Bulletin 2003A)

6000 SERIES DATA SYSTEMS

All 6000 Series Systems combine per-channel low level amplifiers with a high level multiplexer and a programmable gain amplifier to provide complete multi-channel signal processing in a small, rugged package. When equipped with Model 640 input modules, outstanding performance is provided by the chopper stabilized design which offers extremely low drift and noise and accommodates common mode voltages up to 300 volts dc or peak ac. The systems are capable of scan rates to 20,000 channels per second. Integral A-D converters are optional. Other key features are listed below.

- CMV 300V (higher on special orders)
- CMR 120 dB with 1K unbal.
- 0.5 μV Zero Stability
- .01% Gain Stability
- 3rd order filter, each channel (plug in)
- Sequential or Random Access
- 20 kHz Throughput Rate
- 64 Channels per 5.25" high enclosure (Bulletin 2008)

MODEL 1100 THERMOCOUPLE SIMULATOR CALIBRATOR



CALIBRATES . . .

- Digital Thermometers
- Temperature Recorders
- Thermocouple Transmitters

SIMPLE
Just dial the temperature (C or F) (or program remotely)

ACCURATE
Voltage output conforms to NBS 125 within 0.1°

UNIQUE
Outputs on thermocouple alloys or copper

VERSATILE
It's a DC Voltage Standard and a Differential Voltmeter, too!

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Phone (714) 278-0600/TWX 910-335-1259
(See EEM Section 2000)
Specialists in Airborne, Marine and Industrial Instrumentation

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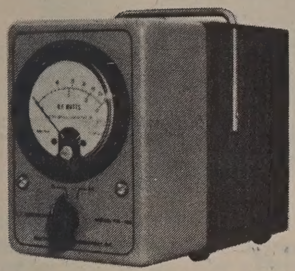
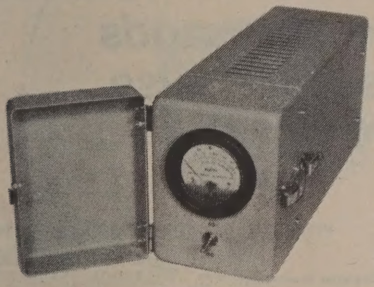
TERMINATION AND IN-LINE RF POWER METERS



PM-10A

Full Scale Ranges	15 & 60 watts
Insertion VSWR	1.1:1
Accuracy (to 500 MHz)	±5%
Frequency Range MHz	.2-1000



DPM-3

Full Scale Ranges	50 & 150 watts
Insertion VSWR	1.1:1
Accuracy (to 500 MHz)	±5%
Frequency Range MHz	.2-1000

DW-1000

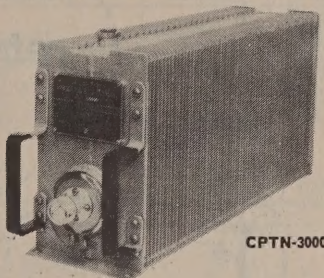
Frequency Range MHz	2-800
Power Range	10-1000 watts
Accuracy	±5% of full scale

Completely Self-Contained — No Plug Ins

COAXIAL DUMMY LOADS AND ATTENUATORS

CPTN-500

- No external power required.
- Up to 5,000 watts average power.
- Frequency range DC-3500 MHz.



CPTN-3000

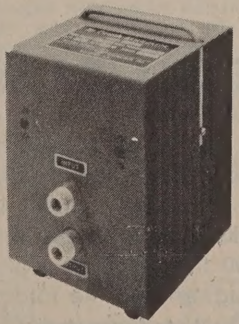
- Rhomic Antenna Terminations also available.
- Oil filled termination cooled by convection — almost completely maintenance free.
- Units may be pulsed.
- Standard impedance is 50 ohms. Units can be furnished with 72, 300 or 600 ohms impedance. Request quotation from factory on special units.

Model	Frequency Range MHz	Connector Type	Average Power Watts	VSWR	Size H x W x D	Weight
CPTN-100	DC-1000	N	100		6.5x4.4x5	7
CPTN-500	DC-1000	N	500	1.1	9.6x6x16	16
CPTNS-500	DC-3500	N	500	1.25	9.6x6x16	16
CPTN-1500	DC-1000	LC	1500	1.15	11x6.4x24.3	32
CPTN-3000	DC-1000	LC	3000*	1.15	11x6.4x24.3	32

* 2500 watts continuous.

Model*	Max. Power Watts	Accuracy	Attenuation Specify
AX-100	100	±0.5 db to 500 MHz	3, 6, 10, 20, 30 db
AX-500	500		
AX-1000	1000		
AX-2000	2000		

*Choose one stock attenuation value.
Extra charge for 3, 6 and 10 db.



AX-100-20

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

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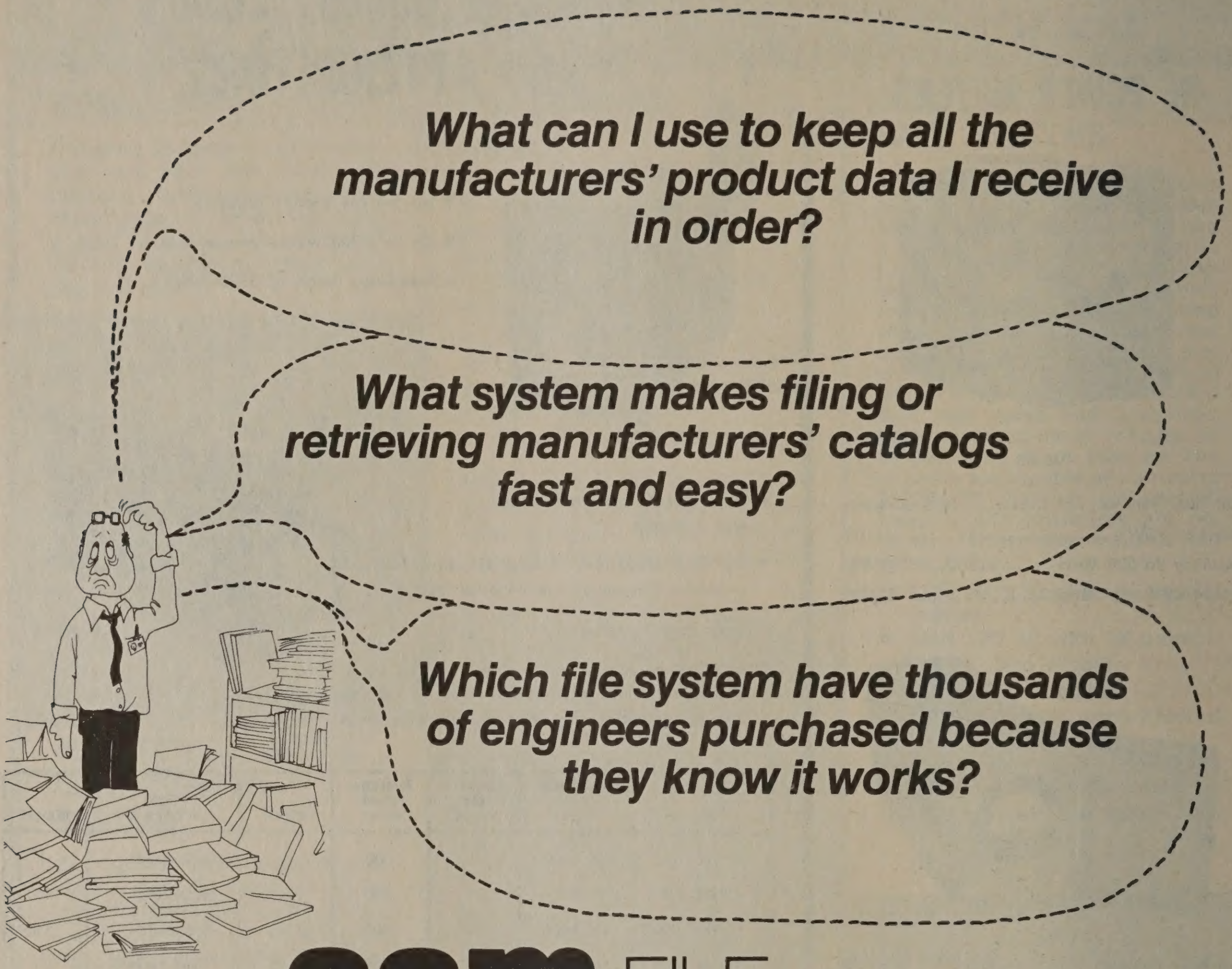
DEPT. EM 116 CHESTNUT STREET • RED BANK, NEW JERSEY 07701
TELEPHONE: (201) 741-0404

SEE OUR OTHER PRODUCTS ON PAGE 2695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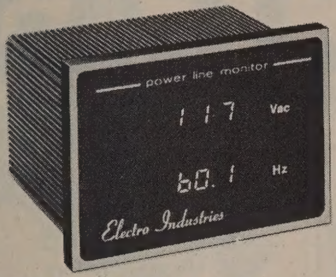
Electro Industries

SOLID-STATE DIGITAL POWER LINE MONITOR



The Power Line Monitor is a solid-state digital meter that was designed to satisfy the requirements for a digital readout device combining the functions normally provided by two distinct conventional line monitoring panel meters.

This digital meter has the unique two-fold capability of monitoring line voltage and line frequency fluctuations through visual presentation as well as by optional digital digit outputs for remote interface.

The unit was designed and built for ruggedness and durability, the LED's Display and the solid-state component will assume a long life operation.

The Power Line Monitor is suited ideally for use with power generation equipment, computerized measuring systems, control panel installations, and in instrumentation laboratories where power sources must be monitored for measuring test equipment accuracies.

SPECIFICATIONS COMMON TO ALL UNITS

OPERATING RANGE: Voltage — 85 - 145V (When power input is parallel Suffix A- 170 - 270V with the measurement input). Measurement input is 0 - 300V (when applying a fixed power input voltage)

VOLTAGE ACCURACY: Voltage — ±.5% f.s. ± 1 Digit

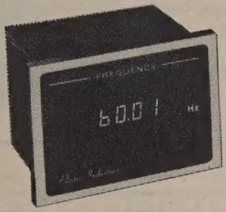
SAMPLE RATE: Voltage — 30m sec. - 600m sec.

DIGITAL DISPLAYS: LED — .3″ high

SIZE: 4.75″ W x 3.25″ H x 3.50″ L
Panel cut out required 4.125″ x 3.125″

MODELS	FREQUENCY RANGE	FREQUENCY ACCURACY		SAMPLE RATE FREQUENCY	PRICE (1 to 9)
LM 150	——	—	Crystal Controlled	—	$129.00
LM 160	42 - 99 Hz.	±1 Hz.		1 sec.	159.00
LM 1400	42 - 999 Hz.	±1 Hz.		1 sec.	189.00
LM 1600	42.0 - 99.9 Hz.	±.1 Hz.		10 sec.	195.00
LM 1600-1	42.0 - 99.9 Hz. or 42 - 999 Hz.	±.1 Hz. or ±1 Hz.		10 sec. or 1 sec.	225.00
LM 1600-10	42.0 - 99.9 Hz.	±.1 Hz.		1 sec.	270.00

SOLID-STATE DIGITAL FREQUENCY MONITOR



The Solid State Digital Frequency Monitor was designed to satisfy the requirements for high resolution and fast updating when measuring low frequency.

The fast updating feature is achieved through a unique phase lock loop scheme. In addition, this technique allows the unit to reject noise on the incoming signal. The accuracy of this unit is controlled by a crystal with maximum aging factor of 20 PPM.

This feature enables the unit to be free from calibration requirements.

The Frequency Monitor is ideally suited for use in monitoring Power Line frequencies and for general low frequency monitoring.

SPECIFICATIONS COMMON TO ALL UNITS

INPUT VOLTAGE RANGE: 2 - 300V.

FREQUENCY ACCURACY: ±1 Digit over operating temperature range

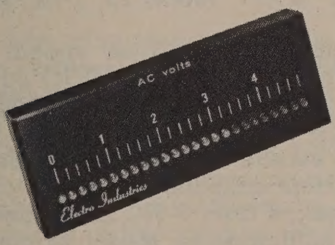
SAMPLE RATE: 1 second

DIGITAL DISPLAY: LED — .4″ high

SIZE: 4.75″ W x 3.25″ H x 3.50″ L

MODELS	FREQUENCY RANGE	FREQUENCY RESOLUTION	PRICE (1 to 9)
LF 60	5.00 - 99.99 Hz.	.01 Hz.	$275.00
LF 400	50.0 - 999.9 Hz.	.1 Hz.	275.00
LF 1000	5 - 9999 Hz.	1. Hz.	185.00

SOLID-STATE ANALOG INDICATOR & CONTROLLER



The Solid State Analog Indicator and controller is a combination of an analog meter and a digital controller. The unit is designed to obtain a highly visual analog indication, as well as being a low cost controller with up to 24 set points. It is a 100% solid state unit without moving parts to wear or break, which makes it extremely resistant to shock and vibration.

Because it is only 5/16″ wide, the unit can easily be mounted flush against a panel using only 2 set screws. The 24 set points can be suitably used on process control equipment, and are easily interfaced with computer systems.

As an option, different color LED's can be used to indicate special scale readings. The unit is low cost, and is available in different ranges.

SPECIFICATION COMMON TO ALL UNITS

ACCURACY: ±2% F.S.

LINEARITY: ±.5% F.S.

TEMPERATURE COEFFICIENT: 150ppm/°C

RANGES	CAT. NO.	RANGES	CAT. NO.	RANGES	CAT. NO.	RANGES	CAT. NO.	RANGES	CAT. NO.	MODELS	PRICES A	PRICES AT
DC Micro Amperes		**DC Milliamperes**		**AC Amperes**		**DC Volts**		**AC Volts**		1 - 9	$68.00	$76.00
0 - 48	AT 1010	0 - 24	AT 1014	0 - 4.8	AT 1018	0 - 2.4	AT 1023	0 - 4.8	AT 1028	10 - 49	62.00	69.00
0 - 240	AT 1011	0 - 48	AT 1015	0 - 24*	AT 1019	0 - 4.8	A 1024	0 - 24	A 1029	50 - 99	56.00	62.00
DC Milliamperes		0 - 240	AT 1016	0 - 48*	AT 1020	0 - 24	A 1025	0 - 48	A 1030	100 - 249	39.00	45.00
0 - 2.4	AT 1012	**DC Amperes**		0 - 240*	AT 1021	0 - 48	A 1026	0 - 240	A 1031			
0 - 4.8	AT 1013	0 - 4.8	AT 1017	0 - 480*	AT 1022	0 - 240	A 1027	90 - 138	AT 1032			
								170 - 265	AT 1033			

* Meters to be used with external 5A current transformer.

ELECTRO INDUSTRIES / PANEL METER DIVISION / **DEPT. EM, 109 NASSAU DRIVE / ALBERTSON, NEW YORK 11507 / TEL: (516) 621-6652**

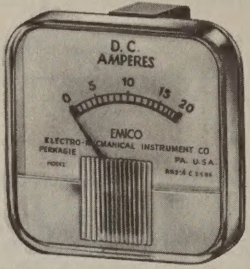
EMICO PRECISION-PLUS

HIGH TORK PRECISION METERS

PRODUCED IN VOLUME AT COMPETITIVE PRICES

EMICO is your dependable VOLUME source for 100% American-made AC and DC meters for a wide range of applications in the electronics, automotive, appliance, test equipment and process industries. Select any standard model or have EMICO design and engineer a meter to your exact requirements, including a custom dial face with special scale, trademark, name or colors. Send for a complete catalog of standard models or mail drawings and specifications for a prompt quotation on a custom meter.

- ■ **Voltmeters**
- ■ **Ammeters**
- ■ **Millivoltmeters**
- ■ **Milliameters**
- ■ **Microammeters**
- ■ **DB meters**
- ■ **VU meters**
- ■ **Circuit indicators**
- ■ **Voltage testers**
- ■ **Induction meters**

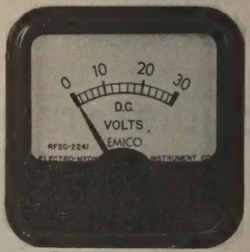


PANEL METERS WITH METAL OR PLASTIC BEZELS

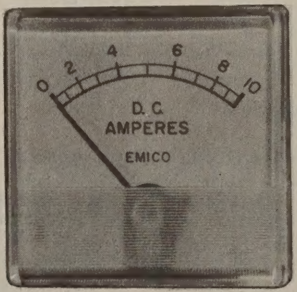
Plastic Bezel Meter
Model 42—2⁵⁄₁₆" square
Model 44—2¹³⁄₁₆" square

Metal Bezel Meter
Model 72—2¼" square
Model 74—2¾" square

Featuring the unique EMICO High-Tork movement, these versatile meters are available as AC or DC ammeters, voltmeters and milliammeters. All AC meters have 5% accuracy; DC meters available with 3% or 5% accuracy. These meters can be mounted into a 2 1-16" diameter panel hole.



THE CHARGE INDICATOR WITH A MODERN LOOK BUT AN OLD-FASHIONED PRICE



Plastic Face Meters

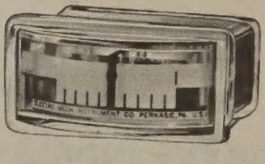
50 Series all approximately 2⅜" square

The eye-catching appearance, durability, and low price tag have made these meters especially popular. The one shown above (Model 53) is ideal for battery charger applications. Features attractive, clear molded plastic bezel and easy-to-read scale that can be customized. Specific models available as DC ammeters, voltmeters and milliammeters with 3% or 5% accuracy. AC model accurate to 5% of full scale.

Send for detailed product data sheets, today.

SG SHELLER-GLOBE CORPORATION
ELECTRO-MECHANICAL INSTRUMENT DIVISION
EMICO PRECISION-PLUS
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

HOW TO GIVE YOUR PRODUCTS AN EDGE



Edge-Reading Indicator
Model 12 1¼" x ⁹⁄₁₆"

DC MILLIAMPERES
0
1
2
3
4
5
ELECTRO MECH INSTR CO PERKASIE, PA. U.S.

Edge-Reading Meter
Model 13 1¹³⁄₁₆" x ¾"

You can engineer added sales appeal into your product by giving it the EMICO edge—either Model 12 or the slightly larger Model 13. Both feature a clear molded plastic front and case plus excellent readability. Model 12, primarily a current indicating device, is available in DC ranges from 0-500 microamperes through 0-50 milliamperes. Model 13 can be supplied as a 0-500 microampes DC meter, as well as an AC or DC ammeter, voltmeter and milliammeter. Either 3% or 5% accuracy is available on DC meters, depending upon the sensitivity. All AC meters have a 5% accuracy rating.

Send for detailed product data sheets, today.

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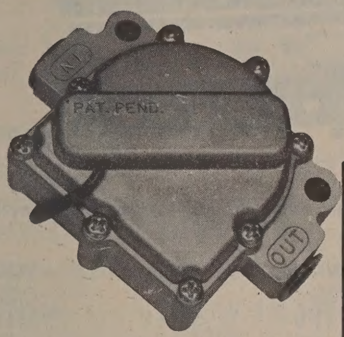
NEW from EMICO . . .

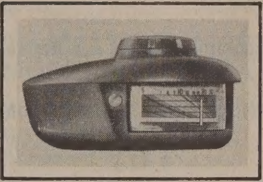
and a lot of other things

THE ENERGY SAVERS



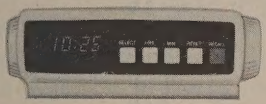
Monitor the usage of critical items and you've got a good head-start on conserving them. Fuel. Gas. Chemicals. Time. You name it.

One or more of these new EMICO products designed into your product or equipment may provide you with that conservation advantage you want and need in today's economy.



FLOW MONITOR—Measures usage of fluids and gases

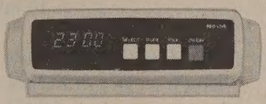
Featuring an uniquely designed and extremely rugged transducer, this monitor is capable of measuring from 0.5 to 16.75 gallons of most liquids per hour. It has a pressure range of 0-400 psi and provides an analog signal output in linear or nonlinear form. A warning light on the readout indicator flashes (see inset) when the flow being monitored falls below a preset performance standard.



TIME MONITOR

Digital clock that also measures elapsed time independently

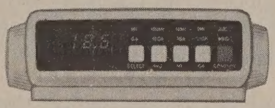
Operates on DC. Time elapsed counter reads in minutes and seconds to 59:59, then in hours and minutes to 99:59. Display and indicator lights change in intensity depending upon environment.



TACH/EVENT COUNTER

Measures RPM or events and signals when an adjustable pre-set standard is exceeded.

Continuously, accurately shows RPM's to nearest hundred. Includes memory for preset standard that can be reset at the push of two buttons.



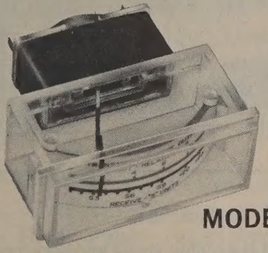
FOUR-FUNCTION COMPUTER

Determines relationship between two variables.

Keeps totals of both variables. Also computes accumulated average and displays total usage of both variables. Operates on DC. Example: miles per gallon computer.

For complete information on any or all of these products, send for detailed product bulletins, today.

NOW . . . BIG VISIBILITY WITH A LITTLE PRICE TAG



Edge-Reading Indicator

MODEL 14—1-13/16" x 3/4"

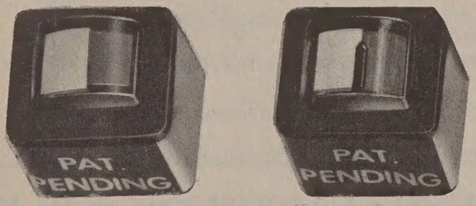
This new edge-reading indicator provides the same excellent readability as EMICO's Model 13 edge-reading meter but with the economy of an indicator. It's the best of both worlds; maybe the best answer for your product.

Basic DC milliammeter movement can easily be converted to a voltmeter by adding external resistor. Adjustment on the back affords a precise setting for best accuracy at one point on the scale. Available from 2 milliamperes up to 100 milliamperes. Clear plastic front and case for ease of illumination. Fits into same size panel cut-out as Model 13.

Send for detailed product data sheet, today.

SG SHELLER-GLOBE CORPORATION
ELECTRO-MECHANICAL INSTRUMENT DIVISION
EMICO PRECISION-PLUS
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

TINY INDICATORS KEEP A BIG EYE ON D.C. CIRCUITS



Flag **Pointer**

Model 802—approx. 1/2" square

Rugged, dependable, and extra low in cost, these micro-miniature circuit indicators:

- **Monitor on-off conditions**
- **Indicate battery-charge conditions**
- **Indicate circuit-operating conditions**

Less than 2 milliwatts required to move flag or pointer. Overload capacity is 15 times current rating without burn-out or calibration shift. All models are packaged in a high-impact, clear plastic case and are available either with wire leads or plug-in jacks for ease of installation.

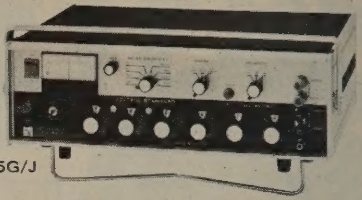
Send for detailed product bulletin, today.

SG SHELLER-GLOBE CORPORATION
ELECTRO-MECHANICAL INSTRUMENT DIVISION
EMICO PRECISION-PLUS
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

AC & DC voltage and current calibrators

General purpose and special purpose standard, sources and references

1030A



MV105G/J

DC VOLTAGE STANDARDS

Applications for Production Line QC, Field Service Calibration Laboratories. Ideal as a Reference/Source/Supply for design and development labs. Simulator for thermocouples and transducers.

MODELS	E 100E	MV 100/J	MV 105/J	MV 106/J	MV 116/J	330J	1030A
Bulletin	(#23)	(#25)	(#25)	(#25)	(#25)	(#20)	(#22)
DC Volts (ranges)	± 11 V ±100 mV	± 11 V ±100 mV	± 11 V ±100 mV	± 11 V ±100 mV ± 10 mV	± 11 V ± 1 V ±100 mV	±311 V ± 31 V ± 3 V ±300 mV	±1111V 111V 11V 100mV
Resolution (1 ppm)	100 μV 1 μV	10 μV 0.1 μV	10 μV 0.1 μV	10 μV 100 nV 10 nV	10 μV 1 μV 100 nV	100 μV 10 μV 1 μV 0.1 μV	100 μV 10 μV 1 μV 0.1 μV
I_{out}	75 mA	50 mA	50 mA	50 mA	50 mA	100 mA	50 mA
Accuracy	±0.005% of setting	±0.003% of setting	±0.003% of setting	±0.003% of setting	±0.003% of setting	±0.002% of setting	±0.003% of setting
Price	$695	$995	$1035	$1150	$1150	$1550	$1995

Option: DIFFERENTIAL VOLTMETER (ΔVM) OPTION "G" (Bulletin 26)

Available in all "MV" models. (Not available in 330 or E100)

For potentiometric and differential measurements: from 0.5μV to 1000 V dc.

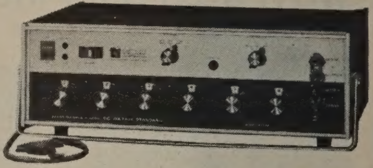
Accuracies: from ±0.005% to ±0.002%. Factory installed. Price: $255

BATTERY/EXTERNAL POWERED DC VOLTAGE STANDARD/SOURCE – MODEL MV 216 A (Bulletin 24)

Internal, re-chargeable battery operation and 117 Vac, 12 Vdc and 24 Vdc external power. Absolute isolation from line. High voltage accuracy and stability. Compliance current. Very low source impedance.

Ranges (dc)	10V	1V	100mV
Resolution (1ppm)	10μV	1μV	100NV
I out	10mA		
Accuracy	0.003% of setting		

Z_{out}	0.01Ω	0.001Ω	20Ω
Power	Internal re-chargeable Batteries also 117 Vac, 12V and 24 Vdc		
Price	$1450		

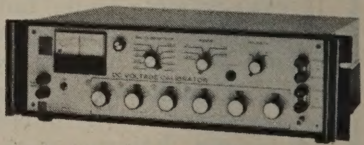


DIFFERENTIAL VOLTMETER (ΔVM) AND CALIBRATOR – MODEL 2902 (Bulletin 21)

The model 2902 is a high accuracy ΔVM for potentiometric and differential DC voltage measurements. Also, it is a highly stable and accurate reference/source/standard.

	MEASURE MODE
Ranges	1000V, 100V, 10V, 1V, 100mVdc
Sensitivity	1000V, 100V, 10V, 1V, 100mV, 10mV, 1mV, 100μV, 10μV
Maximum sensitivity	0.5μV/division
Z_{in}	∞ At null; 10 MΩ off null.
Accuracy	±0.002% of setting.

	OUTPUT MODE
Ranges	100V, 10V, 1V, 100mVdc
Resolution	100μV, 10μV, 1μV, 100NV
Stability	±0.0005%
Current	50 to 100mA
Accuracy	0.002% of setting
Price	$1695



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10 AMP CURRENT CALIBRATOR (Source) AC and DC Amperes, Auxiliary Instrument, Model 3200 (See Bulletin 27)

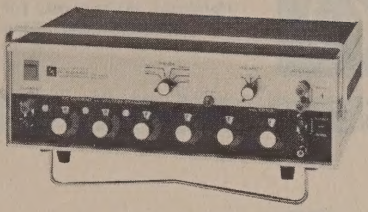
This auxiliary instrument operates from the output of a stable, accurate AC or DC Voltage Calibrator, such as: EDC Model MV 105 J (for d.c.), and EDC Model AC 1000 D/B (for a.c.).

Ranges (ac & dc)	10 A, 1 A, 100 mA, 10 mA, and 1 mA
Accuracy: (dc)	±(0.025% of setting + 0.0025% of range)
(ac)	±(0.035% of setting + 0.0035% of range)
Voltage Compliance	2V (min) to 5V (max).
Price	$1350.00

DC CURRENT AND VOLTAGE STANDARD — MODEL CR 103 J (Bulletin 31)

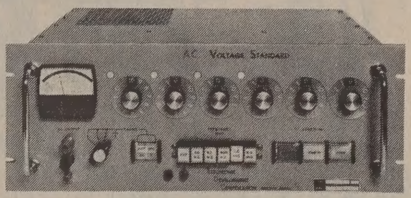
Short-circuit and open-circuit protected. 30 second warm-up. Automatic zero.

	Current Mode	Voltage Mode
DC Ranges	±110 mA	±11 V
	± 11 mA	±1V
		±110 mV
Resolution	100 nA	10 μV
(1 ppm)	10 nA	1 μV
		0.1 μV
Compliance	100 V	50 mA
Accuracy	±0.005% of setting	±0.003% of setting



Price $1595

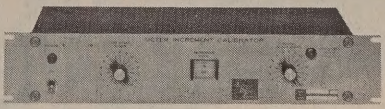
AC VOLTAGE STANDARD — MODEL AC 1000 D/B (Bulletin 41)



Completely solid state. Highly stable. 60 second warm-up. Low output impedance.

Vac rms ranges	1000 V, 1 V, 100 mV, 10 mV
Accuracy	0.025%
Burden	50 VA (2A max.)
Frequency Range	50 Hz to 5 kHz

5 internal frequencies 50 Hz, 60 Hz, 400 Hz, 1 kHz plus optional frequency and unlimited number of frequencies attained by use of external oscillator via front panel terminals.



Distortion	.5%
Weight	45 lbs.
Price	$3990

Option Model IC-15 — Meter increment calibration — Bulletin 42

DIGITALLY PROGRAMMABLE STANDARD MODEL 501 J (Bulletins 51 through 55)

Switching and settling time: 50 μs

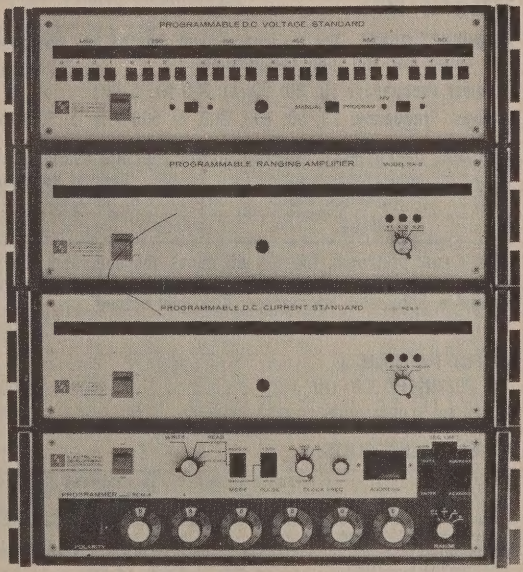
Formats: BCD, ASCII, BINARY, or IEEE 488

Certification N B S traceability

Complete specifications: Bulletins 51, 52, 53, 54, 55

Complete Prices: Bulletin 6

	MAIN FRAME Model (501 J) See Bulletin 51	100 mV RANGE Option: D See Bulletin 51	AMPLIFIER RA-3 See Bulletin 54	DC CURRENT PCS-1 See Bulletin 53
Output d.c.	10.0000 Vdc	100.000 mV	100 & 200 V	10 & 100 mA
Resolution	100μV (10ppm)	1μV(10ppm)	1 & 2mV(10ppm)	0.1 & 100 mA
w/Opt. B	10μV(1ppm)	0.1μV(1ppm)	100 & 200μV	0.01 & 0.1μA
Accuracy	±0.005%	±0.005%	±0.01%	0.01%
Noise	0.0005%	0.0005%	0.0005%	0.0005%
Compliance	50mA	in to 400Ω load	15mA	100V
Prices	$1595	$175	$895	$1350


PROGRAMMABLE D.C. VOLTAGE STANDARD
PROGRAMMABLE RANGING AMPLIFIER
PROGRAMMABLE D.C. CURRENT STANDARD
PROGRAMMER

OPTIONS (Factory installed) (See Bulletin 51).

B— **Additional Resolution** — (see "Resolution, w/Opt. B" above).
C— **Ready Signal** — output signal indicating "ready" state.
D— **100mV Range** — (See "100mV Range" above) (See Opt. D, above).
J — **Bipolar Operation** — Programmable polarity control.
L— **Binary format** — Accepts straight binary program.

ACCESSORIES (May be field installed) (See Bulletin 51).

MR-1 Memory register or buffer storage.
MR-2 Serial-to-parallel converter, w/storage.
AK-1 Negative programming logic.
AM-1 Front panel display and control (for BCD).
AM-2 Front panel display and control (for BINARY).
IS-40 Opto-Isolation.
KT-488 IEEE 488 interface (Kit) See Bulletins 51 & 55.)

AUXILIARY INSTRUMENTS

Separate chassis, plug-in to main frame. No modifications

RCM-4 **Programmer.** (See Bulletin 52) Manually programmed. Automatically sequenced. Up to 40 addresses. Selectable triggering: Manual, automatic or external. Price:
PCS-1 **Programmable DC Current.** (See above) (See Bulletin 53)
RA-3 **Programmable Amplifier.** (See above) (See Bulletin 54)

Electronic Development Corp. 11 Hamlin Street, Boston, MA 02127 (617) 268-9696

All EDC instruments are traceable to the U.S. National Bureau of Standards. Certification supplied with each instrument / All instruments are available under GSA Contact / Export prices slightly higher / Line (Mains) power: 115 Vac. 60 or 400 Hz: or 220 Vac. 50 Hz / Instruments available for no-charge evaluation. Contact your local sales representative or the main plant.

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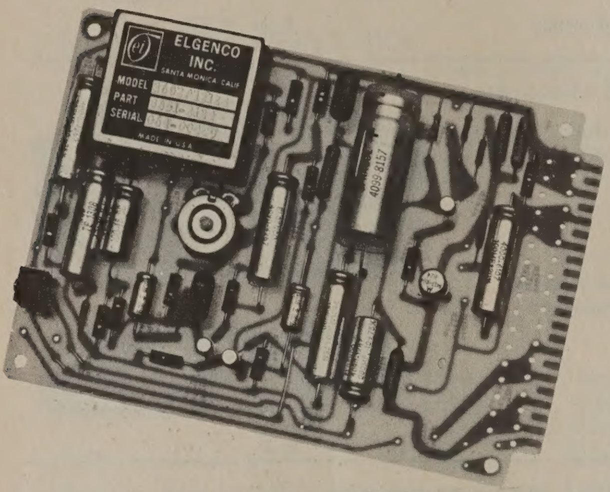
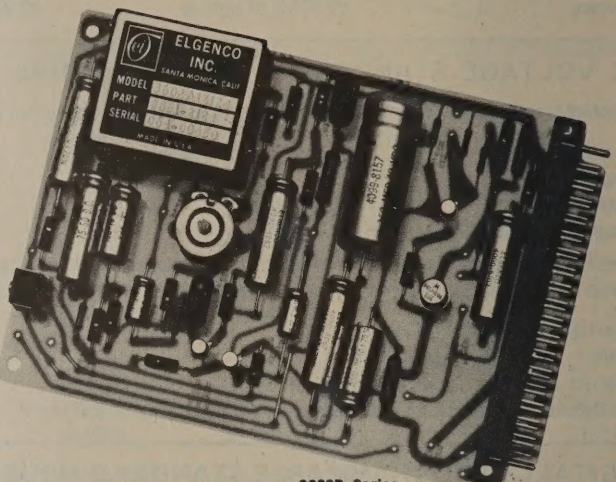
statistical instruments for industry
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

SERIES 3600 FIXED RANGE • NOISE GENERATOR CARDS



3600A Series



3600B Series

SPECIFICATIONS

FREQUENCY RANGE: The frequency band may be any combination of the listed low and high frequencies.

Lower Frequency: 10, 20, 50, or 200 Hz, 5 kHz.

Upper Frequency: 20, 50, 100, 200, or 500 kHz; 1, 2, 3, or 5 mHz.

SPECTRAL UNIFORMITY: Spectral uniformities are available as:

Upper Frequency	Spectral Uniformity
20 kHz to 500 kHz	±0.5, ±1.0, ±2.0 or ±3.0db
1 mHz to 3 mHz	±1.0, ±2.0, or ±3.0db
5 mHz	±2.0 or ±3.0db

As a rule of thumb, the roll off above the specified upper frequency gives a 3db point about twice the specified upper frequency. Roll off above 3db point approaches 12db per octave.

OUTPUT IMPEDANCE:

20 kHz to 500 kHz units ....600 ohms
1 to 5 mHz units ....200 ohms

POWER REQUIREMENTS:

	3600A Series or 3600B Series	Low Current Option 3600A or 3600B	3600C Series
Power supply voltage required	−30 VDC ±1%	−30 VDC ±1%	−24 VDC ±1%
Approximate current..	50 ma	30 ma	37 ma
Output level	0 to 3.0 VRMS	0 to 1.5 VRMS	0 to 2.2 VRMS

Note: The 3600B series units are the same as the 3600A series except the 3600B series have a test point and Elco 00-7023-035-000-001 connector mounted on the PCB.

The 3600A and 3600C units mate with a Cinch 250-22-30-170, Elco 00-6007-022-940-022 connector or equivalent.

SPECIFICATIONS COMMON TO ALL UNITS:

Amplitude Probability Distribution: Gaussian.

Peak to RMS Capability: Minimum dynamic ranges 3.5 to 1 at specified maximum level. Increases with lower output levels.

Maximum Load: 900 ohms minus output impedance.

Operating Temperature Range: 0 to 50°C.

Size: 4½ x 6½ x ⅞ inches.

Weight: 7 oz.

PRICING: (See price list on facing page)

Base Price: 3600A, 3600C and 3600A or C with reduced current option (specify on order).

Base price plus $20.00: 3600B or 3600B with reduced current option (specify on order).

OPTIONS:

Other than specified frequency; add $10.00 each per frequency per board.

Steel shield plate, ¼-inch off conductor side of PCB; add $7.50 each.

Other than specified output impedance; add $5.00 each.

To operate on other power supply voltages, voltage difference must be 30-volts for 3600A or 3600B and 24-volts for 3600C. Specify on order; "Decoupled option for operation on ____________ power supply," and add to price as:

Quantity Per Order	Add Each	Quantity Per Order	Add Each
1	$15.00	25-49	$2.50
2	10.00	50-99	2.00
3	7.50	100-249	1.95
4	6.00	250-499	1.90
5-9	5.00	500 up	1.85

DISCOUNT: Quantity discounts apply as:

Quantity	Discount	Quality	Discount
1-4	List	20-49	13%
5-9	5%	50-99	17%
10-19	10%	100	20%

MODEL 3609A POWER SUPPLY CARD

Size: 4½″ x 6½″ x 2$\frac{1}{16}$″.

Input: 115/230 volts ± 10/20 volts, 50 to 1000 Hz.

Supplies power for up to 2 noise generator cards or up to 4 noise generator cards with reduced current option. Price: **$95.00**

MATING CONNECTOR: Mating Elco Connector; Elgenco, Inc. part numbers 7521-1122, for 3600A, 3600C and 3609A is available at $7.85 each.

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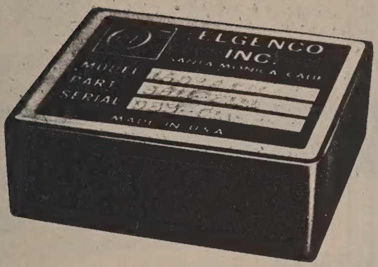
SERIES 1600 • ENCAPSULATED NOISE SOURCE MODULES • 10Hz TO 5MHz



SPECIFICATIONS IN RECOMMENDED CIRCUIT:

The 1600 series provide a low level wide band output. A portion of this wide band is specified to a certain flatness; uniformity. The 3 or 5 millivolt output is for the whole band extending to 5 mHz. Specifications are for 25°C unless specified otherwise.

SPECTRAL DENSITY UNIFORMITY: Available with uniformity to ±½db, ±1db, ±2db, or ±3db and many frequency ranges within 10 Hz to 5 mHz. See price list for complete list of standards.

SPECTRAL DENSITY: Approximately 2 μv/√ Hz .

RMS OUTPUT LEVEL: 1602A series 3 mv; 1603A, 1606A, and 1607A series 5 mv.

OUTPUT IMPEDANCE: Approx 20 ohms.

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian.

OPERATING TEMPERATURE RANGE: 0 to 50°C.

POWER REQUIREMENTS: −30 volts dc ±1% at approximately 3.5 ma. **Note:** external passive components are required to properly install unit.

MOUNTING: .032″ Printed Circuit Leads.

Size: 11/16″ H x 1 53/64″ W x 1 37/64″ D.

WEIGHT: Approx 1.5 oz.

SERIES 3600/1600 PRICES

Frequency Band	Flatness	SERIES 3600 CARDS		SERIES 1600 MODULES	
		Model No.	Price	Model No.	Price
200 Hz to 20 kHz	±½db	3606A-52224	$349.00	1606A-52224	$290.00
50 Hz to 20 kHz	±½db	-55124	$359.00	-55124	$300.00
20 Hz to 20 kHz	±½db	-52124	$379.00	-52124	$320.00
10 Hz to 20 kHz	±½db	-51124	$414.00	-51124	$340.00
200 Hz to 50 kHz	±½db	3606A-52254	$369.00	1606A-52254	$310.00
50 Hz to 50 kHz	±½db	55154	$379.00	-55154	$320.00
20 Hz to 50 kHz	±½db	-52154	$399.00	-52154	$340.00
10 Hz to 50 kHz	±½db	-51154	$434.00	-51154	$365.00
200 Hz to 100 kHz	±½db	3606A-52215	$389.00	1606A-52215	$330.00
50 Hz to 100 kHz	±½db	-55115	$414.00	-55115	$355.00
20 Hz to 100 kHz	±½db	-52115	$419.00	-52115	$360.00
10 Hz to 100 kHz	±½db	-51115	$454.00	-51115	$385.00
200 Hz to 200 kHz	±½db	3606A-52225	$404.00	1606A-52225	$345.00
50 Hz to 200 kHz	±½db	-55125	$404.00	-55125	$355.00
20 Hz to 200 kHz	±½db	-52125	$434.00	-52125	$375.00
10 Hz to 200 kHz	±½db	-51125	$469.00	-51125	$395.00
200 Hz to 500 kHz	±½db	3606A-52255	$424.00	1606A-52255	$365.00
50 Hz to 500 kHz	±½db	-55155	$434.00	-55155	$375.00
20 Hz to 500 kHz	±½db	-52155	$454.00	-52155	$395.00
10 Hz to 500 kHz	±½db	-51155	$489.00	-51155	$420.00
200 Hz to 20 kHz	±1db	3602A-12224	$224.00	1602A-12224	$165.00
50 Hz to 20 kHz	±1db	-15124	$234.00	-15124	$175.00
20 Hz to 20 kHz	±1db	-12124	$254.00	-12124	$195.00
10 Hz to 20 kHz	±1db	-11124	$289.00	-11124	$220.00
200 Hz to 50 kHz	±1db	3602A-12254	$244.00	1602A-12254	$185.00
50 Hz to 50 kHz	±1db	-15154	$254.00	-15154	$195.00
20 Hz to 50 kHz	±1db	-12154	$274.00	-12154	$215.00
10 Hz to 50 kHz	±1db	-11154	$309.00	-11154	$240.00
200 Hz to 100 kHz	±1db	3603A-12215	$264.00	1603A-12215	$205.00
50 Hz to 100 kHz	±1db	-15115	$274.00	-15115	$215.00
20 Hz to 100 kHz	±1db	-12115	$284.00	-12115	$235.00
10 Hz to 100 kHz	±1db	-11115	$329.00	-11115	$260.00
200 Hz to 200 kHz	±1db	3603A-12225	$279.00	1603A-12225	$220.00
50 Hz to 200 kHz	±1db	-15125	$289.00	-15125	$230.00
20 Hz to 200 kHz	±1db	-12125	$309.00	-12125	$250.00
10 Hz to 200 kHz	±1db	-11125	$344.00	-11125	$275.00
200 Hz to 500 kHz	±1db	3603A-12255	$299.00	1603A-12255	$240.00
50 Hz to 500 kHz	±1db	-15155	$309.00	-15155	$250.00
20 Hz to 500 kHz	±1db	-12155	$329.00	-12155	$270.00
10 Hz to 500 kHz	±1db	-11155	$364.00	-11155	$295.00
200 Hz to 50 kHz	±2db	3602A-22254	$224.00	1602A-22254	$165.00
50 Hz to 50 kHz	±2db	-25154	$334.00	-25154	$175.00
20 Hz to 50 kHz	±2db	-22154	$254.00	-22154	$195.00
10 Hz to 50 kHz	±2db	-21154	$289.00	-21154	$220.00
200 Hz to 100 kHz	±2db	3602A-22215	$229.00	1602A-22215	$170.00
50 Hz to 100 kHz	±2db	-25115	$259.00	-25115	$200.00
20 Hz to 100 kHz	±2db	-22115	$259.00	-22115	$200.00
10 Hz to 100 kHz	±2db	-21115	$294.00	21115	$225.00
200 Hz to 200 kHz	±2db	3602A-22225	$249.00	1602A-22225	$190.00
50 Hz to 200 kHz	±2db	-25125	$259.00	-25125	$200.00
20 Hz to 200 kHz	±2db	-22125	$279.00	-22125	$220.00
10 Hz to 200 kHz	±2db	-21125	$314.00	-21125	$245.00
200 Hz to 500 kHz	±2db	3602A-22255	$264.00	1602A-22255	$205.00
50 Hz to 500 kHz	±2db	-25155	$274.00	-25155	$215.00
20 Hz to 500 kHz	±2db	-22155	$294.00	-22155	$235.00
10 Hz to 500 kHz	±2db	-21155	$334.00	-21155	$260.00
200 Hz to 500 kHz	±3db	3602A-32255	$224.00	1602A-32255	$165.00
50 Hz to 500 kHz	±3db	-35155	$234.00	-35155	$175.00
20 Hz to 500 kHz	±3db	-32155	$264.00	-32155	$195.00
10 Hz to 500 kHz	±3db	-31155	$289.00	-31155	$220.00
5 kHz to 1 mHz	±1db	3607A-15316	$415.00	1607A-15316	$346.00
5 kHz to 2 mHz	±1db	-15326	$505.00	-15326	$436.00
5 kHz to 3 mHz	±1db	-15336	$605.00	-15336	$536.00
5 kHz to 1 mHz	±2db	3607A-25316	$325.00	1607A-25316	$256.00
5 kHz to 2 mHz	±2db	-25326	$400.00	-25326	$331.00
5 kHz to 3 mHz	±2db	-25336	$480.00	-25336	$411.00
5 kHz to 5 mHz	±2db	-25356	$640.00	-25356	$571.00
5 kHz to 1 mHz	±3db	3607A-35316	$265.00	1607A-35316	$196.00
5 kHz to 2 mHz	±3db	-35326	$325.00	-35326	$256.00
5 kHz to 3 mHz	±3db	-35336	$395.00	-35336	$326.00
5 kHz to 5 mHz	±3db	-35356	$530.00	-35356	$461.00

NOTE: A SERIES TO OPERATE ON −30VDC
C SERIES TO OPERATE ON −24VDC, PRICE SAME AS (A) SERIES
TO EXTEND 3607A LOW FREQUENCY ADD AS FOLLOWS:

200 Hz add $30.00	20 Hz add $60.00
50 Hz add $40.00	10 Hz add $95.00

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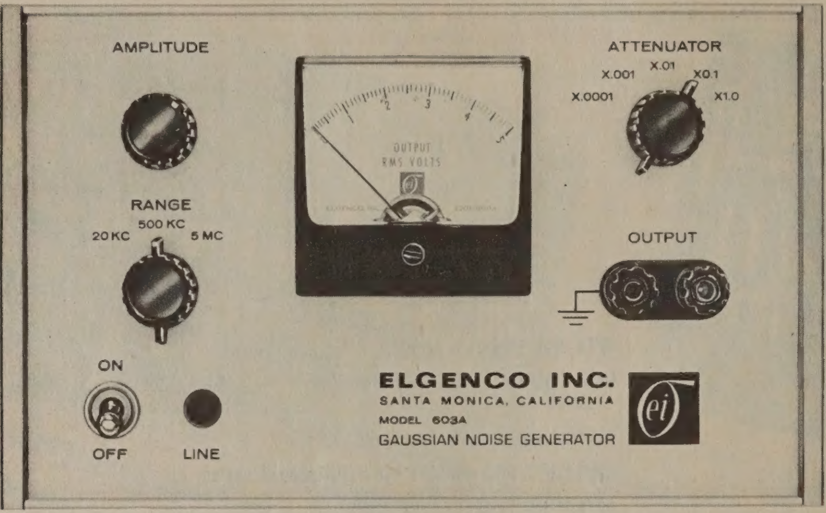
MODELS 602A-200/602A-1390/603A • ALL SOLID STATE NOISE GENERATORS 5 Hz TO 5 MHz



ELGENCO INC.
GAUSSIAN NOISE GENERATOR

SPECIFICATIONS:

These specs are unique to the Series 602A-200, 602A-1390, 603A introduced on this page.

FREQUENCY RANGES: 5 Hz to 20 kHz, 5 Hz to 500 kHz, 5 Hz to 5 mHz.

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian.

OUTPUT SPECTRUM:

Accuracy	602A-1390	602A-200	603A
20 Hz to 20 kHz	±1 db	±1 db	—
20 Hz to 500 kHz	±3 db	±2.5 db	—
500 kHz to 5 mHz	±8 db	±5 db	—
10 Hz to 500 kHz	—	—	±1 db
500 kHz to 5 mHz	—	—	±3 db

RMS OUTPUT LEVEL: (Minimum value of maximum open circuit output).

20 kHz range	3 volts	3 volts	3 volts
500 kHz range	2 volts	2.5 volts	3 volts
5 mHz range	1 volt	2.0 volts	3 volts

OUTPUT IMPEDANCE:

	900 ohms ±10%	200 ohms ±10%	200 ohms ±10%

MAXIMUM LOAD: (on direct output)

	no limit	700 ohms	700 ohms

OUTPUT STEP ATTENUATOR: Five positions: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit. Accuracy:

to 100 kHz	±3%	±3%	—
to 500 kHz	—	—	±3%
to 5 mHz	±10%	±10%	±5%
Output Impedance	200 ohms —	200 ohms ±1%	200 ohms ±1%

SPECTRAL DENSITY: Approximate spectral density (mv √ Hz) for 1 volt RMS output.

20 kHz band	5.0	5.0	5.0
500 kHz band	1.2	1.2	1.2
5 mHz band	0.6	0.4	0.4

PRICE

	$605.00	$730.00	$905.00

SPECIFICATIONS • ALSO COMMON TO SERIES 624A

These specs are common to the Series 602A-200, 602A-1390, 603A introduced on this page and the Series 624A on facing page.

DYNAMIC RANGE: 3.5 to 1 peak to RMS at 3 volts RMS open circuit; 5 to 1 at 2.1 volts RMS. Dynamic range is inversly proportional to output level as set by front panel amplitude control.

OUTPUT METER: Rectifier type meter circuit reads proportional to average value, calibrated to read RMS value of Gaussian Noise; 0-5 volts RMS scale.

OPERATING TEMPERATURE RANGE: 0 to 50°C.

POWER SUPPLY: Built-in highly regulated dc supply.

POWER REQUIREMENTS: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac; approximately 5 watts. A rechargeable battery option is available. Battery is recharged by operating unit on ac line.

DIMENSIONS: 5¼″ high x 8⅝″ wide x 11″ deep.

RACK MOUNT: A rack mounting adapter kit is available for rack mounting two units side by side. Also available is a rack mounting adapter kit for rack mounting one unit. One or two units use 5¼″ x 19″ of rack panel space with adapter kit. Full rack width cabinet option for one unit is available. Size of unit with this option is 5¼″ high x 17″ wide x 11″ deep and comes with rack mounting hardware.

SHIPPING WEIGHT: Approximately 12 lbs.

OPTIONS AVAILABLE: Full rack width cabinet with mounting hardware option; rechargeable battery option; BNC output terminal on rear panel option.

ACCESSORIES AVAILABLE: Dual adapter kit and rack mounting hardware; single unit adapter kit with rack mounting hardware and front and rear dummy panels; rechargeable battery adapter kit.

OPTIONS & ACCESSORIES FOR MODELS 602A/603A/610A & SERIES 624A

Adapter kit, single unit rack mounting (mounts one unit in rack, includes blank panel to make dual unit) Part No. 8804-0002	$110.00
Adapter kit, dual unit and rack mounting hardware (mounts two units side by side) Part No. 8804-0001	$20.00
Full rack width cabinet and rack mounting hardware option	add $85.00
Pink filters, Part No. 8890-0015	$78.00
Rechargeable battery option	add $315.00
Rechargeable battery kit	$325.00

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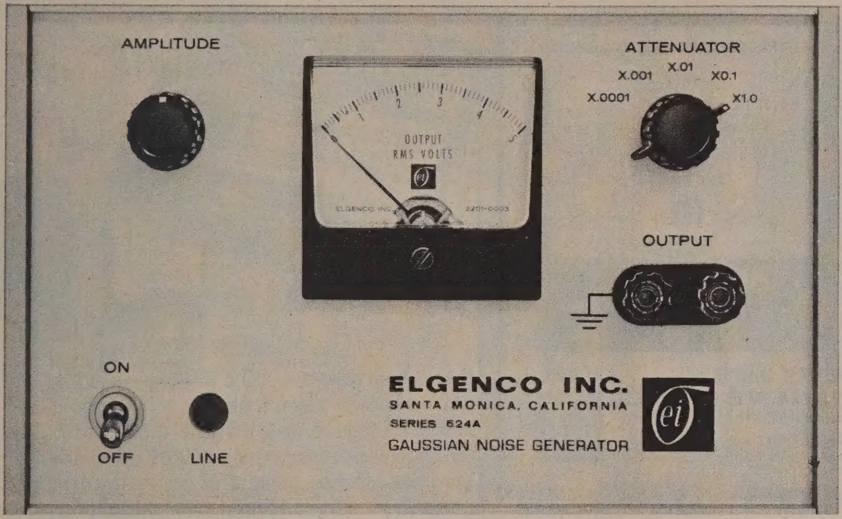
SERIES 624A FIXED RANGE • ALL SOLID STATE NOISE GENERATORS



SPECIFICATIONS • ALSO SEE FACING PAGE

FREQUENCY RANGES: See price list for a partial list of frequency ranges available.

RMS OUTPUT LEVEL: (Minimum value of maximum open circuit output) 3 volts.

OUTPUT IMPEDANCE: 200 ohms ±10%.

MAXIMUM LOAD: (on direct output) 700 ohms.

OUTPUT STEP ATTENUATOR: Five positions: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.

Accuracy: ±3%
Output Impedance: 200 ohms

SPECTRAL DENSITY: Approximate spectral density (mv$\sqrt{\text{Hz}}$) for 1 volt RMS output.

Accuracy	mv	Accuracy	mv
20 kHz band	5.0	200 kHz band	1.6
50 kHz band	3.1	500 kHz band	1.0
100 kHz band	2.2		

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian.

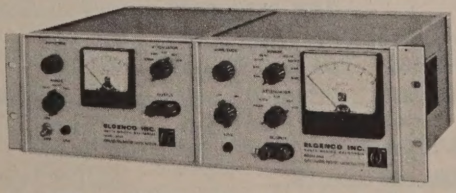
SPECIFICATIONS FOR SERIES 624A

624A-11124	10 Hz to 20 kHz, ±1db	$660.00
-12124	20 Hz to 20 kHz, ±1db	$615.00
-15124	50 Hz to 20 kHz, ±1db	$605.00
-12224	200 Hz to 20 kHz, ±1db	$595.00
624A-11154	10 Hz to 50 kHz, ±1db	$680.00
-12154	20 Hz to 50 kHz, ±1db	$645.00
-15154	50 Hz to 50 kHz, ±1db	$625.00
-12254	200 Hz to 50 kHz, ±1db	$615.00
624A-11115	10 Hz to 100 kHz, ±1db	$700.00
-12115	20 Hz to 100 kHz, ±1db	$665.00
-15115	50 Hz to 100 kHz, ±1db	$645.00
-12215	200 Hz to 100 kHz, ±1db	$635.00
624A-11125	10 Hz to 200 kHz, ±1db	$750.00
-12125	20 Hz to 200 kHz, ±1db	$715.00
-15125	50 Hz to 200 kHz, ±1db	$695.00
-12225	200 Hz to 200 kHz, ±1db	$685.00

SPECIFICATIONS FOR SERIES 624A (Cont'd)

624A-11155	10 Hz to 500 kHz, ±1db	$770.00
-12155	20 Hz to 500 kHz, ±1db	$735.00
-15155	50 Hz to 500 kHz, ±1db	$715.00
-12255	200 Hz to 500 kHz, ±1db	$705.00
624A-21154	10 Hz to 50 kHz, ±2db	$660.00
-22154	20 Hz to 50 kHz, ±2db	$625.00
-25154	50 Hz to 50 kHz, ±2db	$605.00
-22254	200 Hz to 50 kHz, ±2db	$695.00
624A-21115	10 Hz to 100 kHz, ±2db	$665.00
-22115	20 Hz to 100 kHz, ±2db	$630.00
-25115	50 Hz to 100 kHz, ±2db	$610.00
-22215	200 Hz to 100 kHz, ±2db	$600.00
624A-21125	10 Hz to 200 kHz, ±2db	$680.00
-22125	20 Hz to 200 kHz, ±2db	$650.00
-25125	50 Hz to 200 kHz, ±2db	$630.00
-22225	200 Hz to 200 kHz, ±2db	$620.00
624A-21155	10 Hz to 500 kHz, ±2db	$700.00
-22155	20 Hz to 500 kHz, ±2db	$665.00
-25155	50 Hz to 500 kHz, ±2db	$645.00
-22255	200 Hz to 500 kHz, ±2db	$635.00
624A-31155	10 Hz to 500 kHz, ±3db	$660.00
-32155	20 Hz to 500 kHz, ±3db	$625.00
-35155	50 Hz to 500 kHz, ±3db	$605.00
-32255	200 Hz to 500 kHz, ±3db	$595.00
624A-51124	10 Hz to 20 kHz, ±½db	$785.00
-52124	20 Hz to 20 kHz, ±½db	$750.00
-55124	50 Hz to 20 kHz, ±½db	$730.00
-52224	200 Hz to 20 kHz, ±½db	$720.00
624A-51154	10 Hz to 50 kHz, ±½db	$800.00
-52154	20 Hz to 50 kHz, ±½db	$750.00
-55154	50 Hz to 50 kHz, ±½db	$730.00
-52254	200 Hz to 50 kHz, ±½db	$720.00
624A-51115	10 Hz to 100 kHz, ±½db	$825.00
-52115	20 Hz to 100 kHz, ±½db	$790.00
-55115	50 Hz to 100 kHz, ±½db	$770.00
-52215	200 Hz to 100 kHz, ±½db	$760.00
624A-51125	10 Hz to 200 kHz, ±½db	$875.00
-52125	20 Hz to 200 kHz, ±½db	$840.00
-55125	50 Hz to 200 kHz, ±½db	$820.00
-52225	200 Hz to 200 kHz, ±½db	$810.00
624A-51155	10 Hz to 500 kHz, ±½db	$895.00
-52155	20 Hz to 500 kHz, ±½db	$860.00
-55155	50 Hz to 500 kHz, ±½db	$840.00
-52255	200 Hz to 500 kHz, ±½db	$830.00

Model 602A with full rack width mounting option



Models 602A and 610A combined by dual unit adapter kit.

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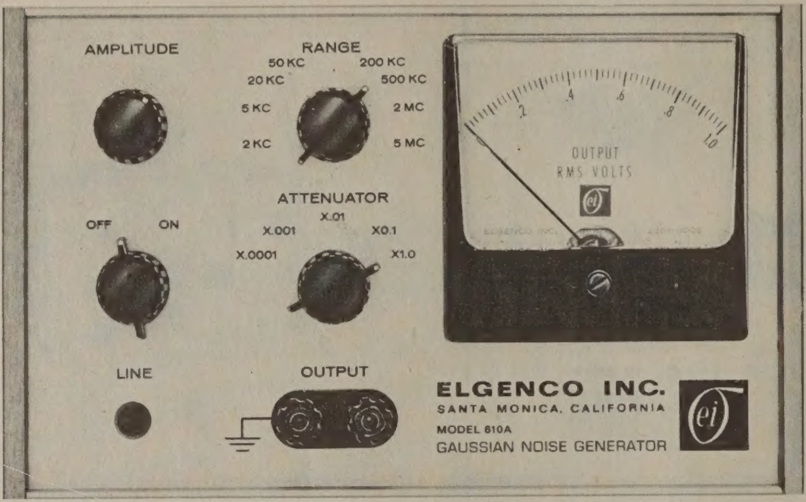
MODEL 610A • ALL SOLID STATE NOISE GENERATOR • 5Hz TO 5MHz



SPECIFICATIONS

FREQUENCY RANGES: Eight ranges selectably by front panel switch; 5 Hz to 2 kHz, 5 Hz to 5 kHz, 5 Hz to 20 kHz, 5 Hz to 50 kHz, 5 Hz to 200 kHz, 5 Hz to 500 kHz, 5 Hz to 2 mHz, and 5 Hz to 5 mHz.

OUTPUT SPECTRUM: Uniform to ±0.5 db from 10 Hz to 500 kHz and ±2.0 db from 500 kHz to 5 mHz.

OUTPUT LEVEL: 0 to 1 volt RMS, adjustable by front panel amplitude control. A dynamic range of 5 to 1 peak to RMS value is provided.

OUTPUT STEP ATTENUATOR: Five positions; X1.0, X0.1, X.01, X.001, X.0001. Accuracy ±0.1 db to 500 kHz; ±0.25 db to 5 mHz.

SPECTRAL DENSITY: Approximate spectral density for 1 volt RMS output.

Band	volts/√ Hz	Band	volts/√ Hz
2 kHz	1.75×10^{-2}	200 kHz	1.75×10^{-3}
5 kHz	1.1×10^{-2}	500 kHz	1.1×10^{-3}
20 kHz	5.5×10^{-3}	2 mHz	5.5×10^{-4}
50 kHz	3.5×10^{-3}	5 mHz	3×10^{-4}

AMPLITUDE PROBABILITY DISTRIBUTION: Symmetrical Gaussian Distribution all ranges.

OUTPUT METER: Meter reads 0 to 1 volt RMS. Accuracy ±2% of full scale to 2 mHz; ±5% to 5 mHz.

MAXIMUM LOAD: 500 ohms on direct output.

OUTPUT IMPEDANCE: Approximately 50 ohms direct output. Step attenuated output 50 ohms ±1%.

POWER SUPPLY: Built-in highly regulated dc supply.

POWER REQUIREMENTS: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac; approximately 7 watts. A rechargeable power option is available. Battery is recharged by operating unit on ac line.

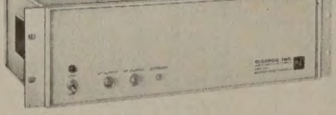
DIMENSIONS: 5¼″ high x 8⅝″ wide x 11″ deep.

RACK MOUNT: A rack mounting adapter kit is available for rack mounting two units side by side. Also available is a rack mounting adapter kit for rack mounting one unit. One or two units use 5¼″ x 19″ of rack panel space with adapter kit. Full rack width cabinet option for one unit is available. Size of unit with this option is 5¼″ high x 17″ wide x 11″ deep and comes with rack mounting hardware.

SHIPPING WEIGHT: Approximately 14 lbs.

PRICE: $1,775.00

MODELS 632A/631A • ALL SOLID STATE NOISE GENERATOR



Model 632A Dual Output DC to 400 Hz and 5 Hz to 40 kHz.. **$3,595**

LOW FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±1.0%.

OUTPUT SPECTRUM: Uniform ±0.1 db from DC to 350 Hz.

MAXIMUM OUTPUT: 1.0 volts rms. A dynamic range of 5 to 1 peak to rms value is provided.

MAXIMUM SPECTRAL DENSITY: Approx. 1.5×10^{-3} volts^2/Hz.

OUTPUT MEAN: Less than 5 mv.

OUTPUT IMPEDANCE: Approximately 1,000 ohms.

HIGH FREQUENCY OUTPUT

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian ±2%.

OUTPUT SPECTRUM: Uniform ±0.5 db from 10 to 35,000 Hz.

MAXIMUM OUTPUT: 1.0 volts rms. A dynamic range of 5 to 1 peak to rms values is provided.

MAXIMUM SPECTRAL DENSITY: Approx. 2×10^{-5} volts^2/Hz.

OUTPUT MEAN: Less than 1 mv.

OUTPUT IMPEDANCE: Approximately 100 ohms.

NOISE REGULATOR: rms output level continuously stabilized against a reference voltage.

OVERLOAD INDICATOR: Panel overload indicator lights when input noise level to regulator is out of regulation range.

POWER: 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.

DIMENSIONS: 5¼″ high x 17″ wide x 11″ deep. 19″ wide with rack mounting flanges mounted (supplied).

Model 631A 5 Hz to 40 kHz **$2,295**

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SERIES 1800 • NOISE SOURCE MODULES • 10KHz TO 100MHz

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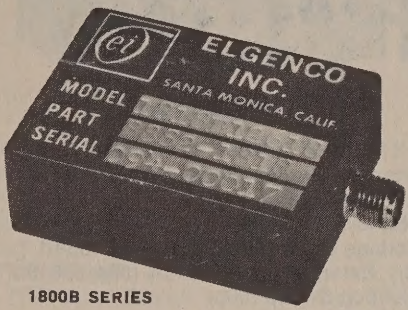
MODEL
PART
SERIAL

1800A SERIES



1800B SERIES

SPECIFICATIONS

The 1800 Series provides a low level wide band output. A portion of this band is specified to a certain flatness; uniformity. The approximate 6 mv open circuit output is for the whole band. The 1800B Series modules are the same as the 1800A series except the output is via a SMA connector. Specifications are for 25°C unless specified otherwise.

SPECTRAL DENSITY UNIFORMITY: Available with uniformity of ±0.5 db, ±1 db, ±2 db, ±3 db and ±4 db for many frequency ranges between lower frequencies of 10 kHz and 2 mHz and upper frequencies of 20 mHz, 30 mHz, 45 mHz, 50 mHz, 70 mHz, 80 mHz and 100 mHz.

SPECTRAL DENSITY: Approximately 0.3 μV per root Hz into 50 ohms.

RMS OUTPUT LEVEL: Approximately 3 mv rms into 50 ohms; 6 mv rms open circuit.

OUTPUT IMPEDANCE: Approximately 50 ohms.

AMPLITUDE PROBABILITY DISTRIBUTION: Gaussian.

OPERATING TEMPERATURE RANGE: 0 to 50°C.

POWER REQUIREMENTS: Model 1815, −15 VDC; Model 1818, −18 VDC; Model 1820, −20 VDC; Model 1822, −22 VDC; Model 1824, −24 VDC (well regulated power is required); current approximately 25 ma. Note: No external components are needed to properly install unit.

MOUNTING: .032″ printed circuit leads.

SIZE: 1.60 x 1.30 x 0.65 inches.

WEIGHT: Approximately 1 oz.

PRICING:

Base Price: 1818A.

Base Price plus $10.00: 1818B.

Base Price plus $20.00: 1815A, 1820A, 1822A and 1824A.

Base Price plus $30.00: 1815B, 1820B, 1822B and 1824B.

SERIES 1800 PRICES

Model No.	Frequency Band	Price
1818A-31427	10 kHz to 20 mHz, ±3 db	$209.00
-21427	10 kHz to 20 mHz, ±2 db	$239.00
-11427	10 kHz to 20 mHz, ±1 db	$349.00
-51427	10 kHz to 20 mHz, ±0.5 db	$469.00
1818A-31437	10 kHz to 30 mHz, ±3 db	$219.00
-21437	10 kHz to 30 mHz, ±2 db	$249.00
-11437	10 kHz to 30 mHz, ±1 db	$369.00
-51437	10 kHz to 30 mHz, ±0.5 db	$519.00
1818A-31447	10 kHz to 45 mHz, ±3 db	$249.00
-21447	10 kHz to 45 mHz, ±2 db	$299.00
-11447	10 kHz to 45 mHz, ±1 db	$469.00
-51447	10 kHz to 45 mHz, ±0.5 db	$649.00
1818A-31457	10 kHz to 50 mHz, ±3 db	$299.00
-21457	10 kHz to 50 mHz, ±2 db	$369.00
-11457	10 kHz to 50 mHz, ±1 db	$519.00
-51457	10 kHz to 50 mHz, ±0.5 db	$769.00
1818A-41477	10 kHz to 70 mHz, ±4 db	$299.00
-31477	10 kHz to 70 mHz, ±3 db	$319.00
-21477	10 kHz to 70 mHz, ±2 db	$389.00
-11477	10 kHz to 70 mHz, ±1 db	$569.00
1818A-41487	10 kHz to 80 mHz, ±4 db	$319.00
-31487	10 kHz to 80 mHz, ±3 db	$339.00
-21487	10 kHz to 80 mHz, ±2 db	$419.00
-11487	10 kHz to 80 mHz, ±1 db	$619.00
1818A-41418	10 kHz to 100 mHz, ±4 db	$349.00
-31418	10 kHz to 100 mHz, ±3 db	$369.00
-21418	10 kHz to 100 mHz, ±2 db	$469.00
-11418	10 kHz to 100 mHz, ±1 db*	$759.00

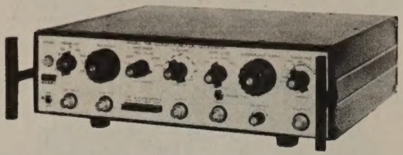
Note: 1815 Series not available in 80 mHz and 100 mHz units.

Model No.	Frequency Band	Price
1818A-32627	2 mHz to 20 mHz, ±3 db	$159.00
-22627	2 mHz to 20 mHz, ±2 db	$189.00
-12627	2 mHz to 20 mHz, ±1 db	$299.00
-52627	2 mHz to 20 mHz, ±0.5 db	$369.00
1818A-32637	2 mHz to 30 mHz, ±3 db	$169.00
-22637	2 mHz to 30 mHz, ±2 db	$199.00
-12637	2 mHz to 30 mHz, ±1 db	$319.00
-52637	2 mHz to 30 mHz, ±0.5 db	$419.00
1818A-32647	2 mHz to 45 mHz, ±3 db	$199.00
-22647	2 mHz to 45 mHz, ±2 db	$249.00
-12647	2 mHz to 45 mHz, ±1 db	$419.00
-52647	2 mHz to 45 mHz, ±0.5 db	$549.00
1818A-32657	2 mHz to 50 mHz, ±3 db	$249.00
-22657	2 mHz to 50 mHz, ±2 db	$319.00
-12657	2 mHz to 50 mHz, ±1 db	$469.00
-52657	2 mHz to 50 mHz, ±0.5 db	$669.00
1818A-42677	2 mHz to 70 mHz, ±4 db	$249.00
-32677	2 mHz to 70 mHz, ±3 db	$269.00
-22677	2 mHz to 70 mHz, ±2 db	$339.00
-12677	2 mHz to 70 mHz, ±1 db	$519.00
1818A-42687	2 mHz to 80 mHz, ±4 db	$269.00
-32687	2 mHz to 80 mHz, ±3 db	$289.00
-22687	2 mHz to 80 mHz, ±2 db	$369.00
-12687	2 mHz to 80 mHz, ±1 db	$569.00
1818A-42618	2 mHz to 100 mHz, ±4 db	$299.00
-32618	2 mHz to 100 mHz, ±3 db	$319.00
-22618	2 mHz to 100 mHz, ±2 db	$419.00
-12618	2 mHz to 100 mHz, ±1 db*	$709.00

*Available 1800B Series only.

EXACT ®

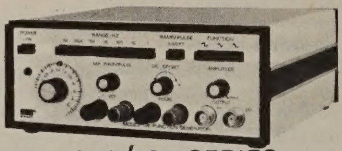
Function Generators



500 SERIES

LOW COST 5 MHz FUNCTION GENERATORS

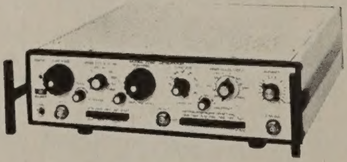
- Sine, Square, Triangle, Ramp, Pulse
- 0.01 Hz to 5 MHz (504, 506, 507)
- 0.0001 Hz to 5 MHz (508)
- VCF (Voltage Controlled Frequency) 1000:1 Manually, Externally or Internally (504, 506, 507)
- 100,000:1 Log Sweep (508)
- 20 Hz to 20 KHz Range
- 20V P-P Open Circuit, 10V P-P into 50 Ohms
- 30V P-P Open Circuit, 15V P-P-50 Ohms (508)
- Variable DC Offset, Variable Symmetry
- Gate and Trigger Modes
- Internal Sweep Generator 100 sec to 10 μ sec (506, 507, 508)
- Logarithmic Sweep Generator (507, 508)
- 80 db Attenuation, 10 db Steps, 20 db Variable
- Model 508 Uses 750 Series Frequency Dials



119/121 SERIES

FUNCTION GENERATORS

- Low Cost
- 0.2 Hz to 2.2 MHz Frequency Range
- VCF and AM Generators
- Sweep and Pulse Capability
- 600Ω and 50Ω Output Impedance
- Battery Powered Units
- 20 V P-P Open Circuit Output



7000 SERIES

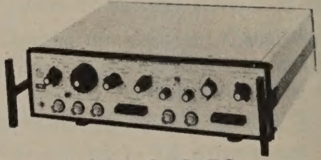
PRECISION 11 MHz FUNCTION GENERATORS

- 0.0001 Hz to 11 MHz Frequency Range
- Sine, Square, Triangle, Ramp, Pulse, ± Sine, ± Square, ± Triangle, ± Ramp, ± Pulse
- Voltage Controlled Frequency 1000:1
- Linear and Logarithmic Sweepers
- 80 db Attenuation, 10 db Steps, 20 db Variable
- AM (External Input) 360° Phase Lock (Model 7056)
- Variable DC Offset, Gate and Trigger Modes
- 30 V P-P Open Circuit 15 V P-P into 50 Ohms
- Ramp Hold, Variable Phase Start/Stop, Pulse and Burst Modes Featured on Some Models

510 SERIES

LOW COST 11 MHz FUNCTION GENERATORS

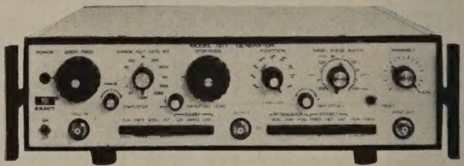
- Low Cost Instruments
- 0.1 to 11 MHz Frequency Range
- Sine, Square, Triangle, Ramp, Pulse
- VCF Generators
- Positive and Negative Ramp or Pulse Outputs
- Linear and Logarithmic Sweepers
- Select Start and Stop Frequency
- 80 db Attenuation, Variable DC Offset, Sync, Trigger
- 20 V P-P Open Circuit 10 V P-P Into 50 Ohms
- AM/FM Generator with 100% Modulation Source



120 SERIES

FUNCTION GENERATORS

- Low Cost and Precision Units
- 5 MHz Generators
- VCF Generators
- Dual Output Instruments
- Linear and Logarithmic Sweepers
- AM/FM Generator
- 20 V P-P Open Circuit 10 V P-P Into 50 Ohms
- Variable DC Offset



7200 SERIES

PRECISION 20 MHz FUNCTION GENERATORS

- 0.0001 Hz to 20 MHz Frequency Range
- Sine, Square, Triangle, Ramp, Pulse, ± Sine, ± Square, ± Triangle, ± Ramp, ± Pulse
- Voltage Controlled Frequency 1000:1
- Linear and Logarithmic Sweepers
- 80 db Attenuation, 10 db Steps, 20 db Variable
- Variable DC Offset
- 30 V P-P Open Circuit 15 V P-P Into 50 Ohms
- Gate and Triggered Mode, Triggered Sweep, Ramp Hold, Variable Phase Start/Stop, Pulse and Burst Modes Featured on Some Models

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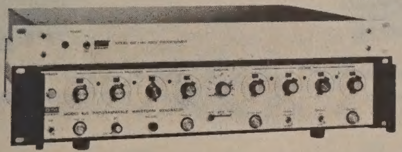
50 MHz Function Generators

NEW!!

750 SERIES

- .0001 Hz to 50 MHz
- Sine, Square, Triangle, Pulse, Ramp
- Start/Stop Frequency Dials Employing Radical New Design. Select Continuous Dial Linear or Log Mode, or High Resolution Dual Dial
- VCF (Voltage Controlled Frequency) 1000:1 Externally, Manually, or Internally with Ramp
- 30V P-P Open Circuit, 15V P-P into 50 Ohms
- Variable DC Offset, Variable Symmetry
- Gate and Trigger Modes
- 80 db Attenuation, 10 db Steps, 20 db Variable

Programmable Generators

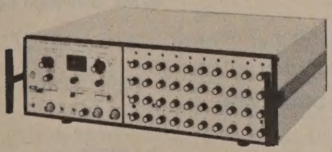


600 SERIES

PROGRAMMABLE FUNCTION GENERATORS

- 0.001 Hz to 1 MHz
- Front Panel or Remote Programming
- Sine, Square, Triangle, Ramp, Pulse
- 1 mV P-P to 9.99 V P-P Into 50 Ohms
- BCD Programming Standard
- 0.5 mSec Programming Time
- Voltage Controlled Frequency 1000:1
- 1.66 MHz and 15.99 V P-P (Remote Only)
- ASCII IEEE 488-1975 Interface Option

Waveform Synthesizers

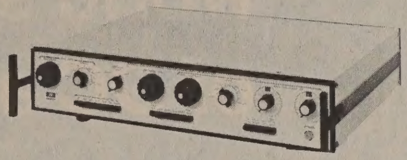


200 SERIES

COMPLEX WAVEFORM SYNTHESIZERS

- Plug-in Programmer (40 Knob or Srewdriver Adjustment)
- Digital and Analog Waveforms
- 40 Increments — Selectable
- 1 μSec to 1 Sec per Increment
- Variable Width and Variable Slope
- 20 V P-P Open Circuit, 10 V P-P Into 50 Ohms
- 60 db Attenuation, 20 db Steps, 20 db Variable
- Variable DC Offset, Gate and Trigger Modes

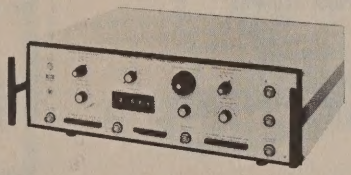
Digitally Synthesized Generators



330 SERIES

MATERIALS TESTING GENERATOR

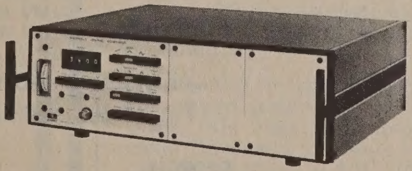
- 336 Materials Testing Generator
- 0.000001 Hz to 1 KHz, Dual Rate Ramp
- Select: First Rate, Break Point, Hold Time, Second Rate
- Gate and Trigger Modes
- 20 V P-P Open Circuit 10 V P-P Into 50Ω



VARIABLE PHASE GENERATOR

- 337 Digital Variable Phase Generator
- 0.00001 Hz to 50 KHz
- 0.2° Phase Lead Setability from 0.0° to 359.8°
- Gate and Trigger Modes
- 20 V P-P Open Circuit 10 V P-P Into 50Ω

NEW!!



340 SERIES

MATERIALS TESTING GENERATOR

- 50 μ Volt Step Resolution
- 1 msec to 99,900 Hr. Period Range
- Metered Output
- Up/Down Indicators
- Plug-in Options include:
- Model 341 Dual Rate Unit
- Model 342 Trigger Unit
- Model 343 Amplitude Control Unit
- Model 344 Variable Phase Unit

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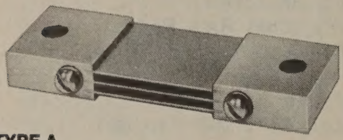
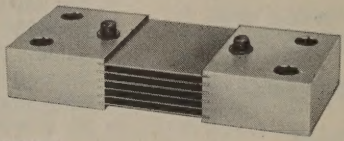
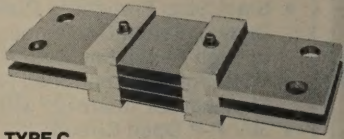


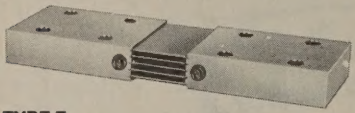
TYPE A
50 MV 15 through 600 amperes
100 MV 50 through 600 amperes



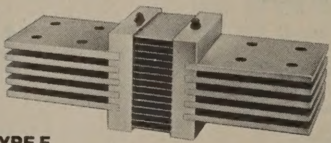
TYPE B
50 MV 300 through 1200 amperes
100 MV 300 through 1200 amperes



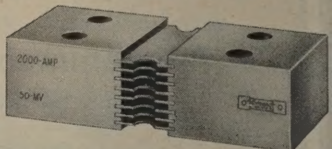
TYPE C
50 MV 1000 through 2000 amperes
100 MV 1000 through 2000 amperes



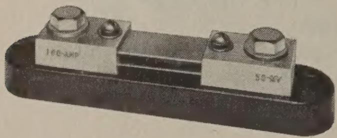
TYPE E
50 MV 1500 through 2000 amperes
100 MV 1500 through 2000 amperes



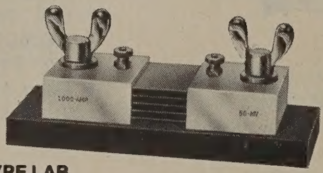
TYPE F
50 MV 2500 through 30000 amperes
100 MV 2500 through 10000 amperes



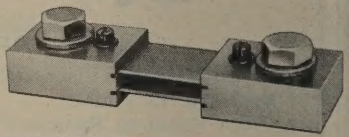
TYPE FL
50 MV 1000 through 3000 amperes



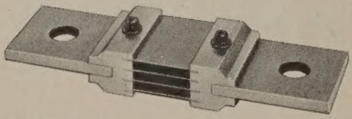
TYPE HA
50 MV 1 through 500 amperes
100 MV 1 through 500 amperes



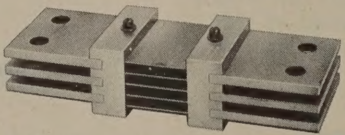
TYPE LAB
50 MV 15 through 1000 amperes
100 MV 15 through 1000 amperes



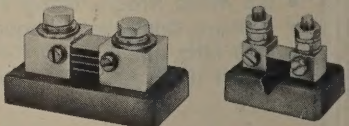
TYPE TRW-50
50 MV 100 through 600 amperes



TYPE W
50 MV 300 through 1000 amperes
100 MV 120 through 500 amperes



TYPE WT
50 MV 1000 through 10000 amperes
100 MV 600 through 6000 amperes



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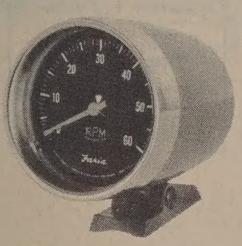
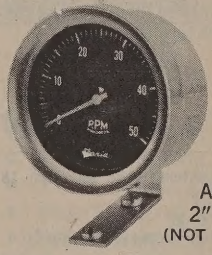


3″ METER



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COMMERCIAL PANEL METERS

- . . . 2½ TIMES the Scale Length of Ordinary Meters
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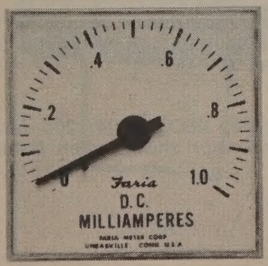
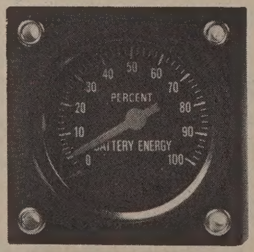
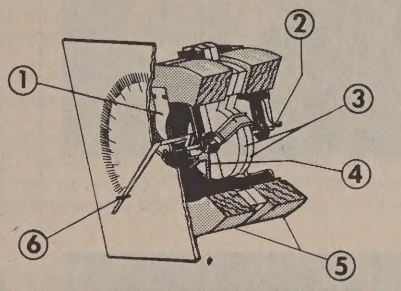


ASA 2½″ METER



MILITARY-AIRCRAFT METER



1. Tension member assures constant band tension while absorbing shock and vibration to prevent band breakage.

2. Strong taut-band eliminates friction and will withstand heavy shock and vibration without damage.

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6. Movement is suppressed slightly against stop peg to eliminate zero adjust. Pointer is always at zero in any position.

Field proven in the most rugged automotive and snowmobile OEM applications, this high performance 250° meter movement is featured in all the case styles shown at left. Write or call for data sheets and prices today!

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AMPERES

2 INCH AMMETERS AND GAUGES

ALL RANGES AVAILABLE AT LOW PRICES!

FLUKE

DIGITAL MULTIMETERS

8020A

- 26 Ranges—5 Functions plus New Conductance Function for up to 10,000 MΩ Leakage Measurements
- Extensive Overload and Transient Protection
- Rugged Construction—1 Year Warranty
- Hi/Lo Power Ohms for In-circuit Resistance and Diode Testing
- 10 MΩ AC/DC Input Impedance Doesn't Load Circuit
- 200 Hour, 9V-Battery Life—Low Battery Indicator
- Large LCD Readout—2000 Counts
- 1 Year Calibration Cycle—Only 3 Adjustments
- One Hand Operation
- Complete with Battery and Test Leads

The new Fluke 8020A continues the standard of excellence set by the highly successful 8000A multimeter family. Many features set the 8020A apart as a truly exceptional instrument. Twenty-four ranges and 5 functions include measuring capability up to 1100V dc, 750V ac, 2A ac/dc and 20 MΩ. HI/LO ohms are included for in-circuit resistance and diode test capability. In addition, a new Conductance function allows resistance and leakage measurements up to 10,000 MΩ, a must for circuit board work and component checking.

The 8020A has been designed with the user in mind and features exclusive one-hand operation. For harsh service environments, the 8020A has a ruggedized case and extensive overload/transient protection backed up by a 1-year warranty. Long term stability (1-year calibration cycle) is excellent with only three cal adjustments. Up to 200 hours of continuous operation can be expected from a single 9V alkaline battery.

BASIC SPECIFICATIONS

	DC Volts	AC Volts	DC Current	AC Current	Ohms	Conductance[5]
Range	0.2-1000V	0.2-750V	0.002-2A	0.002-2A	200Ω-20 MΩ	200 nS, 2 mS
Resolution	100 μV	100 μV	1 μA	1 μA	0.1Ω	0.1 nS
Accuracy[1]	(0.25 + 1)	(0.75 + 2)[2]	(0.75 + 1)	(1.5 + 2)[3]	(0.2 + 1)[4]	(0.3 + 1)[6]

[1] Accuracy for 1 year, ±(% Input + No. of digits), 18°C to 28°C

[2] Except 750V range, (1.0+2)

[3] Except 0.002A range, (2.0+2)

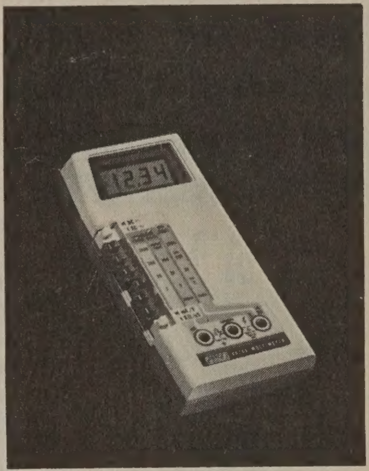
[4] Except 200Ω range, (0.3+3); 20MΩ range, (2.0+1)

[5] Conductance is the inverse of ohms (1/Ω) and is expressed in Siemens (S), formerly the mho. A decrease in conductance units is the same as an increase in resistance. Use of the conductance function allows very high equivalent resistance measurements, e.g., a 2 nS reading on the 200 nS range equals 500 MΩ.

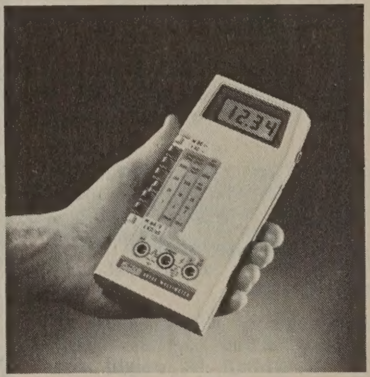
[6] Except 200 nS range, (2.0+10)

GENERAL

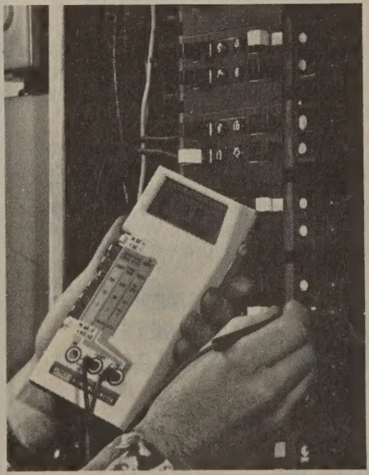
Number of Digits:	3½ (2000 count), autozero, autopolarity
Operating Temperature:	0°C to 50°C
Temperature Coefficient:	0°C to 18°C, 28°C to 50°C; less than 0.1 times the applicable accuracy spec per °C
Input Impedance:	10 MΩ, all voltage ranges
Overload Protection:	Protected up to 1000V dc/750V rms on respective voltage ranges, to 2A on current shunts, to 300V dc/rms for both resistance and conductance.
Calibration Cycle:	1 Year
Power Requirements:	9V battery, transistor type, NEDA 1604; 200 hours life typical with alkaline; indicator shows when battery has 10% of life remaining.



8020A



8020A

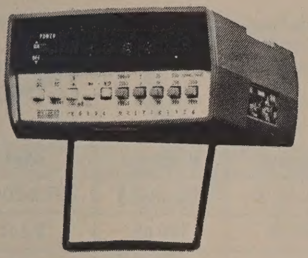


8020A

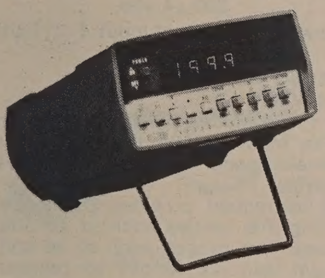
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc.,
P.O. Box 43210, Mountlake Terrace, WA 98043.

FLUKE

DIGITAL MULTIMETERS



8030A



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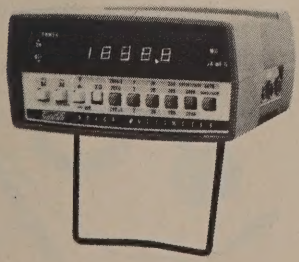


8040A

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043.

8030A

- Measures AC/DC Volts, Current and Resistance
- True RMS on all AC Functions
- Diode Test
- In-Circuit Resistance Measurement
- Overload Protection on all Functions
- Functional Self Check

Model 8030A is a 3½ digit, six-function hand-held multimeter with features that qualify it as an excellent field service and troubleshooting instrument. Measurement functions include ac volts, dc volts, ac current, dc current, resistance and diode test. Each function, with the exception of diode test, has five selectable ranges for a total of 26 ranges (one range for diode test).

True RMS conversion techniques offer high accuracy for noise and other distorted waveforms. AC coupling rejects dc bias during ac voltage measurements. DC coupling is used on the ac current ranges to provide the ac and dc capability necessary for measuring power supply and SCR regulator currents.

In-circuit resistance measurements can be made using the normal resistance ranges. Parallel semi-conductor junctions are ignored by impressing less than 200 mV across the unkonwn resistance.

The diode test function allows measurement of diode and transistor forward voltage drops. A 1 mA bias current is forced through the junction, and the resultant voltage drop is displayed in millivolts.

Durability in the field is assured by extensive input overload protection, rugged, shock-resistant mechanical design, and the use of disposable alkaline batteries. A battery eliminator is also provided for ac line operation. Optional power configurations include rechargeable nickel-cadmium batteries and choice of 100V ac, 115V ac, or 230V ac battery eliminator/chargers.

SPECIFICATIONS

	DC Volts	AC Volts	DC Current	AC Current	Ohms	Diode Test
Range	0.2-1100V	0.2-750V	200μA-2A	200μA-2A	200Ω-2000kΩ	0-2000 mV[4]
Resolution	100 μV	100 μV	100 nA	100 nA	0.1Ω	—
Accuracy[1]	(0.1 + 1)	(0.5 + 2)[2]	(0.35 + 1)	(1 + 2)[3]	(0.4 + 1)	(0.2 + 1)

[1] Accuracy for 1 year, 18°C to 28°C, ±(% Reading + No. of digits)
[2] From 5% of range to full range, 45 Hz to 1 kHz
[3] From 5% of range to full range, 45 Hz to 5 kHz, 200 mA and below
[4] At nominal 1 mA test current

Ordering Information

8030A	DMM with disposable batteries, battery eliminator and test leads
8030A-01	DMM with rechargeable batteries, battery charger/ eliminator and test leads
8030A-03	DMM with disposable batteries and test leads

8040A

- Five Functions, 26 Ranges
- 0.05% Basic DC Accuracy
- True RMS on all AC Measurements
- Selectable Manual or Auto Ranging
- 10 MΩ Input Impedance
- 1100V Overload Protection

The 8040A is a portable 4½ digit, five-function digital multimeter featuring the capabilities of more sophisticated bench instruments while retaining the size of a handheld VOM. Measurement functions include ac volts, dc volts, ac current, dc current and resistance. A total of 26 ranges is provided, five each for ac and dc volts, five each for ac and dc current, and six for resistance measurements. To ensure optimum accuracy when measuring other than pure sinusodial inputs, all ac measurements are made using True RMS conversion techniques. Ranging is switch selectable as well as automatic as a convenience feature to guarantee optimum resolution.

Model 8040A is the smallest autoranging digital multimeter in its class, with rugged mechanical design and overload protection features similar to those found in the 8030A. The 8040A uses disposable alkaline batteries and includes a battery eliminator for ac line operation. Optional power configurations include rechargeable nickel-cadmium batteries and choice of 100V ac, 115V ac or 230V ac battery eliminator chargers.

SPECIFICATIONS

	DC Volts	AC Volts	DC Current	AC Current	Ohms
Range	0.2-1100V	0.2-750V	200 μA-2A	200 μA-2A	200-20MΩ
Resolution	10 μV	10 μV	10 nA	10 nA	0.01Ω
Accuracy[1]	(0.05 + 2)	(0.5 + 10)[2]	(0.3 + 3)	(1 + 10)[3]	(0.2 + 3)

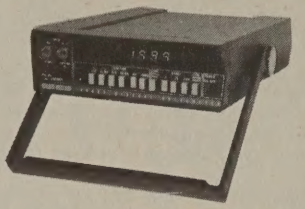
[1] Accuracy for 6 months, 18°C to 28°C, ±(% Reading + No. of digits)
[2] From 5% of range to full range, 45 Hz to 10 kHz
[3] From 5% of range to full range, 45 Hz to 20 kHz

Ordering Information

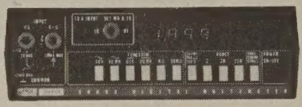
8040A	DMM with disposable batteries, battery eliminator and test leads
8040A-01	DMM with rechargeable batteries, battery charger/ eliminator and test leads
8040A-03	DMM with disposable batteries and test leads

FLUKE

DIGITAL MULTIMETERS

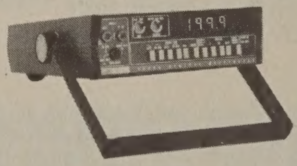


8000A

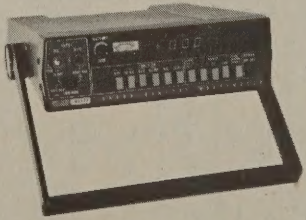


8000A-05

8000A-06



8000A/MAS



8000A/MTR

8000A

The versatile 8000A Digital Multimeter offers a wide range of measurement capability through its excellent specifications and complete selection of options and accessories. Special versions of the 8000A, now available as standard units, expand the applications served by this outstanding DMM.

SPECIFICATIONS

	DC Volts	AC Volts	DC Current	AC Current	Ohms
Range	0.2-1200 V	0.2-1200 V	200 μA-2 A	200 μA-2 A	200 Ω-20 MΩ
Resolution	100 μV	100 μV	100 nA	100 nA	0.1 Ω
Accuracy[1]	(0.1+1)	(0.5 +2)	(0.3+1)	(1+2)	(0.2+1)

[1] Accuracy for 1 year, ±(% Input + No. of Digits), 15°C to 35°C

OPTIONS

RECHARGEABLE BATTERY PACK—
8000A-01
The rechargeable battery pack is entirely self-contained within the 8000A package. It is supplied with standard "D" sized nickel-cadmium batteries which provide, under normal conditions, 1000 discharge-charge cycles of operation. The battery pack will provide a minimum of eight hours operation, with recharge requiring less than 14 hours. Recharging is automatic whenever unit is plugged in and does not affect normal bench operation.

DATA OUTPUT—
8000A-02
The data output option provides parallel, buffered BCD data of the digital readout, polarity and overload. It is suitable for driving a digital printer or providing input to systems. The non-isolated buffered output will sink up to 10 mA of current and has a 15 kΩ pull-up resistor.

HIGH CURRENT—
8000A-05
The Fluke 8000A-05 Digital Multimeter offers extended current measurement capabilities to 20 amps with the -05, line, and -015, battery, options.

All of the specifications for the basic 8000A apply to the 8000A-05, -015 plus the following current specifications:

Range (DC)	10.00 A (1 min. operation 10 A to 20 A)
Accuracy (DC)	10 A Range ±(0.5% of reading + 1 digit)
Range (AC)	10.00 A (1 min. operation 10 A to 20 A)
Accuracy (AC)	10 A Range 45 Hz to 3 kHz ±(1% of reading + 2 digits)

LO OHMS—
8000A-06
The Model 8000A-06 features 0.001Ω resolution and 2 ohm and 20 ohm resistance ranges. The instrument includes a front panel lead resistance cancellation control assuring the user that his measurement of the unknown R does not include the resistance in his test leads. All basic 8000A specs apply plus the following:

Range	1.999 Ω, 19.99 Ω
Accuracy	1.999 Ω range ±(1% of rdg +2 dig)
(1 yr, 15°C-35°C)	19.99 Ω range ±(0.5% of rdg +2 dig)

MILLIAMP-SECONDS—
8000A/MAS
The 8000A/mAS (or Mass Meter) calibrates x-ray tubes by directly measuring current, as a function of time. Addition of mA-sec function has extended overall measurement capability to 31 ranges of ac/dc volts and current, resistance and mAS.

Ranges	2000, 200, 20, 2 mA sec and 200 μA sec.
Accuracy	±(1% of input + 1 digit)

ANALOG METER—
8000A/MTR
The Fluke Model 8000A/MTR is similar to the Model 8000A but also includes an analog panel meter and rechargeable batteries.

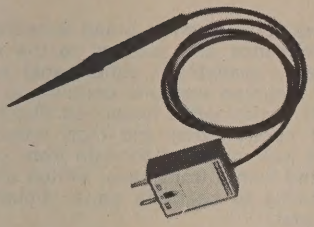
This instrument provides 26 ranges including five ranges each of ac and dc voltage, five ranges each of ac and dc current and six ranges of resistance. The analog panel meter included in the unit is invaluable for peaking or dipping measurements. The panel meter also serves to monitor battery level.

HIGH VOLTAGE—
8000A/HV
The Model 8000A/HV Digital Multimeter is similar to the popular Fluke 8000A with the addition of transient voltage protection on all ac/dc voltage ranges. The instrument will withstand transient voltages up to 6000 volts, 10 microseconds in duration, with a maximum duty cycle of 60 transients per second.

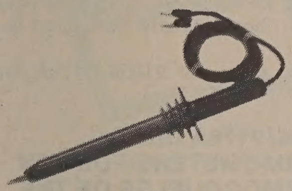
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc.,
P.O. Box 43210, Mountlake Terrace, WA 98043.

FLUKE

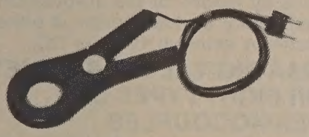
VOLTMETER ACCESSORIES



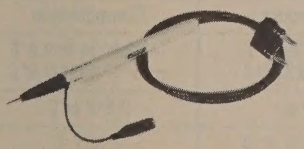
80T-150



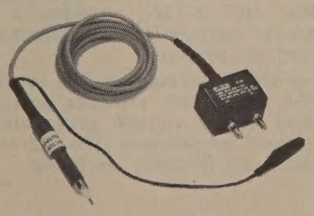
80K-40



80I-600



81RF



82RF

80T-150 Temperature Probe

- Converts DC Voltmeters and Stripchart Recorders to Thermometers
- Wide Temperature Range, −50°C to +150°C or −58°F to +302°F
- Reads Out Directly in Degrees (1 mV DC/°)
- 350V Standoff Allows Measurements in Live Electrical Circuits
- Fast Responding/Low Thermal Mass

The 80T-150 converts dc voltage measuring instruments into direct reading thermometers. It is ideal for a wide range of design, trouble-shooting and evaluation applications and is compatible with surface, ambient and liquid uses. Surface measurements are particularly applicable since no surface preparation is required as with thermocouples. For liquid measurements, recommended applications range from water, lubricants and fuels to most solvents. Liquids with levels as shallow as ½″ can be measured since the temperature sensor is in the probe tip.

For the electronics designer, both device temperatures and local ambients can be quickly monitored to confirm difficult thermal calculations. The troubleshooter will find the probe's direct temperature output a convenient way to attach "hard numbers" to those service problems which show up as overheated components and hot spots. The probe's 350V dc standoff ability makes it much safer than the time honored "hot finger test." A host of non-electronic applications range from air conditioning servicing to lubricant preparation. Send for Application Bulletin AB-28.

SPECIFICATIONS

Range (field selectable by internal jumpers):	−50°C to +150°C or −58°F to +302°F
Accuracy (including nominal 0.25% dc measuring instrument error):*	
+15°C to +35°C (ambient)	±1°C (1.8°F) 0°C to 100°C, decreasing linearly to ±3°C (5.4°F) at −50°C and +150°C
0°C to +15°C and +35°C to +50°C ambient:	Add 1°C (1.8°C) to above
Sensitivity (80T-150 output):	1mV dc/°C or 1mV dc/°F
DC Measuring Instrument Capability	
Input Resistance:	Rated accuracy is achieved with a ≥ 1MΩ input R instrument although operation down to 100K is possible with additional error.
Instrument Type:	With probe output in millivolts/degree, a DMM provides the most convenient readout. For example, a 3½ digit DMM with a ±150 mV range will resolve any centigrade reading to 0.1° (e.g., 150.0 mV = 150.0°C). A FET voltmeter with adequate sensitivity and a dc polarity switch can also be used. Also, strip chart recorders provide a convenient way of looking at temperature trends.
Voltage Standoff:	350V dc or peak ac.
Settling Time:	5.5 seconds to settle within 2° for a 50° change
Output Termination:	Standard ¾″ spaced double banana plug
Power:	Internal disposable battery; 1,000 hours continuous use.

*Additional voltmeter error adds directly to overall measurement uncertainty.

80K-40 General Purpose High Voltage Probe

The 80K-40 is a handheld probe for general purpose HV measurements up to 40 kV. Accuracy and stability of the 1000:1 division ratio is ensured by special metal film resistors having matched temperature coefficients. This unique probe offers an unusually high input impedance to minimize loading of the circuit under test.

(80 K-40) Voltage Range	1 kV to 40 kV.
Input Resistance	1000 MΩ
Ratio	1000:1
Overall Accuracy	20 kV to 30 kV ±2% (Calibrated 1% at 25 kV).
Upper Limit	Changes Linearly from 2% at 30 kV to 4% at 40 kV.

80I-600 AC Clamp-on Current Transformer

The 80I-600 is designed to extend the ac current measuring capabilities of DMM's up to 600 amperes by use of a 1000:1 division ratio. A clamp-on transformer design allows measurements to be made without breaking the circuit under test. Because of the 80I-600's high efficiency and quadrature type of winding, wire size and location of the conductor within the transformer jaws do not affect accuracy of the current measurement.

Range	2A-600A.
Frequency Response	30 Hz - 1 kHz
Accuracy	±3%
Division Ratio	1000:1.

81RF, 82RF RF Probes

	82RF	81RF
Frequency Response	100 kHz to 100 MHz; ±1 dB	100 kHz to 200 MHz: ±1 dB 200 MHz to 500 MHz; ±3 dB
Extended Response (Useful for relative readings)	20 kHz to 250 MHz	200 kHz to 700 MHz
Voltage Range	0.25 V to 30 V RMS 350 VDC Max.	.25 V to 30 V RMS 200 VDC Max.

Physical Accessories

Carrying Cases, Dust Covers, Rack Mounting Hardware, Test Leads are included in the complete line of physical accessories available to protect or enhance the convenience of your Fluke instrument. Ask for the "Digital Voltmeter Accessories" data sheet.

**Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc.,
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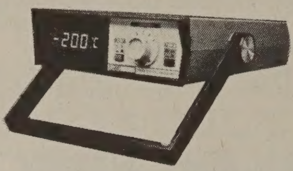
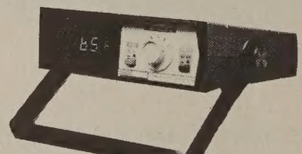
FLUKE

DIGITAL THERMOMETERS

2160A

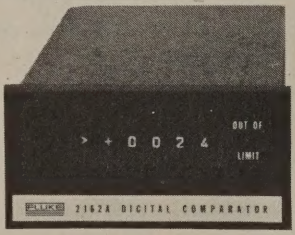


2166A



2168A

2175A



2162A

EXT
FLUKE 2161A MULTIPOINT SELECTOR

2161A

2160A/2170A SERIES

The 2160A and 2170A series Digital Thermometers complement a broad temperature measurement capability that offers unique performance and features to the user. Temperature resolution of 1 degree and 0.2 degree is available in either panel mount or portable bench models. The compact panel mounted versions conform to DIN Standards and are designed for use in industrial enviroments. Advanced Fluke LSI technology means low parts count, low power consumption and high reliability. Temperature scale selection (°F or °C) is easily accomplished through front panel access to a jumper plug on panel mount units and with a front panel switch on the bench models. A further convenience is the ability to calibrate panel mount instruments in place without removal from the panel.

Fluke specifies accuracy in a unique manner. The Total Instrument Accuracy approach gives the accuracy in real terms, °F and °C, and takes operating time and ambient temperature into account. Total Instrument Accuracy gives the user a clear picture of operating accuracy instead of the usual calibration accuracy.

Superior conformity to NBS curves is achieved with 48 straight line segments which have been computer optimized for best possible fit for each thermocouple type. All models feature a high intensity LED display. Open thermocouple indication is provided by a blinking display on all models.

OEM purchase agreements are available on Fluke's line of 2160A/2170A line of thermometers.

2160A/2170A DIGITAL THERMOMETER FOR SINGLE-TYPE OF THERMOCOUPLE

The 2160A and 2170A are panel mounted four-digit 1°F/C or 0.2°F/C, respectively, thermocouple thermometers capable of resolving over the temperature span of any of eight thermocouple types.

2165A/2175A DIGITAL THERMOMETER FOR SINGLE-TYPE OF THERMOCOUPLE

The 2165A and 2175A are portable single-point instruments housed in rugged bench mount cases. They can be equipped with rechargeable batteries for complete portability.

2166A/2176A DIGITAL THERMOMETERS FOR TEN THERMOCOUPLES OF THE SAME TYPE

The 2166A and 2176A are bench type instruments with the capability of monitoring up to ten thermocouples of the same type. Thermocouple channel selection is by means of the 10-position front panel rotary switch. Power is either line voltage or external 12 volts DC.

2168A DIGITAL THERMOMETER FOR EIGHT TYPES OF THERMOCOUPLES

The 2168A is a portable, single-point instrument capable of accepting any one of eight thermocouple types as an input.

SPECIFICATIONS

	2160A SERIES	2170A SERIES
Type of Temperature Sensor	Thermocouple	Thermocouple
Temperature Range (Dependent on Thermocouple Type)	−328° to 3999°F −200° to 2328°C	−99.8° to 999.8°F −99.8° to 999.8°C
Resolution and Repeatability	1°F or C	0.2°F or C
Thermocouple Types	J, K, T, E, R, S, B, C	J, K, T, E

OPTIONS

2161A—Panel mounted, multipoint switch unit for use with 2160A and 2170A. Provides rotary switch selection of ten additional thermocouple inputs of the same type. An eleventh switch position permits cascading 2161A units.

2162A—Panel mounted digital comparator compatible with 2160A and 2170A. Six thumbwheel switches provide single high or low limit or on/off control. Relay output provides for external control. Units may be cascaded for a dual limit.

01—Rechargeable battery pack for use in 2165A and 2175A. Mounts inside instrument to provide continuous 8-hour operation.

02—Field installable option, integral to 2160A and 2170A, provides a BCD, character parallel isolated output of displayed temperature.

04—Field installable option, integral to 2160A and 2170A, provides an isolated analog output voltage proportional to displayed temperature. The -02 and -04 options are mutually exclusive.

ACCESSORIES

Field conversion using of thermocouple type is readily achieved by the appropriate conversion kit. Thermocouple probes are available in the common J, K, and T types. Carrying cases, dust covers and rack mounting hardware are also available to protect and enhance the convenience of your Fluke instrument. Ask for the 2160A/2170A Data Sheet.

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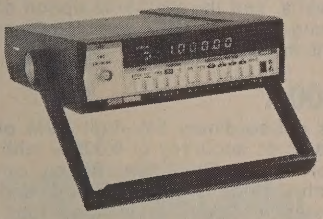
FLUKE

MULTIFUNCTION COUNTER



1900A

1900A

Fluke's versatile 1900A multifunction counter provides frequency, period, period averaging, and totalize measurements over a wide range of applications. In frequency mode, the 1900A verifies the accuracy of signal sources such as generators, oscillators and transmitters. Period mode provides the time duration of a single input cycle, which allows high resolution of low frequency measurements. In period average mode, the counter averages cycle time over 10, 100 or 1000 cycles for still finer resolution. Totalize mode is similar to frequency mode except that the signal gate is left open permanently, a feature useful for totalizing the cycles in a single RF burst or counting electromechanical relay contact bounce.

SPECIFICATIONS

INPUT CHARACTERISTICS

Sensitivity:
25 mV, typically 15 mV rms sine wave, 5 Hz to 80 MHz.

Impedance:
1 MΩ shunted by less than 30 pF.

OPERATING RANGES

Frequency:
5 Hz to 80 MHz. Four manually selected gate times provide resolution of 100 Hz to 0.1 Hz in decade steps.

Period:
5 Hz to 1 MHz single and multiple period averages provide resolution of 100 ns to 100 ps.

Totalize:
1 count to 999999 counts.

TIMEBASE CHARACTERISTICS

Aging Rate:
$<\pm5 \times 10^{-7}$ per month.

Temperature:
$<\pm5 \times 10^{-6}$, 0°C to 50°C.
$<\pm2 \times 10^{-6}$ (typical), 20°C to 30°C.

GENERAL

Display:
6-digit LED, leading zero suppression, annunciation and overflow.

AUTORANGING: In both frequency and period modes, autoranging includes a unique 20% hysteresis in its switching thresholds, to eliminate redundant up range/down range commands. This allows measurements to be made on signals containing large amounts of FM and PM.

AUTORSET: A new measurement sequence is started every time a front panel button is activated.

OPTIONS

1900A-01—Rechargeable Battery.
1900A-02 Data Output.

ACCESSORIES

A53 Whip Antenna
C80 Carrying Case, Soft Vinyl
C86 Carrying Case, Molded Plastic

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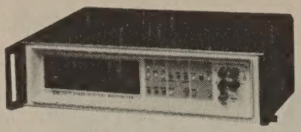
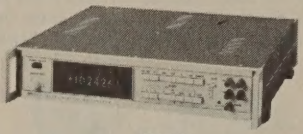
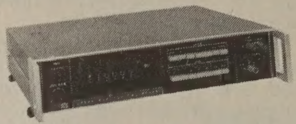
DIGITAL VOLTMETERS


8500A


8375A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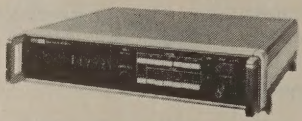
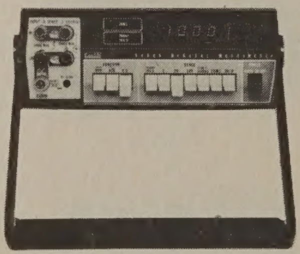
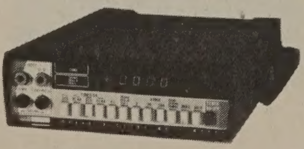
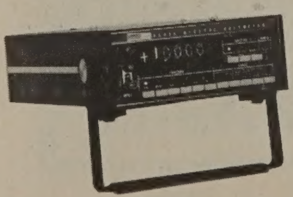

8300A


8800A


8600A


8200A

8500A

The Model 8500A incorporates a microprocessor and bus system providing the ultimate in speed, accuracy, versatility and reliability. This 5½ digit instrument provides five ranges of dc with a resolution of ±1 μV and ±1200V maximum. Mid range basic dc accuracy is 10 ppm for 90 days at 23°C ±5°C.

The Model 8500A can make 500 readings per second when externally commanded via a system interface. DC zero is automatic with the push of a front panel button. With the calibration memory option, recalibration can be accomplished entirely from the front panel in about ten minutes time. The basic instrument includes full autoranging, dc/dc ratio, automatic dc zero, and a unique offset feature which allows measurements of deviation from any stored value.

A wide range of systems options include IEEE 488; bit serial; or duplex register, 16 bit parallel/character serial. Analog options include true rms or average ac volts, 4-wire ohms, ac and dc current and calibration memory.

8375A

The 8375A offers unusual capability in a 5½ digit multimeter. At a very low cost, its standard configuration combines highly accurate measurement of dc volts, true-rms ac volts and broad ranges of resistance, together with a unique self-test feature that permits rapid check-out of all measurement functions. In addition, a powerful set of systems-oriented options are available, all of which can be readily installed in any desired sequence in the field, including Data Output, Remote Control and DC Reference.

8400A

The 8400A's outstanding accuracy is complemented by numerous and versatile functional capabilities. DC voltages are measured on five ranges with resolution to 1 microvolt. Overrange is 20% on all ranges except on the ±1,000 V range. 1100 V can be applied to any voltage range without damaging the unit.

The basic DVM accepts a family of rugged plug-in option cards for AC Volts, Resistance, DC/DC Ratio, True RMS Volts, Data Output and Remote Control.

8300A

The 8300A is a versatile digital voltmeter with five full decades of digits plus a 6th digit for 20% overrange. Its mainframe will accept options in any sequence for expansion from a bench DVM into a bench or systems multimeter.

The basic instrument offers 3 ranges of DC voltage measuring capability including autorange, autopolarity, and switchable active filtering. In addtiion, the 8300A-10 option offers 5 ranges of dc volts, and the 8300A-02 option offers 5 ranges of dc volts and 5 ranges of ohms measurements.

8800A

This extraordinary 5½-digit DVM offers a basic dc accuracy of 0.005% with full autoranging. There are fifteen ranges which include five dc, four ac, and six resistance. Complete isolated four terminal ohms measurements are provided on all ranges. Separate current and voltage inputs are available to provide the ultimate in ohm accuracy by eliminating errors caused by input lead resistance. LED readout is bright and readable. Features isolated Data Output option 8800A-02.

8600A

Fluke 8600A DMM includes a 4½-digit LED readout featuring five ranges of dc volts, five ranges of ac volts, five ranges of dc current, five ranges of ac current and six ranges of resistance. With 26 ranges, the instrument offers more measure power than any other instrument available. **Autorange** and **autozero** are standard. Options include Battery Pack (8600A-01) and Isolated Data Output (8600A-02).

8200A

The Model 8200A four range dc DVM easily expands into a 400 readings per second systems multimeter by installing a family of plug-in options. Standard features of the basic instrument include 60% overrange, switched filter for assured broadband noise rejection, all push button selection, autoranging polarity selection and display as well as full guarding.

SPECIFICATIONS AND OPTIONS

Model	8200A	8300A	8375A	8400A	8500A	8600A	8800A
Digits	4½	5½	5½	5½	5½	4½	5½
Overrange	60%	20%	20%	20%	(6)	(5)	(5)
Basic dc accuracy dc volts sensitivity	0.01% 1μV	0.005% 1μV	0.002% 1μV	0.002% 1μV	0.001% 1μV	0.02% 10μV	0.005% 1μV
No. Ranges— dc volts	6-10mV[1] to 1000V	5-100 mV[3] to 1000V	5-100 mV to 1000V	5-100mV to 1000V	5-312 mV to 1280V	5-200 mV to 1200V	5-200 mV to 1200V
No. Ranges— ac volts	4-1V to 1000V	4-1V to 1000V[2]	4-1V to 1000V	4-1V to 1000V[2]	4-2.5V to 1200V[2]	5-200 mV to 1200V	4-2V to 1200V
No. Ranges— ac & dc current					5-312 μA to 1.28[2]	5-200 μA 2000 mA	
No. Ranges— resistance	6-100Ω to 10 MΩ[2]	5-1 kΩ to 10 MΩ[2]	7-10Ω to 10 MΩ	7-10Ω to 10 MΩ[2]	8-31.2Ω to 260 MΩ[2]	6-200Ω to 20 MΩ	6-200Ω to 20 MΩ
True rms option	√		(4)√	√	√		
Autorange	√	√	√	√	√	√	√
Guarded	√	√	√	√	√		√
Remote Control option	√		√	√	√		
DOU option	√	√	√	√	√	√	√
Battery pack option						√	

(1) 10 mV & 100 mV optional
(2) optional
(3) 100 mV & 1000 mV optional
(4) true rms standard
(5) full scale ranges include 100% overrange
(6) see data sheet

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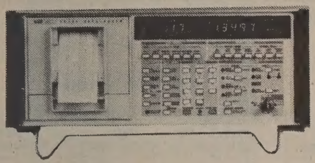
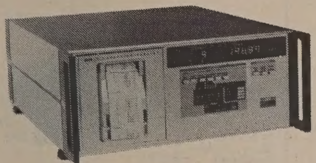
FLUKE

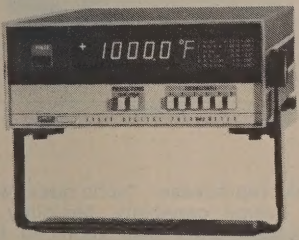
DATA LOGGERS, DIGITAL THERMOMETERS



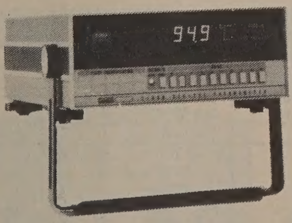
2240A



2200A



2100 A-06



2100A-10

DATA LOGGERS

The Summa II Series Data Logger provide a wide range of data logging features and options through the 2200A and 2240A main frames and option complements. Microprocessor implementation and Fluke's time honored low level signal and temperature measuring expertise combine to produce a data logging system which embodies the following features:

- Complete interactive key board programming of range, function, skip and limits.
- Resolution to 1μV and .1°.
- Scan 1 to 1000 points, up to 60 in the mainframe.
- Mix voltages, thermocouples and thermocouple types on adjacent channels.
- Multiple scan modes - continuous limits monitoring, interval scan, delayed interval scan and monitoring channel.
- Keyboard selectable scan interval (1 second to 24 hours).
- Displays date, time, data, channel identification, function and polarity.
- Display monitor. channel without interrupting scan.
- Internally selectable scanning rates (3 or 15 channels per second).
- Thermocouple conditioning.
- Complete Program List printout.
- Alarms output.
- 6 digits fixed data.
- Digital inputs.
- Field expandable.
- Reference voltages for self check.
- Switch selectable output formats.
- Clock; Days - Hours - Minutes - Seconds.

SPECIFICATIONS

Inputs	Ranges	Data Logger 2240A	Data Logger 2200A	Options Required*
DC Voltage	40, 4V, 0.4V, 0.04V	•	•	—07 Solder Pin Connector or —08 Isothermal Connector
Current Transmitters	1 - 5 mA 4 - 20 mA 10 - 50 mA	• • •	NA NA NA	—28 Current Transmitter Connector —29 Current Transmitter Connector —30 Current Transmitter Connector
Temperature (Resolution 0.1°F/C or 1°F/C)	Thermocouple types J, K, E, T, R, S, B, C, D (W3) or G	•	•	—08 Isothermal Connector
RTD (Resistance Temperature Detector)	—	•	•	—03 RTD Connector 2203A RTD Scanner Chassis

*In addition to options listed, one scanner and one a/d converter (not listed) are required to establish a functioning data logger system. Ask for the Data Logger data sheet for complete details.

DIGITAL THERMOMETERS

The 2100A Digital Thermometer series satisfy a wide variety of temperature measuring applications. Versatility ranges from a systems instrument capable of monitoring up to 100 different thermocouples and outputing data to a digital recorder or computer, to a fully portable battery operated instrument able to take measurements from any type of thermocouple as well as having two direct mV ranges, with resolution of 0.1 degree.

2100A-03

Used to measure the temperature of a single thermocouple of a predetermined type.

2100A-10

Same basic unit as the 2100A-03 but with the addition of 11 manual switches on front panel. This allows up to 10 thermocouples of the same type to be connected to the instrument, one at a time.

2100A-06

Same basic units as the 2100A-03 but with the addition of 8 select switches on front panel. Any one of the six available thermocouple types can be selected.

2150A

The 2150A is a multi-point switch unit. Up to 30 thermocouples can be connected to each unit and units can be connected in series to allow up to 100 points to be monitored by one measuring instrument.

SPECIFICATIONS

	2100A-03	2100A-06	2100A-10
Type of Temperature Sensor	Thermocouple	Thermocouple	Thermocouple
Temperature Range (Dependent on thermocouple type)	−320°F to +3200°F −200°C to +1760°C	−320°F to +3200°F −200°C to +1760°C	−320°F to +3200°F −200°C to +1760°C
Temperature Resolution & Repeatability	0.1°F or C[1]	0.1°F or C[1]	0.1°F or C[1]
Thermocouple Types	J, K, T, E, R, S	J, K, T, E, R, S	J, K, T, E, R, S
Number of Thermocouple Types	1 (Choose from above)	All 6	1 (Choose from above)
Number of Thermocouple Inputs	1	1	10
Accuracy 90 days J, K, T, E 20°C to 30°C	±0.65°F, ±0.45°C	±0.65°F, ±0.45°C	±0.75°F, ±0.55°C
Accuracy 90 days R, S 20°C to 30°C	±1.1°F, ±0.75°C	±1.1°F, ±0.75°C	±1.2°F, ±0.85°C
DC Voltage Ranges	—	400 mV, 40 mV	—
DC Voltage Resolution	—	10 μV, 1 μV	—

[1] 0.2°F or 0.1°C for type R and S thermocouples.

OPTIONS

*2100A-01—Rechargeable Battery Pack for 2100A
2100A-02—Digital Output Unit for 2100A
2100A-04—Analog Output Unit for 2100A

*Option -01, -02 and -04 are mutually exclusive

ACCESSORIES

P20J—Thermocouple Probe - J Type
P20K—Thermocouple Probe - K Type
P20T—Thermocouple Probe - T Type

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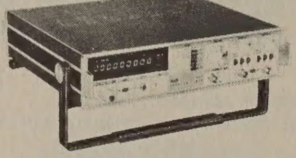
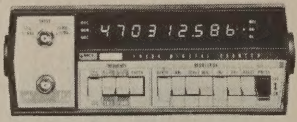
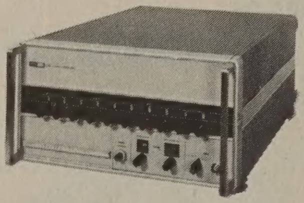
FLUKE

COUNTERS AND SIGNAL SOURCES


1953A


1920A

6011A


645A

6160B/6039A

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043.

COUNTERS

The Fluke line of electronic counters provides time and frequency measurement capability in the range of dc to 1250 MHz. Designed to meet and exceed the stringent accuracy and stability demands placed on today's digital measurement equipment, Fluke counters are reliable, cost effective and competitive. Included in the Fluke line are counters designed for laboratory and field, in both systems and bench applications.

SPECIFICATIONS

	1953A Universal Counter-Timer	1952B Universal Counter/Timer	1920A Communications Center	1910A Multicounter	1911A Multicounter	1912A Multicounter	1925A Multicounter
Frequency Measurement Range	DC to 125 MHz direct, 50 to 1250 MHz prescaled	DC to 80 MHz	Direct: 5 Hz to 125 MHz Prescaled: to 1250 MHz	5 Hz to 125 MHz	Direct: 5 Hz to 125 MHz Prescaled: 50 Hz to 250 MHz	Direct: 5 Hz to 125 MHz Prescaled: 50 Hz to 520 MHz	Direct: 5 Hz to 125 MHz Prescaled: 50 Hz to 520 MHz (Opt.)
Totalize	A Gated by B, DC - 125 MHz	A Gated by B, DC - 80 MHz	—	1 to 9,999,999 counts	1 to 9,999,999 counts	1 to 9,999,999 counts	Data Out (Std) 1 to 9,999,999 counts
Period Measurement Range	DC to 25 MHz	DC to 10 MHz	—	5 Hz to 2 MHz	5 Hz to 2 MHz	5 Hz to 2 MHz	5 Hz to 2 MHz
Time Interval Measurement Range	0.1 μs to 10's	0.1 us to 10^{5}s	—	—	—	—	—
Ratio Measurement Range	(f1) DC - 125 MHz (f2) DC - 25 MHz	(f1) DC to 80 MHz (f2) DC to 10 MHz	—	—	—	—	—
Sensitivity	Channel A: 30 mV rms, dc — 75 MHz Channel B: 30 mV rms, dc — 25 MHz	Channel A: 50 mV rms, dc — 50 MHz Channel B: 50 mV rms, dc — 10 MHz	Direct: 15 mV to 100 MHz, to 25 mV at 125 MHz Prescaled: 15 mV to 1000 MHz, to 30 mV at 1250 MHz	Channel A 15 mV, 5 Hz to 100 MHz 25 mV, 100 MHz to 125 MHz	Channel A: Same as 1910A Channel B: 15 mV, 50 MHz to 175 MHz 30 mV, 175 MHz to 250 MHz	Channel A: Same as 1910A Channel B: 25 mV, 50 MHz to 520 MHz	Channel A: 20 mV, 5 Hz to 100 MHz 35 mV, 100 MHz to 125 MHz
Timebase Aging Rate	±3x10^{-7}/mo.	±5x10^{-7}/mo.	3X10^{-7}/mo.	±5x10^{-7}/mo.	±5x10^{-7}/mo.	±5x10^{-7}/mo.	±3x10^{-7}/mo.
No. of Digits	9	6 (7 opt.)	9	7	7	7	7
Basic Options: -01	—	—	Rech. Battery	Rech. Battery	Rech. Battery	Rech. Battery	N/A
-02	Data Output	—	—	Data Output	Data Output	Data Output	—
-03	—	TCXO	—	TCXO	TCXO	TCXO	TCXO
-04	TXCO	—	TCXO	Superior TCXO	Superior TCXO	Superior TCXO	
-06	—	—	Resolution Mult.	—	—	—	—
-07	520 MHz Presclr.	—	—	—	—	—	520 MHz Presclr.
-10	Oven Osc.	—	—	—	—	—	Oven Osc.
-11	Rem. Programming	—	—	—	—	—	—
-12	Rem. Programming	—	—	—	—	—	—
-13	1000 MHz Presclr.	—	1000 MHz Presclr.	—	—	—	—
-14	1250 MHz Presclr.	—	1250 MHz Presclr.	—	—	—	—
-15	IEEE Interface	—	—	—	—	—	—
-20	Oven Osc.	—	—	—	—	—	—

SIGNAL SOURCES

Fluke signal generators incorporate advanced microprocessor techniques which greatly reduce their size while increasing their overall capability, flexibility and range of application. Cumbersome front panel knobs have been replaced by a universal calculator keyboard enabling free-form entry of volts, millivolts, dBm, Hz, kHz and MHz. Frequencies and levels can be stored and recalled for repetitive testing. Ranges are set automatically for best resolution and programmable limits prevent damage to unit under test.

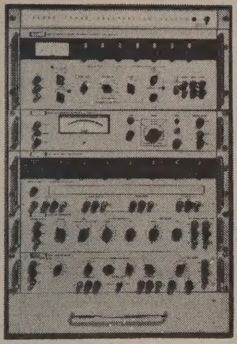
Fluke synthesizers employ both the direct and indirect approach to frequency synthesis and exhibit exceptional accuracy. stability, spectral purity and resolution.

SPECIFICATIONS AND OPTIONS

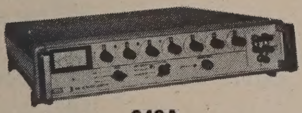
	Signal Generators		Frequency Synthesizers		
Signal Sources	**6010A**	**6011A**	**6160B**	**6039A**	**645A**
Frequency Range	10 Hz-11 MHz	10 Hz-11 MHz	1 MHz-160 MHz	1 MHz-40 MHz	DC-50 MHz
Resolution	0.1 Hz/10 Hz	0.1 Hz/10 Hz	0.1 Hz/1 Hz	0.1 Hz/1 Hz	0.01 Hz
Frequency Std. Aging Rate	1 x 10^8/day, 1 x 10^6/yr	1 x 10^8/day, 1 x 10^6/yr	2 x 10^{-9}/day, 5 x 10^{-6}/yr.	2 x 10^{-9}/day, 5 x 10^{-6}/yr	2 x 10^{-9}/day
Phase Noise	>50 dB	>50 dB	>74 dB	>74 dB	>78 dB
Harmonics	−50 dB, 10 Hz to 1 MHz −40 dB, 1 MHz to 11 MHz	−50 dB, 100 Hz to 1 MHz −40 dB, 1 MHz to 11 MHz	−25 dB	−25 dB	−30 dB
Non-harmonics	−60 dB or −110 dBm	−60 dB or −110 dBm	−83 dB to −100 dB	−80 dB to −100 dB	−100 dB
Output Amplitude (into 50Ω)	0.25 mV to 5V rms, −50 dBm to +27 dBm	0.3972 mV to 5V rms, −55.01 dBm to +26.98 dBm	+3 dBm to +13 dBm	+3 dBm to +13 dBm	0.2V to 1.0V rms
AM Modulation	Std.	Std.	NA	NA	Std.
Basic Options: -01	TCXO	TCXO	—	—	—
-02	Phase Lock Input	Phase Lock Input	Oven Osc.	Oven Osc.	—
-03	Freq. Mod.	Freq. Mod.	—	—	—
-05	IEEE Std-488-1975 Interface	IEEE Std-488-1975 Interface	TCXO	TCXO	—
-06	EIA Std-RS-232C Interface	EIA Std-RS-232C Interface	—	—	—
-12	—	—	—	—	Oven Osc.

FLUKE

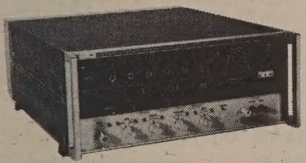
CALIBRATORS, STANDARDS, DIFFERENTIAL VOLTMETERS



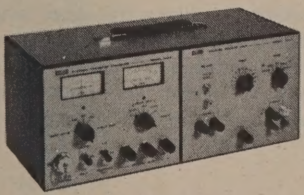
7105A



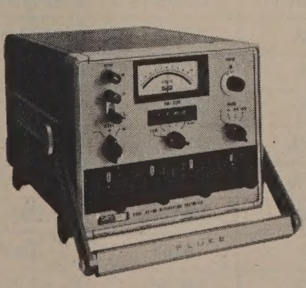
343A



5200A



540B



893A

CALIBRATORS AND STANDARDS

The manufacture of precision test and measurement instruments such as those designed and produced by Fluke requires the measurement and generation of electrical quantities with predictable accuracy, traceable to an industry-accepted reference facility such as the National Bureau of Standards. Fluke's own need for such traceable calibration methods has given rise to development and production of a complete line of voltage and current calibrators, ac and dc reference standards and dc calibration systems, used throughout the world by instrument users and manufacturers in the test and calibration of their own products.

Fluke ac and dc calibrators and standards supply stimulus values for a wide range of precision calibration needs. They are exceptionally stable sources designed with high accuracy and low noise while having extremely low drift rates. Outputs from the calibrators are selected using front panel switches which allow direct dial-out of the full range of output values. The accuracy and resolution of these instruments can satisfy the most critical requirements for a precision calibration or voltage reference source.

Fluke ac and dc voltage and current calibrators combine ruggedness and reliability with extreme accuracy and stability. The results are standards lab instruments with full capability for use in the calibration lab or on the production line.

SPECIFICATIONS

Model	332B	332D	335A	335D	341A	343A	7105A[2]	3330B
Function	dc volts	dc volts	dc volts[1]	dc volts[1]	dc volts	dc volts	dc volts	dc volts dc current
Basic accuracy	0.002%	0.001%	0.002%	0.001%	0.005%	0.002%	0.0004%	0.003% voltage 0.006% current
Range	0 to 1100V	0 to 1100V	0 to 1100V	0 to 1100V	0 to 1100V	0 to 1100V	0 to 1100V	0 to 1100V 0 to 100 mA

Model	382A	515A	5200A	760A	731B	510A	540B
Function	dc volts dc current	ac/dc volts ohms	ac volts	ac/dc volts current, ohms	dc voltage standard	ac voltage standard	ac-dc transfer standard
Basic accuracy	0.01%	0.003% dc volts 0.04% at 10V ac 0.015% 1 KΩ to 1 MΩ	0.02% 30 Hz to 20 kHz[3]	0.05% 0.2% ac volts 0.1% dc current 0.25% ac current 0.1% ohms	10 ppm/ 30 days 30 ppm/yr 2 ppm transfer	Midband 0.015%/ 30 days 0.02%/yr	±0.01% of input (all ranges except 1000)
Range	0 to 50V 0 to 2A	4 ranges dc 3 ranges ac 10Ω to 10 MΩ	0 to 100V[4]	1 mV-1000V 1μA-10A 1Ω-10MΩ	1.018V 1.019V 1V 10V	10V rms	0.5 to 1000V in 14 ranges

[1] Includes 0.002% differential voltmeter and high Z null detector in same unit
[2] Calibrates voltmeters and dc calibrators (self calibrating)
[3] Reduced accuracy at higher frequencies; to 1 MHz
[4] Operates to 1200V using companion model 5215A power amplifier

DIFFERENTIAL VOLTMETERS

Seven models of differential voltmeters are currently available from Fluke. All models are solid-state instruments. Standard features include full overload protection, a single meter scale for all modes and ranges, and long-term accuracy. A rechargeable battery pack for portable operation and a recorder output are either standard or optional for most of the differential voltmeters.

The inherent characteristics of the differential voltmeter satisfy a number of measurement requirements encountered in the laboratory environment. Among these are infinite input resistance at null, analog meter detection of small voltage changes or excursions. and accurate comparision of two or more voltages.

SPECIFICATIONS AND OPTIONS

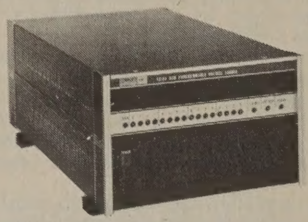
MODEL	883AB	885AB	887AB
Function	AC/DC	DC	AC/DC
Basic Accuracy	0.005% dc 0.1% ac	0.0025%	0.0025% dc 0.05% ac
Range	0-1100V	0-1100V	0-1100V
Frequency Range—AC	20 Hz-100 kHz	—	20 Hz-100 kHz
Rechargeable Battery	Std.	Std.	Std.
Recorder Output	Std.	Std.	Std.

MODEL	891A	893A/AR	895A	931B
Function	DC	AC/DC	DC	True RMS
Basic Accuracy	0.01%	0.01% dc 0.05% ac	0.0025%	0.05%
Range	1100V	0-1100V	0-1100V	10mV-1100V
Frequency Range—AC	—	5 Hz-100 kHz	—	2 Hz-2 MHz Bandwidth
Rechargeable Battery	Opt.	Opt.	NA	Std.
Recorder Output	Opt.	Opt.	Std.	Std.

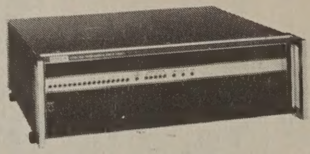
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043.

FLUKE

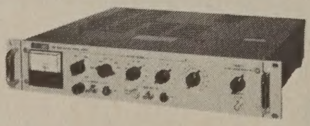
PROGRAMMABLE POWER SOURCES
HIGH VOLTAGE POWER SUPPLIES



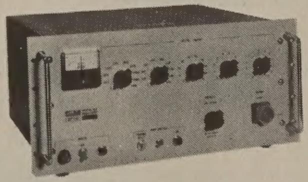
4210A



4250A



415B



410B

PROGRAMMABLE POWER SOURCES

The Fluke 4200 series of programmable power sources are designed specifically for automatic test systems. Speed, accuracy, low programming noise, true current limiting, isolated control logic, ac or dc external refrence capability and full digital control assure optimum performance for a broad range of applications.

SPECIFICATIONS

Model	Output Voltage/Current	Code	Resolution	Accuracy—90 Day ±(% Output + μV)	Settling Time	Programming Noise
4210A	0 to ±9.999V/ 100 mA	BCD	1 mV (100 μV option)	±(0.01+100)	18 μs	50 mV pk
4250A	0 to ±9.999V/ 1A 0 to ±65V/1A	BCD	1 mV (100 μV option) 10 mV (1 mV option)	±(0.01+100) ±(0.01+700)	70 μs 70 μs	50 mV pk 100 mV pk
4270A	0 to ±9.999V/ 0.5A 0 to ±99.99V/ 0.5A	BCD	1 mV (100 μV option) 10 mV (1 mV option)	±(0.01+100) ±(0.01+700)	80 μs 110 μs	50 mV pk 100 mV pk
4216A	0 to ±16.383V/ 100 mA	Binary	1 mV	±(0.01+100)	18 μs	50 mV pk
4265A	0 to ±16.383V/ 1A 0 to ±65.532V/ 1A	Binary	1 mV 4 mV	±(0.01+100) ±(0.01+700)	70 μs 70 μs	50 mV pk 100 mV pk
4275A	0 to ±32.767V/ 0.5A 0 to ±110V/0.5A	Binary	0.5 mV 2 mV	±(0.01+160) ±(0.01+530)	85 μs 85 μs	50 mV pk 100 mV pk

OPTIONS

4200A-03	External Reference	**4210A-09**	Multi-Strobe Logic
4210A-07	100μV Resolution (4210A only)	**4250A-06**	Programmable Current Limit

HIGH VOLTAGE POWER SUPPLIES

All Fluke power supplies combine the high reliability of silicon transistor amplifiers with the high voltage capability of series pass tubes to provide conservative voltage and current ratings. Supplies feature extremely low ripple and excellent regulation. Outputs are available at both front and rear panels. All models are protected against overcurrent by an adjustable circuit that disables the supply when output current exceeds the rated value.

SPECIFICATIONS

	408B	410B	412B	415B
Output voltage	0-6000V	0-10,000V	0-2100V	0-3100V
Current	0-20 mA	0-10 mA	0-30 mA	0-30 mA
Regulation line	0.001%	0.001%	0.001%	0.0005%
load	0.001%	0.001%	0.001%	0.0005%
Stability hour	±0.005%	±0.005%	±0.005%	±0.002%
day	±0.020%	±0.020%	±0.020%	±0.010%
Maximum ripple RMS	<1 mV	<1 mV	<500 μV	<100 μV
Resolution	5 mV	5 mV	5 mV	5 mV
Calibration	±0.25%	±0.25%	±0.25%	±0.25%

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc.,
P.O. Box 43210, Mountlake Terrace, WA 98043.

FLUKE

PRICE LIST

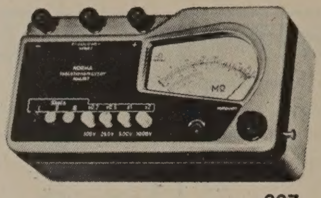
A53	$ 20
A81-115	15
C80	15
C86	15
P20J	25
P20K	25
P20T	25
1900A	345
-01	50
-02	70
1910A	395
-01	120
-02	30
-03	150
-04	200
1911A	495
-01	120
-02	30
-03	150
-04	200
1912A	620
-01	120
-02	30
-03	150
-04	200
1920A	895
1920A-13	1095
1920A-14	1295
-01	150
-02	200
-04	200
-06	100
1925A	750
-02	NC
-04	200
-10	400
1952B	795
-03	200
1953A	995
-02	200
-04	200
-10	400
-11	300
-12	500
-15	600
-20	750
1953A-07	1395
1953A-13	1595
1953A-14	1795
2100A-03	795
2100A-06	1095
2100A-10	995
2150A-10	315
2150A-20	445
2150A-30	590
2100A-01	210
2100A-02	210
2100A-04	270
2160A	299
-02	100
-04	125
2161A	125
2162A	225
2165A	350
-01	50
-02	100
-04	125
2166A	450
-02	100
2166A—Continued	
-04	$ 125
2168A	550
-02	100
-04	125
2170A	425
-02	100
-04	125
2175A	475
-01	50
-02	100
-04	125
2176A	575
-02	100
-04	125
2200A	2595
-07	25
-08	85
-03	75
2240A	3995
-07	25
-08	85
-28	150
-29	150
-30	150
-03	75
332B	3195
332D	3695
3330B	4495
335A	3695
335D	4295
341A	1695
343A	2195
382A	2495
408B	1395
410B	1395
412B	845
415B	845
4210A	1695
-03	200
-07	300
-09	125
4216A	1695
-03	200
-07	300
-09	125
4250A	2145
-03	200
-06	200
-07	300
-09	125
4265A	2145
-03	200
-06	200
-07	300
-09	125
4270A	2245
-03	200
-06	200
-07	300
-09	125
4275A	2245
-03	200
-06	200
-07	300
-09	125
510A	645
515A	$2145
5200A	5195
5205A	4695
540B	1895
6010A	2495
-01	100
-02	210
-03	525
-05	295
-06	295
6011A	3995
-01	100
-02	210
-03	525
-05	295
-06	295
6039A	3995
-02	595
-05	275
6160B	5995
-02	595
-05	275
645A	15,250
-12	550
7105A	9820
731B	595
760A	3995
80I-600	70
80K-40	50
80T-150C	125
80T-150F	125
8000A	299
-01	50
-015	75
-016	101
-02	100
-025	125
-05	25
-06	51
8000A/MAS	550
8000A/MTR	349
MTR-01	50
8000A/HV	349
HV-01	50
8020A	169
8030A	250
8030A-01	275
8030A-03	235
8040A	440
804A-01	465
8040A-03	425
81RF	40
82RF	75
8200A	1495
8300A	1795
8375A	2395
8400A	2395
8500A	2695
8600A	549
8800A	985
883AB	1995
885AB	1895
887AB	2145
891A	1295
893A	1645
895A	1895
931B	1695

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043.

FREED TRANSFORMER CO., INC.

MEGOHMS
MULTIPLY
GUARD GND
MEGOHMMETER

2030-A-B-C-D-E



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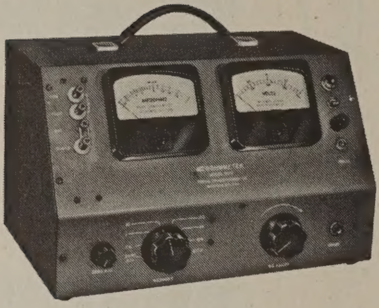


1620-A-B-C-D

MEGOHMS
MEGOHMMETER

1020-C-D

MEGOHMMETERS

Freed can supply a complete range of insulation resistance measuring equipment with fixed and variable d.c. test voltages from 5 to 2500 volts. Insulation and leakage measurements can be made on transformers, motors, cables, electronic assemblies and components, dielectric materials, electrical appliances and tools, capacitors and resistors.

Type	Resistance Range	Test Voltage	Accuracy	Power Requirements	Size and Weight	Price
1620	0.1 to 4,000,000 megohms 1 to 2,000,000 megohms @ 500 volts	Variable 50 to 1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15″ x 9″ x 7½″ 24 lbs. •	400.00
1620-A	0.01 to 4,000,000 megohms 0.1 to 200,000 megohms @ 50 volts 1 to 2,000,000 megohms @ 500 volts	Variable 5-100 volts d.c. 100-1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15″ x 9″ x 7½″ 24 lbs. •	425.00
1620-B	1 to 2,000,000 megohms 10 to 2,000,000 megohms @ 2500 volts	Variable 250-2500 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15″ x 9″ x 7½″ 24 lbs. •	465.00
1620-C	All features same as Type 1620 with additional circuitry for capacitor measurements	Variable 50 to 1000 volts d.c.	±5% at full scale	105-125 volts 50-60 cycles	15″ x 9″ x 7½″ 24 lbs. •	445.00
1620-D	0.01 to 40,000,000 megohms 0.1 to 2,000,000 megohms @ 50 volts 1 to 20,000,000 megohms @ 500 volts	Variable 5-100 volts d.c. 100-1000 volts d.c.	±5% at full scale except highest range ±10%	105-125 volts 50-60 cycles	15″ x 9″ x 7½″ 25 lbs. •	465.00
1020-C	0.1 to 2,000,000 megohms 0.1 to 200,000 megohms @ 50 or 100 volts d.c. 1 to 2,000,000 megohms @ 500 volts d.c.	Fixed 50, 100, 500 volts Regulated	±3% all ranges except highest range ±5%	105-125 volts 50-60 cycles	9½″ x 10½″ x 8″ 18 lbs. •	330.00
1020-D	0.1 to 2,000,000 megohms 0.1 to 200,000 megohms @ 100 or 200 volts d.c. 1 to 2,000,000 megohms @ 500 volts d.c.	Fixed 100, 200, 500 volts Regulated	±3% all ranges except highest range ±5%	105-125 volts 50-60 cycles	9½″ x 10½″ x 8″ 18 lbs. •	330.00
2030-A	10 to 2,000,000 megohms	Fixed 500 volts d.c.	±5% full scale	battery operated transistor supply	6″ x 8″ x 4″ 8 lbs.	225.00
2030-B	1 to 20,000,000 megohms	Fixed 500 volts d.c.	±5% full scale	battery operated transistor supply	6″ x 8″ x 4″ 8 lbs.	260.00
2030-C	1 to 2,000,000 megohms	Fixed 50 volts d.c.	±5% full scale	battery operated transistor supply	6″ x 8″ x 4″ 8 lbs.	235.00
2030-D	1 to 2,000,000 megohms	Fixed 100 volts d.c.	±5% full scale	battery operated transistor supply	6″ x 8″ x 4″ 8 lbs.	235.00
2030-E	1 to 2,000,000 megohms	Fixed 200 volts d.c.	±5% full scale	battery operated transistor supply	6″ x 8″ x 4″ 8 lbs.	235.00
667	0 to 10,000 megohms	Fixed 100-250-500 1000 v.d.c.	± 2.5% of scale length	battery operated transistor supply	8½″ x 4½″ x 5″ 4½ lbs.	350.00

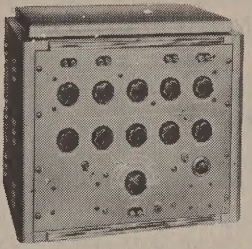
Rack type available — 1620 series 19″ x 10½″ x 9½″
1020 series 19″ x 7″ x 9½″

Prices quoted are subject to change without notice

FREED TRANSFORMER CO., INC.

INCREMENTAL INDUCTANCE BRIDGES

Direct in-line readings of inductance and conductance of iron core component at audio frequencies with or without super-imposed direct current. The bridge uses the Owens circuit with provisions for measuring the series or parallel inductance and conductance of the unknown inductor; five precision resistance and capacitance decades are provided to indicate these values. "Q" or storage factor can be measured as the product of the inductive reactance and the conductance.



1110-C

Type	Inductance Range	Conductance Range	Frequency Range	D.C. Current	Accuracy	Dimensions and Weight	Price
1110-C	1111.1 h to 1 mh 5 decades 1.1 h to 1 μh 2 decades	0.015 μmho—100 mho "Q" = 600 max @ 100 cycles	20 cycles to 10KC	up to 2 amperes	±0.5% to 5 KC ±2% to 10 KC	21¾" x 17½" x 15¼" 50 lbs.	695.00
1115	111.1 h to 100 μh 5 decades 0.11 h to 0.1 μh 2 decades	0.15 μmho—1000 mho "Q" = 600 max @ 100 cycles	20 cycles to 10 KC	up to 15 amperes	±1% to 5 KC ±3% to 10 KC	21¾" x 28" x 15¼" 80 lbs.	995.00
1185	111.1 h to 100 μh 5 decades 0.11 h to 0.1 μh 2 decades	0.15 μmho—1000 mho "Q" = 600 max @ 100 cycles	20 cycles to 10 KC	up to 30 amperes	±1% to 5 KC ±3% to 10 KC	21¾" x 33¼" x 15¼" 100 lbs.	1395.00

NULL DETECTOR

Sensitive null detector for bridge measurements, with self contained selective filters to limit the amplifier characteristics at various bridge measuring frequencies.

1140-B

Type	Sensitivity	Frequency Range	Filter	Power Requirements	Dimensions and Weight	Price
1140-B	10μ volts @ 1 KC for 15% meter deflection filter in	20 to 20,000 cycles	Fixed 60, 400, 1000 cycles Adjustable ±5% of center Other frequencies available	105-125 volts 50-60 cycles	Cabinet 12" x 8½" x 10"—18 lbs. Rack—19" x 6" x 10"	290.00

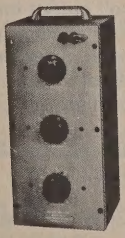
D.C. SUPPLY

A constant voltage transformer regulated current source designed for use with the Freed Incremental Inductance Bridges. Solid state bridge rectification, L-C filters and low internal impedance provides good current regulation with a minimum of circuit complexity.

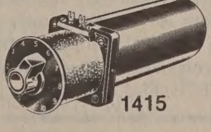
Type	Current Ranges	Voltage Ranges	Regulation	Power Requirement	Dimensions and Weight	Price
1170-A	4 ranges, 0-5, 25, 100 and 1000 milliamperes	Maximum no load voltage 1000 Ma, 270V, 100 Ma, 270V 25 Ma, 85 V, 5 Ma, 48 V	± 1% for line variation 105-125 V	105-125 volts 60 cycles	19" x 10½" x 13½" 66 lbs.	375.00

DECADE CAPACITORS

The Freed series of Decade Capacitors cover a wide range of values and can be supplied as individual decades from 0.0001 PF. per step to 1 mf. per step or in various combinations of assembled decade boxes. All capacitors are non-inductively wound and heat treated for stability.



1250



1415

Type	Total Capacity	Dielectric	Dissipation Factor	Accuracy	Dimensions and Weight		Price
1415	10 μf in steps of 1 μf	Mylar	<0.005	±1%	3" x 3" x 7"	2 lbs.	60.00
1416	1 μf in steps of 0.1 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	75.00
1417	0.1 μf in steps of 0.01 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	60.00
1418	0.01 μf in steps of 0.001 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	60.00
1419	0.001 μf in steps of 0.0001 μf	Polystyrene	<0.0002	±1%	3" x 3" x 7"	2 lbs.	70.00
1250	1.110 μf in steps of 0.001 μf	Polystyrene	<0.0002	±1%	13¾" x 6" x 4½"	8 lbs.	285.00
1352	1.111 μf in steps of 0.0001 μf	Polystyrene	<0.0002	±1%	19" x 5¼" x 10"	13 lbs.	335.00
1353	11.111 μf in steps of 0.0001 μf	Mylar Polystyrene	<0.005	±1%	19" x 5¼" x 10"	14 lbs.	395.00

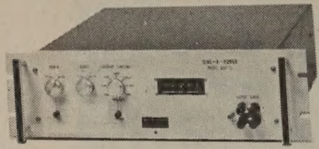
Maximum operating voltage, 500 VDC or peak. Capacitors can be supplied to better than ±1%, write for complete information.
In addtion to listed equipment, Freed manufactures a complete series of decade inductors, AC and DC regulated power supplies, comparison and limit bridges.
Write for complete catalog.

GENERAL RESISTANCE INSTRUMENTS

PRECISION INSTRUMENTATION

GENERAL RESISTANCE INSTRUMENTS

PROGRAMABLE/MANUAL ULTRA-HIGH ACCURACY POWER SUPPLIES



DIAL-A-POWER™ SERIES

Contrary to popular practice in the power supply field, when you set the five decade dials of the DAP to the output you desire, that's the output you get, ±0.01%. This is because our accuracy statement includes **all** the parameters that contribute to power supply inaccuracies.

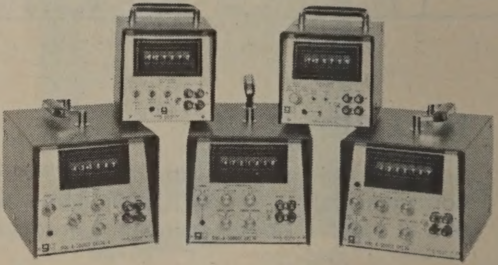
Resolution is 100µV on the 10V range; 1mV on the 100V range. Select a model with remote programing and/or manual operation.

OUTPUT RANGES, F.S., DC	10V & 100V
MAX. LOAD CURRENT:	
0 to 10V (either range)	3A
10 to 25V	1-¾A
25 to 50V	¾A
50 to 100V	¼A
ACCURACY, INCLUDING: TIME: Over 10,000 hours TEMPERATURE: +15 to +45°C LINE REG.: 105 to 125 VAC LOAD REG.: Zero to full	±0.01% of setting

DIALABLE REFERENCE/CALIBRATION SOURCES

- 12 models of dialable DC voltage/current reference/calibration sources
- 5 models that also provide built-in constant current operation
- Highly stable and accurate performance
- Resolutions to 0.1µV
- Accuracies to ±0.0015% of voltage setting
- Voltage outputs to ±100VDC
- Current outputs to ±1A
- "Zero" voltage output impedance
- NEW: a portable source/calibrator & multimeter

DIAL-A-SOURCE™ SERIES



Intended for use in the field, on the production floor, and in the lab, a few applications of the Dial-A-Source Series include: A/D & D/A converter evaluation, instrument calibration, transducer simulation, and stability testing.

PROGRAMABLE REFERENCE/CALIBRATION SOURCES

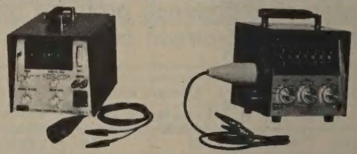
- Resolutions to 0.1µV
- Ranges: 0 to ±1VDC, 10VDC & 100VDC
- Optional constant current operation
- Accuracies to ±0.0025% of setting
- Stabilities to ±7ppm/24 hrs; ±20 ppm/yr

The newest members of the Dial-A-Source family feature remote programing of voltage output, range, polarity, and current limit. Programing instructions can be overridden by switching to the local mode and operating manually.

ELECTRONIC THERMOCOUPLE SIMULATORS

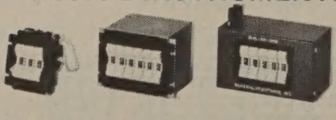
These versatile instruments are not dedicated to a particular temperature range or thermocouple type, so they permit simulation of the five most widely used thermocouple materials (others optional). Since the output is dialed in voltage, rather than in temperature, the ETS/TSC can cope with **any** reference table, **any** thermocouple materials, and **any** temperature. The accuracy of the simulated temperature is ±¼°C, with the exception of platinum.

Because these instruments have "zero" output impedance, the system element (readout, scanner, temperature controller, etc.) undergoing test/analysis/calibration will respond only to the simulated temperature signal provided by the ETS or TSC, without the necessity of disturbing circuit connections. The environment of the system's thermocouple has no effect on the system while the ETS/TSC is connected.



- Truly portable; battery or line operated models
- Models with built-in null detector and "run-up" pot
- Wide range will simulate the output of **any** thermocouple at **any** temperature
- Accuracy: ±¼°C (except platinum)
- Automatic Ice Point References also available

PASSIVE INSTRUMENTS



General Resistance offers a wide selection of:

- **Universal resistance decades:** 39 basic models; accuracies to ±0.01%
- **Kelvin-Varley volt/ratio dividers:** 3, 4, 5, 6 or 7 decades; accuracies to ±½ppm
- **RTD/platinum sensor simulators:** accuracy to ±0.01%, 10Ω to 1kΩ; resolution 1mV

A/S DANBRIDGE INSTRUMENTS

Danbridge has specialized in the development and manufacture of component test equipment since 1949. The Danbridge instrument line complements that of General Resistance and includes **Capacitance Deviation Bridges (1MHz), DC Resistance Bridges, Component Comparators, Capacitance Loss Meters, Decade Capacitors,** and **High-Voltage Insulation Testers.** General Resistance is the sole distributor of A/S Danbridge instruments in the U.S.A. and Canada.

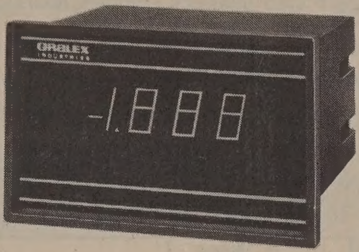
GENERAL RESISTANCE, INC.
75 Haven Avenue
Mt. Vernon, New York 10553
(914) 699-8010 / TWX 710-562-0199

Add Dept. EM to address to tell them you saw it in eem

GRALEX DIGITAL PANEL METERS

A broad range of models are available for most applications

SYSTEMS DPM



A high performance model with outputs and controls for interfacing digital systems

- INSTRUMENTATION INPUT
- 0.05% RDG ACCURACY
- BCD DIGITAL OUTPUTS
- ADJUSTABLE CONVERSION RATE (up to 100 conversions per second)
- HOLD/READ CAPABILITY
- GAS DISCHARGE DISPLAY
- COMPACT CASE SIZE

Ask for Model 36 Brochure

VERSATILE FAMILY

2¾, 3½, 3¾ DIGITS

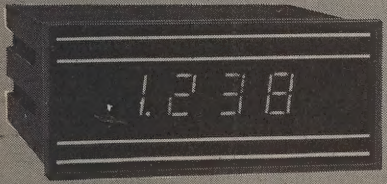
GRALEX INDUSTRIES
3359

Choose the number of digits, display, power and options you require

- LED OR GAS DISCHARGE DISPLAY
- AC LINE OR 5V DC POWER
- NEMA CASE
- HOLD/READ CAPABILITY
- INDUSTRIAL TRANSDUCER READOUT OPTION
- EVENT COUNTER OPTION
- ISOLATED BCD OUTPUT OPTION

Ask for Series 37 Brochure

LOW COST



$^{\$}66^{50}$

in OEM quantities

With the most wanted features at attractively low quantity prices

- 3½ DIGITS, BIPOLAR
- 0.1% RDG ACCURACY
- ½″ BRIGHT LED DISPLAY
- NEMA CASE
- AC LINE OR 5V DC POWER
- 2nd GENERATION LSI RELIABILITY
- BCD OUTPUT OPTION

Ask for Model 38 Data Sheet

DIGITAL AC LINE MONITOR

The modern way to read AC power line voltages

GRALEX
135.9
AC VOLTS

- MEASURE UP TO 600V AC
- 0.5% RDG ACCURACY
- FREQUENCY RANGE TO 20 KHz
- UNIVERSAL LINE POWERING
- GAS DISCHARGE DISPLAY
- INCORPORATES RELIABLE LSI CIRCUITS
- TRUE RMS OPTION

Ask for Digital Line Monitor Data Sheet

SPECIAL REQUIREMENTS

GRALEX CAN PROVIDE CUSTOMIZED UNITS TO SATISFY PARTICULAR NEEDS. THIS INCLUDES PACKAGE, RANGES, SCALING, UNUSUAL OUTPUTS AND THE LIKE. OUR ENGINEERS CAN PROVIDE COST EFFECTIVE SOLUTIONS TO YOUR DPM REQUIREMENTS. CONTACT YOUR LOCAL REPRESENTATIVE OR OUR FACTORY TODAY.

GRALEX INDUSTRIES

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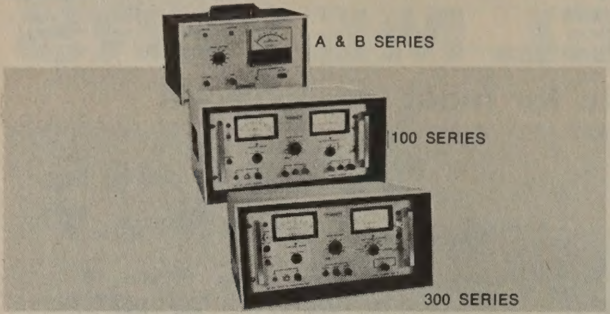
(516) 694-3607

HIPOTRONICS

AC/DC Hipot & Insulation Testers

Non-destructive units for production or laboratory use. . . . In ranges up to 10 kV AC and to 25 kV DC.



AC/DC Hipot Testers & Megohmmeters (300 Series)

Six versatile models are designed in A and B versions to meet the requirements of AC Hipot Testing, DC Hipot Testing and Resistance Measurement. The range capability for current and resistance reading varies according to the model number and selected version.

Every unit contains an overload circuit with continuously adjustable sensitivity from 50 μA to 5 mA allowing non-destructive testing of insulation and dielectrics.

Features

- Dual range output connected kV meter with calibrated set point for megohmmeter readings clearly marked
- Reset button and failure indicator
- Recalibration facilities
- Guard circuit for grounded and ungrounded operation
- Front panel re-entrant test lead connections
- AC/DC function indicator lights
- Zero start interlock compels operator to start tests at zero volts
- Gravity operated shorting solenoid with discharge resistor
- Audible failure signal

Specifications

Input: 115 V AC, 60 Hz, 1 Amp max. **Size & Weight:** 21″Wx19″Dx10″H; approx. 50 lbs. **Meters:** 2% full scale accuracy, 4½″ meter. **Current Meter Ranges: A Series** — Ranges of 0-50/500/5000 μA, dc, 0-5 mA AC, 1 to 1000 megohms in 2 ranges. **B Series** — Ranges of 0-0.5/5/50/500/5000 μA, 0-5 mA AC, 1 to 100,000 megohms in 4 ranges.

Model	Output Voltage (kV)		Current Meter Range		Megohm Ranges
	AC	DC	AC	DC	
H301A	1.0	1.5	0-5 mA	0-50/500/5000 μA	2
H301B	1.0	1.5	0-5 mA	0-0.5/5/50/500/5000 μA	4
H303A	2.5	3.0	0-5 mA	0-50/500/5000 μA	2
H303B	2.5	3.0	0-5 mA	0-0.5/5/50/500/5000 μA	4
H306A	5.0	6.0	0-5 mA	0-50/500/5000 μA	2
H306B	5.0	6.0	0-5 mA	0-0.5/5/50/500/5000 μA	4

AC/DC Hipot Testers (100 Series)

The H100 Series consists of eight models subdivided into four subseries — H103, H106, H115, H125 — based on output voltage range. Each subseries is available in two versions, standard (H) or deluxe (HD) based on the number of ranges provided for current readings.

All units are constructed with a standard 19″ panel and enclosed in an attractive bench top cabinet. A ground lead and a shielded test lead is included with each unit.

Features

- Overload circuit with continuously adjustable overload sensitivity from 50 μA to 5 mA permitting safe, non-destructive testing
- kV meter recalibration facility
- Output control continuously adjustable from zero to max.
- Front panel re-entrant test lead connections
- AC/DC function indicator lights
- Gravity operated output shorting solenoid with discharge resistor
- Audible failure signal

Specifications

Input: 115 V AC, 60 Hz, 5 Amps max. **Size & Weight:** 21″Wx19″Dx10″H; approx. 60 lbs. **Meter:** 2% full scale accuracy. 4½″ meter.

Model	Output Voltage (kV)		Output Current Meter		kV Meter Ranges
	AC	DC	DC	AC	
H103	2.5	3.0	0-5 mA	0-5 mA	0-3 kV
HD103	2.5	3.0	0-50/500/5000 μA	0-5 mA	0-0.6/1.2/3 kV
H106	5.0	6.0	0-5 mA	0.5 mA	0-6 kV
HD106	5.0	6.0	0-50/500/5000 μA	0-5 mA	0-1.2/3/6 kV
H115	12.0	15.0	0-5 mA	0-5 mA	0-15 kV
HD115	12.0	15.0	0-50/500/5000 μA	0-5 mA	0-3.75/7.5/15 kV
H125	10.0	25.0	0-5 mA	0-5 mA	0-25 kV
HD125	10.0	25.0	0-50/500/5000 μA	0-5 mA	0-5/10/25 kV

AC & DC Production Hipot Testers (A & B Series)

The A and B Series of Hipot Testers is designed for simple and reliable production line testing. Each model has continuously variable output voltage and an output connected kV meter providing optimum test accuracy. Non-destructive testing is ensured with a sensitive leakage and arc detection system.

Features

- An AC power on switch, an internal fuse and pilot light
- A continuously adjustable output voltage control
- Corona network arc detector and indicator
- A shielded output lead with an alligator clip termination
- Adjustable overload system

AC Models	Output Voltage	kV Meter
HDA3	3 kV AC	0-3
HDA5	5 kV AC	0-5
HDA10	10 kV AC	0-10

DC Models	Output Voltage	kV Meter
HDB4	4 kV DC	0-4
HDB6	6 kV DC	0-6
HDB12	12 kV DC	0-12

Specifications

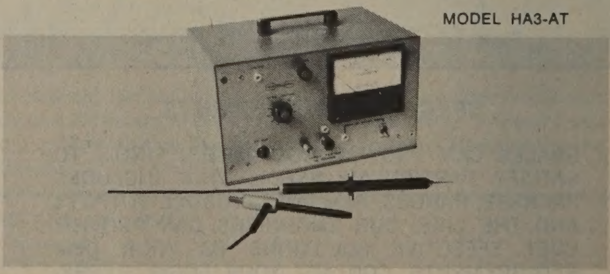
Input: 115 V AC, 60 Hz, 3 Amps max. **Size & Weight:** 7″Hx12″Wx8″D; approx. 20 lbs. **Meter:** 3% full scale accuracy, 4″ meter.

AT Series of UL Testers

Reliable and simple to operate, the AT Series is designed for continuous assembly line testing of electrical appliances and instruments to meet UL standards of dielectric withstand. Visible and audible indicators of component leakage or internal arcing provide safe, non-destructive testing. Direct and accurate output voltage readings will result, independent of the load.

Features

- AC outputs: 1200 volts A1 Series, 0-3,000 volts HA3 Series
- Overload circuit with manual reset and overload pilot light
- Voltmeter connected at output for maximum accuracy (except the model A1-AT which has a 500 VA transformer)
- Visible and audible failure indicators
- Input switch, pilot light and high voltage fuse
- Front panel lead connections


MODEL HA3-AT

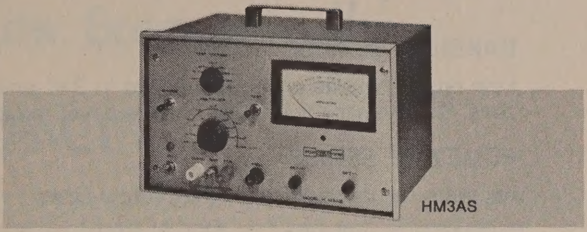
Prices and specifications subject to change without notice.

Megohmmeters/ Insulation Testers

The HM Series consists of six high voltage megohmmeters for precision measurement of resistance in a variety of components and insulations.

The output voltage is double-regulated with a ferro-resonant line and solid state electronic regulators eliminating the need for meter averaging even in the larger capacitive loads.

A complete short circuit protection system permits continuous shorting without injury to the operator or the component.


HM3AS

Features

- A meter multiplier with multiple positions for range selection
- Ferro-resonant line and solid state electronically regulated test voltage
- Dual color meter scale
- Four terminal output network for grounded or ungrounded testing
- Self-contained precision calibrating resistors

Specifications

Input: .... 115 volts, 60 Hz.
Weight: .... 20 lbs. (approx.)
Size: .... 7"Hx12"Wx8"D

Model No.	Output Voltage	Megohm Ranges	Megohm Ranges
HM1	500	1 to 1,000 megohms	2
HM3A	50 100 500 1000	0.1 to 1,000,000 megohms 0.2 to 2,000,000 megohms 1 to 10,000,000 megohms 2 to 20,000,000 megohms	6 6 6 6
HM3AS		Same as HM3A, but with mandatory 2 hand operation	
HM6B	50 250 500	0.1 to 1,000,000 megohms 0.5 to 5,000,000 megohms 1 to 10,000,000 megohms	6 6 6
HM6S		Same as HM6B, but with mandatory 2 hand operation	
M6C	250	0.1 to 1,000,000 megohms	6

AC/DC Kilovoltmeters

Our AC/DC kilovoltmeters offer laboratory precision combined with rugged design and packaging for field use. Separate dividers for AC and DC are enclosed in one oil filled phenolic cylinder for safe storage.

All models are triple range and have a shorting position for transport. Every unit is calibrated with our standard traceable to the National Bureau of Standards which has better than 0.1% accuracy on DC and better than 0.5% accuracy on AC. Surge devices prevent injury to the operator and the component even when short circuits occur at full voltage.

MODEL KV50A

Specifications

	Model KV25A	Model KV50A	Model KV100A	Model KV200A
Accuracy:				
DC	1.0%	1.0%	1.0%	1.0%
AC	1.0%	1.0%	1.0%	1.0%
Tracking	0.5%	0.5%	0.5%	0.5%
Temp. Coef.				
DC	0.025%/C°	0.025%/C°	0.025%/C°	0.025%/C°
AC	0.1%/C°	0.1%/C°	0.1%/C°	0.1%/C°
Freq. Response	DC and 40 to 1000 Hz	DC and 40 to 1000 Hz	DC and 40 to 1000 Hz	DC and 40 to 1000 Hz
Meters (kV)	0-5/10/25	0-10/25/50	0-20/50/100	0-40/100/200
Volts Div.	50/100/250	100/250/500	200/500/1000	400/1000/2000
Imped.	90 megΩ @ 200 pfd	190 megΩ @ 200 pfd	380 megΩ @ 100 pfd	760 megΩ @ 50 pfd
Size	8½Wx10½D x15½"H	8½Wx10½D x15½"H	8½Wx10½D x15½"H	9½Wx10½D x40"H
Weight	18 lbs.	20 lbs.	21 lbs.	40 lbs.

Liquid Dielectric Testers

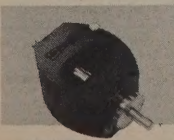
The portable OC Series of liquid dielectric testers is designed to test the breakdown voltage of insulating liquids in accordance with ASTM and various international specifications. The fully automatic models, OC-50A, OC-60A and OC-90A feature automatic rate of rise with manual dwell at any voltage. The fourth model, OC-51M has manually operated variable output with a range of 0-50 kV.

The memory meter, included on all the units, provides accuracy and repeatability of readings, allowing truly comparative readings of different dielectrics and periodic comparative readings of the same dielectric. A variety of test cells (oil cups) are available for use with the units.

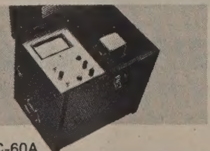
Test Cells

TC/DE ASTM test cell with disc electrodes for testing to ASTM specification D877. (left)

TC/VDE ASTM test cell with VDE electrodes for testing to ASTM specification D1816. (right)


TC/DE

TC/VDE


OC-60A

Specifications

Model No.	Output Voltage	Current	Dimension	Wgt.
OC-50A	0-50 kV rms	2 kVA	15½Wx14½Hx11½"D	60
OC-60A	0-60 kV rms	2 kVA	15½Wx14½Hx11½"D	65
OC-90A	0-90 kV rms	2 kVA	16½Wx18½Hx20¾"D	90
OC-51M	0-50 kV rms	2 kVA	15½Wx14½Hx11½"D	60

Input: 115 volts, 50/60 Hz, 2 Amps, Single phase.

HIPOTRONICS®

HIPOTRONICS, INC.
Brewster, N. Y. 10509 / (914) 279-8031
TELEX: 710-574-2420

Call or write our sales department for more data and descriptive literature. See other Hipotronics' listings under Power Supplies.

Prices and specifications subject to change without notice.

B-R

PANEL/METERS

- **AMMETERS**
- **MILLIAMMETERS**
- **VOLTMETERS**
- **MILLIVOLTMETERS**
- **VU METERS**

BAKELITE SERIES

Low profile bakelite and glass meters in 3½" and 4½" sizes. Smooth satin finish case - modern, yet rugged.

EDGEWISE SERIES

Excellent readability with a long narrow scale.

PROJECTED FRONT SERIES

The newest in meter design. Projected front allows window type mounting. Completely shadow free illumination due to translucent case back.

CUSTOM SERIES

Our ever-popular custom series rectangular meter is made in sizes from 1½" to 8". All have long sweeping scale and 100° movements.

BEZEL MOUNT SERIES

rugged die cast metal bezels are available for the custom meter sizes 1½", 2½", 3½" and 4½".

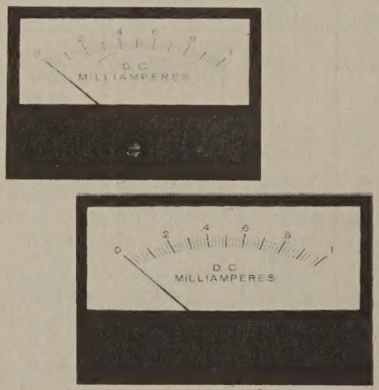
METER MOVEMENTS

one of the most complete selections of meter movements in the industry:

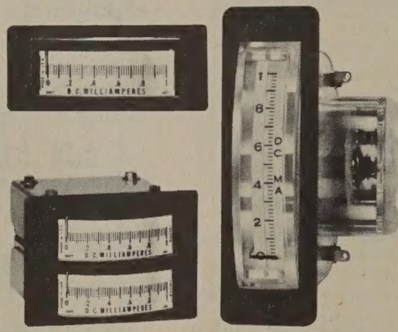
- Self-shielded
- External Magnet
- A.C. Repulsion
- A.C. Rectified.

For detailed description of panel meters and their movements, please request literature from the Burton-Rogers Company, 556 Trapelo Road, Belmont, Mass. 02179.
TOLL FREE PHONE: (800) 225-1375

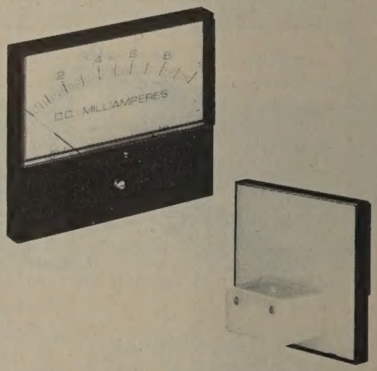
BAKELITE SERIES



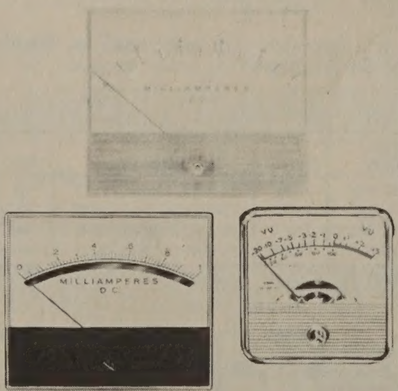
EDGEWISE SERIES



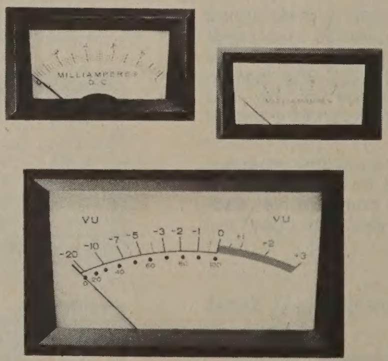
PROJECTED FRONT SERIES



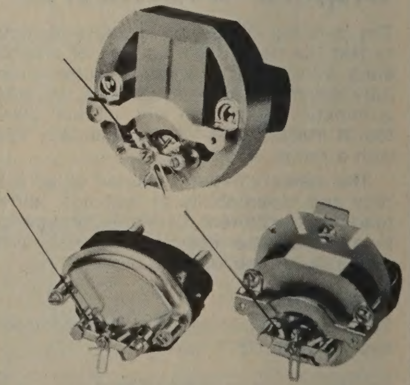
CUSTOM SERIES



BEZEL MOUNT SERIES



METER MOVEMENTS



B-R

BURTON-ROGERS COMPANY
556 Trapelo Road, Belmont, Massachusetts 02179 • (617) 489-1520

Now—Valid testing of up to 20,000 complex wired circuits a minute. Economically.

That's a FACT.®

Our newest FACT (Flexible Automatic Circuit Tester) system, called FACT®-PC, is controlled by a programmable digital processor and specially designed modular software for performing all wiring-analysis functions.

Very high testing rates of complex wiring, computer backplanes, and multilayer PCs are achieved: 10K-20K continuity tests/minute and 4K-10K leakage (at up to 1500 VDC) tests/minute—more than double those previously possible.

FACT-PC complements existing FACT-II systems. Programming, output connectors and fixturing are common between the FACT-PC and FACT-II.

And these FACT interconnection devices help optimize system productivity:

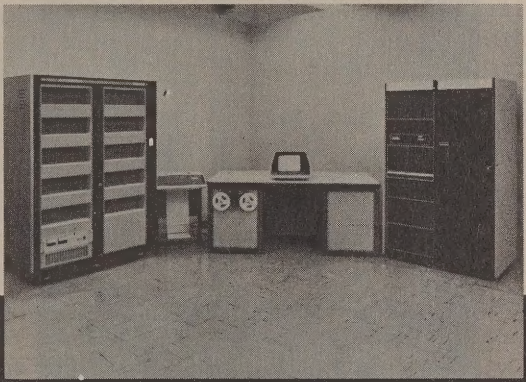
FACT-AID (Automatic Interconnection Device) permits rapid electrical hookup of multilayer boards and backplanes under fully automatic control.

FACT-LIFT (Low Insertion Force Technique) achieves multipin electrical contact to hook up thousands of backplane contacts positively in seconds.

FACT-QUIC (Quick Universal Interface Connector) is for rapid interconnection to FACT switching modules.

FACT SPRING PROBE ADAPTERS are fixtures that feature Quick Interchangeable Test Heads with contact densities of up to 400 probes/sq. in.

The FACT systems and associated interconnection devices offer you the most efficient, economical solution to exacting, large-volume wiring analysis. Two brochures, "FACT-PC" and "The FACT System," explain in detail. Ask for them at Industrial Products Division, FACT Systems, Hughes Aircraft Company, PO Box 92904, Los Angeles, CA 90009; (213) 670-9040.



HUGHES

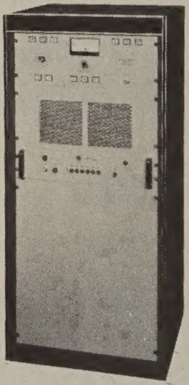
HUGHES AIRCRAFT COMPANY
INDUSTRIAL PRODUCTS DIVISION
FACT SYSTEMS

CENTRALIZED FACT II
WORK STATIONS
THE FACT-PC SYSTEM
Flexible Automatic Circuit Tester - Processor Controlled
THE FACT SYSTEM

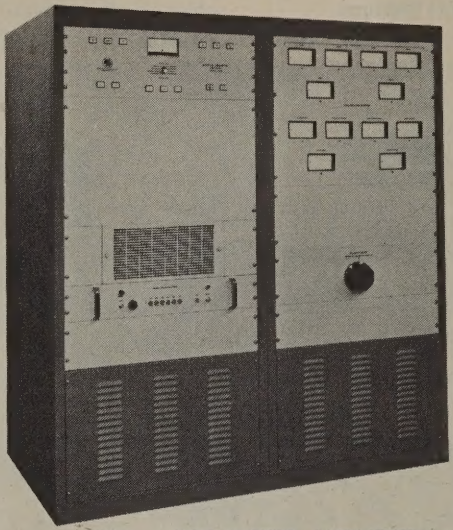
BROADBAND POWER AMPLIFIERS

- Linear, Amplifies All Forms of Modulation
- High Power Gain, Drive with Signal Generator
- No Tuning, No Bandswitching
- Fully Protected, Metered
- System Compatible, Modular
- Drive Mismatched Loads

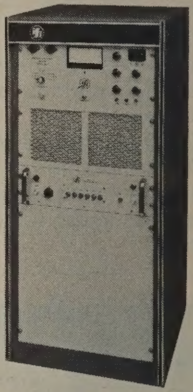
Power Output	Gain	Frequency Range	Model
10 Watts	40dB	5kHz to 250MHz	M5100
100 Watts	47dB	10kHz to 250MHz	M403
400 Watts	50dB	10kHz to 220MHz	M404
1kW	58dB	10kHz to 220MHz	M406
5kW	65dB	1MHz to 100MHz	M469



M406 POWER AMPLIFIER
Most versatile off-the-shelf amplifier available today.

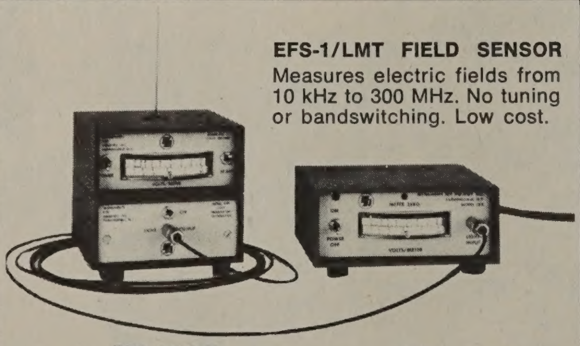


M469 — 5kW POWER AMPLIFIER
Highest Power x Bandwidth



M404 POWER AMPLIFIER
Rugged and reliable medium powered amp.

EFS-1/LMT FIELD SENSOR
Measures electric fields from 10 kHz to 300 MHz. No tuning or bandswitching. Low cost.



NEW!

M5100 POWER AMPLIFIER
Remote Leveling Capability. Work into any load. Auto limit.

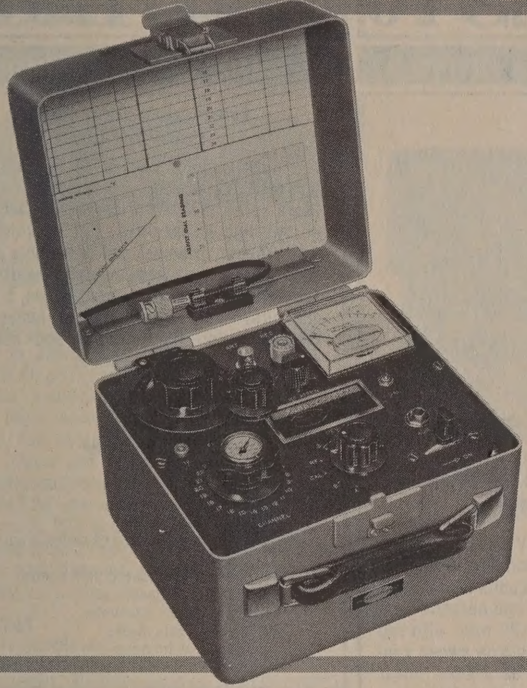
Instruments For Industry offers a complete line of high gain, high power, very wideband amplifiers from milliwatts to kilowatts and from Hertz to Megahertz. Many standard systems are available from stock. Frequency range and outputs can be made to meet your specific requirements. A phone call to our Applications Engineering department will help to solve your broadband power problem.

INSTRUMENTS FOR INDUSTRY, INC.
151 TOLEDO STREET/FARMINGDALE/N.Y. 11735/516-694-1414 ■ Cable: Electronic Hallandale, Fla.
TELEX: 51–43–32

ICM

Frequency Meter

FM-2400CH (25 to 1000 MHz)



The FM-2400CH provides an accurate standard frequency signal for testing and adjustment of mobile transmitters and receivers at predetermined frequencies between 25 and 1000 MHz. Up to 24 crystals may be inserted. The frequencies can be those of the radio frequency channels of operation, and/or of the intermediate frequencies of the receivers between 5 MHz and 40 MHz. Frequency stability (standard) ±.001% from +32° to +122°F. Frequency stability with built-in thermometer, calibrated crystals and temperature corrected charts, ±.00025% form +25° to +125°F. (±.000125% special 450 MHz crystals available). Unit has solid state circuitry and rechargeable batteries.

SPECIFICATIONS

Crystal Oscillator

Frequency Range — 5 to 20 MHz
Frequency Stability — Standard —
±0.0005% from +50° to +104°F
±0.001% from +32° to +122°F
with built-in thermometer —
±0.00025% from +25°F to +125°F
with crystals calibrated and supplied with temperature corrected charts.
±.000125% +55° to +95°F
Frequency Tuning — 0.005%

Transmitter Pickup

Frequency Range — 25 to 500 MHz/1000 MHz
Sensitivity — 100,000 μV at 25 MHz to 250,000 μV at 470 MHz across 50 ohms

Counter Circuit

Frequency Ranges — 0 to 1.5 KHz
0 to 15 KHz
Residual Error — 100 cps at zero beat

RF Signal Generator

Frequency Range — 25 to 500 MHz/1000 MHz
Low Output* — 80 dbm to –100 dbm
High Output — Approximately 500 μV across 50 ohms

Crystal and tuning specifications are the same as for the Crystal Oscillator above.

External Accessories

#246 IF Oscillator, 190 KHz to 8 MHz
Cat. No. 035321 .... $35.00
#241 Audio Oscillator, 1,000 HZ
Cat. No. 035322 .... $35.00

I.F. Signal Generator

Frequency Range — 5 MHz to 20 MHz on Fundamentals, and to 40 MHz on 2nd harmonics
Frequency Stability — ±0.002% from +32° to +122°F
Frequency Tuning — None
Output — 1,000 μV minimum into an open circuit
4 Nickel-Cadmium rechargeable batteries, charger supplied

Panel Controls

Frequency Channel Selector, 24 positions
Frequency Adjust, Calibrated 0 to 100
Function Selector,
7 positions — Battery Test "A"
Battery Test "B"
Calibration "C"
RF
Deviation X.3
Deviation X1
Deviation X3

FM-2400CH (meter only) Cat. No. 035320	**$595.00**
RF Crystals (less temperature correction)	**24.00 ea.**
RF Crystals (less temperature correction)	**18.00 ea.**
IF Crystals	Catalog Price

*CH Model supplied with external attenuator to reduce signal to 0.5 to 2 μV range.

HOW TO ORDER:

MAIL: International Crystal Mfg., Inc., 10 North Lee, Oklahoma City, Okla. 73102
PHONE: Area Code 405 236-3741
CABLE: INCRYSTAL
WESTERN UNION TELEX: 747-147
BELL SYSTEM TWX: 910-831-3177

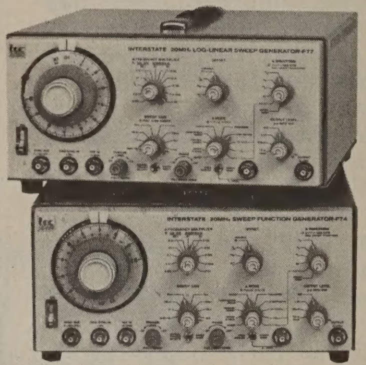
ICM

INTERNATIONAL CRYSTAL MFG. CO., INC.
10 North Lee / Oklahoma City, Okla. 73102

INTERSTATE'S

SERIES 70

Function Generators



Broad Range With Plenty of Power

SERIES 70, a universal signal-source line, offers the ultimate blend of function, pulse, and sweep generator capabilities. Four SERIES 70 models to choose from, all producing sine, square, triangle and dc-level waveforms with 5/95% waveform variable symmetry control, fixed and variable offset, and calibrated coarse/fine frequency tuning. Model F72 combines the capabilities of "true pulse" and function generators into one versatile unit. Models F74 and F77 add sweep capabilities to the "true pulse" and function generator combination. Top-of-the-line F77 also offers selectable log/lin sweep, sweep sync, and analog power amplifier capabilities.

F71 $745
- 0.00002 Hz to 20 MHz range
- 15 V p-p into 50 ohms
- constant duty cycle pulses
- 1000:1 VCF
- waveform inversion
- high/low output, 30-dB separation

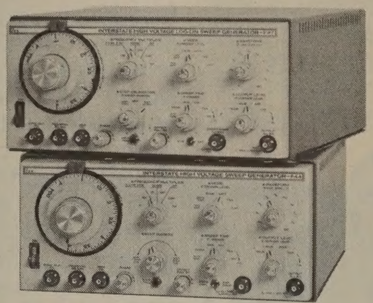
F72 $945
- adjustable rise/fall pulses to 15 ns
- 3 ns to 1000 ms adjustable pulse width
- trigger & gate with variable start-stop phase
- external synchronization
- plus all other F71 features

F74 $995
- fixed rise/fall pulses — 15 ns
- 3 ns to 10 ms adjustable pulse width
- 60-db step attenuator with vernier
- continuous & triggered sweep, sweep-and-hold & burst modes
- sweep up/sweep down
- direct-reading sweep limit control
- sweep ramp/frequency analog outputs
- trigger & gate with variable start-stop phase
- external synchronization
- plus all other F71 features

F77 $1165
- selectable logarithmic/linear sweep characteristics
- sweep synchronization
- analog power amplifier
- plus all other F74 features

SERIES 40

Function Generators



High Performance in the Medium Price Range!

This new high voltage (40 V p-p output) line offers five models, some including frequency marker and calibrator. These units also feature bipolar and unipolar positive and negative variable width pulses down to 120 nsec with rep rates to 4 MHz. F44 features true sweep generator characteristics such as 1000:1 linear sweep capabilities, sweep ramp output, continuous and triggered sweep and direct-reading sweep limit. F47 combines the features of the F44 with 10,000:1 logarithmic sweep and 11-point step frequency calibration between main dial settings. F46 gives the user AM/FM function generator capabilities with sinewave to 8 MHz, internal 400 Hz modulation and a 40-dB dynamic range.

F41 $475
- continuously variable vernier
- 0.0004 Hz to 4 MHz range
- 20 V p-p into 50 ohms
- analog of frequency out
- 1000:1 VCF (FM)
- 11-point calibrator
- variable offset
- sine, square, triangle, dc waveforms & variable width pulse

F43 $525
- external synchronization
- trigger & gate modes with variable start-stop phase
- variable symmetry
- plus all other F41 features

F44 $595
- sweep ramp output
- frequency marker
- direct-reading sweep limit
- continuous & triggered sweep
- plus all other F41 features except calibrator

F46 $695
- sinewave to 8 MHz
- internal 400 Hz modulation
- AM 40-dB dynamic range
- plus all other F41 features except calibrator

F47 $675
- selection of linear or logarithmic sweep characteristics
- 11-point calibrator
- plus all other F44 features

SERIES 30

Function Generators

Interstate's Best Selling Economy Line!

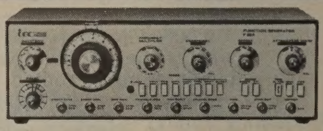
The most popular models in the SERIES 30 line are F31 and F34 — thousands of satisfied users agree that the price/performance value of this line is excellent. F31 provides clean sine, square, triangle, and adjustable dc. F34 adds trigger and gate, variable width pulse and sweep waveforms — continuous, triggered and burst — plus Interstate's exclusive direct-reading sweep limit control and calibrated coarse/fine frequency vernier.

F31 $435
- 0.03 Hz to 3 MHz
- 10 V p-p into 50 ohms
- 2-step, 40-dB attenuator
- 1000:1 VCF
- ±5V offset into 50 ohms

F34 $645
- continuous & triggered sweep & burst modes
- direct-reading sweep limit control
- analog of frequency out
- 5-step, 60-dB attenuator
- trigger & gate modes
- variable width pulse
- plus all other F31 features

F55A

Function Generator



The Sophisticated Generator with Phase-Lock and Phase-Shift at $1645

Phase-lock output is phase-coherent and adjustable in phase through 360° with respect to a reference signal. F55A's special phase-lock capability permits input signal to be frequency-multiplied or divided, as well as changed to any other form. Comprehensive pulse and waveform generation, multiple operating modes, and a host of superior performance features enable this precision instrument to fulfill critical instrumentation parameters for exacting laboratory situations.

- 0.00001 Hz to 11 MHz range
- 3 mV to 15 V p-p into 50 ohms
- sine, square, triangle, ramps
- fixed & variable offset
- 1000:1 VCF
- fixed & variable width pulses & ramps
- pulse width modulation
- trigger & gate modes
- continuous & triggered sweep, sweep-and-hold modes
- burst — single or multiple cycles
- direct-reading sweep limit control
- variable start-stop phase
- waveform inversion
- phase-lock

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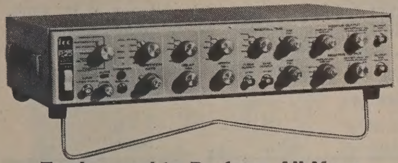
SIGNAL SOURCES

SERIES 20

Pulse Generators



Engineered to Perform All Your Pulse Requirements

Constant duty cycle mode and pulse amplifier mode, in addition to standard pulses, make SERIES 20 pulse generators tremendously versatile instruments, outstanding for their price. Pulse width delay from 10 nsec to 1 second, full range offset, normal and double pulse, trigger and gate modes with slope and level adjustments are standard on all models. P22 and P24 offer selectable positive or negative output. P24 and P25 have variable rise/fall times from 5 nsec to 0.5 sec. P23 and P25 feature simultaneous positive and negative outputs.

P22 $745
- 1 Hz to 50 MHz range
- 10 V p-p output into 50 ohms
- single output, selectable positive or negative pulses
- fixed rise/fall times less than 3.5 ns

P23 $845
- dual outputs, simultaneous positive & negative pulses
- fixed rise/fall times less than 3.5 ns for each output
- plus all other P22 specifications & features

P24 $995
- single output, selectable positive or negative pulses
- adjustable rise/fall times from 5 ns to 0.5 sec
- independent rise & fall controls
- plus all other P22 specifications & features

P25 $1185
- dual outputs, simultaneous positive & negative pulses
- adjustable rise/fall times from 5 ns to 0.5 sec for each output
- independent rise & fall controls
- plus all other P22 specifications & features

P12

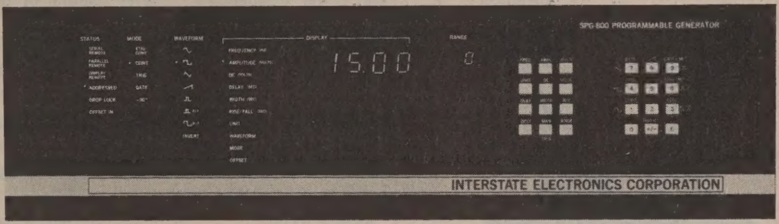
Pulse Generator

Don't Overlook the Economical P12 at $445

- 0.01 Hz to 10 MHz range
- 10 V p-p into 50 ohms
- single or double pulses at rep rates from 0.01 Hz to 10 MHz
- squarewaves to 5 MHz
- pulse width and delay variable from 50 nsec to 1 sec
- simultaneous positive and negative outputs
- normal/complement output selection
- 5-nsec rise/fall times for each output
- adjustable amplitude from 1 V to 10 V into 50 ohm load
- external or manual triggering
- synchronous or asynchronous gating

SPG-800

Programmable Generator


SPG-800 PROGRAMMABLE GENERATOR
DISPLAY
RANGE
15.00
INTERSTATE ELECTRONICS CORPORATION

Interstate's New Synthesized Programmable Generator combines all these instruments in one:

- **Programmable Synthesizer**
- **Programmable Pulse Generator**
- **Programmable Function Generator**
- **Programmable Voltage Source**

This exciting new product from INTERSTATE gives Automatic Test Equipment system designers a truly universal signal source. SPG-800 not only has all the top performance specifications of each of these programmable instruments individually, but several unique extra capabilities from the synergistic effect of their interaction.

Plug-in Construction
- up to 4 instruments in one box
- lowest cost combination of signal sources
- ASCII, IEEE 488, RS-232-C and 20 ma interfaces

Capabilities For All Instruments
- 0.1 Hz to 13 MHz frequency range
- 10 mV to 15 V p-p amplitude

Programmable Function Generator
- sine, square, triangle, ramp, pulse and more
- continuous, trigger, gate, AM and FM modes and more

Programmable Synthesizer
- frequency accuracy to 0.0001%
- tracking signal output (31-43 MHz)
- 1 MHz crystal reference output
- 1 MHz external precision reference input

Programmable Pulse Generator
- true pulse generator with variable rise/fall to less than 20 ns
- width and delay from 40 ns
- single or double pulse modes
- unipolar or bipolar pulses

Programmable Voltage Source
- three-digit resolution to ±9.99 V

For more information, contact your local INTERSTATE representative or call our toll-free number directly: 800/854-3825.

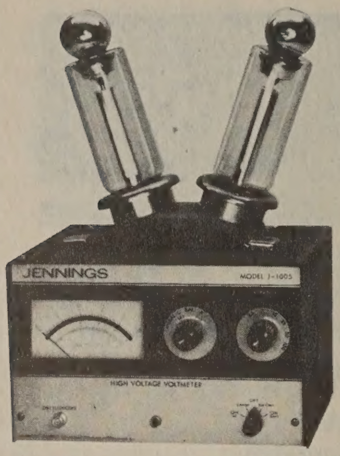
**INTERSTATE
ELECTRONICS
CORPORATION**

SUBSIDIARY OF **ATO**

Dept. 7000, P.O. Box 3117, Anaheim, California 92803 • 714/549-8282
TWX 910-591-1197 TELEX 655443 & 655419

high voltage test and measuring equipment

SOLID STATE AC VOLTMETER



MODEL J-1005

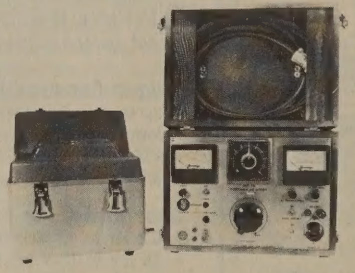
A compact, portable instrument for the accurate, direct reading of very high voltages at rf, audio and power frequencies . . . determination of the amplitude of pulses with oscilloscope connections for viewing wave shapes . . . removable high voltage input circuit for remote panel mounting of the meter . . . internal battery and ac line operation.

Specifications	Model J-1005
Voltage Ranges	Peak Kilovolts (single-ended) 0-2.5, 0-5, 0-10, 0-25, 0-50 Peak Kilovolts (double-ended) 0-2.5, 0-5, 0-10, 0-25, 0-50, 0-100
Frequency Response	Flat from 10 Hz to 20 MHz at full rated voltage. Internal resonances are above 100 MHz.
Accuracy	±3% of full scale on all voltage ranges.
Oscilloscope Connection	600 to 1 division ratio (approx.).
Meter Calibration	The meter is calibrated in peak kilovolts with linear voltage scales of 0-2.5, 0-5, 0-10, 0-25, 0-50.
Input Impedance	Greater than 2 x 10^{12} ohms and approx. 4 pf single-ended to ground, 2 pf double-ended.
Power Supply	117/230 volts ±10%, 50/60 Hz, 5 watts, or rechargeable battery.
Dimensions	Height, 16″; width, 10¾″; depth, 8″.
Net Weight	12 pounds (approx.). Ranges can be increased by using JCD5 series capacitors.

PORTABLE AC HIGH VOLTAGE TESTER

MODEL JHP-70A

The smallest and lightest instrument available at its power level the JHP70A will generate and measure 70,000 volts peak for on-site testing of high voltage components such as capacitors, switches, transformers, bushings, vacuum tubes, etc.



Maximum Output Voltage	**70 KV Peak**
Maximum Continuous Current	**30 MA RMS**
Short Circuit Current (Est.)	**100 MA RMS**
Power Requirements	**105-125 Volts RMS**
Frequency	**50-60 Hz**
Current	**15 Amps**
Surge Current	**10 Amps**
Weight:	
Control Cabinet	**28 lbs.**
Transformer	**43 lbs.**

DIGITAL AC/DC KILOVOLTMETER,

MODEL 12100

Versatility:
Reads average DC, peak AC or true RMS AC.

Accuracy:
DC calibration better than 1% of reading ±0.1% of full scale ±1 digit (LSD).

Wide Range:
0-10, 0-50 kilovolts DC; DC and 8 Hz — 100 KHz.

Bipolar:
Automatically displays correct DC polarity.

Hi Input Impedance
- Portability
- Oscilloscope Jack

Specifications	Model 12100
Voltage Ranges	DC: 0-10 KV, 0-50 KV AC (RMS): 0-10 KV, 0-35 KV ACpk (+): 0-10 KV, 0-50 KV ACpk (−): 0-10 KV, 0-50 KV
Frequency Ranges	8 Hz to 100 KHz on AC peak measurements, 8 Hz to 20 KHz on AC RMS measurements.
Accuracy	DC & AC pk: 1% of reading ±0.1% of full scale ±1 digit (LSD), AC (RMS) ±2% of full scale.
Digital Display	3½ digit high intensity plasma.
Input Impedance	10^{10} ohms and 10 picofarads.
Oscilloscope Connection	BNC connector, output 1 volt for full scale reading.
Power Supply	117 or 230 volts ±10%, 50/60 Hz, 5 watts or rechargeable battery, 8 hours recharge.
Dimensions	6″ x 14″ x 11″
Net Weight	12 lbs. (approx.)

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

high voltage test and measuring equipment

DIGITAL DC HIGH POTENTIAL TESTERS

DIGITAL HIGH POTENTIAL TESTER
MODEL 16420
JENNINGS

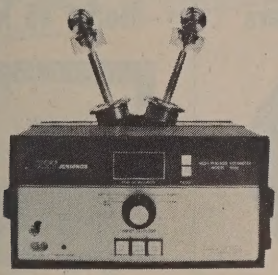
Model 16420

Compact portable instruments for measuring high voltage leakage currents in the insulation of electrical equipment including: rotating machinery, transformers, switchgear, relays, interrupters, contactors, capacitors, cables and insulators. The high voltage power supply is electronically regulated against line and load changes. Circuitry is all solid state and features an adjustable current limiter (30 to 300 microamperes) for protection of the tester and non-destructive testing of components. Model 16400's functions are separately accessible, permitting its use as a portable laboratory high voltage power supply or as a digital kilovoltmeter. AC line operation.

Specifications	MODEL 16420
Max. Output Voltage	40 KV DC
Max. Output Current	300 μamps
Ripple	3% of rated output
Load Regulation	3%
Input Regulation	1%
Displays	Two 3-digit high intensity plasma "kilovolts" and "microamps"
Voltmeter and Microammeter Accuracy	0.5% of full scale, 1 bit LSD
Power Requirements	117/230 volts ±10% 50/60 Hz, 30 watts

DIGITAL AC KILOVOLTMETER

MODEL 11100



Direct Reading: For on-line applications.

Accuracy: Calibration better than 1.0% of full scale.

Wide Range: 0-10, 0-100 kilovolts; 10 Hz - 30 MHz.

Portability: Operates from internal battery or line. Weighs less than twelve pounds.

Oscilloscope Jack • Remote Display • Stability

Specifications	Model 11100
Voltage Ranges	Peak kilovolts (single-ended) 0-10, 0-50 Peak kilovolts (double-ended) 0-10, 0-100
Frequency Range	Flat from 10 Hz to 30 MHz at full rated voltage. Internal resonances are above 100 MHz.
Accuracy	±1% of full scale on both ranges.
Digital Display	3½ digit high intensity plasma.
Input Impedance	2 x 10^{12} ohms and 4 pf single ended to ground, 2 pf double ended.
Oscilloscope Connection	BNC connector, 600-1 division ratio approximate.
Power Supply	117 or 230 volts ±10%, 50/60 Hz, 5 watts or rechargeable battery, 8 hours recharge.
Dimensions	9″ x 16″ x 15″
Net Weight	12 lbs. (approx.)

HIGH VOLTAGE AC DIVIDER

MODEL 13200

These dividers can be used with an oscilloscope to measure and observe voltages up to 50 kv at frequencies up to 20 MHz. Their low circuit loading design and shielded construction make them particularly suitable for rf measurement applications including tank circuit and transmission line voltages, pulse parameters, modulation voltages, and transient wave characteristics.

Specifications	Model 13200
Voltage	50 kv peak
Current	12.5 amperes RMS maximum through the voltage divider.
Input Impedance	Above 10^{12} ohms, 4 pfd.
High Frequency Response	Flat to 20 MHz at 50 kv peak; maximum frequency 50 MHz at 20 kv peak.
Division Ratio	325:1 to termination of 3 ft. of RG-58A/U cable.
Low Frequency Response When operated into shunt resistance of 1 megohm 10 megohms	 1000 Hz 100 Hz
Weight	2 lbs. 4 oz.

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

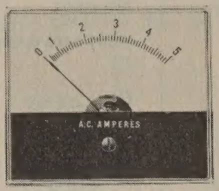
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

Jewell ELECTRICAL INSTRUMENTS, INC.

PANEL METERS AVIONIC PRODUCTS

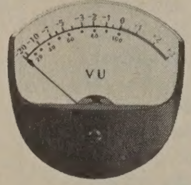
KATY INDUSTRIES, INC. SUBSIDIARY

Series MS Series



Three sizes available, 1½″ (Model MS1), 2½″ (Model MS2), 3½″ (Model MS3) . . . painted cover section can be color styled . . . the modern meter for the modern look.

VU Meters



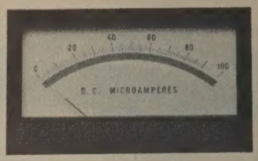
Used for monitoring volume levels in broadcast, recording and communication applications . . . meter is essentially a rectifier-type AC voltmeter of high sensitivity . . . built in some of the conventional meter case designs.

Series 70 Meters

D.C. MILLIAMPERES

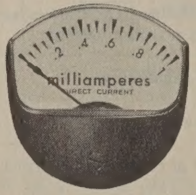
Available in 5 sizes, 1½″ (Model 71), 2½″ (Model 72), 3½″ (Model 73), 4½″ (Model 75) and 6″ (Model 76). All meters front panel mounted . . . behind the panel mounting with black bezel on 2½, 3½ and 4½″ models. Available with taut band, pivot and jewel and iron vane movements.

Model 65 Meters



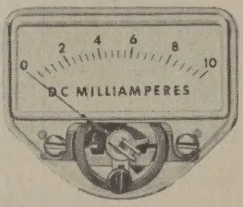
A rectangular styled meter with zero adjustment screw located on front face . . . dial is mounted flush with panel . . . Available with pivot and jewel and taut band.

Series MM Meters



Medallion styled panel meters available in three sizes (1½, 2½ and 3½″). Painted portion of cover can be color styled. Available with taut band, pivot and jewel and iron vane movement.

Series 80 Meters



Series 80 Taut Band meters affords functional design that provides maximum visibility in minimum space. Available in three sizes (1½, 2½ and 3½″).

Series HS Meters

MILLIAMPERES

These meters are noted for their resistance to shock and vibration . . . mechanisms are mounted on rubber at three points . . . special pivots, hair-springs and fastening techniques reduce effects of hard usage. 1½, 2½ and 3½″ models.

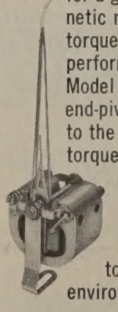
Model 45 Meters

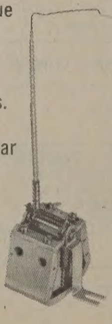
D.C. MICROAMPERES

Modern industrial styling on a 4½″ meter with bakelite cover and glass window. Available with taut band, pivot and jewel and iron vane movements.

AVIONIC PRODUCTS

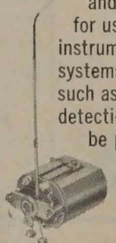
Mechanisms 201/208

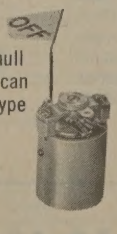




The Model 201 was designed to develop the highest possible torque for a given volume of magnetic material. Its high torque provides unusual performance characteristics. Model 208 is an externally end-pivoted mechanism similar to the Model 201. This high torque mechanism easily operates extremely long and heavy pointers. The Model 208 was developed to satisfy severe environmental requirements.

Mechanisms 202/215





The Model 202 and the Model 215 are center pivoted coaxial flag mechanisms. Lightweight, compact size, and durability make them ideal for use in multi-element aircraft instruments and control systems for functions such as alarm indication and null detection. These mechanisms can be provided with various type flags and pointers.

Mini Indicators

The Model 240 Mini Indicator features a compact moving-coil mechanism which is available in a range of easy to read pointer configurations. This versatile mechanism is also utilized in the Model 241 flag indicators. These compact units provide a confusion-proof display of on-off information such as alarm, position, or malfunction.

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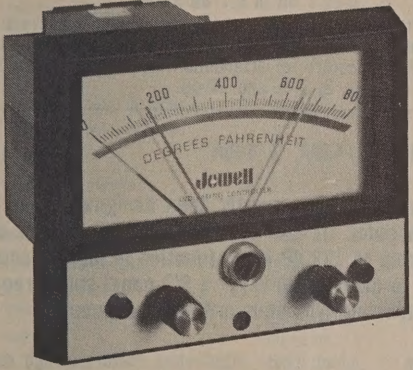
Jewell
ELECTRICAL INSTRUMENTS, INC.

INDICATING CONTROLLER SERVO RECORDERS AVIONIC PRODUCTS

KATY
INDUSTRIES, INC.
SUBSIDIARY

INDICATING CONTROLLER

A Versatile Solid-State Meter Relay for AC, DC and Temperature Ranges

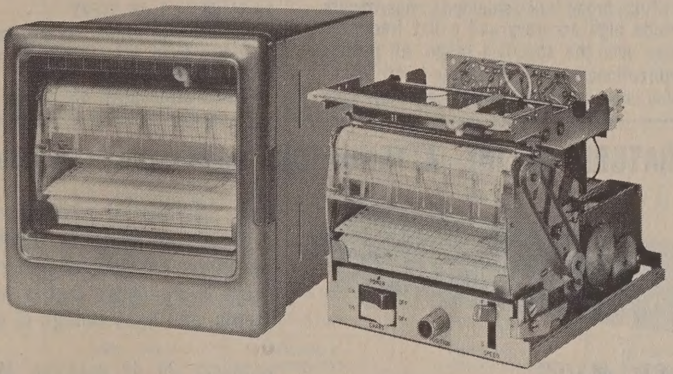


FEATURING

- ☐ PLUG-IN POWER SUPPLY
- ☐ ON-OFF OR TIME PROPORTIONING
- ☐ HORIZONTAL OR VERTICAL MOUNTING
- ☐ RECORDER OUTPUT
- ☐ 4″ MIRROR BAKED SCALE
- ☐ PUSH-TO-SET KNOB
- ☐ PLUG-IN DPDT RELAY
- ☐ ¼″ DIN HOUSING
- ☐ SINGLE OR DOUBLE SET POINT
- ☐ THERMOCOUPLE BREAK PROTECTION
- ☐ LATCHING WITH MANUAL RESET
- ☐ FIXED SET POINT
- ☐ SLAVE SET POINT
- ☐ TRIAC OUTPUT
- ☐ SCREWDRIVER SET POINT ADJUST

MINI•TURE® SERVO RECORDER

- ■ OEM Discounts
- ■ Stock Delivery

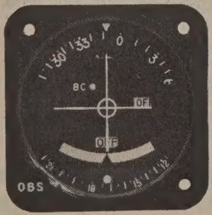


FEATURING

- ☐ 1 MV FULL SCALE
- ☐ METAL CASE WITH DUST SEAL
- ☐ STOCK DELIVERY
- ☐ 0.5% ACCURACY
- ☐ ½ SECOND FULL SCALE RESPONSE
- ☐ Z FOLD CHART PAPER
- ☐ DISPOSABLE INK CARTRIDGE
- ☐ EASY TO LOAD
- ☐ TWO SPEED CHART DRIVE
- ☐ RUGGED DIE CAST FRAME
- ☐ METRIC SPEEDS
- ☐ 100 MM CHART WIDTH

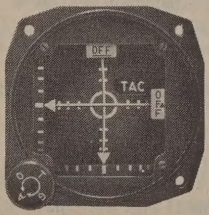
AVIONIC PRODUCTS

308, 309 Indicators



A course Indicator illustrates the degree of deviation from a selected flight path. The basic course indicator contains a Localizer Pointer, a To-From-Off flag and servo course selector. The 309 ILS Indicator is a modified 308 to contain a Glide Slope pointer and associated power failure flag which indicates aircraft deviation from the glide slope path.

Hover Indicator



The Hover Indicator was designed to provide doppler or cable drift information to the helicopter pilot. This instrument is a flight director and is capable of being operated in four models: (1) Automatic Flight Control System (A.F.C.S.), (2) Ground Velocity Reference (G.V.R.), (3) Tactical Air Navigation Beacon Systems (TAC/TACAN), (4) Visual Omni Range (On-On/VOR).

328, 329 Indicators

BC
RN
OFF
OFF
OBS

These course Indicators are highly sophisticated versions of the 308 and 309 models utilizing resolvers, synchros and control transformers which yield greater accuracy required in the more advanced navigation systems such as Area Navigation (R/NAV).

Jewell ELECTRICAL INSTRUMENTS, INC. DEPT. EM GRENIER FIELD, MANCHESTER, NH 03108 (603) 669-6400 TELEX 94-3435

ATTENUATORS

STANDARD IN-LINE ATTENUATORS MODELS 430B, 431C, 432D, 441B, 442D, 452C, 1/432D, 1/442D

Kay Elemetrics' standard line of in-line toggle switch attenuators has been designed to provide a highly accurate fixed amount of loss in circuits operating in the DC to 1 GHz region. This series includes three basic models; the 431C, the 432D, and the 1/432D which provide 0-41 dB, 0-101 dB, and 0-22.1 dB, respectively.

HIGH ACCURACY, LOW LOSS

Attenuation levels are controlled by field-proven, high-frequency toggle switches, constructed of precious metal contacts set in teflon for low loss and superior match. Precision, 1% film resistors are used throughout. The individual pi pads are housed in zinc alloy castings which utilize broad-tuned shielded compartments to provide high accuracy and a flat frequency response over the specified range. All models are bidirectional and are available in 50, 75, or 90 ohm characteristic impedance. They have met rigid environmental tests and are traceable to N.B.S.

0-41 dB in 1 dB STEPS

Standard in-line models 431C, 441B — 50, 75, respectively — provide 0-41 dB of attenuation in six precise steps of 20, 10, 5, 3, 2, and 1 dB.

10-51 dB in 1 dB STEPS

Model 430B is similar to the above series but include a fixed and accurate 10 dB of insertion loss, in addition to the 20, 10, 5, 3, 2, and 1 dB switched attenuation steps.

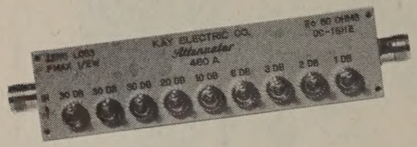
0-101 dB in 1 dB STEPS

In-line attenuator models 432D, 442D, and 452C are extended versions of the 431C series above, providing an addiitonal three 20 dB switch positions over the same 1 GHz frequency range. Specifications for these models are given on page 2881.

0-22.1 dB in 0.1 dB STEPS

The 1/432D, and 1/442D attenuators are nine step models which provide a fine decimal-step control of attenuation in steps of .1, .2, .3, .5, 1, 2, 3, 5, and 10 dB.

MINIATURE IN-LINE ATTENUATORS MODELS 437A, 447A, 438A, 439A, 449A, 1/439A, 1/449A



Kay's new line of miniature rotary attenuators has recently been designed to fill test decimal-step model in addition to the popular six and nine step models. These units have been carefully engineered to supply up to 132 dB of attenuation in highly accurate steps in a package that is small enough to meet small (1¼" x 6") panel space requirements, and light enough (8 oz) to be supported by a standard cable connector.

0-41 dB in 1 dB STEPS

Miniature in-line models 438A — 50 ohms — provide 0-41 dB of attenuation in six ministeps of 20, 10, 5, 3, 2, and 1 dB.

0-101 dB in 1 dB STEPS
0-132 dB in 1 dB STEPS

Models 439A and 449A, extended the attenuation range of the 438A series by providing three additional 20 dB positions. Maintaining the same high accuracy and low insertion loss, models 460A and 470A are available as nine position miniature models with 0-132 dB of attenuation in 1 dB steps.

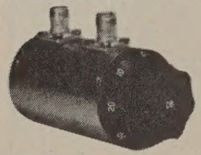
0-22.1 dB in 0.1 dB STEPS

Up to 22.1 dB in 0.1 dB increments is provided by models 1/439A (50 ohm), and 1/449A (75 ohm). These attenuators feature a high degree of accuracy over their vernier ranges when used separately or connected in series with Kay 1 dB step attenuators.

0-102.5 dB in 0.5 dB STEPS

An extension of the 1/439 series, the 437A and 447A provide a high degree of attenuation along with a fine 0.5 dB vernier.

STANDARD ROTARY ATTENUATORS MODELS 435A, 436B, 445A, 446B, 490A, 1/435A, 1/445A



Kay's standard line of rotary attenuators now cover an extended frequency range from DC-2000 MHz. These new improved versions are available in 10 dB steps to 70 dB, 1 dB steps to 10 dB and 0.1 dB steps to 1 dB. 50 or 75 ohms characteristic impedance can be provided.

MECHANICALLY SOUND

All models are mounted in rugged, lightweight, iridited aluminum housings, designed to facilitate panel mounting. A standard ball-detent mechanism is used in all models. All units may be mounted by a standard switch thread.

0-70 dB in 10 dB STEPS

0-70 dB in 10 dB steps is provided by models 436B and 446B — 50 and 75 respectively. Attenuation levels are engraved in white on a handsome black anodized knob at increments of 10, 20, 30, 40, 50, 60, and 70 dB.

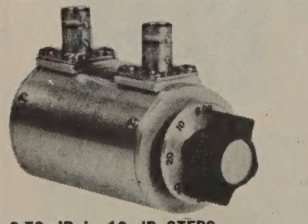
0-10 dB in 1 dB STEPS

Models 435A, and 445A provide from zero to 10 dB of attenuation in steps of 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 dB. This series of rotary attenuators takes up only 2" (diameter) x 2⅛" (depth) of panel area.

0-1 dB in 0.1 dB STEPS

Rotary attenuators 1/435A and 1/445A are decimal step versions of the 435A series. They provide a fine vernier control of attenuation over the DC-1 GHz region when used separate units or combined with the 435A and 436B series attenuators.

MINIATURE ROTARY ATTENUATORS MODELS 500A, 510A, 520A, 530A, 1/500A, 1/510A



Kay's new line of miniature rotary attenuators has recently been designed to fill test equipment and aerospace packaging requirements for small lightweight, high-frequency units with high-accuracy, high-attenuation values. This new series provides the same general specifications and characteristics as the standard rotary series featuring lower VSWR's. The entire unit utilizes only 2½" of panel depth and weighs in at less than 2.5 oz.

0-70 dB in 10 dB STEPS

0-70 dB in 10 dB steps is provided by models 520A and 530A — 50 and 75 ohms. Attenuation values are indicated at 10 dB increments on a black anodized knob.

0-10 dB in 1 dB STEPS

Models 500A and 510A provide up to ten dB of switched attenuation in precise 1 dB steps. 50 and 75 ohms characteristic impedances are available.

0-1 dB in 0.1 dB STEPS

A fine decimal step control of attenuation is provided by models 1/500A (50 ohms), and 1/510A (75 ohms).

KAY ELEMETRICS CORP

MAPLE AVENUE/PINE BROOK, NEW JERSEY 07058
TWX 710-734-4347 TELEPHONE: (201) 227-2000

ATTENUATORS

50 OHM ATTENUATORS

Model		431-C	432-D	1/432-D	439-A	460-A	437-A	1/439A
Attenuation Range		0-41 dB In 1 dB Steps	0-101 dB In 1 dB Steps	0-22.1 dB In 0.1 dB Steps	0-101 dB In 1 dB Steps	0-132 dB In 1 dB Steps	0-102.5 dB In 0.5 dB Steps	0-22.1 dB In 0.1 dB Steps
Frequency		DC-1 GHz	DC-1 GHz	DC-.5 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz	DC-1 GHz
Controls		In-line Toggle Switches	In-line Toggle Switches	In-line Toggle Switches	Miniature In-line Toggle Switches	Miniature In-line Toggle Switches	Miniature In-line Toggle Switches	Miniature In-line Toggle Switches
Typical Overall Accuracy (±dB) or % of Indicated dB	DC-250 MHz	0.5	0.6	0-.5 dB Steps: ±.05 dB/Step 1-10 dB Steps: ±.2 dB/Step	0.5	0.5	0.5	0-.5 dB Steps: ±.05 dB/Step 1-10 dB Steps: ±.3 dB/Step
	250-500 MHz	0.9	1.2		1.0	1.0	1.0	
	500-1000 MHz	1.2	2.0	—	1.5	1.5	1.5	
Maximum VSWR	DC-250 MHz	1.2:1	1.3:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
	250-500 MHz	1.4:1	1.4:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
	500-1000 MHz	1.4:1	1.4:1	—	1.4:1	1.4:1	1.4:1	1.4:1
Insertion Loss Typical (dB)	DC-250 MHz	.1	.1	.2	.1	.25	.25	.1
	250-500 MHz	.2	.3	.2	.2	.3	.35	.2
	500-1000 MHz	.5	.7	—	.5	.7	.7	.5
Power (Watts)		1	1	1	1	1	1	1
Dimensions (Inches)		2 x 7 x 2	2 x 9¾ x 2	2 x 9¾ x 2	1¼ x 6¼ x ⅞	1¼ x 6¼ x ⅞	1¼ x 6¼ x ⅞	1¼ x 6¼ x ⅞

Model		435-A	436-B	1/435-A	500-A	520-A	1/500-A
Attenuation Range		0-10 dB In 1 dB Steps	0-70 dB In 10 dB Steps	0-1 dB In 0.1 dB Steps	0-10 dB In 1 dB Steps	0-70 dB In 10 dB Steps	0-1 dB In 0.1 dB Steps
Frequency		DC-2 GHz	DC-2 GHz	DC-1 GHz	DC-2 GHz	DC-2 GHz	DC-1 GHz
Controls		Rotary-Step	Rotary-Step	Rotary-Step	Miniature Rotary-Step	Miniature Rotary-Step	Miniature Rotary-Step
Typical Overall Accuracy (±dB) or % of Indicated dB	DC-250 MHz	0.1	±(1% +.1)	.025	±.1	±(1% +.1)	.025
	250-500 MHz	0.1	±(1% +.1)	.025	±.1	±(1% +.1)	.025
	500-1000 MHz	0.3	±(1% +.2)	±(2% +.025)	±.3	±(1% +.2)	±(2% +.025)
	1-2 GHz	0.5	±5%	—	±.5	±(2% +.2)	—
Maximum VSWR	DC-250 MHz	1.1:1	1.1:1	1.1:1	1.1	1.1	1.1:1
	250-500 MHz	1.2:1	1.2:1	1.2:1	1.1	1.15	1.2:1
	500-1000 MHz	1.3:1	1.3:1	1.4:1	1.2	1.2	1.4:1
	1-2 GHz	1.5:1	1.5:1	—	1.3	1.3	—
Insertion Loss Typical (dB)	DC-250 MHz	.1	.1	.1	.1	.1	.1
	250-500 MHz	.1	.1	.1	.1	.1	.1
	500-1000 MHz	.2	.2	.2	.2	.2	.2
	1-2 GHz	.5	.5	.5	.3	.3	.5
Power (Watts)		1	1	½	1	1	1
Dimensions (Inches)		2 dia. x 2⅛	2 dia. x 2⅞	2 dia. x 2⅛	1 9/16 dia. x 1¾	1 9/16 dia. x 2½	1 9/16 dia. x 1¾

75 OHM ATTENUATORS

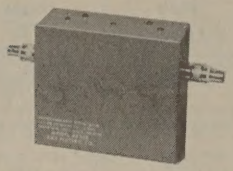
Model		442D	441-C	1/442-C	470-A	445-A	446-B	1/445A
Attenuation Range		0-101 dB In 1 dB Steps	0-41 dB In 1 dB Steps	0-22.1 dB In 0.1 dB Steps	0-132 dB In 1 dB Steps	0-10 dB In 1 dB Steps	0-70 dB In 10 dB Steps	0-1 dB In 0.1 dB Steps
Frequency		DC-1000 MHz	DC-1000 MHz	DC-500 MHz	DC-1000 MHz	DC-1000 MHz	DC-1000 MHz	DC-500 MHz
Controls		In-line Toggle Switches	In-line Toggle Switches	In-line Toggle Switches	Miniature In-line Toggle Switches	Rotary-Step	Rotary-Step	Rotary-Step
Typical Overall Accuracy (±dB) or % of Indicated dB	DC-250 MHz	1.0	0.5	0-5 dB Steps ±.05 dB/Step 1-10 dB Steps ±.2 dB/Step	1.0	0.2	2%	.025
	250-500 MHz	1.2	0.9		1.5	0.2	2%	.05
	500-1000 MHz	2.0	1.2	—	2.0	0.4	5%	—
Maximum VSWR	DC-250 MHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
	250-500 MHz	1.2:1	1.2:1	1.4:1	1.2:1	1.2:1	1.2:1	1.2:1
	500-1000 MHz	1.4:1	1.4:1	—	1.4:1	1.3:1	1.3:1	—
Insertion Loss Typical (dB)	DC-250 MHz	.1	.1	.1	.1	.2	.2	.2
	250-500 MHz	.2	.2	—	.2	.2	.2	.2
	500-1000 MHz	.4	.4	—	.4	.3	.4	—
Power (Watts)		.5	.5	.5	.5	.5	.5	.5
Dimensions (Inches)		2 x 9¾ x 2	2 x 7 x 2	2 x 9¾ x 2	1¼ x 6¼ x ⅞	2 dia. x 2⅛	2 dia. x 2⅞	2 dia. x 2⅛

KAY ELEMETRICS CORP

MAPLE AVENUE/PINE BROOK, NEW JERSEY 07058
TWX 710-734-4347 TELEPHONE: (201) 227-2000

ATTENUATORS

PROGRAMMABLE ATTENUATOR / DC — 1.3 GHz

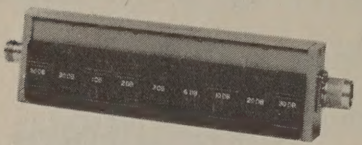


For automatic testing, new programmable, precision attenuator controlled by logic level inputs and powered by the 50/60 Hz AC line (or optional 400 Hz) are offered in cool-running, compact, low-cost units. This nine line model offers 0-135 dB in one dB steps over a DC to 1300 MHz range.

MODEL 4430A

Frequency Range	Attenuation Range	Typical Overall Accuracy	Maximum VSWR	Insertion Loss	Switching Speed	On Levels — Off Levels (with 4490A Logic Adapter)	Logic Input Z (4490A)	Power
DC-1.3 GHz	0-135 dB in one dB steps	±1 dB to .5 GHz ±1.5 dB to 1 GHz	1.2:1 to .5 GHz 1.4:1 to 1 GHz	.2 dB to .5 GHz .5 dB to 1 GHz	20 ms/Line	0-5 V DC or Short 0-1 V DC or Open	1000 Ohms	1 Watt

SLIDING BLOCK ATTENUATORS / DC — 6 GHz



A new coaxial in-line attenuator has recently been introduced by Kay to span the DC — 6 GHz range. Developed from Kay's precision VHF-UHF attenuators the new Model 461B provides any combination of 1 dB stepped increments over a wide 132 dB attenuation range. This feature also allows insertion of the often used 3 dB or 6 dB level points by a single switch throw, eliminating the mechanics of inserting individual pads or the need to go thru a time consuming rotary step cycle.

MODEL 461B
Frequency Range: DC to 4 GHz.
Attenuation Steps: 9 steps.
(dB): 1, 2, 3, 6, 10, 20, 30, 30, 30.

Controls: Slide switches.
Dimensions:
8⅜″ x 2⅜″ x 1⅞″, plus connectors.
Weight: 2.5 lbs.

MODEL 424B
Frequency Range: DC — 6 GHz.
Attenuation Range: 0 - 90 dB in 10 dB steps.
Attenuation Steps: 10, 20, 30, 30 dB.

2000 AND 2100 ATTENUATORS — PROGRAMMABLE AND REMOTE OPERATION

ATTENUATOR 2000
KAY
MANUAL
AUTO

The new Kay 2000 and 2100 attenuators are suitable for remote operation, having no moving parts and thus have unlimited life. These continuously variable, solid-state attenuators can be used for accurate control of attenuation over a wide range and the voltages can be preset to obtain any desired exact value of attenuation.

Models 2000 and 2100 can be used as RF switch with high turnoff ratio or as control elements in a leveler to produce flat output for signal sources. These units are very suitable for automated test systems.

SPECIFICATIONS

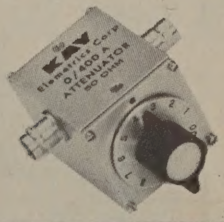
Voltage controlled solid-state attenuators — may be used as AM Modulator (to 30 kHz) or RF Switch.

Frequency Range: 2 to 500 MHz.
Attenuation Range: 0 to above 76 dB.
Insertion Loss: 6 dB max.
VSWR: 1.5:1 max. 1.2:1 typical.
Input level (into 50 or 75 ohms): Max. 2.0 VRMS 10-500 MHz. Max. 0.5 VRMS 2-10 MHz.
Flatness: Over 70 dB Attenuation Range: ±1.5 dB 2-500 MHz, ±0.5 dB 5-200 MHz.

Model 2000 75 ohms
Control Voltage: 0-10 volts DC-30 kHz (3 dB).
Supply Voltage: +10 V, 140 mA. (max).

Model 2100 50 ohms
Control Voltage: 0-12 volts DC-30 kHz (3 dB).
Supply Voltage: +12 V, 200 mA. (max).

CONTINUOUSLY VARIABLE ATTENUATORS



Kay Elemetrics, long the leader in the precision stepped attenuator field, introduces a new series of continuously variable attenuators. The 50 ohm Model 0/400A and 75 ohm Model 0/410A are highly accurate, compact units designed with user requirements and foremost in mind.

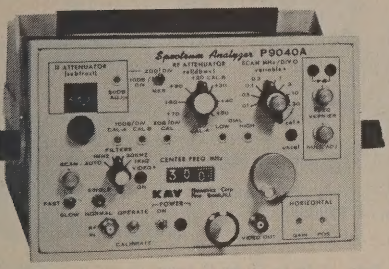
Model	Attenuation Range	Frequency Range	Control	Accuracy	Flatness	Insertion Loss	Maximum VSWR	Impedance	Dimensions	Price
0/400	12 dB	DC-500 MHz	Rotary, Continuously Variable	±0.3 dB	±0.2 dB	1 dB	1.3:1	50 ohms	1½″x2″x2 9/16″	$120
0/410	12 dB	DC-400 MHz		±0.3 dB	±0.2 dB	2 dB	1.35:1	75 ohms	1½″x2″x2 9/16″	$120

KAY ELEMETRICS CORP

MAPLE AVENUE/PINE BROOK, NEW JERSEY 07058
TWX 710-734-4347 TELEPHONE: (201) 227-2000

SPECTRUM ANALYZER

9040-300 MHz SPECTRUM ANALYZER



- **72 dB DYNAMIC RANGE**
- **PHASE LOCKED**
- **1 kHz RESOLUTION**
- **PLUG-IN FORMAT**
- **9014 POWER SUPPLY $190**

The 9040 spectrum analyzer is available both self contained in the 9014 power supply with X and Y outputs for independent use with any oscilloscope, or as a plug in for the 5103 Tektronix oscilloscope.

The 9040 features phase locked operation with 1 kHz resolution in the 1-300 MHz frequency range. The 72 dB dynamic range with sensitivity to -50 dBmv 75 ohm, -100 dBm 50 ohm is displayed in either 10 dB/div or 2 dB/div. Scan width is variable from 3 kHz per division to 30 MHz per division with excellent linearity. Scan speed is variable from 40 sec. per scan to 60 Hz in addition to a one shot sweep for use with XY plotters.

I.F. filters at 1 kHz, 30 kHz, 300 kHz and 1 MHz are manually selected or automatically selected in the Auto Mode to reduce scan loss error. The unit also features built in frequency markers for calibration of both amplitude and frequency with cal adjustments readily accessible on front panel. A precision 0-70 dB rotary attenuator provides attenuation in 10 dB steps with 1% accuracy. Spurious responses are greater than 72 dB down.

DESCRIPTION

Frequency Tuning Range: The P9040 operates over the 500 kHz to 300 MHz frequency range.

Display Flatness: The P9040's amplitude flatness is held to within ±1 dB over any selected frequency span across the unit's 300 MHz range.

Center Frequency Accuracy: The unit's dial accuracy is better than ±1% of the full frequency range at any point.

Frequency Scan, Calibrated: The P9040 provides eight calibrated scan ranges covering 30 MHz/Div. to 0.01 MHz/Div. and a continuously variable vernier.

Dynamic Range: 72 dB at a bandwidth of 1 kHz; 68 dB at a bandwidth of 30 kHz; 62 dB at a bandwidth of 1 MHz.

Sensitivity: The CW signal input sensitivity is −52 dBmv at a 1 kHz bandwidth (−102 dBm at 50 ohms).

Scan Modes and Rates: The P9040 provides variable scan rate control:
Fast — 2.5 msec/Div. to 50 msec/Div.
Slow — 25 msec/Div. to .5 sec/Div.
Single Shot — Spring loaded switch for manual actuation.
Linelock

IF Filters: Automatic (for the elimination of scan loss) and manual filter actuation are provided: At 1 MHz and 300 kHz, both with a shape factor of 5:1. At 30 kHz with a shape factor of 2:1, and at 1 kHz with a shape factor of 10:1 (All specified at the 3 dB point).

Resolution Bandwidth: P9040 resolution is provided in variable bandwidth ranges from 30 MHz per division to 3 kHz per division.

Frequency Resolution: Signal resolution is within 1 kHz.

Vertical Display Accuracy: This P9040 characteristic is within ±0.2 dB per dB, maximum, of 2 dB, over the entire range.

RF Attenuation: A precision, decade attenuator controls the RF input level. Its accuracy over the 500 kHz to 300 MHz range is ±1%.

FREQUENCY CALIBRATOR ACCURACY: A 30 MHz, ±0.005% display harmonic (comb) marker is included as an accurate calibration reference standard.

Amplitude Calibrator Accuracy: The 30 MHz frequency standard is also referenced for an accurate 20 dBmv amplitude calibrator (−30 dBm ±0.5 dB at 50 ohms).

Intermodulation Distortion: At any point across the 500 kHz to 300 MHz frequency range IMD is more than 72 dB down, with any two signals equal to or below the reference level.

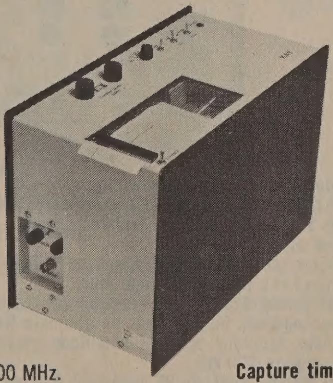
Spurious Signals (Internally Generated): Greater than 72 dB down or below the dynamic range of the unit.

Phase Lock: Active in the 0.03 and 0.01 MHz/Div. scan ranges, this P9040 feature aids narrow dispersion testing.

OSCILLOSCOPE: Wide range GAIN AND POSITION front panel adjustments are provided for P9040 interface with the display system.

Impedance: The P9040 is available in either 50 or 75 ohms. The unit is calibrated in dBmv in the 50 ohm version and in dBmv in the 75 ohm.

9021 NEW 8 BIT x 256 WORD DIGITAL CAPTURE AND CHART RECORDER FOR CATV SWEEP TESTING



Built in Timer (0.25, 0.5, 1 and 2 hour time intervals) for unattended CATV measurements over several days.

Portable unit with very easy to read hard copy.

Can be operated on self-contained battery or external source.

SPECIFICATIONS

Frequency Range: 5 to 400 MHz.

Minimum sweep signal input for full scale deflection: +15 dBmv.

Minimum signal input to trigger unit: −20 dBmv.

Synch frequency: 50 MHz.

Capture time: 2.56 milliseconds ±.1%

Vertical resolution: 8 bits.

Horizontal resolution: 256 words.

Memory size: 2000 bit digital, MOS.

Power: Self-contained rechargeable batteries or from DC supply input voltage 10-16 volts.

Source DC supply current: 350 mA standby — 2.5 Amp recording.

Size: 6″ x 8″ x 10½″, 15 cm x 20 cm x 51 cm.

Weight: 10 lbs., 4.5 kilograms.

Chart size: Width 2″, 50 mm.

Attenuator range: 0-29 dB.

Input VSWR: 1.2:1.

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SWEEP GENERATORS

9063 1 MHz to 1500 MHz SWEEP

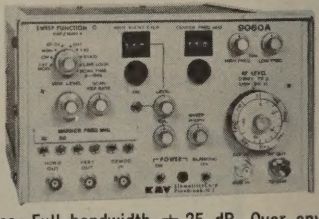
Frequency Range: 1 MHz to 1500 MHz in 2 bands. Band #1: 1 MHz to 900 MHz. Band #2: 800 MHz to 1500 MHz.
Dial Accuracy: Band #1: ±15 MHz. Band #2: ±10 MHz.
Sweep Width: Band #1: 100 kHz to 1000 MHz. Band #2: 100 kHz to 700 MHz.
RF Output: .5 v rms (+54 dBmv 75Ω)
(+ 7 dBm 50Ω)
Flatness: Band #1: UHF ±0.25 dB Band #2: ±0.3 dB over all: ±.5 dB
VHF ±0.25 dB
Attenuation: 80 dB total; 70 dB rotary attenuator in 10 dB steps. Accuracy: ±(1% of attenuation +.1 dB) and 10 dB of variable attenuation.
Harmonic Signals: Band #1 & Band #2: Greater than 30 dB down relative to the fundamental output.
Spurious Signals: greater than 30 dB down on band #1. Band #2 is a fundamental frequency output and there are no spurious signals.
Sweep Linearity: 1% of straight line.
Residual FM: Band #1 — 15 kHz rms. Band #2 — 15 kHz rms.
Drift: 750 kHz long term.
Sweep Modes:
(A) Recurring sweep, internally triggered from 1 Hz to 100 Hz continuously variable.
(B) Linelock
(C) Manual sweep.
Sweep Voltage: Sawtooth ±5 V P-P min.
Ext Trig: +1 volt pulse, with 2 ms rise time will trigger the 9063's sweep circuits. (optional @ $150.00).
Summation Sweep: 2 to 5 ms scan time continuously variable. (optional @ $150.00).
Variable Scan Rep. Rate: .1 Hz to 50 Hz (1 scan/10 sec to 1 scan/20 ms).
CW Range: 1 MHz to 1500 MHz in two bands.
Ext FM Position: Unit can be modulated at rates from dc to 5 kHz. Required input voltage ±8 V.
Markers: Up to 6 single frequency and/or harmonic comb markers, individually switched.
Accuracy ±.01% from 0°C to 50°C
±.005% @ 25°C.
Ext AM: DC to 10 kHz 75% AM @ 5 kHz
50% AM @ 10 kHz

9062 1 MHz to 1000 MHz SWEEP

Frequency Range: 1 MHz to 1000 MHz in 1 band.
Dial Accuracy: ±10 MHz.
Sweep Width: 100 kHz to 1000 MHz.
RF Output: .5 V rms (+54 dBmv 75Ω)
(+ 7 dBm 50Ω)
Flatness: UHF ±0.25 dB
VHF ±0.25 dB
over all: ±.5 dB
Attenuation: 80 dB total; 70 dB rotary attenuator in 10 dB steps. Accuracy: ±(1% of attenuation +.1 dB) and 10 dB of variable attenuation.
Harmonic Signals: Greater than 30 dB down relative to the fundamental output.
Spurious Signals: Greater than 30 dB down.
Sweep Linearity: 1% of straight line.
Residual FM: 15 kHz rms.
Drift: 750 kHz long term.
Sweep Modes:
(A) Recurring sweep, internally triggered from 1 Hz to 100 Hz continuously variable.
(B) Linelock
(C) Manual sweep.
Sweep Voltage: Sawtooth ±5 V P-P min.
Ext Trig: +1 volt pulse, with 2 ms rise time will trigger the 9062's sweep circuits. (optional @ $150.00).
Summation Sweep: 2 to 5 ms scan time continuously variable. (optional @ $150.00).
Variable Scan Rep. Rate: 1 Hz to 50 Hz (1 scan/10 sec to 1 scan/20 ms).
CW Range: 1 MHz to 1000MHz.
Ext FM Position: Unit can be modulated at rates from dc to 5 kHz. Required input voltage ±8 V.
Markers: Up to 5 single frequency and/or harmonic comb markers, individually switched.
Accuracy ±.01% from 0°C to 50°C
±.005% @ 25°C.
Ext AM: DC to 10 kHz 75% AM @ 5 kHz
50% AM @ 10 kHz.
Power: 30 watts, 115 VAC 50/60 Hz 220 VAC (Available).

9060 500 kHz to 500 MHz SWEEP

Frequency Range: Continuously variable 500 kHz to 500 MHz (Utilizing manual sweep control 500 kHz to 600 MHz).
Frequency Dial Calibration: Digital readout at 200 kHz intervals, dial accuracy ±5 MHz.
Ext FM: ±8 V will frequency modulate unit ±300 MHz
(A) Maximum rate for full frequency output is 5 kHz
(B) ±10 V at 100 kHz rate will sweep unit over 100 MHz band.
Sweep Width: 80 kHz to 600 MHz continuously variable.
Output Amplitude: (1 Vrms to 32 μV)
+13 dBm to −77 dBm 50 ohm output impedance
+60 dBmv to −30 dBmv 75 ohm output impedance.
Output Attenuation: 90 dB, 70 dB in 10 dB steps, 20 dB of variable control
Accuracy of step attenuator: ±(1% of attenuation +.1 dB).
Residual FM: 3 kHz rms.
Display Linearity: 1% of straight line frequency.
Sweep Modes:
(A) Recurring sweep, internally triggered from .01 Hz to 100 Hz in 4 overlapping ranges
(B) Linelock
(C) Externally triggered sweep
(D) Summation sweep.
Sweep Voltage: Sawtooth ±5 V P-P min.
Ext Trig: ±1 volt pulse, with 2 ms rise time will trigger the 9060's sweep circuits.
Summation Sweep: 2 to 5 ms scan time continuously variable.
Ext AM: DC to 10 kHz: 75% @ 5 kHz
50% @ 10 kHz.



RF Output Flatness: Full bandwidth ±.25 dB. Over any 10% segment ±.15 dB (Up to +.05 dB using external ALC sampler).
Spurious Signals: Harmonically related signals −35 dB, non-harmonically related signals −35 dB.
Drift: Short term 100 kHz/5 min from 0°C to 50°C provided unit has stabilized at a particular temperature.
Markers: Birdie bypass markers with provisions for up to six plug-in marker modules. Markers may be at single frequencies or at harmonic intervals. Accuracy ±.01%, amplitude greater than 2 V P-P, marker width approx. 200 kHz.
External Marker Input: An RF connector is provided for the injection of a CW signal to provide for an external birdie marker.
Marker Identifier: A variable pulse marker which is continuously variable over the 500 MHz center frequency range and which can be used as a pulse marker or as a counter of the harmonic birdie markers. This marker appears at the same output as the birdie markers.
Amplitude: +3 V
Accuracy: ±1% over full band.
Power: 30 watts, 115 VAC 50/60 Hz 220 VAC (Available).

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GENERATORS

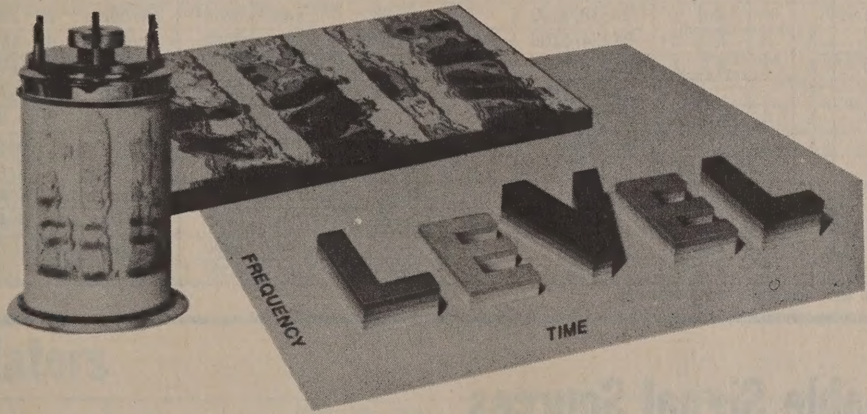
PULSED CARRIER GENERATORS

- FREQUENCIES TO 250 MHz
- OFF LEVELS TO 95 dB
- FAST RISE AND DECAY TIMES

Model	5070B	5071B
Carrier Frequency	10-120 MHz	10-250 MHz
Dial Accuracy	1%	1%
Carrrier Off-Level	85 dB to 30 MHz 80 dB to 70 MHz 70 dB to 120 MHz	95 dB to 100 MHz 90 dB to 150 MHz 76 dB to 250 MHz
Pulse Rate	50-5000 PPS	
Pulse Width	100 ns-100 μs	
Rise and Decay Pulsed RF	10 ns	
Video Pulse	20 ns	——
Sync Output #1	+1 V into 50 ohms 25 nsec rise time precedes output pulse by approx. 50 nsec.	+4 V into 50 ohms 20 nsec rise time 50 nsec wide precedes sync pulse #2 by variable 250 nsec to 100 μsec
#2		+.5 V into 50 ohms 30 nsec rise & decay 120 nsec wide precedes RF pulse by approx. 70 nsec.
Output Amplitude RF	0.5 Vrms into 50 ohms	
Video	±3 Volts into 50 ohms	——
Ext Trigger Input	—2 Volt pulse required	
Ext Modulation Input	+2 Volt pulse required	
Attenuator	101 dB in 1 dB Steps	102.5 dB in .5 dB Steps

SONAGRAPH — AUDIO SPECTRUM ANALYZER

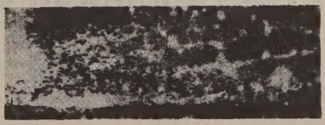
KAY Sound Spectrographs analyze a signal and print out a graph showing all component frequencies, their relative levels and their duration.



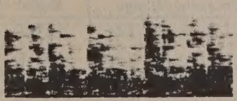
NOW WITH NEW, OPTIONAL
500 Hz FILTER AND SONATAPE PLUG-IN

- DOPPLER SHIFTS
- MISSILE CHARACTERISTICS
- RESONANCE AND DAMPENING
- RADAR AND SONAR RETURNS
- DETECTS AND CHARACTERIZES ENGINE SIGNATURES
- NATURAL PHENOMENON - EARTHQUAKES & MAGNETIC DISTURBANCES
- SPEECH ANALYSIS

BIOACOUSTIC

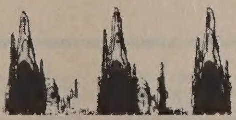


GEOPHYSICAL

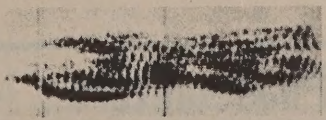


MECHANICAL

ACOUSTIC



PHYSIOLOGICAL



GEOMAGNETIC

KAY ELEMETRICS CORP

MAPLE AVENUE/PINE BROOK, NEW JERSEY 07058
TWX 710-734-4347 TELEPHONE: (201) 227-2000

KH KROHN-HITE CORPORATION

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Avon, Massachusetts 02322
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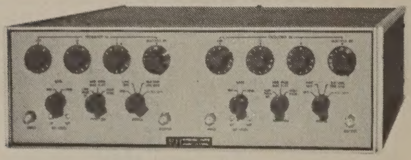
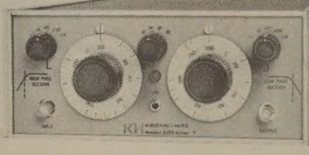
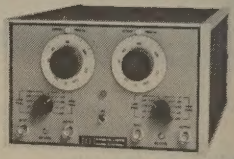
Variable Filters


Model 3343


Model 3550

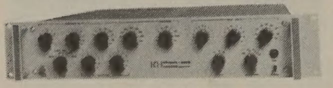

Model 3202

Model 3200

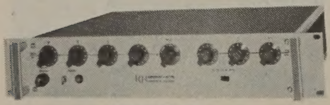
Frequency Range	Filter Model	BAND PASS	BAND REJECT	HIGH PASS	LOW PASS	Battery Kits No./Price	Freq. Acc. %	Attenuation Slope db/Octave	Hum and Noise (RMS)	Max. Atten-uation	Output Volt/Amps (RMS)	3db Points	Rack Mounting Kit — $25.	Base Price
.001Hz - 99.9kHz	3320			X	X	BK332/$100	2	24	0.5mv	80db	5v/50ma	DC - 1MHz	RK-58	$ 775
.001Hz - 99.9kHz	3322	X	X	X	X	BK334/$200	2	24/48	0.5mv	80db	5v/50ma	DC - 1MHz	RK-519	$1490
.001Hz - 99.9kHz	3340			X	X	BK332/$100	2	48	0.5mv	80db	5v/50ma	DC - 1MHz	RK-58	$1175
.001Hz - 99.9kHz	3342	X	X	X	X	BK334/$200	2	48/96	0.5mv	80db	5v/50ma	DC - 1MHz	RK-519	$2125
.01Hz - 99.9kHz	3321			X	X	BK332/$100	2	24	0.5mv	80db	5v/50ma	DC - 1MHz	RK-58	$ 670
.01Hz - 99.9kHz	3323	X	X	X	X	BK334/$200	2	24/48	0.5mv	80db	5v/50ma	DC - 1MHz	RK-519	$1290
.01Hz - 99.9kHz	3341			X	X	BK332/$100	2	48	0.5mv	80db	5v/50ma	DC - 1MHz	RK-58	$1075
.01Hz - 99.9kHz	3343	X	X	X	X	BK334/$200	2	48/96	0.5mv	80db	5v/50ma	DC - 1MHz	RK-519	$1900
.02Hz - 20kHz	3750	X	X	X	X	BK375/$200	5	6, 12, 18, 24	0.5mv	80db	10v/2ma	DC - 1MHz	RK-519	$ 995
.2Hz - 20kHz	3700	X				BK370/$100	5	24	0.2mv	80db	5v/1ma	N/A	RK-38	$ 625
2Hz - 200kHz	3550	X	X	X	X	N/A	5	24	0.2mv	60db	5v/10ma	.2Hz - 3MHz	RK-38	$ 695
10Hz - 1MHz	3100	X				N/A	5	24	0.1mv	80db	3v/10ma	N/A	RK-38	$ 695
10Hz - 3MHz	3103	X				N/A	5	24	0.15mv	80db	3v/10ma	N/A	RK-38	$ 725
10Hz - 3MHz	3103-4	X				N/A	5	18	0.15mv	80db	3v/10ma	N/A	RK-38	$ 725
20Hz - 200kHz	3500	X				N/A	10	24	0.2mv	60db	5v/3.5ma	N/A	RK-38	$ 525
20Hz - 2MHz	3200*			X	X	N/A	5	24	0.1mv	80db	3v/10ma	DC - 10MHz	See Note	$ 495
20Hz - 2MHz	3202*	X	X	X	X	N/A	5	24/48	0.1mv	80db	3v/10ma	DC - 10MHz	See Note	$ 895

*Rack Model (19″ Panel) add $25. Add Suffix 'R' to Model No.

Programmable Signal Sources

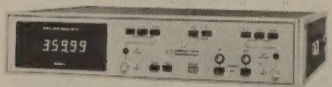

Model 5500AR

Frequency Range	Model	Operating Modes	Output Waveforms	Max. Output	Output Imped. (Ohms)	Aux. Outputs	DC Offset	Ext. VC	Additional Features	Price
0.0001 Hz to 5MHz	5500AR	CONT, TRIG, GATE	∿⎍∧ ⋀⋀ ⎍⊔	30V p-p	50	5V ⎍	±7.5V	1000:1	PRO-GRAM-MABLE	$2195


Model 4141R

Frequency Range	Osc. Model	Freq. Acc. %	Max. Volts	Output Impedance	Dist. %	Square Wave	Prog. Amp.	Base Price
0.1 Hz to 100 kHz	4030R	0.5	10 RMS	200/600	0.01	optional	optional	$1700
0.1 Hz to 100 kHz	4031R	0.1	10 RMS	200/600	0.01	optional	optional	$2300
1 Hz to 1 MHz	4140R	0.5	10 RMS	50	0.02	yes	yes	$1495
1 Hz to 1 MHz	4141R	0.1	10 RMS	50	0.02	yes	yes	$1795

Phasemeters

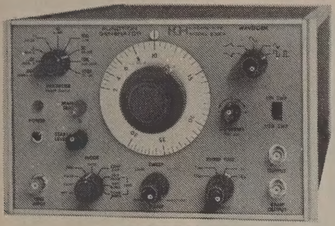

Model 6500

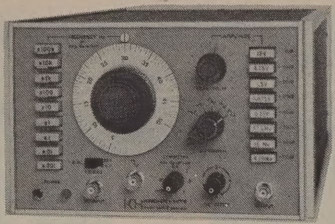
Model	Phase Accuracy	Frequency Range	Resolution	Input Waveforms	Input Voltage Range	Display	Rack Mounting Kit – $25.	Base Price
6500	.02%	3Hz - 5MHz	.01°	∿⎍∧⎍	0.01V-120V RMS	5 digit readout	RK-319	$1995
6400	0.1°	3Hz - 5MHz	0.1°	∿⎍∧⎍	0.01V-120V RMS	4 digit readout	RK-319	$1400
6200	0.5°	10Hz - 1MHz	0.1°	∿⎍	0.1V-120V RMS	3½ digit readout	RK-38	$ 795

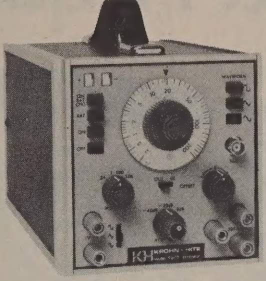
KROHN-HITE CORPORATION

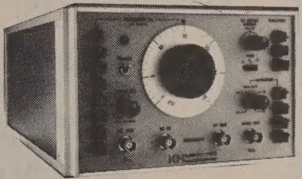
Avon Industrial Park
Avon, Massachusetts 02322
(617) 580-1660
TWX 710-345-0831

Function Generators


Model 5300A


Model 5400B


Model 5600


Model 5800A

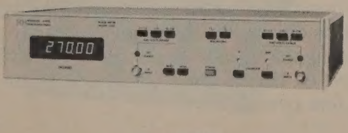
Frequency Range	Model	Output Waveforms	Max. Output	Output Impedance (Ohms)	Aux. Outputs	D.C. Offset	Ext. V.C.	Additional Features	Rack Mounting Kit—$25.	Base Price
.2Hz - 2MHz	1000	∿⊓∧	20V p-p	50	TTL ⎍	—	1000:1	1000:1 Tuning	RK-39	$ 245
.2Hz - 2MHz	1200	∿⊓∧	20V p-p	50	TTL ⎍	±10V	1000:1	Int. Lin. Swp. V.C. Output	RK-39	$ 295
.2Hz - 2MHz	1400	∿⊓∧⎍⊔∧∧	20V p-p	50	⎍∧ MKR.	±10V	1000:1	Int. Lin. Swp. Int. MKR., Sym. Cont.	RK-314	$ 495
.2Hz - 2MHz	1600	∿⊓∧⎍⊔∧∧	20V p-p	50	⎍∧∧MKR.	±10V	1000:1	Int. Lin/Log Swp. Int. MKR., Sym. Cont.	RK-314	$ 675
.003Hz - 30MHz	2000	∿⊓∧⎍⊔∧∧	30V p-p	50	⎍, CVO,	±15V	1000:1	P.B. Attenvator Sym. Control	RK-58	$ 895
.003Hz - 30MHz	2200	∿⊓∧⎍⊔∧∧	30V p-p	50	⎍, CVO,	±15V	1000:1	Int. Lin/Log Swp. Int. MKR., Sym. Cont.	RK-519	$1195
.002Hz - 3MHz	5100B	∿⊓∧^~⎍⊔∧∧	20V p-p	50	5V⊓	±5V	1000:1	Sym. Control Output Protect Cir.	RK-58	$ 495
.002Hz - 3MHz	5200A	∿⊓∧^~⎍	20V p-p	50	⊓∧	±5V	1000:1	Int. Lin. Swp. Output Protect Cir.	RK-58	$ 595
.002Hz - 3MHz	5300A	∿⊓∧^~⎍	20V p-p	50	⊓∧∧	±5V	1000:1	Int. Lin/Log Swp. Output Protect Cir.	RK-58	$ 695
.002Hz - 5MHz	5400B	∿⊓∧^~⎍⊔∧∧	30V p-p	50	5V⊓	±10V	1000:1	Sym. Control Output Protect Cir.	RK-58	$ 595
.002Hz - 2MHz	5600	∿⊓∧	15V p-p	50/600 Bal.	1V∿⊓∧	±5V	—	Battery Operated	N/A	$ 395*
.002Hz - 2MHz	5700	∿⊓∧	15V p-p	50/600 Bal.	1V⊓	±5V	—	1000:1 Tuning	N/A	$ 295
.2Hz - 2MHz	5800A	∿⊓∧	15V p-p	50	1V⊓	—	—	1000:1 Tuning	N/A	$ 245

*Battery Kit. Part No. BK-560; Price $100.

RC Oscillators

Frequency Range	Model	Freq. Acc. %	Output Each Phase			Quad. Output	Output Waveforms	Freq. Resp. (db)	Dist. %	Rack Mounting Kit — $25.	Base Price
			Power (mw)	Impedance (Ohms)	Max. Volts						
0.001Hz - 100kHz	4024A	0.5	125	200/600	10	Yes	∿⊓⎍	0.01	0.01	Suffix R	$1400
0.001Hz - 100kHz	4025A	0.1	125	200/600	10	Yes	∿⊓⎍	0.01	0.01	Suffix R	$1950
.01Hz - 1MHz	4100A	0.5	500	50	10		∿⊓	0.05	0.02	Suffix R	$ 695
0.1Hz - 100kHz	4000A	0.5	125	200/600	10	Yes	∿	0.01	0.01	Suffix R	$ 995
0.1Hz - 100kHz	4001A	0.1	125	200/600	10	Yes	∿	0.01	0.01	Suffix R	$1495
10Hz - 10MHz	4200A	2.0	500	50	10		∿∿	0.025	0.1	RK-58	$ 495
10Hz - 10MHz	4300A	2.0	500	50	10/20		∿⊓∿	0.025	0.1	RK-58	$ 550

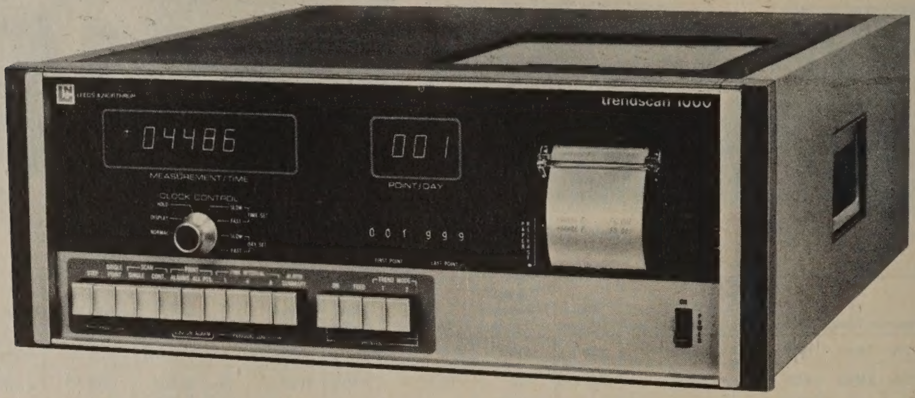
Laboratory Power Amplifiers


Model 7500

Frequency Range	Model	Output Power (watts)	Dist. %	Freq. Resp. (db)	Input Volts (RMS)	Max. Voltage Gain	Matched Load (Ohms)	Max. Output Volts (RMS)	Max. Output Current	Rack Mtg. Kit $25	Base Price
DC - 1MHz	DCA-10*	10	0.1	±1.0	10	10	600-1000	105	130ma	Suffix R	$895
DC - 1MHz	7500	75	0.1	±0.1	1.25	100	200	125	625ma	RK519	$1500
DC - 1MHz	MT-56‡	75	—	—	125	—	1-1000	100	6.5A	N/A	$295

‡Accessory matching transformer

Leeds & Northrup's Trendscan 1000 Data Acquisition System



...lets you speed read your data with logging, trending and alarming up to 1000 points

Features

- **Scanning, alarming, logging up to 1000 points.**
- **3+ or 4+ digit measurements . . . Single or Multi-range.**
- **Linear and non-linear inputs . . . TC, RTD, V, mV, mA and contact closure.**
- **Easy programming . . . range selection, point skip, alarm commutation.**
- **Integral printer . . . ribbonless, non-impact, 21 alphanumeric columns.**
- **Unique Trend Mode . . . prints bar graphs (Trendbars) for trending or profiling.**
- **Full alphanumeric printing of legends, status and static data.**
- **Built-in clock.**
- **Six internal digit alarms . . . or 128 with external Trendscan Alarm Processor.**
- **Remote location of input switching assemblies . . . up to 3200 feet (1000 meters).**
- **Low thermal input switching relays . . . convenient isothermal input connectors.**
- **Self-test of each range . . . independent of inputs.**
- **Flexible input/output peripheral interface.**

The Trendscan 1000 Data Acquisition System provides a highly flexible means of scanning, alarming, trending and/or logging up to 1000 inputs—thermocouples, RTDs, transmitters, EMF signals, current signals and/or contact closures. Single ranges or multi-ranges (3) are available with 3+ or 4+ digit resolution. Multi-range units may include any combination of linear or non-linear signals including TC, RTD, mV, V, mA or contact closure.

A complete 20 point system can be provided in a single compact (7″ × 19″ × 22½″) chassis for bench use or rack mount. This includes two 10 point input switching relay cards with isothermal connectors (5 inputs per card for RTD)—basic point selection and scanning controls with point display—signal conditioning, A/D conversion, linearization and measurement display—an integral printer for data logging and a clock which provides system or real time with controls to initiate a periodic data log at intervals up to 8 hours.

INPUT SWITCHING When more than 20 inputs are needed, input switching relays and input connectors are supplied in Model 2701 Trendscan Input Frames which accommodate up to 10 input cards (100 inputs) per frame. Up to 10 frames can be supplied for 1000 inputs. These frames may be located up to 3200 feet (1000 meters) away from the Trendscan 1000 for convenient and economical installation near the input elements.

Point selection signals are supplied to each of the 2701 Input Frames through a 42 conductor matrix cable from the Trendscan 1000 where the point selection and scanning controls are located. A set of input signal leads for each range are connected between the 2701 Input Frame(s) and the 2700 Trendscan. No power connections are required for the Input Frames.

ALARMS Up to 6 bipolar digital alarms and a per point alarm programming feature are available. The Trendscan 1000 can be specified with 1, 2 or 3 internally mounted alarm modules, each with two independent alarms. A module has two sets of digital switches to set a 4 digit limit corresponding to the 4 most significant digits of the measurement. Each alarm limit has a separate sense switch for HI or LO limit, and a polarity select switch. One reset switch is provided on each module common to both alarms. Each alarm has an LED indicator and a SPDT output relay connected to screw terminals at the rear of the Trendscan.

When more than 6 alarms are required, the 2783 Trendscan Alarm Processor is available in place of the internal alarms for up to 128 different dual level alarms.

PROGRAMMING Following a very simple sequence, any one of up to 250 input points may be addressed and assigned to any one of three available ranges (except RTD ranges which are assigned in groups of 5 inputs). Any point may be skipped or assigned to any one, none or all of the 6 internal alarms. Points programmed for point skip do not cause a loss of time during the scan cycle.

Systems with more than 250 input points are programmed in a similar manner except that range, point skip and alarm assignments are made in groups of 5 points rather than on a per-point basis. All programming is stored in solid state memory (RAM) with a continuously charged battery back-up for 1000 hour program retention without line power.

LEEDS & NORTHRUP

North Wales, Pa. 19454
Attn: MD 337-K
(215) 643-2000

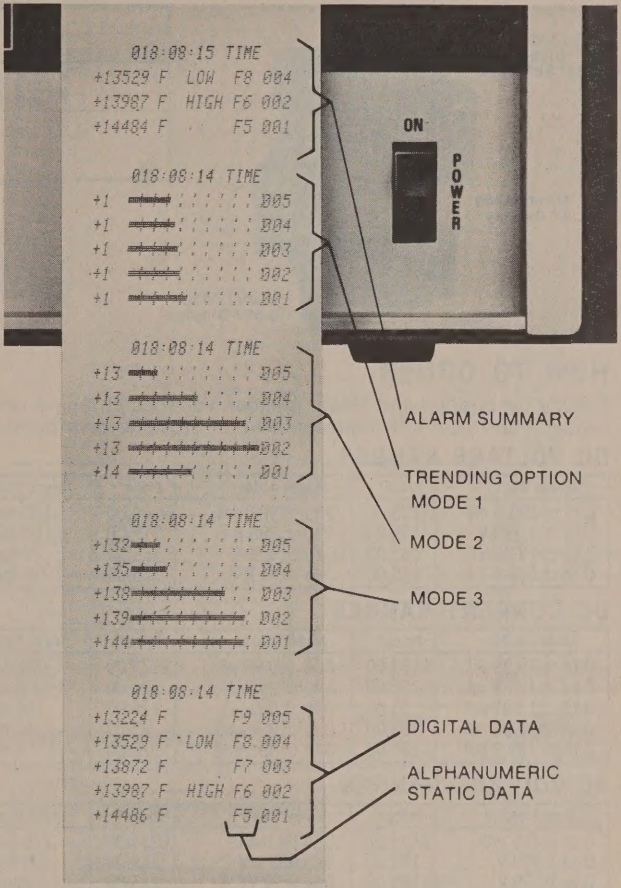
PRINTOUT Trendscan 1000 systems offer unique capabilities for data presentation. An integral ribbonless printer prints out point identification, optional 4 character static data, status reports on inputs (e.g. OPEN or OVLD) and alarms (e.g. HIGH or LOW), four or five digit presentation of measured variable with polarity and legend plus an independent line stating time of printout, all arranged in an orderly format. In addition, an exclusive Trend Mode feature is available which graphically presents the least significant digits in the measurement as a bar graph (Trendbar) preceded by a numeric printout of the most significant digit(s). Three modes of increasing resolution are available for the Trendbar graph in which 1, 2 or 3 of the most significant features are suppressed and printed out, and the next two digits are presented in the Trendbar format.

The three modes of digital suppression allow successively higher resolution with the Trendbar for critical analysis in analog form. Best resolution is achieved in Mode 3 which can be as high as 1 part in 40,000 on a 4+ digit instrument or 1 part in 4,000 on a 3+ digit instrument, depending on the total range selected.

Printout of any single point, group of points or all points, may be initiated either manually, in response to an alarm, or on a preset time interval in any one of the formats desired. In addition, detection of alarms can initiate a printout. A summary of printout of all points in alarm can be manually initiated.

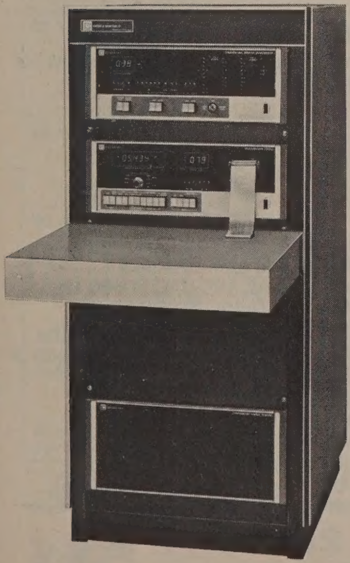
INPUT/OUTPUT INTERFACE OPTIONS Where data records other than the integral printer are needed, interface options are available for: Paper tape punch, 7 Track Magnetic Tape, 9 Track Magnetic Tape, Teletype Writers, Line Printers, CRTs, Programmable Calculators, and RS-232-C/TTY interface for full bidirectional control.

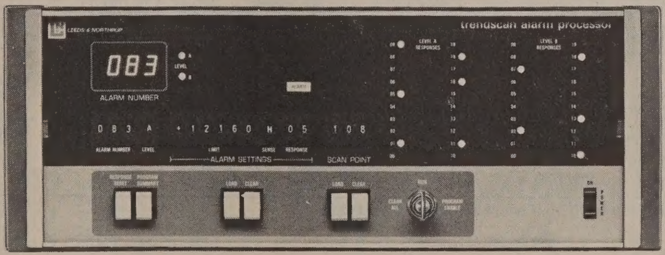
Where the measurement data presented on the integral printer is the only record desired, a limit interface to other equipment can be provided. This option permits remote signals to control start of scan and scan-rate. Ouput from the Trendscan 1000 interface to external equipment is TTL compatible, serial by character, and includes measurement data with the following point status information: high or low alarm, open input or overload, last point indication, scan point and next scan point advance indication. Provision is also made for 4 digits of static data entry from external BCD switches.



```
018:08:15 TIME
+13529 F  LOW  F8 004
+13987 F  HIGH F6 002
+14484 F       F5 001

018:08:14 TIME
+1                005
+1                004
+1                003
+1                002
+1                001

018:08:14 TIME
+13               005
+13               004
+13               003
+13               002
+14               001

018:08:14 TIME
+132              005
+135              004
+138              003
+139              002
+144              001

018:08:14 TIME
+13224 F       F9 005
+13529 F  LOW  F8 004
+13872 F       F7 003
+13987 F  HIGH F6 002
+14486 F       F5 001
```

EXPANDED TRENDSCAN SYSTEMS





The Trendscan 1000 can be combined with a Trendscan Alarm Processor to create a Data Acquisition System with extensive and flexible alarm capability. The Trendscan Alarm Processor is conveniently packaged in a 7″ × 19″ rack chassis and can be mounted with the Trendscan 1000 and related Input Frames in a variety of cabinets to provide a compact totally integrated system with broad data measurement and surveillance capacity.

The Trendscan Alarm Processor provides 64 or 128 programmable single or dual level alarms. Any one or more of the inputs from the Trendscan 1000 can be assigned at random to any one of these alarms.

Responses to alarms can take the form of illuminated LED indicators on the front panel, relay contact closures (made through screw type terminals on the rear of the chassis), and a serial BCD output.

Input and alarm assignments are programmed through an array of programming switches on the front panel into a solid state memory in the Alarm Processor—a memory which has a 1000 hour program retention time in the event of power loss. A locking switch with a removable key prevents tampering after the alarms have been programmed.

api SERIES 4400 DIGITAL PANEL INSTRUMENTS

MILLIVOLTS AC
+1901
PSI
292
DEGREES F
+1450

Model 4424
0.55″ Display with Digital Setpoints

Model 4443
1″ Display

Model 4424
0.55″ Display

MODEL	
4424	**4443**
• 0.6″ gapless display • 3½ digits	• 1.0″ gapless display • 3 digits
• High noise rejection • Auto polarity • Multiplexed BCD outputs	

HOW TO ORDER

Specify description and Model number. For special ranges or application assistance, contact your local LFE representative or stocking distributor.

DC VOLTAGE RANGES

Model 4424†	Price*	Model 4443	Price*	Input Resistance	Maximum Overload
0 to ±199.9 mV	$135.00	0 to ±99.9 mV	$175.00	>100 megohms	240 V rms
0 to ±1.999 V	135.00	0 to ±999 mV	175.00	>100 megohms	240 V rms
0 to ±19.99 V	135.00	0 to ±9.99 V	175.00	10 megohms	240 V rms
0 to ±199.9 V	135.00	0 to ±99.9 V	175.00	10 megohms	240 V rms

DC CURRENT RANGES

Model 4424†	Price*	Model 4443	Price*	Input Resistance	Maximum Overload
0 to ±19.99 μA	$135.00	0 to ±9.99 μA	$175.00	10 K ohms	5 mA
0 to ±199.9 μA	135.00	0 to ±99.9 μA	175.00	1 K ohm	15 mA
0 to ±1.999 mA	135.00	0 to ±999 μA	175.00	100 ohms	50 mA
0 to ±19.99 mA	135.00	0 to ±9.99 mA	175.00	10 ohms	150 mA
0 to ±199.9 mA	135.00	0 to ±99.9 mA	175.00	1 ohm	500 mA

AC VOLTAGE RANGES

Model 4424†	Price*	Model 4443	Price*	Input Resistance	Maximum Overload
0 to 199.9 mV	$195.00	0 to 99.9 mV	$235.00	275 K ohms	±10 V peak
0 to 1.999 V	195.00	0 to 999 mV	235.00	275 K ohms	±10 V peak
0 to 19.99 V	195.00	0 to 9.99 V	235.00	1 megohm	±500 V peak
0 to 199.9 V	195.00	0 to 99.9 V	235.00	1 megohm	±500 V peak
0 to 500 V	195.00	0 to 500 V	235.00	1 megohm	±750 V peak

AC CURRENT RANGES

Model 4424†	Price*	Model 4443	Price*	Input Resistance	Maximum Overload
0 to 19.99 μA	$195.00	—	—	10 K ohms	5 mA
0 to 199.9 μA	195.00	0 to 99.9 μA	$235.00	1 K ohm	15 mA
0 to 1.999 mA	195.00	0 to 999 μA	235.00	100 ohms	50 mA
0 to 19.99 mA	195.00	0 to 9.99 mA	235.00	10 ohms	150 mA

TEMPERATURE RANGES

Model 4424	Price*	Model 4443	Price*	Temperature Coefficient (Typical)	T/C Type	Accuracy
0 to +1000°F	$225.00	0 to +1000°F	$265.00	±.03 deg/°C	J(I/C)	±1.5°F
0 to +550°C	225.00	0 to +550°C	265.00	±.03 deg/°C	J(I/C)	±1.0°C
+600 to +1800°F	225.00	N/A	N/A	±0.1 deg/°C	K(C/A)	±2°F
+300 to +1000°C	225.00	+300 to +1000°C	265.00	±0.1 deg/°C	K(C/A)	±2°C

* Press listed above are net each for lots of 1-9. Deduct 5% for lots of 10-24.
† UL recognized.

SPECIFICATIONS

Accuracy (Model 4424):
DC Ranges: 0.05% Rdg. ±0.1% FS
AC Ranges: @ 60 Hz, ±.01% Rdg. ±0.1% FS
From 50 to 1000 Hz, 0.1% Rdg. ±0.2% FS

Accuracy (Model 4443):
DC Ranges: 0.05% Rdg. ±0.2% FS.
AC Ranges: @ 60 Hz, ±.01% Rdg. ±0.2% FS
From 50 to 1000 Hz, 0.1% Rdg. ±0.4% FS

Input Isolation from Power Line: 500 volts peak.

Operating Temperature: +5°C to +55°C.

Storage Temperature: −20°C to +85°C.

Display Blanking: Requires two TTL loads.

Programmable Decimal Points: Available at rear terminals as an option.

Polarity:
Positive Logic "1" +2.4V minimum @ −40 μA.
Negative Logic "0" +0.4V maximum @ +1.6 mA.

Reading Rate: 3.3 reading/second. Special reading rates optional.

Power: Standard, 120 VAC 50/60 Hz. Strappable, 240 VAC 50/60 Hz.

Digit Serial Multiplexed BCD Outputs: (Standard) will drive 1 TTL load or 9 LTTL loads.

Input Bias Current:
4.0 pA typical.
1.0 nA maximum, basic ranges.

Power Dissipation: 4 watts typical.

Warm Up Time: Less than 5 minutes.

NEW DIGITAL CONTROL METERS

DIGITAL MEASUREMENTS FOR

AC VOLTAGE	**PRESSURE**
DC VOLTAGE	**PROCESS CONTROL**
AC CURRENT	**RPM**
DC CURRENT	**TEMPERATURE**

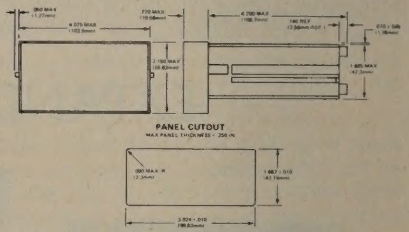
Digital Control Meters control and display temperature, voltage, or current in brilliant high intensity display. If either setpoint is exceeded a LED indicator lights and a relay switches for precise quick-control.

Setpoint adjustment is also fast, and easy: simply depress and rotate the control knob to obtain the desired high or low limit. Digital Control Meter displays the setpoint value during setting, reverts to displaying the controlled variable as soon as the knob is released.

For details on Digital Control option contact your local LFE representative or stocking distributor.

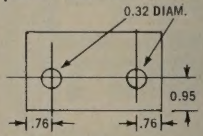
DIMENSIONS

DIGITAL PANEL INSTRUMENTS



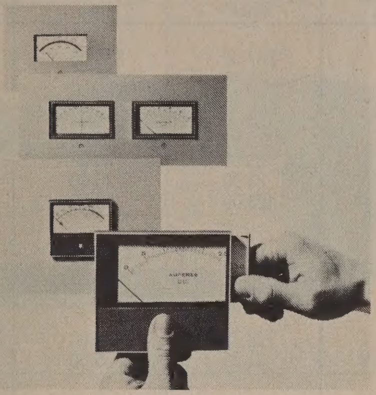
DIGITAL CONTROL METERS

All other dimensions are the same as for digital panel instruments.



PROCESS CONTROL DIVISION
LFE CORPORATION
1601 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154/(617) 890-2000/TWX 710-324-0681

api SERIES 7000 PANEL METERS & PYROMETERS



- Three-way choice of mounting — front mount, bezel mount, lens mount.
- Phenolic fronts and cases — rugged and reliable.
- Glass windows — scratch-proof, free of static electricity.
- Front decorator plates — flat black, two shades of grey, tan, and olive.
- Insertable scales — field changeable, reduces inventory, eliminates damage.
- Taut band mechanism and 1% tracking — standard in the most popular DC ranges.
- Self shielding — for mounting on either magnetic or non-magnetic panels.

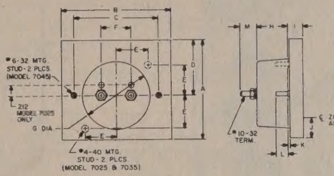
PANEL METERS

			Model 7025 2½″	Model 7035 3½″	Model 7045 4½″	Model 7055 5½″
Panel Meter Ranges			Price*	Price*	Price*	Price*
DC microamperes	0-10	TB	$49.00	$49.00	$51.00	$53.00
	0-20	TB	39.25	39.25	41.25	43.25
	25-0-25	TB	33.50	33.50	35.50	37.50
	0-50	TB	33.50	33.50	35.50	37.50
	50-0-50	TB	29.50	29.50	31.50	33.50
	0-100	TB	29.50	29.50	31.50	33.50
	100-0-100	TB	27.50	27.50	29.50	31.50
	0-200	TB	27.50	27.50	29.50	31.50
	0-600	PJ	25.50	25.50	27.50	29.50
	500-0-500	PJ	25.50	25.50	27.50	29.50
DC milliamperes	0-1	PJ	25.50	25.50	27.50	29.50
	0-5	PJ	25.50	25.50	27.50	29.50
	0-10	PJ	25.50	25.50	27.50	29.50
	0-26	PJ	25.50	25.50	27.50	29.50
	0-80	PJ	25.50	25.50	27.50	29.50
	0-100	PJ	27.00	27.00	29.00	31.00
	0-500	PJ	27.00	27.00	29.00	31.00
DC amperes	0-1	PJ	29.50	29.50	31.50	33.50
	0-3	PJ	29.50	29.50	31.50	33.50
	0-5	PJ	29.50	29.50	31.50	33.50
	0-10	PJ	29.50	29.50	31.50	33.50
	0-15	PJ	29.50	29.50	31.50	33.50
	0-25	PJ	29.50	29.50	31.50	33.50
DC millivolts	0-10	TB	39.25	39.25	41.50	43.50
	0-50	PJ	27.00	27.00	29.00	31.00
	0-100	PJ	27.00	27.00	29.00	31.00
	50-0-50	PJ	27.00	27.00	29.00	31.00
	100-0-100	PJ	27.00	27.00	29.00	31.00
DC volts	0-6	PJ	27.00	27.00	29.00	31.00
	0-10	PJ	27.00	27.00	29.00	31.00
	0-15	PJ	27.00	27.00	29.00	31.00
	0-30	PJ	27.00	27.00	29.00	31.00
	0-50	PJ	27.00	27.00	29.00	31.00
	0-150	PJ	27.00	27.00	29.00	31.00
	0-300	PJ	27.00	27.00	29.00	31.00
	0-500	PJ	27.00	27.00	29.00	31.00
AC volts (rectifier type)	0-10	PJ	32.00	32.00	34.00	36.00
	0-15	PJ	32.00	32.00	34.00	36.00
	0-150	PJ	32.00	32.00	34.00	36.00
	0-300	PJ	32.00	32.00	34.00	36.00
AC milliamperes (rectifier type)	0-1	PJ	30.50	30.50	32.50	34.50
	0-47**	PJ	30.50	30.50	32.50	34.50

* The prices listed are net each for lots of 1-9. Deduct 10% for lots of 10-24.

** AC load: scale reads 0-150% load.

DIMENSIONS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•6-32 MTG. STUD-2 PLCS (MODEL 7045)
.212 MODEL 7025 ONLY
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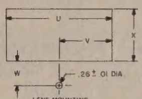
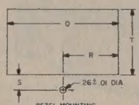
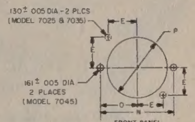


LENS MOUNTING



BEZEL MOUNTING


.130 ± .005 DIA - 2 PLCS (MODEL 7025 & 7035)
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E
N

FRONT PANEL MOUNTING (FRONT VIEW)

Model	A	B	C	D	E	F	G
7025	2.41	2.81	—	1.18	0.94	1.25	2.20
7035	3.01	3.51	—	1.53	1.125	1.25	2.79
7045	4.05	4.61	3.50	2.29	—	1.25	2.79
7055	4.53	5.66	4.50	2.695	—	1.25	2.79
Model	**H**	**I**	**J**	**K**	**L**	**M**	
7025	1.39	.56	.43	.02	.56	.675	
7035	1.37	.58	.53	.02	.56	.675	
7045	1.37	.58	.77	.02	.56	.675	
7055	1.37	.58	.845	.02	.56	.675	

SPECIFICATIONS

		DC Ranges		AC Ranges (rectifier type)	
		Current	Voltage	Current	Voltage
Accuracy		±2%	±2%	±3%	±3%
Tracking	Pivot-and-jewel mechanism	2%	2%	3%	3%
	Taut-band mechanism ≥ 20 μa ≥ 10 mV	1%	1%	3%	3%
Overload Capacity	Momentary (1 sec.)	1000%	< 100V 1000% > 100V 200%	150%	150%
	Continuous	150%	120%	150%	120%
Overshoot (maximum)		20%	20%	20%	20%
Response Time (maximum)	Sensitivity ≥ 50 μa Sensitivity < 50 μa	1.5 sec 3 sec	1.5 sec 3 sec	1.5 sec 3 sec	1.5 sec 3 sec

Effects of shock, vibration, humidity, and temperature are equal to or better than ANSI C39.1-1972

Safety (dielectric test, leakage, and other hazards): instruments are equal to or better than ANSI C39.5-1974

PYROMETERS

Pyrometer Ranges (10Ω Ext. Resistance)				Model 7035 (±2% Accuracy)	Model 7045 (±2% Accuracy)	Model 7055 (±1% Accuracy)
F°	C°	T/C		Price*	Price*	Price*
−150 to + 250	−100 to + 120	T	TB	$50.00	$52.00	$66.00
−75 to + 225	−60 to + 110	J	TB	50.00	52.00	66.00
0 to + 300	0 to + 150	J	TB	47.00	49.00	63.00
0 to + 500	0 to + 260	J	TB	47.00	49.00	63.00
0 to + 800	0 to + 430	J	TB	47.00	49.00	63.00
0 to +1000	0 to + 500	J	TB	47.00	49.00	63.00
0 to +1500	0 to + 800	K	TB	47.00	49.00	63.00
0 to +2000	0 to +1100	K	TB	47.00	49.00	63.00
0 to +2500	0 to +1370	K	TB	47.00	49.00	63.00

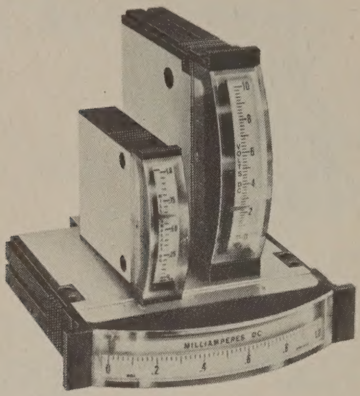
ACCESSORIES

Bezel Kit .... $3.00 Panel Lens Kit ... 1.50 Color Plates .... .65	Colors: tan olive dark grey light grey flat black

LFE CORPORATION

PROCESS CONTROL DIVISION
1601 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154/(617) 890-2000/TWX 710-324-0681

api SERIES 1000 EDGEWISE PANEL METERS



- Stackable
- 1½", 2½", and 3½" sizes
- Easy dial changing
- 18 stock ranges
- Tough, high temperature polycarbonate case
- Resists shock and vibration
- Red dragon-tooth pointer
- Solder terminals
- Clip-on mounting
- 2% Accuracy
- Horizontal or vertical mounting

Range	Resistance ±20%	Model 1015 - 1½"	Model 1025 - 2½"	Model 1035 - 3½"
		Price*	Price*	Price*
Microamperes DC				
0-50	1000 Ω	$27.00	$30.00	$33.00
50-0-50	1000 Ω	23.75	26.75	29.75
0-100	1000 Ω	23.75	26.75	29.75
100-0-100	680 Ω	23.00	26.00	29.00
0-200	680 Ω	23.00	26.00	29.00
250-0-250	127 Ω	23.00	26.00	29.00
0-500	127 Ω	23.00	26.00	29.00
500-0-500	32 Ω	23.00	26.00	29.00
Milliamperes DC				
0-1	32 Ω	23.00	26.00	29.00
1-0-1	10 Ω	23.00	26.00	29.00
0-2	10 Ω	23.00	26.00	29.00
Process Control†				
4-20 mA DC	2.4 Ω	28.75	32.50	36.25
1-5v DC	1000 Ω/V	31.25	35.00	38.75
Millivolts DC				
0-50	12.5 Ω	25.00	28.00	31.00
Volts DC				
0-10	1000 Ω/V	25.00	28.00	31.00
0-50	1000 Ω/V	25.00	28.00	31.00
0-100	1000 Ω/V	25.00	28.00	31.00
0-150	1000 Ω/V	25.00	28.00	31.00
Amperes AC				
0-1	—	43.00	46.00	49.00
0-3	—	43.00	46.00	49.00
0-5	—	43.00	46.00	49.00
0-25	—	43.00	46.00	49.00
0-50	—	43.00	46.00	49.00
Volts AC				
0-150	1000 Ω/V	30.00	33.00	36.00
Illumination — 6 or 12 VDC — Adder		N/A	5.00	5.00
Panel Cut Out		.500" x 1.650"	.680" x 2.560"	.080" x 3.300"
Meter Depth		2.115"	3.170"	3.225"

† Scale 0-100%

* The prices listed are net each for lots of 1-9. Deduct 10% for lots of 10-24.

Series 1000 available in VU ranges. Consult local LFE representative or stocking distributor.

DIGITAL PANEL METERS
MODEL 4352

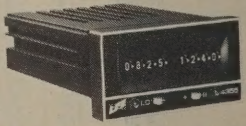
19.73
DC MILLIVOLTS

Model Number	4352
Number of digits	3½
Readout range	±1999
Accuracy: R = reading FS = full scale	0.1% R ±0.1% FS

DC Range	Input	Price*
0-20 mV	100 MegΩ	$215.00
0-200 mV	100 MegΩ	215.00
0-2 V	100 MegΩ	215.00
0-20 V	1 MegΩ	215.00
0-200V	10 MegΩ	215.00
0-20 μA	10 KΩ	215.00
0-200 μA	1 KΩ	215.00
0-2 mA	100 Ω	215.00
0-20 mA	10 Ω	215.00
0-200 mA	1 Ω	215.00

* The prices listed are net each for lots of 1-9. Deduct 5% for lots of 10-24.

DUAL CONTROL COMPARATOR
MODEL 4355



The LFE Model 4355 Dual Control Comparator adds limit-set, GO/NO/GO, or ON/OFF control capability to any measuring device with TTL-compatible parallel BCD output: digital panel meters, digital voltmeters, up/down counters, scalers, digital temperature indicators, and other process digitizers. Model 4355 is designed to function with LFE Model 4352 digital panel meters.

The Model 4355 makes two simultaneous thumbwheel-input comparisons with one 4-digit (or 3½-digit) input word, triggered by the trailing edge of a logic 1 pulse. Algebraic sign of each setpoint is independently selected with two front-panel switches.

ACCESSORIES

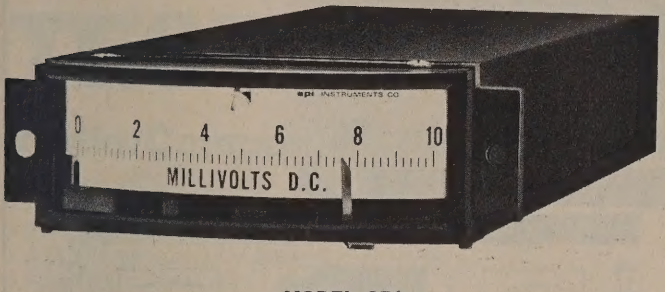
Input and +5 VDC Connector (required for all models)
P/N 1125-272 .... $ 3.50
AC power connector required only for 115/230 VAC models)
P/N 1125-273 .... 3.50
Interface Cable: 24" long, with connectors to mate one LFE 4352 DPM with one LFE 5355 Dual Digital Comparator,
P/N 1125-276 .... 25.00

Input	Supply Voltage	Price*
Dual ±9999 thumbwheel setpoints	+5 VDC	$195.00
Dual ±9999 thumbwheel setpoints	115/230 VAC	215.00
Dual ±9999 hardwired setpoints	+5 VDC	140.00

LFE CORPORATION

PROCESS CONTROL DIVISION
1601 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154/(617) 890-2000/TWX 710-324-0681

api COMPACK METER-RELAY CONTROLLERS



MODEL 371

SOLID-STATE COMPACK MOTOR LOAD ALARM

- Prevents overload damage after startup
- Eliminates nuisance tripping

HOW TO ORDER

Specify the model number of the Compack Controller (single setpoint only)

Specify the rated full load current (refer to manufacturer's nameplate on motor housing) and the required options

MODEL 303-XU	MODEL 503-XU	MODEL 603-XU
$203.00	$206.00	$209.00

Options	Price Adder	
Rated full load current	Up to 35 amperes	no adder
	Over 35 amperes	$30.00

COMPACK CONTROLLER MODEL NUMBER†

Style and Size	Optical	Solid State
3¼″ black phenolic panelist	303-KU	303-XU
4½″ black phenolic panelist	503-KU	503-XU
5½″ black phenolic panelist	603-KU	603-XU
Edgewise (horizontal or vertical)	371-K	371-X

Featuring 5A SPDT relay output.

Current and Voltage Ranges				Optical Compack Controllers †				Solid State Compack Controllers †			
				Model 303-KU	Model 503-KU	Model 603-KU	Model 371-K	Model 303-XU	Model 503-XU	Model 603-XU	Model 371-X
Microamperes DC	0 to 5	Microamperes AC	—	$207.00	$210.00	$213.00	$216.00	$194.00	$197.00	$200.00	$203.00
	0 to 10		—	185.00	188.00	191.00	194.00	173.00	176.00	179.00	182.00
	0 to 20		—	169.00	172.00	175.00	178.00	173.00	176.00	179.00	182.00
	0 to 50		—	161.00	164.00	167.00	170.00	173.00	176.00	179.00	182.00
	0 to 100		0 to 100	154.00	157.00	160.00	163.00	173.00	176.00	179.00	182.00
	0 to 200		—	149.00	152.00	155.00	158.00	173.00	176.00	179.00	182.00
	0 to 500		—	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	5-0-5*		—	218.00	221.00	224.00	227.00	221.00	224.00	227.00	230.00
	50-0-50*		—	187.00	190.00	193.00	196.00	221.00	224.00	227.00	230.00
		Add $5.00 for AC ranges									
Milliamperes DC	0 to 1	Milliamperes AC	0 to 1	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	0 to 5		—	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	0 to 10		—	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	0 to 25		—	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	0 to 50		0 to 47	145.00	148.00	151.00	154.00	173.00	176.00	179.00	182.00
	0 to 100		—	152.00	155.00	158.00	161.00	173.00	176.00	179.00	182.00
		Add $5.00 for AC ranges									
Amperes DC	0-1 & up.	Amperes AC	0 to 1	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
			0 to 5	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
Requires external shunt; to be ordered separately. not included in price;			0 to 10	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
			0 to 20	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
			0 to 30	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
			0 to 40	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
		For AC ranges add $20.00 to 0-1 mA DC prices	0 to 50	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
Millivolts DC	0 to 5	Millivolts AC	—	180.00	183.00	186.00	189.00	186.00	189.00	192.00	195.00
	0 to 10		—	159.00	162.00	165.00	168.00	166.00	169.00	172.00	175.00
	0 to 50		—	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 100		0 to 100	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 250		0 to 250	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
		Add $5.00 for AC ranges (X series) Add $25.00 for AC ranges (K series, 0-250 mV min.)									
Volts DC	0 to 1	Volts AC	—	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 5		—	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 10		0 to 10	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 30		—	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 50		0 to 50	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 150		0 to 150	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
	0 to 300		—	147.00	150.00	153.00	156.00	166.00	169.00	172.00	175.00
		Add $5.00 for AC ranges									

Temperature Ranges (Thermocouple)			Optical Compack Controllers—On-Off Control †				Solid State Compack Controllers—On-Off Control †			
°F	°C	T/C	Model 303-KU	Model 503-KU	Model 603-KU	Model 371-K	Model 303-XU	Model 503-XU	Model 603-XU	Model 371-X
0 to 150	−16 to 66	J	—	—	—	—	$211.00	$214.00	$217.00	$220.00
0 to 300	0 to 150	J	$184.00	$187.00	$190.00	$193.00	211.00	214.00	217.00	220.00
0 to 500	0 to 260	J	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 800	0 to 400	J	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 1000	0 to 500	J	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 1500	0 to 800	K	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 2000	0 to 1100	K	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 2500	0 to 1370	K	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00
0 to 3000	0 to 1650	R	174.00	177.00	180.00	183.00	200.00	203.00	206.00	209.00

Temperature Ranges† (Thermocouple)			Optical Compack Controllers—Time Proportioning Control				Optical Compack Controllers—SCR Driver Control			
°F	°C	T/C	Model 303-K	Model 503-K	Model 603-K	Model 371-K	Model 303-K	Model 503-K	Model 603-K	Model 371-K
0 to 300	0 to 150	J	$234.00	$237.00	$240.00	$243.00	$259.00	$262.00	$265.00	$268.00
See temperature ranges above		J/K/R	224.00	227.00	230.00	233.00	249.00	252.00	255.00	258.00

The above prices are for single setpoint. Add $33 for double setpoint. The listed prices are net each for lots of 1-9. Deduct 5% for lots of 10-24. Consult LFE representative for ranges, accessories, and options not listed.

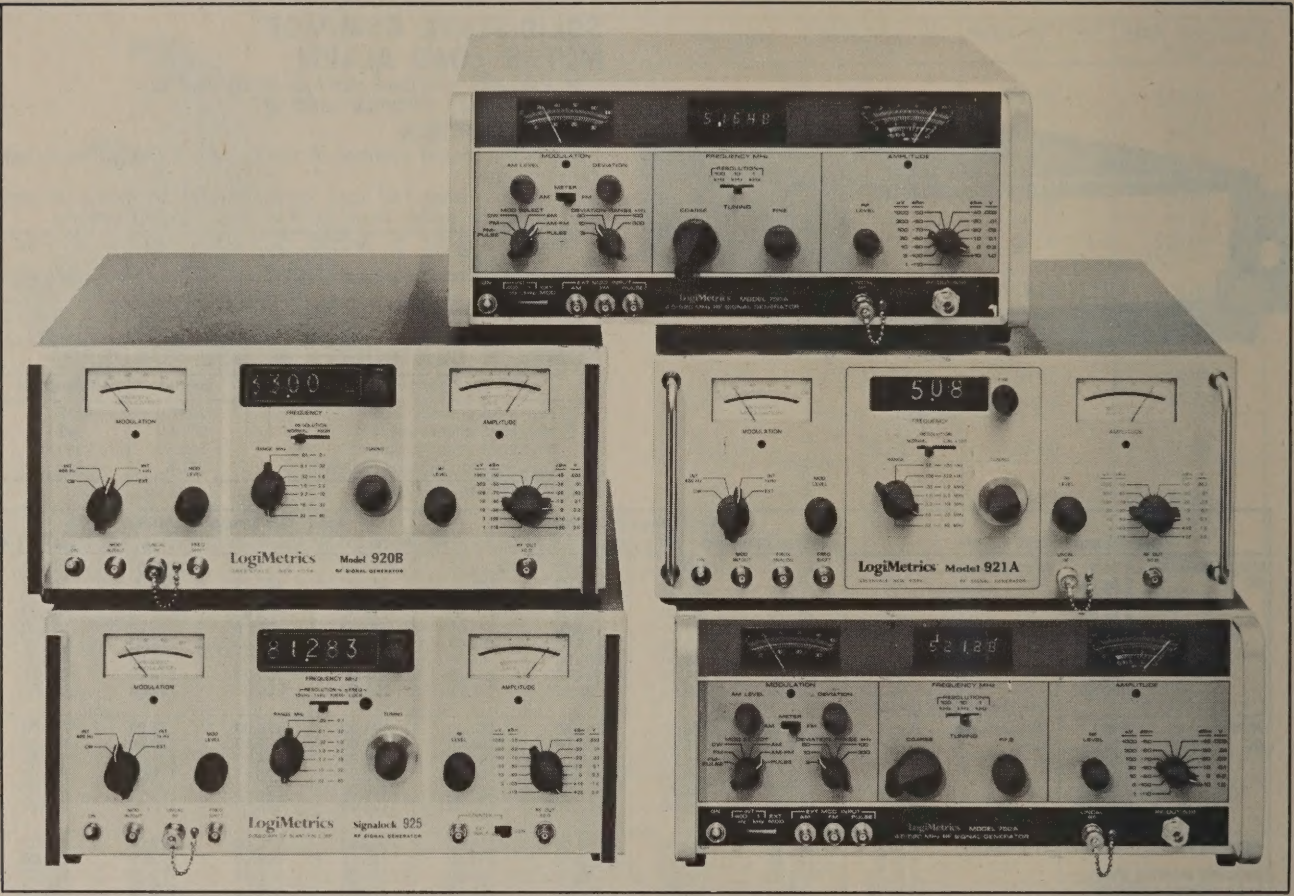
* These ranges are for double setpoint only. The $33 adder is included in the above prices.

† Model numbers ending with a "U" are Underwriters Laboratory recognized.

LFE CORPORATION

PROCESS CONTROL DIVISION
1601 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154/(617) 890-2000/TWX 710-324-0681

LogiMetrics RF SIGNAL GENERATORS



LogiMetrics provides the industry's most complete line of solid state signal generators, all of which are equipped with digital frequency readout. The signal generators cover the range of 50 kHz to 520 MHz with integral counters and leveled outputs. A precision attenuator allows the power to be varied from +23 dBm (3 V RMS) to –127 dBm (0.1 μV RMS) into 50 ohms.

The generators inherent stability and ease of calibration allow users to perform RF measurements with superior convenience and accuracy and at the best cost effectiveness.

Model 315 combines two models 925 for single sideband test.

Among the many features offered in the line is Signalock®*, the capability to count external signals and full modulation. Solid state design, self calibration and plug-in circuit cards insure ease of maintenance and long equipment life.

LogiMetrics signal generators are available with Federal Stock Nomenclature and under G.S.A. contract.

* LogiMetrics holds the original patents on the digital readout signal generator and Signalock®, the circuit that is the key to stabilized signal generators. These patents are licensed to other major companies.

Model	Frequency Range MHz	Accuracy	Digits Display	Features
925	.05 to 80	±10 Hz	6	AM, Signalock®
920B	.05 to 80	±500 Hz	5	AM, High Accuracy
921A	.05 to 80	0.01%	3 (+ x 100)	AM, Low Cost
750A	4.5 to 520	±0.0001%	5	FM/AM Pulse
950A	1.5 to 80	±500 Hz	5	FM/AM Com. Test
315	.25 to 80	±10 Hz	6	Two Tone S.S.B. Test

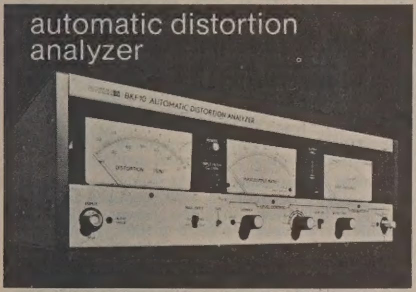
LogiMetrics 121-03 Dupont Street, Plainview, New York 11803/ (516) 681-4700/TWX: 510-221-1833

RADIOMETER ELECTRONICS TEST INSTRUMENTS

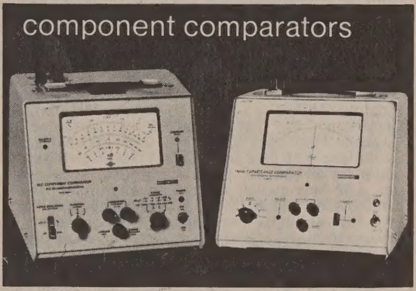
Audio/Component/Communications

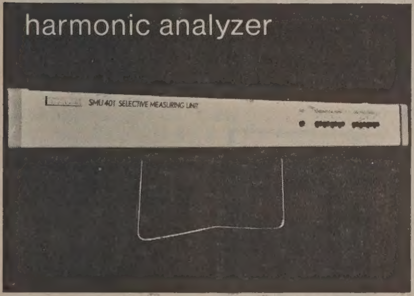
- Automatic Distortion Analyzers
- Precision Stereo Modulators
- AM/FM Modulation Meters
- Harmonic Analyzers
- Picoammeter/Megohmmeters
- Component Reliability Testers
- Component Comparators
- Component Multimeters

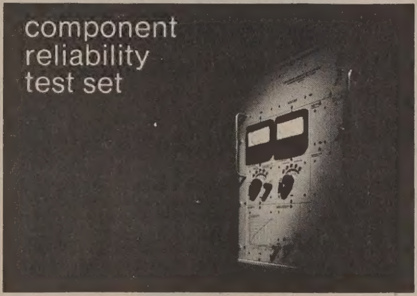
am, fm modulation meters

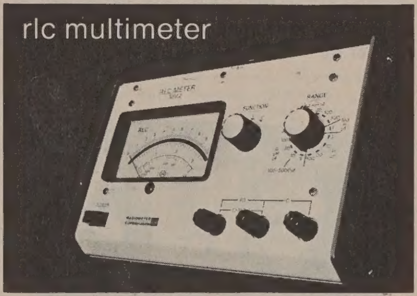

automatic distortion analyzer
BKF10 AUTOMATIC DISTORTION ANALYZER
DISTORTION

picoammeter megohmmeter
MEGOHMMETER
IM6
pA MΩ
TEST VOLTAGE


component comparators


harmonic analyzer
SMU 401 SELECTIVE MEASURING UNIT


component reliability test set


rlc multimeter
RLC METER
RANGE

stereo modulator
MODULATION FREQ.
FUNCTION
SMG 40 STEREO GENERATOR

Automatic Distortion Analyzer—BKF10
Swept measurements of total harmonic distortion.

Harmonic Analyzer—SMU 401
Automatic sweep measurements of selected individual harmonics, 2nd through 5th.

Stereo Modulator—SMG 40
Advanced design signal source; superior flexibility.

Picoammeter/Megohmmeter—IM6
Unusually versatile low current and high resistance measurements.

Component Reliability Test Set—CLT1
Fast, nondestructive test method.

AM/FM Modulation Meters—AFM2, AFM3
Wideband and narrowband models cover 5 to 1002 MHz.

Component Comparators—TRB11, CMB12
Precise measurements against R, L & C standards.

R, L, C Multimeter—MM2
Fast measurements at appropriate frequencies.

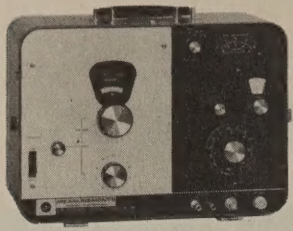
Complete information and specifications on request.

RADIOMETER
COPENHAGEN

THE LONDON COMPANY
U.S. Representatives for Radiometer Copenhagen.
811 Sharon Drive • Cleveland, Ohio 44145
Telephone 216/871-8900

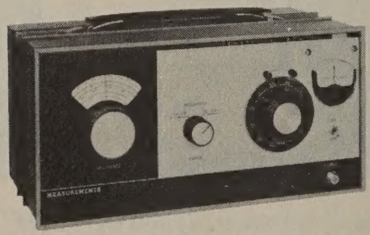
TEST INSTRUMENTS BY RADIOMETER ELECTRONICS... Superior performance you need every day.

INSTRUMENTS FOR RESEARCH, PRODUCTION AND SERVICE



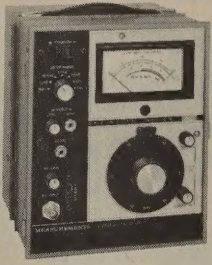
MODEL 1400 SERIES Standard FM Signal Generator

Frequency Accuracy: Individually calibrated dial, direct reading, accuracy ±0.5%. Electronic vernier tuning, with or without modulation; ±20 kHz shift at 470 MHz. Incremental tuning ±16 kHz. • **Output Voltage Scales:** 0.1 to 100,000 microvolts & (-8 to -128dBm) across a 50-ohm termination. Reference level automatically maintained ±10% from 25 to 470 MHz. (Optionally available 880 to 960 MHz harmonic band). • **Output Voltage, IF Oscillator (Model 1418 only)**: Maximum output better than 0.5 volts into a 50-ohm resistive load (crystal position 0.3 volts). A front panel potentiometer gain control provides at least 50 to 1 attenuation. • **Modulation Frequencies:** Internal: 1 kHz oscillator; 20 Hz sawtooth sweep oscillator; dc incremental. Note: Internal modulation signals available at EXT MOD binding posts. External: dc coupled to 20 kHz (1 volt r.m.s. required for 16 kHz deviation) • **Modulation Fidelity**: Within ±1 db to 15 kHz. • **Modulation Distortion**: Less than 3% at 16 kHz deviation • **Residual FM**: Less than 100 Hz at 460 MHz. • **Deviation:** ±16 kHz peak. Direct reading on panel meter for all ranges. Accuracy ±10%, uncalibrated ±32 kHz switch for sweep alignment. (Not available on Model 1418) • **Frequency Stability:** Less than 0.001% frequency shift (short term, 5 minute stability) after 1-hour warm-up. • **Leakage:** Double shielding for oscillator unit and multisection individually-shielded r-f filters reduce stray leakage to levels low enough for accurate sensitivity measurements to 0.1 uV. • **Power Supply:** 115 or 230 volts ±10%, 50-60 Hz, 21 watts. • **Weight:** 12.15 kg (27 lbs.) with cover. **Dimensions:** 25 cm (10'') high x 35 cm (14'') wide x 26.87 cm (10¾'') deep, with cover.



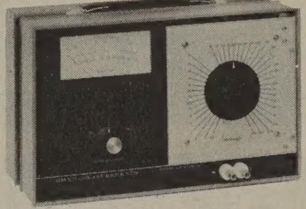
MODEL 950 Field Strength Calibrator

Carrier Frequency: Calibrated 54 to 250 MHz in 2 bands; dial also segmented by TV channels 2 through 13 and CATV channels A through N (CATV pilot frequency 73.5, 112.5 and 225 MHz). Special frequencies on request. • **Frequency Accuracy:** ±0.5% (hand calibrated). • **Attenuator:** Piston type. • **Output Voltage:** 100,000 microvolts across 75 ohms automatically maintained and metered. Can be attenuated to 0.3 microvolts. Calibrated +40 to -70 dBmV. • **Signal Level Accuracy:** ±.75 dB at 100,000μv. • **Source Impedance:** 75 ohms resistive (other impedances on request). • **Power Supply:** 115 or 230 volts ±10%, 50-60 Hz, 12 watts. • **Dimensions:** 17.99 cm (7'') high x 32.39 cm (12¾'') wide x 19.05 cm (7½'') deep.• **Weight:** Approximately 5.90 kg. (13 lbs.)



MODEL 920 Standard Deviation Meter

Carrier Frequency Range: 25 to 1000 MHz. (25 to 50 MHz local oscillator provides useful harmonics to 1000 MHz.) • **Sensitivity:** 25 millivolts from 25 to 500 MHz; 50 millivolts from 500 to 1000 MHz. • **Residual Frequency Modulation:** Less than 100 Hz at 500 MHz. • **Input Impedance:** Nominal 50 ohms. • **Deviation Ranges:** 0 to 2 kHz; 0 to 6 kHz; 0 to 20 kHz. • **Deviation Accuracy:** ±3% of full scale. • **Audio Distortion:** Less than 1% at PHONES jack. • **Modulation Frequency Response:** Flat from 100 Hz to 8 kHz. • **Speaker Output:** 200 milliwatt audio amplifier with de-emphasis; matched to built-in speaker. • **Scope Output:** Provides for visual observation of modulated signal without de-emphasis. • **Size:** 22.54 cm. (8-7/8'') high x 18.42 cm. (7-¼'') wide x 20.95 cm. (8-¼'') deep with cover and back containing power supply. • **Weight:** 4.54 kg. (10 lbs.) 5.67 kg. (12-½ lbs.) with battery . • **Power Supply:** 115 volts ±10%, 50-60 Hz; 12-volt storage battery or 9 ''D'' size dry cells. 3 watts maximum.



MODEL OP-963 Output Power Meter

Power Range: 0.1 milliwatt to 100 Watts in 5 ranges -10 to +10 dbm, ref. level 1 mw. • **Power Accuracy:** Indicated power accurate within ±0.25 db at full scale reading. • **Impedance Range:** 2.5 ohms to 20,000 ohms in 40 steps. • **Impedance Accuracy:** Within ±2% of indicated value 20 Hz to 20 KHz. • **Mounting:** Portable, extruded aluminum case with handle. • **Weight:** Approximately 5.4 kg (12 lbs.) • **Size:** 34.29 cm (13½'') wide x 22.88 cm (9'') high x 17.14 cm (6¾'') deep.

MODEL 159 SERIES Megacycle (Grid-dip) Meter

159-LF OSCILLATOR (100 kHz to 4.5 MHz)

159-RF OSCILLATOR (2.2 MHz to 420 MHz)

159-UHF OSCILLATOR (420 MHz to 940 MHz)

159-Power Supply Only

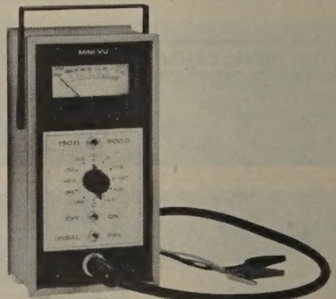
159 COMBINATION (100 kHz to 940 MHz)
One each of above units.

MODEL CB-27E Service Monitor

RECEIVER & TRANSMITTER SERVICING

Frequency Accuracy: ±3 PPM (.0003%) of mid-channel frequency at 25°C (77°F) +10 PPM (.001%) over operating range. • **Frequency Stability:** ±2 PPM (.0002%) in any 10 minute interval, after 1 second lock-up. • **Frequency Setability:** Frequency can be shifted ±5 kHz from mid-channel. • **Output Voltage:** 0.1 microvolt to 100 millivolts (-7 to -128 dBm) variable and maintained within ±2 dB. Resistive attenuator with five 20 dB steps plus a 20 dB vernier for any step. • **Amplitude Modulation:** Internal: 1 kHz with less than ±0.5%distortion variable from 0 to 100%. Calibrated at 30% to within ±5% of reading. External: 50 Hz to 5 kHz also variable from 0 to 100% modulation. • **Spectral Purity:** Harmonics: -40 dB relative to fundamental. In Band Non-Harmonics: (Mixer products, spurs, etc.) -50 dB relative to carrier peak. AM Noise Floor: -40 dB (related to 1 kHz at 30% modulation). • **RF Leakage:** Less than 0.1 microvolt 1'' from any surface. • **I.F. Output:** 455 kHz crystal, internally or externally modulated, plus two unassigned I.F. crystal positions.

RF Power Measurements: AM carrier output to 8 watts (±5%F.S.) average. SSB output to 24 watts (±5% F.S.) peak envelope power (PEP). • **Modulation Measurements:** 0 to 100% referenced to a 4 watt carrier output. Calibrated at 80% modulation to within ±5% of reading. • **Mid-Channel Accuracy:** Transmitter offset from mid-channel can be read from the panel meter and monitored down to zero beat against the accurate time base standard. • **Audio:** The built-in speaker, external jack and scope output jack • **Dimensions:** 15.2 cm (6'') high x 31.8 cm (12½'') wide x 19.1 cm (7½'') deep. • **Weight:** 5 kg. (11 lbs.) less batteries.



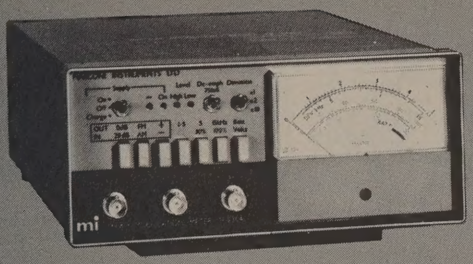
MODEL 945 Mini-Vu Audio Level Meter

Input: Balanced or unbalanced (selected by switch) • **Input Z:** 10K ohms min. • **Frequency Response:** ±1 dB 30 Hz to 15 kHz • **Range Selector:** 12 positions, eleven 10 dB positions (-60 VU to +40 VU) plus a calibrate position. • **Power Source:** 6.75 Volt Mercury Cell, Approximate life 250 hrs. operation • **Input Connector:** Tip, ring and sleeve jack on six foot test cable • **Operating Temp. Range:** -10°C to +55°C ambient • **Accuracy:** ±1dB • **Compact Size:** 17.78 cm (7'') high x 10.16 cm (4'') wide x 7.62 cm (3'') deep. • **Weight:** .91kg (2 lbs.)

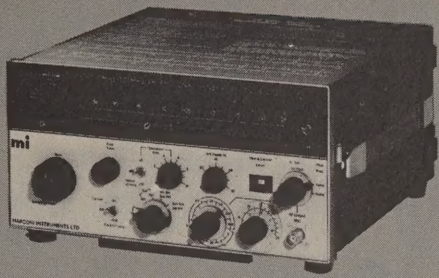
McGRAW-EDISON COMPANY
Edison Electronics Division

MEASUREMENTS

Grenier Field Municipal Airport, Manchester, N.H. 03103 • (603) 669-0940 • TWX 710-220-1747



Model 2304
Automatic Modulation
Meter for Mobile Radio



Model 2015/2
Transistorized replacement for Model 1066B/6.

FM/AM SIGNAL GENERATORS

DESCRIPTION	FREQUENCY	FEATURES
FM/AM SIGNAL GENERATOR Model 2002B	10KHz to 88MHz	0.1μV to 1V ±1dB, fully solid state, AM variable to 100%, FM deviation ±1KHz to ±50KHz max. dependent upon range. Incremental frequency controls with discrimination of 0.025% and direct readout in KHz. Xtal calibrator. External frequency shift permits phase mod. or phase locking. Digital Synchronizer available.
FM/AM SIGNAL GENERATOR (6625-913-7223) Model 995B/Series	200KHz to 220MHz	0.1μV to 100mV. Calibrated ΔF. Step attenuator, Crystal standardized; extremely stable. Deviation ±600KHz on top bands. Has simultaneous FM & AM. Also available for narrow band working FM spurious less than 25Hz Model 995B/5.
FM SIGNAL GENERATOR (6625-937-2801) Model 1066B/6	10MHz to 470MHz	0.1μV to 100mV. FM at 1 KHz and 5 KHz internal, deviation to ±400 KHz, ΔF to ±100 KHz, both meter monitored. Stability .0025% 10 min. Xtal calibrator.
FM/AM SIGNAL GENERATOR Model 2015/2	10 MHz to 520 MHz	Transistorized replacement for Model 1066B/6. Automatically leveled output 0.1 uV to 100 mV; internal modulation at 1 kHz and 5 kHz, FM deviation to 400 kHz, AM to 80%; No non harmonic spurious; Stability .002% 5 min. Digital Synchronizer Model 2171 optional.
FM/AM SIGNAL GENERATOR Model 2015	10MHz to 520MHz	Covers 10MHz to 520MHz in 11 bands with discrimination permitting tuning to narrow band (±3KHz) receivers. FM deviation 10KHz and 100KHz. AM to 80%. Precision ALC eliminates need for external set carrier control. Fundamental signal with low spurious content. Will also operate from external 24VDC. Portable, 5½" high 11" wide. Lowest cost for performance generator on USA market today.
DIGITAL SYNCHRONIZER Model 2171	10MHz to 520MHz	Used with Model 2015 to set frequency to stability of ±2 in 10^7 to resolution of 100Hz. Once locked frequency may be digitally tuned to at least 1% from center frequency, with full modulation capabilities retained.
LOW NOISE VHF/UHF FM SIGNAL GENERATORS Models 2011-2012-2013	130MHz to 180MHz 400MHz to 520MHz 800 MHz to 960MHz	Highly stable low noise unit for testing narrow band mobile receivers. Velvet vernier tuning. Infinitesimal leakage. Noise less than —140dB/Hz, VHF/UHF; —125dB/Hz, 800 — 960MHz, 20KHz from carrier. Output level 0.01μV to 100mV into 50Ω FM deviation to ±30KHz f_m 300Hz to 3KHz.
AM/FM SIGNAL GENERATOR AND SWEEP GENERATOR Model 2008	10KHz to 510MHz	This unique combination Generator/Sweeper provides both facilities without sacrifice to the precision quality of either function. Eleven bands with 1 : 1.5 cover span from VLF thru UHF. Output 0.1μV to 100mV into 50Ω. Stability 5 p.p.m. FM deviation ±3KHz ±10KHz ±30KHz ±100KHz and above 45MHz ±300KHz. Mod. frequency to 125KHz. AM to 80%. Comprehensive sweep facilities on all bands. Full Modulation facilities may be retained in sweep mode. Xtal calibrator and markers.

FM DEVIATION METERS

FM DEVIATION/ AM MODULATION METER Model 2300A (USA) (6625-480-8706)	4MHz to 1000MHz to 2500MHz using ext. oscillator	Wide range, mod. freq. up to 200KHz; deviation ranges ±1.5, ±5, ±15, ±50, ±150, ±500KHz. Local oscillator can be xtal locked, external oscillator can be used. De-emphasis 50μsec. 75μsec. switch selected. FM accuracy ±3% for deviation up to ±500KHz f_m 30Hz to 150KHz. AM modulation two ranges 30% and 100% mod. freqs. 30Hz to 50KHz (carrier 4 to 350MHz).
FM DEVIATION/ AM MODULATION METER Model 2300B	4MHz to 1200MHz	Measures FM deviation to 500KHz, AM depth to 95% at carriers up to 400MHz. Very low internal noise allows narrow deviation measurements. Filter for noise measurement. De-emphasis 50μS, 75μS and 750μS. Distortion and channel separation on FM stereo meets FCC testing requirements.
PORTABLE AUTOMATIC MODULATION METER Model 2304	25 MHz to 1000 MHz	Completely automatic tuning and level setting. Measures FM on ranges 1.5 kHz to 150 kHz, AM 30% and 100% for modulating frequency 50 Hz to 9 kHz. Accuracy 3%. Optional internal rechargeable battery.
PROGRAMMABLE FM/AM MODULATION METER Model 2301A	4MHz to 1000MHz	FM deviation in six ranges from ±1.5KHz to ±500KHz f_m 30Hz to 200KHz demodulated output distortion 0.25%. AM 30% and 100%. Automatic internal carrier level setting.

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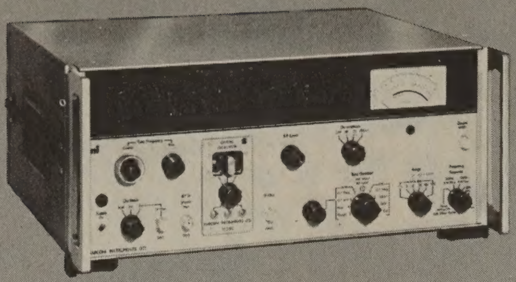
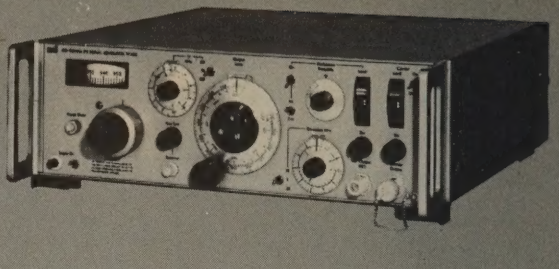
TELEPHONE: (201) 767-7250



FM/AM Modulation Meter
Model 2300B



Model 2013
Low Noise 800-960MHz
Signal Generator

MOBILE RADIO TEST GEAR

DESCRIPTION	FREQUENCY	FEATURES
PORTABLE AUTOMATIC MODULATION METER Model 2304	25 MHz to 1000 MHz	Completely automatic tuning and level setting. Measures FM on ranges 1.5 kHz to 150 kHz, AM 30% and 100% for modulating frequency 50 Hz to 9 kHz. Accuracy 3%. Optional internal rechargeable battery.
MOBILE RADIO SIGNAL GENERATORS	All Mobile Bands	Special low noise signal generator series for all bands. 130MHz thru 960MHz. See Signal Generator Section, Models 2011, 2012, 2013, and general purpose 2015.
AUTOMATIC DISTORTION METER Model 2337	20Hz to 20KHz	Simultaneous indication of level down to 3mV, distortion down to 0.1% without tuning adjustments. With external filter, the unit becomes ideal for SINAD testing.

DIGITAL COMMUNICATIONS – P.C.M. TEST GEAR

DESCRIPTION	FREQUENCY	FEATURES
MULTIPLEX TEST SET Model 2807	Voice Channel	Both sinewave and pseudo random noise stimulus available to measure channel gain, frequency response, idle channel noise, gain linearity, quantization distortion and interchannel crosstalk. National and International models available.
DATA LINE ANALYZER Model 2809	300Hz to 3400Hz	Used for testing data transmission lines and links; measures peak-to-average rating (PAR), frequency response and system noise level. Has correction for phase-intercept distortion.

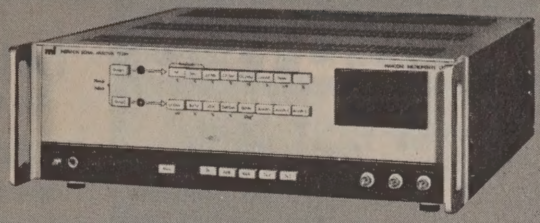
PROGRAMMABLE ATTENUATORS

DESCRIPTION	FREQUENCY	FEATURES
UHF ATTENUATOR Model 2168	DC to 1000MHz	Attenuation range 0 to 139 dB in 1 dB steps. Accuracy ±0.5%, ±0.1 dB at 1KHz, ±1.5%, ±0.2 dB at 1GHz.
MF ATTENUATOR Model 2165	DC to 500KHz	Attenuation range 0 to 99.9 dB in 0.1 dB steps. Accuracy 1% of setting ±0.01 dB. Output/input impedance 600Ω unbalanced. Usable to at least 1MHz.

INTERMODULATION AND BASEBAND TEST GEAR

DESCRIPTION	FREQUENCY	FEATURES
NOISE LOADING TEST SET (6625-965-8625) (AN/GSM 161A) Model 2090A	12KHz to 12.388MHz (i.e. up to 2700 channels)	Solid state unit has built-in standardizing noise source in receiver for gain setting, out-of-band testing, etc. Includes noise generator, receiver and a choice of many different filters. NPR measurements can be made up to 75 dB.
NOISE LOADING TEST SET (6625-591-8383) Model 2090B	12KHz to 12.388MHz	Designed to meet latest CCIR and CCITT accuracy requirements (Recommendation 399-1 Oslo 1966). Includes ALC on generator; suitable for use with A or B series filters.
Model 2099AB		This filter extension box can be added to any 2090A or 2090B system to provide accommodation for up to nine extra high, low or band stop filters and six extra band pass filters with oscillators. Minor modification required to existing generators and receivers to provide access. Simple field modification kits available.
AUTOMATIC WHITE NOISE TEST SET Model 2090C	6 kHz to 12.360 MHz	The automatic alternative to Model 2090B. Provides digital readout in all commonly used measurement units. In programmable mode all control transfers to auxiliary computer or optional Remote Control unit TK2085. Ideal for design, manufacturing, commissioning and maintenance of FDM systems, particular when rapid testing is critical. Suitable for A or B series filters.
HF SPECTRUM ANALYZER Model 2370	30Hz to 110MHz	Comprehensive spectrum analyzer system with dispersion from 20Hz/div to 100MHz full width, resolution 0.1 dB, filter bandwidths from 5Hz to 50KHz, displayed dynamic range 100dB, 10 x 12 cm flicker-free digitally stored display, frequency measurement to counter accuracy. Built in tracking generator for Network Analysis.
TWELVE CHANNEL NOISE GENERATOR (6625-948-4724) Model TM7816A	300Hz to 3400Hz	Generates twelve non-related channels of Gaussian noise from twelve separate solid state sources. Output: each channel 1mW in 600Ω balanced, 300Hz to 3400Hz. Attenuation to —32 dBm in 2 dB steps. Spurious noise in OFF channel (all other channels ON) is less than 15 dBrnC. Programmable option available.
TV AUTOMATIC MONITORING SYSTEM Model 2914/15		See television section overleaf.

Model 2910 series
Non Linear Distortion Analyzer with Sampler



Model 2914
Automatic TV Quality Analyzer

TV TRANSMISSION TEST EQUIPMENT

DESCRIPTION	FEATURES
TV SIDEBAND ANALYZER Model 2360R	Provides a symmetrical or asymmetrical swept video signal for testing video amplifiers or transmitters using 625, 525 or 405 line systems, positive or negative modulation. Uses Converter TM6936 for UHF channels.
TV SWEEPER Model 2361	Main sweep unit has internal rep. rate 0.01Hz to 100Hz with linear, semi log, CW, single shot and manual modes. TV field lock, blanking and phase shift controls and alternate trace separation. Produces ultra flat, low distortion sweep. Plug-ins available: Video 25KHz to 30MHz. VHF 1 to 300MHz, UHF 220MHz to 1000MHz.
TV SWEEP ANALYZER Model 2900	Comprehensive frequency sweep analyzer combines Model 2361 Sweeper and video unit, Blanking and Sync Mixer Model 2908 and Differential Probes unit, Model 2907. Measures response of active or passive transmission networks. Differential measurements on composite signal to an accuracy of 0.01dB. Also measures termination impedance and return loss.
LUMINANCE/CHROMINANCE GAIN & DELAY TEST SET Model 2904/1	Measures gain and delay inequality with gain discrimination 0.5dB, delay discrimination 2 nanoseconds, visible display of misalignment with waveform monitor.
NON-LINEAR DISTORTION ANALYZER with SAMPLER Model 2910	Makes accurate, simultaneous measurements from Vertical Internal Test Signal or Full Field Signal of differential gain, differential phase and luminance non-linearity, even in the presence of noise. Gain and phase can be directly measured against a calibrated pulse which can be varied over the ranges of 0 to 11% in .1% steps and 0 to 11° in .1° steps respectively, with the luminance non-linearity being resolvable down to 0.1% using an external scope display.
TV TESTLINE GENERATOR AND INSERTER Model 2913	Erases and inserts Vertical Interval Test Signals on selected lines, Generates full field test signals. Can be remote programmed. Ideal for use with TV Automatic Quality Monitoring System. NTSC and PAL versions available.
TV AUTOMATIC QUALITY MONITORING SYSTEM Models 2914 and 2915	Automatically analyzes and displays all essential parameters including: amplitudes of bar, sync, various T pulses, and noise; luminance linearity, chrominance gain, chrominance/luminance crosstalk, differential gain and phase, etc., all measured in the most suitable units of measure and presented digitally when under manual control (see illustration above). Data Selector Model 2917 enables both local and remote print out of results. Versions to meet International, F.C.C. and NTC recommendations.

COMMUNICATIONS RECEIVERS

Model 958	10KHz to 30MHz	A unique series of communications receivers covering 10KHz thru 470MHz. All feature superb construction and top performance. Low frequency models provide AM/CW/SSB, high frequency offer AM/FM. Xtal locking facility optional on all models to enhance stability. Optional Panoramic Display Units available.
Model 1830	120KHz to 30MHz	
Model 990R	27MHz to 240MHz	
Model 1990R	25MHz to 470 MHz	

BRIDGES AND Q METERS

UNIVERSAL BRIDGE Model 1313A	1KHz and 10KHz 20Hz to 20KHz External	0.1μH to 110H, 0.1pF to 100μF, 0.003Ω to 110MΩ. Accuracy 0.1%. Built-in osc. and det. Direct reading; simplest possible operation. Uses adapter TM6113 for biasing inductors to 200mA.
PORTABLE UNIVERSAL BRIDGE Model 2700	1KHz internal 20Hz to 20KHz External	0.2μH to 110H, 0.5pF to 1100μF, 0.01Ω to 11MΩ. Accuracy 1%. Transistorized, simple. Measures incremental L, electrolytics & non-linear resistance using external bias supplies.
Q METER Model 1245A	1KHz to 300MHz	Q ranges 5 to 1000, ΔQ 25-0-25. Accuracy 5% to 100MHz, 20% to 300MHz. Calibrated capacitor 7.5 to 500pF, ΔC ranges ±1 and ±5pF. Extremely stable and easy to operate. Uses separate oscillators. Dielectric and Series Loss Test Jigs available. Also HF & LF inductors.

MICROWAVE SIGNAL SOURCES

Model 6055	0.85 to 2.15GHz	A unique series of transistor and gunn diode microwave signal sources covering 400MHz to 18.0GHz. Digital display of frequency, accuracy typically ±1%. Variable output levels typically 10mW on gunn diode sources. Up to 150mW on transistor models, Gunn Diode Models are 6057, 6058 and 6059. Special frequency coverages on request.
Model 6056	2.0 to 4.0GHz	
Model 6057	4.5 to 8.5GHz	
Model 6058	8.0 to 12.5GHz	
Model 6059	12.0 to 18.0GHz	
Model 6070	0.4 to 1.2GHz	

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MODUTEC

#1 IN TAUT BAND PANEL METERS

See overleaf for ranges & prices

TAUT BAND PANEL METERS

2% F.S. accuracy in ranges for all applications

MOVING MAGNET PANEL METERS

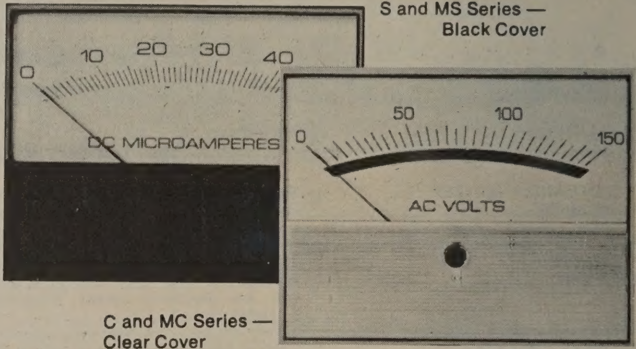
5% F.S. accuracy, high quality & style, low cost

Available in Taut Band & Moving Magnet Versions

SURFACE MOUNT

S and MS Series — Black Cover
Handsome aspect ratio and clean-cut detailing add distinction to any panel. Optional colors available.

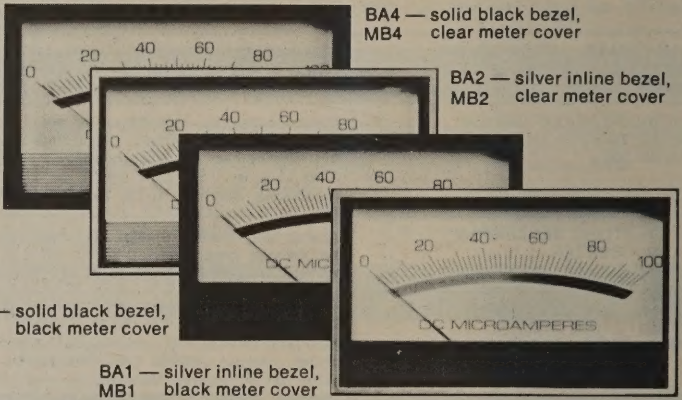
C and MC Series — Clear Cover
Clear acrylic case front reduces contrast between the meter and adjacent panel for a pleasing overall effect.


S and MS Series — Black Cover

C and MC Series — Clear Cover

BEZEL MOUNT

BA and MB Series
Actually a package comprising a surface mount meter and a slender, graceful bezel in the combination shown. Mounting hardware and instructions are included. Bezels are available in optional colors; all meter options apply.


BA4 — solid black bezel,
MB4 clear meter cover

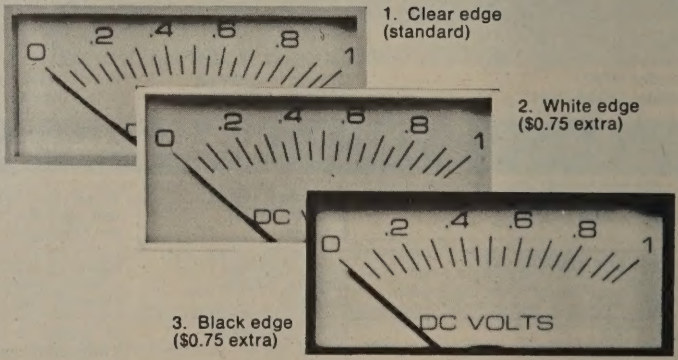
BA2 — silver inline bezel,
MB2 clear meter cover

BA3 — solid black bezel,
MB3 black meter cover

BA1 — silver inline bezel,
MB1 black meter cover

WINDO-MOUNT™

W and MW Series
A sophisticated and original design that has been widely imitated, these original Windo-mount meters are easily installed without special adapters, and do not sink the meter dial deep behind the panel. Uniquely attractive edge options are available, as shown at right.


1. Clear edge (standard)

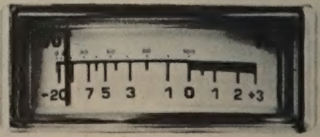
2. White edge ($0.75 extra)

3. Black edge ($0.75 extra)

Available in Moving Magnet Version

0
.2
.4
.6
.8
1.0
DC MILLIAMPERES

SQUARE An attractive and useful shape, in 1″ and 2″ (MSQ) sizes, and all ranges including VU. Available for surface mount or Windo-mount (above), but not bezel mount.



EDGE READING meter comes in all ranges, including VU, is about 1.8″ wide, and installs without modification as either surface mount or flush mount.

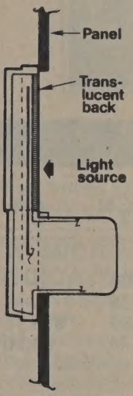
24 OR LESS CATALOG METERS SHIPPED IN 1 WEEK OR YOU PAY ½ PRICE
FAST DELIVERY OF OPTIONS AND SPECIALS FROM FACTORY MODIFICATION CENTERS

TAUT BAND METER SIZES-1½″ • 2½″ • 3½″ • 4½″ • 5½″ & 8″

MOVING MAGNET METER SIZES-1″ • 1½″ • 2″ • 2½″ • 3½″ & EDGE READING (2″)

See next page for ranges & prices

Available in taut band and moving magnet versions



L SERIES

Trans-Lit™ Panel Meters

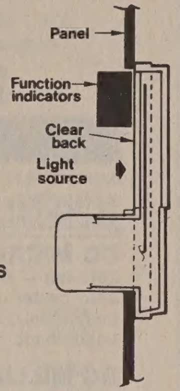
- Dial printed on translucent back for illumination through the meter dial — highest quality lighting of any meter.
- Optional smoke-grey covers enable "meter blackout" technology.
- Save money in installation and illumination accommodations.
- Available in Surface Mount, Bezel Mount, and Windo-Mount styles.

Available in taut band versions

V SERIES

Thru-Vue™ Panel Meters

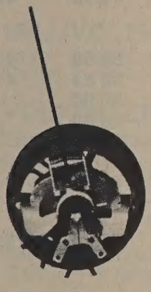
- Clear area over dial accommodates function indicators, etc., for reading "through the meter".
- Optional smoke-grey covers enable "meter blackout" technology.
- Bring high volume design advantages to custom and small run units.
- Multiple metering functions visible through one cutout — save space and installation costs.



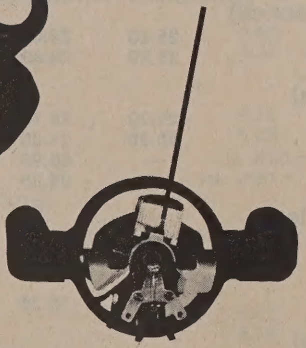
HIGH TORQUE METER MOVEMENTS

Unpointered • Pointered • Dial Mounted

Stnd. Type



Round-clamp mt.



FP-3 (FPZ also available)

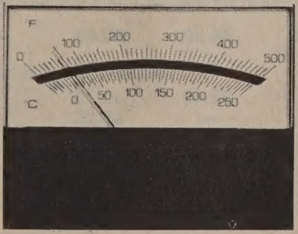
Modutec furnishes large numbers of uncased and dial mounted mechanisms to a variety of users. Units are available to fit standard cutouts and also are manufactured to meet individual requirements for performance, size, and shape. Made in USA.

The high torque and other desirable features of Modutec meter movements make them very useful in applications such as torque motors, recorder pen motors, flag indicators, etc.

High precision taut band movements, or ultra-economical moving magnet movements, will provide ideal answers to your needs, with benefits in cost, appearance, and space utilization.

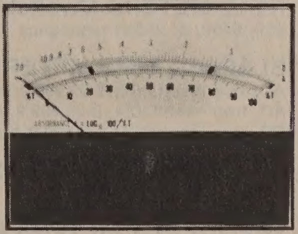
Phone or write for full information.

PYROMETERS & THERMOCOUPLES



Utilizing precise and reliable Modutec taut band movements, in all panel meter styles, sizes 1½″ through 5½″, Modutec pyrometers have thermistor copper error compensation, and are supplied in 19 ranges from −150°F to +3000°F. Many useful options can be incorporated. Thermocouples are stocked in useful variety, in types E, J, K, R, and T. Wire, connectors, and hardware are also available.
For details request Catalog PYR-1105.

CONTROL METERS



A new approach to actuating and monitoring IC control circuits.
Modutec Control Meters have precise taut band movements with low and/or high set potentiometers incorporated into the meter, the setting being indicated by pointers visible through the mirror-scale slot. They are available in 3½″, 4½″, and 5½″ sizes.
For information, including detailed typical applications, request Catalog CM-1012.

MODUTEC, INC.

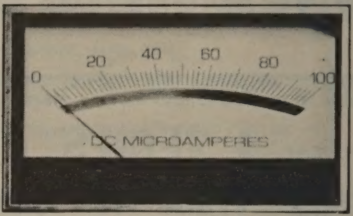
18 Marshall St., Norwalk, CT 06854 (203) 853-3636 TWX: 710-468-2039

MODUTEC

(see preceding spread for description)

TAUT BAND PANEL METERS

Modutec 100° Taut Band Panel Meters are Number 1 nationally in sales — for many good reasons! Meet or exceed the performance requirements of USA STD C-39.1. Full-scale accuracy 2% (AC 3%), tracking 1.5% (AC 2%), repeatability 0.5%. Trend-setting styling, high torque, high precision, low friction movements. Numerous options available for immediate incorporation in any catalog meter. Plus fast service!



Ranges, Sizes, Prices (Request Modutec Catalog 262 for detailed information)

Note: Prices are approximately median for range groups; catalog price for any specific range may differ slightly.

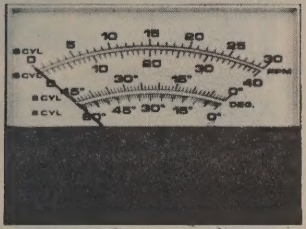
SIZE:	1½"	2½"	3½"	4½"	5½"	8"
DC MICROAMMETERS (Available in all series)						
Zero left — 5 ranges: 0-20μA to 0-500μA	$28.30	$26.95	$28.30	$30.10	$36.00	—
Zero center — 5 ranges: 10-0-10μA to 500-0-500μA	29.35	28.05	29.35	31.35	37.35	—
Logarithmic, zero left — 4 ranges: 0-100μA to 0-1000μA	—	—	43.60	45.70	55.35	$75.15
Logarithmic, suppressed zero — 4 ranges: 10-100μA to 100-1000μA	—	—	47.85	50.15	60.70	83.20
DC MILLIAMMETERS (Available in all series)						
Zero left — 15 ranges: 0-1mA to 0-750mA	26.30	25.00	26.30	27.90	33.25	41.95
Zero center — 8 ranges: 1-0-1mA to 500-0-500mA	26.95	25.75	26.95	28.45	34.05	43.15
DC AMMETERS (Available in all series)						
Zero left — 22 ranges: 0-1A to 0-2000A	25.20	24.10	25.20	26.85	32.00	40.15
Zero center — 13 ranges: 1-0-1A to 500-0-500A	26.40	25.30	26.40	28.10	33.60	42.55
DC MILLIVOLTMETERS (Available in all series)						
Zero left — 2 ranges: 0-50mV and 0-100mV	25.20	24.10	25.20	26.85	32.00	40.15
Zero center — 2 ranges: 50-0-50mV and 100-0-100mV	25.80	24.80	25.80	27.55	32.90	41.45
DC VOLTMETERS (Available in all series)						
Zero left — 23 ranges: 0-1V to 0-1000V	25.20	24.10	25.20	26.85	32.00	40.15
Zero center — 10 ranges: 5-0-5V to 600-0-600V	25.80	24.80	25.80	27.45	32.85	41.40
Expanded scale, volts — 8 ranges: 5V to 300V±10%, ±.05% acc.	—	86.95	91.25	95.60	99.80	—
Exp. scale, % deviation — 3 ranges: 12,28,120V±10%, ±.05% acc.	—	86.95	91.25	95.60	99.80	—
AC MILLIAMMETERS (Available in all series)						
8 ranges: 0-15mA to 0-500mA	32.35	30.30	32.35	35.60	40.70	—
AC AMMETERS (Available in all series)						
24 ranges: 0-1A to 0-2000A	32.35	30.30	32.35	35.60	40.70	53.80
AC VOLTMETERS (Available in all series)						
11 ranges: 0-3V to 0-600V	30.10	28.70	30.10	31.80	38.50	50.45
Expanded scale, volts: 105-125V or 210-250V at ±0.5% acc.	—	84.15	88.20	95.10	92.15	—
Expanded scale, volts: 95-135V or 190-270V at ±1.0% acc.	—	84.15	88.20	95.10	92.15	—
NULL METERS (Available in all series)						
35Ω, 640Ω, or 2550Ω resistance	35.45	34.50	35.45	—	—	—
ELAPSED TIME METERS (Series S, C, BA, W)						
AC, non-resettable; 0-99,999.9 mins. or hrs.	—	32.45	40.75	—	—	—
AC, front-resettable; 0-99,999.9 mins. or hrs.	—	—	55.05	—	—	—
DC, non-resettable; 0-9,999.9 hrs.; 4-10, 10-20, 104-120VDC	—	—	56.50	—	—	—
RF AMMETERS (Series S, C, BA, W)						
6 ranges: 0-1A to 0-10A	—	—	34.25	39.00	46.40	—
FREQUENCY METERS (Series S, C, BA, W)						
7 ranges: 47-53Hz to 380-420Hz	—	—	54.35	—	—	—
VU METERS (Available in all series)						
Per USA Std. C-16.5-1954	35.45	34.10	35.45	36.70	—	—
VU type DC Microammeters	26.50	25.90	26.50	28.15	—	—
S, C, and W Series — Prices are listed above.						
BA Series — Add to the prices listed above:	3.15	3.15	3.15	3.35	3.55	5.00
K Series (MIL Spec.) — Add to the prices listed above: (plus bezel mount adder if desired)	9.45	8.65	9.45	11.00	12.60	—
R Series (interchangeable dial) — Add to the prices listed above:	—	—	4.30	5.00	5.70	10.00
L & V Series — Add to the prices listed above: (plus bezel mount adder if desired)	—	—	2.85	3.60	3.60	4.30

DISCOUNT SCHEDULE: 1-9 NET; 10-24 15%; 25-49 35%; 50-99 45% on total order for one shipment.

MODUTEC

(see preceding spread for description)

MOVING MAGNET PANEL METERS & INDICATORS



M-Series Panel Meters are for those users — high volume in particular — who do not require the rigorous performance characteristics of Modutec Taut Band Meters. Featuring sales-making appearance and advanced engineering, M-Series Meters are rugged and dependable, with 5% f.s. accuracy, improvable to 3%, as one of many catalog-listed options available in this unique line of low-cost meters.

M SERIES — Ranges, Sizes, Prices (Request Catalog MM353 for detailed information)

Note: Prices are approximately median; catalog prices for specific ranges may differ slightly. SIZE:	1"	1½"	2" SQ. or 2½"	3½"	Edge Reading (1.8")
DC MICROAMMETERS & LEVEL (BALANCE) INDICATORS					
Standard Sensitivity					
Zero Left — 3 ranges: 0-200μA to 0-500μA	$5.75	$6.12	$6.58	$6.92	$5.61
Zero Center — 3 ranges: 100-0-100μyA to 500-0-500μA	5.61	5.95	6.40	6.81	5.43
High Sensitivity					
Zero Left — 4 ranges: 0-200μA to 0-1000μA	7.61	7.83	8.24	8.58	6.86
Zero Center — 3 ranges: 100-0-100μA to 500-0-500μA	7.72	7.95	8.35	8.76	6.97
DC MILLIAMMETERS					
Zero Left — 14 ranges: 0-1mA to 0-500mA	4.63	4.97	5.38	5.83	4.11
Zero Center — 8 ranges: 1-01mA to 500-0-500mA	4.75	5.09	5.54	6.06	4.34
DC AMMETERS (Battery & Circuit Condition Indicators)					
Zero Left — 9 ranges: 0-1A to 0-30A Ammeters with ext. shunts can be supplied to 125A	4.40	4.75	5.26	5.72	4.11
Zero Center — 6 ranges: 1-0-1A to 25-0-25A	4.58	4.97	5.20	5.90	4.29
DC MILLIVOLTMETERS					
Zero Left — 0-50mV, 0-100mV	4.92	5.26	5.72	6.18	4.34
Zero Center — 50-0-50mV, 100-0-100mV	5.04	5.32	5.83	6.29	4.40
DC VOLTMETERS (Battery & Circuit Condition Indicators)					
Standard Sensitivity					
Zero Left — 20 ranges: 0-1V to 0-500V (Multiplier resistor furnished externally above 15V)	4.86	5.20	5.66	6.29	4.23
Zero Center — 9 ranges: 5-0-5V to 500-0-500V	5.04	5.38	5.90	6.52	4.58
High Sensitivity					
Zero Left — 19 ranges: 0-1V to 0-500V	5.20	5.54	6.06	6.69	4.75
Zero Center — 9 ranges: 5-0-5V to 500-0-500V	5.38	5.72	6.24	6.86	4.92
AC MILLIAMMETERS					
Zero Left — 6 ranges: 0-10mA to 0-500mA	4.86	5.26	5.66	6.29	4.40
AC AMMETERS — AVAILABLE ON SPECIAL ORDER					
AC VOLTMETERS (Multiplier resistor furnished externally above 15V)					
Zero Left — 8 ranges: 0-5V to 0-300V	5.09	5.43	6.01	6.40	4.63
VU METERS Supplied with either recording or broadcasting type scales, printed in black and red on white background. Designed to read zero VU (100%) with 1.23V applied to meter with the circuit supplied. DC Type are the same indicators, but the resistor/rectifier package is not supplied.					
AC TYPE — supplied with resistor/rectifier package					
Standard Sensitivity (1 mA basic)	7.20	7.61	8.06	8.58	6.81
High Sensitivity (200μA basic)	9.44	9.83	10.30	10.81	9.10
DC TYPE — resistor/rectifier package not supplied					
Standard Sensitivity (1 mA basic — 300 ohms)	6.63	5.90	6.35	6.86	5.15
High Sensitivity (200μA basic — 1140 ohms)	7.67	8.06	8.52	9.04	7.26

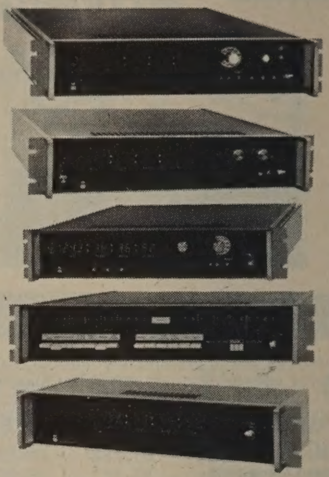
Bezel Mount — Available only on 1½", 2½", 3½" meters; added unit cost $2.40, before discount.
Surface Mount and Windo Mount styles with clear cover — deduct $0.35 from unit prices, before discount.

DISCOUNT SCHEDULE (per type): 1-9 list; 10-24 10%; 25-99 20%; 100-249 30%; 250-499 40%; 500+ inquire.

MODUTEC, INC. 18 Marshall St., Norwalk, CT 06854 (203) 853-3636 TWX: 710-468-2039

moxon INSTRUMENTATION

TIMING PRODUCTS NEW TIMING PRODUCTS ADVANCE STATE-OF-ART TECHNOLOGY



New generation timing products meet current demands and easily expand to interface with new computer requirements . . . and without permanent printed wire mother boards.

Applications include • indexing magnetic tape for data reduction • common reference for calculating velocity, frequency, etc. • sync. remote test sites to N.B.S. • precise time correlation for hospital intensive care • automatic event sequencing for industrial processing • computer time entry and automatic computer controlled data reduction.

MODEL 514 TIME CODE GENERATOR — Supplies all popular codes. Serial or parallel output, BCD or binary.

MODEL 520 TIME CODE TRANSLATOR — Accepts all standard and many non-standard time codes. Standard decoded outputs: serial, parallel and synchronization pulse rates.

MODEL 540 TIME CODE TRANSLATOR/GENERATOR — Provides translation and generation within the same chassis.

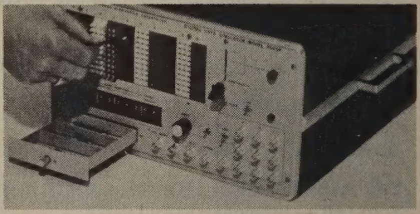
MODEL 524 TAPE SEARCH AND CONTROL UNIT — Interfaces Models 520 or 540 to any standard instrumentation tape recorder and provides output for search and playback.

MODEL 552 TIME CODE REMOTE DISPLAY — Converts parallel BCD for seven segment readout, anywhere in data line.

MODEL 562 TIMING TERMINAL UNIT — 21 channel plug-in unit expands to most popular amplifier and driver applications.

MODEL 544 TIME CODE TRANSLATOR/GENERATOR/TAPE SEARCH — Provides simultaneous translation, generation and search-to-start functions for highest performance at low cost.

DIGITAL GENERATORS WORLD'S LARGEST DIGITAL DATA GENERATOR SELECTION



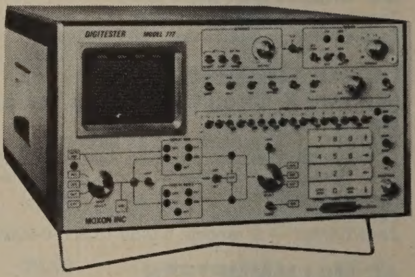
These precision, compact instruments utilize exclusive patented linear programming to provide the equivalent of up to 960 toggle switches . . . in a portable bench-top housing. All units have both serial and parallel outputs with data rates in excess of 10 MHz.

MODEL 912 — multiple serial words from 4 to 960 bits or 12 parallel outputs of 80 bits each.

MODEL 912CR — 960 bits • IBM card programming from front panel.

MODEL 916 — 480 bits serial or 16 parallel outputs of 30 bits each or 8 outputs with 60 bits or 2 outputs with 240 bits each.

DIGITAL GENERATOR/ANALYZER/COMPARATOR WORLD'S FIRST 3 IN 1 INSTRUMENT



The Digitester Model 777 is a new 1024 bit instrument offering more digital and/or micro-processor development and test capabilities than any single unit currently available.

A keyboard is used to generate and a CRT displays the bit pattern program, ready for edit or storage in an internal memory, or for transmission to the Device Under Test (DUT). The 777 receives and displays DUT bit patterns and compares the received pattern with the anticipated response.

Features of the Digitester include • generation/analysis/comparison of 1024 serial bits or 64 parallel words of 16 bits each at rates up to 20 MHz • simultaneous generate and receive • adjustable input thresholds/output levels • 1 bit inversion • program of start/stop • keyboard programming or edit • 4 internal memories • big jitter-free 5″ CRT display • internal crystal, variable or external clock • 16 bit serial or parallel combinatorial trigger (pre-/post trigger).

VIDEO CHARACTER GENERATORS COMPLETE GENERATE/EDIT SYSTEM FOR ANY TV APPLICATION

VIDEO TITLING GENERATOR
MODEL 74

This series of Video Character Generators produce 16 lines of 32 characters each in black or white for commercial broadcast or closed circuit TV applications.

Character messages may first be generated and displayed in a preview position prior to insertion into a program. Characters are easy-to-read 7 x 8 dot matrix, in place of conventional 5 x 7.

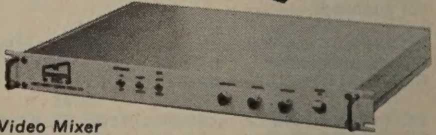
Message viewing modes are full page and 1-line or 2-lines, using a roll-up/roll-down feature that displays individual lines at locations on the screen selected by the cursor.

A second page of internal memory may also be programmed and displayed in all three modes: page, single or dual line.

The Model 74 consists of a generator and integrated keyboard, providing standard 64 character ASCII set.

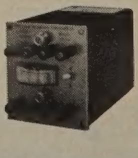
Generators also include character enhancement and selectable black or white characters.

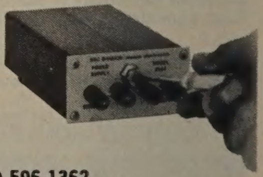
The units are supplied with all connectors required for connection to composite sync and video inputs which provide program, preview and sync outputs.



Model 557 Video Mixer

POWER SUPPLIES FINEST ISOLATED POWER SUPPLIES AVAILABLE IN WIDE RANGE OF OUTPUTS





To insure testing results that are precise, try one of the Mitey Mite Series Power Supplies that essentially eliminate noise, ripple and spikes . . . power supplies that provide battery quality DC . . . 0 to 30 volts with current to 0.5 amps. DC isolation: 10,000 megohms, AC isolation: less than 0.1 pF and ripple typically below 20 microvolts peak-to-peak.

MOXON INC. • 2222 Michelson Drive • Irvine, California 92715 • Phone (714) 833-2000 • TWX (910) 596-1362

moxon TRANSDUCERS & GAUGING SYSTEMS

VARIABLE RELUCTANCE TRANSDUCERS

A LEADING SUPPLIER OF PRECISION TRANSDUCERS SINCE 1938

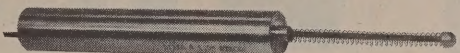
Moxon variable reluctance transducers offer several advantages, including direct measurement, friction free operation for long life, and low cost. In addition to the types listed below, Moxon manufactures special purpose transducers to meet specific customer applications along with compatible electronics.

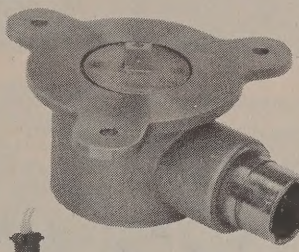
LINEAR POSITION — Offered in 3-wire, 4-wire and DC-DC types • displacement ranges 0.01 to 16 inches • linearity ± 0.1% to 1% full scale.

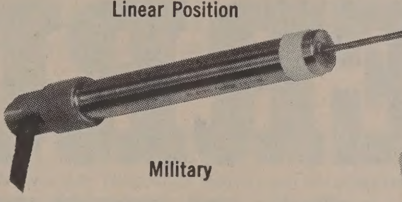
MILITARY — Linear displacement transducers, built to military specifications, meet or exceed performance parameters listed above.

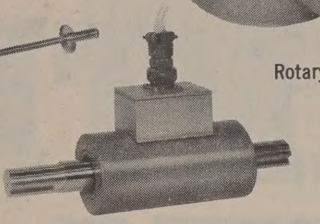
ROTARY — Offered in 3-wire or 4-wire types • displacement ranges 0 to ± 60° • linearity ± 0.5% typical.

TORQUE — Offers readout in both rotating directions • range 5 to 3,000 inch pounds • speeds to 6,000 RPM • optional RPM pick off • DC input/DC output.


Linear Position


Rotary


Military


Torque

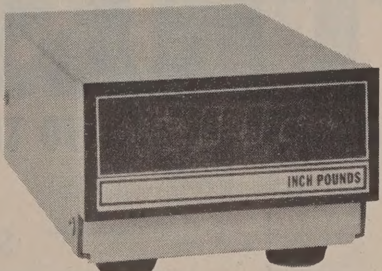
GAUGING SYSTEMS

PRECISE DIGITAL READOUT OF 1 TO 20 TRANSDUCERS

MICRO-MOX

A compact one-channel instrument that accepts a bipolar analog signal from any DC transducer and converts it into a precise digital readout. The easy-to-read 7-segment digital display has $\frac{1}{2}$" high characters on a black background. Meter options are 3½ or 4½ digits plus overflow with 10ms to 0.1% response time. Calibration and meter control access behind removable front meter bezel.

Integral power supply has 5 or 24VDC regulated output @ 40ma full scale • isolated serial BCD output data • polarity and print command • calibration in engineering units such as inches, grams, inch pounds, foot pounds, millimeters, etc.



MICRO COMPUTER GAUGING SYSTEM

REDUCES GAUGING TIME OVER 90%

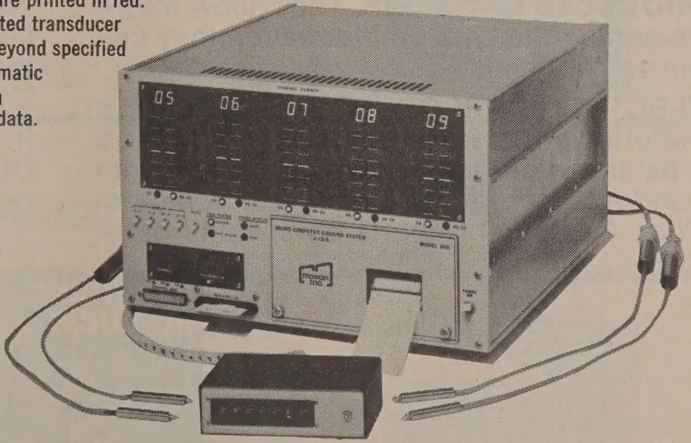
The Model 360 AUTO-MASTER is the first system of its kind. In one installation this system reduced calibration and inspection time from 6 hours to 20 minutes.

The system employs a built-in microprocessor that provides fast handling of 1 to 20 electro-mechanical transducer inputs. This allows up to 20 transducers to be positioned and automatically calibrated to measure any parameter that can be gauged by micrometer accurate linear transducers (see below).

Measurement readout is provided by vertical LED arrays and GO/NO-GO comparator indicators for each channel.

In addition, a printed record of all measurements is provided for subsequent diagnosis on command from a front panel pushbutton. The printout also includes day, time of day, work station identification and serial number of the unit under test. Readings not within limits are printed in red.

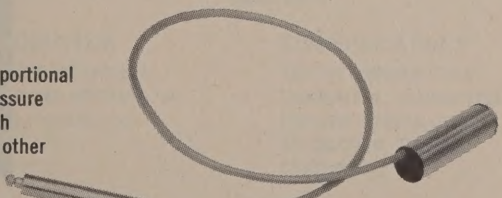
Disconnected transducer probes or those beyond specified limit initiate automatic system shut-down assuring reliable data.



GAUGING SYSTEM TRANSDUCERS

These precision transducers are of the linear DC-DC type. They employ separate but integral electronics so the smaller transducer housing, which fits standard gauging tool holders, can be more easily installed in confined spaces. Shielded electronics also reduces electrical interference.

Variable DC voltage output is proportional to mechanical deflection • a 2-ounce pressure produces full scale deflection of 0.05 inch • standard dome tip easily replaced with other A.G.D. gauging tips.



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First in Electronics through Innovation

SLIMLINES . . . the METERS that GROW

the BROADEST and MOST POWERFUL line of digital meters . . . IN THE WORLD

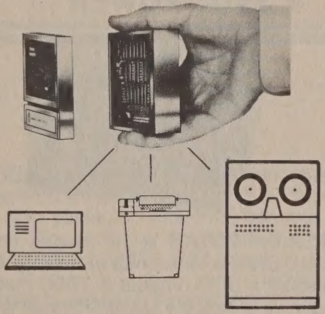
METERS . . . what an inadequate word to describe these compact workhorses! Most meters on the market are designed to be looked at. Slimlines work for a living.

They combine high-performance measurement circuitry with all of the control inputs and data outputs needed for fast, efficient systems interface. And their quality is backed up by an unheard-of 5-year warranty!

THERMOCOUPLE
THERMOMETER
+1825 F
NATIONWIDE ELECTRONIC SYSTEMS, INC.

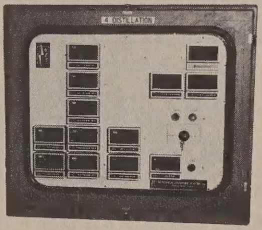
SOLVE MEASUREMENT PROBLEMS!

The widest selection of meters on the market, with a model to fit your need. **VOLTMETERS** from $76, **AMMETERS** from $185, **OHMMETERS** from $255, **WATTMETERS** from $416, **TRI-SCALE METERS** from $580, **CUSTOM METERS** with special scaling from $300, **TRANSDUCER READOUTS** from $88, **FREQUENCY METERS** and **TACHOMETERS** from $300, **CLOCKS** from $76, **CALENDARS** from $199, **STOPWATCHES** from $200, **RTD THERMOMETERS** from $380, **THERMISTOR THERMOMETERS** from $280, **THERMOCOUPLE THERMOMETERS** from $280, **COUNTERS** from $175, **TENSION & COMPRESSION METERS** from $560, **VACUUM & PRESSURE METERS** from $550, **REMOTE DISPLAYS** from $145, **POWER FACTOR METERS** from $415. NEW PRODUCTS: **PRODUCTION RATE METERS** from $240, **PRODUCTION YIELD** from $240, **WATT-HOUR METERS**, $600, **VARS METERS** from $500, **RELATIVE HUMIDITY METERS** from $455.



TRANSMIT & RECORD DATA!

A NES EXCLUSIVE! Plug-on **ASCII BUSTLES** (from $180) give Slimlines incredible power: connect 100 Slimlines to a single pair of wires . . . meters transmit readings in serial ASCII to teletypewriters or printers for logging, CRT terminals for real-time dislay, computers or microprocessors for on-line processing. Address meters at random or program for automatic self-scan. Build a complete system one step at a time. **RECEIVING BUSTLES** . . . control equipment from a teletypewriter. **BCD BUS BUSTLES** from $160: up to 100 Slimlines on a parallel BCD data bus . . . use with printers, microprocessors, minicomputers, etc. **ISOLATOR/DRIVER INTERFACES** (from $150): isolating buffers and interface to high-level logic.

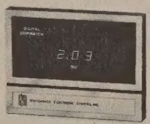


AUTOMATE!

Monitor the reading of **any Slimline** and control, alarm, or automate! **COMPARATOR/CONTROLLERS** (from $196) do it automatically, providing outputs for solid-state relays, indicators, motor controls, solenoid actuators, etc. **PRELOADERS** from $124 and **SCANNERS** from $175, too.

COMPLETE SYSTEMS!

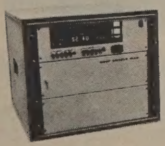
We will design and build instrumentation and control systems to solve specific problems . . . large or small, at reasonable cost. Call our applications engineering department.

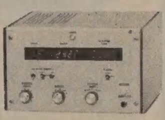


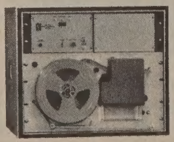
READ-ONLY MODELS = LOW COST!

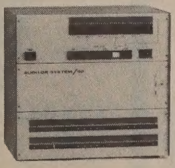
Same high quality, appearance, and **5-year warranty** as the other Slimlines . . . only the data outputs and control inputs have been left off to substantially lower the cost! **CLOCKS, VOLTMETERS, TRANSDUCER READOUTS, STOPWATCHES & COUNTERS** with more units due for release shortly!

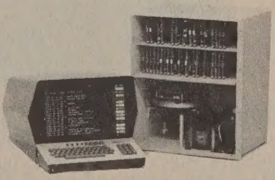
OTHER PRODUCTS FROM NES:











MEASUREMENT

METERS, CIRCUIT CARDS, and complete Systems for all types of Measurement Applications.

PROCESS CONTROL

AUTOMATIC TESTING, PROCESS ALARMS, BATCHING, SORTING . . . small & large Systems to fit any need.

DATA ACQUISITION

DATA LOGGERS, RECORDERS, and **CUSTOMIZED SYSTEMS**, for Transmitting, Printing, and storing Data.

COMMUNICATIONS

TRAFFIC LOGGERS, CODE CONVERTERS, TRANSMITTER LOGGERS, BROADCAST AUTOMATION, TELETYPE SYSTEMS, etc.

NATIONWIDE ELECTRONIC SYSTEMS, Inc.
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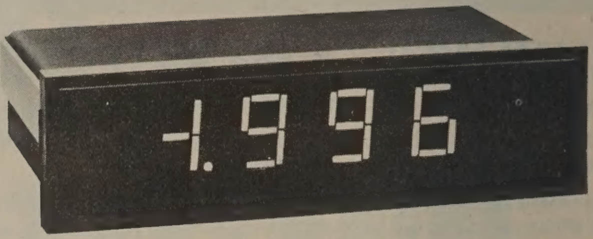
NEWPORT

VOLTAGE, CURRENT & RATIO DIGITAL PANEL METERS

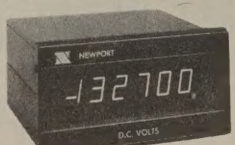
- DIFFERENTIAL INPUT
- 13mm (½ IN.) LED DISPLAY
- AUTOMATIC ZERO AND POLARITY
- DUAL SLOPE, AVERAGE VALUE
- 10μV RESOLUTION (OPTION)
- 60dB CMR DC TO 60Hz
- VOLTAGE AND RATIO MEASUREMENT
- BCD OUTPUTS (OPTION)
- DIN STANDARD CASES
  96mm(W) X 71mm(D) X 24 OR 48mm(H)
- LOW POWER CONSUMPTION (1 WATT)
- 5VDC POWER



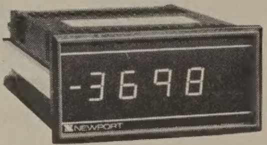
DIGITAL EDGEWISE METER

MODEL 213
2000 COUNTS
$65/100's

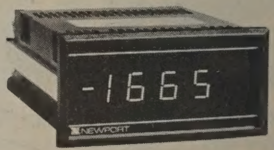
MODEL 216
6000 COUNTS
$71.50/100's



SERIES 200AS • 10 ranges voltage and current • Differential input • Beckman display • BCD outputs • 1000 megohm input impedance • Up to 60 readings per second • Optional extra zeros for weight applications (shown above) • From $159



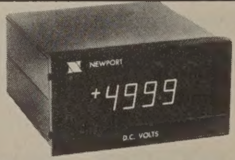
MODEL 204 • Monitors current or voltage transmitter loops • Displays in engineering units — watts, volts, amps, flow, pressure, volume, temperature, etc. • Replaces pointer-type meters • 3999 counts • 13mm LED display • From $145



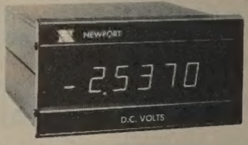
MODEL 203A • 3½ Digit • ½" LED display • Auto. zero and polarity • Dual slope, average value • 100μV resolution • 120dB CMR up to 500V • Voltage and ratio measurement • Parallel BCD outputs • Available in DIN or NEMA case • Orange LED display (option) • $69/100's

-16970
NEWPORT

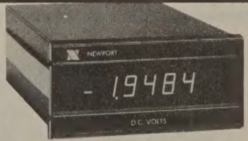
MODEL 2003A • 4½ Digit • 13mm (½") LED display • Automatic zero and polarity • Dual slope, average value • 10μV resolution • 120dB CMR up to 500V • Voltage and ratio measurement • Parallel BCD outputs • Available in DIN or NEMA case • Orange LED disp. (option) • $129/100's



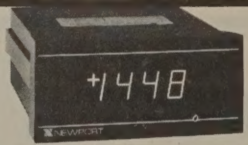
SERIES 400AS • Auto polarity, to ±4999 counts • DC voltage and current • Gated, buffered BCD outputs • 0.1% reading error • Up to 60 readings/second • Display blanking • Extruded aluminum case • Isolation of inputs from digital ground • Beckman display • From $189



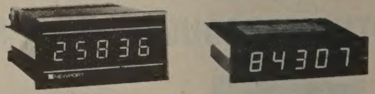
SERIES 2000AS • Voltage, current, ratio models • ±39,999 counts full scale • 20 readings per second • High accuracy, ±.01%R ±.005%FS • Isolated, gated and buffered BCD outputs • Beckman display • 300VCM between analog and digital • From $385



SERIES 2000BS • DC voltage, current and ratio models • To ±39,999 counts optional • Buffered, isolated, gated outputs • .02% reading error • Up to 30 readings/second • Differential input • Beckman display • From $280



MODEL 258 • Voltage, current, ratio models • 1999 counts • Beckman gas discharge display • AC powered • NEMA style case • Parallel BCD output standard • 100μV resolution • Automatic zero and polarity • From $137



MODEL 6152/6153 • Remote display • Displays up to 5 digits • Parallel BCD, Hexadecimal or octal inputs • Display blanking • Optional annunciator display • Integral AC supply or 5VDC powered • 13mm LED display • DIN standard case • From $72

NEWPORT LABORATORIES INC.
630 East Young Street
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TWX 910-595-1787

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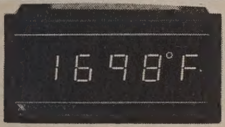
DIGITAL TEMPERATURE METERS NEWPORT

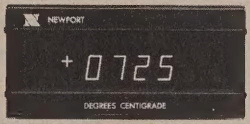
- BIPOLAR OPERATION
- J, K, T, E, B, R, S & W THERMOCOUPLE MODELS WITH 0.1° CONFORMITY AND 0.1° RESOLUTION
- OPEN THERMOCOUPLE INDICATION
- RTD MODEL WITH 0.01° RESOLUTION
- PRECALIBRATED PLUG-IN SENSOR MODULES
- DUAL SLOPE, AVERAGE VALUE
- 13mm (½ INCH) LED DISPLAY
- ORANGE LED DISPLAY (OPTION)
- PARALLEL BCD OUTPUT STANDARD
- AUTOMATIC ZERO & POLARITY
- DIN CASE WITH SCREW TERMINAL INPUTS
- 350V ANALOG TO DIGITAL ISOLATION
- DIGITAL SET POINT ALARM (OPTION)
- 0-1V LINEARIZED ANALOG OUTPUT (OPTION)
- BENCH STYLE METAL CASE (OPTION)

2 5 5 7°C
NEWPORT

MODEL 267A
7800 Counts
From $250



SERIES 268 • 1° resolution for TC's, 0.1° resolution for RTD's • DIN standard case • Overall error .3% typical • Types J, K, T, & E TC's and 100Ω RTD • 2000 counts • Line powered or 5VDC powered for battery operation • Newport Polylog linearizer • Open TC indication • From $165



SERIES 260 • Linearization conformity to 0.8°C, for J, K, T, S, R & E TC's • Linearization conformity to 0.1°C, for RTD's • Digital linearization • Models from −310° to +3100°F and 0°K to 400°K • Parallel BCD outputs • Beckman display • From $385

NEWPORT
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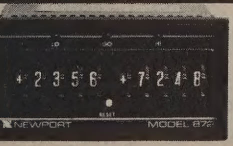
ERROR
DEGREES CENTIGRADE

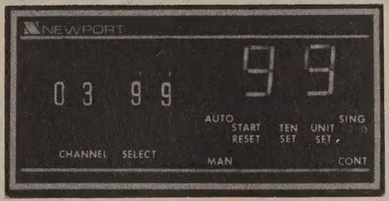
SERIES 2600 • 0.1° resolution; conformity to 0.2°C; for J, K, T, E, W TC's and 100 ohm platinum resistance sensors • Digital linearization • Models from −365°F to +4120°F • Displays in degrees, F, C or K • Auto zero • Isolated, gated BCD outputs • From $750

SYSTEM COMPONENTS

MODEL 810 • Digital printer • 9 columns, std.; expandable to 18 • Small size 4½" H. X 8½" W. • Programmable two-color printing • Reliable rotating drum printer • Fixed or floating decimal point • Uses standard adding machine paper • Last line visible without advancing paper • From $495



SERIES 870 • Dual or single limit comparators • Capacity to ±39999 • Hi, Lo, Go lamps on dual comparator • DIN case, 96mm W. X 48mm H. X 130mm D. • Relay output • Compares parallel BCD or binary input data with numbers preset on front panel thumbwheel switches • From $115



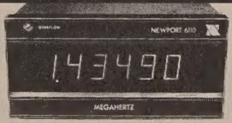
LOW LEVEL SCANNERS

MODEL 850 • Controller for up to 100 channels • Thumbwheel selection of first and last point • Manual, single, and continuous scan modes • Adjustable scan rate up to 10 ch./sec. • 13mm (½ in.) LED ch. I.D. • DIN case (96 W. X 48 H. X 130 D.) mm • From $235

MODEL 851 • 10 channel 2 pole Reed relay card • Low thermal EMF for TC signals • Low pass filter per channel • From $125

MODEL 852 • Low pass filter per channel • 10 channel reed relay card for switching 3-wire RTD's • High level switching up to 200 volts • From $250

TIME & EVENT METERS



MODEL 6110, 6130 • Direct readout of RPM, frequency, time interval, period, period average, totalize and ratio • High noise immunity • Optically-coupled, isolated input with anti-contact bounce circuit • High input sensitivity • Buffered and gated BCD outputs • Beckman or 13mm (½ in.) LED display • From $210

POWER FAIL
RESET
RUN
SET
12.28.28
HRS
MIN
SEC

MODEL 6700S • 12, 24 or 100 hour display • 100 day display optional • Selectable timing pulses • Front panel preset/reset • Power-line time base • Power failure indicator • Crystal time base, optional • Beckman display • From $275

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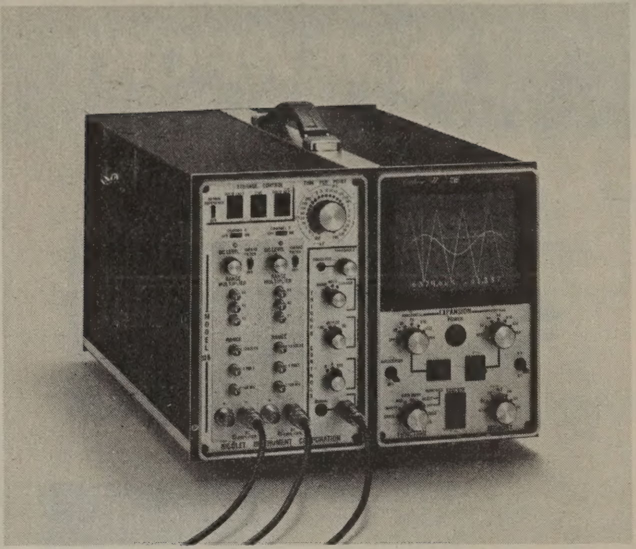
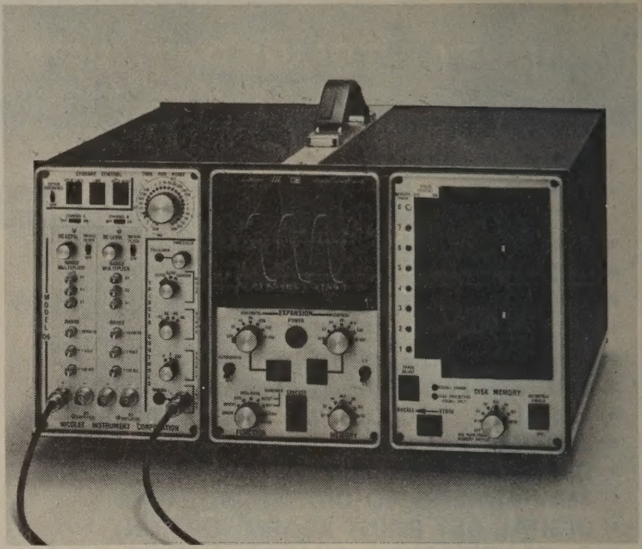
Phone 6103-63041 TELEX 841417908



EXPLORER II

For visual observation of waveforms, just as analog oscilloscopes are used. Has order-of-magnitude better accuracy, resolution, and waveform storage. 1 mHz or 10 mHz bandwidth.



EXPLORER III

For visual observations of waveforms, but with internal high capacity additional memory for permanent records. Includes digital I/O for calculator and computer interfacing.

New! General Purpose Oscilloscopes

For low frequency high precision measurements, there is no other general purpose oscilloscope which even approaches the performance, efficiency, and ease of operation of Explorers II and III.

These two new digital oscilloscopes are designed for use in exactly the same applications as analog oscilloscopes, both storage and non-storage. They're equally useful in more advanced applications, too.

What do they do that's better?

- Resolution 0.025% vs 0.4%. Accuracy 0.2% vs 2%.
- Storage at the touch of a button. No adjustments.
- Superimposition of stored and live waveforms.
- Numerical voltage and time values shown for any selected point.
- Easy zoom-in scale magnification, up to x64.
- Non-fading stored waveforms.
- Pre-trigger information, as well as the usual post-trigger information, may be viewed.
- And a great deal more.

Explorer III has a superb additional feature, a built-in magnetic disk recorder which can hold up to 32 waveforms for later recall or for permanent filing. Two seconds to record, two to recall. Recordings may be one at a time, under manual control, or automatically in sequence as the signals occur. Or, one long 32 k point record may be made of slower signals. To make an equivalent recording using a chart recorder, of comparable resolution, would involve a roll of paper 2 meters wide, and 320 meters long.

Explorer III also has digital I/O, for interfacing to the HP9825 calculator, and IEE (HPIB) standard buss.

NIC
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INSTRUMENT
CORPORATION
5225 Verona Road Madison, Wisconsin 53711 Telephone: 608/271-3333

Mainframe Specifications (EXPLORER II & III)

Memory:	4096 12 bit words. All 4096 words can be used for one waveform, or two 2048 point waveforms can be stored, or four 1024 point waveforms.
Variable Persistence:	Each waveform is shown, as it occurs. The trace remains until the next signal is received, however long the interval. Depressing one of the two "hold" buttons causes either the last or next signal to be held until the "live" pushbutton is depressed.
Out of Sight Storage:	One or more waveforms can be placed in memory out of sight, for later recall, while the oscilloscope is in use for other purposes in the meantime.
Superimposition of Waveforms:	Two or more stored waveforms can be viewed superimposed for comparison. A stored and live waveform may also be superimposed, or two live waveforms. Zoom-in scale magnification may be used to observe very small difference in all three cases. (Up to x64 magnification.)
Display:	Either YT or XY display may be used.
Numerics:	These show true time and voltage for any selected point, with respect to zero or with respect to any other selected point.
Autocenter:	When in use, expanded displays are automatically centered vertically, and the numbers shown indicate the voltage and time corresponding to screen center.
Pen Recorder Output:	Microprocessor controlled pen recorder drive voltages cause external XY recorders to plot waveform information with constant speed per motion along the waveform, rather than constant horizontal pen speed, for much faster recordings.
Waveform Subtraction:	Two stored waveforms may be subtracted, to produce the difference waveform.
Status Storage:	The oscilloscope operating control settings are recorded with the waveform information to insure that waveforms recalled later will indicate true time and voltages independent of intervening control setting changes.
Power:	85 watts, 115 v ±10% or 230 v± 10%, 48-60 Hz. Specify voltage when ordering.

Weight:	(Explorer II) 32 lbs. Explorer III) 42 lbs.
Size:	(Explorer II) Bench top cabinet 18" long x 11-1/2" wide x 8-3/4" high. (Explorer III) Rack mount cabinet 18" long x 17" wide x 8-3/4" high (not including rack mount ears.)

Explorer III Additional Spec's (mainframe)

Disk Recorder:	Capacity 32 k 12 bit bytes Recording time 2 seconds Recall time 2 seconds Manual or automatic recording sequence Eight individually protectable tracks Disks removable for filing
I/O Buss:	IEEE (HPIB) or 12 line binary.
Interchangeability	Explorer II may be converted at the factory to an Explorer III, at any time within 2 years of purchase.

Plug-in Unit Descriptions

Model 206-1 and 206-2 are one and two channel plug-ins which have 12 bit ADC's. These contain buffer memories which allow observation of pre-trigger signal information. Bandwidths are 1 mHz, with signal measurement rate of 2 mHz (for both signal channels in the case of Model 206-2).

CMRR is 1000:1 dc to 10 kHz, or better, over a range at least 10 times the amplifier signal range selected (up to ±200 v max.) Sample and hold aperture time is ±5 ns or less. Sweep timing is accurate to 0.01%, with sweep start time error of ±25 ns.

These are the most versatile of the 1 mHz plug-on units.

Model 205 is a single input plug-in the same as Model 206-1 except that it contains no buffer memory for observation of pre-trigger signal information.

Model 204-1 and 204-2 are 10 mHz bandwidth plug-ins, one and two channel which have 8 bit ADCs. Sensitivity ranges are ±1 volt to ±200 volts. They include buffer memories for observing pre-trigger information. Sweep speed ranges 50 ns per data point to 20 seconds per point. Amplifiers are single input rather than differential.

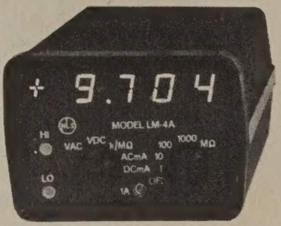
Model 201-1 an1 201-2 will be available in September, 1977. These are low bandwidth (1 kHz), high sensitivity units for measuring slowly changing variables. They have high input impedance, drift stabilized dc amplifiers with 10 μv maximum sensitivity (±20 millivolts full scale, with 0.025% resolution and essentially no dc drift with time and temperature). Excellent for low level transducer signal measurements with sweep durations of up to days in length.

SPANKING NEW VOLKSMETERS!

Now with an internal current measuring function and those astounding new Rollaball switches.

All fitted into the same small case and at the usual low prices.

To add an internal current measuring function (up to 1 ampere) to its line of miniature digital multimeters, NLS developed new miniature Rollaball rotary switches. Rollaball switches are of an unbelievably simple design which makes them extremely wear-free and they exhibit outstanding electrical characteristics. Check the specifications and prices below and then compare prices, performance and the variety of NLS' Digital Multimeters to any DMMs anywhere. Volksmeters have more capability and perform better at lower prices.



NLS' Silver Jubilee Products!

MODEL	RANGES	DC ACCURACY	RESOLUTION	DIGITS	PRICE
LM-3A	VDC, VAC, DCmA & ACmA - 1, 10, 100 & 1000. *100% over-range - 1000 VDC or VRMS AC & 1 A max. OHMS - 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ & 10 MΩ	±1% Rdg	1 mV	3	$125
LM-3.5A*		±0.5% Rdg	1 mV	3-1/2	$147
LM-40A		±0.1% Rdg	100 µV	4	$190
LM-4A		±0.03% Rdg	100 µV	4	$227

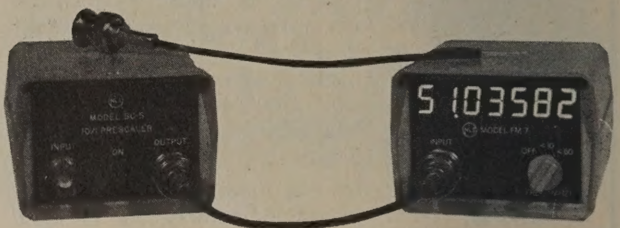
Size: 1.9" H x 2.7" W x 4.0" D   Rechargeable Batteries & Charger Unit Included.

FANTASTIC PERFORMANCE!

FM-7 & SC-5 Frequency Meters measure up to 60 MHz for $195; up to 512 MHz for $89 more. Examine the other great features!

NLS' Silver Jubilee Year

SC-5   FM-7



With Rechargeable Batteries & Charger Unit. **$89**   With Rechargeable Batteries & Charger Unit **$195**

Features Include:

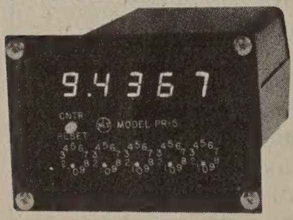
- By using the new NLS SC-5 Prescaler, the range of the FM-7 Frequency Meter, which is 10 Hz to 60 MHz, may be extended to 512 MHz (the upper VHF & UHF frequency bands). ● The FM-7 utilizes an LED readout, providing 7-digit resolution. ● The FM-7 can be calibrated to an accuracy of 0.00001%. ● The SC-5 is accurate to one part per million. ● Each unit has 30 millivolts sensitivity, is battery powered and has a charger unit included. ● Dimensions of each are 1.9" H x 2.7" W x 3.9" D. ● The units may be obtained separately or as a "Frequency Duo."

LOOK AGAIN!!

NLS' Counter specs are amazing and the prices will please you.

NLS' Silver Jubilee Year

PR-5 PRESET COUNTER

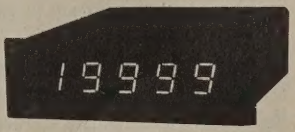


Unit Quantity—$149

Features Include:

- Five-digit LED display of count plus 5-digit preset. ● Counts at 500 kHz pulse and 300 Hz contact closure. ● Small: 2.25" H x 3.25" W x 4.0" D; fits in the palm of your hand. ● Permits multiple presets. ● Optional battery pack for standby operation. ● Solid-state LSI circuitry with high noise immunity.

PC-4 EVENT COUNTER



Unit Quantity—$54.50

Features Include:

- Counts to 19999 events @ up to 200 kHz. ● Programmable decimal. ● TTL or switch input. ● Electronic reset. ● Display inhibit/dimming and lamp test. ● Leading zero suppression capability. ● Multiplexed BCD output. ● Multiple units may be cascaded. ● Large 0.3" LED display. ● Small size: 1" H x 2.5" W x 3.25" D. ● Operates from +5 vdc supply; using less than 0.75 watts. ● Optional 115 vac operation.

TAKE YOUR PICK!!

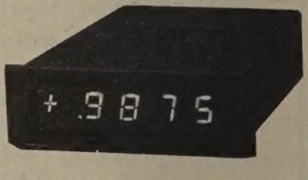
NLS' DPMs fill every need and the prices are pleasing.

NLS' Silver Jubilee Year

PM SERIES   DC OR AC VOLTS

Features Include:

- Operates from a +5V separate power supply. ● Overload indication. ● Auto zeroing. ● Low power consumption. ● Programmable decimal. ● Protected input. ● Smallest package available anywhere - 1" H x 2.5" W x 3.25" D. ● MOS/LSI construction. ● Large 0.3" LED display. ● Volts dc models have range change capability.



PM-4 PANEL METER

Prices below are for OEM Quantity - 100

MODEL	RANGES	ACCURACY	AUTO POLARITY	MUX BCD OUTPUT	DIGITS	PRICE
PM-3	VDC 1V, 10V, 100V, or 1000V (PM-3.5 has 100% over-range - 1200V maximum)	±0.1% F.S.	No	Optional	3	$ 66.00
PM-3/OL		±0.1% F.S.	Standard	Optional	3	$ 70.00
PM-3.5		±0.05% F.S.	Standard	Standard	3-1/2	$ 78.20
PM-4		±0.02% F.S.	Standard	Optional	4	$115.60
PM-3.5AC	VAC - 2V, 20V, 200V or 1000V	±0.5% F.S.	N/A	Standard	3-1/2	$105.20

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Originator of the digital voltmeter.
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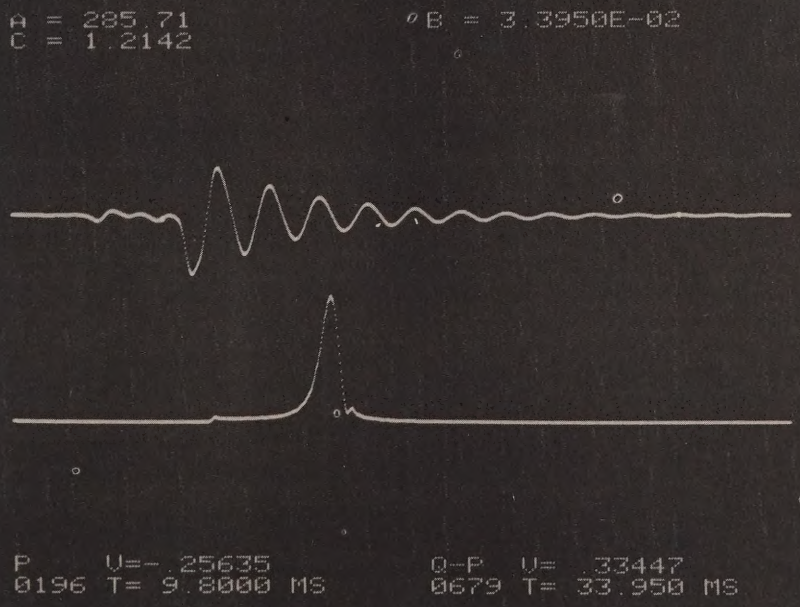
Distributor inquiries invited.

Time and Frequency Domain Analysis



NORLAND INSTRUMENTS — Fort Atkinson, Wisconsin 53538 — (414) 563-8456

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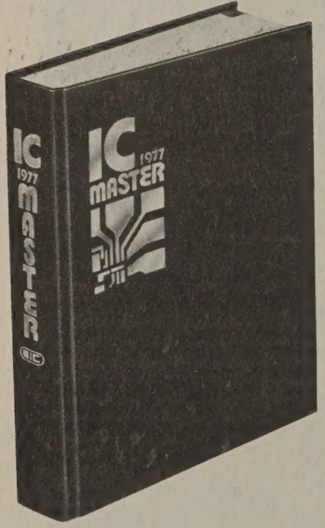

The new IC MASTER is the ultimate IC source book.

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- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
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- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

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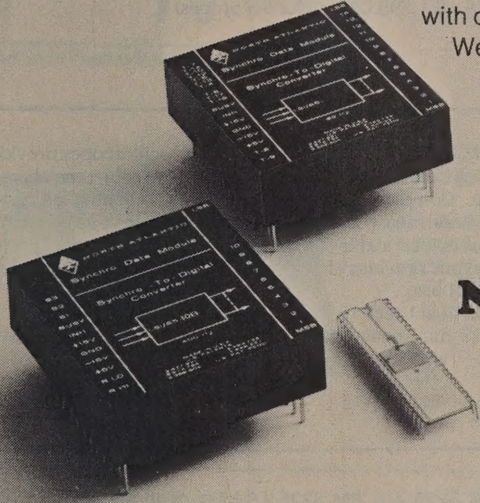

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LAZY EIGHT AMBIGUITY INDICATOR
Programmable for Synchro or Resolver and Line-Line Voltage
2 channel

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IEEE Interface (optional) for ATE

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AC ratiometer capability
Autoranging and reference AGC
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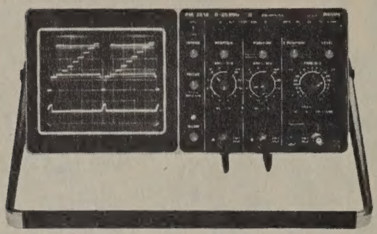
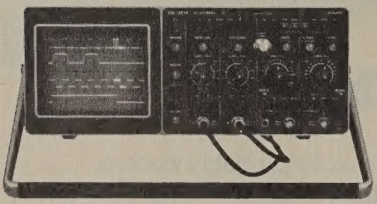


PM 3212 25 MHz Portable Dual Trace Oscilloscope

- **Comprehensive triggering**
- **25 MHz at 2 mV**
- **Double insulation**
- **8 x 10 cm bright 10 kV display**

The Philips PM 3212 is the most versatile instrument in its price range available. Its size, weight and complete functional capability make it an ideal scope for field or lab use. Triggering includes AC, DC, TV, Auto on both channels, and even composite. A 550 KHz chopping rate allows HF signal viewing with no interference. Add mode with Channel B inversion provides A-B capability, with triggering possible on the differential signals.

PM 3212 - $ 1155.00 (including probes)

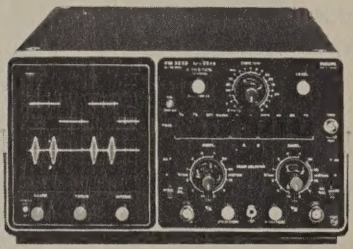


PM 3214 25 MHz Dual Trace Osilloscope with Delayed Time Base

- **Complete triggering on both time bases**
- **25 MHz at 2 mV**
- **Double insulation**
- **8 x 10 cm sharp 10 kV display**
- **Alternate time base display**
- **Battery option (internal)**

The PM 3214 with its complete triggering facilities and delayed time base is the ideal digital service oscilloscope. Alternate time base display allows full viewing of the main time base with intensified zone and complete delayed time base expansion simultaneously for both channels. "User-oriented" front panel design allows quick and efficient measurements to be made without error. Completely separate delayed time base controls allow use of full capability without confusion.

PM 3214 - $ 1,395.00* including probes)



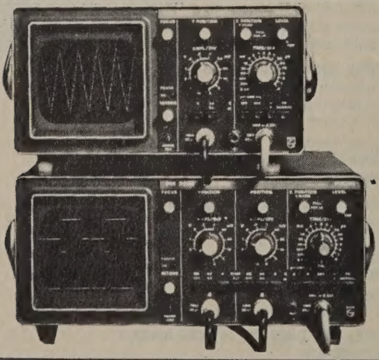
PM 3232 and PM 3233 Dual Beam 10 MHz Oscilloscopes

- **Dual beam operation — no alternate or chopped displays**
- **10 kV 8 x 10 cm display**
- **10 MHz at 2 mV**
- **Comprehensive triggering facilities**

The PM 3232 and PM 3233 dual beam oscilloscopes provide measuring capability with no phase errors as in time shared displays. Complete triggering capability including an auto mode where trigger is derived from peak to peak value of the signal, provides stable displays of all measurements. Front panel layout provides efficient operation, ideal for laboratory and school use.

PM 3232 dual beam 10 MHz oscilloscope - $ 1,015.00

PM 3233 dual beam 10 MHz oscilloscope with delay lines with delay lines - $ 1,085.00



PM 3225 and PM 3226 Single and Dual Trace Oscilloscopes

- **15 MHz at 2 mV**
- **Lightweight, compact portable**
- **Complete triggering facilities**

The PM 3225 and PM 3226 15 MHz oscilloscopes are truly lightweight portables which are designed for use in servicing, production and education. Automatic triggering provides, stable displays under almost any signal conditions. A minimum of controlled use, a maximum of functional capability that is efficient to use due to the functional front panel design. Sturdy, rugged construction leads to reliability under the most demanding conditions.

PM 3225 - 15 MHz single trace oscilloscope - **$545.00**
PM 3226 - dual trace 15 MHz oscilloscope - **$695.00**
PM 3226P - dual trace with A-B capability — **$850.00**

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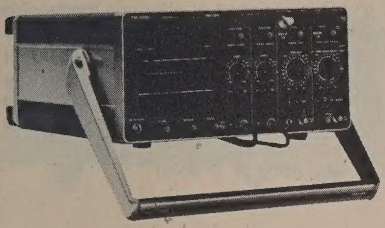
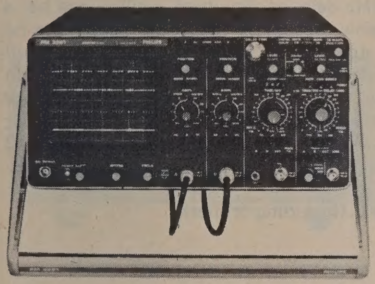


PM 3260E Dual Trace 120 MHz Oscilloscope

- Lightweight portable
- Separate delayed time base
- Complete triggering facilities

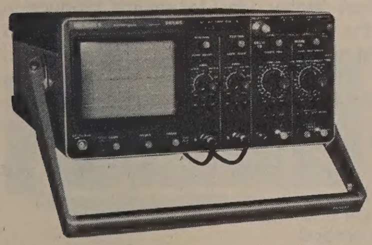
The PM 3260E is a dual trace, 120 MHz portable oscilloscope with delayed time base at 5 mV per cm. At 18.5 lbs. the PM 3260E has a switching regulated supply which will accepted voltage inputs of 100 - 250 V AC (40 - 440 Hz) or DC. Complete triggering facilities for main and delayed time bases. X-Y operation via A or B channels or Inversion of both channels and Add mode for A ± B operation. 20 kV, 8 x 10 cm. CRT for bright displays at low rep rates. Cold switching controls provide logical front panel layout wih separate delayed time base section.
PM 3260E - $ 2,145.00 (including probes)



PM 3261 120 MHz Portable Oscilloscope for Digital Testing

- Digital delay mode
- Special TTL trigger circuits

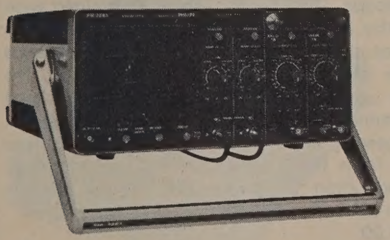
Same basic specs as PM 3260E with the addition of a digital delay counter that can be preset from 1 to 99,999 to start the delayed time base. Delayed time base can be set to start at any preset Nth after main base starts. Trigger selection includes TTL threshold window to insure positive triggering on TTL transitions and not on spurious pulses or noise. The oscilloscope provides a TTL pulse output simultaneous with the delayed timebase. This output can be used along with main time base trigger to measure time from start to end pulse.
PM 3261 - $ 2, 795.00 (including probes)



PM 3265E 150 MHz Portable Oscilloscope

- Alternate time base display
- Cold switching controls
- 2.3 nS risetime

The PM 3265E is a dual trace 150 MHz portable oscilloscope with separate delayed time base control section. Alternate time base display capability allows viewing of time base with intensified zone and full screen delayed time base of both channels simultaneously. "User-oriented" front panel design, enabled by cold switching technique, provides a most efficient use of the instrument. Switching regulated supply provides power input capability from 100 - 250 V AC (40 440 Hz) or DC at total of 45 watts.
PM 3265E - $ 2,895.00 (including probes)



PM 3265 150 MHz Multiplier Oscilloscope

- 150 MHz dual trace
- 100 MHz multiplier (A X B)
- Alternate time base display

The PM 3265 is a 150 MHz dual trace oscilloscope with delayed time base and also features a 100 MHz multiplication capability, Real time power can be displayed for circuit and device analysis. A X B output provided for average instrument with cold switched controls and logical front panel layout. Alternate time base display allows main and delayed time base to be presented simultaneously for both channels. B Channel display is provided in addition to A X B display for reference.
PM 3265 - $ 3,595.00 (including probes)

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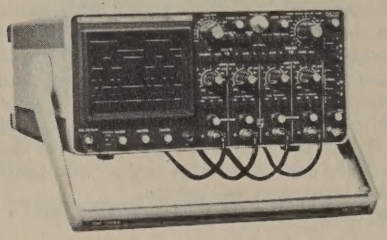
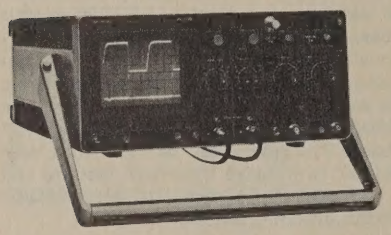


PM 3244 4 Trace Portable Oscilloscope

- 50 MHz, delayed time base
- Complete triggering facilities
- Up to 6 traces with A + B and C + D

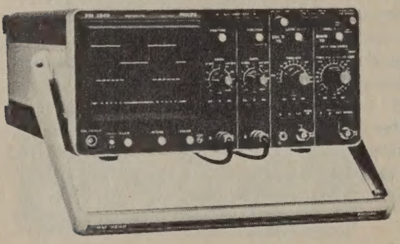
The PM 3244 is a 50 MHz 4 trace portable scope with delayed time base at 5 mV per cm. Displays any combination of channels A, B, C and D in chopped or alternate mode with A ± B and C ± D possibilities. X deflection possible using any selected channel or external input for X —Ya, Yb, Yc, Yd display. Complete triggering facilities including composite trigger, with AC or DC coupling. 8 x 10 cm 10 kV CRT. Cold switching allows all the controls necessary for a 4 trace scope in a portable instrument.
PM 3244 - $ 2,895.00 (including 4 probes)



PM 3243 50 MHz Multiplier/Storage Oscilloscope

- A X B capability to 40 MHz
- Variable persistence and complete storage
- Delayed time base

The PM 3243 50 MHz delayed time base oscilloscope has a 40 MHZ multiplication capability. Real time power can be displayed as well as stored in the variable persistence and full storage mode. A fully comprehensive storage scope with delayed time base and complete triggering facilities makes for a versatile laboratory and field instrument. A X B output provided for additional laboratory measurements. PM 3243 has all the features of the other Philips high frequency portables.
PM 3243 - $ 3,895.00 (including probes)

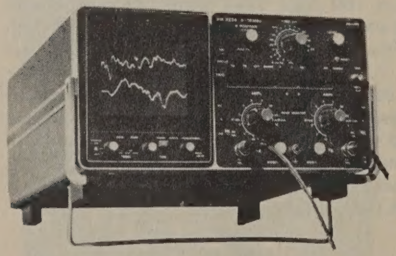


PM 3240, PM 3240X 50 MHz Portable Oscilloscope and TV version

- Seperate delayed time base control section
- 18.5 lbs./ 23 watts
- Complete triggering facilities
- TV line and frame sync

PM 3240 is an ultra lightweight dual time base instrument with a bright 8 x 10 cm display. Ideal for service, production and laboratory use, the PM 3240 has all the features needed for analog and digital measurements. A bright CRT coupled with an efficient front panel design, incorporating comprehensive triggering and display controls make the PM 3240 an ideal field service portable. For television applications, the PM 3240 includes odd/even frame selection as well as line frame synchronization and line/sync and delayed time base.

PM 3240 - 50 MHz dual trace oscilloscope - $ 1,725.00 (including probes)
PM 3240X 50 MHz dual trace TV oscilloscope - $ 1,895.00 (including probes)



PM 3234 10 MHz Dual Beam Storage Scope

- Dual beam operation
- Variable persistence and full storage
- Bright displays with 8.5 kV CRT
- Complete triggering including one shot
- 10 MHz at 2 mV

The PM 3234 is a dual beam operation storage and variable persistence oscilloscope. Dual beam display, combined with the storage facilities, insures true displays and recording including single shot phenomena. Use of variable persistence allows the storage of multiple traces for comparison. No chopping and no alternate display provides total signal storage of both channels even with fast one shot signals. AC, DC and Auto triggering are provided, with Auto position triggering derived from the incoming signal peak to peak value. 24V DC operation is possible as well as AC line voltages, Maximum writing speed is 1 div/mS.
PM 3234 - $ 2,495.00

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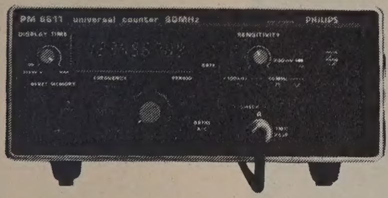
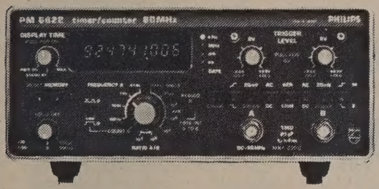


PM 6610 Universal counters

- 5 models to choose from
- Measure frequency, period, ratio, totalize and time interval
- Comprehensive triggering
- Bright, 9-digit gas discharge display

The PM 6610 series is a family of universal frequency counters designed to fulfill a broad range of measurement applications. The PM 6611 provides for frequency, ratio, period average, and totalizing measurements up to 80 MHz and the PM 6612 also permits time interval measurements. The PM 6613, PM 6614 and PM 6615 extend the range of frequency measurements to 250, 520 and 1000 MHz, resp. Options available include internal rechargeable battery pack, digital or analog outputs, rack mounting and either of four time base oscillators.

PM 6611- 80 MHz - $ 750. PM 6612 - 80 MHz - $ 790.
PM 6613 - 250 MHz - $ 875 PM 6614 - 520 MHz - $ 975.
PM 6615 - 1000 MHz - $ 1,175.00



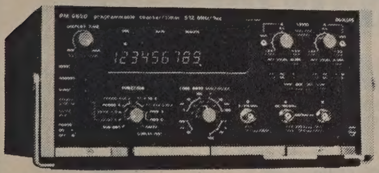
PM 6620 Series Universal Timer/Counters

- Comprehensive Time and Frequency Measurements
- Two 80 MHz Channels with Complete Triggering Controls
- Models Available with Trigger Hold-Off, 520 or 1000 MHz Frequency Range

The PM 6620 series comprises three compact instruments offering time and frequency measurement capabilities. All models provide for measuring (single shot and averaging), time interval, period, frequency, ratio and pulse counting. Two identical 80 MHz input channels are equipped with comprehensive triggering controls and monitoring facilities. The PM 6622 also includes a trigger hold-off control which permits masking unwanted stop pulses such as those generated by contact bounce or ringing. The PM 6624 and PM 6625 extend the range of frequency measurements to 520 or 1,000 MHz respectively.

All of the options available for the PM 6610 series above are also compatible with the PM 6620 series.

PM 6622 - 80 MHz - $ 965. PM 6625 - 1000 MHz - $ 1,565.
PM 6624 - 520 MHz - $ 1,365.



PM 6650 Programmable Timer/Counter

- Complete Time and Frequency Measurement System
- 10 nS Single Shot T.I. Resolution
- Direct Counting to 520 MHz
- GPIB Option
- 1 and 12.6 GHz Sub-Units Available

The PM 6650 is a complete time and frequency measurement system for the lab or systems use. The instrument's basic architecture includes a 100 MHz clock; a 512 MHz RF channel with 62 dB dynamic range; two very fast (1 nS), equalized 160 MHz channels with comprehensive triggering facilities; and a nine-digit gas discharge display. This architecture provides for: frequency measurements to 512 Mhz with 1 Hz resolution in 1 sec.; single shot T.I. measurments with 10 nS resolution; average T.I. measurments with 1 pS resolution; and accurate monitoring of trigger levels for easy pulse parameter measurements. The PM 6650 is available with a plug-in IEEE Bus module which provides for complete control of all instrument functions including trigger level adjustments.

PM 6650B - $ 3,855.00

PM 6664 AUTOMATIC 520MHz COUNTER
PHILIPS
474.499.11
808560.13

PM 6661 80 MHz, PM 6664 520 MHz Automatic Frequency Counters

- Fully Automatic Frequency Measurements
- Automatic PIN Diode Attenuator with 50:1 Range
- 8—digit LED display with leading zero blanking and grouped digits for easy reading.
- Compact, rugged steel housing.
- 98% AM Tolerance

These compact instruments have been designed to provide accurate, easy to read frequency measurements with an absolute minimum of operation attention. Fully automatic operation has been achieved by replacing the usual sensitivity control or attenuator switch by a high effective automatic Pin diode attenuator.

Both models provide 1 Hz resolution up to 80 MHz and the PM 6661 provides 10 Hz resolution between 10 and 520 MHz.

The PM 6661 time base ageing rate is 2 ppm/yr. and temperature stability is 15 ppm, 0 - 50° C. The PM 6664 ageing rate is 0.1 ppm/month and temperature stability is 1ppm, 0 - 50° C.

PM 6661 - 80 MHz - $295.00 PM 6664 - 520 MHz - $ 675.

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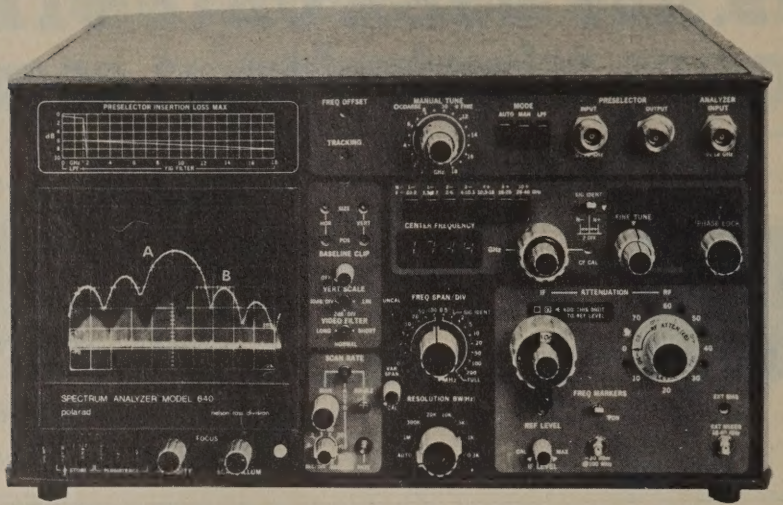
PRESELECTOR INSERTION LOSS MAX
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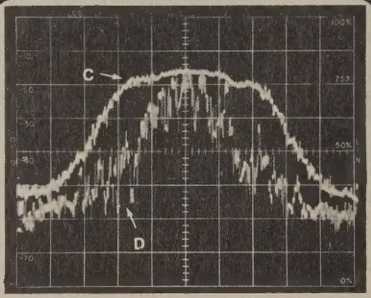
MANUAL TUNE
MODE
PRESELECTOR
ANALYZER INPUT
TRACKING
CENTER FREQUENCY
BASELINE CLIP
VERT SCALE
VIDEO FILTER
FREQ SPAN/DIV
ATTENUATION
SCAN RATE
RESOLUTION BW(Hz)
FREQ MARKERS
RF LEVEL
A
B
SPECTRUM ANALYZER MODEL 640
polarad
FOCUS

MODEL 640 includes preselector and memory. Display: Split Memory Comparison. "A" is stored reference pulsed spectrum (Peak mode). "B" is incoming pulsed spectrum. Frequency and level differences are easily measured.


100%
75%
50%
0%
C
D

SPLIT MEMORY. Comparison of maximum vs. instantaneous levels of FM broadcast. 20kHz/Div Span. 10 dB/Div, "C" is stored max. level vs. frequency. "D" is incoming level, using flicker-free updated memory mode.

Digital Memory & I/O Interface... New Dimensions in RF/Microwave Spectrum Analyzers

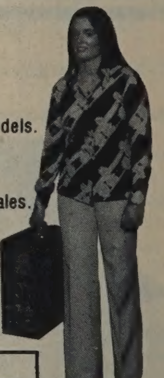
COMPACT N-R 600 SERIES 100 kHz-40 GHz WITH DIGITAL MEMORY

- **Eliminate annoying flicker— even when highly selective, slow scans are used.**
- **Provide precise on-screen comparisons; dual display of stored and incoming signals.**
- **Plot maximum signal level vs. frequency for any desired time interval.**
- **Have memory I/O interface for remote storage and recall of standard displays.**
- **Also used for signal processing; "talker" and "listener" functions. Adaptable to IEEE 488 Bus.**

New N-R 600 Series Summary		**U.S.A. Prices**	
Model		**Without Memory**	**Including Memory**
632	100 kHz to 2 GHz	$ 5,975	$ 7,075
630	10 MHz to 40 GHz, 7 Bands	$ 7,750	$ 8,850
640	630 plus Internal Preselector	$10,150	$11,250
631	10 MHz to 40 GHz, 6 Bands	$ 7,100	$ 8,200
641	631 plus Internal Preselector	$ 9,500	$10,600

N-R 600 SERIES provide the absolute calibrated analysis features needed for today's stringent applications, at very affordable prices. Select among 5 easy-to-use models. Digital Memory (Option 1) is only one of the N-R 600 SERIES' outstanding design features. Some others include:

- LED frequency readout. Absolute level calibrations.
- Calibrated 0-2 GHz frequency spans.
- Resolution: 300Hz (phase-locked) to 1 MHz BW, auto-tracked or selectable.
- −115 dBm sensitivity, Model 632. To −110 dBm, other Models. Sensitivity conservatively rated @ S+N=2N, 1kHz BW.
- Internal tracked preselector (Models 640 & 641).
- 70 dB Log Scale (10 dB/Div.). Also 2 dB/Div and Linear Scales.
- Parallax-free internal CRT graticule. Scale illumination. Std. camera mount.
- Interface for Tracking Generator (Option 2).
- Compact, portable, all solid-state construction. Models 630, 631 & 632 are 7" high; approx. 40 lbs.



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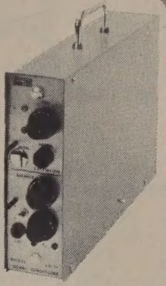
PPM, INC.



SIGNAL CONDITIONERS

THE SG-11 IS A PLUG-IN MODULE with power supply, balance calibration and monitoring circuits. The power supply circuit offers high temperature and time stability, providing line and load regulation of 0.01%; excitation voltage is adjustable from 0 to 16 volts at 0 to 150 mA. Featured is a self-restoring current limit circuit. All units may be wired for constant-current operation.

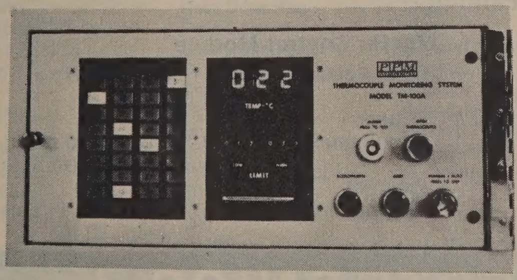
THE SG-11 has very high isolation to line—under 0.03 pF coupling capacitance from power line to DC output—SG-11 performance approximates battery operation.

All controls are 10 turn potentiometers of very high resolution. Calibration is bipolar single shunt.

Two types of enclosures are available: A 19" relay rack that permits the mounting of eight units side-by-side and a portable enclosure accepting a single plug-in unit. A plug-in power supply is also available.

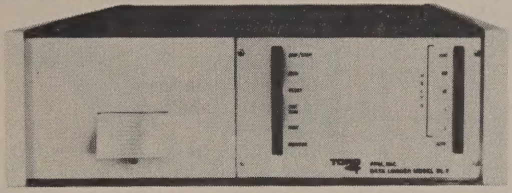
MODEL SG-11 PLUG-IN UNIT (eight shown in rack)	**$187.50**
PORTABLE ENCLOSURE (MODEL SG-11-P as shown)	**$ 39.50**
RELAY-RACK MOUNTING ENCLOSURE (MODEL SG-11-R as shown) with solder terminals only	**$129.00**
RELAY-RACK MOUNTING ENCLOSURE (MODEL SG-11-RC as shown) with MS connectors (mating connectors included)	**$395.00**

THE MODEL SG-16 series (not illustrated) provides lowest-cost strain-gage conditioning. A 20 channel system with common power supply occupies only 5¼ inches of vertical panel space at a total cost of $75 per channel. Amplifier options range from $10 per channel for 10ma galvo drive amplifiers to $100 per channel for low-drift differential amplifiers. Write for Bulletin SG-16.



THERMOCOUPLE MONITOR

THE TM 100A SCANS UP TO 100 THERMOCOUPLES, displaying temperature in digital form. A high-low limit circuit compares temperature with preset thumbwheel switches; a lamp matrix displays all out-of-limit channels. Interface provides for auxiliary printout or computer entry of data.

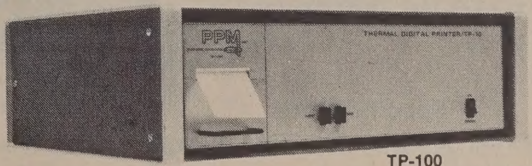


DATA LOGGER

THE MODEL DL-2 IS A COMPLETE DATA ACQUISITION SYSTEM in a compact, portable package. It scans up to 100 differential signals, digitizes them and a thermal printer records their values. Options include floating decimals, internal digital clock, conditioning for thermocouple or strain-gage transducers and punched paper or magnetic tape recording.

Input signals include DC voltage, resistance and frequency. Write for Bulletin DL-2.

Data Logger with 10 Channels	**$2320.00**
Data Logger with 100 Channels	**$3220.00**



TP-100

SILENT THERMAL PRINTER

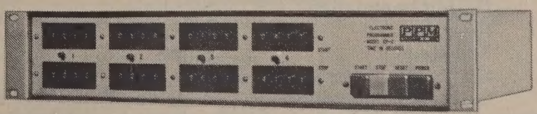
THE TP-100 IS A SILENT, ALPHA-NUMERIC THERMAL PRINTER. It prints up to 20 columns at speeds to 5 lines/second from BCD or ASCII inputs.

This high-performance instrument is simple and compact, with only one moving part. Quiet and reliable operation, long life as well as low cost, result from the use of a simple mechanism whose only function is to advance paper.

A choice of input interface options is available, as well as an internal digital clock or voltmeter. The Model TP-100M is available for O.E.M. applications; it is a plug-in unit with all electronics, but less cabinet and power supply.

Model TP-100, 12 columns, as shown. Unit price.	**$595.00**
Model TP-100M, 12 columns. 100 each.	**200.00**

Write for Bulletin TP-100, or call collect today.



DIGITAL TIMERS-PROGRAMMERS

The EP series of solid-state digital electronic programmers provide relay or solid-state switch operation at digitally-preset start and stop times. Each channel operates independently of all others. Units available from 1 to 1000 channels, with timing from microseconds to hours.

Write for Bulletin EP.

Bulletin PE-2-7

Prices subject to change without notice.

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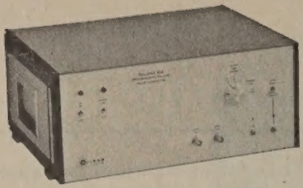


PULSPAK 10A Precision High Voltage Pulse Generator

1 nS Command Jitter • Trigger Input: 2-10 volts

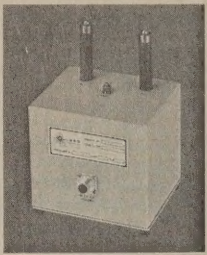
Pulse Output: 10 kV

$2,250

Key Performance Specifications

Output pulse		
	Peak volts	+ 10 kV
	Peak Current	200 Amps
	Output Impedance	50 Ohms
	Risetime (10-90%)	< 10 nS
	Fall-time	150 nS
	Throughput Delay	70 nS or less
	Internal Repetition Rates	1, 5, 10 Hz

External power requirements
115 VAC, 60 Hz at 3 Amps
External dimensions/weight
17" wide, 7" tall and 13" deep, 35 lbs.



TX-40 Pulse Transformer

$330

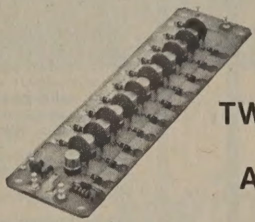
Transform 10 kV to 40 kV

Specifications

(TX-40 driven by PULSPAK 10A)

Input	10 kV, 50 ohms
Output	40 kV, 2000 ohms
Output pulse risetime	30 nS

External dimensions/weight
6" wide, 8¾" tall and 5" deep, 12 lbs.



TWM-1000N Pulse Amplifier

$235

Less than 1 nS Command Jitter
Compact • Versatile

Specifications

Input trigger 1-10 volts
Output pulse (standard is negative)

	50 Ohm Load	1000 Ohm Load
Peak voltage	~ 400 V	~ 1000 V
Risetime	~ 10 nS	~ 5 nS
Decay time	~ 60 nS	~ 1 μS

Supply voltage + 125 VDC, 1.5 mA

SW-50K High Precision Switch

±1 nS Jitter • Compact

$182
(Quantity Discounts Available)

Specifications

Operating range: 10 kV to 50 kV

Jitter: ± 1 nS (when used with PULSPAK 10A)

Lifetime: 10 k shots at 250 millicoulomb/shot and peak current of 50 kA

Gas: Synthetic air (Hydrocarbon free dry air)

Trigger: Pulse risetime<50 nS at 50% charge voltage

Switch Inductance: Depends on circuit application; typically in 100 to 200 nH range

ANVIL L SYSTEM Electrical Isolation in a Precision Pulse Generator

$3,020 - $10,800
(1-8 channels)

Fiber Optic Coupled • 1 nS Risetime into 50 Ohms

Key Performance Specifications

Remote Output Pulser (ANVIL-160)

Peak volts	+ 140 to + 220 V., unit-to-unit variation
Peak current	3.2 Amps
Output impedance	50 ohms
Risetime	≲ 2 nS
Fall-time	55 nS
Single shot jitter	± 0.25 nS
External Dimensions	4" wide, 3" tall and 6" deep

Master Control Module

Input Power	115 VAC, 60 Hz at 2 Amps
Trigger Requirements	2-10 volts, > 40 nS wide pulse, 50 ohms
External dimensions/weight	17" wide, 7" tall and 13" deep, 20 lbs.

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Our inventory. It's the biggest in the industry, with over 8,000 items of electronic test equipment in stock and ready to go. And it's getting better all the time, because we add more state-of-the-art equipment every month. This means we can deliver one special instrument . . . or a dozen . . . within hours of the time you place your order.

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And renting helps your financial strength, too. Since you pay only for the time you have your instruments, you'll never have to spend your money on idle equipment.

And renting from REI makes even more sense . . . because we're better equipped to fill your needs than any other rental company.

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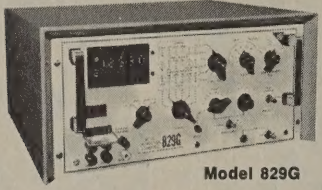
AC / DC Voltage, Current and Power Standard


Model 829G

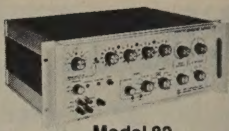
Model 829G	Measure & Deliver
Full-scale ranges	AC/DC Volts 0.01 — 1400 V AC/DC Current 10 $_\mu$A-14A Ohms 0.1-10 meg.
Accuracies of reading	±0.05% DC ±0.08% AC ±0.06%Ohms
AC Frequencies	50, 60, 400, 1000 Hz

Model 5058A

Model 5058A Wattmeter Calibration Module for use with two Model 829G's. For calibration of wattmeters ranging from 0.05 watt to 14,000 watts.

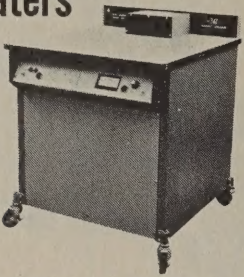
Precision Standard

for AC/DC Voltage and Current


Model 82

Tests a wide range of analog and digital meters. AC and Bipolar DC voltage ranges of 100mV, 1V and 10V. AC and Bipolar DC current ranges of 100uA, 1mA, 10mA and 100mA. Nominal accuracies of 0.01% DC and 0.05% AC. Percent error deviation dial. Frequency variable from 40Hz to 1kHz. Four fractional scale division ranges.

Magnet Chargers and Treaters



Model 747

High energy magnet charger covers full range of charging applications, from the lowest to the highest coercive forces, in all configurations. Available in five separate energy-storage capacity levels from 2,000 to 10,000 watt-seconds.

Model 107A

Saturates most medium size and instrument magnets, including core types, using variety of fixtures. Two output ranges: Maximum 18-watt-seconds. Booster unit also available.

Model 1500

Produces 225 watt-seconds for large Alnico meter magnets plus cobalt platinum and barium ferrite materials. Wirewound fixtures plug into front panel through safety interlocks.

Model 2470-350

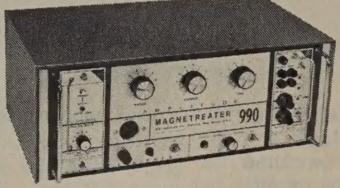
Variable output voltage with energies up to 440 watt-seconds for saturating up to 4 lbs. of Alnico V using wire-wound fixture. Bench or rack mounting available. Accessory Booster available for doubling output.

Model 2470-700R

With variable voltage outputs and energies up to 880 watt-seconds. Will saturate Alnico V up to 5½ pounds, as well as many core-type indicating meters completely assembled and encased. Rack mounting only.

Model 942

Saturate Alnico magnets to 34 lbs. and high coercive force barium ferrite compounds of any shape or number of poles. Outputs to 3,600 watt-seconds. Safety interlocked.



Magnetreater® Model 990

Completely solid-state demagnetizer for stabilization of permanent magnets. Power continuously variable from less than 1 VA to in excess of 80,000 VA. Resolution 0.1%. Can be programmed for automatic or semiautomatic operation.

Magnetreater®/Charger Model 580

Combination Magnet Charger and Magnetreater capable of charging and stabilizing permanent magnet materials and assemblies. Completely solid-state, providing high reliability. Energy storage for the charging mode is 105 watt-seconds; Magnetreater mode is 54 watt-seconds. Can be combined with RFL Gaussmeter for automatic or semiautomatic operation.

Gaussmeters

Model 505

Model 505, a low cost unit ranging from 5 gauss to 50 kilogauss in 7 full-scale ranges. Measures permanent magnet, DC and AC fields to 20 kHz. Built in probe calibration and zero center mode for determining polarity. Accuracy: ±3%.

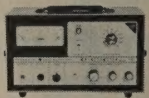
Model 750A, sensitive wide-range device for analog measurement of 0.10 gauss to 50 kilogauss in 18 full-scale ranges. Measures permanent magnetic fields, DC and AC, to 400Hz. Polarity sensitive, self-calibrating. Nominal accuracy ±1%.

Model 750D, sensitive high-range device for digital measurement of 10 gauss to 100 kilogauss in five full-scale ranges. Measures permanent magnetic fields, DC and AC, to 400 Hz. 3½-digit panel meter. Polarity sensitive. Self-calibrating. Nominal accuracy ±0.2%.

Probes — Are InAs elements for temperature stability. Choice of flat, axial or tangential in various sizes to fit most gaps. Flat ranges from .015" thick x .080" wide x .309" long.

Reference Magnets — Traceable to NBS with 50 gauss to 20K gauss fields and gaps from .040" to .343" are standards for probe calibration.

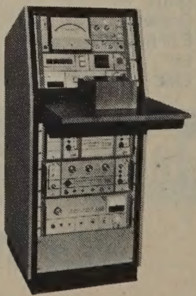
Magnetometer



Model 101

Solid state low level magnetic flux density measurements from 1 gamma to 100,000 gamma (1 oersted). Temperature compensation is provided to enable virtual drift-free operation.

Automagnetic® Systems



A combination of RFL standard magnetizing, measuring and demagnetizing equipment permits interconnection for semi-automatic and completely automatic systems designed for individual requirements. Processing includes TWT, BAR and C shaped magnets, DC meters, Torque motors, accelerometers and other designs embodying permanent magnets.

Crystal Impedance Meters

Model	Module	Frequency Range	Impedance Range
5950	254	2.5 kHz - 4 MHz	10 ohms - 400 K ohms
5950	460	4 MHz - 60 MHz	2 - 75 ohms
1207	n/a	60 - 200 MHz	10 - 125 ohms

Model 5950-254/460 replaces discontinued RFL Models 459B, 531 and 541C.

Reference standards for measuring resonance and anti-resonance of quartz crystals in determination of capacitance, inductance and performance index. Meet U.S. MIL-C-3098E/Amd. 1 and U.K. Defense DEF-5271 A.

New Model 5950 completely solid-state CIM measures semi-automatically. Consists of a main-frame and two interchangeable RF modules covering a frequency range of 2.5kHz to 60MHz.

RFL *RFL Industries, Inc.*

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These state-of-the-art designs all employ some form of *direct* synthesis . . . widely acknowledged to be the most advanced technique in frequency synthesis. By eliminating all of the limitations of the phase-locked-loop technique, Rockland synthesizer designs offer greatly superior performance at very reasonable prices. The newest Rockland synthesizer, the Model 5600, is remarkable in that it provides the superiority of direct synthesis at a price significantly *lower* than phase-locked designs in the same frequency range.

NEW! Model 5600 Programmable Frequency Synthesizer

- Direct Digital Synthesis — No Heterodyning or Phase-Locking
- 0.1 to 160MHz — without Multipliers
- Constant 1Hz Resolution throughout range
- High-Speed Switching — 20μsec
- High Spectral Purity: —70dB Spurious, —35dB Harmonic
- Low Phase Noise: —70dB typical
- Remote-Digital and Front-Panel Programming
- Excellent Temperature Stability: ±1 x 10^{-8}/°C (or ±1 x 10^{-6}/°C optionally) from 0°C to 50°C . . . or use external reference.

Models 5100 and 5110 Frequency Synthesizers

- Direct Digital Synthesis — No Heterodyning, no Phase-Locking
- DC — 2MHz Range. To 3MHz (Option 13)
- 0.001Hz Resolution over entire range
- High Spectral Purity: —70dB Spurious, —55dB Harmonic
- Low Phase Noise: —50dB
- High-Speed Switching: 1.5μsec Programming Delay, 625nsec Update
- No Switching Transients
- Excellent Temperature Stability: ±1 x 10^{-8}/°C (or ±1 x 10^{-6}/°C optionally) from 0°C to 50°C . . . or use external reference.
- Remote and Local Frequency and Amplitude Programming (Model 5110 remote only -- for OEM Systems)

System 51 Programmable Multichannel Frequency Synthesizer System

- Direct Digital Synthesis — No Heterodyning or Phase-Locking
- DC to 3MHz Range — Constant 1Hz Resolution throughout range
- Up to 48 Channels
- Very Fast Switching: 2μsec Programming Delay, 1μsec Update
- Sine and Squarewave Outputs
- No Switching Transients — Amplitude and Phase Continuity Maintained
- High Spectral Purity: —50dB Spurious, —40dB Harmonic
- Low Phase Noise: —50dB
- Excellent Temperature Stability: ±1 x 10^{-6}/°C, from 0°C to 50°C
- Manual/Automatic Programming

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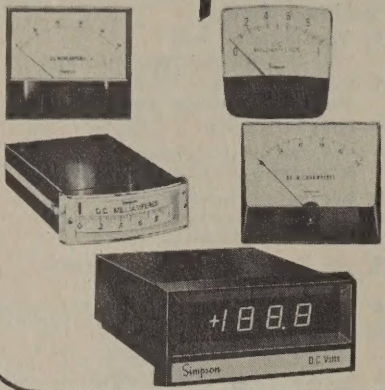
PANEL METERS

If it's a meter — stock or special — analog, digital, Ana-Led® or meter relay, Simpson makes it



STANDARD ANALOG PANEL METERS Industry's Widest Source

Century Series, modern styling in 1½, 2½, 3½ and 4½″ sizes, wide choice of ranges. **Wide-Vue®**, popular style, in 1½, 2½, 3½, 4½ and 8″ sizes, many stock ranges to select from. **Edgewise meters** save precious panel space, available in barrel and stackable models with vertical or horizontal scales, in all standard ranges plus specials. Other panel meter types also available include Bold-Vue®, Designer series, round and rectangular, metal cased. 250° long scale meters provide double the length of standard scales. The famous Simpson self-shielded meter movement provides calibration that is not affected by stray magnetic fields or magnetic mounting. A wide variety of stock DC, AC, RF, DB, wattmeters, percent load, elapsed time, frequency, and segmental ranges are available through worldwide electronics distributors.

DIGITAL PANEL METERS

Highly reliable 3½ digit instruments utilize state-of-the-art LSI circuitry and provide 0.1% of reading accuracy. Designed to fit 1.682″ x 3.622″ cutouts. Adapters are available for other popular domestic and IEC/DIN cutout sizes. Automatic zero and polarity indication. Choice of 120/240 V AC, 50-400 Hz or 5 V DC operation. Input/output edge connector is included.

Low Cost Series 2860 DPM has 0.43″ LED readout.

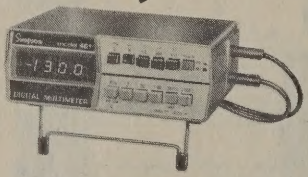
Available in 9 stock DC ranges **$69.00**

Deluxe Series 2850 DPM. Choice of 0.43″ LED or 0.55″ planar gas discharge display. BCD output for computer or recorder interfacing.

Available in 9 stock DC ranges plus specials including AC ranges **$138.00**

Simpson®

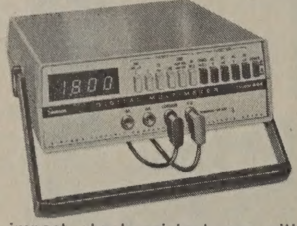
DIGITAL MULTIMETERS



NEW MODEL 461 — DIGITAL MULTIMETER

Compact 2″ x 5.6″ x 4.6″ instrument weighs only 1 lb. 3 oz. 3½ digit, 0.33″ LED readout. ±0.5% accuracy on all DC V ranges. High impact, shock-resistant case with tilt-view adjustable handle. 26 ranges, pushbutton selection: 5 AC and 5 DC current ranges to 2 amps, 6 resistance ranges to 20 M, 5 AC voltage ranges to 600 V, 5 DC voltage ranges to 1000 V. Conforms to ANSI C39.5 requirements. With nickel-cadmium batteries and recharger/adapter.

Model 461, for 120 V AC (50-400 Hz) line and battery operation. Catalog No. 12136	**$130.00**
Model 461, for 230 V AC (50-400 Hz) line and battery operation. Catalog No. 12137	**$130.00**
40 KV High Voltage Probe, Catalog No. 00749	**$36.75**
Carrying Case, Catalog No. 00747	**$19.50**
RF Probe, Catalog No. 00748	**$26.25**
Model 153 AC Amp-Clamp Adapter, Catalog No. 12138	**$29.50**



MODEL 464 PRICE/ PERFORMANCE BREAKTHROUGH

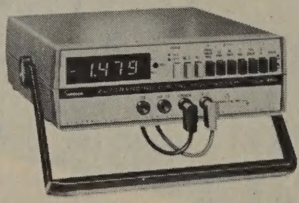
For field or factory, production line, lab or R & D testing and for general electronic/electrical servicing. 3½ digit, 0.43″ LED readout ±0.1% accuracy on DC ranges. High impact, shock-resistant case with tilt-view, adjustable handle. 28 ranges, pushbutton selection: 6 AC and 6 DC current ranges to 10 amps, 6 resistance ranges to 20 MΩ, 5 AC voltages to 600 V, 5 DC voltages to 1000 V. Conforms to ANSI C39.5 requirements.

464A for AC line operation.

For 120 V. Catalog No. 12583	**$210.00**
For 220 V. Catalog No. 12597	**$210.00**
For 240 V. Catalog No. 12595	**$210.00**

464D for AC line or rechargeable battery operation. Batteries not incl.

For 120 V. Catalog No. 12584	**$247.00**
For 220 V. Catalog No. 12598	**$247.00**
For 240 V. Catalog No. 12596	**$247.00**



MODEL 465 AUTORANGING DMM

Automatically selects and displays the proper measuring range. Has bright 3½ digit 0.43″ LED readout. Custom MOS/LSI circuitry provides high 0.1% DC V accuracy. Measures DC voltage to 1000 volts, AC voltage to 600 volts, resistance to 20 megohms, plus low-power ohms ranges, AC/DC current to 10 amps. High-impact shock-resistant case with tilt-view adjustable handle.

465A for AC line operation.

For 120 V. Catalog No. 12561	**$295.00**
For 220 V. Catalog No. 12562	**$295.00**
For 240 V. Catalog No. 12563	**$295.00**

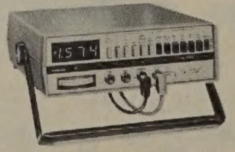
465D for AC line or rechargeable battery operation. Batteries not incl.

For 120 V. Catalog No. 12564	**$332.00**
For 220 V. Catalog No. 12565	**$332.00**
For 240 V. Catalog No. 12566	**$332.00**

MODEL 360-2 DIGITAL VOLT-OHM-MILLIAMMETER

Choice of nickel-cadmium rechargeable battery operation or AC line operation. Large bright 3½ digit 0.43″ LED readout, plus calibrated zero center analog meter for nulling, peaking, scanning trends. Exclusive MOS/LSI circuitry provides compactness with high reliability and low power dissipation. 29 ranges: 7 AC and 7 DC current ranges to 10 amps, 5 DC voltage ranges to 1000 V, 5 AC voltage ranges to 600 V, 6 resistance ranges including 2 low ohms ranges.

360-2, line and battery operation, 120 V AC (50-400 Hz), Catalog No. 12286	**$257.00**
360-2, line and battery operation, 220 V AC (50-400 Hz), Catalog No. 12287	**$257.00**
Carrying Case, Catalog No. 00816	**$26.25**



460-3 DIGITAL MULTIMETER

32 ranges with separate low-power ohms ranges for most measurement application. 3½ digit 0.54″ LED readout. Custom MOS/LSI circuitry gives 0.1% DC V accuracy. Calibrated auxiliary analog display. Measures AC/DC current to 10 amps, AC voltage to 600 V, DC voltage to 1000 V, resistance to 20 megohms. High impact case with tilt-view adjustable handle.

460-3A. for AC line operation.

For 120 V. Catalog No. 12541	**$285.00**
For 220 V. Catalog No. 12546	**$285.00**
For 240 V. Catalog No. 12542	**$285.00**

460-3D for AC line or rechargeable bat. operation. Batteries not incl.

For 120 V. Catalog No. 12543	**$322.00**
For 220 V. Catalog No. 12545	**$322.00**
For 240 V. Catalog No. 12544	**$322.00**

ACCESSORIES FOR 464, 465, 460-3, 360-2

High Voltage Probe, Catalog No. 00432	**$36.75**
Carrying Case, (not for 360-2), Catalog No. 01617	**$26.25**
RF Probe, Catalog No. 00433	**$26.25**
Model 154, AC Amp-Clamp Adapter, Catalog No. 12222	**$29.50**

Simpson® 260 FAMILY OF VOMS

260-6® VOLT-OHM-MILLIAMMETER

Fast, accurate measurements of 27 popular ranges. Direct dial reading of Amp-Clamp ranges. Rugged taut band movement, varistor protected. External access battery and fuse compartment. Multi-purpose test leads with combination probe and alligator clips. Two batteries supplied — 9 V (NEDA 1604) and 1.5 V "D" size (NEDA 13F). Complete with batteries, test leads and manual, Catalog No. 12167 ...... $79.50

260-6P. Circuit overload protected. Reset pushbutton releases when overload exists. Will not reset until overload is eliminated. With batteries, test leads and manual, Catalog No. 12171 .... $119.00

260-6M, with Mirror Scale, Catalog No. 12168 .... $82.50

260-6RT, in Roll Top Case, Catalog No. 12169 .... $89.50

260-6MRT, with Mirror Scale and in Roll Top Case, Catalog No. 12170 .... $92.50

260-6PM, Protected with Mirror Scale, Catalog No. 12175 .... $122.00

260-6PRT, Protected in Roll Top Case, Catalog No. 12172 .... $129.00

Low-Power Ohms Probe, Catalog No. 00735 .... $32.50

Vinyl Ever-Redy Case, Catalog No. 00805 .... $22.65

260-6XL VOLT-OHM-MILLIAMMETER

For the special needs of solid-state electronics. 33 ranges with extra voltage, current, resistance and low-power ohms functions. Extra shock and drop resistant construction. High impact, custom-molded panel and case. Extra large viewing area with color-keyed scales. Plus, all the features of the 260 Series 6. Complete with batteries, test leads and manual, Catalog No. 12177 .... $93.00

260-6XLM, with Mirror Scale, Catalog No. 12186 .... $96.00

260-6XLP Circuit overload protected — same as 260-6XL. With batteries, test leads and manual, Catalog No. 12176 .... $128.00

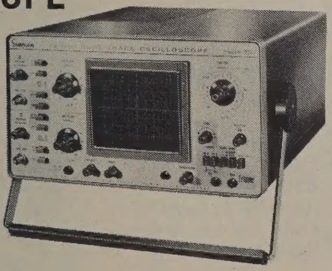
260-6XLPM, Protected with Mirror Scale, Catalog No. 12187 .... $131.00

30 KV Probe, Catalog No. 00509 .... $24.30

Vinyl Ever-Redy Case, Catalog No. 00805 .... $22.65

Simpson® MODEL 452

DUAL TRACE TRIGGERED SWEEP SCOPE



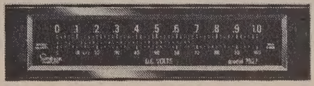
For design, development and service of digital circuitry, communications, audio, TV. Uses reliable integrated circuitry and solid state components. Differential vertical amplifier stages provide DC to 15 MHz bandwidth with smooth rolloff to beyond 27 MHz. Triggering is internal and external with 3 TV sync positions (TVV, TVH, VITS). Trace automatically shifts from Chop to Alternate as you change sweep times. Also 24 nsec rise time, front panel X-Y displays CHA, CHB, A&B, A+B or A−B. 0.5 V P-P 1 KHz square wave calibrator. Voltage calibrated 11-step vertical and horizontal inputs, X5 magnification.

Model 452, for 120 V AC, Catalog No. 12513 .... $635.00

Model 452, for 220-240 V AC, Catalog No. 12515 .... $635.00

Low-Cap. 10-1 Probe, Catalog No. 07548 .... $18.40

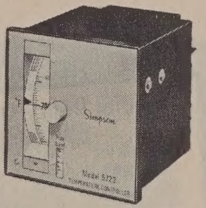
Simpson® ANA-LED

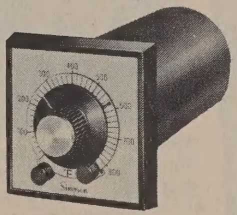


MODEL 7527 SOLID-STATE PANEL METER/CONTROLLER

The best of analog and digital techniques for unique advantages. Choice of "bar" or dot display, through or front panel mounting. Instant response, no moving parts. Extreme resistance to shock and vibration. 5" direct-reading horizontal linear LED scale. Vertical scale available. No pointers, no blinking digits. 15 msec max. response, no overshoot. Set-point modules for on/off limit control and output devices available.

Many variations available $130.05





CONTROLLERS • RECORDERS

Model 5850 Solid State, Non-Indicating Controller provides precision control of voltage, current or temperature. Single or double set-points. Rugged sealed, all metal housing. Solid state circuitry with 10-amp relay output. Wide selection of ranges.

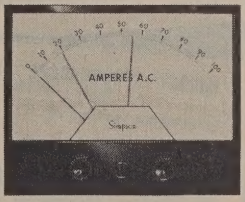
Single Set-Point Models $96.00

Double Set-Point Models $165.00

Model 3623XA Edgewise Controllers. 3½" size, single or double setpoint with removable knobs. Wide variety of ranges. **Model 3323XA Rugged Seal Controllers.** 3½, 4½ and 4 x 6" sizes. Variety of ranges.

Model 2750 Miniature Strip Chart Recorders. Panel mount or portable. 3¾" square. Versatile models for electrical value, event or temperature recording. Wide complete selection of ranges and accessories.

Quantity OEM prices available on request.



MANY OTHER INSTRUMENTS IN STOCK AT YOUR LOCAL ELECTRONICS DISTRIBUTOR — WRITE FOR FULL LINE CATALOG

Simpson®

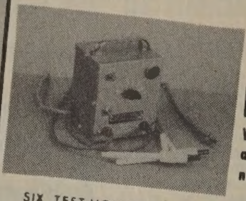
SIMPSON ELECTRIC COMPANY
Dept. EM, 953 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260 • Telex 72-2416 • Cable SIMELCO

Insulation Testers

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX 910-830-6972

High-voltage Insulation Tester with buzzer signal on breakdowns ...grounds ....shorts

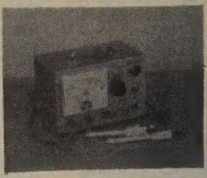


MODEL
101

Watch what you are doing . . . not the tester

SIX TEST VOLTAGES . . 500 to 2500 V.A.C. PRICED SO YOU CAN AFFORD TO SPOT A FEW ALONG YOUR ASSEMBLY LINES.

Adjustable High-voltage Tester with buzzer signal on breakdowns ...grounds ....shorts

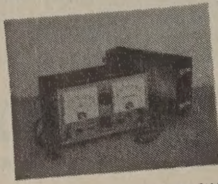


MODEL
106

Voltmeter shows actual Test Voltage

CONTINUOUSLY VARIABLE TEST VOLTAGE RATINGS TO 10,000 VOLTS AC & DC . . RECOMMENDED FOR BREAKDOWN TESTING AT FINAL ASSEMBLY AND INSPECTION

High-voltage Leakage Tester checks insulation for...leakage ...grounds .....arcing

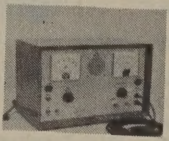


MODEL
122

16 lb. Portable for lab and field work

VARIABLE VOLTAGE RATINGS TO 2.5 KV AC & DC. DUAL RANGE LEAKAGE METER 0/100/1000 μa. . . . CAPACITY COMPENSATION. . . MEASURES INSULATION RESISTANCE, CAPACITY, POWER FACTOR.

High-voltage Leakage Tester audibly signals excess leakage ...grounds .....arcing

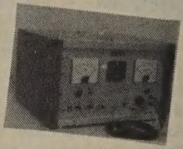


MODEL
103

Measures Leakage . . . not capacity current

TEST VOLTAGE CONTINUOUSLY VARIABLE ADJUSTABLE LEAKAGE LIMIT. . CAPACITY COMPENSATION ON AC TESTS. . . RATINGS TO 10,000 VOLTS AC & DC. . . . LIMITED ENERGY. . NON-DESTRUCTIVE. . . FOR LAB AND PRODUCTION LINE SERVICE. . . . . .

Automatic H-V Insulation Tester for precision checking... breakdowns ...leakage ...grounds

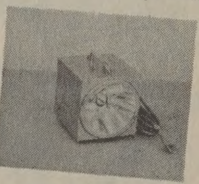


MODEL
103-MP

Automatic Test Cycle

FULLY AUTOMATIC TEST CYCLE. . . CONTROLLED RATE-OF-RISE. . . ADJUSTABLE TEST VOLTAGE, DWELL TIME, & LEAKAGE LIMIT. . . CAPACITY COMPENSATION ON AC TEST. . . FOR PRECISION TEST OF CRITICAL PARTS & ASSEMBLIES. . .

General Utility Stroboscope .....with high intensity daylight lamp



MODEL
168

200/5,000 Flashes per Minute

ECONOMY UNIT FOR MOTION STUDY AND INSPECTION APPLICATIONS . . . HIGH INTENSITY WHITE LIGHT . . . INSTANT STARTING . . . OPERATES FROM INTERNAL OSCILLATOR OR EXTERNAL TRIGGER.

Inspection Stroboscope .....with high intensity daylight lamp

MODEL
161

0/2,000 Flashes per Minute

LIGHT WEIGHT INEXPENSIVE TRIGGERED FLASH UNIT.....PUSH-TO-SEE SWITCH.... INTENSE WHITE LIGHT FOR INSPECTION ON – THE – GO

Stroboscopes

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA
TELEPHONE: 405-223-4773 TWX 910-830-6972

MIDGET STROBOSCOPE FLASH HEAD

MODEL
166

0/10,000 Flashes per Minute

FOR WORK ON MINIATURIZED EQUIPMENT .... FOR PRINTING TRADES. . . . FOR BIO–MEDICAL WORK. . ADAPTS TO ANY SLAUGHTER STROBOSCOPE...

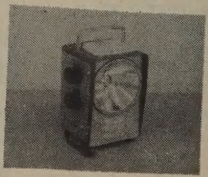
Precision Digital Stroboscope ...with high intensity daylight lamp

MODEL
169

110/25,000 Flashes per Minute

PRECISION STROBOSCOPIC TACHOMETER WITH 5 DIGIT READOUT – INSTANT STARTING – HIGH INTENSITY WHITE LIGHT – INTERNAL OSCILLATOR CONTROL OR LINE SYNCHRONIZED OPERATION – CAN BE TRIGGERED FROM EXTERNAL TTL LOGIC.

Metered Precision Stroboscope .....with high intensity daylight lamp



MODEL
165

110/25,000 Flashes per Minute

PRECISION STROBOSCOPE TACHOMETER INSTANT STARTING. . .HIGH INTENSITY WHITE LIGHT. . . OPERATES FROM EXTERNAL CONTACTS OR INTERNAL OSCILLATOR. . EASILY SYNCHRONIZED. .OUTPUT JACKS TO COUPLE SCOPE, ETC....

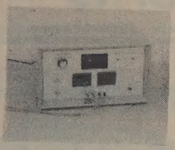
Coil & Winding Testers

WRITE FOR DATA SHEETS ON THE UNITS SHOWN ALL ARE STANDARD PRODUCTION ITEMS, AVAILABLE FOR EARLY DELIVERY . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER CO.
MOORE & HAILEY STREETS
ARDMORE, OKLA. 73401
TELEPHONE: 405-223-4773 TWX: 910-830-6972

Precision Digital Ohmmeter

. . . for accurate resistance testing



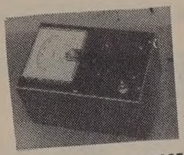
SERIES
203

0.001 — 19.99K Ohms Range

CONSTANT CURRENT 4 WIRE SYSTEM . . . SELF PROTECTING . . . GO/NO-GO LIMIT STYLE WITH BUZZER REJECTION SIGNAL . . . 3½ DIGIT READOUT.

High Energy Coil Tester

surge test coils for . . . shorts
. . . grounds
. . . opens



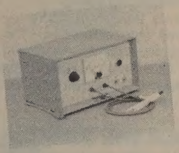
SERIES
640

High Level Tester

DETECTS WEAKNESSES AS WELL AS DEFECTS . . . USE WITH CORE OR SOLENOID TYPE COILS . . . REQUIRES NO OPERATOR SKILL.

Adjustable Limit Megohmmeter

. . . with buzzer signal on rejections



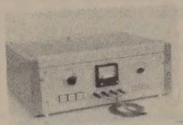
SERIES
205

1 to 20,000 Megohms

DRIFT FREE . . . NO WARM-UP . . . RUGGED TAUT BAND MOVEMENT . . . ADJUSTABLE REJECTION LIMIT WITH BUZZER SIGNAL.

Resistance Deviation Bridge

. . . for precision high speed testing



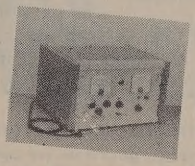
SERIES
223

0.01/10,000 Ohms

LESS THAN 0.2 SEC. RESPONSE . . . SOLID STATE . . . SELF CALIBRATING INDICATES PERCENT DEVIATION . . . ADJUSTABLE HIGH/LOW LIMITS WITH BUZZER SIGNAL FOR GO/NO-GO TESTING.

Adjustable HI Voltage Surge Tester

. . . tests coils and windings for shorts
. . . grounds
. . . opens



SERIES
648

Ratings to 10,000 Volts

DIRECT READING PULSE-SURGE TESTER . . . REQUIRES NO ACTIVE MASTER . . . PRECISE ENERGY CONTROL . . . GO/NO-GO OPERATION FOR UNSKILLED PERSONNEL.

Automatic Test Equipment

WRITE FOR DETAILS ON THE EQUIPMENT SHOWN THESE ARE FULLY ENGINEERED, PROVEN, STANDARD DESIGNS AVAILABLE ON A REASONABLE DELIVERY SCHEDULE . . . LET US QUOTE ON YOUR REQUIREMENTS . . .

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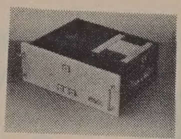
TELEPHONE: 405-223-4773 TWX: 910-830-6972

Micro-Processor Control Panel



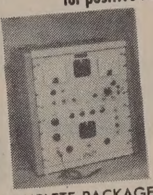
SERIES
720

Brain Package

HANDLES MULTIPLE TEST PANELS AND SINGLE OR DUAL TEST FIXTURES PLUS PERIPHERAL EQUIPMENT . . . SOLID STATE . . . PLUG-IN P-C BOARD CONSTRUCTION . . . COMPATIBLE STANDARD LOGIC . . . FULLY PROGRAMMABLE.

Automatic Final Test Station

for positive checking . . . ground lead
. . . dielectric
. . . run test

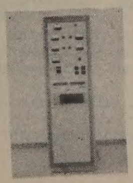


SERIES
950

COMPLETE PACKAGE FINAL TEST STATION . . . STEP OR RAMP FUNCTION DIELECTRIC TEST . . . FULLY AUTOMATIC CYCLE INCLUDING TEST RUN . . . ACCESSORY RUN TEST INSTRUMENTATION AVAILABLE.

Automatic Cable & Harness Tester

. . . for continuity . . . breakdowns
. . . megohms



SERIES
727

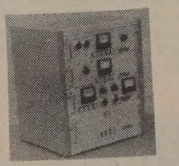
Expandable to 9,999 Circuits

Micro-Processor Controlled

SELF PROGRAMMING WITH MAGNETIC TAPE CASSETTE STORAGE AND RECOVERY OF PROGRAMS . . . MODULAR CONSTRUCTION . . . TESTING RATES TO 3000 CIRCUITS PER MINUTE . . . GO/NO-GO OPERATION . . . DIGITAL READOUT.

Automatic Coil & Winding Test Station

micro-processor controlled . . . coils
. . . armatures
. . . stators
. . . fields



SERIES
720

Test Rates to 1000 Parts per Hour

READY-TO-GO PACKAGE HANDLES 90% OF COILS WINDING TEST APPLICATIONS . . . QUICK CHANGE TEST FIXTURES . . . FULLY AUTOMATIC GO/NO-GO CYCLE.

High Speed Circuit Tester

. . . for accuracy and integrity

SERIES
703

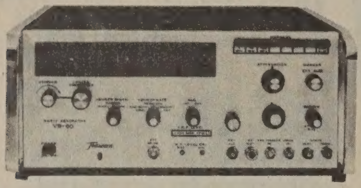
3000 Tests per Minute

SELF PROGRAMMING FOR TESTING UP TO 500 POINTS . . . MICRO PROCESSOR CONTROLLED . . . GO/NO-GO OPERATION DIGITAL READOUT OF FAULT AND LOCATION.

Sweep Generators. Spectrum Analyzers. Oscillator Attenuators. Filters and R.F. Components

INSTRUMENTS

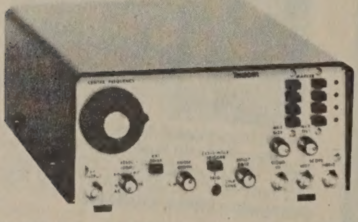
Texscan was incorporated on May 10, 1965 to engage in the design and manufacture of instruments and components for the electronic industry. The original line was limited to only a few of the products presently produced and consisted principally of sweep signal generators, display oscilloscopes and various coaxial and microwave components. Today, Texscan offers a complete line from a single source.



VS SERIES - SWEEP/SIGNAL GENERATORS

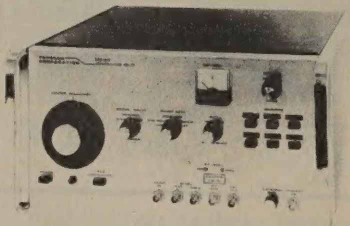
The VS series sweep/signal generators are completely solid state, low distortion, wide sweep instruments containing sufficient features for wide application in the industry. These include variable sweep rate capability, excellent linearity, with attenuated outputs and have extensive marker capability. The unit shown is the VS-60, and its controls are typical. Controls may be deleted or rearranged on other units. This line includes instruments with extensive tuning range.

Model	Frequency Range
VS-20	500 Hz to 25 MHz
VS-30A	300 kHz to 100 MHz
VS-40A	1 MHz to 300 MHz
VS-50A	5 MHz to 500 MHz
VS-60B	5 MHz to 1000 MHz
VS-80	1 MHz to 1200 MHz
VS-80DH	0.5 MHz to 1200 MHz
VS-90B	5 MHz to 2350 MHz
VS-340	3.6 GHz to 4.3 GHz
	5.8 GHz to 6.5 GHz



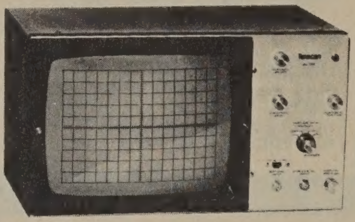
WB SERIES - SWEEP/SIGNAL GENERATORS

The WB series sweep signal generators are designed to make swept measurements at relatively low cost. They cover the frequency range of DC to 960 MHz in four units: DC to 32 MHz, 4 to 400 MHz, 1 to 500 MHz and 1 to 960 MHz. The unit covering 1 to 960 MHz is a two band unit. The bands are 1 to 500 MHz and 450 to 960 MHz. The instruments are less than one-half rack unit width, approximately 4-3/16 inches high and 12-5/8 inches deep.



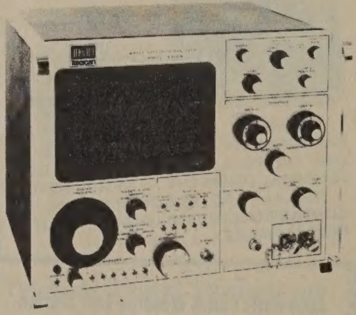
SS SERIES - HIGH POWER SWEEP/SIGNAL GENERATORS - 5 WATTS

The SS series utilizes solid state power amplifier output devices. This combination eliminates the costly replacements previously associated with high power tube-type sweep/signal generators. These units produce 5 watts into 50 Ω and are VSWR protected. Frequency range is 1 to 1000 MHz.

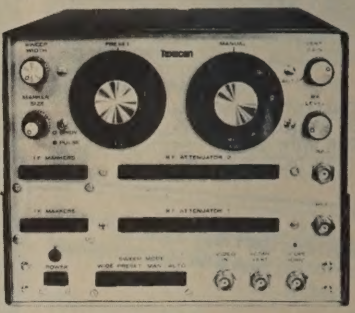


DU SERIES OSCILLOSCOPES

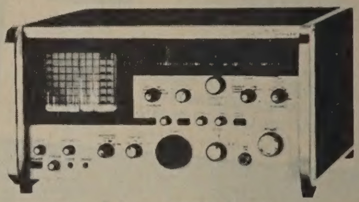
Texscan oscilloscopes are sensitive, large screen, solid state, X-Y display units designed to satisfy the particular needs of a production or laboratory testing system using sweep generator techniques. These display units are complete with cathode ray tube, vertical and horizontal deflection amplifiers, video (Z axis) amplifier, and high and low voltage supplies.



The Model 9650 tracking sweep spectrum analyzer makes possible dynamic measurements of over 100 dB. This technique provides rapid observation of many band pass — band reject responses previously available only on a point-to-point basis. This unique instrument combines the features of a sweep generator, spectrum analyzer, display section, reflection bridge and associated 1 dB step attenuators.



The Ultima 9000 Series and related products mark Texscan's entry into the realm of TV tuner and chassis testing. TV industry sweep instruments are by nature custom designed and the Texscan 9000 Series is fully flexible to meet user requirements.



SPECTRUM ANALYZER AL-60

1 MHz to 3 GHz, solid state, −110 to +30 dBm. Texscan's line of lab spectrum analyzers consists of the AL-60, 1 MHz to 3 GHz. Designed for maximum reliability and maintainability, accurate frequency and amplitude identification.

PORTABLE SPECTRUM ANALYZERS

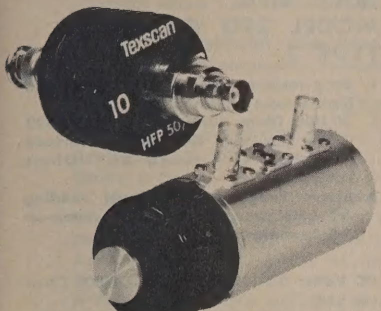
The AL-50 family of portable spectrum analyzers provides the user with a rugged instrument for making RF measurements both in the lab and in the field. There are three units in the series — the AL-50, single resolution 4-300 MHz, AL-51 selectable resolution and phase lock, 4-1000 MHz, and the AL-55, 4-350 MHz, with crystal markers and special hum modulation measurement circuittry. These units will operate from an internal 12V rechargeable battery, an AC power converter, or 12V vehicular systems. Weighing less than 25 lbs., they are provided with a protective cover and rugged field carrying case with handle.

Texscan

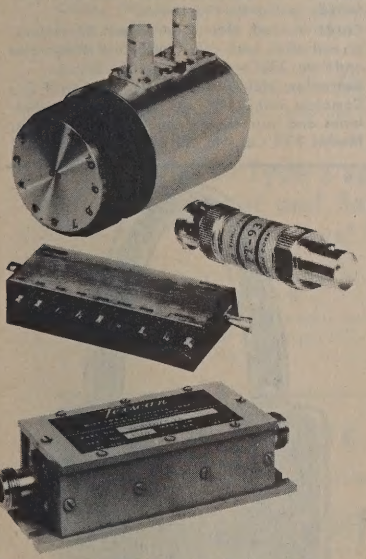
2446 North Shadeland Avenue, Indianapolis, Indiana 46219, PH: 317-357-8781, TWX: 810-341-3184, Telex: 272110
1, Northbridge Road, Berkhamsted, Hertfordshire, England UK, PH: 04427-71138, Telex: 82258
8 Munchen 90, Schlierseestrasse 31A, West Germany, PH: 0811/69 5421, Telex: 522915
Texscan East Coast Regional Office: 162 Highview Terrace, Dover, N.J., PH: 201-366-9421

weep Generators. Spectrum Analyzers. Oscillators. Attenuators. Filters and R.F. Components

ATTENUATORS



New High Performance Attenuators — New HFP Series are 10 watt CW fixed attenuators and FP are subminiature with an exacting range from DC — 18 GHz. With a conservative 2 watt rating at room temperature these attenuators are ideal for environmental protection, ruggedness and low cost. The attenuators are also packaged in convienent laboratory protective cases.

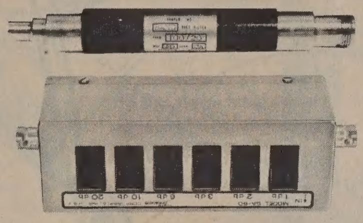


Attenuators — RA Series — Rotary — DC — 4000 MHz, direct reading in dB, 8 attenuation ranges up to 120 dB, 50 to 75 ohm. Texscan offers a complete range of attenuators with steps of 0.1, 1.0 and 10.0 dB, covering attenuation ranges of 1.0, 10.0 and 120.0 dB. Wide selection of connector choices available.

FP Series — Fixed Coaxial — DC — 18 GHz, 2 watt average power, values up to 50 dB.

PA Series — Digitally Programmable — DC — 1250 MHz, 6 millisecond switching speed. Three different units cover 0 — 127 dB in 1.0 dB steps. Each pad represents a single binary digit for easy mating to a digital system.

FILTERS



Filters — Tunable Bandpass — 48 MHz to 4 GHz, 3 dB BW, 1% to 10%, 3 and 5 sections. Any single model covers more than an octave.

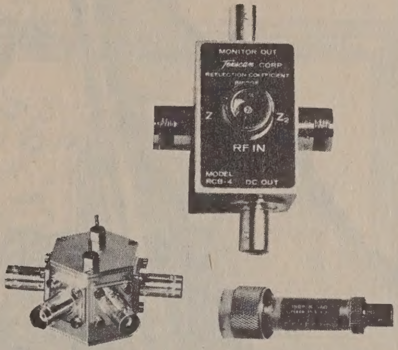
Bandpass/Lowpass — 10 MHz to 13 GHz. Five different types available, each with its own unique characteristics. Choice of connector style as well as special mechanical designs to fit your packaging requirements, 48 hour delivery.

Lumped Component — 5 MHz to 100 MHz, 3 to 8 sections. Miniature size provides freedom in circuit layout, reducing overall package volume. Available in bandpass and lowpass designs.

Cavity Bandpass — 30 MHz to 3000 MHz, 2 to 6 sections, 0.2 to 3%, 3 dB BW. Designed to provide low insertion loss at narrow bandwidths.

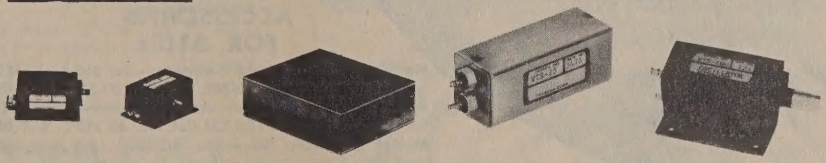
Waveguide — 4 GHz to 18 GHz Bandpass. Custom designs from 0.25 to 10% bandwidths.

COMPONENTS



RF COMPONENTS	FREQUENCY RANGE
Detectors	100 KHz — 4000 MHz
Minimum Loss Pads	DC — 1000 MHz
Reflection Coefficient Bridges	500 KHz — 2.5 GHz
Terminations	DC — 1000 MHz
RF Coax Switches	DC — 2000 MHz
Voltage Monitors	500 KHz — 4 GHz
Mismatches	DC — 2.5 GHz

OSCILLATORS



Solid State Oscillators — Texscan's seven lines of solid state RF sources span between 2.5 MHz to 20 GHz and supply RF power up to one watt. Both electronically and mechanically tuned devices are available.

BITE Oscillators — Texscan's PMO series operate with TTL logic pulses at a .001 duty. They require a 20 mW input for a 200 mW peak RF output making them ideal for battery operation. The PMO series is also available with a direct pulse drive input.

SOLID STATE OSCILLATORS

Frequency Range	Series	Tuning	Tuning Range	Power Range
2.5 MHz - 2 GHz	VTS	Elect.	Up to an octave	200 - 1000 mW
1 GHz - 8 GHz	VTO	Elect.	Up to an octave	20 - 150 mW
10 MHz - 4 GHz	MTO	Mech.	Up to an octave	10 - 1000 mW
4 GHz - 20 GHz	GTO	Mech.	Up to 65%	5 - 1000 mW
4 GHz - 18 GHz	ETO	Elect.	Up to 2500 MHz	10 - 100 mW
32 MHz - 1 GHz	LTO	Elect.	Up to 3 octaves	
VHF - 18 GHz	PMO	Mech.	Up to an octave	0.1 - 500 mW Peak

Texscan

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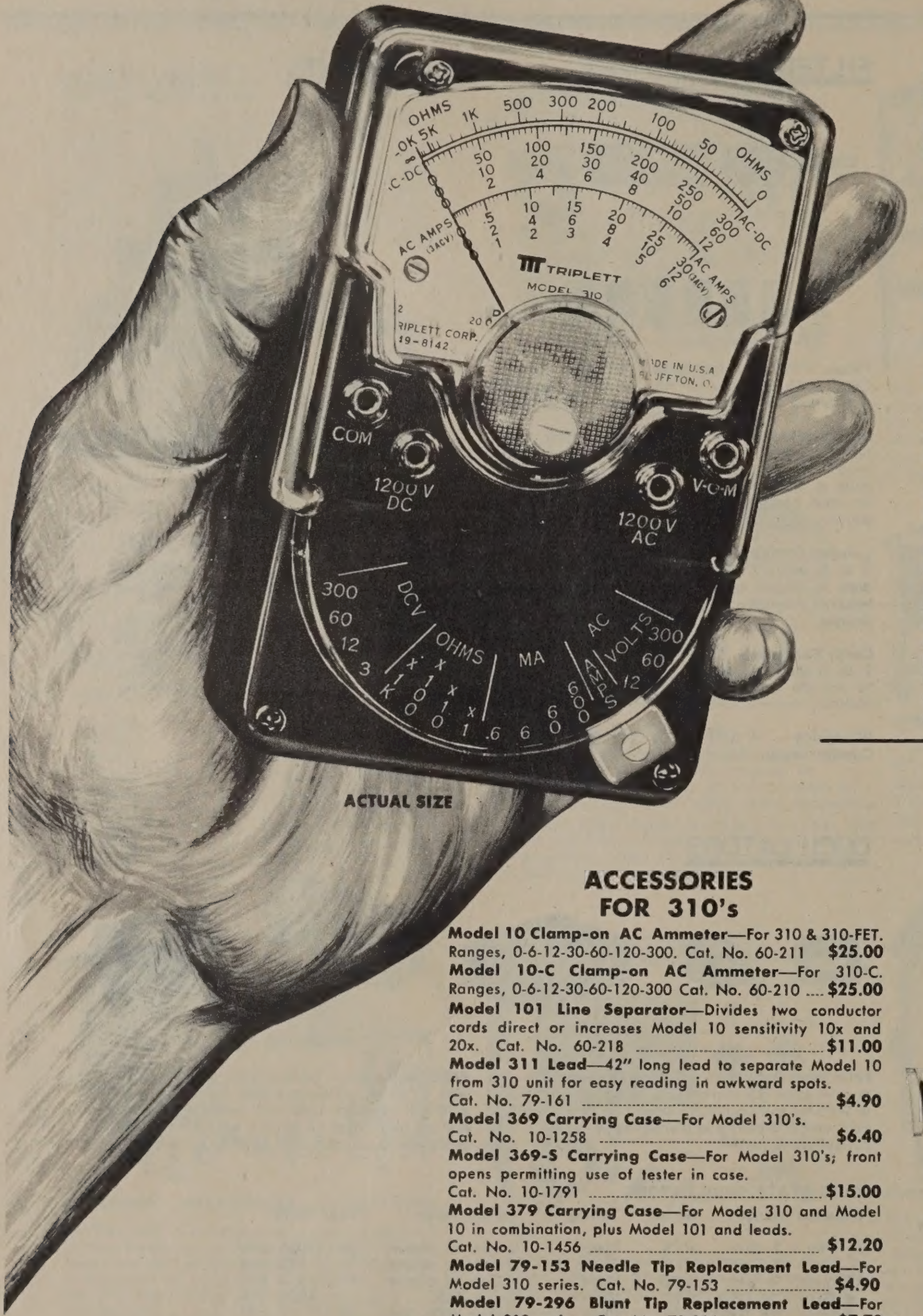
8 Munchen 90, Schlierseestrasse 31A, West Germany, PH: 0811/69 5421, Telex: 522915
Texscan East Coast Regional Office: 162 Highview Terrace, Dover, N.J., PH: 201-366-9421

TRIPLETT TEL: (419) 358-5015 TWX 810-490-2400
DEPT. EM TRIPLETT CORPORATION, BLUFFTON, OHIO 45817

GENERAL MULTI-PURPOSE V-O-Ms



ACTUAL SIZE

DROP RESISTANT
Hand Size MODEL 310 V-O-M TYPE 3

1. **Drop-resistant, hand-size V-O-M with high-impact thermoplastic case.**
2. **20,000 Ohms per volt DC and 5,000 Ohms per volt AC; diode overload protection with fused Rx1 Ohms range.**
3. **Single range switch; direct reading AC Amp range to facilitate clamp-on AC Ammeter usage.**

RANGES

DC Volts: 0-3-12-60-300,1,200 (20,000 Ohms per Volt).
AC Volts: 0-3-12-60-300-1,200 (5,000 Ohms per Volt).
Ohms: 0-20k-200k-2MΩ-20MΩ (200 Ohm center scale on low range).
DC Microamperes: 0-600 at 250 mV.
DC Milliamperes: 0-6-60-600 at 250 mV.
Accuracy: ±3% DC; ±4% AC; (full scale).
Scale Length: 2⅛″.
Meter: Self-shielded; diode overload protected; spring backed jewels.
Case: Molded, black, high impact thermoplastic with slide latch cover for access to batteries and fuse, 2¾″ w x $1\frac{5}{16}$″ d x 4¼″ h.
Batteries: NEDA 15V 220 (1), 1½V 910F (1): Complete with 42″ leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.
Model 310 Cat. No. 3018 .... **$53.00**

ACCESSORIES FOR 310's

Model 10 Clamp-on AC Ammeter—For 310 & 310-FET. Ranges, 0-6-12-30-60-120-300. Cat. No. 60-211 **$25.00**

Model 10-C Clamp-on AC Ammeter—For 310-C. Ranges, 0-6-12-30-60-120-300 Cat. No. 60-210 .... **$25.00**

Model 101 Line Separator—Divides two conductor cords direct or increases Model 10 sensitivity 10x and 20x. Cat. No. 60-218 .... **$11.00**

Model 311 Lead—42″ long lead to separate Model 10 from 310 unit for easy reading in awkward spots. Cat. No. 79-161 .... **$4.90**

Model 369 Carrying Case—For Model 310's. Cat. No. 10-1258 .... **$6.40**

Model 369-S Carrying Case—For Model 310's; front opens permitting use of tester in case. Cat. No. 10-1791 .... **$15.00**

Model 379 Carrying Case—For Model 310 and Model 10 in combination, plus Model 101 and leads. Cat. No. 10-1456 .... **$12.20**

Model 79-153 Needle Tip Replacement Lead—For Model 310 series. Cat. No. 79-153 .... **$4.90**

Model 79-296 Blunt Tip Replacement Lead—For Model 310 series. Cat. No. 79-296 .... **$7.70**

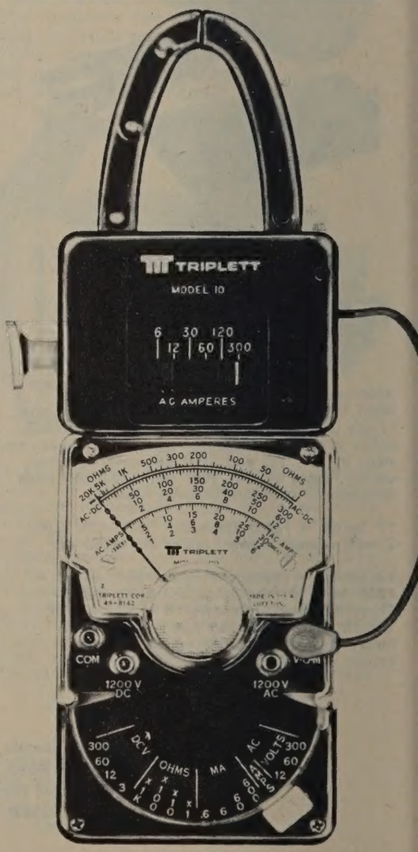
HAND SIZE V-O-M CLAMP-ON AMMETERS
MODEL 100 WITH TYPE 3 MODEL 310

1. **Complete maintenance kit with V-O-M and clamp-on AC ammeter.**
2. **Diode overload-protected; 20,000 Ohms per volt on DC.**
3. **AC clamp-on will read up to 300 Amps AC.**

Model 100—Complete set includes Model 310 Type 3, Model 10, Model 101, No. 311 lead and Model 379 case. Shpg. Wt. 7 lbs. Cat. No. 3014 .... **$101.00**

Model 100-C—Complete set includes Model 310-C, Model 10-C, Model 101, No. 311 lead and Model 379 case. Shpg. Wt. 7 lbs. Cat. No. 3010 .... **$115.00**

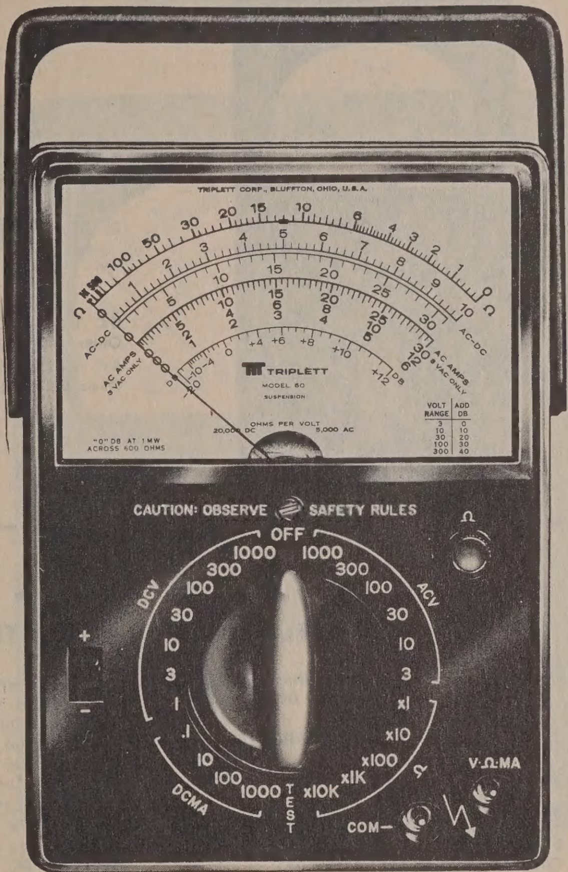
Model 100-FET—Complete set includes Model 310-FET, Model 10, Model 101, No. 311 lead and Model 379 case. Shpg. Wt. 7 lbs. Cat. No. 3013 .... **$134.00**



MODEL 100

X'TRA RUGGED, OVERLOAD PROTECTED, SAFETY DESIGNED

MODEL 60 V-O-M TYPE 2



1. **X'TRA RUGGED—Will withstand an accidental drop up to a five foot height.**
2. **OVERLOAD PROTECTED—All ranges protected by diode and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.**
3. **SAFETY DESIGNED FOR YOU—Designed to most rigid safety standards; completely insulated unit including newly designed safety leads.**

RANGES

DC Volts: 0-0.3-1-3-10-30-100-300-1000 (Approx. 20,000 Ohms per Volt).
AC Volts: 0-3-10-30-100-300-1000 (Approx. 5,000 Ohms per Volt).
Ohms: 0-1k-10k-100k-1MΩ-10MΩ (12 Ohms center scale on low range).
DC Microamperes: 0-100 at approx. 320mV.
DC Milliammeters: 0-10-100-1000 at approx. 320mV.
Decibels: −20 to +52 ("0"db at 1mW on 600 Ohm line).
Accuracy: ±2% DC; ±3% AC; (full scale).
Scale Length: 4½".
X'TRA Rugged—Will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.
Overload Protected—All ranges protected by diodes and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.
Safety Designed to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.
Meter: Diode overload protected ruggedized suspension movement, easily replaced integral module, DC polarity reversing switch.
Confidence test: Reassurance check of instrument meter.
Case: Molded, International Safety Orange, high impact thermoplastic; easy external access to sealed battery and fuse compartment; molded plastic handle will hold tester at 30° angle; 5¼" W X 7½" H X 3¼" D.
Batteries: NEDA 9V 1604 (1), 1½V 13F (1).
Complete with 48" safety test leads, insulated alligator clips, batteries, spare 1/8A and 1A fuses and instruction manual. Shpg. wt. 4 lbs.
Model 60 Cat. No. 3145 .... **$99.00**

Model 60 Type 2 approved by Mining Enforcement and Safety Administration Approval 2G-2880.

Model 60-A, similar to Model 60 with mirror scale and ±1½% DC accuracy. Cat. No. 3148 .... **$106.00**

Model 60-K, includes complete Model 60, Model 10 Clamp-on AC Ammeter, Model 101 Line Separator, Model 10 attachment lead and leather case. Cat. No. 3150 .... **$162.00**

MODEL 310-C V-O-M TYPE 3

1. **Hand-size V-O-M with diode overload-protected suspension movement.**
2. **20,000 Ohms per volt DC and 15,000 Ohms per volt AC.**
3. **Single, enclosed range switch minimizes error; DC polarity-reversing switch.**

RANGES

DC Volts: 0-3-12-60-300-600 (20,000 Ohms per Volt).

AC Volts: 0-3-12-60-300-600 (15,000 Ohms per Volt).

Ohms: 0-20k-200k-2MΩ-20MΩ (200 Ohm center scale on low range).

DC Microamperes: 0-600 at 250 mV.

DC Milliamperes: 0-6-60-600 at 250 mV.

Accuracy: ±3% DC; ±4% AC; (full scale).

Scale Length: 2⅛".

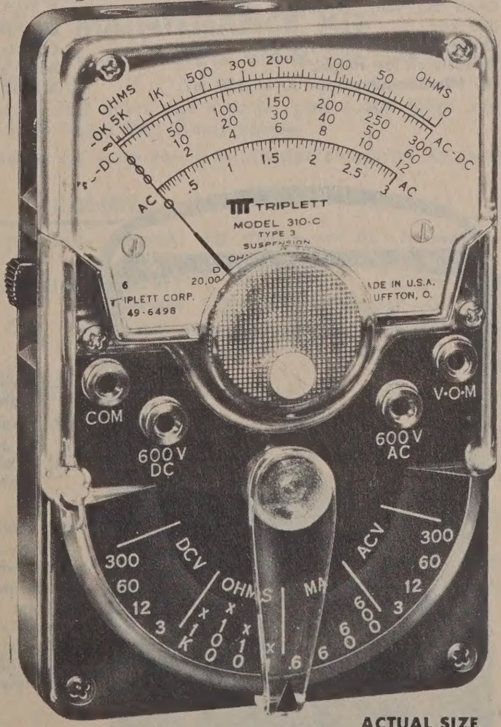
Meter: Self-shielded, diode overload protected suspension movement; DC polarity-reversing switch; single, enclosed range switch.

Case: Molded black, 2¾" w X 1$\frac{5}{16}$" d X 4¼" h.

Batteries: NEDA 15V 220 (1), 1½V 910F (1).

Complete with 42" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.

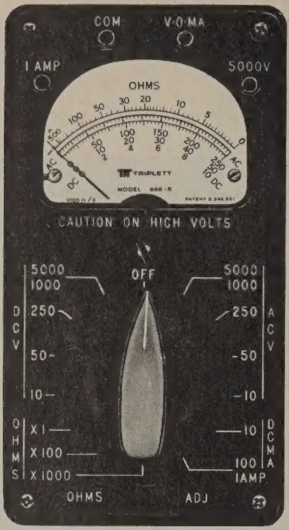
Model 310-C Cat. No. 3022 .... **$68.00**



ACTUAL SIZE

TRIPLETT DEPT. EM **TRIPLETT CORPORATION, BLUFFTON, OHIO 45817**
TEL: (419) 358-5015 TWX 810-490-2400

GENERAL MULTI-PURPOSE V-O-Ms


COM
V-O-MA
1 AMP
5000V
OHMS
TRIPLETT
MODEL 666-R
CAUTION ON HIGH VOLTS
OFF
5000
1000
250
50
10
DCV
ACV
X1
X100
X1000
OHMS
DCMA
100
1AMP
ADJ

MODEL 666-R V-O-M TYPE 1

1. **Rugged 16-range V-O-M; single range switch minimizes error.**
2. **3 ohmmeter ranges reading to 3 megohms.**
3. **AC and DC voltage ranges from 10 to 5000 volts.**

RANGES

DC Volts: 0-10-50-250-1,000-5,000 (1,000 Ohms per Volt).

AC Volts: 0-10-50-250-1,000-5,000 (1,000 Ohms per Volt).

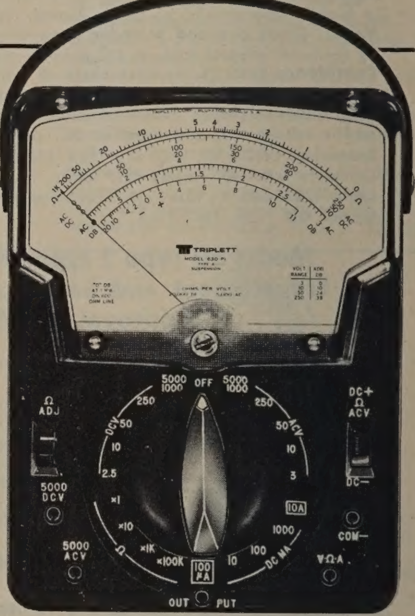
Ohms: 0-3k-300k-3MΩ (20 Ohm center scale on low range).
DC Milliamperes: 0-10-100 at 250 mV.
DC Amperes: 0-1 at 250 mV.
Accuracy: ±3% DC; ±4% AC; (full scale).
Scale Length: 3".
Meter: Rugged spring-backed instrument jewels.
Case: Molded, black, $3\frac{1}{16}$" w X $2\frac{9}{16}$" d X $5\frac{7}{8}$" h.
Batteries: NEDA 1½V 15A (2), 1½V 14F (1). Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 3 lbs.
Model 666-R Cat. No. 3066 .... **$59.00**

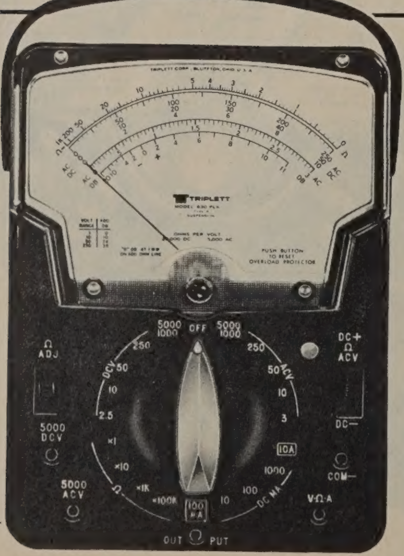
MODEL 630-PL V-O-M TYPE 4

1. **27-range V-O-M with single range switch minimizes error; DC polarity reversing switch.**
2. **5" suspension meter with diode overload protection.**
3. **4 ohmmeter ranges with 4.4 Ohms center scale.**

RANGES

DC Volts: 0-2.5-10-50-250-1,000-5,000 (20,000 Ohms per Volt); 0-0.25 at 100 ua.
AC Volts: 0-3-10-50-250-1,000-5,000 (5,000 Ohms per Volt). Frequency range 10 Hz to 500 kHz.
Ohms: 0-1k-10k-1MΩ-100MΩ (4.4 Ohm center scale on low range).
DC Microamperes: 0-100 at 250 mV.
DC Milliamperes: 0-10-100-1,000 at 250 mV.
DC Amperes: 0-10 at 250 mV.
Decibels: −20 to +49 ("0" dB at 1 mW on 600 Ohm Line).
Output Volts (AC): 0-3-10-50-250 (5,000 Ohms per Volt).
Accuracy: ±2% DC; ±3% AC; (full scale).
Scale Length: 4½".
Meter: Diode overload protected suspension movement, DC polarity reversing switch.
Case: Molded, black, 5½" w X 3-11/32" d X 7½" h.
Batteries: NEDA 30V 210 (1), 1½V 13F (1). Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.
Model 630-PL Cat. No. 3050 .... **$86.00**


TRIPLETT
MODEL 630-PL
Ω ADJ
5000 OFF 5000
1000 1000
DCV
ACV
250
50
10
2.5
3
×1
×10
×1K
×100K
100 µA
10A
1000
100
DC MA
DC+ Ω ACV
DC−
5000 DCV
5000 ACV
COM−
V-Ω-A
OUT PUT


TRIPLETT
MODEL 630-PLK
PUSH BUTTON TO RESET OVERLOAD PROTECTOR
Ω ADJ
5000 OFF 5000
1000 1000
DCV
ACV
250
50
10
2.5
3
×1
×10
×1K
×100K
100 µA
10A
1000
100
DC MA
DC+ Ω ACV
DC−
5000 DCV
5000 ACV
COM−
V-Ω-A
OUT PUT

MODEL 630-PLK V-O-M TYPE 5

1. **Burnout-proof solid-state overload protection; suspension movement.**
2. **Single range switch minimizes error; DC polarity-reversing switch.**
3. **4 ohmmeter ranges with 4.4 Ohms center scale.**

RANGES

DC Volts: 0-2.5-10-50-250-1,000-5,000 (20,000 Ohms per Volt); 0-0.25 at 100 uA.
AC Volts: 0-3-10-50-250-1,000-5,000 (5,000 Ohms per Volt).
Ohms: 0-1k-10k-1MΩ-100MΩ (4.4 Ohm center scale on low range).
DC Microamperes: 0-100 at 250 mV.
DC Milliamperes: 0-10-100-1,000 at 250 mV.
DC Amperes: 0-10 at 250 mV.
Decibels: −20 to +49 ("0" dB at 1 mW on 600 Ohm line).
Output Volts (AC): 0-3-10-50-250 (5,000 Ohms per Volt).
Accuracy: ±2% DC; ±3% AC; (full scale).
Scale Length: 4½".
Meter: Diode overload protected suspension movement, DC polarity reversing switch.
Overload Protection: Complete tester protected with solid-state switching circuit.
Case: Molded, black, 5½" w X 3-11/32" d X 7½" h.
Batteries: NEDA 30V 210 (1), 1½V 13F (1). Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.
Model 630-PLK Cat. No. 3055 .... **$128.00**

TRIPLETT TEL: (419) 358-5015 TWX 810-490-2400
DEPT. EM TRIPLETT CORPORATION, BLUFFTON, OHIO 45817

GENERAL MULTI-PURPOSE V-O-Ms

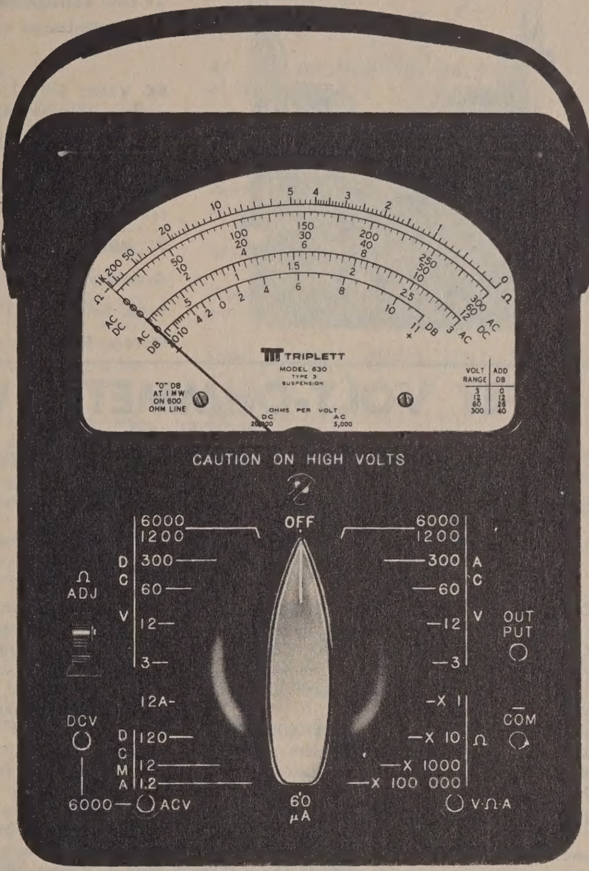
MODEL 630 V-O-M TYPE 3

1. **Diode overload-protected suspension movement V-O-M; single range switch minimizes error.**
2. **4 ohmmeter ranges with 4.4 Ohms center scale.**
3. **Simplified scale—only 4 arcs for all 27 ranges.**

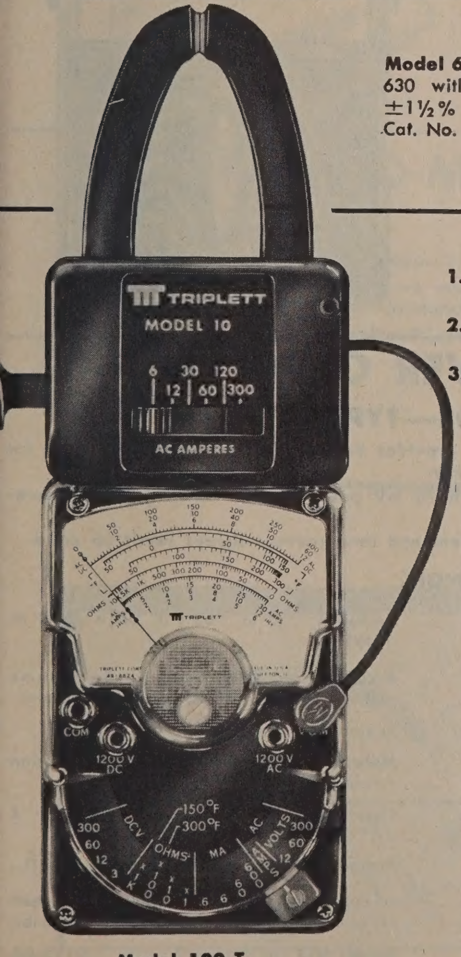
RANGES

DC Volts: 0-3-12-60-300-1,200-6,000 (20,000 Ohms per Volt).
AC Volts: 0-3-12-60-300-1,200-6,000 (5,000 Ohms per Volt).
Ohms: 0-1k-10k-1MΩ-100MΩ (4.4 Ohm center scale on low range).
DC Microamperes: 0-60 at 250 mV.
DC Milliamperes: 0-1.2-12-120 at 250 mV.
DC Amperes: 0-12.
Decibels: −20 to +51 ("0" dB at 1 mW on 600 Ohm line).
Output Volts (AC): 0-3-12-60-300 (5,000 Ohms per Volt).
Accuracy: ±2% DC; ±3% AC; (full scale).
Scale Length: 4⅜".
Meter: Diode overload protected suspension movement.
Case: Molded, black, 5½" w X 3-11/32" d X 7½" h.
Batteries: NEDA 30V 210 (1), 1½V 13F (1).
Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.

Model 630 Cat. No. 3030 .... **$82.00**


TRIPLETT
MODEL 630
TYPE 3
SUSPENSION
"0" DB AT 1 MW ON 600 OHM LINE
OHMS PER VOLT DC 20,000 AC 5,000
VOLT RANGE ADD DB
CAUTION ON HIGH VOLTS
OFF
6000
1200
300
60
12
3
D C V
A C
Ω ADJ
OUT PUT
12A-
X 1
X 10
X 1000
X 100 000
D C M A
120
12
1.2
DCV
COM
Ω
6000 — ACV
60 µA
V·Ω·A

Model 630-A: Similar to Model 630 with mirror scale and ±1½% DC accuracy.
Cat. No. 3034 .... **$94.00**


TRIPLETT
MODEL 10
6 30 120
12 60 300
AC AMPERES
TRIPLETT
COM
1200 V DC
1200 V AC
150°F
300°F
DCV
OHMS
MA
AC VOLTS

Model 100-T.

MODEL 100-T MAINTENANCE KIT

1. **Complete maintenance kit—Drop-Resistant hand-size V-O-M with two temperature ranges and clamp-on AC Ammeter.**
2. **High-impact thermoplastic case; 20,000 ohms per Volt DC and 5,000 Ohm per Volt AC; diode overload protection with fused Rx1 Ohms range.**
3. **Single range switch; direct reading AC Amp range facilitates clamp-on AC Ammeter usage, reads to 300 Amps AC.**

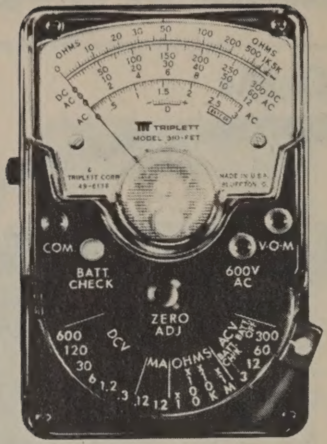
RANGES

DC Volts: 0-3-12-60-300, 1,200 (20,000 Ohms per Volt).
AC Volts: 0-3-12-60-300-1,200 (5,000 Ohms per Volt).
Ohms: 0-20k-200k-2MΩ-20MΩ (200 Ohm center scale on low range).
DC Microamperes: 0-600 at 250 mV.
DC Milliamperes: 0-6-60-600 at 250 mV.
Temperature: −50°F to +150°F
+50°F to +300°F
Accuracy: ±3% DC; ±4% AC; ±3% temperature; (full scale).
Scale Length: 2⅛".
Meter: Self-shielded; diode overload protected; spring backed jewels.
Case: Molded, black, high impact thermoplastic with slide latch cover for access to batteries and fuse, 2¾"w x 1 5/16"d x 4¼"h.
Batteries: NEDA 15V 220 (1), 1½V 910F (1):
Complete with 42" leads, 31" temperature probe, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.
Model 390 .... **$74.00**

Model 10 Clamp-on AC Ammeter—For 390. Ranges, 0-6-12-30-60-120-300. Cat. No. 60-211 .... **$25.00**
Model 101 Line Separator—Divides two conductor cords direct or increases Model 10 sensitivity 10x and 20x. Cat. No. 60-218 .... **$11.00**
Model 311 Lead—42" long lead to separate Model 10 from 390 unit for easy reading in awkward spots. Cat. No. 79-161 **$4.70**
Temperature Probe—31" long lead, interchangeable, curve matched thermistor with removable protective sleeve.
Cat. No. 79-386 .... **$18.90**
Model 379 Carrying Case—For Model 390 and Model 10 in combination, plus Model 101 and leads. Cat. No. 10-1456 ...... **$12.20**

Complete with above items, 42" leads, alligator clips and batteries for Model 390 and instruction manual. Weight approx. 2 lbs. complete.
Model 100-T. Cat. No. 3011 .... **$120.00**

HANDSIZE FET V-O-M



MODEL 310-FET—TYPE 1

1. **Hand-size FET V-O-M with 10 megohm DC input resistance and diode overload-protected suspension movement.**
2. **Low voltage range of 300 mV DC; X1 megohm range.**
3. **Single range switch; DC polarity-reversing switch.**

RANGES

DC Volts: 0-0.3-1.2-6-30-120-600. Input resistance 10 megohms.

AC Volts: 0-3-12-60-300-600 (5,000 Ohms per Volt).

Ohms: 0-5k-500k-50MΩ-5,000MΩ (50 Ohm center scale on low range).

DC Milliamperes: 0-0.12-1.2 at 300 mV.

Accuracy: ±3% DC; ±4% AC; (full scale).

Scale Length: 2⅛".

Meter: Self-shielded, diode overload protected suspension movement; DC polarity-reversing switch.

Case: Molded, black, 2¾" w X 1$\frac{5}{16}$" d X 4¼" h.

Batteries: NEDA 7V 1501M (1), 1½V 910A (1).

Complete with 42" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.

Model 310-FET Cat. No. 3027 ....**$88.00**

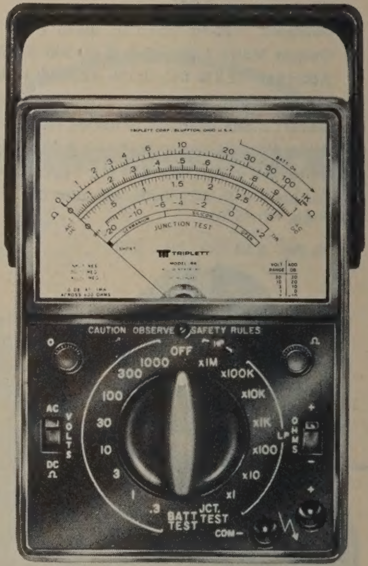
Model 100-FET Cat. No. 3013 ......**$134.00**

See Page 2 for additional 310 accessories.

FET VOLT-OHMMETER WITH LOW POWER OHMS

MODEL 64

1. **X'TRA RUGGED/OVERLOAD PROTECTED (all ranges)/SAFETY DESIGNED solid state Volt-Ohmmeter.**
2. **LOW-POWER OHMS—LPΩ™—6 ranges with 90mV power source for in-circuit measurements plus junction test circuit.**
3. **EXCLUSIVE TRIPLETT MICRO POWER—TMP™—permits continuous operation with carbon battery life in excess of a year.**



RANGES

DC Volts: 0-0.3-1-3-10-30-100-300-1,000. Input resistance 11.12 megohms all ranges.

AC Volts: 0-0.3-1-3-10-30-100-300-1,000. Input impedence 10 megohms all ranges. Frequency range 20Hz to 20kHz, except 300 and 1000V.

Ohms—Low Power: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ. (Max. voltage 90mV, Max. power 0.8mW, 10 Ohm center scale on low range).

Ohms—Conventional: 1000MΩ. (Max. voltage 0.9V, Max. power 0.08μW, 10M ohm center scale).

Junction Test: Checks diodes and transistor junctions (silicon-germanium-open or shorted); forward and reverse conduction. (Max. voltage 0.9V, Max. power 0.8mW).

Decibels: −40dB to +62dB.

Accuracy: ±3% all ranges (full scale).

Scale Length: 4½".

X'TRA Rugged: Will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.

Overload Protected: All ranges protected by diodes and unusual two fuse arrangement, including 1 amp and 2 amp/1000V fuses.

Safety Designed to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.

Meter: Diode overload protected, ruggedized suspension meter movement module; "+ jack" polarity reversing switch.

Case: Molded, green high impact thermoplastic; easy external access to sealed battery and fuse compartment; molded plastic handle will hold tester at 30° angle; 5¼"W x 7½"H x 3¼"D.

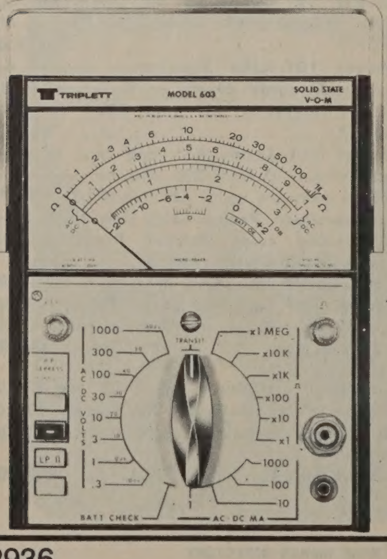
Batteries: NEDA 9V 1604 (2), 1½V 13F (1).

Complete with 48" safety test leads, insulated alligator clips, batteries, spare 1A fuse and instruction manual. Shpg. wt. 4 lbs.

Model 64 Cat. No. 3152 ....**$136.00**

FET V-O-M WITH LOW POWER OHMS

MODEL 603—TYPE 1



1. **Exclusive TRIPLETT MICRO POWER—TMP™ provides battery life in excess of a year for carbon batteries with unit left ON continuously.**
2. **LOW-POWER OHMS—LPΩ™—6 ranges with 70 mV power source for in-circuit measurements without component damage.**
3. **FET V-O-M WITH AUTO-POLARITY—convenient and time saving, always reads up scale.**

RANGES

DC Volts: 0-0.3-1-3-10-30-100-300-1,000. Input resistance 11.12 megohms with 1.12 Meg in Probe.

AC Volts: 0-0.3-1-3-10-30-100-300-1,000. Input impedance 10 megohms. Frequency range 20 Hz to 10 kHz.

Ohms—Low Power: 0-1k-10k-100k-1MΩ-10MΩ-1000MΩ. (70 mV open circuit voltage, 123 μW maximum power applied to device under test, 10 Ohm center scale on low range).

Ohms—Conventional: 0-1k-10k-100k-1MΩ-10MΩ-1000MΩ. (1.5V open circuit voltage, 56 mW maximum power applied to device under test, 10 Ohm center scale on low range).

AC and DC Milliamperes: 0-1-10-100-1000 at 316 mV.

Decibels: −30 to +62 ("0" dB is equal to .776V).

Accuracy: ±3% all Voltage and Ohms ranges, ±4% all Current ranges; (full scale).

Scale Length: 4⅛".

Meter: Diode overload protected suspension movement.

Case: Shielded, molded, black, 5⅛" w X $3\frac{3}{16}$" d X 6½" h.

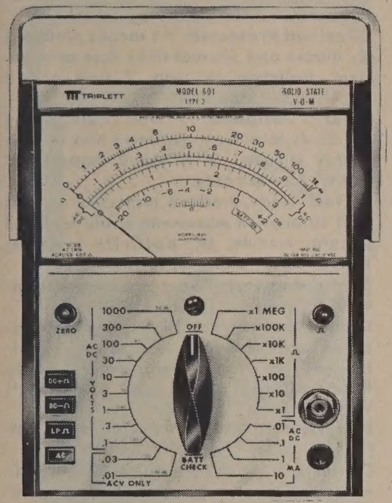
Batteries: NEDA 9V 1604 (2), 1½V 13F (1).

Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.

Model 603 Cat. No. 3037 ....**$173.00**

FET V-O-M WITH LOW POWER OHMS

MODEL 601—TYPE 2



1. **LOW-POWER OHMS—LPΩ™—7 ranges with 75 mV power source.**
2. **High sensitivity—10 mV AC full scale at 10 megohm input impedance; 100 mV DC at 11 megohm input resistance.**
3. **Simplified scale—only 4 arcs for all 53 ranges.**

RANGES

DC Volts: 0-0.1-0.3-1-3-10-30-100-300-1,000. Input resistance 11 megohms with 690k series resistor in probe tip. Includes 40 dB 60 Hz rejection.

AC Volts: 0-0.01-0.03-0.1-0.3-1-3-10-30-100-300-1,000. Input impedance 10 megohms. Frequency range 50 Hz to 50 kHz. Capacitance at input jack 60 mm fd max.

Ohms—Low-power: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ-1,000MΩ (75 Mv open circuit voltage, 100 μW maximum power applied to device under test, 10 Ohm center scale on low range).

Ohms—Conventional: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ-1,000MΩ (1.5V open circuit voltage, 56 mW maximum power applied to device under test, 10 Ohm center scale on low range).

AC and DC Milliamperes: 0-0.01-0.1-1-10 at 100 mV.

Decibels: −60 to +62 ("0" dB is equal to .775V).

Accuracy: DC ±2% Voltage, ±3% Current; AC ±3% Voltage, ±4% Current; full scale).

Scale Length: 4⅛″.

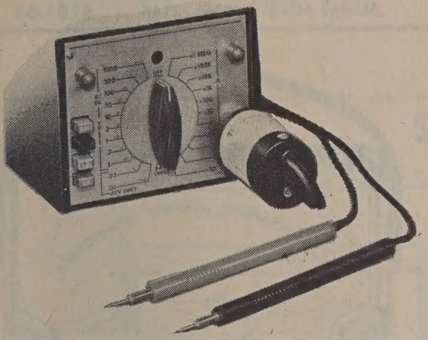
Meter: Diode overload protected suspension movement.

Case: Shielded, molded, black, 5⅛″ w X 3 3/16″ d X 6½″ h.

Batteries: NEDA 1½V 15A (10).

Complete with 48″ leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.

Model 601 Cat. No. 3033 .... **$215.00**



AC CURRENT LEAKAGE ADAPTER

Adapter used with new or existing Model 601 V-O-M's for testing appliances, motors, hand tools, industrial equipment and machines, etc. for AC current leakage. Meets proposed ANSI Standard C101.1 for commercial appliance AC Current Leakage tests.

Leakage Readings: 7 ranges, 10 μA f.s. to 30 mA f.s.

Resolution: .2 μA on lowest V-O-M range.

Accuracy: ±4% of full scale.

Frequency Response: Approximates the C.F. Dalziel's "50 Percentile threshold of Perception Curve, within ± 1.0 dB".

Input Impedance: 1500 Ω test load.

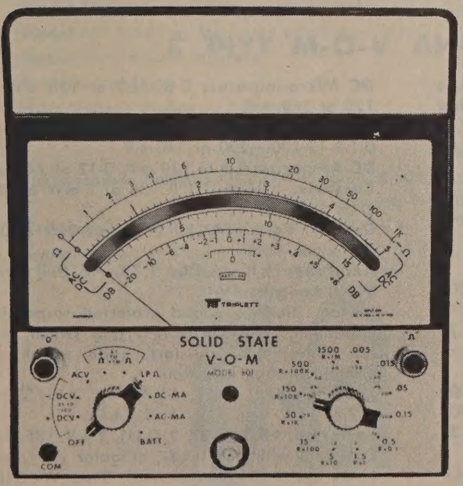
Leakage Adapter for Model 601
Cat. No. 60-407 .... **$34.30**

FET V-O-M WITH LOW POWER OHMS

MODEL 801—TYPE 2

1. **LOW-POWER OHMS—LPΩ™—8 ranges with 35 mV power source and 1 Ohm center scale.**
2. **High sensitivity—5 mV AC full scale at 10 megohm input impedance; 50 mV DC at 11 megohm input resistance.**
3. **Simplified scale—8″ meter with only 4 arcs for all 73 ranges.**

RANGES



DC Volts: 0-0.05-0.15-0.5-1.5-5-15-50-150-500-1,500. Input resistance 11 megohms with 1 megohm series resistor in probe tip. Includes 40 dB 60 Hz rejection.

AC Volts: 0-0.005-0.015-0.05-0.15-0.5-1.5-5-15-50-150-500-1,500. Input impedance 10 megohms. Frequency range 50 Hz to 50 kHz. Capacitance at input jack 60 mm fd max.

Ohms—Low-power: 0-100-1k-10k-100k-1MΩ-10MΩ-100MΩ-1,000MΩ (35 mV open circuit voltage, 35 μW maximum power applied to device under test, and 1 Ohm center scale on low range).

Ohms—Conventional: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ-1,000MΩ (1.5 open circuit voltage, 56mW maximum power applied to device under test, and 10 Ohm center scale on low range).

AC and DC Microamperes: 0-5-15-50-150-500 at 45 mV.

AC and DC Milliamperes: 0-1.5-5-15-50-150-500 at 45 mV.

AC and DC Amperes: 0-1.5 at 45 mV (Optional external shunt for 0-15A measurements).

Decibels: −70 to +66 ("0" dB is equal to .775 V).

Accuracy: DC ±2% Voltage, ±3% Current; AC ±3% Voltage, ±4% Current; (full scale).

Scale Length: 6¾″.

Meter: Diode overload protected suspension movement.

Case: Shielded, molded, black, 8″ w X 5″ d X 7″ h.

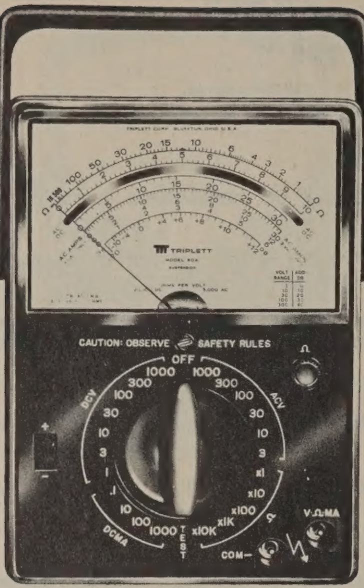
Batteries: NEDA 9V 1604 (3), 1½V 13F (1).

Complete with 48″ shielded probe, 36″ grd. lead, alligator clips, batteries and instruction manual. Shpg. Wt. 10½ lbs.

Model 801 Cat. No. 3071 ....**$265.00**

LABORATORY ACCURACY V-O-Ms

MODEL 60-A



1. **X'TRA RUGGED—Will withstand an accidental drop up to a five foot height.**
2. **OVERLOAD PROTECTED—All ranges protected by diode and unusual three fuse arrangement, including 1/8 amp, 1 amp and 2 amp/1000V fuses.**
3. **SAFETY DESIGNED FOR YOU—Designed to most rigid safety standards; completely insulated unit including newly designed safety leads.**

RANGES

DC Volts: 0-0.3-1-3-10-30-100-300-1000 (Approx. 20,000 Ohms per Volt).
AC Volts: 0-3-10-30-100-300-1000 (Approx. 5,000 Ohms per Volt).
Ohms: 0-1k-10k-100k-1MΩ-10MΩ (12 Ohms center scale on low range).
DC Microamperes: 0-100 at approx. 320mV.
DC Milliammeters: 0-10-100-1000 at approx. 320mV.
Decibels: −20 to +52 ("0"dB at 1mW on 600 Ohm line).
Accuracy: ±1½% DC; ±3% AC; (full scale).
Scale Length: 4½".
X'TRA Rugged: Will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.
Overload Protected: All ranges protected by diodes and unusual three fuse arrangement, including 1/8 amp, 1 amp and 2 amp/1000V fuses.
Safety Designed to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.
Meter: Diode overload protected ruggedized suspension movement, easily replaced integral module, DC polarity reversing switch, mirror scale, ½% resistors.
Confidence test: Reassurance check of instrument meter.
Case: Molded, black, high impact thermoplastic; easy external access to sealed battery and fuse compartment; molded plastic handle will hold tester at 30° angle; 5¼" W X 7½" H X 3¼" D.
Batteries: NEDA 9V 1604 (1), 1½V 13F (1).
Complete with 48" safety test leads, insulated alligator clips, batteries, spare 1/8A and 1A fuses and instruction manual. Shpg. wt. 4 lbs.
Model 60-A Cat. No. 3148 ....**$106.00**

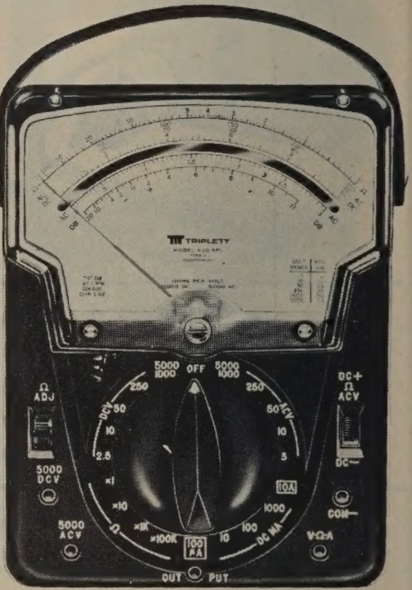
MODEL 630-APL V-O-M TYPE 4

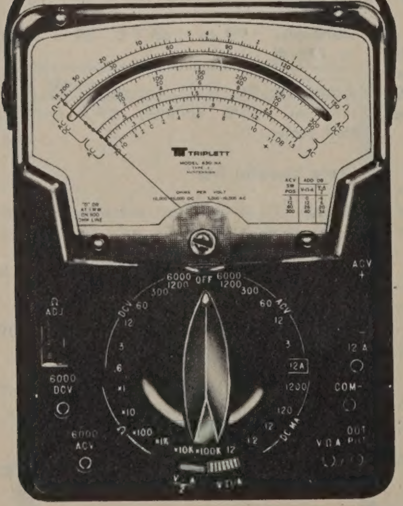
1. **Accuracy 1½% DC and 3% AC; mirrored scale; diode overload-protected suspension movement.**
2. **27 range V-O-M with single range switch minimizes error; DC polarity reversing switch.**
3. **4 ohmmeter ranges with 4.4 Ohms center scale.**

RANGES

DC Volts: 0-2.5-10-50-250-1,000-5,000 (20,000 Ohms per Volt); 0-0.25 at 100 μA.
AC Volts: 0-3-10-50-250-1,000-5,000 (5,000 Ohms per Volt). Frequency range 10 Hz to 500 kHz.
Ohms: 0-1k-10k-1MΩ-100MΩ (4.4 Ohm center scale on low range).
DC Microamperes: 0-100 at 250 mV.
DC Milliamperes: 0-10-100-1,000 at 250 mV.
DC Amperes: 0-10 at 250 mV.
Decibels: −20 to +49 ("0" dB at 1 mW on 600 Ohm line).
Output Volts (AC): 0-3-10-50-250 (5,000 Ohms per Volt).
Accuracy: ±1½% DC; ±3% AC; (full scale).
Scale Length: 4½".
Meter: Diode overload protected suspension movement, DC polarity reversing switch, mirror scale, ½% resistors.
Case: Molded, black, 5½" w X 3-11/32" d X 7½" h.
Batteries: NEDA 30V 210 (1), 1½V 13F (1).
Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. wt. 5 lbs.
Model 630-APL Cat. No. 3038 .... **$94.00**

Model 630-APLK: Similar to Model 630-APL with solid-state switching circuit overload protection for burnout protection of entire tester. Cat. No. 3120.
$136.00





MODEL 630-NA V-O-M TYPE 3

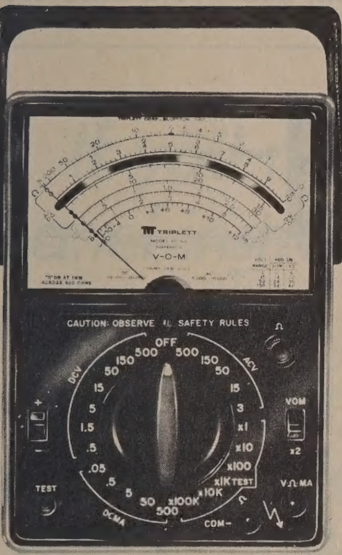
1. **70-range V-O-M with single range switch and DC polarity-reversing switch.**
2. **Accuracy 1½% DC and 3% AC; mirrored scale.**
3. **Diode overload-protected suspension movement; temperature compensation.**

RANGES

DC Volts: 0-0.6-3-12-60-300-1,200-6,000 (10,000 Ohms per Volt). 0-0.3-1.5-6-30-150-600-3,000 (20,000 Ohms per Volt). 0-0.120 at 60 microamperes; 0-0.240 at 120 microamperes.
AC Volts: 0-3-12-60-300-1,200-6,000 (5,000 Ohms per Volt). 0-1.5-6-30-150-600-3,000 (10,000 Ohms per Volt). Frequency range 35 Hz to 20 kHz.
Ohms: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ (4.4 Ohm center scale on low range).
DC Microamperes: 0-60-600 at 120 mV; 0-120 at 240 mV.
DC Milliamperes: 0-6-60-600 at 120 mV; 0-1.2-12-120-1,200 at 240 mV.
DC Amperes: 0-6 at 120 mV; 0-12 at 240 mV.
Decibels: −26 +51 ("0" dB at 1 mW on 600 Ohm line).
Output Volts (AC): 0-3-12-60-300 (5,000 Ohms per Volt).
Accuracy: ±1½% DC; ±3% AC; (full scale).
Scale Length: 4½".
Meter: Diode overload protected suspension movement, DC polarity reversing switch, mirror scale, ½% resistors, slide switch for doubling range selection.
Case: Molded, black, 5½" w X 3-11/32" d X 7½" h.
Batteries: NEDA 30V 210 (1), 1½V 13F (1).
Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.
Model 630-NA Cat. No. 3042 .... **$118.00**

LABORATORY ACCURACY V-O-Ms

MODEL 60-NA



1. **X'TRA RUGGED—50ranges with mirror scale and ±1½% DC accuracy—will withstand an accidental drop up to a five foot height.**
2. **OVERLOAD PROTECTED—All ranges protected by diode and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.**
3. **SAFETY DESIGNED FOR YOU—Designed to most rigid safety standards; completely insulated unit including newly designed safety leads.**

RANGES

DC Volts: 0-0.15-0.5-1.5-5-15-50-150-500 (Approx. 20,000 Ohms/Volt).

X2: 0-0.3-1-3-10-30-100-300-1000 (Approx. 10,000 Ohms/Volt).

AC Volts: 0-3-15-50-150-500 (Approx. 10,000 Ohms/Volt).

X2: 0-6-30-100-300-1000 (Approx. 5,000 Ohms/Volt).

Ohms: 0-1k-10k-100k-1MΩ-10MΩ-100MΩ (6 Ohm center scale on low ranges).

DC Microamperes: 0-50-500 at approx. 150mV.

X2: 0-100 at approx. 300mV.

DC Milliammeters: 0-5-50-500 at approx. 150mV.

X2: 0-1-10-100-1000 at approx. 300mV.

Decibels: −20 to +52 ("O"dB at 1mW on 600 Ohm line).

Accuracy: ±1½% DC: ±3% AC (Full scale).

Frequency Response: ACV through 300 compensated from 20Hz to 20kHz.

Scale Length: 4½".

X'TRA Rugged: Will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.

Overload Protected: All ranges protected by diodes and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.

Safety Designed to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.

Meter: Diode overload protected ruggedized suspension movement, easily replaced integral module, DC polarity reversing switch, X2 range doubling switch, mirror scale, ½% resistors.

Confidence Test: Reassurance check of instrument meter.

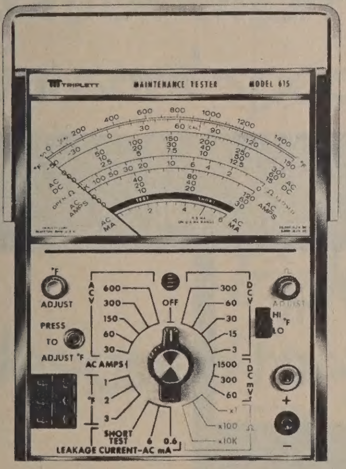
Case: Molded, gray, high impact thermoplastic, easy external access to sealed battery and fuse compartment; molded plastic handle will hold tester at 30° angle; 5¼"W x 7½"H x 3¼"D.

Batteries: NEDA 30V 210 (1), 1½V 13F (1). Complete with 48" safety test leads, insulated alligator clips, batteries, spare ⅛A and 1A fuses and instruction manual. Shpg. wt. 4 lbs.

Model 60-NA Cat. No. 3151 .... **$136.00**

SPECIAL FEATURE V-O-Ms

MODEL 615 MAINTENANCE TESTER



1. **Maintenance tester . . . measures AC/DC Volts, Ohms, temperature and AC current leakage.**
2. **Two electrically compensated temperature ranges with switch selection for up to three temperature probes; ideal for air-conditioning, refrigeration maintenance.**
3. **Low millivolt ranges for thermocouple circuit touble-shooting; special scale for direct reading of AC Amps with clamp-on adapter accessory.**

RANGES

DC Volts: 0-.06-.3-1.5-3-15-30-60-300 (20,000 ohms/volt).

AC Volts: 0-3-30-60-150-300-600 (5,000 ohms/volt).

Ohms: 0-1K-100K-1MΩ. 10 ohm center scale on low range.

AC Amperes: (requires accessory Model 20-A Adapter) 0-6-12-30-60-120.

Temperature: −50°F to +150°F; −50°F to +1500°F.

AC Current Leakage: (through a network that simulates the human body. Short test and 0-0.6-6mA AC for ANSI C101.1—1971 commercial appliance AC Current Leakage Tests.

Accuracy: ±2% DC Voltage and Ohms ranges: ±3% AC Voltage and temperature ranges, ±4% AC Current Leakage ranges, ±8% AC Ampere ranges (basic VOM ±3%, Adapter ±5%).

Scale Length: 4½".

Meter: Diode overload protected suspension movement.

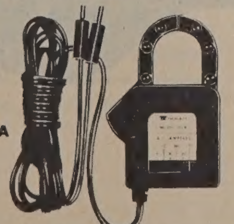
Case: Black, molded high impact plastic, 5⅛" W x 3$\frac{3}{16}$" D x 6½" H.

Batteries: NEDA 9V 1604 (2), 1½V 13F (1). Complete with 48" leads, 6' thermocouple probe, alligator clips, batteries and instruction manual. Shpg. Wt. 2½ lbs.

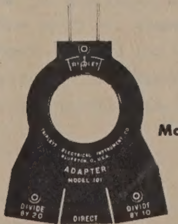
Model 615 Cat. No. 3127 .... **$170.00**

OPTIONAL ACCESSORIES

Model 10 Clamp-on AC Ammeter Adapter	Cat. No. 60-211	**$25.00**
Model 611 Leads — Model 10 attachment lead.	Cat. No. 79-160	**4.90**
Model 101 AC Line Separator	Cat. No. 60-218	**11.00**
Replacement Leads	Cat. No. 79-127	**4.90**
High Voltage Probes — 0-30KVDC	Cat. No. 79-70	**27.00**
0-30KVAC	Cat. No. 79-71	**27.00**
0-60KVAC	Cat. No. 79-152	**27.00**
Thermocouple Probes — General Purpose, Replacement, 6'.	Cat. No. 79-340	**10.60**
Heavy Duty, Stainless Steel Sheath, 6'.	Cat. No. 79-339	**15.50**
Carrying Case — Black leather, Model 639-OS.	Cat. No. 10-1793	**22.20**
Carrying Case — Black molded plastic, with foam insert, holds tester and accessories.	Cat. No. 10-2691	**24.90**



Model 20-A



Model 101

MAINTENANCE TESTER KIT

Model 615-K, complete with Model 615, Model 20-A, Model 101, black molded case, 48" leads, 6' thermocouple probe, alligator clips, batteries and instruction manual.

Cat. No. 3128 .... **$234.00**

TRIPLETT

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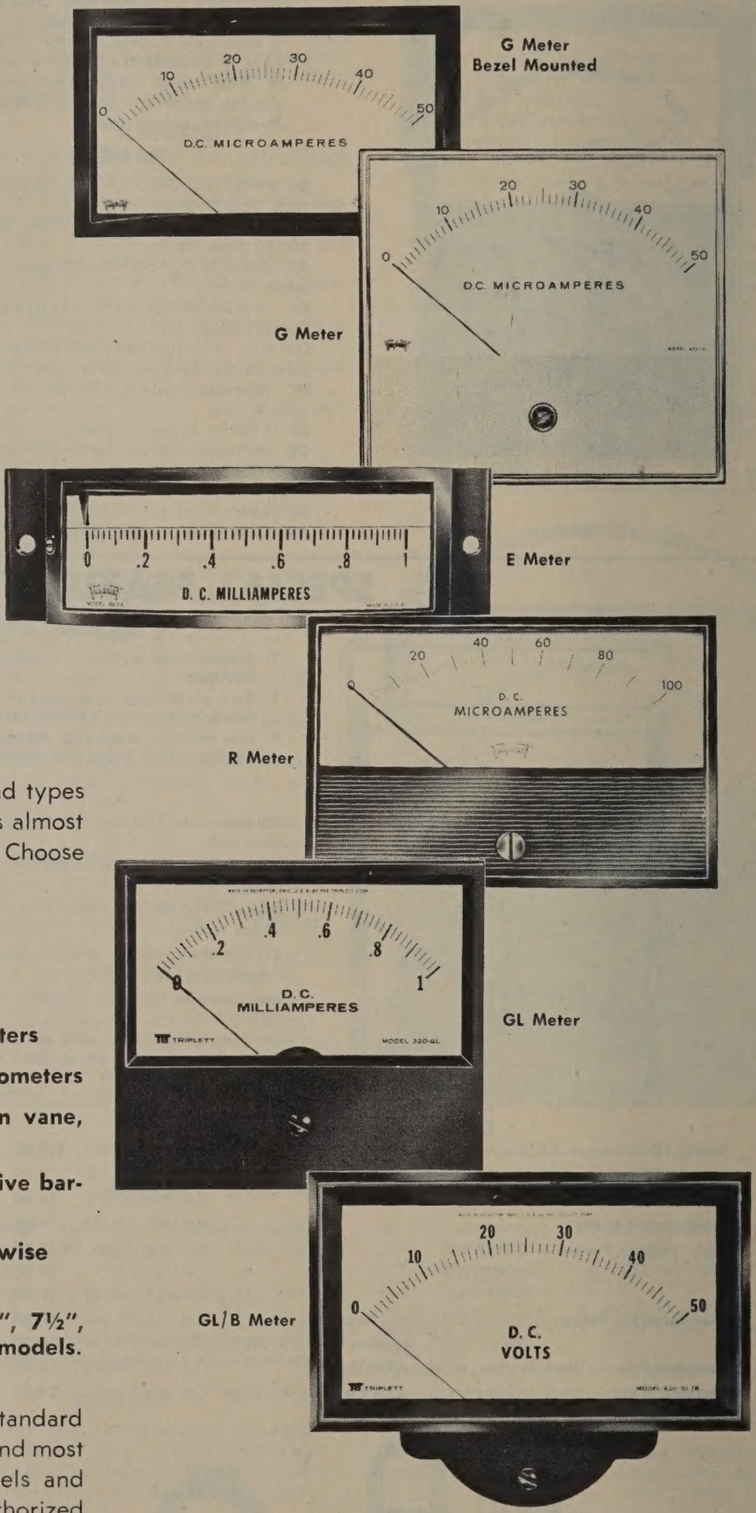
TRIPLETT CORPORATION, BLUFFTON, OHIO 45817

For your standard panel instrument needs... Buy Triplett's off the shelf Panel Instruments


G Meter
Bezel Mounted
D.C. MICROAMPERES
G Meter
D.C. MICROAMPERES
E Meter
D. C. MILLIAMPERES
R Meter
D. C.
MICROAMPERES
GL Meter
D.C.
MILLIAMPERES
TRIPLETT
MODEL 320-GL
GL/B Meter
D. C.
VOLTS
TRIPLETT

With 1369 different sizes, styles and types of analog panel instruments, there's almost certainly one to suit your needs. Choose from:

- **AC, DC, and RF types**
- **Volt, millivolt and VU meters**
- **Amp, milliamp and microamp meters**
- **Null meters, ohmmeters and pyrometers**
- **Pivot and jewel, suspension, iron vane, d'Arsonval**
- **All DC movements contain exclusive bar-ring self shielded magnet**
- **½", 1½", 2½", 3½", 4½" edgewise types**
- **1½", 2½", 3½", 4½", 5½", 6½", 7½", 8½" round, square & rectangular models.**

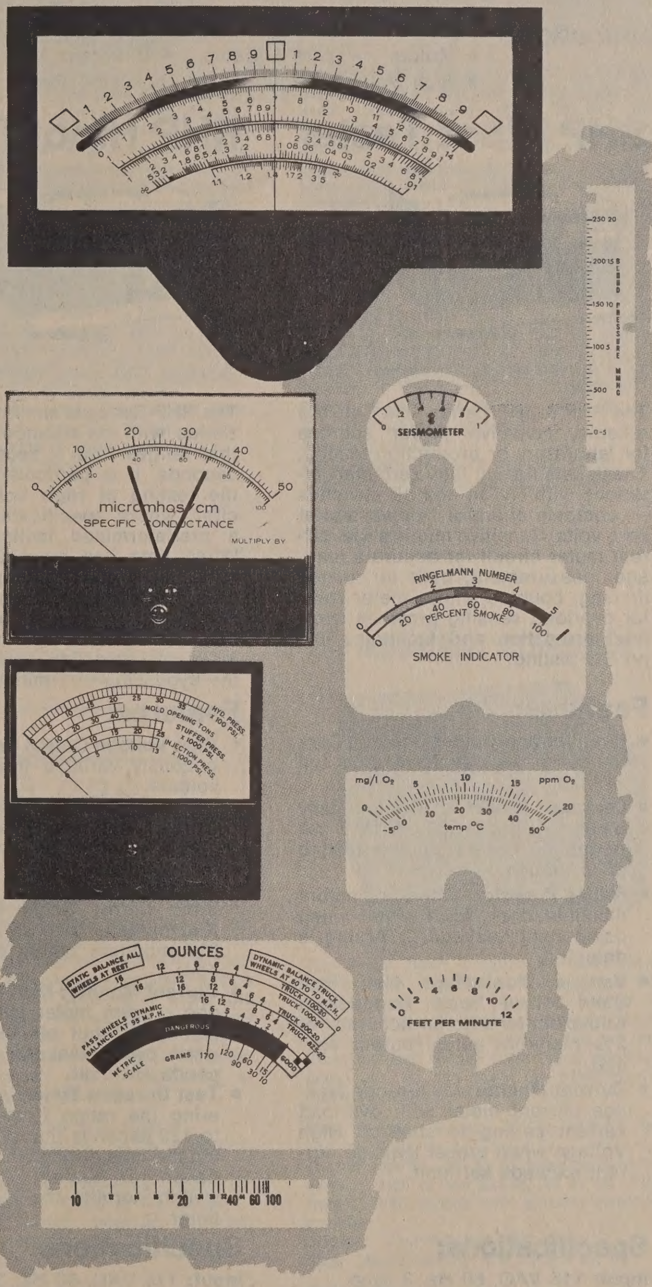
In addition to a large stock of standard models at the Bluffton, Ohio, plant and most Triplett distributors, standard models and specials are available from 40 authorized Sales / Service / Modification Centers throughout the United States and in Canada.

TRIPLETT

TEL: (419) 358-5015 TWX 810-490-2400
DEPT. EM **TRIPLETT CORPORATION, BLUFFTON, OHIO 45817**

If you need panel instruments with custom dials, cases, accuracy, tracking, resistance, response time, or practically any combination of unusual specs...

Buy Triplett's designed-for-you Panel Instruments


micromhos/cm
SPECIFIC CONDUCTANCE
MULTIPLY BY
SEISMOMETER
BLOOD PRESSURE MMHG
RINGELMANN NUMBER
PERCENT SMOKE
SMOKE INDICATOR
HYD PRESS x 100 PSI
MOLD OPENING TONS
STUFFER PRESS x 1000 PSI
INJECTION PRESS x 1000 PSI
mg/l O2
ppm O2
temp °C
OUNCES
STATIC BALANCE ALL WHEELS AT REST
DYNAMIC BALANCE TRUCK WHEELS AT 60 TO 70 M.P.H.
TRUCK 1100-20
TRUCK 1000-20
TRUCK 900-20
TRUCK 825-20
PASS WHEELS DYNAMIC BALANCED AT 95 M.P.H.
DANGEROUS
GOOD
METRIC SCALE
GRAMS
FEET PER MINUTE

Although we stock some 1369 different styles, sizes and types of standard panel instruments, a very large proportion of our customers buy custom instruments.

Because they need:

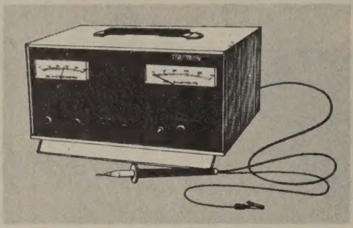
Custom Dials. Reading in such units as pH, roentgens, mm Hg, rpm, %, inches. **Custom Cases.** Square, round, rectangular, edgewise (horizontal and vertical), wide, narrow, shallow. **Custom Ranges.** 0-28.4, 25-0-75, 80-220, 75-0 or virtually any electrical range not listed in catalog. **Custom Accuracy.** To within ½% with mirror scales and knife-edge pointers. **Custom Tracking.** To match the specific needs of existing or new instrument designs. **Custom Resistance.** For low circuit loading with tolerances as low as ±1%. **Custom Damping.** To meet stringent electrical and vibration requirements. What custom panel instrument specifications do you need to make your product more reliable, more accurate, more rugged and — in the long run — less expensive? For quick, dependable delivery of small quantities of Triplett's "designed-for-you" panel instruments, contact your Triplett Sales/Service/Modification Center. For prototypes or production quantities, contact your Triplett representative. He'll put you in touch with our Instrument Designers/Engineers who'll help you analyze the problem and suggest the optimum cost/result solution.

TOROTRON CORP. DEPT. EM, 255 WASHINGTON ST., MT. VERNON, NY 10553, (914) 664-2050

AC/DC Hipot Insulation Tester

Application: • Production testing for insulation resistance, Dielectric withstand, etc. • High Voltage Capacitor • Motors • Wire & Cable • Dielectric Materials • Transformers & Coils • Bushing & Insulators • High Voltage Rectifiers • UL Listed Electrical Hi Pot Tests.

SHP Hipot Tester



The RHP & SHP Series Test Sets are reliable, sensitive power sources for laboratory or production testing. These sets having fully zero start interlock with HV on and off switches — compels operator to start test at zero volts. Sensitive multi-range current meter circuit for accurate leakage measurement, built in current limiting, coupled with a meter relay for overload sensing provides overload protection and facilitates GO no GO testing.

Features:

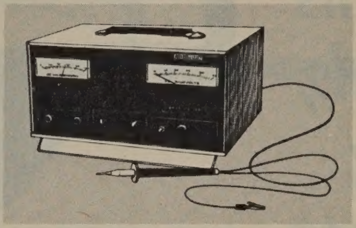
- **High Voltage Output Control:** Continuously variable from 0 to full voltage.
- **Leakage Detector:** Continuously adjustable from 500 μA to 5 mA permitting non-destructive testing of insulation.
- **Arcing Detector:** Visual Indicators illuminated on front panel when component Leakage or Arcing is detected.
- **Voltage Monitoring:** 4½″ Taut Band Mirror Scale Ruggedized Kilovoltmeter with an accuracy of 2% monitors actual output voltage.
- **Current Monitor:** Multi-range leakage current meter with overload current setting to shut off High Voltage when preset leakage current exceeds set limit.

Specifications:

Input: 115 VAC, 60 Hz, 3 Amp.
Size & Weight: 9½″H x 17″W x 11″D. Approx. 22 lbs.
Meter: 2% full scale accuracy. 4½″ ruggedized meter.

DC Model	Output Voltage	Current Meter Range	Price 1-5
SHP-02	2 KVDC	50 μA 500 μA 5000 μA	$400
SHP-04	4 KVDC		425
SHP-07	7 KVDC		440
SHP-12	12 KVDC		460

RHP Hipot Tester



The RHP Series is similar to the SHP Series, with the addition of a TIMER that ranges from 2 seconds to 120 seconds. It is particularly useful in the testing of High Voltage Capacitor, where specification calls for a predetermined testing duration. When time has elapsed the timer shuts the High Voltage off and places a short circuit on output terminals so as to discharge the circuit and permit safe removal of test leads. An override switch permits the bypassing of Timer Unit.

Features:

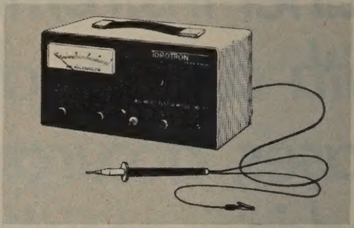
- **High Voltage Output Control:** Continuously variable from 0 to full voltage.
- **Leakage Detector:** Continuously adjustable from 500 μA to 5 mA permitting non-destructive testing of insulation.
- **Voltage Monitoring:** 4½″ Taut Band Mirror Scale Ruggedized Kilovoltmeter with an accuracy of 2% monitors actual output voltage.
- **Current Monitor:** Multi-range leakage current meter with overload setting to shut off High Voltage when preset leakage current exceeds set limit.
- **Test Duration Timer:** A timer covering the range from 2 seconds to 120 seconds that permits limiting the time during which the component is tested. An override switch permits the bypassing of timer.

Specifications:

Input: 115 VAC, 60 Hz, 3 Amp.
Size & Weight: 9½″H x 17″W x 11″D. Approx. 22 lbs.
Meter: 2% .full scale accuracy. 4½″ ruggedized meter.
Timer Range: 2-120 seconds.

DC Model	Output Voltage	Current Meter Range	Price 1-5
RHP-02	2 KVDC	50 μA 500 μA 5000 μA	$450
RHP-04	4 KVDC		480
RHP-07	7 KVDC		520
RHP-12	12 KVDC		580

THP Hipot Tester



The THP AC/DC testers are Hi Quality Low Cost Production HI POT Testers. Designed for use by unskilled personnel.

Features:

- **High Voltage Output Control:** Continuously variable from 0 to full voltage.
- **Leakage Detector:** Continuously adjustable from 500 μA to 5 mA permitting non-destructive testing of insulation.
- **Arcing Detector:** Visual indicators illuminated on front panel when component Leakage or Arcing is detected.
- **Voltage Monitoring:** 4½″ Taut Band Mirror Scale Ruggedized Kilovoltmeter with an accuracy of 2% monitors actual output voltage.

Specifications:

Input: 115 VAC, 60 Hz, 3 Amp Max.
Size & Weight: 7″H x 12″W x 6″D. Approx. 18 lbs.
Meter: 2% full scale accuracy. 4½″ ruggedized meter.
Output: Shielded Hi Voltage Probe.
Short Circuit Current: 18 mA.

For "Audio Alarm and latching relay" add "-AD" to Part Number and $30 to Price. Example: THP-05-AD.

AC Model	Output Voltage	Price 1-5
THP-02	2 KVAC	$175
THP-03	3 KVAC	185
THP-05	5 KVAC	200
THP-10	10 KVAC	315

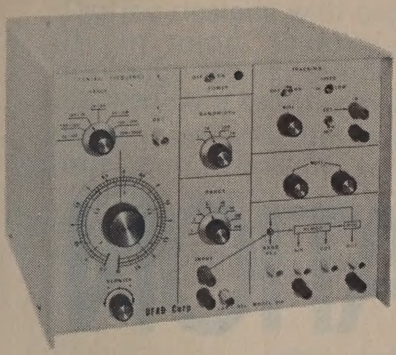
DC Model	Output Voltage	Price 1-5
THP-03D	3 KVDC	$185
THP-04D	4 KVDC	200
THP-07D	7 KVDC	220
THP-12D	12 KVDC	325

NOTES: • HiPot Testers available in many other voltage ratings and features. Consult factory for modifications. • All output voltages referenced to ground. Floating output available on request.

Additional Features: • Zero Start Interlock • Audible Failure Signal

Specification and price subject to change without notice.

LAB-ALL



Wide ranging signal analysis capability: Simultaneous Frequency, Amplitude, Phase and Distortion outputs.

The LAB-ALL is configured as a high performance 'Front End' for your standard lab instruments (Scope, DVM and frequency counter).

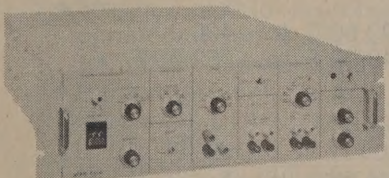
Frequency Range: 30Hz to 100kHz.
Input Range: 30mV to 300VRMS.
Tracking Range: 20:1.
Four analysis bandwidths.
Excellent accuracy.

Functions:
- Tracking Bandpass/Notch Filter
- Wave Analyzer
- Distortion Analyzer
- Network Analyzer
- Spectrum Analyzer
- Phase Sensitive Voltmeter
- Phase Meter
- Servo Analyzer . . . . . and more!

Applications:
- Lab signal analysis
- Doppler shift measurements
- Rotational machinery balancing
- Determining transmission line attenuation and phase shift
- Speaker & microphone testing
- Noise measurements
- Amplifier distortion, phase response & amplitude testing
- Analyze low-pass and high-pass filter characteristics

$2495

PROGRAMMABLE DISTORTION ANALYZER



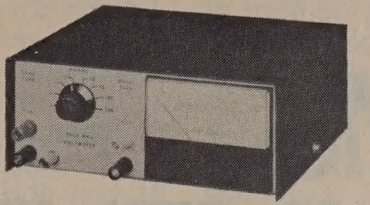
The DA-72 is a fast, accurate system component for automated distortion analysis. Its functions are programmed by binary coded command signals from a computer or other system controller.

Frequency Range: 20Hz-100kHz (phase locked).
Input Range: 30mV to 300VRMS.
Distortion Range: 0.3% to 100%.
Speed: Up to 10 measurements/sec.
Four analysis bandwidths.
Local or remote operation.
Control lines: 19 parallel, TTL.
Distortion measurements are made by an RMS responding converter with high accuracy.

Outputs: Distortion & fundamental; 0-3VDC, calibrated. Distortion & fundamental; 0-3VAC, uncalibrated. Analyzer oscillator signal; approximately 2VAC (center frequency).

$3500

TRUE RMS VOLTMETER

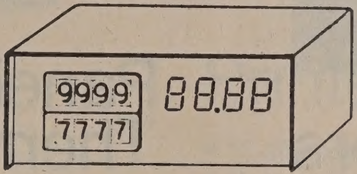


An accurate, wideband true RMS voltmeter with a modest price. The low cost and excellent performance are possible because of a proprietary computational RMS converter design. A 3½ inch, taut-band, mirrored scale meter is standard. The converter output is on the front panel for ease of use. The output is scaled 0 to +1VDC on the "Ones" ranges and 0 to +3VDC on the "Threes" ranges to simplify interpretation of the data.

Frequency Range: 10Hz to 1MHz.
Voltage Range: 733A 100mV to 300V full scale.
733B 30mV to 100V full scale.
733C 3mV to 10V full scale.
Response: Root-mean-square (ANY waveshape).
Basic Accuracy: ±1% of full scale.
Crest Factor: Greater than 5.5:1 at full scale.
Converter Accuracy: ±0.25% of full scale.
Power: 115 or 230V, 2 watts.
Size: 8"w x 3.5"h x 7.5"d.

$345

INDUSTRIAL TACHOMETER

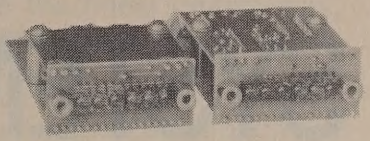


The basic tachometer is a 4-digit rate indicator (RPM, FPM, Hz, etc.) which can be set to read in engineering units by a DIP-switch programmable time base and selectable decimal point location. Setpoints are optional, with a choice of one or two setpoints of either two or four digits each. The setpoints each have three clocked outputs: Display < Setpoint, Display = Setpoint and Display > Setpoint. Dual setpoint models may be configured as double-ended limit comparators.

Display: Four 0.3 inch LED digits.
Time Base: Programmable, .01 to 2 seconds.
Display Update: 1 or 2 second intervals.
Setpoints: Digital by thumbwheel switches.
Outputs: Buffered 5V CMOS (2 TTL loads).
Input: Accepts various magnetic, optoelectronic and other sensors with 5V outputs.
Power: 115VAC.

From $225

MINIATURE EVENT COUNTER AND DOWN-TIME CLOCK

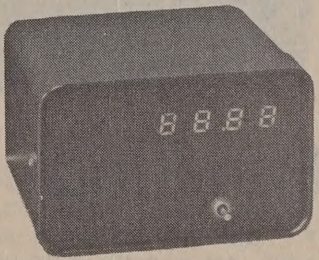


The miniature event counter and its companion down-time clock are both 6-digit devices. The event counter displays up to 999,999 counts. The down-time clock accumulates to 99,999.9 minutes. Operation: The down-time clock senses the counter input and automatically starts if no input occurs within a preset delay time (up to 1 min.). The down-time count continues until the count input returns, then stops and reactivates the time delay, to be ready if the count input ceases again. The counter and clock are available singly or assembled into custom multi-unit systems with DC supply, battery backup and other options.

Size: 1.8"w x .85"h x 3.25"d (each).
Count Rate: 2400 counts per minute (counter).
Display: 6 LED digits, .11"h (magnified).
Power: 6-9VDC, < 0.5W each with display on.
Display Blanking: Standard.
Reset: External.
Count Input: Form A contact closure, electronic switches with 6-9VDC outputs.

$44.50 Counter
$59.50 Clock

INDUSTRIAL STOPCLOCK



This 4-digit timer is suited for many different applications. It offers a choice of five timing ranges, eight remote triggering options (four AC and four DC) and an optional selector switch for up to 6 separate trigger inputs. Other features include: Easy panel mounting or bench use, AC line power, an easily read LED display, small size and low cost.

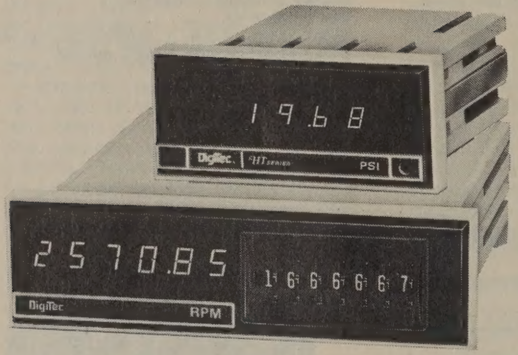
Time Ranges: 9.999s, 99.99s, 999.9s, 9999s and 9.999min.
Trigger Inputs: Up to 6, pulse or maintained contact, high or low active, AC or DC. Trigger from 115VAC signals with optional transformer module.
Display: Four 0.3 inch LED digits.
Size: Approximately 4"w x 2.5"h x 4"d.

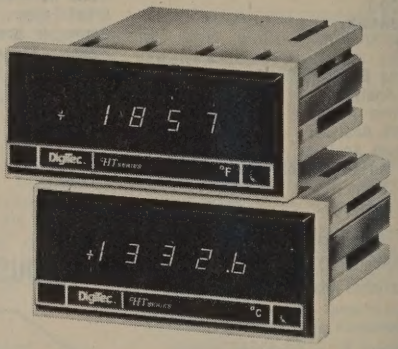
From $140

UFAD CORPORATION

700 THIRTY-SIXTH STREET SE
GRAND RAPIDS, MI 49508
(616) 241-6000

SYSTEMS INSTRUMENTATION





Panel Indicators

- 71 different models
- 3½, 4½ or 6 digit LED display
- DCV, DCA & Autoranging
- ACV (Avg.), ACV (true rms)
- Accepts an input current, voltage or pulses from any transducer/transmitter and displays in desired engineering units. (i.e., 4-20 mA, 1-5V, dc-1MHz)
- Rotational or linear measurements (RPM, IPS, FPM, Hz or any other unit)
- Flow rate or total flow measurements (bbls/hr, gals/min, bbls, gals, liters or other volume units)
- Pressure or force measurements (psi, lbs, kg or other units)
- Ratio measurements for draw or % of elongation
- 115/230V ac or 5V dc operation
- Buffered parallel BCD output with "single line enable" for systems compatibility
- Field programmable; thumbwheel switches or rear connector

Panel Mount Thermometers

- 28 different models
- 3½ and 4½ digit LED display
- Thermistor: −30.00°C to +100.00°C
  −22.00°F to +199.99°F
- Platinum Resistance: −100.00°C to +400.00°C
  −148.00°F to +752.00°F
- Thermocouple:

TYPE	°C	°F
E	− 98.0° to +1000.0°C	−144.0° to +1832.0°F
J	−180.0° to + 760.0°C	−292.0° to +1400.0°F
K	− 20.0° to +1372.0°C	000.0° to +2500.0°F
T	−152.0° to + 400.0°C	−240.0° to + 752.0°F

- Accuracy to 0.3°C or 0.5°F
- 115/230V or 5VDC Operation
- Buffered parallel BCD output with single line multiplex to eliminate complex BCD switching
- Sample on command

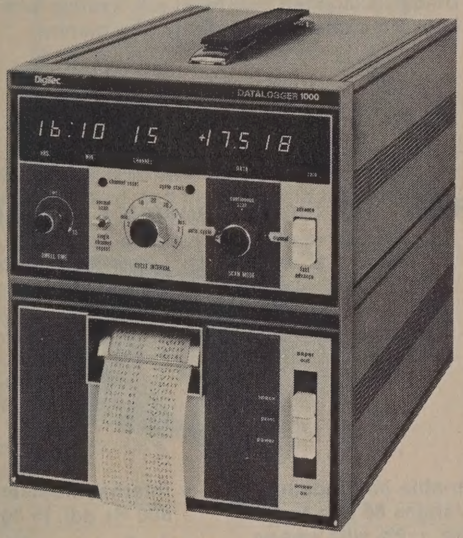
DigiTec designs with quality and reliability in mind. Quality is assured by thorough testing during production and backed by a full year warranty.

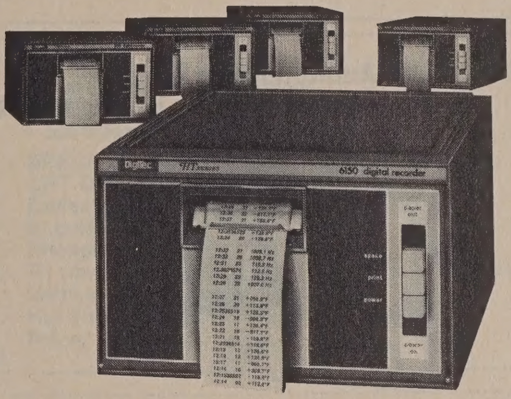
Easy maintainability is a by-product of our construction technique. This, coupled with our 30 worldwide and 18 domestic service centers gives you the edge in minimum downtime.

In addition to panel meters and printers, we manufacture the finest multimeters, thermometers, counters and data acquisition systems.

For complete details of our product line, please contact us or our representative in your area.

DigiTec: precision measurements to count on!





Dataloggers

- 20,000 count (4½ digit) display of measured data
- Continuous visual display of all information, data, time and channel
- 20 internal channels (field expandable to 100)
- Hardcopy printout of all displayed data with 2 colors and data separation
- 30 different field-interchangeable, signal conditioning modules supply different parameter capabilities
- Parameters include: ACV, DCV, ACV (true rms), DCV (autoranging), Temperature (RTD-Thermistor or Thermocouple), and scaled modules for transducer/transmitter outputs
- FET or relay switching
- Internal crystal clock supplies real or elapsed time display
- Compact size and weight affords portability
- Low power consumption
- 9 selectable cycle intervals from 1 min. to 5 hours
- Unlimited alarm capability
- Optional BCD outputs
- Simplicity of operation, no special training required for operator

Printers

- 12 different models
- Numeric or alpha-numeric configuration
- Fast front panel loading
- Up to 21 column capacity
- Models with intervals event counter and clock
- Inputs: parallel, serial/parallel, or serial RS232
- Floating decimal
- Column blanking on command
- Red and black printing or electro-sensitive
- Mean time between failure—25,428 hours
- OEM configurations

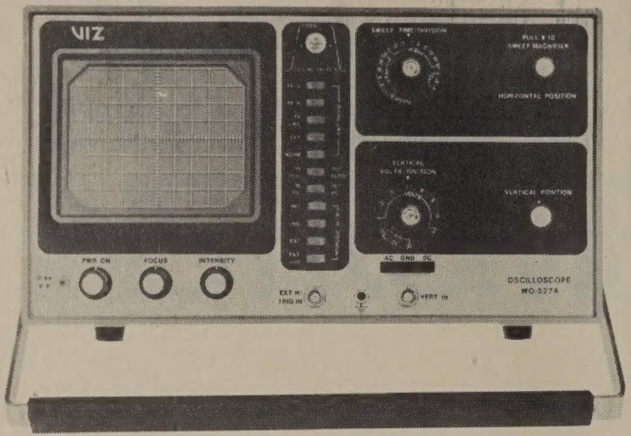
DigiTec.

**UNITED
SYSTEMS
CORPORATION**

918 Woodley Road, Dayton, Ohio 45403
(513) 254-6251, TWX (810) 459-1728

WO-527A 15 MHz. Trigger Sweep Scope

$479.00

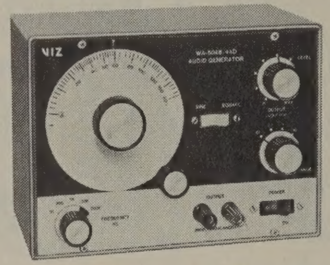


VIZ

- Freq. resp. DC to 15 MHz (−3 dB) sensitivity 10 mV/cm. to 20V in 11 ranges. Rise time 24 n. sec. Horz. Osc. Freq. DC to 1MHz.
- Trigger mode normal or auto freq. resp. DC to 30 MHz.
- Calibrated time base 0.5μ sec. to 0.5 sec., 19 ranges.
- Preset TVV and TVH plus special TV line selector to display single line of TV video frame.
- Times 10 sweep Mag. advanced I.C. circuitry thru-out full shield CRT with P-31 Phos.
- Unique simplified trig. level adj. system with LED indicators show trig. polarity at a glance.

WA-504B/44D Audio Sine/Sq.-Wave Generator

$120.00



- Output 20 Hz to 200 kHz in 4 ranges, stability ± 0.5% and ± 5% dial cal.
- Voltage output 4 ranges 0.01 to 10V at 600Ω.
- Sine wave harmonic distortion 0.15% sq. wave rise and fall 150 ns., tilt 2%.
- All solid-state, throughout, 3 wire AC cord.

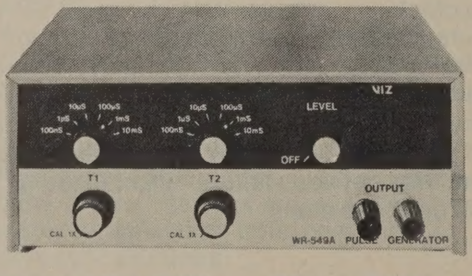
WR-50C RF Signal Generator

$120.00

- Tunable on fundamental 6 ranges 85 kHz to 40 MHz ± 2% with sweep output at 455 kHz and 10.7 MHz plus External xtal.
- RF output 0.05V rms, 2 step 10 to 1 plus fine adj. attenuator.
- Internal Modulating freq. 600 Hz adj. to 80%.
- Audio output 6V rms across 15 kΩ load.
- FET amplifier for rugged stability, 3 wire AC cord.

WR-549A Pulse Generator

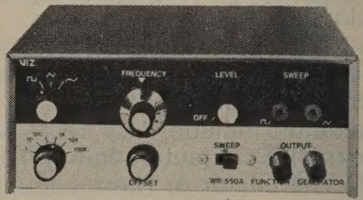
$119.00



- Freq. range 5 Hz to 5 MHz ±5% output adj. 0-15V into 600Ω, 0-6V into 50Ω.
- Pulse width adj. 100 ns. to 0.1 sec. rise and fall time 20 ns.
- TTL and CMOS compatible, on and off time independently adj.
- Ideal for logic design or digital circuit trouble-shooting
- 3 wire AC cord.

WR-550A Function Generator

$139.00



- Sine, sawtooth and sq. wave output 1 Hz to 1MHz.
- Peak to peak output 0-20V at 600Ω plus 10V adj. offset.
- 10 to 1 freq. sweep with ext. sweep voltage of any wave form.
- Freq. stability 200 PPM/°C, accuracy to 100 kHz ± 5% of dial above 100 kHz ± 8%.
- TTL and CMOS compatible with sq. and sawtooth fix output 4 VDC.
- 3 wire AC cord.

VIZ

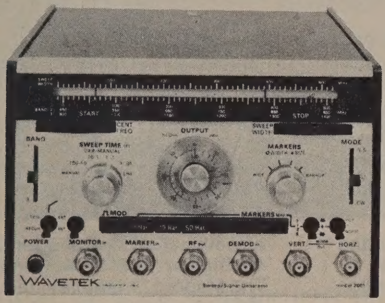
Test Instruments Group
of VIZ Mfg. Co.
335 E. Price St. Philadelphia, Pa. 19144 (215) 844-2626

These instruments are available through local VIZ distributors

formerly
RCA
Instruments

WAVETEK®
INDIANA INCORPORATED

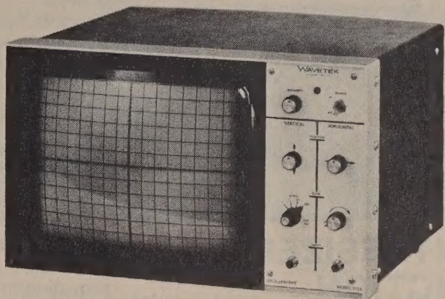
MODEL 2001 SWEEP SIGNAL GENERATOR



- **1 MHz to 1400 MHz in one unit.**
- **Ideal for both broad and narrow-band applications.**
- **Calibrated RF output system.**
- **Manual, triggered, or recurring sweep mode.**
- **Excellent flatness and display linearity.**

SPECIFICATIONS
Frequency Range: 1 to 1400 MHz.
RF Output:
Continuously adjustable from +10 dBm to -80 dBm.
Display Linearity: 2%.
Output Flatness: ±0.5 dB.
Spurious Signals: -30 dB.
Marker Accuracy: 0.005%.
Price: $1,950.

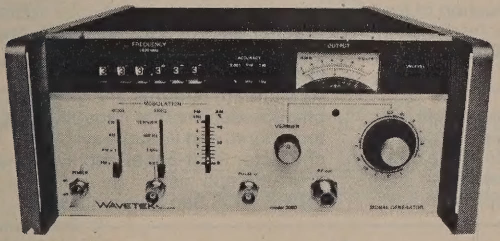
MODEL 1901C DISPLAY OSCILLOSCOPE



- **Large 12-inch diagonal CRT.**
- **1 mV/ division sensitivity.**
- **Bright, well-focused trace.**
- **Ideal for production test applications.**

SPECIFICATIONS
CRT Display: 12-inch diagonal.
Deflection: Magnetic.
Acceleration Voltage: 9 kV nominal.
Phosphor:
P1 (medium persistence); P4 and P7 available as options.
Vertical Bandwidth: DC to 15 kHz.
Horizontal Linearity: 3%.
Price: $545.

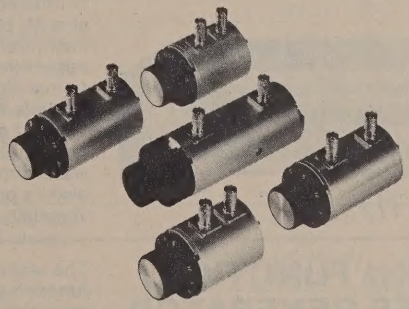
MODEL 3000 SIGNAL GENERATOR



- **1 MHz to 520 MHz with 1 kHz resolution.**
- **Over-all frequency accuracy of 0.001%.**
- **Phase-lock stability.**
- **Built-in frequency programmability.**
- **Calibrated output from +13 dBm to -137 dBm.**
- **Internal and external AM/FM capability.**

SPECIFICATIONS
Frequency Range: 1 MHz to 520 MHz.
Resolution: 1 kHz.
Accuracy: CW and AM modes: 0.001%.
Stability: CW and AM modes: 0.2 PPm/hour.
Power Level: +13 dBm to -137 dBm.
Residual FM: Typically 200 Hz.
AM/FM Modulation: Internal—400 Hz and 1 kHz.
Programmability: Frequency is digitally programmable.
Price: $2,400.

SERIES 5000 ATTENUATORS



- **Broadband operation.**
- **Low VSWR.**
- **High repeatable accuracy.**
- **Ideal for systems manufacturers, plant and field use.**

SPECIFICATIONS
Frequency Range: DC to 2,000 MHz.
Impedance: 50 ohms (75-ohm units also available).
Attenuation:
Model 5001: 0–1 in 0.1 dB steps.
Model 5010: 0–10 in 1 dB steps.
Model 5070: 0–70 in 10 dB steps.
Model 5080: 0–80 in 1 dB steps.
Prices: Models 5001, 5010, and 5070: $95.
Model 5080: $195.

WAVETEK®
Indiana Incorporated
66 North First Avenue, P.O. Box 190
Beech Grove, Indiana 46107 (317) 783-3221

WAVETEK® P.O. Box 651, San Diego, CA 92112 Phone (714) 279-2200. TWX 910-335-2007

30 MHz FUNCTION GENERATOR

Model 162

The Model 162 provides an extremely wide frequency range for both high and low frequency applications from 30 μHz to 30 MHz.

Variable Rise and Fall Time

For maximum utility in pulse applications, the Model 162 provides positive, negative and balanced pulse outputs. The duty cycle, rise and fall times and dc offset levels of these outputs are all independently variable.

Dual High/Low Outputs

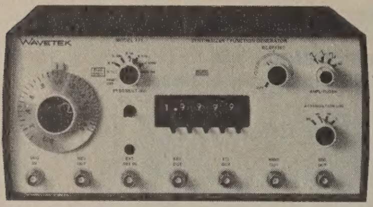
The output system of the Model 162 is designed to give maximum control and clean signals at all output levels. The step attenuator operates in 10 dB increments with an overlapping vernier control, giving control over an 80-dB dynamic range.

Trigger and Gated Operation

The Model 162 is settable for single cycles or "bursts" of cycles of the selected waveform. You can trigger the generator with an external command signal or with the manual front panel switch. The trigger start/stop point can be easily adjusted to give haversine outputs as well as complex waveforms.

PRICE (FOB San Diego) **$995**

SYNTHESIZER/ FUNCTION GENERATOR



Model 171

The Model 171 is a function generator and synthesizer combined in one package providing the best of both units at function generator prices.

0.1 Hz to 2 MHz Frequency Range

The Model 171 frequency range is 0.1 Hz to 2 MHz in the function generator mode. In the synthesizer mode, range is from 1 Hz to 2 MHz with accuracy of 0.005%. You have either mode, function generator or synthesizer, with the flip of a switch.

Two Simultaneous Outputs

The Model 171 features two simultaneous outputs with a maximum of 10 volts peak-to-peak into matched termination. The outputs are from 50 and 600 ohm sources. The output is continuously variable from 0 to −80 dB with a combination step and vernier attenuator.

4½ Digit or 1000:1 Dial Control

The Model 171 features frequency control by a dial or a digital switch. You can use digital control in the synthesizer mode with frequency resolution from 0.001 Hz on the lowest decade range to 100 Hz on the highest range. Resolution is full 4½ digits (1.9999). Dial control, in the generator mode, provides ±3% full scale accuracy with infinite resolution.

0.005% Frequency Accuracy

In the synthesizer mode, the output waveform is phase-locked to an internal crystal providing ±0.005% frequency accuracy and frequency stability of 0.0001% per °C.

PRICE (FOB San Diego) **$795**

PROGRAMMABLE SIGNAL SOURCE

Model 172

The Model 172 provides top system performance in its standard configuration and offers a versatile package of options that allows it to perform multiple tasks in systems applications.

Microprocessor Control

The instrument features a microprocessor-controlled interface and preprocessor to simplify programming and application of the instrument. The microprocessor numeric capability relieves the system controller from formatting responsibility.

Multiple Waveforms

The 172 generates sine, square, triangle, ramp, pulse, haversine, and havertriangle waveforms. A no-waveform or dc mode can also be programmed which expands the versatility of the unit to a dc supply with a 50 ohm source impedance. All waveforms may be phase-locked to your external frequency for system frequency coherence.

GPIB Compatibility and Programming Versatility

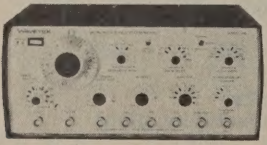
The standard Model 172 accepts synchronous, bit parallel, byte serial ASCII programming. For greater versatility, an option is available which fully conforms to the requirements of IEEE 488-1975, the General Purpose Interface Bus (GPIB).

Other Features

As standard features, the Model 172 also offers sweep and FM capability, trigger and tone burst, and variable symmetry. A 32-character front-panel display is one of many available options.

PRICE (FOB San Diego) **$3,895**

20 MHz FUNCTION/ PULSE GENERATOR

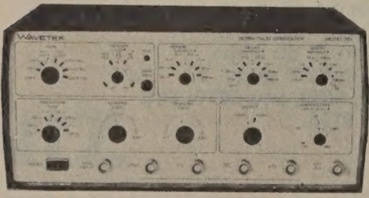


Model 145

The Model 145 offers both the versatility of a function generator and the precise requirements of a pulse generator—both at a cost much lower than that of separate instruments. It operates over a frequency range of 0.001 Hz to 20 MHz, providing sine, square and triangle functions, plus pulse and inverted pulse. With a simple turn of the mode switch, the instrument can be a precision waveform generator with versatile function generator features or a precision pulse generator with controllable period, delay and width. The output of the generator is variable to a full 30 volts peak to peak with simultaneous ECL, ECL, TTL and $\overline{\text{TTL}}$ outputs, and an output sync signal. Features used in either mode include triggering and gating with manual pushbutton or external signals; external voltage control of frequency/period; signal baseline offset and 0 to 60 dB attenuation; and a 0 to +2V signal output proportional to the generator frequency/period.

PRICE (FOB San Diego) **$895**

PULSE GENERATOR



Model 801

The Model 801 is a 50 MHz pulse generator with full pulse shaping and triggering control. Its versatile output system lets you have a variable output and fixed ECL, $\overline{\text{ECL}}$ and TTL outputs simultaneously. You can complement the outputs, independently adjust both levels of the variable output from −20 to +20 volts (20V p-p max) and adjust the rise and fall from <5 ns to 250 ns. All pulses can be fully shaped with independent width, rate and delay controls.

Not only do you get full pulse capability, but also format versatility. Operating modes include continuous, triggered and gated for both single and double pulses. A burst mode gives you an exact number of pulses with each triggering. Another mode allows you to reconstruct or reshape pulses.

Triggering is by a front-panel switch or an external signal. A front-panel LED indicates trigger acceptance. You can trigger and gate on the rising or falling edge of the trigger signal and a particular trigger signal level.

PRICE (FOB San Diego) **$995**

SANGAMO WESTON
Schlumberger

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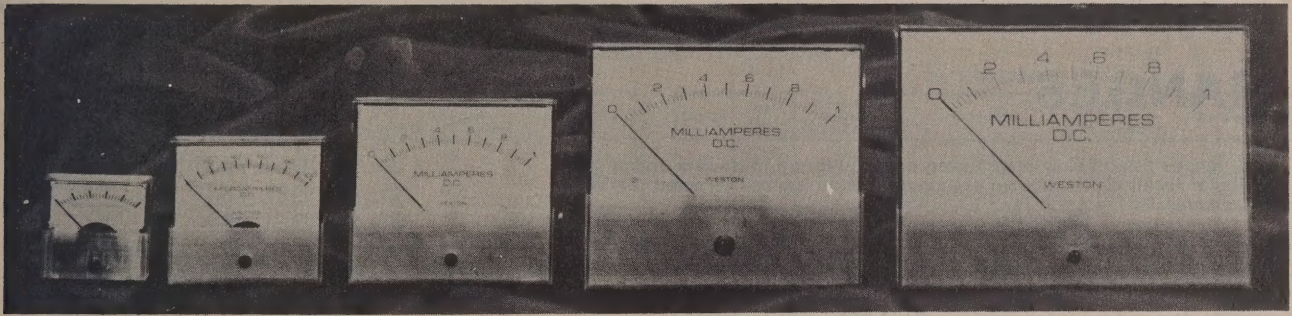
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

MUSTANG
Panel Meters



MUSTANG

MUSTANG is a new line of precision panel meters by Weston, manufacturers of panel instruments since 1888. MUSTANG answers your need for true economy combined with style, ruggedness and reliability. You'll be glad to know abut the:

- Versatile appearance options—panel, bezel or window mounting
- Taut-band and pivot-and-jewel mechanisms
- Tough plastic pointer—ignores handling and electrical overloads
- White plastic scale, molded-in color which can't chip or yellow
- Ring-Lock mounting option—makes installation a real snap
- Backlighting feature—bright, uniform scale illumination when you need it.

The MUSTANG panel meter contains fewer parts than any other analog panel meter made today. That's why it offers unsurpassed reliability and economy. For top value in new applications or replacement. MUSTANG is your best choice.

The MUSTANG mechanism is a self-shielding CORMAG™ design, exhaustively tested in the lab and in the field to provide day-after-day accuracy and reliability. Welded electrical connections are used throughout. A unique caging design is used in taut band meters for added protection from environmental shock and vibration.

Small in overall size, The MUSTANG mechanism permits rear illumination without shadowing the lower part of the scale. Despite this small size, enough torque is available for crisp, low-overshoot response in VU applications.

PERFORMANCE SPECIFICATIONS

Taut Band or Pivot & Jewel

	DC	AC
Accuracy F.S. (5.2)†	±2%	±3%
Tracking (5.34)	2%	
Repeatability (5.34)	1% (DCμA>200μA) 2% (DCμA≤200μA)	2%
Balance (5.3)	±2%	
Overshoot (5.33)	20% max for 1½ and 2½" 25% max for 3½ and 4½" 30% max for 6"*	
Response time (5.36)*	2 Sec. Typical*	
Effect of overload		
Momentary (5.8)	2%	
Sustained (5.11)	1%	1.5%
Short time (5.10)		1%

Operating temperature (5.6.3)	−4°F to +122°F −20°C to +50°C	
Storage temperature (5.6)	−4°F to +150°F −20°C to +65°C	
Shock (5.9), 50G	2%	
Vibration (5.13)	2%	
Dielectric (5.5)	2600 Vrms (1500 Vrms for 1½" size)	
Pointer type	Knife edge Black, Red or White	
Housing materials—UL Flammability classes	Case Cycoloy® KHP	94 V-O
	Lexan® Optional	94 V-O
	Cover NAS polystyrene	94 H-B
	Lexan® Optional	94 V-O

*See ANSI C39.1, 1972 for further details

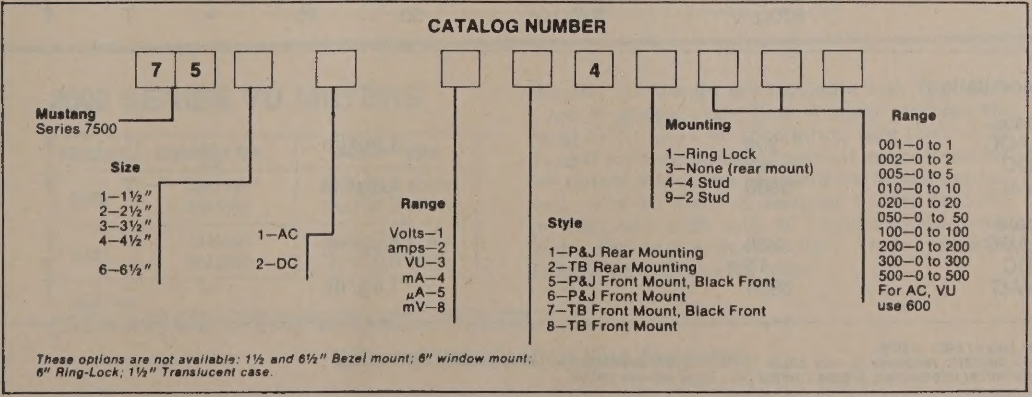
†Note: Numbers in parenthesis refer to pertinent paragraphs of ANSI C39.1-1972 performance specifications

Cycoloy® is a registered trademark of Borg-Warner Corp.

Lexan® is a registered trademark of General Electric Co.

HOW TO ORDER

Standard ranges and options are conveniently specified by constructing a catalog number by the guide below. Please consult your local representative, distributor, or service center for features not included in this description.



CATALOG NUMBER

Mustang
Series 7500

Size
1—1½"
2—2½"
3—3½"
4—4½"
6—6½"

1—AC
2—DC

Range
Volts—1
amps—2
VU—3
mA—4
μA—5
mV—8

Style
1—P&J Rear Mounting
2—TB Rear Mounting
5—P&J Front Mount, Black Front
6—P&J Front Mount
7—TB Front Mount, Black Front
8—TB Front Mount

Mounting
1—Ring Lock
3—None (rear mount)
4—4 Stud
9—2 Stud

Range
001—0 to 1
002—0 to 2
005—0 to 5
010—0 to 10
020—0 to 20
050—0 to 50
100—0 to 100
200—0 to 200
300—0 to 300
500—0 to 500
For AC, VU use 600

These options are not available: 1½ and 6½" Bezel mount; 6" window mount; 6" Ring-Lock; 1½" Translucent case.

SANGAMO WESTON
Schlumberger

WESTON INSTRUMENTS
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

MUSTANG
Panel Meters

RANGES

All ranges listed below are stocked both at Weston in Newark and at distributor locations throughout the United States, except as noted. T=Taut Band only. P=Pivot and Jewel only. •=Both.

MODEL NUMBERS
1½" MODEL 7511
2½" MODEL 7521
3½" MODEL 7531
4½" MODEL 7541
6" MODEL 7561

Range	Resistance/Sensitivity		Scale Div.						
	Taut Band Ohms ± 20%	Pivot & Jewel Ohms ± 20%	1½"	2½"-6"	1½"	2½"	3½"	4½"	6"
Microamperes DC									
0-50	1100	—	25	50	T	T	T	T	T
0-100	650	2265	20	50	•	•	•	•	•
0-200	208	570*	20	40	•	•	•	•	•
0-500	45	180	25	50	T	T	T	T	T
Milliamperes DC									
0-1	15	57	20	50	•	•	•	•	•
0-2	10	15	20	40	—	—	T	T	T
0-5	10	6.3	25	50	T	T	T	T	T
0-10	5	5	20	50	T	T	T	•	T
0-20	2.5	2.5	20	40	•	T	T	T	—
0-50	1	1	25	50	T	T	T	T	T
0-100	.5	.5	20	50	T	T	T	T	T
0-200	.25	.25	20	40	T	T	T	T	T
0-500	.1	.1	25	50	T	T	T	T	T
Amperes DC									
0-1	50mV	50mV	20	50	T	T	T	T	T
0-2	50mV	50mV	20	40	—	—	—	T	P
Volts DC									
0-1	1000Ω/v	1000Ω/v	20	50	—	T	—	T	—
0-2			20	40	T	—	T	T	—
0-5			25	50	T	T	T	T	T
0-10			20	50	—	—	—	T	—
0-15			15	60	—	T	—	T	T
0-30			30	60	T	T	T	T	T
0-50			25	50	T	T	—	T	T
0-100			20	50	—	—	—	—	—
0-150			15	60	T	T	T	T	T
0-200	10,000Ω/v	10,000Ω/v	20	40	T	—	T	T	—
0-300			30	60*	T	T	—	T	T
0-500			25	50	—	—	—	—	—
Volts AC									
0-150	870Ω/v	870Ω/v	15	60	T	T	T	T	T
0-300	870Ω/v	870Ω/v	30	60	•	T	T	T	•
vu or Modulation									
"A" Scale									
0-200µADC	208	—	Log/lin		—	T	T	T	—
0-1mADC	15	—			—	T	T	T	—
0-1.73VAC	3900	—	Log/lin		—	T	T	T	—
"B" Scale									
0-200µADC	208	—	Log/lin		—	—	T	T	—
0-1mADC	15	—			—	—	T	T	—
0-1.73VAC	3900	—	Log/lin		—	—	T	T	—

**6" Model only—1140Ω ±20%.*
DC and AC ballistic response is very close to ANSI C16.5 specification for vu meters. For detailed technical information, please contact your local representative.

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614 Frelinghuysen Avenue, Newark, New Jersey 07114
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MUSTANG Panel Meters

AC MICROAMMETERS, RECTIFIER TYPE

2½" MODEL 2022

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
100	50	5500	5841100	5500	5842100
200	40	2600	5841200	2400	5842200
500	50	1000	5841500	1000	5842500

3½" MODEL 2032

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
100	50	5500	5841100	5500	5842100
200	40	2600	5841200	2400	5842200
500	50	1000	5841500	1000	5842500

4½" MODEL 2042

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
100	50	5500	5841100	5500	5842100
200	40	2600	5841200	2400	5842200
500	50	1000	5841500	1000	5842500

5½" MODEL 2052

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
100	50	5500	5841100	5500	5842100
200	40	2600	5841200	2400	5842200
500	50	1000	5841500	1000	5842500

AC MILLIAMMETERS, RECTIFIER TYPE

2½" MODEL 2022

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
1	50	530	4841001	500	4842001
2	40	280	4841002	270	4842002
5	50	115	4841005	115	4842005

3½" MODEL 2032

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
1	50	530	4841001	500	4842001
2	40	280	4841002	270	4842002
5	50	115	4841005	115	4842005

4½" MODEL 2042

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
1	50	530	4841001	500	4842001
2	40	280	4841002	270	4842002
5	50	115	4841005	115	4842005

5½" MODEL 2052

Range	Scale Div.	Pivot & Jewel Resistance Ohms (Approx.)	Catalog No. †△	Taut Band Resistance Ohms (Approx.)	Catalog No. †△
1	50	530	4841001	500	4842001
2	40	280	4841002	270	4842002
5	50	115	4841005	115	4842005

** Stock item.*
† When ordering meters, model number must precede catalog number.
△ When ordering meter with optional black painted front change second digit of catalog number "8" to "7."

AC IRON VANE

AC VOLTMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-125 Hz△

	2½" MODEL 2024		3½" MODEL 2034		4½" MODEL 2044		CATALOG NO.
Range	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	
7.5	75	37.5	75	37.5	75	37.5	1841975
10	50	66.5	50	66.5	50	66.5	1841010***
15	75	150	75	150	75	150	1841015**
25	50	500	50	500	50	500	1841025
30	60	600	60	600	60	600	1841030
50	50	1665	50	1665	50	1665	1841050*
100	50	6700	50	6700	50	6700	1841100
150	75	15,000	75	15,000	75	15,000	1841150*
300	60	60,000	60	60,000	60	60,000	1841300*
500	50	100,000	50	100,000	50	100,000	1841500**

△ Can be adjusted for 400 (± 10%) Hz

NOTE: Power Consumption: 150 Volt Range at 115 Volts, 1.15 Watts, at 60 Hz, 1.15 Volt-Amperes

AC AMMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-500 Hz

	2½" MODEL 2024		3½" MODEL 2034		4½" MODEL 2044		CATALOG NO.
Range	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	
1	50	.25	50	.25	50	.25	2841001*
2	40	.06	40	.062	40	.062	2841002
3	60	.025	60	.025	60	.025	2841003
5	50	.016	50	.016	50	.016	2841005*
10	50	.0045	50	.0045	50	.0045	2841010*
15	75	.0015	75	.0025	75	.0025	2841015
20	40	.0011	40	.0011	40	.0011	2841020*
25	50	.0011	50	.0011	50	.0011	2841025**
30	60	.00056	60	.00056	60	.00056	2841030*
50	50	.00027	50	.00027	50	.00027	2841050*

NOTE: Power Consumption: 5 Ampere Range at 5 Amperes, 0.45 Watts, 0.45 Watts; at 60 Hz, 0.45 Volt-Amperes.

AC MILLIAMMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-500 Hz

*Denotes Stock Item
**Model 2044 In Stock Only
***Models 2034, 2044 In Stock Only

	2½" MODEL 2024		3½" MODEL 2034		4½" MODEL 2044		CATALOG NO.
Range	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	Scale Div.	Nominal Resistance	
10	20	2550	50	2550	50	2550	4841010
50	25	100	50	100	50	100	4841050*
100	20	25	50	25	50	25	4841100*
200	40	6.3	40	6.33	40	6.33	4841200
250	25	6.3	50	4.0	50	4.0	4841250
500	25	1.0	50	1.0	50	1.0	4841500*

2000 SERIES VU METERS

Model	Catalog No.	Scale Type
2022	3841001* 3841002	Type 30 A scale Type 30 B scale
2032	3841001* 3841002	Type 30 A scale Type 30 B scale

Weston VU Meters are available with Type A or Type B scales. The Type A scale stresses the level in VU units for monitoring wire lines. The Type B scale emphasizes percent use of transmitter output and is the standard for broadcast service. The VU meter is designed to read zero VU, or 100%, with 1.228 volts AC applied to the meter and a 3600 ohm series resistor. This represents 4dB above 1 MW in 600 ohms.

** Stock item.*
† When ordering meters, model number must precede catalog number.
△ When ordering meter with optional black painted front change second digit of catalog number "8" to "7."

External Illumination Kits Available

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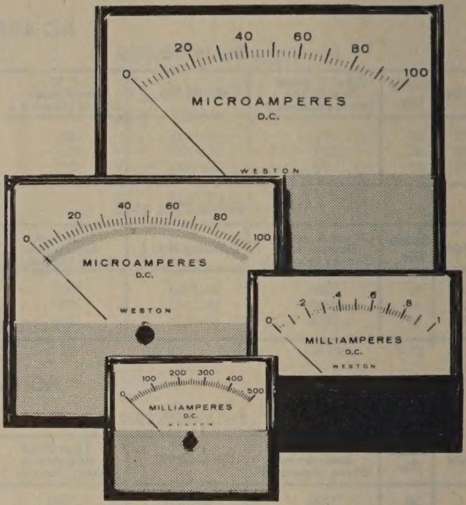
2000 Series Panel Meters



MICROAMPERES D.C.
WESTON
MILLIAMPERES D.C.

Specifications

Size	Model	Function & Mechanism	Accuracy (% Full Scale)	Scale Length	Pointer	Type*** Scale
2½"	2021 2022	DC—CORMAG® AC RECT.—CORMAG®	2% 3%*	2.13" 2.13"	Knife-Edge Knife-Edge	Plain Plain
3½"	2031 2032	DC—CORMAG® AC RECT.—CORMAG®	2%** 3%*	2.7" 2.7"	Knife-Edge Knife-Edge	Plain Plain
4½"	2041 2042	DC—CORMAG AC RECT.—CORMAG	2%** 3%*	3.7" 3.7"	Knife-Edge Knife-Edge	Plain Plain
5½"	2051 2052	DC—CORMAG® AC RECT.—CORMAG®	2%** 3%*	4.5" 4.5"	Knife-Edge Knife-Edge	Plain Plain

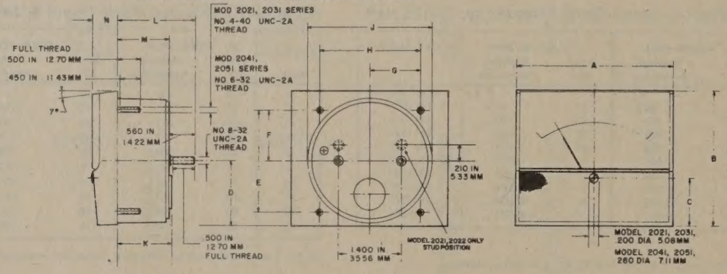
*On Sinewave. 25-20.000 Hz for current meters. 25-1500 Hz voltmeters.
**Available with increased accuracy and tracking on special order.
***Mirror scale available on special order.
(Higher frequency available on special order.)

Dimensions

Model	A	B	C	D	E	F	G	H	J	K	L	M	N
2021 2022	2.810 71.37mm	2.400 in. 60.96 mm	.985 in. 25.02 mm	1.160 in. 29.46 mm	1.880 in. 47.75 mm	.940 in. 23.88 mm	.940 in. 23.88 mm	1.880 in. 47.75 mm	2.200 in. 55.88 mm	1.220 in. 30.99 mm	1.725 in. 43.82 mm	1.140 in. 28.96 mm	.560 in. 14.22 mm
2031 2032	3.500 in. 88.90 mm	2.980 in. 75.69 mm	1.060 in. 26.92 mm	1.440 in. 36.58 mm	2.250 in. 57.15 mm	1.125 in. 28.58 mm	1.125 in. 28.58 mm	2.250 in. 57.15 mm	2.750 in. 69.85 mm	1.200 in. 30.48 mm	1.725 in. 43.82 mm	1.140 in. 28.96 mm	.560 in. 14.22 mm
2041 2042	4.530 in. 115.06 mm	4.050 in. 102.87 mm	1.480 in. 37.59 mm	1.780 in. 45.21 mm	3.560 in. 90.42 mm	2.020 in. 51.31 mm	2.000 in. 50.80 mm	4.000 in. 101.60 mm	2.750 in. 69.85 mm	1.200 in. 30.48 mm	1.725 in. 43.82 mm	1.140 in. 28.96 mm	.600 in. 15.24 mm
2051 2052	5.630 in. 143.00 mm	4.490 in. 114.45 mm	1.460 in. 37.08 mm	1.590 in. 40.39 mm	3.000 in. 76.20 mm	2.150 in. 54.61 mm	2.625 in. 66.68 mm	5.250 in. 133.35 mm	2.750 in. 69.85 mm	1.200 in. 30.48 mm	1.725 in. 43.82 mm	1.140 in. 28.96 mm	.600 in. 15.24 mm

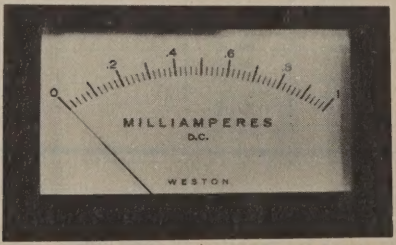
See diagram for dimensions

TYPICAL DIMENSIONS FOR MODEL SERIES: 2021, 2031, 2041, 2051



MOD 2021, 2031 SERIES
NO 4-40 UNC-2A THREAD
N
L
M
FULL THREAD
500 IN 12 70 MM
450 IN 11 43 MM
7°
MOD 2041, 2051 SERIES
NO 6-32 UNC-2A THREAD
560 IN 14 22 MM
NO 8-32 UNC-2A THREAD
F
E
D
K
500 IN 12 70 MM FULL THREAD
J
H
G
210 IN 5 33 MM
1 400 IN 35 56 MM
MODEL 2021, 2022 ONLY STUD POSITION
A
B
C
MODEL 2021, 2031, 200 DIA 5 08 MM
MODEL 2041, 2051, 280 DIA 7 11 MM

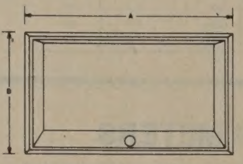
NOTE: SELF-CONTAINED AMMETERS
ABOVE 10 AMPS HAVE ¼ X 28 CONNECTION STUDS.
"L" DIMENSION BECOMES 1.990



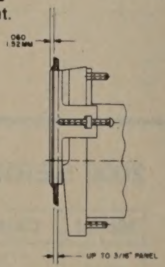
0
.2
.4
.6
.8
1
MILLIAMPERES
D.C.
WESTON

RECESS *(Bezel mounting)*

Only the scale is visible since meter is mounted behind the panel . . . half bezel fits into panel cutout.

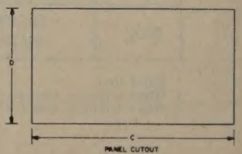


Note: Half bezel mounting easily adaptable to external illumination.



060
1 52 MM
UP TO 3/16" PANEL

Model	A	B	C	D	Catalog. No.
2021/22/24	3.120 in. 79.25 mm	1.720 in. 43.69 mm	3.000 in. 76.20 mm	1-19/32 (1.609) in. 40.87 mm	020090271495
2031/32/34	3.860 in. 98.04 mm	2.265 in. 57.54 mm	3-23/32 (3.718) in. 94.43 mm	2-5/32 (2.156) in. 54.74 mm	020090271922
2041/42/44	4.960 in. 125.98 mm	2.900 in. 73.66 mm	4-13/16 (4.812) in. 122.22 mm	2-3/4 (2.750) in. 69.85 mm	020090271923
2051/52	6.060 in. 153.92 mm	3.300 in. 83.82 mm	5-7/8 (5.875) in. 149.22 mm	3-5/32 (3.156) in. 80.16 mm	020090271924



D
C
PANEL CUTOUT

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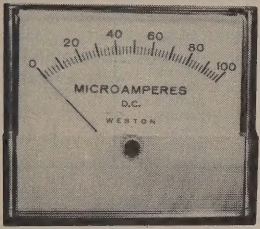
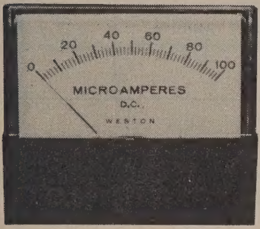
2000 Series Panel Meters

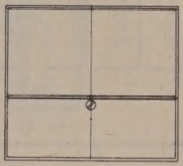
CONVENTIONAL

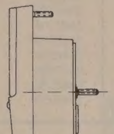
Use same dimensions, whether you choose a meter with taut band or pivot and jewel movement.

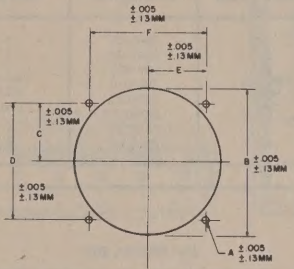


Model	A	B	C	D	E	F
2021	.125 in. 3.17 mm	2.200 in. 55.88 mm	.940 in. 23.88 mm	1.880 in. 47.75 mm	.940 in. 23.88 mm	1.880 in. 47.75 mm
2031	.125 in. 3.17 mm	2.820 in. 71.63 mm	1.125 in. 28.57 mm	2.250 in. 57.15 mm	1.125 in. 28.57 mm	2.250 in. 57.15 mm
2041	.166 in. 4.21 mm	2.820 in. 71.63 mm	2.020 in. 51.31 mm	3.562 in. 90.47 mm	2.000 in. 50.80 mm	4.000 in. 101.60 mm
2051	.166 in. 4.21 mm	2.820 in. 71.63 mm	2.150 in. 54.61 mm	3.000 in. 76.20 mm	2.625 in. 66.67 mm	5.250 in. 133.35 mm









DRILLING PLAN

DC MICROAMMETERS

2½″ MODEL 2021

Range	Scale Div.	Pivot & Jewel Resistance (Ohms)	Catalog No. †△	Taut Band Resistance (Ohms)	Catalog No. †△
50	50	2500	5841050*	950	5842050*
100	50	2300	5841100*	845	5842100*
200	40	850	5841200	275	5842200*
500	50	230	5841500	60	5842500*
50-0-50	40	2300	8888001	845	8888004*
100-0-100	40	850	8888002	275	8888005*
500-0-500	50	85	8888003	16.5	8888006

3½″ MODEL 2031

Range	Scale Div.	Pivot & Jewel Resistance (Ohms)	Catalog No. †△	Taut Band Resistance (Ohms)	Catalog No. †△
50	50	2500	5841050*	950	5842050*
100	50	2300	5841100*	845	5842100*
200	40	850	5841200	275	5842200*
500	50	230	5841500	60	5842500
50-0-50	40	2300	8888001*	845	8888004*
100-0-100	40	850	8888002	275	8888005
500-0-500	50	85	8888003	16.5	8888006

4½″ MODEL 2041

Range	Scale Div.	Pivot & Jewel Resistance (Ohms)	Catalog No. †△	Taut Band Resistance (Ohms)	Catalog No. †△
50	50	2500	5841050*	950	5842050*
100	50	2300	5841100*	845	5842100*
200	40	850	5841200*	275	5842200*
500	50	230	5841500	60	5842500*
50-0-50	40	2300	8888001*	845	8888004
100-0-100	40	850	8888002	275	8888005
500-0-500	50	85	8888003	16.5	8888006

5½″ MODEL 2051

Range	Scale Div.	Pivot & Jewel Resistance (Ohms)	Catalog No. †△	Taut Band Resistance (Ohms)	Catalog No. †△
50	50	2500	5841050*	950	5842050
100	50	2300	5841100	845	5842100
200	40	850	5841200*	275	5842200
500	50	230	5841500	60	5842500
50-0-50	40	2300	8888001*	845	8888004
100-0-100	40	850	8888002	275	8888005
500-0-500	50	85	8888003	16.5	8888006

DC MILLIAMMETERS

2½″ MODEL 2021

Range	Scale Div.	Pivot & Jewel Res. Ohms ±20%	Catalog No. †△	Taut Band Res. Ohms ±20%	Catalog No. †△
1	50	85	4841001*	16.5	4842001*
2	40	16	4841002	8.2	4842002
5	50	9	4841005	4.7	4842005
10	50	2.2	4841010*	2.2	4842010
20	40	1.6	4841020	2.0	4842020
50	50	2.0	4841050*	2.0	4842050
100	50	1.0	4841100*	1.0	4842100
200	40	0.5	4841200*	0.5	4842200
300	60	0.33	4841300*	0.33	4842300
500	50	0.2	4841500	0.2	4842500

3½″ MODEL 2031

Range	Scale Div.	Pivot & Jewel Res. Ohms ±20%	Catalog No. †△	Taut Band Res. Ohms ±20%	Catalog No. †△
1	50	85	4841001*	16.5	4842001*
2	40	16	4841002	8.2	4842002
5	50	9	4841005	4.7	4842005
10	50	2.2	4841010*	2.2	4842010
20	40	1.6	4841020	2.0	4842020
50	50	2.0	4841050*	2.0	4842050
100	50	1.0	4841100*	1.0	4842100
200	40	0.5	4841200	0.5	4842200
300	60	0.33	4841300	0.33	4842300
500	50	0.2	4841500*	0.2	4842500

4½″ MODEL 2041

Range	Scale Div.	Pivot & Jewel Res. Ohms ±20%	Catalog No. †△	Taut Band Res. Ohms ±20%	Catalog No. †△
1	50	85	4841001*	16.5	4842001*
2	40	16	4841002	8.2	4842002
5	50	9	4841005*	4.7	4842005
10	50	2.2	4841010	2.2	4842010
20	40	1.6	4841020	2.0	4842020
50	50	2.0	4841050*	2.0	4842050
100	50	1.0	4841100	1.0	4842100
200	40	0.5	4841200	0.5	4842200
300	60	0.33	4841300*	0.33	4842300
500	50	0.2	4841500	0.2	4842500

5½″ MODEL 2051

Range	Scale Div.	Pivot & Jewel Res. Ohms ±20%	Catalog No. †△	Taut Band Res. Ohms ±20%	Catalog No. †△
1	50	85	4841001*	16.5	4842001*
2	40	16	4841002	8.2	4842002
5	50	9	4841005	4.7	4842005
10	50	2.2	4841010	2.2	4842010
20	40	1.6	4841020	2.0	4842020
50	50	2.0	4841050	2.0	4842050
100	50	1.0	4841100	1.0	4842100
200	40	0.5	4841200	0.5	4842200
300	60	0.33	4841300	0.33	4842300
500	50	0.2	4841500	0.2	4842500

* *Stock item.*
† *When ordering meters, model number must precede catalog number.*
△ *When ordering meter with optional black painted front change second digit of catalog number "8" to "7."*

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2000 Series Panel Meters

DC AMMETERS

2½" MODEL 2021

Range	Scale Div.	Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
1	50	Approx. 50MV Drop	2841001*	Approx. 50MV Drop	2842001
2	40		2841002		2842002
5	50		2841005*		2842005
10	50		2841010		2842010
20	40		2841020		2842020
25	50		2841025*		2842025
30	60		2841030		2842030
50	50		2841050*		2842050

3½" MODEL 2031

Range	Scale Div.	Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
1	50	Approx. 50MV Drop	2841001*	Approx. 50MV Drop	2842001
2	40		2841002		2842002
5	50		2841005*		2842005
10	50		2841010*		2842010
20	40		2841020		2842020
25	50		2841025		2842025
30	60		2841030		2842030
50	50		2841050*		2842050

4½" MODEL 2041

Range	Scale Div.	Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
1	50	Approx. 50MV Drop	2841001*	Approx. 50MV Drop	2842001
2	40		2841002*		2842002
5	50		2841005*		2842005
10	50		2841010		2842010
20	40		2841020		2842020
25	50		2841025*		2842025
30	60		2841030		2842030
50	50		2841050*		2842050

5½" MODEL 2051

Range	Scale Div.	Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
1	50	Approx. 50MV Drop	2841001*	Approx. 50MV Drop	2842001
2	40		2841002		2842002
5	50		2841005*		2842005
10	50		2841010*		2842010

DC VOLTMETERS

2½" MODEL 2021

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
2	40	1000	1841002	1000	1842002
5	50		1841005*		1842005
10	50		1841010*		1842010
15	30		1841015		1842015
25	50		1841025		1842025
30	60		1841030		1842030
50	50		1841050*		1842050
100	50		1841100		1842100
150	30		1841150*		1842150
200	40		1841200*		1842200
300	60		1841300*		1842300
500	50		1841500		1842500

3½" MODEL 2031

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
2	40	1000	1841002	1000	1842002
5	50		1841005		1842005
10	50		1841010*		1842010
15	75		1841015		1842015
25	50		1841025*		1842025
30	60		1841030		1842030
50	50		1841050*		1842050
100	50		1841100		1842100
150	75		1841150*		1842150
200	40		1841200		1842200
300	60		1841300*		1842300
500	50		1841500		1842500

4½" MODEL 2041

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
2	40	1000	1841002	1000	1842002
5	50		1841005		1842005
10	50		1841010*		1842010
15	75		1841015		1842015
25	50		1841025		1842025
30	60		1841030		1842030
50	50		1841050*		1842050
100	50		1841100		1842100
150	75		1841150*		1842150
200	40		1841200		1842200
300	60		1841300*		1842300
500	50		1841500		1842500

5½" MODEL 2051

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
2	40	1000	1841002	1000	1842002
5	50		1841005		1842005
10	50		1841010		1842010
15	75		1841015		1842015
30	60		1841030		1842030
50	50		1841050		1842050
100	50		1841100		1842100
150	75		1841150		1842150
200	40		1841200		1842200
300	60		1841300		1842300
500	50		1841500		1842500

AC VOLTMETERS, RECTIFIER TYPE

2½" MODEL 2022

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
15	30	1000	1841015	1000	1842015
30	60		1841030		1842030
75	75		1841075		1842075
150	75		1841150		1842150
300	60		1841300		1842300

3½" MODEL 2032

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
15	30	1000	1841015	1000	1842015
30	60		1841030		1842030
75	75		1841075		1842075
150	75		1841150*		1842150
300	60		1841300		1842300

4½" MODEL 2042

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
15	30	1000	1841015	1000	1842015
30	60		1841030		1842030
75	75		1841075		1842075
150	75		1841150		1842150
300	60		1841300		1842300

5½" MODEL 2052

Range	Scale Div.	OHMS PER VOLT			
		Pivot & Jewel	Catalog No. †△	Taut Band	Catalog No. †△
15	75	1000	1841015	1000	1842015
30	60		1841030		1842030
75	75		1841075		1842075
150	75		1841150		1842150
300	60		1841300		1842300

** Stock item.*
† When ordering meters, model number must precede catalog number.
△ When ordering meter with optional black painted front change second digit of catalog number "8" to "7."

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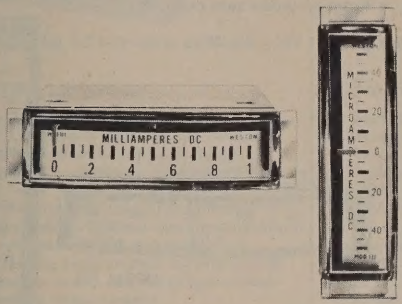
Edgewise Panel Meters

WESTON Model 111

- **Completely flat—can be stacked side-by-side**
- **Flat self-shielded Cormag® mechanism**
- **Saves panel space**



MODEL 111

SPECIFICATIONS

Accuracy: 2% of full scale value for DC (**Model 111**).
3% of full scale value for AC Rectifier Type (**Model 112**)

Scale Length: 1.24 inches

Pointer: Red Lance Type

Movement: Self shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

Ranges: Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

Mounting: Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. For "stacking," thru-holes are provided so stack can be bolted together.

Zero corrector not used on ammeters, milliammeters above 10 Ma, rectifier meters and suppressed zero meters.

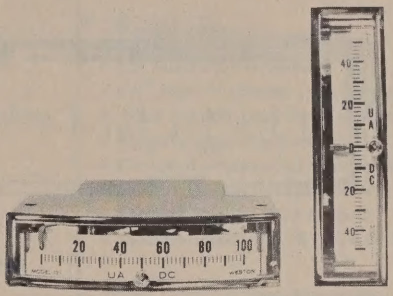
All resistances are approximate

RANGES

DC VOLTMETERS (Model 111)	**RESISTANCE**
0-10	5000 Ω/v
0-25	5000 Ω/v
0-50	5000 Ω/v
0-100	5000 Ω/v
0-150	5000 Ω/v
0-300	5000 Ω/v
DC MILLIAMMETERS (Model 111)	**RESISTANCE**
0-1	39 Ohms
0-5	5.2 Ohms
0-10	2.3 Ohms
0-25	2.0 Ohms
0-100	0.5 Ohm
0-150	0.33 Ohm
0-250	0.2 Ohm
0-500	0.1 Ohm
DC MICROAMMETERS (Model 111)	**RESISTANCE**
0-50	2300 Ohms
0-100	900 Ohms
0-200	600 Ohms
0-500	134 Ohms
50-0-50	900 Ohms
DC AMMETERS (Model 111)	**RESISTANCE**
0-1	0.05 Ohm
AC VOLTMETERS (Rectifier-Type) (Model 112)	**RESISTANCE**
0-150	2000 Ω/v
0-300	2000 Ω/v

WESTON Model 121

- **Completely flat—can be stacked side-by-side**
- **Parallax eliminated—in-line pointer and scale**
- **Flat self-shielded Cormag® mechanism**
- **Saves panel space**
- **Optional self-contained illumination feature**
- **Front mounted zero corrector**



MODEL 121

SPECIFICATIONS

Accuracy: 2% of full scale value for DC (**Model 121**),
3% of full scale value for AC Rectifier Type (**Model 122**)

Scale Length: 1.875 inches; Anti-parallax in-line scale

Pointer: Red Lance Type

Movement: New shelf shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

Ranges: Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

Mounting: Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. (Bezel furnished for single meter mounting.) For "stacking" thru holes are provided so stack can be bolted together.

Illumination: Two G.E. 328 lamps are used. Recommended operating voltage—5 volts (less than 200 ma per bulb). Expected life greater than 5,000 hours.

Dielectric: 1500 volts RMS

RANGES

DC VOLTMETERS	**RESISTANCE**
0-10	5000 Ω/v
0-25	5000 Ω/v
0-50	5000 Ω/v
0-100	5000 Ω/v
0-150	5000 Ω/v
0-300	5000 Ω/v
DC MILLIAMETERS	**RESISTANCE**
0-1	39 Ohms
0-5	5.2 Ohms
0-10	2.3 Ohms
0-25	2.0 Ohms
0-100	0.5 Ohms
0-150	0.33 Ohms
0-250	0.2 Ohms
0-500	0.1 Ohms
DC MICROAMMETERS	**RESISTANCE**
0-50	2300 Ohms
0-100	900 Ohms
0-200	600 Ohms
0-500	134 Ohms
50-0-50	900 Ohms
DC AMMETERS	**RESISTANCE**
0-1	0.05 Ohm
AC VOLTMETERS (Rectifier-Type)	**RESISTANCE**
0-150	2000 Ω/v
0-300	2000 Ω/v

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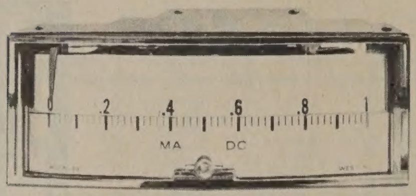
Edgewise Panel Meters

WESTON Model 231

Scale Length: 2.75" Anti-parallax in-line scale
Zero Corrector: Front only
Illumination: Optional—2 #328 lamps, 5V @ 200mA each 5000 hr. life
Mounting: Vertical Panel Standard; Horizontal scale (zero left) standard or Vertical scale (zero bottom) standard. Screw-clamps are standard. For stacking, through holes are provided so stack can be bolted together.



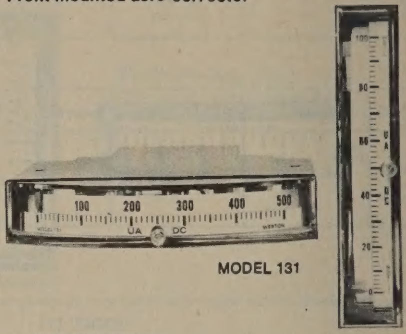
SPECIFICATIONS

Accuracy	±2% of full scale, DC ranges ±3% of full scale, AC rectifier-input ranges
Range Capability	Voltage: 50 mV minimum span, 300V maximum self contained Current: 50 µA minimum span, 2A maximum self contained
Mechanical Suppression	25% with zero adjuster 50% without zero adjuster
Dielectric	2600 Vrms maximum
Shock, Vibration	Per ANSI C39.1-1972
Pointer	Dragon tooth (Model 231) Lance type all others
Mechanism	Modular CORMAG thin-line type, pivot & jewel (Spring loaded jewels)
Response Time	2 Sec.
Magnetic Shielding	Self-shielded mechanism, steel external cover
Terminals	†8-32 threaded posts

Range	
D.C. Microamperes	
0-50	2300
50-0-50	900
0-100	900
100-0-100	600
0-200	600
0-500	134
500-0-500	38
D.C. Milliamperes	
0-1	38
1-0-1	—
0-5	5.2
0-10	2.3
0-25	2.0
0-100	.5
0-250	.2
0-500	.1
D.C. Amperes	
0-1	.05
D.C. Volts	
0-10	
0-25	
0-50	5000 Ω/V
0-100	
0-150	
0-300	
A.C. Volts	
0-150	2000 Ω/V
0-300	

WESTON Model 131

- **Completely flat—can be stacked side-by-side**
- **Parallax eliminated—in-line pointer and scale**
- **Flat self-shielded Cormag® mechanism**
- **Saves panel space**
- **Optional self-contained illumination feature**
- **Front mounted zero corrector**



MODEL 131

SPECIFICATIONS

Accuracy: 2% of full scale value for DC
3% of full scale value for AC Rectifier Type

Scale Length: 2.75 in.; Anti-parallax in-line scale

Pointer: Red Lance Type

Movement: New self-shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

Ranges: Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

Mounting: Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. For "stacking", thru holes are provided so stack can be bolted together.

Illumination: Two readily accessible G.E. 328 lamps are used. Recommended operating voltage—5 volts (less than 200 ma per bulb). Expected life greater than 5,000 hours.

Dielectric: 1500 volts RMS

RANGES

DC VOLTMETERS	**RESISTANCE**
0-10	5000 Ω/v
0-25	5000 Ω/v
0-50	5000 Ω/v
0-100	5000 Ω/v
0-150	5000 Ω/v
0-300	5000 Ω/v
DC MILLIAMMETERS	**RESISTANCE**
0-1	38 Ohms
0-5	5.2 Ohms
0-10	2.3 Ohms
0-25	2.0 Ohms
0-100	0.5 Ohm
0-150	0.33 Ohm
0-250	0.2 Ohm
0-500	0.1 Ohm
DC MICROAMMETERS	**RESISTANCE**
0-50	2300 Ohms
0-100	900 Ohms
0-200	600 Ohms
0-500	134 Ohms
50-0-50	900 Ohms
DC AMMETERS	**RESISTANCE**
0-1	0.05 Ohm
AC VOLTMETERS (Rectifier-Type)	**RESISTANCE**
M-132	
0-150	2000 Ω/v
0-300	2000 Ω/v

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Digital Panel Meters

MODEL 1220 (BIPOLAR)

1659
WESTON
MILLIVOLTS DC

Also available for AC operation as Model 1221

Features

- All digital logic circuitry contained on a single MOS LSI plug-in chip—added reliability
- LED plug-in readout—added reliability
- Instant accuracy—requires no warm-up time
- Requires only 4 sq. in. space
- Complete instrument uses approximately ¾ watt power—conservatively rated to operate in 60°C ambient—added reliability
- Fixed or remote programmed decimal points
- Range change easily accomplished—simplifying stocking requirements
- Input vs readout "slope" changes easily accomplished
- Ruggedized — engineered to meet Military shock and vibration specs. — exceeds requirements of ACA C39.1 specifications for analog panel meters
- Model 1220 weighs less than 4 oz.

SPECIFICATIONS

Full Scale Ranges	
Volts:	**Input Impedance:**
0—100 millivolts	>100 megohms
0—1 volt	>100 megohms
0—10 volts	5 megohms
0—100 volts	5 megohms
0—1000 volts	5 megohms
Current:	**Input Impedance:**
0—10 microamps	10 K ohms
0—100 microamps	1 K ohms
0—1 milliamp	100 ohms
0—10 milliamps	10 ohms
0—100 milliamps	1 ohm
Accuracy:	±0.1% of reading ±1 digit @ 25°C ±10°C
Overrange:	100% (reads 1999) except on 1000V range (Stated accuracy applies to full overrange.)
Readout:	3½ digits, 7 segment LED
Out-of-Range Indication:	Flashing "1" in most significant digit with blanking of the remaining digits
Operating Temperature Range:	0-60°C (32-140°F)
Temperature Coefficient	±0.01% F.S. ±1 digit (±0.005% reading/°C)
Common Mode Rejection:	Battery operation: >120 dB Line operation: 80 dB
Normal Mode Rejection:	30 dB at 60 Hz
Sampling Rates:	>3 per second
Response Time:	<1.5 seconds
Power Requirements:	**Model 1220:** +5.5 volts DC ±10% (.75 watts) **Model 1221:** 117 volts ±10% or 234 volts ±10% 50 to 400 Hz
Storage Temperature:	—40°C to 70°C
Weight:	Approximately 4 oz

NOTE: Input PC board connectors are not supplied with the DPM. They may be ordered as an accessory under part No. 9790-0273883.

MODEL 1230

WESTON
VOLTS D.C.
-1230

Available in 2½ Digit as Model 1232

Features

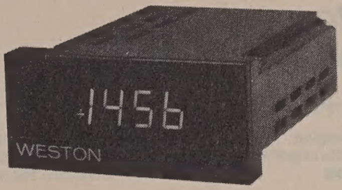
- Dual Slope Integration* A/D Converter
- Automatic bipolar operation
- Automatic zeroing
- Reliable TTL Logic and C-MOS analog gates
- 100% overrange (except 1 KV range)
- 2 nA maximum input bias current
- 7.5 conversions per second
- 0.55" Sperry displays
- 80 dB CMRR
- 25 dB NMRR (10 dB on 1 volt range)
- Signal and control terminals:
    - Hold
    - Print Command
    - Outrange
    - Polarity

SPECIFICATIONS

Full Scale Ranges:	
Volts	**Input Impedance**
0—100 millivolts	>100 megohms
0—1 volt	>1000 megohms
0—10 volts	5 megohms
0—100 volts	5 megohms
0—1000 volts	5 megohms
Current:	
0—10 microamps	10K
0—100 microamps	1K
0—1 milliamp	100 ohms
0—10 milliamps	10 ohms
0—100 milliamps	1 ohm
Accuracy:	1230: ±0.1% of reading ±1 digit 1232: ±0.5% of reading ±1 digit
Overrange:	100% except on 1000V range. Stated accuracy applies to full overrange.
Readout:	7 Segment, Sperry Display
Out-of-Range Indication:	"1" in most significant digit with blanking of the remaining digits.
Operating Temperature Range	0-50°C, (32-122°F)
Temperature coefficient:	±100 PPM/°C
Common Mode Rejection:	80 dB with 1000 ohm unbalance at 60 Hz
Storage Temperature:	—40°C to +70°C
Sampling Rate:	7.5 per second
Response Time:	<1.0 seconds
Power:	117 volts ±10%, 50 Hz to 60 Hz, 4.7 watts. Can be changed to 230 volts ±10% in field.
Weight:	Approximately 13 oz.

Connector supplied as
an accessory under P/N 9790-0267253

2460 SERIES



Features

- LSI Solid-state reliability
- 0.6" High Brightness LED Display
- Noise-immune Dual Slope Integration*
- Floating signal input section
- Choice of single-ended or differential inputs
- Isolated, interactive systems interface
- Latched, parallel BCD outputs
- Industry-standard 1.75" by 4.0" DPM case

SPECIFICATIONS

Resolution	0.05% (1 in 2,000)
Accuracy	±(0.05% Rdg. ± 1 count)
Display	0.6" (15mm) LED; ±1999
Polarity	Automatic Bipolar with sign
Temperature Coefficient:	
of Zero	10 µV/°C max.
of F.S.	100 ppm/°C max.
Series Mode Rejection	30 dB min. (Standard Filter)
Common Mode Rejection	80 dB min. (1 kΩ unbalance)
Signal Integration Time	16.7 mSec (117/234 vac versions) 20 mSec (220/240 vac versions)
Measurement Rate (approx):	
Internal	2/Sec.
External	to 25/Sec.
Isolation Voltage:	
Analog-Digital	200 volts AC/DC
Analog-Power	500 volts AC/DC (1500 optional)
Digital-Power	500 volts AC/DC (1500 optional)
Systems Interface:	
Data Format	8421 BCD (parallel, latched)
Fanout	Per Model Specifications
Hold	via logical 0 or ground
Print (EOC)	Logical 1 pulse @ data update
Ext. Sync.	Logical 1 pulse initiates conversion
Polarity	Logical 1 = positive signal
Outrange	Logical 1 = overload signal

Power Requirements:
Models 2461-2464 – 117/234 or 220/240 vac, 50-400 Hz, 3½W
Models 2465-2466 – 5 VDC ±10% 2W

Operating Ambient	0-50°C, 10-85% R.H.
Storage Ambient	–55 to +85°C, 0-95% R.H.
Weight	13 oz. (370 g) approx.

Model 1234

VOLTS DC
WESTON

Features

- Dual Slope Integration* A/D Converter
- Automatic bipolar operation
- Reliable TTL Logic
- 3 nA maximum input bias current
- 7.5 conversions per second
- 0.55" Sperry displays
- 80 dB CMRR
- 40 db NMRR
- Signal and control terminals:
    - Hold
    - Print Command
    - Outrange
    - Polarity

SPECIFICATIONS

Accuracy:	
Short-term	±0.01% rdg. ±0.025% f.s. (23 C, 30 min. warmup)
Long-term	±0.03% rdg. ±0.02% f.s.
Linearity Error	(0.01% rdg. + 0.015% f.s.)
Input Bias Current	3 nanoamperes
A.C. Rejection (NMRR)	40 dB minimum at 60 Hz (standard filter)
Common Mode Rejection	80 dB minimum, 60 Hz and 1000 ohm unbalance
Reading Rate	7.5 per second (15 sec or 30 sec optional)
Step Input Response	2 seconds max. for full scale step
A/D Conversion Method	Dual Slope Integration*
Display Type	0.55" seven-segment gas plasma (±19999)
Operating Temperature	0° to 50°C
Storage Temperature	−40° to +70°C
Temp. Coefficient	(50 ppm rdg. + 0.3 digit) °C
Outrange Indication	Display blanked except MSD "1" and polarity
Control Outputs:	
Hold	Logic "0" retains most recent data
Convert (option)	1 µSec TTL pulse causes conversion within 10mSec
Status Outputs:	
Print Command	Logic "0" signifies valid output data
Polarity	Logic "1" signifies positive input signal
Overrange	Logic "1" signifies signal beyond 19999 counts
BCD Output (option)	1-2-4-8 parallel, TTL DTL (2 u.l.)
Decimal Selection	External, by grounding appropriate terminal
Power Input	117 v. ± 10%, 50-60 Hz. 6 watts (available for 100, 220, or 240 volt line)
Size	Approx. 1.75" x 4.0" x 4.25" (see drawing)
Weight	Approx. 2 pounds (0.9 kg)

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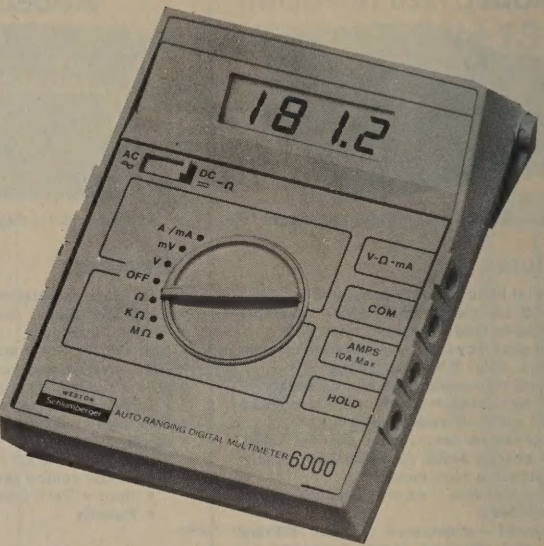
AC/DC Multimeters

Model 6000 *Autoranging* Digital Multimeter



Features

- Autoranging
- Long life Liquid Crystal Display
- Portable
- LSI microcircuitry
- Patented Dual Slope Integration*
- More than 200 hours battery life

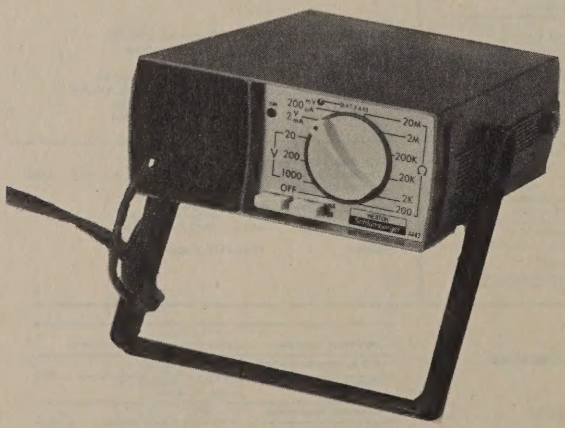
Specifications

Polarity	Automatic bipolar
NMRR (DC only)	66 dB at 50 Hz (20 dB near zero)
Display	1999 with polarity (0.5"/12.7 mm LCD)
Display Hold	SPST contact closure (HOLD to COM) retains reading
Operating Power	Two 9V "transistor" batteries (NEDA 1604, PP3 or RR3)
Battery Life	200 operating hours (350 hours with alkaline batteries)
Low Battery Warning	Valid reading blinks during final 10 hours
Outrange Indication	Blinking "1888" display ("1" and "888" alternate)
Operating Ambient	5°-50°C, 10-85% R.H.
Storage Temperature	−10 to +55°C
A.C. Frequency Influence:	
0-2/20/200 V	Less than 0.25 dB to 16 kHz
0-200 mV, 0-1000 V and current	Less than 0.5 dB to 1000 Hz
Weight	22 oz (625 g) incl. batteries
Size	7" x 5.75" x 2.25" (178 x 146 x 58 mm) overall

Specifications[1]	D.C. Voltage	A.C. Voltage	D.C. Current	A.C. Current	Resistance
Accuracy	0.35% Rdg ± 2d	0.5% Rdg ± 5d[2]	0.75% Rdg ± 3d	1.5% Rdg ± 5d[2]	0.5% Rdg ± 1d[3]
Input Impedance	10 Megohms	9 Megohms//39 pF	10Ω[4]	10Ω[4]	—
Resolution	100 uV	100 uV	1 uA	1 uA	0.1 ohm
Maximum Reading	1000 V	1000 V	10 A	10 A	20 Megohm
Overload Rating	1500 V peak	1000 V (1500 V peak)	1/4A/250 V fuse[4]	1/4A/250 V fuse[4]	250 V (350 V peak)
Temperature Coefficient[5]	250 ppm/°C[6]	600 ppm/°C	300 ppm/°C	750 ppm/°C	600 ppm/°C[3]

Notes: *(1) Specifications guaranteed for 90 days and when operated at 23°C ±5°C*
(2) 40 to 400 Hz; ±2% Rdg ±5d for 0 to 1000 VAC range
(3) ±1% Rdg ±2d and 2000 ppm/°C for 200 ohm range (4) Except 0-2A/10A ranges: 0.01 ohm input, 15A maximum
(5) Offset Tempco 1d/5°C beyond the 23°C ±5°C range (6) Tempco for 1000 V range is 350 ppm/°C max.

MODEL 4442 DIGITAL MULTIMETER



General Specifications

DISPLAY
1999, −1999 (non-blinking) 0.19" character size.
Leading zero blanking — Least significant digit never blanked.
Overrange indication — blinking 1 in thousands place with a polarity and decimal indication. Balance of digits blanked.
Moving decimal point.

BATTERIES
Four "C" size nickel cadmium supplied with meter

CONVERSION RATE
Approximately 4 per second

POLARITY
Automatic

CMRR
80 dB (Approaches ∞ on battery)

NMRR
38 dB

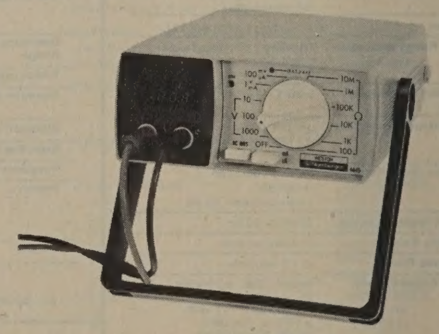
INPUT POWER
Battery operation
Line operation—115 V, 50-400 Hz (All Models)

TEMPERATURE
25°C ± 3°C with guaranteed accuracy (Operable from 0 C to 50 C — derate accuracy)

SIZE
2.25" H x 5.45" W x 7" D

WEIGHT
Less than 2½ pounds

MODEL 4445 RMS DMM AC/DC MULTIMETER



Features:

- True RMS AC measurements.
- 3½ Digit non-blinking LED readout.
- All solid state MOS LSI circuitry.
- Dual Slope conversion for accuracy and long term stability.
- Self-contained battery pack provides up to 10 hours of continuous use.
- 117 Volt battery charger supplied as standard equipment.
- Automatic blanking of digits not in use to conserve battery life.
- Fully-overload protected-fuses externally replaceable.
- Shock-proofed, high impact plastic case.
- Weighs less than 2½ pounds.

GENERAL SPECIFICATIONS

DISPLAY
1999, −1999 (non-blinking) 0.19" character size
Leading zero blanking — Least significant digit never blanked
Outrange indication — blinking 1 in thousands place with a polarity and decimal indication: Balance of digits blanked
Moving decimal point

BATTERIES
Four "C" size nickel cadmium supplied with meter

CONVERSION RATE
Approximately 4 per second

POLARITY
Automatic

CREST FACTOR
4:1 at full scale (except where limited by maximum input), inversely proportional to input valve (IE, 8:1 at half scale, 40:1 at tenth scale, 2:1 at 100% overrange)

OVERRANGE
100% (Reads 1999) except on 1000 V range

CMRR
80 dB (Approaches ∞ on battery)

NMRR
38 dB

INPUT POWER
Battery operation
Line operation — 115 V, 50-400 Hz

TEMPERATURE
25°C ± 3°C with guaranteed accuracy (Operable from 0°C to 50°C — derate accuracy)

SIZE
2.25" H x 5.45" W x 7" D

WEIGHT
Less than 2½ pounds

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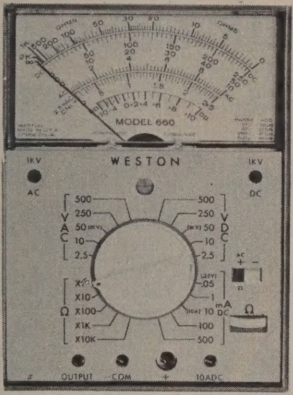
TEST EQUIPMENT

WESTON® Model 660 Drop-Proofed VOM

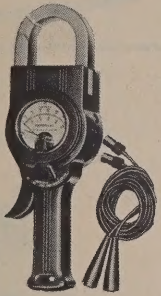


SPECIFICATIONS

Accuracy	2% DC (1.5% on 50 *ua* range) 3% AC
Sensitivity	20,000 ohms/volt DC 5,000 ohms/volt AC
Dimensions	7"H X 5"W X 2¼"D
Weight	Less than 2 lbs. (Batteries included)
Ranges	
DC Millivolts	0-250
DC Volts	0-2.5/0-10/0-50/0-250/0-500/0-1000
AC Volts	0-2.5/0-10/0-50/0-250/0-500/0-1000
VAC Output	0-2.5/0-10/0-50/0-250
DC Microamps	0-50
DC Milliamps	0-1/0-10/0-100/0-500
DC Amps	0-10
Ohms	R×1(0-2K)20Ωcenter/R×10(0-20K)200Ωcenter/R×100(0-200K)2000Ω center/R×1000(0-2Meg)20KΩcenter/R×10K(0-20Meg)200KΩcenter
dB Scales	(1 mw on 600 ohm line) −10 to +10/+2 to +22/+16 to +36/+30 to +50/+36 to +56

Also available: Model 661 High Accuracy VOM • Model 662 Fully Overload-Protected VOM Model 666 Solid State Circuit Tester • Model 663 High Accuracy Fully Overload Protected VOM

WESTON® Model 633 A-C Clamp Ammeter and Volt Ammeter



Accurate within 3%
Scale Length: 2.36"
Size: 13⅝" x 4⅜" x 2½"— 346 x 111 x 64 mm
Weight: 3¾ lbs.

Outstanding Features:

- Non-Shatterable Glass
- Adjustable Pointer Stop (Model 633 VA-1 only)
- Safety Type Trigger
- Insulated For 750 Volt Service
- Can Be Hung On A Conductor, Leaving Operator's Hands Free
- Accepts Conductors Up to 2" In Diameter

Ranges:

Model 633 Type VA-1 Cat. No. 633-9901001 (Incl. Potential Leads) 1000/250/100/25/10 amperes a-c 700/350/175 volts a-c

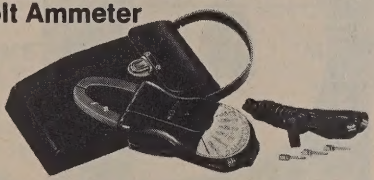
Model 633 Type A-1 Cat. No. 633-2901001 500/250/100/50/25/10 amperes a-c

Model 633 Type A-2 Cat. No. 633-2901002 1000/500/250/100/25/10 amperes a-c

Model 633 Type A-3 Cat. No. 633-2901003 2000/1000/500/250/100/50 amperes a-c

Leather carrying case for types VA2, A1, A2, A3 Model 9959 - P/N 90856

WESTON Model 749 A-C Clamp Volt Ammeter



Accurate with 3%
Scale Length: 2.36"
Size: 7½" x 3" x 1¼"—191 x 77 x 32 mm
Weight: 14 oz.

Outstanding Features:

- Pocket Size
- Precision Ground Faces Provide Positive Jaw Contact
- Shatterproof Wrap-around Plastic Window
- Uses Shock-mounted Core Magnet Mechanism
- Fully Insulated for 750 Volt Services

Plug-in adapter, Model 9886, designed for use with Model 749, facilitates current measurements of double conductor leads without breaking the circuit. Used on direct reading or as a 10-to-1 divider for low current measurements. Simplifies voltage testing during current checks.

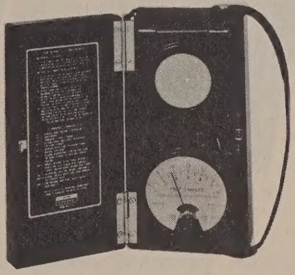
Model 749 (Ind. case, leads, battery, clips, probes)
Cat. No. 749-2901001
300/150/60/30/15/6 amperes a-c
600/300/150 volts a-c

Model 9886 Plug-in adapter—P/N 159983

All meters are stock items. Any other practical range can be supplied.

WESTON®

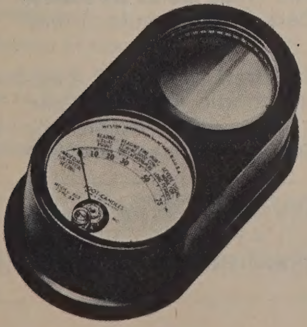
Model 615 Broad Range Light Meter



Features

- Ranges 0-1.2/3/12/30/120/300/1200 Foot Candles
- Viscor and Cosine correction supplied
- More than one year of operation from one 9 volt transistor battery
- Portable—7"x3½"x2½" 2 lbs.
- Light level guidelines in cover

WESTON® Model 703 Illumination Meters



Model 703-0275190, Illumination Meter 0-60 foot-candles (with Viscor and cosine correction filters)

Model 703-996007, Illumination Meter 0-100 foot-candles (with Viscor and cosine correction filters)

Model 703-0275191, Illumination Meter 0-200 foot-candles (with Viscor and cosine correction filters)

Model 703-0275192, Illumination Meter 0-600 foot-candles (with Viscor and cosine correction filters)

Model 703-9960009, Illumination Meter 0-30 foot-candles (with Viscor filter)

Model 703-9960011, Illumination Meter 0-75 foot-candles (with Viscor filter)

Model 703-9960010, Illumination Meter 0-75 foot-candles (with Glass Filter)

Model 703-9960051, Illumination Meter 0-150 foot-candles (with Quartz Filter) for Ultra violet use. Fluorescent characters and pointer on black background scale.

Model 9959-0074472, Leather Carrying Case

Model 9924-0092108, Multiplier Disc (X10) (Not usable with cosine corrected instruments.)

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGI NIE
DER

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe and the United Kingdom. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

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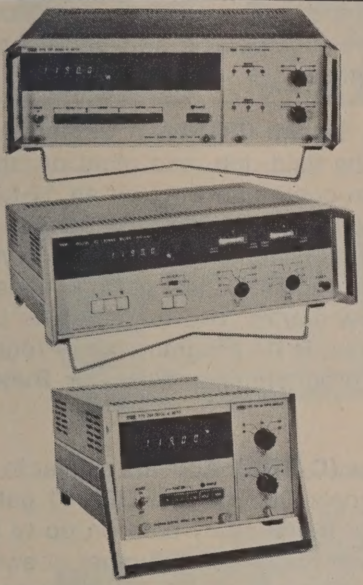
YEW Precision Electrical Measurement Instrumentation



PRECISION DIGITAL AC POWER INSTRUMENTATION

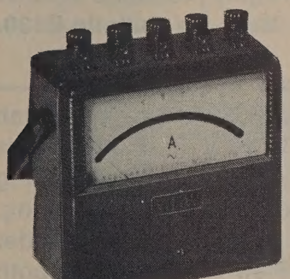
YEW's offers a complete line of digital precision low frequency instrumentation for True RMS Volts/Amps and Watts to ±0.01% accuracy.

Model	Accuracy	Range *		Frequency Range	Approx. Price
		V	A		
APR-2	±0.01%	120	5	DC & 60 Hz	$18,000
2885-16 1ϕ, 2W	±0.03%	75/100/ 150/300	0.5/1/2 5/10/20	20 Hz - 10 kHz	$ 4,995
2503-01 1ϕ, 2W	±0.1%	3/10/30/100/ 300/600	0.1/0.3/1/ 3/6/10/30	Watts 40 Hz to 1.2 kHz V & A 25 Hz to 2 kHz	$ 4,595
2503-03 3ϕ, 3W	±0.1%	3/10/30/100/ 300/600	0.1/0.5/1/ 3/6/10/30		$ 7,090
2504 1ϕ, 2W	±0.25%	30/60/100/ 150/300	0.5/1/2/ 5/10		$ 2,750
2505 3ϕ, 4W	±0.25%	100/150/ 300/600	2/5/10/20		$ 7,300

* Watt Range — VA at unity power factor.

NOTE: Above instruments useable from 0.0 P.F. to 1.0 (unity) P.F.

Taut-band Precision Portables



YEW is the world's largest and most respected manufacturer of precision, tautband, 0.5% portable instruments.

FEATURES:

- **Full One Year Warranty**
- **Fast and Complete Service Facilities Manned by Factory Personnel**
- **Lowest Prices in the Field**
- **Guaranteed 0.5% Accuracy Traceable to N.B.S.**
- **Tautband Friction-Free Meter Movements**

AMMETERS AND VOLTMETERS

Specifications: DC: Moving Coil, AC: Iron Vane, Accuracy: ±0.5%, Scale Length: 130 mm

Model	Range
2011-01	DC 3/10/30/100uA
2011-02	DC 10/30/100/300uA
2011-03	DC 0.1/0.3/1/3mA
2011-04	DC 1/3/10/30mA
2011-05	DC 10/30/100/300mA
2011-06	DC 0.1/0.3/1/3A
2011-07	DC 1/3/10/30A
2011-08	DC 0.3/1/3/10V
2011-09	DC 3/10/30/100V
2011-10	DC 30/100/300/1000V
2013-01	AC 20/100mA
2013-02	AC 50/250mA
2013-03	AC 100/500mA
2013-04	AC 0.2/.1A
2013-05	AC 0.5/2.5A
2013-06	AC 1/5A
2013-07	AC 2/10A
2013-08	AC 5/25A
2013-09	AC 10/50A
2013-10	AC 20/50/100/200mA
2013-11	AC 0.1/0.2/0.5/1A
2013-12	AC 0.5/1/2/5A
2013-13	AC 2/5/10/20A
2013-14	AC 10/20/50/100A
2013-15	AC 15/30V
2013-16	AC 30/75V
2013-17	AC 75/150V
2013-18	AC 150/300V
2013-19	AC 300/750V
2013-28	AC 150/300/600V

Price: $134.00 to $157.00

MULTI-RANGE AC AND DC METERS

Specifications — Same as 2011 and 2013

Model	Range
2012-00	DC 17 Range, Voltage: up to 1000V, Current: up to 30A **Price: $277.00**
2014-00	AC 13 Range, Voltage: up to 750V, Current: up to 30A **Price: $269.00**

WATTMETER

Specifications — Electrodynamometer, Accuracy: ±0.5%, Scale Length: 130 mm, Frequency: DC, 25 Hz to 1 kHz

Model	Range
2041-01	0.2/1A 120/240V
2041-02	1/5A 120/240V
2041-03	5/25A 120/240V
2041-11	0.2/1A 120/240V PF 0.2
2041-12	1/5A 120/240V PF 0.2
2041-13	5/25A 120/240V PF 0.2
2041-21	0.2/1A 30/60V PF 0.2
2041-22	1/5A 30/60V PF 0.2
2042-01	0.2/1A 120/240V (3 phases)
2042-02	1/5A 120/240V (3 phases)
2042-03	5/25A 120/240V (3 phases)

Price: $332.00 to $437.00

HIGH FREQUENCY METERS

Specifications — Thermocouple, Accuracy: ±0.5% (60 Hz) for Voltmeter, ±1.0% (60 Hz) for Ammeter, Frequency: up to 100 kHz for Voltmeter, Maximum: up to 5 MHz for Ammeter, Scale Length: 130 mm

Model	Range
2016-01	5/10/20/50mA
2016-02	20/50/100/200mA
2016-03	100/200/500/1000mA
2016-04	15/30/75/150V

Price: $347.00

YEW® **YOKOGAWA**
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Elmsford, New York 10523
Phone: (914) 592-6767
TWX: 710-567-1256

60 Years of Measuring and Recording Instrumentation

Instruments for Data Acquisition, Recording, Controlling

High performance recorders—here now to help you track processes, power, experiments, tests, and pollution. The line includes servo, direct writing and event recorders; miniature recorders; two of the lowest-cost programmable data acquisition systems available; and high performance X-Y recorders. Intertech gas analysis systems and components available for continuous stack, ambient air monitoring, and process control.

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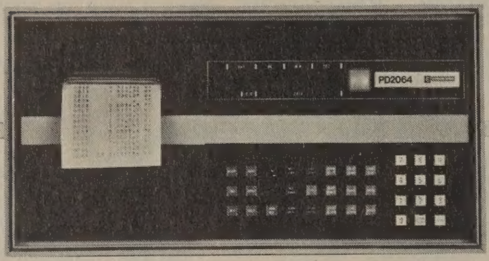
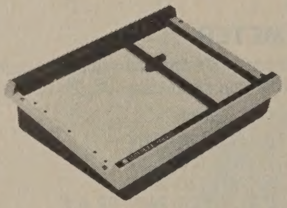
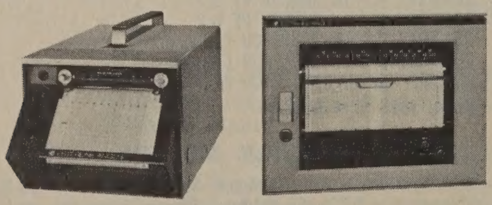


Key-Programmable Data System (PD-2064): Gathers analog and digital data in the field, lab, and plant on up to 248 channels, pushbutton-controlled through an 11-function keyboard and microprocessor setup. Functions in the self-contained system include signal conditioning, crystal controlled clocking, measurement as fast as 25 channels/second, optional high/low alarms, two outputs plus LED display, integration. Special ROM programs and Program Bank available. Simple programming. **Write for Bulletin B110.** Base price $4150.

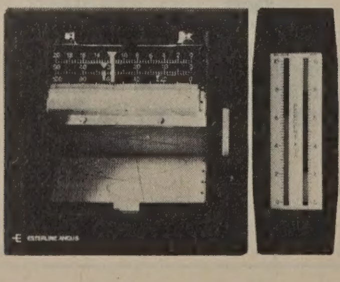
Count/Time Data Systems (C/TDS): Appears similar to the PD-2064, the C/TDS models DE2100 and DE2101 gather production, research, and traffic study data on up to 248 channels. On each channel they record number of switch operations or totalize On-time duration with printed tape and computer-compatible outputs listing performance by channel for the last minute, hour, 8 hours, or month. Key programming through microprocessor makes C/TDS extremely versatile. Optional alarms. Highly protected against the worst electrical environments. **Write for Bulletin B130.** Base price $3450.



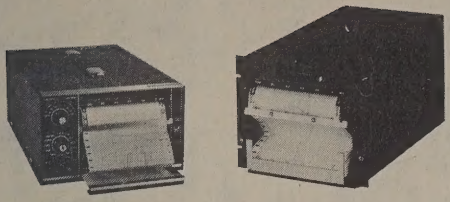
X-Y recorders for every need: Model 530 is for general lab use, with a sensitivity of 1 mV/in to 10 V/in. Model 540 is a two-pen crossover ideal for analytical readout, plotting dependent vs. independent voltages, or statistical plotting. Model 575 is stripped down for OEM applications, or order with add-on multirange module. Slew speed 45 ips both axes. Pen drop repeat rate of 45 cycles/sec. **Write for Bulletin E500.** Prices begin $1035.



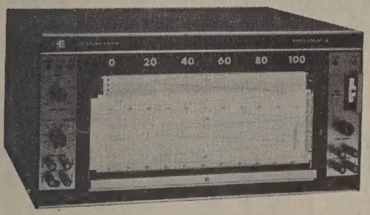
Direct writing recorders: Widest range of direct writing instruments—from 4½″ single channel curvilinear to four 2³⁄₁₆″ channel Rectigraph recorders. Electrodynamometer or permanent magnet moving coil types. To record (generally) mA, A, V, W, Vars, KVA, frequency, pressure, vacuum, speed, position. Electric or spring drives with hr., min., and sec. chart speeds. From $620. **Bulletin C200.**



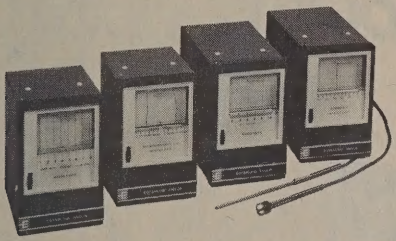
Miniservo® III recorders 1, 2 or 3 pens: 7″ x 7″ panel mounted servo recorder with independent amplifier per channel and built-in transmitter loop power supply ideal for process industry and nuclear power applications. Dependability built in with dither-free conductive plastic feedback pot, miniature DC servo motors and sturdy chart drive motor (fully enclosed and lubed). Options include indicator/annunciator, dual-speed stepper motor drive, two alarms/channel, event pulse to mark event start or stop. **Write for Bulletin F620.** Base price $550.



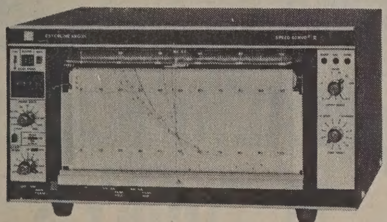
Miniservo® recorders: Basic OEM unit (right) starts at $320. Stock benchmount models include: AC unit S22087-1A at $550. Selectable chart speeds of 6, 12, 24 cm/hr. and 1, 2, 4, 10, 20 cm/min. Selectable input signal ranges of zero to: 1, 5, 10, 50, 100, 500 mV; 1, 5, 10, 50, and 100 V. ± Full scale zero adjust. AC/Battery unit S22243-1A ($795) operates from 8-hour internal 12 V rechargeable battery (included) or switch selectable 120/230 V, 50/60 Hz battery charger or external battery. Same chart speeds, ranges, zero adjust as AC Model S22087-1A. **Bulletins F613, F614.**



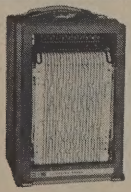
Speed Servo® II recorders: Single pen, two-pen crossover, two-pen side-by-side. 0.3 sec. response, 10″ recorder available fully equipped for versatile lab use or stripped for OEM use. All feature linear servo motor, wireless feedback potentiometer, and disposable writing system or inkless writing system. 2, 5, or 10 chart speed drives; accessible front controls 0.5 mV-100 VDC input spans; E, J, K, R, S and T thermocouple compatible. Alarms. Bench, rack mount or panel mount styles. Prices from $1095.

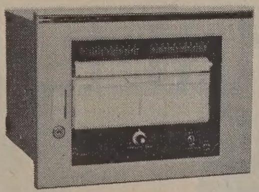


Minigraph recorders: Small low cost analog single channel, two-channel, time share and temperature inkless recorders available in 70 chart speeds. For lab, industry, education. Priced from $115. **Hook-on current transformer:** 50 or 60 Hz, indoor rated (to 750 V), 5-250 amp range dial-set. $190. **Event Minigraphs:** for 4 or 8 channel on/off or yes/no applications. From $131. **Request Bulletins C230, C231, and D330.**

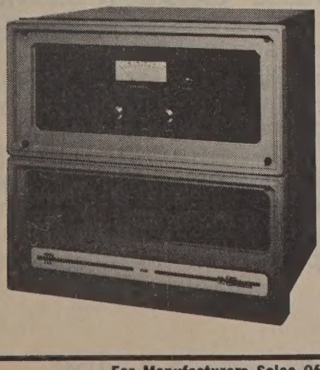


Ink and inkless multipoint: A 24- or 48-point 10″ rotary servo recorder with ink system with 1½ sec. print rate. Slide switch selects points to be deleted or printed. 1 mV minimum span. From $1795. Inkless multipoint recorder thermally brands analog data on up to 24 channels at 1 second print rate on 10″ heat-sensitive chart. Universal input panel accepts millivolt/volt or thermocouple inputs. Options include channel print/skip switches, dual range control, alarms, and time/I.D. recording. From $1725. **Ink Bulletin F600. Inkless Bulletin F720.**





Event recorders: 5, 10, 15, 20 or 40 channels ink or inkless for yes-no, on-off recording of events. 8″ x 8″ flush cases, front switch board or wall mounted cases, too. Electric or spring chart drives with hour, minute and second speeds. Hundreds of varieties possible in A, E, or S Series. Prices from $575.



Intertech gas analysis systems and components: For stack monitoring, process control, and ambient air monitoring. Automatic continuous analysis of parameters: CO, CO$_2$, HC, NO$_X$ and many others. **Write for Bulletin G1300 and application questionnaire.**

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FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

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Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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GOULD/Brush Analog and Digital Recording Systems. The Most complete Line.

GOULD/Brush direct writing recorders produce written records of highest accuracy, trace clarity, crispness and uniformity.

Gould offers a complete selection of general purpose, high performance direct writing and strip chart recorders with many exclusive features.

Most models are available in both portable and rack mounted versions. These quality recorders are ideally suited for industrial and scientific applications that require the highest precision, sensitivity and accuracy.

For brochure call toll free at (800) 325-6400
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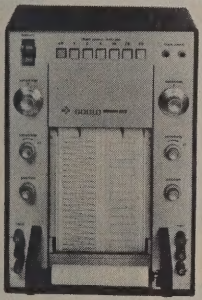
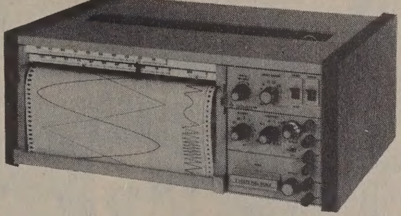
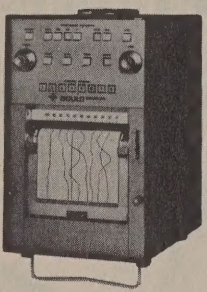
In Missouri: (800) 342-6600



GOULD/Brush 222•2-CHANNEL. Portable battery operated version of Brush 220 recorder. Internal recharger. 30Hz frequency response. Sensitivity 1mV/div. to 500Vf.s.

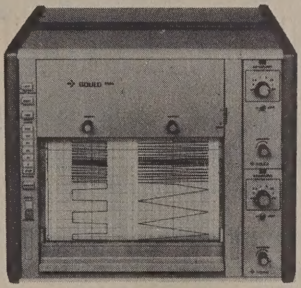


GOULD/Brush 110 STRIP CHART. Most versatile 10-inch recorder. One or two channels; integrator optional. Lifetime thermal pen guarantee. 0.25 sec. f.s. response.

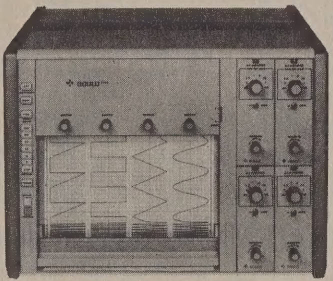


GOULD/Brush 816 • 8-CHANNEL HI-SPEED MULTIPOINT. Data is recorded at a rate 2 sec. / point to 16 points / sec.

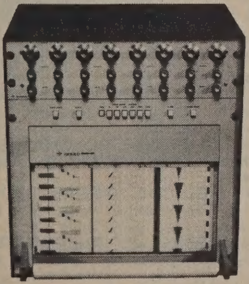
GOULD/Brush 260•6-CHANNEL. High precision and operator conveniences. Built-in preamps. 1mV/div. to 500Vf.s. sensitivity.



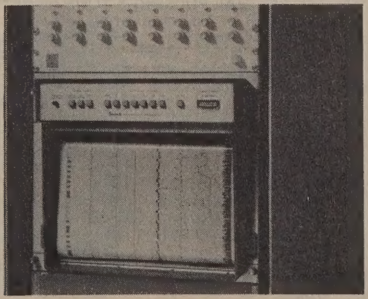
GOULD / Brush 2400 • 2-CHANNEL. Channels are a true 100mm wide. Plug-in preamps. 30Hz frequency response.



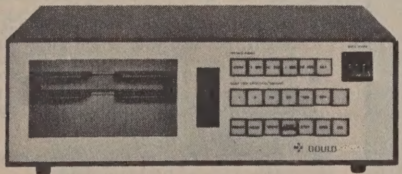
GOULD / Brush 2400 • 4-CHANNEL. 50mm channels, 50Hz frequency response, 99.65% linearity.



GOULD/Brush 481•8-CHANNEL. 1mV/div. to 500 V f.s. sensitity. Model 480 available without preamps.



GOULD/Brush 200•8-CHANNEL. The world's standard for high performance recorders. Tailored to your specific requirements.



GOULD 6100 DATA ACQUISITION SYSTEM. 128 floating and integrating inputs, real time monitoring, 200 points/sec., 3M tape cartridge.

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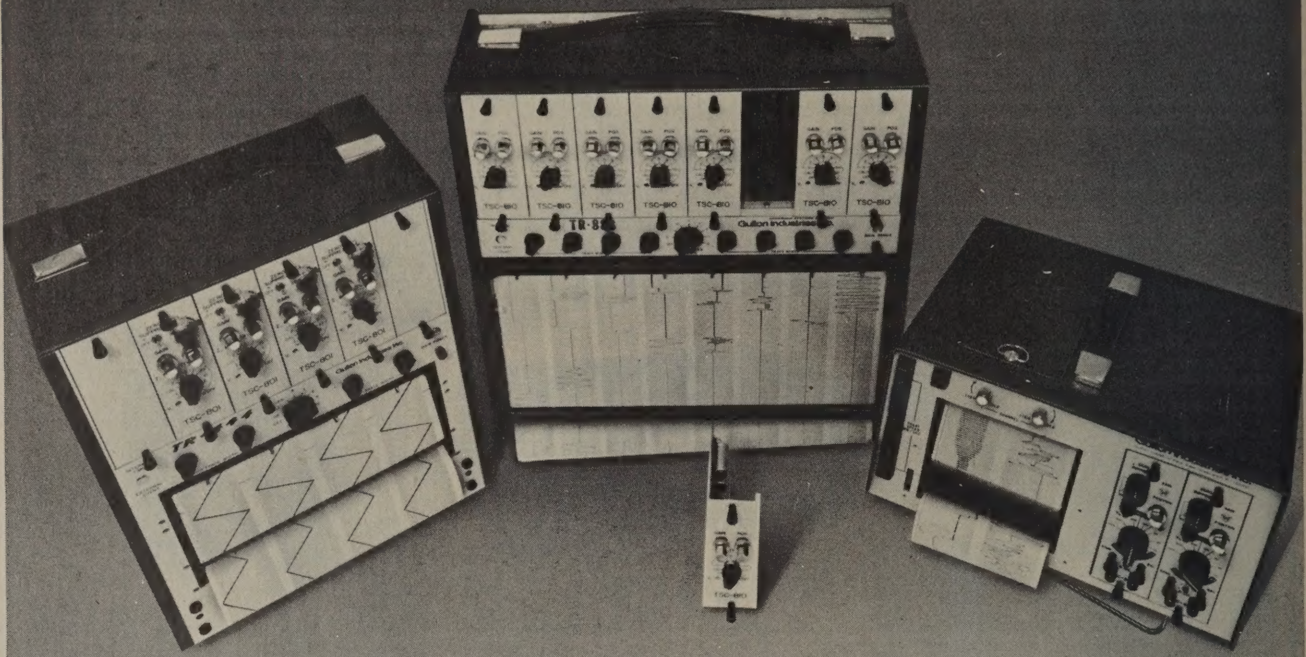

2 WEEKS DELIVERY ON PORTABLE MULTICHANNEL RECORDERS

2, 4, 6 and 8 CHANNEL RECORDERS WITH OUR OFF-THE-SHELF PLUG-IN SIGNAL CONDITIONERS . . . THESE ARE THE SMALLEST, LIGHTEST, MOST VERSATILE PORTABLE RECORDERS AVAILABLE

COMPARE THESE FEATURES WITH ANY OTHER RECORDER'S:

- True portability: for example, our 8 channel recorder weighs only 65 lbs. and measures 17½" x 19" x 6". Our 2-channel is only 30 lbs.
- Frequency response: 100 Hz (-3dB) for 2, 4, and 6-channel recorders, 125 Hz (-3dB) for 8-channel recorder.
- Interchangeable signal conditioners provide recording of temperature (thermocouple and thermistor), ac and dc strain, volts, millivolts, microvolts (down to 20 microvolts/div.), ac to dc, frequency to dc, EKG, and log to dc.
- Electrically selectable chart speeds from 0.5 to 100 mm/sec.
- Inkless writing by reliable heated stylus on rectilinear chart paper.

PLUG-IN SIGNAL CONDITIONERS FOR GULTON PORTABLE MULTICHANNELS

- TSC-800 LOW GAIN—Low cost. Single span. 10 mV/div. sensitivity.
- TSC-801 MEDIUM GAIN — 1 mV/div. sensitivity.
- TSC-810 LOW GAIN — 10 mV/div. sensitivity.
- TSC-820 HIGH GAIN — 10 uV/div. sensitivity. For use with strain gage transducers.
- TSC-510 AC STRAIN — 5 uV RMS/div. For use with strain gages, LVDT's, and variable reluctance transducers. Toggle switch permits bypass of signal conditioning circuitry.
- TSC-500 J, T, K or E — Preamps with thermocouple compensation.
- TSC-811 CURRENT TO DC — Monitor currents from 1 to 20 m/A. Four ranges.
- TSC-815 DIAL PULSING & TONE BURST MONITOR — For monitoring telephone communications.
- TSC-822 HIGH GAIN — Same as TSC-820, except without DC excitation.
- TSC-823 HIGH/LOW GAIN — Two ranges: 5uV/div. to 500 uV/div. and 5 mV/div. to 500 mV/div. Zero suppression.
- TSC-830 FREQUENCY TO DC CONVERTER — Input frequency range 10 Hz to 20 KHz.
- TSC-831 FREQUENCY TO DC CONVERTER — Same as TSC-830, but with f.s. range suppression and 10X scale expansion.
- TSC-840 AC TO DC CONVERTER — 50 Hz to 100 kHz range. Inputs to 250 VRMS.
- TSC-840A AC TO DC CONVERTER — 50 Hz to 100 kHz range. Inputs to 1000 VRMS.
- TSC-841 AC TO DC CONVERTER — 100A to 1000A. Use with clamp-on current transformer.
- TSC-843 COMMUNICATIONS PREAMP — Converts AC to log. Records DC signals up to 100 Hz.
- TSC-850 EKG SIGNAL CONDITIONER —For research and laboratory diagnostic use.
- TSC-870 MEDICAL THERMISTOR PROBE — Temperature range 50° to 113°F.
- TSC-871 INDUSTRIAL THERMISTOR PROBE — Temperature range 0° to 100°C.
- TSC-880 LOG TO DC — Range −80 dB to +40 dB over 50 Hz to 100 kHz.

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Measurement & Control Systems Division

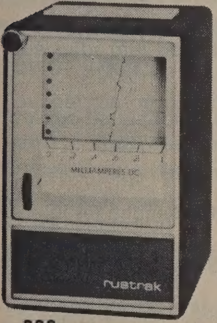
Gulton Industries Inc., East Greenwich, R.I. 02818 (401) 884-6800 TWX 710-387-1500

Rustrak Miniature Chart Recorders

Rustrak miniature chart recorders generally measure 5-5/8″ high x 3-5/8″ wide x 4-1/8″ deep, and offer a wide range of sensitivities, writing and chart speeds. Accuracy is typically ±2% of full scale and response time is 0.8 to 1.0 seconds. The recorders operate in both chart rewind and tear-off modes. Chart width of single channel recorders is 2-5/16″, dual channels 1″ each.

Single Channel DC Recorder.

Basic recoruer in the Rustrak line. Ranges from 0-10 microamperes to 0-5 amperes DC; 0-10 millivolts to 0-500 VDC. Multipliers and shunts available. Chart speeds 1/32″ to 480″ per hour. Many available options, features and accessories. AC models also available.



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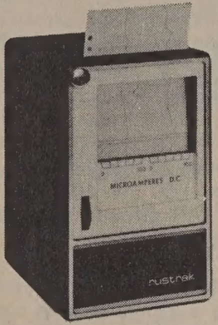


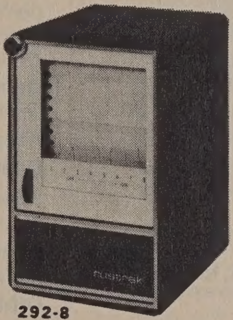
291

Dual Channel DC Recorder

Same as basic Model 288 except dual channel with two galvanometers. Available in combinations of current and voltage or different ranges each channel. Usable chart width, 1″ per channel. AC models also available.

Event Recorders, 4, 8, 16, 24 Channels

Record worktime; productivity of machines and personnel; provide data for time study, cost analysis, security control. Chart speeds to 50 inches per minute with definition of up to 16 events per second.



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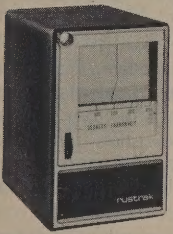
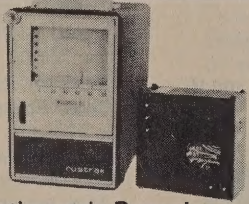


2122

Temperature Recorders.

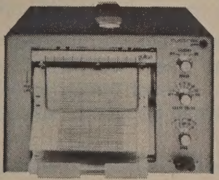
Wide variety of temperature recorders using thermocouples, thermistors or nickel wire sensors. Ranges from −100° F. to +2400° F. and custom spans as narrow as 25° F. Also available in °C. and in single or dual channels.

400



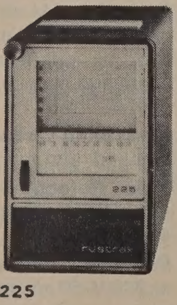
Potentiometric Recorder.

100 mV direct writing recorder offers 1 megohm input impedance and solid-state amplifier. Series of plug-in modules available for increased sensitivity to 1 mV full-scale. Other plug-ins with cold junction compensation and for special applications.



4″ Servo Recorders

OEM and lab models. More features and options than any recorder in its price class. Choose from 49 plug-in range cards to record temperature, dc volts, dc current. Tearoff, reroll or z-fold chart styles. High/low solid state alarm contacts and event pen optional.



225

RH/TEMP Recorder

Electronically monitors relative humidity from 10% to 90% and temperature from 60° to 90°F on a single chart. Chart lasts 2 months, continuous operation. No ink to add or messy cartridges to change. Sensors included. Ideal for computer room, clean rooms, or offices.

gulton®

Measurement & Control Systems Division
Gulton Industries Inc., East Greenwich, Rhode Island 02818
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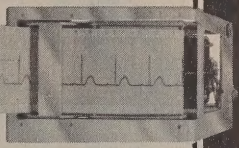
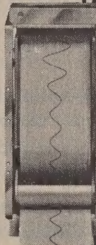
Gulton OEM Recorder Building Blocks

Models available in 1,2,3,4,6 and 8 channels...full alphanumeric thermal printing available... extremely sturdy, long life ceramic stylus optionally available ...frequency response up to 140 Hz (-3dB).



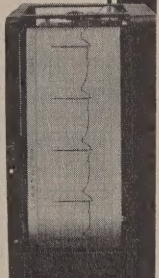
MED-102
Select exactly the package you want…from basic module without amplifier/power supply and transformer to full alphanumeric printout capabiltity. Frequency response is 140 Hz (-3dB). MED-100 version meets AHA and UL 544.

MED-110
Slide mounted unit has horizontal transport and internal rewind. Offers full alphanumeric printing. Less amplifier power supply and transformer.



MED-120 DC
Low power consumption for portable battery operation. Miniature size, only 3″ w x 5½″ h x 4½″ d.

Mark 3
Records analog data while printing alphanumeric data in chart margin. Frequency response is 100 Hz (-3dB). Large chart viewing area. Minimum depth requirement.



Multichannel Building Blocks
Standard units available are 2,3,4,6 and 8 channel configurations. Basic design adaptable to many individual requirements.

There are many more recorder models available. Custom variations on any particular model easily accomplished. Call or write now for comprehensive data.

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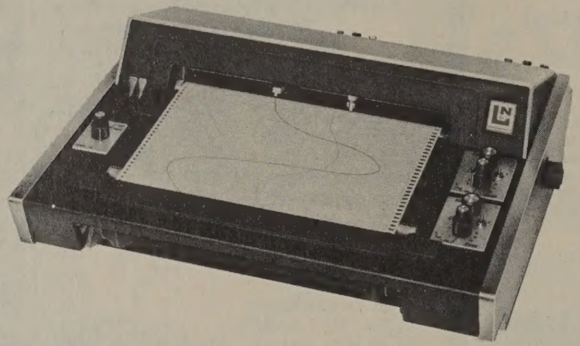
Lab Recorders with the performance, versatility and reliability you've come to expect from Leeds & Northrup



Speedomax XL 625-Series Flat-Bed Lab Recorder

A broad selection of convenience features in a flat-bed lab recorder

- **All-solid-state shielded circuitry, including F.E.T. low-level input circuit**
- **0.5 second span-step-response time**
- **Single- or two-channel models**
- **Interchangeable fixed, dual-fixed, or AZAR® (adjustable-zero, adjustable-range) ranges**
- **AZAR range continuously adjustable from 400 μV to 100 V**
- **All ranges feature continuous uncalibrated zero adjustment, ±100% of span**
- **Exclusive automatic gain and damping for all ranges**
- **Easy range-change with plug-in range modules**
- **Convenient rear-mounted quick-disconnect 5-way input terminals, and terminal board connections for remote operations**
- **Conductive-plastic linear "slidewire" with infinite resolution, optimum performance**
- **Drop-in chart replacement and chart reroll**
- **Tearoff bar is standard; positive chart feedout if reroll is not used**
- **Single, dual or multiple (6 or 10) chart speeds**
- **Metric or English calibration and exact chart drive, readily convertible**
- **Zero-left or zero-right calibration of span and chart**
- **Stable mounting on shelf or lab table only 12" deep**
- **Disposable marker pen system for simple, clean, instant-start recording**
- **Separate mechanical pen lifters standard; electrical pen lifters optional; electrically-actuated event pen optional**

Specifications

(Specs meet or exceed performance requirements of ANSI Spec. C39.4-1966)

Measuring Circuit—D-c potentiometer, with F.E.T. low-level input circuit, for each channel; potentiometric up to 5 V and voltage-divider network (2.5 megohms, fixed) above 5 V.

Record—One- or two-channel, with independent pen systems. Record can be zero-left (standard) or zero-right (reversed-polarity option).

Range Spans—Fixed Spans: 1 millivolt to 100 volts. (Note: When specified for any span less than 50 mV, the recorder is supplied with a plug-in low-level preamplifier.) Dual Spans: Switch selection of either of two fixed emf spans within three categories: 1-50 mV; 100 mV-5V; and 10 V-100 V. Adjustable Spans: AZAR circuits available to provide (a) 16 switch-selected spans from 1 mV to 100 V, or (b) 10 spans from 100 mV to 100 V. AZAR circuits include a continuously adjustable uncalibrated vernier to provide a maximum 2.5:1 "span-down," permitting a minimum span of 400 μV. Both fixed and AZAR spans are also provided with an uncalibrated zero adjustable to ±100% of span.

Gain and Damping Adjustments—Preset: do not require resetting with a span change.

Accuracy Rating—±0.25% of span.

Deadband—0.1% of electrical span.

Span Step-Response-Time Rating—0.5 second for full-scale response.

Source Impedance Rating—Up to 25,000 ohms on all spans for rated response.

Off-Balance Input Impedance—3.5 megohms for spans $\leq$5 V; 2.5 megohms for spans $>$5 V.

Chart—English: Standard Speedomax W chart, 9⅞" in calibrated width, fractional-inch horizontal spacing, 30 yards per roll. Metric: Chart is 250 mm in calibrated width, with metric horizontal spacing, 27 meters per roll.

Chart Speed—Many listed single speeds, ranging from 1 in/hr to 720 in/hr, or 3 cm/hr to 1800 cm/hr; or switch-selected combination of two speeds. Rotary switch selection from standard six-speed combinations or rotary-switch selection from a standard ten-speed combination. For remote start/stop of chart drive, a recessed female receptacle (two-blade) is mounted at the rear of the recorder.

Recording Pens—Standard pens are disposable marker type.

Event Pens—An electrically-actuated event pen is optional. Connections are brought to the terminal board on the rear for remote actuation.

Pen Lifter—Mechanical type; separate lifter for each recorder pen. The optional event pen has a separate lifter. Electric pen lifter, for independent operation of each recorder pen, is optional and may be remotely operated from terminal connections at rear.

Measuring-Circuit Current Source—Supplied by an a-c line, rectified, and regulated by precision Zener-diode circuit.

Noise Rejection—Common Mode: At line frequency or d-c, 80 dB or 100 V, whichever is less. Normal Mode: At line frequency, 40 dB.

Power Requirements—Operates on 120 V, 60 Hz, or 120, 220 or 240 V, 50 Hz, as specified.

Power Consumption—Single-channel: 20 VA. Two-channel: 35 VA.

Case Dimensions—16⅝" deep by 18" wide by 7" high (422 × 457 × 178 mm). Base is designed so recorder will sit on a shelf or lab table 12" deep (305 mm).

Weight—Single-channel: 28 lb (12.7 kg); two-channel: 30 lb (13.6 kg).

LEEDS & NORTHRUP

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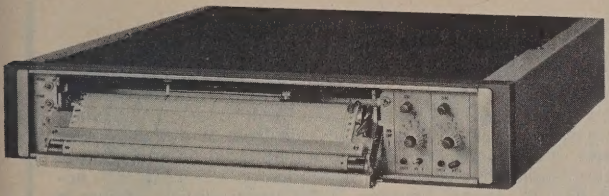


Speedomax XL630-Series Lab/Test Recorder

Provides one or two pen 10″ wide recording in only 3½″ of vertical panel space.

- **Unique Maxi-View™ chart drive feature provides "instant replay" of previous records**
- **10″ wide recording in only 3½″ of vertical panel space**
- **Disposable markers standard . . . thermal marking system optional**
- **One or two full scale, cross-over pens . . . English or metric calibration**
- **Lever-operated manual chart advance**
- **Single, dual or adjustable-zero, adjustable spans**
- **Wide selection of ranges**
- **Mechanical pen lifters standard . . . electrical lifters optional**
- **Meets ANSI C39.4-1966 Performance Standard and ANSI C39.5 (Proposed Safety Standard)**
- **Bench, rack or panel mount**
- **Electronic Off-Scale limit protection**

Specifications

Recorder meets or exceeds specifications listed in ANSI Standard Specifications for Automatic Null-Balancing Electrical Measuring Instruments C39.4-1966 and ANSI C39.5 (Proposed Safety Standard).

Measuring Circuit—D-c potentiometer.

Record—One or two channels with independent disposable markers. Thermal marking system optionally available for single-channel recorder.

Range Spans—Emf spans provided by interchangeable plug-in modules.

Fixed Spans—1 mV to 100 V d-c.

Adjustable Spans—(1) Low-Level AZAR (Adjustable Zero, Adjustable Range) Circuit provides selection of 1, 2, 5, 10, 20, 50 mV and 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 V d-c. (2) High-Level AZAR Circuit provides selection of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 V d-c. Both AZAR circuits contain a continuously adjustable uncalibrated vernier between fixed span steps to provide a 2.5:1 span turndown. All spans are provided with an uncalibrated ±100% zero adjustment.

Accuracy—±0.25% of span.

Dead Band—≤0.1% of span.

Span Step-Response-Time—0.5 second for full scale response.

Source Impedance—≤25,000 ohms.

Off-Balance Input Impedance—Spans up to 100 mV: from 3.5 megohms at 1 Hz to 0.2 megohm at 40 Hz and above; Span 0.1 to 5 V: 3.5 megohms; Spans over 5 V: 2.5 megohms.

Balance Input Impedance—Spans up to 5 V: 30 megohms; Spans over 5 V: 2.5 megohms.

Common Mode Rejection—Greater than 80 dB at full source impedance.

Normal Mode Rejection—Greater than 40 dB at line frequency.

Power Requirements—Operates on 120 volts, 60 Hz or on 120, 220, or 240 volts, 50 Hz as specified.

Power Consumption—One Channel: 20 volt-amperes
Two Channels: 35 volt-amperes

Chart—9⅞ inches (250 millimeters) in calibrated width and 30 yards (about 27 meters) long.

Chart Speeds—Single or switch selection of two speeds (1 to 720 in/hr or 3 to 1800 cm/hr). Mechanical ten-speed changer (0.5 to 3600 in/hr or 1 to 7200 cm/hr). Electronic ten-speed changer (1 to 360 in/hr or 6 to 720 cm/hr).

Pen Lifters—Mechanical type. Solenoid operated type optionally available.

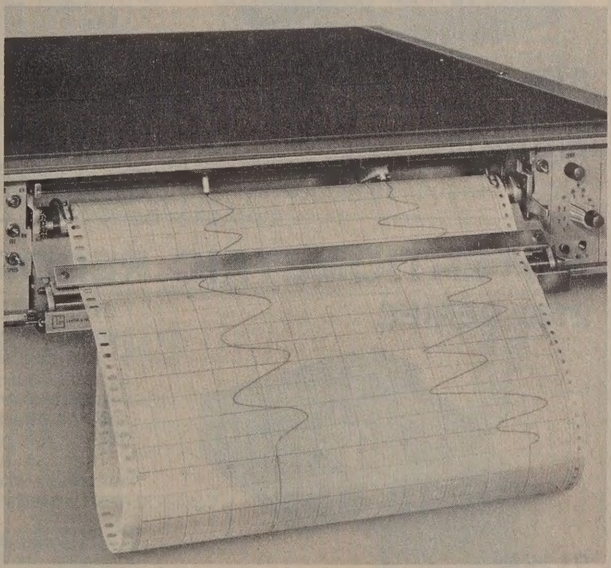
Event Marker—Optionally available for X1 channel only; equipped with disposable marker or thermal marking system.

Scale—An optional scale with pointers can be supplied.

Case—Designed for panel, cabinet-type relay rack, telephone-type relay rack, or bench mounting. Chassis of panel, cabinet-type relay rack, or telephone-type relay rack recorder supported on drawer-type slides; bench-type recorder supported on four feet.

Dimensions—Panel, cabinet-type relay rack, or telephone-type relay rack recorders: 3½″ high by 19″ wide by 19½″ deep behind panel (89 mm × 483 mm × 495 mm). Bench type recorders: 4″ high by 19″ wide by 21¾″ deep (102 mm × 483 mm × 552 mm).

Weight—One-pen models, 27 lb (12.3 kg) and two-pen models, 37 lb (16.8 kg).



SIMPLE RECORD REVIEW Push a lever and unroll your chart for an "instant replay" review of previous record . . . then push and automatically rewind . . . all without stopping the regular chart drive. This unique feature gives you the chart visibility of "free fall" operation even when the chart is operated in the reroll mode.

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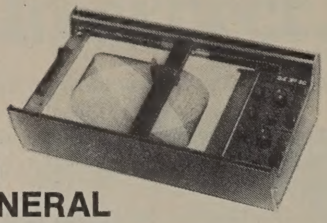
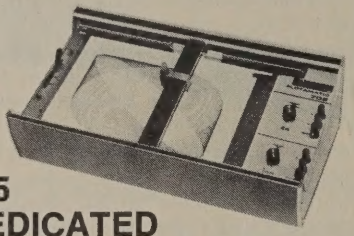
X-Y PLOTAMATIC RECORDERS

700 SERIES 8½" x 11" (DIN. A4)



715 GENERAL PURPOSE



705 DEDICATED OEM

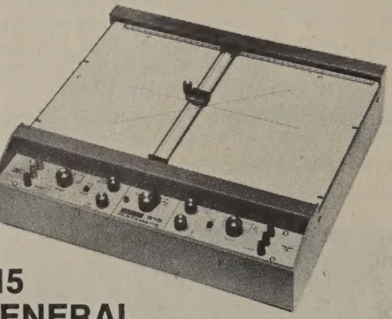
700 SERIES RECORDERS WITH PAD/LOAD®

The 700 Series recorders, while low in cost, still meet or exceed the performance specifications of many higher priced recorders. The new "PAD/LOAD®" paper handling system, operates three times faster than those available on conventional single sheet machines. A 50-sheet pad of paper is loaded into the recorder, and as each page is consumed, the operator simply tears off the used sheet, exposing a new sheet.

All 700 Series PLOTAMATICS have • I/C circuitry • No mechanical or photo choppers • Clean fibre-tip pens • Electronic over-drive protection • Operate from 50-400 Hz power • Buffered feedback potentiometers for noise immunity • ±0.2% F.S. accuracy • Differential guarded inputs with 140 db CMR • Constant 1 meg input impedance • No servo gain adjustments.

MODEL NO.		APPLICATION	RANGE	SLEWING SPEED
English	Metric			
705		dedicated - OEM	1 range: 100 mV/in	17 in/sec
	705M	dedicated - OEM	1 range: 40 mV/cm	43 cm/sec
715		general purpose	5 ranges: 1 mV/in to 10 V/in	17 in/sec
	715M	general purpose	5 ranges: .05 mV/cm to 5.0 V/cm	43 cm/sec
7T		plug-in time base generator (use with 700 or 800 Series)	0.5, 1, 2, 5, 10, 20, 50 sec/in and 0.25, 0.5, 1, 2.5, 5, 10, 25 sec/cm	

800 SERIES 11" x 17" (DIN. A3)



815 GENERAL PURPOSE

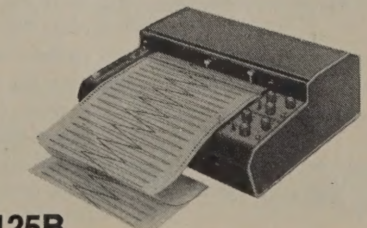
800 SERIES RECORDERS

800 Series recorders meet or exceed the performance specifications of many higher-priced units. All 800 Series PLOTAMATICS have • I/C circuitry • No mechanical or photo choppers • Fibre-tip or optional capillary pens • Electronic overdrive protection • Differential-pressure paper hold-down • Buffered feedback potentiometers for noise immunity • ±0.2% F.S. accuracy • Differential, guarded inputs with 140 db CMR • Constant 1 meg input impedance • No servo gain adjustments • Holds either 8½" x 11" x 17" paper.

MODEL NO.		APPLICATION	INPUT RANGES	SLEWING SPEED
English	Metric			
805		dedicated - OEM	1 range: 100 mV/in	30 in/sec
	805M	dedicated - OEM	1 range: 40 mV/cm	76 cm/sec
810		remote control - OEM	1 range: 1 mV/in	30 in/sec
	810M	remote control - OEM	1 range: 0.5 mV/cm	76 cm/sec
815		general purpose	5 ranges: 1 mV/in to 10 V/in	30 in/sec
	815M	general purpose	5 ranges: 0.5 mV/cm to 5.0 V/cm	76 cm/sec

POTENTIOMETRIC RECORDERS

2100 SERIES



2125B 2-PEN GENERAL PURPOSE

2100 SERIES FLATBED POTENTIOMETRIC STRIP CHART RECORDERS

The 10" 2100 Series features single or two-pen models for dedicated or general purpose applications. The versatile chart drive pulls both Z-fold and roll chart. Features include • Z-fold or roll chart without adjustment • Tear bar adjacent to pen tips for immediate data access • Up to 10 chart speeds independent of line frequency • Optional TTL proportional chart drive • Rugged die-cast aluminum construction • Electronic over-range protection • 3200 feet of trace from snap-in disposable fibre-tip pens • Optional event markers • .25% accuracy • .5 second response • Optional alarm circuits.

MODEL NO.		APPLICATION	STANDARD SPAN (Options Available)
English	Metric		
2110B	2110M	Single Pen Dedicated	Single Span 1 V
2115B	2115M	Single Pen General Purpose	13-Span 1 mV — 10 V
2120B	2120M	2-Pen Dedicated	Single Span 1 V
2125B	2125M	2-Pen General Purpose	13-Span 1 mV — 10 V

REFER TO POTENTIOMETRIC RECORDER SECTION FOR COMPLETE MFG. LISTING

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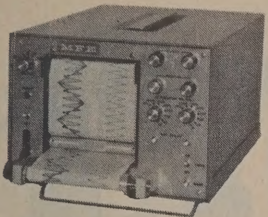
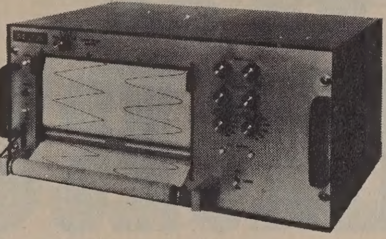
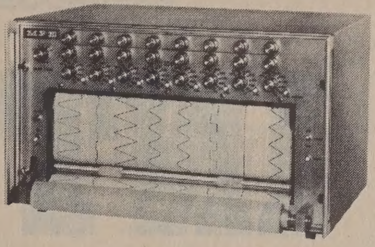
STRIP CHART RECORDERS

PORTABLE/RACK MOUNT RECORDING SYSTEMS



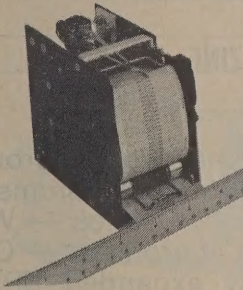


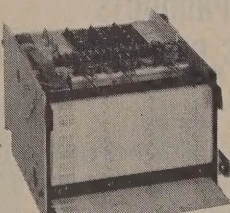


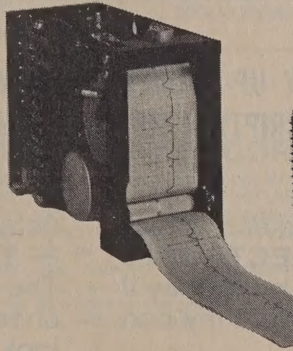
MFE portable or rack mount single and multi-channel recording systems are completely self-contained lightweight instruments. Features include • inkless heated stylus writing • solid state design • 40 Hz full scale bandwidth • wide channels • dc to 100 Hz (-3 db) 10 mm pp • 7 step attenuators • multiple chart speeds • 10 mv/mm sensitivity or optional 1 mv/mm.

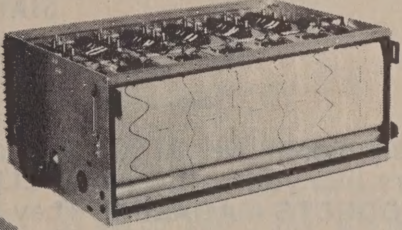
MODEL	NO. CHANNELS	CHANNEL WIDTH	FREQUENCY, RANGE	PANEL HEIGHT	WT.
M21CAHA	1	50 mm	dc to 100 Hz	8¾″	15 lbs.
M-51	1	100 mm	dc to 15 Hz	8¾″	20 lbs.
M-22CAHA	2	50 mm	dc to 100 Hz	8¾″	22 lbs.
M-52	2	100 mm	dc to 15 Hz	10½″	40 lbs.
M-23CAHA	3	50 mm	dc to 100 Hz	8¾″	39 lbs.
M-53	3	100 mm	dc to 15 Hz	10½″	48 lbs.
M-24CAHA	4	50 mm	dc to 100 Hz	8¾″	45 lbs.
M-26DAHA	6	50 mm	dc to 100 Hz	10½″	57 lbs.
M-28D	8	40 mm	dc to 100 Hz	10½″	64 lbs.
OPTION 01	1 mv/mm				

OEM RECORDER MODULES







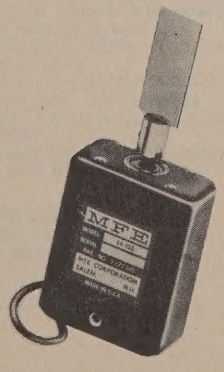


MFE single through 8 channel thermal writing recorder modules are designed for maximum flexibility. The basic transport is equipped with the MFE moving iron pen motor(s), chart drive motor(s), stylus heat power supply and control potentiometer, for each channel and front loading paper supply and drive mechanism. To the basic module are added MFE plug-in solid state drive amplifiers, power supplies and accessory equipment: event marker(s), paper take-up, front panel, and portable case. Modules are available with 40, 50, 80, or 100 mm-wide channels. Main power options include: 100, 117, 220, 230, 240V; 50 or 60 Hz, or 12 Vdc. Also available: thermal edge printing, single or multiple line, velocity feedback and position feedback recorders, and UL 544 listed recorders.

SCANNING AND TORQUE MOTORS

MFE's Scanning/Torque Motors are an adaptation of the basic moving iron principle which accomplishes the transition from electrical signal to mechanical force or position in a highly efficient manner. These devices produce an output torque proportional to input current over ±15° of motion.* 20 basic models offer a wide range of size, price, and performance characteristics.

- MOVING IRON PRINCIPLE
- HIGH RELIABILITY
- ±15° DEFLECTION
- LONG LIFE
- HIGH FREQUENCY RESPONSE
- RUGGED, COMPACT
- LINEAR OR TANGENT CORRECTED
- LOW POWER INPUT
- VALUE PRICED



REFER TO SCANNING AND MOTOR SECTION FOR COMPLETE MFG. LISTING

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*The S4 Series of Optical Scanning Motors includes bearingless single frequency resonant systems designed to operate from 200 to 2000 Hz, as well as scanners complete with velocity feedback and position feedback transducers.

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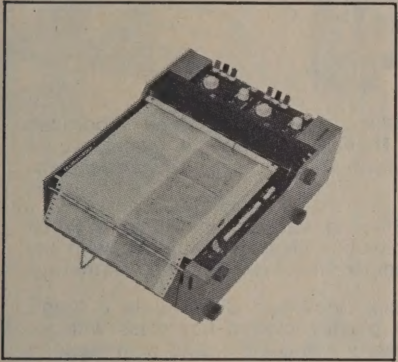


3050 SERIES FLAT BED RECORDERS

The Model 3050 is a plug-in type single and dual pen strip chart recorder with a self-balancing potentiometric mechanism. A wide selection of plug-in modules make this recorder particularly suited for a variety of applications. Exceptionally well shielded and guarded input circuits provide a high degree of noise immunity so extremely stable recordings are assured.

Recorder functions can be further expanded through such options as remote control of chart speed, bi-directional paper feeding, remote control of pen lift, re-transmitting slide wire, alarm circuits, time markers, etc.

SPECIFICATIONS

Channels: Single (3051) or dual pen (3052)
Chart: 250 mm Z-Fold or Roll
Writing: Ink or Electrostatic
Chart Drive: 60cm/min. to 2cm/hr. in 8 ranges
Plug-ins: Modular input units indicated below
Input Impedance: 2 megohms max.

Plug-in Modules

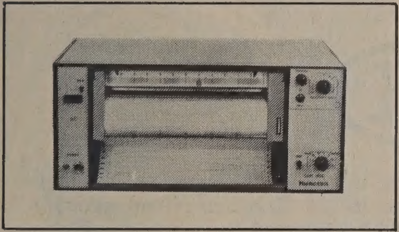
3053-11: DC 0.5mV to 5V/cm (13 ranges)
3053-12: DC 25μV to 5V/cm (17 ranges)
3053-13: DC 5μV to 5V/cm (9 ranges)
3053-31: AC 2.5/5/10V/cm (3 ranges)
3053-41: DC OFF-SET UNIT
3053-21: Single range
3053-22: Single range

Price:

3051: Start @ $920.00, 3052: Start @ $1,364.00, Plug-in modules: Start @ $105.00

Precision Temperature Measurement Modules for 3050 Series Recorders

3053-55: −50°C to 110°C
3053-56: 0°C to 1,200°C (CA)
3053-57: −200°C to 300°C (CC)
3053-59: ±60mV (CA, CC, PR, CRC & IC)



3040 SERIES LABORATORY RECORDER

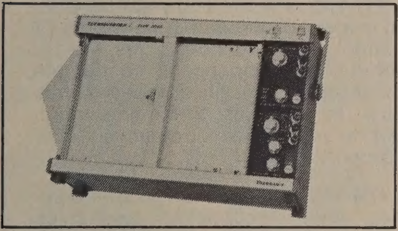
The 3040 Series Laboratory Recorders are selfbalancing potentiometric recorders with either a single pen or dual pens. It uses a high-frequency modulated DC amplifier for high noise rejection and stable recording. These recorders have a maximum sensitivity of 200μV/200mm and an accuracy of ±0.3%.

SPECIFICATIONS

Accuracy: ±0.3%
Chart: 250mm (10") wide, 15m (45 feet) long z-fold chart used.
Input range: 0.5mV to 100V/200mm (17 ranges)

Price:

3046 (single pen): $995.00
3047 (dual pen): $1,575.00



3083 SERIES X-Y RECORDER

The Model 3083 is a plug-in type single pen X-Y recorder with an 8½ x 11" chart (DIN and JIS Size A-4). Both rool chart and sheet are available. With the optional Paper Take-Up Unit, this X-Y Recorder may be used as a continuous recording strip chart recorder. The pen holder supplied permits the use of a standard commercial felt-tip pen, ball-point pen or pencil in addition to the unit's ink writing system.

SPECIFICATIONS

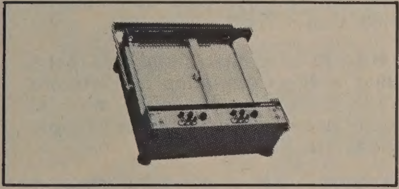
Accuracy: ±0.3%
Pen speed: Approx. 0.7 seconds for 200mm

Plug-in-modules

Interchangeable with plug-ins for 3050 series Flat Bed Recorder except 3053-42 Time Base Unit with DC ranges of 0.5mV to 5V/cm (10 ranges) 3085 Paper Take-Up Unit

Price

3083: $1,253.00, Plug-ins: Start @ $105.00



3070 SERIES X-Y RECORDER

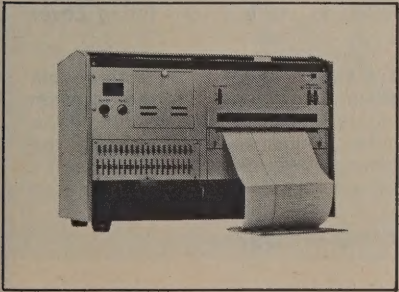
The Models 3077 and 3078 are single pen and dual pen X-Y Recorders respectively with a DC servo system. DC measuring ranges are from 100 μV to 10V/cm (16 ranges) for applications requiring wide ranges. A time base is built-in as standard. Common mode rejection is high 160 dB at DC and 140dB at 60Hz. Desk-top, portable and rack mounting are available.

SPECIFICATIONS

Accuracy: ±0.3%
Recording area: 250 x 250 mm (10" x 10")
Pen speed: Approx. 1 second for full scale.
Input impedance: 1 MΩ constant

Price:

3077: $1,843.00 (1 pen)
3078: $2,622.00 (2 pen)



2900 SERIES LIGHT BEAM OSCILLOGRAPH

This series consists of photographic recorders which use light sensitive paper. Since these units respond to very high frequencies they are most suitable for recording waveforms which change at very high speeds. Three models, 6-channel, 9-channel and 18-channel, are available. The long optical arm (450mm) which is common to all models, provides high-accuracy recordings with minimum arc distortion.

SPECIFICATIONS

Model: Type 2901 6 channels, portable
Type 2924 9 channels, desk-top or rack mount available
Type 2925 18 channels, desk-top or rack mount available
Frequency: DC to 3,500Hz, depending on galvanometers used
Sensitivity: Approx. 3.3 μA/mm to 2.8mmA/mm, depending on galvanometers used.
Recording width: 127mm for 2901, 178mm for 2924 and 2925
Light source: High tension mercury arc lamp
Paper speed: Up to 200mm per second

Price:

2901: $2,248.00, 2924: $2,809.00
2925: $3,456.00, 2916 Galvanometers: Start @ $83.00

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HYGRADE®

HYGRADE Polytube 463 Class F Flexible Fiberglass Sleeving is an acrylic-coated material especially compatible with the wire enamels used in motors and transformers.

HYGRADE Thermoflex 1200 Class C Flexible Fiberglass Sleeving is made of 100% tightly braided fiberglass. For use at continuous temperatures as high as 1200°F. (UL FR-1)

HYGRADE Thermoflex 500 Class C Flexible Fiberglass Sleeving is made of tightly braided and pigmented fiberglass. For continuous operating temperatures to 500°F. (UL FR-1)

HYGRADE SR-398 Silicone Rubber Coated Fiberglass Sleeving is a Class H material made of closely-woven glass braid, coated with highly abrasion-resistant silicone rubber. (UL FR-1)

HYGRADE SV-862 Silicone Varnish Impregnated Fiberglass Sleeving is a flexible Class H insulation with unusual resistance to temperature extremes and weathering.

HYGRADE VF Flexible Fiberglass Sleeving is a tough, Class B insulation of plastic-covered fiberglass with excellent electrical resistance, flexibility, and heat stability. (UL FR-1)

ELECTRICAL GRADE PLASTIC TUBINGS

FLEXITE®

FLEXITE TEFLON* TFE Extruded Tubing offers unequaled quality, performance and stability over the widest temperature range of any flexible insulation (−70°C to +260°C). Its unique characteristics are superb electrical properties, unmatched chemical resistance, zero moisture absorption, non-corrosive to all metals, completely inert to fungi, and excellent anti-stick properties—having the lowest coefficient of friction of any solid material. With nearly infinite life under normal operating conditions, Teflon TFE is the ultimate space age insulating material.

FLEXITE TEFLON* FEP Extruded Tubing is a fluorocarbon material that combines long-term reliability (matched only by TFE) with chemical inertness, flexibility, superb electrical characteristics and a useful continuous operating temperature range of −70°C to +200°C.

FLEXITE SR-200 Silicone Rubber Extruded Tubing is made of an extremely elastic compound, and is excellent for high voltage applications at Class H temperatures to −70°C.

FLEXITE HT-105C Extruded Vinyl Tubing is UL recognized for continuous use at 105°C. It is a strong, very flexible tubing for many applications. (UL FR-1) (CSA)

FLEXITE E Extruded Vinyl Tubing is an extremely flexible tubing designed primarily for low temperature applications (to −68°C), as in aeronautical instrumentation.

FLEXITE Shrinkdown HT-105 is a flexible material made in expanded sizes to shrink 50% with 110°C heating; has outstanding electrical and mechanical properties (UL FR-1)

FLEXITE Shrinkdown LM-145 is a very flexible modified polyolefin tubing that will shrink 50% with 120°C heating and conform closely to the object it covers. It is suitable for use at temperatures to 135°C; has excellent mechanical strength and abrasion resistance.

FLEXITE Shrinkdown PO-135 is a thermally-stable Class B (130°C) crosslinked material extruded from specially-formulated polymers. Supplied in expanded sizes, PO-135 may easily be assembled over components, connectors, cables, or other irregular shapes. When exposed to heat (150°C), it shrinks 50% in diameter, forming a tough, smooth insulating covering with excellent chemical, electrical and oil resistant properties. (UL FR-1)

FLEXITE Shrinkdown HM-140 is a heat shrinkable semi-rigid polyolefin tubing with exceptional mechanical strength and electrical properties. It has outstanding chemical resistance and may be operated continuously at temperatures from −55°C to +175°C.

FLEXITE Shrinkdown HA-150 is a heat shrinkable polyvinylidene fluoride tubing with an operating temperature range of −55°C to +175°C. It is a very tough material with high resistance to abrasion and cut through suitable for strain relief applications. (UL FR-1)

FLEXITE Shrinkdown TE-250 is a heat shrinkable Class C tubing with the unique properties of Teflon, plus the ability to shrink upon heating to make a form-fitting cover over shapes.

FLEXITE SPIRAL-CUT CABLE WRAP is an expandable plastic wrap for harnessing, insulating, and the abrasion protection of wires, tubing lines, cables, or bundles in diameters up to four inches. Quick and easy to apply, the cable wrap provides openings through which leads can be broken out at any point, yet creates a firm, homogeneous

Ask for data sheets on these HYGRADE and FLEXITE products

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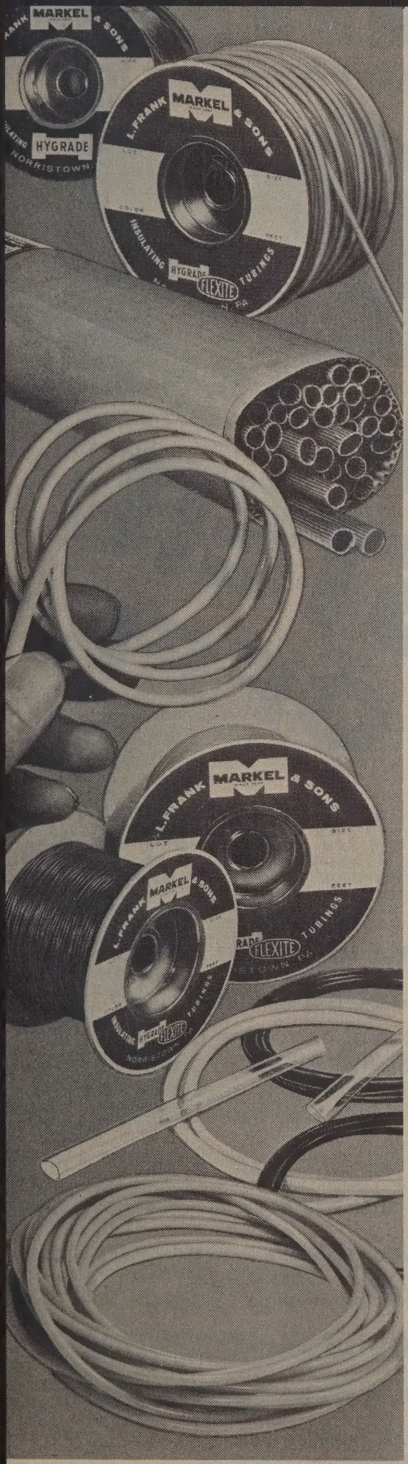
Insulating Tubings and Sleevings— High Temperature Wire and Cable



harness assembly which can be channeled, bent or flexed without danger of cut-through. Manufactured in five different materials to meet a wide variety of requirements over a temperature range from −100°C to +260°C.

FLUID AND MECHANICAL GRADE PLASTIC TUBINGS

FLEXTECH®

FLEXTECH AR-400 Abrasion-Resistant Tubing is extruded from a Markel patented composition of reinforced Teflon and exhibits abrasion resistance many times greater than conventional Teflon tubings. It also offers good antistick properties, chemical inertness, high and low temperature stability, and meets the electrical requirements of MIL-I-22129C. Ideal for an extremely wide range of mechanical and viscous fluid transfer uses.

FLEXTECH AR-420 Abrasion-Resistant Tubing is extruded from a Markel-formulated reinforced Teflon. With chemical properties similar to AR-400, cut-through and abrasion resistance second only to AR-400, AR-420 also offers excellent flexibility and meets the requirements of MIL-I-22129C. Ideal for fluidic controls and transfer of fluids in difficult environments.

FLEXTECH TEFLON* FEP is a fluorocarbon tubing suitable for continuous 200°C use in applications requiring the chemical inertness, durability, and other desirable properties of TFE but without the extreme high temperature requirements. It has nearly zero moisture absorbency, good antistick properties and semi-transparency ideal for fluid transfer.

FLEXTECH FN NYLON Tubings (FN-1000, standard wall and FN-2000, heavy wall) are extruded from polyamides specially compounded to provide flexibility, heat stability and ultraviolet resistance. They have low moisture absorption (1.5%), excellent mechanical strength, and are superior in corrosion resistance, flexibility and fatigue life. Both FN types are self-extinguishing and are available in non-toxic formulations for food and beverage and other uses at operating temperatures from −70°C to +70°C.

FLEXTECH HP NYLON Tubings (HP-1000, 1600 psi and HP-2500, 2800 psi Burst Strength) are extruded from a polyamide designed specifically for the conveyance of air, gases and liquids under high pressures. They are odorless, tasteless, non-corrosive, fungus-resistant and self-extinguishing. HP tubings have exceptional mechanical strength, are non-toxic, easy to clean and highly recommended for food processing or other heavy duty applications. Temperature ratings for HP-1000: −44°C to +93°C; for HP-2500: −85°C to +105°C.

FLEXTECH LP-80 POLYETHYLENE is a specially compounded tubing designed for the conveyance of air, gases and liquids under low pressure conditions. A strong flexible material with a useful working temperature range of −70°C to +80°C, it is odorless, tasteless, non-toxic, non-corrosive and fungus-resistant. Easily installed using standard fittings.

FLEXTECH U-585 POLYURETHANE is one of the most versatile of materials, combining long life with high working-pressure ratings, superb resistance to fuels and solvents, excellent flexibility, high resistance to abrasion, and low moisture absorption. U-585 preserves its rubber-like pliability and resistance to kinking over a temperature range of −70°C to +105°C, making it suitable for cryogenic use where clamped or pinched to control fluid flow.

FLEXTECH RETRACTABLE NYLON AIR HOSE is a seamless-extruded, abrasion-resistant, long life nylon hose that is helically coiled for spring-like action. It extends easily with minimum resistance and automatically retracts to its original coil configuration upon release. This self-storing feature keeps hose off the floor and out of the way, eliminating the need for expensive reel devices. It never becomes twisted or tangled, has long life, is lightweight and flexible, making it easy to use with any type of air-powered tool. Retractable air hose will not absorb oil and can be used to feed lubricant in air stream.

Ask for data sheets on these FLEXTECH products

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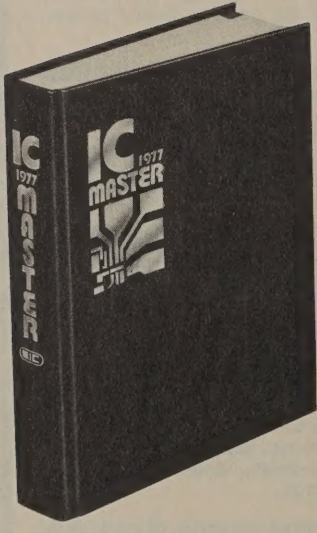

The new IC MASTER is the ultimate IC source book.

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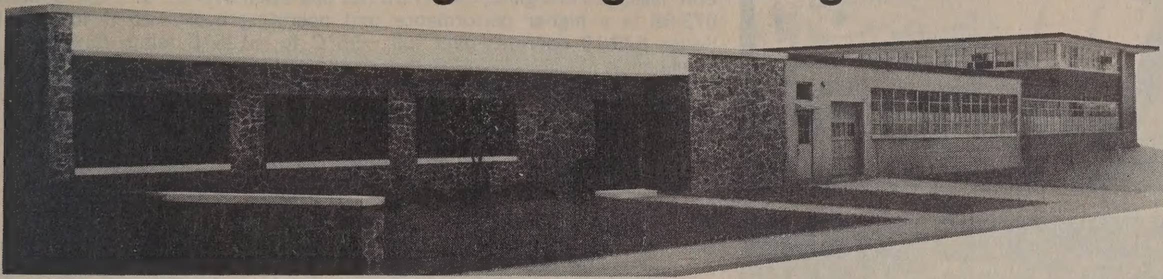
VARFLEX the complete line of electrical insulating sleeving and tubing



Whatever your problem, heat, cold, flexibility miniaturization, high insulating or dielectric strength—Varflex can supply the required reliability and delivery. Our rapidly expanding plant is fully equipped to supply sleeving for any combination of characteristics you may need. In addition to maintaining large stock for off-the-shelf delivery, Varflex has the productive capacity to provide prompt delivery (often 48 hours) on special orders. As insulation specialists, we are ready to work with you on unusual specifications or applications.

Here is a brief description of Varflex products

VARGLAS SILICONE RUBBER SLEEVING. The ultimate in flexibility, yet dielectric protection to 8000 volts. Class H-A-1 certified to meet Government Specification MIL-I-3190/6 (formerly MIL-I-18057A) Class H-B-1 (4000 volts) available, also. Continuous exposure from —70° to 400°F. does not affect coating or Fiberglas braid. Class H-C-1 (2500 volts), Class H-C-2 (1500 volts) and Class H-C-3 also available.

VARGLAS SILICONE RESIN SLEEVING. Class H-A-1 is recommended for applications requiring extremes of heat endurance and high dielectric strength (7000 volts). Class H-B-1 is identical except for dielectric guarantee (4000 volts). Good abrasion resistance. Class H-A-1 meets the requirements of MIL-I-3190/5. Four other standard grades available where 7000 volt test not important.

SILFLEX SLEEVING. A light coating of Silicone resin on Fiberglas braid. Extremely flexible within a temperature range from minus 85°F. to 500°F.

VARGLAS SILICONE LEAD WIRE. Made from solid or stranded wire covered with one or more walls of Fiberglas braid and impregnated with Silicone. Built to your specifications.

VARGLAS SILICONE TYING CORDS. Continuous filament Fiberglas cords impregnated with Silicone resin, 1/64″ to 1/8″ diameter. Specify Type 46 for dry cure, Type 48 for tacky cure.

VARGLAS S1600 SLEEVING. Newest development in Fiberglas yarn. Will retain "life" at temperatures up to 1600°F. (400 degrees higher than E glass).

VARGLAS POLYURETHANE CLASS F SLEEVING. Made with Polyurethane resins on Fiberglas braid. Offers better than Class B heat resistance (up to 155°C continuously). Available in F-A-1, F-B-1 and F-C-1 grades.

VARGLAS ACRYLIC CLASS F SLEEVING. Highly resistant to acids, organic solvents, oils and water and exhibits fair resistance to alkalies. It is compatible with polyester, acrylic, epoxy, phenolic and formvar wire enamels. Designed to perform for long periods in the 155°C range without loss of any electrical or physical properties. Available in five grades. Class F-A-1 (7000 volts) meets the requirements of MIL-I-3190/3.

VARFIL SLEEVING. Fiberglas braids impregnated with polyester resin. Four grades available in coils as well as 36″ lengths in most sizes. In a class by itself because of its toughness, flexibility, high temperature resistance and ability to withstand bending and twisting without dielectric loss. Compatible with varnish. Over 1000 hours at 125°C., with intermittent operation at 150°C.

VARFLO SLEEVING. Class B insulation. Good flexibility, solvent, oil and moisture resistance. The A grade passes 90° Navy bend test after 2000 hours at 300°F. with 3500 volt end point. Varflo has good shelf life and will not lose dielectric strength when subjected to severe twisting. Classes B-A-1, B-B-1 and B-C-1 are available. Flame and fungus resistant if specified. B-A-1 approved under MIL-I-3190/2 (formerly MIL-I-21557B).

VARGLAS VARNISHED SLEEVINGS. Flexible continuous coatings of flame resistant oleoresinous varnish built up over fine Fiberglas braids in several carefully controlled operations. Operate at temperatures up to 130°C continuously. Available in five grades.

VARGLAS LECTON SLEEVING. Specifically designed for hermetic motors. Non-contamination of Freon and other refrigerants in Class B motors. B-A-1, B-B-1, and B-C-1 grades.

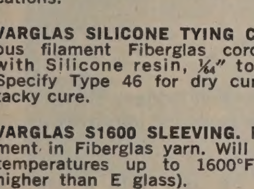
VARGLAS NON-FRAY SLEEVINGS. Type H: The normalizing treatment given the Fiberglas braid removes the organic impurities and tends to hold the individual filaments together. The lack of any bonding agent means it may be subjected to temperatures as high as 1200°F. Recommended for applications where dielectric requirements are not of prime importance. Resists fungus and is noncorrosive. Type HP: Similar to Type H, but dyed various colors for coding purposes. Ideal as secondary insulation where primary covering might disintegrate due to high temperature or continual flexing. Colors may fade at 300°F. Type HO: A very light treatment of resin added after the braid has been normalized — just enough to hold the sleeving round for accurate cutting. Will distend to cover soldered joints or terminals. Avaliable in eight colors. Colors fade at 300°F., but sleeving unaffected up to 1200°F. Best of the three from a non-fray standpoint.

VARGLAS LITEWALL SLEEVINGS. Wall thickness of Type A is .008″ and of Type B, .006″. These extremely flexible, finer braids are supplied untreated, heat treated and/or dyed. Produced in fractional sizes. Because of the construction, one size can be used to cover several different wire sizes. Specify Type HA or HB if heat treated braids preferred.

SYNTHOLVAR EXTRUDED TUBING. Made from vinyl polymers. High dielectric and tensile strength. Will not support combustion nor absorb moisture. Smooth surface, thin wall and flexibility all make for ease in assembling operations. Type SHH recognized by U/L for 105°C applications. Type LT will function at temperatures down to —50°C. Specify fungus resistant tubing where needed. Special formulations for high and low temperature environment. Made to meet applicable Government Specifications MIL-I-631 and MIL-I-7444.

RAYON SLEEVING. These sleevings are varnish impregnated. NEMA grades A-A-1, A-B-1, A-C-1, A-C-2 and A-C-3 readily available.

NYLON UNTREATED SLEEVING. This product has outstanding abrasion resistance and is the ultimate in flexibility. It is intended for use over insulated wire and cable, not as primary insulation.



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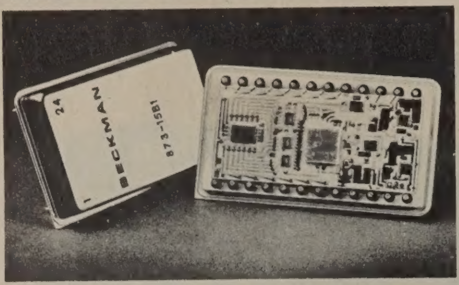
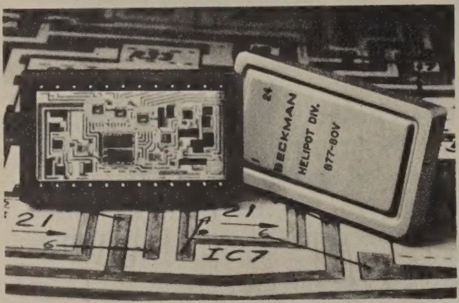
A/D and D/A Converters



12-Bit, TTL A/D Converters

Beckman 12-bit, TTL successive approximation A/D converters are available in three performance and packaging options. Series 873-78 is a low-priced unit packaged in a glass, 24-pin DIP for operation over 0° to +70° C. Series 873-88 is a higher performance unit operating over −25°C to +85°C. Series 873-15 operates over full −55°C to +125°C temp. range and is screened to MIL-STD-883A. Both 873-88 and 873-15 are hermetically sealed in a 24-pin, metal DIP. All are available with full scale voltages of 10 volts unipolar and 5 & 10 volts bipolar. Features include:

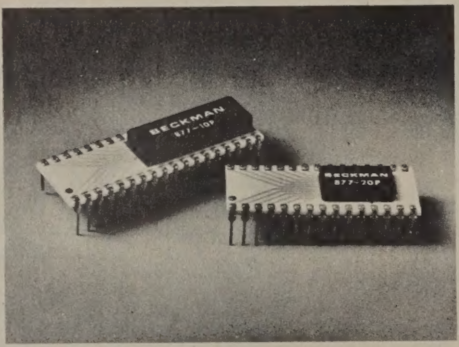
- 12-bit resolution
- ±½ LSB in 12 (±½ LSB quantizing error)
- Internal reference



12-Bit TTL D/A Converters

Beckman offers a complete range of 12-bit, TTL D/A converters for commercial, industrial and military applications. The economy 877-80 is packaged in a glass, 24-pin DIP and operates over 0° to +70°C. Series 877-85 is a higher performance converter specified over −25°C to +85°C. Series 877-15 operates over full −55°C to +125°C temp. range and is screened to MIL-STD-883. Both 877-85 & 877-15 are hermetically sealed in a 24-pin, metal DIP. All are available in voltage and current output models. Features include:

- 12-bit resolution
- ±½ LSB (877-80, 877-85) or ±1 LSB (877-15) in 12 linearity
- 300 nsec conversion settling time (current output models)
- Internal reference

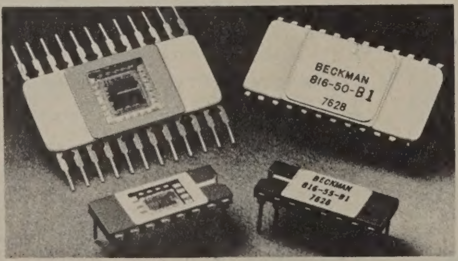


12-Bit, CMOS D/A Converters

Beckman Series 877-10 and 877-20 are 12-bit precision digital-to-analog converters designed specifically for 8-bit microprocessor compatibility. The input registers can accommodate 12-bit words in 4-bit and 8-bit segments. Series 877-10 is a complete internally referenced and output buffered 12-bit converter. Series 877-20 is an externally referenced 4-quadrant multiplying converter. The input and control lines of both series can be driven by TTL or CMOS logic.

- ±½ LSB in 12 linearity over specified operating temperature
- Low power dissipation
- Low cost
- Commercial, industrial, military temperature range and performance options

For complete technical information on Beckman's full line of standard A/D and D/A converters contact your local Beckman sales representative.

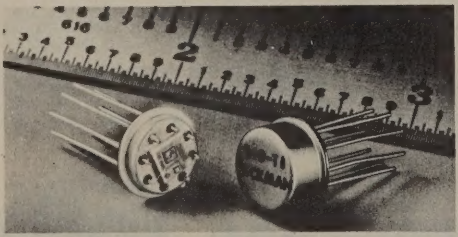


Thin Film Ladder Networks

Series 816-50 and Series 816-55 Thin Film Ladder Networks are low-cost, 12-bit current summing (R-2R-4R-8R) and voltage summing (R-2R) building blocks for unique A/D and D/A converter applications. Both offer 0 to +70°C and −55°C to +125°C temperature range options. Series 816-50 and 816-55 feature:

- 12-bit resolution
- ±½LSB in 12-bit accuracy over full temp. range
- High stability — low noise characteristics

Beckman also stocks a complete line of standard, thick film ladders. Consult your local Beckman sales representative for complete technical information.



Series 840 Precision Voltage Reference

Series 840 Precision Voltage Reference provides the user with a self-contained, ready to use hybrid reference functionally laser trimmed to deliver +10Vdc output at ±0.1% max. absolute accuracy with low ±5 ppm/°C temperature coefficient. Series 840-T1 operates over the −55°C to +125°C temperature range; 840-T2 operates over the −25°C to +85°C range. Features include:

- ±0.1% max. output voltage accuracy (840-T1)
- ±5 ppm/°C output voltage TC
- Hermetically sealed, 8-pin to-5 package

For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

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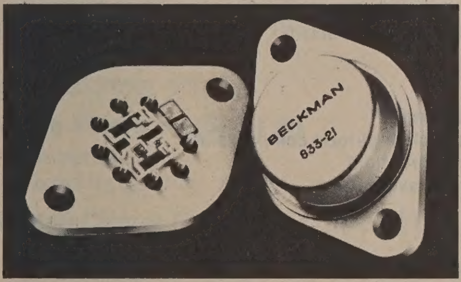
Beckman is a fully qualified supplier of Navy Standard Electronic Module Program modules. Cost effective, low profile, hermetic, ceramic hybrid packaging allows high density and high performance electrical functions to be packaged in the standard 1-A SEM configuration. One hybrid on each side allows 40 pin-outs of high density packaging. Precision active filters, digital-to-analog and analog-to-digital converters and other complex functions can cost effectively utilize the functional trimming and density capabilities of hybrid technology. Thin or thick film can be combined with most semiconductor technologies to provide the optimum in integration. Functionally specified standard or specials are available. Consult the factory for complete details.



Power Amplifiers

Beckman Series 833-21 are general purpose operational amplifiers capable of providing output currents in excess of 1 ampere at ±12V. Available off-the-shelf in an 8-pin, TO-3 package, Series 833-21 features:

- Wide full power bandwidth (15kHz)
- Low quiescent power (100mW @ ±15V)
- High slew rate (3V/μs)

Beckman stocks a complete line of standard power amplifiers to meet industrial and military application requirements. Consult your local Beckman sales representative for complete technical information.

Beckman
HELIPOT DIV

DC Voltage Regulators

Beckman hybrid circuit voltage regulators are available in high performance military or low-cost industrial models, and cover the entire voltage range of requirements for most semiconductor circuitry (from 3 to 120 volts) with either positive or negative outputs. Both preset output and adjustable output models are available with regulation to ±0.005% (line and load). All offer maximum flexibility of performance parameters so that modifications can be made to satisfy individual system requirements. Consult your local Beckman sales representative for complete technical information.

Custom Hybrid Microcircuits

Beckman custom microcircuit ability is based upon thick and thin film material technologies with an integrated circuit chip handling capability. With these combinations, Beckman can supply a wide variety of linear and digital circuits including: active filters for telephone tone filter products, DACs and ADCs from commercial to military standards, power linears from amplifiers to voltage regulators, passive substrate to multilayer digital hybrids, dual logarithmic amplifiers, hammer driver circuits, decoder driver circuits, signal conditioning circuits, oscillator circuits, and massive resistors for use as infrared heating sources.

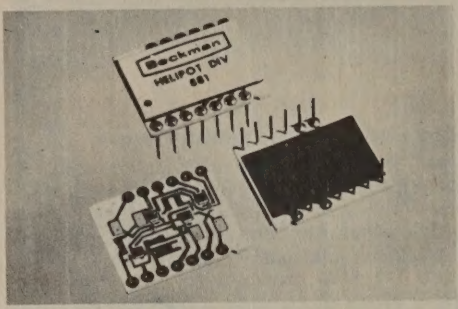
For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

Telecommunication/Filter Products



Model 881 Universal Active Filters

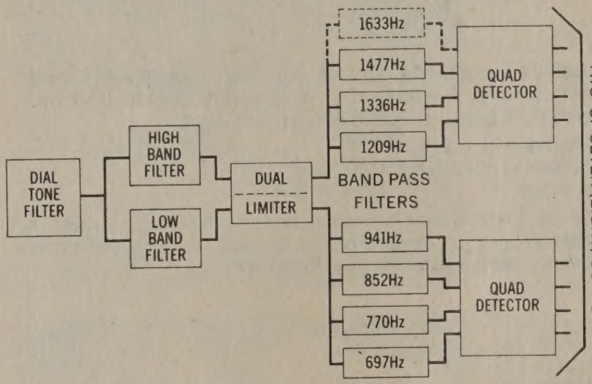
Model 881 is a two-pole, audio-frequency filter that can be used as a basic building block to generate virtually any complex filter function. Model 881 features:

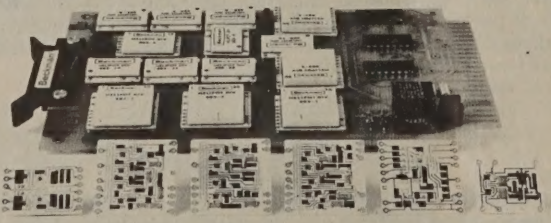
- Simultaneous high-pass, low-pass, and band-pass outputs
- Inverting, non-inverting or differential operation
- 10kHz maximum operating frequency
- 0.5 to 50 adjustable Q range

Series 883 Telecommunication Products

Beckman Series 883 are standard tone-decoding building blocks for high-performance central office, PBX, accounting system or industrial control telecommunication applications.

Series 883 are pretuned to meet Bell System performance requirements, and are available off-the-shelf as individual modules or in preassembled, standard rack-mountable PC cards.





Model 883-1 Dial-Tone Filter

- Modified dual-notch active filter
- 50dB notch attenuation
- ±12V power supply operation

Model 883-2 Low-Band Filter

- Modified Cauer low-pass filter
- 941Hz upper cutoff frequency
- >20dB attenuation above 1190Hz

Model 883-3 High-Band Filter

- Modified Cauer high-pass filter
- 1209Hz lower cutoff frequency
- >dB attenuation below 995Hz

Model 883-4 Dual Limiter

- Two-section signal amplitude compression
- ±300mV input threshold
- 11V p-p square wave output

Model 883-5 Quad Tone Detector

- Four preset threshold detectors
- Preset time delay/invalid tone rejection
- TTL complementary output logic

Models 883-6 to 883-16 Band-Pass Filters

- Eight standard telephone frequency filters: 697, 770, 852, 941, 1209, 1336, 1477 and 1633Hz
- ±0.5% f_o accuracy/high f_o stability
- High input impedance/low output impedance

Models 883-107 and 883-108 Tone Receiver Cards

- Complete hybrid set and necessary system components
- Preassembled and test standard PC board
- Standard 22-pin, 0.156" (3,962mm) spacing, edge plug
- 4 X 3 tone matrix with 2 of 7 output (883-107)
- 4 X 4 tone matrix with 2 of 8 output (883-108)

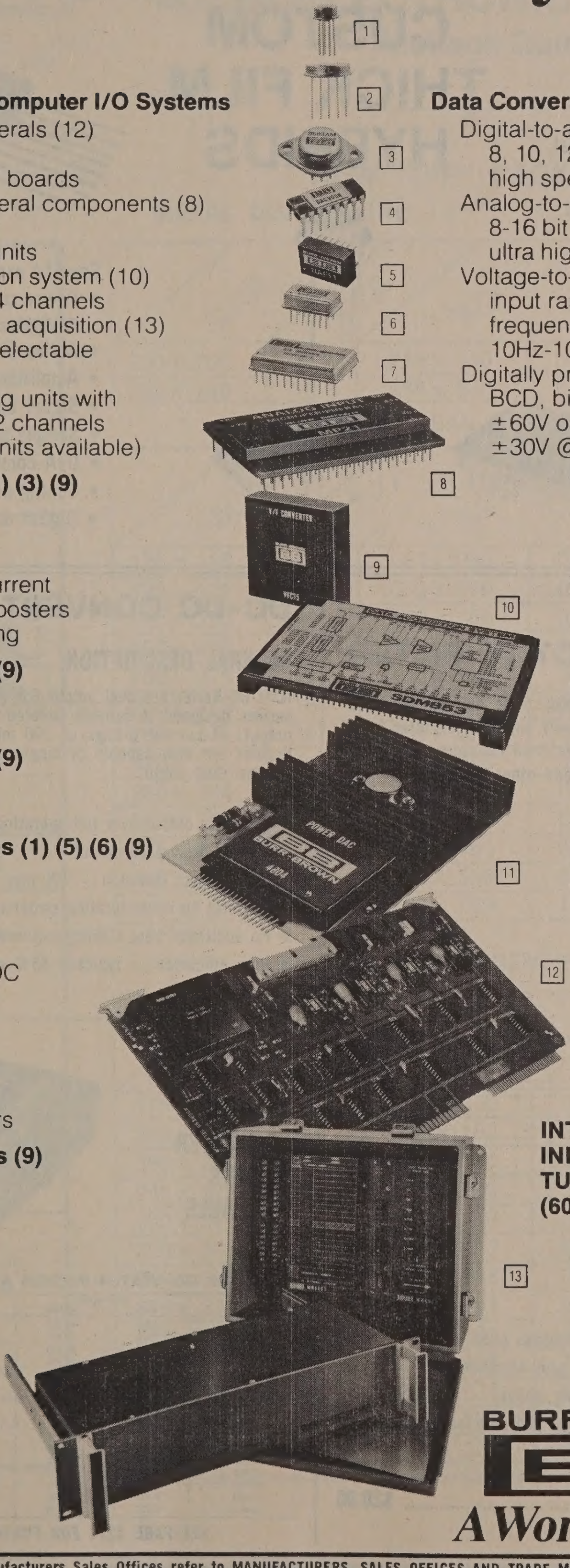
For custom versions of these products or application assistance, call Microcircuit Application Engineering (714) 871-4848, Ext. 3235.

For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

Burr Brown's Complete Product Story



Data Acquisition And Computer I/O Systems
- Microcomputer peripherals (12)
  - analog input/output
  - plug compatible PC boards
- Microcomputer peripheral components (8)
  - analog input/output
  - hybrid compatible units
- Modular data acquisition system (10)
  - building blocks 8-64 channels
- Micromux remote data acquisition (13)
  - local receiver with selectable BAUD rate
  - multiplex transmitting units with capacities up to 512 channels (intrinsically safe units available)

Operational Amplifier (1) (3) (9)
- General purpose
- Low drift
- Low bias current
- High voltage & high current
- Buffer amp & power boosters
- Wideband & fast settling

Isolation Amplifiers (8) (9)
- Optically coupled
- Transformer coupled

Active Filters (4) (5) (6) (9)
- Universal
- Fixed frequency

Analog Circuit Functions (1) (5) (6) (9)
- Multipliers/dividers
- IC multipliers/dividers
- Computing true RMS-to-DC converters
- Thermal true RMS-to-DC converters
- Log amplifier
- Oscillators
- Two-quadrant analog divider
- Multifunction converters

Modular Power Supplies (9)

Data Conversion Products
- Digital-to-analog converters (4) (6) (7) (8) (9)
  - 8, 10, 12, 16 bit, low drift
  - high speed, high resolution
- Analog-to-digital converters (7) (8) (9)
  - 8-16 bit binary, 4-digit BCD
  - ultra high speed, 12 bit CMOS
- Voltage-to-frequency converters (1) (9)
  - input range 1mV to 10V
  - frequency range 1Hz-10kHz, 10Hz-100kHz, 50Hz-500kHz
- Digitally programmed voltage sources (11)
  - BCD, binary programming, ±10V, ±60V output
  - ±30V @ 1A, ±100V @ ±100mA
- Multiplexers (4)
  - 4,8 channel differential
  - 8,16 channel single-ended
  - CMOS protected inputs
- Sample/holds (2) (5) (6)
  - selectable acquisition time and droop
  - selectable gain 1-1000
  - fast, 0.01%, low cost
- Peak detectors (5) (9)
  - gain accuracy ±0.01%
  - low droop rate ±5mV/sec.
- Comparators (5)
  - fast settling
  - window dual limit

Instrumentation And Data Amplifiers (1) (5) (9)
- Low drift
- High input impedance
- Low bias current
- Variable gain differential
- Programmable gain

**INTERNATIONAL AIRPORT
INDUSTRIAL PARK
TUCSON, ARIZONA 85734
(602) 294-1431**

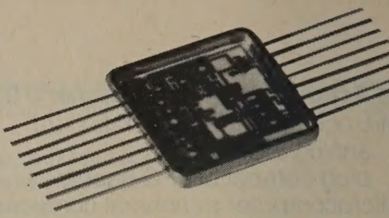
BURR-BROWN

A World Leader

INTEGRATED
CIRCUITS
INCORPORATED

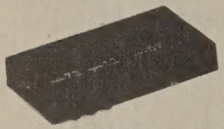
13256 NORTHRUP WAY
BELLEVUE, WASHINGTON 98005
TELEPHONE: (206) 747-8556

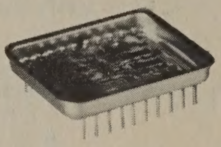
CUSTOM THICK FILM HYBRIDS

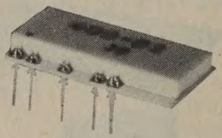


Broad capability in commercial, industrial, and military applications offering:

- Total design services
- Processing per MIL-STD-883 and MIL-M-38510
- Multi-layer capability
- Full range of packaging methods





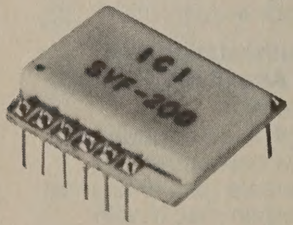


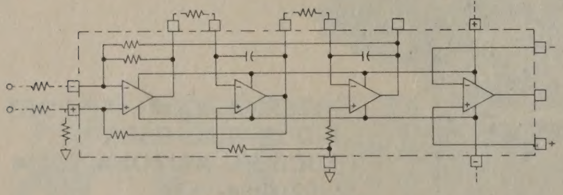
Specific experience in:

- Power conversion and regulator devices
- Active filters
- Amplifiers and preamplifiers
- Signal conditioning electronics
- Sample and hold circuits
- D/A converters
- Timing devices
- Digital devices

MODEL SVF 200
STATE VARIABLE ACTIVE FILTER

Model SVF 200 is a two-pole audio-frequency filter that can be used as a basic building block to generate virtually any complex filter function. The SVF 200 may be adjusted using external resistors, to provide Butterworth, Chebyshev, Cauer parameter and other functions.





MODEL SVF 200 FEATURES:

- Short circuit output current limiting
- Simultaneous bandpass, lowpass, and highpass outputs.
- Independent bandwidth, frequency, and gain adjustments.
- Constant bandwidth and constant Q tuning modes.
- Additional 'free' compensated amplifier for odd pole isolation, gain or feed forward element.

Price (1-9) **$20.00**

DC-DC CONVERTERS

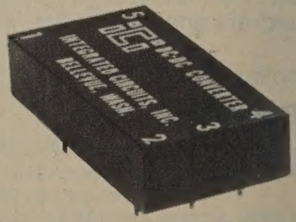
GENERAL DESCRIPTION:

ICI's DC Series are dual output 6.0 watt, high efficiency DC to DC converters designed to provide isolated positive and negative DC voltage outputs at current ratings of 200 milliamperes from each output. The devices are also capable of single ended outputs equal to twice the nominal dual output.

- 6.0 watts output over full operating temperature range.
- 200 ma. from each output.
- Input/output isolation — 100 meg. Ω min. at 500 VDC.
- Operates in non-saturating switching mode.
- No additional heat sinking required.
- High efficiency — typically 83% at rated load.

Price (1-9) **$42.00**

**STANDARD
CONVERTER
MODELS
AVAILABLE**



STANDARD CONVERTER MODELS AVAILABLE

MODEL NUMBER	INPUT VOLTAGE		NOMINAL OUTPUT	OUTPUT POWER
	NOMINAL	MAXIMUM		
DC-512	5 VDC	6.5 VDC	±12 VDC @ 180 mA	4.5W @ 85°C
DC-515	5 VDC	6.5 VDC	±15 VDC @ 150 mA	4.5W @ 85°C
DC-512LP	5 VDC	6.5 VDC	±12 VDC @ 50 mA	2.0W @ 85°C
DC-515LP	5 VDC	6.5 VDC	±15 VDC @ 75 mA	2.5W @ 85°C
DC-1205	12 VDV	15 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-1212	12 VDC	15 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-1215	12 VDC	15 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-1218	12 VDC	15 VDC	±18 VDC @ 170 mA	6.0W @ 85°C
DC-2805	28 VDC	32 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-2812	28 VDC	32 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-2815	28 VDC	32 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-2818	28 VDC	32 VDC	±18 VDC @ 170 mA	6.0W @ 85°C
DC-4805	48 VDC	56 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-4812	48 VDC	56 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-4815	48 VDC	56 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-4818	48 VDC	56 VDC	±18 VDC @ 170 mA	6.0W @ 85°C

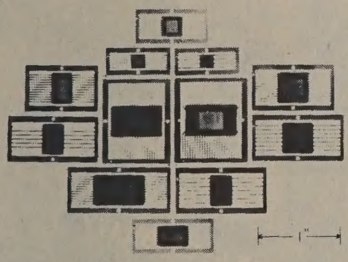
SEE PAGE 3271 FOR FURTHER INFORMATION

M S I
MINI-SYSTEMS, INC.
20 David Road, North Attleboro, MA 02761
TELEPHONE: (617) 695-0206
TWX NO. 710-348-0564

HERMETIC MICROELECTRONIC FLAT-PAKS

Package Guide

MINI-SYSTEMS' packages now and in the future will cater to new I.C. devices and hybrid microcircuit requirements. MINI-SYSTEMS pays consistent attention to quality, customer service and deliveries.



DESIGN FEATURES

- .030″ and .050″ lead centers
- .080″ deep versions
- Available with beryllia bases
- Designed to meet MIL-std-883 requirements
- Greater packaging density
- Size and weight reductions

MINI-SYSTEMS' packages can be custom designed to fit your specific requirements. They are available with metal or ceramic bases. They can be selectively plated. And most packages are available in extra deep versions.

NEW "DIP" PACKAGES

METAL DUAL-IN-LINE .100″ LEAD CENTERS

PACKAGE DIMENSION	NUMBER OF LEADS	GLASS FREE AREA (MIN)	INSIDE HEIGHT	PACKAGE PART NO.	100 PC PRICE* W/LID & PREF 50 μ IN GOLD
.250 x .750	14	.135 x .540	.075	10F14M-1	4.69
.250 x .750	16	.135 x .540	.075	10F16M-1	4.71

.050″ LEAD CENTERS

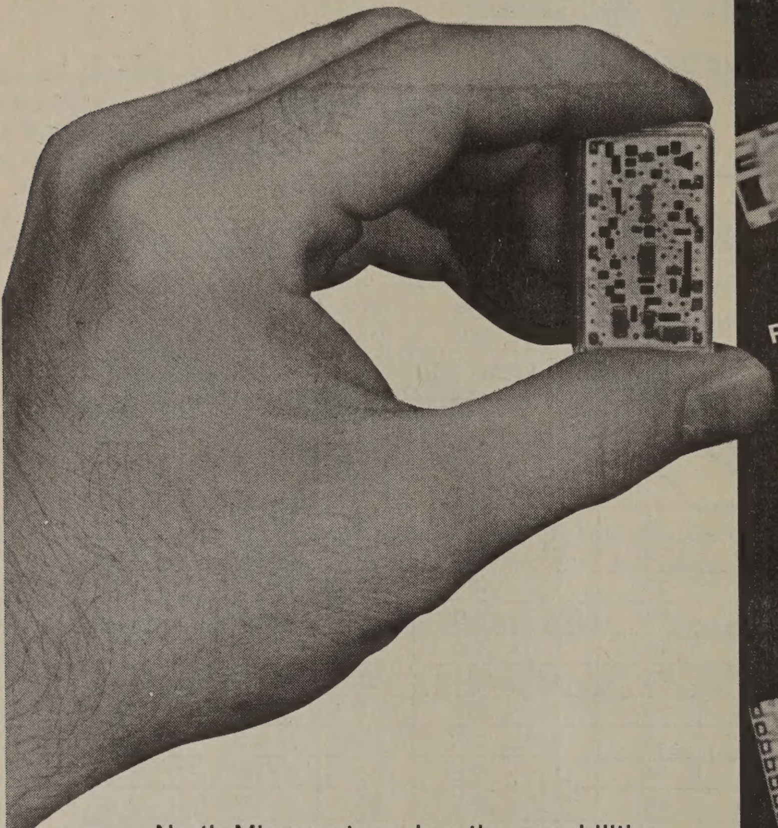
PACKAGE DIMENSION	NUMBER OF LEADS	GLASS FREE AREA (MIN)	INSIDE HEIGHT	PACKAGE PART NO.	100 PC PRICE* W/LID & PREF 50 μ IN GOLD
.125 x .125	6	.040 x .065	.038	5A6M	2.27
.175 x .175	8	.070 x .090	.032	5C8M	2.28
.250 x .250	10	.150 x .180	.040	5H10M	2.85
.250 x .250	14	.150 x .180	.040	5H14M-2	2.74
.250 x .375	14	.140 x .290	.040	5J14M	3.10
.250 x .375	16	.135 x .290	.035	5J16M-2	3.14
.265 x .375	10	.155 x .285	.040	5K10M	3.12
.375 x .375	14	.253 x .283	.080	5L14M-1	3.36
.266 x .375	14	.155 x .285	.040	5K14M	3.13
.375 x .375	16	.253 x .283	.080	5L16M-1	3.37
.375 x .625	16	.285 x .485	.090	5R16M-1	4.62
.375 x .625	22	.240 x .530	.090	5R22M-1	4.53
1.0 x 1.0	30	.760 x .760	.117	5X30M-1	10.26

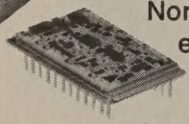
.030″ LEAD CENTERS

PACKAGE DIMENSION	NUMBER OF LEADS	GLASS FREE AREA (MIN)	INSIDE HEIGHT	PACKAGE PART NO	100 PC PRICE* W/LID & PREF 50 μ IN GOLD
.175 x .175	12	.070 x .090	.032	3C12M	2.29
.250 x .250	16	.150 x .180	.040	3H16M	2.78
.250 x .250	16	.130 x .170	.080	3H16M-1	2.84
.250 x .375	16	.160 x .255	.040	3J16M	2.94
.250 x .375	16	.153 x .248	.080	3J16M-1	2.99
.250 x .375	24	.138 x .293	.040	3J24M	3.12
.250 x .375	24	.128 x .288	.080	3J24M-1	3.17
.375 x .375	24	.263 x .293	.040	3L24M	3.23
.375 x .375	24	.253 x .283	.080	3L24M-1	3.31
.375 x .625	24	.285 x .485	.090	3R24M-1	4.57
.375 x .625	44	.243 x .533	.090	3R44M-1	4.71
.375 x .625	48	.210 x .290	.065	3R48M	4.81
.545 x .545	64	.330 x .330	.090	3T64M-1	6.08

GOLD PRICE SUBJECT TO CHANGE DEPENDING ON FLUCTUATIONS OF GOLD MARKET. *EACH

HYBRID Microcircuits

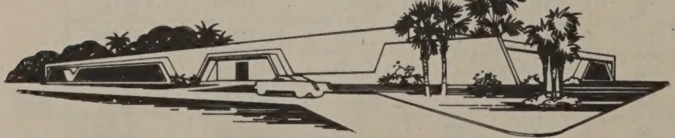




North Microsystems has the capabilities, experience and facilities to satisfy your volume requirements for quality thick-film hybrids.

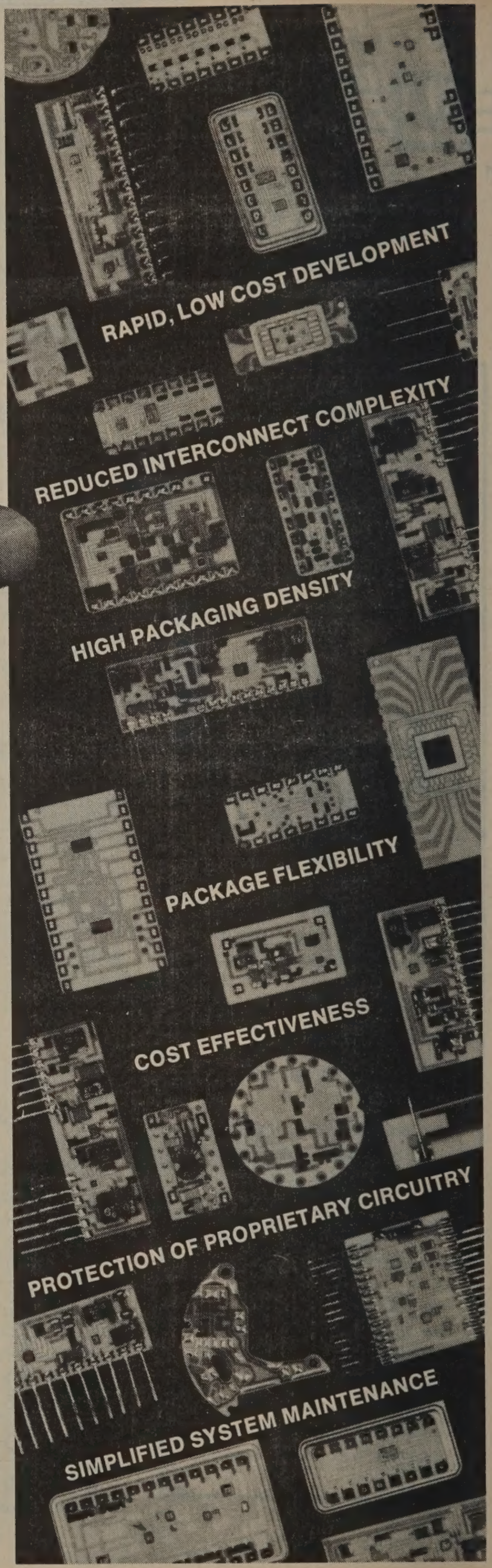
We specialize in telecommunications applications (active filters, tone receivers, etc.) but furnish products to many segments of the electronics industry. Custom circuit inquiries are invited.

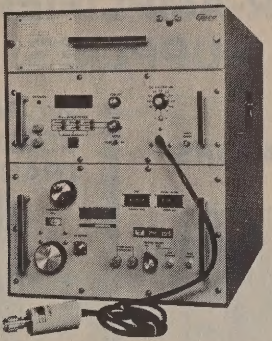
Our new 50,000-square-foot plant is one of the most modern and well-equipped hybrid facilities in the country. Visit us in Florida or write for our brochure.



NORTH
ELECTRIC COMPANY
MICROSYSTEMS DIVISION
A United Telecom Company

700 Hillsboro Plaza / Deerfield Beach, Florida 33441
Phone 305-421-8450 / TELEX & TWX 510-953-7523


RAPID, LOW COST DEVELOPMENT
REDUCED INTERCONNECT COMPLEXITY
HIGH PACKAGING DENSITY
PACKAGE FLEXIBILITY
COST EFFECTIVENESS
PROTECTION OF PROPRIETARY CIRCUITRY
SIMPLIFIED SYSTEM MAINTENANCE



High Power Microwave Signal Generation

CW or PULSE 150-25,000 MHz

Epsco offers you off-the-shelf capability encompassing the vast majority of user requirements. Should you need a special design, however, our engineers can provide state-of-the-art expertise that can save you time and money. Call us. We'll be happy to discuss it.

PEAK POWER CALIBRATION SYSTEM

(Mil spec. AN/USM-397)

A secondary standard for calibrating TACAN, DME, DABS, ATC, IFF and other accuracy-demanding systems in the 925 to 1225 MHz frequency range. Power accuracy of ±0.3 dB is directly traceable to the National Bureau of Standards. Peak power of 5kW. Direct readout of pulse power, pulse width, PRF, and operating frequency. Pulse duration from 0.35 to 5 microseconds. Automatic sequencing. Sync output. Accepts internal/external trigger.

PULSE SIGNAL SOURCES

Model PH40K

The highest pulse power available in a single generator.

Covering the range from 150 to 6100 MHz, tuneable plug-in oscillator heads provide guaranteed minimum powers as high as 40kW. Magnetron plug-ins further extend the upper limit to 16,500 MHz. Pulses are continuously variable in width from 0.4 to 25μs and in repetition rate from 10 to 10,000 pps. Available also in pulse modulator configuration (MH250).

Model PG5KB

Wide range, medium power unit.

With guaranteed minimum powers as high as 5kW, the Model PG5KB covers 150 to 6100 MHz with plug-in heads. Magnetron plug-ins further extend the upper limit to 16,500 MHz. Pulses are continuously variable in width from 0.3 to 50μs and in repetition rate from 20 to 25,000 pps.

CW SIGNAL SOURCE

Model C203

The highest CW power available in a single instrument.

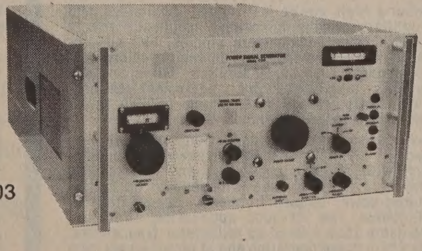
Covering the range from 200 to 6100 MHz with plug-in heads, the Model C203 provides full power modulation at 0.5 duty cycle with internal 1000 Hz square wave generator or from an external pulse source. Power levels of oscillator heads are from 0.5W to 100W.

CAVITY OSCILLATORS AND AMPLIFIERS

Standard oscillator models for CW or pulse applications in a variety of configurations cover selected frequency bands from 150 to 6100 MHz. Cavity amplifiers from 150 to 3000 MHz, CW and pulse, for applications in TACAN, DME, and similar requirements. These cavities cover the power output range from 0.5W to 40kW.

PG5KB

PH40K

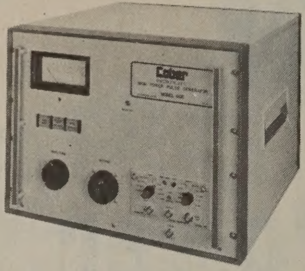


C203

Epsco
INCORPORATED
APPLIED MICROWAVE DIVISION
411 Providence Highway • Westwood, MA 02090
(617) 329-1500 • TWX (710) 348-0484

HIGH POWER-AMPLIFIERS, PULSE GENERATORS, D.C. POWER SUPPLIES, MICROWAVE SYSTEMS

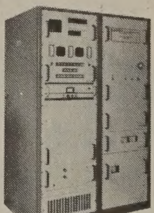
HIGH POWER PULSE GENERATORS



Model 606 generates 31KW pulses, 2500 volts at 12.5 amps. Pulse width is 50 nanoseconds to 10 milliseconds, rep rate 1 shot to 1MHz with rise time of 20 nanoseconds. Drives grids of tubes and guns, use it for gas discharge and plasma studies as well as component testing, laser applications and more.

Cober's pulse generators are versatile lab instruments and provide high power kilowatt pulses in nanoseconds. A broad line is available from stock with pulse widths out to D.C., both positive and negative polarities or alternating polarities and outputs floating to 50 KV. Plug-in accessories provide an extensive range of voltage and current combinations.

LABORATORY MICROWAVE SIGNAL GENERATORS AND AMPLIFIERS

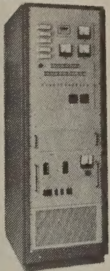


Model 225I is broadband, TWTA providing 250 watts CW or 1KW pulsed from 1.0-1.5GHz. Pulse width is variable from 0.5-20 microseconds and is used for CW and pulse jamming studies on countermeasures programs.

Cober's high power R.F. signal generators and amplifiers provide microwave frequency energy for use in antenna-pattern studies, EMI susceptibility measurements, and in testing microwave components such as TR limiters, filters and circulators. In ground support equipment stations, Cober units are the basic source of high power microwave test frequencies.

Cober's sources use magnetrons or amplifiers such as klystrons and TWT's working in conjunction with suitable oscillators and drivers. The choice of the final tube is dependent on the required power output, frequency, bandwidth and, of course, the intended application. Units are available from L-Band to millimeter frequencies, for CW or pulse operation and at power levels from several hundred watts to the megawatt region.

MICROWAVE COMMUNICATIONS TRANSMIT SUBSYSTEMS



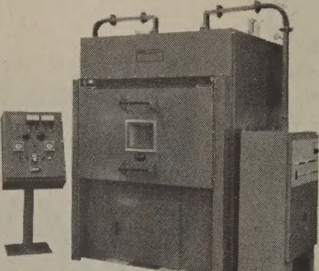
Model 1400-KK12, 14-14.5GHz, 1.25KW Klystron PA is uplink HPA for satellite communications. Handles data, voice and TV signals and can be supplied with preset channel tuning and for local or remote operation.

Cober HPA's and transmitters are the heart of satellite and troposcatter communications systems. All circuitry is fully solid state except for the final amplifier tube. Features include complete equipment and personnel safety, flexible controls and status indicators and a full complement of accessories for the greatest possible system versatility. Careful design assures low distortion, spurious and harmonic content.

Cober HPA's and transmitters are available at power levels of several hundred watts to many kilowatts at microwave frequencies. Cober has standard units for the "L," "S" and "C" band tropo frequencies and for the 5.9-6.4GHz, 7.9-8.4GHz and 14.0-14.5GHz satellite communications frequencies.

Frequency upconverters to translate a 70MHz modulated IF to the microwave carrier frequency are also available for integral mounting in HPA's. Model 1400-UP70 converts 70MHz to any selected carrier frequency in the 14.0-14.5GHz range.

MICROWAVE HEATING SYSTEMS

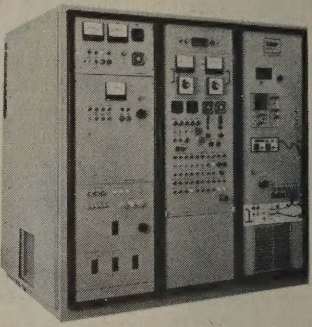


Model BPH 18A, 18KW, 2450MHz industrial microwave oven provides rapid and efficient processing. System includes auxiliary high temperature hot air heating. Cavity size is 4′ x 4′ x 4′ and has remote control and automatic process cycling.

For industrial applications. Full range of power packs from 1 to 50KW at both 2450MHz and 915MHz. Complete systems for laboratories, food, chemical, rubber, foundry and factory applications. Ovens, components, waveguide and instrumentation for users to assemble their own systems and complete applications assistance to adopt microwaves to new processes for efficient, energy conscious, smoke free, high quality electronic processing.

PULSE MODULATORS AND D.C. POWER SUPPLY SYSTEMS

Cober's line of pulse modulators include units to drive high powered pulsed microwave tubes, high power lasers, plasma tubes, and ultra-violet sources. Power levels range from a few kilowatts to over 100 megawatts. In addition to standard modulators, we specialize in the generation of state of the art nanosecond rise times and high rep rates. Full MIL Spec solid state modulators are supplied for systems use, and soft tube and hard tube units are furnished for laboratories and particle accelerator facilities.



Model 2048 is 35KV TWT Test Set. Includes highly regulated D.C. power supplies and Cober developed grid modulator. Unique feature is oscilloscope "floating" at 35KV with all controls at ground potential that allows precise display of TWT pulses.

Cober's unique pulse capability is combined with its power supply "know-how" to provide special pulsed systems for fusion research programs. This pulse and D.C. capability has made Cober the leading supplier of high power microwave tube test equipment.

Cober Laboratory and MIL Spec DC supplies operate over 5KW and at voltages between 5KV and 1000KV. Standard electro-mechanical or electronic regulator modules can be incorporated to furnish regulation and ripple to 0.001%. Our Systems Engineering Group designs full MIL Spec units and provides all integration and software to satisfy Government requirements.

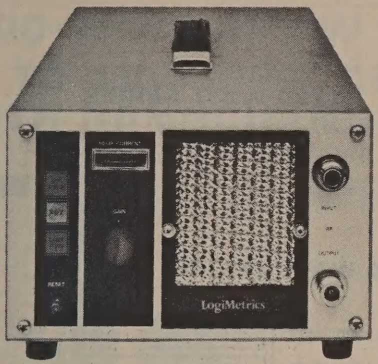
The products shown on this page are representative of Cober's very broad line. They have in common a concept of standard packaged modules and designs which make it as easy and as economical for our customers to buy units to their own specifications as it is for them to buy our standard products. If your need is in the area of high power electronics won't you please call us.

Cober
electronics,inc.

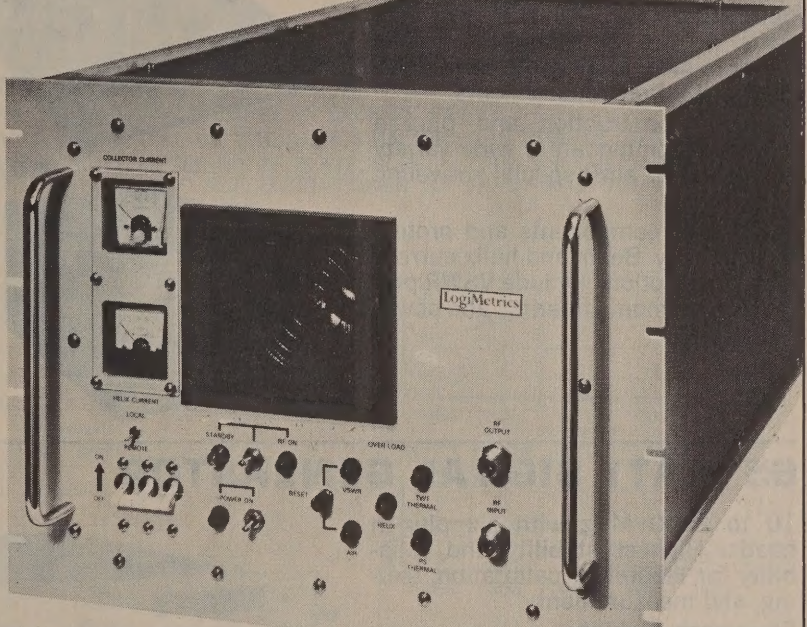
"THE HIGH POWER PEOPLE"

DEPT. EM, 7 GLEASON AVE., STAMFORD, CT 06902
PHONE: (203) 327-0003 TWX: 710-474-3371

LogiMetrics TWT AMPLIFIERS


RESET
LogiMetrics

Series A100, A200, A300


COLLECTOR CURRENT
HELIX CURRENT
LOCAL
REMOTE
STANDBY
RF ON
POWER ON
RESET
OVER LOAD
VSWR
HELIX
TWT THERMAL
PS THERMAL
RF OUTPUT
RF INPUT
LogiMetrics

Series A500, A600

The LogiMetrics Traveling Wave Tube Amplifiers comprise the most complete product line available from one manufacturer. These compact, solid state units cover the frequency range from 0.45 to 18.0 GHz offering CW power outputs from 0.5 to 600 watts and peak pulse power up to 2 kw.

The amplifiers utilize integrated circuit power supplies and PPM Traveling Wave Tubes in their most efficient configurations. They are packaged for ease of maintenance and long equipment life.

Each TWT is protected by helix current and voltage sensors, filament surge limiting and thermal overload sensors. The high power amplifiers (A500 and A600 series) offer remote monitoring and control as standard features.

Options are available for military and commercial system applications including airborne and communication systems. The amplifiers are available under G.S.A. Contract.

Series	Frequency Range (GHz)	Power Output Min (Watts)	Gain Min (dB)	N.F. Max (dB)
A100	1.0 to 18.0	1	30	30
A102	1.0 to 18.0	2	30	30
A103	2.0 to 18.0	1	30	20
A200	1.0 to 18.0	10	35	35
A300	1.0 to 18.0	20	35	35
A400	All Communications Bands as specified			
A500	0.45 to 18.0	100	30	35
A600	0.45 to 18.0	200	30	35
A700	0.7 to 18.0	1kw	30	35

LogiMetrics 121-03 Dupont Street, Plainview, New York 11803/ (516) 681-4700/TWX: 510-221-1833

MCL INC
LA GRANGE ILL

MICROWAVE AMPLIFIERS AND GENERATORS

TWT AMPLIFIERS

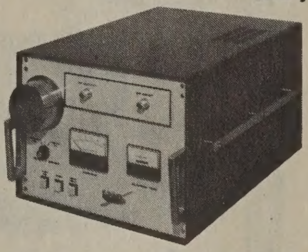
Four models cover your power requirements: 10, 20, 100 and 200 watts. All provide stable microwave power to meet testing, measurement, and calibration requirements.

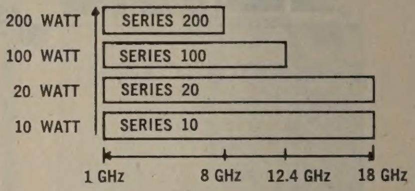
Modular construction and plug-in boards accommodate a wide variety of standard and special traveling wave tubes.

Solid state components and protective circuitry. Beam and helix current metering. Options include VSWR protection, harmonic filtering, and power monitoring.

10 /20 WATT SERIES

100 /200 WATT SERIES





65 WATT SIGNAL GENERATOR

10 to 2500 MHz with six plug-in heads. Highest stability and reliability for laboratory calibration, testing, and measurement.

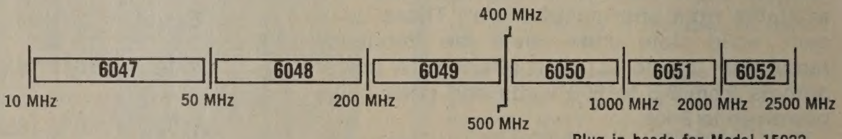
Frequency Stability: ±0.003%/10 minutes.

Power Stability: ±0.2 db/hour.

Internal and external modulation. Single control tuning to 1% of actual frequency. Front panel power indication.

All solid state components (except osc. tube), regulated power supplies, and conservative design provide laboratory quality in a compact unit.

MODEL 15122 SIGNAL GENERATOR

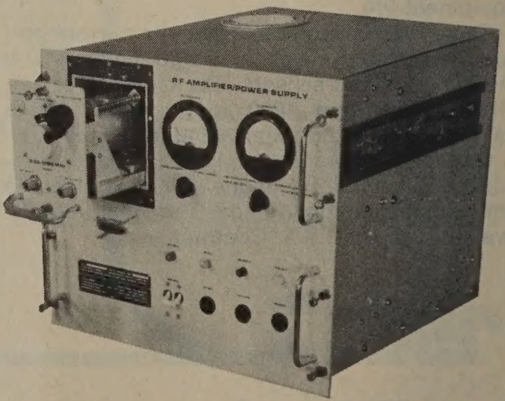


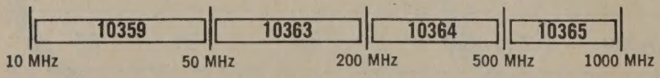
Plug in heads for Model 15022

200 WATT CW AMPLIFIER

10 to 1000 MHz with four plug-in heads. The amplifier can be used to drive higher power amplifiers or as a final amplifier driven by a lower power source.

MODEL 10358





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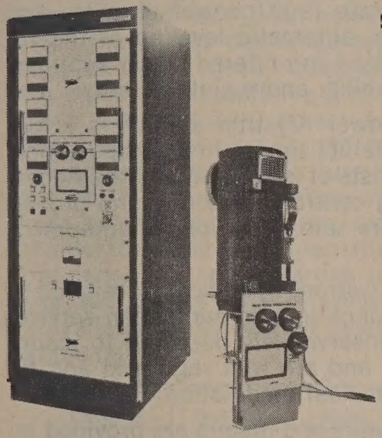
MCL
INC
LA GRANGE ILL

MICROWAVE SYSTEMS

1000-WATT RF CW POWER AMPLIFIER SYSTEM 50 TO 1100 MHZ* COVERAGE IN ONE PACKAGE WITH BANDCHANGE CAVITIES

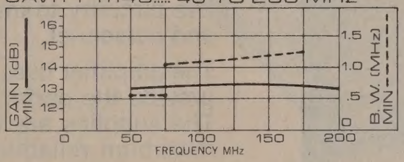


MODEL 10270/SPECIFY CAVITY DESIRED

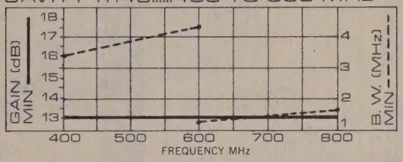
SPECIFICATIONS

- FRONT PANEL DIAL TUNING OF EACH RF CAVITY.
- FRONT PANEL DIAL VS. FREQUENCY CALIBRATION CHARTS ON EACH CAVITY.
- FRONT PANEL METERING OF PLATE, SCREEN, GRID AND FILAMENT CIRCUITS AND FORWARD AND REFLECTED POWER OF INPUT AND OUTPUT CIRCUITS.
- ELAPSED TIME INDICATOR.

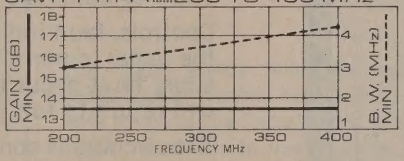
CAVITY 11143..... 40 TO 200 MHZ



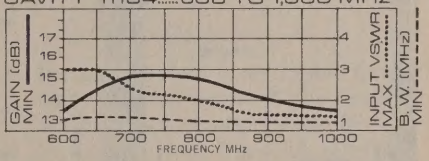
CAVITY 11145......400 TO 800 MHZ



CAVITY 11144......200 TO 400 MHZ



CAVITY *11104......600 TO 1,000 MHZ



*11104 cavity is available with a frequency range of 800 to 1100 MHz with a power output of 500 watts

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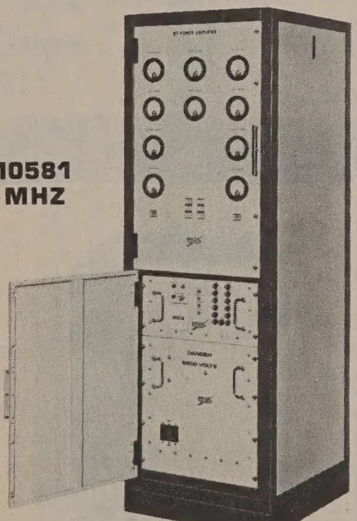
COMMUNICATION AMPLIFIERS

This line of high power amplifiers was designed specifically to fill the need for high power linear amplification to extend the communication range of existing AM transmitters. The amplifiers are also useful in Class B television or Class C FM service. The amplifiers are a complete package providing metering, safety features, and support circuitry. These versatile quality constructed units provide a simple and convenient means of obtaining increased power.

- Front panel dial tuning. Some models available with servo/local remote tuning.
- Individual front panel metering of plate, screen, grid and filament circuits, plus input and output RF power (forward and reflected).
- Elapsed time indicator.

MODEL 10581
225-400 MHZ



SPECIFICATIONS

Frequency MHz	Power Out (FM)	Power Out (PEP)	Power Out CW 90% AM	Bandwidth @ 3 db	Gain	Size	Primary Power	Output VSWR	Model Number
120-160	2000 W	4000 W	1500 W	4 MHz	12 db	79″ H. x 24″ W. x 24″ D.	380 V, 3 phase, 50 Hz	1.25	10297
148-154	2000 W	4000 W	1500 W	6 MHz	10 db	61″ H. x 25″ W. x 28″ D.	208 V, 3 phase, 50 Hz	1.25	10288
148-156	2000 W	7.2 KW	2.0 KW	4 MHz	12 db	80″ H. x 24″ W. x 24″ D.	208 V, 3 phase, 60 Hz	1.25	10333
225-400	2000 W	4000 W	1400 W	4 MHz	13 db	72″ H. x 19″ W. x 24″ D.	208 V, 3 phase, 60 Hz	1.25	10581

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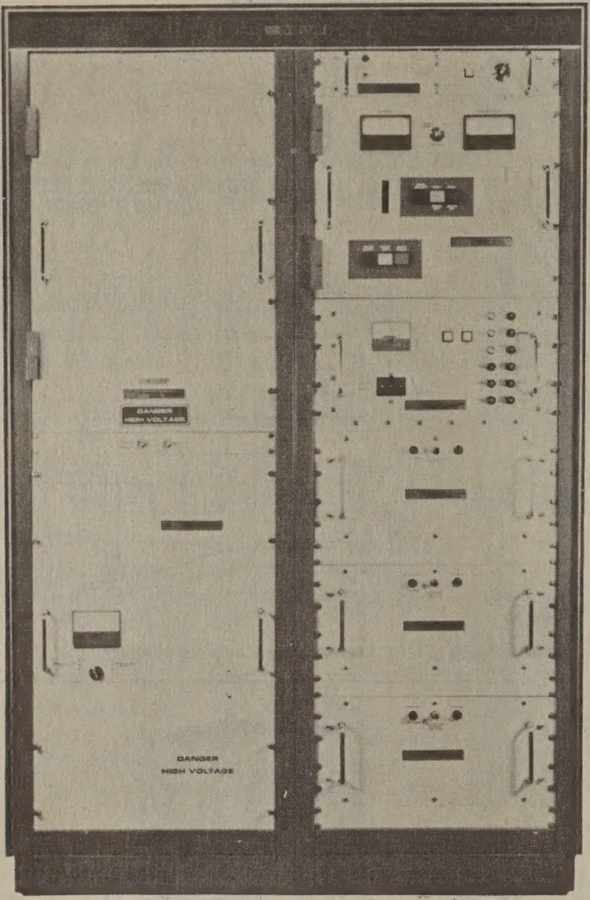
MICROWAVE SYSTEMS

500-2000-WATT KLYSTRON CW AMPLIFIER SYSTEMS



Front view of the MCL Model Number 10475 2KW Klystron Communication Amplifier System. System features include the following: Automatic turn on sequencing, solid state fault/control circuitry and LED fault indicators, automatic leveling of the RF output, highly regulated and filtered power supplies, and ease of serviceability and maintainability.

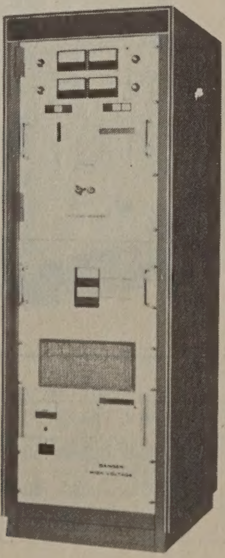
This line of high Power Klystron amplifiers is designed for up-link satellite service in the tropo bands. The equipment consists of a klystron and the necessary power supplies, control-monitoring and protective circuitry to insure safe operation for equipment and personnel.

The amplifier uses Klystrons specifically designed to provide the performance in communication service. The supplies are conservatively designed to insure maximum reliability and are well regulated and filtered to minimize residual modulation.

Controls, fault indicators and meters are provided on the panel to permit ease of operation. Should a transitory fault occur the unit will automatically recycle and return to full service.

The circuitry is contained in slide out drawers or slide out shelves to permit complete maintenance from the front panel. In addition, test points are placed throughout at crucial circuit locations.

Freq. GHz	Power Output	Model
.775-.985	2 KW	10495
1.7-2.4	2 KW	10496
1.6	2 KW	10475
5.925-6.425	.7 to 3 KW	10497



Suggested applications include biological research, factory test-source.

This series includes 8 individual systems, each embodying highly desirable features such as high power capability, broad frequency range. (Any of these systems can be custom modified.) Each system is engineered conservatively and quality built, affording users maximum reliability and economy.

Freq. MHz	Power Output	Model
1700-2400	1.0 KW	10282
1700-2400	1.0 KW	10283
2400-2700	1.0 KW	10284
2850-3050	1.0 KW	10285
4400-5000	1.0 KW	10276
5900-6400	1.0 KW	10278
7100-10000	1.0 KW	10286
10000	2.0 KW	10473
15000-18000	0.5 KW	10287

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M-C-L
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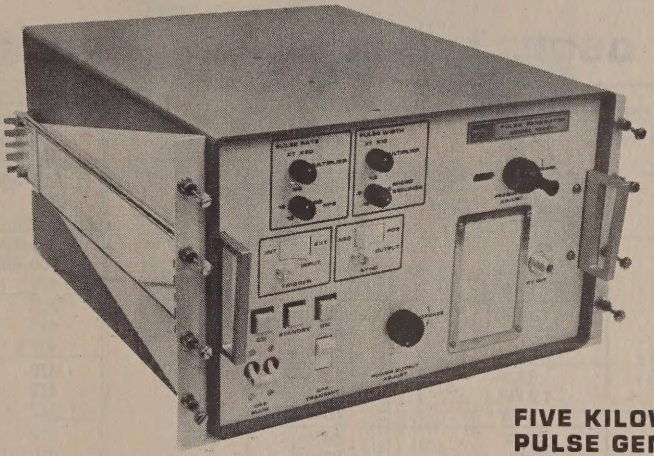
MICROWAVE SYSTEMS

PULSE SYSTEMS

MCL has designed a number of high power pulse systems for special applications. The systems listed are but a few of the many designed and have been selected since they typify the broad capability of MCL. These equipments are complete assemblies and include the necessary power supplies, protective circuits and control circuitry to provide turn-key operation. The applications vary from ground and airborne radar to laboratory test instrumentation. The capability and expertise represented by this array of systems is available to solve your system problems.

Frequency	Power Out	Model
120-400	2 KW	10224
145-154	50 KW	10258
146	100 KW	10343
150-160	125 KW	10275
216	30 KW	10264
205-225	50 KW	10472
476	10 KW	10315
500	15 KW	10292
1010-1050	1 KW	10109
2300-2450	350 W	10116

MODEL 10461 RF PULSE GENERATOR



FIVE KILOWATT RF PULSE GENERATOR

The Model 10461 Pulse Generator is continuously tunable from 900 to 1220 MHz which is the Tacan Band. The generator is extremely useful as a Tacan test set. Peak power output is five kilowatts at .01 duty cycle. Pulse width and pulse repetition rates are adjustable.

The instrument is complete with power supplies, grid pulse modulator, cavity oscillator, cooling, output circulator, and protective circuitry.

The power output is adjustable from 50 watts to 5.0 kilowatts. A three digit numerical read-out with calibration chart provides accurate frequency setting.

The 10461 is a solid state instrument except for the planar triode oscillator. An output circulator is provided to minimize frequency pulling and power variations due to load mismatch; operation into open or short circuit conditions will not damage the equipment.

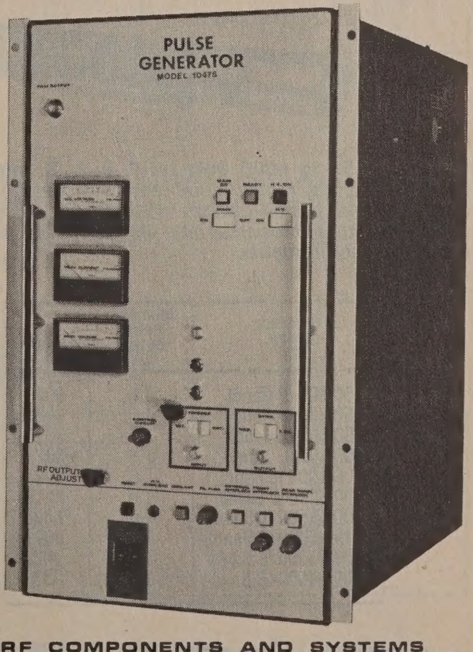
HIGH POWER LONG PULSE MODULATOR

Designed to fulfill the need for a high power long pulse modulator in laboratory or field. The unit interfaces readily with plate pulsed oscillator cavities or other microwave tubes.

SPECIFICATIONS

	10478	10477
Output Voltage KV (Positive Only)*	Adj. 0-10 KV (0-8 KV @ 3 A)	Adj. 0-10 KV (10 KV@6A)
Pulse Rise Time Microsecond	1	1
Pulse Fall Time Microsecond	5	2
Pulse Width Microsecond	Adj.: 100-2000	Adj.: 10-100
Pulse Repetition Rate: PPS	Adj.: 10-500	Adj.: 10-500
Duty Factor %	6	5
Ripple %	Less than 5	Less than 5
Primary Input Voltage	208 V	208 V
Size in Inches	19″ x 36″ x 23½″	19″ x 36″ x 23½″

*Polarity can be reversed but pulse rise and fall times will be increased.



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MCL INC LA GRANGE ILL

MICROWAVE CAVITIES AND FILTERS

The listed models are MCL standards, produced to satisfy the demanding needs of the original equipment manufacturer engaged in producing industrial or military equipment. These reliable, rugged cavities have been used in missiles, helicopters, ships and mobile applications. If your cavity needs are not listed here, minor modifications to existing units or custom design by MCL could make your requirements a reality.

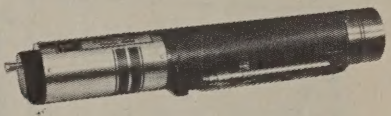
PULSE OSCILLATORS

Freq. in MHz	Power Output	Model
150/160	25 KW	11050
230	2.5 KW	8035
415/475	20 KW	9048
450/500	1.5 KW	8002-8
500/1000	50 KW	6057
630/710	2 KW	8002-11M
900	20 W	8063
900/1050	1.0 KW	8041
960/1060	2.5 KW	9017
990/1010	3250 W	9010B
1090	150 W	8042
1260/1420	15 W	8000-17
1420/1600	1.5 KW	8003-18
1500	1.0 KW	8044
2300/2450	1.0 KW	8043B
2400	500 W	8075
2700	20 W	8064
2840/3000	10 W	9019
2840/3180	10 W	9012
3380/4000	2 KW	9057
3500/3520	2 KW	9058
3575/3635	500 W	9021
4275/4325	100 W	9202
4300	1.0 KW	9009
4300	250 W Max.	9018
4820/5220	10 W	9013
5000	20 W	8065
5000	20 W, Peak	9014
5300/5500	15 W, Min.	9022B
8500	20 W, Peak, Min.	8066

PULSE AMPLIFIERS

Freq. in MHz	Power Output	Model
100/200	10 KW	11087
150/160	125 KW	11051
180/220	2.5 KW	3058
200/400	10 KW	11088
216	3.0 KW	3031
216	300 W	3029
225/400	1.2 KW	11009
400/800	10 KW	11089
420	5.0 KW	3021
420	200 W	3022
425	400 W	3014
430.5	8.0 W	11033
470	2.0 KW	3045
476	250 W	3023
512	2.5 KW	3044B
512	10 KW	11067
550/1212	100 W	2045
600/700	.55 KW	2044
700/800	15 KW	11031
800/1000	10 KW	11090
1000	2.0 KW Min.	2023A
1025/1150	1.5 KW	3042
1025/1350	10 KW Peak	11011
1434/1487	63 W, CW	3057
1545	2.0 KW	3047
1545	100 W	3046
2300/2450	2.5 KW	3059

EXTENDED RANGE PULSE CAVITIES



Coverage: 150 to 4000 MHz (VHF, P. L. S. and C Bands)
Extended tuning ranges combined with overall frequency coverage and power output make these cavities readily applicable to a broad variety of industrial, military and scientific requirements.

Frequency Range MHz	Minimum Power Output KW	Model Number
200-400 (P Band)	1.5	8021
250-500 (P Band)	1.5	8026
300-600 (L Band)	1.5	8018
400-800 (L Band)	1.5	8022
500-1000 (L Band)	1.5	8024
600-1200 (L Band)	1.0	8019
1000-1500 (L Band)	1.0	8028
1450-2000 (S Band)	1.0	8029
2000-3000 (S Band)	1.0	8027
3000-4000 (C Band)	1.0	8030

FILTERS COAXIAL LOW PASS

FREQUENCY RANGE FROM 200-2000 HZ

MCL Low Pass Filters are designed for cut off at a specific frequency (see table). The cut off curve is relatively steep and is sufficient for most applications; however, additional filter sections can be employed to increase the offband attenuation. For special applications, MCL's capability includes custom filter designs on a quick reaction basis.

TYPICAL SPECIFICATIONS

Max. VSWR (Passband): 1.4:1.
Max. Insertion Loss (Passband): .3 db.
Impedance: 50 ohms.
Power Rating, CW: 3 KW.
Power Rating, Peak: 50 KW.
Finish: Silverplate.
Flanges: LC and EIA RS-225.

Model Number		Cut Off Frequency MHz	Insertion Loss @ 1.25 Fco	Insertion Loss @ 1.5 Fco —6.0 Fco
1⅝	LC			
19051	19061	200	10	30
19052	19062	400	10	30
19053	19063	700	10	30
19054	19064	1000	10	30
19055	19065	2000	20	30

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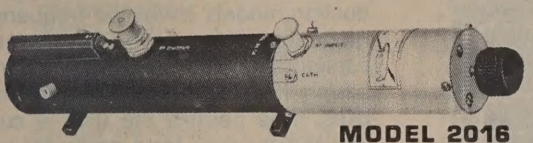
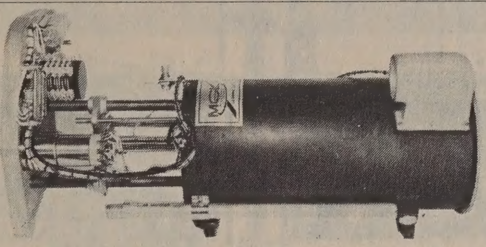
MICROWAVE CAVITIES

CW AMPLIFIERS



MODEL 2016
960-1215 MHZ



MODEL 11010
225-400 MHZ

Freq. in MHz	Power Output	Gain	Bandwidth	Dimensions	Model
30/150	40 W	13 db	3.0 MHz	7¼″ H. x 11¼″ W. x 13¼″ L.	2052
40/200	100 W	13 db Min.	1.5 MHz	11¼″ H. x 7½″ W. x 15″ L.	11024
150/300	40 W	13 db	3.0 MHz	4″ dia. x 32½″ L.	2051
225/250	25 W	12 db Min.	3 MHz	4⅝″ H. x 6¼″ L. x 3¾″ W.	2002-2
225/400	2 KW	13 db	4 MHz	11¾″ H. x 18½″ L. x 10″ W.	11097
225/400	1 KW	10 db	3 MHz	8¼″ H. x 19¾″ L. x 8¼″ W.	11099
225/400	120 W	13 db	4 MHz	8⅞″ H. x 20⅜″ L. x 9 7/32″ W.	11010
280/315	25 W	11 db	3 MHz	3¾″ H. x 4⅝″ L. x 3½″ W.	2002-4
360/480	1.5 KW	10 db	6.0 MHz	6″ dia. x 21″ L.	11030
360/480	120 W, Min.	13 db	6.0 MHz	3¾″ dia. x 15¾″ L.	11029
374/376	1.4 KW	13 db	10 MHz	6″ dia. x 15⅝″ L.	11057
374/376	60 W	13 db	8.0 MHz	6″ dia. x 10 5/16″ L.	11056
420/470	2.5 KW	13 db	3.0 MHz	6″ dia. x 27½″ L.	11074
500/560	25 W	10 db	6 MHz	2″ H. x 9″ L. x 5⅝″ W.	2002-9
560/630	25 W	11 db	6 MHz	2″ H. x 8¾″ L. x 2⅝″ W.	2002-10
630/710	25 W	11 db	6 MHz	2″ H. x 7¾″ L. x 2⅝″ W.	2002-11
710/800	25 W	10 db	3 MHz	2¼″ H. x 7½″ L. x 3″ W.	2002-12
800/900	25 W/CW	12 db	4 MHz	2¼″ H. x 7½″ L. x 3″ W.	2002-13
900/1000	22 W, CW	10 db	3 MHz	2⅛″ H. x 11⅛″ L. x 3½″ W.	2002-14
960/1215	20 W	12 db	4.0 MHz	2¼″ dia. x 17⅜″ L.	2016A
960/1000	100 W	10 db	2.5 MHz	2¼″ dia. x 16¼″ L.	2043
1260/1420	25 W	9 db	3 MHz	2 5/16″ H. x 8⅛″ L. x 2¾″ W.	2002-17
1260/1540	25 W, CW Min.	9.2 db Min.	10 MHz Min.	2 3/16″ H. x 4½″ L. x 2¼″ W.	3051
1650	30 W	10 db	10 MHz Min.	2¼″ H. x 4¼″ L. x 2⅜″ W.	2063
1650	125 W, CW	10 db	8 MHz Min.	3″ H. x 5″ L. x 2¼″ W.	2065
2000	20 W	10 db	30 MHz	5″ H. x 4½″ W. x 8½″ L.	3028
2000	50 W	7.0 db	3.0 MHz	4½″ H. x 3″ W. x 8″ L.	2047
2101.8	15 W	11 db Min.	15 MHz	5½″ H. x 3½″ W. x 8¾″ L.	3020
2106	10 W	7.0 db	10 MHz	3¼″ H. x 4⅞″ W. x 7″ L.	3006B
2125/2350	1.0 W	10 db	3.5 MHz	1½″ dia. x 5½″ L.	2014A
2200/2300	85 W	9.0 db Min.	10 MHz	2⅜″ dia. x 3¾″ L.	3018
2282.5	50 MW	10 db	15 MHz	1½″ H. x 3⅞″ W. x 4⅛″ L.	1010
2250	22 W	9.0 db Min.	4.0 MHz	2⅜″ H. x 6″ W. x 4″ L.	3040

CW OSCILLATORS

The CW Oscillator cavities designed by MCL cover a very wide range of frequencies, power levels and applications, and have been used by OEM in industrial and military applications ranging from oil exploration to aircraft altimeters. The listings below, though not complete, typify the broad expanse of MCL's experience in CW Oscillator design and manufacture. If your exact requirements cannot be met using a listed cavity, call us for assistance.

MODEL 9015
4300 MHZ

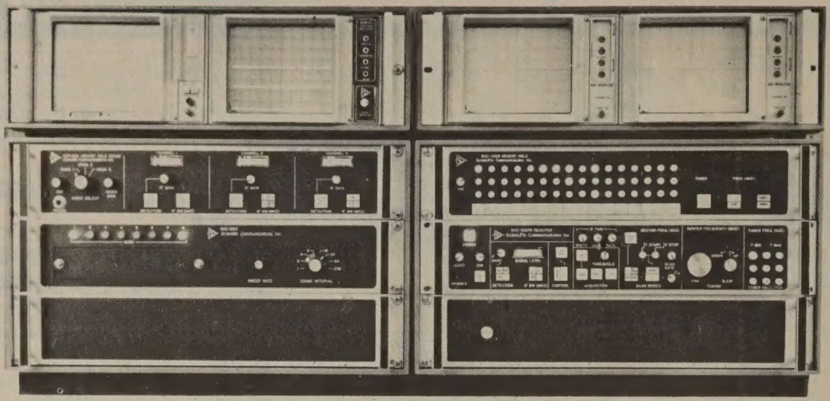
SPECIFICATIONS

Frequency in MHz	Power Output	Dimensions	Model
400/500	1.5 W	1⅞″ W. x 2 7/16″ H. x 8 9/16″ L.	6002-7
800/900	40 W	3″ W. x 2″ H. x 6″ L.	6003-13
10000	20 W	3¼″ H. x 2 3/16″ W. x 5⅞″ L.	6024
4300	2.0 MW, Min.	⅝″ dia. x 2⅝″ L.	9015
4300	5.0 MW	11/16″ dia. x 2⅞″ L.	7200
5250/6050	5.0 MW, Min.	⅝″ dia. x 3″ L.	7014

—MCL / INC DESIGNERS AND MANUFACTURERS OF RF COMPONENTS AND SYSTEMS
TEN NORTH BEACH LA GRANGE ILLINOIS 60525 312-354-4350

Capability in MICROWAVE SURVEILLANCE RECEIVERS

Scientific Communications, Inc. offers a full line of solid state microwave surveillance receivers. Current production models cover the frequency range from 5Khz to 40 Ghz. Various configurations are available by combining fully developed subassemblies. This permits the user a customized receiver for a particular application with future expansion capability. All designs are state-of-the-art yet are the most cost effective receivers available. All units offer performance parameters that meet or exceed specifications offered for any comparable equipment. Many unique features are offered to enhance manual operation capability. Most systems offer full computer compatibility. All units are designed to the intent of MIL-E-5400 or MIL-E-16400. Reliability and performance achieved from numerous systems at sea, in the air, and ground based have enhanced the reputation of Scientific Communications, Inc. as a leader in the field of Surveillance receivers. Contact SCI for your applications that range from fixed frequency down conversion to full spectrum coverage.



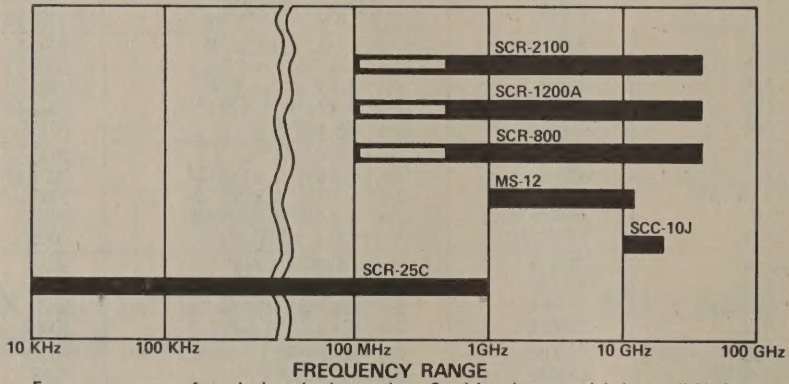
The SCR-2100 is a complete solid-state receiver system providing **spectrum** surveillance, **acquisition,** and **analysis capability** in the 0.1 GHz to 40 GHz range.

The system consists of either **19″ rack mount or aircraft style control panels** and numerous remote controlled units in **ATR configurations.**

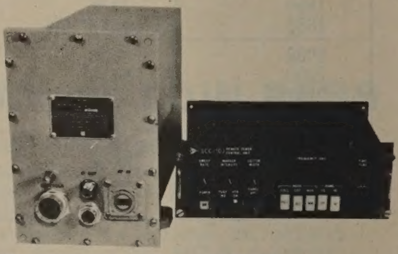
Independent octave band tuners allow **simultaneous panoramic reception** over the microwave spectrum or a mix of multiple tuners on a given band. Any combination of eight tuners may be used. Options permit **simultaneous signal analysis of all 8 tuners.**

Phase lock frequency accuracy is achieved with a frequency synchronizer.

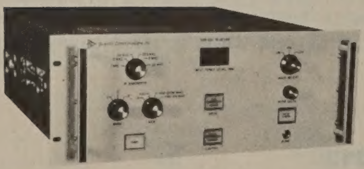
Complete digital control, computer compatibility, scratch pad memories, optimized search and aquisition capability, signal identification from memory comparison, digital refreshed displays.



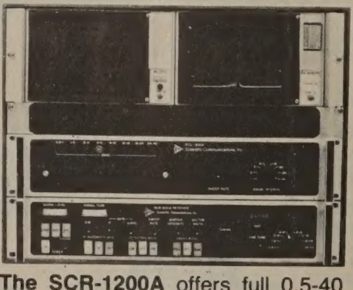
Frequency coverage of standard production receivers; Special equipment and designs available from 10 KHz to 40 GHz.



The SCC-10J offers 10-20 Ghz coverage when added to the WLR-1 or APR-9 series receivers.



The SCR-25C offers computer controlled analysis capability over the range of 5Khz to 1 Ghz. Features include accurate digital display of received signal amplitude.



The SCR-1200A offers full 0.5-40 Ghz coverage in the most cost effective full performance receiver for search and analysis capability. Simultaneous multi-band RF Panoramic capability with included video multiplexer is one of many outstanding features.

The SCR-800 is a full capability control/IF processor assembly and is compatable with all SCI Remote Tuners from .5-40 Ghz.

Scientific Communications, Inc.

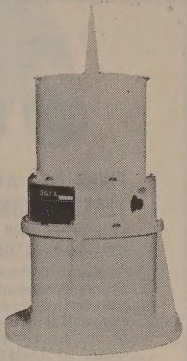
3425 Kingsley • Garland, Texas 75041 214•271-3685 • Twx 910-860-5172

VEGA PRECISION LABORATORIES, INC.

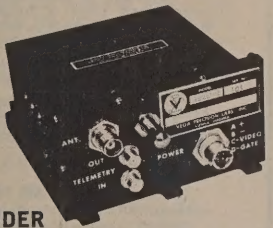
VEGA MAJOR PRODUCTS: Portable Radar Tracking Systems • Command and Data Systems • Target Control Systems • Radar Transponders • Radar Beacons • Transmitters • Receivers • Location and Navigation Systems • Radar Augmentation Devices • Special Test Equipment • R-NAV Devices • Antennas and Microwave Devices • Ranging Systems

X BAND RACON TRANSPONDER

(MODEL 361X)



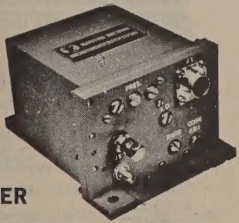
This Vega RACON is a navigation aid suitable for positioning offshore drilling equipment, buoy moorings, and defining most sea and landmark locations. **Transmitter:** ±3 MHz, 300 watts minimum, 2 pulse reply. **Receiver:** −65 dbm sensitivity. **Environmental:** Watertight, temp. −40°C to +70°C. **Power:** 24 to 30 VDC (no internal ground). **Size:** Overall height 15 in. Diameter: 8½ in. **Weight:** Approximately 9 lbs.



C-BAND RADAR TRANSPONDER

MODEL 302C-2

Freq: 5.4-5.9 GHz; **Receiver Type:** Superhet with sensitivity of −70 dbm; **Transmitter Type:** Magnetron with 400 w min. peak power output; **Input Power:** 22 to 32 VDC; **Size:** 43 cu. in.; **Weight:** 43 oz.; **Temp:** −35°C to +75°C; **Altitude:** 230,000 ft.; **Humidity:** 100%; **Shock:** 125 g in any direction, 3 shocks in opposite directions along each axis for 6 μsec. each; **Acceleration:** 125 g applied along any axis for 3 minutes; **RFI:** Per MIL-1-26600. **Vibration:** Sinusoidal, 5 to 25 Hz 0.4 in. DA and 15 g 15 to 2500 Hz.



C-BAND RADAR TRANSPONDER

MODEL 321C

Freq: 5400-5900 MHz; **Receiver Type:** Superhet with sensitivity of −70 dbm, 100% firing; **Transmitter Type:** Triode Cavity with 300 w min. peak power output; **Input Power:** 24 to 32 VDC, 45 w; **Size:** 38 cu. in.; **Weight:** 44 oz.; **Temp:** −37°C to +75°C; **Altitude:** 230,000 ft.; **Acceleration:** 125 g; **Shock:** 125 g; **Vibration:** Sinusoidal, 5 to 25 Hz, 0.4 DA. 25 to 2500 Hz, 15 g **RFI:** Per MIL-1-26600.

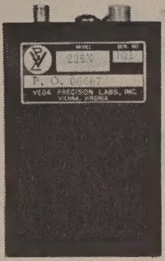
CAVITY BACKED HELIX ANTENNAS

MODELS 815S, 820C and 830X — C, S, and X BAND

An optical quartz-loaded, cavity backed helix radiator which produces a circularly polarized radiation pattern. The use of quartz material provides for high and low temperature stability with no degradation in electrical performance. Flush mounting is normally used on reentry vehicles with no performance deterioration as a result of reentry heat.

X-BAND RADAR TRANSPONDER

VEGA'S MODEL 229X



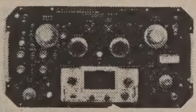
Miniature all solid-state radar transponder is smaller than a king size pack of cigarettes; weighs only 10 oz. This X-Band (9.1-9.6 GHz) unit employs the latest state-of-the-art solid-state devices and construction techniques, and features high sensitivity (−40 dBm full-firing) with average power output of 4 watts peak. It operates with an input voltage from 24 to 32 VDC and draws only 60 milliamperes quiescent or 80 milliamperes at a PRF of 2500 PPS. Uses single or double pulse codes and operates with practically all X-Band airborne, ship and ground radars in use today without any change to the radar. A circularly polarized antenna is attached to the top of the unit. Optional battery pack available. Also available in C-Band (5.4-5.9 GHz).

C, S AND X-BAND STUB ANTENNAS

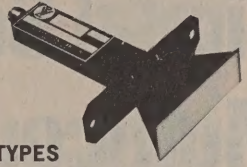
MODELS 832S, 845CX

A vertically polarized omnidirectional antenna enclosed within a radome, it is compact and extremely lightweight while maintaining the electrical and environmental characteristics of this type antenna. Height of the radome is approximately ¾″; diameter is approximately 1″. The skin of the vehicle serves as the ground plane for the antenna due to the simplified mounting technique. Mounting is accomplished via a "D" hole (.505 dia. x .480 flat) through the vehicle skin. It is then secured to the vehicle with a locking nut.

RADAR SIMULATORS C-BAND X-BAND S-BAND



The 616C, 617X, and 627S Series are designed to interrogate and measure parameters of radar transponders or beacons during final checkout on a launch pad or flight line. They are particularly useful when tracking radars are located at great distances from launch sites. Transmitters and receivers are calibrated and controllable from the front panel in tuned frequency, output power, code spacing and sensitivity. Built-in oscilloscopes are hooded for daylight viewing. A resonant stubhorn antenna is standard. The internal battery supply includes a self-contained charging circuit. Telescoping legs are optional.

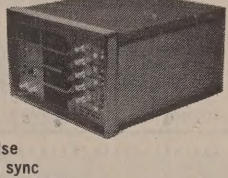


HORN ANTENNA TYPES

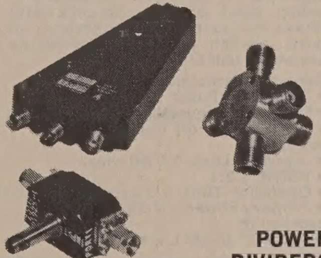
The Model 844X-2 Flared Horn Antenna was developed for use in target drone applications. Radiation coverage is controlled to the desired beamwidths by the flared aperture. A colinear type feed is employed to couple energy from the TNC input connector into the waveguide. Construction utilizes standard aluminum waveguide parts dip-brazed together. The radome is epoxied in position over the aperture. Flared horn antennae of this type are available in other frequency bands utilizing the same design.

DIGITAL CODE GENERATOR

MODEL 766



Generates extremely accurate pulse stream for pulse position code simulation. Pulse stream starts with a sync pulse followed by five data pulses. Each data pulse is independently adjustable for both delay from the sync pulse and for pulse width. Delay adjustable from 0.0 to 999.9 microseconds in 0.1 microsecond steps. Width is continuously adjustable from 0.1 to 1.0 microseconds. Operates from 115 VAC, 50 to 400 Hz. Outputs are TTL positive logic terminated in 50 ohms.



POWER DIVIDERS

Vega produces an assortment of power dividers with two, three or four-way division in addition to a variable power divider. Choice of input connectors (TNC or SMA) is offered in most models. All designs are well engineered and provide low VSWR, low insertion loss, and balanced power division with high power capabilities. Some designs are qualified for missile and satellite use. Frequency ranges extend through X-Band with stripline and coaxial devices.

Vega's antenna and microwave engineering staff specialize in the design and development of aircraft, space and missile components. Among our designs are units intended for RPV control. A single basic system can be used to control virtually any vehicle. Our laboratory utilizes the latest in equipment and suitable antenna test ranges are maintained. Some of the more popular available components are shown above.

VEGA PRECISION LABORATORIES, INC.

800 Follin Lane, S.E. • Vienna, Va. 22180 • (703) 938-6300 • Telex: 89-2521

RF Filters, Converters, Switches, Amplifiers, Multipliers, Signal Sources, Multicouplers

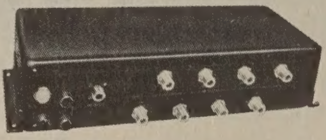
FIXED PAD ATTENUATORS & TERMINATIONS (DC—3 GHz)

FOR TYPES BNC, TNC C, N & OSM CONNECTORS

Integrated line of fixed pad attenuators, terminations and impedance-matching transformers provides means for rapid and accurate division of voltages over the frequency range of DC to 3 GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

General characteristics:

Frequency Range:	DC—3 GHz
VSWR:	1.25:1
Attenuation Accuracy:	±0.5 dB
Impedances (nominal):	50, 75, 90 ohms
Attenuation values:	1, 2, 3, 4, 6, 10, 12, 15, 20 dB (standard)



MULTICOUPLERS

Model HFM Series is designed to meet the needs of most systems.

General features:

High isolation between outputs
High dynamic range
Low noise
Modular construction
Solid-state
Octave bandwidth (if desired)

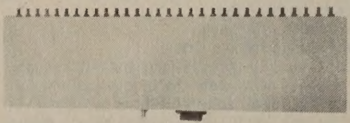
Model PM Series of passive multicouplers provides the ultimate performance in signal distribution.

BROADBAND MULTIPLIERS (5-18,000 MHz)

These units utilize solid state devices. Using the frequency multiplier as the basic tool, lines of Signal Sources, Frequency Synthesizers and Multiplier Chains are now available.

General characteristics:

Frequency Range:	5-18,000 MHz
Bandwidths:	up to 27%
Power Output:	up to 5 watts
Efficiency:	as high as 50%

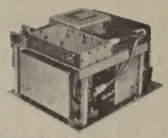


SWITCHES (10-1000 MHz)

A series of computer compatible solid state switches using PIN diodes in a broadband stripline matching structure. Can be directly addressed without interfacing. Units available with equal path lengths to all outputs, providing good phase coherence with phase and amplitude tracking on all ports. Switch matrix configurations are also available.

General Characteristics:

- Frequency Band: 10-1000 MHz
- Switch Configuration: 1x2 to 1x30
- Isolation: 70 dB min. (higher available)
- Insertion Loss: 1.0 dB max.
- VSWR: 1.2:1
- Operation Time: 1.0 μsec.
- Primary Power: ±4.5V, 50ma per crosspoint
- Sizes: 2" to 16"L x 4"W x ½"H



CONVERTERS

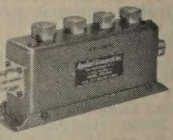
State of the art converters available for military or commercial application throughout the frequency range. All units are constructed to meet mil applications.

TELEMETRY CONVERTERS

These units permit the ready adapting of existing UHF telemetry receiving equipment for use in the 1435 to 1540 and 2200 to 2300 MHz telemetry band with high conversion gain.

General characteristics:

Long term stability:	better than ±.1 PPM over temperature range
Image rejection:	>than 50 dB
Noise figure:	better than 5 dB for 100 mc bandwidth (2.2 to 2.3 GHz)

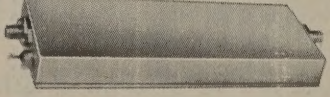


FILTERS (5-12,000 MHz)

Advanced network design techniques have developed filters operating in the frequency range up to 12,000 MHz. With electrical performance approximating theoretical expectations. In addition to Bandpass, Band Reject and Multiplex Filters, advanced network designs are available for antenna couplers, Diplexers, Interdigital Filters and many other types.

General characteristics:

Frequency Range:	5-12,000 MHz
Bandwidths:	up to several octaves
Insertion Loss:	as low as 0.25 dB
Power:	up to 3.5 kW (cw)
Band Reject Notches:	as narrow as ¼ % fo
Band Reject Attenuation:	as great as 75 dB



SOLID STATE RF AMPLIFIERS

(Power, low-noise, broadband, phase matched, linear and high dynamic range)

Constructed to meet mil and missile applications.

General characteristics:

Frequency Range:	up to 4 GHz
Bandwidths:	up to multiple octaves
Phase matching:	to within 1° over an octave
Noise figure:	as low as 1.5 dB
Gains:	up to 120 dB
Power output:	>than 20 watts

For complete details, write or call

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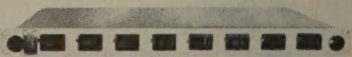
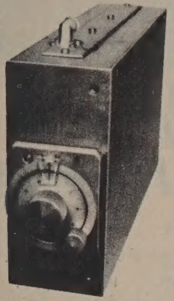


TUNABLE BAND REJECT FILTERS (5-2000 MHz)

Tunable multicontrol band reject filters provide high rejection of more than one and up to eight unwanted signals, or, extreme rejection of one. Low insertion loss and sharp skirt selectivity in the band reject region. Eight knobs and counter readout allow continuous tuning.

General Characteristics:

- Center Frequency: 5-2000 MHz
- Out-of-Band Insertion Loss: 0.5 dB
- Notch Bandwidth: narrow as ¼ % fo
- Notch Depth: 20 dB/section
- VSWR (outside of notch region): 1.5:1
- Size: 24" x 2" x 8"
- Connectors: BNC

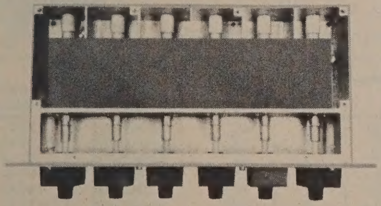


BAND REJECT FILTER (225 to 400 MHz)

Single knob control band reject filters reject unwanted signals, with extreme selectivity through L-band. Tune ranges of nearly an octave can be obtained. Units are tunable over the range 225 to 400 MHz. The bandwidth is >1 MHz at the 60 dB points. Total notch depth is 60 dB. Use of helical resonators provides for high rejection and low insertion loss in the passband of <1 dB. The phase linearity in the passband is achieved by utilizing quarterwave coaxial lines.

PERFORMANCE SPECIFICATIONS

Insertion Loss (out of notch region): 1 dB
Notch Range: 225 to 400 MHz
Typical Notch Specs: Frequency 225.2 MHz;
1 dB bandwidth 11.1 MHz;
Depth 68 dB
Impedance (I & O): 50 ohms
VSWR (I & O) (out of notch region): <1.3:1
Group Delay (out of notch region): <20 ns



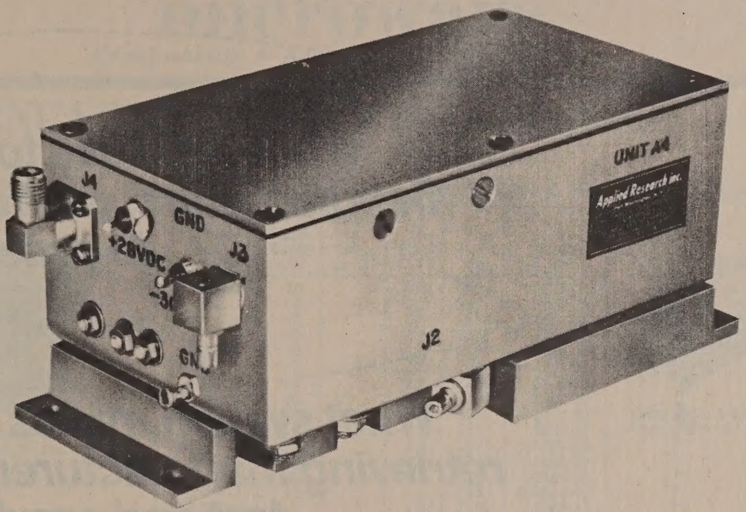
BAND REJECT FILTER (240 to 365 MHz)

Band reject filters operating from the HF range to K-band exhibit a wide bandpass frequency range without reentrances. Resonant elements are independently tuned or ganged to a single knob control. Operation is over frequency ranges greater than one octave, providing high rejection at one frequency or rejection by greater than 15 to 20 dB to as many as six separate and independent frequencies within the band.

Two or more notches can be aligned to adjacent frequencies to vary the depth and/or bandwidth of the band rejection curve. With all rejection notches tuned to a single frequency, the resultant response is such that an undesired signal approximately one percent away from a desired signal is attenuated by more than 70 to 80 dB while the desired signal is passed with only a 1 dB insertion loss.

PERFORMANCE SPECIFICATIONS

Insertion Loss (out of notch region):
<1 dB 100 to 1000 MHz
Bandpass: DC to 1000 MHz
Notch Frequency: 240 to 365 MHz
Typical Rejection below Passband: 240 MHz/
23 dB; 325 MHz/19 dB; 365 MHz/17 dB
Impedance (I & O): 5 ohms
VSWR (I & O): <1.35:1



Frequency Generation thru Multiplication & Phase-Lock techniques

VHF to Ku-Band (10 MHz to 1.5 GHz)

Applied Research offers many proven designs using both techniques. And we're capable of meeting your exact requirements, precisely.

Our Phase-lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. And our multipliers are available as passive devices or in combination with amplifiers having multiplication factors of from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

What's more, we can supply crystal oscillators or internal drivers to provide a self-contained source.

SOME PERFORMANCE SPECIFICATIONS

Phase-Lock Signal Source
Output: 494 MHz @ 10 watts
Stability: .005% from internal crystal oscillator

Phase-Lock Synthesizer
Input: 6 MHz & 200 MHz @ 10 dBm each
Output: 218, 224, 230, 236, 242, 248, 254, 260 MHz @ 10 dBm each
Spurious: 60 dBc min.

Ku-Band Multiplier
Input: 45.5 to 46.1 MHz @ 1 dBw; (other inputs available)
Output: 15.3 to 15.5 GHz @ 100 milliwatts
Spurious: 60 dBc min.

C-Band Multiplier
Input: 50.3 to 51.5 MHz @ 1 milliwatt; (other inputs available)
Output: 5030 to 5150 MHz @ 200 milliwatts
Spurious: 60 dBc min.

For complete details, write or call today.

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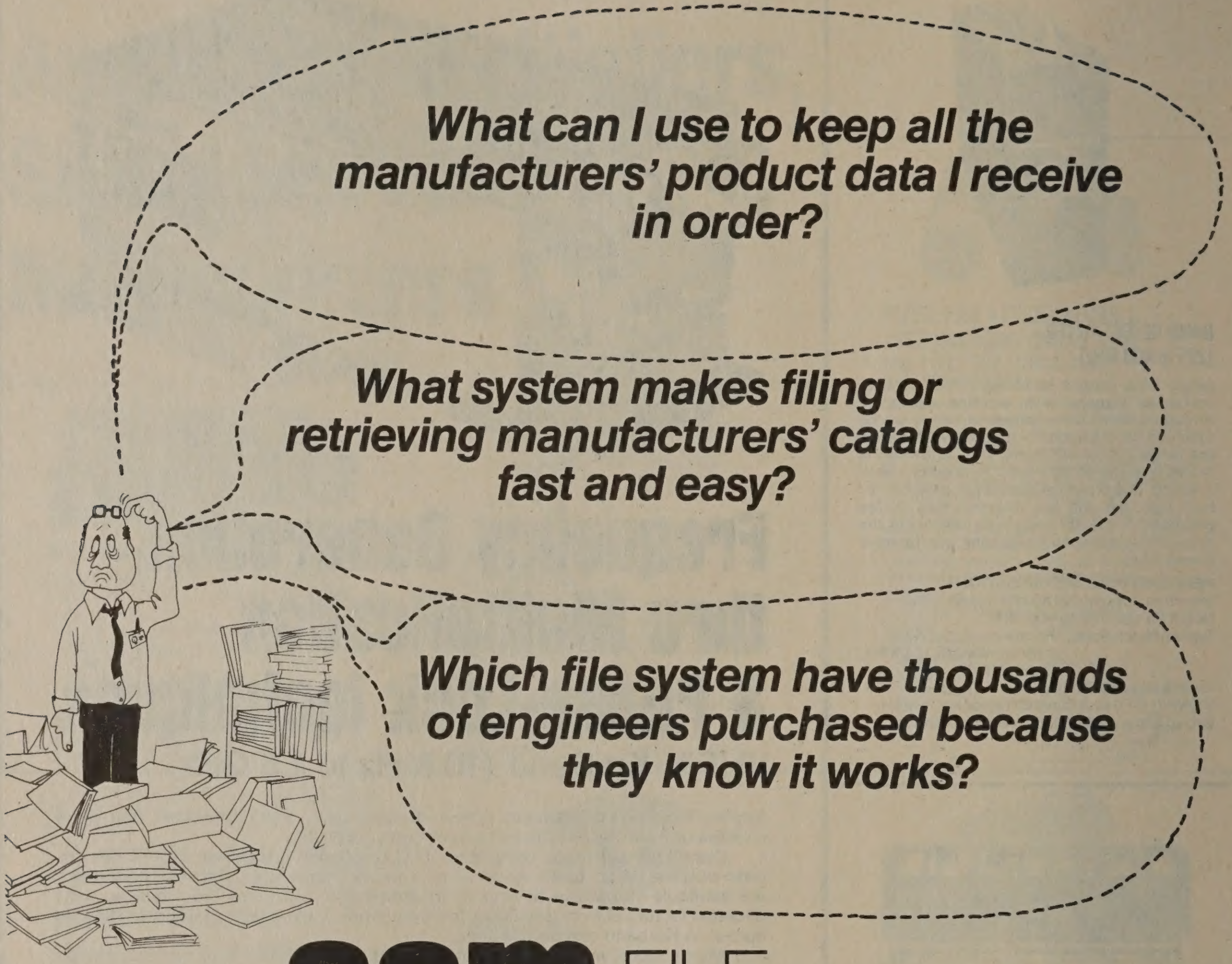
Low Pass Filters, High Power Varactor, Multipliers, Digital Attenuators


What can I use to keep all the manufacturers' product data I receive in order?
What system makes filing or retrieving manufacturers' catalogs fast and easy?
Which file system have thousands of engineers purchased because they know it works?

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THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

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ARRA INC.
ANTENNA & RADOME RESEARCH ASSOCIATES

Coaxial • Waveguide • Solid State
# microwave
Components • Assemblies • Sub-Systems

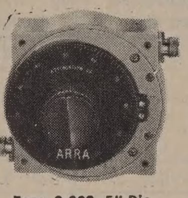
VARIABLE ATTENUATORS DC THRU 18000 MHz

Direct Reading

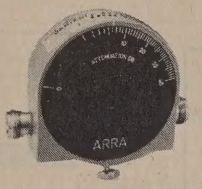
Low Ins. Loss • 1.5 Max. VSWR • 10 Watts Aver. Power

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Form Type	Model No.
DC-0.3	50	2.0	0-760	7684-50*
DC-1.0	20	1.5	0-760	7684-20*
0.5-1.0	60	1.0	0-214	2952-60
0.5-1.0	100	1.5	0-214	2952-100
0.9-1.3	60	1.0	0-660	2-3952-60
0.9-1.3	100	1.5	0-660	2-3952-100
1.0-2.0	10	1.0	0-1014	3617-10F
1.0-2.0	60	1.0	0-660	3952-60X
1.0-2.0	100	1.5	0-660	3952-100X
1.4-2.4	80	1.25	0-660	3-4952-80
2.0-4.0	10	1.0	0-51	4674-10F
2.0-4.0	20	1.5	0-51	4674-20F
2.0-4.0	30	2.0	0-51	4674-30F
2.0-4.0	60	1.0	0-660	4952-60X
2.0-4.0	100	1.5	0-660	4952-100X
2.5-4.0	10	0.75	0-51	4674-10G
2.5-4.0	20	1.0	0-51	4674-20G
4.0-8.0	10	0.6	0-39	5684-10F
4.0-8.0	20	1.0	0-39	5684-20F
4.0-8.0**	60	1.0	0-660	5952-60X
4.0-8.0**	100	1.5	0-660	5952-100X
5.4-11.0	10	1.0	0-39-2	5-6684-10F
5.4-11.0	20	1.5	0-39-2	5-6684-20F
7.0-11.0	10	0.5	0-39-2	6684-10F
7.0-11.0	20	1.0	0-39-2	6684-20F
8.0-12.4	10	0.5	0-39-2	6684-10X
8.0-12.4	20	1.0	0-39-2	6684-20X
12.4-18.0	10	0.5	0-39-2	9684-10F
12.4-18.0	20	1.0	0-39-2	9684-20F
12.4-18.0	30	1.0	0-39-2	9684-30F

*See catalog for VSWR, Ins. Loss and Power.
**Only less than octave — consult factory.



Form 0-660: 5″ Dia.
Form 0-214: 6″ Dia.



Form 0-39 & 0-39-2: 3″ Dia.
Form 0-51: 5″ Dia.

Miniature

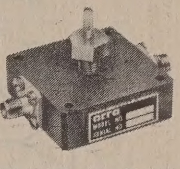
0.5 dB Max. Ins. Loss • 5 Watts Aver. 3 KW Peak • 2 Ounces

Freq. Range (GHz)	Atten. Range (dB)	Atten. vs. Freq. (±dB)	Max. VSWR	Form Type	Model No.
1.0-2.0	10		1.8	3651	3814-10
1.5-2.0	15		1.7	3651	3814-15
2.0-4.0	10		1.8	2191	4804-10
2.0-4.0	20		1.5	3651	4814-20
2.5-4.0	10		1.5	2191	4804-10X
3.0-4.0	10	1.5	1.5	3347	4603-10
4.0-8.0	10		1.5	2191	5804-10
4.0-8.0	20		1.5	2191	5804-20
4.0-8.0	30		1.5	3651	5814-30
4.0-8.0	10	1.5	1.5	3347	5603-10
6.0-11.0	10		1.5	2191	5-6804-10
6.0-11.0	20		1.5	2191	5-6804-20
6.0-11.0	30		1.5	2191	5-6804-30
6.0-11.0	40		1.5	3651	5-6814-40
8.0-18.0	10	1.5	1.5*	2191	9803-10
8.0-12.4	10		1.5*	2191	6804-10
8.0-12.4	20		1.5*	2191	6804-20
8.0-12.4	30		1.5*	2191	6804-30
8.0-12.4	40		1.5*	3651	6814-40
8.0-12.4	10	1.5	1.5	3347	6603-10
8.5-10.5	10	0.5	1.5	2191	6803-10A
8.5-10.5	20	0.5	1.5	2191	6803-20A
10.5-12.4	10	0.5	1.6	2191	6803-10B
10.5-12.4	20	0.5	1.6	2191	6803-20B
12.0-18.0	10		1.5	2191	9804-10X
12.0-18.0	20		1.5	2191	9804-20X
12.0-18.0	30		1.7	2191	9804-30X
12.0-18.0	40		1.7	2191	9804-40X
12.0-18.0	10	1.0	1.5	2191	9803-10A
12.0-18.0	15	1.0	1.7	2191	9803-15A

*1.7 VSWR above 11.0 GHz.

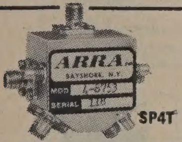
ARRA
MOD
SERIAL

Form 2191: 1¾x1x½″
Form 3651: 2x1¼x½″



Form 3347: 1½x1½x½″

BROADBAND DIODE DEVICES



SP4T

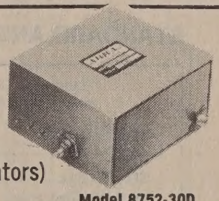
SPST & SPNT Switches

- High Isolation
- Low Insertion Loss
- Integrated Drivers Available

Con-figuration	Freq. Range (MHz)	Switching Time (nsec)	Average Power (Watts)	Model Number	
				With Driver	Without Driver
SPST	100-18000	20	2	F8753-80D	F8753-80
SPST	200-18000	50	5	8753-80D	8753-80
SPST	500-18000	10	2	H8753-80D	H8753-80
SPDT	200-18000	500	2	2-8753D	2-8753
SP3T	200-18000	500	2	3-8753D	3-8753
SP4T	200-18000	500	2	4-8753D	4-8753
SP5T	200-18000	500	2	5-8753D	5-8753

Attenuators & Modulators

- Absorptive for all Values
- Each Model 200-18000 MHz
- Low Insertion Loss
- Integrated Linearized Driver (Attenuators)
- TTL Compatible Driver (Modulators)



Model 8752-30D

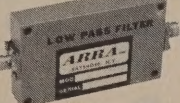
Configuration	Attenuation (dB)	Switching Time	Model No.
Cont. Variable	35	50 μsec	8752-35D
Cont. Variable	65	50 μsec	8752-65D
On/Off	30	20 nsec	8752-30M
On/Off	65	20 nsec	8752-65M

COAXIAL COMPONENTS

Phase Shifters

DC-18GHz
Model

Microwave Filters



.03-18GHz
Bandpass & Reject

Broadband Fixed Attenuators

DC-18GHz
High Power

Broadband Terminations

DC-18GHz
High Power

Couplers & Hybrids

ARRA
DIRECTIONAL COUPLER

Bands from
.5-18GHz

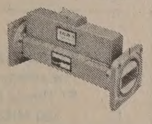
Power Dividers

ARRA
MOD
SERIAL

Bands from
.25-18GHz

Motorized Variable Attenuators
500 Watt Variable Attenuators . . . Lots More

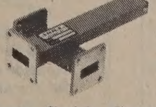
WAVEGUIDE COMPONENTS & ASSEMBLIES



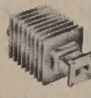
Broadband Diode Switches

Variable Attenuators

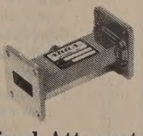
ARRA will fabricate your special waveguide assemblies in any material and finish . . . from the simplest straight section and single bend to complex combinations of bends, miters, twists, etc.



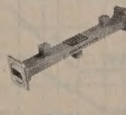
Cross Guide Couplers



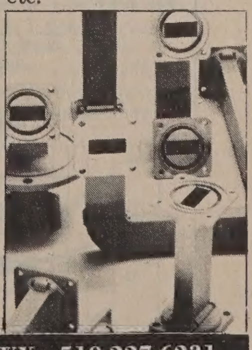
Dummy Loads



Fixed Attenuators



Filters



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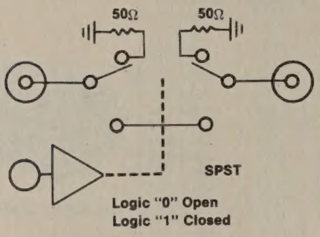
DAICO INDUSTRIES, INC.

MULTIPOLE DIODE SWITCHES TTL, CMOS, ECL INTERFACE

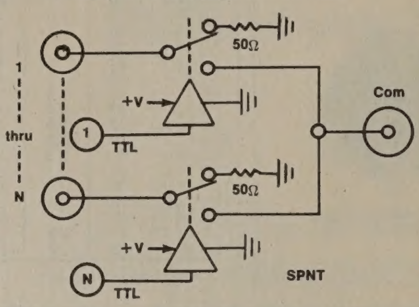
HIGH SPEED-LOW TRANSIENT-BALANCED SWITCHES

TTL controlled — SMA connectors — single five volt supply Applications — Blanking — Pulse Modulation — High Speed Commutation. Designs also available to accommodate different voltages, connectors, logic or mounting.

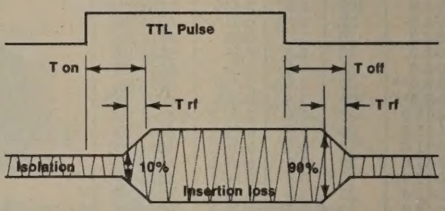
TYPE	PART NUMBER	FREQUENCY MHz	ISOLATION dB MIN	INSERTION dB MAX	T RF Nanosec	T ON Nanosec	TRANSIENT MILLIVOLTS
SPST	100C1041	1-100	60	0.7	5	30	150
SPST	100C1051	20-300	60	1.5	5	35	150
SP2T	100C1052-10	1-100	50	0.8	5	40	150
SP2T	100C1052-100	30-300	40	1.2	5	40	150
SP4T	100C1024	20-200	55	0.5	5	50	150
TRANS.	100C1143	20-800	40	1.3	5	35	35



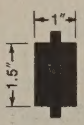
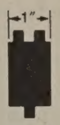
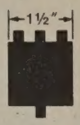
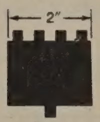
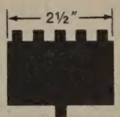
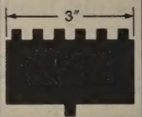
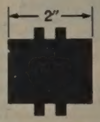
TYPICAL SWITCH SCHEMATIC MULTIPOLE



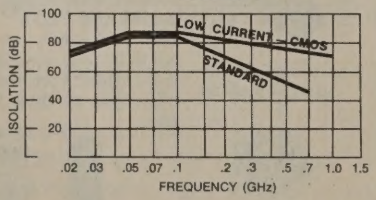
SWITCHING SPEED



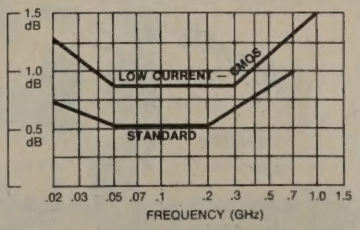
STANDARD AND LOW CURRENT MULTIPOLE SWITCHES

SOLID STATE SIZE Size Matrix all 0.70 thick	 SPST	 SP2T	 SP3T	 SP4T	 SP5T	 SP6T	 TRANSFER
STANDARD	100C1281	100C1282	100C1283	100C1284	100C1285	100C1286	100C1287
LOW CURRENT C-MOS	100C1291	100C1292	100C1293	100C1294	100C1295	100C1296	100C1297

TYPICAL PERFORMANCE
ISOLATION



TYPICAL PERFORMANCE
INSERTION LOSS



TYPICAL PERFORMANCE	**Standard**	**Low Current**
Frequency (MHz)	20-600	20-1000
RF Power (0.1dB comp. at 100 MHz) (dBm)	+17	+23
Impedance, nominal (ohms)	50	50
VSWR thru	1.25	1.25
VSWR UnusedPorts	1.35	1.35
Insertion Loss at 160 MHz (dB)	0.6	0.8
Insertion Loss Flatness (dB per 100 MHz)	.02	.05
Isolation at 100 MHz (dB)	90	90
RF Transition 10% to 90% (T RF) microsec.	.01	1
Total Switching Time (T on or T off) microsec.	0.1	5
Control Line ("1" on, "0" Off) Load	1 LS	1 CMOS
DC Power Plus 5 volts at (ma) per section	30	1.5
or Plus 12 Volts at (ma) per section	——	2.0
or Plus 15 Volts at (ma) per section	——	2.2
3rd Order I.P. (100 MHz) (dBm)	40	40

DAICO INDUSTRIES, INC.
2351 East Del Amo Blvd.
Compton, California 90220
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TWX 910-346-6741

Add Dept. EM to address to tell them you saw it in eem

DAICO INDUSTRIES, INC. HYBRID INTEGRATED CIRCUIT R.F. COMPONENTS

HYBRID SWITCH SELECTION

REFER TO SIZE CHART FOR P/N SUFFIX CODE. EXAMPLE: DS 0012 A

	SP2T	SP3T	SP4T	SP5T	2P1T	2P2T	TRANS.
STANDARD **10-300 MHz** **+10 dBm** **TTL** **1 microsec.** **±5 volts (*5 volts)**	DS 0012 A DS 0062 B DS 0036 A*	DS 0099 D	DS 0014 E DS 0063 D	DS 0027 F DS 0057 G	DS 0025 A DS 0055 B	DS 0049 C DS 0029 B	
LOW CURRENT **10-500 MHz** **+20dBm** **CMOS/TTL** **1-10 microsec.** **12 volts (*5 volts)**	DS 0075 A DS 0074 A	DS 0073 D	DS 0085 H	DS 0015 G DS 0018 F	DS 0019 A DS 0041 B	DS 0020 C* DS 0046 B*	DS 0097 D

SWITCHES HIGH SPEED, LOW TRANSIENT

DS 0050 A Modulator
DS 0042 A SP2T
DS 0089 C 2P2T
DS 0070 A P1 Switch
DS 0071 A Attenuator

50 nanosecond switching
Balanced Design

SIZE CHART

A	— 14 pin DIP	½ x ¾
B	— 22 Pin Flat	⅜ x ⅝
C	— 16 Pin DIP	½ x 1
D	— 24 Pin DIP	¾ x ¾
E	— 34 Pin Flat	1 x 1
F	— 24 Pin DIP	¾ x 1⅛
G	— 30 Pin Flat	⅞ x 1⅝
H	— 14 Pin DIP	⅝ x ⅞
J	— 14 Pin DIP	¾ x ¾

VOLTAGE CONTROLLED ATTENUATORS (ANALOG)

Type	DA 0066 A	DA 0098 H	DA 0030 A	DA 0010 B
Range	20 dB	40 dB	20 dB	15 dB
Frequency	10-500	20-500	20-200	400-700
Control	0 to 5 volts	0 to 5 volts	External	0 to 5 volts
Linearity	±1 dB	±3 dB	N.A.	±1 dB
Intercept 3rd	+35 dBm	+25 dBm	+20 dBm	+25 dBm
VSWR	1.15/1	1.25/1	1.5/1	1.5/1

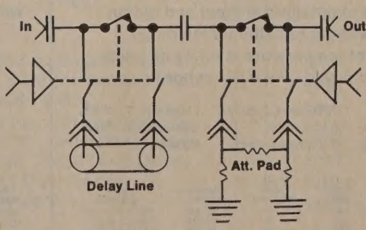
STEP ATTENUATORS

DA 0051
Dual Section
Attenuator — Size A

DA 0051-1	2 dB	4 dB
DA 0051-2	8 dB	16 dB
DA 0051-3	1 dB	32 dB
DA 0051-4	3 dB	6 dB
DA 0051-5	10 dB	20 dB
DA 0051-6	.75 dB	1.5 dB
DA 0051-7	.25 dB	.50 dB
DA 0051-8	12 dB	24 dB

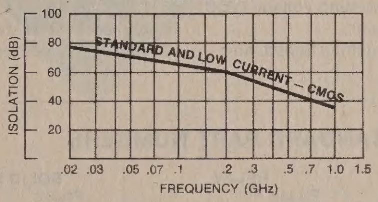
STEP PHASE SHIFTERS, STEP ATTENUATORS

Dual Pi Switch
DS 0079

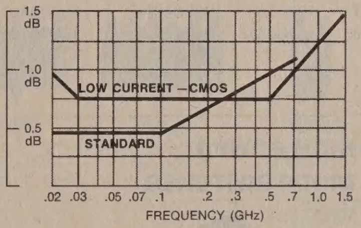


BUILDING BLOCK COMPONENTS

TYPICAL PERFORMANCE
HYBRID ISOLATION



TYPICAL PERFORMANCE
HYBRID INSERTION LOSS



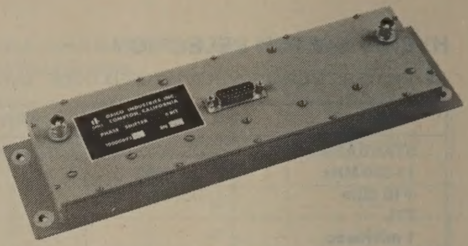
CONTROLLED ATTENUATORS, HIGH SPEED DESIGN

Thin Film Hybrid Packaging Techniques have allowed miniaturization of most of Daico Industries product line. Switches include drivers compatible with TTL or CMOS. Step attenuators are packaged in dual section units. These wide band devices are available in frequency ranges from 10 to 50 MHz, 50 to 500 MHz and 100 to 800 MHz. Custom designed to your specifications. Daico Industries can provide prototypes in one of our stock packages. Please contact us with your requirements.

DAICO INDUSTRIES, INC.

PROGRAMMABLE — PHASE SHIFTERS & ATTENUATORS

Programmable Attenuators and Phase Shifters are comprised of a series of combining elements with either RF relays or solid state switches to perform an additive function of attenuation or delay. The units either switch attentuator pads or closely controlled coaxial line lengths in and out of the series path. Simplicity of design allows the user to specify the desired attenuation sections or delay sections in a standard package alleviating the need for costly non-recurring engineering. Attenuators are available with constant phase shift over the full attenuation range.



PROGRAMMABLE PHASE SHIFTERS & ATTENUATORS

GENERAL SPECIFICATIONS

	Relay	Solid State	High Speed
Frequency Range (MHz)	20-500	20-800	20-500
RF Power (dBm)	+30	+18	+10
Impedance, Ohms Nom.	50	50	50
VSWR (Max.)	1.25/1	1.25/1	1.35/1
Insertion Loss at 100 MHz	0.2 dB/sect.	0.3 dB/sect.	1.8 dB/sect.
Control	Relay Coil	TTL	TTL
Operating Voltage (VDC)	6, 12, 18, 28	5	5
Power	1 watt/sect.	150 MW/sect.	1 watt/sect.
Switching Speed, nom.	2 millisec.	1 microsec.	30 nanosec.

PHASE SHIFTER	Relay	Solid State	High Speed
Sections	2-10	2-8	2-8
Range	360°-LSB	360°-LSB	360°-LSB
MSB	180°	180°	180°
Accuracy (standard)	±3°	±3°	±2°
ATTENUATOR			
Sections	2-8	2-8	2-8
Max. Range at 100 MHz	127 dB	127 dB	63 dB
Max. Range at 500 MHz	63 dB	63 dB	63 dB
Max. MSB at 100 MHz	32 dB	32 dB	32 dB
Max. MSB at 500 MHz	16 dB	16 dB	16 dB
Min. LSB	0.25 dB	0.25 dB	0.25 dB
Accuracy (standard)	1%	1%	1%

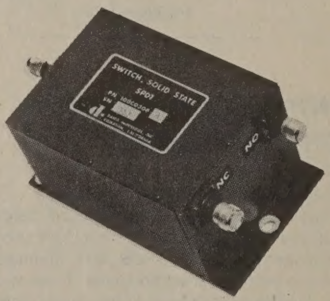
STANDARD PART NUMBERS

	RELAY		SOLID STATE		HIGH SPEED	
Sect.	Phase Shifter	Attenuator	Phase Shifter	Attenuator	Phase Shifter	Attenuator
4	100D0884	100D0809-4	100D0894	100D0589-4	100D1254	100D1264
6	100D0886	100D0469-6	100D0896	100D0589-6	100D1256	100D1266
7	100D0887	100D0469-7	100D0897	100D1107	100D1257	100D1267
8	100D0888	100D0469-8	100D0898	100D1108	100D1258	100D1268

CONSTANT PHASE ATTENUATORS

Sect.	Part Number	Freq. (MHz)	Range (dB)	Switch
6	100D1171	85-190	63	Solid State
6	100D1071	1200-2300	63	Solid State
7	100D1081	120-220	63.5	Solid State
7	100D0712	DC-400	63	Relay
8	100D1138	30-350	63.5	High Speed

HIGH POWER DIODE SWITCHES

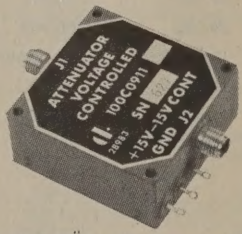


Daico Industries high-power diode switches have been successfully employed in numerous CW and pulse systems. CW power level handling capability to 1000 watts has been achieved in T/R applications. Peak power to 8 KW is available in multipole switches over the range of 50 to 2500 MHz.

Representative designs (adaptable to other frequency ranges and power levels)

Type	Part Number	Freq. MHz	Power Watts CW	Power Watts Peak	Iso (dBmin)	I.L. (dBmax)
SP2T	100C0657	50-200	200	1 KW	45	0.3
SP2T	100C0881	1-32	500	1 KW	30	.05
T/R	100C1069	100-500	1000	2 KW	50	.20
SP2T	100C0932	950-1225	10	2 KW	23	.35
SP4T	100D1004	1700-2000	220	2 KW	60	.8
SP2T	100C1032	30-1500	20	250W	75	.30

VOLTAGE CONTROLLED ATTENUATORS (ANALOG)

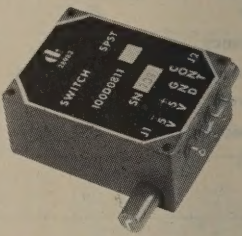


Daico Industries voltage controlled attenuators are analog devices offered in decade band widths from 10 to 1000 MHz. These solid state units will handle power levels up to +10 dBm with no measurable compression. Constant impedance of 50 ohms is maintained at input and output ports over the full attenuation range. Excellent temperature stability of ±0.5 dB is achieved over a 60° range.

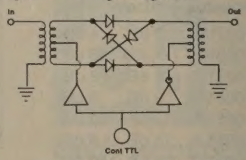
Power: ±15 volts at 30 ma
Linearity: ±5%
Control: 0 to 5 volts
Connectors: SMA
Slew Rage: 5 microsec. nom.
VSWR: 1.3/1

Part Number	Range (dB)	Scale Factor (dB/volt)	Frequency (MHz)	Size (inches)
100C0911	20	4	20-500	1½ x 1½ x .69
100C0912	40	8	20-500	1½ x 2 x .75
100C0913	60	12	20-500	1½ x 2 x .75
100C1025	25	5	15-30	1½ x 1½ x .75
100C1087	40	8	1.5-30	1½ x 2 x .75

BI-PHASE MODULATORS



The Daico Industries Bi-Phase modulator is available for use in low power and high power applications in the frequency range of 30-400 MHz. The unit exhibits a low insertion loss of less than 1 dB. Built in drivers provide direct interface with digital TTL logic signals.

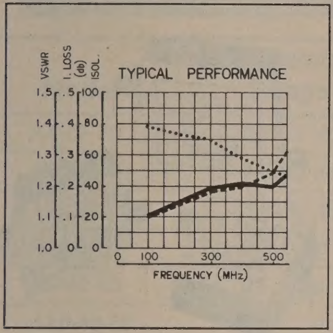


Part Number	Frequency (MHz)	RF Power (CW)	Insertion Loss (dB)	VSWR (nom)
100C1146	30-100	+7 dBm	1.0	1.15/1
100C1157	300-400	5 watts	0.8	1.20/1

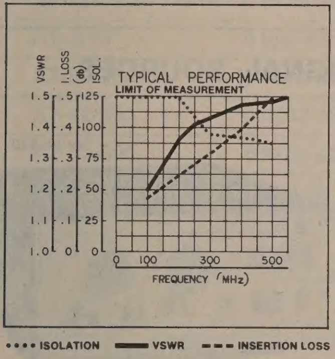
DAICO INDUSTRIES, INC.

RF RELAYS, DC-500 MHz, 50 watts cw

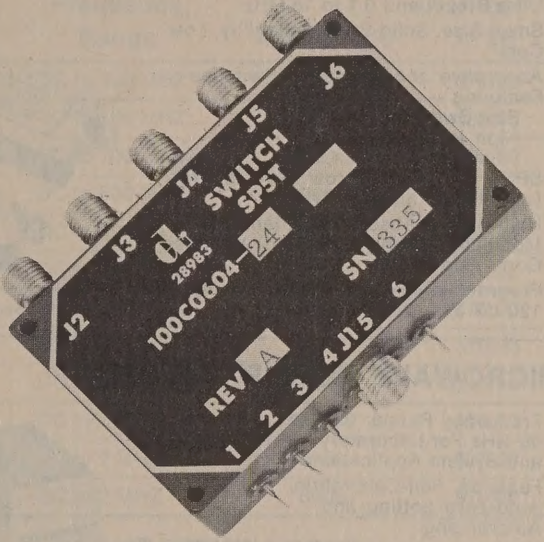
STANDARD



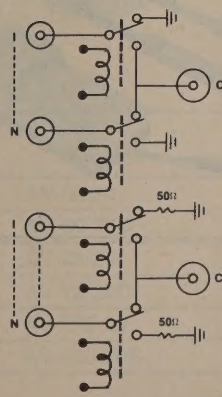
HIGH ISOLATION



Daico Industries RF relays employ hermetically sealed switching elements which provide extreme resistance to the severe environments encountered in military aircraft and communications systems, including 20 g's vibration to 3 KHz, 80 g's shock and altitude in excess of 100,000 ft. A continual test and evaluation program assures switch performance in excess of 20 million operations. These units are operable at extremely low current levels and may be ordered with 6-, 12-, 18- or 24-volt coils. Units also available to 1.5 GHz with 50 ohm termination, reference SP2T P/N 100C0878, Transfer P/N 100C0608.



RF RELAYS DC-500 MHz 50 watts cw SMA Conn. SIZE MATRIX	SPST	SP2T	SP3T	SP4T	SP5T	SP6T	TRANS.
STANDARD		100C0073 1x1½x.56	100C0254 1½x1½x.63	100C0259 2x1½x.63	100C0604 2½x1½x.69	100C0605 3x1½x.69	100C0347 2x1½x.87
HIGH ISOLATION		100C0109 1½x1½x.63	100C0630 1½x1¾x1.5	100C0104 1½x1¾x1.5			100C0608 1¼x1¼x1.3
STANDARD 50 OHM TERMINATION	100C0610 1x1½x.55	100C0611 1½x1½x.63	100C0612 2x1½x.63	100C0613 2½x1½x.63	100C0614 3x1½x.63	100C0615 3½x1¾x.63	
HIGH ISOLATION & 50 OHM TERMINATION	100C0609 1x1½x.50	100C0350 1½x1½x.75	100C0285 2x1½x.75	100C0485 2½x1½x.75			



Switching Speed: 5 millisec. max.
R. F. Power: 50W CW, 500 W Peak
Drive Current: 24 mills nom. at 24 VDC. Other coils available include 6, 12, 18 VDC.

Units can be provided with Fail Safe (no power) to a through path.

Can be operated directly from TTL with integrated circuit 75450 Dual Driver, 54 45 Decoder or equivalent.

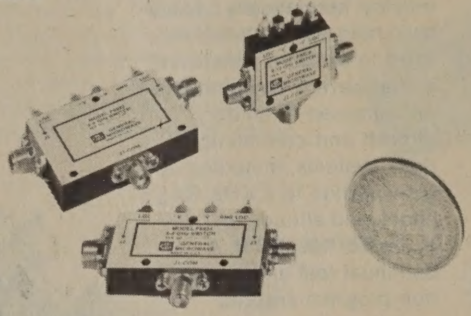
ALSO AVAILABLE

Type	Part Number	Frequency	Isolation	Connector
SP2T	100C0878	DC-1500 MHz	45 dB	SMA
SP2T	100C0076	DC-400 MHz	45 dB	BNC or TNC
SP2T	100C0942	DC-300 MHz	70 dB	75 ohm SMC
SP3T	100C1015	DC-450 MHz	50 dB	BNC or TNC
SP4T	100C0954	DC-100 MHz	55 dB	75 ohm TNC
SP6T	100C1026	DC-450 MHz	50 dB	BNC or TNC
SP7T	100C1094	DC-200 MHz	50 dB	SMA
SP8T	100C1159	DC-200 MHz	50 dB	SMA
2P4T	100C0368	DC-250 MHz	100 dB	SMA
14P2T	100D0872	DC-500 MHz	40 dB	SMA
14P4T	100D0873	DC-500 MHz	40 dB	SMA
1P28T	100D0742	DC-400 MHz	45 dB	Type N

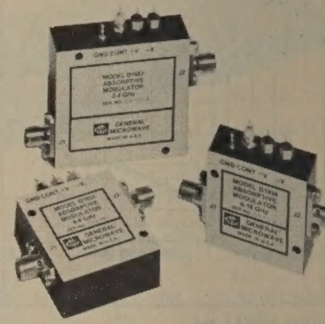
GENERAL MICROWAVE CORPORATION

PIN DIODE CONTROL DEVICES

- Ultra-Broadband 0.1 to 18 GHz
- Small Size, Solid-State Reliability, Low Cost
- Absorptive and Reflective Switches Featuring —
  Fast Switching Speed,
  High Isolation,
  Low Insertion Loss, and
  SPST and Multi-Throw Models With (or without) Integral Driver
- High-Speed Absorptive Attenuator/Modulators With (or without) Voltage-Controlled Drivers
- Programmable Step Attenuators to 120 dB in 1, 2, 6 or 10 dB Steps



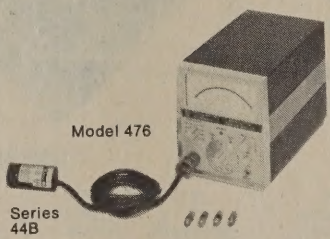
Series F892 Switches



Series D195 Modulators

MICROWAVE POWER METERS

- Frequency Range: 0.01 to 40 GHz For Laboratory and System Applications
- Features Self-Calibration, Auto-Zero Setting and Autoranging
- Field Replaceable Sensing Elements
- Direct Reading From 10nW to 3W
- Accuracy as-good-as 0.5%
- Analog and Digital Models
- Available in Customized MIL-Versions



SOLID-STATE SIGNAL SOURCES

- Six Models Cover 0.4 to 18 GHz Range
- RF Power up-to 150 mW
- Internal or External Modulation
- Digital Frequency Readout
- Light Weight, Small Size
- Low Cost

BROADBAND RADIATION HAZARD METERS

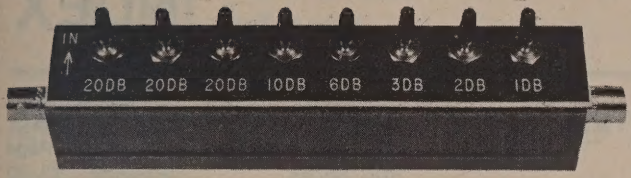
- Detects and Measures Potentially Hazardous Nonionizing Electromagnetic Energy Radiating or Leaking From RF and Microwave Sources
- Power Range 0.2 to 200 mW/cm²
- Designed to Comply With U.S. Dept. HEW Standards and Assure Conformance With OSHA Radiation Protection Guide
- Other Models Available

RAHAM
Model 3
Isotropic
0.3 to 18GHz

RAHAM
Model 12
Ultra-
broadband
.01 to 18GHz

GENERAL MICROWAVE CORPORATION
155 Marine Street, Farmingdale, N. Y. 11735
(516) 694-3600 TWX: 510-224-6406

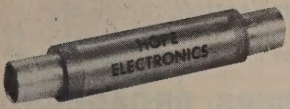
HOPE ELECTRONICS



ATTENUATORS

Model	Attenuation Range	Attenuation Steps	Frequency Range	Impedance	Price 1 - 24
AT-42-50	0 to 42 db	1, 2, 3, 6, 10, 20	DC to 300 MHZ	50Ω	$75.00
AT5-42-50	0 to 42 db	1, 2, 3, 6, 10, 20	DC to 500 MHZ	50Ω	$85.00
AT10-32-50	0 to 32 db	1, 2, 3, 6, 10, 10	DC to 1000 MHZ	50Ω	$90.00
AT5-3-50	0 to 3 db	.1, .2, .4, .5, .8, 1	DC to 500 MHZ	50Ω	$75.00
AT-82-50	0 to 82 db	1, 2, 3, 6, 10, 20, 20, 20	DC to 300 MHZ	50Ω	$89.00
AT5-82-50	0 to 82 db	1, 2, 3, 6, 10, 20, 20, 20	DC to 500 MHZ	50Ω	$99.00
AT-42-75	0 to 42 db	1, 2, 3, 6, 10, 20	DC to 300 MHZ	75Ω	$70.00
AT-3-75	0 to 3 db	.1, .2, .4, .5, .8, 1	DC to 300 MHZ	75Ω	$70.00
AT-82-75	0 to 82 db	1, 2, 3, 6, 10, 20, 20	DC to 300 MHZ	75Ω	$85.00
AT-42-600	0 to 42 db	1, 2, 3, 6, 10, 20	DC to 2 MHZ	600Ω	$70.00
AT-82-600	0 to 82 db	1, 2, 3, 6, 10, 20, 20, 20	DC to 2 MHZ	600Ω	$85.00
AT-3-600	0 to 3 db	.1, .2, .4, .5, .8, 1	DC to 2 MHZ	600Ω	$70.00

FIXED ATTENUATORS AND TERMINATIONS



Model	Attenuation	Frequency Range	Impedance	Price 1 - 24
A50-1	1 db	DC to 1 GHZ	50Ω	$12.00
A50-2	2 db	DC to 1 GHZ	50Ω	$12.00
A50-3	3 db	DC to 1 GHZ	50Ω	$12.00
A50-6	6 db	DC to 1 GHZ	50Ω	$12.00
A50-10	10 db	DC to 1 GHZ	50Ω	$12.00
A50-20	20 db	DC to 1 GHZ	50Ω	$12.00
A600-3	3 db	DC to 2 MHZ	600Ω	$12.00
A600-6	6 db	DC to 2 MHZ	600Ω	$12.00
A600-10	10 db	DC to 2 MHZ	600Ω	$12.00
A600-20	20 db	DC to 2 MHZ	600Ω	$12.00
T50	Termination	DC to 1 GHZ	50Ω	$10.00
T60	Termination	DC to 1 GHZ	60Ω	$10.00
T65	Termination	DC to 1 GHZ	65Ω	$10.00
T75	Termination	DC to 1 GHZ	75Ω	$10.00
T93	Termination	DC to 1 GHZ	93Ω	$10.00
T600	Termination	DC to 2 MHZ	600Ω	$10.00

CONTINUOUSLY VARIABLE ATTENUATORS

Model	Attenuation Range	Frequency Range	Impedance	Calibration	Price 1 - 24
AV-50-20	0 to 20 db	DC to 50 MHZ	50Ω	None	$50.00
AV-50-20C	0 to 20 db	DC to 50 MHZ	50Ω	1 db increments	$70.00
AV-75-20	0 to 20 db	DC to 50 MHZ	75Ω	None	$50.00
AV-75-20C	0 to 20 db	DC to 50 MHZ	75Ω	1 db increments	$70.00
AV-600-20	0 to 20 db	DC to 2 MHZ	600Ω	None	$50.00
AV-600-20C	0 to 20 db	DC to 2 MHZ	600Ω	1 db increments	$70.00

HOPE ELECTRONICS 20 NEWARK POMPTON TURNPIKE, WAYNE N.J. 07470 (201) 777-3522

Mini-Circuits MCL Laboratory

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PC Board Mounting

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Here are some of the ways Mini-Circuits achieves high reliability.

At Mini-Circuits Laboratory reliability and quality control are the most important considerations in the manufacture of our products. Some of the procedures which are incorporated to ensure that every unit shipped has quality built in are as follows:

- HTRB Testing — Each diode is preconditioned for 168 hrs. at 150°C with one volt reverse bias applied.
- 100% testing of each diode.
- 100% testing of each unit.
- 100% inspection of every solder connection.
- All transformers and diodes bonded to the header for protection against severe shock and vibration conditions.
- Diode power dissipation derated greater than 50%.
- All components rated for greater than +125°C operation.
- All transformer leads double wrapped.
- Heavy coated wire insulation for Hi-Pot/altitude requirements.
- Completely encapsulated for protection against mechanical shock and vibration and temperature shock.
- Permanent case marking of model number, cannot be removed by cleaning agents or ultrasonic baths.
- Cupro-Nickel case for long lasting finish especially under salt atmosphere conditions.

As a consequence of these considerations Mini-Circuits Laboratory guarantees its products for **one full year** after shipment.

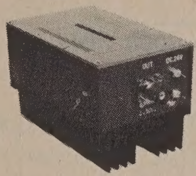
MINI-CIRCUITS LABORATORY / 2625 EAST 14th ST. / BROOKLYN, NY 11235 / (212) 769-0200 / INT'L TELEX 620156
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

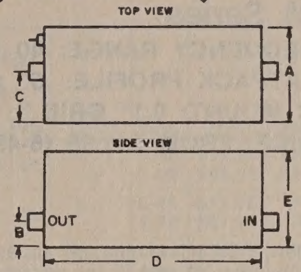
Mini-Circuits Laboratory MCL

AMPLIFIERS
Broadband

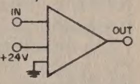
AMPLIFIERS, BROADBAND High Power (+28dBm)
ZHL Series

- **FREQUENCY RANGE: 2 MHz TO 500 MHz**
- **COMPACT: 4.13″ x 2.69″ x 2.63″**
- **CONNECTORS: BNC**
- **PRICE: $199 (1-9)**





	A	B	C	D	E
INCHES	2.69	.81	1.34	4.13	2.63
CM	6.8	2.05	3.4	10.49	6.69



The ZHL-1 RF power amplifier is capable of providing approximately 1 watt of power output over a broad frequency range from 2 MHz to 500 MHz. Using an ultra linear Class A design, the ZHL-1 provides a minimum of 16 dB gain over the full frequency range. Gain flatness is typically within ±0.5 dB.

The ZHL-1 is unconditionally stable and can be connected to any load impedance without amplifier damage or oscillation.

Having a two stage design, and incorporating a highly reliable power output transistor enables the ZHL-1 to be designed for reliability of performance.

BNC connectors are supplied. Housed in a 3/16 inch aluminum case, the ZHL-1 is constructed to withstand tough environments. This rugged case includes a hefty heat sink as an integral part of the case construction. Unit weight is 1.38 lbs. (625 grams).

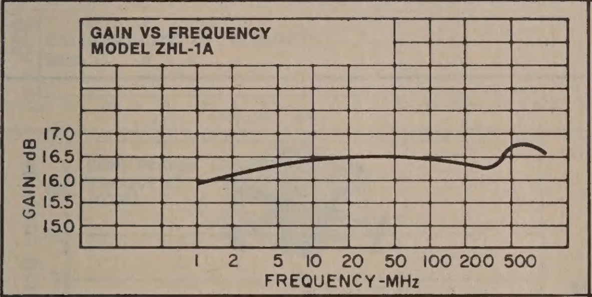
The high performance ZHL-1A is offered at a remarkable price of ½ to ⅓ the cost of competitive units.

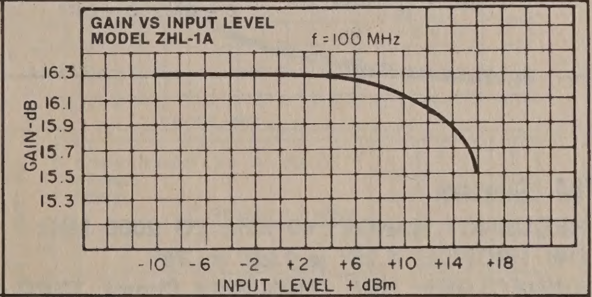
SPECIFICATIONS

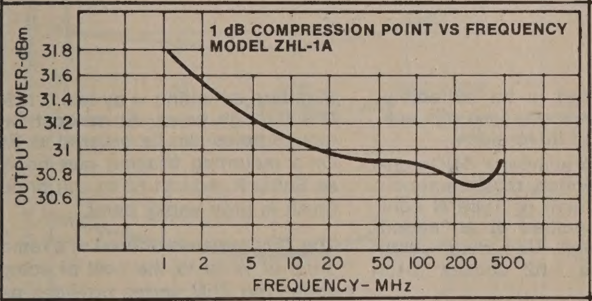
Model No.	Frequency Range MHz	Gain dB	Gain Flatness dB	Maximum Power Output dBm 1-dB Compression	Noise Figure dB	Intercept Point 3rd Order dBm	Impedance Ohms		VSWR, Max.		DC Power		Quantity	Price
							Input	Output	Input	Output	Voltage	Current		
ZHL-1A	2-500	16 Min.	1.0 dB Max.	+28 Min.	11 Typ.	+38 Typ.	50	50	2:1	2:1	+24V	0.6A	**1-9**	**$199**

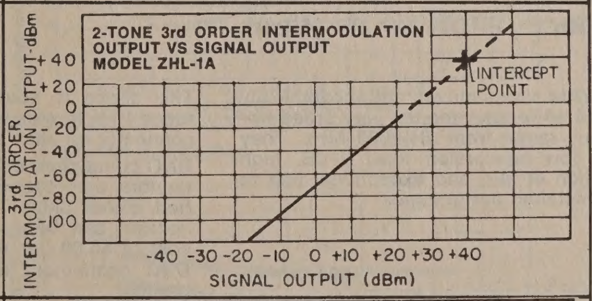
COMMON SPECIFICATIONS

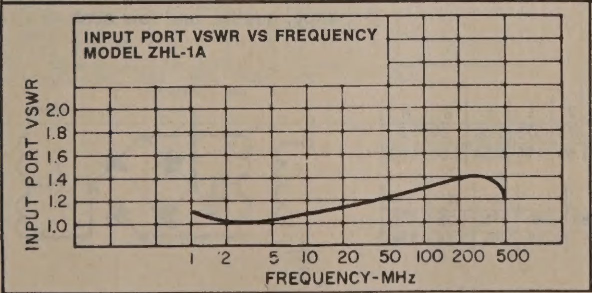
Total Input Power: +20 dBm **Operating Temperature:** −0°C to +65°C **Storage Temperature:** −55°C to +100°C

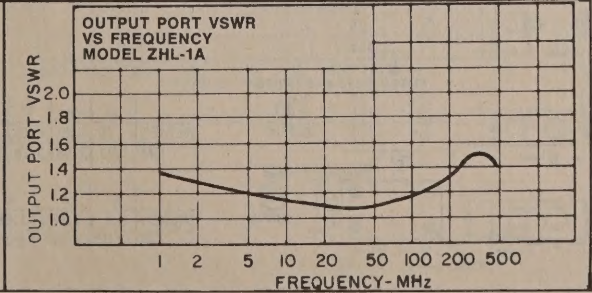












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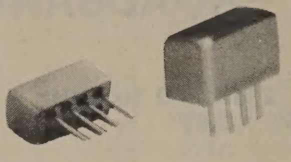
DOMESTIC TELEX 125460

Mini-Circuits Laboratory
MCL

DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

TFM Series

- **FREQUENCY RANGE: 40 KHz TO 2000 MHz**
- **FLATPACK PROFILE: .5″ x .2″ x .2″**
- **PC MOUNT: 0.1″ GRID**
- **PRICE: FROM $11.95 (6-49)**



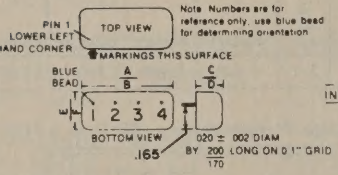
flatpack

The new TFM microminature series offers a number of significant advantages over other available models: (1) versatility in mounting configuration, (2) simpler PC layout and wiring, (3) smaller size and (4) very low cost.

The TFM series covers the .04-2000 MHz range and features wide bandwidth, isolation greater than 45 dB and conversion loss of 6 dB.

The TFM units require less PC area than a flatpack or TO-5 can. Unit weight is .07 ounces (1.8 grams). Use the TFM series to solve your tight space problems. Take advantage of the mounting versatility— plug it upright on a PC board or mount it sideways as a flatpack. Simplify PC layout and reduce board connections with the TFM series . . . **only four pins have to be wired.**

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.2 in.) the TFM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. It's pins are oriented on a 0.1 inch grid for PC board mounting.

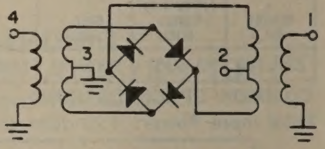

PIN 1
LOWER LEFT
HAND CORNER
TOP VIEW
Note Numbers are for reference only, use blue bead for determining orientation
MARKINGS THIS SURFACE
BLUE BEAD
A
B
C
D
1 2 3 4
BOTTOM VIEW
.165
020 ± 002 DIAM
BY 200/170 LONG ON 0 1″ GRID

	A	B	C	D	E	F	G
INCHES	500	.480	.255	.240	.230	.210	.165
CM	1.27	1.22	.64	.60	.58	.53	.41

Note TFM-11, 12
C = 0.385″, D = 0.405

PIN LAYOUT

	Fig. 15
LO	4
RF	1
IF	2
Case Ground	3



ZFM Series

- **FREQUENCY RANGE: 40 KHz TO 2000 MHz**
- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), TYPE N**
- **PRICE: FROM $41.95 (4-24)**

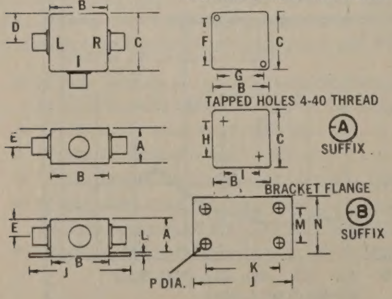
The ZFM series mixers are economically priced while covering the very broad frequency range from .04-2000 MHz. They offer low conversion loss, 6 dB, high isolation 40 dB, and exceptional unit to unit matched performance.

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors, a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams).

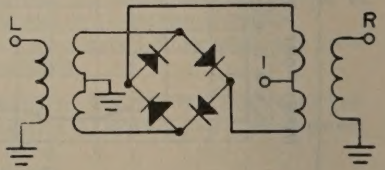
Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.

The ZFM series is offered at a remarkable price of ½ to ⅓ the cost of competitive units. The ZFM series provides performance, quality, and low cost.


MOUNTING OPTIONS THRU HOLES
B
D
L
R
C
I
F
G
TAPPED HOLES 4-40 THREAD
E
A
T
H
A
SUFFIX
BRACKET FLANGE
M
N
B
SUFFIX
J
K
P DIA.

	A	B	C	D	E	F	G	H
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03

	I	J	K	L	M	N	P
INCHES	0.8	2.188	1.688	.060	.75	1.25	.125
CM	2.03	5.56	4.29	0.15	1.91	3.18	.318



Mini-Circuits MCL Laboratory

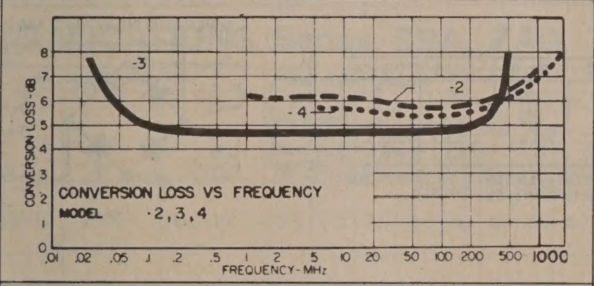
DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

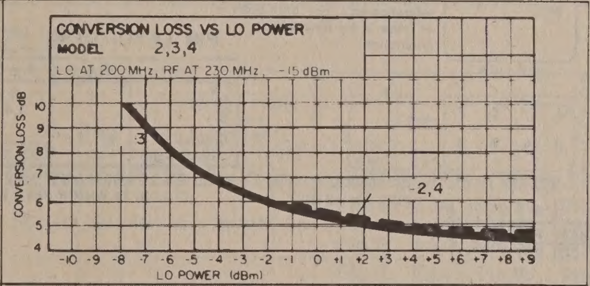
SPECIFICATIONS Series TFM/ZFM

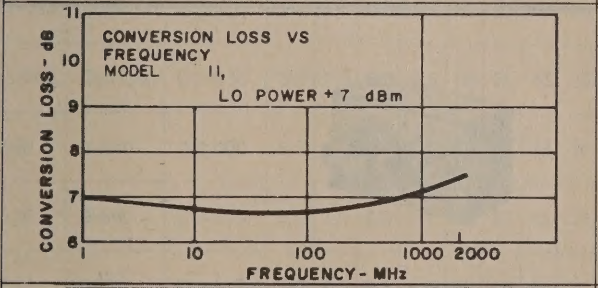
Frequency Range, MHz			Conversion Loss, dB				Isolation, dB															
			One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower							
							LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF					
LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Pin Layout	Quan.	Price	Model No.
.04-400	.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	55	40	50	35	45	30	35	25	35	25	Fig. 15 —	5-49 1-24	$19.95 $49.95	TFM-3 ZFM-3
1-1000	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	45	40	40	25	35	25	30	25	25	20	Fig. 15 —	6-49 4-24	$11.95 $41.95	TFM-2 ZFM-2
1-2000	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	45	40	35	25	27	20	25	20	25	20	Fig. 15 —	1-24 1-24	$39.95 $79.95	TFM-11 ZFM-11
5-1250	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	45	40	40	30	35	25	30	25	25	20	Fig. 15 —	5-49 4-24	$19.95 $49.95	TFM-4 ZFM-4
800-1250	800-1250	50-90	—	—	6.0	7.5	Over Full Range LO-RF: 35 Typ., 25 Min. LO-IF: 30 Typ., 20 Min.												Fig. 15 —	1-24 1-24	$39.95 $69.95	TFM-12 ZFM-12

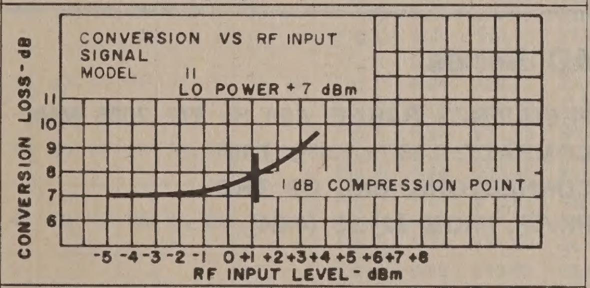
COMMON SPECIFICATIONS

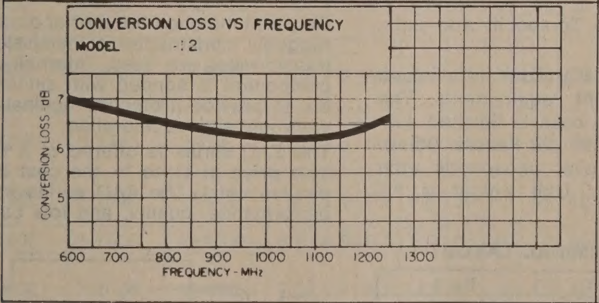
Signal, 1 dB compression level +1 dBm. Impedance, all ports 50 ohms. Total input power 50 mW. Total input, current peak 40 mA. Operating and Storage Temperature: −55°C to +100°C. Pin Temperature (TFM) 510°F (10 sec).

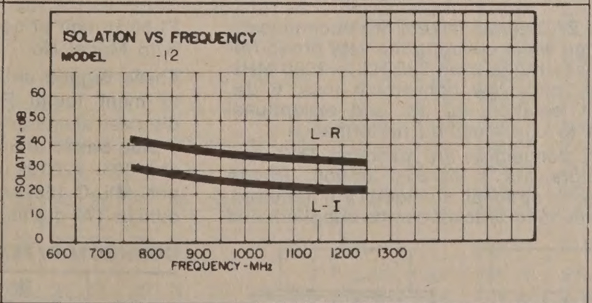










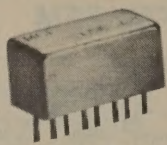


Mini-Circuits Laboratory

DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

SRA Series

- **FREQUENCY RANGE: 500 Hz TO 2000 MHz**
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: 0.2″ GRID**
- **PRICE: FROM $9.95 (1-49)**



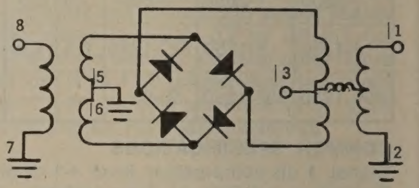
The model SRA-1 has become an industry standard through the world and is used by all branches of the Department of Defense, NASA, FAA, and every major communications company. In over 300 different military contracts, over a period of years, the SRA-1 has proven to be one of the most reliable mixers obtainable, even when considering high priced models.

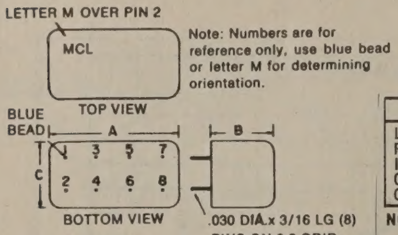
Having a volume of only .128 cu. inches, the SRA series covers a very broad frequency range from 500 Hz to 2000 MHz. Offered at the lowest prices available in the industry, these rugged units provide low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, these high performance units have their pins oriented on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration, and acceleration.

SCHEMATIC FIG. 4A




LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
TOP VIEW
BLUE BEAD
A
B
C
1 3 5 7
2 4 6 8
BOTTOM VIEW
.030 DIA.x 3/16 LG (8) PINS ON 0.2 GRID

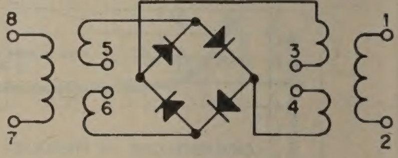
	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

PIN LAYOUTS

	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 4A
LO	8	8	8	8	8
RF	1	3,4	1	1	1
IF	3,4	1	3,4	3,4	3
Ground	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
Case Ground	2	2,5,6,7	—	2,5,6,7	2,5,6,7

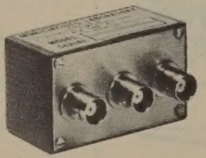
NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER EXCEPT FOR FIG. 4A IN WHICH PIN 4 IS PRESENT, BUT UNUSED.

SCHEMATIC FIG. 1, 2, 3 AND 4



ZAD Series

- **FREQUENCY RANGE: 500 Hz TO 2000 MHz**
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $24.95 (4-24)**



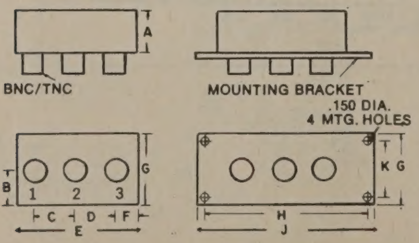
The ZAD series mixers are economically priced while covering the very broad frequency range from 500 Hz to 2000 MHz. They offer low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.

BNC connectors are standard. TNC connectors are a no-cost option. Please specify optional connectors if required. A mounting bracket can be supplied. Add $1.50 to unit price. To specify add suffix B to Model No.

These rugged units are double shielded to meet tough RFI requirements. The die-cast aluminum case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

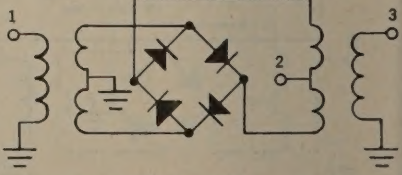
The ZAD series is offered at a remarkable price of ½ to ⅓ the cost of competitive units. The ZAD series provides performance, quality, and low cost.



CONNECTOR/TERMINAL LAYOUT

	Fig. A	Fig. B
	Term./Conn.	Term./Conn.
LO	1	1
RF	2	3
IF	3	2

	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8



NOTE: For Models ZAD-50 and -11 connector/terminal 2 is at dc ground through an inductance.

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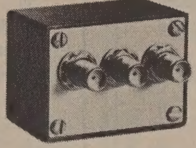
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

Mini-Circuits Laboratory

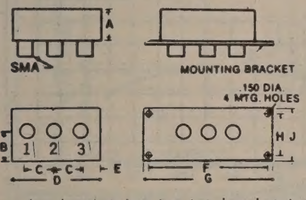
DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

ZLW Series

- **FREQUENCY RANGE: 500 Hz TO 2000 MHz**
- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $34.95 (4-24)**



The ZLW series mixers are economically priced while covering the very broad frequency range from 500 Hz to 2000 MHz. They offer low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

Available with SMA (3mm) connectors the ZLW series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

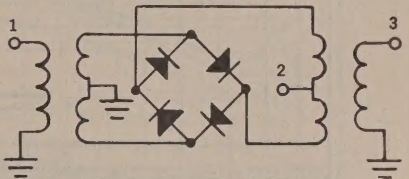
CONNECTOR/TERMINAL LAYOUT

	Fig. A	Fig. B
LO	1	1
RF	2	3
IF	3	2

A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

The ZLW series is offered at a remarkable price of ½ to ⅓ the cost of competitive units. The ZLW series provides performance, quality, and low cost.



NOTE: For Models ZLW-11 connector/terminal 2 is at dc ground through an inductance.

SPECIFICATIONS Series SRA, ZAD, ZLW

Frequency Range, MHz			Conversion Loss, dB				Isolation, dB												Pin or Conn Layout	Quantity	Price	Model No.
			One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower							
							LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF					
LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.				
.0005-10	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	60	50	50	40	50	40	45	35	45	35	Fig. 3 Fig. B Fig. B	5-24 4-24 4-24	$24.95 $39.95 $49.95	SRA-8 ZAD-8 ZLW-8
.003-100	.003-100	DC-100	5.5	7.5	6.5	8.5	65	50	60	45	45	30	40	25	35	25	30	20	Fig. 3 Fig. B Fig. B	5-24 4-24 4-24	$19.95 $34.95 $44.95	SRA-6 ZAD-6 ZLW-6
.025-200	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	45	35	40	30	35	25	30	20	Fig. 1 Fig. B Fig. B	6-49 4-24 4-24	$12.95 $26.95 $36.95	SRA-3 ZAD-3 ZLW-3
.1-500	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	45	30	40	25	35	25	30	20	Fig. 1 Fig. B Fig. B	6-49 4-24 4-24	$11.95 $26.95 $36.95	SRA-1-1 ZAD-1-1 ZLW-1-1
.5-500	.5-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	45	30	40	25	35	25	30	20	Fig. 1 Fig. B Fig. B	1-49 4-24 4-24	$ 9.95 $24.95 $34.95	SRA-1 ZAD-1 ZLW-1
1-750	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	45	30	40	25	35	25	30	20	Fig. 4 Fig. B Fig. B	6-49 4-24 4-24	$12.95 $29.95 $39.95	SRA-1W ZAD-1W ZLW-1W
1-1000	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	30	35	20	35	20	30	20	30	20	Fig. 2 Fig. A Fig. B	5-24 4-24 1-24	$14.95 $34.95 $39.95	SRA-2 ZAD-2 ZLW-2
5-1250	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	50	40	40	20	40	20	30	20	30	20	Fig. 2 Fig. A Fig. A	5-24 4-24 10-24	$16.95 $36.95 $46.95	SRA-4 ZAD-4 ZLW-4
5-1500	5-1500	10-600	7.0	8.5	7.5	9.5	50	45	45	40	35	30	30	25	30	20	25	20	Fig. 4A Fig. B	1-24 1-24	$29.95 $39.95	SRA-5 ZAD-50
5-1500	5-1500	.5-1000	6.5	8.5	6.5	8.0	55	40	50	40	35	25	35	25	30	20	30	20	Fig. A	1-9	$49.95	ZLW-5
5-2000	5-2000	10-600	7.0	8.5	8.5	11.0	50	45	45	40	35	25	30	20	30	20	25	20	Fig. 4A Fig. B Fig. B	1-24 1-24 1-24	$29.95 $49.95 $59.95	SRA-11 ZAD-11 ZLW-11
800-1250	800-1250	50-90	—	—	6.0	7.5	Over full range LO-IF: 30 typ. 20 min. LO-RF: 35 typ. 25 min.												Fig. 4A Fig. B Fig. B	1-24 1-24 1-24	$29.95 $49.95 $59.95	SRA-12 ZAD-12 ZLW-12

COMMON SPECIFICATIONS

Signal, 1 dB compression level +1 dBm. Impedance, all ports 50 ohms. Total input power 50 mW. Total input, current peak 40 mA. Operating and Storage Temperature: −55°C to +100°C. Pin Temperature (SRA only) 510°F (10 sec).

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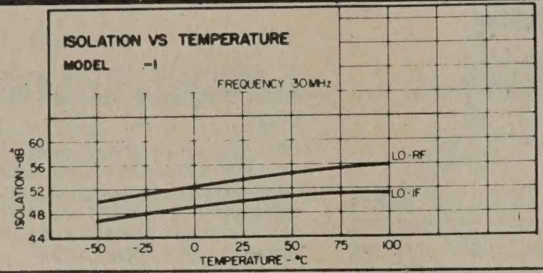
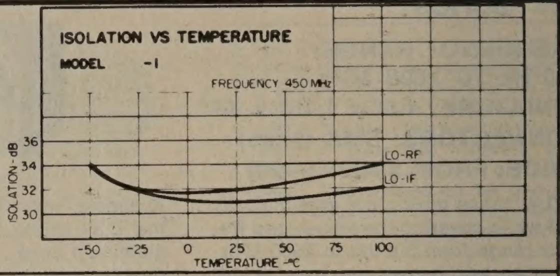
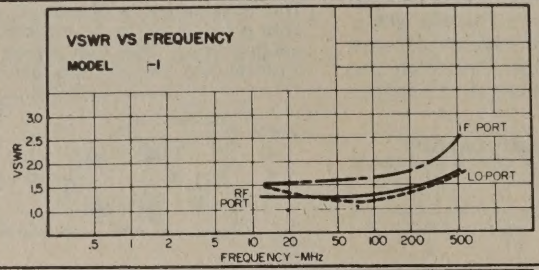
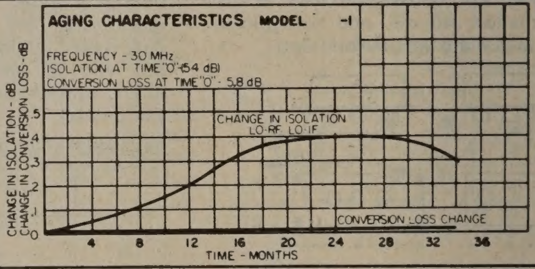
Mini-Circuits Laboratory MCL

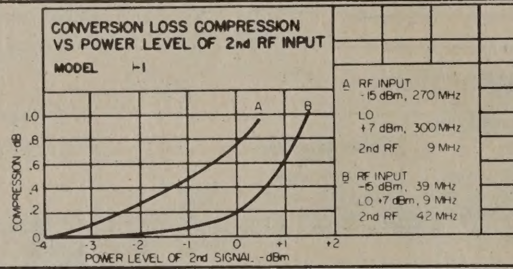
DOUBLE-BALANCED MIXERS
Series SRA, ZAD, ZLW (Con't)

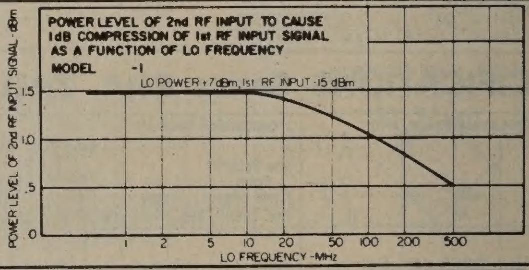


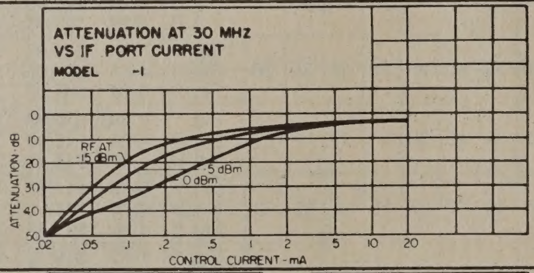


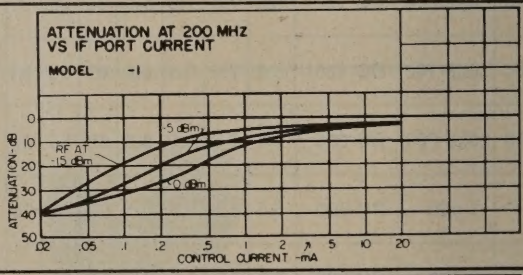


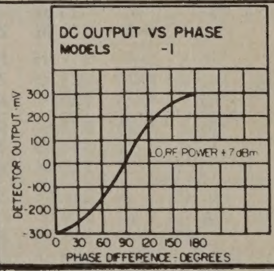


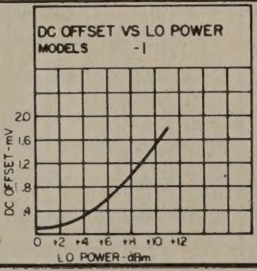


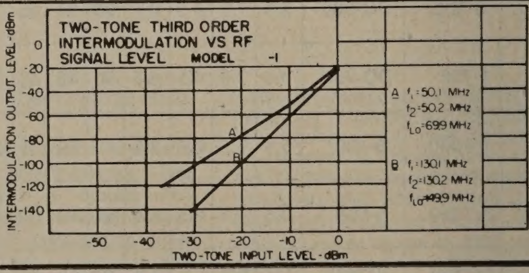


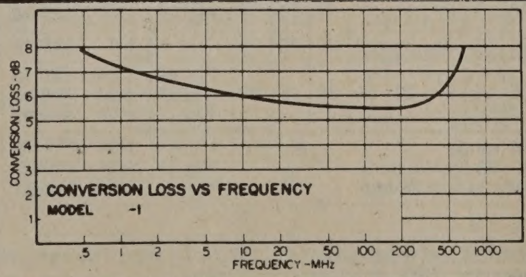


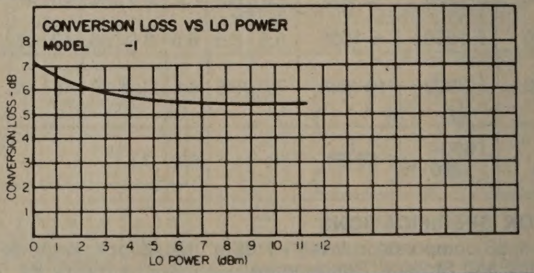






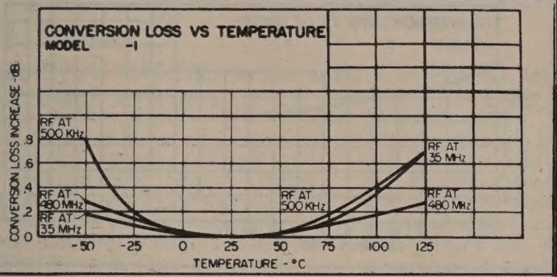


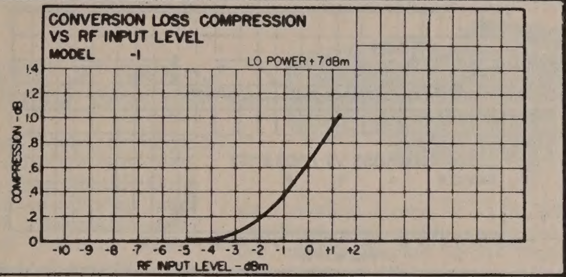


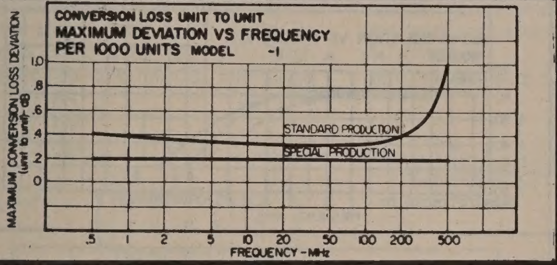


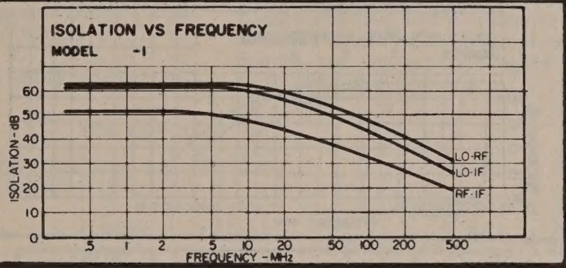
Mini-Circuits Laboratory MCL

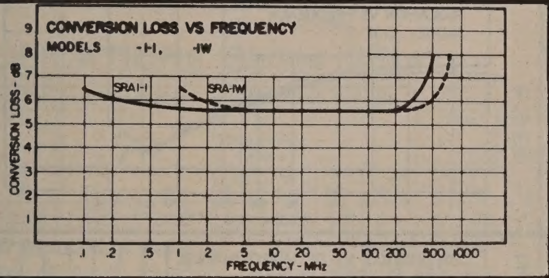
DOUBLE-BALANCED MIXERS Series SRA, ZAD, ZLW (Con't)

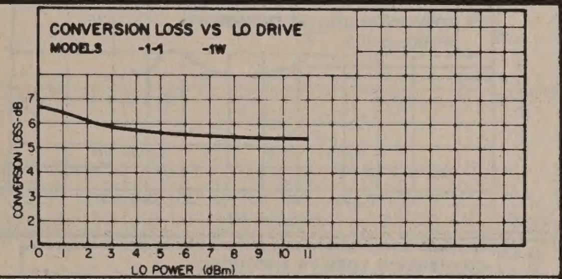

CONVERSION LOSS VS TEMPERATURE
MODEL -1

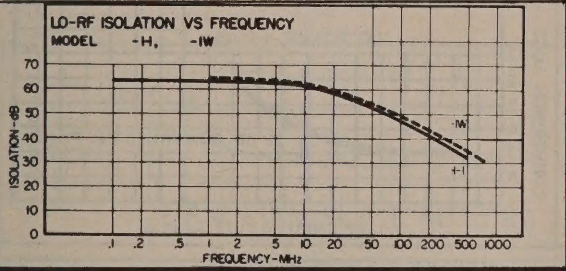

CONVERSION LOSS COMPRESSION VS RF INPUT LEVEL
MODEL -1

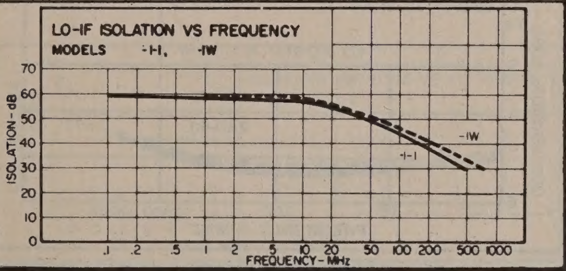

CONVERSION LOSS UNIT TO UNIT MAXIMUM DEVIATION VS FREQUENCY PER 1000 UNITS MODEL -1

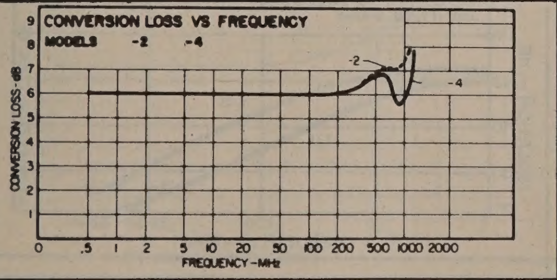

ISOLATION VS FREQUENCY
MODEL -1

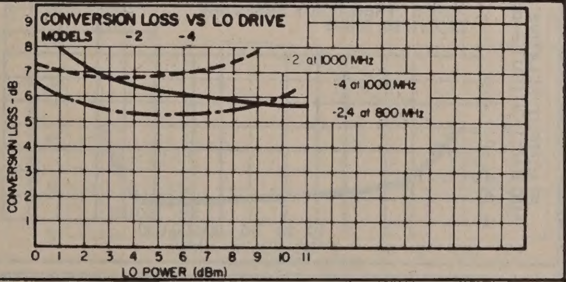

CONVERSION LOSS VS FREQUENCY
MODELS -1-1, -1W

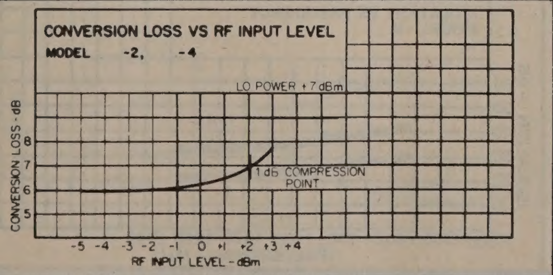

CONVERSION LOSS VS LO DRIVE
MODELS -1-1 -1W

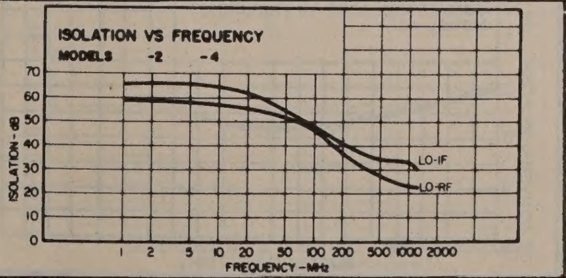

LO-RF ISOLATION VS FREQUENCY
MODEL -1-1, -1W


LO-IF ISOLATION VS FREQUENCY
MODELS -1-1, -1W


CONVERSION LOSS VS FREQUENCY
MODELS -2 -4

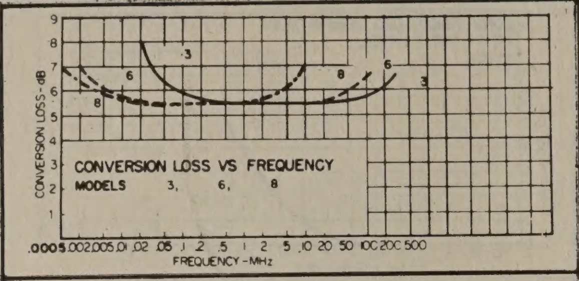

CONVERSION LOSS VS LO DRIVE
MODELS -2 -4

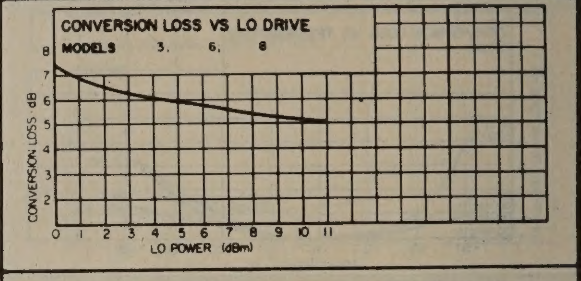

CONVERSION LOSS VS RF INPUT LEVEL
MODEL -2, -4

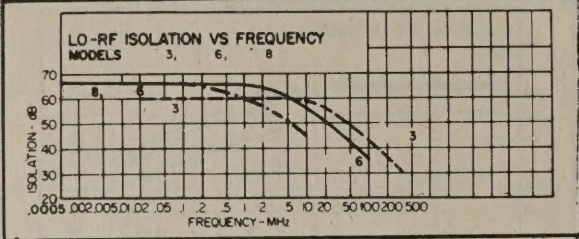

ISOLATION VS FREQUENCY
MODELS -2 -4

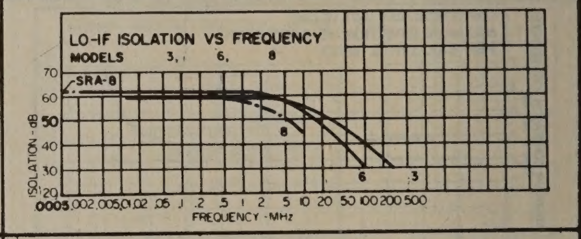
Mini-Circuits Laboratory

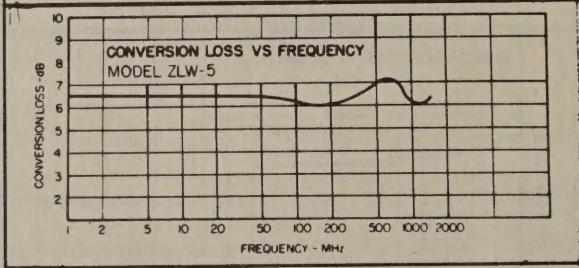
DOUBLE-BALANCED MIXERS Series SRA, ZAD, ZLW (Con't)

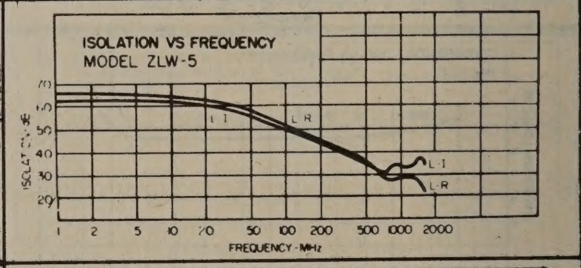

CONVERSION LOSS VS FREQUENCY
MODELS 3, 6, 8

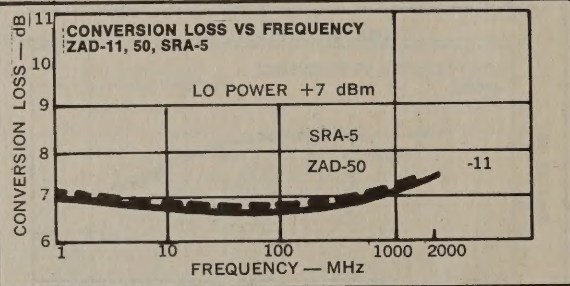

CONVERSION LOSS VS LO DRIVE
MODELS 3, 6, 8

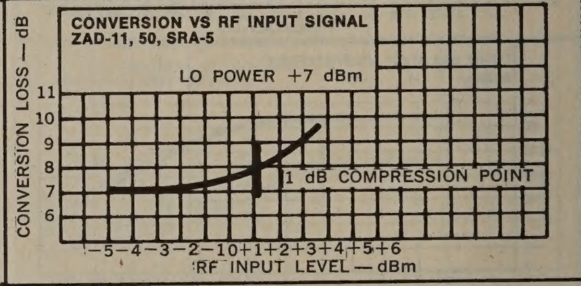

LO-RF ISOLATION VS FREQUENCY
MODELS 3, 6, 8

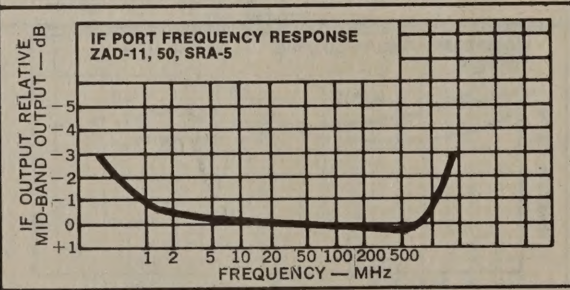

LO-IF ISOLATION VS FREQUENCY
MODELS 3, 6, 8

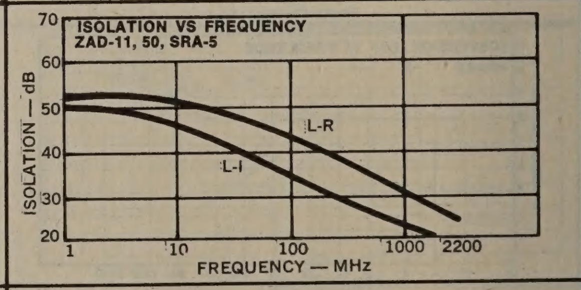

CONVERSION LOSS VS FREQUENCY
MODEL ZLW-5

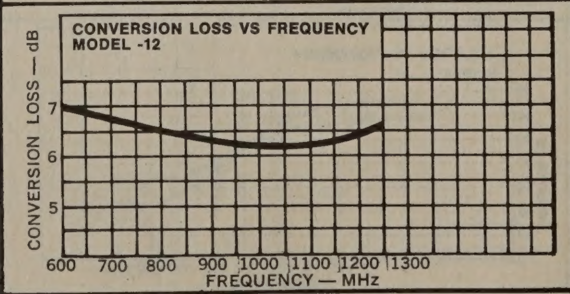

ISOLATION VS FREQUENCY
MODEL ZLW-5

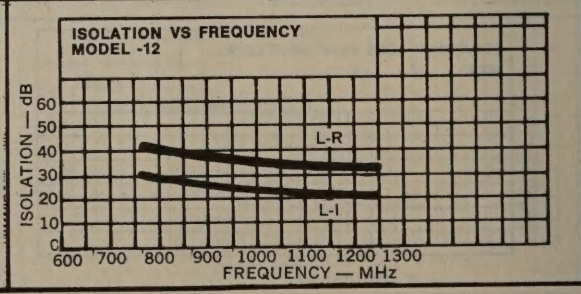

CONVERSION LOSS VS FREQUENCY
ZAD-11, 50, SRA-5


CONVERSION VS RF INPUT SIGNAL
ZAD-11, 50, SRA-5


IF PORT FREQUENCY RESPONSE
ZAD-11, 50, SRA-5


ISOLATION VS FREQUENCY
ZAD-11, 50, SRA-5


CONVERSION LOSS VS FREQUENCY
MODEL -12


ISOLATION VS FREQUENCY
MODEL -12

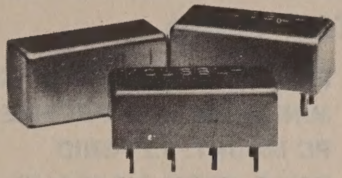
MINI-CIRCUITS LABORATORY / 2625 EAST 14th ST. / BROOKLYN, NY 11235 / (212) 769-0200 / INT'L TELEX 620156
A DIVISION SCIENTIFIC COMPONENTS CORP. DOMESTIC TELEX 125460

Mini-Circuits Laboratory MCL

DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

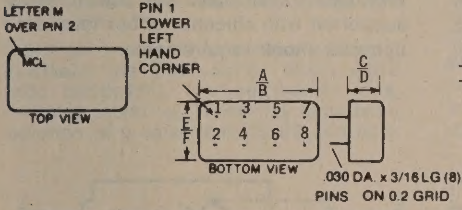
SBL-1 Series

- **FREQUENCY RANGE: 1-500 MHz**
- **MINIATURE: .4″ x .8″ x .3″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $2.95 (500 UP)**



For demanding industrial and commercial applications, where low-cost and high-performance are critical; Model SBL-1 will fill your need. Don't let the low price mislead you. As the world's number one manufacturer of double-balanced mixers, Mini-Circuits' has accumulated extensive experience in high-volume production and testing, a key factor in achieving a successful low cost/high performance line of products. The tough SBL-1 covers the broad frequency range of 1-500 MHz with 6 dB conversion loss and isolation greater than 40 dB. Only well-matched hot-carrier diodes and ruggedly constructed transmission-line transformers are used. Internally, every component is bonded to the header for excellent protection against shock, vibration and acceleration. Weight is .18 oz. (5.2 grams).

Here are some of the steps taken to ensure quality: Every SBL-1 is RF tested two times, every solder connection is 100 per cent inspected under high power microscopes, all transformer leads are double-wrapped, and all components are rated for more than +85°C operation. Of course, our one-year guarantee applies to these units.

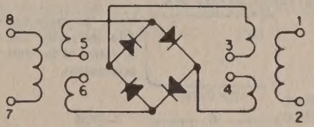

LETTER M OVER PIN 2
MCL
TOP VIEW
PIN 1 LOWER LEFT HAND CORNER
A/B
C/D
E/F
1 3 5 7
2 4 6 8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C	D	E	F
INCHES	.770	.800	.305	.285	.370	.400
MM	19.5	20.3	7.7	7.2	9.3	10.1

PIN LAYOUTS

	Fig. 16
LO	8
RF	1
IF	3, 4
Ground	2, 5, 6, 7

NOTE:
PINS 3 AND 4 MUST BE CONNECTED TOGETHER.

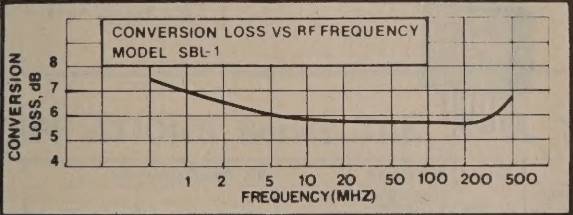


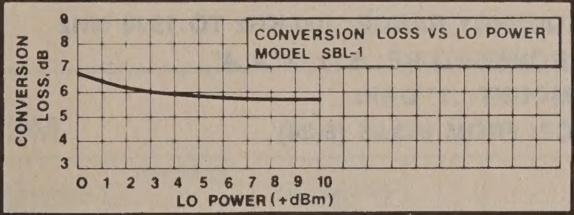
SPECIFICATIONS Series SBL-1

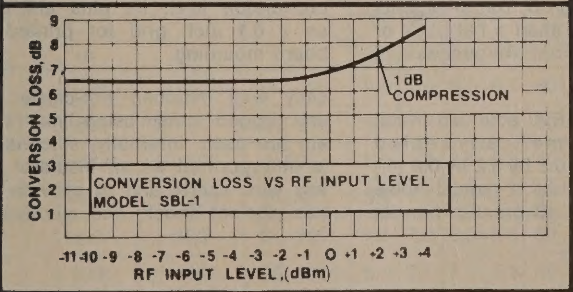
Model No.	Frequency Range MHz			Conversion Loss, dB				Isolation, dB												Pin Layout	Quan.	Price
				One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower						
								LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF				
	LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
SBL-1	1-500	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	45	30	40	25	35	25	30	20	Fig. 16	500 up	$2.95

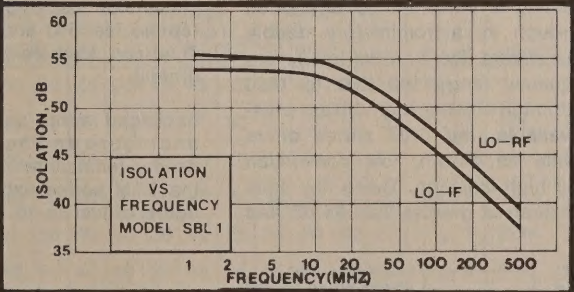
COMMON SPECIFICATIONS

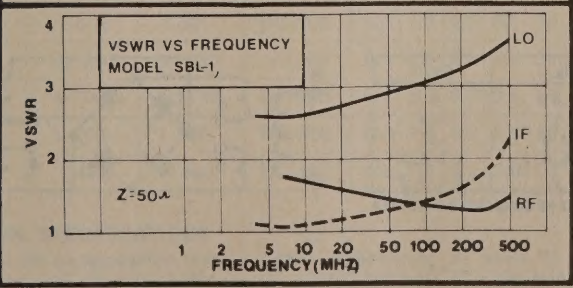
Impedance, all ports, 50 ohms. Input power: 50 mW. Peak IF current: 40 mA. Operating and Storage Temperature: −20°C to +85°C. Pin Temperature (10 sec): 510°F.

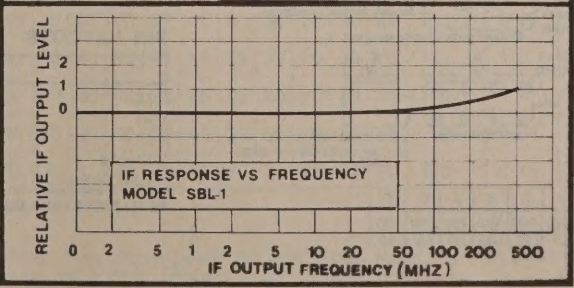












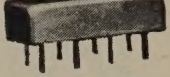
MINI-CIRCUITS LABORATORY / 2625 EAST 14th ST. / BROOKLYN, NY 11235 / (212) 769-0200 / INT'L TELEX 620156
A DIVISION SCIENTIFIC COMPONENTS CORP. DOMESTIC TELEX 125460

Mini-Circuits Laboratory MCL

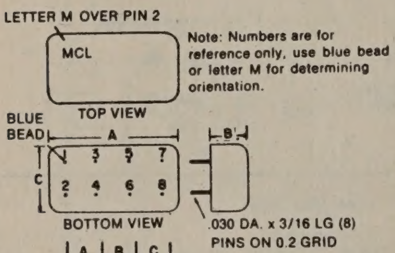
DOUBLE-BALANCED MIXERS Standard Level (+7dBm LO)

TAK Series

- **FREQUENCY RANGE: 10 KHz TO 1250 MHz**
- **MINIATURE LOW PROFILE: .8" x .4" x .2"**
- **PC MOUNT: 0.2" GRID**
- **PRICE: FROM $17.95 (1-4)**



Only 0.2 inches high, the low profile TAK series of double balanced mixers cover a very broad frequency range from 10 KHz to 1250 MHz. Exhibiting a flat conversion loss, these low profile units have a conversion loss typically 5.5 dB and isolation typically greater than 40 db. Packaged within an RFI shielded metal enclosure and hermetically sealed header, this low profile unit is only .064 cubic inches. The TAK series has its 8 pins located on a 0.2 inch grid. Unit weight is .13 ounces (3.7 grams). Internal components include well matched hot-carrier diodes and extra wideband transmission line transformers supported with silicone rubber for vibration and shock requirements.

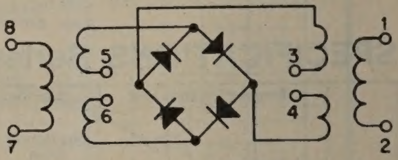

LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
TOP VIEW
BLUE BEAD
A
B
C
1
3
5
7
2
4
6
8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.2	.4
CM	2	.5	1

PIN LAYOUTS

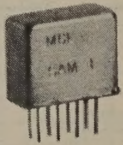
	Fig. 1	Fig. 2
LO	8	8
RF	1	3, 4
IF	3, 4	1
Ground	2, 5, 6, 7	2, 5, 6, 7
Case Ground	2	2, 5, 6, 7

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER



SAM Series

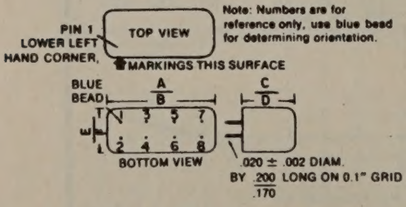
- **FREQUENCY RANGE: 100 KHz TO 1500 MHz**
- **MICROMINIATURE: .5" x .2" x .4"**
- **PC MOUNT: .1" GRID**
- **PRICE: FROM $13.95 (6-24)**



Representing a performance and price breakthrough in microminiature double balanced mixers, the SAM series covers the frequency range 100 KHz to 1500 MHz. Although smaller than mixers presently available, the SAM series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 5.5 dB. The SAM units require less PC area than a flat-pack or TO-5 can. Unit weight is .07 ounces (1.9 grams).

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) the SAM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock, and vibration.

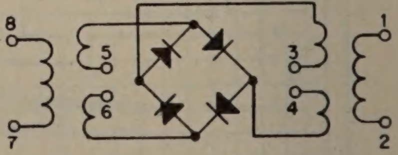

PIN 1 LOWER LEFT HAND CORNER,
TOP VIEW
Note: Numbers are for reference only, use blue bead for determining orientation.
MARKINGS THIS SURFACE
BLUE BEAD
A/B
C/D
E
F
1
3
5
7
2
4
6
8
BOTTOM VIEW
.020 ± .002 DIAM. BY .200/.170 LONG ON 0.1" GRID

	A	B	C	D	E	F
INCHES	.500	.480	.405	.390	.230	.210
CM	1.27	1.22	1.03	.99	.58	.53

PIN LAYOUTS

	Fig. 1	Fig. 2
LO	8	8
RF	1	3, 4
IF	3, 4	1
Ground	2, 5, 6, 7	2, 5, 6, 7
Case Ground	2	2, 5, 6, 7

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER



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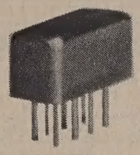
A DIVISION SCIENTIFIC COMPONENTS CORP. DOMESTIC TELEX 125460

Mini-Circuits
MCL
Laboratory

DOUBLE-BALANCED MIXERS
Standard Level (+7dBm LO)

TSM Series

- **FREQUENCY RANGE: 100 KHz TO 500 MHz**
- **MICROMINIATURE LOW PROFILE: .5″ x .2″ x .25″**
- **PC MOUNT: .1″ GRID**
- **PRICE: FROM $16.95 (5-24)**

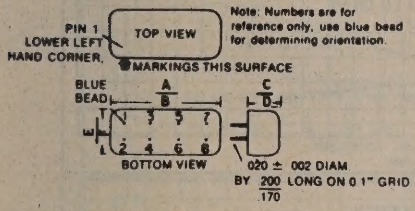


Representing a performance and price breakthrough in microminiature low profile double balanced mixers, the TSM series covers the frequency range 100 KHz to 500 MHz.

Although smaller than mixers presently available, the TSM series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 5.5 dB. The TSM units require less PC area than a flat-pack or TO-5 can. Unit weight is .07 ounces (1.8 grams).

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.25 in.) The TSM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock and vibration.

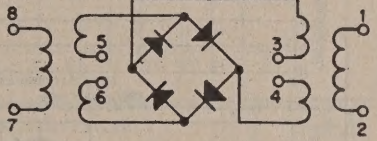

PIN 1
LOWER LEFT
HAND CORNER.
TOP VIEW
Note: Numbers are for reference only, use blue bead for determining orientation.
MARKINGS THIS SURFACE
BLUE
BEAD
A
B
C
D
E
F
1
3
5
7
2
4
6
8
BOTTOM VIEW
020 ± 002 DIAM
BY 200/170 LONG ON 0 1" GRID

	A	B	C	D	E	F
INCHES	.500	.480	255	.240	.230	.210
CM	1.27	1.22	.64	.60	.58	.53

PIN LAYOUTS

	Fig. 1
LO	8
RF	1
IF	3, 4
Ground	2, 5, 6, 7
Case Ground	2

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER



SPECIFICATIONS Series TAK, SAM, TSM

Model No.	Frequency Range, MHz			Conversion Loss, dB				Isolation, dB												Pin Layout	Quantity	Price
				One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower						
								LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF				
	LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
TAK-5	.01-250	.01-250	DC-250	5.5	7.0	6.5	8.5	60	50	55	45	50	40	45	35	40	30	35	25	Fig. 1	**1-4**	**$17.95**
TAK-6	.5-600	.5-600	DC-600	5.5	7.5	6.5	8.5	60	50	55	45	50	30	45	30	40	25	30	20	Fig. 1	**1-4**	**$17.95**
TAK-7	2-1000	2-1000	.5-500	5.5	7.5	6.5	8.5	45	30	45	30	35	20	35	20	30	20	30	20	Fig. 2	**1-4**	**$19.95**
TAK-9	5-1250	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	50	40	40	20	40	20	30	20	30	20	Fig. 2	**1-4**	**$21.95**
SAM-1	1-600	1-600	DC-600	5.5	7.0	6.5	8.5	55	45	50	40	45	30	40	25	35	20	30	20	Fig. 1	**6-24**	**$13.95**
SAM-2	1-1000	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	50	40	40	25	40	25	35	20	30	20	Fig. 1	**1-24**	**$17.95**
SAM-3	.1-500	.1-500	DC-500	5.5	7.0	6.5	8.5	60	50	50	40	50	35	45	30	35	30	30	20	Fig. 1	**5-24**	**$15.95**
SAM-4	5-1250	5-1250	.5-1000	6.5	8.5	6.5	8.5	55	40	50	40	35	25	35	25	30	20	30	20	Fig. 2	**1-9**	**$19.95**
SAM-5	5-1500	5-1500	.5-1000	6.5	8.5	6.5	8.5	55	40	50	40	35	25	35	25	30	20	30	20	Fig. 2	**1-9**	**$24.95**
TSM-1	1-500	1-500	DC-500	6.0	7.5	6.5	8.5	60	45	55	45	45	35	40	30	35	25	35	25	Fig. 1	**5-24**	**$16.95**
TSM-3	.1-400	.1-400	DC-400	5.3	7.0	6.5	8.0	60	50	55	45	50	35	45	30	35	25	35	25	Fig. 1	**5-24**	**$18.95**

COMMON SPECIFICATIONS

Signal, 1 dB compression level +1 dBm. Impedance, all ports 50 ohms. Total input power 50 mW. Total input, current peak 40 mA. Operating and storage temperature −55°C to +100°C. Pin temperature 510°F (10 sec).

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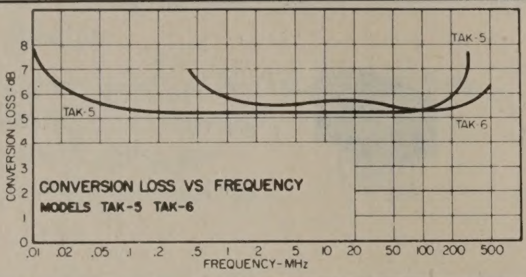
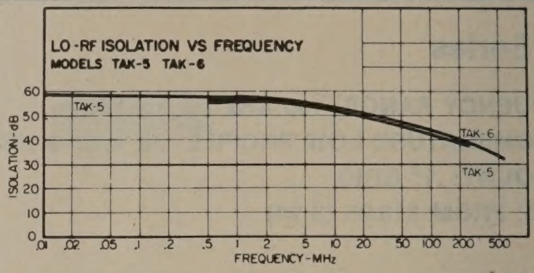
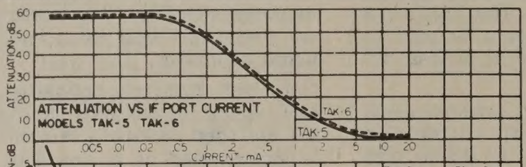
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

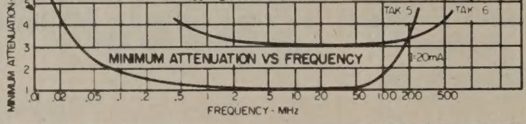
Mini-Circuits MCL Laboratory

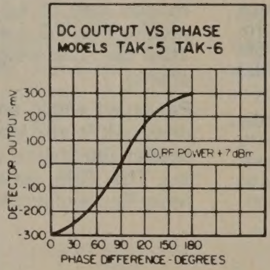
DOUBLE-BALANCED MIXERS Series TAK, SAM, TSM (Con't)

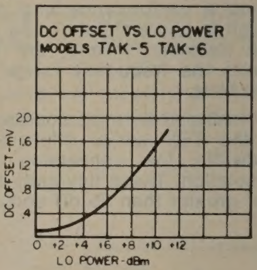


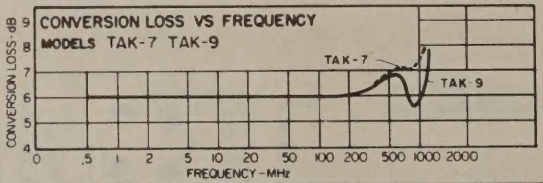


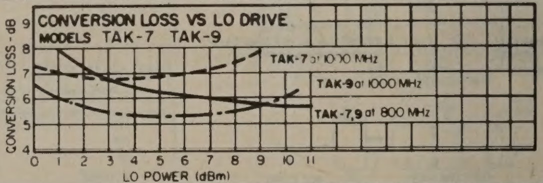


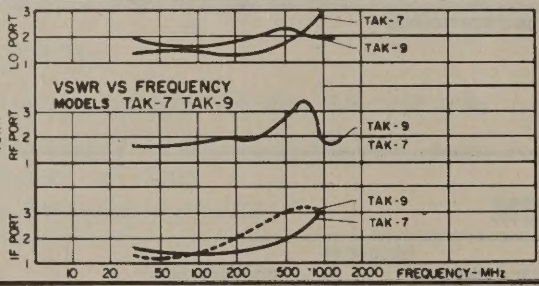


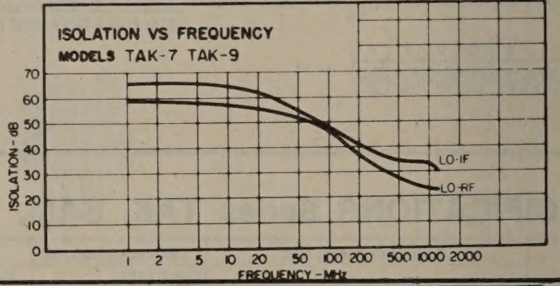


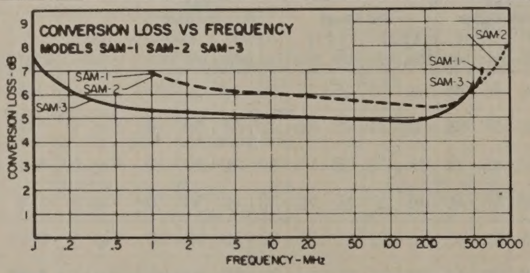


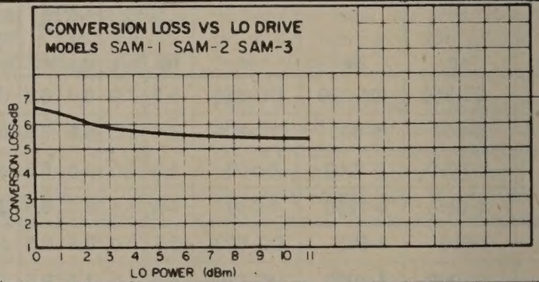


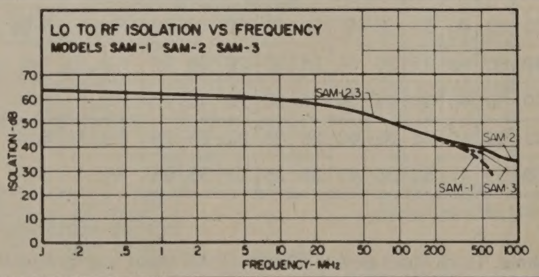


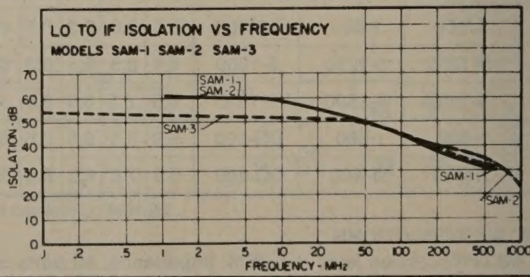






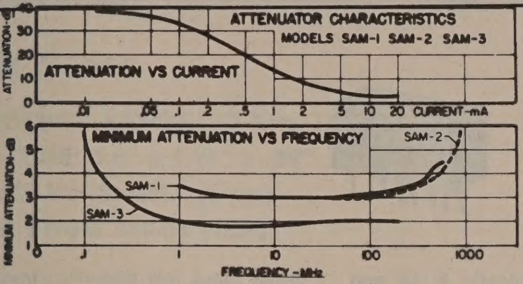


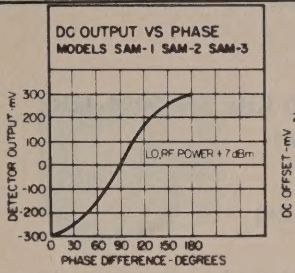


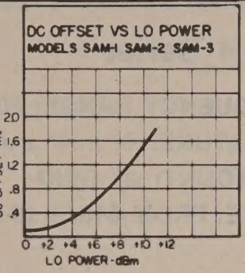


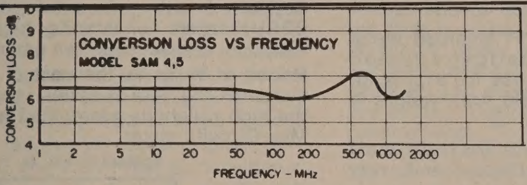
Mini-Circuits MCL **Laboratory**

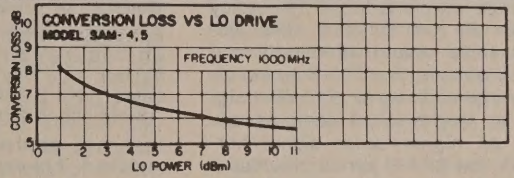
DOUBLE-BALANCED MIXERS
Series TAK, SAM, TSM (Con't)

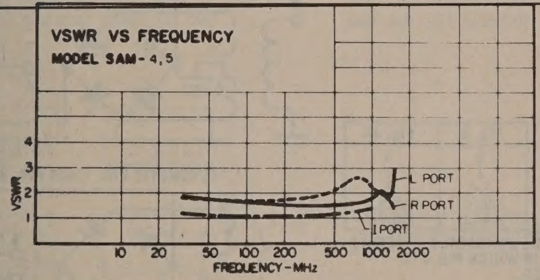


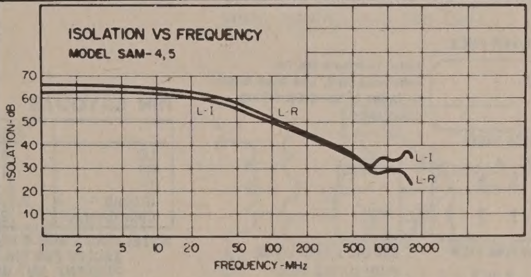


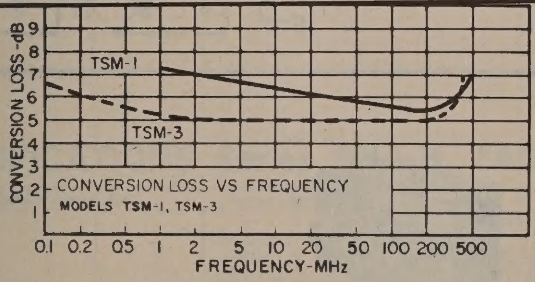


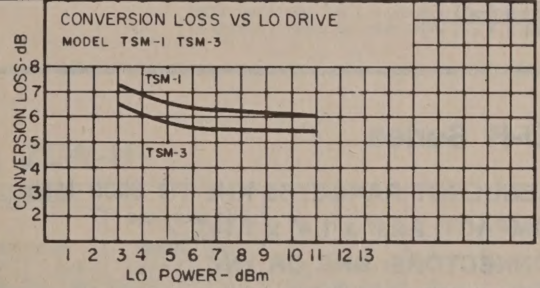


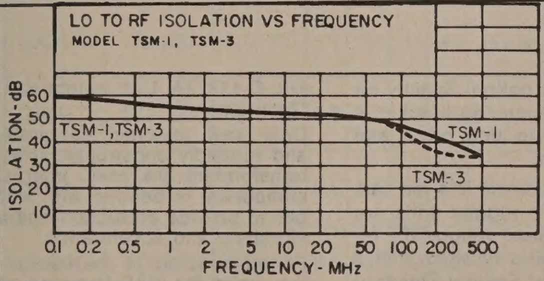


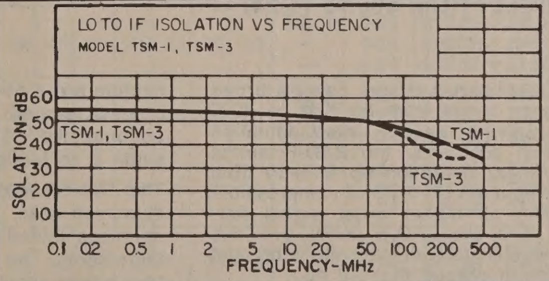


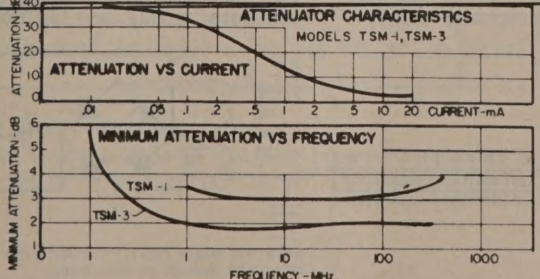


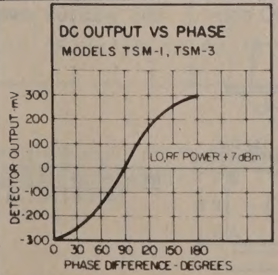


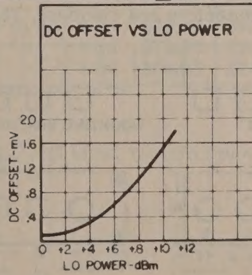










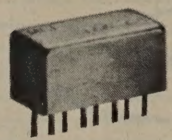


Mini-Circuits MCL Laboratory

DOUBLE-BALANCED MIXERS High Level (+17dBm LO)

SRA-H Series

- **FREQUENCY RANGE: 50 KHz TO 3000 MHz**
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $15.95 (5-24)**

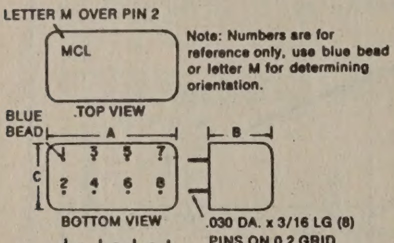


Having only 0.1 cu. inches, the high level SRA-H series covers a broad frequency range from 50 KHz to 3000 MHz. Designed to solve severe intermodulation distortion problems, the SRA-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the SRA-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, this tiny unit has its 8 pins located on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Internal components include well matched hot-carrier diodes and very broad band, low distortion transformers. Supported with silicone rubber, the SRA-H series withstands high shock, vibration, and acceleration environments.

Priced at ½ to ⅓ the cost of competitive units the SRA-H series incorporates the high reliability associated with every Mini-Circuits mixer.


LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
.TOP VIEW
BLUE BEAD
A
B
C
1 3 5 7
2 4 6 8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

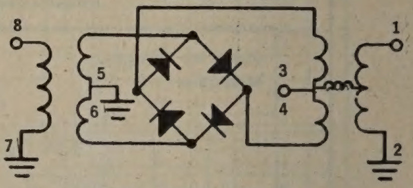
	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

PIN LAYOUTS

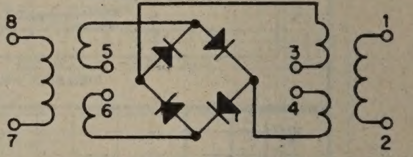
	Fig. 1	Fig. 4	Fig. 4A
LO	8	8	8
RF	1	1	1
IF	3,4	3,4	3
Ground	2,5,6,7	2,5,6,7	2,5,6,7
Case Ground	2	2,5,6,7	2,5,6,7

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER EXCEPT FOR FIG. 4A IN WHICH PIN 4 IS PRESENT, BUT UNUSED.

SCHEMATIC FIG. 4A

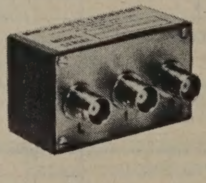


SCHEMATIC FIG. 1 AND FIG. 4



ZAD-H Series

- **FREQUENCY RANGE: 50 KHz TO 3000 MHz**
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $30.95 (4-24)**



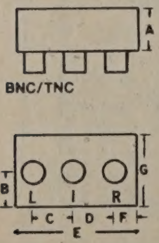
The ZAD-H series mixers cover a broad frequency range from 50 KHz to 3000 MHz. Solving severe intermodulation distortion problems, the ZAD-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the ZAD-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

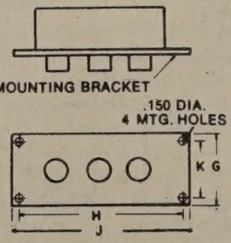
BNC connectors are standard. TNC connectors are a no-cost option. Specify on order if required. A mounting bracket is optional. Add $1.50 to unit price and suffix B to Model No.

The ZAD-H series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

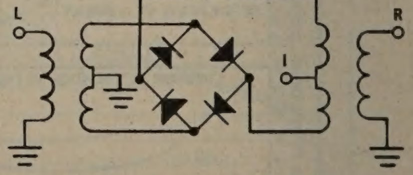
Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Priced at ½ to ⅓ the cost of competitive units the ZAD-H series offers performance, quality, and low cost.





	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8



NOTE: For Model ZAD-11H connertor/terminal I is at dc ground through an inductance.

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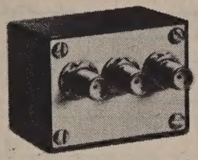
Mini-Circuits MCL Laboratory

DOUBLE-BALANCED MIXERS
High Level (+17dBm LO)

ZLW-H Series

- **FREQUENCY RANGE: 50 KHz TO 1000 MHz**
- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $40.95 (4-24)**

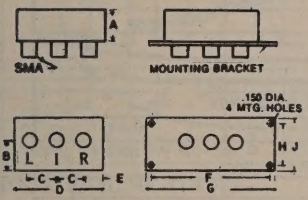


The ZLW-H series mixers cover a broad frequency range from 50 KHz to 1000 MHz. Solving severe intermodulation distortion problems, the ZLW-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the ZLW-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

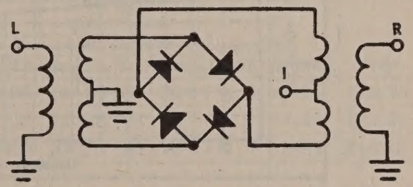
Available with SMA (3mm) connectors, the ZLW-H series is housed in a die cast aluminum case. A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Priced at ½ to ⅓ the cost of competitive units the ZLW-H series offers performance, quality, and low cost.



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9



NOTE: For Model ZLW-11H connector/terminal I is at dc ground through an inductance.

SPECIFICATIONS Series SRA-H, ZAD-H, ZLW-H

Frequency Range, MHz			Conversion Loss, dB				Isolation, dB															
			One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower							
							LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF					
LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Pin Layout	Quantity	Price	Model No.
.05-200	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	35	45	30	40	30	35	25	30	20	Fig. 1	5-24	$17.95	SRA-3H
																			—	4-24	$32.95	ZAD-3H
																			—	4-24	$42.95	ZLW-3H
.5-500	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	35	45	30	40	30	35	25	30	20	Fig .1	5-24	$15.95	SRA-1H
																			—	4-24	$30.95	ZAD-1H
																			—	4-24	$40.95	ZLW-1H
1-750	1-750	DC-750	5.5	7.5	6.5	8.5	50	40	45	35	45	25	40	25	35	25	30	20	Fig. 4	5-24	$19.95	SRA-1WH
																			—	4-24	$34.95	ZAD-1WH
																			—	4-24	$44.95	ZLW-1WH
2-1000	2-1000	DC-1000	6.0	7.5	8.5	10.0	50	40	45	35	35	25	30	20	35	25	25	20	Fig. 4	5-24	$29.95	SRA-2H
																			—	4-24	$44.95	ZAD-2H
																			—	4-24	$54.95	ZLW-2H
10-3000	10-3000	DC-1000	8	10	10	12	27	20	27	20	25	18	25	18	23	16	23	16	Fig.4A	1-24	$49.95	SRA-11H
																			—	1-24	$79.95	ZAD-11H
																			—	1-24	$89.95	ZLW-11H

COMMON SPECIFICATIONS

Signal, 1 dB compression level +10 dBm. Impedance, all ports 50 ohms. Total input power 500 mW. Total input, current peak 40 mA. Operating and Storage Temperature: −55°C to +100°C. Pin Temperature (SRA-H only) 510°F (10 sec).

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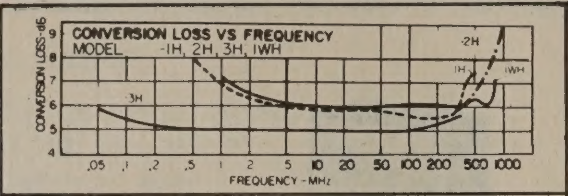
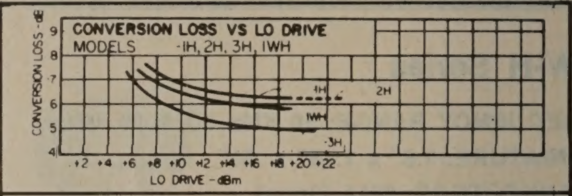
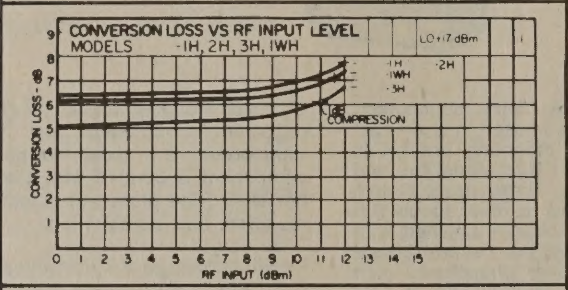
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

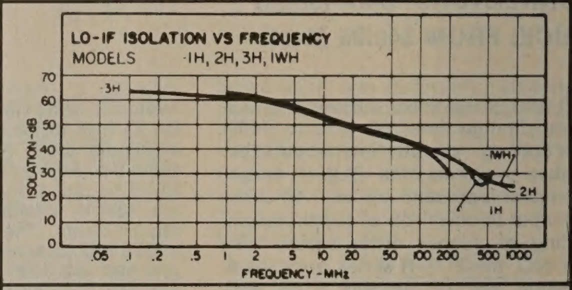
Mini-Circuits Laboratory MCL

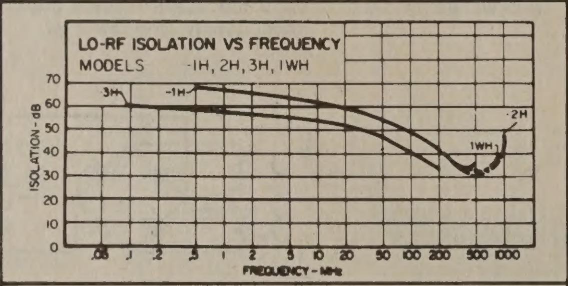
DOUBLE-BALANCED MIXERS
Series SRA-H, ZAD-H, ZLW-H,

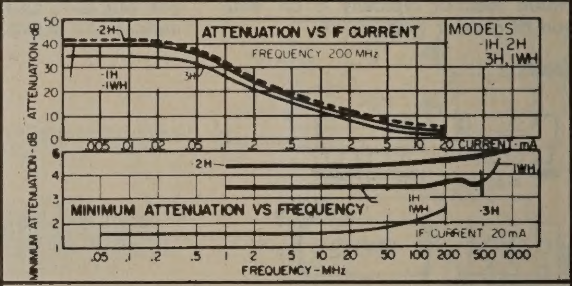


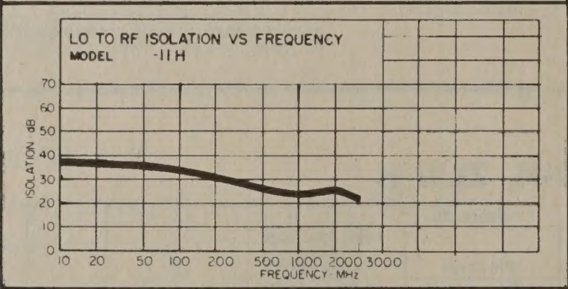


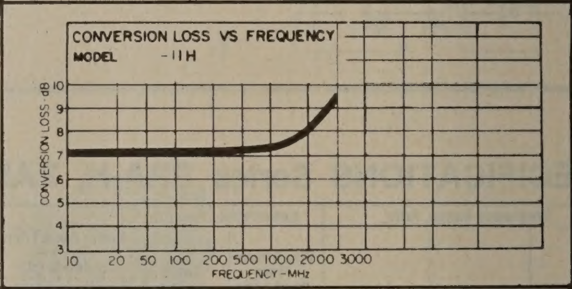


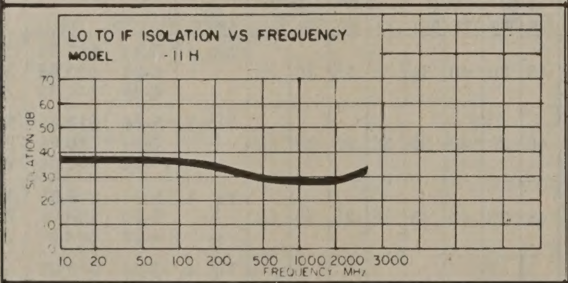


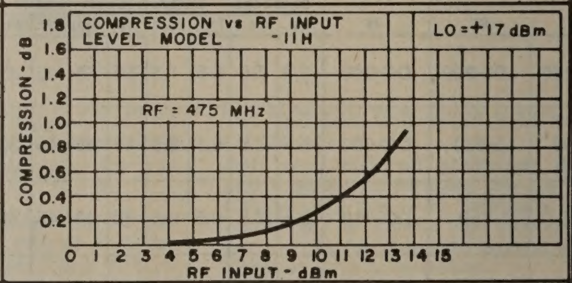


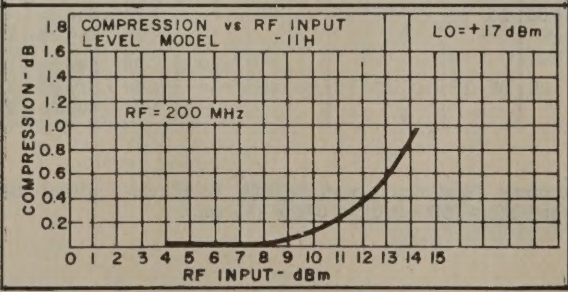


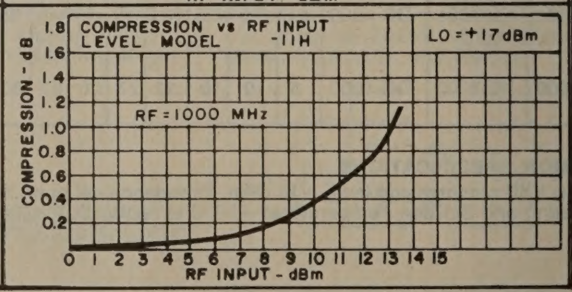








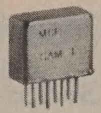




Mini-Circuits Laboratory
MCL

DOUBLE-BALANCED MIXERS High Level (+17dBm LO)

SAM-H Series

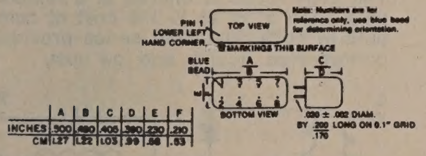


- **FREQUENCY RANGE: 100 KHz TO 1000 MHz**
- **PC MOUNT: 0.1″ GRID**
- **MICROMINIATURE: .5″ x .2″ x .4″**
- **PRICE: FROM $19.95 (5-24)**

Representing a performance and price breakthrough in microminiature double balanced mixers, the SAM-H series covers the frequency range 100 KHz to 1000 MHz. Although smaller than mixers presently available, the SAM-H series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 6.0 dB. The SAM-H units require less PC area than a flat-pack or TO-5 can. Unit weight is .07 ounces (1.9 grams).

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) the SAM-H series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock, and vibration.

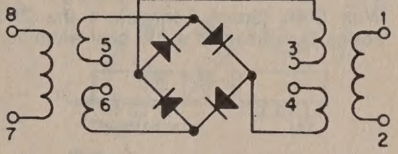

PIN 1 LOWER LEFT HAND CORNER,
TOP VIEW
Note: Numbers are for reference only, use blue bead for determining orientation.
MARKINGS THIS SURFACE
BLUE BEAD
A
B
C
D
1 3 5 7
2 4 6 8
BOTTOM VIEW
.020 ± .002 DIAM. BY .200/.170 LONG ON 0.1″ GRID

	A	B	C	D	E	F
INCHES	.500	.480	.405	.390	.230	.210
CM	1.27	1.22	1.03	.99	.58	.53

PIN LAYOUTS

	Fig. 1	Fig. 4
LO	8	8
RF	1	1
IF	3, 4	3, 4
Ground	2,5,6,7	2,5,6,7
Case Ground	2	2,5,6,7

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

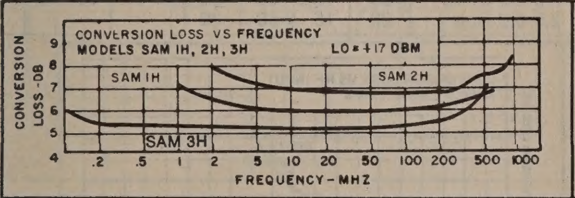


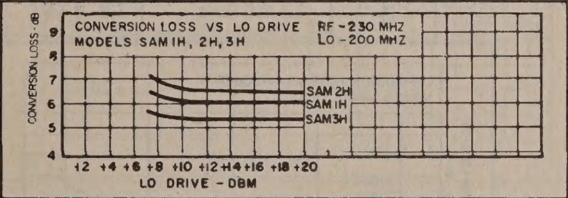
SPECIFICATIONS Series SAM-H

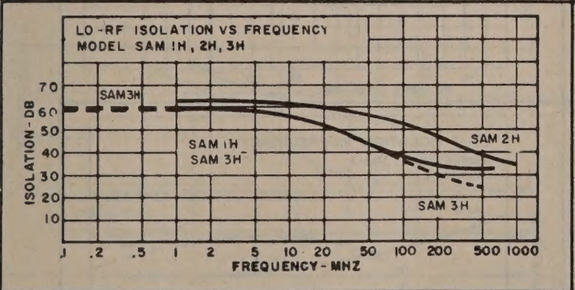
Model No.	Frequency Range, MHz			Conversion Loss dB				Isolation, dB												Pin Layout	Quantity	Price
				One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower						
								LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF				
	LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.			
SAM-1H	1-600	1-600	DC-600	6.0	7.5	6.5	8.5	55	45	50	40	40	25	35	25	35	20	30	20	Fig. 1	5-24	$19.95
SAM-2H	5-1000	5-1000	DC-1000	6.7	8.0	7.5	9.5	55	45	50	40	40	25	35	20	35	20	25	15	Fig. 4	1-24	$34.95
SAM-3H	.1-500	.1-500	DC-500	5.5	7.0	6.5	8.0	55	45	50	40	40	25	35	20	30	20	20	15	Fig. 1	5-24	$19.95

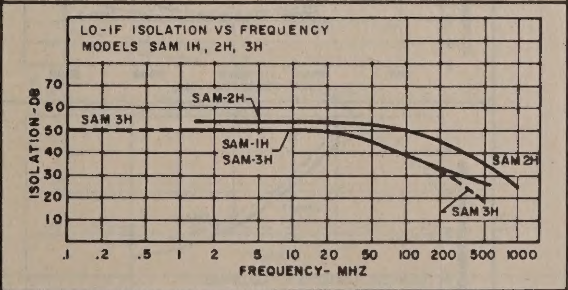
COMMON SPECIFICATIONS

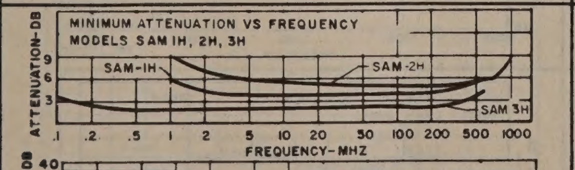
Signal, 1 dB compression level +7 dBm. Impedance, all ports 50 ohms. Total input power 100 mW. Total input, current peak 40mA. Operating and storage temperature −55°C to +100°C. Pin temperature 510°F (10 sec).

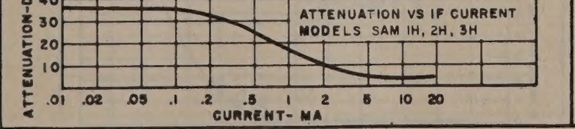


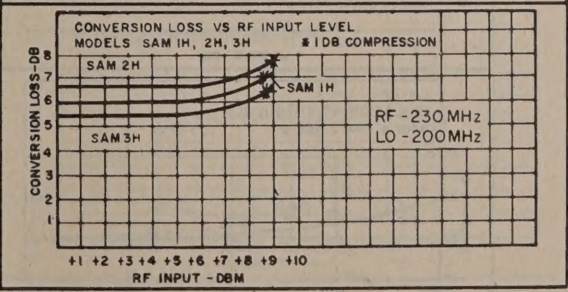










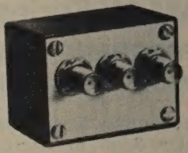


Mini-Circuits MCL Laboratory

MICROWAVE MIXERS

Balanced (+7dBm LO)

ZMA Series



- **FREQUENCY RANGE: 1000 MHz TO 3000 MHz**
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $49.95 (1-9)**

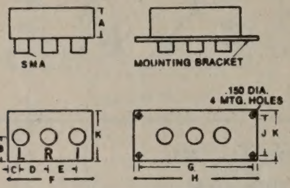
The ZMA series mixers are very economically priced while covering the broad frequency range from 1000 MHz to 3000 MHz. They offer low conversion loss, 7 dB, and high LO-IF isolation, 50 dB, over most of its frequency range.

With SMA (3mm) connectors the ZMA series is housed in a die cast aluminum case. These rugged units are shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

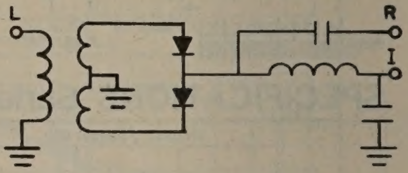
A mounting bracket is available. Add $1.50 to unit price and suffix B to Model No.

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

The ZMA series is offered at a remarkable price of ½ to ⅓ the cost of competitive units. The ZMA series provides performance, quality, and low cost.

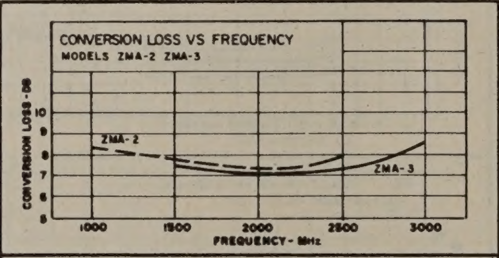


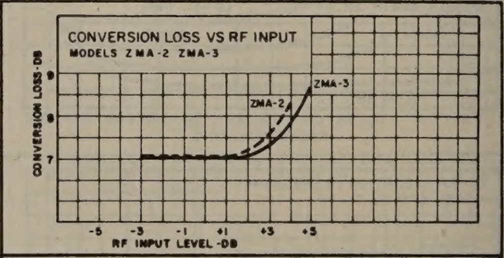
	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.690	.688	.437	.562	2.25	2.95	3.25	1.10	1.40
CM	2.9	1.75	1.7	1.1	1.4	5.7	7.49	8.25	2.29	3.55

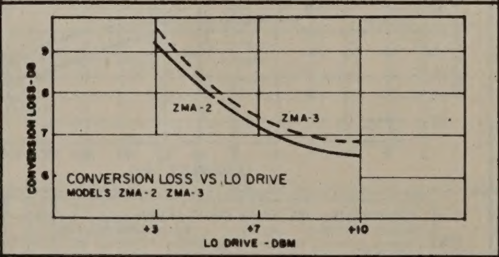


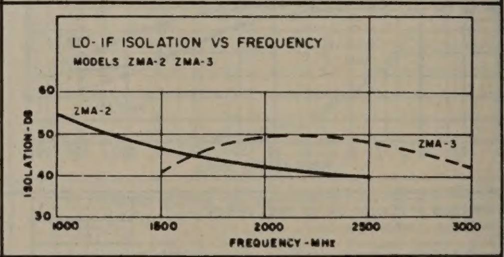
SPECIFICATIONS Series ZMA

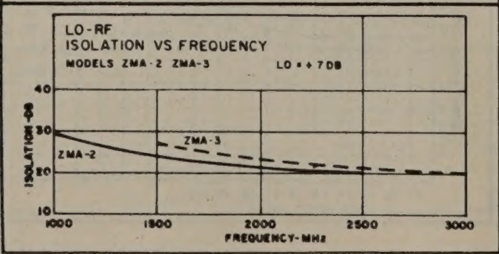
Frequency Range, GHz			Conversion Loss, dB			Isolation, dB							
							LO-RF		LO-IF				
LO	RF	IF	Over Frequency Band	Typ.	Max.	Over Frequency Band	Typ.	Min.	Typ.	Min.	Quantity	Price	Model No.
1-2.5	1-2.5	DC-.15	1.4-2 GHz 1.0-2.5 GHz	7.0 8.0	8.5 9.0	1.0-1.5 GHz 1.5-2.0 GHz 2.0-2.5 GHz	25 22 20	20 17 15	50 40 35	35 30 25	1-9	$49.95	ZMA-2
1.4-3.0	1.4-3.0	DC-.5	1.6-2.5 GHz 1.4-3.0 GHz	6.5 7.0	8.0 9.0	1.4-2.0 GHz 2.0-2.5 GHz 2.5-3.0 GHz	25 28 23	20 18 15	50 50 50	35 30 30	1-9	$54.95	ZMA-3

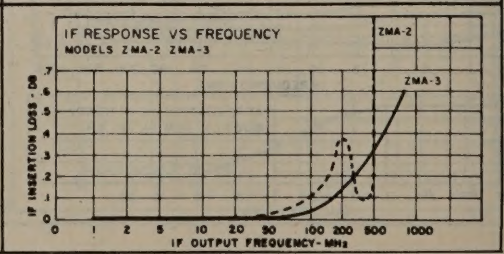












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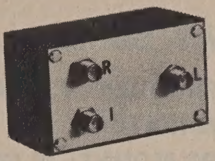
DOMESTIC TELEX 125460

Mini-Circuits MCL Laboratory

MICROWAVE MIXERS

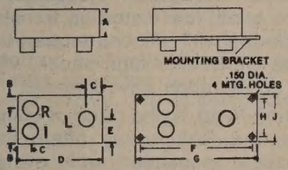
Double Balanced (+10dBm LO)

MA Series



- FREQUENCY RANGE: 1 MHz TO 2500 MHz
- COMPACT: 2.25" x 1.4" x 1.15"
- CONNECTORS: SMA (3mm)
- PRICE: FROM $99.95 (1-9)

A price/performance breakthrough in microwave double balanced mixers has been achieved with the MA Series. A new 1 to 2500 MHz mixer, the MA Series offers 9.0 dB conversion loss and isolation of 40 dB.



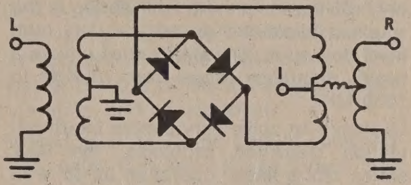
Housed in a die cast aluminum case, these rugged units are shielded to meet tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 596 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Mounting bracket is available. Add $1.50 to unit price and suffix B to Model No.

Only well matched hot-carrier diodes and rugged coaxial transmission line transformers are used. Extra special care has been taken to enable these units to be used in environments of severe shock and vibration.

	A	B	C	D	E	F	G	H	J
INCHES	1.15	.360	.516	2.25	.690	2.95	3.25	1.10	1.40
CM	2.9	.9	1.3	5.7	1.75	7.49	8.25	2.8	3.55

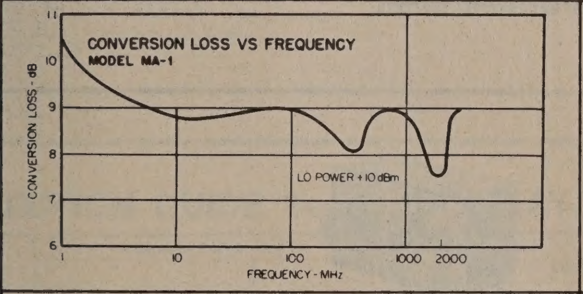
MA Series is offered at a remarkable price of ⅓ to ¼ of competitive units.

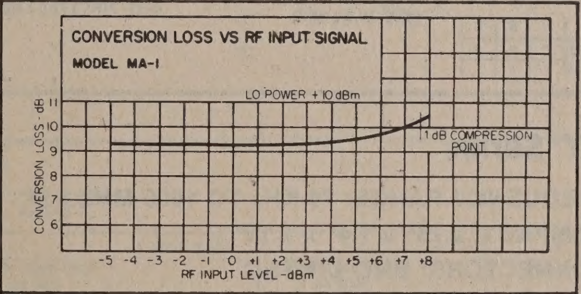


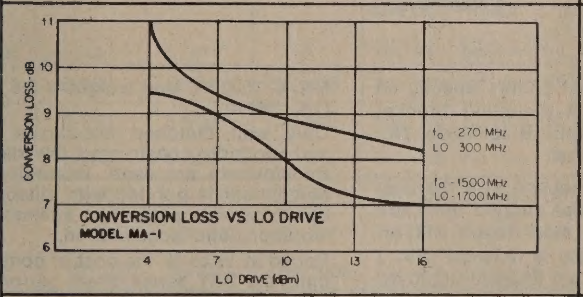
SPECIFICATIONS Series MA

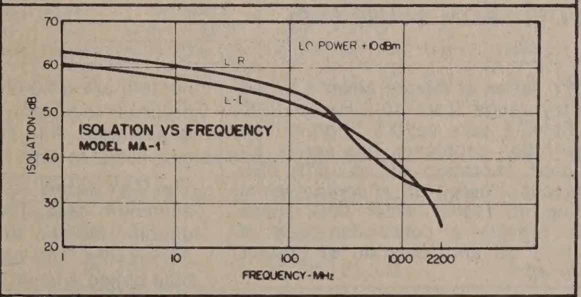
Frequency Range, GHz			Conversion Loss, dB			Isolation, dB							Model No.
LO	RF	IF	Over Frequency Band	Typ.	Max.	Over Frequency Band	Typ.	Min.	Typ.	Min.	Quantity	Price	
.001-2.5	.001-2.5	.001-1.0	1-5 MHz	9.5	11.0	Lower Band*	60	50	55	45	1-9	$99.95	MA-1
			5-1000 MHz	9.0	10.5	Mid Range	40	30	40	30			
			1000-2500 MHz	8.0	11.0	Upper Band**	35	25	30	20			

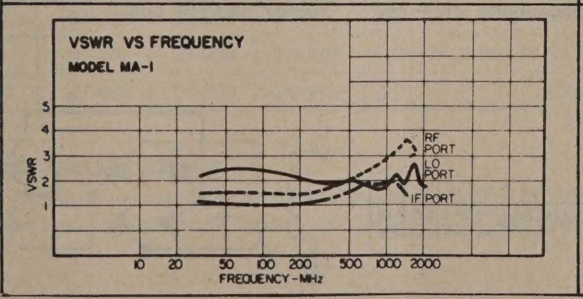
*Lower Band Edge to One Decade Higher **Upper Band Edge to One Octave Lower

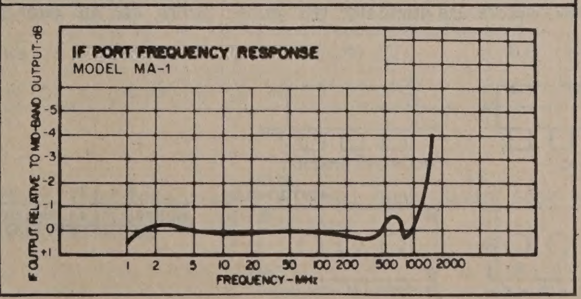












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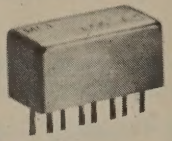
Mini-Circuits Laboratory

DOUBLE-BALANCED MIXERS
Very High Level (+23dBm LO)

RAY Series

- **FREQUENCY RANGE: 70 KHz TO 1000 MHz**
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $31.95 (4-9)**



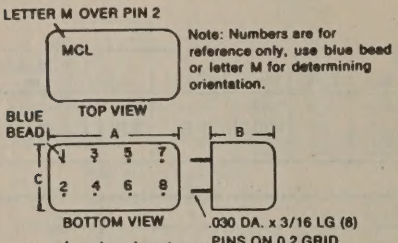
Housed in a volume of only 0.1 cu. inches and requiring a PC board area of only .32 sq. inches the RAY series is the smallest packaged mixers for very high level operation. The RAY series covers a broad frequency range from 70 KHz to 1000 MHz.

Designed to solve very severe intermodulation distortion problems, the RAY series offers linear operation up to +15 dBm signal input at only 1 dB of compression. Reducing all higher order IMD, the RAY series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Packaged within an RFI shielded metal enclosure and hermetically sealed header this tiny unit has its 8 pins located on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Internal components include well matched hot-carrier diodes and very broad band, low distortion transformers. Supported with silicone rubber, the RAY series withstands high shock, vibration, and acceleration environments.

Costing ⅓ to ¼ the price of competitive units, the RAY series offers the high reliability associated with every Mini-Circuits mixer.

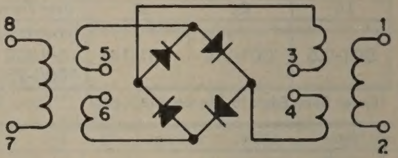

LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
TOP VIEW
BLUE BEAD
A
B
C
1
3
5
7
2
4
6
8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

PIN LAYOUTS

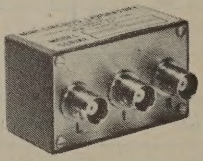
	Fig. 1	Fig. 4
LO	8	8
RF	1	1
IF	3, 4	3, 4
Ground	2,5,6,7	2,5,6,7
Case Ground	2	2,5,6,7

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER



ZAY Series

- **FREQUENCY RANGE: 70 KHz TO 1000 MHz**
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $41.95 (4-9)**



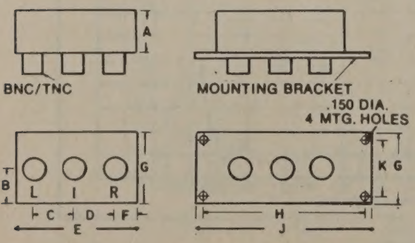
The ZAY series of mixers cover a broad frequency range from 70 KHz to 1000 MHz. Solving very severe intermodulation distortion problems, this series offers linear operation up to +15 dBb signal input at only 1 dB of compression. Reducing all higher order IMD, these models provide a conversion loss of typically 6 dB and isolation of greater than 40 dB.

BNC connectors are standard. TNC connectors are a no-cost option. Specify on order if required. A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit cost.

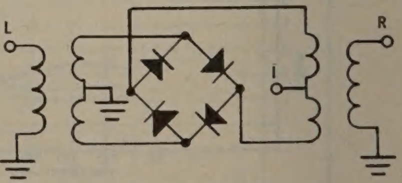
The ZAY series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Priced at ⅓ to ¼ the cost of competitive units the ZAY series offers performance, quality, and low cost.



	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8



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A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

Mini-Circuits
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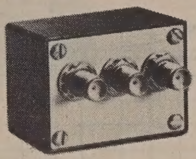
Laboratory

DOUBLE-BALANCED MIXERS Very High Level (+23dBm LO)

ZMY Series

- **FREQUENCY RANGE: 70 KHz TO 1000 MHz**
- **MINIATURE: 1.5" x 1.15" x .88"**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $51.95 (4-9)**



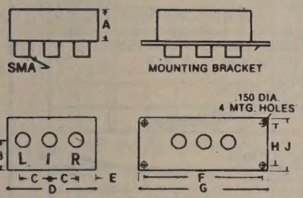
The ZMY series of mixers cover a broad frequency range from 70 KHz to 1000 MHz. Solving very severe intermodulation distortion problems, the ZMY series offers linear operation up to +15 dBb signal input at only 1 dB of compression. Reducing all higher order IMD, the ZMY series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Available with SMA (3mm) connectors, the ZMY series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

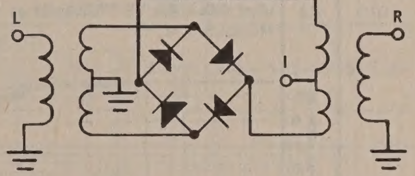
A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Priced at ⅓ to ¼ the cost of competitive units the ZMY series offers performance, quality, and low cost.



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9



SELECTION GUIDE Series RAY, ZAY, ZMY

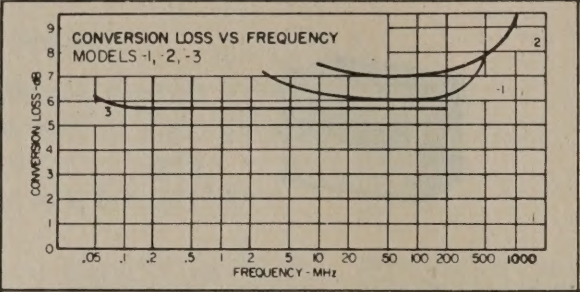
	Frequency Range, MHz			Conversion Loss, dB				Isolation, dB														
				One Octave From Band Edge		Total Range		Lower Band Edge To One Decade Higher				Mid Range				Upper Band Edge To One Octave Lower						
								LO-RF		LO-IF		LO-RF		LO-IF		LO-RF		LO-IF				
Model No.	LO	RF	IF	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Pin Layout	Quantity	Price
RAY-1	5-500	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	55	45	40	30	40	30	30	25	30	20	Fig. 1	4-9	$31.95
ZAY-1	5-500	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	55	45	40	30	40	30	30	25	30	20		4-9	$41.95
ZMY-1	5-500	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	55	45	40	30	40	30	30	25	30	20		4-9	$51.95
RAY-2	10-1000	10-1000	DC-1000	7.0	8.5	8.5	10.0	50	35	50	35	40	30	35	25	35	25	25	20	Fig. 4	4-9	$51.95
ZAY-2	10-1000	10-1000	DC-1000	7.0	8.5	8.5	10.0	50	35	50	35	40	30	35	25	35	25	25	20		4-9	$61.95
ZMY-2	10-1000	10-1000	DC-1000	7.0	8.5	8.5	10.0	50	35	50	35	40	30	35	25	35	25	25	20		4-9	$71.95
RAY-3	.07-200	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	55	45	40	30	40	30	30	25	30	20	Fig. 1	4-9	$31.95
ZAY-3	.07-200	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	55	45	40	30	40	30	30	25	30	20		4-9	$41.95
ZMY-3	.07-200	.07-200	DC-200	6.0	7.5	6.5	8.0	55	45	55	45	40	30	40	30	30	25	30	20		4-9	$51.95

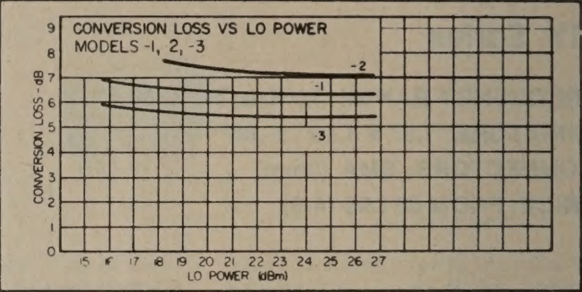
COMMON SPECIFICATIONS

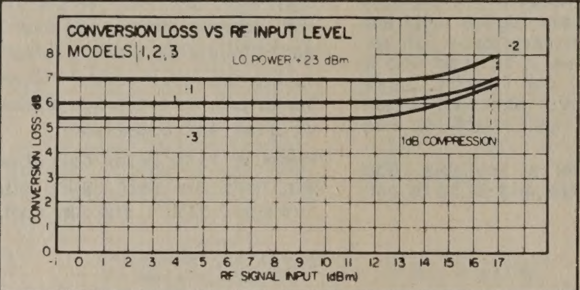
Signal, 1 dB compression level +15 dBm. Impedance, all ports 50 ohms. Total input power 1 W. Total input, current peak 40 mA. Operating and storage temperature −55°C to +100°C. Pin temperature (RAY only) 510°F (10 sec).

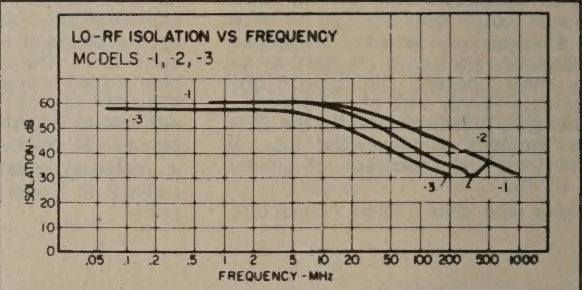
Mini-Circuits Laboratory

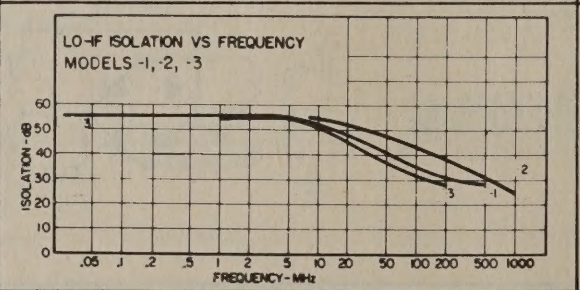
DOUBLE-BALANCED MIXERS Series RAY, ZAY, ZMY

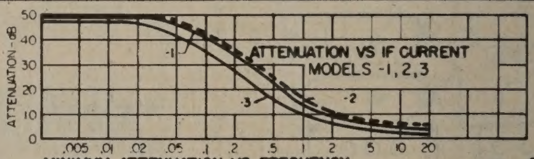


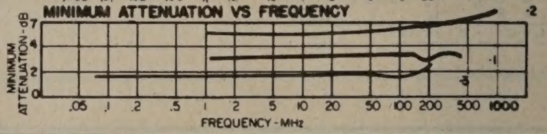








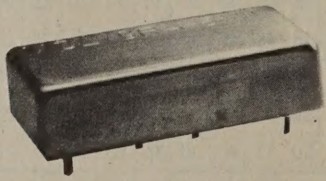




STANDARD LEVEL (+7 dBm LO)

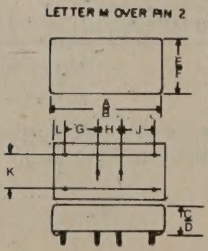
GRA Series

- **FREQUENCY RANGE: 500 Hz TO 500 MHz**
- **LOW PROFILE: 1″ x .5″ x .25″**
- **PC MOUNT: 1″ x .5″ BOARD AREA**
- **PRICE: FROM $10.95 (1-49)**



These double-balanced mixers are exact mechanical and electrical replacements for existing designs, see table. Offered at the lowest price available in the industry these rugged units provide low conversion loss, 6 dB, high isolation 40 dB and exceptional unit to unit matched performance. The units are packaged within an RFI shielded metal enclosure and hermetically sealed header.

For more detailed specifications see Microwaves Product Data Directory or call factory.



NOTE NUMBERS ARE FOR REFERENCE ONLY USE BLUE BEAD OR LETTER M FOR DETERMINING ORIENTATION

	A	B	C	D	E	F	G	H	J	K	L
IN.	.990	1.020	.240	.280	.490	.515	.302	.202	.302	.302	.130
MM	25.1	25.9	6.09	7.1	12.4	13.0	7.6	5.1	7.6	5.1	3.3

EXACT MECHANICAL REPLACEMENT FOR EXISTING DESIGNS — at lower cost with improved features.

Use Mini-circuits	To replace
GRA-1	M6K, M6N, M6F, M6KC
GRA-3	M6A, M6Q
GRA-8	M6J

WEIGHT

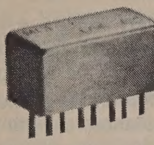
7.1 grams 0.25 ounces

Mini-Circuits
MCL
Laboratory

LIMITERS/AMPLIFIERS
Broadband

LIMITERS
PLS Series

- **FREQUENCY RANGE: 100 KHz TO 150 MHz**
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: $15.95 (5-49)**



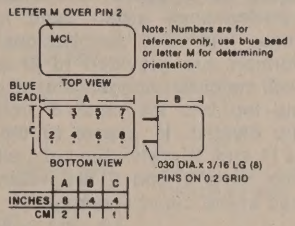
Having a volume of only .128 cu. inches, the PLS series covers a very broad frequency range from 100 KHz to 150 MHz. They have a dynamic range from +6 - +20 dBm and provide exceptionally hard limiting of a .05 dB output change per dB input change.

The PLS series has been designed to provide very small phase variations as the input level is changed. A bias current of about 3 mA from a 50 Ω source is required to excite the PLS limiter.

When the PLS series limiter is used with Mini-Circuits ZHL series amplifiers, a constant +15 dBm output can be obtained from 1 to 150 MHz.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, these high performance units have their pins oriented on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internallly, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration.


LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
TOP VIEW
BLUE BEAD
A
B
C
1
3
5
7
2
4
6
8
BOTTOM VIEW
.030 DIA.x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

PIN CONNECTIONS

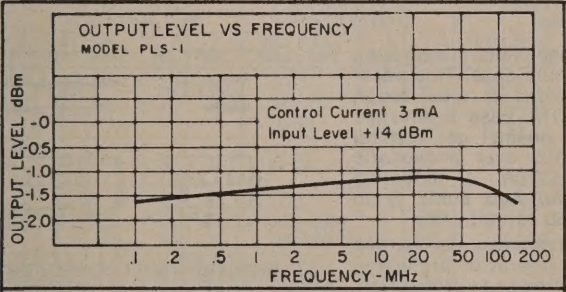
	Fig. 14
Output	8
Input	1
Control	3, 4
Ground	2, 5, 6, 7
Case Ground	2

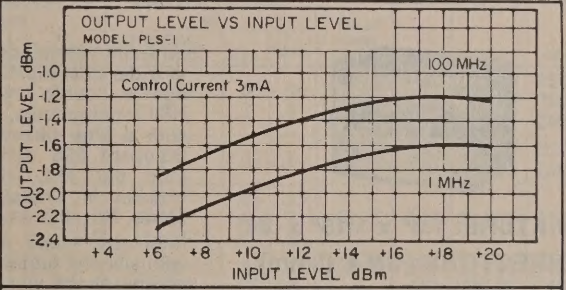
NOTE: PINS 3 & 4 CONNECT TOGETHER

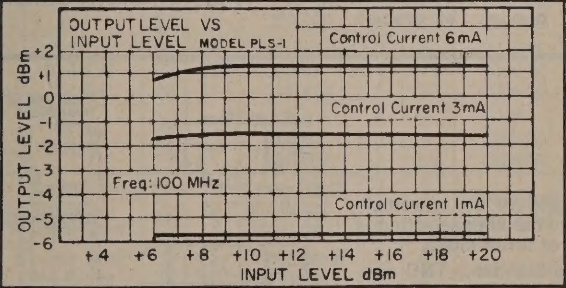
SPECIFICATIONS

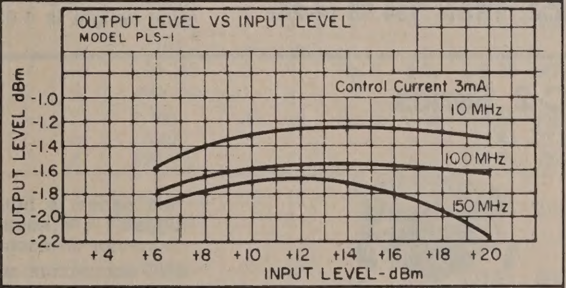
Model No.	Frequency Range MHz	Input Level Range dBm	Output Level (Control Current 3 mA)	Control Current Source Impedance	Limiting (△ Output/△ Input dB/dB)			Relative Phase Variation			Control Current mA	Pin Layout	Qty.	Price
					Input Level dBm Typ.			Input Level Typ.						
PLS-1	0.1-150	+6-+20	−1.6 dBm Typ.	50 ohms	+6-+10	+10-+16	+16-+20	+6-+10	+10-+16	+16-+20	3 Typ.	Fig. 14	**5-49**	**$15.95**
					0.1	.05	0.1	0.05	0.05	1.0				

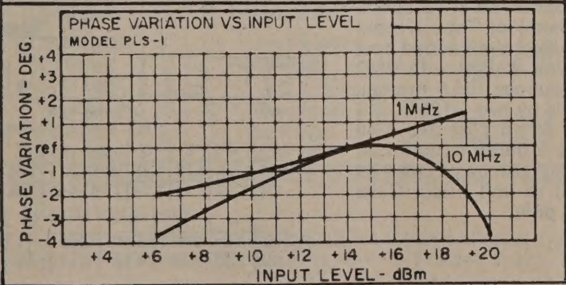
Impedance, All Ports: 50 ohms. **Operation and Storage Temperature:** −55°C to +100°C.

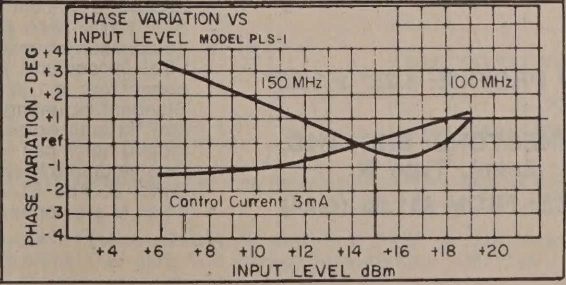












Mini-Circuits Laboratory
MCL

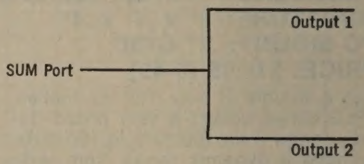
POWER SPLITTER-COMBINERS
Two-Way—0°

These two-way 0° splitter/combiners are high performance broad band hybrid junctions. Internally, terminations and transformers are provided to ensure a very well matched impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the two output (1 and 2) ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the ouput S port.

They feature exceptionally good amplitude and phase balance between the signals at the 2 output ports. Typically, over most of the frequency ranges, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

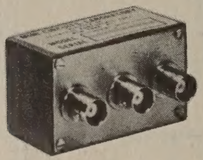
These high performance splitter/combiners are offered at a remarkable price of ½ to ⅓ of competitive units.

Five packaging styles are available to meet a wide range of applications.



Case Styles

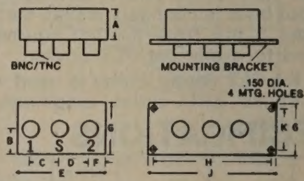
ZSC-2 Series



- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC, TNC**
- **PRICE: FROM $24.95 (4-24)**

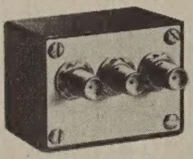
This rugged package is double shielded to meet tough RFI requirements. The die-cast aluminum case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. BNC connectors are standard. TNC connectors are a no-cost option. Please specify optional connectors if required. A mounting bracket can be supplied. Add $1.50 to unit price. To specify add suffix B to Model No. Unit weight is 2.6 ounces (74 grams).



	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.365	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

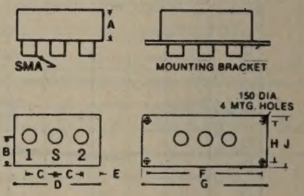
ZMSC-2 Series



- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $34.95 (4-24)**

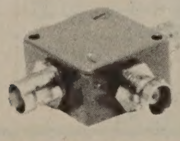
With SMA (3mm) connectors this housing is a die cast aluminum case. This package is double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. Unit weight is 1.02 ounces (34 grams).



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

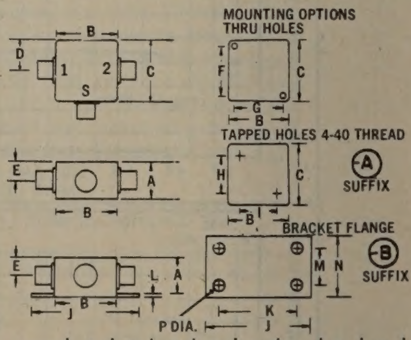
ZFSC-2 Series



- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), Type N**
- **PRICE: FROM $31.95 (4-24)**

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors, a no-cost option must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams). Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.



	A	B	C	D	E	F	G	H
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03

	I	J	K	L	M	N	P
INCHES	0.8	2.188	1.688	.060	.75	1.25	.125
CM	2.03	5.56	4.29	0.15	1.91	3.18	.318

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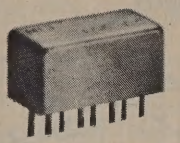
DOMESTIC TELEX 125460

Mini-Circuits Laboratory MCL

POWER SPLITTER-COMBINERS Two-Way—0°

Case Styles (con't)

PSC-2 Series



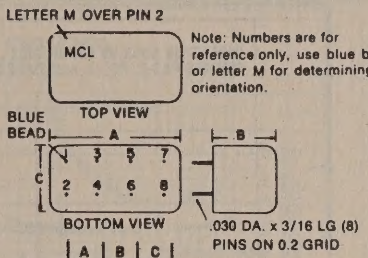
- MINIATURE: .8″ x .4″ x .4″
- PC MOUNT: 0.2″ GRID
- PRICE: FROM $9.95 (6-49)

Having a volume of only .128 cu. inches, this package has an RFI shielded metal enclosure and hermetically sealed header. The PC pins are oriented on a 0.2 inch grid.

Internally, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration. Unit weight is .18 ounces (5.2 grams).

PIN LAYOUT

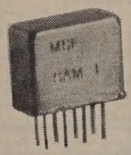
	Fig. 8		Fig. 8
SUM Port	1	Output 2	6
Output 1	5	Ground	2,3,4,7,8



Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

MSC-2 Series



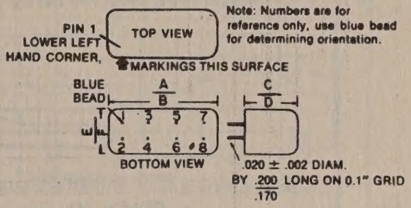
- MICROMINIATURE: .5″ x .2″ x .4″
- PC MOUNT: .1″ GRID
- PRICE: FROM $16.95 (6-24)

This package requires less PC area than a flat-pack or TO-5 can. The package has an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) PC pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock and vibration.

PIN LAYOUT

	Fig. 8		Fig. 8
SUM Port	1	Output 2	6
Output 1	5	Ground	2,3,4,7,8


PIN 1 LOWER LEFT HAND CORNER,
TOP VIEW
MARKINGS THIS SURFACE
BLUE BEAD
A/B
C/D
E
1 3 5 7
2 4 6 8
BOTTOM VIEW
.020 ± .002 DIAM. BY .200/.170 LONG ON 0.1" GRID

Note: Numbers are for reference only, use blue bead for determining orientation.

	A	B	C	D	E	F
INCHES	.500	.480	.405	.390	.230	.210
CM	1.27	1.22	1.03	.99	.58	.53

SPECIFICATIONS Series PSC-2, ZSC-2, ZMSC-2, MSC-2, ZFSC-2

Frequency Range (MHz)	Isolation Between Output 1 and 2, dB			Insertion Loss, db (above 3 db split)			Phase Unbalance, Degrees			Amplitude Unbalance, dB			Pin or Conn. Layout	Quan.	Price	Model No.
	Over Freq. Band (MHz)	Typ.	Min.	Over Freq. Band (MHz)	Typ.	Max.	Over Freq. Band (MHz)	Typ.	Max.	Over Freq. Band (MHz)	Typ.	Max.				
.002 to 60	.015-6 .004-60	40 27	30 20	.01-3 .002-20 20-60	.2 .3 .6	.4 .6 1.0	.01-3 .002-20 20-60	.5 1 2	2 3 4	.002-20 20-60	.05 .1	.15 .3	Fig. 8 — —	6-49 4-24 4-24	$19.95 $34.95 $44.95	PSC-2-2 ZSC-2-2 ZMSC-2-2
55 to 85	55-85	35	30	55-85	.3	.5	—	—	—	55-85	.05	.1	Fig. 8 —	6-49 4-24	$19.95 $34.95	PSC-2-375 ZSC-2-375
0.25 to 300	10-50 2-150 0.25-300	40 25 20	30 20 15	1-50 0.25-100 100-300	.2 .5 .6	.5 .75 1.0	0.25-50 50-150 150-300	.5 1 2	2 3 5	1-50 50-150 150-300	.05 .05 .1	.15 .2 .3	Fig. 8	6-49	$11.95	PSC-2-175
.1 to 400	2-40 .4-400 .1-.4	40 25 20	30 20 15	.1-100 100-200 200-400	.2 .5 .6	.5 .75 1.0	0.1-100 100-200 200-400	.5 1 2	2 3 4	.1-100 100-200 200-400	.05 .05 .1	.15 .2 .3	Fig. 8 — —	6-49 4-24 4-24	$ 9.95 $24.95 $34.95	PSC-2-1 ZSC-2-1 ZMSC-2-1
.1 to 450	2-250 0.4-450 0.1-0.4	35 30 20	25 20 15	2-100 .1-250 250-450	.3 .4 .6	.5 .75 1.0	0.1-100 100-200 200-450	.5 1 2	2 3 4	.1-100 100-200 200-450	.05 .05 .1	.15 .2 .3	Fig. 8	6-24	$16.95	MSC-2-1
1 to 650	10-200 1-650	35 25	25 20	1-200 200-500 500-650	.3 .5 .7	.5 .8 1.0	1-100 100-400 400-650	.5 1 2	2 3 4	1-100 10-400 400-650	.05 .05 .1	.15 .2 .3	Fig. 8 — —	6-49 4-24 4-24	$14.95 $29.95 $39.95	PSC-2-1W ZSC-2-1W ZMSC-2-1W
0.2 to 1000	Lower Band† Mid Range Upper Band†	20 25 23	12 20 18	Lower Band† Mid Range Upper Band†	.2 .5 .9	.5 1.0 1.2	Lower Band* Upper Band*	.5 1	2 4	Lower Band* Upper Band*	.05 .1	.15 .3	—	4-24	$44.95	ZFSC-2-4
1 to 750	Lower Band† Mid Range Upper Band†	30 28 25	25 20 20	Lower Band† Mid Range Upper Band†	.2 .4 .8	.5 .8 1.0	Lower Band* Upper Band*	.5 1	2 4	Lower Band* Upper Band*	.05 .1	.15 .3	—	4-24	$35.95	ZFSC-2-1W
5 to 500	Lower Band† Mid Range Upper Band†	30 28 25	25 20 20	Lower Band† Mid Range† Upper Band†	.2 .3 .6	.5 .6 .8	Lower Band Upper Band	.5 1	2 4	Lower Band* Upper Band*	.05 .1	.15 .3	—	4-24	$31.95	ZFSC-2-1
10 to 1000	Lower Band† Mid Range Upper Band†	30 25 23	20 20 18	Lower Band† Mid Range† Upper Band†	.2 .5 .9	.5 1.0 1.2	Lower Band Upper Band	.5 1	2 4	Lower Band* Upper Band*	.05 .1	.15 .3	—	4-24	$39.95	ZFSC-2-2

†Lower Band Edge to one decade higher. Upper Band Edge to one octave lower. *Lower Band Edge to one octave from Upper Band Edge. Upper Band Edge to one octave lower.

COMMON SPECIFICATIONS

VSWR: 1.2 typ. Matched Power Rating: 1 watt max. Internal Load Dissipation (except 2-1W): ⅛ watt. Only 2-1W: ¼ watt. Impedance, All Ports (except 2-175 and 2-375): 50 ohms. Only 2-175 and 2-375: 75 ohms. Operating and Storage Temperature: −55°C to +100°C.

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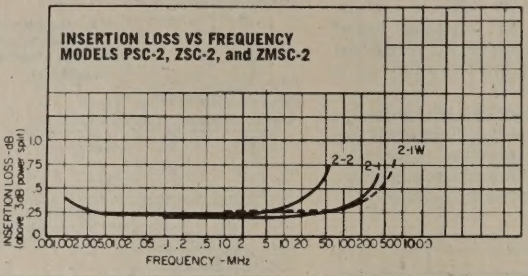
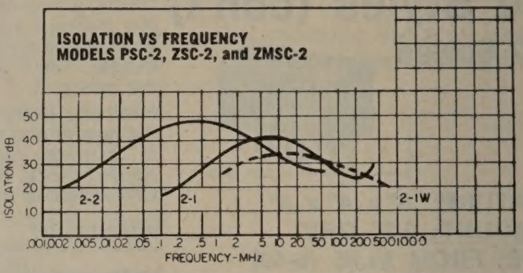
Mini-Circuits Laboratory

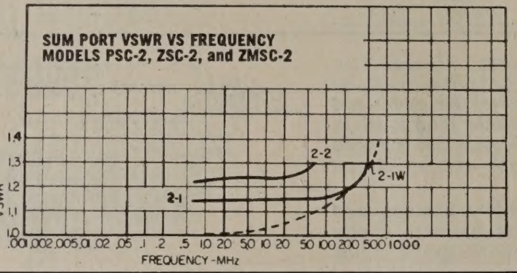
MCL

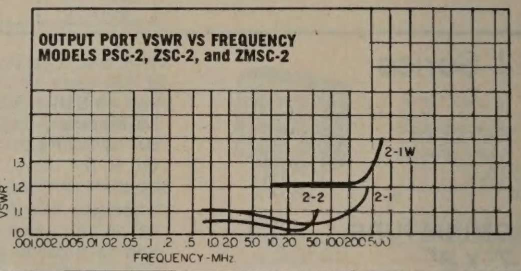
POWER SPLITTER-COMBINERS

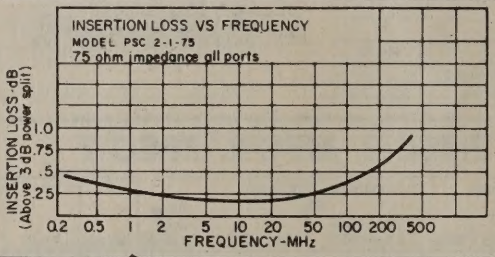
Series PSC-2, ZSC-2, ZMSC-2, MSC-2, ZFSC-2 (Con't)

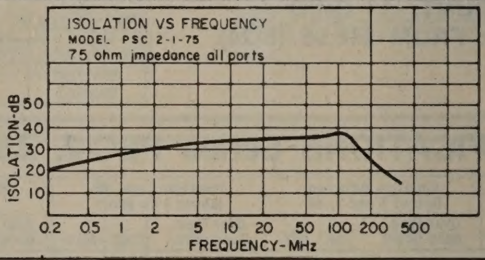


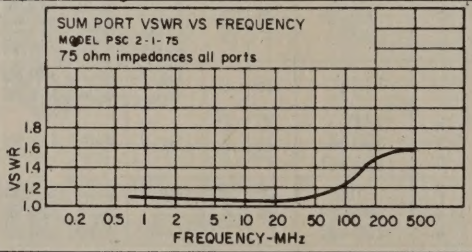


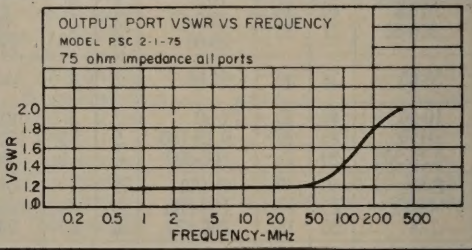


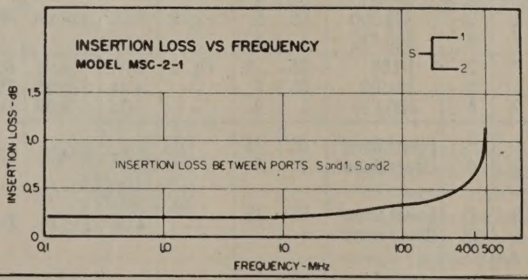


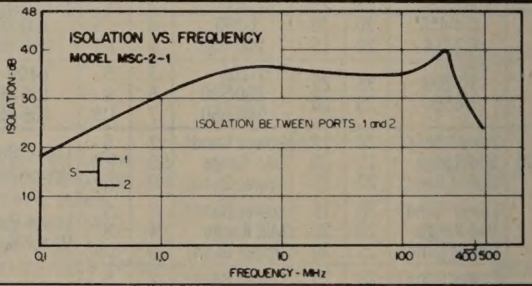


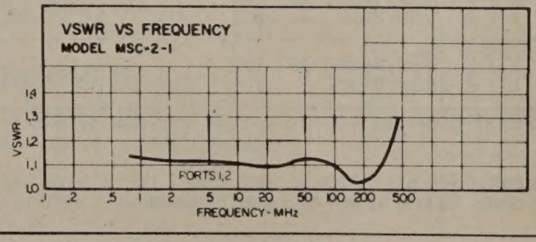


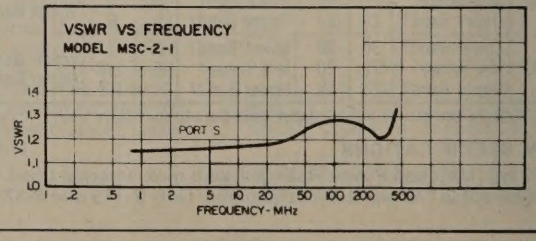










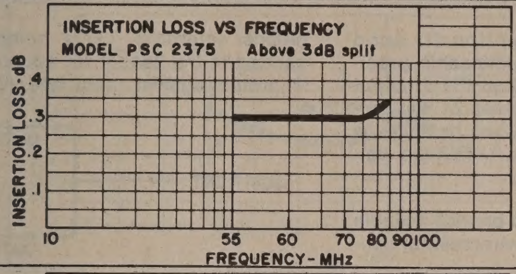


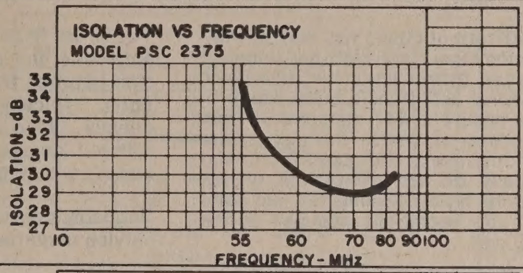
Mini-Circuits Laboratory

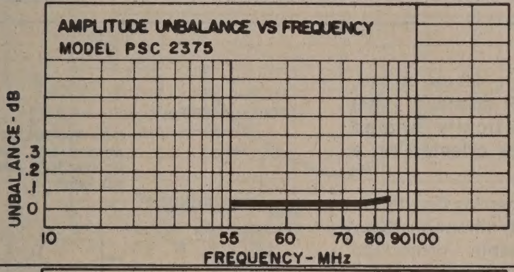
MCL

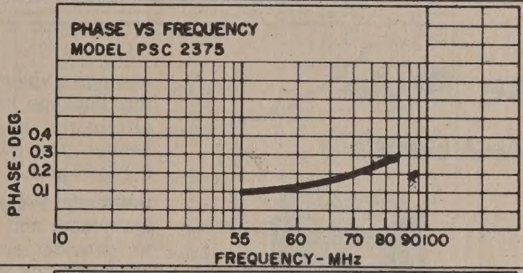
POWER SPLITTER-COMBINERS

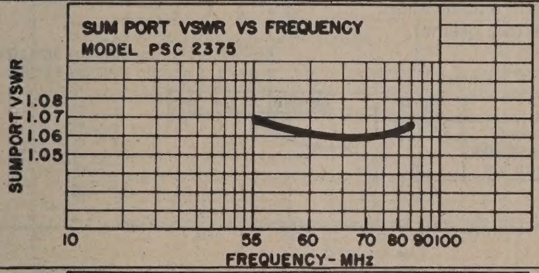
Series PSC-2, ZSC-2, ZMSC-2, MSC-2, ZFSC-2 (Con't)

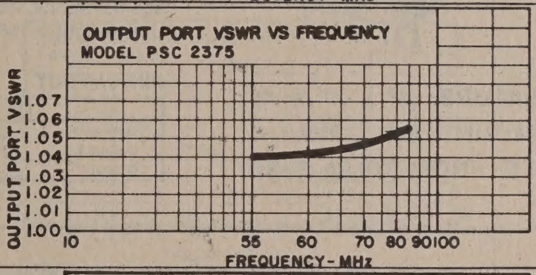


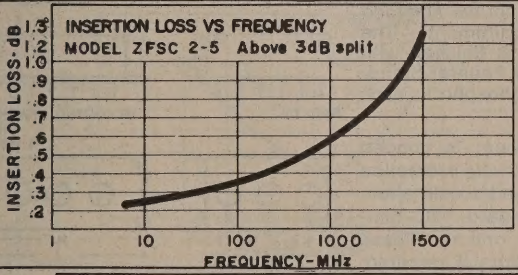


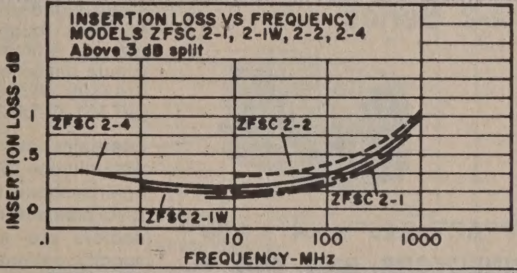


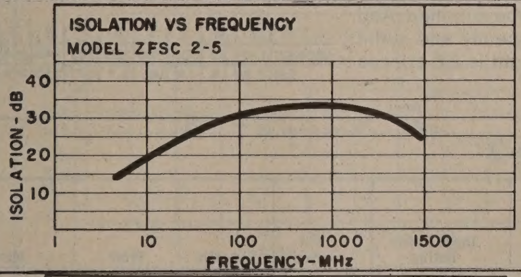


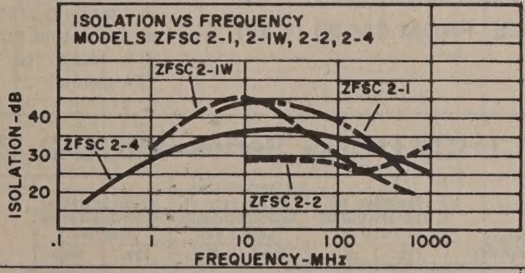


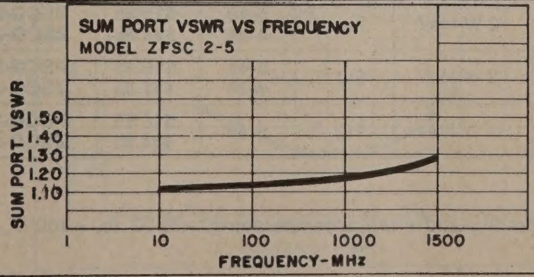


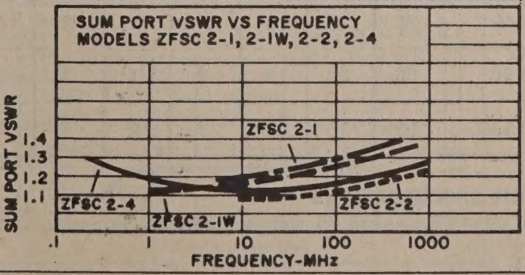












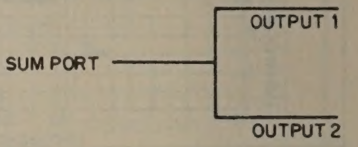
Mini-Circuits MCL Laboratory

POWER SPLITTER-COMBINERS Two-Way—90°

These 90° out-of-phase two-way power/splitter combiners are high performance broad band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. The signals are 90° out of phase at the output ports and are equally divided derivatives of the signal at the S port. Signals fed into ports 1 and 2 are vectorially summed at the output S port.

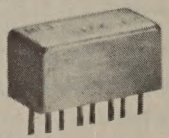
The units feature exceptionally good amplitude and phase relationship precision between the signals at the 2 output ports. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

Ruggedly constructed to provide reliable service under severe environmental conditions. Internally, every component is banded to the header for added strength to protect against shock and vibration.



Case Style

PSCQ-2 Series



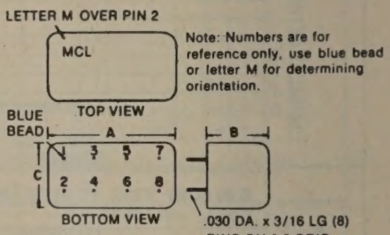
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: 0.2″ GRID**
- **PRICE: FROM $19.95 (5-49)**

Havings a volume of only .128 cu. inches, this package has an RFI shielded metal enclosure and hermetically sealed header. The PC pins are oriented on a 0.2 inch grid.

Internally, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration. Unit weight is .18 ounces (5.2 grams).

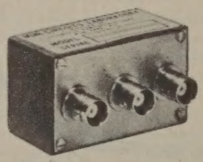
PIN LAYOUT

	Fig. 7		Fig. 7
SUM Port Output 1 Output 2	1 2 5	Ground Terminate with 50Ω	3,4,7,8 6


LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
TOP VIEW
BLUE BEAD
A
B
C
1 3 5 7
2 4 6 8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

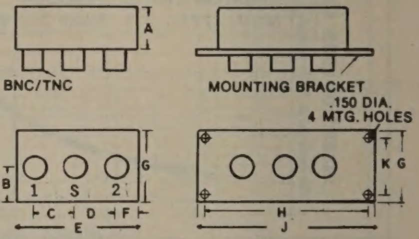
ZSCQ-2 Series



- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC, TNC**
- **PRICE: FROM $34.95 (4-24)**

This rugged package is double shielded to meet tough RFI requirements. The die-cast aluminum case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. BNC connectors are standard. TNC connectors are a no-cost option. Please specify optional connectors if required. A mounting bracket can be supplied. Add $1.50 to unit price. To specify add suffix B to Model No. Unit weight is 2.6 ounces (74 grams).



	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

SPECIFICATIONS Series PSCQ-2, ZSCQ-2

Frequency Range (MHz)	Isolation, dB Between Output 1 and 2		Insertion Loss, dB (Average of Coupled Outputs Less 3 dB)		Phase Deviation From Quadrature Degrees		VSWR	Input Power Rating	Pin Layout	Quantity	Price	Model No.
	Typ.	Min.	Typ.	Max.	Typ.	Max.						
25-50	30	20	.3	.7	1	3	1.2 Typ.	2 W Max.	Fig. 7	5-49 4-24	$19.95 $34.95	PSCQ-2-50 ZSCQ-2-50
55-90	30	20	.3	.7	1	3	1.2 Typ.	2 W Max.	Fig. 7	5-49 4-24	$19.95 $34.95	PSCQ-2-90 ZSCQ-2-90
120-180	23	15	.3	.7	2	4	1.35 Typ.	2 W Max.	Fig. 7	5-49	$19.95 $34.95	PSCQ-2-180 ZSCQ-2-180

COMMON SPECIFICATIONS

Internal Load Dissipation: ⅛ watt. Impedance, all ports: 50 ohms. Operating and storage temperature: −55°C to +100°C.

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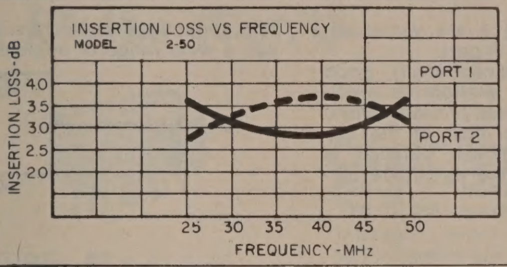
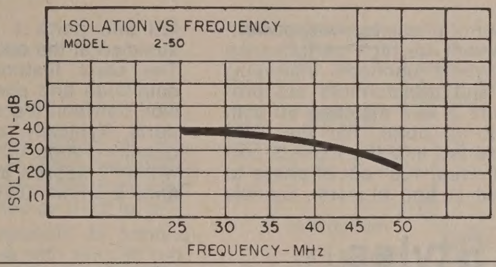
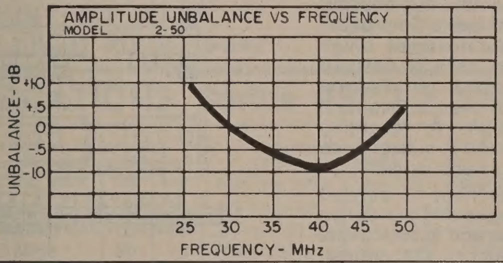
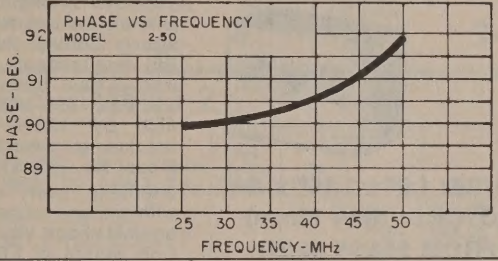
Mini-Circuits Laboratory MCL

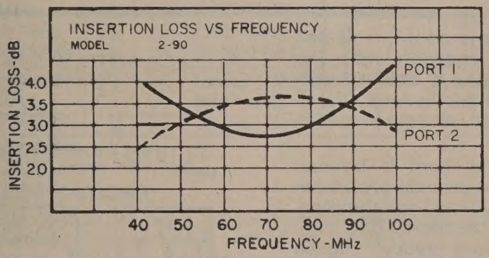
POWER SPLITTER-COMBINERS Series PSCQ-2, ZSCQ-2 (Con't)

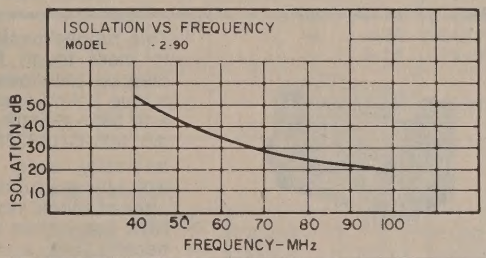


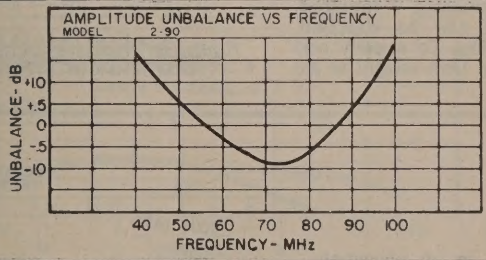


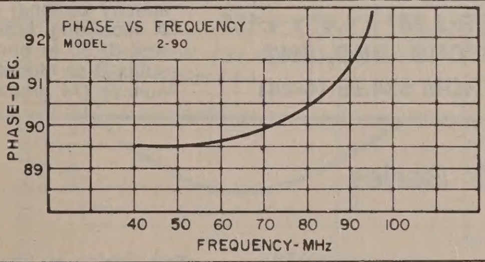


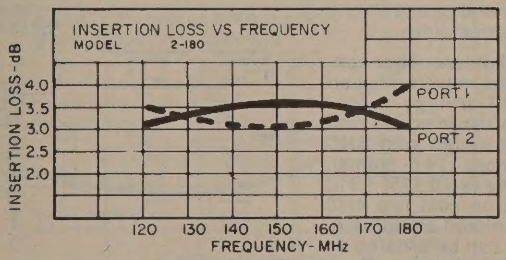


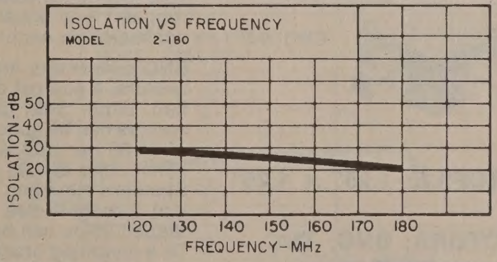


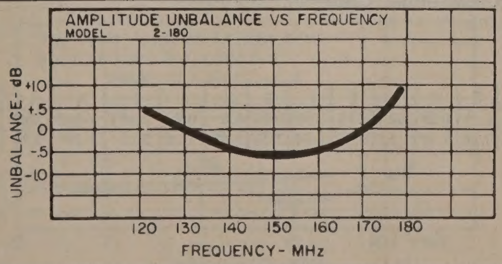


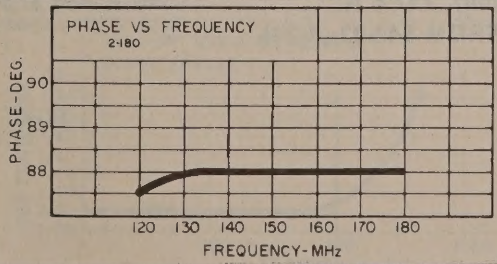












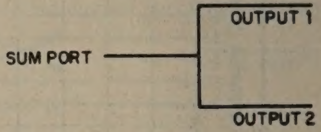
Mini-Circuits Laboratory
MCL

POWER SPLITTER-COMBINERS
Two-Way—180°

These 180° out-of-phase two-way power/splitter combiners are high performance broad band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. For the 180° models signals fed into the input S port are equally divided, 180° out of phase to the two output (1 and 2) ports. Signals fed into ports 1 and 2 are vectorially summed at the output S port.

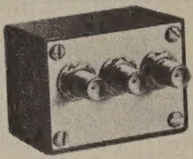
The units feature exceptionally good amplitude and phase relationship precision between the signals at the 2 output ports. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

Three package styles are available to suit a wide range of applications.



Case Styles

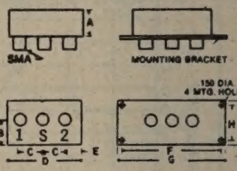
ZMSCJ-2 Series



- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $44.95 (4-24)**

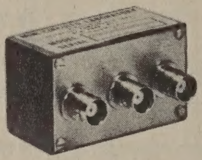
With SMA (3mm) connectors this housing is a die cast aluminum case. This package is double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. Unit weight is 1.02 ounces (34 grams).



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

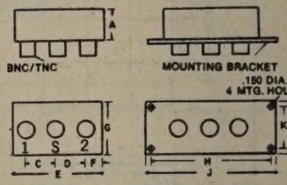
ZSCJ-2 Series



- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC, TNC**
- **PRICE: FROM $34.95 (4-24)**

This rugged package is double shielded to meet tough RFI requirements. The die-cast aluminum case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. BNC connectors are standard. TNC connectors are a no-cost option. Please specify optional connectors if required. A mounting bracket can be supplied. Add $1.50 to unit price. To specify add suffix B to Model No. Unit weight is 2.6 ounces (74 grams).



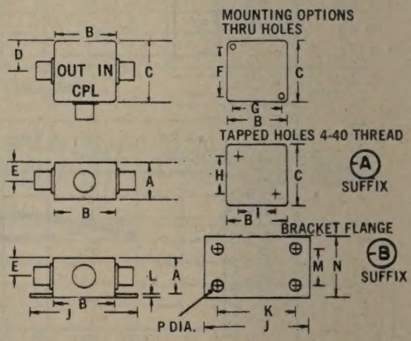
	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

ZFSCJ-2 Series

- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), TYPE N**
- **PRICE: FROM $49.93 (4-24)**

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors, a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams). Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8	0.8	2.188	1.688	.060	.75	1.25	.125
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03	2.03	5.56	4.29	0.15	1.91	3.18	.318

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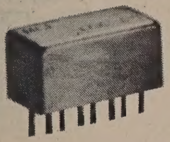
A DIVISION SCIENTIFIC COMPONENTS CORP. DOMESTIC TELEX 125460

Mini-Circuits MCL Laboratory

POWER SPLITTER-COMBINERS
Two-Way–180°

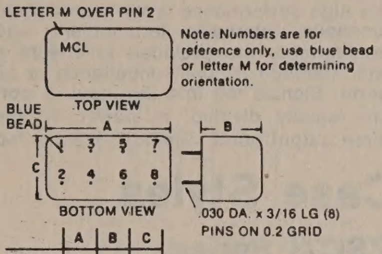
Case Styles (Con't)

PSCJ-2 Series



- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: 0.2″ GRID**
- **PRICE: FROM $19.95 (5-24)**

Having a volume of only .128 cu. in., this package has an RFI shielded metal enclosure and hermetically sealed header. The PC pins are oriented on a 0.2 in. grid. Internally, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration. Unit weight is .18 ounces (5.2 grams).



Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

SPECIFICATIONS Series PSCJ-2, ZSCJ-2, ZMSCJ-2

Freq. Range (MHz)	Isolation, dB Between Outputs 1 and 2			Insertion Loss, dB (Above 3 dB Split)			Phase Deviation Degrees From 180°			VSWR (Typ.)	Match Power Rating (Watts)	Pin Layout	Quantity	Price	Model No.
	Over Freq. Band	Typ.	Min.	Over Freq. Band	Typ.	Max.	Over Freq. Band	Typ.	Max.						
.01-20	.05-2 MHz	40	30	.05-10 MHz	.2	.5	.01-10 MHz	1.0	2.0	1.2	1	Fig. 8	5-24	$29.95	PSCJ-2-2
	.01-5 MHz	35	25	.01-.05 MHz	.3	.8	10-20 MHz	1.0	2.5			—	4-24	$44.95	ZSCJ-2-2
	5-20 MHz	25	18	10-20 MHz	.3	.6						—	4-24	$54.95	ZMSC-J-2-2
1-200	1-50 MHz	40	30	1-5 MHz	.75	1.0	1-50 MHz	1.0	2.5	1.2	1	Fig. 8	5-24	$19.95	PSCJ-2-1
	50-150 MHz	35	25	5-50 MHz	.6	.8	50-200 MHz	2.0	4.0			—	4-24	$34.95	ZSCJ-2-1
	150-200 MHz	30	23	50-200 MHz	.75	1.2						—	4-24	$44.95	ZMSCJ-2-1
1-500	Lower band†	30	20	Lower band†	.7	1.2	Lower band†	.5	2.0	1.2	1	—	4-24	$49.95	ZFSCJ-2-1
	Mid band	33	25	Mid band	.7	1.1	Mid band	.5	2.0						
	Upper band*	30	20	Upper band*	.8	1.3	Upper band*	2.0	6.0						

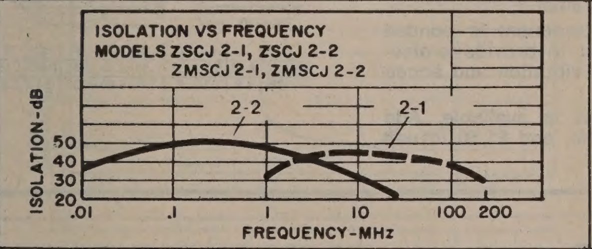
† Lower band edge to one decade higher
* Upper band edge to one octave lower

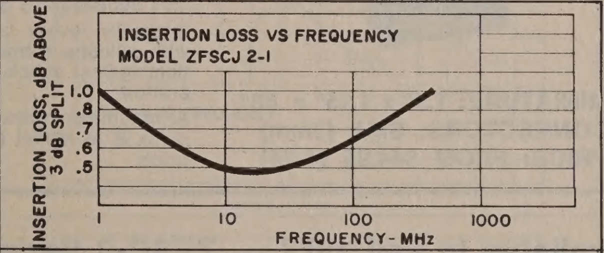
COMMON SPECIFICATIONS

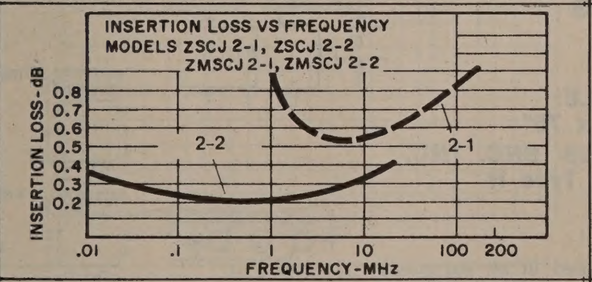
Internal load dissipation: ⅛ watt. Impedance, all ports: 50 ohm. Operating and storage temperature: −55°C to +100°C.

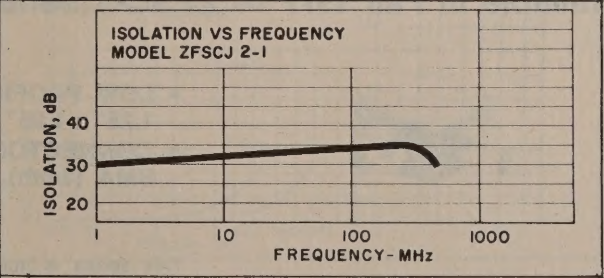
PIN LAYOUT

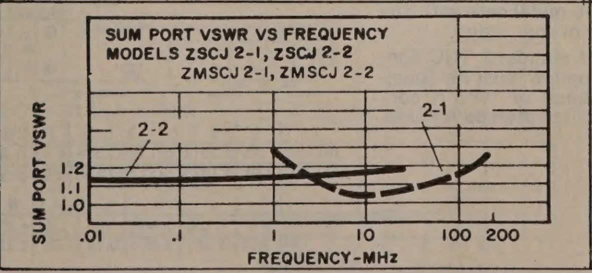
	Fig. 7		Fig. 7		Fig. 7
SUM Port Output 1	1 2	Output 2 Ground	5 3,4,7,8	Terminate with 50Ω	6

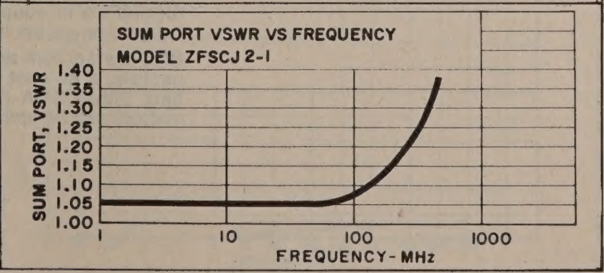












Mini-Circuits Laboratory

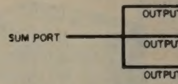
MCL

POWER SPLITTER-COMBINERS
Three-Way—0°

These 3-way 0° power divider/combiners are high performance broad band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in power, to the three output ports. Similarly, signals fed the ports 1, 2, 3 are vectorially summed at the S port.

The units feature exceptionally good amplitude and phase balance between the signals at the output ports. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

These 3-way units are offered at a remarkable price of ½ to ⅓ of competitive units. A choice of packaging styles is available.



Case Styles

ZSC-3 Series

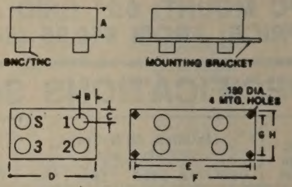
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $34.95 (4-24)**

This rugged package is double-shielded to meet tough RFI requirements. BNC connectors are standard. TNC connectors are a no-cost option. Please specify on order.

The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.9 ounces (81 grams).

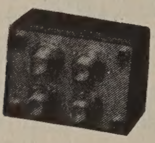
Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.



	A	B	C	D	E	F	G	H
INCHES	1.15	.781	.346	2.25	2.95	3.25	1.10	1.40
CM	2.9	1.98	.876	5.7	7.5	8.3	2.79	3.55

ZMSC-3 Series

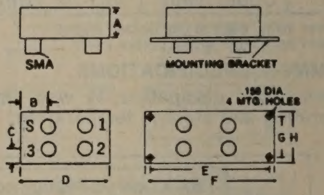


- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $44.95 (4-24)**

With SMA (3mm) connectors the housing is a die-cast aluminum case. The package is double-shielded to meet tough RFI requirements. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.04 ounces (40.5 grams).

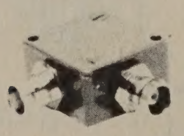
Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.



	A	B	C	D	E	F	G	H
INCHES	0.88	0.5	.315	1.50	2.19	2.50	0.84	1.15
CM	2.2	1.3	.8	3.8	5.56	6.35	2.1	2.9

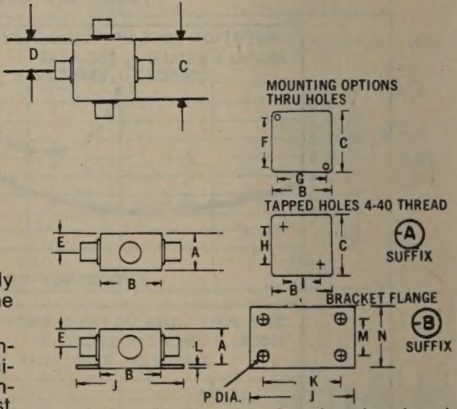
Available in Fall 1977 — ZFSC-3 Series



- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), Type N**

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of four sides.

BNC connectors are standard. TNC connectors, a no-cost option must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost.



	A	B	C	D	E	F	G	H
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03

	I	J	K	L	M	N	P
INCHES	0.8	2.188	1.688	.060	.75	1.25	.125
CM	2.03	5.56	4.29	0.15	1.91	3.18	.318

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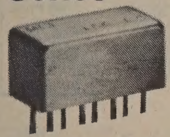
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

POWER SPLITTER-COMBINERS
Three-Way—0°

Case Styles (Con't)

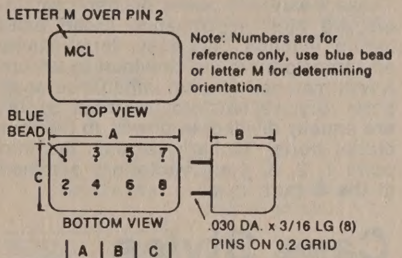
PSC-3 Series



- **MINIATURE: .8" x .4" x .4"**
- **PC MOUNT: 0.2" GRID**
- **PRICE: FROM $19.95 (5-49)**

Having a volume of only .128 cu. inch, this package has an RFI shielded metal enclosure with a hermetically sealed header. PC pins are oriented on a 0.2" grid. Unit weight is .18 ounces (5.2 grams).

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.



Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

SPECIFICATIONS Series PSC-3, ZSC-3, ZMSC-3

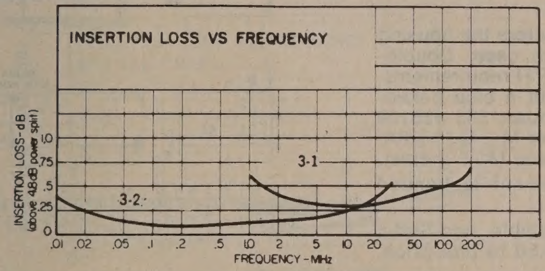
Model No.	Frequency Range MHz	Isolation (dB) Between Outputs 1, 2, and 3				Insertion Loss dB (Above 4.8 dB Split)						VSWR	Match Power Rating	Pin Layout	Quantity	Price
PSC-3-1		1-50 MHz		50-200 MHz		3-30 MHz		1.5-100 MHz		1-200 MHz				Fig. 9	6-49	$19.95
ZSC-3-1	1-200	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	1.1 Typ.	1 W Max.		4-24	$34.95
ZMSC-3-1		45	30	40	25	.3	.5	.4	.7	.6	1.0				4-24	$44.95
PSC-3-2		.01-5 MHz		5-30 MHz		.05-5 MHz		.01-15 MHz		15-30 MHz				Fig. 9	6-49	$29.95
ZSC-3-2	.01-30	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	1.1 Typ.	1 W Max.		4-24	$44.95
ZMSC-3-2		45	35	40	30	.15	.3	.25	.45	.45	.75				4-24	$54.95

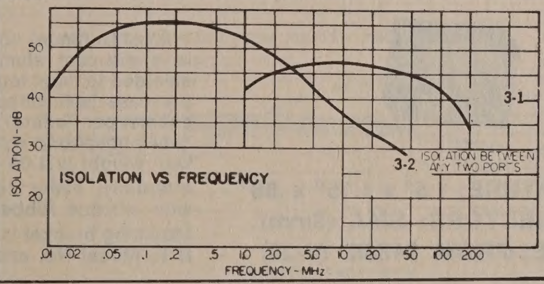
COMMON SPECIFICATIONS

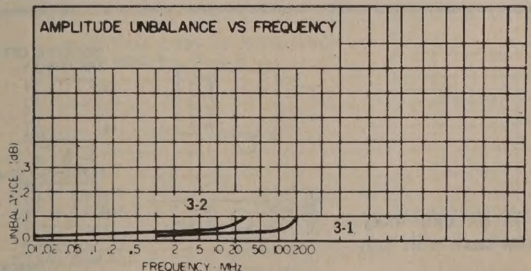
VSWR: 1.1 typ. Matched Power Rating: 1 watt max. Internal Load Dissipation: ⅜ watt. Impedance, All Ports: 50 ohms. Operating and Storage Temperature: −55°C to +100°C.

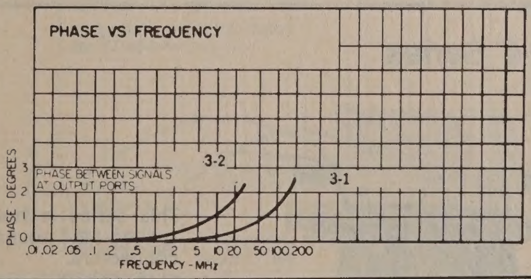
PIN LAYOUT

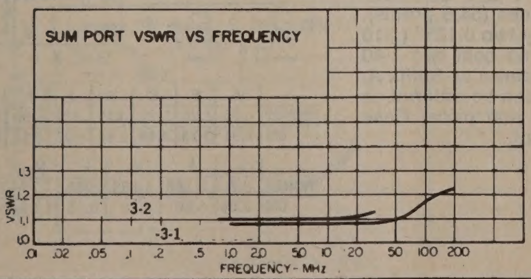
	Fig. 9		Fig. 9
SUM Port	6	Output 3	5
Output 1	1	Ground	3, 4, 7, 8
Output 2	2		

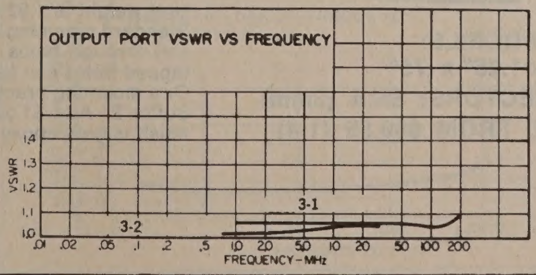










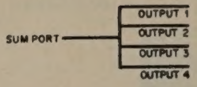


Mini-Circuits Laboratory MCL

POWER SPLITTER-COMBINERS Four-Way—0°

These 4-way, 0°, power divider/combiners are high performance broad band hybrid junction. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in power, to the four output ports. Similarly, signals fed into ports 1, 2, 3, 4 are vectorially summed at the S port.

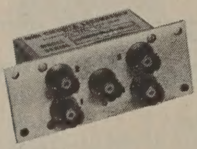
The units feature exceptionally good amplitude and phase balance between the signals at the output ports. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.
These 4-way units are offered at a remarkable price ½ to ⅓ of competitive units. A choice of packaging styles is available.



	Pins Fig. 10
SUM Port	4
Output 1	7
Output 2	8
Output 3	1
Output 4	2
Ground	3, 5, 6

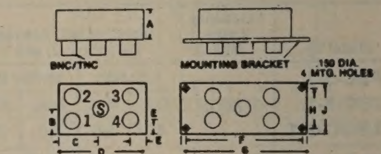
Case Styles

ZSC-4 Series



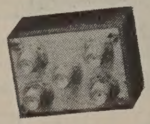
- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $38.95 (4-24)**

This rugged package is double-shielded to meet tough RFI requirements. BNC connectors are standard. TNC connectors are a no-cost option. Please specify on order.
The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 3.0 ounces (85 grams).
Internally, every component is bonded with silicone rubber.
A mounting bracket is available. Add Suffix B to Model No. and $1.50 to unit price. Photo shows unit with bracket.



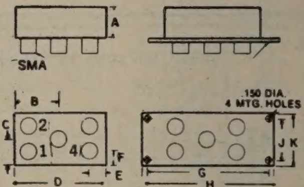
	A	B	C	D	E	F	G	H	J
INCHES	1.15	.70	1.125	2.25	.405	2.95	3.25	1.10	1.40
CM	2.9	1.8	2.85	5.7	1.03	7.49	6.25	2.79	3.55

ZMSC-4 Series



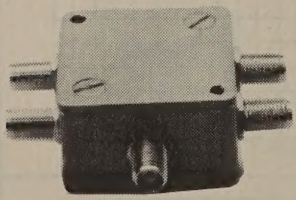
- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $48.95 (4-24)**

With SMA (3mm) connectors the housing is a die-cast aluminum case. Double-shielded to meet tough RFI requirements, the case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.04 ounces (40.5 grams).
Internally, every component is bonded with silicone rubber.
Mounting bracket is available. Add Suffix B to Model No. and $1.50 to unit price.



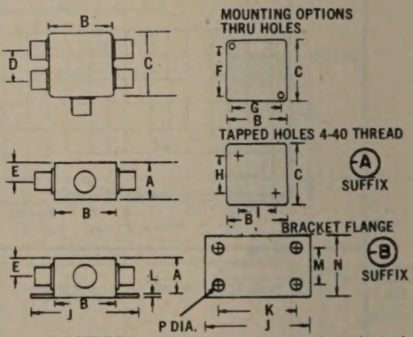
	A	B	C	D	E	F	G	H	J	K
INCHES	0.88	0.75	.575	1.50	.313	.315	2.19	2.50	.84	1.15
CM	2.2	1.9	1.46	3.8	.795	.8	5.56	6.35	2.1	2.9

ZFSC-4 Series



- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $89.95 (1-4)**

This series is housed in an extremely rugged 1¼″ square metal case with four connectors.
SMA (3mm) connectors are standard. Unit weight is 1.92 ounces (54.5 grams). Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.



	A	B	C	D	E	F	G	H
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03

	I	J	K	L	M	N	P
INCHES	0.8	2.188	1.688	.060	.75	1.25	.125
CM	2.03	5.56	4.29	0.15	1.91	3.18	.318

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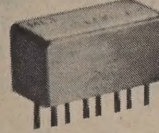
POWER SPLITTER-COMBINERS Four-Way—0°

Case Styles

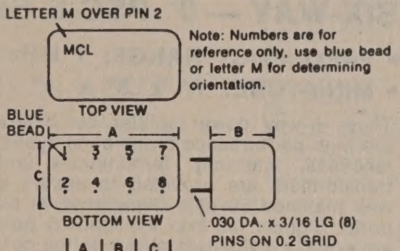
PSC-4 Series



- MINIATURE: .8″ x .4″ x .4″
- PC MOUNT: 0.2″ GRID
- PRICE: FROM $23.95 (6-49)

Having a volume of only .128 cu. in., this package has an RFI shielded metal enclosure with a hermetically sealed header. PC pins are oriented on a 0.2″ grid. Unit weight is .18 ounces (5.2 grams).

Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.



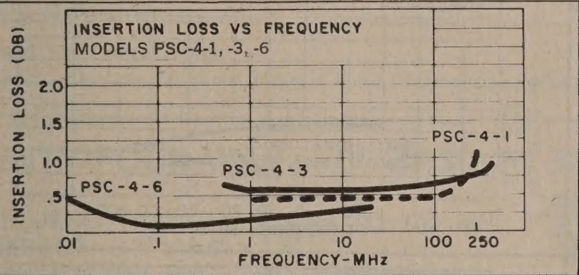
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

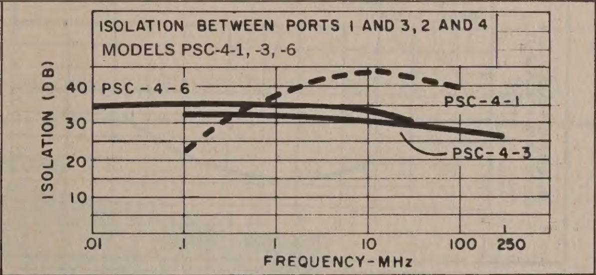
	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

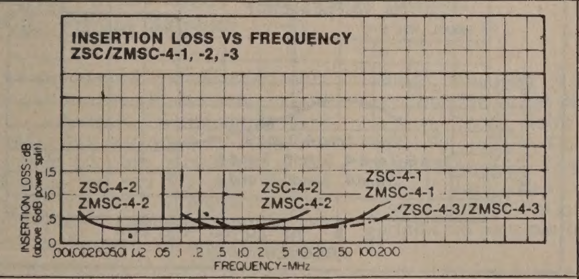
SPECIFICATIONS Series PSC-4, ZSC-4, ZMSC-4, ZFSC-4

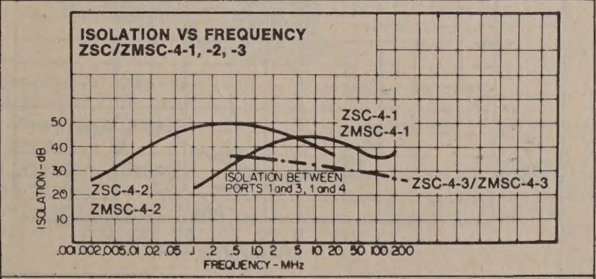
Frequency Range MHz	Isolation, dB Between Outputs 1-3, 4 and 2-3, 4			Insertion Loss (Above 6 dB Split)			VSWR (Typ.)	Match Power Rating (Watt)	Pin Layout	Quantity	Price	Model No.
	Over Freq. Band	Typ.	Min.	Over Freq. Band	Typ.	Max.						
.002-20	.002-.01 MHz .01-4 MHz 4-20 MHz	30 45 40	20 35 30	.002-.005 MHz .005-1 MHz 1-20 MHz	.45 .3 .7	.75 .5 1.0	1.2	1	— —	4-24 4-24	$64.95 $74.95	ZSC-4-2 ZMSC-4-2
.01-40	.01-5 MHz .5-20 MHz 20-40 MHz	35 32 28	28 25 22	.01-.02 MHz .02-20 MHz 20-40 MHz	.8 .5 .5	.3 .5 1.0	1.2	1	Fig. 10	6-49	$29.95	PSC-4-6
1-200	1-10 MHz 10-100 MHz 100-200 MHz	30 35 30	20 30 20	1-10 MHz 10-100 MHz 100-200 MHz	.4 .5 .7	.7 .8 1.2	1.2	1	Fig. 10	6-49	$24.95	PSC-4-1-75
.1-200	1-10 MHz 10-100 MHz 100-200 MHz	35 40 40	20 30 30	.1-10 MHz 10-100 MHz 100-200 MHz	.4 .5 .7	.6 .75 1.0	1.2	1	Fig. 10 — —	6-49 4-24 4-24	$28.95 $41.95 $51.95	PSC-4-1 ZSC-4-1 ZMSC-4-1
.250-250	.25-10 MHz 10-50 MHz 50-250 MHz	35 40 40	20 30 20	.25-10 MHz 10-100 MHz 100-250 MHz	.4 .5 .7	.7 .75 1.2	1.1	1	Fig. 10 — —	6-49 4-24 4-24	$23.95 $38.95 $48-95	PSC-4-3 ZSC-4-3 ZMSC-4-3
1-1000	Lower band Mid range Upper band	40 30 26	30 20 15	Lower band Mid range Upper band	.4 .6 1.6	.8 1.5 2.0	1.2	1	—	1-4	$89.95	ZFSC-4-1

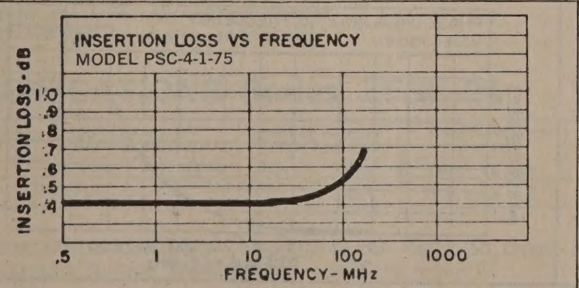
COMMON SPECIFICATIONS Matched Power Rating: 1 watt max. Internal Load Dissipation: ⅜ watt. Impedance, All Ports: 50 ohms. Operating and Storage Temperature: −55°C to +100°C.

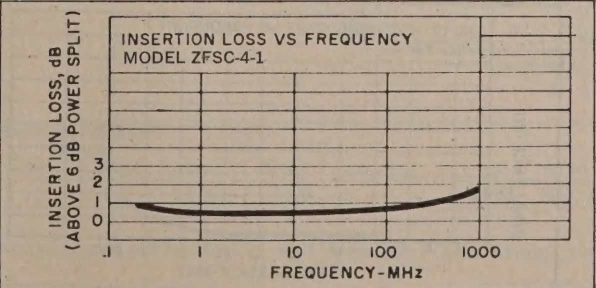












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Laboratory

POWER SPLITTER-COMBINERS
Six-Way

SIX-WAY — 0° PSC-6 Series

- **FREQUENCY RANGE: 1 MHz TO 175 MHz**
- **MINIATURE: .8″ x .8″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $59.95 (1-5)**

These 6-way power splitter/combiners are high performance broad-band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the output ports. Similarly, signals fed into the output ports are vectorially summed at the S port.

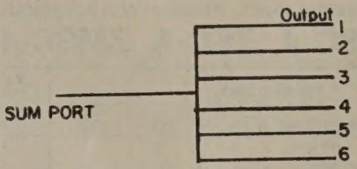
These hermetically sealed units perform well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

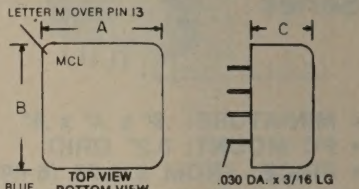
Unit weight is .27 ounces (9 grams).

PIN LAYOUT

	Fig. 11		Fig. 11
SUM Port	1	Output 4	12
Output 1	3	Output 5	16
Output 2	4	Output 6	15
Output 3	8	Case Ground	2,5,7,11,13,14

Do not make any connections to pins 6, 9, 10





.030 DA. x 3/16 LG
PINS ON 0.2 GRID

Note: Numbers are for reference only, use blue bead for determining orientation.

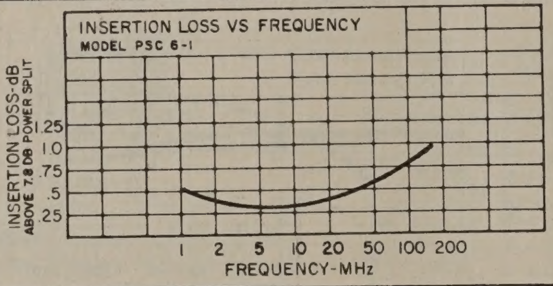
	A	B	C
INCHES	.8	.8	.4
CM	2	2	1

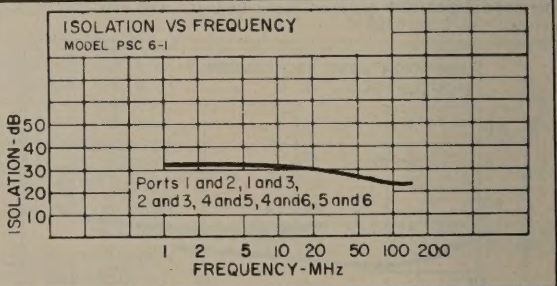
SPECIFICATIONS Series PSC-6

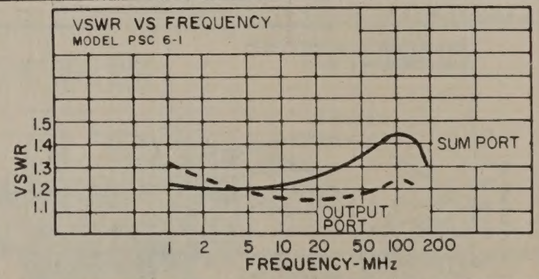
Frequency Range MHz	Isolation, dB Between Output 1 and 2, 1 and 3, 2 and 3, 4 and 5, 4 and 6, 5 and 6			Isolation, dB Between Output 1 and 4, 1 and 5, 1 and 6, 2 and 4, 2 and 5, 2 and 6, 3 and 4, 3 and 5, 3 and 6			Insertion Loss, dB (Above 7.8 dB Split)			VSWR	Match Power Rating	Pin Layout	Quantity	Price	Model No.
	Over Freq. Band	Typ.	Min.	Over Freq. Band	Typ.	Min.	Over Freq. Band	Typ.	Max.						
1-175	1-50 MHz 50-175 MHz	30 26	24 18	1-50 MHz 50-175 MHz	45 33	30 25	1-50 MHz 50-175 MHz	.4 .75	.7 1.2	1.2 Typ.	1 W Max.	Fig. 11	**1-5**	**$59.95**	**PSC-6-1**

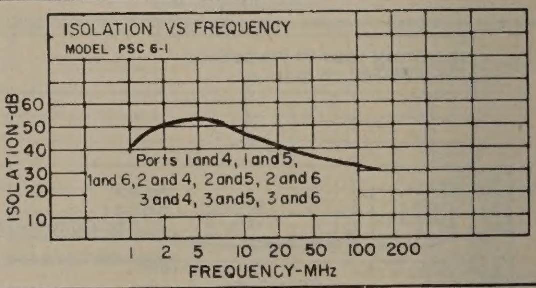
COMMON SPECIFICATIONS

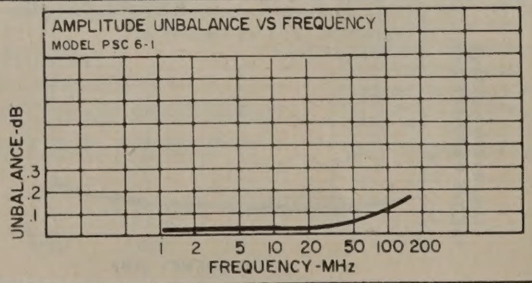
Impedance, all ports: 50 ohms. Internal Load Dissipation: ⅞ watt. Operating and Storage Temperature: −55°C to +100°C. Pin Temp. (10 secs.): 510°F.

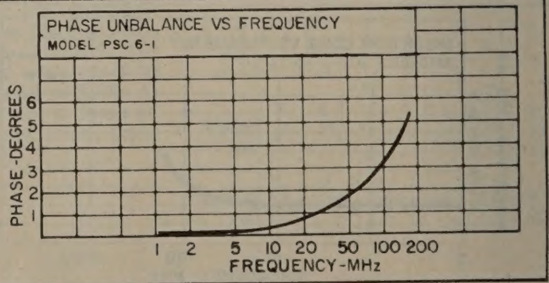












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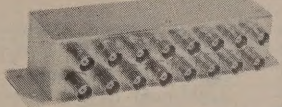
DOMESTIC TELEX 125460

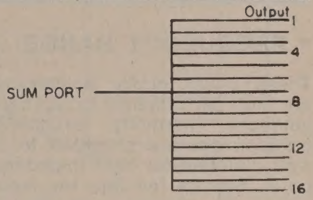
Mini-Circuits Laboratory MCL

POWER SPLITTER-COMBINERS
Sixteen-Way and Twenty-Four-Way

SIXTEEN-WAY — 0° ZFSC-16 Series

- **FREQUENCY RANGE: .5 MHz TO 125 MHz**
- **COMPACT: 6.7″ x 1.6″ x 1.5″**
- **CONNECTORS: BNC, TNC, SMA (3mm)**
- **PRICE: FROM $174.95 (1-4)**



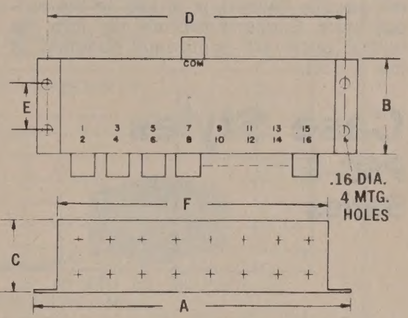


These 16-way power splitter/combiners are high performance broad-band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the sixteen output ports. Similarly signals fed into ports 1, through 16 are vectorially summed at the output S Port.

Housed in an extremely rugged metal case to withstand severe mechanical stress, mounting is simple and convenient with the flange design. The units have a grey epoxy paint finish. Unit weight is 16.22 ounces (459.15 grams).

BNC connectors are standard. Specify TNC if required as a no-cost option. SMA (3mm) connectors can be specified at an additional cost per unit of $15.00.

	A	B	C	D	E	F
Inches	6.688	1.609	1.5	6.22	0.88	5.75
CM	16.99	4.09	3.81	15.8	2.24	14.61



SPECIFICATIONS Series ZFSC-16

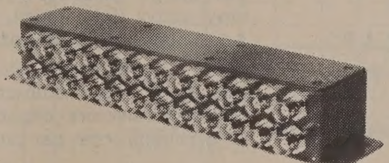
Frequency Range MHz	Isolation, dB Between Output 1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10, 11 and 12, 13 and 14, 15 and 16			Isolation, dB Between Output 1 and 3, 4; 3 and 1, 2; 5 and 7, 8; 7 and 5, 6; 9 and 11, 12; 11 and 9, 10; 13 and 15, 16; 15 and 13, 14			Isolation, dB Between Output 1, or 2, or 3, or 4, to 5, or 6, or 7, or 8 and 9 or 10, or 11, 12 to 13 or 14 or 15, or 16			Isolation, dB Between Output 1, or 2, or 3, or 4, or 5, or 6, or 7, or 8 to 9 or 10, or 11, or 12 or 13, or 14, or 15, or 16			Insertion Loss, dB (Above 12 dB Split)			Phase Unbalance, Degrees			VSWR (Typ.)	Match Power Rating (Watts)	Quantity	Price	Model No.
	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.					
5-125	.5-25 25-75 100-125	35 28 24	28 22 18	.5-25 25-75 100-125	30 25 20	24 18 15	.5-25 25-125	40 40	35 30	.5-25 25-75 75-125	55 50 45	40 40 35	.5-25 25-75 75-125	.5 .8 1.0	.8 1.2 1.6	.5-50 50-125	1.0 3.0	3.0 6.0	SUM Port 1.5 Outputs 1.2	1	1-4	$174.95	ZFSC-16-1

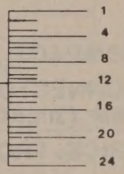
COMMON SPECIFICATIONS

Impedance, all ports: 50 ohms. Internal Load Dissipation: 1 watt. Operating and Storage Temperature: −55°C to +100°C.

TWENTY-FOUR-WAY — 0° ZFSC-24 Series

- **FREQUENCY RANGE: .2 MHz TO 100 MHz**
- **COMPACT: 6.7″ x 1.6″ x 1.5″**
- **CONNECTORS: BNC, TNC, SMA (3mm)**
- **PRICE: FROM $264.95 (1-4)**

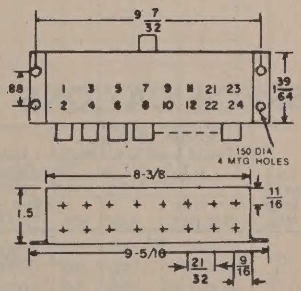




These 24-way power splitter/combiners are high performance broad-band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the 24 output ports. Similarly signals fed into ports 1, through 24 are vectorially summed at the output S port.

Housed in an extremely rugged metal case to withstand severe mechanical stress, mounting is simple and convenient with the flange design. The units have a grey epoxy paint finish. Unit weight is 21.86 ounces (620 grams).

BNC connectors are standard. Specify TNC if required as a no-cost option. SMA (3mm) connectors can be specified at an additional cost per unit of $25.00.



SPECIFICATIONS Series ZFSC-24

Frequency Range MHz	Insertion Loss, dB (above 13.8 dB split)			Isolation Between Output Ports, dB		Phase Unbalance Degrees		Amplitude Unbalance Degrees		VSWR Port		Quantity	Price	Model No.
	Freq. Band	Typ.	Max.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Sum	Output			
.2-100	.2-100 MHz	1	2	25	20	2.0	5.0	0.2	0.5	1.5 typ.	1.2 typ.	1-4	$264.95	ZFSC-24-1

COMMON SPECIFICATIONS Impedance, All Ports: 50 ohms. Internal Load Dissipation: 1 watt. Matched Power Rating: 1 watt. Operating and Storage Temperature: −55°C to +100°C.

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Mini-Circuits Laboratory
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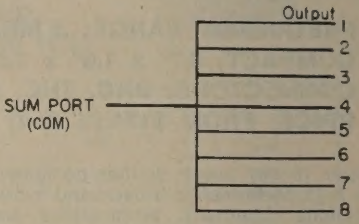
POWER SPLITTER-COMBINERS
Eight-Way—0°

• FREQUENCY RANGE: .5 MHz TO 175 MHz

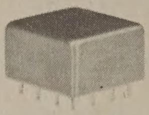
These 8-way power splitter/combiners are high performance broad-band hybrid junctions. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the output ports. Similarly, signals fed into the output ports are vectorially summed at the S port.

Feaured are exceptionally good amplitude and phase balance between the signals at the output ports. Typically over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB. These high performance units are offered at a remarkable price of ½ to ⅓ the cost of competitive units.



Case Styles

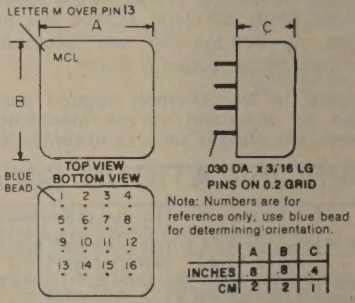
PSC-8 Series



- **MINIATURE: .8″ x .8″ x .4″**
- **PC MOUNT: 0.2″ GRID**
- **PRICE: FROM $59.95 (1-5)**

Ruggedly constructed to provide reliable service under severe environmental conditions, internally, every component is bonded to the header for added strength to protect against shock and vibration. These hermetically sealed units perform well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

Unit weight is .27 ounces (9 grams).



.030 DA. x 3/16 LG PINS ON 0.2 GRID

Note: Numbers are for reference only, use blue bead for determining orientation.

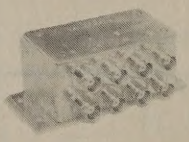
	A	B	C
INCHES	.8	.8	.4
CM	2	2	1

PIN LAYOUT

	Fig. 12		Fig. 12		Fig. 12
SUM Port	2	Output 4	13	Output 7	8
Output 1	1	Output 5	16	Output 8	4
Output 2	5	Output 6	12	Case Ground	3,6,7,14,15
Output 3	9				

Do not make any connections to pins 10, 11

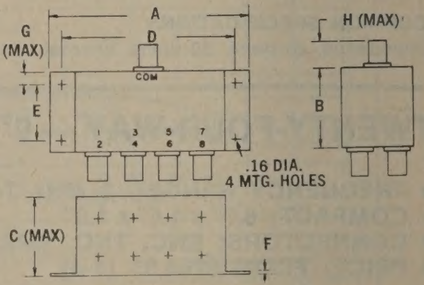
ZFSC-8 Series



- **COMPACT: 4″ x 1.6″ x 1.5″**
- **CONNECTORS: BNC, TNC, SMA (3mm)**
- **PRICE: FROM $89.95 (1-4)**

Housed in an extremely rugged metal case to withstand severe mechanical stress, mounting is simple and convenient with the flange design. The units have a grey epoxy paint finish. Unit weight is 9.5 ounces (269.34 grams).

BNC connectors are standard. Specify TNC if required as a no-cost option. SMA (3mm) connectors can be specified at an additional cost per unit of $15.00.



	A	B	C	D	E	F	G	H
INCHES	4.08	1.64	1.57	3.56	.88	.06	.45	.56
CM	10.36	4.17	3.99	9.04	2.24	.15	1.14	1.42

SPECIFICATIONS Series PSC-8/ZFSC-8

Frequency Range MHz	Isolation, dB Between Output 1 and 3, 4; 3 and 1, 2; 5 and 7, 8; 7 and 5, 6			Isolation, dB Between Output 1 and 2, 3 and 4, 5 and 6, 7 and 8			Isolation, dB Between Output 1, or 2, 3, or 4, to 5, or 6, 7, or 8			Insertion Loss, dB (Above 9 dB Split)			VSWR (Typ.)	Matched Power Rating (Watts)	Pin Layout	Quantity	Price	Model No.
	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Min.	Over Freq. Band MHz	Typ.	Max.						
.5-175	2-50 .5-100 100-175	40 30 25	30 20 18	2-50 .5-100 100-175	35 30 23	28 20 18	1-50 .5-100 100-175	45 40 40	35 30 30	1-50 .5-100 100-175	.6 .8 1.0	1.0 1.2 1.6	1.25	1	Fig. 12	**1-5**	**$59.95**	**PSC-8-1**
.5-175	.5-50 50-100 100-175	35 28 25	27 23 20	5-20 20-100 100-175	35 25 22	28 20 18	.5-100 100-175	43 38	35 30	1-50 .5-100 100-175	.5 .6 .8	.8 1.0 1.2	1.25	1	—	**1-4**	**$89.95**	**ZFSC-8-1**

COMMON SPECIFICATIONS

Impedance, all ports: 50 ohms. Internal Load Dissipation: ⅝ watt.
Operating and Storage Temperature: −55°C to +100°C. Pin Temperature (PSC-8): 510°F.

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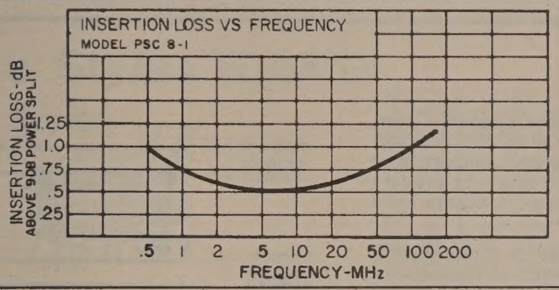
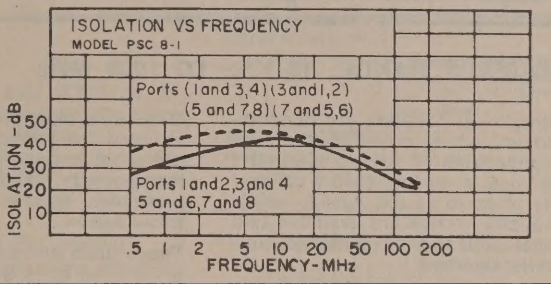
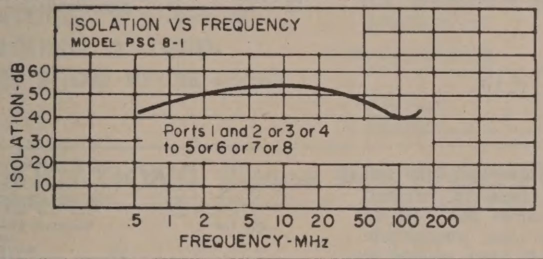
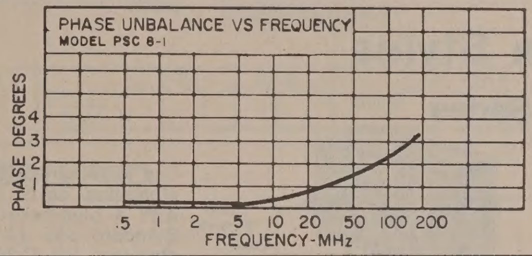
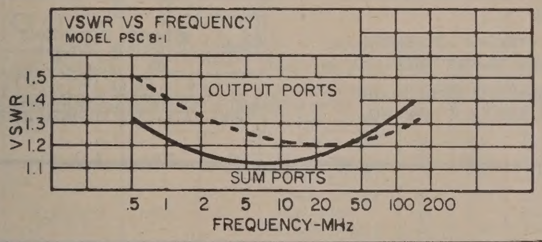
POWER SPLITTER-COMBINERS Series PSC-8, ZFSC-8 (Con't)

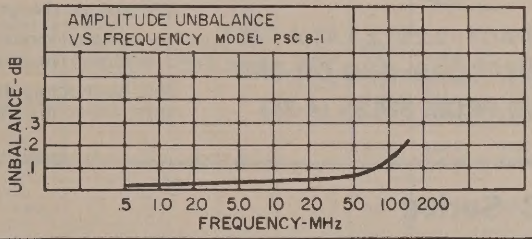


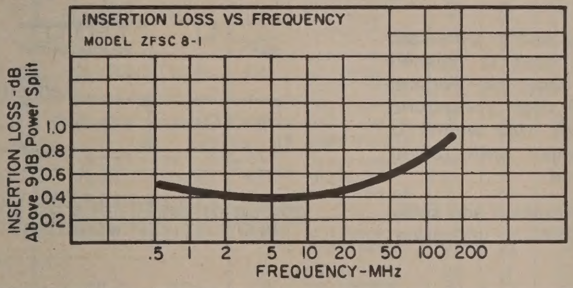


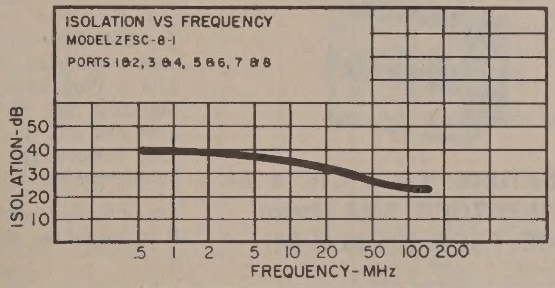


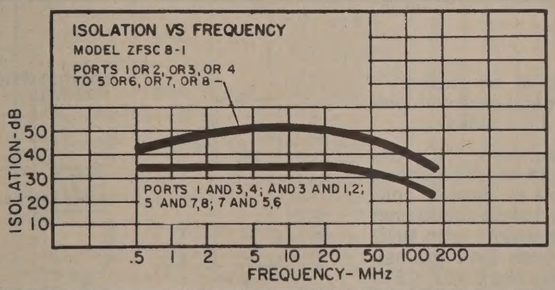


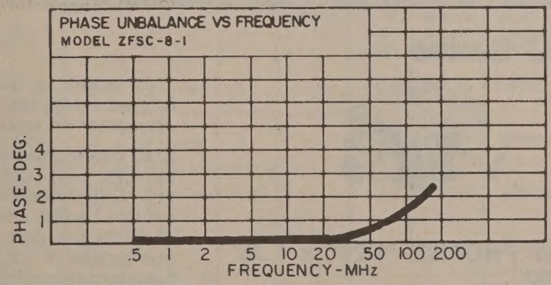


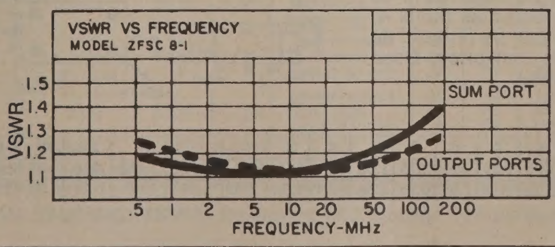


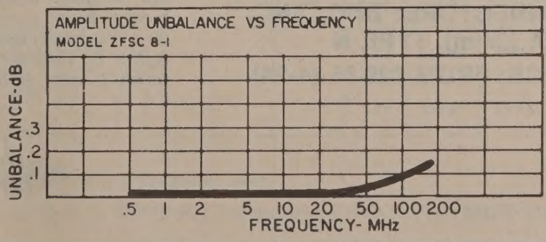












Mini-Circuits MCL Laboratory

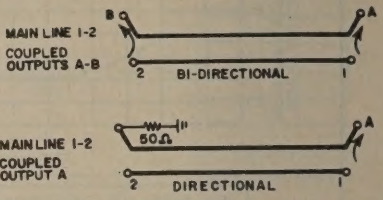
DIRECTIONAL COUPLERS

- **FREQUENCY RANGE: 10 KHz TO 1000 MHz**

These directional couplers are economically priced while covering the frequency range from 10 KHz to 1000 MHz Main-line loss is as low as 0.1 dB and directivity of up to 35 dB. A wide selection of coupling ratios are available and exceptional unit to unit matched performance is standard.

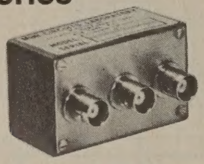
Only well matched and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

These units are offered at a remarkable price of ⅓ to ⅕ the cost of competitive units.


B
A
MAIN LINE 1-2
COUPLED OUTPUTS A-B
2
BI-DIRECTIONAL
1
A
50Ω
MAIN LINE 1-2
COUPLED OUTPUT A
2
DIRECTIONAL
1

Case Styles

ZDC Series

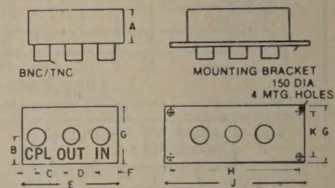


- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $26.95 (4-24)**

The ZDC series is housed in a die-cast aluminum case. The case is finished with a blue-baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

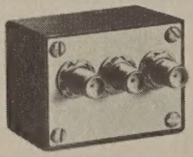
For optional mounting bracket add suffix B to Model No. and $1.50 to unit price.

BNC connectors are standard. Specify on order no-cost optional TNC's if needed.


A
BNC/TNC
MOUNTING BRACKET
.150 DIA
4 MTG. HOLES
B
CPL OUT IN
G
C
D
F
E
K G
H
J

	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

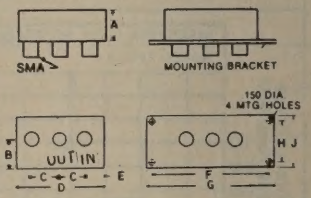
ZMDC Series



- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $36.95 (4-24)**

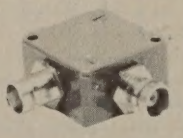
The ZMDC series is housed in a die-cast aluminum case. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams). SMA (3mm) connectors are supplied.

For optional mounting bracket add suffix B to Model No. and $1.50 to unit price.


A
SMA
MOUNTING BRACKET
.150 DIA
4 MTG. HOLES
B
OUT IN
C
C
E
D
H J
F
G

	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

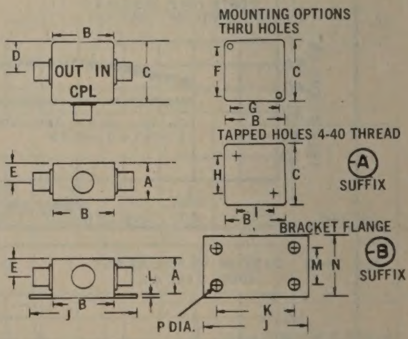
ZFDC Series



- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), TYPE N**
- **PRICE: FROM $29.95 (4-24)**

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors, a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams). Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.


MOUNTING OPTIONS
THRU HOLES
B
D
OUT IN
CPL
C
F
C
G
B
TAPPED HOLES 4-40 THREAD
E
A
H
C
A
SUFFIX
B
B
BRACKET FLANGE
E
L
A
M
N
B
SUFFIX
B
J
P DIA.
K
J

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8	0.8	2.188	1.688	.060	.75	1.25	.125
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03	2.03	5.56	4.29	0.15	1.91	3.18	.318

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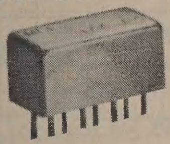
DOMESTIC TELEX 125460

Mini-Circuits
MCL
Laboratory

DIRECTIONAL COUPLERS

Case Styles (Con't)

PDC Series

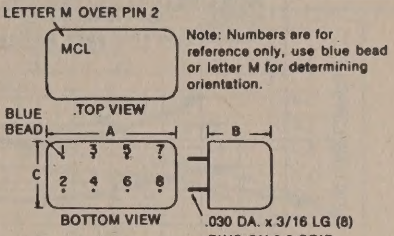


- MINIATURE: .8″ x .4″ x .4″
- PC MOUNT: .2″ GRID
- PRICE: FROM $11.95 (5-49)

Having a volume of only 0.128 cu. in., the PDC Series is offered at the lowest prices available in the industry.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, these high performance units have their pins oriented on a 0.2 in. grid. Unit weight is .18 ounces (5.2 grams).

The PDC Series uses the same construction technology as the SRA double-balanced mixer.


LETTER M OVER PIN 2
MCL
Note: Numbers are for reference only, use blue bead or letter M for determining orientation.
.TOP VIEW
BLUE BEAD
A
B
C
1
3
5
7
2
4
6
8
BOTTOM VIEW
.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

PIN LAYOUTS

	Fig. 5	Fig. 6		Fig. 5	Fig. 6		Fig. 5	Fig. 6
Main Line 2	4	4	Couple A	3	3	Ground	2,5,7,8	2,5,7,8
Main Line 1	1	1	Couple B	—	6			

SPECIFICATIONS Series PDC/ZDC/ZMDC/ZFDC

Frequency Range MHz	Coupling, dB (Input to Coupled Port)	Coupling Flatness dB	VSWR (Typ.)	Directivity, dB			Main Line Loss, dB (Includes Theoretical Power Split Loss)			Input Power, W		Pin Layout	Quan-tity	Price	Model No.
				Over Freq. Band	Typ.	Min.	Over Freq. Band	Type.	Max.	Total Range	Lower Band Edge to One Decade Higher				
.01-35	15 ±0.5	±0.5	1.15	Lower range† Mid range Upper range†	38 35 28	30 25 20	One octave from band edge Total range	.2 .3	.4 .6	4	2	Fig. 5 — —	5-49 4-24 4-24	$19.95 $34.95 $44.95	PDC-15-6 ZDC-15-6 ZMDC-15-6
.02-50	14.5 ±0.5	±0.5	1.15	Lower range† Mid range Upper range†	35 35 28	30 25 20	One octave from band edge Total range	.2 .3	.4 .6	4	2	—	4-24 4-24	$35.95 $45.95	ZDC-15-6-75 ZMDC-15-6-75
.05-200	19.2 ±0.5	±0.5	1.1	Lower range† Mid range Upper range†	40 35 22	30 20 15	One octave from band edge Total range	.3 .4	.5 .6	4	—	Fig. 6	6-49	$ 9.95	PDC-10-1B*
.2-250	19.5 ±0.5	±0.5	1.2	Lower range† Mid range Upper range†	36 33 25	30 25 20	One octave from band edge Total range	.25 .35	.5 .6	4	1.5	Fig. 5 — —	5-49 4-24 4-24	$11.95 $26.95 $36.95	PDC-20-3 ZDC-20-3 ZMDC-20-3
0.5-500	11.5 ±0.5	±0.6	1.2	Lower range† Mid range Upper range†	32 32 22	25 25 15	One octave from band edge Total range	.65 .85	1.0 1.3	3	1.5	Fig. 5 — —	5-49 4-24 4-24	$11.95 $26.95 $36.95	PDC-10-1 ZDC-10-1 ZMDC-10-1
1-400	11.5 ±0.5	±0.5	1.2	Lower range Mid range Upper range†	42 35 22	30 24 15	One octave from band edge Total range	.7 .9	.9 1.2	4	2	Fig. 6	5-49	$14.95	PDC-20-1B*
1-1000	11 ±0.5	±0.5‡	1.2	Lower range† Mid range Upper range†	40 25 25	30 20 20	Lower range† Mid range Upper range†	1.2 1.2 1.6	1.7 1.7 2	2	1	—	5-49	$24.95	PDC-10-21
5-750	11 ±0.5	±0.5	1.25	Lower range† Mid range Upper range†	35 25 25	30 20 20	Lower range† Mid range Upper range†	1.1 1.2 1.4	1.6 1.7 1.9	2	1	—	5-49	$19.95	PDC-10-22
25-400	21 ±0.75	±0.5	1.25	25-150 MHz 150-300 MHz 300-400 MHz	25 35 25	20 25 20	25-50 MHz 50-300 MHz 300-400 MHz	.2 .1 .15	.5 .2 .3	5	3	Fig. 5 — —	5-49 4-24 4-24	$19.95 $34.95 $44.95	PDC-20-1 ZDC-20-1 ZMDC-20-1
250-1000	10.5 ±0.5	±0.5	1.5	250-400 MHz 400-800 MHz 800-1000 MHz	40 30 20	30 20 15	250-600 MHz 600-1000 MHz	1.1 1.6	1.4 1.9	5	—	Fig. 5 — —	5-49 4-24 4-24	$24.95 $34.95 $44.95	PDC-10-2 ZDC-10-2 ZMDC-10-2
.03-50	15 ±0.05	±0.5	1.15	Lower range† Mid range Upper range†	38 35 28	30 25 20	One octave from band edge Total range	.2 .3	.4 .6	4	2	—	4-24	$34.95	ZFDC-15-6
.1-2000	19.5 ±0.5	±0.5#	1.2	.1-1 MHz 1-100 MHz 1000-2000 MHz	30 40 22	20 30 10	.1-.5 MHz 250-1000 MHz 1000-2000 MHz	.4 .7 1.5	1 1.4 2.3	½	2	—	1-4	$79.95	ZFDC-20-5
.2-250	19.5 ±0.5	±0.25	1.2	Lower range† Mid range Upper range†	36 33 25	25 25 20	One octave from band edge Total range	.25 .35	.5 .6	4	1.5	—	4-24	$29.95	ZFDC-20-3
1-500	10.5 ±0.25	±0.25	1.2	Lower range† Mid range Upper range†	35 33 28	30 25 20	One octave from band edge Total range	0.8 1.0	1.1 1.3	3	1.5	—	4-24	$29.95	ZFDC-10-1
1-1000	11 ±0.5	±0.5‡	1.2	Lower range† Mid range Upper range†	40 25 25	30 20 20	Lower range† Mid range Upper range†	1.2 1.2 1.6	1.7 1.7 2.0	2	1	—	4-24	$44.95	ZFDC-10-21
10-1000	10.75 ±0.5	±0.75	1.5	Lower range† Mid range Upper range†	35 30 27	28 25 20	One octave from band edge Total range	1.2 1.5	1.6 2.0	3	1.5	—	4-24	$39.95	ZFDC-10-2
1-750	11 ±0.5	±0.5	1.25	Lower range† Mid range Upper range†	35 25 25	30 20 20	Lower range† Mid range Upper range†	1.1 1.2 1.4	1.6 1.7 1.9	2	1	—	4-24	$34.95	ZFDC-10-22

±2.0 over 1000 MHz ‡ Upper band ±0.75

* These units require an external 50 ohm resistor.

† Lower range is from lowest edge of band to one decade higher. Upper range is from highest edge of band to one decade lower.

COMMON SPECIFICATIONS Operating and Storage Temperature: −55°C to +100°C. Pin Temperature (PDC only): 510°F (10 sec).

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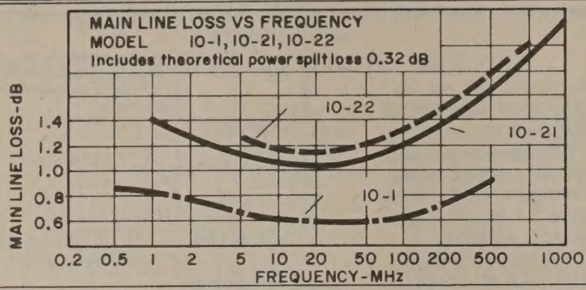
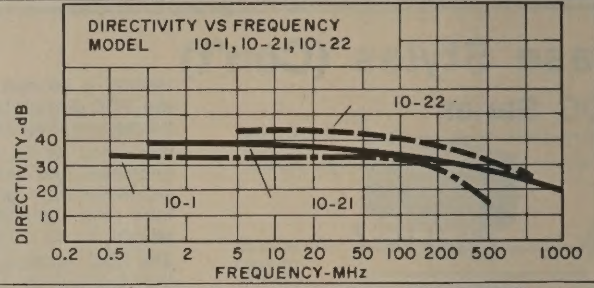
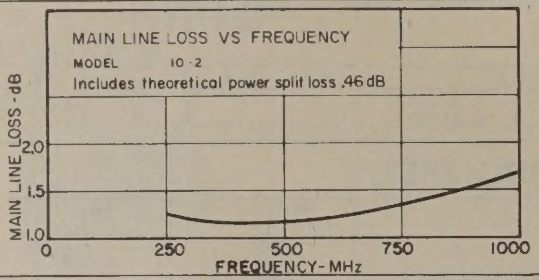
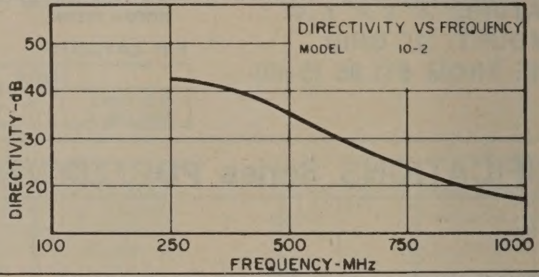
Mini-Circuits Laboratory

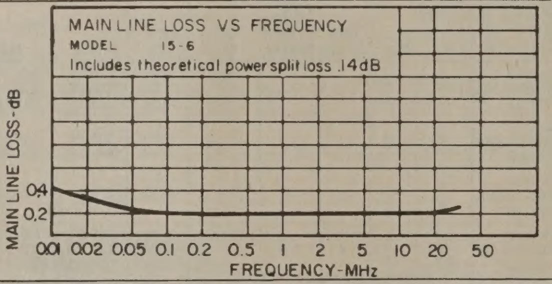
DIRECTIONAL COUPLERS
Series PDC, ZDC, ZMDC and ZFDC

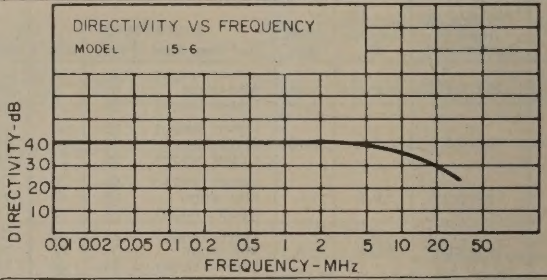


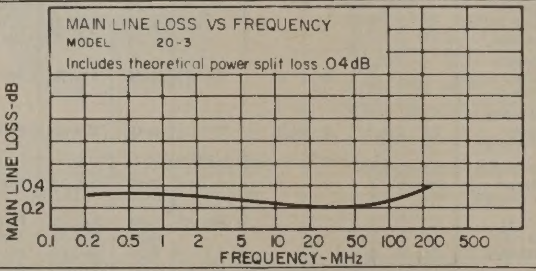


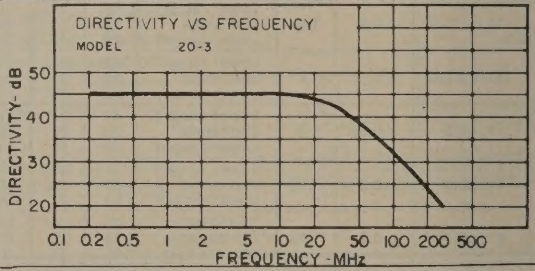


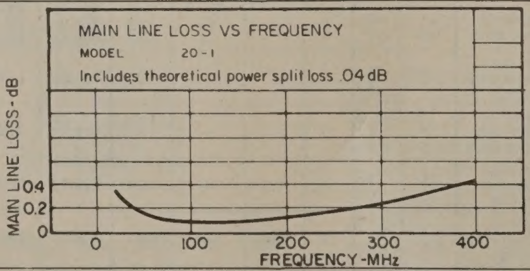


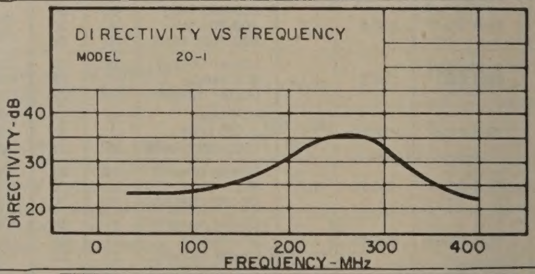


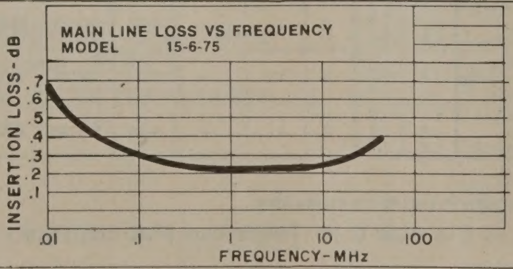


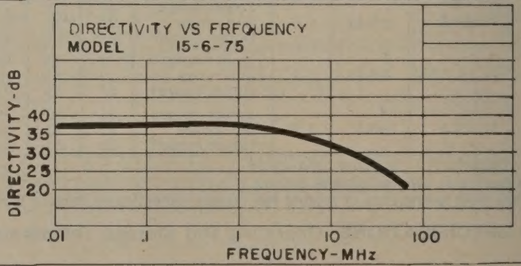












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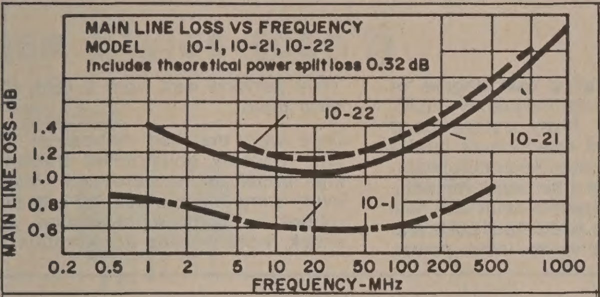
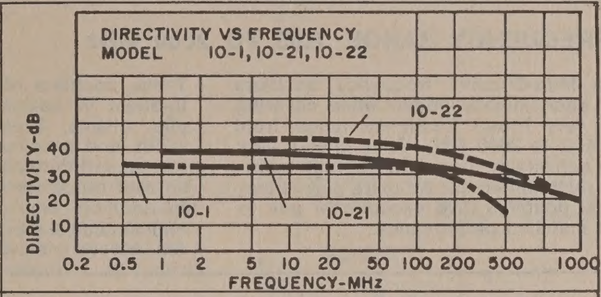
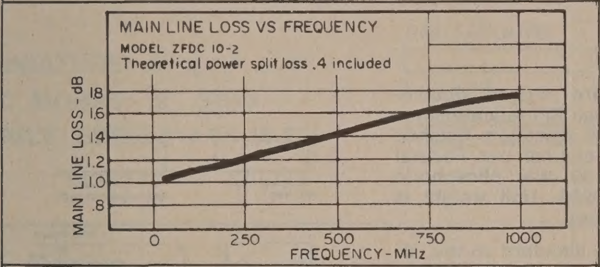
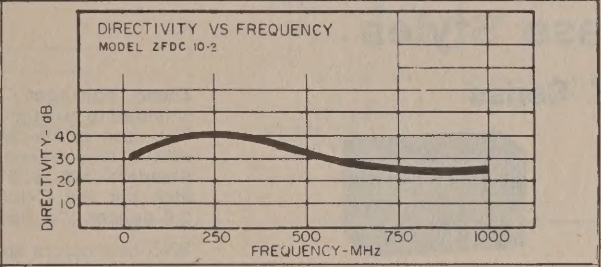
Mini-Circuits MCL Laboratory

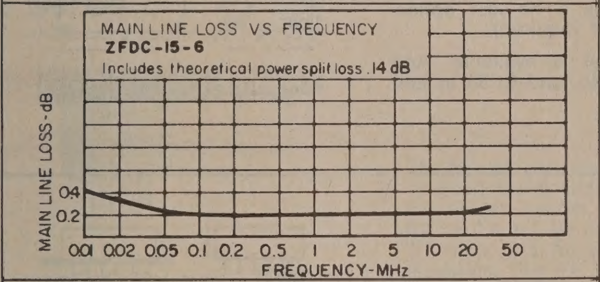
DIRECTIONAL COUPLERS Series PDC, ZDC, ZMDC, ZFDC* (Con't)

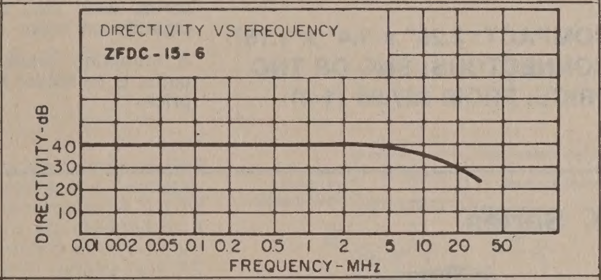


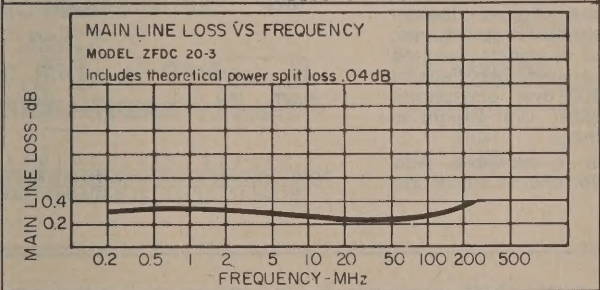


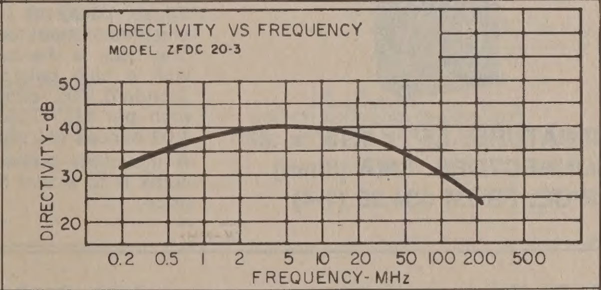


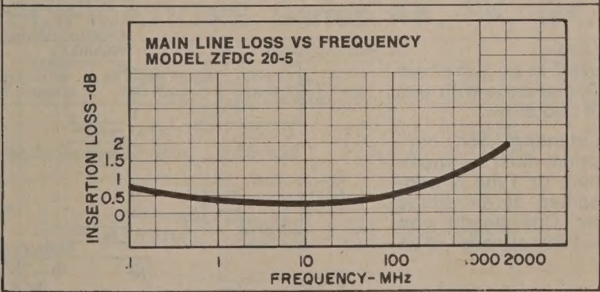


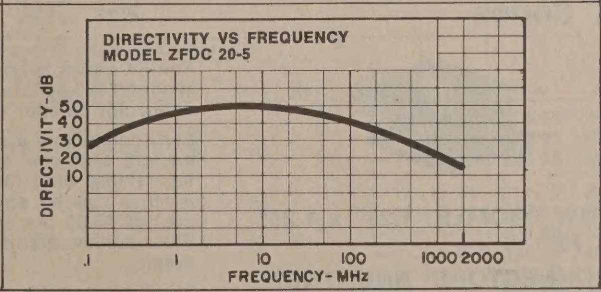












Mini-Circuits Laboratory

FREQUENCY DOUBLERS 0dBm to 20dBm Power Range

• FREQUENCY RANGE: 0.05 TO 2000 MHz

The Mini-Circuits' frequency doublers are economically priced while covering the very broad frequency range from 50 KHz to 2000 MHz. They offer a very low conversion loss, 12.5 dB, high spuriout rejection 40 dB. An extra plus is that these doublers give exceptional unit to unit matched performance.

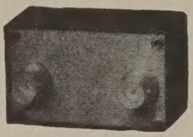
These doublers offer a new degree of freedom in designing frequency multiplier chains. Their many octave band width, and excellent rejection of fundamental and third harmonics enable a significant reduction in filter requirements. In addition, thev operate with 50 ohm impedances at input and output ports and are not very sensitive to input power.

They perform well from 0 dBm to +20 dBm input.

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

Case Styles

GK Series

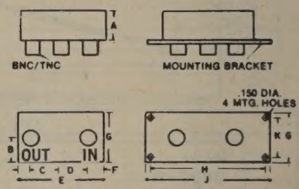


- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $27.95 (1-4)**

These packages are rugged double-shielded to meet tough RFI requirements. The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

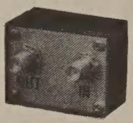
BNC connectors are standard on the GK series with TNC as a no-cost option (specify on order if required).

A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.



	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

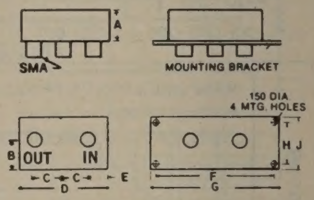
MK Series



- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $34.95 (1-4)**

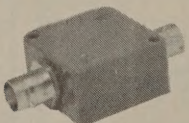
These packages are rugged double-shielded to meet tough RFI requirements. The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

A mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.



	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

FK Series

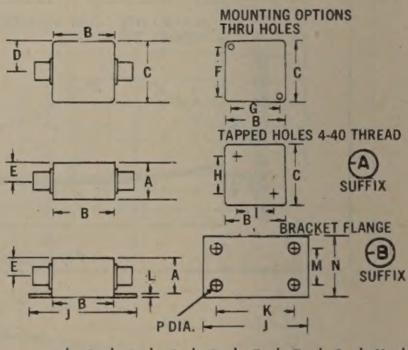


- **LOW PROFILE: 1.25″ x 1.25″ x .75″**
- **CONNECTORS: BNC, TNC, SMA (3mm), TYPE N**
- **PRICE: FROM $59.95 (1-4)**

The FK series is housed in an extremely rugged 1¼″ square metal case with one connector on each of two sides.

BNC connectors are standard. TNC connectors, a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams).

Standard mounting is by two 0.125″ (.318 cm) through holes. At no cost two 4-40 tapped holes can be ordered as Suffix A. Or a mounting bracket can be ordered as Suffix B. Add $1.50 to unit price. Case finish is grey epoxy paint.



	A	B	C	D	E	F	G	H
INCHES	.75	1.25	1.25	.625	.375	1.00	1.00	0.8
CM	1.91	3.18	3.18	1.59	0.95	2.54	2.54	2.03

	I	J	K	L	M	N	P
INCHES	0.8	2.188	1.688	.060	.75	1.25	.125
CM	2.03	5.56	4.29	0.15	1.91	3.18	.318

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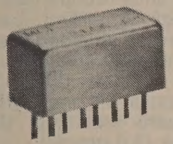
Mini-Circuits MCL Laboratory

FREQUENCY DOUBLERS
0dBm to 20dBm Power Range

Case Styles (con't)

RK Series



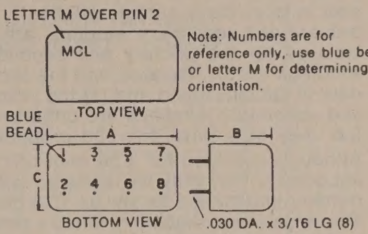
- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $14.95 (5-24)**

Having a volume of only .128 cu. inches, the RK series is packaged within an RFI shielded metal enclosure and hermetically sealed header. These high performance units have their pins oriented on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

PIN LAYOUTS

	Fig. 13
Input	1,3,4*
Output	8
Ground	2,5,6,7

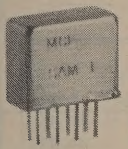
* Connect all pins together



Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

AK Series



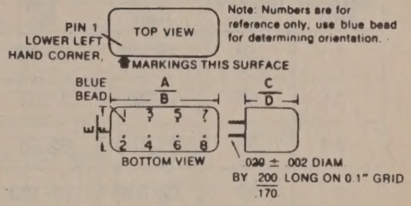
- **MICROMINIATURE: .5″ x .2″ x .4″**
- **PC PINS: .1″ GRID**
- **PRICE: FROM $19.95 (5-24)**

The AK units are packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.). Its pins are oriented on a 0.1 inch grid for printed circuit board mounting. The AK units require less PC area than a flat-pack or TO-5 can. Unit weight is .07 ounces (1.9 grams).

PIN LAYOUTS

	Fig. 13
Input	1,3,4*
Output	8
Ground	2,5,6,7

* Connect all pins together


PIN 1 LOWER LEFT HAND CORNER.
TOP VIEW
MARKINGS THIS SURFACE
BLUE BEAD
A/B
C/D
E
F
1 3 5 7
2 4 6 8
BOTTOM VIEW
.020 ± .002 DIAM BY .200/.170 LONG ON 0.1" GRID

Note: Numbers are for reference only, use blue bead for determining orientation.

	A	B	C	D	E	F
INCHES	.500	.480	.405	.390	.230	.210
CM	1.27	1.22	1.03	.99	.58	.53

SPECIFICATIONS Series AK, FK, GK, MK, RK

Frequency Input	Range MHz Output	RF Input Power Full Range	Conversion Loss, dB			Spurious Harmonic Output, dB Relative to F2							Pin Layout	Quantity	Price	Model No.
			Over Freq. Band MHz	Typ.	Max.	Over Freq. Band MHz	F1 Typ.	F1 Max.	F3 Typ.	F3 Max.	F4 Typ.	F4 Max.				
.05-150	.1-300	+0 dBm to +13 dBm	.05-50 50-150	11 11.5	13 15	.1-100 100-300	−40 −35	−30 −20	−45 −40	−30 −20	−16 −16	−12 −12	Fig. 13 — —	5-24 1-4 1-4	$14.95 $27.95 $34.95	RK-3 GK-3 MK-3
1-500	2-1000	+1 dBm to +15 dBm	1-100 100-300 300-500	13 13.5 14.0	15 15.5 16.5	2-200 200-600 600-1000	−40 −25 −20	−30 −20 −15	−50 −40 −30	−40 −30 −25	−16 −16 −16	−12 −12 —	Fig. 13 Fig. 13 — —	5-24 5-24 1-4 1-4	$19.95 $15.95 $29.95 $39.95	AK-2 RK-2 GK-2 MK-2
10-1000	20-2000	+10dBm to +20 dBm*	10-600 600-1000	13 14	15 17	10-1000	−20	−15	−25	−20	—	—	— — —	1-4 1-4 1-4	$54.95 $64.95 $59.95	GK-5 MK-5 FK-5

* For GK-5/MK-5/FK-5 Full range is +13 dBm to +20 dBm above 700 MHz.

COMMON SPECIFICATIONS

Impedance, all ports: 50 ohms. Total Input Power: 100 mW (except for FK Series, 500 mW.) Pin Temp. (AK & RK): 510°F (10 sec.). Operating and Storage Temperature: −55°C to +100°C.

Mini-Circuits Laboratory

MCL

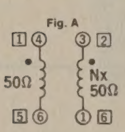
RF TRANSFORMERS Wideband (10KHz to 800MHz)

These microminiature wideband RF Transformers cover the frequency range from 10 KHz to 800 MHz. They operate with impedance levels from 12.5 ohms to 800 ohms and provide very low insertion loss, typically less than 0.5 dB.

These microminiature series are available in three basic configurations: (1) the primary and secondary windings are DC isolated (2) the primary and secondary windings are DC isolated and the secondary is center-tapped and (3) the primary and secondary windings are unbalanced (i.e. they both have one end grounded).

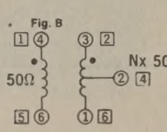
Although specified for a 50 ohm primary impedance they may be operated with a primary impedance as low as 12.5 ohms. The impedance matching ratio is essentially constant over the primary impedance range. The frequency response may change somewhat.

Fig. A



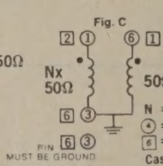
1 ④
③ 2
50Ω
Nx 50Ω
5 ⑥
① 6

Fig. B



1 ④
③ 2
50Ω
Nx 50Ω
② 4
5 ⑥
① 6

Fig. C



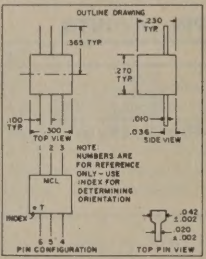
2 ①
⑥ 1
Nx 50Ω
50Ω
6 ③
PIN 6 ③ MUST BE GROUND

N = Impedance Ratio
④ = T Series
6 = TMO Series
Case Ground TMO Series is 7.8.

SERIES T from $2.95

PLASTIC CASE

Having a volume of less than .02 cu. inches, these tiny units have their adjacent pins spaced 0.1 inches. Between rows the pin spacing is 0.3 inches. The T-series transformers can be inserted into a standard DIP socket. Unit weight is .01 ounces (.04 grams).

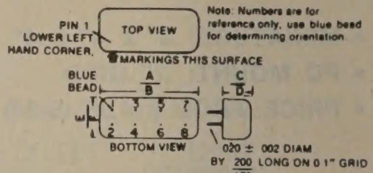


OUTLINE DRAWING
.230 TYP
.365 TYP
.270 TYP
.100 TYP
.300
TOP VIEW
.010
.036
SIDE VIEW
1 2 3
NOTE: NUMBERS ARE FOR REFERENCE ONLY – USE INDEX FOR DETERMINING ORIENTATION
MCL
T
INDEX
6 5 4
PIN CONFIGURATION
.042 ±.002
.020 ±.002
TOP PIN VIEW

SERIES TMO from $4.95

METAL CASE

The TMO units require less PC area than a flat-pack or TO-5 can. Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.25 in.). Its pins are oriented on a 0.1 inch grid for printed circuit board mounting. Unit weight is 0.7 ounces (1.0 grams)



PIN 1 LOWER LEFT HAND CORNER.
TOP VIEW
Note: Numbers are for reference only, use blue bead for determining orientation
MARKINGS THIS SURFACE
BLUE BEAD
A
B
C
D
E
F
1 3 5 7
2 4 6 8
BOTTOM VIEW
.020 ± .002 DIAM
BY .200/.170 LONG ON 0.1" GRID

	A	B	C	D	E	F
INCHES	.500	.480	.255	.240	.230	.210
CM	1.27	1.22	.64	.60	.58	.53

SPECIFICATIONS SERIES T, TMO

Impedance Ratio	Primary Impedance Ohms	Insertion Loss			Maximum Amplitude Unbalance		Maximum Phase Unbalance Degrees		Pin Layout	Quantity	Price	Model No.
		3 dB MHz	2 dB MHz	1 dB MHz	.1 dB MHz	.5 dB MHz	1° MHz	5° MHz				
1	50	.15-400	.35-200	2-50	—	—	—	—	Fig. A	10-49 10-49	$2.95 $4.95	T1-1 TMO1-1
1.5	50	.1-300	.2-150	.5-80	—	—	—	—	Fig. A	10-49 10-49	$3.95 $6.25	T1.5-1 TMO1.5-1
2.5	50	.01-100	.02-50	.05-20	—	—	—	—	Fig. A	10-49 10-49	$3.95 $5.95	T2.5-6 TMO2.5-6
4	50	.02-200	.05-150	.1-100	—	—	—	—	Fig. A	10-49 10-49	$3.95 $5.95	T4-6 TMO4-6
9	50	.15-200	.3-150	2-40	—	—	—	—	Fig. A	10-49 10-49	$3.45 $5.45	T9-1 TMO9-1
16	50	.3-120	.7-80	5-20	—	—	—	—	Fig. A	10-49 10-49	$3.95 $5.95	T16-1 TMO16-1
1	50	.05-200	.08-150	.2-80	.5-80	.05-200	.5-80	.05-200	Fig. B	10-49 10-49	$3.95 $5.95	T1-1T TMO1-1T
2	50	.07-200	.1-100	.5-50	1-50	.07-200	1-50	.07-200	Fig. B	10-49 10-49	$4.25 $6.25	T2-1T TMO2-1T
2.5	50	.01-100	.02-50	.05-20	.1-20	.01-100	.1-20	.01-100	Fig. B	10-49 10-49	$4.25 $6.25	T2.5-6T TMO2.5-6T
3	50	.05-250	.1-200	.5-70	1-70	.05-250	1-70	.05-250	Fig. B	10-49 10-49	$3.95 $5.95	T3-1T TMO3-1T
4	50	.2-350	.35-300	2-100	5-100	.2-350	5-100	.2-350	Fig. B	10-49 10-49	$2.95 $4.95	T4-1 TMO4-1
5	50	.3-300	.6-200	5-100	10-100	.3-300	10-100	.3-300	Fig. B	10-49 10-49	$4.25 $6.25	T5-1T TMO5-1T
13	50	.3-120	.7-80	5-20	5-20	.3-120	5-20	.3-120	Fig. B	10-49 10-49	$4.25 $6.25	T13-1T TMO13-1T
2	50	.025-600	.05-400	.05-200	—	—	—	—	Fig. C	10-49 10-49	$3.45 $5.45	T2-1 TMO2-1
3	50	.5-800	2-400	—	—	—	—	—	Fig. C	10-49 10-49	$4.25 $6.25	T3-1 TMO3-1
4	50	.2-60	.5-500	2-250	—	—	—	—	Fig. C	10-49 10-49	$3.45 $5.45	T4-2 TMO4-2
8	50	.15-250	.25-200	2-100	—	—	—	—	Fig. C	10-49 10-49	$3.45 $5.45	T8-1 TMO8-1
14	50	.2-150	.5-100	2-50	—	—	—	—	Fig. C	10-49 10-49	$4.25 $6.25	T14-1 TMO14-1

COMMON SPECIFICATIONS

Operating and Storage Temperature: T Series −20°C to +85°C, TMO Series −55°C to +100°C. Total Input Power: ¼ watt.

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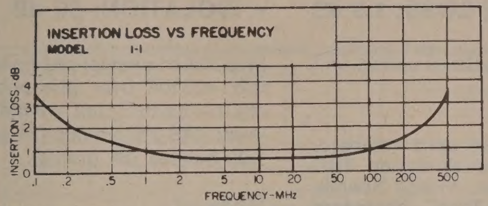
Mini-Circuits Laboratory

MCL

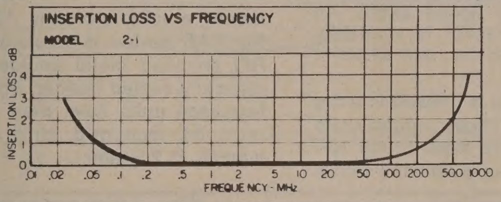
RF TRANSFORMERS Wideband (10KHz to 800MHz)

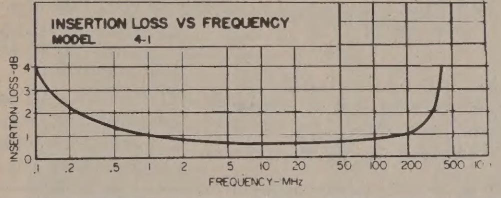


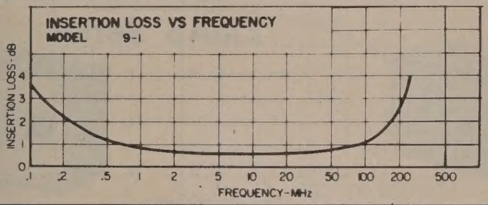
DESIGNERS KIT AVAILABLE

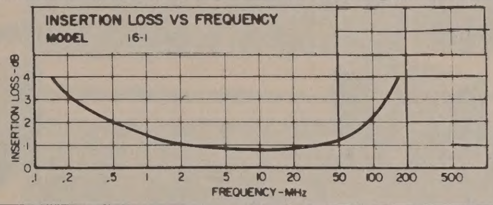
(TK-1) — 2 transformers of each Type T1-1, T2-1, T4-1, T9-1, T16-1 **$32.00**

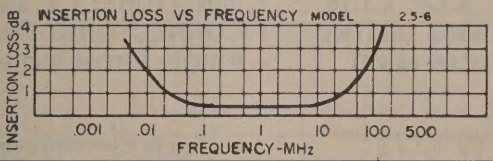
(TMK-2) — 2 transformers of each Type TM01-1, TM02-1, TM04-1, TM09-1, TM016-1 **$49.50**

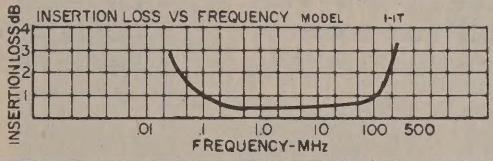


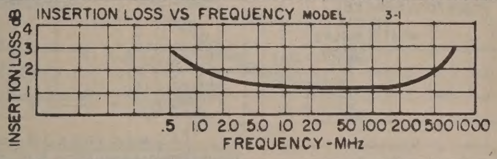


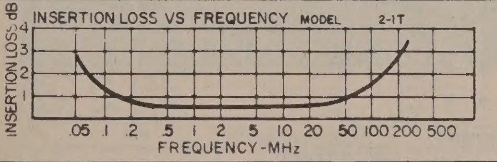


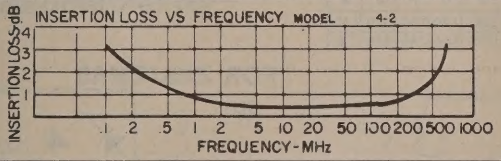


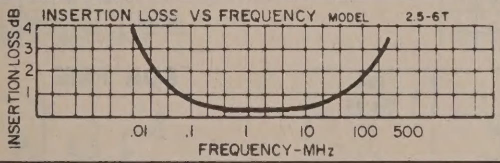


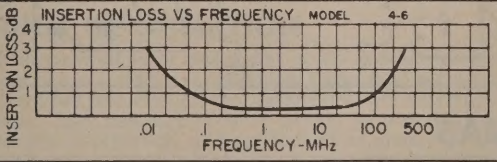


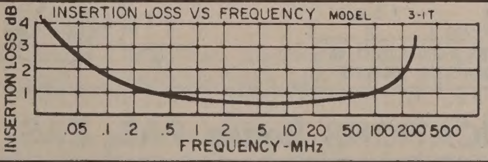


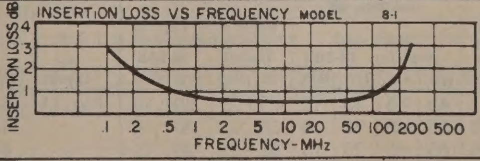


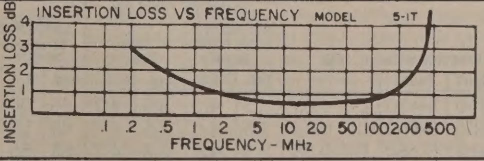


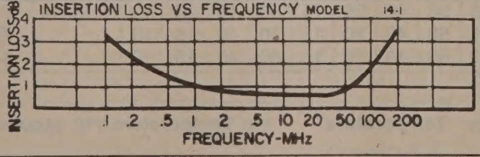


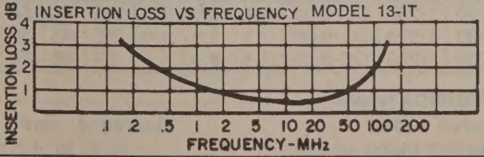












MINI-CIRCUITS LABORATORY / 2625 EAST 14th ST. / BROOKLYN, NY 11235 / (212) 769-0200 / INT'L TELEX 620156
A DIVISION SCIENTIFIC COMPONENTS CORP.
DOMESTIC TELEX 125460

Mini-Circuits MCL Laboratory

ELECTRONIC ATTENUATOR/ SWITCH

- **FREQUENCY RANGE: 1 TO 450 MHz**
- **INSERTION LOSS: 1.5 dB**
- **ISOLATION: 50 dB**

The PAS/ZAS/ZMAS series of electronic attenuator/switches enable attenuation control of RF signals with a maximum of only 20 mA of control current. Due to the specific properties of these attenutors, for a single frequency input all harmonics even and odd order, are virtually eliminated at the output. As a consequence the intercept point is greater than +45 dBm.

The attenuator/switches are economically priced while covering the very broad frequency range from 1-450 MHz. They offer low insertion loss, 1.5 dB, high isolation 50 dB, and exceptional unit to unit matched performance.

ZAS/ZMAS

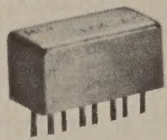
Having BNC connectors as a standard, the ZAS series has as an option TNC connectors at no cost. Please specify when ordering. SMA (3mm) connectors are supplied with the Series ZMAS. An optional mounting bracket is available. Add suffix B to Model No. and $1.50 to unit price.

The ZAS/ZMAS series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weights are as follows: ZAS 2.6 ounces (74 grams), ZMAS 1.02 ounces (34 grams).

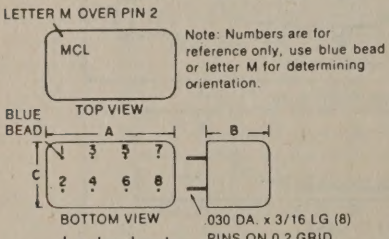
PAS

Having a volume of only .128 cu. inches, the PAS series is packaged within an RFI shielded metal enclosure and hermetically sealed header. These high performance units have their pins oriented on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

PAS Series



- **MINIATURE: .8″ x .4″ x .4″**
- **PC MOUNT: .2″ GRID**
- **PRICE: FROM $27.95 (5-24)**



Note: Numbers are for reference only, use blue bead or letter M for determining orientation.

.030 DA. x 3/16 LG (8) PINS ON 0.2 GRID

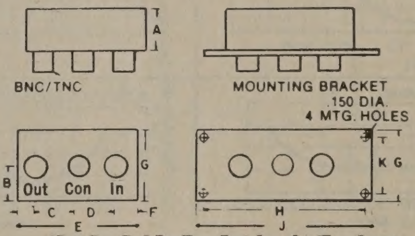
	A	B	C
INCHES	.8	.4	.4
CM	2	1	1

	Pins
	Fig. 14
Output	8
Input	1
Control	3, 4
Ground	2, 5, 6, 7
Gase Ground	2

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

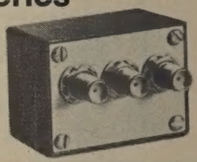
ZAS Series

- **COMPACT: 2.25″ x 1.4″ x 1.15″**
- **CONNECTORS: BNC OR TNC**
- **PRICE: FROM $42.95 (4-24)**

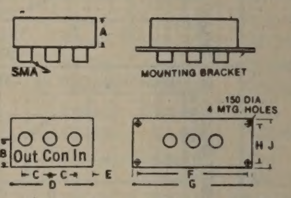


	A	B	C	D	E	F	G	H	J	K
INCHES	1.15	.63	.750	.730	2.25	.385	1.40	2.95	3.25	1.10
CM	2.9	1.6	1.9	1.85	5.7	.977	3.55	7.49	8.25	2.8

ZMAS Series

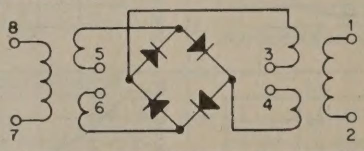


- **MINIATURE: 1.5″ x 1.15″ x .88″**
- **CONNECTORS: SMA (3mm)**
- **PRICE: FROM $52.95 (4-24)**

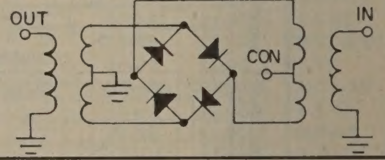


	A	B	C	D	E	F	G	H	J
INCHES	0.88	0.66	.438	1.50	.312	2.19	2.50	0.84	1.15
CM	2.2	1.7	1.1	3.8	.79	5.56	6.35	2.1	2.9

FOR PAS



FOR ZAS/ZMAS



SPECIFICATIONS Series PAS, ZAS, ZMAS

				Insertion Loss, dB				Isolation, dB														
	Frequency Range, MHz			One Octave From Band Edge		Total Range		Lower Band Edge to One Decade Higher				Mid Range				Upper Band Edge to One Octave Lower						
								IN-OUT		IN-CON		IN-OUT		IN-CON		IN-OUT		IN-CON				
Model No.	Output	Input	Control	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Pin Layout	Quantity	Price
PAS-1	5-450	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	35	25	45	35	25	15	35	25	20	10	Fig. 14	5-24	$27.95
ZAS-1	5-450	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	35	25	55	45	25	15	35	25	20	10		4-24	$42.95
ZMAS-1	5-450	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	35	25	55	45	25	15	35	25	20	10		4-24	$52.95
PAS-3	1-200	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	35	25	50	40	20	15	50	40	15	10	Fig. 14	5-24	$28.95
ZAS-3	1-200	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	35	25	50	40	20	15	50	40	15	10		4-24	$43.95
ZMAS-3	1-200	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	35	25	50	40	20	15	50	40	15	10		4-24	$53.95

COMMON SPECIFICATIONS

Total Input Power: 1 Watt
Total Input Current Peak: 40 mA

Operating and Storage Temperature: −55°C to +100°C

Pin Temperature (10 seconds): 510°F

MINI-CIRCUITS LABORATORY / 2625 EAST 14th ST. / BROOKLYN, NY 11235 / (212) 769-0200 / INT'L TELEX 620156
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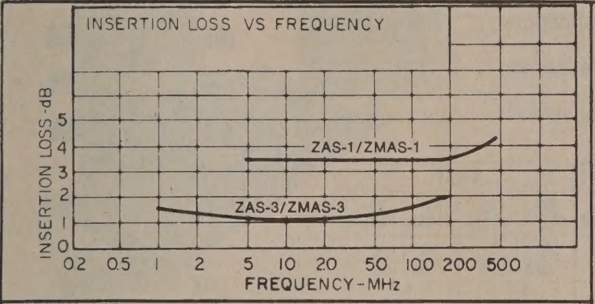
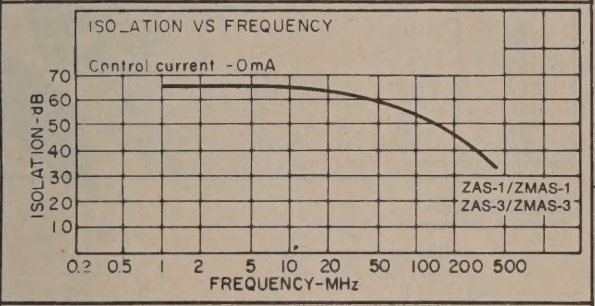
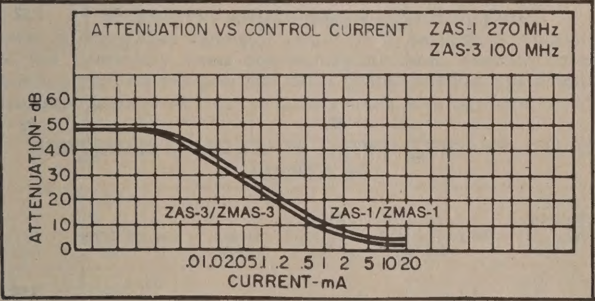
DOMESTIC TELEX 125460

Mini-Circuits Laboratory MCL

ELECTRONIC ATTENUATOR/ SWITCH

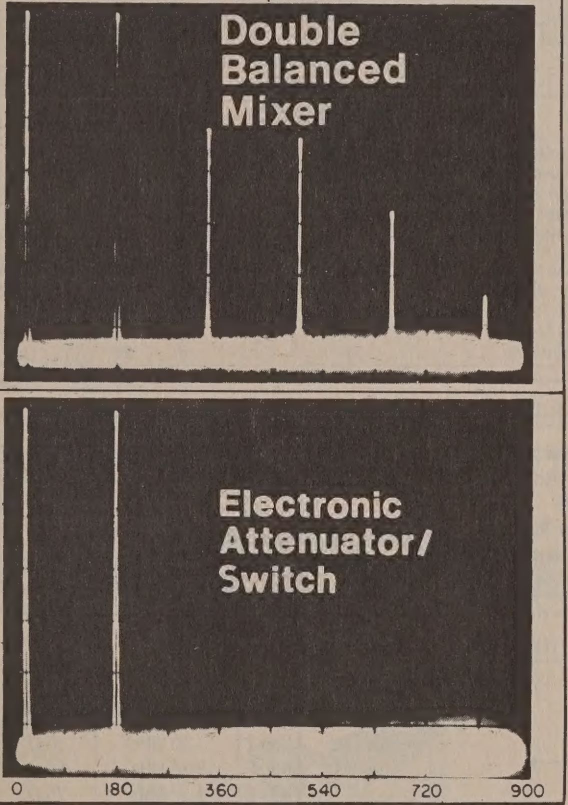

INSERTION LOSS VS FREQUENCY


ISOLATION VS FREQUENCY


ATTENUATION VS CONTROL CURRENT ZAS-1 270 MHz ZAS-3 100 MHz

TYPICAL HARMONIC SPECTRUM COMPARING ATTENUATORS - CONTROL CURRENT SET FOR 10dB ATTEN.

SIGNAL FREQUENCY - 180 MHz VERTICAL SCALE - 10 dB per cm
HORIZONTAL SCALE - 100 MHz per cm SIGNAL POWER - 0 dBm



ORDERING INFORMATION

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information, and application engineering data.

Send your order to any of the local sales offices.

Prices listed in this catalog are domestic F.O.B. Brooklyn, N.Y.

Mini-Circuits Laboratory reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes.

WARRANTY

Scientific Components Corporation, Mini-Circuits Laboratory division, warrants each new device to be free from defects in material and workmanship. The sellers obligation under this warranty is limited to repairing, or at his option, replacing any device or parts except tubes, semiconductors, lamps, fuses, or batteries, for any device returned to the sellers premise, transportation charges prepaid, within one year after delivery to the original purchaser, and which after examinations by the seller shall prove to be defective within the terms of the warranty. This warranty excludes all other warranties expressed or implied. Seller shall not be liable for any special, indirect, or consequential damages. This warranty does not extend to any device or part which in the opinion of the seller has been subjected to use in violation of seller's instructions or to any misuse, negligence, or accident.

WIDEBAND POWER DIVIDERS & HYBRID TRANSFORMERS

North Hills

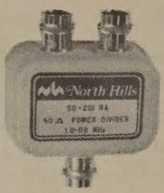
POWER DIVIDERS

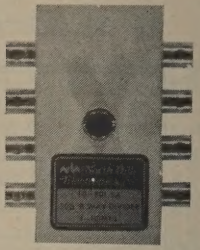
0.2-110 and 30-225 MHz
2, 4, and 8-way
50 and 75 ohms

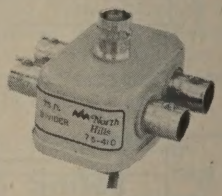
Series 01 and 10 Power Dividers are designed for low power applications in the 0.2 to 110 and 30 to 225 MHz frequency ranges.

Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports.

50 and 75 ohm impedances are standard. Other impedances available on special order.







	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		30 - 225		0.2 - 110		30 - 225		0.2 - 110		30 - 225	
Insertion Loss (dB)	0.25		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		30		30		30		30		30	
Amplitude Balance (± dB)	0.5		0.5		0.5		0.5		1.0		0.5	
Phase Balance (± °)	0.5		2.0		1.0		2.0		0.5		2.0	
Input VSWR	1.1		1.25		1.1		1.25		1.1		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

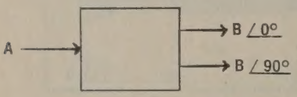
HYBRID TRANSFORMERS

Frequency Range: 0.2 - 110 MHz
Insertion Loss: 1 dB max.
VSWR: 1.2 max.
Power Rating: 0.5 watts
Impedance: 50 or 75 ohms
Isolation: 30 dB min.

Model	Output for Inputs A & B
212RE	A+B and A−B
221RA	A−B
231RA	A+B

90° HYBRIDS

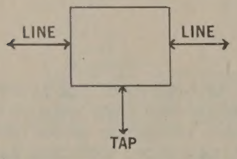
50 or 75 ohms



Model	Frequency Range	Impedance
H50-1	1-10 MHz	50 Ω
H50-2	3-30 MHz	50 Ω
H75-1	1-10 MHz	75 Ω
H75-2	3-30 MHz	75 Ω

TRANSMISSION LINE COUPLERS (BI-DIRECTIONAL)

0.1 to 30 MHz, DC isolated tap

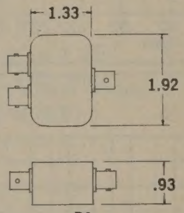


Model	Tap Coupling	Impedance
L50-1	16 dB	50 Ω
L50-2	26 dB	50 Ω
L75-1	16 dB	75 Ω
L75-2	26 dB	75 Ω

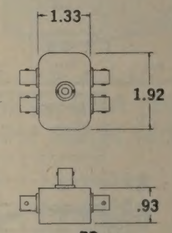
DIRECTIONAL COUPLERS

Model	Impedance	Frequency Range	Coupling
D50-2001	50 Ω	.2-10 MHz	20 dB
D50-2002	50 Ω	2-30 MHz	20 dB
D75-2001	75 Ω	.2-10 MHz	20 dB
D75-2002	75 Ω	2-30 MHz	20 dB

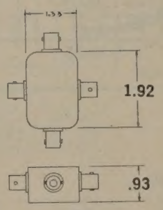
CASE STYLES



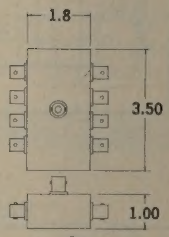
RA



RB



RE



SA

BNC Connectors are standard. Other connectors available on special order. Stud mounting standard.

Different case styles, including printed circuit types with solder terminals, available on special order.

SPECIAL UNITS — 10 Hz to 1 GHz

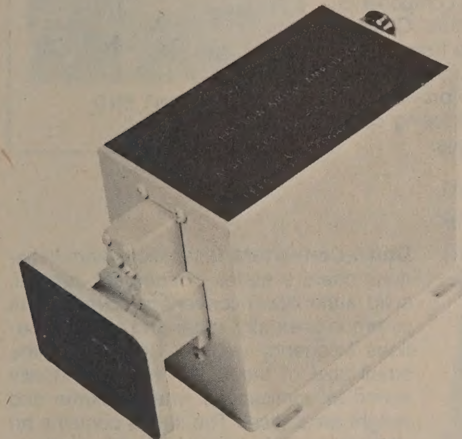
In addition to our standard lines, North Hills custom designs to specific requirements. Examples of these include:

- Active unity – or high-gain power splitters, adders and combiners.
- High power dividers.
- Power dividers for video applications with response down to 1 kHz.
- Non-standard impedances.

North Hills Electronics, INC.

GLEN COVE, N.Y. 11542 • 516-671-5700

Capability
in
TRANSISTOR AMPLIFIERS



Ga As FET Low Noise Amplifiers Scientific Communications has available a line of microwave Ga As Fet Low Noise Amplifiers covering the telemetry, communications, radar and military frequency ranges. Several options are available for input and output connections and for input power requirements.

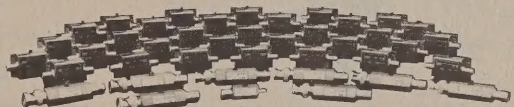
Ga As FET LOW NOISE AMPLIFIERS

MODEL	FREQUENCY RANGE (GHz)	GAIN (dB min.)	GAIN FLATNESS (+ dB max.)	NOISE (1) FIGURE (db max.)	VSWR IN (max.)	VSWR OUT (max.)	POWER OUT AT 1.0dB COMPRESSION (dBm Min.)
SCF-149-30	1.43-1.54	30	0.5	1.8	1.50:1	1.50:1	+5
SCF-164-30	1.635-1.645	30	0.5	1.8	1.50:1	1.50:1	+5
SCF-169-30	1.67-1.70	30	0.5	1.8	1.50:1	1.50:1	+5
SCF-225-30A	2.20-2.30	30	0.5	1.5	1.50:1	1.50:1	+5
SCF-225-30	2.20-2.30	30	0.5	1.7	1.50:1	1.50:1	+5
SCF-225-26	2.20-2.30	26	0.5	2.0	1.50:1	1.50:1	+5
SCF-2729-20	2.70-2.90	20	0.5	2.5	1.50:1	1.50:1	+5
SCF-3034-20	3.00-3.40	20	0.5	2.0	1.50:1	1.50:1	+5
SCF-395-30	3.70-4.20	30	0.5	2.9	1.25:1	1.25:1	+5
SCF-395-30A	3.70-4.20	30	0.5	3.5	1.25:1	1.25:1	+5
SCF-395-30B	3.70-4.20	30	0.5	2.6	1.25:1	1.25:1	+5
SCF-395-30C	3.70-4.20	30	0.5	2.4	1.25:1	1.25:1	+5
*SCF-395-50	3.70-4.20	50	0.5	2.6	1.25:1	1.25:1	+10
*SCF-395-50A	3.70-4.20	50	0.5	2.0	1.25:1	1.25:1	+10
SCF-395-50B	3.70-4.20	50	0.5	2.6	1.25:1	1.25:1	+10
*SCF-395-50C	3.70-4.20	50	0.5	2.9	1.25:1	1.25:1	+10
*SCF-395-50D	3.70-4.20	50	0.5	1.8	1.25:1	1.25:1	+10
*SCF-395-505	3.70-4.20	50	0.5	1.5	1.25:1	1.25:1	+10
SCF-470-26	4.40-5.0	26	0.5	3.5	1.25:1	1.25:1	+5
SCF-470-30	4.40-5.00	30	0.5	3.0	1.25:1	1.25:1	+5
SCF-470-27	4.40-5.00	27	0.5	2.2	1.25:1	1.25:1	+5
SCF-550-24	5.25-5.75	24	0.5	4.0	1.25:1	1.25:1	+5
SCF-565-30	5.40-5.90	30	0.5	3.0	1.25:1	1.25:1	+5
SCF-5964-101	5.925-6.425	10	0.5	3.5	1.50:1	1.50:1	+5
SCF-5964-251	5.925-6.425	25	0.5	4.0	1.50:1	1.50:1	+5
SCF-750-20	7.25-7.75	20	0.5	4.5	1.25:1	1.25:1	+5
SCF-750-10	7.25-7.75	10	0.5	3.0	1.25:1	1.25:1	+5
SCF-750-50	7.25-7.75	50	0.5	3.5	1.25:1	1.25:1	+8
SCF-910-20	9.0-9.2	20	0.5	4.0	1.25:1	1.25:1	+6
SCF-9096-20	9.0-9.6	20	0.5	4.5	1.25:1	1.25:1	+6
SCF-10K11	10.7-11.2	25	0.5	5.5	1.25:1	1.25:1	+6
SCF-11K12	11.7-12.2	25	0.5	5.5	1.25:1	1.25:1	+6

*CPR-229 Waveguide IN
(1) at 25°C

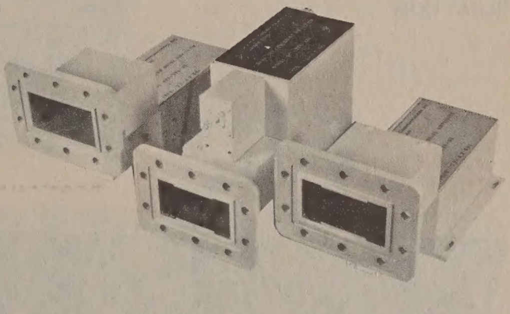
TELEMETRY AND COMMUNICATIONS SERIES

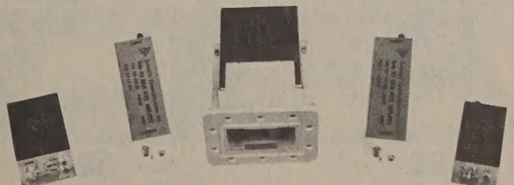
This Series of microwave transistor amplifiers is designed for optimum performance in the commonly used communication and telemetry bands. Special emphasis is placed on the gain and noise characteristics. The amplifiers provide low noise amplification with high reliability under adverse operating conditions.



LOW NOISE SOLID STATE TRANSISTOR AMPLIFIERS (BIOPOLAR)

MODEL NO.	FREQ. RANGE MHz	GAIN dB Min.	GAIN FLATNESS ± dB Max.	NOISE FIGURE dB Max.	VSWR (50 OHMS) IN Max.	VSWR (50 OHMS) OUT Max.	POWER OUTPUT dBm, Min.
SC-110A	5-110	20	0.5	3.0	2.0	2.0	+2
SC-104D	5-100	40	0.5	2.0	2.0	2.0	+2
SC-1041	50-200	30	0.5	2.0	2.0	1.5	+7
SC-330	30-300	23	0.5	4.0	2.0	2.0	0
SC-330A	30-300	20	0.5	3.5	2.0	2.0	0
SC-1013	30-300	50	0.5	4.0	2.0	2.0	0
SC-240	20-400	20	1.0	4.0	2.0	2.0	0
SC-250	20-500	20	1.0	3.5	2.0	2.0	0
SC-250M	20-500	40	1.0	2.7	2.0	2.0	0
SC-2001	20-1000	18	1.0	4.0	2.0	2.0	+3
SC-550A	50-500	25	0.5	2.0	2.0	2.0	+5
SC-1035A	100-500	30	0.5	1.75	2.0	2.0	+5
SC-255	250-500	20	0.5	4.0	2.0	2.0	0
SC-306	300-600	20	0.5	4.0	2.0	2.0	+3
SC-3009	300-400	30	0.5	1.5	2.0	2.0	+7
SC-3013	400-600	30	0.5	1.75	2.0	2.0	+7
SC-1027	420-450	30	0.5	1.6	2.0	2.0	+0
SC-501A	500-1000	20	0.5	2.25	2.0	2.0	+5
SC-612	600-1200	20	1.0	2.5	2.0	2.0	+3
SC-3007	950-1250	20	0.5	2.25	2.0	2.0	+5
SC-3001	1200-1400	20	0.5	2.2	2.0	2.0	+5
SC-3008	1435-1540	20	0.5	2.5	2.0	2.0	+5
SC-1042	1000-1600	20	0.5	3.5	1.5	1.5	+5
SC-3008A	1400-1600	20	0.5	3.0	1.5	1.5	+5
SC-3005	1400-1700	20	0.5	3.0	2.0	2.0	+5
SC-1039A	1000-2000	20	1.0	2.5	2.0	2.0	0
SC-1039	1000-2000	20	1.0	4.0	2.0	2.0	+5
SC-3004A	1700-2400	20	0.5	3.0	2.0	1.5	+7
SC-3004	1700-2300	18	0.5	3.5	2.5	2.0	+3
SC-3002	2200-2300	18	0.5	3.0	2.0	2.0	+3
SC-3002A	2200-2300	20	0.5	2.5	2.5	1.5	+5
SC-3016A	2200-2300	30	0.5	2.5	2.5	1.5	+7
SC-3003	2800-3100	17	0.5	4.3	2.0	2.0	+3





Scientific Communications, Inc.

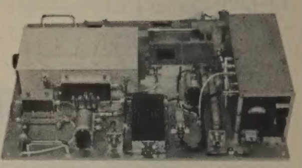
3425 Kingsley • Garland, Texas 75041 214•271-3685 • Twx 910-860-5172

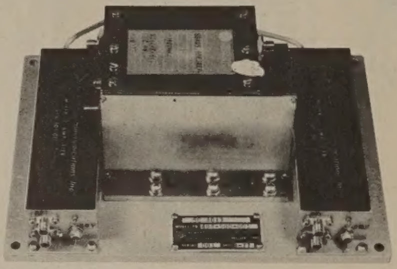
Capability in PARAMETRIC AMPLIFIERS

and OTHER MICROWAVE PRODUCTS

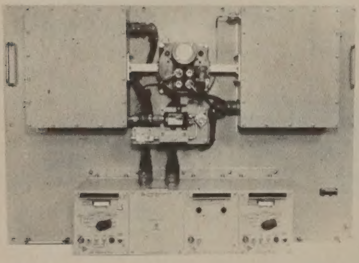
Scientific Communications' parametric amplifiers cover a wide range of applications including radar, telemetry, radio astronomy and satellite communications. Cryogenic or uncooled units are available in frequency ranges from below 500 MHz to above 30 GHz and solid state pumps are standard in most bands. Fixed-tuned, tunable, or broadband amplifiers with band-widths of 10% or more can be supplied. Standard models are available in many radar and telemetry bands; in addition, SCI can design amplifiers to suit nearly any realizable set of customer specifications. Scientific Communications offers state-of-the-art performance in noise temperature and other parameters. Amplifiers are supplied to operate in adverse environments and meet rigid military specifications. These low-noise amplifiers provide a cost-effective answer for stringent applications. SCI delivers production quantities of parametric amplifiers to tight delivery schedules. During peak production the company consistently maintains a quick response capability as well as the flexibility to undertake extensive development efforts.

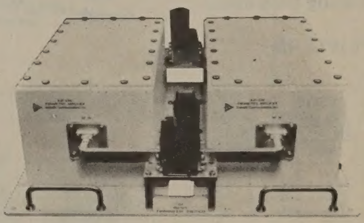
RF Front Ends Scientific Communications also offers a custom capability to design and manufacture RF subassemblies for a variety of receiver applications. Typical subassemblies include the combining of preamplifier and down-converter or the incorporation of such components as filters, limiters, power dividers and detectors. Custom assemblies previously supplied have ranged from a preselected/isolated amplifier to a complete RF front end for a radar retrofit. SCI maintains the flexibility to provide fast turn-around on urgent requirements without losing cost-effectiveness on production-oriented programs.

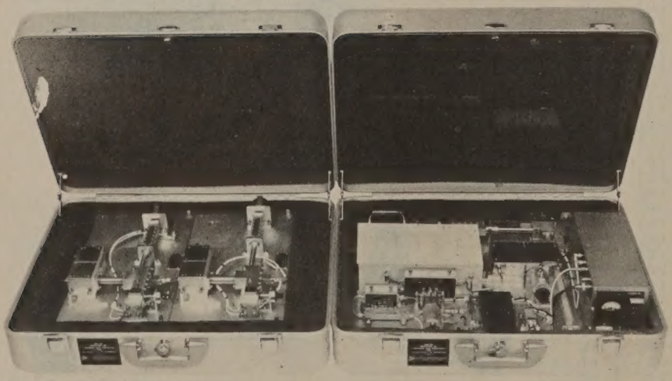

RF FRONT END


DOWN CONVERTER

Down-Converters Scientific Communications offers a series of compact, rugged, solid state down-converters covering the common telemetry, radar and communications frequency ranges. Because of the small size of the units, they are ideally suited to applications where volume and weight are critical. The series contains an integral crystal-controlled local oscillator and includes a preselect filter and isolator.


MILSAT COM


Ku BAND


RADIO ASTRONOMY

MODEL	CENTER FREQUENCY	BANDWIDTH (min.)	GAIN (min.)	NOISE TEMPERATURE/ FIGURE (MAX)
UHFR-527	527 MHz	45 MHz	16dB	55°K
UHFR-606	606 MHz	576-636 MHz	16dB	45°K
UHFR-950A	850 MHz	725-985 MHz	17dB	120°K
LC-100	965 MHz	100MHz	24dB	20°K
SCP-294	1300 MHz	100MHz	15dB	95°K
LR-140	1275 MHz	200 MHz	35dB	90°K
LR-143	1424 MHz	50 MHz	32dB	75°K
LC-160A	1685 MHz	100 MHz	30dB	28°K
LR-169	1685 MHz	30 MHz	30dB	80°K
SCP-101B	2.250 GHz	100 MHz	17dB	90°K
ST-221A	2.250 GHz	100 MHz	30dB	60°K
SCP-293	2.250 GHz	100 MHz	45dB	65°K
SCP-295	2.250 GHz	100 MHz	30dB	70°K
SCP-281	2.8 GHz	200 MHz	16dB	90°K
S-290	2.950 GHz	250 MHz	30dB	120°K
SCP-280	3.245 GHz	250 MHz	26dB	28°K
SCP-298	3.25 GHz	300 MHz	22dB	110°K
SR-395	3.95 GHz	500 MHz	50dB	65°K
SCP-291	3.95 GHz	500 MHz	50dB	120°K
SCP-292A	3.95 GHz	500 MHz	50dB	90°K
SCP-292B	3.95 GHz	500 MHz	50dB	80°K
SCP-292	3.95 GHz	500 MHz	50dB	130°K
C-100	4.995 GHz	120 MHz	20dB	100°K
SCP-287	4.6 GHz	400 MHz	13dB	135°K
SCP-304	7.5 GHz	500 MHz	33dB	125°K
SCP-304A	7.5 GHz	500 MHz	50dB	150°K
SCP-297	9.1 GHz	200 MHz	17dB	2.6dB
SCP-284	9.1 GHz	200 MHz	15dB	260°K
SCP-286	9.33 GHz	260 MHz	16dB	2.8dB
SCP-289	9.1 GHz	200 MHz	15dB	2.5dB
XC-1070	10.70 GHz	400 MHz	20dB	40°K
SCP-296	12.73 GHz	30 MHz	30dB	230°K
SCP-282	13.7 GHz	100 MHz	20dB	3.4dB
K-101	20.15 GHz	400 MHz	20dB	4.0dB
Ka-101	30.15 GHz	400 MHz	20dB	5.0dB

Scientific Communications, Inc.

3425 Kingsley • Garland, Texas 75041
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The Answer Line is 800-854-2436

For questions on prices, products or applications, Telonic has installed a toll free phone line* that lets you call at no charge to talk with engineers, marketing personnel, even our president if you think he can best answer your questions — on any of our product lines:

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We're trying our best to give you direct communication with the Telonic people who can quickly and correctly service your requirements. It's also an ideal way of relaying purchase orders. Try it.

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Integrated Packages • Front Ends • Down Converters • Up Converters • Multiplier Chains

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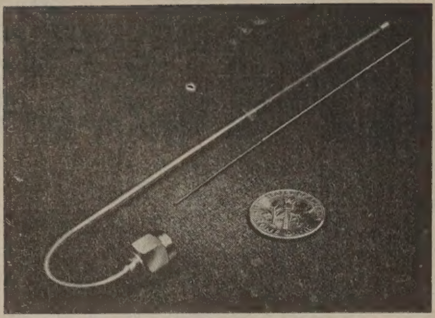
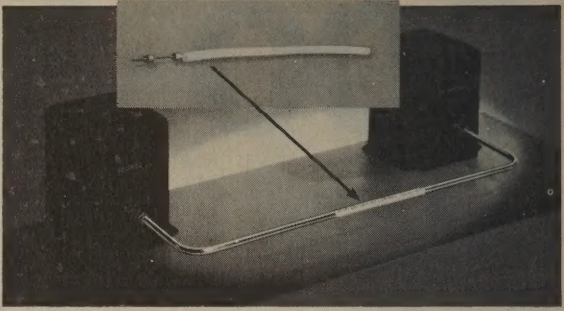
MICRO-COAX® The RELIABLE Semi-



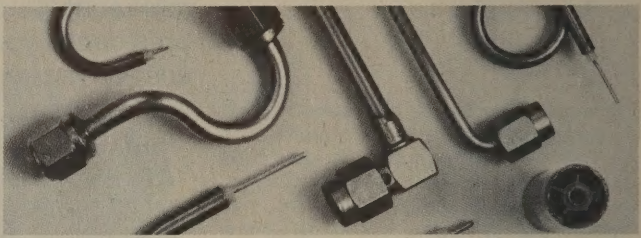
IMPEDANCE TRANSFORMER IN-A-CABLE adds reliability and eliminates up to 4 connectors. Designed for use between low impedance solid state sources and standard 50 and 75 ohm interconnections.

MICROWAVE LOW-PASS FILTER IN-A-CABLE gives reliability of a monolithic seal and can eliminate up to 4 connectors. Use wherever rigid tubular designs are employed.



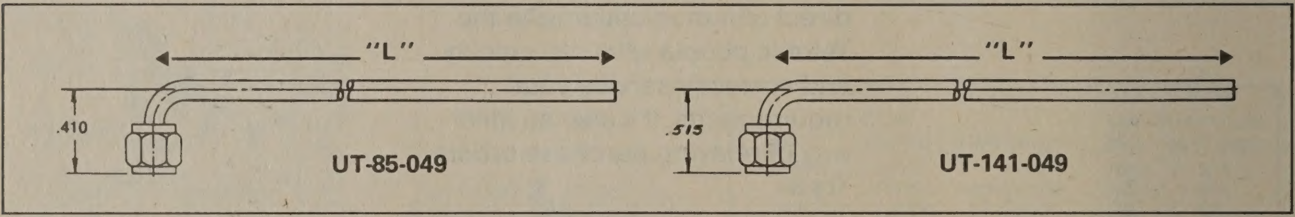
MICRO-COAX CABLE ASSEMBLIES

The usefulness of Micro-Coax semi-rigid coaxial cable is increased by its ability to be formed or fabricated into simple or complex geometric assemblies. Coiling, bending, stripping, and soldering, attaching connectors and other secondary operations result in delivery of maximum power in minimum space. The fabrication potential of Micro-Coax Cable is practically limitless, meeting mechanical and environmental requirements in phase matching, attenuation and VSWR optimization, assembly, encapsulating and insulating, and delay calibration. UTI provides finished assemblies, pretested and ready for installation.



LOW-PROFILE RIGHT-ANGLE MICRO-COAX CONNECTOR ASSEMBLIES

Reduce space requirements • Economical • Lengths from 2" to 48" • Silver plate is standard • Tin plate on special order



STANDARD GENERAL PURPOSE 50 OHM MICRO-COAX CABLES

Typical applications include: Microwave transmission lines • Amplifier shielding or isolation • Totally shielded interconnections • Microwave delay lines

Micro-Coax Part Number	Normal Impedance and Tolerance (ohms)	Outer(1) Conductor Diameter ±.001"	Dielectric Diameter ±.001"	Center Conductor Diameter (inches) Nominal	Center Conductor Material	Minimum Inside Bend Radius (inches)	Max. Temp. (°C)	Weight (lbs./100')	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Typical Attenuation (dB/100')/Power Kilowatts (CW)				
												0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
UT- 85	50.0±1.5	.0865 ·•	.066	.0201	SPCW	.125	150	1.4	2500	1500	60	13.0/0.221	19.0/0.151	44.0/0.065	64.5/0.045	96.0/0.030
UT- 85C	50.0±1.5	.0865 ·•	.066	.0201	SPC	.125	150	1.4	2500	1500	60	13.0/0.221	19.0/0.151	44.0/0.065	64.5/0.045	96.0/0.030
UT-141	49.0±1.0	.141 •	.116	.0359	SPCW	.250	175	3.2	5000	1900	34	7.5/0.742	11.0/0.506	26.0/0.214	39.5/0.140	60.5/0.091
UT-141A	50.0±1.0	.141 ·•	.1175	.0359	SPCW	.250	175	3.2	5000	1900	33	7.5/0.742	11.0/0.506	26.0/0.214	39.5/0.140	60.5/0.091
UT-141AA	50.0±0.5	.141 ·•	.1175	.0359	SPCW	.250	175	3.2	5000	1900	33	7.5/0.742	11.0/0.506	26.0/0.214	39.5/0.140	60.5/0.091
UT-141B	50.0±1.0	.141 •	.1175	.0359	SP BeCu	.250	175	3.2	5000	1900	33	8.5/0.742	12.0/0.506	28.0/0.214	41.0/0.140	62.0/0.091
UT-141C	50.0±1.0	.141 ·•	.1175	.0359	SPC	.250	175	3.2	5000	1900	33	7.5/0.742	11.0/0.506	26.0/0.214	39.5/0.140	60.5/0.091
UT-141L	50.0±1.0	.141	.1175	.0359	Tophet C†	.250	175	3.2	5000	1900	33	45.0/0.742	57.5/0.506	130.0/0.214	187.0/0.140	268.0/0.091
UT-250A	50.0±0.5	.250 •	.209(2)	.0640	SPC	.375	200	10.0	7000	3000	19	4.3/2.622	6.4/1.762	16.5/0.683	26.0/0.434	41.0/0.275
UT-325A	50.0±1.0	.325(2)	.285(2)	7x .0312	SPC	.750	200	14.5	7500	3000	14	3.0/4.733	5.0/2.840	13.0/1.092	20.5/0.693	
UT-390	50.0±0.5	.390(2)	.332(2)	.102	SPC	.750	200	25.0	12000	6000	12	3.0/5.512	4.5/3.675	12.0/1.378	19.0/0.870	

† Trademark W.B. Driver Co.

ULTRAMINIATURE 50 OHM MICRO-COAX CABLES

Typical applications include: High reliability miniature packages • Miniature delay lines • Printed circuit wiring • High speed computers

UT- 8	50.0±5.0	.008	.0045	.002	C	.032	85	.10	250	150		141.0/	200.0/	448.0/		
UT-13	50.0±4.0	.013	.010	.0031	SPCW	.063	85	.10	250	150		63.0/	89.5/	202.0/	288.0/	413.0/
UT-20	50.0±3.0	.023	.017	.005	SPCW	.063	85	.10	750	500	240	51.0/0.005	72.0/0.004	163.0/0.002	233.0/0.001	334.0/
UT-34	50.0±3.0	.034 ·•	.026	.008	SPCW	.125	100	.19	2000	750	150	32.0/0.019	45.5/0.013	104.0/0.006	149.0/0.004	215.0/0.003
UT-47	50.0±2.5	.047 ·•	.037	.0113	SPCW	.125	100	.38	2000	1000	109	22.0/0.035	31.0/0.015	71.5/0.011	103.0/0.007	151.0/0.005
UT-70-50 (Old No. UT-701)	50.0±2.0	.070	.059	.0179	SPC	.125	150	.79	2300	1200	68	14.5/0.163	21.0/0.113	49.0/0.048	71.0/0.033	105.0/0.022

ULTRAMALLEABLE 50 OHM MICRO-COAX CABLES

Typical applications are identical to ultraminiature cables above where slight sacrifices can be made in VSWR and impedance matching to attain higher power ratings and easier bends

UT-20M	50.0±8.0	.023	.013(5)	.0045	SPCW	.032	175	.10	750	500		51.0/0.019	72.0/0.013	163.0/0.006	233.0/0.004	334.0/
UT-34M	50.0±6.0	.0375	.024(5)	.008	SPCW	.063	200	.27	2000	750	150	32.0/0.072	45.5/0.050	104.0/0.022	149.0/0.015	215.0/0.010
UT-47M	50.0±4.0	.050	.037(5)	.0113	SPCW	.063	200	.45	2000	1000	109	22.0/0.132	31.0/0.096	71.5/0.042	103.0/0.029	151.0/0.020

Rigid Coaxial Cable MICRO-COAX®

10, 15, 25, 70, 75, 93 and 95 OHM MICRO-COAX CABLES

Typical applications include: CATV amplifier wiring • Capacitor sections • Low impedance matching for solid state units • Quarter-wave transformer sections

Micro-Coax Part Number	Nominal Impedance and Tolerance (ohms)	Outer Conductor Diameter ±.001"(1)	Dielectric Diameter ±.001"	Center Conductor Diameter (inches) Nominal	Center Conductor Material	Minimum Inside Bend Radius (inches)	Max. Temp. (°C)	Capacitance (pF/ft)	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Typical Attenuation (dB/100')/Power Kilowatts (CW)				
												0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
UT- 34-25 (Old No. UT- 25)	25±3.0	.034	.024	.0126	SPCW	.125	100	58.5	500	200	143.7	47.5/0.013	67.5/0.009	153.0/0.004	218.5/0.003	313.5/0.001
UT- 34-95	95±4.0	.034	.027	.0028	SPCW	.125	100	15.4	2000	1000	17.5	40.5/0.013	57.5/0.009	131.0/0.004	188.0/0.003	270.0/0.001
UT- 47-70	70±3.0	.047	.0375	.0071	SPCW	.125	100	20.6	2000	1000	11.8	23.5/0.150	33.5/0.110	77.5/0.045	112.0/0.030	163.0/0.019
UT- 43-10 (Old No. UT-10)	10±3.0	.043	.036	.0285	C	.250	100	145.0	500	200	81.0	61.5/0.013	87.0/0.009	179.5/0.004	281.5/0.003	402.5/0.001
UT- 90-25	25±3.0	.090	.073	.040	SPC	.125	175	58.5	1000	750	46.0	15.5/0.182	22.0/0.130	51.5/0.056	75.0/0.038	111.0/0.026
UT- 85-70 (Old No. UT-70)	70±2.0	.085 •	.057	.0113	SPCW	.125	175	20.6	2000	1200	78.0	15.0/0.190	22.0/0.130	50.5/0.057	74.0/0.039	109.5/0.026
UT- 85-75 (Old No. UT-852)	75±2.0	.085	.067	.0113	SPCW	.125	150	19.3	2500	1200	67.0	14.0/0.205	20.0/0.143	46.5/0.062	68.0/0.042	100.5/0.028
UT- 85-93 (Old No. UT-851)	93±1.5	.085	.073	.008	SPCW	.125	150	15.6	2500	1200	65.0	15.0/0.190	21.5/0.133	50.0/0.057	73.0/0.039	107.5/0.027
UT-130-93 (Old No. UT- 93)	93±1.5	.130	.1055	.0113	SPCW	.250	175	15.6	3000	1500	45.0	10.5/0.488	15.0/0.341	36.5/0.140	53.5/0.095	80.5/0.063
UT-141-15	15±3.0	.141	.114	.080	SPC	.250	175	97.0	1000	750	27.0	9.0/0.618	13.0/0,428	32.0/0.173	47.5/0.117	71.5/0.077
UT-141-70	70±1.0	.141	.107	.0201	SPCW	.250	175	20.6	5000	2000	41.0	8.5/0.655	12.5/0.445	30.0/0.185	44.5/0.125	67.5/0.082
UT-141-70C	70±1.0	.141	.107	.0201	SPC	.250	175	20.6	5000	2000	41.0	8.5/0.655	12.5/0.445	30.0/0.185	44.5/0.125	67.5/0.082
UT-141-75	75±1.0	.141 *	.1175	.0201	SPCW	.250	175	19.3	5000	2000	38.0	8.0/0.696	11.5/0.484	28.0/0.198	41.5/0.133	63.5/0.087
UT-141-75C	75±1.0	.141	.1175	.0201	SPC	.250	175	19.3	5000	2000	38.0	8.0/0.696	11.5/0.484	28.0/0.198	41.5/0.133	63.5/0.087
UT-250-75	75±1.0	.250(2)	.210(2)	.0359	SPCW	.500	200	19.3	7000	3000	21.0	4.5/2.505	6.5/1.735	175.0/0.644	27.0/0.418	42.5/0.265

AIR ARTICULATED (SPLINE) 50 OHM MICRO-COAX CABLES

Typical applications include: Spacecraft interconnections • Antenna feed cables • Liquid level sensing devices • Low loss receivers

Micro-Coax Part Number	Outer Conductor Diameter ±.002"	Dielectric Diameter ±.002"	Number of TFE Splines	Center Conductor SPCT Outside Diameter ±.001"	Center Conductor Inside Diameter ±.002"	Minimum Inside Bend Radius (inches)	Max. Temp. (°C)	Weight (lbs./100')	Dielectric Strength (VRMS, 60 Hz)	Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz)	Higher Order Mode (GHz)	Typical Attenuation (dB/100')/Power Kilowatts (CW)				
												0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	12.0 GHz
OFHC Copper																
UT-S-250-50	.250	.221	3	.087	.066	3.0	200	5.6	4000	1400	21.0	3.7/0.46	5.4/0.32	13.8/0.12	21.5/0.08	25.0/0.07
UT-S-325-50	.325	.285	5	.110	.090	5.0	200	9.5	5000	2000	16.4	2.8/0.61	4.2/0.41	11.0/0.15	16.5/0.10	19.0/0.09
UT-S-375-50	.375	.325	5	.125	.085	5.0	200	15.0	5000	2200	14.4	2.5/0.68	3.7/0.46	9.2/0.19	14.3/0.12	17.0/0.10
UT-S-390-50	.390	.340	5	.136	.096	5.0	200	16.3	5000	2200	13.6	2.3/0.74	3.4/0.50	8.0/0.21	12.0/0.14	15.0/0.11
UT-S-500-50	.500	.450	5	.174	.134	6.0	200	21.0	7500	3000	10.4	1.8/0.94	2.7/0.63	6.0/0.28	10.0/0.16	
1100 Aluminum																
UT-S-250-50 AL	.250	.221	3	.087	.066	3.0	200	2.6	4000	1400	21.0	4.2/0.37	6.5/0.26	17.5/0.09	24.3/0.06	27.5/0.05
UT-S-325-50 AL	.325	.285	5	.110	.090	5.0	200	4.5	5000	2000	16.4	3.4/0.49	5.0/0.33	13.2/0.12	20.8/0.08	23.6/0.07
UT-S-390-50 AL	.390	.340	5	.136	.096	5.0	200	7.5	5000	2200	13.6	2.8/0.60	4.2/0.40	11.4/0.15	18.3/0.11	21.0/0.08
UT-S-500-50 AL	.500	.450	5	.174	.134	6.0	200	11.0	7500	3000	10.4	2.3/0.76	3.4/0.51	9.7/0.22	15.9/0.13	

SPECIAL ORDER LOW IMPEDANCE AND HIGH IMPEDANCE MICRO-COAX CABLES

Typical applications include: Medical electronics • Computers • Aerospace • Detectors • Test equipment

Micro-Coax Part Number	Nominal Impedance and Tolerance (ohms)	Outer Conductor Diameter ±.001"	Outer Conductor Material	Dielectric Diameter ±.001"	Dielectric Material	Center Conductor Diameter (inches) Nominal	Center Conductor Material	Capacitance (Pf./Ft.)	Minimum Inside Bend Radius (inches)	Typical Attenuation (dB/100')				
										0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
UT-34-10	10.0±4.0	.034	Copper	.025	TFE	.0201	SPC	145.0	.125	88.5	124.0	280.0	400.0	566.0
UT-34-17	17.0±4.0	.034	Copper	.024	TFE	.0159	SPC	85.0	.125	58.5	83.0	188.0	270.0	392.0
UT-44-5	5.0±1.0	.044	Copper	.036	TFE	.032	SPC	290.0	.250	117.5	166.0	374.0	531.0	755.0
UT-47-35	35.0±1.5	.047	Copper	.037	TFE	.016	SPC	41.0	.125	25.0	25.0	36.0	119.0	173.0
UT-70-25	25.0±2.0	.070	Copper	.056	TFE	.032	SPC	57.0	.125	19.0	33.0	64.0	93.0	136.0
UT-75-10	10.0±3.0	.075	Copper	.057	TFE	.0453	SPC	145.0	.250	39.0	55.0	126.0	181.0	259.0
UT-85-15	15.0±2.0	.0865	Copper	.066	TFE	.046	SPC	97.0	.250	24.5	34.5	79.5	115.0	167.0
UT-90-35	35.0±2.0	.090	Copper	.074	TFE	.032	SPC	41.0	.250	13.5	19.0	45.0	66.0	98.0
UT-141-10	10.0±1.5	.141	Copper	.118	TFE	.092	SPC	145.0	.250	19.0	27.5	63.5	92.0	135.0
UT-141-25	25.0±1.0	.141	Copper	.116	TFE	.064	SPC	57.0	.250	10.0	19.0	33.5	50.0	105.0
UT-141-35	35.0±2.0	.141	Copper	.117	TFE	.0508	SPC	41.0	.250	8.0	12.0	29.0	43.0	65.5
UT-300-25	25.0±2.0	.300(2)	Copper	.261(2)	TFE	.144	SPC	57.0	.500	4.5	7.0	17.0	26.5	42.5
UT-325-12.5	12.5±2.0	.325(2)	Copper	.285(2)	TFE	.213	SPCT	121.0	.750	7.0	10.0	24.0	36.5	56.0

Micro-Coax Part Number	Nominal Impedance and Tolerance (ohms)	Outer Conductor Diameter ±.001"	Outer Conductor Material	Dielectric Diameter ±.001"	Dielectric Material	Center Conductor Diameter (inches) Nominal	Center Conductor Material	Minimum Inside Bend Radius (inches)	Typical Attenuation (dB/100')				
									0.5 GHz	1.0 GHz	5.0 GHz	10.0 GHz	20.0 GHz
UT-48-75	75.0±3.0	.048	Copper	.037	TFE	.0063	SPCW	.125	23.0	33 0	76.0	110.0	160.0
UT-85-70-B	70.0±2.0	.084	Copper	.056	TFE	.0113	SP BeCu	.125	16.0	23.0	51.0	74.5	110.0
UT-90-70	70.0±2.0	.090	Copper	.074	TFE	.0142	SPCW	.125	12.5	18.0	42.5	62.5	93.0
UT-90-100	100.0±2.0	.090(2)	Copper	.075(2)	TFE	.0069	SPCW	.125	16.0	23.0	54.0	78.5	115.5
UT-130-93-AL	93.0±1.5	.130	1100 AL	.1055	TFE	.0113	SPCW	.250	11.0	16.0	38.0	55.0	82.5
UT-130-93-SS	93.0±1.5	.130	304 SS	.1055	TFE	.0113	SPCW	.250	15.5	22.0	55.0	75.0	110.0
UT-141-100	100.0±2.0	.141	Copper	.1175	TFE	.0108	SPCW	.250	10.0	14.0	33.5	50.0	75.5
UT-250-110	110.0±2.0	.250(2)	Copper	.210(2)	TFE	.0159	SPCW	.250	8.5	12.5	30.0	45.0	68.0

(1) For plated conductor allow additional +.001".
(2) Dimensional tolerance ±.002".
(3) Dimensional tolerance ±.003".
(4) IP: Irradiated polyolefin.
(5) Nominal Dielectric Diameter.

*: Tin-plated (TP)
•: Silver-plated (SP)
SPC: Silver-plated copper.
SPCW: Silver-plated, copper-clad steel.

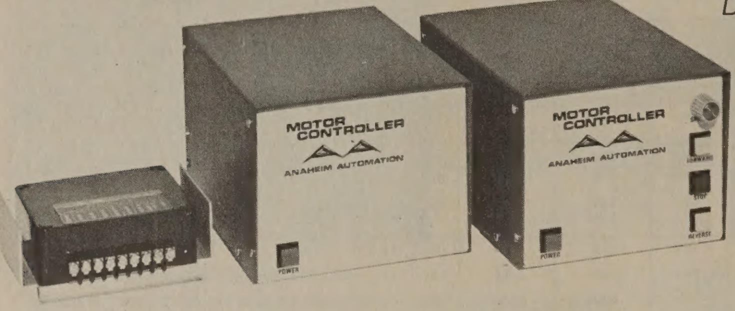
SP BeCu: Silver-plated beryllium copper.
SS: Type 304 Stainless steel.
SPCT: Silver-plated copper tube.
AL: Aluminum.

UNIFORM TUBES, INC.
. . . a UTI Company
COLLEGEVILLE, PA. 19426, U.S.A.
Phone 215/539-0700 • TWX 510-660-6107 • Telex 84-6428

Catalogs on Request

DRIVERS & MOTOR CONTROLLERS

ANAHEIM AUTOMATION



MODEL NUMBER	I/Ø AMPS PHASE	MOTOR TYPE	EXCITATION	ROTATION CONTROL	POWER SUPPLY VOC MAX.	POWER SUPPLY VOC NOM.	POWER SUPPLY VOC MIN.	PULSE GENERATOR
MODULAR/UNIPOLAR MOTOR DRIVERS								
M 31	3.0	3 + 4 Ø	S	FC + RC	35	28	15	N.A.
M 32	3.0	3 + 4 Ø	D	FC + RC	35	28	15	N.A.
M 38	3.0	3 + 4 Ø	HS	FC + RC	35	28	15	N.A.
M 61	6.5	3 + 4 Ø	S	FC + RC	35	28	15	N.A.
M 62	6.5	3 + 4 Ø	D	FC + RC	35	28	15	N.A.
M 68	6.5	3 + 4 Ø	HS	FC + RC	35	28	15	N.A.
M 65	6.5	5 Ø	2-2-2 2-3-2	FC + RC	35	28	15	N.A.
M 61284	6.5	4 Ø	MULTIMODE	FC + RC	35	28	15	N.A.
M 6128	6.5	3 + 4 Ø	MULTIMODE	FC + RC	35	28	15	N.A.
M 6128PG	6.5	3 + 4 Ø	MULTIMODE	FC + RC	35	28	15	M
MODULAR/BIPOLAR MOTOR DRIVERS								
MBU 32	3.0	4 Ø	D	FC + RC	32	28	24	N.A.
MB 32 - 15 MB 32 - 30	3.0	4 Ø	D	C + DC	± 22 ± 35	± 15 ± 30	± 12 ± 22	M
MB 52 - 15 MB 52 - 30	5.0	4 Ø	D	C + DC	± 22 ± 35	± 15 ± 30	± 12 ± 22	M
MB 58 - 15 MB 58 - 30	5.0	4 Ø	HS	C + DC	± 22 ± 35	± 15 ± 30	± 12 ± 22	M
PCB MOUNTED/UNIPOLAR DRIVERS								
DR 52	0.5	4 Ø	D	C + DC	35	28	10	M
D 21	2.0	4 Ø	S	FC + RC/C + DC	35	28	10	M
D 22	2.0	4 Ø	D	FC + RC/C + DC	35	28	10	M
D 28	2.0	4 Ø	HS	FC + RC/C + DC	35	28	10	M
2D 22IC[1]	2.0	4 Ø	D	FC + RC	35	28	15	N.A.
D 31	3.0	3 + 4 Ø	S	FC + RC	35	28	15	M
D 32	3.0	3 + 4 Ø	D	FC + RC	35	28	15	M
D 38	3.0	3 + 4 Ø	HS	FC + RC	35	28	15	M
D 41284	4.0	4 Ø	MULTIMODE	FC + RC	± 20	± 15	± 12	M
D 61284	6.5	4 Ø	MULTIMODE	FC + RC	35	28	15	M
DS 61284	6.5	4 Ø	MULTIMODE	FC + RC	35	28	15	M + SP
D 6128	6.5	3 + 4 Ø	MULTIMODE	FC + RC	35	28	15	M
DS 6128	6.5	3 + 4 Ø	MULTIMODE	FC + RC	35	28	15	M + SP

[1] TWO INDEPENDENT DRIVERS ON ONE PCB with Opto. coupled clock lines

PCB MOUNTED/BIPOLAR DRIVERS								
DB 22	2.0	4 Ø	D	C + DC	± 18	± 15	± 10	M
DB 28	2.0	4 Ø	HS	C + DC	± 18	± 15	± 10	M
DBU 32	3.0	4 Ø	D	C + DC	34	28	24	M
DB 62-15	6.5	4 Ø	D	FC + RC/C + DC	± 22	± 15	± 12	M
DB 62-30	6.5	4 Ø	D	FC + RC/C + DC	± 35	± 30	± 22	M
DBS 62-15	6.5	4 Ø	D	FC + RC/C + DC	± 22	± 15	± 12	M + SP
DBS 62-30	6.5	4 Ø	D	FC + RC/C + DC	± 35	± 30	± 22	M + SP
DB 68	6.5	4 Ø	HS	FC + RC	± 35	± 30	± 22	M
DBS 68	6.5	4 Ø	HS	FC + RC	± 35	± 30	± 22	M + SP
MC + MCL MOTOR CONTROLLERS								
MC 6128	6.5	3 + 4 Ø	MULTIMODE	FC + RC	115 VAC 60Hz			N.A.
MCL 6128	6.5	3 + 4 Ø	MULTIMODE	F + R RUN	115 VAC 60Hz			MAN. ADJ.

PRESET MOTOR DRIVERS				THUMBWHEEL SWITCH	MOTOR OPERATION		
PMD 73-11	6.5	4 Ø	MULTIMODE	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M
PMD 73-22	6.5	4 Ø	MULTIMODE	2-5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M
PMD 73-33	6.5	4 Ø	MULTIMODE	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 73-44	6.5	4 Ø	MULTIMODE	2-5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 76-1U	6.5	4 Ø	MULTIMODE	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 76-2U	6.5	4 Ø	MULTIMODE	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 76-1B	6.5	4 Ø	D	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 76-2B	6.5	4 Ø	D	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP
PMD 76-UB	6.5	4 Ø	MULTIMODE	5 DECADE	RUN-JOG-INDEX	115 VAC 60 Hz	M + SP

Footnotes:

3 Ø — 3 Phase Motors
4 Ø — 4 Phase Motors
5 Ø — 5 Phase Motors
S — Single
D — Dual
HS — Half-Step

C & DC — Clock Input with Direction Control Line
FC & RC — Forward and Reverse Clock Lines
M — Manual Pulse Generator
SP — Speed Ramping Pulse Generator for Ramping
Multimode — Single, Dual and Half-Step

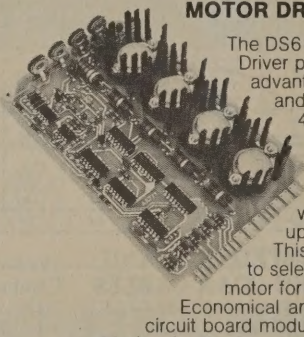
Note: Some motor manufacturers refer to their 4Ø motors as 2Ø; others as 8Ø.

MODULAR AND PCB-MOUNTED DRIVERS AND CONTROLS FOR 2-8 PHASE STEPPER MOTORS

- **Multi-mode control for single, dual or half-step excitation**
- **May be used with all standard makes of stepper motors**
- **Up/down pulse generator enables speed ramping to 6000 PPS**
- **All units operate over wide supply voltage range**
- **36 standard driver models, 11 controller styles available from stock**

A complete selection of standard electronic stepper motor drives is offered by ANAHEIM AUTOMATION, drawing upon many years of experience in design and stepper system applications. With proper selection, stepping motor performance may be significantly improved. Modifications to these units or custom driver systems are readily made to answer unique requirements.

MOTOR DRIVER/*DS61284*



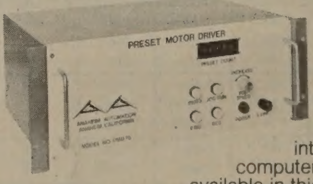
The DS61284 Multimode Motor Driver provides the combined advantages of multimode drive and speed ramping for 4-phase stepper motor operation. This driver operates from a wide range in power supply voltages and will drive motors requiring up to 6.5 Amperes/Phase. This flexibility allows the user to select the most appropriate motor for his application. Economical and compact, the printed circuit board module plugs into a standard 22 pin edge card connector, and is easy to mount.

PRESET MOTOR DRIVER/*PMD73*

PRESET MOTOR DRIVER

The Preset Motor Driver PMD73 Series provides the user with the ability to preselect the number of steps a motor is to travel. Three modes of motor operation are available: Run, Jog, and Index. An up/down pulse generator furnishes the signals necessary for speed ramping to obtain optimal motor performance automatically.

PRESET MOTOR DRIVER/*RACK MOUNTABLE*



The PMD76 Series is contained in a Rack-Mountable cabinet, designed for applications requiring special features, packaging and operational flexibility. Special interfaces, including computer control, are available in this series.

"Standard design which can be modified to meet customer requirements."

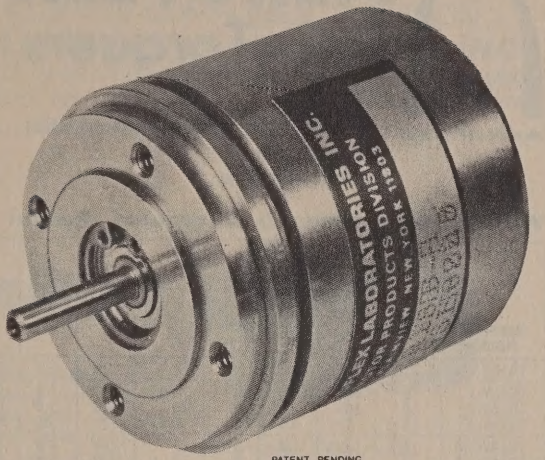
ANAHEIM AUTOMATION

MACHINE AND PROCESS CONTROL
PRODUCTS DIVISION
922 ORANGEFAIR LN., ANAHEIM, CA 92801
(714) 992-6990

AEROFLEX

brushless DC motors— featuring:

- **A complete package with fully integrated electronics.**
- **Solid state switching techniques and patented solid state sensing.**
- **Inverted rotor-to-stator relationship.**
- **Speed independent non-contacting rotor position sensors.**



PATENT PENDING

You no longer have to endure the penalties of brush wear and high power loss. You can have the high starting torque/speed characteristics of conventional, permanent magnet DC motors —plus the brushless advantages of greater reliability, higher efficiency, lower operating temperatures, and a service life limited principally by bearing wear. Also, being brushless, they run without fear of sparking so they can be used in exposive, corrosive and other hostile environments.

Aeroflex brushless DC motors have the high starting torque and linear speed/torque characteristics of conventional, permanent magnet, DC motors. The solid-state commutation circuitry is available with integral speed regulation, to meet custom requirements.

The motor can be supplied for operation from a fixed polarity voltage and rotation in either direction, or with the direction of rotation reversing with reverse polarity voltage.

Fan and blower motor applications can benefit by the higher reliability of the Aeroflex brushless DC motors. In addition, these motors may be used in AC blower applications without the rotational speed/line frequency limitations of AC motors.

In instrumentation and control applications, their reliability and long life can significantly enhance total system performance. They are compatible with pulse modulation and pulsed variable rep-rate types of servo control techniques.

Contact Aeroflex Motor Applications Engineering for assistance.

TYPICAL PERFORMANCE DATA

FRAME SIZE	8	11	15	25	33
Stall Torque (oz/in)	.2-.8	1-1.5	1.5-8	3-13	5-40
Stall Power (watts)	6	8	14-22	23-35	50-110
Rotor Moment of Inertia (gm cm^2)	.5	1.0	5.0	140	750
Rated Torque (oz/in)	.1-.4	.5-.75	1-5	1.75-8	3.5-25
Speed at Rated Load (rpm)	2,500/5,000	2,500/5,000	150/5,000	150/5,000	150/5,000
No Load Speed (rpm)	5,000/10,000	5,000/10,000	3,000/10,000	3,000/10,000	3,000/10,000
Weight (oz.)	2.5	5.0	10	25	65
Dim. "A" Length	1.25	1.75	2.00	4.00	5.00
Dim. "B" Dia.	.750	1.062	1.437	2.75	3.31
Dim. "C" Pilot Dia.	.500	.825	.875	N/A	N/A
Dim. "D" Pilot Length	.040	.062	.040	N/A	N/A

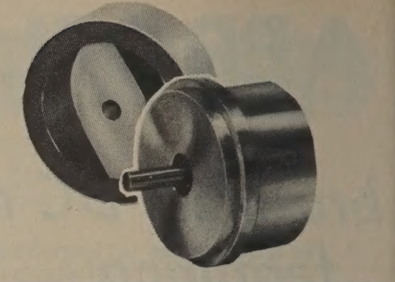
NOTES:

1. Designed to meet military and industrial specifications.
2. Available with speed regulation to ±1% for variations in load torque and supply voltage.
3. Shaft details as requested.
4. Synchro type mounting optional.
5. Excitation voltage - standard ratings available.
6. Peak torque ratings approx. 40% above continuous value.
7. Efficiency up to 75%.
8. Consult our engineering staff for other ratings.

AEROFLEX

MOTOR PRODUCTS DIVISION
AEROFLEX LABORATORIES INC.
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N. Y. 11803
DEPT. EM **TEL. (516) 694-6700**

AEROFLEX *brushless* D.C. Torquers



FEATURES:

AEROFLEX

- No commutator brush or contact friction
- Unlimited life
- Infinite resolution
- Direct Drive
- No radio noise or explosion hazard
- No motor ripple or "slot lock"

Wide Angle *brushless* D.C. Torquers (Partial Listing)

Basic Part Number	Peak Torque (oz. in.)	Peak Power (watts)	Continuous Torque (oz. in.)	Continuous Power at 25°C (watts)	Driving Voltage for Continuous Torque (volts D.C.)	Angular Excursion (degrees)	Torque Sensitivity (oz. in./amp.)	Back EMF (v/rad/sec)	Resistance at 25°C (ohms)	Electrical Time Constant L/R (sec)	Rotor Inertia (oz. in. sec²)	VISCOUS DAMPING		Weight (oz.)	PANCAKE DIMENSIONS		
												Infinite	Zero		O.D. (inch)	Thick. (inch)	I.D. (inch)
												Source Impedance (oz. in./rad/sec)					
TQ10Y-10	1.3	21	.5	2.4	12	120	2.5	.018	60	3×10^{-4}	1.6×10^{-5}	1.5×10^{-5}	1.1×10^{-3}	1	1.000	.350	.125
TQ10Y-1	6	110	1.5	7	34.5	120	7.6	.055	175	2×10^{-4}	4×10^{-5}	4×10^{-5}	2.4×10^{-3}	2	1.000	.700	.125
TQ10Y-2	6	103	1.5	7	26	120	5.8	.041	100	2×10^{-4}	4×10^{-5}	4×10^{-5}	3×10^{-3}	2	1.000	.700	.125
TQ10Y-4	6	85	1.5	5	5.6	120	1.6	.011	6	2×10^{-4}	4×10^{-5}	4×10^{-5}	3×10^{-3}	2	1.000	.700	.125
TQ18W-30	3	25	1.8	8	17	120	3.9	.027	36	5×10^{-4}	2.4×10^{-4}	3×10^{-4}	2×10^{-3}	3	1.718	.350	.187
TQ18W-37	3	20	1.9	8	15	120	3.5	.025	27	5×10^{-4}	2.4×10^{-4}	3×10^{-4}	2×10^{-3}	3	1.718	.350	.187
TQ18W-23	8	45	4	11	22.5	120	8.5	.060	48	8×10^{-4}	4.8×10^{-4}	3×10^{-4}	1×10^{-2}	4	1.718	.700	.187
TQ18W-35	8	35	4	9	4.6	120	2.2	.015	2.5	8×10^{-4}	4.8×10^{-4}	3×10^{-4}	1×10^{-2}	4	1.718	.700	.187
TQ18-25	5.6	25	3	7	20	50	9	.063	60	2×10^{-4}	3.2×10^{-4}	2×10^{-4}	1×10^{-3}	3	1.718	.350	.250
TQ18-26	5.6	25	3	7	13.4	50	5.6	.040	25	2×10^{-4}	3.2×10^{-4}	2×10^{-4}	1.1×10^{-3}	3	1.718	.350	.250
TQ18-28	10	47	5	12	7.6	50	3.3	.024	5	2×10^{-4}	5.8×10^{-4}	4×10^{-4}	1.6×10^{-2}	4	1.718	.600	.250
TQ18-1	18	75	8	14	51	50	30	.210	190	2×10^{-4}	6.7×10^{-4}	5×10^{-4}	3.3×10^{-2}	4	1.718	.700	.250
TQ18-11	18	75	8	14	12.8	50	7.5	.053	12	2×10^{-4}	6.7×10^{-4}	5×10^{-4}	3.3×10^{-2}	4	1.718	.700	.250
TQ18-47	18	80	8	16	20	50	10	.071	25	2×10^{-4}	6.7×10^{-4}	5×10^{-4}	2.9×10^{-2}	4	1.718	.700	.250
TQ25W-2	15	60	8	17	32.0	120	15	.106	60	2×10^{-3}	9×10^{-4}	1×10^{-4}	2.6×10^{-2}	4	2.500	.500	.250
TQ25W-4	15	60	8	17	52.8	120	25	.175	165	2×10^{-3}	9×10^{-4}	1×10^{-4}	2.6×10^{-2}	4	2.500	.500	.250
TQ25W-1	33	130	16	30	33.8	120	18	.130	38	3×10^{-3}	2.1×10^{-3}	2×10^{-4}	6×10^{-2}	7	2.500	1.000	.250
TQ25-6	30	63	10	7	8.3	50	12	.085	10	3×10^{-3}	1.5×10^{-3}	2×10^{-3}	1.6×10^{-1}	6	2.500	.500	.250
TQ25-9	30	70	15	17	9.5	50	8.5	.060	5.4	2×10^{-3}	1.5×10^{-3}	2×10^{-3}	9.4×10^{-2}	6	2.500	.500	.250
TQ25-2	80	150	25	14	14.8	50	27	.190	16	5×10^{-3}	4.4×10^{-3}	5×10^{-3}	3.2×10^{-1}	12	2.500	1.000	.250
TQ34W-1	40	90	30	37	25.7	120	21	.150	18	3×10^{-3}	4.2×10^{-3}	5×10^{-3}	1.8×10^{-1}	13	3.313	.625	.375
TQ34W-10	40	90	30	36	40	120	33	.240	44	3×10^{-3}	4.2×10^{-3}	5×10^{-3}	1.8×10^{-1}	13	3.313	.625	.375
TQ34W-12	80	180	60	83	38.6	120	28	.200	18	4×10^{-3}	8.4×10^{-4}	1×10^{-2}	3×10^{-1}	21	3.313	1.125	.375
TQ34-14	80	150	28	17	47.3	50	80	.570	135	1×10^{-3}	9.1×10^{-3}	1.5×10^{-2}	3.4×10^{-1}	16	3.375	.600	.250
TQ34-4	130	220	40	20	22.2	50	45	.310	25	1×10^{-3}	9.1×10^{-3}	1×10^{-2}	5.6×10^{-1}	16	3.375	.725	.250
TQ40W-4	150	270	60	45	8.5	120	12	.090	1.7	2×10^{-3}	2×10^{-2}	1×10^{-2}	6.3×10^{-1}	30	4.000	.850	.375
TQ40W-11	150	250	60	40	14.5	120	22	.160	5.2	2×10^{-3}	2×10^{-2}	1×10^{-2}	6.8×10^{-1}	30	4.000	.850	.375
TQ40W-1	260	250	120	50	14.1	120	34	.250	4.0	3×10^{-3}	4×10^{-2}	2×10^{-2}	1.9	51	4.000	1.500	.375
	Lb. Ft.		Lb. Ft.				Lb.Ft./Amp.				Lb. In. Sec²	Lb. In./Rad./Sec.		Lb.			
TQ52W-1	1.5	152	1.1	75	21.3	90	.31	.42	6.2	6.5×10^{-3}	6.9×10^{-3}	6.3×10^{-4}	2.6×10^{-1}	5	5.125	1.500	.750
TQ52-2	2.6	250	1.0	40	21.9	20	.57	.79	12	3×10^{-3}	8.8×10^{-3}	1.2×10^{-3}	4.5×10^{-1}	5	5.187	1.250	.984
TQ56-1	4.2	270	1.5	36	16.2	20	.70	.95	7.3	6×10^{-3}	1.8×10^{-2}	4.4×10^{-2}	1.06	10	5.625	2.000	1.000
TQ64W-5	4.2	230	2.4	91	14.5	90	.39	.53	2.3	6×10^{-3}	3×10^{-2}	2.5×10^{2}	1.06	16	6.235	2.300	1.187
TQ64-1	4.5	230	3.3	127	14.7	30	.39	.53	1.7	7×10^{-3}	5×10^{-2}	5.6×10^{-2}	1.25	16	6.375	2.300	1.187
TQ74W-5	4.2	300	1.5	39	24.2	110	.96	1.2	15	8×10^{-3}	5×10^{-2}	1.2×10^{-2}	5.8×10^{-1}	10	7.310	1.440	1.000
TQ74W-6	7.8	350	5.1	150	18.2	110	.62	.86	2.2	7×10^{-3}	1.5×10^{-1}	6×10^{-3}	2.4×10^{-1}	27	7.310	3.440	1.000
TQ74-4	3.3	170	1.6	43	15.1	30	.33	.46	1.7	4×10^{-3}	2.6×10^{-2}	4.4×10^{-2}	1.25	8	7.375	1.160	.812
TQ74-2	7.0	350	4.5	150	20.1	30	.66	.89	2.95	6×10^{-3}	5×10^{-2}	6×10^{-2}	2.4	19	7.380	2.290	.812
TQ82W-1	4.0	450	2.5	174	31.3	120	.48	.7	6.4	2.8×10^{-2}	3×10^{-2}	2×10^{-2}	1.2	12	8.190	1.380	.820
TQ120-2	22	375	18	178	20.2	40	2.05	2.1	2.3	1.5×10^{-2}	3.2×10^{-1}	2×10^{-1}	2.2×10^{1}	49	12.500	2.250	1.380
TQ140W-1	18	580	17	500	51	120	1.70	2.3	5.2	4×10^{-2}	6×10^{-1}	1.5	1.2×10^{1}	60	14.000	3.000	1.500

Full Rotation *brushless* D.C. Torque Motors

A torque delivery system designed to achieve maximum power efficiency within a minimum of space, weight and power. It consists of a permanent magnet brushless DC torquer mechanically coupled with a brushless resolver.

(Partial Listing)

Characteristics	TFR47-5P	TFR47-3P	TFR47-4P	TFR90-1P	TFR120-2P
Peak Torque	1.2 lb. ft.	4.1 lb. ft.	7.8 lb. ft.	16 lb. ft.	45 lb. ft.
Power	180 watts	240 watts	350 watts	180 watts	450 watts
Resistance	16 ohms	13 ohms	13 ohms	0.3 ohms	5.6 ohms
Size	4.625 in. O.D. x .62 in. Thick	4.625 in. O.D. x 1.75 in. Thick	4.625 in. O.D. x 2.25 in. Thick	9.00 in. O.D. x 2.50 in. Thick	12.00 in. O.D. x 3.25 in. Thick

Wide Angle *brushless* Tachometers

Basic Part Number	Output Sensitivity (v/rad/sec)	Resistance at 25°C (Ohms)	Rotor Inertia (oz. in. sec²)	Pancake Dimensions		
				O.D. (inch)	Thick. (inch)	I.D. (inch)
TG10Y-58	.03	210	1.6×10^{-5}	1.000	.350	.125
TG10Y-59	.06	390	4×10^{-5}	1.000	.700	.125
TG18W-56	.09	550	2.4×10^{-4}	1.718	.350	.187
TG18W-57	.24	1025	4.8×10^{-4}	1.718	.700	.187
TG18-54	.17	520	3.2×10^{-4}	1.718	.350	.250
TG18-55	.39	980	6.7×10^{-4}	1.718	.700	.250
TG25W-9	.7	920	2×10^{-3}	2.500	1.000	.250
TG25W-10	.5	500	1.5×10^{-3}	2.500	.500	.250
TG34W-5	1.0	1000	4.2×10^{-3}	3.313	.625	.375
TG34-41	1.5	825	9.1×10^{-3}	3.375	.725	.375
TG40W-5	1.2	335	2×10^{-2}	4.000	.850	.375
TG40W-3	2.5	535	4×10^{-2}	4.000	1.500	.375
TG52W-5	5.0	1100	1.1×10^{-1}	5.125	1.500	.750
TG52-7	3.7	360	1.4×10^{-1}	5.187	1.250	.984

For Commercial/Industrial Applications

Ask Aeroflex about the **Valueline**-Brushless, Wide Angle, Direct Drive, Low Cost, DC Torque Motors.

Available in a great variety of sizes and outputs, Valueline offers these designer benefits: • No gear trains required • System simplification • Precise positioning • Smooth, quiet output • Unlimited life

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MOTOR PRODUCTS DIVISION

AEROFLEX LABORATORIES INC.

SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N.Y. 11803
DEPT. EM
TEL. (516) 694-6700

AEROFLEX

SPECIAL DESIGN FEATURES AVAILABLE . . .
- CHOICE OF OPERATING VOLTAGES
- POLY-PHASE DESIGN
- VARIABLE FREQUENCIES

ROTATING COMPONENTS DIVISION
AEROFLEX LABORATORIES INC.
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, NY 11803
DEPT. EM **TEL. (516) 694-6700**

THE SOURCE FOR THE BROADEST VARIETY OF ROTATING COMPONENTS FOR THE MILITARY AND INDUSTRIAL ELECTRONICS INDUSTRY

- SYNCHRONOUS MOTORS
- INDUCTION MOTORS
- PM GENERATORS
- BRUSHLESS DC MOTORS
- SERVO MOTORS
- GEAR MOTORS
- TACHOMETER GENERATORS
- DRAG CUP MOTORS
- INDUCTION GENERATORS
- FANS
- BLOWERS

GEAR MOTORS

R.C. offers a wide range of integral motor-gearhead combinations with synchronous and induction motors as well as Servo motors in all R.C.I. frame sizes including 8, 10, 11, 15, 18, on up to 3⅞ O.D.

- Precision engineered for long life.
- Torque up to 4000 in oz.
- All Ratios.
- Backlash: 30 minutes maximum.
- Temperature Range: —55°C to + 150°C.
- Lubrication: MIL-L-6085, MIL-G-3278.
- Environmental Testing: MIL-E-5272.
- Mechanical slip clutch available on request.
- Ball bearings are stainless steel ABEC 5 or better as reqd.
- All gears precision class 2 or better per AGMA 236.04

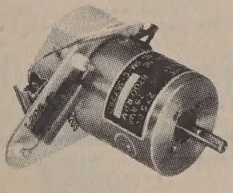
INDUCTION DRIVE MOTORS

Powerful • Rugged • Extremely Reliable • Versatile in Application

Frequencies:	50-60-400 cps • Variable Frequency • Dual Frequency
Speeds:	450 thru 22,000 rpm • 1-2-3 Speeds
Horsepower:	1/2000 to ¼ H.P.
Voltages:	To 440V AC • Single or Dual Voltages
Phases:	1-2-3 • Reversible or Unidirectional
Bearings:	Precision Life Lubricated Ball Bearings
Mounting:	Face, Base, Flange, Servo
MIL SPECS:	Exceed MIL-M-7969, MIL-M-17059, MIL-M-13787, MIL-E-16400, MIL-E-5400, MIL-E-5272, MIL-STD-202 Also for quality commercial applications
Life:	In excess of 10,000 hours in many designs
Gearheads:	Available with all models Hundreds of models available

BRUSHLESS DC MOTORS

• IMPROVE YOUR PRODUCT • REPLACE BRUSH TYPE MOTORS, FANS, BLOWERS.



OPERATE FROM DC POWER SOURCES • SOLAR CELLS.

LIFE — extremely long — no brushes to replace — no brush dust.

SAFER — no sparking in explosive atmosphere.

RFI — minimal.

MIL SPEC APPROVED for severe environments.

SPEEDS — wide selection as required.

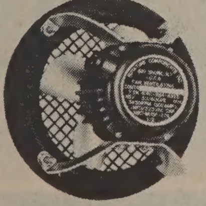
QUIET — no brush noise.

EFFICIENT — low input power.

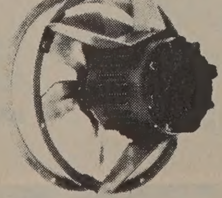
SUPERIOR at high altitudes.

USES — Aircraft — Submarines — Spacecraft — Ground Equipment — Any Electronic Equipment.

FANS

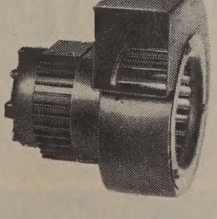


- 50/60 Hz
- 400 Hz
- 1 or 3 Phase

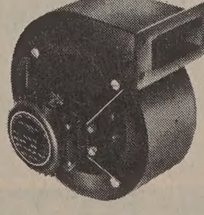


- 115-208 Volts
- 3300-11,000 RPM
- 40-1000 CFM

BLOWERS



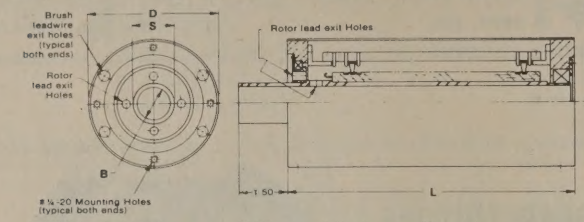
- Single
- Double
- 115-208 Volts



- 50-60 Hz
- 400 Hz
- 1 or 3 Phase

SLIP RING ASSEMBLIES

DAY-490 / DAY-499

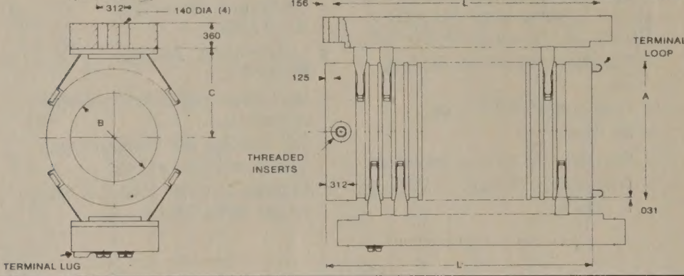

Brush leadwire exit holes (typical both ends)
Rotor lead exit Holes
D
S
B
# ¼-20 Mounting Holes (typical both ends)
Rotor lead exit Holes
1 50
L

FRAME: Anodized Aluminum
RINGS: Coin Silver
BRUSHES: Silver Graphite
LEAFS: Beryllium Copper
CIRCUIT TERMINATION: Silver Lugs or Leadwire
CURRENT: 10 amp per circuit (20 amp available at extra cost)
VOLTAGE: 250V max. AC or DC
DIELECTRIC STRENGTH: 750 Vrms.
INSULATION RESISTANCE: 50 meg min
CONTACT RESISTANCE VARIATION: 10 milliohms max at max speed
OPERATING TEMP.: 0 to 250 F
HUMIDITY: 95% ° max.

MODEL	"B" DIA.	"D" DIA.	"S" DIA.	MAX RPM	MIN LIFE 10^6	TQUE IN-LBS.
DAY-490	1.00	4.00	1.250	5000	50	.21
DAY-491	1.75	5.00	2.125	4000	40	.30
DAY-492	2.75	6.50	3.125	3000	30	.40
DAY-493	3.75	7.50	4.125	2500	25	.50
DAY-494	4.75	8.50	5.125	2000	20	.61
DAY-495	5.75	9.50	6.125	1500	15	.71
DAY-496	6.75	10.50	7.125	1500	10	.82
DAY-497	7.75	11.50	8.125	1000	10	.92
DAY-498	8.75	13.00	9.125	1000	10	1.02
DAY-499	9.75	14.00	10.125	750	7.5	1.12

NO. OF CIRCUITS	"L"
4-10	4.88
11-20	6.75
21-30	8.63
31-40	10.50
41-50	12.38

CAY-731 / CAY-740

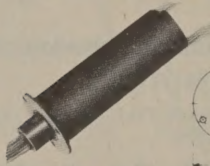

1 250
312
140 DIA (4)
360
C
B
TERMINAL LUG
156
L
TERMINAL LOOP
125
A
THREADED INSERTS
312
031
L

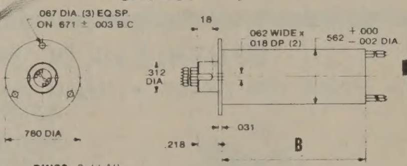
RINGS: Coin Silver
BRUSHES: Silver Graphite, two per ring
LEAFS: Beryllium Copper
INSULATION: Epoxy or Laminated Plastic
CURRENT: 10 amps per circuit standard (20 amps with 4 brushes per ring)
VOLTAGE: 250V max. AC or DC
DIELECTRIC STRENGTH: 750 Vrms.
CONTACT RESISTANCE VARIATION: 10 milliohms max
NO. OF CIRCUITS: 50 max

PART NO.	A	B	C
CAY-731	1.875	1.250	1.447
CAY-732	2.750	2.125	1.829
CAY-733	3.750	3.125	2.281
CAY-734	4.875	4.125	2.822
CAY-735	5.875	5.250	3.307
CAY-736	7.000	6.250	3.857
CAY-737	8.000	7.250	4.342
CAY-738	9.000	8.250	4.837
CAY-739	10.000	9.250	5.332
CAY-740	11.000	10.250	5.827

TO DETERMINE "L" DIMENSION USE THE FOLLOWING FORMULA:
"L" = .750 + .1875 x (No. of Rings)

CAY-604

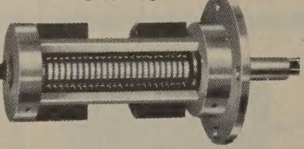


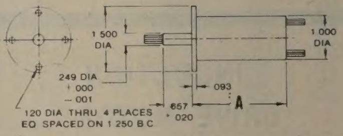

067 DIA (3) EQ SP. ON 671 ± 003 B.C
780 DIA
18
062 WIDE x 018 DP (2)
562 + 000 − 002 DIA
312 DIA
031
218
B

NUMBER OF RINGS	"B"
1 thru 12	.741
13 thru 24	1.137
25 thru 40	1.665

RINGS: Gold Alloy
BRUSHES: Gold Alloy Wire, Spring Temper
BALL BEARINGS: Stainless Steel, Shielded
SHAFT: Stainless Steel
HOUSING: Anodized Aluminum
TORQUE: 1 in. — oz. max
SPEED: 200 RPM max

CAY-110

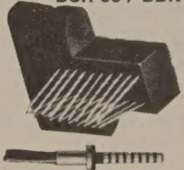


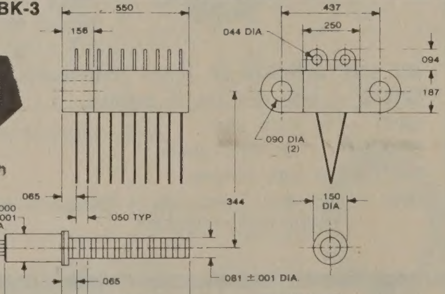

1 500 DIA
249 DIA + 000 − 001
120 DIA THRU 4 PLACES EQ SPACED ON 1 250 B.C.
093
657 + 020
A
1 000 DIA

CURRENT: 1 amp max per ring
VOLTAGE: 100V max
DIELECTRIC STRENGTH: 500Vrms.
CONTACT RESISTANCE VARIATION: 20 milliohms max
LIFE: 5 x 10^6 revs, min
ROTATION: Bi-directional
LEADWIRE: Teflon Insulated

NUMBER OF RINGS	"A"
1 thru 12	1.48"
13 thru 24	2.20"
25 thru 30	2.56"

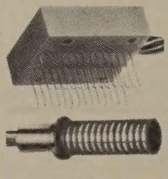
BSR-58 / BBK-3

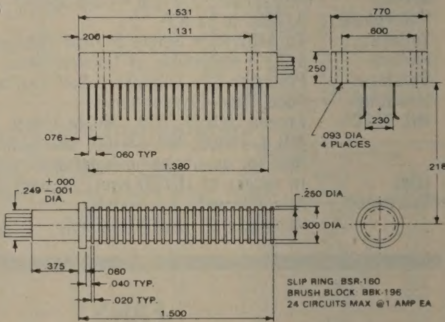



550
156
437
250
044 DIA
094
187
090 DIA (2)
344
150 DIA
065
+ 000 125 − 001 DIA
050 TYP
081 ± 001 DIA
065
050 TYP
250
550

SLIP RING BSR-58
BRUSH BLOCK BBK-3
10 CIRCUITS MAX @ ½ AMP EA

BSR-160 / BBK-196

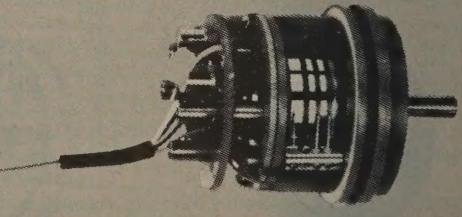



1 531
206
1 131
250
770
600
230
093 DIA 4 PLACES
076
060 TYP
1 380
218
+ 000 249 − 001 DIA
.250 DIA
300 DIA
375
080
040 TYP.
020 TYP.
1 500

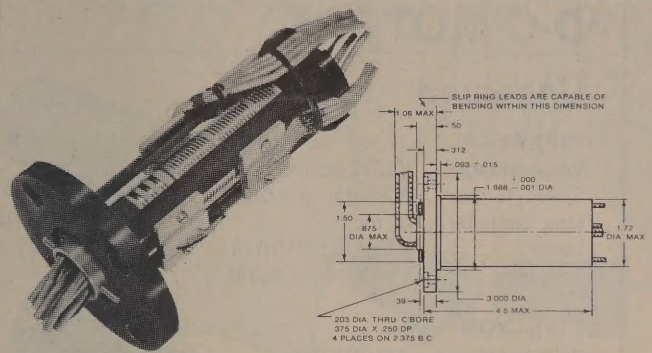
SLIP RING BSR-160
BRUSH BLOCK BBK-196
24 CIRCUITS MAX @1 AMP EA

ENCODERS & SWITCHES

Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as Size 5.



airflyte ELECTRONICS CO.

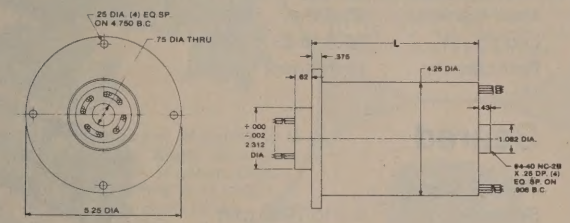

SLIP RING LEADS ARE CAPABLE OF BENDING WITHIN THIS DIMENSION
1.06 MAX
.50
.312
.093 ± .015
1.886 +.000 −.001 DIA
1.50
.875 DIA. MAX
1.72 DIA. MAX
.39
3.000 DIA
4.5 MAX
.203 DIA. THRU C'BORE .375 DIA. X .250 DP. 4 PLACES ON 2.375 B.C.

CAY-150

NOTES:
MECHANICAL
1. **Rings:** Gold alloy
2. **Brushes:** Gold alloy wire, spring temper
3. **Ball Bearings:** Stainless steel
4. **Shaft:** Stainless steel, type 303
5. **Housing:** Anodized aluminum
6. **Torque:** 48 ring assembly 6.0 in-oz. maximum
7. **Speed:** 600 r.p.m. maximum-intermittent
8. **Life:** 2000 hours'@100 r.p.m.

ORDERING INFORMATION:
CAY-150-
No. of Rings (48 maximum)

ELECTRICAL
1. **Current:** Signal level to 2 amps.
2. **Voltage:** 400 vdc maximum
3. **Dielectric Strength:** 1000 Volts rms (all combinations).
4. **Contact Resistance:**
   A. Less than 8 milliohms @200 rpm
5. **No. of Rings:** 48 maximum
6. **Leadwire:** #28 awg 18" long


.25 DIA. (4) EQ.SP. ON 4.750 B.C.
.75 DIA THRU
5.25 DIA
L
.375
.62
4.25 DIA.
.43
+.000 −.002 2.312 DIA
1.062 DIA.
#4-40 NC-2B X .25 DP. (4) EQ. SP. ON .906 B.C.

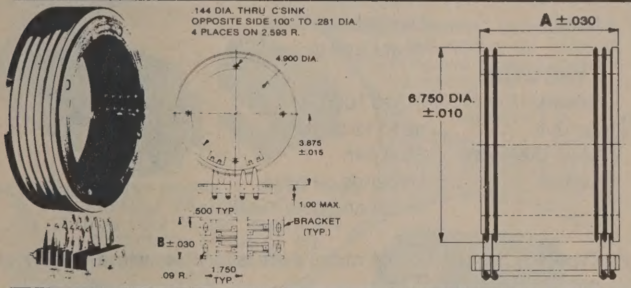
DAY-705

NOTES:
MECHANICAL
1. **Rings:** Coin silver
2. **Brushes:** Silver graphite
3. **Ball Bearings:** Shielded
4. **Shaft:** Anodized aluminum
5. **Housing:** Anodized aluminum
6. **Torque:** ½ in.oz. per circuit
7. **Speed:** 500 rpm maximum
8. **Life:** 3000 hours at 100 rpm

ORDERING INFORMATION:
DAY-705-☐
No.of Rings (160 maximum)

ELECTRICAL
1. **Current:** 5 amps maximum per circuit
2. **Voltage:** 0 to 150 volts, AC or DC
3. **Dielectric Strength:** 500 Volts rms (all combinations).
4. **Contact Resistance Variation:** 8 milliohms peak at maximum speed
5. **No. of Rings:** 160 maximum
6. **Leadwire:** #24 awg, teflon insulated.

No. of Rings	"L" ±.025"
1-20	5.375
21-40	8.187
41-60	11.000
61-80	13.812
81-100	16.625
101-120	19.437
121-140	22.250
141-160	25.062

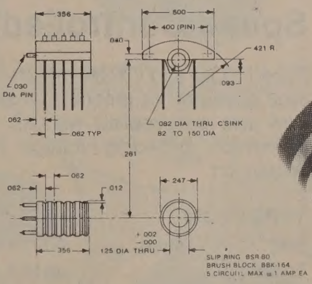

.144 DIA. THRU C'SINK OPPOSITE SIDE 100° TO .281 DIA. 4 PLACES ON 2.593 R.
4.900 DIA.
3.875 ±.015
1.00 MAX.
.500 TYP.
BRACKET (TYP.)
B ±.030
.09 R.
1.750 TYP.
A ±.030
6.750 DIA. ±.010

CAY-94

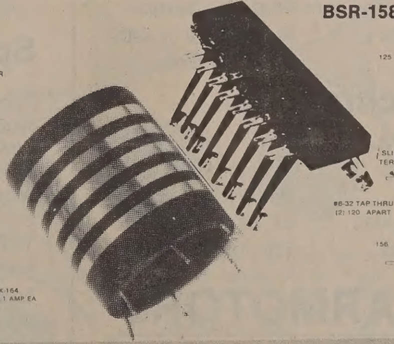
1. **Rings:** Coin silver
2. **Brushes:** Silver graphite (two per ring)
3. **Brush Leafs:** Beryllium copper
4. **Insulation:** Phenolic
5. **Leadwire:** Available upon request
6. **Speed:** 750 r.p.m.
7. **Life:** 1000 hours
8. **Current:** 5 amps per ring: 10 amps per ring when 4 brushes are used
9. **Voltage:** 300 VR.M.S.
10. **Dielectric Strength:** 500 Volts rms (all combinations).
11. **Insulation Resistance:** 10 megohms minimum at 500 VDC
12. **Noise:** The Contact Resistance Change in Each Circuit Shall be Less Than .005 Ohms At Maximum Speed

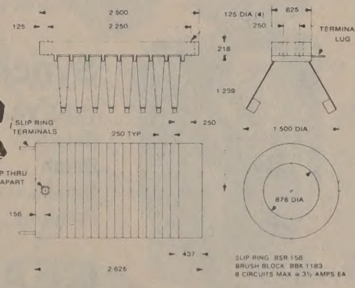
Part No.	A	B	No. of Rings
-41	6.065	6.497	41
-37	5.499	5.931	37
-33	4.933	5.365	33
-29	4.367	4.799	29
-25	3.801	4.233	25
-21	3.235	3.667	21
-19	2.952	3.384	19
-17	2.669	3.101	17
-15	2.386	2.818	15
-13	2.103	2.535	13
CAY-94 -11	1.820	2.252	11

BSR-80 / BBK-164

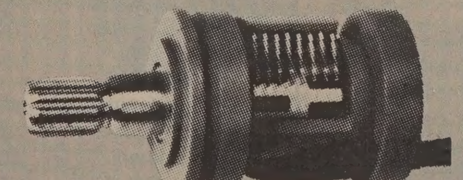

.356
.500
.400 (PIN)
.040
.421 R
.093
.030 DIA. PIN
.062
.062 TYP
.082 DIA. THRU C'SINK 82° TO .150 DIA.
.281
.062
.012
.247
+.002 −.000 .125 DIA. THRU
.356
SLIP RING BSR-80
BRUSH BLOCK BBK-164
5 CIRCUITS MAX @ 1 AMP EA

BSR-158 / BBK-1183




2.500
2.250
.125
.125 DIA (4)
.625
.250
TERMINAL LUG
.218
1.239
SLIP RING TERMINALS
.250
.250 TYP
1.500 DIA
#8-32 TAP THRU (2) 120° APART
.876 DIA
.156
.437
2.625
SLIP RING BSR-158
BRUSH BLOCK BBK-1183
8 CIRCUITS MAX @ 3½ AMPS EA

ENCODERS A wide variety of encoders is available: T / B, BCD, Gray, etc. Special encoders may require nominal tooling charges. Encoders can be supplied with built-in logic circuitry. Sizes: 8-33.



SWITCHES When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

CATALOGS • MANY STOCK ITEMS • FINE DESIGN STAFF

CONTACT **Airflyte ELECTRONICS CO.**
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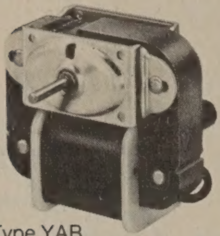
(201) 436-2230 • TWX 710-729-4489

A complete line of motors...designed for you

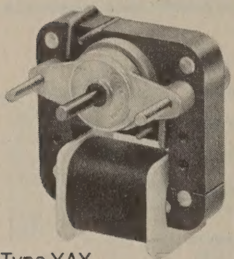
A-C MOTORS

Unidirectional


Type YAB

TYPE YAB

Rated hp	.0017 to .012
Depth	39.69 to 57.15 mm
Dimensions	71.44 x 65.88 mm
Remarks	51.59 mm mtg. centers


Type YAX

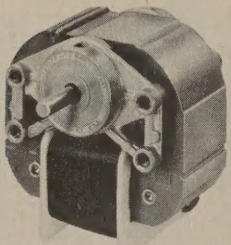
TYPE YAX

Rated hp	.002 to .013
Depth	38.46 to 67.03 mm
Dimensions	73.41 x 63.5 mm
Remarks	47.63 mm mtg. centers

TYPE YAR

Rated hp	.005 to .042
Depth	48.42 to 84.93 mm
Dimensions	84.14 x 82.55 mm
Remarks	Our highest powered A-C motor

Unit Bearing


Type YAR

TYPE YAU

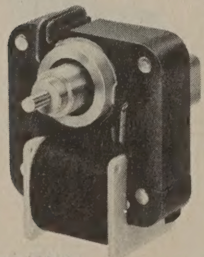
Rated hp	.003 to .008
Depth	39.29 to 55.17 mm
Dimensions	74.61 x 63.5 mm
Remarks	For low noise and long life

Reversible

TYPE YAE

Rated hp	.00015 to .006
Depth	39.69 to 49.21 mm
Dimensions	76.2 x 73.03 mm
Remarks	Mechanical or electronic switching

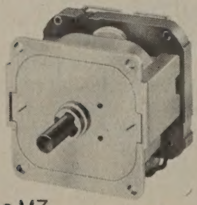
Synchronous


Type YAU

TYPE YAJ

Rated hp	.003 to .009
Depth	39.69 to 57.15 mm
Dimensions	61.12 x 65.88 mm
Remarks	For precise timing

GEARMOTORS*


Type MZ

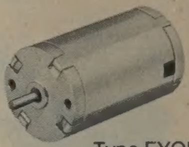
TYPE MZ

Torque output ..	up to 15 lb-in.
Gear ratios	3.33:1 to 3125:1
Remarks	Face mounting with on-center output shaft

*Several models available, including pancake gearheads.

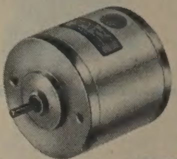
D-C MOTORS

Ungeared


Type FYQM

TYPE FYQM

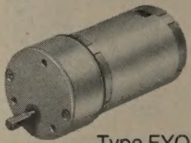
Voltage range ..	6 to 32 v d-c
Speed/torque ..	3000 rpm at 1.5 oz-in.
Max. diameter ..	32 mm
Length	44.45 to 57.15 mm
Remarks	Permanent magnet


Type CYQM

TYPE CYQM

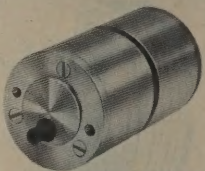
Voltage range ..	6 to 32 v d-c
Speed/torque ..	2700 rpm at 4 oz-in.
Max. diameter ..	50.8 mm
Length	50.8 to 63.5 mm
Remarks	Permanent magnet

Geared


Type FYQH

TYPE FYQH

Speeds	0.4 to 1900 rpm
Torque........	up to 3 lb-in.
Max. diameter ..	35.05 mm
Length	Depends on base motor and gear ratios


Type CYQH

TYPE CYQH

Speeds	0.3 to 1000 rpm
Torque........	up to 15 lb-in.
Max. diameter ..	50.8 mm
Length	Depends on base motor and gear ratios

Type FYQM and CYQM motors are available with a variety of pancake gearheads.

Speed-Controlled Units

Type FYQM and CYQM motors are available with a centrifugal type governor for mechanical speed control. Both motor types can also be supplied with an integral brushless tachometer generator, providing voltage feedback for electrical speed regulation.

TYPE FYQM

Reg. speed range	400 to 4800 rpm
Torque.............	up to 1.5 oz-in. at 3000 rpm
Max. diameter	32 mm
Length	53.09 to 56.39 mm
Remarks	Available with Type FYQH gearhead

TYPE CYQM

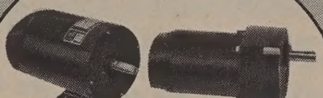
Reg. speed range	400 to 4800 rpm
Torque.............	up to 6 oz-in. at 1800 rpm
Max. diameter	50.8 mm
Length	57.15 to 76.20 mm
Remarks	Available with Type CYQH gearhead

Barber-Colman Company
MOTOR DIVISION
Dept. S, 14116 Rock Street, Rockford, Ill. 61101

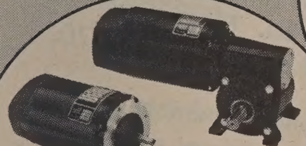
Bodine offers a broad line of fhp motors, gearmotors and speed controls.

More than 4000 standards. Hp from 1/2000 thru 1/3. Torques . . . 0.3 Oz-in. thru 350 Lb-in. Customs and specials . . . available in small and large quantities. Bodine distributors STOCK more than 425 motors, gearmotors, speed/torque controls. Call 312-478-3515 . . . or write for Catalog S. Bodine Electric Co., 2500 W. Bradley Place, Chicago, Illinois 60618.

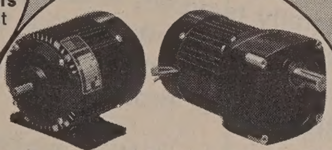
BODINE
ELECTRIC
COMPANY
BODINE MOTORS
GEARMOTORS
SPEED CONTROLS



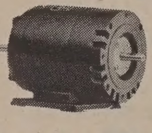
42A Permanent Magnet D-C Motors and Parallel Shaft Gearmotors. Just 4.30″ in diameter. Motors TENV ⅛, ⅙, ¼ Hp. Gearmotors have helical steel gearing.



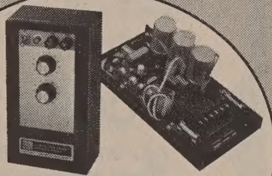
New 32A Permanent Magnet D-C Motors and Right Angle Gearmotors. Only 3.55″ in diameter. TENV Hp 1/12 thru ⅛ at 2500 Rpm. Many gear ratios available.



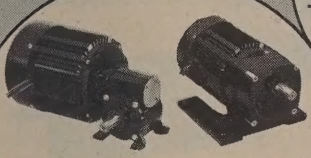
42R Induction Motors and Parallel Shaft Gearmotors. Motors 1/20 thru ¼ Hp. All A-C winding types. Gearmotor ratios to 300:1. Helical steel gearing.



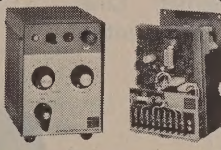
Torque Motors. Selected K-2, N-line and 48R motors for holding, positioning and winding applications. Intermittent and continuous duty. Standard ratings 7 thru 92 Oz-in.



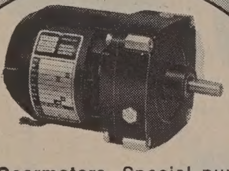
Encased and Chassis-type Speed Controls for Permanent Magnet Drives. Provides not only speed adjustment, but also adjustment of torque output. Available from stock.



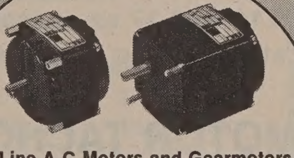
48R Induction Motors . . . Right Angle and Parallel Shaft Gearmotors. Motors thru ⅓ Hp. Available 115/230V in 50 or 60 Hz. Gearmotor ratios thru 30:1.



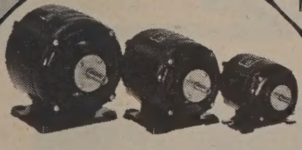
Encased and Chassis-type D-C Motor Speed Controls for Shunt Wound D-C Control Motors and Gearmotors. Nine encased models and four chassis models stocked.



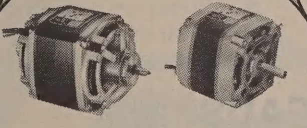
N-1S Gearmotors. Special purpose gearmotors for applications not requiring the ruggedness of the N-1D. In-line shaft. Only 3.41″ square. 100 lot minimum order.



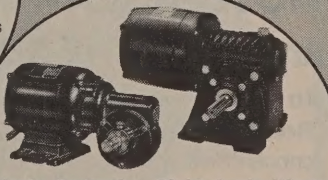
K-2 Line A-C Motors and Gearmotors. Instrument quality. Normal slip, high slip, and synchronous windings. Gearmotor torques thru 120 Oz-in. Only 2.405″ square. Stocked.



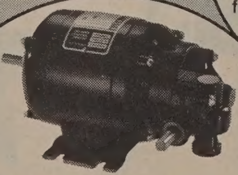
N-Line Motors. Three basic sizes; 3.36″, 4.50″ and 5.68″ in diameter. Stock ratings from 1/125 thru ¼ Hp. All popular windings are available.



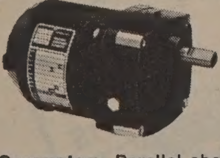
K-4 Motors. Special purpose motors for high volume applications. Standard ratings from 1/60 thru 1/20 Hp. Only 2.88″ square. 500 lot minimum order.



Single Reduction Right Angle Worm Gearmotors. 6 frame sizes with stock ratings to over 200 Lb-in. Ratios thru 60:1. Ample reserves for overloads.



N-1R Gearmotors. Single and double reduction right angle worm gearmotors. Stock ratings thru 5 Lb-in. Many ratios available for a wide range of speed selection.



N-1D Gearmotors. Parallel shaft helical and spur gearing. Ratings thru 40 Lb-in. Ratios thru 900:1. Only 3.41″ square.

Double Reduction Right Angle Worm Gearmotors. Provide high torques at low speeds. Stock ratings over 200 Lb-in. Ample reserves for overloads.

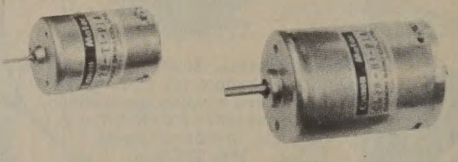
Canon®

D.C. MOTORS for OEMS

subfractional h.p.

Canon offers OEM users one of the world's broadest selections of subfractional h.p. d.c. motors at very competitive prices. Choose from literally hundreds of existing models, or, if you are a large quantity user, we'll supply units to your precise specs. Stall Torques range from 1/2 to 35 oz.-in., speeds to nearly 10,000 rpm ungeared. Most are available for broad voltage ranges, typically: 3-12, 3.3-16, 6-24, 24-70.

Mountings: Most are tapped for front mount. Others available.
Shafts: Length, flats, pinions, pulleys, etc. to customer specs.



IRON CORE TYPE

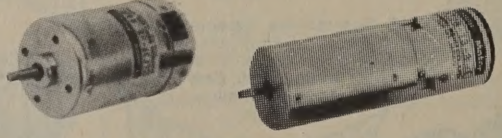
to 35 oz.-in. torque

Ungoverned and Mechanically Governed. Line includes low cogging models and models with extra long life brushes

BRUSHLESS TYPE

0.14 to 4.17 oz.-in. torque

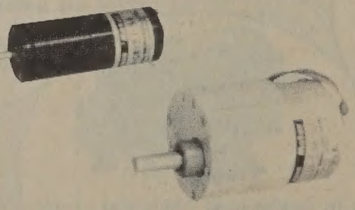
with or without electronics



MOTOR TACHOMETERS

to 20 oz.-in. torque

a.c. or d.c. output

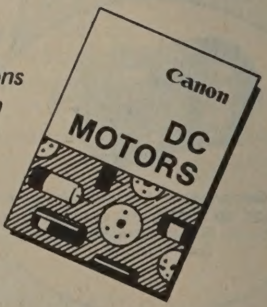


MOTOR GEARHEADS and GEARHEADS

to 140 oz.-in. output torque

Reductions from 1/5 to 1/3000 offset or concentric shafts. Mate with most Canon Iron Core and Brushless Motors.

Short Form Specifications Catalog and Data Sheets on individual motors available.



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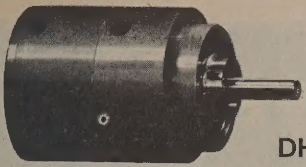
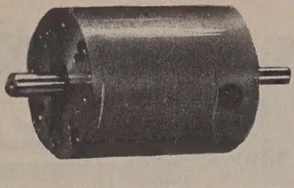
Electronics Components Div.
10 Nevada Drive,
Lake Success, L. I., N. Y. 11040

516/488-6700
Telex No. 96-1333
Cable - Canon USA LAKS



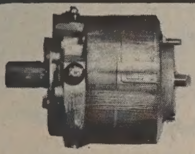
DH-4500-A-1

- Dual (coaxial) Tape Drive Motor
- 210 OZ.-IN. Peak Torque
- 4.5 inch outside diameter



DH-4000-AB-1

- Tape Transport Drive Motor
- 1100 OZ.-IN. Peak Torque
- 4 inch outside diameter



DH-3375-B-2

- Printer Carriage Drive
- 180 OZ.-IN. Peak Torque
- Alnico magnets

MOTOR ENCODER

- Motor Torque 270 OZ.-IN.
- Integral shaft position encoder
- Resolution up to 1000 cycles
- Gallium Arsenide light source

CLIFTON PRECISION

PERMANENT MAGNET

MOTORS

MOTOR TACHOMETERS AND MOTOR ENCODERS

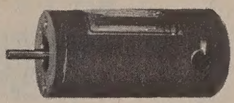
More O.E.M.'s now specify Clifton. They know that Clifton's advanced materials technology produces high quality P.M. motors that are rugged and reliable.

Applications include:

- REEL DRIVES
- PRINTER CARRIAGE DRIVES
- PAPER REEL TAKEUPS
- DISK MEMORY DRIVES
- PHASE LOCK SERVOS
- FACSIMILE EQUIPMENT
- MEDICAL INSTRUMENTS
- LABORATORY INSTRUMENTS

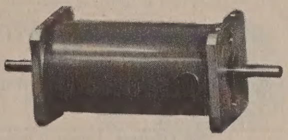
Litton CLIFTON PRECISION

Marple & Broadway, Clifton Heights, Pa. 19018
Att: John Staiber (215) 622-1000



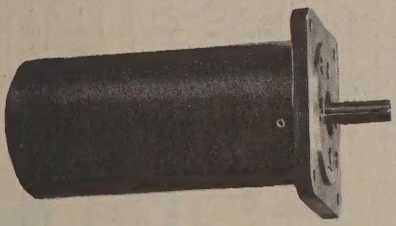
DH-2000-A-1

- Instrument Recorder Drive and Printer Carriage Drive
- 200 OZ.-IN. Peak Torque
- 2 inch outside diameter



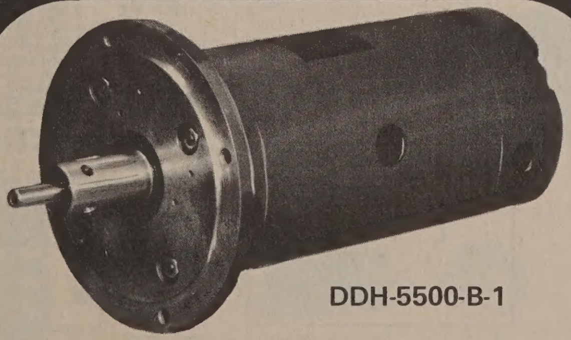
DH-2250-C-1

- Printer Carriage Drive
- Peak Torque 270 OZ.-IN.
- 2.25 inch outside diameter



DKH-4000-A-1

- Tape Transport Drive Motor
- 2000 OZ.-IN. Peak Torque
- 4 inch outside diameter



DDH-5500-B-1

- Dual (coaxial) Tape Drive Motor
- Peak Torque 1750 OZ.-IN.
- 5.5 inch outside diameter

RAPiD SYN DRIVERS

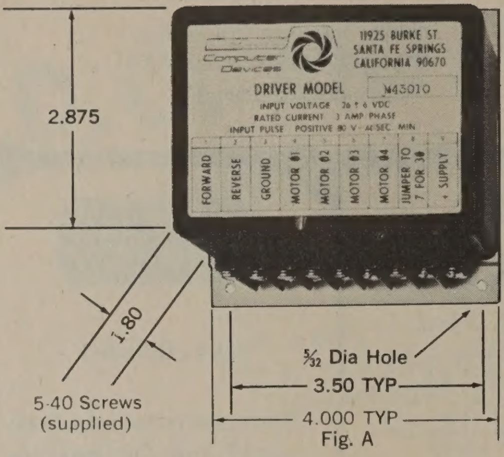

2.875
1.80
5-40 Screws
(supplied)
5/32 Dia Hole
3.50 TYP
4.000 TYP
11925 BURKE ST
SANTA FE SPRINGS
CALIFORNIA 90670
Computer Devices
DRIVER MODEL M43010
INPUT VOLTAGE 26 ± 6 VDC
RATED CURRENT 3 AMP PHASE
INPUT PULSE POSITIVE 80 V - 40 SEC. MIN
FORWARD
REVERSE
GROUND
MOTOR #1
MOTOR #2
MOTOR #3
MOTOR #4
JUMPER TO 7 FOR 30
+ SUPPLY

Fig. A

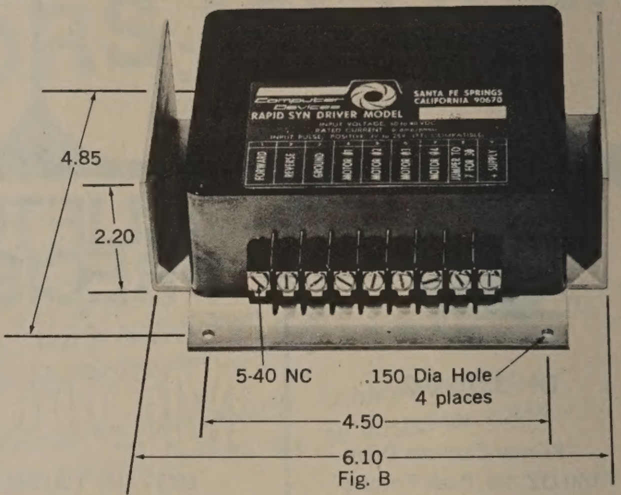

4.85
2.20
5-40 NC
.150 Dia Hole
4 places
4.50
6.10
Computer Devices
SANTA FE SPRINGS
CALIFORNIA 90670
RAPID SYN DRIVER MODEL
FORWARD
REVERSE
GROUND
MOTOR #1
MOTOR #2
MOTOR #3
MOTOR #4
JUMPER TO 7 FOR 30
+ SUPPLY

Fig. B

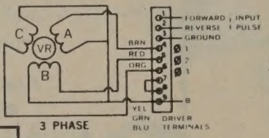
DESCRIPTION

Rapid-Syn Drivers are solid state pulse-to-step converters capable of providing bi-directional operation of the stepping motor.

All Rapid-Syn Drivers listed, except Model M2301F, are designed to drive 3 Phase and 4 Phase motors regardless of type or step angle of the motor. Model M2301F is a bi-polar driver designed for 4 Phase PM motors.

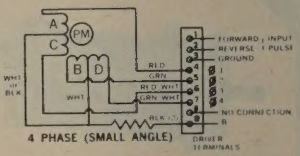
All models require 2.4 to 30 volts positive going pulse with a minimum pulse width of 20 micro-seconds (TTL compatable). For rated input voltage and maximum current rating of various models, refer to table.

FIG. 1


C
A
VR
B
BRN
RED
ORG
YEL
GRN
BLU
FORWARD
REVERSE
GROUND
INPUT PULSE
Ø1
Ø2
Ø3
B
DRIVER TERMINALS

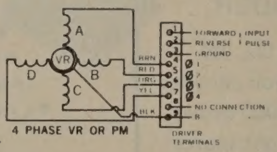
3 PHASE

FIG. 3


A
PM
C
B
D
WHT or BLK
RED
GRN
RED WHT
GRN WHT
WHT
BLK
FORWARD
REVERSE
GROUND
INPUT PULSE
Ø1
Ø2
Ø3
Ø4
NO CONNECTION
B
DRIVER TERMINALS

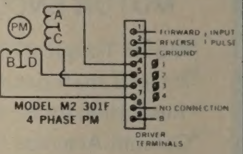
4 PHASE (SMALL ANGLE)

FIG. 2


A
VR
B
C
D
BRN
RED
ORG
YEL
BLK
FORWARD
REVERSE
GROUND
INPUT PULSE
Ø1
Ø2
Ø3
Ø4
NO CONNECTION
B
DRIVER TERMINALS

4 PHASE VR OR PM

FIG. 4


PM
A
C
B
D
FORWARD
REVERSE
GROUND
INPUT PULSE
Ø1
Ø2
Ø3
Ø4
NO CONNECTION
B
DRIVER TERMINALS

MODEL M2 301F 4 PHASE PM

GENERAL SPECIFICATIONS

Operating Temperature Range: 0°C to 60°C
Input Impedance: 3KΩ Minimum
Switching Capability: 10K PPS Minimum

Model No.	Rated Current Amp/Phase Max.	Dimensions	Rated Voltage VDC	Excitation Mode	Connection Diagram	Type
M61	6	B	10 to 40	Single Phase	Fig. 1, 2, 3	Unipolar
M62	6	B	10 to 40	Dual Phase	Fig. 1, 2, 3	Unipolar
M68	6	B	10 to 40	Half Angle	Fig. 1, 2, 3	Unipolar
M43010	3	A	22 to 34	Single Phase	Fig. 1, 2, 3	Unipolar
M43020	3	A	22 to 34	Dual Phase	Fig. 1, 2, 3	Unipolar
M83010	3	A	22 to 34	Half Angle	Fig. 1, 2, 3	Unipolar
M2301F	3	A	22 to 34	Two Phase	Fig. 4	Bipolar
BPM-5-15	5	B	±12 to 22	Two Phase	—	Bipolar

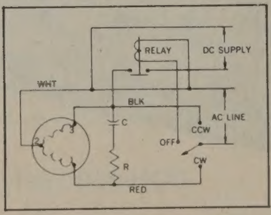
AC SYNCHRONOUS MOTORS

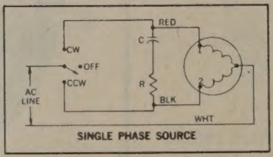
**120 VAC
60 Hz**

Model No.	Size	Speed (RPM)	Resist. Per Phase (Ohms)	Torque (Oz. In.)	Rotor Inertia (GM CM²)	Phase Shifting Component		Weight (Oz.)	Length (In.)	Fig. No.
						Res. ± 5%	Cap. ± 5%			
20PE-450	20	450	770	4.0	26	—	1.0 MFD-300VAC	8	1.00	8
20PS-300	20	300	770	4.0	26	—	1.0 MFD-300VAC	8	1.00	8
23H-400	23	200	420	25	120	200Ω-5W	1.75MFD-330VAC	32	3.25	6
23H-600	23	72	1100	25	50	500Ω-5W	.75MFD-330VAC	20	2.25	6
28PF-600	28	600	1000	10	93	—	1.0 MFD-300VAC	24	2.25	10
28PS-300	28	300	1000	12	93	—	1.0 MFD-300VAC	24	2.25	10
34H-400	34	200	225	50	1100	300Ω-25W	3.75MFD-330VAC	75	3 11/16	7
34H-600	34	72	300	100	550	400Ω-25W	2.25MFD-330VAC	50	2 7/16	7

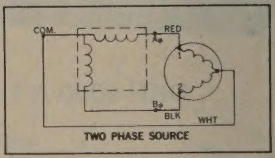
— CONNECTION DIAGRAMS —

Synchronous Motors Increase Holding Torque with a D.C. Source


RELAY
DC SUPPLY
WHT
BLK
C
AC LINE
CCW
OFF
CW
R
RED
1
2


RED
C
CW
OFF
CCW
AC LINE
R
BLK
WHT
1
2

SINGLE PHASE SOURCE


COM.
RED
A
B
BLK
WHT
1
2

TWO PHASE SOURCE

COMPUTER DEVICES CORPORATION OF CALIFORNIA
TEL. (213) 698-2595 TELEX 69-6352
11901 BURKE STREET / SANTA FE SPRINGS, CALIFORNIA 90670

RAPiD SYN
STEPPING MOTORS AND CONTROLS

INCREASE PRODUCT RELIABILITY—REDUCE COSTS!

Choose Steppers and Controls from the broad, flexible line of Computer Devices Corporation, and be assured of top quality at prices you can live with. Check our widest range of step angles in 2, 3, 4 and 5 phase units—all designed to operate from a wide variety of solid state logics which are stock items. Also available, RAPID SYN Synchronous 72, 200, 300, 450 and 600 RPM motors . You'll like our service on your special require-ments.

RAPID-SYN STEPPERS ... RATINGS AND CHARACTERISTICS*

Step Angle	Size	*Model Number	Type	Res/ϕ (Ohms)	Rated Voltage (VDC)	Static Stall Torque (Oz. In.)	Detent Torque (Oz. In.)	Dynamic Torque (Oz. In.)	Response (PPS)	Induct. mh	Rotor Inertia (gm. cm.^{2})	Weight (Oz.)	Length Max. (In.)	Fig. No.
1.8°	23	23F-180	VR/5ϕ	0.4	2.0	50	0	25	2000	1.00	350	66	4.938	10
	23	23D-6102	PM/4ϕ	5.1	5.1	53	5	35	700	6.80	87	20	2.0	6
	23	23D-6108	PM/4ϕ	0.63	1.3	53	5	35	1100	.68	87	20	2.0	6
	23	23D-6204	PM/4ϕ	2.6	4.3	100	8	65	900	6.30	200	32	3.25	6
	23	23D-6209	PM/4ϕ	0.37	1.7	100	8	65	1350	.80	200	32	3.25	6
	23	23D-6306	PM/4ϕ	1.16	3.4	150	10	100	1050	3.90	320	44	4.0	6
	23	23D-6309	PM/4ϕ	0.48	2.2	150	10	100	1150	1.43	320	44	4.0	6
	23	23H-02	PM/4ϕ	80	28	30.0	1.0	20.0	700	73.00	30.0	17.0	2.000	6
	23	23H-05	PM/4ϕ	5	6	30.0	1.0	20.0	1000	5.10	30.0	17.0	2.000	6
	23	23H-501	PM/4ϕ	5	6	60.0	2.0	40.0	450	67.00	120.0	20.0	2.250	6
	23	23H-502	PM/4ϕ	20	12	60.0	2.0	40.0	425	16.30	120.0	20.0	2.250	6
	23	23H-503	PM/4ϕ	80	24	60.0	2.0	40.0	425	66.50	120.0	20.0	2.250	6
	23	23H-700	PM/4ϕ	3	6	90.0	4.0	65.0	480	11.50	200.0	30.0	3.250	6
	34	34D-9106	PM/4ϕ	0.95	2.9	150	5	110	750	3.8	643	52	2.45	7
	34	34D-9109	PM/4ϕ	0.39	1.8	150	5	115	875	1.63	643	52	2.45	7
	34	34D-9209	PM/4ϕ	0.55	2.9	300	10	200	750	2.71	1200	88	3.7	7
	34	34D-9311	PM/4ϕ	0.52	2.8	450	15	300	650	1.90	1850	124	5.31	7
	34	34D-9314	PM/4ϕ	0.31	2.2	450	15	300	750	1.0	1850	124	5.31	7
	34	34H-02	PM/4ϕ	0.50	2	125.0	4.0	90.0	1100	1.76	375.0	45.0	2.500	7
	34	34H-501	PM/4ϕ	20	14	140.0	6.0	100.0	500	65.00	550.0	50.0	2.437	7
	34	34H-507	PM/4ϕ	150	35	140.0	6.0	100.0	500	1.25	550.0	50.0	2.437	7
	34	34H-508	PM/4ϕ	10	8	140.0	6.0	100.0	500	27.00	550.0	50.0	2.437	7
	34	34H-509	PM/4ϕ	4.50	5.5	140.0	6.0	100.0	500	20.00	550.0	50.0	2.437	7
	34	34H-510	PM/4ϕ	0.50	2.0	140.0	6.0	100.0	550	1.50	550.0	50.0	2.437	7
	34	34H-700	PM/4ϕ	0.70	3.0	280.0	10.0	200.0	800	4.00	1100.0	76.0	3.687	7
	34	34H-901	PM/4ϕ	1.1	4.5	500.0	15.0	250.0	600	6.13	1800.0	150.0	5.312	7
	42	42D-111-12	PM/4ϕ	.37	2.3	625	5	425	500	2.4	3900	125	4.74	8
	42	42D-112-12	PM/4ϕ	.60	3.6	1125	30	840	300	5.3	8150	232	6.99	8
2.25°	23	23F-215	VR/5ϕ	0.4	2.0	50	0	25	2000	1.76	350	66	4.938	10
5°	23	23H-300	PM/4ϕ	3.0	6	45.0	6.0	30.0	350	5.80	120.0	30.0	3.25	6
	23	23V-300	VR/4ϕ	3.0	6	40.0	0	22.0	420	7.50	120.0	30.0	3.25	6
	34	34H-300	PM/4ϕ	0.75	3	90.0	7	60.0	400	3.4	1200.0	75.0	3.687	7
7.5°	11	11RS-01	VR/4ϕ	100	28	2.3	0	1.20	750	45.00	2.5	5.0	1.400	2
	15	15RS-03	VR/4ϕ	55	28	8.0	0	5.0	1100	47.0	3.0	6.5	1.500	3
	20	20PS-24S	PM/4ϕ	90.0	24.0	7.0	2.0	4	275	40.0	26	8	1.00	8
	20	20RS-01	VR/4ϕ	20.0	28	30.0	0	10.0	700	47.0	10.0	20.0	2.500	5
	23	23PS-01B	PM/4ϕ	70.0	28	13	1.2	8	425	66.5	30	8	1.050	8
	28	28PS-05-24	PM/4ϕ	175	24	18.5	3.0	12.5	140	260.0	93	24	2.25	11
11.25°	20	20PE-24S	PM/4ϕ	90.0	24.0	7.0	2.0	4	275	40.0	26	8	1.00	9
15°	8	08R-01	VR/4ϕ	100	28	1.0	0	0.6	1400	65.0	0.18	1.8	1.000	1
	8	08V-01	VR/3ϕ	60	28	1.3	0	0.50	1100	30.0	0.18	1.8	1.000	1
	11	11R-01	VR/4ϕ	55	28	5.8	0	3.25	1040	45.0	1.0	4.7	1.625	2
	11	11V-01	VR/3ϕ	80	28	2.75	0	1.75	630	56.0	1.0	4.7	1.625	2
	15	15R-01	VR/4ϕ	35	28	8.0	0	4.50	1170	60.00	0.7	6.5	1.500	3
	15	15V-01	VR/3ϕ	16	28	5.8	0	2.25	1000	14.0	0.6	6.5	1.500	3
	18	18R-01	VR/4ϕ	55	28	11.5	0	8.0	620	140.0	5.0	13.0	1.875	4
	20	20R-03	VR/4ϕ	35	28	18.0	0	6.6	625	75.0	3.5	20.0	2.500	5
	20	20R-07	VR/4ϕ	20	28	38.0	0	25.0	400	51.0	10.0	20.0	2.500	5
	20	20R-17	VR/4ϕ	10	28	40.0	0	30.0	700	24.0	10.0	20.0	2.500	5
	20	20V-01	VR/3ϕ	10	28	50.0	0	13.6	475	30.0	10.0	20.0	2.500	5
	20	20V-03	VR/3ϕ	20	28	40.0	0	10.0	400	54.0	10.0	20.0	2.500	5
	28	28PF-08-24	PM/4ϕ	175	24	17.5	1.5	12.0	130	260.0	93	24	2.25	11
45°	8	08M-01	PM/4ϕ	65	28	1.0	0.10	0.35	700	35.0	0.3	1.75	1.000	1
	11	11M-01	PM/4ϕ	45	28	2.5	0.20	1.50	425	14.0	1.2	4.5	1.625	2
	15	15M-01	PM/4ϕ	30	28	8.1	0.30	4.80	300	17.9	5.0	10.0	2.100	3
	18	18M-01	PM/4ϕ	40	28	6.0	0.25	3.5	350	14.0	4.0	13.0	1.875	4
	20	20M-01	PM/4ϕ	12	28	15.0	0.40	8.7	300	13.0	15.0	26.0	2.500	5
90°	8	08P-02	PM/4ϕ	100	28	0.8	0.10	0.25	350	18.0	0.3	1.75	1.000	1
	11	11P-01	PM/4ϕ	60	28	2.5	0.20	1.10	240	22.0	1.2	4.3	1.625	2
	15	15P-03	PM/4ϕ	20	28	11.0	0.30	7.0	175	14.1	5.0	10.0	2.100	3
	18	18P-01	PM/4ϕ	20	28	8.0	0.25	6.0	260	20.0	4.0	13.0	1.875	4
	20	20P-03	PM/4ϕ	12	28	20.0	0.40	9.0	160	13.0	10.0	20.0	2.500	5

Fig. 1 Size 8 — 3/4″ Dia.

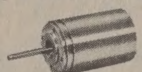


Fig. 2 Size 11 — 1 1/16″ Dia.

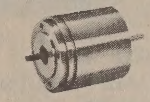


Fig. 3 Size 15 — 1 7/16″ Dia.

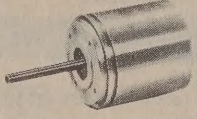


Fig. 4 Size 18 — 1 3/4″ Dia.

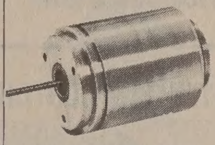


Fig. 5 Size 20 — 2″ Dia.

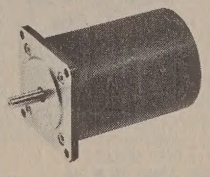


Fig. 6 Size 23 — 2 3/32″ Dia.

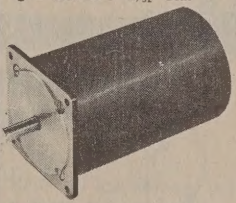


Fig. 7 Size 34 — 3 3/8″ Dia.

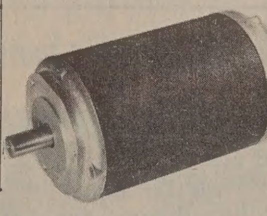
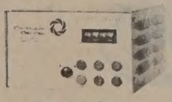


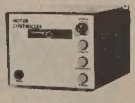
Fig. 8 Size 42 — 4 1/2″ Dia.

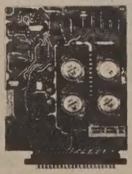
Pulse Source

Driver

ELECTRONIC ANCILLARIES


Preset Indexer


Adjustable Speed Drive


Accelerating Decelerating Drive

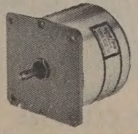


Fig. 11 Pacesetter 2.75″ Dia.

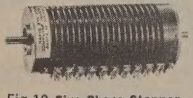


Fig.10 Five Phase Stepper 2.2″ Dia.

Fig. 9 Commercial Grade Stepper 2.0″ x 2.25″ Dia.

*For complete Model No. and detailed specifications, call or write to factory

Computer Devices

COMPUTER DEVICES CORPORATION OF CALIFORNIA

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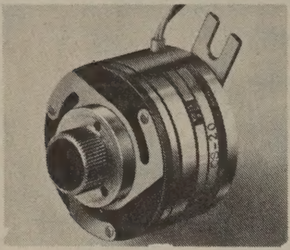
11901 BURKE STREET / SANTA FE SPRINGS, CALIFORNIA 90670

CLUTCHES & BRAKES ELECTRO MAGNETIC

SERIES 11 AND SERIES 20 . . . Two complete series of small clutches, brakes and clutch couplings for industrial and business machine applications.



CHARACTERISTICS	SERIES 11	SERIES 20
Diameter	1.25"	1.78"
Length (approx.)	1.25"	1.65"
Static Torque without burnishing	5 lb. in. min.	12 lb. in min.
Dynamic or slip torque	5 lb. in. at 1800 RPM 4 lb. in. at 3600 RPM	12 lb. in. at 1800 RPM 8 lb. in. at 3600 RPM
Mechanical response time		
65% rated torque	20 MS*	27 MS*
100% rated torque	40 MS*	45 MS*
Electrical response time	5 MS*	12 MS*
Power requirement	5 watts	6 watts
Coil voltages available	6,12,24,90 VDC	12,24,90 VDC
Standard bore sizes	3/16", 1/4", 5/16"	1/4", 5/16", 3/8"
Standard lead wires	26 AWG 12" L	22 AWG 12" L

*With forcing voltage the response time can be reduced and torque increased.

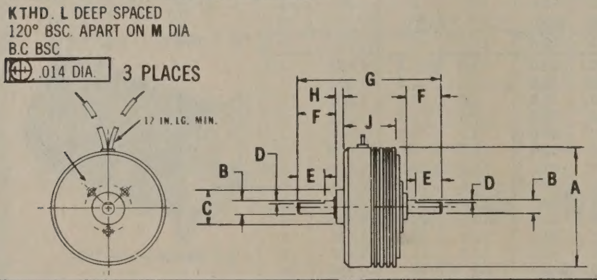
For further information ask for Bulletin #11/20

FEATURES

- High torque in compact package
- Fast response
- Ease of maintenance
- Available as stock items
- Standardized design at competitive price
- Flange or shaft mounting
- Long life
- Zero backlash armature with spring release
- **NO BURNISHING REQUIRED**

HYSTERESIS CLUTCHES/BRAKES

A continuous slip device capable of providing precise, infinitely adjustable torque control. Units are basically direct current sensitive, having excellent reliability, repeatability and linearity. Described below are some of the infinite variations of Hysteresis Brakes manufactured. Also available are a similar wide variety of clutches.



HYB-HYSTERESIS BRAKES SPECIFICATIONS

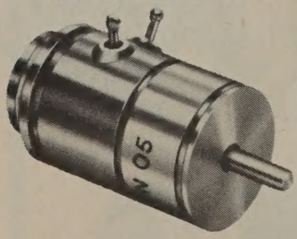
Size	A	B	C	D	E	F	G	H	J	K	L	M
	±.015	+.0000 −.0005	+.0000 −.0005	±.005	± .015	MIN.	± .015	±.005	± .015	THD.2B	MIN.	BSC.
10	1.250	.1875	.3750	.020	.375	.500	2.125	.050	.900	4-40	.125	.687
20	1.750	.1875	.5000	.020	.375	.500	2.030	.090	.765	4-40	.125	.687
30	1.953	.1875	.5000	.020	.375	.500	2.280	.090	1.000	4-40	.125	.687
35	2.093	.2500	.6250	.030	.500	.750	3.020	.090	1.200	6-32	.250	.937
40	2.875	.2500	.6250	.030	.500	.750	3.415	.090	1.540	8-32	.312	1.000
45	3.625	.3750	.8750	.062	.750	1.000	4.155	.125	1.530	8-32	.312	1.500
50	4.437	.5000	1.1250	.062	1.000	1.250	5.140	.150	2.000	10-32	.500	1.750
55	5.484	.5000	1.1250	.062	1.000	1.250	5.175	.150	2.060	10-32	.562	1.750

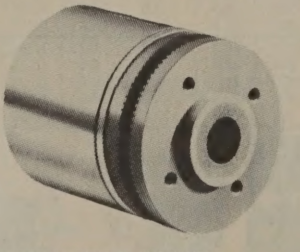
Information on sizes 70/85/120 rated at 750/1600/3000 oz. in respectively, available on request.

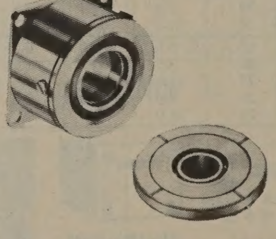
TECHNICAL DATA	10	20	30	35	40	45	50	55
Torque—Oz. In. Min. At Rated Voltage	4	8	20	35	60	125	210	425
Watts—Max. At Rated Voltage At 25°C.	4.0	4.0	4.5	7.0	7.0	7.0	7.0	8.0
Dissipation Capacity, Max. Avg.—Watts	5	10	15	20	50	80	120	150
Maximum Recommended Speed (Input)—RPM.	3600	3600	3600	3600	3600	3600	3600	3600
Moment Of Inertia—Oz. In. Sec.^{2} x 10^{-3} (Input)	.144	.57	.58	1.4	4.57	12.7	30.6	91.3
Drag Torque—Oz. In. Max. (De-energ. & Degaussed)	.20	.20	.20	.30	.40	.70	1.0	1.0
Weight—Lb. Max.	.3	.60	.80	1.2	2.6	4.1	7.8	12.5

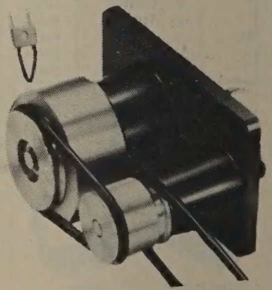
For further information ask for Bulletin # HCB

OTHER AVAILABLE UNITS









SUBMINIATURE CLUTCHES/ BRAKES

Fast response, low drag torque, high torque-to-inertia ratio, zero backlash. Torque from 3.5 to 240 oz. in. and response time from 4 to 50 mili. sec. Variety of designs for use as clutches, brakes, or clutch/brake combinations.

For further information ask for Bulletin #SCB

TOOTH TYPE CLUTCHES

Positive engagement and high torque to weight ratio make them ideal for airborne and space applications. Clutches and brakes available to 700 lb. in. Unit shown rated at 250 lb. in. in a 2-1/8" diameter x 2" long package.

For further information ask for Bulletin # TTC

APILON® FACED CLUTCHES and BRAKES

For severe service over extended periods of time. Special APILON ceramic friction facing has exceptionally high wear resistance and heat dissipation properties. Life expectancy of APILON faced units is in the area of 100 million operating cycles. The mechanical life of the unit matches the extraordinary life of the facings.

For further info ask for Bulletin # AFC

CUSTOM-DESIGNED UNITS

Delevan can provide units to meet the highly specialized requirements of virtually any commercial, industrial or military application. Here is a clutch/brake used to incrementally move recording type. The molded frame not only supports the clutch and brake, but also includes an idler pulley for a secondary speed output.

Delevan
Division

AMERICAN
PRECISION
INDUSTRIES INC.

270 QUAKER RD. / EAST AURORA, N. Y. 14052
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EAD Eastern Air Devices

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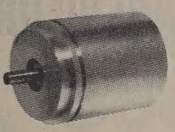
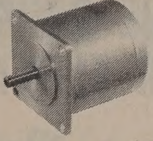
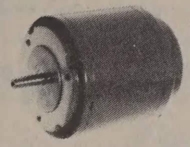
STEPPING MOTORS



Sizes 8 through 20 VR and PM stepping motors, 7.5, 10, 15, 22.5, 30, 45, and 90 degree step angles with a wide range of voltage and torque ratings. Heat sinks and mechanical dampers available.

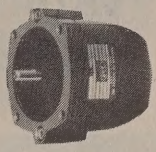


Size 23 (2 7/32″ dia.) and size 34 (3⅜″ dia.) permanent magnet stepping motors with 1.8, 1.875, 2, 2.5, 5, and 7.5 degree step angles. Torque ratings from 50 to 150 oz. in. for size 23, and 150 to 450 oz. in. for size 34.



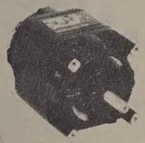
Size 42 (4 3/16″ dia.) permanent magnet stepping motors with 1.8 degree step angles. Torque ratings from 150 to 400 oz. in.

TACHOMETER ALTERNATOR

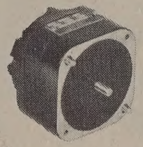


Model J15. Rugged PM design for maintenance free industrial applications. Output 5 volts/1000 RPM. 2.5% max. distortion, 0.1% linearity.

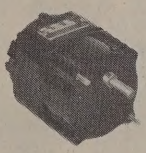
INSTRUMENT MOTORS AND GEAR MOTORS



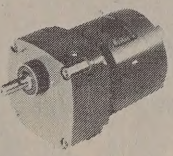
Holtzer Cabot Model M instrument motors with ratings up to 1/20 HP. Available as induction, torque, and synchronous motors in either face or foot mount. Only 2⅞″ sq. Popular for floppy disk drive applications.



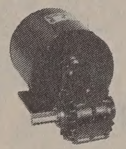
Holtzer Cabot Model L & S instrument motors with ratings up to 1/100 HP. Available as servo, polarized synchronous, synchronous, torque, induction, and DC motors. Only 2 9/16″ square.



Holtzer Cabot Model L & S instrument gear motors with ratings through 150 oz. in. Available with gear reductions from 3:1 to 3600:1 in either spur or in helical gearing. Only 2 9/16″ square.



Size 34 (3⅜″ dia.) synchronous and nonsynchronous gear motors. Speeds from 2 RPM to 150 RPM. Torque output up to 40 lb. in. For applications that require quiet operation and long life.



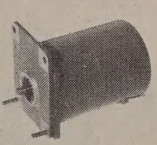
Holtzer Cabot right angle gear motors. Up to ⅛ HP in a variety of voltages, either AC or DC. Gear ratios from 6:1 to 1140:1 in either single or double reduction gear reducers.

SYNCHRONOUS AND INDUCTION MOTORS

Size 34 (3⅜″ dia.) and 44 (4⅜″ dia.) synchronous and induction motors. 1/300 through ½ HP. 600 to 12,000 RPM. Single or dual speeds, single or dual voltage. 50/60 or 400 Hz.

Size 39 (3⅞″ dia.) synchronous and induction motors. 1/200 through ½ HP. 600 to 3600 RPM. Single or dual speeds. 50/60 Hz.

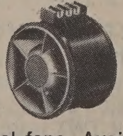
BRUSHLESS DC MOTORS



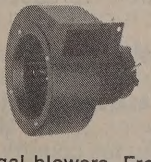
Size 15 brushless DC motors. Various voltage and torque ranges. Typical are 24 VDC, 0.6 oz. in. @ 3000 RPM and @ 45% efficiency.

FANS AND BLOWERS

Propeller and Tubeaxial fans. Up to 12″ dia. up to 1500 CFM. The EAD line of axial fans for cooling application is manufactured for continuous duty and efficient air circulation.



Vaneaxial fans. Available in 1½″, 2″, and 4¾″ dia. from 3 to 500 CFM at high static pressures. EAD V-Line fans are small and powerful air moving devices particularly suited to high-density electronic packages.



Centrifugal blowers. From 3 to 2000 CFM, static pressures up to 5″ of water. These centrifugal squirrel cage blowers have general-purpose performance characteristics for systems with medium back pressures.

EAD Motors

Holtzer Cabot Instrument Motors

Janette

Gear Motors and Reducers

A division of
Electro Audio Dynamics, Inc.

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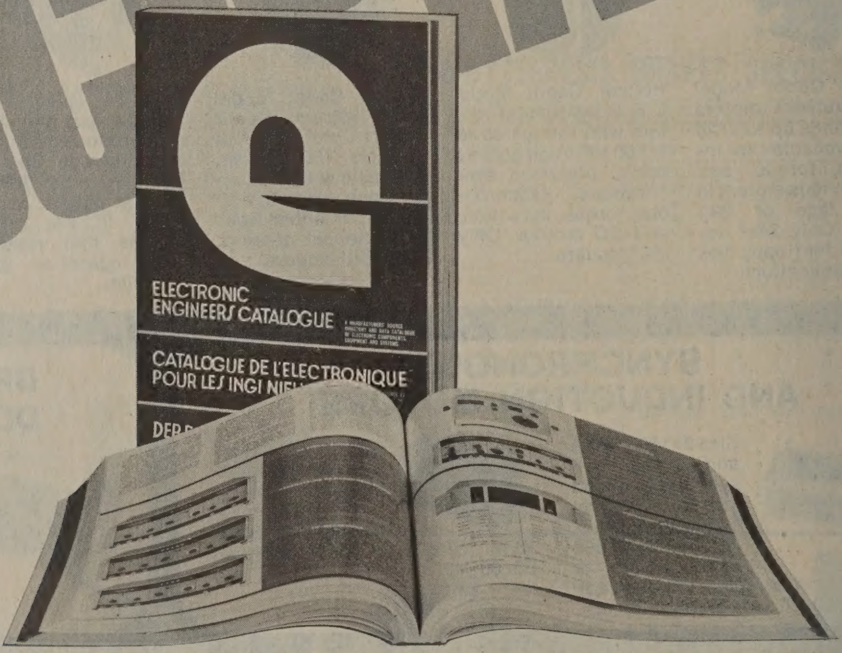
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

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SLIP RING ASSEMBLIES

STANDARD MODELS FROM THE FABRICAST CATALOG with BORE SIZES THRU 8 INCHES

BEST DELIVERY SLIP RING ASSEMBLIES

DELIVERY

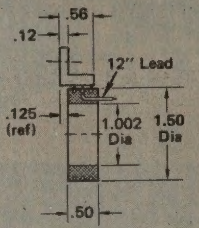
For BEST COST and BEST DELIVERY of multi-track units, Fabricast maintains all the components necessary to manufacture the slip ring assemblies shown.

PART NUMBER CODING — Specify fully when ordering

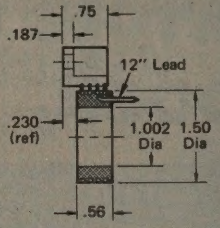
Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY

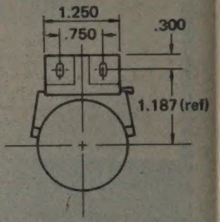
TYPE 1301
3 Ring


.56
.12
12" Lead
.125 (ref)
1.002 Dia
1.50 Dia
.50

TYPE 1401
4 Ring

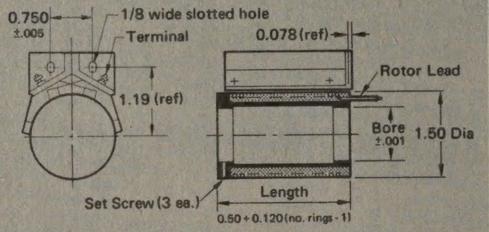

.75
.187
12" Lead
.230 (ref)
1.002 Dia
1.50 Dia
.56

TYPICAL END VIEW

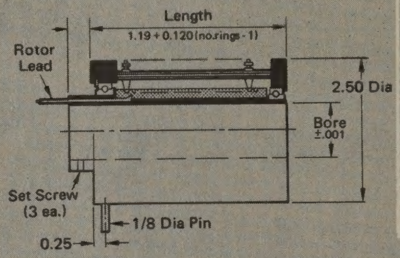

1.250
.750
.300
1.187 (ref)

5 amp — 1000 VAC Hi-Pot — .010 ohm Dynamic Resistance — Coin Silver Rings — Silver Graphite Brushes

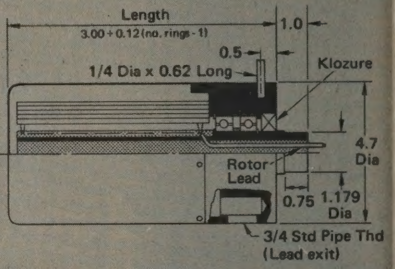
Slip Ring Assembly Type 1057
Separate Rotor and Brush Block
5 amp — 50 rings max — Bore 1.002 dia max


0.750 ±.005
1/8 wide slotted hole
Terminal
0.078 (ref)
Rotor Lead
1.19 (ref)
Bore ±.001
1.50 Dia
Set Screw (3 ea.)
Length
0.50 + 0.120 (no. rings - 1)

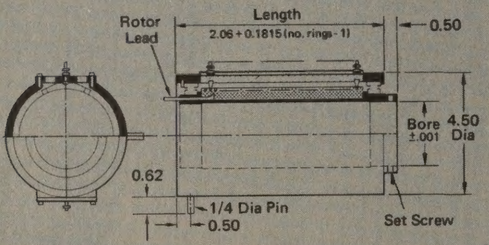
Slip Ring Assembly Type 1186
Self-contained — Shaft Mtg
5 amp — 50 rings max — Bore 1.002 dia max


Length
1.19 + 0.120 (no. rings - 1)
Rotor Lead
2.50 Dia
Bore ±.001
Set Screw (3 ea.)
1/8 Dia Pin
0.25

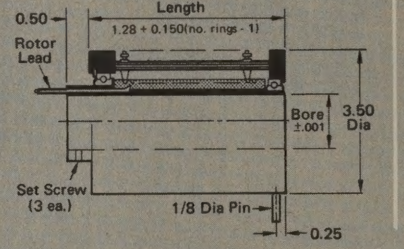
Slip Ring Assembly Type 1302
Self-contained — Sealed Housing
5 amp — 50 rings max — Solid Bore


Length
3.00 + 0.12 (no. rings - 1)
1.0
0.5
1/4 Dia x 0.62 Long
Klozure
4.7 Dia
Rotor Lead
0.75
1.179 Dia
3/4 Std Pipe Thd (Lead exit)

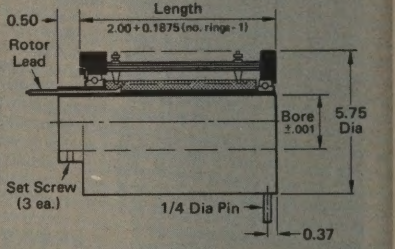
Slip Ring Assembly Type 1067
Self-contained — Shaft Mtg
5 amp — 100 rings max — Bore 2.502 dia max


Rotor Lead
Length
2.06 + 0.1815 (no. rings - 1)
0.50
Bore ±.001
4.50 Dia
0.62
1/4 Dia Pin
0.50
Set Screw

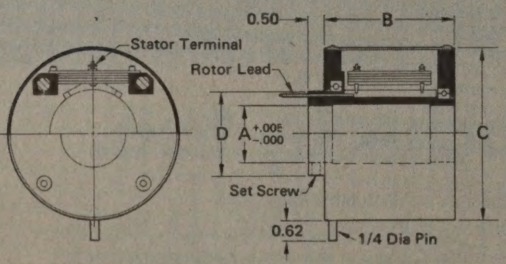
Slip Ring Assembly Type 4268
Self-contained — Shaft Mtg
5 amp — 100 rings max — Bore 1.752 dia max


0.50
Length
1.28 + 0.150 (no. rings - 1)
Rotor Lead
Bore ±.001
3.50 Dia
Set Screw (3 ea.)
1/8 Dia Pin
0.25

Slip Ring Assembly Type 1390
Self-contained — Shaft Mtg
5 amp — 100 rings max — Bore 4.252 dia max


0.50
Length
2.00 + 0.1875 (no. rings - 1)
Rotor Lead
Bore ±.001
5.75 Dia
Set Screw (3 ea.)
1/4 Dia Pin
0.37

SELF CONTAINED COVERED STATOR TERMINAL SLIP RING ASSEMBLIES


0.50
B
Stator Terminal
Rotor Lead
D
A +.005 -.000
C
Set Screw
0.62
1/4 Dia Pin

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"	Sleeve Exten. Dia "D"
	Nominal	Range					
1292	SOLID	———	41	5 amp std 2 brushes per ring	.85 + .088 (no. rings - 1)	2.50	2.19
1294	SOLID	———	48		1.12 + .110 (no. rings - 1)	2.25	.87
1295	SOLID	———	200		7.50 + .150 (no. rings - 1)	5.00	2.50
1297	.500	.378 - .565	50		1.25 + '120 (no. rings - 1)	2.75	1.05
1298	1.000	.566 - 1.002	50		1.25 + .120 (no. rings - 1)	3.00	1.30
1272	1.000	1.000 - 1.750	100	10 amp or lo noise 4 brushes per ring	2.00 + .150 (no. rings - 1)	5.25	2.56
1273	2.000	1.750 - 2.625	100		2.00 + .150 (no. rings - 1)	6.25	3.50
1274	3.000	2.625 - 3.750	58		2.00 + .160 (no. rings - 1)	7.50	4.50
1275	4.000	3.750 - 4.750	48		2.00 + .186 (no. rings - 1)	9.00	6.00
1276	5.000	4.750 - 5.750	63		2.00 + .186 (no. rings - 1)	10.50	7.00
1277	6.000	5.750 - 6.750	58		2.00 + .1875 (no. rings - 1)	12.00	8.00
1278	8.000	6.750 - 8.750	58		2.00 + .1875 (no. rings - 1)	15.00	10.00
1282	1.000	1.000 - 1.250	16	50 amp std 100 amp 4 brushes per ring	3.00 + 1.050 (no. rings - 1)	8.00	2.56
1283	2.000	1.250 - 2.000	16		3.00 + 1.050 (no. rings - 1)	9.00	3.50
1284	3.000	2.000 - 3.125	9		3.00 + 1.120 (no. rings - 1)	10.00	4.50
1285	4.000	3.125 - 4.375	8		3.00 + 1.116 (no. rings - 1)	11.50	6.00
1286	5.000	4.375 - 5.375	10		3.00 + 1.116 (no. rings - 1)	12.50	7.00
1287	6.000	5.375 - 6.375	10		3.00 + 1.125 (no. rings - 1)	13.50	8.00
1288	8.000	6.375 - 8.375	10		3.00 + 1.125 (no. rings - 1)	16.00	10.00

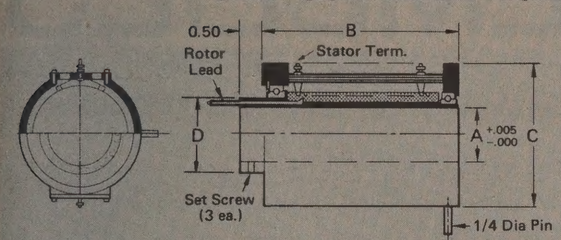
CHARACTERISTICS **HOUSING:** Bell, Bell Spacer and Cover type construction. All other characteristics same as for Self Contained Rigid Housing Slip Ring Assembly.

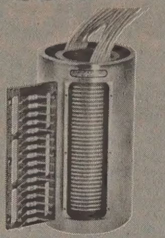
WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. MANUFACTURERS OF SLIP RING ASSEMBLIES

2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733
Phone 213/443-3247 (S. El Monte/Los Angeles)

SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES





TYPE	BORE DIA "A," inches		NO. RINGS MAX	CURRENT	LENGTH "B," inches	Housing Dia "C"	Sleeve Exten. Dia "D"
	Nominal	Range					
4150	1.000	.000 - 1.002	64	5 amp std 2 brushes per ring	1.19 + .120 (no. rings - 1)	2.50	1.30
4200	1.312	1.000 - 1.312	100		1.19 + .125 (no. rings - 1)	3.00	1.81
4237	1.750	1.312 - 1.752	78		1.19 + .130 (no. rings - 1)	3.37	2.31
4268	2.000	1.750 - 2.002	100		1.28 + .150 (no. rings - 1)	3.62	2.56
4350	2.750	2.250 - 2.752	100	10 amp std or lo noise 4 brushes per ring	1.75 + .150 (no. rings - 1)	4.50	3.50
4400	3.250	2.750 - 3.252	100		1.75 + .160 (no. rings - 1)	5.00	4.00
4462	3.750	3.250 - 3.752	100		1.75 + .160 (no. rings - 1)	5.50	5.00
4500	4.250	3.750 - 4.252	100		1.75 + .187 (no. rings - 1)	6.00	5.50
4600	5.250	4.250 - 5.252	79		1.75 + .165 (no. rings - 1)	7.00	6.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00	7.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00	8.00
4900	8.750	7.250 - 8.750	58		1.75 + .187 (no. rings - 1)	11.00	10.00
1271	1.000	.000 - 2.000	15	50 amp std	3.50 + 1.050 (no. rings - 1)	4.50	2.92
1291	3.000	2.000 - 3.252	9	50 amp std	4.50 + 1.120 (no. rings - 1)	6.50	5.00

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems.

RINGS: Coin Silver 5 amp rings.
Copper 50 amp rings.

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG — 20% C)
Two brushes per ring.
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance max
5 Milliohms max with 4 brushes per ckt.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

HI-POT: 1200 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

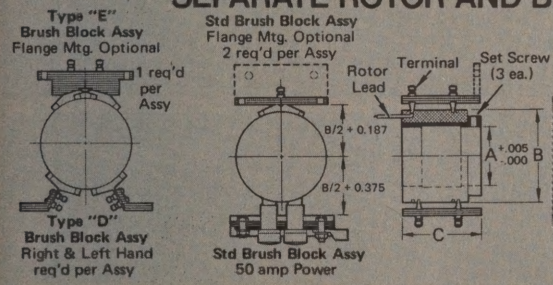
ROTOR LEADS: 5 amp Leads — 20 ga per MIL-W-16878 type "E"
50 amp Leads — 8 ga per MIL-W-16878 type "B"

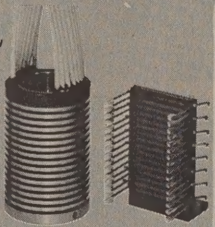
HOUSING: One piece steel tubing construction.

COVER: Easily removable for brush and ring inspection.

BEARINGS: Shielded or sealed ball bearings.

SEPARATE ROTOR AND BRUSH BLOCK SLIP RING ASSEMBLIES


Type "E" Brush Block Assy Flange Mtg. Optional
1 req'd per Assy
Std Brush Block Assy Flange Mtg. Optional 2 req'd per Assy
Rotor Lead
Terminal
Set Screw (3 ea.)
B/2 + 0.187
B/2 + 0.375
A +.005 -.000
B
C
Type "D" Brush Block Assy Right & Left Hand req'd per Assy
Std Brush Block Assy 50 amp Power



TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	Slip Ring Dia "B"	LENGTH "C", inches
	Nominal	Range				
2050	SOLID	.000 - .127	18	5 amp std	.500	.625 + .125 (no. rings - 1)
2087	SOLID	.000 - .377	48	5 amp std	.875	.625 + .110 (no. rings - 1)
2112	.375	.000 - .627	100	5 amp std	1.125	.625 + .125 (no. rings - 1)
2150	.750	.620 - 1.002	64	5 amp std	1.500	.625 + .120 (no. rings - 1)
2237	1.250	1.000 - 1.502	78	5 amp std	2.375	.750 + .130 (no. rings - 1)
2268	1.500	1.250 - 1.752	107	5 amp std	2.687	1.000 + .150 (no. rings - 1)
2350	2.000	1.750 - 2.502	100	5 amp std	3.500	1.000 + .150 (no. rings - 1)
2375	2.500	2.370 - 2.875	48	5 amp std	3.750	1.000 + .200 (no. rings - 1)
2462	3.000	2.750 - 3.752	112	5 amp std	4.625	1.250 + .160 (no. rings - 1)
2500	4.000	3.250 - 4.002	108	5 amp std	5.000	1.250 + .187 (no. rings - 1)
2600	5.000	4.000 - 5.002	48	5 amp std	6.000	1.250 + .186 (no. rings - 1)
2700	6.000	5.000 - 6.002	63	5 amp std	7.000	1.250 + .186 (no. rings - 1)
2800	7.000	6.000 - 7.002	58	5 amp std	8.000	1.250 + .1875 (no. rings - 1)
2900	8.000	7.000 - 9.002	58	5 amp std	10.000	1.250 + .1875 (no. rings - 1)
3268	1.000	.750 - 1.187	16	50 amp std	2.687	2.000 + 1.050 (no. rings - 1)
3300	1.500	1.187 - 1.500	6	50 amp std	3.000	2.000 + 1.000 (no. rings - 1)
3350	2.000	1.500 - 2.000	16	50 amp std	3.500	2.000 + 1.050 (no. rings - 1)
3462	3.000	2.000 - 3.125	9	50 amp std	4.625	2.000 + 1.120 (no. rings - 1)
3600	4.000	3.125 - 4.500	8	50 amp std	6.000	2.000 + 1.116 (no. rings - 1)
3700	5.000	4.500 - 5.500	10	50 amp std	7.000	2.000 + 1.116 (no. rings - 1)
3800	6.000	5.500 - 6.500	10	50 amp std	8.000	2.000 + 1.125 (no. rings - 1)
3900	7.000	6.500 - 8.500	10	50 amp std	10.000	2.000 + 1.125 (no. rings - 1)

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)	Type Brush Block
X	X	X	X	X	X

CHARACTERISTICS

RINGS: Coin Silver 5 amp rings.
Copper 50 amp rings.

BRUSHES: Silver Graphite.
Fabricast Grade 180 (80% AG — 20% C)
Two Brushes per ring
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance max.
5 Milliohms max with 4 brushes per ckt.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

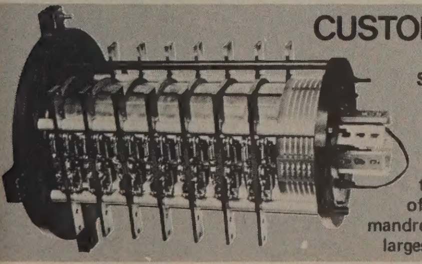
HI-POT: 1200 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 amp Leads — 20 ga per MIL-16878 type "E"
50 amp Leads — 8 ga per MIL-W-16878 type "B"

BRUSH BLOCK: Glass epoxy.
Optional mounting methods shown.

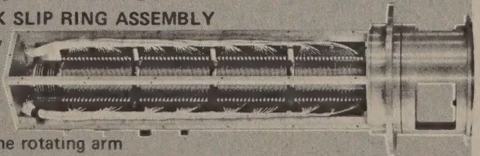
CUSTOM DESIGNED SLIP RING ASSEMBLIES



CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

WRITE OR PHONE FOR THE FABRICAST CATALOG

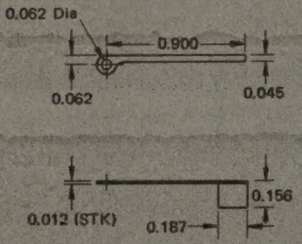
Fabricast, Inc. MANUFACTURERS OF SLIP RING ASSEMBLIES

2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733
Phone 213/443-3247 (S. El Monte/Los Angeles)

BRUSH ASSEMBLIES

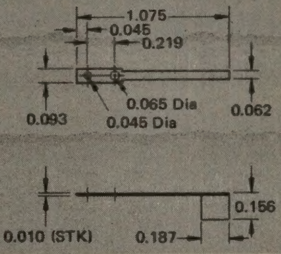
LEAF TYPE (BRUSH MATERIAL - FAG 180 LEAF MATERIAL - BeCu) STOCK DELIVERY

2.0 AMP SINGLE BRUSH
P/N 1113007 BRUSH - .040 WIDE



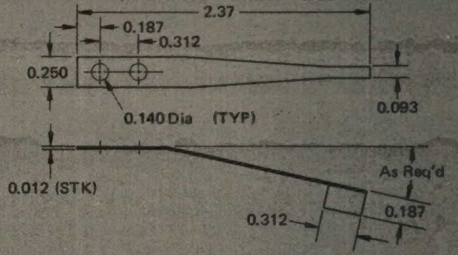
0.062 Dia
0.900
0.062
0.045
0.156
0.012 (STK)
0.187

2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE



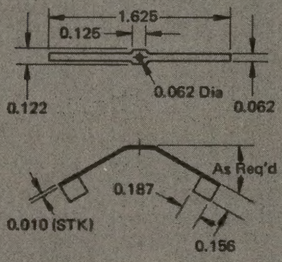
1.075
0.045
0.219
0.065 Dia
0.045 Dia
0.093
0.062
0.156
0.010 (STK)
0.187

5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE



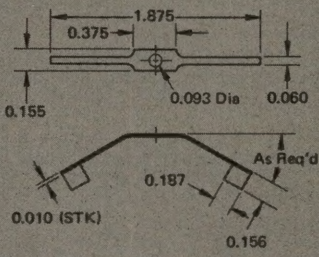
2.37
0.187
0.312
0.250
0.140 Dia (TYP)
0.093
0.012 (STK)
As Req'd
0.312
0.187

5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE



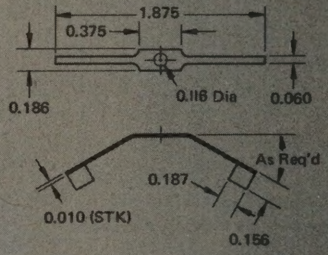
1.625
0.125
0.062 Dia
0.122
0.062
As Req'd
0.187
0.010 (STK)
0.156

5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE



1.875
0.375
0.093 Dia
0.060
0.155
As Req'd
0.187
0.010 (STK)
0.156

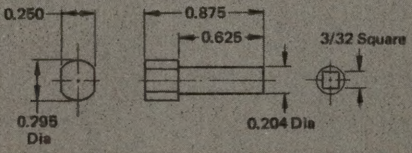
5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE



1.875
0.375
0.116 Dia
0.060
0.186
As Req'd
0.187
0.010 (STK)
0.156

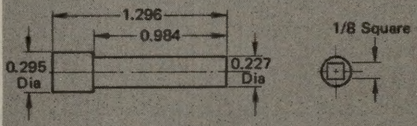
PLUNGER TYPE (BRUSH MATERIAL - FAG 180 HOLDER - BRASS) STOCK DELIVERY

2.5 AMP CAPACITY - 3/32" SQUARE BRUSH
HOLDER ASSY P/N 1070004
BRUSH ASSY P/N 1072-1



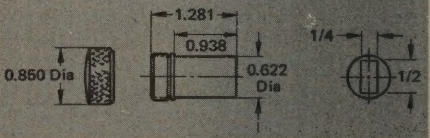
0.250
0.875
0.625
3/32 Square
0.795 Dia
0.204 Dia

4.0 AMP CAPACITY - 1/8" SQUARE BRUSH
HOLDER ASSY P/N 1051032
BRUSH ASSY P/N 1072-2



1.296
0.984
0.295 Dia
0.227 Dia
1/8 Square

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH
HOLDER ASSY P/N 1092006
BRUSH ASSY P/N 1092003



1.281
0.938
0.850 Dia
0.622 Dia
1/4
1/2

BRUSH MATERIAL

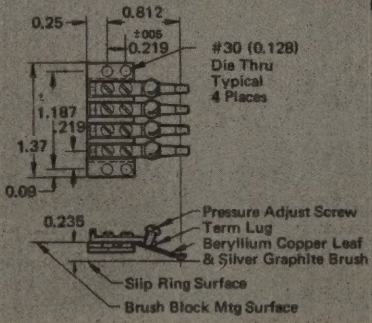
- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG150	50% silver, 50% graphite	Over 3500 ft. per min.	100 Amps per sq. in.
FAG180	80% silver, 20% graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG193	93% silver, 7% graphite	Up to 250 ft. per min.	300 Amps per sq. in.

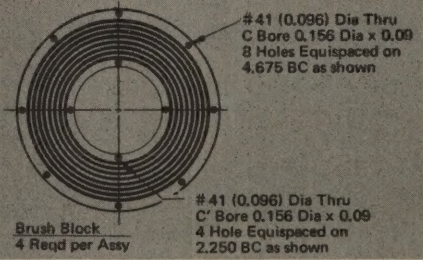
COIN SILVER RINGS – ½" TO 24" DIA – QUOTATION UPON REQUEST

PANCAKE TYPE SLIP RING ASSEMBLY

TYPE 1062 8 RINGS - 5 AMP CAPACITY

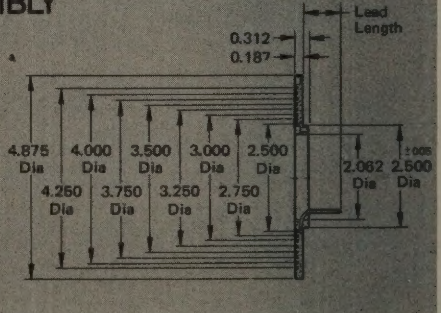


0.25
0.812
±005
0.219
#30 (0.128) Dia Thru Typical 4 Places
1.187
.219
1.37
0.09
0.235
Pressure Adjust Screw
Term Lug
Beryllium Copper Leaf & Silver Graphite Brush
Slip Ring Surface
Brush Block Mtg Surface



#41 (0.096) Dia Thru C Bore 0.156 Dia x 0.09 8 Holes Equispaced on 4.675 BC as shown
#41 (0.096) Dia Thru C' Bore 0.156 Dia x 0.09 4 Hole Equispaced on 2.250 BC as shown

Brush Block
4 Reqd per Assy



Lead Length
0.312
0.187
4.875 Dia
4.000 Dia
3.500 Dia
3.000 Dia
2.500 Dia
4.250 Dia
3.750 Dia
3.250 Dia
2.750 Dia
2.062 Dia
±005
2.500 Dia

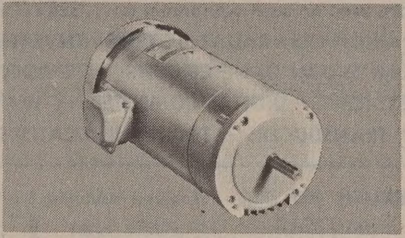
WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. MANUFACTURERS OF SLIP RING ASSEMBLIES

2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733
Phone 213/443-3247 (S. El Monte/Los Angeles)

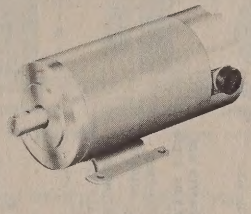
AC and DC MOTORS

DC Motors



For general duty on variable- or constant-speed applications where the power supply is d-c or where a-c/d-c conversion is used for controlled speeds. Also ideal for reversing applications. Type BC direct-current motors will start, accelerate, and run fractional-horsepower devices smoothly and easily. They are available in open, totally enclosed, explosion-proof, and severe-duty enclosures with solid base, round frame, or end mounting in most ratings. Special-purpose type motors are also available for full- and half-wave rectified power drives. For complete information, write for Bulletins GEA-9956 and GEA-9965.

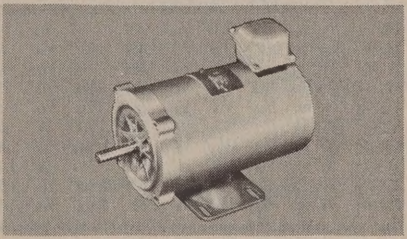
Reel-Drive Motors



GE's 6 5/16 inch diameter fhp direct-current motors are widely used for reel drives. Special end mountings and shaft extensions meet exacting application requirements. Series, split-series, compound, shunt, and compensated-shunt winding designs offer a broad design choice. Stall torque ratings from 3 to 120 ounce-feet and higher span various application needs, and motor voltage requirements are normally matched to your system design. Write for Bulletins GEA-9956 and GEA-9965.

New Permanent Magnet Motors

GE's BPA-34 permanent-magnet motors are smaller and lighter than comparable wound-field motors of the same rating. Permanent magnets replace field windings, eliminating the need for field power supply and the chance of field-winding failure or burnout; and with battery power efficiency is increased, battery drain decreased. Two leads from power supply reduce connect and disconnect time. The motor features double shielded ball bearings.

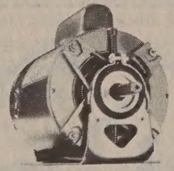


In 3.4 inch-diameter totally enclosed frame, the BPA-34 is available in face, flange, or welded-base design for conventional d-c voltages, producing a d-c rating of about ⅓ hp at 3450 rpm, ⅕ hp at 1725 rpm, and 1/7 hp at 1140 rpm on a continuous basis.

New NEMA 56 frame 5⅝ inch diameter, permanent magnet motors at 1725 rpm, ⅙ thru 1 hp, are available in C-face and bolt-on base for rectified and d-c power supplies for conventional d-c voltages.

These motors are ideally suited for such applications as copy machines, tape reel drives, printers, and filing equipment, and for any other equipment, including heavier drive applications, utilizing variable-speed drives or battery power. Write for Bulletin GEA-10087.

NEMA 48- and 56-Frame Ac Induction Motors



Dependable Form G Motors in Thousands of Variations

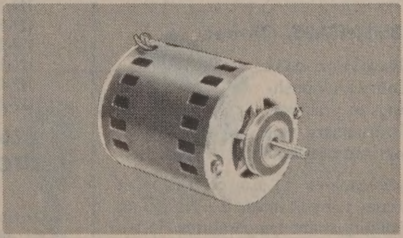
Form G a-c induction motors are available in most any electrical type, enclosure, and mounting in a variety of ratings from 1/20 to 5 hp for a complete range of commercial/industrial applications. For complete information write for Bulletins GEC-5000 and GEA-9964. New Form G5 motors (shown) also available in ⅛ through ¾ hp open split-phase and capacitor-start designs. Write for Bulletin GEA-10117.

Small Induction and Synchronous Motors

Versatility is synonymous with General Electric Small Induction and Synchronous motors. With this complete line, GE offers the design engineer the widest possible application freedom, plus the traditional fine quality of General Electric motors.

These small diameter motors are designed to provide dependable power for a wide variety of applications, including data communication printers, cash registers, telecopiers, typewriters, audio recording equipment, air compressors, projectors, computer card readers, disc file drives, as well as various machine tool applications. And many other jobs as well.

Such versatility is made possible by the choice of mounting styles, electrical types, bearing and insulation systems available.



M-49 FRAME MOTOR

The 3½ inch diameter M-49 motor is specifically built for applications requiring AC power in a limited space. This reversible motor can be mounted at any angle because it is available with either steel-backed babbit sleeve or ball bearings. The M-49 is offered in reluctance synchronous, permanent split-capacitor, split-phase and capacitor-start models. Shaft diameter is 5/16 or ⅜ inches.

19-FRAME MOTOR

The 3⅞ inch diameter 19-frame motor is designed to meet most small induction motor needs. Available with bolted cast-aluminum endshields, the 19-frame comes in synchronous, polyphase, permanent split-capacitor, split-phase and capacitor-start electrical types. This motor also features all-angle mounting, with the choice of either steel-backed babbit sleeve or ball bearings. On open models, a standard NEMA 42-frame mount is offered. Standard shaft diameters are 5/16 or ⅜ inches.

Write for Bulletin GEA-9964

For complete information contact your nearby GE Sales Office or write to
General Electric Co., Section 998-34. Dept. EM, Schenectady, N.Y. 12345.

GENERAL ELECTRIC

GRAPHALLOY

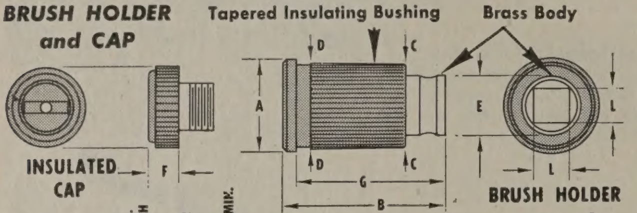
SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES . . .

GRAPHALLOY BRUSHES

***are used on such equipment as . . .* SERVO SYSTEMS • SYNCHROS • CHOPPERS • RADAR • GYROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • GUIDED MISSILES • PULSE SYSTEMS • DIGITAL COMPUTERS • WAVE GUIDES • SONAR • TRANSDUCERS • TORQUE INDICATORS**

Silver GRAPHALLOY Brushes have been widely used because *of* LOW *and* CONSTANT CONTACT DROP, EXTREMELY LOW ELECTRICAL NOISE *and* LONG LIFE. Over 200 grades are now serving in a wide variety of applications. Silver GRAPHALLOY Brushes on 1/2"-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 R.P.M. *Our Engineering Department will assist in determining the exact grade of* GRAPHALLOY *for your needs.* Ask for our Brush Inquiry Form 109.

BRUSH HOLDER and CAP



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.		OVERALL LENGTH		Other Sizes Available				BROACHED HOLE
					A	B	F	C	D	E	G	L
14326	1/8" sq.	3/16"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	1/4"	13/32"	1/16"	.437"	7/8"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	1/4"	7/16"	1/16"	.484"	7/8"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	1/4" x 3/16"	5/16"	9/16"	1/8"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	1/4" sq.	5/16"	9/16"	1/8"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	3/8" x 1/4"	7/16"	43/64"	1/8"	.718"	1 7/16"	1/4"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	3/8" sq.	7/16"	13/16"	1/8"	.921"	1 13/16"	1/4"	.813"	.828"	.628"	1 5/8"	.382"
31392†	1/2" sq.	9/16"	1 1/8"	1/8"	1.237"	1 13/16"	1/4"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	3/4" x 1/2"	7/8"	1 33/64"	1/8"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	3/4" sq.	7/8"	1 33/64"	1/8"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

Request and fill in Brush Inquiry Sheet, Form 109, so that we can supply the proper grade of brush material.

BRUSH ASSEMBLIES

135-10
218-21
135-6

CONTACTS

GRAPHALLOY, because of its inherent non-welding and arc-quenching characteristics, is used widely for contacts. Ask for Data Sheet 950.

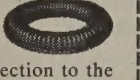
BUSHINGS, Oil-free

Replace oil-lubricated bushings in synchros, instruments, timers and missiles.

Advantages: 1) Lower friction at room temperatures. 2) No oil to solidify at low temperatures. 3) No oil to carbonize at prolonged elevated temperatures.

*Ask for Data Sheets 270 and 277 on Miniature Bronze-*GRAPHALLOY *Bushings.*

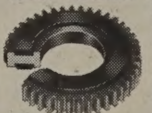
CONNECTORS (garter springs)



These silver-plated coil spring Connectors make for positive electrical connection to the brass body of the brush holder by snapping into the groove on the holder. The connecting lead can be pre-soldered to the Connector.

GARTER SPRING CONNECTORS	BRUSH SIZE	BRUSH HOLDER NO.
127-9	1/8" sq.	14326
127-9	5/32" sq.	11509
127-10	3/16" sq.	11570
127-14	1/4" x 3/16"	19011
127-14	1/4" sq.	11527
127-18	3/8" x 1/4"	14292
127-20	3/8" sq.	12166
127-24	1/2" sq.	31392
127-32	3/4" x 1/2"	35439
127-32	3/4" sq.	35440

CLUTCH FACINGS and CLUTCH GEAR ASSEMBLIES



Torque remains same within close operating limits despite changes in temperature and humidity. For instrumentation, guided missiles, constant friction devices.

SLIP RINGS Solid Coin Silver

Standard Coin Silver Slip Rings, both *cylindrical* and *flat* types, are illustrated at right. We recommend the cylindrical type rings with three brushes per ring . . . spaced at 120°. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type or slip-ring assemblies can be furnished with leads attached.

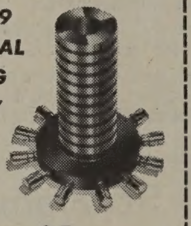
No. 168 Series flat type to 20" O.D.

Standard "Flat" rings have 1/4" radial contact surface and 1/8" radial spacing between adjacent rings.

No. 116 Series cylindrical type to 36" O.D.

Copper Slip Rings, flat or cylindrical, are available.

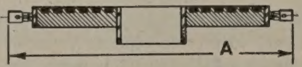
Model 319 CYLINDRICAL SLIP-RING assembly



MODEL	RINGS	LENGTH
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D.
Slip-ring 1 5/8"
Terminal 4"
Assembly I.D.: .814"/.813"
Range: Same as for Model 399

Model 409 FLAT SLIP-RING assembly



Solid Coin Silver Rings

MODEL	RINGS	OVERALL O.D.—"A"
409-2	2	5 1/2"
409-4	4	7"
409-6	6	8 1/2"
409-10	10	11 1/2"

Hub: O.D. 2"
I.D. 1.753"/1.751"
Length 1 1/8"
To 5 amps., 125 v.
More rings on application.

SPRING BINDING POSTS

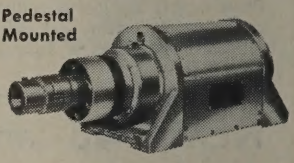
(with or without Insulated Cap)

O.D.: 3/8", 1/2", 17/32"
Lgth.: 5/8", 3/4", 25/32"

Also Miniature Spring Type!

19185
22978

Model 399 BRUSH and SLIP-RING assembly



MODEL	RINGS	bolt slot distances CL to CL		**OVERALL LENGTH
		WIDTH	LENGTH	
399-4	4	4 1/2"	7 3/4"	13 1/4"
399-6	6	4 1/2"	8 1/2"	14"
399-10	10	4 1/2"	10"	16"
399-14	14	4 1/2"	11 1/2"	18"

Specifications: Width 6 1/2"—Height 6 1/2". Shaft CL above base 3 1/4".
Applications: from strain gage or thermocouple up to 5 amperes, 125 volts, 250°F.
Speeds to 5,000 RPM.
Three Silver-GRAPHALLOY Brushes per solid coin silver slip ring.
Extraneous noise level low.
Rugged in design and construction.
Readily connected mechanically and electrically.
Complete coupling provided for 15/16" shaft.
More rings and higher speeds available upon application.

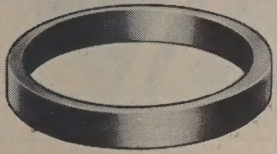
Write for data sheets

CALL ON OUR OVER 60 YEARS OF DESIGN EXPERIENCE FOR HELP IN SOLVING YOUR BRUSH PROBLEMS!

**GRAPHITE METALLIZING CORPORATION : 1036 Nepperhan Avenue
YONKERS, New York 10702**

SLIP RINGS of Solid Coin Silver

Standard Coin-Silver Slip Rings, both cylindrical and flat types, are illustrated below. We recommend the cylindrical-type ring with three brushes per ring . . . spaced at 120°. The cylindrical rings are designed for press fitting over insulation on standard steel shafting. The flat-type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type or slip-ring assemblies can be furnished with leads attached.


Cylindrical
116

Flat
168

Standard Coin Silver Slip Rings

Part No.	OD	ID	Width
116S-4	1/4	.127/ .123	3/16
116S-6	3/8	.252/ .248	3/16
116S-8	1/2	.377/ .373	3/16
116S-10	5/8	.502/ .498	3/16
116S-12	3/4	.627/ .623	3/16
116S-14	7/8	.752/ .748	1/4
116S-16	1	.877/ .873	1/4
116S-18	1 1/8	1.000/ .996	1/4
116S-19	1 3/16	1.000/ .996	1/4
116S-23	1 7/16	1.250/1.246	1/4
116S-27	1 11/16	1.500/1.496	1/4
116S-31	1 15/16	1.750/1.746	1/4
116S-35	2 3/16	2.000/1.996	1/4
116S-39	2 7/16	2.250/2.246	1/4
116S-43	2 11/16	2.500/2.496	1/4
116S-52	3 1/4	3.000/2.996	5/16
116S-60	3 3/4	3.500/3.496	5/16
116S-68	4 1/4	4.000/3.996	5/16
116S-76	4 3/4	4.500/4.496	5/16
116S-84	5 1/4	5.000/4.996	5/16
116S-92	5 3/4	5.500/5.496	5/16
116S-102	6 3/8	6.000/5.996	5/16
116S-118	7 3/8	7.000/6.996	5/16
116S-134	8 3/8	8.000/7.996	5/16
116S-150	9 3/8	9.000/8.996	5/16
116S-166	10 3/8	10.000/9.996	5/16

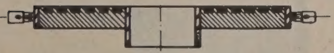
Larger Cylindrical and Flat Rings are available!

Part No.	OD	ID	Thickness
168S-20	1 1/4	3/4	3/16
168S-32	2	1 1/2	3/16
168S-44	2 3/4	2 1/4	3/16
168S-56	3 1/2	3	3/16
168S-68	4 1/4	3 3/4	3/16
168S-80	5	4 1/2	3/16
168S-92	5 3/4	5 1/4	3/16
168S-104	6 1/2	6	3/16
168S-116	7 1/4	6 3/4	3/16
168S-128	8	7 1/2	3/16
168S-140	8 3/4	8 1/4	3/16
168S-152	9 1/2	9	3/16
168S-164	10 1/4	9 3/4	3/16
168S-176	11	10 1/2	1/4
168S-188	11 3/4	11 1/4	1/4
168S-200	12 1/2	12	1/4
168S-212	13 1/4	12 3/4	1/4
168S-224	14	13 1/2	1/4
168S-236	14 3/4	14 1/4	1/4
168S-248	15 1/2	15	1/4
168S-260	16 1/4	15 3/4	5/16
168S-272	17	16 1/2	5/16
168S-284	17 3/4	17 1/4	5/16
168S-296	18 1/2	18	5/16
168S-308	19 1/4	18 3/4	5/16
168S-320	20	19 1/2	5/16

BRONZE and COPPER Slip Rings, cylindrical or flat, are available in the above sizes.

Cylindrical coin-silver rings, stacked with insulating rings between them, are press-fitted over insulation on the shaft. The insulation should be kept concentric on the shaft to avoid losing the high degree of concentricity already built into the slip rings and to maintain the effectiveness of the highly finished ring surface.

Model 409 Flat Slip-Ring Assembly



Where cylindrical-type slip rings cannot be used because of axial space limitations, standard flat (or disc type) coin-silver slip rings will solve the problem. A series of these rings has been designed so that the rings will nest with a standard 1/8"-spacing between successive rings. Each ring provides a radial contact surface of 1/4" width. Our 3/16"-square brush in Brush Holder 11570 should be used with these rings. We strongly recommend three brushes per ring to reduce noise level to a minimum.

BINDING POSTS

Binding Posts (normally spring-type 19185 or 22978) insure simple, low resistance, positive electrical connections between brush shunts (which have been threaded through brush-holder caps) and the external circuits. Binding posts are used also with brush and slip-ring assemblies and with brush-holder assemblies to make connection between the assembly and the external circuit.

Miniature (Spring-type) Miniature binding posts are valuable where space is at a premium, particularly for some rotary strain-gage and rotary thermocouple applications. These miniature binding posts are not insulated.

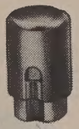
30624

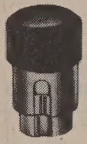
30625

Metal Binding Post (Spring-type) 30624
Not Insulated
1/8" O.D. x 11/32" long. Stud. 2-56 x 7/32" long.

Metal Binding Post (Spring-type) 30625
Not Insulated
5/32" O.D. x 15/32" long. Stud 2-56 x 7/32" long.

Standard (Spring Type) — Standard spring-type binding posts are used for most rotary strain-gage and thermocouple applications. These binding posts may be furnished with either *red or black* insulating caps.


19185


22978-1
22978-2
40541-1
40541-2

22978-A

Metal Binding Post (Spring-type) 19185
No insulated cap.
3/8" O.D. x 5/8" long. Wire hole dia. 3/32"
I.D. Thd. 6-32

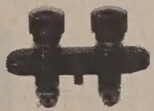
Metal Binding Post (Spring-type) 22978
Insulated Cap: Black—1: Red—2
7/16" OD. x 3/4" long.
Wire hole dia. 3/32". I.D. Thd. 6-32

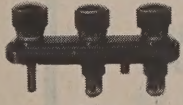
Metal Binding Post (Spring-type) 40541
Insulated Cap: Black—1; Red—2
1/2" O.D. x 3/4" long. Wire hole dia. 1/8" Thd. 6-32

Insulated Binding Post Base 22978-A
For 22978-1 & 22978-2

Screw-Type Binding Posts — Screw-type binding posts, such as are used for aircraft applications, provide constant blocking pressure on the wire. They are well insulated, and have non-removable phenolic knobs and molded bases. These posts are furnished in single, double or triple configuration.

20123


20124


20125

Single Binding Post (Screw-type) 20123
1/2" O.D. x 7/8" long. Stud 6-32 x 9/16" long.

Double Binding Post (Screw-type) 20124
Each Post 1/2" O.D. x 3/4" long.
Studs 6-32 x 1/2" long.
Plate: 11/16" x 2"

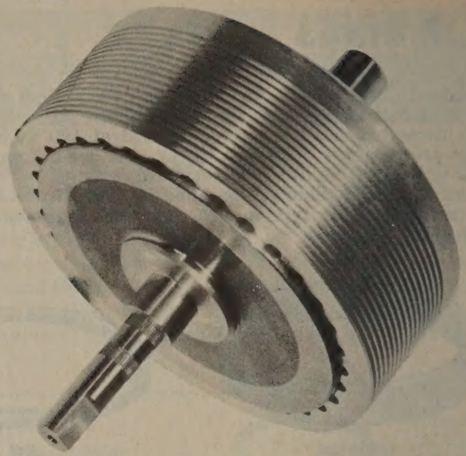
Triple Binding Post (Screw-type) 20125
Each Post 1/2" O.D. x 3/4" long.
Studs 6-32 x 1/2" long.
Plate: 11/16" x 2.4"

SPECIAL BINDING POSTS

Special binding posts are designed where particular characteristics are required.

HYSTERESIS CLUTCHES & BRAKES

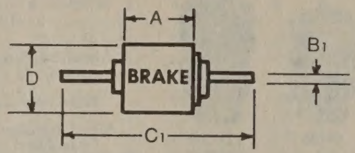
offer maximum reliability — smooth clutching minimum maintenance. They are ideal for tension control and power absorption devices where smooth variable slip torque is required. Torque is proportional to control current. Clutch-brake combinations and fixed field clutches also available.

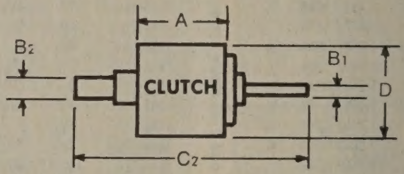


	PMC-6 PMB-6	PMC-16 PMB-16	PMC-35 PMB-35	PMC-120 PMB-120	PMC-175 PMB-175	PMC-325 PMB-325	PMC-.75K PMB-.75K	PMC-1.5K PMB-1.5K	PMC-3K PMB-3K	PMC-5K PMB-5K
A	.76	.81	1.72	1.53	1.98	2.06	3.62	5.83	4.37	5.12
B_1	.187	.187	.250	.375	.500	.500	.75	.875	.786	1.181
B_2	.375	.375	.500	.625	.750	.750	1.312	1.500	1.000	1.181
C_1	2.12	2.15	3.82	3.96	4.37	5.15	6.37	10.00	10.04	12.12
C_2	2.93	2.84	4.41	4.64	5.40	5.75	8.12	11.06	9.63	9.87
D	1.75	1.93	2.46	3.62	4.43	5.48	7.25	8.50	12.00	14.00

SPECIFICATIONS	MODELS					
	PMC-6 PMB-6	PMC-16 PMB-16	PMC-35 PMB-35	PMC-120 PMB-120	PMC-175 PMB-175	PMC-325 PMB-325
TORQUE - RATED OZ. IN.	6	16	35	120	175	325
OUTPUT INERTIA SLUG FT^2	1.55×10^{-6}	3.03×10^{-6}	6.3×10^{-6}	5.4×10^{-5}	1.5×10^{-4}	2.0×10^{-4}
CONTROL WATTAGE	2.5	4.5	12	5	3	7

	PMC-.75K PMB-.75K	PMC-1.5K PMB-1.5K	PMC-3K PMB-3K	PMC-5K PMB-5K
TORQUE - RATED OZ. IN.	750	1500	3000	5000
OUTPUT INERTIA SLUG FT^2	6.3×10^{-3}	1.26×10^{-2}	2.68×10^{-2}	4.05×10^{-2}
CONTROL WATTAGE	8.1	17	25	6

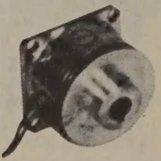




FRICTION CLUTCHES & BRAKES — FLANGE MOUNTED

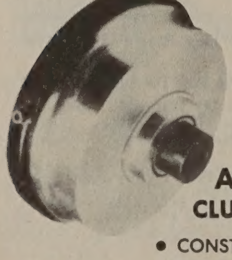
LOW COST • HIGH TORQUE • LOW CONTROL POWER • FAST RESPONSE • MIN. EFFECT BY AMBIENTS

SPECIFICATIONS	MODELS						
	FC-25 FB-25	FFC-35 FFB-35	FFC-60 FFB-60	FFC-160 FFB-160	FFC-480 FFB-480	FFC-960 FFB-960	FFC-3.5K FFB-3.5K
TORQUE - RATED OZ. IN.	25	35	60	160	480	960	3500
OUTPUT INERTIA - SLUG FT.^{2}	1.06×10^{-6}	2×10^{-6}	2.8×10^{-5}	5.11×10^{-6}	1.7×10^{-5}	6.56×10^{-5}	5.86×10^{-4}
CONTROL WATTAGE	3	6	3.6	9	10	10	30



CROWN TOOTH CLUTCHES & BRAKES

MAX. TORQUE – MIN. SIZE
POSITIVE ENGAGEMENT
LOW CONTROL POWER
FAST RESPONSE



ADJUSTA-TORQ CLUTCHES & BRAKES

- CONSTANT REPEATABLE SLIP TORQUE
- LIFE LIMITED ONLY BY BEARINGS
- CAN BE RUN IN OIL

USE AS A TORQUE LIMITING SLIP DEVICE, CLUTCH COUPLING, CONSTANT DRAG BRAKE OR IN TENSIONING APPLICATIONS.

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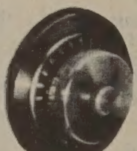
PERMANENT MAGNET

TENSION BRAKES



- CONSTANT PRESET TENSION
- MANUAL ADJUSTABLE TORQUE

0-3 OZ. IN. OR 0-10 OZ. IN.
PROVIDE SMOOTH, REPEATABLE TENSION FOR YARN, FIBER AND FINE WIRE

FAIL-SAFE BRAKES

FOR POSITIVE SHAFT BRAKING WHEN POWER FAILS

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SPECIALS GEMCOR WILL DESIGN NEW UNITS OR MODIFY EXISTING UNITS TO SUIT CUSTOMER'S SPECIAL REQUIREMENTS. THIS SERVICE IS AVAILABLE ON HYSTERESIS, FRICTION AND PERMANENT MAGNET TYPES.

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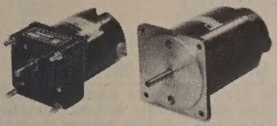
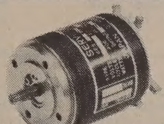
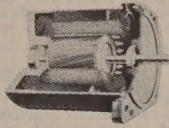
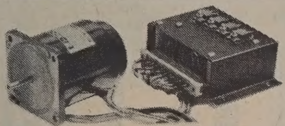
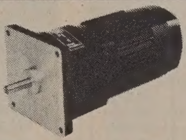
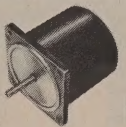
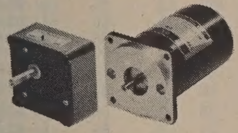
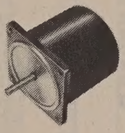
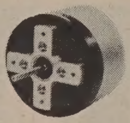
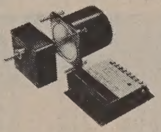
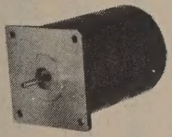
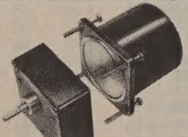
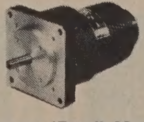
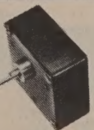
D.C. MOTORS	SPECIAL PURPOSE MOTORS	M-SERIES STOCK MOTORS
 **D.C. Motors** Diameter from 1.5″ to 4.0″	 **A.C. Servo Motors** 60 & 400 HZ, Sizes 8-42	 **Direct Drive Motors** 50 Stock Models, 1/750-1/10 H.P.
 **Brushless D.C. Motors** Diameters from 0.8″-4.0″	 **High-Power Servo Motors** Rapid Response to 1/10 H.P.	 **Single & Dual Speed Induction Motors** 200 Stock Models, 0.8-3000 RPM
 **Interchangeable Gearheads & Tachometers** 1-5000 RPM Speed Controlled	 **Type S Motors & Gearmotors** Retrofit Interchangeability	 **Single & Dual Speed Synchronous Motors** 200 Stock Models, 1-3600 RPM
 Variable Reluctance Steppers 7.5°, 11.25°, 12°, 15°, 22°, 45°, 90° Steps	 **Capstan Motors** Meets new DIN standards	 **Brushless Variable Speed Motors & Controls** 150 Stock Models, .03-1750 RPM
 **1.8° Permanent Magnet Steppers** Diameters from 1″-4″	 **Direct Drive Turntable Motors** 0.035% Typical Wow/Flutter	 **Instantly Reversible Brake Motors** 150 Stock Models
 Stepper Motor Drivers Plug-In or P.C. Board Mounted	 **Torque (Reel) Motors** Linear Torque/Speed Curves	 **Interchangeable Gearheads** 200 Stock Gear Reducers

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"M" SERIES MOTORS AND INTERCHANGEABLE GEARHEADS

IMMEDIATE DELIVERY FROM STOCK

- **3 Frame Sizes — Rated 1/750 to 1/18 hp**
- **Torque Ratings from 0.7 to 1500 oz.-in.**
- **More than 600 Models Available from Stock**
- **Built by JAPAN SERVO COMPANY, Subsidiary of Hitachi, Ltd., Japan's Leading Maker of Precision Motors**

"M" Series motors are precision machined to highest quality standards; utilize permanently lubricated, electronically selected ball bearings. Rabbeted joints and brushed lead-wire openings form a totally enclosed, protected motor housing. All insulation materials are rated Class A or better. Modular concept, using interchangeable gearheads with pinion shaft motors, reduces costly tooling changes and permits a greater number of different models to be manufactured using common parts. Motors and gearheads never need re-oiling, insuring long service without maintenance. Designed for smooth, silent power; geartrains use high precision, accurately hobbed gears housed in a rigid diecast enclosure which combines great structural strength with efficient heat dissipation. Each motor is individually tested and run for six hours.

- **Instantly Reversible**
- **Totally Enclosed**
- **Permanently Lubricated**
- **Ball Bearing Construction**

DIRECT DRIVE MOTORS
INTERCHANGEABLE GEARHEAD MOTORS

INDUCTION MOTORS

Most popular type, with low starting current. May be started, stopped and reversed continuously with low-inertia loads. May be stalled at full voltage for short periods without damage. Continuous duty rated. Smooth, quiet and relatively efficient. Speed changes slightly with change in torque load.

1/250 hp MOTORS

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IM6P3-1800	0.9	140	6G	$51.50
IM6P3-900	1.7	140	6G	51.50
IM6P3-600	2.6	140	6G	51.50
IM6P3-450	3.4	140	6G	50.50
IM6P3-360	4.3	140	6G	50.50
IM6P3-300	5.2	140	6G	50.50
IM6P3-225	6.9	140	6G	50.50
IM6P3-180	8.6	140	6G	50.50
IM6P3-120	13	140	6G	49.00
IM6P3-90	17	140	6G	49.00
IM6P3-60	26	140	6G	49.00
IM6P3-36	43	94	6G	49.00
IM6P3-30	52	78	6G	49.00
IM6P3-18	86	55	6G	48.00
IM6P3-15	103	46	6G	48.00
IM6P3-10	155	31	6G	48.00
IM6P3-6	258	18	6G	48.00
IM6P3-5	310	15	6G	48.00
IM6S3	1500	3.5	6	36.00
IM6S3D1	1500/3000	2.0	6	50.00

1/50 hp MOTORS

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IM8P7-1800	0.9	600	8G-3	$65.50
IM8P7-900	1.7	600	8G-3	65.50
IM8P7-600	2.6	600	8G-3	65.50
IM8P7-450	3.4	600	8G-3	64.00
IM8P7-360	4.3	600	8G-3	64.00
IM8P7-300	5.2	600	8G-3	64.00
IM8P7-225	6.9	600	8G-2	64.00
IM8P7-180	8.6	600	8G-2	64.00
IM8P7-120	13	600	8G-2	62.00
IM8P15-90	17	600	8G-2	62.00
IM8P15-60	26	600	8G-2	62.00
IM8P15-36	43	390	8G-1	62.00
IM8P15-30	52	325	8G-1	60.00
IM8P15-18	86	196	8G-1	60.00
IM8P15-15	103	163	8G-1	60.00
IM8P15-10	155	108	8G-1	60.00
IM8P15-6	258	65	8G-1	60.00
IM8P15-5	310	54	8G-1	60.00
IM8S15	1500	13.5	8	42.00
IM8S12D6	1500/3000	5.0	8	60.00

1/25 hp MOTORS

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IM10P30-180	8.6	1500	10G-2	$126.00
IM10P30-90	17	1500	10G-2	126.00
IM10P30-60	26	1340	10G-2	126.00
IM10P30-30	52	723	10G-1	122.00
IM10P30-15	103	359	10G-1	122.00
IM10P30-6	258	145	10G-1	122.00
IM10S30	1500	27.8	10	76.00
IM10S30D15	1500/3000	13.6	10	100.00

Induction motors listed above are also available with the following additional output speeds: 1, 2.1, 3.1, 4.1, 6.2, 8.3, 10, 16, 21, 31, 62, 124 rpm. Also available with dual output speeds.

INDUCTION MOTORS WITH BUILT-IN BRAKING

Induction motor with built-in braking device has same advantages as Type IM, but will stop and reverse direction more rapidly without "coasting." Intended for duty cycles of 30 minutes or less requiring precise positioning or rapid direction reversal with holding brake action.

1/200 hp MOTORS WITH BRAKING

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
RM6P2-1800	0.9	140	6G	$55.50
RM6P2-900	1.7	140	6G	55.50
RM6P2-600	2.6	140	6G	55.50
RM6P2-450	3.4	140	6G	54.50
RM6P2-360	4.3	140	6G	54.50
RM6P2-300	5.2	140	6G	54.50
RM6P2-225	6.9	140	6G	54.50
RM6P2-180	8.6	140	6G	54.50
RM6P2-120	13	140	6G	53.00
RM6P2-90	17	140	6G	53.00
RM6P4-60	26	140	6G	53.00
RM6P4-36	43	108	6G	53.00
RM6P4-30	52	90	6G	53.00
RM6P4-18	86	62	6G	52.00
RM6P4-15	103	52	6G	52.00
RM6P4-10	155	35	6G	52.00
RM6P4-6	258	21	6G	52.00
RM6P4-5	310	17	6G	52.00
RM6S4	1500	4	6	40.00

1/35 hp MOTORS WITH BRAKING

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
RM8P7-1800	0.9	600	8G-3	$69.50
RM8P7-900	1.7	600	8G-3	69.50
RM8P7-600	2.6	600	8G-3	69.50
RM8P7-450	3.4	600	8G-3	68.00
RM8P7-360	4.3	600	8G-3	68.00
RM8P7-300	5.2	600	8G-3	68.00
RM8P7-225	6.9	600	8G-2	68.00
RM8P7-180	8.6	600	8G-2	68.00
RM8P7-120	13	600	8G-2	66.00
RM8P7-90	17	600	8G-2	66.00
RM8P20-60	26	600	8G-2	66.00
RM8P20-36	43	590	8G-1	66.00
RM8P20-30	52	492	8G-1	64.00
RM8P20-18	86	296	8G-1	64.00
RM8P20-15	103	247	8G-1	64.00
RM8P20-10	155	163	8G-1	64.00
RM8P20-6	258	98	8G-1	64.00
RM8P20-5	310	82	8G-1	64.00
RM8S20	1500	20.4	8	46.00

1/15 hp MOTORS WITH BRAKING

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
RM10P40-180	8.6	1500	10G-2	$130.00
RM10P40-90	17	1500	10G-2	130.00
RM10P40-60	26	1500	10G-2	130.00
RM10P40-30	52	1029	10G-1	126.00
RM10P40-15	103	515	10G-1	126.00
RM10P40-6	258	206	10G-1	126.00
RM10S40	1500	39.6	10	80.00

Induction motors with braking device listed above are also available with the following additional output speeds: 1, 2.1, 3.1, 4.1, 6.2, 8.3, 10, 16, 21, 31, 62, 124 rpm.

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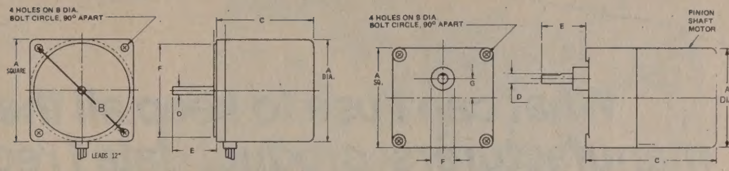
"M" SERIES MOTORS AND INTERCHANGEABLE GEARHEADS



MOTOR FRAME DIMENSIONS, INCHES

Reference	Body Dia., A	Bolt Circle, B	Body Lgth., C	Shaft Dia., D	Shaft Dia., E	Pilot, F	Shaft Offset, G
6	2.36	2.756	2.56	3/16	0.87	2.126	—
6G	2.36	2.756	3.62	1/4	1.04	0.472	0.394
8	3.15	3.701	2.95	1/4	1.26	2.874	—
8G-1	3.15	3.701	4.25	5/16	1.34	0.709	0.591
8G-2	3.15	3.701	4.49	5/16	1.34	0.709	0.591
8G-3	3.15	3.701	4.84	5/16	1.34	0.709	0.591
10	4.02	4.724	4.06	5/16	1.69	3.701	—
10G-1	4.02	4.724	5.67	3/8	1.26	0.945	0.787
10G-2	4.02	4.724	6.02	3/8	1.26	0.945	0.787

SYNCHRONOUS MOTORS

Synchronous motors have same advantages as Type IM induction motors, but with constant speed and lower efficiency. Designed for use where precise speeds and/or timekeeping properties are required.

1/375 hp SYNCHRONOUS MOTORS

Model Number	Speed, rpm	Torque, Oz-In.	Frame Dimensions, Reference	Net Each
SM6P2-1800	1	140	6G	$53.50
SM6P2-900	2	140	6G	53.50
SM6P2-600	3	140	6G	53.50
SM6P2-450	4	140	6G	52.50
SM6P2-360	5	140	6G	52.50
SM6P2-300	6	140	6G	52.50
SM6P2-225	8	140	6G	52.50
SM6P2-180	10	140	6G	52.50
SM6P2-120	15	135	6G	51.00
SM6P2-90	20	100	6G	51.00
SM6P2-60	30	67	6G	51.00
SM6P2-36	50	40	6G	51.00
SM6P2-30	60	34	6G	51.00
SM6P2-18	100	23	6G	50.00
SM6P2-15	120	20	6G	50.00
SM6P2-10	180	13	6G	50.00
SM6P2-6	300	8	6G	50.00
SM6P2-5	360	6	6G	50.00
SM6S2	1800	1.5	6	38.00
HM6S2D1	1800/3600	0.75	6	60.00

1/75 hp SYNCHRONOUS MOTORS

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
SM8P5-1800	1	600	8G-3	$67.50
SM8P5-900	2	600	8G-3	67.50
SM8P5-600	3	600	8G-3	67.50
SM8P5-450	4	600	8G-3	66.00
SM8P5-360	5	600	8G-3	66.00
SM8P5-300	6	600	8G-3	66.00
SM8P5-225	8	600	8G-2	66.00
SM8P10-180	10	600	8G-2	66.00
SM8P10-120	15	600	8G-2	64.00
SM8P10-90	20	543	8G-2	64.00
SM8P10-60	30	362	8G-2	64.00
SM8P10-36	50	217	8G-1	64.00
SM8P10-30	60	181	8G-1	62.00
SM8P10-18	100	109	8G-1	62.00
SM8P10-15	120	91	8G-1	62.00
SM8P10-10	180	60	8G-1	62.00
SM8P10-6	300	36	8G-1	62.00
SM8P10-5	360	30	8G-1	62.00
SM8S10	1800	7.5	8	44.00
HM8S5D2	1800/3600	1.8	8	68.00

1/35 hp SYNCHRONOUS MOTORS

Model Number	Speed, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
SM10P20-180	10	1500	10G-2	$128.00
SM10P20-90	20	1108	10G-2	128.00
SM10P20-60	30	737	10G-2	128.00
SM10P20-30	60	398	10G-1	124.00
SM10P20-15	120	199	10G-1	124.00
SM10P20-6	300	80	10G-1	124.00
SM10S20	1800	15.3	10	78.00
HM10S15D7	1800/3600	5.6	10	110.00

Synchronous motors listed above are also available with the following additional output speeds: 12, 18, 24, 36, 72, 144 rpm. Also available with dual output speeds.

VARIABLE SPEED AC MOTORS

Variable speed AC motors feature 15:1 speed ratio with constant torque, tachometer-generator, feed-back regulated solid state control unit, instantly reversible, extremely smooth and quiet operation. AC design eliminates brush replacement and increases life expectancy more than tenfold.

1/250 hp VARIABLE SPEED AC MOTORS

Model Number	Constant Torque Speed Range, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IMT6P3-1800	.06-.83	140	6G	$115.50
IMT6P3-900	.11-1.7	140	6G	115.50
IMT6P3-600	.17-2.5	140	6G	115.50
IMT6P3-450	.22-3.3	140	6G	114.50
IMT6P3-360	.28-4.2	140	6G	114.50
IMT6P3-300	.33-5.0	140	6G	114.50
IMT6P3-225	0.4-6.7	140	6G	114.50
IMT6P3-180	0.6-8.3	140	6G	114.50
IMT6P3-120	0.8-12.5	140	6G	113.00
IMT6P3-90	1.1-17	140	6G	113.00
IMT6P3-60	1.7-25	121	6G	113.00
IMT6P3-36	2.8-42	73	6G	113.00
IMT6P3-30	3.3-50	60	6G	113.00
IMT6P3-18	6-83	42	6G	112.00
IMT6P3-15	7-100	35	6G	112.00
IMT6P3-10	10-150	23	6G	112.00
IMT6P3-6	17-250	14	6G	112.00
IMT6P3-5	20-300	12	6G	112.00
IMT6S3	100-1500	2.7	6	100.00

1/50 hp VARIABLE SPEED AC MOTORS

Model Number	Constant Torque Speed Range, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IMT8P15-1800	.06-.83	600	8G-3	$143.50
IMT8P15-900	.11-1.7	600	8G-3	143.50
IMT8P15-600	.17-2.5	600	8G-3	143.50
IMT8P15-450	.22-3.3	600	8G-3	142.00
IMT8P15-360	.28-4.2	600	8G-3	142.00
IMT8P15-300	.33-5.0	600	8G-3	142.00
IMT8P15-225	0.4-6.7	600	8G-2	142.00
IMT8P15-180	0.6-8.3	600	8G-2	142.00
IMT8P15-120	0.8-12.5	600	8G-2	140.00
IMT8P15-90	1.1-17	550	8G-2	140.00
IMT8P15-60	1.7-25	366	8G-2	140.00
IMT8P15-36	2.8-42	220	8G-1	140.00
IMT8P15-30	3.3-50	183	8G-1	138.00
IMT8P15-18	6-83	110	8G-1	138.00
IMT8P15-15	7-100	92	8G-1	138.00
IMT8P15-10	10-150	61	8G-1	138.00
IMT8P15-6	17-250	36	8G-1	138.00
IMT8P15-5	20-300	30	8G-1	138.00
IMT8S15	100-1500	7.6	8	120.00

1/25 hp VARIABLE SPEED AC MOTORS

Model Number	Constant Torque Speed Range, rpm	Torque, Oz.-In.	Frame Dimensions, Reference	Net Each
IMT10P30-180	0.6-8.3	1500	10G-2	$200.00
IMT10P30-90	1.1-17	1195	10G-2	200.00
IMT10P30-60	1.7-25	795	10G-2	200.00
IMT10P30-30	3.3-50	429	10G-1	196.00
IMT10P30-15	7-100	215	10G-1	196.00
IMT10P30-6	17-250	86	10G-1	196.00
IMT10S30	100-1500	16.5	10	150.00

Variable speed AC motors listed above are also available in 12 other speed ranges.

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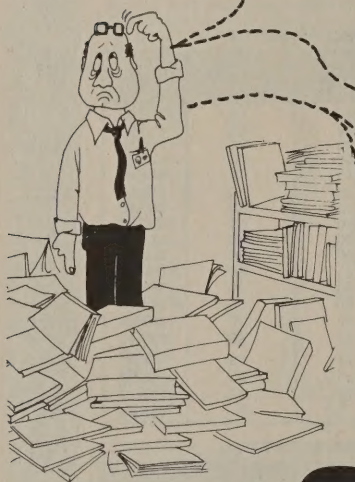

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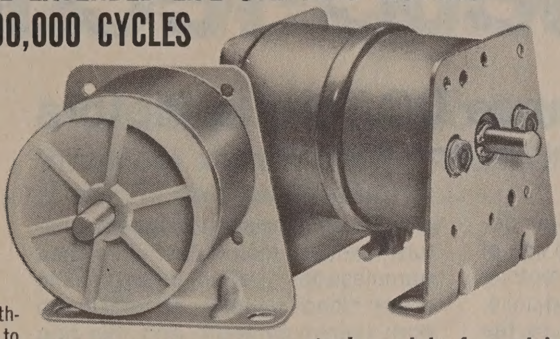
LEDEX

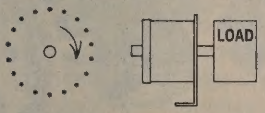
SERIES 50-L EXTENDED LIFE STEPPING MOTORS NOW 10,000,000 CYCLES



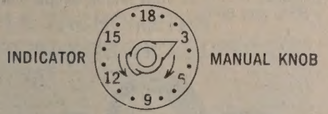
TORQUES TO 246 OUNCE INCHES

New internal design extends life 3 times without changing external dimensions. Accurate to ±1°, non-accumulative. Series 50-L stepping motors are engineered expressly for simplicity of construction and economy. All parts are permanently lubricated and enclosed for maintenance free operation. Their high torque to size ratio is a major benefit.

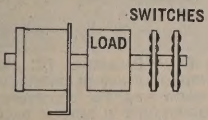
With a **unidirectional** Series 50 you can . . .



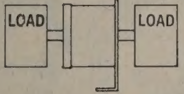
drive your load remotely through a series of short steps and stop at any one of 12, 18, 24, or 36 positions.



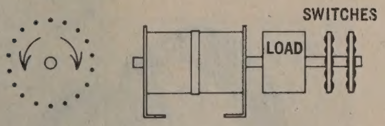
or add a knob for manual reset in either direction . . .



or add rotary switches for a combination power positioning drive and a step or program switch



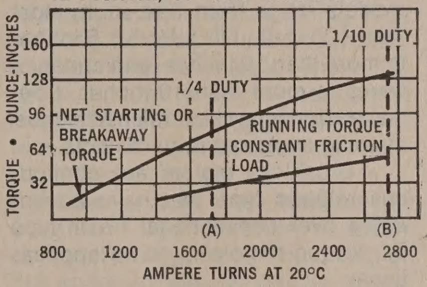
or use shaft extensions on each end to direct-couple two loads and drive them in the same direction at the same time.



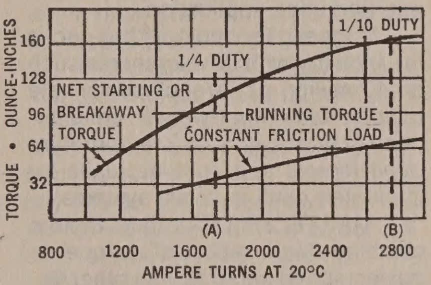
With a **bidirectional** Series 50 you can do all this . . . plus **remotely position** loads CW or CCW.

stock models for quick prototype starts

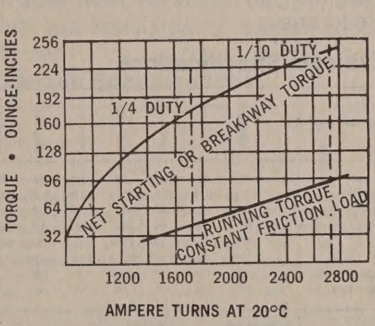
12 POSITION, 30° STEP INCREMENTS



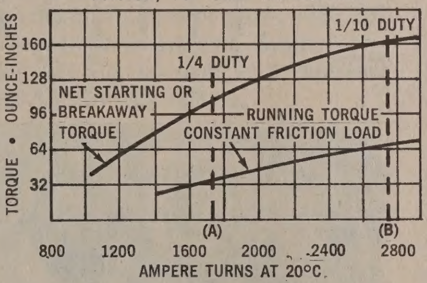
18 POSITION, 20° STEP INCREMENTS



36 POSITION, 10° STEP INCREMENTS



24 POSITION, 15° STEP INCREMENTS



Top curve in each graph shows net starting or breakaway torque, typical when friction component of load is high in beginning — as in driving a valve. **Lower** curve applies when friction load is consistent throughout stroke. Dotted lines "A" show output at 1/4 duty, 84 watts; dotted lines "B" 1/10 duty at 210 watts.

Highlights	Unidirectional	Bidirectional
Voltage	6 to 220 VDC	6 to 220 VDC
Length	1.9″	2.5″
Width	$2\frac{1}{16}$″ (Dia.)	2.5″
Height	$2\frac{1}{8}$″ (Sq. plate)	$2\frac{13}{32}$
Weight	14 oz.	24 oz.
Price, 1-9	$30	$48
Price, 1000 up	$15	$25

All working parts are completely enclosed. Minimum life is 10 million steps. For bidirectional, 10 million in each direction. And, the Series 50-L works on simple square wave input pulses . . . so you don't need expensive logic circuitry. Ledex Series 50-L stepping motors are engineered for high torque-to-size, uniform stepping accuracy, construction simplicity and economy.

Newly developed tooth clutch drive gives positive grip stepping action (no slip) and doubles as a built-in electromechanical clutch brake to eliminate the natural tendency of overdriving at the end of a step.

Catalog D-7002 lists complete details on stock models, performance data and engineering considerations.

LEDEX

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PHONE: (513) 224-9530

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High Performance DC Torque Motors

Brush type and Brushless, More than 500 standard models

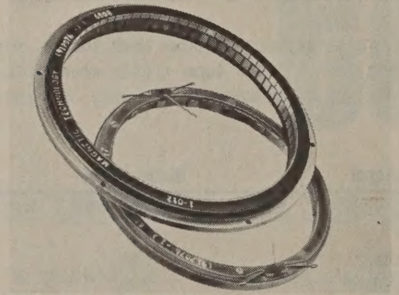
Magnetic Technology® offers designers the broadest standard line of high performance DC torque motors, as well as exotic one-of-a-kind units. These motors are produced to the most exacting reliability and performance standards, and have been proven in aerospace, ground-based and undersea applications.

Magnetic Technology® has paced the industry with developments such as 40 million oz-in/sec² power rate motors, ultra light-weight units for deep space use, 500°F temperature rated motors and compact units for implanted cardiac assist systems.

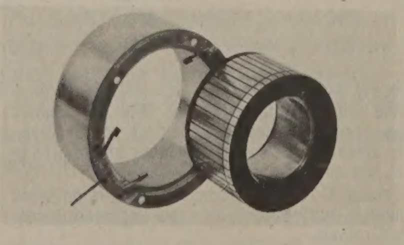
MAGTECH® DC torque motors combine high ratios of torque to power, speed and size with other desirable characteristics such as low electrical time constant and low ripple torque.

Example Specifications

Mag. Tech. Part No.	1500G-050	1937G-050	2340-077	2813-100	3680-185	6960-195	14000E-300
Peak Torque	15 OZ.IN.	20 OZ.IN.	60 OZ.IN.	90 OZ.IN.	500 OZ.IN.	10 LB.FT.	120 LB.FT.
Power @ Tp (watts)	40	56	60	42	110	112	695
No Load Speed (rad/sec)	340	375	134	60	29	7.5	4.0
I.D.	.455	.625	1.250	1.000	1.500	4.500	9.308
O.D. (inches)	1.500	1.937	2.343	2.813	3.680	6.980	14.000
Length (inches)	0.50	0.50	0.77	1.00	1.85	1.95	3.00
Weight (oz.)	2.5	4.2	7.6	18	49	145	850



Typical high performance units



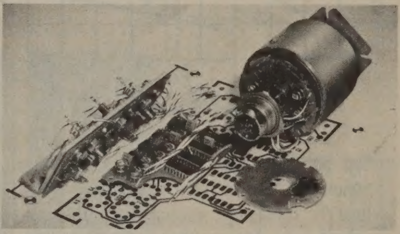
These permanent magnet, armature excited motors are furnished frameless for direct mounting to the driven load without gears. Large bore, minimum width and thin-ring configurations make possible compact system packaging.

Peak torque ratings of standard models range from 7 oz-in. to more than 120 lb-ft., OD's from 1.5 inches to more than 19 inches, and armature bores to more than 10 inches. Special designs may be furnished to meet specific customer requirements.

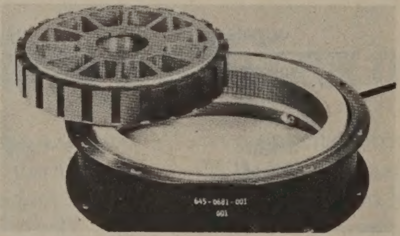
Brushless motors are continuous rotation type that have advantages over conventional brush-type DC torque motors in some applications.

Example Brushless Specifications

Mag Tech Part No.	1600B-035	2375D-050	3625B-050	3350B-125	11500-082	19300-150
Peak Torque (oz-in)	6	32	45	300	1000	14000
Pwr/Phase (watts)	26	80	25	200	60	680
O.D.	1.6	2.375	3.625	3.35	11.478	19.30
I.D.	.810	1.250	2.50	1.83	9.75	14.623



Brushless motor and electronics

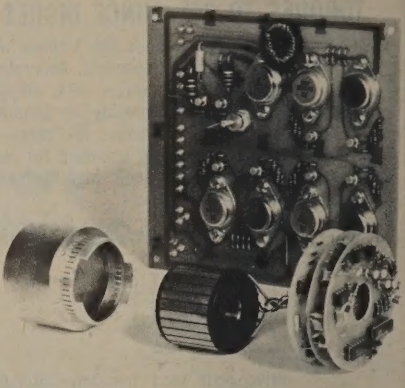


Magnetic Technology,® a division of Vernitron Corporation, 21001 Kittridge Street, Canoga Park, California 91303. TWX 910-494-1217. Telephone (213) 887-7700.

Magnetic Technology®

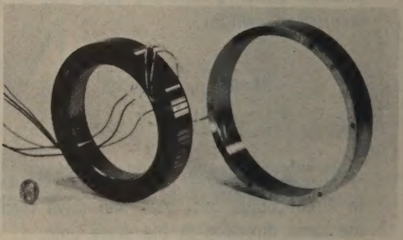
Special Products

Magnetic Technology® also produces linear actuators, and a wide variety of custom devices including the examples below.

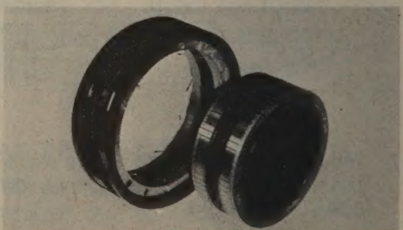


High Efficiency Brushless Motor System. The model 2250-150 operates at 1100 rpm with a 20 oz-in load. The overall system efficiency is above 70% for all input voltages between 18 and 32 volts and at temperatures between −55°C and 85°C.

Rare Earth Brushless DC motor. Special motor developed for use as cardiac assist incorporating rare earth magnets to prevent alteration of motor characteristics in case of over current. Motor designed for maximum efficiency, i.e. lowest temperature rise under continuous load conditions.



Limited Angle Brushless DC Torquers



Precision Motor Tachometer

Magnetic Technology®

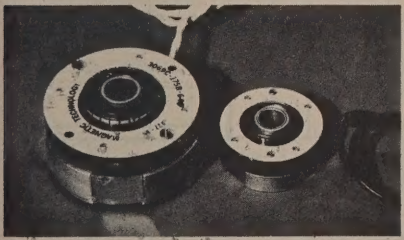
Tachometers

Any of the more than 500 standard MAGTECH® torque motors may be operated as a tachometer generator. In addition, separate product lines of precision tachometers and industrial tachometers are available. These range from .05% ripple voltage units usable at rates less than one revolution per day and units with a 50,000:1 dynamic range, to popular industrial units.

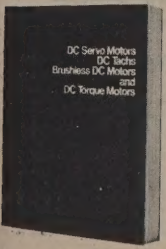
These tachometers feature open, frameless configuration for direct drive mounting. The direct mounting without gears eliminates dead zones and inaccuracies that can result from gearing backlash and gear imperfections. Typical characteristics include high voltage gradient, low time constant, high coupling stiffness and resolution, and accuracy at low speeds.

EXAMPLE TACHOMETER SPECIFICATIONS INCLUDING INDUSTRIAL TYPES*

Mag. Tech. Part No.	1917-067	2000-100*	3069C-175*	3375C-070	7200-160	15000-248
O.D. (inch)	1.917	2.000	3.069	3.375	7.200	15.75
I.D. (inch)	0.624	0.500	0.625	2.249	3.500	9.00
Length (inch)	.67	1.00	1.75	.68	1.59	2.80
Volts/Krpm	45.1	9.56	31.5	84	1218	6820
Ripple (%)	6	1.5	2	1.5	0.1	0.03
Resistance (Ω)	360	110	75	300	5000	3800
Inertia (oz-in-sec²)	0.0013	0.0012	0.011	0.02	0.56	15.9



Typical industrial units



DC Servo Motors
DC Tachs
Brushless DC Motors
and
DC Torque Motors

162 Pages of Vital Technical Assistance

Send for your free copy.

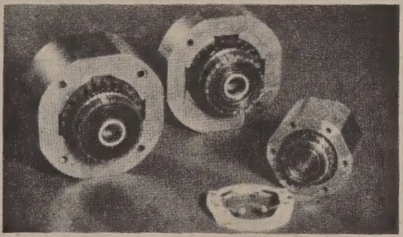
Industrial DC Servo Motors

Brushless and Brush-type, Frameless or Housed, Motor-Tach Combinations

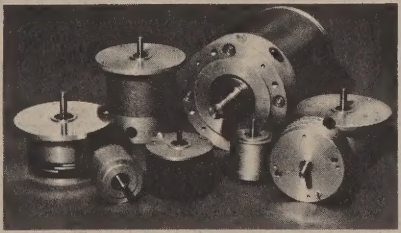
Only subtle design, performance and materials variations distinguish these quality, direct drive motors from Magnetic Technology's® established military grade motors. Yet, through volume production they are priced for industrial applications.

Features include fast response, high torque, precise positioning, high tracking accuracy, quiet operation, and relatively low ripple. These DC servo motors utilize a permanent magnetic field for higher efficiency plus a moving iron armature for maximum thermal inertia.

The motors are available in frameless configuration to allow compact packaging and mounting of the armature directly on the driven load. Housed units, with shaft and bearings also are available. Direct coupling to the driven load eliminates the disadvantages of gears and couplings in servo systems. System simplification is possible and excellent system stability results.



Carriage drive motors for printers.



Send for your free copy of our new 162 page product and application guide. Magnetic Technology,® a division of Vernitron Corporation, 21001 Kittridge Street, Canoga Park, California 91303. TWX 910-494-1217. Telephone (213) 887-7700.

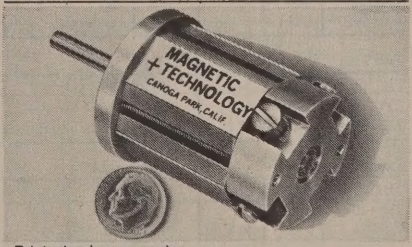
Applications for these units include disc memory systems, card sorters, tape transports and printers, N.C. machine table drives and feedback tachometers.

Continuous rotation brushless units, for constant or variable speed operation, also are available. Electronic drive and control systems can be supplied with these units.

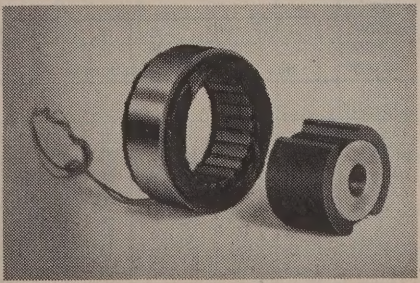
In addition to MAGTECH® industrial servo motors and tachometers, motor-tach combinations can be supplied. A number of standard combinations are available, but virtually any motor and tachometer can be combined to meet drive and tachometer sensitivity requirements. The combination unit is smaller, lighter, easier to mount and generally lower in cost than separate units. These units aid reduction of system resonances.

Example Specifications

Mag Tech Part No.	1310-150	1937D-150	3069-175	3069-237	H5500-550	6002-325
Stall Torque (oz-in)	22.5	50	85	175	1650	1350
Pwr @ Tp @ 25°C (watts)	58	50	67	123	1480	150
Ripple Torque (%)	5	5	6	6	3	10
Elec Time Const (sec)	0.0005	.0006	.001	.015	.003	0.002
No Load Speed (rad/sec)	320	140	105	95	120	15
O.D.	1.375	1.937	3.50	3.069	5.0	6.002
Length	1.50	1.50	2.50	2.37	5.50	3.25



Print wheel servo motor.



Brushless DC direct drive motor specifically for use in computer peripheral spindle drives — currently in high volume production.

Magnetic Technology®

Micro Mo ELECTRONICS, INC.

3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

MOTOR SPECIFICATIONS

- Measured at 25°C (77°F)
- Operational temperature range: — 50°C (— 58°F) to +75°C (+167°F)
- Maximum rotor temperature: + 75°C (+ 167°F); special models up to + 125°C (+ 258°F)

1*	2*	3*		4*	5	6*	7	8	9		10		11	12	13	14
Motor Types 060 and 1212	Output Power (max.)	Stall Torque		Max. Effi-ciency	Test Voltage	Noload Speed ± 15%	Specific Speed Per Volt ± 15%	Volts Per 1000 rpm ± 15%	Specific Torque ± 15%		Friction Torque (max.)		Armature Resis-tance ± 10%	Armature Induc-ance	Typical Starting Voltage	Angular Acceleration (min.)
Unit:	Watts	gr.cm	oz-in.	%	Volts	rpm	rpm/v	Volts	gr.cm/A	oz-in/A	gr.cm.	oz-in.	Ohm	μH	mV	(Rad/s²)•10³
060/.004	New Model — Specifications On Request.															
060/.006	0.50	6.6	.092	50	4.5	33600	5900	0.17	18.7	26	0.20	003	17.0	590	300	66
060/.007	0.50	3.7	.05	60	1.2	25200	5900	0.17	16.5	23	0.20	003	19.0	590	300	30
060/.008	0.20	2.5	.035	52	2.0	25500	13800	0.07	7.1	10	0.20	003	5.3	180	600	—
Type 050																
050/.04	0.33	6.0	083	59	12.0	19200	1690	0.59	57.6	80	0.35	.005	109.0	1200	250	28.5
050/.055	0.26	5.6	078	59	6.0	18800	3320	0.30	29.4	41	0.33	005	30.0	250	220	26.0
050/.08	0.26	8.0	110	66	4.0	16500	4280	0.23	22.8	32	0.30	004	11.0	230	95	38.0
050/.010	0.24	5.7	079	61	2.0	16300	8570	0.12	11.4	16	0.30	004	3.8	40	70	29.5
050/.013	0.30	7.5	100	65	1.5	15100	10460	0.10	9.3	13	0.30	004	1.8	25	25	35.0
050/.015	0.40	9.6	130	68	1.5	16500	11360	0.09	8.6	12	0.30	004	1.3	20	30	42.0
Type 1616																
1616/012	—	9.2	128	68	12.0	17200	1485	0.67	65.5	91	0.30	004	83.0	—	—	—
1616/006	3.8	9.2	.128	71	6.0	15200	26.05	—	37.4	52	0.30	004	23.7	—	—	—
1616/004	—	12.5	175	72	4.0	17100	4388	0.23	22.2	31	0.30	004	6.9	—	—	—
Type 250																
250/.055	0.66	17.5	244	72	12.0	14700	1250	0.80	78.0	1.08	0.44	006	52.0	850	230	44.0
250/.07	0.43	14.0	195	72	6.0	11900	2030	0.49	48.0	67	0.35	005	20.0	350	130	38.7
Type 1624																
1624E012	—	39.5	550	81	12.0	14500	1278	0.82	79.9	1.11	0.40	006	24.0	850	360	82.0
1624E006	—	—	—	—	—	12,000	—	—	—	—	—	—	—	—	—	—
1624E003	—	47.0	65	81	3.0	11500	3875	0.26	25.2	35	0.50	007	1.6	230	360	70.0
Type 030																
030/.05	0.35	10.2	142	58	12.0	14100	1250	0.80	78.0	1.08	0.63	009	86.0	1000	—	14.0
030/.055	0.35	9.0	125	56	9.0	14000	1660	0.60	59.0	818	0.63	009	55.0	600	—	16.1
030/.08	0.41	13.7	190	64	6.0	13000	2270	0.44	43.0	597	0.59	008	18.0	300	—	16.4
030/.010	0.43	9.4	131	55	3.0	16300	5830	0.17	17.0	236	0.66	009	5.0	60	—	20.4
030/.015	0.55	12.6	175	61	2.0	16400	8610	0.12	11.4	158	0.66	009	1.7	30	—	16.7
030/.020	0.61	17.9	248	67	1.5	14300	9860	0.10	9.9	137	0.63	009	0.8	18	—	16.5
Type 230																
230/.06	0.53	24.2	333	69	12.0	8200	700	1.43	139.0	1.92	0.71	010	67.0	1300	180	25.0
230/.017	1.10	47.1	652	77	3.0	8200	2780	0.36	35.0	0.49	0.71	010	2.2	65	30	33.5
230/.020	0.77	34.2	475	77	2.0	6700	3420	0.29	28.0	0.39	0.65	009	1.3	50	25	27.5
Type 235																
235/.06	0.53	27.3	380	71	12.0	7300	620	1.61	156.0	2.17	0.67	009	67.0	1300	180	25.0
235/.10	0.75	39.3	547	76	6.0	7200	1120	0.82	80.0	1.13	0.66	009	12.0	350	90	34.1
235/.15	0.75	40.8	293	77	3.0	7000	2350	0.43	41.0	570	0.66	009	3.0	85	40	32.3
Type 2232																
2232H012	—	116.0	1.61	82	12.0	11000	924	1.08	105.0	1.46	1.0	014	10.8	—	—	—
2232H003	—	136.0	1.89	84	3.0	10600	3560	0.28	27.4	38	1.0	.014	0.6	—	—	—
2232H006	New Model — Specifications On Request.															
Type 330																
330/.05	2.3	94.0	1.31	81	48.0	9360	200	5.00	494.0	6.85	1.00	0.014	250.0	4800	250	54.0
330/.055	1.9	79.8	1.11	81	30.0	10250	345	2.90	282.0	3.92	0.80	0.011	105.0	2200	190	73.6
330/.07	2.6	100.4	1.44	84	24.0	9640	405	2.45	240.0	3.33	0.80	0.011	57.0	1600	110	75.0
330/.09-X	2.3	81.6	1.18	85	18.0	8050	510	1.96	191.0	2.65	0.68	0.009	25.0	600	90	70.0
330/.09	1.5	136.7	1.90	83	12.0	9130	675	1.48	144.0	2.00	0.80	0.011	21.0	650	85	52.0
330/.12	2.46	147.4	2.05	84	12.0	9670	810	1.23	120.0	1.67	1.02	0.014	9.7	400	50	60.0
330/.17	3.10	142.8	1.98	86	6.0	9000	1510	0.66	65.0	90	0.77	0.011	2.9	130	22	70.0
330/.22	3.40	172.2	2.40	87	4.5	8730	1950	0.51	50.0	69	0.80	0.011	1.3	70	15	61.5

* 1 Replace the digit after the "slash" with one of the following letters.
A = Pinion gear on shaft for gearboxes type 06/1, 05/1, 05/2, 05/3, 05/40.
B = Straight shaft — see motor drawings.
C = Special shafts.
D = Pinion gear on shaft for 03/2 gearbox.
Example — Model 1212 A 001 = motor with pinion gear for 06/1 gearhead.

*2; *3; *4; *6; At voltage specified in column 5.
*18 Rotor to case thermal resistance computed with rotor at zero velocity.
*19 Radial shaft load rating at 3000 RPM.
*23 Weights in parenthesis are for motor with gearbox (same case).

See Page 4 for English-Metric Conversion Data

Micro MoElectronics, INC.
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

15		16	17		18*		19*		20*		21		22		23*		24*	25*	26	
Armature Inertia $10\bullet^{4}$ (max.)		Mechanical Time Const. (max.)	Thermal Resistances (max.) Case to ambient		Rotor to case		Maximum-Shaft Load Radial		Axial		Case Diameter		Case Length		Weight		Gearboxes	Direction of Rotation	Motor Case Config.	Motor Types 060 and 1212
gr.cm s^2	oz-in s^2	ms	°C/W	°F/W	°C/W	°F/W	gr.	oz	gr.	oz	mm	in	mm	in	gr.	oz				Unit:
																				060/.004
1.0	.014	85	60	110	30	54	—	—	50	1.77	12	.473	12	.473	6.5	.23	0	L	A	060/.006
1.0	.014	85	60	110	30	54	—	—	50	1.77	12	.473	12	.473	6.5	.23	0	L	A	060/.007
1.0	.014	50	60	110	30	54	—	—	50	1.77	12	.473	12	.473	6.5	.23	0	L	A	060/.008
																				Type 050
2.0	.027	75	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/..04
2.0	.027	70	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/..055
2.0	.027	65	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/..08
1.9	.026	60	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/..010
2.2	.030	50	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/..013
2.3	.031	46	45	81	17	30.5			50	1.77	15	.589	16	.628	12	.422	†‡	R	B	050/.015
																				Type 1616
																				1616/012
																				1616/004
																				1616/006
																				Type 250
4.0	.055	35	35	63	14	25			60	2.12	15	.589	24	.943	20	.704	†‡	L	C	250/..055
4.0	.055	29	35	63	14	25			60	2.12	15	.589	24	.943	20	.704	†‡	L	C	250/..07
																				Type 1624
5.0	.07	—	35	63	14	25	—	—	60	2.12	16	.629	24	.945	22	.78	X	R	CI	1624E012
5.0	.07	—	35	63	14	25	—	—	60	2.12	16	.629	24	.945	22	.78	X	R	CI	1624E006
5.0	.07	—	35	63	14	25			60	2.12	16	.629	24	.945	22	.78	X	R	CI	1624E003
																				Type 030
7.0	.097	100	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/..05
6.0	.083	82	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/..055
8.0	.112	74	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/..08
5.0	.070	70	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/.010
8.0	.112	77	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/..015
10.0	.138	72	35	63	15	27			50	1.77	20	.786	17	.668	22(24)	.774(.844)	~□	L	D,F,G	030/..020
																				Type 230
9.6	.133	31	28	51	10	18			50	1.77	20	.786	25	.982	37(43)	1.302(1.513)	★□	L	E,I	230/..06
14.0	.194	23	28	51	10	18			50	1.77	20	.786	25	.982	37(43)	1.302(1.513)	★□	L	E,I	230/..017
16.0	.222	23	28	51	10	18			50	1.77	20	.786	25	.982	37(43)	1.302(1.513)	★□	L	E,I	230/.020
																				Type 235
10.0	.138	20	28	51	10	18			60	2.12	22	.864	25	.98	46	1.62	□	L	J	235/.06
12.0	.166	25	28	51	10	18			60	2.12	22	.864	25	.982	46	1.619	□	L	J	235/..10
13.0	.180	29	28	51	10	18			60	2.12	22	.864	25	.982	46	1.619	□	L	J	235/..15
																				Type 2232
—	—	—	28	51	10	18	—	—	60	2.12	22	.864	32	1.26	—	—	□	L	L	2232H012
—	—	—	28	51	10	18	—	—	60	2.12	22	.864	32	1.26	—	—	□	L	L	2232H003
																				2232H006
																				Type 330
17.0	.236	13	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..05
11.0	.152	13	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..055
14.0	.194	13	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/.07
20.0	.278	14	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..09· X
15.0	.208	14	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..09
23.0	.292	14	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/...12
20.0	.274	12	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..17
26.0	.361	12	25	45	8	14.4	5000	177.0	150	5.31	22	.864	33	1.30	65	2.3	□	L	K	330/..22

24: The following symbols indicate the gearbox types suitable for the motor.
0 = Screw-On gearboxes, ratios from 6:1 to 1,000,000:1.
† = Slip-On gearboxes of type 05/1 (plastic case .668 in. in diameter) ratios from 3.45:1 to 5760:1.
‡ = Slip-On gearboxes of type 05/2 and 05/3 (metal case .628 in. in diameter) ratios from 3.45:1 to 235,000:1.
x = Slip-On gearbox of type 05/4 available. Same ratio as 05/3.
~ = Also with Built-in gearboxes, ratios 4:1, 15:1, 59:1.
★ = Also with Built-in gearboxes, ratios 4:1, 15:1, 59:1.
□ = Slip-On gearboxes of type 03/2 (metal case 23.8mm (.941 in. in diameter) ratios from 3:1 to 983,447:1 peak torque up to 4000 grcm (55.5 oz-in.)

25. Direction of rotation seen from shaft end, red lead +R = clockwise; L = counterclockwise.

Micro Mo ELECTRONICS, INC.
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

MOTOR SPECIFICATIONS

- Measured at 25°C (77°F)
- Operational temperature range: — 50°C (— 58°F) to +75°C (+167°F)
- Maximum rotor temperature: + 75°C (+ 167°F); special models up to + 125°C (+ 258°F)

1*	2*	3*		4*	5	6*	7	8	9		10		11	12	13	14
Motor Type	**Output Power (max.)**	**Stall Torque**		**Max. Efficiency**	**Test Voltage**	**Noload Speed ± 15%**	**Specific Speed Per Volt ± 15%**	**Volts Per 1000 rpm ± 15%**	**Specific Torque ± 15%**		**Friction Torque (max.)**		**Armature Resistance ± 10%**	**Armature Inductance**	**Typical Starting Voltage**	**Angular Acceleration (min.)**
Unit:	**Watts**	**gm.cm**	**oz-in.**	**%**	**Volts**	**rpm**	**rpm/v**	**Volts**	**gr.cm/A**	**oz-in/A**	**gr.cm.**	**oz-in.**	**Ohm**	**μH**	**mV**	**(Rad/s²)•10³**
Type 2644																
2644M024	3.4	204.	2.8	78	24	7600	320	3.1	293	4.1	3.0	.04	33.6	—	340	60
2644M018	4.4	270.	3.8	79	18	6800	375	2.6	256	3.6	3.0	.04	17.2	—	220	100
2644M012	3.7	280.	3.9	80	12	5100	425	2.3	218	3.0	3.0	.04	9.4	—	125	72
2644M006	1.7	133.	1.8	79	6	5100	355	1.2	112	1.6	3.0	.04	5.0	—	135	30
Type 2844	**Specifications available on request**															
2844M018 2844M012 2844M006																
Type 3540 (Operational Temperature Range, -50° to +125° C)																
3540/215	8.9	525	7.3	—	24	6800	300	3.3	330	4.6	20	.28	15	—	900	29
3540/217	10.0	553	7.7	—	18	7146	397	2.5	246	3.4	20	.28	8	—	650	29
3540/220	6.6	420	5.8	—	12	6300	550	1.8	178	2.5	20	.28	5	—	560	29
3540/228	6.0	380	5.3	—	6	6300	1100	.91	88	1.2	20	.28	1.4	—	320	29
3540/230	8.0	420	5.8	—	6	7560	1260	.80	77	1.1	20	.28	1.1	—	290	29
Type 3557																
3557/215	12.0	875	12.0	76	32	5400	175	5.7	560	7.8	20	.3	20	—	710	70
3557/217	12.0	810	11.3	74	24	5400	230	4.4	420	5.8	20	.3	12	—	570	64
3557/220	12.0	930	13.0	75	20	5250	270	3.7	365	5.1	20	.3	7.5	—	410	64
3557/226	11.5	845	12.0	75	12	5400	460	2.2	210	2.9	20	.3	2.9	—	280	58
3557/230	11.5	795	11.0	74	9	5800	660	1.5	145	2.0	20	.3	1.6	—	220	58
3557/240	9.0	675	9.4	72	6	5300	900	1.1	105	1.5	20	.3	0.9	—	170	40
Type 4022	**Specifications available on request**															
4022N018 4022N012 4022N005																

ENGLISH-METRIC CONVERSION DATA

1 in. oz. = 72.0 Gram cm
1 oz. = 28.0 grams
1 in. = 2.54 cm
1 in. = 25.4 mm
1 °F. = .555 °C. (Temperature change only)

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15		16	17		18*		19*		20*		21		22		23*		24*	25*	26	
Armature Inertia 10•⁴ (max.)		Mechanical Time Const. (max.)	Thermal Resistances (max.) Case to ambient		Rotor to case		Maximum-Shaft Load Radial		Axial		Case Diameter		Case Length		Weight		Gearboxes	Direction of Rotation	Motor Case Config.	Motor Type
gm.cm s^2	oz-in s^2	ms	°C/W	°F/W	°C/W	°F/W	gm.	oz	gm.	oz	mm	in	mm	in	gm.	oz				Unit:
																				Type 2644
30	.42	20	19	34	7	12.6					26	1.02	43	1.69	115	4.1	Δ	L	M	2644M024
35	.49	20	19	34	7	12.6					26	1.02	43	1.69	115	4.1	Δ	L	M	2644M018
28	.39	20	19	34	7	12.6					26	1.02	43	1.69	115	4.1	Δ	L	M	2644M012
14	.20	20	19	34	7	12.6					26	1.02	43	1.69	115	4.1	Δ	L	M	2644M006
															Specifications available on request					Type 2844
																				2844M018 2844M012 2844M006
																				Type 3540
180	2.5	15	14	25	4.3	7.7	4080	146	5000	177	35	1.38	43	1.69	190	6.8	Δ	L	N	3540/215
180	2.5	15	14	25	4.3	7.7	4080	146	5000	177	35	1.38	43	1.69	190	6.8	Δ	L	N	3540/217
180	2.5	15	14	25	4.3	7.7	4080	146	5000	177	35	1.38	43	1.69	190	6.8	Δ	L	N	3540/220
180	2.5	15	14	25	4.3	7.7	4080	146	5000	177	35	1.38	43	1.69	190	6.8	Δ	L	N	3540/228
180	2.5	15	14	25	4.3	7.7	4080	146	5000	177	35	1.38	43	1.69	190	6.8	Δ	L	N	3540/230
																				Type 3557
250	3.5	17	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/215
250	3.5	18	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/217
290	4.0	18	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/220
290	4.0	20	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/226
270	3.8	20	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/230
330	4.6	26	10	18	3	5.4	4080	146	5100	177	35	1.38	57	2.24	275	9.8	Δ	L	N	3557/240
															Specifications available on request					Type 4022
																				4022N018 4022N012 4022N005

*18: Rotor to case thermal resistance computed with rotor at zero velocity.

*19: Radial shaft load rating at 3000 RPM.

*23: Weights in parenthesis are for motor with gearbox (same case).

24: The following symbols indicate the gearbox types suitable for the motor.
Δ = Planetary gearboxes to be available by January 1976.

25: Direction of rotation seen from shaft end, red lead tR = clockwise; L = counterclockwise.

Micro Mo ELECTRONICS, INC.
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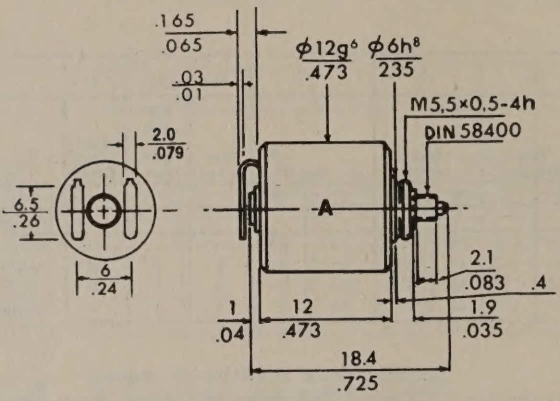
MECHANICAL DATA: MOTORS, TACHOMETERS

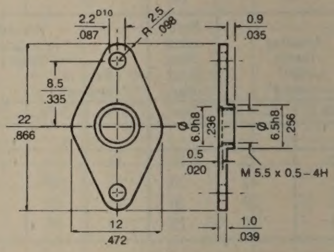
NOTE: Dimensions are in $\frac{\text{mm}}{\text{inches}}$

060

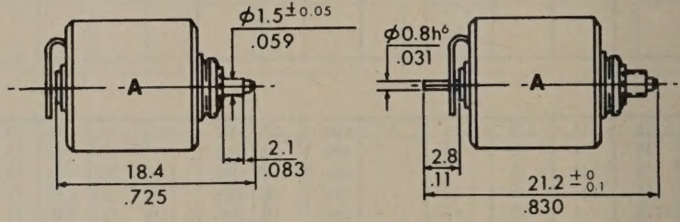


.165
.065
.03
.01
φ12g⁶
.473
φ6h⁸
235
M5,5×0,5-4h
DIN 58400
2.0
.079
6.5
.26
6
.24
A
2.1
.083
.4
1
.04
12
.473
1.9
.035
18.4
.725

* Pinion Specifications:
$z = 9$ teeth
$m = 0.20$
D tip = 2.34 — 0.015
D root = 1.42 — 0.015
correction factor:
$x = + 0.35$
$a = 20°$, involute

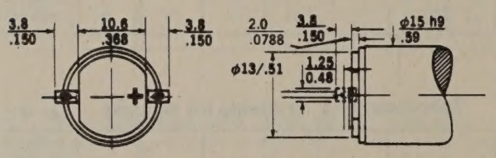


2.2 D10
.087
R 2.5
.098
0.9
.035
8.5
.335
22
.866
ø 6.0h8
.236
ø 6.5h8
.256
0.5
.020
M 5.5 x 0.5 – 4H
12
.472
1.0
.039



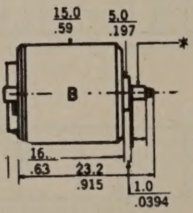
φ1.5±0.05
.059
A
2.1
.083
18.4
.725
φ0.8h⁶
.031
A
2.8
.11
21.2 +0 -0.1
.830

050



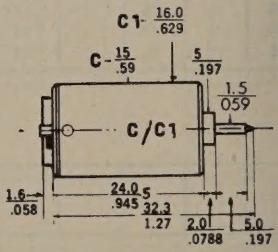
3.8
.150
10.6
.368
3.8
.150
2.0
.0788
3.8
.150
φ15 h9
.59
φ13/.51
1.25
0.48

Solder Tab Brush Assembly



15.0
.59
5.0
.197
*
B
16.
.63
23.2
.915
1.0
.0394

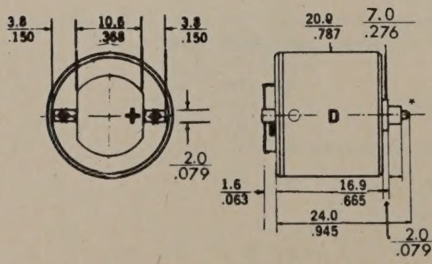
250



C1- 16.0 / .629
C- 15 / .59
5
.197
1.5
.059
C/C1
1.6
.058
24.0
.945
5
32.3
1.27
2.0
.0788
5.0
.197

*Pinion - 9 teeth / m = 0.2 / P.A. = 20°

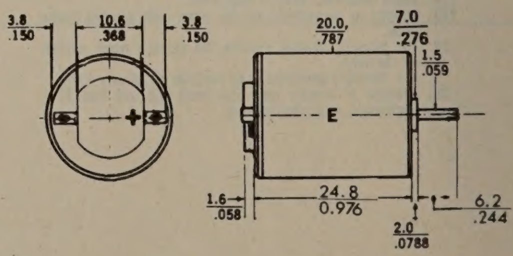
030



3.8
.150
10.6
.368
3.8
.150
20.0
.787
7.0
.276
D
*
2.0
.079
1.6
.063
16.9
.665
24.0
.945
2.0
.079

*Pinion - 9 teeth / m = 0.2 / P.A. = 20°

230



3.8
.150
10.6
.368
3.8
.150
20.0,
.787
7.0
.276
1.5
.059
E
1.6
.058
24.8
0.976
6.2
.244
2.0
.0788

Micro Mo ELECTRONICS, INC.
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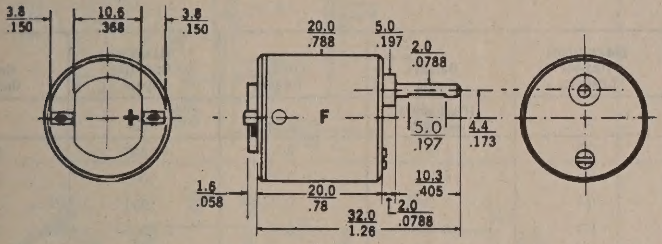
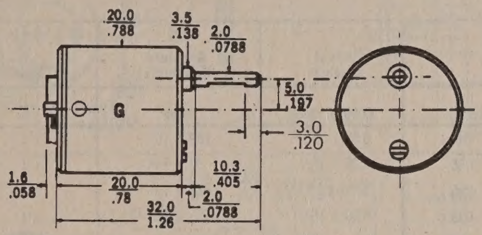
030 Built in Reductions

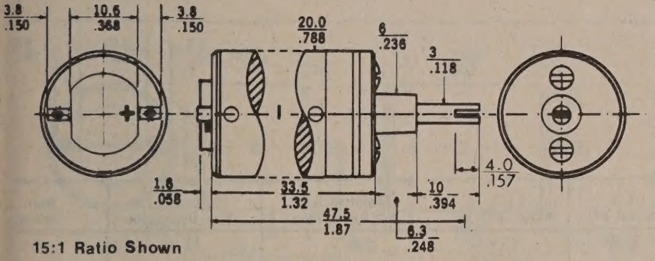

3.8
.150
10.6
.368
3.8
.150
20.0
.788
5.0
.197
2.0
.0788
F
5.0
.197
4.4
.173
10.3
.405
1.6
.058
20.0
.78
2.0
.0788
32.0
1.26

4:1 Ratio


20.0
.788
3.5
.138
2.0
.0788
G
5.0
.197
3.0
.120
10.3
.405
1.6
.058
20.0
.78
2.0
.0788
32.0
1.26

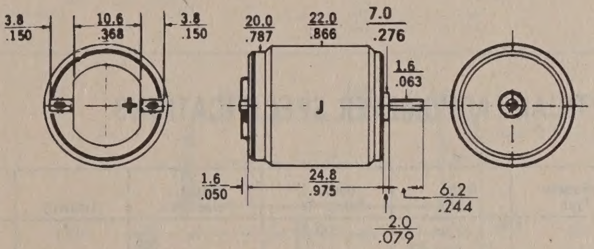
15:1 and 59:1 Ratios

232

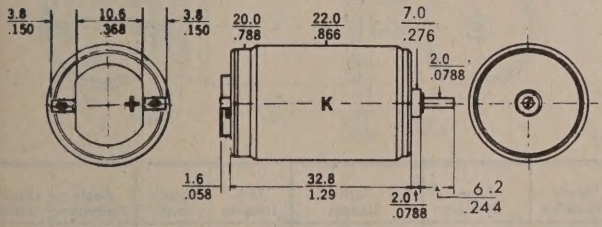

3.8
.150
10.6
.368
3.8
.150
20.0
.788
6
.236
3
.118
I
4.0
.157
1.6
.058
33.5
1.32
10
.394
47.5
1.87
6.3
.248

15:1 Ratio Shown
4:1 Ratio has Output Shaft 4.4 mm off center and Gearing Boss is 4 mm long.

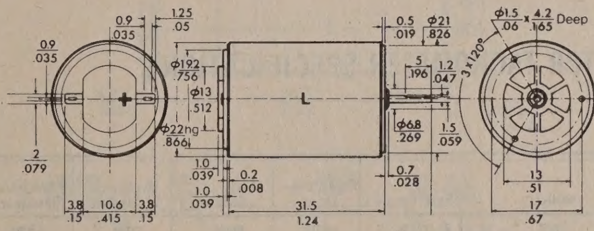
235


3.8
.150
10.6
.368
3.8
.150
20.0
.787
22.0
.866
7.0
.276
1.6
.063
J
1.6
.050
24.8
.975
6.2
.244
2.0
.079

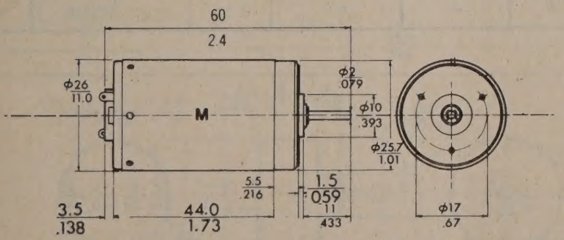
330


3.8
.150
10.6
.368
3.8
.150
20.0
.788
22.0
.866
7.0
.276
2.0
.0788
K
1.6
.058
32.8
1.29
2.0
.0788
6.2
.244

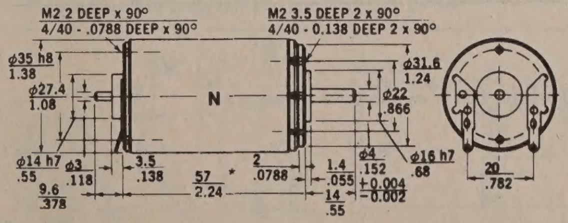
22.32


0.9
.035
1.25
.05
0.9
.035
ϕ19.2
.756
ϕ13
.512
ϕ22ng
.866
2
.079
1.0
.039
0.2
.008
1.0
.039
3.8
.15
10.6
.415
3.8
.15
31.5
1.24
L
0.5
.019
ϕ21
.826
5
.196
1.2
.047
ϕ6.8
.269
1.5
.059
0.7
.028
ϕ1.5 x 4.2 Deep
.06 .165
3x120°
13
.51
17
.67

26.44


60
2.4
ϕ26
11.0
M
ϕ2
.079
ϕ10
.393
ϕ25.7
1.01
5.5
.216
1.5
.059
11
.433
3.5
.138
44.0
1.73
ϕ17
.67

35.40


M2 2 DEEP x 90°
4/40 - .0788 DEEP x 90°
M2 3.5 DEEP 2 x 90°
4/40 - 0.138 DEEP 2 x 90°
ϕ35 h8
1.38
ϕ27.4
1.08
N
ϕ31.6
1.24
ϕ22
.866
ϕ14 h7
.55
ϕ3
.118
3.5
.138
9.6
.378
57*
2.24
2
.0788
1.4
.055
ϕ4
.152
+0.004
−0.002
14
.55
ϕ16 h7
.68
20
.782

*Length for 35.57, Length for 35.40 = 40mm

Micro Mo ELECTRONICS, INC.
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TACHOMETER SPECIFICATIONS

- Measured at 25°C (77°F)
- Operational temperature range: — 50°C (— 58°F) to +75°C (+167°F)
- Maximum rotor temperature: + 75°C (+ 167°F); special models up to + 125°C (+ 258°F)

Type	Output Gradient	Armature Resistance	Linearity	Bidirectional Gradient Tolerance	Output Ripple	Friction Torque	Maximum Operating Speed	Mech. Outline
Unit:	V/1000 rpm	Ohm	%	%	(Peak above average)	gr.cm	rpm	
050/ . . . 04	0.55 ± 15%	109 ± 15%	± 1	± 0.5	± 5%	0.3	5000	A
050/ . . . 055	0.30 ± 15%	32 ± 15%	± 1	± 0.5	± 5%	0.3	5000	B
250/ . . . 055	0.30 ± 15%	52 ± 15%	± 1	± 0.4	± 5%	0.35	5000	C
030/ . . . 055	0.60 ± 15%	55 ± 15%	± 1	± 0.5	± 5%	0.35	5000	D
230/ . . - 05	1.4 ± 15%	67 ± 15%	± 0.6	± 0.3	± 5%	0.35	5000	E
330/ . . . 055-133	2.4 ± 1%	105 ± 15%	± 0.5	± 0.25	± 5%	0.1	5000	F
330/ . . . 05-133	4.3 ± 1%	250 ± 15%	± 0.5	± 0.25	± 5%	0.1	5000	F

OPTICAL TACHOMETER SPECIFICATIONS

Tachometer Type	Motor Type	Output 1 Pulses/Rev.	Output 2 Pulses/Rev.	Linearity	L.E.D. Current-MA	L.E.D. Voltage @20 MA	Phototransistor Vce Rating-Volts	Phototransistor Max. Dissipation	Mech. Outline
01A2	22mm	15	15	0.4%	5-20 MA	1.65 V	40 V	50 MW	G
01A3	Any	15	15	0.4%	5-20 MA	1.65 V	40 V	50 MW	H
01A4	35mm	15	15	0.4%	5-20 MA	1.65 V	40 V	50 MW	I
01A9	22	15	1	0.4%	5-20 MA	1.65 V	40 V	50 MW	G
01A10	15, 16	15	15	0.4%	5-20 MA	1.65 V	40 V	50 MW	J

MOTOR TACHOMETER SPECIFICATIONS

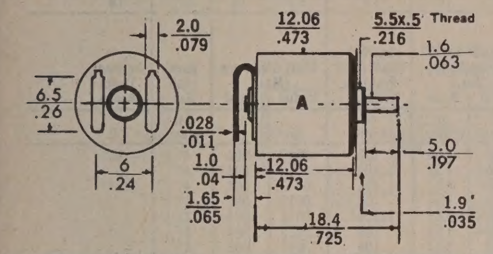
MODEL		Peak Torque +	Peak Power Input +	Electrical T. Constant +	Mechanical T. Constant	Armature Resistance +	Thermal Resistance	Torque Constant +	Tach Gradient	Tach Linearity	Ripple Output	Ripple Frequency	Mech. Outline
Type		gr.cm/oz-in	watts	msec.	msec.	ohms	°C/watt	gr.cm/oz-in	volts/1000 rpm	%	%	Hz/rev.	
050/	+ 0507/204-8	—	—	—	150	—	45	—	55	± 1%	± 5%	7	K
050/	+ 0507/204-8	—	—	—	70	—	35	—	55	± 1%	± 5%	7	L
235/2	+ 0307/205-8	—	—	—	36	—	28	—	60	± 1%	± 5%	7	M
339/5	+ 2307/205-8	—	—	—	26	—	25	—	60	± 1	± 5%	7	M
3540/	+ 2307/205-8	—	—	—	15	—	14	—	60	± 5%	± 5%	7	N
3557/	+ 3307/205-8	—	—	—	18	—	10	—	4.3	± 5%	± 5%	7	N

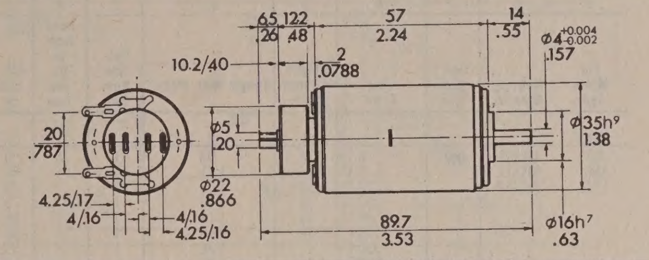
* 1 Output is photo transistor emitter
+2 Motor winding can be any winding shown in motor section

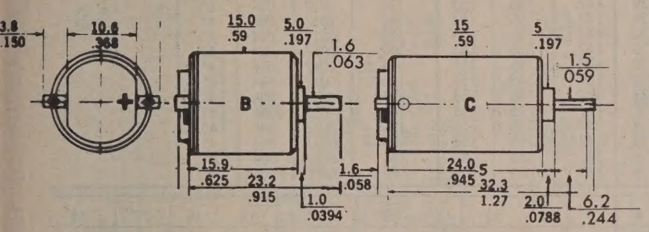
Micro Mo ELECTRONICS, INC.
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

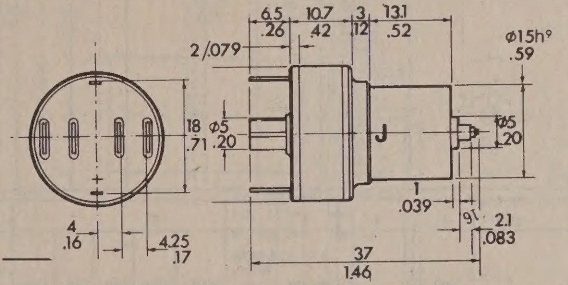
MECHANICAL DATA: TACHOMETERS

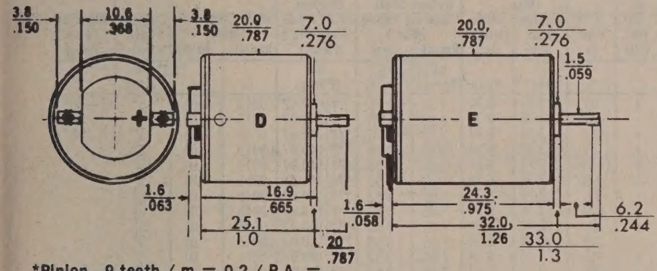
NOTE: Dimensions are in mm / inches


2.0 .079
12.06 .473
5.5x.5 Thread .216
1.6 .063
6.5 .26
A
.028 .011
1.0 .04
12.06 .473
5.0 .197
6 .24
1.65 .065
18.4 .725
1.9 .035

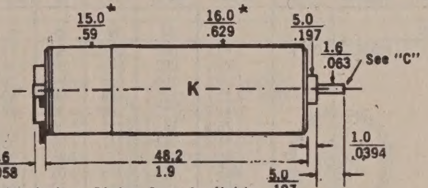

6.5 12.2 .26 .48
57 2.24
14 .55
φ4 +0.004 -0.002 .157
10.2/40
2 .0788
20 .787
φ5 .20
I
φ35h9 1.38
φ22 .866
4.25/.17
4/.16
4/.16
4.25/.16
89.7 3.53
φ16h7 .63


3.8 .150
10.6 .368
15.0 .59
5.0 .197
1.6 .063
15 .59
5 .197
1.5 .059
B
C
15.9 .625
23.2 .915
1.6 .058
1.0 .0394
24.0 .945
5
32.3 1.27
2.0 .0788
6.2 .244


6.5 .26
10.7 .42
3 .12
13.1 .52
φ15h9 .59
2/.079
18 .71
φ5 .20
J
φ5 .20
1 .039
.16
2.1 .083
4 .16
4.25 .17
37 1.46

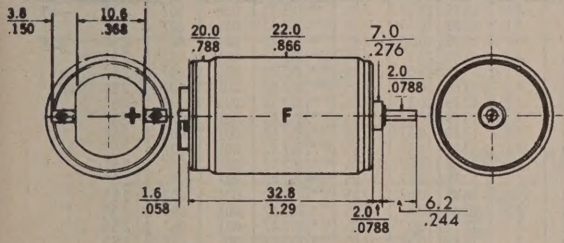

3.8 .150
10.6 .368
3.8 .150
20.0 .787
7.0 .276
20.0 .787
7.0 .276
1.5 .059
D
E
1.6 .063
16.9 .665
1.6 .058
24.3 .975
25.1 1.0
.20 .787
32.0 1.26
33.0 1.3
6.2 .244

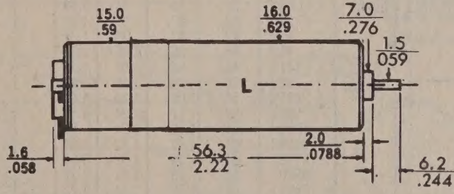
*Pinion - 9 teeth / m = 0.2 / P.A. =

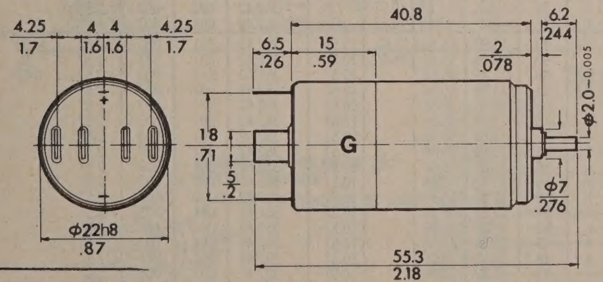

15.0* .59
16.0* .629
5.0 .197
1.6 .063
See "C"
K
1.0 .0394
1.6 .058
48.2 1.9
5.0 .197

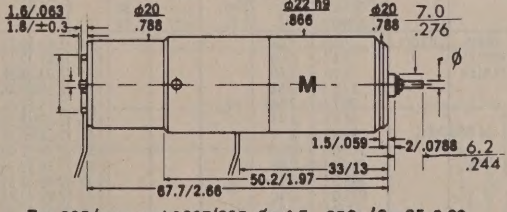
NOTE C — Straight shaft or Pinion Gear Available

*For 1616 & 1624 Motor Tach increase these diameters by 1mm


3.8 .150
10.6 .368
20.0 .788
22.0 .866
7.0 .276
2.0 .0788
F
1.6 .058
32.8 1.29
2.0 .0788
6.2 .244

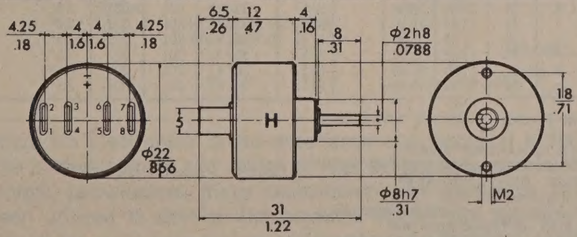

15.0 .59
16.0 .629
7.0 .276
1.5 .059
L
1.6 .058
56.3 2.22
2.0 .0788
6.2 .244

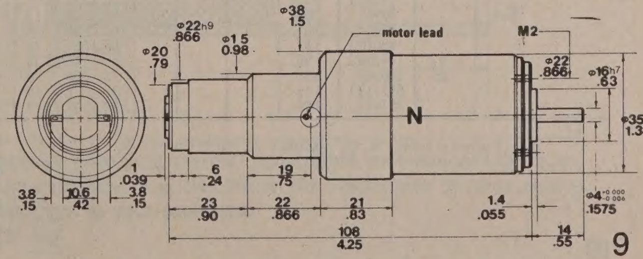

4.25 1.7
4 4 1.6 1.6
4.25 1.7
40.8
6.2 .244
6.5 .26
15 .59
2 .078
φ2.0 -0.005
18 .71
G
5 .2
φ7 .276
φ22h8 .87
55.3 2.18


1.6/.063
1.8/±0.3
φ20 .788
φ22 h9 .866
φ20 .788
7.0 .276
φ
M
1.5/.059
2/.0788
6.2 .244
33/1.3
50.2/1.97
67.7/2.66

For 235/xxx and 0307/205 ∅=1.5 .059; ∠2=25 0.98

For 338/xxx and 0307/205 ∅=2.0 .0788; ∠2=33 1.3


4.25 .18
4 4 1.6 1.6
4.25 .18
6.5 .26
12 .47
4 .16
8 .31
φ2h8 .0788
1 2 3 4 5 6 7 8
5 .2
H
φ22 .866
18 .71
31 1.22
φ8h7 .31
M2


φ38 1.5
φ22h9 .866
φ15 0.98
φ20 .79
motor lead
M2
φ22 .866
φ16h7 .63
N
φ35h9 1.38
1 .039
6 .24
19 .75
3.8 .15
10.6 .42
3.8 .15
23 .90
22 .866
21 .83
1.4 .055
φ4 +0.000 -0.006 .1575
108 4.25
14 .55

Micro MoElectronics, INC.
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

GEARHEAD SPECIFICATIONS

1	2	3	4	5	6*	7	8*	9	10	11	12*	13*	14*	15	16	17*	18
For Motor Type	Housing Material	Gear Box Type	Gear Ratio	Weight Without Motor	Length With Motor L	Outline Number	Rotational Direction	Efficiency	Output Torque (Max.) Continuous Duty	Output Torque (Max.) Intermittent Duty	Output Shaft Bearing Rating (Max.) Radial	Output Shaft Bearing Rating (Max.) Axial	Gearbox Shaft Axial Pressure (Max.)	Shaft Clearance (Max.) Radial	Shaft Clearance (Max.) Axial	Back Lash (Max.)	Ambient Temp. Range
Units:				oz	in			%	oz-in	oz-in	oz (Force)	oz (Force)	oz (Force)	in	in	Degrees	°F
060.... AND 1212....	BRASS NICKEL PLATED	06/1	6:1	.28	.93	1	‡	90	1.39	3.47	7.05	3.53	106	.0012	.004	4°	— 60° to 248°
			15:1	.29	1.01	1	‡	81	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			28:1	.33	1.09	1	=	73	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			52:1	.33	1.09	1	=	73	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			96:1	.36	1.18	1	‡	66	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			178:1	.36	1.18	1	‡	66	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			330:1	.4	1.26	1	=	59	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			610:1	.4	1.26	1	=	59	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			1130:1	.43	1.34	1	‡	53	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			2100:1	.43	1.34	1	‡	53	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			3900:1	.47	1.42	1	=	48	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			7250:1	.47	1.42	1	=	48	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			13500:1	.5	1.51	1	‡	43	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			25000:1	.5	1.51	1	‡	43	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			46000:1	.54	1.59	1	=	39	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			86000:1	.54	1.59	1	=	39	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			160000:1	.57	1.67	1	‡	35	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			300000:1	.57	1.67	1	‡	31	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			550000:1	.6	1.76	1	=	31	1.39	3.47	7.05	3.53	106	.0012	.004	4°	
			1000000:1	.6	1.76	1	=	31	1.39	3.47	7.05	3.53	106	.0012	.004	4°	

1	2	3	4	5		6*					7	8*	9	10	11	12*	13*	14*	15	16	17*	18
For Motor Type	Housing Material	Gear Box Type	Gear Ratio	Weight Without Motor	Length Without Motor L1	050/0 L2	250/0 L2	030/4 L3	235/4 L3	330/4 L3	Outline Number	Rotational Direction	Efficiency	Output Torque (Max.) Continuous Duty	Output Torque (Max.) Intermittent Duty	Output Shaft Bearing Rating (Max.) Radial	Output Shaft Bearing Rating (Max.) Axial	Gearbox Shaft Axial Pressure (Max.)	Shaft Clearance (Max.) Radial	Shaft Clearance (Max.) Axial	Back Lash (Max.)	Ambient Temp. Range
Units:				oz	in	in	in	in	in	in			%	oz-in	oz-in	oz (Force)	oz (Force)	oz (Force)	in	in	Degrees	°F
050.... 250....	PLASTIC	05/1	3.45:1	.092	.645	.881	1.23				2a	‡	90	2.78	8.34	3.52	1.76	**) 17.62	.0015	.01	5°	—60° to 158°
			6.3:1	.092	.685	.944	1.29				2a	=	81	2.78	8.34	3.52	1.76	***)140.97	.0015	.01	5°	
			11.8:1	.106	.685	.944	1.29				2a	=	81	2.78	8.34	3.52	1.76	***)140.97	.0015	.01	5°	
			22:1	.123	.669	.968	.92				2b	‡	73	2.78	8.34	3.52	1.76	***)140.97	.0015	.01	5°	
			41:1	.123	.669	.968	.92				2b	‡	73	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			76:1	.141	.712	1.00	1.35				2b	=	66	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			141:1	.141	.712	1.00	1.35				2b	=	66	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			262:1	.152	.775	1.05	1.41				2b	‡	59	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			485:1	.162	.775	1.05	1.41				2b	‡	59	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			900:1	.175	.84	1.12	1.48				2b	=	53	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			1670:1	.175	.84	1.12	1.48				2b	=	53	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			3120:1	.183	.901	1.19	1.55				2b	‡	48	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
			5750:1	.183	.901	1.19	1.55				2b	‡	48	2.78	8.34	7.05	3.52	***)140.97	.0015	.01	5°	
050.... 250....	BRASS NICKEL PLATED	05/2 05/3* 05/4*	3.45:1	.32	.71	.83	1.15				3a	‡	90	4.1	13.89	10.57	7.05	**)105.73	.001	.007	2.5°	—60° to 248°
			6.3:1	.36	.79	.91	1.23				3a	=	81	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			11.8:1	.36	.79	.91	1.23				3a	=	81	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			22:1	.43	.87	.99	1.31				3b	‡	73	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			41:1	.43	.87	.99	1.31				3b	‡	73	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			76:1	.46	.96	1.07	1.39				3b	=	66	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
1616 1624		05/20* 05/30* 05/40*	141:1	.46	.96	1.07	1.39				3b	=	66	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			262:1	.50	1.04	1.15	1.48				3b	‡	59	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			485:1	.50	1.04	1.15	1.48				3b	‡	59	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			900:1	.57	1.12	1.24	1.56				3b	=	53	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			1670:1	.57	1.12	1.24	1.56				3b	=	53	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			3120:1	.61	1.k0	1.32	1.64				3b	‡	48	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			5750:1	.61	1.20	1.32	1.64				3b	‡	48	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			10600:1	.68	1.29	1.41	1.72				3b	=	43	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			19800:1	.68	1.29	1.41	1.72				3b	=	43	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			37000:1	.71	1.37	1.49	1.81				3b	‡	39	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			68200:1	.71	1.37	1.49	1.81				3b	‡	39	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			123000:1	.75	1.45	1.57	1.89				3b	=	35	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
			235000:1	.75	1.45	1.57	1.89				3b	=	35	4.1	13.89	10.57	7.05	***)352.42	.001	.007	2.5°	
2017.... 2025... 2233....	BRASS NICKEL PLATED	03/2	3.1:1	2.01				1.50	1.81	2.12	4	=	90	13.89	55.56	17.62	10.57	352.42	.001	.003	2.5°	—60° to 248°
			5.4:1	2.08				1.50	1.81	2.12	4	=	90	13.89	55.56	(70.48)	10.57	352.42	.001	.003	2.5°	
			9.7:1	2.40				1.72	2.03	2.35	4	‡	86	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			17.2:1	2.54				1.84	2.15	2.46	4	=	81	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			30.7:1	2.54				1.84	2.15	2.46	4	=	81	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			54.6:1	2.71				1.95	2.26	2.58	4	‡	73	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			97.3:1	2.71				1.95	2.26	2.58	4	‡	73	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			173.0:1	2.89				2.07	2.38	2.69	4	=	66	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			308.0:1	2.89				2.07	2.38	2.69	4	=	66	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			548.0:1	3.10				2.18	2.49	2.81	4	‡	59	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			975.0:1	3.10				2.18	2.49	2.81	4	‡	59	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			1734:1	3.28				2.29	2.61	2.92	4	=	53	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			3088:1	3.28				2.29	2.61	2.92	4	=	53	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			5490:1	3.45				2.41	2.72	3.03	4	‡	48	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			9780:1	3.45				2.41	2.72	3.03	4	‡	48	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			17386:1	3.63				2.52	2.83	3.15	4	=	43	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			30969:1	3.63				2.52	2.83	3.15	4	=	43	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			55057:1	3.81				2.64	2.95	3.26	4	‡	39	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			98070:1	3.81				2.64	2.95	3.26	4	‡	39	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			174350:1	3.98				2.75	3.06	3.38	4	=	35	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			310560:1	3.98				2.75	3.06	3.38	4	=	35	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			552113:1	4.16				2.87	3.18	3.49	4	‡	31	13.89	55.56		10.57	352.42	.001	.003	2.5°	
			983447:1	4.16				2.87	3.18	3.49	4	‡	31	13.89	55.56		10.57	352.42	.001	.003	2.5°	

*05/3 outline is number 3c, 05/4 outline is 3d, 05/40 outline is 3e.

8 — Rotational Direction of Gearbox shaft same as motor: Symbol =
Opposite to motor direction: Symbol ‡

12 — Values in parenthesis apply to special models with ball bearings. models 05/3K, 03/2K

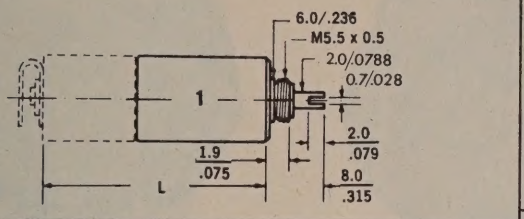
14 — **Without counter-force
***With counter-force per installation instructions.

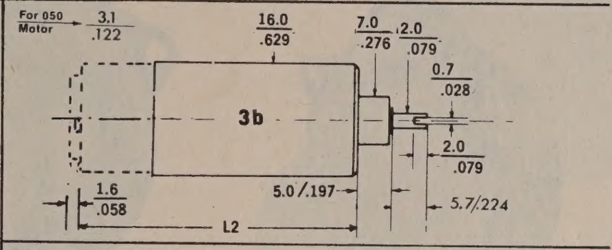
17 — At Load Shaft with blocked motor shaft.
Lower Backlash units available on Special Order.

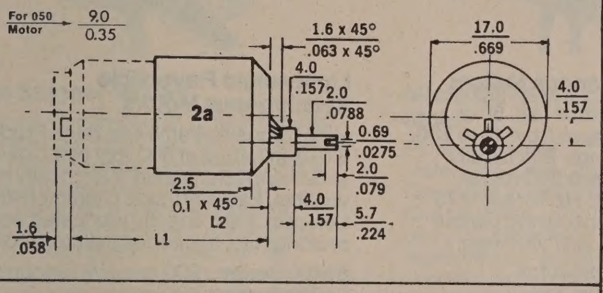
Micro Mo ELECTRONICS, INC.
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

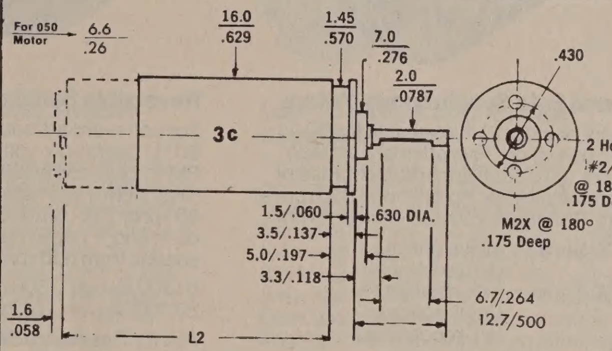
MECHANICAL DATA: GEARHEADS

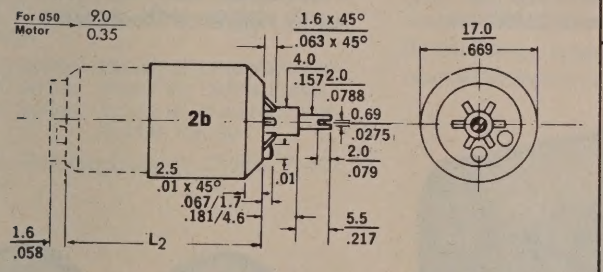
NOTE: Dimensions are in $\frac{\text{mm}}{\text{inches}}$

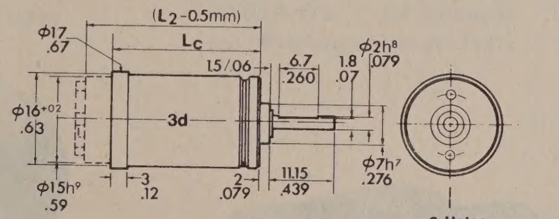

6.0/.236
M5.5 x 0.5
2.0/.0788
0.7/.028
1
1.9
.075
2.0
.079
8.0
.315
L


For 050 Motor
3.1
.122
16.0
.629
7.0
.276
2.0
.079
0.7
.028
3b
2.0
.079
1.6
.058
5.0/.197
5.7/.224
L2

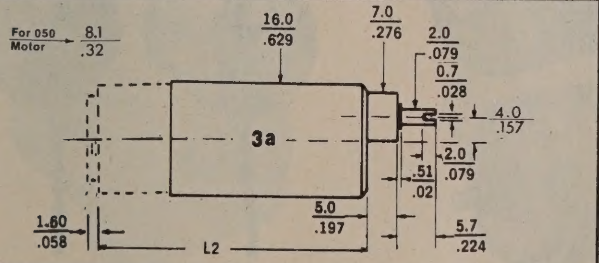

For 050 Motor
9.0
0.35
1.6 x 45°
.063 x 45°
4.0
.157
2.0
.0788
0.69
.0275
2.0
.079
17.0
.669
4.0
.157
2a
2.5
0.1 x 45°
L2
4.0
.157
5.7
.224
1.6
.058
L1

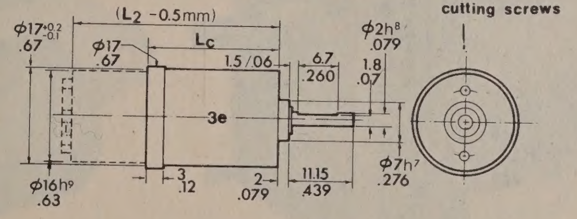

For 050 Motor
6.6
.26
16.0
.629
1.45
.570
7.0
.276
2.0
.0787
.430
3c
2 Holes
#2/56
@ 180°
.175 Deep
M2X @ 180°
.175 Deep
1.5/.060
.630 DIA.
3.5/.137
5.0/.197
3.3/.118
6.7/.264
12.7/500
1.6
.058
L2

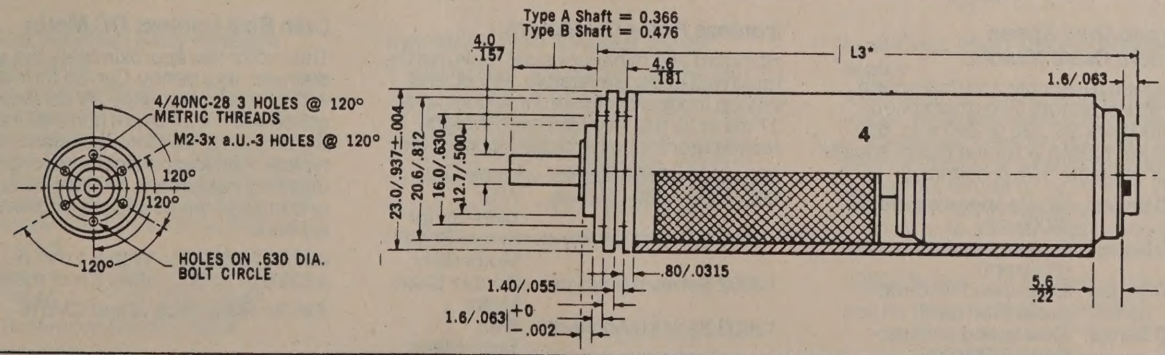

For 050 Motor
9.0
0.35
1.6 x 45°
.063 x 45°
4.0
.157
2.0
.0788
0.69
.0275
2.0
.079
17.0
.669
2b
2.5
.01 x 45°
.01
.067/1.7
.181/4.6
5.5
.217
1.6
.058
L2


(L2-0.5mm)
ϕ17
.67
Lc
1.5/06
6.7
.260
1.8
.07
ϕ2h8
.079
3d
ϕ16+02
.63
ϕ15h9
.59
3
.12
2
.079
11.15
.439
ϕ7h7
.276

2 Holes on .430 BCD use thread cutting screws


For 050 Motor
8.1
.32
16.0
.629
7.0
.276
2.0
.079
0.7
.028
4.0
.157
3a
2.0
.079
.51
.02
5.0
.197
5.7
.224
1.60
.058
L2

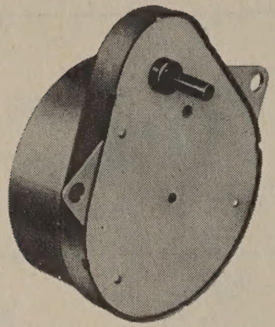

(L2 -0.5mm)
ϕ17+0.2-0.1
.67
ϕ17
.67
Lc
1.5/06
6.7
.260
1.8
.07
ϕ2h8
.079
3e
ϕ16h9
.63
3
.12
2
.079
11.15
.439
ϕ7h7
.276


Type A Shaft = 0.366
Type B Shaft = 0.476
4.0
.157
L3*
4.6
.181
1.6/.063
4/40NC-28 3 HOLES @ 120°
METRIC THREADS
M2-3x a.U.-3 HOLES @ 120°
120°
120°
120°
HOLES ON .630 DIA. BOLT CIRCLE
23.0/.937±.004
20.6/.812
16.0/.630
12.7/.500
4
.80/.0315
1.40/.055
1.6/.063 +0 −.002
5.6
.22

Micro Mo Electronics' broad experience and technical expertise in development and design of high performance precision motors, tachometers, motor tachometers and gearheads has been utilized to develop the products shown. Our appreciation of the customer's system performance requirements, servo stability problems, thermal constraints, mechanical interfaces, and cost factors allows Micro Mo Electronics to offer unique solutions to your problems.

Try Us!

AC & DC MOTORS

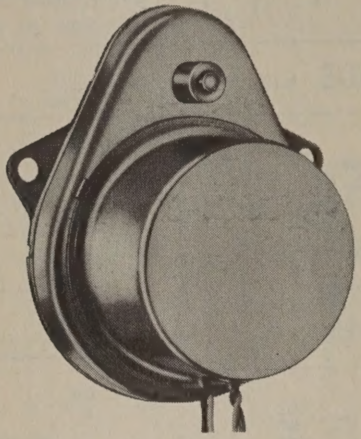


Shaded Pole Synchronous Motors

Military or industrial. Available for 50 or 60 Hz operation. Five standard voltage ratings; 150 output speeds, clockwise or counterclockwise. Rotor speed 300 rpm at 60 Hz. Running torque 30 oz-in at 1 rpm.

22100 Series	Military Motor Unidirectional
42100 Series	Industrial Motor Unidirectional U/L recognized

Ask for Reference Sheet CM801

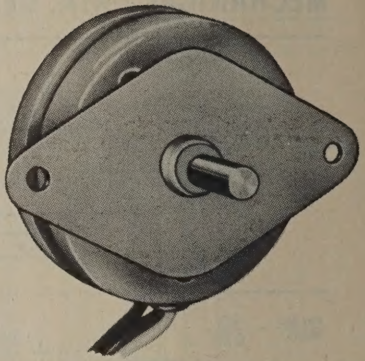


Reversible Synchronous Motors

For commercial/industrial use. 50 or 60 Hz operation; voltages from 12 to 230. PM rotor, 2-coil windings. Electrically reversible. Rotor speeds 300 rpm at 60 Hz or 720 rpm at 60 Hz. Torque 0.75 oz-in and 1.1 oz-in respectively. Output speeds from 300 rpm to 1/1000 rpm.

81300 Series	300 rpm rotor
S7100 Series	720 rpm rotor

Ask for Reference Sheets CM803 and S7100

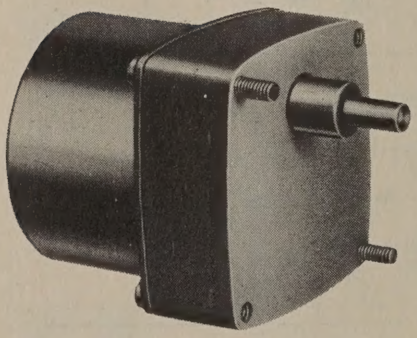


Lightweight Reversible Synchronous Motors

High torque-to-frame size ratio. Produces 6.0 oz-in torque at 300 rpm or 4.0 oz-in at 600 rpm rotor speed. Electrically reversible. Fast start/stop characteristics. Low cost. Permanently lubricated bearing prolongs life, minimizes maintenance.

81700 Series	300 rpm U/L recognized
81800 Series	600 rpm

Ask for Reference Sheet CM821

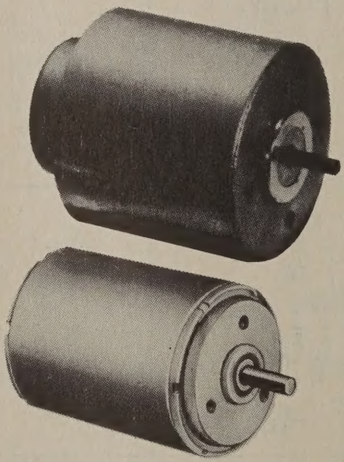


Single and Dual Speed Instrument Drive Motors

Single speed reversible and dual speed unidirectional motors. Two rotor speeds 300 or 600 rpm. 24, 120 or 240 V ac, 60 Hz or 50 Hz. NEMA 2-11 gear box or square gear box available. U/L recognized.

86100 Series	Single speed reversible (300 rpm)
86600 Series	Single speed reversible (600 rpm)
86500 Series	Dual speed unidirectional (300 rpm)
86700 Series	Dual speed unidirectional (600 rpm)
A86100 Series	Dual speed unidirectional (300 rpm)
86800 Series	Dual speed unidirectional (600 rpm)

Ask for Reference Sheet CM860

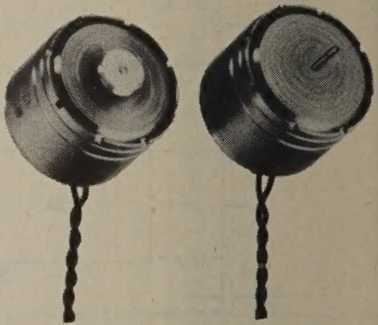


Ironless Rotor DC Motors

Standard and miniature sizes. Low inertia, rapid response. Reversible. 12V dc and 24V dc models available. Time constants 17 ms or 23 ms. Available with integral tachometer for use in closed loop system.

9904-120-10803 Series	Motor Only
9904-120-10804 Series	With Tachometer
12601 Series (Miniature)	Single Shaft Motor Only
12602 Series (Miniature)	Double Shaft Motor
12603 Series (Miniature)	With Tachometer

Ask for Reference Sheet CM815 & CM817



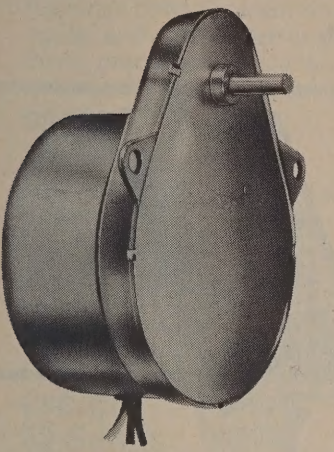
Coin Size Ironless DC Moto

This motor has approximately the same diameter as a penny. Can be furnished with or without a pulley. 9V dc. Rotor speed 5320 ± 950 rpm nominal. Torque 3 gcm (.04 oz-in) Motor constant 50 mA-typical. Applications include portable dictating equipment, mini digital cassette or cartridge drives and paper drives for printers.

4322 010 59200	With 8.1 mm dia. pulley
4322 010 77000	With 6 mm shaft

Ask for Reference Sheet CM816

STEPPER MOTORS

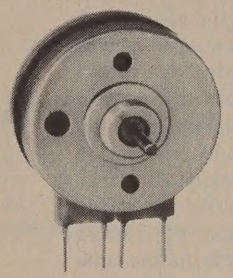


Pulse Stepper Motors

Industrial, unidirectional or bidirectional. Step rate 0-80 steps/sec. Rotor torque 0.2 oz-in. Double-torque-version also available in unidirectional model. SPDT switching of input provides stepping pulses (no logic required). Rotor steps 15° with each pulse applied; can be supplied with gearing to increase torque or reduce step angle. Standard voltages are 6, 12 or 27V dc; other windings are available.

45100 Series	Industrial, Unidirectional
44100 Series	Industrial, Bidirectional
44600 Series	Industrial, Unidirectional, Double Torque

Ask for Reference Sheets CM802, PI-107, PI-122

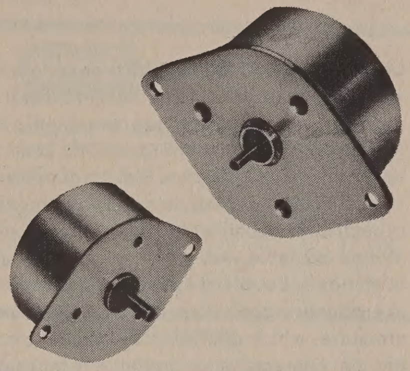


Micro Miniature Logic Stepper Motor

Extremely small—1" diameter (approximately the same diameter as a 25¢ piece). Operating voltage 12V dc-15° step angle. Can be driven up to 500 PPS with torque up to 0.2 oz-in. Ideal for battery driven applications—automotive digital clocks, portable digital cassettes or cartridge drives and similar instruments where space and weight are at a premium.

82100 Series Logic Stepper Motor

Ask for Reference Sheet CM818

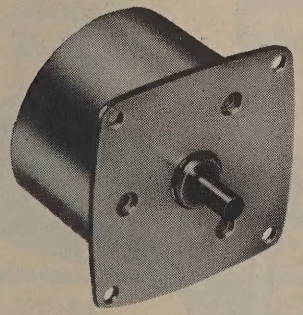


Low-Cost Light Duty 4-phase Stepper Motors

7° 30′ step angle. Bidirectional. 5 or 12V dc models available. Excellent pull-in rates and good stepping accuracy. 82200 Series furnishes .750 oz-in pull-in/out torque and a pull-in rate to 440 steps/sec. 82400 Series furnishes 2.4 oz-in pull-in/out torque and a pull-in rate to 350 steps/sec. Gear box can be furnished to reduce step angle and increase torque on either series.

82200 Series	7° 30′ Step angle
82400 Series	7° 30′ Step angle

Ask for Reference Sheet CM814

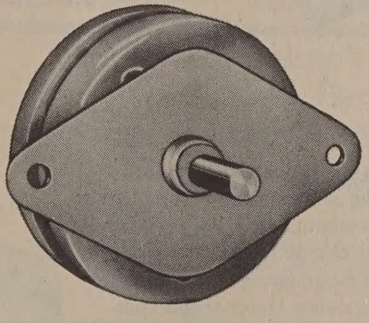


Low-Cost Medium Duty 4-phase Stepper Motor

Available in either 5V dc or 12V dc models. 82600 Series offers 6.50 oz-in max. pull-in/out torque and 210 steps/sec. max. pull-in rate with 15° step angle .82800 Series offers 7.50 oz-in max. pull-in/out torque and 235 steps/sec. max. pull-in rate with 7° 30′ step angle. Can be fitted with gear box if desired.

82600 Series	15° Step Angle
82800 Series	7° 30′ Step Angle

Ask for Reference Sheet CM814

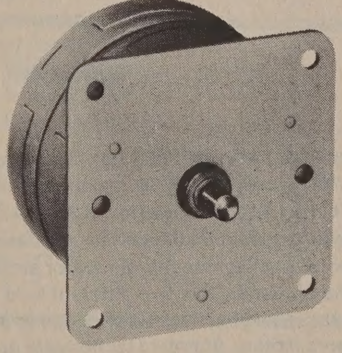


Industrial-Type Stepper Motor

4-phase stator and permanent magnet rotor. Pull-in/out torque 7.5 oz-in—holding torque 13 oz-in. Pull-in/out rates to 120 steps/sec. Bidirectional. 5V or 12V dc. 7° 30′ step angle. Suitable for use in instrumentation and computer peripherals.

82700 Series 7° 30′ Step Angle

Ask for Reference Sheet CM819



Low-Cost, High Torque Stepper Motor

A bidirectional permanent magnet stepper motor. Standard construction provides 2 or 4 phase operation, a 7° 30′ or 15° step angle and roller or sleeve bearings. Max. pull-in/out torque 23 oz-in. Max. pull-in rate 500 steps/sec. Operating voltages from 5V dc to 33V dc. Highly effective with long life and efficient utilization of power.

82900 Series 7° 30′ Step Angle

Ask for Reference Sheet CM820

NORTH AMERICAN PHILIPS CONTROLS CORP.

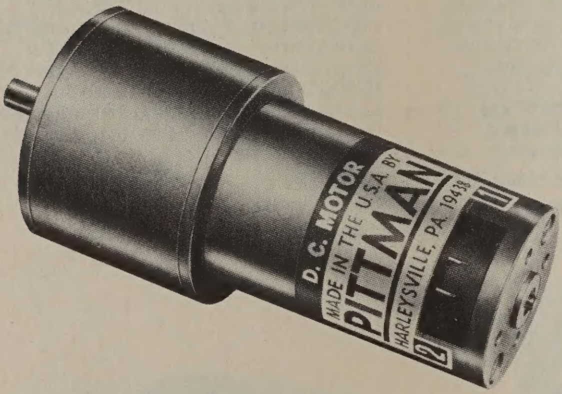
Cheshire, Conn. 06410 • (203) 272-0301

For cost effective solutions to your miniature D-C motor application problems...

Put over forty years of Pittman experience to work for you.

LO-COG® SERVO MOTORS: Three series of d-c motors having diameters of 1.8″, 1.58″ and 2.05″. Each is built in several lengths ranging upward from 2″ exclusive of bearing bosses and shaft extensions. Most models can be supplied for inputs from 6 to 48 VDC. Load speeds from under 1,000 rpm to approximately 10,000 rpm. Stall torques from under one oz.-in. to more than 100 oz.-in. Quality materials and construction, as well as automated testing of each motor, ensure high performance and durability at moderate cost. All motors available with your choice of self-aligning oil-impregnated bronze bushings or double-shielded ball bearings. Custom modifications possible in production quantities. These LO-COG motors are equipped with skewed armatures which offer very low magnetic cogging yet provide the desirable thermal characteristics and high torques of iron armature designs.

D. C. MOTOR
MADE IN THE U.S.A. BY
PITTMAN
HARLEYSVILLE, PA. 19438
2
1



GEARMOTORS: PITMO® gearmotors are built in two series having gearbox diameters of 1.375″ and 2.00″ with overall lengths from 2.93″ to 3.69″, depending on choice of motor section, exclusive of bearing bosses and shaft extensions. Gears are sintered iron to precision tolerances. Selected armature windings and gear ratios provide output shaft speeds under load from approximately 2 rpm to 650 rpm, depending on application. Gear design strength limits are 160 oz.-in. and 300 oz.-in. respectively for the two series. Motor sections feature LO-COG construction as described above. Any of these gearmotors may be ordered with integral tachometer described below.

MOTOR-TACHOMETERS: PITMO® motor-tachs are offered in two series — 1.18″ diameter and 1.58″ diameter, both exclusive of terminals and terminal blocks. Lengths range from 3.31″ to 4.09″, not including bearing bosses and shaft extensions, depending on desired motor characteristics. Separate motor and tachometer-generator armatures are mounted on a single shaft and operate within two different field magnet systems. Motor section performances generally follow those of the PITTMAN 8310 and 9410 series of servo motors. Standard tachometer gradient is two volts per 1,000 rpm with typical ripple of 6% peak-to-peak with no filtering. A wide range of windings is available for both motors and tachs.

Typical applications include digital tape cassette and cartridge drives, chart and pen drives, and other velocity or position servo systems where accuracy of speed control or high damping is a requirement.

D. C. MOTOR
MADE IN THE U.S.A. BY
PITTMAN
HARLEYSVILLE, PA. 19438
2
1

For specifications, performance curves and prices for models of PITMO miniature d-c motors to meet your needs, call or write us today.

112R-4

THE PITTMAN CORPORATION

A Subsidiary of Penn Engineering & Manufacturing Corp.

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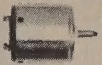
HARLEYSVILLE, PA. 19438
PHONE: 215-256-6601 • TWX: 510-661-8696

escap® DC MICROMOTORS

The Unique design and construction of escap® skew-wound ironless rotors provide low rotor inertia, rapid response (time constant down to less than 9 ms.), low starting voltage, high power to volume ratio, low torque ripple, and efficiencies of 80% and better. The escap® line reflects the highest level of engineering skills, Swiss precision manufacturing and the best performance-to-cost ratio available.

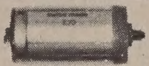
escap® 15 Series



High efficiency — long life — low inertia — in a case size of 15 mm.

Output power (watts)	—	0.24	to	0.4
Operating voltage	—	1.5	to	12
Stall torques (oz-in)	—	0.07	to	0.13
No-load speed (rpm)	—	15,000	to	20,600
Moment of rotor inertia (gcm²)	—	0.2	to	0.32
Torque constants (oz-in/A)	—	0.12	to	0.9

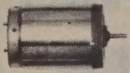
escap® 16 Series



High efficiency — long life — torque practically pulse-free — in a case size of 16 mm. (Available as a tachometer).

Output power (watts)	—	0.3	to	0.7
Operating voltage	—	4	to	12
Stall torques (oz-in)	—	0.14	to	0.41
No-load speed (rpm)	—	9,000	to	17,000
Moment of rotor inertia (gcm²)	—	0.32	to	0.7
Torque constants (oz-in/A)	—	0.31	to	1.3

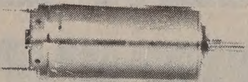
escap® 22 Series



High starting torque — fast acceleration — in a case size of 22 mm.

Output power (watts)	—	1.4	to	2.4
Operating voltage	—	3.5	to	36
Stall torques (oz-in)	—	1.0	to	1.7
No-load speed (rpm)	—	7,300	to	8,500
Moment of rotor inertia (gcm²)	—	1.5	to	3.5
Torque constants (oz-in/A)	—	0.6	to	6.0

escap® 23 D Series



Low inertia — mechanical time constant only 10 ms — in a case size of 23 mm.

Output power (watts)	—	3.4	to	3.8
Operating voltage	—	6	to	15
Stall torques (oz-in)	—	3.5	to	4.2
No-load speed (rpm)	—	4,900	to	5,250
Moment of rotor inertia (gcm²)	—	4.7	to	5.9
Torque constants (oz-in/A)	—	1.6	to	3.8

escap® 26 P Series

High efficiency — long life — low inertia — in a case size of 26 mm. (Available as a tachometer).

Output power (watts)	—	1.0	to	3.9
Operating voltage	—	3	to	24
Stall torques (oz-in)	—	0.72	to	4.0
No-load speed (rpm)	—	5,200	to	8,300
Moment of rotor inertia (gcm²)	—	3.8	to	8.5
Torque constants (oz-in/A)	—	0.5	to	4.6

escap® 28 D Series

Fastest response — mechanical time constant of only 9 ms — high efficiency.

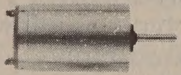
Output power (watts)	—	6.1	to	15
Operating voltage	—	6	to	24
Stall torques (oz-in)	—	10.4	to	15.6
No-load speed (rpm)	—	3,200	to	5,400
Moment of rotor inertia (gcm²)	—	16.9	to	19.2
Torque constants (oz-in/A)	—	2.5	to	6

escap® 28 PL Series

Good regulation — low inertia — high temperature rotor — in a case size of 28mm. (Available as motor-generator sets).

Output power (watts)	—	4.5	to	7.6
Operating voltage	—	9	to	36
Stall torques (oz-in)	—	5.0	to	7.9
No-load speed (rpm)	—	4,700	to	5.250
Moment of rotor inertia (gcm²)	—	10.0	to	17.5
Torque constants (oz-in/A)	—	2.6	to	9.9

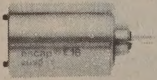
escap® 34 L Series



High efficiency — large power output — in a case size of 34 mm.

Output power (watts)	—	4.5	to	14.8
Operating voltage	—	4.5	to	36
Stall torques (oz-in)	—	4.6	to	16.0
No-load speed (rpm)	—	2,500	to	5,900
Moment of rotor inertia (gcm²)	—	16	to	32.2
Torque constants (oz-in/A)	—	2.4	to	8.1

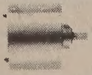
escap® Reduction Gearboxes



Interface with 15 & 16 Series.

Model	Running Torque	Ratios to:
E16	2.8 oz-in	2090
E26	8.0 oz-in	560

escap® Reduction Gearboxes



Interface with 22, 23, 26, 28 & 34 Series Motors.

Model	Running Torque	Ratios to:
B26/K26	13 oz-in/21 oz-in	2050
A42/P42	70 oz-in/70 lb-in	3840/2178

Note: All values nominal for operational at 25°C ambient temperature. Specifications subject to change without notice.

PRECISION MADE IN SWITZERLAND

Portescap U.S.
Member of the Portescap Group
730 Fifth Avenue
New York, N.Y. 10019

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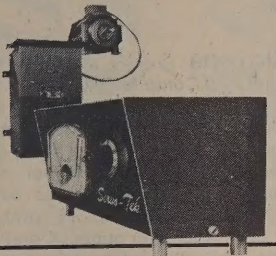
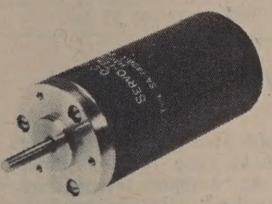


Solid-State "500" Series Precision Adjustable-Speed Drives*

All Motors Totally Enclosed, Fan-Cooled

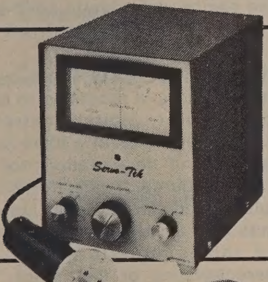
MAINTENANCE — Design eliminates vacuum tubes, selenium rectifiers and time delays. Utilizes silicon diodes, transistors and a magnetic amplifier for exceptionally long service life. Modular plug-in construction requires only a screwdriver for servicing.
REMOTE CONTROL — A 10-turn potentiometer provides precise adjustment and can be placed in any convenient location. Meter monitors operation and continuously indicates speed.
GEARED MOTORS — Motors are available with integral gear reducers.
BRAKE-REVERSING — Relay-controlled braking and reversing models available.
SPEED RANGE — Infinitely adjustable from less than 24 rpm to 3600 rpm (150:1) while delivering full-rated torque. Continuous duty rating at all speeds.
REGULATION — Temperature-compensated tachometer feed-back provides both line and load regulation of better than ⅓ of 1% of rated speed.

Models available from ⅛ to 1½ hp



D-C Permanent-Magnet Tachometer Generators *Temperature-Compensated*

Applications
SERVOS — The highly linear output and wide speed range are ideal for velocity or integrating servos. Low-driving torque permits its use as a damping or rate signal in all types of servos.
TEMPERATURE-COMPENSATED — The voltage output @ +25°C will not deviate from this amount by more than 1/100 of 1% per degree of change when operated at any temperature within the temperature range of −20°C to +75°C.
SIZE — Miniature. Approx. Dia. 1⅛".
OUTPUT — Various models with outputs as high as 45v/1000 rpm.
LINEARITY — On most models from 0 to 12,000 rpm is better than 1/10 of 1% of voltage output at 3600 rpm.
BRUSH LIFE — Better than 100,000 hours (10 years) of continuous operation at 3600 rpm.
BIDIRECTIONAL OPERATION — Output in either direction is held to ¼ of 1% tolerance.
RIPPLE — The rms value will not exceed 3% of the d-c value at any speed in excess of 40 rpm.
CONSTRUCTION — Aluminum housings with protective treatment; stainless steel shafts; fully shielded stainless steel ball bearings; Mylar insulation.
Consult our Engineering Department for information on our low ripple generators.

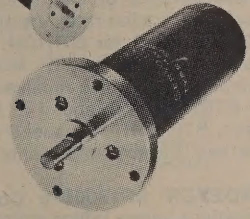


DC Servo Control

A device which is so versatile it can be programmed to operate as either a bi-directional speed regulator or positioning servo. A d-c permanent magnet servo motor and temperature compensated d-c generator (torque unit) designed for maximum reliability provide control to the driven load. An integrated operational amplifier with external gain adjustment coupled with a high efficiency booster provide high follow-up accuracy and excellent dynamic response under various load conditions. A highly regulated temperature compensated reference supply insures stable operation with variations in ambient temperature, line voltage and time.

Features

Adjustable, stepless bi-directional speed control — Dynamic speed range in excess of 2000:1 — High accuracy maintained with load, line voltage and temperature variation — Adjustable output torque control — Controlled deceleration capability — Remote programming capability — Easy conversion from one mode to the other.



D-C Permanent-Magnet Servo Motors

Model SU-680D-29 Delivers 13.3 Watts of Continuous Power Output at 9000 rpm

Applications
Chart Recorder Pen Drives, Null-seeking Devices, Capstan Drives for Tape Transports, Proportioning Applications; Prime Mover in Servo-Mechanisms.

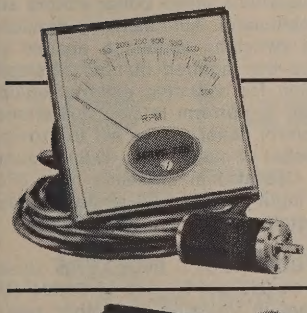
Specifications

DYNAMIC: Maximum No-Load Speed @ 23v D-C — 10,000 rpm; ±500 rpm; Full Load Torque @ 9,000 rpm — 2.0 oz-in (max.); Stall Torque @ 23v D-C (Theo.) — 20.0 oz-in (min.); Frictional Torque — 0.25 oz-in (max.); Acceleration at Stall (Torque/Inertia) — 46,800 RAD/SEC^2 (min.); Case Temperature Rise @ Full Load (Free Air Dissipation) −55°C (max.); Case Temperature Rise Per Watt of I^2R loss (Free Air Dissipation) −6°C.

STATIC: D-C Resistance — 3.24 Ohms (typ.); Inductance — 2.5 Millihenry (typ.); Rotor Inertia — 30.0 GM-CM^2 (typ.); Total Weight — 8.25 oz. (max.); Length — 3.25 in., excluding shaft; Maximum Ambient Temp. −40°C.

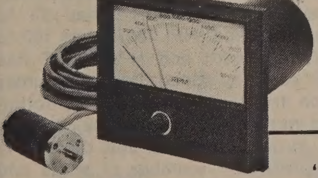
FUNCTIONAL CONSTANTS: Inertial Time Constant — 25.0 Milliseconds (max.); Electrical Time Constant — 0.77 Milliseconds (typ.); Torque Constant — 2.8 oz-in/Amp. (min.); Voltage Constant (back emf) — 2.07 x 10^{-3} volts/rpm (min.); Viscous Damping Factor — 1.79 x 10^{-3} oz-in/rpm (min.).

Other Models Available



Accurate Speed Indicating Systems

A truly versatile "package" provides accurate speed indication for almost anything that moves. Nearly every industrial process or machine can benefit by the economy and safety of continuous speed indication.
SELF POWERED — No batteries or external power required.
LOW VOLTAGE — Connecting cable can be as long as 500 ft.
PERMANENTLY LUBRICATED BALL BEARINGS.
EASILY READ 4½" INDICATOR.
TAUT BAND MOVEMENT — Withstands vibration and shock.
STANDARD RANGES — 0 to 100, 250, 500, 1000, 2000, 3000, 4000, 6000, 8000, 10,000 and 12,000 rpm. These speeds can also be provided to read "Percent of Full Speed" or "Percent of Capacity."
0 to 10 rpm available at small additional cost.
Complete System includes Generator, Indicator (specify range), Mounting Base, Coupling and 15 ft. of Connecting Cable.



Control Meter Relay Systems

A speed monitoring system using an optically controlled meter relay and a d-c tachometer generator. Ideal for use in process and control applications requiring under and over speed limit control while continuously monitoring speed settings and changes. Also can be used to directly control power to motors, alarms, solenoids, etc. without the use of power controls. Both single and double set-point systems are available from 10 to 12,000 rpm full scale. System accuracy is 2% of full scale including indication and set-point accuracy. The set-point repeatability is 0.5% Input power requirement is 3 watts at 105 to 130 volts AC 60 Hz.

CALL OR WRITE FOR INFORMATION ON OUR NEW
"SCR Series Adjustable Speed Drives," "Control Meter Relay System," "Digital Speed Indicating System" and "DC Motor Tachometer" or Our Full Line Catalog and Tachometer Test Report.

***An additional discount is available to resale organizations and original equipment manufacturers using these drives as an integral part of their product.**
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SLO-SYN® Synchronous/Stepping

M SERIES STEPPING MOTORS Shown in chart with M prefix. Represent the most advanced permanent magnet stepping motor design available and the most complete range in both torque ratings and size. Provide the highest torque per pound and torque to inertia ratios. Can be driven at rates above 20,000 steps per second with minimum of power input. Have Class B insulation and may be operated at ambients from −40°C to +65°C. Stepping increment is 1.8° using a 4-step input sequence; 8-step input sequence gives an 0.9° stepping increment. Step accuracy choice of either ±3% or ±5%. Chart shown gives off-the-shelf SLO-SYN drives for motors listed but custom drives can be designed by Superior Electric or built by the user if desired. For torque vs speed characteristics and complete ratings and specifications, request Superior Electric Catalog MSM1171.

PRECISION STEPPING MOTORS Shown in chart with HS prefix. Designed for phase-switched d-c stepping. Make 200 steps of 1.8° per shaft revolution. Each step is accurate within ±3% nonaccumulative. Can be used with SLO-SYN controls and drives or with user-designed and built drives. With proper circuitry, may be operated at speeds greater than 1000 steps per second without missing steps.

BIFILAR MOTORS Shown in chart with 4-number suffixes. Contain twice the windings of a 3-lead motor for better L/R time constant, better performance. Use simple drive circuitry or recommended SLO-SYN drives. Make 200 steps of 1.8° per shaft revolution except LS prefixed types which have a 0.72° step angle and TS prefixed types which have a 5° step angle. X prefixed are explosion proof. Step accuracy is ±5% nonaccumulative.

AC SYNCHRONOUS MOTORS

PERMANENT MAGNET A-C CONTROL MOTORS have no brushes, ratchets or detents feature extremely rapid starting, stopping and reversing characteristics. Need only a single-pole, 3-position switch for complete forward, reverse and "off" control. No excessive inrush current when energized because starting and operating currents are nearly identical. Can be completely stalled or overdriven without overheating and without harmful effects on components. Start or stop in less than 5° of shaft rotation; no need for electrical or mechanical braking. Phase-shifting resistor and capacitor must be used when operating from a single-phase source. Speeds available are 28.8, 72 or 200 rpm at 60 hertz.

TYPE	MAXIMUM AMPERES	TORQUE (Oz-In)	MAXIMUM MOMENT OF INERTIA OF A RIGIDLY ATTACHED LOAD (Lb-In²)
120 Volts, 50/60 hertz, 1 Phase, 28.8 RPM at 60 hertz			
LS50	0.2	40	0.5
120 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz			
• TS25	0.2	25	0.12
• TS50	0.3	50	0.25
120 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz			
• SS25	0.1	25	0.15
• SS50	0.3	50	0.5
• SS150	0.4	150	1.5
SS150M†	0.4	150	1.5
• SS250	0.6	250	3
• X250‡	0.6	250	3
• SS400	0.6	400	4.5
• X1000‡	3.0	1000	9
• X1500	3.0	1500	12
240 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz			
TS52	0.2	50	0.25
240 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz			
SS52	0.2	50	0.5
• SS152	0.2	150	1.5
• SS252	0.4	250	3
• X252‡	0.4	250	3
• SS402	0.4	400	4.5
• X1002‡	1.5	1000	9

† Militarized.

‡ Explosion-proof.

• Available off-the-shelf from distributor stock

CONTROLS AND DRIVES

TRANSLATOR ST1800B For pulse-to-step conversion of data to bifilar motors. Converts low-level signal pulses or square waves into the correct switching sequence needed to drive a SLO-SYN motor at the desired stepping rate. Input is 105-125 volts a-c, 1.5 amps. Signal input impedance is 500 ohms. Input may be triggered by pulse or square wave or by an external switch. Operates in ambients from 0°C to +40°C. Ideal for a wide range of programmed positioning and indexing functions. Approx. shipping weight 12 lbs.

ADJUSTABLE SPEED DRIVE ST1800BV Essentially a translator with a built-in oscillator to supply triggering signals. The oscillator frequency can be adjusted to vary the speed from 4 steps per second up to the maximum permissible with the motor used. Have same other characteristics as SLO-SYN Translator ST1800B.

TRANSLATOR MODULES Plug-in printed circuit boards with logic capabilities for stepping SLO-SYN motors. STM1800 and STM1800C are basic translators capable of bidirectional operation of motors. Those suffixed V, i.e. STM1800V and STM1800CV, are similar but have built-in oscillators to provide triggering signals. Potentiometers are supplied with V-suffixed models for adjusting the oscillator speed. STM1800 and STM1800V have speeds to 500 steps/sec and are used with HS and bifilar motors. STM1800C and STM1800CV have speeds to 2000 steps/sec and are used with M Series motors. Types STM1800 and STM1800V require 8 amps power supply transformer T5934-G2. Types STM1800C and STM1800CV require 10 amp power supply transformer T6382.

HIGH SPEED TRANSLATORS Used with precision (HS prefix) and M series (M prefix) motors to provide high stepping speeds. High speed translator HTR400 has 50 to 2000 step/sec speed; HTR103RT has 100 to 3000 step/sec speed; and HTR105RT has 100 to 5000 step/sec speed. Acceleration and deceleration is adjustable. Each pulse received from a built-in oscillator or from an external source will cause the translator to advance the motor one step. Triggering pulses can be supplied by tape readers, computers, oscillators, etc. Ambient temperature: 0°C to 40°C operating; −55°C to 85°C storage. Rack mounted design with plug-in solid-state circuitry.

BUFFERED TRANSLATOR Drives M Series (M prefix) motors in response to commands from computer, digital control or other device which operates at a fixed pulse rate. Acceleration and deceleration not required from pulse source. Translator stores incoming pulses and feeds them to the motor, automatically accelerating and decelerating at a rate compatible with the response characteristics of the motor. Acceleration and deceleration rates are approximately 6000 steps/sec² for BTR103RT and 15,000 steps/sec² for BTR105RT. Motor is driven one step for each pulse received from control unit. BTR103RT has speed of 100 to 3000 steps/sec, BTR105RT has speed of 100 to 5000 steps/sec. Rack mounted only.

PRESET INDEXER SP1800B-5 Controls indexing operations where bifilar motors are used for positioning. Automatically provides the correct switching sequence needed to drive motors the required number of steps. Has provision for actuating external equipment needed to perform related operations. Dials on control panel can be set to provide desired number of steps up to 99,999 counting range. Operates in ambients from 0°C to +40°C. Input current 1.25 amps. Approx. shipping weight 19 lbs.

HIGH SPEED PRESET INDEXERS Used with precision (HS prefix) and M Series (M prefix) motors in indexing and other positioning operations. HPR400R-5 has 50 to 2000 steps/sec speed; HPI 153RT has 100 to 3000 step/sec speed; and HPI 155RT has 100 to 5000 step/sec speed. Decade counter controls on front panel permit selecting positioning increments up to 99,999 counting range. On index command, unit drives the motor the prescribed number of steps and then actuates a relay which controls external equipment. Count can also be set by computer or external decade switches. Ambients: 0°C to 40°C operating; −55°C to 85°C storage. Rack mounted only.

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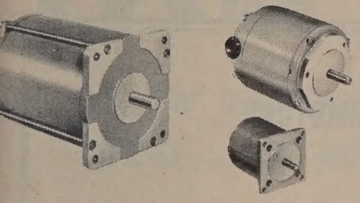
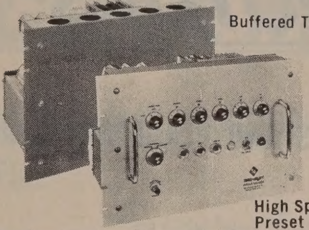
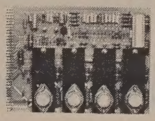
Motors, Controls and Drives



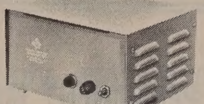


Buffered Translator

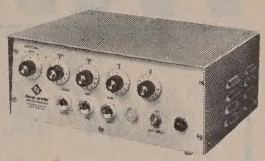
High Speed Preset Indexer



Translator Module



Translator



Preset Indexer

DRIVE TYPE		MOTOR TYPE	MOTOR RATINGS AND SPECIFICATIONS							
			STEP ACCURACY	DC VOLTS	AMPS PER WINDING	HOLDING TORQUE OZ-IN	MOTOR DIA. INCHES	MOTOR LENGTH INCHES	SHAFT DIA. INCHES	NET WT. LBS
UP TO 500 STEPS/SEC										
● ST1800B‡ Translator ST1800BV Adj. Speed Drive ● STM1800§‡ Translator Module ● STM1800V§‡ Translator Module	● SP1800B-5‡ Preset Indexer	● HS25	±3%	5.4	1.5	70	2.22	3.25	.250	2
		● HS50	±3%	3.0	4.0	175	3.38	3.69	.375	4¾
		● HS50L	±3%	4.5	3.5	320	3.38	5.31	.375	7½
		● LS50-1005*	±5%	3.0	4.0	75	3.38	3.69	.375	4¾
		● LS50-1006*	±5%	12.0	1.0	75	3.38	3.69	.375	4¾
		● SS25-1001	±5%	11.8	0.44	28	2.72	2.25	.250	1¼
		● SS50-1008	±5%	8.0	0.85	70	3.25	2.44	.375	3
		● SS150-1010	±5%	10.0	1.25	250	4.19	4.44	.375	6½
		● SS250-1027	±5%	4.6	3.1	300	4.19	4.72	.375	6½
		● SS400-1021	±5%	5.3	3.4	500	4.19	6.59	.500	12¼
		● SS1800-1007	±5%	11.5	3.9	3000	6.5	8.63	.625	45
		TS25-1008**	±5%	5.4	1.5	40	2.22	3.25	.250	2
		TS50-1001**	±5%	3.0	4.0	65	3.25	3.69	.375	4¾
		X250-1003	±5%	4.6	3.1	300	4.19	4.88	.375	6½
		X1500-1001	±5%	12.0	3.8	2500	6.5	7.63	.625	38
UP TO 2000 STEPS/SEC										
● STM1800C††‡ Translator Module ● STM1800CV††‡ Translator Module		● M061-FC08	±3%	1.3	3.9	53	2.22	2	.250	1¼
		● M061-FD08	±5%							
		● M062-FC09	±3%	1.7	4.7	100	2.22	3	.250	2
		● M062-FD09	±5%							
		● M063-FC09	±3%	2.2	4.6	150	2.22	4	.250	2¾
		● M063-FD09	±5%							
		● M091-FC09	±3%	1.8	4.7	150	3.25	2.45	.375	3¼
		● M091-FD09	±5%							
		● M092-FC09	±3%	2.5	4.6	300	3.25	3.70	.375	5½
		● M092-FD09	±5%							
		● M093-FC11	±3%	2.8	5.5	450	3.25	5.07	.375	7¾
		● M093-FD11	±5%							
		● M111-FD12	±5%	2.3	6.1	625	4.19	4.72	.375	8
		● M112-FJ12	±5%	3.6	6.1	1125	4.19	7.16	.625	14½
● HTR400 Translator	● HPR400R-5† Preset Indexer	● HS25	±3%	5.4	1.5	70	2.22	3.25	.250	2
		● HS50	±3%	3.0	4.0	175	3.38	3.69	.375	4¾
		● HS50L	±3%	4.5	3.5	320	3.38	5.31	.375	7¾
		HS400B-1003	±3%	4.2	4.3	850	4.19	6.97	.500	13¾
UP TO 3000 STEPS/SEC										
● BTR103RT Buffered Translator ● HTR103RT Translator	● HPI 153RT† Preset Indexer	● M112-FJ25	±5%	1.8	12.7	1125	4.19	7.16	.625	14½
UP TO 5000 STEPS/SEC										
● BTR105RT Buffered Translator ● HTR105RT Translator	● HPI 155RT† Preset Indexer	● M061-FC02§§	±3%	5.1	1.0	53	2.22	2	.250	1¼
		● M061-FD02§§	±5%							
		● M062-FC04	±3%	4.3	1.8	100	2.22	3	.250	2
		● M062-FD04	±5%							
		● M063-FC06	±3%	3.4	2.9	150	2.22	4	.250	2¾
		● M063-FD06	±5%							
		● M091-FC06§§	±3%	2.9	3.05	150	3.25	2.45	.375	3¼
		● M091-FD06§§	±5%							
		● M092-FC09	±3%	2.5	4.6	300	3.25	3.70	.375	5½
		● M092-FD09	±5%							
		● M093-FC14	±3%	2.2	7.0	450	3.25	5.07	.375	7¾
		● M093-FD14	±5%							
		● M111-FD16	±5%	1.7	8.0	625	4.19	4.72	.375	8

*LS50-1005 and LS50-1006 have 0.72° stepping increment.
**TS25-1008 and TS50-1001 have 5° stepping increment.
†Cabinet available at additional cost.
††Also requires T6382 power supply transformer.

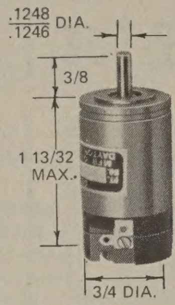
‡Also requires series dropping resistor.
§Also requires T5934-G2 power supply transformer.
§§Require modified drives. Consult factory.

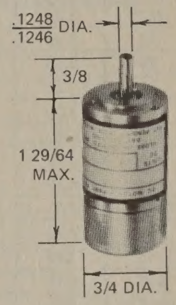
● Available off-the-shelf from distributor stock.

TRW GLOBE MOTORS

D.C. 3/4″ DIA. PERMANENT MAGNET MOTORS AND PLANETARY GEARMOTORS

TYPE SD — BASIC MOTOR



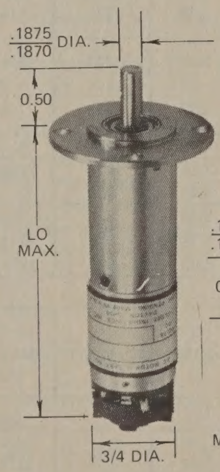


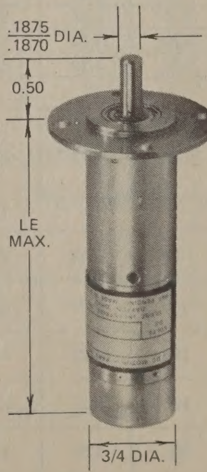
Type SD d.c. motors are designed to meet the requirements of MIL-M-8609; however, designs exceeding this specification to meet customer controlled applications are common. A variety of standard windings are available to provide a wide range of speed and torque characteristics.

STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque max. rated (oz. in.)	Torque nominal stall (oz. in.)	Current max. no load (amps)	Current max. rated load (amps)	Current nominal stall (amps)	Part Number open 136A207 (Armature Dash Number)	Part Number enclosed 136A208 (Armature Dash Number)
6	14,500-17,500	0.20	1.50	.360	0.78	3.6	-17	-17
6	12,000-14,000	0.28	1.20	.290	0.78	2.2	-16	-16
6	9,000-10,500	0.32	0.90	.210	0.60	1.4	-15	-15
12	13,000-15,500	0.22	1.60	.170	.38	1.50	-14	-14
12	9,500-11,000	0.37	0.80	.120	.37	0.93	-13	-13
12	8,500-10,000	0.25	0.60	.105	.26	0.70	-12	-12
27	15,500-18,500	0.17	1.80	.085	.17	1.15	-1	-1
27	13,000-16,000	0.22	1.50	.075	.17	0.85	-2	-2
27	10,000-12,500	0.31	1.20	.060	.17	0.48	-3	-3
27	9,000-10,500	0.31	0.90	.050	.14	0.30	-4	-4
27	7,000- 8,500	0.24	0.80	.045	.08	0.21	-5	-5
50	13,000-15,500	0.26	0.90	.040	.10	0.22	-7	-7
50	11,500-13,500	0.31	1.10	.035	.10	0.26	-6	-6
50	11,000-13,000	0.26	0.75	.032	.08	0.18	-8	-8
50	8,000- 9,500	0.18	0.50	.025	.05	0.08	-9	-9
50	7,000- 8,300	0.15	0.45	.022	.04	0.07	-10	-10
50	5,500- 6,500	0.11	0.35	.018	.03	0.05	-11	-11

TYPE SD PLANETARY GEARMOTORS





This small size, lightweight gearmotor is comprised of a 3/4″ Type SD motor coupled with a precision planetary geartrain. The combination provides smooth, dependable performance and maximum output torque in the smallest possible space. It is designed to provide a military quality gearmotor of exceptionally compact size.

STANDARD PART NUMBERS AND DATA

Speed Reduction Ratio	Maximum Continuous Torque (oz. in.)	Torque Multiplier Ratio	L Max.	LO Max.	LE Max.	Standard Part Numbers Prefix* open type	Standard Part Numbers Prefix* enclosed type
3.82:1	1.0	3.1	2 5/16″	2 3/8″	2 13/32″	168A247	168A249
5.77:1	1.5	4.6				168A248	168A250
14.58:1	3.0	9.3	2 35/64″	2 39/64″	2 41/64″	168A204	168A223
22.03:1	4.5	14				168A205	168A224
33.28:1	7.0	21				168A206	168A225
55.66:1	10	28	2 23/32″	2 25/32″	2 13/16″	168A207	168A226
84.11:1	14	43				168A208	168A227
127.1:1	21	65				168A209	168A228
192:1	30	93				168A210	168A229
321:1	45	130	2 57/64″	2 61/64″	2 63/64″	168A211	168A230
485:1	70	200				168A212	168A231
733:1	100	300				168A213	168A232
1108:1	150	450				168A214	168A233
1853:1	200	600	3 1/16″	3 1/8″	3 5/32″	168A215	168A234
2799:1	300	900				168A216	168A235
4230:1	300	1400				168A217	168A236
6391:1	300	2100				168A218	168A237
10689:1	300	2800	3 7/32″	3 19/64″	3 21/64″	168A219	168A238
16150:1	300	4200				168A220	168A239
24403:1	300	6400				168A221	168A240
36873:1	300	9700				168A222	168A241

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.
Max. Intermittent Torque = 2 x Max. Cont. Torque.
Momentary Stall Torque = 5 x Max. Cont. Torque.
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

***HOW TO ORDER:**

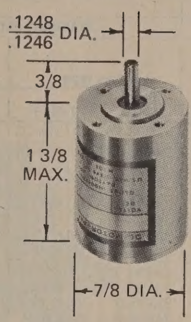
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS, an Electronic Components Division of TRW INC. 2275 STANLEY AVE. DAYTON, OHIO 45404 (513) 228-3171

TRW GLOBE MOTORS

D.C. 7/8″ DIA. PERMANENT MAGNET MOTORS AND PLANETARY GEARMOTORS

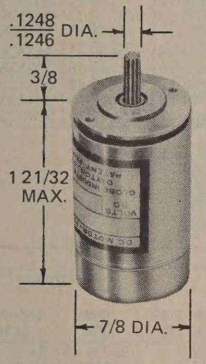
TYPE SS—BASIC MOTOR



The Globe Types SS d.c. motor are specifically designed as a component for precision airborne accessory equipment, but may be applied to a variety of other applications where size and weight are important considerations. Type SS motors can be made with different windings to produce a variety of characteristics. Weight 2 oz.

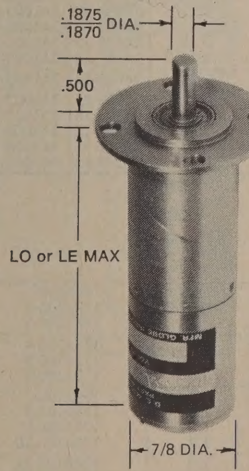
STANDARD PART NUMBERS AND DATA

Open Housing	Part Number Prefix* Tapped Hole Mount	Part Number Prefix* Servo Mount
Plain Shaft	41A100	41A499
Pinion Shaft	41A552	41A677
Enclosed Housing		
Plain Shaft	41A119	41A678
Pinion Shaft	41A676	41A679



		Torque		Current			
Voltage (v.d.c.)	Speed no load (rpm)	max. rated (oz. in.)	nominal stall (oz. in.)	max. no load (amps)	max. rated load (amps)	nominal stall (amps)	Armature Dash No.*
6	11,000-13,500	0.28	1.6	.46	1.00	4.1	-17
6	8,000-11,000	0.38	1.3	.37	1.00	2.7	-16
12	13,500-17,000	0.22	2.0	.27	.54	3.2	-15
12	10,000-13,000	0.33	1.7	.21	.54	1.9	-14
27	17,000-20,000	0.17	2.9	.15	.26	2.4	-13
27	15,000-18,000	0.20	2.5	.14	.25	1.7	-12
27	12,000-15,000	0.25	2.0	.11	.24	1.15	-1
27	10,000-13,000	0.31	1.6	.095	.23	0.76	-2
27	8,000-10,500	0.45	1.3	.08	.23	0.48	-3
27	6,500- 9,000	0.45	1.0	.07	.20	0.32	-4
27	5,500- 7,500	0.36	0.82	.055	.15	0.21	-5
50	10,200-12,500	0.32	0.97	.05	.13	0.23	-7
50	8,600-11,000	0.42	1.20	.055	.13	0.26	-6
50	6,100- 7,500	0.38	0.54	.03	.09	0.12	-9

TYPE SS PLANETARY GEARMOTORS



STANDARD PART NUMBERS AND DATA

			Standard Part Number Prefix*			
			enclosed type		open type	
Speed Reduction Ratio	Max. Continuous Torque (oz. in.)	Torque Multiplier Ratio	dimension LE	part no. prefix	dimension LO	part no. prefix
3.82:1	1.0	3.1	2 35/64″	43A197	2 17/64″	43A196
5.77:1	1.5	4.6		43A200		43A199
14.58:1	3.0	9.3	2 25/32″	43A140	2 1/2″	43A100
22.03:1	4.5	14		43A141		43A101
33.28:1	7.0	21		43A142		43A102
55.66:1	10	28	2 61/64″	43A143	2 43/64″	43A103
84.11:1	14	43		43A144		43A104
127.1:1	21	65		43A145		43A105
192:1	30	93		43A146		43A106
321:1	45	130	3 1/8″	43A147	2 27/32″	43A107
485:1	70	200		43A148		43A108
733:1	100	300		43A149		43A109
1108:1	150	450		43A150		43A110
1853:1	200	600	3 9/32″	43A151	3″	43A111
2799:1	300	900		43A152		43A112
4230:1	300	1400		43A153		43A113
6391:1	300	2100		43A154		43A114
10689:1	300	2800	3 29/64″	43A155	3 11/64″	43A115
16150:1	300	4200		43A156		43A116
24403:1	300	6400		43A157		43A117
36873:1	300	9700		43A158		43A118

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

Momentary Stall Torque = 5 x Max. Cont. Torque.

Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

*HOW TO ORDER:

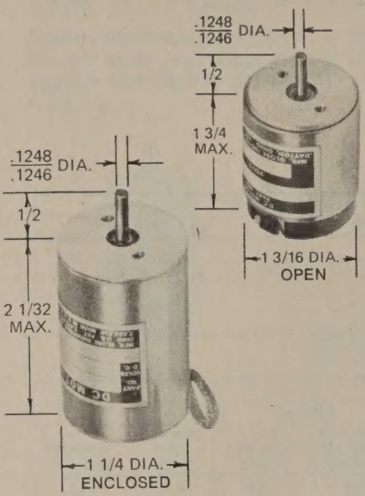
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS

D.C. 1-1/4" DIA. PERMANENT MAGNET MOTORS

TYPE MM — BASIC MOTOR

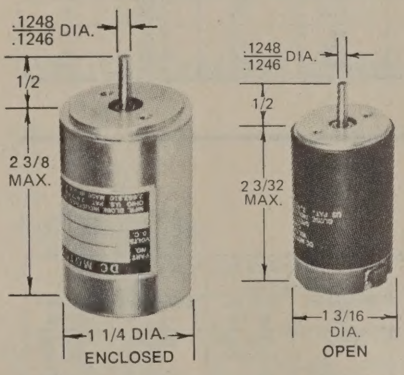
These Globe d.c. motors are specifically designed for use in airborne equipment, missiles, and commercial applications where a combination of small size, reliability, and high torque is desired.



STANDARD PART NUMBERS AND DATA

Vol-tage (v.d.c.)	Speed no load (rpm)	Torque max. rated (oz. in.)	Torque nom. stall (oz. in.)	Current max. no load (amps)	Current max. rated load (amps)	Current nom. stall (amps)	Standard Part Numbers* open type plain shaft	open type pinion	enclosed type plain shaft	enclosed type pinion
4	16,000-19,000	.25	4.9	1.5	2.4	21.	3A998-23	3A1524-23	3A1002-23	3A1525-23
6	18,900-22,500	.5	7.4	1.2	2.3	24.9	3A998-14	3A1524-14	3A1002-14	3A1525-14
6	15,600-18,600	.85	5.8	1.0	2.3	16.3	3A998-6	3A1524-6	3A1002-6	3A1525-6
6	12,000-14,000	.75	4.6	.80	2.0	9.9	3A998-5	3A1524-5	3A1002-5	3A1525-5
12	18,000-21,400	.5	7.4	.56	1.2	11.8	3A998-24	3A1524-24	3A1002-24	3A1525-24
12	14,500-17,000	.7	5.9	.50	1.2	7.5	3A998-3	3A1524-3	3A1002-3	3A1525-3
12	12,400-14,700	.75	4.6	.40	1.2	5.1	3A998-21	3A1524-21	3A1002-21	3A1525-21
12	11,000-13,000	1.0	4.6	.35	1.2	4.6	3A998-4	3A1524-4	3A1002-4	3A1525-4
24	19,200-22,800	.35	7.4	.30	.60	6.3	3A998-7	3A1524-7	3A1002-7	3A1525-7
24	16,000-19,000	.6	5.8	.25	.60	3.8	3A998-1	3A1524-1	3A1002-1	3A1525-1
24	11,500-14,000	1.0	4.6	.18	.60	2.1	3A998-2	3A1524-2	3A1002-2	3A1525-2
24	10,700-12,700	1.0	3.6	.17	.60	1.6	3A998-8	3A1524-8	3A1002-8	3A1525-8
24	9,600-11,400	1.0	2.9	.15	.50	1.1	3A998-22	3A1524-22	3A1002-22	3A1525-22
24	8,000-10,000	1.0	2.9	.13	.45	0.93	3A998-10	3A1524-10	3A1002-10	3A1525-10
24	6,000- 7,000	.8	2.3	.08	.30	0.55	3A998-11	3A1524-11	3A1002-11	3A1525-11
50	14,300-17,000	.7	4.8	.11	.30	1.3	3A998-25	3A1524-25	3A1002-25	3A1525-25
50	9,500-11,500	1.0	3.8	.07	.30	0.71	3A998-16	3A1524-16	3A1002-16	3A1525-16
50	8,000-10,000	1.0	3.0	.07	.20	0.50	3A998-12	3A1524-12	3A1002-12	3A1525-12
50	6,700- 8,000	.8	2.4	.05	.16	0.30	3A998-15	3A1524-15	3A1002-15	3A1525-15
50	4,600- 5,500	.8	1.9	.04	.12	0.20	3A998-13	3A1524-13	3A1002-13	3A1525-13

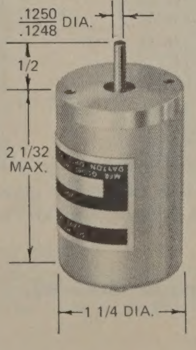
TYPE LL — BASIC MOTOR



STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque max. rated (oz. in.)	Torque nom. stall (oz. in.)	Current max. no load (amps)	Current max. rated load (amps)	Current nom. stall (amps)	Part Number* open type	Part Number* enclosed type
6	15,600-18,500	1.0	8.7	1.4	2.7	22.4	3A999-23	3A1003-23
6	12,500-14,500	1.3	8.7	1.1	2.4	17.7	3A999-14	3A1003-14
6	10,000-12,200	1.6	6.9	.95	2.6	11.6	3A999-6	3A1003-6
6	7,600- 9,400	1.6	5.5	.70	2.0	7.0	3A999-5	3A1003-5
12	11,500-14,000	1.1	8.7	.52	1.7	8.4	3A999-24	3A1003-24
12	9,000-11,000	1.7	6.9	.42	1.2	5.3	3A999-3	3A1003-3
24	16,000-19,000	.75	11.0	.36	1.0	7.3	3A999-21	3A1003-21
24	14,400-17,000	.85	11.0	.32	.85	6.5	3A999-4	3A1003-4
24	12,000-14,500	1.0	8.7	.28	.80	4.5	3A999-7	3A1003-7
24	10,400-12,300	1.1	6.9	.23	.75	3.0	3A999-1	3A1003-1
24	7,400- 8,900	1.6	5.5	.17	.70	1.7	3A999-2	3A1003-2
24	6,900- 8,200	1.8	4.3	.16	.65	1.2	3A999-8	3A1003-8
24	6,200- 7,400	1.8	3.4	.14	.60	0.89	3A999-22	3A1003-22
24	5,200- 6,200	1.2	3.4	.12	.45	0.74	3A999-10	3A1003-10
50	7,600- 9,400	1.5	5.7	.09	.25	0.92	3A999-11	3A1003-11
75	14,000-17,000	1.0	8.6	.10	.29	1.6	3A999-25	3A1003-25
75	9,000-11,000	1.7	6.8	.07	.29	0.85	3A999-16	3A1003-16
75	8,000-10,000	1.8	5.4	.06	.26	0.60	3A999-12	3A1003-12
75	6,500- 8,000	1.2	4.3	.05	.20	0.37	3A999-15	3A1003-15
75	4,500- 5,300	1.0	3.4	.04	.10	0.23	3A999-13	3A1003-13

TYPE JM — BASIC MOTOR



STANDARD PART NUMBERS AND DATA

6	11,200-13,700	1.20	8.2	.70	3.50	15.4	178A100-1
6	9,100-11,100	1.50	6.5	.55	2.80	9.9	178A100-2
6	7,500- 9,200	1.80	5.2	.44	2.40	6.3	178A100-3
12	11,200-13,700	1.20	8.2	.35	1.45	8.0	178A100-4
12	9,500-11,600	1.40	6.5	.28	1.40	5.1	178A100-5
12	7,500- 9,200	1.60	5.2	.23	1.15	3.2	178A100-6
27	13,700-16,700	1.10	9.9	.18	0.80	4.5	178A100-7
27	10,500-13,000	1.60	7.9	.14	0.75	2.8	178A100-8
27	8,700-10,600	1.70	6.2	.12	0.70	1.8	178A100-9
27	7,000- 8,600	1.80	5.0	.09	0.55	1.2	178A100-10
50	10,500-13,000	1.80	7.1	.08	0.40	1.4	178A100-11
50	8,200-10,000	1.90	5.6	.06	0.35	.88	178A100-12
50	6,500- 8,000	1.80	4.5	.05	0.26	.56	178A100-13
50	5,200- 6,300	2.10	3.5	.04	0.25	.36	178A100-14
115	9,500-11,600	1.90	6.7	.03	0.18	.52	178A100-15
115	7,500- 9,200	1.90	5.3	.03	0.14	.33	178A100-16
115	6,000- 7,500	1.90	4.2	.02	0.11	.21	178A100-17
115	4,800- 5,800	1.20	3.4	.02	0.09	.14	178A100-18

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

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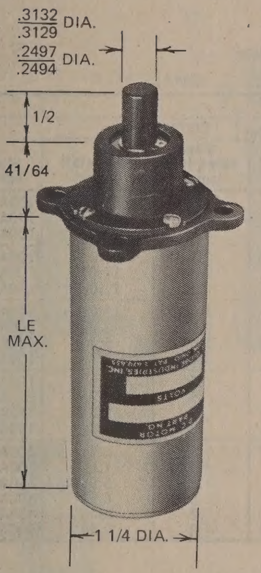
TRW GLOBE MOTORS

D.C. 1-1/4″ DIA. PLANETARY GEARMOTORS

TYPE MM, LL, JM PLANETARY GEARMOTORS



These Globe planetary gearmotors provide torques to 1,250 oz. in. and are designed for use in airborne equipment, missiles and other applications where reliability and miniature size are governing factors.

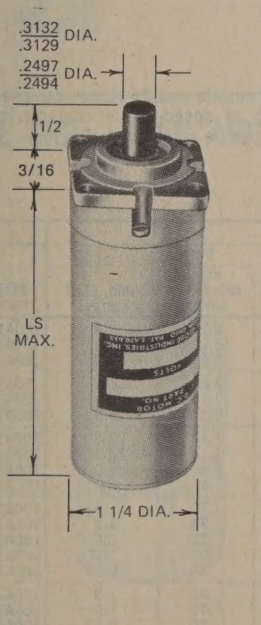
TYPE MM — STANDARD PART NUMBERS AND DATA

Speed Reduction Ratio	Maximum Continuous Torque (oz. in.)	Torque Multiplier Ratio	Part Number Prefix* Eared Flange 5/16″ shaft	Part Number Prefix* Eared Flange 1/4″ shaft	Part Number Prefix* Square Flange 5/16″ shaft	Part Number Prefix* Square Flange 1/4″ shaft	Dim. LE	Dim. LS
18.78	20	12	5A537	5A2292	5A538	5A2312	2.437	2.891
27.94	29	17	5A539	5A2293	5A540	5A2313		
81.37	70	41	5A541	5A2294	5A542	5A2314	2.562	3.016
121.10	105	62	5A543	5A2295	5A544	5A2315		
147.70	128	75	5A545	5A2296	5A546	5A2316		
352.60	247	145	5A547	5A2297	5A548	5A2317	2.828	3.281
524.60	366	215	5A549	5A2298	5A550	5A2318		
639.90	445	262	5A551	5A2299	5A552	5A2319		
780.60	544	320	5A553	5A2300	5A554	5A2320		
1528.00	850**	500	5A555	5A2301	5A556	5A2321	3.203	3.656
2273.00	1250**	740	5A557	5A2302	5A558	5A2322		
3382.00	1250**	1100	5A559	5A2303	5A560	5A2323		
4126.00	1250**	1350	5A561	5A2304	5A562	5A2324		
6621.00	1250**	1730	5A563	5A2305	5A564	5A2325	3.344	3.797
9851.00	1250**	2580	5A565	5A2306	5A566	5A2326		
12016.00	1250**	3150	5A567	5A2307	5A568	5A2327		
17879.00	1250**	4700	5A569	5A2308	5A570	5A2328		
21808.00	1250**	5700	5A571	5A2309	5A572	5A2329		

TYPE LL — STANDARD PART NUMBERS AND DATA

18.78	20	12	5A501	5A2332	5A502	5A2352	2.781	3.234
27.94	29	17	5A503	5A2333	5A504	5A2353		
81.37	70	41	5A505	5A2334	5A506	5A2354	2.928	3.375
121.10	105	62	5A507	5A2335	5A508	5A2355		
147.70	128	75	5A509	5A2336	5A510	5A2356		
352.60	247	145	5A511	5A2337	5A512	5A2357	3.187	3.641
524.60	366	215	5A513	5A2338	5A514	5A2358		
639.90	445	262	5A515	5A2339	5A516	5A2359		
780.60	544	320	5A517	5A2340	5A518	5A2360		
1528.00	850**	500	5A519	5A2341	5A520	5A2361	3.562	4.016
2273.00	1250**	740	5A521	5A2342	5A522	5A2362		
3382.00	1250**	1100	5A523	5A2343	5A524	5A2363		
4126.00	1250**	1350	5A525	5A2344	5A526	5A2364		
6621.00	1250**	1730	5A527	5A2345	5A528	5A2365	3.687	4.141
9851.00	1250**	2580	5A529	5A2346	5A530	5A2366		
12016.00	1250**	3150	5A531	5A2347	5A532	5A2367		
17879.00	1250**	4700	5A533	5A2348	5A534	5A2368		
21808.00	1250**	5700	5A535	5A2349	5A536	5A2369		

**1/4″ dia. shaft units limited to 600 oz. in. maximum continuous duty torque. Use 5/16″ dia. shaft if torque requirements exceed this value.



TYPE JM — STANDARD PART NUMBERS AND DATA

18.78	20	12	311A201	311A237	311A202	311A238	2.437	2.891
27.94	29	17	311A203	311A239	311A204	311A240		
81.37	70	41	311A205	311A241	311A206	311A242	2.562	3.016
121.10	105	62	311A207	311A243	311A208	311A244		
147.70	128	75	311A209	311A245	311A210	311A246		
352.60	247	145	311A211	311A247	311A212	311A248	2.828	3.281
524.60	366	215	311A213	311A249	311A214	311A250		
639.90	445	262	311A215	311A251	311A216	311A252		
780.60	544	320	311A217	311A253	311A218	311A254		
1528.00	850**	500	311A219	311A255	311A220	311A256	3.203	3.656
2273.00	1250**	740	311A221	311A257	311A222	311A258		
3382.00	1250**	1100	311A223	311A259	311A224	311A260		
4126.00	1250**	1350	311A225	311A261	311A226	311A262		
6621.00	1250**	1730	311A227	311A263	311A228	311A264	3.344	3.797
9851.00	1250**	2580	311A229	311A265	311A230	311A266		
12016.00	1250**	3150	311A231	311A267	311A232	311A268		
17879.00	1250**	4700	311A233	311A269	311A234	311A270		
21808.00	1250**	5700	311A235	311A271	311A236	311A272		

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

Momentary Stall Torque = 5 x Max. Cont. Torque.

Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

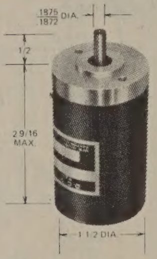
***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS

D.C. 1-1/2" DIA. PERMANENT MAGNET MOTORS

TYPE BD — BASIC MOTOR

Globe Type BD d.c. motors are designed to missile and aircraft standards. Twenty-one standard armature windings provide a large number of speed and torque characteristics in a comprehensive range of voltages. Units for operation at other voltages can be made available.

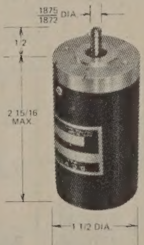


STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque max. rated (oz. in.)	Torque nom. stall (oz. in.)	Current max. no load (amps)	Current max. rated load (amps)	Current nom. stall (amps)	Standard Part No.*
6	13,000-15,500	1.7	24	1.60	4.5	55.0	100A104-2
6	10,000-12,000	2.3	19	1.30	4.6	35.0	100A104-3
6	8,000- 9,500	3.2	15	.97	4.6	22.0	100A104-4
12	12,500-14,500	1.8	24	.76	2.3	27.0	100A104-5
12	10,000-12,000	2.4	19	.60	2.3	17.0	100A104-6
12	8,000- 9,500	3.2	15	.49	2.3	11.0	100A104-7
27	14,000-16,500	1.6	27	.39	1.0	15.0	100A104-8
27	11,000-13,000	2.0	22	.30	1.0	9.8	100A104-9
27	9,000-10,500	2.8	17	.24	1.0	6.4	100A104-10
27	7,000- 8,500	3.6	14	.20	1.0	3.9	100A104-11
50	10,500-12,500	2.1	20	.16	.5	4.6	100A104-12
50	8,000- 9,500	2.8	16	.13	.5	2.9	100A104-13
50	6,500- 8,000	3.7	13	.10	.5	1.8	100A104-14
50	5,000- 6,000	3.5	10	.08	.4	1.2	100A104-15
115	13,000-15,500	1.6	18	.09	.3	2.3	100A104-16
115	11,000-13,000	2.2	14	.07	.3	1.5	100A104-17
115	9,000-10,500	2.8	11	.06	.3	0.95	100A104-18
115	7,000- 8,500	3.6	9	.05	.3	0.61	100A104-19
115	6,000- 7,000	2.9	7	.04	.2	0.40	100A104-20
115	4,500- 5,500	2.7	6.5	.04	.2	0.26	100A104-21

TYPE BL — BASIC MOTOR

Globe Type BL d.c. motors are designed to aircraft and missile quality standards. Twenty-one standard armature windings provide a large number of speed-torque characteristics at various voltages. Units for operation at other voltages can be made available.



STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque max. rated (oz. in.)	Torque nom. stall (oz. in.)	Current max. no load (amps)	Current max. rated load (amps)	Current nom. stall (amps)	Standard Part No.*
6	10,000-12,500	3.3	37	1.50	5.2	62.0	100A108-1
6	8,500-10,500	4.0	29	1.20	5.2	45.0	100A108-2
6	6,500- 8,000	5.0	23	.93	5.1	28.0	100A108-3
12	10,000-12,500	3.3	37	.71	2.6	36.0	100A108-4
12	8,500-10,500	4.4	29	.56	2.7	22.0	100A108-5
12	6,500- 8,000	5.0	23	.44	2.8	14.0	100A108-6
27	11,500-14,000	2.9	42	.36	1.4	20.0	100A108-7
27	8,500-10,500	3.7	33	.28	1.4	12.0	100A108-8
27	7,000- 9,000	5.0	27	.22	1.4	8.0	100A108-9
27	5,500- 7,000	6.0	21	.18	1.4	5.2	100A108-10
50	8,500-10,500	3.8	31	.15	.72	5.9	100A108-11
50	6,500- 8,000	5.0	25	.16	.74	3.7	100A108-12
50	5,500- 7,000	6.5	20	.09	.73	2.4	100A108-13
50	4,500- 5,500	7.5	16	.075	.66	1.5	100A108-14
50	3,500- 4,500	6.0	12.5	.055	.43	0.94	100A108-15
115	8,500-10,500	4.2	22	.065	.34	1.9	100A108-16
115	7,000- 9,000	5.0	17	.055	.40	1.2	100A108-17
115	5,500- 7,000	5.0	14	.045	.28	0.77	100A108-18
115	4,500- 5,500	4.2	11	.035	.19	0.50	100A108-19
115	4,000- 5,000	3.5	8.8	.030	.14	0.33	100A108-20
115	3,000- 4,000	2.9	8.1	.025	.10	0.21	100A108-21

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

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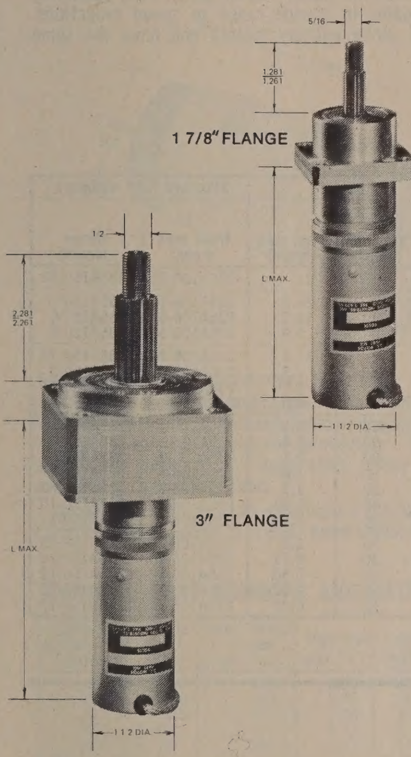
TRW GLOBE MOTORS

D.C. 1-7/8" & 3" FLANGE PLANETARY GEARMOTORS
D.C. 2-1/4" DIA. PERMANENT MAGNET MOTORS
TYPE BD, BL — PLANETARY GEARMOTORS



TRW/Globe's 1⅞" and 3" diameter planetary geartrains provide high torque outputs in a small package. Coupled to the Type BD or BL motor, they are ideal for business machinery, machine tools, aircraft, and missile applications.

1-7/8" FLANGE — STANDARD PART NUMBERS AND DATA

Speed Reduction Ratio	Torque Multiplier	Max. Cont. Rating (lb. in.)	Type BD		Type BL	
			"L" max.	Part No. Prefix	"L" max.	Part No. Prefix*
3.81:1	3.5	1.1	3.34	102A152	3.72	102A170
5.54:1	5.1	1.6		102A153		102A171
14.5 :1	13	4.1	3.53	102A156	3.91	102A174
21.1 :1	19	6.0		102A157		102A175
30.7 :1	27	8.6		102A158		102A176
55.3 :1	47	14.6	4.09	102A160	4.47	102A178
80.4 :1	68	21.0		102A161		102A179
117.0 :1	99	31.0		102A162		102A180
170.0 :1	144	45.0		102A163		102A181
211.0 :1	171	53.0	4.28	102A189	4.66	102A199
306.0 :1	248	77.0		102A190		102A200
445.0 :1	360	100.0		102A191		102A201
647.0 :1	524	100.0		102A192		102A202
941.0 :1	762	100.0		102A193		102A203

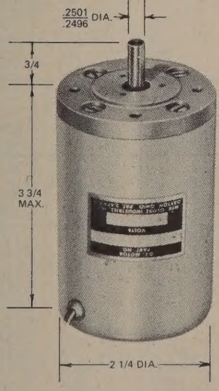
3" FLANGE — STANDARD PART NUMBERS AND DATA

Speed Reduction Ratio	Torque Multiplier	Max. Cont. Rating (lb. in.)	Type BD "L" max.	Type BD Part No. Prefix	Type BL "L" max.	Type BL Part No. Prefix*
306:1	248	77	5.17	102A165	5.55	102A183
445:1	360	112		102A166		102A184
647:1	524	164		102A167		102A185
941:1	762	238		102A168		102A186
1166:1	896	280	5.34	102A194	5.72	102A204
1696:1	1305	407		102A195		102A205
2466:1	1900	550		102A196		102A206
3584:1	2760	550		102A197		102A207
5211:1	4000	550		102A198		102A208

NOTE: Shaft spline details available from factory. For prototype use, TRW/Globe will broach holes in customer's parts.

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.
Max. Intermittent Torque = 2 x Max. Cont. Torque.
Momentary Stall Torque = 5 x Max. Cont. Torque.
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

TYPE GRP — BASIC MOTOR



Type GRP precision permanent magnet d.c. motors provide extremely high output and efficiency for their frame size. This unit is designed to meet the requirements of MIL-M-8609; however, designs exceeding this specification to meet customer controlled applications are common. Various standard armature windings make it possible to furnish a wide range of speed and torque characteristics.

STANDARD PART NUMBERS AND DATA

		Torque		Current			
Voltage (v.d.c.)	Speed no load (rpm)	max. rated (oz. in.)	nom. stall (oz. in.)	max. no load (amps)	max. rated load (amps)	nominal stall (amps)	Standard Part No.*
6	4,700-5,300	8.0	40	2.00	7.0	45.0	166A100-4
12	6,300-7,000	8.0	54	1.34	6.0	47.0	166A100-5
12	4,700-5,300	12.0	50	1.00	5.8	28.0	166A100-6
27	8,500-9,500	10.0	99	0.80	3.4	40.0	166A100-7
27	6,500-7,300	13.0	96	0.62	3.4	25.0	166A100-8
27	5,300-5,900	16.0	89	0.50	3.3	16.0	166A100-9
27	4,200-4,800	16.0	72	0.40	2.7	10.0	166A100-10
50	6,300-7,100	14.0	107	0.32	1.9	11.8	166A100-11
50	4,900-5,500	14.5	83	0.25	1.5	7.5	166A100-12
50	3,900-4,400	15.0	66	0.20	1.2	4.7	166A100-13
115	7,300-8,100	12.0	123	0.16	0.90	6.8	166A100-14
115	5,900-6,500	15.5	99	0.14	0.85	4.4	166A100-15
115	4,700-5,300	16.0	80	0.12	0.70	2.8	166A100-16
115	3,700-4,100	15.0	62	0.09	0.50	1.8	166A100-17
115	3,000-3,400	14.5	51	0.07	0.45	1.2	166A100-18
115	2,400-2,700	14.0	41	0.06	0.35	0.8	166A100-19

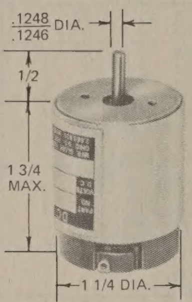
***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS

D.C. 1-1/4" DIA. PERMANENT MAGNET MOTORS

TYPE CMM — BASIC MOTOR

Globe Type CMM motors are designed for applications which require small size, reliability and high torque. Planetary geartrains are available in a wide range of speed reductions. Type CMM motors are commercial versions of Globe military motors and have the same performance characteristics.

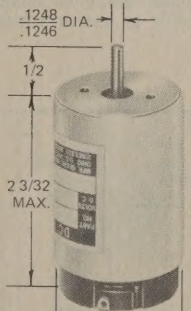


STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque		Current			Standard Part Numbers*	
		max. rated (oz. in.)	nom. stall (oz. in.)	max. no load (amps)	max. rated load (amps)	nom. stall (amps)	front face mount	flange mount
4	16,000-19,000	.25	4.9	1.5	2.4	21	235A106-23	235A150-23
6	18,900-22,500	.5	7.4	1.2	2.3	24.9	235A106-14	235A150-14
6	15,600-18,600	.85	5.8	1.0	2.3	16.3	235A106-6	235A150-6
6	12,000-14,000	.75	4.6	.80	2.0	9.9	235A106-5	235A150-5
12	18,000-21,400	.50	7.4	.56	1.2	11.8	235A106-24	235A150-24
12	14,500-17,000	.70	5.9	.50	1.2	7.5	235A106-3	235A150-3
12	12,400-14,700	.75	4.6	.40	1.2	5.1	235A106-21	235A150-21
12	11,000-13,000	1.0	4.6	.35	1.2	4.6	235A106-4	235A150-4
24	19,200-22,800	.35	7.4	.30	.60	6.3	235A106-7	235A150-7
24	16,000-19,000	.60	5.8	.25	.60	3.8	235A106-1	235A150-1
24	11,500-14,000	1.0	4.6	.18	.60	2.1	235A106-2	235A150-2
24	10,700-12,700	1.0	3.6	.17	.60	1.6	235A106-8	235A150-8
24	9,600-11,400	1.0	2.9	.15	.50	1.1	235A106-22	235A150-22
24	8,000-10,000	1.0	2.9	.13	.45	0.93	235A106-10	235A150-10
24	6,000- 7,000	.8	2.3	.08	.30	0.55	235A106-11	235A150-11
50	14,300-17,000	.7	4.8	.11	.30	1.3	235A106-25	235A150-25
50	9,500-11,500	1.0	3.8	.07	.30	0.71	235A106-16	235A150-16
50	8,000-10,000	1.0	3.0	.07	.20	0.50	235A106-12	235A150-12
50	6,700- 8,000	.8	2.4	.05	.16	0.30	235A106-15	235A150-15
50	4,600- 5,500	.8	1.9	.04	.12	0.20	235A106-13	235A150-13

TYPE CLL — BASIC MOTOR

Globe Type CLL motors are designed for applications which require small size, reliability and high torque. Planetary geartrains are available in a wide range of speed reductions. Type CLL motors are commercial versions of Globe military motors and have the same performance characteristics.



STANDARD PART NUMBERS AND DATA

Voltage (v.d.c.)	Speed no load (rpm)	Torque		Current			Standard Part No.*
		max. rated (oz. in.)	nom. stall (oz. in.)	max. no load (amps)	max. rated load (amps)	nominal stall (amps)	
6	15,600-18,500	1.0	8.7	1.4	2.7	22.4	313A102-23
6	12,500-14,500	1.3	8.7	1.1	2.4	17.7	313A102-14
6	10,000-12,200	1.6	6.9	.95	2.6	11.6	313A102-6
6	7,600- 9,400	1.6	5.5	.70	2.0	7.0	313A102-5
12	11,500-14,000	1.1	8.7	.52	1.7	8.4	313A102-24
12	9,000-11,000	1.7	6.9	.42	1.2	5.3	313A102-3
24	16,000-19,000	.75	11.0	.36	1.0	7.3	313A102-21
24	14,400-17,000	.85	11.0	.32	.85	6.5	313A102-4
24	12,000-14,500	1.0	8.7	.28	.80	4.5	313A102-7
24	10,400-12,300	1.1	6.9	.23	.75	3.0	313A102-1
24	7,400- 8,900	1.6	5.5	.17	.70	1.7	313A102-2
24	6,900- 8,200	1.8	4.3	.16	.65	1.2	313A102-8
24	6,200- 7,400	1.8	3.4	.14	.60	0.89	313A102-22
24	5,200- 6,200	1.2	3.4	.12	.45	0.74	313A102-10
50	7,600- 9,400	1.5	5.7	.09	.25	0.92	313A102-11
75	14,000-17,000	1.0	8.6	.10	.29	1.6	313A102-25
75	9,000-11,000	1.7	6.8	.07	.29	0.85	313A102-16
75	8,000-10,000	1.8	5.4	.06	.26	0.60	313A102-12
75	6,500- 8,000	1.2	4.3	.05	.20	0.37	313A102-15
75	4,500- 5,300	1.0	3.4	.04	.10	0.23	313A102-13

***HOW TO ORDER:**

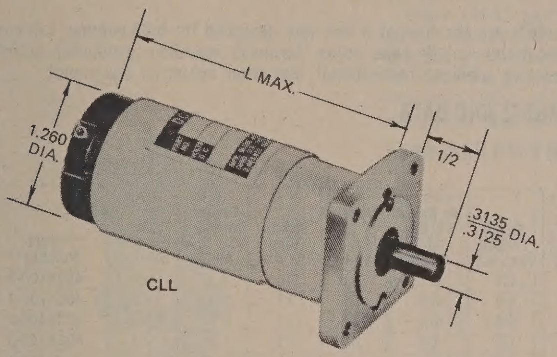
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS, an Electronic Components Division of TRW INC. 2275 STANLEY AVE. DAYTON, OHIO 45404 (513) 228-3171

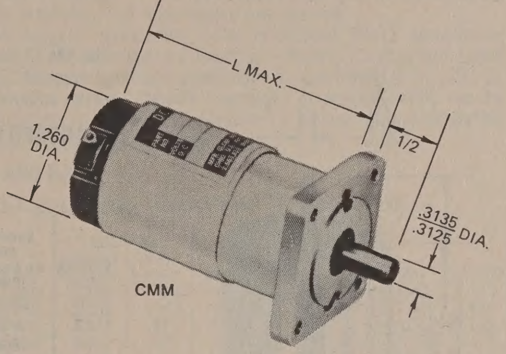
TRW GLOBE MOTORS

D.C. 1-1/4" DIA. PERMANENT MAGNET PLANETARY GEARMOTORS

TYPE CMM, CLL—PLANETARY GEARMOTORS



CLL



CMM

Type CLL and CMM gearmotors are of the same high quality construction as Globe MM and LL gearmotors and provide the same outstanding performance characteristics although NOT designed to meet MIL-specs for environmental protection. These gearmotors are specifically designed for application where small size, reliability and high torque are desired.

Globe Type CMM and CLL gearmotors are rugged, high-quality units combining Type CMM and CLL commercial motors with a proven planetary geartrain offering 83 standard speed reduction ratios from 4:1 to 46,656:1 with maximum continuous torque from 3.0 to 1250 oz. in. Since the geartrain is of modular design, literally thousands of special ratios can be furnished.

STANDARD PART NUMBERS AND DATA

Speed Reduction Ratio	Torque Multi-plier	Max. Cont. Torque (oz. in.)	Type CMM Gearmotor		Type CLL Gearmotor	
			dim. "L"	Part No.*	dim. "L"	Part No.*
4:1	3.0	5.1	2.86	317A102	3.22	319A100
5:1	3.8	6.5	2.86	317A103	3.22	319A101
6:1	4.5	7.7	2.86	317A104	3.22	319A102
16:1	10	17	3.11	317A105	3.45	319A103
20:1	13	22	3.11	317A106	3.45	319A104
24:1	15	26	3.11	317A107	3.45	319A105
25:1	16	27	3.11	317A108	3.45	319A106
30:1	19	32	3.11	317A109	3.45	319A107
36:1	23	39	3.11	317A110	3.45	319A108
64:1	33	56	3.34	317A111	3.69	319A109
80:1	41	70	3.34	317A112	3.69	319A110
96:1	49	83	3.34	317A113	3.69	319A111
100:1	51	87	3.34	317A114	3.69	319A112
120:1	61	104	3.34	317A115	3.69	319A113
125:1	64	109	3.34	317A116	3.69	319A114
144:1	74	126	3.34	317A117	3.69	319A115
150:1	77	131	3.34	317A118	3.69	319A116
180:1	92	156	3.34	317A119	3.69	319A117
216:1	110	187	3.34	317A120	3.69	319A118
256:1	105	179	3.58	317A121	3.92	319A119
320:1	130	221	3.58	317A122	3.92	319A120
384:1	157	167	3.58	317A123	3.92	319A121
400:1	164	279	3.58	317A124	3.92	319A122
480:1	197	335	3.58	317A125	3.92	319A123
500:1	205	349	3.58	317A126	3.92	319A124
576:1	235	401	3.58	317A127	3.92	319A125
600:1	246	418	3.58	317A128	3.92	319A126
625:1	256	435	3.58	317A129	3.92	319A127
720:1	295	502	3.58	317A130	3.92	319A128
750:1	306	520	3.58	317A131	3.92	319A129
864:1	352	598	3.58	317A132	3.92	319A130
900:1	370	629	3.58	317A133	3.92	319A131
1,024:1	334	568	3.81	317A134	4.16	319A132
1,080:1	442	757	3.58	317A135	3.92	319A133
1,280:1	416	707	3.81	317A136	4.16	319A134
1,296:1	530	901	3.58	317A137	3.92	319A135
1,536:1	500	850	3.81	317A138	4.16	319A136
1,600:1	522	887	3.81	317A139	4.16	319A137
1,920:1	625	1063	3.81	317A140	4.16	319A138
2,000:1	652	1108	3.81	317A141	4.16	319A139
2,304:1	750	1250	3.81	317A142	4.16	319A140
2,400:1	780	1250	3.81	317A143	4.16	319A141

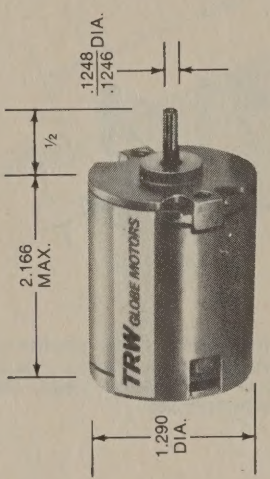
Speed Reduction Ratio	Torque Multi-plier	Max. Cont. Torque (oz. in.)	Type CMM Gearmotor		Type CMM Gearmotor	
			dim. "L"	Part No.*	dim. "L"	Part No.*
2,500:1	815	1250	3.81	317A144	4.16	319A142
2,880:1	940	1250	3.81	317A145	4.16	319A143
3,000:1	980	1250	3.81	317A146	4.16	319A144
3,125:1	1020	1250	3.81	317A147	4.16	319A145
3,456:1	1130	1250	3.81	317A148	4.16	319A146
3,600:1	1170	1250	3.81	317A149	4.16	319A147
3,750:1	1220	1250	3.81	317A150	4.16	319A148
4,096:1	1070	1250	4.03	317A151	4.39	319A149
4,320:1	1410	1250	3.81	317A152	4.16	319A150
4,500:1	1470	1250	3.81	317A153	4.16	319A151
5,120:1	1340	1250	4.03	317A154	4.39	319A152
5,184:1	1690	1250	3.81	317A155	4.16	319A153
5,400:1	1760	1250	3.81	317A156	4.16	319A154
6,144:1	1610	1250	4.03	317A157	4.39	319A155
6,400:1	1680	1250	4.03	317A158	4.39	319A156
6,480:1	2110	1250	3.81	317A159	4.16	319A157
7,680:1	2010	1250	4.03	317A160	4.39	319A158
7,776:1	2530	1250	3.81	317A161	4.16	319A159
8,000:1	2100	1250	4.03	317A162	4.39	319A160
9,216:1	2390	1250	4.03	317A163	4.39	319A161
9,600:1	2520	1250	4.03	317A164	4.39	319A162
10,000:1	2620	1250	4.03	317A165	4.39	319A163
11,520:1	3010	1250	4.03	317A166	4.39	319A164
12,000:1	3140	1250	4.03	317A167	4.39	319A165
12,500:1	3280	1250	4.03	317A168	4.39	319A166
13,824:1	3620	1250	4.03	317A169	4.39	319A167
14,400:1	3780	1250	4.03	317A170	4.39	319A168
15,000:1	3940	1250	4.03	317A171	4.39	319A169
15,625:1	4100	1250	4.03	317A172	4.39	319A170
17,280:1	4520	1250	4.03	317A173	4.39	319A171
18,000:1	4710	1250	4.03	317A174	4.39	319A172
18,750:1	4910	1250	4.03	317A175	4.39	319A173
20,736:1	5430	1250	4.03	317A176	4.39	319A174
21,600:1	5660	1250	4.03	317A177	4.39	319A175
22,500:1	4900	1250	4.03	317A178	4.39	319A176
25,920:1	6790	1250	4.03	317A179	4.39	319A177
27,000:1	7070	1250	4.03	317A180	4.39	319A178
31,104:1	8150	1250	4.03	317A181	4.39	319A179
32,400:1	8500	1250	4.03	317A182	4.39	319A180
38,880:1	10200	1250	4.03	317A183	4.39	319A181
46,656:1	12200	1250	4.03	317A184	4.39	319A182

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

TRW GLOBE MOTORS

D.C. ECONO-MITE PERMANENT MAGNET MOTORS
TYPE EM-13 — BASIC 1¼″ DIA. MOTOR

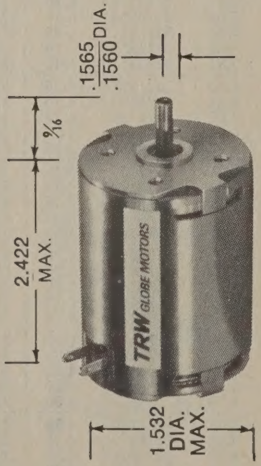


The EM-13 and EM-15 motors are the first of a new line designed for high-volume, low-cost production. Typical applications include tape decks, business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment.

STANDARD PART NUMBERS AND DATA

Voltage (VDC)	Speed ± 800 No Load (RPM)	Current No Load (Max Amps)	Rated Torque (Oz. In.)	Current At Rated Torque (Max Amps)	Iinertia X 10-4 (Oz. In. Sec.^{2})	Temp.* Rise (°C/Watt)	Torque Constant (Oz. In./Amp)	Resistance ± 15% (Ohms)	Part Number**
6	4200	0.3	0.5	0.6	1.5	15	1.3	5.4	405A100-3
12	4800	0.15	0.5	0.3	1.5	15	2.6	15.3	405A100-1
24	4800	0.08	0.5	0.2	1.5	15	5.2	51.9	405A100-2
6	4500	0.3	1.0	1.4	1.5	15	1.3	2.4	405A119-3
12	5400	0.15	1.50	0.7	1.5	15	2.6	6.7	405A119-1
24	5600	0.08	1.7	0.45	1.5	15	5.2	28.0	405A119-2
6	5300	0.3	2.1	2.4	2.2	11	1.2	1.2	405A219-3
12	5400	0.15	2.5	1.1	2.2	11	2.8	4.8	405A219-1
24	5600	0.08	3.0	0.7	2.2	11	5.7	16.8	405A219-2

TYPE EM-15 — BASIC 1½″ DIA. MOTOR



Designed for economy in commercial and industrial applications, the EM-15 motor is available with the following special order options: geartrain, EMI filters, integral tachometer generators, stud mounting, and rear terminals.

STANDARD PART NUMBERS AND DATA

Sleeve Bearings

Voltage (VDC)	Speed ± 800 No Load (RPM)	Current No Load (Max Amps)	Rated Torque (Oz. In.)	Current At Rated Torque (Max Amps)	Inertia X 10-4 (Oz. In. Sec.^{2})	Temp.* Rise (°C/Watt)	Torque Constant (Oz. In./Amp)	Resistance ± 15% (Ohms)	Part Number**
6	4800	0.5	3.0	3.0	4.75	8.5	1.4	0.7	403A114-1
12	5200	0.25	3.5	1.6	4.75	8.5	2.7	2.3	403A114-2
24	5400	0.125	4.0	1.0	4.75	8.5	5.5	8.3	403A114-3
6	5500	0.6	4.0	4.0	6.0	7.0	1.3	0.45	403A116-1
12	5500	0.3	4.5	2.2	6.0	7.0	2.7	1.7	403A116-2
24	5500	0.15	5.0	1.2	6.0	7.0	5.5	6.2	403A116-3

Ball Bearings

Voltage (VDC)	Speed ± 800 No Load (RPM)	Current No Load (Max Amps)	Rated Torque (Oz. In.)	Current At Rated Torque (Max Amps)	Inertia X 10-4 (Oz. In. Sec.^{2})	Temp.* Rise (°C/Watt)	Torque Constant (Oz. In./Amp)	Resistance ± 15% (Ohms)	Part Number**
6	5000	0.25	3.5	3.2	4.75	8.5	1.4	0.7	403A115-1
12	5300	0.125	4.0	1.8	4.75	8.5	2.7	2.3	403A115-2
24	5500	0.06	4.5	1.0	4.75	8.5	5.5	8.3	403A115-3
6	5600	0.4	4.5	4.0	6.0	7.0	1.3	0.45	403A117-1
12	5600	0.2	5.0	2.3	6.0	7.0	2.7	1.7	403A117-2
24	5600	0.1	5.5	1.3	6.0	7.0	5.5	6.2	403A117-3

*Winding temp rise measured when mounted to 8″ x 8″ x ¼″ Alum plate. Multiply by 1.4 when mounted to a heat insulator.

****HOW TO ORDER:**

Units shown above are standard and may be ordered by part number. Consult TRW Globe for variations in mechanical or electrical performance to suit specific applications.

Ask for Bulletin E-2109 and E-2404 for complete details.

TRW/GLOBE MOTORS, an Electronic Components Division of TRW INC. / 2275 STANLEY AVE. / DAYTON, OHIO 45404 / (513) 228-3171

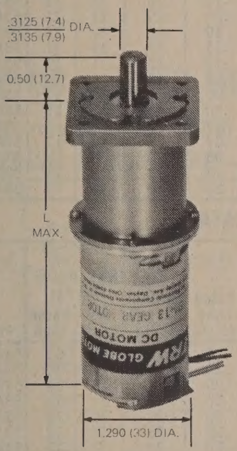
TRW GLOBE MOTORS

D.C. ECONO-MITE PERMANENT MAGNET

TYPE EM-13 — (1¼″ DIA.) PLANETARY GEARMOTORS

Type EM-13 gearmotors are of the same high quality construction as Globe military gearmotors and provide the same outstanding performance characteristics although **not** designed to meet MIL-Specs for environmental protection. These gearmotors are specifically designed for application where small size reliability and high torque are desired.

Globe EM-13 gearmotors are rugged, high-quality units combining EM-13 commercial motors (see Bulletin E-2109) with a proven planetary geartrain offering 30 standard speed reduction ratios from 4:1 to 46,656:1 with maximum continuous torque from 1.5 to 1250 oz. in. Since the geartrain is of modular design, literally thousands of special ratios can be furnished. Send complete application information to receive a prompt recommendation from Globe. Ask for Bulletin E-2129 for complete details.



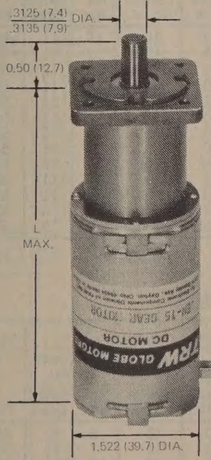
STANDARD PART NUMBERS AND DATA

		405A100 Type (Basic Motor)			405A119 Type		405A219 Type		
Speed Reduction	Torque Multiplier	Max Cont. Torque (Oz. In.)	Part No.*	"L" Max (Applies to both)	Max Cont. Torque	Part No.*	Max Cont. Torque	Part No.*	"L" Max
4:1	3	1.5	407A100	3.158	5.1	407A184	9	407A267	3.476
5:1	3.8	1.9	407A101	3.158	6.5	407A185	11.5	407A268	3.476
16:1	10	5	407A103	3.347	17	407A187	30	407A270	3.715
20:1	13	7	407A104	3.347	22	407A188	40	407A271	3.715
25:1	16	8	407A106	3.347	27	407A190	48	407A273	3.715
36:1	23	12	407A108	3.347	39	407A192	69	407A275	3.715
64:1	33	14	407A109	3.630	56	407A193	100	407A276	3.948
80:1	41	21	407A110	3.630	70	407A194	125	407A277	3.948
100:1	51	26	407A112	3.630	87	407A196	155	407A279	3.948
125:1	64	32	407A114	3.630	109	407A198	195	407A281	3.948
180:1	92	46	407A117	3.630	156	407A201	275	407A284	3.948
256:1	105	53	407A119	3.863	179	407A203	315	407A286	4.181
320:1	130	65	407A120	3.863	221	407A204	390	407A287	4.181
400:1	164	85	407A122	3.863	279	407A206	495	407A289	4.181
500:1	205	105	407A124	3.863	349	407A208	620	407A291	4.181
625:1	256	130	407A127	3.863	435	407A211	770	407A294	4.181
750:1	306	155	407A129	3.863	520	407A213	920	407A296	4.181
1024:1	334	170	407A132	4.096	568	407A216	1000	407A299	4.414
1280:1	416	210	407A134	4.096	707	407A218	1250	407A301	4.414
1600:1	522	260	407A137	4.096	887	407A221	1250	407A304	4.414
2000:1	652	330	407A139	4.096	1108	407A223	1250	407A306	4.414
2500:1	815	410	407A142	4.096	1250	407A226	1250	407A309	4.414
3125:1	1020	500	407A145	4.096	1250	407A229	1250	407A312	4.414
4096:1	1070	540	407A149	4.329	1250	407A233	1250	407A316	4.747
5120:1	1340	670	407A152	4.329	1250	407A236			
6400:1	1680	840	407A156	4.329	1250	407A240			
8000:1	2100	1050	407A160	4.329	1250	407A244			
10000:1	2620	1250	407A163	4.329					
12500:1	3280	1250	407A166	4.329					
15625:1	4100	1250	407A170	4.329					

*Add dash number to part number for voltage: —1 = 12V —2 = 24V —3 = 6V

TYPE EM-15 — (1½″ DIA.) PLANETARY GEARMOTORS

Type EM-15 d.c. gearmotors are designed for high-volume, low-cost production. Typical applications include business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment where high torque at lower speeds are needed. Request Bulletin E-2429 for complete details.



STANDARD PART NUMBERS AND DATA

Ratio	Torque Multiplier	Part No.*	—1 Max Cont. Torque (Oz. In.)	—2 Max Cont. Torque	—3 Max Cont. Torque	"L" Max Inches	Part No.*	—1 Max Cont. Torque	—2 Max Cont. Torque	—3 Max Cont. Torque	"L" Max Inches
4	3	409A100	9	10.5	12	3.697	409A266	12	14	15	3.976
5	3.8	409A101	11.5	13.5	15	3.697	409A267	15	17	19	3.976
16	10	409A103	30	35	40	3.936	409A269	40	45	50	4.215
20	13	409A104	40	46	52	3.936	409A270	52	60	65	4.215
25	16	409A106	48	56	64	3.936	409A272	64	72	80	4.215
36	23	409A108	69	81	92	3.936	409A274	92	105	115	4.215
64	33	409A109	100	116	132	4.169	409A275	132	150	165	4.448
80	41	409A110	125	144	164	4.169	409A276	164	185	205	4.448
100	51	409A112	155	180	204	4.169	409A278	204	230	255	4.448
125	64	409A114	195	225	256	4.169	409A280	256	290	320	4.448
180	92	409A117	275	325	368	4.169	409A283	368	415	460	4.448
256	105	409A119	315	370	420	4.402	409A285	420	475	525	4.681
320	130	409A120	390	455	520	4.402	409A286	520	585	650	4.681
400	164	409A122	495	575	650	4.402	409A288	650	740	820	4.681
500	205	409A124	620	720	820	4.402	409A290	820	925	1025	4.681
625	256	409A127	770	900	1020	4.402	409A293	1020	1150	1250	4.681
750	306	409A129	920	1070	1250	4.402	409A295	1250	1250	1250	4.681
1024	334	409A132	1000	1170	1250	4.635	409A298	1250	1250	1250	4.914
1280	416	409A134	1250	1250	1250	4.635	409A300	1250	1250	1250	4.914
1600	522	409A137	1250	1250	1250	4.635	409A303				4.914
2000	652	409A139	1250	1250	1250	4.635	409A305	EM13 Recommended below double lines			4.914
2500	815	409A142	1250	1250	1250	4.635	409A308				4.914
3125	1020	409A145				4.635	409A311				4.914
4096	1070	409A149	EM13 Recommended below double lines			4.868	409A315				5.147
5120	1340	409A152				4.868	409A318				5.147
6400	1680	409A156				4.868	409A322				5.147
8000	2100	409A160				4.868	409A326				5.147
10000	2620	409A163				4.868	409A329				5.147
12500	3280	409A166				4.868	409A332				5.147
15625	4100	409A170				4.868	409A336				5.147

*Add dash number to part number for voltage: —1 = 6V —2 = 12V —3 = 24V

Special order options:

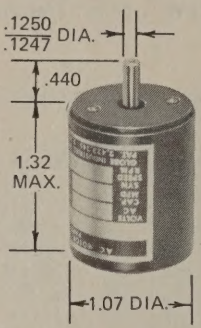
- Integral tachometer generators.
- Stud mounting.
- Rear terminals.
- Other ratios.
- Ball bearing motors.

TRW GLOBE MOTORS, an Electronic Components Division of TRW INC. 2275 STANLEY AVE. DAYTON, OHIO 45404 (513) 228-3171

TRW GLOBE MOTORS

A.C. 1″ DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS

TYPE SC — BASIC MOTOR



Globe Type SC a.c. motors are available in many variations. Motors are wound a) three-phase, two or four pole or b) single-phase, two, four, or six pole. Type SC motors are designed to meet the requirements of MIL-M-7969.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

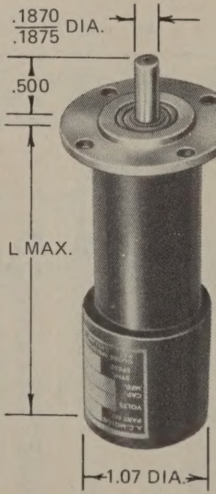
Voltage (vac)	Freq. (Hz)	Poles	Phase	† Schematic Wiring	Variable Lead Color B	Variable Lead Color C	Phasing Capacitor (mfd)(wvac)	Sync. Speed (rpm)	Max. Rated Load @ Sync. Speed (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No.
27	400	2	1	A		Black	1.50 100	24,000	.16	.16	11	11	53A1000-2
27	400	2	3	B		Black	Not Req'd	24,000	.13	.13	11	11	53A1001-2
27	400	4	1	A		Green	1.50 100	12,000	.16	.16	12	12	53A1002-2
27	400	4	3	B		Green	Not Req'd	12,000	.20	.20	11	11	53A1003-2
27	400	6	1	C	White	Gray	1.50 100	8,000	.10	.10	12	12	53A111-2
115	400	2	1	A		Black	0.068 300	24,000	.16	.16	11	11	53A1005-2
115	400	2	3	B		Black	Not Req'd	24,000	.13	.13	11	11	53A1006-2
115	400	4	1	A		Green	0.068 300	12,000	.16	.16	12	12	53A1007-2
115	400	4	3	B		Green	Not Req'd	12,000	.20	.20	11	11	53A1008-2
115	400	6	1	C	Black	Gray	0.22 300	8,000	.10	.10	15	15	53A107-2
115	60	2	1	D	White		2.00 200	3,600	.07	.07	8	8	53A118-2
115	60	4	1	D	Red		2.00 200	1,800	.07	.07	12	12	53A338-2
115	60	6	1	D	Black		2.50 200	1,200	.05	.04	9	9	53A117-2
200	400	2	3	B		Black	Not Req'd	24,000	.13	.13	11	11	53A1010-2
200	400	4	3	B		Green	Not Req'd	12,000	.20	.20	11	11	53A1011-2

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage (vac)	Freq. (Hz)	Poles	Phase	† Schematic Wiring	Variable Lead Color B	Variable Lead Color C	Phasing Capacitor (mfd)(wvac)	Min. Speed @ Rated Load (rpm)	Rated Load (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No.
27	400	2	1	A		Black	1.25 100	21,000	.20	.20	9	12	53A1000-1
27	400	2	3	B		Black	Not Req'd	21,000	.30	.30	7	13	53A1001-1
27	400	4	1	A		Green	1.50 100	10,000	.25	.25	13	13	53A1002-1
27	400	4	3	B		Green	Not Req'd	10,000	.30	.30	11	13	53A1003-1
27	400	6	1	C	White	Gray	1.50 100	6,000	.20	.20	10	12	53A111-1
115	400	2	1	A		Black	0.100 300	21,000	.20	.20	9	12	53A1005-1
115	400	2	3	B		Black	Not Req'd	21,000	.30	.30	7	13	53A1006-1
115	400	4	1	A		Green	0.068 300	10,000	.25	.25	13	13	53A1007-1
115	400	4	3	B		Green	Not Req'd	10,000	.30	.30	11	13	53A1008-1
115	400	6	1	C	Black	Gray	0.22 300	6,000	.12	.12	14	14	53A107-1
115	60	2	1	D	White		2.00 200	2,500	.10	.10	8	8	53A118-1
115	60	4	1	D	Red		2.00 200	1,000	.05	.05	12	12	53A338-1
115	60	6	1	D	Black		2.50 200	500	.05	.05	11	11	53A117-1
200	400	2	3	B		Black	Not Req'd	21,000	.30	.30	7	13	53A1010-1
200	400	4	3	B		Green	Not Req'd	10,000	.30	.30	11	13	53A1011-1

†See page 3125 for Schematic drawings.

TYPE SC — PLANETARY GEARMOTORS



This extremely small size and lightweight gearmotor consists of a Globe Type SC a.c. motor and a precision planetary geartrain. The combination provides smooth, dependable performance and maximum output torque in the smallest possible space.

Type SC gearmotors are designed to meet MIL-M-7969.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the speed reduction ratios from page 3110, Type SD — Planetary Gearmotor chart.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

Voltage (vac)	Freq. (Hz)	Poles	Phase	† Schematic Wiring	Lead Color B	Lead Color C	Lead Color Var.	Phasing Capacitor (mfd)(wvac)	Sync. Speed (rpm)	Normal Rated Load @ Sync. Speed (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No.*
27	400	2	1	A			Blk	1.25 100	24,000	.16	.16	11	11	59A1002
27	400	2	3	B			Blk	Not Req'd	24,000	.13	.13	11	11	59A1004
27	400	4	1	A			Grn	1.5 100	12,000	.16	.16	12	12	59A1006
27	400	4	3	B			Grn	Not Req'd	12,000	.20	.20	11	11	59A1008
115	400	2	1	A			Blk	0.068 300	24,000	.16	.16	11	11	59A1012
115	400	2	3	B			Blk	Not Req'd	24,000	.13	.13	11	11	59A1014
115	400	4	1	A			Grn	0.068 300	12,000	.16	.16	12	12	59A1016
115	400	4	3	B			Grn	Not Req'd	12,000	.20	.20	11	11	59A1018
115	400	6	1	C	Blk	Gry		0.22 300	8,000	.10	.10	15	15	59A109
200	400	2	3	B			Blk	Not Req'd	24,000	.13	.13	11	11	59A1022
200	400	4	3	B			Grn	Not Req'd	12,000	.20	.20	11	11	59A1024
115	60	2	1	D		White		2.00 200	3,600	.07	.07	8	8	59A113
115	60	6	1	D		Blk		2.50 200	1,200	.05	.05	9	9	59A112

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage (vac)	Freq. (Hz)	Poles	Phase	† Schematic Wiring	Lead Color B	Lead Color C	Lead Color Var.	Phasing Capacitor (mfd)(wvac)	Min. Speed @ Rated Load (rpm)	Rated Load (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No.*
27	400	2	1	A			Blk	1.50 100	21,000	.20	.20	9	12	59A1001
27	400	2	3	B			Blk	Not Req'd	21,000	.30	.30	7	13	59A1003
27	400	4	1	A			Grn	1.5 100	10,000	.25	.25	13	13	59A1005
27	400	4	3	B			Grn	Not Req'd	10,000	.30	.30	11	13	59A1007
115	400	2	1	A			Blk	0.10 300	21,000	.20	.20	9	12	59A1011
115	400	2	3	B			Blk	Not Req'd	21,000	.30	.30	7	13	59A1013
115	400	4	1	A			Grn	0.068 300	10,000	.25	.25	13	13	59A1015
115	400	4	3	B			Grn	Not Req'd	10,000	.30	.30	11	13	59A1017
115	400	6	1	C	Blk	Gry		0.22 300	6,000	.12	.12	14	14	59A110
200	400	2	3	B			Blk	Not Req'd	21,000	.30	.30	7	13	59A1021
200	400	4	3	B			Grn	Not Req'd	10,000	.30	.30	11	13	59A1023

†See page 3125 for Schematic drawings.

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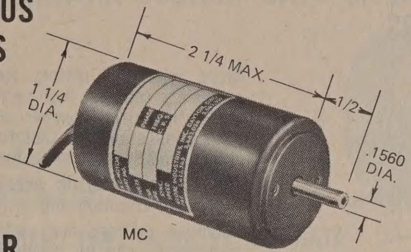
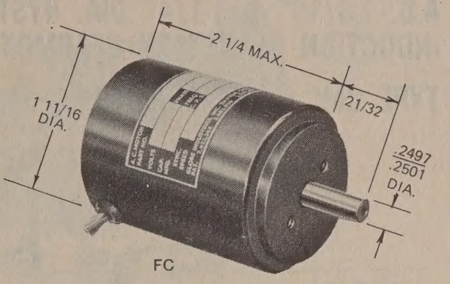
TRW GLOBE MOTORS

A.C. 1-1/4" & 1-11/16" DIA.
HYSTERESIS SYNCHRONOUS AND INDUCTION MOTORS



MC



FC

TYPE MC — BASIC MOTOR

Type MC motors are designed to meet the requirements of MIL-M-7969.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic*	Variable Lead Color	Phasing Capacitor (mfd)	Phasing Capacitor (w.v.a.c.)	Sync Speed (rpm)	Max. Rated Load @ Sync Speed (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Normal Rated Load	Part No. Tapped Hole Mount
115	60	2	1	E	White	1.00	200	3,600	.70	.50	12	12	18A108
115	60	4	1	E	Black	1.00	200	1,800	.65	.50	12	12	18A107
115	60	6	1	F	Yellow	1.00	200	1,200	.50	.40	12	12	18A437
115	400	2	1	A	Black	0.18	350	24,000	.80	.55	23	33	18A1003-2
115	400	2	3	B	Black	Not Required		24,000	.80	.80	20	30	18A1004-2
115	400	4	1	A	Green	0.082	500	12,000	.65	.45	17	20	18A1005-2
115	400	4	3	B	Green	Not Required		12,000	.85	.85	16	21	18A1006-2
115	400	6	1	F	Gray	0.15	400	8,000	.45	.25	16	18	18A250
200	400	2	3	B	Black	Not Required		24,000	.80	.80	20	30	18A1008-2
200	400	4	3	B	Green	Not Required		12,000	.75	.75	14	18	18A1009-2

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic*	Variable Lead Color	Phasing Capacitor (mfd)	Phasing Capacitor (w.v.a.c.)	Min. Speed @ Rated Load (rpm)	Rated Load (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No. Tapped Hole Mount
115	400	2	1	A	Black	0.18	350	21,000	1.0	.8	16	32	18A1003-1
115	400	2	3	B	Black	Not Required		22,000	1.5	1.5	16	40	18A1004-1
115	400	4	1	A	Green	0.082	500	10,000	1.0	1.0	17	28	18A1005-1
115	400	4	3	B	Green	Not Required		10,500	1.5	1.5	14	28	18A1006-1
200	400	2	3	B	Black	Not Required		22,000	1.5	1.5	16	40	18A1008-1
200	400	4	3	B	Green	Not Required		10,500	1.5	1.5	14	28	18A1009-1

TYPE FC — BASIC MOTOR

Type FC motors are available with a wide variety of performance characteristics and are designed to meet the characteristics of MIL-M-7969.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic*	Variable Lead Color B	Variable Lead Color C	Phasing Capacitor (mfd)	Phasing Capacitor (w.v.a.c.)	Sync Speed (rpm)	Max. Rated Load @ Sync Speed (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No. Tapped Hole Mount
115	60	2	1	G	White	Yellow	3.0	200	3,600	1.0	1.0	20	20	75A121-2
115	60	4	1	G	White	Green	2.0	200	1,800	1.0	1.0	11	12	75A120-2
115	60	6	1	H	White	Gray	1.5	200	1,200	0.8	0.8	20	20	75A119-2
115	400	2	1	A		Black	0.22	400	24,000	1.0	1.0	28	40	75A1003-2
115	400	2	3	B		Black	Not Required		24,000	1.0	1.0	23	37	75A1004-2
115	400	4	1	A		Green	0.12	500	12,000	1.0	1.0	19	24	75A1005-2
115	400	4	3	B		Green	Not Required		12,000	1.2	1.2	21	26	75A1006-2
115	400	6	1	H	Black	Gray	1.3	200	8,000	0.8	0.8	35	45	75A107-2
200	400	2	3	B		Black	Not Required		24,000	1.0	1.0	24	38	75A1008-2
200	400	4	3	B		Green	Not Required		12,000	1.2	1.2	21	28	75A1009-2

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic*	Variable Lead Color B	Variable Lead Color C	Phasing Capacitor (mfd)	Phasing Capacitor (w.v.a.c.)	Min. Speed @ Rated Load (rpm)	Rated Load (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Rated Load	Part No. Tapped Hole Mount
115	60	2	1	G	White	Yellow	3.0	200	3,000	1.4	1.4	18	20	75A121-1
115	60	4	1	G	White	Green	2.0	200	1,300	1.0	1.0	11	12	75A120-1
115	60	6	1	H	White	Gray	1.5	200	600	1.0	1.0	15	17	75A119-1
115	400	2	1	A		Black	0.22	400	21,500	1.5	0.8	19	50	75A1003-1
115	400	2	3	B		Black	Not Required		22,500	2.5	2.5	10	65	75A1004-1
115	400	4	1	A		Green	0.12	500	10,000	1.5	1.5	15	31	75A1005-1
115	400	4	3	B		Green	Not Required		11,000	2.5	2.5	12	40	75A1006-1
200	400	2	3	B		Black	Not Required		22,500	2.5	2.5	10	65	75A1008-1
200	400	4	3	B		Green	Not Required		11,000	2.5	2.5	12	40	75A1009-1

*See page 3125 for Schematic drawings.

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

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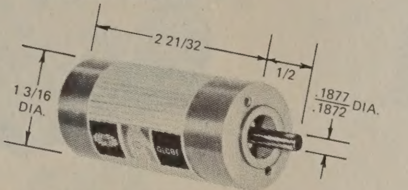
TRW GLOBE MOTORS

A.C. 1-3/16" & 1-1/4" DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS

TYPE CMC — BASIC MOTOR



Globe Type CMC motors are designed to meet requirements for extremely compact high-performance synchronous motors in high-quality industrial/commercial products. They are ideally suited to such applications as dictating machines, recorders, business machines, industrial timers, tools, and controls.

Thermosetting plastic encapsulation provides protection against shock and vibration and is impermeable to dirt and moisture.

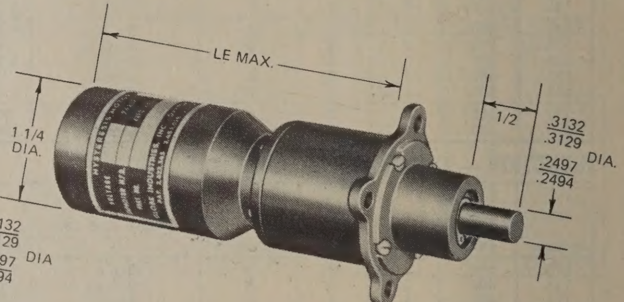
Induction versions and units for operation at other voltages and frequencies can be provided. Single phase operation requires a phasing capacitor (not furnished by Globe). See page 3125 for schematic drawing J.

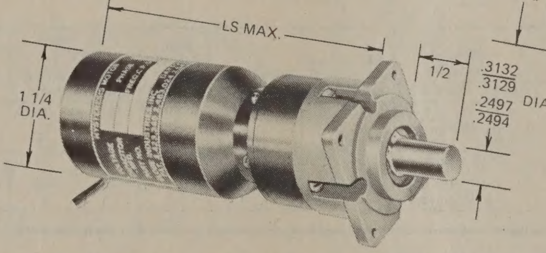
STANDARD PART NUMBERS AND DATA

Voltage (v.a.c.)	Frequency (Hz)	Phase	Speed (rpm)	Torque		Current max. (amps)	Power Input max. (watts)	Capacitor		Standard* Part No.
				max. start (oz. in.)	max. sync. (oz. in.)			(mfd)	(w.v.d.c.)	
115	60	1	3,600	.70	.70	.12	11	1.2	400	144A110-2
115	60	1	1,800	.75	.75	.12	10	1.2	400	144A110-4

TYPE MC — PLANETARY GEARMOTORS

These small, lightweight gearmotors consist of Globe Type MC hysteresis synchronous or induction motors and a precision planetary geartrain. Type MC planetary gearmotors are designed to meet all applicable MIL-specs including high and low temperature and complete environmental protection requirements.





HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic†	Variable Lead Color	Phasing Capacitor (mfd)(wvac)	Motor Sync. Speed (rpm)	Normal Rated Load @ Sync. Speed (oz. in.)	Motor Min. Pull Up Torque (oz. in.)	Max. Power (watts)		Standard Part Number Prefix*					
												Even Ratio		Odd Ratio			
										No Load	Normal Rated Load	eared flange	square flange	square flange		square flange	
												¼" shaft	¼" shaft	¼" shaft	5/16" shaft	¼" shaft	5/16" shaft
115	60	2	1	E	White	1.00 200	3,600	.70	.50	12	12	33A603	33A613	33A648	33A513	33A643	33A638
115	60	4	1	E	Black	1.00 200	1,800	.65	.50	12	12	33A604	33A614	33A649	33A514	33A644	33A639
115	60	6	1	F	Yellow	1.00 200	1,200	.65	.40	12	12	33A1214	33A1215	33A1217	33A1216	33A1219	33A1218
115	400	6	1	F	Gray	0.15 400	8,000	.45	.25	16	18	33A1208	33A1209	33A1211	33A1210	33A1213	33A1212

												All Ratios			
												eared flange		square flange	
												¼" shaft	5/16" shaft	¼" shaft	5/16" shaft
115	400	2	1	A	Black	.18 350	24,000	.80	.55	23	33	33A2008	33A2108	33A2208	33A2308
115	400	2	3	B	Black	Not Req'd	24,000	.80	.80	20	30	33A2010	33A2110	33A2210	33A2310
115	400	4	1	A	Green	0.082 500	12,000	.65	.45	17	20	33A2012	33A2112	33A2212	33A2312
115	400	4	3	B	Green	Not Req'd	12,000	.85	.85	16	21	33A2014	33A2114	33A2214	33A2314
200	400	2	3	B	Black	Not Req'd	24,000	.80	.80	20	30	33A2018	33A2118	33A2218	33A2318
200	400	4	3	B	Green	Not Req'd	12,000	.75	.75	14	18	33A2020	33A2120	33A2220	33A2320

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage	Frequency (Hz)	Poles	Phase	Schematic†	Variable Lead Color	Phasing Capacitor (mfd)(wvac)	Motor Min. Speed @ Rated Load (rpm)	Normal Rated Load (oz. in.)	Motor Min. Pull Up Torque (oz. in.)	Max. Power (watts)		Standard Part Number Prefix*			
												All Ratios			
										No Load	Normal Rated Load	eared flange		square flange	
												¼" shaft	5/16" shaft	¼" shaft	5/16" shaft
115	400	2	1	A	Black	.18 350	21,000	1.0	0.8	16	32	33A2007	33A2107	33A2207	33A2307
115	400	2	3	B	Black	Not Req'd	22,000	1.5	1.5	16	40	33A2009	33A2109	33A2209	33A2309
115	400	4	1	A	Green	0.082 500	10,000	1.0	1.0	17	28	33A2011	33A2111	33A2211	33A2311
115	400	4	3	B	Green	Not Req'd	10,500	1.5	1.5	14	28	33A2013	33A2113	33A2213	33A2313
200	400	2	3	B	Black	Not Req'd	22,000	1.5	1.5	16	40	33A2017	33A2117	33A2217	33A2317
200	400	4	3	B	Green	Not Req'd	10,500	1.5	1.5	14	28	33A2019	33A2119	33A2219	33A2319

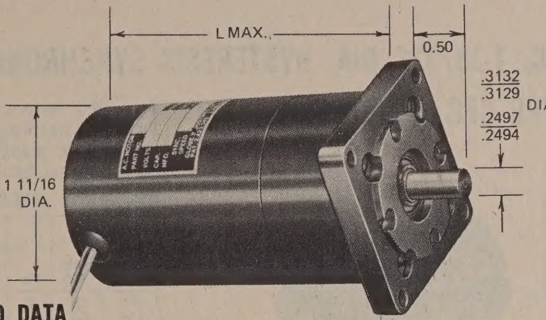
†See page 3125 for Schematic drawings.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the even speed reduction ratio desired from page 3117 or the odd speed reduction ratio from page 3123.

TRW GLOBE MOTORS

A.C. 1-11/16″ DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS TYPE FC



Globe Type FC planetary gearmotors offer 83 even (see shaded area page 11) and 18 odd ratios ranging from 4:1 to 46,656:1. Special geartrains are available with ratios up to 17,000,000:1.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

Voltage	Fre-quency (Hz)	Poles	Phase	† Sche-matic	Lead Color B	Lead Color C	Phasing Capacitor (mfd)	Phasing Capacitor (wvac)	Motor Sync. Speed (rpm)	Normal Rated Load Sync. Speed (oz. in.)	Motor Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Normal Rated Load	Standard Part No. Prefix* Odd Ratio ¼″ shaft	Standard Part No. Prefix* Odd Ratio 5/16″ shaft	Standard Part No. Prefix* Even Ratio ¼″ shaft
115	60	2	1	G	White	Yellow	3.0	200	3,600	1.0	1.0	20	20	83A510	83A116	83A138
115	60	4	1	G	White	Green	2.0	200	1,800	1.0	1.0	11	12	83A509	83A115	83A137
115	60	6	1	H	White	Gray	1.5	200	1,200	.8	.8	20	20	83A508	83A114	83A136
115	400	6	1	H	Black	Gray	1.3	200	8,000	.8	.8	35	45	83A113	83A108	83A122

Voltage	Fre-quency (Hz)	Poles	Phase	† Sche-matic	Lead Color	Phasing Capacitor (mfd)	Phasing Capacitor (wvac)	Motor Sync. Speed (rpm)	Normal Rated Load Sync. Speed (oz. in.)	Motor Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Normal Rated Load	All Ratios ¼″ shaft	All Ratios 5/16″ shaft
115	400	2	1	A	Black	0.22	400	24,000	1.0	1.0	28	40	83A1008	83A1108
115	400	2	3	B	Black	Not Required		24,000	1.0	1.0	23	37	83A1010	83A1110
115	400	4	1	A	Green	0.12	500	12,000	1.0	1.0	19	24	83A1012	83A1112
115	400	4	3	B	Green	Not Required		12,000	1.2	1.2	21	26	83A1014	83A1114
200	400	2	3	B	Black	Not Required		24,000	1.0	1.0	24	38	83A1018	83A1118
200	400	4	3	B	Green	Not Required		12,000	1.2	1.2	21	28	83A1020	83A1120

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage	Fre-quency (Hz)	Poles	Phase	† Sche-matic	Lead Color B C D	Phasing Capacitor (mfd)	Phasing Capacitor (wvac)	Motor Min. Speed @ Rated Load (rpm)	Rated Load (oz. in.)	Min. Pull Up Torque (oz. in.)	Max. Power (watts) No Load	Max. Power (watts) Normal Rated Load	Standard Part No. Prefix* All Ratios ¼″ shaft	Standard Part No. Prefix* All Ratios 5/16″ shaft
115	400	2	1	A	Black	0.22	400	21,500	1.5	.8	19	50	83A1007	83A1107
115	400	2	3	B	Black	Not Required		22,500	2.5	2.5	10	65	83A1009	83A1109
115	400	4	1	A	Green	0.12	500	10,000	1.5	1.5	15	31	83A1011	83A1111
115	400	4	3	B	Green	Not Required		11,000	2.5	2.5	12	40	83A1013	83A1113
200	400	2	3	B	Black	Not Required		22,500	2.5	2.5	10	65	83A1017	83A1117
200	400	4	3	B	Green	Not Required		11,000	2.5	2.5	12	40	83A1019	83A1119

†See page 3125 for Schematic drawings.

DIMENSIONS — EVEN RATIOS

Speed Reduction Ratio	Dimension LE	Dimension LS	Dim. "L"	Speed Reduction Ratio	Dimension LE	Dimension LS	Dim. "L"
4:1	2.87	3.28	3.190	720:1	3.28	3.68	3.594
5:1	2.87	3.28	3.190	750:1	3.28	3.68	3.594
6:1	2.87	3.28	3.190	864:1	3.28	3.68	3.594
16:1	2.87	3.28	3.190	900:1	3.28	3.68	3.594
20:1	2.87	3.28	3.190	1,024:1	3.65	4.06	3.964
24:1	2.87	3.28	3.190	1,080:1	3.28	3.68	3.594
25:1	2.87	3.28	3.190	1,280:1	3.65	4.06	3.964
30:1	2.87	3.28	3.190	1,296:1	3.28	3.68	3.594
36:1	2.87	3.28	3.190	1,536:1	3.65	4.06	3.964
64:1	3.02	3.42	3.325	1,600:1	3.65	4.06	3.964
80:1	3.02	3.42	3.325	1,920:1	3.65	4.06	3.964
96:1	3.02	3.42	3.325	2,000:1	3.65	4.06	3.964
100:1	3.02	3.42	3.325	2,304:1	3.65	4.06	3.964
120:1	3.02	3.42	3.325	2,400:1	3.65	4.06	3.964
125:1	3.02	3.42	3.325	2,500:1	3.65	4.06	3.964
144:1	3.02	3.42	3.325	2,880:1	3.65	4.06	3.964
150:1	3.02	3.42	3.325	3,000:1	3.65	4.06	3.964
180:1	3.02	3.42	3.325	3,125:1	3.65	4.06	3.964
216:1	3.02	3.42	3.325	3,456:1	3.65	4.06	3.964
256:1	3.28	3.68	3.594	3,600:1	3.65	4.06	3.964
320:1	3.28	3.68	3.594	3,750:1	3.65	4.06	3.964
384:1	3.28	3.68	3.594	4,096:1	3.78	4.18	4.099
400:1	3.28	3.68	3.594	4,320:1	3.65	4.06	3.964
480:1	3.28	3.68	3.594	4,500:1	3.65	4.06	3.964
500:1	3.28	3.68	3.594	5,120:1	3.78	4.18	4.090
576:1	3.28	3.68	3.594	5,184:1	3.65	4.06	3.964
600:1	3.28	3.68	3.594	5,400:1	3.65	4.06	3.964
625:1	3.28	3.68	3.594	6,144:1	3.78	4.18	4.099

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the even or odd speed reduction ratio desired. See page 3117 for Torque Multiplier and Max. Continuous Torque. For higher ratios consult factory.

DIMENSIONS — ODD RATIOS

Speed Reduc-tion Ratio	Torque Multi-plier	Gear Train Max. Cont. Rating (oz. in.)	Dimension LE	Dimension LS	Dim. "L"
4.33:1	3.2	5.4	2.87	3.28	3.190
5.28:1	4	6.8	2.87	3.28	3.190
18.78:1	12	20	2.87	3.28	3.190
27.94:1	17	29	2.87	3.28	3.190
81.37:1	41	70	3.02	3.42	3.325
121.1:1	62	105	3.02	3.42	3.325
147.7:1	75	128	3.02	3.42	3.325
352.6:1	145	247	3.28	3.68	3.594
524.6:1	215	366	3.28	3.68	3.594
639.9:1	262	445	3.28	3.68	3.594
780:6:1	320	544	3.28	3.68	3.594
1,528:1	500	850‡	3.66	4.06	3.964
2,273:1	740	1250‡	3.66	4.06	3.964
3,382:1	1100	1250‡	3.66	4.06	3.964
4,126:1	1350	1250‡	3.66	4.06	3.964
6,621:1	1730	1250‡	3.78	4.18	4.099
9,851:1	2580	1250‡	3.78	4.18	4.099
12,016:1	3150	1250‡	3.78	4.18	4.099
17,879:1	4700	1250‡	3.78	4.18	4.099
21,808:1	5700	1250‡	3.78	4.18	4.099

‡¼ O.D. shafts are limited to 600 oz. in.

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

Momentary Stall Torque = 5 x Max. Cont. Torque.

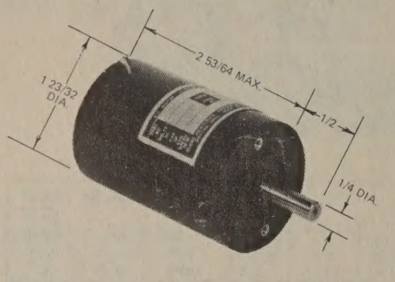
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

TRW GLOBE MOTORS, an Electronic Components Division of TRW INC. 2275 STANLEY AVE. DAYTON, OHIO 45404 (513) 228-3171

TRW GLOBE MOTORS

A.C. 1-23/32″ DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION MOTORS

TYPE CFC — BASIC MOTOR



Type CFC motors are totally enclosed for dirt and moisture resistance, and have life-lubricated bearings. Induction versions, units for operation at other voltages and frequencies, and integral planetary geartrains are available. Single phase operation requires a phasing capacitor (not furnished by Globe).

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

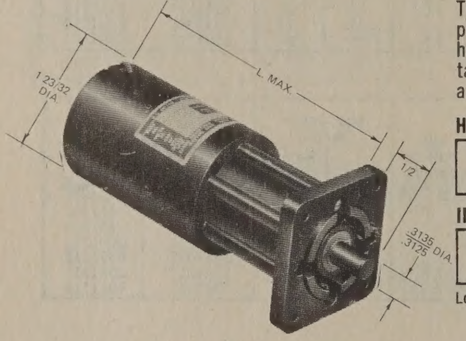
Voltage (v.a.c.)	Freq. (Hz)	Ph.	Capacitor (mfd)	Capacitor (v.a.c.)	Speed no load (rpm)	Speed rated load (rpm)	Torque rated load (oz. in.)	Torque stall (oz. in.)	Power no load (watts)	Power rated load (watts)	Schematic	Standard Part No.
115	60	1	1.0	200	3600		1.40	1.80	14	15	K	138A201-2
115	60	1	1.0	200	1800		2.00	2.25	16	17	L	138A201-4
115	60	1	1.5	200	1200		1.20	1.50	15	16	M	138A201-6

INDUCTION — STANDARD PART NUMBERS AND DATA

Voltage (v.a.c.)	Freq. (Hz)	Ph.	Capacitor (mfd)	Capacitor (v.a.c.)	Speed no load (rpm)	Speed rated load (rpm)	Torque rated load (oz. in.)	Torque stall (oz. in.)	Power no load (watts)	Power rated load (watts)	Schematic	Standard Part No.
115	60	1	1.0	200	3500	3000	1.5	2.5	14	15	K	138A202-2
115	60	1	3.5	200	1700	1550	.75	3.8	16	17	L	138A202-4
115	60	1	1.5	200	1000	800	.5	2.0	15	16	M	138A202-6

TYPE CFC — PLANETARY GEARMOTORS

COMMERCIAL MOTORS



Type CFC planetary gearmotors are lightweight a.c. commercial/industrial units designed to provide performance and size advantages of military gearmotors in lower cost package. Both hysteresis synchronous and induction versions can be provided with any of 83 standard planetary geartrains with speed reduction ratios (see shaded areas page 11) from 4:1 to 46,656:1, and torques to 1000 oz. in.

HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

115	60	1	1.0	200	3600	1.40	1.80	14	15	K	230A395
115	60	1	3.5	200	1800	2.00	2.25	16	16	L	230A396
115	60	1	1.5	200	1200	1.20	1.50	15	16	M	230A397

INDUCTION — STANDARD PART NUMBERS AND DATA

115	60	1	1.0	200	**	1.5	2.5	14	16	K	230A398
115	60	1	3.5	200	**	.75	3.8	16	17	L	230A399
115	60	1	1.5	200	**	.5	2.0	15	16	M	230A400

Low slip-high torque units available on special request.

PERFORMANCE CHARACTERISTICS

Speed Reduction Ratio	Dim. "L"	Gearmotor Output Speeds** 3,600 rpm input	1,800 rpm input	1,200 rpm input
4:1	4.01	900.0	450.0	300.0
5:1	4.01	720.0	460.0	240.0
6:1	4.01	600.0	300.0	200.0
16:1	4.25	225.0	112.5	75.0
20:1	4.25	180.0	90.0	60.0
24:1	4.25	150.0	75.0	50.0
25:1	4.25	144.0	72.0	48.0
30:1	4.25	120.0	60.0	40.0
36:1	4.25	100.0	50.0	33.33
64:1	4.48	56.25	28.12	18.75
80:1	4.48	45.00	22.50	15.00
96:1	4.48	37.50	18.75	12.50
100:1	4.48	36.00	18.00	12.00
120:1	4.48	30.00	15.00	10.00
125:1	4.48	28.80	14.40	9.60
144:1	4.48	25.00	12.50	8.333
150:1	4.48	24.00	12.00	8.000
180:1	4.48	20.00	10.00	6.666
216:1	4.48	16.66	8.333	5.555
256:1	4.68	14.06	7.031	4.687
320:1	4.68	11.25	5.625	3.750
384:1	4.68	9.375	4.687	3.125
400:1	4.68	9.000	4.500	3.000
480:1	4.68	7.500	3.750	2.500
500:1	4.68	7.200	3.600	2.400
576:1	4.68	6.250	3.125	2.083
600:1	4.68	6.000	3.000	2.000
625:1	4.68	5.760	2.880	1.920

Speed Reduction Ratio	Dim. "L"	Gearmotor Output Speeds** 3,600 rpm input	1,800 rpm input	1,200 rpm input
720:1	4.68	5.000	2.500	1.666
750:1	4.68	4.800	2.400	1.600
864:1	4.68	4.166	2.083	1.388
900:1	4.68	4.000	2.000	1.333
1,024:1	4.95	3.515	1.757	1.172
1,080:1	4.68	3.333	1.666	1.111
1,280:1	4.95	2.812	1.406	0.938
1,296:1	4.68	2.777	1.388	0.926
1,536:1	4.95	2.343	1.171	0.781
1,600:1	4.95	2.250	1.125	0.750
1,920:1	4.95	1.875	0.937	0.625
2,000:1	4.95	1.800	0.900	0.600
2,304:1	4.95	1.562	0.781	0.521
2,400:1	4.95	1.500	0.750	0.500
2,500:1	4.95	1.440	0.720	0.480
2,880:1	4.95	1.250	0.625	0.417
3,000:1	4.95	1.200	0.600	0.400
3,125:1	4.95	1.152	0.576	0.384
3,456:1	4.95	1.041	0.520	0.347
3,600:1	4.95	1.000	0.500	0.333
3,750:1	4.95	0.960	0.480	0.320
4,096:1	5.18	0.879	0.439	0.293
4,320:1	4.95	0.833	0.417	0.278
4,500:1	4.95	0.800	0.400	0.267
5,120:1	5.18	0.703	0.352	0.234
5,184:1	4.95	0.694	0.347	0.231
5,400:1	4.95	0.667	0.333	0.222
6,144:1	5.18	0.586	0.293	0.195

Speed Reduction Ratio	Dim. "L"	Gearmotor Output Speeds** 3,600 rpm input	1,800 rpm input	1,200 rpm input
6,400:1	5.18	0.563	0.281	0.188
6,480:1	4.95	0.556	0.278	0.185
7,680:1	5.18	0.469	0.234	0.156
7,776:1	4.95	0.463	0.231	0.154
8,000:1	5.18	0.450	0.225	0.150
9,216:1	5.18	0.391	0.195	0.130
9,600:1	5.18	0.375	0.182	0.125
10,000:1	5.18	0.360	0.180	0.120
11,520:1	5.18	0.313	0.156	0.104
12,000:1	5.18	0.300	0.150	0.100
12,500:1	5.18	0.288	0.144	0.096
13,824:1	5.18	0.260	0.130	0.087
14,400:1	5.18	0.250	0.125	0.083
15,000:1	5.18	0.240	0.120	0.080
15,625:1	5.18	0.230	0.115	0.077
17,280:1	5.18	0.208	0.104	0.069
18,000:1	5.18	0.200	0.100	0.067
18,750:1	5.18	0.192	0.096	0.064
20,736:1	5.18	0.183	0.087	0.058
21,600:1	5.18	0.167	0.083	0.056
22,500:1	5.18	0.160	0.080	0.053
25,920:1	5.18	0.139	0.069	0.047
27,000:1	5.18	0.133	0.067	0.044
31,104:1	5.18	0.116	0.058	0.039
32,400:1	5.18	0.111	0.056	0.037
38,880:1	5.18	0.093	0.046	0.031
46,656:1	5.18	0.077	0.039	0.026

**Synchronous Motor. Output Torque = Torque Multiplier x Motor Torque.
Torque Multiplier = Reduction Ratio x Efficiency. Torque Max. Cont. Rating Refers to Max. Cont. Duty Rating of Geartrain.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number prefix from the standard part number and data table, plus speed reduction ratio desired. See page 3117 for Torque Multiplier and Max. Continuous Torque.

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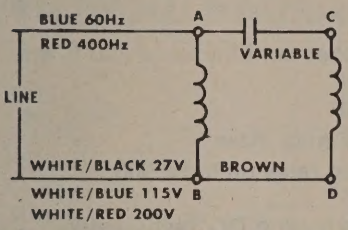
TRW GLOBE MOTORS

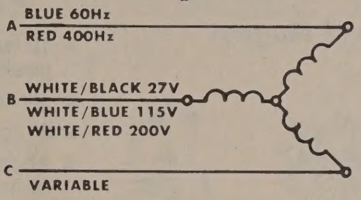
SCHEMATIC WIRING

A


BLUE 60Hz
RED 400Hz
A
C
VARIABLE
LINE
WHITE/BLACK 27V
BROWN
WHITE/BLUE 115V
B
D
WHITE/RED 200V

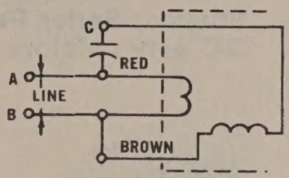
CW rotation (viewing shaft end). For CCW rotation reverse C and D.

B


A
BLUE 60Hz
RED 400Hz
B
WHITE/BLACK 27V
WHITE/BLUE 115V
WHITE/RED 200V
C
VARIABLE

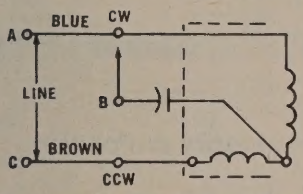
ABC phase sequence for CW rotation (viewing shaft end). For CCW rotation reverse any two leads.

C


C
RED
A
LINE
B
BROWN

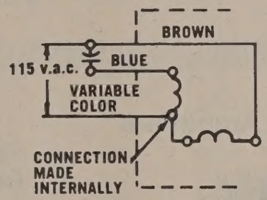
CW rotation (viewed from shaft end). For CCW rotation reverse A and B.

D


BLUE
CW
A
LINE
B
BROWN
C
CCW

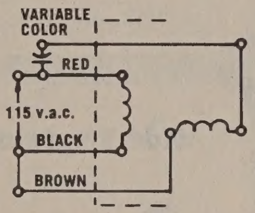
Single phase only. Capacitor A and B for CW rotation (viewed from shaft end). B to C for CCW rotation.

E


BROWN
115 v.a.c.
BLUE
VARIABLE COLOR
CONNECTION MADE INTERNALLY

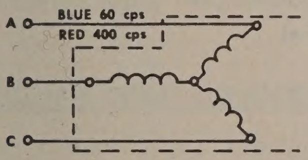
CW rotation (viewed from shaft end). For CCW rotation connect line to blue instead of brown.

F


VARIABLE COLOR
RED
115 v.a.c.
BLACK
BROWN

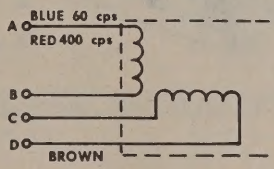
CW rotation (viewed from shaft end). For CCW rotation reverse red and black.

G


A
BLUE 60 cps
RED 400 cps
B
C

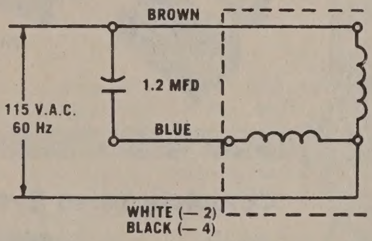
To run single-phase, connect line to A and C; for clockwise rotation, connect capacitor B to C; for counterclockwise rotation, connect capacitor B to A.

H


A
BLUE 60 cps
RED 400 cps
B
C
D
BROWN

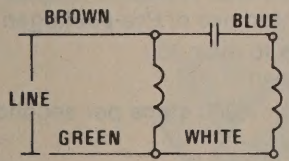
To run single-phase, connect line to A and B; for clockwise rotation, connect B to D and condenser to A and C; for counterclockwise rotation, reverse C and D.

J


BROWN
1.2 MFD
115 V.A.C. 60 Hz
BLUE
WHITE (— 2)
BLACK (— 4)

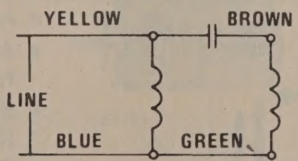
CW rotation (viewed from shaft end). For CCW rotation, connect line to blue and white (—2) or to blue and black (-4).

K


BROWN
BLUE
LINE
GREEN
WHITE

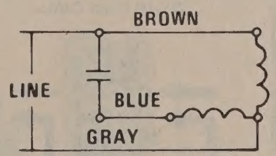
CW rotation (viewing shaft end). For CCW rotation, connect line to blue and white.

L


YELLOW
BROWN
LINE
BLUE
GREEN

CW rotation (viewing shaft end). For CCW rotation, reverse brown and green.

M


BROWN
LINE
BLUE
GRAY

CW rotation (viewing shaft end). For CCW rotation, connect line to blue and gray.

TRW GLOBE FEATURES

All motors have double-shielded, life-lubed ball bearings (—55°C to 85°C) and precision ground stainless steel shafts. Gearmotor shafts may be either stainless or carbon steel. Shaft variations available include length, smaller diameter, flats, pinions, gears, holes, threaded ends, and tapers.

D.C. motors have a life of 1,000 hours continuous duty for 27 v.d.c. models. A.C. motors have a life of 200 to 5,000 hours continuous duty depending on voltage, frequency, number of poles, and gear ratio.

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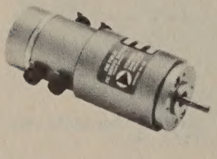
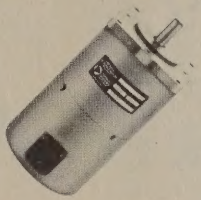
Permanent Magnet

DC Servo Motors & Servo Control Systems

for Analog or High-speed Stepper Applications

Snapper Series Permanent Magnet DC Servo Motors


2212

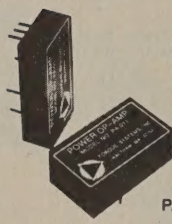

5115

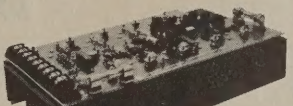
3323

*Optional for all motors

- 10 oz. - inches continuous to 100 ft. lbs. peak torque
- .01 to 15 HP
- 2″ to 9.8″ Frame Sizes
- Acceleration rates up to 50,000 radians/sec^2
- Low Ripple Mating DC Tachometers*
- Integrally Mounted Optical Encoders*
- Double Shaft Extension on Motor/Tachometers*
- Low Cost for OEM use

Wide Bandwidth DC Servo Amplifiers


PA-011

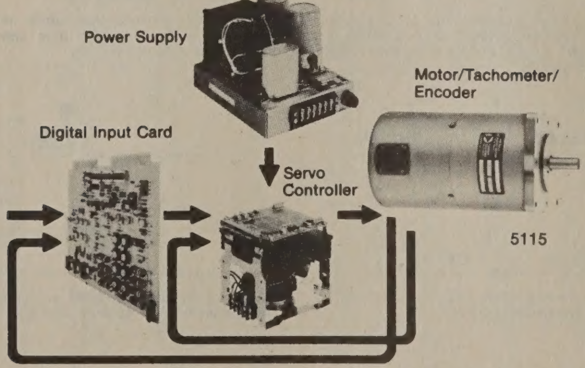

PA-601

PA-122

For Accurate Velocity or Position Control

- Transistorized
- High Gain
- Short Circuit protected
- Priced for volume use
- Bi-directional

Complete Servo Systems



COMPLETE SYSTEMS include, as required, the following Torque Systems' hardware: Motor/Tachometer/Encoder Assembly; Rate Loop Controller Module; Line to DC Power Supply Module; Digital Input Card(s).

For Analog or Digital Velocity or Position – Input Commands can range from Manual to Computer

- Horsepower Ratings 1/20 to over 1/2 HP
- Available as Modules of Pre-packaged
- Accelerations to over 300 rpm/millisecond
- Slew Rates to 50,000 steps per second (3,000 rpm)
- Overshoot Control
- **Microprocessor Based Systems with Programmable Velocity, Acceleration and Position**
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2440 WEST CARSON STREET • TORRANCE, CALIFORNIA 90501 • (213) 328-2504, TWX: 910-349-6250

Vernitorq® BRUSHLESS DC TORQUE MOTORS

Type Number		VBTM10-A	VBTM12-B	VBTM15-A	VBTM18-A	VBTM23-B	VBTM26-A	VBTM34-B	VBTM52-A
Peak Torque	(oz-in)	1.3	4.5	5	12	25	18	130	600
Power @ Peak Torque	(watts)	16	36	28	67	63	57	278	360
Continuous Torque	(oz-in)	.5	.9	2.8	4	7	6	40	150
Power @ Continuous Torque	(watts)	2.4	1.5	9	8	5	6.5	27	23
Input Volt @ Cont. Torque	(volts)	12	4	24	15	7	22	16	10
Torque Sensitivity	(oz-in/amp)	2.5	2.25	7.5	8	10	6.5	24	67
D. C. Resistance	(ohms)	60	9	62	30	10	7.5	9.5	4.5
Angular Excursion	(degrees)	120	120	50	120	60	60	120	40
Back EMF	(volts/rad/sec)	.018	.017	.055	.060	.100	.125	.195	.480
Elec. Time Constant L/R	(seconds)	$3x10^{-4}$	$3x10^{-4}$	$2.2x10^{-4}$	$6x10^{-4}$	$1.2x10^{-3}$	$3.2x10^{-3}$	$3.2x10^{-3}$	$7.0x10^{-3}$
Rotor Inertia	(oz-in sec^2)	$1.8x10^{-5}$	$1.7x10^{-4}$	$3.7x10^{-4}$	$6.9x10^{-4}$	$1.76x10^{-3}$	$1.95x10^{-3}$	$2.2x10^{-2}$	$12x10^{-2}$
Viscous Damping	(oz-in/rad/sec)								
Infinite Source Impedance		$1.5x10^{-5}$	$7x10^{-5}$	$8.3x10^{-5}$	$5x10^{-4}$	$3x10^{-2}$	$3.2x10^{-2}$	$1x10^{-2}$	$2x10^{-2}$
Zero Source Impedance		$7.5x10^{-4}$	$4.4x10^{-3}$	$6.6x10^{-3}$	$3.3x10^{-2}$	0.10	.10	.50	7.1
Weight	(oz) Max.	1.5	2.5	3	3.9	8	7	26	88
Dimensions	(inches)								
	A	1.000	1.178	1.500	1.719	2.270	2.500	3.400	5.250
	B	.350	.610	.500	.940	.720	.500	1.500	1.700
	C	.125	.125	.125	.187	.250	250	.250	.500

NOTES: 1. Vernitorq motors have no friction or ripple torque.

2. Vernitorq brushless tachometer generators are also available in the various frame sizes.

Vernitorq® BRUSHLESS DC TORQUE MOTORS

▪ Limited rotation, wide angle ▪ Infinite resolution for precise positioning ▪ Direct drive for increased sensitivity, and response ▪ Simplified design for economy, compact packaging.

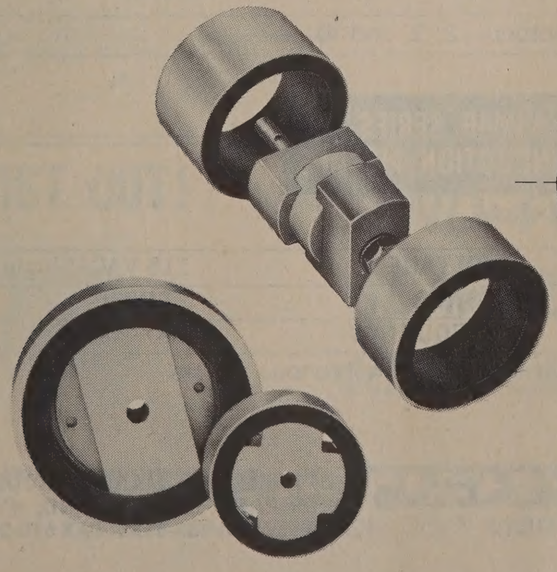
Elimination of brushes, use of toroidal field windings and permanent magnet rotors provides smooth operation without slot effect. Infinite resolution and high linearity result, allowing these motors to provide high accuracy in positioning, actuating, tensioning, measuring and indicating applications for both military and industrial use.

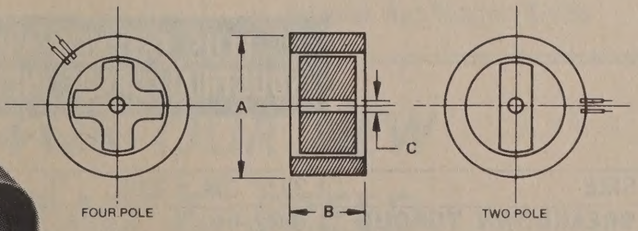
Vernitorq motors develop high torque with low input power and high acceleration rates which make it possible to couple them directly to the driven load without gears. The elimination of gearing aids response and eliminates backlash, gear tooth resilience, acceleration attenuation and other disadvantages of gearing.

Brushless and gearless operation eliminates electrical and mechanical noise; and explosion hazard. It also reduces the number of moving parts and associated friction wear.

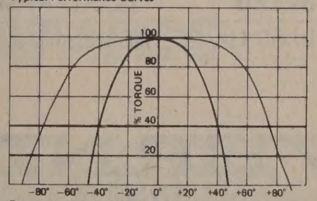
Vernitorq brushless DC torque motors are available in two and four-pole configurations, in a variety of sizes and outputs.

The motors are normally supplied "frameless" — without housing, shaft and bearings. Housed versions, with or without mounting flanges, are also available for all units.





Typical Performance Curves



Output torque vs angular excursion for input current.

● 2 POLE MOTOR ● 4 POLE MOTOR

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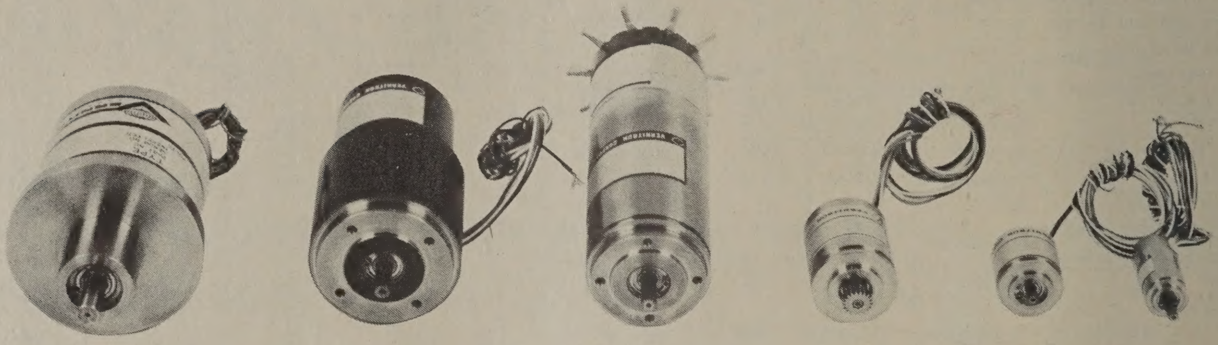
the best known name in

MOTORS, TACHOMETERS, INTEGRATORS & STEPPER MOTORS

Over 1500 standard designs
or, custom designed to YOUR requirements



ALL UNITS WITH AND WITHOUT GEARHEADS

the full range of motors

TYPES		Servomotors Viscous Damped Motors Inertially Damped Motors	Hysteresis Synchronous Motors Stepper Motors Motor Generators Rate Motor Tachometers	Computing Motor Tachometers Integrating Motor Tachometers Spin (Gyro) Motors
SIZES	BuOrd Size 5 (0.5″ Dia.) to BuOrd Size 23 (2.250″ Dia.)			
SPEEDS	900 RPM to 36,000 RPM (Stepper Motors in Steps of 7.5°, 15°, 45°, and 90°)			
FREQUENCY	50, 60, 80, 400, 420, 480, 1000, and 1200 (Sine or Square Wave) Variable Frequency Motors are also standard at Vernitron			
VOLTAGES	6.3V (Filament) to 280V			
PHASES	1, 2, and 3 (In Stepper Motors — 2, 3, and 4)			

PLUS THE NEW 14M4B SERIES INDUSTRIAL GRADE INDUCTION MOTORS

typical data

SIZE	1.375″ Dia. x 2.5″	**VOLTAGE**	115 VAC, Single ϕ
BREAKDOWN TORQUE	1.0 Oz.-In.	**POWER**	27 Watts
NO LOAD SPEED	11,000 RPM	**FREQUENCY**	400 Hz

Also available in 60 Hz, 26 VAC versions. Ask about our industrial synchronous motors.

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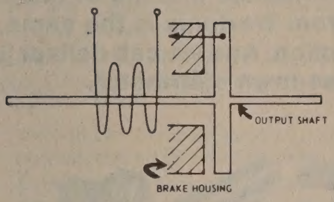
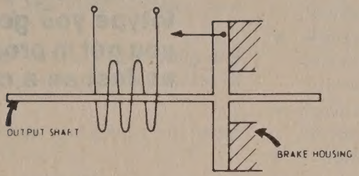
DEPT. EM, 300 MARCUS BOULEVARD
DEER PARK, LONG ISLAND, NY 11729
PHONE (516) 586-5100 TWX 510-227-6079

SCHEMATICS

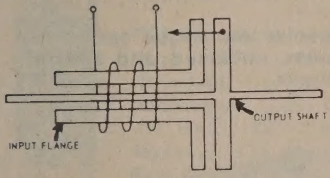
TYPE — MB
TYPE — WMB


OUTPUT SHAFT
BRAKE HOUSING

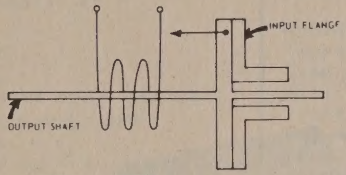
TYPE — SB
TYPE — WSB


OUTPUT SHAFT
BRAKE HOUSING

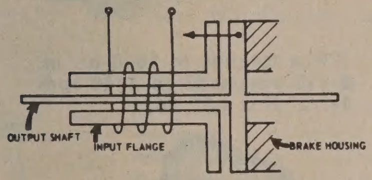
TYPE — MC
TYPE — WMC


OUTPUT SHAFT
INPUT FLANGE

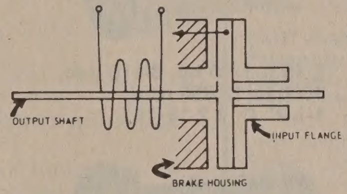
TYPE — SC
TYPE — WSC


INPUT FLANGE
OUTPUT SHAFT

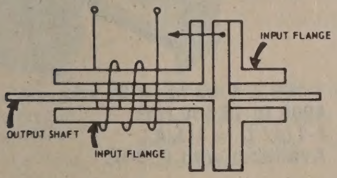
TYPE — MCSB
TYPE — WMCSB


OUTPUT SHAFT
INPUT FLANGE
BRAKE HOUSING

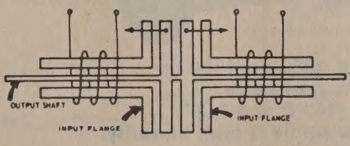
TYPE — SCMB
TYPE — WSCMB


OUTPUT SHAFT
INPUT FLANGE
BRAKE HOUSING

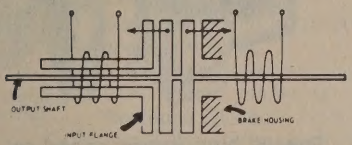
TYPE — MCSC
TYPE — WMCSC


INPUT FLANGE
OUTPUT SHAFT
INPUT FLANGE

TYPE — MCMC
TYPE — WMCMC


OUTPUT SHAFT
INPUT FLANGE
INPUT FLANGE

TYPE — MCMB
TYPE — WMCMB


OUTPUT SHAFT
INPUT FLANGE
BRAKE HOUSING

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* FORMERLY DIVISION OF DYNAMIC INSTRUMENT CORP.

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- **Precision** Instrument Type Standard Length
- **Precision** Instrument Type Wafer Length
- **Industrial Type** (Enclosed Frame)
- **Industrial Type** (Open Frame)
- **Unitized Modules** (In-line Servo Assemblies)
- **Special** Application Units

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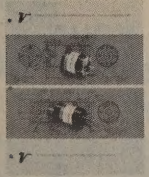

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pm motors

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servo motors
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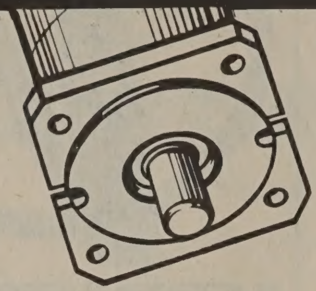
ac & dc tachometers



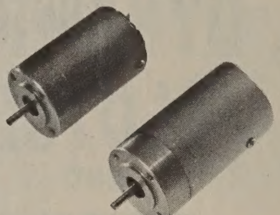
1/100 hp to 1/4 hp

military & commercial

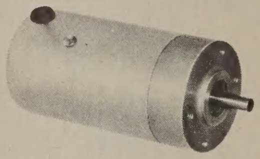
The quality, performance and life of the prototype you get from Wertonix is the same as you get in production. And we can deliver just as fast as a cross-town distributor.

Special low torque speed reducer, enclosed and special blower.

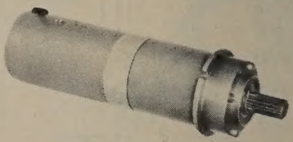
Ratings @ continuous duty.



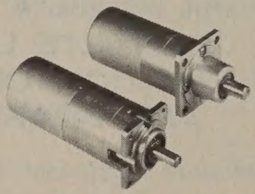
1/100 & 1/65 hp, 3-50 vdc, 4500 to 24,000 rpm, 1-1/4 D. x 2-1/32".



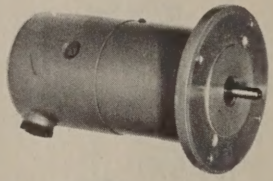
1/45 & 1/30 hp, 3-115 vdc, 3500 to 12,650 rpm, 1-1/2" D. x 2-15/16".



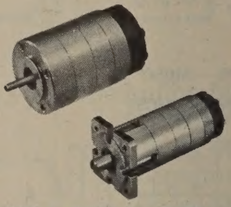
G'Box torques to 1600 oz. in., 3-115 vdc, 0.53 to 3446 rpm, 1-1/2" D. x 4-37/64".



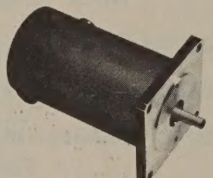
G'Box torques to 1250 oz. in., 3-50 vdc, 0.2 to 6300 rpm, 1-1/4" D. x 4."



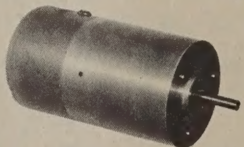
50 & 100 vdc/1000 rpm tach/generator, 3-1/14" D. x 6-1/2"; Low ripple & high linearity.



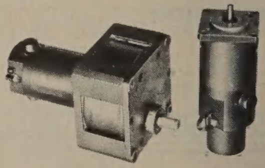
1/100 & 1/65 hp, 3-50 vdc, 4900 to 16,400 rpm, 1-1/4" D. x 1-3/4". Available with G'Box.



1/12 & 1/10 hp, 6-115 vdc, 2600 to 8550 rpm, 2-1/8" D. x 4".



7, 20, 35, & 45 vdc/1,000 rpm tach/generator, 1-1/4" D. x 3-1/4". Ripple — 3% RMS, Alnico V magnet for good linearity.



Special high torque speed reducer with tach/generator.

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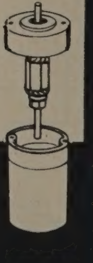
Work directly with the people who design and build to your standard or special requirements — from sketch or phone call. We can build to specs from scratch, often within 24 hours.



WERTRONIX

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BULOVA® / SCANNERS & CHOPPERS

DRIVERS — LOW COST LOCK IN AMPLIFIER

OPERATING PRINCIPLE AND BASIC FEATURES

The same basic principle, mechanical resonance, is involved in the three basic types of units which are the foundation of Bulova's line of Optical Scanners and Light Choppers. (The fourth, the linear scanner, is a galvanometer movement)

Application of this principle enables design of optical scanning and chopping devices which have many advantageous properties. Chief of these are:

- Reliability: No rotating parts, no bearings, no lubrication; hence no wear and no service problems
- Excellent Accuracy: ±1% usual ±0.1 attainable. Can be any discrete fixed frequency, even fractions of a hertz
- Small Size: Down to 0.5 in.^{3} and less than 0.5 oz.
- Low Power: In milliwatt range.
- Virtually Drift Free: Exceptional stability with time, excellent temperature characteristics
- Reference Signals: Inherently available through driver. Also, an optional, isolated pick-up can be incorporated directly in the scanner or chopper as a signal source.
- Environment: Withstand vibration to 20g, shock to 100g; temperature from cryogenic to 250°C; altitude to space vacuum; radiation >2 x 10^{13} NVT.
- Raster Scan: X-Y mounts and slaved units provide synchronized raster scan.

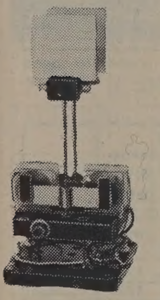
Torsion Bar
Type L45

SCANNERS

Frequencies from d.c. to 16 kHz
Scan Angle to 30°

TORSION BAR

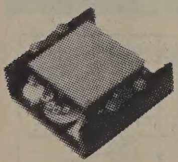
Type L45: Single Mirror
Type L44: Dual Mirror
Frequency: L45, 600 Hz to 16 kHz; L44, 100 Hz to 1000 Hz (any fixed discrete)
Accuracy: ±2% standard
Scan Angle, P to P: 10° max reduces to 2° at higher frequencies. L44, 20° max
Mirror Size: 30mm x 30mm max, reduces as frequency increases
Power: 500 milliwatts, max. with driver



Dual Mirror
Torsion Bar
Type L44

TAUT BAND TYPE L50

Frequency: 5 Hz to 400 Hz (any fixed discrete)
Accuracy: ±2% standard
Scan Angle, P to P: 30° max, reduces with frequency increase to 5° at upper end
Mirror Size: 30 x 30mm, standard max. (This type scanner also can mount larger mirrors.) Reduces as frequency increases.
Power: 500 milliwatts max. with driver

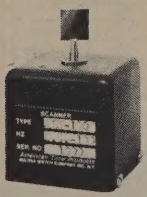


Taut Band
Type L50

LINEAR (Analog) ALS Series

Note: The data given are for one representative model. Contact factory with specific requirements.

Frequency: dc to 300 Hz
Accuracy: ±.05% repeatability, p to p
Mirror Size: 30 x 30 mm Standard, larger available
Scan Angle: p to p: up 30° @ 100 Hz, (greater angles as specials)
Tracking: follows any waveform — ramp, sawtooth, step or combination — linearly
Operating Modes: Tracks analog input with mirror position proportional to input current. Can hold any static angle, move and hold again; scan around any selected "center" left or right of the true center. Centers automatically with current off:
Power: <30mA/degree



Linear
Scanner
Model
ALS 100

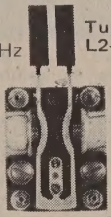
MIRRORS

Flatness: 1/2 wavelength standard, 1/4 or better available
Stock Sizes, mm: 30 x 30, 20 x 20, 15 x 15, 10 x 10, 7 x 7, 5 x 5, 2 x 3.

*Patents pending and issued.

CHOPPERS

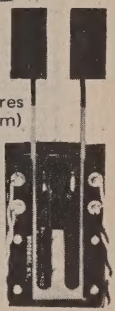
Frequencies from 5 Hz to 10 kHz
Many Modulation Patterns



Tuning Fork
L2-Miniature

TUNING FORK

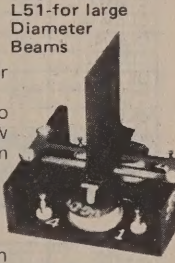
Type L2: Miniature (.68 W x .35 H x L to 1.7")
Type L8: L2 with integral driver (1.5" W x 38" H x 1.5 L)
Type L40: (.88 W x .63 H x L up to 2.94)
Frequency: 10 Hz to 3000 Hz (any fixed discrete)
Aperture: Max. (L40): Width 0.6", length .63". All reduce with increase in frequency
Accuracy: ±1% Standard, special to 0.1%
Power: 500 milliwatts max., with driver



Tuning Fork
L40-for Apertures
Up to .6" (15mm)

TAUT BAND TYPE L51C

Frequency: 5 Hz to 100 Hz (any fixed discrete)
Accuracy: ±2% standard
P to P: 30° max. reduces with frequency increase to 5° at upper end. Excursion a function of vane length
Vane: Length 1 1/2" x 1" max. Can chop 1 or two beams to 0.60" diameter. Reduces with frequency increase to 0.30" dia. max. at 100 Hz.
Power: 500 milliwatts, max., with driver



Taut Band
L51-for large
Diameter
Beams

LINEAR (Galvanometer) Type ALC

Frequency: dc to 300 Hz
Vanes & Filters: various to 4 sq. in. area
Scan Angle: to 30° p to p @ 100 Hz, greater available
Operating Modes: shutter, continuous, sweep position step and hold on command, follow analog input for any waveform for beam attenuation.
Power: <30mA/degree

DRIVERS

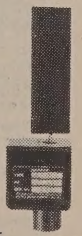
Resonant scanners and choppers can be driven in any one of three modes:

1 Closed loop at the natural frequency of the fork torsion bar or taut band with negative feedback from the pick-up coil;
2 Open loop at the natural frequency; or
3 In a phase lock or frequency lock loop.

Electrical or mechanical dampening can be included to reduce Q and automatic gain control can be added.

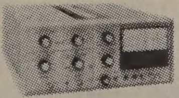
For the analog ALS and ALS-C series, open loop or velocity feedback are available.

All drivers provide a reference signal for synchronizing other devices.



Linear
Galvanometer
Type ALC

LOW COST LOCK-IN AMPLIFIER



Bulova has designed a low-cost Lock-In Amplifier for use with scanners, choppers and other instruments in applications where it is desired to distinguish and pull out weak signals from high back-ground noise. It is available in three forms: cased as a lab bench instrument, for standard rack mounting or for incorporation without casing as a module in OEM's instrumentation.

BULOVA

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
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WOODSIDE, N. Y. 11377 • 212 335-6000

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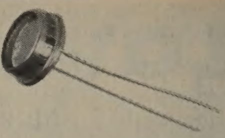

Part No.	Diam. X Length (inches)	Resistance @ 2 ftc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL5M9M	.55 X .18	11K	1:1000	170	2000-500[1]
CL709L	.36 X .18	28K		100	125
CL909L	.21 X .15	100K		100	50

Type 9 CdS, peak spectral response 5500 angstroms combines high speed with extreme temperature stability and high linearity.

CL5M3	.55 X .18	7.2K	1:10,000	250	2000-500[1]
CL603	.25 X .5	133K		300	75
CL603A	.25 X .5	75K		300	75
CL603AL	.25 X .5	3.5K		170	75
CL703	.36 X .18	133K		300	125
CL703A	.36 X .18	67K		300	125
CL703L	.36 X .18	2.7K		100	125
CL903	.21 X .15	133K		250	50
CL903A	.21 X .15	67K		250	50
CL903L	.21 X .15	6.0K		100	50

Type 3 CdSe, peak spectral response 7350 angstroms, fast response, and very high light-to-dark resistance ratio. Can be used for high speed switching or counting. Sensitive to near infra red. For use with incandescent or neon lamps.

CL5M4	.55 X .18	1.5K	1:400	250	2000-500[1]
CL5M4L	.55 X .18	0.25K		170	2000-500[1]
CL604	.25 X .5	30K		300	75
CL604L	.25 X .5	1.5K		170	75
CL704	.36 X .18	30K		300	125
CL704L	.36 X .18	0.6K		100	125
CL904	.21 X .15	30K		250	50
CL904L	.21 X .15	2K		100	50

Type 4 CdSe, peak spectral response 6900 angstroms, lowest resistance photocells available. Can be used for "on-off" applications when low resistance is desired. For use with incandescent or neon lamps.

CL5M5	.55 X .18	9K	1:100	250	2000-500[1]
CL5M5L	.55 X .18	1.5K		170	2000-500[1]
CL605	.25 X .5	166K		300	75
CL605L	.25 X .5	7.5K		170	75
CL705	.36 X .18	166K		300	125
CL705L	.36 X .18	3.3K		100	125
CL905	.21 X .15	166K		250	50
CL905L	.21 X .15	10K		100	50

Type 5 CdS, peak spectral response 5500 angstroms (closely matches the human eye), most stable, lowest memory photocell available. Can be used in light measuring applications and precision low speed switching. For use with incandescent, fluorescent or neon lamps.

CL705HL	.36 X .18	28K	1:1000	100	125
CL905HLL	.21 X .15	15K		60	50
CL905HL	.21 X .15	100K		100	50
CL905HN	.21 X .15	700K		100	50

Type 5H CdS, peak spectral response 5500 angstroms (closely matches the human eye). Combines high speed, stability, linearity, and uniform color temperature response. Footnote 1. with and without heat sink.

Part No.	Diam. X Length (inches)	Resistance @ 2 ftc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL707H	.36 X .18	500K	1:1000	300	125
CL707HM	.36 X .18	100K		250	125
CL907H	.21 X .15	600K		250	50
CL907HN	.21 X .15	300K		100	50
CL907HL	.21 X .15	24K		100	50

Type 7H CdS peak Spectral response 6200 angstroms. Very fast decay time coupled with low resistance and high linearity. Ideal for beam breaking applications.

CL5M7	.55 X .18	7.2K	1:300	250	2000-500[1]
CL607	.25 X .5	133K		300	75
CL707	.36 X .18	133K		300	125
CL707L	.36 X .18	2.7K		100	125
CL907	.21 X .15	133K		250	50
CL907N	.21 X .15	66K		100	50

Type 7 CdS, peak spectral response 6150 angstroms, moderate speed and ratio. Can be used in general beam breaking applications. For use with incandescent, neon or fluorescent lamps.

Part No.	Diam. X Length (inches)	Resistance @ 2 fc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)	Type
CL703/2	.36 X .18	50K	1:10,000	300	125	3 CdSe
CL703L/2	.36 X .18	6.5K	1:10,000	100	125	3 CdSe
CL704/2	.36 X .18	17K	1:400	300	125	4 CdSe
CL704L/2	.36 X .18	1.5K	1:400	100	125	4 CdSe
CL705/2	.36 X .18	166K	1:100	300	125	5 CdS
CL705L/2	.36 X .18	7.5K	1:100	100	125	5 CdS

Plastic Encapsulated Photoconductive Cells

CL5P4	.430 X .130	2.7K	1:400	250	250	Type 4 CdSe
CL5P4L	.430 X .130	0.45K		170	250	
CL7P4	.283 X .075	54K		300	125	
CL7P4L	.283 X .075	1K		170	125	
CL9P4L	.180 X .065	2K		100	50	
CL5P5	.430 X .130	9K	1:100	250	250	Type 5 CdS
CL5P5M	.430 X .130	6K		250	250	
CL5P5L	.430 X .130	1.5K		170	250	
CL7P5	.283 X .075	166K		300	125	
CL7P5L	.283 X .075	3.3K		170	125	
CL9P5	.180 X .065	166K		250	50	
CL9P5L	.180 X .065	10K		100	50	
CL7P5HL	.283 X .075	28K	1:1000	170	125	Type 5H CdS
CL9P5HL	.180 X .065	100K		100	50	
CL7P7HL	.283 X .075	10K	1:1000	170	125	Type 7H CdS
CL7P7HM	.283 X .075	30K		400	125	
CL9P7HL	.180 X .065	24K		100	50	
CL9P7HLL	.180 X .065	4.5K		70	50	
CL5P9M	.430 X .130	9K	1:1000	250	250	Type 9 CdS
CL7P9L	.283 X .075	28K		170	125	
CL9P9L	.180 X .065	100K		100	50	
CL9P9LL	.180 X .065	15K		70	50	

CLAIREX ELECTRONICS

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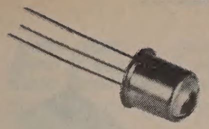

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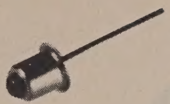


Phototransistors

PHOTO TRANSISTORS and DARLINGTON PHOTOTRANSISTORS

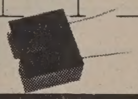
TO 18 FLAT WINDOW

Part No.	I_L (ma) V_{CE} = 5V Min Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE} = 10V	P_T (mw) 25°C
CLT 2065	7.0	5.0	40	50	250
CLT 2064	3.0 7.0	5.0	50	50	250
CLT 2030	1.0 3.0	5.0	30	25	250
CLT 2020	0.4 1.2	5.0	30	25	250
CLR 2060	1.4 4.0 14.0	0.20 2.0	40	100	250
CLR 2050	0.6 1.8 6.0	0.20 2.0	40	100	250
CLR 2049	.2 .6	0.20	40	100	250

WINDOW LENS .115 LENGTH X .077 DIAMETER

Part No.	Lens	I_L (ma) V_{CE}=5V Min Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE}=10V	P_T (mw) 25°C
CLT 5170	L	1.4 - 6.0	5 20	40	25	50
CLT 5160	L	0.5 - 2.0 7.0	5 20	40	25	50
CLR 5101	L	2.0 20.0 -	0.2 2.0	40	100	50

-2 Designation is with second lead welded to the header



TO 18 LENS

Part No.	I_L (ma) V_{CE} = 5V Min Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE} = 10V	P_T (mw) 25°C
CLT 2165	15.0	5.0	40	50	250
CLT 2164	7.0	5.0	40	50	250
CLT 2160	4.0 12.0	5.0	30	25	250
CLT 2150	2.4 7.2	5.0	40	25	250
CLT 2140	1.2 3.6	5.0	40	25	250
CLR 2180	0.6 4.0	0.02 0.20	40	100	250
CLR 2170	0.2 0.8 2.0	0.02 0.20	40	100	250

WINDOW LENS .110 LENGTH X .060 DIAMETER

Part No.	Window or Lens	I_L (ma) V_{CE}=5V Min Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE}=10V	P_T (mw) 25°C
CLR 3180	L	2.0	0.2	40	100	50
CLT 3170	L	2.0 7.0	5 20	40	10	50
CLT 3160	L	0.5 - 2.0 7.0	5 20	50	10	50
CLT 3030	W	0.25 1.0 3.0	5 20	40	10	50
CLT 3020	W	0.10 0.40 1.2	5 20	50	10	50

OPTICAL SWITCHES

Part No.	Dimensions Height, Width, Thickness Inches	Gap Width Inches	Slit on Sensor	$I_{CE\ min}$ (ma) V_{CE} = 5V	@ I_F ma	BV_{CEO} Volts	$I_{D\ max}$ (na) V_{CE} = 10V	Internal R_L	Sensor Darlington	Sensor Transistor
CL155	1.3 x .950 x .500	.250	–	12	10	30	100	Yes	✓	
CL155A	1.3 x .950 x .500	.250	–	1	20	30	100	No		✓
CL155B	1.3 x .950 x .500	.250	–	12	10	30	100	No	✓	
CL155C	1.3 x .950 x .500	.250		.5	10	30	100	No		✓
CL1200	.425 x .500 x .250	.100		1	20	40	50	No		✓
CL200D	.425 x .500 x .250	.100		10	20	40	100	No	✓	
CL1200S	.425 x .500 x .250	.100	.005	.1	20	40	50	No		✓
CL1300	1.3 x .950 x .500	.250		10 @ .5V	20	30	100	No		✓

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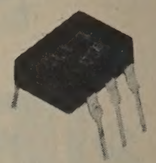
Clairex Opto-Isolators



LED PHOTOCONDUCTIVE CELL ISOLATORS

Part No.	Dia. Inch	Length inch	R "ON" Ohms Max	I_F ma	R "OFF" Ohms Min	Cell Volts PAC	Cell po mw	V_F	T_d msec	Isolation Voltage PAC
CLM6000	.250	.230	250	40	500K	60	50	2v@20ma	500 Max	2500
CLM6200	.250	.230	6000	16	10 Meg	60	50	2v@16ma	12 Typ	2500
CLM6500	.310	.230	300	16	10 Meg	100	50	2.5v@16ma	80 Typ	2500
CLM8000	.415	.320	400	40	500K	220	125	3.2v@20ma	500 Typ	2500
CLM8200	.415	.320	2800	16	10 Meg	220	125	2.0v@16ma	20 Typ	2500
CLM8200/2	.415	.320	5000	16	10 Meg	100	125	2.0v@16ma	30 Typ	2500
CLM8500	.415	.320	2000	16	10 Meg	220	125	2.8v@15ma	40 Typ	2500
CLM8500/2	.415	.320	1000	16	1 Meg	100	125	2.8v@15ma	150 Typ	2500
CLM8500HV	.415	.320	5000	16	10 Meg	400	125	2.5v@16ma	40 Typ	2500
CLM8600	.415	.320	2000	16	10 Meg	500	100	2.5v@16ma	40 Typ	2500
CLM9000	.550	.350	1200K	16	1000 Meg	3500	400	2.8v@16ma	20 Typ	4000

IRED — PHOTOTRANSISTOR DIP ISOLATORS

Part No.	C.T.R. $V_{CE}=10V$ % Min	C.T.R. $V_{CE}=10V$ % Max	I_F ma	Isolation Volts PAC	BV_{CEO} $I_C=1$ ma Volts	I_{CEO} @$V_{CE}=10V$ na
CLI-2	30	100	10	2500	50	25
CLI-3	100 30	200 –	10 1	2500	50	25
CLI-4	150 40	– –	10 1	2500	40	50
CLI-5	20	–	10	2500	50	25
CLI-6	50	–	10	2500	40	50
CLI-7	12	–	16	2500	30	50
CLI-8	20	–	10	2500	30	50
CLI-9	6	30	10	2500	30	100
CLI506	6	–	10	2500	30	100
CLI25	20 5	 –	±10 ± 1	2500	50	50
CLI26	40 10	– 	±10 ± 1	2500	50	50

IRED — PHOTOTRANSISTOR AXIAL ISOLATOR

Part No.	C.T.R. % Min	C.T.R. % Max	I_F ma	Isolation Volts PAC	BV_{CEO} Volts	I_{CEO} na
CLA7	20		10	7000	40	50

IRED — PHOTODARLINGTON DIP ISOLATORS

Part No.	C.T.R. $V_{CE}=10V$ % Min	C.T.R. $V_{CE}=10V$ % Max	I_F ma	Isolation Volts PAC	BV_{CEO} $I_C=.1$ ma Volts	I_{CEO} @ $V_{CE}=10V$ na
CLI10	800 600	– –	10 1	2500	50	100
CLI11	500	–	1	2500	40	100
CLI12	300 200	– –	10 1	2500	40	100
CLI13	100	–	10	2500	55	100
CLI14	100	–	10	2500	30	100
CLI27	400 50	– –	±10 ± 1	2500	40	100
CLI28	600 100	– –	±10 ± 1	2500	40	100

IRED — PHOTODARLINGTON AXIAL ISOLATOR

Part No.	C.T.R. % Min	C.T.R. % Max	I_F ma	Isolation Volts PAC	BV_{CEO} Volts	I_{CEO} na
CLA7D	400	–	10	7000	40	100

PHOTOMOD® PHOTOCONDUCTIVE CELL — LAMP ISOLATORS

Part No.	Dia. Inch	Length Inch	R "ON" Ohms Max	@ Lamp Rated Voltage Volts	R "OFF" Ohm Min	Cell Volts PAC	Isolation Voltage PAC
CLM3006A	.415	1.125	160	6	10 Meg	100	2500
CLM4006A	.415	1.125	55	6	1 Meg	100	2500
CLM3012A	.415	1.125	160	12	100 Meg	100	2500
CLM4012A	.415	1.125	30	12	1 Meg	100	2500
CLM5H10A	.415	1.125	3000	10	10 Meg	100	2500
CLM7H16A	.415	1.125	550	16	10 Meg	170	2500
CLM3120A	.415	1.125	1150	120	100 Meg	100	2500
CLM4120A	.415	1.125	160	120	1 Meg	100	2500
CLM3000	.420 X .445 X .620		500	14	1 Meg	175	1600
CLM3500	.420 X .445 X .620		160	120	1 Meg	250	1600

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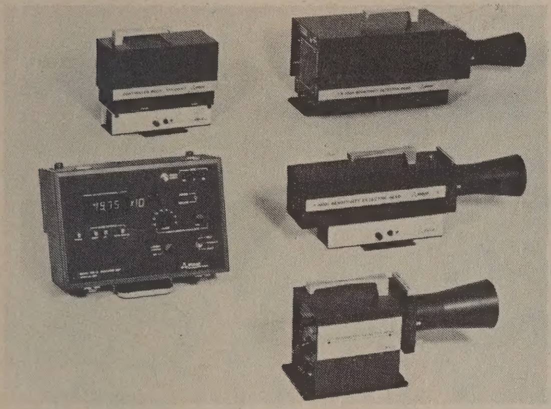
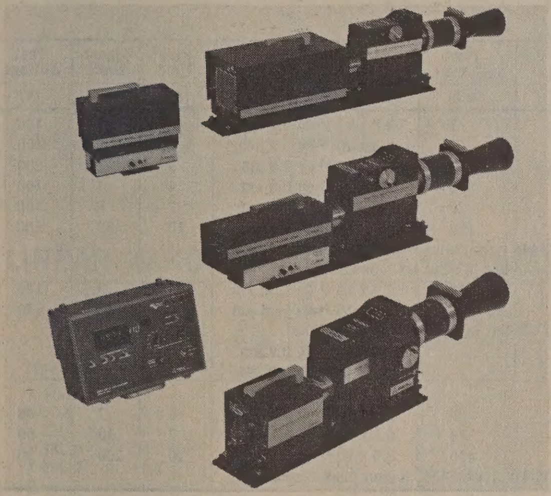
LIGHT MEASUREMENT INSTRUMENTS





MODEL 580 RADIOMETER/PHOTOMETER SYSTEMS

The Model 580 Systems provide fast, accurate measurements of optical radiation in radiometric and photometric terms. The systems are inherently capable of measuring both continuous (cw) sources as well as pulsed events as fast as one nanosecond in duration. An autoranging digital panel display provides readings of average power and integrated energy. The Detector Heads also have provision for oscilloscope display of pulsed light signals so that wave shape measurements can be made, i.e., peak power, pulse duration, and rise and fall times. The spectral range is from 0.2 μm (200 nm) in the ultraviolet to 3.2 μm (3200nm) in the near infrared. The overall dynamic range is over fifteen decades (full scale) of light intensities. The basic system concept can be used in a great variety of applications due to the designed modular approach of interchangeable Detector Heads and accessories. The Model 580 has become an industry standard for most laser output measurements.

MODEL 580/585 SPECTRORADIOMETER SYSTEMS

The Model 580/585 Systems add a digital grating monochromator and additional optics onto the Model 580 Radiometer Detector Head, thereby allowing absolute measurements of the power and energy of chromatic cw and pulsed light sources as a function of wavelength. A truly functional system with provision for recorder ouput and BCD computer interface, the 580/585 can measure over a 12-decade range of light levels. The system can also be used as a radiometer and photometer.

MODEL 550 RADIOMETER/PHOTOMETER SYSTEM

The Model 550 Radiometer/Photometer provides fast, precise measurements with direct readings in 12 photometric and radiometric units. The direct readings, which are easily taken from a 3½ digit panel meter and digital decade indicator, eliminate the need for post measurement calculations. The system is both manual and autoranging over seven full scale decades. Measurements can be obtained of both pulsed and continuous sources with excellent accuracy, repeatability, and stability. Provision for ambient compensation permits its use outside of a dark room environment. High sensitivity is achieved through the use of a single, low noise silicon multiprobe detector.

MODEL 550/555 SPECTRORADIOMETER SYSTEM

The Model 550/555 Spectroradiometer System integrates all the state-of-the-art features of the Model 550 Radiometer with the precision and accuracy of a holographic grating monochromator to yield a low cost, compact, light weight, high efficiency measurement system capable of providing radiometric measurements of both continuous and pulsed sources as a function of wavelength. The Model 550/555 covers a wide spectral region extending from 280 nm in the ultraviolet to 1100 nm in the near-infrared with an absolute system measurement accuracy of ±3%. Ancillary components expand the basic manual system into a completely automatic measurement system with programmable wavelength scan ranges and scan speeds, automatic order sorting filter sequencing, and interface compatibility for automatic data acquisition, conversion, and printout.

Other standard light measurement instruments together with accessories and optical calibration standards are available.
E G & G also offers complete optical calibration services.

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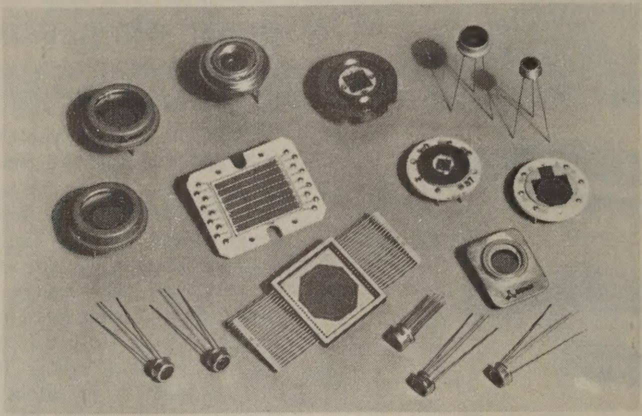
SILICON PHOTODIODES



SILICON PIN PHOTODIODES High Speed Photoconductive

- Spectral Range: 0.35 to 1.15 μm
- Responsivity: 0.5 A/W @ 0.9 μm; 0.42 A/W @ 1.06 μm (YAG Series)
- Linearity of Response: Within 5% over 7 Decades
- Operating Voltage: 0 to 180 Volts

	Active Area	Package	Dark Current	NEP (λ, 600, 1)	Rise Time	Capacitance	Test Voltage
Type No.	(mm²)	(JEDEC)	(nA)	(watts)	(ns)	(pf)	(V)
SGD-040A	0.82	TO-5	3	9.6 x 10^{-14} @ 0.9 μm	3	2	100
SGD-040B	0.82	TO-46	3	9.6 x 10^{-14} @ 0.9 μm	3	2	100
SGD-040L	0.82	TO-5/Lens	3	9.6 x 10^{-14} @ 0.9 μm	3	2	100
SGD-100A	5.1	TO-5	10	1.0 x 10^{-13} @ 0.9 μm	4	4	100
SGD-160	13	TO-8	50	3.0 x 10^{-13} @ 0.9 μm	7	8	100
SGD-444	100	TO-36	200	5.9 x 10^{-13} @ 0.9 μm	10	80	100
SGD-444-2		Same as SGD-444 but in bi-cell configuration					
SGD-444-4		Same as SGD-444 but in quad-cell configuration					
YAG-100A	5.1	TO-5	20	2.2 x 10^{-13} @ 1.06 μm	8	3.5	180
YAG-444	100	TO-36	200	5.6 x 10^{-13} @ 1.06 μm	8	35	180
YAG-444-4		Same as YAG-444 but in quad-cell configuration					
SND-130	0.82	TO-46	—	1.5 x 10^{-14} @ 0.9 μm			
SND-140	5.1	TO-5	—	2.7 x 10^{-14} @ 0.9 μm			
SND-680	23.6	TO-8	—	5.5 x 10^{-14} @ 0.9 μm			
DT-25	5.1	TO-5	30	3.5 x 10^{-13} @ 0.9 μm	5	7	90
DT-40	13	TO-8	70	6.0 x 10^{-13} @ 0.9 μm	7	10	90
DT-110	100	TO-36	400	9.5 x 10^{-13} @ 0.9 μm	10	100	90
SHS-100		Similar to SGD-100A with 30% higher peak responsivity					

SILICON PHOTOVOLTAIC DETECTORS — Low Noise

- Spectral Range: 0.35 to 1.15 μm (PV Series); 0.20 to 1.15 μm (UV Series)
- Responsivity: 0.47 A/W @ .95 μm; 0.09 A/W @ 0.2 μm (UV Series)
- Linearity of Response: Within 1% over 7 Decades
- Operating Mode: Photovoltaic — no bias

	Active Area	Package	Shunt Resistance	NEP (λ, 600, 1)	Rise Time	Capacitance
Type No.	(mm²)	(JEDEC)	(MΩ)	(watts)	(ns)	(pf)
PV-040	0.82	TO-46	500	1.0 x 10^{-14} @ 0.95 μm	12	25
PV-100A	5.1	TO-5	100	3.2 x 10^{-14} @ 0.95 μm	25	150
PV-215	23.6	TO-8	50	4.3 x 10^{-14} @ 0.95 μm	30	700
PV-444A	100	TO-36	10	9.0 x 10^{-14} @ 0.95 μm	45	2800
PV-800A	314	Special	5	1.3 x 10^{-13} @ 0.95 μm	75	9000
UV-100A	5.1	TO-5	100	2.3 x 10^{-13} @ 0.23 μm	25	150
UV-215	23.6	TO-8	50	2.5 x 10^{-13} @ 0.23 μm	30	700
UV-444A	100	TO-36	10	5.0 x 10^{-13} @ 0.23 μm	45	2800
UV-800A	314	Special	5	7.5 x 10^{-13} @ 0.23 μm	75	9000

SILICON DETECTOR/ AMPLIFIER COMBINATIONS

- Spectral Range: 0.35 to 1.15 μm (except HUV Series); 0.20 to 1.15 μm (HUV Series)
- Supply Voltage: ±15 Volts

	Active Area	Package	Responsivity R_f = 200 MΩ	NEP (λ, f, 1)	Gain Band-width Product	Slew Rate
Type No.	(mm²)	(JEDEC)	(V/W)	(watts)	(MHz)	(v/μsec)
HAD-1000A	5.1	TO-5	10^8 @ 0.9 μm	1.5 x 10^{-13} @ 0.95 μm @ 400Hz	2.0	6
HAV-1000	5.1	TO-5	10^8 @ 0.9 μm	1.1 x 10^{-13} @ 0.95 μm @ 400Hz	1.0	6
HAV-4000A	100	Modified DIP	10^8 @ 0.9 μm	9.0 x 10^{-14} @ 0.95 μm @ 400Hz	0.1	5
HUV-1000	5.1	TO-5	10^7 @ 0.23 μm	7.0 x 10^{-13} @ 0.23 μm @ 400Hz	1.0	6
HUV-4000A	100	Modified DIP	10^7 @ 0.23 μm	6.0 x 10^{-13} @ 0.23 μm @ 400Hz	0.1	5
MHZ-018	5.1	Modified DIP	10^8 @ 0.9 μm	4.7 x 10^{-11} @ 0.95 μm @ 18MHz	100	
MHZ-018Y	5.1	Modified DIP	5x10^9 @ 1.06 μm	5.9 x 10^{-11} @ 1.06 μm @ 18MHz	100	
MHZ-016	13	Modified DIP	10^8 @ 0.9 μm	6.8 x 10^{-11} @ 0.95 μm @ 16MHz	100	

CUSTOM PHOTODIODES

In addition to these standard photodiode products, E G & G engineering and production capabilities permit the design and fabrication of custom photodiode devices. Special configurations such as larger and smaller areas, circular and rectangular active areas, arrays, matrices can be manufactured per specific customer requirements. Inquiries for both small and OEM quantities are welcome.

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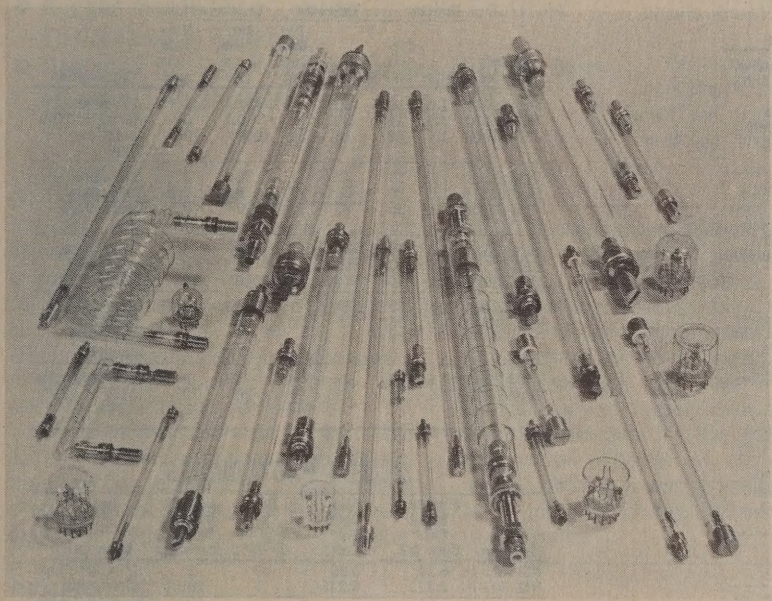
XENON FLASHTUBES



Xenon flashtubes. dc krypton arc lamps, and long arc Xenon lamps are available from E G & G in a wide variety of configurations and envelope materials. Tubes are available in linear, bulb-type, helical, "U" shape, coaxial, and air or liquid cooled designs. Envelope materials include quartz, UV inhibiting quartz, and hard glass with a wide range of bore and arc length sizes. Custom configurations are available upon request.

Common applications involve the use of these lamps as the primary light source for:

Laser stimulation
Photocopy systems
Phototypesetting machines
Microfiche systems
Strobes
UV curing of polymers
Marine, aircraft and satellite beacons
Warning beacons
Photoresist exposure
Large area indoor lighting

LINEAR XENON FLASHTUBES — QUARTZ

Type No.	Bore Size I.D. x O.D (mm)	Arc Length (inches)	Max. Energy 1.0 msec pulse (joules)	Min. Operating Voltage (kv)	Min. Trigger Voltage (kv)	Ave.* Power @ 25°C Ambient (watts)
FX-1C-6	4 x 6	6	1680	0.7	20	40
FX-5C-9	4 x 6	9	2520	1.2	20	50
FX-33C-1.5	4 x 6	1.5	420	0.5	15	10
FX-33C-2	4 x 6	2	560	0.6	15	15
FX-38C-2	4 x 6	2	560	0.6	15	15
FX-38C-3	4 x 6	3	840	0.7	15	20
FX-42C-3	7 x 9	3	1490	1.0	20	60
FX-45C-6	7 x 9	6	2980	1.1	20	80
FX-47C-3	13 x 15	3	2040	1.0	20	75
FX-47C-6.5	13 x 15	6.5	5500	1.0	25	100
FX-47C-12	13 x 15	12	8160	1.3	25	125
FX-47C-18	13 x 15	18	12,240	1.6	25	135
FX-52C-3S	7 x 9	3	1490	1.0	20	60
FX-55C-6S	7 x 9	6	2980	1.1	20	80
FX-77C-4	19 x 22	4	5040	1.0	25	125
FX-77C-8	19 x 22	8	10,000	1.2	25	150
FX-77C-13	19 x 22	13	16,400	1.5	25	200
FX-81C-4	10 x 12	4	3080	1.0	25	80
FX-81C-6.5	10 x 12	6.5	5000	1.0	25	90
FX-81C-8	10 x 12	8	6160	1.0	25	100
FX-84C-1.5	4 x 6	1.5	420	0.5	15	10
FX-85C-3	4 x 6	3	840	0.7	15	20
FX-98C-3	5 x 7	3	1050	0.8	15	30
FX-103C-2	4 x 6	2	560	0.6	15	15
FX-103C-3	4 x 6	3	840	0.7	15	20
FX-147C-2	3 x 5	2	420	0.5	15	15

*Forced air cooling (10-15 cu. ft./min.) increases ave. power by approx. factor of 8. Water cooling (1.0 gpm) increases ave. power by approx. factor of 50.

LINEAR WATERCOOLED XENON FLASHTUBES

Type No.	Bore Dia. I.D. (mm)	Arc Length (inches)	Max. Energy (joules)	Average Power (kw)	Operating Voltage Range (kv)	Trigger Voltage Range (kv)
FX-62B-3	7	3	600	4	1.5-2.5	25-30
FX-65B-6	7	6	2000	8	1.5-2.5	25-30
FX-67B-6.5	13	6.5	4000	10	1.7-3.0	25-30
FX-74B-1.5	4	1.5	100	0.5	1.2-1.8	25-30
FX-75B-3	4	3	400	1.0	1.2-2.5	25-30

BULB TYPE XENON FLASHTUBES

Type No.	Max. Energy (joules)	Average Power (watts)	Operating Voltage Range (volts)	Min. Trigger Voltage (kv)	Max. Rep. Rate (pps)	Arc Dis-charge Length (inches)
FX-6A, FX-6AU, FX-48, FX-101, FX-108, FX-108AU	5	7	400-1000	2.5	500	5/16
FX-6B, FX-6BU, FX-35B, FX-101B, FX-102, FX108B, FX-108BU	5	7	500-1000	4.0	2500	5/16
FX-127	5	7	500-1000	4.0	2500	1/8
FX-76, FX-133, FX-138	20	20	500-1500	5.0	2500	5/16
FX-124, FX-137	15	20	500-1500	5.0	2500	1/8
FX-132	200	100	100-1500	7.0	500	3/8

DC KRYPTON ARC DISCHARGE TUBES

Type No.	Bore Dia. I.D. (mm)	Arc Length (ins.)	Ave. Power Water Cooled (kw)	Steady State Voltage (Vdc)	Steady State Current (Adc)	Static Imped-ance (Ohms)	Min. Anode Voltage (kvdc)	Min. Trigger Voltage (kv)
FK-99C-2	4	2	2750	81	34	2.3	1-1.5	15-20
FK-99C-3	4	3	4000	125	32	3.9	1-1.5	15-20
FK-111C-2	7	2	4000	80	50	1.6	1-1.5	15-20
FK-111C-3	7	3	6000	115	52	2.2	1-1.5	15-20
FK-125C-2	5	2	3500	81	43	1.9	1-1.5	15-20
FK-125C-3	5	3	5000	115	44	2.6	1-1.5	15-20
FK-128C-3	10	3	8000	97	84	1.2	1-1.5	15-20
FK-128C-10	10	10	15000	276	56	4.9	1-1.5	15-20

XENON FLASHTUBES FOR PULSED DYE LASERS

Type No.	Bore Dia. I.D. (mm)	Arc Length (inches)	Max. Energy (joules)	Operating Voltage (kv)	Pulse Width (μs)
FX-139C-3.5	3.5	3.5	10	10	1
FX-140C-3.5	5.0	3.5	25	10	2
FX-141C-3.5	7.0	3.5	100	10	3
FX-142C-3.5	7.0	3.5	200	20	6
FX-143C-6.0	15.0	6.0	1000	20	12

NSL OPTOELECTRONIC

- PHOTOCELLS
- PHOTODIODES
- PHOTOTRANSISTORS
- PHOTODARLINGTONS
- PHOTOVOLTAIC CELLS
- OPTICALLY COUPLED ISOLATORS
- OPTOELECTRONIC ARRAYS
- SOLID STATE RELAYS

CdS & CdSe PHOTOCELLS

Cell Type No.	Typ. 1 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt.	Max. Power MW.	Description
NSL-312	75	100	70	50	CdSe Photoconductive Cell in Hermetic Glass and Metal TO-18. Hermetic CdS and epoxy coated "open pill" versions also available.
NSL-313	30	100	70	50	
NSL-314	14	100	70	50	
NSL-315	550	1000	250	50	
NSL-316	260	1000	250	50	
NSL-317	110	1000	250	50	
NSL-318	50	500	120	50	
NSL-443	200	300	2000	1000	CdS Photoconductive Cell in Hermetic Glass and Metal 1.25" Dia Case. Epoxy coated "open pill" versions also available.
NSL-444	120	100	2000	1000	
NSL-445	26.0	15	420	1000	
NSL-446	11.4	5	420	1000	
NSL-447	5.5	1	420	1000	
NSL-361	65	200	70	100	CdSe Photoconductive Cell in Hermetic Glass and Metal ¼" Dia. Case. Hermetic CdS versions also available.
NSL-362	28	200	70	100	
NSL-363	12	200	70	100	
NSL-364	5.2	200	70	100	
NSL-365	550	3000	250	100	
NSL-366	230	3000	250	100	
NSL-367	100	3000	250	100	
NSL-481	43.0	65	120	200	CdS Photoconductive Cell in Hermetic Glass and Metal TO-5. Hermetic CdSe and epoxy coated "Open Pill" versions also available.
NSL-482	18.6	15	120	200	
NSL-483	8	1.8	120	200	
NSL-484	3.5	0.25	120	200	
NSL-485	330	200	250	200	
NSL-486	155	130	250	200	
NSL-487	66	20	250	200	
NSL-294	.75	10	70	500	CdS/Se photo-conductive cell
NSL-297	7.5	100	250	500	
NSL-3921	4.0	2	80	200	CdSe Photoconductive Cell in Plastic Case. Glass Lens and Epoxy Coated "Open Pill" and CdS versions also available
NSL-3931	1.7	2	80	200	
NSL-3941	0.75	1	80	200	
NSL-3951	40.0	20	320	200	
NSL-3961	17.0	20	320	200	
NSL-3971	7.5	10	320	200	
NSL-491	9.3	14	80	500	CdS Photoconductive Cell in Hermetic Glass and Metal TO-8. Hermetic CdSe version also available.
NSL-492	4.0	3.2	80	500	
NSL-493	1.7	0.4	80	500	
NSL-494	0.75	0.05	80	500	
NSL-495	40	32	320	500	
NSL-496	17	4.0	320	500	
NSL-497	7.5	0.54	320	500	
NSL-41385	18	6	150	250	CdS Photoconductive Cell in .5" L x .33" W x .05" D rectangular, epxoy coated package.
NSL-41386	8	6	150	250	
NSL-41387	3.5	1	150	250	
NSL-41388	1.6	0.54	150	250	

PHOTODETECTOR LAMP ASSEMBLIES

CdSe Photodetector

	Emitter		Detector				
Module Type No.	Volts	Current MA	Max. ON Res. Ω	Min. OFF Res. MΩ	Max. Volts	Max. Power	Description
PL-1033-1	10	15	100	10	80	250	Phenolic .75" x .75" x .625" Pin Leads for P.C. Board Mounting. (Matched, Multi-Detector Configurations also available)
PL-1036-1	10	15	400	100	320	250	
PL-2H33-1	200	2	100	10	80	250	
PL-2H36-1	200	2	400	100	320	250	
PL-3A33-1	100	2	150	10	80	250	
PL-3A36-1	100	2	500	100	320	250	
PL-5S33-1	2	25	200	10	80	250	
PL-5S36-1	2	25	2000	100	320	250	
PLT-10384	10	15	400	10	80	100	Standard Tube; Axial Leads
PLT-10387	10	15	5000	100	320	100	
PLT-2H384	200	2	500	10	80	100	
PLF-5S380	2	25	250	10	80	100	4 Leaded, Hermetic TO-5
PLF-5S387	2	25	4000	100	320	100	
PLS-5S380	2	25	250	10	80	100	Small Tube, Axial Leads
PLS-5S387	2	25	4000	100	320	100	
PLM-5S310	2	25	500	10	80	50	Miniature Tube, Axial Leads
PLM-5S387	2	25	5000	100	320	50	

NATIONAL SEMICONDUCTORS LTD.

331 Cornelia St., Plattsburgh, N.Y. 12901 - Tel. (518) 561-3160
2150 Ward Street, Montreal, Que. H4M 1T7 - Tel. (514) 744-5507
TWX 610-421-3362

Silicon Photodetector

	Emitter		Detector	Coupled Characteristics			
Module Type No.	Volts	Current MA	Min. BV_{CEO}	Typ. Dark Curr. nA	Curr. Trans. Ratio %	Rise Fall Time μsec	Description
PLF-6S610	1.5	50	30	1	30	3	4 Leaded, Hermetic TO-5 Isolation: 700V
PLF-6S510	1.5	50	50	2	0.1	0.5	
PLF-6S910	1.5	50	15	20	1000	70	
PLM-6S610	1.5	50	30	1	30	3	Miniature Tube, Axial Leads. Isolation: 2.5 kV
PLM-6S510	1.5	50	50	2	0.1	0.5	
PLM-6S910	1.5	50	15	20	1000	70	
PLS-6S610	1.5	50	30	1	30	3	Small Tube, axial leads. Isolation: 5kV.
PLS-6S510	1.5	50	50	2	0.1	0.5	
PLS-6S910	1.5	50	15	20	1000	70	
ORL-6S600	1.5	25	30	1	0.1	5	Reflective .5" x .225" x .375" PCB Mount.
ORL-6S900	1.5	25	15	20	20	70	
ORM-6S600	1.5	25	30	1	0.1	5	Mini-Reflective .316" x .225" x .19".
ORM-6S900	1.5	25	15	20	20	70	

SILICON PHOTODIODES

NSL Type No.	Minimum Short Ckt.* Curr. MA	Min. Open Ckt.* Volt.	Dark Curr. μA @ 1 V @ 55°C	Reverse Voltage Recom. Maximum	Description
NSL-701-1	0.30	0.35	10	5	.1" x .2" Chip. Wire Leads
NSL-801-1	0.325	0.275	5	10	
NSL-701-9	0.30	0.35	10	5	9 element Cell, 0.1" Spacing
NSL-702	0.6	0.35	10	5	.2" x .2" Chip. Wire Leads
NSL-802	0.65	0.275	5	10	
NSL-703	1.4	0.35	40	5	.2" x .4" Chip. Wire Leads
NSL-803	1.5	0.275	20	10	
NSL-705	4.5	0.35	50	5	.76" x .354" Chip. Wire Leads
NSL-805	4.77	0.275	25	10	
NSL-706	2.9	0.35	40	5	.4" x .4" Chip. Wire Leads
NSL-806	3.0	0.275	20	10	
NSL-707	3.3	0.35	50	5	.2" x 1" Chip. Wire Leads
NSL-807	3.5	0.275	25	10	
NSL-708	1.3	0.35	30	5	.1" x 1" Chip. Wire Leads
NSL-808	1.4	0.275	15	10	
NSL-710	0.125	0.4	2	5	TO-18 Package
NSL-810	0.150	0.275	1	10	
NSL-751	1.4	0.35	40	5	0.5" dia. Epoxy Package
NSL-851	1.5	0.275	20	10	
NSL-781	0.28	0.35	10	5	Hermetic TO-5 Case
NSL-881	0.3	0.275	5	10	
NSL-782	0.42	0.35	10	5	
NSL-791	0.60	0.35	10	5	Hermetic TO-8 Case
NSL-792	1.1	0.35	30	5	

*At 500 Ftc (25 MW/cm²) 2870°K Source.

SILICON PHOTOTRANSISTORS & PHOTODARLINGTONS

	I_{CEO} MA @ 5 V			Dark I_{CEO} @ 15V 25°C — nA		
NSL Type No.	Min.	Typ.	MW/cm²	Typ.	Max.	Description
NSL-610-1	.2	1	10	1	50	TO-18 Encased Power Dissipation @ 25°C 200 mW, BV_{CEO} 30 volts
NSL-610-3	1	3	10	1	50	
NSL-610-6	4	6	10	1	50	
NSL-610-9	7	9	10	1	50	
NSL-611	8	15	10	10	100	
NSL-910	1	6	.1	20	250	TO-18, BV_{CEO} 15 V

SOLID STATE RELAYS

NSL Type No.	Max. Load RMS Amps	Surge Current - Peak Amps 1 cycle	Surge Current - Peak Amps 10 cycles	Dimensions L x W x D; inches	Description
1208/2408L	8	70	45	2.1 x 2.1 x 1.1	Prefix D, DC input 3 to 35V; Prefix A, AC input 90 to 250V AC/DC.
1212/2412M	12	100	60	2 x 1.75 x 1.1	
1220/2420N	20	150	90	1.8 x 1 x 1	
1204/2404Q	4	35	20	1.75 x 1.75 x 2.69	
1206/2406Q	6	50	30	1.75 x 1.75 x 2.69	

RAYTHEON

OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

RAYTHEON OPTOELECTRONICS

- **Standard and "State of the Art" Opto-Components**
- **Improved Cost/Performance Ratios**
- **Rugged Mechanical Construction with Certified Environmental Reliability**
- **Designed for Both Commercial and Military Optoelectronic Applications**

Raytheon is a specialist in the development and manufacture of quality, competitively priced photo-conductive cell/arrays and photo-optical isolators (Raysistors®). These components are designed with characteristics and features that meet the requirements of the various optical and/or isolation circuits in use today or in development for the future.

Raytheon standard photocells and arrays have been used effectively for more than a decade in a wide range of applications at all levels of industry. Raytheon is also prepared to comply with requests for special products to meet your specific application or required characteristics.

OPTO-ISOLATORS RAYSISTORS®

Raysistor is a Raytheon trade mark for an optoelectronic circuit component (photo-optical isolator). The Raysistor combines a reliable energy emitter source (incandescent, neon, or light-emitting diode) and a bulk-effect photo-resistive element. A wide variety of package configurations, ratings, and electrical characteristics are available.

Raysistors perform a variety of switching and control functions where isolation between the controlling element and the controlled circuit is critical. The characteristics of these devices demonstrate their versatility, sensitive control property, circuit isolation, and lack of distortion in the signal. In addition to their suitability for general feedback systems, Raysistors are especially attractive for AGC, Logic Translation facsimile and photo multiplier systems, voltage or signal isolators, variable resistors, SCR and Triac firing circuits, signal modulators for audio effects, solid-state switches, etc. For dual function controls, the Raysistor is produced with multiple photo-cells and/or energy emitters to provide excellent tracking and matching characteristics.

PHOTOCONDUCTIVE CELLS

Raytheon's extensive line of photo-conductive cells and arrays represents the "state of the art" in stability and uniformity of characteristics with aging. They are available in a wide range of sensitivities.

Standard Raytheon photocells are available in four different spectral response photosensitive materials, each of which exhibit its own individual optical characteristic. A variety of packages are available, including hermetically sealed, single or dual element, and plastic coated. Plastic coated devices are passivated for long term environmental protection.

GENERAL NOTES

1. Energy emitter source: "N"-neon, "I"-incandescent, "L"-light emitting diode (LED). See tables.
2. Indicated control voltages or current will ensure long life. Constant operation at higher voltages will result in modified life expectancy. (Incandescent designs are derated to insure long life.)
3. "ON" Resistance: Measured after 16 hours of operation. All resistances measured with 1.5 volts applied to signal terminals.
4. Control to signal circuit isolation: Values indicated are maximum potentials (DC or peak AC) that can be applied between control and signal circuits. Tested per MIL STD 202D, Method 301.
5. "OFF" RESISTANCE: Measures 5 seconds after removal of control voltage or current. Ultimate dark resistance is many times greater.
6. Maximum Cell Voltage: Voltage applied to cell must not exceed specified maximum. Maximum voltage is normally present when cell is in dark condition.
7. Cell Power Dissipation: Ambient temperature directly effects maximum power dissipation of photoconductive cells. Rated power dissipation applies when device is operated at 30°C or below. Derating curves are specified on individual data sheets.
8. Response Speeds:
   - 8.1 "RISE TIME": Defined as time for voltage across photocell to fall to 10% of its initial value, measured from instant that maximum rated control voltage or current is applied to energy emitter source.
   - 8.2 "DECAY TIME": Defined as time for voltage across photocell to rise to either 50% or 90% of its final value from instant that maximum rated control voltage or current is removed from energy emitter source. Percentage values depend on specific component. Majority are 90%.
   - 8.3 Test Conditions:
     Control Voltage/Current—As Rated
     Signal Voltage—50 Volts DC
     Signal Circuit Load—100K Ohms
9. Capacitance: Measurements made in dark condition.

OPTO-ISOLATORS—RAYSISTORS®

	Control Circuit			Signal Circuit-Photodetector						General			
				Resistance-ohms									
Model No.	Voltage Vdc	Current (Ma)	Isolation D.C. Peak Volts	Max On Res.	Min Off Res.	Voltage Max. Vdc	Power Max mW	Typ. Rise (sec)	Switching Decay (sec)	Shunt Cap (Pf)	Coupling Cap (Pf)	Construction■ Fig.	Emitter[1] Source
FLYING LEAD—METAL TUBE													
CK1101	120*	0.5-3.5	1500	1000	10^7	100	100	.002	.060	1.0	.001	A	N
CK1102	0-1	0-50	1500	700	10^7	100	100	.035	.350	1.1	.003	A	I
CK1103	0-5	0-200	1500	150	10^7	100	100	.040	.750	1.0	.003	A	I
CK1104	0-25	0-37	1500	150	$5x10^6$	100	100	.035	.450	0.9	.003	A	I
CK1112	0-10	0-18	1500	700	10^7	100	100	.030	.400	1.0	.004	A	I
CK1113	†	0-25	1500	750	10^7	100	100	.005	.175	1.0	.004	A	L
PRINTED CIRCUIT													
CK1101P	120*	0.5-3.5	1500	1000	10^7	100	100	.002	.060	1.0	.001	B	N
CK1102P	0-1	0-50	1500	700	10^7	100	100	.035	.350	1.1	.003	B	I
CK1103P	0-5	0-200	1500	150	10^7	100	100	.040	.750	1.0	.003	B	I
CK1104P	0-25	0-37	1500	150	$5x10^6$	100	100	.035	.450	0.9	.003	B	I
CK1112P	0-10	0-18	1500	700	10^7	100	100	.030	.400	1.0	.004	B	I
CK2008P	120*	0.5-3.5	1500	300	10^7	100	100	.005	.120	1.0	.003	B	N
CK2025P	0-10	0-18	1500	1000	10^6	100	100	.030	.650	1.0	.003	B	I
CK1113P	†	0-25	1500	750	10^7	100	100	.005	.175	1.0	.004	B	L

*Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated range.
†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having a resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.
■Outlines on pages 6 to 8

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RAYTHEON

OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

OPTO—ISOLATORS—RAYSISTORS® (Cont'd)

	Control Circuit			Signal Circuit-Photodetector						General			
Model No.	Voltage Vdc	Current (Ma)	Isolation D.C. Peak Volts	Resistance-ohms Max On Res.	Min Off Res.	Voltage Max. Vdc	Power Max mW	Typ. Rise (sec)	Switching Decay (sec)	Shunt Cap (Pf)	Coupling Cap (Pf)	Construction Fig.	Emitter[1] Source
HIGH VOLTAGE—FLYING LEAD													
CK2029	0-10	0-35	10,000	2000	10^8	250	250	.035	.325	1.3	.10	C	I
CK2032	0-10	0-18	10,000	450	10^7	250	250	.030	.300	1.3	.10	C	I
CK2034	†	0-25	10,000	500	10^7	250	250	.005	.175	1.2	.10	C	L
CK2035	120*	0.5-3.5	10,000	1000	10^7	250	200	.008	.350	1.2	.10	C	N
CK2129	120*	0.5-3.5	10,000	2000	10^7	250	250	.010	.350	1.2	.15	C	N
HIGH VOLTAGE—MOLDED CASE													
CK1105	120*	0.5-3.5	25,000	10,000	10^7	250	250	.010	.800	1.8	.2	D	N
CK1106	0-120	0-25	25,000	300	10^7	250	250	.050	.700	1.8	.3	D	I
CK1108	0-5	0-200	25,000	250	10^7	300	250	.040	.650	1.7	.2	D	I
CK2030	0-10	0-18	25,000	700	10^7	300	250	.030	.450	1.8	.2	D	I
CK2065	0-10	0-18	25,000	500	10^7	300	250	.030	.500	1.8	.2	D	I
CK2066	0-25	0-37	25,000	350	10^7	300	250	.040	.650	1.8	.2	D	I
CK2067	†	0-40	25,000	1000	10^7	300	250	.010	.650	1.8	.2	D	L
TUBULAR—AXIAL LEAD													
CK2145	†	0-25	1500	250	$5x10^5$	60	50	.003	.900	1.5	.5	E	L
CK2146	†	0-25	1500	2500	10^7	100	100	.002	.030	1.5	.5	E	L
TUBULAR—FLYING LEAD													
CK2177	0-12	0-24	2000	400	10^7	250	350	.040	.300	2.0	0.5	F	I
CK2178	0-12	0-24	2000	1500	10^7	300	350	.040	.500	2.0	0.5	F	I
TO-5													
CK1114	0-1	0-18	500	650	10^7	100	100	.025	.275	1.5	1.0	G	I
CK1115	0-4	0-55	500	200	10^7	200	100	.035	.300	2.0	1.0	G	I
CK1116	0-4	0-20	500	350	10^7	100	100	.030	.350	2.0	1.0	G	I
CK1117	0-3	0-15	500	400	10^7	100	100	.030	.300	2.0	1.0	G	I
CK2002	0-5	0-60	500	40	$5x10^6$	100	100	.035	.450	2.0	1.0	G	I
CK2039	0-1	0-18	500	800	10^6	100	100	.030	.300	1.5	1.0	G	I
CK2046	0-1	0-18	500	350	10^6	100	100	.025	.300	1.5	1.0	G	I
CK2070	0-1	0-18	500	2500	10^6	100	100	.025	.550	2.0	1.0	G	I
CK2071	0-4	0-55	500	1000	10^6	100	100	.035	.850	2.0	1.0	G	I
CK2072	0-4	0-20	500	1800	10^6	100	100	.030	.600	2.0	1.0	G	I
CK2095	0-4	0-20	500	1200	10^6	75	75	.035	.850	2.0	1.0	G	I
CK2101	0-5	0-22	500	50	10^6	100	100	.020	.500	1.5	1.0	G	I
CK2124	0-3	0-15	500	450	10^6	100	100	.025	.800	1.5	1.0	G	I
CK2127	0-3	0-15	500	700	10^6	100	100	.025	.700	1.5	1.0	G	I
CK2118	0-4	0-55	500	100	10^6	100	100	.035	.300	1.5	1.0	G	I
CK2080	0-4	0-55	500	750	10^8	240	150	.035	.550	2.5	1.0	G	I
CK2140	†	0-25	500	7500	$5x10^7$	100	75	.002	.015	2.0	1.0	G	L
CK2141	†	0-25	500	5000	$5x10^7$	150	100	.004	.120	2.0	1.0	G	L
CK2142	†	0-25	500	500	10^7	150	100	.005	.650	2.0	1.0	G	L
CK2143	†	0-25	500	3000	$5x10^6$	150	100	.005	.850	2.5	1.0	G	L
TO-8													
CK2102	0-5	0-60	1500	300	10^7	250	150	.035	.700	1.8	1.0	AA	I
CK2103	0-5	0-60	1500	50	10^6	100	100	.035	.900	1.8	1.0	AA	I
CK2104	0-5	0-60	1500	50	10^6	100	100	.035	1.2	1.8	1.0	AA	I
CRYSTAL CAN													
CK1121	0-5	0-55	1000	150	10^7	100	100	.035	.300	2.0	.10	H	I
CK1121W	0-5	0-55	500	150	10^7	100	100	.035	.300	2.0	.10	H	I
CK1122	0-10	0-18	1000	750	10^7	100	100	.030	.300	2.0	.10	H	I
CK1122B	0-10	0-18	1000	600	10^8	200	125	.030	.225	2.0	.15	H	I
CK1122W	0-10	0-18	1000	850	10^8	200	125	.030	.225	2.0	.15	H	I
CK1123	0-25	0-37	1000	150	10^7	150	100	.040	.400	2.0	.10	H	I
CK1124	150*	.2-1.2	1000	3000	10^7	150	100	.005	.125	1.8	.10	H	N

*Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated range.

†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having a resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION

DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

OPTO—ISOLATORS—RAYSISTORS® (Cont'd)

	Control Circuit			Signal Circuit-Photodetector						General			
Model No.	Voltage Vdc	Current (Ma)	Isolation D.C. Peak Volts	Resistance-ohms Max On Res.	Resistance-ohms Min Off Res.	Voltage Max. Vdc	Power Max mW	Typ. Rise (sec)	Switching Decay (sec)	Shunt Cap (Pf)	Coupling Cap (Pf)	Construction Fig.	Emitter[1] Source
CRYSTAL CAN (Cont'd)													
CK2000	0-25	0-37	1000	40	10^7	150	100	.035	.400	1.8	.10	H	I
CK2000B	0-25	0-37	500	40	10^7	100	100	.040	.400	1.8	.10	H	I
CK2003	0-10	0-18	500	225	10^7	100	100	.030	.250	2.0	.15	H	I
CK2013	0-25	0-37	500	100	10^6	100	100	.035	.700	2.0	.10	H	I
CK2015	0-25	0-37	1000	1500	10^8	200	125	.035	.175	2.0	.10	H	I
CK2018	0-5	0-55	1000	200	10^9	200	125	.035	.175	2.0	.10	H	I
CK2019	0-25	0-37	1000	1000	10^6	150	100	.040	.750	2.5	.15	H	I
CK2028A	0-25	0-37	1000	200	10^6	100	100	.040	.850	2.0	.10	H	I
CK2028B	0-25	0-37	500	200	10^6	100	100	.040	.850	2.5	.15	H	I
CK2051	0-10	0-18	1000	2000	10^6	125	125	.030	.950	2.0	.10	H	I
CK2052	0-25	0-37	1000	300	10^6	125	125	.040	.950	2.0	.10	H	I
CK2053	0-5	0-55	1000	1250	10^6	125	125	.040	.950	2.0	.10	H	I
CK2086	0-10	0-18	1000	1000	10^7	150	125	.030	.300	1.8	.10	H	I
CK2112	0-10	0-18	500	300	10^7	150	125	.035	.350	1.8	.10	H	I
CK2132	0-10	0-18	1000	750	10^8	150	125	.030	.125	1.8	.10	H	I
CK2139	0-5	0-55	1000	100	10^7	125	125	.040	.300	1.8	.10	H	I
CK2147	†	0-25	1000	1000	10^8	150	125	.003	.075	1.8	.10	H	L
CK2148	†	0-25	1000	300	10^6	125	125	.015	.350	1.8	.10	H	L
CK2149	†	0-25	1000	150	10^6	125	125	.015	.700	1.8	.10	H	L
TO-5 EPOXY SHELL													
CK2078	0-10	0-18	1000	850	10^7	150	125	.035	.350	2.0	1.0	I	I
CK2137	0-12	0-25	1000	500	10^7	150	125	.050	.750	2.0	1.0	I	I
TO-5—DUAL††													
CK2150	0-5	0-55	500	300	10^6	75	75	.040	.800	2.0	1.0	J	I
CK2151	0-5	0-55	500	850	10^6	75	75	.060	.850	2.0	1.0	J	I
CK2153	0-3	0-15	500	1000	10^6	75	75	.050	.800	2.0	1.0	J	I
CK2154	0-3	0-15	500	8000	10^6	75	75	.050	.850	2.0	1.0	J	I
CK2155	†	0-40	500	900	10^6	75	75	.010	.500	2.0	1.0	J	L
CK2157	†	0-40	500	600	10^6	75	75	.010	.650	2.0	1.0	J	L
CRYSTAL CAN—DUAL††													
CK2170	0-10	0-18	500	850	10^6	75	75	.035	.800	2.0	1.0	K	I
CK2171	0-10	0-18	500	2000	10^6	75	75	.035	.950	2.0	1.0	K	I
CK2172	0-25	0-37	500	300	10^6	75	75	.045	.950	2.0	1.0	K	I
CK2173	†	0-25	500	600	10^6	75	75	.010	.650	2.0	1.0	K	L
EPOXY TUBE, FLYING LEAD—DUAL††													
CK2160	0-10	0-18	1500	850	10^7	75	75	.035	.450	2.5	1.0	L	I
CK2161	0-10	0-18	1500	3000	10^6	75	75	.035	.850	2.5	1.0	L	I
CK2162	†	0-25	1500	1500	10^6	75	75	.010	.600	2.5	1.0	L	L
EPOXY 7 PIN—DUAL††													
CK2033	0-10	0-18	1500	500	10^7	200	125	.040	.500	2.5	1.0	M	I
CK2038	0-10	0-18	1500	1500	10^6	200	125	.045	.850	2.5	1.0	M	I
CK2037	†	0-25	1500	1200	10^6	200	125	.012	.450	2.5	1.0	M	L
EPOXY 9 PIN—DUAL††													
CK2042	0-10	0-18	1500	1000	10^6	150	125	.035	.950	2.0	1.0	N	I
CK2043	0-25	0-37	1500	300	10^6	150	125	.045	.950	2.0	1.0	N	I
PRINTED CIRCUIT—DUAL††													
CK2040	0-25	0-37	1500	300	10^7	200	150	.055	.500	3.0	1.0	O	I
CK2041	120*	0-3.5	1500	1000	10^7	150	125	.008	.100	3.0	1.0	O	N

*Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated range.

†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having a resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.

††Signal Circuit ratings are for each half of cell. Typical dual isolators Cell to Cell resistance balance 90%, resistance tracking 10%.

RAYTHEON

OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

PHOTOCONDUCTIVE CELLS—SINGLE

Type	Sensitive Material	Pk Spectral Response A	Resistance-Ohms @ ±33% 2 Feet C	Dark Resistance "Off R" Ohms	Rise Time Typ. Sec	Decay Time Typ. Sec	Voltage Max. Vdc	Power Max. mW	Construction Type
1/4" GLASS VIAL									
CK1201	CdSe	7150	600	10^7	.005	.080	75	75	Q
CK1202	CdSe	7150	1200	10^7	.005	.060	100	100	Q
CK1203	CdSe	7150	3500	10^7	.006	.060	150	100	Q
CK1204	CdSe	7150	7000	10^8	.006	.050	200	125	Q
CK1205	CdS/Se	6550	10,000	10^6	.006	.150	150	125	Q
CK1206	CdSe	7150	20,000	10^8	.005	.040	200	150	Q
CK1207	CdSe	7150	100K	10^9	.004	.015	200	150	Q
CK1208	CdS/Se	6150	3000	10^6	.005	.175	75	75	Q
CK1209	CdS/Se	5500	6000	10^6	.005	.250	75	75	Q
CK1221	CdS	5150	7000	500K	.007	.900	75	75	Q
CK1222	CdS	5150	12,000	10^6	.007	.800	75	75	Q
CK1223	CdS	5150	20,000	10^6	.007	.500	100	100	Q
CK1224	CdS/Se	6550	1000	10^7	.006	.900	75	75	Q
CK1225	CdS/Se	6150	10,000	10^7	.006	.700	125	125	Q
CK1226	CdS/Se	5500	15,000	10^6	.007	.950	100	100	Q
CK1227	CdS/Se	6150	100K	5x10^7	.005	.500	200	150	Q
CK1228	CdS	5150	130K	5x10^7	.005	.500	200	150	Q
TO-5 HERMETIC									
CK1241	CdSe	7150	800	10^7	.005	.080	75	75	Z
CK1242	CdSe	7150	1200	10^7	.005	.060	100	100	Z
CK1243	CdSe	7150	3500	10^7	.006	.060	100	100	Z
CK1244	CdSe	7150	7000	10^8	.006	.060	100	100	Z
CK1245	CdS/Se	6550	1500	10^6	.005	.450	100	100	Z
CK1246	CdSe	7150	10,000	10^8	.005	.010	200	150	Z
CK1247	CdSe	7150	30,000	10^8	.005	.005	200	150	Z
CK1248	CdS/Se	6150	7000	10^7	.005	.250	100	125	Z
CK1249	CdS/Se	6150	4000	10^6	.006	.500	100	100	Z
CK1261	CdS	5150	6000	500K	.007	1.200	75	75	Z
CK1262	CdS	5150	12,000	10^6	.007	.900	75	75	Z
CK1263	CdS	5150	20,000	10^6	.007	.500	100	100	Z
CK1264	CdS	5150	10,000	10^7	.006	.500	100	100	Z
CK1265	CdS/Se	6550	3000	10^7	.005	.400	100	100	Z
CK1266	CdS/Se	6150	3000	10^6	.005	.375	75	75	Z
CK1267	CdS/Se	6150	15,000	10^7	.007	.200	200	125	Z
CK1268	CdS	5150	80,000	10^7	.006	.300	200	125	Z
TO-8 HERMETIC									
CK1251	CdSe	7150	250	10^7	.005	.175	150	125	R
CK1252	CdSe	7150	12,000	10^8	.005	.150	300	250	R
CK1253	CdS/Se	6550	8000	10^7	.005	.450	200	150	R
CK1254	CdS/Se	6550	10,000	10^7	.006	.400	300	250	R
CK1255	CdS/Se	6100	3000	10^6	.005	.600	200	150	R
CK1256	CdS/Se	6100	4000	10^7	.006	.500	250	250	R
CK1257	CdS	5150	10,000	10^6	.005	.950	200	150	R
CK1258	CdS	5150	12,000	10^8	.007	.650	200	200	R
TO-3 POWERCELL									
CK1286	CdSe	7150	12,000	10^8	3.0	.300	300	600	S
CK1287	CdS/Se	6550	6500	10^8	3.5	.450	300	600	S
CK1288	CdS/Se	5550	9000	10^8	4.0	.550	300	600	S
CK1289	CdS	5150	12,000	10^8	5.0	.650	300	600	S

—All recorded measurements taken at room ambient of 25°C at 2850°K color temperature of a calibrated and aged incandescent light source after cells were light adapted at 30 ft-c for 16 hours.

■Outlines on pages 6 to 8

OPTO-ISOLATORS—RAYSISTORS®
PHOTOCONDUCTIVE CELLS

PHOTOCONDUCTIVE CELLS—SINGLE (Cont'd)

Type	Sensitive Material	Peak Spectral Response Å	Resistance @ ±33% 2 Feet C Ohms	Dark Resistance "Off R" Ohms	Rise Time Typ. Sec	Decay Time Typ. Sec	Voltage Max. VDC	Power Max. mW	Construction Type
TO-6 HERMETIC									
CK1290	CdS	5100	6500	10^7	4.0	.575	450	1000	T
CK1291	CdS	5100	12,000	10^7	4.0	.575	450	1000	T
CK1292	CdS/Se	5500	5000	10^7	4.0	.450	450	1000	T
CK1293	CdS/Se	6100	3000	10^8	3.0	.325	450	1000	T
TO-18 DIA OPEN—EPOXY									
CK1210	CdSe	7150	8500	10^7	.007	.250	75	75	U
CK1211	CdS/Se	6550	6000	10^6	.006	.500	75	75	U
CK1212	CdS/Se	6100	1500	5×10^5	.007	1.2	75	75	U
CK1213	CdS/Se	5500	9000	5×10^5	.009	1.2	75	75	U
CK1214	CdS	5100	7000	5×10^5	.010	1.3	75	75	U
TO-5 DIA OPEN—EPOXY									
CK1216	CdSe	7150	1000	10^7	.005	.175	100	100	V
CK1217	CdS/Se	6550	1500	10^7	.004	.400	100	100	V
CK1218	CdS/Se	6550	3500	10^6	.005	.550	150	100	V
CK1219	CdS/Se	5500	5000	10^6	.006	.700	100	100	V
CK1220	CdS	5100	7000	10^6	.007	.950	100	125	V
TO-8 DIA OPEN—EPOXY									
CK1230	CdSe	7150	12,000	10^7	.005	.125	175	200	W
CK1231	CdS/Se	6550	10,000	10^7	.006	.400	175	200	W
CK1232	CdS/Se	6100	4000	10^6	.005	.600	175	200	W
CK1233	CdS/Se	5500	7500	10^6	.005	.750	175	200	W
CK1234	CdS	5100	14,000	10^6	.005	.950	200	200	W

PHOTO CONDUCTIVE CELLS—DUAL

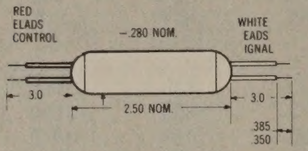
Type	Peak Spectral Response Å	Resistance @ ±33% 2 Feet C ½ Ohms	Dark Resistance ½ Ohms	Balance %	Tracking %	Number of Leads	Voltage ½ VDC	Power ½ mW	Construction Type
TO-5 HERMETIC DUAL									
CK1280	7150	1500	10^7	85	10	4	125	75	X
CK1281	6550	4500	10^7	85	10	4	125	75	X
CK1282	6150	9000	10^6	85	10	4	125	75	X
CK1283	5150	15K	10^6	85	10	4	125	75	X
CK1284	7150	25K	10^8	85	10	4	125	75	X
CK1285	7150	120K	10^8	85	10	3	150	100	X
TO-8 HERMETIC DUAL									
CK1273	7150	1500	10^7	85	10	3	125	125	Y
CK1274	6550	6500	10^7	85	10	3	125	125	Y
CK1276	5150	6000	10^6	85	10	3	125	125	Y
CK1277	7150	1800	10^7	85	10	4	125	125	Y
CK1278	6550	7500	10^7	85	10	4	125	125	Y
CK1279	5150	12,000	10^6	85	10	4	125	125	Y

—All recorded measurements taken at room ambient of 25°C at 2850°K color temperature of a calibrated and aged incandescent light source after cells were light adapted at 30 ft-c for 16 hours.

RAYTHEON

OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

(A)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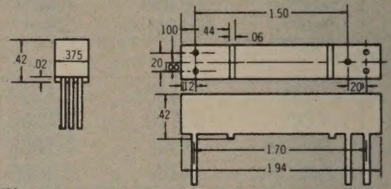
Terminal Connections
Red Leads - Control Crt (Lamp)
White Leads - Signal Crt. (Cell)

(B) Printed Circuit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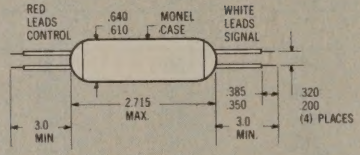
Pins 3 Shield (Ground)
Pins 4, 5 Signal Circuit (Photocell)

(C) High Voltage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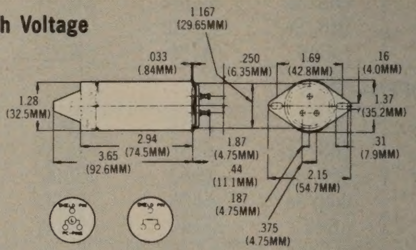
High Voltage - Flying Leads
Red Leads - Control Circuit (Lamp)
White Leads - Signal Circuit (Cell)

(D) High Voltage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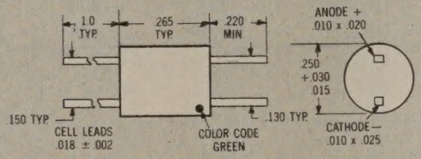
High Voltage - Epoxy Basing
Red Base - Control Circuit
Black Base - Signal Circuit

(E)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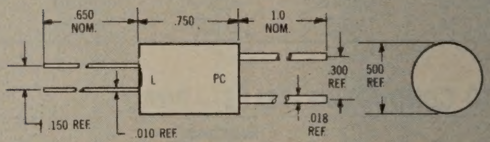
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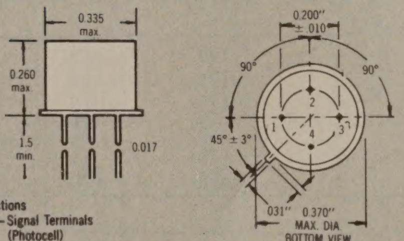
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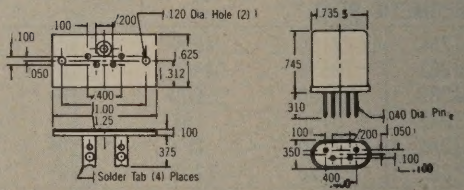
1.5
min.
0.017
0.200"
± .010"
90°
90°
45° ± 3°
1
2
3
4
.031"
0.370"
MAX. DIA
BOTTOM VIEW

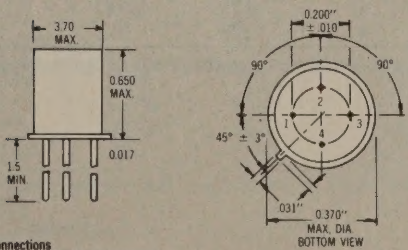
Terminal Connections
Leads 1 and 3—Signal Terminals (Photocell)
Leads 2 and 4—Control Terminals (Light Source)

(H)


.100
.200
.120 Dia. Hole (2)
.100
.050
.625
.312
.400
1.00
1.25
.100
.375
Solder Tab (4) Places
.735
.745
.310
.040 Dia. Pin
.100
.200
.050
.350
.100
.400

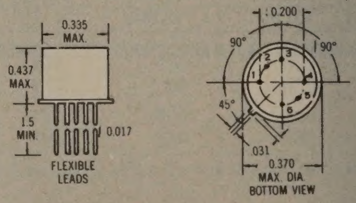
Terminal Connections
Pins 1 & 2 Control Circuit (Light Source)
1 2 3 4
Pins 3 & 4 Signal Circuit (Photoresistor)

(I)


3.70
MAX.
0.650
MAX.
0.017
1.5
MIN.
0.200"
± .010"
90°
90°
45° ± 3°
1
2
3
4
.031"
0.370"
MAX. DIA
BOTTOM VIEW

Terminal Connections
Pins 4 & 2 Control Circuit (Light Source)
Pins 3 & 1 Signal Circuit (Photoresistor)

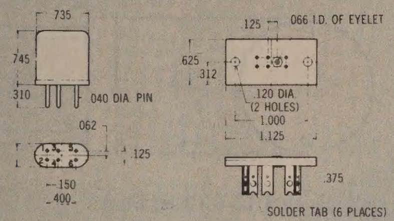
(J)


0.335
MAX.
0.437
MAX.
1.5
MIN.
0.017
FLEXIBLE
LEADS
0.200
90°
90°
45°
1
2
3
4
5
6
.031
0.370
MAX. DIA
BOTTOM VIEW

Terminal Connections
Pins #2 & #5—Control Circuit (Energy Emitter)
Pins #1 & #6—Signal Circuit (Photoresistor #1)
Pins #3 & #4—Signal Circuit (Photoresistor #2)

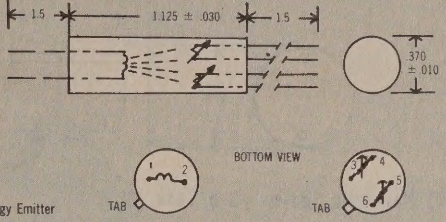
OPTO-ISOLATORS—RAYSISTORS®
PHOTOCONDUCTIVE CELLS

(K)


.735
.745
.310
.040 DIA. PIN
.062
.125
.150
.400
.125
.066 I.D. OF EYELET
.625
.312
.120 DIA.
(2 HOLES)
1.000
1.125
.375
SOLDER TAB (6 PLACES)

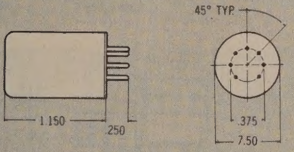
Terminal Connections
Crystal Can—6-Pin Header
Pin #1—PC #1
Pin #2—PC #2
Pin #3—PC #1
Pin #4—PC #2
Pin #5—Lamp Control
Pin #6—Lamp Control

(L)


1.5
1.125 ± .030
1.5
.370
± .010
BOTTOM VIEW
1
2
3
4
5
6
TAB
TAB

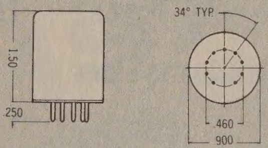
Terminal Connections.
Control Circuit
Pins #1 & #2—Energy Emitter
Identified—Yellow Dot.
Signal Circuit
Pins #3 & #4 Photo Resistor #1
Pins #5 & #6 Photo Resistor #2

(M)


45° TYP.
1.150
.250
.375
7.50

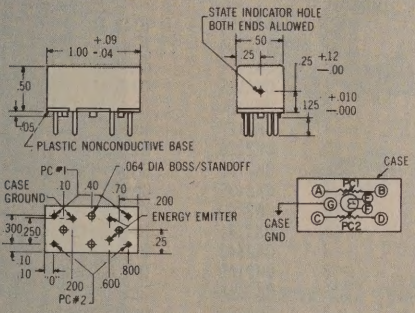
Terminal Connections
Pin #1—Lamp Control
Pin #2—PC #1
Pin #3—PC #1
Pin #4—NC
Pin #5—Lamp Control
Pin #6—PC #2
Pin #7—PC #2

(N)

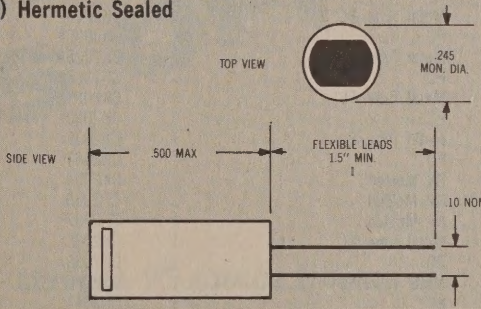

34° TYP.
.150
.250
.460
.900

Terminal Connections
9-Pin Header—Epoxy Shell—Design
Pin #1—N.C.
Pin #2—PC #1
Pin #3—PC #1
Pin #4—Control Lamp
Pin #5—Control Lamp
Pin #6—PC #2
Pin #7—PC #2
Pin #8—PC #3
Pin #9—PC #3

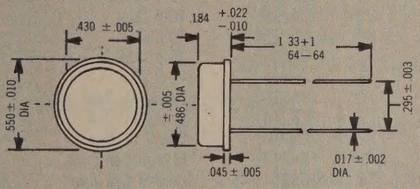
(O)


STATE INDICATOR HOLE
BOTH ENDS ALLOWED
+.09
1.00 -.04
.50
.05
.50
.25
.25 +.12 −.00
.125 +.010 −.000
PLASTIC NONCONDUCTIVE BASE
PC #1
.064 DIA BOSS/STANDOFF
CASE GROUND
.10
.40
.70
.200
ENERGY EMITTER
.300
.250
"0"
.25
.10
.10
"0"
.200
.600
.800
PC#2
CASE
CASE GND
PC1
PC2
A B C D E F G

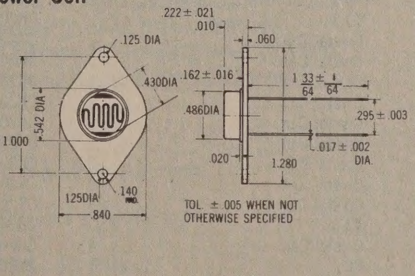
(Q) Hermetic Sealed


TOP VIEW
.245
MON. DIA.
SIDE VIEW
.500 MAX
FLEXIBLE LEADS
1.5" MIN.
.10 NOM.

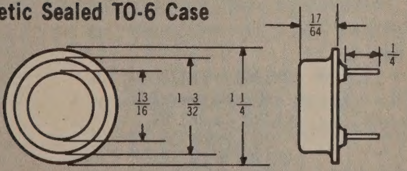
(R) Hermetic Sealed TO-8 Case


.430 ± .005
.550 ± .010 DIA
.184 +.022 −.010
1 33/64 +1/64 −1/64
± .005
.486 DIA
.295 ± .003
.045 ± .005
.017 ± .002 DIA.

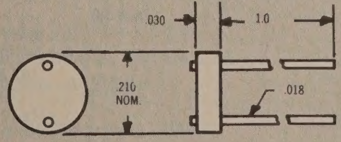
(S) TO-3 Power Cell


.222 ± .021
.010
.125 DIA
.060
.430DIA
.162 ± .016
1 33/64 ± 1/64
.486DIA
.295 ± .003
.542 DIA
1.000
.017 ± .002
DIA.
.020
1.280
.125DIA
.140
.840
TOL. ± .005 WHEN NOT
OTHERWISE SPECIFIED

(T) Hermetic Sealed TO-6 Case


17/64
1/4
13/16
1 3/32
1 1/4

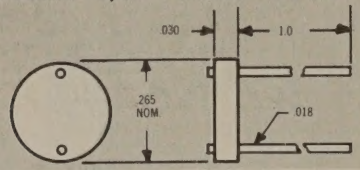
(U) Epoxy Coated "Open" Photocell TO-18 Dia.


.030
1.0
.210
NOM.
.018

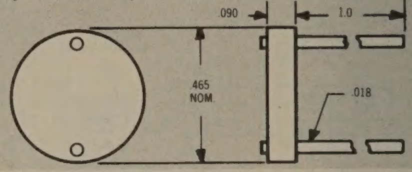
RAYTHEON

OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

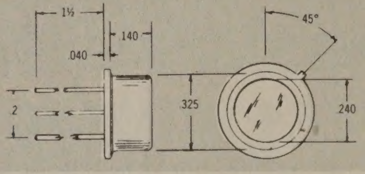
(V) Epoxy Coated "Open" Photocell TO-5 Dia.


.030
1.0
.265
NOM
.018

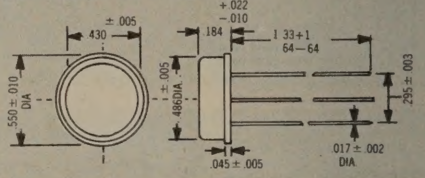
(W) Epoxy Coated "Open" Photocell TO-8 Dia.


.090
1.0
.465
NOM
.018

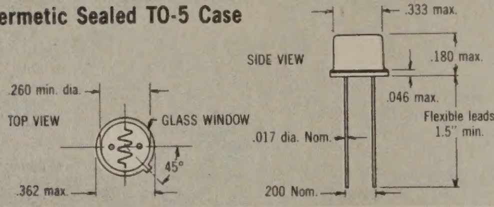
(X) Hermetic Sealed TO-5 Case, Dual


1½
140
.040
45°
2
.325
.240

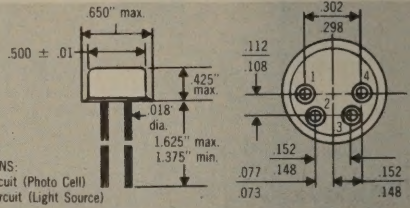
(Y) Hermetic Sealed TO-8 Case, Dual


± .005
.430
+.022
−.010
.184
1 33+1
64−64
.550 ± .010
DIA
.486 DIA. ± .005
.295 ± .003
.045 ± .005
.017 ± .002
DIA.

(Z) Hermetic Sealed TO-5 Case


.333 max.
SIDE VIEW
.180 max.
.260 min. dia.
.046 max.
TOP VIEW
GLASS WINDOW
Flexible leads
1.5" min.
.017 dia. Nom.
45°
.362 max.
200 Nom.

(AA) TO-8


.650" max.
.500 ± .01
.425"
max.
.018"
dia.
1.625" max.
1.375" min.
.302
.298
.112
.108
1
2
3
4
.152
.148
.077
.073
.152
.148

TERMINATION CONNECTIONS:
Leads 1 and 4—Signal Circuit (Photo Cell)
Leads 2 and 3—Control Circuit (Light Source)

LOCATING GUIDE OPTO-ISOLATORS (RAYSISTORS®)

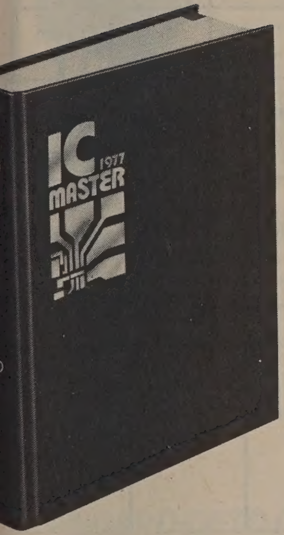
		PAGE NO.
CK1101	Metal Tube, FL	1
CK1101P	PC	1
CK1102	Metal Tube, FL	1
CK1102P	PC	1
CK1103	Metal Tube, FL	1
CK1103P	PC	1
CK1104	Metal Tube, FL	1
CK1104P	PC	1
CK1105	HV, Molded	2
CK1106	HV, Molded	2
CK1108	HV, Molded	2
CK1112	Metal Tube, FL	1
CK1112P	PC	1
CK1113	Metal Tube, FL	1
CK1113P	PC	1
CK1114	TO-5	2
CK1115	TO-5	2
CK1116	TO-5	2
CK1117	TO-5	2
CL1121	Crystal Can	2
CL1121W	Crystal Can	2
CK1122	Crystal Can	2
CK1122B	Crystal Can	2
CK1122W	Crystal Can	2
CK1123	Crystal Can	2
CK1124	Crystal Can	2
CK2000	Crystal Can	2
CK2000B	Crystal Can	3
CK2002	TO-5	2
CK2003	Crystal Can	3
CK2008P	PC	1
CK2013	Crystal Can	3
CK2015	Crystal Can	3
CK2018	Crystal Can	3
CK2019	Crystal Can	3
CK2025P	PC	1
CK2028A	Crystal Can	3
CK2028B	Crystal Can	3
CK2029	HV, FL	2
CK2030	HV, Molded	2
CK2032	HV, FL	2
CK2033	Epoxy 7 Pin Dual	3
CK2034	HV, FL	2
CK2035	HV, FL	2
CK2037	Epoxy 7 Pin Dual	3
CK2038	Epoxy 7 Pin Dual	3
CK2039	TO-5	2
CK2040	PC Dual	3
CK2041	PC Dual	3
CK2042	Epoxy 9 Pin Dual	3
CK2043	Epoxy 9 Pin Dual	3
CK2046	TO-5	2
CK2051	Crystal Can	3
CK2052	Crystal Can	3
CK2053	Crystal Can	3
CK2056	HV, Molded	2
CK2066	HV, Molded	2
CK2067	HV, Molded	2
CK2070	TO-5	2
CK2071	TO-5	2
CK2072	TO-5	2
CK2078	TO-5 Epoxy	3
CK2080	TO-5	2
CK2086	Crystal Can	3
CK2095	TO-5	2
CK2101	TO-5	2
CK2102	TO-8	2
CK2103	TO-8	2
CK2104	TO-8	2
CK2112	Crystal Can	3
CK2118	TO-5	2
CK2124	TO-5	2
CK2127	TO-5	2
CK2129	HV, FL	2
CK2132	Crystal Can	3
CK2139	Crystal Can	3
CK2140	TO-5	2
CK2141	TO-5	2
CK2142	TO-5	2
CK2143	TO-5	2
CK2145	Tubular, Axial	2
CK2146	Tubular, Axial	2
CK2147	Crystal Can	3
CK2148	Crystal Can	3
CK2149	Crystal Can	3
CK2150	TO-5 Dual	3
CK2151	TO-5 Dual	3
CK2153	TO-5 Dual	3
CK2154	TO-5 Dual	3
CK2155	TO-5 Dual	3
CK2157	TO-5 Dual	3
CK2160	Epoxy FL Dual	3
CK2161	Epoxy FL Dual	3
CK2162	Epoxy FL Dual	3
CK2170	Crystal Can Dual	3
CK2171	Crystal Can Dual	3
CK2172	Crystal Can Dual	3
CK2173	Crystal Can Dual	3
CK2177	Tubular FL	2
CK2178	Tubular FL	2

LOCATING GUIDE—PHOTO CONDUCTIVE CELLS

		PAGE NO.
CK1201 to CK1209	¼" Glass Vial	4
CK1210 to CK1214	TO-18 Open	5
CK1216 to CK1228	¼" Glass Vial	4
CK1230 to CK1234	TO-8 Open	5
CK1241 ro CK1249	TO-5 Hermetic	4
CK1251 to CK1258	TO-8 Hermetic	4
CK1261 to CK1268	TO-5 Hermetic	4
CK1273 to CK1279	TO-8 Hermetic, Dual	5
CK1280 to CK1285	TO-5 Hermetic, Dual	5
CK1286 to CK1289	TO-3 Power Cell	4
CK1290 to CK1293	TO-6 Hermetic	5

WHEN THE CHIPS ARE DOWN...

THE NEW 1977
IC MASTER
PAYS OFF!



The new IC MASTER is the ultimate IC source book.

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- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

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INCORPORATED

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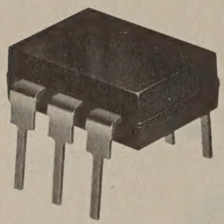
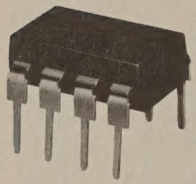
OPTICALLY COUPLED ISOLATORS

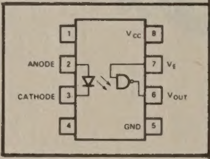
5KV — UL APPROVED

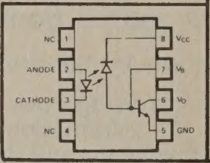


PART NUMBER	CTR% TYP @I_f = 10 mA	CTR% MIN	V_f@ 50mA I_f	V_R@ ≤10μA I_R	BV_{CEO} ≤100μA (V)	BV_{CEO} ≤100μA (V)	I_{CEO} @10V (nA)	$V_{CE(sat)}$ TYP@ (V)	I_c(mA)	I_f(mA)	MINIMUM ISOLATION VOLTS (DC)	MAX t_r 100ΩRL 10V_{CE}
SPX-35	150	100	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	5000	8μ Sec
SPX-103	150	100	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	3550	8μ Sec
SPX-6	100	50	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	5000	5μ Sec
SPX-53	100	50	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	3550	5μ Sec
SPX2E	80	30	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	5000	5μ Sec
SPX-33	80	30	≤ 1.5V	3V	30V	7V	≤ 50	0.4	2.0	20	3550	5μ Sec
SPX-26	30	10	≤ 1.7V	3V	30V	5V	≤ 100	0.6	2.0	20	3550	8μ Sec Typ.

HIGH SPEED OPTICAL ISOLATORS

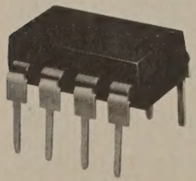


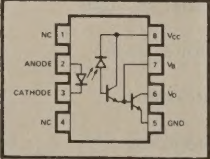




PART NUMBER	DESCRIPTION	APPLICATION	TYPICAL DATA RATES	CURRENT TRANSFER RATIO	SPECIFIED INPUT CURRENT	INPUT TO OUTPUT INSULATION
SCH4360	Ultra High Speed Optically Coupled Logic Gate	Line Receiver, High Speed Logic Ground Isolation	10M bit/s	600% Typ.	5.0mA	3000V
SCH4350	High Speed Transistor Output Isolator	Line Receiver, Analog Circuits, TTL/CMOS, TTL/LTTL, Ground Isolation	1M bit/s	7% Min.	16mA	3000V

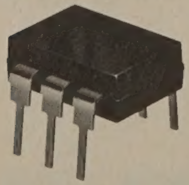
LOW INPUT CURRENT/ HIGH GAIN ISOLATORS

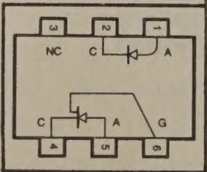




PART NUMBER	DESCRIPTION	APPLICATION	TYPICAL DATA RATES	CURRENT TRANSFER RATIO	SPECIFIED INPUT CURRENT	INPUT TO OUTPUT INSULATION
SCH4370	Low Input Current, High Gain. V_{cc}=18V Max.	Line Receiver, Ultra Low Current Ground Isolation, CMOS/LTTL CMOS/TTL, CMOS/CMOS	300k bit/s	400% Min.	0.5mA	3000V

PHOTO SCR ISOLATORS





PART NUMBER	TURN ON CURRENT (MAX) (IF)	FORWARD BLOCKING VOLTAGE (V_{AX} @ RGK = 27Kohm)	FORWARD VOLTAGE LED (V_F @ IF = 10mA)	ANODE VOLTAGE (DC) (VAK @ IA = 140mA; V_{cc} = 50V)	ISOLATION VOLTAGE (DC)
SCS11C1	11mA	200V Min.	1.5V Max.	1.5V Max.	5000V Min.
SCS11C3	14mA	200V Min.	1.5V Max.	1.5V Max.	5000V Min.

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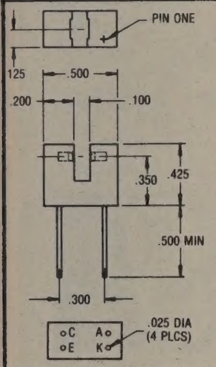
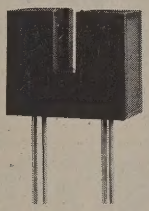
OPTICAL SWITCHES

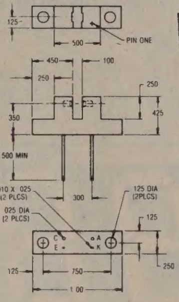
SPX 1872

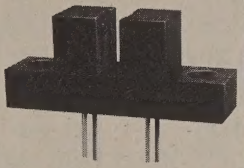

PIN ONE
.125
.500
.200
.100
.350
.425
.500 MIN
.300
C
A
E
K
.025 DIA
(4 PLCS)



ELECTRICAL CHARACTERISTICS:
A. ANODE
K. CATHODE
E. EMITTER
C. COLLECTOR

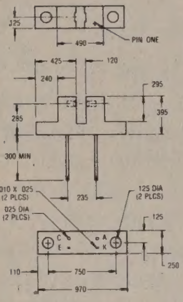
SPX 1873

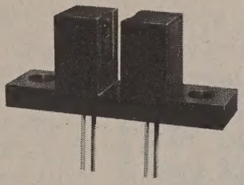

125
500
PIN ONE
450
100
250
250
425
350
500 MIN
010 X 025
(2 PLCS)
300
125 DIA
(2PLCS)
025 DIA
(2 PLCS)
125
C
E
A
K
125
750
250
1 00



ELECTRICAL CHARACTERISTICS:
A. ANODE
K. CATHODE
E. EMITTER
C. COLLECTOR

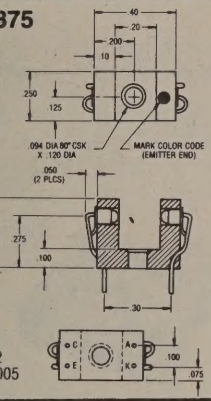
SPX 1874


125
490
PIN ONE
425
120
240
295
395
285
300 MIN
010 X 025
(2 PLCS)
235
125 DIA
(2 PLCS)
025 DIA
(2 PLCS)
125
C
E
A
K
110
750
250
970



ELECTRICAL CHARACTERISTICS:
A. ANODE
K. CATHODE
E. EMITTER
C. COLLECTOR

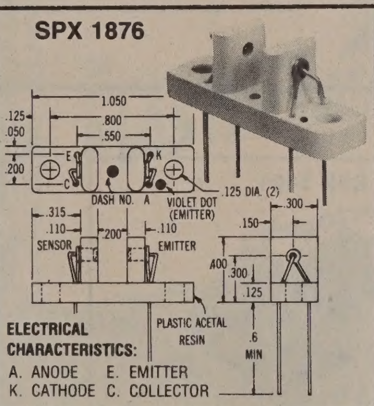
SPX 1875


.40
.20
.200
10
.250
.125
.094 DIA 80° CSK
X .120 DIA
MARK COLOR CODE
(EMITTER END)
.050
(2 PLCS)
.350
.275
.100
.30
C
E
A
K
.100
.075

ELECTRICAL CHARACTERISTICS:
A. ANODE
K. CATHODE
E. EMITTER
C. COLLECTOR

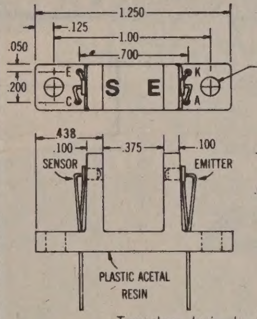
Two place decimals ± .02
Three place decimals ± .005

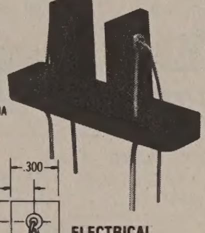
SPX 1876


1.050
.125
.800
.050
.550
.200
E
C
K
.125 DIA. (2)
DASH NO.
A
VIOLET DOT
(EMITTER)
.315
.110
.200
.110
SENSOR
EMITTER
.300
.150
.400
.300
.125
PLASTIC ACETAL
RESIN
.6
MIN

ELECTRICAL CHARACTERISTICS:
A. ANODE E. EMITTER
K. CATHODE C. COLLECTOR

SPX 1877


1.250
.125
1.00
.050
.700
.200
E
C
S
E
K
A
.125 DIA
(2)
.438
.100
.375
.100
SENSOR
EMITTER
.300
.150
.625
.500
.125
.375
MIN
PLASTIC ACETAL
RESIN



ELECTRICAL CHARACTERISTICS:
A. ANODE
K. CATHODE
E. EMITTER
C. COLLECTOR

Two place decimals ± .02 Three place decimals ± .005

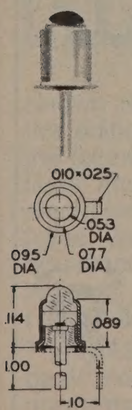
COUPLED ELECTRICAL CHARACTERISTICS (25°C)

*Phototransistor Output
**Photodarlington Output

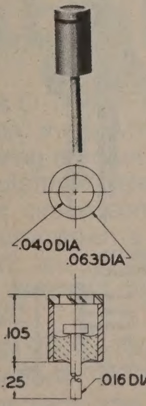
	Device Part Number	Min	Typ	Max	Unit
On-State Output Current (I_F = 20 mA, V_{CE} = 5V)	SPX 1872, 1873, 1874 −1*	200	500		μA
	SPX 1872, 1873, 1874 −2*	600	1200		μA
	SPX 1872, 1873, 1874 −3**	2000	5000		μA
	SPX 1872, 1873, 1874 −4*	3000	6000		μA
On-State Output Current (I_F = 30 mA, V_{CE} = 5V)	SPX 1875, 1876, −1*	150	400	600	μA
	SPX 1877 −1*	100	200	500	μA
	SPX 1875, 1876 −2*	500	1000		μA
	SPX 1877 −2*	400	800		μA
	SPX 1875, 1876 −3**	1500	4000		μA
	SPX 1877 −3**	1000	3000		μA

STANDARD OPTO COMPONENTS

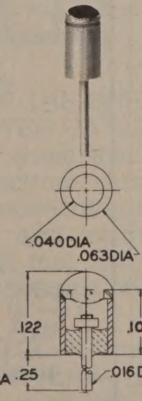
SE 1450[4]
SD 1410
SD 1420
SD 1440


010×025
.053
DIA
095
DIA
077
DIA
.114
.089
1.00
.10

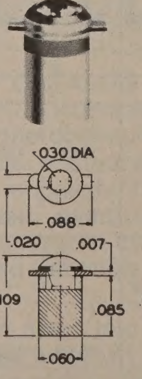
SD 1441


.040 DIA
.063 DIA
.105
.25
.016 DIA

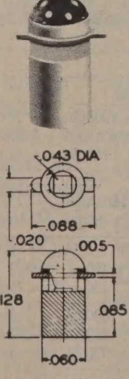
SD 1442


.040 DIA
.063 DIA
.122
.105
.25
.016 DIA

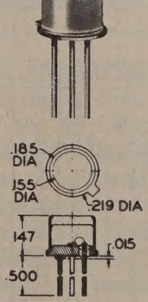
SE 2450
SD 2410
SD 2420
SD 2440[5]


.030 DIA
.088
.020
.007
.109
.085
.060

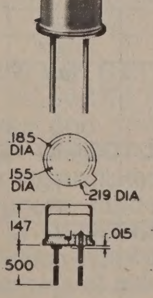
SE 2460[6]
SD 2441


.043 DIA
.088
.020
.005
.128
.085
.060

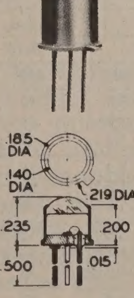
SE 3450 SD 3422
SE 3451 SD 3440
SD 3410 SD 3443[3]
SD 3420 SD 3444[3]
SD 3421


.185
DIA
.155
DIA
.219 DIA
.147
.015
.500

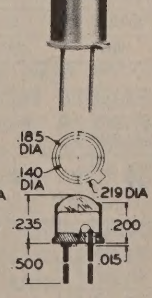
SE 3453[2]
SE 3455[1]


.185
DIA
.155
DIA
.219 DIA
.147
.015
.500

SE 5450 SD 5422
SE 5451 SD 5440
SD 5410 SD 5443[3]
SD 5420 SD 5444[3]
SD 5421


.185
DIA
.140
DIA
.219 DIA
.235
.200
.015
.500

SE 5453[2]
SE 5455[1]


.185
DIA
.140
DIA
.219 DIA
.235
.200
.015
.500

1. Replaces SSL 55B, 55C, 56
2. Replaces SSL 5A, 5B, 5C (High Pulse Applications)
3. Low Cost/High Gain Detector
4. Replaces SSL 15, SSL 315 (Available in Detectors)
5. Replaces TIL 601/604, MRD 601/604, LIS AX 601/604, OP 601/604
6. Replaces TIL 23/24, SSL 65/66, OP 122/124

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INCORPORATED

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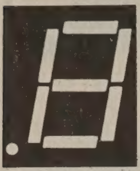
(214) 234-4271 Telex 730890

NOW!...SPECTRONICS LARGE NUMERIC DISPLAYS IN SINGLE AND MULTI-DIGITS

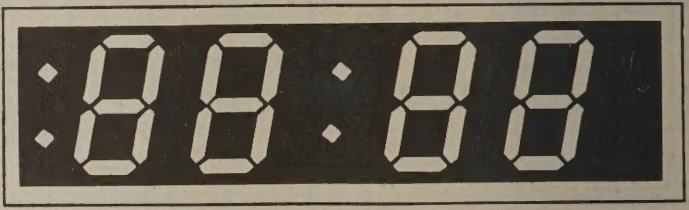
Spectronics has the VLEDS you need for large numeric display applications . . . in red single and multi-digits.



Single-Digits SPX 300 and 500 series single-digit numeric displays feature wide viewing angles, continuous uniform segments and high contrast. Plus, they are categorized for uniformity of luminous intensity and are available in both common cathode and common anode configurations. SPX 300 characters are .3 inches high; SPX 500 characters are .5 inches high. Plus and minus — left and right decimal points offered.

Multi-Digits For multi-digit applications, Spectronics offers the SPX 766 and SPX 767. Both displays feature .7 inch-high characters, colon, plus and minus.

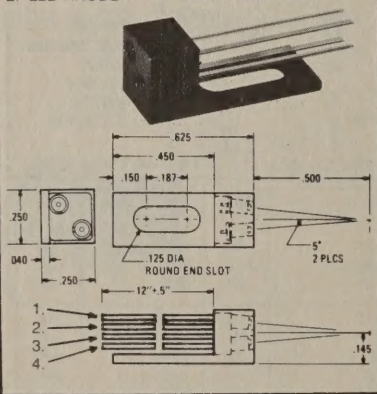
For special multi-digit applications give us the opportunity to quote on your requirement.



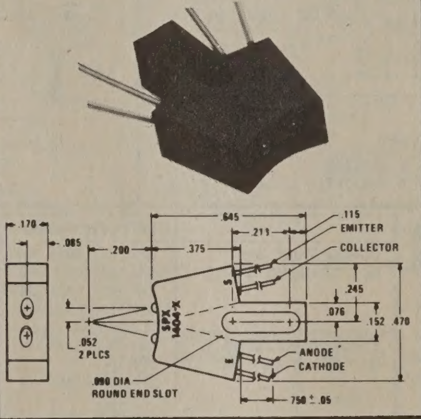
OPTICAL REFLECTIVE SWITCHES

SPX 2498

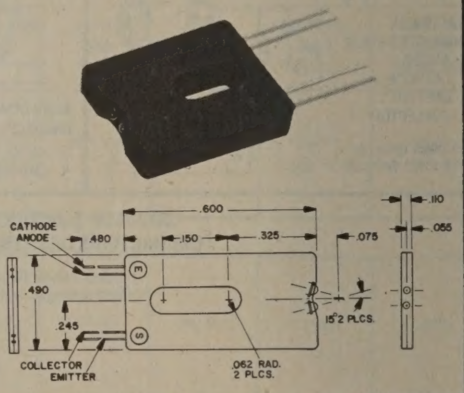
1. LED CATHODE 3. SENSOR COLLECTOR
2. LED ANODE 4. SENSOR EMITTER


.625
.450
.150
.187
.500
.250
.040
.250
.125 DIA
ROUND END SLOT
5°
2 PLCS
12"+.5"
1.
2.
3.
4.
.145

SPX 1404

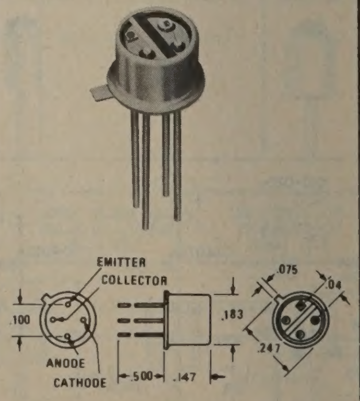

.170
.085
.200
.375
.645
.211
.115
EMITTER
COLLECTOR
SPX 1404
.245
.076
.152
.470
.052
2 PLCS
.090 DIA
ROUND END SLOT
ANODE
CATHODE
.750 ± .05

SPX 1160


CATHODE
ANODE
.480
.600
.150
.325
.075
.110
.055
.490
.245
15°2 PLCS.
COLLECTOR
EMITTER
.062 RAD.
2 PLCS.

SPX 1396

NOTE: Collector common to case.

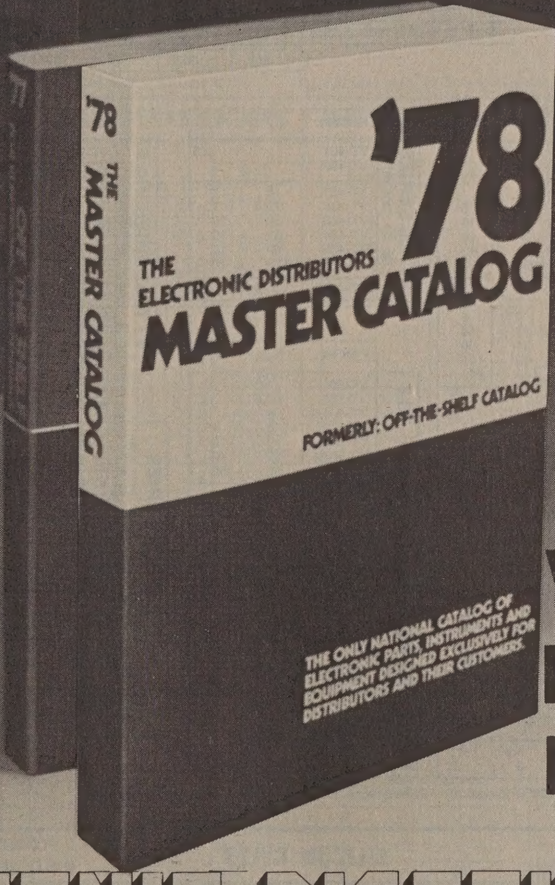

EMITTER
COLLECTOR
.100
ANODE
CATHODE
.183
.500
.147
.075
.04
.247

OPTICAL REFLECTIVE SWITCHES (LED and Phototransistor)

Optical/Electrical Characteristics at $T_A = 25°C$ unless otherwise specified.

PARAMETER	LED FWD VOLTAGE		COLLECTOR BREAKDOWN	EMITTER BREAKDOWN	LIGHT CURRENT			DARK CURRENT	LIGHT CURRENT RISE TIME
TEST CONDITION	$I_F = 50mA$		$I_C = 100\mu A$	$I_E = 100\mu A$	$V_{CE} = 5V$ LED $I_F = 30mA$			V_{CS} as shown $I_F = 0; H = 0$	$V_{CC} = 5V$; $I_C = 1mA$ $R_L = 1K\Omega$
SYMBOL	V_F		$V_{BR(CEO)}$	$V_{BR(ECO)}$	I_L			I_D	t_r
UNIT	VOLTS		VOLTS	VOLTS	MA			nA	μsec
	TYP	MAX	MIN	MIN	Min	Typ	d^1	MAX	TYP
SPX-2498-1		2.0	10		.04	.07	.5	1000@$V_{CE} = 10V$	6
SPX-2498-2	1.3	1.6	50	7	.125	.20	.5	250nA@$V_{CE} = 30V$	8
SPX-2498-3*	1.3	1.6	15	7	2.0	4.0	.5	250@$V_{CE} = 10V$	50@$R_L = 100\Omega$
SPX-1404-1		2.0	10		0.2	0.3	.2	100@$V_{CE} = 10V$	6
SPX-1404-2	1.3	1.6	50	7	0.4	0.6	.2	250nA@$V_{CE} = 30V$	8
SPX-1404-3*	1.3	1.6	15	7	2.0	4.0	.2	250@$V_{CE} = 10V$	50@$R_L = 100\Omega$
SPX-1396-1		1.5V@25mA	15	5	0.4	0.7	.05	70@$V_{CE} = 5V$	35
SPX-1396-2	1.3	1.5V@25mA	50	5	1.0	1.5	.05	150 and	35
SPX-1396-3	1.3	1.5V@25mA	50	5	2.0	2.5	.05	250 $I_F = 25mA$	35
SPX-1160-1		2.0	10	7	.5	.75	.075	1000@$V_{CE} = 10V$	4
SPX-1160-2			50	7	1.0	1.5	.075	250@$V_{CE} = 30V$	5
SPX-1160-3			10	7	5.0	10.0	.075	1000@$V_{CE} = 10V$	25@$R_L = 100\Omega$

*Sensor is photodarlington d^1 is distance to reflective surface.


'78
THE
MASTER CATALOG
'78
THE
ELECTRONIC DISTRIBUTORS
MASTER CATALOG
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THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

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The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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INDUSTRY'S BROADEST LINE OF DETECTORS

- Photoconductive Cells
- Phototransistors and Photodarlingtons
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Custom I-C's Design and Fabrication (Not detailed in this short form)

PHOTOCONDUCTIVE CELLS

LIGHT DEPENDENT RESISTORS

Photoconductors are thin films of CdS or CdSe on a ceramic substrate.
The material is designated by the second digit (O, 1, 2, 3, 4 or 7) of the part number.

Material	0-CdS	1-CdSe	2-CdS	3-CdS	4-CdSe	7-CdS
Peak Spectral nm	565	735	515	550	675	615

FIGURE A

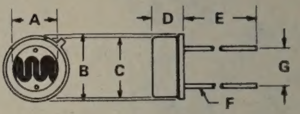
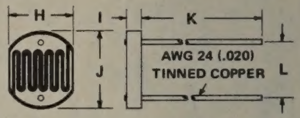


FIGURE B



	DIM.	VT 200	VT 300	VT 500
FIGURE A	A	.155	.240	.430
	B	.210	.360	.550
	C	.183	.325	.486
	D	.140/.154	.172/.183	.190/.230
	E	1.5/1.53	1.5/1.53	1.5/1.53
	F	.016/.019	.016/.019	.019
	G	.100	.200	.295

	DIM.	VT 400	VT 700	VT 800	VT 900
FIGURE B	H	.360/.380	.300/.320	.216/.236	.144/.164
	I	.070/.090	.070/.090	.070/.090	.070/.090
	J	.420/.440	.353/.373	.256/.276	.172/.192
	K	.75 min.	.75 min.	.75 min.	.75 min.
	L	.285/.305	.255/.275	.190/.210	.090/.110

	Part No.	R_1*	R_2*
VT 200 SERIES (Fig. A) Hermetic TO-18 (50 mW)	VT-201	4.3	.5
	VT-202	8	.75
	VT-202H	15	1
	VT-203	22	5
	VT-203H	44	5
	VT-204L	88	10
	VT-204	110	20
	VT-205	1000	200
	VT-211	2.3	.5
	VT-211H	3.5	1
	VT-212L	6	5
	VT-212	7.8	5
	VT-213L	16	10
	VT-213	22	50
	VT-213H	32	50
	VT-214L	64	100
	VT-214	140	200
	VT-221	6.8	.75
	VT-222	10	1
	VT-222H	20	1
	VT-223	40	5
	VT-223H	65	5
	VT-224L	80	10
	VT-224	500	50
	VT-225	1000	200
	VT-23L	11	1
	VT-231	22	1
	VT-232	100	50
	VT-233L	150	50
	VT-233	350	100
	VT-234	700	200
	VT-235	1400	200
	VT-241	2	.5
	VT-241H	4	1
	VT-242L	8	1
	VT-242	15	10
	VT-242H	30	10
	VT-271	4	2.5
	VT-272	6	5

		Part No.	R_1*	R_2*
VT 300 SERIES (Fig. A) Hermetic TO-5 (125 mW)		VT-30L	1.8	.1
		VT-301	3	.2
		VT-301H	3	1
		VT-302L	10	1
		VT-302	16	5
		VT-303L	32	10
		VT-303	70	10
		VT-304	144	50
		VT-305	1000	200
		VT-311L	2.1	.5
		VT-311	4.2	1
		VT-312L	8.4	5
		VT-312	22	50
		VT-312H	30	50
		VT-313L	60	100
		VT-314	140	200
		VT-32L	1.95	.1
		VT-321	3.9	.2
		VT-321H	7.8	1
		VT-322L	15.6	5
		VT-322	31.2	10
		VT-325	1000	200
		VT-333L	14	5
		VT-333	28	10
		VT-34L	.6	.1
		VT-341	1.2	.2
		VT-341H	2.4	1
		VT-342L	4.8	1
		VT-342	7	5
		VT-343L	14	10
		VT-343	28	10
	DUAL ELEMENT	VT-301/2	7.5	1
		VT-302/2	16	5
		VT-303L/2	32	5
		VT-312/2	5	1
		VT-313L/2	10	1
		VT-333/2	60	25
		VT-34L/2	1.5	.1
		VT-341/2	3	.2

	Part No.	R_1*	R_2*
VT 400 SERIES (Fig. B) (300 mW)	VT-401	1	.25
	VT-402	9	1
	VT-431	6	1
	VT-432	10.5	1
	VT-433	18	10
	VT-434	32	10
	VT-435	60	10
	VT-436	110	10
	VT-471	.9	.3

	Part No.	R_1*	R_2*
VT 500 SERIES (Fig. A) Hermetic TO-8 (500 mW)	VT-50L	1.3	.1
	VT-501	2.6	.2
	VT-501H	4	.5
	VT-502L	8	1
	VT-502	16	5
	VT-503L	32	10
	VT-503	66	50
	VT-51L	.7	.1
	VT-511L	1.4	.2
	VT-511	2.3	.5
	VT-511H	4.6	1
	VT-512L	9.2	10
	VT-521	2.6	.1
	VT-521H	5	.5
	VT-522L	9	1
	VT-522	18	5
	VT-523L	36	10
	VT-533L	12.5	5
	VT-533	25	10
	VT-54L	.25	.1
	VT-541	.5	.5
	VT-541H	1	1
	VT-542L	1.5	1
	VT-542	2	1

	Part No.	R_1*	R_2*
VT 700 SERIES (Fig. B) (250 mW)	VT-70L	1.6	1
	VT-701	3.0	5
	VT-721	2.6	1
	VT-721H	4.8	2
	VT-732	10.0	10
	VT-74L	.45	.5
	VT-741	.90	.5
	VT-771	2.0	2
	VT-773	8.4	10

		Part No.	R_1*	R_2*
VT 800 SERIES (Fig. B) (175 mW)		VT-801	3.0	.25
		VT-804	140.0	50
		VT-811	4	5
		VT-811H	8	10
		VT-82L	1.90	.1
		VT-833	33.0	15
		VT-835	330.0	100
		VT-841L	.90	.5
		VT-871	3.0	10
	DUAL ELEMENT	VT-811/2	2.4*	1
		VT-833/2	52 *	10
		VT-841/2	2.4*	.5
		VT-871/2	8.8*	1

	Part No.	R_1*	R_2*
VT 900 SERIES (Fig. B) (80 mW)	VT-901	4.3	.5
	VT-902	8.0	.75
	VT-903H	44.0	5
	VT-904L	88.0	10
	VT-904	110.0	20
	VT-912L	6.0	5
	VT-912	15.0	20
	VT-913H	32.0	50
	VT-914L	64.0	100
	VT-914	140.0	200
	VT-93L	11.0	1
	VT-931	22.0	1
	VT-932	100.0	50
	VT-941	2.0	.5
	VT-971	4.5	1

*R_1 2fc resistance in K ohms (tolerance ±33⅓% (2850°K source) — Resistance for dual element cells is for each ½.
*R min dark resistance (Megohms) in 5 sec

SILICON CELLS

PHOTOVOLTAIC CURRENT GENERATORS

POWER CONVERSION OR INSTRUMENT APPLICATIONS

	PART NO.	DIMENSIONS	I_{SC}@ 100fc
LOW CAPACITANCE DETECTORS High Speed Low leakage	VTS 3080	.8 x .8 in (2.03 x 2.03) cm	2.5 mA
	VTS 3081	.8 x .4 in (2.03 x 1.02) cm	1.2 mA
	VTS 3082	.4 x .4 in (1.02 x 1.02) cm	0.6 mA
	VTS 3083	.8 x .2 in (2.03 x .51) cm	0.55 mA
	VTS 3084	.4 x .2 in (1.02 x .51) cm	0.27 mA
	VTS 3085	.2 x .2 in (.51 x .51) cm	0.14 mA
	VTS 3086	.1 x .2 in (.25 x .51) cm	0.065 mA
	VTS 3087	.087 x .2 in (.22 x .51) cm	0.055 mA
	VTS 1086	See VT800 Series Dwg.	.065 mA
	VTS 4085	See VT700 Series Dwg.	.14 mA
	VTS 5086	See VT300 Series Dwg.	.065 mA
	VTS 5088	See VT300 Series Dwg.	.12 mA
	VTS 6089	See VT500 Series Dwg.	.28 mA
	VTS 7080A	1¼″ diameter hermetic	1.5 mA

	PART NO.	DIMENSIONS	I_{SC}@ 100fc
BES BLUE ENHANCED DETECTORS	VTS 3070	.8 x .8 in (2.03 x 2.03) cm	1.9 mA
	VTS 3071	.8 x .4 in (2.03 x 1.02) cm	.93 mA
	VTS 3072	.4 x .4 in (1.02 x 1.02) cm	.46 mA
	VTS 3073	.8 x .2 in (2.03 x .51) cm	.42 mA
	VTS 3074	.4 x .2 in (1.02 x .51) cm	.21 mA
	VTS 3075	.2 x .2 in (.51 x .51) cm	.10 mA
	VTS 3076	.1 x .2 in (.25 x .51) cm	.05 mA
	VTS 3077	.087 x .2 in (.22 x .51) cm	.042 mA
	VTS 1076	See VT800 Series Dwg.	.05 mA
	VTS 4075	See VT700 Series Dwg.	.10 mA
	VTS 5076	See VT300 Series Dwg.	.05 mA
	VTS 5078	See VT300 Series Dwg.	.09 mA
	VTS 6079	See VT500 Series Dwg.	.23 mA
	VTS 7070A	1¼″ diameter hermetic	1.12 mA

	PART NO.	DIMENSIONS	I_L* mA
SOLAR CELLS	VTS 3011	.087 x .20 in (.22 x .51) cm	1.7
	VTS 3012	.10 x .20 in (.22 x .51) cm	2.0
	VTS 3013	.20 x .20 in (.51 x .51) cm	4.2
	VTS 3014	.40 x .20 in (1.02 x .51) cm	8.4
	VTS 3018	.80 x .20 in (2.03 x .51) cm	17.0
	VTS 3020	.40 x .40 in (1.02 x 1.02) cm	18.0
	VTS 3022	.40 x .40 in (1.02 x 1.02) cm	21.0
	VTS 3024	.80 x .40 in (2.03 x 1.02) cm	38.0
	VTS 3026	.80 x .40 in (2.03 x 1.02) cm	44.0
	VTS 3028	.80 x .80 in (2.03 x 2.03) cm	79.0
	VTS 3050	1.25 Ø in (2.86 Ø) cm	110.0

*I_L min @ 0.4 volts for 100 mW/cm² @ 2850°K (m = 1 Equivalent)

VACTEC, INC. 2423 Northline Ind. Blvd., Maryland Heights, Mo. 63043 Phone: (314) 872-8300

VACTEC

INDUSTRY'S BROADEST LINE OF DETECTORS

- Photoconductive Cells
- Phototransistors and Photodarlingtons
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Custom I-C's Design and Fabrication (Not detailed in this short form)

PHOTODIODES

BLUE ENHANCED   P.I.N.

BLUE ENHANCED

P.N.	I_L^*(μA)	I_D^* max	C_J^*	P.N.	I_L^*(μA)	I_D^* max	C_J^*
VTB1012	13	500pA	.31nF	VTB9415B	1.3	4pA	.6nF
VTB1013	13	20	.31	VTB9416B	1.3	2	.6
VTB9412	13	500	.31	VTB1112B	6	500	.31
VTB9413	13	20	.31	VTB1113B	6	20	.31
VTB1112	60	500	.31	VTB5040	45	2000	1.0
VTB1113	60	20	.31	VTB5041	45	100	1.0
VTB1012B	1.3	500	.31	VTB5040B	4.5	2000	1.0
VTB1013B	1.3	20	.31	VTB5041B	4.5	100	1.0
VTB9412B	1.3	500	.31	VTB5050	130	3500	3.0
VTB9413B	1.3	20	.31	VTB5051	130	250	3.0
VTB9414B	1.3	10	.6	VTB6060	350	5000	8.0
				VTB6061	350	2000	8.0

P.I.N.

P.N.	I_L^*(μA)	I_D^* max	C_J^*
VTP1012	17	7nA	6pF
VTP1013	17	1.5	6
VTP1112	60	7	6
VTP1113	60	1.5	6
VTP5040	54	15	15
VTP5041	54	3	15
VTP5050	71	18	20
VTP5051	71	3.5	20
VTP6060	240	35	60
VTP6061	240	7	60

PACKAGE STYLES

See 931-932 Series under Phototransistors for all VTB94 — Series. For all VTB1 — and VTP1 — Series see TO-18, 101, 111 Series under Phototransistors. For VTB5 — and VTP5 — Series see VT300 under Photoconductive. For VTB6 — and VTP6 — Series see VT500 under Photoconductive.

*I_L is measured at 100 f.c., I_D at −2.0V for Blue Enhanced and −50V for P.I.N. C_J is at zero bias, for Blue Enhanced and −15V for P.I.N.   B Suffix indicates I-R cutoff filter.

PHOTOTRANSISTORS • PHOTODARLINGTONS

NPN SILICON
PASSIVATED

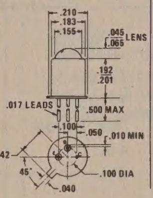
Hermetic VTT, VTA 101 and 111 SERIES TO-18			P.N.	I_{CEO} TYP.**	WINDOW
	PHOTOTRANSISTORS	LARGE CHIP*	VTT1012	.5	Flat
			VTT1011	1.0	"
			VTT1010	2.0	"
			VTT1013	4.0	"
			VTT1110	2.0	Lens
			VTT1111	3.5	"
			VTT1112	6.0	"
			VTT1113	12.0	"
		SMALL CHIP*	VTT1020	.125	Flat
			VTT1021	.250	"
			VTT1022	.500	"
			VTT1023	1.0	"
			VTT1120	.5	Lens
			VTT1121	1.0	"
			VTT1122	2.0	"
			VTT1123	4.0	"
	PHOTODARLINGTONS	LARGE CHIP*	VTA1011	2.0	Flat
			VTA1012	6.0	"
			VTA1013	15.0	"
			VTA1111	9.0	Lens
			VTA1112	35.0	"
		SMALL CHIP*	VTA1021	.5	Flat
			VTA1022	1.5	"
			VTA1023	4.0	"
			VTA1121	3.0	Lens
			VTA1122	8.0	"

				P.N.	I_{CEO} TYP.**	WINDOW
VTT, VTA 312 SERIES	COAXIAL	TRANS.	SM. CH.	VTT3121	1	Lens
				VTT3122	3	"
				VTT3123	8	"
		DARL.	SM. CH.	VTA3121	3	Lens
				VTA3122	8	"
VTT, VTA 931-932 SERIES	CERAMIC BASE	PHOTOTRANS.	LG. CH.	VTT9310	.5	EPOXY LENS WITH SLIGHT MAGNIFICATION
				VTT9311	1	
				VTT9312	2	
				VTT9313	4	
			SM. CH.	VTT9320	.125	
				VTT9321	.25	
				VTT9322	.5	
				VTT9323	1	
		PHOTODARL.	LG. CH.	VTA9311	2	
				VTA9312	6	
				VTA9313	15	
			SM. CH.	VTA9321	.5	
				VTA9322	1.5	
				VTA9323	4	

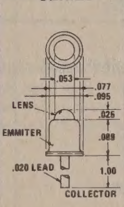
CHIPS For Custom or Hybrid Mounting

	P.N.	I_{CEO} TYP.**	I_{CEO} TYP. RANGE	$V_{(BR)(CEO)}$	SIZE (in.)
TRANS.	VTT-C25	.5	4-1	40	.025 x .025
	VTT-C40	1.5	4-1	35	.04 x .04
	VTT-C50	2.0	4-1	30	.05 x .05
DARL.	VTA-C25	1.5	6-1	40	.025 x .025
	VTA-C50	8.0	6-1	30	.05 x .05

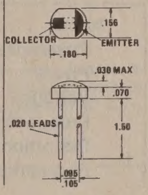
101,111,102,112 SERIES



312 SERIES



931 and 932 SERIES



*Small chips are 25 x 25 mil., Large are 50 x 50 mil.
**I_{CEO} -in mA @ 5 mW/cm² for phototransistors and .2 mW/cm² for darlingtons (V_{CE} = 5V.)

VACTROLS

PHOTOCONDUCTOR—LIGHT SOURCE
OPTO-COUPLERS—ISOLATORS

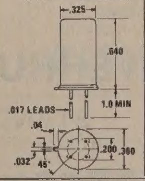
INPUT-OUTPUT ISOLATION FOR ON-OFF OR
PROPORTIONAL CONTROL OF OUTPUT RESISTANCE

		Part Number	LAMP OR LED		Cell Resis.-ohms	
			mA	Volts	ON Light Adap'd (max.)	OFF (5 sec) (min.)
Plastic Axial VTL 3 SERIES Photoconductor	INCANDESCENT TYPES	VTL3A11	55	1.5	350	5 x 10^7
		VTL3A12	15	3.0	350	
		VTL3A13	60	4.0	160	
		VTL3A14	40	6.0	160	
		VTL3A15	14	10	350	
		VTL3A16	25	12	400	
		VTL3A17	40	12	160	↓
		VTL3A21	55	1.5	800	10^6
		VTL3A22	15	3.0	600	
		VTL3A23	60	4.0	300	
		VTL3A24	40	6.0	350	
		VTL3A25	14	10	600	
		VTL3A26	25	12	500	
		VTL3A27	40	12	150	↓
		VTL3A31	55	1.5	5000	10^7
		VTL3A32	15	3.0	4000	
		VTL3A33	60	4.0	500	
		VTL3A34	40	6.0	800	
		VTL3A35	14	10	3000	
		VTL3A36	25	12	2000	
		VTL3A37	40	12	300	↓
		VTL3A41	55	1.5	200	10^6
		VTL3A42	15	3.0	200	
		VTL3A43	60	4.0	55	
		VTL3A44	40	6.0	55	
		VTL3A45	14	10	150	
		VTL3A46	25	12	100	
		VTL3A47	40	12	40	↓

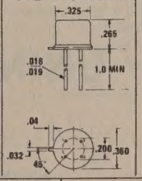
		Part Number	LAMP OR LED		Cell Resis.-ohms	
			mA	Volts	ON Light Adap'd (max.)	OFF (5 sec) (min.)
VTL 3 SERIES	NEON TYPES	VTL3B18	—	120	7000	5 x 10^7
		VTL3B19	—	120	1150	↓
		VTL3B28	—	120	5000	10^6
		VTL3B29	—	120	650	↓
		VTL3B38	—	120	15K	10^7
		VTL3B39	—	120	6000	↓
		VTL3B48	—	120	1000	10^6
		VTL3B49	—	120	160	↓
VTL 1 SERIES	INCAND.	VTL1A1	55	1.5	500	10^7
		VTL1A2	40	6	250	
		VTL1A3	14	10	800	
		VTL1A4	25	12	250	
	NEON	VTL1B5	—	150	1000	
		VTL1B6	—	90	5000	↓
VTL 2 SERIES	LED	VTL2C1	40	1.5	10K	10^8
		VTL2C2	40	1.5	500	10^6
		VTL2C3	40	1.5	2K	10^7
		VTL2C4	40	1.5	100	.4 x 10^6

		Part Number	LAMP OR LED		Cell Resis.-ohms	
			mA	Volts	ON Light Adap'd (max.)	OFF (5 sec) (min.)
VTL 5 SERIES	LED	VTL5C1	40	1.5	500	5 x 10^7
		VTL5C2	40	1.5	500	10^6
		VTL5C3	40	1.5	2000	10^7
		VTL5C4	10	—	200	.4 x 10^6
		VTL5C6	40	1.5	3500	10^8
		VTL5C7	2	—	1500	10^6
		DUAL ELEMENT				
		VTL5C3/2	40	1.5	3000	10^7
		VTL5C4/2	10	—	300	.4 x 10^6

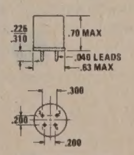
VTL 1 SERIES



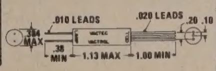
VTL 2 SERIES



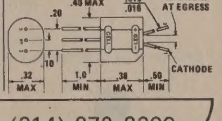
VTL 9 SERIES



VTL 3 SERIES



VTL 5 SERIES



VACTEC, INC. 2423 Northline Ind. Blvd., Maryland Heights, Mo. 63043   Phone: (314) 872-8300

abacus controls inc.

DEPT. EM
89 READINGTON ROAD
SOMERVILLE, NJ 08876
(201) 526-6010

POWER FREQUENCY CONVERTERS

USEABLE AS AC POWER SUPPLY, MOTOR CONTROLLER, POWER OSCILLATOR, POWER CONVERTER, LABORATORY QUALITY AC SOURCE

MODEL	152-	162-	113-	223-	243-	263-
Output						
Power (Volt-Amps)	500	600	1000	2000	4000	6000
Phase	Single	Single	Single	Single	Single	Single
Voltage #	100-130	100-130	100-130	100-130	115/230	115/230
Frequency	See Below*	See Below*	See Below*	See Below*	See Below*	See Below*
Distortion	4%	4%	4%	4%	4%	4%
Regulation	2%	2%	2%	2%	2%	2%
Input						
Voltage #	105-125	105-125	105-125	120/208	120/208	120/208
Phase	Single	Single	Single	Three	Three	Three
Frequency	47-63**	47-63**	47-63**	47-63**	47-63**	47-63**

MODEL	117-	118-	228-	238-	268-	219-
Output						
Power (Volt-Amps)	1000	1600	2500	3500	6000	10000
Phase	Three	Three	Three	Three	Three	Three
Voltage #	120/208	120/208	120/208	120/208	120/208	120/208
Frequency	See Below*	See Below*	See Below*	See Below*	See Below*	See Below*
Distortion	4%	4%	4%	4%	4%	4%
Regulation	5%	5%	5%	5%	5%	5%
Input						
Voltage #	105-125	105-125	120/208	120/208	120/208	120/208
Phase	Single	Single	Three	Three	Three	Three
Frequency	47-63**	47-63**	47-63**	47-63**	47-63**	47-63**

*Frequency Options
(Add Dash No. to Part No.)

-1 400 Hz ±.05%
-2 350-450 Hz ±.25%
-3 500 Hz ±.05%
-4 60 Hz ±.05%
-5 45-65 Hz ±.25%

**400 Hz Input Models also Available.

#Other Voltages Available. Consult Factory.

FEATURES

- Digital Sine Wave Generation
- Switching Power Transistors
- High Efficiency
- Input and Output Protected with Fuses and/or Circuit Breakers
- Short Circuit Protected

● UNINTERRUPTIBLE POWER SUPPLIES (UPS)

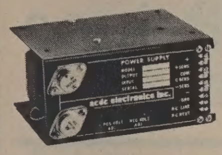
STANDBY EMERGENCY POWER SUPPLIES

● BATTERY STANDBY POWER SUPPLIES

BATTERY CHARGERS

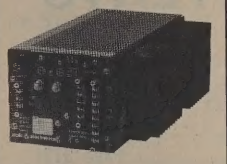
● POWER INVERTERS DC-AC

acdc electronics
PRODUCTS AND CAPABILITIES



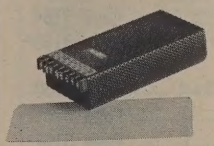
OEM The Value Engineered Series

The OEM series features the low price and compatible construction to meet the needs of today's OEM manufacturers—large and small. With excellent stability, overload protection and built-in convection cooling, the OEM series provides new flexibility in power supply systems designs. Single, dual & triple output.



JP&JT High Efficiency Switching Power Supplies

These 20KHz inaudible switching power supplies operate from a selectable input of 115/230 VAC, 47 63Hz with 70% efficiency and 0.1% regulation. Overvoltage and overload protection is standard and radiated, and conducted EMI is minimized by shielding and filtering. Eighteen models cover the range. Single and multiple output. 48 VDC input available.

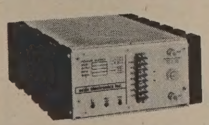


JR Miniaturized High Efficiency Switching Power Supply

Still the leader in miniaturized power supplies, this compact, precision-regulated DC supply provides AC conversion, isolation, regulation and low output noise (only 25 mv p-p) in a slim, light package. At only one-fifth the usual size and weight, it's the answer to those "impossible" packaging problems.

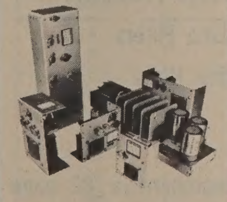
PCM Miniature Encapsulated Power Supply Modules

Available with either single or dual outputs, these miniature encapsulated power supply modules are particularly applicable for driving operational amplifiers, digital logic, shift registers, ROMS, RAMS, A-D and D-A converters and other signal conditioning instrumentation.



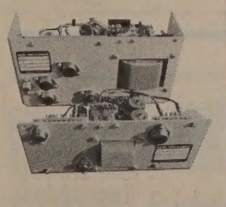
HCM High Current Power Supplies

There are 10 models in this new series with ratings from 25 amps @ 28 volts to 100 amps @ 5 volts. Two case sizes and two current ratings for each of five output voltages: 5, 12, 15, 24 and 28 volts. Overvoltage protection available. Excellent for multi-input applications.



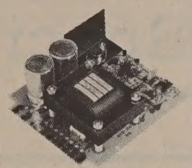
EC Low Cost Power Supplies

No bells and whistles. No fancy frills or extras. 42 single output models from 2v @ 3A to 24v @ 10A. Double and triple output models, too. Electrically and mechanically interchangeable in form, fit and function with other open frame power supplies that meet accepted industry standard. 2 year guarantee. Optional overvoltage protection.



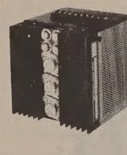
MP Microprocessor Power Supplies

The unique demands of microprocessor-based systems and their increasing popularity has resulted in the development of a special breed of low-cost power supply. ACDC's MP Series are designed to power a wide range of micros, including the 8080A. These devices offer 0.1% regulation, and come with a 24-month guarantee. Delivery is from stock.



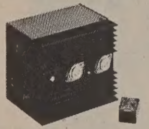
CD A Complete Regulated DC Power Supply On A Card

Designed for versatile mounting inside your equipment, the compact size of the CD series lets you put your power supply right where it's needed. This addition to the growing line of ACDC power supply modules has all of the performance features you need—stability, regulation and floating output. Lowest prices, and off-the-shelf delivery, too!



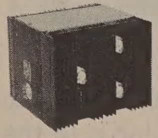
IC Optimum Performance For IC Applications

A complete line of power supply modules designed to deliver optimum performance with IC circuits. Overvoltage and overload protection, plus stability and regulation matched to the application, make the IC series first choice in digital logic designs.



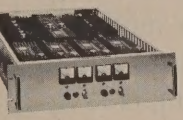
OA Dual Output Power Supply Module For OP Amps

Built-in tracking and long-term stability are the special features of our OA series power supply modules. Both regulation and temperature stability are optimized to assure the best performance in your op-amp applications. Size and weight are ideal for rack mounting. 0.01% regulation.



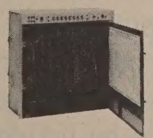
BX Precision Power Supply Modules

All of the high performance features you need are available in these precision power modules. For minimum output impedance and ripple, coupled with 0.01% regulation, specify the BX series.



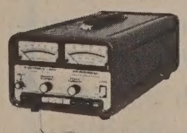
III Rack Systems

ACDC's new standardized rack system. It provides you with a method for packaging total power supply systems in a single compact unit...quickly, easily, economically. Five basic models, all designed to fit standard 19" racks. Available in kit form, factory assembled, and/or factory wired.



CPS Custom Power Supplies

Power supplies including such features as auto-progression, margining, sequencing, transistor switching, phase control and series regulation, as well as special packaging configurations.



EL750 Electronic Load Instrument

A precision, programmable instrument for static and dynamic testing of DC power sources. Dissipates up to 750 watts of DC power. Selectable constant current or constant resistance operating modes. Load current is programmed by external DC voltage. Dynamic loading is accomplished by integral square wave generator or by various externally applied waveforms.

EMERSON

ACDC ELECTRONICS
DIVISION OF
EMERSON ELECTRIC CO.
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OCEANSIDE, CALIFORNIA 92054
(714) 757-1880
REGIONAL SALES AND SERVICE OFFICE
524 SOUTH AVENUE EAST, CRANFORD, NEW JERSEY 07016 (201) 272-3377

abbott Power Supply Modules

The Next 12 Pages List 680 Regulated Modules with Specifications and Prices

The most complete line of small size MIL-Spec and OEM type power modules available in the industry is fully described in the following 12 pages. The Abbott line of power modules includes output voltages from 3 volts to 100 volts DC, output current from 2 milliamperes to 20 amperes and output power from 1 watt to 300 watts. Sizes, weights, regulations and environments are shown for the various input and output powers. Abbott is proud to continue its policy of introducing new products to meet the growing demands of our customers by listing a completely new line of power modules. The Model D Series is a high efficiency, industrial DC power supply. Inputs are 115 VAC, 220 VAC, 1ϕ, 3ϕ and 48 VDC. Look through the next 12 pages and you may find the power module you want is a standard Abbott model.

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abbott POWER SUPPLY CATALOG 1975-76

See Abbott's 1977 catalog for complete information on all our products plus additional items such as:

- Quality Control System
- Thermal Data
- Input Currents
- Overvoltage Protectors
- Input Line Filters
- Operating Hints

To receive your free copy of this comprehensive 60 page Power Supply Catalog, simply call or write Abbott.

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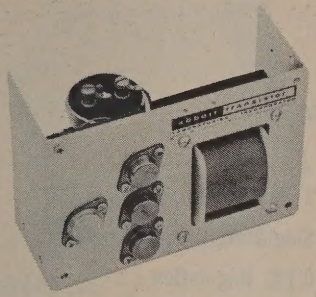
abbott AC to DC Lowest Cost



features

- 110/220 VAC Input
- Single, Dual, and Triple Outputs
- +71° Ambient Operation
- 47-440 Hz Input Frequency
- Hi-Reliability

specifications

INPUT VOLTAGE RANGE: 105 to 125 VRMS, standard. 210 to 250 VRMS available at no additional charge. To specify this type range, add the prefix "E" to the Model No. (eg. ENLS5T3).
105 to 125/210 to 250 dual input available for an additional charge of $5.00. To specify this range, add the prefix "I" to the Model No. (eg. INLS5T3).

INPUT FREQUENCY: 47-440 Hz, single phase (derate current 10% for 50 Hz operation).

LINE REGULATION: 0.02% for 10% input change (single output).
0.1% for 10% input change (dual/triple output).

LOAD REGULATION: 0.1% for no load to full load change with line constant (single output).
0.2% for no load to full load change with line constant (dual/triple output).

RIPPLE: 1.0 mV RMS maximum; 1.5 mV peak-to-peak typical, 5 mV peak-to-peak maximum.

LOAD TRANSIENT RECOVERY TIME: 50 μSec typical after a 50% step change in load current.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against a short circuit of any duration. The output voltage automatically restores to normal in approximately 5 mSec after removal of the short.

REVERSE VOLTAGE PROTECTION: Provided on output and on pass element.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra sensing leads. The resulting circuit action compensates for a DC voltage drop of up to 0.5 Vdc in the load leads. Open sense lead protection is built-in.

STABILITY: Typically, ±.05% for 24 hours after warm-up (single output), and ±0.3% for 24 hours after warm-up (dual and triple output).

TEMPERATURE: Operating: 0°C to +50°C, derated to 40% at +71°C.
Storage: −40°C to +85°C.

TEMPERATURE COEFFICIENT: ±.04% per degree Celsius maximum, ±.002% per degree Celsius typical.

EFFICIENCY: Typically 45% to 60%.

ENVIRONMENT: Designed to meet vibration per MIL-STD-810B, Method 514, Procedure 1, and shock per MIL-STD-810B, Method 516, Procedure 5.

OVERVOLTAGE PROTECTION: Standard on 5V outputs. Available on all other outputs as an optional feature by adding "-1" to the Model No. Cost is $8 for single outputs and $16 for dual and triple output units.

Output Voltage Range	Output Current (Amps)	Size	Weight (Lbs.)	Model Number	Price 1-24 Pcs.
SINGLE OUTPUT					
4.75-5.25	3	A	2	NLS5T3	$31.00
	6	B	4	NLS5T6	49.00
	9	C	5.5	NLS5T9	61.00
	12	D	7.5	NLS5T12	69.00
	17	E	10	NLS5T17	89.00
11.5-12.5	1.8	A	2	NLS12T1.8	31.00
	3.5	B	4	NLS12T3.5	49.00
	5	C	5.5	NLS12T5	61.00
	7	D	7.5	NLS12T7	69.00
	10	E	10	NLS12T10	89.00
14.5-15.5	1.5	A	2	NLS15T1.5	31.00
	3	B	4	NLS15T3	49.00
	4.5	C	5.5	NLS15T4.5	61.00
	6	D	7.5	NLS15T6	69.00
	9	E	10	NLS15T9	89.00
23-25	1.2	A	2	NLS24T1.2	31.00
	2.4	B	4	NLS24T2.4	49.00
	3.6	C	5.5	NLS24T3.6	61.00
	4.7	D	7.5	NLS24T4.7	69.00
	7.1	E	10	NLS24T7.1	89.00
27-29	1	A	2	NLS28T1	31.00
	2	B	4	NLS28T2	49.00
	3	C	5.5	NLS28T3	61.00
	4	D	7.5	NLS28T4	69.00
	6	E	10	NLS28T6	89.00

Output Voltage Range	Output Current (Amps)	Size	Weight (Lbs.)	Model Number	Price 1-24 Pcs.
DUAL OUTPUTS					
11.5-13.5 13.5-15.5	1.0 0.8	AA	2	NLD12T1	$ 55.00
	1.7 1.5	BB	4	NLD12T1.7	75.00
	3.3 3.0	CC	7	NLD12T3.3	89.00
TRIPLE OUTPUTS					
4.75-5.25 ±11.5-±12.5	3 1	AAA	5	NLT12T3	69.00
	6 1.7	BBB	8	NLT12T6	99.00
	12 1.7	CCC	11	NLT12T12	139.00
4.75-5.25 ±14.5-±15.5	3 0.8	AAA	5	NLT15T3	69.00
	6 1.5	BBB	8	NLT15T6	99.00
	12	CCC	11	NLT15T12	139.00

Size	Length	Height	Depth
A	4.87	4	1.62
B	5.62	4.87	2.5
C	7	4.87	2.75
D	9	4.87	2.75
E	14	4.87	2.75
AA	6.5	4	1.62
BB	7	4.87	2.5
CC	9.4	4.87	2.75
AAA	10.25	4	2.5
BBB	11	4.87	2.75
CCC	14.25	4.87	2.75

QUANTITY DISCOUNTS

1-24 pieces	Price listed (This is the net price)
25-49 pieces	Less 4% of the 1-24 piece price
50-99 pieces	Less 8% of the 1-24 piece price
100-199 pieces	Less 12% of the 1-24 piece price
Above 199 pieces	Write nearest office for exact quotation

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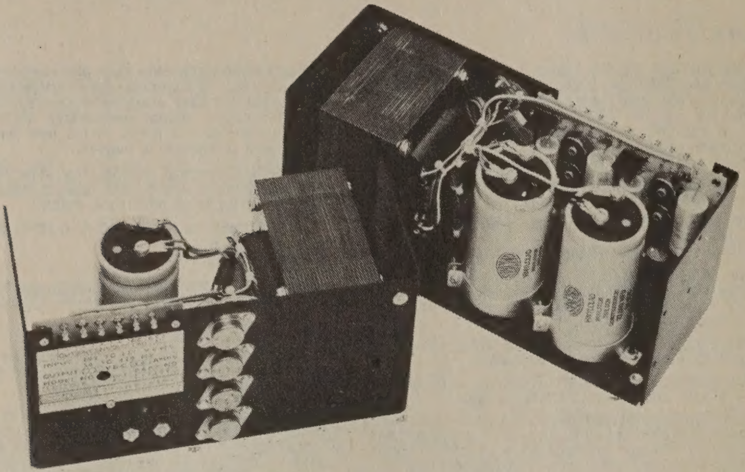
AC to DC Low Cost

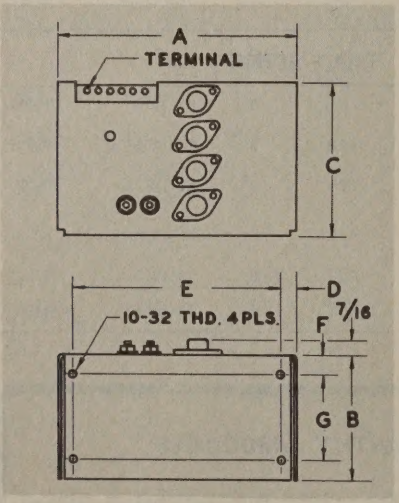


features

- 1 Day Stock Delivery
- Single and Dual Outputs
- 0.1% Regulation
- +60°C Ambient Operation
- 47-420 Hz Input Frequency

DELIVERY FROM STOCK

These reliable Abbott power modules are designed to meet the needs of OEM engineers. For their intended application, these units are not only rated high in overall quality, but also priced relatively low. Thus, they provide more quality per dollar compared to similar items on the market. Your best buy in OEM power modules is ABBOTT.



Size	A	B	C	D	E	F	G
L1	7½	3 1/16	3⅝	½	6½	⅝	1 13/16
L2	8½	4	4¾	½	7½	⅝	2¾
L3	9¼	4	4¾	½	8¼	⅝	2¾
L4	9½	3 1/16	3⅝	½	8½	⅝	1 13/16
L5	10	4	4¾	½	9	⅝	2¾
L6	10¾	4	4¾	½	9¾	⅝	2¾

specifications

INPUT VOLTAGE RANGE: 103 to 127 VRMS.

INPUT FREQUENCY: 47 to 420 Hertz, 1 Phase.

LINE REGULATION: 0.1% or 10 mV (whichever is greater), for input change of 103 to 127 VAC.

LOAD REGULATION: 0.1% or 10 mV, (whichever is greater), from no load to full load.

RIPPLE: 10 mV rms; 30 mV peak-to-peak.

OUTPUT VOLTAGE ADJUSTMENT RANGE: Voltage is continuously adjustable between the limits shown on the table by means of a screwdriver adjustment potentiometer.

ISOLATION VOLTAGE: 300 VDC between output terminals and chassis ground.

INSULATION RESISTANCE: 50 megohms between output terminals and chassis ground when measured at 50 VDC.

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded.

TEMPERATURE: Operating: 0°C to +50°C ambient without derating, forced air or heat-sinking. Storage: −50°C to 85°C.

TEMPERATURE COEFFICIENT: 0.08% per degree Celsius.

ALTITUDE: 10,000 feet above sea level.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed within approx. 25 msec.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 75 microseconds after a 50% step change in load current. Maximum overshoot/undershoot is 5% of nominal output voltage.

TURN ON/TURN OFF OVERSHOOT: The output voltage overshoot during "turn on" or "turn off" will not exceed 1% of the output voltage.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

OVERVOLTAGE PROTECTION: Additional circuitry will reduce the output voltage to approximately 1 VDC within 25 μsec typ., if the output voltage rises 10% or 2 VDC (whichever is greater) above nominal. Available as an optional feature by adding "-1" to the model number and $8 ($16 for dual output units) to the 1-24 piece price.

OUTPUT IMPEDANCE: DC to 1K Hz — .003 R_L ohms or .03 ohms, whichever is greater.
1K Hz to 10K Hz — .008 R_L or .08 ohms, whichever is greater.
10K Hz to 100K Hz — .015 R_L or .30 ohms, whichever is greater.
R_L = rated load resistance.

RELIABILITY: The Mean Time between failure (MTBF) per MIL-HDBK-217A under worst case operating conditions is in excess of 100,000 hours per single output units and in excess of 70.000 hours per dual output units. For example: LC12T10 - 114,268 hours (MTBF); LC28T1 - 158,290 hours (MTBF); LLC12T5 - 75,593.

SINGLE OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size (See Dwg)	Wt. (Lbs.)	Model Number	Price 1-24 Pieces
4.5 - 5.5	6.0	L1	5.5	LC5T6	$62.00
	10.0	L3	12.5	LC5T10	82.00
11.5 - 12.5	2.5	L1	5.5	LC12T2.5	62.00
	5.0	L2	8.7	LC12T5	73.00
	10.0	L3	12.5	LC12T10	99.00
14.5 - 15.5	2.0	L1	5.5	LC15T2	62.00
	4.0	L2	8.7	LC15T4	73.00
	8.0	L3	12.5	LC15T8	99.00
23 - 25	1.2	L1	5.5	LC24T1.2	62.00
	2.5	L2	8.7	LC24T2.5	73.00
	5.0	L3	12.5	LC24T5	99.00
27 - 29	1.0	L1	5.5	LC28T1	62.00
	2.1	L2	8.7	LC28T2.1	73.00
	4.3	L3	12.5	LC28T4.3	99.00

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size (See Dwg)	Wt. (Lbs.)	Model Number	Price 1-24 Pieces
±11.5 - ±12.5	1.2	L4	6.0	LLC12T1.2	$87.00
	2.5	L5	9.2	LLC12T2.5	93.00
	5.0	L6	13.5	LLC12T5	119.00
±14.5 - ±15.5	1.0	L4	6.0	LLC15T1	87.00
	2.0	L5	9.2	LLC15T2	93.00
	4.0	L6	13.5	LLC15T4	119.00

Dual Output Units:

1. Both outputs are isolated and non-tracking so each output can be used as a completely separate power supply.
2. The output current listed is for each output voltage.

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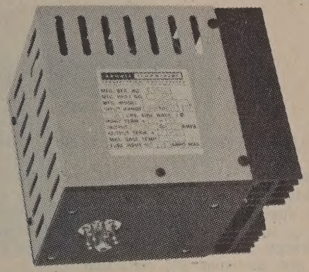
AC to DC Industrial



features

- Single and Dual Outputs
- −4 to +160°F ambient
- 5 to 37 VDC
- 0.15 to 20 amps
- 0.1% regulation
- Stock delivery

specifications

INPUT VOLTAGE RANGE: 105-125 VRMS

INPUT FREQUENCY RANGE: 50-420 Hertz, 1 phase

LINE REGULATION: 0.1% or 10 mv (whichever is greater) for input change of 105-125 VRMS

LOAD REGULATION: 0.1% or 10 mv (whichever is greater) for change from no load to full load

RIPPLE: 0.02% or 5 mv RMS (whichever is greater)

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in table by means of an externally accessible screwdriver adjustment potentiometer

ADJUSTMENT RESOLUTION: 30 mv max.

POLARITY: Inputs and outputs are isolated; either positive or negative side may be grounded

TEMPERATURE: Operating: −4°F (−20°C) to +160°F (+71°C) without derating, forced air, or heatsinking. Storage: −40°F (−40°C) to +185°F (+85°C)

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 75 microseconds after a 50% step change in load current

TURN ON/TURN OFF OVERSHOOT: The output voltage overshoot during "turn on" or "turn off" will not exceed 0.1% of the output voltage, or 20 mv, whichever is greater

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

OVERVOLTAGE PROTECTION, 230 VAC OPERATION, AND REMOTE VOLTAGE ADJUSTMENT: Available as optional features.

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number	Price 1-24 pcs.
4.5-5.5	0.15	AA	3.0	RN5S0.15	$ 72
	0.3	AA	3.0	**RN5S0.3**	78
	0.6	BB	6.0	RN5S0.6	93
	1.2	BB	6.0	**RN5S1.2**	103
	2.5	CC	8.0	**RN5S2.5**	106
	5.0	DD	13.0	**RN5S5**	126
	10	FF	22.0	**RN5S10**	178
	15	GG	28.0	RN5T15	225
	20	JJ	33.0	**RN5T20**	262
5.5-6.5	0.15	AA	3.0	RN6S0.15	72
	0.3	AA	3.0	RN6S0.3	78
	0.6	BB	6.0	RN6S0.6	93
	1.2	BB	6.0	**RN6S1.2**	103
	2.5	CC	8.0	RN6S2.5	106
	5.0	DD	13.0	RN6S5	126
	10	FF	22.0	RN6S10	178
	15	GG	28.0	RN6T15	225
	20	JJ	33.0	RN6T20	262
6.5-7.5	0.15	AA	3.0	RN7S0.15	72
	0.3	AA	3.0	RN7S0.3	78
	0.6	BB	6.0	RN7S0.6	93
	1.2	BB	6.0	RN7S1.2	103
	2.5	CC	8.0	RN7S2.5	106
	5.0	DD	13.0	RN7S5	126
	10	FF	22.0	RN7S10	178
	15	GG	28.0	RN7T15	225
	20	JJ	33.0	RN7T20	262
7.5-8.5	0.15	AA	3.0	RN8S0.15	72
	0.3	AA	3.0	RN8S0.3	78
	0.6	BB	6.0	RN8S0.6	93
	1.2	BB	6.0	RN8S1.2	103
	2.5	CC	8.0	RN8S2.5	106
	5.0	DD	13.0	RN8S5	126
	10	FF	22.0	RN8S10	178
	15	GG	28.0	RN8T15	225
	20	JJ	33.0	RN8T20	262
8.5-9.5	0.15	AA	3.0	RN9S0.15	72
	0.3	AA	3.0	RN9S0.3	78
	0.6	BB	6.0	RN9S0.6	93
	1.2	BB	6.0	RN9S1.2	103
	2.5	CC	8.0	RN9S2.5	106
	5.0	DD	13.0	RN9S5	126
	10	FF	22.0	RN9S10	178
	15	HH	31.0	RN9T15	225
	20	JJ	33.0	RN9T20	262
9.5-10.5	0.15	AA	3.0	RN10S0.15	72
	0.3	AA	3.0	RN10S0.3	78
	0.6	BB	6.0	RN10S0.6	93
	1.2	BB	6.0	RN10S1.2	103
	2.5	CC	8.0	RN10S2.5	106
	5.0	DD	13.0	RN10S5	126
	10	FF	22.0	RN10S10	178
	15	HH	31.0	RN10T15	225
	20	JJ	33.0	RN10T20	262
11-13	0.15	AA	3.0	RN12S0.15	$ 72
	0.3	AA	3.0	**RN12S0.3**	78
	0.6	BB	6.0	RN12S0.6	93
	1.2	BB	6.0	**RN12S1.2**	103
	2.5	CC	8.0	RN12S2.5	106
	5.0	DD	13.0	RN12S5	126
	10	GG	22.0	RN12S10	178
	15	HH	31.0	RN12T15	225
	20	JJ	33.0	RN12T20	262
13-15	0.15	AA	3.0	RN14S0.15	72
	0.3	AA	3.0	RN14S0.3	78
	0.6	BB	6.0	RN14S0.6	93
	1.2	BB	6.0	**RN14S1.2**	103
	2.5	CC	8.0	RN14S2.5	110
	5.0	DD	13.0	**RN14S5**	157
	10	GG	28.0	RN14T10	220
	15	HH	31.0	RN14T15	267
14-16	0.15	AA	3.0	RN15S0.15	72
	0.3	AA	3.0	RN15S0.3	78
	0.6	BB	6.0	RN15S0.6	93
	1.2	BB	6.0	RN15S1.2	103
	2.5	CC	8.0	RN15S2.5	110
	5.0	DD	13.0	RN15S5	157
	10	GG	28.0	RN15S10	220
	15	HH	31.0	RN15S15	267
17-19	0.15	AA	3.0	RN18S0.15	72
	0.3	AA	3.0	RN18S0.3	78
	0.6	BB	6.0	RN18S0.6	93
	1.2	BB	6.0	RN18S1.2	103
	2.5	CC	8.0	RN18S2.5	110
	5.0	DD	13.0	RN18S5	157
	10	GG	28.0	RN18T10	220
19-21	0.15	AA	3.0	RN20S0.15	72
	0.3	AA	3.0	RN20S0.3	78
	0.6	BB	6.0	RN20S0.6	93
	1.2	BB	6.0	RN20S1.2	103
	2.5	CC	8.0	RN20S2.5	110
	5.0	DD	13.0	RN20S5	157
	10	GG	28.0	RN20T10	220
21-23	0.15	AA	3.0	RN22S0.15	72
	0.3	AA	3.0	RN22S0.3	78
	0.6	BB	6.0	RN22S0.6	93
	1.2	BB	6.0	RN22S1.2	103
	2.5	CC	8.0	RN22S2.5	110
	5.0	EE	13.0	RN22S5	157
	10	GG	28.0	RN22T10	220
23-25	0.15	AA	3.0	RN24S0.15	$ 72
	0.3	AA	3.0	RN24S0.3	78
	0.6	BB	6.0	RN24S0.6	93
	1.2	BB	6.0	**RN24S1.2**	103
	2.5	CC	8.0	RN24S2.5	110
	5.0	EE	13.0	**RN24S5**	157
	10	GG	28.0	RN24T10	220
25-27	0.15	AA	3.0	RN26S0.15	78
	0.3	BB	6.0	RN26S0.3	93
	0.6	BB	6.0	RN26S0.6	103
	1.2	CC	8.0	RN26S1.2	110
	2.5	DD	13.0	RN26S2.5	141
	5.0	EE	20.0	RN26S5	157
27-29	0.15	AA	3.0	RN28S0.15	78
	0.3	BB	6.0	RN28S0.3	93
	0.6	BB	6.0	**RN28S0.6**	103
	1.2	CC	8.0	**RN28S1.2**	110
	2.5	DD	13.0	RN28S2.5	141
	5.0	EE	20.0	**RN28S5**	157
29-31	0.15	AA	3.0	RN30S0.15	78
	0.3	BB	6.0	RN30S0.3	93
	0.6	BB	6.0	RN30S0.6	103
	1.2	CC	8.0	RN30S1.2	110
	2.5	DD	13.0	RN30S2.5	141
	5.0	EE	20.0	RN30S5	157
35-37	0.15	AA	3.0	RN32S0.15	78
	0.3	BB	6.0	RN32S0.3	93
	0.6	BB	6.0	RN32S0.6	103
	1.2	CC	8.0	RN32S1.2	110
	2.5	DD	13.0	RN32S2.5	141
	5.0	EE	20.0	RN32S5	157

DUAL OUTPUT

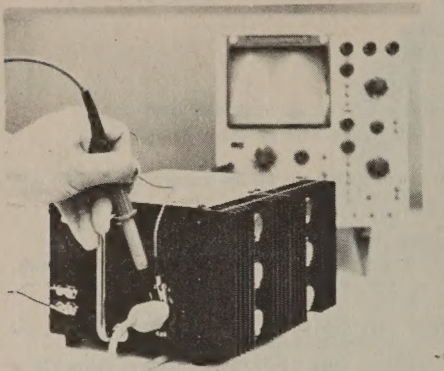
Output Voltage Range	Output Current (Each Side)	Size	Weight (Lbs.)	Model Number	Price 1-24 Pcs.
±11-±13	1.2	3C	8.0	RRN12S1.2	$141
	2.5	3D	11.0	RRN12S2.5	157
	5.0	3F	21.0	RRN12S5	262
±14-±15	1.2	3C	8.0	RRN15S1.2	141
	2.5	3D	11.0	RRN15S2.5	157
	5.0	3F	21.0	RRN15S5	262

Note: Both outputs are isolated and non-tracking, so each output can be used as a separate power supply.

* See Page 3160 for size charts Note: Other standard models are available. For complete information, please consult our nearest office.

abbott DC to 60 ∿ 1 φ

DC TO 60 Hz INVERTERS



features

- Sine Wave Output
- 12, 24, 28, 36 VDC Inputs
- Low Cost
- High Reliability
- −20°C to +55°C ambient operation
- Reverse Polarity Protection

specifications

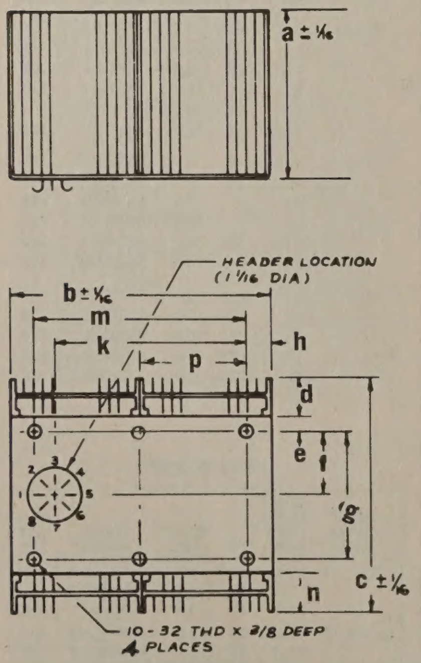
INPUT VOLTAGE RANGE: 11 to 15 VDC for KN's; 22 to 30 VDC for PN's; 29 to 38 VDC for LN's
OUTPUT VOLTAGE: 115 VAC ±2% 60 Hz or 220 VAC ±2% 50 Hz
OUTPUT FREQUENCY STABILITY: ±2 Hz
LINE REGULATION: 3% for specified input voltage range with load constant
LOAD REGULATION: 3% for load change of half load to full load with line constant: 6% for change of no load to full load
WAVE FORM: Sine wave with maximum 5% distortion
LOAD POWER FACTOR: Full rated output VA from unity to 0.7 PF lagging or leading
EFFICIENCY: At full load and nominal input voltage: 40% minimum on KN's; 50% minimum on PN's; 58% minimum on LN's
OPERATING TEMPERATURE RANGE: −4°F to +131°F (−20°C to +55°C) ambient air temperature
INPUT TRANSIENT PROTECTION: 45 VDC for 0.1 second
ALTITUDE: 10,000 feet above sea level
OVERLOAD PROTECTION: Magnetic type circuit breaker

DELIVERY FROM STOCK

Abbott has designed a new line of quality, low cost DC to 60 Hz Sine Wave inverters. These units will convert DC battery voltage to regulated 60 Hz power to drive any AC equipment, such as, lamps, compressors, motors, televisions, radios, power tools, appliances, test equipment, etc. Surge current capabilities of these units is up to 3 times rated output power.

Input Voltage Range (VDC)	Output Power (VA)	Size (See Below)	Weight (Lbs.)	Model Number 115 VAC, 60 Hz Output	Model Number 220 VAC, 50 Hz Output	Unit Prices 1-4 pcs.
11-15	30	K2	16	KN3T-115-60	KN3T-220-50	$262
	60	F2	18	KN6T-115-60	KN6T-220-50	295
	120	J2	30	KN12T-115-60	KN12T-220-50	361
22-30	60	K2	16	PN6T-115-60	PN6T-220-50	262
	120	F2	18	PN12T-115-60	PN12T-220-50	295
	240	J2	30	PN24T-115-60	PN24T-220-50	361
29-38	80	K2	16	LN8T-115-60	LN8T-220-50	262
	160	F2	18	LN16T-115-60	LN16T-220-50	295
	320	J2	30	LN32T-115-60	LN32T-220-50	361

abbott Size Charts



Size	a	b	c	d	e	f	g	h	k	m	n	p
AA	6½	4	1⅞	—	¼	11/16	1⅜	½	2⅜	3	—	—
BB	5	4	4½	—	⅜	⅞	3¾	⅜	1⅝	3 11/16	—	—
CC	5	4	5¾	—	⅜	⅞	3 7/16	1	1	2 7/16	1¼	—
C3	7⅝	4	5¾	—	⅜	⅞	3 7/16	1	1	2 7/16	1¼	—
DD	5	4	7½	—	⅜	½	4⅜	1	1	2½	2⅜	—
D3	7 5/16	4	7½	—	⅜	½	4¾	1	1	2½	2⅛	—
EE	5	8	8¾	—	½	2⅝	5¼	¾	5⅞	6½	2⅛	—
FF	5	8	8¾	1¼	½	2⅝	5¼	¾	5⅞	6½	1¼	—
F2	5	8	8¾	1¼	½	**	5¼*	¾	**	6½*	1¼	—
F3	5	8	8¾	1¼	½	2⅝	5¼	¾	5⅞	6¾	1¼	—
GG	5	12	8	1¼	⅜	**	4¾	1¼	**	9½	1¼	4¾
HH	6½	12	8	1¼	⅜	**	4¾	1¼	**	9½	1¼	4¾
JJ	6½	12	9¾	2⅛	⅜	**	4¾	1¼	**	9½	2⅛	4¾
J2	6½	12	9¾	2⅛	⅜	**	4¾†	1¼	**	9½†	2⅛	—
K2	5	8	7½	—	½	**	5¼†	¾	**	6½†	1¼	—

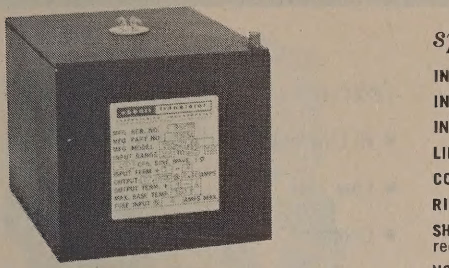
** Terminal strip located on A x C surface.
† Dimensions locate rubber feet in lieu of inserts.
‡ 8-32 x ⅜ on case AA; ¼-20 x ⅜ on case GG, HH, & JJ.

abbott transistor
INDUSTRIAL PRODUCTS DIVISION

GENERAL OFFICES
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

EASTERN OFFICES
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

abbott 60 ∿ to DC Hermetically Sealed



features

- Compact
- Hermetically Sealed
- Close Regulation
- High Reliability
- 5 to 740 Volts

specifications

INPUT VOLTAGE RANGE: 105 to 125 volts AC

INPUT FREQUENCY RANGE: 55 to 65 Hertz, 1 phase

INPUT TRANSIENT PROTECTION: In accordance with MIL-STD-704A, Figure 3, Limit 1 (180 VAC for 0.1 sec.)

LINE REGULATION: ±0.2% for 105-125 VAC input, with constant load

COMBINED LINE AND LOAD REGULATION: ±0.5% for 105-125 VAC input and load variation of ½ to full load

RIPPLE: 0.2% RMS

SHORT CIRCUIT PROTECTION: Protected against short circuit conditions of any duration. Output automatically recovers upon removal of short.

VOLTAGE ADJUSTMENT RANGE: 12% by screwdriver adjustment

TEMPERATURE: +160°F (+71°C) maximum at mounting base using adequate heat sink
−4°F (−20°C) minimum at mounting base
Storage: −30°C to +85°C

RELIABILITY: 80,000 hours.

ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810B including: altitude, vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

ISOLATION: Inputs, outputs, and case are isolated so that either a plus or minus output voltage polarity can be obtained.

OUTPUT VOLTAGE AND CURRENT: See specific models listed

Output Voltage Range	Output Current (Amps)	Size*	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs.
4.7-5.3	1.0	9B	4.0	V05DS-5A	$200	$185
	2.0	9A	4.2	V1DS-5A	205	190
	4.0	10A	6.1	V2DS-5A	220	200
	6.0	11C	8.3	V3DS-5A	230	210
	12.0	13A	16.1	V6DS-5A	290	265
5.3-5.9	0.9	9B	4.0	V05DS-5.6A	200	185
	1.8	9A	4.2	V1DS-5.6A	205	190
	3.6	10A	6.1	V2DS-5.6A	220	200
	5.4	11C	8.3	V3DS-5.6A	230	210
	10.8	13A	16.1	V6DS-5.6A	290	265
5.9-6.6	0.8	9B	4.0	V05DS-6.3A	200	185
	1.6	9A	4.2	V1DS-6.3A	205	190
	3.2	10A	6.1	V2DS-6.3A	220	200
	4.8	11C	8.3	V3DS-6.3A	230	210
	9.6	13A	16.1	V6DS-6.3A	285	260
6.6-7.4	0.7	9B	4.0	V05DS-7A	200	185
	1.4	9A	4.2	V1DS-7A	205	190
	2.8	10A	6.1	V2DS-7A	220	200
	4.2	11C	8.3	V3DS-7A	230	210
	8.4	13A	16.1	V6DS-7A	285	260
7.4-8.3	0.63	9B	4.0	V05DS-7.9A	195	180
	1.26	9A	4.2	V1DS-7.9A	200	185
	2.52	10A	6.1	V2DS-7.9A	210	195
	3.78	11C	8.3	V3DS-7.9A	225	205
	7.56	12A	11.6	V6DS-7.9A	285	260
8.3-9.3	0.57	9B	4.0	V05DS-8.8A	195	180
	1.14	9A	4.2	V1DS-8.8A	200	185
	2.28	10A	6.1	V2DS-8.8A	210	195
	3.42	11C	8.3	V3DS-8.8A	225	205
	6.84	12A	11.6	V6DS-8.8A	285	260
9.3-10.4	0.50	9B	4.0	V05DS-9.9A	195	180
	1.00	9A	4.2	V1DS-9.9A	200	185
	2.00	10A	6.1	V2DS-9.9A	210	195
	3.00	11C	8.3	V3DS-9.9A	225	205
	6.00	12A	11.6	V6DS-9.9A	285	260
	12.00	13A	16.1	V12DS-9.9A	355	325
10.4-11.6	0.45	9B	4.0	V05DS-11A	195	180
	0.91	9A	4.2	V1DS-11A	200	185
	1.82	10A	6.1	V2DS-11A	210	195
	2.73	11C	8.3	V3DS-11A	225	205
	5.46	12A	11.6	V6DS-11A	285	260
	10.92	13A	16.1	V12DS-11A	355	325
11.6-13.0	0.40	9B	4.0	V05DS-12.3A	195	180
	0.81	9A	4.2	V1DS-12.3A	200	185
	1.62	10A	6.1	V2DS-12.3A	210	195
	2.43	11C	8.3	V3DS-12.3A	225	205
	4.86	12A	11.6	V6DS-12.3A	280	255
	9.72	13A	16.1	V12DS-12.3A	345	315
	19.44	16A	16.3	V24DS-12.3A	430	395
13.0-14.8	0.36	9B	4.0	V05DS-13.8A	$190	$175
	0.72	9A	4.2	V1DS-13.8A	195	180
	1.44	10A	6.1	V2DS-13.8A	205	190
	2.16	11C	8.3	V3DS-13.8A	220	200
	4.32	12A	11.6	V6DS-13.8A	280	255
	8.64	13A	16.1	V12DS-13.8A	345	315
	17.28	16A	16.3	V24DS-13.8A	430	395
14.8-16.6	0.32	9B	4.0	V05DS-15.7A	190	175
	0.64	9A	4.2	V1DS-15.7A	195	180
	1.28	10A	6.1	V2DS-15.7A	205	190
	1.92	11C	8.3	V3DS-15.7A	220	200
	3.84	12A	11.6	V6DS-15.7A	280	255
	7.68	13A	16.1	V12DS-15.7A	335	305
	15.36	16A	16.3	V24DS-15.7A	420	385
16.6-18.6	0.28	9B	4.0	V05DS-17.6A	190	175
	0.57	9A	4.2	V1DS-17.6A	195	180
	1.14	10A	6.1	V2DS-17.6A	205	190
	1.71	11C	8.3	V3DS-17.6A	220	200
	3.42	12A	11.6	V6DS-17.6A	280	255
	6.84	13A	16.1	V12DS-17.6A	335	305
	13.68	16A	16.3	V24DS-17.6A	420	385
18.6-20.8	0.255	9B	4.0	V05DS-19.7A	190	175
	0.510	9A	4.2	V1DS-19.7A	195	180
	1.02	10A	6.1	V2DS-19.7A	205	190
	1.53	11C	8.3	V3DS-19.7A	220	200
	3.06	12A	11.6	V6DS-19.7A	275	250
	6.12	13A	16.1	V12DS-19.7A	335	305
	12.24	16A	16.3	V24DS-19.7A	420	385
20.8-23.3	0.230	9B	4.0	V05DS-22A	185	170
	0.460	9A	4.2	V1DS-22A	190	175
	0.920	10A	6.1	V2DS-22A	200	185
	1.38	11C	8.3	V3DS-22A	210	195
	2.76	12A	11.6	V6DS-22A	275	250
	5.52	13A	16.1	V12DS-22A	330	300
	11.02	16A	16.3	V24DS-22A	410	375
23.3-26.1	0.205	9B	4.0	V05DS-24.7A	185	170
	0.410	9A	4.2	V1DS-24.7A	190	175
	0.820	10A	6.1	V2DS-24.7A	200	185
	1.23	11C	8.3	V3DS-24.7A	210	195
	2.46	12A	11.6	V6DS-24.7A	275	250
	4.92	13A	16.1	V12DS-24.7A	330	300
	9.84	16A	16.3	V24DS-24.7A	410	375
26.1-29.2	0.180	9B	4.0	V05DS-27.6A	185	170
	0.360	9A	4.2	V1DS-27.6A	190	175
	0.720	10A	6.1	V2DS-27.6A	200	185
	1.08	11C	8.3	V3DS-27.6A	210	195
	2.16	12A	11.6	V6DS-27.6A	275	250
	4.32	13A	16.1	V12DS-27.6A	315	290
	8.64	16A	16.3	V24DS-27.6A	400	365
29.2-32.6	0.160	9B	4.0	V05DS-31A	$185	$170
	0.320	9A	4.2	V1DS-31A	190	175
	0.640	10A	6.1	V2DS-31A	200	185
	0.960	11C	8.3	V3DS-31A	210	195
	1.92	12A	11.6	V6DS-31A	275	250
	3.84	13A	16.1	V12DS-31A	335	305
	7.68	16A	16.3	V24DS-31A	420	385
32.6-36.5	0.145	9B	4.0	V05DS-34.6A	185	170
	0.290	9A	4.2	V1DS-34.6A	190	175
	0.580	10A	6.1	V2DS-34.6A	200	185
	0.870	11C	8.3	V3DS-34.6A	210	195
	1.74	12A	11.6	V6DS-34.6A	275	250
	3.48	13A	16.1	V12DS-34.6A	355	325
	6.96	16A	16.3	V24DS-34.6A	440	400
36.5-40.9	0.130	9B	4.0	V05DS-38.7A	185	170
	0.260	9A	4.2	V1DS-38.7A	190	175
	0.520	10A	6.1	V2DS-38.7A	200	185
	0.780	11C	8.3	V3DS-38.7A	220	200
	1.56	12A	11.6	V6DS-38.7A	280	255
	3.12	13A	16.1	V12DS-38.7A	385	350
	6.24	16A	16.3	V24DS-38.7A	460	420
40.9-45.8	0.115	9B	4.0	V05DS-43.3A	185	170
	0.230	9A	4.2	V1DS-43.3A	190	175
	0.460	10A	6.1	V2DS-43.3A	200	185
	0.690	11C	8.3	V3DS-43.3A	220	200
	1.38	12A	11.6	V6DS-43.3A	280	255
	2.76	13A	16.1	V12DS-43.3A	400	365
	5.52	16A	16.3	V24DS-43.3A	485	445
45.8-51.4	0.103	9B	4.0	V05DS-48.6A	190	175
	0.206	9A	4.2	V1DS-48.6A	195	180
	0.412	10A	6.1	V2DS-48.6A	215	190
	0.618	11C	8.3	V3DS-48.6A	225	205
	1.24	12A	11.6	V6DS-48.6A	285	260
	2.48	13A	16.1	V12DS-48.6A	420	385
	4.94	16A	16.3	V24DS-48.6A	505	460
51.4-59.0	0.091	9B	4.0	V05DS-55.2A	205	190
	0.182	9A	4.2	V1DS-55.2A	210	195
	0.365	10A	6.1	V2DS-55.2A	225	205
	0.546	11C	8.3	V3DS-55.2A	235	215
	1.10	12A	11.6	V6DS-55.2A	290	265
	2.20	13A	16.1	V12DS-55.2A	420	385
	4.40	16A	16.3	V24DS-55.2A	505	460
59.0-740.0	174 other standard models are available with output voltages between 59.0 and 740.0 VDC at output power ratings of 5, 10, 20, 30, 60, 120 or 240 watts. For complete information, please consult one of the offices listed below.					

* See Page 3168 for size charts.

abbott transistor
LABORATORIES, INCORPORATED

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EASTERN OFFICES
1224 Anderson Ave.
Fort Lee, N.J. 07024
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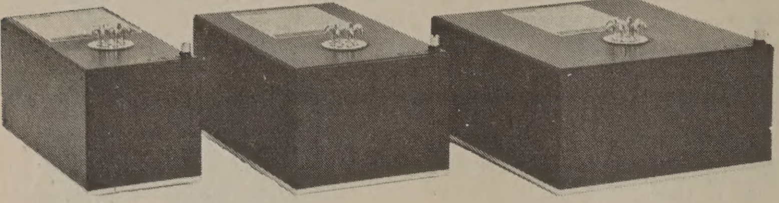
Telex 13-5332

abbott AC to DC Hi-Efficiency



features

- Hi-Efficiency (64 to 77%)
- Low EMI
- Compact
- +160°F Operation
- Hi-Reliability
- Hermetically Sealed

specifications

INPUT VOLTAGE RANGE: 115 VRMS, ±10%

INPUT FREQUENCY RANGE: 47 to 440 Hz, 1 Phase

EFFICIENCY: Typical efficiency ranges from 64 to 77%

OUTPUT VOLTAGE AND CURRENT: See specific models listed in tables

LINE REGULATION: 0.4% or 50 mv (whichever is greater) for input change of 103.5 to 126.5 VRMS with load constant

LOAD REGULATION: 0.4% or 50 mv (whichever is greater) from no load to full load with line constant

RIPPLE AND NOISE (PARD): 0.2% plus 125 mv peak-to-peak from +25°C to +71°C. At 0°C peak-to-peak ripple increases to 0.4% plus 200 mv maximum. Measurements made with a scope having a 25MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

ADJUSTMENT RESOLUTION:

Nominal Output Voltage	Resolution
3-16 VDC	35 millivolts
18-50 VDC	60 millivolts

ISOLATION VOLTAGE: 500 VDC input to output and input to case, 100 VDC output to case.

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 VDC

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded

TEMPERATURE RANGE: Operating: 0°C (32°F) to +71°C (+160°F) baseplate temperature. Storage: −55°C (−65°F) to +85°C (+185°F)

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

ENVIRONMENT: Hermetically sealed and encapsulated to meet severe environmental requirements, including:
Vibration: MIL-STD-810B, Method 514, Procedure I, Curve H (±10g's) and Procedure XII. Also MIL-STD-167B, Type I
Shock: MIL-STD-810B, Method 516, Procedure II (75g's crash safety)
Humidity: MIL-STD-810B, Method 507, Procedure I
Saltspray: MIL-STD-983E, Paragraph 4.4.12
Saltfog: MIL-STD-810B, Method 509, Procedure I.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration

INPUT TRANSIENT PROTECTION: Unit will withstand 180 VAC for 0.1 second in accordance with MIL-STD-704A, Figure 3, Limit 1

OVERVOLTAGE PROTECTION: Available as separate modules.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "Sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.3 volts in the load leads

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 7 msec. after a 50% step change in load current. Maximum over/undershoot is less than 0.8 VDC or 3% of the output voltage, whichever is greater

OUTPUT IMPEDANCE: DC to 1 KHz: .04 R_L or 0.1 ohm, whichever is greater. 1 KHz to 10 KHz: .06 R_L or 0.15 ohms, whichever is greater. 10 KHz to 100 KHz: .08 R_L or 0.4 ohms, whichever is greater.
R_L = Rated Load

ELECTROMAGNETIC INTERFERENCE: EMI filters are used in each unit for suppression of conducted interference

RELIABILITY: The Mean Time Betwen Failure (MTBF) per MIL-HDBK-217A under worst conditions of full rated output current, 126.5 VAC input voltage, and **40°C baseplate temperature was calculated to be 50,000 hours.**

Output Voltage Range	Output Current (Amps)	Size*	Weight (Lbs)	Model Number	Price 1-4 pcs
4.7-5.3	5.0	11F	2.8	VN25D-5A	$345
	10.0	12C	4.0	VN50D-5A	390
	20.0	14E	5.4	VN100D-5A	413
5.3-5.9	4.5	11F	2.8	VN25D-5.6A	345
	9.0	12C	4.0	VN50D-5.6A	390
	18.0	14E	5.4	VN100D-5.6A	413
5.9-6.6	4.0	11F	2.8	VN25D-6.3A	345
	8.0	12C	4.0	VN50D-6.3A	390
	16.0	14E	5.4	VN100D-6.3A	413
6.6-7.4	3.6	11F	2.8	VN25D-7.0A	345
	7.2	12C	4.0	VN50D-7.0A	390
	14.4	14E	5.4	VN100D-7.0A	413
7.4-8.3	3.2	11F	2.8	VN25D-7.9A	345
	6.4	12C	4.0	VN50D-7.9A	390
	12.8	14E	5.4	VN100D-7.9A	413
8.3-9.3	2.8	11F	2.8	VN25D-8.8A	345
	5.7	12C	4.0	VN50D-8.8A	390
	11.4	14E	5.4	VN100D-8.8A	413
9.3-10.4	2.5	11F	2.8	VN25D-9.9A	345
	5.1	12C	4.0	VN50D-9.9A	390
	10.2	14E	5.4	VN100D-9.9A	413
10.4-11.6	2.3	11F	2.8	VN25D-11A	$345
	4.6	12C	4.0	VN50D-11A	390
	9.2	14E	5.4	VN100D-11A	413
11.6-13.0	2.0	11F	2.8	VN25D-12.3A	345
	4.1	12C	4.0	VN50D-12.3A	390
	8.2	14E	5.4	VN100D-12.3A	413
13.0-14.8	1.8	11F	2.8	VN25D-13.8A	345
	3.6	12C	4.0	VN50D-13.8A	390
	7.2	14E	5.4	VN100D-13.8A	413
14.8-16.6	1.6	11F	2.8	VN25D-15.7A	345
	3.2	12C	4.0	VN50D-15.7A	390
	6.4	14E	5.4	VN100D-15.7A	413
16.6-18.6	1.4	11F	2.8	VN25D-17.6A	345
	2.8	12C	4.0	VN50D-17.6A	390
	5.6	14E	5.4	VN100D-17.6A	413
18.6-20.8	1.2	11F	2.8	VN25D-19.7A	345
	2.5	12C	4.0	VN50D-19.7A	390
	5.0	14E	5.4	VN100D-19.7A	413
20.8-23.3	1.1	11F	2.8	VN25D-22A	345
	2.3	12C	4.0	VN50D-22A	390
	4.6	14E	5.4	VN100D-22A	413
23.3-26.1	1.0	11F	2.8	VN25D-24.7A	$345
	2.0	12C	4.0	VN50D-24.7A	390
	4.0	14E	5.4	VN100D-24.7A	413
26.1-29.2	0.9	11F	2.8	VN25D-27.6A	345
	1.8	12C	4.0	VN50D-27.6A	390
	3.6	14E	5.4	VN100D-27.6A	413
29.2-32.6	0.8	11F	2.8	VN25D-31A	345
	1.6	12C	4.0	VN50D-31A	390
	3.2	14E	5.4	VN100D-31A	413
32.6-36.5	0.7	11F	2.8	VN25D-34.6A	345
	1.4	12C	4.0	VN50D-34.6A	390
	2.8	14E	5.4	VN100D-34.6A	413
36.5-40.9	0.6	11F	2.8	VN25D-38.7A	345
	1.3	12C	4.0	VN50D-38.7A	390
	2.6	14E	5.4	VN100D-38.7A	413
40.9-45.8	0.5	11F	2.8	VN25D-43.3A	345
	1.1	12C	4.0	VN50D-43.3A	390
	2.2	14E	5.4	VN100D-43.3A	413
45.8-50.0	0.5	11F	2.8	VN25D-47.9A	345
	1.0	12C	4.0	VN50D-47.9A	390
	2.0	14E	5.4	VN100D-47.9A	413

* See Page 3168 for size charts.

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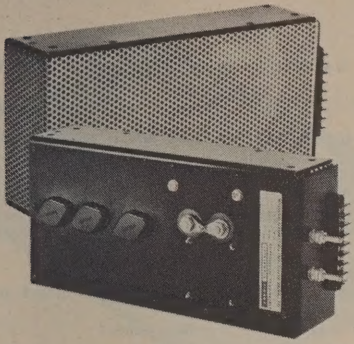
Telex 13-5332

abbott AC (1φ/3φ) or 48 Vdc to DC Hi-Efficiency



features

- 1.3 watts/in³
- Universal 1φ & 3φ AC input
- 48 Vdc input
- Up to 80% efficient
- Operation to −20°C

AC INPUT — MODEL DA'S

Output Voltage	Output Current* (Amps)	Size	Model Number	Price 1-9 pcs.
5	10.0	D1	DA50-5	$345
	20.0	D3	DA100-5	360
	40.0	D4	DA200-5	375
±12	2.1	D2	DA50-12	$385
	4.2	D3	DA100-12	390
	8.3	D5	DA200-12	395
±15	1.7	D2	DA50-15	$385
	3.3	D3	DA100-15	390
	6.7	D5	DA200-15	395

DC INPUT — MODEL DC'S

Output Voltage	Output Current* (Amps)	Size	Model Number	Price 1-9 pcs.
5	10.0	D1	DC50-5	$325
	20.0	D3	DC100-5	340
	30.0	D4	DC150-5	355
±12	2.1	D2	DC50-12	$355
	4.2	D3	DC100-12	365
	6.3	D5	DC150-12	375
±15	1.7	D2	DC50-15	$355
	3.3	D3	DC100-15	365
	5.0	D5	DC150-15	375

*For dual output units, output current listed is for each output.

SIZE CHART

Case Size	Width	Depth	Height
D1	5.5	9.4	2.0
D2	5.5	10.2	2.0
D3	5.5	10.5	2.5
D4	5.5	11.0	2.5
D5	5.5	11.2	2.5

specifications

INPUT: DA Models: 103.5 to 126.5 Vrms, 1φ or 3φ"Y";
207 to 253 Vrms, 1φ or 3φ"△";
47 to 500 Hz
DC Models: 41 to 52 Vdc

EFFICIENCY: Minimum efficiency at full load is 60%. Efficiency typically ranges from 63% to 80%, depending on output voltage/power.

AC INRUSH CURRENT: Limited by series power thermistors.

LINE EFFECT (REGULATION): Less than 0.5% over full input range.

LOAD EFFECT (REGULATION): Less than 0.5% from no load to full load.

PARD (RIPPLE & NOISE): Less than 100 mV p-t-p, 0°C to +71°C, when measured with an oscilloscope with a 1 MHz bandwidth.

OUTPUT VOLTAGE ADJUSTMENT: Output is factory set to within 1% of nominal voltage. Units may be trimmed up to 6% above nominal voltage by means of external resistance. Remote voltage adjustment/programming is available as an optional feature. With this feature, output can be adjusted ±6% from nominal. This option can be specified by adding "-1" to the Model No. e.g., DA50-5-1 indicates inclusion of this feature. Charge is $10 additional for 1 to 9 pieces.

ISOLATION: Voltage — 500 Vdc input to case, input to output; 100 Vdc output to case. Resistance — 50 megohms @ 50 Vdc input to case, input to output, output to case.

TEMPERATURE RANGE: −20°C to +71°C ambient operating temperature. See load vs. temperature curve below.

THERMAL PROTECTION: Power shutdown if temperature exceeds safe operating limits.

TEMPERATURE COEFFICIENT: 0.01%/°C typical; 0.03%/°C maximum.

SHORT CIRCUIT PROTECTION: Complete protection from short circuits of any duration. Automatic recovery when short is removed.

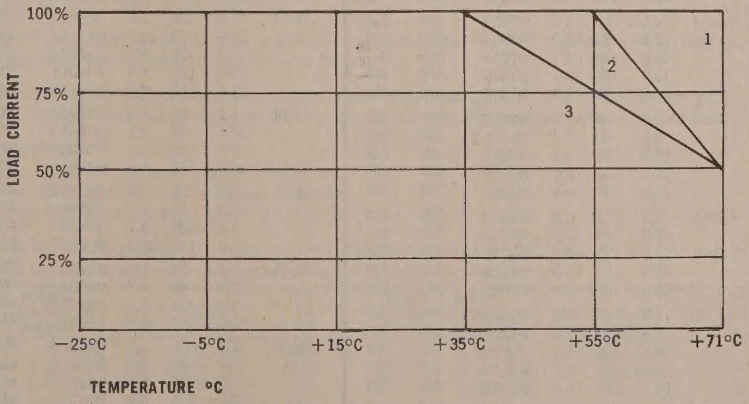
OVERVOLTAGE PROTECTION: Standard on all units. Set at 6.2 ±0.5 Vdc on 5V units, 14 ±1 Vdc on 12V units and 17 ±1 Vdc on 15V units.

REMOTE ERROR SENSING: Sensing terminals are provided to compensate for up to 0.5 Vdc drop in the load leads. Open sense lead protection is also provided.

LOAD TRANSIENT RESPONSE: Output returns to regulation band within 1.0 mS after a 50% step change in load current.

TURN-ON/TRANSIENT OVERSHOOT: Maximum output voltage overshoot is less than 0.8V under all conditions.

HOLDUP TIME: Typically 20 mS at full load and nominal line voltage.



1 All units, case temperature
2 All units except DA200-5 and DC150-5, ambient temperature
3 DA200-5 and DC150-5, ambient temperature

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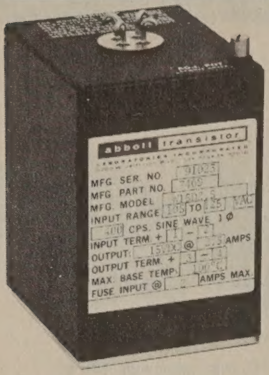
abbott 400 ∿ to DC Hi-Performance Single & Dual Output



features

- Low Peak-to-Peak Ripple
- RFI/EMI to MIL-STD-461
- Small
- Hermetically Sealed
- +100°C Operation
- 0.1% Regulation

specifications

INPUT VOLTAGE RANGE: 105 to 125 VRMS

INPUT FREQUENCY RANGE: 380 to 420 Hertz, 1 phase

INPUT POWER: Per MIL-STD-704A for category B equipment

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 105 to 125 VRMS with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full load with line constant

RIPPLE: 0.02% or 5 mv (whichever is greater) 25 mv peak-to-peak maximum, each output, measured with scope having 25 MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accesible screwdriver adjustment potentiometer

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 750 vdc input to output and input to case • 200 vdc output to case

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 vdc

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded

TEMPERATURE RANGE: Operating: −55° to +100°C maximum at center of mounting base
Storage: −65°C to +125°C

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810B and MIL-E-5400K, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION: MIL-STD-704A Figure 3, Limit 1 (180 VAC for 0.1 seconds)

OVERVOLTAGE PROTECTION: Overvoltage protection modules are available for these units.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

ELECTROMAGNETIC INTERFERENCE: Built to meet the requirements of MIL-STD-461 for generation of and susceptability to radiated and conducted interference

RELIABILITY: The Mean Time Between Failure (MTBF) per MIL-HDBK-217 under worst case operating conditions of full rated output current, 125 vac input voltage, and +100°C base plate temperature, has been calculated for typical units. Values are: W5D10 — 56,148 hrs; W95D0.3 —47,393 hrs; WW3D0.3 — 67,385 hrs; WW30D4.0 — 48,618 hrs.

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs.
4.5-5.5	2.5	2E	1.9	W5D2.5	$285	$260
	5.0	4D	2.7	W5D5.0	320	295
	10.0	10B	5.1	W5D10	403	367
	15.0	14C	8.9	W5D15	509	463
	20.0	14C	8.9	W5D20	548	499
5.5-6.5	2.5	2E	1.9	W6D2.5	285	260
	5.0	4D	2.7	W6D5.0	320	295
	10.0	10B	5.1	W6D10	403	367
	15.0	14C	8.9	W6D15	509	463
	20.0	14C	8.9	W6D20	548	499
6.5-7.5	2.5	2E	1.9	W7D2.5	285	260
	5.0	4D	2.7	W7D5.0	320	295
	10.0	10B	5.1	W7D10	403	367
	15.0	14C	8.9	W7D15	509	463
	20.0	14C	8.9	W7D20	548	499
7.5-8.5	2.5	2E	1.9	W8D2.5	285	260
	5.0	4D	2.7	W85D5.0	320	295
	10.0	10B	5.1	W8D10	403	367
	15.0	14C	8.9	W8D15	509	463
	20.0	14C	8.9	W8D20	548	499
8.5-9.5	2.5	2E	1.9	W9D2.5	295	270
	5.0	4D	2.7	W9D5.0	340	310
	10.0	10B	5.1	W9D10	426	388
	15.0	14C	8.9	W9D15	543	493
	20.0	14C	8.9	W9D20	581	528
9.5-10.5	2.5	2E	1.9	W10D2.5	295	270
	5.0	4D	2.7	W10D5.0	340	310
	10.0	10B	5.1	W10D10	426	388
	15.0	14C	8.9	W10D15	543	493
	20.0	14C	8.9	W10D20	581	528
10.5-11.5	2.5	2E	1.9	W11D2.5	295	270
	5.0	4D	2.7	W11D5.0	340	310
	10.0	10B	5.1	W11D10	426	388
	15.0	14C	8.9	W11D15	543	493
	20.0	14C	8.9	W11D20	581	528
11-13	2.5	2E	1.9	W12D2.5	295	270
	5.0	4D	2.7	W12D5.0	340	310
	10.0	10B	5.1	W12D10	426	388
	15.0	14C	8.9	W12D15	543	493
	20.0	14C	8.9	W12D20	581	528
13-15	1.2	2E	1.9	W14D1.2	$285	$260
	2.5	4D	2.7	W14D2.5	320	295
	5.0	10B	5.1	W14D5.0	403	367
	10.0	14C	8.9	W14D10	509	463
	15.0	14C	8.9	W14D15	548	499
14-16	1.2	2E	1.9	W15D1.2	285	260
	2.5	4D	2.7	W15D2.5	320	295
	5.0	10B	5.1	W15D5.0	403	367
	10.0	14C	8.9	W15D10	509	463
	15.0	14C	8.9	W15D15	548	499
15-17	1.2	2E	1.9	W16D1.2	285	260
	2.5	4D	2.7	W16D2.5	320	295
	5.0	10B	5.1	W16D5.0	403	367
	10.0	14C	8.9	W16D10	509	463
	15.0	14C	8.9	W16D15	548	499
17-19	1.2	2E	1.9	W18D1.2	285	260
	2.5	4D	2.7	W18D2.5	320	295
	5.0	10B	5.1	W18D5.0	403	367
	10.0	14C	8.9	W18D10	509	463
19-21	1.2	2E	1.9	W20D1.2	290	265
	2.5	4D	2.7	W20D2.5	340	310
	5.0	10B	5.1	W20D5.0	426	388
	10.0	14C	8.9	W20D10	543	493
21-23	1.2	2E	1.9	W22D1.2	290	265
	2.5	4D	2.7	W22D2.5	340	310
	5.0	10B	5.1	W22D5.0	426	388
	10.0	14C	8.9	W22D10	543	493
23-25	1.2	2E	1.9	W24D1.2	290	265
	2.5	4D	2.7	W24D2.5	340	310
	5.0	10B	5.1	W24D5.0	426	388
	10.0	14C	8.9	W24D10	543	493
25-27	1.2	2E	1.9	W26D1.2	290	265
	2.5	4D	2.7	W26D2.5	340	310
	5.0	10B	5.1	W26D5.0	426	388
	10.0	14C	8.9	W26D10	543	493
27-29	1.2	2E	1.9	W28D1.2	$290	$265
	2.5	4D	2.7	W28D2.5	340	310
	5.0	10B	5.1	W28D5.0	426	388
	10.0	14C	8.9	W28D10	543	493

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs.
±3.75- ±4.25	0.3	8B	1.9	WW4D0.3	$300	$270
	0.5	9C	2.2	WW4D0.5	335	300
	1.0	9C	2.2	WW4D1.0	365	325
	2.0	9D	3.1	WW4D2.0	409	372
	4.0	11D	5.5	WW4D4.0	444	404
±4.5- ±5.5	0.3	8B	1.9	WW5D0.3	300	270
	0.5	9C	2.2	WW5D0.5	335	300
	1.0	9C	2.2	WW5D1.0	365	325
	2.0	9D	3.1	WW5D2.0	409	372
	4.0	11D	5.5	WW5D4.0	444	404
±11- ±13	0.3	8B	1.9	WW12D0.3	315	280
	0.5	9C	2.2	WW12D0.5	345	310
	1.0	9C	2.2	WW12D1.0	385	345
	2.0	9D	3.1	WW12D2.0	444	404
	4.0	11D	5.5	WW12D4.0	496	451
±14- ±16	0.3	8B	1.9	WW15D0.3	315	280
	0.5	9C	2.2	WW15D0.5	345	310
	1.0	9C	2.2	WW15D1.0	385	345
	2.0	9D	3.1	WW15D2.0	444	404
	4.0	11D	5.5	WW15D4.0	554	504
±29- ±31	0.3	9C	2.2	WW30D0.3	340	305
	0.5	9C	2.2	WW30D0.5	375	335
	1.0	9D	3.1	WW30D1.0	430	385
	2.0	11D	5.5	WW30D2.0	565	514
	4.0	14C	8.0	WW30D4.0	730	664

Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

* See Page 3168 for size charts.

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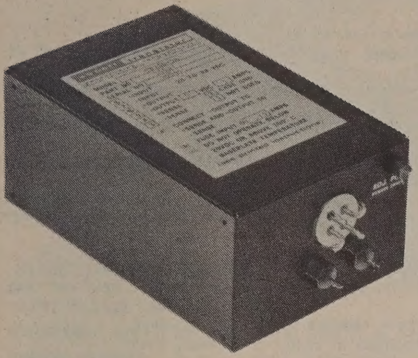
abbott 400 ∿ to DC Hi-Efficiency



features

- Up to 70% Efficiency
- +100°C Operation
- EMI to MIL-STD-461
- Hermetically Sealed
- Environment to MIL-STD-810
- Single and Dual Outputs

In order to meet the high efficiency requirements of many of today's airborne systems, Abbott engineers have designed and developed a new line of AC to DC power modules. Specifically designed for 400 Hz operation, these hermetically sealed units achieve power conversion efficiencies of up to 70%. We have designated this new line the Model UN series.

The UN's employ pulse width modulation at a switching frequency of 18 to 20 KHz. Three hermetically sealed linear IC's are used to provide stable and reliable control over the full temperature range of −55°C to +100°C.

The performance features of the UN's make them well suited for any application requiring reliable and rugged 400 Hz to DC conversion.

specifications

INPUT VOLTAGE RANGE: 115 Vrms ±10%

INPUT FREQUENCY RANGE: 380 to 420 Hz, 1ϕ

EFFICIENCY: Typical efficiency ranges from 53 to 70%

INRUSH CURRENT: Less than 8 times normal steady-state full load input current

LINE EFFECT (REGULATION): 0.3% for input change of 103.5 to 126.5 VAC RMS

LOAD EFFECT (REGULATION): 0.5% for load change of no load to full load

PARD (RIPPLE & NOISE): 100 mV peak-to-peak, 25 mV rms from +25°C to +100°C; 130 mV peak-to-peak, 40 mV rms from −55°C to +25°C. Measured at power module terminals with measurement system noise bandwidth of 25 MHz.

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer

ADJUSTMENT RESOLUTION:

Nominal Output Voltage	Resolution
5-10 VDC	37 mV
12-18 VDC	49 mV
24-31 VDC	75 mV

ISOLATION VOLTAGE: 250 VDC between input and output and input and case; 50 VDC between ouput and case

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case and output and case when measured at 50 VDC

TEMPERATURE RANGE: Operating; −55°C to +100°C baseplate temperature. Derate maximum output current linearly above 85°C baseplate temperature to 80% of full load rating at 100°C baseplate temperature. Storage; −65°C to +125°C

TEMPERATURE EFFECT (COEFFICIENT): 0.03% per degree Celsius

ENVIRONMENT: Hermetically sealed and encapsulated to meet the environmental requirements of MIL-STD-810 and MIL-E-5400, Class 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against overloads (greater than 150% rated load) and short circuits of any duration. The output automatically restores to normal when the fault is removed

INPUT TRANSIENT PROTECTION: In accordance with MIL-STD-704A, Figure 3, Limit 1 (180 VAC for 0.1 sec)

OVERVOLTAGE PROTECTION: Internal OVP is available as an optional feature and is indicated by adding "-1" to the model number (i.e. UN25D-5A-1 indicates that OVP has been included). The price is $20.00 additional on 1-4 pieces. The overvoltage threshold is factory set to approximately 2V or 10% (whichever is greater) above the nominal output voltage. The OVP circuitry has a built-in delay of approximately 500 microseconds to minimize 'nuisance' tripping

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit can monitor the voltage directly at the load by using extra "sense" leads. The resulting circuit action will compensate for a DC voltage drop of up to 0.3 volts in the load leads

LOAD TRANSIENT RESPONSE: Output voltage returns to regulation limits within 2 ms after a 50% step change in load current. Maximum overshoot is less than 0.8V

TURN-ON/TURN-OFF OVERSHOOT: No overshoot during turn-on into loads greater than half load. For loads less than half load, turn-on overshoot is less than 0.8V for 25 ms. No turn-off overshoot under any conditions

OUTPUT IMPEDANCE:

DC-500 Hz: 0.02R_L or .04 ohm, whichever is greater
500-5 KHz: 0.10 R_L or .35 ohm, whichever is greater
5K-100 KHz: 0.30 R_L or .10 ohm, whichever is greater

ELECTROMAGNETIC INTERFERENCE: Designed to meet the requirements of MIL-STD-461A for generation of conducted and radiated interference. Test report on a typical model is available

Output Voltage Range	Output Current (Amps)	Size *	Wt. (Lbs.)	Model Number	Price 1-4 Pcs.
SINGLE OUTPUT					
4.75-5.25	5.0	10G	2.8	UN25D-5A	$355
	10.0	11K	4.8	UN50D-5A	425
	20.0	12G	7.9	UN100D-5A	525
5.7-6.3	4.17	10G	2.8	UN25D-6A	355
	8.33	11K	4.8	UN50D-6A	425
	16.67	12G	7.9	UN100D-6A	525
9.5-10.5	2.5	10G	2.8	UN25D-10A	355
	5.0	11K	4.8	UN50D-10A	425
	10.0	12G	7.9	UN100D-10A	525
11.4-12.6	2.08	10G	2.8	UN25D-12A	355
	4.17	11K	4.8	UN50D-12A	425
	8.33	12G	7.9	UN100D-12A	525
14.25-15.75	1.67	10G	2.8	UN25D-15A	$355
	3.33	11K	4.8	UN50D-15A	425
	6.67	12G	7.9	UN100D-15A	525
17.1-18.9	1.39	10G	2.8	UN25D-18A	355
	2.78	11K	4.8	UN50D-18A	425
	5.56	12G	7.9	UN100D-18A	525
22.8-25.2	1.04	10G	2.8	UN25D-24A	355
	2.08	11K	4.8	UN50D-24A	425
	4.17	12G	7.9	UN100D-24A	525
26.6-29.4	0.89	10G	2.8	UN25D-28A	355
	1.79	11K	4.8	UN50D-28A	425
	3.57	12G	7.9	UN100D-28A	525
29.45-32.55	0.81	10G	2.8	UN25D-31A	325
	1.61	11K	4.8	UN50D-31A	425
	3.23	12G	7.9	UN100D-31A	525
45.6-50.4	0.52	10G	2.8	UN25D-48A	$355
	1.04	11K	4.8	UN50D-48A	425
	2.08	12G	7.9	UN100D-48A	525
DUAL OUTPUT					
±11.4 to ±12.6	1.04	10H	3.2	UUN25D-12A	$395
	2.08	11K	4.8	UUN50D-12A	465
	4.17	12G	7.9	UUN100D-12A	595
±14.25 to ±15.75	0.83	10H	3.2	UUN25D-15A	395
	1.67	11K	4.8	UUN50D-15A	465
	3.33	12G	7.9	UUN100D-15A	595

* See Page 3168 for size charts.

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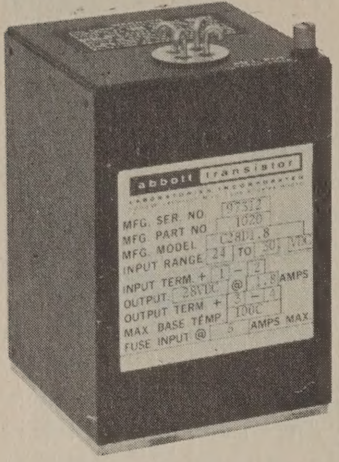
abbott 28 VDC to DC

Hi-Performance Single & Dual Output



features

- Low Peak-to-Peak Ripple
- RFI/EMI to MIL-STD-461
- Small
- Hermetically Sealed
- +100°C Operation
- 0.1% Regulation

specifications

INPUT VOLTAGE RANGE: 24 to 30 vdc. Other input ranges are available

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 24 to 30 vdc with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for load change of no load to full load with line constant

RIPPLE: 0.02% or 5 mv RMS (whichever is greater) 50 mv peak-to-peak maximum, each output, measured with scope having a bandwidth of 25 MHz

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer.

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 200 volts DC between input and output, input and case, and output and case.

INSULATION RESISTANCE: 50 megohms minimum at 50 volts DC between input and output, input and case, and output and case.

POLARITY: Inputs and outputs are isolated; either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating: −55°C to +100°C maximum at center of mounting base.
Storage: −65°C to +125°C.

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810B and MIL-E-5400K, Class 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION
Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

INPUT TRANSIENT PROTECTION: MIL-STD-704A, Limit 1, Category B (80 volts for 0.1 sec.).

OVERVOLTAGE PROTECTION: Overvoltage protection modules are available for use with these units.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

ELECTROMAGNETIC INTERFERENCE: Built to meet the requirements of MIL-STD-461 for generation of and susceptability to radiated and conducted interference.

RELIABILITY: The mean time between failure (MTFB) per MIL-HDBK-217 under worst case operating conditions of full rated output current, 30 vdc input voltage, and +100°C base plate temperature has been calculated for typical units. Values are: C5D10 — 41,305 hrs; C95D0.25 — 55,463 hrs; CC3D3.5 — 34,710 hrs; CC30D3.5 — 20,105 hrs.

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs.
4.5-5.5	2.5	2D	1.2	C5D2.5	$291	$265
	5.0	6B	1.7	C5D5.0	319	290
	10.0	7A	2.6	C5D10	395	359
5.5-6.5	2.5	2D	1.2	C6D2.5	291	265
	5.0	6B	1.7	C6D5.0	319	290
	10.0	7A	2.6	C6D10	395	359
6.5-7.5	2.5	2D	1.2	C7D2.5	291	265
	5.0	6B	1.7	C7D5.0	319	290
	10.0	7A	2.6	C7D10	395	359
7.5-8.5	1.8	2D	1.2	C8D1.8	291	265
	3.5	6B	1.7	C8D3.5	319	290
	7.5	7A	2.6	C8D7.5	395	359
8.5-9.5	1.8	2D	1.2	C9D1.8	291	265
	3.5	6B	1.7	C9D3.5	319	290
	7.5	7A	2.6	C9D7.5	395	359
9.5-10.5	1.8	2D	1.2	C10D1.8	291	265
	3.5	6B	1.7	C10D3.5	319	290
	7.5	7A	2.6	C10D7.5	395	359
10.5-11.5	1.8	2D	1.2	C11D1.8	291	265
	3.5	6B	1.7	C11D3.5	319	290
	7.5	7A	2.6	C11D7.5	395	359
11-13	1.2	2D	1.2	C12D1.2	291	265
	2.5	6B	1.7	C12D2.5	319	290
	5.0	7A	2.6	C12D5.0	395	359
13-15	1.2	2D	1.2	C14D1.2	291	265
	2.5	6B	1.7	C14D2.5	319	290
	5.0	7A	2.6	C14D5.0	395	359
14-16	1.2	2D	1.2	C15D1.2	291	265
	2.5	6B	1.7	C15D2.5	319	290
	5.0	7A	2.6	C15D5.0	395	359
15-17	1.2	2D	1.2	C16D1.2	291	265
	2.5	6B	1.7	C16D2.5	319	290
	5.0	7A	2.6	C16D5.0	395	359

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs.
17-19	1.2	2D	1.2	C18D1.2	$291	$265
	2.5	6B	1.7	C18D2.5	319	290
	5.0	7A	2.6	C18D5.0	395	359
19-21	0.8	2D	1.2	C20D0.8	291	265
	1.8	6B	1.7	C20D1.8	319	290
	3.5	7A	2.6	C20D3.5	395	359
21-23	0.8	2D	1.2	C22D0.8	291	265
	1.8	6B	1.7	C22D1.8	319	290
	3.5	7A	2.6	C22D3.5	395	359
23-25	0.8	2D	1.2	C24D0.8	291	265
	1.8	6B	1.7	C24D1.8	319	290
	3.5	7A	2.6	C24D3.5	395	359
25-27	0.8	2D	1.2	C26D0.8	291	265
	1.8	6B	1.7	C26D1.8	319	290
	3.5	7A	2.6	C26D3.5	395	359
27-29	0.8	2D	1.2	C28D0.8	291	265
	1.8	6B	1.7	C28D1.8	319	290
	3.5	7A	2.6	C28D3.5	395	359
29-31	0.6	2D	1.2	C30D0.6	291	265
	1.2	6B	1.7	C30D1.2	319	290
	2.5	7A	2.6	C30D2.5	395	359
31-33	0.6	2D	1.2	C32D0.6	291	265
	1.2	6B	1.7	C32D1.2	319	290
	2.5	7A	2.6	C32D2.5	395	359
33-35	0.6	2D	1.2	C34D0.6	291	265
	1.2	6B	1.7	C34D1.2	319	290
	2.5	7A	2.6	C34D2.5	395	359
35-37	0.6	2D	1.2	C36D0.6	291	265
	1.2	6B	1.7	C36D1.2	319	290
	2.5	7A	2.6	C36D2.5	395	359

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number	Price 1 pc.	Price 2-4 pcs
±2.75-±3.25	0.5	10C	2.3	CC3D0.5	$352	$320
	1.0	10C	2.3	CC3D1.0	380	346
	2.0	10D	2.5	CC3D2.0	409	372
	3.5	11E	3.9	CC3D3.5	455	414
±4.5-±5.5	0.5	10C	2.3	CC5D0.5	352	320
	1.0	10C	2.3	CC5D1.0	380	346
	2.0	10D	2.5	CC5D2.0	409	372
	3.5	11E	3.9	CC5D3.5	455	414
±11-±13	0.5	10C	2.3	CC12D0.5	363	330
	1.0	10C	2.3	CC12D1.0	392	357
	2.0	10D	2.5	CC12D2.0	444	404
	3.5	11E	3.9	CC12D3.5	519	472
±14-±16	0.5	10C	2.3	CC15D0.5	363	330
	1.0	10C	2.3	CC15D1.0	392	357
	2.0	10D	2.5	CC15D2.0	444	404
	3.5	11E	3.9	CC15D3.5	519	472
±19-±21	0.5	10C	2.3	CC20D0.5	369	336
	1.0	10D	2.5	CC20D1.0	403	367
	2.0	11E	3.9	CC20D2.0	462	420
	3.5	14D	7.9	CC20D3.5	547	498
±23-±25	0.5	10C	2.3	CC24D0.5	375	341
	1.0	10D	2.5	CC24D1.0	415	378
	2.0	11E	3.9	CC24D2.0	485	441
	3.5	14D	7.9	CC24D3.5	565	514

Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

† See Page 3168 for size charts.

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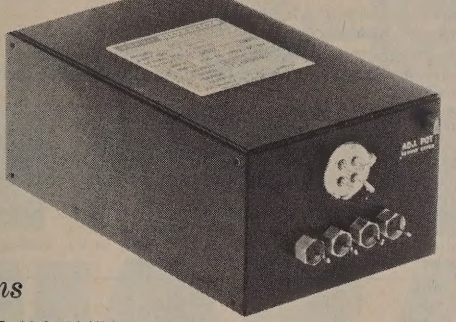
Telex 13-5332

abbott DC to DC Hi-Efficiency



features

- Wide Range DC Input
- Up to 70% Efficiency
- EMI Filters
- Reverse Polarity Protection
- +100°C Operation
- Single & Dual Outputs

specifications

INPUT VOLTAGE RANGE: 20 to 32 VDC

EFFICIENCY: Typical efficiency ranges from 50 to 70%.

INRUSH CURRENT: Less than 8 times normal steady-state full load input current

LINE EFFECT (REGULATION): 0.5% for input change of 20 to 32 VDC

LOAD EFFECT (REGULATION): 0.5% for load change of no load to full load

PARD (RIPPLE & NOISE): 100 mv peak-to-peak, 25 mv rms from 25°C to +100°C; 130 mv peak-to-peak, 40 mv rms from −55°C to +25°C. Measured at power module terminals with measurement system noise bandwidth of 25 MHz

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Wider output ranges are available by restricting the input voltage range. Consult the factory for further information

ADJUSTMENT RESOLUTION:

Nominal Output Voltage	Resolution
5-10 VDC	37 mv
12-18 VDC	49 mv
24-31 VDC	75 mv

ISOLATION VOLTAGE: 100 VDC between input & output and input & case; 50 VDC between output & case

INSULATION RESISTANCE: 50 megohms minimum between input & output, input & case and output & case when measured at 50 VDC

POLARITY: Inputs and outputs are isolated; either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating; −55°C to +100°C baseplate temperature. Derate maximum output current linearly above 85°C baseplate temperature to 80% of full load rating at 100°C baseplate temperature. Storage; −65°C to +125°C

TEMPERATURE EFFECT (COEFFICIENT): 0.03% per degree Celsius

ENVIRONMENT: Hermetically sealed and encapsulated to meet the environmental requirements of MIL-STD-810 and MIL-E-5400, Class 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

Output Voltage Range	Output Current (Amps)	Size*	Weight (Lbs.)	Model Number	Price 1-4 pcs.
4.75-5.25	5.0	10E	1.8	BN25D-5A	$323
	10.0	11J	2.9	BN50D-5A	375
	20.0	12F	4.4	BN100D-5A	446
5.7-6.3	4.17	10E	1.8	BN25D-6A	323
	8.33	11J	2.9	BN50D-6A	375
	16.67	12F	4.4	BN100D-6A	446
9.5-10.5	2.5	10E	1.8	BN25D-10A	323
	5.0	11J	2.9	BN50D-10A	375
	10.0	12F	4.4	BN100D-10A	446
11.4-12.6	2.08	10E	1.8	BN25D-12A	323
	4.17	11J	2.9	BN50D-12A	375
	8.33	12F	4.4	BN100D-12A	446
14.25-15.75	1.67	10E	1.8	BN25D-15A	323
	3.33	11J	2.9	BN50D-15A	375
	6.67	12F	4.4	BN100D-15A	446
17.1-18.9	1.39	10E	1.8	BN25D-18A	323
	2.78	11J	2.9	BN50D-18A	375
	5.56	12F	4.4	BN100D-18A	446
22.8-25.2	1.04	10E	1.8	BN25D-24A	323
	2.08	11J	2.9	BN50D-24A	375
	4.17	12F	4.4	BN100D-24A	446

* See Page 3168 for size charts.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against overloads (greater than 150% rated load) and short circuits of any duration. The output automatically restores to normal when the fault is removed

INPUT TRANSIENT PROTECTION: Each unit is completely protected against the transients of MIL-STD-704, Category B, (80 VDC for 0.1 sec) having rise times greater than 100 microseconds. Unit will turn off and resume operation when the input returns to normal

OVERVOLTAGE PROTECTION: Internal OVP is available as an optional feature and is indicated by adding "—1" to the model number (i.e.: BN25D-5A-1 indicates that OVP has been included.) The price is $20.00 additional on 1-4 pieces. The overvoltage threshold is factory set to approximately 2 V or 10% (whichever is greater) above the nominal output voltage. The OVP circuitry has a built-in delay of approximately 500 microseconds to minimize 'nuisance' tripping

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit can monitor the voltage directly at the load by using extra "sense" leads. The resulting circuit action will compensate for a DC voltage drop of up to 0.3 volts in the load leads

LOAD TRANSIENT RESPONSE: Output voltage returns to regulation limits within 2 ms after a 50% step change in load current. Maximum overshoot is less than 0.8 V

TURN-ON/TURN-OFF OVERSHOOT: No overshoot during turn-on into loads greater than half load. For loads less than half load, turn-on overshoot is less than 0.8 V for 25 ms. No turn-off overshoot under any conditions

OUTPUT IMPEDANCE:

DC-500 Hz	0.02 R$_L$ or 0.04 ohms
500-5K Hz	0.10 R$_L$ or 0.35 ohms
5K-100K Hz	0.30 R$_L$ or 0.10 ohms

ELECTROMAGNETIC INTERFERENCE: Designed to meet the requirements of MIL-STD-461 for generation of conducted and radiated interference. Test report on a typical model is available

RELIABILITY: The Mean Time Between Failures (MTBF) per MIL-HDBK-217A under worst case operating conditions of 32 VDC input, full load output, and 100°C baseplate temperature was calculated to be 13,950 hours for Model BN100D-5A. At 71°C baseplate temperature, the MTBF increases to 23,000 hours

Output Voltage Range	Output Current (Amps)	Size*	Weight (Lbs.)	Model Number	Price 1-4 pcs.
26.6-29.4	0.89	10E	1.8	BN25D-28A	$323
	1.79	11J	2.9	BN50D-28A	375
	3.57	12F	4.4	BN100D-28A	446
29.45-32.55	0.81	10E	1.8	BN25D-31A	323
	1.61	11J	2.9	BN50D-31A	375
	3.23	12F	4.4	BN100D-31A	446
45.6-50.4	0.52	10E	1.8	BN25D-48A	323
	1.04	11J	2.9	BN50D-48A	375
	2.08	12F	4.4	BN100D-48A	446
±11.4 to ±12.6	1.04	10F	2.2	BBN25D-12A	375
	2.08	11J	2.9	BBN50D-12A	436
	4.17	12F	4.4	BBN100D-12A	498
±14.25 to ±15.75	0.83	10F	2.2	BBN25D-15A	375
	1.67	11J	2.9	BBN50D-15A	436
	3.33	12F	4.4	BBN100D-15A	498

Dual Output Units: 1) The output current listed is for each output.

2) The negative output is "semiregulated" and will meet regulation specifications only when operated into a balanced load.

3) The negative output will typically be within 4% of the positive output voltage for load imbalances up to 4:1 in magnitude.

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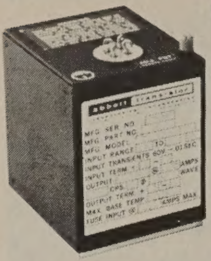
abbott DC to Sine Wave ∿1 ϕ



DC to 400 Hz

POWER MODULES

features

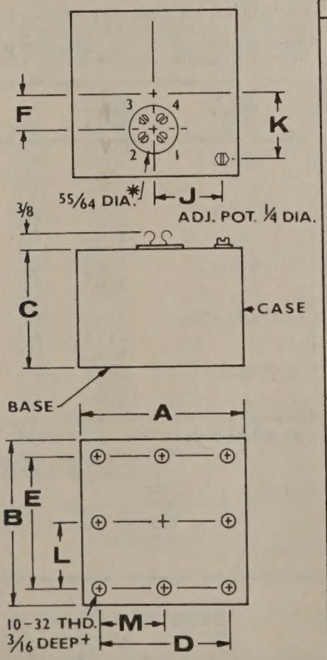
- Close regulation
- 400 or 1600 Hertz
- Hermetically sealed
- No moving parts
- Compact

specifications

Input Voltage Range: 24 to 30 volts DC. Other input ranges are available.
Load Regulation: ±0.5% from ½ to full load.
Frequency Stability: ±0.5%
Voltage Adjustment Range: 12% by screwdriver adjustment.
Reliability: 55,000 hours MTBF typical per MIL-HDBK-217 under worst case operation conditions.
Input Transient Protection: In accordance with MIL-STD-704A, Limit 1, Category B (80 volts for 0.1 seconds).
Environment: +212°F max. at mtg. base using adequate heat sink. −65°F min. at mtg. surface. Altitude: To vacuum (true hermetic seal). Vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-STD-810B and MIL-E-5400K.
Output Voltage, Current, and Frequency: See specific models listed (Outputs and inputs are isolated).
Output freqencies up to 1600 Hz are listed in our catalog as standard models. Contact our nearest office for your free copy.

Input Voltage Range	Output Frequency (Hertz)	Output Voltage Range	Output Power (Volt-Amps)	Harmonic Distortion (%)	Size (See Below)	Weight (Lbs.)	Model Number	Price 1 Piece	Price 2-4 Pieces
24-30	400	25.4-28.6	5	2.0	4	1.6	S05D-27A-400	$326	$297
			10	2.5	4C	1.7	S1D-27A-400	338	308
			20	2.5	4B	2.3	S2D-27A-400	350	319
			30	2.5	6A	2.4	S3D-27A-400	363	330
			60	3.0	12	4.8	S6D-27A-400	479	436
			120	4.0	14	9.1	S12D-27A-400	755	687
24-30	400	108-122	5	2.0	4	1.6	S05D-115A-400	297	269
			10	2.5	4C	1.7	S1D-115A-400	308	280
			20	2.5	4B	2.3	S2D-115A-400	320	291
			30	2.5	6A	2.4	S3D-115A-400	332	302
			60	3.0	12	4.8	S6D-115A-400	451	410
			120	4.0	14	9.1	S12D-115A-400	719	654
24-30	800	25.4-28.6	5	2.0	4	1.6	S05D-27A-800	357	324
			10	2.5	4C	1.7	S1D-27A-800	368	335
			20	2.5	4B	2.3	S2D-27A-800	380	346
			30	2.5	6A	2.4	S3D-27A-800	392	357
			60	3.0	12	4.8	S6D-27A-800	479	436
			120	4.0	14	9.1	S12D-27A-800	786	715
24-30	800	108-122	5	2.0	4	1.6	S05D-115A-800	326	297
			10	2.5	4C	1.7	S1D-115A-800	338	308
			20	2.5	4B	2.3	S2D-115A-800	350	319
			30	2.5	6A	2.4	S3D-115A-800	363	330
			60	3.0	12	4.8	S6D-115A-800	479	436
			120	4.0	14	9.1	S12D-115A-800	755	687

abbott Size Charts



Size	A	B	C	D	E	F	J	K	L	M
1	1½	2¾	3	1.00	2.25	9/16	½	1⅛	—	—
1A	1½	2¾	2¾	1.00	2.25	9/16	½	1⅛	—	—
1B	1½	2	2	1.00	1.50	0	½	¾	—	—
2	1⅞	2¾	3¼	1.37	2.25	¾	11/16	1⅛	—	—
2C	2	2¾	2⅛	1.50	2.25	0	¾	1⅛	—	—
2D	2	3	3½	1.50	2.50	¾	¾	1¼	—	—
2E	2⅛	3¼	3¼	1.62	2.75	⅞	13/16	1⅜	—	—
3	2¾	2¾	3	2.25	2.25	¾	1⅛	1⅛	—	—
3A	2¾	2¾	2¾	2.25	2.25	¾	1⅛	1⅛	—	—
4	2¼	2¾	3¼	1.75	2.25	¾	⅞	1⅛	—	—
4B	2½	3	3¾	2.00	2.50	¾	1	1¼	—	—
4C	2¼	2¾	3½	1.75	2.25	¾	⅞	1⅛	—	—
4D	2½	3½	3½	2.00	3.00	0	1	1½	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	1⅛	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	1⅛	1¼	—	—
6A	2¾	3	4	2.25	2.50	¾	1⅛	1¼	—	—
6B	2¾	3⅛	3⅝	2.25	2.62	¾	1⅛	15/16	—	—
7	2¾	2¾	4	2.25	2.25	¾	1⅛	1⅛	—	—
7A	2⅞	3⅜	4½	2.37	2.87	¾	1 3/16	1 7/16	—	—
8B	2⅝	3½	2⅞	2.12	3.00	¾	1 1/16	1½	—	—
9A	2¾	4¾	3¾	2.25	4.25	0	1⅛	2⅛	—	—
9B	2¾	4¾	3½	2.25	4.25	0	1⅛	2⅛	—	—
9C	2½	4⅜	3⅛	2.00	3.87	1	1	1 15/16	—	—
9D	2⅝	4¾	3⅝	2.12	4.25	1	1 1/16	2⅛	—	—
10A	3	5	4	2.50	4.50	0	1¼	2¼	—	—
10B	2⅞	4¼	4⅜	2.37	3.75	1⅜	1 3/16	1⅞	—	—
10C	3⅜	3⅜	3¾	2.87	2.87	¾	1 7/16.	1 7/16	—	—
10D	3½	3½	4	3.00	3.00	¾	1½	1½	—	—
10E	2⅜	6¼	2½	1.87	5.75	**	**	**	2.87	—
10F	2¾	6¼	2½	2.25	5.75	**	**	**	2.87	—
10G	3½	5½	2½	3.00	3.50	**	**	**	—	—
10H	4	5½	2⅝	3.50	3.50	**	**	**	—	—
11	3	5½	3¼	2.50	5.00	2⅛	1¼	2½	2.50	—
11C	4¼	5¼	4	3.75	4.75	0	1⅞	2⅜	2.37	—
11D	4	4⅞	3⅞	3.50	4.37	1⅜	1¾	2 3/16	—	—
11E	3¾	4½	4¼	3.25	4.00	¾	1⅝	2	—	—
11F	2¾	6¼	2¾	2.25	5.75	1	1⅛	2⅞	2.87	—
11J	3⅜	6¼	2½	2.87	5.75	**	**	**	2.87	—
11K	3⅝	8 13/16	2⅝	2.55	4.31	**	**	**	—	—
12	3	5½	4	2.50	5.00	2⅛	1¼	2½	2.50	—
12A	4½	6	4	4.00	5.50	0	2	2¾	2.75	—
12C	3⅞	6¼	2¾	3.37	5.75	1½	1 11/16	2⅞	2.87	—
12F	5½	5⅞	2⅝	5.00	5.37	**	**	**	2.68	2.50
12G	5⅛	8¾	2⅝	4.62	6.56	**	**	**	3.28	—
13A	5½	6½	4½	5.00	6.00	0	2½	3	3.00	2.50
14	6	6	4	5.50	5.50	2⅜	2¾	2¾	2.75	2.75
14C	5½	5½	3⅝	5.00	5.00	1⅞	2½	2½	2.50	2.50
14D	6	6¼	3⅞	5.50	5.75	1¼	2¾	2⅞	2.87	2.75
14E	5¾	6¼	2¾	5.25	5.75	1¼	2⅝	2⅞	2.87	2.62
16A	6¾	7½	4¼	6.25	7.00	2¾	3⅛	3½	3.50	3.12

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DEMICALS .XX ±0.015.

* Models CC and WW use special 8 pin header.
Model VN uses special 9 pin header.
Size of special headers is 1 5/16 dia. by 5/16 high.

† 6-32 Thd, 3/16 deep on case size 1B.

** Model BN & UN uses special terminals on A x C face.

Add Dept. EM to address to tell them you saw it in eem

when you order any Acopian power module listed on the following 30 pages...

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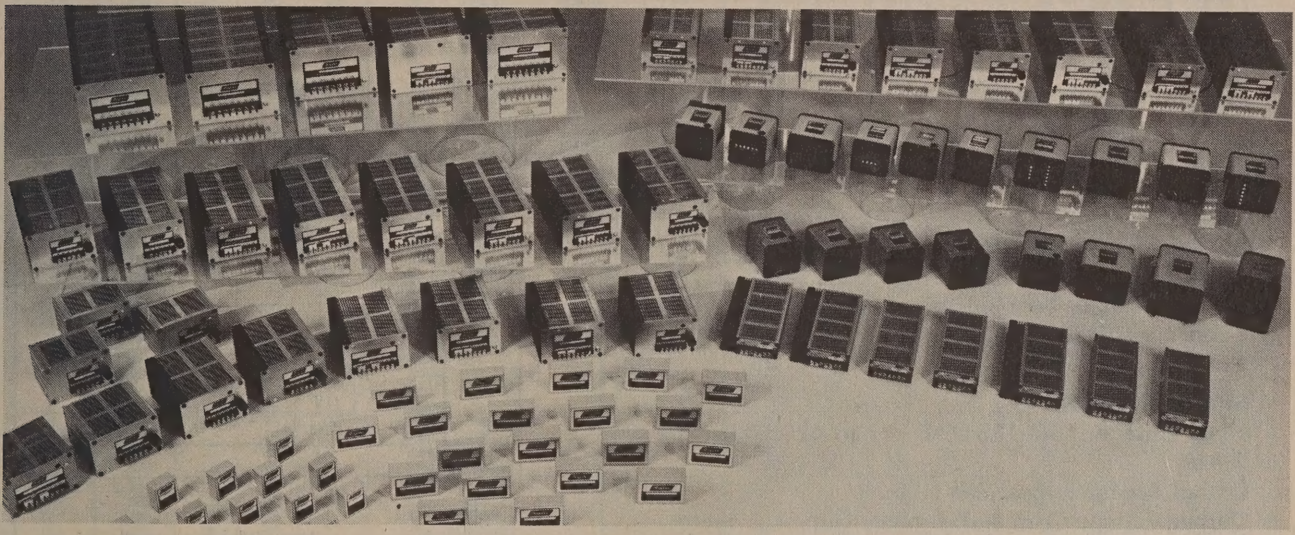

Any time you order Acopian power modules selected from the thousands of models described on the following pages, shipment will be made within 3 days after your purchase order is received. To save more time, telephone your order. Call us, or your local Acopian representative. We'll ship within 3 days after you've put down the phone.

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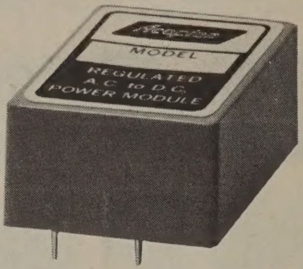
Acopian

MINIATURIZED REGULATED SINGLE OUTPUT


Acopian
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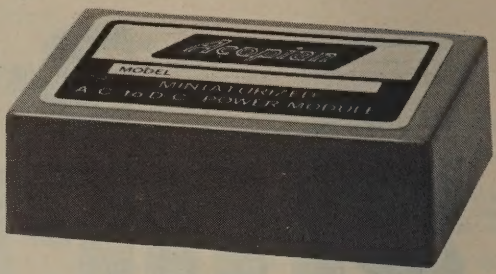
REGULATED
A C to D C
POWER MODULE


Acopian
MODEL
MINIATURIZED
A C to D C POWER MODULE

ALL MODELS U.L. RECOGNIZED

Conserve space with mini-modules as small as 2.3″ x 1.8″ x 1.0″. Models with outputs ranging from 1 to 75 volts, and from 30 ma to 2.5 amps are available. All feature excellent regulation and ripple parameters, and are short circuit protected. Rugged encapsulated construction and generously derated components insure years of reliable operation. Mini-modules are also available with multiple outputs—see pages 4 and 5.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

SPECIFICATIONS

Input Voltage: 105–125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See table.

Output Voltage Trim Adjustment: Output is factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Output may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Output is floating. Either positive or negative terminal may be grounded.

Ambient Operating Temperature: −20 to +71°C. (Model 5E150, 0 to +71°C.) No derating required.

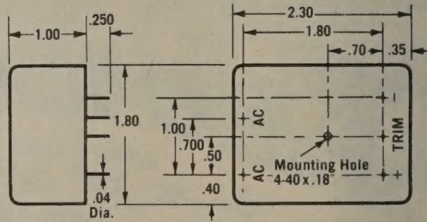
Storage Temperature: −55 to +85°C.

Temperature Coefficient: From 9 to 75 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

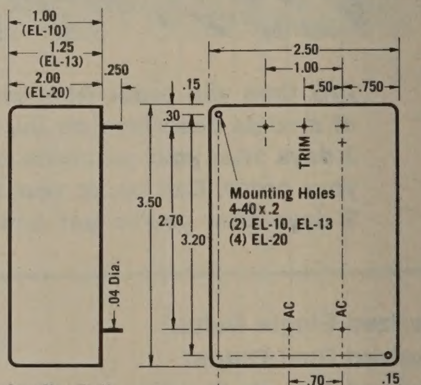
Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

Weight:	7 oz. (Case size ES-10.)
	1 lb. (Case size EL-10.)
	1 lb. 3 oz. (Case size EL-13.)
	2 lb. (Case size EL-20.)

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "−230" to model number and $10.00 to price.


1.00
.250
2.30
1.80
.70
.35
1.80
1.00
.700
.50
.40
.04
Dia.
+ AC
TRIM
AC
Mounting Hole
4-40 x .18"

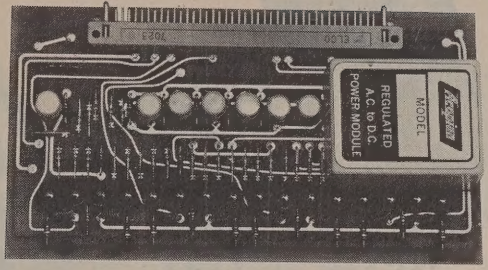
Case Size ES-10


1.00
(EL-10)
1.25
(EL-13)
2.00
(EL-20)
.250
.15
2.50
1.00
.50
.750
.30
3.50
2.70
3.20
.04 Dia.
TRIM
Mounting Holes
4-40 x .2
(2) EL-10, EL-13
(4) EL-20
AC
AC
.70
.15
2.20

Case Sizes EL-10, EL-13, and EL-20.

High voltage displays such as NIXIE* indicators may be powered with the Model NX-25A or NX-50. With an input of 115 VAC 47-420 Hz, they provide nominal (unregulated) outputs of 185 VDC.

*Registered trademark of Burroughs Corp.

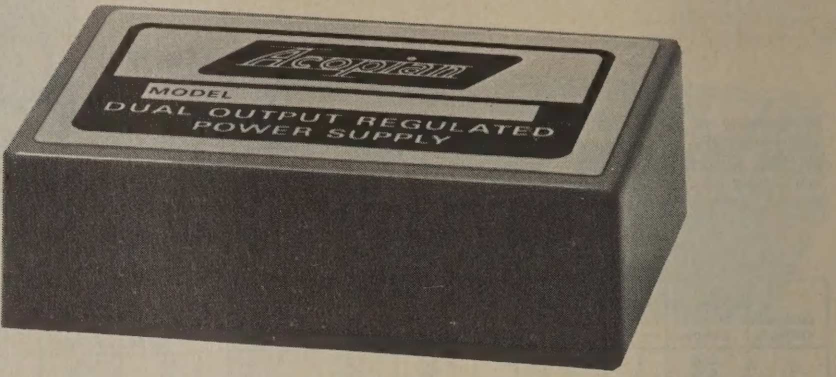


Placement of a mini-module on a printed circuit assembly eliminates the need for an outboard power supply, as well as all the associated wiring, connectors and hardware. Layout and construction are simplified, equipment size can be reduced, and system reliability is improved.

		Regulation					
Output Voltage	Output Current Amps.	Load ±%	Line ±%	Ripple mv RMS	Price	Model	Case Size
1	.250	.1	.05	0.5	$ 49	1E25	ES-10
1	.500	.2	.05	1	59	1E50A	EL-10
1.5	.250	.1	.05	0.5	49	1.5E25	ES-10
1.5	.500	.2	.05	1	59	1.5E50A	EL-10
1.5	1.0	.3	.05	1	98	1.5E100	EL-13
1.5	2.5	.3	.05	1	125	1.5E250	EL-20
2	.200	.1	.05	0.5	49	2E20	ES-10
2	.400	.2	.05	1	59	2E40A	EL-10
3	.250	.1	.05	0.5	49	3E25	ES-10
3	.500	.2	.05	1	59	3E50A	EL-10
3.6	.250	.05	.05	0.5	39	3.6E25	ES-10
3.6	.500	.1	.05	1	59	3.6E50A	EL-10
3.6	1.0	.3	.05	1	98	3.6E100	EL-13
3.6	2.5	.3	.05	1	125	3.6E250	EL-20
4	.200	.05	.05	0.5	49	4E20	ES-10
4	.400	.1	.05	1	59	4E40A	EL-10
5	.250	.05	.05	0.5	39	5E25	ES-10
5	.500	.1	.05	1	49	5E50A	EL-10
5	1.0	.2	.05	1	69	5E100	EL-13
5	1.5	.3	.1	1	98	5E150	EL-13
5	2.0	.15	.05	1	110	5E200	EL-20
5	2.5	.15	.05	1	125	5E250	EL-20
6	.200	.05	.05	0.5	39	6E20	ES-10
6	.400	.1	.05	1	59	6E40A	EL-10
6	.550	.2	.05	1	79	6E55	EL-10
6	1.0	.2	.05	1	98	6E100	EL-13
6	1.75	.15	.05	1	125	6E175	EL-20
7	.170	.05	.05	0.5	49	7E17	ES-10
7	.340	.1	.05	1	59	7E34A	EL-10
7	.450	.2	.05	1	79	7E45	EL-10
7	.900	.2	.05	1	98	7E90	EL-13
7	1.15	.15	.05	1	125	7E115	EL-20
8	.150	.05	.05	0.5	49	8E15	ES-10
8	.300	.1	.05	1	59	8E30A	EL-10
8	.700	.2	.05	1	98	8E70	EL-13
8	1.1	.15	.05	1	125	8E110	EL-20
9	.130	.05	.05	0.5	39	9E13	ES-10
9	.260	.1	.05	1	59	9E26A	EL-10
9	.450	.15	.05	1	79	9E45	EL-10
9	.850	.15	.05	1	98	9E85	EL-13
9	1.5	.15	.05	1	125	9E150	EL-20
10	.120	.02	.02	0.5	30	10E12	ES-10
10	.240	.05	.05	1	59	10E24A	EL-10
10	.400	.15	.05	1	79	10E40	EL-10
10	.750	.15	.05	1	98	10E75	EL-13
10	1.2	.1	.05	1	125	10E120	EL-20
11	.110	.02	.02	0.5	39	11E11	ES-10
11	.220	.05	.05	1	59	11E22A	EL-10
11	.350	.15	.05	1	79	11E35	EL-10
11	.600	.15	.05	1	98	11E60	EL-13
11	1.0	.1	.05	1	125	11E100	EL-20
12	.100	.02	.02	0.5	30	12E10	ES-10
12	.200	.05	.05	1	59	12E20A	EL-10
12	.400	.1	.05	1	79	12E40	EL-10
12	.700	.1	.05	1	98	12E70	EL-13
12	1.2	.15	.05	1	125	12E120	EL-20
13	.100	.02	.02	0.5	39	13E10	ES-10
13	.200	.05	.05	1	59	13E20A	EL-10
13	.350	.1	.05	1	79	13E35	EL-10
13	.600	.1	.05	1	98	13E60	EL-13
13	1.0	.1	.05	1	125	13E100	EL-20
14	.100	.02	.02	0.5	39	14E10	ES-10
14	.200	.05	.05	1	59	14E20A	EL-10
14	.300	.1	.05	1	79	14E30	EL-10
14	.500	.1	.05	1	98	14E50	EL-13
14	1.0	.1	.05	1	125	14E100	EL-20
15	.100	.02	.02	0.5	30	15E10	ES-10
15	.200	.05	.05	1	59	15E20A	EL-10
15	.400	.1	.05	1	79	15E40	EL-10
15	.600	.1	.05	1	98	15E60	EL-13
15	1.0	.1	.05	1	125	15E100	EL-20
16	.080	.02	.02	0.5	39	16E08	ES-10
16	.160	.05	.05	1	59	16E16A	EL-10
16	.350	.1	.05	1	79	16E35	EL-10
16	.500	.1	.05	1	98	16E50	EL-13
16	.900	.1	.05	1	125	16E90	EL-20
17	.070	.02	.02	0.5	39	17E07	ES-10
17	.140	.05	.05	1	59	17E14A	EL-10
17	.325	.1	.05	1	79	17E33	EL-10
17	.450	.1	.05	1	$ 98	17E45	EL-13
17	.750	.1	.05	1	125	17E75	EL-20
18	.060	.02	.02	0.5	30	18E06	ES-10
18	.120	.05	.05	1	59	18E12A	EL-10
18	.270	.1	.05	1	79	18E27	EL-10
18	.400	.1	.05	1	98	18E40	EL-13
18	.550	.1	.05	1	125	18E55	EL-20
19	.060	.02	.02	0.5	39	19E06	ES-10
19	.120	.05	.05	1	59	19E12A	EL-10
19	.250	.1	.05	1	79	19E25	EL-10
19	.400	.1	.05	1	98	19E40	EL-13
19	.700	.1	.05	1	125	19E70	EL-20
20	.060	.02	.02	0.5	39	20E06	ES-10
20	.120	.05	.05	1	59	20E12A	EL-10
20	.200	.1	.05	1	79	20E20	EL-10
20	.400	.1	.05	1	98	20E40	EL-13
20	.700	.1	.05	1	125	20E70	EL-20
21	.060	.02	.02	0.5	39	21E06	ES-10
21	.120	.05	.05	1	59	21E12A	EL-10
21	.175	.1	.05	1	79	21E18	EL-10
21	.375	.1	.05	1	98	21E38	EL-13
21	.600	.1	.05	1	125	21E60	EL-20
22	.050	.02	.02	0.5	39	22E05	ES-10
22	.100	.05	.05	1	59	22E10A	EL-10
22	.150	.1	.05	1	79	22E15	EL-10
22	.300	.1	.05	1	98	22E30	EL-13
22	.500	.1	.05	1	125	22E50	EL-20
23	.050	.02	.02	0.5	39	23E05	ES-10
23	.100	.05	.05	1	59	23E10A	EL-10
23	.200	.1	.05	1	79	23E20	EL-10
23	.300	.1	.05	1	98	23E30	EL-13
23	.600	.1	.05	1	125	23E60	EL-20
24	.050	.02	.02	0.5	30	24E05	ES-10
24	.100	.05	.05	1	59	24E10A	EL-10
24	.200	.1	.05	1	79	24E20	EL-10
24	.350	.1	.05	1	98	24E35	EL-13
24	.600	.1	.05	1	125	24E60	EL-20
25	.050	.02	.02	0.5	39	25E05	ES-10
25	.100	.05	.05	1	59	25E10A	EL-10
25	.190	.1	.05	1	79	25E19	EL-10
25	.325	.1	.05	1	98	25E33	EL-13
25	.550	.1	.05	1	125	25E55	EL-20
26	.040	.02	.02	0.5	39	26E04	ES-10
26	.080	.05	.05	1	59	26E08A	EL-10
26	.170	.1	.05	1	79	26E17	EL-10
26	.300	.1	.05	1	98	26E30	EL-13
26	.450	.1	.05	1	125	26E45	EL-20
27	.040	.02	.02	0.5	39	27E04	ES-10
27	.080	.05	.05	1	59	27E08A	EL-10
27	.160	.1	.05	1	79	27E16	EL-10
27	.300	.1	.05	1	98	27E30	EL-13
27	.500	.1	.05	1	125	27E50	EL-20
28	.040	.05	.05	0.5	39	28E04	ES-10
28	.080	.02	.02	1	59	28E08A	EL-10
28	.150	.1	.05	1	79	28E15	EL-10
28	.300	.1	.05	1	98	28E30	EL-13
28	.500	.1	.05	1	125	28E50	EL-20
30	.080	.02	.02	1	59	30E08A	EL-13
32	.070	.02	.02	1	59	32E07A	EL-13
34	.060	.02	.02	1	59	34E06A	EL-13
35	.050	.02	.02	1	59	35E05A	EL-13
36	.050	.02	.02	1	59	36E05A	EL-13
38	.040	.02	.02	1	59	38E04A	EL-13
40	.030	.02	.02	1	62	40E03A	EL-13
40	.060	.02	.02	1	89	40E06A	EL-13
42	.030	.02	.02	1	62	42E03A	EL-13
44	.030	.02	.02	1	62	44E03A	EL-13
45	.030	.02	.02	1	62	45E03A	EL-13
48	.030	.02	.02	1	62	48E03A	EL-13
48	.050	.02	.02	1	89	48E05A	EL-13
50	.030	.02	.02	1	62	50E03A	EL-13
50	.050	.02	.02	1	89	50E05A	EL-13
55	.040	.02	.02	1	89	55E04A	EL-13
60	.050	.02	.02	1	89	60E05A	EL-13
65	.050	.02	.02	1	89	65E05A	EL-13
70	.040	.02	.02	1	89	70E04A	EL-13
75	.030	.02	.02	1	89	75E03A	EL-13
185	.025	Unregulated		2V	35	NX-25A	EL-10
185	.050	Unregulated		3.5V	49	NX-50	EL-13

ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919 • 3-DAY SHIPMENT GUARANTEED

3


Acopian
MODEL
DUAL OUTPUT REGULATED
POWER SUPPLY

MINIATURIZED REGULATED MULTIPLE OUTPUT

ALL MODELS U.L. RECOGNIZED

These dual and triple output mini-modules are compact and convenient sources of the voltages required to power operational amplifiers and related circuits. They may be mounted directly on printed circuit board assemblies, simplifying system layout and minimizing the connectors and wiring required.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Compact, lightweight

SPECIFICATIONS

Input Voltage: 105–125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See table.

Output Voltage Setting: Each output is factory preset to ±2% (1 to 9 volt outputs) or ±1% (10 to 28 volt outputs) of the nominal output voltage. Outputs of Case Size END modules, except those marked (*), may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Single output sections may be used in either polarity. Dual output sections, marked (*), are provided with a plus/common/minus output connection configuration.

Ambient Operating Temperature: −20 to +71°C. No derating required.

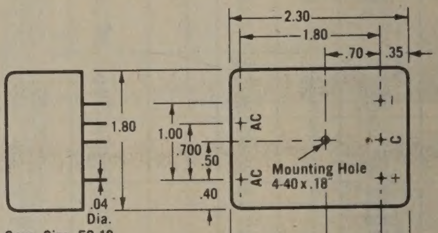
Storage Temperature: −55 to +85°C.

Temperature Coefficient: From 9 to 28 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

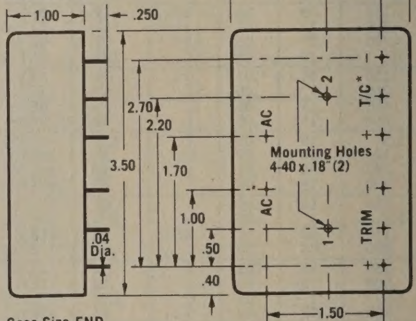
Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

Weight: 7 oz. (Case size ES-10.)
13 oz. (Case size END.)
1 lb. (Case size EL-10.)
1 lb. 3 oz. (Case size EL-13.)
2 lb. (Case size EL-20.)

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "−230" to model number and $10.00 to price.

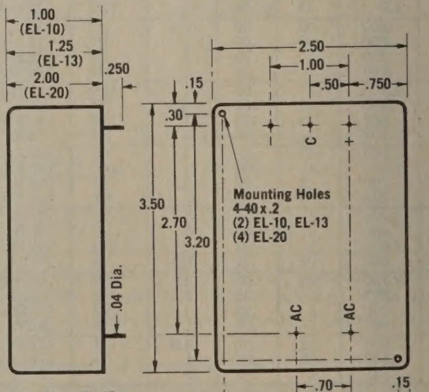

2.30
1.80
.70
.35
1.80
1.00
.700
.50
.40
.04 Dia.
AC
AC
C
+
−
Mounting Hole 4-40 x .18"

Case Size ES-10


1.00
.250
2.70
2.20
3.50
1.70
1.00
.50
.40
.04 Dia.
AC
AC
2
1
T/C*
TRIM
+
−
Mounting Holes 4-40 x .18" (2)
1.50

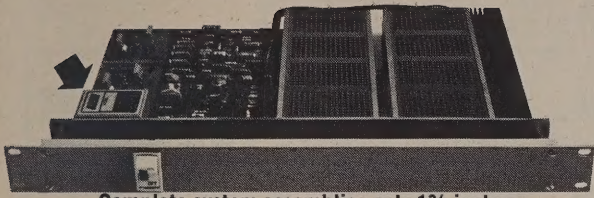
Case Size END

*TRIM or COMMON, depending upon model

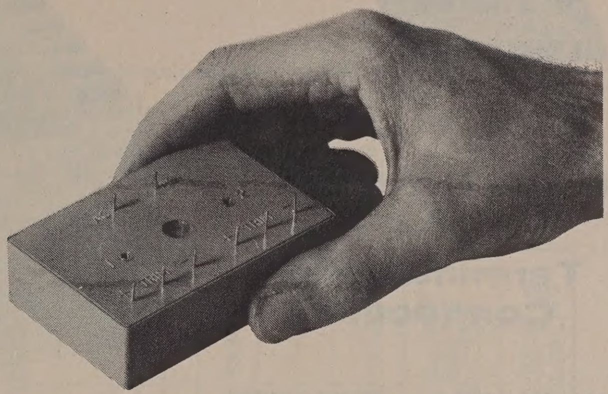

1.00 (EL-10)
1.25 (EL-13)
2.00 (EL-20)
.250
.15
.30
3.50
2.70
3.20
.04 Dia.
2.50
1.00
.50
.750
C
+
AC
AC
Mounting Holes 4-40 x .2 (2) EL-10, EL-13 (4) EL-20
.70
.15
2.20

Case Sizes EL-10, EL-13, and EL-20.

4 *ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919 • 3-DAY SHIPMENT GUARANTEED*



Complete system assemblies only 1¾-inches high. Mini-modules permit exceptional flexibility in the design of rack-mounting assemblies built on standard 19-inch panels as small as 1¾-inches high.



Dual output modules have isolated outputs; triples provide two balanced and tracking voltages in a three-terminal configuration, plus an isolated third output for logic, control circuits, etc.

HOW TO ORDER:

Any two of the sections listed below, or two of the same section, can be combined into a multiple-output module. The complete model number is the combination of the two section numbers selected. Note that some sections provide two outputs; combination with a single output section results in a triple-output module.

Example: The combination of sections 6E20D and 15E10D is the Model 6E20D-15E10D. Always assign the lower voltage section first. For pricing purposes, add the costs of the sections selected. Example: The price of the Model 6E20D-15E10D is $39.00 plus $29.00, or $68.00 total.

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to order")	Case Size
		Load ±%	Line ±%				
1	.250	.1	.05	0.5	$39	1E25D	END
1.5	.250	.1	.05	0.5	39	1.5E25D	END
2	.200	.1	.05	0.5	39	2E20D	END
3	.250	.1	.05	0.5	39	3E25D	END
3.6	.250	.05	.05	0.5	39	3.6E25D	END
4	.200	.05	.05	0.5	39	4E20D	END
5	.250	.05	.05	0.5	39	5E25D	END
6	.200	.05	.05	0.5	39	6E20D	END
7	.170	.05	.05	0.5	39	7E17D	END
8	.150	.05	.05	0.5	39	8E15D	END
9	.130	.05	.05	0.5	29	9E13D	END
10	.120	.02	.02	0.5	29	10E12D	END
±12*	.050	.10	.05	1.0	49	D12E05	END
12	.100	.02	.02	0.5	29	12E10D	END
12	.150	.05	.05	0.5	33	12E15D	END
13	.100	.02	.02	0.5	29	13E10D	END

Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to order")	Case Size
		Load ±%	Line ±%				
14	.100	.02	.02	0.5	$29	14E10D	END
±15*	.050	.10	.05	1.0	49	D15E05	END
15	.100	.02	.02	0.5	29	15E10D	END
15	.150	.05	.05	0.5	33	15E15D	END
16	.080	.02	.02	0.5	29	16E08D	END
17	.070	.02	.02	0.5	29	17E07D	END
18	.060	.02	.02	0.5	29	18E06D	END
20	.060	.02	.02	0.5	29	20E06D	END
21	.060	.02	.02	0.5	29	21E06D	END
22	.050	.02	.02	0.5	29	22E05D	END
23	.050	.02	.02	0.5	29	23E05D	END
24	.050	.02	.02	0.5	29	24E05D	END
25	.050	.02	.02	0.5	29	25E05D	END
26	.040	.02	.02	0.5	29	26E04D	END
27	.040	.02	.02	0.5	29	27E04D	END
28	.040	.02	.02	0.5	29	28E04D	END

*Dual output section. Combination with a single output section results in a triple output module.

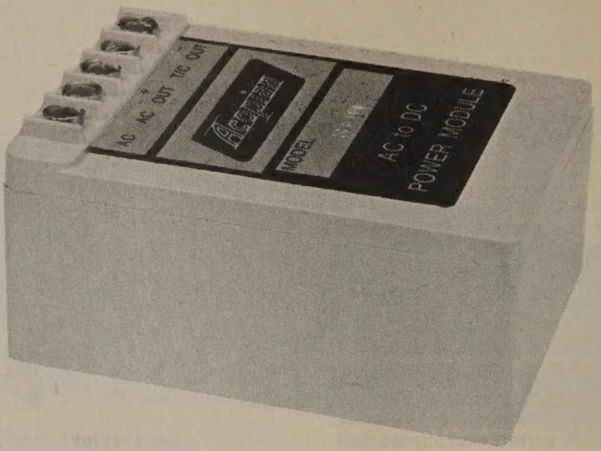
DUAL OUTPUT SUPPLIES FOR OP AMPS

(These model numbers are complete as shown.)

Nominal Output Voltages	Output Current Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
±12	.025	.1	.05	1	$ 24	D12-03	ES-10
±12	.050	.1	.05	1	39	D12-05	ES-10
±12	.100	.05	.05	1	49	D12-10A	EL-10
±12	.150	.05	.05	1	59	D12-15A	EL-10
±12	.200	.05	.05	1	69	D12-20	EL-10
±12	.300	.05	.05	1	98	D12-30	EL-13
±12	.350	.05	.05	1	105	D12-35	EL-13
±12	.500	.1	.05	1	130	D12-50	EL-20

Nominal Output Voltages	Output Current Amps.	Regulation		Ripple mv RMS	Price	Model	Case Size
		Load ±%	Line ±%				
±15	.025	.1	.05	1	$ 24	D15-03	ES-10
±15	.050	.1	.05	1	39	D15-05	ES-10
±15	.100	.05	.05	1	49	D15-10A	EL-10
±15	.150	.05	.05	1	59	D15-15A	EL-10
±15	.200	.05	.05	1	69	D15-20	EL-10
±15	.300	.05	.05	1	98	D15-30	EL-13
±15	.350	.05	.05	1	105	D15-35	EL-13
±15	.500	.1	.05	1	130	D15-50	EL-20

Acopian



MINIATURIZED REGULATED

Terminal Strip Connections

ALL MODELS U.L. RECOGNIZED

Although small in size, these mini-modules offer high performance at modest prices. All models, with series regulated outputs ranging from 1 to 75 volts and as high as 2.5 amps, may be mounted in an area only 3.5″ x 2.5″. Dual output models are available with the ratings commonly required for driving op amps and other balanced loads. Terminal strip input/output connections eliminate all need for sockets or soldering. Short circuit protection, encapsulated construction, and conservative design assure long term reliability.

STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

SPECIFICATIONS

Input Voltage: 105–125 VAC, 47 to 420 Hz, single phase.

Output Specifications: See tables.

Output Voltage Trim Adjustment: Outputs factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Single output models may be trimmed to the nominal voltage rating with an external trim resistor.

Polarity: Either positive or negative terminal of a single output module may be grounded. Dual output modules have a positive/common/negative output terminal configuration.

Ambient Operating Temperature: −20 to +71°C. (Model 5EB150, 0 to +71°C.) No derating required.

Storage Temperature: −55 to +85°C.

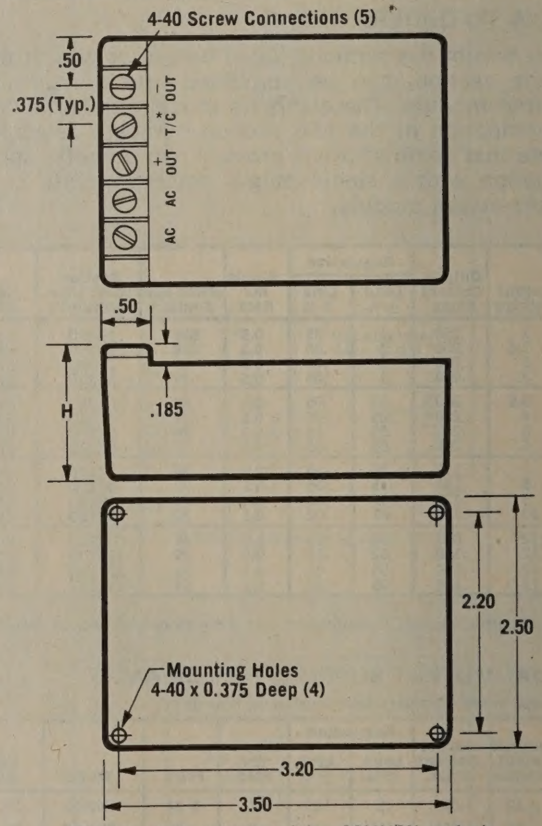
Temperature Coefficient: From 9 to 75 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

Impedance: 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

Optional 230 Volt Input: All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "–230" to model number and $10.00 to price.

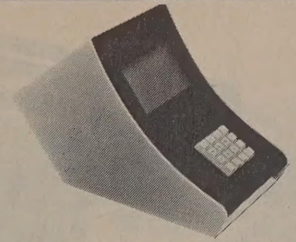
High voltage displays such as NIXIE* indicators may be powered with the Model NX-25B or NX-50B. With an input of 115 VAC 47-420 Hz, they provide nominal (unregulated) outputs of 185 VDC.

*Registered trademark of Burroughs Corp.



*TRIM on single output modules; COMMON on duals

Case	H	Approx. Weight
EB-10	1.375	15oz
EB-13	1.625	1lb 5oz
EB-20	2.375	2lb 1oz



An Acopian miniaturized power module is used in the Valitron credit validation system manufactured by Video Systems Corporation. A Valitron terminal is capable of retrieving and displaying credit information for any of 100,000 accounts on a six inch video screen, in response to an account number being entered via its keyboard.

SINGLE OUTPUT MODELS

Output Voltage	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price	Model	Case Size
1	.500	.4	.05	1	$ 65	1EB50	EB-10
1.5	.500	.3	.05	1	65	1.5EB50	EB-10
1.5	1.0	.5	.05	1	105	1.5EB100	EB-13
1.5	2.5	.6	.05	1	130	1.5EB250	EB-20
2	.400	.25	.05	1	65	2EB40	EB-10
3	.500	.25	.05	1	65	3EB50	EB-10
3.6	.500	.15	.05	1	65	3.6EB50	EB-10
3.6	1.0	.4	.05	1	105	3.6EB100	EB-13
3.6	2.5	.4	.05	1	130	3.6EB250	EB-20
4	.400	.15	.05	1	65	4EB40	EB-10
5	.500	.15	.05	1	55	5EB50	EB-10
5	1.0	.25	.05	1	75	5EB100	EB-13
5	1.5	.35	.1	1	105	5EB150	EB-13
5	2.0	.25	.05	1	115	5EB200	EB-20
5	2.5	.25	.05	1	130	5EB250	EB-20
6	.400	.1	.05	1	65	6EB40	EB-10
6	.550	.25	.05	1	85	6EB55	EB-10
6	1.0	.25	.05	1	105	6EB100	EB-13
6	1.75	.2	.05	1	130	6EB175	EB-20
7	.340	.1	.05	1	65	7EB34	EB-10
7	.450	.2	.05	1	85	7EB45	EB-10
7	.900	.25	.05	1	105	7EB90	EB-13
7	1.15	.2	.05	1	130	7EB115	EB-20
8	.300	.1	.05	1	65	8EB30	EB-10
8	.700	.2	.05	1	105	8EB70	EB-13
8	1.1	.2	.05	1	130	8EB110	EB-20
9	.260	.1	.05	1	65	9EB26	EB-10
9	.450	.15	.05	1	85	9EB45	EB-10
9	.850	.2	.05	1	105	9EB85	EB-13
9	1.5	.2	.05	1	130	9EB150	EB-20
10	.240	.05	.05	1	65	10EB24	EB-10
10	.400	.15	.05	1	85	10EB40	EB-10
10	.750	.2	.05	1	105	10EB75	EB-13
10	1.2	.15	.05	1	130	10EB120	EB-20
11	.220	.05	.05	1	65	11EB22	EB-10
11	.350	.15	.05	1	85	11EB35	EB-10
11	.600	.15	.05	1	105	11EB60	EB-13
11	1.0	.15	.05	1	130	11EB100	EB-20
12	.200	.05	.05	1	65	12EB20	EB-10
12	.400	.1	.05	1	85	12EB40	EB-10
12	.700	.15	.05	1	105	12EB70	EB-13
12	1.2	.2	.05	1	130	12EB120	EB-20
13	.200	.05	.05	1	65	13EB20	EB-10
13	.350	.1	.05	1	85	13EB35	EB-10
13	.600	.1	.05	1	105	13EB60	EB-13
13	1.0	.15	.05	1	130	13EB100	EB-20
14	.200	.05	.05	1	65	14EB20	EB-10
14	.300	.1	.05	1	85	14EB30	EB-10
14	.500	.1	.05	1	105	14EB50	EB-13
14	1.0	.15	.05	1	130	14EB100	EB-20
15	.200	.05	.05	1	65	15EB20	EB-10
15	.400	.1	.05	1	85	15EB40	EB-10
15	.600	.1	.05	1	105	15EB60	EB-13
15	1.0	.15	.05	1	130	15EB100	EB-20
16	.160	.05	.05	1	65	16EB16	EB-10
16	.350	.1	.05	1	85	16EB35	EB-10
16	.500	.1	.05	1	105	16EB50	EB-13
16	.900	.15	.05	1	130	16EB90	EB-20
17	.140	.05	.05	1	65	17EB14	EB-10
17	.325	.1	.05	1	85	17EB33	EB-10
17	.450	.1	.05	1	105	17EB45	EB-13
17	.750	.15	.05	1	130	17EB75	EB-20
18	.120	.05	.05	1	65	18EB12	EB-10
18	.270	.1	.05	1	85	18EB27	EB-10

Output Voltage	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price	Model	Case Size
18	.400	.1	.05	1	$105	18EB40	EB-13
18	.550	.1	.05	1	130	18EB55	EB-20
19	.120	.05	.05	1	65	19EB12	EB-10
19	.250	.1	.05	1	85	19EB25	EB-10
19	.400	.1	.05	1	105	19EB40	EB-13
19	.700	.1	.05	1	130	19EB70	EB-20
20	.120	.05	.05	1	65	20EB12	EB-10
20	.200	.1	.05	1	85	20EB20	EB-10
20	.400	.1	.05	1	105	20EB40	EB-13
20	.700	.1	.05	1	130	20EB70	EB-20
21	.120	.05	.05	1	65	21EB12	EB-10
21	.175	.1	.05	1	85	21EB18	EB-10
21	.375	.1	.05	1	105	21EB38	EB-13
21	.600	.1	.05	1	130	21EB60	EB-20
22	.100	.05	.05	1	65	22EB10	EB-10
22	.150	.1	.05	1	85	22EB15	EB-10
22	.300	.1	.05	1	105	22EB30	EB-13
22	.500	.1	.05	1	130	22EB50	EB-20
23	.100	.05	.05	1	65	23EB10	EB-10
23	.200	.1	.05	1	85	23EB20	EB-10
23	.300	.1	.05	1	105	23EB30	EB-13
23	.600	.1	.05	1	130	23EB60	EB-20
24	.100	.05	.05	1	65	24EB10	EB-10
24	.200	.1	.05	1	85	24EB20	EB-10
24	.350	.1	.05	1	105	24EB35	EB-13
24	.600	.1	.05	1	130	24EB60	EB-20
25	.100	.05	.05	1	65	25EB10	EB-10
25	.190	.1	.05	1	85	25EB19	EB-10
25	.325	.1	.05	1	105	25EB33	EB-13
25	.550	.1	.05	1	130	25EB55	EB-20
26	.080	.05	.05	1	65	26EB08	EB-10
26	.170	.1	.05	1	85	26EB17	EB-10
26	.300	.1	.05	1	105	26EB30	EB-13
26	.450	.1	.05	1	130	26EB45	EB-20
27	.080	.05	.05	1	65	27EB08	EB-10
27	.160	.1	.05	1	85	27EB16	EB-10
27	.300	.1	.05	1	105	27EB30	EB-13
27	.500	.1	.05	1	130	27EB50	EB-20
28	.080	.05	.05	1	65	28EB08	EB-10
28	.150	.1	.05	1	85	28EB15	EB-10
28	.300	.1	.05	1	105	28EB30	EB-13
28	.500	.1	.05	1	130	28EB50	EB-20
30	.080	.02	.02	1	65	30EB08	EB-13
32	.070	.02	.02	1	65	32EB07	EB-13
34	.060	.02	.02	1	65	34EB06	EB-13
35	.050	.02	.02	1	65	35EB05	EB-13
36	.050	.02	.02	1	65	36EB05	EB-13
38	.040	.02	.02	1	65	38EB04	EB-13
40	.030	.02	.02	1	69	40EB03	EB-13
40	.060	.02	.02	1	95	40EB06	EB-13
42	.030	.02	.02	1	69	42EB03	EB-13
44	.030	.02	.02	1	69	44EB03	EB-13
45	.030	.02	.02	1	69	45EB03	EB-13
48	.030	.02	.02	1	69	48EB03	EB-13
48	.050	.02	.02	1	95	48EB05	EB-13
50	.030	.02	.02	1	69	50EB03	EB-13
50	.050	.02	.02	1	95	50EB05	EB-13
55	.040	.02	.02	1	95	55EB04	EB-13
60	.050	.02	.02	1	95	60EB05	EB-13
65	.050	.02	.02	1	95	65EB05	EB-13
70	.040	.02	.02	1	95	70EB04	EB-13
75	.030	.02	.02	1	95	75EB03	EB-13
185	.025	Unregulated		2V	40	NX-25B	EB-10
185	.050	Unregulated		3.5V	55	NX-50B	EB-13

DUAL OUTPUT MODELS

Output Voltage Voltages	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price	Model	Case Size
±12	.100	.05	.05	1	$ 55	DB12-10	EB-10
±12	.150	.05	.05	1	65	DB12-15	EB-10
±12	.200	.05	.05	1	75	DB12-20	EB-10
±12	.300	.05	.05	1	105	DB12-30	EB-13
±12	.350	.05	.05	1	110	DB12-35	EB-13
±12	.500	.1	.05	1	135	DB12-50	EB-20

Output Voltage Voltages	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price	Model	Case Size
±15	.100	.05	.05	1	$ 55	DB15-10	EB-10
±15	.150	.05	.05	1	65	DB15-15	EB-10
±15	.200	.05	.05	1	75	DB15-20	EB-10
±15	.300	.05	.05	1	105	DB15-30	EB-13
±15	.350	.05	.05	1	110	DB15-35	EB-13
±15	.500	.1	.05	1	135	DB15-50	EB-20

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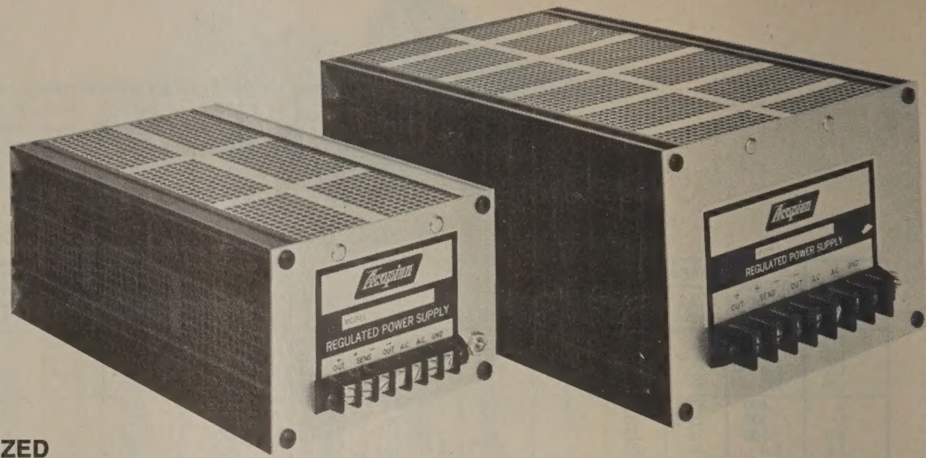
Acopian

SERIES A REGULATED PREMIUM PERFORMANCE

SERIES B REGULATED LOWEST COST


Acopian
REGULATED POWER SUPPLY
MODEL
OUT SENS OUT AC AC GND
Acopian
REGULATED POWER SUPPLY
OUT SENS OUT AC AC GND

ALL MODELS U.L. RECOGNIZED

A broad selection of power supplies offering unusually high performance — many models have regulation of ±0.005%. Electronic current limiting and provision for remote voltage sensing are standard features; overvoltage protection is available as a built-in option. Rugged extruded aluminum cases include threaded mounting holes on bottom, back, and side, permitting mounting in any position.

SERIES A PREMIUM PERFORMANCE POWER SUPPLIES

STANDARD FEATURES

- Provision for remote sensing and/or external output adjustment
- Short circuit proof with automatic recovery (electronic current limiting)
- Can be mounted on any of three surfaces (case sizes H11 and H16, two surfaces)
- Convection cooled — no heat sinking or forced-air ventilation is necessary
- Silicon semiconductors
- Completely serviceable

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

Output Specifications: See pages 10 and 11. Series A supplies have model numbers beginning with the letter A.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, so that drops in the load line are compensated, is a standard feature.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

Ambient Operating Temperature: −20 to +71°C.

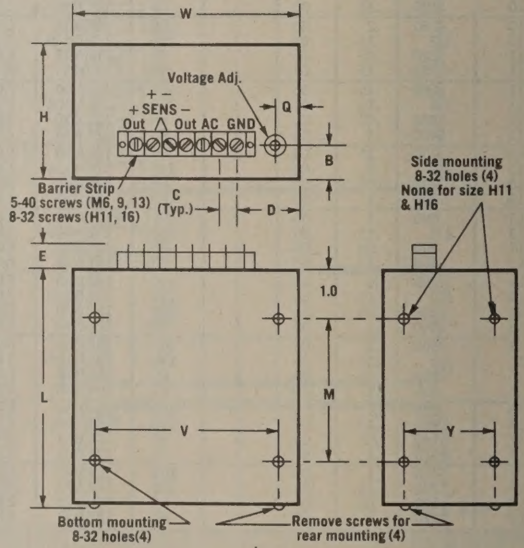
Storage Temperature: −55 to +85°C.

Response Time: Less than 20 microseconds.

OPTIONS

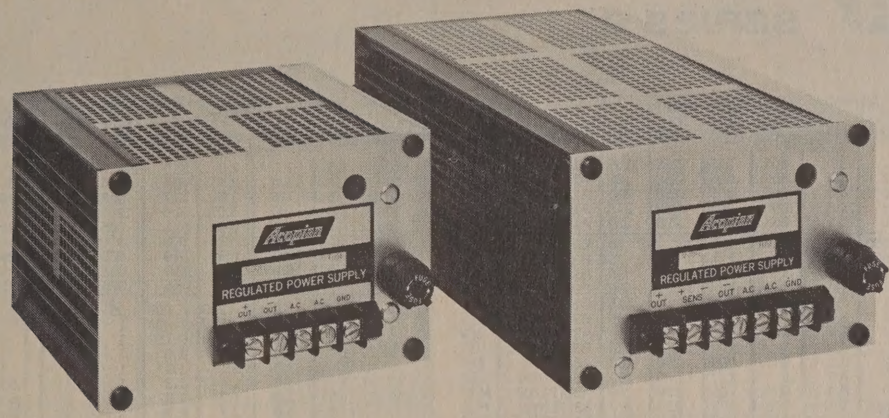
Overvoltage Protection: An internal preset overvoltage protector is available on all models. To order, add prefix "V" to the model number, and increase standard price as follows:

For all case sizes except H16:	
Nominal output voltages from 3 to 28 V.	$25.00
30 to 70 V.	35.00
Case size H16 (all voltages)	75.00


W
H
Voltage Adj.
+ −
+ SENS −
Out
Out AC GND
Q
B
Barrier Strip
5-40 screws (M6, 9, 13)
8-32 screws (H11, 16)
C
(Typ.)
D
Side mounting
8-32 holes (4)
None for size H11
& H16
E
1.0
L
M
V
Y
Bottom mounting
8-32 holes(4)
Remove screws for
rear mounting (4)

Size	L	W	H	M	V	Y	E	Q	B	C	D	Approx. Weight
M6	6.59	5.12	3.44	4.0	4.5	3.0	.38	.5	.75	.375	1.44	4 lb 4 oz
M9	9.25	5.12	3.44	6.0	4.5	3.0	.38	.5	.75	.375	1.44	7 lb 4 oz
M13	13.25	5.12	3.44	10.0	4.5	3.0	.38	.5	.75	.375	1.44	11 lb
H11	11.25	7.37	5.12	8.0	6.75	4.56	.75	1.12	1.25	.562	2.25	18 lb 4 oz
H16	16.00	7.37	5.12	11.0	6.75	4.56	.75	1.12	1.25	.562	2.25	23 lb

230 Volt Input: Available on some models. Contact factory for information.


Acopian
REGULATED POWER SUPPLY
+ OUT − OUT AC AC GND
Acopian
REGULATED POWER SUPPLY
+ OUT SENS − OUT AC AC GND

These low-cost supplies provide the same high reliability as the Series A, and without sacrificing the basic features necessary for most applications. Many models have regulation of ±0.1% or better. All components are generously derated to insure a long and trouble-free life. And they use the same rugged construction as the Series A line. Overvoltage protection and other options are available.

SERIES B LOW-COST POWER SUPPLIES

STANDARD FEATURES

- Delivers current surges without damage — built-in fuse protects supply against prolonged overloads and shorts
- May be mounted on any of three surfaces
- Convection cooled — no heat sinking or forced-air ventilation is necessary
- Silicon semiconductors
- Completely serviceable

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

Output Specifications: See pages 10 and 11. Series B supplies have model numbers beginning with the letter B.

Remote Voltage Adjustment/Sensing: Available as an option. See below.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

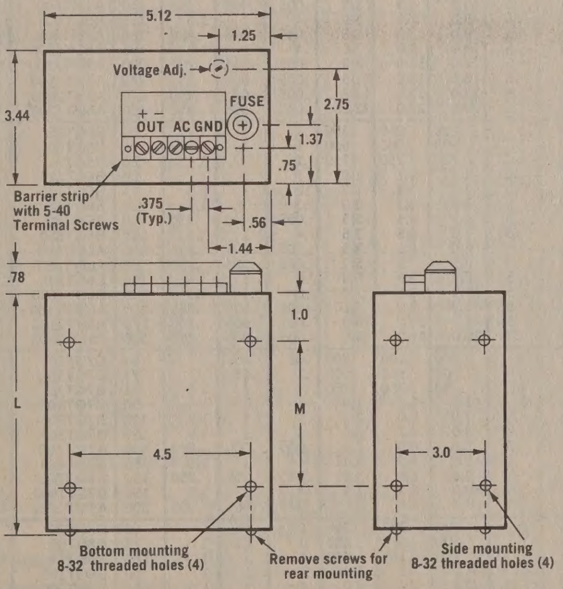
Ambient Operating Temperature: 0 to +71°C.

Storage Temperature: −55 to +85°C.

OPTIONS

Overvoltage Protection: An internal preset overvoltage protector is available on all models up to 70 V. To order, add prefix "V" to the model number and add $25.00 to the standard price of models with output voltages of 3 to 28 V, $35.00 to the price of models with output voltages from 30 to 70 V.

Remote Voltage Sensing: Provision for sensing the output voltage across the load, so that drops in the load lines are compensated, is available on all models. (This option also permits the use of an externally located potentiometer to adjust output voltage.) To order, add prefix "R" to the model number. No increase in price.


5.12
1.25
Voltage Adj.
FUSE
+ −
OUT AC GND
3.44
2.75
1.37
.75
Barrier strip with 5-40 Terminal Screws
.375 (Typ.)
.56
1.44
.78
1.0
L
M
4.5
3.0
Bottom mounting 8-32 threaded holes (4)
Remove screws for rear mounting
Side mounting 8-32 threaded holes (4)

Size	L	M	Approx. Weight
G3	3.71	1.62	3lb 2oz
G5	5.09	3.00	4lb 14oz
G6	6.59	4.00	5lb 8oz
G9	9.25	6.00	7lb 4oz
G13	13.25	10.00	11lb

230 Volt Input: All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to model number and $10.00 to price.

SERIES A
SERIES B

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
1.5	.5	6.0	4.3	3.5	.005	.005	.250	$155	A1.5MT600	M6
1.5	.5	9.0	7.2	5.5	.005	.005	.250	180	A1.5MT900	M9
1.5	.5	12.0	10.0	8.0	.005	.005	.250	200	A1.5MT1200	M13
1.5	.5	22.0	18.5	15.5	.005	.005	.250	270	A1.5HT2200	H11
1.5	.5	32.0	27.0	22.5	.005	.005	.250	320	A1.5HT3200	H16
3	.5	.250	.250	.250	.2	.1	1	60	B3GT25	G3
3	.5	.500	.500	.500	.2	.1	1	75	B3GT50	G3
3	.5	.750	.750	.750	.2	.1	1	80	B3GT75	G3
3	.5	1.2	1.1	1.0	.2	.1	1	90	B3GT120	G3
3	.5	2.1	2.1	2.0	.5	.1	1	110	B3GT210	G5
3	.5	4.0	3.5	3.0	.5	.1	1.5	135	B3GT400	G6
3	.5	6.0	4.3	3.5	.005	.005	.250	160	A3MT600	M6
3	.5	7.0	5.9	4.9	.5	.1	1.5	170	B3GT700	G9
3	.5	9.0	7.2	5.5	.005	.005	.250	180	A3MT900	M9
3	.5	10.0	9.0	7.0	.5	.1	1.5	190	B3GT1000	G13
3	.5	12.0	10.0	8.0	.005	.005	.250	200	A3MT1200	M13
3	.5	20.0	16.5	13.5	.005	.005	.250	270	A3HT2000	H11
3	.5	30.0	25.0	20.0	.005	.005	.250	320	A3HT3000	H16
3.6	.5	.250	.250	.250	.2	.1	1	60	B3.6GT25	G3
3.6	.5	.500	.500	.500	.2	.1	1	75	B3.6GT50	G3
3.6	.5	.750	.750	.750	.2	.1	1	80	B3.6GT75	G3
3.6	.5	1.2	1.1	1.0	.2	.1	1	90	B3.6GT120	G3
3.6	.5	2.1	2.1	2.0	.5	.1	1	110	B3.6GT210	G5
3.6	.5	4.0	3.5	3.0	.5	.1	1.5	135	B3.6GT400	G6
3.6	.5	6.0	4.3	3.5	.005	.005	.250	160	A3.6MT600	M6
3.6	.5	7.0	5.9	4.9	.5	.1	1.5	170	B3.6GT700	G9
3.6	.5	9.0	7.2	5.5	.005	.005	.250	180	A3.6MT900	M9
3.6	.5	12.0	10.0	8.0	.005	.005	.250	200	A3.6MT1200	M13
3.6	.5	22.0	18.5	15.5	.005	.005	.250	270	A3.6HT2200	H11
3.6	.5	32.0	27.0	22.5	.005	.005	.250	320	A3.6HT3200	H16
5	.5	.250	.250	.250	.1	.1	1	60	B5GT25	G3
5	.5	.500	.500	.500	.1	.1	1	75	B5GT50	G3
5	.5	.750	.750	.750	.1	.1	1	80	B5GT75	G3
5	.5	1.2	1.1	1.0	.1	.1	1	90	B5GT120	G3
5	.5	1.7	1.5	1.3	.2	.1	1.5	95	B5GT170	G3
5	.5	2.1	2.1	2.0	.2	.1	1.5	110	B5GT210	G5
5	.5	4.0	3.5	3.0	.3	.1	1.5	130	B5GT400	G6
5	.5	5.0	4.4	3.0	.4	.1	1.5	140	B5GT500	G6
5	.5	5.1	3.6	2.6	.005	.005	.250	150	A5MT510	M6
5	.5	6.0	4.3	3.5	.005	.005	.250	160	A5MT600	M6
5	.5	8.0	7.0	5.0	.4	.1	1.5	165	B5GT800	G9
5	.5	9.0	7.2	5.5	.005	.005	.250	180	A5MT900	M9
5	.5	10.0	9.0	7.0	.4	.1	1.5	185	B5GT1000	G13
5	.5	12.0	10.0	8.0	.005	.005	.250	200	A5MT1200	M13
5	.5	16.5	14.0	11.5	.005	.005	.250	240	A5HT1650	H11
5	.5	22.0	18.5	15.0	.005	.005	.250	270	A5HT2200	H11
5	.5	32.0	27.0	22.0	.005	.005	.250	320	A5HT3200	H16
6	1	.250	.250	.250	.1	.1	1	60	B6GT25	G3
6	1	.500	.500	.500	.1	.1	1	75	B6GT50	G3
6	1	.750	.750	.750	.1	.1	1	80	B6GT75	G3
6	.5	1.2	1.1	1.0	.1	.1	1	90	B6GT120	G3
6	.5	1.7	1.5	1.3	.2	.1	1.5	95	B6GT170	G3
6	.5	3.2	3.1	3.0	.3	.1	1.5	125	B6GT320	G6
6	.5	4.9	3.5	2.5	.005	.005	.250	140	A6MT490	M6
6	.5	5.5	4.5	3.5	.4	.1	1.5	145	B6GT550	G6
6	.5	6.0	4.5	3.5	.005	.005	.250	160	A6MT600	M6
6	.5	8.5	7.5	5.2	.005	.005	.250	180	A6MT850	M9
6	.5	8.8	6.9	5.0	.4	.1	1.5	180	B6GT880	G9
6	.5	10.0	8.0	7.0	.4	.1	1.5	185	B6GT1000	G13
6	.5	11.0	9.3	7.5	.005	.005	.250	200	A6MT1100	M13
6	.5	21.0	17.0	14.0	.005	.005	.250	270	A6HT2100	H11
6	.5	28.0	23.0	19.0	.005	.005	.250	320	A6HT2800	H16
7	1	.200	.200	.200	.05	.05	1	60	B7GT20	G3
7	1	.500	.500	.500	.1	.05	1	75	B7GT50	G3
7	1	.750	.750	.750	.1	.1	1	85	B7GT75	G3
7	1	1.0	1.0	1.0	.1	.1	1	90	B7GT100	G3
7	.5	2.0	2.0	2.0	.2	.1	1.5	115	B7GT200	G5
7	.5	3.0	2.7	2.5	.3	.1	1.5	125	B7GT300	G6
7	.5	5.0	4.0	3.0	.005	.005	.250	140	A7MT500	M6
7	.5	6.5	5.2	4.0	.4	.1	1.5	160	B7GT650	G9
7	.5	8.0	6.5	5.0	.005	.005	.250	180	A7MT800	M9
7	.5	10.0	8.0	7.0	.4	.1	1.5	190	B7GT1000	G13
7	.5	10.0	8.8	7.0	.005	.005	.250	200	A7MT1000	M13
8	1	.200	.200	.200	.05	.05	1	60	B8GT20	G3
8	1	.500	.500	.500	.1	.05	1	75	B8GT50	G3
8	1	.750	.750	.750	.1	.1	1	80	B8GT75	G3
8	1	1.0	1.0	1.0	.1	.1	1	90	B8GT100	G3
8	.5	2.0	2.0	2.0	.2	.1	1.5	115	B8GT200	G5
8	.5	3.0	2.7	2.5	.2	.1	1.5	125	B8GT300	G6
8	.5	5.0	4.0	3.0	.005	.005	.250	140	A8MT500	M6
8	.5	6.5	5.2	4.0	.3	.1	1.5	160	B8GT650	G9
8	.5	8.0	6.5	5.0	.005	.005	.250	180	A8MT800	M9
8	.5	10.0	8.0	7.0	.4	.1	1.5	180	B8GT1000	G13
8	.5	10.5	8.8	7.0	.005	.005	.250	200	A8MT1050	M13
8	.5	20.0	16.8	13.5	.005	.005	.250	270	A8HT2000	H11
8	.5	28.0	23.0	19.0	.005	.005	.250	320	A8HT2800	H16
9	1	.200	.200	.200	.05	.05	1	60	B9GT20	G3
9	1	.500	.500	.500	.1	.05	1	75	B9GT50	G3
9	1	.750	.750	.750	.1	.1	1	85	B9GT75	G3
9	1	1.0	1.0	1.0	.1	.1	1	90	B9GT100	G3
9	.5	2.0	2.0	2.0	.2	.1	1.5	115	B9GT200	G5
9	.5	3.0	2.7	2.5	.2	.1	1.5	125	B9GT300	G6
9	.5	6.5	5.2	4.0	.3	.1	1.5	155	B9GT650	G9
9	.5	10.0	8.3	7.0	.4	.1	1.5	190	B9GT1000	G13
9	.5	10.0	8.3	7.0	.005	.005	.250	200	A9MT1000	M13
10	1	.200	.200	.200	.05	.05	1	60	B10GT20	G3
10	1	.500	.500	.500	.1	.05	1	75	B10GT50	G3
10	1	.750	.750	.75	.1	.1	1	85	B10GT75	G3
10	1	1.0	1.0	1.0	.1	.1	1	90	B10GT100	G3
10	.5	2.0	2.0	2.0	.2	.1	1.5	$115	B10GT200	G5
10	.5	3.0	2.7	2.5	.2	.1	1.5	125	B10GT300	G6
10	.5	4.5	3.6	2.7	.005	.005	.250	140	A10MT450	M6
10	.5	6.0	5.0	4.0	.3	.1	1.5	165	B10GT600	G9
10	.5	7.5	6.0	4.5	.005	.005	.250	180	A10MT750	M9
10	.5	10.0	8.3	7.0	.4	.1	1.5	180	B10GT1000	G13
10	.5	10.0	8.3	7.0	.005	.005	.250	200	A10MT1000	M13
10	.5	18.0	15.0	12.0	.005	.005	.250	270	A10HT1800	H11
10	.5	25.0	20.0	16.5	.005	.005	.250	320	A10HT2500	H16
12	1	.200	.200	.200	.05	.05	1	60	B12GT20	G3
12	1	.500	.500	.500	.1	.05	1	75	B12GT50	G3
12	1	.750	.750	.750	.1	.1	1	85	B12GT75	G3
12	1	1.0	1.0	1.0	.1	.1	1	90	B12GT100	G3
12	1	1.3	1.1	1.0	.1	.1	1	95	B12GT130	G3
12	1	1.5	1.4	1.3	.1	.1	1.5	105	B12GT150	G3
12	.5	2.0	1.7	1.5	.2	.1	1.5	110	B12GT200	G5
12	.5	3.0	2.7	2.5	.2	.1	1.5	125	B12GT300	G6
12	.5	3.8	3.3	2.6	.2	.1	1.5	130	B12GT380	G6
12	.5	4.0	3.3	2.6	.005	.005	.250	140	A12MT400	M6
12	.5	6.5	5.3	4.0	.3	.1	1.5	165	B12GT650	G9
12	.5	6.5	5.3	4.0	.005	.005	.250	180	A12MT650	M9
12	.5	9.0	7.5	6.0	.4	.1	1.5	190	B12GT900	G13
12	.5	9.0	7.5	6.0	.005	.005	.250	200	A12MT900	M13
12	.5	17.0	14.3	11.5	.005	.005	.250	270	A12HT1700	H11
12	.5	21.0	17.5	14.5	.005	.005	.250	320	A12HT2100	H16
13	1	.200	.200	.200	.05	.05	1	60	B13GT20	G3
13	1	.500	.500	.500	.1	.05	1	75	B13GT50	G3
13	1	.750	.750	.750	.1	.1	1	85	B13GT75	G3
13	1	1.0	1.0	1.0	.1	.1	1	90	B13GT100	G3
13	1	1.5	1.4	1.3	.1	.1	1.5	105	B13GT150	G3
13	.5	2.0	2.0	2.0	.2	.1	1.5	115	B13GT200	G5
13	.5	3.0	2.7	2.5	.2	.1	1.5	130	B13GT300	G6
13	.5	3.5	3.0	2.5	.005	.005	.250	140	A13MT350	M6
13	.5	5.0	4.5	4.0	.2	.1	1.5	155	B13GT500	G9
13	.5	8.0	7.5	7.0	.3	.1	1.5	185	B13GT800	G13
13	.5	8.0	7.5	7.0	.005	.005	.250	200	A13MT800	M13
14	1	.200	.200	.200	.05	.05	1	60	B14GT20	G3
14	1	.500	.500	.500	.1	.05	1	75	B14GT50	G3
14	1	.750	.750	.750	.1	.1	1	80	B14GT75	G3
14	1	1.0	1.0	1.0	.1	.1	1	90	B14GT100	G3
14	1	1.5	1.4	1.3	.1	.1	1.5	105	B14GT150	G3
14	.5	2.0	2.0	2.0	.2	.1	1.5	115	B14GT200	G5
14	.5	3.0	2.7	2.5	.2	.1	1.5	130	B14GT300	G6
14	.5	3.0	2.7	2.5	.005	.005	.250	140	A14MT300	M6
14	.5	5.0	4.5	4.0	.2	.1	1.5	155	B14GT500	G9
14	.5	7.0	6.5	6.0	.3	.1	1.5	185	B14GT700	G13
14	.5	8.0	6.7	7.0	.005	.005	.250	200	A14MT800	M13
15	1	.200	.200	.200	.05	.05	1	60	B15GT20	G3
15	1	.500	.500	.500	.1	.05	1	75	B15GT50	G3
15	1	.750	.750	.750	.1	.1	1	85	B15GT75	G3
15	1	1.0	1.0	1.0	.1	.1	1	90	B15GT100	G3
15	1	1.3	1.1	1.0	.1	.1	1	95	B15GT130	G3
15	1	1.5	1.4	1.3	.1	.1	1.5	105	B15GT150	G3
15	.5	2.0	1.7	1.5	.1	.1	1.5	115	B15GT200	G5
15	.5	3.0	2.8	2.5	.1	.1	1.5	130	B15GT300	G6
15	.5	3.0	2.8	2.5	.005	.005	.250	140	A15MT300	M6
15	.5	4.2	3.8	3.0	.15	.1	1.5	155	B15GT420	G9
15	.5	5.5	4.7	4.0	.005	.005	.250	180	A15MT550	M9
15	.5	6.0	5.0	4.0	.2	.1	1.5	180	B15GT600	G9
15	.5	7.0	6.0	5.0	.2	.1	1.5	185	B15GT700	G13
15	.5	8.0	6.5	5.5	.005	.005	.250	200	A15MT800	M13
15	.5	15.0	12.8	10.5	.005	.005	.250	270	A15HT1500	H11
15	.5	19.0	16.3	13.5	.005	.005	.250	320	A15HT1900	H16
16	1	.200	.200	.200	.05	.05	1	60	B16GT20	G3
16	1	.500	.500	.500	.1	.05	1	75	B16GT50	G3
16	1	.750	.750	.750	.1	.1	1	85	B16GT75	G3
16	.5	1.0	1.0	1.0	.1	.1	1	95	B16GT100	G3
16	.5	3.0	2.5	2.0	.15	.1	1	140	B16GT300	G9
16	.5	5.0	5.0	5.0	.2	.1	1.5	180	B16GT500	G9
16	.5	6.5	5.0	5.5	.005	.005	.250	200	A16MT650	M13
18	1	.200	.200	.200	.05	.05	1	60	B18GT20	G3
18	1	.500	.500	.500	.05	.05	1	75	B18GT50	G3
18	1	.750	.750	.750	.1	.1	1	80	B18GT75	G3
18	.5	1.1	1.1	1.0	.1	.1	1	90	B18GT110	G5
18	.5	2.1	2.0	1.8	.1	.1	1	115	B18GT210	G5
18	.5	2.1	2.1	2.0	.005	.005	.250	130	A18MT210	M6
18	.5	3.0	2.8	2.5	.15	.1	1	150	B18GT300	G9
18	.5	4.5	4.0	3.5	.005	.005	.250	170	A18MT450	M9
18	.5	5.5	5.0	5.0	.2	.1	1.5	180	B18GT550	G13
18	.5	6.5	6.0	5.5	.005	.005	.250	200	A18MT650	M13
18	.5	14.0	12.0	10.0	.005	.005	.250	270	A18HT1400	H11
18	.5	18.0	15.5	13.0	.005	.005	.250	320	A18HT1800	H16
20	1	.200	.200	.200	.05	.05	1	60	B20GT20	G3
20	1	.500	.500	.500	.05	.05	1	75	B20GT50	G3
20	1	.750	.750	.750	.1	.05	1	80	B20GT75	G3
20	1	1.1	1.1	1.0	.1	.1	1	90	B20GT110	G5
20	.5	1.7	1.7	1.5	.1	.1	1.5	105	B20GT170	G5
20	.5	2.0	2.0	2.0	.005	.005	.250	130	A20MT200	M6
20	.5	2.7	2.0	1.2	.15	.1	1.5	150	B20GT270	G6
20	.5	4.0	3.5	3.0	.005	.005	.250	170	A20MT400	M9
20	.5	5.0	5.0	5.0	.15	.1	1.5	180	B20GT500	G13
20	.5	6.0	5.5	5.0	.005	.005	.250	200	A20MT600	M13
20	.5	13.0	11.3	9.5	.005	.005	.250	270	A20HT1300	H11
20	.5	16.0	14.0	12.0	.005	.005	.250	320	A20HT1600	H16
24	1	.200	.200	.200	.05	.05	1	60	B24GT20	G3
24	1	.500	.500	.500	.05	.05	1	75	B24GT50	G3
24	1	.750	.750	.750	.1	.05	1	80	B24GT75	G3
24	1	1.1	1.1	1.0	.1	.1	1.5	95	B24GT110	G5
24	.5	1.7	1.7	1.5	.1	.1	1.5	105	B24GT170	G5

*or 2 mv, whichever is greater

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
24	.5	2.1	2.0	2.0	.1	.1	1.5	$115	B24GT210	G5
24	.5	2.1	2.0	2.0	.005	.005	.250	130	A24MT210	M6
24	.5	3.5	3.0	2.5	.15	.1	1.5	160	B24GT350	G9
24	.5	3.5	3.0	2.5	.005	.005	.250	175	A24MT350	M9
24	.5	5.0	5.0	5.0	.15	.1	1.5	185	B24GT500	G13
24	.5	5.5	5.0	4.5	.005	.005	.250	200	A24MT550	M13
24	.5	12.0	10.5	9.0	.005	.005	.250	270	A24HT1200	H11
24	.5	15.0	13.0	11.0	.005	.005	.250	320	A24HT1500	H16
25	1	.200	.200	.200	.05	.05	1	65	B25GT20	G3
25	1	.500	.500	.500	.05	.05	1	75	B25GT50	G3
25	1	.750	.750	.750	.1	.05	1	80	B25GT75	G3
25	1	1.2	1.1	1.0	.1	.1	1.5	95	B25GT120	G5
25	.5	1.7	1.7	1.5	.1	.1	1.5	115	B25GT170	G5
25	.5	2.1	2.1	2.0	.1	.1	1.5	125	B25GT210	G5
25	.5	3.5	3.0	2.5	.15	.1	1.5	160	B25GT350	G9
25	.5	5.0	5.0	5.0	.15	.1	1.5	185	B25GT500	G13
28	1	.100	.100	.100	.05	.05	1	65	B28GT10	G3
28	1	.200	.200	.200	.05	.05	1	70	B28GT20	G3
28	1	.500	.500	.500	.05	.05	1	75	B28GT50	G3
28	1	.800	.800	.800	.1	.05	1	95	B28GT80	G5
28	1	1.1	1.1	1.0	.1	.05	1	110	B28GT110	G5
28	.5	1.8	1.6	1.5	.1	.1	1.5	120	B28GT180	G5
28	.5	2.1	2.1	2.0	.1	.1	1.5	125	B28GT210	G5
28	.5	2.1	2.1	2.0	.005	.005	.250	135	A28MT210	M6
28	.5	3.0	2.7	2.5	.15	.1	1.5	145	B28GT300	G9
28	.5	3.0	2.7	2.5	.005	.005	.250	160	A28MT300	M9
28	.5	5.0	5.0	5.0	.15	.1	1.5	185	B28GT500	G13
28	.5	5.0	5.0	5.0	.005	.005	.250	200	A28MT500	M13
28	.5	11.0	9.5	8.0	.005	.005	.250	270	A28HT1100	H11
28	.5	14.0	12.0	10.0	.005	.005	.250	320	A28HT1400	H16
30	1	.100	.100	.100	.05	.05	1	65	B30GT10	G3
30	1	.200	.200	.200	.05	.05	1	70	B30GT20	G3
30	1	.500	.500	.500	.05	.05	1	75	B30GT50	G3
30	1	.750	.750	.700	.1	.05	1	95	B30GT75	G5
30	1	1.1	1.1	1.0	.1	.1	1	110	B30GT110	G5
30	.5	1.7	1.6	1.5	.1	.1	1.5	120	B30GT170	G5
30	.5	2.1	2.1	2.0	.1	.1	1.5	125	B30GT210	G5
30	.5	2.1	2.1	2.0	.005	.005	.250	140	A30MT210	M6
30	.5	3.0	2.7	2.5	.005	.005	.250	165	A30MT300	M9
30	.5	5.0	5.0	5.0	.15	.1	1.5	185	B30GT500	G13
30	.5	5.0	5.0	5.0	.005	.005	.250	200	A30MT500	M13
30	.5	10.0	9.0	8.0	.005	.005	.250	270	A30HT1000	H11
30	.5	14.0	12.0	10.0	.005	.005	.250	320	A30HT1400	H16
32	1	.100	.100	.100	.05	.05	1	65	B32GT10	G3
32	1	.300	.300	.300	.05	.05	1	75	B32GT30	G3
32	1	.500	.500	.500	.05	.05	1	80	B32GT50	G3
32	1	.600	.600	.600	.1	.05	1	95	B32GT60	G3
32	1	1.0	1.0	1.0	.1	.1	1	110	B32GT100	G5
32	1	1.5	1.5	1.5	.1	.1	1.5	125	B32GT150	G5
34	1	.200	.200	.200	.05	.05	1	70	B34GT20	G3
34	1	.800	.800	.800	.1	.1	1	105	B34GT80	G5
34	1	1.5	1.5	1.5	.1	.1	1.5	125	B34GT150	G5
35	1	.100	.100	.100	.05	.05	1	65	B35GT10	G3
35	1	.200	.200	.200	.05	.05	1	70	B35GT20	G3
35	1	.500	.500	.500	.05	.05	1	80	B35GT50	G3
35	1	.600	.600	.600	.1	.05	1	95	B35GT60	G3
35	1	.800	.800	.800	.1	.1	1.5	105	B35GT80	G5
36	1	.100	.100	.100	.05	.05	1	65	B36GT10	G3
36	1	.200	.100	.100	.05	.05	1	75	B36GT20	G3
36	1	.500	.500	.500	.05	.05	1	85	B36GT50	G3
36	1	.600	.600	.500	.1	.05	1	95	B36GT60	G5
36	1	.800	.750	.700	.1	.05	1	105	B36GT80	G5
36	.5	1.3	1.3	1.3	.1	.1	1.5	115	B36GT130	G6
36	.5	1.3	1.3	1.3	.005	.005	.250	130	A36MT130	M6
36	.5	2.3	2.0	1.8	.1	.1	1.5	160	B36GT230	G9
36	.5	2.3	2.0	1.8	.005	.005	.250	175	A36MT230	M9
36	.5	4.0	3.2	2.5	.005	.005	.250	210	A36MT400	M13
40	1	.100	.100	.100	.05	.05	1	65	B40GT10	G3
40	1	.200	.200	.200	.05	.05	1	75	B40GT20	G3
40	1	.300	.300	.300	.05	.05	1	85	B40GT30	G3
40	1	.400	.400	.400	.05	.05	1	90	B40GT40	G3
40	1	.500	.500	.500	.1	.05	1	100	B40GT50	G5
45	1	.100	.100	.100	.05	.05	1	65	B45GT10	G3
45	1	.200	.200	.200	.05	.05	1	75	B45GT20	G3
45	1	.300	.300	.300	.05	.05	1	85	B45GT30	G3
45	1	.400	.400	.400	.05	.05	1	100	B45GT40	G3
48	1	.100	.100	.100	.05	.05	1	70	B48GT10	G3
48	1	.200	.200	.200	.05	.05	1	80	B48GT20	G3
48	1	.300	.300	.300	.05	.05	1	95	B48GT30	G3
48	1	.400	.400	.400	.05	.05	1	105	B48GT40	G3
48	1	.600	.600	.600	.1	.1	1	120	B48GT60	G5
48	1	1.1	1.0	.600	.1	.1	1.5	135	B48GT110	G6
48	1	1.8	1.6	1.2	.1	.1	1.5	165	B48GT180	G9
48	1	1.8	1.6	1.2	.005	.005	.250	180	A48MT180	M9
48	.5	3.0	2.6	2.1	.005	.005	.250	210	A48MT300	M13
50	1	.100	.100	.100	.05	.05	1	65	B50GT10	G3
50	1	.200	.200	.200	.05	.05	1	75	B50GT20	G3
50	1	.300	.300	.300	.05	.05	1	95	B50GT30	G3
50	1	.400	.400	.400	.05	.05	1	105	B50GT40	G3
50	1	.500	.500	.500	.05	.05	1	130	B50GT50	G5
50	.5	2.7	2.3	1.8	.005	.005	.250	220	A50MT270	M13
55	1	.100	.100	.100	.05	.05	1	75	B55GT10	G3
55	1	.200	.200	.200	.05	.05	1	95	B55GT20	G3
55	1	.300	.300	.300	.05	.05	1	105	B55GT30	G3
55	1	.400	.400	.400	.05	.05	1	125	B55GT40	G5
55	1	.500	.500	.500	.05	.05	1	130	B55GT50	G5
60	1	.050	.050	.050	.05	.05	1	75	B60GT05	G3
60	1	.100	.100	.100	.05	.05	1	85	B60GT10	G3
60	1	.200	.200	.200	.05	.05	1	95	B60GT20	G3
60	1	.300	.300	.300	.05	.05	1	$125	B60GT30	G3
60	1	.400	.400	.400	.05	.05	1	130	B60GT40	G5
65	1	.050	.050	.050	.05	.05	1	75	B65GT05	G3
65	1	.100	.100	.100	.05	.05	1	85	B65GT10	G3
65	1	.300	.300	.300	.05	.05	1	125	B65GT30	G3
67	1	.050	.050	.050	.05	.05	1	75	B67GT05	G3
67	1	.100	.100	.100	.05	.05	1	85	B67GT10	G3
67	1	.300	.300	.300	.05	.05	1	125	B67GT30	G3
70	1	.050	.050	.050	.05	.05	1	75	B70GT05	G3
70	1	.100	.100	.100	.05	.05	1	85	B70GT10	G3
70	1	.200	.200	.200	.05	.05	1	95	B70GT20	G3
70	1	.300	.300	.300	.05	.05	1	125	B70GT30	G3
75	1	.050	.050	.050	.05	.05	1	85	B75GT05	G3
75	1	.100	.100	.100	.05	.05	1	95	B75GT10	G3
75	1	.200	.200	.200	.05	.05	1	125	B75GT20	G3
75	.5	2.0	1.3	1.5	.005	.005	.250	220	A75MT200	M13
80	1	.050	.050	.050	.05	.05	1	85	B80GT05	G3
80	1	.100	.100	.100	.05	.05	1	95	B80GT10	G3
80	1	.200	.200	.200	.05	.05	1	125	B80GT20	G3
85	1	.050	.050	.050	.05	.05	1	90	B85GT05	G3
85	1	.100	.100	.100	.05	.05	1	115	B85GT10	G3
85	1	.200	.200	.200	.05	.05	1	125	B85GT20	G3
90	1	.050	.050	.050	.05	.05	1	95	B90GT05	G3
90	1	.100	.100	.100	.05	.05	1	120	B90GT10	G3
90	1	.200	.200	.200	.05	.05	1	130	B90GT20	G3
90	1	1.5	1.3	1.0	.005	.005	.250	220	A90MT150	M13
95	1	.050	.050	.050	.05	.05	1	110	B95GT05	G3
95	1	.100	.100	.100	.05	.05	1	120	B95GT10	G3
95	1	.200	.200	.200	.05	.05	1	130	B95GT20	G3
100	1	.050	.050	.050	.05	.05	1	110	B100GT05	G3
100	1	.100	.100	.100	.05	.05	1	120	B100GT10	G3
100	1	.200	.200	.200	.05	.05	1	130	B100GT20	G3
100	1	.460	.460	.340	.1	.1	1.5	130	B100GT46	G6
100	1	.650	.650	.650	.1	.1	1.5	160	B100GT65	G9
100	1	1.3	1.2	1.0	.005	.005	.250	220	A100MT130	M13
105	1	.050	.050	.050	.05	.05	1	115	B105GT05	G3
105	1	.100	.100	.100	.05	.05	1	125	B105GT10	G3
105	1	.200	.200	.200	.05	.05	1	135	B105GT20	G3
110	1	.050	.050	.050	.05	.05	1	115	B110GT05	G3
110	1	.100	.100	.100	.05	.05	1	125	B110GT10	G3
110	1	.200	.200	.200	.05	.05	1	135	B110GT20	G3
115	1	.050	.050	.050	.05	.05	1	115	B115GT05	G3
115	1	.100	.100	.100	.05	.05	1	125	B115GT10	G3
115	1	.200	.200	.200	.05	.05	1	135	B115GT20	G3
120	1	.050	.050	.050	.05	.05	1	115	B120GT05	G3
120	1	.100	.100	.100	.05	.05	1	125	B120GT10	G3
120	1	.200	.200	.200	.05	.05	1	135	B120GT20	G3
120	1	.400	.400	.300	.1	.1	1.5	150	B120GT40	G6
120	1	.550	.550	.550	.1	.1	1.5	160	B120GT55	G9
120	1	1.2	1.1	1.0	.005	.005	.250	220	A120MT120	M13
125	1	.050	.050	.050	.05	.05	1	120	B125GT05	G3
125	1	.100	.100	.100	.05	.05	1	130	B125GT10	G3
125	1	.200	.200	.200	.05	.05	1	140	B125GT20	G3
130	1	.200	.200	.200	.05	.05	1	140	B130GT20	G3
135	1	.200	.200	.200	.05	.05	1	140	B135GT20	G3
140	1	.200	.200	.200	.05	.05	1	140	B140GT20	G3
150	1	.050	.050	.050	.05	.05	1	120	B150GT05	G3
150	1	.100	.100	.100	.05	.05	1	130	B150GT10	G3
150	1	.200	.200	.200	.05	.05	1	140	B150GT20	G3
150	1	.320	.320	.250	.1	.1	1.5	140	B150GT32	G6
150	1	.420	.420	.420	.1	.1	1.5	160	B150GT42	G9
150	1	1.0	.900	.800	.005	.005	.250	240	A150MT100	M13
200	1	.050	.050	.050	.5	.5	5	125	B200GT05	G3
200	1	.100	.100	.100	.5	.5	5	135	B200GT10	G3

*or 2 mv, whichever is greater

MODELS WITH WIDE ADJUSTMENT RANGES

Load Regulation: ±0.005%*

Line Regulation: ±0.005%*

Ripple: 0.250 mv RMS

Other Specifications:
Same as Series A

Contact factory for information on other models with wide adjustment ranges.

Output Voltage Range	Output Current Amps. at			Price	Model	Size
	40°C	55°C	71°C			
0-6	1.2	1.2	1.2	$110	A06MT120	M6
0-6	2.0	2.0	2.0	125	A06MT200	M6
0-6	3.0	2.5	2.0	150	A06MT300	M6
0-6	5.0	4.0	3.0	170	A06MT500	M9
0-6	8.0	7.0	6.0	205	A06MT800	M13
0-6	12.0	10.0	7.0	275	A06HT1200	H11
0-6	16.0	13.0	10.0	325	A06HT1600	H16
0-15	1.0	1.0	1.0	110	A015MT100	M6
0-15	2.0	2.0	2.0	150	A015MT200	M6
0-15	2.5	2.0	1.5	170	A015MT250	M9
0-15	5.0	4.0	2.5	205	A015MT500	M13
0-15	8.0	6.0	4.0	275	A015HT800	H11
0-15	10.0	8.0	6.0	325	A015HT1000	H16
0-30	.500	.500	.500	125	A030MT50	M6
0-30	1.0	1.0	1.0	150	A030MT100	M6
0-30	1.6	1.4	1.2	170	A030MT160	M9
0-30	2.5	2.0	1.5	205	A030MT250	M13
0-30	4.0	3.0	2.0	275	A030HT400	H11
0-30	5.0	4.0	3.0	325	A030HT500	H16
0-50	.350	.340	.330	125	A050MT35	M6
0-50	.600	.500	.400	150	A050MT60	M6
0-50	.850	.750	.650	170	A050MT85	M9
0-100	.100	.090	.080	160	A0100MT10	M6
0-100	.250	.200	.150	180	A0100MT25	M6

Acopian

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MODEL
FUSE
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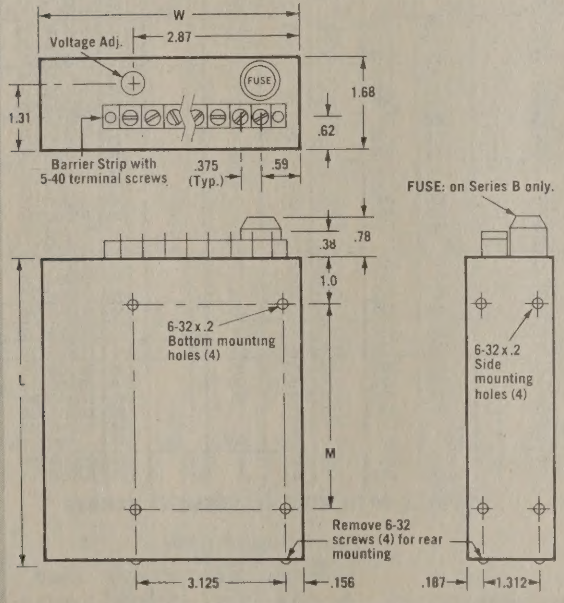
NARROW PROFILE REGULATED

ALL MODELS U.L. RECOGNIZED

Where only a narrow mounting space is available, Acopian narrow profile power supplies fit when many others cannot. Choose from Series A (high performance) and Series B (lower priced) models with output ratings up to 150 volts, up to 4 amps.


W
Voltage Adj.
2.87
FUSE
1.31
1.68
.62
Barrier Strip with
5-40 terminal screws
.375
(Typ.)
.59
FUSE: on Series B only.
.38
.78
1.0
6-32 x .2
Bottom mounting
holes (4)
6-32 x .2
Side
mounting
holes (4)
L
M
Remove 6-32
screws (4) for rear
mounting
3.125
.156
.187
1.312

Size	L	W	M	Approx. Weight
F6	6.59	3.44	4.0	2lb 4oz
F6T	6.59	3.81	4.0	2lb 4oz
N8	8.47	3.44	5.0	3lb
F8T	8.47	3.81	5.0	3lb 2oz
N8T	8.47	3.81	5.0	3lb 2oz
N8H	8.47	4.68	5.0	3lb 14oz

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

Output Specifications: See table. Series A supplies have model numbers beginning with the letter A; Series B, with the letter B.

Remote Voltage Adjustment/Sensing: Standard in Series A, not available in Series B.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

Ambient Operating Temperature: Series A, −20 to +71°C; Series B, 0 to 71°C.

Storage Temperature: −55 to +85°C.

Short Circuit and Overload Protection: Series A, electronic current limiting with automatic recovery; Series B, fused — delivers current surges without damage.

OPTIONS

Overvoltage Protection: An internal preset overvoltage protector is available on all models up to 70 V. To order, add prefix "V" to the model number and add $25.00 to the standard price of models with output voltages of 3 to 28 V, $35.00 to the price of models with output voltages from 30 to 70 V.

230 Volt Input: Available on some models. Contact factory for information.

MODELS WITH WIDE ADJUSTMENT RANGES

Output Voltage Range	Output Current (To +71°C)	Regulation		Ripple mv RMS	Price	Model	Size
		Load ±%*	Line ±%*				
0-7	1.0	0.005	0.005	0.250	$100	A07NT100	N8
0-7	2.1	0.005	0.005	0.250	135	A07NT210	N8H
0-18	.400	0.005	0.005	0.250	90	A018NT40	N8
0-18	1.0	0.005	0.005	0.250	120	A018NT100	N8H
0-32	.250	0.005	0.005	0.250	90	A032NT25	N8
0-32	.600	0.005	0.005	0.250	130	A032NT60	N8H
0-60	.125	0.005	0.005	0.250	130	A060NT12	N8T
0-60	.250	0.005	0.005	0.250	150	A060NT25	N8H
0-150	.050	0.005	0.005	0.250	145	A0150NT05	N8T
0-150	.100	0.005	0.005	0.250	165	A0150NT10	N8H

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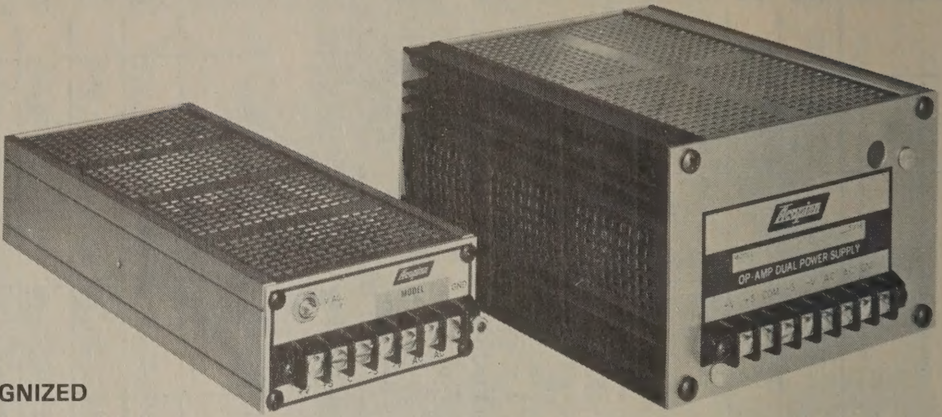
Nominal Output Voltage	Adjust ±V.	Output Current Amps. at			Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	71°C	Load ±%*	Line ±%*				
1	.5	1.1	1.0	1.0	.005	.005	.250	$ 95	A1NT110	N8
1	.5	2.2	2.1	2.0	.005	.005	.250	125	A1NT220	N8T
1	.5	4.0	3.5	3.0	.005	.005	.250	150	A1NT400	N8H
1.5	.5	1.1	1.0	1.0	.005	.005	.250	95	A1.5NT110	N8
1.5	.5	2.2	2.1	2.0	.005	.005	.250	125	A1.5NT220	N8T
1.5	.5	4.0	3.5	3.0	.005	.005	.250	150	A1.5NT400	N8H
2	.5	1.1	1.0	1.0	.005	.005	.250	95	A2NT110	N8
2	.5	2.2	2.1	2.0	.005	.005	.250	125	A2NT220	N8T
2	.5	3.5	3.3	3.0	.005	.005	.250	150	A2NT350	N8H
3	.5	.500	.500	.500	.5	.05	1	80	B3FT50	F6
3	.5	1.0	1.0	1.0	.5	.1	1	85	B3FT100	F6
3	.5	1.1	1.0	1.0	.005	.005	.250	95	A3NT110	N8
3	.5	2.2	2.1	2.0	.005	.005	.250	125	A3NT220	N8T
3	.5	4.0	3.5	3.0	.005	.005	.250	150	A3NT400	N8H
3.6	.5	.500	.500	.500	.5	.05	1	80	B3.6FT50	F6
3.6	.5	1.0	1.0	1.0	.5	.1	1	85	B3.6FT100	F6
3.6	.5	1.1	1.0	1.0	.005	.005	.250	95	A3.6NT110	N8
3.6	.5	2.2	2.1	2.0	.005	.005	.250	125	A3.6NT220	N8T
3.6	.5	4.0	3.5	3.0	.005	.005	.250	150	A3.6NT400	N8H
5	.5	.500	.500	.500	.1	.1	1	80	B5FT50	F6
5	.5	1.0		1.0	.1	.1	1	85	B5FT100	F6
5	.5	1.1	1.0	1.0	.005	.005	.250	95	A5NT110	N8
5	.5	2.2	2.1	2.0	.005	.005	.250	125	A5NT220	N8T
5	.5	4.0	3.5	3.0	.005	.005	.250	150	A5NT400	N8H
6	1	.500	.500	.500	.1	.1	1	80	B6FT50	F6
6	.5	1.0	1.0	1.0	.1	.1	1	85	B6FT100	F6
6	.5	1.1	1.0	1.0	.005	.005	.250	95	A6NT110	N8
6	.5	2.2	2.1	2.0	.005	.005	.250	125	A6NT220	N8T
6	.5	3.0	3.0	3.0	.005	.005	.250	150	A6NT300	N8H
7	1	.500	.500	.500	.1	.1	1	80	B7FT50	F6
7	1	1.0	1.0	1.0	.1	.1	1	90	B7FT100	F6
7	.5	1.1	1.0	1.0	.005	.005	.250	100	A7NT110	N8
7	.5	2.0	2.0	2.0	.005	.005	.250	130	A7NT200	N8H
8	1	.500	.500	.500	.1	.1	1	80	B8FT50	F6
8	1	1.0	1.0	1.0	.1	.1	1	90	B8FT100	F6
8	.5	1.1	1.0	1.0	.005	.005	.250	100	A8NT110	N8
8	.5	2.0	2.0	2.0	.005	.005	.250	135	A8NT200	N8H
9	1	.500	.500	.500	.1	.1	1	85	B9FT50	F6
9	1	1.0	1.0	1.0	.1	.1	1	95	B9FT100	F6
9	.5	1.1	1.0	1.0	.005	.005	.250	105	A9NT110	N8
9	.5	2.0	2.0	2.0	.005	.005	.250	135	A9NT200	N8H
10	1	.500	.500	.500	.1	.1	1	85	B10FT50	F6
10	1	1.0	1.0	1.0	.1	.1	1	95	B10FT100	F6
10	.5	1.1	1.0	1.0	.005	.005	.250	105	A10NT110	N8
10	.5	2.0	2.0	2.0	.005	.005	.250	135	A10NT200	N8H
11	1	.500	.500	.500	.1	.1	1	85	B11FT50	F6
11	1	1.0	1.0	.750	.1	.1	1	95	B11FT100	F6
11	.5	1.1	1.0	1.0	.005	.005	.250	105	A11NT110	N8
11	.5	2.0	2.0	2.0	.005	.005	.250	135	A11NT200	N8H
12	1	.500	.500	.500	.1	.1	1	85	B12FT50	F6
12	1	1.0	1.0	.750	.1	.1	1	95	B12FT100	F6
12	.5	1.1	1.0	1.0	.005	.005	.250	105	A12NT110	N8
12	.5	2.0	2.0	2.0	.005	.005	.250	135	A12NT200	N8H
13	1	.500	.500	.500	.1	.1	1	85	B13FT50	F6
13	1	1.0	1.0	.750	.1	.1	1	95	B13FT100	F6
13	.5	1.1	1.0	1.0	.005	.005	.250	105	A13NT110	N8
13	.5	2.0	2.0	2.0	.005	.005	.250	135	A13NT200	N8H
14	1	.500	.500	.500	.1	.1	1	85	B14FT50	F6
14	1	1.0	1.0	.750	.1	.1	1	95	B14FT100	F6
14	.5	1.1	1.0	1.0	.005	.005	.250	105	A14NT110	N8
14	.5	2.0	2.0	2.0	.005	.005	.250	135	A14NT200	N8H
15	1	.500	.500	.500	.1	.1	1	85	B15FT50	F6
15	1	1.0	1.0	.750	.1	.1	1	95	B15FT100	F6
15	.5	1.1	1.0	1.0	.005	.005	.250	105	A15NT110	N8
15	.5	2.0	2.0	2.0	.005	.005	.250	135	A15NT200	N8H
16	1	.500	.500	.500	.1	.1	1	85	B16FT50	F6
16	1	1.0	1.0	.750	.1	.1	1	95	B16FT100	F6
16	.5	1.0	1.0	1.0	.005	.005	.250	110	A16NT100	N8
16	.5	1.75	1.75	1.75	.005	.005	.250	135	A16NT175	N8H
18	1	.500	.500	.500	.1	.1	1	85	B18FT50	F6
18	1	.750	.750	.750	.1	.1	1	95	B18FT75	F6
18	.5	1.0	1.0	1.0	.005	.005	.250	115	A18NT100	N8
18	.5	1.5	1.5	1.5	.005	.005	.250	130	A18NT150	N8H
20	1	.400	.400	.400	.05	.05	1	85	B20FT40	F6
20	1	.750	.750	.750	.1	.1	1	95	B20FT75	F6
20	.5	.900	.900	.900	.005	.005	.250	110	A20NT90	N8
20	.5	1.25	1.25	1.25	.005	.005	.250	130	A20NT125	N8H
24	1	.200	.200	.200	.05	.05	1	75	B24FT20	F6
24	1	.400	.400	.400	.05	.05	1	85	B24FT40	F6
24	1	.750	.750	.750	.1	.1	1	95	B24FT75	F6
24	.5	.900	.800	.750	.005	.005	.250	110	A24NT90	N8
24	.5	1.0	1.0	1.0	.005	.005	.250	120	A24NT100	N8
24	.5	1.25	1.25	1.25	.005	.005	.250	130	A24NT125	N8H
25	1	.200	.200	.200	.05	.05	1	75	B25FT20	F6
25	1	.400	.400	.400	.05	.05	1	85	B25FT40	F6
25	1	.750	.750	.750	.1	.05	1	95	B25FT75	F6
25	.5	.750	.750	.750	.005	.005	.250	120	A25NT75	N8
25	.5	1.25	1.25	1.25	.005	.005	.250	130	A25NT125	N8H
26	1	.200	.200	.200	.05	.05	1	75	B26FT20	F6
26	1	.400	.400	.400	.05	.05	1	85	B26FT40	F6
26	1	.750	.750	.750	.1	.05	1	95	B26FT75	F6
26	.5	1.25	1.25	1.25	.005	.005	.250	130	A26NT125	N8H
28	1	.200	.200	.200	.05	.05	1	75	B28FT20	F6
28	1	.400	.400	.400	.05	.05	1	85	B28FT40	F6
28	1	.700	.700	.700	.1	.05	1	95	B28FT70	F6
28	.5	.800	.800	.800	.005	.005	.250	120	A28NT80	N8T
28	.5	1.25	1.25	1.25	.005	.005	.250	130	A28NT125	N8H
30	1	.200	.200	.200	.05	.05	1	75	B30FT20	F6
30	1	.400	.400	.400	.05	.05	1	85	B30FT40	F6
30	1	.500	.500	.500	.05	.05	1	95	B30FT50	F6
30	.5	.750	.750	.750	.005	.005	.250	125	A30NT75	N8T
30	.5	1.1	1.1	1.1	.005	.005	.250	135	A30NT110	N8H
32	1	.100	.100	.100	.05	.05	1	75	B32FT10	F6
32	1	.200	.200	.200	.05	.05	1	85	B32FT20	F6
32	1	.400	.400	.400	.05	.05	1	95	B32FT40	F6
32	.5	.600	.600	.600	.005	.005	.250	125	A32NT60	N8
32	.5	1.1	1.1	1.1	.005	.005	.250	$135	A32NT110	N8H
34	1	.100	.100	.100	.05	.05	1	75	B34FT10	F6
34	1	.200	.200	.200	.05	.05	1	85	B34FT20	F6
34	1	.400	.400	.400	.05	.05	1	95	B34FT40	F6
34	.5	.600	.600	.600	.005	.005	.250	125	A34NT60	N8
34	.5	1.1	1.1	1.1	.005	.005	.250	135	A34NT110	N8H
35	1	.100	.100	.100	.05	.05	1	75	B35FT10	F6
35	1	.200	.200	.200	.05	.05	1	85	B35FT20	F6
35	1	.400	.400	.400	.05	.05	1	95	B35FT40	F6
35	.5	.600	.600	.600	.005	.005	.250	125	A35NT60	N8
35	.5	1.1	1.1	1.1	.005	.005	.250	135	A35NT110	N8H
36	1	.100	.100	.100	.05	.05	1	75	B36FT10	F6
36	1	.200	.200	.200	.05	.05	1	85	B36FT20	F6
36	1	.400	.400	.400	.05	.05	1	95	B36FT40	F6
36	.5	.600	.600	.600	.005	.005	.250	125	A36NT60	N8
36	.5	1.0	1.0	1.0	.005	.005	.250	135	A36NT100	N8H
38	1	.100	.100	.100	.05	.05	1	75	B38FT10	F6
38	1	.200	.200	.200	.05	.05	1	85	B38FT20	F6
40	1	.100	.100	.100	.05	.05	1	75	B40FT10	F6
40	1	.200	.200	.200	.05	.05	1	90	B40FT20	F6
40	1	.400	.400	.400	.05	.05	1	100	B40FT40	F6
40	.5	.600	.600	.600	.005	.005	.250	125	A40NT60	N8
40	.5	.750	.750	.750	.005	.005	.250	135	A40NT75	N8T
45	1	.100	.100	.100	.05	.05	1	75	B45FT10	F6
45	1	.200	.200	.200	.05	.05	1	90	B45FT20	F6
45	1	.400	.400	.400	.05	.05	1	100	B45FT40	F6
45	.5	.600	.600	.600	.005	.005	.250	135	A45NT60	N8T
48	1	.050	.050	.050	.05	.05	1	80	B48FT05	F6
48	1	.100	.100	.100	.05	.05	1	90	B48FT10	F6
48	1	.200	.200	.200	.05	.05	1	100	B48FT20	F6
48	1	.400	.400	.400	.05	.05	1	110	B48FT40	F6
48	.5	.500	.500	.500	.005	.005	.250	135	A48NT50	N8T
50	1	.050	.050	.050	.05	.05	1	80	B50FT05	F6T
50	1	.100	.050	.100	.05	.05	1	90	B50FT10	F6T
50	1	.200	.050	.200	.05	.05	1	100	B50FT20	F6T
50	1	.400	.400	.400	.05	.05	1	110	B50FT40	F6T
50	1	.450	.450	.450	.005	.005	.250	135	A50NT45	N8T
55	1	.050	.050	.050	.05	.05	1	80	B55FT05	F6T
55	1	.100	.100	.100	.05	.05	1	90	B55FT10	F6T
55	1	.200	.200	.200	.05	.05	1	100	B55FT20	F6T
55	1	.400	.400	.400	.005	.005	.250	140	A55NT40	N8T
60	1	.050	.050	.050	.05	.05	1	80	B60FT05	F6T
60	1	.100	.100	.100	.05	.05	1	90	B60FT10	F6T
60	1	.150	.150	.150	.05	.05	1	100	B60FT15	F6T
60	1	.300	.300	.300	.05	.05	1	125	B60FT30	F8T
60	1	.350	.350	.350	.005	.005	.250	145	A60NT35	N8T
65	1	.050	.050	.050	.05	.05	1	80	B65FT05	F6T
65	1	.100	.100	.100	.05	.05	1	90	B65FT10	F6T
65	1	.250	.250	.250	.05	.05	1	125	B65FT25	F8T
65	1	.270	.270	.270	.005	.005	.250	145	A65NT27	N8T
67	1	.050	.050	.050	.05	.05	1	80	B67FT05	F6T
67	1	.100	.100	.100	.05	.05	1	90	B67FT10	F6T
70	1	.050	.050	.050	.05	.05	1	80	B70FT05	F6T
70	1	.100	.100	.100	.05	.05	1	95	B70FT10	F6T
70	1	.200	.200	.200	.05	.05	1	105	B70FT20	F8T
70	1	.250	.250	.250	.005	.005	.250	145	A70NT25	N8T
75	1	.050	.050	.050	.05	.05	1	90	B75FT05	F6T
75	1	.100	.100	.100	.05	.05	1	100	B75FT10	F6T
75	1	.200	.200	.200	.05	.05	1	125	B75FT20	F8T
75	1	.250	.250	.250	.005	.005	.250	145	A75NT25	N8T
80	1	.050	.050	.050	.05	.05	1	90	B80FT05	F6T
80	1	.100	.100	.100	.05	.05	1	100	B80FT10	F6T
80	1	.200	.200	.200	.05	.05	1	125	B80FT20	F8T
80	1	.250	.250	.250	.005	.005	.250	155	A80NT25	N8T
85	1	.050	.050	.050	.05	.05	1	100	B85FT05	F6T
85	1	.100	.100	.100	.05	.05	1	125	B85FT10	F6T
85	1	.200	.200	.200	.05	.05	1	125	B85FT20	F8T
85	1	.250	.250	.250	.005	.005	.250	155	A85NT25	N8T
90	1	.050	.050	.050	.05	.05	1	100	B90FT05	F6T
90	1	.100	.100	.100	.05	.05	1	125	B90FT10	F6T
90	1	.200	.200	.200	.05	.05	1	135	B90FT20	F8T
90	1	.250	.250	.250	.005	.005	.250	155	A90NT25	N8T
95	1	.050	.050	.050	.05	.05	1	115	B95FT05	F6T
95	1	.100	.100	.100	.05	.05	1	125	B95FT10	F6T
95	1	.200	.200	.200	.05	.05	1	135	B95FT20	F8T
95	1	.200	.200	.200	.005	.005	.250	155	A95NT20	N8T
100	1	.020	.020	.020	.05	.05	1	105	B100FT02	F6T
100	1	.050	.050	.050	.05	.05	1	115	B100FT05	F6T
100	1	.100	.100	.100	.05	.05	1	130	B100FT10	F6T
100	1	.200	.200	.200	.05	.05	1	145	B100FT20	F8T
100	1	.200	.200	.200	.005	.005	.250	155	A100NT20	N8T
105	1	.050	.050	.050	.05	.05	1	115	B105FT05	F6T
105	1	.100	.100	.100	.05	.05	1	130	B105FT10	F6T
105	1	.200	.200	.200	.05	.05	1	145	B105FT20	F8T
105	1	.200	.200	.200	.005	.005	.250	155	A105NT20	N8T
110	1	.050	.050	.050	.05	.05	1	120	B110FT05	F6T
110	1	.100	.100	.100	.05	.05	1	135	B110FT10	F6T
110	1	.200	.200	.200	.05	.05	1	145	B110FT20	F8T
110	1	.200	.200	.200	.005	.005	.250	155	A110NT20	N8T
115	1	.050	.050	.050	.05	.05	1	125	B115FT05	F6T
115	1	.100	.100	.100	.05	.05	1	135	B115FT10	F6T
115	1	.200	.200	.200	.05	.05	1	145	B115FT20	F8T
115	1	.200	.200	.200	.005	.005	.250	155	A115NT20	N8T
120	1	.050	.050	.050	.05	.05	1	130	B120FT05	F6T
120	1	.200	.200	.200	.05	.05	1	145	B120FT20	F8T
120	1	.200	.200	.200	.005	.005	.250	160	A120NT20	N8T
125	1	.050	.050	.050	.05	.05	1	130	B125FT05	F6T
125	1	.200	.200	.200	.05	.05	1	150	B125FT20	F8T
125	1	.200	.200	.200	.005	.005	.250	160	A125NT20	N8T
130	1	.150	.150	.150	.05	.05	1	140	B130FT15	F8T
130	1	.170	.170	.170	.005	.005	.250	160	A130NT17	N8T
135	1	.150	.150	.150	.005	.005	.250	160	A135NT15	N8T
140	1	.130	.130	.130	.005	.005	.250	160	A140NT13	N8T
150	1	.100	.100	.100	.05	.05	1	140	B150FT10	F8T
150	1	.100	.100	.100	.005	.005	.250	160	A150NT10	N8T

*or 2 mv, whichever is greater

Acopian

DUAL OUTPUT For Op Amps.



ALL MODELS U.L. RECOGNIZED

Series D dual output power supplies are a convenient source of the tracking voltages required for powering operational amplifiers and related circuits. Their positive/common/negative output terminal configuration minimizes system wiring. Provision for remote sensing permits compensation of load line effects. Although moderately priced, they are sturdily constructed and conservatively rated.

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

Output Voltages: Tracking within 1%.
Output Currents:
Output Voltage Adjustment Ranges:
See tables. Outputs are short circuit protected.

Load Regulation: ±0.1%.

Line Regulation: ±0.1%.

Ripple: 1.5 mv RMS.

Polarity: Positive output, common, and negative output.

Remote Voltage Sensing: Standard.

Ambient Operating Temperature: −10 to +71°C.

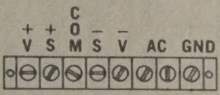
Storage Temperature: −55 to +85°C.

OPTIONS

Overvoltage Protection: A built-in preset overvoltage protection circuit is available on all models. If either output fails, both outputs are "crowbarred." To order, add prefix "V" to the model number, and increase standard price by $30.00.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to model number and $10.00 to price.

***Connections:**
(Supplies for Op Amps)



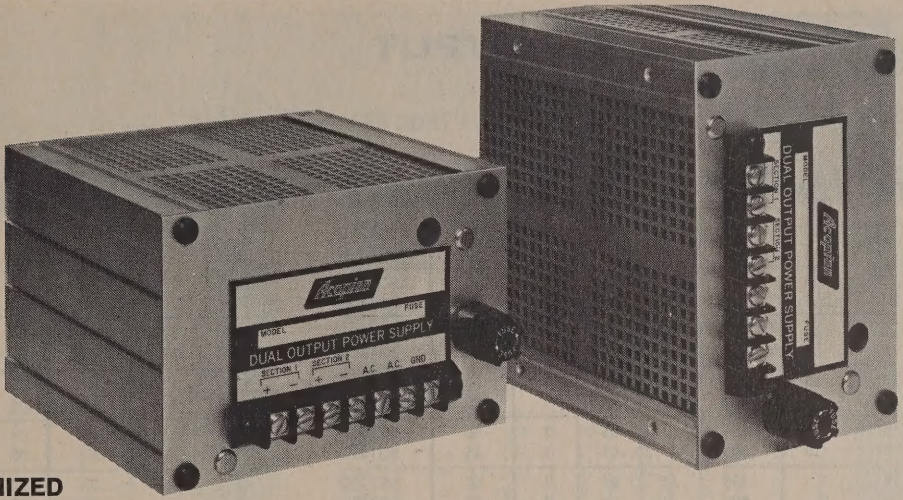
Nominal Output Voltages	Adjust ±V.	Output Current Amps. at 40°C	55°C	71°C	Price	Model	Size*
±5	.5	.750	.650	.550	$125	TD5-75	TG5
±5	.5	1.5	1.25	1.0	150	TD5-150	TG6
±5	.5	2.5	2.0	1.5	160	TD5-250	TG9
±12	1	1.0	.900	.800	125	TD12-100	TG5
±12	1	1.6	1.4	1.0	150	TD12-160	TG6
±12	1	2.5	2.0	1.5	160	TD12-250	TG9
±12	.5	4.5	3.7	3.0	215	TD12-450	TG13
±12	.5	8.5	7.0	5.5	299	TD12-850	TH11
±15	1	.400	.400	.400	85	TD15-40	TG5
±15	1	1.0	.900	.800	125	TD15-100	TG5
±15	1	1.6	1.4	1.0	150	TD15-160	TG6
±15	1	2.5	2.0	1.5	160	TD15-250	TG9
±15	.5	4.5	3.7	3.0	225	TD15-450	TG13
±15	.5	8.5	7.0	5.5	299	TD15-850	TH11

NARROW PROFILE MODELS — for limited space applications

Nominal Output Voltage	Adjust ±V.	Output Current Amps. at 40°C	55°C	71°C	Price	Model	Size*
±12	1	.500	.500	.400	$115	FD12-50	TN6
±12	.5	1.0	.900	.800	145	LD12-100	TN8H
±15	1	.500	.500	.400	115	FD15-50	TN6
±15	.5	1.0	.900	.800	145	LD15-100	TN8H

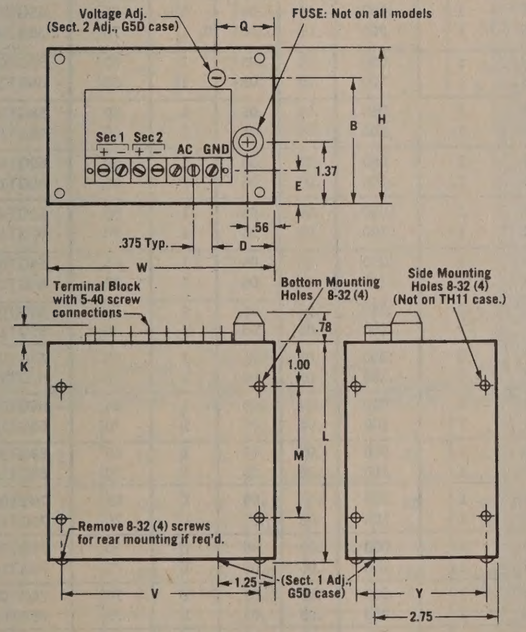
14 *ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919 • 3-DAY SHIPMENT GUARANTEED*

DUAL OUTPUT General Purpose


Acopian
MODEL
FUSE
DUAL OUTPUT POWER SUPPLY
SECTION 1
SECTION 2
A.C.
A.C.
GND

ALL MODELS U.L. RECOGNIZED

Acopian general purpose duals furnish two completely independent outputs, either identical or different, in less space and at less cost than two equivalent single output supplies. Thousands of output voltage/current rating combinations are available. Mounting and system wiring are simplified. Quality components, generously derated, insure long-term reliability.


Voltage Adj.
(Sect. 2 Adj., G5D case)
Q
FUSE: Not on all models
Sec 1
Sec 2
+
−
+
−
AC
GND
B
H
1.37
E
.56
.375 Typ.
D
W
Terminal Block with 5-40 screw connections
Bottom Mounting Holes 8-32 (4)
Side Mounting Holes 8-32 (4) (Not on TH11 case.)
.78
K
1.00
L
M
Remove 8-32 (4) screws for rear mounting if req'd.
1.25
(Sect. 1 Adj., G5D case)
V
Y
2.75

Size	L	W	H	M	V	Y	E	Q	B	K	D	Approx. Weight
G5D	5.09	5.12	3.44	3.00	4.50	3.00	.75	1.25	2.73	.38	1.44	4 lb
TG5	5.09	5.12	3.44	3.00	4.50	3.00	.75	1.25	2.73	.38	1.44	3 lb 4 oz
TG6	6.59	5.12	3.44	4.00	4.50	3.00	.75	1.25	2.73	.38	1.44	4 lb 4 oz
TG9	9.25	5.12	3.44	6.00	4.50	3.00	.75	1.25	2.73	.38	1.44	6 lb 8 oz
TG13	13.25	5.12	3.44	10.00	4.50	3.00	.75	1.25	2.73	.38	1.44	12 lb
TH11	11.25	7.37	5.12	8.00	6.75	4.56	.75	2.73	4.36	.38	2.38	18 lb 4 oz
TN6	6.59	3.44	1.68	4.00	3.12	1.31	.62	2.87	1.31	.53	.59	2 lb 4 oz.
TN8H	8.47	4.68	1.68	5.00	3.12	1.31	.62	2.87	1.31	.53	.59	3 lb 14 oz

STANDARD FEATURES

- A broad selection of output combinations
- May be mounted on any of three surfaces
- Delivers current surges without damage—built-in fuse protects supply against prolonged overloads and shorts
- Silicon semiconductors
- Rugged construction

HOW TO ORDER: Select the two sections desired. The complete model number is the combination of the two sections selected. Example: The combination of section 5GT20D and section 8GT50D is Model 5GT20D-8GT50D. Always assign the lower voltage section first. For pricing purposes, add the cost of the individual sections selected. Example: The price of Model 5GT20D-8GT50D is $60.00 plus $65.00, or $125.00 total.

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

Output Specifications: See pages 16 and 17. No derating required through ambient temperature range of −10 to +71°C.

Polarity: Outputs are floating. Each output may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 V above ground.

Ambient Operating Temperature: −10 to +71°C.

Storage Temperature: −55 to +85°C.

Dimensions and Weight: Case size G5D.

Optional 230 Volt Input: All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to the model number, and $10.00 to the standard price.

Acopian DUAL OUTPUT

(500 MA MAXIMUM)

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
1.5	.5	.200	.4	.05	1	$60	1.5GT20D
1.5	.5	.400	.5	.1	1	65	1.5GT40D
2.5	.5	.200	.4	.05	1	60	2.5GT20D
2.5	.5	.400	.5	.1	1	65	2.5GT40D
3	.5	.200	.3	.05	1	60	3GT30D
3	.5	.400	.5	.1	1	65	3GT40D
3.6	.5	.200	.2	.05	1	60	3.6GT20D
3.6	.5	.400	.3	.1	1	65	3.6GT40D
5	.5	.200	.2	.05	1	60	5GT20D
5	.5	.500	.3	.05	1	65	5GT50D
6	1	.200	.05	.05	1	60	6GT20D
6	1	.500	.15	.05	1	65	6GT50D
7	1	.200	.05	.05	1	60	7GT20D
7	1	.500	.15	.05	1	65	7GT50D
8	1	.200	.05	.05	1	60	8GT20D
8	1	.500	.1	.05	1	65	8GT50D
9	1	.200	.05	.05	1	60	9GT20D
9	1	.500	.1	.05	1	65	9GT50D
10	1	.250	.05	.05	1	60	10GT25D
10	1	.500	.1	.05	1	65	10GT50D
11	1	.250	.05	.05	1	60	11GT25D
11	1	.500	.1	.05	1	65	11GT50D
12	1	.250	.05	.05	1	60	12GT25D
12	1	.500	.1	.05	1	65	12GT50D
13	1	.250	.05	.05	1	60	13GT25D
13	1	.500	.1	.05	1	65	13GT50D
15	1	.150	.05	.05	1	55	15GT15D
15	1	.250	.05	.05	1	60	15GT25D
15	1	.500	.1	.05	1	65	15GT50D
16	1	.250	.05	.05	1	60	16GT25D
16	1	.500	.1	.05	1	65	16GT50D
17	1	.250	.05	.05	1	60	17GT25D
17	1	.500	.1	.05	1	65	17GT50D
18	1	.250	.05	.05	1	60	18GT25D
18	1	.500	.1	.05	1	65	18GT50D
19	1	.250	.05	.05	1	60	19GT25D
19	1	.500	.1	.05	1	65	19GT50D
20	1	.250	.05	.05	1	60	20GT25D
20	1	.500	.1	.05	1	65	20GT50D
21	1	.250	.05	.05	1	60	21GT25D
21	1	.500	.1	.05	1	65	21GT50D
22	1	.250	.05	.05	1	60	22GT25D
22	1	.500	.1	.05	1	65	22GT50D
23	1	.250	.05	.05	1	60	23GT25D
23	1	.500	.1	.05	1	65	23GT50D
24	1	.250	.05	.05	1	60	24GT25D
24	1	.500	.05	.05	1	65	24GT50D
25	1	.250	.05	.05	1	60	25GT25D
25	1	.500	.05	.05	1	65	25GT50D
	1	.250	.05	.05	1	60	26GT25D
26	1	.400	.05	.05	1	65	26GT40D
28	1	.250	.05	.05	1	60	28GT25D
28	1	.400	.05	.05	1	65	28GT40D
30	1	.250	.05	.05	1	60	30GT25D
30	1	.400	.05	.05	1	65	30GT40D
31	1	.100	.05	.05	1	60	31GT10D
31	1	.300	.05	.05	1	65	31GT30D
32	1	.100	.05	.05	1	60	32GT10D
32	1	.300	.05	.05	1	65	32GT30D
33	1	.100	.05	.05	1	60	33GT10D
33	1	.300	.05	.05	1	65	33GT30D

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
34	1	.100	.05	.05	1	$60	34GT10D
34	1	.300	.05	.05	1	65	34GT30D
35	1	.100	.05	.05	1	60	35GT10D
35	1	.200	.05	.05	1	65	35GT20D
36	1	.100	.05	.05	1	60	36GT10D
36	1	.200	.05	.05	1	65	36GT20D
38	1	.100	.05	.05	1	60	38GT10D
38	1	.200	.05	.05	1	65	38GT20D
40	1	.100	.05	.05	1	60	40GT10D
40	1	.200	.05	.05	1	65	40GT20D
42	1	.100	.05	.05	1	60	42GT10D
42	1	.200	.05	.05	1	65	42GT20D
44	1	.100	.05	.05	1	60	44GT10D
44	1	.200	.05	.05	1	65	44GT20D
45	1	.100	.05	.05	1	60	45GT10D
45	1	.200	.05	.05	1	65	45GT20D
46	1	.100	.05	.05	1	60	46GT10D
46	1	.200	.05	.05	1	65	46GT20D
48	1	.100	.05	.05	1	60	48GT10D
48	1	.200	.05	.05	1	65	48GT20D
50	1	.100	.05	.05	1	65	50GT10D
50	1	.200	.05	.05	1	70	50GT20D
52	1	.100	.05	.05	1	65	52GT10D
52	1	.200	.05	.05	1	70	52GT20D
54	1	.100	.05	.05	1	65	54GT10D
54	1	.200	.05	.05	1	70	54GT20D
55	1	.100	.05	.05	1	65	55GT10D
55	1	.200	.05	.05	1	70	55GT20D
56	1	.050	.05	.05	1	60	56GT05D
56	1	.100	.05	.05	1	65	56GT10D
58	1	.050	.05	.05	1	60	58GT05D
58	1	.100	.05	.05	1	65	58GT10D
60	1	.050	.05	.05	1	60	60GT05D
60	1	.100	.05	.05	1	65	60GT10D
62	1	.050	.05	.05	1	65	62GT05D
62	1	.100	.05	.05	1	70	62GT10D
64	1	.050	.05	.05	1	65	64GT05D
64	1	.100	.05	.05	1	70	64GT10D
65	1	.050	.05	.05	1	65	65GT05D
65	1	.100	.05	.05	1	70	65GT10D
67	1	.050	.05	.05	1	65	67GT05D
67	1	.100	.05	.05	1	70	67GT10D
68	1	.050	.05	.05	1	65	68GT05D
68	1	.100	.05	.05	1	70	68GT10D
69	1	.050	.05	.05	1	65	69GT05D
69	1	.100	.05	.05	1	70	69GT10D
70	1	.050	.05	.05	1	65	70GT05D
70	1	.100	.05	.05	1	70	70GT10D
75	1	.050	.05	.05	1	70	75GT05D
75	1	.100	.05	.05	1	75	75GT10D
76	1	.020	.05	.05	1	70	76GT02D
76	1	.050	.05	.05	1	75	76GT05D
80	1	.020	.05	.05	1	70	80GT02D
80	1	.050	.05	.05	1	75	80GT05D
85	1	.020	.05	.05	1	70	85GT02D
85	1	.050	.05	.05	1	75	85GT05D
90	1	.020	.05	.05	1	70	90GT02D
90	1	.050	.05	.05	1	75	90GT05D
95	1	.020	.05	.05	1	75	95GT02D
95	1	.050	.05	.05	1	80	95GT05D
100	1	.020	.05	.05	1	75	100GT02D
100	1	.050	.05	.05	1	80	100GT05D

(1 AMP MAXIMUM)

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
1.5	.5	.200	.4	.05	1	$60	1.5GT20D
1.5	.5	.400	.5	.1	1	65	1.5GT40D
2.5	.5	.200	.4	.05	1	60	2.5GT20D
2.5	.5	.400	.5	.1	1	65	2.5GT40D
3	.5	.200	.3	.05	1	60	3GT20D
3	.5	.400	.5	.1	1	65	3GT40D
3	.5	.700	.5	.1	1	75	3GT70D
3	.5	1.0	.5	.1	1	85	3GT100D
3.6	.5	.200	.2	.05	1	60	3.6GT20D
3.6	.5	.400	.3	.1	1	65	3.6GT40D
3.6	.5	.700	.4	.1	1	75	3.6GT70D
3.6	.5	1.0	.5	.1	1	85	3.6GT100D
5	.5	.200	.2	.05	1	60	5GT20D
5	.5	.500	.3	.05	1	65	5GT50D
5	.5	.700	.4	.05	1	75	5GT70D
5	.5	1.0	.5	.05	1	85	5GT100D
6	1	.200	.05	.05	1	60	6GT20D
6	1	.500	.15	.05	1	65	6GT50D
6	.5	.700	.2	.05	1	75	6GT70D
6	.5	1.0	.3	.05	1	85	6GT100D
7	1	.200	.05	.05	1	60	7GT20D
7	1	.500	.15	.05	1	65	7GT50D
7	.5	.700	.2	.05	1	75	7GT70D
7	.5	1.0	.3	.05	1	85	7GT100D
8	1	.200	.05	.05	1	60	8GT20D
8	1	.500	.1	.05	1	65	8GT50D
8	.5	.700	.15	.05	1	75	8GT70D
8	.5	1.0	.2	.05	1	85	8GT100D
9	1	.200	.05	.05	1	60	9GT20D
9	1	.500	.1	.05	1	65	9GT50D
9	.5	.700	.15	.05	1	75	9GT70D
9	.5	1.0	.2	.05	1	85	9GT100D

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
10	1	.250	.05	.05	1	$60	10GT25D
10	1	.500	.1	.05	1	65	10GT50D
10	.5	.700	.15	.05	1	75	10GT70D
10	.5	1.0	.2	.05	1	85	10GT100D
12	1	.250	.05	.05	1	60	12GT25D
12	1	.500	.1	.05	1	65	12GT50D
12	.5	.700	.1	.05	1	75	12GT70D
12	.5	1.0	.1	.05	1	85	12GT100D
14	1	.250	.05	.05	1	60	14GT25D
14	1	.500	.1	.05	1	65	14GT50D
14	.5	.700	.1	.05	1	75	14GT70D
14	.5	1.0	.1	.05	1	85	14GT100D
15	1	.250	.05	.05	1	60	15GT25D
15	1	.500	.1	.05	1	65	15GT50D
15	.5	.700	.1	.05	1	75	15GT70D
15	.5	1.0	.1	.05	1	85	15GT100D
16	1	.250	.05	.05	1	60	16GT25D
16	1	.500	.1	.05	1	65	16GT50D
16	.5	.700	.1	.05	1	75	16GT70D
16	.5	1.0	.1	.05	1	85	16GT100D
18	1	.250	.05	.05	1	60	18GT25D
18	1	.500	.1	.05	1	65	18GT50D
18	.5	.700	.1	.05	1	75	18GT70D
18	.5	1.0	.1	.05	1	85	18GT100D
19	1	.250	.05	.05	1	60	19GT25D
19	1	.500	.1	.05	1	65	19GT50D
19	.5	.750	.1	.05	1	85	19GT75D
20	1	.250	.05	.05	1	60	20GT25D
20	1	.500	.1	.05	1	65	20GT50D
20	.5	.750	.1	.05	1	85	20GT75D

(90 TO 150 VOLTS)

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
90	1	.050	.05	.05	1	$75	90GT05D
90	1	.100	.05	.05	1	85	90GT10D
95	1	.050	.05	.05	1	80	95GT05D
95	1	.100	.05	.05	1	85	95GT10D
100	1	.050	.05	.05	1	80	100GT05D
100	1	.100	.05	.05	1	85	100GT10D
105	1	.050	.05	.05	1	80	105GT05D
105	1	.100	.05	.05	1	85	105GT10D
110	1	.050	.05	.05	1	80	110GT05D
110	1	.100	.05	.05	1	85	110GT10D
115	1	.050	.05	.05	1	80	115GT05D
115	1	.100	.05	.05	1	85	115GT10D
120	1	.050	.05	.05	1	80	120GT05D

Nominal Output Voltage	Adjust ±V.	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price per Section	Section (See "How to Order")
120	1	.100	.05	.05	1	$85	120GT10D
125	1	.050	.05	.05	1	80	125GT05D
125	1	.100	.05	.05	1	85	125GT10D
130	1	.050	.05	.05	1	85	130GT05D
130	1	.100	.05	.05	1	90	130GT10D
135	1	.050	.05	.05	1	85	135GT05D
135	1	.100	.05	.05	1	90	135GT10D
140	1	.050	.05	.05	1	85	140GT05D
140	1	.100	.05	.05	1	90	140GT10D
145	1	.050	.05	.05	1	85	145GT05D
145	1	.100	.05	.05	1	90	145GT10D
150	1	.050	.05	.05	1	85	150GT05D
150	1	.100	.05	.05	1	90	150GT10D

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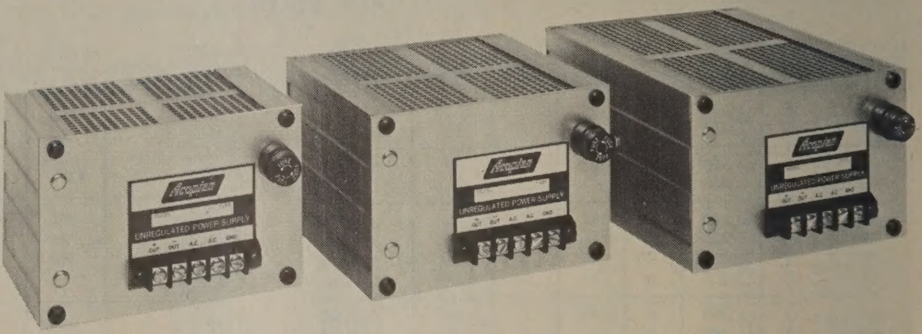
Acopian

SERIES U UNREGULATED



U.L. RECOGNIZED

Low-cost DC power suitable for driving loads such as lamps, relays, and small motors is provided by Series U unregulated power supplies. All components are generously derated, insuring a long and trouble-free life; built-in fusing prevents damage due to prolonged overloading or short circuits. Mechanically similar to the regulated supplies shown on pages 8 and 9, they are housed in extruded aluminum cases which can be mounted in any position.

STANDARD FEATURES

- Silicon rectifiers
- Capacitive filtering
- Fused input
- May be used in series or parallel
- No derating or heat sinking required
- Completely serviceable

SPECIFICATIONS

Input Voltage: 0–125 VAC, 50–400 Hz, single phase.

Output Voltage:
Output Current: } See table
Ripple:

Load Regulation: Nominal output voltage is based on 115 VAC input, with approximately 50% of rated output current being drawn.

Line Regulation: With fixed load, output voltage change is proportional to input voltage change.

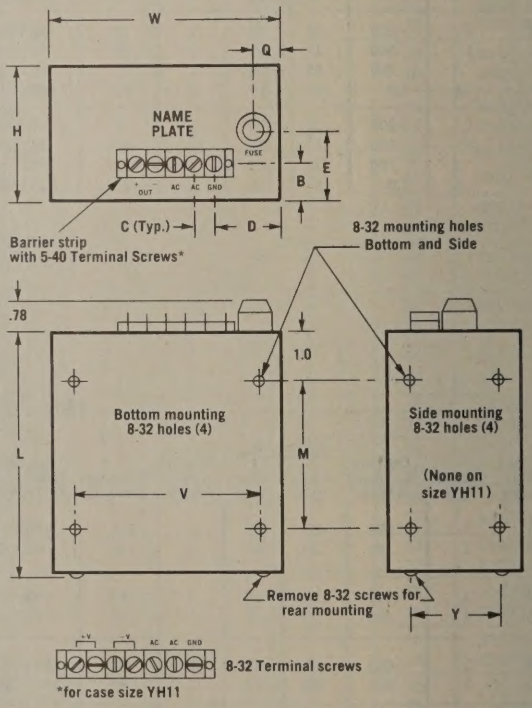
Output Voltage Adjustment: An adjustable autotransformer (not included) may be used to adjust output voltage by varying the AC input voltage to the supply.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

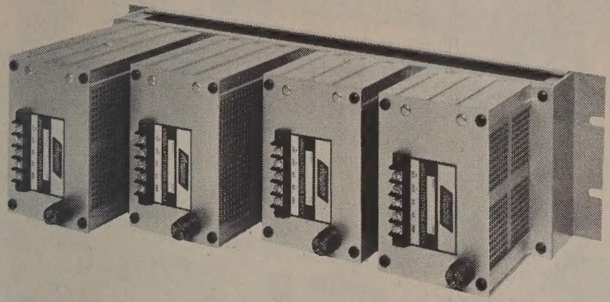
Ambient Operating Temperature: −10 to +65°C. No derating required.

Storage Temperature: −55 to +85°C.

Optional 230 Volt Input
Provision for inputs of 210–250 VAC, 50–400 Hz, replacing the standard 105–125 VAC input voltage range, is available on all models except those having an output current rating of 20 ma. To order, add the suffix "-230" to the model number, and $10.00 to the standard price.

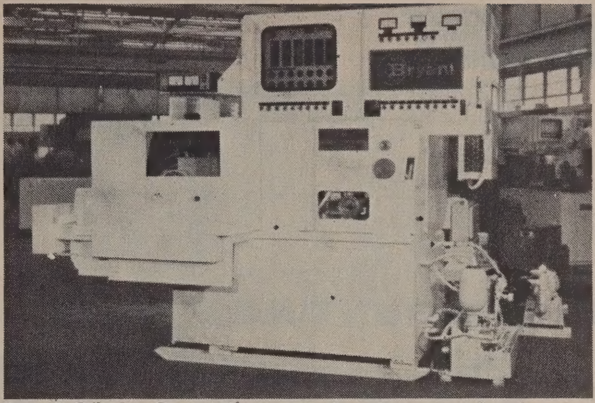

W
Q
H
NAME PLATE
FUSE
OUT
AC AC GND
E
B
C (Typ.)
D
Barrier strip with 5-40 Terminal Screws*
8-32 mounting holes Bottom and Side
.78
1.0
L
M
Bottom mounting 8-32 holes (4)
Side mounting 8-32 holes (4)
(None on size YH11)
V
Remove 8-32 screws for rear mounting
Y
+V
−V
AC AC GND
8-32 Terminal screws
*for case size YH11

Size	L	W	H	M	V	Y	Q	E	B	D	C	Approx. Weight
Y3	3.71	5.12	3.44	1.62	4.5	3.0	.56	1.37	.75	1.44	.375	2 lb. 8 oz.
Y5	5.09	5.12	3.44	3.00	4.5	3.0	.56	1.37	.75	1.44	.375	4 lb. 8 oz.
Y6	6.59	5.12	3.44	4.00	4.5	3.0	.56	1.37	.75	1.44	.375	7 lb. 8 oz.
YH11	11.25	7.37	5.12	8.0	6.75	4.56	1.10	2.64	1.25	2.25	.562	18 to 23 lb.



The cross-sectional dimensions of Series U power supplies permit efficient rear mounting on either 3½″ or 5¼″ rack assemblies. Threaded holes on three surfaces permit mounting in any position. See page 22.

Nominal Output Voltage	Output Amps.	Output Voltage N/L—F/L	Ripple Volts RMS	Price	Model	Size
4	.200	4.4 to 3.6	.2	$35	U4Y20	Y3
5	10.0 (@ 5.0)	7.6 to 3.0 (4.2)	1.8 (1.5)	85	U5Y1000	Y6
6	.800	6.6 to 5.4	.7	40	U6Y80	Y3
6	10.0 (@ 5.0)	8.8 to 3.9 (5.1)	2.2 (1.7)	85	U6Y1000	Y6
7	1.0	7.7 to 6.3	.8	40	U7Y100	Y3
8	.400	8.8 to 7.2	.4	35	U8Y40	Y3
9	1.0	9.9 to 8.1	.7	40	U9Y100	Y3
9	10.0 (@ 5.0)	11.5 to 5.7 (7.3)	2.5 (2.0)	85	U9Y1000	Y6
10	10.0 (@ 5.0)	12.4 to 6.4 (8.0)	2.7 (2.1)	85	U10Y1000	Y6
11	10.0 (@ 5.0)	14.0 to 7.6 (9.6)	3.0 (2.2)	85	U11Y1000	Y6
12	1.5	14.9 to 10.9	2.5	35	U12Y150	Y3
12	10.0 (@ 5.0)	16.0 to 9.2 (11.3)	3.4 (2.3)	85	U12Y1000	Y6
14	1.0	15.4 to 12.6	.7	40	U14Y100	Y3
14	10.0 (@ 5.0)	17.2 to 10.5 (12.2)	3.5 (2.4)	85	U14Y1000	Y6
15	10.0 (@ 5.0)	18.3 to 11.2 (13.4)	3.6 (2.4)	85	U15Y1000	Y6
16	1.0	17.6 to 14.4	.7	40	U16Y100	Y3
16	10.0 (@ 5.0)	19.5 to 12.0 (14.4)	3.7 (2.5)	85	U16Y1000	Y6
17	.250	18.7 to 15.3	.2	35	U17Y25	Y3
17	1.0	18.7 to 15.3	.7	40	U17Y100	Y3
18	1.0	19.8 to 16.2	.7	40	U18Y100	Y3
18	10.0 (@ 5.0)	22.0 to 14.0 (16.5)	4.0 (2.6)	85	U18Y1000	Y6
19	.600	20.9 to 17.1	.5	35	U19Y60	Y3
20	10.0 (@ 5.0)	24.8 to 16.5 (19.1)	4.2 (2.6)	85	U20Y1000	Y6
24	1.0	26.4 to 21.6	1.7	35	U24Y100	Y3
24	5.0	26.5 to 21.0	2.5	85	U24Y500	Y6
24	10.0	26.8 to 20.0	3.2	125	U24Y1000	Y6
24	17.0	26.4 to 21.6	1.5	160	U24Y1700	YH11
24	23.0	27.0 to 21.0	1.5	190	U24Y2300	YH11
25	5.0	28.1 to 22.3	2.5	85	U25Y500	Y6
27	5.0	30.0 to 24.0	2.6	85	U27Y500	Y6
28	1.0	30.8 to 25.2	1.7	35	U28Y100	Y3
28	5.0	31.2 to 24.8	2.6	85	U28Y500	Y6
28	8.0	31.4 to 25.0	3.2	125	U28Y800	Y6
28	15.0	30.8 to 25.2	1.5	160	U28Y1500	YH11
28	20.0	30.4 to 24.5	1.5	190	U28Y2000	YH11
30	1.0	33.0 to 27.0	1.6	45	U30Y100	Y5
30	2.0	33.0 to 27.0	1.5	65	U30Y200	Y5
30	5.0	33.0 to 26.5	2.6	85	U30Y500	Y6
32	.400	35.2 to 28.8	.6	35	U32Y40	Y3
32	5.0	35.5 to 28.0	3.3	85	U32Y500	Y6
35	1.0	38.5 to 34.5	1.6	45	U35Y100	Y5
35	2.0	38.5 to 31.5	1.5	65	U35Y200	Y5
35	5.0	38.0 to 30.0	3.3	85	U35Y500	Y6
37	.400	40.3 to 33.7	.6	35	U37Y40	Y3
37	5.0	40.5 to 32.2	3.3	85	U37Y500	Y6
38	5.0	43.0 to 34.0	3.3	85	U38Y500	Y6
40	1.0	44.0 to 36.0	1.6	45	U40Y100	Y5
40	2.0	44.0 to 36.0	1.5	65	U40Y200	Y5
40	5.0	45.0 to 37.0	3.3	85	U40Y500	Y6
41	.400	45.1 to 36.9	.6	35	U41Y40	Y3
42	5.0	48.0 to 36.0	6.5	85	U42Y500	Y6
44	.100	48.4 to 39.6	.7	50	U44Y10	Y3
44	2.0	48.4 to 39.6	1.5	65	U44Y200	Y5
45	1.0	49.5 to 40.5	1.6	50	U45Y100	Y5
45	5.0	51.0 to 38.5	6.5	85	U45Y500	Y6
48	.400	52.8 to 43.2	.6	45	U48Y40	Y3
50	1.0	55.0 to 45.0	1.6	50	U50Y100	Y5
52	.400	57.2 to 46.8	.6	45	U52Y40	Y3



Bryant Grinder Corporation uses Acopian unregulated power supplies in the programmable controller of the Centra-Form Grinder. The controller features a display which provides immediate diagnosis of machine malfunctions.

Nominal Output Voltage	Output Amps.	Output Voltage N/L—F/L	Ripple Volts RMS	Price	Model	Size
55	.250	60.5 to 49.5	.4	$45	U55Y25	Y3
55	1.0	59.4 to 48.4	2.8	55	U55Y100	Y5
56	.400	61.6 to 51.4	.6	50	U56Y40	Y3
60	1.0	65.3 to 53.0	2.8	60	U60Y100	Y5
62	.400	69.0 to 58.0	1.5	50	U62Y40	Y3
65	.250	71.5 to 58.5	.4	50	U65Y25	Y3
72	.250	79.2 to 64.8	.9	50	U72Y25	Y3
80	.150	88.0 to 72.0	.6	45	U80Y15	Y3
80	.300	88.0 to 72.0	1.0	50	U80Y30	Y3
85	.150	93.5 to 76.5	.6	50	U85Y15	Y3
90	.150	99.0 to 81.0	1.1	45	U90Y15	Y3
90	.400	99.0 to 81.0	2.2	55	U90Y40	Y3
95	.150	105 to 85	1.1	55	U95Y15	Y3
100	.200	110 to 93	1.0	55	U100Y20	Y3
110	.200	121 to 100	1.0	55	U110Y20	Y3
120	.200	132 to 110	1.0	55	U120Y20	Y3
130	.200	143 to 120	1.5	55	U130Y20	Y3
140	.200	154 to 126	1.7	60	U140Y20	Y3
150	.200	165 to 135	1.7	60	U150Y20	Y3
165	.200	176 to 144	1.7	60	U165Y20	Y3
170	.200	187 to 153	2.0	60	U170Y20	Y3
180	.200	190 to 162	2.0	60	U180Y20	Y3
200	.200	220 to 180	2.0	65	U200Y20	Y3
210	.100	231 to 189	2.0	55	U210Y10	Y3
215	.100	236 to 193	2.0	60	U215Y10	Y3
230	.100	252 to 207	3.0	60	U230Y10	Y3
250	.100	275 to 225	3.0	60	U250Y10	Y3
250	.200	275 to 225	5.0	80	U250Y20	Y5
275	.100	303 to 247	3.0	60	U275Y10	Y3
275	.200	303 to 247	3.6	80	U275Y20	Y5
300	.200	330 to 270	5.0	80	U300Y20	Y5
325	.200	360 to 295	6.0	80	U325Y20	Y5
340	.100	374 to 306	3.0	60	U340Y10	Y3
350	.200	385 to 330	6.0	80	U350Y20	Y5
360	.100	396 to 324	3.0	60	U360Y10	Y3
370	.100	407 to 333	3.0	60	U370Y10	Y3
375	.200	412 to 352	6.0	80	U375Y20	Y5
400	.200	440 to 360	6.0	80	U400Y20	Y5
420	.100	462 to 378	7.0	60	U420Y10	Y3
425	.200	467 to 383	9.1	80	U425Y20	Y5
450	.200	495 to 405	9.1	80	U450Y20	Y5
475	.020	523 to 426	3.1	50	U475Y02	Y3
475	.200	524 to 426	9.1	80	U475Y20	Y5
500	.200	550 to 450	9.1	80	U500Y20	Y5
525 †	.100	574 to 473	4.8	80	U525Y10	Y5
550 †	.100	605 to 495	4.8	80	U550Y10	Y5
575 †	.100	630 to 518	4.8	80	U575Y10	Y5
580 †	.020	638 to 522	3.1	55	U580Y02	Y3
600 †	.100	660 to 540	10.0	80	U600Y10	Y5
625 †	.100	680 to 565	10.0	80	U625Y10	Y5
650 †	.100	715 to 595	10.0	80	U650Y10	Y5
675 †	.100	732 to 608	10.0	80	U675Y10	Y5
700 †	.100	770 to 630	10.0	80	U700Y10	Y5
725 †	.100	790 to 665	10.0	80	U725Y10	Y5
750 †	.020	825 to 675	3.1	60	U750Y02	Y3
750 †	.100	838 to 710	13.0	80	U750Y10	Y5
800 †	.100	880 to 720	13.0	80	U800Y10	Y5
850 †	.100	935 to 765	13.0	80	U850Y10	Y5
900 †	.020	990 to 810	5.0	65	U900Y02	Y3
900 †	.100	990 to 810	13.0	80	U900Y10	Y5
950 †	.100	1045 to 855	13.0	80	U950Y10	Y5
1000 †	.100	1100 to 900	13.0	80	U1000Y10	Y5

†Not U.L. recognized when this catalog was published.

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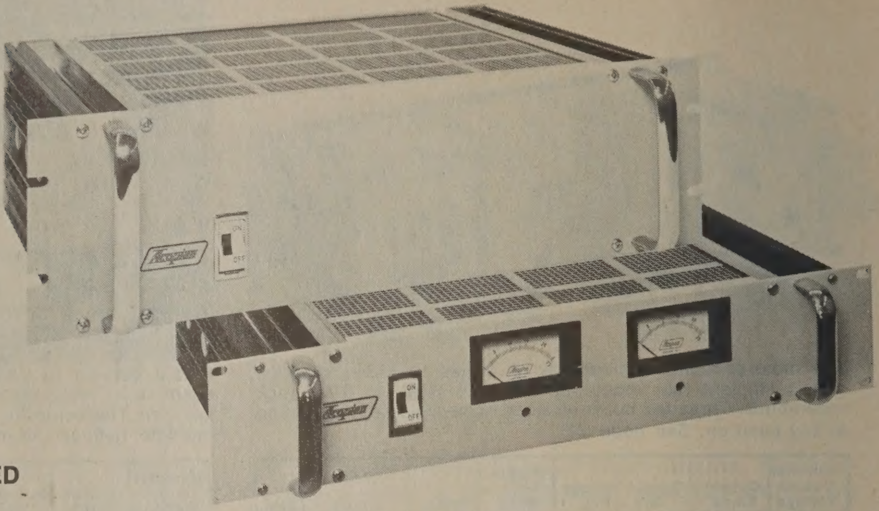


RACK MOUNTING

Up to 50 Volts
Up to 60 Amps

ALL MODELS U.L. RECOGNIZED

Acopian rack-mounting power supplies feature excellent regulation and ripple specifications in 76 models with outputs up to 50 volts and 60 amps. Metering and overvoltage protection are available as options. These power supplies are constructed in sturdy extruded aluminum assemblies designed expressly for mounting in standard 19″ wide RETMA cabinet racks. The front panels are finished in light gray enamel; sides are black; the remaining casework is finished in gold alodyne.

STANDARD FEATURES

- Excellent line and load regulation, low noise
- Convection cooled
- Silicon semiconductors for maximum reliability
- Short circuit proof
- Attractively finished in light gray enamel and gold alodyne

SPECIFICATIONS

Input Voltage: 105–125 VAC, 50–400 Hz, single phase.

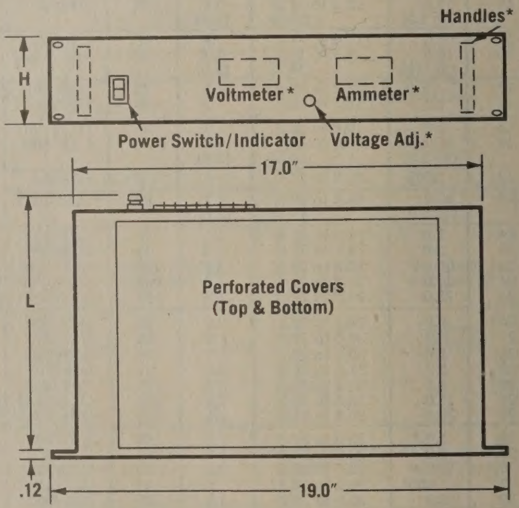
Output Voltage/Current:
Line Regulation:
Load Regulation:
Ripple:
Output Voltage Adjustment Range:
} See table.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

Storage Temperature: −55 to +85°C.

Ambient Operating Temperature: −20 to +55°C.

Protection: Short circuit. Overvoltage protection optional; see "Options."



*Optional

Size	H	L	Approx. Weight
3P11	3½	11.0	22lb
5P12	5¼	12.0	28lb
5P17	5¼	17.0	43lb

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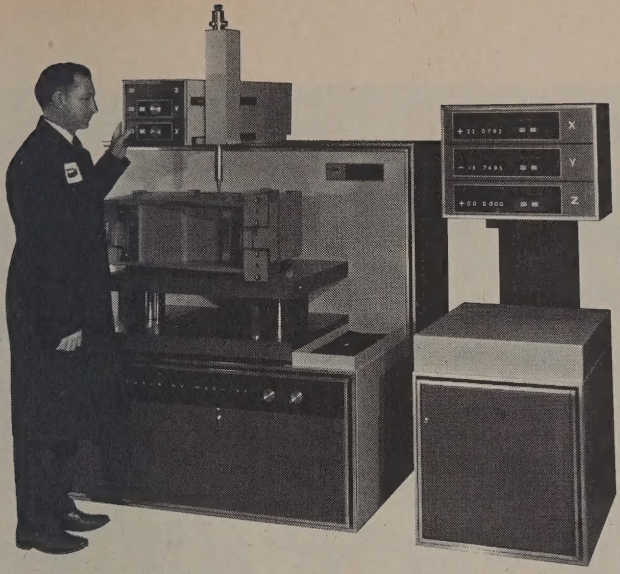
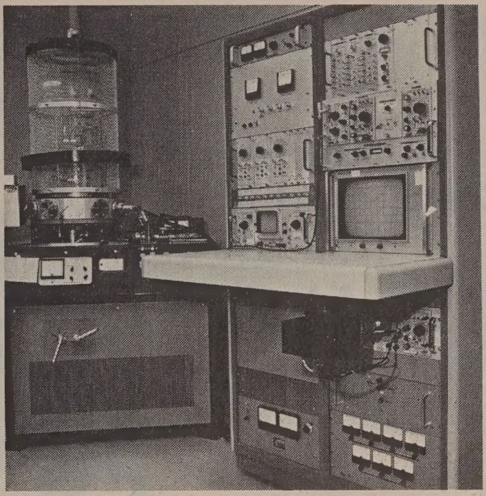


The Bendix Corp. eliminated the coupling of AC into the low level circuitry of this Cordax three-axis measurement system by using Acopian DC-output supplies for powering electromechanical components.



Sandia Laboratories uses Acopian power supplies in test equipment. Shown above is a Sandia electron beam nondestructive dielectric strength tester which is used to evaluate ceramic materials.

OPTIONS

Overvoltage Protection: An internally installed and preset overvoltage protector is available for all models. To order, add the prefix "V" to the model number and $25.00 to the price of models with an output current rating of 20 amps or less (at 40°C); add $75.00 to the price of higher current models.

Front Panel Voltage Adjustment: Standard models have a voltage adjustment located at the rear. A voltage control mounted on the front panel is available as an option. To order, add suffix "P" to the model number and $5.00 to price.

Voltmeter: Add suffix "F" to model number and $15.00 to price.

Ammeter: Add suffix "A" to model number and $15.00 to price.

230 Volt Input: Add suffix "-230" to model number and $10.00 to price.

Handles: Add suffix "H" to model number and $10.00 to price.

EXAMPLE: The Model 5PT20 equipped with all options is designated as the Model V5PT20AFHP-230. (List suffix letters in alphabetical sequence.)

Nominal Output Voltage	Adjust Range ±V	Output Current Amps.		Regulation		Ripple mv RMS	Price	Model	Size
		40°C	55°C	Load* ±%	Line* ±%				
1.5	.5	20	20	.005	.005	.25	$280	1.5PT20	3P11
1.5	.5	32	27	.005	.005	.25	330	1.5PT32	5P12
1.5	.25	60	47	.05	.05	1	525	1.5PT60	5P17
3	.5	20	20	.005	.005	.25	280	3PT20	3P11
3	.5	30	25	.005	.005	.25	330	3PT30	5P12
3	.25	60	47	.05	.05	1	525	3PT60	5P17
3.6	.5	20	20	.005	.005	.25	280	3.6PT20	3P11
3.6	.5	32	27	.005	.005	.25	330	3.6PT32	5P12
3.6	.25	60	47	.05	.05	1	525	3.6PT60	5P17
4	.25	60	47	.05	.05	1	525	4PT60	5P17
5	.5	20	20	.005	.005	.25	280	5PT20	3P11
5	.5	32	27	.005	.005	.25	330	5PT32	5P12
5	.25	60	47	.05	.05	1	525	5PT60	5P17
6	.5	20	20	.005	.005	.25	280	6PT20	3P11
6	.5	28	23	.005	.005	.25	330	6PT28	5P12
6	.25	58	45	.05	.05	1	525	6PT58	5P17
7	.5	20	20	.005	.005	.25	280	7PT20	3P11
8	.5	20	20	.005	.005	.25	280	8PT20	3P11
8	.5	28	23	.005	.005	.25	330	8PT28	5P12
8	.25	54	42	.05	.05	1	525	8PT54	5P17
9	.5	20	20	.005	.005	.25	330	9PT20	3P11
9	.5	52	41	.05	.05	1	550	9PT52	5P17
10	.5	20	20	.005	.005	.25	330	10PT20	3P11
10	.5	25	20	.005	.005	.25	350	10PT25	5P12
10	.5	50	39	.05	.05	1	550	10PT50	5P17
12	.5	17	17	.005	.005	.25	280	12PT17	3P11
12	.5	22	22	.005	.005	.25	330	12PT22	5P12
12	.5	45	35	.05	.05	1	550	12PT45	5P17
13	.5	16	16	.005	.005	.25	330	13PT16	3P11
13	.5	43	34	.05	.05	1	550	13PT43	5P17
14	.5	12	12	.005	.005	.25	280	14PT12	3P11
15	.5	10	10	.005	.005	.25	280	15PT10	3P11
15	.5	19	16	.005	.005	.25	330	15PT19	5P12
15	.5	40	31	.05	.05	1	590	15PT40	5P17
16	.5	10	10	.005	.005	.25	280	16PT10	3P11
18	.5	10	10	.005	.005	.25	280	18PT10	3P11
18	.5	18	15	.005	.005	.25	330	18PT18	5P12
18	.5	36	28	.05	.05	1	590	18PT36	5P17
20	.5	10	10	.005	.005	.25	$280	20PT10	3P11
20	.5	16	14	.005	.005	.25	330	20PT16	5P12
20	.5	32	25	.05	.05	1	590	20PT32	5P17
22	.5	10	10	.005	.005	.25	280	20PT10	3P11
24	.5	10	10	.005	.005	.25	280	24PT10	3P11
24	.5	15	13	.005	.005	.25	330	24PT15	5P12
24	.5	30	23	.05	.05	1	590	24PT30	5P17
25	.5	10	10	.005	.005	.25	280	25PT10	3P11
26	.5	10	10	.005	.005	.25	280	26PT10	3P11
28	.5	10	10	.005	.005	.25	280	28PT10	3P11
28	.5	14	12	.005	.005	.25	330	28PT14	5P12
28	.5	28	22	.05	.05	1	590	28PT28	5P17
30	.5	10	10	.005	.005	.25	330	30PT10	3P11
30	.5	14	12	.005	.005	.25	350	30PT14	5P12
32	.5	5	5	.005	.005	.25	230	32PT5	3P11
32	.5	10	10	.005	.005	.25	280	32PT10	5P12
34	.5	5	5	.005	.005	.25	230	34PT5	3P11
34	.5	10	10	.005	.005	.25	280	34PT10	5P12
35	.5	5	5	.005	.005	.25	230	35PT5	3P11
35	.5	10	10	.005	.005	.25	280	35PT10	5P12
36	.5	5	5	.005	.005	.25	230	36PT5	3P11
36	.5	10	10	.005	.005	.25	280	36PT10	5P12
38	.5	5	5	.005	.005	.25	280	38PT5	3P11
38	.5	10	10	.005	.005	.25	330	38PT10	5P12
40	.5	5	5	.005	.005	.25	280	40PT5	3P11
40	.5	10	10	.005	.005	.25	330	40PT10	5P12
42	.5	5	5	.005	.005	.25	280	42PT5	3P11
42	.5	10	10	.005	.005	.25	330	42PT10	5P12
44	.5	5	5	.005	.005	.25	280	44PT5	3P11
44	.5	10	10	.005	.005	.25	330	44PT10	5P12
45	.5	5	5	.005	.005	.25	280	45PT5	3P11
45	.5	10	10	.005	.005	.25	330	45PT10	5P12
46	.5	5	5	.005	.005	.25	280	46PT5	3P11
46	.5	10	10	.005	.005	.25	330	46PT10	5P12
48	.5	5	5	.005	.005	.25	280	48PT5	3P11
48	.5	10	10	.005	.005	.25	330	48PT10	5P12
50	.5	5	5	.005	.005	.25	280	50PT5	3P11
50	.5	10	10	.005	.005	.25	330	50PT10	5P12

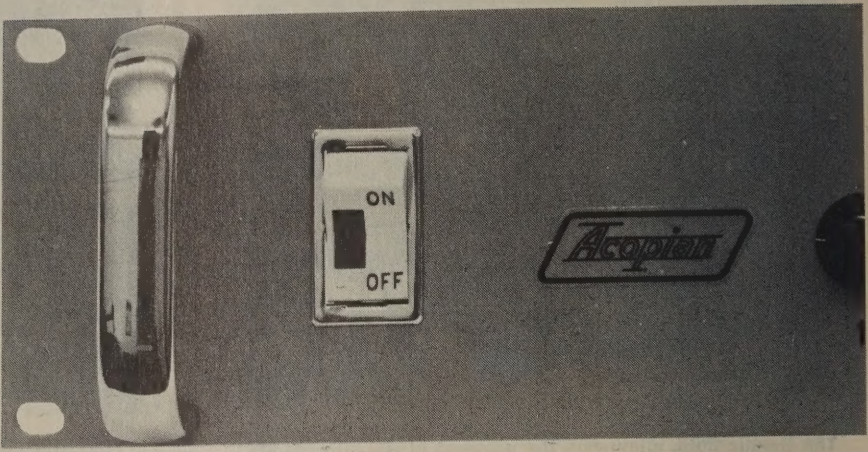
*or 2 mv, whichever is greater

ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919

MULTIPLE-OUTPUT POWER SUPPLY SYSTEMS

shipped in only

9 days



Now you can fill your requirements for completely wired multiple-output rack-mounting power supply systems, without any need to search through a catalog and prepare time-consuming mechanical layouts, item-by-item pricing and detailed purchase requisitions. Instead, simply call the Acopian "hotline" and specify the output voltages and currents that you require.

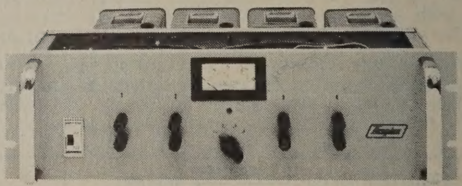
Acopian power systems offer the features that are most often required, and at reasonable cost. Each system is designed and constructed to provide an optimum mechanical and wiring configuration for the complement of power modules necessary to deliver the outputs specified. Acopian production expertise assures shipment of each system, completely wired and 100% tested, within 9 days after your order is received.

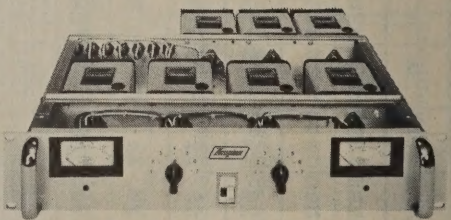
Ordering an Acopian power system is this easy:
List the DC outputs that you require. (Or, select the power modules that you wish to be included.) Note the system features which you consider necessary. Then, call the "Power Systems Hotline" collect at (215) 258-5441 and ask for the POWER SYSTEM DEPARTMENT.

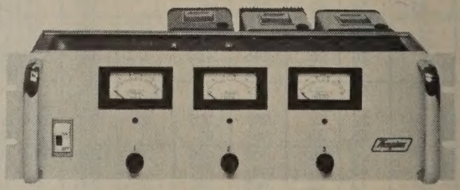
An Acopian Applications Engineer will answer—on the phone—any questions which you may have. A distinctive system model number will be assigned, and a firm price will be quoted. Your completely-wired power supply system will be shipped within 9 days.

System Description
Any of the power modules listed in this catalog can be included in a power system. The rack assembly will be designed and wired in a manner optimum for the complement of modules included.

TYPICAL BUILT-TO-ORDER POWER SUPPLY SYSTEMS







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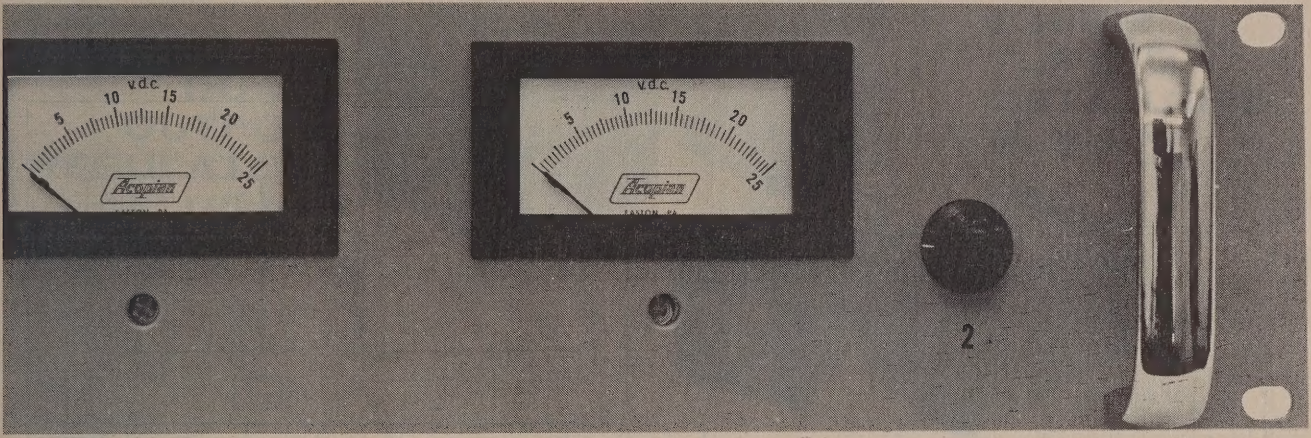


Now you can design your power system on the phone . . . just call Acopian.

Pricing of assemblies equipped with plug-in type power modules is calculated as indicated below, and includes wiring, all necessary fuses, power switch/indicator on front panel, and all input and output connections via terminal strip(s) at the rear. When rear panel space is insufficient for terminal strips, a connector may alternately be furnished. Minimum price, $150.00.

To obtain pricing information for assemblies containing other than plug-in type modules, contact factory.

Panel height (19″ wide)	Price (not including plug-in power modules)
3½″	$20.00 plus $5.00 per output
5¼″	$25.00 plus $5.00 per output
7″	$30.00 plus $5.00 per output
8¾″	$35.00 plus $5.00 per output
10½″	$40.00 plus $5.00 per output

Description

The standard front panel is ⅛-inch aluminum finished in light gray baked enamel. Also available, at no additional cost, are Emcor or Amco gray formed steel panels. (The panel can also be supplied in any other color conventional type enamel supplied by customer, at an additional charge of $10 per purchase order.)

The rear portion of the assembly is normally constructed from extruded aluminum panels, alodyne finished.

Accessories and Options

Voltmeters and/or ammeters – $15.00 each.

Front panel voltage adjustments – $5.00 each.

Front panel handles – $10.00/pair.

Chassis slides – $50.00/pair.

Other features and accessories

Should you require any non-standard features, call the Acopian "hotline" at Area Code 215, 258-5441 and discuss your needs with an Acopian Application Engineer. A procurement charge of $25.00 minimum (exclusive of material) will apply if components not stocked by Acopian are specified. Engineering charges to cover special layout and wiring may also apply. Extra charges are minimized and delivery accelerated when the customer provides any special components which he wishes to be incorporated into a power system.

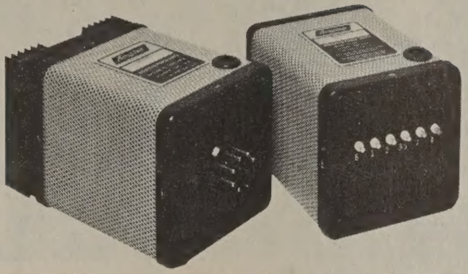
Redundant outputs — For applications where extreme reliability is a critical consideration, as in data communications and process controls, the use of redundant output power systems is recommended. Two power modules are included for each output and interwired in a manner permitting one to continue furnishing the required output should the other fail. See pages 24-25 for further information, or call the "Power Systems Hotline," (215) 258-5441.

Delivery — Shipment of your completely-wired power supply system will be made nine days after receipt of order. Of course, the famous Acopian three-day shipping guarantee on any of 82,000 different individual power modules remains unchanged.

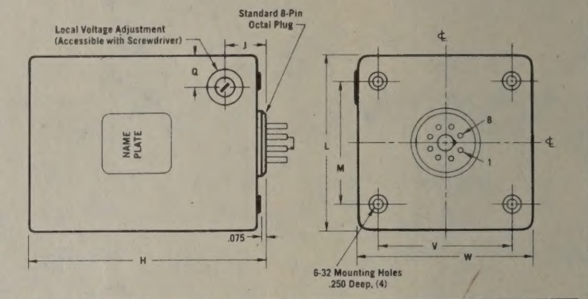
Guarantee—Acopian Corp. warrants each power supply system to be free from defects in material and workmanship for a period of five years from date of delivery.

Acopian

SINGLE OUTPUT REGULATED PLUG-IN



An Acopian plug-in power module can be installed in a matter of seconds. Simply plug it into an octal socket. You don't even have to screw it down (although threaded holes are provided) unless it is to be mounted in other than a vertical position, or will be subjected to shock or vibration.



Size	L	W	H	M	V	J	Q	Approx. Weight
AS	3.40	3.28	4.67	2.625	2.625	1.00	0.66	2lb 8oz
BS	3.40	3.28	5.25	2.625	2.625	1.00	0.66	2lb 14oz
TS	3.33	4.15	4.85	2.562	2.750	1.12	0.62	3lb 6oz
US	3.33	4.15	5.43	2.562	2.750	1.12	0.62	3lb 8oz
WS	3.40	5.02	5.43	2.562	3.562	1.12	0.62	4lb 14oz
HS	3.40	5.02	6.57	2.562	3.562	1.12	0.62	5lb

Standard models are available for any voltage from 1 to 200. For information on those not listed, contact factory.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Polarity: Output floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

Ambient operating temperature: −10 to +65°C. No derating required.

MIL Tested/Increased Temperature Range: Contact factory for specific information.

Storage Temperature: −55 to +85°C.

Installation: Plugs into standard octal socket. Mounting holes (6-32) provided at each corner for installation in any position.

OPTIONS

Solder Terminals: All models can be furnished with solder terminals instead of the octal-type plug. To order, add suffix "L" to model number and $5.00 to price.

Remote Output Adjustment: All models have a local voltage adjustment. When provision for remote (external) adjustment is also desired, add prefix "E" to model number. No increase in price.

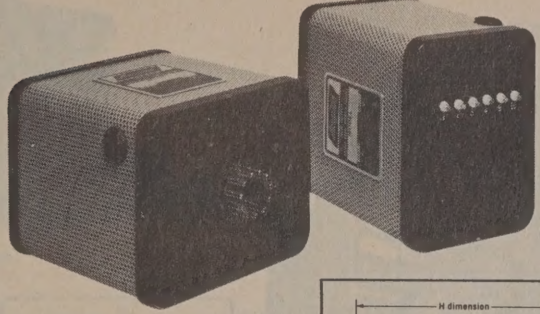
Remote Sensing: Provision for remote sensing of the output voltage to compensate for drops in the load lines can be furnished at an additional charge of $10.00 per unit. Add prefix "R" to model number when ordering. "R" power supplies have a local voltage adjustment and provision for remote (external) output adjustment.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "–230" to model number and $10.00 to price.

Nominal Output Voltage	Adjustment ±Volts	Output Current Amps.	Regulation Load ±%	Regulation Line ±%	Ripple mv RMS	Price	Model	Size
5	1	.050	.5	.5	5	$ 45	5L05	AS
5	1	.100	.5	.5	5	50	5L10	AS
5	1	.200	.5	.5	5	55	5L20	AS
5	1	.200	.2	.05	1	65	5J20	AS
5	1	.400	.3	.05	1	75	5J40	AS
5	1	.750	.4	.05	1	80	5J75	AS
5	.5	1.0	.5	.05	1	95	5J100	AS
5	.5	1.5	.4	.05	1	115	5J150	US
5	.5	2.0	.5	.05	1	145	5J200	WS
5	.5	3.0	.5	.05	1	155	5J300	WS
5	.5	4.0	.5	.05	1	165	5J400	HS
5	.5	5.0	.7	.05	1	180	5J500	HS
12	1	.100	.5	.5	5	45	12L10	AS
12	1	.200	.5	.5	5	50	12L20	AS
12	1	.200	.05	.05	0.5	60	12J20	AS
12	1	.400	.5	.5	5	70	12L40	AS
12	1	.400	.1	.05	1	75	12J40	AS
12	1	.750	.15	.05	1	80	12J75	AS
12	1	1.0	.1	.05	1	95	12J100	AS
12	.5	2.0	.1	.05	1	160	12J200	WS
12	.5	3.0	.25	.05	1	170	12J300	HS
15	1	.100	.05	.05	0.5	60	15J10	AS
15	1	.200	.05	.05	0.5	65	15J20	AS
15	1	.400	.5	.5	5	70	15L40	AS
15	1	.400	.1	.05	1	75	15J40	AS
15	1	.750	.5	.5	5	75	15L75	AS
15	1	.750	.15	.05	1	80	15J75	AS
15	1	1.0	.15	.05	1	95	15J100	AS
15	1	1.5	.2	.05	1	135	15J150	US
15	.5	2.0	.1	.05	1	160	15J200	WS
15	.5	3.0	.25	.05	1	170	15J300	HS
24	1	.100	.05	.05	0.5	60	24J10	AS
24	1	.200	.5	.5	5	65	24L20	AS
24	1	.200	.05	.05	0.5	70	24J20	AS
24	1	.400	.5	.5	5	70	24L40	AS
24	1	.400	.05	.05	1	75	24J40	AS
24	1	.750	.5	.5	5	75	24L75	AS
24	1	.750	.1	.05	1	85	24J75	AS
24	1	1.0	.1	.05	1	100	24J100	US
24	1	1.5	.15	.05	1	135	24J150	WS
24	.5	2.0	.1	.05	1	160	24J200	WS
28	1	.100	.05	.05	0.5	65	28J10	AS
28	1	.200	.5	.5	5	65	28L20	AS
28	1	.200	.05	.05	0.5	70	28J20	AS
28	1	.400	.5	.5	5	70	28L40	AS
28	1	.400	.05	.05	1	75	28J40	AS
28	1	.750	.1	.05	1	95	28J75	TS
28	1	1.0	.1	.05	1	105	28J100	US
28	1	1.5	.15	.05	1	150	28J150	WS
28	.5	2.0	.1	.05	1	175	28J200	WS

Acopian

DUAL OUTPUT REGULATED PLUG-IN



Space-saving Acopian duals combine two electrically independent DC outputs in a single case. Either identical or different outputs may be selected. And with a choice of more than 300 output ratings, over 10,000 combinations can be supplied . . . each with Acopian's usual 3-day shipment guarantee.

SPECIFICATIONS

Input Voltage: 105-125 VAC, 50-400 Hz, single phase.

Output Adjustment Range: ±1 volt.

Polarity: Outputs are floating. Each section may be independently connected to provide any combination of positive and negative outputs.

Short Circuit Protection: Delivers current surges without damage—to protect against prolonged overloads and shorts, use of an input fuse is recommended.

Ambient operating temperature: −10 to +65°C. No derating required.

MIL Tested/Increased Temperature Range: Contact factory for specific information.

Storage Temperature: −55 to +85°C.

HOW TO ORDER

Select the two sections desired. The complete model number is the combination of the two sections selected. Example: The combination of section 6J20D and section 12L40D is Model 6J20D-12L40D. Always assign the lower voltage section first. Where the indicated case sizes for the two sections differ, the larger case size applies.

For pricing purposes, add the cost of the individual sections selected.

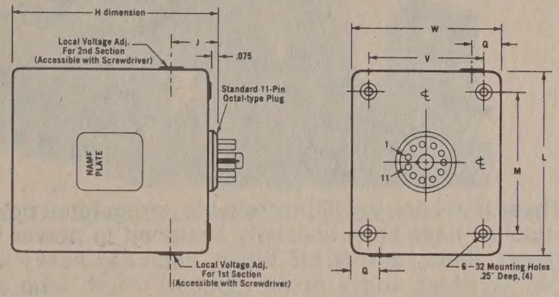
OPTIONS

Solder Terminals: All models can be furnished with solder terminals instead of the 11-pin plug. To order, add suffix "L" to model number and $5.00 to price.

Remote Output Adjustment: All models have local voltage adjustments. When provision for remote (external) adjustments is also desired, add prefix "E" to model number.

Remote Sensing: Provision for remote sensing of the output voltages, to compensate for drops in the load lines, can be furnished at an additional charge of $20.00 per unit. Add prefix "R" to model number when ordering.

230 Volt Input: All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "−230" to model number and $10.00 to price.



Size	L	W	H	M	V	J	Q	Approx. Weight
ADJ	3.28	3.40	4.60	2.625	2.625	1.0	.66	1lb 8oz
TDJ	4.15	3.33	4.85	2.750	2.562	1.12	.62	3lbs
UDJ	4.15	3.33	5.43	2.750	2.562	1.12	.62	3lbs
WDJ	5.02	3.40	5.43	3.562	2.562	1.12	.62	4lb 12oz

Standard models are available for any voltages from 1 to 150, and with current ratings to 1 amp. For information on those not listed, contact factory.

Nominal Output Voltage	Output Current Amps.	Regulation		Ripple mv RMS	Price per Section	Section (See "How to Order")	Size
		Load ±%	Line ±%				
5	.200	.2	.05	1	$64	5J20D	TDJ
5	.400	.3	.05	1	67	5J40D	TDJ
6	.100	.05	.05	1	60	6J10D	ADJ
6	.200	.5	.5	5	55	6L20D	TDJ
6	.200	.05	.05	1	64	6J20D	TDJ
6	.400	.5	.5	5	64	6L40D	TDJ
6	.400	.15	.05	1	67	6J40D	TDJ
10	.100	.05	.05	1	55	10J10D	ADJ
10	.200	.5	.5	5	55	10L20D	TDJ
10	.200	.05	.05	1	60	10J20D	TDJ
10	.400	.5	.5	5	64	10L40D	TDJ
10	.400	.1	.05	1	67	10J40D	TDJ
12	.100	.05	.05	1	55	12J10D	ADJ
12	.200	.5	.5	5	55	12L20D	TDJ
12	.200	.05	.05	1	60	12J20D	TDJ
12	.400	.5	.5	5	64	12L40D	TDJ
12	.400	.1	.05	1	67	12J40D	TDJ
15	.060	.02	.02	.25	44	15J06D	ADJ
15	.100	.05	.05	1	55	15J10D	ADJ
15	.200	.5	.5	5	55	15L20D	TDJ
15	.200	.05	.05	1	60	15J20D	TDJ
15	.400	.5	.5	5	64	15L40D	TDJ
15	.400	.1	.05	1	67	15J40D	TDJ
18	.100	.5	.5	5	55	18L10D	ADJ
18	.100	.05	.05	1	60	18J10D	ADJ
18	.200	.5	.5	5	60	18L20D	TDJ
18	.200	.05	.05	1	64	18J20D	TDJ
18	.400	.5	.5	5	64	18L40D	TDJ
18	.400	.1	.05	1	67	18J40D	TDJ
24	.100	.05	.05	1	60	24J10D	TDJ
24	.200	.5	.5	5	60	24L20D	TDJ
24	.200	.05	.05	1	64	24J20D	TDJ
24	.400	.5	.5	5	64	24L40D	TDJ
24	.400	.1	.05	1	67	24J40D	TDJ
28	.100	.05	.05	1	60	28J10D	TDJ
28	.200	.5	.5	5	60	28L20D	TDJ
28	.200	.05	.05	1	64	28J20D	TDJ
28	.400	.5	.5	5	64	28L40D	TDJ
28	.400	.05	.05	1	67	28J40D	TDJ
30	.100	.05	.05	1	60	30J10D	TDJ
30	.200	.5	.5	5	60	30L20D	TDJ
30	.200	.05	.05	1	64	30J20D	TDJ
30	.400	.5	.5	5	64	30L40D	TDJ
30	.400	.05	.05	1	67	30J40D	TDJ

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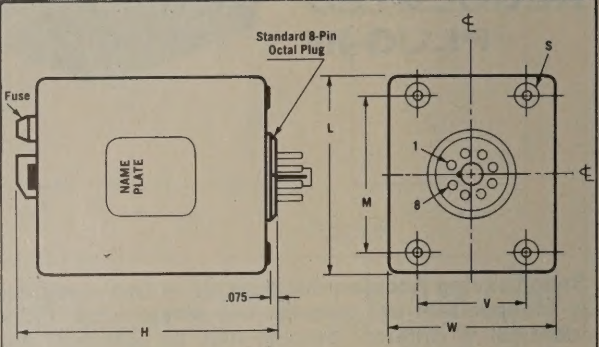
Acopian

UNREGULATED PLUG-IN FOR RELAYS, LAMPS AND NIXIE TUBES



Size	L	W	H	M	V	S	Approx. Weight
G	3.40	3.28	5.0	2.625	2.625	Four 6–32 x ¼″ deep mounting holes	2lb 8oz
K	4.15	3.33	5.2	2.750	2.562	Four 6–32 x ¼″ deep mounting holes	2lb 14oz
Q	4.15	3.33	7.0	2.750	2.562	Four 10–32 x ½″ long mounting studs	7lb

These low-cost, yet highly reliable unregulated power supplies have been specially designed to power DC relays, lamps and NIXIE tubes. Each has husky silicon rectifiers and a fused input to insure long and trouble-free operation. Installation consists of simply plugging the unit into a standard octal socket.

SPECIFICATIONS

Input Voltage: 0-125 VAC, 50-400 Hz, single phase.

Output Voltage:
Output Current: } See table.
Ripple:

Load Regulation: Nominal voltage is based on 115 VAC input with approximately one-half load. At no load, the output voltage will increase by approximately 10%. At full load, the output voltage will be reduced by approximately 10%.

Line Regulation: Output voltage change due to input voltage change is directly proportional to the change in input.

Polarity: Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

Ambient Operating Temperature: −10 to +65°C. No derating required.

Storage Temperature: −55 to 85°+.

Installation: Plugs into standard octal socket.

OPTIONS

Solder Terminals: All models can be furnished with solder terminals instead of the octal plug. To order, add suffix "L" to model number and add $10.00 to price. Example: Model 24U100 becomes 24U100L.

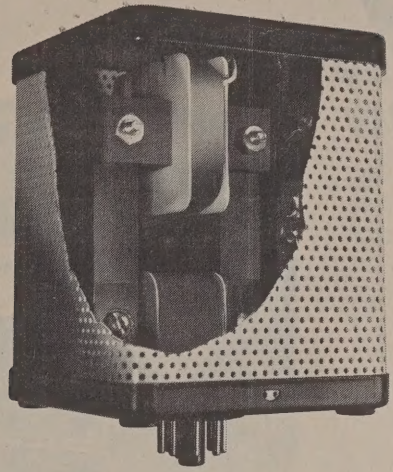
230 Volt Input: All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "-230" to model number and $10.00 to price.

Nominal Output Voltage	Output Current Amps.	Ripple Volts RMS	Model	Price	Size
4	.200	.2	4U20	$35	G
6	.800	.7	6U80	40	G
7	1.0	.8	7U100	40	G
7	2.0	1.5	7U200	60	Q
8	.400	.4	8U40	35	G
9	.600	.6	9U60	35	G
9	1.0	.7	9U100	40	G
13	.600	.5	13U60	35	G
13	2.5	1.8	13U250	65	Q
14	1.0	.7	14U100	40	G
16	1.0	.7	16U100	40	G
18	1.0	.7	18U100	40	G
20	3.0	2.3	20U300	65	Q
22	.400	.7	22U40	40	G
24	.600	1.1	24U60	35	G
24	1.0	1.7	24U100	35	G
24	3.0	2.2	24U300	65	Q
28	1.0	1.7	28U100	35	G
28	3.0	2.7	28U300	65	Q
30	1.0	1.6	30U100	45	K
30	2.0	1.5	30U200	65	Q
32	.400	.6	32U40	35	G
35	1.0	1.6	35U100	45	K
35	2.0	1.5	35U200	65	Q
40	1.0	1.6	40U100	45	K
40	2.0	1.5	40U200	65	Q
45	1.0	1.6	45U100	50	K
48	.400	.6	48U40	45	G
56	.400	.6	56U40	50	G
62	.300	2.7	62U30	50	K
72	.250	.9	72U25	50	G
80	.150	.6	80U15	45	G
80	.300	1	80U30	50	K
100	.200	1	100U20	55	K
120	.200	1	120U20	55	K
140	.200	2	140U20	60	K
150	.200	2	150U20	60	K
160	.100	1.7	160U10	55	G
*180	.100	1.7	180U10	55	G
*200	.150	2	200U15	60	K
250	.100	3	250U10	60	K
340	.100	3	340U10	60	K
420	.100	6.7	420U10	60	K
475	.020	3.1	475U02	50	G
580	.020	3.1	580U02	55	G
750	.020	3.1	750U02	60	G
900	.020	5	900U02	65	G

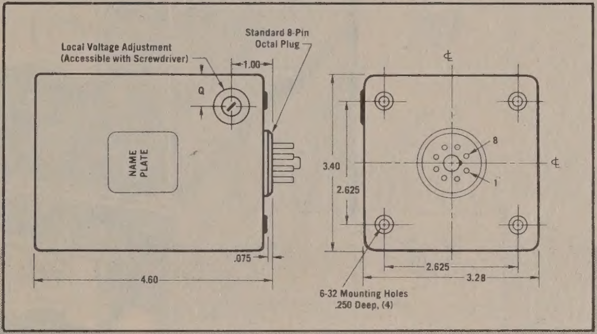
*Suitable for supplying input voltages to NIXIE tubes. NIXIE is a registered trademark of Burroughs Corporation.

Acopian

HIGH ISOLATION REGULATED PLUG-IN



For applications where high isolation in a regulated power supply is required, such as in powering strain gage and other transducer bridge circuits, Acopian offers models with ratings from 5 to 36 volts and 0.050 to 0.200 amperes. All models feature input-output isolation of 10,000 megohms minimum to ground in parallel with 10 pF maximum. To install, simply plug into a standard octal socket. No other mounting is normally required, but threaded holes are provided in the base for fastening the module in other than a vertical position, or to secure it against shock or vibration. Both slot (narrow adjustment about a nominal voltage) and wide voltage adjustment models are available.


Local Voltage Adjustment (Accessible with Screwdriver)
Standard 8-Pin Octal Plug
1.00
Q
NAME PLATE
.075
4.60
3.40
2.625
8
1
2.625
3.28
6-32 Mounting Holes .250 Deep, (4)

SPECIFICATIONS

Isolation: 10,000 megohms to ground (min) in parallel with 10 pF (max).

Leakage Current: 10 uA max.

Input-Output Coupling: 1 pF max.

Input Voltage: 105-125 VAC, 50-60 Hz, single phase.

Output Voltage:
Output Current:
Voltage Adjustment:
Ripple:
See table.

Load Regulation: ±0.05%

Line Regulation: ±0.05%

Polarity: Output floating; either positive or negative terminal may be grounded.

Ambient Operating Temperature: −20 to +71°C. No derating required.

Storage Temperature: −55 to +85°C.

Installation: Plugs into standard octal socket. Mounting holes (6-32) provided at each corner for installation in any position.

Weight: 1 lb 8 oz

OPTIONS

Remote Output Adjustment: All standard models are provided with local voltage adjustment. For remote (external) adjustment, add prefix "E" to model number. Example: Model 15X10 will be E15X10. No increase in price.

Solder Terminals: All Acopian plug-in power supplies are also available with solder terminals in place of an octal-type plug. To order, add suffix "L" to model number and $5.00 to price. Example: Model 12X20 becomes Model 12X20L.

Nominal Output Voltage	Adjustment ± Volts	Output Current Amps.	Ripple μV RMS	Price	Model
5	1	.100	250	$75	5X10
5	1	.200	350	95	5X20
6	1	.100	250	75	6X10
6	1	.200	350	95	6X20
7	1	.100	250	75	7X10
7	1	.200	350	95	7X20
8	1	.100	250	75	8X10
8	2	.150	300	95	8X15
8	1	.200	350	95	8X20
9	1	.100	250	75	9X10
9	1	.200	350	95	9X20
10	1	.100	250	75	10X10
10	2	.150	300	95	10X15
10	1	.200	350	95	10X20
12	1	.100	250	75	12X10
12	1	.200	350	95	12X20
15	1	.100	250	75	15X10
15	1	.200	350	95	15X20
16	1	.100	250	75	16X10
16	1	.200	350	95	16X20
18	1	.100	250	75	18X10
18	2	.150	300	95	18X15
18	1	.200	350	95	18X20
20	1	.100	250	75	20X10
20	1	.200	350	95	20X20
22	1	.100	250	75	22X10
22	2	.150	300	95	22X15
22	1	.200	350	95	22X20
24	1	.100	250	75	24X10
24	2	.150	300	95	24X15
24	1	.200	350	95	24X20
25	1	.100	250	75	25X10
25	2	.150	350	95	25X15
28	1	.100	250	75	28X10
28	2	.150	350	95	28X15
30	1	.050	200	75	30X05
30	2	.100	250	95	30X10
32	1	.050	200	85	32X05
32	2	.100	250	95	32X10
34	1	.050	200	85	34X05
34	2	.100	250	95	34X10
35	1	.050	200	95	35X05
36	1	.050	200	95	36X05

Acopian

Acopian
VOLTS
V COARSE
V FINE
CURRENT
AMPS
ON
V
A

BENCHTOP POWER SUPPLIES

These benchtop power supplies provide all the performance and operating features necessary in a laboratory instrument. A wide choice of single and multiple output models offer optimum combinations of the operating features and output ratings that are most often needed.

They are also "human engineered" for convenience and ease of use. Two meters provide for the simultaneous monitoring of voltage and current on single output supplies, or a combination of two output voltages or currents on dual and triple output models. When more than one is required, they may be stacked to conserve bench space. Interlocking design prevents the upper units from slipping off.

Coarse and fine voltage controls permit setting outputs to a high degree of resolution, and adjustable current limiting prevents the load from drawing a higher current than intended. Many models provide constant voltage/constant current crossover, and may be used to deliver a regulated current to a varying impedance load. Some also include adjustable overvoltage protection.

The rugged casework is attractively finished in black and gold. "Five way" output binding posts and a retracting handle contribute to user convenience.

SPECIFICATIONS

Input Voltage: 105-125 Vac, 50-400 Hz, single phase.

Output Ratings: See table.

Regulation, Ripple (constant voltage operation):
Line Regulation: ±0.01% or 2 mv, whichever is greater.
Load Regulation: ±0.01% or 2 mv, which is greater.
Ripple: 0.25 mv rms.
(Model KT7-20, ±10-20 V outputs only: Line regulation, ±0.05%; load regulation, ±0.05%, ripple, 1.0 mv rms.)

Regulation, Ripple (constant current operation):
Line Regulation: 2.0 ma (Model K7S500, 6.0 ma).
Load Regulation: 10.0 ma.
Ripple: 1.0 ma rms (Model K7S500, 2.0 ma rms).

Output Current Control: Outputs marked ACL are short circuit and overload protected by means of a continuously adjustable rolloff type current limiting circuit.

Output marked CV/CC deliver a constant voltage with increasing load until the current limiting point (continuously adjustable) is reached, beyond which voltage decreases as required to maintain a constant current. In addition to providing short circuit and overload protection, this feature permits the supply to be used as a current regulated power source.

Temperature Coefficient: 0.015%/° C.

SINGLE OUTPUT MODELS

OUTPUT VOLTAGE RANGE	OUTPUT CURRENT, AMPS.	CURRENT CONTROL	PRICE	MODEL	CASE SIZE
0-7	1.0	ACL	$99	K7S100	K9
0-7	2.0	CV/CC	135	K7S200	K10
0-7	5.0	CV/CC	190	K7S500	K11
0-18	0.6	ACL	99	K18S60	K9
0-18	1.0	CV/CC	120	K18S100	K10
0-32	0.35	ACL	99	K32S35	K9
0-32	0.6	CV/CC	120	K32S60	K10
0-50	0.35	CV/CC	120	K50S35	K10

DUAL OUTPUT MODELS

OUTPUT VOLTAGE RANGES	CURRENT PER OUTPUT, AMPS.	CURRENT CONTROL	PRICE	MODEL	CASE SIZE
0-20/0-20	0.25	ACL	$139	K20D25	DK9
0-20/0-20	0.5	ACL	175	K20D50	DK10

TRIPLE OUTPUT MODEL

OUTPUT VOLTAGE RANGE	CURRENT PER OUTPUT, AMPS.	CURRENT CONTROL	PRICE	MODEL	CASE SIZE
0-7 ±10-20 (tracking)	2.0 0.5	CV/CC Fixed	$235	KT7-20	TK10

Stability: Over an eight-hour period, following a 30 minute warmup.
Constant voltage operation: 0.1%.
Constant current operation: 15 ma.

Temperature Range:
Operating: 0 to +50° C.
Storage: −40 to +85° C.

Protection:
Input: Line fuse.
Overload: Adjustable electronic current limiting.
Overvoltage: "Crowbar" circuit, continuously adjustable down to 3 volts, protects load by effectively short circuiting output when "crowbar" trip point setting is exceeded. (Models K7S200, K7S500 and KT7-20 only.)

Transient Response Time: Less than 50 μsec, for a step change in input from 105 to 125 Vac, or in output current from no load to full rated output current.

Output Impedance (constant voltage operation):
Less than 0.03 ohms from dc to 1 kHz.
Less than 0.5 ohms from 1 kHz to 100 kHz.

Meters: Two, each accurate to 2% of full scale. On multiple output models, selector switches permit monitoring every output voltage and current.

Controls:
Power switch
Output voltage, coarse and fine adjustments
Output current limit
Overvoltage protection trip point (Models K7S200, K7S500 and KT7-20 only)
Meter switches (multiple output models only)

Construction: Gold-finished extruded aluminum top and sides. Bottom, perforated aluminum panel. Front and rear panels, molded black phenolic. Retracting handle. Input power cord, 3-wire UL approved. Output connections, "five way" binding posts.

Case Size	Dimensions (overall) H x W x D (inches)	Approx. Weight
K9 DK9	3.3 x 8.5 x 10.9	4 lb 1 oz 4 lb 6 oz
K10 DK10 TK10	3.3 x 8.5 x 11.3	5 lb 5 lb 6 oz 7 lb 6 oz
K11	3.3 x 8.5 x 12.2	7 lb 8 oz

Warranty:
All Acopian products listed in this brochure are covered by a firm five year warranty which includes the cost of both parts and labor.

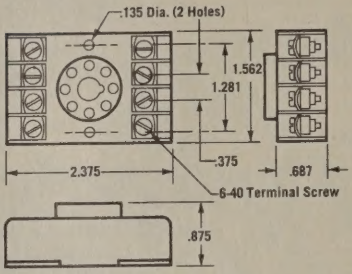
ACCESSORY SOCKETS

FOR PLUG-IN TYPE POWER SUPPLIES

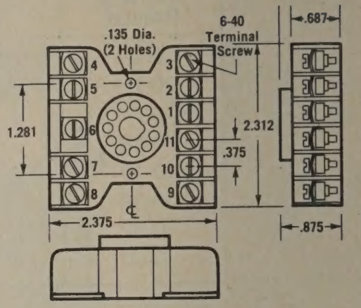
RETMA-numbered screw-type terminals simplify wiring and permit the use of wire terminals or bare wire, 12 to 20 gauge. Rated at 300 volts RMS, 10 Amp.

FOR MINIATURIZED POWER MODULES

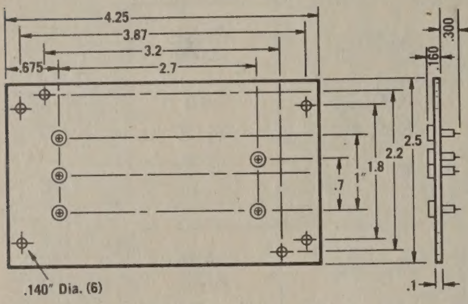
Each of these sockets has a sturdy phenolic base with gold plated teflon-insulated contacts.


.135 Dia. (2 Holes)
1.562
1.281
.375
.687
2.375
6-40 Terminal Screw
.875

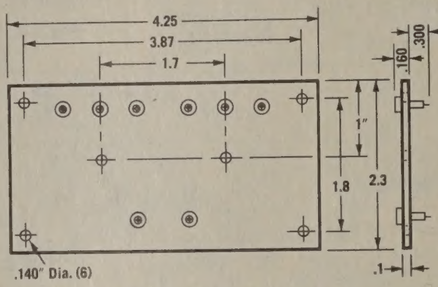
Model SL608 (for 8-pin plugs) . . . . $5.00 ea.


.135 Dia. (2 Holes)
6-40 Terminal Screw
.687
4
5
6
7
8
3
2
1
11
10
9
1.281
2.312
.375
2.375
.875

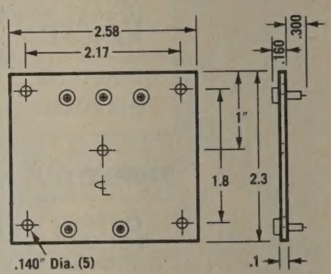
Model SL611 (for 11-pin plugs) . . . . $5.00 ea.


4.25
3.87
3.2
.675
2.7
.300
.160
2.5
2.2
1.8
1"
.7
.140" Dia. (6)
.1

Model EL-1 (for case sizes EL-10, EL-13 and EL-20) . . . . $5.00 ea.

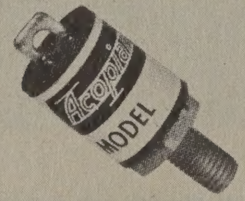

4.25
3.87
1.7
.300
.160
1"
1.8
2.3
.140" Dia. (6)
.1

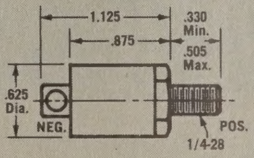
Model END-1 (for case sizes END and ENS) . . . . . . $5.00 ea.


2.58
2.17
.300
.160
1"
1.8
2.3
.140" Dia. (5)
.1

Model ES-1 (for case size ES-10) . . . . $3.50 ea.

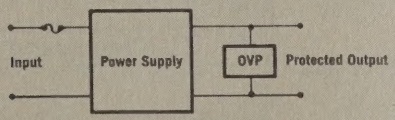
OVERVOLTAGE PROTECTORS


Acopian
MODEL


1.125
.875
.330 Min.
.505 Max.
.625 Dia.
NEG.
POS.
1/4-28

An Acopian "crowbar" overvoltage protector prevents the output voltage of a power supply from exceeding the voltage rating of the protector under any condition. Any higher voltage switches the protector "on," short circuiting the power supply output and disabling the supply by causing the input fuse to blow. They are often used to protect integrated circuits and other sensitive loads.

Note: Insulated mounting hardware is included.


Input
Power Supply
OVP
Protected Output

SPECIFICATIONS

Voltage Ratings: See table.

Maximum Current: 25 Amp.

Operating Temperature Range: −20 to +75°C.

Response Time: < 500 nsec.

Standby Power: 1 mw/volt (approx.)

For voltages higher than those listed, contact factory.

For use on output of (volts)	Trip Voltage Range*		Model	Price
	Minimum	Maximum		
3	3.4	4.2	3P25	$25
3.6	4.0	5.0	3.6P25	25
4	4.5	5.6	4P25	25
5	5.7	6.8	5P25	25
6	6.8	8.2	6P25	25
7	8.0	9.4	7P25	25
8	9.1	10.8	8P25	25
9	10.2	12.0	9P25	25
10	11.5	13.3	10P25	25
11	12.7	14.7	11P25	25
12	13.8	15.9	12P25	25
13	14.9	17.2	13P25	25
14	16.1	18.5	14P25	25
15	17.2	19.6	15P25	25
16	18.4	21.0	16P25	25
17	19.5	22.3	17P25	25
18	20.7	23.5	18P25	25
19	21.8	24.7	19P25	25
20	23.0	26.2	20P25	25
21	24.1	27.3	21P25	25
22	25.3	28.6	22P25	25
23	26.5	30.0	23P25	25
24	27.6	31.1	24P25	25
25	28.8	32.3	25P25	25
26	29.9	33.5	26P25	25
27	31.0	34.6	27P25	25
28	32.2	35.8	28P25	25
29	33.4	37.0	29P25	35
30	34.5	38.2	30P25	35
32	36.8	40.8	32P25	35
34	39.1	43.3	34P25	35
35	40.2	44.5	35P25	35
36	42.4	46.8	36P25	35
38	44.7	49.2	38P25	35
40	47.0	51.5	40P25	35
42	49.0	53.9	42P25	35
44	51.1	56.3	44P25	35
45	52.1	57.4	45P25	35
46	53.2	58.6	46P25	35
48	55.2	60.6	48P25	35

*Range indicated takes into account all tolerances and drift due to temperature changes from −20 to +75°C.

Acopian

WHAT DOES ACOPIAN'S 3-DAY SHIPPING PROMISE MEAN?

For more than a decade, Acopian has been shipping standard AC to DC power modules three days after receipt of an order. During this period, the Acopian line has expanded from the original plug-in modules to a number of complete power supply families.

Our unique 3-day shipping guarantee has prompted many questions. Here are some of those most often asked.

Q. What does Acopian's 3-day shipping promise mean?

A. It means that any time you order power modules selected from our catalog, shipment will be made 3 days after we receive your purchase order.

Q. Has Acopian ever failed to meet this promise?

A. Never.

Q. Do I have to ask for 3-day shipment on my order?

A. No. It's automatic. In fact, you must tell us if you want the shipment delayed.

Q. What if I need four or five different models? Does Acopian still keep the 3-day promise?

A. Yes. Guaranteed 3-day shipment applies to one model or to a combination of models.

Q. Is the 3-day promise affected by quantity? Suppose we need 50 or 100 pieces?

A. The 3-day promise applies to small quantities. Acopian will ship a portion of a larger order in 3 days and, after discussing your requirements with you, schedule the balance.

Q. What do you mean by a "portion"? Isn't Acopian hedging?

A. Not at all. Our experience substantiates that shipping five or ten units in 3 days will get almost any project underway. Rarely are larger quantities required at one time.

Q. It takes me so long to get a requisition processed and approved that your 3-day shipment doesn't mean much to me. What's your answer to this problem?

A. Processing your internal paperwork is out of our control. However, verbal orders are acceptable. We suggest you ask your purchasing people to use the phone. Telephone orders to our area representatives are also shipped in 3 days. All we require is the purchase order number.

Q. How long after you ship will I have the power supplies?

A. Transportation time is out of our control. Some carriers are quite efficient. Even overnight service coast-to-coast is not unusual. Your purchasing department probably knows the fastest shipping method to your location. If not, Acopian can recommend the fastest carrier.

Q. I'm curious. You say Acopian has never failed to meet the 3-day promise. How do you do it?

A. We can't tell you all of the details, but it's in our attitude and commitment supported by efficient personnel, streamlined procedures and modern facilities. Facilities that have been designed and equipped specifically to meet our 3-day shipping promise.

It may surprise you to know we manufacture each power supply to order and do not ship from inventory.

Q. I've seen other power supply manufacturers advertise "stock delivery." Why should I consider 3-day shipment a significant benefit?

A. Because a "delivery-from-stock" promise is not precise. It may even be misleading. Consider what happens if the power module you require is out-of-stock when your order reaches a typical vendor. Four to six weeks is not unusual before inventory is replenished and your order is shipped. Consider further how this problem is compounded when you need four or five regulated outputs for your project. The significant difference, then, is that fulfillment of a "ship-from-stock" promise is dependent on a variable —the quantity in stock when your order is received. Acopian's 3-day shipment promise contains no unknowns.

Q. In a legitimate emergency, do you ever do better than 3 days?

A. Yes. Please call in an emergency. If we can't do it, we'll tell you immediately.

If you don't find the answers to your questions here, please call or write to our Vice-President, Marketing. You will receive a prompt and straightforward reply.

ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919 • 3-DAY SHIPMENT GUARANTEED **31**

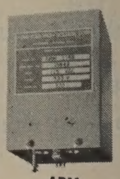
High Voltage Power Supplies and Modules

Telephone: (213) 997-7222

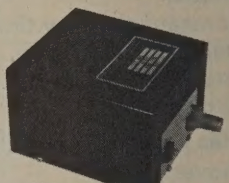
Advanced High Voltage Company makes many other types of High Voltage Supplies. Telephone for complete catalog and application assistance.

Eout Nom. kV	Iout Max. mA	Model No.	Features, Specifications and Options
200V 400V 600V 800V 1.1 1.5 2.0	15.0 7.5 5.0 3.7 3.0 2.0 1.5	DRF 325 DRF 335 DRF 345 DRF 355 DRF 365 DRF 375 DRF 385	Miniature, fully regulated DC to DC converter with 0.05% line and load regulation. Has remote programming capability. 3 watts output. Shielded, RFI decoupled. **Input:** 28 VDC. **Output Adjustment Ranges:** −30% to +10%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** −10°C to +65°C. **Dimensions:** 3.0″ x 1.5″ x 0.6″. (Flange length is 3.625″.) **Weight:** 4 oz. **Options:** Negative output (−01), remote program (−05), ±15 volt input (−33). Other options.
200V 400V 600V 800V 1.1 1.5 2.0	15.0 7.5 5.0 3.7 3.0 2.0 1.5	DUG 103 DUG 113 DUG 123 DUG 133 DUG 143 DUG 153 DUG 163	Miniature DC to DC converter similar to DRF series above, but with floating output. Units are line regulated adjustable and/or programmable. Minimum adjustment range is −20% to +10%. Other electrical and mechanical specifications same as DRF series.
200V 400V 600V 800V 1.0 1.2 1.5 1.8 2.2	30.0 15.0 10.0 7.5 6.0 5.0 4.0 3.3 2.7	ARM 016 ARM 026 ARM 036 ARM 046 ARM 056 ARM 066 ARM 076 ARM 086 ARM 096	Line operated, 6 watt supply for photomultiplier and similar applications. Units are shielded, serviceable short circuit proof and light weight. Input and output are RFI decoupled. Standard adjustment range is −30% to +10%. Series has wide range of options. **Input:** 117 VAC, 50 to 400 Hz. **Regulation (L/L):** 0.02%, (better with less than 0 to full load changes). **Ripple and Noise:** 0.02%. **Operating Temperature:** −10°C to +65°C. **Size:** 3.04″ x 2.60″ x 4.23″. **Weight:** 32 oz. **Options:** Negative output (−01), wide adjustment range (−04), remote program (−05). Other options.
3.0 4.0 5.0 8.0 10 12 15 18 22	5.0 4.0 3.0 2.0 1.5 1.3 1.0 0.8 0.7	ARA 106 ARA 116 ARA 126 ARA 146 ARA 156 ARA 166 ARA 176 ARA 186 ARA 196	Line operated, 15 watt High Voltage Module. Adjustable and/or programmable to zero. Fully serviceable, short circuit proof and shielded. Standard adjustment range is −30% to +10%. **Input:** 117 VAC, 50 to 400 Hz. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** −10°C to +65°C. **Dimensions:** 4.66″ x 3.98″ x 3.0″. **Weight:** 3.5 lbs. **Options:** 0 to 110% voltage adjustment (−03), remote program (−05), negative output (−01), lower ripple figure (−09). Other options.
800V 1.0 1.5 2.5 3.5 5.0 7.5 10 12.5 15 18 22	18.0 15.0 10.0 6.0 4.0 3.0 2.0 1.5 1.2 1.0 0.8 0.6	DRM 105 DRM 115 DRM 125 DRM 135 DRM 145 DRM 155 DRM 165 DRM 175 DRM 185 DRM 195 DRM 205 DRM 215	Fully regulated High Voltage Module. 15 watts output. All solid state silicon. Output adjustment +10%, −30%. Short-circuit proof. HV return may be floated to 500 volts from chassis. Magnetically shielded. Serviceable. **Input:** 28 VDC. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 150 ppm. **Operating Temperature:** −20°C to +65°C. **Options:** Negative output (−01), wider adjustment range (−04), remote program (−05), wider operating temperature range (−16), 30 watts output power (−19), 15 volts input (−33). Size: 2.34 x 2.7 x 3.77 (to 5 KV), 3.04 x 3.54 x 4.84 (over 5 KV). Other options.
800V 1.0 1.5 2.5 3.5 5.0 7.5 10 12.5 15 18	18.0 15.0 10.0 6.0 4.0 3.0 2.0 1.5 1.2 1.0 0.8	DUM 044 DUM 054 DUM 064 DUM 074 DUM 084 DUM 094 DUM 104 DUM 114 DUM 124 DUM 134 DUM 144	28 VDC operated High Voltage Modules similar to DRM series above, except HV output is not in the regulation loop. This allows floating HV option with only 30 to 40 pf capacitance to input. More economical than DRM series where the higher internal impedance can be tolerated. (See regulation graph.) Input regulation, ripple and other data per DRM series.

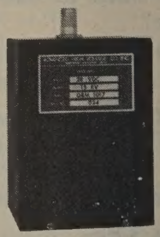
DRF/DUG



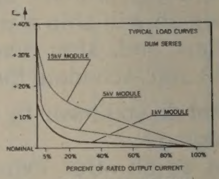
ARM



ARA



DRM/DUM

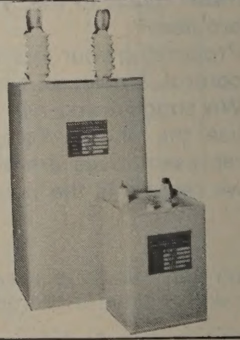


DUM LOAD CURVES

Eout Nom. kV	Iout Max. mA	Model No.	DC Output Impedance Megohms	Case Width	Case Depth	Case Height	Terminal Height	Approx. Weight Pounds
				Inches				
1.0	1.5	AUC 017	0.90	3.75	1.75	3.38	0.38	1
1.0	5.0	AUC 015	0.65	3.75	2.25	3.38	0.38	1
1.0	10.0	AUC 011	0.04	3.75	2.25	3.38	0.38	2
2.0	1.5	AUC 027	0.13	3.75	1.75	3.38	0.38	1
2.0	5.0	AUC 025	0.10	3.75	2.25	3.38	0.38	2
2.5	10.0	AUC 031	0.08	3.75	2.25	3.75	0.63	3
5.0	1.5	AUC 037	0.40	3.75	2.25	3.38	0.56	2
5.0	5.0	AUC 035	0.25	3.75	2.25	3.75	0.63	3
5.0	10.0	AUC 041	0.13	3.75	4.56	5.88	1.06	11
10	1.5	AUC 047	1.50	3.75	3.19	4.50	1.06	4
10	5.0	AUC 045	0.50	3.75	4.56	5.88	1.06	8
10	10.0	AUC 051	0.26	3.75	4.56	8.00	1.06	12
15	1.5	AUC 057	1.60	3.75	3.19	5.50	1.69	5
15	5.0	AUC 055	0.50	3.75	4.56	6.13	1.69	11
15	10.0	AUC 061	0.28	4.69	6.00	8.50	1.69	20
20	1.5	AUC 067	1.70	3.75	4.56	5.88	2.25	9
20	5.0	AUC 065	0.86	3.75	4.56	8.00	2.25	12
25	10.0	AUC 071	0.30	5.63	7.38	12.13	3.25	45
30	1.5	AUC 077	2.00	3.75	4.56	7.50	3.25	11
30	5.0	AUC 075	1.00	4.69	6.00	8.50	3.25	22
37.5	10.0	AUC 081	1.30	11.13	14.63	16.25	4.31	124
50	1.5	AUC 087	5.00	4.69	6.00	8.50	4.31	18
50	5.0	AUC 085	1.20	5.63	7.38	12.13	4.31	40
75	1.5	AUC 097	4.70	5.63	7.38	12.13	7.50	45
75	5.0	AUC 095	2.20	11.13	14.63	16.13	7.50	124

AUC SERIES

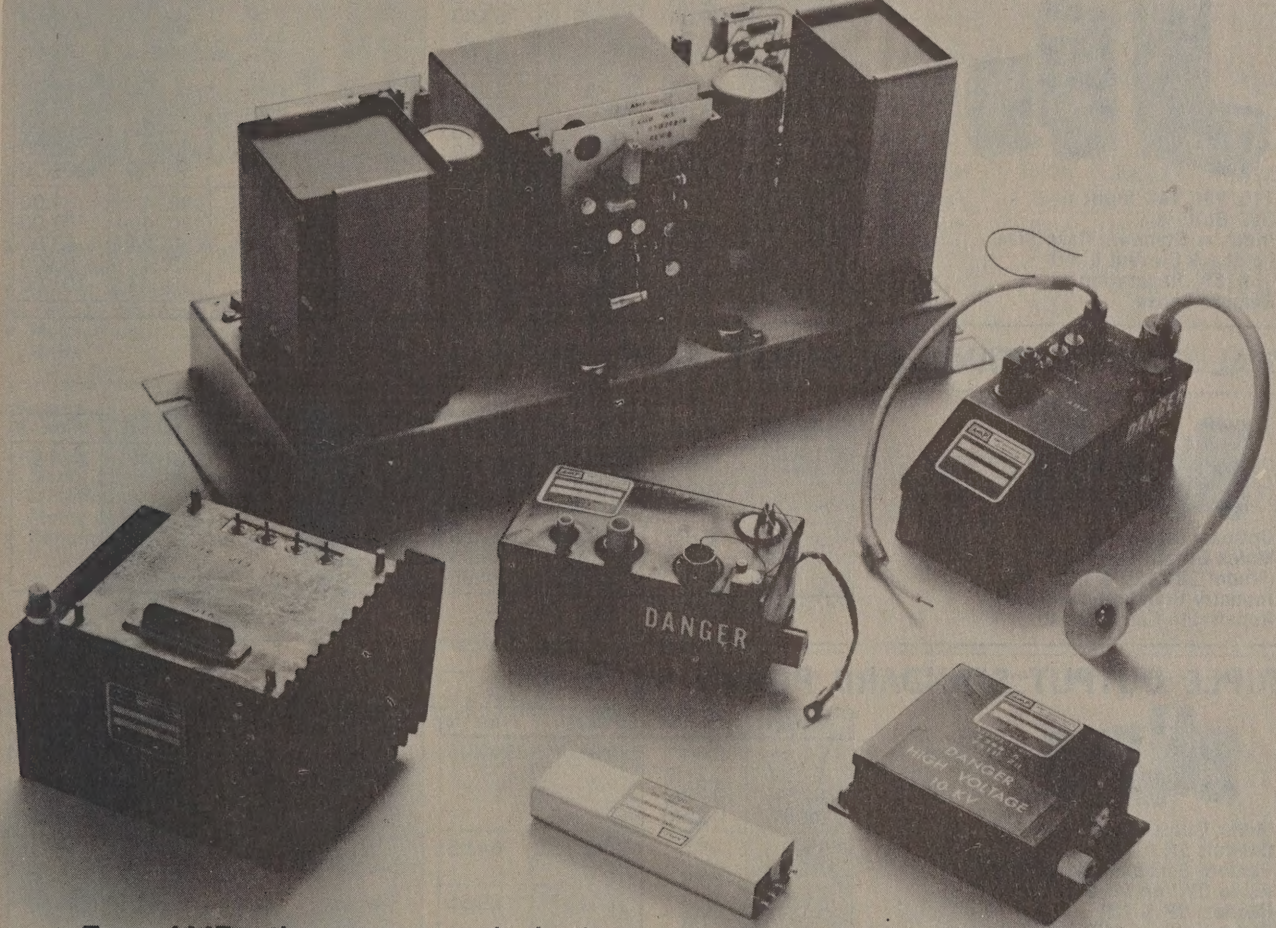
Economy High Voltage Module. Output adjustable by varying input voltage. Hermetically sealed. Shielded. **Input:** 117 VAC nom., 50 to 400 Hz. **Ripple at F/L:** 1% rms. **Operating Temperature:** 0 to +85°C.



ADVANCED HIGH VOLTAGE CO., INC.

14532 ARMINTA AVE. • VAN NUYS, CALIF. 91402 • PHONE: (213) 997-7222

The power you need is the power you get.



From AMP—the power supply that's a perfect match to the system, any electronic system. We're the specialists.

The power behind multicolor CRT displays, for instance, with a big family of 1 through 18-KV fast-switching supplies. Ones that change output voltage levels in millionths of a second, and do it with long-life dependability in environmental extremes.

Whatever your application, military or commercial—no matter how demanding the complexity, performance and miniature size requirements — we'll fit a power supply to your need. With over 1000 existing designs—up to 60 KV and 2 KW —your power supply could be "on the shelf." Or we'll quickly tailor one for you.

And we also engineer some very unusual low-voltage supplies, as well as multiple output types combining both low and high voltages. All feature our unique oil/gas dielectric for high reliability and long life.

Give us your specifications. We'll get data back to you immediately. Contact: AMP Incorporated, Capitron Division, Elizabethtown, PA 17022. (717) 367-1105.

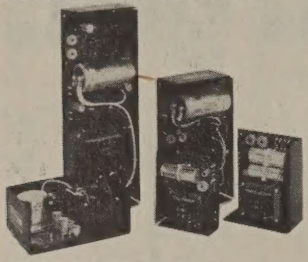
AMP
INCORPORATED

ALPHA POWER INC

DEPT. EM, 20536 PLUMMER ST, CHATSWORTH, CALIFORNIA 91311 (213) 998-9873

DC POWER SUPPLIES

SINGLE OUTPUT STANDARD POWER SUPPLIES

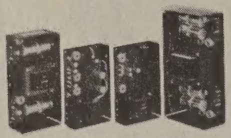


- 115/230 VAC Input
- OVP Built-in
- Industry Standard Case Size
- Foldback Current Limit
- ±.015% Regulation
- Remote Sense

Voltage	Current	Model	Price 1-9
5 Volts	3.0A	3B5	$31.00
	6.0A	3C5	51.00
	9.0A	3CC5	63.00
	12.0A	3D5	80.00
	18.0A	3DD5	101.00
6 Volts	2.6A	3B6	31.00
	5.0A	3C6	51.00
	8.0A	3CC6	63.00
	10.0A	3D6	80.00
	15.5A	3DD6	101.00
12 Volts	1.7A	3B12	31.00
	3.4A	3C12	51.00
	5.1A	3CC12	63.00
	7.0A	3D12	80.00
	10.0A	3DD12	101.00

Voltage	Current	Model	Price 1-9
15 Volts	1.5A	3B15	$31.00
	3.0A	3C15	51.00
	4.5A	3CC15	63.00
	6.0A	3D15	80.00
	9.0A	3DD15	101.00
20 Volts	1.3A	3B20	31.00
	2.6A	3C20	51.00
	3.9A	3CC20	63.00
	5.2A	3D20	80.00
	8.0A	3DD20	101.00
24 Volts	1.2A	3B24	31.00
	2.4A	3C24	51.00
	3.6A	3CC24	63.00
	4.8A	3D24	80.00
	7.0A	3DD24	101.00

DUAL OUTPUT STANDARD POWER SUPPLIES



- Optional (at no cost) Molex Output Connector (Model 2BB12D & 2BB15D)
- Industry Standard Case Size
- Repairable Construction

Voltage	Current	Model	Price 1-9
±12V	1.0A	2BB12D	$39.95
	1.6A	3K12D	59.95
	3.2A	3L12D	84.95
±15V	0.8A	2BB15D	$39.95
	1.5A	3K15D	59.95
	3.0A	3L15D	84.95

Voltage	Current	Model	Price 1-9
5 Volts 9-15V *(or 5V	2.0A 0.5A* 0.35A)	2BBMPD	$44.95

* Customer Selectable

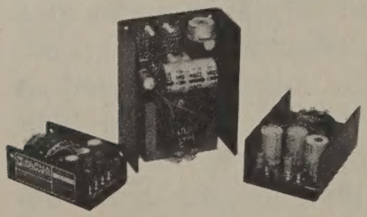
TRIPLE OUTPUT STANDARD POWER SUPPLIES

- Molex Output Connector (Models 2P & 2Q)
- Remote Sense on 5V Outputs
- Fixed OVP on All Outputs (Models 2P & 2Q)
  Other Units — OVP on 5V Outputs

Voltage	Current	Model	Price 1-9
5 Volts 9-15V 9-15V *(or 5V	2.0A 0.25A 0.25A* 0.25A)	2BBMP	$49.95
5 Volts ±12/15V	3.0A 0.5A	2CC515T	64.95
5 Volts ±12/15V	7.0A 1.0A	2D515T	89.95

Voltage	Current	Model	Price 1-9
5 Volts ±12V	8.0A 1.7A	2P512T	$109.00
5 Volts ±15V	8.0A 1.5A	2P515T	109.00
5 Volts ±12V	15.0A 3.4A	2Q512T	159.00
5 Volts ±15V	15.0A 3.0A	2Q515T	159.00

LOW POWER / OPEN FRAME POWER SUPPLIES



- Smallest, Lowest Priced Open Frame Available
- Fixed Voltage Monolythic Regulators Dramatically Increase Reliability
- Single, Dual & Triple Output Units Available in All Case Sizes

Voltage	Current	Model	Price 1-9
5 Volts	0.50A	1A5	$18.95
	1.1A	1B5	22.95
	2.2A	1C5	26.95
12 Volts	0.25A	1A12	18.95
	0.6A	1B12	22.95
	1.2A	1C12	26.95
15 Volts	0.20A	1A15	18.95
	0.5A	1B15	22.95
	1.0A	1C15	26.95
±12V Dual	0.125A	1A12D	24.95
	0.3A	1B12D	27.95
	0.6A	1C12D	31.95
±15V Dual	0.10A	1A15D	24.95
	0.25A	1B15D	27.95
	0.5A	1C15D	31.95

Voltage	Current	Model	Price 1-9
5 Volts ±12V Triple	0.25A 0.06A	1A512T	$30.95
	0.5A 0.125A	1B512T	33.95
	1.0A 0.25A	1C512T	39.95
5 Volts ±15V Triple	0.25A 0.05A	1A515T	30.95
	0.5A 0.125A	1B515T	33.95
	1.0A 0.25A	1C515T	39.95

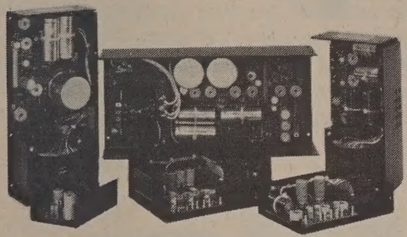
THE SOURCE

ALPHA POWER INC

DEPT. EM / 9020 ETON AVE. / CANOGA PARK, CA 91304 / (213) 998-9873

DC POWER SUPPLIES

MICROPROCESSOR POWER SUPPLIES



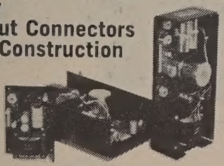
- Compatible with Most Microprocessor Systems
- OVP on All Units
- Remote Sense on 5V Outputs
- Molex Output Connector on Larger Units

Voltage	Current	Model	Price 1-9
±5 Volts +12V	1.0/0.4A 0.25A	1CMP	$39.95
5 Volts 9-15V 9-15V *(or 5V	2.0A 0.25A 0.25A* 0.25A)	2BBMP	49.95
5 Volts 12V 9-12V *(or 5V	3.0A 0.6A 0.6A* 0.38A)	2CCMP	69.95
5 Volts ±12/15V	3.0A 0.5A	2CC515T	64.95
5 Volts ±12/15V	7.0A 1.0A	2D515T	89.95
5 Volts 12 Volts 9 Volts *(or 5V	7.0A 1.0A 1.2A* 0.75A)	2DMP	94.95

Voltage	Current	Model	Price 1-9
5 Volts ±12V	8.0A 1.7A	2P512T	$109.00
5 Volts ±15V	8.0A 1.5A	2P515T	109.00
+5V +12V −12V −5V	8.0A 1.7A 1.0A 0.6A	2PMP	119.00
5 Volts ±12V	15.0A 3.4A	2Q512T	159.00
5 Volts ±15V	8.0A 3.0A	2Q515T	159.00
+5V +12V −12V −5V	15.0A 3.4A 1.7A 1.0A	2QMP	169.00

DISK-DRIVE POWER SUPPLIES

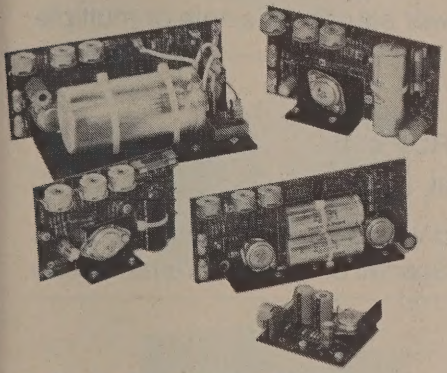
- Single & Dual Drive Models
- Model 2BXFD for Schugart Mini-Floppy
- Molex Output Connectors
- Repairable Construction



Voltage	Current	Model	Price 1-9
+5V +12V	0.5A$_{AVE}$ (0.7A$_{PK}$) 0.9A$_{AVE}$ (1.7A$_{PK}$)	2BXFD	$46.95
+24V +5V −5V	4.0A 3.0A 0.6A	2PFD	117.50

Voltage	Current	Model	Price 1-9
+24V +5V −12V	4.0A 6.0A 1.0A	2QXFD	$134.95

SUB-MODULAR SERIES BUILDING BLOCKS



- Standard Approach to Building Custom Power Supplies
- Adjustable Output Voltage Current Limit and OVP
- Remote Sensing and Built-in Logic Inhibit Function
- Available as Individual Units, or Complete Kit Including Transformer
- Built-in OVP (except SMAA)

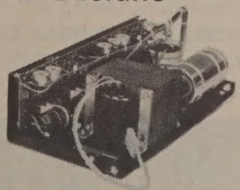
Voltage	Current	Model	Price 1-9
2 Volts	0.4A	SMAA2	$17.50
	1.0A	SMA2	25.00
	3.0A	SMB2	30.00
	6.0A	SMC2	40.00
	12.0A	SMD2	50.00
	18.0A	SME2	60.00
5 Volts	0.4A	SMAA5	17.50
	1.0A	SMA5	25.00
	3.0A	SMB5	30.00
	6.0A	SMC5	40.00
	12.0A	SMD5	50.00
	18.0A	SME5	60.00
6 Volts	0.35A	SMAA6	17.50
	0.88A	SMA6	25.00
	2.5A	SMB6	30.00
	5.2A	SMC6	40.00
	10.4A	SMD6	50.00
	15.6A	SME6	60.00
12 Volts	0.23A	SMAA12	17.50
	0.58A	SMA12	25.00
	1.7A	SMB12	30.00
	3.4A	SMC12	40.00
	6.8A	SMD12	50.00
	10.2A	SME12	60.00

Voltage	Current	Model	Price 1-9
15 Volts	0.20A	SMAA15	$17.50
	0.50A	SMA15	25.00
	1.5A	SMB15	30.00
	1.5A	SMC15	40.00
	30.0A	SMD15	50.00
	6.0A	SME15	60.00
18 Volts	0.19A	SMAA18	17.50
	0.48A	SMA18	25.00
	1.4A	SMB18	30.00
	2.8A	SMC18	40.00
	5.6A	SMD18	50.00
	8.4A	SME18	60.00
20 Volts	0.18A	SMAA20	17.50
	0.45A	SMA20	25.00
	1.3A	SMB20	30.00
	2.6A	SMC20	40.00
	5.2A	SMD20	50.00
	7.8A	SME20	60.00
24 Volts	0.17A	SMAA24	17.50
	0.43A	SMA24	25.00
	1.2A	SMB24	30.00
	2.5A	SMC24	40.00
	5.0A	SMD24	50.00
	7.5A	SME24	60.00

CASE SIZES

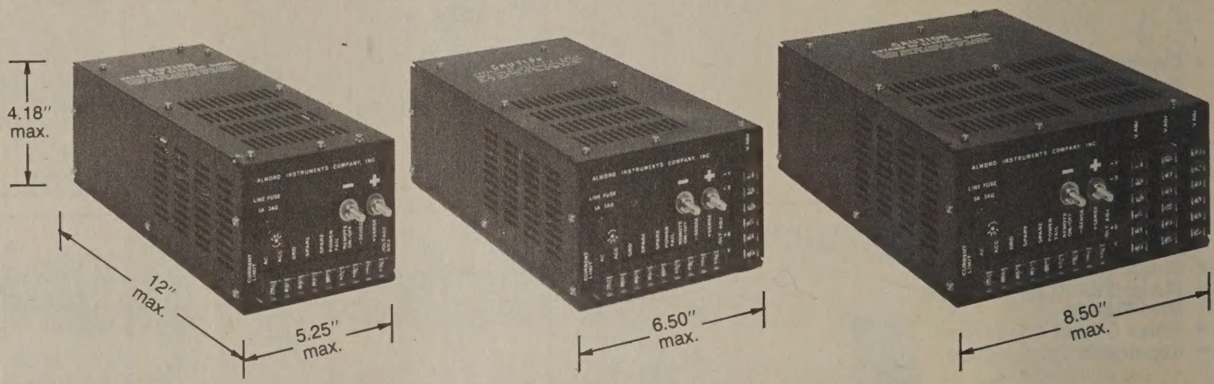
Model No.	Size	Model No.	Size
2B, 3B	4.87 x 4.00 x 2.10	1A	2.80 x 1.80 x 1.40
2BB	6.50 x 4.00 x 2.00	1B	3.50 x 2.20 x 1.60
3C	5.62 x 4.87 x 2.95	1C	4.00 x 3.20 x 1.90
2CC, 3CC	7.00 x 4.87 x 3.20	2BX	5.00 x 4.00 x 2.10
2D, 3D	9.00 x 4.87 x 3.20	2QX	10.50 x 6.25 x 3.25
3DD	14.00 x 4.87 x 3.20	SMAA	2.50 x 3.00 x 1.12
2K	7.87 x 4.00 x 2.95	SMA	4.50 x 3.00 x 1.31
2L	9.38 x 4.87 x 3.20	SMB	5.75 x 3.00 x 1.31
2P	11.00 x 4.87 x 3.12	SMC	7.50 x 3.00 x 1.31
2Q	13.50 x 6.25 x 3.75	SMD, E	7.00 x 3.00 x 3.43

CUSTOM DESIGNS



Call us for quotes on your high volume low cost linear or switching regulated custom supplies.

The SWITCHERS from ALMOND



High efficiency over extreme input line voltage variation makes Almond Switchers ideal for new system designs or existing system update.

Ruggedized, modular construction provides a reliable power source for single or multiple DC output voltages.

350 watts output over −10°C to +60°C without derating.

Output regulation <.25% — output ripple and noise (PARD) < 1%.

All protective circuitry standard (i.e. soft start, current limit, OVP, thermal).

28 STANDARD MODELS AVAILABLE providing standard voltage combinations of 5, 12, 15, 18, 24 and 28 VDC at currents from 2 to 70 amperes. Special output requirements can be assembled from standard modules.

Delivery: Off the shelf to 30 days.

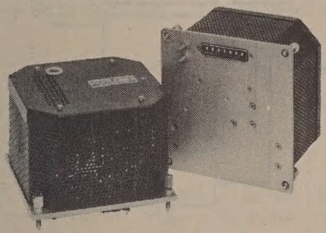
Contact the Factory or your Almond representative for detailed specifications or special requirements. Ask for catalog AN1577.

ALMOND INSTRUMENTS COMPANY, INC.

1223 E. Edna Place, Covina, California 91724 • Telephone (213) 967-4151 • TWX (910) 584-1320

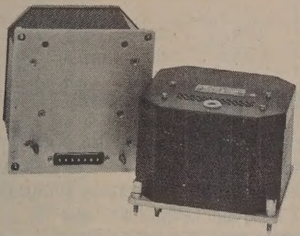
MILITARY QUALIFIED POWER SUPPLIES

Over the past eight years, AIC has designed, developed and produced over 5,000 military-qualified power supplies for over 50 major programs. These power supplies are fully qualified to the following military specifications: MIL-E-16400, MIL-S-901, MIL-E-5400 and MIL-STD-461. Programs include U.S. Navy S3A; U.S. Navy DD963; U.S. Navy military retrofit programs; various U.S. Navy navigation systems; U.S. Air Force fighter aircraft; and aircraft computer power supplies. A few examples are shown below.



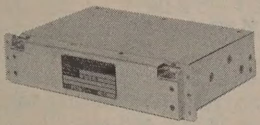
Low Output Noise
P/N 2-11075

Shipboard qualified to MIL-E-16400. Features 115V, 3Ø, 400 Hz input ±15V at 3.2A output. Line/load regulation 0.01%. Output noise less than 10 microvolts narrow band noise from 100 Hz to 50 KHz.



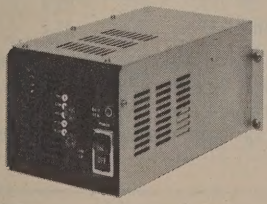
P/N 2-10701

Shipboard qualified to MIL-E-16400. Features 115V, 3Ø, 400 Hz input, 5V at 25A output. Line/load regulation 0.5%. Ripple 25 mv p-p. Efficiency 47%.



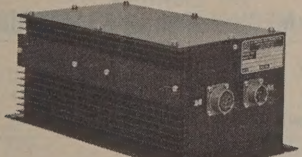
P/N 2-11470

Aircraft computer multiple output power supply qualified to MIL-E-5400. Input 28±4V. Features 4 separate regulated outputs and 2 watts/cu. in.



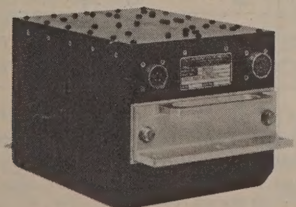
P/N 2-11020

Shipboard qualified multiple input, multiple output. Features 115/230/28 Vdc input with 4 separate regulated DC outputs, output power 100 watts. This power supply contains internal battery charger and power on clear and power fail logic interface.



P/N 2-10568D

Shipboard qualified. Features low magnetic radiated noise. Input voltage 115/230, output 28V, 12A. Ripple 20 mv p-p.

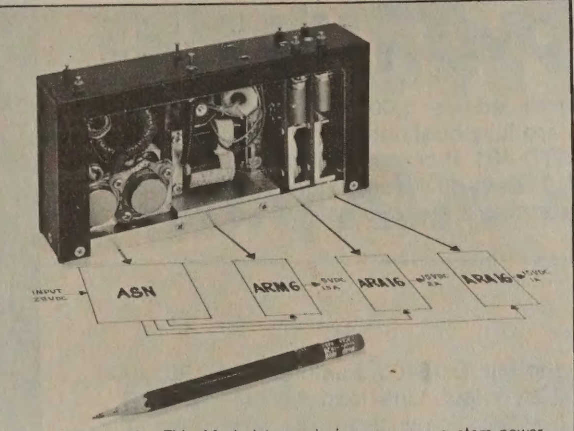


P/N 2-11290

480V input, 60 Hz, 3Ø. Features low power line harmonic distortion reflected onto the power line due to rectification. This unit delivers up to 1 kilowatt of DC power and reflects less than 4% harmonic distortion onto the input power line.

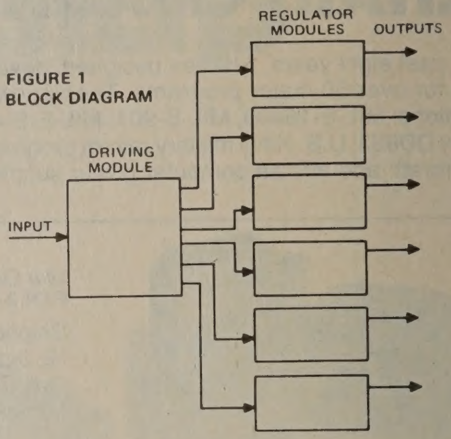
ARNOLD MAGNETICS

Design As You Order MODULAR POWER SUPPLIES



Arnold Magnetics Thin-Mods let you design your own custom power conversion system as you order. No engineering charges . . . no lost design time. And, the complete power supply is provided in a pre-tested, encapsulated miniature package.

FIGURE 1
BLOCK DIAGRAM



HOW TO SPECIFY AND ORDER

(OR ONE PHONE CALL AND WE'LL DO THE REST—(213) 870-7014 OR (213) 390-3537)

1. **BLOCK DIAGRAM:** Construct your Power Conversion System block diagram in Figure 1.
   A. Use one block for the Driving Module.
   B. Use one block for each output required.
2. **REGULATOR SELECTION:** Select Regulator Modules from Table M1. Enter the following in Table M3 for each output.
   A. Module Model Number.
   B. Output voltage (nominal) from Table M1 in Volts column.
   C. Maximum output current for application in Amps column.
   D. Output power in Watts column.
   E. Input power (Watts/Efficiency) in Input Power column.
3. **DRIVING MODULE SELECTION:** Select Driving Module from Table M2 using prime power source and Total Input Power from Table M3. The Driving Module must be capable of providing more power than the Total Input Power required for the Regulator Modules.
4. **CASE SIZE SELECTION:** Using the sum of all module lengths selected from Table M3, select the shortest case size that will accommodate from Table M4.
5. **PRICING:** Price and Weight for complete power system is the sum of the applicable column from Table M3.
6. **PART NUMBER:** Construct Power Converter Part Number as follows: Driving Module Model Number from Table M2 — Last Letter of Regulator Module Model Number from Table M1 — Operating Voltage (VDC)/Operating Current (AMPS) — Case Size Letters from Table M4. List Regulators in descending order of operating current.

   Example: APT-M5/15V-T30/1-A15/.2-DA
   INPUT: (APT)-105 to 125 VRMS 47-500 Hz
   OUTPUTS:
   1. (ARM 6) — Delivers 5 VDC @ 15 AMPS, overvoltage protection option (V) at 6.5 volts max.
   2. (ART 30) — Delivers 30 VDC @ 1 AMP
   3. (ARA 16) — Delivers 15 VDC @ .2 AMP

   CASE SIZE: DA (Table M4) 10½ × 1⅝ × 3⅝
7. **DELIVERY:** 2-4 weeks ARO.
8. **HOW TO ORDER:** Order using AMC P/N (defined as above) and base price (1 pc) from Table M3. Price discounts 2-4 pcs. .90 × base price, 5-9 pcs .85 × base price, 10-24 pcs. .80 × base price. Consult sales representative or factory for higher quantity price discounts and special modules.

TABLE M3 SPECIFICATION WORK FORM

Required Outputs				Regulator Input Power (Watts/Eff.)	Module			
No.	Volts (1) (Nominal)	Amps (Max. Req.)	Output Power (Watts)		Model Number	Length (Inches)	Price (1 Pc.)	Weight (Oz.)
1								
2								
3								
4								
5								
6								
Total Regulator Input Power								
Driving Module Output Power (2)								
					Total			

NOTES: (1) From Table M1.
(2) From Table M2, must exceed Total Regulator Input Power.

TABLE M4 MECHANICAL CHARACTERISTICS

Case Size (See Table I, Next Page)	Number of Terminals	Total of Module Lengths (Inches)	External Length (Max. Inches)	Number of Mtg Holes
AA		3.2	31/2	4
BA		4.7	5	4
CA		6.7	7	6
FA		8.2	8-1/2	6
DA		10.2	10-1/2	6
AB		2 X 33.2	3-1/2	4
BB		2 X 4.7	5	4
CB		2 X 6.7	7	6
FB		2 X 8.2	8-1/2	6
DB		2 X 10.2	10-1/2	6

Terminals: Turret style with Teflon insulation. Case: Black anodized aluminum.
Mounting Holes: Threaded for 6/32 screw, ¼" deep.

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Design As You Order
MODULAR POWER SUPPLIES

ARNOLD MAGNETICS

TABLE M1
GENERAL SPECIFICATIONS FOR REGULATOR MODULES

- ARM — Magnetic Amplifier Regulator — High Power — High Efficiency
- ARF — Magnetic Amplifier Regulator — Medium Power - High Efficiency
- ART — Switching Regulator — Medium Power — High Efficiency
- ARA — Series Regulators — Low Power — Low Voltage
- ARC — Series Regulators — Medium Power — Low Voltage
- ARB — Series Regulators — Low Power — High Voltage

Output Voltage (vdc) Adjustable ±5%		Output Current (amps) @71°C, Case Temp.	Regulator Power Efficiency	Module Model Number	Module Length (inches)	Module Weight (ounces)	Module Price (1 pc)
Min.	Max.	Max.					
4.2	6	4.0	70%	ART 6	1.2	10.0	$190
4.2	6	4.0	55%	ARA 6	0.6	4.5	89
4.2	6	6.0	55%	ARC 6	1.2	9.0	122
4.2	6	6.0	70%	ARF 6	1.8	20.0	182
4.2	6	20.0	70%	ARM 6	1.8	20.0	327
6.1	16	2.5	80%	ART 16	1.2	10.0	190
6.1	16	2.5	65%	ARA 16	0.6	4.5	89
6.1	16	5.0	65%	ARC 16	1.2	9.0	122
6.1	16	5.0	80%	ARF 16	1.8	20.0	182
6.1	16	9.0	80%	ARM 16	1.8	20.0	327
16.1	30	1.0	80%	ART 30	1.2	10.0	190
16.1	30	1.5	80%	ARA 30	0.6	4.5	89
16.1	30	3.0	80%	ARC 30	1.2	9.0	122
16.1	30	3.0	80%	ARF 30	1.8	20.0	182
16.1	30	5.0	80%	ARM 30	1.8	20.0	327
30.1	50	0.5	80%	ARB 50	0.6	4.5	107
30.1	50	1.5	80%	ARF 50	1.8	12.0	182
30.1	50	3.0	80%	ARM 50	1.8	20.0	327
70	100	0.25	80%	ARB 100	0.6	4.5	107
70	100	0.75	80%	ARF 100	1.8	20.0	182
70	100	1.5	80%	ARM 100	1.8	20.0	327
110	160	0.16	80%	ARB 160	0.6	4.5	113
161	200	0.13	80%	ARB 200	0.6	4.5	120
201	250	0.10	80%	ARB 250	0.6	4.5	132
251	300	0.01	80%	ARB 300	0.6	4.5	172

ELECTRICAL SPECIFICATIONS

Regulation — Line (max): (Line Variation ± 10%)
0.1% + 10 MV for ARA, ARC & ARB
0.2% + 10 MV for ARF & ARM
1.0% + 10 MV for ART

Regulation — Load (max): (Load Variation ½ FL - FL)
0.1% + 10 MV for ARA, ARC & ARB
0.2% + 10 MV for ARF & ARM
1.0% + 10 MV for ART

Ripple & Noise (max): 0.1% VRMS + 10 MV for ARA, ARC & ARB
0.5% VRMS + 10 MV for ARF, ARM & ART

Temperature Coefficient: 0.01%/°C for ARA, ARC & ARB
0.02%/°C for ARF, ARM & ART

Operating Case Temperature: −10°C to +71°C

Isolation: Input, case & outputs are isolated (floating) from each other.

Short Circuit Protection:
All outputs are short circuit protected and feature foldback current limiting.

Output Voltage Adjustment Range: ±5% minimum

APPLICATION NOTES

1. Isolation test voltage is 50 VDC or 1.3 × voltage, whichever is greater.
2. ATA & ATB driving modules may not be used with ARF & ARM regulator modules.
3. Add 0.6 inches to the ATA & ATB module length for each additional amp of output current over 3 amps for each regulator module.
4. Efficiency: Divide the total regulator input power by the driver efficiency to obtain the unit input power. Divide the total output power by the unit input power to obtain the approximate unit efficiency.
   Note: The actual unit efficiency will vary, depending on the input voltage and output current levels.
5. Consult the factory for output voltage adjustment ranges greater than ±5%. The unit efficiency will decrease and output power derating might be required.
6. Consult the factory for special requirements
   - (a) Straight cut off current limiting for capacitor charging and filament applications.
   - (b) Non-standard case sizes.
   - (c) Steel or helicoil mounting inserts.
   - (d) Additional filtering for low ripple & noise requirements.
   - (e) Low level output turn-on/turn-off by logic control.

TABLE M2
GENERAL SPECIFICATIONS FOR DRIVING MODULES

- 115 VAC, 47-500 Hz
  (25 KHz Converter)
  APS — 100 Watts
  APT — 200 Watts
- 115 VAC, 400 Hz
  (Transformer)
  ATA — 50 Watts
  ATB — 100 Watts
- 115 VDC
  (25 KHz Inverter)
  ASH — 110 Watts
  ASK — 220 Watts
- 12 VDC
  (25 KHz Inverter)
  ASL — 45 Watts
  ASA — 90 Watts
- 28 VDC
  (25 KHz Inverter)
  ASM — 100 Watts
  ASN — 200 Watts
- 48 VDC
  (25 KHz Inverter)
  ASG — 50 Watts
  ASJ — 90 Watts

Input	Output Power (watts)	Module Model Number	Module Length (inches)	Weight (oz.)	Driver Power Efficiency	Price (1 pc)
105-125 VAC, 47-500 Hz	100	APS	4.2	23	90%	$254
105-125 VAC, 47-500 Hz	200	APT	4.8	26	90%	383
105-125 VAC, 340-500 Hz	50	ATA	3.6*	30	85%	185
105-125 VAC, 340-500 Hz	100	ATB	4.3*	35	85%	230
11-13 VDC	45	ASL	2.4	18	80%	170
11-13 VDC	90	ASA	2.4	20	80%	246
24-30 VDC	100	ASM	2.4	18	90%	170
24-30 VDC	200	ASN	2.4	20	90%	246
44-52 VDC	50	ASG	2.4	18	90%	187
44-52 VDC	90	ASJ	2.4	20	90%	280
105-125 VDC	110	ASH	2.4	18	90%	187
105-125 VDC	220	ASK	2.4	20	90%	280

*See Application Notes 2 and 3

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ARNOLD MAGNETICS

High Voltage — Isolated

DC-DC POWER SUPPLIES

FEATURES

- Wide output voltage choice
- High voltage input to output isolation
- Short circuit protected
- Miniature size
- Lightweight
- Fully encapsulated
- Conduction cooled
- Meets MIL-E-5272

SPECIFICATIONS

MODEL	SHU	SMU	SHU
Input (VDC)	11-13	26-30	26-30
Output (VDC)	5-2500	2-5000	3-5000
Output Voltage Adjustment	90% to 105% of nominal output		40% - 105%
Output Ripple	0.5% VRMS +10 MV Max.	0.3% VRMS +10 MV Max.	0.5% VRMS +10 MV Max.
Output Isolation	3 x output voltage (1KV Min.,5KV Max.)	3 x output voltage (1KV Min., 5.5KV Max.)	
Operating Temperature	−10°C to +71°C (Case Temperature)		

Model SHU — 11 to 13 VDC to Single or Multiple DC Outputs

Output				Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (VDC)	Current (Amps)	Regulation Line (%)	Regulation Load (%)			
5	2.50	0.3	2.0	A	SHU-5EE	$362
12	1.00	0.3	2.0	A	SHU-12EE	362
15	1.00	0.3	2.0	A	SHU-15EE	362
30	0.50	0.3	2.0	A	SHU-30EE	362
50	0.40	0.3	2.0	A	SHU-50EE	362
100	0.20	0.3	2.0	A	SHU-100EE	362
250	0.08	0.3	2.0	A	SHU-250EE	362
500	0.04	0.3	2.0	A	SHU-500EE	386
750	0.02	0.3	2.0	A	SHU-750EE	408
1000	0.02	0.3	2.0	A	SHU-1000EE	426
1500	0.01	0.3	2.0	A	SHU-1500EE	473
2000	0.01	0.3	2.0	A	SHU-2000EE	544
2500	0.008	0.3	2.0	A	SHU-2500EE	544
15 -15	0.40 0.40	0.3	2.0	A	SHU-30(CT) EE	413
24 12	0.20 0.40	0.3	2.0	A	SHU-24-12EE	422
180 5	0.05 2.00	0.3	3.0	A	SHU-180-5EE	457
15 -15 5	0.20 0.20 1.00	0.3	3.0	A	SHU-30(CT)-5EE	499
-24 -12 5	0.10 0.20 1.00	0.3	3.0	A	SHU-24-12-5EE	499
180 15 -15 5	0.02 0.20 0.20 1.00	0.3	3.0	A	SHU-180-30(CT)-5EE	583

Model SMU — 26 to 30 VDC to Single DC Output

Output				Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (VDC)	Current (Amps)	Line Reg. %	Load Reg. %			
2	0.75	0.3	2.0	M	SMU-.002	$313
3	0.75	0.3	2.0	M	SMU-.003	313
5	0.50	0.3	2.0	M	SMU-.005	298
6	0.50	0.3	2.0	M	SMU-.006	298
10	0.30	0.3	2.0	M	SMU-.010	288
12	0.25	0.3	2.0	M	SMU-.012	288
15	0.20	0.3	2.0	M	SUM-.015	282
28	0.11	0.3	2.0	M	SMU-.028	282
50	0.06	0.3	2.0	M	SMU-.05	282
100	0.03	0.3	2.0	M	SMU-.1	282
150	0.02	0.3	2.0	M	SUM-.15	282
300	0.01	0.3	2.0	M	SUM-.3	298
500	0.006	0.3	2.0	M	SUM-.5	305
750	0.004	0.3	2.0	M	SMU-.75	313
1000	0.003	0.3	2.0	M	SUM-1	384
1500	0.002	0.3	2.0	M	SMU-1.5	391
2000	0.0015	0.3	2.0	M	SMU-2	407
2500	0.0012	0.3	2.0	M	SMU-2.5	424
3000	0.001	0.3	2.0	M	SMU-3	456
3500	0.0008	0.3	2.0	M	SMU-3.5	581
4000	0.0007	0.3	2.0	M	SMU-4	581
5000	0.0006	0.3	2.0	M	SMU-5	658

Model SHU — 26 to 30 VDC to Single DC Output

Output				Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (VDC)	Current (Amps)	Line Reg. %	Load Reg. %			
3	5.00	0.3	2.0	A	SHU-3	$305
5	5.00	0.3	2.0	A	SHU-5	313
5	8.00	0.3	2.0	A	SHU-5WW	362
6	5.00	0.3	2.0	A	SHU-6	313
10	4.00	0.3	2.0	A	SHU-10	313
12	3.33	0.3	1.5	A	SHU-12	313
15	2.66	0.3	1.5	A	SHU-15	313
24	1.66	0.3	1.5	A	SHU-24	313
28	1.42	0.3	1.5	A	SHU-28	313
30	1.34	0.3	1.5	A	SHU-30	313
50	0.80	0.3	1.5	A	SHU-50	313
100	0.40	0.3	1.5	A	SHU-100	313
150	0.26	0.3	1.5	A	SHU-150	313
250	0.16	0.3	1.5	A	SHU-250	313
300	0.13	0.3	1.5	A	SHU-300	313
500	0.08	0.3	1.5	A	SHU-500	336
750	0.053	0.3	1.5	A	SHU-750	336
1000	0.040	0.3	1.5	A	SHU-1000	360
1500	0.026	0.3	1.5	A	SHU-1500	407
2000	0.020	0.3	1.5	A	SHU-2000	478
2500	0.016	0.3	2.0	A	SHU-2500	478
3000	0.013	0.3	2.0	A	SHU-3000	539
3500	0.011	0.3	2.0	A	SHU-3500	564
4000	0.010	0.3	2.0	A	SHU-4000	587
5000	0.008	0.3	2.0	A	SHU-5000	611

Model SHU — 26 to 30 VDC to Multiple DC Outputs

Output				Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (VDC)	Current (Amps)	Line Reg. %	Load Reg. %			
15 5	1.00 2.50	0.20	2.00	A	SHU-15-5	$384
15 -15	1.00 1.00	0.20	2.00	A	SHU-30CT	356
-28 12	0.80 1.50	0.20	2.00	A	SHU-28-12	384
28 5	0.50 2.50	0.20	2.00	A	SHU-28-5	384
180 5	0.10 3.00	0.20	2.00	A	SHU-180-5	391
15 -15 5	0.50 0.50 2.00	0.20	3.00	A	SHU-30CT-5	433
180 15 -15	0.03 0.30 0.30	0.20	3.00	A	SHU-180-30 CT	430
180 15 -15 5	0.03 0.30 0.30 2.00	0.20	3.00	A	SHU-180-30 CT-5	517

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High Voltage — Isolated

AC-DC POWER SUPPLIES

ARNOLD MAGNETICS

Model PHU — 115 VRMS 47-500 Hz to Single or Multiple DC Outputs

FEATURES

- Wide output voltage choice
- High voltage input to output isolation
- Multiple outputs standard
- Short circuit protected
- Miniature size
- Lightweight
- Fully encapsulated
- Meets MIL-E-5272

Single Output Models

Output		Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (Volts)	Current (Amps)			
2	5.00	A	PHU-2	$344
3	5.00	A	PHU-3	344
5	5.00	A	PHU-5	344
6	5.00	A	PHU-6	344
10	4.00	A	PHU-10	367
12	3.30	A	PHU-12	367
15	2.60	A	PHU-15	367
18	2.20	A	PHU-18	367
22	1.80	A	PHU-22	367
24	1.60	A	PHU-24	367
28	1.40	A	PHU-28	367
30	1.30	A	PHU-30	367
50	0.80	A	PHU-50	367
100	0.40	A	PHU-100	367
200	0.20	A	PHU-200	367
300	0.13	A	PHU-300	367
500	0.80	A	PHU-500	367
750	0.05	A	PHU-750	367
1000	0.03	A	PHU-1000	384
1500	0.01	A	PHU-1500	548
2000	0.01	A	PHU-2000	548

Multiple Output Models

Output		Case Size (See Table I)	Model Number	Price (1 Pc)
Voltage (Volts)	Current (Amps)			
15 5	1.00 2.50	A	PHU-15-5	$432
15 -15	1.30 1.30	A	PHU-30(CT)	414
-24 15	0.80 1.50	A	PHU-24-15	414
180 5	0.10 3.00	A	PHU-180-5	414
15 -15 5	0.50 0.50 2.00	A	PHU-30(CT)-5	493
180 15 -15	0.03 0.30 0.30	A	PHU-180-30(CT)	493
750 150 5	0.01 0.10 1.00	A	PHU-750-150-5	510
15 -15 5 -5	0.30 0.30 1.00 1.00	A	PHU-30(CT)-10(CT)	535
-24 15 -15 5	0.10 0.30 0.30 2.00	A	PHU-30(CT)-24-5	559
180 15 -15 5	0.03 0.30 0.30 2.00	A	PHU-180-30(CT)-5	559

SPECIFICATIONS

Input: 105 to 125 VRMS, 47-500 Hz

Output: 2 VDC thru 2000 VDC

Output Voltage Adjustment: +5.0% minimum

Line Regulation: 0.3% maximum

Load Regulation: (½ FL-FL) 2.0% maximum

Output Isolation: 3 x output voltage (1kV min., 5kV max.)

Operating Temperature: —10°C to +71°C (case temp.)

Cooling: Primarily cooling by conduction thru mounting surface.

Environmental: Per MIL-E-5272

OPTIONS FOR POWER SUPPLIES

Consult factory for prices, specifications and availability.

Option Letter	Option
A	External (Remote) output voltage adjustment
C	Line to Line and center tapped load configuration
(CT)	Center tapped outputs
E	Non-standard input voltage range
G	Flexible leads
I	EMI/RFI Qualified
S	Short terminals
T	Wide temperature range
TP	Input transient protection
V	Overvoltage protection

TABLE I — CASE SIZES FOR POWER SUPPLIES

Case Size	L (Length)	W (Width)	H (Height)	Approx. Weight (Oz.)
A	3-1/2	1-5/8	3-5/8	27
B	5	1-5/8	3-5/8	38
C	7	1-5/8	3-5/8	54
D	10-1/2	1-5/8	3-5/8	81
AA	3-1/2	1-5/8	3-5/8	27
BA	5	1-5/8	3-5/8	38
CA	7	1-5/8	3-5/8	54
FA	8-1/2	1-5/8	3-5/8	50
DA	10-1/2	1-5/8	3-5/8	81
AB	3-1/2	3-1/4	3-5/8	54
BB	5	3-1/4	3-5/8	76
CB	7	3-1/4	3-5/8	108
FB	8-1/2	3-1/4	3-5/8	100
DB	10-1/2	3-1/4	3-5/8	162
M	1-7/8	2-1/32	2-3/4	4

Prices and specifications subject to change without notice.

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DC-DC UNREGULATED POWER CONVERTERS

- High Efficiency (90% Typ. & Fl.)
- Isolated Input/Output
- 0.5% Maximum Ripple
- Submodular Construction

11 TO 14 VDC INPUT				
Output @ 12 VDC Input		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
12	4.0	DDU 1201	A	$127.40
	7.0	DDU 1202	B	158.40
	12.0	DDU 1203	D	230.00
24	2.0	DDU 1204	A	127.40
	3.5	DDU 1205	B	158.40
	6.0	DDU 1206	D	230.00
48	1.0	DDU 1207	A	127.40
	1.8	DDU 1208	B	158.40
	3.0	DDU 1209	D	230.00
110	0.5	DDU 1210	A	127.40
	0.8	DDU 1211	B	158.40
	1.5	DDU1212	D	230.00

22 TO 30 VDC INPUT				
Output @ 24 VDC Input		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
12	4.0	DDU 2401	A	$127.40
	7.0	DDU 2402	B	158.40
	15.0	DDU 2403	D	230.00
24	2.0	DDU 2404	A	127.40
	3.5	DDU 2405	B	158.40
	8.0	DDU 2406	D	230.00
48	1.0	DDU 2407	A	127.40
	1.8	DDU 2408	B	158.40
	4.0	DDU 2409	D	230.00
110	0.5	DDU 2410	A	127.40
	0.8	DDU 2411	B	158.40
	2.0	DDU 2412	D	230.00

44 TO 56 VDC INPUT				
Output @ 48 VDC Input		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
12	4.0	DDU 4801	A	$127.40
	7.0	DDU 4802	B	158.40
	15.0	DDU 4803	D	230.00
24	2.0	DDU 4804	A	127.40
	3.5	DDU 4805	B	158.40
	8.0	DDU 4806	D	230.00
48	1.0	DDU 4807	A	127.40
	1.8	DDU 4808	B	158.40
	4.0	DDU 4809	D	230.00
110	0.5	DDU 4810	A	127.40
	0.8	DDU 4811	B	158.40
	2.0	DDU 4812	D	230.00

105 TO 140 VDC INPUT				
Output @ 110 VDC Input		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
12	4.0	DDU 11001	A	$127.40
	7.0	DDU 11002	B	158.40
	15.0	DDU 11003	D	230.00
24	2.0	DDU 11004	A	127.40
	3.5	DDU 11005	B	158.40
	8.0	DDU 11006	D	230.00
48	1.0	DDU 11007	A	127.40
	1.8	DDU 11008	B	158.40
	4.0	DDU 11009	D	230.00
110	0.5	DDU 11010	A	127.40
	0.8	DDU 11011	B	158.40
	2.0	DDU 11012	D	230.00

DC-DC REGULATED POWER CONVERTERS

- 0.2% Line Regulation (LL-HL)
- 0.2% or 20 mV Load Regulation (NL-FL)
- Pulse Width Modulated Inverters or Switching Output Regulators for Outputs > 10 A or 100W
- High Efficiency (70% Typ. @ Fl. @ Nom. Line)
- Overload/Short Circuit Protected
- Isolated Input/Output
- 0.3% Maximum Ripple
- 5% Adjustment Range
- Overvoltage Protection Option[1]

SINGLE OUTPUT MODELS

11 TO 14 VDC INPUT				
5	2.0	DDR 1200	A	$150.90
	5.0	DDR 1201	B	160.90
	10.0	DDR 1202	C	182.00
	22.0	DDS 1209	E	340.30
12	1.0	DDR 1210	A	150.90
	2.0	DDR 1211	B	160.90
	4.0	DDR 1212	C	182.00
	12.0	DDR 1213	E	330.20
15	1.0	DDR 1203	A	150.90
	2.0	DDR 1204	B	160.90
	4.0	DDR 1205	C	182.00
	10.0	DDR 1214	E	330.20
28	0.5	DDR 1206	A	150.90
	1.0	DDR 1207	B	160.90
	2.0	DDR 1208	C	182.00
	5.0	DDR 1215	E	330.20
50	0.5	DDR 1216	A	160.90
100	0.3	DDR 1217	A	160.90
200	0.1	DDR 1218	A	160.90
250	0.1	DDR 1219	A	165.90

22 TO 30 VDC INPUT				
5	2.0	DDR 2400	A	$150.90
	5.0	DDR 2401	B	160.90
	10.0	DDR 2402	C	182.00
	25.0	DDS 2409	E	340.30
12	1.0	DDR 2410	A	150.90
	2.0	DDR 2411	B	160.90
	4.0	DDR 2412	C	182.00
	12.0	DDR 2413	E	330.20
15	1.0	DDR 2403	A	150.90
	2.0	DDR 2404	B	160.90
	4.0	DDR 2405	C	182.00
	12.0	DDR 2414	E	330.20
28	0.5	DDR 2406	A	159.90
	1.0	DDR 2407	B	160.90
	2.0	DDR 2408	C	182.00
	6.0	DDR 2415	E	330.20
50	0.5	DDR 2416	A	160.90
100	0.3	DDR 2417	A	160.90
200	0.1	DDR 2418	A	160.90
250	0.1	DDR 2419	A	165.90

44 TO 56 VDC INPUT				
5	2.0	DDR 4800	A	$150.90
	5.0	DDR 4801	B	160.90
	10.0	DDR 4802	C	182.00
	25.0	DDS 4809	E	340.30
12	1.0	DDR 4810	A	150.90
	2.0	DDR 4811	B	160.90
	4.0	DDR 4812	C	182.00
	12.0	DDR 4813	E	330.20
15	1.0	DDR 4803	A	150.90
	2.0	DDR 4804	B	160.90
	4.0	DDR 4805	C	182.00
	12.0	DDR 4814	E	330.20
28	0.5	DDR 4806	A	150.90
	1.0	DDR 4807	B	160.90
	2.0	DDR 4808	C	182.00
	6.0	DDR 4815	E	330.20
50	0.5	DDR 4816	A	160.90
100	0.3	DDR 4817	A	160.90
200	0.1	DDR 4818	A	160.90
250	0.1	DDR 4819	A	165.90

105 TO 140 VDC INPUT				
5	2.0	DDR 11000	A	$150.90
	5.0	DDR 11001	B	160.90
	10.0	DDR 11002	C	182.00
	25.0	DDS 11009	E	340.30
12	1.0	DDR 11010	A	150.90
	2.0	DDR 11011	B	160.90
	4.0	DDR 11012	C	182.00
	12.0	DDR 11013	E	330.20
15	1.0	DDR 11003	A	150.90
	2.0	DDR 11004	B	160.90
	4.0	DDR 11005	C	182.00
	12.0	DDR 11014	E	330.20
28	0.5	DDR 11006	A	150.90
	1.0	DDR 11007	B	160.90
	2.0	DDR 11008	C	182.00
	6.0	DDR 11015	E	330.20
50	0.5	DDR 11016	A	160.90
100	0.3	DDR 11017	A	160.90
200	0.1	DDR 11018	A	160.90
250	0.1	DDR 11019	A	165.90

MULTIPLE OUTPUT MODELS

11 TO 14 VDC INPUT				
+5 −5	4.0 4.0	DDR 1220	B	$199.40
+15 −15	0.5 0.5	DDR 1221	A	151.50
+15 −15	2.0 2.0	DDR 1222	B	216.90
+15 −15	4.0 4.0	DDR 1223	D	322.60
+28 −28	1.0 1.0	DDR 1224	B	216.90
+28 −28	2.0 2.0	DDR 1225	D	322.60
+5 +15 −15	2.0 0.5 0.5	DDR 1230	B	202.50
+5 +15 −15	4.0 1.0 1.0	DDR 1231	C	260.40
+5 +15 −15	10.0 2.0 2.0	DDR 1232	E	359.40
+5 +15 −15	20.0 1.0 1.0	DDR 1233	G	522.00
+12 +15 −15	1.0 0.5 0.5	DDR 1234	B	202.50
+12 +15 −15	2.5 1.0 1.0	DDR 1235	C	260.40
+12 +15 −15	6.0 2.0 2.0	DDR 1236	E	359.40
+12 +15 −15	10.0 1.0 1.0	DDR 1237	G	452.00

22 TO 30 VDC INPUT				
+5 −5	4.0 4.0	DDR 2420	B	$199.40
+15 −15	0.5 0.5	DDR 2421	A	151.50
+15 −15	2.0 2.0	DDR 2422	B	216.90
+15 −15	4.0 4.0	DDR 2423	D	322.60
+28 −28	1.0 1.0	DDR 2424	B	216.90
+28 −28	2.0 2.0	DDR 2425	D	322.60
+5 +15 −15	2.0 0.5 0.5	DDR 2430	B	202.50
+5 +15 −15	4.0 1.0 1.0	DDR 2431	C	260.40
+5 +15 −15	10.0 2.0 2.0	DDR 2432	E	359.40
+5 +15 −15	25.0 2.0 2.0	DDR 2433	G	522.00
+12 +15 −15	1.0 0.5 0.5	DDR 2434	B	202.50
+12 +15 −15	3.0 1.0 1.0	DDR 2435	C	260.40
+12 +15 −15	6.0 2.0 2.0	DDR 2436	E	359.40
+12 +15 −15	15.0 2.0 2.0	DDR 2437	G	452.00

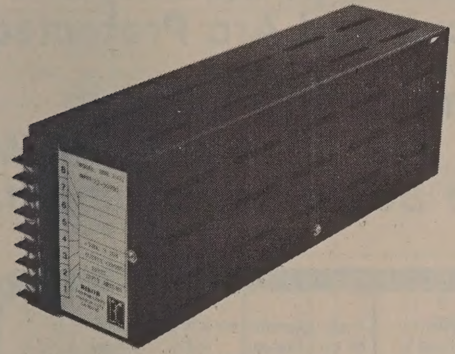
44 TO 56 VDC INPUT				
+5 −5	4.0 4.0	DDR 4820	B	$199.40
+15 −15	0.5 0.5	DDR 4821	A	151.50
+15 −15	2.0 2.0	DDR 4822	B	216.90
+15 −15	4.0 4.0	DDR 4823	D	322.60
+28 −28	1.0 1.0	DDR 4824	B	216.90
+28 −28	2.0 2.0	DDR 4825	D	322.60
+5 +15 −15	2.0 0.5 0.5	DDR 4830	B	202.50
+5 +15 −15	4.0 1.0 1.0	DDR 4831	C	260.40
+5 +15 −15	10.0 2.0 2.0	DDR 4832	E	359.40
+5 +15 −15	25.0 2.0 2.0	DDR 4833	G	522.00
+12 +15 −15	1.0 0.5 0.5	DDR 4834	B	202.50
+12 +15 −15	3.0 1.0 1.0	DDR 4835	C	260.40
+12 +15 −15	6.0 2.0 2.0	DDR 4836	E	359.40
+12 +15 −15	15.0 2.0 2.0	DDR 4837	G	452.00

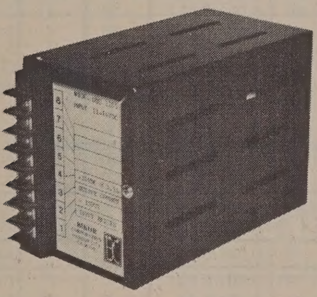
105 TO 140 VDC INPUT				
+5 −5	4.0 4.0	DDR 11020	B	$199.40
+15 −15	0.5 0.5	DDR 11021	A	151.50
+15 −15	2.0 2.0	DDR 11022	B	216.90
+15 −15	4.0 4.0	DDR 11023	D	322.60
+28 −28	1.0 1.0	DDR 11024	B	216.90
+28 −28	2.0 2.0	DDR 11025	D	322.60
+5 +15 −15	2.0 0.5 0.5	DDR 11030	B	202.50
+5 +15 −15	4.0 1.0 1.0	DDR 11031	C	260.40
+5 +15 −15	10.0 2.0 2.0	DDR 11032	E	359.40
+5 +15 −15	25.0 2.0 2.0	DDR 11033	G	522.00
+12 +15 −15	1.0 0.5 0.5	DDR 11034	B	202.50
+12 +15 −15	3.0 1.0 1.0	DDR 11035	C	260.40
+12 +15 −15	6.0 2.0 2.0	DDR 11036	E	359.40
+12 +15 −15	15.0 2.0 2.0	DDR 11037	G	452.00

BIKOR CORPORATION 1228 253rd ST., HARBOR CITY, CA 90710 • (213) 325-2820

AC TO DC REGULATED POWER CONVERTERS

- Pulse Width Modulated Inverters or Switching Output Regulators for Outputs > 10A or 100W
- 105-125 VAC, 47-420 Hz Input
- 220 VAC Input Option[2]
- Operate on AC or DC Inputs
- 0.2% Line Regulation (LL-HL)
- 0.2% or 20 mV Load Regulation (NL-FL)
- 0.3% Maximum Ripple
- Overload / Short Circuit Protected
- Lightweight / Small Size
- 5% Output Voltage Adjust Range
- Overvoltage Protection Option[1]
- Submodular Construction





SINGLE OUTPUT MODELS

Output		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
5	5.0	ADR 1100	B	$185.90
	10.0	ADR 1101	C	216.00
	25.0	ADS 1112	E	374.30
12	2.0	ADR 1102	B	185.90
	5.0	ADR 1103	C	216.00
	13.0	ADR 1113	E	380.20
15	2.0	ADR 1104	B	185.90
	4.0	ADR 1105	C	216.00
	12.0	ADR 1114	E	380.20
28	1.0	ADR 1106	B	185.90
	2.0	ADR 1107	C	216.00
	8.0	ADR 1115	E	380.20
48	0.5	ADR 1108	B	185.90
48	1.0	ADR 1109	C	216.00
	4.0	ADR 1116	E	380.20
100	0.3	ADR 1110	B	185.90
200	0.1	ADR 1111	B	185.90
250	0.1	ADR 1117	B	190.90

MULTIPLE OUTPUT MODELS

Voltage (VDC)	Current (Amps)	Model No.	Case Size	Price (1-24)
+5	4.0	ADR 1120	B	$250.90
−5	4.0			
+15	0.5	ADR 1121	B	179.00
−15	0.5			
+15	2.0	ADR 1122	B	250.90
−15	2.0			
+15	4.0	ADR 1127	E	374.50
−15	4.0			
+28	1.0	ADR 1128	B	250.90
−28	1.0			
+28	2.0	ADR 1129	E	374.50
−28	2.0			

MULTIPLE OUTPUT MODELS

Output		Model No.	Case Size	Price (1-24)
Voltage (VDC)	Current (Amps)			
+15	2.0	ADR 1123	B	$227.50
+15	0.5			
−15	0.5			
+5	5.0	ADR 1124	C	294.40
+15	1.0			
−15	1.0			
+5	8.0	ADR 1125	C	267.60
+15	0.5			
−15	0.5			
+5	10.0	ADR 1127	E	393.40
+15	2.0			
−15	2.0			
+5	25.0	ADR 1128	G	502.00
+15	2.0			
−15	2.0			
+12	1.0	ADR 1129	B	227.50
+15	0.5			
−15	0.5			
+12	3.0	ADR 1130	C	294.40
+15	1.0			
−15	1.0			
+12	6.0	ADR 1131	E	393.40
+15	2.0			
−15	2.0			
+12	15.0	ADR 1132	G	502.00
+15	2.0			
−15	2.0			
+5	5.0	ADR 1126	C	302.50
+15	0.5			
−15	0.5			
+250	0.1			

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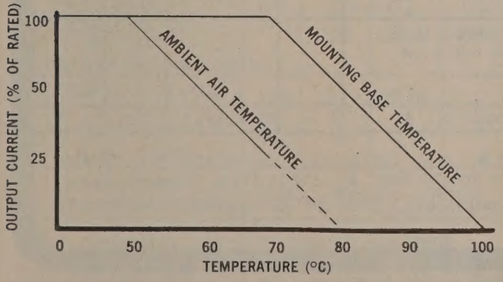
[1] Overvoltage Option: Add "V" followed by voltage to be protected. Example: ADR1128 V5 has 5 VDC output protected. Price: $20, for outputs up to 12A, $30 over 10A.

[2] 220 VAC Input: Contact factory.

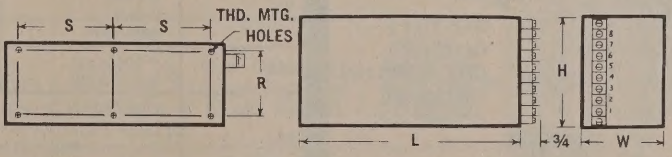
SPECIAL POWER SYSTEMS

- Xenon Power Supplies and Igniters: 75W, 150W and 300W
- High Voltage Converters, DC/DC and AC/DC: Up to 40 KV @ 200W
- Square Wave Inverters, DC/AC and AC/AC: 40 Hz to 25 kHz, 30W to 1200W
- Special Voltages and Currents, Single and Multiple Outputs with No Engineering Cost
- X-ray Tube Power Supplies Using Switching Converters

TEMPERATURE RATINGS FOR ALL MODELS



MECHANICAL SPECIFICATIONS FOR ALL MODELS



Case	L	W	H	R	S	Number of Mounting Holes / Thread Size	Weight (Typ.)
A	5¾ (14.61)	3 (7.62)	4 (10.16)	2.4 (6.10)	5 (12.70)	4 / #6-32 THD.	1¼ (.57)
B	8 (20.32)	3 (7.62)	4 (10.16)	2.4 (6.10)	3.5 (8.89)	6 / #6-32 THD.	1¾ (.79)
C	12 (30.48)	3 (7.62)	4 (10.16)	2.4 (6.10)	5.5 (13.97)	6 / #6-32 THD.	2½ (1.13)
D	10 (25.40)	4 (10.16)	4⅝ (11.75)	3 (7.62)	4.5 (11.43)	6 / #10-32 THD.	3½ (1.59)
E	15 (38.10)	4 (10.16)	4⅝ (11.75)	3 (7.62)	4.5 (11.43)	8 / #10-32 THD.	4¼ (1.93)
G	15 (38.10)	6 (15.24)	4⅝ (11.75)	5 (12.7)	4.5 (11.43)	8 / #10-32 THD.	6 (2.72)

NOTE: Sizes, Inches (CM); Weight, Pounds (KG)

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

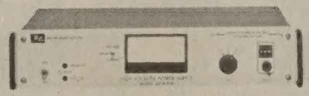
BIKOR CORPORATION 1228 253rd ST., HARBOR CITY, CA 90710 • (213) 325-2820

BERTAN ASSOCIATES, INC.

HIGH VOLTAGE
REGULATED POWER SUPPLIES

• Output to 50kV • Low Noise and High Stability
• Remote Programmable • Short Circuit and Arc Protected

Laboratory Instruments, OEM Modules and Custom Designs for Nuclear Instrumentation, Precision CRT, SEM and other High Performance Electron Beam Requirements



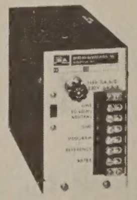
Series 205A and 210

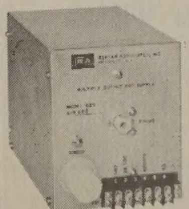
LABORATORY POWER SUPPLIES

Model 215

NUCLEAR INSTRUMENTATION MODULES
Series NIM

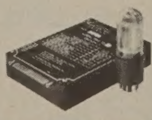
PROGRAMMABLE HIGH VOLTAGE MODULES
Series 602A, 603 and 605





MULTIPLE OUTPUT CRT SUPPLIES
Models 620, 625 and 630

PRECISION PMT POWER SUPPLY
Model PMT-20



Model	Output Volts	Output mA	Regulation Line/Load %	Ripple mV p-p	Remote Program	H x W x D Inches	*Input Power	Price
205A-01R	0 to ± 1,000	30	0.001/0.01	10	✓	3.5x19x10	A	$ 525
205A-03R	0 to ± 3,000	10	0.001/0.01	15	✓	3.5x19x10	A	$ 525
205A-05R	0 to ± 5,000	5	0.001/0.01	50	✓	3.5x19x10	A	$ 550
205A-10P,N	0 to 10,000**	2	0.001/0.01	100	✓	3.5x19x10	A	$ 650
205A-20P,N	0 to 20,000**	1	0.001/0.01	300	✓	3.5x19x10	A	$ 850
205A-30P,N	0 to 30,000**	0.5	0.001/0.01	400	✓	5.3x19x15	A	$1050
205A-50P,N	0 to 50,000**	0.3	0.001/0.01	2V	✓	5.3x19x15	A	$1450
210-01R	0 to ± 1,000	150	0.001/0.01	50	✓	5.3x19x15	A	$ 875
210-03R	0 to ± 3,000	50	0.001/0.01	50	✓	5.3x19x15	A	$ 875
Series 205A and 210 are available with remote digital programming option accepting either 16 bit binary or 4 decade BCD input. TTL compatible.								$ 500 Add'l
215	0 to ± 3,000	5	0.001/0.01	10		5x7.6x7.3	A	$ 385
NIM301	0 to ± 1,000	3	0.001/0.01	1	✓	Dual NIM	B	$ 350
NIM303	0 to ± 3,000	1	0.001/0.01	3	✓	Dual NIM	B	$ 375
NIM305	0 to ± 5,000	0.5	0.001/0.01	5	✓	Dual NIM	B	$ 400
NIM313	0 to ± 3,000	10	0.001/0.01	10	✓	Dual NIM	A	$ 425
NIM315	0 to ± 5,000	5	0.001/0.01	25	✓	Dual NIM	A	$ 450
NIM342	0 to ± 2,000	1	0.001/0.001	2	✓	Single NIM	B	$ 375
NIM345	0 to ± 5,000	0.3	0.001/0.001	5	✓	Single NIM	B	$ 400
NIM353	0 to ± 3,000	2	0.001/0.001	5	✓	Single NIM	A	$ 425
NIM355	0 to ± 5,000	1	0.001/0.001	10	✓	Single NIM	A	$ 450
602A-15P,N	0 to 1,500**	10	0.001/0.01	15	✓	5x3x7⅝	A	$ 295
602A-30P,N	0 to 3,000**	5	0.001/0.01	30	✓	5x3x7⅝	A	$ 295
602A-50P,N	0 to 5,000**	2	0.001/0.01	50	✓	5x3x7⅝	A	$ 325
602A-150P,N	0 to 15,000**	0.6	0.001/0.01	300	✓	5x3x7⅝	A	$ 425
602A-300P,N	0 to 30,000**	0.4	0.001/0.001	200	✓	4x8x9¼	A	$ 875
603-10P,N	0 to 1,000**	30	0.001/0.02	15	✓	5x5.5x7.5	A	$ 395
603-15P,N	0 to 1,500**	20	0.001/0.02	20	✓	5x5.5x7.5	A	$ 395
603-30P,N	0 to 3,000**	10	0.001/0.02	30	✓	5x5.5x7.5	A	$ 395
603-50P,N	0 to 5,000**	5	0.001/0.02	50	✓	5x5.5x7.5	A	$ 425
605-15P,N	400 to 1,500**	6	0.01/0.02	0.01%		5.1x2.8x4.8	C,D	$ 225
605-30P,N	700 to 3,000**	3	0.01/0.02	0.01%		5.1x2.8x4.8	C,D	$ 225
605-75P,N	2,000 to 7,500**	1	0.01/0.02	0.01%		5.1x2.8x4.8	C,D	$ 255
605-150P,N	4,000 to 15,000**	0.3	0.01/0.02	0.01%		5.1x2.8x4.8	C,D	$ 295
620 620AC	6-20kV 0-5kV 150-500V	0.2 0.2 1	0.002/0.03 0.002/0.03 0.002/1	0.02% 0.02% 0.05%	✓	6 x 5 x 10	C,D A	$ 495 $ 545
625	4-15kV 300-1,000V	0.2 1	0.002/0.03 0.002/1	0.03% 0.05%		5.1x2.8x4.8	C,D	$ 295
630	High Speed Dynamic Electrostatic Focus Supply. Static Focus Variable 0 to + 5,000 V @ 2 mA. Dynamic Focus 0 to 250 V/25 μsec. G-2 Supply +300 V included.				✓	5.1x5.3x6.5	A	$ 595
PMT-20P,N	0 to 2,000**	2	0.001/0.001	2	✓	1.1x3.9x5.3	D,E	$ 175

***Input Power:** A - 115/230V±10%, 50-400 Hz. B - ± 12V,±24Vdc input from NIM bin. C - +28 Vdc. D - Other dc input available on special order. E - ±12 to ±18 or +24 to +36 Vdc.

****Specify Output Polarity Suffix:** P-Positive, N-Negative (e.g. 205A-10P specifies 0 to +10,000V).

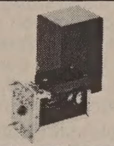
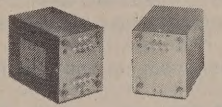
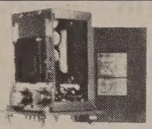
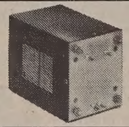
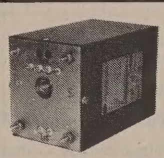
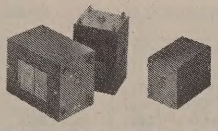
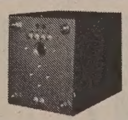
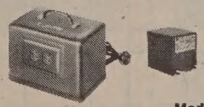
Prices and Specifications subject to change without notice.

BERTAN ASSOCIATES, Inc. 3 Aerial Way, Syosset, N.Y. 11791 • (516) 433-3110

1 AEROVISTA PARK, SAN LUIS OBISPO, CA. 93401 TOLL-FREE: PHONE 800-235-4150 • IN CA. 800-592-5910

CEA
a Division of Berkleonics, Inc.

PRODUCT SELECTION GUIDE

PRODUCT DESCRIPTION	TECHNICAL SPECIFICATIONS										SPECIAL PACKAGING AVAILABLE	PRODUCT INFORMATION DATA PAGE
		OUTPUT RANGE										
	INPUT	E VOLTS	I AMPS	P WATTS	BEST EFF.	BEST RESPONSE	CLASS	LINE + LOAD REG. (%)	RIPPLE (RMS) (%)	TEMP. COEFF. (%/°C)		
C1, C2, C3 SERIES SINGLES, DUALS, TRIPLES	A.C. or D.C.	5, 12 15, 18 24, 48	to 70	to 480	80%	—	C1	±0.1 ±0.005	≤25 mv	±0.01		3215
							C2, C3	±1.0 ±0.2	≤50 mv	±0.01		
CEA6 SERIES A.C.-D.C. SINGLE OUTPUT MODULES HIGHEST REGULATION	A.C. only	3.5 to 500	.05 to 25	to 800	75%	10 µ sec	A	.05	.01	.01		3216
							B	.01	.001	.005		
							C	.0025	.0005	.001		
							D	.0005	.0003	.0005		
CEAD6 SERIES A.C.-D.C. DUAL ± OUTPUT MODULES HIGHEST REGULATION	A.C. only	3.5 to 500	.05 to 10	to 300	75%	10 µ sec	A	.05	.01	.01		3217
							B	.01	.001	.005		
							C	.0025	.0005	.001		
							D	.0005	.0003	.0005		
CEAC6 SERIES A.C.-D.C. CONSTANT CURRENT SUPPLIES	A.C. only	0 to 200	.002 to 5.0	to 160	75%	10 µ sec	A	.5	.1	.1		CALL FACTORY FOR CATALOG
							B	.1	.01	.05		
							C	.025	.005	.01		
							D	.005	.003	.005		
CEA1 SERIES A.C.-D.C. SINGLE OUTPUT MODULES UNREGULATED	A.C. only	4.5 to 620	.05 to 25	to 1000	90%	—	—	LINE = NONE LOAD = 10%	5.0 rms	—		CALL FACTORY FOR CATALOG
CEA3 SERIES A.C. D.C.-D.C. SINGLE OUTPUT MODULES MINIATURE SIZE HIGH EFFICIENCY EMI/RFI FILTERING	A.C. or D.C.	4.0 to 256	.1 to 60	to 640	80%	1 m sec	A	1.0	0.3	0.1		3214 and 3215
							B	0.1	0.07	.01		
CEA2 SERIES D.C.-D.C. D.C. CONVERTERS EMI/RFI FILTERING	D.C. ONLY	3.5 to 500	.05 to 40	to 640	90%	10 µ sec	A	LINE = NONE LOAD = 10%	1.0	0.1		3214
						1 m sec	C	LINE = 0.5% LOAD = 0.5%	0.3	.05		
THIN LINE	A.C. IN	5V ±15V	.7 .125	3.5	70%	50 µ sec	—	±0.02	≤2 mv	±0.01		CALL FACTORY FOR CATALOG
CEAT SERIES A.C.-DC/D.C.-A.C. TRIPLE OUTPUT MODULES +5V & ±15V	A.C. or D.C.	4.5 to 6.0 ±10 to ±18	.1 to 20 .25 to 5.0	to 250	60%	10 µ sec	—	.02 .01	1 mv	.01		3217
CEA11 THRU CEA35 SERIES A.C.-A.C. SHIELDED LINE ISOLATORS UNREGULATED	A.C. ONLY	110 or 220	2.2 to 17.3	250 to 2000	96%	60 Hz		4%	—	—	 Modular	CALL FACTORY FOR CATALOG
							Available in Three Classes of Shielding. Maximum Coupling Capacitance of .01 pfd, .001 pfd, and 0.0005 pfd					
COMPACT NI-CAD A.C.-D.C. BATTERY CHARGERS	110 VAC ONLY	1.2 to 36	22 MA to 1.1	to 40	—	60 Hz	Available in Two Configurations, One for Commercial Applications, One for Military (Sealed Case and Connector)					CALL FACTORY FOR CATALOG
MOUNTING & TERMINATIONS	Sizes — Weights — Wiring											Call Factory
THERMAL DATA THERMAL RADIATORS	(a) Internal Dissipation (b) Temperature Rise — Chassis Mounting (c) Temperature Rise — Chassis and Radiator Mounting Effect of forced air cooling											CALL FACTORY FOR CATALOG
NEW PRODUCTS	Custom Supplies and Military Applications										*	3217

CALL FACTORY TOLL FREE — U.S.: 800-235-4150 — CALIFORNIA 800-592-5910 (Subject to Change Without Notice)

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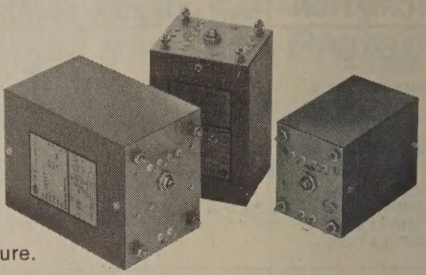
CEA's DC TO DC SWITCHERS

STANDARD FEATURES INCLUDE



- 80°C BASE TEMPERATURE without derating.
  Floating outputs, + or − output may be ±500VDC from case.
  Remote sensing on regulated models, eliminating load lead errors.
  Adjustment of output ±5% regulated models.
  Other ranges are optional.
  Remote adjustment optional at no charge.
  Series starting with rated load, for multiple supply to common load application.
  Short circuit output currents will not damage supplies.
  No voltage overshoot on turn-on or turn-off.
  MIL-T-27 modular case sizes with removable covers for servicing.
  Critical components pretested, aged, and graded.
- BURN-IN (stabilization), 16 hrs. min. at rated load and high base temperature.
- 100% TESTING after burn-in, test data with shipment. **Specifications guaranteed, not just typical.**
- 3 YEAR WARRANTY for parts and labor against defects in workmanship and materials.

CEA2 SERIES — DC TO DC

SPECIFICATIONS

REGULATION — STABILITY — RIPPLE

Class of Regula-tion	Line Regulation for Full DC Input Change	Load Regulation from 10% to Full Load	Ripple P-P*	Temperature Coefficient Per Degree C	Effi-ciency Up to	Option Re-quired
A	None	10% + .5 V	3.0%	0.1%	90%	F
C	0.5%	0.5%	1.0%	0.02%	80%	None

*Output ripple measured at 300 kHz bandwidth. Output voltages less than 10 VDC have minimum ripple of 20 mv.

Input Voltage: 21 to 30VDC standard, other input ranges are optional.

Recovery Time: As fast as 10 μs for "A" regulation supplies. For "C" supplies typically less than 1ms for a 50% to 100% load change.

Insulation Resistance: 100 Megohms DC for input, output and case.

Temperature, Base: −20°C to +80°C operating, −40°C to +85°C storage.

PART NUMBERS

Example: 1% Reg, 5V, 40A with options "F1" and "P3"; "CEA2C50X403F1P3"

CEA2__ ___ ___ ___ ___

YOUR SELECTION:

Specify regulation — Insert A or C

Specify output voltage — Insert any digits, 35 to 500

Specify voltage decimal — Insert X, Y or Z

Specify desired options — Insert option symbols

Specify output currents — Insert bracketed digits

OUTPUT VOLTAGE		OUTPUT RATED CURRENT																													
2 Digits Under 10V 3 Digits 10V and Over	Deci-mal Code	.05A (500)			.1A (101)			.25A (251)			.5A (501)			1A (102)			2.5A (252)			5A (502)			10A (103)			20A (203)			40A (403)		
select any voltage between limits		Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price	Size	Thermal	Price
		"A" Regulation Below																													
3.5 to 9.9	X													FA	3	104	GA	4	109	HA	5	121	KA	6	140	NA	7	225	QA	7	327
10.0 to 15.9	Y													FA	3	104	GA	5	109	JA	6	121	MA	6	189	PA	7	279	RA	7	412
16.0 to 29.9	Y										FA	3	104	GA	4	109	JA	5	121	MA	5	194	PA	6	279	RA	7	412			
30.0 to 59.9	Y										GA	4	109	JA	4	128	MA	5	194	PA	6	279	RA	6	412						
60.0 to 99.9	Y				FA	1	104	GA	3	109	HA	5	121	KA	5	140	NA	6	237	RA	6	412									
100 to 159	Z				FA	3	104	GA	5	109	JA	5	128	MA	5	194	QA	6	327												
160 to 299	Z	FA	2	104	GA	3	109	JA	5	128	MA	5	194	PA	6	279															
300 to 500	Z	GA	3	109	HA	4	121	LA	5	182	NA	6	225	RA	5	412															
		"C" Regulation Below																													
3.5 to 9.9	X													FA	5	190	GA	7	201	HA	8	225	KA	9	249	NA	9	394	QA	9	576
10.0 to 15.9	Y													FA	5	190	GA	7	201	JA	8	225	MA	8	327	PA	9	497	RA	9	714
16.0 to 29.9	Y										FA	5	190	GA	6	201	JA	7	225	MA	8	327	PA	9	497	RA	9	714			
30.0 to 59.9	Y										GA	6	201	JA	7	225	MA	7	327	PA	8	497	RA	9	714						
60.0 to 99.9	Y				FA	4	190	GA	5	201	HA	7	225	KA	7	249	NA	9	394	RA	8	714									
100 to 159	Z				FA	5	190	GA	7	201	JA	7	225	MA	8	327	QA	8	576												
160 to 299	Z	FA	5	194	GA	6	201	JA	7	225	MA	7	327	PA	8	497															
300 to 500	Z	GA	5	201	HA	7	225	LA	7	327	NA	9	394	RA	8	714															

(Subject to Change Without Notice)

CEA3 SERIES — DC TO DC OR AC TO DC

SPECIFICATIONS

REGULATION — STABILITY — RIPPLE — BASE MODEL PRICE

Class of Regulation	Line Plus Load Regulated	Line Regulation for 10% Line Change	Load Regulation 10% Load to Full Load	Temperature Coefficient Per Degree C	Stability for 40 Hours	Ripple P-P*	BASE MODEL PRICE
A	0.5%	0.25%	0.25%	0.5%	0.5%	1.0%	As Tabulated
B	±0.1%	±0.05%	±0.05%	±0.02%	±0.1%	0.2%.	A plus $40.00

*Output ripple measured at 300 kHz bandwidth. Output voltages less than 10 VDC have minimum ripple of 20 mv.

"CONTINUED ON NEXT PAGE"

CEA's DC TO DC SWITCHERS

CEA's SPECIFICATIONS (CONTINUED)

Input Voltage and Frequency: 105 to 125 volts, 50 to 420 Hz or 120 to 180VDC, extended ranges optional.

Efficiency: Up to 80%. The output rectifier voltage drop of 1.2 volts is a major loss, hence a 5V output is 64% on some models.

Insulation Resistance: 100 Megohm DC standard for input, output and case.

Temperature, Base: −20°C to +80°C operating, −40°C to +85°C storage.

Recovery Time: Typically less than 1ms for a 50% to 100% load change.

PART NUMBERS

Example: .1% Reg, 5V, 60A, with options "F" and "W"; "CEA3B50X603FW"

CEA3___ ___ ___ ___ ___

YOUR SELECTION:

Specify regulation — Insert A or B

Specify output voltage — Insert any digit, 40 to 256

Specify voltage decimal — Insert X, Y or Z

Specify output currents — Insert bracketed digits

Specify desired options — Insert option symbols

OUTPUT VOLTAGE		OUTPUT RATED CURRENT																													
2 Digits Under 10V 3 Digits 10V and Over	Decimal Code	.1A (101)			.25A (251)			.5A (501)			1A (102)			2.5A (252)			5A (502)			10A (103)			20A (203)			40A (403)			60A (603)		
Select any voltages between the limits		Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price
4.0 to 7.9	X													GA	5	261	HA	6	315	JA	7	346	MA	7	424	NA	9	491	PA	9	552
8.0 to 15.9	X Y										GA	5	261	HA	6	315	JA	7	363	KA	8	388	NA	9	491	RA	8	685			
16.0 to 31.9	Y							GA	5	261	NA	5	303	JA	7	363	KA	8	388	NA	8	491	RA	7	685						
32.0 to 63.9	Y				GA	5	261	HA	5	303	HA	6	363	KA	8	388	NA	8	484	RA	7	685									
64.0 to 127	Y Z	GA	4	261	HA	5	303	JA	6	346	KA	7	363	NA	8	491	RA	7	685												
128 to 256	Z	HA	5	303	JA	6	346	KA	7	388	NA	7	491	RA	7	685															

OPTIONAL FEATURES FOR DC TO DC POWER CONVERTERS

Symbol Option	Option Description	Prices
	FIXED OUTPUTS	
F	Fixed output ±5%	No Charge
F1	Fixed output ±1%	$15
	EXTENDED TEMPERATURE RANGE	
H1	Temperature range −55°C to +80°C	$50 or 50%
H2	Temperature range −40°C to +80°C	$15 or 15%
H3	Temperature range −55°C to +115°C	$100 or 100%
	SPECIAL CONNECTIONS	
N1	Screw terminals #6-32	$15
	PROTECTION CIRCUITS	
Std.	Current limiting	No Charge
P2	Overtemperature cutout	$20
P3	Crowbar voltage limit	$30 or 15%

Symbol Option	Option Description		Prices
	REMOTE PROGRAMMING		
R	Remote adjust (no pot provided)		No Charge
R1	Remote adjust with 1% linearity		$20 or 10%
R2	Remote adjust plus internal pot		$5
R3	Remote adjust with pot provided		$5
	HIGH FLOAT VOLTAGE		
U	Output float up to ±1000V		$10 or 10%
	RUGGEDIZED		
W	Potted for ruggedization in in polyurethane resin	FA, GA, HA, JA	$15
		KA, LA	$20
		MA, NA	$25
		PA	$30
		QA	$35
		RA	$40
W2	Lightweight rigid foam.		"W" +$20

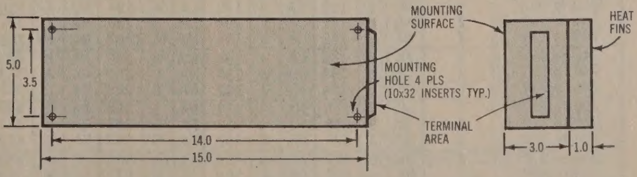
C2, C3 SERIES

SPECIFICATIONS

SIMILAR TO THE CEA2 AND CEA3 SERIES CIRCUITRY REPACKAGED IN A RACK MOUNTABLE CONFIGURATION WITH NATURAL CONVECTION COOLING.

EMI-RFI FILTERING AVAILABLE

MOUNTING DETAIL



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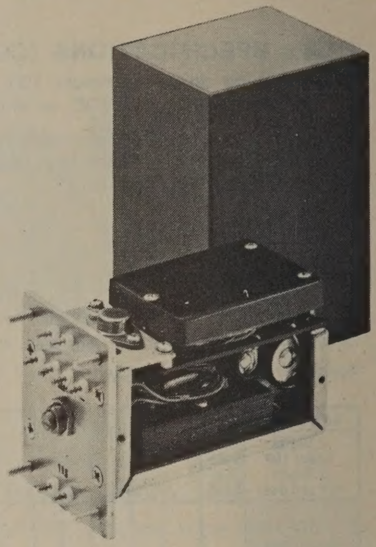
CEA's AC TO DC POWER SUPPLIES

STANDARD FEATURES INCLUDE

- INPUTS 50 to 420 Hz, 95 to 460VAC.
- REGULATION from .05% to .0005% for line plus load.
- 80°C BASE TEMPERATURE without derating.
- SHIELDING, line isolation, eliminating glitches and other noise problems. 20 db standard, up to 100 db optional.
  Floating outputs, + or — output may be ±500VDC from case.
  Remote sensing standard, all models, eliminates load lead errors.
  Adjustment of output ±5% standard. Other ranges are optional.
  Remote adjustment optional at no charge.
  Series starting with rated load, for multiple supplies to a common load.
  Short circuit output current will not damage supplies.
  No voltage overshoot on turn-on or turn-off.
  MIL-T-27 modular case sizes with removable covers for servicing.
  Critical components pretested, aged, and graded.
- BURN-IN (stabilization), 16 hrs. min. at rated load and high base temperature.
- 100% TESTING after burn-in, test data with shipment.

Specifications guaranteed, not just typical.

- 3 YEAR WARRANTY for parts and labor against defects in workmanship and materials.



CEA6 SERIES

SPECIFICATIONS

REGULATION — STABILITY — RIPPLE — BASE MODEL PRICE

Class of Regulation	Line Plus Load Regulation	Line Regulation for 10% Line Change	Load Regulation for No Load to Full Load	Temperature Coefficient Per Degree C	Stability for 40 Hours	RMS Ripple	Option Required	Output Current Limit	BASE MODEL PRICE
A	±0.05%	±0.01%	±0.04%	±0.01%	±0.05%	0.01%	None	25A	Tabulated below
B	±0.01%	±0.002%	±0.008%	±0.005%	±0.01%	0.001%	None	25A	A plus $20.00
C	±0.0025%	±0.0005%	±0.002%	±0.001%	±0.0025%	0.0005%	F's or R's	5A	A plus $80.00
D	±0.0005%	±0.0001%	±0.0004%	±0.0005%	±0.0005%	0.0003%	F's or R's	1A	A plus $175.00

Input Voltage and Frequency: 105 to 125 volts — 50 to 420 Hz are standard. DC and other voltage ranges are optional.

Output Voltage and Current: 3.5 to 500VDC — .05 to 25A. See correlation in table below.

Recovery Time: As fast as 10 microseconds, depending on model selected.

Insulation Resistance: 100 Megohms — standard for input, output and case; 1K Megohms for option "T"; 10K Megohms for option "TI."

Temperature, Base: −20°C to +80°C operating, −40°C to +85°C storage.

PART NUMBERS

Example: .01% Reg, 5V, 1A with options "F" and "P3"; "CEA6B50X102FP3"

YOUR SELECTION: **CEA6__ ___ _ __ ___**

Specify regulation — Insert A, B, C or D

Specify output voltage — Insert any digits, 35 to 500

Specify voltage decimal — Insert X, Y or Z

Specify desired options — Insert option symbols

Specify output currents — Insert bracketed digits

OUTPUT VOLTAGE		OUTPUT RATED CURRENT																										
2 digits under 10V 3 digits 10V & over	Decimal Code	.05A (500)			.1A (101)			.25A (251)			.5A (501)			1A (102)			2.5A (252)			5A (502)			10A (103)			25A (253)		
Select any voltage between limits		Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price	Size	Thermal	A-Reg. Price
3.5 to 9.9	X				FA	1	109	GA	2	109	HA	3	128	JA	4	128	MA	5	194	NA	7	225	QA	7	346	SA	8	460
10.0 to 12.4	Y				FA	1	109	GA	2	109	HA	3	128	JA	5	128	MA	5	194	NA	7	225	QA	7	346	SA	9	460
12.5 to 27.4	Y				GA	1	109	HA	3	121	JA	4	128	KA	5	152	NA	6	225	PA	7	279	RA	7	424	TA	9	479
27.5 to 29.9	Y				GA	1	109	HA	3	121	KA	3	152	LA	5	158	NA	6	225	PA	7	279	RA	8	424	TA	9	479
30.0 to 39.9	Y				GA	2	109	JA	3	128	LA	3	158	NA	4	225	PA	6	279	QA	7	346	SA	8	460			
40.0 to 49.9	Y				HA	2	128	JA	3	128	LA	4	158	NA	5	225	PA	7	279	QA	7	346	SA	8	460			
50.0 to 59.9	Y	HA	1	128	JA	2	128	KA	3	152	MA	4	194	PA	5	280	QA	6	346	RA	7	424	TA	8	779			
60.0 to 79.9	Y	JA	1	158	KA	2	182	LA	3	194	MA	5	230	PA	5	339	QA	7	406	SA	7	557	TA	9	605			
80.0 to 89.9	Y	JA	1	158	KA	2	182	LA	4	194	MA	5	230	PA	5	339	RA	6	509	SA	8	557						
90.0 to 99.9	Y	JA	2	158	KA	2	182	LA	4	194	MA	5	230	QA	5	406	RA	7	509	SA	7	557						
100 to 119	Z	KA	2	182	LA	2	194	MA	4	230	NA	5	261	QA	5	406	RA	7	509	TA	8	605						
120 to 139	Z	KA	2	182	LA	3	194	MA	4	242	NA	6	285	QA	6	448	SA	7	636	TA	8	709						
140 to 159	Z	KA	3	182	LA	3	194	MA	5	242	NA	6	285	RA	5	576	SA	7	636									
160 to 199	Z	LA	3	194	MA	3	230	NA	5	285	PA	6	363	RA	6	576	SA	8	636									
200 to 219	Z	LA	3	194	MA	3	242	NA	5	285	PA	6	363	RA	6	576	TA	7	709									
220 to 259	Z	MA	3	255	NA	3	310	PA	5	388	QA	6	484	SA	6	714	TA	8	806									
260 to 279	Z	MA	3	255	NA	4	310	PA	5	388	QA	6	484	SA	6	714												
280 to 339	Z	NA	3	327	PA	3	400	QA	5	509	RA	5	673	SA	7	757												
340 to 379	Z	NA	3	327	PA	4	400	QA	5	509	RA	6	673	TA	7	854												
380 to 500	Z	PA	3	400	QA	4	509	RA	5	673	SA	6	757	TA	7	854												

"C" and "D" regulation not available in FA case for voltage range 3.5VDC to 8.4VDC, order GA or larger case.

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CEA
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CEA's AC TO DC POWER SUPPLIES

CEAD6 SERIES — DUAL POWER SUPPLIES

SPECIFICATIONS

Similar to CEA6 Series, single output power supplies. Prices per Regulation varies with classification:

"A" Regulation — Base Price
"B" Regulation — $40.00 + Base Price
"C" Regulation — $160.00 + Base Price
"D" Regulation — $350.00 + Base Price

CALL FACTORY TOLL FREE FOR BASE PRICES.

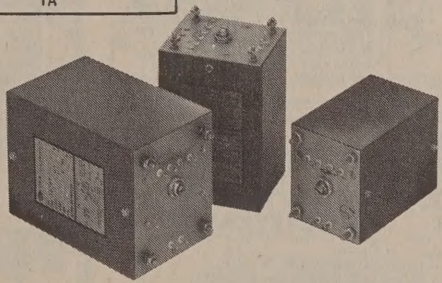
OPTIONAL FEATURES

The extra charge for each option is either a flat rate or percentage of the base model price; add the larger number to the base price.

Symbol Option	Option Description
	FIXED OUTPUTS
F	Fixed output ±1.0%
F1	Fixed output ±0.1%
F2	Fixed output ±0.01%
	ADJUSTABLE OUTPUTS
G	Output adjust range ±1%
Std.	Output adjust range ±5%
G1	Output adjust range ±10%
G2	Output adjust range ±20%
G3	Output adjust range ±30%
G4	Output adjust range ±40%
G5	Output adjust range ±50%
Note: Next larger case size may be required for Options G2, G3, G4 and G5. The temperature coefficient is degraded in Classes B, C and D for Options G2 thru G5.	
	EXTENDED TEMPERATURE RANGE
H1	Temperature range −55°C to +80°C
H2	Temperature range −40°C to +80°C
H3	Temperature range −55°C to +115°C
	DUAL OUTPUT ISOLATION
K	Isolated outputs
	AC INPUT VOLTAGE AND FREQUENCY
L	Input 95-135V, 50-420 Hz
L1	Input 208V ±10%, 50-420 Hz
L2	Input 230V ±10%, 50-420 Hz
L3	Input 460V ±10%, 50-420 Hz
L4	Input 105-125V, 400 ±20 Hz
L5	Input 115/230V, 50-420 Hz
	PROTECTION CIRCUITS
P1	Current limiting
P2	Overtemperature output
P3	Crowbar voltage limit

Symbol Option	Option Description
	REMOTE PROGRAMMING
R	Remote adjust (no pot provided)
R1	Remote adjust with 1% linearity
R3	Remote adjust without pot provided (A&B only)
	OPTIONAL STARTING CIRCUITS
S1	Start with 30,000 mfd/amp-100,000 mfd. max.
S2	Start positive output first
S3	Start negative output first
	HIGH ISOLATION
T	40 db transformer shielding
T1	100 db transformer shielding
	HIGH FLOAT VOLTAGE
U	Output float up to ±1000V
	RUGGEDIZED
W	Potted for ruggedization in polyurethane resin HA, JA KA, LA MA, NA PA QA RA SA TA

ASK ONE OF OUR SALES ENGINEERS FOR SPECIFIC APPLICATION DATA AND PRICING INFORMATION



CEAT SERIES — TRIPLE +5V AND ±15V

SPECIFICATIONS — PART NUMBERS — PRICE (OPTIONS AVAILABLE — CALL FACTORY)

Part Number	+5V Output Current	±15V Output Current	Line Regulation (10% Change)		Load Regulation (N/L to F/L)		RMS Ripple	Temperature Coefficient	Case Size	Ther-Mal No.	Base Price
			+5V	±15V	+5V	±15V					
CEAT50J15	1.0A	.25A	±.02% for all Models	±.01% for all Models	±.02% +.0005 Ω for all Models	±.01% for all Models	1 mV for all Models	±.01%/°C for all Models	JA	3	$128
CEAT50M15	2.5A	.5A							MA	4	194
CEAT50N15	5.0A	1.0A							NA	5	225
CEAT50Q15	10.0A	2.5A							QA	6	346
CEAT50S15	20.0A	5.0A							SA	7	460

CEA's CUSTOM POWER SUPPLIES

- MILITARY APPLICATION (JANTX SEMICONDUCTORS)
- TTL OR CMOS COMPATIBLE
- HIGH EFFICIENCY SWITCHERS
- INPUT PROTECTION CIRCUITS (MIL-STD-1399 OR 704)
- RFI/EMI (MIL-STD-461A)
- MULTI-OUTPUT MODULES OR RACK SUPPLIES

These standard catalog power supplies can be electrically and mechanically modified for specific applications. Our sales engineers are standing by to discuss your particular requirements.

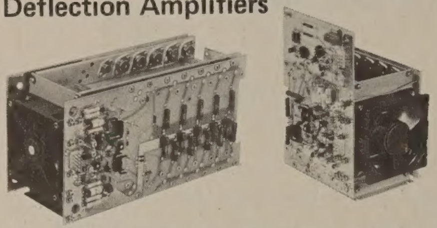
CALL TOLL FREE

CPS

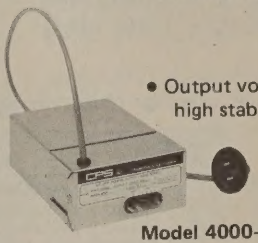
HIGH PRECISION, HIGH VOLTAGE POWER SUPPLIES

For high-precision electron beam control in CRT's, X-Ray equipment, scanning electron microscopes and photomultiplier tubes. A full range of standard and custom models offered to commercial and Mil-Spec OEM's.

Precision CRT Focus and Deflection Amplifiers

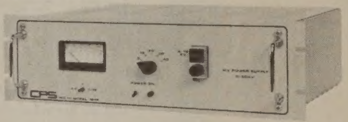


Cost-effective devices optimized for high writing rates and crisp character generation. Unique power-on-demand feature offers power savings of at least 50% over conventional systems and accommodates rapid and accurate beam focusing and positioning. High voltages up to ±90VDC.



Model 4000-1009

Model 100-50



FEATURES

- Output voltages to 50kV
- Low ripple, precision regulation, high stability
- Remote programming and metering models
- Short circuit and arc protection
- Self restoring
- Multiple output voltage options
- Solid state design, advanced encapsulation techniques utilized
- UL Recognition

APPLICATIONS

Radiographic Equipment (Medical and Material Analysis) • Radar Displays • Precision CRT Displays • Phototypesetters • Photomultiplier Tubes • Optical Recorders • COM (Computer Output Microfilm)

Series	Output Voltage	Output Current	Regulation (%) Line	Regulation (%) Load	Ripple (P-P)	Stability (%) 1-Hour	Stability (%) 8-Hour	Temp. Coeff./°C	Input Power	Features	Size (Inches) H W D
GENERAL PURPOSE – PRECISION & ULTRA PRECISION HIGH VOLTAGE POWER SUPPLIES											
1000	±10kV to 20kV ±20kV to 30kV	125 μA 250 μA	0.001 0.001	0.001 0.001	≤200mV ≤300mV	0.01 0.01	0.02 0.02	25PPM	115/220V 47 to 440 Hz	Output voltage programmable.	4-5/8" x 4-1/2" x 9"
100 – 30 – 50 –250	±1kV to 30kV ±10kV to 50kV ±10kV to 50kV	1.0 mA 1.0 mA 2.0 mA	0.001 0.001 0.005	0.001 0.001 0.005	≤200mV ≤500mV ≤500mV	0.005 0.005 0.005	0.01 0.01 0.01	25PPM 25PPM 100PPM	100/115/220V 47 to 440 Hz	Single & Bi-polar output versions; output voltage programmable remotely; output metering.	4-3/4" x 8" x 11-1/2"
– 1591 – 1601	+10kV to 30kV +20kV to 50kV	300 μA 500 μA	0.05 0.05	0.05 0.05	≤2.5V ≤1.5V	0.05 0.05	0.1 0.1	100PPM 100PPM	+28 Vdc +28 Vdc	Ruggedized Ruggedized	2-1/8" x 3-3/4" x 6" 5-1/4" x 5-1/2" x 12-1/2"
5001A – 2 – 5 – 10 – 20	±0.5 to 2.0 kV ±2.0 to 5.0 kV ±5.0 to 10.0kV ±10.0 to 20.0kV	5.0 mA 2.0 mA 1.0 mA 250 μA	0.01 0.01 0.01 0.01	0.005 .005 .005 .005	≤200mV ≤500mV ≤1V ≤2V	0.01 0.01 0.01 0.01	0.02 0.02 0.02 0.02	100PPM 100PPM 100PPM 100PPM	100/115/220 Vac 47 to 440 Hz; or, +28 Vdc	Output voltage programmable remotely.	2-11/16" x 5-1/2" x 9"
5003A	10V to ±2kV 10V to ±2kV 10V to ±2kV	5.0 mA 10.0 mA 20.0 mA	0.01 0.01 0.01	0.01 0.01 0.01	≤5mV ≤5mV ≤10mV	0.01 0.01 0.01	0.02 0.02 0.02	100PPM 100PPM 100PPM	100/115/220 Vac 47 to 65 Hz 47 to 65 Hz +24 & +28 Vdc	Output voltage programmable remotely.	4-1/2" x 2-1/2" x 7-1/2" (DC Input Power) 7" x 3-3/8" x 7-1/2" (AC Input Power)
MULTIPLE OUTPUT – HIGH VOLTAGE POWER SUPPLIES FOR COMMERCIAL & MILITARY APPLICATIONS											
4000 – 1008 (Anode) (Focus)	10 to 20kV 100 to 1kV	200 μA 1.0 mA	0.1 1.0	0.1 5.0	15V 10V	0.1 1.0	0.2 2.0	200PPM 1000PPM	+18 Vdc to +30 Vdc	U.L. Approved	2" x 4" x 5-1/2"
4000 – 1487 (Anode) (Focus) (G-2)	+15 kV +3.2 to +5.3 kV +500V	30 μA 300 μA 50 μA	0.05 0.1 1.0	0.05 0.1 1.5	7.5V 2.5V 0.5V	0.05 0.05 0.05	0.1 0.1 0.1	250PPM 250PPM 250PPM	+28 Vdc	Mil-E-5400 qualified for Avionic system application.	3-13/16" x 4" x 6"
4000 – 1592 (Anode) (Focus) (G-1) (G-2)	+15 kV +2.2 to +2.4 kV –10 to –50V +300V	200 μA 500 μA 10 μA 100 μA	0.05 0.05 0.2 0.05	0.05 0.1 0.2 0.5	3V 5V 0.1V 1V	0.01 0.01 0.01 1.0	0.02 0.02 0.02 2.0	200PPM 200PPM 200PPM 1000PPM	±18 Vdc	Qualified to ground based Mil-Spec requirements. Focus can be modulated over range of 0 to +400V remote output voltages monitor.	2-1/2" x 6-1/4" x 9-3/16"
4000 – 1617 (Anode) (Focus) (G-2)	+20 kV +3 to 5.5 kV +300V	200 μA 500 μA 1.0 mA	0.03 0.03 0.05	0.03 0.03 0.05	5V 5V 1V	0.01 0.01 0.01	0.02 0.02 0.02	100PPM 100PPM 100PPM	+28 Vdc	Output voltage programmable remotely; H.V. output monitor; can be dynamically modulated; static focus externally programmable.	2-3/4" x 6-1/4" x 9"
4000 – 1702 (Anode) (Focus) (G-1) (G-2)	+10 to 12 kV 2.7 kV to +4.0 kV –60V +600 to +720V	40 μA 25 μA 75 μA 250 μA	0.05 0.05 0.05 0.05	0.05 1.0 0.3 0.3	5V 10V 60 mV 1V	0.01 0.2 0.02 0.02	0.02 0.5 0.05 0.05	200PPM 200PPM 200PPM 200PPM	±15V & ±20V	Output voltage metering. Focus output adjustable; focus can be dynamically modulated.	2-1/2" x 5-3/4" x 9"
4000 – 1733 (Anode) (G2) (G1)	+16kV +400V –110V	200 μA 200 μA 200 μA	0.01 0.01 0.01	0.01 0.01 0.01	15V 500mV 300mV	0.01 1.0 1.0	0.1 2.0 2.0	250PPM 250PPM 250PPM	+22 Vdc	Mil-E-5400/16400 qualified for avionic system application.	2-1/8" x 4-3/4" x 5-1/2"

FOCUS AND DEFLECTION AMPLIFIERS FOR PRECISION CRT APPLICATIONS

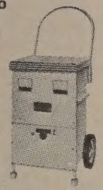
Model	Input Impedance	Bandwidth	Small Signal Step Settletime	Linearity	Drift	Output Noise + Ripple	Operating Temperature	Features	Size
Mark I Focus Amplifier	1 kΩ	500 kHz with 64 μH coil	1% of final value in 1.2 μsec	±0.3% from best straight line	±0.05%/°C	100 μA rms	0°C to 50°C	Power-on-demand. High voltages up to ±180 Vdc	8-1/2" L, 7-1/8" W, 10-1/4" H
Mark I X & Y Deflection Amplifier	1 kΩ	1 MHz with 15 μH yoke (custom interfaces available)	1% of final value in 650 nsec	±0.3% from best straight line	±0.05%/°C	100 μA rms	0°C to 50°C	Power-on-demand. High voltages up to ±180 Vdc	14-1/4" L, 7-1/8" W, 7-1/5" H

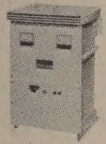
For complete information and applications assistance, contact the precision high voltage power supply specialists at:

CPS INC. 722 E. Evelyn Avenue · Sunnyvale, California 94086 · Phone (408) 738-0530 Telex 357-450

CHRISTIE SINCE 1929 ELECTRIC CORP.

SCO


RA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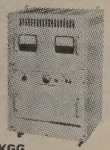

KKGG

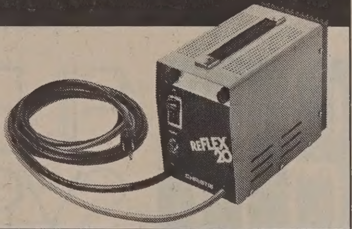
D-C POWER SUPPLIES GENERAL PURPOSE HIGH CURRENT

	Power Supply Series	D-C Output Volt Range	Std. Current Ratings (amps)	Inter-mittent Current Rating	Type of Regulator	Typical Regulation (±)	Typical Ripple	Typical Response Time	A-C Input
Most Economical	SCO	2-15 2-37 2-48	100 50 40	—	SCR	0.25%	1%	75 msec.	1-ph.
	RA	28	100, 200, 300, 400, 600, 1000	500%	Shunt	2% load	1%	—	3-ph.
	K	22-32 26-36(32) 110-135 220-280	50, 100, 200, 300 400, 500, 600, 800 1000, 1200, 1500 40, 60, 100, 200, 300 100	500%	Magamp	0.25%	1%	50 msec.	3-ph.
	EE	0-15 0-30 0-40 0-31/0-62 0-135	1000 1500 150, 300, 600 700/350 150. 300	—	SCR	0.1%	0.1%-0.4%	50 msec.	3-ph.
Most Sophisticated	KKGG	15(26)-36	50, 100, 200, 400, 600	—	Transistor	0.01%	0.0025%	0.05 msec.	3-ph.

REFLEX® 20 20-MINUTE CHARGERS & NI-CAD BATTERY PACK SYSTEMS

Patented REFLEX battery charging principle employing depolarization pulses, provides complete recharge for sealed ni-cads in 20 minutes.

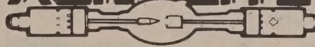
Companion long-life REFLEX-20 battery packs with ½ AA to F size cells are produced specifically for Christie REFLEX chargers.



REFLEX® CHARGERS FOR AIRCRAFT APPLICATIONS

The same principle is employed for fully charging vented aircraft 5 to 50 ampere-hour ni-cads in one hour.

CHRISTIE XENOLITE®



XENON AND MERCURY ARC LAMP SYSTEMS

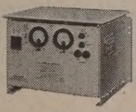
Lamphouses Power Supplies Igniters
Optics Bulbs Slide Projectors

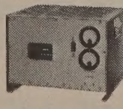
CHARGERS FOR LARGE REV BATTERIES

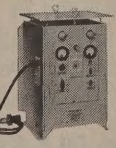
Nominal Battery Voltages	Std. Current Ratings (amps)	Service	Typical Regulation	Typical Ripple	A-C Input
6, 12, 24	25, 50	Float or Charge	±0.25%	1%	Ratings with * are 3-ph; all others 1-ph.
12, 24, 36	150*				
36, 48	25, 50, 60*, 130*				
72, 120	12, 25, 30*, 50, 60*, 100*				

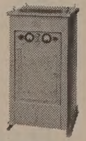
MILITARY POWER SUPPLIES & CHARGERS

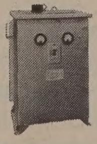
Typical Special Army, Navy, Air Force, A.E.C. and NASA Units


30 AMP AUTOMATIC BATTERY CHARGER

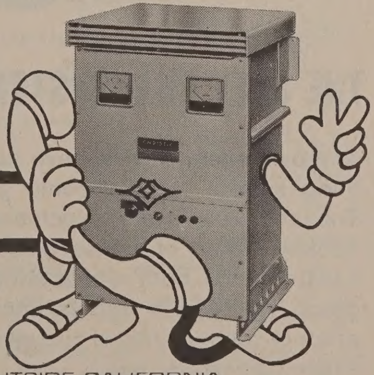

50 AMP RADIO POWER


75 AMP MISSILE TESTING SUPPLY


HELICOPTER STARTING POWER SUPPLY


175 AMP FORKLIFT TRUCK CHARGER

TALK TO THE CHRISTIE



OUTSIDE CALIFORNIA
CALL TOLL-FREE 24 HRS
(800) 421-2058

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ELECTRIC CORP.
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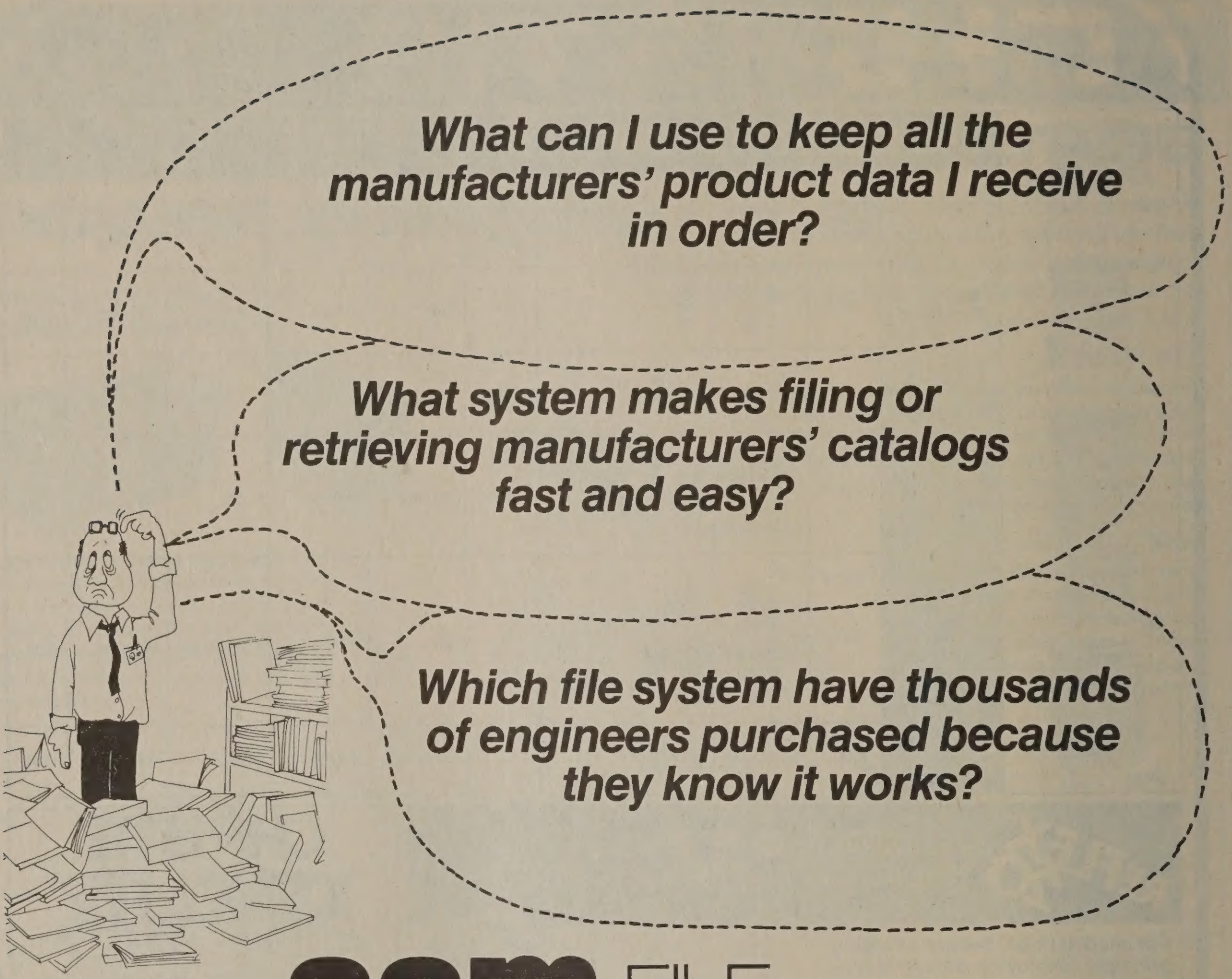
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What system makes filing or retrieving manufacturers' catalogs fast and easy?
Which file system have thousands of engineers purchased because they know it works?

eem FILE SYSTEM

THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

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DC to DC Converters

MODEL NUMBERS

CASE UNITS

1.5" x 3" Extruded Aluminum

REGULATED

Basic Model No.	$I_{IN\ MAX}$	Case Depth	Mounting Dim.	Base Price
PS 330	.25	1.20	℄ x 1.20	$165.00
PS 331	.60	1.50	.70 x 1.20	168.00
PS 332	1.00	2.30	1.50 x 1.20	180.00
PS 333	2.00	3.80	2.50 x 1.20	195.00
PS 334	4.00	7.00	5.00 x 1.20	215.00

UNREGULATED

PS 335	.25	.75	℄ x 1.20	74.00
PS 336	.60	1.00	℄ x 1.20	78.00
PS 337	1.00	1.30	℄ x 1.20	81.00
PS 338	2.00	2.00	.70 x 1.20	94.00
PS 339	4.00	3.50	2.00 x 1.20	121.00

PC CARDS .75" Thick

REGULATED

Basic Model No.	I_{IN}	Hgt.	Lgth.	Mounting Dim. Fr. Edge CtoC	Base Price
PS 340	.25	2.50	3.00	.60 x 1.00	$ 92.00
PS 341	.60	2.50	3.50	.60 x 1.00	97.00
PS 342	1.00	2.50	4.00	.60 x 1.00	99.00
PS 343	2.00	2.50	5.00	1.30 x 1.50	114.00
PS 344	4.00	3.00	8.00	2.50 x 2.00	133.00

UNREGULATED

PS 345	.25	2.50	2.00	.60 x 1.00	38.00
PS 346	.60	2.50	2.50	.60 x 1.00	40.00
PS 347	1.00	2.50	3.00	.60 x 1.00	42.00
PS 348	2.00	2.50	3.00	.60 x 1.00	45.00
PS 349	4.00	3.00	6.00	1.50 x 1.50	68.00

RECTIFIER SYSTEMS

To find unit price, multiply base price times multiplier

	Output Voltage	Base Price Multiplier
AC—AC Square Wave	2 to 1500VAC	1.00
FW—Full Wave	5 to 35VDC	1.12
BCT—Bridge Center Tap	5 to 60VDC	1.24
B—Bridge	36 to 1500VDC	1.15
VD—Voltage Doubler	1501 to 3000VDC	1.20
VQ—Voltage Quadrupler	3001 to 6000VDC	1.35

QUANTITY DISCOUNTS

	Unit Price
1-3	
4-29	LESS 10%
30-99	LESS 20%
100-499	LESS 30%
500-999	LESS 40%

Discounts on larger quantities negotiable.
Discounts applicable only on scheduled quantities
Contract not to exceed one (1) year.

ORDERING INFORMATION

PS 207 — 22 — 3000 — VQ +F — P

❶ ❷ ❸ ❹ ❺ ❻

❶ **Basic Model Number Determines Wattage, Size and Mounting.**

❷ **Input Voltage: This number indicates $E_{IN\ MIN}$ on the regulated units and E_{IN} Nom. on the unregulated units.**

❸ **Output Voltage: May be any voltage between 2 volts and 1500 volts AC or between 5 volts and 6000 volts DC.**

❹ **Rectifier System: Select for applicable output voltage, refer to rectifier systems above.**

❺ **When a positive ground is required add +F after rectifier system. Nothing is added for negative ground.**

❻ **Modifications:**
—P for program connection.
—E for enable operation.

A On output voltages less than 20 volts the switching spikes will be about 100 mv p-p. These can be easily reduced by adding a capacitor on the output terminals.

B Because of common mode ripple it is necessary to know when a positive ground system is used (see ordering information).

C The conversion frequency will be approximately 18KHz at nominal input and output voltages.

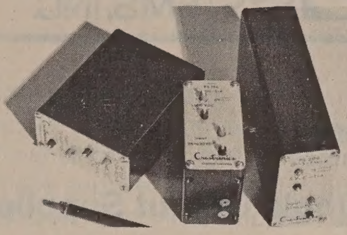
ISOLATION

All outputs greater than 100 VDC will be isolated to 6000 VDC. All outputs less than 99 VDC will be isolated to 100 VDC. Isolation resistance will be greater than 10K Meg. For special isolation requirements call our engineering department.

Reliability

Short Circuit Protected

Filtered Input



Crestronics Inc. DC to DC Converters are designed as a power supply for electronic circuits with a minimum of interference in the audio and rf ranges. The 18KHz conversion employed eliminates all audio range problems and an internal input filter reduces the rfi conductance noise to a level of less than 30 mv P-P across a one ohm resistor in series with the input.

REGULATED UNITS

1.0 INPUT

1.1 Voltage - -$E_{IN\ MIN}$ - - Customer may specify any input voltage between 11 and 28 volts DC. $E_{IN\ MIN}$ is the lowest input voltage applied. This should include the lowest excursion of ripple.

1.2 Input Voltage Differential - - ΔE_{IN} - - The normal ΔE_{IN} is 4 volts DC. For ΔE_{IN} greater than 4 volts derate the input current to

$$I\ \text{derate} = \frac{6\ I_{IN\ MAX}}{\Delta E_{IN} + 2}$$

1.3 Input Current - - $I_{IN\ MAX}$ - - See Model Numbers
$I_{IN\ MAX}$ shall be derated for a ΔE_{IN} greater than 4 volts—See 1.2
$I_{IN\ MAX}$ shall be derated for greater than 70° operation—See 10.2

2.0 OUTPUT

2.1 Voltage - - E_o - - Customer may specify output voltage up to 1500 VAC ⊓⊔ or 6000 VDC. See ordering information # ❸

2.1.1 The output voltage is screwdriver adjustable from —20% to +5% of nominal.

2.2 Power - - P_o - - The output power is expressed as $(.7\ E_{IN\ MIN}\ I_{IN}) - I_o$

3.0 REGULATION

3.1 Line .... .01%/ △ input volt
3.2 Temperature .... (.02%/°C) —2mv/°C
3.3 Load .... 100% to 10%
For 30 VDC & Over 3%
For 29 VDC & under .... $\% = \frac{(.02\ E_o) + .3}{E_o \times 10^{-2}}$

4.0 EFFICIENCY - - Efficiency is expressed in % as $\frac{(.7\ E_{IN\ MIN}\ I_{IN}) - I_o}{E_{IN\ MIN}\ I_{IN} \times 10^{-2}}$

UNREGULATED UNITS

5.0 INPUT

5.1 Voltage - - E_{IN} - - Customer may specify any input voltage between 5 and 35 VDC

5.2 Current - - I_{IN} - - See Model Numbers

6.0 OUTPUT

6.1 Voltage - - E_o - - Customer may specify any output voltage up to 1500 VAC or 6000 VDC.

E_o is proportional to E_{IN} Ratio $= \frac{E_{IN} - 1}{E_o}$

E_o shall not exceed 1.1 E_o

6.2 Power - - P_o - - $P_o = (.75\ E_{IN}\ I_{IN}) - I_o$

7.0 REGULATION

7.1 Line - - - - Directly proportional

7.2 Load - - - 100% to 10% $\% = \frac{(.05\ E_o) + .3}{E_o \times 10^{-2}}$

8.0 EFFICIENCY - - Efficiency is expressed in % as $\frac{(.75\ E_{IN}\ I_{IN}) - I_o}{E_{IN}\ I_{IN} \times 10^{-2}}$

9.0 RIPPLE - - - - .3% P-P max.

GENERAL

10.0 TEMPERATURE

10.1 Temperature measured at mounting surface
10.2 For temperature greater than 70°C — Derate input $I_{IN\ MAX}$ 1%/°C

11.0 CASE .... Black Anodized Extruded Aluminum
11.1 Back Plate .... Clear Anodized Aluminum
11.2 Name Plate .... Metal Photo Corp.
11.3 Size .... See Model
11.4 Mounting .... See Model
11.5 Weight .... 1.7 gram per cubic CM

12.0 TO DETERMINE INPUT CURRENT $I_{IN} = \frac{(E_o\ I_o) + I_o}{.7\ E_{IN\ MIN}}$

13.0 PROGRAMMABLE - - - - "P" Suffix with E_o set at nominal, E_o will be approximately1%/.1ua or 1%/.1V. From the summing junction, approximately 7.0 volts.

14.0 ENABLE - - - - "E" Suffix unit will normally be inhibited with ½ E_{IN} on enable lead. Unit will be Enabled when Enable lead is within 1V of negative input. Enable current will be $\frac{E_{IN}}{10K}$

Crestronics Inc. Engineering staff will design to your mechanical and/or electrical specifications

Crestronics Inc.

P. O. BOX S
CRESTLINE, CALIF. 92325

23539 CREST FOREST DRIVE
PHONE (714) 338-1722

DATEL SYSTEMS, INC.

POWER SUPPLIES

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Single Output Supplies P. 1

Dual Output Supplies P. 3

Triple Output Supplies P. 5

Microcomputer Supply P. 5

High Voltage Supplies P. 6

Heavy Duty Supplies P. 7

DC-DC Converters P. 9

See these other Datel products in EEM, Vol. I.

- **A/D and D/A Converters**
- **OP Amps, Max's, V/F's S/H's, Filters**
- **DPM's**
- **Printers**
- **Data Acquisition Systems**
- **Data Loggers**

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HOT LINE PHONES

Datel has provided Hot Line Phones to give you the fastest, best customer service possible. Use these Hot Line phone numbers for your convenience.

SPECIFICATIONS, 25°C	UPM-5/250 UCM-5/250	UPM-5/500 UCM-5/500	UPM-5/1000 UCM-5/1000	UPM-5/1000B UCM-5/1000B	UPM-5/2000 UCM-5/2000
Output Voltage	5VDC	5VDC	5VDC	5VDC	5VDC
Output Voltage Accuracy	±1%	±1%	±1%	±2%	±1%
Rated Output Current	250mA	500mA	1.0A	1.0A	2.0A
Line Regulation, max.	.05%	.05%	.05%	0.25%	.05%
Load Regulation, max.	0.1%	0.1%	0.1%	0.25%	0.1%
Temp. Coefficient, max.	.02%/°C	.02%/°C	.02%/°C	.02%/°C	.02%/°C
Output Ripple, RMS max.	1mV	1mV	1mV	1mV	1mV
Output Impedance, max.	.05Ω	.05Ω	.01Ω	.01Ω	.005Ω
Trans. Recovery Time, max.	50 μsec.	50 μsec.	50 μsec.	50 μsec.	50 μsec.
Isolation Resistance, min.	100 Meg.	100 Meg.	100 Meg.	100 Meg.	100 Meg.
Isolation Capacitance, max.	250pF	250pF	250pF	250pF	250pF
Breakdown Voltage, min.	1500VAC	1500VAC	1500VAC	1500VAC	1500VAC
Operating Temp. Range	−25°C to +71°C (No Derating)				(2)
Storage Temp. Range	−25°C to +85°C				
Case Material	Phenolic	Phenolic	Phenolic	Phenolic	Phenolic
Module Size, inches	3.5X2.5X.875	3.5X2.5X.875	3.5X2.5X1.25	3.5X2.5X1.25	3.5X2.5X1.56
Module Size, millimeters	88,9X63,5X22,2	88,9X63,5X22,2	88,9X63,5X31,8	88,9X63,5X31,8	88,9X63,5X39,6
Module Weight	14 oz.(397g)	14 oz.(397g)	18 oz.(510g)	18 oz.(510g)	24 oz.(680g)
Other Versions	E,J (1)	E,J (1)	E,J	E,J	E,J
Mating Socket	MS-7	MS-7	MS-7	MS-7	MS-7
Price (1-9)	$39.00	$49.00	$69.00	$49.00	$79.00

Notes: 1. For "E" version module size is C2 (3.5X2.5X1.25 inches, 18 oz.)
2. For UPM-5/2000 operating temp. range should be restricted for a max. case temperature of 80°C in use.

DATEL SYSTEMS, INC.

1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

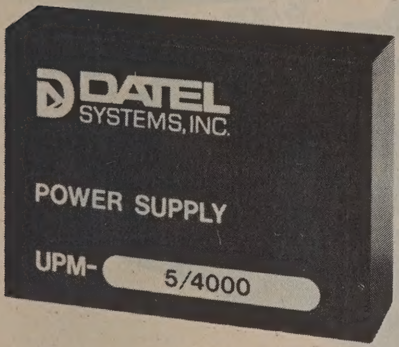
DATEL SYSTEMS, INC.

SINGLE OUTPUT POWER SUPPLIES

This line of single output, voltage regulated DC power supplies features six 5 volt output models with output currents from 250mA to 4 amperes. In addition, there are 4 other models with 6V to 15V outputs. All outputs have current limiting short circuit protection. Temperature coefficients are .02%/°C and output ripple voltage is 1 to 2 millivolts RMS.

Model UPM-5/4000 is a special high current, high efficiency supply in a compact C3 case size. Full load efficiency of 65% is achieved by a high performance switching regulator.

The UCM-versions have input-output connections made to a terminal strip on top of the modules. These supplies are useful in applications where it is impractical or undesirable to use printed circuit cards or sockets. For simple mounting to a metal chassis, screw inserts are provided on the bottom of the modules.



INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz

There is no extra charge for E and J versions. When ordering, add E or J suffix after model number. Note that in some instances the module size is larger for the E version. MS-7 sockets for the UPM-version are $3.50 each.

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

UPM-5/4000 UCM-5/4000	UPM-6/150A	UPM-9/100A	UPM-12/100A	UPM-15/100A	SPECIFICATIONS, 25°C
5VDC	6VDC	9VDC	12VDC	15VDC	Output Voltage
±1%	±1%	±1%	±1%	±1%	Output Voltage Accuracy
4.0A	150mA	100mA	100mA	100mA	Rated Output Current
.05%	.05%	.05%	.02%	.02%	Line Regulation, max.
0.1%	0.1%	0.1%	.05%	.05%	Load Regulation, max.
.02%/°C	.02%/°C	.02%/°C	.02%/°C	.02%/°C	Temp. Coefficient, max.
2mV	1mV	2mV	2mV	2mV	Output Ripple, RMS max.
.005Ω	.05Ω	0.1Ω	0.1Ω	0.1Ω	Output Impedance, max.
50 μsec.	50 μsec.	50 μsec.	50 μsec.	50 μsec.	Trans. Recovery Time, max.
100 Meg.	100 Meg.	100 Meg.	100 Meg.	100 Meg.	Isolation Resistance, min.
250pF	250pF	250pF	250pF	250pF	Isolation Capacitance, max.
1500VAC	1500VAC	1500VAC	1500VAC	1500VAC	Breakdown Voltage, min.
−25°C to +71°C (No Derating)					Operating Temp. Range
−25°C to +85°C					Storage Temp. Range
Phenolic	Phenolic	Phenolic	Phenolic	Phenolic	Case Material
3.5X2.5X1.56	3.5X2.5X.875	3.5X2.5X.875	3.5X2.5X.875	3.5X2.5X.875	Module Size, inches
88,9X63,5X39,6	88,9X63,5X22,2	88,9X63,5X22,2	88,9X63,5X22,2	88,9X63,5X22,2	Module Size, millimeters
24 oz.(680g)	14 oz.(397g)	14 oz.(397g)	14 oz.(397g)	14 oz.(397g)	Module Weight
E,J	E,J (1)	E,J (1)	E,J (1)	E,J (1)	Other Versions
MS-7	MS-7	MS-7	MS-7	MS-7	Mating Socket
$99.00	$39.00	$39.00	$49.00	$49.00	Price (1-9)

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

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DATEL SYSTEMS, INC.

DUAL OUTPUT POWER SUPPLIES

HOT LINE PHONES

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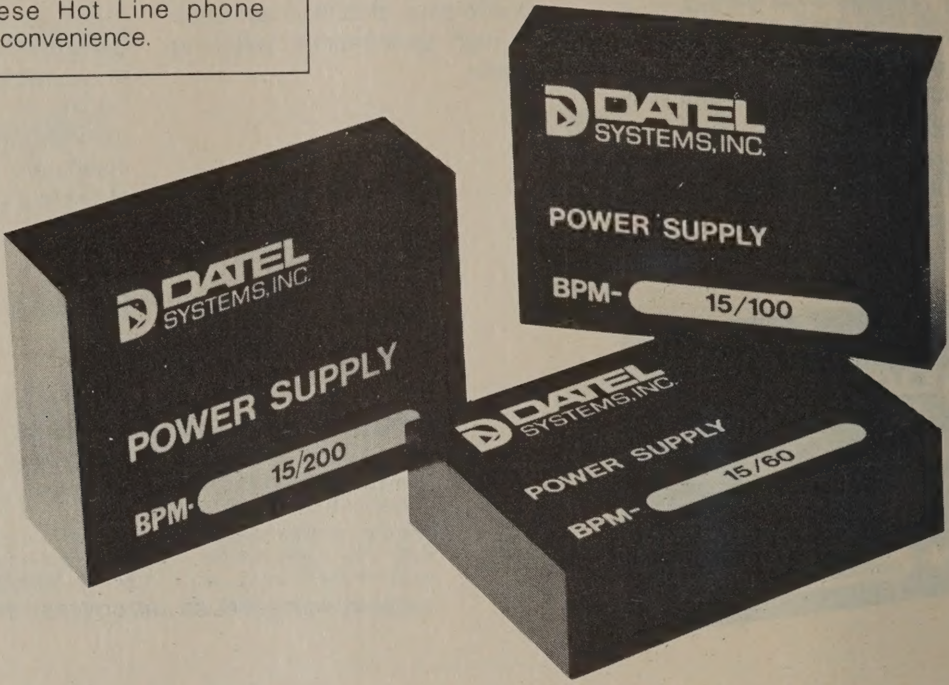

SPECIFICATIONS, 25°C	BPM-5/250	BPM-5/500	BPM-12/60	BPM-12/100	BPM-12/200
Output Voltage	±5VDC	±5VDC	±12VDC	±12VDC	±12VDC
Output Voltage Accuracy	±1%	±1%	±1%	±1%	±1%
Rated Output Current	±250mA	±500mA	±60mA	±100mA	±200mA
Line Regulation, max.	.05%	.05%	.02%	.02%	.02%
Load Regulation, max.	0.1%	0.1%	.05%	.05%	.05%
Temp. Coefficient, max.	.02%/°C	.02%/°C	.02%/°C	.02%/°C	.02%/°C
Output Ripple, RMS max.	1mV	1mV	2mV	2mV	2mV
Output Impedance, max.	.05Ω	.03Ω	0.2Ω	0.1Ω	.05Ω
Trans. Recovery Time, max.	50 μsec.	50 μsec.	50 μsec.	50 μsec.	50 μsec.
Isolation Resistance, min.	100 Meg.	100 Meg.	100 Meg.	100 Meg.	100 Meg.
Isolation Capacitance, max.	250pF	250pF	250pF	250pF	250pF
Breakdown Voltage, min.	1500VAC	1500VAC	1500VAC	1500VAC	1500VAC
Operating Temp. Range	−25°C to +71°C (No Derating)				(3)
Storage Temp. Range	−25°C to +85°C				
Case Material	Phenolic	Phenolic	Phenolic	Phenolic	Phenolic
Module Size, inches	3.5X2.5X.875	3.5X2.5X1.25	3.5X2.5X.875	3.5X2.5X.875	3.5X2.5X1.25
Module Size, millimeters	88,9X63,5X22,2	88,9X63,5X31,8	88,9X63,5X22,2	88,9X63,5X22,2	88,9X63,5X31,8
Module Weight	14 oz.(397g)	18 oz.(510g)	14 oz.(397g)	14 oz.(397g)	18 oz.(510g)
Other Versions	E,J (1)	E,J (2)	E,J (1)	E,J (1)	E,J
Mating Socket	MS-7	MS-7	MS-7	MS-7	MS-7
Price (1-9)	$69.00	$79.00	$39.00	$49.00	$59.00

Notes: 1. For "E" version module size is C2 (3.5X2.5X1.25 inches, 18 oz.)
2. For "E" version module size is C3 (3.5X2.5X1.56 inches, 24 oz.)
3. For BPM-12/300 and BPM-15/300, operating temp. range should be restricted for max. case temperature of 80°C in use.

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DATEL SYSTEMS, INC.

DUAL OUTPUT POWER SUPPLIES

This broad line of dual output, voltage regulated DC power supplies features 14 different models with a wide choice of output voltages and currents. Output voltages are ±5, ±12, and ±15VDC with ±1% accuracy. Rated output currents range from ±60 to ±500mA with output short circuit protection.

Temperature coefficient is .02% per degree Centigrade and output ripple voltage is 1 to 2 millivolts RMS. These rugged, encapsulated modules are useful for powering a wide variety of devices including linear IC's, op amps, data converters, and other analog circuits.

The BCM-versions have input-output connections made to a terminal strip on top of the modules. These supplies are useful in applications where it is impractical or undesirable to use printed circuit cards or sockets. For simple mounting to a metal chassis, screw inserts are provided on the bottom of the modules.

INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz.
E version: 220VAC ±10% @ 48-440 Hz.
J version: 100VAC ±10% @ 48-440 Hz.

There is no extra charge for E and J versions. When ordering, add E or J suffix after model number. Note that in some instances the module size is larger for the E version. MS-7 sockets for the BCM-version are $3.50 each.

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

BPM-12/300	BPM-15/60 BCM-15/60	BPM-15/100 BCM-15/100	BPM-15/200 BCM-15/200	BPM-15/300 BCM-15/300	SPECIFICATIONS, 25°C
±12VDC	±15VDC	±15VDC	±15VDC	±15VDC	Output Voltage
±1%	±1%	±1%	±1%	±1%	Output Voltage Accuracy
±300mA	±60mA	±100mA	±200mA	±300mA	Rated Output Current
.02%	.02%	.02%	.02%	.02%	Line Regulation, max.
.05%	.05%	.05%	.05%	.05%	Load Regulation, max.
.02%/°C	.02%/°C	.02%/°C	.02%/°C	.02%/°C	Temp. Coefficient, max.
2mV	2mV	2mV	2mV	2mV	Output Ripple, RMS max.
.05Ω	0.2Ω	0.1Ω	.05Ω	.03Ω	Output Impedance, max.
50 μsec.	50 μsec.	50 μsec.	50 μsec.	50 μsec.	Trans. Recovery Time, max.
100 Meg.	100 Meg.	100 Meg.	100 Meg.	100 Meg.	Isolation Resistance, min.
250pF	250pF	250pF	250pF	250pF	Isolation Capacitance, max.
1500VAC	1500VAC	1500VAC	1500VAC	1500VAC	Breakdown Voltage, min.
(3)		−25°C to +71°C (No Derating)		(3)	Operating Temp. Range
		−25°C to +85°C			Storage Temp. Range
Phenolic	Phenolic	Phenolic	Phenolic	Phenolic	Case Material
3.5X2.5X1.56	3.5X2.5X.875	3.5X2.5X.875	3.5X2.5X1.25	3.5X2.5X1.56	Module Size, inches
88,9X63,5X39,6	88,9X63,5X22,2	88,9X63,5X22,2	88,9X63,5X31,8	8,9X63,5X39,6	Module Size, millimeters
24 oz.(680g)	14 oz.(397g)	14 oz.(397g)	18 oz.(510g)	24 oz.(680g)	Module Weight
E,J	E,J (1)	E,J (1)	E,J	E,J	Other Versions
MS-7	MS-7	MS-7	MS-7	MS-7	Mating Socket
$79.00	$39.00	$49.00	$59.00	$79.00	Price (1-9)

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

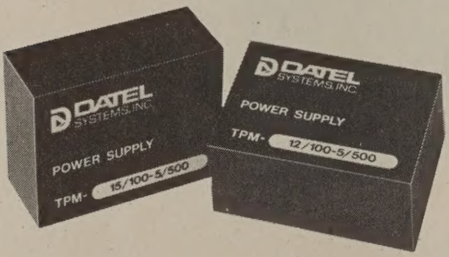
TRIPLE OUTPUT AND MICROCOMPUTER SUPPLIES

TRIPLE OUTPUT SUPPLIES

These power modules are specially designed for operation with data conversion and other circuits where both a dual analog supply and a 5V logic supply are required. Using a triple output supply to power these circuits can be more economical than using two separate equivalent supplies.

INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz
Mating MS-13 sockets are $3.50 each



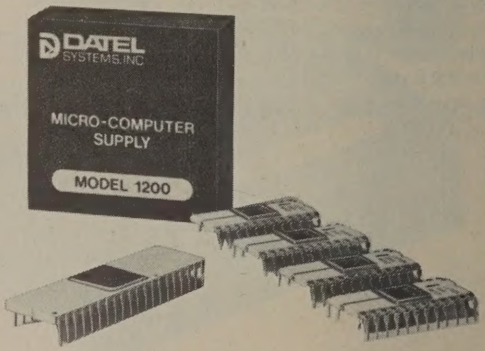
SPECIFICATIONS, 25°C	TPM-12/100-5/500	TPM-15/100-5/500
Output Voltages	±12VDC/5VDC	±15VDC/5VDC
Output Voltage Accuracy	±1%	±1%
Rated Output Current	±100mA/500mA	±100mA/500mA
Line Regulation, max.	.02%/.05%	.02%/.05%
Load Regulation, max.	.05%/0.1%	.05%/0.1%
Temperature Coefficient, max.	.02%/°C	.02%/°C
Output Ripple, RMS max.	2mV/1mV	2mV/1mV
Output Impedance, max.	0.1/.05 ohm	0.1/.05 ohm
Transient Recovery Time, max.	50μsec.	50μsec.
Isolation Resistance, min.	100 Meg.	100 Meg.
Isolation Capacitance, max.	250pF	250pF
Breakdown Voltage, min.	1500VAC	1500VAC
Operating Temp. Range	−25°C to +71°C (No Derating)	
Storage Temp. Range	−25°C to +85°C	
Case Material	Phenolic	Phenolic
Module Size, inches	3.5X2.5X1.56	3.5X2.5X1.56
Module Size, millimeters	88,9X63,5X39,6	88,9X63,5X39,6
Module Weight	24 oz.(681g)	24 oz.(681g)
Other Versions	E,J	E,J
Mating Socket	MS-13	MS-13
Price (1-9)	$67.00	$67.00

MICROCOMPUTER SUPPLY

Model 1200 microcomputer supply is a DC-DC converter designed to operate from a 5 volt logic supply to power a CPU and 4K of memory. The output voltages of +12, −5, and −9V in conjunction with the 5V input will power an 8080 CPU and four 2107A RAM's or four 1702A ROM's. This supply operates with a full load efficiency of 48% and has output current limiting protection.

Operating temperature range is −25°C to +71°C and storage temperature range is −55°C to +85°C.

Mating sockets, 2 DILS-1 or DILS-2 terminal strips, are $5.00 per pair.



SPECIFICATIONS, 25°C	MODEL 1200
Outputs	±12VDC @ 160 mA
	−9VDC @ 300mA
	−5VDC @ 2mA
Output, Voltage Accuracy	±1% (+12V & −9V), ±5% (−5V)
Input Voltage	5VDC ±0.25V
Input Current, no load	0.3 Amp.
Input Current, full load	1.6 Amp.
Efficiency, full load	48%
Line Regulation, max., all outputs	.05%
Load Regulation, max., +12 V out	.05%
Load Regulation, max., −9V out	0.1%
Load Regulation, max., −5V out	1.0%
Temperature Coefficient, max.	.02%/°C
Output Ripple, RMS max.	1mV
Transient Recovery Time, max.	50μsec.
Case Material	Diallyl Phthalate
Module Size, inches	2.0X2.0X0.75
Module Size, millimeters	50,8X50,8X19,1
Module Weight	4.5 oz.(128g)
Mating Socket	DILS-1, DILS-2
Price (1-9)	$89.00

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

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DATEL
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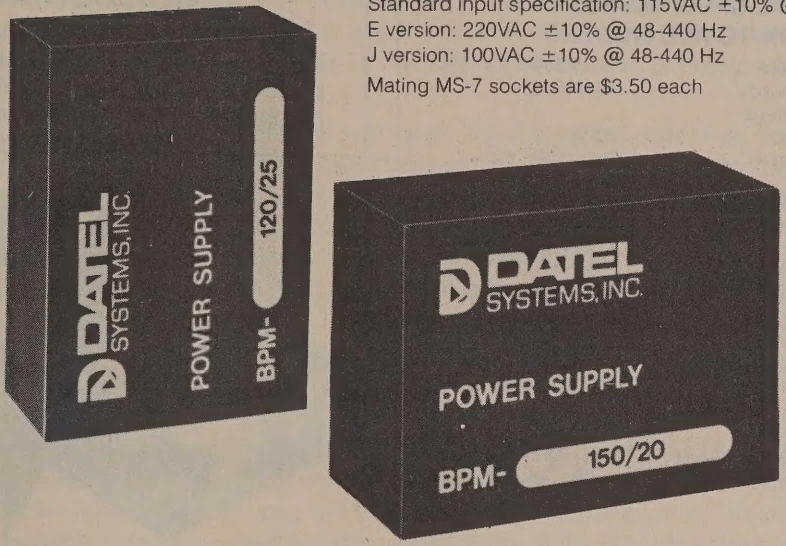
HIGH VOLTAGE SUPPLIE



INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz
Mating MS-7 sockets are $3.50 each

HIGH VOLTAGE MODULES

SPECIFICATIONS, 25°C	BPM-120/25	BPM-150/20	BPM-180/16
Output Voltage	±120VDC	±150VDC	±180VDC
Output Voltage Accuracy	±1%	±1%	±1%
Rated Output Current	25mA	20mA	16mA
Line Regulation, max.	.05%	.05%	.05%
Load Regulation, max.	0.2%	0.2%	0.2%
Temperature Coefficient, max.	.02%/°C	.02%/°C	.02%/°C
Output Ripple, RMS max.	10mV	10mV	10mV
Output Impedance, max.	5 ohms	5 ohms	5 ohms
Transient Recovery Time, max.	50μsec.	50μsec.	50μsec.
Isolation Resistance, min.	100 Meg.	100 Meg.	100 Meg.
Isolation Capacitance, max.	250pF	250pF	250pF
Breakdown Voltage, min.	1500VAC	1500VAC	1500VAC
Operating Temp.Range	−25°C to +71°C (No Derating)		
Storage Temp. Range	−55°C to +85°C		
Case Material	Phenolic	Phenolic	Phenolic
Module Size, inches	3.5X2.5X1.56	3.5X2.5X1.56	3.5X2.5X1.56
Module Size, millimeters	88,9X63,5X39,6	88,9X63,5X39,6	88,9X63,5X39,6
Module Weight	24 oz.(681g)	24 oz.(681g)	24 oz.(681g)
Other Versions	E,J	E,J	E,J
Mating Socket	MS-7	MS-7	MS-7
Price	$79.00	$79.00	$79.00

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

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DATEL SYSTEMS, INC.

HEAVY DUTY POWER SUPPLIES

GENERAL SPECIFICATIONS COMMON TO ALL MODELS

Input Voltage	115/230VAC ±10%
Line Frequency	48-440 Hz
Output Voltage Adjustment	±5%
Output Ripple	1mV RMS, max. 3mV P-P typ.
Transient Response	50μsec. max.
Output Protection	Current Limiting or Foldback Limiting
Overvoltage Protection, 5V outputs	6.2V ±5%
Voltage Stability, after warmup	±0.25%, 24 hours
Dual Output Tracking	.05%, 0.1% over temp. range
Operating Temperature Range	0°C to 71°C
Storage Temperature Range	−25°C to +85°C

HOT LINE PHONES

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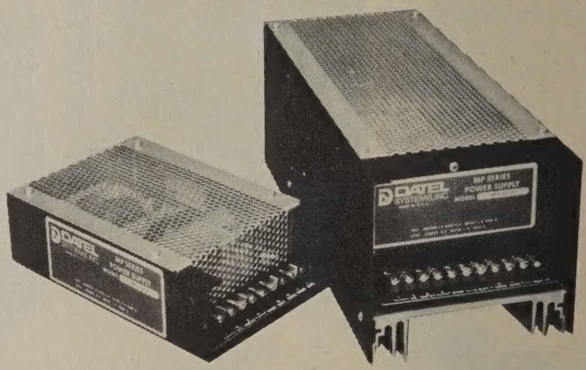


MODEL	OUTPUT VOLTAGE & CURRENT (0 to 65°C)	OUTPUT I AT 71°C[1]	LINE REG. (MAX.)[2]	LOAD REG. (MAX.)[3]	TEMPCO (TYPICAL)	RIPPLE (RMS MAX.)[4]	EFFICIENCY (NOM. LINE)
SINGLE OUTPUT							
MPS-5/3	5V @ 3.0A	2.5A	0.1%	0.1%	.01%/°C	1mV	40%
MPS-5/6	5V @ 6.0A	5.0A	0.1%	0.1%	.01%/°C	1mV	40%
MPS-5/12	5V @ 12.0A	10.0A	0.1%	0.1%	.01%/°C	1mV	40%
MPS-5/18	5V @ 18.0A	15.0A	0.1%	0.1%	.01%/°C	1mV	40%
DUAL OUTPUT							
MPD-12/1	±12V @ 1.0A	0.85A	.05%	.05%	.01%/°C	1mV	50%
MPD-15/1	±15V @ 1.0A	0.85A	.05%	.05%	.01%/°C	1mV	50%
MPD-12/1.5	±12V @ 1.5A	1.25A	.05%	.05%	.01%/°C	1mV	50%
MPD-15/1.5	±15V @ 1.5A	1.25A	.05%	.05%	.01%/°C	1mV	50%
MPD-12/3	±12V @ 3.0A	2.5A	.05%	.05%	.01%/°C	1mV	50%
MPD-15/3	±15V @ 3.0A	2.5A	.05%	.05%	.01%/°C	1mV	50%
TRIPLE OUTPUT							
MPT-12/1-5/3	±12V @ 1A 5V @ 3A	0.85/2.5A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%
MPT-15/1-5/3	±15V @ 1A 5V @ 3A	0.85/2.5A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%
MPT-12/1.5-5/6	±12V @ 1.5A 5V @ 6A	1.25/5.0A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%
MPT-15/1.5-5/6	±15V @ 1.5A 5V @ 6A	1.25/5.0A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%
MPT-12/1.5-5/12	±12V @ 1.5A 5V @ 12A	1.25/10.0A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%
MPT-15/1.5-5/12	±15V @ 1.5V 5V @ 12A	1.25/10.0A	.05/0.1%	.05/0.1%	.01%/°C	1mV	45%

Notes: 1. 15% derating from 65°C output.
2. For ±10% line change.
3. No load to full load.
4. Typically 3mV peak to peak.
5. 0.1% tracking over operating temp. range.

DATEL SYSTEMS, INC.

1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

DATEL SYSTEMS, INC.

HEAVY DUTY POWER SUPPLIES

The MP Series high power, line operated supplies are new entries in the field of low cost, open frame type supplies. Although priced competitively with the open frame units, the MP Series offers significant advantage in performance and design features. The 16 models in this series offer popular single, dual, and triple outputs for use with data conversion devices, operational amplifiers, and other analog and digital circuits. Output power capability ranges from 15 Watts to 105 Watts and prices are from $38 to $149.

The unique feature of the MP Series over open frame type supplies is its conservative thermal design which results in full rated output over 0°C to 65°C ambient temperature and only 15% derating at 71°C. This results in approximately twice the output power at 65°C compared with open frame supplies. The careful attention to thermal design is evidenced by use of conservatively rated components including 85°C computer grade aluminum electrolytic capacitors, integral heat sink and chassis design, and a high efficiency linear regulator design. The power transformer is a low loss type with no derating for 50 Hz operation. It is layer wound with polyester impregnation, and incorporates a Faraday shield which is connected to chassis ground. Power supply efficiency is 50% for ±12V and ±15V outputs and 40% for 5V outputs.

Other significant features include output current limiting protection, .05% tracking of dual outputs, barrier strip terminal connector, ventilating protective cover, remote sensing with open lead protection, and ±5% output voltage adjustment by means of externally accessible trimming potentiometers. In addition, all 5V outputs have built-in overvoltage protection as a standard feature.

TRACKING (DUALS)[5]	REMOTE SENSING	OVER-VOLT. PROTECTION	CASE SIZE (HXWXL, INCHES/CM)	WEIGHT (LBS./KG)	PRICE (1-9)	MODEL
						SINGLE OUTPUT
—	YES	YES	3.0X4.6X7.6 7,6X11,7X19,3	3.6 1,6	$ 38.00	MPS-5/3
—	YES	YES	5.0X5.3X10.3 12,7X13,5X26,2	6.5 2,9	$ 56.00	MPS-5/6
—	YES	YES	5.0X5.3X11.9 12.7X13,5X30,2	10.4 4,7	$ 88.00	MPS-5/12
—	YES	YES	5.0X5.3X11.9 12,7X13,5X30,2	14.0 6,3	$ 99.00	MPS-5/18
						DUAL OUTPUT
.05%	YES	NO	3.5X4.8X10.00 8,9X12,2X25,4	5.0 2,3	$ 54.00	MPD-12/1
.05%	YES	NO	3.5X4.8X10.0 8,9X12,2X25,4	5.0 2,3	$ 54.00	MPD-15/1
.05%	YES	NO	4.7X5.3X10.3 11,9X13,5X26,2	6.5 2,9	$ 65.00	MPD-12/1.5
.05%	YES	NO	4.7X5.3X10.3 11,9X13,5X26,2	6.5 2,9	$ 65.00	MPD-15/1.5
.05%	YES	NO	5.0X5.3X10.3 12,7X13,5X26,2	10.5 4,8	$ 95.00	MPD-12/3
.05%	YES	NO	5.0X5.3X10.3 12,7X13,5X26,2	10.5 4,8	$ 95.00	MPD-15/3
						TRIPLE OUTPUT
.05%	5V ONLY	5V ONLY	4.4X4.8X11.0 11,2X12,2X27,9	11.0 5,0	$ 85.00	MPT-12/1-5/3
.05%	5V ONLY	5V ONLY	4.4X4.8X11.0 11,2X12,2X27,9	11.0 5.0	$ 85.00	MPT-15/1-5/3
.05%	5V ONLY	5V ONLY	5.0X5.3X14.0 12,7X13,5X35,6	14.0 6,3	$116.00	MPT-12/1.5-5/6
.05%	5V ONLY	5V ONLY	5.0X5.3X14.0 12,7X13,5X35,6	14.0 6,3	$116.00	MPT-15/1.5-5/6
.05%	5V ONLY	5V ONLY	5.0X5.3X15.6 12,7X13,5X39,6	17.0 7,7	$149.00	MPT-12/1.5-5/12
.05%	5V ONLY	5V ONLY	5.0X5.3X15.6 12,7X13,5X39,6	17.0 7,7	$149.00	MPT-15/1.5-5/12

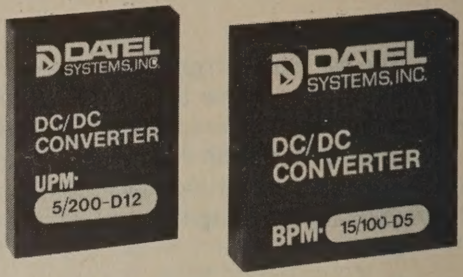
THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

DC-DC CONVERTERS

1 AND 3 WATT DC-DC CONVERTERS

This broad line of DC-DC converters features 17 one watt models and 18 three watt models with single and dual output voltages. Input voltages are 5, 12, and 28V with single outputs of 5, 12, 24, and 28V, and dual outputs of ±12, ±15, and ±18V. Output voltage accuracies are ±1% with .02%/°C temperature coefficient. Other features include low output ripple, 100 megohm isolation, grounded internal copper shield, and output current limiting.



1 WATT SERIES

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	INPUT VOLTAGE	INPUT VOLT. TOLERANCE	NO LOAD INPUT CURRENT	FULL LOAD INPUT CURRENT	EFFICIENCY (FULL LOAD)
UPM-5/200-D12	+ 5V	200mA	12VDC	±10%	40mA	170mA	50%
UPM-5/200-D28	+ 5V	200mA	28VDC	±10%	20mA	72mA	50%
UPM-12/80-D5	+12V	80mA	5VDC	−5, +10%	95mA	370mA	50%
UPM-12/80-D28	+12V	80mA	28VDC	±10%	20mA	65mA	55%
UPM-24/40-D5	+24V	40mA	5VDC	−5, +10%	95mA	370mA	50%
UPM-24/40-D12	+24V	40mA	12VDC	±10%	40mA	150mA	55%
UPM-28/25-D5	+28V	25mA	5VDC	−5, +10%	70mA	280mA	50%
UPM-28/25-D12	+28V	25mA	12VDC	±10%	40mA	105mA	55%
BPM-12/25-D5	±12V	25mA	5VDC	−5, +10%	90mA	220mA	55%
BPM-12/25-D12	±12V	25mA	12VDC	±10%	25mA	90mA	55%
BPM-12/25-D28	±12V	25mA	28VDC	±10%	15mA	38mA	55%
BPM-15/25-D5	±15V	25mA	5VDC	−5, +10%	80mA	300mA	50%
BPM-15/25-D12	±15V	25mA	12VDC	±10%	40mA	115mA	55%
BPM-15/25-D28	±15V	25mA	28VDC	±10%	15mA	48mA	55%
BPM-18/25-D5	±18V	25mA	5VDC	−5, +10%	95mA	370mA	50%
BPM-18/25-D12	±18V	25mA	12VDC	±10%	40mA	136mA	55%
BPM-18/25-D28	±18V	25mA	28VDC	±10%	15mA	58mA	55%

3 WATT SERIES

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	INPUT VOLTAGE	INPUT VOLTAGE TOLER.	NO LOAD INPUT CURRENT	FULL LOAD INPUT CURRENT	EFFICIENCY (FULL LOAD)
UPM-5/500-D5	+ 5V	500mA	5VDC	−5, +10%	300mA	1250mA	40%
UPM-5/500-D12	+ 5V	500mA	12VDC	±10%	100mA	470mA	45%
UPM-5/500-D28	+ 5V	500mA	28VDC	±10%	50mA	200mA	45%
UPM-12/250-D5	+12V	250mA	5VDC	−5, +10%	300mA	1250mA	50%
UPM-12/250-D28	+12V	250mA	28VDC	±10%	50mA	195mA	55%
UPM-24/125-D5	+24V	125mA	5VDC	−5, +10%	300mA	1250mA	50%
UPM-24/125-D12	+24V	125mA	12VDC	±10%	90mA	450mA	55%
UPM-28/100-D5	+28V	100mA	5VDC	−5, +10%	270mA	1120mA	50%
UPM-28/100-D12	+28V	100mA	12VDC	±10%	90mA	420mA	55%
BPM-12/100-D5	±12V	100mA	5VDC	−5, +10%	210mA	960mA	50%
BPM-12/100-D12	±12V	100mA	12VDC	±10%	90mA	400mA	50%
BPM-12/100-D28	±12V	100mA	28VDC	±10%	40mA	156mA	55%
BPM-15/100-D5	±15V	100mA	5VDC	−5, +10%	350mA	1300mA	45%
BPM-15/100-D12	±15V	100mA	12VDC	±10%	80mA	460mA	55%
BPM-15/100-D28	±15V	100mA	28VDC	±10%	50mA	195mA	55%
BPM-18/100-D5	±18V	100mA	5VDC	−5, +10%	350mA	1500mA	50%
BPM-18/100-D12	±18V	100mA	12VDC	±10%	120mA	545mA	55%
BPM-18/100-D28	±18V	100mA	28VDC	±10%	60mA	240mA	55%

DATEL SYSTEMS, INC.

1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

DATEL SYSTEMS, INC.

DC-DC CONVERTERS

GENERAL SPECIFICATIONS—ALL MODELS

Output Voltage Accuracy	±1%
Output Noise and Ripple, max.	20mV P-P (2mV RMS)
Back Ripple Current, max.	1% of IIN
Capacitive Coupling, max.	100 pF
Breakdown Voltage, min.	300VDC
Transient Recovery Time, max.	50μsec.
Operting Temp. Range	−25°C to +71°C
Storage Temp. Range	−55°C to +85°C
Case Material	Diallyl Phthalate

MODULE SIZES

F Case: ......1.5X2.0X0.375 inches 38,1X50,8X9,5 mm
Weight: ......1.5 oz. (43g.)

G1 Case: .....2.0X2.0X0.432 inches 50,8X50,8X11,0 mm
Weight: ......2.5 oz. (71g.)

Both 1 and 3 watt series use 2 DILS-1 or DILS-2 terminal strips (at $5.00/pair) for sockets.

24V and 48V input models of these DC-DC converters are available on special order. Contact factory for price and availability.

1 WATT SERIES

LINE REGULATION	LOAD REGULATION	TEMP. COEFFICIENT	OUTPUT IMPEDANCE	CASE SIZE (L X W X H INCHES/CM)	PRICE (1-9)	MODEL
.05%	0.1%	.02%/°C	.07Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-5/200-D12
.05%	0.1%	.02%/°C	.07Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-5/200-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-12/80-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-12/80-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-24/40-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-24/40-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-28/25-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$42.00	UPM-28/25-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-12/25-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-12/25-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-12/25-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-15/25-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-15/25-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-15/25-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-18/25-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-18/25-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X1.5X.38 50,8X38,1X9,5	$49.00	BPM-18/25-D28

3 WATT SERIES

LINE REGULATION	LOAD REGULATION	TEMP. COEFFICIENT	OUTPUT IMPEDANCE	CASE SIZE (L X W X H INCHES/CM)	PRICE (1-9)	MODEL
.05%	0.1%	.02%/°C	.07Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-5/500-D5
.05%	0.1%	.02%/°C	.07Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-5/500-D12
.05%	0.1%	.02%/°C	.07Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-5/500-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-12/250-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-12/250-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-24/125-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-24/125-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-28/100-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$64.00	UPM-28/100-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-12/100-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-12/100-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-12/100-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-15/100-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-15/100-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-15/100-D28
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-18/100-D5
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-18/100-D12
.05%	.05%	.02%/°C	0.2Ω	2.0X2.0X.43 50,8X50,8X11,0	$69.00	BPM-18/100-D28

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

DATEL SYSTEMS, INC.

4.5, 5, AND 10 WATT DC-DC CONVERTERS

GENERAL SPECIFICATIONS—ALL MODELS

Output Voltage Accuracy	±1%
Output Noise and Ripple, max.	1mV RMS (4.5 W series) 2mV RMS (5 & 10 W series)
Back Ripple Current, max.	1% of IIN
Capacitive Coupling, max.	100 pF (4.5 W series) 50 pF (5 & 10 W series)
Breakdown Voltage, min.	300VDC
Transient Recovery Time, max.	50µsec.
Operating Temp. Range	−25°C to +71°C
Storage Temp. Range	−55°C to +85°C
Case Material	Aluminum (4.5 W series) Diallyl Phthalate (5 W series) Phenolic (10 W series)

For the 10 Watt Series operating temp. range should be restricted for a max. case temperature of 80°C in use.

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	INPUT VOLTAGE	INPUT VOLTAGE TOLER.	NO LOAD INPUT CURRENT	FULL LOAD INPUT CURRENT	EFFICIENCY (FULL LOAD)
4.5 WATT SERIES							
BPM-15/150-D5	±15V	150mA	5VDC	±0.25V	400mA	1750mA	51%
BPM-15/150-D24	±15V	150mA	24VDC	±2.5V	80mA	350mA	54%
BPM-15/150-D28	±15V	150mA	28VDC	±3V	70mA	300mA	54%
5 WATT SERIES							
UPM-5/1000-D12	+5V	1000mA	12VDC	±10%	200mA	830mA	50%
UPM-5/1000-D28	+5V	1000mA	28VDC	±10%	100mA	360mA	50%
UPM-12/420-D5	+12V	420mA	5VDC	−5, +10%	500mA	2000mA	50%
UPM-12/420-D28	+12V	420mA	28VDC	±10%	75mA	325mA	55%
UPM-24/210-D5	+24V	210mA	5VDC	−5, +10%	400mA	1830mA	55%
UPM-24/210-D12	+24V	210mA	12VDC	±10%	170mA	760mA	55%
UPM-28/180-D5	+28V	180mA	5VDC	−5, +10%	400mA	1830mA	55%
UPM-28/180-D12	+28V	180mA	12VDC	±10%	170mA	760mA	55%
BPM-12/210-D5	±12V	210mA	5VDC	−5, +10%	500mA	2000mA	50%
BPM-12/210-D12	±12V	210mA	12VDC	±10%	170mA	760mA	55%
BPM-12/210-D28	±12V	210mA	28VDC	±10%	75mA	325mA	55%
BPM-15/165-D5	±15V	165mA	5VDC	−5, +10%	500mA	2000mA	50%
BPM-15/165-D12	±15V	165mA	12VDC	±10%	170mA	760mA	55%
BPM-15/165-D28	±15V	165mA	28VDC	±10%	75mA	325mA	55%
BPM-18/140-D5	±18V	140mA	5VDC	−5, +10%	500mA	2000mA	55%
BPM-18/140-D12	±18V	140mA	12VDC	±10%	170mA	760mA	55%
BPM-18/140-D28	±18V	140mA	28VDC	±10%	75mA	325mA	55%
10 WATT SERIES							
UPM-5/2000-D12	+5V	2000mA	12VDC	±10%	300mA	1660mA	50%
UPM-5/2000-D28	+5V	2000mA	28VDC	±10%	150mA	720mA	50%
UPM-12/840-D5	+12V	840mA	5VDC	−5, +10%	1000mA	4000mA	50%
UPM-12/840-D28	+12V	840mA	28VDC	±10%	150mA	650mA	55%
UPM-24/420-D5	+24V	420mA	5VDC	−5, +10%	900mA	3600mA	55%
UPM-24/420-D12	+24V	420mA	12VDC	±10%	360mA	1530mA	55%
UPM-28/360-D5	+28V	360mA	5VDC	−5, +10%	900mA	3600mA	55%
UPM-28/360-D12	+28V	360mA	12VDC	±10%	360mA	1530mA	55%
BPM-12/420-D5	±12V	420mA	5VDC	−5, +10%	1000mA	4000mA	50%
BPM-12/420-D12	±12V	420mA	12VDC	±10%	360mA	1530mA	55%
BPM-12/420-D28	±12V	420mA	28VDC	±10%	150mA	650mA	55%
BPM-15/330-D5	±15V	330mA	5VDC	−5, +10%	1000mA	4000mA	50%
BPM-15/330-D12	±15V	330mA	12VDC	±10%	360mA	1530mA	55%
BPM-15/330-D28	±15V	330mA	28VDC	±10%	150mA	650mA	55%
BPM-18/280-D5	±18V	280mA	5VDC	−5, +10%	900mA	3600mA	55%
BPM-18/280-D12	±18V	280mA	12VDC	±10%	360mA	1530mA	55%
BPM-18/280-D28	±18V	280mA	28VDC	±10%	150mA	650mA	55%

DATEL SYSTEMS, INC.

1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

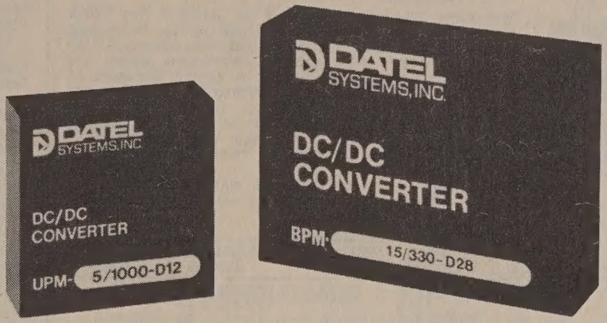
DATEL SYSTEMS, INC.

DC-DC CONVERTERS

MODULE SIZES

B Size . . . . 2.0 × 2.0 × 0.4 inches
50,8 × 50,8 × 10,2 mm
3.0 oz. (85g.)
G2 Size: . . . . 2.0 × 2.0 × .750 inches
50,8 × 50,8 × 19,1 mm
Weight . . . . 4.5 oz. (128g.)
CB Size: . . . . 3.5 × 2.5 × .875 inches
88,9 × 63,5 × 22,2 mm
Weight . . . . .14 oz. (397g.)

The 5 watt series use 2 DILS-1 or DILS-2 terminal strips (at $5.00/pair) for sockets. The 10 watt series use the MS-7 socket at $3.50 each. The 4.5 watt series use the MS-6 socket at $3.50 each. 24V and 48V input models of these DC-DC converters are available on special order. Contact factory for price and availability.



LINE REGULATION	LOAD REGULATION	TEMP. COEFFICIENT	OUTPUT IMPEDANCE	CASE DIMENSIONS	PRICE (1-9)	MODEL
						4.5 WATT SERIES
.05%	.05%	.005%/°C	.05Ω	B	$79.00	BPM-15/150-D5
.05%	.05%	.005%/°C	.05Ω	B	$79.00	BPM-15/150-D24
.05%	.05%	.005%/°C	.05Ω	B	$79.00	BPM-15/150-D28
						5 WATT SERIES
.05%	0.1%	.02%/°C	.005Ω	G2	$69.00	UPM-5/1000-D12
.05%	0.1%	.02%/°C	.005Ω	G2	$69.00	UPM-5/1000-D28
.05%	.05%	.02%/°C	.015Ω	G2	$69.00	UPM-12/420-D5
.05%	.05%	.02%/°C	.15Ω	G2	$69.00	UPM-12/420-D28
.05%	.05%	.02%/°C	.03Ω	G2	$69.00	UPM-24/210-D5
.05%	.05%	.02%/°C	.03Ω	G2	$69.00	UPM-24/210-D12
.05%	.05%	.02%/°C	.035Ω	G2	$69.00	UPM-28/180-D5
.05%	.05%	.02%/°C	.035Ω	G2	$69.00	UPM-28/180-D12
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-12/210-D5
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-12/210-D12
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-12/210-D28
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-15/165-D5
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-15/165-D12
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-15/165-D28
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-18/140-D5
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-18/140-D12
.05%	.05%	.02%/°C	.03Ω	G2	$75.00	BPM-18/140-D28
						10 WATT SERIES
.05%	0.1%	.02%/°C	.005Ω	CB	$89.00	UPM-5/2000-D12
.05%	0.1%	.02%/°C	.005Ω	CB	$89.00	UPM-5/2000-D28
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-12/840-D5
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-12/840-D28
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-24/420-D5
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-24/420-D12
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-28/360-D5
.05%	.05%	.02%/°C	.02Ω	CB	$89.00	UPM-28/360-D12
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-12/420-D5
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-12/420-D12
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-12/420-D28
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-15/330-D5
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-15/330-D12
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-15/330-D28
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-18/280-D5
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-18/280-D12
.05%	.05%	.02%/°C	.02Ω	CB	$94.00	BPM-18/280-D28

THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT

DATEL SYSTEMS, INC.

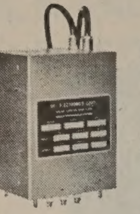
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021

HOT LINE: SOUTHERN CALIFORNIA (213) 933-3613; (714) 835-6519 / NORTHERN CALIFORNIA (408) 733-9703 / MID-ATLANTIC REGION (301) 948-0282 / NORTHEAST REGION (617) 828-6566

HIGH VOLTAGE EQUIPMENT

UNREGULATED MODULES COMPACT HIGH VOLTAGE

SERIES "S"



These power supplies are designed for operation from either a 0-115 volt or 0-125 volt line at 60/400 cycles. Three input terminals are provided to permit proper line connection. The output is available from shielded polyethylene cables and may be varied over the full range by varying the input AC line. The two output cables are insulated for the full output voltage, so that either the positive or negative terminal may be grounded.* All units have selenium rectifiers and are hermetically sealed in an epoxy, vacuum filled, metal case.

Units for 50 cycle operation at various line voltages are available on request.

*Model 40-2-4 is designed with one output cable for single polarity operation. When ordering, please specify polarity.

Model No.	Max. Output Voltage	Max. Rated Current	**Ripple at Full Load %RMS/MA at 60 CPS	Dimensions (Inches)	Net Weight (Lbs.)
2.5-2-6	0-2.5 KV	2 MA	0.25	3 x 2⅝ x 4¼	3¼
5-2-4	0-5.0 KV	2 MA	0.25	3 x 3½ x 3⅞	4¼
10-1-12	0-10 KV	1.25 MA	0.30	3 x 3½ x 4⅞	5½
15-1-8	0-15 KV	1.25 MA	0.25	4¼ x 5 x 5¾	11½
20-1-4	0-20 KV	1.25 MA	0.25	4¼ x 5⅛ x 6¾	14
25-1-3	0-25 KV	1.25 MA	0.30	4¾ x 6 x 7¼	20¼
30-1-5	0-30 KV	1.25 MA	0.20	5 x 6½ x 8	24½
40-1-1	0-40 KV	1 MA	0.15	6¼ x 8¼ x 7	26
40-2-4*	0-40 KV	2 MA	0.30	6¼ x 8¼ x 7	30
50-1-5	0-50 KV	1 MA	0.25	9⅞ x 7¾ x 9⅜	52
60-1.5-1	0-60 KV	1.5 MA	0.15	12¼x9¼x11¼	87
1-5-2	1 KV	5 MA	.20	3 x 2¾ x 4¼	3½
2.5-5-3	2.5 KV	5 MA	.20	3½ x 3 x 5	5
5-5-4	5 KV	5 MA	.25	4 x 3⅜ x 5¼	7½
7.5-5-1	7.5 KV	5 MA	.20	4⅜ x 3¾ x 5½	8½
10-5-1	10 KV	5 MA	.25	4⅜ x 3¾ x 5½	10
15-5-1	15 KV	5 MA	.30	5¾ x 5 x 6¾	19½
20-5-3	20 KV	5 MA	.25	6⅛ x 6⅛ x 6½	21
25-5-1	25 KV	5 MA	.25	6¾ x 6¼ x 7¼	27¼
30-5-8	30 KV	5 MA	.30	7¼ x 6½ x 7¾	38
1-10-1	1 KV	10 MA	.10	3½ x 3 x 5	5
2.5-10-1	2.5 KV	10 MA	.10	4 x 3⅜ x 5¼	6½
5-10-2	5 KV	10 MA	.12	4⅜ x 3¾ x 5½	9
7.5-10-1	7.5 KV	10 MA	.10	4¾ x 4 x 7¼	13½
10-10-3	10 KV	10 MA	.10	5 x 4⅜ x 6¾	14½
15-10-2	15 KV	10 MA	.15	6⅛ x 6⅛ x 6½	22½
20-10-3	20 KV	10 MA	.15	6¾ x 6¼ x 7¼	27½
25-10-2	25 KV	10 MA	.10	7½ x 6½ x 8½	38
30-10-3	30 KV	10 MA	.15	8 x 7¾ x 8¾	50
40-15-1	40 KV	15 MA	.3	8¼ x 9½ x 11¼	95

*Single polarity unit, state positive or negative output.
**Ripple at 400 cycles is 15% of ripple at 60 cycles, shown above.

PHOTOMULTIPLIER POWER SUPPLIES PMS SERIES

The PMS Series is a family of extremely compact, rugged design DC to DC proportional converters for use as power sources for photomultiplier and other tube applications. They feature reverse polarity protection, output isolated from the input, and are momentary short circuit protected.

SPECIFICATIONS

Model	Input DC	Output Voltage	Output Load	Ripple P-P	Capacity Mfd.	Size D x L
PMS 1-1	3 - 15V	300-1500V	1.5 Meg	1.5V	.02	1 x 2¼
PMS 1-2	3 - 10V	300-1000V	800 K	1.0V	.02	1 x 2⅝
PMS 1-3A	3 - 15V	300-1500V Negative	1.0 Meg	1.0V	.02	1¼ x 2½
PMS 1-4	3 - 19V	300-2000V	2.0 Meg	7.0V	.002	1 x 2¼
PMS 1-5	3 - 10V	300-1000V	3.0 Meg	.5V	.02	1 x 2½
PMS 1-6	3 - 15V	400-2500V	5 Meg	30V	.003	1 x 2¼
PMS 1-7	4 - 12V	500-1500V	1.0 Meg	6.0V	.005	2.4 x 1.5 x .812
PMS B2-.025	3 - 10V 12MA @ 1.8KV & 180 Meg	300-2000V	80 Meg MIN.	3.0V	.002	1 x 2¼
PMS 3-.5	3 - 15V	300-3000V	6 Meg	7.5V	.005	1¼ x 2⅜
PMS 5-.5	3 - 15V	500-5000V	10 Meg	5.0V	.01	1 7/16 x 3⅛
PMS 10-.025	3 - 10V	3KV - 10KV	25 ua	50V	.002	2.07 x 2.32 x 3.13

HIGHLY REGULATED ADJUSTABLE HIGH VOLTAGE MODULES SERIES "HRM"

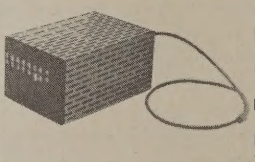
SPECIFICATIONS

Input: 115V ±10% 60 cps
Output: Regulation for 10% line change .03% max. Regulation for NL to FL .03% max
Ripple: .03% RMS max
Temp. Range: −54°C to +65°C operating
Temp. Coefficient: 0.02%/°C

- No voltage overshoot
- Adjustable output
- Short circuit proof (no fuses)
- Meet environmental and transient requirements of MIL-E-16400

Model No. Pos. Output	Model No. Neg. Output	Output Voltage	Max. Current	Dimensions Inches	Net Wt. (Lbs.)
.6HRM5P1	.6HRM5N1	300-600V	5MA	4⅜ x 3⅜ x 4¾	7
1.2HRM5P1	1.2HRM5N1	600-1.2KV	5MA	4⅜ x 3¾ x 4¾	7½
1.7HRM5P1	1.7HRM5N1	900-1.7KV	5MA	4⅜ x 3¾ x 4¾	9
2.5HRM4P1	2.5HRM4N1	1.3-2.5KV	4MA	4⅜ x 3¾ x 4¾	9
3.5HRM3P1	3.5HRM3N1	1.7-3.5KV	3MA	4 11/16 x 4 x 4 15/16	10
5HRM2P1	5HRM2N1	2.5-5.0KV	2MA	4 11/16 x 4 x 4 15/16	10
7HRM1.5P1	7HRM1.5N1	3.5-7.0KV	1.5MA	5½ x 4½ x 6	15
10HRM1P1	10HRM1N1	5.0-10KV	1MA	5½ x 4½ x 6	15
15HRM1.5P1	15HRM1.5N1	7.5-15KV	1.5MA	7¼ x 4 5/16 x 7½	20
20HRM1P1	20HRM1N1	10-20KV	1MA	7¼ x 4 5/16 x 8	20
25HRM2P1	25HRM2N1	12-25KV	2MA	9¼ x 5½ x 9⅝	35
30HRM.75P1	30HRM.75N1	15-30KV	0.75MA	8¼ x 5 5/16 x 7⅞	37
40HRM.5P1	40HRM.5N1	20-40KV	0.5MA	6¼ x 8¼ x 8	42
50HRM.5P1	50HRM.5N1	25-50KV	0.5MA	10 x 8 x 10	60

HARD/HDRD SERIES HIGHLY REGULATED MODULAR SUPPLIES



Input: HARD 115V 50/60 Hz 1φ
HDRD 28V DC ±10%
Output: Variable via resistive program from 50% to 100% of rated output (see chart)
Regulation: Line ±.005% for ±10% Line
Load ±.005% for 0 to Full Load
Ripple: .03% RMS at Full Load
Temp. Range: —20°C to +55°C
Temp. Coef: ±.02%/°C

Model	Output Voltage	Output Current	Model	Output Voltage	Output Current
1.2HARD2-1	1200	2 MA	10HARD1-1	10 KV	1 MA
1.2HARD10-1	1200	10 MA	10HARD2-1	10 KV	2 MA
1.2HARD20-1	1200	20 MA	15HARD.25-1	15 KV	.25 MA
2.5HARD1-1	2500	1 MA	15HARD.5-1	15 KV	.5 MA
2.5HARD4-1	2500	4 MA	15HARD1-1	15 KV	1 MA
2.5HARD8-1	2500	8 MA	20HARD.2-1	20 KV	.2 MA
5HARD.5-1	5000	.5 MA	20HARD.5-1	20 KV	.5 MA
5HARD2-1	5000	2 MA	20HARD1-1	20 KV	1 MA
5HARD4-1	5000	4 MA	30HARD.75-1	30 KV	.75 MA
10HARD.25-1	10KV	.25 MA	40HARD.5-1	40 KV	.5 MA

"HIGH POT" TESTERS "TC" SERIES POWER SUPPLIES

DEL TC Series multi-purpose D.C. Power Supplies are compact, fully instrumented and fully protected units providing ratings up to 80,000 volts D.C. continuously variable.

Seleninum Rectifiers used throughout to provide long life and instantaneous operation. No filament warm up time required.

All high voltage components immersed in special high grade insulating oil. This assures LONG trouble-free LIFE.

STANDARD MODELS

Model No.	Full Load Voltage Range (kv)	Current Range (ma)	Ripple* (% rms/ma at 60 Hz)	Dimensions** Complete Unit (in., w x d x h)	Dimensions** Tank Only (in., w x d x h)
30TC-5-1	0-30	0-5	0.4	14½ x 13½ x 25¾	14 x 13 x 16½
40TC-5-1	0-40	0-5	0.5		
50TC-5-1	0-50	0-5	0.4		
60TC-5-1	0-60	0-5	0.4		
30TC-20-1	0-30	0-20	0.4	17 x 17 x 32	16½ x 16½ x 21½
40TC-20-1	0-40	0-20	0.4		
50TC-10-1	0-50	0-10	0.4		
60TC-10-1	0-60	0-10	0.4		
70TC-5-1	0-70	0-5	0.4		
80TC-5-1	0-80	0-5	0.4		

*%/ma is specified at maximum voltage and current. Percentage shown is also accurate for lower currents down to less than 15% of the maximum ma rating.
**Dimensions are nominal. Outline drawings available on request.

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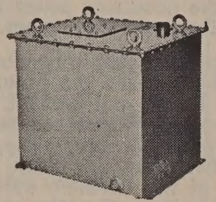
RACK MOUNT POWER SUPPLIES "RHPT" SERIES HIGH POT TESTER

The Del RHPT series of rack mounted Hi Pot Testers are general-purpose power supplies which are fully instrumented, completely enclosed, and fully protected. These units are designed for standard 19-inch racks and have light gray panels. They are recommended for all commercial, industrial, and laboratory uses where reliable dc high-voltage sources are required.

Model No.	Output Voltage Range (kv)	Max. Current (ma)	Model No.	Output Voltage Range (kv)	Max. Current (ma)
1RHPT-5-1	0-1	5	10RHPT-1.25-1	0-10	1.25
1RHPT-10-1	0-1	10	10RHPT-5-1	0-10	5
1RHPT-25-1	0-1	25	10RHPT-10-1	0-10	10
1RHPT-50-1	0-1	50	10RHPT-25-1	0-10	25
1RHPT-100-1	0-1	100	10RHPT-50-1	0-10	50
1RHPT-500-1	0-1	500	10RHPT-100-1	0-10	100
1RHPT-1000-1	0-1	1000	10RHPT-150-1	0-10	150
1RHPT-1500-1	0-1	1500	15RHPT-1.25-1	0-15	1.25
2.5RHPT-2-1	0-2.5	2	15RHPT-5-1	0-15	5
2.5RHPT-5-1	0-2.5	5	15RHPT-10-1	0-15	10
2.5RHPT-10-1	0-2.5	10	15RHPT-25-1	0-15	25
2.5RHPT-25-1	0-2.5	25	15RHPT-50-1	0-15	50
2.5RHPT-50-1	0-2.5	50	15RHPT-75-1	0-15	75
2.5RHPT-100-1	0-2.5	100	20RHPT-1.25-1	0-20	1.25
2.5RHPT-200-1	0-2.5	200	20RHPT-5-1	0-20	5
2.5RHPT-400-1	0-2.5	400	20RHPT-10-1	0-20	10
2.5RHPT-600-1	0-2.5	600	20RHPT-25-1	0-20	25
5RHPT-2-1	0-5	2	20RHPT-50-1	0-20	50
5RHPT-5-1	0-5	5	20RHPT-75-1	0-20	75
5RHPT-10-1	0-5	10	25RHPT-1.25-1	0-25	1.25
5RHPT-25-1	0-5	25	25RHPT-5-1	0-25	5
5RHPT-50-1	0-5	50	25RHPT-10-1	0-25	10
5RHPT-100-1	0-5	100	25RHPT-25-1	0-25	25
5RHPT-200-1	0-5	200	30RHPT-1.25-1	0-30	1.25
5RHPT-300-1	0-5	300	30RHPT-5-1	0-30	5
7.5RHPT-5-1	0-7.5	5	30RHPT-10-1	0-30	10
7.5RHPT-10-1	0-7.5	10	30RHPT-25-1	0-30	25
7.5RHPT-25-1	0-7.5	25	40RHPT-2-1†	0-40	2
7.5RHPT-50-1	0-7.5	50	50RHPT-1-1	0-50	1
7.5RHPT-100-1	0-7.5	100	60RHPT-1-1	0-60	1

SERIES "O" OIL INSULATED TANK UNITS



DEL SERIES "O", oil insulated, High Voltage Power Supplies offers one of the most comprehensive lines of basic high voltage units available to industry and laboratories. These D.C. supplies are designed to provide long, reliable service in such applications as dielectric testing, capacitor chargers, electrostatic precipitators, electron microscopes, image intensifiers, plasma research and accelerators. Series "O" supplies feature reversible polarity on most units, shielded polyethylene output cables, high quality insulating oil in dust free tank, quiet, long life operation with low corona.

STANDARD MODELS

Model No.	Output Voltage (kv)	Output Current (ma)	Model No.	Output Voltage (kv)	Output Current (ma)	Model No.	Output Voltage (kv)	Output Current (ma)
PSO20-200-3	20	200	PSO50-50-8	50	50	PSO100-300-1	100	300
PSO20-300-2	20	300	PSO50-75-1	50	75	PSO100-500-1	100	500
PSO25-50-2	25	50	PSO50-100-4	50	100	PSO120-5-3	120	5
PSO25-200-11	25	200	PSO50-200-5	50	200	PSO120-10-1	120	10
PSO25-400-1	25	400	PSO50-220-2	50	220	PSO120-30-1	120	30
PSO25-500-6	25	500	PSO50-300-1	50	300	PSO130-2-3	130	2
PSO30-3-2	30	3	PSO50-500-3	50	500	PSO150-5-5	150	5
PSO30-5-4	30	5	PSO60-1-1A†	60	1	PSO150-10-1	150	10
PSO30-5-16	30	5	PSO60-5-2	60	5	PSO150-20-1	150	20
PSO30-20-9	30	20	PSO60-10-1	60	10	PSO150-50-3	150	50
PSO30-30-5	30	30	PSO60-100-2	60	100	PSO150-100-1	150	100
PSO30-75-1	30	75	PSO70-5-1	70	5	PSO150-150-1	150	150
PSO30-150-4	30	150	PSO70-5-3	70	5	PSO150-200-1	150	200
PSO30-200-2	30	200	PSO75-30-1	75	30	PSO150-300-1	150	300
PSO30-500-1	30	500	PSO75-60-1	75	60	PSO160-2-1	160	2
PSO40-5-6	40	5	PSO80-5-1	80	5	PSO200-10-1	200	10
PSO40-10-4	40	10	PSO80-5-4	80	5	PSO200-150-1	200	150
PSO40-20-1	40	20	PSO80-10-1B	80	10	PSO200-250-1	200	250
PSO40-220-1	40	220	PSO80-60-1	80	60	PSO250-1-2	250	1
PSO50-1-2†	50	1	PSO100-2-1	100	2	PSO250-3-2	250	3
PSO50-5-6	50	5	PSO100-30-6	100	30	PSO250-10-2	250	10
PSO50-5-9	50	5	PSO100-50-1	100	50	PSO300-10-1	300	10
PSO50-10-2	50	10	PSO100-100-1	100	100	PSO300-50-2	300	50
PSO50-20-2	50	20	PSO100-150-1	100	150			
PSO50-30-4	50	30	PSO100-200-3	100	200			

† Polarity — All units feature reversible polarity except Models PSO 40-2-3, PSO 50-1-2, and PSO 60-1-1A which supply positive outputs only.

NOTE: Larger units are shipped without oil to reduce transportation costs. See notations on price list.

COMPLETE LINE OF CONTROL PANELS AND REGULATED CONTROLS AVAILABLE FOR ALL SERIES "O" POWER SUPPLIES.

HRPS SERIES HIGHLY-REGULATED — POWER SUPPLIES

- **Designed to Withstand Vacuum Sparkovers**
- **Automatic Overload Tripout**

Input: 115 or 230 volts 50/60 Hz.

Output: Adjustable 5 to 100% (See Chart Below)

Ripple: .01% RMS — at full load

Response Time: 100μsec

- **Hybrid Series Regulator**
- **Fast Dynamic Response**
- **Short Circuit Protection**

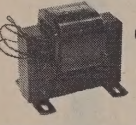
Regulation: Line: ±.0025% (For ±10% Line Change). Load: ±.005% (0 to Full Load)

Resolution: 1%

Size: 1-15KV Units—24 x 29 x 53 in.
30-50KV Units—24 x 29 x 70 in.

Model Number	Output Current	Output Voltage	Insulation
HRPS1-1000	1000MA	50V — 1000V	AIR
HRPS2.5-400	400MA	125V — 2500V	AIR
HRPS5-200	200MA	250V — 5000V	AIR
HRPS10-100	100MA	500V — 10,000V	AIR
HRPS15-66	66MA	750V — 15,000V	AIR
HRPS30-33	33MA	1500V — 30,000V	OIL
HRPS50-20	20MA	2500V — 50,000V	OIL
		Also Available	
HRPS60-30	30MA	30,000-60,000V	OIL

TRANSFORMER HIGH VOLTAGE LINE ISOLATION



OPEN TYPE CONSTRUCTION — EPOXY COATED

These Isolation Transformers are designed for continuous operation at rated voltage and power. They are epoxy coated for use in air and are well suited for applications requiring a reliable source of isolated line voltage at power ratings up to 1 KVA.

Type	KVA	Size	Insulation KV DC Working	Type	KVA	Size	Insulation KV DC Working
AD 1640	.200	6⅛x4x5⅛	10	AD 3062	.750	10½x7½x9½	30
AD 1641	.500	7⅝x5⅞x7¾	10	AD 3063	1.000	11x9x9½	30
AD 1642	.750	9½x6-5/16x8¼	10	AD 3064	.250	10x7x6½	40
AD 1643	1.000	8½x8x9¾	10	AD 3065	.500	11¼x7¼x8¾	40
AD 1644	.200	8½x4x5⅝	20	AD 3066	.750	12½x7½x9½	40
AD 1645	.500	10¼x5⅝x7½	20	AD 3067	1.000	12¾x9x9½	40
AD 1646	.750	9¾x6¾x8	20	AD 3068	.250	12¼x7¼x6½	50
AD 1647	1.000	11¼x6⅝x8¾	20	AD 3069	.500	13¼x7¼x8¾	50
AD 3060	.250	8½x7¼x6½	30	AD 3070	.750	14½x7½x9½	50
AD 3061	.500	9¾x7x8¾	30	AD 3071	1.000	14¾x9x9½	50

Primaries: 115/230V 60 Hz. **Secondaries:** 115V.

HIGH VOLTAGE TRANSFORMERS

FOR VOLTAGE DOUBLER OR ONE END GROUND OPERATION

These transformers are designed for either voltage doubler or one end ground use (except where noted). When used in voltage doubler applications, the D.C. voltage will be approximately two times the peak secondary voltage and the maximum D.C. current from the doubler can be approximately 30% of the maximum secondary current (RMS) and depends on the value of the doubler capacitors. Units are designed for use under oil and for use in air up to 15KVP epoxy coated.
Primary: 115V-50/60 Hz.

Type	Sec. Volts (Peak)	Max. Sec. Current (MA RMS)	Size
AD 4710	2,500	10	4¼x2½x3½
AD 4711	5,000	10	3¼x3-9/16x4¼
AD 4712	7,500	10	4½x4x5½
AD 4713	10,000	10	5⅜x4⅜x6⅝
AD 4714	15,000	10	6¾x3½x5¾
AD 4715	20,000	10	8¾x8½x8
AD 4716	30,000	10	9¼x5½x9¼
AD 4717	50,000	10	10⅝x6½x11
AD 4718	100,000*	10	14¼x9½x15
AD 4719	150,000*	10	14⅛x10x16½
AD 3100	2,500	30	3-9/16x3x4¼
AD 3101	5,000	30	4½x4-5/16x5⅜
AD 3102	7,500	30	6½x4⅛x6⅜
AD 3103	10,000	30	7x4½x6¾
AD 3104	20,000	30	8⅞x6x9⅞
AD 3105	30,000	30	11⅞x7½x12½
AD 3106	50,000	30	11⅜x10x14¾
AD 3107	100,000*	30	12⅞x12x17
AD 3108	150,000*	30	16⅛x13¾x20½
AD 3109	2,500	60	3⅞x3¾x4⅝
AD 3110	5,000	60	4⅜x4⅜x5⅞
AD 3111	7,500	60	6¾x5¼x7⅛
AD 3112	10,000	60	7⅜x5½x7¾
AD 3113	20,000	60	9⅜x9⅛x13
AD 3114	30,000	60	9⅞x7¾x11¾
AD 3115	50,000	60	13½x10¼x15¾
AD 3116	100,000*	60	14x14x19½
AD 3117	150,000*	60	17¼x16¼x22

*End ground operation only.
Units also available in sturdy metal tanks designed for oil insulation and supplied with porcelain output bushings.

Send for Complete Catalogs on • Capacitors • High Power Supplies • Transformers

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Dept. EM, 250 E. Sandford Blvd.
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WALL PLUG-IN LOW VOLTAGE

CONVERTERS / POWER SUPPLIES / CHARGERS

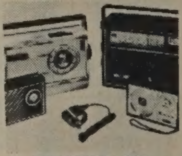
CONVERTER/CHARGER FOR PORTABLE MEDICAL-ELECTRONIC EQUIPMENT

CHARGER FOR BATTERY ELECTRIC-STARTER SYSTEMS

AC ADAPTER FOR TV GAMES

CONVERTER/"FAST" CHARGER FOR CALCULATORS

MICROPROCESSOR POWER SUPPLIES


AC CONVERTER FOR PORTABLE ELECTRONIC EQUIPMENT

"FAST" CHARGER FOR ELECTRONIC FLASH

STANDARDS CATALOG

DYNAMIC STANDARDS
WALL PLUG-IN
CONVERTERS
CHARGERS
POWER SUPPLIES

This 8 page catalog contains detailed specifications on Dynamic:

- **Standard Converters**
- **Chargers**
- **Power Supplies**

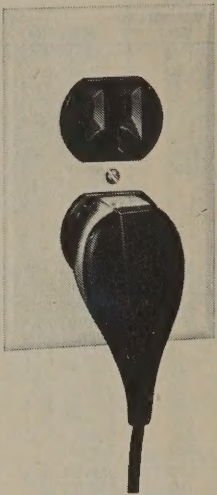
...in both wall plug-in and desk top configurations. Models shown can be ordered by part number...eliminating the need for special engineering charges.

The catalog covers Nickel Cadmium Chargers, AC/DC Converters and Lead Acid Chargers and contains:

- **Specifications**
- **Regulation Charts and Curves**
- **Outline Drawings**

All units are designed to meet or exceed requirements for UL and CSA listings. Available on request.

Designed to be listed under the U/L • CSA SPECIFICATIONS



Dynamic Instrument Corp. has designed, developed and patented a complete range of low-voltage, filtered, transistor-regulated power supplies and chargers designed to supply the necessary power to a vast variety of Electronic equipment.

Utilizing a wall plug-in type unit eliminates or greatly reduces the problems involved with UL listing your product. They also remove the major heat source, reduce size and weight, and also greatly increase your design flexibility. The latest design applications of the Dynamic wall plug-in supplies are in conjunction with such sophisticated equipment as mini-computers, calculators, keyboard logic circuits, and remote CRT Terminals.

Just call or write: Dept. WPX-1.

Dynamic's product range and capabilities also cover:

POWER CONVERSION

AC-AC for products requiring low-level AC voltage. AC-DC for small electric motor driven products that do not use batteries.

SECONDARY BATTERY CHARGING

Dynamic Chargers for charging Nickel-Cadmium; Lead-Acid and Manganese-Alkaline Batteries.

AC-DC CONVERSION/CHARGING

Dynamic Converter-Chargers providing rechargeability or instant use of battery operated products.

FAST CHARGING SYSTEMS

Dynamic design and production capability relative to Fast Charging Systems.

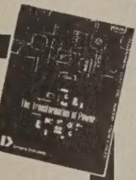
TRANSFORMERS

Internal, External and Wall-Mounted Dynamic Transformers.

SPECIALTY TRANSFORMERS

Dynamic Plug-In, Printed Circuit Transformers; Sub-Miniature Transformers; Ferro-resonant Transformers; Multi-Input Voltage and Multi-Output Voltage Transformers.

THE TRANSFORMATION OF POWER



A unique brochure explaining the many advantages and application possibilities of Dynamic's patented U/L listed transformers, converters, chargers and power supplies, technical data sheets and bulletins, are available on specific products. A request on your letterhead or phone our Sales Engineering Department WPX-1.

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MANUFACTURERS OF POWER CONVERSION AND BATTERY CHARGING SYSTEMS TO THE ORIGINAL EQUIPMENT MANUFACTURER

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HAUPPAUGE, N.Y. 11787
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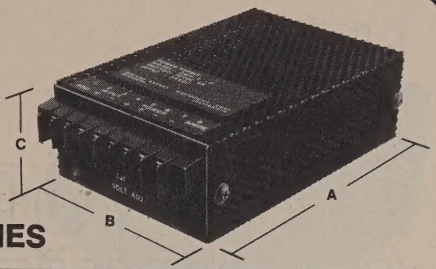
TWX 510-227-9884

NEW 100 WATT SWITCHERS

INTERNATIONAL INPUT RANGE

90-132VAC, 47-440Hz

- 5 Volts @ 20 Amps
- 70% minimum efficiency
- >1.5 Watt/cubic inch power density
- Conduction or convection cooled



DM SERIES

Model	Output Volts (Adj. ±5%)	Output Amps (71°C Rating)*	Dimensions (Inches) A	B	C	Price (1-9 pcs.)
DM-5-10	5	10	6	4	2	$220
DM-5-20	5	20	6	4	2½	$280
DM-6.3-8	6	8	6	4	2	$220
DM-6.3-17	6	17	6	4	2½	$280
DM-12-4	12	4	6	4	2	$220
DM-12-8	12	8	6	4	2½	$280
DM-15-3.5	15	3.5	6	4	2	$220
DM-15-7	15	7	6	4	2½	$280
DM-24-2	24	2	6	4	2	$220
DM-24-4	24	4	6	4	2½	$280
DM-28-1.8	28	1.8	6	4	2	$220
DM-28-3.5	28	3.5	6	4	2½	$280

*Baseplate rating

SPECIFICATIONS

DM SERIES

AC Input Power: 90-132VAC, 47-440Hz, 1 ∅

Hold-Up Time: 15 msec. minimum @ nominal line and full load. No loss of regulation.

Line Regulation: 0.4%, for 90-132VAC change

Load Regulation: 0.4%, No load to full load

Ripple and Noise: 0.2% RMS, 100mV Peak-Peak max.

Efficiency (Nominal Line): 70% minimum

Frequency of Operation: >20KHz. No audible noise

Temperature Coefficient: 0.03% per degree centigrade

Conduction Cooling: Standard

Operating Range: —20°C to +71°C @ mounting base

Convection Cooling: With optional heat sink

Operating Range: —20°C to +71°C (see graph for derating)

Storage Temperature: —55°C to +85°C

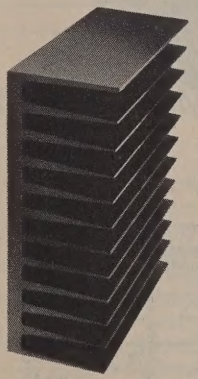
Overload Protection: Factory preset foldback current limiting circuitry. Recovery is automatic.

Overvoltage Protection: Factory preset crowbar OVP standard on every model

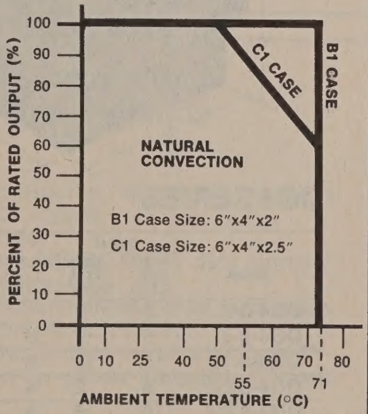
Voltage Adjustment: ±5% by screwdriver adjustment

Mounting: Available on two surfaces

OPTIONAL HEAT SINK



Heat Sink for use with B1 and C1 case. (Add 1.75" to dimension C)



Derating Curve for DM Series with Heat Sink

Optional heat sink is available for convection cooling. Heat sink attaches to base plate of DM Series power supply with four mounting screws. Fins must be vertically oriented for maximum cooling; a second mounting surface is provided for this purpose. See output current vs. ambient temperature curves for output derating characteristics of B1 and C1 case sizes. Heat sinks are made of 6063-T5 extruded aluminum alloy with black anodized finish. Specify Model HS-DM. Unit price is $9.00 for 1 to 9 pieces.

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NEW 60 WATT 24VDC TO DC CONVERTERS

WIDE INPUT RANGE 21-27VDC

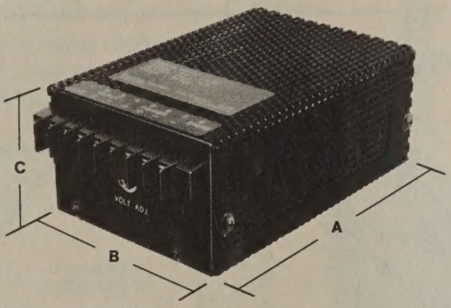
(with 28V or 48V optional inputs available)

- 60% typical efficiencies
- 1 Watt/cubic inch power density
- Conduction or convection cooled

SPECIFICATIONS DG4/DG6 SERIES

	DG4	DG6
Input Power:	21-27VDC	21-27VDC
Line Regulation:	0.5%	0.05% +1mV
Load Regulation:	1.0% ½-FL	0.05% +1mV
Ripple and Noise:	0.2% RMS, 100mV p-p	0.01% +1mV RMS
Efficiency (Nominal Line):	50% to 65%	40% to 55%

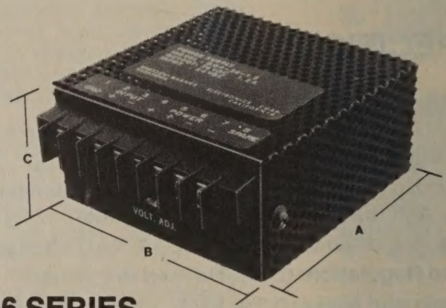
Frequency of Operation: >20KHz. No audible noise.
Temperature Coefficient: 0.03%/°C
Conduction Cooling: Standard
Operating Range: —20°C to +71°C @ mounting base
Convection Cooling: With optional heat sink (see next pg.)
Operating Range: —20°C to +71°C (see graph for derating)
Storage Temperature: —55°C to +85°C
Overload Protection: Factory preset foldback current limiting circuitry. Recovery is automatic.
Overvoltage Protection: Factory preset crowbar OVP standard on every model.
Voltage Adjustment: ±5% by screwdriver adjustment.
Mounting: Available on two surfaces.



DG4 SERIES

Model	Output Volts (Adj. ±5%)	Output Amps (71°C Rating)*	Dimensions (inches) A	Dimensions (inches) B	Dimensions (inches) C	Price (1-9 pcs.)
DG4-5-2	5	2	4	4	2	$140
DG4-5-7	5	7	6	4	2	$180
DG4-5-12	5	12	6	4	2½	$250
DG4-6.3-2	6	2	4	4	2	$140
DG4-6.3-6	6	6	6	4	2	$180
DG4-6.3-11	6	11	6	4	2½	$250
DG4-12-2	12	2	4	4	2	$140
DG4-12-4	12	4	6	4	2	$180
DG4-12-6	12	6	6	4	2½	$250
DG4-15-1.5	15	1.5	4	4	2	$140
DG4-15-3	15	3	6	4	2	$180
DG4-15-5	15	5	6	4	2½	$250
DG4-24-1.2	24	1.2	4	4	2	$140
DG4-24-2	24	2	6	4	2	$180
DG4-24-3	24	3	6	4	2½	$250
DG4-28-1.2	28	1.2	4	4	2	$140
DG4-28-1.8	28	1.8	6	4	2	$180
DG4-28-2.5	28	2.5	6	4	2½	$250

*Baseplate rating



DG6 SERIES

Model	Output Volts (Adj. ±5%)	Output Amps (71°C Rating)*	Dimensions (inches) A	Dimensions (inches) B	Dimensions (inches) C	Price (1-9 pcs.)
DG6-5-1.5	5	1.5	4	4	2	$140
DG6-5-5	5	5	6	4	2	$180
DG6-5-8	5	8	6	4	2½	$250
DG6-6.3-1.5	6	1.5	4	4	2	$140
DG6-6.3-4	6	4	6	4	2	$180
DG6-6.3-7	6	7	6	4	2½	$250
DG6-12-1.5	12	1.5	4	4	2	$140
DG6-12-3	12	3	6	4	2	$180
DG6-12-5	12	5	6	4	2½	$250
DG6-15-1.2	15	1.2	4	4	2	$140
DG6-15-2.5	15	2.5	6	4	2	$180
DG6-15-3.5	15	3.5	6	4	2½	$250
DG6-24-1.2	24	1.2	4	4	2	$140
DG6-24-2	24	2	6	4	2	$180
DG6-24-3	24	3	6	4	2½	$250
DG6-28-1.2	28	1.2	4	4	2	$140
DG6-28-1.8	28	1.8	6	4	2	$180
DG6-28-2.5	28	2.5	6	4	2½	$250

*Baseplate rating

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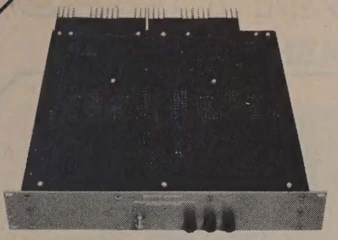
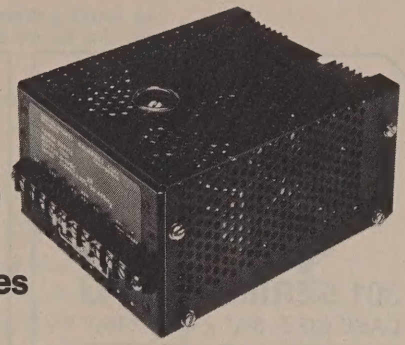


901 SERIES $620

CASE SIZE: 3½" x 17" x 19"

SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
901-3	3	48.0
901-5	5	48.0
901-6	6	47.0
901-10	10	38.0
901-12	12	33.0
901-15	15	25.0
901-18	18	25.0
901-20	20	23.0
901-24	24	20.0
901-28	28	19.0
901-32	32	16.0
901-36	36	13.0
901-48	48	10.0

DUAL OUTPUT SUPPLIES



D Series Op Amp Power Supplies

Designed specifically for use with today's operational amplifiers. Low-profile packages — designed for 5 inch rack mounting on any of 3 mounting surfaces. D Series covers both ±12 volts and ±15 volts up to 6.8 amps.

MODEL NO.	OUTPUT VOLTAGE (VDC)	MAXIMUM AMPS @ 40°C AMBIENT	MAXIMUM DIMENSIONS (INCHES) H	W	L	PRICE
D12-1.5 D15-1.3	±12 ±15	1.5 A 1.3 A	3.31	5.00	6.50	$180
D12-2.8 D15-2.4	±12 ±15	2.8 A 2.4 A	3.31	5.00	9.37	$195
D12-4.2 D15-3.7	±12 ±15	4.2 A 3.7 A	4.94	4.94	9.37	$295
D12-6.8 D15-6.2	±12 ±15	6.8 A 6.2 A	4.94	7.50	9.37	$350

Consult factory for other outputs.

SPECIFICATIONS 301 Thru 901 SERIES AND "D" SERIES

Regulation Line: .01% +1 MV for line variation from 105 to 132VAC.

Regulation Load: .02% +1 MV from zero to full rated load.

Ripple: ½ millivolt RMS with plus or minus output terminal grounded, at 60 Hz and 115VAC line input.

Temperature Range, Operating: —20°C to +71°C continuous duty.

Temperature Range, Storage: —55°C to +85°C.

Input Voltage: 105 to 132VAC, 45 to 440 Hz. 210 to 264VAC, 45 to 440 Hz at no extra cost ("V" option).

Transient Recovery: Less than 50 microseconds.

Temperature Coefficient: .01% per degree centigrade.

Overload Protection: Automatic current limiting at 110% to 130% of rated current. Automatic recovery on removal of overload.

Remote Sensing: Standard feature.

Remote Voltage Adjustment: Standard feature. (Except 901 series)

Remote Programming: 100 ohms per volt. (Except 901 series)

Thermal Protection: Built-in thermostat on heat sink. (Except 901 series)

Relative Humidity: 75%.

Input and Output Connections: Heavy duty terminal block on rear of chassis.

Finish: Black anodized aluminum, black semi-gloss enamel Fed. Std. 595, Color 27038.

Paralleling Capability: Built-in for paralleling without modification to power supplies. (Except 901 series)

OPTIONS

AC Input Option: Add suffix "V". All units are available with 210 to 264VAC, 45 to 440 Hz at no extra charge.

Overvoltage Load Protection Option: Add suffix "L". Protects easily damaged loads from overvoltage transients.

High Humidity Option: Add suffix "H" for 95% relative humidity operation.

Fungus Proofing Operation: Add suffix "F". Treatment with MIL-V-1973 varnish protects circuits from fungus.

DB
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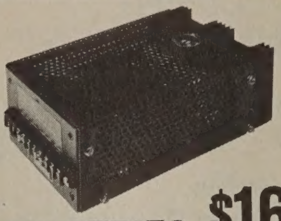
MODULAR DC POWER SUPPLIES

Series 301-901

301 SERIES $150

CASE SIZE: 3 3/16" x 4 15/16" x 6½"

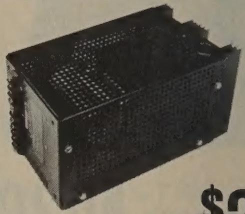
SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
301-3	3	3.8
301-5	5	3.7
301-6	6	3.2
301-10	10	2.7
301-12	12	2.5
301-15	15	2.2
301-18	18	2.0
301-20	20	1.8
301-24	24	1.4
301-28	28	1.3
301-32	32	1.2
301-36	36	1.1
301-48	48	0.9



401 SERIES $165

CASE SIZE: 3 3/16" x 4 15/16" x 9⅜"

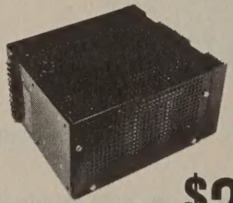
SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
401-3	3	5.3
401-5	5	5.1
401-6	6	4.8
401-10	10	4.2
401-12	12	4.0
401-15	15	3.5
401-18	18	3.2
401-20	20	3.1
401-24	24	2.5
401-28	28	2.3
401-32	32	2.1
401-36	36	2.0
401-48	48	1.6



501 SERIES $220

CASE SIZE: 4 15/16" x 4 15/16" x 9⅜"

SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
501-3	3	11.0
501-5	5	10.5
501-6	6	9.0
501-10	10	7.5
501-12	12	7.3
501-15	15	6.0
501-18	18	5.5
501-20	20	5.0
501-24	24	4.0
501-28	28	3.5
501-32	32	3.2
501-36	36	3.0
501-48	48	2.5



601 SERIES $260

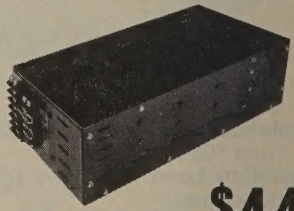
CASE SIZE: 4 15/16" x 7½" x 9⅜"

SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
601-3	3	13.1
601-5	5	12.6
601-6	6	12.4
601-10	10	10.8
601-12	12	10.0
601-15	15	9.0
601-18	18	7.9
601-20	20	7.4
601-24	24	6.7
601-28	28	6.0
601-32	32	5.7
601-36	36	5.4
601-48	48	4.1

701 SERIES $330

CASE SIZE: 4 15/16" x 7½" x 11⅞"

SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
701-3	3	22.0
701-5	5	20.0
701-6	6	19.0
701-10	10	16.0
701-12	12	15.0
701-15	15	14.0
701-18	18	13.0
701-20	20	12.0
701-24	24	11.0
701-28	28	10.0
701-32	32	9.0
701-36	36	8.0
701-48	48	6.0



801 SERIES $440

CASE SIZE: 4 15/16" x 7½" x 17"

SERIES	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (AMPS) @ 40°C
801-3	3	33.0
801-5	5	31.0
801-6	6	30.0
801-10	10	24.0
801-12	12	21.0
801-15	15	19.0
801-18	18	16.5
801-20	20	15.2
801-24	24	14.0
801-28	28	13.0
801-32	32	11.7
801-36	36	10.4
801-48	48	7.7

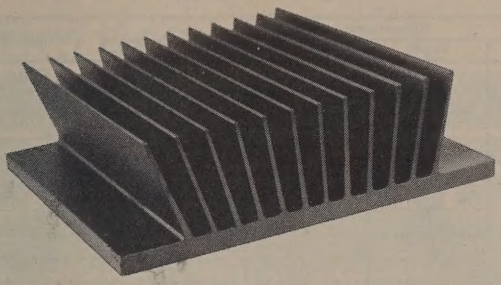
FIRST IN DC POWER

DRESSEN-BARNES ELECTRONICS
DIVISION OF AMERICAN ELECTRONICS INC.
1600 East Valencia Ave., Fullerton, CA 92632 • (714) 871-3020 • TWX 910-592-1256

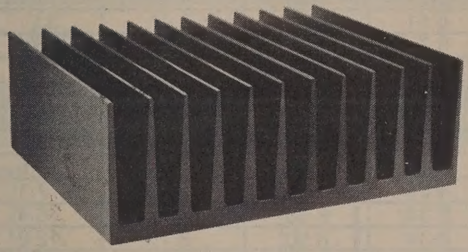
FIVE YEAR WARRANTY 5 DRESSEN-BARNES

Prices and specifications subject to change without notice.

OPTIONAL HEAT SINKS

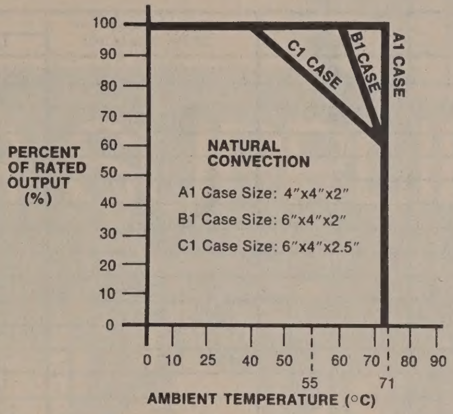


Heat Sink for use with A1 case.
(Add 1.2″ to dimension C)



Heat Sink for use with B1 and C1 case.
(Add 1.75″ to dimension C)

Derating Curve for DG4/DG6 Series with Heat Sink



Optional heat sinks are available for convection cooling. Heat sinks attach to base plates of DG4 or DG6 Series power supplies with four mounting screws. Fins must be vertically oriented for maximum cooling; a second mounting surface is provided for this purpose. See output current vs. ambient temperature curves for output derating characteristics of A1, B1, and C1 case sizes. Heat sinks are made of 6063-T5 extruded aluminum alloy with black anodized finish. Specify Model HS-DG. Unit price is $9.00 for 1 to 9 pieces.

E & DE SERIES

Dressen-Barnes presents a practical, low-cost, economical series of single and dual power supplies.

Functional, popular output features, simplicity in design, low-profile, reliability, 0.1% regulation with Dressen-Barnes engineering and quality craftsmanship.

Perforated cover available to comply with UL design requirements.

SPECIFICATIONS

Regulation: Line: .1% or 5MV, whichever is greater, for line variation from 105 to 125VAC.

Regulation: Load: .1% or 5MV, whichever is greater, from zero to full rated load.

Ripple: 3MV RMS over entire operating range.

Temperature Range: Operating: 0°C to +71°C continuous duty.

Temperature Range, Storage: —55°C to +85°C.

Input Voltage: 105-125/210-250VAC, 47-63 Hz.

Transient Recovery: Less than 100 microseconds.

Temperature Coefficient: .015% per degree centigrade.

Overload Protection: Automatic current limiting at 110% to 130% of rated current. Automatic recovery on removal of overload.

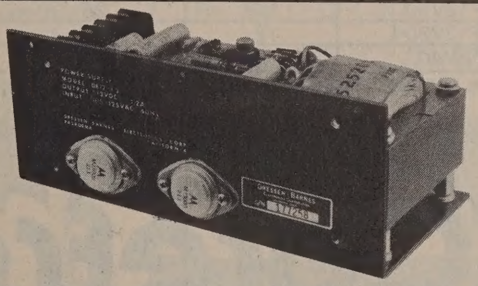
Remote Sensing: Standard feature.

Voltage Adjustment: Standard feature, ±5% by screwdriver.

Remote Programming: 100 ohms per volt.

Relative Humidity: 75%.

Input and Output Connections: Heavy duty terminal block.



Controls: DC output control . . . Simple screwdriver voltage adjustment over entire voltage range. Remote Sensing . . . Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Finish: Black anodized aluminum.

Mounting: Two surfaces, each with tapped mounting holes.

MODEL NO.	OUTPUT VOLTAGE	OUTPUT CURRENT AMPS 40°C	50°C	60°C	PRICE (1-9 pcs)
E5-7.0	5	7.0	5.6	4.2	$ 59.
E12-3.5	12	4.0	3.2	2.8	59.
E15-3.0	15	3.0	2.7	2.4	59.
E24-2.5	24	2.5	2.0	1.8	59.
E28-2.0	28	2.0	1.8	1.5	59.
DE12-2.0	±12	±2.0	1.6	1.4	69.
DE15-1.5	±15	±1.5	1.3	1.2	69.

Consult factory for other voltages and prices.

FIRST IN DC POWER

DRESSEN-BARNES ELECTRONICS
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Prices and specifications subject to change without notice.

30 SIZES OF RECHARGEABLE POWER !

BATTERY NO.	Norm. Voltage	Nominal Capacity @ 20 Hr. Rate (A.H.)	Dimensions Inches				Weight (lbs.)
			Length	Width	Height	Height (Over Term.)	
CF6V1	6	0.9	2.00	1.65	1.97	2.20	0.55
CF12V1	12	0.9	3.30	2.00	1.97	2.20	1.1
CF12V1-L	12	0.9	4.02	1.65	1.97	2.20	1.1
CF18V1	18	0.9	4.90	2.00	1.97	2.20	1.7
CF12V1.5	12	1.5	7.02	1.33	2.40	2.60	1.9
CF2V2.5	2	2.6	2.30	1.04	2.60	2.94	0.46
CF6V2.5	6	2.6	3.17	2.31	2.60	2.86	1.4
CF6V4.5	6	4.5	6.00	1.34	3.70	3.90	2.5
CF12V2.5	12	2.6	4.60	3.12	2.60	2.86	2.8
CF6V2.6	6	2.6	5.30	1.35	2.37	2.56	1.4
CF12V2.6	12	2.6	5.30	2.72	2.37	2.56	2.8
CF2V5	2	5.2	2.33	1.06	3.95	4.33	0.78
CF6V5	6	5.2	3.18	2.31	3.95	4.16	2.4
CF24V20	24	22	9.83	6.51	6.53	6.75	33
CF24V30	24	28	12.50	6.7	6.5	6.75	46.5
CF12V5	12	5.2	4.62	3.18	3.95	4.16	4.7
CF12V5-L	12	5.2	6.12	2.42	3.94	4.16	4.8
CF12V5PP	12	5.2	6.34	2.61	6.60	NA	5.0
CF8V6	8	6.0	3.34	2.15	6.50	6.72	3.9
CF6V8	6	8	6.00	2.00	3.75	3.93	3.6
CF12V8	12	8	6.00	4.03	3.75	3.93	7.1
CF6V15	6	15	3.60	3.34	6.50	6.75	6.4
CF12V15	12	15	7.22	3.34	6.50	6.75	12.8
CF12V20	12	22	6.51	4.91	6.53	6.75	16.2
CF2V30	2	28	3.34	2.15	6.50	6.85	3.8
CF6V30	6	28	6.25	3.35	6.50	6.75	11.5
CF6V30-L	6	28	10.04	2.15	6.50	6.75	11.5
CF12V30	12	28	6.70	6.25	6.50	6.75	23.0
CF12V30-L	12	28	10.04	4.31	6.50	6.75	23.0
CF6V40	6	44	6.51	4.91	6.53	6.75	16.5

STOCK BATTERY CONFIGURATIONS AVAILABLE

Specifications are subject to change without notice

Carefree® power

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You can't spill it. It's sealed with a dual cover. It's rechargeable and maintenance free.

those are just a few reasons why our batteries are called Carefree®

in 30 sizes

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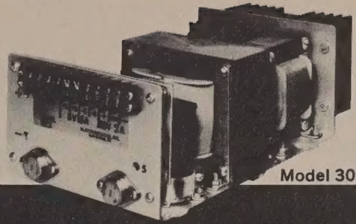
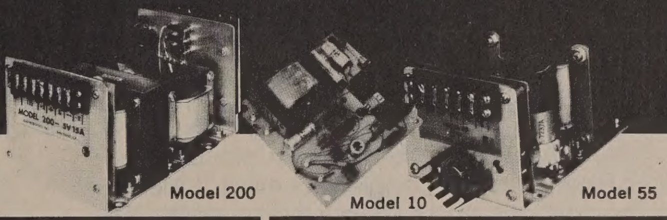


Model 302

DC POWER SUPPLIES

MICROPROCESSOR MODELS

SINGLES—DUALS—TRIPLES



Model 200 Model 10 Model 55

Full Rating To 71°C

60 WATTS $59

MODEL	VOLTAGE	AMPS
55 - 3	2.5 - 3.5	5.0
55 - 4	3.5 - 4.5	5.0
55 - 5	4.5 - 5.5	5.0
55 - 6	5.5 - 6.5	4.5
55 - 7	6.5 - 7.5	4.5
55 - 8	7.5 - 8.5	4.5
55 - 9	8.5 - 9.5	4.0
55 - 10	9.5 - 10.5	4.0
55 - 11	10.5 - 11.5	4.0
55 - 12	11.0 - 13.0	3.0
55 - 14	13.0 - 15.0	3.0
55 - 16	15.0 - 17.0	3.0
55 - 18	17.0 - 19.0	2.5
55 - 20	19.0 - 21.0	2.0
55 - 22	21.0 - 23.0	2.0
55 - 24	23.0 - 25.0	2.0
55 - 26	25.0 - 27.0	2.0
55 - 28	27.0 - 29.0	2.0
55 - 30	29.0 - 30.0	2.0
55 - 1212	±11.0 - 13.0	1.0
55 - 1515	±14.0 - 16.0	1.0
55 - 1818	±17.0 - 19.0	1.0

Size: 6.00 L x 3.50 W x 3.13 H Wt.: 4.25 lbs.

QUANTITY	PRICE	WITH OVERVOLTAGE
SINGLE (Models 55 - 3 thru 55 - 30)		
1 - 9	$59 ea.	$65 ea.
10 - 24	$56 ea.	$60 ea.
DUAL (Models 55 - 1212 thru 55 - 1818)		
1 - 9	$69 ea.	$79 ea.
10 - 24	$65 ea.	$74 ea.

10 WATTS $35

MODEL	VOLTAGE	AMPS
10 - 5	4.5 - 5.5	1.2
10 - 10	9 - 11	0.9
10 - 12	11 - 13	0.8
10 - 15	14 - 16	0.6
10 - 24	23 - 25	0.4
10 - 28	26 - 30	0.35
10 - 1212	±11 - 13	0.35
10 - 1515	±14 - 16	0.35
10 - 1818	±17 - 19	0.35

ANY OUTPUT TO 30 VOLTS AVAILABLE

Size: 4.5 L x 4.5 W x 1.63 H Wt.: 1.2 Lbs.

SINGLE	PRICE	WITH OVERVOLTAGE
1 - 9	$35 ea.	$40 ea.
10 - 24	$32 ea.	$36 ea.
DUAL		
1 - 9	$45 ea.	$55 ea.
10 - 24	$42 ea.	$51 ea.

30 WATTS $31

MODEL	VOLTAGE	AMPS
30 - 5	5	3.0
30 - 10	10	1.8
30 - 12	12	1.5
30 - 15	15	1.2
30 - 24	24	1.0
30 - 28	28	1.0

ANY OUTPUT TO 30 VOLTS AVAILABLE

Size: 4.0 L x 2.75 W x 4.5 H Wt.: 2.1 Lbs.

QUANTITY	PRICE	WITH OVERVOLTAGE
1 - 9	$31.00 ea.	$36.00 ea.
10 - 24	$29.20 ea.	$33.70 ea.

TRIPLE $70

MODEL	VOLTAGE	AMPS
300	5 V	1
	±12 or 15 V	0.25
301	5 V	5A
	±12 or 15 V	1A
302	5 V	15A
	±12 or 15 V	2A
401	5 V	25A
	±12 or 15 V	3A

Size: 300 - 4.5 L x 4.5 W x 2.25 H; Wt.: 2 Lbs.
301 - 7.0 L x 6.0 W x 3.38 H; Wt.: 6 Lbs.
302 - 13.25 L x 6.0 W x 4.00 H; Wt.: 16.5 Lbs.
401 - 15.0 L x 7.0 W x 5.25 H; Wt.: 22.5 Lbs.

	MODEL	PRICE	WITH OVERVOLTAGE
1 - 9	300 - 12 300 - 15	$ 70 ea.	$ 80 ea.
	301 - 12 301 - 15	$ 99 ea.	$111 ea.
	302 - 12 302 - 15	$159 ea.	$174 ea.
	401 - 12 401 - 15	$279 ea.	$299 ea.
10 - 24	300 - 12 300 - 15	$ 65 ea.	$ 75 ea.
	301 - 12 301 - 15	$ 93 ea.	$104 ea.
	302 - 12 302 - 15	$149 ea.	$163 ea.
	401 - 12 401 - 15	$262 ea.	$280 ea.

200 WATTS $99

MODEL	VOLTAGE	AMPS
200 - 5	4.5 - 5.5	15.0
200 - 10	9.5 - 10.5	12.0
200 - 12	11.5 - 12.5	10.0
200 - 15	14.5 - 15.5	9.0
200 - 24	23.5 - 24.5	7.5
200 - 28	27.5 - 28.5	7.0
200 - 48	47.5 - 48.5	4.0
200 - 0505	± 4.5 - 5.5	7.0
200 - 1212	±11.5 - 12.5	5.0
200 - 1515	±14.5 - 15.5	4.5
200 - 2424	±23.5 - 24.5	3.5
200 - 2828	±27.5 - 28.5	3.5

ANY SINGLE OUTPUT TO 50 VOLTS AVAILABLE
ANY DUAL OUTPUT TO 30 VOLTS AVAILABLE

Size: 10.75 L x 5.50 W x 5.00 H Wt.: 15 Lbs.

SINGLE	PRICE	WITH OVERVOLTAGE
1 - 9	$99 ea.	$114 ea.
10 - 24	$94 ea.	$107 ea.
DUAL		
1 - 9	$119 ea.	$129 ea.
10 - 24	$113 ea.	$122 ea.

100 WATTS $72

MODEL	VOLTAGE	AMPS
100 - 5	5	10
100 - 10	10	7
100 - 12	12	6
100 - 15	15	6
100 - 24	24	4
100 - 28	28	3.5
100 - 0505	± 5	5
100 - 1212	±12	3.5
100 - 1515	±15	3
100 - 2424	±24	2
100 - 2828	±28	2

ANY OUTPUT TO 30 VOLTS AVAILABLE

Size: 7 L x 5.5 W x 5.5 H Wt.: 6 Lbs.

SINGLE	PRICE	WITH OVERVOLTAGE
1 - 9	$72 ea.	$78 ea.
10 - 24	$68 ea.	$73 ea.
DUAL		
1 - 9	$85 ea.	$97 ea.
10 - 24	$81 ea.	$91 ea.

ELECTRICAL SPECIFICATIONS: ALL MODELS

INPUT: 105-125 VAC. 50-420 Hz (230V OPTIONAL)

REGULATION: LINE: 0.005% or 2 MV MIN (10 VOLT CHANGE)
LOAD: 0.05% or 10 MV MIN (FULL LOAD CHANGE)

RIPPLE: LESS THAN 250 MICROVOLTS

IMPEDANCE: 100 Hz - 0.001 OHMS
1 KHz - 0.005 OHMS
10 KHz - 0.01 OHMS
100 KHz - 0.1 OHMS

RECOVERY TIME: 25 MICROSECONDS

OVERSHOOT: NONE ON TURN ON OR OFF

TEMPERATURE:
OPERATING —20 TO +71°C
STORAGE —65 TO +85°C
COEFFICIENT 0.01%/°C MAX

CURRENT LIMITING: FIXED - FOLD-BACK TYPE - AUTOMATIC RECOVERY

OUTPUT: FLOATING

SEMICONDUCTORS: SILICON

CAPACITORS: COMPUTER GRADE 10 YEAR LIFE

OVERVOLTAGE PROTECTION: OPTIONAL

ORDERING INFORMATION

All prices FOB San Diego
One Year Warranty
For Overvoltage Models Add -0 To Model Number
Free Catalog on Request

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With the Uglies you've got your pick. 16 voltages. Multi currents. Varied inputs. Shapes and sizes for every requirement.

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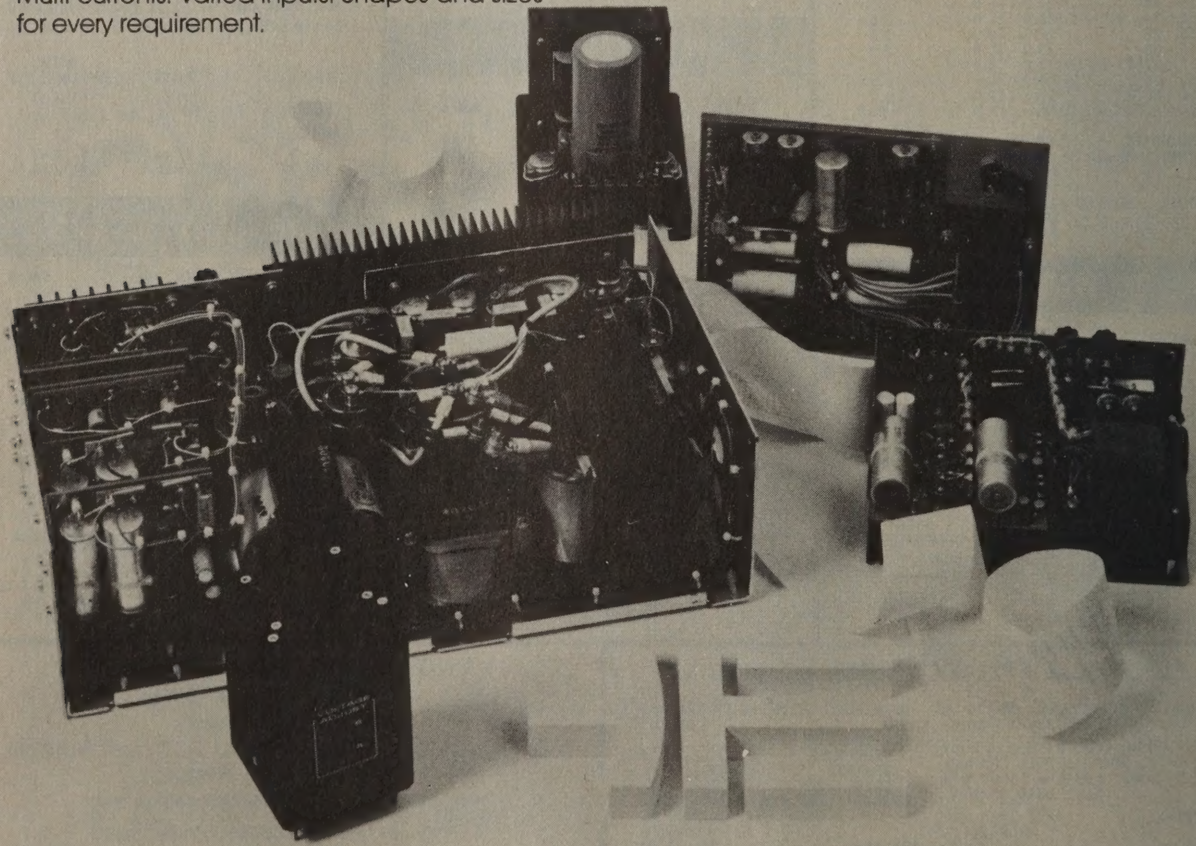

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power supplies

FROM

ELECTRONIC MEASUREMENTS

DC OUTPUT SCR REGULATED

On the next three pages you will find the industry's largest selection of DC output SCR regulated power supplies in the 500 watt to 60kw range. All units regulate voltage and current output to 0.1% and feature low ripple, high efficiency and reliability and the smallest package sizes available.

Turn Page for Specific Models→

FOR CUSTOM POWER SUPPLIES

If your requirements cannot be satisfied with standard E/M products we are eager to make modifications to meet specific applications. Standard units can have special panels, optional features or alternate packages. If you are an OEM a custom power supply may be required. Our design and production technology includes series pass, ferroresonant, switch mode and SCR phase control techniques. A prompt technical appraisal of your specification and a realistic quotation are only a letter or phone call away — if you give us the opportunity.

OTHER POWER PRODUCTS

E/M is also actively engaged in design and production of special purpose power sources. These include Arc lamp power supplies for krypton, xenon and mercury lamps, plasma arc power supplies, battery eliminators, open frame power supplies and switch mode power sources. Contact us for specific information and applications assistance in any of these areas.

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DC output SCR regulated power supplies

FEATURES:

- Highest wattage per cubic inch in the industry
- High efficiency
- Constant-voltage or constant-current output, with automatic crossover
- Remote sensing and programming
- Series or parallel operation
- Master/slave operation (single-phase only)
- Circuit breaker or fuse protected
- Thermal overload protection
- Mode indicator lights (single-phase only)
- Rack or bench mount
- Optional over-voltage protection
- Optional input voltages
- Five-year warranty

APPLICATIONS:

- CW lasers
- Pulse lasers
- Capacitor forming
- Focusing coils for accelerators
- Cryogenic magnet applications
- Electroplating
- Battery charging
- Aging racks for semiconductors and IC's
- Electronic memory systems
- General electronic applications

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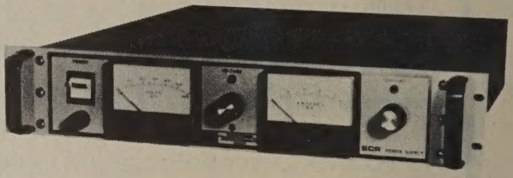
single phase SCR models

(500, 800, 1600, 2400 watts)



MAJOR SPECIFICATIONS:

AC input voltage: 500, 800 & 1600 W models — 105-130V, 47-63 Hz; 2400 W models — 190-253V, 47-63 Hz. Optional inputs available.

AC input current: 500 W—7.5A; 800 W—12A; 1600 W — 24A; 2400 W — 18A (220V).

DC output: regulation, voltage mode — 0.1%; regulation, current mode — 0.25%; stability — 0.05%, 8 hours; temperature coefficient — 0.02%/°C.

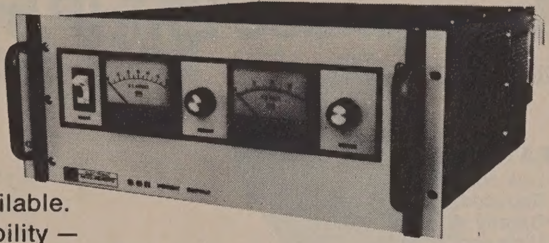
Size: 500 & 800 W models — 3½"H x 19"W x 18½"D (88mm x 483mm x 470mm); 1600 W models — 5¼"H x 19"W x 18½"D (133mm x 483mm x 470 mm); 2400 W models — 7"H x 19"W x 18½"D (177mm x 483mm x 470mm).

Output Voltage (V)	Output Current (A)	Voltage Ripple (mA rms)	Current Ripple (mV rms)	Model	Price ($)
0-7.5	60	90	640	SCR7.5-60	550
	100		1000	SCR7.5-100	700
	180		1920	SCR7.5-180	950
	250		2990	SCR7.5-250	1100
0-10	40	90	320	SCR10-40	495
	80		600	SCR10-80	700
	150		1200	SCR10-150	925
	210		1680	SCR10-210	1100
0-20	25	90	100	SCR20-25	495
	40		120	SCR20-40	650
	80		320	SCR20-80	895
	120		480	SCR20-120	1100
0-40	13	100	33	SCR40-13	475
	20	80	30	SCR40-20	600
	40	100	100	SCR40-40	850
	60	100	150	SCR40-60	1100
0-60	9	120	18	SCR60-9	495
	13	80	15	SCR60-13	600
0-60	26	90	39	SCR60-26	900
	40		60	SCR60-40	1100
0-80	6	150	11	SCR80-6	495
	10	90	10	SCR80-10	650
	20	120	30	SCR80-20	950
	30	100	35	SCR80-28	1100
0-150	3	300	6	SCR150-3	450
	5	150	5	SCR150-5	625
	10	200	13	SCR150-10	950
	15	200	20	SCR150-15	1100
0-300	1.5	500	3	SCR300-1.5	525
	3	250	3	SCR300-3	700
	5	300	5	SCR300-5	950
	8	300	8	SCR300-8	1100
0-600	0.75	1000	2	SCR600-.75	500
	1.5	1000	2	SCR600-1.5	700
	3	1000	4	SCR600-3	950
	5	1000	5	SCR600-4	1100

ELECTRONIC MEASUREMENTS INC.
405 Essex Road, Neptune, N.J. 07753
Phone: (New Jersey) 201-922-9300. TOLL FREE 800-631-4298 / TELEX: 132-424
Specialists in Power Conversion Equipment

three phase SCR models

(2500, 5000, 10,000 watts)



MAJOR SPECIFICATIONS:

AC input voltage: 2.5 KW models — 190-240V, 3Ø 47-63 Hz @ 10A; 5 KW models — 190-240V, 3Ø 47-63 Hz @ 20A; 10 KW models—400-505V, 3Ø 57-63 Hz @ 18A. Optional inputs available.

DC output: regulation, voltage and current mode — 0.1%; stability — 0.05%; temperature coefficient, 0.05%/°C; operating temperature, 0-50°C.

Sizes: 2.5 KW models — 7″H x 19″W x 20″D (177mm x 483mm x 508mm); 5 KW models — 8¾″H x 19″W x 20″D (222mm x 483mm x 508mm); 10 KW models — 12¼″H x 19″W x 20″D (311mm x 483mm x 508mm).

Output Voltage (V)	Output Current (A)	Voltage Ripple (mV rms)	Current Ripple (mA rms)	Model	Price ($)
0-6	600	10	300	**SCR6-600**	2500
0-7.5	300	10	150	**SCR7.5-300**	1700
0-10	250 500	10	125 250	**SCR10-250** **SCR10-500**	1600 2400
0-20	125 250 500	10	30 60 120	**SCR20-125** **SCR20-250** **SCR20-500**	1500 2050 3100
0-30	100 200	10	30 60	**SCR30-100** **SCR30-200**	1500 2050
0-40	60 125 250	10	10 30 125	**SCR40-60** **SCR40-125** **SCR40-250**	1500 1950 2900
0-50	200	10	60	**SCR50-200**	3150
0-80	30 60	10	10 10	**SCR80-30** **SCR80-60**	1500 1950
0-100	100	10	30	**SCR100-100**	3150
0-120	20 40	10	3 10	**SCR120-20** **SCR120-40**	1500 1950
0-160	15 30 60	10	3 3 10	**SCR160-15** **SCR160-30** **SCR160-60**	1550 2000 2950
0-250	10 20 40	10	3 3 10	**SCR250-10** **SCR250-20** **SCR250-40**	1500 2100 3150
0-500	5 10	10	3 3	**SCR500-5** **SCR500-10**	1725 2500

three phase EMCV&EMCC models

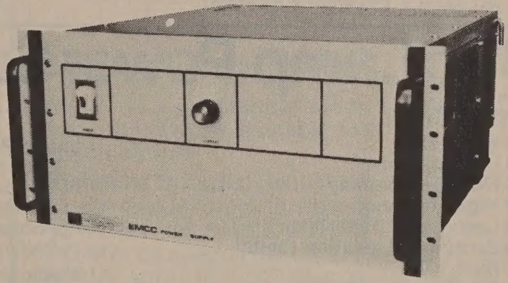
(2500, 5000, 10,000 watts)

MAJOR SPECIFICATIONS:

AC input voltage: 2.5 KW models — 190-240V, 3Ø 47-63 Hz @ 10A; 5 KW models — 190-240V; 3Ø 47-63 Hz @ 20A; 10 KW models — 400-505V; 3Ø 57-63 Hz @ 18A. Optional inputs available.

DC output: regulation — 1%; stability — 0.05%; temperature coefficient — 0.05%/°C; operating temperature — 0-50°C.

Sizes: 2.5 KW models — 7″H x 19″W x 20″D (177mm x 483mm x 508 mm); 5 KW models — 8¾″H x 19″W x 20″D (222mm x 483mm x 508mm); 10 KW models — 12¼″H x 19″W x 20″D (311mm x 483mm x 508mm).



*At maximum output. Ripple is less at reduced power output.

EMCV Output		EMCC Output		Ripple*		Model (EMCV or EMCC)	Price ($)
Volts	Amps	Amps	Volts	EMCV (mV rms)	EMCC (mA rms)		
1.5-6	600	50-600	6	150	17A	**6-600**	2200
1.5-7.5	300	30-300	7.5	150	6A	**7.5-300**	1500
1.5-10	250 500	50-250 100-500	10	150	4A 8A	**10-250** **10-500**	1400 2150
2-20	125 250 500	25-125 50-250 100-500	20	150	1A 2A 4A	**20-125** **20-250** **20-500**	1300 1800 2700
3-30	100 200	25-100 50-200	30	150	500 1000	**30-100** **30-200**	1300 1750
4-40	60 125 250	10-60 25-125 50-250	40	150	225 475 1000	**40-60** **40-125** **40-250**	1300 1650 2500
5-50	200	40-200	50	150	600	**50-200**	2800
10-80	30 60	5-30 10-60	80	150	60 120	**80-30** **80-60**	1300 1700
15-100	100	20-100	100	150	500	**100-100**	2800
15-120	20 40	5-20 5-40	120	300	50 100	**120-20** **120-40**	1300 1650
20-160	15 30 60	5-15 5-30 10-60	160	300	30 60 120	**160-15** **160-30** **160-60**	1300 1650 2600
25-250	10 20 40	2-10 5-20 5-40	250	300	12 24 48	**250-10** **250-20** **250-40**	1300 1750 2800
50-500	5 10	1-5 2-10	500	300	6 12	**500-5** **500-10**	1500 2200

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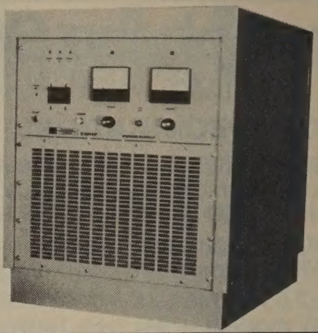
Specialists in Power Conversion Equipment

three phase EMHP models

(20, 30 & 60 kilowatts)



FEATURES:

- Low cost
- Reduced delivery time
- Greatly increased efficiency
- High performance

APPLICATIONS:

- Electromagnets
- Magnetic beam bending
- Cryogenic magnets
- Precision electroplating
- Electrochemical processes
- DC motor power
- Large relay systems
- High energy electronic systems
- High power illumination systems
- Thermodynamic and thermonuclear research
- Inverter power source
- Battery charging
- Industrial DC power

MAJOR SPECIFICATIONS:

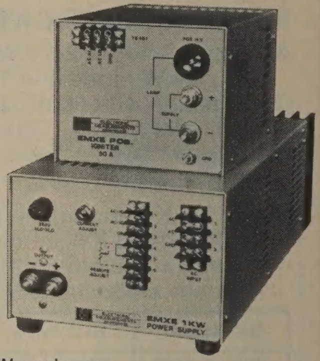
AC input voltage: 460 VAC ±10%, 60 Hz. (Optional inputs available.)

DC output: regulation, 0.1%; stability, 0.05%.

Size: Series 15 (19″ panel) — 21.69″W x 26.62″H x 25.00″D (55.1mm x 67.6mm x 63.5mm); Series 25 (24″ panel) — 26.75″W x 32.00″H x 25.00″D (67.9mm x 81.3mm x 63.5mm); Series 40 (24″ panel) — 26.75″W x 47.62″H x 25.00″D (67.9mm x 130.9mm x 63.5mm).

Model	Voltage (V)	Current (A)	Voltage Ripple (V rms)	Current Ripple (A rms)	Typical Price
SERIES 15 (20 KW max., 19″ panel, 26⅝″ package)					
EMHP10-1000	0-10	0-1000	0.10	10	$4000
EMHP20-750	0-20	0-750	0.15	5.7	
EMHP40-400	0-40	0-400	0.25	2.5	
EMHP80-250	0-80	0-250	0.50	1.6	
EMHP150-130	0-150	0-130	0.75	0.7	
EMHP600-30	0-600	0-30	3.00	0.2	
SERIES 25 (30 KW max., 24″ panel, 32″ package)					
EMHP10-1500	0-10	0-1500	0.1	15	$5000
EMHP20-1000	0-20	0-1000	0.15	7.5	
EMHP40-600	0-40	0-600	0.25	3.8	
EMHP80-375	0-80	0-375	0.5	2.4	
EMHP150-200	0-150	0-200	0.70	1.0	
EMHP600-50	0-600	0-50	3.0	0.3	
(SERIES 40 (60 KW max., 24″ panel, 47⅝″ package)					
EMHP10-3000	0-10	0-3000	0.1	30	$9000
EMHP20-1500	0-20	0-1500	0.15	12	
EMHP40-900	0-40	0-900	0.25	6	
EMHP80-600	0-80	0-600	0.5	4	
EMHP150-350	0-150	0-350	0.75	2	
EMHP600-100	0-600	0-100	3.0	0.5	

Arc Lamp Power Supplies (Xenon & Mercury — 35W to 1 KW)



FEATURES:

- Small size
- Light weight
- Flexible mounting
- High efficiency
- Low ripple (better than 1%)
- Excellent regulation (better than 1%)
- Low in-rush currents
- Long-term stability
- Remotely adjustable (500 W and 1000 W, standard; 200 W, optional)
- No audible noise
- Low energy starting
- Input surge protection
- Automatic starting
- Adjustable output
- Modulation capability (optional)

APPLICATIONS:

Optical Instrumentation:
Metallographs
Monochromators
Spectrophotometers
Fluorescent microscopes
Artificial aging equipment
Optical test stands
Laser pumping
Weathering & light fastness testers

Graphic Arts:
Integrated circuit manufacture
Color matching

Image Projection:
Slide projectors
Motion picture projectors
Contour projection
Photoelectric scanning
Railway identification systems

Medical:
Photo coagulators
Skin irradiation equipment

SPECIFICATIONS:

AC input: 100-130 VAC, 47-63 Hz. 200 W package, 2.5A; 500 W package, 8.4A; 1000 W package, 15A. (Optional inputs available.)

DC output: 200 W package, to 13A; 500 W package, to 27A; 1000 W package, to 55A. Ripple, less than 0.1% below 20 KHz.

	Power Supply Unit			Igniter Unit		
Basic Model*	Voltage	Current (amps DC)	Mode**	Peak Volt.	Boost Volt.	Lamp Applications
EMXE 75	14	to 7.0	CP	15 KV	180	35 & 75 watt xenon
EMXE 150	20	to 8.5	CC or CP	35 KV	180	150 watt xenon
EMXE 150/VIX	12	12.5	CC	35 KV	180	VIX 150
EMHG 200	65-50	3.1-4.0	CP	12 KV	180	200 watt mercury (50 & 100 watt available)
EMXE 500	20	to 27	CC	35 KV	180	450 & 500 watt xenon
EMHG 500	85-70	5.9-7.1	CP	12 KV	180	300 to 500 watt mercury
EMXE 1000	20	to 55	CC	35 KV	180	600 to 1000 watt xenon
EMHG 1000	80	12.5	CP	12 KV	180	600 to 1000 watt mercury

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DC-to-DC POWER SUPPLIES from Endicott Coil

Activate your information displays

When you must convert low DC line voltages to nominal 200 or 250 V DC levels to activate your information displays, ask us to recommend the DC-to-DC power supply that's right for your application.

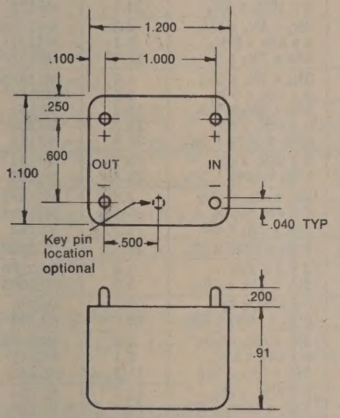
ENDICOTT
COIL CO INC
E715-215U

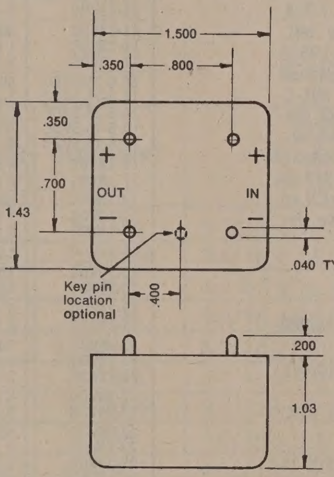
E 700

ENDICOTT
COIL CO INC
E712-215R
7448

unregulated

regulated


1.200
.100
1.000
.250
.600
1.100
OUT
IN
+
+
−
−
.040 TYP
Key pin location optional
.500
.200
.91


1.500
.350
.800
.350
.700
1.43
OUT
IN
+
+
−
−
.040 TYP
Key pin location optional
.400
.200
1.03

Specifications for E 700

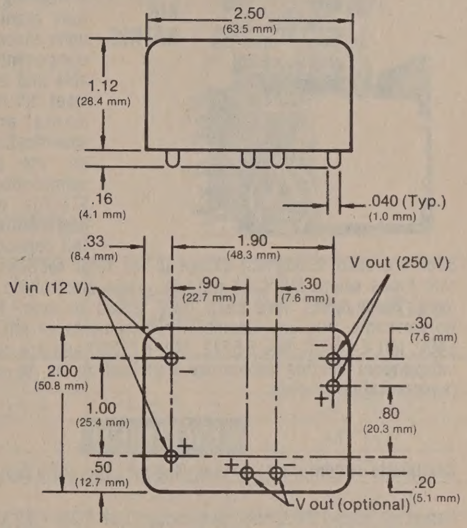
Input: Standard inputs 5, 9, 12, 15 V DC (others up to 48 V DC)
Output: 200 V DC @ 15 MA.
Input/Output Isolation: 600 V RMS; 60 Hz. breakdown for 1 minute
Weight: 30 gms. (unregulated)
40 gms. (regulated)
Size: 1.1″ (27.94 mm) x 1.2″ (30.48 mm) x .910″ (23.11 mm) max. high (unregulated)
1.43″ (36.32 mm) x 1.5″ (38.10 mm) x 1.03″ (26.16 mm) max. high (regulated)
Mounting: Designed for PC mounting
Packaging: Plastic case, fully encapsulated

Although we develop our lightweight, compact DC-to-DC power supplies to activate "glow-type" information displays, our customers have demonstrated that this "big performer in a little package" has a host of other applications besides. Here are just some of them:

- Outputs to 1,500 V @ 1 MA. for portable oscilloscopes and photo-multiplier applications.
- Low wattage fluorescent tube power supply for battery operation (4 watt to 8 watt).
- High frequency AC excitation for remote sensors and transducers.
- Multiple DC and/or AC outputs from battery sources.
- Highly isolated power supplies for electromedical applications.

ENDICOTT
COIL CO INC
E912-2530
7449

E 900


2.50
(63.5 mm)
1.12
(28.4 mm)
.16
(4.1 mm)
.040 (Typ.)
(1.0 mm)
.33
(8.4 mm)
1.90
(48.3 mm)
V out (250 V)
V in (12 V)
.90
(22.7 mm)
.30
(7.6 mm)
.30
(7.6 mm)
2.00
(50.8 mm)
1.00
(25.4 mm)
.80
(20.3 mm)
.50
(12.7 mm)
.20
(5.1 mm)
V out (optional)
+
−

Specifications for E 900

Input: 12 V DC standard (5 V, 9 V, 15 V DC, and other inputs available to your specification)
Standard Outputs: Available with either single or dual outputs, capable of up to 12 watts total. Single: 250 V DC @ 30 MA. (45 MA. on special order). Dual: 250 V DC @ 30 MA., and -16 V DC @ up to 100 MA. to provide the -12 V DC needed for the drive electronics in many applications using the Burroughs SELF-SCAN® displays.
Input/Output Isolation: 600 V RMS (60 Hz. breakdown for 1 minute)
Weight: 122 gms.
Size: 2″ (50.8 mm) x 2.5″ (63.5 mm) x 1.12″ (28.4 mm)
Mounting: Designed for PC board mounting
Packaging: Aluminum case, acting as heat sink, may rise 10–15° C. above ambient temperature at full load; may be connected to ground to provide electrostatic shielding

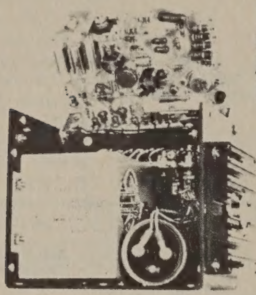
- **Pin layout permits mounting on most standard motherboards.**
- **Lightweight and compact size of these power supplies keeps the equipment in which they are used easily portable.**
- **Models shown here are fully encapsulated.**

Endicott Coil Co., Inc.
P. O. Box 67/30 Charlotte St., Binghamton, N.Y. 13905
Phone: 607-797-1263

MIL SPEC MS Series

Repairable MS Series · Military Specifications SINGLE/DUAL OUTPUT DC Modular Power Supplies

MEETS COMPONENT, WORKMANSHIP AND ENVIRONMENTAL REQUIREMENTS OF MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200



75°C FREE AIR RATING

Transpac MS Series DC Power Modules are capable of meeting the highest military requirements. These units incorporate full MIL components where applicable and are designed to meet full military environmental and component specifications. Transformers are per MIL-T-27A, semiconductors are MIL-STD-701 or MIL-S-19500 preferred types. Tantalum foil capacitors per MIL-C-3965 are used throughout except in the filter sections of higher current types where MIL-C-62 military grade electrolytic capacitors are used. These units have been fully tested to meet the component, workmanship, and environmental requirements of MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200 and are supplied with an independent testing laboratory certification as to compliance for representative models.

CERTIFIED

Certificate of Conformity by Independent Laboratory supplied on request

Input: 103.5-126.5 VAC (standard) or 108-132 VAC (specify), 47-440 Hz

Ripple: Less than 800μv RMS except 50 through 310 VDC where ripple is less than 0.005% RMS

Line Regulation: Less than ±0.01% or 5 mv, whichever is greater, for full input change

Load Regulation: Less than 0.05% or 8 mv for 0-100% load change

Transient Response: Less than 50 μsec for step line or load change

Maximum Case Temperature: 115°C

Free Air Operating Temperature: −55°C to +75°C (full tantalum type up to 1 ampere most models) −40°C to +75°C (semitantalum type above 1 ampere) full ratings, no external heat sinking

Temperature Coefficient: Less than 0.01% per degree C or 3 mv

Long Term Stability: Within 10 mv or 0.1%, whichever is greater for 8 hours (line, load temperature constant)

Interconnection: Series or parellel operation

Voltage Adjustment: External screwdriver voltage control

Remote Voltage Control: Provision for external control of output voltage

Remote Sensing: Remote sensing facilities provided

Short Circuit Protection: Automatic short circuit protection and automatic recovery

Overvoltage Protection: Fixed 5 volt and dual output units add suffix (-O) to model number. For other MS units order model OV448M

Polarity: Ungrounded or + / − grounded

Transistor Types: MIL-STD-701 and MIL-S-19500

Military Specs: MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200 where applicable

SINGLE OUTPUT

Output Voltage (DC)	Current	Size - W x D x H (Inches)	Weight (Lbs.)	Model
5VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS51
5VDC	3 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS53
5VDC	6 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	22.5	MS56
5VDC	12 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	23.2	MS512
5VDC	20 Amp	$4\frac{15}{16}$ x 7½ x 14⅞	32.0	MS520
0-7VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS07P5*
0-7VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS071*
0-7VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS072
0-7VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS074
0-7VDC	8 Amp	6 x $10\frac{5}{16}$ x $6\frac{5}{16}$	24.1	MS078
0-10VDC	50 MA	3 x 3 x 3¼	1.6	MS01P05*
10-20VDC	250 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS10P3*
11-12VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS124
11-12VDC	8 Amp	6 x $10\frac{5}{16}$ x $6\frac{5}{16}$	24.1	MS128
11-13VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS12P5*
11-13VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS121*
11-13VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.2	MS122
14.5-15.5VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS15P5*
14.5-15.5VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS151*
14.5-15.5VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS152
14.5-15.5VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS154
14.5-15.5VDC	8 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	24.8	MS158
17-18VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS184
17-18VDC	8 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	24.8	MS188
17-19VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS18P5*
17-19VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS181*
17-19VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS182
19-21VDC	5 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	24	MS205V25R
20-30VDC	50 MA	3 x 3 x 3¼	1.6	MS20P05*
20-30VDC	250 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS20P3*
23-24VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS244
23-24VDC	8 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	24.1	MS248
23-25VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS24P5*
23-25VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS241*
23-25VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS242
27-28VDC	4 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS284
27-28VDC	8 Amp	$6\frac{15}{16}$ x 10⅝ x $6\frac{5}{16}$	24.1	MS288
27-29VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS28P5*
27-29VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS281*
27-29VDC	2 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS282
30-40VDC	250 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS30P3
31-32VDC	4 Amp	$6\frac{15}{16}$ x 9¼ x $6\frac{5}{16}$	23.9	MS324
31-33VDC	500 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS32P5*
31-33VDC	1 Amp	4 x 4¾ x $5\frac{15}{16}$	6.1	MS321*
40-50VDC	50 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS40P05*
40-50VDC	250 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS40P3*
44-45VDC	4 Amp	$6\frac{15}{16}$ x 9¼ x $6\frac{5}{16}$	23.9	MS454
44-46VDC	500 MA	4 x 4¾ x $5\frac{15}{16}$	6.1	MS45P5*
44-46VDC	1 Amp	5¾ x $7\frac{3}{16}$ x 5¼	11.3	MS451
44-46VDC	2 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	23.7	MS452
50-60VDC	50 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS50P05*
50-60VDC	250 MA	$3\frac{5}{16}$ x $4\frac{3}{16}$ x 5½	4.8	MS50P3*
60-70VDC	100 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS60P1*
70-80VDC	100 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS70P1*
80-90VDC	100 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS80P1*
90-100VDC	100 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS90P1*
100-110VDC	100 MA	3¼ x 3¼ x $4\frac{31}{32}$	3.9	MS100P1*
150-160VDC	100 MA	5 x 5¾ x 6	9.5	MS150P1
200-210VDC	100 MA	5 x 5¾ x 6	9.5	MS200P1
247.5-260VDC	100 MA	5 x 5¾ x 6	9.5	MS250PIR†
250-260VDC	100 MA	5 x 5¾ x 6	9.5	MS250P1
300-310VDC	100 MA	5 x 5¾ x 6	9.5	MS300P1

DUAL OUTPUT

Output Voltage (DC)	Current	Size - W x D x H (Inches)	Model
±12VDC	500 MA	5¾ x $7\frac{3}{16}$ x 5¼	MS12P5-1
±12VDC	1 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	MS121-2
±12VDC	2 Amp	$6\frac{15}{16}$ x 9¼ x $6\frac{5}{16}$	MS122-2
±15VDC	500 MH	5¾ x $7\frac{3}{16}$ x 5¼	MS15P5-1
±15VDC	1 Amp	6 x $8\frac{15}{16}$ x $6\frac{5}{16}$	MS151-2
±15VDC	2 Amp	$6\frac{15}{16}$ x 9¼ x $6\frac{5}{16}$	MS151-2

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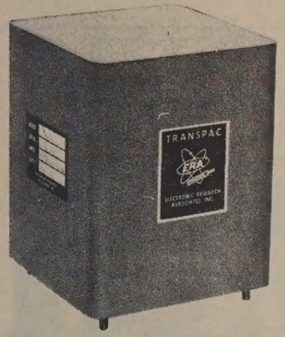
MTT Series

Technipower "PM95" Series Equivalents
FORM • FIT • FUNCTION
DC Modular Power Supplies

MEETS ENVIRONMENTAL REQUIREMENTS FOR "TYPE APPROVAL" OF MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200



DIRECT TECHNIPOWER REPLACEMENTS FOR "PM95" SERIES

ERA Transpac's "MTT" Series of Power Modules are designed to directly replace the Technipower "PM 95" Series...Form, Fit, and Function. The "MTT" Series allows OEM manufacturers a competitive alternate source for OEM or replacement.

Input: 105-125 VAC, 47-440 Hz

Ripple: 2mv RMS or .002%

Output Control Range: ±5%, screwdriver adjustment

Line Regulation: Less than 0.05% + 5mv for full input change

Load Regulation: Less than 0.05% + 5mv for 0-100% load change

Transient Response: Less than 50 microseconds for step line or load change

Remote Sensing: Facilities provided

Operating Temperature: -55°C to +95°C (Max. base Temp.)

Storage Temperature: -62°C to +105°C

Temperature Coefficient: 1mv/°C

Polarity: Ungrounded or +/- Grounded

Short Circuit Protection: Automatic protection with automatic recovery

Overvoltage protection: Optional

SINGLE OUTPUT

OUTPUT VOLTAGE (DC)	CURRENT	SIZE W x D x H INCHES	TECHNIPOWER MODEL	ERA MODEL
5 VDC	750 MA	3-1/16 x 3-9/16 x 4-7/8	PM-5.5-0.750	MTT5P75
5 VDC	1.5 AMP	3-1/16 x 4-5/16 x 5-9/16	PM-5.5-1.5	MTT51P5
5 VDC	3 AMP	4 x 4-11/16 x 6	PM-5.5-3.0	MTT53
5 VDC	6 AMP	4-5/16 x 5-1/16 x 6-13/16	OM-5.5-6.0	MTT56
5 VDC	12 AMP	6-9/16 x 6-3/4 x 7	PM-5.5-12.0	MTT512
6 VDC	750 MA	3-1/16 x 3-9/16 x 4-7/8	PM-6.0-0.750	MTT6P75
6 VDC	1.5 AMP	3-11/16 x 4-5/16 x 5-9/16	PM-6.0-1.5	MTT61P5
6 VDC	3 AMP	4-5/16 x 5-1/16 x 6-13/16	PM-6.0-3.0	MTT63
6 VDC	6 AMP	4-15/16 x 6-9/16 x 7	PM-6.0-6.0	MTT66
6 VDC	12 AMP	6-9/16 x 6-3/4 x 7	PM-6.0-12.0	MTT612
12 VDC	375 MA	3-1/16 x 39/16 x 4-7/8	PM-12.0-0.375	MTT12P37
12 VDC	750 MA	3-3/8 x 3-15/16 x 5-1/4	PM-12.0-0.750	MTT12P75
12 VDC	1.5 AMP	4 x 4-11/16 x 6	PM-12.0-1.5	MTT121P5
12 VDC	3 AMP	4-15/16 x 6-9/16 x 7	PM-12.0-3.0	MTT123
15 VDC	375 MA	3-1/16 x 3-9/16 x 4-7/8	PM-14.5-0.375	MTT15P37
15 VDC	750 MA	3-3/8 x 3-15/16 x 5-1/4	PM-14.5-0.750	MTT15P75
15 VDC	1.5 AMP	4 x 4-11/16 x 6	PM-14.5-1.5	MTT151P5
15 VDC	3 AMP	4-15/16 x 6-9/16 x 7	PM-14.5-3.0	MTT153

DUAL OUTPUT

± 12 VDC	1.5 AMP	4-15/16 x 6-9/16 x 7	—	MTT121P5-2
± 12 VDC	3 AMP	6-9/16 x 6-3/4 x 7	—	MTT123-2
± 15 VDC	1.5 AMP	4-15/16 x 6-9/16 x 7	—	MTT151P5-2
± 15 VDC	3 AMP	6-9/16 x 6-3/4 x 7	—	MTT153-2

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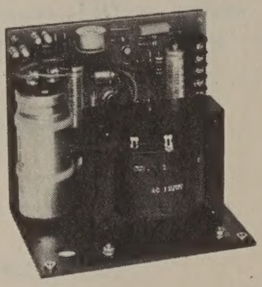
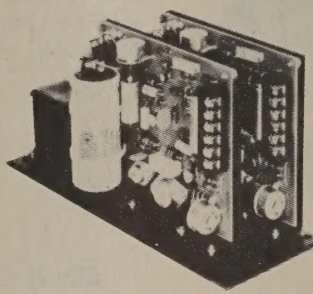
OE Series

"OEM" Open Frame DC Modular Power Supplies

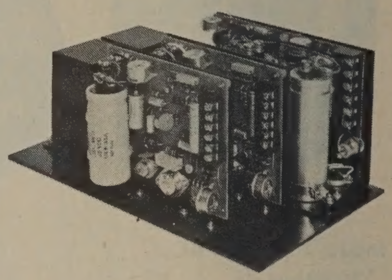
SINGLE OUTPUT



DUAL OUTPUT



TRIPLE OUTPUT



"OE" Series Power Supplies

"OE" series power supplies are highly regulated open frame DC power supplies which come complete with isolating input transformers, OVP protective circuitry and full heat sinking. These low cost units are available in either single or multiple outputs and are ideally suited for all OEM, IC, Op-Amp, Computer, and general applications.

The "OE" series are premium engineered and conservatively designed using top quality components including computer grade capacitors. The power modules are fully repairable and of conservative thermal design.

Input: 105-125 VAC, 47-63 Hz, 380-420 Hz, single phase

Output: Refer to Model Table

Adjustment Range: ±0.5 volt or ±5%, whichever is smaller

Input Regulation: Within 0.05% +5 mv for ±10% input change

Load Regulation: Within 0.05% +5 mv for 0 to 100% load change

Ripple: Less than 1.0 mv RMS

Temperature Range: −20°C to +71°C derated as follows: (Percent of rated load) +40°C/100%, +50°C/75%, +60°C/50%, +71°C/40%

Response Time: Less than 50 μsec for 10-100% load change

Overcurrent Protection: Built-in, fold-back type

Overvoltage Protection: Built-in, full adjustment range

Maximum Case Temperature: 120°C measured at power transistor base

Polarity: Ungrounded or +/− grounded

Line Derating: Input 47-53 Hz, derated by 10%

Logic Inhibit Circuitry: Provided

Remote Sensing: Terminals are provided to maintain regulation at the load

OPTIONS

AC Input: All models are available for 208 VAC input (Suffix "Y," or 230 VAC input Suffix "X")

Dual AC Input: Operation at either 115/230 VAC input can be provided. Use Suffix "Z"

CUSTOM DESIGNS

The unique "building block" characteristics of ERA TRANSPAC DC power supply assemblies provide a practical solution to economic custom designed power supplies. Standard off-the-shelf assemblies are used to provide a variety of single or multiple voltage and current outputs. These are packaged to meet the customers unique form factor and only the transformer and metal work are custom designed. The result is a proven reliable design with the high engineering and fabrication costs eliminated and available within a short delivery cycle.

Forward your specification requirements for our comments and fast quotation on a no obligation basis.

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OE
Series

"OEM" Open Frame DC Modular Power Supplies

SINGLE OUTPUT

Output Voltage	Current (40°C)	Model
5VDC	3 Amp	OE53/5
5VDC	6 Amp	OE56/5
5VDC	12 Amp	OE512/5
5VDC	20 Amp	OE520/5
5VDC	35 Amp	OE535/5
5VDC	65 Amp	OE565/5
5VDC	100 Amp	OE5100/5
12VDC	1.5 Amp	OE53/12
12VDC	3.3 Amp	OE56/12
12VDC	6.5 Amp	OE512/12
12VDC	12.8 Amp	OE520/12
12VDC	18 Amp	OE535/12
12VDC	25 Amp	OE565/12
12VDC	53 Amp	OE5100/12
15VDC	1 Amp	OE53/15
15VDC	2.5 Amp	OE56/15
15VDC	5.3 Amp	OE512/15
15VDC	10.5 Amp	OE520/15
15VDC	14.6 Amp	OE535/15
15VDC	29 Amp	OE565/15
15VDC	44 Amp	OE5100/15
24VDC	900 MA	OE53/24
24VDC	1.8 Amp	OE56/24
24VDC	3.8 Amp	OE512/24
24VDC	7.5 Amp	OE520/24
24VDC	10 Amp	OE535/24
24VDC	19 Amp	OE565/24
24VDC	29 Amp	OE5100/24
28VDC	800 MA	OE53/28
28VDC	1.5 Amp	OE56/28
28VDC	3.3 Amp	OE512/28
28VDC	6.5 Amp	OE520/28
28VDC	11 Amp	OE535/28
28VDC	16 Amp	OE565/28
28VDC	25 Amp	OE5100/28

DUAL OUTPUT

Output Voltage #1	Current #1 (40°)	Output Voltage #2	Current #2(40°C)	Model
12VDC	1 Amp	12VDC	1 Amp	OE56-12T*
15VDC	1 Amp	15VDC	1 Amp	OE56-15T*
12VDC	1.5 Amp	12VDC	1.5 Amp	OE53-12/2
15VDC	1.3 Amp	15VDC	1.3 Amp	OE53-15/2
12VDC	3.2 Amp	12VDC	3.2 Amp	OE56-12/2
15VDC	2.9 Amp	15VDC	2.9 Amp	OE56-15/2

* Voltage tracking within 0.1%

TRIPLE OUTPUT

Output Voltage #1	Current #1 (40°C)	Output Voltage #2	Current #2 (40°C)	Output Voltage #3	Current #3 (40°C)	Model
5VDC	6 Amp	12VDC	1.5 Amp	12VDC	1.5 Amp	OE56-12/3
5VDC	6 Amp	15VDC	1 Amp	15VDC	1 Amp	OE56-15/3
5VDC	12 Amp	12VDC	3.5 Amp	12VDC	3.5 Amp	OE512-12/3
5VDC	12 Amp	15VDC	3 Amp	15VDC	3 Amp	OE512-15/3

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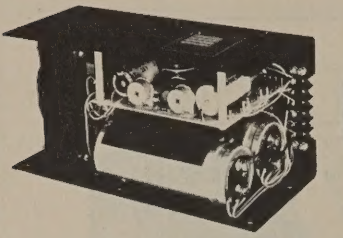
S,D,T, Series

ACDC "OEM" Series Equivalents Form • Fit • Function Open Frame DC Modular Power Supplies



DIRECT ACDC REPLACEMENT FOR "OEM" SERIES

Single, Dual and Triple Output
Open Frame Construction • 0.05% Regulation
Covers Available • Optional Overvoltage Protection

ERA Transpac's "S, D, T" Series of power modules are designed to directly replace the ACDC "OEM" Series...Form, Fit and Function.The "S, D, T" Series allows OEM manufacturers a competitive alternate source for OEM or replacement.

"S" SERIES SINGLE OUTPUT

Output Voltage	Adj. Range ± V	Maximum Current Rating (Amps) 40°C	55°C	71°C	Case Size	ACDC Model Number	ERA Model Number (Add –0 for OVP)
5	.25	3	2.5	1.9	H	OEM5N3.0	S5H3
		5.7	4.8	3.7	A	OEM5N5.7	S5A5P7
		10	8.5	6.5	B	OEM5N10	S5B10
		17	14.5	11.0	C	OEM5N17	S5C17
		25	21.2	16.3	D	OEM5N25	S5D25
		35	29.8	22.8	E	OEM5N35	S5E35
6	.25	2.7	2.3	1.7	H	OEM6N2.7	S6H2P7
		5.2	4.4	3.4	A	OEM6N5.2	S6A5P2
		9.5	8.1	6.2	B	OEM6N9.5	S6B9P5
		15	12.7	9.7	C	OEM6N15	S6C15
		22	18.7	14.3	D	OEM6N22	S6D22
		30.7	26.1	20.0	E	OEM6N30.7	S6E30P7
10	.5	3.5	3.0	2.3	A	OEM10N3.5	S10A3P5
		6.5	5.5	4.2	B	OEM10N6.5	S10B6P5
		10.2	8.6	6.6	C	OEM10N10.2	S10C10P2
		14.9	12.7	9.7	D	OEM10N14.9	S10D14P9
		21.0	17.9	13.6	E	OEM10N21	S10E21
12	.5	1.7	1.4	1.1	H	OEM12N1.7	S12H1P7
		3.2	2.7	2.1	A	OEM12N3.2	S12A3P2
		5.8	4.9	3.8	B	OEM12N5.8	S12B5P8
		9.5	8.1	6.2	C	OEM12N9.5	S12C9P5
		13.0	11.1	8.5	D	OEM12N13	S12D13
		18.5	15.7	12.0	E	OEM12N18.5	S12E18P5
15	.5	1.5	1.3	1.0	H	OEM15N1.5	S15H1P5
		2.7	2.3	1.7	A	OEM15N2.7	S15A2P7
		5.0	4.2	3.2	B	OEM15N5	S15B5
		8.2	7.0	5.3	C	OEM15N8.2	S15C8P2
		11.2	9.5	7.3	D	OEM15N11.2	S15D11P2
		15.8	13.4	10.3	E	OEM15N15.8	S15E15P8
16	.5	2.6	2.2	1.7	A	OEM16N2.6	S16A2P6
		4.7	4.0	3.0	B	OEM16N4.7	S16B4P7
		7.7	6.5	5.0	C	OEM16N7.7	S16C7P7
		10.8	9.2	7.0	D	OEM16N10.8	S16D10P8
		15.0	12.8	9.8	E	OEM16N15	S16E15
20	1	2.1	1.8	1.4	A	OEM20N2.1	S20A2P1
		3.8	3.2	2.5	B	OEM20N3.8	S20B3P8
		6.2	5.3	4.0	C	OEM20N6.2	S20C6P2
		8.7	7.4	5.7	D	OEM20N8.7	S20D8P7
		12.2	10.4	7.9	E	OEM20N12.2	S20E12P2
24	1	1.0	.85	.65	H	OEM24N1.0	S24H1
		1.8	1.5	1.2	A	OEM24N1.8	S24A1P8
		3.3	2.8	2.1	B	OEM24N3.3	S24B3P3
		5.4	4.6	3.5	C	OEM24N5.4	S24C5P4
		7.5	6.4	4.9	D	OEM24N7.5	S24D7P5
		10.6	9.0	6.9	E	OEM24N10.6	S24E10P6
26	1	1.7	1.4	1.1	A	OEM26N1.7	S26A1P7
		3.1	2.6	2.0	B	OEM26N3.1	S26B3P1
		5.0	4.2	3.2	C	OEM26N5.0	S26C5
		7.1	6.1	4.6	D	OEM26N7.1	S26D7P1
		10.0	8.5	6.5	E	OEM26N10.0	S26E10
28	1	1.6	1.4	1.0	A	OEM28N1.6	S28A1P6
		2.9	2.5	1.9	B	OEM28N2.9	S28B2P9
		4.7	4.0	3.1	C	OEM28N4.7	S28C4P7
		6.7	5.7	4.4	D	OEM28N6.7	S28D6P7
		9.3	7.9	6.1	E	OEM28N9.3	S28E9P3

"D" SERIES DUAL OUTPUT

Output Voltage	Adj. Range ± V	Maximum Current Rating (Amps) 40°C	55°C	71°C	Case Size	ACDC Model Number	ERA Model Number (Add –0 for OVP)
± 12	.5	1.5	1.3	1.0	A	OEM12D1.5	D12A1P5
		2.7	2.3	1.8	B	OEM12D2.7	D12B2P7
± 15	.5	1.3	1.1	0.8	A	OEM15D1.3	D15A1P3
		2.4	2.0	1.6	B	OEM15D2.4	D15B2P4

"T" SERIES TRIPLE OUTPUT

Output Voltage	Adj. Range ± V	Maximum Current Rating (Amps) 40°C	55°C	71°C	Case Size	ACDC Model Number	ERA Model Number (Add –0 for OVP)
5 ± 12	0.25 .5	3.0 .75	2.6 .64	2.0 .49	A	TR101	T101
5 ± 15	0.25 .5	3.0 .64	2.6 .54	2.0 .42	A	TR102	T102
5 ± 12	0.25 0.5	5.0 1.0	4.2 0.85	3.2 .65	B	TR201	T201
5 ± 15	0.25 0.5	5.0 0.85	4.2 0.72	3.2 0.55	B	TR202	T202
5 ± 12	0.25 0.5	10.0 1.0	8.4 0.85	6.4 .65	C	TR301	T301
5 ± 15	0.25 0.5	10.0 0.85	8.4 0.72	6.4 .55	C	TR302	T302

DIMENSIONS AND WEIGHTS

	Case Size	Height in. / mm	Width in. / mm	Depth in. / mm	Weight lbs. / Kg
S, D, & T	A	3.19	6.25	4.94	4.5
		81.0	158.8	125.5	2.0
	B	3.19	10.0	4.94	7.5
		81.0	254.0	125.5	3.4
	C	4.94	10.0	4.94	12.0
		125.4	254.0	125.5	5.4
	D	4.94	12.0	6.62	20.0
		125.4	304.8	168.1	9.1
	E	4.94	16.0	7.25	29.0
		125.4	406.4	184.2	13.2
	H	2.75	4.0	4.87	2.25
		69.9	101.6	123.7	1.0

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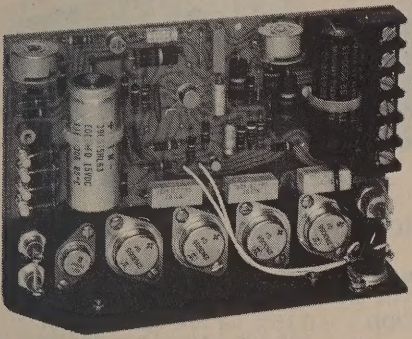
"R" Series

"Build or Buy" DC Regulator Power Supply Assemblies



The "R"-series units are complete regulator assemblies which provide highly regulated DC output when used in conjunction with an external AC input source. The three and six ampere models (R53 and R56 types) require only an input transformer for operation. The higher current types (R512 and R520) require in addition, an input filter capacitance. Refer to "Application Notes" for recommended AC input, heat sinking, and other data.

Input: AC center tapped, ±10% nominal, 47-63 hz, 380-420 hz. Refer to "Application Notes" for specific values.
Output Voltage: Nominal 4.7-30 VDC depending on Model Types. Refer to Model Chart.
Output Current: 1.2-20 amperes depending on model type and heat sinking. Refer to Model Chart and "Application Notes."
Input Regulation: Within 0.05% + 5mV for ±10% input change.
Load Regulation: Within 0.05% + 5mV for 0 to 100% load change.
Ripple: Less than 1.0mV RMS.
Remote Sensing: Provided

Temperature Range: -20°C to +71°C derated as follows: (Percent of rated load) +40°C/100% +50°C/75%, +60°C/50%, +71°C/40%.
Temperature Coefficient: 0.01% + 1mv/per°C.
Response Time: Less than 50 sec for 10-100% load change.
Overcurrent Protection: Built-in, fold-back type.
Overvoltage Protection: Built-in, full adjustment range.
Maximum Case Temperature: 120°C measured at power transistor base.
Polarity: Ungrounded or +/- Grounded.
Weight: See listing under Case Size.
Line Derating: Input 47-53hz, derate by 10%.
Logic Inhibit Circuitry: Provided

COMPLETE WITH:

- ☐ Power Rectifiers
- ☐ Input Filter*
- ☐ IC Regulator
- ☐ Power Transistors
- ☐ Regulator Components
- ☐ Logic Inhibit
- ☐ Adjust Controls
- ☐ Input/Output Terminations
- ☐ Mounting Facilities
- ☐ Over-Voltage Protector
- ☐ Over-Current Protector
- ☐ Thermal Protection†

* Provided on R53 and R56 Models
† Provided on R512 and R520 Models

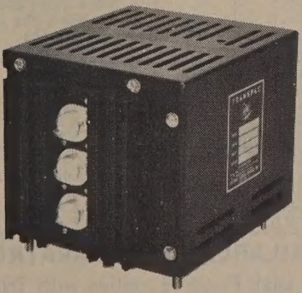
SINGLE OUTPUT

Output Voltage	Current (40°C)	Model
5VDC	3 Amp	R53/5
5VDC	6 Amp	R56/5
5VDC	12 Amp	R512/5
5VDC	20 Amp	R520/5
6VDC	2.75 Amp	R53/6
6VDC	5.5 Amp	R56/6
6VDC	7.5 Amp	R512/6
6VDC	5.5 Amp	R520/6
12VDC	2 Amp	R53/12
12VDC	4 Amp	R56/12
12VDC	8 Amp	R512/12
12VDC	16 Amp	R520/12
15VDC	1.8 Amp	R53/15
15VDC	3.5 Amp	R56/15
15VDC	6.5 Amp	R512/15
15VDC	13 Amp	R520/15
24VDC	1.3 Amp	R53/24
24VDC	2.6 Amp	R56/24
24VDC	6 Amp	R512/24
24VDC	12 Amp	R520/24
28VDC	1.2 Amp	R53/28
28VDC	2.4 Amp	R56/28
28VDC	5 Amp	R512/28
28VDC	10 Amp	R520/28

DUAL VOLTAGE TRACKING MODELS

Output Voltage	Current #1 (40°C)	Output Voltage	Current #2 (40°C)	Model
±12VDC	1 Amp	±12VDC	1 Amp	R56-12T
±15VDC	1 Amp	±15VDC	1 Amp	R56-15T

Solid-State Sinusoidal AC Regulators



Transpac RT modular AC regulators are all solid-state designs for incorporation into equipment or for external and bench use. Utilizes a unique design approach incorporating a modulated AC bridge which is referenced to variations in the output level. This special circuitry permits fast-acting RMS regulation independent of input frequency, and provides sinusoidal output. RT units are highly efficient, require minimum no-load current and operate over a wide range of load power factors.

- Provide highly RMS-regulated sinusoidal output
- Operate over a wide range of AC inputs and frequencies
- Run cool and quiet with no distorted magnetic field interference
- Operate over a wide range of leading or lagging power factors
- Provide a modular AC Regulator for end-equipment or bench use

Power Rating	Size (Inches)	Weight	Model
250 VA	$6\frac{5}{16}$ x $7\frac{1}{4}$ x $4\frac{7}{8}$	13 lbs.	RT250
500 VA	$6\frac{7}{8}$ x $8\frac{7}{8}$ x $7\frac{1}{2}$	28 lbs.	RT500
1000 VA	$7\frac{13}{16}$ x $9\frac{15}{16}$ x $7\frac{5}{8}$	43 lbs.	RT1000

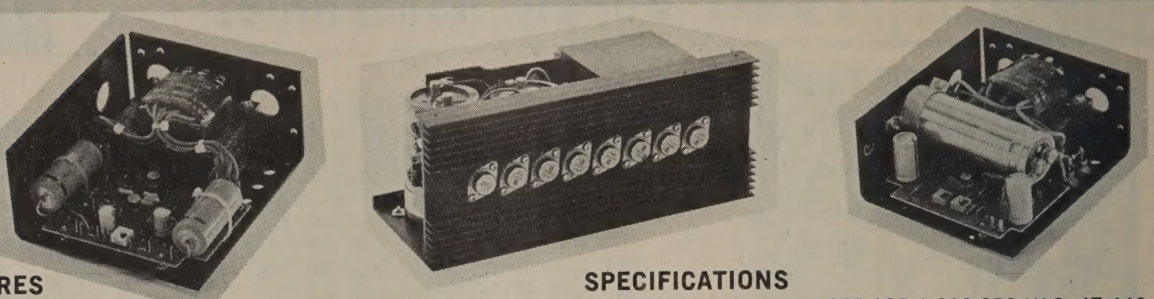
ERA TRANSPAC CORPORATION

A Subsidiary of Electronic Research Associates, Inc.

311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

FARATRON

OPEN FRAME SINGLE OUTPUT POWER SUPPLIES



FEATURES

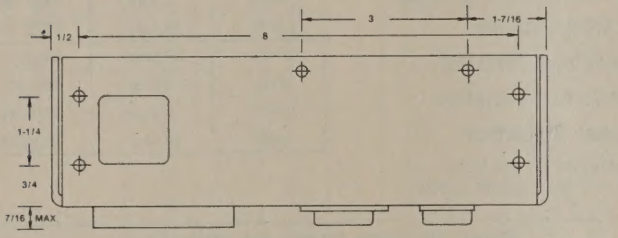
- U.L. recognized
- Open frame construction using heavy gauge anodized aluminum
- 3 surface mounting on B, C and D cases
- 36 different outputs available from five basic case sizes
- 6 different voltages available in each basic case size
- Integrated circuit regulators
- Sockets used in most models for power transistors
- Quick disconnect terminals used on B, C and D models for input/output connection
- Non-breakable barrier strip used for input/output connections on E and F cases

OPTIONS

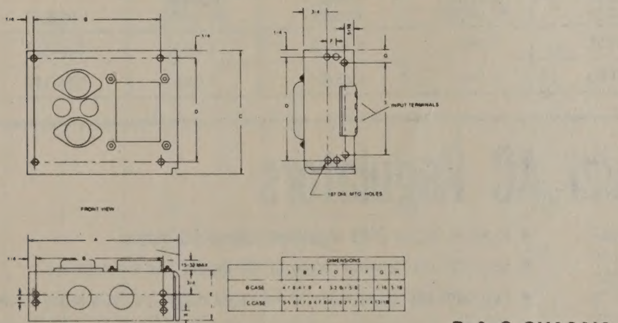
OVERVOLTAGE PROTECTION:

a) FIXED — Factory preset at 120%, ±10% of nominal voltage, add suffix M1

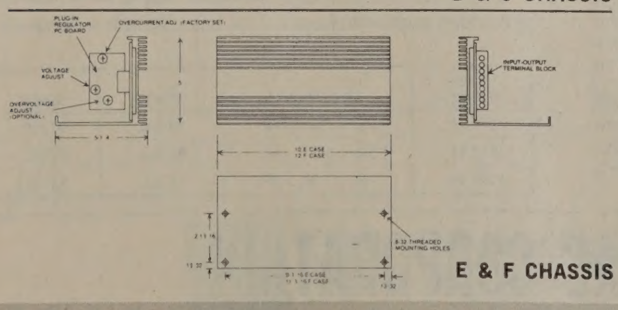
b) VARIABLE — Add suffix M2



D CHASSIS



B & C CHASSIS


PLUG-IN REGULATOR PC BOARD
OVERCURRENT ADJ. (FACTORY SET)
VOLTAGE ADJUST
OVERVOLTAGE ADJUST (OPTIONAL)
INPUT-OUTPUT TERMINAL BLOCK
10 E CASE
12 F CASE
8-32 THREADED MOUNTING HOLES
13/32

E & F CHASSIS

SPECIFICATIONS

AC INPUT	105-125 / 210-250 VAC, 47-440 Hz
OUTPUT RATING	Refer to chart for output rating of individual units
LINE REGULATION	0.15% for line variations of 105-125 VAC or 210-250 VAC
LOAD REGULATION	0.15% for 100% load changes
RIPPLE AND NOISE	1.5 mv RMS, 5 mv pk-pk with either negative or positive terminal grounded
VOLTAGE ADJUSTMENT	±5% minimum
OVERLOAD PROTECTION	Foldback circuit protects circuitry against overload and short circuit conditions. Recovery is instantaneous upon removal of external malfunction. Factory pre-set at 130-140% of 45°C rating.
OPERATING TEMP.	Full load rating at 45°C.
STORAGE TEMP.	−20°C to +85°C
TEMP. COEFFICIENT	±0.02% per degree centigrade
REMOTE SENSING	Remote sensing terminals are provided on all models

Voltage	45°C Current Amps	Model Number	Case	Dimensions
5	3.0	OEM-5B-3	B	4⅞ x 4 x 1⅝
	6.0	OEM-5C-6	C	5⅝ x 4⅞ x 2½
	10.0	OEM-5D-10	D	9 x 4⅞ x 2¾
	12.0	OEM-5D-12	D	9 x 4⅞ x 2¾
	17.0	OEM-5E-17	E	10 x 5 x 5¼
	20.0	OEM-5E-20	E	10 x 5 x 5¼
	25.0	OEM-5F-25	F	12 x 5 x 5¼
	30.0	OEM-5F-30	F	12 x 5 x 5¼
6	2.7	OEM-6B-2.7	B	4⅞ x 4 x 1⅝
	5.4	OEM-6C-5.4	C	5⅝ x 4⅞ x 2½
	9.0	OEM-6D-9.0	D	9 x 4⅞ x 2½
	10.7	OEM-6D-10.7	D	9 x 4⅞ x 2½
	15.1	OEM-6E-15.1	E	10 x 5 x 5¼
	17.8	OEM-6E-17.8	E	10 x 5 x 5¼
	22.2	OEM-6F-22.2	F	12 x 5 x 5¼
	26.7	OEM-6F-26.7	F	12 x 5 x 5¼
12	1.7	OEM-12B-1.7	B	4⅞ x 4 x 1⅝
	3.5	OEM-12C-3.5	C	5⅝ x 4⅞ x 2½
	6.8	OEM-12D-6.8	D	9 x 4⅞ x 2½
	10.5	OEM-12E-10.5	E	10 x 5 x 5¼
	13.5	OEM-12F-13.5	F	12 x 5 x 5¼
15	1.5	OEM-15B-1.5	B	4⅞ x 4 x 1⅝
	3.5	OEM-15C-3.5	C	5⅝ x 4⅞ x 2½
	6.0	OEM-15D-6.0	D	9 x 4⅞ x 2½
	9.0	OEM-15E-9.0	E	10 x 5 x 5¼
	12.0	OEM-15F-12.0	F	12 x 5 x 5¼
24	1.1	OEM-24B-1.1	B	4⅞ x 4 x 1⅝
	2.1	OEM-24C-2.1	C	5⅝ x 4⅞ x 2½
	4.8	OEM-24D-4.8	D	9 x 4⅞ x 2½
	6.6	OEM-24E-6.6	E	10 x 5 x 5¼
	10.5	OEM-24F-10.5	F	12 x 5 x 5¼
28	0.8	OEM-28B-0.8	B	4⅞ x 4 x 1⅝
	1.6	OEM-28C-1.6	C	5⅝ x 4⅞ x 2½
	4.2	OEM-28D-4.2	D	9 x 4⅞ x 2½
	6.0	OEM-28E-6.0	E	10 x 5 x 5¼
	9.5	OEM-28F-9.5	F	12 x 5 x 5¼

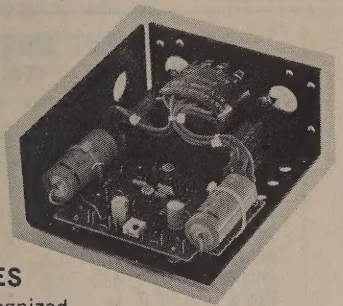
OTHER PRODUCTS AVAILABLE FROM FARATRON

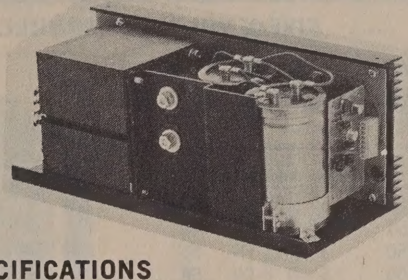
- A complete line of Floppy Disk Power Supplies with Triple or Quadruple outputs.
- Custom Unregulated Supplies.
- Regulated Single & Dual Card Supplies.
- Power Supplies available fully encased.
- Silicon Controlled Rectifier Tester.

FARATRON CORP. • Dept. EM, 280 Green St., South Hackensack, N.J. 07606 • TWX 710-990-5022 • Phone (201) 488-1440

OPEN FRAME DUAL OUTPUT TRACKING POWER SUPPLIES

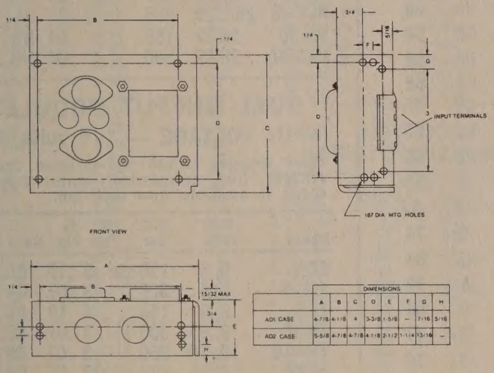
FARATRON





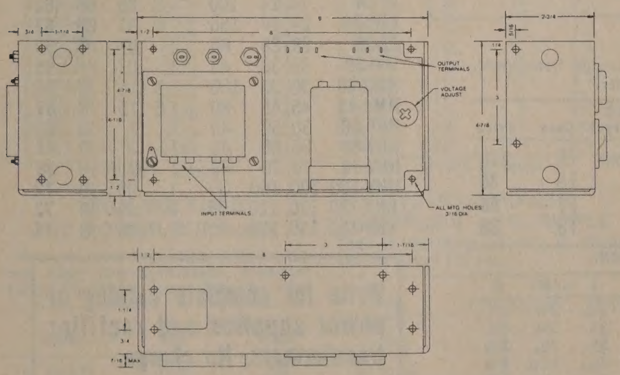
FEATURES

- U.L. recognized
- Open frame construction using heavy gauge anodized aluminum
- 3 surface mounting
- Integrated circuit regulators
- Sockets used in all models for power transistors
- Quick disconnect terminals used for input/output connection
- Wide range adjustment (12 to 15 VDC)
- Tracking
- Full rating at 45°C
- Full rating from 47-440 Hz



	DIMENSIONS							
	A	B	C	D	E	F	G	H
AD1 CASE	4-7/8	4-1/8	4	3-3/8	1-5/8	—	7/16	5/16
AD2 CASE	5-5/8	4-7/8	4-7/8	4-1/8	2-1/2	1-1/4	13/16	—

AD1 & AD2 CHASSIS



AD3 CHASSIS

SPECIFICATIONS

MODELS	OEM-AD1-152, AD2-152, AD3-152
INPUT	105-125 / 210-250 VAC, 47-440 Hz
OUTPUT VOLTAGES	±12 to ±15 VDC (all models)
OUTPUT CURRENT	0.5A for Model OEM-AD1-152 1.0A for Model OEM-AD2-152 3.0A for Model OEM-AD3-152
TRACKING	2% maximum difference between positive and negative outputs. Maximum change of 0.2% for all conditions of line load and temp.
VOLTAGE ADJUSTMENT	Continuously adjustable from 12 VDC to 15 VDC
LINE REGULATION	0.15%
LOAD REGULATION	0.15%
RIPPLE	1.5 mv RMS
TEMP. COEFFICIENT	0.03% per degree centigrade
REMOTE SENSING	Provided on all models.
OVERLOAD PROTECTION	Internal foldback circuit protects unit against sustained shorts and overloads. Recovery is automatic upon removal of external malfunction.
STORAGE TEMP.	−20°C to +85°C
OPERATING TEMP.	Full rating at 45°C.

MODEL: OEM-AD1-152 DIMENSIONS: 4⅞ x 4⅛ x 1⅝

Output Voltage	Output Current Rating — Amps			
	45°C	50°C	60°C	71°C
±12 VDC	0.5	0.44	0.33	0.2
±15 VDC	0.6	0.53	0.40	0.24

MODEL: OEM-AD2-152 DIMENSIONS: 5⅝ x 4⅞ x 2½

Voltage Output	Output Current Rating — Amps			
	45°C	50°C	60°C	71°C
±12 VDC	1.0	0.86	0.66	0.40
±15 VDC	1.2	1.06	0.77	0.48

MODEL: OEM-AD3-152 DIMENSIONS: 9 x 4⅞ x 2¾

Output Voltage	Output Current Rating — Amps			
	45°C	50°C	60°C	71°C
±12 VDC	3.0	2.65	1.96	1.20
±15 VDC	3.6	3.18	2.36	1.44

OTHER PRODUCTS AVAILABLE FROM FARATRON

- A complete line of Floppy Disk Power Supplies with Triple or Quadruple outputs.
- Custom Unregulated Supplies.
- Regulated Single & Dual Card Supplies.
- Power Supplies available fully encased.
- Silicon Controlled Rectifier Tester.

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FERROTRAN
ELECTRONICS CO., INC.

SOLID STATE POWER SUPPLY MODULES

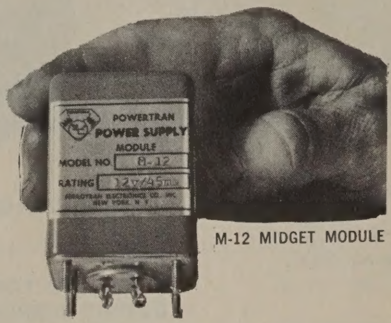
All silicon, long-life semi-conductor, regulated POWERTRAN power supply modules. Guaranteed 3 years.

FIXED VOLTAGE MODULES

INPUT VOLTAGE — 115 volts A.C.

Single output voltage; all-steel MIL-T-27 cases; 4 pin connector; screw type studs for fastening to the chassis; grey paint.

Model	D.C. Volts	D.C. Cur.	% Reg.	% Rip.	Case	Price
SML-5	5	80ma	.5	.10	A	$47
ML-5	5	150	.5	.2	EB	46
E-5	5	250	.3	.01	FB	53
EH-5	5	500	.5	.1	GB	56
EHC-5	5	1a	.5	.2	HA	62
SML-6	6	75	.5	.10	A	47
ML-6	6	125	.5	.1	EB	46
E-6	6	200	.3	.01	FB	53
EH-6	6	450	.3	.1	GB	56
EHC-6	6	900	.5	.2	HA	62
SML-10	10	70	.5	.20	A	47
ML-10	10	100	.5	.1	EB	46
E-10	10	175	.2	.10	FB	54
EH-10	10	350	.2	.3	GB	57
EHC-10	10	600	.5	.2	HA	64
SML-12	12	65	.5	.20	A	47
ML-12	12	100	.5	.2	EB	46
E-12	12	150	.2	.20	FB	54
EH-12	12	325	.2	.1	GB	57
EHC-12	12	550	.5	.2	HA	64
SML-15	15	60	.8	.20	A	47
E-15	15	150	.2	.05	FB	54
EH-15	15	300	.2	.1	GB	57
EHC-15	15	500	.5	.2	HA	64
SMF-20	20	30	1.2	.25	A	44
E-20	20	120	.2	.10	FB	54
EH-20	20	250	.2	.1	GB	57
EHC-20	20	450	.5	.2	HA	64
SML-24	24	50	.8	.30	A	47
E-24	24	120	.2	.10	FB	54
EH-24	24	225	.2	.1	GB	57
SMF-28	28	25	1.2	.3	A	45
E-28	28	120	.2	.1	FB	55
EH-28	28	200	.2	.1	GB	57
SMF-30	30	20	1.5	.3	A	45
E-30	30	100	.3	.01	GB	54
EH-30	30	200	.2	.1	HB	57
SMF-40	40	15	1.5	.2	A	45
M-40	40	40	1.5	.22	EB	46
M-45	45	35	1.5	.2	EB	46
MC-45	45	100	1.5	.1	HB	48



M-12 MIDGET MODULE

Model	D.C. Volts	D.C. Cur.	% Reg.	% Rip.	Case	Price
SMF-50	50	15ma	1.5	.2	A	$46
M-50	50	40	1.5	.2	EB	47
SMF-60	60	10	1.5	.1	A	46
HV-60	60	60	1.5	.15	GA	58
SMF-70	70	10	1.2	.1	A	46
HV-75	75	60	1.3	.1	GA	58
HM-100	100	6	1	.05	GB	54
HV-100	100	60	1.5	.1	GA	64
HV-120	120	55	1.3	.12	HA	68
HM-150	150	5	1	.05	GB	54
HV-150	150	40	1	.1	HA	68
HV-175	175	40	1.2	.12	HA	68
HM-200	200	5	.5	.05	GB	58
HV-200	200	40	1.3	.12	HA	68
HM-250	250	4	1	.05	HB	60
HV-250	250	40	1.5	.05	JB	72
HM-300	300	3	1	.05	HB	62
HV-300	300	35	1.5	.1	JB	74
HM-400	400	2	1	.05	HB	66
HV-400	400	20	1.5	.2	JA	79
HM-500	500	1.8	1	.05	JB	66
HV-500	500	15	1.5	.2	JB	77
HM-750	750	1.2	1	.1	JB	70
HV-750	750	8.5	1.2	.3	JB	95
HM-1000	1000	1	1	.1	JB	74
HV-1000	1000	5	1.3	.3	LB	100

Most units shown are available with 220 volts A.C. input and with P.C. pins.

UNREGULATED MODULES

INPUT VOLTAGE — 115 Volts A.C.

Model	D.C. Volts	D.C. Current	Case	Price
SU-100	100	.2ma	HA	$45
SU-150	150	.1	HA	34
SU-200A	200	.09	HA	45
SU-250	250	.065	HA	45
SU-300	300	.06	HA	45
SU-400	400	.06	HA	46
SU-500	500	.05	LB	56
SU-750	750	.03	LB	66
SU-900	900	.025	LB	66
SU-1000	1000	.02	LB	68
SU-1400	1400	5	LB	68
SU-2000	2000	2	LB	78

Ideal raw D.C. supplies containing transformer, rectifiers and capacitor filter.

Model	D.C. Volts	D.C. Current	Case	Price
NI-4	200	12ma	EB	$38
NI-6	175	35	FB	38
NI-7	180	30	FB	38
NI-8	200	25	FB	38

CASE DIMENSIONS

	L	W	H		L	W	H
EB	1 15/16	1 13/16	2 7/16	HB	3 1/16	2 5/8	3 3/16
FB	2 5/16	2 1/16	2 1/2	JA	3 9/16	3 1/16	4 7/8
GA	2 3/4	2 3/8	3 13/16	JB	3 9/16	3 1/16	3 7/8
GB	2 3/4	2 3/8	2 13/16	LB	4 5/16	3 11/16	4 1/2
HA	3 1/16	2 5/8	4 1/4	A	3	1 3/16	1 1/4

ADJ. OUTPUT MODULES

INPUT VOLTAGE — 115 volts A.C.

Output voltage adjustable thru screwdriver control on stud side of case.

Model	D.C. Volts	D.C. Cur.	% Reg.	% Rip.	Case	Price
MV-5	4.5-5.5	200ma	.7	.1	HB	$58
MCS-5	4.5-5.5	450	.8	.1	HB	64
HCV-5	4.5-5.5	1a	.4	.2	JA	80
MV-6	5.8-7	200	.6	.2	HB	58
MCS-6	5.8-7	450	.8	.3	HB	64
HCV-6	5.5-6.8	1a	.4	.2	JA	80
MV-10	9-12	200	.4	.03	HB	58
MCS-10	9-11	450	.5	.1	HB	64
HCV-10	8.5-11.8	1a	.4	.1	JA	80
MV-12	11-13	200	.2	.025	HB	58
MCS-12	11-13	400	.5	.05	HB	64
HCV-12	11-14.5	1a	.4	.05	JA	80
MV-15	14-16	200	.5	.03	HB	58
MCS-15	14-16	350	.5	.05	HB	64
HCV-15	14-18	800	.4	.1	JA	80
MV-20	19-22	180	.5	.03	HB	58
MCS-20	19-22	350	.5	.05	HB	66
HCV-20	18-22	700	.4	.3	JA	81
MV-24	23-26	180	.5	.04	HB	58
MCS-24	23-26	350	.5	.05	HB	66
HCV-24	23-26	700	.4	.3	JA	81
MV-28	27-29	150	.5	.04	HB	58
MCS-28	27-29	300	.4	.04	HB	68
HCV-28	26.5-29	600	.25	.3	JA	81
MV-30	28-32	150	.5	.04	HB	60
MCS-30	28-32	300	.4	.04	HB	66

DUAL OUTPUT MODULES

INPUT VOLTAGE — 115 volts A.C.

These modules furnish two matched output voltages from independent units. Current shown is available from each tap.

Model	D.C. Volts	D.C. Cur.	% Reg.	% Rip.	Case	Price
EE-5	5, 5	150ma	.5	.10	GB	$62
EEH-5	5, 5	300	.3	.01	GB	67
EE-6	6, 6	150	.4	.10	GB	62
EEH-6	6, 6	300	.3	.01	GB	67
EEH-10	10, 10	250	.3	.01	GB	67
EE-12	12, 12	120	.3	.05	GB	62
EEH-12	12, 12	225	.3	.01	GB	67
MM-15	15, 15	55	1	.006	GB	55
EE-15	15, 15	100	.3	.04	GB	62
EEH-15	15, 15	200	.3	.01	GB	67
HMC-20	20. 20	120	1.2	.04	JB	50
EE-24	24, 24	100	.3	.05	GB	62
EEH-24	24, 24	150	.3	.01	GB	67
EE-28	28, 28	80	1	.01	HB	62
MM-30	30, 30	45	1	.01	HB	55
HMC-30	30, 30	100	1.5	.15	JB	56
HMC-45	45, 45	80	1.5	.15	JB	67
HHV-50	50, 50	40	1	.2	JB	62
HHV-60	60, 60	40	1	.2	JB	67
HHV-70	70, 70	40	1	.2	JB	68
HHV-100	100, 100	30	1	.08	JB	72
HHV-120	120, 120	25	1	.05	JB	72
HHV-150	150, 150	20	1	.05	JB	75

Write for complete catalog of power supplies and rectifier transformers. No charge.

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GATES

A single source for all possible types of "brute force" and regulated power supplies that can fill 90% of your design and application needs. Gates Power Supplies give you absolutely lowest cost and long life. The units are excellently constructed of high rated components for trouble free, years of service.
Silicon or Selenium. Single and three-phase units. 1 to unlimited Volts, 1 to unlimited Amps. Metered and unmetered Static or variable outputs. Rack, cabinet or chassis mounts. Unit or hundred quantities 48 hour delivery. Two year guarantees. Power Supplies for OEM Application, Testing Prototype, Lab Type Units, Plating, Motor Control, Cathode Protection, Transistor Power, Anodizing, Battery Charging, Battery Conversions, Marine Types, Aircraft Starting.

ECONOMY RANGE DC POWER SUPPLIES

Less Than 1% Ripple, Good Regulation, Rack Mount Type, Heavy Duty Construction, Powerstat, Fused 2% Meters, 115 VAC Input.

Model	Output Volts DC	@ Amps
GT 12-5	0-12	5
GT 12-10	0-12	10
GT 12-15	0-12	15
GT 12-25	0-12	25
GT 12-100	0-12	100
GT 14-5	0-14	5
GT 14-15	0-14	15
GT 14-20	0-14	20
GT 14-30	0-14	30
GT 14-40	0-14	40
GT 14-50	0-14	50
GT 14-75	0-14	75
GT 14-100	0-14	100
GT 16-5	0-16	5
GT 16-10	0-16	10
GT 16-25	0-16	25
GT 16-30	0-16	30
GT 16-40	0-16	40
GT 16-50	0-16	50
GT 16-70	0-16	70
GT 16-80	0-16	80
GT 28-5	0-28	5
GT 28-12	0-28	12
GT 28-24	0-28	24
GT 28-50	0-28	50
GT 32-5	0-32	5
GT 32-8	0-32	8
GT 32-12	0-32	12
GT 32-15	0-32	15
GT 32-24	0-32	24
GT 32-30	0-32	30
GT 32-50	0-32	50
GT 32-60	0-32	60
GT 48-5	0-48	5
GT 48-10	0-48	10
GT 48-15	0-48	15
GT 48-25	0-48	25
GT 48-35	0-48	35
GT 48-50	0-48	50
GT 48-60	0-48	60
GT 48-80	0-48	80
GT 48-100	0-48	100
GT 80-5	0-80	5
GT 80-10	0-80	10
GT 80-20	0-80	20
GT 80-50	0-80	50
GT 80-100	0-80	100
GT 115-5	0-115	5
GT 115-10	0-115	10
GT 115-15	0-115	15
GT 115-20	0-115	20
GT 115-25	0-115	25
GT 115-30	0-115	30
GT 115-40	0-115	40
GT 115-50	0-115	50
GT 115-60	0-115	60
GT 115-70	0-115	70
GT 125-5	0-125	5
GT 125-10	0-125	10
GT 125-15	0-125	15
GT 125-20	0-125	20
GT 125-25	0-125	25
GT 125-30	0-125	30
GT 125-40	0-125	40
GT 125-50	0-125	50
GT 125-80	0-125	80
GT 130-2	0-130	2
GT 130-5	0-130	5
GT 130-10	0-130	10
GT 200-10	0-200	10
GT 300-1	0-300	1
GT 300-2	0-300	2
GT 350-1	0-350	1

PRICE — Inquire

HIGH VOLTAGE DC POWER SUPPLIES

1% Ripple, Good Regulation, Cabinets, Meters, Heavy Duty Construction, Powerstat, Fused, 2% Meters, Heavy Duty Line Cord.

Model	Output VDC	Amps
GP 30-200	0-30	200
GP 30-250	0-30	250
GP 30-300	0-30	300
GP 32-5	0-32	5
GP 32-10	0-32	10
GP 32-30	0-32	30
GP 32-40	0-32	40
GP 32-100	0-32	100
GP 32-150	0-32	150

HIGH VOLTAGE DC POWER SUPPLIES (Cont'd)

Model	Output VDC	Amps
GP 48-100	0-48	100
GP 50-50	0-50	50
GP 60-6	0-60	6
GP 60-10	0-60	10
GP 60-12	0-60	12
GP 60-20	0-60	20
GP 60-50	0-60	50
GP 60-80	0-60	80
GP 60-250	0-60	250
GP 125-2.5	0-125	2.5
GT 125-3	0-125	3
GP 125-5	0-125	5
GP 125-3	0-125	3
GP 125-5	0-125	5
GP 125-10	0-125	10
GP 125-20	0-125	20
GP 125-24	0-125	24
GP 125-40	0-125	40
GP 125-60	0-125	60
GP 125-80	0-125	80
GP 125-120	0-125	120
GP 125-125	0-125	125
GP 240-5	0-240	5
GP 240-10	0-240	10
GP 250-5	0-250	5
GP 250-15	0-250	15
GP 250-12	0-250	12
GP 250-20	0-250	20
GP 250-25	0-250	25
GP 250-40	0-250	40
GP 250-50	0-250	50
GP 250-75	0-250	75
GP 300-1	0-300	1
GP 300-2.5	0-300	2.5
GP 300-3	0-300	3
GP 300-5	0-300	5
GP 500-5	0-500	5
GP 500-5	0-500	5
GP 500-10	0-500	10
GP 500-20	0-500	20
GP 500-25	0-500	25
GP 500-30	0-500	30
GP 500-35	0-500	35
GP 1000-1	0-1000	1
GP 1000-½	0-1000	½

LOW-COST BASIC/OEM SUPPLIES

Model	Output Volts DC	Amps	Ripple
L 6.3-30	6.3	30	1%
L 12-12	12	12	1MV/.01%
L 12-15	12	15	1%
L 12-24	12	24	5%
L 12-24	12	24	1%
L 12-50	12	50	5%
L 12-50	12	50	1%
L 24-30	24	30	1%
L 28-1	28	1	1/0.5%
L 28-2	28	5	5%
L 28-5	28	5	1%
L 28-8	28	8	5%
L 28-12	28	12	5%
L 28-24	28	24	N.F.
L 28-24	28	24	5%
L 28-30	28	30	5%
L 28-50	28	50	N.F.
L 28-50	28	50	5%
L 28-50	28	50	1%
L 28-100	28	100	1%
L 115-2.5	115	2.5	5%
L 115-5	115	5	5%
L 115-10	115	10	N.F.
L 115-10	115	10	5%
L 220-5	220	5	5%
L 220-10	220	10	5%
L 440-5	440	5	5%

PRICE — Inquire

12 VOLT POWER SUPPLIES — 1% RIPPLE

Fixed 12 VDC Power Supplies. 1% Ripple. Cabinet Meters $20 extra.

Model	Output Volts DC	@ Amps
GS 12-1	12	1
GS 12-3	12	3
GS 12-3	12	3
GS 12-10	12	10
GS 12-15	12	15
GS 12-20	12	20
GS 12-25	12	25
GS 12-30	12	30
GS 12-40	12	40

Higher voltages also available.

PRICE — Inquire

24 VOLT POWER SUPPLIES — RACK TYPE — 1% RIPPLE

Model	Output Volts DC	@ Amps
G 24-3	24	3
G 24-6R	24	6
G 24-15R	24	15
G 24-20R	24	20
G 24-25R	24	25
G 24-30R	24	30
G 24-50	24	50
G 24-100	24	100
G 24-150	24	150

Also supplied unfiltered and higher voltages.

PRICE — Inquire

NEW

RACK MOUNT, TRANSISTORIZED LINE & LOAD REGULATED POWER SUPPLIES

**Regulation: ±0.1%, Line & Load ±100 mv.
Input: 115 VAC, 60 Hz, single phase.**

Model	Output Volts DC	@ Amps
GQ 15-5	0-15	5
GQ 15-10	0-15	10
GQ 15-24	0-15	25
GQ 15-50	0-15	50
GQ 36-5	0-36	5
GQ 36-10	0-36	10
GQ 36-15	0-36	15
GQ 36-25	0-36	25
GQ 36-50	0-36	50
GQ 60-5	0-60	5
GQ 60-10	0-60	10
GQ 60-15	0-60	15
GQ 60-20	0-60	20
GQ 125-2.5	0-125	2.5
GQ 125-5	0-125	5
GQ 125-10	0-125	10

INDUSTRIAL LINE 1ϕ - CABINET - NO METERS

Model	Output VDC	@ Watts	Input
GK 115-125A	115	125	115
GK 115-125B	115	125	230
GK 115-125C	115	125	440
GK 115-250A	115	250	115
GK 115-250B	115	250	230
GK 115-250C	115	250	440
GK 115-375A	115	375	115
GK 115-375B	115	375	230
GK 115-375C	115	375	440
GK 115-500A	115	500	115
GK 115-500B	115	500	230
GK 115-500C	115	500	440
GK 115-750A	115	750	115
GK 115-750B	115	750	230
GK 115-750C	115	750	440
GK 115-1000A	115	1000	115
GK 115-1000B	115	1000	230
GK 115-1000C	115	1000	440
GK 230-125A	230	125	115
GK 230-125B	230	125	230
GK 230-125C	230	125	440
GK 230-250A	230	250	115
GK 230-250B	230	250	230
GK 230-250C	230	250	440
GK 230-375A	230	375	115
GK 230-375B	230	375	230
GK 230-375C	230	375	440
GK 230-500A	230	500	115
GK 230-500B	230	500	230
GK 230-500C	230	500	440
GK 230-750A	230	750	115
GK 230-750B	230	750	230
GK 230-750C	230	750	440
GK 230-1000A	230	1000	115
GK 230-1000B	230	1000	230
GK 230-1000C	230	1000	440

PRICE — Inquire

1Ø & 3Ø SILICON PLATING SUPPLIES

Volt & Amp. Meters, *Powerstat Control (control starts at zero). Overload Protection. AC Input—110-115-220 VAC 1ϕ, or 220-440-480 VAC 3ϕ. 3ϕ Units 5% Ripple, Cabinet Enclosure. Also available at 28 VDC.

Model	Output VDC	Amps
GI 10-6	6	10
GI 10-6F*	6	10
GI 10-9	9	10
GI 10-9F	9	10
GI 10-12	12	10
GI 10-12F	12	10
GI 25-6	6	25
GI 25-6F	6	25
GI 25-9	9	25
GI 25-9F	9	25
GI 25-12	12	25
GI 25-12F	12	25
GI 25-18	18	25
GI 25-18F	18	25
GI 25-24	24	25
GI 25-24F	24	25
GI 35-6	6	35
GI 35-6F	6	35
GI 35-9	9	35
GI 35-9F	9	35
GI 35-12	12	35
GI 35-12F	12	35
GI 35-18	18	35
GI 35-18F	18	35
GI 35-24	24	35
GI 35-24F	24	35
GI 50-6	6	50
GL 6-50	6	50
GL 8-60	8	50
GL 9-50	9	50
GL 10-50	10	50
GL 12-50	12	50
GL 15-50	15	50
GL 18-50	18	50
GL 6-75	6	75
GL 9-75	9	75
GL 12-75	12	75
GL 18-75	18	75
GL 6-100	6	100
GL 9-100	9	100
GL 12-100	12	100
GL 18-100	18	100
GL 20-100	20	100
GL 30-100	30	100
GL 6-150	6	150
GL 9-150	9	150
GL 12-150	12	150
GL 18-150	18	150
GL 6-200	6	200
GL 9-200	9	200
GL 12-200	12	200
GL 18-200	18	200
GL 20-200	20	200
GL 30-200	30	200
GL 6-250	6	250
GL 9-250	9	250
GL 12-250	12	250
GL 18-250	18	250
GL 20-250	20	250
GL 30-250	30	250
GL 6-300	6	300
GL 9-300	9	300
GL 12-300	12	300
GL 18-300	18	300
GL 20-300	20	300
GL 30-300	30	300
GL 6-400	6	400
GL 6-500	6	500
GL 9-500	9	500
GL 12-500	12	500
GL 18-500	18	500
GL 20-500	20	500
GL 30-500	30	500
GL 6-1000	6	1000
GL 9-1000	9	1000
GL 12-1000	12	1000
GL 18-1000	18	1000
GL 20-1000	20	1000
GL 30-1000	30	1000

PRICES AND COMPLETE CATALOG ON REQUEST

**GATES
ELECTRONICS, CO., INC.**
526 VAN NEST AVE., BRONX, N.Y. 10460
(212) 881-5900, 823-8200

NOBRUSH® FREQUENCY GEORATOR CORPORATION

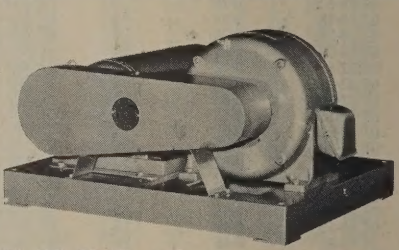
Celebrating our 25th anniversary

PERMANENT MAGNET GENERATOR DESIGN

"NoBrush" Motor Generators and Frequency Converters are efficient, compact, dependable, quiet running units for powering all types of electronic systems and electrical equipment. The heart of each "NoBrush" power system is a "NoBrush" permanent magnet generator which features a cast aluminum rotor designed to give superior voltage stability. • A typical "NoBrush" generator is mounted with a high quality induction or synduction motor within a single aluminum alloy shell. • Oversize pre-lubricated ball bearings sealed for life, coupled with the absence of brushes, commutators or slip rings, insure long-term maintenance-free operation. • Georator brushless permanent magnet generators are noted for their compact construction, ruggedness, ability to withstand short circuits, and excellent wave form. • All Georator power systems whether utilized for frequency conversion or basic power requirements, provide true "line isolation and stabilization" for protecting sensitive electronic systems from momentary power interruptions, switching transients, brown outs, or voltage spikes.

PERMANENT MAGNET FEATURES:

- ☐ *Line Isolation and Stabilization*
- ☐ *Stable Output Voltage*
- ☐ *High Overload Capacity*
- ☐ *Withstands Short Circuits*
- ☐ *Extremely Low R. F. Noise*
- ☐ *Minimum Maintenance*
- ☐ *Lightweight*
- ☐ *Low Audible Noise*
- ☐ *Cool Operation*
- ☐ *Operates in Adverse Environments*



50 TO 60 Hz and 60 TO 50 Hz FREQUENCY CONVERTERS

These ruggedly built, belt driven, motor-generator sets are mounted on a sturdy steel frame base. Units in the 0.5 to 5 KVA power range are designed around the highly efficient NoBrush Permanent Magnet Generator. Units in the 6.25 to 25 KVA power range have brushless rotating rectifier type generators with voltage regulators, to provide ±1% output voltage regulation. These motor-generators provide frequency conversion, basic power, and superior line isolation and stabilization for exported and imported electrical and electronic equipment.

50 to 60 Hz

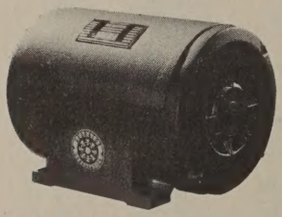
Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-110	2.0	1/1	115/230	420
37-151	2.5	3/1	115/230	420
37-109	5.0	3/3	120/208	465
37-177	6.25	3/1	115/230	750
37-184	12.5	3/1	115-120/230-240	1,050
37-xxx	25.0	3/3	208-240/416-480	1,550

60 to 50 Hz

Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-105	0.5	1/1	115/230	230
37-102	1.5	1/1	115/220	400
37-111	1.5	3/1	115/230	400
37-095	2.5	3/1	115/230	440
37-197	6.25	3/1	115/230	750
37-180	12.5	3/3	220/440	1,000
37-170	12.5	3/1	115-120/230-240	1,100
37-192	25.0	3/1	208-240/230-240	1,580

Universal 50/60 to 60/50 Hz

Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-116	1.5	3/1	115/230	380
37-112	2.5/1.5	3/3-1	115/200 & 115	400

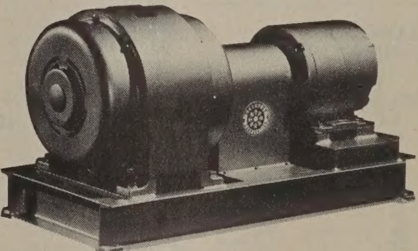


60 TO 60 Hz LINE ISOLATOR SERIES 30 UNIT SHELL

This small isolator stabilizer Motor-Generator offers full line isolation for small power requirements up to 1 KVA. Permanent magnet field generator coupled with the high inertia of the rotating system assures maximum electrical isolation between line and load. The rugged unit shell construction gives long, maintenance-free operation.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
35-118	0.35	1/1	115/230	115/230	14.5"/14.0"/110 lbs.
30-194	0.5	3/1	115/230	230/460	14.8"/16.1"/120 lbs.
30-198	0.5	1/1	115/230	115/230	14.8"/16.1"/120 lbs.
30-195	1.0	3/3	120/208	230/460	14.8"/16.1"/130 lbs.
30-199	1.0	1/3	120/208	115/230	14.8"/16.1"/130 lbs.

These 60 to 60 Hz brushless generators, including those in the next column are designed to accept long term input variation of up to ±15% from nominal with no change in output. Inertia stabilization allows these units to absorb input line transients of as much as 30% for as long as 500 milliseconds with less than 1% change in output.



60 TO 60 Hz ISOLATOR STABILIZER SERIES 37 IN LINE

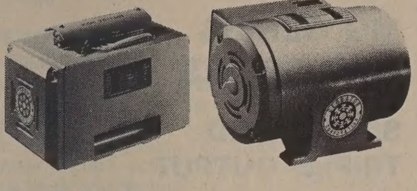
Larger Motor Generators in ratings up to 25 KVA are also available to provide full line isolation and distortion free power to protect electronic equipment from power line excursions and momentary power loss.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
37-015	1.5	3/1	115/230	220/440	18.3"/34"/300 lbs.
37-118	1.5	1/1	115/230	230	18.3"/34"/315 lbs.
37-130	2.5	3/3	120/208	220/440	18.3"/34"/21[illegible] lbs.
37-133	2.5	1/3	120/208	230	18.3"/34"/400 lbs.
37-070	2.5	3/1	115/230	220/440	18.3"/34"/335 lbs.
37-134	2.5	1/1	115/230	230	18.3"/34"/400 lbs.
37-123	5.0	3/3	120/208	220/440	18.3"/38"/410 lbs.
37-AAA	6.25	3/1	120/240	220/440	26.0"/48"/650 lbs.
37-129	12.5	3/1	120/240	230/460	29.0"/62"/910 lbs.
37-135	12.5	3/3	120/208	230/460	29.0"/62"/910 lbs.
37-136	18.75	3/3	120/240	230/460	37.5"/70"/1300 lbs.
37-137	18.75	3/1	120/208	230/460	29.0"/63"/1000 lbs.
37-138	25	3/3	120/240	230/460	37.5"/72"/1550 lbs.
37-139	25	3/1	120/208	230/460	29.0"/65"/1230 lbs.

Series 37 Data Sheets containing detailed specifications are available upon request.

CONVERTERS & GENERATORS

The simplest, most rugged, most dependable power source.



60 TO 400 Hz FREQUENCY CONVERTERS SERIES 30 UNIT SHELL

A highly compact, brushless, Motor Generator Set for conversion of 50 or 60 Hz power to 400 Hz or higher frequencies. Generator and Motor Rotors are pressed on a common shaft, with shielded ball bearing at ends of shaft, all contained within an aluminum alloy shell.

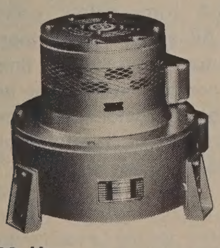
Model No.	KVA Rating	Phase In/Out	Output Voltages Full Load *	Input Voltage **	Dimensions H"/L"/Weight
30-021	0.15	1/1	115/200	115/230	8"/11"/40 lbs.
30-001	0.25	1/1	115	115/230	8"/11"/43 lbs.
30-004	0.25	1/3	115/200	115/230	8"/11"/43 lbs.
30-002	0.5	1/1	115	115/230	8"/11"/51 lbs.
30-005	0.5	1/3	115/200	115/230	8"/11"/51 lbs.
30-016	0.5	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-006	0.75	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-003	1.0	1/1	115	115/230	12¼"/15¼"/118 lbs.
30-025	1.0	1/3	115/200	115/230	12¼"/15¼"/107 lbs.
30-007	2.0	1/3	115/200	115/230	12¼"/15¼"/137 lbs.
30-020	2.0	3/3	115/200	208-220/440	12¼"/15¼"/121 lbs.
30-029	2.5	3/3	115/200	208-220/440	12¼"/15¼"/153 lbs.

☐ Other Generator Outputs Available: 120, 180, 280, 360, and 840 Hz

☐ Other Standard and Non-Standard Voltages.

☐ Exact 400 Hz Output.

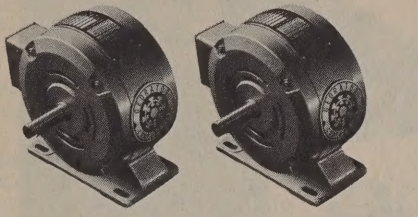
☐ DC Outputs at Low or High Voltage.



60 TO 400 Hz FREQUENCY CONVERTER SERIES 33 VERTICAL

High quality induction motor is close coupled to a famous "NoBrush" generator for a really outstanding unit. Very compact, with high power to weight and size ratio. Available variations include: 50 Hz Input; Standard and Non-Standard AC output voltages; DC outputs at low or high voltage; and other output frequencies.

Model No.	KVA Rating	Phase In/Out	Dimensions Diameter	Height	Weight
33-001	2.5	3/1	20.5"	18.3"	173 lbs.
33-002	3.5	3/1	20.5"	18.3"	178 lbs.
33-003	5.0	3/1	20.5"	18.3"	273 lbs.
33-004	5.0	3/3	20.5"	18.3"	250 lbs.
33-005	7.5	3/3	20.5"	19.5"	259 lbs.
33-006	10.0	3/3	20.5"	19.5"	340 lbs.
33-102	15.0	3/3	24.0"	24.2"	485 lbs.
30-120	25.0	3/3	23.0"	26.5"	1,213 lbs.



ALTERNATORS PERMANENT MAGNET

The original, revolutionary, "NoBrush" generator. Permanent magnets yield stability, reproducibility, ruggedness and virtually zero R.F. noise. Available in large variety of ratings, frequencies and voltages. Supplementary windings with rectifiers available for D.C. output.

400 Hz ALTERNATORS

Model No.	KVA Rating	Phase Out	Speed RPM	Dimensions H"/L"/Weight
36-001	0.25	1	3428	8¼"/4 1/16"/17 lbs.
36-003	0.5	1	3428	8¼"/4 1/16"/22 lbs.
36-030	0.5	3	3428	8¼"/4 1/16"/21½ lbs.
36-006	1.0	1	1714	12 3/16"/4 9/16"/35½ lbs.
36-007	1.0	3	1714	13 3/16"/4 9/16"/35½ lbs.
36-008	2.0	3	1714	13 3/16"/4 9/16"/45 lbs.
36-009	2.5	1	1714	17¼"/6¾"/105 lbs.
36-010	5.0	1	1714	17¼"/6¾"/137 lbs.
36-011	5.0	3	1714	17¼"/6¾"/103½ lbs.
36-012	7.5	3	1714	17¼"/6¾"/120 lbs.
36-013	10.0	3	1714	17¼"/6¾"/135 lbs.
36-151	15.0	3	1714	25"/11.2"/310 lbs.
36-152	25.0	3	1714	25.3"/17"/730 lbs.

☐ Alternator Frequencies Available Include:
50, 60, 120, 180, 240, 300, 360, 420, 840 Hz.

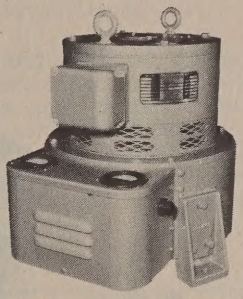
☐ All Units are Available with:
- Standard and Non-Standard AC Voltages.
- Multiple DC Outputs/Low Voltage taps.
- Special Housings for Flange Mountings.

☐ Separate ROTORS and STATORS can be provided for OEM Applications.

☐ Permanent Magnet Alternators for: Pilot Excitors—Field Flashing—Tachometers—Control Applications—Aircraft.

LIGHTWEIGHT 400 Hz ENGINE-GENERATORS

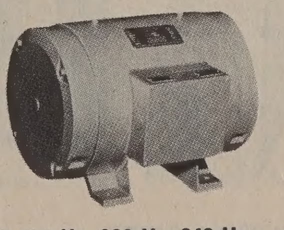
Lightweight portable 400 Hz permanent magnet engine generators are available with 1 φ or 3 φ outputs from 0.5 KVA to 2.0 KVA. Choice of outputs include 400 Hz, or combination of AC and DC output, or entire output rectified to single or dual DC output.



VOLTAGE REGULATED 60 TO 400 Hz FREQUENCY CONVERTERS

This new, Series 39, Regulated, Vertical Frequency Converter combines the "NoBrush" permanent magnet generator together with control windings and simplified sensing electronics, to provide both the traditional "Brushless" rugged design and a closely regulated 400 Hz power system. Voltage regulation is ± 1.5% no load to full load, 0.8 to 1.0 power factor, with a voltage adjustment feature of ± 5%.

Model No.	KVA Rating	Voltage Output	Voltage Regulation	Phase In/Out
39-001	5	120/208	± 1.5%	3/3
39-002	5	115/230	± 1.5%	3/1



60 TO 180 Hz, 360 Hz, 840 Hz FREQUENCY CONVERTERS FOR HIGH FREQUENCY TOOLS, MOTORS, AND LIGHTING

These frequency converters are available for powering high frequency metal-working tools, wood-working tools, motors, and lighting systems. The highly dependable, minimum maintenance, PERMANENT MAGNET BRUSHLESS DESIGNS are available in many ratings up to: 5 KVA for 180 Hz applications; 10 KVA for 360 Hz applications; and 30 KVA for 840 Hz applications.

GEORATOR CORPORATION

Makers of NOBRUSH® power systems

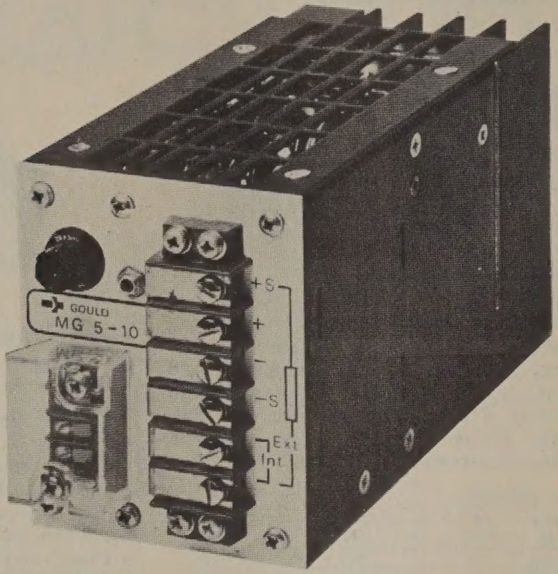
9016 PRINCE WILLIAM STREET MANASSAS, VIRGINIA 22110
TELEPHONE: (703) 368-2101

Celebrating our 25th anniversary

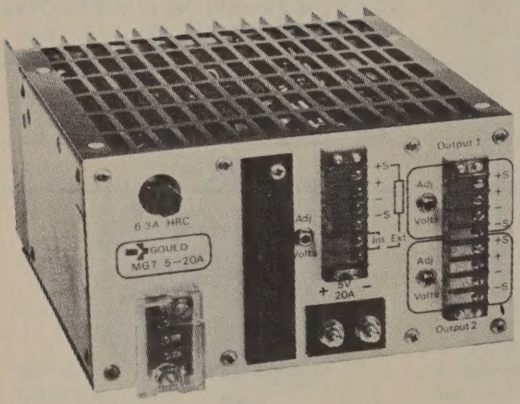
GOULD

Gould Inc., Instrument Systems Div.
Power Supply Dept., 3631 Perkins Ave.
Cleveland, Ohio 44114 (216) 361-3315

SWITCHING POWER SUPPLIES



MG SERIES SINGLE OUTPUT SHOWN IS MG5-10 MODEL



MGT5-20A TRIPLE OUTPUT

SELECTION GUIDE

Model Number	Input	Output		Dimensions, inches			Weight lbs.	Unit List Price
		Volts DC	Amps	X max.	Y max.	Z max.		
SINGLE OUTPUT								
MG5-10	Note 1	5V	10A	2.8	6.5	3.5	2.7	**$250**
MG5-20A	115VAC +10% −20% 45-440Hz Note 3	5V	20A	4.2	6.5	3.5	4.4	**$295**
MG5-40A		5V	40A	6.4	7.0	3.5	7.5	**$360**
MG5-60A		5V	60A	8.5	7.0	3.5	10.0	**$485**
MG12-8A		12V	8A	4.2	6.5	3.5	4.4	**$295**
MG15-8A		15V	8A	4.2	6.5	3.5	4.4	**$295**
MG15-14A		15V	14A	6.4	7.0	3.5	7.5	**$320**
MG24-4A		24V	4A	4.2	6.5	3.5	4.4	**$295**
MG24-8A		24V	8A	6.4	7.0	3.5	7.5	**$320**
TRIPLE OUTPUT								
MGT5-20A	115VAC +10% −20% 45-440Hz Note 3	5V ±15V (±12V Note 2	20A 1.75A 1.75A)	6.4	7.0	3.5	7.5	**$400**

Note 1: Factory set for 115VAC +10 −20% 45-440Hz but can be **field adjusted** for 220VAC.
Note 2: 12 volt option must be specified on original order. Factory set. **Not** field adjustable.
Note 3: 220/240VAC can be supplied on order.

MG SERIES
MGT SERIES

SINGLE AND TRIPLE OUTPUT

- ☐ SMALL
- ☐ LIGHTWEIGHT
- ☐ HIGHLY EFFICIENT
- ☐ LOW COST

MG Series of switching regulator power supplies offer greatly reduced size and considerably higher efficiencies than conventional linear power supplies. In a conventional power supply much of the volume is occupied by the voltage transformer and heatsinks of the series elements. The power supply becomes much smaller and more efficient if these can be eliminated.

In the MG Series this is achieved by rectifying the input voltage directly and replacing the series element by a Pulse Width Modulated inverter circuit. Isolation is maintained by the use of a screened transformer in the inverter stage and efficiency is further improved by the use of high performance diodes as the final rectifying elements.

MGT5-20A triple-output power supply delivers 5V at 20A and either ±15V or ±12V outputs at 1.75A via linear regulators. In common with other units in the MG Range it provides significant advantages of size, weight and efficiency over conventional linear supplies.

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE

−10°C to +70°C ambient — derating on all outputs from 50°C at 2½%/°C.

TEMPERATURE COEFFICIENT

±0.01% per degree Centigrade.

POWER DENSITIES

Units have power densities in excess of 1 Watt/Cu. Inch. The power supply is convection cooled and under normal operating conditions does not require forced air cooling. The unit should be mounted to allow the free passage of air through the unit in a vertical direction.

GOULD

Gould Inc., Instrument Systems Div.
Power Supply Dept., 3631 Perkins Ave.
Cleveland, Ohio 44114 (216) 361-3315

FEATURES

ADJUSTABLE OUTPUT

Front panel potentiometer adjusts output voltage ±5%.

REMOTE SENSING

Available from front panel. Voltage drop in the output leads should not exceed 0.5V total. The remote sensing terminals are situated on the 6-way terminal block on the front panel. To operate the unit under remote sensing conditions remove the links connecting +S to + and −S to −, and connect +S and −S to the point at which the regulated voltage is required.

REMOTE PROGRAMMING (MG Series Only)

Output voltage may be programmed from 1V upwards by insertion of a programming resistor on front panel. Programming resistance 1000 Ω/V. ±0.5%.

REMOTE SWITCH-OFF (MG Series Only)

Output may be reduced to zero by connecting short-circuit between 1 and 6 of program terminal block.

SERIES AND PARALLEL OPERATION

For the **MG** Series there is no limit on paralleled output operation. Series operation is permissible for all units up to a maximum total voltage of 250VDC. **MGT** Series outputs can be connected in series or in parallel with limitations. Consult factory for details.

PERFORMANCE CHARACTERISTICS

OUTPUT VOLTAGE REGULATION

Main output 0.1% maximum for worst case combination of 0-100% load change on all outputs and ±10% line change.

Auxiliary outputs MGT Series 0.01% maximum for worst case combinations of 0-100% load change on all outputs and ±10% line change.

OUTPUT IMPEDANCE

Main output 100m Ω @ 100KHz.

Auxiliary outputs MGT Series 250m Ω @ 100KHz.

RIPPLE

Voltage output 10mV RMS, 50mV P-P max. (30MHz bandwidth).

Auxiliary outputs MGT Series 3mV RMS, 20mV P-P max. (30MHz bandwidth).

SWITCH-ON TIME

Outputs will reach specification within 4 cycles.

TRANSIENT RESPONSE

MG Series

For step load changes of 10-100% or 100-10%, output voltage returns to within the regulation band in approximately 1mS.

MGT Series

Main output For step load changes of 10-100% or 100-10% voltage deviations are typically 400mV and output voltage returns to within the regulation band in band within 2.5 mS.

Auxiliary outputs For step load changes of 10-100% or 100-10%, output will recover to within 10mV of the regulation band within 100 μs.

Interaction For a step current reduction on the main output in excess of 50% of the starting current, e.g. 10A to 5A or 20A to 10A, a negative transient deviation from specification may be experienced on the auxiliary outputs under worst case conditions of output setting, voltage input and output loads.

OVERLOAD PROTECTION

MG Series

Constant current, set at 110% ±5% full load.

MGT Series

Constant current on all three outputs, set to 110% ±5% of full load. Auto-Reset thermostat protects auxiliary outputs against prolonged short circuit but does not affect main voltage output.

OVERVOLTAGE PROTECTION

MG Series

Output shut down if voltage of output exceeds —

6.5V on the 5V units.
15V on the 12V units.
28.8V on the 24V units.

MGT Series

All outputs shut down if voltage of main output exceeds 120% - 130%. No protection for auxiliary outputs.

OUTPUT HOLD-UP

MG and MGT Series

Output maintained for the duration of a missing cycle at maximum output current and −10% when the unit is operating at up to 105% output voltage rating.

MGT Series

Output maintained for the duration of a missing cycle at maximum output current and −10% input when the unit is supplying 5.25VDC @ 20 Amps and 2 X 15.5VDC @ 1.75 Amps.

EFFICIENCY

In excess of 60%. Typically 75% for **MG** Series and 65% for the **MGT** Series.

MECHANICAL SPECIFICATIONS

MOUNTING

Mounting is to tapped holes in frame. Mounting screws, washers, spare fuses, output terminal nuts and terminal block lugs are supplied with each unit.

Units may be mounted from base or one side. If necessary units may be mounted from other side or from above in the inverted position without limitation. Note that lefthand mounting is standard except for **MG5-60** which is righthand mounted.

Mounting holes in your chassis should be drilled to .138 inch

INSULATION

Between AC input and output terminals and case connected together tested to 2.1KV peak for one minute.

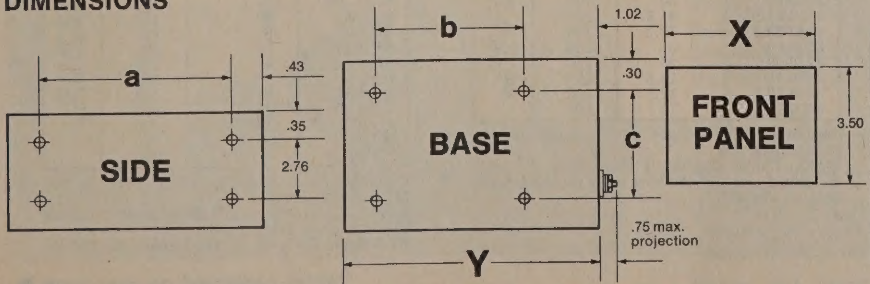
Between DC output and case (and also between any two DC outputs, **MGT** Series) ±250VDC continuous, tested to ±500VDC for one minute.

INPUT/OUTPUT CONNECTIONS

Input connections are to enclosed terminals on front panel. Output connections (main for **MGT** Series) are to large studs on front panel except for **MG5-10** whose connections are on front mounted terminal strip.

Auxiliary outputs for **MGT** Series are from front panel terminal strip.

DIMENSIONS



	Mounting Dimensions					
	X max.	Y max.	a	b	c	Wt. (lbs.)
MG5-10	2.8	6.5	3.94	2.76	2.16	2.7
MG5-20A	4.2	6.5	3.94	2.76	3.54	4.4
MG5-40A	6.4	7.0	4.33	3.15	5.71	7.5
MG5-60A	8.5	7.0	4.33	3.15	7.81	10.0
MG12-8A	4.2	6.5	3.94	2.76	3.54	4.4
MG15-7A	4.2	6.5	3.94	2.76	3.54	4.4
MG15-14A	6.4	7.0	4.33	3.15	5.71	7.5
MG24-4A	4.2	6.5	3.94	2.76	3.54	4.4
MG24-6A	6.4	7.0	4.33	3.15	5.71	7.5
MGT5-20A	6.4	7.0	4.33	3.15	5.71	7.5

HIPOTRONICS

High Voltage DC Power Supplies

Model 8120-8 120kV — 8 mA HV DC Power Supply

Hipotronics offers a full line of unregulated power supplies with output voltages ranging from 1 to 1,000 kV and current outputs from 1.3 mA to 50 A.

Conservatively designed for continuous use, every model is supplied with a fully instrumented control console. The type of transformer insulation varies according to the voltage requirements. All units below 30 kV are air insulated while oil insulation is provided for higher voltages.

A complete overload system with surge devices protects the control circuitry against repeated short circuits at full output and ensures safe, trouble free operation.

Design Features

- Reversible polarity
- Output-connected, triple-range voltage meter
- Triple-range current meter in return leg of HV circuit
- Adjustable overload relay, 10% to 110% rated current, with reset button
- Rated current available from zero to rated voltage
- Meter recalibration potentiometers

Customized Capability

Hipotronics has designed and custom-manufactured a wide variety of power supplies for a wide variety of uses. Customized power supplies include application-oriented units for: Electrostatics, accelerators, lasers, high power radar, high voltage component testing, and many more.

Personnel Safety Features

- Output shorting solenoid and/or bleeder resistor
- Series-limiting resistor in output circuit
- External interlock provision and pilot light
- Zero start interlock and pilot light

Equipment Safety Features

- Surge protection for meters and relays
- Backup circuit breaker in primary of HV transformer
- Input circuit breakers and pilot light

Specifications

1 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)
801-1000	1000	1
802-500	500	2
803-330	330	3
804-250	250	4
805-200	200	5
806-165	165	6
807.5-130	130	7.5
810-100	100	10
815-65	65	15
820-50	50	20
825-40	40	25
830-33	33	30
840-25	25	40
850-20	20	50
860-16	16	60
875-13	13	75
890-11	11	90
8100-10	10	100
8120-8	8	120
8150-6.5	6.5	150
8200-5	5	200

Input: 115 volts, 50/60 Hz, 1 phase, 12 amps.
Regulation: 15% no load to full load.
Ripple: 2% rms.
HV Output: 20-foot shielded cable (bushing available on request).

1.5 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)
801-1500	1500	1
802-750	750	2
803-500	500	3
804-375	375	4
805-300	300	5
806-250	250	6
807.5-200	200	7.5
810-150	150	10
815-100	100	15
820-75	75	20
825-60	60	25
830-50	50	30
840-37.5	37.5	40
850-30	30	50
860-25	25	60
875-20	20	75
890-17	17	90
8100-15	15	100
8120-12.5	12.5	120
8150-10	10	150
8200-7.5	7.5	200
8250-6.0	6	250
8300-5.0	5	300

Input: 115 volts, 50/60 Hz, 1 phase, 20 amps.
Regulation: 15% no load to full load.
Ripple: 2% rms.
HV Output: 20-foot shielded cable (bushing available on request).

2.5 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)
801-2500	2500	1
802-1250	1250	2
803-830	830	3
804-625	625	4
805-500	500	5
806-425	425	6
807.5-300	300	7.5
810-250	250	10
815-160	160	15
820-125	125	20
825-100	100	25
830-80	80	30
840-60	60	40
850-50	50	50
860-40	40	60
875-33	33	75
890-27	27	90
8100-25	25	100
8120-20	20	120
8150-16	16	150
8200-12.5	12.5	200
8250-10	10	250
8300-8	8	300
8400-6	6	400
8500-5	5	500

Input: 115 volts, 50/60 Hz, 1 phase, 30 amps.
Regulation: 15% no load.
Ripple: 2% rms.
HV Output: 20-foot shielded cable (bushing available on request).

5 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)	Input
801-5000	5000	1	208/220 v, 3 phase, 50/60 Hz, 20 amps
802-2500	2500	2	
803-1666	1666	3	
804-1250	1250	4	
805-1000	1000	5	
806-840	840	6	
807.5-670	670	7.5	
810-500	500	10	
815-335	335	15	
820-250	250	20	
825-200	200	25	
830-166	166	30	208/220 v, single phase, 50/60 Hz, 35 amps
840-125	125	40	
850-100	100	50	
860-84	84	60	
875-67	67	75	
890-56	56	90	
8100-50	50	100	
8120-41.5	41.5	120	
8150-33.3	33.3	150	
8200-25	25	200	
8250-20	20	250	
8300-16.6	16.6	300	
8400-12.5	12.5	400	
8500-10.0	10	500	

Regulation: 10% 3 phase, 15% 1 phase, no load to full load.
Ripple: 1% or 5% rms, 3 phase units; 2% rms.
HV Output: 20-foot shielded cable (bushing available on request).

10 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)	Input
801-10A	10 amp	1	208/220 v, 3 phase, 50/60 Hz, 40 amps
802-5A	5 amp	2	
803-3.3A	3.3 amp	3	
804-2.5A	2.5 amp	4	
805-2A	2 amp	5	
806-1.65A	1.65 amp	6	
807.5-1.3A	1.3 amp	7.5	
810-1A	1 amp	10	
815-650	650	15	
820-500	500	20	
825-400	400	25	
830-330	330	30	
840-250	250	40	440/480 v, single phase, 50/60 Hz, 35 amps
850-200	200	50	
860-160	160	60	
875-130	130	75	
890-110	110	90	
8100-100	100	100	
8120-80	80	120	
8150-65	65	150	
8200-50	50	200	
8250-40	40	250	
8300-33	33	300	
8400-25	25	400	
8500-20	20	500	
8600-16	16	600	
8750-13	13	750	
81000-10	10	1000	

Regulation: 10% 3 phase, 18% 1 phase, no load to full load.
Ripple: 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
HV Output: Cable to 60 kV; Toroid over 600 kV.

Tables continued on next page ➤

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15 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)	Input
801-15A	15 amp	1	440/480 v, 3 phase, 25 amps
802-7.5A	7.5 amp	2	
803-5A	5 amp	3	
804-3.75A	3.75 amp	4	
805-3A	3 amp	5	
806-2.5A	2.5 amp	6	
807.5-2A	2 amp	7.5	
810-1.5A	1.5 amp	10	
815-1A	1 amp	15	
820-750	750	20	
825-600	600	25	
830-500	500	30	
840-375	375	40	
850-300	300	50	
860-250	250	60	
875-200	200	75	440/480 v, 1 phase, 50/60 Hz, 45 amps
890-170	170	90	
8100-150	150	100	
8120-125	125	120	
8150-100	100	150	
8200-75	75	200	
8250-60	60	250	
8300-50	50	300	
8400-37.5	37.5	400	
8500-30	30	500	
8600-25	25	600	
8750-20	20	750	
81000-15	15	1000	

Regulation: 10% 3 phase, 18% 1 phase, no load to full load.
Ripple: 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
HV Output: Cable to 600 kV; Toroid over 600 kV.

25 KILOWATT OUTPUT UNITS

Model No.	Current (mA)	Voltage (kV)	Input
801-25A	25 amp	1	440/480 v, 3 phase, 50/60 Hz, 45 amps
802-12.5A	12.5 amp	2	
803-8.8A	8.8 amp	3	
804-6.2A	6.2 amp	4	
805-5A	5 amp	5	
806-4.2A	4.2 amp	6	
807.5-3.3A	3.3 amp	7.5	
810-2.5A	2.5 amp	10	
815-1.7A	1.7 amp	15	
820-1.25A	1.25 amp	20	
825-1A	1 amp	25	
830-830	830	30	
840-620	620	40	
850-500	500	50	
860-420	420	60	
875-335	335	75	
890-280	280	90	
8100-250	250	100	1 phase, 80 amps
8120-200	200	120	
8150-170	170	150	
8200-125	125	200	
8250-100	100	250	
8300-85	85	300	
8400-62	62	400	
8500-50	50	500	
8600-42	42	600	
8750-33	33	750	
81000-25	25	1000	

Regulation: 10% 3 phase, 18% 1 phase, no load to full load.
Ripple: 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
HV Output: Cable to 600 kV; Toroid over 600 kV.

50 KILOWATT OUTPUT UNITS

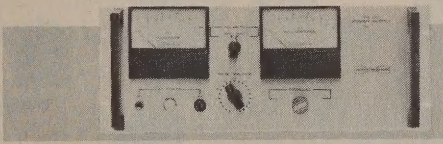
Model No.	Current (mA)	Voltage (kV)	Input
801-50A	50 amp	1	440/480 v, 3 phase, 50/60 Hz, 90 amps
802-25A	25 amp	2	
803-16.6A	16.6 amp	3	
804-12.5A	12.5 amp	4	
805-10A	10 amp	5	
806-8.4A	8.4 amp	6	
807.5-6.7A	6.7 amp	7.5	
810-5A	5 amp	10	
815-3.3A	3.3 amp	15	
820-2.5A	2.5 amp	20	
825-2A	2 amp	25	
830-1.7A	1.7 amp	30	
840-1.25A	1.25 amp	40	
850-1A	1 amp	50	
860-830	830	60	
875-670	670	75	
890-560	560	90	
8100-500	500	100	
8120-420	420	120	1 phase, 160 amps
8150-335	335	150	
8200-250	250	200	
8250-200	200	250	
8300-166	166	300	
8400-125	125	400	
8500-100	100	500	
8600-83	83	600	
8750-67	67	750	
81000-50	50	1000	

Regulation: 10% 3 phase, 18% 1 phase, no load to full load.
Ripple: 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
HV Output: Cable to 600 kV; Toroid over 600 kV.

Metered Power Packs

The R Series consists of eight metered DC high voltage power packs with output voltages from 2.5 to 60 kV and a current rating of 5 mA on all models except the R60 A which has a 2.5 mA rating.

These compact, highly miniaturized units are designed for long life and trouble free operation. All units are housed in hermetically sealed cans, and are filled with mineral type transformer oil or epoxy. The conservative design precludes component failure caused by long term corona degradation of the insulation and guarantees a pure DC output free of interfering high frequency signals which might possibly influence or affect the system which it is powering.



MODEL R20B,
20 kV-5 mA
HV SUPPLY

Specifications

Input: 0-125 volts, output voltages and currents (stated for nominal 117 volt input)

Regulation: 10 to 15% no load to full load

Ripple: 0.5% rms per milliampere output

Model No.	Output (kV)	Current (mA)	(% rms/mA) Ripple	Polarity	kV Meter (kV)	Current Meter (mA)	Size WxHxD (in.)
R2B	0-2.5	5	.5	Reversible	0-3	0-5	19x7x8
R5B	0-5	5	.5	Reversible	0-6	0-5	19x7x8
R10B	0-10	5	.5	Reversible	0-12	0-5	19x7x8
R15B	0-15	5	.5	Reversible	0-15	0-5	19x7x8
R20B	0-20	5	.5	Reversible	0-25	0-5	19x7x8
R30B	0-30	5	.5	Reversible	0-30	0-5	19x12x10
R50B	0-50	5	.5	Reversible	0-50	0-5	19x12x10
R60B	0-60	2.5	.5	Reversible	0-60	0-2.5	19x12x10

Optional Extras

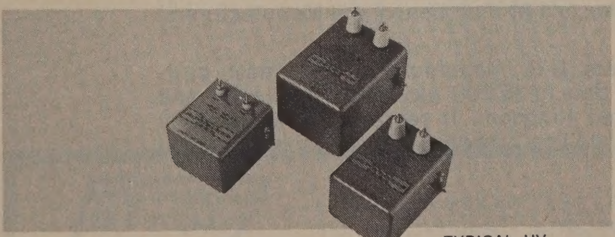
1. Bench top cabinet
2. Short circuit limiter — ideal for capacitor charging, flocking, electrostatic operations, etc. Supply will short circuit on output and limit current to 5 mA

Standard HV Power Packs

A wide range of durable, lightweight power packs are available with outputs from 2.5 to 60 kV and current ratings from 2 to 10 mA. Solid state rectifiers ensure compactness and good regulation on every unit.

The output connections are high voltage ceramic bushings on Models 30 kV and below, and plug-in receptacles for coaxial cables on higher voltage units.

Every component in the supply is operated below its design rating and pre-assembly hipot tested at 1½ times its operating voltage.



TYPICAL HV
POWER PACKS

Specifications

Model No.	Output (kV)	Current (mA)	Size HxWxD (in.)
2.5B	2.5	5	3 9/16x3¾x2¾
2.5C	2.5	10	4⅜x3⅞x3 5/16
5B	5	5	4⅜x3⅞x3 5/16
7.5C	7.5	10	5 5/16x3 15/16x3⅜
10B	10	5	5 5/16x3 15/16x3⅜
10C	10	10	6⅛x4⅝x4
15B	15	5	6x4⅝x4
15C	15	10	8x6x5
20B	20	5	6 1/16x4⅝x4
25C	25	10	10x6x5
30B	30	5	8x6x5
40A	40	2	10x6x5
50B	50	5	10 1/16x8x6
60A	60	2.5	10 1/16x8x6

Input: 0-125 volts, output voltages and currents (stated for nominal 117 volt input)
Regulation: 10 to 15% no load to full load
Ripple: 0.5% rms per milliampere output

HIPOTRONICS®

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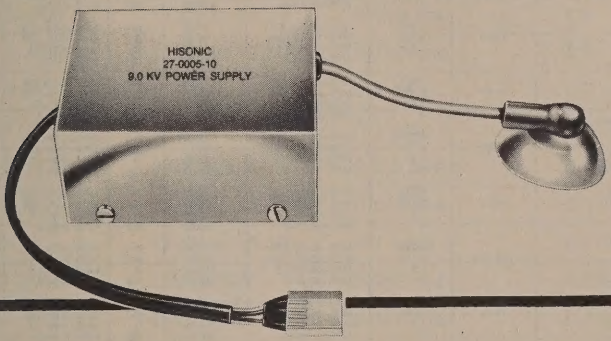
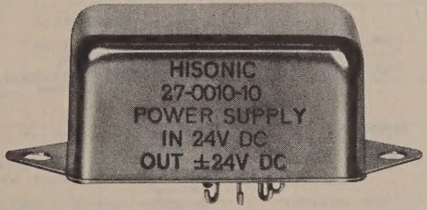


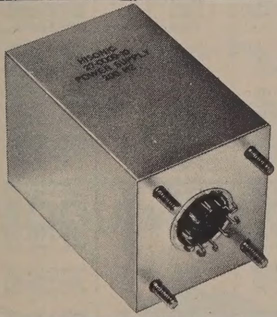
HIGH VOLTAGE DC TO DC POWER SUPPLY

DC Input: 23 V @ 240 ma
Outputs: 9 KV DC @ 60 ua
400 V DC @ 4 ma
12 V RMS (13 KHZ) @ 75 ma
Special characteristics: designed for operation @ 35,000 ft.
Physical size:
3.7" x 2.81" x 1.75" metal cased

LOW VOLTAGE DUAL OUTPUT DC TO DC POWER SUPPLY

DC Input: 24 V @ 350 ma
Outputs: +24 V @ 125 ma
−24 V @ 125 ma
Special characteristics: hermetically sealed.
Physical size: 2.125" x 1.25" x .875" metal cased





MULTI-OUTPUT DC TO AC POWER SUPPLY

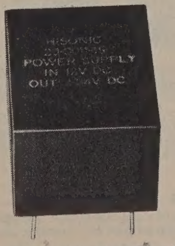
DC Input: 28 V @ 2.5 a
Outputs: 30 V peak @ 270 ma
30 V peak @ 630 ma
30 V peak @ 1 ma w/ct
3.8 V peak @ 320 ma
Special characteristics: all outputs are 200 HZ square wave — hermetically sealed
Physical size: 3.125" x 2.312" x 2.06" metal cased
Output voltage(s) may be revised as long as the total power remains the same.

STANDARD EPOXY INCAPSULATED DC TO DC POWER SUPPLIES

DC Input 12 V @ 150 ma

Part No's	Output
27-0011-11	±6 V DC @ 100 ma
-12	±10 V DC @ 60 ma
-13	±12 V DC @ 50 ma
-14	±18 V DC @ 32 ma
-15	±24 V DC @ 25 ma

Physical size: 1.65" x 1.3" x 1"



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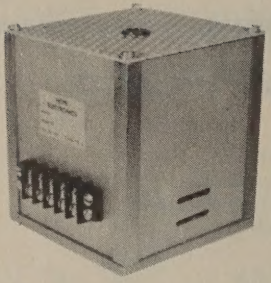

MODEL MPS-.05-

Input	115V AC 10% 50 to 400 cps
Output	See specific model listing
Regulation	LINE .05% or 3 mv (whichever is greater) for 10% line change LOAD .05% or 3 mv (whichever is greater) for 0 to full load
Ripple	Less than .002% or 1 mv peak to peak (whichever is greater)
Overload Protection	Solid state short circuit and overload protected, instantaneous recover and automatic reset
Output Adjustment	See specific model listing. Wider ranges available as specials
Remote Sensing	Standard
Polarity	May be either positive or negative. Output floating (up to 300 volts)
Temperature Coefficient	Less than .015% °C or lmv/°C whichever is greater
Operating Temperature	20′C to 71° (maximum base temperature)

MODEL MPS-.5-

Input	115V AC 10% 50 to 400 cps
Output	See specific model listing
Regulation	LINE .5% for 10% line change LOAD .5% for 0 to full load
Ripple	Less than .01% or 2 mv peak to peak (whichever is greater)
Overload Protection	Solid state short circuit and overload protected, instantaneous recover and automatic reset
Output Adjustment	See specific model listing. Wider ranges available as specials
Remote Sensing	Available as option
Polarity	May be either positive, or negative. Output floating (up to 300 volts)
Temperature Coefficient	Less than .05%′C or 5mv/°C whichever is greater
Operating Temperature	20°C to 71°C (maximum base temperature)

COOLING

Some of these models may require additional cooling in the form of external heat sinks. Either of the following methods is acceptable, provided the power supply's mounting plate surface temperature is held below 80°C.

1. Bolted to chassis of equivalent thermal conductivity of a piece of aluminum ⅛" thick, 12" wide and 16" long. Thermal compound similar to Wakefield, Type 120 thermal joint compound should be used between power supply base plate and chassis.
2. Using Hope Electronics' heat sink (see list) bolted to power supply mounting plate, this model power supply may be operated up to 55°C ambient temperature without additional cooling. Thermal compound similar to Wakefield, Type 120 thermal joint compound should be used between power supply base plate and heat sink.
3. A blower may be used for cooling provided there is sufficient air flow to maintain the power supply mounting plate surface temperature below 80°C.

FEATURES

SILICON TRANSISTORS are used exclusively to insure continuous duty at full ratings.

SHORT CIRCUIT PROTECTION. The output may be short circuited without damage. A current limiting circuit reduces the output voltage when the full load rating is exceeded. The power supply automatically restores itself to normal operation after the short or overload is removed.

OVERTEMPERATURE PROTECTION. To prevent damage to supply, a thermal cutout shuts off AC power if a mounting base plate temperature of 100°C is exceeded. The cutout may be manually reset after unit cools.

OPTIONAL FEATURES

A. Various types of input and output connectors are available. Contact factory for price on type of connector you require.
B. 230V input
C. Overvoltage protection
D. Dual output models
E. External voltage adjustment
F. Wider temperature range models
G. Wider output adjustment 50%
H. Rack mounting

OUTPUT VOLTAGE ADJUST RANGE	OUTPUT CURRENT (AMPS)	.05% REGULATION		CASE SIZE	.5% REGULATION		CASE SIZE
		MODEL No.	PRICE		MODEL No.	PRICE	
4-6	0.750	MPS-.05-5-.750	$ 75.00	A-1	MPS-.5-5-.750	$ 65.00	A
	1.5	MPS-.05-5-1.5	95.00	A-2	MPS-.5-5-1.5	85.00	A-1
	3	MPS-.05-5-3	125.00	B	MPS-.5-5-3	115.00	B
	6	MPS-.05-5-6	160.00	DD	MPS-.5-5-6	150.00	DD
5-7	0.750	MPS-.05-6-.750	75.00	A-1	MPS-.5-6-.750	65.00	A
	1.5	MPS-.05-6-1.5	95.00	A-2	MPS-.5-6-1.5	85.00	A-1
	3	MPS-.05-6-3	125.00	B	MPS-.5-6-3	115.00	B
	6	MPS-.05-6-6	160.00	DD	MPS-.5-6-6	150.00	DD
7-9	0.750	MPS-.05-8-.750	75.00	A-1	MPS-.5-8-.750	60.00	A
	1.5	MPS-.05-8-1.5	95.00	A-2	MPS-.5-8-1.5	85.00	A-1
	3	MPS-.05-8-3	125.00	B	MPS-.5-8-3	115.00	B
	6	MPS-.05-8-6	160.00	DD	MPS-.5-8-6	150.00	DD
8-12	0.375	MPS-.05-10-.375	70.00	A-1	MPS-.5-10-.375	60.00	A
	0.750	MPS-.05-10-.750	85.00	A-2	MPS-.5-10-.750	75.00	A-1
	1.5	MPS-.05-10-1.5	95.00	B	MPS-.5-10-1.5	85.00	B
	3	MPS-.05-10-3	125.00	DD	MPS-.5-10-3	115.00	DD
10-14	0.375	MPS-.05-12-.375	75.00	A-1	MPS-.5-12-.375	65.00	A
	0.750	MPS-.05-12-.750	90.00	A-2	MPS-.5-12-.750	80.00	A-1
	1.5	MPS-.05-12-1.5	115.00	B	MPS-.5-12-1.5	100.00	B
	3	MPS-.05-12-3	145.00	DD	MPS-.5-12-3	135.00	DD
13-17	0.375	MPS-.05-15-.375	75.00	A-1	MPS-.5-15-.375	65.00	A
	0.750	MPS-.05-15-.750	90.00	A-2	MPS-.5-15-.750	80.00	A-1
	1.5	MPS-.05-15-1.5	115.00	B	MPS-.5-15-1.5	100.00	B
	3	MPS-.05-15-3	150.00	DD	MPS-.5-15-3	150.00	DD
16-20	0.375	MPS-.05-18-.375	75.00	A-1	MPS-.5-18-.375	65.00	A
	0.750	MPS-.05-18-.750	90.00	A-2	MPS-.5-18-.750	80.00	A-1
	1.5	MPS-.05-18-1.5	115.00	B	MPS-.5-18-1.5	100.00	B
	3	MPS-.05-18-3	150.00	DD	MPS-.5-18-3	130.00	DD
18-22	0.375	MPS-.05-20-.375	75.00	A-1	MPS-.5-20-.375	65.00	A
	0.750	MPS-.05-20-.750	90.00	A-2	MPS-.5-20-.750	80.00	A-1
	1.5	MPS-.05-20-1.5	115.00	B	MPS-.5-20-1.5	100.00	B
	3	MPS-.05-20-3	150.00	DD	MPS-.5-20-3	130.00	DD
21-27	0.375	MPS-.05-24-.375	75.00	A-1	MPS-.5-24-.375	65.00	A
	0.750	MPS-.05-24-.750	90.00	A-2	MPS-.5-24-.750	80.00	A-1
	1.5	MPS-.05-24-1.5	115.00	B	MPS-.5-24-1.5	100.00	B
	3	MPS-.05-24-3	150.00	DD	MPS-.5-24-3	130.00	DD
25-31	0.375	MPS-.05-28-.375	75.00	A-1	MPS-.5-28-.375	65.00	A
	0.750	MPS-.05-28-.750	90.00	A-2	MPS-.5-28-.750	80.00	A-1
	1.5	MPS-.05-28-1.5	115.00	B	MPS-.5-28-1.5	100.00	B
	3	MPS-.05-28-3	150.00	DD	MPS-.5-28-3	130.00	DD
30-36	0.200	MPS-.05-33-.200	75.00	A-1	MPS-.5-33-.200	65.00	A
	0.375	MPS-.05-33-.375	85.00	A-2	MPS-.5-33-.375	75.00	A-1
	0.750	MPS-.05-33-.750	105.00	B	MPS-.5-33-.750	95.00	B
	1.5	MPS-.05-33-1.5	135.00	DD	MPS-.5-33-1.5	125.00	DD
35-43	0.200	MPS-.05-39-.200	75.00	A-1	MPS-.5-39-.200	65.00	A
	0.375	MPS-.05-39-.375	90.00	A-2	MPS-.5-39-.375	80.00	A-1
	0.750	MPS-.05-39-.750	105.00	B	MPS-.5-39-.750	95.00	B
	1.5	MPS-.05-39-1.5	140.00	DD	MPS-.5-39-1.5	125.00	DD
40-48	0.200	MPS-.05-44-.200	80.00	A-1	MPS-.5-44-.200	70.00	A
	0.375	MPS-.05-44-.375	95.00	A-2	MPS-.5-44-.375	85.00	A-1
	0.750	MPS-.05-44-.750	110.00	B	MPS-.5.44-.750	100.00	B
	1.5	MPS-.05-44-1.5	150.00	DD	MPS-.5-44-1.5	140.00	DD
45-55	0.200	MPS-.05-50-.200	95.00	A-1	MPS-.5-50-.200	85.00	A
	0.375	MPS-.05-50-.375	105.00	A-2	MPS-.5-50-.375	95.00	A-1
	0.750	MPS-.05-50-.750	120.00	B	MPS-.5-50-.750	110.00	B
	1.5	MPS-.05-50-1.5	150.00	DD	MPS-.5-50-1.5	140.00	DD
54-66	0.150	MPS-.05-60-.150	95.00	A-1	MPS-.5-60-.150	85.00	A
	0.375	MPS-.05-60-.375	105.00	A-2	MPS-.5-60-.375	95.00	A-1
	0.750	MPS-.05-60-.750	120.00	B	MPS-.5-60-.750	110.00	B
	1.5	MPS-.05-60-1.5	180.00	DD	MPS-.5-60-1.5	155.00	DD
65-75	0.150	MPS-.05-70-.150	105.00	A-2	MPS-.5-70-.150	95.00	A-1
	0.375	MPS-.05-70-.375	115.00	B	MPS-.5-70-.375	105.00	B
	0.750	MPS.-05-70-.750	135.00	C	MPS-.5-70-.750	125.00	C
75-85	0.150	MPS-.05-80-.150	105.00	A-2	MPS-.5-80-.150	95.00	A-1
	0.375	MPS-.05-80-.375	115.00	B	MPS-.5-80-.375	105.00	B
	0.750	MPS-.05-80-.750	135.00	C	MPS-.5-80-.750	125.00	C
85-95	0.150	MPS-.05-90-.150	115.00	A-2	MPS-.5-90-.150	105.00	A-1
	0.375	MPS-.05-90-.375	125.00	B	MPS-.5-90-.375	115.00	B
	0.750	MPS-.05-90-.750	155.00	C	MPS-.5-90-.750	145.00	C
95-105	0.150	MPS-.05-100-.150	115.00	A-2	MPS-.5-100-.150	105.00	A-1
	0.375	MPS-.05-100-.375	125.00	B	MPS-.5-100-.375	115.00	B
	0.750	MPS-.05-100-.750	155.00	C	MPS-.5-100-.750	145.00	C
105-115	0.150	MPS-.05-110-.150	120.00	B	MPS-.5-110-.150	110.00	B
	0.375	MPS-.05-110-.375	165.00	C	MPS-.5-110-.375	150.00	C
	0.750	MPS-.05-110-.750	230.00	D	MPS-.5-110-.750	215.00	D
115-125	0.150	MPS-.05-120-.150	140.00	B	MPS-.5-120-.150	125.00	B
	0.375	MPS-.05-120-.375	175.00	C	MPS-.5-120-.375	160.00	C
	0.750	MPS-.50-120-.750	230.00	D	MPS-.5-120-.750	•215.00	D
125-135	0.150	MPS-.05-130-.150	140.00	B	MPS-.5-130-.150	125.00	B
	0.375	MPS-.05-130-.375	175.00	C	MPS-.5-130-.375	160.00	C
	0.750	MPS-.05-130-.750	230.00	D	MPS-.5-130-.750	215.00	D
135-145	0.150	MPS.-05-140-.150	140.00	B	MPS-.5-140-.150	125.00	B
	0.375	MPS-.05-140-.375	180.00	C	MPS-.5-140-.375	165.00	C
	0.750	MPS-.05-140-.750	260.00	D	MPS-.5-140-.750	245.00	D
145-155	0.150	MPS-.05-150-.150	140.00	B	MPS-.5-150-.150	125.00	B
	0.375	MPS-.05-150-.375	185.00	C	MPS-.5-150-.375	170.00	C
	0.750	MPS-.05-150-.750	260.00	D	MPS-.5-150-.750	245.00	D

CASE SIZE	LENGTH	HEIGHT	WIDTH
A	4	4-1/16	4
A-1	4	4-9/16	4
A-2	4	5	4
B	5	5	4
C	6	5	4
D	7	5	4
DD	7	5	5

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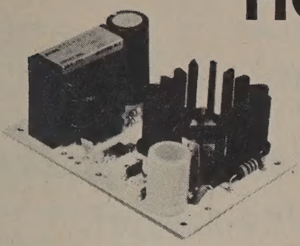
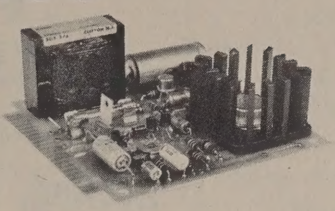


HOPE ELECTRONICS

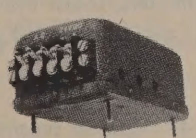
POWER SUPPLIES



LOW COST PLUG-IN

Model	Output Voltage	Output Current	Regulation	Ripple & Noise	Dimensions W L H	Price 1-24
EP5-.750	4.5V to 5.5V	0-750 ma	1%	<10 mv	4½x3x1⅞	$24.50
EP5-1/5	4.5V to 5.5V	0-1.5 amps	1%	<10 mv	4½x4½x1¾	$31.50
EP5-2.5	4.5V to 5.5V	0-2.5 amps	1%	<10 mv	4½x6½x2½	$37.50
EP5-4	4.5V to 5.5V	0-4 amps	1%	<10 mv	4½x6½x3	$45.50
EP15-.400	11.5V to 15.5V	0-400 ma	1%	<10 mv	4½x3x1⅞	$24.50
EP15-.700	11.5V to 15.5V	0-700 ma	1%	<10 mv	4½x4½x1¾	$31.50
EP15-1	11.5V to 15.5V	0-1 amp	1%	<10 mv	4½x6½x2½	$37.50
IP5-1/.1	4.5V to 5.5V	0-1 amp	0.1%	<1 mv	4½x4½x2¼	$33.00
IP5-2.5/.1	4.5V to 5.5V	0-2.5 amps	0.1%	<1 mv	4½x6½x2½	$45.00
IP15-.5/.1	11.5V to 15.5V	0-500 ma	0.1%	<1 mv	4½x4½x2¼	$33.00
IP15-1/.1	11.5V to 15.5V	0-1 amp	0.1%	<1 mv	4½x6½x2½	$45.00
IP30-.2/.1	15V to 30V	0-200 ma	0.1%	<2 mv	4½x4½x2¼	$35.00
IP50-.1/.1	25V to 55V	0-100 ma	0.1%	<50 mv	4½x4½x2¼	$45.00
IP100-.05/.1	50V to 105V	0-50 ma	0.1%	<100 mv	4½x4½x2¼	$45.00
IP200-.025/.1	100 to 210V	0-25 ma	0.1%	<200 mv	4½x4½x2¼	$45.00
DUAL OUTPUT						
EP12-.200/D	±11 to 13	0-200 ma	1%	<10 mv	4½x4½x1⅞	$45.00
EP15-.200/D	±14 to 16	0-200 ma	1%	<10 mv	4½x4½x1⅞	$45.00
DUAL OUTPUT TRACKING						
IP12-.200/DT	±11V to 13V	0-200 ma	0.1%	<2 mv	4½x6½x2¼	$59.00
IP15-.200/DT	±11V to 16V	0-200 ma	0.1%	<2 mv	4½x6½x2¼	$59.00
IP15-.025/DT	15V	0-25 ma	0.1%	<2 mv	4½x3x1⅞	$29.00
IP12-.400/DT	±11V to 13V	0-400 ma	0.1%	<2 mv	4½x7½x2½	$85.00
IP15-.400/DT	±14V to 16V	0-400 ma	0.1%	<2 mv	4½x7½x2½	$85.00

MODULAR SUPPLIES



Model	Output Voltage	Output Current	Regu-lation	Ripple & Noise	Price 1-24
MPS-SAE-5	5V	750 ma	.5%	<10 mv	$35.00
MPS-SAE-12	12V	400 ma	.5%	<10 mv	$35.00
MPS-SAE-15	15V	250 ma	.5%	<10 mv	$35.00
MPS-SAE-24	24V	250 ma	.5%	<10 mv	$35.00
MPS-SAE-28	28V	250 ma	.5%	<10 mv	$35.00

LAB SUPPLIES

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Model	Output Voltage	Output Current	Regu-lation	Ripple & Noise	Price 1-24
PS30-1EM	0-30V	0-1 amp	.05%	<500 v	$128.00
PS30-.3EM	0-30V	0-300 ma	.01%	<500 v	$125.00
PS15-2EM	0-15V	0-2 amps	.05%	<500 v	$128.00
PS50-.5EM	0-50V	0-300 ma	.1%	<1 mv	$138.00
PS100-.2EM	0-100V	0-200 ma	.1%	<2 mv	$155.00

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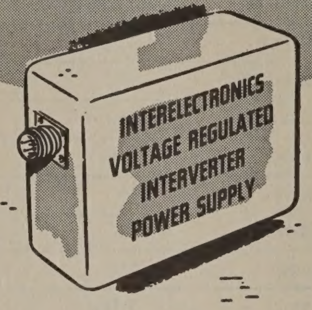
DC-DC, DC-AC, SOLID-STATE POWER INVERTERS

over 260,000 logged hours— voltage-regulated, frequency-controlled, for missile, telemeter, ground-support, 135°C all-silicon units available now—



Interelectronics all-silicon thyratron-like gating elements and cubic-grain toroidal magnetic components convert DC to any desired number of AC or DC outputs from 1 to 10,000 watts.

Ultra-reliable in operation (over 260,000 logged hours), no moving parts, unharmed by shorting output or reversing input polarity. High conversion efficiency (to 92%, including voltage regulation by Interelectronics patented reflex high-efficiency magnetic amplifier circuitry).

Wide input voltage range (1 to 250 volts DC). Wide input voltage regulation (output voltage maintained with variations up to 50% in input voltage).

Light weight (to 6 watts/oz.), compact (to 8 watts/cu. in.), low ripple (to 0.01 mv. p-p), excellent voltage regulation (to 0.1%), precise frequency control (to 0.2%) with Interelectronics extreme environment magnetostrictive standards or to 0.0001% with fork or piezoelectric standards.

Complies with MIL specs. for shock (100G 11 misc.), acceleration (100G 15 min.), vibration (100G 5 to 5,000 cps.), temperature (to 150 degrees C), RF noise (I-26600).

AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver up to ten times rated line current into a short circuit to actuate MIL type magnetic circuit breakers or fuses, will start gyros and motors with starting current surges up to ten times normal operating line current.

Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equipment. Single and polyphase units now power airborne and marine missile gyros, synchros, servos, magnetic amplifiers.

Interelectronics—first and most experienced in the solid-state power supply field produces its own all-silicon solid-state gating elements, all high flux density magnetic components, high temperature ultra-reliable film capacitors and components, has complete facilities and know how—has designed and delivered more working KVA than any other firm!

For complete engineering data, write Interelectronics today, or call (914) EL 8-8000 in Congers.

INTERELECTRONICS CORPORATION
550 U.S. Route 303, Congers, New York 10920

INTEGRATED
CIRCUITS
INCORPORATED

13256 NORTHRUP WAY
BELLEVUE, WASHINGTON 98005
TELEPHONE: (206) 747-8556

DC-DC CONVERTERS

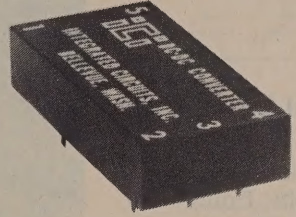
ENGINEERING AND DESIGN CAPABILITY

ICI's converters offer a unique combination of high power, high efficiency and low cost. Thick film micro-circuit processes permit the highest level of reliability and the smallest package size.

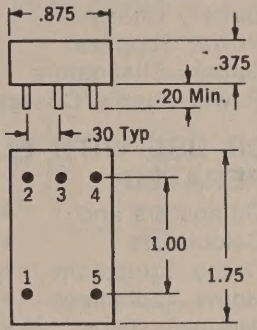
These versatile devices will operate over their full temperature range at their rated output power without the need of heat sinks or external components. Reflected line transients are reduced by a nonsaturating switching circuit which operates at a nominal frequency of 150 KHz ICI power converters feature:

- Input/Output Isolation: 100 MegΩ minimum at 500 VDC
- Package size of less than 0.6 cubic inches
- High efficiency of up to 83% of rated load
- Single and dual polarity outputs

Standard models are described below. Special versions are available in any single or dual output configuration from 5 to 50 VDC and in lower or higher output power.



OUTLINE DIMENSIONS



STANDARD CONVERTER MODELS AVAILABLE

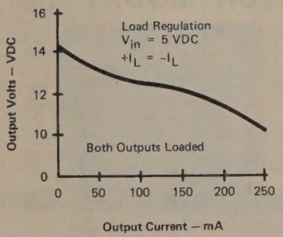
MODEL NUMBER	INPUT VOLTAGE NOMINAL	INPUT VOLTAGE MAXIMUM	NOMINAL OUTPUT	OUTPUT POWER
DC-512	5 VDC	6.5 VDC	±12 VDC @ 180 mA	4.5W @ 85°C
DC-515	5 VDC	6.5 VDC	±15 VDC @ 150 mA	4.5W @ 85°C
DC-512LP	5 VDC	6.5 VDC	±12 VDC @ 50 mA	2.0W @ 85°C
DC-515LP	5 VDC	6.5 VDC	±15 VDC @ 75 mA	2.5W @ 85°C
DC-1205	12 VDV	15 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-1212	12 VDC	15 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-1215	12 VDC	15 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-1218	12 VDC	15 VDC	±18 VDC @ 170 mA	6.0W @ 85°C
DC-2805	28 VDC	32 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-2812	28 VDC	32 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-2815	28 VDC	32 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-2818	28 VDC	32 VDC	±18 VDC @ 170 mA	6.0W @ 85°C
DC-4805	48 VDC	56 VDC	+ 5 VDC @ 1.25 A	6.0W @ 70°C
DC-4812	48 VDC	56 VDC	±12 VDC @ 250 mA	6.0W @ 85°C
DC-4815	48 VDC	56 VDC	±15 VDC @ 200 mA	6.0W @ 85°C
DC-4818	48 VDC	56 VDC	±18 VDC @ 170 mA	6.0W @ 85°C

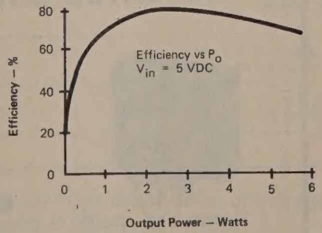
DATA SHEETS AVAILABLE FOR INDIVIDUAL MODELS

TYPICAL PERFORMANCE DATA

MODEL DC — 515
OUTPUT VOLTAGE ±15 VOLTS DC

TYPICAL PERFORMANCE DATA





ELECTRICAL CHARACTERISTICS

Parameters	Conditions	Min	Typ	Max	Units
Output Voltage $\pm V_O$	$+I_L = -I_L = 150mA$	14.2	15.0	15.8	VDC
Output Current $\pm I_L$	T = −20° to 85°C	0	150	200	mA
Output Balance $(+I_L = -I_L)$	T = −20° to 85°C	—	0.1	0.3	VDC
Load Regulation (I_L = 50 to 150 mA)	T = −20° to 85°C	—	1.5	—	VDC
Output Ripple	f > 100 kHz	—	0.5	0.8	V_{pp}
Output Power	T = −20° to 85°C	—	—	4.5	Watts
Input Voltage	T = −20° to 85°C	4.0	5.0	6.5	VDC
Input No Load Current	T = −20° to 85°C	—	125	175	mA
Efficiency	P_O = 4.0 Watts	73	79	—	%
Output Voltage T.C.	T = −20° to 85°C I_L = 150 mA	—	.02	—	%/°C
Line Ripple Current		—	—	150	mA RMS
Converter Frequency		—	150	—	KHz
Isolation Input/Output	500 VDC	100	—	—	MegΩ
Operating Temperature		-20	—	85	°C
Storage Temperature		-65	—	+150	°C
Line Regulation	Output varies in proportion to input				

T = 25°C unless specified otherwise.

SEE PAGE 2982 FOR FURTHER INFORMATION

JEROME INDUSTRIES

DEPT. EM, 391 LAKESIDE AVE.
ORANGE, N.J. 07050 • (201) 678-9595

POWER PLUG-IN ADAPTERS

- Transformers
- Battery Chargers
- Power Supplies
- Battery Eliminators
- Power Supply/Chargers.

FOR USE WITH ELECTRICALLY OPERATED:

- Computers and
- Calculators
- Office Equipment
- Home Appliances
- Alarm Systems
- Instruments
- Photographic Equipment
- Games and Toys
- Medical Appliances
- Gardening Appliances

The Jerome plug-in power units are primarily isolation step down transformers (fig. 1) making the products they operate safer to use.

Power supplies, battery chargers, battery eliminators, and combinations of these, include the isolation transformers plus rectifying and voltage regulating circuits (fig. 2 and 3).

Although many standard units are available, electrically most are engineered and designed to meet the specific requirements of the products they are to energize. Accessories can also be designed for special applications.

By using these plug-in units the designer has more flexibility and can simplify, enhance the appearance, and improve the portability of his product by not having to include a power supply in the product enclosure.

Other advantages:

- Power supply heat not included in product
- Easier maintenance of power source
- Reduction or elimination of the costly need to submit equipment for U.L. and CSA investigation.

MODELS PI-B, PI-D AND PI-E

These units come in attractive stylized molded cases to make them suitable accessories for any consumer, commercial or industrial product.

MECHANICAL FEATURES

- Model PI-B — cord set output (terminal plugs to specification)
- Model PI-D — screw terminal output
- Model PI-E (Same as PI-B except smaller case)
- Molded case — dual tapered surfaces for positive push-pull grip
- Case can be molded in a variety of colors and materials
- Hot leafed stamped logos or design enhance the case appearance.
- Designed for U.L. and C.S.A. listing

ELECTRICAL FEATURES

- Units available to supply voltage output up to 30 volts and currents up to 5 amperes.
- Isolated — low voltage operation of product.

GENERAL FOR ALL ADAPTERS

AVAILABLE AS:

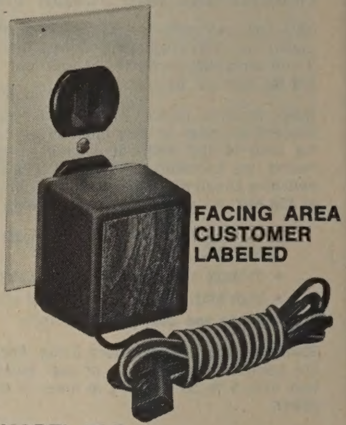
- Transformers
- Power supplies
- Battery chargers for Ni-Cad, Lead Acid, Manganese-Alkaline and other batteries
- Battery eliminators

OTHER AVAILABLE FEATURES

- On and Off switch
- Pilot light
- Regulated output
- Fast Charge Circuits
- Cut off circuits
- And others to customer requirements.
- 240/120 switchable input

JEROME INDUSTRIES CORP.
ORANGE, NEW JERSEY

MODEL PI-D



MODEL PI-B

MODEL PI-E (SMALLER CASE)

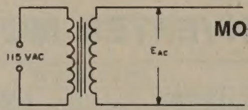


Fig. 1

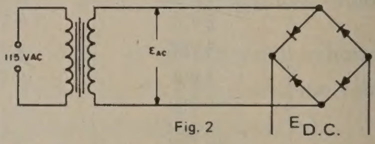


Fig. 2

TYPICAL OF
MANY CIRCUITS
AVAILABLE

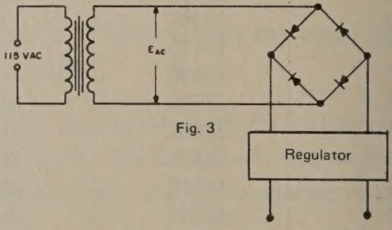
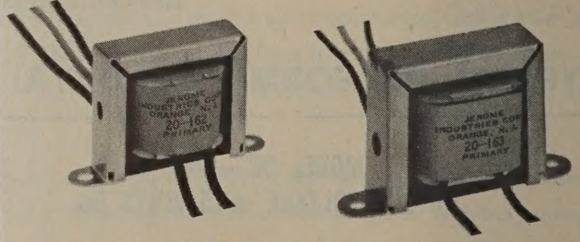


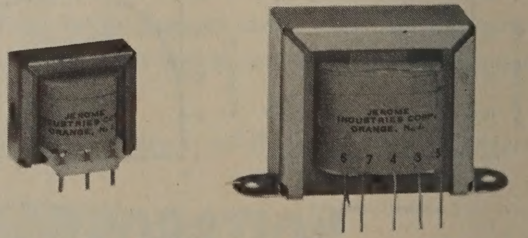
Fig. 3

Regulator D.C.

TRANSFORMERS — CHASSIS MOUNT


JEROME INDUSTRIES CORP. ORANGE, N.J. 20-162 PRIMARY
JEROME INDUSTRIES CORP. ORANGE, N.J. 20-163 PRIMARY

TRANSFORMER — PRINTED CIRCUIT MOUNT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JEROME INDUSTRIES CORP. ORANGE, N.J.
5 7 4 3 5

Designed for Minimum Size and Weight, Single and Multiple Input and Output.

K.G.S.
electronics, inc.

kgs electronics

2029 North Lincoln Avenue • Pasadena, California 91103 • Telephone (213) 798-0786

REGULATED DC TO DC POWER CONVERTERS

KGS ELECTRONICS manufactures a line of pulse width modulated converters that provide regulated DC voltage up to 10 amperes.

The converter transforms an unregulated DC input to a regulated fixed or adjustable DC output.

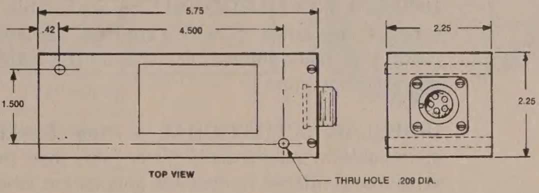
The Model LT Series are primarily designed to control the light intensity of incandescent bulbs in aircraft instrument lighting.

FEATURES

- State of art design for regulation and positive logic for output overvoltage and overload protection.
- All models are serviceable, small and lightweight (67 watts per pound and 3.4 watts per cubic inches typical for the Model LT-100).
- Operates over −55°C to +71°C case temperature.

MODEL LT-52A EXTERNAL CONNECTORS

Pin No.	Description	Remarks
A	+28 VDC Input	20 to 40 VDC
B	Common Ground	Input/Output Return
C	+5 VDC Output	Adjustable: 0 to 5 VDC
D	Remote Control	5K Ohm Rheostat to Gnd.
E	Spare	



BASE PLATE AVAILABLE (See Product File 31)

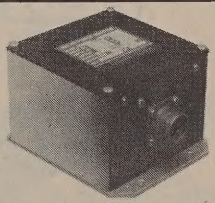
MOUNTING DETAIL

MODELS AVAILABLE

Model Specification	LT-52A	LT-70	LT-100	LT-53	LS-120	RB-125
Power, VA	50	70	100	50	120	140
Output, VDC	0 to 5 (1)	0 to 12 (1)	0 to 28 (1)	0 to 5 (2)	28	28
Output, ADC	10	5.8	3.6	10	4.0	5.0
Input, VDC	20 to 40	20 to 40	20 to 40	20 to 40	20 to 36	11 to 16
Regulation, %	1.5	1.5	1.5	1.5	2.0	2.0
Efficiency, %	71	78	84	71	85	86
Ripple, mvpp	25	25	25	25	50	50
Weight, lbs.	1.5	1.5	1.5	1.5	1.5	1.5
Size	2.25″ Width x 2.25″ Height x 5.75″ Depth					

NOTES: (1) External potentiometer adjusts the output voltage.
(2) External 0 to 28 VDC source controls the output voltage.

REGULATED POWER INVERTERS



Regulated DC to AC inverter, AC to AC frequency changers and UPS systems are available from KGS ELECTRONICS for the general aviation, industrial and consumer markets.

GENERAL DESCRIPTION

Model Specification	SPC-5 SPC-10	SPC-25	SPC-50	SPS-206	SPS-406	SPS-205	SPS-405	SPC-6-(3)
Power, VA	50 100	250	500	200	400	200	400	100 250 (3) 500
Output, VAC	115/26	115/26	115/26	115	115	115 230(2)	115 230(2)	115
Frequency, Hz	400	400	400	60	60	50	50	400
Distortion, %	5	5	5	7	7	7	7	7
Efficiency, %	72 typ	72 typ	72 typ	70 typ	70 typ	70 typ	70 typ	65 typ
Input	28 VDC power source(1)							115 VAC 60 Hz
Size	.9 to 1.7 VA/cubic inch @ 400 Hz .5 to 1.0 VA/cubic inch @ 50/60 Hz } depending on output power							
Weight	20 to 50 VA/lb. @ 400 Hz 7 to 23 VA/lb. @ 50/60 Hz } depending on output power							
Temperature	−65°F to +160°F operating							

NOTES: (1) 14 VDC input units are available in the Models SPC-5, SPC-10 and SPC-25.
Add -14 after the model number to indicate input voltage.
(2) Add -230 after model number to indicate 230 vac output voltage.
(3) Add -VA rating after SPC-6 to indicate desired output power.

For complete data, write KGS ELECTRONICS INC. today or call (213) 798-0786.

KEPCO power supplies

Power Supplies for the OEM, Power Supplies for the Laboratory. Power Supplies for the System Designer . . .

Kepco offers a broad spectrum of well made a-c to d-c and d-c to d-c voltage and current stabilizers employing various control techniques:

LINEAR: Series pass and shunt circuits.
FERRORESONANT: Modular & systems styles.
SWITCHING: 25 KHz modules for small size.

KEPCO also produces a variety of specialty Power Supplies.

UNIPOLAR OPERATIONAL: programmable power supplies responsive to analog controls, variable resistance and analog inputs (including an IEEE-488 compatible programmer).

UNIPOLAR OPERATIONAL — High Speed: programmable at substantially faster rates than the conventionally filtered models for application where the energy storage of an ordinary output capacitor is not desired.

BIPOLAR OPERATIONAL — High Speed: called "BOP", these power supplies are programmable in four quadrants (plus and minus voltage, plus and minus current, source and sink) going linearly through zero. BOP's function just like a power op-amp.

OEM MODULAR: these models, provided without meters or controls, are designed to be built right into your system. There are three different types catalogued below; Linear (series pass) Ferroresonant (saturating transformer) and Switching (25 KHz).

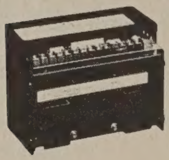
OEM MODULAR MODELS

LINEAR

Programmable voltage stabilizer, current limited.

PAT

20 WATTS



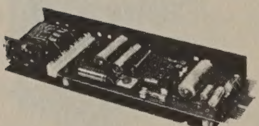
MODEL	VOLTS	AMPS
PAT 7–2	0–7	0–2
PAT 15–1.5	0–15	0–1.5
PAT 21–1	0–21	0–1
PAT 40–0.5	0–40	0–0.5
PAT 72–0.3	0–72	0–0.3
PAT 100–0.2	0–100	0–0.2

Suffix "E" (zeroing)
Suffix "R" (calibration)
Suffix "T" (0.005% per °C TC option)

Programmable voltage stabilizer, current limited.

PCX

20 WATTS



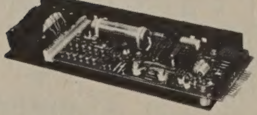
MODEL	VOLTS	AMPS
PCX 7–2	0–7	0–2
PCX 15–1.5	0–15	0–1.5
PCX 21–1	0–21	0–1
PCX 40–0.5	0–40	0–0.5
PCX 72–0.3	0–72	0–0.3
PCX 100–0.2	0–100	0–0.2

Suffix "E" (zeroing)
Suffix "R" (calibration)
Suffix "T" (0.005% per °C TC option)
Suffix "C" optional case

Same as PCX, except fast programmable, capacitorless output. Restricted to non-capacitive loads.

OPS group I

20 WATTS



MODEL	VOLTS	AMPS
OPS 7–2B	0–7	0–2
OPS 15–1.5B	0–15	0–1.5
OPS 21–1B	0–21	0–1
OPS 40–0.5B	0–40	0–0.5
OPS 72–0.3B	0–72	0–0.3
OPS 100–0.2B	0–100	0–0.2

Suffix "C" optional case

Programmable current stabilizer, voltage limited.

CCP

20 WATTS

MODEL	VOLTS	AMPS
CCP 7–2	0–7	0–2
CCP 15–1.5	0–15	0–1.5
CCP 21–1	0–21	0–1
CCP 40–0.5	0–40	0–0.5
CCP 72–0.3	0–72	0–0.3
CCP 100–0.2	0–100	0–0.2

Suffix "E" (zeroing)
Suffix "R" (calibration)
Suffix "P" (current control rheostat)
Suffix "VM" (voltage repeater)

Non-programmable voltage stabilizers with re-entrant current limiting, built-in overvoltage crowbar.

BKF I

15–25 WATTS

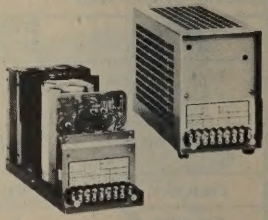
MODEL	VOLTS	AMPS
BKF 1.25–7	1.25 ±10%	0–7
BKF 3.5–5	3.5 ±10%	0–5
BKF 5–3	5.0 ±10%	0–3
BKF 5–5	5.0 ±10%	0–5
BKF 12–1.4	12.0 ±10%	0–1.4
BKF 12–2.4	12.0 ±10%	0–2.4
BKF 15–1.2	15.0 ±10%	0–1.2
BKF 15–2	15.0 ±10%	0–2
BKF 24–0.8	24.0 ±10%	0–0.8
BKF 24–1.2	24.0 ±10%	0–1.2
BKF 28–0.6	28.0 ±10%	0–0.6
BKF 28–1	28.0 ±10%	0–1

Suffix "V" (crowbar adjust)

Non-programmable, voltage stabilizer with re-entrant current limiting. Built-in overvoltage crowbar.

BKF II

100 WATTS



MODEL	VOLTS	AMPS
BKF 5–11	5 ±5%	0–11
BKF 8–10	8 ±5%	0–10
BKF 12–7	12 ±5%	0–7
BKF 15–6	15 ±5%	0–6
BKF 24–4	24 ±5%	0–4
BKF 28–4	28 ±5%	0–4
BKF 36–3	36 ±5%	0–3
BKF 48–2.5	48 ±5%	0–2.5

Suffix "C" optional case
Suffix "V" (crowbar adjust)

Programmable voltage *and* current stabilizer with automatic crossover, optional crowbar overvoltage protector.

PTR

50 WATTS

MODEL	VOLTS	AMPS
PTR 7–5.5	0–7	0–5.5
PTR 15–3.3	0–15	0–3.3
PTR 21–2.5	0–21	0–2.5
PTR 40–1.4	0–40	0–1.4
PTR 72–0.8	0–72	0–0.8
PTR 100–0.6	0–100	0–0.6

Suffix "E" (zeroing)
Suffix "R" (calibration)
Suffix "T" (0.005% per °C TC option)
Suffix "VP" (overvoltage crowbar)

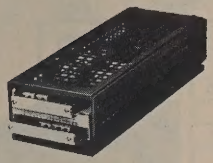
KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

KEPCO POWER SUPPLIES

Same as the PTR, programmable voltage and current stabilizer with capacitorless output for fast programming capability (no overvoltage crowbar). Restricted to non-capacitive loads.

OPS
group III
50 WATTS

MODEL	VOLTS	AMPS
OPS 7–5.5	0–7	0–5.5
OPS 15–3.3	0–15	0–3.3
OPS 21–2.5	0–21	0–2.5
OPS 40–1.4	0–40	0–1.4
OPS 72–0.8	0–72	0–0.8
OPS 100–0.6	0–100	0–0.6



DTM
20 WATTS

Dual tracking output.

MODEL	VOLTS	AMPS
DTM 2X16–0.6	0–±16	0–±0.6

FERRORESONANT

60–450 WATTS

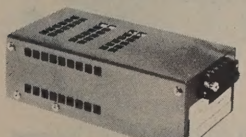
Fixed output, heavy duty stabilizers for exceptional longevity under rugged conditions. PRM's offer high efficiency (60–75%) and excellent source isolation.
For custom volt-ampere combinations, consult factory.

Size D
PRM
60 WATTS

Tap adjustable output, 60 Watts.

MODEL	VOLTS	AMPS
PRM 5–10	5.0*	10.0*
PRM 6.3–8	6.3*	8.0*
PRM 8–7	8.0*	7.0*
PRM 10–6	10.0*	6.0*
PRM 12–5	12.0*	5.0*
PRM 15–4	15.0*	4.0*
PRM 18–3.3	18.0*	3.3*
PRM 21–2.9	21.0*	2.9*
PRM 26–2.3	26.0*	2.3*
PRM 36–1.7	36.0*	1.7*
PRM 48–1.25	48.0*	1.25*
PRM 60–1	60.0*	1.00*
PRM 70–0.86	70.0*	0.86*
PRM 90–0.67	90.0*	0.67*
PRM 120–0.50	120.0*	0.50*
PRM 160–0.37	160.0*	0.37*
PRM 240–0.25	240.0*	0.25*

*Nominal output-two settings above and below nominal are available.
Suffix "–50" (for 50 Hz)
Current rating reduced 20%.

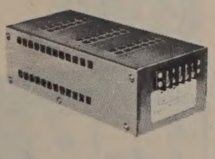


Size B
PRM
120 WATTS

Fixed output, 120 Watts.

MODEL	VOLTS	AMPS
PRM 5–15	5.2	0–15
PRM 6–15	6.3	0–15
PRM 12–10	12.0	0–10
PRM 18–6.7	18.0	0–6.7
PRM 24–5	24.0	0–5
PRM 28–4.3	28.0	0–4.3
PRM 36–3.3	36.0	0–3.3
PRM 48–2.5	48.0	0–2.5
PRM 60–2	60.0	0–2
PRM 120–1	120.0	0–1

Suffix "–50" (for 50 Hz)
Current rating reduced 20%.

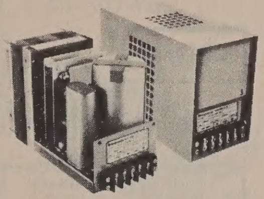


Fixed output, 180 Watts.

MODEL	VOLTS	AMPS
PRM 5–25	5.2	0–25
PRM 6–25	6.3	0–25
PRM 12–15	12.0	0–15
PRM 18–10	18.0	0–10
PRM 24–8	24.0	0–8
PRM 28–7	28.0	0–7
PRM 36–5	36.0	0–5
PRM 48–4	48.0	0–4
PRM 60–3	60.0	0–3
PRM 120–1.5	120.0	0–1.5

Suffix "–50" (for 50 Hz)
Current rating reduced 20%.
Suffix "C" optional case

Size A
PRM
180 WATTS

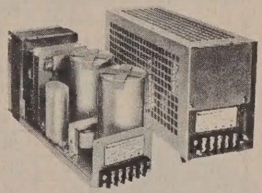


180 Watts with an extra Pi section filter for low ripple.

MODEL	VOLTS	AMPS
PRM 5–25F	5.2	0–25
PRM 6–25F	6.3	0–25
PRM 12–15F	12.0	0–15
PRM 18–10F	18.0	0–10
PRM 24–8F	24.0	0–8
PRM 28–7F	28.0	0–7
PRM 36–5F	36.0	0–5
PRM 48–4F	48.0	0–4
PRM 60–3F	60.0	0–3
PRM 120–1.5F	120.0	0–1.5

Suffix "–50" (for 50 Hz)
Current rating reduced 20%.
Suffix "C" optional case

Size C
PRM
180 WATTS

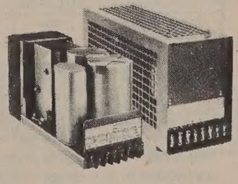


300 Watts comprised of two 150 Watt sections in dual output configuration.

MODEL	VOLTS	AMPS
PRM 2X4.5–20	4.5	0–20
PRM 2X5–20	5.2	0–20
PRM 2X6–20	6.3	0–20
PRM 2X12–12	12.0	0–12
PRM 2X15–10	15.0	0–10
PRM 2X18–8	18.0	0–8
PRM 2X24–6	24.0	0–6
PRM 2X28–5	28.0	0–5
PRM 2X36–4	36.0	0–4
PRM 2X48–3	48.0	0–3
PRM 2X60–2.5	60.0	0–2.5

Suffix "–50" (for 50 Hz)
Current rating reduced 20%.
Suffix "C" optional case,
2 sections are independent, may be combined in series or in parallel.

Size C
PRM
300 WATTS

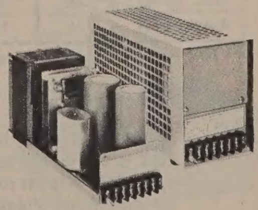


Fixed output, 450 Watts.

MODEL	VOLTS	AMPS
PRM 12–35	12	0–35
PRM 24–20	24	0–20
PRM 28–17	28	0–17
PRM 48–10	48	0–10

Suffix "–50" (for 50 Hz)
Current rating reduced 20%.
Suffix "C" optional case

Size C
PRM
450 WATTS



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KEPCO POWER SUPPLIES

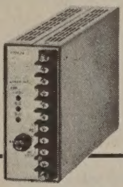
SWITCHING

25 KHz converters which offer a considerable reduction in size and weight, owing to the elimination of source frequency magnetics. Efficiency ranges from 65—80%. Kepco's switch mode stabilizers control voltage with a current limit and built-in overvoltage circuit. A logic programmable on-off circuit is standard.

RMK

Size A

2³⁄₁₆" x 5⅛" x 7½"
Weight: 3 lbs.

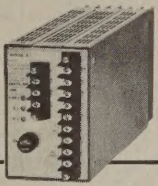


MODEL	NOMINAL* OUTPUT VOLTAGE	OUTPUT CURRENT				
		30°C	40°C	50°C	60°C	71°C
RMK 05—A	5V	12.0 A	10.8 A	10.0 A	8.3 A	5.0 A
RMK 09—A	9V	7.6 A	6.8 A	6.0 A	5.2 A	2.7 A
RMK 12—A	12V	6.3 A	5.6 A	5.0 A	4.3 A	2.0 A
RMK 15—A	15V	5.0 A	4.5 A	4.0 A	3.4 A	1.7 A
RMK 24—A	24V	3.2 A	2.8 A	2.5 A	2.2 A	1.0 A

RMK

Size B

3⁹⁄₃₂" x 5⅛" x 8¾"
Weight: 4.75 lbs.

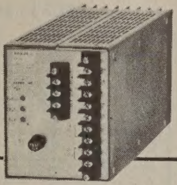


MODEL	NOMINAL* OUTPUT VOLTAGE	OUTPUT CURRENT				
		30°C	40°C	50°C	60°C	71°C
RMK 05—B	5V	36.0 A	34.0 A	26.0 A	17.0 A	9.0 A
RMK 09—B	9V	20.0 A	17.0 A	15.0 A	10.0 A	5.2 A
RMK 12—B	12V	16.6 A	15.0 A	12.0 A	8.0 A	4.2 A
RMK 15—B	15V	13.3 A	13.3 A	10.2 A	6.2 A	3.3 A
RMK 24—B	24V	8.5 A	8.5 A	7.5 A	4.7 A	2.3 A

RMK

Size C

4¹⁄₁₆" x 5⅛" x 8¾"
Weight: 5.25 lbs.



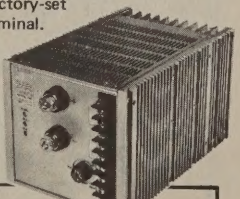
MODEL	NOMINAL* OUTPUT VOLTAGE	OUTPUT CURRENT				
		30°C	40°C	50°C	60°C	71°C
RMK 05—C	5V	40.0 A	38.0 A	30.0 A	21.5 A	14.0 A
RMK 09—C	9V	22.0 A	22.0 A	17.2 A	12.5 A	7.7 A
RMK 12—C	12V	17.0 A	17.0 A	14.6 A	10.5 A	5.8 A
RMK 15—C	15V	14.0 A	14.0 A	12.3 A	8.3 A	4.7 A
RMK 24—C	24V	9.0 A	9.0 A	8.0 A	5.5 A	3.0 A

*Adjustable ±10%. You may order them to be factory-set anywhere in the range −30% to +10% of the nominal.

RMK

Size D

5⅛" x 6³⁄₃₂" x 8¹³⁄₁₆"
Weight: 9 lbs.



MODEL	NOMINAL* OUTPUT VOLTAGE	OUTPUT CURRENT				
		30°C	40°C	50°C	60°C	71°C
RMK 05—D	5V	75 A	75 A	60 A	42 A	30 A
RMK 12—D	12V	36 A	36 A	32 A	22 A	12 A
RMK 24—D	24V	18 A	18 A	16 A	11 A	6 A

* +10%, −30% voltage adjustment range.

Other switch-mode products available include d-c to d-c converters (24V d-c and 48V d-c input) and multiple output units in many of the popular voltage combinations. Please consult the factory for details.

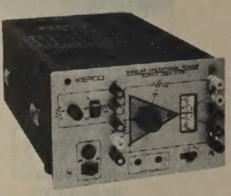
LABORATORY/SYSTEMS MODELS

Bipolar operational power amplifiers for bi-directional control linearly through zero.

Low Voltage Models

MODEL	VOLTS	AMPS
BOP 15—20M	+15 to −15	+20 to −20
BOP 36—1.5M	+36 to −36	+1.5 to −1.5
BOP 36—5M	+36 to −36	+5 to −5
BOP 72—1.5M	+72 to −72	+1.5 to −1.5
BOP 72—5M	+72 to −72	+5 to −5

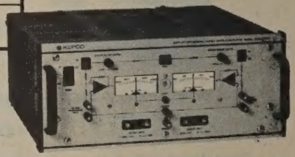
BOP



High Voltage Models

MODEL	VOLTS	AMPS
BOP 500M	+500 to −500	+.08 to −.08
BOP 1000M	+1000 to −1000	+.04 to −.04

BOP

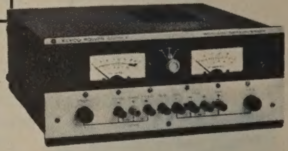


Multiple output voltage stabilizer with adjustable current limits. The + and − outputs track a single panel control. The logic output is crowbar protected.

MODEL	VOLTS	AMPS
MPS 620M	0—6V 0— +20V 0— −20V	0—5A 0—1A 0—1A

MPS

70 WATTS

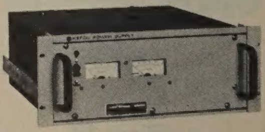


Ferroresonant stabilized 1000 W designs producing fixed voltages.

MODEL	VOLTS	AMPS
PRR 12—77M	12	0—77
PRR 24—42M	24	0—42
PRR 28—36M	28	0—36
PRR 48—22M	48	0—22

PRR

1000 WATTS



Small bench-style voltage stabilizers with current limiting.

Low Voltage (Transistor)

MODEL	VOLTS	AMPS
ABC 2—1M	0—2	0—1
ABC 7.5—2M	0—7.5	0—2
ABC 10—0.75M	0—10	0—0.75
ABC 15—1M	0—15	0—1
ABC 18—0.5M	0—18	0—0.5
ABC 30—0.3M	0—30	0—0.3
ABC 40—0.5M	0—40	0—0.5
ABC 100—0.2M	0—100	0—0.2

ABC

20 WATTS

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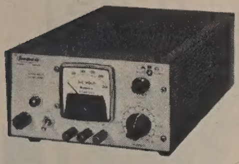
KEPCO POWER SUPPLIES

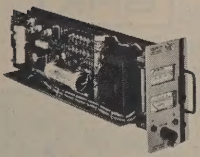
ABC



High Voltage (Hybrid)

MODEL	VOLTS	AMPS
ABC 200M	0–200	0–0.1
ABC 425M	0–425	0–0.05
ABC 1000M	0–1000	0–0.02
ABC 1500M	0–1500	0–0.01
ABC 2500M	0–2500	0–0.002

PCX-MAT
20 WATTS



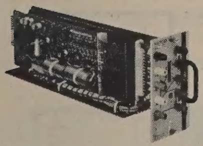
Plug-in style voltage stabilizers.

MODEL	VOLTS	AMPS
PCX 7–2MAT	0–7	0–2
PCX 15–1.5MAT	0–15	0–1.5
PCX 21–1MAT	0–21	0–1
PCX 40–0.5MAT	0–40	0–0.5
PCX 72–0.3MAT	0–72	0–0.3
PCX 100–0.2MAT	0–100	0–0.2

Suffix "E" (zeroing)
Suffix "R" (calibration)
Suffix "T" (0.005% per °C TC option)

Same as PCX-MAT, except equipped with an operational patch panel rather than meters and controls. OPS-II features a capacitorless output for fast programming. Restricted to non-capacitive loads.

OPS group II
20 WATTS

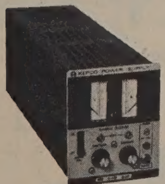


MODEL	VOLTS	AMPS
OPS 7–2BTA	0–7	0–2
OPS 15–1.5BTA	0–15	0–1.5
OPS 21–1BTA	0–21	0–1
OPS 40–0.5BTA	0–40	0–0.5
OPS 72–0.3BTA	0–72	0–0.3
OPS 100–0.2BTA	0–100	0–0.2

PCX–MAT and OPS–II models may be plugged into a choice of single, dual or triple bench style housings - or into rack housings RA–32 and RA 22-6A. (See Hardware)

Systems-oriented power supplies providing programmable voltage and current control in an automatic crossover configuration with overvoltage crowbar. Consult factory about the ATE options package for automatic test equipment applications.

JMK
50–100 WATTS

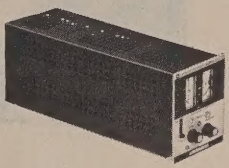


MODEL	VOLTS	AMPS
JMK 6–5M	0–6	0–5
JMK 6–10M	0–6	0–10
JMK 15–3M	0–15	0–3
JMK 15–6M	0–15	0–6
JMK 25–2M	0–25	0–2
JMK 25–4M	0–25	0–4
JMK 36–1.5M	0–36	0–1.5
JMK 36–3M	0–36	0–3
JMK 55–1M	0–55	0–1
JMK 55–2M	0–55	0–2
JMK 75–0.7M	0–75	0–0.7
JMK 75–1.5M	0–75	0–1.5
JMK 100–0.5M	0–100	0–0.5
JMK 100–1M	0–100	0–1

Suffix "T" (0.005% per °C TC option)

Same as JMK, except the capacitorless output circuit is suitable for fast programming applications. No overvoltage crowbar. Restricted to non-capacitive loads.

OPS group IV-V
50–100 Watts



OPS GROUP IV

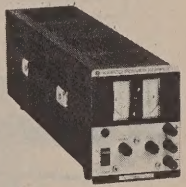
MODEL	VOLTS	AMPS
OPS 6–5M	0–6	0–5
OPS 15–3M	0–15	0–3
OPS 25–2M	0–25	0–2
OPS 36–1.5M	0–36	0–1.5
OPS 55–1M	0–55	0–1
OPS 75–0.7M	0–75	0–0.7
OPS 100–0.5M	0–100	0–0.5

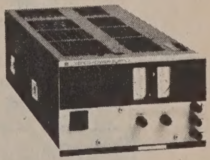
OPS GROUP V

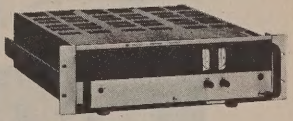
MODEL	VOLTS	AMPS
OPS 6–10M	0–6	0–10
OPS 15–6M	0–15	0–6
OPS 25–4M	0–25	0–4
OPS 36–3M	0–36	0–3
OPS 55–2M	0–55	0–2
OPS 75–1.5M	0–75	0–1.5
OPS 100–1M	0–100	0–1

General purpose laboratory/systems voltage stabilizer featuring adjustable current limiting, programmability, optional crowbar. Also available, unmetered for OEM use. Consult factory about the ATE options package for automatic test equipment application.

JQE
100–1000 WATTS





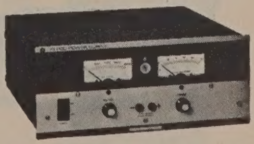


MODEL	VOLTS	AMPS
JQE 6–10M	0–6	0–10
JQE 6–22M	0–6	0–22
JQE 6–45M	0–6	0–45
JQE 6–90M	0–6	0–90
JQE 15–6M	0–15	0–6
JQE 15–12M	0–15	0–12
JQE 15–25M	0–15	0–25
JQE 15–50M	0–15	0–50
JQE 25–4M	0–25	0–4
JQE 25–10M	0–25	0–10
JQE 25–20M	0–25	0–20
JQE 25–40M	0–25	0–40
JQE 36–3M	0–36	0–3
JQE 36–8M	0–36	0–8
JQE 36–15M	0–36	0–15
JQE 36–30M	0–36	0–30
JQE 55–2M	0–55	0–2
JQE 55–5M	0–55	0–5
JQE 55–10M	0–55	0–10
JQE 55–20M	0–55	0–20
JQE 75–1.5M	0–75	0–1.5
JQE 75–3M	0–75	0–3
JQE 75–8M	0–75	0–8
JQE 75–15M	0–75	0–15
JQE 100–1M	0–100	0–1
JQE 100–2.5M	0–100	0–2.5
JQE 100–5M	0–100	0–5
JQE 100–10M	0–100	0–10
JQE 150–1.5M	0–150	0–1.5
JQE 150–3.5M	0–150	0–3.5
JQE 150–7M	0–150	0–7

Suffix "E" (zeroing)
("E" included with "Y" option).
Suffix "T" (0.005% per °C TC option)
Suffix "Y" (added terminals to program current limit)
Suffix "Y" not available on 1/4 rack JQE Models — use JMK Models.

High voltage laboratory power supplies offering continuously adjustable/programmable voltage and current in an automatic crossover configuration.

APH
20 WATTS



High Voltage Models

MODEL	VOLTS	AMPS
APH 500M	0–500	0–0.04
APH 1000M	0–1000	0–0.02
APH 2000M	0–2000	0–0.01

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KEPCO POWER SUPPLIES

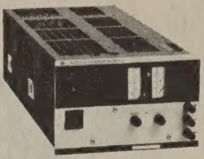
Same as JQE, except the capacitorless output is optimized for fast programming. Restricted to non-capacitive loads.

OPS
VI-VII-VIII

250–1000 WATTS

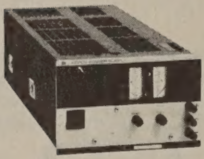
OPS GROUP VI

MODEL	VOLTS	AMPS
OPS 6–22M	0–6	0–22
OPS 15–12M	0–15	0–12
OPS 25–10M	0–25	0–10
OPS 36–8M	0–36	0–8
OPS 55–5M	0–55	0–5
OPS 75–3M	0–75	0–3
OPS 100–2.5M	0–100	0–2.5
OPS 150–1.5M	0–150	0–1.5



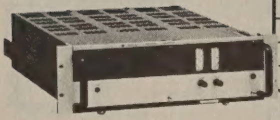
OPS GROUP VII

MODEL	VOLTS	AMPS
OPS 6–45M	0–6	0–45
OPS 15–25M	0–15	0–25
OPS 25–20M	0–25	0–20
OPS 36–15M	0–36	0–15
OPS 55–10M	0–55	0–10
OPS 75–8M	0–75	0–8
OPS 100–5M	0–100	0–5
OPS 150–3.5M	0–150	0–3.5



OPS GROUP VIII

MODEL	VOLTS	AMPS
OPS 6–90M	0–6	0–90
OPS 15–50M	0–15	0–50
OPS 25–40M	0–25	0–40
OPS 36–30M	0–36	0–30
OPS 55–20M	0–55	0–20
OPS 75–15M	0–75	0–15
OPS 100–10M	0–100	0–10
OPS 150–7M	0–150	0–7

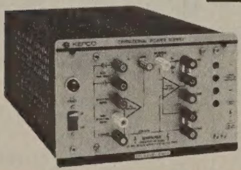


Similar to APH, except equipped with an operational patch panel and featuring a capacitorless output for fast programming applications. Restricted to non-capacitive loads.

OPS
group IX B

20 WATTS

MODEL	VOLTS	AMPS
OPS 500B	0–500	40 mA
OPS 1000B	0–1000	20 mA
OPS 2000B	0–2000	10 mA

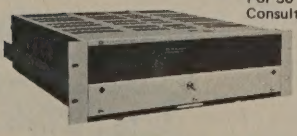


A capacitorless, fast programmable design for high voltage. Restricted to non-capacitive loads.

OPS
group X

MODEL	VOLTS	AMPS
OPS 3500	0–3500	0–10 mA
OPS 5000[1]	0–5000	0–5 mA

[1] For 50 Hz, choose suffix "–50". Consult factory.



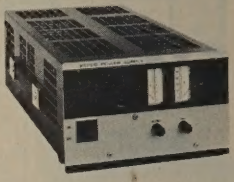
Low voltage systems power supplies optimized for logic systems. Programmable voltage stabilization with adjustable current limiting, built-in adjustable crowbar.

MODEL	VOLTS	AMPS
CPS 6–10M	0–6	0–10
CPS 6–22M	0–6	0–22
CPS 6–45M	0–6	0–45
CPS 6–90M	0–6	0–90
CPS 15–6M	0–15	0–6
CPS 15–12M	0–15	0–12
CPS 15–25M	0–15	0–25
CPS 15–50M	0–15	0–50

Suffix "E" (zeroing)
Suffix "T" (0.005% per °C TC option)

CPS

100–1000 WATTS



Programmable voltage and current stabilizer for high voltage arranged in an automatic crossover configuration. Provision is made for disconnecting the output capacitor for high speed programming.

MODEL	VOLTS	AMPS
BHK 500–0.4M	0–500	0–0.4
BHK 1000–0.2M	0–1000	0–0.2
BHK 2000–0.1M	0–2000	0–0.1

BHK

200 WATTS

Adjustable voltage stabilizers.

MODEL	VOLTS	AMPS
HB 4AM	0–325	0–0.4
HB 8AM	0–325	0–0.8
HB 525M	0–525	0–0.5

HB

Shunt stabilized, high current power supply. Built-in overvoltage crowbar.

MODEL	VOLTS	AMPS
KW6–500M(1)	4–6	0–500
KW6–600M(2)	4–6	0–600

(1) For 380V, 50 Hz 3 ϕ power.
(2) For 208V, 60 Hz 3 ϕ power.

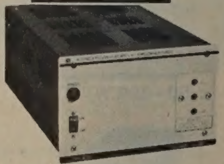
KW

3600 WATTS

Low power shunt stabilized power supplies that can be used on their own, or serve as an interface for higher-powered operational power supplies. NTC program (and allow other units to be programmed) with respect to a *common negative* connection.

MODEL	VOLTS	AMPS
NTC–200	0–200	0–10
NTC–2000	0–2000	0–1

NTC

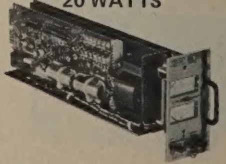


Fast recovery current stabilizers in plug-in configuration.

MODEL	VOLTS	AMPS
CC 7–2M	0–7	0–2
CC 15–1.5M	0–15	0–1.5
CC 21–1M	0–21	0–1
CC 40–0.5M	0–40	0–0.5
CC 72–0.3M	0–72	0–0.3
CC 100–0.2M	0–100	0–0.2

CC

20 WATTS



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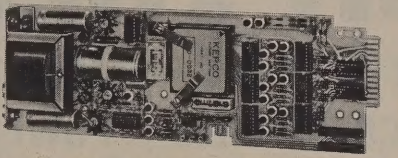
PROGRAMMERS

These programmers are designed for use with all Kepco operationally-programmable power supplies (high speed *and* conventionally filtered). They enable you to interface your d-c power supplies with the logic bus of a computer-controlled system.

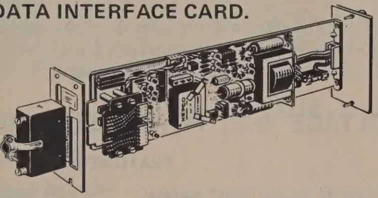
SN

PARALLEL DATA INPUT

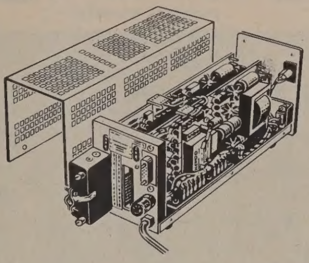


5 digital interfaces for programmable power supplies offering 8-, 10-, or 12-bit binary resolution, or 2-digit, 3-digit BCD resolution. SN's are optically isolated so that they may be used to drive arbitrarily grounded unipolar power supplies.

HARDWARE FOR USE WITH THE SN PARALLEL DATA INTERFACE CARD.

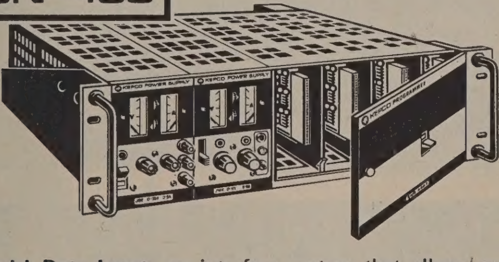


SNK–1 – Slide Adapter [shown with an SN–3 (3 BCD) card mounted in place.] This adapter enables the SN parallel data interface card to be mounted in any of Kepco's 1/6-slot hardware systems, including bench and rack housings.



CA–6 – Dual Card Enclosure [shown with two SN-12 (12-bit binary) cards installed.] The CA-6 fits a ¼-width slot and enables up to 8 SN Cards to be fitted into a 5¼" x 19" rack space.

SN-488



SN-488 Serial Data Input: an interface system that allows any Kepco operationally programmable d-c power supply to function as a *listener* on the *General Purpose Interface Bus* (IEEE-488). The system consists of optically isolated two-channel cards each with 12-bit resolution (or 3 BCD) that plug into either a 4-card or an 8-card housing. The housing contains the "handshake" interface and distributor that allows up to 8 dual cards to be addressed from a single bus connector.

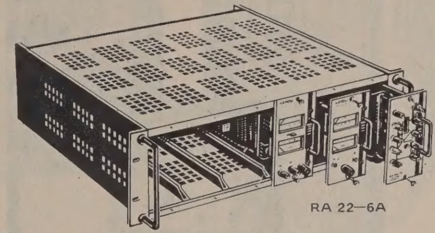
KEPCO POWER SUPPLIES HARDWARE

RA 22-6A

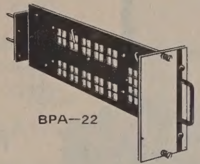
Rack System

FOR PLUG-IN MODELS: OPS–II, PCX–MAT and CC

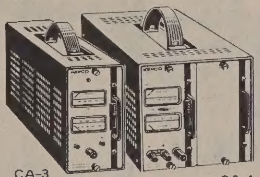
(OPS-I and PCX models can also be mounted using BPA-22 Adapter)



RA 22–6A

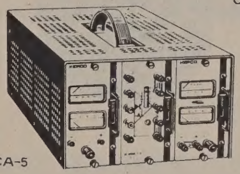


BPA–22



CA-3

CA-4



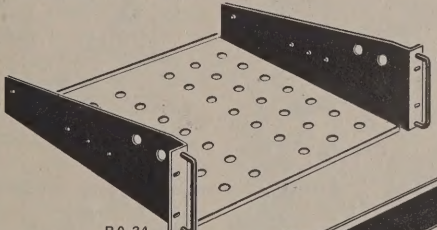
CA-5

Bench Housings:
CA-3 — Single
CA-4 — Dual
CA-5 — Triple

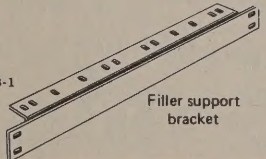
RA 24

Rack System

The RA–24 will house ¼-, ½-, and ¾-rack models in the following groups: APH, BOP, CPS, JMK, JQE, NTC, MPS, OPS IV, V, VI, VII, IX-B.

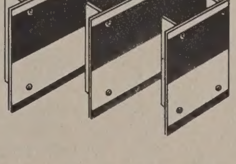


RA 24



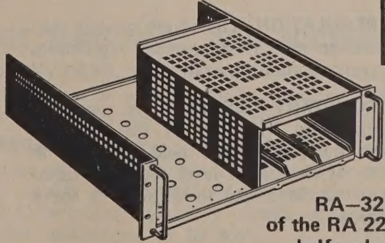
FSB-1

Filler support bracket



RA-32

Rack System



RA–32 Combines (3) slots of the RA 22–6A system with a half-rack space from RA–24.

Data subject to change without notice.

Kepco's more than 30 years experience as the foremost supplier of voltage and current stabilizers has resulted in an unusually comprehensive inventory of power supplies in all styles, ranges, degrees of precision and power. All are backed by an unconditional 5-year warranty.

For complete specifications—
write Dept. ACA-61 for New Kepco Catalog/Handbook

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KILOVOLT
CORPORATION

HIGH VOLTAGE

POWER SUPPLIES • INSULATION TESTERS ACCESSORIES • POWER PACKS

A pioneer in high voltage techniques, KILOVOLT CORPORATION designs and manufactures a wide variety of power supplies and insulation testers and power packs ranging from 1,000 to 1,000,000 volts. These units are soundly engineered, ruggedly constructed and conservatively rated. Units are custom designed for all types of industrial processing as well as experimental laboratory work.

In addition, KILOVOLT CORPORATION can furnish anti-corona hardware devices, isolating resistors, high voltage voltmeters and high voltage spark gaps. Why not check us for all your high voltage requirements.

HIGH VOLTAGE D.C. POWER SUPPLIES FOR INDUSTRY

FEATURES

- **Reversible Polarity Output (most models)**
- **Continuously Variable Output Control**
- **Adjustable Over-Current Shut-Off**
- **Adjustable Over-Voltage Shut-off**
- **Safety Interlock on H.V. Cabinet Door**
- **Zero-Start Interlock**
- **Dual Range Voltage and Current Meter**
- **Fail-Safe Output Shorting Mechanism**
- **Circuit-Breaker Operation**
- **Functional Pilot Lamps**
- **Surge Limiting Resistor**
- **External Interlock**

OUTPUT		MODEL	OUTPUT		MODEL	OUTPUT		MODEL	OUTPUT		MODEL
KV	MA	NUMBER	KV	MA	NUMBER	KV	MA	NUMBER	KV	MA	NUMBER
0-1	500	KV1-500	0-10	30	KV10-30	0-30	500	KV30-500	0-150	500	KV150-500
0-1	1,000	KV1-1,000	0-10	50	KV10-50	0-30	1,000	KV30-1,000	0-200	5	KV200-5
0-1	3,000	KV1-3,000	0-10	100	KV10-100	0-50	50	KV50-50	0-200	10	KV200-10
0-1	5,000	KV1-5,000	0-10	250	KV10-250	0-50	100	KV50-100	0-250	2	KV250-2
0-1	15,000	KV1-15,000	0-10	500	KV10-500	0-50	300	KV50-300	0-250	5	KV250-5
0-3	200	KV3-200	0-10	1,500	KV10-1,500	0-50	1,000	KV50-1,000	0-250	10	KV250-10
0-3	1,000	KV3-1,000	0-20	10	KV20-10	0-60	10	KV60-10	0-250	25	KV250-25
0-3	2,000	KV3-2,000	0-20	50	KV20-50	0-120	5	KV120-5	0-350	2	KV350-2
0-3	5,000	KV3-5,000	0-20	150	KV20-150	0-120	10	KV120-10	0-350	5	KV350-5
0-3	10,000	KV3-10,000	0-20	300	KV20-300	0-120	30	KV120-30	0-500	2	KV500-2
0-5	100	KV5-100	0-20	800	KV20-800	0-120	100	KV120-100	0-500	20	KV500-20
0-5	500	KV5-500	0-30	20	KV30-20	0-150	5	KV150-5	0-600	2	KV600-2
0-5	1,000	KV5-1,000	0-30	50	KV30-50	0-150	10	KV150-10	0-600	5	KV600-5
0-5	2,000	KV5-2,000	0-30	100	KV30-100	0-150	30	KV150-30	0-600	20	KV600-20
0-5	3,000	KV5-3,000	0-30	200	KV30-200	0-150	100	KV150-100	0-1,000	5	KV1,000-5

ELECTRO-MECHANICAL REGULATION. The above models may be ordered with either voltage regulation, current regulation, or both by means of a servo regulating system.

SATURABLE REACTOR CONSTANT CURRENT. By use of a saturable reactor in conjunction with any of the standard models above, the output current can be held constant to within approximately 10% of the preset level for load variations from short circuit to full load and to within 3% for a half-load to full load change.

REGULATED HIGH VOLTAGE D.C. POWER SUPPLIES

Highly regulated against input line variations or changes in load, these power supplies employ fast response electronic regulation.

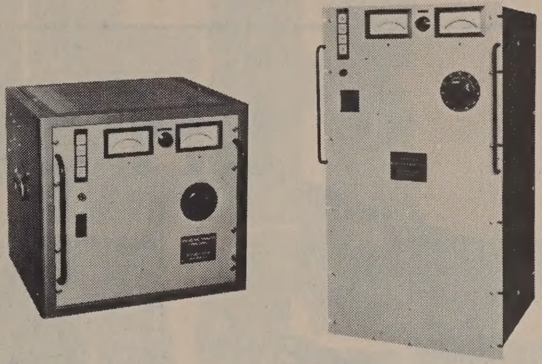
FEATURES

- **Continuously Variable Output**
- **Overload Protection**
- **Zero-Start Interlock**
- **Cabinet Interlock**
- **Provisions for External Interlock**
- **Reversible Polarity Output (most models)**
- **Circuit Breaker Operation**
- **Monitoring Pilot Lamps**
- **Electronically Protected 4½" Meters**

OUTPUT (MAX.) KV	MA	MODEL NUMBER	OUTPUT (MAX.) KV	MA	MODEL NUMBER
1.5	100	KVR1.5-100	10	250	KVR10-250
1.5	200	KVR1.5-200	10	500	KVR10-500
1.5	500	KVR1.5-500	10	1000	KVR10-1000
1.5	1000	KVR1.5-1000	15	7	KVR15-7
3	100	KVR3-100	15	45	KVR15-45
3	200	KVR3-200	15	150	KVR15-150
3	500	KVR3-500	15	250	KVR15-250
3	1000	KVR3-1000	15	750	KVR15-750
7	100	KVR7-100	20	10	KVR20-10
7	250	KVR7-250	20	50	KVR20-50
7	500	KVR7-500	20	150	KVR20-150
7.5	1000	KVR7.5-1000	20	500	KVR20-500
10	50	KVR10-50	20	750	KVR20-750
10	100	KVR10-100	24	10	KVR24-10

OUTPUT (MAX.) KV	OUTPUT (MAX.) MA	MODEL NUMBER	OUTPUT (MAX.) KV	OUTPUT (MAX.) MA	MODEL NUMBER
24	45	KVR24-45	50	100	KVR50-100
24	200	KVR24-200	75	5	KVR75-5
24	500	KVR24-500	75	10	KVR75-10
24	1000	KVR24-1000	75	50	KVR75-50
30	1	KVR30-1	75	100	KVR75-100
30	10	KVR30-10	100	5	KVR100-5
30	45	KVR30-45	100	25	KVR100-25
30	100	KVR30-100	150	5	KVR150-5
30	200	KVR30-200	150	15	KVR150-15
30	400	KVR30-400	200	5	KVR200-5
30	800	KVR30-800	200	12	KVR200-12
50	5	KVR50-5	250	5	KVR250-5
50	15	KVR50-15	250	10	KVR250-10
50	50	KVR50-50			

REGULATED HIGH VOLTAGE D.C. POWER SUPPLIES (cont'd.)



CURRENT REGULATION. Voltage regulated power supplies can be provided with current regulation capability on special order.

HIGH-VOLTAGE D.C. INSULATION TESTERS

FEATURES

- **Reversible Polarity Output (most models)**
- **Continuously Variable Output Control with Vernier Adjust**
- **Adjustable Overcurrent and Overvoltage Shutoffs**
- **Safety Interlock**
- **Provision for External Interlock**
- **Zero-Start Interlock**
- **Triple Range Current Meters**
- **Triple Range Voltage Meters**
- **Fail-Safe Output Shorting Mechanism**
- **Meters Electronically Protected**
- **Functional Pilot Lamps**
- **Selenium Rectifiers**
- **Surge Limiting Resistor**
- **Circuit Breaker Operation**

OUTPUT KV	OUTPUT MA	MODEL NO.	OUTPUT KV	OUTPUT MA	MODEL NO.
0-30	5	DC 30-5	0-250	5	DC 250-5
0-60	5	DC 60-5	0-350	5	DC 350-5
0-120	5	DC 120-5	0-600	5	DC 600-5
0-150	5	DC 150-5	0-1,000	5	DC 1,000-5

HIGH VOLTAGE A.C. INSULATION TESTERS

for Dielectric Testing under ASTM, MIL and Federal Specs.

FEATURES

• Motor-Driven output control with adjustable speeds permits selection of proper rate-of-rise for various specification testing. • Plexiglas, Safety-Interlocked Access Door • 4½″ Memory-type Voltage Meter • Functional Pilot Lamps • Dual Range Circuit Breaker Operation • Plug-in Test Jigs available, most models.

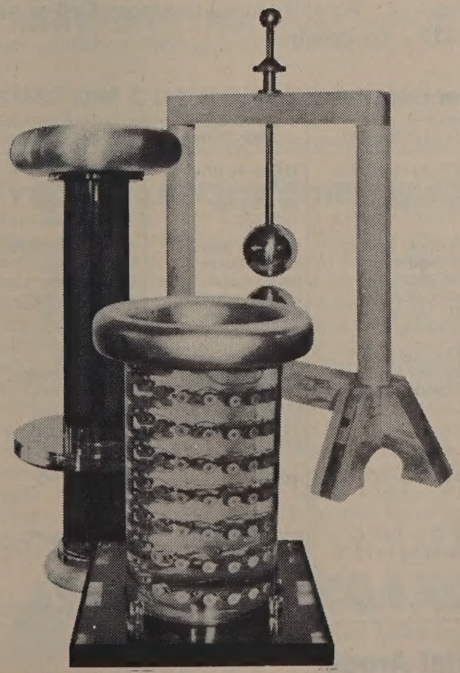
OUTPUT KV	OUTPUT KVA	MODEL NO.
0-15	5	AC 15-5
0-25	2.5	AC 25-2.5
0-25	5	AC 25-5
0-60	2.5	AC 60-2.5
0-100	5	AC 100-5

HIGH VOLTAGE A.C./D.C. INSULATION TESTERS

FEATURES

• Reversible Polarity D.C. Output (most models) • Continuously Variable Voltage Output Control • Adjustable D.C. Over-Current Shut-Off • Zero-Start Interlock • Safety Interlock on High Voltage Cabinet Door • Provision for External Interlock • Electronically-Protected Meters • Fail-Safe Output Shorting Mechanism • Functional Pilot Lamps • Circuit-Breaker Operation • Surge-Limiting Resistor.

OUTPUT KV Peak AC	OUTPUT KV Peak DC	OUTPUT MA AC	OUTPUT MA DC	MODEL NO.
15	30	20	5	DAC 15/30-20-5
30	60	20	5	DAC 30/60-20/5
75	150	20	5	DAC 75/150-20/5
125	250	20	5	DAC125/250-20/5



HIGH VOLTAGE D.C. POWER PACKS

These units are high voltage sections of standard power supplies minus meters and controls and contain the basic components described for standard power supplies — filter system, fail-safe mechanism, surge resistor, meter multiplier, primary gaps, etc.

HIGH VOLTAGE HARDWARE AND ACCESSORIES

MULTIPLIERS AND DIVIDERS. High voltage resistance strings, accurate to 0.15% or better with division ratios which may be specified. Stability is 25 PPM/°C; current drain 1 ma. Accuracy traceable to NBS standards as an option.

ELECTRONIC CROWBAR designed to protect Klystron or other sensitive loads from damage by discharge of power supply energy can be manufactured into your custom-built power supply or provided as separate devices. A typical unit has a response time of 3-5 microseconds and is capable of discharging five microfarads in approximately one millisecond at 20 KV.

CALIBRATED SPARK GAPS provided with micrometer calibration and may be used for determining crest voltage.

HIGH VOLTAGE OUTPUT BUSHING. Oil filled and terminated with anti-corona toroids, these devices are designed for oil-to-air outlet of very high voltages; available in two ratings, 300 and 600 KV D.C.

Call or write for a copy of our latest catalog.

KILOVOLT CORPORATION

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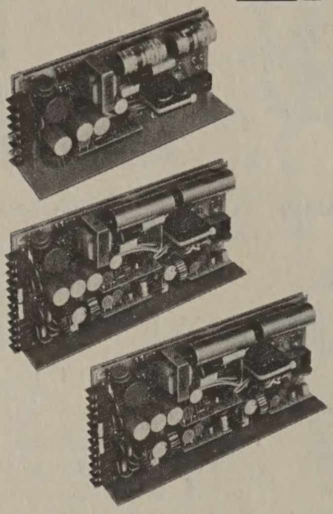
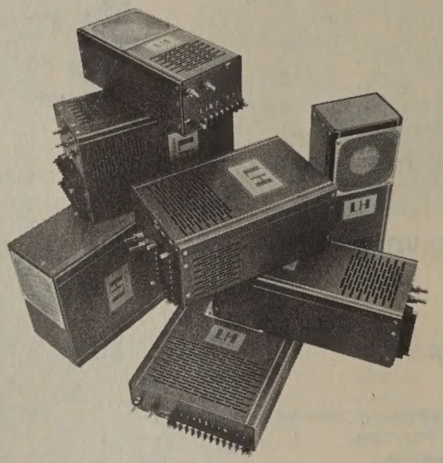
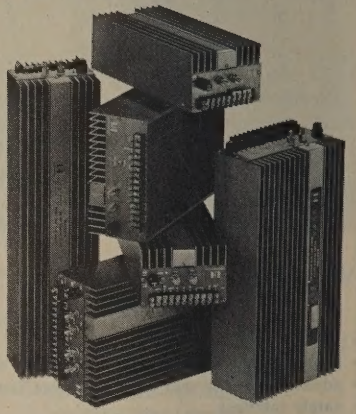
LH Switchers



Tiny-**MITE** Series



Mighty-**MITE** Series



LH Series
Little-**MITE** Series
Dyna-**MITE** Series

We Make More Single- and Multiple-Output Switchers Than Anybody Else.
Try us for Size — and Economy and Efficiency, too

Wide selection of power ratings and configurations — We make switching regulated power supplies. Exclusively. 1, 2, 3, 4, 5, and 6 output switchers. From 100 to 1500 watts in a variety of packaged and open-frame configurations for a broad range of applications.

More power in smaller packages — Nobody packs more power in smaller packages: up to 2.26 watts/in.^{3} — more than twice the density of competitive switchers; 4 to 5 times the density of linears... Efficiency to 80% ... *All models designed to meet UL 478* ... Each guaranteed two years.

Five standard series; custom designs, too — Right now we offer our standard **LH Series** plus the four MITE Series switchers, which include: **Mighty-MITE** (MM) Series — 375 to 1000 watts. High power density. *Fan-cooled.* **Little-MITE** (LM) Series — 250 to 600 watts. Medium high power. *Convection-cooled.* **Tiny-MITE** (TM) Series — 100 to 150 watts. *Open frame. Convection-cooled.* **Dyna-MITE** (DM) Series — 250 to 600 watts. *DC input. Convection-cooled.*

Major specs for each series appear in the tabulation. And if one of our standard LH or MITE Series models won't do your job, we'll customize one that will.

We'd like to tell you more. Call or write for details.

LH RESEARCH Switching Regulated Power Supplies

Specifications	LH Series	MM Series	DM, LM, TM Series
Input	115 ±10% VAC or 230 ±10% VAC, 47-440 Hz.	115 ±10% VAC or 230 ±10% VAC, 47-63 Hz. 115/230 ±10% VAC 47-63 Hz optional	92-130 VAC or 180-260 VAC, 47-440 Hz. 48 VDC (DM Series)
Outputs	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6	1, 2, 3, 4
Line Regulation	±0.2% for 10% line change	0.4% on primary output, 0.2% on all others	0.4% over entire input range
Efficiency	Up to 80%	Up to 80%	Up to 80%
Load Regulation	0.4% from zero to full load	0.4% from zero to full load	0.4% from zero to full load
Ripple and Noise	1% or 50 mv peak to peak	1% or 50 mv peak to peak	1% or 50 mv peak to peak
Overvoltage Protection	Standard on primary output, factory set at 125%. Optional for other outputs	Standard on primary output, factory set at 125%. Optional for other outputs	Standard on primary output, factory set at 125%. Optional for other outputs
Overshoot and Undershoot	2% peak deviation for a load change of 25% @ 5A/µsec	2% peak deviation for a load change of 25% @ 5A/µsec	2% peak deviation for a load change of 25% @ 5A/µsec

Specifications	LH Series	MM Series	DM, LM, TM Series
Response Time	200 µsec after a 25% load change @ 5A/µsec	200 µsec after a 25% load change @ 5A/µsec	200 µsec to 1% after a 25% load change @ 5A/µsec
Dropout Time	Outputs remain in regulation for 20 msec after nominal AC power is removed	Outputs remain in regulation for 20 msec after nominal AC power is removed	Outputs remain in regulation for 20 msec after nominal AC power is removed
Current Limit	Fold-back current limiting provided	Fold-back current limiting provided. Constant current limiting optionally available	Fold-back current limiting provided
Temperature Coefficient	±0.02%/°C	±0.02%/°C	±0.02%/°C
Operating Temperature Range	0°C to +40°C derating to 70°C	0°C to +40°C derating to 70°C	0°C to +50°C derating to 70°C
Storage Temperature Range	−55°C to +85°C	−55°C to +85°C	−55°C to +85°C

Representatives in Major Industrial Areas

© 1977, LH RESEARCH, INC.

HIGHER VOLTAGE

REGULATED POWER SUPPLIES: Precise voltage or current regulation of ±0.01% for line or load changes. Adjustable from Zero. Short circuit protected. R or E programming. Completely solid state. AC/DC ratings to 2 Megavolts and 1 Megawatt.

Bulletin RDC-1000

ADJUSTABLE POWER SUPPLIES: DC unregulated. All models fully controlled and protected with ratings from 1KV to 2000 KV at 1 Megawatt. Special "S" model with simple or no controls. Many variations in options and features available.

Bulletin ADC-1000

PRECISION DIVIDERS: Accuracies of 0.01%, 0.1%, 1.0%. DC/ACP, DC, AC RMS. Variable ratios.

Bulletin HVD-1000

DC INSULATION TESTERS: Qualitative or quantitative testing to 1 Megavolt. Portable or mobile. Burn and "Thumper" feature.

Bulletin DCI-2000

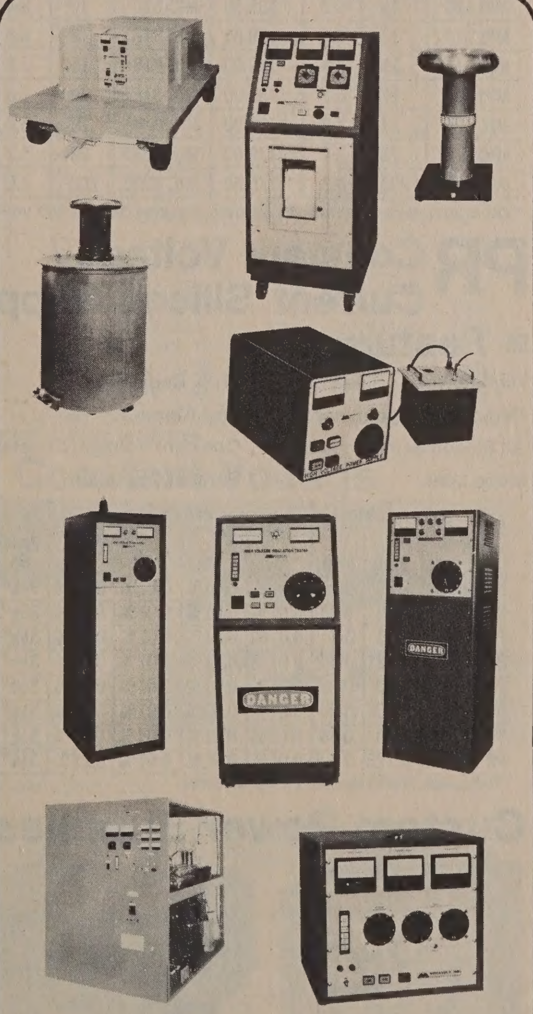
AC INSULATION TESTERS: Ratings to 400KV/1000KVA. Memory meter indicates breakdown voltage. High speed overload. Options include, Corona free, automatic voltage sequencing, variable speed control. Conforms to ASTM.

Bulletin ACI-3000

TRANSFORMERS: Isolation to 500KVDC. Filament. Air, Oil, Gas, Insulation. Ratings to 300KVRMS/400 KVA.

CUSTOM COMPONENTS: Spark gaps. Crowbars. Oil filled bushings. Anti-corona Spheres and Toroids. Shielded cables. Shorting and Disconnect Switches. Series Limiting Resistors. Capacitors. Rectifiers.

TYPICAL APPLICATIONS Dielectric Heating • Electro Static Cooling • Carbon Deposition • Beam Separator • X-Ray Thickness Gauge • Pulse Charging Lines • Capacitor Charging • Air Purifying • Paint Spraying • Fiber Flocking • Mineral Separation • Grain Cleansing • Recovery of Precious Metal Dust • Electron and Field Ion Microscopy • Testing Large Rotating Machinery • Cloud Chamber • Vacuum Arc Experiments • Removal of Liquid Fuel Contaminants • Killing Bacteria • Electron Beam Welding and Machining • Zone Heating • Testing Liquid and Solid Dielectrics • Processing Razor-Blades • Processing Vegetables • Spectroscopy • Spark Chamber • Processing Synthetic Rubber • Charging Electrostatic Antennae for Cloud Study • Ion Propulsion Engines • Injection and Focusing Devices on High Energy Accelerators • Sparking of Cathode Ray Tubes • Life Testing and Processing of Vacuum Tubes • Energizing Laser Devices • Charging Paper for Xerography Printing • Radar • Image Intensifier • Sputtering Processes • Impulse Testing • Explosive Forming • Electrophoresis • Ion Implantation • Tomography • TWT



- 400 Standard Models with Voltage Ranges to 2 Megavolt and Powers to 1000 KW
- Completely Solid State, Self Protecting
- Safe Simple, Foolproof Operation
- Maximum Personnel and Equipment Protection
- Standard Models Easily Modified for Custom Design.

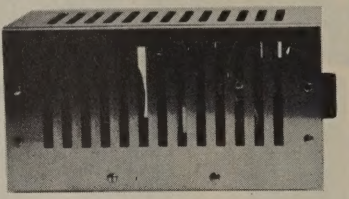
MEGAVOLT CORPORATION
150 West Edsall Blvd., Palisades Park, N.J. 07650
(201) 944-6410 • Telex: UNAWORLD CRESSKILL 135489

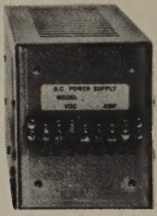
HIGH VOLTAGE SPECIALISTS

Mid-Eastern Industries
A Division of Eanco, Inc.
DEPT. EM 539 Jacksonville Road • Warminster, Pennsylvania 18974 • (215) 672-4800

MIC Modular Power Supply System

RA5-1 $35.00





B5 $5.00

P5 $20.00

B5M
$35.00

P5M
$40.00

■ Features

- Low Cost
- .02% Load Regulation
- Parallel or Series Operation
- .02% Line Regulation
- Full Repairability
- 500 Microvolts Ripple
- Remote Sensing
- 0-50°/71°C Operation
- Integrated Circuit Control

Model Number	Output		Price	Model Number	Output		Price	Model Number	Output		Price	Model Number	Output		Price
	Volts	Amps			Volts	Amps			Volts	Amps			Volts	Amps	
MIC A3	3	6.0	$139.00	MIC B3	3	12.0	$187.00	MIC D3	3	18.0	$250.00	MIC E3	3	9.0	$146.00
MIC A5	5	5.8	139.00	MIC B5	5	11.6	187.00	MIC D5	5	17.4	250.00	MIC E5	5	8.7	146.00
MIC A6	6	5.5	139.00	MIC B6	6	11.0	187.00	MIC D6	6	16.5	250.00	MIC E6	6	8.2	146.00
MIC A8	8	5.0	139.00	MIC B8	8	10.0	187.00	MIC D8	8	15.0	250.00	MIC E8	8	7.5	146.00
MIC A10	10	4.7	139.00	MIC B10	10	9.4	187.00	MIC D10	10	14.1	250.00	MIC E10	10	7.0	146.00
MIC A12	12	4.4	139.00	MIC B12	12	8.8	187.00	MIC D12	12	13.2	250.00	MIC E12	12	6.6	146.00
MIC A15	15	3.9	139.00	MIC B15	15	7.8	187.00	MIC D15	15	11.7	250.00	MIC E15	15	5.8	146.00
MIC A18	18	3.5	139.00	MIC B18	18	7.0	187.00	MIC D18	18	10.5	250.00	MIC E18	18	5.2	146.00
MIC A24	24	2.9	139.00	MIC B24	24	5.8	187.00	MIC D24	24	8.7	250.00	MIC E24	24	4.3	146.00
MIC A28*	28	2.6	139.00	MIC B28*	28	5.2	187.00	MIC D28*	28	7.8	250.00	MIC E28*	28	3.9	146.00
MIC A200	200	0.5	175.00	MIC B200	200	1.0	225.00	—	—	—	—	MIC E200	200	0.7	189.00
												MIC F5	5	50	467.00

* Other standard models with outputs between 28 and 200 volts are available. Consult factory.

PR Constant Voltage / Current Silicon Supplies

■ Features

- High Power — Small Size
- .01% Regulation
- Remotely Programmable
- Low Ripple
- All Silicon Semiconductors
- Constant Voltage/Constant Current
- Mode Lites
- Parallel Operation

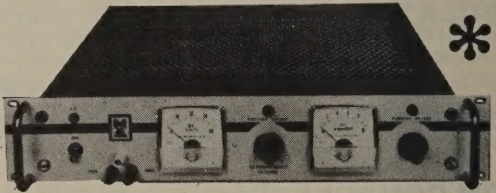
Model Number	Output		Regulation				Panel Ht.	Price
			Line		Load			
	Volts	Amps	CV	CC	CV	CC		
PR 20-15	0-20	0-15	0.01%	0.01%	0.01%	0.25%	3½″	$577.00
PR 40-10	0-40	0-10	0.01%	0.01%	0.01%	0.25%	3½″	566.00
PR 60-7	0-60	0-7	0.01%	0.01%	0.01%	0.25%	3½″	594.00
PR 125-3.2	0-125	0-3.2	0.01%	0.01%	0.01%	0.25%	3½″	688.00
PR 20-25	0-20	0-25	0.01%	0.01%	0.01%	0.25%	5¼″	786.00
PR 40-20	0-40	0-20	0.01%	0.01%	0.01%	0.25%	5¼″	803.00
PR 60-14	0-60	0-14	0.01%	0.01%	0.01%	0.25%	5¼″	786.00
PR 125-6.5	0-125	0-6.5	0.01%	0.01%	0.01%	0.25%	5¼″	1012.00

*Photograph illustrates both **PR** and **HV** Series.

HV Constant High Voltage Supplies

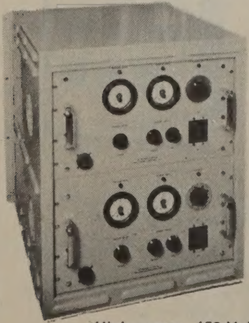
■ Features

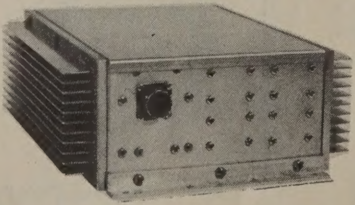
- All Solid State
- Adjustable Current Limit
- < 1 Millivolt Ripple
- 10-Turn Voltage Adjustments
- Remote Programming
- Remote Sensing

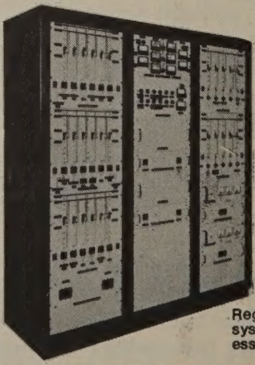

*

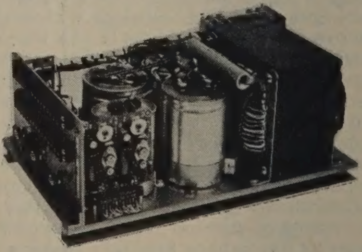
Model Number	Output		Regulation		Size	Price
	Volts	Amps	Line	Load		
HV 350-1	0-350	1	0.005%	0.01%	3½ x 19 x 16½	$790.00
HV 350-2	0-350	2	0.005%	0.01%	5¼ x 19 x 16½	925.00
HV 350-3	0-350	3	0.005%	0.01%	7 x 19 x 16½	1100.00

Custom Power Supplies and Systems


High power, 150-Volt, constant current//constant voltage, shipboard-qualified power supply.


Mil Spec 4 output regulated power supply.


Regulated, no-break, redundant power distribution system with battery back-up for petroleum processing industry.

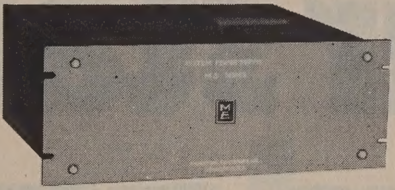

Regulated multi-output power supply for mini-computer.

Mid-Eastern Industries
A Division of Eanco, Inc.
DEPT. EM 539 Jacksonville Road • Warminster, Pennsylvania 18974 • (215) 672-4800

MS High Power System Component Power Supplies

■ Features

- Most Complete Coverage
  - Up to 600 Volts
  - Up to 1200 Amperes
  - 139 Standard Models
- Low Cost
- All Solid State
- Extreme Reliability
- 10 Year Guarantee



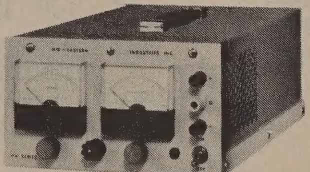
Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height	Model Number	Inches in Height
MS9-600	48⅝	MS20-10	3½	MS34-6	3½	MS65-3	3½	MS128-2	3½	MS350-1.5	5¼
MS9-1200	67⅞	MS20-30	5¼	MS34-20	5¼	MS65-10	5¼	MS128-6	5¼	MS350-3	8¾
MS12-12	3¼	MS20-45	8¾	MS34-30	8¾	MS65-15	8¾	MS128-10	8¾	MS350-5	12¼
MS12-40	5¼	MS20-80	12¼	MS34-50	12¼	MS65-25	12¼	MS128-15	12¼	MS350-7	17½
MS12-60	8¾	MS20-120	17½	MS34-75	17½	MS65-35	17½	MS128-24	17½	MS350-10	24
MS12-100	12¼	MS20-180	24	MS34-125	24	MS65-50	24	MS128-35	24	MS350-30	67⅞
MS12-150	17½	MS20-400	67⅞	MS34-300	67⅞	MS65-75	48⅝	MS128-45	48⅝	MS410-1.5	5¼
MS12-225	24	MS25-8	3½	MS38-6	3½	MS65-150	67⅞	MS128-90	67⅞	MS410-3	8¾
MS12-400	67⅞	MS25-25	5¼	MS38-20	5¼	MS77-3	3½	MS240-.75	3½	MS410-5	12¼
MS13.5-12	3½	MS25-37	8¾	MS38-30	8¾	MS77-10	5¼	MS240-3	5¼	MS410-7	17½
MS13.5-40	5¼	MS25-60	12¼	MS38-50	12¼	MS77-15	8¾	MS240-5	8¾	MS410-10	24
MS13.5-60	8¾	MS25-90	17½	MS38-75	17½	MS77-25	12¼	MS240-7	12¼	MS410-30	67⅞
MS13.5-100	12¼	MS25-140	24	MS38-125	24	MS77-35	17½	MS240-10	17½	MS470-2	8¾
MS13.5-150	17½	MS25-200	48⅝	MS38-300	67⅞	MS77-50	24	MS240-15	24	MS470-3	12¼
MS13.5-225	24	MS25-400	67⅞	MS46-5	3½	MS77-75	48⅝	MS240-40	67⅞	MS470-5	17½
MS13.5-400	67⅞	MS29-8	3½	MS46-15	5¼	MS77-150	67⅞	MS273-.75	3½	MS470-7	24
MS17-10	3½	MS29-25	5¼	MS46-22	8¾	MS109-2	3½	MS273-3	5¼	MS470-10	48⅝
MS17-30	5¼	MS29-37	8¾	MS46-40	12¼	MS109-6	5¼	MS273-5	8¾	MS470-20	67⅞
MS17-45	8¾	MS29-60	12¼	MS46-60	17½	MS109-10	8¾	MS273-7	12¼	MS545-2	8¾
MS17-80	12¼	MS29-90	17½	MS46-90	24	MS109-15	12¼	MS273-10	17½	MS545-3	12¼
MS17-120	17½	MS29-140	24	MS46-120	48⅝	MS109-24	17½	MS273-15	24	MS545-5	17½
MS17-180	24	MS29-200	48⅝	MS46-240	67⅞	MS109-35	24	MS273-40	67⅞	MS545-7	24
MS17-400	67⅞	MS29-400	67⅞			MS109-45	48⅝			MS545-10	48⅝
						MS109-90	67⅞			MS545-20	67⅞

NOTE: The digits of the Model Number indicate the output voltage and current in amps. Example: MS9-600 has an output of 9 volts, current of 600 amps. MS9-1200 has an output of 9 volts at 1200 amps. **Consult factory for prices.**

HW Constant Voltage/ Constant Current Power Supplies

■ Features

- Models up to 200 Volts
- Remotely Programmable
- Remote Sensing
- Series and Parallel Operation
- 500μ Volts Ripple
- .01% Load Regulation
- Half Rack Size
- Separate Voltmeter and Ammeter
- Rack or Bench mounted
- .005% Line Regulation



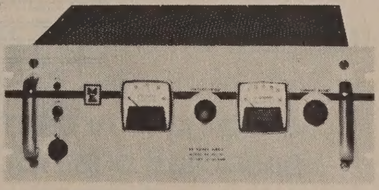
Model Number	Output		Regulation				Price
	Voltage	Amps	Line		Load		
			CV	CC	CV	CC	
HW 10-8	0-10	0-8	0.01%	0.1%	0.01% or 1 mv	0.5%	$295.
HW 10-15	0-10	0-15	0.01%	0.1%	0.01% or 1 mv	0.5%	369.
HW 20-4	0-20	0-4	0.01%	0.1%	0.01% or 1 mv	0.5%	295.
HW 20-10	0-20	0-10	0.01%	0.1%	0.01% or 1 mv	0.5%	369.
HW 40-2	0-40	0-2	0.01%	0.1%	0.01% or 1 mv	0.5%	295.
HW 40-5	0-40	0-5	0.01%	0.1%	0.01% or 1 mv	0.5%	369.
HW 60-1.5	0-60	0-1.5	0.01%	0.1%	0.01% or 1 mv	0.5%	310.
HW 60-3	0-60	0-3	0.01%	0.1%	0.01% or 1 mv	0.5%	369.
HW 100-2	0-100	0-2	0.01%	0.1%	0.01% or 1 mv	0.5%	423.
HW 200-1	0-200	0-1	0.01%	0.1%	0.01% or 1 mv	0.5%	476.

Prices include: meters, case, carry handle, and rubber feet.
Options: overvoltage, 10-turn potentiometers, and special input voltage.

RA Constant Voltage Silicon Supplies

■ Features

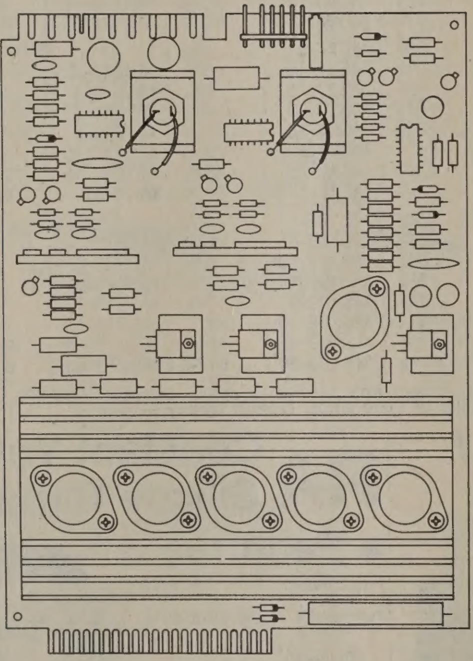
- High Power — Small Size
- Remotely Programmable
- Low Ripple
- Parallel Operation
- .01% Regulation
- All Silicon Semiconductors



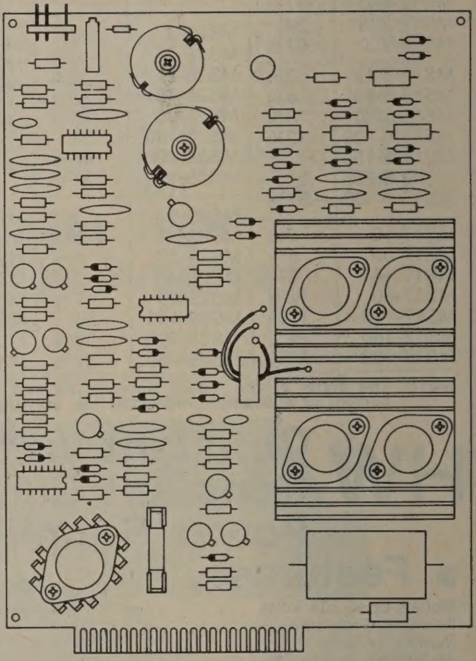
Model Number	Output		Voltage Regulation		Panel Height	Price
	Voltage	Amps	Line	Load		
RA 20-15	0-20	0-15	0.01%	0.01%	3½″	$478.00
RA 40-10	0-40	0-10	0.01%	0.01%	3½″	478.00
RA 60-7	0-60	0-7	0.01%	0.01%	3½″	495.00
RA 125-3.2	0-125	0-3.2	0.01%	0.01%	3½″	495.00
RA 20-25	0-20	0-25	0.01%	0.01%	5½″	544.00
RA 40-20	0-40	0-20	0.01%	0.01%	5½″	522.00
RA 60-14	0-60	0-14	0.01%	0.01%	5½″	605.00
RA 125-6.5	0-125	0-6.5	0.01%	0.01%	5½″	676.00
RA 40-30	0-40	0-30	0.01%	0.01%	7″	764.00
RA 60-20	0-60	0-20	0.01%	0.01%	7″	792.00
RA 125-10	0-125	0-10	0.01%	0.01%	7″	885.00

Options include: meters, overvoltage, 10-turn potentiometers, and special input voltages.

We can make our standard line supplies...



±12V
6,8A



5V
60A

NCRNCRNCRNCRNCRNCR

your supply.

The design and manufacture of power supplies for NCR corporation commercial systems, demand a high level of quality and reliability. High quality and reliability are words we define as total dependability.

And that same field-tested dependability in our power supplies is available for application in your OEM commercial systems.

ADVANTAGES:

- DESIGNED AND BUILT TO THE HIGHEST COMMERCIAL STANDARDS
- FIELD PROVEN IN NCR COMMERCIAL SYSTEMS
- WORLD-WIDE FIELD SERVICE AVAILABLE
- PRICE BENEFITS FROM VOLUME PRODUCTION
- UL, CSA, VDE RECOGNIZED

Give us a call and we'll review your power requirements with you...and show you how our existing design-proven power supplies will perform to your satisfaction.

You'll find our power supplies are available for OEM computer, point of sale, EDP, bank telling and telecommunications use:

- Switching regulator and linear designs
- 11 models — single/multi-output
- Voltage ranges, from 2 to 30V
- 50 current levels from .01 to 225 amps
- Overcurrent/overvoltage protection
- Filtering to meet world-wide EMI requirements
- Manufactured in accordance with UL, CSA and European safety requirements

NCR POWER SYSTEMS DIVISION

Formerly Scott Electronics Division

Dept. EM, 584 S. Lake Emma Road
P.O. Box 898
Lake Mary, Florida 32746
Telephone (305) 323-9250

PRECISION CURRENT & VOLTAGE SOURCES

PRECISION CURRENT SOURCES

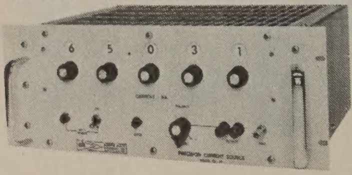
ACCURACIES TO 0.01% **STABILITIES TO 2 PPM**

APPLICATIONS:

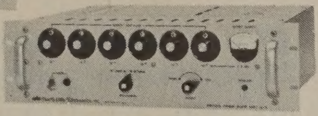
- Laboratory and Production Testing of Semiconductors, Gyros, Lamps, Meters, Thermistors, etc.
- Systems requiring a Precision Constant Current Setting such as X-ray Equipments, Electron Beam Welders, and Electron Beam Microscopes.

FEATURES:

- Digital In-Line Current Setting and Readout.
- 5 or 6 Decade Dividers for Setting to 1 Part in 100,000 or 1 Part in 1,000,000 of Full Scale.
- Uni- and Bi-Polar Models.
- External Modulation Capability.
- Externally Programmable Models.
- Automatic Protection Circuits.

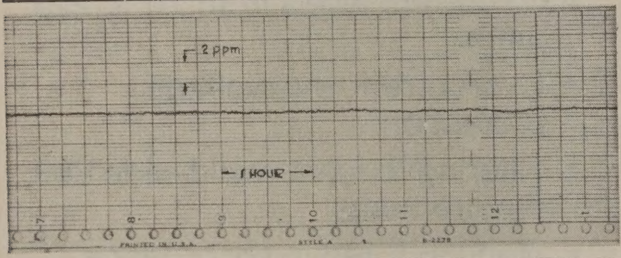


CS-11



CS-31

Model	Current Range (mA)	Compliance Range (V)	Accuracy (%)	Stability (ppm)
CS-11	0 - 100	100	0.015	10
CS-12	0 - 1000	12.5	0.015	10
CS-13	0-5000	25	0.03	10
CS-14	0 - 10,000	12.5	0.03	10
CS-21	0 - ±500	±100	0.05	10
CS-31	0 - 2000	60	0.01	5
CS-111	0 - 500	250	0.1	30
CS-120	0 - 10	2000	2.0	1000
CS-151	0 - ±10	± 10	0.01	2
CS-152	0 - ±150	± 25	0.01	2
CS-153	0 - ±150	±100	0.01	2



DIGITAL PRECISION CURRENT, VOLTAGE AND VOLTAGE/CURRENT SOURCES

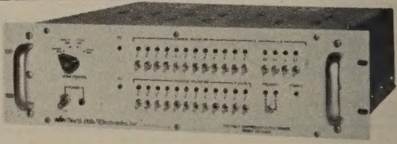
FOR COMPUTER-CONTROLLED AUTOMATIC TEST SYSTEMS

Output Selection: 4 digit BCD or 16 bit binary
Accuracy: 0.02% +½ LSB
Stability: 50 ppm
Regulation
vs. line: 10 ppm
vs. load: 10 ppm
vs. temperature: 25 ppm/°C
Response Time: 100 μsec

CONSTANT VOLTAGE		
Model DVS-40	**Full-Scale Volts**	**Max. Amps.**
−010	10	2
−015	15	1.5
−020	20	1
−050	50	0.5
−075	75	0.3
−110	100	0.2

CONSTANT CURRENT		
Model DCS-30	**Full-Scale Amps.**	**Max. Volts**
−110	0.1	100
−150	0.5	40
−210	1	40
−220	2	40
−250	5	20
−310	10	10

CONSTANT VOLTAGE/CURRENT		
Model	**Full-Scale Volts**	**Full-Scale Amps.**
DCVS-220	±100	±0.33
DCVS-222	±20	±2.0
DCVS-224	±40	±1.0



DCVS-220

PRECISION VOLTAGE/CURRENT SOURCES

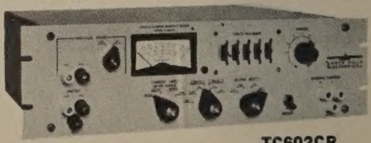
These highly stable and accurate precision sources can be operated in either constant voltage or constant current modes.

All models include such features as manual and remote programming, and output voltage regulation by either local or remote sensing.

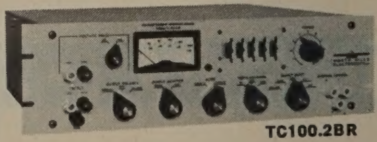
Voltage and current outputs are selected on decade switches whose markings form an in-line digital readout.

Automatic protection limits output voltage and current to safe levels. No voltage or current overshoot occurs during turn-on or turn-off. A warning indicator alerts the operator if the actual output should differ from the dialed setting beyond the specified limits. Models TC-100.2BR and TC-602CR include a panel meter to monitor output current.

Model	Constant Voltage (V)	Constant Current (mA)	Accuracy (%)	Stability (ppm)	Decades
CVS-264	0 to ±100 @ 100 mA max.	0 to ±100 @ 100 V max.	0.1	25	5
TC-100.2 BR	0 to 100 @ 200 mA max.	0 to 100 @ 100 V max.	0.01	5	5 + vernier
TC-602 CR	0 to 60 @ 2 A max.	0 to 2000 @ 60 V max.	0.01	5	5 + vernier



TC602CR



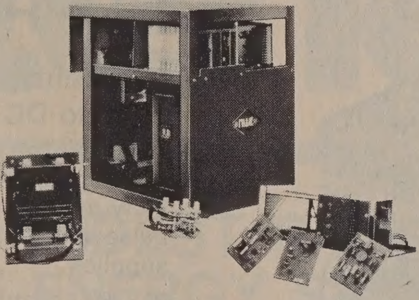
TC100.2BR

North Hills Electronics, INC. GLEN COVE, N.Y. 11542 • 516-671-5700

CUSTOM BUILT AC/DC POWER SUPPLIES, INDUSTRIAL AND LABORATORY TYPES,

TO YOUR SPECIFICATIONS – HIGH OR LOW CURRENT, VOLTAGE OR FREQUENCY, CONSTANT OUTPUT, PRECISE REGULATION FOR SPECIALIZED APPLICATIONS

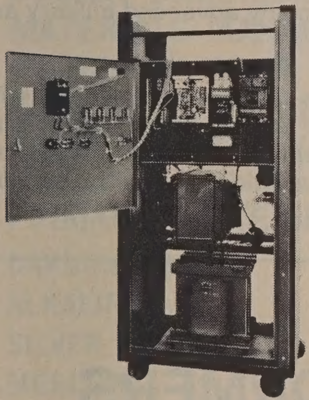
Manufacturing power supplies utilizing forced air, water, natural convection and oil cooling systems; both regulated and non-regulated using saturable reactor; variac or SCR controls.



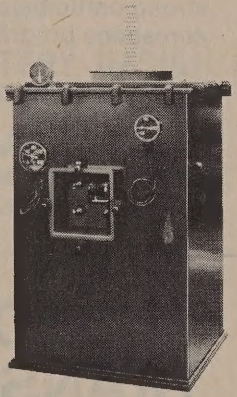
75 KVA water-cooled SCR controlled supply for electric melting furnace.

MANUFACTURING RANGE

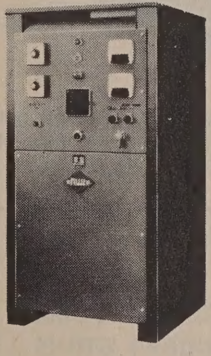
Up to 150 KV
1 ma to 50,000 AMP
4 Hz to 20 Khz
5 KVA to 2000 KVA
50 lb. to 15,000 lb.



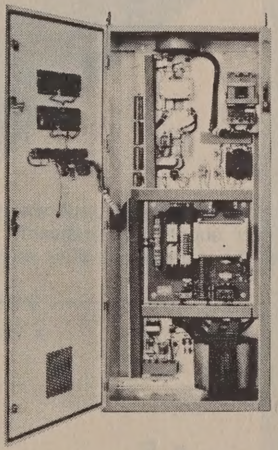
45.5 KVA Saturable Reactor controlled precisely regulated high voltage power supply for sputtering film application.



This unit is typical of our oil-filled power supplies and is rated 45 KV DC at 1 amp output.



Distortion free high current low voltage programmed power supply with precise regulation used for laboratory component testing.



Solid State SCR type Controller with current limiter and spark rate control used with an NWL manufactured Transformer Rectifier set.

NWL also manufactures various types of power transformers, reactors, chokes. See our full page ad in the transformer section of EEM.

Our engineers are available to assist you in selecting magnetic components to meet your application requirements.

NWL TRANSFORMERS

"Manufacturers of the World's Finest Electrical Equipment"

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opt INDUSTRIES INC.

Dept. EM, 300 Red School La.
Phillipsburg, NJ 08865
(201) 454-2600 TWX 510-235-2920

CUSTOM POWER SUPPLIES

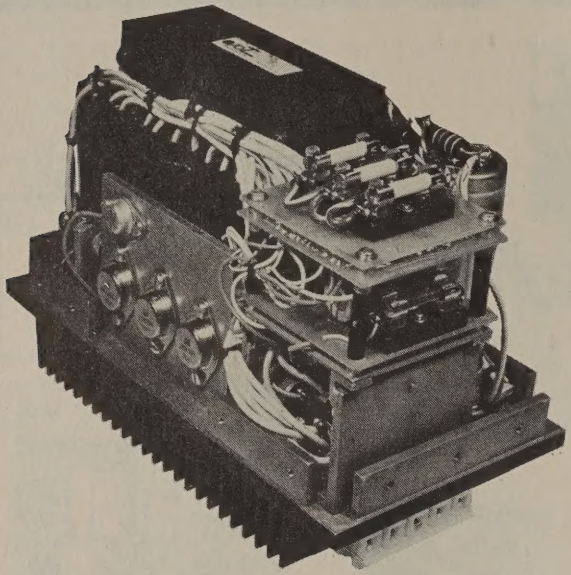
- Switching Regulator
- DC to DC Converter
- Linear
- Ferroresonant

OPT specializes in custom designed high reliability military, and hi-grade commercial linear and pulse width modulated switching regulator power supplies.

At OPT, custom power supplies are professionally designed and skillfully manufactured to achieve outstanding reliability and performance.

Our high quality standards are reflected by our strong participation in many advanced military and aerospace programs.

We would be pleased to discuss your requirements. Our outstanding power supply design team, augmented by our excellent magnetics group, offers seasoned engineering solutions to your power supply requirements.

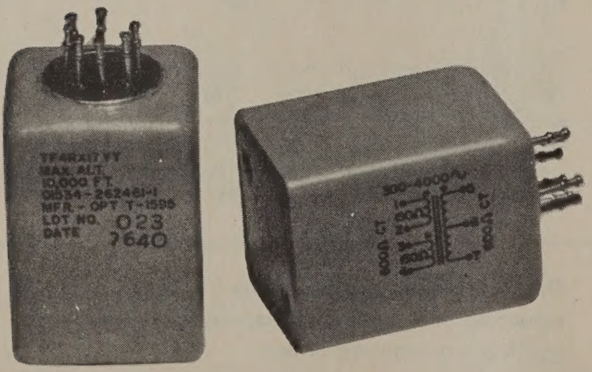


This custom Naval Underwater 3 Phase 400 Hz multiple output power supply was delivered ready for dockside installation exactly eight weeks after receipt of order.

CUSTOM TRANSFORMERS

- MIL-T-27
- MIL-T-16315
- MIL-T-21038
- Quality OEM Commercial Magnetics

OPT offers you one source for all your custom transformer requirements, military and commercial. Our technology and production capability run the full gamut of todays demanding magnetic requirements and include: power, audio pulse, hybrid, D.C. converter, reactor, toroids, ferroresonant, multiphase, high Q coils, magnetic amplifiers and special purpose transformers.



OTHER PRODUCTS

OPT Industries also manufactures custom filters. See our Product Data on this unique line of products in Section 2300 page 2466.

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THE WORLD'S WIDEST RANGE OF PORTABLE ENERGY SYSTEMS

DESIGN ENGINEERS!
MATERIALS MANAGERS!
MATCH UP YOUR BATTERY DESIGN APPLICATIONS
WITH THE PROPER POWER SOURCE
FROM MATSUSHITA ELECTRIC

	APPLICATIONS
PRIMARY BATTERIES	
CARBON ZINC ALKALINE SILVER OXIDE MERCURY LITHIUM	CALCULATORS / RADIOS TAPE PLAYERS / LIGHTS WATCHES SMOKE DETECTORS PHOTO PRODUCTS REFERENCE AND BIAS USES
RECHARGEABLE BATTERIES	
NICKEL CADMIUM GEL CELL LEAD ACID	POWER TOOLS / CALCULATORS COMPUTER MEMORY ALARM AND STANDBY SERVICE PORTABLE APPLIANCES
SOLAR BATTERIES	
SILICON — PLANAR & MESA TYPES POWER GENERATING AND DETECTION DEVICES	REMOTE POWER SUPPLIES DETECTION APPLICATIONS BATTERY CHARGING

ALSO AVAILABLE: AIR AND THERMAL BATTERIES FOR SPECIAL APPLICATIONS

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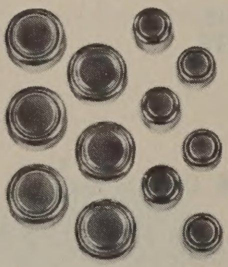
HIGH POWER AND HIGH CURRENT PERFORMANCE / LONG SHELF LIFE AND A BROAD OPERATING TEMPERATURE RANGE

WATCH AND HEARING AID BATTERIES



SILVER OXIDE AND MERCURY SYSTEMS

LITHIUM

LITHIUM
BATTERY

RELIABLE INERT PACKAGING / HIGH ENERGY DENSITY AND CELL VOLTAGE / LONG SHELF LIFE

SPECIFICATIONS — DRY BATTERIES (CARBON - ZINC)

Model	Size	(V)	Dimensions Diam. (inches)	Dimensions Height (inches)	Weight (oz.)	Representative Performance	
UM-1N	D	1.5	1.339	2.421	3.74	540 min. (2Ω 30 min. x 2/D)	54 hrs. (10Ω 4 hrs./D)
UM-1D	D	1.5	1.339	2.421	3.46	385 min. (2Ω 30 min. x 2/D)	38.5 hrs. (10Ω 4 hrs./D)
UM-1	D	1.5	1.339	2.421	3.07	720 min. (4Ω 30 min. x 2/D)	155 hrs. (40Ω 4 hrs./D)
UM-2N	C	1.5	1.024	1.969	1.87	200 min. (2Ω 15 min. x 2/D)	22 hrs. (10Ω 2 hrs./D)
UM-2D	C	1.5	1.024	1.969	1.66	135 min. (2Ω 15 min. x 2/D)	15.5 hrs. (10Ω 2 hrs./D)
UM-2	C	1.5	1.024	1.969	1.59	275 min. (4Ω 30 min./D)	145 hrs. (75Ω 4 hrs./D)
UM-3N	AA	1.5	0.571	1.969	0.67	195 min. (5Ω 15 min. x 2/D)	5.8 hrs. (10Ω 1 hr./D)
UM-3D	AA	1.5	0.571	1.969	0.67	170 min. (5Ω 15 min. x 2/D)	4.9 hrs. (10Ω 1 hr./D)
UM-3	AA	1.5	0.571	1.969	0.53	305 min. (10Ω 30 min./D)	83 hrs. (150Ω 4 hrs./D)
UM-3PZ	AA	1.5	0 571	1.969	0.57	150 min. (5Ω 15 min. x 2/D)	4.8 hrs. (10Ω 1 hr./D)
UM-4D	AAA	1.5	0.413	1.752	0.29	320 min. (15Ω 10 min./D)	
UM-5D	N	1.5	0.473	1.181	0.23	200 min. (15Ω 10 min./D)	
006PD	—	9.0	wide long tall 0.689 x 1.024 x 1.929		1.34	29 hrs. (600Ω 4 hrs./D)	13.4 hrs. (600Ω cont.)
006P	—	9.0	wide long tall 0.689 x 1.024 x 1.929		1.31		37 hrs. (900Ω 4 hrs./D)
006PN	—	9.0	wide long tall 0.689 x 1.024 x 1.929		1.42		28.3 hrs. (600Ω cont.)

SPECIFICATIONS — ALKALINE - Mn BATTERIES

Model	Size	(V)	Capacity (to 0.9V/cell)	Dimensions Diam. (inches)	Dimensions Height (inches)	Weight (oz.)	Rated Drain (mA)
AM-1	D	1.5	31 hrs. (4Ω cont.)	1.339	2.402	5.05	320
AM-2	C	1.5	12.5 hrs. (4Ω cont.)	1.024	1.969	2.58	300
AM-3	AA	1.5	12 hrs. (10Ω cont.)	0.571	1.969	0.88	130
AM-4	AAA	1.5	27 hrs. (50Ω cont.)	0.414	1.752	0.42	25
AM-5	N	1.5	19 hrs. (50Ω cont.)	0.473	1.181	0.35	25
6AM6	—	9	4 hrs. (125Ω cont.)	1.024 x 0.689 x 1.929		1.77	20
PX-825	—	1.5	11 hrs. (50Ω cont.)	0.910	0.240	0.28	25
PX-30	—	3	11 hrs. (100Ω cont.)	0.945	0.492	0.55	25

SPECIFICATIONS — SILVER OXIDE BATTERIES (SILVER)

Model	(V)	Cap. (mAh)	Dimensions Diam. (inches)	Dimensions Height (inches)	Weight (oz.)	Rated Drain (μA)
WS-1	1.55	35	0.311	0.142	0.028	75
WS-6	1.55	60	0.311	0.213	0.043	100
WS-11	1.55	100	0.457	0.165	0.064	100
WS-14	1.55	165	0.457	0.221	0.095	240
WL-1	1.55	38	0.311	0.142	0.028	100
WL-6	1.55	70	0.311	0.213	0.043	100
WL-11	1.55	120	0.457	0.165	0.074	240
WL-14	1.55	190	0.457	0.213	0.099	240

SPECIFICATIONS — MERCURY CELLS

Model	(V)	Cap. (mAh)	Dimensions Diam. (inches)	Dimensions Height (inches)	Weight (oz.)	Standard Drain (mA)	Maximum Drain (mA)
H-A	1.35	40	0.311	0.142	0.03	1	1.5
H-B	1.35	55	0.457	0.138	0.05	1.2	2
H-C	1.35	125	0.457	0.213	0.09	2.5	5
H-D	1.35	225	0.618	0.240	0.16	5	10
H-G	1.35	2,000	1.000	0.670	1.06	20	40
H-J	1.35	2,000	1.213	0.520	1.13	40	60
H-L	1.35	3,000	1.213	0.670	1.52	40	60
H-N	1.35	450	0.646	0.449	0.32	10	20
HM-N	1.4	450	0.646	0.449	0.32	10	20
H-O	1.35	225	0.465	0.579	0.21	5	10
H-P	1.35	800	0.646	0.662	0.49	20	40
H-R	1.35	640	0.473	1.162	0.46	20	35
H-T	1.35	1,850	0.571	1.969	1.06	40	100
H-U	1.35	2,900	0.650	1.969	1.52	80	150
H-Ya	1.35	11,500	1.339	2.402	6.00	310	500

SPECIFICATIONS — Li BATTERIES

Model	Type	(V)	Capacity (mAh)	Dimensions (max.) Diam. (inches)	Dimensions (max.) Height (inches)	Weight (oz.)	Standard Disch. (mA)	Maximum Disch. (mA)
BR-425	Pin	2.8	20	0.165	1.020	0.02	0.5	1
BR-435	Pin	2.8	40	0.165	1.413	0.03	1	2
BR-2325	Coin	2.8	140	0.906	0.098	0.11	0.5	5
LR-1/2A	Cylinder	2.8	750	0.661	0.886	0.335	20	40
LR-2/3A	Cylinder	2.8	1200	0.661	1.315	0.477	35	70
LR-C	Cylinder	2.8	5000	1.024	1.969	1.66	150	300

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RECHARGEABLE BATTERIES

NICKEL CADMIUM

STATE OF THE ART / HIGH RATE, FAST AND STANDARD CHARGE CYLINDRICAL CELLS / SINTERED ELECTRODES AND RESEALABLE VENTS / HUNDREDS OF CYCLES OR LONG STANDBY SERVICE

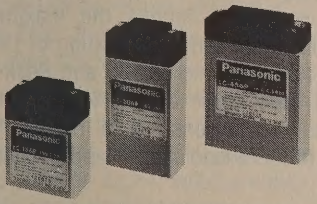
SPECIFICATIONS -- Ni - Cd BATTERIES

Model	(V)	Capacity 5 hr. (mAh)	Dimensions		Weight (oz.)	Quick Charge		Standard Charge	
			Diam. (inches)	Height (inches)		(mA)	(hrs.)	(mA)	(hrs.)
NR-N	1.2	150	0.473	1.181	0.300	38	6	15	15
NR-AAA	1.2	180	0.414	1.752	0.353	45	6	18	15
NR-2/3AA	1.2	250	0.571	1.181	0.424	75	4.5	25	15
NR-AA	1.2	500	0.571	1.988	0.742	150	4.5	50	15
NR-1/2SC	1.2	600	0.906	1.044	0.988	150	6	60	15
NR-1/2C	1.2	800	1.024	1.221	1.518			80	15
NR-SC	1.2	1,200	0.906	1.693	1.589	300	6	120	15
NR-C	1.2	1,800	1.024	1.969	2.471			180	15
NR-D	1.2	4,000	1.299	2.402	4.942			400	15
NR-F	1.2	6,000	1.339	3.583	8.119			600	15
NR-SC.H	1.2	1,200	0.906	1.693	1.589			40	48 up
NR-C.H	1.2	1,800	1.024	1.969	2.471			60	48 up
NR-D.H	1.2	4,000	1.299	2.402	4.942			133	48 up

SPECIFICATIONS — LEAD - ACID BATTERIES

Model	(V)	Capacity (Ah)	Dimensions			Weight (oz.)	Remarks
			(inches) long	(inches) wide	(inches) tall		
LC-156	6	1.5 (10h. rate)	2.60	1.30	3.347	13.4	
LC-306	6	3.0 (10h. rate)	2.60	1.30	4.921	23.3	
LC-456	6	4.5 (10h. rate)	3.701	1.30	4.921	32.5	
LC-606	6	6.0 (10h. rate)	3.583	1.929	4.528	42.4	
LC-756	6	7.5 (10h. rate)	4.528	1.929	4.528	53.0	
TY-355C	6	3.0 (5h. rate)	2.60	1.30	4.921	23.3	Special use
4-TY-355C	24	3.0 (5h. rate)	2.756	5.355	5.118	95.3	Special use
TY-360-1	12	9.0 (3h. rate)	1.890	9.528	7.284	169.4	Special use
LCB-350	12	3.5 (5h. rate)	8.386	4.961	2.166	77.7	Liquid Electrolyte Special use

GEL CELL LEAD ACID



USABLE IN ANY POSITION / GELLED CONTROLLED ELECTROLYTE / LEAD CALCIUM GRIDS / EXCELLENT CAPACITY, CHARGE RETENTION AND CYCLE LIFE

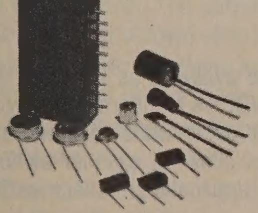
SPECIFICATIONS — SILICON PHOTO - VOLTAIC DETECTOR

Model	Type	Element Size (inch)	Active Area (inch²)	Open Circuit Voltage (mV)	Short Circuit Current (μA)	Conjunction Capacity (pF)	Response Time		Remarks
							Rise Up (μS)	Fall Down (μS)	
BP-4M	Mesa	0.16φ	0.018	380	80	2030	16	17	
BP-4MC	Mesa	0.16φ x 0.31	0.018	380	80	2030	16	17	Phenol
BP-35K	Mesa	0.12 x 0.2	0.021	380	100	2400	18	19	
BP-5S	Mesa	0.2 x 0.2	0.036	380	170	3450	21	23	
BP-5SA	Mesa	0.2 x 0.2 x 0.4	0.036	380	170	3450	21	23	Phenol
BP-410K	Mesa	0.16 x 0.4	0.057	380	270	4500	27	29	
BP-8M	Mesa	0.32φ	0.074	380	360	6100	32	35	
BP-10S	Mesa	0.4 x 0.4	0.147	380	600	9500	37	39	
BP-2SPC	Planar	0.08 x 0.08	0.004	450	22	450	7	7	Glass Seal
BP-2SPM	Planar	0.08 x 0.08	0.004	460	35	450	7	8	Resin Mold
BP-2SPL	Planar	0.08 x 0.08	0.004	470	50	450	7	8	Lens Glass Seal
BP-3SPC	Planar	0.12 x 0.12	0.011	450	55	780	13	13	Glass Seal
BP-3SPM	Planar	0.12 x 0.12	0.011	460	75	780	13	14	Resin Mold
BP-3SPL	Planar	0.12 x 0.12	0.011	470	80	780	13	13	Lens Glass Seal
BP-2SPS	Planar	0.08 x 0.08	0.004	450	20	400	5	5	Ceramic Stem
BP-24KPS	Planar	0.09 x 0.15	0.010	450	45	760	7	7	Ceramic Stem
BP-3SPS	Planar	0.12 x 0.12	0.011	450	50	780	8	8	Ceramic Stem
BP-4SPS	Planar	0.15 x 0.15	0.018	450	80	1300	10	10	Ceramic Stem
Remarks				$T_a=25°C$ $=77°F$	$T_a=25°C$ $=77°F$	$V_R=0V$ $f=1MHz$	$V_R=0V$ $R_L=1k\Omega$	$V_R=0V$ $R_L=1k\Omega$	

SOLAR CELLS

SPECIFICATIONS — SILICON SOLAR CELLS

Model (Unit Module)	Dimensions (inches)	Peak Power		
		V	mA	mW
BP-M260	1.023 Dia.	0.42	119	50
BP-M500	1.969 Dia.	0.45	420	189
BP-2040K	0.787 x 1.575 Rect.	0.45	173	78



SILICON POWER GENERATING AND DETECTION DEVICES

"PANAQUICK" QUICK CHARGE CONTROL MODULES FOR NICKEL CADMIUM AND LEAD ACID SYSTEMS

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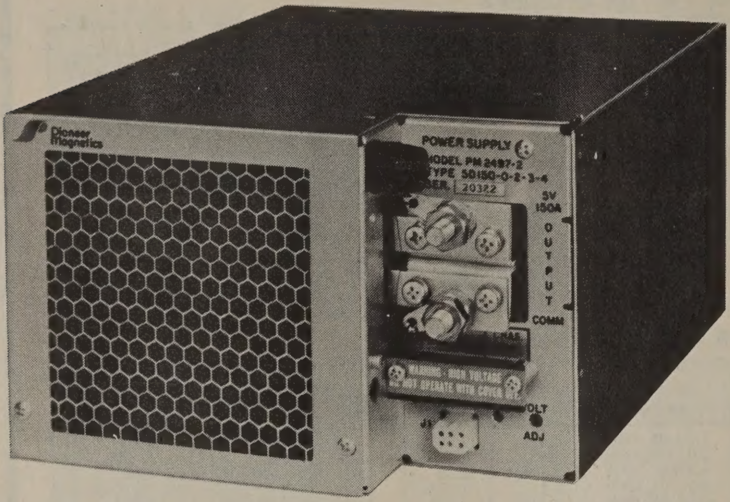
Brownoutproof Switching Power Supplies: the Dependables.



Features:

- ☐ Widest range of brownout protection
- ☐ 30 mS output holdup after input power loss with full load
- ☐ Full output rating at 50°C ambient
- ☐ 60% to over 80% efficiency
- ☐ Soft start
- ☐ Shortcircuit proof
- ☐ Overvoltage protection
- ☐ Designed to meet or recognized to UL478 and CSA154
- ☐ MTTR less than 15 minutes
- ☐ Field proven MTBF over 40,000 hours for slot supplies

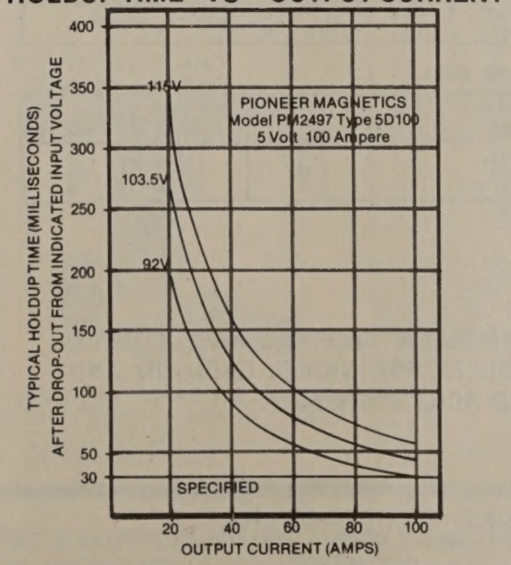
The Dependables

The Dependables are a family of single and multiple output, high current, switching regulated power supplies designed primarily for OEM digital applications where superior dynamic load and line performance is required. Their low RFI/EMI radiation and low output ripple (less than 3 mV peak-to-peak, 60 and 120 Hz ripple) also makes them attractive for analog applications.

Brownoutproof = More Uptime

Beyond inherent advantages of switching supplies over linear types (i.e., high efficiency, low weight and small size), the Dependables are uniquely immune to most utility power variations. They can supply their specified regulated outputs at full load over input variations from 92 to 138 or 184 to 250 VAC; and they'll continue to do so for several minutes even if input voltages drop to 70 or 140 VAC.

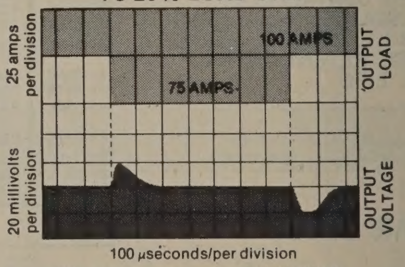
HOLDUP TIME VS OUTPUT CURRENT



Easy to Specify

Unique to the Dependables is a worst-case method of specifying voltage regulation that simplifies the design engineer's task by giving a known limit to cumulative tolerances. This limit – 2% – defines the maximum deviation from a set value from any combination of Drift, Line Regulation, Static and Dynamic Loads, and Peak-to-Peak Noise and Ripple. Well within this ±2% total error band, the typical transient response of a 5 Volt 100 Ampere supply to a 25 Ampere load step is approximately 20 mV.

TYPICAL TRANSIENT RESPONSE TO 25% LOAD STEP



This is the response of a Model PM2497, 5 Volt, 100 ampere unit to a 25 ampere load step.

DC to DC Units Too

The Dependables are also available as DC input versions with 24, 48, 120 or 240 VDC as standard source voltages. Pioneer Magnetics can provide units that operate from both AC and DC sources allowing ease of switching to battery back-up for UPS applications. Check with us for further information.

Our Experience

Since 1958 Pioneer Magnetics has specialized in the design and manufacture of switching power supplies. A continual development program ensures that every switching supply we manufacture is properly designed, conservatively rated and thoroughly tested. Only then do we feel it has earned the name: the Dependables.

SINGLE OUTPUT POWER SUPPLIES

AC-Input Units: 92 to 138 or 184 to 250 VRMS (specify choice), other ranges available on request, single phase, 47 to 63 Hz. Will regulate through line dips to 70 or 140 VRMS.

DC-Input Units:

NOMINAL VOLTAGE	INPUT RANGE
24	22-31
48	42-54
120	100-145
220	200-250

Output: *

AC INPUT MODEL	PM2496	PM2497	PM2498	OUTPUT VOLTAGE ADJUSTMENT RANGE
DC INPUT MODEL	PM2721	PM2722	— — —	
OUTPUT VOLTAGE	OUTPUT CURRENT	OUTPUT CURRENT	OUTPUT CURRENT	
2	100	200	400	1.5-2.5
3	60	100	200	2.5-3.5
5	50	100	200	4.5-5.5
5	60	120	—	4.5-5.5
5	—	150	300	4.5-5.5
12	25	60	120	10.8-13.2
15	25	50	100	12.8-15.8
18	22	45	90	15.3-18.9
21	18	38	76	17.9-22.1
24	16	33	66	20.4-25.2
28	13	27	54	23.8-29.4
48	8	16	32	42.0-50.0
SIZE (INCHES) WEIGHT	5 x 8 x 11 16 pounds	5 x 8 x 11 18 pounds	5 x 16 x 11 35 pounds	

*Other output volt/amp combinations are available.

Total Error Band: ±2% (±100 mV for 2 and 3-volt units) including the following:

Input power variation over the specified range.
Static loads from 0 to 100%.
Dynamic Load Steps (10 μsec rise) 25% on 5 VDC units, up to 90% on higher voltage units.
Ripple and switching spikes.
Temperature stability over full operating range 0° to 50°C.
Drift for an 8-hour period following initial warmup.

Overshoot: No turn-on or turn-off overshoot.

Power Loss Holdup: For AC-input units only. Output will remain within regulation 30 milliseconds after loss of AC input when operating at full load and nominal line.

Overvoltage Protection: Overvoltage shutdown, to protect the load, is provided and set at 125% ±10% of rated output. An additional overvoltage crowbar is available as an option.

Overload Protection: All units are protected against overload and short-circuit. The output recovers automatically from over-current shutdown after load fault is removed.

Overtemperature Protection: Automatically shuts unit down in the event of overtemperature condition.

Reverse Voltage Protection: Supply is protected against reverse voltage applied across the output terminals.

Remote Sense: Standard on all units. Handles up to one volt drop in the output leads.

Input Fuse: Standard on all units.

EMI: Meets VDE 0875 Level N requirements for input conducted EMI with external filter.

Environmental: Temperature, operating: 0° to 50°C at 100% rated power, derates linearly to 80% of rated power at 71°C.

Size and Weight: See output chart.

MULTIPLE OUTPUT POWER SUPPLIES

Standard Multiple Output Power Supply with the flexibility to meet your exact custom requirements.

Specifications similar to single-output with the following additions and changes.

Outputs: Up to four completely isolated outputs. Either polarity can be chosen for each output. See chart below.

<table>
<tr><td colspan="2">AC INPUT MODEL</td><td colspan="2">PM2675</td><td colspan="2">PM2676</td><td>PM2677</td><td colspan="2">PM2678</td></tr>
<tr><td colspan="2">DC INPUT MODEL</td><td colspan="2">PM2775</td><td colspan="2">PM2776</td><td>PM2777</td><td colspan="2">PM2778</td></tr>
<tr><td colspan="2">MAXIMUM TOTAL OUTPUT POWER IN WATTS</td><td colspan="2">375</td><td colspan="2">600</td><td>750</td><td colspan="2">850 (see note 1)</td></tr>
<tr><td rowspan="2">MAIN CHANNEL (see note 2)</td><td>OUTPUT VOLTAGES AVAILABLE</td><td colspan="7">2, 3, 5, 12, 15, 18, 21, 24, 28, 48</td></tr>
<tr><td>MAXIMUM POWER IN WATTS (see note 3)</td><td colspan="2">250</td><td colspan="2">500</td><td>600</td><td colspan="2">750</td></tr>
<tr><td rowspan="2">SECOND CHANNEL</td><td>OUTPUT VOLTAGE</td><td>5</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td><td>28</td></tr>
<tr><td>OUTPUT CURRENT MAX. (see note 4)</td><td>10</td><td>10</td><td>10</td><td colspan="4">(see note 5)</td></tr>
<tr><td rowspan="2">THIRD CHANNEL</td><td>OUTPUT VOLTAGE</td><td>5</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td><td>28</td></tr>
<tr><td>OUTPUT CURRENT MAX. (see note 4)</td><td>7</td><td>7</td><td>7</td><td colspan="4">(see note 5)</td></tr>
<tr><td rowspan="2">FOURTH CHANNEL</td><td>OUTPUT VOLTAGE</td><td>5</td><td>12</td><td>15</td><td>18</td><td>21</td><td>24</td><td>28</td></tr>
<tr><td>OUTPUT CURRENT MAXIMUM</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td><td>3</td><td>3</td></tr>
</table>

Note 1: Brownout capability reduced for this Model.

Note 2: Main channel must maintain 50 watt minimum load so that other channels regulate properly.

Note 3: Maximum power for 2 and 3 volt outputs is 60% figure given.

Note 4: Check with factory for higher current ratings.

Note 5: Check with factory for current ratings on these and other special voltages.

Overvoltage Protection: Automatic overvoltage protection is provided on the main channel as standard. OVP on other channels can be provided as an option. Overvoltage crowbar is optionally available for the main channel.

Remote Sense: Standard on main and channels two and three.

Size: 5'' x 8'' x 11¾'' (PM2677 and PM2678 add 1-9/16'' for external fan).

Weight: 20 pounds.

Options

- Power Fail Signal
- Logic Inhibit
- True Inhibit
- OV Crowbar
- Remote Programming ±5%
- Local Margin Check
- Remote Margin Check to ±10%
- Paralleling
- Reverse Input Protection (DC-input units)
- Output Out of Tolerance
- Output Power Good
- Sequencing (Multiple-output units)
- Additional outputs
- Automatic battery backup and charging
- Additional EMI filtering

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SEALED RECHARGEABLE LEAD-ACID STANDARD CELLS AND BATTERIES

SPECIAL BATTERY CONFIGURATIONS AVAILABLE ON SPECIAL ORDER

D CELLS

Button-Top

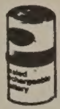


FIG. 1

1—Tab

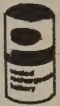


FIG. 2

2—Tab

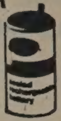


FIG. 3

Product No.	Voltage	Capacity (A.H.)		Discharge Current at 10 Hr. Rate	Length	Dia.	Weight	Fig.
		20 Hr. Rate	10 Hr. Rate					
0810-0001	2	2.7	2.5	250ma	2.46	1.35	6.4 oz.	1
0810-0002	2	2.7	2.5	250ma	2.58	1.35	6.4 oz.	2
0810-0003	2	2.7	2.5	250ma	2.58	1.34	6.4 oz.	3

X CELLS

Button-Top

FIG. 1

1—Tab

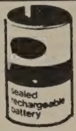


FIG. 2

2—Tab

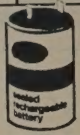


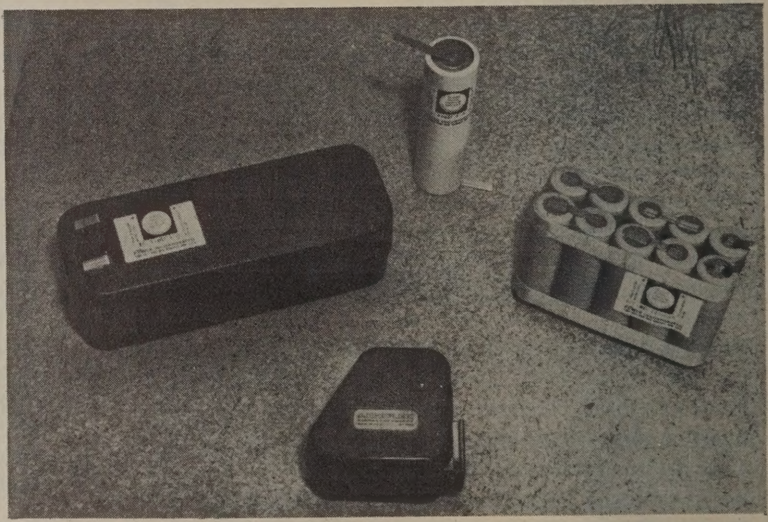
FIG. 3

Product No.	Voltage	Capacity (A.H.)		Discharge Current at 10 Hr. Rate	Length	Dia.	Weight	Fig.
		20 Hr. Rate	10 Hr. Rate					
0800-0001	2	5.2	5.0	500ma	2.91	1.74	13.4 oz.	1
0800-0002	2	5.2	5.0	500ma	3.1	1.74	13.4 oz.	2
0800-0003	2	5.2	5.0	500ma	3.1	1.74	13.4 oz.	3
25 amp hour	2	25	25	2.5 amp	6.5	2.5	59,5	3

CUSTOM REPLACEMENT BATTERIES for the PHOTOGRAPHIC INDUSTRY

Power Incorporated is capable of supplying you faster, because we have over 10,000 cell and battery sizes in our stock (pictured are only four). We are manufacturers of nickel - cadmium batteries for those involved in the photographic industries. Let us replace your worn batteries with a rechargeable nickel - cadmium battery by Power Incorporated. We guarantee our products and can meet your demands on a day to day basis.

Our specialty is manufacturing new rechargeable nickel - cadmium batteries . . . but we are also equipped to rebuild dead batteries . . . send us your dead battery . . . we can rebuild it at a lower cost.



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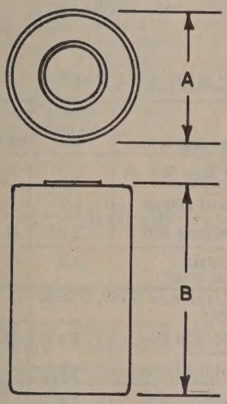


FIG. A

TYPICAL CYLINDRICAL CELLS (FIG. A) 1.2 VOLTS PER CELL

Type	Capacity mAH	Dimensions (in.) A	Dimensions (in.) B	Wt. (oz.)
110SC	110	0.574	0.702	0.3
150SC	150	0.475	1.135	0.4
170SC	170	0.643	0.656	0.4
180SC	180	0.405	1.730	0.4
200SC	200	0.673	0.655	0.5
225SC	225	0.675	0.646	0.4
250SCS	250	0.565	1.165	0.5
450SC	450	0.675	1.120	0.7
500SC	500	0.554	1.920	1.0
600SC	600	0.625	1.920	1.0
750SC	750	1.020	0.910	1.1
900SC	900	0.562	3.532	1.4
1000SC	1000	1.000	1.280	1.1
1200SC	1200	0.875	1.600	1.5
1800SC	1800	1.000	1.840	2.5
2000SC	2000	1.272	1.400	2.8
4000SC	4000	1.289	2.300	4.6
7000SC	7000	1.290	3.490	7.6
10,000SC	10,000	1.683	4.218	12.5

Oval cell also available (Fig. C) in 4000 mAH, W-2.080, T-1.260 and H-1.656. Wt. 0.37 oz.

All battery configurations available with pressure contact buttons or solder lug terminals.

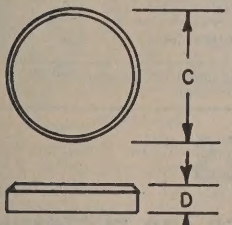


FIG. B

TYPICAL BUTTON CELLS (FIG. B) 1.2 VOLTS PER CELL

Type	Capacity mAH	Dimensions (in.) C	Dimensions (in.) D	Wt. (oz.)
20B	20	0.449	0.201	0.04
50B	50	0.606	0.230	0.09
100B	100	0.984	0.240	0.28
150B	150	0.984	0.260	0.30
180VBH*	180	0.984	0.290	0.39
225B	225	0.984	0.339	0.41
225BH*	225	0.984	0.347	0.44
250VBH*	250	1.340	0.210	0.58
400B	400	0.992	0.571	0.66
450B	450	1.689	0.299	1.10
500BH*	500	1.340	0.374	0.90
1000VBH*	1000	2.000	0.330	2.24
2000VBH*	2000	2.000	0.590	3.50

*H denotes high rate discharge capability.

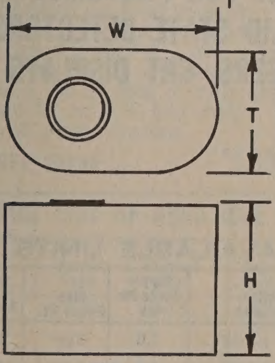


FIG. C

ALSO MARKETS:

- Emergency lighting units.
- Flashlight and lantern rechargeable batteries.
- Custom and prototype design battery packs built to your specifications.
- Battery chargers for all types of batteries.
- Batteries - NICKLE CADMIUM - SILVER CADMIUM - SILVER ZINC - MERCURY - SEALED LEAD-ACID.

All cylindrical and oval battery types feature a pressure safety device for security and reliability making them especially suited for cordless consumer and electronic products.

CUSTOM BATTERY PACKS

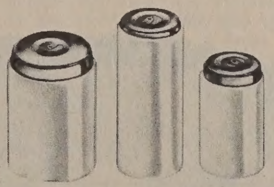
Cylindrical cells are incased in a rigid, high impact case. Case materials are highly dielectric to provide maximum cell insulation at minimum cost. The case is vented to each cell to provide cooling and long life. Packs are available to your specifications in any voltage.

FAST CHARGE CELLS

Special fast charge cells are available on special order either individually or in custom battery packs with thermistors for extra fast recharge capability.

Button cell batteries are constructed of sealed nickle cadmium button cells (see fig. B) to meet almost any application requirement. The compact size of button cells permits easy stacking to form multiple cell batteries of optimum power/volume ratio and space utilization. Completely sealed button cells are ideally suited for portable radios, flashlights, photoflash, alarms, and any low-drain, high capacity application.

TYPICAL BUTTON CELL BATTERIES



INVESTIGATE direct current emergency power sources available in any regulated voltage or current, featuring automatic SCR solid state switchover to a self-contained battery. We have the answer to reliable economical D.C. power with automatic emergency back-up.

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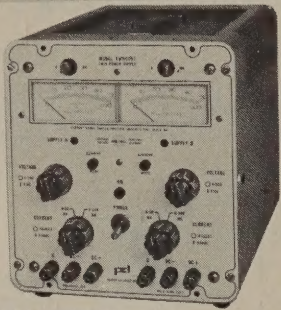
LABORATORY POWER SUPPLIES

SINGLE OUTPUT

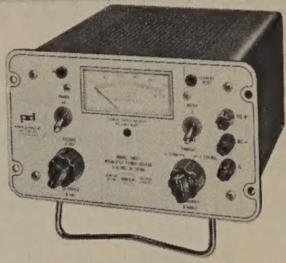
Model 5015T
5¾″ w x 8⅝″ h x 10⅞″ d

DUAL OUTPUT



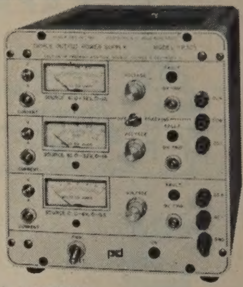
Model TW5005T
7¾″ w x 8⅝″ h x 13½″ d

SINGLE OUTPUT



Model 5005T
8⅜″ w x 4¾″ h x 9″ d

TRIPLE OUTPUT



Model TP325
7¾″ w x 8⅝″ h x 13½″ d

• Laboratory workhorse power supplies with over 12 years of field history • Continuously adjustable voltage, current or current limiting controls with limiter or current mode indicating lamps • No RFI generating SCR or switching circuits • Modular package construction suitable for bench or rack mounting • Processed under a "Predictable Reliability" Program for 5-year minimum operation to published specifications. This program features: Avalanche-controlled rectifiers, 100% stress testing of transistors, preaged zener references with maximum I/F noise specifications, computer grade capacitors, low T.C. 1% tin oxide film resistors in critical circuits, etc. • Supplies are burned in under full load for a minimum of 50 hours prior to test.

PARTIAL LIST OF AVAILABLE UNITS

Model	Voltage	Current Amps.	Voltage Regulation	Current Regulation	Ripple Pk to Pk mV	Case	*PRICE
5005T	0-50	0-0.5	0.005% +1 mV	better than 500 μA	1.0	A	$164.50
2015R	0-20	0-1.5	+0.03% or 5 mV†	0.02% or 200 μA	1.0	A	$195.00
5015T	0-50	0-1.5	+0.01% or 3 mV†	current limit only	1.0	B	$259.00
TW5005T (dual)	0-50, 0-.5 A each output		each output same as 5005T	each output same as 5005T	1.0	C	$319.00
TP330 Triple Output	Same as Model TP325 except 6V supply replaced with 0-15V, 0-2.5A. For COS/MOS applications.						$435.00
4050	* 0-40	0-5.0	0.01% +3 mV	current limit only	3.0	C	$349.50
1120S	0-120	0-1.0	0.01% +3 mV	current limit only	1.0	C	$324.50
*TP325 Triple Output	**0-32	0-1A	.01% +1 mV	adj. current limit	1.0	C	$420.00
	**0-32	0-1A	.01% +1 mV	adj. current limit	1.0		
	0-6	0-5A	.01% +1 mV per amp	adj. current limit	2.0		

†Whichever is greater
*Built-in adj. overvoltage crowbar

**Tracking or non-tracking operation by panel switch with common output terminal

HIGH VOLTAGE POWER SOURCES

CALIBRATED POWER SOURCES FOR PHOTOMULTIPLIER PROPORTIONAL AND SOLID STATE DETECTORS, ELECTRON OPTICS, LASERS, CRT DISPLAYS

MODEL 1556B

Calibrated high voltage power sources supplying tightly regulated DC for critical applications where stability, low noise and reliability are of prime consideration. • .25% calibration accuracy • 10 MV resolution • Sealed transformers and rectifiers • Self-restoring overload and short circuit protection • All solid state except for "Series" Pass Tube • Voltage and current metering.

PARTIAL LIST OF AVAILABLE UNITS

Model	Voltage	Current mA	Regulation Line or Load	Ripple Pk to Pk mV	Size Panel Ht.	*PRICE
2K20	1-2012	0-20	0.001% +2 mV	1.0	3½″	$370.00
1570	1-3012	*0-40	0.001% +2 mV	1.0	5¼″	$575.00
1556B	10-6021	0-20	0.001% +2 mV	1.0	7″	$750.00
1543A	10-10021	0-10	0.001% +2 mV	5.0	10½″	$995.00
**3K10B	10-3000	0-10	.001% +3 mV	3.0	3.0″	$390.00

**All Solid State. Write for specification sheets.
*Adj. current limiting 5-40 mA.

*Prices subject to change without notice • F.O.B. Westbury, N.Y.

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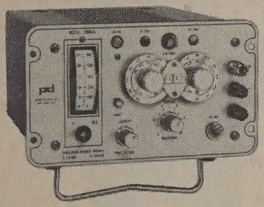
TECHNICAL DATA

CALIBRATED POWER SOURCES

CALIBRATED, STABLE, LOW NOISE, HIGH RESOLUTION POWER SOURCES FOR PRECISION LABORATORY APPLICATIONS

0-20 VDC/0-500 mA

MODEL 2005A

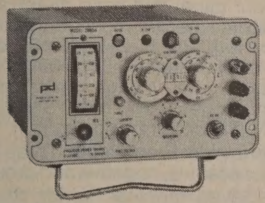


***$370.00**

• Two dual concentric switches (four decades) and a calibrated potentiometer provide digital readout to five significant figures • A toggle switch provides readout to six figures above 10 volts • Last-place potentiometer has 10 μV resolution • Source impedance is less than two milliohms at DC, less than 0.5 ohms at 1 MHz • Recovery time is less than 25 microseconds to return within a 100 μV band of the programmed voltage for an 80% load change • Front and rear access terminals.

• Better than 0.1% calibration accuracy • Critical components in temperature stabilized oven • 10 PPM plus 100 μV stability for 8 hours • Temperature coefficient better than 10 PPM or 50 μV per °C • Self-restoring overload and short circuit protection with adjustable current limit control and flashing limit indicator • 100 μV maximum peak-to-peak ripple (250 μV on Model C400) • Solid silver decade switch contacts • 100 hour minimum burn-in prior to calibration • Individual calibration data furnishd with each unit • Provisions for remote sensing and remote resistance programming at 1000 Ω/volt • Voltage or current metering.

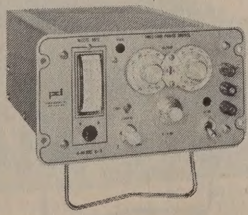
0-20 VDC/0-2 A



• Two dual concentric switches (four decades) and a calibrated potentiometer provide digital readout to five significant figures • A toggle switch provides readout to six figures above 10 volts • Last-place potentiometer has 10 μV resolution • Source impedance is less than two milliohms at DC, less than 0.5 ohms at 1 MHz • Recovery time is less than 25 microseconds to return within a 100 μV band of the programmed voltage for an 80% load change • Front and rear access terminals.

MODEL 2020A ***$395.00**

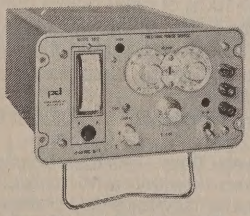
0-40 VDC/0-1 A



• Two dual concentric switches (4 decades) and a calibrated 10-turn potentiometer provide calibrated readout to six significant figures • Sixth place interpolation with 10 microvolt resolution • Dial accuracy is 0.1% plus one millivolt below one volt, 0.1% from one to forty volts • Front and rear access terminals • Bail/carrying handle tilts front panel for viewing ease • Electrical characteristics similar to Model 2005A.

MODEL 4010 ***$395.00**

0-100 VDC/0-400 mA



• Two dual concentric switches (4 decades) and a calibrated 10-turn potentiometer provide calibrated readout to six significant figures • Sixth place interpolation with 10 microvolt resolution • Dial accuracy is 0.1% plus one millivolt below one volt, 0.1% from one to 100 volts • Front and rear access terminals • Bail/carrying handle tilts front panel for viewing ease • Electrical characteristics similar to Model 2005A.

MODEL C400 ***$395.00**

PARTIAL LIST OF AVAILABLE PRECISION POWER SOURCES

Model	Range Volts	Current Amps	Regulation Line/Load	Max. Ripple Pk to Pk	Stability	TC Per °C	Size	Special Features	*Price
2005A	0-20	0-0.5	.0005% +100 μV	100 μV	.001% +100 μV/8 hrs.	.001% or 50μV	8⅜ x 4¾ x $8\frac{27}{32}$	4 decade readout with .1% accuracy. Continuous current limiting with panel pushbutton setting. Remote programmable 1000Ω/V.	$370.00
2020A	0-20	0-2.0	.0005% +100 μV	100 μV	.001% +100 μV/8 hrs.	.001% or 50μV	8⅜ x 4¾ x $11\frac{9}{16}$	4 decade readout with .1% accuracy. Remote programmable 1000Ω/V.	$395.00
4010	0-40	0-1.0	.0005%	100 μV	.001% +100 μV/8 hrs.	.001% or 50μV	8⅜ x 4¾ x $11\frac{9}{16}$	Same as 2020A.	$395.00
C400	0-100	0-0.4	.001% +100 μV	250 μV	.001% +100 μV•8 hrs.	.001% or 50μV	8⅜ x 4¾ x $11\frac{9}{16}$	4 decade readout with 1% accuracy. Continuous current limiting. Remote programmable 1000Ω•V.	$395.00
3K10B	10- 3000	0-0.01	.001% or 3 mV	3 mV	.005% +1V•8 hrs.	.005%	3 x 8½ x 11½	Calibrated readout to ¼%. Arc and short circuit proof.	$390.00

POWER DESIGNS

POWER DESIGNS INC.
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

* F.O.B. Westbury, New York
Prices subject to change
without notice.

POWER DESIGNS PACIFIC INC.
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

TECHNICAL DATA

Uniply®

A Laboratory of Power Supplies in a Single Package

The UNIPLY® principle involves a regulator technique that provides a general purpose power source functionally replacing four conventional power supplies.
The regulator system comprises a number of unregulated DC sources, a number of power semiconductors selected for optimum voltage and current characteristics and a single control amplifier which selects through "OR" gates that combination of unregulated source and power semiconductors that satisfy the demands of the load and the panel control settings with minimum power supply losses.
Ranging is automatic and transient-free. Operation is electronic, without relays or manual switching and utilizes linear circuits only. No triacs, SCR's or switching circuits are employed.

A built-in front panel continuously adjustable overvoltage "crowbar" in conjunction with an inhibit switch limiting the automatic ranging to 6 volts provides completely safe operation with digital circuit loads. The UNIPLY® technique permits increased power supply capability with increasing AC line voltages. Up to 150% of panel ratings is available at line voltages over 105 volts. Useful output at reduced levels is available at line voltages as low as 85 volts. A flashing panel indicator signals loss of regulation if load demands exceed the regulator capability or AC input voltages are inadequate.
Two voltage and current ranges are provided on the taut-band suspension panel meter to increase resolution. Ranges switch automatically with range switch setting.

Model 6050A: 0-7V at 5A / 0-15V at 3A / 0-25V at 2A / 0-60V at 1A *$249.00

SPECIFICATIONS

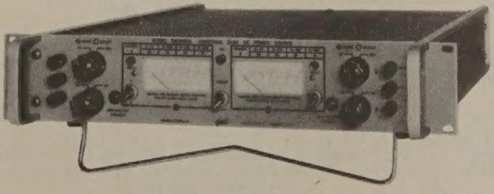
Input: 105-125 volts, 57-440 Hz, 100 watts nominal.
Line Regulation: 0.01% + 1 millivolt.
Load Regulation: 0.01% + 1 millivolt for load variations from 0-100% of rated output current.
Polarity: Either positive or negative output terminal may be operated at ground potential
Ripple and Noise: Less than 1 millivolt peak-to-peak.
Source Impedance: <0.005 Ω at DC, 0.1 Ω to 20 KHz, 1.0 to 1 MHz.
Recovery Time: Less than 50 microseconds to return to within a 15 millivolt band of the original voltage for a step change in rated load of 10% to 100% (1 microsecond rise time).
Stability: 0.02% +3 millivolts per 24 hours.
Operating Temperature: 0-50°C at full load. Storage: −20°C to +85°C.
Temperature Coefficient: 0.02% per degree C.
Current Limiting: Concentric switch/potentiometer provides continuous adjustment in two ranges: 0-500 milliamperes, 0-5 amperes.
Metering: Front panel taut-band meter and a selector switch permit monitoring voltage or current with an accuracy of ±3% of full scale. Voltage ranges 0-6V/0-60V change automatically with voltage range control. Current ranges 0-500 mA/0-5A change automatically with current range control.
Output Terminals: Front Panel: Three binding posts for positive, negative and ground.
Rear Panel: Seven terminal barrier strip for output voltage, sensing, voltage programming and parallel operation.
Dimensions: 8⅜" wide x 4¾" high x 11⁹⁄₁₆" deep.
Weight: 15½ lbs.
Overvoltage Crowbar: Built-in overvoltage crowbar adjustable from 2.0 V to 70 V from the front panel.

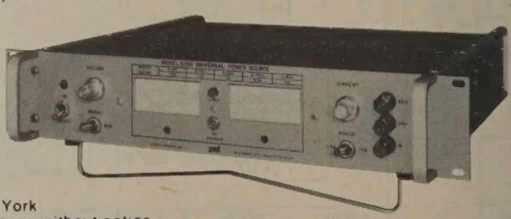
Model TW6050A: TWO MODEL 6050A SOURCES IN A 3-1/2" x 19" RACK MOUNTING PACKAGE *$449.00

More compact than two Model 6050A units, the Model TW6050A offers two independent sources which are electrically identical to the Model 6050A, but permit series operation to 120 V at 1 ampere or parallel operation to 7V at 10 amperes.

Model 6150: 0-7V at 15A / 0-15V at 7.5A 0-25V at 5A / 0-60V at 2A * $370.00

The Model 6150 offers more than twice the output power of the Model 6050A, with essentially the same electrical characteristics. Two taut-band meters are provided. Each instrument has two voltage and current ranges 0-6V/0-60V, 0-1.5A/0-15A. Ranges switch automatically with range switch setting. The Model 6150 mounts in a 19" rack, measures 3½"H x 16"D and is suitable for laboratory bench operation as well.





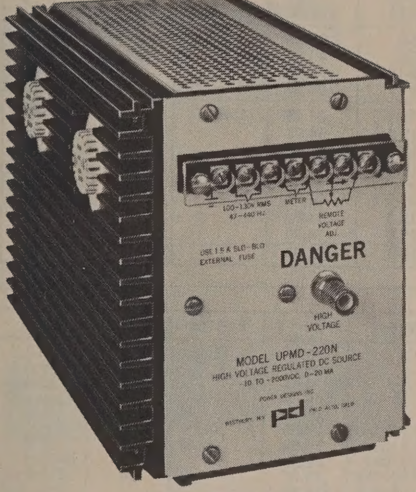
* FOB Westbury, New York
Prices subject to change without notice

POWER DESIGNS

POWER DESIGNS INC.
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

POWER DESIGNS PACIFIC INC.
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

MODULAR HIGH VOLTAGE PRECISION POWER SOURCES



10-2000 VDC, 0-20 MA
10-3000 VDC, 0-10 MA
10-5000 VDC, 0-5 MA

The UPMD series of high voltage sources are compact modular units designed for critical applications where high stability, low noise and flexibility of output voltage control are important considerations.

They are ideal for such applications as photomultipliers, Geiger-Muller counters, proportional detectors, CRT sources, high resolution video displays, electrostatic lenses, etc.

Remote control of the high voltage output is achieved by means of an external potentiometer operating at low potentials with respect to ground. Output voltage resolution is a function of the resolution of this control. Options are available for remote voltage control at any desired input/output voltage ratio or for digital operation with an external D/A converter.

A unique overvoltage/arc suppression system is incorporated to protect the supply and its load in the event of loss of output voltage control or an overvoltage due to L di/dt transients generated by sustained load arcing. The circuit operates to clamp the output voltage to approximately 200 volts above any setting, hold this clamp for approximately two seconds and shutting down the supply electronically if the fault persists. The supply may be manually reset by momentary interruption of the AC line.

An internal 1% multiplier permits connection of an external meter for monitoring. A zener diode across the metering terminals minimizes shock hazard.

The compact size (4½″ x 6″ x 7½″), excluding the high voltage connector and light weight (8 lbs.) is achieved through the use of high frequency inverter technology in conjunction with a fast series regulator. RFI and EMI is held to low levels through the use of careful shielding and low pass AC line and DC output filters.

High voltage transformers and high voltage components encapsulated in readily replaceable epoxy modules. Low voltage components are accessible on epoxy coated PC boards.

An SHV (Safety High Voltage) BNC receptacle is utilized for the output voltage. A mating connector is furnished with each unit.

Characteristics

INPUT: 105-125 V, 47-440 Hz, 60 w (115 V line)

OUTPUT: See Table

REGULATION: .001% or 10 MV (whichever is greater), for line or load variations.

NOISE AND RIPPLE: 10 MV peak-to-peak to 1 MHz

STABILITY: Less than .01% or 15 MV (whichever is greater)

TEMPERATURE: 0-50°C

TEMPERATURE COEFFICIENT: Less than 50 PPM/°C

PROTECTION: Current limiter and overvoltage system limits output to safe levels.

SIZE: 4½″ x 6″ x 7½″

WEIGHT: 8 lbs.

MOUNTING: In any plane

Table

MODEL	*OUTPUT POLARITY	VOLTAGE RANGE	OUTPUT CURRENT	**UNIT PRICE
UPMD-220N	NEGATIVE	10-2000 VDC	0-20 MA	$385.00
UPMD-220P	POSITIVE	10-2000 VDC	0-20 MA	395.00
UPMD-310N	NEGATIVE	10-3000 VDC	0-10 MA	385.00
UPMD-310P	POSITIVE	10-3000 VDC	0-10 MA	395.00
UPMD-550N	NEGATIVE	10-5000 VDC	0-5 MA	440.00
UPMD-550P	POSITIVE	10-5000 VDC	0-5 MA	450.00

*Corresponding output terminal connected to chassis. **Subject to change without notice. FOB Westbury, N.Y.

OPTIONS		
	1. Remote voltage programming (specify ratio)	**$50.00**
	2. Isolation up to 250V above chassis	**$50.00**

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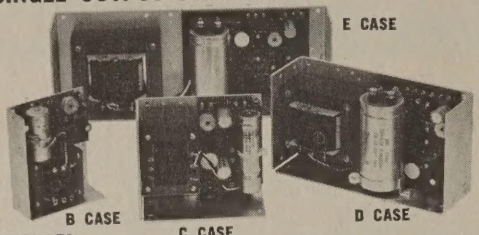
Dept. EM
531 Dawson Dr., Camarillo, CA 93010
Phone: (805) 484-2806 TWX: 910-336-1297

POWER-ONE, INC.
DC POWER SUPPLIES

Compare These Important Features . . . Discover For Yourself Why Power-One Is Number-One

- 67 Standard Stocked Models — The industry's most comprehensive OEM product line.
- All models are deliverable from stock — call your local Power-One Stocking Center for fast delivery.
- All units UL recognized.
- Full 2 year warranty — transferable to your customer.

SINGLE OUTPUT STANDARD

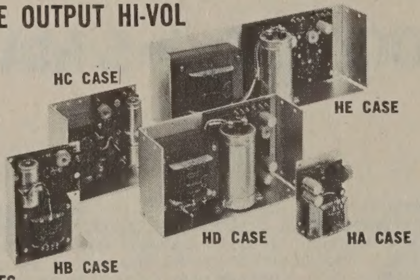


FEATURES

- ±.02% Regulation
- Remote Sensing
- Foldback Current Limit
- Industry Standard Size
- Full Rated to 50°C
- I.C. Regulated Design
- Reverse Voltage Protection
- Remote Programming Capability
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9	Voltage	Current	Model	Price 1-9
5 VOLTS	3.0 6.0 12.0 18.0	B5-3 C5-6 D5-12 E5-18	$24.95 44.95 74.95 104.95	18 VOLTS	1.3 2.6 5.2 7.8	B24-1.2 C24-2.4 D24-4.8 E24-7.2	$24.95 44.95 74.95 104.95
6 VOLTS	3.0 6.0 12.0 18.0	B5-3 C5-6 D5-12 E5-18	24.95 44.95 74.95 104.95	20 VOLTS	1.3 2.6 5.2 7.8	B24-1.2 C24-2.4 D24-4.8 E24-7.2	24.95 44.95 74.95 104.95
12 VOLTS	1.7 3.4 6.8 10.2	B15-1.5 C15-3 D15-6 E15-9	24.95 44.95 74.95 104.95	24 VOLTS	1.2 2.6 5.2 7.2	B24-1.2 C24-2.4 D24-4.8 E24-7.2	24.95 44.95 74.95 104.95
15 VOLTS	1.5 3.0 6.0 9.0	B15-1.5 C15-3 D15-6 E15-9	24.95 44.95 74.95 104.95				

SINGLE OUTPUT HI-VOL

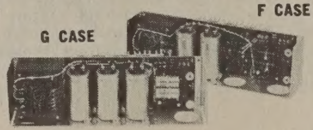


FEATURES

- 115/230 VAC Input
- OVP on 5V Models
- ±.05% Regulation
- Industry Standard Size
- Foldback Current Limit
- Full Rated to 50°C
- I.C. Regulated Design
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9	Voltage	Current	Model	Price 1-9
2 VOLTS	3.0 6.0 12.0 18.0	HB2-3 HC2-6 HD2-12 HE2-18	$29.95 49.95 79.95 109.95	24 VOLTS	1.2 2.4 4.8 7.2	HB24-1.2 HC24-2.4 HD24-4.8 HE24-7.2	$24.95 44.95 74.95 104.95
5 VOLTS	1.2 3.0 6.0 12.0 18.0	HA5-1.2/OVP HB5-3/OVP HC5-6/OVP HD5-12/OVP HE5-18/OVP	22.95 24.95 49.95 79.95 114.95	28 VOLTS	1.0 2.0 4.0 6.0	HB24-1.2 HC28-2 HD28-4 HE28-6	24.95 44.95 74.95 104.95
12 VOLTS	0.5 1.7 3.4 6.8 10.2	HA15-0.5 HB12-1.7 HC12-3.4 HD12-6.8 HE12-10.2	22.95 24.95 44.95 74.95 104.95	48 VOLTS	0.5 1.0 3.0 4.0	HB48-0.5 HC48-1 HD48-3 HE48-4	32.00 49.95 79.95 109.95
15 VOLTS	0.5 1.5 3.0 6.0 9.0	HA15-0.5 HB15-1.5 HC15-3 HD15-6 HE15-9	19.95 24.95 44.95 74.95 104.95	175-210 VOLTS 240-260 VOLTS	0.12 0.1	HB200-0.12 HB250-0.1	34.95 34.95

SINGLE OUTPUT HIGH POWER



FEATURES

- 115/230 VAC Input
- 53%-66% Efficiency
- True Master/Slave Operation
- ±.01% Regulation
- Remote Programming Capability
- Foldback Current Limit
- Remote Sensing
- OVP on 5V Models
- TTL Controlled Inhibit
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9
5 VOLTS	25 35	F5-25/OVP G5-35/OVP	$149.00 185.00
12 VOLTS	16	F15-15	149.00
15 VOLTS	15	F15-15	149.00
24 VOLTS	12	F24-12	149.00
28 VOLTS	10	F24-12	149.00

SINGLE OUTPUT HIGH EFFICIENCY

RG CASE
RD CASE
RE CASE

FEATURES

- Efficiency up to 66%
- Ultra-Reliable Linear Design
- RFI/EMI Free Operation
- 30μ Second Transient Response
- Extended Low Line "Brown-Out" Capability
- High Packaging Density
- Full Rated to +50°C
- OVP on all Models

Model 5 Volts	DC Output Current — Efficiency @ Nominal Line AC Input: 105-125 VAC Standard	AC Input: 98-125 VAC Extended	AC Input: 91-125 VAC Extended	Price 1-9
RD5-15/OVP	9A, 66% 12A, 63% 15A, 60%	9A, 64% 12A, 58%	9A, 61%	$99.95
RE5-23/OVP	14A, 63% 18A, 60% 23A, 57%	14A, 61% 18A, 55%	14A, 58%	130.00
RG5-40/OVP	25A, 63% 32A, 60% 40A, 57%	25A, 61% 32A, 55%	25A, 58%	220.00

DIMENSION CHART

Case Size	Dimensions, Inches	Case Size	Dimensions, Inches	Case Size	Dimensions, Inches
HA	3.75 x 3.0 x 1.6	F, G, RG	16.75 x 4.87 x 5.0	CBB, HCBB	11.0 x 4.87 x 3.2
B, HB	4.87 x 4.0 x 2.1	AA, HAA, HTAA	6.5 x 4.0 x 2.1	DBB, HDBB	14.25 x 4.87 x 3.2
C, HC	5.62 x 4.87 x 2.95	BB, HBB	7.0 x 4.87 x 2.95	CP-131	11.0 x 4.87 x 3.2
D, HD, RD	9.0 x 4.87 x 3.2	CC, HCC	9.38 x 4.87 x 3.2	OVP-12	1.6 x 1.6 x 0.7
E, HE, RE	14.0 x 4.87 x 3.2	BAA, HBAA	10.25 x 4.0 x 2.95	OVP-24	2.8 x 2.0 x 0.9

- 2 hour burn-in — all units undergo:
  1. Full function test.
  2. Minimum 2 hour burn-in
  3. Final full functional test.

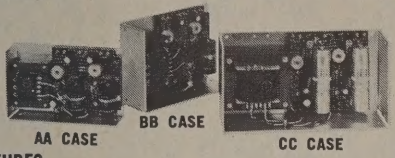
Discounts:

Liberal discounts are offered to quantity buyers. OEM contracts available. Consult Power-One of your local factory representative for a prompt quotation.

Dept. EM
531 Dawson Dr., Camarillo, CA 93010
Phone: (805) 484-2806 TWX: 910-336-1297

POWER-ONE, INC.
DC POWER SUPPLIES

DUAL OUTPUT STANDARD ±0.1% Tracking Accuracy

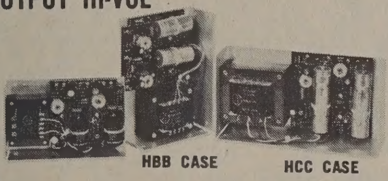


FEATURES

- Tracking Outputs
- Remote Sensing
- ±.02% Regulation
- Foldback Current Limit
- Remote Programming Capability
- I.C. Regulated Design
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9
±12 VOLTS	1.0/1.0	AA15-0.8	$42.95
	1.7/1.7	BB15-1.5	53.95
	3.4/3.4	CC15-3	84.95
±15 VOLTS	0.8/0.8	AA15-0.8	42.95
	1.5/1.5	BB15-1.5	53.95
	3.0/3.0	CC15-3	84.95

DUAL OUTPUT HI-VOL

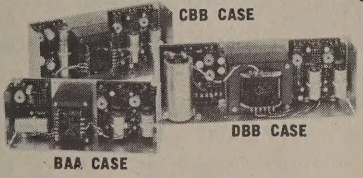


FEATURES

- 115/230 VAC Input
- OVP on 5V Outputs
- ±.05% Regulation
- Foldback Current Limit
- I.C. Regulated Design
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9
±5 VOLTS	3.0/3.0	HBB5-3/OVP	$61.95
	6.0/6.0	HCC5-6/OVP	92.95
±12 to 15 VOLTS	1, 0.8/1,0.8	HAA15-0.8	39.95
	1.7, 1.5/1.7, 1.5	HBB15-1.5	49.95
	3.4, 3.0/3,4, 3.0	HCC15-3.0	79.95
5 VOLTS and 9-15 VOLTS (ISOLATED OUTPUTS)	2.0/0.5	HAA512	44.95
	3.0/1.25	HBB512	54.95
	6.0/2.5	HCC512	86.95

TRIPLE OUTPUT STANDARD ±0.1% Tracking Accuracy

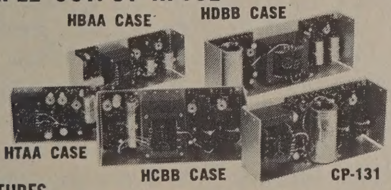


FEATURES

- Tracking Regulators (Dual Output Section)
- Remote Sensing
- Remote Programming Capability
- ±.02% Regulation
- Foldback Current Limit
- I.C. Regulated Design
- Two Hour Burn-in
- Two Year Warranty

Voltage	Current	Model	Price 1-9
5 VOLTS and ±12 VOLTS	3.0/1.0/1.0	BAA-40W	$69.95
	6.0/1.7/1.7	CBB-75W	91.95
	12.0/1.7/1.7	DBB-105W	126.95
5 VOLTS and ±15 VOLTS	3.0/0.8/0.8	BAA-40W	69.95
	6.0/1.5/1.5	CBB-75W	91.95
	12.0/1.5/1.5	DBB-105W	126.95

TRIPLE OUTPUT HI-VOL

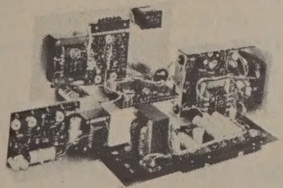


FEATURES

- 115/230 VAC Input
- OVP on 5V Outputs
- ±.05% Regulation
- Foldback Current Limit
- I.C. Regulated Design
- Two Hour Burn-in
- Two Year Warranty

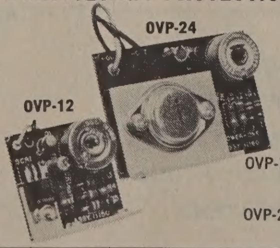
Voltage	Current	Model	Price 1-9
5 VOLTS and ±12 VOLTS	3.0/1.0/1.0	HBAA-40W	$69.95
	6.0/1.7/1.7	HCBB-75W	91.95
	8.0/1.7/1.7	CP-131	110.00
	12.0/1.7/1.7	HDBB-105W	126.95
5 VOLTS and ±15 VOLTS	3.0/0.8/0.8	HBAA-40W	69.95
	6.0/1.5/1.5	HCBB-75W	91.95
	8.0/1.5/1.5	CP-131	110.00
	12.0/1.5/1.5	HDBB-105W	126.95
5 VOLTS and ±9-15 VOLTS	2/.2/.2	HTAA-16W	49.95

CUSTOM DESIGNS



Power-One is an experienced manufacturer of custom power supplies for high quantity applications requiring special electrical and mechanical configurations. We excell at open-frame multiple output designs, regulated or unregulated.

OVERVOLTAGE PROTECTION



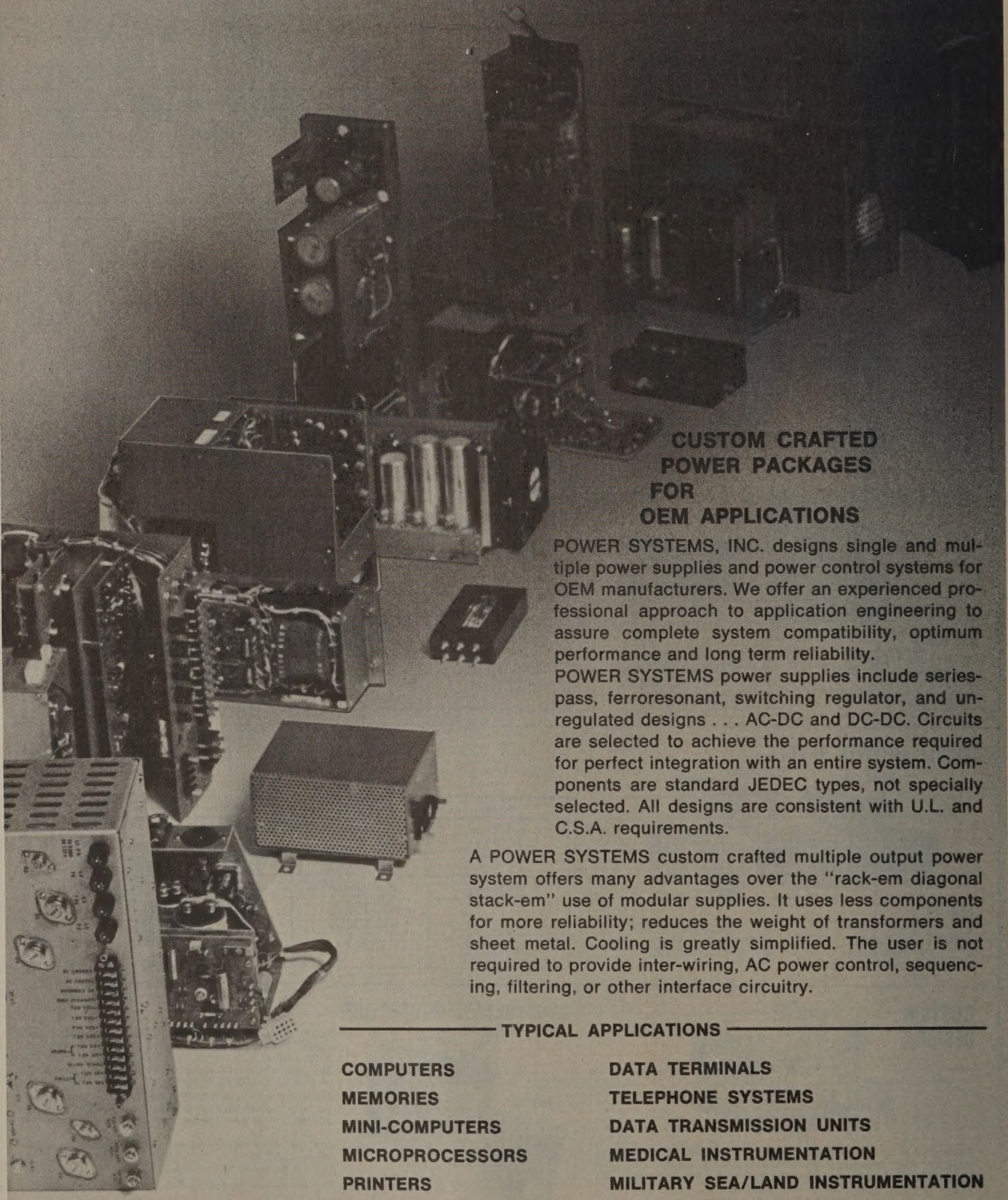
These optional Overvoltage Protection modules are available for use with any power supply NOT supplied with built-in OVP. Each is adjustable from 6.4V to 36V and should be used when maximum load protection is of prime importance.

Mounting holes are provided on all chassis for these modules, which mount within the specified outline dimensions of each power supply.

OVP-12	For use on all models except E & F case sizes. When used on ±9V thru ±15V models, one OVP-12 protects both outputs.	$7.95
OVP-24	For use on E & F case models.	14.95

Power Systems inc

12 Tobey Road
Bloomfield, CT 06002
(203) 243-0357



CUSTOM CRAFTED POWER PACKAGES FOR OEM APPLICATIONS

POWER SYSTEMS, INC. designs single and multiple power supplies and power control systems for OEM manufacturers. We offer an experienced professional approach to application engineering to assure complete system compatibility, optimum performance and long term reliability.

POWER SYSTEMS power supplies include series-pass, ferroresonant, switching regulator, and unregulated designs . . . AC-DC and DC-DC. Circuits are selected to achieve the performance required for perfect integration with an entire system. Components are standard JEDEC types, not specially selected. All designs are consistent with U.L. and C.S.A. requirements.

A POWER SYSTEMS custom crafted multiple output power system offers many advantages over the "rack-em diagonal stack-em" use of modular supplies. It uses less components for more reliability; reduces the weight of transformers and sheet metal. Cooling is greatly simplified. The user is not required to provide inter-wiring, AC power control, sequencing, filtering, or other interface circuitry.

TYPICAL APPLICATIONS

COMPUTERS
MEMORIES
MINI-COMPUTERS
MICROPROCESSORS
PRINTERS
DATA TERMINALS
TELEPHONE SYSTEMS
DATA TRANSMISSION UNITS
MEDICAL INSTRUMENTATION
MILITARY SEA/LAND INSTRUMENTATION

Power Systems inc

Power supplies
are available with
the following specifications:
Additional details are listed in
the POWER SYSTEMS short form catalog.

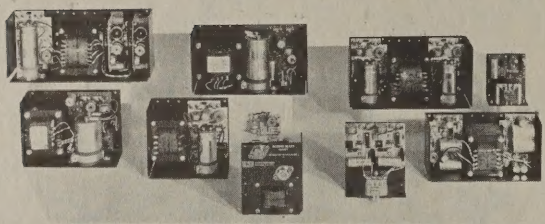
Outputs	Voltages (VDC)	Current (Amps)	Power (Watts)
1	5 to 48	0.5 to 105	6 to 525
2	5 to 48	0.25 to 25	6 to 840
3	5 to 200	0.05 to 50	30 to 770
4	5 to 200	0.5 to 90	45 to 750
5 or more	5 to 48	0.3 to 50	45 to 3245

POWER SYSTEMS, INC. 12 Tobey Road, Bloomfield, CT 06002 (203) 243-0357

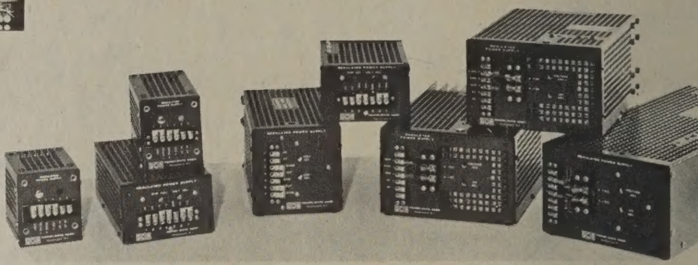
The Power/Mate power supply

When you can't afford failure, you can't afford less!

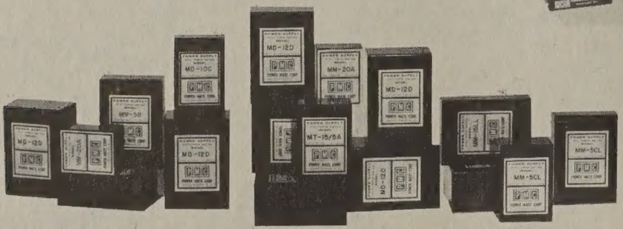
The First Switching Supplies Designed For Reliability!



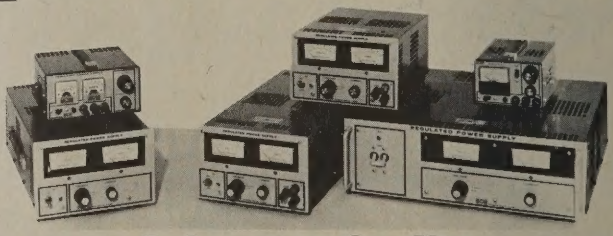
The Open-Frame Supplies With 33% More Power!



The Modular Supplies That Are A Generation Ahead!



Mini Size, Mini Price, Maximum Performance!



Laboratory Quality At Production Prices!

The Power Supply Catalog
Power/Mate Corp.

Send for our FREE catalog of over 1,000 power supplies. All stocked in-depth for same day shipment !

PMC **Power/Mate Corp.**

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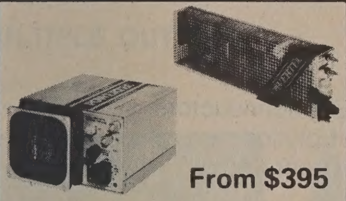
POWERTEC
D.C. POWER SUPPLIES

POWERTEC, INC.
9168 DeSoto Ave., Chatsworth, Calif. 91311
(213) 882-0004 · TWX (910) 494-2092

- **Write or phone for complete details**
- **Prices and specifications subject to change without notice.**

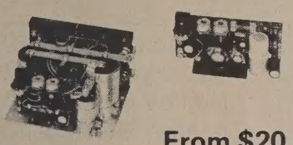


From $395

SUPERSWITCHER SERIES switching power supplies offer 5V @ 150A in the industry "standard" forced-air SuperSwitcher™ model (9N) and 5V @ 50A in the new convection cooled Contortionist model (9E). Both models offer other voltages with efficiencies to 80%.
FEATURES: Input line tolerance of +10/-20%. 24 hour burn-in. Logic inhibit standard. 9N: 6000 units field proven in 4 years. 9E: Versatile package with 5 new protective features, patents pending.

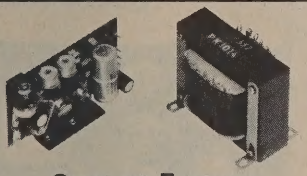
From $29.00

OEM II SERIES, a second generation open-frame design, offers the industry's widest choice of package configurations with 10 single and 6 multiple output sizes to choose from. Added to this series are 4 new 8-10V units.
FEATURES: IC regulated design. Adjustable current limiting. Metal film resistors. All hermetic power semiconductors. Multi outputs fully isolated and interconnectable in any positive/negative configuration. 115/230V input and electrostatic shield, standard.



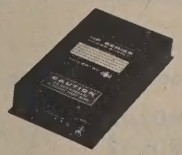
From $20

SM SERIES sub-modular DC power supplies are available for assembly of "off-the-shelf" custom power supplies by user or Powertec. 59 models in 10 basic power packages offer outputs from 1.2V to 30V, and up to 75A.
FEATURES: Built-in rectifier, filter, regulator. Adjustable voltage, current limit and OVP. Logic inhibit function. Remote sensing and programming. Computer-grade capacitors. Associated transformers, heatsinks and thermostats also available.



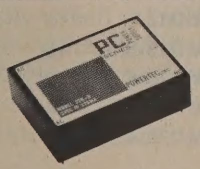
Contact Factory

PK SERIES power supplies combine sub-modules (SM Series) in kit form with a custom input transformer to provide an almost unlimited variety of multiple outputs, each at the required voltage and current.
FEATURES: Minimum number of components. Completely engineered, tested, and documented. Maximum form factor flexibility. Easily spared and maintained. Sub-modules, heatsinking and transformer are only components required. Minimal assembly costs.



From $475

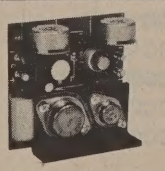
HP SERIES militarized regulated DC power modules are designed to meet airborne specifications and applications with a flat pack modular concept.
FEATURES: Up to 28V, up to 120A. 30 different models. Series regulated design. Excellent power/cost ratios. High power density, up to 5 watts/in^3. 3Ø, 400Hz input.



From $30

PC SERIES

- Fixed DC Voltage
- PC Card Mountable
- Single/Dual Output
- Potted Construction
- 5-24 VDC to 1A



From $16.95

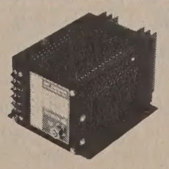
DCR SERIES

- DC Voltage Regulators
- Up to 24 VDC
- Up to 12A
- 2 Power Ratings

From $56.35

XR SERIES

- 3 Package sizes
- Single/Dual output
- Up to 36V
- Up to 3A
- Built-in OVP



From $138

SR SERIES

- 4 Package Sizes
- Up to 28V
- Up to 35A
- Built-in OVP
- 55°C Full Rated

CUSTOM POWER SUPPLIES

Powertec Maintains a Strong Applications Group and an Innovative Engineering Staff for Modified Standard and Custom Designs.

REACOR INC

STANDARD OEM POWER MODULES

SPECIFICATIONS

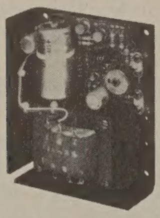
A.C. Input: 115/230 ± 10% Volts, 47-440 Hz
Regulation: 0.1% Line, 0.1% Load
Ripple: 1mv RMS, 3mv Peak to Peak
Temperature Coefficient: 0.03%/°C
Ambient Operating Temperature: Full Output 0-50°C, Derate Linearly to 50% of full Output at 71°C
Storage Temperature: —55°C to +85°C
Overload Protection: Foldback Current Limiting w/Automatic Recovery, Adjustable on all Models except "B" Size.
Output Adjustment: ±5%

FEATURES

I.C. Regulation
Hermetically Sealed Semiconductors
Computer Grade Electrolytics
Remote Sensing and Programming
Screw Terminal Outputs
Automatic Series or Parallel Operation
Logic Inhibit Function — TTL Compatible
Screen Covers Available
Liberal Quantity Discounts
5 Year Warranty

SINGLE OUTPUT

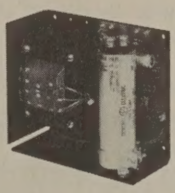
Case B



Model	Volts	Amps
RMB2-3	2	3
RMB5-3	5	3
RMB6-2.5	6	2.5
RMB9-2	9	2
RMB12-1.6	12	1.6
RMB15-1.4	15	1.4
RMB20-1	20	1.2
RMB24-1	24	1
RMB28-1	28	0.8

PRICE: $32.00

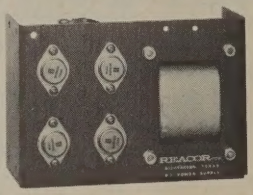
Case C



Model	Volts	Amps
RMC2-6	2	6
RMC5-6	5	6
RMC6-5	6	5
RMC9-4	9	4
RMC12-3.3	12	3.3
RMC15-2.8	15	2.8
RMC20-2.4	20	2.4
RMC24-2.2	24	2.2
RMC28-2.0	28	2

PRICE: $54.00

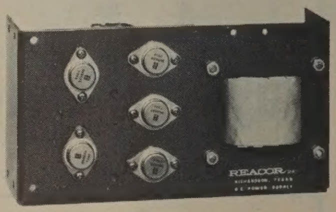
Case CC



Model	Volts	Amps
RMCC2-9	2	9
RMCC5-9	5	9
RMCC6-8.5	6	8.5
RMCC9-7	9	7
RMCC12-5.7	12	5.7
RMCC15-4.8	15	4.8
RMCC20-3.8	20	3.8
RMCC24-3.3	24	3.3
RMCC28-3.1	28	3.1

PRICE: $67.00

Case D



Model	Volts	Amps
RMD2-12	2	12
RMD5-12	5	12
RMD6-10	6	10
RMD9-8.5	9	8.5
RMD12-7	12	7
RMD15-6.3	15	6.3
RMD20-5.2	20	5.2
RMD24-5	24	5
RMD28-4.2	28	4.2

PRICE: $87.00

OPTIONS

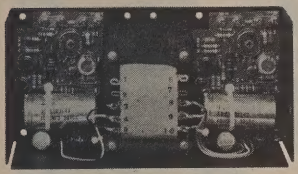
Built-In Over Voltage protection **$8.00**	Built-in Over Voltage protection **$8.00**	Built-in Over Voltage protection **$8.00**	Built-in Over Voltage protection **$8.00**
Shielded Transformer. **$2.50**	Shielded Transformer **$2.50**	Shielded Transformer **$2.50**	Shielded Transformer **$2.50**
Screen Cover **$2.50**	Screen Cover **$3.00**	Screen Cover **$4.50**	Screen Cover **$6.00**

Add Dept. EM to address to tell them you saw it in eem

REACOR INC

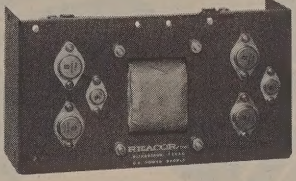
STANDARD OEM POWER MODULES

MULTIPLE OUTPUT



Case K Dual Output

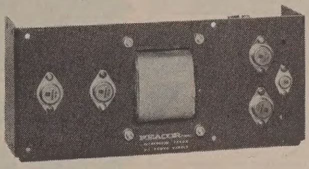
Select any two outputs from Case B single output table eg: +5 Volts at 3 Amps and —9 Volts at 2 Amps. Outputs are supplied floating



Case L Dual or Triple Output

Select from the following combinations of outputs. (See single output tables for voltage and current values)

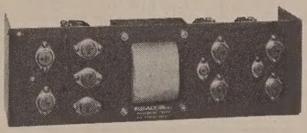
a/ 2 Size "C" outputs
b/ 1 Size "C" & 1 Size "B" output
c/ 3 Size "B" outputs



Case R Dual/Triple/Quadruple Outputs

Select from the following combinations of outputs (See single output tables for voltage and current values)

b/ 1 Size "C" & 2 Size "B" outputs
c/ 4 Size "B" outputs



Case S Dual/Triple/Quadruple/5 & 6 Outputs

Select from the following combinations of outputs (See single output tables for voltage and current values)

a/ 2 Size "D" outputs
b/ 1 Size "D" & 2 Size "C" outputs
c/ 1 Size "D" & 3 Size "B" outputs
d/ 4 Size "C" outputs
e/ 2 Size "C" & 3 Size "B" outputs

HOW TO ORDER MULTIPLE OUTPUT SUPPLIES

a) Specify case size and outputs eg: R(5V, 6A), (15V, 1.4A), (15V, 1.4A) describes a multiple supply which will deliver + 5 Volts at 6 Amps, ± 15 Volts, 1.4 Amps.

b) Model Numbers will be assigned sequentially and can be assigned in advance.

c) To Determine Price:

Output Cost	Case Factor	Shielded Transform.	Screen Cover
B Size $26	K Size $10	$2.50	$ 5.00
C Size $38	L Size $10	$2.50	$ 8.00
CC Size $52	R Size $20	$2.50	$10.00
D Size $68	S Size $20	$2.50	$12.50

Overvoltage Protection — $8.00 per output
Dual ± outputs require only one OVP.

Add Total Cost for Outputs Used + Add Case Factor + Add Cost for Options = Total Price

---

REACOR INC
718 Lingco Dr.
Richardson, Texas 75080
(214) 231-7218

CUSTOM POWER SOURCES

Reacor specializes in custom designed power sources, such as ferroresonant and switching supplies. We will supply you a complete quotation in three days or less and can ship most prototypes within two weeks.

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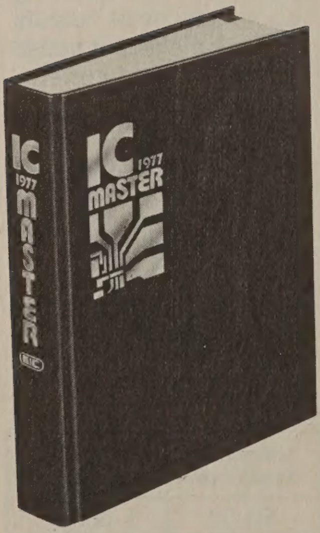
THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
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- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
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switching power supplies

- MTBF'S OF 126,000 HOURS
- OVER 50,000 SWITCHERS DELIVERED
- 11 YEARS EXPERIENCE IN SWITCHING POWER SUPPLIES
- 100% BURN-IN TO PREVENT INFANT MORTALITIES
- ONLY COMPUTER GRADE COMPONENTS
- VACUUM EPOXY IMPREGNATED MAGNETICS
- 90/110/220/240 VAC INPUTS AVAILABLE

SINGLE OUTPUTS

Volts DC	Amps	Model	Price
1.5–6.0	5	105	$99.
5.0	1	ET13	77.
	5	105	99.
	10	210	245.
	25	325	320.
	50	705	495.
	100	710	595.
	120	712	650.
6.0	5	105	99.
	20	325C	320.
6–12	3	108	99.
6–28	1.5	106	109.
12	3	108	99.
12–15	2.5	107	99.
	4	250	260.
	10	350	320.
16–23	1.5	106	109.
24–28	1.5	106	109.
	2	251	260.
	5	351	320.
30	5	351C	320.

DUAL OUTPUTS

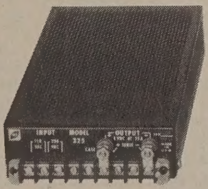
Volts DC	Amps	Model	Price
±12	±.200	ET-21	$77.
±12 to ± 15	±.750	115	99.
	±3	302	395.
±15	±.200	ET-24	77.

MULTI OUTPUTS

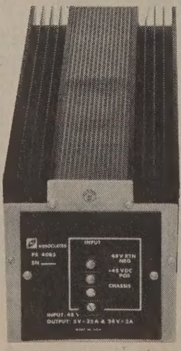
Volts DC@Amps	Model	Price
5V@.6A & ±12V@.100A	ET-31	$91.
5V@.5A & ±15V@.060A	ET-32	91.
5V@5A & ±15V@.400A	213	345.
5V@5A & 24V@1.0A	211	275.
5V@10A & 12V@2A	314	375.
5V@12A & 12V@1A	316	375.

DC TO DC CONVERTERS

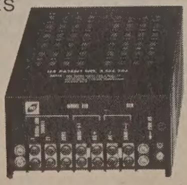
Input	Volts DC	Amps	Model	Price
12VDC	5	50	460	$450
48VDC	5	10	2105	395.
48VDC	5	50	4505	550.
48VDC	12–15	4	2505	405.
48VDC	±12–±15	±12	4525	750.
48VDC	24–28	2	2515	405.
48VDC	24–30	12	4545	550.
48VDC	5 @	25	4585	750.
	24–30 @	5		



300 SERIES

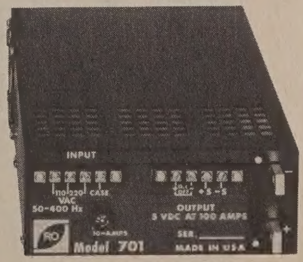


4000 SERIES



200 and 2000 SERIES

100 SERIES



700 SERIES

ET SERIES

5 year warranty

Call or write for complete catalog

RO ASSOCIATES, INCORPORATED
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- SHORT CIRCUIT PROTECTED
- NO DERATING THROUGH +71°C
- MTBF 150,000 HOURS AT 25°C

The **SQ** and **P741 Series** incorporate the same reliable design and manufacturing techniques used in the high performance **P and SP5900 Series** described on catalog page 15. The smaller sized **SQ Series** units use minimal P.C. Board real estate and deliver moderate output power levels. The slightly larger **P741 Series** units provide higher power output ratings than the **SQ Series** and are packaged to achieve the best possible utilization of space. Both series are ideally suited to applications requiring high reliability, low cost and better than average line and load regulation.

REGULATED POWER SUPPLY
SEMICONDUCTOR CIRCUITS, INC.
MODEL SQ2.15.50
REGULATED POWER SUPPLY
P741 1015

GENERAL SPECIFICATIONS

INPUT VOLTAGE AND FREQUENCY
105 to 125 Vac — 50 to 440 Hz

OUTPUT VOLTAGE TOLERANCE
±1% (Fixed): Dual Output Models
+4%/-1% (Fixed): Single Output Models

RIPPLE AND NOISE (PARD)
1mV RMS

DUAL OUTPUT TRACKING
1mV/mV (Typical)

TEMPERATURE COEFFICIENT
0.02%/°C (Typical)

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-40°C to +85°C

I/O ISOLATION RESISTANCE
50 Megohms

SHORT CIRCUIT PROTECTION
Current Limiting

ORDERING INFORMATION

Output Voltage (Vdc)	Output Current (mA)	Regulation Line (%)	Regulation Load (%)	Pkg. (Fig.)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
5V	200	0.25	0.4	1	SQ1.5.200	$25.95	$22.50	$21.50
	500	0.2	0.25	2	P741-5005	29.95	27.00	25.00
10V	125	0.25	0.4	1	SQ1.10.125	25.95	—	21.50
12V	100	0.25	0.4	1	SQ1.12.100	25.95	22.50	21.50
15V	100	0.25	0.4	1	SQ1.15.100	25.95	—	21.50
±7.5V	±60	0.15	0.15	1	SQ3130	25.95	—	21.50
±12V	±30	0.25	0.25	1	SQ2.12.30	25.95	22.00	20.00
	±50	0.25	0.25	1	SQ2.12.50	29.95	27.00	26.00
	±100	0.2	0.2	2	P741-1012	29.95	—	26.00
±15V	±30	0.25	0.25	1	SQ2.15.30	25.95	22.00	20.00
	±50	0.25	0.25	1	SQ2.15.50	29.95	27.00	26.00
	±100	0.2	0.2	2	P741-1015	29.95	—	26.00

MECHANICAL INFORMATION

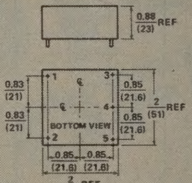

Fig. 1

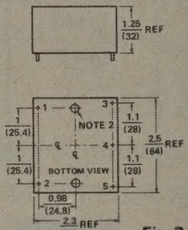

Fig. 2

CONNECTIONS

Single Outputs	Dual Outputs
PIN 1 AC in	PIN 1 Ac in
2 AC in	2 AC in
3 -Vdc out	3 -Vdc out
4 Do Not Connect	4 Common out
5 +Vdc out	5 +Vdc out

NOTES:
1. Five Pins, 0.040 (1.0) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts No 4-40 x 0.10 (2.5) Dp Min
3. All Dimensions are in Inches and (mm)

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
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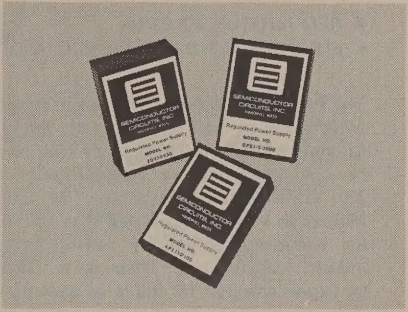
Value Products from the NO. 1 SOURCE

- **HIGHLY RELIABLE**
- **COOL, EFFICIENT OPERATION**
- **ULTRA-LOW PRICED**

The APS and DPS Series of encapsulated modular power supplys are specifically designed to provide reliable and economical DC power for applications not requiring extremely tight line and load regulation.

Incorporating proprietary design techniques, the **APS Series** delivers dual outputs suitable for many analog applications. The time-proven **DPS Series** offers single outputs in a range of current levels that meet the needs of logic applications.

Both families feature MTBF's >150,000 hours, low case temperature rise (up to 18°C cooler than other manufacturers' equivalent products) and require no derating through 71°C.



GENERAL SPECIFICATIONS

INPUT VOLTAGE AND FREQUENCY
105 to 125 Vac — 50 to 440 Hz

OUTPUT VOLTAGE TOLERANCE
±1% (Fixed): APS, DPS
±2% (Fixed): ED

REGULATION
0.5% Line and Load: APS, DPS
1.0% Line and Load: ED

RIPPLE AND NOISE (PARD)
1mV RMS (Typical)

DUAL OUTPUT TRACKING
1mV/mV (Typical)

TEMPERATURE COEFFICIENT
0.02%/°C (Typical)

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-40°C to +85°C

I/O ISOLATION RESISTANCE
50 Megohms

SHORT CIRCUIT PROTECTION
Current Limiting

ORDERING INFORMATION

Output Voltage (Vdc)	Output Current (mA)	AC Pin Spacing Inches (mm)	Pkg. (Fig. 1)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
5V	500	2.0 (51) 2.2 (56)	A	DPS5S500 DPS903*	$30.95 35.95	$27.50 —	$25.50 27.50
	1000	2.0 (51) 2.2 (56)	B	DPS1.5.1000 DPS905*	36.95 41.95	33.00 35.50	31.00 33.50
	1500	2.0 (51) 2.2 (56)	C	DPS1.5.1500 DPS940	44.95 45.95	— —	41.75 42.25
	2000	2.0 (51) 2.2 (56)	C	DPS1.5.2000 DPS941	68.95 69.95	52.00 52.50	50.00 50.50
12V	500	2.0 (51)	B	DPS12S500	44.95	35.00	33.00
180V	30	2.0 (51)	B	ED180S30	49.95	—	39.00
250V	30	2.0 (51)	B	ED250S30	54.95	—	40.00
±5V	±500	2.0 (51)	B	APS5D500	44.95	33.00	32.00
±7.5V	±150 ±300	2.0 (51) 2.0 (51)	A B	APS3130-1 APS3130-2	38.95 58.95	— —	29.00 40.00
±12V	±100	2.0 (51) 2.2 (56)	A	APS12D100 APS908-2	27.95 28.95	27.00 —	26.50 27.00
	±200	2.0 (51) 2.2 (56)	B	APS12D200 APS921	32.95 33.95	32.00 —	31.50 32.00
	±300	2.0 (51) 2.2 (56)	C	APS12D300 APS5950	52.95 53.95	51.50 —	50.50 52.00
±15V	±100	2.0 (51) 2.2 (56)	A	APS15D100 APS902-2	27.95 28.95	27.00 27.50	26.50 27.00
	±200	2.0 (51) 2.2 (56)	B	APS15D200 APS920	32.95 33.95	32.00 32.50	31.50 32.00
	±300	2.0 (51) 2.2 (56)	C	APS15D300 APS5951	52.95 53.95	51.50 53.00	50.50 52.00

* Includes Over Voltage Clamp Protection

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

MECHANICAL INFORMATION

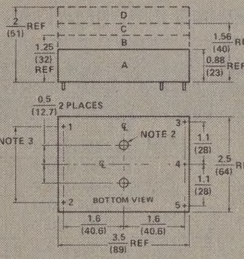


Fig. 1

CONNECTIONS

Single Outputs
2.0" AC Pin Spacing
PIN 1 AC in
2 AC in
3 -Vdc out
4 Do Not Connect
5 +Vdc out

Single Outputs
2.2" AC Pin Spacing
PIN 1 AC in
2 AC in
3 No Connection
4 -Vdc out
5 +Vdc out

Dual Outputs
2.0" and 2.2" AC Pin Spacing
PIN 1 AC in
2 AC in
3 -Vdc out
4 Common out
5 +Vdc out

NOTES:
1. Five Pins, 0.040 (1.0) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts No 4-40 x 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions are in Inches and (mm).

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
TEL. (617) 373-9104 • TWX. 710-347-0269

Industry Standard, High Performance Power Supplys®

P & SP5900

Value Products from the NO. 1 SOURCE

- REGULATION TO 0.01%
- FULL OPERATION UP TO 85°C (M OPTION)
- MTBF > 150,000 HOURS

The P and SP5900 Series of high performance modular encapsulated power supplys are the standard of the industry with a proven record in the field since 1968. Continuous design improvements with respect to magnetics and regulator circuitry have led to an increased reliability (MTBF), a lower case temperature rise (up to 18°C cooler than other manufacturers units), and highest actual performance. The Militarized version (Suffix M) of these units is designed to meet the more demanding temperature, humidity and vibration requirements of military and critical industrial applications. These units include hermetically sealed components and tantalum capacitors for full rated operation through +85°C.**

GENERAL SPECIFICATIONS

INPUT VOLTAGE AND FREQUENCY
105 to 125 Vac — 50 to 440 Hz

OUTPUT VOLTAGE TOLERANCE
±1% (Fixed)

RIPPLE AND NOISE (PARD)
1mV RMS

DUAL OUTPUT TRACKING
1mV/mV (Typical)

TEMPERATURE COEFFICIENT
0.02%/°C (Typical)

OPERATING TEMPERATURE RANGE**
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE**
-40°C to +85°C

SHORT CIRCUIT PROTECTION
Current Limiting

ORDERING INFORMATION

Output Voltage (Vdc)	Output Current (mA)	Regulation Line (%)	Regulation Load (%)	AC Pin Spacing Inches (mm)	Pkg. (Fig. 1)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
5V	500	0.05 0.05	0.05 0.05	2.0 (51) 2.2 (56)	A	P1.5.500 SP5903*	$37.95 43.95	$28.50 30.50	$27.00 29.00
	1000	0.05 0.05	0.1 0.1	2.0 (51) 2.2 (56)	B	P1.5.1000 SP5905*	56.95 62.95	40.00 42.00	38.00 40.00
	1500	0.05 0.05	0.2 0.2	2.0 (51) 2.2 (56)	C	P1.5.1500 SP5940	64.95 65.95	— —	52.00 52.50
	2000	0.05 0.05	0.2 0.2	2.0 (51) 2.2 (56)	C	P1.5.2000 SP5941	75.95 76.95	55.00 55.50	52.00 52.50
±5V	±500	0.05 0.05	0.05 0.05	2.0 (51) 2.2 (56)	B	P5D500 SP5925	66.95 67.95	44.00 —	42.00 42.50
±12V	±30	0.05 0.05	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.12.25 SP5907	25.95 26.95	— —	21.00 21.50
	±60	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.12.60 SP5909	35.95 36.95	— —	27.00 27.50
	±100	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.12.100 SP5908-2	46.95 47.95	— —	30.50 31.00
	±200	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	B	P2.12.200 SP5921	66.95 67.95	— —	42.00 42.50
	±300	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	C	P2.12.300 SP5950	84.95 85.95	56.50 —	53.50 54.00
±15V	±30	0.05 0.05	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.15.25 SP5915	26.95 27.95	23.00 23.50	21.00 21.50
	±60	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.15.60 SP5904	35.95 36.95	— —	27.00 27.50
	±100	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	A	P2.15.100 SP5902-2	46.95 47.95	31.50 32.00	30.50 31.00
	±200	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	B	P2.15.200 SP5920	66.95 67.95	44.00 44.50	42.00 42.50
	±300	0.01 0.01	0.05 0.05	2.0 (51) 2.2 (56)	C	P2.15.300 SP5951	84.95 85.95	56.50 —	53.50 54.00
±120V	±20	0.01	0.05	2.0 (51)	C	P2.120.20	84.95	81.00	76.50

*Includes Clamp Type Over Voltage Protection set at approximately 6.5 Vdc.

**M Option Temperature Ranges: -40°C to +85°C (Operating), -55°C to +125°C (Storage). Please consult factory for specific models.

MECHANICAL INFORMATION

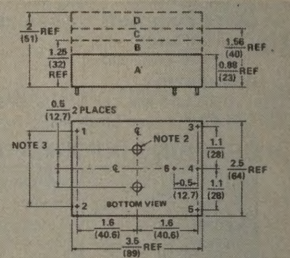


Fig. 1

CONNECTIONS

Single Output Models

PIN FUNCTION	AC Pin Spacing 2.0"		AC Pin Spacing 2.2"
ACin	1	PIN NO.	1
ACin	2		2
-Vdc out	3		4
Do Not Connect	4		3
+Vdc out	5		5
High Isolation	6		6
	(J Option Only)		

Dual Outputs
2.0" and 2.2" AC Pin Spacing

PIN	
1	AC in
2	AC in
3	-Vdc out
4	Common out
5	+Vdc out
6	High Isolation (J Option Only)

NOTES:
1. Five Pins, 0.040 (1.0) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts No 4-40 x 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions are in Inches and (mm)

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
TEL. (617) 373-9104 • TWX. 710-347-0269

ES, EA

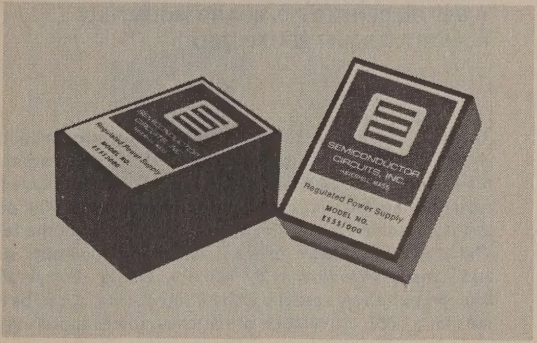
High Efficiency Power Supplys®

Value Products from the NO. 1 SOURCE

- **EFFICIENCY TO 80%**
- **LINE TRANSIENT IMMUNITY >60 dB**
- **LOW CASE TEMPERATURE RISE: 15°C TYP**

The ES/EA Series of line powered, encapsulated modular power supplys features efficiencies to 80% which remain nearly constant over the entire input voltage range. High efficiency reduces internal power dissipation, and cooler operation results. These benefits combine to provide higher overall system reliability.

Key to this performance is a highly efficient ripple regulation circuit that dissipates 4 to 5 times less power than equivalent conventional power supply designs. In addition, the high efficiency regulator circuit contains low pass filtering that provides immunity to line transient effects. . .unmatched by conventional power supply designs.



GENERAL SPECIFICATIONS

INPUT VOLTAGE AND FREQUENCY
105 to 125 Vac — 50 to 440 Hz

OUTPUT VOLTAGE TOLERANCE
±1% (Fixed)

REGULATION
0.15% Line and Load

RIPPLE AND NOISE (PARD)
7mV RMS

TEMPERATURE COEFFICIENT
0.02%/°C (Typical)

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-40°C to +85°C

I/O ISOLATION RESISTANCE
50 Megohms

SHORT CIRCUIT PROTECTION
Power Foldback

ORDERING INFORMATION

Output Voltage (Vdc)	Output Current (mA)	AC Pin Spacing Inches (mm)	Pkg. (Fig. 1)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
5V	1000	2.0 (51)	B	ES5S1000	$61.95	$56.00	$53.50
		2.2 (56)		EA5S1000	62.95	—	54.00
	1500	2.0 (51)	B	ES5S1500	68.95	—	61.50
		2.2 (56)		EA5S1500	69.95	—	62.00
	2000	2.0 (51)	C	ES5S2000	78.95	72.00	68.00
		2.2 (56)		EA5S2000	79.95	—	68.50
	3000	2.0 (51)	C	ES5S3000	98.95	82.00	79.00
		2.2 (56)		EA5S3000	99.95	—	79.50
	4000	2.0 (51)	D	ES5S4000	118.95	88.00	85.00
		2.2 (56)		EA5S4000	119.95	—	85.50
12V	800	2.0 (51)	B	ES12S800	68.95	61.50	58.50
		2.2 (56)		EA12S800	69.95	—	59.00
	1200	2.0 (51)	D	ES12S1200	78.95	72.00	68.00
		2.2 (56)		EA12S1200	79.95	—	68.50
	1500	2.0 (51)	D	ES12S1500	98.95	—	72.50
		2.2 (56)		EA12S1500	99.95	—	73.00
15V	650	2.0 (51)	B	ES15S650	68.95	—	64.75
		2.2 (56)		EA15S650	69.95	—	65.75
19V	1000	2.0 (51)	D	ES19S1000	98.95	—	72.50
		2.2 (56)		EA19S1000	99.95	—	73.00
24V	400	2.0 (51)	B	ES24S400	68.95	—	64.75
		2.2 (56)		EA24S400	69.95	—	65.75
±12V	±500	2.0 (51)	D	ES12D500	124.95	105.00	94.00
		2.2 (56)		EA12D500	125.95	—	94.50
±15V	±500	2.0 (51)	D	ES15D500	124.95	105.00	94.00
		2.2 (56)		EA15D500	125.95	—	94.50

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

MECHANICAL INFORMATION

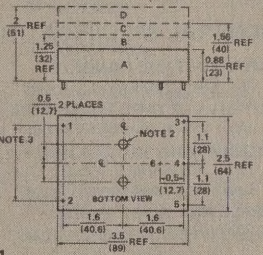


Fig. 1

CONNECTIONS

Single Outputs
2.0" AC Pin Spacing
PIN 1 AC in
2 AC in
3 -Vdc out
4 Do Not Connect
5 +Vdc out
6 High Isolation (J option only)

Single Outputs
2.2" AC Pin Spacing
PIN 1 AC in
2 AC in
3 Do Not Connect
4 -Vdc out
5 +Vdc out
6 High Isolation (J option only)

Dual Outputs
2.0" and 2.2" AC Pin Spacing
PIN 1 AC in
2 AC in
3 -Vdc out
4 Common out
5 +Vdc out
6 High Isolation (J option only)

NOTES:
1. Five Pins, 0.40 (1) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts No. 4-40 x 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions are in Inches and (mm)

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

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POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
TEL. (617) 373-9104 • TWX. 710-347-0269

µD

24 Pin DIP DC/DC Converters

Value Products from the NO. 1 SOURCE

- **HIGH DENSITY 24 PIN DIP PACKAGING**
- **0.5" ON CENTER P.C. BOARD MOUNTING**
- **SHORT CIRCUIT PROTECTED**

The **µVERTER Series** are highly efficient, ultra-miniature DC/DC converters that are packaged in a 24-pin DIP configuration. These units can drive up to 25-IC modules of Op Amps, yet are suitable for P.C. card files requiring 0.5 inch on center mounting. Lower profile packages for OEM applications are available on request. Please contact the factory.

The **µVERTER Series** offers a selection of outputs suitable for many applications including µP's, memory, CMOS devices and level shifting. Though not always required, the π filter of Fig. 3 can be connected by the user for a 60dB attenuation of switching spikes appearing at the input.

GENERAL SPECIFICATIONS

INPUT VOLTAGE RANGE
Vin +15%, -10%

OUTPUT VOLTAGE TOLERANCE
Vout ±3% at specified Vin and F.L.

REGULATION
Line: 1%/% Vin
Load: See Load curve

RIPPLE AND NOISE (PARD)
30mV RMS

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-55°C to +85°C

EFFICIENCY
65 to 85%

I/O ISOLATION
300 Vdc (min)

OSCILLATOR FREQUENCY RANGE
40 to 60 KHz

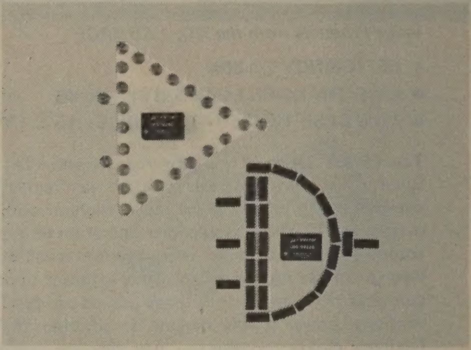
ORDERING INFORMATION

Input Voltage (Vdc)	Output Voltage (Vdc)	Output Current (mA)	Model Number	Unit Price	Special In Stock Pricing Qty. (3-9)	Special In Stock Pricing Qty. (10 & Up)
5	5V	220	UD5 5S220	$26.95	**$22.00**	**$20.90**
12			UD12 5S220			
5	12V ±12V 24V	100 ±50 50	UD5 12D50	31.95	**22.00**	**20.90**
12			UD12 12D50			
5	15V ±15V 30V	90 ±45 45	UD5 15D45	31.95	**22.00**	**20.90**
12			UD12 15D45			

HINTS

1. Dual outputs can provide a single output at full rated power when wired as shown in the connecting instruction.
2. IT IS IMPORTANT for both test and usage that each active output be decoupled by connection of a 10 µF/35V tantalum capacitor AS CLOSE AS POSSIBLE TO THE LOAD.
   Dual output applications will require 2 capacitors. For realistic readings, noise measurements should be taken across the capacitor(s).

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations



MECHANICAL INFORMATION

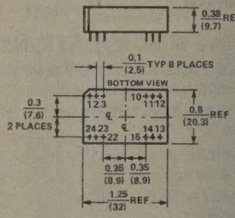


Fig. 1

CONNECTIONS

PINS	5, 12 or 15 Vdc	±12 or ±15 Vdc	24 or 30 Vdc
1 & 24	+Vdc in	+Vdc in	+Vdc in
2 & 23	Do not connect	-Vdc out	-Vdc out
3 & 22	-Vdc out	Common out	Do not connect
10 & 15	-Vdc out	Common out	Do not connect
11 & 14	+Vdc out	+Vdc out	+Vdc out
12 & 13	-Vdc in	-Vdc in	-Vdc in

NOTES:
1. Twelve pins 0.020 (0.5) Dia x 0.15 (3.8) Lg Min
2. All Dimensions are in Inches and (mm)

LOAD CURVE

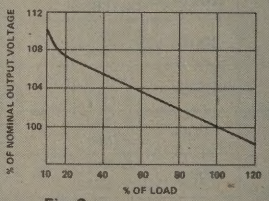


Fig. 2

EXTERNAL π FILTER FOR 60 dB SPIKE ATTENUATION

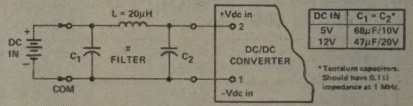


Fig. 3

Prices and Specifications Subject to Change Without Notice

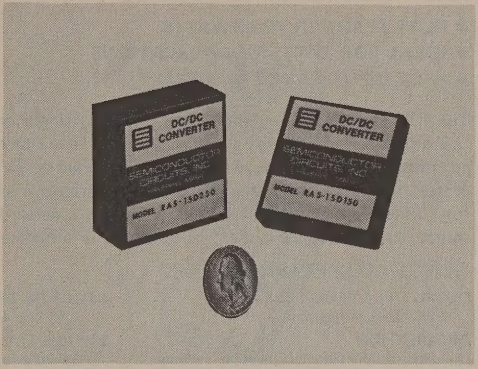
SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
TEL. (617) 373-9104 • TWX. 710-347-0269

General Purpose Economy, Regulated DC/DC Converters...Two Pin-Outs

RD, RA

Value Products from the NO. 1 SOURCE

- **SHORT CIRCUIT PROTECTED OUTPUTS**
- **HIGH PERFORMANCE π INPUT FILTER**
- **EFFICIENCY TO 65%**



The RD and RA Series are economy priced, high performance DC/DC converters designed for all but the most demanding analog and digital applications. The families differ only in pin-out, and feature efficiency to 65%, MTBF's in excess of 150,000 hours and low input ripple through use of an internal high performance π input filter (see catalog page 9). Both families feature I/O isolation and deliver higher in-circuit performance than equivalent converters offered by other manufacturers.

The RD Series pin pattern enjoys widespread industrial usage. **The RA Series** models are pinned out to be plug-in compatible with equivalent competitive units.

ORDERING INFORMATION

Input Voltage Range (Vdc)	Output Voltage (Vdc)	Output Current (mA)	Pkg. (Fig.)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
4.5 - 5.5	5V	600	1-B	RD5-5S600	$59.95	$57.00	$54.00
			2-B	RA5-5S600	60.45	–	54.50
10.8 - 13.2			1-B	RD12-5S600	59.95	57.00	54.00
			2-B	RA12-5S600	60.45	–	54.50
21.6 - 26.4			1-B	RD24-5S600	59.95	57.00	54.00
			2-B	RA24-5S600	60.45	–	54.50
42.0 - 56.0			1-B	RD48-5S600	62.95	59.75	56.75
			2-B	RA48-5S600	63.45	–	57.25
4.5 - 5.5		1000	1-C	RD5-5S1000	64.95	61.75	58.75
			2-C	RA5-5S1000	65.45	–	59.25
10.8 - 13.2			1-C	RD12-5S1000	64.95	61.75	58.75
			2-C	RA12-5S1000	65.45	–	59.25
21.6 - 26.4			1-C	RD24-5S1000	64.95	61.75	58.75
			2-C	RA24-5S1000	65.45	–	59.25
42.0 - 56.0			1-C	RD48-5S1000	67.95	64.50	61.25
			2-C	RA48-5S1000	68.45	–	61.75
4.5 - 5.5	12V	300	1-B	RD5-12S300	59.95	57.00	54.00
10.8 - 13.2				RD12-12S300	59.95	–	54.00
21.6 - 26.4				RD24-12S300	59.95	–	54.00
42.0 - 56.0				RD48-12S300	62.95	–	56.75
4.5 - 5.5		500	1-C	RD5-12S500	64.95	–	58.75
10.8 - 13.2				RD12-12S500	64.95	–	58.75
21.6 - 26.4				RD24-12S500	64.95	–	58.75
42.0 - 56.0				RD48-12S500	67.95	–	61.25
4.5 - 5.5	±12V	±150	1-B	RD5-12D150	59.95	57.00	54.00
			2-B	RA5-12D150	60.45	57.50	54.50
10.8 - 13.2			1-B	RD12-12D150	59.95	–	54.00
			2-B	RA12-12D150	60.45	–	54.50
21.6 - 26.4			1-B	RD24-12D150	59.95	–	54.00
			2-B	RA24-12D150	60.45	–	54.50
42.0 - 56.0			1-B	RD48-12D150	62.95	59.75	56.75
			2-B	RA48-12D150	63.45	–	57.25
4.5 - 5.5		±250	1-C	RD5-12D250	64.95	–	58.75
			2-C	RA5-12D250	65.45	–	59.25
10.8 - 13.2			1-C	RD12-12D250	64.95	–	58.75
			2-C	RA12-12D250	65.45	–	59.25
21.6 - 26.4			1-C	RD24-12D250	64.95	61.75	58.75
			2-C	RA24-12D250	65.45	–	59.25
42.0 - 56.0			1-C	RD48-12D250	67.95	–	61.25
			2-C	RA48-12D250	68.45	–	61.75
4.5 - 5.5	±15V	±150	1-B	RD5-15D150	59.95	57.00	54.00
			2-B	RA5-15D150	60.45	57.50	54.50
10.8 - 13.2			1-B	RD12-15D150	59.95	57.00	54.00
			2-B	RA12-15D150	60.45	57.50	54.50
21.6 - 26.4			1-B	RD24-15D150	59.95	57.00	54.00
			2-B	RA24-15D150	60.45	–	54.50
42.0 - 56.0			1-B	RD48-15D150	62.95	59.75	56.75
			2-B	RA48-15D150	63.45	–	57.25
4.5 - 5.5		±250	1-C	RD5-15D250	64.95	61.75	58.75
			2-C	RA5-15D250	65.45	–	59.25
10.8 - 13.2			1-C	RD12-15D250	64.95	61.75	58.75
			2-C	RA12-15D250	65.45	–	59.25
21.6 - 26.4			1-C	RD24-15D250	64.95	–	58.75
			2-C	RA24-15D250	65.45	–	59.25
42.0 - 56.0			1-C	RD48-15D250	67.95	–	61.25
			2-C	RA48-15D250	68.45	–	61.75

GENERAL SPECIFICATIONS

INPUT REFLECTED RIPPLE
1% Ein (max)

OUTPUT VOLTAGE TOLERANCE
±1% (Fixed)

REGULATION
Line: 0.05%
Load: 0.05%; 0.1% on 5V Output Models

RIPPLE AND NOISE
1mV RMS (max); 30mV p-p (typ)

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-40°C to +85°C

EFFICIENCY
50–65%

I/O ISOLATION
300Vdc (min)

OSCILLATOR FREQUENCY RANGE
6-20 KHz

TEMPERATURE COEFFICIENT
0.02%/°C (typical)

DUAL OUTPUT TRACKING
1mV/mV (typical)

SHORT CIRCUIT PROTECTION
Current Limiting

MECHANICAL INFORMATION

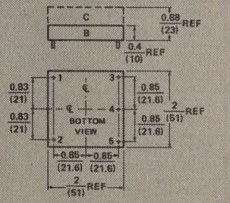


Fig. 1

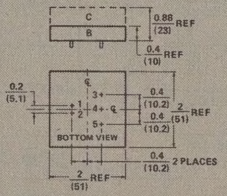


Fig. 2

CONNECTIONS

Single Outputs	Dual Outputs
PIN 1 +Vdc in	PIN 1 +Vdc in
2 -Vdc in	2 -Vdc in
3 +Vdc out	3 +Vdc out
4 Do Not Connect	4 Common out
5 -Vdc out	5 -Vdc out

NOTES:
1. Five Pins 0.040 (1.0) Dia x 0.2 (5.1) Lg Min
2. All Dimensions are in Inches or (mm)

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCES DIVISION
306 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830
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High Efficiency, Ripple Regulator, Single Output DC/DC Converters

SW, CW

Value Products from the NO. 1 SOURCE

- OUTPUT POWER TO 48 WATTS
- IDEAL FOR BATTERY APPLICATIONS
- WIDE INPUT RANGE - TO 200%

The **SW** and **CW** Series are highly efficient, single output DC/DC converters. Using proportional energy transfer high efficiency techniques, these encapsulated modular converters are specifically designed to efficiently maintain well regulated outputs where large input voltage variations exist. These units are ideal for applications where the input DC power is derived from a poorly regulated source; such as a battery, a motor generator or a fuel cell.

SWITCHING REGULATOR
SEMICONDUCTOR CIRCUITS, INC.
MODEL CW24-5S4000
MODEL SW12-5S1000

GENERAL SPECIFICATIONS

OUTPUT VOLTAGE TOLERANCE
±2% (Trim Adjustable)

REGULATION
Line: 0.3% - Rated Output to 3 Amps
0.5% - Rated Output Above 3 Amps
Load: 0.3% - Rated Output to 3 Amps
0.5% - Rated Output Above 3 Amps

RIPPLE AND NOISE
7mV RMS Rated Output to 3 Amps
13mV RMS Rated Output Above 3 Amps

OPERATING TEMPERATURE RANGE
-25°C to +71°C - Rated Output to 3 Amps
-25°C to +60°C - Rated Output Above 3 Amps

STORAGE TEMPERATURE RANGE
-25°C to +85°C

EFFICIENCY
60–70% for Rated Outputs to 12V
65–80% for Rated Outputs Greater than 12V but less than 15V
75–85% for Rated Outputs Above 15V

I/O ISOLATION
Not Galvanically Isolated

SHORT CIRCUIT PROTECTION
Power Foldback

ORDERING INFORMATION

Input Voltage Range (Vdc)	Output Voltage (Vdc)	Output Current (mA)	Pkg. (Fig.)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
+(9-18)	+5V	1000	1	SW12-5S1000	$30.95	—	$28.00
+(18-32)			2	SW24-5S1000	32.95	31.95	28.00
+(9-18)		2000	1	SW12-5S2000	39.95	38.00	36.00
			4-B	CW12-5S2000	46.00	—	41.00
+(18-32)			2	SW24-5S2000	41.95	40.00	38.00
			4-B	CW24-5S2000	48.95	45.00	43.00
+(9-18)		3000	3-B	SW12-5S3000	64.95	60.00	58.00
			4-C	CW12-5S3000	69.95	—	62.00
+(18-32)			3-B	SW24-5S3000	66.95	63.50	59.00
			4-C	CW24-5S3000	71.95	67.50	63.00
+(9-18)		4000	3-B	SW12-5S4000	79.95	76.00	70.00
			4-C	CW12-5S4000	84.95	80.00	74.00
+(18-32)			3-B	SW24-5S4000	81.95	77.50	72.00
			4-C	CW24-5S4000	86.95	81.50	76.00
+(9-18)		6500	4-D	CW12-5S6500	99.95	—	88.00
+(18-32)			4-D	CW24-5S6500	94.95	90.00	86.00
+(18-32)	+12V	1000	2	SW24-12S1000	41.95	—	37.00
			4-C	CW24-12S1000	46.95	—	41.00
		2000	2	SW24-12S2000	49.95	47.50	44.00
			4-C	CW24-12S2000	54.95	—	48.00
		3500	3-D	SW24-12S3500	94.95	—	86.00
			4-D	CW24-12S3500	99.95	—	88.00
+(18-32)	+15V	1000	2	SW24-15S1000	44.95	—	40.00
			4-C	CW24-15S1000	49.95	—	47.50
		2000	2	SW24-15S2000	50.95	—	48.50
			4-C	CW24-15S2000	55.95	—	53.50
+(28-38)	+24V	1000	2	SW32-24S1000	49.95	—	47.50
			4-C	CW32-24S1000	54.95	—	52.50
		2000	3-B	SW32-24S2000	69.95	—	66.00
			4-C	CW32-24S2000	73.95	—	70.00

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

MECHANICAL INFORMATION

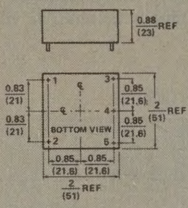

0.88 (23) REF
0.83 (21)
0.85 (21.6)
2 (51) REF
BOTTOM VIEW
1
2
3
4
5

Fig. 1

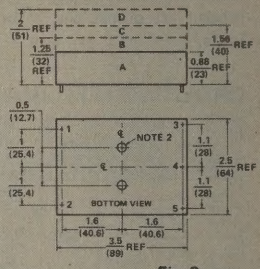

D
C
B
A
2 (51) REF
1.25 (32) REF
1.56 (40) REF
0.88 (23) REF
0.5 (12.7)
1 (25.4)
NOTE 2
1.1 (28)
2.5 (64) REF
BOTTOM VIEW
1.6 (40.6)
3.5 (89) REF

Fig. 3

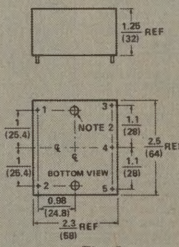

1.25 (32) REF
1 (25.4)
NOTE 2
1.1 (28)
2.5 (64) REF
BOTTOM VIEW
0.98 (24.8)
2.3 (58) REF

Fig. 2

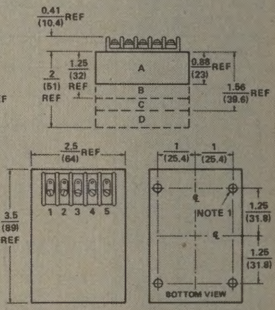
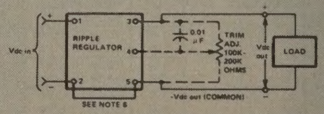

0.41 (10.4) REF
A
B
C
D
1.25 (32) REF
2 (51) REF
0.88 (23) REF
1.56 (39.6) REF
2.5 (64) REF
3.5 (89) REF
1 2 3 4 5
1 (25.4)
NOTE 1
1.25 (31.8)
BOTTOM VIEW

Fig. 4

CONNECTIONS

PIN/TERMINAL
1 +Vdc in
2 -Vdc in (com)[6]
3 +Vdc out
4 Trim Adjust
5 -Vdc out (com)[6]

NOTES:
1. Five Pins, 0.040 (1) Dia x 0.20 (5.1) Lg Min
2. Mounting Inserts 4-40 x 0.1 (2.5) Lg Min
3. Dimensions are given in both Inches and (mm)
4. For ±5% Output Trim, Connect a 100K 200K Ohm Potentiometer as shown below
5. If the Lengths of the Trim Potentiometers Leads exceed 4", connect a 0.01μF Capacitor in close Proximity to Pins/Terminals 3 and 4
6. Pins/Terminals 2 and 5 internally connected, and form a signal common; Connect Externally using Heavy Conductor to Form a Low Impedance Power Current Return (See Below)


Vdc in
+
-
RIPPLE REGULATOR
1
2
3
4
5
0.01 μF
TRIM ADJ. 100K-200K OHMS
Vdc out
LOAD
-Vdc out (COMMON)
SEE NOTE 6

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

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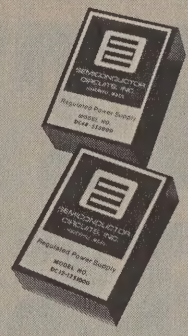
Higher Efficiency, Broad Input Range, Single Output DC/DC Converters

Value Products from the NO. 1 SOURCE

- **OUTPUTS TO 250V FOR PLASMA DIGITAL DISPLAYS**
- **WIDER INPUT RANGE - TO 200%**
- **IDEAL FOR BATTERY OPERATION**

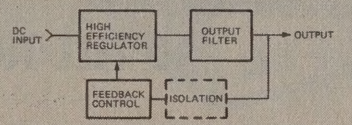


The **DC Series** of regulated, single output DC/DC converters incorporates a high efficiency, proportional energy transfer technique. These devices operate with efficiencies to 80%, which reduces heat generation and increases overall system reliability.

The **DC Series** units tolerate extremely wide input voltage variations — to 200% — a feature which particularly suits this family for operation from batteries, motor generators, fuel cells and other poorly regulated sources of DC input power.

Most **DC Series** models include input-to-output (I/O) isolation. This feature permits either output terminal to serve as output common and affords a simple method for obtaining a positive or a negative output voltage for either polarity of input voltage.

The models having rated outputs of 180 and 250V are ideal for powering plasma digital displays.



BLOCK DIAGRAM

GENERAL SPECIFICATIONS

OUTPUT VOLTAGE TOLERANCE
±2% (Fixed)

REGULATION
1.0% Line and Load

RIPPLE AND NOISE
7mV RMS

OPERATING TEMPERATURE RANGE
-25°C to +71°C (No Derating)

STORAGE TEMPERATURE RANGE
-40°C to +85°C

I/O ISOLATION
300Vdc (min)

SHORT CIRCUIT PROTECTION
Power Foldback

ORDERING INFORMATION

Input Voltage Range (Vdc)	Output Voltage (Vdc)	Output Current (mA)	Efficiency (%)	Pkg. (Fig. 1)	Model Number	Unit Price	Special In-Stock Pricing Qty. (3-9)	Special In-Stock Pricing Qty. (10 & Up)
9-18	5V	2000	55-65	C	DC12-5S2000	$85.95	—	$77.50
18-36			55-65	C	DC24-5S2000	85.95	81.50	77.50
35-70			55-65	C	DC48-5S2000	85.95	—	77.50
18-36		3000	55-65	C	DC24-5S3000	94.95	90.00	85.50
35-70			55-65	C	DC48-5S3000	94.95	90.00	85.50
91-8	12V	800	70-75	C	DC12-12S800	85.95	—	81.50
18-36			70-75	C	DC24-12S800	85.95	—	81.50
9-18		1000	70-75	C	DC12-12S1000	85.95	—	77.50
18-36			70-75	C	DC24-12S1000	85.95	81.50	77.50
35-70			70-80	C	DC48-12S1000	85.95	—	77.50
35-70		2000	70-75	D	DC48-12S2000	124.95	—	109.50
18-36	15V	800	70-80	C	DC12-15S800	85.95	—	81.50
35-70					DC48-15S800	85.95	—	81.50
35-70		1000	70-80	C	DC48-15S1000	94.95	—	90.00
		2000	70-80	D	DC48-15S2000	124.95	—	109.50
9-18	24V	500	75-80	C	DC12-24S500	85.95	—	81.50
18-36				B	DC24-24S500	85.95	—	81.50
35-70				B	DC48-24S500	85.95	—	81.50
+(9-18)	+180V	30	70-80	B	DC12-180S30	55.95	—	50.50
+(18-36)					DC24-180S30	55.95	—	50.50
+(35-70)					DC48-180S30	65.95	—	59.95
+(9-18)	+250V	30	70-80	B	DC12-250S30	59.95	—	54.00
+(18-36)					DC24-250S30	59.95	—	54.00
+(35-70)					DC48-250S30	69.95	—	63.00

MECHANICAL INFORMATION

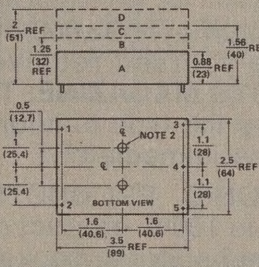


Fig. 1

CONNECTIONS

PIN 1 +Vdc in
2 -Vdc in
3 +Vdc out
4 Do Not Connect
5 -Vdc out

NOTES:
1. Five Pins 0.040 (1.0) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts 4-40 x 0.10 (2.5) Dp Min
3. All Dimensions are in Inches and (mm)

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 35 and 36
Prices and Specifications Subject to Change Without Notice

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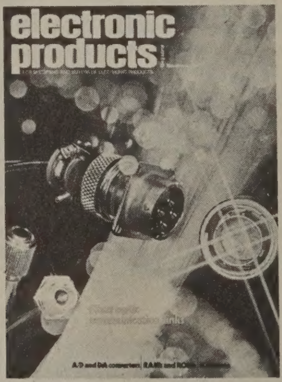

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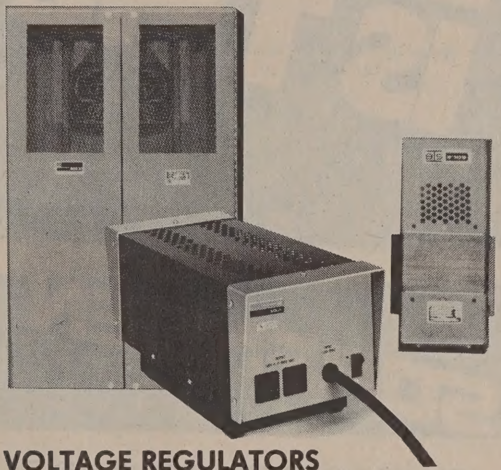

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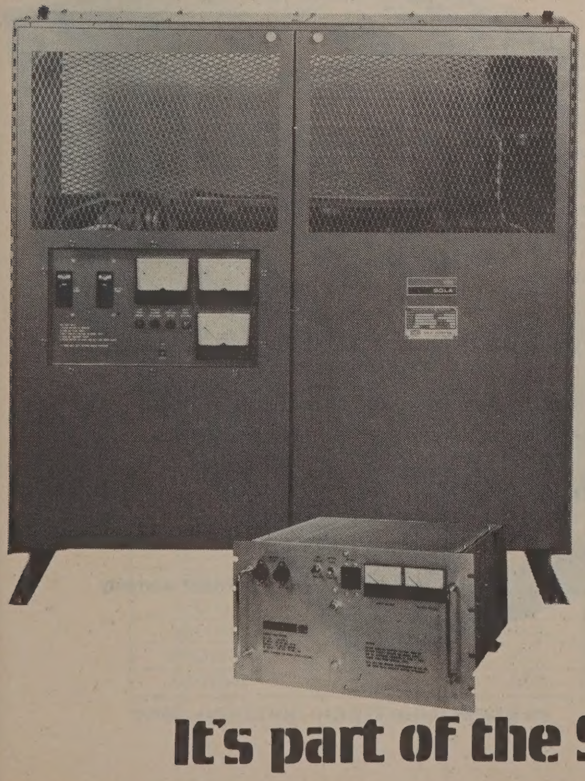

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They stand the test when power fails and valuable equipment and systems are endangered. Look to Sola for your UPS needs.

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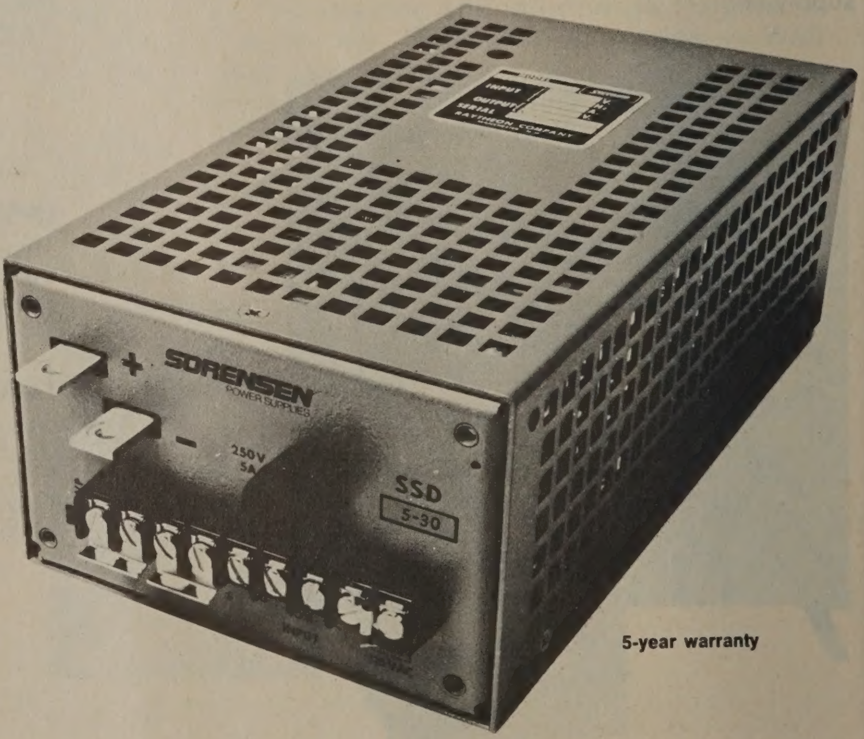
SORENSEN POWER SUPPLIES

NEW SSD SERIES

HIGH EFFICIENCY MODULAR DC SWITCHING POWER SUPPLIES

Standard Features:

☐ 115/220 Vac input by external barrier strip change.
☐ High efficiency (up to 78%).
☐ 50/60-Hz operation with no derating.
☐ Logic shutdown for system applications.
☐ Extra long hold-up time.
☐ Low ripple and noise through use of double-stage filtering.
☐ Wide-range output voltage adjustment.
☐ 20-kHz switching.
☐ UL component recognition.
☐ Built-in adjustable over-voltage protection.
☐ Convection cooled.
☐ Made in USA of quality components.
☐ Remote sensing.
☐ Superior line and load regulation.
☐ Heavy duty output terminals.
☐ Five-year warranty, backed by worldwide service organization.



5-year warranty

SORENSEN POWER SUPPLIES

NEW SSD SERIES

Common Specifications:

Efficiency: 72-78%

Dimensions: In. (mm)
Module III - 3.313 (84), 5.125 (130), 9.5 (241)
Module IIIA - 3.313 (84), 5.125 (130), 14.0 (356)

Stability: .05% for 24 hours after warmup

Temperature Coefficient: .008% per °C

RFI: Minimized through computer-optimized input/output filtering. Meets most portions of MIL-STD 461A for both narrowband and broadband interference. Surpasses performance of conventional regulators.

Transient Response: 1 millisecond for half-load to full-load change and return to a one-percent band.

Resolution: .05% V out max

Adjustable Built-in Overvoltage Protection: All Models

Automatic Current Limiting: Adjustable from 20 to 150% rated full-load current.

Temperature Range: Operating: 0° to 71°C
Storage: −55° to +85°C

Programming: Resistance =1000Ω/V
Signal = Volt/Volt

Series Operation: to 100 Vdc

Turn on/off Overshoot: None

Isolation: 2100 Vdc, Input to Chassis
500 Vdc, Output to Chassis

Fall Out: Will provide full output current at regulated voltage for 40 milliseconds following removal of nominal input power, half output for 80 milliseconds.

Voltage Regulation: Line: 0.03% over full AC input range.
Load: 0.03% for zero to full load.

Voltage Ripple: Typical 5mV rms, 20mV pk-pk (20Hz to 20 MHz).
Maximum 8mV rms, 50mV pk-pk (20Hz to 20MHz).

Input Power: 98-132 Vac
187-250 Vac
Frequency: 47-63 Hz single phase.
360-440 Hz (double rms Ripple spec.)
No derating.
Voltage selectable by a single link on the front panel.
Direct-current operation from 255-345 Vdc

Output: (See table) Wide adjustment range. Output is floating; either positive or negative terminal can be referenced. Resolution of output adjustment, 0.05% Vo maximum.

Model No.	Module Package	Output Voltage Set Range (Vdc)		Output Current (Adc)*			
		Min	Max	40°C	50°C	60°C	71°C
SSD2-30	III	1.8	3.0	30.0	27.0	22.5	15.0
SSD2-45	IIIA	1.8	3.0	45.0	40.5	32.8	22.5
SSD5-30	III	4.7	6.5	30.0	27.0	22.5	15.0
SSD5-45	IIIA	4.7	6.5	45.0	40.5	32.8	22.5
SSD9-20	III	6.5	9.5	20.0	18.0	15.0	10.0
SSD9-30	IIIA	6.5	9.5	30.0	27.0	22.5	15.0
SSD12-15	III	9.5	13.0	15.0	13.5	11.2	7.5
SSD12-22	IIIA	9.5	13.0	22.0	19.8	16.5	11.0
SSD15-12	III	13.0	17.0	12.0	10.8	9.0	6.0
SSD15-18	IIIA	13.0	17.0	18.0	16.2	13.5	9.0
SSD18-10.5	III	16.0	21.0	10.5	9.4	7.8	5.2
SSD18-16	IIIA	16.0	21.0	16.0	14.4	12.0	8.0
SSD24-8.5	III	20.0	26.0	8.5	7.6	6.3	4.2
SSD24-13	IIIA	20.0	26.0	13.0	11.7	9.8	6.5
SSD28-7	III	25.0	33.0	7.0	6.3	5.2	3.5
SSD28-11	IIIA	25.0	33.0	11.0	9.9	8.3	5.5
SSD36-5	III	32.0	43.0	5.0	4.5	3.7	2.5
SSD36-8	IIIA	32.0	43.0	8.0	7.5	6.0	4.0
SSD48-4	III	42.0	56.0	4.0	3.6	3.0	2.0
SSD48-6	IIIA	42.0	56.0	6.0	5.4	4.5	3.0

***FREE-AIR RATING - NO EXTERNAL HEATSINK.**

Consult Factory for Prices. (603) 668-4500

SORENSEN IS THE SOURCE.

SORENSEN COMPANY
676 ISLAND POND RD.,
MANCHESTER, N.H. 03103
TEL: (603) 668-4500
TWX: 710-220-1339

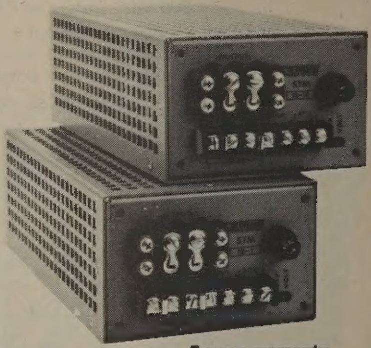
A Raytheon Company

SORENSEN POWER SUPPLIES

STM SERIES

HIGH PERFORMANCE MODULAR DC SWITCHING POWER SUPPLIES

- **Low ripple, superior RFI performance**
- **Built-in adjustable overvoltage protection standard on all models**
- **Efficiencies to 75%**



5-year warranty

Common Specifications:

Efficiency: to 75%

Volume: 160 in ^{3} for Module III:
238 in^3 for Module IIIA,
352 in^3 for Module IVA,
518.5 in^3 for Module VI.

Stability: .05% for 24 hours after warmup

Temperature Coefficient: .01% per °C

RFI: Minimized through computer-optimized input/output filtering. Meets most portions of MIL-STD 461A for both narrowband and broadband interference. Surpasses performance of conventional regulators.

Transient Response: 1 millisecond for half-load to full-load change and return to a one-percent band.

Resolution: .05% V_{out} max

Adjustable Built-in Overvoltage Protection: All models.

Automatic Current Limiting: Adjustable from 50 to 125% rated full-load current.

Temperature Range: Operating: 0° to 71°C
Storage: −40° to +85°C

Programming: Resistance = 1000 Ω/V
Signal = Volt/Volt

Series Operation: to 200 Vdc

Turn on/off Overshoot: None

Isolation: 1300 Vdc, Input to Chassis
500 Vdc, Output to Chassis

Output Impedance (typical):
.005Ω at 10 kHz
.01Ω at 50 kHz
.015Ω at 100 kHz
.02Ω at 500 kHz

Fall Out: Will provide full output at regulated voltage for 15 milliseconds following removal of nominal input power, half output for 30 milliseconds.

Voltage Regulation (comb. line and load): .05%

Ripple (p—p): 50 mV (Worst case. Typically less than 30 mV)

Input Power: 105—132 Vac.
50—440 Hz.
127—172 Vdc.

STM SERIES

Model No.	Module Package	OUTPUT VOLTAGE Set Range (Vdc)		OUTPUT CURRENT (Adc)*				RIPPLE (mVrms)	INPUT POWER	
		min.	max.	40°C	50°C	60°	71°C		AC Amps at 115V	DC Amps at 150V
STM3.5-24	III	3.0	4.5	24.0	19.4	14.9	9.6	10	1.8	1.5
STM3.5-36	IIIA	3.0	4.5	36.0	29.1	22.3	14.4	10	3.8	2.2
STM3.5-60	IVA	3.0	4.5	60.0	48.0	36.0	24.0	10	5.2	2.7
STM3.5-100	VI	3.0	4.5	100.0	80.0	60.0	40.0	10	9.5	5.0
STM5-24	III	4.5	6.0	24.0	19.4	14.9	9.6	10	2.3	1.5
STM5-36	IIIA	4.5	6.0	36.0	29.1	22.3	14.4	10	4.2	2.5
STM5-60	IVA	4.5	6.0	60.0	48.0	36.0	24.0	10	6.4	3.4
STM5-100	VI	4.5	6.0	100.0	80.0	60.0	40.0	10	11.8	6.2
STM9-12	III	6.0	10.0	12.0	9.7	7.5	4.8	3	2.1	1.5
STM9-20	IIIA	6.0	10.0	20.0	16.2	12.4	8.0	3	3.8	2.2
STM9-30	IVA	6.0	10.0	30.0	24.0	18.0	12.0	3	5.5	2.9
STM9-50	VI	6.0	10.0	50.0	40.0	30.0	20.0	3	9.2	4.9
STM12-12	III	9.5	13.5	12.0	9.7	7.5	4.8	3	2.9	1.5
STM12-20	IIIA	9.5	13.5	20.0	16.2	12.4	8.0	3	4.8	2.8
STM12-30	IVA	9.5	13.5	30.0	24.0	18.0	12.0	3	7.1	3.8
STM12-50	VI	9.5	13.5	50.0	42.0	30.0	20.0	3	11.9	6.3
STM15-10	III	13.0	17.0	10.0	8.1	6.2	4.0	3	2.7	1.8
STM15-15	IIIA	13.0	17.0	15.0	12.1	9.3	6.0	3	4.3	2.6
STM15-24	IVA	13.0	17.0	24.0	19.2	14.4	9.6	3	7.2	3.8
STM15-32	VI	13.0	17.0	32.0	25.6	19.2	12.8	3	9.6	5.1
STM18-10	III	16.0	20.0	10.0	8.1	6.2	4.0	3	3.2	1.8
STM18-15	IIIA	16.0	20.0	15.0	12.1	9.3	6.0	3	5.0	3.0
STM18-24	IVA	16.0	20.0	24.0	19.2	14.4	9.6	3	8.2	4.3
STM18-32	VI	16.0	20.0	32.0	25.6	19.2	12.8	3	11.0	5.8
STM24-8.5	III	19.0	25.0	8.5	6.8	5.3	3.4	3	3.3	1.9
STM24-13	IIIA	19.0	25.0	13.0	10.5	8.0	5.2	3	5.5	3.2
STM24-21	IVA	19.0	25.0	21.0	16.8	12.6	8.4	3	9.0	4.7
STM24-28	VI	19.0	25.0	28.0	22.4	16.8	11.2	3	12.0	6.3
STM28-7	III	24.0	30.0	7.0	5.6	4.3	2.8	3	3.2	1.9
STM28-11	IIIA	24.0	30.0	11.0	8.9	6.8	4.4	3	5.5	3.2
STM28-18	IVA	24.0	30.0	18.0	14.4	10.8	7.2	3	9.0	4.7
STM28-24	VI	24.0	30.0	24.0	19.2	14.4	9.6	3	12.0	6.3
STM36-4	III	29.0	43.0	4.0	3.2	2.5	1.6	3	4.0	1.9
STM36-6	IIIA	29.0	43.0	6.0	4.8	3.7	2.4	3	4.5	2.6
STM36-10	IVA	29.0	43.0	10.0	8.0	6.0	4.0	3	7.2	3.8
STM36-14	VI	29.0	43.0	14.0	11.2	8.4	5.6	3	10.0	5.3
STM48-4	III	42.0	56.0	4.0	3.2	2.5	1.6	3	4.0	1.9
STM48-6	IIIA	42.0	56.0	6.0	4.8	3.7	2.4	3	5.5	3.2
STM48-10	IVA	42.0	56.0	10.0	8.0	6.0	4.0	3	9.1	4.8
STM48-14	VI	42.0	56.0	14.0	11.2	8.4	5.6	3	12.8	6.7

*FREE — AIR RATING — NO EXTERNAL HEATSINK.

Consult Factory for Prices. (603) 668-4500

SORENSEN POWER SUPPLIES

DCR-A&B SERIES

HIGH CURRENT SOLID STATE REGULATED POWER SUPPLIES FOR LABORATORY AND TEST EQUIPMENT USE

- **Remote voltage, current, or resistance programming**
- **Constant voltage, constant current operation with automatic crossover**
- **No overshoot with turn-on, turn-off, or power failure**

5-year warranty

Model No.	RACK HEIGHT (IN)	VOLTAGE (VDC)	OUTPUT Current (adc) 40°	55°	71°	CONSTANT CURRENT REGULATION	CONSTANT VOLTAGE REGULATION	CONSTANT VOLTAGE RIPPLE (PARD) rms	CONSTANT CURRENT RIPPLE (PARD) rms^1	OPTIONAL OVERVOLTAGE PROTECTION	DRIFT (TYP) % Io MAX	TEMP. COEFF. (TYP) (mV/°C)	(mA/°C)
DCR10-40B	3½	0-10	40	30	20	.25%	.03%	.65%	.65%	INTERNAL	.15	1.5	12
DCR10-80B	5¼	0-10	80	60	40	.25%	.03%	.65%	.65%	INTERNAL	.15	1.5	24
DCR10-120B	7	0-10	120	90	60	.25%	.03%	.65%	.65%	INTERNAL	.15	1.5	36
DCR10-170B	7 F	0-10	170	127	85	.25%	.03%	.65%	.65%	INTERNAL	.15	1.5	51
DCR20-25B	3½	0-20	25	19	13	.25%	.03%	.325%	.325%	INTERNAL	.15	3.0	7.5
DCR20-50B	5¼	0-20	50	37	25	.25%	.03%	.325%	.325%	INTERNAL	.15	3.0	15
DCR20-80B	7	0-20	80	60	40	.25%	.03%	.325%	.325%	INTERNAL	.15	3	24
DCR-20-115B	7 F	0-20	115	86	58	.25%	.03%	.325%	.325%	INTERNAL	.15	3	35
DCR20-250A	17½	0-20	275	250	165	.4%	±.10% or ±8mV^2	.8%E$_0$ + 60mV or 160mV^4	.8%	VP 18	.50	8	500
DCR20-500A	22¾	0-20	550	500	330	.4%	"	"	.8%	VP 24	.50	8	1000
DCR20-1000A	42½	0-20	1100	1000	66.0	4%	"	"	.8%	——	.50	8	2000
DCR40-13B	3½	0-40	13	9	6.6	.25%	.03%	.225%	.225%	INTERNAL	.15	6.0	3.9
DCR40-25B	5¼	0-40	25	19	13	.25%	.03%	.225%	.225%	INTERNAL	.15	6.0	7.5
DCR40-40B	7	0-40	40	30	20	.25%	.03%	.225%	.225%	INTERNAL	.15	6	12
DCR40-70B	7 F	0-40	70	55	40	.25%	.03%	.225%	.225%	INTERNAL	.15	6	21
DCR40-125A	17½	0-40	138	82.5	82.5	.2%	±.10% or ±15mV^2	.4%E$_0$ + 60mV or 160mV^4	.45%	VP 19	.50	16	250
DCR40-250A	22¾	0-40	275	165	165	.4%	"	"	.45%	VP 19	.50	16	500
DCR40-500A	42½	0-40	550	330	330	.4%	"	"	"	——	.50	16	1000
DCR60-9B	3½	0-60	9	7	5	.25%	.03%	.2%	.2%	INTERNAL	.15	9.0	2.7
DCR60-18B	5¼	0-60	18	13	8.6	.25%	.03%	.2%	.2%	INTERNAL	.15	9.0	5.4
DCR60-30B	7	0-60	30	23	16.5	.25%	.03%	.2%	.2%	INTERNAL	.15	9	9
DCR60-45B	7 F	0-60	45	35	26.5	.25%	.03%	.2%	.2%	INTERNAL	.15	9	13.5
DCR80-6B	3½	0-80	6	4.5	3.3	.25%	.03%	.18%	.18%	INTERNAL	.15	12.0	1.8
DCR80-12B	5¼	0-80	12	9	6.3	.25%	.03%	.18%	.18%	INTERNAL	.15	12.0	3.6
DCR80-20B	7	0-80	20	15.5	11.9	.25%	.03%	.18%	.18%	INTERNAL	.15	12.0	6
DCR80-33B	7 F	0-80	33	26	20	.25%	.03%	.18%	.18%	INTERNAL	.15	12.0	9.9
DCR150-3B	3½	0-150	3	2.3	1.7	.25%	.03%	.2%	.2%	INTERNAL	.15	22.5	.9
DCR150-6B	5¼	0-150	6	4.5	3.3	.25%	.03%	.2%	.2%	INTERNAL	.15	22.5	1.8
DCR150-12B	7	0-150	12	9	6.6	.25%	.03%	.2%	.2%	INTERNAL	.15	22.5	3.6
DCR150-18B	7 F	0-150	18	14	10	.25%	.03%	.2%	.2%	INTERNAL	.15	22.5	5.4
DCR150-35A	17½	0-150	38.5	23	23	.4%	±.10% or ±30mV^2	.4%E$_0$ + 200mV or 500mV^4	.4%	VP 20	.50	60	70
DCR150-70A	22¾	0-150	77	47	47	.4%	"	"	"	VP 20	.50	60	140
DCR300-1.5B	3½	0-300	1.5	1.1	.8	.25%	.03%	.23%	.23%	INTERNAL	.15	45	.45
DCR300-3B	5¼	0-300	3	2.3	1.65	.25%	.03%	.23%	.23%	INTERNAL	.15	45	.9
DCR300-6B	7	0-300	6	4.5	3.3	.25%	.03%	.23%	.23%	INTERNAL	.15	45	1.8
DCR300-9B	7 F	0-300	9	7	5.5	.25%	.03%	.23%	.23%	INTERNAL	.15	45	2.7
DCR300-18A	17¼	0-300	19.8	12	12	.4%	±.10% or ±60mV^2	.4%E$_0$ +400mV	.4%	VP 21	.50	120	36
DCR300-35A	22¾	0-300	38.5	23	23	.4%	"	"	.4%	VP 21	.50	120	70
DCR600-.75B	3½	0-600	.75	.55	.4	.25%	.03%	.2%	.2%	INTERNAL	.15	90	.225
DCR600-1.5B	5¼	0-600	1.5	1.1	.83	.25%	.03%	.2%	.2%	INTERNAL	.15	90	.45
DCR600-3B	7	0-600	3	2.3	1.65	.25%	.03%	.2%	.2%	INTERNAL	.15	90	.9
DCR600-4.5B	7 F	0-600	4.5	3.5	2.5	.25%	.03%	.2%	.2%	INTERNAL	.15	90	1.35
DCR600-18A	22¾	0-600	19.8	12	12	.4%	±.10% or +120mV^2	.4%E$_0$ +800mV	.4%	VP 22	.50	240	36

DCR-A&B SERIES

Common Specifications;

Resolution (voltage): 0.05% of E_0 max. (typical)

Resolution (current): 0.5% (DCR-A) 0.05% (DCR-B), typical

Remote sensing: Max. drop per load lead 3V (DCR-A), 8V (DCR-B)

Overload/short circuit protection: Adjustable. Current limiting with automatic recovery.

Series operation: To 200 Vdc max. (150 and 300V models — 2 in series)

Parallel operation: Master-slave, 4 units max.

Operating temperature range: 0°C to +71°C

Storage temperature: −40°C to +85°C

Isolation voltage: 1000 Vdc input to output

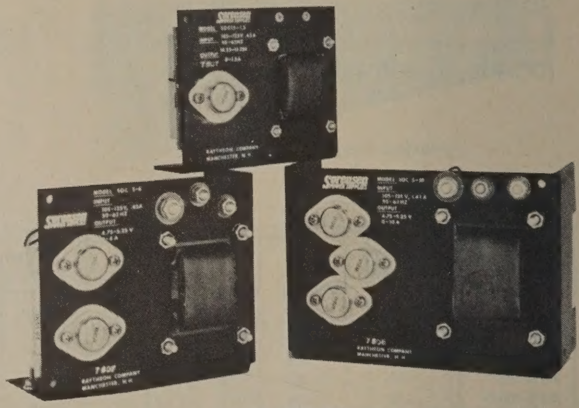
Model No.	TRANSIENT RESPONSE TIME (msec)	OUTPUT IMP (OHMS) @ 1kHz (TYP)	REMOTE PROG. (TYP)		EFFICIENCY % (TYP)	METERS (2% accuracy)		INPUT POWER				PWR FACTOR (TYP)	SIGNAL (VOLT IN/ VOLT OUT)
			OHMS/ V	OHMS/A		VOLTMETER	AMMETER	VOLTAGE (Vac)	CURRENT MAX (Aac)	FREQUENCY'' (Hz)	PHASE		
DCR10-40B	50	.02	1200	10	61	0-12V	0-50A	103-127	8.7	50-63	1	.65	1/1
DCR10-80B	50	.009	1200	5	62	0-12V	0-100A	103-127	16	50-63	1	.69	1/1
DCR10-120B	50	.007	1200	3.3	62	0-12V	0-150A	103-127	24.5	50-63	1	.67	1/1
DCR10-170B	50	.005	1200	2.35	63.5	0-12V	0-200A	187-229	20	50-63	1	.66	1/1
DCR20-25B	50	.025	600	16	71	0-25V	0-30A	103-127	9.4	50-63	1	.65	1/2
DCR20-50B	50	.012	600	8	69	0-25V	0-60A	103-127	20	50-63	1	.62	1/2
DCR20-80B	50	.009	600	5	70	0-25V	0-100A	103-127	30	50-63	1	.66	1/2
DCR-20-115B	50	.006	600	3.5	70.5	0-25V	0-120A	187-229	26.5	50-63	1	.60	1/2
DCR20-250A	40	.008	160	0.6	66	0-25V	0-300A	187-229/ 207-253	37	50-63	3	.57	1/3.22
DCR20-500A	40	.005	160	0.3	78	0-25V	0-600A	414-506	28	50-63	3	.65	1/3.22
DCR20-1000A	40	.003	160	0.15	74	0-25V	0-1200A	414-506	60	57-63	3	.63	1/3.22
DCR40-13B	50	.04	300	30	71	0-50V	0-15A	103-127	9.8	50-63	1	.65	1/4
DCR40-25B	50	.025	300	16	79	0-50V	0-30A	103-127	16	50-63	1	.68	1/4
DCR40-40B	50	.016	300	10	78	0-50V	0-50A	103-127	26.8	50-63	1	.66	1/4
DCR40-70B	50	.01	300	6	77	0-50V	0-100A	187-229	29.7	50-63	1	.58	1/4
DCR40-125A	40	.006	80	1.2	72	0-50V	0-150A	187-229/ 207-253	35	50-63	3	.60	1/6.22
DCR40-250A	40	.006	80	0.6	75	0.50V	0-300A	414-506	$60^{14}/_{27}$	57-63	3	.67	1/6.22
DCR40-500A	40	.004	80	0.3	79	0.50V	0-600A	414-506	60	57-63	3	.59	1/6.22
DCR60-9B	50	.06	200	46	75	0-80V	0-10A	103-127	9.7	50-63	1	.65	1/6
DCR60-18B	50	.04	200	22	81	0-80V	0-20A	103-127	19	50-63	1	.60	1/6
DCR60-30B	50	.022	200	13	84	0-80V	0-40A	103-127	27	50-63	1	.68	1/6
DCR60-45B	50	.014	200	9	79.9	0-80V	0-50A	187-229	29.0	50-63	1	.56	1/6
DCR80-6B	50	.110	150	68	77	0-100V	0-8A	103-127	8.3	50-63	1	.65	1/8
DCR80-12B	50	.06	150	33	83	0-100V	0-15A	102-127	15	50-63	1	.65	1/8
DCR80-20B	50	.035	150	20	82	0-100V	0-30A	103-127	25.6	50-63	1	.66	1/8
DCR80-33B	50	.022	150	12	80.9	0-100V	0-40A	187-229	27.2	50-63	1	.57	1/8
DCR150-3B	50	.53	80	134	74	0-200V	0-5A	103-127	8.2	50-63	1	.65	1/15
DCR150-6B	50	.30	80	66	84	0-200V	0-8A	103-127	15.5	50-63	1	.60	1/15
DCR150-12B	50	.16	80	33	84	0-200V	0-15A	103-127	27	50-63	1	.69	1/15
DCR150-18B	50	.057	80	22	83	0-200V	0-20A	187-229	27	50-63	1	.58	1/15
DCR150-35A	40	.02	20	4.3	77	0-200V	0-50A	187-229/ 207-253	35	50-63	3	.64	1/17.66
DCR150-70A	40	.02	20	2.2	81	0-200V	0-80A	414-506	$69^{14}/_{27}$	57-63	3	.69	1/17.66
DCR300-1.5B	50	1.8	40	270	74	0-400V	0-2A	103-127	8.9	50-63	1	.60	1/30
DCR300-3B	50	1.1	40	133	82	0-400V	0-5A	103-127	15.7	50-63	1	.60	1/30
DCR300-6B	50	.65	40	66	84	0-400V	0-8A	103-127	27	50-63	1	.69	1/30
DCR300-9B	50	.34	40	44	83.3	0-400V	0-10A	187-229	27.4	50-63	1	.57	1/30
DCR300-18A	40	.04	10	8.3	78	0-400V	0-20A	187-229/ 207-253	35	50-63	3	.69	1/33.22
DCR300-35A	40	.02	10	4.3	82	0-400V	0-50A	414-506	$60^{14}/_{27}$	57-63	3	.68	1/33.22
DCR600-.75B	50	8	20	530	74	0-800V	0-1A	103-127	8.9	50-63	1	.60	1/60
DCR600-1.5B	50	4.3	20	266	86	0-800V	0-2A	103-127	15.2	50-63	1	.60	1/60
DCR600-3B	50	2.0	20	133	86	0-800V	0-5A	103-127	27.4	50-63	1	.66	1/60
DCR600-4.5B	50	.98	20	89	85	0-800V	0-5A	187-229	26.8	50-63	1	.57	1/60
DCR600-18A	40	.35	5	8.3	81	0-800V	0-20A	414-506	$60^{14}/_{27}$	57-63	3	.68	1/67.66

Consult Factory for Prices. (603) 668-4500

SORENSEN POWER SUPPLIES SOC SERIES

OPEN CONSTRUCTION, INDUSTRY-RATED OEM DC POWER SUPPLIES

- Standard voltage and package sizes
- 115/208/230 Vac input standard
- Made in USA with quality components
- No overshoot with turn-on, turn-off, or power failure


1-year warranty

Common Specifications:

AC Input Power: Vac: 105-125 (190-226). (210 to 250 available by using taps on power transformer.)

Frequency: 50 to 63Hz. (Derate I_O 10% at 50Hz.) For 400Hz operation, consult factory.

Input Current rms:

	115V	208V	230V
Series A	0.43A	0.23A	0.21A
Series B	0.85A	0.45A	0.425A
Series C	1.41A	0.86A	0.75A
Series E	3.0A	1.8A	1.5A
Series F	4.0A	2.44A	2.0A

Voltage Regulation (comb. line and load): ±0.15% +6mV for 105 to 125 Vac and 100% load change.

Voltage Ripple and Noise: 1.5mVrms, 5mVpp.

Temperature Coefficient: 0.03%/°C.

Transient Response Time: 50μSec (for changes in load between 10%-100% and 100%-10%) to recover to ±50mV band.

Drift (24 hours): 0.2% after 1-hour warm-up.

Remote Sensing: 100mV maximum drop in each leg.

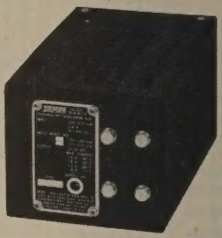
Operating Temperature: 0°C to 60°C

SORENSEN POWER SUPPLIES QSA SERIES

WIDE RANGE CONVECTION-COOLED MODULAR POWER SUPPLIES

- Superior regulation and ripple specifications
- 14 models available up to 330 volts output
- Remote sensing and programming
- Thermal and short circuit protection

5-year warranty



Model No.	Module Size	Output Voltage (Vdc)	Output Current (Adc)				Constant Voltage Regulation[2]	Resolution (mV Typ)
			40°C	50°C	60°C	71°C		
QSA10-1.4	I	0-10	0-1.5	0-1.4	0-1.2	0-.9	±.005% or ±.2mV[2]	28
QSA10-2.2	II	0-10	0-2.4	0-2.2	0-1.9	0-1.5	±.005% or ±.2mV[2]	28
QSA10-3.7	III	0-10	0-4.0	0-3.7	0-3.1	0-2.5	±.005% or ±.2mV[2]	28
QSA18-1.1	I	14-22	0-1.2	0-1.1	0-.9	0-.7	±.005%	45
QSA18-1.9	II	14-22	0-2.1	0-1.9	0-1.6	0-1.3	±.005%	45
QSA18-3.0	III	14-22	0-3.3	0-3.0	0-2.5	0-2.0	±.005%	45
QSA48-.4	I	35-60	0-.44	0-.4	0-.34	0-.27	±.005%	135
QSA48-.8	II	35-60	0-.88	0-.8	0-.68	0-.53	±.005%	135
QSA48-1.2	III	35-60	0-1.3	0-1.2	0-1.0	0-.8	±.005%	135
QSA75-.5	II	60-90	0-.55	0-.5	0-.42	0-.33	±.005%	115
QSA75-.8	III	60-90	0-.88	0-.8	0-.68	0-.53	±.005%	115
QSA120-.5	III	90-150	0-.55	0-.5	0-.42	0-.33	±.01%	145
QSA175-.25	III	150-200	0-.28	0-.25	0-.21	0-.17	±.01%	160
QSA265-.15	III	200-330	0-.17	0-.15	0-.13	0-.1	±01%	160

NOTES: (1) With load change (NL-to-FL or FL-to-NL) and line-voltage change (±10%) combined. (2) Whichever is greater.

SOC SERIES

Model No.	Series	Voltage**	Output Current (Adc) * @ 40°C	@ 50°C	@60°C
SOC 2-3	A	2V	3.0	2.4	1.8
SOC 2-6	B	2V	6.0	4.9	3.8
SOC 2-10	C	2V	10.0	8.0	6.5
SOC 2-18	E	2V	18.0	15.0	12.0
SOC 2-25	F	2V	25.0	21.5	17.5
SOC 5-3	A	5V	3.0	2.4	1.8
SOC 5-6	B	5V	6.0	4.9	3.8
SOC 5-10	C	5V	10.0	8.0	6.5
SOC 5-18	E	5V	18.0	15.0	12.0
SOC 5-25	F	5V	25.0	21.5	17.5
SOC 12-1.6	A	12V	1.6	1.3	1.0
SOC 12-4.0	B	12V	4.0	3.0	2.5
SOC 12-6.0	C	12V	6.0	5.0	4.2
SOC 12-11	E	12V	11.0	9.2	6.8
SOC 12-15	F	12V	15.0	12.75	9.5
SOC 15-1.5	A	15V	1.5	1.2	1.0
SOC 15-3.0	B	15V	3.0	2.6	2.2
SOC 15-5.0	C	15V	5.0	4.2	3.5
SOC 15-9.5	E	15V	9.5	7.6	5.6
SOC 15-13	F	15V	13.0	10.5	8.0
SOC 24-1.0	A	24V	1.0	0.75	0.55
SOC 24-2.2	B	24V	2.2	1.9	1.6
SOC 24-3.5	C	24V	3.5	2.9	2.4
SOC 24-6.6	E	24V	6.6	5.2	3.8
SOC 24-9	F	24V	9.0	7.0	5.0
SOC 28-0.8	A	28V	0.8	0.64	0.45
SOC 28-2.0	B	28V	2.0	1.7	1.4
SOC 28-3.1	C	28V	3.1	2.6	2.0
SOC 28-6.0	E	28V	6.0	4.6	3.3
SOC 28-8	F	28V	8.0	6.0	3.75

* Free-air rating — no external heatsink. ** ±5% adjustable. Consult Factory for Prices. (603) 668-4500

Common Specifications cont.

Storage Temperature: –20°C to +85°C.

Overshoot: No overshoot on turn-on, turn-off, or power failure.

Overvoltage Protection: Available on all models except 2 volt. Specify by adding "VP" suffix to model number.

Current Foldback: Automatic, Adjustable; 80-150% of rated current: Factory-set to 140% of rated (40°C) output current.

Cooling: Convection.

Size:
Series A: 4.875 x 4.00 x 1.625in.
Series B: 5.625 x 4.875 x 2.50in.
Series C: 7.00 x 4.875 x 2.75in.
Series E: 14.00 x 4.875 x 2.75in.
Series F: 16.75 x 4.875 x 4.875in.

Weight:
Series A: 2 lbs.
Series B: 4 lbs. 4 oz.
Series C: 6 lbs. 6 oz.
Series E: 12 lbs. 6 oz.
Series F: 16 lbs.

Mounting: Three mounting surfaces on all package sizes.

Finish: Black anodize.

QSA SERIES

Common Specifications:

Constant Voltage Ripple (PARD): 300 microvolts rms (3 miliovolts peak to peak).

Remote Sensing: 1.5 volts drop maximum per load lead.

Overload/Short Circuit Protection: Current foldback (current limiting for 10-volt models).

Overvoltage Protection (Optional): Should the output voltage tend to exceed the adjustable overvoltage trip level, a sensing/SCR crowbar circuit operates in 10 microseconds to reduce the output voltage to 2.5Vdc or less (see Optional Overvoltage Protection column in table).

Series Operation: Two units may be operated in series (10-volt models may be operated in series up to a total output of 200 volts).

Parallel Operation: Four units may be operated in parallel.

Drift: 0.025%/8 hours (after 30-minute warmup) with constant line, load and ambient temperature.

Remote Prog.: 1V/V

Input Power: 105-125V, 200-240V, 210-250V single phase, 47-440Hz

Operating Temperature Range: 0°C to +71°C

Storage Temperature Range: 40°C to +85°C (with VP)

Output Floating: Either side of the output may be grounded.

Cooling: Convection.

Isolation Voltage: 1000Vdc — input; 700 Vdc — output.

Finish: Case is finished in black wrinkle paint.

Model No.	Optional Overvoltage Protection	Temperature Coefficient (%°C)	Transient Response (μs Typ)	Output Impedance (R + jωL)	Remote Prog. Ohms/V	Efficiency (% Typ)	Input Power Current Max (Aac)	Power Factor (Typ)
QSA10-1.4	VP1	.01 (or .5mV/°C)^2	20^3	300μΩ + .2μH	100	29	.6, .3	.84
QSA10-2.2	VP1	.01 (or .5mV/°C)^2	20^3	200μΩ + .2μH	100	35	.8, .4	.83
QSA10-3.7	VP1	.01 (or .5mV/°C)^2	20^3	100μΩ + .2μH	100	39	1.4, .7	.83
QSA18-1.1	VP1	.01	20^3	750μΩ + .4μH	40	31	.8,.4	.83
QSA18-1.9	VP1	.01	20^3	400μΩ + .4μH	40	33	1.3, .65	.83
QSA18-3.0	VP1	.01	20^3	300μΩ + .3μH	40	38	1.8, .9	.82
QSA48-.4	VP3	.015	20^4	2.4mΩ + .8μH	40	38	.7, .35	.83
QSA48-.8	VP3	.015	20^4	2.4mΩ + .8μH	40	44	1.3, .65	.79
QSA48-1.2	VP3	.015	20^4	2.4mΩ + .4μH	40	45	1.8, .9	.79
QSA75-.5	VP3	.015	20^4	3.8mΩ + .8μH	40	51	1.2, .6	.78
QSA75-.8	VP3	.015	20^4	3.8mΩ + .4μH	40	53	1.7, .85	.79
QSA120-.5	VP8	.015	20^5	6.0mΩ + .8μH	40	50	1.8, .9	.79
QSA175-.25	VP23	.015	20^5	40mΩ + 1.6μH	90	54	1.2, .6	.75
QSA265-.15	VP23	.015	20^5	70mΩ + 1.6μH	90	48	1.3, .65	.72

(3) To return to ±10mV band for a step-load change of NL-to-FL or FL-to-NL
(4) To return to ±15mV for a step-load change of NL-to-FL or FL-to-NL.
(5) To return to ±20mV for a step-load change of NL-to-FL or FL-to-NL.

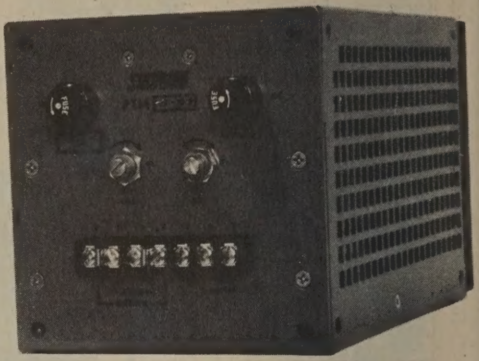
Consult Factory for Prices. (603) 668-4500

SORENSEN
POWER SUPPLIES

PTM SERIES

SINGLE AND DUAL OUTPUT LINEAR MODULAR POWER SUPPLIES

- **High reliability**
- **Convection cooled**
- **Built-in adjustable overvoltage protection standard on all models**



5-year warranty

Common Specifications:

	PTM Single	PTM Dual
Voltage Regulation (line and load comb.)	0.05% + 5 mV	0.02%
Voltage Ripple (PARD)[1]	1 mV rms, 5 mV peak-to-peak	
Temperature Coefficient .	0.01%/°C or 1 mV/°C whichever is greater	
Transient Response Time	50 μsec (for changes in load between 10-100% and 100-10% to recover to ±20 mV band)	
Tracking Accuracy	Adjustable to 0.2%	
Drift (24 hours)	0.1% after 1 hour warmup	
Remote Programming ...	500 ohms/volt	
Remote Sensing	250 mV max. drop in each leg	
Power Factor (Typical) ...	80%	
Operating Temperature ..	0°C to 71°C	
Storage Temperature	−40°C to +85°C	
Finish	Textured blue thermal paint	
Cooling	Convection	

Current Foldback

PTM SINGLE — Automatic, adjustable; 50-130% of rated current; factory-set to 125% of rated (40°C) output current.

PTM DUAL — Automatic, adjustable; factory-set to 125% of rated (40°C) output current.

Overvoltage Protection

PTM SINGLE — Automatic, adjustable crowbar action; response time 100μsec typ. to avoid nuisance tripping.

PTM DUAL - DC outputs are protected from an overvoltage condition by an internally adjustable protection circuit. The outputs are sensed separately and in the event of an overvoltage condition in either output, both outputs are shorted by an internal SCR within 50 μsec. The SCR shorts the positive output to the negative output. This feature together with built-in reverse-polarity diodes on each output effectively keeps the outputs within 2.5 volts of the common after an OVP trip. The circuit is designed to tolerate the OVP tripped condition indefinitely.

NOTES:

(1) PARD — The "Periodic and Random Deviation" of the output power from its average value, with all external operational and environmental parameters maintained constant.

(2) 132 Vac at 20% reduced rating, reduce linearly from 125 Vac.

Module Package PTM Dual	Size (in.) H	Size (in.) W	Size (in.) L	Weight (lbs)	Input Power at 1φ 50-440 Hz AC volts/AC amps 105-125[2]	200-240V	210-250V
I	3.315	3.875	6.500	5.5	0.6	0.35	0.3
II	3.315	5.125	6.500	7.5	0.9	0.48	0.45
III	3.315	5.125	9.500	11	1.8	0.96	0.90

(Units shipped wired for nominal 115-Vac input)

Module Package PTM Single	Size (in.) H	Size (in.) W	Size (in.) L	Weight (lbs)	Input Power at 1φ 50-440 Hz AC volts/AC amps 105—125V[2]	200—240V	210—250V
I	3.315	3.875	6.500	5	0.8	0.42	0.40
II	3.315	5.125	6.500	7.5	1.3	0.68	0.65
III	3.315	5.125	9.500	11	2.4	1.3	1.2
IIIB	5.125	5.125	9.500	13.5	3.0	1.6	1.5

(Units shipped wired for nominal 115-Vac input)

PTM SERIES

Single Output Series

Model No.	Module Package	Adjustment Range (Vdc)		Current (Adc)				Output Adjust Resolution (mV typ.)
		Min.	Max.	@40°C	@50°C	@60°C	@71°C	
PTM 3-4	I	2.8	3.5	4.0	3.6	2.8	1.6	10
PTM 3-7	II	2.8	3.5	7.0	6.3	4.9	2.8	10
PTM 3-11	III	2.8	3.5	11.0	9.6	7.8	4.4	10
PTM 3-16	IIIB	2.8	3.5	16.0	14.0	11.0	6.5	10
PTM 5-4	I	4.8	5.5	4.0	3.6	2.8	1.6	10
PTM 5-7	II	4.8	5.5	7.0	6.3	4.9	2.8	10
PTM 5-11	III	4.8	5.5	11.0	9.6	7.8	4.4	10
PTM 5-16	IIIB	4.8	5.5	16.0	14.0	11.0	6.5	10
PTM 12-2.7	I	11.4	12.6	2.7	2.4	1.9	1.1	25
PTM 12-4.4	II	11.4	12.6	4.4	4.0	3.1	1.8	25
PTM 12-6.5	III	11.4	12.6	6.5	5.7	4.6	2.7	25
PTM 12-10.5	IIIB	11.4	12.6	10.5	9.5	7.0	4.0	25
PTM 15-2.4	I	14.25	15.75	2.4	2.1	1.7	0.95	25
PTM 15-3.5	II	14.25	15.75	3.5	3.1	2.5	1.6	25
PTM 15-5.5	III	14.25	15.75	5.5	4.9	3.9	2.5	25
PTM 15-9.5	IIIB	14.25	15.75	9.5	8.5	6.5	3.6	25
PTM 24-1.6	I	23	25	1.6	1.4	1.1	0.65	50
PTM 24-2.3	II	23	25	2.3	2.1	1.7	1.1	50
PTM 24-4	III	23	25	4.0	3.6	2.9	1.9	50
PTM 24-6.8	IIIB	23	25	6.8	6.0	4.5	2.7	50
PTM 28-1.4	I	27	29	1.4	1.2	1.0	0.55	50
PTM 28-2	II	27	29	2.0	1.8	1.5	1.0	50
PTM 28-3.5	III	27	29	3.5	3.1	2.6	1.8	50
PTM 28-6.0	IIIB	27	29	6.0	5.5	4.0	2.4	50

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Dual Output Series

PTM 12-1D	I	+11, −11	+13, −13	1.0	0.9	0.7	0.4	25
PTM 12-1.6D	II	+11, −11	+13, −13	1.6	1.44	1.12	0.64	25
PTM 12-3D	III	+11, −11	+13, −13	3.0	2.7	2.1	1.2	25
PTM-15-.8D	I	+14, −14	+16, −16	0.8	0.72	0.56	0.32	25
PTM 15-1.5D	II	+14, −14	+16, −16	1.5	1.35	1.05	0.6	25
PTM 15-2.8D	III	+14, −14	+16, −16	2.8	2.52	1.96	1.12	25
PTM-5/12DI	I	+4.75, −11	+5.5, −13	2.0, 0.5	1.8, 0.45	1.4, 0.35	0.8, 0.2	10, 25
PTM-5/12DII	II	+4.75, −11	+5.5, −13	3.5, 1.0	3.15, 0.9	2.45, 0.7	1.4, 0.4	10, 25
PTM-5/12DIII	III	+4.75, −11	+5.5, −13	6.0, 1.5	5.4, 1.35	4.2, 1.05	2.4, 0.6	10, 25

Consult Factory for Prices. (603) 668-4500

SORENSEN POWER SUPPLIES

SRL SERIES

MEDIUM POWER, HIGH PERFORMANCE POWER SUPPLIES FOR LABORATORY AND SYSTEMS USE

- **Remotely programmable in voltage and current modes with automatic crossover**
- **Low ripple and peak-to-peak noise specifications**
- **Fast response time over full load range**

5-year warranty

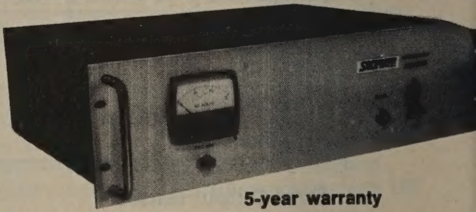
Model No.	Output Power				Constant Voltage Mode					Constant Current Mode		
	Voltage (Vdc)	Current (Adc)			Regulation[1]	Ripple (PARD)		Resolution mV (Typ.)	Transient Response µS (Typ.)[2]	Regulation[1]	Ripple[3] (PARD) mA rms (10 Hz to 7MHz)	Resolution mA (Typ.)
		55°	60°	71°C		uV rms (10 Hz to 7MHz)	mV p — p (7 Hz to 25MHz)					
SRL10-25	0-10	25	22	16.7	.01% or 2mV[2]	350	20	5	150	.02% + 4mA	10	3.75
SRL10-50	0-10	50	44	33.5	.01% or 2mV[2]	300	10	1	150	.02% + 4mA	20	7.5
SRL10-100	0-10	100	88	67	.01% or 2mV[2]	300	20	5	150	.02% + 6mA	30	15.0
SRL20-12	0-20	12	10.5	8	.01% or 2mV[2]	200	20	2	70	.02% + 4mA	3	1.8
SRL20-25	0-20	25	22	16.7	.01% or 2mV[2]	300	20	5	150	.02% + 4mA	10	3.75
SRL20-50	0-20	50	44	33.5	.01% or 2mV[2]	500	40	5	150	.02% + 4mA	10	7.5
SRL40-6	0-40	6*	5.3	4	.01% or 2mV[2]	200	20	4	70	.02% + 1mA	0.5	0.9
SRL40-12	0-40	12	10.5	8	.01% or 2mV[2]	300	20	5	150	.02% + 4mA	1	1.8
SRL40-25	0-40	25	22	16.7	.01% or 2mV[2]	500	10	4	150	.02% + 4mA	10	3.75
SRL40-50	0-40	50	44	33.5	.01% or 2mV[2]	700	40	5	150	.02% + 4mA	10	7.5
SRL60-4	0-60	4	3.5	2.68	.01% or 2mV[2]	300	20	6	70	.02% + 1mA	0.5	0.6
SRL60-8	0-60	8	7	5.36	.01% or 2mV[2]	300	20	5	70	.02% + 1mA	1	1.2
SRL60-17	0-60	17	14.9	11.4	.01% or 2mV[2]	500	10	6	150	.02% + 4mA	3	2.5
SRL60-35	0-60	35	31	23.4	.01% or 2mV[2]	700	40	5	150	.02% + 4mA	10	5.25

SORENSEN POWER SUPPLIES

ACR SERIES

HIGH EFFICIENCY SOLID STATE LINE VOLTAGE REGULATORS

- **Insensitive to frequency variations**
- **Wide input voltage range**
- **Low distortion**
- **Power levels to 15kVA**



5-year warranty

Model No.	Output Power*		Voltage Regulation		Response Time	Temp. Coeff.	Input Power			% Efficiency
	Vac	kVa Range	Line	Load			V	Aac max	Freq.	full VA
ACR500	↑	0-.50	↑	↑	↑	↑	↑	6	↑	88
ACR1000		0-1.0	±0.1%	±0.1%	30ms[1]	0.015%		12		90
ACR2000	110 to	0-2.0				E_o/°C	95 To	24		90
ACR3000	120 Vac	0-3.0	↓	↓	↓	↓	130 Vac Single	36	50/60 Hz[2]	92
ACR5000	Single	0-5.0	↑	↑	↑	↑	Phase	60		95
ACR7500	Phase	0-7.5	±0.15%	±0.15%	50ms[1]	0.03% E_o/°C		92		94
ACR10,000		0-10.0						123		95
ACR15,000	↓	0-15.0	↓	↓	↓	↓	↓	181	↓	95

Consult Factory for Prices. (603) 668-4500

*ACR units may be connected in multiple to supply regulated three phase power (Write for Application Note PAN-ACR-2).

Specifications:

- **Remote Programming:** 10 ohms per volt (Typ.)
- **Remote Sensing:** All models 1.5 volts drop maximum per load lead.
- **Input Power Factor (Typical):** 0.75
- **RFI:** Meets MIL-I-26600 specifications for Class III equipment.

Notes:

1. The speed to recover to 63% of the peak deviation of the transient caused by maximum line or load changes. Complete recovery may be from 1 to 8 Hz depending on the magnitude of line or load change or up to 10 Hz for a simultaneous combination of worst-case line and load changes.
2. May be operated from 47 to 53 Hz or 57-63 Hz. All units are factory adjusted for optimum 60 Hz performance and may be readjusted for optimum 50 Hz performance.

SRL SERIES

- **Remote Sensing:** 1 volt per load lead (maximum allowable)
- **Series Operation:** Up to 200 Vdc output maximum
- **Parallel Operation:** 3 units maximum in parallel
- **Operating Temperature Range:** 0°C to 71°C
- **Storage Temperature:** −40°C to +85°C
- **Isolation voltage to Ground:** 1000 Vdc input; 200 Vdc output
- **RFI:** MIL-I-6181D
- **Output Voltage Turn-On/Turn-Off Overshoot:** None
- **Output Current Turn-On/Turn-Off Overshoot:** None
- **Overload/Short Circuit Protection:** Crosssover to current mode or crossover to voltage mode
- **Overvoltage Protection:** 10 microsecond crowbar
- **Finish:** Case is finished in black semi-gloss baked enamel; front panel is finished in black semi-gloss enamel / white lettering.
- **Programming:** Adjustable resistance and voltage (gain) programming constants. Complete details are in Sorensen's Performance Note PAN-SRL-1.

Model No.	Temperature Coefficient		(Drift[4] (Typ.)		Programming Constants				Meter (2% accuracy)		Input Power (single phase, 47-53/57-63 Hz)		Power Factor (Typ.)
	Voltage (Δ/ C)	Current (Δ/ C)	Voltage (%)	Current	Voltage Mode[8] Ohms (· .5%)	Voltage Mode[8] Volts	Current Mode Ohms (· 10%)	Current Mode Volts	Voltmeter	Ammeter	Voltage (Vac)	Current Max (Aac)	
SRL10-25	.01%, · 200μV	01% · 1ma	025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	40ΩAmp	20mV/Amp	0-12V	0-30A	105-125[6]	7.5	0.67
SRL10-50	01%, · 200μV	01%, · 1mA	025%, + 500μV	03%, + 3mA	200Ω/volt	1 volt/volt	20Ω/Amp	8mV/Amp	0-12V	0-60A	105-125[6]	14.7	0.73
SRL10-100	01%, · 200μV	.01%, + 2mA	025%, + 500uV	.03% + 10mA	200Ω/volt	1 volt/volt	10Ω/Amp	2.5mV/Amp	0-12V	0-120A	105-125[6]	32.5	0.66
SRL20-12	01%, · 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	80Ω/Amp	80V/Amp	0-25V	0-15A	105-125[6]	7.8	0.65
SRL20-25	.01%, · 200μV	01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	40Ω/Amp	20mV/Amp	0-25V	0-30A	105-125[6]	13.6	0.64
SRL20-50	.01%, · 200μV	.01%, · 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	20Ω/Amp	8mV/Amp	0-25V	0-60A	105-125[6]	28.0	064
SRL40-6	.01%, · 200μV	.01%, + 0.5mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	150Ω/Amp	150V/Amp	0-50V	0-8A	105-125[6]	6.3	0.58
SRL40-12	.01%, + 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	80Ω/Amp	80mV/Amp	0-50V	0-15A	105-125[6]	13.2	0.56
SRL40-25	.01%, · 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	40Ω/Amp	20V/Amp	0-50V	0-30A	105-125[6]	22.0	0.675
SRL40-50	.01%, · 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	20Ω/Amp	8mV/Amp	0-50V	0-60A	190-230[7]	25.0	0.66
SRL60-4	.01%, + 200μV	.01%, + 0.5mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	250Ω/Amp	250mV/Amp	0-80V	0-5A	105-125[6]	6.0	0.66
SRL60-8	.01%, · 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	125Ω/Amp	125mV/Amp	0-80V	0-10A	105-125[6]	12.5	0.54
SRL60-17	.01%, + 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	60Ω/Amp	40mV/Amp	0-80V	0-20A	105-125[6]	22.0	0.685
SRL60-35	01%, + 200μV	.01%, + 1mA	.025%, + 500μV	.03%, + 3mA	200Ω/volt	1 volt/volt	25Ω/Amp	15mV/Amp	0-80V	0-40A	190-230[7]	26.0	0.6

NOTES:

1. With load change (NL to FL or FL to NL) and line voltage change (± 10%) combined.
2. Whichever is greater.
3. At full compliance voltage.
4. For 8 hours (after 30 min. warmup) with constant line, load and ambient temperature.
5. To return to a bandwidth of ± 10mV for a step load change of NL to FL or FL to NL.
6. Standard model has 105-125 Vac input. Models with M1 suffix (example SRL10-50 M1) have 190-230 Vac input. Models with M2 suffix (example SRL10-50 M2) have 210-250 Vac input.
7. Models SRL40-50 and SRL60-35 have 190-230 Vac input. Models SRL40-50 M2 and SRL60-35 M2 have 210-250 Vac input.
8. Voltage-mode constants are factory selected. They may be altered at rear terminal board.

Consult Factory for Prices. (603) 668-4500

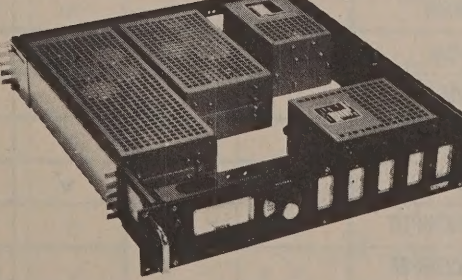
SORENSEN POWER SUPPLIES

RACKS

POWER ASSEMBLIES

Sorensen rack assemblies offer a standard 19-inch width, two heights, three depths and are supplied both with and without slide adapters and with or without metering. Quarter-rack and full-rack metering schemes are available.

Any of Sorensen's modular power supplies may be inserted into single- or multiple-output rack systems. These modulars include the high-efficiency SSD & STM Series (60 models), the PTM's (singles and duals), and the high-performance QSA Series.



SPELLMAN
HIGH VOLTAGE ELECTRONICS CORPORATION

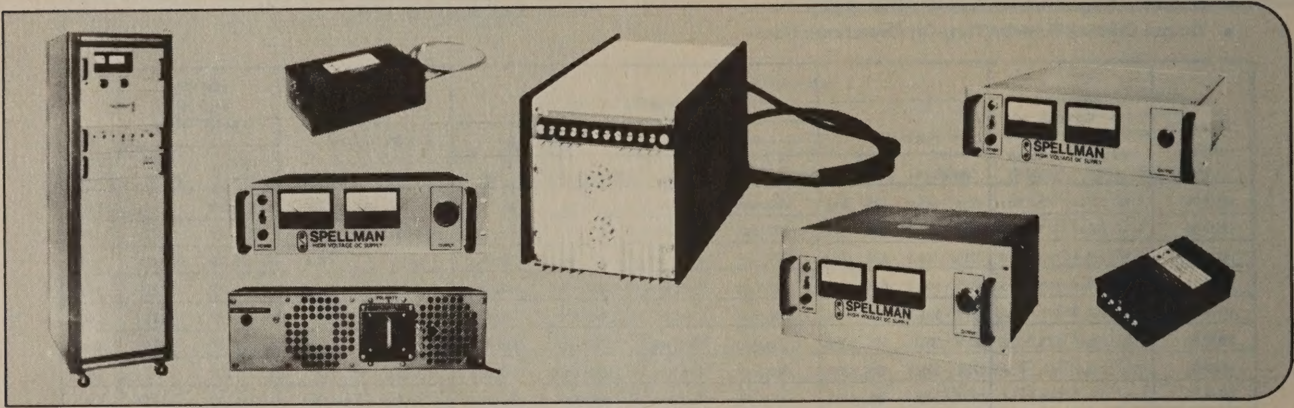
OUR THIRD DECADE OF LEADERSHIP IN HIGH-VOLTAGE TECHNOLOGY.

7 FAIRCHILD AVE., PLAINVIEW, N. Y. 11803 • (516) 822-2130 • TWX: 510-221-2155

HIGH VOLTAGE POWER SUPPLIES

RACK MOUNTED • MODULAR • CUSTOM

for Commercial, Industrial, Military Applications



APPLICATIONS

	MODELS	CRT	SEM	PMT	IMAGE INTENSIFIER	ION SOURCE	ION, ELECTRON ACCELERATOR	CAPACITOR CHARGING	GENERAL LABORATORY	ELECTROSTATIC	LASER
RACK	RHSR	√	√	√		√			√		√
	RHR	√	√	√	√	√	√	√	√	√	√
	UHR	√		√	√	√	√	√	√	√	√
	CRT 30, 40	√							√		
	SEM 60		√						√		
MODULAR	SRM	√	√	√		√			√		
	FWRM	√	√	√	√	√			√	√	
	WRM	√	√	√	√	√			√	√	√
	FRM	√		√					√	√	
	RM	√		√					√	√	√
	UM	√		√					√	√	
	RMC	√		√					√		
	RV20P10	√							√		
	RV16P8F	√							√		
	PMT2N10			√							
	HP					√	√	√	√		√

Call or write for full line catalog

SPELLMAN
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HIGH VOLTAGE POWER SUPPLIES

RACK MOUNTED • MODULAR • CUSTOM

for Commercial, Industrial, Military Applications

The Spellman line of rack mounted high voltage power supplies offers —

- Models through 400KV and 400 Watts
- Wide variety of options
- Fixed or reversible polarity
- Fully protected — "Arc-Proof"
- Current Limiting
- Low temperature coefficients

Spellman's line of high voltage power supply modules includes —

- Models through 30KV and 30 Watts
- Fully adjustable
- Super-regulated, Well-regulated, Regulated and Proportional Models
- Multiple Output CRT Supplies
- "Slot" units
- Excellent Regulation, Ripple and Transient response
- Militarized to MIL-E-5400

FEATURES

	MODELS	MAXIMUM VOLTAGE RANGE (KV)	MAXIMUM POWER (WATTS)	RACK	MODULAR	REGULATION %	RIPPLE %	PROGRAMMING/V (VOLTAGE), R (RESISTANCE)	FULLY ADJUSTABLE	MILITARIZED VERSION AVAILABLE	MULTIPLE OUTPUT	SIZE
RACK	RHSR	60	60	√		.001	.001	V,R	√		*	5¼ x 19 x 16½ in. 133MM x 483MM x 418MM
	RHR	400	400	√		.01	.02	V*,R*	√		*	
	UHR	400	400	√		1	.1		√			
	CRT 30,40	40	120	√		.01	.01	V,R	√		√	
	SEM 60	60	25	√		.001	.001	V,R	√		√	
MODULAR	SRM	30	30		√	.001	.001	V,R	√		*	3½ x 5½ x 9½ in. 88MM x 140MM x 241MM
	FWRM	30	30		√	.01	.01	V,R			*	3⅝ x 6⅝ x 2¹⁄₁₆ in. 91MM x 168MM x 51.6MM
	WRM	30	30		√	.01	.01	V,R	√		*	
	FRM	30	10		√	1	.01	V,R			*	3⅝ x 5⅛ x 1⁹⁄₁₆ in. 91MM x 130MM x 39MM
	RM	30	10		√	1	.01	V,R	√		*	
	UM	24	1.5		√	15	.1	V,R	√			2⅝ x 4½ x 1⁹⁄₁₆ in. 66MM x 113MM x 39MM
	RMC	15	6		√	.05	.01				√	3⅝ x 6⅝ x 2¹⁄₁₆ in. 91MM x 168MM x 51.6MM
	RV20P10	20	10		√	.005	.01	V,R	√	√		4⅞ x 3⅛ x 2¹⁄₁₆ in. 122MM x 78MM x 51.6MM
	RV16P8F	16	8		√	.005	.01	V,R	√	√	√	
	PMT2N10	2	10		√	.005	10MV	V,R				3 x 5 x 7¾ in. 75MM x 127MM x 197MM
	HP	30	4000	√		.002	.01		√			22 x 24 x 50 in. 559MM x 610MM x 1270MM

*OPTIONAL

Standard Power Supplies

Choose the power supplies that set the standards for dependability and value.

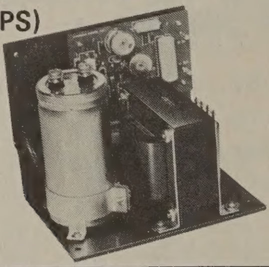
SPECIFICATIONS*

Input: 115/230 VAC ±10%, 47 to 440 Hz. **Line Regulation:** ±0.1%. **Load Regulation:** ±0.1%, no load to full load. **Ripple:** 0.1%, typically 0.5 to 2mV rms. **Short Circuit Protection:** Fold-back current limiting, adjustable from 20% to full load. **Response Time:** 50 microsec. **Temperature Rating:** 0 to 50°C. (to 70°C with derating.) **Adjustable Voltage Range:** ±10%.

For other voltages, or special requirements, contact the factory. For specs and prices of additional models, consult the 1977 Standard Power Catalog.

Immediate delivery from over 70 distributor locations nationwide.

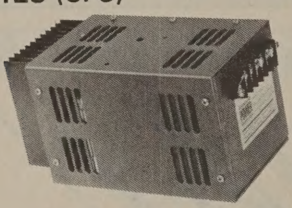
OPEN-FRAME "BLUE LINE" SERIES (SPS)



5 Vdc			12 Vdc			15 Vdc			24/28 Vdc		
Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price
1.5	SPS 15-5	$ 24.95	0.8	SPS 15-12	$ 24.95	0.7	SPS 15-15	$ 24.95	0.5	SPS 15-24/28	$ 24.95
3.0	SPS 30-5	29.95	1.8	SPS 30-12	29.95	1.6	SPS 30-15	29.95	1.2	SPS 30-24/28	29.95
5.0	SPS 40-5	52.00	3.5	SPS 40-12	52.00	3.0	SPS 40-15	52.00	1.8	SPS 40-24/28	52.00
6.0	SPS 60-5	64.50	5.0	SPS 60-12	64.50	4.0	SPS 60-15	64.50	2.5	SPS 60-24/28	64.50
10	SPS 75-5	74.50									
12	SPS 120-5	105.00	10	SPS 120-12	105.00	8.0	SPS 120-15	105.00	6.0	SPS 120-24/28	105.00
18	SPS 180-5	119.00									
25	SPS 220-5	179.00	20	SPS 220-12	179.00	18	SPS 220-15	179.00	12	SPS 220-24/28	179.00
25	SPS 250-5†	189.00	20	SPS 250-12†	189.00	18	SPS 250-15†	189.00	12	SPS 250-24/28†	189.00
35	SPS 320-5	199.00									
35	SPS 350-5†	210.00									

Models also availabe: 48, 120, 250 Vdc. +Models with built-in fan.

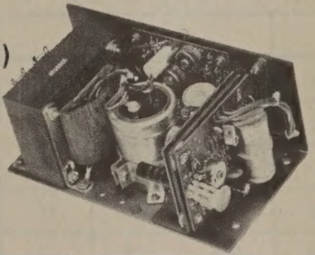
COVERED "BLUE LINE" SERIES (CPS)



5 Vdc			12 Vdc			15 Vdc			24/28 Vdc		
Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price
3.0	CPS 30-5	$ 49.00	1.8	CPS 30-12	$ 49.00	1.6	CPS 30-15	$ 49.00	1.2	CPS 30-24/28	$ 49.00
6.0	CPS 60-5	90.00	5.0	CPS 60-12	90.00	4.0	CPS 60-15	90.00	2.5	CPS 60-24/28	90.00
10	CPS 75-5	95.00									
12	CPS 120-5	130.00	10	CPS 120-12	130.00	8.0	CPS 120-15	130.00	6.0	CPS 120-24/28	130.00
18	CPS 180-5	150.00									
25	CPS 220-5	195.00	20	CPS 220-12	195.00	18	CPS 220-15	195.00	12	CPS 220-24/28	195.00
25	CPS 250-5†	199.00	20	CPS 250-12†	199.00	18	CPS 250-15†	199.00	12	CPS 250-24/28†	199.00
35	CPS 320-5	210.00									
35	CPS 350-5†	220.00									
50	CPS 500-5†	345.00	40	CPS 500-12†	345.00	33	CPS 500-15†	345.00	20	CPS 500-24/28†	345.00

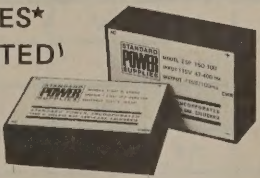
†Models with built-in fan.

DUAL-OUTPUT "BLUE LINE" SERIES (SPS-D)



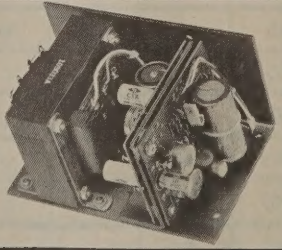
5 Vdc	10 to 12 Vdc	12 to 15 Vdc	12 to 15 Vdc	Model Number	Price
Amp	Amp	Amp	Amp		
2.0	0.6			SPS 30DA 5/12	$ 49.00
		0.7	0.7	SPS 30DA 12/15	49.00
2.0/2.0				SPS 40D 5/5	60.00
2.0	1.0			SPS 40D 5/12	60.00
		1.2	1.2	SPS 40D 12/15	60.00
3.0	1.8			SPS 60D 5/12	75.00
		1.8/1.6	1.8/1.6	SPS 60D 12/15	75.00
6.0	3.0			SPS 90D 5/12	94.00
		3.0	3.0	SPS 90D 12/15	94.00
10.0	4.0			★SPS 130D 5/12	139.00
		5.0/4.0	5.0/4.0	★SPS 130D 12/15	139.00
12.0	8.0			SPS 250D 5/12	179.00
		8.0/6.0	8.0/6.0	SPS 250D 12/15	179.00

"ESP" DC POWER MODULES* (CIRCUIT BOARD MOUNTED)



Single-Output Series				Dual-Output Series			
Volts	Amps	Model Number	Price	Volts	Amps	Model Number	Price
5 Vdc	0.5	ESP5-500	$ 53.00	±12 Vdc	0.12	ESP12D-120	$ 53.00
5 Vdc	1.0	ESP5-1000	72.00	±12 Vdc	0.24	ESP12D-240	72.00
10 Vdc	0.12	★ESP10-120	39.00	±12 Vdc	0.40	★ESP12D-400	99.00
15 Vdc	0.1	ESP15-100	32.00	±15 Vdc	0.025	ESP15D-25	38.00
				±15 Vdc	0.10	ESP15D-100	53.00
				±15 Vdc	0.20	ESP15D-200	72.00
				±15 Vdc	0.35	★ESP15D-350	99.00

TRIPLE-OUTPUT "BLUE LINE" SERIES (SPS-T)



5 Vdc	12 to 15 Vdc	12 to 15 Vdc	Model Number	Price
Amp	Amp	Amp		
2	0.25	0.25	SPS 30TA 5/12/15	$ 75.00
3	0.7	0.7	SPS 50TA 5/12/15	89.00
5	0.7	0.7	SPS 60TA 5/12/15	95.00
3	1.5	1.5	SPS 70TA 5/12/15	98.00
5	1.8	1.8	SPS 80T 5/12/15	104.00
7	1.8	1.8	SPS 90T 5/12/15	114.00
7	3.5	3.5	SPS 120T 5/12/15	139.00
12	1.5	1.5	★SPS 220T 5/12/15	149.00
12	2.8	2.8	★SPS 240T 5/12/15	159.00
12	3.5	3.5	SPS 250T 5/12/15	179.00

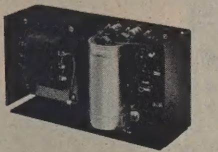
The "Black Line" Series power supplies are unregulated.

Selector Guide

STANDARD POWER INCORPORATED

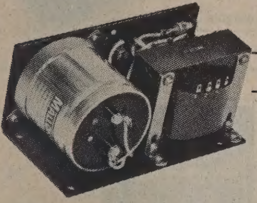
★ NEW PRODUCTS

*NARROW SILHOUETTE "SLIM LINE" SERIES (SLS)



5 Vdc			12 Vdc			15 Vdc			24 Vdc			28 Vdc		
Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price	Amp	Model Number	Price
3.0	*SLS 32-5	$ 31.00	1.8	*SLS 32-12	$ 31.00	1.6	*SLS 32-15	$ 31.00	1.2	*SLS 32-24	$ 31.00	1.0	*SLS 32-28	$ 31.00
6.0	*SLS 42-5	53.00	3.5	*SLS 42-12	53.00	3.0	*SLS 42-15	53.00	2.3	*SLS 42-24	53.00	1.8	*SLS 42-28	53.00
12.0	*SLS 92-5	79.00	6.8	*SLS 92-12	79.00	6.0	*SLS 92-15	79.00	4.8	*SLS 92-24	79.00	4.0	*SLS 92-28	79.00
18.0	*SLS 122-5	105.00	10.2	*SLS 122-12	105.00	9.0	*SLS 122-15	105.00	7.2	*SLS 122-24	105.00	6.0	*SLS 122-28	105.00

RAW POWER, "BLACK LINE" UNREGULATED SERIES* (B)

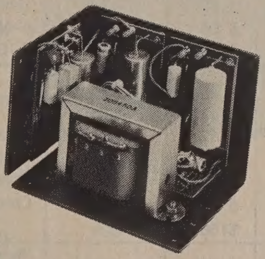


7 Vdc (Nom. @ F.L.)			12 Vdc (Nom. @ F.L.)			16 Vdc (Nom. @ F.L.)			20 Vdc (Nom. @ F.L.)			24 Vdc (Nom. @ F.L.)		
F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price
1.8	15B7	$ 19.00	1.2	15B12	$ 19.00	0.9	15B16	$ 19.00	0.75	15B20	$ 19.00	0.6	15B24	$ 19.00
3.0	30B7	23.00	2.4	30B12	23.00	1.8	30B16	23.00	1.5	30B20	23.00	1.2	30B24	23.00
6.0	*60B7	34.00	4.8	*60B12	34.00	3.6	*60B16	34.00	3.0	*60B20	34.00	2.4	*60B24	34.00
10	100B7	44.00	7.0	100B12	44.00	6.0	100B16	44.00	5.0	100B20	44.00	3.5	100B24	44.00
20	200B7	59.00	15	200B12	59.00	12.5	200B16	59.00	10	200B20	59.00	7.5	200B24	59.00
												20	500B24	120.00
												30	750B24	195.00

VOLTAGE CONTROL REGULATORS (VCR)

5 Vdc			12/15 Vdc			18/24 Vdc		
F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price	F.L. Amp	Model Number	Price
6	VCR 5-6	$16.00	6	VCR 12/15-6	$16.00	4.5	VCR 18/24-4.5	$16.00
12	VCR 5-12	22.00	12	VCR 12/15-12	22.00	8	VCR 18/24-8	22.00

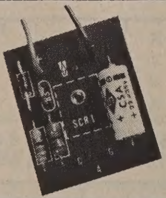
*MICROPROCESSOR "SMP" SERIES



Model Number	Price	Amps @ +5V	Amps @ +12V	Amps @ -5V	Amps @ -9 to -12V
*SMP 32-5	$ 29.00	2.5			
*SMP 42-5	48.00	4.5			
*SMP 30-1	49.00	1.0*	0.5*		0.4/0.5
*SMP 30-2	54.00	1.0*	0.5*	0.07*	0.4/0.5
*SMP 50-1	72.00	3.0	0.6*		0.4/0.5
*SMP 50-2	79.00	3.0	0.6*	0.5*	0.4/0.5
*SMP 60-1	92.00	5.0	0.6*		0.4/0.5
*SMP 60-2	99.00	5.0	0.6*	0.5*	0.4/0.5
*SMP 80-1	115.00	6.0	1.5		1.2/1.5
*SMP 80-2	122.00	6.0	1.5	0.5*	1.2/1.5
*SMP 100-1	137.00	8.0	2.5		1.2/1.5
*SMP 100-2	144.00	8.0	2.5	0.5*	1.2/1.5
*SMP 30B	27.50	1.0**	0.5**		

*Fixed Output (Nominal)
**Unregulated

OVERVOLTAGE PROTECTION DEVICES (OVP)

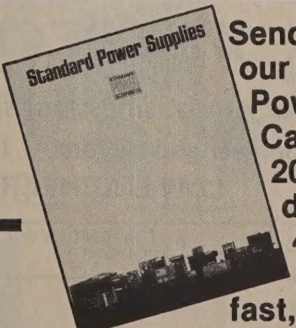


Voltage (Vdc)	Model Number & Output Current (Continuous)							
	8 Amp	Price	16 Amp	Price	35 Amp	Price	60 Amp	Price
6.5 (Fixed)	OVP-0	$ 6.00						
5.35 to 32 Vdc	OVP-1	8.00	OVP-2	$12.00	OVP-3	$19.00	OVP-4	$35.00
5.0 to 8.0 Vdc	OVP-11	8.00	OVP-12	12.00	OVP-13	19.00	OVP-14	35.00
25 to 75 Vdc	★OVP-21	10.00	★OVP-22	14.00	★OVP-23	21.00	★OVP-24	37.00

See Page 25 for Built-In OVP Circuits

CONSTANT CURRENT SUPPLIES (SCC)

Model Number	Price	Current Regulation Range (Amperes) and Compliance Voltage				
		.03 to 1A	.05 to 2A	0.1 to 4A	0.1 to 12A	0.1 to 15A
SCC 30-1	$ 55.00	30 Vdc				
SCC 30-2	55.00		15 Vdc			
SCC 60-2	84.00		30 Vdc			
SCC 60-4	84.00			15 Vdc		
SCC 120-4	125.00			30 Vdc		
SCC 120-12	125.00				8 Vdc	
SCC 250-15	225.00					15 Vdc



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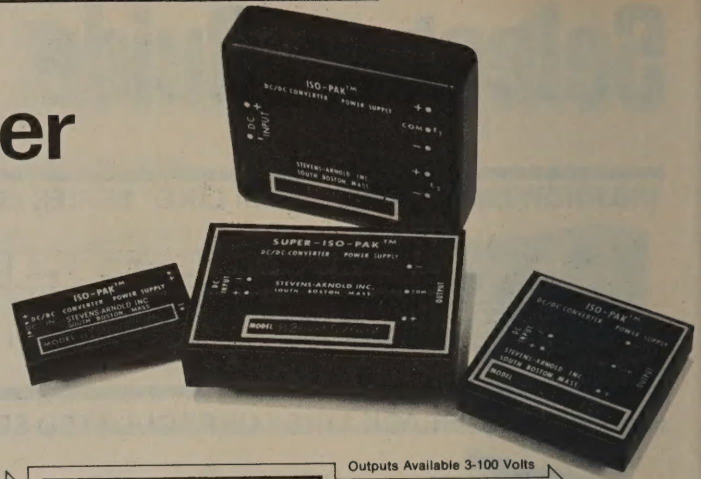
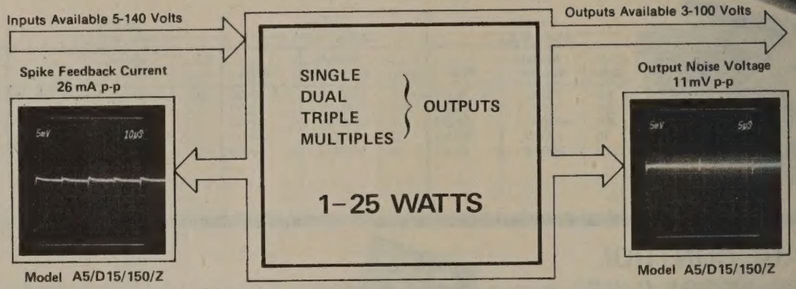
STANDARD POWER

ISO-PAK™ DC/DC Converter Power Supplies are the Expert's Choice


ISO-PAK™ DC/DC CONVERTER POWER SUPPLY
STEVENS-ARNOLD INC. SOUTH BOSTON MASS.
SUPER-ISO-PAK™ DC/DC CONVERTER POWER SUPPLY
MODEL

FEATURING . . .

- Low Noise
- Isolated — Regulated
- High Efficiency


Inputs Available 5-140 Volts
Outputs Available 3-100 Volts
Spike Feedback Current 26 mA p-p
Output Noise Voltage 11mV p-p
SINGLE
DUAL
TRIPLE
MULTIPLES
OUTPUTS
1–25 WATTS
5mV
10μS
5μS
Model A5/D15/150/Z
Model A5/D15/150/Z

Selected Items Taken from 900 Stock Models. For Full Specifications — 35 Parameters for each Item — Request Catalogs Listed.

Series	Inputs	Outputs	Watts	Eff.(FL)	Case	Price (1-9)	Catalog No.*	Applications
		SINGLE OUTPUTS						
H	See Listing Below	5, 6, 8, 12, or 15 V	1.5	50%	W	$ 34	607	Regulated, High Efficiency and Fast Recovery, Isolated Power for DTL/TTL, C-MOS Microprocessors, Memories, A-D/D-A Converters
F		5, 6, 8, 12, or 15 V	5	70%	Z	$ 89	606	
M		5, 6, 8, 12, or 15 V	10	65%	X	$ 99	608	
P		5, 6, 8, 12, or 15 V	25*	65%	V	$160	609	
		DUAL OUTPUTS						
A	See Listing Below	±12 or ±15 V ±30 mA	0.9	45%	Z	$ 42	602	Regulated, Low Noise, High Efficiency, Isolated Power for Linear IC's; Function Modules, A-D/D-A Converters, etc.
A		±12 or ±15 V ±60 mA	1.8	52%	Z	$ 52	602	
A		±12 or ±15 V ±100 mA	3.0	60%	Z	$ 69	602	
A		±12 or ±15 V ±150 mA	4.5	65%	Z	$ 79	602	
N		±12 or ±15 V ±330 mA	10	65%	X	$ 99	608	
R		±12 or ±15 V ±830 mA	25*	65%	V	$165	609	
B		±12 or ±15 V ±60 mA	1.8	52%	Y	$ 62	602	Super-Isolation (8000VDC, 5pF) for Medical, Utility and Industrial Applications.
		TRIPLE OUTPUTS						
C	See Below	±15 V, ±165 mA/5 V, 750mA	9	50%	X	$ 99	604	Regulated ±15 V, +5 V with Transformer Isolated Output Grounds for A-D/D-A Converters, Data Acquisition Systems and Modules.
S	See Below	±15 V, ±330 mA/5 V, 3 Amps	25*	65%	V	$175	609	
WC	6.5 – 40	±15 V, ±165 mA/5 V 2 Amps	15	70%	U	$114	613	
WC	6.5 – 40	±15 V, ±100 mA/5 V 1 Amp	8	65%	X	$ 99	613	
Nominal Inputs	5, 6, 12 VDC 24, 28, 48 VDC	Case Size (W) 1" x 2" x 0.375 (Z) 2" x 2" x 0.375" (Y) 2" x 3" x 0.60" (X) 2.56" x 3" x 0.75" (V) 4" x 6" x 0.75" (U) 2.56" x 4.5" x 0.75"						* RATINGS WITH HEAT SINKS

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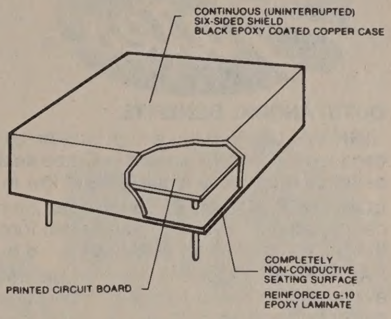
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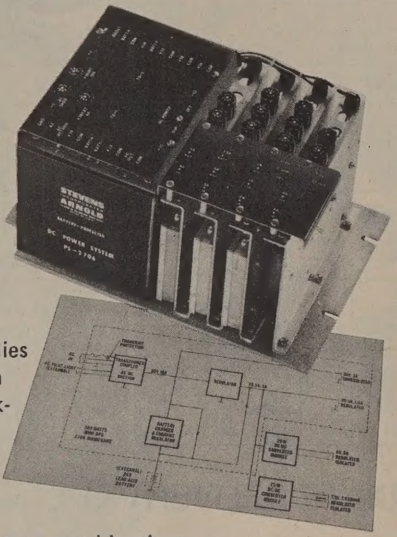
REINFORCED G-10 EPOXY LAMINATE

NEW



300VA UNINTERRUPTIBLE MINI-UPS POWER SUPPLY

Complete Mini-UPS system supplies all regulated DC voltages from an AC source using an external Back-Up Battery.
Model 2700 Mainframe has 3 Uncommitted DC/DC Converter Module slots to permit hundreds of user-selected DC output combinations.

FEATURES:

- Mainframe Prices start at $395
- Regulated DC outputs are tailored to your special requirements
- 100 Hour Burn-In
- Modular concept reduces field service costs

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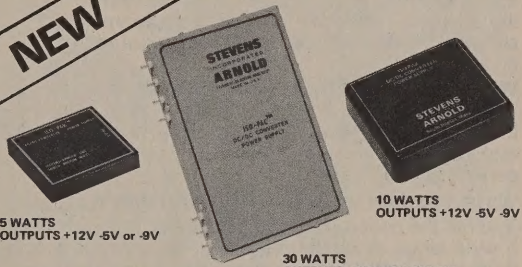
Catalog 615

NEW



5 WATTS
OUTPUTS +12V -5V or -9V

30 WATTS
OUTPUTS +12V +5V -5V -9V

10 WATTS
OUTPUTS +12V -5V -9V

LOW NOISE SERIES U MICROPROCESSOR/MICROCOMPUTER DC/DC CONVERTER MODULES

Power Microprocessors from 5VDC, 12V, 28V, 48V or 60VDC Logic Supplies or Batteries.

FEATURES:

- **Milliwatts to 30 Watts**
- **1 to 4 Outputs**
- **Fully Isolated, Regulated**
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- **Controlled Transient Characteristics**
- **Design Flexibility: Other Input/Outputs Available**

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Catalog 616

Applications Information

Get in touch with us today. Request this helpful information plus our Short Form Catalog which lists hundreds of Models.

- **Tips on Specifying Modular Plug-in DC/DC Converter Power Supplies**
- **Determine Noise of DC/DC Converters**
- **Uninterruptable Power for Volatile Semi-conductor Memories**
- **Prevent Damaging Overloads to DC/DC Converters**
- **DC/DC Converters for Strain Gage Applications**

200 Watts
60 Hz
UL-544 Approved

200 Watts
20 kHz
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HIGH VALUE. You get a high watt-hr. per dollar value because the materials used in Gates sealed lead-acid batteries are readily available and low in cost.

LONG SERVICE LIFE. You can get more than 600 deep discharge cycles . . . and even longer life when the battery is used as a standby . . . 8 to 10 years.

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EASY RECHARGE. You get the utmost versatility in the charging methods—constant voltage; modified constant voltage with tapering charge current; or constant current.

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WIDE TEMPERATURE RANGE FOR OPERATION. You get the option of discharging Gates batteries over a wide range of temperatures, the capacity being a function of both temperature and discharge rate.

SEALED CONSTRUCTION. You get individual cells in a sealed case that prevents acid, water and acid vapor leakage. The rugged metal case also maximizes resistance to shock and vibration.

LONG SHELF LIFE. You get an exceptionally low self-discharge rate.

SAFETY. You have virtually no problems with thermal runaway caused by overcharging.

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6 VOLT LANTERN BATTERY

CELLS

Product No.	Voltage	Capacity (Ampere-Hours)		Discharge Current at 10 Hr. Rate	Length Inches/mm		Diameter Inches/mm		Approx. Weight Ounces/Grams	
		20 Hr. Rate	10 Hr. Rate							
0810-0004	2	2.7	2.5	250 mA	2.66	67.56	1.34	34.16	6.4	181.4
0800-0004	2	5.2	5.0	500 mA	3.17	80.52	1.74	44.32	13.0	368.6

BATTERIES

Product No.	Voltage	Capacity (Ampere-Hours)		Discharge Current at 10 Hr. Rate	Length Inches/mm		Width Inches/mm		Height Inches/mm		Approx. Weight Pounds/Kilograms	
		20 Hr. Rate	10 Hr. Rate									
0810-0011	6	2.7	2.5	250 mA	4.2	106.7	1.5	38.1	2.7	68.6	1.3	0.59
0800-0011	6	5.2	5.0	500 mA	5.4	137.2	1.9	48.3	3.1	78.7	2.8	1.27
0802-0008	6	10.4	10.0	1000 mA	5.4	137.2	3.6	91.4	3.1	78.7	5.3	2.40
0800-0027	8	5.2	5.0	500 mA	7.1	180.3	1.9	48.3	3.1	78.7	3.7	1.68
0810-0008	12	2.7	2.5	250 mA	4.2	106.7	2.8	71.1	2.7	68.6	2.5	1.13
0810-0016	12	2.7	2.5	250 mA	8.2	208.3	1.5	38.1	2.7	68.6	2.5	1.13
0800-0008	12	5.2	5.0	500 mA	5.4	137.2	3.6	91.4	3.1	78.7	5.3	2.40
0800-0016	12	5.2	5.0	500 mA	10.6	269.2	1.9	48.3	3.1	78.7	5.3	2.40

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ETERNACELL® LITHIUM PRIMARY BATTERIES

The lithium primary battery with organic electrolyte is the most significant improvement in battery technology in the past 25 years. Compared with all other primary battery types, the lithium system is markedly superior in every aspect of battery performance. The Power Conversion ETERNACELL is the first commercially available lithium primary battery.

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- 3.0 volts-per-cell nominal operating voltage (with adapter, single cell replaces 2 ordinary cells).
- Highest energy per unit weight and volume to 145WH-Hr./LB. 5-10 year shelf life
- Outstanding high and low-temperature performance–down to −65F and + up to +165F.
- 1/2AA, AA, C, 1-1/4C, D, 9V Transistor type to 30 A.H., . . . hermetically sealed cells available.

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ETERNACELL
ETERNACELL®
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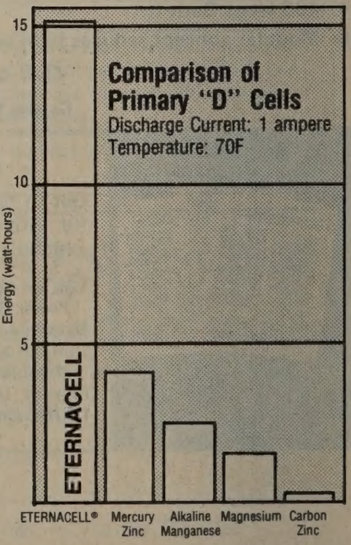

IMMEDIATE DELIVERY ON GATES & ETERNACELL BATTERIES

TAUBER ELECTRONICS, INC.
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Telephone (714) 274-7242

Tecnetics' broad range of power converters, the stepping stones to your product's success

SERIES DC-DC	OUTPUT POWER Watts	OUTPUT VOLTAGE VDC	INPUT VOLTAGE VDC	PRICE RANGE 1 to 9
3150-48	150	5-48	48	595
3100-48	100	5-48	48	495
3100-28	100	5-48	28	495
3050-48	50	5-48	48	425
3050-28	50	5-48	28	425
3025-48	25	5-48	48	395
3025-28	25	5-48	28	395
9525-48	25	5-24	48	250,295,365
9525-28	25	5-24	28	250,295,365
9584	10	5V-5KV	28	210-310
9589	6	5V-5KV	28	190-280
9567	3	5V-5KV	28	180-270
9583	1	5V-3KV	28	200-280
1205	25	5-28	12,24,28,48	198
1000	10	5-24	5,6,12,24,28,48	115,125,140
1600	6	5-24	5,6,12,24,28,48	89,99,109
1300	3	5-24	5,6,12,24,28,48	79,89,99
1100	1	5-24	5,6,12,24,28,48	59,65
HC	max. 3	5-300	5,12,20	49,59,69
HCH, N, E	max. 3	5-300	6,5,12,15,20,24,28	49,59,69
AC-DC				
4200	200	5-48	115	845
4100	100	5-48	115	450
4050	50	5-48	115	425
4025	25	5-48	115	395
4100-3	100	5-48	115	450
4050-3	50	5-48	115	425
4025-3	25	5-48	115	395

Whether you are designing military hardware, space vehicles, communication equipment or other high technology products, the components you select can mean the difference between success or failure in the final product. That's why more and more design engineers are finding the power converters they need in the Tecnetics catalog.

Tecnetics offers the broadest range of state of the art DC-DC power converters, and we are now extending our expertise into 400 Hz power supplies. We have been developing and refining these products since 1959, so that today each one is unsurpassed in terms of efficiency, reliability, control circuitry and documentation.

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• Efficiencies up to 86% • MTBF up to 40,000 hrs. • Single, dual and triple outputs • Remote error sensing • Densities up to 1.65 watts per cubic inch • EMI protection • Mil spec environmental protection • Short circuit and overload protection • Input-output isolation

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A **BENRUS** DIVISION

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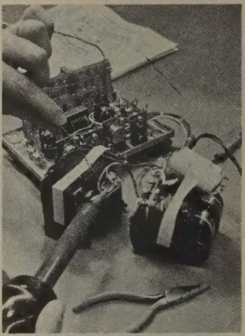
- Moderate Environment AC-DC Series
- High Efficiency AC-DC Switcher Series
- High Efficiency DC-DC Converter Series
- High Efficiency DC-AC Sine Wave Inverter Series



Technipower was founded on the principle of providing the system engineer with a reliable, practical and economical alternative to expensive custom-built or laboratory type power supplies. The concept developed by Technipower to accomplish this objective is to assemble and package the highest quality parts and materials into a standard module. In this way, the system engineer can specify precision regulated power by selecting a single part number as he would a component. Costly software documentation and servicing logistics are kept to a minimum. No elaborate parts lists or expensive servicing manuals are required. ☐ From design through production, every stage in the making of power supplies is done in-house at the modern 203,000 square foot Benrus Corporation complex in Ridgefield, Connecticut. The comprehensive Technipower design/data catalog provides a large range of models from which the designer can select the exact power supply required. Complete details, including specifications, application data and model capabilities are provided. Our staff of expert power supply engineers is available to assist the equipment designer in catalog module modification or in custom designing.

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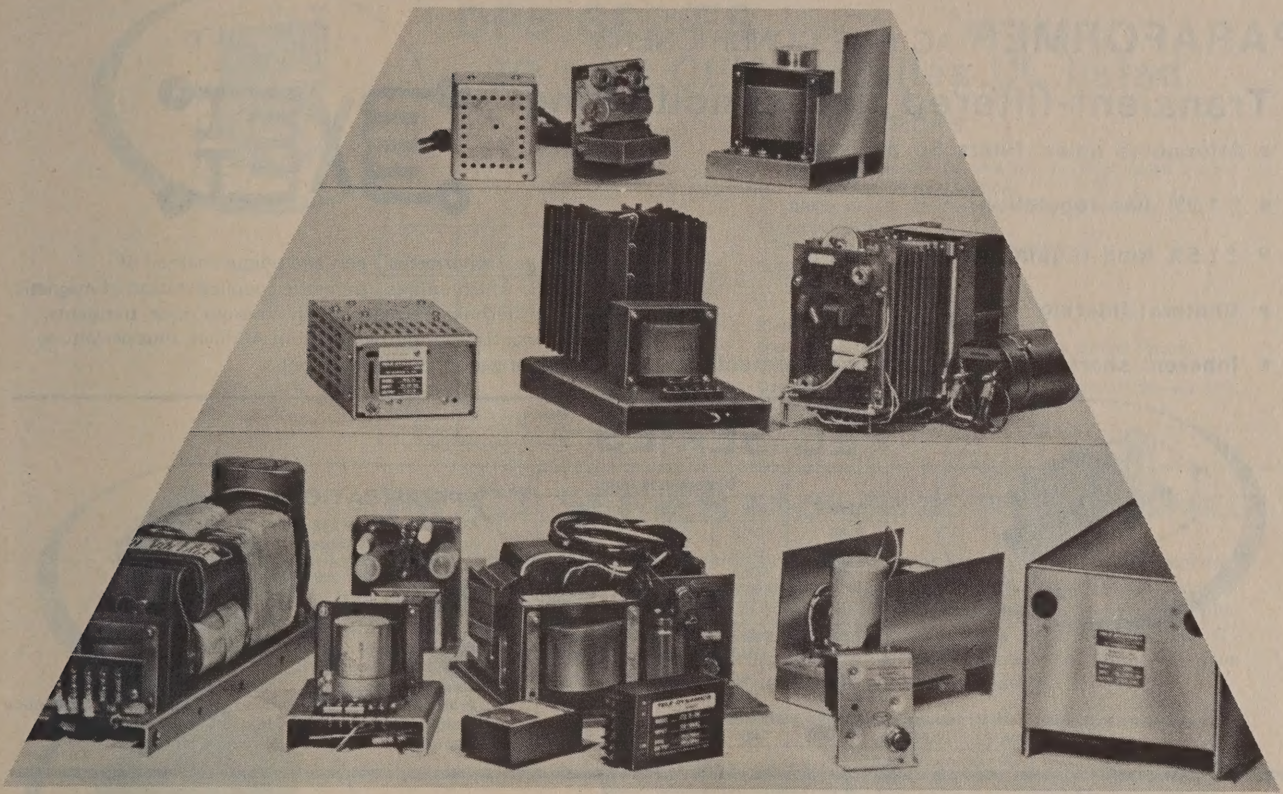
TELE-DYNAMICS



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Modular power supplies **Miniature power supplies**

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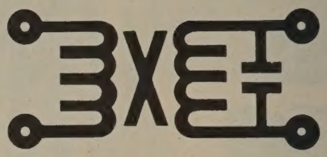
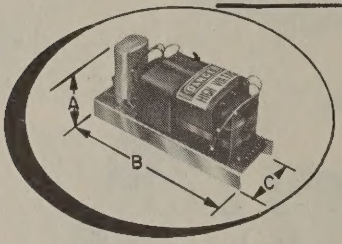
PARAFORMER® AC LINE CONDITIONERS

Transient-filtered line conditioning



- Attenuates noise; filters 50 db to 1 MHz
- ± 1.0% line regulation
- ±1.5% load regulation
- Bilateral filtering
- Inherent short circuit and overload protection

Tele-Dynamics Paraformer is a new and unique method of energy transfer which utilizes parametric coupling instead of magnetic coupling. This technique regulates and filters out noise, transients, and other unwanted spurious signals from AC lines, thus permitting optimum performance of end equipment.



PEC SERIES

Model	Dimensions (mm)		
	A	B	C
P-60	107.9	228.6	101.6
P-150	152.4	304.8	101.6
P-500	190.5	431.8	127.0
P-1000	190.5	431.8	260.3

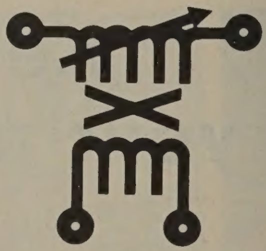
Model	Power (VA)	Weight (kg)	Fuse (amps)
P-60	60	5.4	4
P-150	150	16	4
P-500	500	27	10
P-1000	1000	54	20

SPECIFICATIONS

AC input: 198 to 242 volts, 1ϕ, 50 Hz
Ac output: See table of models
  Voltage: 220 ±4 volts, 1ϕ, 50 Hz
  Power: 60 to 1000 VA
Regulation:
  Line: ±1.0%
  Load: ±2.0%
Response time: Instantaneous
Power efficiency: 65%
Temperature: 0 to 55°C
Protection: Inherent overload and short circuit protection
Weight: See table of models, 5.4 to 54 kg
Controls: Start pushbutton (some models)

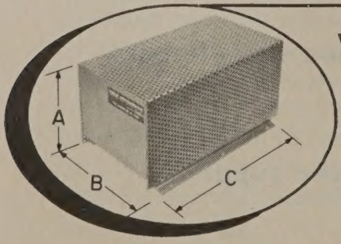
VARAX® AC LINE VOLTAGE REGULATORS

Solve brown-out problems



- Efficiency greater than 90% at full load
- High reliability; no semiconductors in AC path
- True rms regulation
- Insensitive to line frequency changes
- 1% Regulation, line and load

Varax employs a closed loop feedback system which utilizes the parametric energy concept to vary an inductor in series with the AC line. This increase or decrease in inductance permits control over wide ranges of line input fluctuations. This permits optimum performance of equipment under changing input conditions such as "brown-out", or in-plant line voltage variations.



VARAX® LR SERIES

Model	Dimensions (mm)		
	A	B	C
LR-504	177.8	212.7	342.9
LR-1504	177.8	212.7	342.9
LR-5004	449.3	482.6	254.0

SPECIFICATIONS

AC input: 180 to 250 volts, 50 Hz
AC output: 220 volts, 50 Hz
Output power:
  LR-504: 500 VA
  LR-1504: 1500 VA
  LR-5004: 5000 VA
Regulation:
  Line: ±1%
  Load: ±1%
Response time: 50 milliseconds
Power efficiency: Greater than 90%
Distortion: Less than 5%
Controls: Output voltage adjust ±3%
Operating temperature: 0 to 55°C
Weight:
  LR-504: 14 kg
  LR-1504: 22 kg
  LR-5004: 78 kg

For additional information
see Designer's Handbook.
Send for your FREE copy today.

TELE-DYNAMICS DIVISION OF AMBAC

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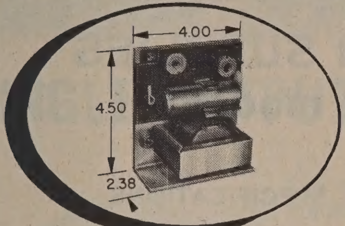


DPS SERIES

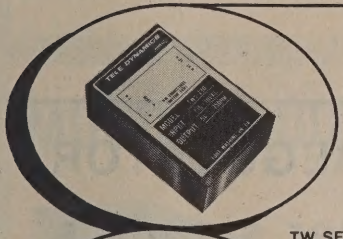
20 watt OEM supplies UL listed.

MODEL	INPUT VOLTAGE	DC OUTPUT
DPS-1	115 VAC	5/6V, 3/2.5A
DPS-2		12/15V, 1.5/1.2A
DPS-3		24V, 0.8A
DPS-8	220 VAC	5/6V, 3/2.5A
DPS-9		12/15V, 1.5/1.2A
DPS-10		24V, 0.8A
OVP-3	Overvoltage Protection (Option)	

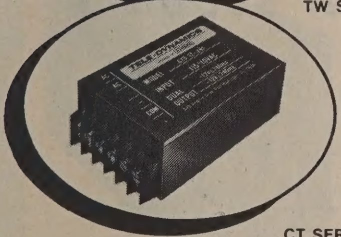
SPECIFICATIONS

AC input:
DPS-1, -2, -3: 105-125 volts AC, 1Φ, 57 to 63 Hz (derate 20% for 400 Hz operation)
DPS-8, -9, -10: 200-240 volts AC, 1Φ, 47 to 63 Hz
DC output: See table
Voltage: 5-6, 12-15, and 24 volts, floating
Regulation:
Line: ±0.25%
Load: ±0.25%
Ripple: 0.3% +10 mv rms max
Overload protection: Adjustable foldback current limiting
Overvoltage protection: Optional OVP-3
Controls: Output voltage adjust ±2%, nominal, (±10% with 20% derating). Current limit adjust
Temperature: 0 to 40° C (derate current 2%/° C over 40° C)
Weight: 1.9 pounds

TW/CT SERIES MINIATURE DC POWER SUPPLIES



TW SERIES



CT SERIES

The TW and CT series of miniature power supplies are rugged modular assemblies that provide well-regulated, reliable DC power. The TW supplies are designed for mounting to PC boards. Electrical connections can be made either with connector pins or by soldering. The CT supplies are intended for chassis mounting and each CT supply is equipped with a terminal block for electrical connections. All models have threaded inserts for securing the units to the mounting surface.

APPLICATIONS	MODEL	OUTPUT Voltage (volts)	OUTPUT Current (ma)	REGULATION Line (%)	REGULATION Load (%)	RIPPLE (mv rms)	CASE SIZE
SINGLE OUTPUT LOGIC SUPPLIES	TW5-250	5.0	250	±0.02	±0.04	1.0	1
	TW5-500 *	5.0	500	±0.02	±0.04	1.0	3
	TW5-1000 *	5.0	1000	±0.02	±0.04	1.0	4
	TW5-2000	5.0	2000	±0.02	±0.05	1.0	5
SINGLE OUTPUT GENERAL PURPOSE SUPPLIES	TW3 6-250	3.6	250	±0.05	±0.05	0.5	1
	TW6-200	6.0	200	±0.05	±0.05	0.5	1
	TW10-120	10	120	±0.02	±0.02	0.5	2
	TW12-120	12	120	±0.02	±0.02	0.5	2
	TW15-100	15	100	±0.02	±0.02	0.5	2
	TW18-65	18	65	±0.02	±0.02	1.0	2
	TW20-60	20	60	±0.02	±0.02	1.0	2
	TW24-50	24	50	±0.02	±0.02	1.0	2
	TW28-40	28	40	±0.02	±0.02	1.0	2
DUAL OUTPUT OP AMP SUPPLIES	TWD12-120	±12	120	±0.02	±0.02	0.5	3
	TWD12-240	±12	240	±0.02	±0.02	0.5	4
	TWD12-400	±12	400	±0.02	±0.02	0.5	5
	TWD15-25	±15	25	±0.2	±0.2	2.0	3
	TWD15-65	±15	65	±0.02	±0.02	0.5	3
	TWD15-100	±15	100	±0.02	±0.02	0.5	3
	TWD15-200	±15	200	±0.02	±0.02	0.5	4
	TWD15-350	±15	350	±0.02	±0.02	0.5	5
	TWD18-65	±18	65	±0.02	±0.05	1.0	4
	TWD24-50	±24	50	±0.02	±0.02	0.5	3
	TWD26-45	±26	45	±0.02	±0.05	1.0	4
TRIPLE OUTPUT A/D AND D/A CONVERTER SUPPLIES	TWT155-1	±15	100	±0.02	±0.03	1.0	4
		5.0	250	±0.05	±0.05	1.0	
	TWT155-2	±15	100	±0.02	±0.03	1.0	6
		5.0	500	±0.02	±0.06	1.0	
SINGLE OUTPUT LOGIC SUPPLIES	CT5-500*	5.0	500	±0.05	±0.1	2.0	7
	CT5-1000*	5.0	1000	±0.05	±0.15	2.0	7
	CT5-2000	5.0	2000	±0.05	±0.15	2.0	7
DUAL OUTPUT OP AMP SUPPLIES	CTD12-120	±12	120	±0.05	±0.05	1.0	7
	CTD12-240	±12	240	±0.05	±0.05	1.0	7
	CTD12-400	±12	400	±0.05	±0.05	1.0	8
	CTD15-100	±15	100	±0.05	±0.05	1.0	7
	CTD15-200	±15	200	±0.05	±0.05	1.0	7
	CTD15-350	±15	350	±0.05	±0.05	1.0	8
	CTD15-500	±15	500	±0.05	±0.05	1.0	8

*With overvoltage protection. Overvoltage crowbar set to trip at 6.2 volts nominal.

Single, dual or triple output

GENERAL SPECIFICATIONS

Input voltage: 115 ±10 VAC
Input frequency: 50 to 400 Hz
Input isolation: 50 megohms
Output impedance: 0.2 ohms at 10 kHz
Output voltage setting: ±2% of rated voltage
Storage temperature: -25 to +85°C
Operating temperature: -25 to +71°C
Temperature coefficient: 0.02%/°C

Output current vs temperature: Each output is rated for full current at temperatures between -25° and +70°C with no derating.

CASE SIZES

1. 2 x 3 x 1
2. 1.75 x 2.25 x 1
3. 2.50 x 3.50 x 0.88
4. 2.50 x 3.50 x 1.25
5. 2.50 x 3.50 x 1.62
6. 2.50 x 3.50 x 1.88
7. 2.70 x 4 (plus 0.38 for terminal block) x 1.44
8. 2.70 x 4 (plus 0.38 for terminal block) x 2

For additional information see Designer's Handbook. Send for your FREE copy today.

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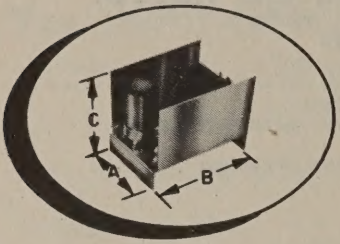
II-OEM SERIES DC POWER SUPPLIES
30, 60 and 120 Watt models



MODEL	DC OUTPUT	POWER GROUP
30-OEM-1	3.6 to 9V	30 watts or 2.5 amps max
30-OEM-2	9 to 17V	
30-OEM-3	17 to 30V	
30-OEM-4	30 to 60V	
60-OEM-1	3.6 to 9V	60 watts or 5 amps max
60-OEM-2	9 to 17V	
60-OEM-3	17 to 30V	
60-OEM-4	30 to 60V	
120-OEM-1	3.6 to 9V	120 watts or 10 amps max
120-OEM-2	9 to 17V	
120-OEM-3	17 to 30V	
120-OEM-4	30 to 60V	

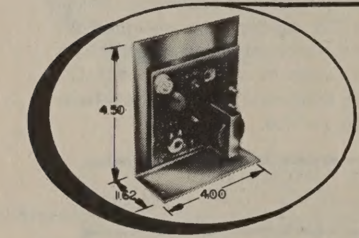
DIMENSIONS (IN.)

MODEL	A	B	C
30-OEM	5.0	5.0	5.0
60-OEM	5.0	7.0	5.38*
120-OEM	5.0	10.00	7.00

*7.0 for 60-OEM-4-only

SPECIFICATIONS

Ac input: 105-125 volts AC, 1Φ, 47 to 63 Hz (derate output current 10% at 50 Hz.)
DC output: See table for models
Voltage: Adjustable 3.6 to 60 volts in four ranges, floating
Power: 30, 60, 120 watt models
Regulation:
Line: ±1%
Load: ±1%
Ripple: 0.1% +10 mv rms max
Controls: Output voltage adjust
Temperature: 0 to 45°C (to 65°C with 2%/°C derating from 45°C)



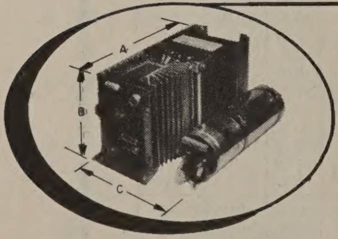
CVR-120 VOLTAGE REGULATOR
for use with DC power supplies

SPECIFICATIONS

AC input: 100-130 volts AC, 1Φ, 47-420 Hz
AC output:
Voltage: 135 volts peak ±10% (270 volts peak to peak)
Power: 120 VA
Regulation:
Line: ±1.0% for 10% line variations
Load: ±1.0%
Power factor: ±1.0% (+0.7 to -0.7)
Type: Peak clipping
Response time: 10-50 microseconds
Efficiency: 75% min. at nominal input voltage and full load

Temperature:
Operating range: 0 to 40°C (to 70°C with 2%/°C derating from 40°C)
Temperature coefficient: 0.025%/°C
Protection: Internal overcurrent protection
Weight: 10 oz.
Controls: Output voltage adjust ±10%
Phase shift: None

APPLICATION: Used as preregulator for electronic equipment.



BRUTE SERIES ADJUSTABLE DC POWER SUPPLIES
300, 600 and 1200 watt models

MODEL	DC OUTPUT
Brute I	5-50/2-25V. 6/12A
Brute II	5-50/2-25V. 12/24A
Brute III	5-50/2-25V. 25/50A
K1	Fine Voltage Adjust Kit (Option)
K2-I	Ripple Reduction Kit Brute I (Option)
K2-II	Ripple Reduction Kit Brute II (Option)
K2-III	Ripple Reduction Kit Brute III (Option)
K3	OVP-1 Overvoltage Protection (Option)

DIMENSIONS (IN.)

MODEL	A	B	C
BRUTE-I	11.00	6.750	7.650
BRUTE-II	12.00	6.750	7.650
BRUTE-III	14.00	10.00	11.120

- Greater than 75% efficiency
- Remote sensing
- Adjustable constant current operation 0-100%

SPECIFICATIONS

AC input: 105-130/210-260 volts AC, 1Φ, 47 to 63 Hz
DC output: See table for models
Voltage: Adjustable in two ranges, 5 to 50 volts or 2 to 25 volts (reconnectable)
Current: to 50 amperes
Regulation:
Line: ±0.1% or 50 mv
Load: ±0.1% or 50 mv
Ripple: 1% or 500 mv rms max
Overload protection: By adjustable current limiting
Overvoltage protection: Optional OVP-1
Controls: Current limit adjust 0 to 100%
Output voltage adjust 10 to 100%;
Ripple adjust
Temperature: 0 to 55°C with convection cooling
Weight: 300 watts-20 pounds; 600 watts-30 pounds; 1200 watts-50 pounds

For additional information see Designer's Handbook. Send for your FREE copy today.

TRIO LABS

Efficient • Reliable • Compact

SWITCHING POWER SUPPLIES

SINGLE OUTPUT SWITCHERS

SHOWN:
TRIO-750 W SWITCHER

Trio Single Output Switching Power Supplies are designed to provide maximum w/in³ in a compact self contained package. UL Recognized, all units are equipped with overload and overvoltage protection, voltage adjust., remote sense and can be paralleled.

With MTBF's of 30,000 hours and up, Trio Single Output Switchers are the obvious solution to your low voltage high current needs.

Power	Input	DC Out	I Out (Max)	Eff. (Typ.)	Size (Inches)
125 W	95–130 VAC / 188–256 VAC 45–440 HZ, SINGLE PHASE	TYPICAL: 2,5,6,12,20,24,28 VDC. (Other Voltages Available)	25a	65%	3.28 X 7.55 X 6.78
175 W	STRAPPABLE		35a	65%	4.75 X 4.25 X 11.0
300 W			60a	70%	4.93 X 5.5 X 12.0
500 W			100a	70%	4.93 X 5.5 X 16.0
600 W	95–130 VAC or 188–242 VAC, 45–60HZ SINGLE PHASE		120a	75%	5.0 X 8.0 X 11.0
750 W			150a	75%	5.0 X 8.0 X 11.0

MULTIPLE OUTPUT SWITCHERS

SHOWN:
TRIO-175 W SWITCHER

Trio Multiple Output Switchers are designed to provide all your power needs, logic, memory and/or accessories, in one box.

Standard features include UL recognition, overload and overvoltage protection, voltage adjust., ride through and remote sense.

Available with up to 4 outputs, Trio Multiple Output Switchers are the latest development in Switching technology and packaging.

Power	Input	Outputs	Typical VDC Out.	Efficiency	Size (Inches)
100 W	95–130 VAC / 188–256 VAC, 45–440HZ, SINGLE PHASE	3	5±12 5±15 5±18	65%	3.28 X 7.55 X 6.78
125 W		2	±12 ±15, ±18	67%	3.28 X 7.55 X 6.78
175 W	STRAPPABLE	3	5±12 5±15 5±18	55%	4.75 X 4.25 X 11.0
300 W		2	±12 ±15 ±18	62%	4.93 X 5.5 X 12.0
400 W	95–130 VAC or 188–242 VAC, 45–60HZ SINGLE PHASE	3 or 4	5/12/12/5 5/15/15/5	60%	5.0 X 8.0 X 14.33
475 W		3 or 4	5/12/12/5 5/15/15/5	60%	5.0 X 8.0 X 14.33

CUSTOM SWITCHERS

Trio custom switching power supplies run the gamut from slight modifications of our standard units to 1.25 KW three output supplies.

Trio's years of specializing in power supplies can save you time and money by making your custom requirement a modification of a Trio existing design.

RUGGEDIZED SWITCHERS

All Trio switching power supplies can be ruggedized to meet the environmental performance requirements of military specifications such as MIL E 16400.

This added feature at nominal cost allows you to satisfy most military requirements with a standard supply without incurring substantial NRE costs.

MILITARY SWITCHERS

Trio has been designing military power supplies for over 15 years with over 50,000 units in the field.

And Trio supplies have met the most stringent airborne, shipboard and groundbase specifications for sonar, radar, navigational, airborne and surface fire control and communications systems.

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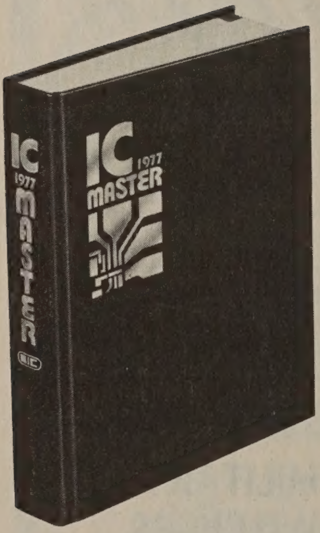

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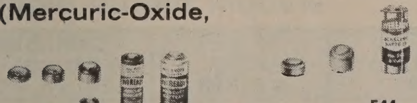
	FEATURES	APPLICATIONS
CARBON ZINC 915 950 935 216 732	Low cost, voltage drops gradually with use, variety of shapes and sizes ranging from 1.5 to 510 volts.	Radios, barricade flashers, telephone amplifiers, marine depth finders, toys, lighting systems, signaling circuits, novelties, flashlights, lanterns and fluorescent lights, cameras and flash guns, paging devices, laboratory instruments, alarm systems, remote controlled models.
HEAVY DUTY) **(Zinc Chloride)** 1215 1250 1235 1222 1209	Premium quality, extra life in heavy duty use, good shelf life, service life and resistance to leakage, good low temperature characteristics.	Flashlights and lanterns, transistor radios, cassette tape recorders and players, communications equipment, camera film drive, toys, pocket electronic calculators, other motor driven devices.
ALKALINE MANGANESE **Primary-Secondary** 522 E91 E93 E95 561	Good low temperature performance, voltage falls gradually with use, good shelf life, low impedance, 50 to 100 percent more energy than carbon-zinc batteries, high efficiency under continuous or heavy-duty high-drain conditions.	Radios, heated clothing, bicycle lights horns, shavers, electronic photoflash, lighting systems, movie cameras, radio-controlled models, model-plane ignition, toys, television sets, cassette tape recorders and players. Pocket electronic calculators, oceanographic instrument and buoys. Portable communication systems and smoke detector/alarms.
MINIATURE ALKALINE **Silver-Oxide)** **(Mercuric-Oxide,**  544 E132B E401	Constant voltage under discharge, long shelf life, high energy density per unit volume.	Electric / electronic / digital watches, hearing aids, reference voltage source, photoelectric exposure devices, instruments, wireless microphones, electronic thermometers, paging devices, walkie-talkies, test instruments, radiation detection.
NICKEL-CADMIUM RECHARGEABLE **(High rate and fast charge types)** CF225 CH150 CH450 CF1 CH2.2	High rate energy source, high cycle life and maintenance free, relatively constant discharge voltage, good high and low temperature characteristics, fast charge types, hermetically sealed rugged and dependable batteries, button cell stacks made to order, cylindrical cell batteries custom designed to your specifications.	Portable lawn and garden tools and appliances, shavers, toothbrushes, photoflash equipment, dictating machines, movie cameras, instruments, portable communication equipment, tape recorders, slide projectors, radios, television sets, blenders, pocket electronic calculators, alarm systems, office equipment.

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UEC POWER SYSTEMS

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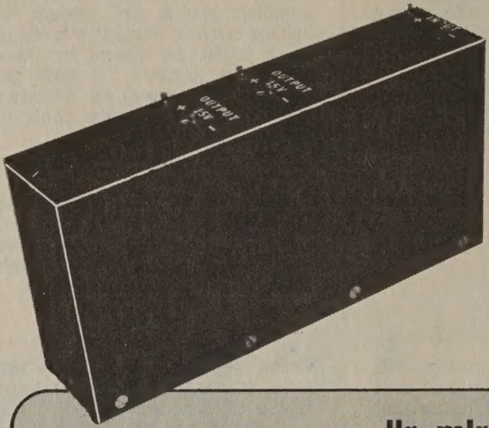
dc to dc converters



input:

	ADD TO MODEL NUMBER:
12VDC ±1.5V	—D1
28VDC ±4V	—D2
48VDC ±6V	—D3
115VDC ±15V	—D4

llr, mlr series

Line and Load, Reg: 0.2%
Ripple: 0.1% +5 MV RMS
Temperature: −10°C to +71°C base plate

lsr, msr, hsr series

Line and Load, Reg: 1.0%
Ripple: 0.3% +15 MV RMS
Temperature: −10°C to +71°C base plate

All models have overvoltage protection and current limiting output is isolated from input and can be used as positive or negative.

single output models

OUTPUT VOLTAGE ADJUSTABLE ±5%	OUTPUT CURRENT AMPS	TYPE REGULATOR	EFFICIENCY TOTAL	MODEL NUMBER	CASE SIZE 1⅝″ W x 3⅝″ H LENGTH, INCH.
5	4	LINEAR	45%	LLR-54	3.5
	4	SWITCHER	65%	LSR-54	3.5
	8	LINEAR	45%	MLR-58	3.5
	8	SWITCHER	65%	MSR-58	3.5
	18	SWITCHER	65%	HSR-518	5.0
12	3.0	LINEAR	55%	LLR-123	3.5
	3.0	SWITCHER	75%	LSR-123	3.5
	6.0	LINEAR	55%	MLR-126	3.5
	6.0	SWITCHER	75%	MSR-126	3.5
	10.0	SWITCHER	75%	HSR-1210	5.0
15	2.5	LINEAR	57%	LLR-152	3.5
	2.5	SWITCHER	77%	LSR-152	3.5
	5	LINEAR	57%	MLR-155	3.5
	5	SWITCHER	77%	MSR-155	3.5
	10	SWITCHER	77%	HSR-1510	5.0

optional features:

Wider Temperature Range: −55°C to +85°C
Input Transient Protection to meet MIL-STD-704
EMI/RFI to MIL-STD-461 (model "L" types only)

Wider Input Range
Lower Ripple
Thermal Protection
Logic Control Inhibit

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POWER SYSTEMS

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ac to dc converters

All models on the preceding pages are available with 105 to 125V AC, 47-550 Hz input. Consult factory for specifications.

custom designed power supplies

Universal Electronics has built a wide variety of specials to customer specifications including full compliance with all applicable military specs.

- Up to 3000 W and 300 AMP
- Multiple outputs — up to 6 outputs
- MTBF to 110,000 hours
- Special case configurations
- Wide temperature range —55°C - 120°C

dc to dc converters

l series

Line and Load, Reg: 0.1%
Ripple: 0.1% +10 MV RMS
Temperature: −10°C to +71°C base plate

s series

Line and Load, Reg: 1.0%
Ripple: 0.3% +20 MV RMS
Temperature: −10°C to +71°C base plate
Input and outputs are isolated from each other.

All models have overvoltage protection and current limiting on all outputs.

multiple output models

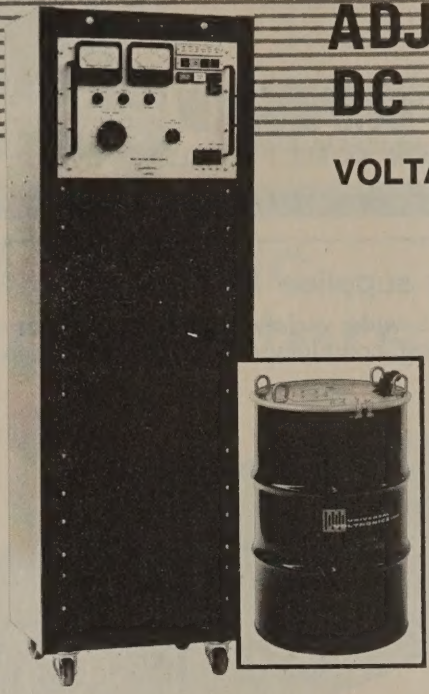
OUTPUT VOLTAGE ADJUSTABLE ±5%	OUTPUT CURRENT AMP	REGULATOR TYPE	EFFICIENCY TOTAL	MODEL NUMBER	CASE SIZE 1⅝″ W x 3⅝″ H LENGTH, INCH.
+5 −5	4 4	LINEAR	45%	L-2040	5
		SWITCHER	65%	S-2040	
+5 −5	8 8	LINEAR	45%	L-2080	7
		SWITCHER	65%	S-2080	
+15 −15	2.5 2.5	LINEAR	57%	L-2075	5
		SWITCHER	77%	S-2075	
+15 −15	5 5	LINEAR	57%	L-2150	7
		SWITCHER	77%	S-2150	
+5 +15 −15	4 2.5 2.5	LINEAR	54%	L-3095	5
		SWITCHER	74%	S-3095	7
+5 +15 −15	8 5 5	LINEAR	54%	L-3190	10
		SWITCHER	74%	S-3190	7
+5 −5 +15	4 4 2.5	LINEAR	50%	L-3077	5
		SWITCHER	69%	S-3077	7

optional features

Wider Temperature Range: −55°C to +85°C
Input Transient Protection to MIL-STD-704
EMI/RFI to MIL-STD-461 (model "L" types only)

Wider Input Range
Lower Ripple
Thermal Protection
Logic Inhibit (T²L)

ADJUSTABLE HIGH VOLTAGE DC POWER SUPPLIES



BA 70-10 ADJUSTABLE HIGH VOLTAGE DC POWER SUPPLIES
BA 70-11 EXTRA HIGH VOLTAGE DC POWER SUPPLIES
BA 70-13 MULTI-RANGE, HIGH VOLTAGE POWER SUPPLIES
BPE 70-5 HIGH VOLTAGE DC POWER PACKS ENCAPSULATED
BPO 70-5 HIGH VOLTAGE DC POWER PACKS OIL IMMERSED

Series "BA" adjustable power supplies and series "BP" power packs are available at voltage ratings from 1 KVDC through 2000 KVDC at output power ratings from 1 watt to 250 kilowatts continuous. The adjustable series includes applications oriented control features and package design. The power pack series has many applications in OEM systems and for general laboratory use.

VOLTAGE RANGES TO 2,000,000 VOLTS DC

☐ **CONSERVATIVELY RATED — HIGH RELIABILITY**

Every UVC power supply includes conservatively rated high voltage components designed and manufactured under the strict control of the specialized UVC technical staff to insure continuous duty, long term, trouble free operation.

Each power supply offers a standard ripple specification of 5% maximum or better. Optional filters and attenuators are available for every UVC supply to reduce ripple to as low as .01% rms.

☐ **REVERSIBLE POLARITY**

Each power supply offers the flexibility of reversible output polarity performance.

☐ **FULLY SELF-PROTECTING**

Overvoltage and overcurrent protection features are available as both adjustable range and fixed value circuits. All access areas and doors are interlocked for personnel protection and all energy storage components and circuits are discharge protected for personnel protection.

☐ **"APPLICATIONS ORIENTED" CONTROLS OPTIONAL**

Rack mounted, floor and bench operable as well as portable design are among the packages available for UVC standard high voltage power supplies.

☐ **12-MONTHS WARRANTY**

A one year factory backed and field supported warranty policy accompanies each shipment.

HIGH VOLTAGE TERMINATIONS

C70-7 HIGH VOLTAGE TERMINATIONS

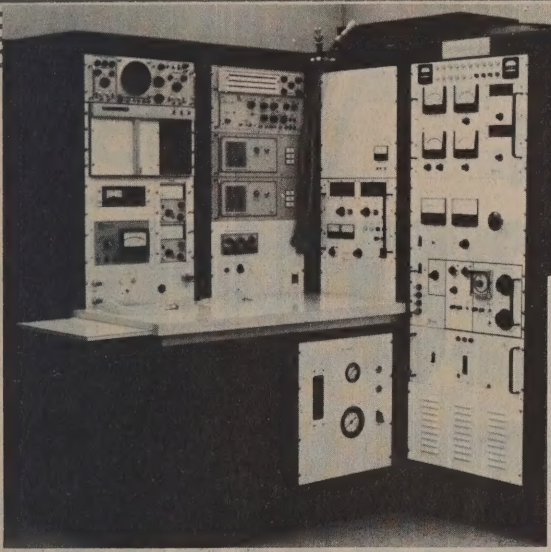
☐ **CORONA-FREE TERMINATIONS**
☐ **ELIMINATES THE HIGH STRESS POINTS**
☐ **MORE LINEAR DISTRIBUTION OF VOLTAGE GRADIENTS**

UVC high voltage terminations and connection links have been designed and fabricated specifically for use in high voltage applications requiring careful attention to terminal and connection problems • The standard terminations have been manufactured in a variety of geometrical configurations which have been chosen for their well-defined corona and leakage onset characteristics • Accurate machining and polishing, along with adequate theoretical and field experience on these terminals have given UVC the ability to advise on a particular size, shape or spacing for a particular application or site condition.

WRITE OR PHONE FOR SPECIFIC BULLETINS AND COMPLETE INFORMATION:

Write or call
UNIVERSAL VOLTRONICS CORPORATION
27 Radio Circle Drive, Mount Kisco, N.Y. 10549
(914) 241-1300

PRECISION REGULATED HIGH VOLTAGE DC POWER SUPPLIES


TWT/CFA POWER SUPPLY SYSTEMS

BRE 70-10 REGULATED HIGH VOLTAGE DC POWER SUPPLIES

Precisely regulated performance over wide adjustment range, low ripple, fast response and high stability enable the series "BRE" power supplies to be used in exacting work for X-Ray Spectroscopy, computerized tomography, electron microscopes, TWT's, ion bombardment experiments, particle separators.

☐ TWT/CFA POWER SUPPLY SYSTEMS

Available with Cathode, Heater, Collector, Anode and Helix outputs. Each UVC Black Box system features:

- **PULSED OR CW OPERATION**
- **TURN ON/OFF SEQUENCE CONTROL TO INSURE SAFE AND PROPER PERFORMANCE**
- **FAST-ACTING CROWBAR PROTECTION**

You can forget about power problems when you marry your TWT's to UVC Black Boxes.

☐ FROM 1KV THROUGH 500 KVDC

These precisely regulated power supplies are available in voltage ratings from 1 KV through 500 KVDC at continuous duty output power up to 100 KW. Our regulation circuitry techniques realize performance specifications which are virtually independent of input line variations or no load-full load changes.

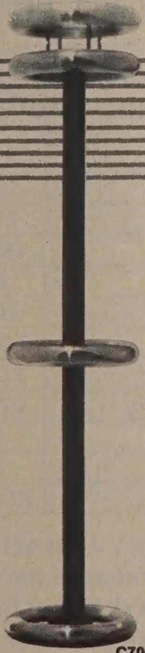
☐ LOW RIPPLE . . . HIGH STABILITY

Ripple in most cases is 0.01% rms and the output polarity is available as both fixed and reversible. Two voltage adjustment schemes are offered, namely digital dialable control for the most exacting applications and continuous coarse and vernier controls.

☐ WIDE ADJUSTMENT RANGE

In the digital dialable scheme, we allow for adjustment in increments of 10 KV, 1 KV, 100 volts, 10 volts, 1 volt and 0-1 volt vernier. This system provides the assurance that the actual output is always within 1% of the dial readings. As indicated you may select a coarse, and vernier voltage adjustment scheme and realize economic savings without sacrificing basic regulated performance. Regulation accuracy of ± 0.25%; ± 0.1%; ± 0.05% and ± 0.01% for line or load changes is available on most series "BRE" power supplies.

HIGH VOLTAGE DIVIDERS


C70-8 HIGH VOLTAGE DIVIDERS

UVC offers five types of voltage dividers for measurement of various types and shapes of high voltages. These include Resistive, Capacitive, Mixed (Resistive-Capacitive), Impulse Resistive, Impulse Capacitive. Selection of a voltage divider type depends upon the shape of measured voltage and the kind of information required.

These dividers may also be used for measurement and/or sensing of special high voltage transients. They are optimized in such a way as to drain a minimum of power from the voltage source and can be placed within close proximity to grounded objects without significant interferences on the divider ratio.

The low voltage components are enclosed in the bottom cylinder, which is made of steel for the purpose of shielding. The BNC connector for connections of instruments and the attenuating switch are mounted directly on the steel cylinder. High voltage components are enclosed in phenolic type cylinders. Specially designed high voltage terminals facilitate high voltage connections.

WRITE OR PHONE FOR SPECIFIC BULLETINS AND COMPLETE INFORMATION:

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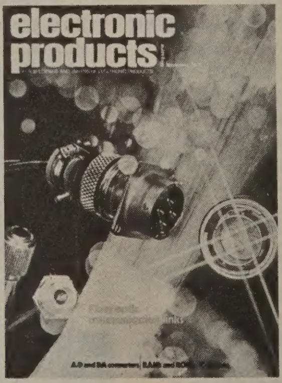

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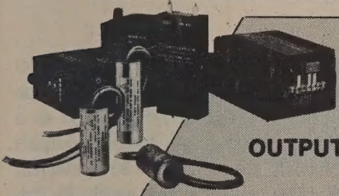
MINIATURE HIGH VOLTAGE POWER SUPPLIES

Venus Scientific Inc.

Electro-Optics • CRT Display • Night Vision Equipment

VENUS

STD PRODUCT (QUICK) SELECTION CHART



Model No.	OUTPUT VOLTAGE RANGE 1KV 5KV 10KV 15KV 20KV 25KV 30KV	−55° to +71°C Full Rating	Output Proportional to Input	Floating Bias Supply	Switching Penetron	Low Power Battery Operated	PMT	Focus	Dynamic Focus	CRT	Hi-Bright CRT	X-Ray Microscope	High Al + Version Avail.	Volume in Cubic Inches	10 Pc. Pr. $
C-8T		2 ma	✓	✓				✓	✓					3	66
C-2T		8 ma	✓	✓					✓					3	61
C-15		9 ma	✓				✓	✓	✓				✓	3	69
C-30		500 μa	✓				✓	✓	✓				✓	3	83
CS-14		320 μa			✓					✓				60	1950
CS-18		200 μa			✓					✓	✓			180	3600
F-6		16 ma		✓				✓	✓					7	209
F-12		8 ma		✓			✓	✓	✓					7	235
F-25		4 ma					✓	✓	✓					7	260
F-50		2 ma						✓	✓					7	295
G-6		500 μa						✓		✓				15	395
G-10		500 μa								✓				15	490
G-12		500 μa								✓				15	550
H-16F		500 μa						✓		✓				31	560
H-20		500 μa								✓	✓	✓		31	560
H-20N	NEG	500 μa								✓	✓	✓		31	560
H-30		300 μa								✓	✓	✓		44	646
H-30N	NEG	300 μa								✓	✓	✓		44	646
K-15		1 ma	✓				✓	✓	✓				✓	2	149
K-30		500 μa	✓				✓	✓	✓				✓	3	158
LR-2N	NEG	5ma					✓							33	174
LR-6		500 μa						✓						33	125
LR-15		300 μa						✓		✓				33	153
LR-20		150 μa						✓		✓				33	169
LU-15		300 μa	✓					✓		✓				27	100
M-15N		10 μa	✓			✓								3	120
MF-8		1 ma		✓				✓	✓					4	190
MF-25		1 ma					✓	✓	✓					4	260
MG-3		1 ma					✓	✓		✓				7	365
MG-12		500 μa								✓				7	590
O-6.75	A.C. OUTPUT	—				✓								2	125
Q-15		400 μa	✓			✓	✓	✓						2	173
Q-30		200 μa	✓			✓	✓	✓						2	178
ST-10N	NEG	10 μa	✓			✓								7	175

- ***Off the shelf delivery***
- ***Proven economical designs***
- ***Field tested by many companies***
- ***No non-recurring engineering or development costs***
- ***MIL and commercial power supplies available***
- ***MIL-Q-9858A***
- ***Custom power supplies***

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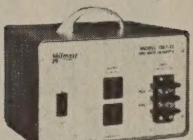
Wilmore Electronics Company, Inc.

POWER CONVERSION EQUIPMENT

DC-TO-AC INVERTERS . . . UPS/STANDBY POWER

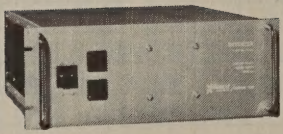


MODEL 1057 300-WATT STEPPED-WAVE INVERTER

Economically priced and ideally suited for instruments requiring frequency stability, the 300-watt Model 1057 is an inexpensive alternative to sine-wave power. The switching-mode wave-shaping technique yields a three-level-step waveshape which has approximately the same peak-to-rms voltage ratio as a true sine wave. Versions for input voltages of 12 Vdc, 24 Vdc, 28 Vdc and 32 Vdc are standard. Outputs of 115 Vac or 230 Vac and 50 Hz or 60 Hz are also standard. All models are more than 80% efficient and have a frequency stability of ±0.25%. Units are 8¼″h x 11″w x 8½″d and weigh 25 lbs. Single piece price is $295.00 for all versions. For more detailed specifications request Bulletin 9091C.

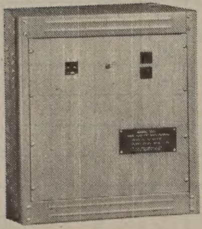
MODEL 1172 500-WATT SQUARE-WAVE INVERTER

The Model 1172 is an inexpensive, rugged 500-watt inverter designed to power heavy duty loads. The inverter will provide 1000 watts for a short period of time for surge-demanding loads such as refrigerator compressors and small power tools. The Model 1172 is a modular inverter and two units may be easily paralleled in the field for added continuous and surge power. Versions for input voltages of 12 Vdc, 24 Vdc and 32 Vdc are standard. Outputs of 115 Vac or 230 Vac and 50 Hz or 60 Hz are also standard. This square-wave-output inverter is more than 80% efficient for most of the output load range. The frequency stability is ±2 Hz and the output voltage is proportional to the input dc line. All units are 7″h x 8½″w x 11″d and weigh 32 lbs. The price of the twelve-volt-input version is $225.00, while the 24-V and 32-V versions are $280.00 each. For more detailed specifications request Bulletin 1101A.



MODEL 1081 500-WATT SINE-WAVE INVERTER

Designed to power those loads that are extremely wave-shape and frequency sensitive, the Model 1081 inverter offers a well-filtered sine wave with a frequency stability of ±0.25% and a voltage regulation of ±2% with line, load and temperature. Standard input voltages are 12 Vdc, 24 Vdc, 48 Vdc and 120 Vdc. The output for all versions is 115 Vac at 60 Hz. All units are for mounting in a standard 19″ rack and measure 6¾″h and 20½″d. All units weigh approximately 100 lbs. The single piece price for the Model 1081 is $995.00. For more detailed information request Bulletin 9091C.



OTHER STANDARD INVERTERS

Wilmore Electronics manufactures a complete line of solid-state inverters ranging in output power from 15 watts to 1500 watts. These units include highly efficient and economical square-wave-output units, units whose output wave shape is a three-level-step approximation to a sine wave and, for the most demanding loads, low-distortion sine wave output units. Pictured is the 1500 watt Model 1207, available in input voltages up to 120 Vdc, providing a frequency-stable, single-phase 60 Hz output at either 115 Vac or 230 Vac. All standard Wilmore inverters are protected against overloads and short circuits. For information about other standard inverters or about a custom-designed inverter to meet a particular requirement, please contact our sales department or our applications engineering group.

MODEL 1252 AUTOMATIC STANDBY AC POWER SOURCE

When commercial ac power fails, this standby ac power source continues to supply needed power to critical loads by switching to inverter operation. Upon restoration of ac power, the Model 1252 automatically returns to normal operation, and the internal battery charger recharges the batteries. Two basic versions are available, one providing a stepped-wave approximation to a sine wave output and 250 watts of power and the other supplying 500 watts of square-wave power. Standard battery input voltages are 12 Vdc and 24 Vdc. All units are 5¼″h x 17″w x 14″d and weigh 45 lbs. Single piece price is $525.00. Battery not included. For more detailed information request Bulletin 6021.

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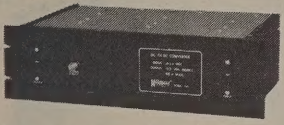
Wilmore Electronics Company, Inc.

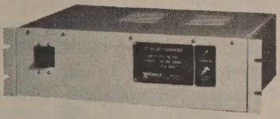
POWER CONVERSION EQUIPMENT

SINGLE- AND MULTIPLE-OUTPUT DC-TO-DC CONVERTERS



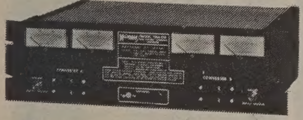
MODEL 1265 48-V AND 24-V TO 13-V DC-TO-DC CONVERTERS

The Model 1265, capable of delivering 420 watts, is a highly efficient, rugged converter which has been used in a variety of applications including that of providing power for mobile-radio base stations that are located where battery voltages other than 12 Vdc are available. The Model 1265 is particularly well-suited for applications in which extended periods of "standby" service are encountered because of the minimal no-load power required, less than 5 watts. These units are well regulated and fully protected and isolated. Units are 5¼"h x 19"w x 12"d and weigh 15 lbs. Price in quantity of ten is $470.00 each. For more detailed specifications request Bulletin 5061.



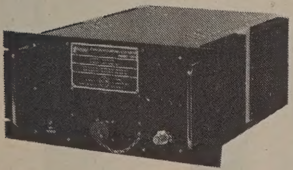
SERIES 1240 DC-TO-DC CONVERTERS

The Series 1240 converters are designed to take power from standard station batteries at 48V, 125V or 250V and convert to output voltages ranging from 24 Vdc to 125 Vdc. These converters are highly efficient up to 87% for some models, and are fully protected against large input transients as well as short circuits and overloads. Typical applications include uses within the utilities industries, with supervisory control systems and to power alarm and security systems. There are sixteen standard models with output power ranging from 240 watts to 600 watts. All models are 5¼"h x 19"w x 14"d and weigh approximately 40 lbs. Prices in quantity of ten begin at $580.00. For more information request Bulletin 4011.



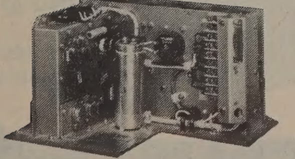
MULTIPLE-OUTPUT DC-TO-DC CONVERTERS

Wilmore specializes in both standard and custom multiple-output dc-to-dc converters. One example, pictured at the left, is a Series 1260 converter. This series accepts standard input voltages of 24V, 48V or 125V and offers dual, triple or quadruple outputs at all standard output voltages such as 5V, ±12V, ±15V, etc. The combined output power capability of this series is 250 watts, available in almost any combination of voltages and current levels. Standard enclosures are 5¼"h x 19"w for rack mounting, but the modular design allows for considerable flexibility in packaging. For information about these converters or other multiple-output converters, please contact our applications engineering department.



MODEL 1254 STANDARD CAPACITOR-CHARGING CONVERTER

Intended for use with lasers, flash lamps and other pulsed-load systems, these dc-input power converters are designed to charge energy-storage capacitors repetitively to a precisely regulated peak voltage. Special advantages of these converters include an overall efficiency of approximately 70%, a peak-voltage regulation precision of better than ±0.5%, and the ability to be used with essentially any size of load capacitor and with pulse-discharge repetition rates ranging from zero to several hundred pulses per second. There are three standard versions of the Model 1254 with energy delivery rates of 300, 600 and 1200 joules per second. The standard input voltage range is 20-32 Vdc and outputs are available in three standard ranges from 450 volts to 2800 volts. The Model 1254 units are intended for mounting in a standard 19" rack; smaller, lighter, higher-efficiency units are available for military (and similar) applications. The Model 1254-1200 (pictured at left) measures 8¾"h x 20"d and weighs 35 lbs. Single piece prices begin at $940.00 for the Model 1254-300. For additional information request Bulletin 6031.



CUSTOM-DESIGNED POWER CONDITIONING EQUIPMENT

Because user's needs tend to be highly individualized, the majority of Wilmore's manufacturing involves custom, rather than standard, units. Engineering charges for custom units are modest; turn-around times are exceedingly short. Especially if you are an OEM, a custom unit can probably save you money by ensuring that you get exactly what you want but no more, by ensuring that you have thermal and electronic safety margins where you need them, and by being carefully integrated in numerous other ways with the overall electrical and mechanical planning for your product. Wilmore's custom-designed converters are serving throughout the world in both industrial and aerospace applications. Uses range from spacecraft (LES-6, OSO, IMP, SAS, Pioneer 10 & 11 to name a few) to providing power conversion for the communications system for the Trans-Alaskan Pipeline. We would like to bring our cost-reducing problem-solving experience to bear on your problems.

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ACDCo Power WHERE you need it!

Inverters-Uninterruptible Power Systems-Battery Chargers-Frequency Changers-Power Supplies

ACDCo Power Equipment is designed to meet high reliability and performance standards providing maximum life with minimum maintenance to protect all system circuits that require dependable, high quality power.

HARDWARE

Inverters, Power — DC to AC Output: Fixed-base, portable, mobile and marine.

ACDCo INVERTERS are used in one of the **roughest** of Marine Environments on the **U.S. Coast Guard's - Rescue Life Boats** to power their Navigation and Communication equipment.

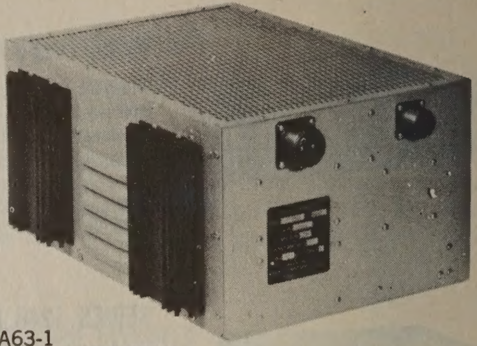
Uninterruptible AC Power Systems: 36 VA to 5 KVA.

Frequency Converters — AC to AC: 50/60 Hz, 60/50 Hz, 50/400 Hz and 60/400 Hz.

Battery Chargers — AC to DC Power Supply: 0-30 VDC/30-300 VDC Auctioneer Units and Automatic Transfer.

Power Supplies: Constant current and constant voltage current regulated and modular.

Power Monitors (AC & DC) & Fault Detectors: Special & custom power analizing, monitoring & recording systems, & controls.



A63-1
1 KVA INVERTER

TYPICAL SPECIFICATIONS

Input: ±15% from nominal.

Output: Sine wave, 120 Volts RMS, 60 Hz.

Voltage Regulation: 2% over full input and load range.

Frequency Regulation: 1% over full input and load range.

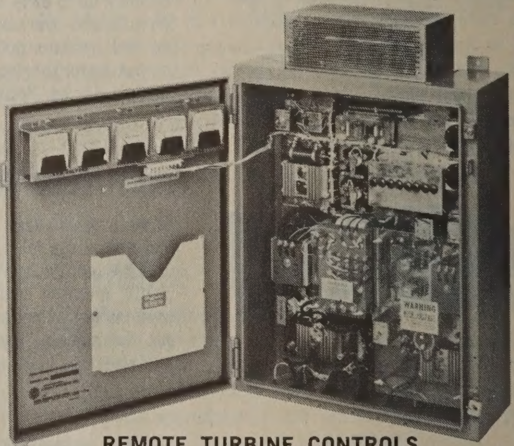
Power Factor: .9 Lead to .8 Lag.

Efficiency: Over 80% at nominal input.

Distortion: Less than 5%.

Overload: Within specifications for ONE MINUTE at 140% load.

Overload Protection: No damage from short to open circuit, reversal of input, or input voltage to 140% nominal.



REMOTE TURBINE CONTROLS FOR THE ALASKAN PIPELINE

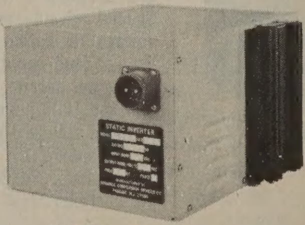
DESIGN FEATURES

Ruggedized construction, no moving parts, completely solid state, easy servicing — sides fold down, plug-in transistors and I/C's on Printed Circuit Boards, all P/C boards plug-in removable.

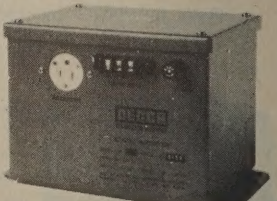
STATIC INVERTER MODELS

Rating	12VDC	24VDC	32VDC	48VDC	120VDC
36VA	A12-1	A13-1	A19-1	A14-1	A16-1
72VA	A22-1	A23-1	A29-1	A24-1	A26-1
125VA	A32-1	A33-1	A39-1	A34-1	A36-1
250VA	A42-1	A43-1	A49-1	A44-1	A46-1
500VA	A52-1	A53-1	A59-1	A54-1	A56-1
1000VA		A63-1	A69-1	A64-1	A66-1
1750VA		A63-2		A64-2	A66-2
2500VA		A73-1		A74-1	A76-1
3750VA				A74-2	A76-2
5000VA				A84-1	A86-1

Three Phase Models Available up to 15KVA



A43-1
250VA
INVERTER



A12-1
36VA
INVERTER

ADVANCE CONVERSION DEVICES COMPANY

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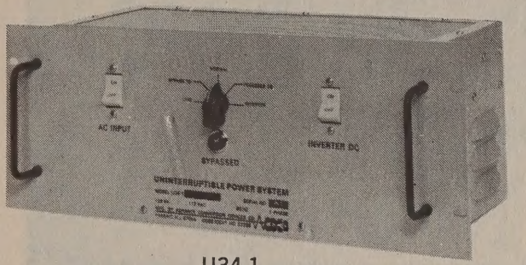
ACDCo Power WHEN you need it!

Protect Against Costly Power Interruptions

ACDCo Uninterruptible Power Systems protect critical circuits for computer peripherals, process controls, telephone switch boards, high risk medical or experimental procedures and all systems requiring dependable emergency power when normal AC is lost.


AC INPUT
BYPASSED
INVERTER DC
UNINTERRUPTIBLE POWER SYSTEM

U34-1

Typical UPS Model U34-1 is used to power a critical liquid hydrogen temperature control system at a major government research nuclear reactor.

UNINTERRUPTIBLE POWER SYSTEMS

Your margin of safety to insure continuous high quality power even in the event of any utility line or generator power fluctuation or failure. ACDCo's UPS systems are designed to provide full output capacity even under "brownout" conditions where voltage reductions as severe as 15% are encountered. The reserve (battery back-up) for power outages is not diminished by extended operation in brownout conditions.

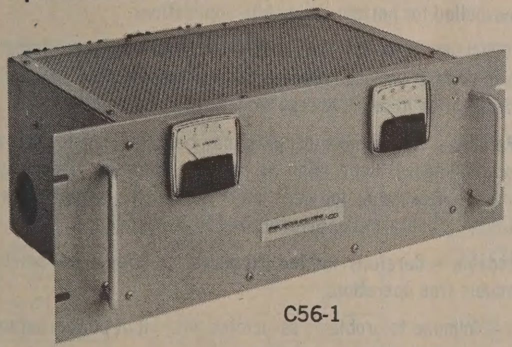
The use of power transistors rather than SCR's in the inverter greatly reduces the susceptibility to transients which can be present on power lines due to faults, switchovers, lightning and other factors. These transients usually cause the problems that the UPS was intended to protect. If the inverter can malfunction as a result of the transient, then the expected protection is absent when it is most needed.

DESIGN FEATURES

- **Ruggedized construction**
- **Easy servicing**
- **Plug-in Transistors and I/C's**
- **Removable P/C Boards**
- **Optimized design to provide maximum value for the procurement dollar**

VA Rating	36VA	72VA	125VA	250VA	500VA	1KVA	1.75KVA	2.5KVA	3.75KVA	5KVA
Model No.	U14-1	U24-1	U34-1	U44-1	U54-1	U64-1	U64-2	U74-1 U76-1	U74-2 U76-2	U84-1 U86-1

Three phase models also available from 100VA to 1500VA.
Typical specifications relate to those of static inverters.



C56-1

AC TO AC FREQUENCY CONVERTERS

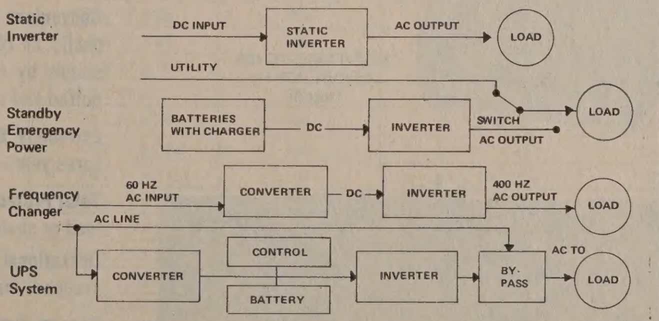
Available in eight power sizes from 36VA to 5000VA plus three phase up to 15 KVA. Power frequencies changed from: 50 to 60 Hz, 60 to 50 Hz, 50 to 400 Hz, and 60 to 400 Hz.

Options available for laboratory applications include metering, front panel controls, etc.

SPECIAL POWER SYSTEMS BULLETIN

Ask for our power systems outline discussion in which ACDCo answers many outstanding questions of systems configuration.

ACDCo POWER SYSTEMS FUNCTIONAL DIAGRAMS


Static Inverter
DC INPUT
STATIC INVERTER
AC OUTPUT
LOAD
UTILITY
Standby Emergency Power
BATTERIES WITH CHARGER
DC
INVERTER
SWITCH
AC OUTPUT
LOAD
Frequency Changer
60 HZ AC INPUT
CONVERTER
DC
INVERTER
400 HZ AC OUTPUT
LOAD
AC LINE
UPS System
CONVERTER
CONTROL
BATTERY
INVERTER
BY-PASS
AC TO
LOAD

WIND DRIVEN SYSTEMS

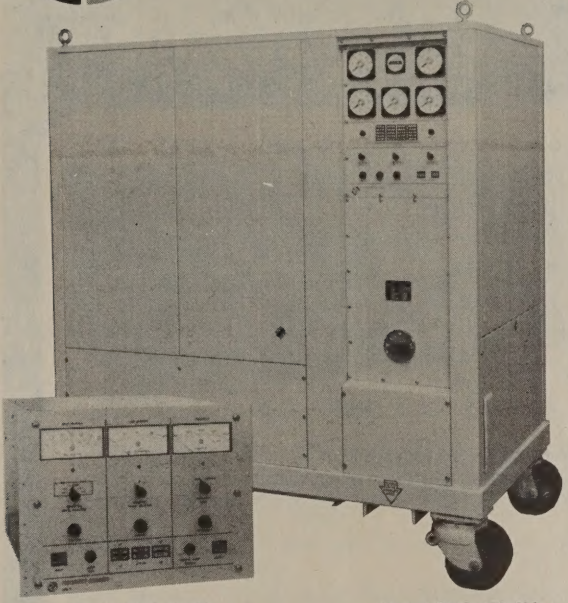
ACDCo designs and manufactures the electronic control, regulation, and power subsystems for "modern" power conversion from this "ancient" energy source.

ADVANCE CONVERSION DEVICES COMPANY

109 EIGHTH STREET PASSAIC, NEW JERSEY 07055 Phone (201) 778-0707

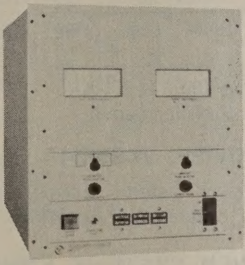
ACDCo

FREQUENCY CHANGERS • INVERTERS UNINTERRUPTIBLE POWER SYSTEMS

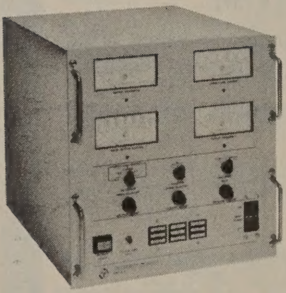


Model SMG-5-403
5 KVA, 400 Hz
Output

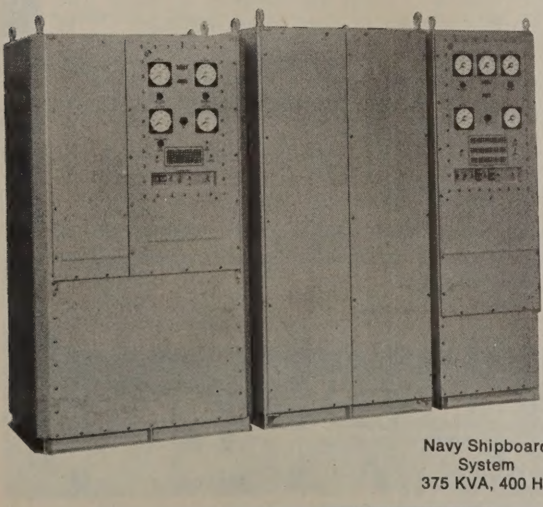
Model SMG-150-403
150 KVA, 400 Hz
Output



Model SMG-5-51
5 KVA, 50/60 Hz
Output



Model SMG-15-403
15 KVA, 400 Hz
Output



Navy Shipboard
System
375 KVA, 400 Hz

ALS has achieved major innovations in solid state power conversion techniques and power systems control. These accomplishments enable ALS to offer competitively priced frequency changers, inverters and uninterruptible power systems which embody the best characteristics of both solid state and rotating machine equipment without the performance and reliability limitations of either. Systems providing output capacities up to 1250 KVA and frequencies in the range of 45 to 450 Hz have been delivered.

In its SMG Series Frequency Changers, ALS has implemented a truly advanced and effective concept in solid state power conversion equipment. Immune to input power and output load conditions, these units are inherently dependable and totally self-protecting. Unlike ordinary units, the SMG Series will not be damaged or clear fuses despite line transients, loss of one or more input phases, output overload, short circuit or arbitrary operation of any control. Thermal and electrical stress of components is well below ratings. Power semiconductor devices in particular, are operated at less than 25% of ratings.

Most solid state systems produce less noise and vibration compared to their motor-generator predecessors. However, at 66 decibels, the SMG Series are the quietest units available.

Unquestionably, the SMG Series provides the optimum answer for most frequency changer requirements. However, should special requirements indicate the need for a unique design, ALS will welcome the opportunity to propose systems optimized to the application.

EXCLUSIVE FEATURES

Truly Quiet — Produces a tenth or less of the noise inherent in other solid state units. The SMG Series is ideal for applications where noise is undesirable.

Compact and Lightweight — By far, the smallest and lightest units produced. The SMG Series is unexcelled for portable or mobile applications.

Unprecedented Efficiency — At full load, dissipates a third or less of the power lost by competitive units at no load. Relative to other systems, the SMG Series will recover the purchase price in saved energy alone within seven years.

Convenient to Parallel — Any number of units may be paralleled to increase capacity or obtain redundancy. Conversion to parallel operation is accomplished simply by mating a single cable for each unit. No control manipulation is required and units may be energized or de-energized in any sequence.

Extremely Dependable — Carefully limited stressing of critical components assures years of trouble-free operation.

Total Protection — Immune to problems associated with input power, output overload or short circuit, and control manipulation.

Operational Simplicity — Controls and indicators are self-explanatory and logically grouped. Training of operating personnel is not required.

Reserve Capacity — Will support loads with high inrush demand. The SMG Series is particularly useful for motor loads or systems with capacitive filters.

Low Output Impedance — Has about one-fourth the open loop impedance of ordinary frequency changers. In applications involving nonlinear or dynamic loads, the SMG Series will out-perform other units of up to four times greater nameplate KVA ratings.

Fast Response — Following a 100% of rated current step change in load, the SMG Series will recover to the regulation band within two cycles of output. This, in combination with its low impedance, makes the SMG Series absolutely unbeatable for the most demanding stepped load applications.

Arbitrary Input Connection — Operates on any input phase rotation. The SMG Series eliminates concern for damage whenever the input source is changed.

SMG Series Solid State Frequency Changers 5 KVA to 300 KVA, 50/60 Hz or 400 Hz

SPECIFICATIONS

INPUT

Voltage: Available in all standard, domestic and foreign nominal voltages ±10% or per customer specifications. Frequency 45 to 450 Hz.

OUTPUT

Voltage: Available in all standard, domestic and foreign voltages or per customer specifications. Output adjustment is ±10% from nominal or optionally 0 to 110%. Regulation is ±0.5% for the combined effects of line, load and temperature.

Waveform: 2% THD at full load. 1% available optionally.

Current: Adjustable current limit from 25 to 125% of ratings. Manual current limit override allows over 150% of rating for motor starting. Regulation is ±1% for the combined effect of line, load and temperature.

Power Factor: Full rated power from 0.5 capacitive to 0.5 inductive.

Phase Displacement: 120° $\pm < 1°$ for balanced loads. Load may be 100% unbalanced. Line-to-line voltage will remain within ±1% from the average for each 10% of load unbalance.

Incidental Modulation: 0.025% peak FM and 0.025% to 1.0% peak AM depending on input power frequency and phase unbalance.

Response Time: ¼ cycle for 400 Hz 3 phase, 1 cycle for 50 Hz single phase.

Recovery Time: 2 cycles for 400 Hz 3 phase, 4 cycles for 50 Hz single phase.

Frequency: 50, 60 and 400 Hz adjustable ±5% are standard. Stability is ±0.1% constant environment, ±0.5% from cold start. Quartz time base with ±0.001%.

Instrumentation: All indications are accurate to ±2% of full scale. Provided are input/output voltmeter, ammeter, dial and pointer frequency meter.

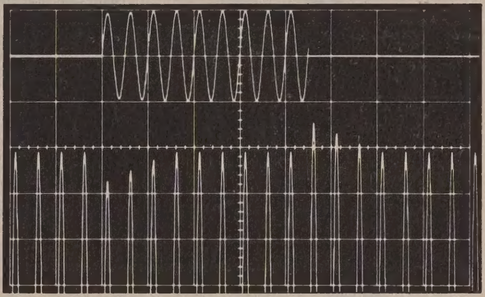
Status Lamps: Depending on model, 6 to 20 lamps indicate system operating status.

Protection: Combination of circuit breakers, fuses, sensing circuitry, air switches, thermostats and contactors positively protect the unit from fault loads, improper input voltages and consequential power train damage.

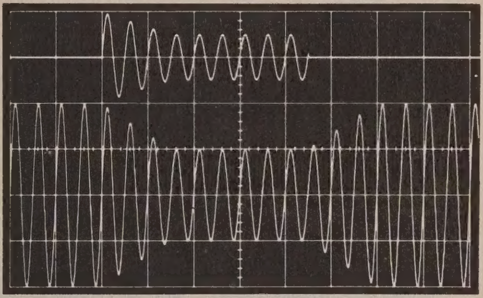
Environment: 0-50°C continuous, full ratings.

EMI

Shielded and filtered. Meets most EMI requirements. Optional filters for the most stringent requirements can be provided.



Dynamic Characteristics — The typical transient response and recovery characteristics of the SMG Series is shown. The upper trace is rated load current and the lower trace is output voltage expanded to 5% per division.



Automatic Voltage/Current Crossover — The typical crossover characteristics of the SMG Series is demonstrated by setting current limit at 50% of ratings and applying full rated load. For the first half cycle, full load current results. Thereafter the output voltage complies rapidly to half the initial value where the resulting load current is within the set 50% limit. Upon load removal, the output voltage returns to its initial value.

Model	Power	Phase	Output Frequency	Size (Inches)	Weight (Lbs.)	Parallelable Unit (Option 02)	
				H x W x D		H x W x D	Weight
SMG-5-51	0-5 KVA	1	Fixed 50 or 60 Hz (Specify) Variable (Option 05) 45 to 55 Hz 50 to 60 Hz 55 to 65 Hz (Specify)	21 x 17 x 25	450	21 x 17 x 25	485
SMG-5-53		3		21 x 17 x 25	480	21 x 17 x 25	510
SMG-7.5-51	0-7.5 KVA	1		24.5 x 17 x 25	520	24.5 x 17 x 25	600
SMG-7.5-53		3		24.5 x 17 x 25	550	24.5 x 17 x 25	630
SMG-15-53	0-15 KVA	3		45.5 x 17 x 25	850	45.5 x 17 x 25	910
SMG-30-53	0-30 KVA	3		72 x 24 x 36	1200	72 x 24 x 36	1330
SMG-5-401	0-5 KVA	1	Fixed 400 Hz Variable (Option 05) 380 to 420 Hz	14 x 17 x 21.5	155	14 x 17 x 25	170
SMG-5-403		3		14 x 17 x 21.5	165	14 x 17 x 25	190
SMG-7.5-401	0-7.5 KVA	1		14 x 17 x 21.5	165	14 x 17 x 25	180
SMG-7.5-403		3		14 x 17 x 21.5	175	14 x 17 x 25	200
SMG-15-403	0-15 KVA	3		17.5 x 17 x 21.5	280	17.5 x 17 x 25	310
SMG-30-403	0-30 KVA	3		31.5 x 17 x 21.5	480	31.5 x 17 x 25	530
SMG-150-403	0-150 KVA	3		81 x 64 x 42	4600	81 x 64 x 42	5300

Special Requirements. ALS will design systems optimized for specific applications. We welcome your inquiry regarding special requirements and our application engineers will be pleased to assist you in the formulation of specifications tailored to your needs.

Our extensive experience in providing AC power for a wide variety of applications will be of value in identifying any characteristics of your application that may require special consideration.

Options (Specify by number)

01 — 120/208 or 266/460 Dual Input Operation
02 — Parallel Operation
03 — Redundant Parallel Operation
04 — Wattmeter
05 — Dual Mode Fixed/Variable Output Frequency

A L S

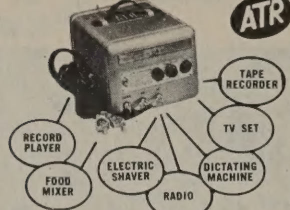
A·L·S ELECTRONICS CORPORATION
1400 N. Baxter Street • Anaheim, Calif. 92806 • (714) 956-9200 • TWX 910-591-2711

INVERTERS, VIBRATORS, "A" ELIMINATORS, ETC.

ATR ELECTRONICS, INC.

MANUFACTURERS OF QUALITY PRODUCTS SINCE 1931
(612) 222-3791 • Dept. EM, 300 E. Fourth St., St. Paul, MN 55101

ALL ATR INVERTERS LISTED ARE FREQUENCY STABLE AND HAVE AUTOMATIC FREQUENCY CONTROL



DC TO AC UNIVERSAL INVERTERS

Frequency Stable with Automatic Frequency Control.

New, universal inverters for operating 110V, 60 cycle AC equipment from DC voltages in autos, buses, trucks, boats, trains, planes and DC districts. Designed especially for standard 110 VAC tape recorders, TV sets, radios, PA systems, electric razors, test equipment, etc. Units are carefully engineered and ruggedly constructed to provide long life operation. All feature complete RF interference suppression and exceptional frequency stability. Have operating efficiency in excess of 75%. Four-point voltage regulator corrects output voltage for minimum and maximum loads, and also helps compensate for input voltages lower or higher than normal. Inverters are recommended for use with loads having power factors in excess of 70%. Built-in toggle switch selects most efficient operation for use with TV sets or tape recorders. Inverters are not recommended for use with large motor driven appliances such as refrigerators, washing machines, etc. All have On-Off switches. Housed in attractive brown hammerloid metal cabinet with convenient leather carrying strap. Sizes: Standard Model RSF 8½x9⅞x5¼"; Heavy-Duty Model RHG, 6⅞x11¼x8½"; Extra-Heavy-Duty Model HSJ, 6½x12⅞x8½". With battery cables for instant connection to power source. Models with "P" suffix equipped with adapter cord for use in auto cigarette lighter receptacles.

Mfr's Type	DC Input (Volts)	AC Output 60 Cycles (Volts)	Output Wattage Int.	Output Wattage Cont.	Shipping Wt. (Lbs.)	Net Price
12U-RSF	12	110	175	150	22	**$92.51**
12U-RSF-P	12	110	175	150	22	**92.51**
12U-RHG	12	110	275	250	27	**116.46**
12U-HSJ	12	110	300	275	37	**156.99**
*28U-RSF	28	110	125	100	22	**120.69**
*28U-RHG	28	110	175	150	27	**151.50**
*28U-HSJ	28	110	250	200	37	**188.09**
32U-RSF	32	110	150	100	22	**120.69**
32U-RHG	32	110	200	180	30	**151.50**
32U-HSJ	32	110	325	225	37	**188.09**
50U-RSF	50	110	150	100	22	**120.69**
50U-RHG	50	110	225	200	27	**163.36**
110U-RSF	110	110	250	150	22	**96.13**
110AU-RHG	110	110	325	250	27	**137.75**
110BU-RHG	110	110	450	350	30	**163.36**
110U-HSJ	110	110	600	400	37	**179.43**
220U-RSF	220	110	250	150	22	**116.46**
220U-RHG	220	110	325	250	27	**163.36**
220U-HSJ	220	110	500	300	37	**188.09**

*Recommended for 24V battery operation. **Before ordering, check wattage of equipment with which inverter will be used.**

PORTABLE PLUG-IN TYPE INVERTERS — DC TO AC

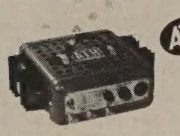
Frequency Stable with Automatic Frequency Control.

Specially Designed for Operating Standard AC Dictating Machines, Record Players, Incandescent Lamps, Electric Razors, Electronic Test Equipment, and other Small Electrical and Electronic Devices from DC Voltages in Automobiles, Buses, Trucks, Boats, Planes, Trains, and DC Districts.

Lightweight inverters for operating 110 VAC equipment from DC voltage sources. Feature excellent frequency stability and high efficiency. 12V units plug into cigarette lighter receptacle of any vehicle; others are equipped with standard 2-prong plugs. All are designed especially for use with dictating machines; record players, electric razors, test equipment, etc. Not recommended for large tape recorders and motor driven appliances such as refrigerators, washing machines, etc. Brown Hammerloid case with leather carrying strap. Sizes: DME, 5¼x4¾x2¾"; RME & RMF, 8⅜x8x3¾".

Mfr's Type	DC Input (Volts)	AC Output 60 Cycles (Volts)	Output Wattage Int.	Output Wattage Cont.	Shipping Wt. (Lbs.)	Net Price
12-DME	12	110	60	40	5	**$30.47**
†12T-RME-1	12	110	125	110	14	**63.21**
*28-RME	28	110	100	80	12	**79.78**
32-RME	32	110	100	80	12	**79.78**
110-RME	110	110	150	100	12	**76.53**
220-RME	220	110	150	100	12	**79.78**

*Recommended for 24V operation. **Check wattage rating of equipment before ordering. RME Model Inverters equipped with voltage regulator.**
†This Inverter specially designed and recommended also for use with portable TV set.



± SOLID STATE INVERTERS — DC TO AC

Frequency Stable with Automatic Frequency Control.

Specially Designed to Provide 117V 60 Cycle AC Power for the Operation of Tape Recorders, VTR Equipment, Public Address Systems, TV Sets, Ham Gear, Small Portable Tools and Appliances, Test Instruments, Closed Circuit TV, Scientific Laboratory and Hospital Equipment, Small AC-DC Universal Motors, Fluorescent and Incandescent Lamps from 12 VDC Storage Battery Power in Automobiles, Buses, Trucks, Campers, Motor Homes, Boats, and Aircraft.

ATR SOLID STATE Inverters are Universal Type Inverters recommended for the applications as listed above plus hundreds more! These Inverters are very well filtered and feature quick starting, frequency stability with varying load and input voltage, rugged heavy-duty construction, reverse polarity protection, and built-in power factor corrector utilizing a simple toggle switch. With ATR Inverters, the need for special equipment is eliminated. They are designed for quiet, long-life operation at high efficiency and maximum reliability. All models indicated here are equipped with heavy duty power transistors and plug-in oscillator for automatic frequency control. These Inverters also come equipped with four-point voltage regulators which make possible the correct output voltage for minimum to maximum loads and also help compensate for input voltages which are lower or higher than normal. The operating efficiency is approximately 80%. To figure approximate current consumption from storage battery, divide the rated input wattage of the load being operated by the storage battery voltage, and further divide this answer by .80 which will give the approximate current consumption from the battery based on the actual load being operated. These Inverters are recommended primarily for use with loads having power factors in excess of 70%. **Inverters come complete with battery cables ready for operation.**

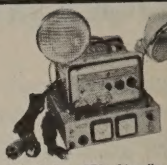
Mfr's Type	DC Input (Volts)	AC Output 60 Cycles (Volts)	Output Wattage Int.	Output Wattage Cont.	Shipping Wt. (Lbs.)	Net Price
12U-S3A	12	117	325	300	17	**$168.78**
*12U-S3A-P	12	117	325	300	17	**168.78**
12U-S5G	12	117	600	550	27	**276.19**
12U-S6M	12	117	700	650	36	**320.35**
12U-S9M	12	117	1000	900	37	**369.75**

*"-P" model is equipped with cigarette lighter cord set to plug into dash receptacle. Caution — Do not load beyond 150 watts due to possible damage to cigarette receptacle wiring.
±Inverters equipped with Solid State Oscillator.

Dimensions of Model 12U-S3A, 11x9x4". Dimensions of Model 12U-S5G, 11x9¾x5¼". Dimensions of Model 12U-S6M or 12U-S9M, 11x11¼x6¾".

All ATR Inverters are housed in attractively finished brown-hammerloid metal cabinets and are complete with battery cables ready for operation.

Note Carefully: ATR Inverters are not recommended for the operation of refrigerators, washing machines, or similar motor-driven appliances; also, ATR Inverters are not recommended for operating toasters, electric irons, sun lamps, or similar appliances of high wattage or low power factor. Any attempt to use the Inverter for applications not recommended will ruin the Inverter immediately and void the guarantee.



STANDBY POWER SYSTEMS FOR EMERGENCY LIGHTING AND POWER

Illustrates ATR Standby Power System complete with lamps, automatic crossover, and battery charger.
Completely Automatic Standby Power Units specially designed to permit the instantaneous continued operation of critical lighting equipment, PA systems, amplifiers, intercom systems, burglar alarms, fire alarms, synchronous electric clocks, electric time and recording clocks, incubators, gas valves, telephone and test equipment, and similar critical devices in the event of 115 volt AC commercial power line failure. For use: In hospitals, banks, hotels, theatres, factories, office buildings, schools, homes and other areas of operation.

Type	Storage Battery Input (Volts)	AC Output 60 Cyc. (Volts)	Output Wattage Int.	Output Wattage Cont.	Shipping Wt. (lbs.)	Net Price Without Lamps
‡1232-ETS	12	110	175	150	38	**$322.40**
‡1233-ETH	12	110	275	250	43	**346.36**
‡1234-ETJ	12	110	300	275	53	**386.85**
†1235-S3A	12	110	325	300	33	**398.68**
†1236-S5G	12	110	600	550	43	**506.08**
†1237-S6M	12	110	700	650	50	**556.29**

†Solid State type. ‡Vibrator type.
For Units with Lamps add **$49.61** additional Net.

All Models designated above **are housed in** attractively finished brown-hammerloid metal cabinets. Dimensions of all Models **without lamps** are as follows: ETS, 11"Wx11¾"Dx9"H; ETH, 11"Wx11¾"Dx11"H; ETJ, 11"Wx13"Dx12½"H; S3A, 11"Wx11¾"Dx7¾"H; S5G, 11"Wx11¾"Dx9"H; S6M, 11"Wx11¾"Dx11"H. For units with Lamps, change W to 16" and add 7½" to H; also increase shipping weight by 5 lbs.

SHAV-PAKS

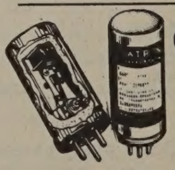
Every man should have this lightweight ATR Inverter in his car for that "Keep Clean-Shaved Look." Will operate standard AC electric shavers and other small electrical devices from your car or boat. Complete with 3 ft. cord set. Plugs into cigarette lighter receptacle. Fuse protected, rugged construction, and attractively housed in grey hammerloid-finish steel case. Input: 12 VDC. Output: 110 VAC. 60 cycles, 15-25 watts. Size: 4x2⅝x2¾". Ship. wt., 2½ lbs.

Model 12-SPB .... Net **$22.75**

BATTERY ELIMINATOR & CHARGER

For Demonstrating and Testing Transistor or Vibrator-Type Auto Radios. Ideal as a Power Supply for Model Railroad Trains, Radio Sets, Electro Plating Outfits, and other 6 or 12 VDC Equipment. May also be used as a Battery Charger. Designed for testing DC electrical apparatus on regular 110 VAC lines — equipped with full-wave solid state rectifier, assuring noiseless, interference-free operation. Fully automatic and fool-proof; has voltmeter, ammeter, and 8-position voltage control. Fuse protected and housed in heavy gauge brown hammerloid-finish metal case. 6 ft. cord set included. Size: Model 610C-ELIF, 6½x8⅛x8½", ship. wt., 22 lbs.; Model 620C-ELIT, 6½x12⅞x8½", ship. wt., 33 lbs.

Model 610C-ELIF (6 volt at 10 amps or 12 volt at 6 amps) .... Net **$90.75**
Model 620C-ELIT (6 volt at 20 amps or 12 volt at 10 amps) .... Net **120.70**



VIBRATORS

For All Auto Radio Sets Since 1954 Use One of the ATR Vibrators Listed Below.

ATR Vibrators Feature:
Ceramic Stack Spacers with two-bolt stack construction.
Instant Starting—as a result of highly efficient magnetic circuit with formed base for more uniform operation on both high and low voltages.
Large Oversize Tungsten Contacts having Full Wiping Action — for greater reliability and longer life.
Perforated Reed of Highest Quality Swedish Spring Steel.
Highest Precision Construction and Workmanship.

Ship. Wt., ½ lb.

ATR No. 1400 (Bulk), 4 Prong, 6 Volt.	Net **$5.95**
ATR No. 1843 (Bulk), 3 Prong, 12 Volt.	Net **5.95**
ATR No. 1840 (Bulk), 4 Prong, 12 Volt.	Net **5.95**

Vibrators: ATR manufactures many different styles and types of light-duty and heavy-duty vibrators. If you have a requirement, give all available information including manufacturer and vibrator type number and then request availability and price information.

BIOMETRICS INSTRUMENT CORP.

a subsidiary of **VARO INC.**

STATIC POWER CONVERSION EQUIPMENT

Biometrics Instrument Corporation, a subsidiary of Varo, Inc., has an unusual variety of expertise in the design of highly specialized power conversion equipment. Since 1946, Varo has continually advanced the development of more reliable, smaller, lighter, and more versatile power conversion equipment to meet exacting specifications for widely varied military applications and environments.

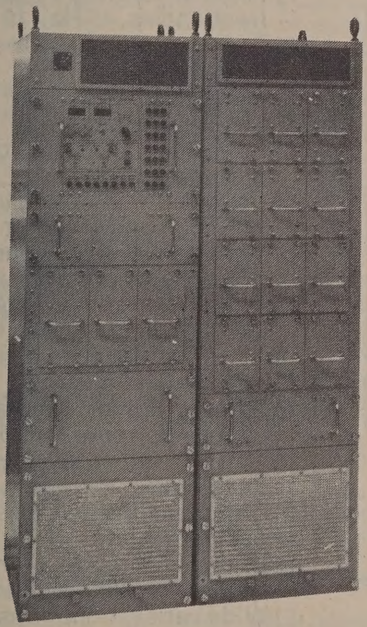
Three major product areas are addressed by Biometrics —

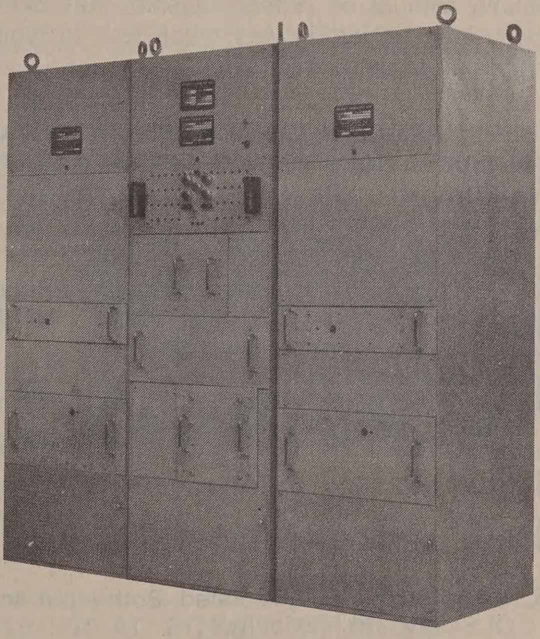
SHIPBOARD POWER SYSTEMS
including
- INVERTERS
- CONVERTERS
- FREQUENCY CHANGERS

HIGH VOLTAGE POWER SUPPLIES
including
- IMAGE CONVERTER POWER SUPPLIES
- IMAGE INTENSIFIER POWER SUPPLIES
- SPECIAL PURPOSE POWER SUPPLIES

AIRBORNE POWER SYSTEMS
including
- INVERTERS
- CONVERTERS
- POWER SUPPLIES

Biometrics has specialized for many years in the design, development and production of ruggedized shipboard power conversion equipment. Most equipment is designed and qualified to meet the shock and vibration requirements of MIL-S-901 and MIL-STD-167. New equipment currently under development utilizes the STANDARD ELECTRONIC MODULE (SEM) concept for increased maintainability and reliability considerations. Illustrated below are just two of the many units under development at Varo.





The Varo Model 4406, 10KW Static Inverter is being developed for operation from an ungrounded submarine DC source. It is capable of parallel operation with remote start-up, shutdown and load transfer. It will provide 200 percent (200%) of rated current for three (3) minutes into a fault and sustain an overload of 125 percent (125%) for one hour.

The following parameters illustrate the Model 4406 static inverter's salient performance features:

Input - - -	180-355 VDC
Output - - -	120 VAC, 3-phase, 3-wire, 400 Hz
Rating - - -	12.5KVA @ .8 lag. p.f.
Regulation - -	±0.5%
Efficiency - -	〉80%
Distortion - -	3.0%
Maintainability -	Plug-in drawers
Parallel Operation	Up to three (3) units
Logic - - -	Standard Electronic Modules (SEM)

Varo is in the process of developing a Family of Frequency Changers designed for shipboard use. They are being developed to convert Type I power to Type III power (60 Hz to 400 Hz). The 60KW unit (Varo Model 4412) pictured above represents one unit of a Family of Frequency Changers ranging from 10KW to 250KW. They use common interchangeable modules for improved logistic and maintenance.

A summary of general performance characteristics for the Family of Frequency Changer system is as follows:

Input - - -	450 VAC, 3-phase, 60 Hz
Output - - -	450 VAC, 3-phase, 3-wire, 400 Hz
Ratings - - -	10KW, 16KW, 25KW, 40KW, 60KW, 100KW, 160KW, 250KW
Regulation - -	±0.5%
Efficiency - -	〉80%
Distortion - -	3.0%
Parallel Operation	Parallable between ratings
Logic - - -	Standard Electronic Modules (SEM)

BIOMETRICS INSTRUMENT CORP., 2201 W. WALNUT ST., P.O. BOX 401267, GARLAND, TEXAS 75040 (214) 276-6141, (TWX) 910-860-5093
a subsidiary of **VARO INC.**

VARO

Behlman Engineering Corporation

P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691

A.C. POWER

FROM THE A.C. POWER SUPPLY PROBLEM SOLVERS
STANDARDS ■ SPECIALS ■ CUSTOM

A.C. POWER SUPPLY RATING COMPARISONS

The methods used in arriving at the ratings of A.C. Power Supplies vary greatly from manufacturer to manufacturer. There are no standards existing for the purpose of quick and valid comparisons and a certain amount of "Specsmanship" has been the result. This can easily lead to getting very much less for your power supply dollar than you are entitled to.

THERE ARE SIX MAJOR AND VERY IMPORTANT CONSIDERATIONS TO TAKE INTO ACCOUNT WHEN LOOKING INTO THE NAMEPLATE RATINGS OF A.C. POWER SUPPLIES. THEY ARE:

1. The Output Power or Voltampere (VA) Rating.
2. The Output Current Rating.
3. The Effect On The Supply Of Loads Having High Inrush or High Peak Recurrent Currents.
4. How The Ratings Are Affected By Low Input Line Voltages.
5. How The Ratings Are Affected By Low Power Factor Loads.
6. Is The Supply Fully Isolated, Both Input and Output, For Reasons Of Safety and Flexibility?

Please Contact Us For Additional Information Concerning A.C. Power Supply Rating Comparisons.

- ☐ Single, two and three phase outputs
- ☐ Up to 5000 VA per phase in 144 standard models
- ☐ Fixed or variable output frequencies, 45 Hz - 10 kHz
- ☐ Tight regulation vs. line and load changes
- ☐ Instant response time
- ☐ Low output distortion
- ☐ Full rated output into loads of any power factor
- ☐ Up to 150% of rated output with high power factor loads
- ☐ Instantaneous overload protection, automatic recovery
- ☐ Complete transformer-coupled isolation, input and output
- ☐ All silicon solid state, entirely new circuit concepts
- ☐ Smaller, lighter, simpler, less expensive, more reliable
- ☐ Can be used as linear power amplifier
- ☐ Complete line of plug-in oscillators
- ☐ Digital LED readout for frequency, volts and amperes
- ☐ Wide variety of options available

SPECIFICATIONS

INPUT VOLTAGE: 115 VAC ± 10%, single phase. Units up to 750 VA output.

115/230 VAC ± 10%, single phase. 1000 to 1500 VA output. Three phase inputs available.

120/208 or 230 VAC ± 10%, three phase. Units over 1500 VA output.

INPUT FREQUENCY: 48-72 Hz

EFFICIENCY: 50-70%, depending on operating conditions.

Various input voltage, frequency and power options are available, many at no extra charge.

OUTPUT VOLTAGE: 0-130 for single phase and 0-130 line to neutral for 2 or 3 phase units. Other ranges or combinations of ranges available.

LOAD REGULATION: ± 0.5%. No load to full load. Adjustable through zero for specific loads.

LINE REGULATION: ± 0.1% for ± 10% line change.

POWER FACTOR: Full rated VA into any power factor load down to zero, lead or lag.

DISTORTION: 0.5% max. harmonic distortion at frequency extremes. Less at mid-band.

OVERLOAD AND FAULT PROTECTION: Instantaneous, automatic recovery short circuit and overload protection. Fast acting main circuit breaker and fuses for fault protection.

METERING: Output voltmeter. Digital readout optional.

EXTERNAL INPUT: Via optional plug-in. 9 volts RMS. 15K ohms input impedance.

OPERATING TEMPERATURE: 0° to 55°C.

FRONT PANEL COLOR: Dark grey, white lettering.

Some of the special options available include input power types, output voltage ranges or combinations of ranges, metering, digital LED readout for frequency, volts, amperes and phase angle, higher and lower frequency outputs, higher and lower power outputs, physical configurations, paint colors, tighter regulation specifications, single to multi-phase output switching, etc. Completely special or custom units providing solutions to virtually any A.C. power supply problem can be furnished.

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LINE
ON
VOLTS ADJUST
AC POWER SUPPLY
MOD. 50-A SER. 184
0-130V 150-2000 Hz
INPUT 115V 50-60 Hz
OUTPUT 350 VA
ON
GND.
BEHLMAN ENG. CORP.
SANTA BARBARA, CALIF.

10/500 SERIES

The 10/500 series of AC Power Supplies are linear power amplifiers driven by plug-in oscillators. Fixed and variable frequency oscillators, with frequency accuracies to 0.001% and 0.1%, respectively, are available in a wide variety of standard models. An almost unlimited variety of oscillators with various degrees of accuracy and many special features can be provided.

For single phase power output a power amplifier is driven by a single phase oscillator. Two separate power amplifiers driven by a two phase oscillator and three separate power amplifiers driven by a three phase oscillator are used to provide two and three phase power outputs. Units are available capable of providing a choice of single or multi-phase output by means of a front panel mode selector switch.

The output power is transformer coupled and completely isolated. It can be left floating or one side grounded.

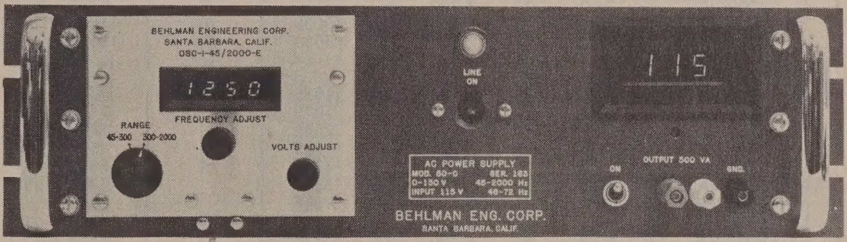
Line input to these units is via very advanced isolating magnetics.

These power supplies are capable of providing continuous full-rated volt-ampere output under worst case conditions, i.e., zero power factor loads either leading or lagging, 10% low line and output voltage at 75% of maximum. With unity power factor loads, nominal line and maximum output voltage, continuous duty at 150% of rating is permissible. The graph outlined below shows maximum power output for various conditions of load power factor output voltage, line voltage and ambient temperature. Even though these power supplies are rated under worst case conditions and in addition have a 50% overload capability they are nevertheless smaller, lighter and less expensive than other supplies whose ratings have been derived under considerably more favorable operating conditions.

Complete overload, short circuit and fault protection is provided by a combination of an instantaneous, automatic-recovery electronic protector plus a fast acting main circuit breaker.

NEW from Behlman

Model 50-C with Plug-In OSC-1-45/2000-E


BEHLMAN ENGINEERING CORP.
SANTA BARBARA, CALIF.
OSC-1-45/2000-E
1250
RANGE
45-300 300-2000
FREQUENCY ADJUST
VOLTS ADJUST
LINE
ON
115
AC POWER SUPPLY
MOD. 50-C SER. 163
0-130 V 45-2000 Hz
INPUT 115 V 46-72 Hz
OUTPUT 500 VA
ON
GND.
BEHLMAN ENG. CORP.
SANTA BARBARA, CALIF.

Digital readouts with LED's now available as an optional feature on all Behlman Engineering Corporation A.C. Power Sources, Plug-In Oscillators and UPS. The digital display of Volts, Amperes, Frequency in hertz and Phase Angle in degrees may be obtained. Please call or write for additional details.

The graph to the right relates output power limits, expressed as a percentage of rated output, to various conditions of output voltage, load power factor, line voltage, ambient temperature and proximity to minimum frequency ratings.

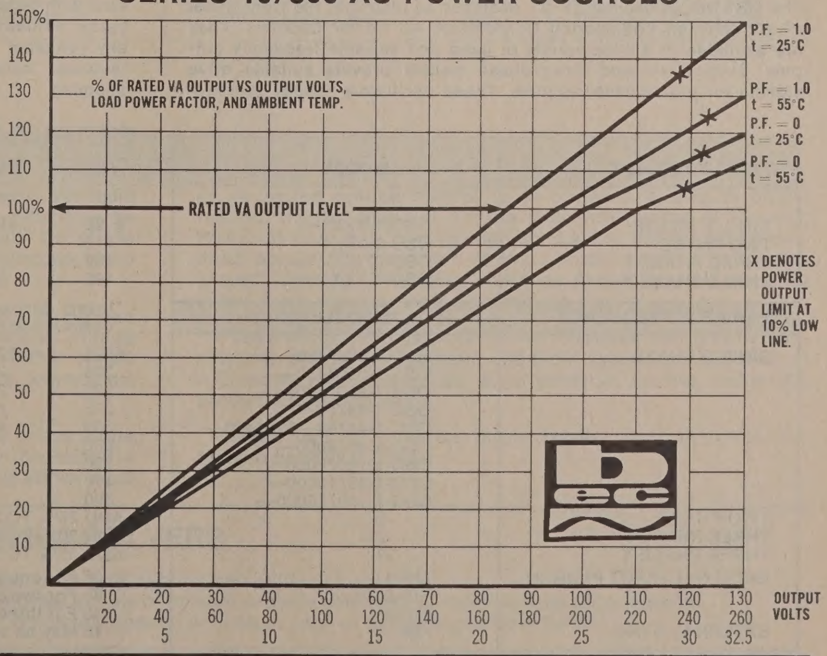
The output voltages shown are the three most popular ranges. Other voltage ranges are comparable on a pro-rata basis.

An important advantage, inherent in Behlman Engineering Corp. A.C. Power Sources, lies in the availability of power amplifiers in four separate output frequency ranges. The narrow band power supplies effect cost and weight savings that add to the already existing size, weight and cost advantages of our full frequency models.

Many AC power supplies require derating to half power in the 5 kHz to 10 kHz range. This derating is not required with the Behlman Engineering 10/500 series.

This graph carries an important message: Don't buy an AC power supply without knowing how its ratings were determined.

SERIES 10/500 AC POWER SOURCES



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SERIES 10/500 AC POWER SOURCES

MAIN FRAME AMPLIFIERS

TO ORDER: Use model number corresponding to output power level and number of phases required. Add letter corresponding to desired frequency range. All units are in rack mounting enclosure. Cabinet enclosed versions of any of these units are available. Order plug-in oscillator as listed below.

OUTPUT POWER	MAXIMUM AMPERES (per phase 0-130 V.)	MODEL NUMBER	OUTPUT FREQUENCY RANGE (Hz)				WEIGHT (lbs.) A MODELS	DIMENSIONS
			150-2000	150-10,000	45-2000	45-10,000		
SINGLE PHASE			A	B	C	D		
100 VA	1.2	10-	515	CONSULT FACTORY FOR PRICE AND DELIVERY	590	CONSULT FACTORY FOR PRICE AND DELIVERY	26	5¼″Hx15″Dx19″W
250 VA	3.0	25-	590		675		38	5¼″Hx15″Dx19″W
350 VA	4.2	35-	795		915		50	5¼″Hx15″Dx19″W
500 VA	6.0	50-	1040		1195		60	5¼″Hx19″Dx19″W
750 VA	9.0	75-	1525		1795		65	5¼″Hx19″Dx19″W
1000 VA	12.0	100-	1945		2225		95	8¾″Hx19″Dx19″W
1500 VA	18.0	150-	2725		3045		120	14″Hx19″Dx19″W
2000 VA	24.0	200-	3500		4050		135	14″Hx19″Dx19″W
3000 VA	36.0	300-	4900		5700		180	21″Hx19″Dx19″W
5000 VA	60.0	500-	7600		8900		300	29¾″Hx19″Dx19″W
TWO PHASE								
200 VA	1.2	2-10-	1050		1205		42	5¼″Hx15″Dx19″W
500 VA	3.0	2-25-	1260		1445		70	5¼″Hx19″Dx19″W
700 VA	4.2	2-35-	1785		2050		80	7″Hx19″Dx19″W
1000 VA	6.0	2-50-	2160		2485		105	8¾″Hx19″Dx19″W
1500 VA	9.0	2-75-	3130		3650		130	14″Hx19″Dx19″W
2000 VA	12.0	2-100-	3970		4540		140	14″Hx19″Dx19″W
3000 VA	18.0	2-150-	5585		6250		185	21″Hx19″Dx19″W
4000 VA	24.0	2-200-	7170		8285		210	21″Hx19″Dx19″W
6000 VA	36.0	2-300-	10030		11655		300	28″Hx19″Dx19″W
10000 VA	60.0	2-500-	15555		18195		500	45½″Hx19″Dx19″W
THREE PHASE Y								
300 VA	1.2	3-10-	1535		1765		42	5¼″Hx19″Dx19″W
750 VA	3.0	3-25-	1875		2150		72	7″Hx19″Dx19″W
1050 VA	4.2	3-35-	2665		3065		110	8¾″Hx19″Dx19″W
1500 VA	6.0	3-50-	3225		3695		145	14″Hx19″Dx19″W
2250 VA	9.0	3-75-	4680		5450		155	14″Hx19″Dx19″W
3000 VA	12.0	3-100-	5835		6665		200	21″Hx19″Dx19″W
4500 VA	18.0	3-150-	7965		8905		280	28″Hx19″Dx19″W
6000 VA	24.0	3-200-	10220		11840		325	28″Hx19″Dx19″W
9000 VA	36.0	3-300-	14325		16665		390	42″Hx19″Dx19″W
15000 VA	60.0	3-500-	22040		25795		675	70″Hx19″Dx19″W

*Also available with 3-phase Scott T output. Add "T" after "2" in model no. For example: 2T-35-.

SERIES OSC PLUG-IN OSCILLATORS

The OSC series oscillators are designed to plug into the front panel of all Behlman Engineering Corporation AC Power Supplies. They are available in a wide variety of fixed and variable frequency outputs. Single, two and three phase models provide suitable drive signals for multi-phase supplies. These oscillators readily synchronize with external signals. In addition to the standard units shown below virtually any combination of fixed or variable frequencies to any practical degree of accuracy can be provided. Many special features, including provisions for external sync or drive, can be supplied.

FIXED FREQUENCY	MODEL	FREQUENCY ACCURACY					
		1%	0.5%	0.25%	0.1%	0.01%	0.001%
		E	F	G	H	J	K
SINGLE PHASE	OSC-1-XXX*—	$ 95	$110	$130	$155	$330	$485
TWO PHASE	OSC-2-XXX*—	170	190	210	235	395	555
THREE PHASE T	OSC-2T-XXX*—	180	200	220	245	410	475
THREE PHASE Y	OSC-3-XXX*—	195	220	240	265	445	585
VARIABLE FREQUENCY	**MODEL**	*Insert desired frequeny in place of XXX. Add code letter for desired frequency accuracy to model number.					
SINGLE PHASE	OSC-1-380/420—	$225	$245	$270	$345		
	OSC-1-350/450—	225	245	270			
	OSC-1-300/500—	225	275	295			
	OSC-1-44/66—	235	295	320			
	OSC-1-44/66—320/480—	330	415				
	OSC-1-45/2000—	360					
	OSC-1-150/2000—	350					
	OSC-1-45/10000—	410					
	OSC-1-150/10000—	390					
TWO PHASE	-2-	ADD 25% TO SINGLE PHASE PRICE					
THREE PHASE T	-2T-	ADD 30% TO SINGLE PHASE PRICE					
THREE PHASE Y	-3-	ADD 35% TO SINGLE PHASE PRICE					
EXTERNAL INPUT PLUG-IN	EIP-1	$ 25 For one phase external input					
	EIP-2, 2T	35 For two phase external input					
	EIP-3	45 For three phase external input					
EXTERNAL SYNC	-SN	15 May be added to all fixed or variable frequency oscillators					

Behlman Engineering Corporation

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UNINTERRUPTIBLE A.C. POWER SOURCES

The UPS-10/500 Series of uninterruptible A.C. power sources are available in the same basic sizes and power ratings as the Series 10/500 standard line of A.C. Power Supplies. Battery back-up power can be furnished by a variety of gelled or liquid electrolyte storage batteries. The lower powered units (100-350 VA) can be furnished with built-in gelled electrolyte batteries.

The photograph illustrates a Model UPS-25 with an output power capability of 250 VA and a self-contained battery pack for 15 minutes of standby operation.

All of the UPS units include a battery charger, electromechanical or solid state bypass switch, appropriate indicating lights and power line failure alarm provisions. The output frequency of the UPS is phase locked to the input power line frequency under conditions of normal operation. In the event the A.C. power line fails, the UPS continues to furnish the load with A.C. power by operating from the battery bank. The output frequency of the UPS is then determined by the highly stable internal oscillator. During normal operation the load is supplied with power from the output of the UPS. Therefore, there is no switch overtime involved if input power is interrupted.

Battery banks can be furnished for relay rack mounting or to the customer's specific requirements. Battery interconnect cables are provided with all standard UPS configurations. Please call or write for additional details.

OUTPUT POWER	MAXIMUM AMPERES (per phase)	MODEL NUMBER		WEIGHT (lbs.)	DIMENSIONS** (Not incl. Batteries)
		ELECTRO-MECH. BYPASS SW.	SOLID STATE BYPASS SW.		
SINGLE PHASE					
100 VA	1.2	UPS-10-C	UPS-10-C-SS	28	*5¼″H x 15″D x 19″W
250 VA	3.0	UPS-25-C	UPS-25-C-SS	41	*5¼″H x 15″D x 19″W
350 VA	4.2	UPS-35-C	UPS-35-C-SS	54	*5¼″H x 15″D x 19″W
500 VA	6.0	UPS-50-C	UPS-50-C-SS	65	5¼″H x 19″D x 19″W
750 VA	9.0	UPS-75-C	UPS-75-C-SS	70	5¼″H x 19″D x 19″W
1000 VA	12.0	UPS-100-C	UPS-100-C-SS	102	8¾″H x 19″D x 19″W
1500 VA	18.0	UPS-150-C	UPS-150-C-SS	129	14″H x 19″D x 19″W
2000 VA	24.0	UPS-200-C	UPS-200-C-SS	145	14″H x 19″D x 19″W
3000 VA	36.0	UPS-300-C	UPS-300-C-SS	194	21″H x 19″D x 19″W
5000 VA	60.0	UPS-500-C	UPS-500-C-SS	308	29¾″H x 19″D x 19″W
THREE PHASE Y					
300 VA	1.2	UPS3-10-C	UPS3-10-C-SS	45	5¼″H x 19″D x 19″W
750 VA	3.0	UPS3-25-C	UPS3-25-C-SS	77	7″H x 19″D x 19″W
1050 VA	4.2	UPS3-35-C	UPS3-35-C-SS	118	8¾″H x 19″D x 19″W
1500 VA	6.0	UPS3-50-C	UPS3-50-C-SS	159	14″H x 19″D x 19″W
2250 VA	9.0	UPS3-75-C	UPS3-75-C-SS	167	14″H x 19″D x 19″W
3000 VA	12.0	UPS3-100-C	UPS3-100-C-SS	215	21″H x 19″D x 19″W
4500 VA	18.0	UPS3-150-C	UPS3-150-C-SS	301	28″H x 19″D x 19″W
6000 VA	24.0	UPS3-200-C	UPS3-200-C-SS	349	28″H x 19″D x 19″W
9000 VA	36.0	UPS3-300-C	UPS3-300-C-SS	420	42″H x 19″D x 19″W
15000 VA	60.00	UPS3-500-C	UPS3-500-C-SS	725	70″H x 19″D x 19″W

*Available with salf-contained gel-cels
**Add 3.5″ for all -SS models

PROGRAMMABLE A.C. POWER SOURCES

The entire Series 10/500 A.C. Power Supplies are available with programmable plug-in oscillators. These units may be programmed for output voltage level, frequency or phase angle/s. Any or all of the above functions may be incorporated into a single plug-in oscillator.

All of the generally accepted methods of programming can be used with these units. This includes resistance and voltage programming as well as digital programming with either binary or BCD format from computers, micro-processors, keyboards, punched tape or key punched cards.

Manual local control over voltage, frequency or phase angle can be provided on the front panel of the plug-in oscillator in the form of multi-turn potentiometers. Selection of either local or automatic remote control is an optional feature. A digital readout display mounted on the main front panel of the A.C. Power Supply can be provided to display the functions outlined above. The selection of the desired function to be displayed (Voltage, Frequency or Phase Angle) may be made by either local manual control or remote control.

These programmable A.C. Power Supplies can greatly simplify the design of automatic checkout systems, simulation of A.C. power line anomalies, environmental testing, automatic production testing, etc.

Please call or write for more details. Your inquiries will receive prompt attention.

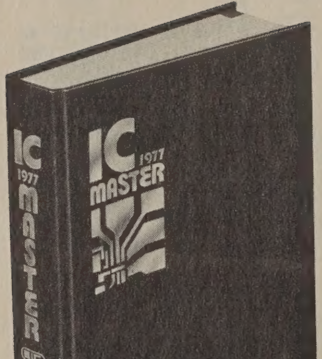
THE A.C. POWER SUPPLY PROBLEM SOLVERS

DO YOU HAVE A SPECIAL AC PROBLEM?

- Behlman Engineering versatility can solve it.
- A great variety of options provide solutions to many special requirements.
- Completely special or custom units or systems can be provided.

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
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- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
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United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

BULOVA® Inverters and Frequency Changers

Features:

- Up to 500—VA Output
- Fully Regulated Sine Wave
- All Solid-State
- Protected Input/Output

Performance Specifications:

OUTPUT:

Frequency Output: 50 or 60 Hz, standard; other specific frequency, custom

Frequency Regulation: ±1%, ±.1%, ±.015%, ±.005% or better.

Temperature Range: 0° C to + 50° C

Wave Shape: Sine Wave, 3% Distortion max.

Output Voltage: 115 or 230V AC nominal

Voltage Regulation: ± 1% any combination of full line and load change

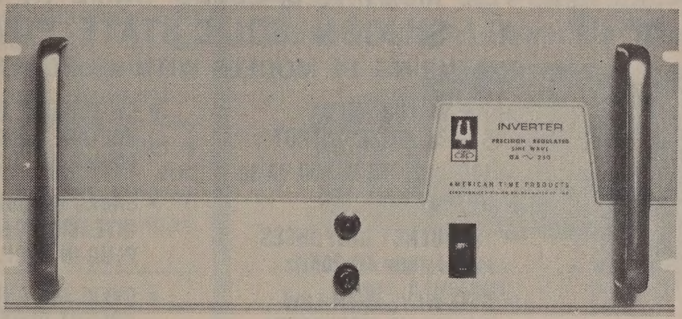
INPUT:

115V AC or 230V AC, ±10%, 45 to 65 Hz; or 22 to 30V DC

Applications:

Ideally suited for synchronous motor drives, chronographs, stroboscopes, generator frequency control; running timers, clock and time-of-day systems, tape recorders, general laboratory use.

INVERTERS

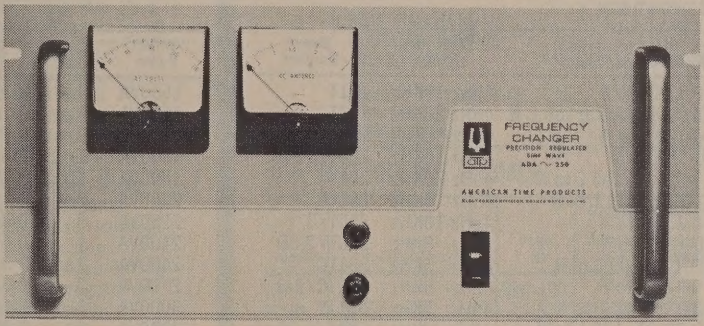


(Meters optional)

Model	Input VDC	Output VA	Output Freq. Hz	Output Volt	Wt. Lbs. (2)	Dimensions (For 19" Rack) H	Dimensions (For 19" Rack) D
DA-100S	22-30	100	50 or 60	115(1)	65	5¼"	13"
DA-250S	22-30	250	50 or 60	115(1)	70	8¾"	13"
DA-500S	22-30	500	50 or 60	115(1)	130	10½"	15"

(1) 230 Volt Available (2) For 50 Hz, add about 5 lbs.

FREQUENCY CHANGERS



(Meters optional)

Model	Input VAC. ±10%	Input Freq. Hz	Output VA	Output Freq. Hz	Output Volt	Wt. Lbs. (2)	Dimensions (For 19" Rack) H	Dimensions (For 19" Rack) D
ADA-100S	115/230	45-65	100	50 or 60	115	75	5¼"	13"
ADA-250S	115/230	45-65	250	50 or 60	115 (1)	80	8¾"	13"
ADA-500S	115/230	45-65	500	50 or 60	115	130	10½"	15"

(1) 230 Volt Available (2) For 50 Hz, add about 5 lbs.

5VA INVERTER — PRECISION FREQUENCY

Model DA5S

Standard 115 V 60 Hz, available at any fixed frequency from 50 to 400 Hz

- Accuracy to ±.0002%
- Sine Wave, max. THD 5%
- Input 28V DC ± 4V

Size: 4½" x 5" x 3¼"
Weight: 3 lbs. approx.

BULOVA
ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

AMERICAN TIME PRODUCTS

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Call or Write for Full Spec Bulletin

Aiken Industries
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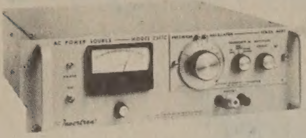
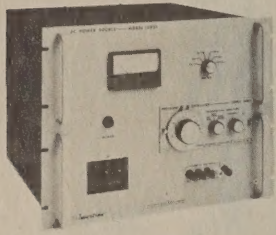
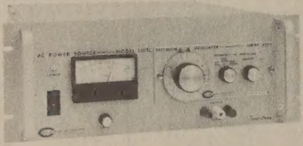
Division

AC POWER SOURCES



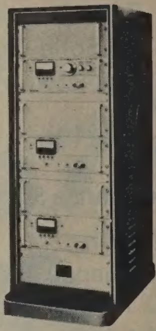




SOLID STATE *Invertron*®

THE MOST RESPECTED NAME IN AC POWER
ALL-SILICON SOLID-STATE POWER SOURCES
FEATURING 14 MODELS WITH 48 POWER LEVELS

- 100 VA TO 6000 VA SINGLE-PHASE OUTPUT
- 100 VA 2ϕ TO 18,000 VA 3ϕ OUTPUT
- FREQUENCY RESPONSES FROM 45Hz TO 20KHz
- SINE-WAVE WITH LOW HARMONIC DISTORTION
- EXCELLENT LINE AND LOAD REGULATION TO .01%
- SWITCHABLE OUTPUT VOLTAGE RANGES FOR FULL POWER AT LOWER VOLTAGES
- BROAD CHOICE OF INTERCHANGEABLE PLUG-IN OSCILLATORS
- OVERLOAD AND SHORT-CIRCUIT PROTECTION
- OPTIONAL INPUT VOLTAGES: 117 V 1ϕ TO 460 V 3ϕ



Invertrons® have earned world-wide respect through their versatility, reliability, and outstanding performance. In addition to low distortion, high input stability and high power density, these silicon solid-state AC power sources use plug-in oscillators as frequency-determining elements and can be stacked electrically to provide one-, two-, or three-phase power. All Invertrons® fit a standard 19" rack, or may be ordered with the appropriate cabinet for floor or bench use.

Output Power	ϕ*	Standard Output Voltage Ranges**	Frequency Range	Model Number
100VA	1	0-135 L to N	45Hz-10KHz	101T
150VA	3	0-17.5, 30, 75, 130 L-N	45Hz-20KHz	153T
160VA	1	0-120 L to N	45Hz- 5KHz	161T
200VA	3Δ	0-35 L to N	45Hz-10KHz	200T/2-3D
250VA	1	0-30, 75, 135 L to N	45Hz-20KHz	251T
250VA	1	0-67.5, 135 L to N	45Hz- 5KHz	251TC
300VA	3	0-135 L to N	45Hz-10KHz	300T/3-3
320VA	3Δ	0-120 L to N	45Hz- 5KHz	320T/2-3D
350VA	1	0-120, 240 L to N	45Hz- 5KHz	351TC
480VA	3	0-120 L toN	45Hz- 5KHz	480TC/3-3
500VA	1	0-135, 270 L to N	45Hz- 5KHz	501TC
500VA	3Δ	0-30, 75, 135 L to N	45Hz-20KHz	500T/2-3D
500VA	3Δ	0-135, 270 L to N	45Hz- 5KHz	500TC/2-3D
500VA	3	0-30, 45, 75, 135 L-N	45Hz-10KHz	503T
700VA	3Δ	0-120, 240 L to N	45Hz- 5KHz	700TC/2-3D
750VA	1	0-30, 75, 135, 270 L-N	45Hz-10KHz	751T
750VA	3	0-30, 75, 135 L to N	45Hz-20KHz	750T/3-3
750VA	3	0-67.5, 135 L to N	45Hz- 5KHz	750TC/3-3
900VA	1	0-30, 60, 120, 240 L-N	45Hz- 5KHz	901T
1000VA	1	0-30, 75, 135, 270 L-N	45Hz-10KHz	1001T
1000VA	3Δ	0-135, 270 L to N	45Hz- 5KHz	1000TC/2-3D
1050VA	3	0-120, 240 L to N	45Hz- 5KHz	1050TC/3-3
1200VA	1	0-30, 60, 120, 240 L-N	45Hz- 5KHz	1201T
1500VA	1	0-30, 60, 120, 240 L-N	45Hz- 5KHz	1501T

*Models designated "D" are open delta configuration; all others 4-wire wye.

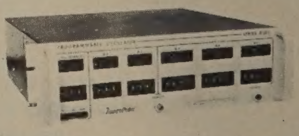
**Other output ranges available on special order.

Output Power	ϕ*	Standard Output Voltage Ranges**	Frequency Range	Model Number
1500VA	3Δ	0-30, 75, 135, 270 L-N	45Hz-10KHz	1500T/2-3D
1500VA	3	0-135, 270 L to N	45Hz- 5KHz	1500TC/3-3
1500VA	3	0-75, 135 L to N	45Hz- 5KHz	1503T
1800VA	1	0-60, 120, 240 L to N	45Hz- 5KHz	1800T/2-1
1800VA	3Δ	0-30, 60, 120, 240 L-N	45Hz- 5KHz	1800T/2-3D
2000VA	3Δ	0-30, 75, 135, 270 L-N	45Hz-10KHz	2000T/2-3D
2250VA	3	0-30, 75, 135, 270 L-N	45Hz-10KHz	2250T/3-3
2400VA	1	0-60, 120, 240 L to N	45Hz- 5KHz	2400T/2-1
2400VA	3Δ	0-30, 60, 120, 240 L-N	45Hz- 5KHz	2400T/2-3D
2700VA	3	0-30, 60, 120, 240 L-N	45Hz- 5KHz	2700T/3-3
3000VA	1	0-60, 120, 240 L to N	45Hz- 5KHz	3000T/2-1
3000VA	3Δ	0-30, 60, 120, 240 L-N	45Hz- 5KHz	3000T/2-3D
3000VA	3	0-30, 75, 135, 270 L-N	45Hz-10KHz	3000T/3-3
3600VA	3	0-30, 60, 120, 240 L-N	45Hz- 5KHz	3600T/3-3
4000VA	1	0-120 L to N	45Hz- 2KHz	4000T/4-1
4500VA	3	0-30, 60, 120, 240 L-N	45Hz- 5KHz	4500T/3-3
4800VA	1	0-120, 240 L to N	45Hz- 2KHz	4800T/4-1
5400VA	3	0-60, 120, 240 L to N	45Hz- 5KHz	5400T/6-3
6000VA	1	0-120, 240 L to N	45Hz- 2KHz	6000T/4-1
7200VA	3	0-60, 120, 240 L to N	45Hz- 5KHz	7200T/6-3
9000VA	3	0-60, 120, 240 L to N	45Hz- 5KHz	9000T/6-3
12000VA	3	0-120, 240 L to N	45Hz- 2KHz	12000T/12-3
14400VA	3	0-120, 240 L to N	45Hz- 2KHz	14400T/12-3
18000VA	3	0-120, 240 L to N	45Hz- 2KHz	18000T/12-3

2 phase versions available at comparable power levels.

REMOTE-PROGRAMMABLE INVERTRONS®

Solid state Invertrons® combined with 830T-Series Programmable Oscillators provide the most advanced programmable AC power sources available on the market today. 830T-Series Programmable Oscillators feature simultaneous and independent programming of frequency, phase, and amplitude compatible with remote controllers such as a computer, punched tape, cards, etc. Models are available in single, two or three phase.



CALIFORNIA INSTRUMENTS COMPANY

A Division of Aiken Industries, Inc.
5150 Convoy Street • San Diego, California 92111 • (714) 279-8620 • Telex: 695047
Representatives in principal cities throughout the world.

Aiken Industries
California Instruments
Division

OSCILLATORS
AC LINE CORRECTORS

800T-SERIES PLUG-IN OSCILLATORS

Companion Plug-in Oscillators are available in three types: (A) General-purpose, fixed-frequency; (B) Crystal-controlled, high-stability fixed-frequency; and (C) Continuously variable frequencies. All may be used with the Solid-State Invertrons® to create 1φ, 2φ, or 3φ custom AC power sources tailored to exact requirements. The fixed-frequency oscillators may be ordered with a servo-feedback option for systems requiring extremely high amplitude stabilities and accuracies. This feature provides overall regulation of up to 0.01% against line and load changes.

800T VARIABLE-FREQUENCY MODELS

Freq. Range	Freq. Accy. @ 25°C	Model Number
20Hz to 20KHz in three bands Sine or Square Wave	±1.0%	(1φ) 800T-20/20K-1-1 (2φ) 800T-20/20K-1-2 (3φ) 800T-20/20K-1-3 (3φ) 800T-20/20K-1-3D
45Hz to 75Hz in one band Sine or Square Wave	±0.25%	(1φ) 800T-45/75-.25-1 (2φ) 800T-45/75-.25-2 (3φ) 800T-45/75-.25-3 (3φ) 800T-45/75-.25-3D
300Hz to 500Hz in one band Sine or Square Wave	±0.25%	(1φ) 800T-300/500-.25-1 (2φ) 800T-300/500-.25-2 (3φ) 800T-300/500-.25-3 (3φ) 800T-300/500-.25-3D

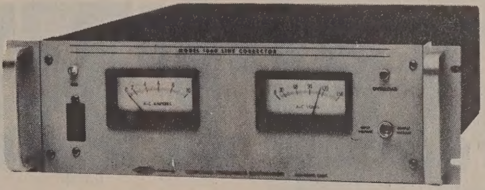
810T FIXED-FREQUENCY GENERAL-PURPOSE MODELS

Any Single Freq. 45Hz to 10KHz Sine or Square Wave	±0.1%	(1φ) 810T-Freq.-1.1 (2φ) 810T-Freq.-.1-2 (3φ) 810T-Freq.-.1-3 (3φ) 810T-Freq.-.1-3D
Any Single Freq. 45Hz to 10KHz Sine or Square Wave	±0.1%	(1φ only) System-Servo oscillator with servo feedback set to maintain power source output at 115 VAC. Provides 0.01% line and load regulation from power source.
Any Single Freq. 45Hz to 10KHz Sine or Square Wave	±0.1%	(1φ only) System-Servo oscillator with servo feedback adjustable to produce power source output of 105 to 135 VAC. Provides 0.01% line and load regulation from power source.

820T FIXED-FREQUENCY CRYSTAL-CONTROLLED MODELS

400Hz Sine or Square Wave	±0.01%	(1φ) 820T-400-.01-1 (2φ) 820T-400-.01-2 (3φ) 820T-400-.0001-3
400Hz Sine or Square Wave	±0.0001%	(1φ) 820T-400-.01-1 (2φ) 820T-400-.0001-2 (3φ) 820T-400-.0001-3
Any Single Freq. 45Hz to 10KHz Sine or Square Wave	±0.01%	(1φ) 820T-Freq.-.01-1 (2φ) 820T-Freq.-.01-2 (3φ) 820T-Freq.-.01-3 (3φ) 820T-Freq.-.01-3D
Any Single Freq. 45Hz to 10KHz Sine or Square Wave	±0.0001%	(1φ) 820T-Freq.-.0001-1 (2φ) 820T-Freq.-.0001-2 (3φ) 820T-Freq.-.0001-3 (3φ) 820T-Freq.-.0001-3D

SERIES 1000 DYNAMIC AC LINE CORRECTORS
For Precision AC Power Independent of Powerline Disturbances



- PEAK INSTANTANEOUS POWER TO FIVE TIMES RATING
- 3.5-TO-1 CREST FACTOR
- REDUCES 500 VOLT 10 μSEC TRANSIENTS BY 1000-TO-1
- PURE SINE WAVE POWER
- HARMONIC DISTORTION REDUCTION OF 50:1
- SUPER REGULATION
  - LINE — 0.025%
  - LOAD — 0.025%
- PEAK AMPLITUDE STABILITY: ±0.01% CYCLE-TO-CYCLE
- IMPULSE SETTLING TIME LESS THAN 20 MICROSECONDS
- PEAK AMPLITUDE INSTABILITY LESS THAN 0.01%
- LOW OUTPUT TEMPERATURE COEFFICIENT — 0.005%/°C
- 100 DB COMMON MODE ISOLATION
- HIGH STABILITY — 0.05%/24 HOURS
- AUTOMATICALLY RECOVERS FROM OVERLOAD IN LESS THAN ONE CYCLE
- MONITORING OF VOLTAGE AND CURRENT OUTPUT
- SELF-CONTAINED AIR COOLING
- ALL-SILICON SOLID STATE

115 VOLT OUTPUT MODELS

Model	Input Voltage Range	Freq. Hz	Output Power (VA) Contin-uous	Output Power (VA) Max. Inst. Peak	Exact Output Volts
1040 1050 LC1201B	95-115, 105-125, 115-135 (selectable by tap switch)	380-420 47-53 57-63	1200	5000	115V RMS ±0.15% Setable to 0.01% (±0.25% 400Hz Models)
1340 1350 1360		380-420 47-53 57-63	3000	15,000	
1361	180-264 in three ranges	57-63			

230 VOLT OUTPUT MODELS

1052A 1062	180-220, 198-244, 216-264 (selectable by tap switch)	47-53 57-63	1000	5000	220,230 or 240V RMS ±0.15% Setable to 0.01% (Single Output voltage only; specify on order)
1352 1362		47-53 57-63	3000	15,000	

*At power factors of 1.0 to ±0.7.

MECHANICAL

	1000 VA Models	3000 VA Models
Dimensions:	19″ x 5¼″H x 17½″D	19″W x 14″H x 20¼″D
Net Wt.:	55 lbs.	175 lbs.
Shipping Wt.:	70 lbs.	235 lbs.

CALIFORNIA INSTRUMENTS COMPANY

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WE INTERRUPT THIS CATALOG

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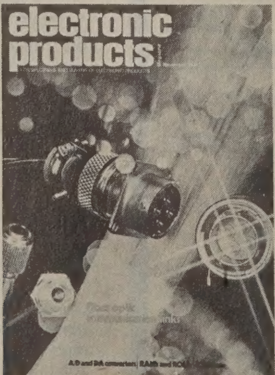

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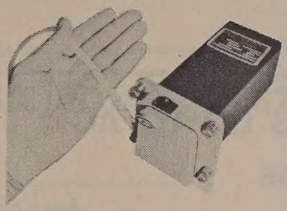
DATA PRINTERS

STRIP PRINTERS

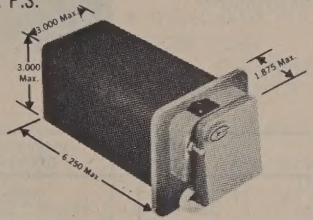
MODEL AN16



A high reliability, compact, lightweight, fully alpha-numeric Strip Printer utilizing the simplest method of data reproduction, impacting pressure sensitive paper between a hammer and a character wheel "on-the-fly." Designed for military airborne applications, it meets all the requirements of MIL-E-5400, Class 2, Curve III.

- High Reliability: 5000 hours airborne MTBF
- Compact Size: 3″ x 3″ x 6.25″
- Lightweight: 4 pounds
- Low Maintenance: No lubrication or adjustments
- DTμL Input: 6 BIT parallel
- Character Selection: 64 characters, ASCII
- Character Rate: 25 per second
- Configuration: 1A) Printer with controls
  2A) 1A with paper storage
  3A) 2A with 400 Hz, P.S.
  4A) 1A with 400 Hz, P.S.

AN-16-1A STRIP PRINTER



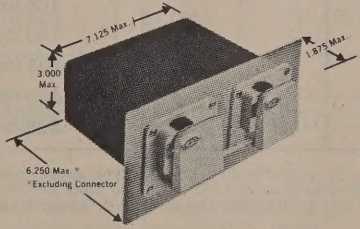
Input Power AN-16-1A and -2A only

Voltage	Regulation	Standard
+26 VDC	±2 VDC	1.5a ave 2.5a peak 12% duty cycle
+12 VDC	±5%	20 ma max.
−12 VDC	±5%	20 ma max.
+4.9 VDC	±5%	350 ma max.

AN-16-2A

For Record Storage

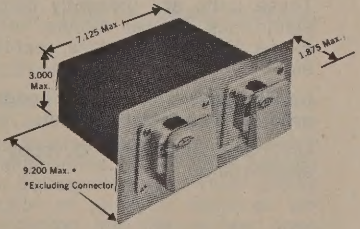
When the system application requires a take-up spooler which will store all or any portion of a printed record, the spooler module is added to the printer and both modules are then mounted to a common panel and enclosed by a single rear cover. Power for the spooler is derived at the printer interface connector at the rear of the enclosure.



AN-16-3A

For Record Storage and Integrated Power Supply

If the system application requires that the printer and spooler derive its own DC voltages, a power supply module is added to the rear of the spooler module and suitably interconnected into the printer and spooler modules.

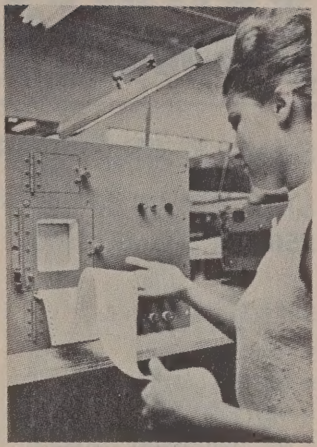


Input Power

Voltage	Regulation	Standard
28 VDC	±5%	75 ma max.
115V 400 Hz 3φ	±10% ±20 Hz	60 Watts max.

LINE PRINTERS

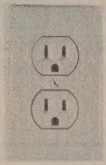
MODEL 2000



This Digital Line Printer utilizes a unique hypocyclodial printing mechanism to provide high reliability, at high printing speeds in rugged military environments. Designed to meet the requirements of MIL-E-16400 for use in military programs.

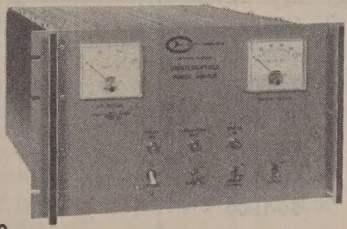
- High Reliability: 2000 hours shipboard MTBF
- Size: 19″W x 10.5″H x 20″D
- Weight: 70 pounds
- DTμL Data Input: 4 BIT, parallel BCD
- Data Columns: 21 maximum
- Character Positions: 12 per column
- Printing Speed: 15 lines per second

UNINTERRUPTIBLE POWER



We have come to depend on the wall socket, but when all else fails, you can rely on the Clary uninterruptible power source. Perfect insurance against utility outages, brown out and line transients. The Clary "MINI-UPS" is available in single phase ratings from 625 VA to 5 KVA. Ask for our brochure/specification.

VA	Unit Price
625	— $1650
1250	— $2050
2500	— $3390
5000	— $7500



THE RELIABLE POWER SOURCE

MINI-UPS SPECIFICATIONS

Model Number	UPS 625-1	UPS 1250-1	UPS 2500-1	UPS 5000-1/-3
INPUT Voltage (VAC)	115 ±15%	115 ±15%	115 ±15%	115 or 230 ±15%
Frequency* (Hz) ±3	60	60	60	60
Phase	Single 2 Wire & GND	Single 2 Wire & GND	Single 2 Wire & GND	Single 3 Wire & GND
Current** (Max. Amp)	11A	22A	44A	88/44A
BATTERY VOLTAGE	84 VDC	84 VDC	84 VDC	84 VDC
Full load back-up time***	Optional	Optional	Optional	Optional
OUTPUT Voltage (VAC)	115 ±2%	115 ±2%	115 ±2%	115 or 230 ±15%
Frequency* (Hz) ±0.25%	60	60	60	60
Phase	Single 2 Wire & GND	Single 2 Wire & GND	Single 2 Wire & GND	Single 3 Wire & GND
Power KVA 0.8 pf	0.625	1.250	2.500	5.000
Current (Amps) at: (Cont.) 100%	5.4	10.9	22.0	44/22
(15 Min.) 110%	5.9	12.0	24.0	48/24
(15 Sec.) 150%	8.1	16.4	33.0	66/33
(15 Cycles) 200%	10.8	21.8	44.0	88/44
HARMONIC DISTORTION at: 100% load	2½% THD	2½% THD	2½% THD	2½% THD
Size — Inches (H x W x D)	10½x19x19	10½x19x19	21x19x19	50x23x23
Weight — Lbs. (less battery)	110	125	220	500

*Input 50 Hz / Output 50 Hz (Optional)

**At full load and discharged battery, input at 115 VAC

***Batteries are available in separate rack or free-standing enclosures. Back-up time to be specified by customer.

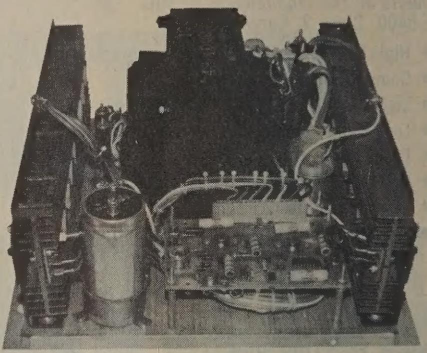
CLARY CORPORATION

PRECISION INSTRUMENT DIVISION / 320 W. Clary Ave., San Gabriel, CA 91776 / (213) 287-6111

computer power, inc

SINGLE AND *THREE PHASE INVERTERS DC TO AC

SINE WAVE 60 Hz FOR ALL TYPES OF LOADS
250 VA TO 30 KVA



SPECIAL FEATURES

- HIGH MTBF
- 70 - 85% EFFICIENCY
- NEW PATENTED SIMPLIFIED DESIGN
- NO FEED BACK LOOPS
- OVERLOAD PROTECTION
- LOW COST
- SELF CLEARING POWER COMPONENTS

APPLICATIONS

- COMPUTER ELECTRONICS
- BLOWER MOTORS
- INCANDESCENT LOADS
- RECTIFIER LOADS
- FLUORESCENT LOADS
- RELAYS AND TRANSFORMERS
- RF TRANSMITTERS
- HID LOADS

MODEL	OUTPUT VA	INPUT VOLTS	ϕ	WEIGHT	100 PIECE QUANTITY PRICE
12-250	250	12 VDC	1	30 lbs.	$249.00
12-375	375	12 VDC	1	35 lbs.	280.00
24-500	500	24 VDC	1	38 lbs.	310.00
28-750	750	28 VDC	1	42 lbs.	335.00
48-1000	1000	48 VDC	1	52 lbs.	390.00
48-1250	1250	48 VDC	1	57 lbs.	450.00
56-1500	1500	56 VDC	1	60 lbs.	525.00
56-1800	1800	56 VDC	1	62 lbs.	795.00
48-2400	2.4 KVA	48 VDC	1	90 lbs.	1195.00
48-3000	3 KVA	48 VDC	1	135 lbs.	1250.00
56-4500	4.5 KVA	56 VDC	1	185 lbs.	1640.00
56-5000	5 KVA	56 VDC	1	190 lbs.	1995.00
56-6000	6 KVA	56 VDC	1	225 lbs.	2100.00
54-7500	7.5 KVA	56 VDC	1	260 lbs.	2800.00
60-10,000	10 KVA	120 VDC	1	325 lbs.	3900.00

Note: *All of the above units are single phase, three phase units are available by synchronizing three of the above models. Total output power of a three phase unit will become 3 times the above single phase output ratings. Example: 3 each of 48-1000 (1000 VA) units produces 3000 VA when connected in three phase, 50 cycle outputs available on special request. Units available with AC inputs for frequency changer or UPS applications. See catalog page xx for UPS data.

Input and output terminations are terminal blocks.

Units are designed for cabinet mounting in power equipment terminated on aluminum buss bars.

Units are designed for cabinet mounting in power equipment.

All units are available on special request for 19″ rack mounting.

All units available on special request with special D.C. input voltage and/or A.C. output voltage requirements.

These units are presently being used for driving computer electronics, blower motors, incandescent lamps, fluorescent lamps, HID lamps, relays, rectifier loads, RF transmitter loads, etc.

Loads such as heavy air conditioners or refrigeration must be ordered on special request.

Units available with A.C. input for frequency changer or UPS applications.

ELECTRICAL SPECIFICATIONS

INPUT BATTERY VOLTAGE RANGE: ±15%

OUTPUT VOLTAGE: 1ϕ 120/240/277
3ϕ 120/208

VOLTAGE REGULATION: ±6%

FREQUENCY STABILITY: ±1%

OUTPUT WAVE FORM: Sine Wave

PROTECTIVE CIRCUITS: Overload and Short Circuit

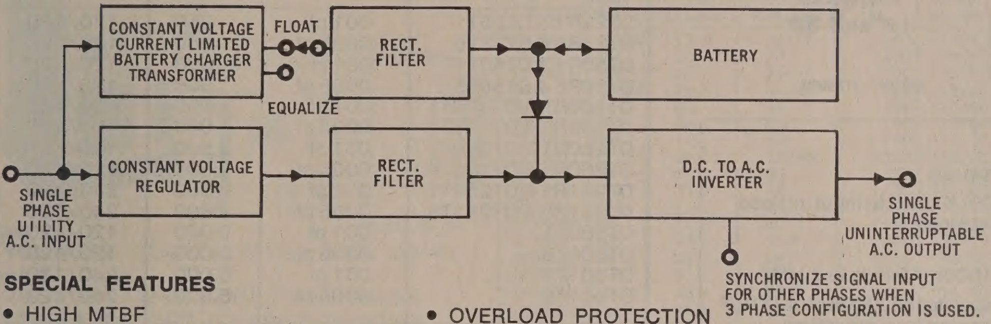
PEAK OUTPUT CURRENT: 2 Times Full Load Max.

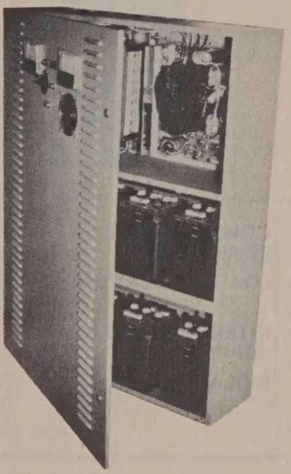
AMBIENT TEMPERATURE OPERATING RANGE: 0 to 60°C
NON-OPERATING: −55 to +85°C

DEPT. EM, 124 WEST MAIN STREET HIGH BRIDGE, NEW JERSEY 08829, (201) 735-8000

UNINTERRUPTIBLE POWER SYSTEMS

250 VA TO 30 KVA


CONSTANT VOLTAGE CURRENT LIMITED BATTERY CHARGER TRANSFORMER
FLOAT
EQUALIZE
RECT. FILTER
BATTERY
CONSTANT VOLTAGE REGULATOR
RECT. FILTER
D.C. TO A.C. INVERTER
SINGLE PHASE UTILITY A.C. INPUT
SINGLE PHASE UNINTERRUPTABLE A.C. OUTPUT
SYNCHRONIZE SIGNAL INPUT FOR OTHER PHASES WHEN 3 PHASE CONFIGURATION IS USED.



SPECIAL FEATURES

- HIGH MTBF
- 60 - 70% EFFICIENCY
- NEW PATENTED SIMPLIFIED DESIGN
- NO FEED BACK LOOPS
- OVERLOAD PROTECTION
- LOW COST
- SELF CLEARING POWER COMPONENTS

MODEL NUMBER	MAXIMUM RATED OUTPUT V.A. SINGLE PHASE	MAXIMUM RATED OUTPUT CURRENT @ 120 VAC	RUNNING TIME AT FULL LOAD	RUNNING TIME AT HALF LOAD	MINIMUM 60 Hz INPUT SERVICE	CABINET SIZE IN INCHES D W H	SHIPPING WEIGHT IN POUNDS LESS BATTERIES
UPS-24-500	500	4.2 A	2 HRS.	4 HRS.	120 V 10 A	11x35x32	160
UPS-24-750	750	6.3 A	1½ HRS.	3 HRS.	120 V 13 A	11x35x32	175
UPS-48-1000	1000	8.4 A	2 HRS.	4 HRS.	120 V 18 A	11x35x48	275
UPS-48-1500	1500	12.5 A	1½ HRS.	3 HRS.	220 V 13 A	11x35x48	300
UPS-48-3000	3000	25.0 A	1½ HRS.	3 HRS.	220 V 26 A	*18x32x68	650
UPS-48-4500	4500	37.0 A	1½ HRS.	3 HRS.	220 V 40 A	*18x32x68	800
UPS-60-10,000	10,000	84.0 A	1½ HRS.	3 HRS.	220 V 100 A	*18x32x68	1000

* Open battery racks are used on these models

Note: *All of the above units are single phase, three phase units are available by synchronizing three of the above models. Total output power of a three phase unit will become 3 times the above single phase output ratings. Example: 3 each of 48-1000 (1000 VA) units produces 3000 VA when connected in three phase, 50 cycle outputs available on special request. Units available with AC inputs for frequency changer or UPS applications. See catalog page xx for UPS data.

Input and output terminations are terminal blocks.

All units are available on special request for 19″ rack mounting.

All units available on special request with special D.C. input voltage and/or A.C. output voltage requirements.

These units are presently being used for driving computer electronics, blower motors, incandescent lamps, fluorescent lamps, HID lamps, relays, rectifier loads, RF transmitter loads, etc.

Loads such as heavy air conditioners or refrigeration must be ordered on special request.

GENERAL ELECTRICAL SPECIFICATIONS

All systems are mounted in a heavy metal grey cabinet and are designed for easy access to all equipment from the front. The inverter and charger section is located above and completely separated from the battery compartment. The battery section has a stepped arrangement for battery mounting which allows visual electrolyte level inspection of all cells. Batteries are shipped separately and are mounted into the cabinet upon installation.

OUTPUT VOLTAGE: 120 VAC, ±6%, sine wave.

The above voltage variations are for all cases of battery voltages and load changes from zero to 100%. Optional output voltages of 240 VAC, three wires or 277 VAC are available on all models. Other voltages available on request.

OUTPUT FREQUENCY: 60 Hz, ±1%.

OUTPUT EMERGENCY OVERLOAD CAPABILITY: 130% of volt ampere rating at 90% output voltage. (130% rating for 30 minutes.) 2 times full load current at short circuit.

SHORT CIRCUIT PROTECTION: Electronic short circuit and overload protection is supplied at no extra cost. This means there are no output fuses to blow. Upon removal of the overload or short circuit, the output voltage will come up immediately.

INTERRUPTION OF OUTPUT VOLTAGE DURING POWER LINE FAILURE OR POWER LINE RESTORATION: None.

FRONT PANEL CONTROLS & INDICATORS: A.C. output voltmeter - 2% • D.C. voltmeter - 2% • Hi-charge light • Incoming A.C. 'ON' light • Test switch • Frequency differential light.

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DELTEC
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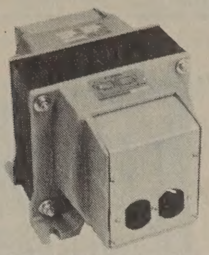
SUPER ISOLATION TRANSFORMERS 60Hz SINGLE PHASE MODELS

STOP LINE NOISE • ELIMINATE POWER AND SYSTEM GROUND LOOPS • REMOVE ELECTROMAGNETIC NOISE



250VA to 15KVA
RATINGS
1Ø and 3Ø

MODEL DT250R1

COMMON-MODE REJECTION:	>140 db
LOAD REGULATION:	±3%, Output to Input, no load to full load
INTERCOUPLING NOISE SUPPRESSION:	>150db, 10 KHz to 1 MHz
ISOLATION:	Capacitance, .0005 pf or .001 pf Resistance, greater than 10,000 Megohms

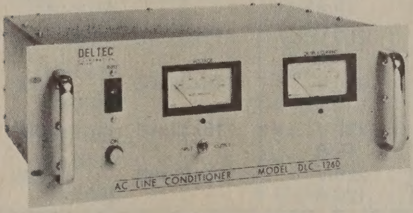
Model Number*	Interwinding Capacitance	Power (VA)	Input/Output
DT25R1 & DT25T1	.001 pf	250	120/120
DT25R5 & DT25T5	.0005 pf	250	120/120
DT50R1 & DT50T1	.001 pf	500	120/120
DT50R5 & DT50T5	.0005 pf	500	120/120
DT100R1 & DT100T1	.001 pf	1,000	120/120
DT100R5 & DT100T5	.0005 pf	1,000	120/120
DT250R1 & DT250T1	.001 pf	2,500	120/120
DT250R5 & DT250T5	.0005 pf	2,500	120/120
DT251R1 & DT251T1	.001 pf	2,500	240/120
DT251R5 & DT251T5	.0005 pf	2,500	240/120
DT500T1	.001 pf	5,000	120/120
DT500T5	.0005 pf	5,000	120/120
DT501T1	.001 pf	5,000	240/120
DT501T5	.0005 pf	5,000	240/120

*R Denotes Receptacle,
T Denotes Terminal on Input and Output

DELTEC
CORPORATION

ISOLATED AC LINE CONDITIONERS IVACON™ 1200VA TO 30KVA, 1Ø AND 3Ø

PURE SINE WAVE OUTPUT • HIGH EFFICIENCY • WIDE INPUT VOLTAGE RANGE • ELIMINATE COMMON-MODE NOISE & GROUND LOOPS, BROWNOUT PROBLEMS • OVERLOAD & SHORT-CIRCUIT PROTECTION



MODEL DLC 1260

AC Output **Regulation:** ±3% of Nominal Output **Isolation:** Input to Output Capacitance .005 pf	**Normal-Mode Noise Suppression:** >120 db, 1 KHz to 1 MHz **Harmonic Distortion:** <5%, 50% — 100% Load

Model Number	Input* Volts AC	Input* Freq. Hz	Output Volts AC	Output Power VA	Circuit Breaker	Meters	H	W	D
DLC 1260	90-125	58-62	115	1,200	Yes	Yes	7	17	14¼
DLC 1260A	90-125	58-62	115	1,200	No	No	7	17	14¼
DLC 1262	190-270	58-62	230	1,200	Yes	Yes	7	17	14¼
DLC 1262A	190-270	58-62	230	1,200	No	No	7	17	14¼
DLC 1860	90-125	58-62	115	1,800	Yes	Yes	10½	17	20
DLC 1860A	90-125	58-62	115	1,800	No	No	10½	17	20
DLC 1862	190-270	58-62	230	1,800	Yes	Yes	10½	17	20
DLC 1862A	190-270	58-62	230	1,800	No	No	10½	17	20
DLC 3060	90-125	58-62	115	3,000	Yes	Yes	14	17	20
DLC 3060A	90-125	58-62	115	3,000	No	No	14	17	20
DLC 3062	190-270	58-62	230	3,000	Yes	Yes	14	17	20
DLC 3062A	190-270	58-62	230	3,000	No	No	14	17	20
DLC 5060	90-125	58-62	115	5,000	Yes	Yes	14	17	20
DLC 5060A	90-125	58-62	115	5,000	No	No	14	17	20
DLC 5062	190-270	58-62	230	5,000	Yes	Yes	14	17	20
DLC 5062A	190-270	58-62	230	5,000	No	No	14	17	20

*Regulation available to 70 VAC input at 80% load factor.

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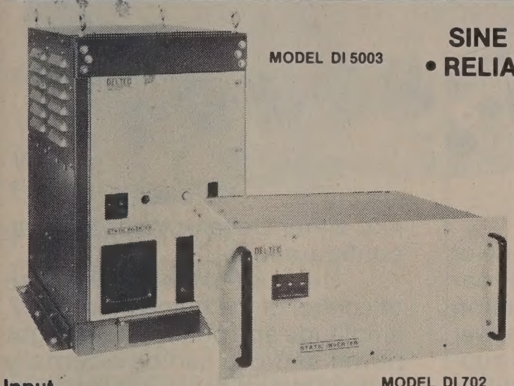
DC TO AC INVERTERS 30VA TO 37.5KVA SINGLE AND THREE PHASE


MODEL DI 5003

MODEL DI 702

SINE WAVE OUTPUT • AC MOTOR START CAPABILITY • RELIABLE ¼-START SYSTEM • OVERLOAD AND SHORT CIRCUIT PROTECTION

Model #	Input VDC	Input Current No Load	Input Current Full Load	Power VA	Output VAC/Hz	Front Panel H x W	Case* H x W x D
DI 301	12/24	12/6	34/17	300	115/60	5.25 x 19	4.75 x 16.7 x 13.5
DI 302	48	3.5	10	300	115/60	5.25 x 19	4.75 x 16.7 x 13.5
DI 303	125	1.3	3.9	300	115/60	5.25 x 19	4.75 x 16.7 x 13.5
DI 701	12/24	22/11	84/42	700	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 702	48	6.3	21	700	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 703	125	2.4	8.0	700	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 704	250	1.2	4.0	700	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 1201	12/24	24/12	132/66	1,200	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 1202	48	6	33	1,200	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 1203	125	3.5	13	1,200	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 1204	250	1.8	6.5	1,200	115/60	8.75 x 19	8.25 x 16.7 x 18
DI 1802	48	12.5	50	1,800	116/60	14 x 19	13.5 x 16.7 x 20
DI 1803	125	4.8	19.2	1,800	115/60	14 x 19	13.5 x 16.7 x 20
DI 3002	48	21	84	3,000	115/60	—	30 x 17 x 21
DI 3003	125	8	32	3,000	115/60	—	30 x 17 x 21
DI 5003	125	13.8	53.5	5,000	115/60	—	30 x 17 x 21
DI 10003	125	26.6	107	10,000	115/60	—	53 x 45 x 32

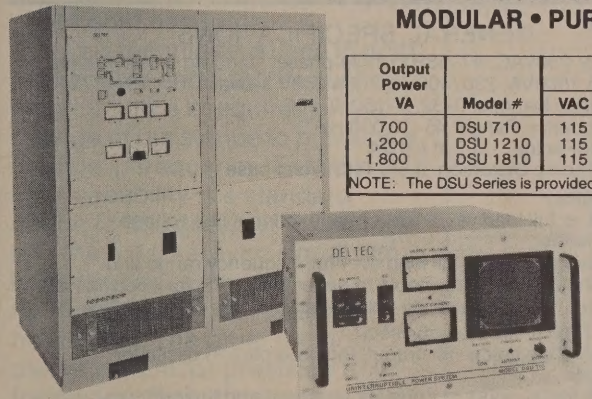
*W — Case width only, screw heads protrude .17 inches each side
D — Case depth only, connectors protrude .5 inches on units through DI 1803
Connections on DI 3002 through DI 10003 are inside the case

Input
VOLTAGES: 12/24 VDC, 48 VDC, 125 VDC, 250 VDC
Output
VOLTAGE: 115 VAC ±2 VAC (230 VAC available)
REGULATION: ±3% of nominal for line and load changes
HARMONIC DISTORTION: <5% near full load, nominal output

DELTEC
CORPORATION

UNINTERRUPTIBLE POWER SYSTEMS FROM 700VA TO 37.5KVA SINGLE & THREE PHASE

• ON-LINE SYSTEMS (NO-BREAK POWER) • REDUNDANT SYSTEMS AVAILABLE • OVERLOAD/SHORT-CIRCUIT PROTECTION • ALL SOLID STATE - MODULAR • PURE SINE WAVE OUTPUT • HIGH EFFICIENCY


MODEL 5656A

MODEL DSU 710

Output Power VA	Model #	Input VAC	Input Phase	Input Hz	Output VAC	Output Phase	Output Hz	Battery	Backup Time	H x W x D
700	DSU 710	115	1	47-63	115	1	60	Internal	5-60 minutes	10½ x 17 x 20
1,200	DSU 1210	115	1	47-63	115	1	60	Internal	15-40 minutes	15¾ x 17 x 20
1,800	DSU 1810	115	1	47-63	115	1	60	Internal	10-30 minutes	24½ x 17 x 20

NOTE: The DSU Series is provided with sealed internal batteries.

Output Power VA	Input Model #	Input Phase	Input Hz	Output Phase	Output Hz	Battery (External)	H x W x D
2,000	5244	1	47-63	1	60	48 VDC	61 x 24 x 32
	5245	1	47-63	1	60	125 VDC	
3,000	5246	1	47-63	1	60	48 VDC	61 x 24 x 32
	5247	1	47-63	1	60	125 VDC	
5,000	5248	1	47-63	1	60	125 VDC	61 x 24 x 32
	5249	3	47-63	1	60	125 VDC	
7,500	5250	3	47-63	1	60	125 VDC	61 x 29 x 32
10,000	5254	3	47-63	1	60	125 VDC	61 x 46 x 32
15,000	5255	3	47-63	1	60	125 VDC	61 x 53 x 32
*20,000	5256	3	47-63	1	60	125 VDC	61 x 68 x 68
*25,000	5257	3	47-63	1	60	125 VDC	61 x 68 x 32
*30,000	5258	3	47-63	1	60	125 VDC	61 x 68 x 32
6,000	5262	3	47-63	3	60	125 VDC	61 x 46 x 32
9,000	5263	3	47-63	3	60	125 VDC	61 x 46 x 32
15,000	5264	3	47-63	3	60	125 VDC	61 x 68 x 32
*22,500	5265	3	47-63	3	60	125 VDC	61 x 125 x 32
*30,000	5266	3	47-63	3	60	125 VDC	61 x 125 x 32
37,500	5267	3	47-63	3	60	125 VDC	61 x 125 x 32

NOTE: 1) Battery chargers for external battery systems are sized for reservoir up to 1 hour backup time, others available on request. Backup time to be specified by customer.
2) Single phase input/output voltages available—115 to 440 VAC (customer specified).
3) Three phase input/output voltages available—208 to 480 VAC (customer specified).

STANDARD OPTIONS—Sensors, Alarms, Controls • Static Reverse Transfer Switch (4 ms) • Frequency Synchronization and Phase Lock

"DSU" Systems are low- to medium-power-systems, rack-mountable, and self-contained for simplicity of installation. Built-in gelled-electrolyte batteries provide reliable, maintenance-free power. The systems are complete with circuit breakers, rectifier/battery-charger, inverter, batteries, meters, sensors, alarms and control circuitry.

"5000" Series Models are capable of providing long-term battery power for standard loads. The basic system consists of: circuit breakers, rectifier/battery-charger, inverter and standard sensing and control circuitry. Modular design permits building the system to customer requirements.

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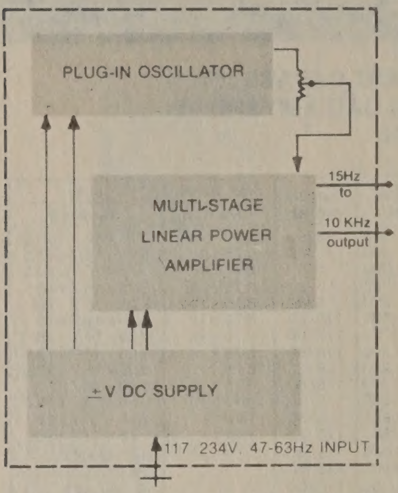
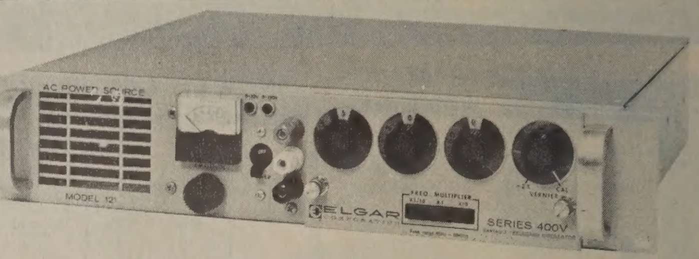
AC POWER SOURCES





Elgar has long been the industry leader in producing solid-state Frequency Converters (AC Power Sources) for a variety of applications. These include laboratories, receiving inspection, production testing, computer-controlled automatic test systems, and facilities which require variable voltage, fixed or variable frequencies independent of power line and load variations.

Think of an Elgar AC power source as a high-power linear amplifier driven by a precision oscillator. Actually, the basic power amplifier consists of a ± DC supply and a multi-state amplifier with a multiple-tap power output transformer. Output frequency is established by a plug-in oscillator.

Although frequently classed as instruments, Elgar power sources are actually power systems. They can deliver a variety of voltages and frequencies at the output, and the phase angles of the oscillators can be controlled, enabling the user to interconnect the output of two or more power sources into 2-phase and either Delta or Wye, 3-phase configurations.

Because of the relative ease of control of the output frequency, amplitude and phase angle, Elgar power sources can be externally programmed by a computer or other digital commands via an Elgar Decoder Programmer Oscillator. This enables avionics and other system designers to automatically "exercise" their end products under simulated power conditions.

Since the many possible output variations are achieved either by a plug-in device or by external interconnection, Elgar power sources can serve many needs without fear of obsolescence.

STANDARD MODELS

SINGLE PHASE		TWO PHASE		THREE PHASE			
MODEL	RATING VA	MODEL	RATING VA	MODEL	RATING VA	MODEL	RATING VA
121	120	240-2	240	153A	150	1500-3	1500
251	250	500-2	500	240-3D	240	1753A	1750
351	350	700-2	700	360-3	360	2000-3D	2000
501A	500	1000-2	1000	503	500	2250-3	2250
751A	750	1500-2	1500	500-3D	500	3000-3	3000
1001A	1000	2000-2	2000	750-3	750	3500-3D	3500
1751	1750	3500-2	3500	1000-3D	1000	5250-3	5250
2000-1	2000			1000-3Y	1000	10500-3	10500
3500-1	3500			1050-3	1050		

Note: D is an open delta configuration.

GENERAL SPECIFICATIONS

Input: 115 or 230VAC, 47–63Hz single-phase, standard for all models through 1500VA, 230/400V or 120/208V 3-phase for 1751, 1753A.

Output Voltage Ranges: 0–32, 0–130, 0–260

Output Frequency Range: 45–10,000 Hz

Load Power Factor: ±0.7 at full VA

Output Harmonic Distortion: 0.6% THD worst case

Line Regulation:
±0.25% at full load vs. ±10% change of input line voltage.

Load Regulation:
±1% from no load to full load over full frequency range and ±10% input range. Adjustable to better than 0.1% for specific load conditions. Fixed frequency systems always less than ±0.25%.

Response Time: Less than 50 μsec.

Noise Level: 70db below full output. Includes plug-in oscillator.

Gain Stability:
±0.25% for 24 hours at constant line, load and temperature.

Temperature Range:
Operating, -20° to +50°C; Storage, -40° to +80°C.

STANDARD AMPLIFIER MAIN FRAME DATA

MODEL	OUTPUT POWER VA	Height Inches	Width Inches	Depth Inches	Weight Inches
121	120	3.5	19	15	45
251	250	5.25	19	16	70
351	350	5.25	19	16	94
501A	500	7	19	17	100
751A	750	7	19	19	115
1001A	1000	12.25	19	19	210
1751	1750	14	19	19	230
153A	150	5.25	19	16	70
503A	500	7	19	19	105
1753A	1750	14	19	19	230

NEW "C" SERIES MODELS

Elgar's new "C" series provides lighter weight, reduced size and higher efficiency than the standard line. While available only with a single range output (0-125V) due to the transformerless approach employed, an optional auto-transformer is available to provide 26V or 230V output ranges.

MODEL	OUTPUT POWER VA	Height Inches	Width Inches	Depth Inches	Weight Lbs
251C	250	5.25	19	16	34
501C	500	5.25	19	16	46
1001C	1000	8.75	19	20	76
1503C	1500	8.75	19	20	100

ELGAR CORPORATION®

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OSCILLATORS

ELGAR
FREQ. MULTIPLIER
OSCILLATOR
MODEL 403-V
VERNIER

Variable Frequency Oscillator

FREQUENCY GENERATION TECHNIQUES

The output frequency of the power source is determined by the plug-in oscillator which develops the low distortion sine wave to the power amplifier. A variety of interchangeable versions are available, including 45Hz to 10KHz, narrow range variable or fixed frequencies with accuracies to 0.0001%.

Depending on the accuracy of frequency control desired, either of two methods of frequency generation is utilized. One method employs a modified phase shift oscillator.

This technique is used in both the variable and fixed frequency plug-ins since it requires only a change of resistance to produce a change in frequency. External sync capability is a standard option to this group of oscillators and the external sync signal can be sine or square wave, fundamental or odd order harmonics. The other method uses a crystal for precision fixed frequency. By utilizing these two methods of frequency generation, Elgar offers over 50 standard plug-in oscillators and programmable oscillators as well.

PLUG-IN OSCILLATOR MODULES AVAILABLE FOR USE WITH ALL ELGAR AC POWER SOURCES

VARIABLE FREQUENCY

Type	Model	Frequency Range (Hz)	Phase	Calibration Accuracy	Phase Angle	Frequency Temp. Coeff.
Decade Dial	401-V	45-10000	1	±1%	----	±0.02%/°C
	402-V	45-10000	2	"	90±1°	"
	403-V	45-10000	3	"	120±1°	"
Continuous Dial	431-V	300-500	1	±0.25%	----	±0.02%/°C
	432-V	300-500	2	"	90±1°	"
	433-V	300-500	3	"	120±1°	"
	461-V	45-70	1	"	----	"
	462-V	45-70	2	"	90±1°	"
	463-V	45-70	3	"	120±1°	"
	4641-V	45-70 & 350-450	1	"	----	"
	4642-V	45-70 & 350-450	2	"	90±1°	"
	4643-V	45-70 & 350-450	3	"	120±1°	"
FIXED FREQUENCY						
R-C Phase Shift	451-.1	50	1	±0.1%	----	±0.015%/°C
	452-.1	50	2	"	90±1°	"
	453-.1	50	3	"	120±1°	"
	461-.1	60	1	"	----	"
	462-.1	60	2	"	90±1°	"
	463-.1	60	3	"	120±1°	"
	441-.1	400	1	"	----	"
	442-.1	400	2	"	90±1°	"
	443-.1	400	3	"	120±1°	"
Crystal Control	461-.01	60	1	±0.01%	----	±0.0002%/°C
	462-.01	60	2	"	90±1°	"
	463-.01	60	3	"	120±1°	"
	441-.01	400	1	"	----	"
	442-.01	400	2	"	90±1°	"
	443-.01	400	3	"	120±1°	"
	461-.0001	60	1	±0.0001%	----	±0.00005%/°C
	463-.0001	60	3	"	120±1°	"
	441-.0001	400	1	"	----	"
	443-.0001	400	3	"	120±1°	"
Crystal Control with Amplitude Servo Control	461-.01SS	60	1	±0.01%	----	±0.0002%/°C
	463-.01SS	60	3	"	120±0.01°	"
	441-.01SS	400	1	"	----	"
	443-.01SS	400	3	"	120±0.01°	"

These oscillators provide 0.01% line and 0.01% load regulation and 0.01° phase angle regulation around the power amplifier(s) at the point(s) of sense. They also provide 0.1% amplitude and 0.1° phase angle stability for 1000 hours at constant line, load and temperature. Normally for fixed voltage applications. Please specify voltage. Amplitude temperature coeff. 0.005%/°C.

PROGRAMMABLE OSCILLATORS

Digital Decoder Programmers (DDP's) which provide the interface between a computer and any Elgar AC Power Source System are available to enable programming of every function controllable in an AC Source including frequency, voltage amplitude, and phase angle in multi-phase systems. Special purpose programmable oscillators such as Elgar's TG-704 are also available to simulate transients and line distortion as well.

Available with BCD inputs or per the IEEE standard interface bus. Elgar's DDP's enable the use of Elgar AC Power Sources with the most advanced Automatic Test equipment.

ELGAR
DECODER PROGRAMMER

Digital Decoder Programmer

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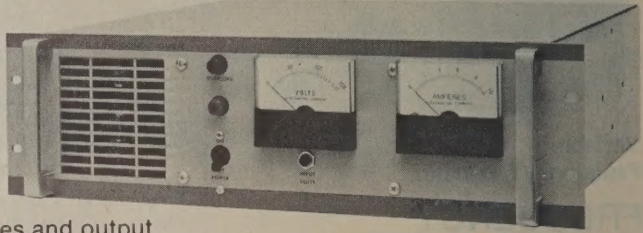
AC LINE CONDITIONERS AND HIGH ISOLATION TRANSFORMERS



Elgar AC Line Conditioners provide precise, clean AC power to critical loads by eliminating high-speed AC line and load transients and distortion as well as providing precise regulation. These versatile instruments have response times 5,000 times faster than the fastest conventional AC line regulators and line isolation of 70 to 100 db, far superior to mere isolation transformers. All Elgar AC line conditioners are designed for continuous operation and are contained in rack-mount enclosures. Front panel controls include meters to monitor input and output voltages and output load current, an overload indicator and an input circuit breaker.

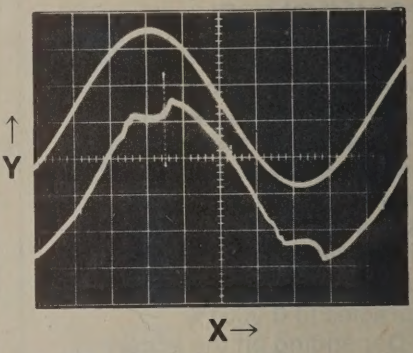
Users of voltage-sensitive equipment need isolation from high-speed AC line transients. These transients can cause erratic operation, component failures, and a reduction in equipment life. In sensitive instrumentation and data processing equipment, high-speed line transients often are the cause of erroneous information.

Elgar AC Line Conditioners are the best, most reliable solution to these problems.

GENERAL SPECIFICATIONS

INPUT/OUTPUT ISOLATION: 100 db (60 Hz)
OUTPUT DISTORTION: 0.2% max for up to 10% input harmonic distortion*
LINE REGULATION: ±0.025% for ±10% input AC line variation
LOAD REGULATION: ±0.025% for no load/full change full current into unity to zero lagging or leading load**
REDUCES 500V 10μ SEC TRANSIENTS BY 1000:1
SUPPLIES PEAK CURRENTS 3.5 TIMES RMS RATING
TEMPERATURE COEFFICIENT: 0.005% per °C
PEAK AMPLITUDE STABILITY: ±0.01% (cycle to cycle)
AMPLITUDE DRIFT: ±0.05% 24 hrs constant line, load and temperature
IMPULSE SETTLING TIME: less than 20 μsec
AMBIENT TEMPERATURE: 0–55°C
OVERLOAD INDICATION: Front panel lamp lights when rated output current is exceeded
OVERLOAD PROTECTION: Continuous overload actuates front panel circuit breaker
METERING: Reads: input voltage, output voltage, & output current
COOLING: Forced Air

*400 Hz models 0.5% max. **400 Hz models ±0.1%



Y=75 volts/cm
X=2 millisec/cm

The lower trace shows a very distorted input AC line waveform with a 75 volt peak spike riding on it. The upper trace shows the output of the Elgar AC Line Conditioner which is perfectly clean and shows no trace of the AC input anomalies.

STANDARD MODELS

	OUTPUT				INPUT
	POWER, VA		Voltage	FREQ	Voltage
MODEL	Cont.	Peak	VRMS	HZ	Range[2]
6006B	1000	5000	115	57–63	95–135
6106B	870	4300	100[1]	57–63	80–120
6226B	1000	5000	220	57–63	180–260
6426B	1000	5000	240	57–63	200–280
6005B	1000	5000	115	47–53	95–135
6105B	870	4300	100[1]	47–53	80–120
6225B	1000	5000	220	47–53	180–260
6245B	1000	5000	240	47–53	200–280
6004B	1000	5000	115	380–420	95–135
3006B	3000	15000	115	57–63	95–135[3]
3106B	2600	13000	100[1]	57–63	80–120[4]
3226B	3000	15000	220	57–63	180–260
3246B	3000	15000	240	57–63	200–280
3006B	3000	15000	115	57–63	95–135[3]
3106B	2600	13000	100[1]	57–63	80–120[4]
3226B	3000	15000	220	57–63	180–260
3246B	3000	15000	240	57–63	200–280
3004B	3000	15000	115	380–420	95–135
5005B	5000	25000	115	47–53	95–135[3]
5105B	4350	21500	100[1]	47–53	80–120[4]
5225B	5000	25000	220	47–53	180–260
5245B	5000	25000	240	47–53	200–280
5006B	5000	25000	115	57–63	95–135[3]
5106B	4350	21500	100[1]	57–63	80–120[4]
5226B	5000	25000	220	57–63	180–260
5246B	5000	25000	240	57–63	200–280

HIGH ISOLATION TRANSFORMERS

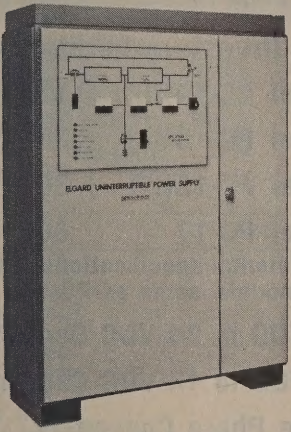
Elgar's new HIT series of extremely High Isolation Transformers are now available in standard ratings from 1KVA to 20KVA single phase, 3KVA to 60KVA three phase with effective coupling capacitance values of .001pF or .0005pF. All models are designed for 50 or 60Hz operation and are connectable for 120 or 240VAC use, to 480VAC on the larger models.

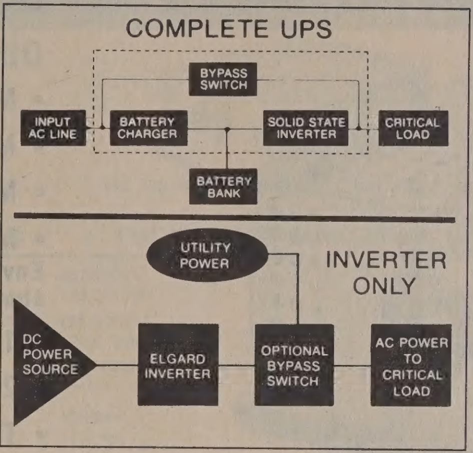
PHYSICAL DATA

MODEL	SIZE-INCHES			WEIGHT
	Height	Width	Depth	Pounds
SERIES 6000B	5.25	19.0	16.0	65
SERIES 3000B	12.25	19.0	20.0	175
SERIES 5000B	24.50	19.0	20.2	375

ELGAR CORPORATION®
8225 MERCURY COURT
SAN DIEGO, CALIFORNIA 92111
(714) 565-1155 TWX: 910-335-1246

UPS/INVERTERS





ELGARD UPS, all solid-state Uninterruptible Power Systems, combine a battery charger, battery bank, solid-state inverter and bypass switch to provide clean, continuous power to critical loads. The battery charger converts AC line power to DC. Normally, this DC power simultaneously float-charges the battery bank and powers the inverter. Upon loss of input AC, the inverter continues to furnish the critical load with uninterruptible AC power by drawing its energy from the battery bank. Since the battery bank is always connected to the inverter as well as to the battery charger, there is no switchover time. AC output frequency from the Uninterruptible Power Source is phase-locked to the input AC under normal conditions. When there is no input AC, the output frequency is automatically determined by the stable internal oscillator.

In the unlikely event of a component failure within the Uninterruptible Power Source, the bypass switch will be activated and the critical load will automatically transfer to the input AC line. The standard switch is an electromechanical contactor which performs the reverse transfer with a 50- to 150-millisecond interruption. An optional solid-state bypass switch (SBS) that can make the transfer with no interruption in power to the load is available for all UPS and Inverter models.

ELGARD INVERTERS are designed to accept DC input power (derived from a nominally 125 or 130VDC rectifier system or from a battery bank with a final discharge voltage of 105VDC) and convert it to tightly regulated, single-phase AC power.

ELGARD UPS are designed for a useful life of 15 to 20 years. Mathematical analysis and operating history indicate the anticipated mean-time between failures (MTBF) will be about 20,000 hours, depending upon the model and features selected. With appropriate interface of the bypass switch (electromechanical or static) with the load, so that bypass action does not cause a transient greater than the load can tolerate, an MTBF in excess of 100,000 hours for the output load bus can be demonstrated.

GENERAL SPECIFICATIONS

Input and Output Voltages:
  0.5 to 2.5KVA: 115VAC std., 230V, 100V and 200V available.
  5KVA and above, single-phase: 230VAC std., 115V available
  Three-phase models: 120/208, 380, 480 available
Voltage Regulation: ±1%
Instantaneous Transient (50% load change):
  Single phase models: ±15%
  Three phase models: ±10%
Frequency: 60Hz Std., 50Hz available
Frequency Stability: ±0.25%
Continuous Power: Rated KVA at 0.8 to 1.0 P.F.
Load Power Factor: 0.7 lag to unity
Harmonic Distortion: 5% THD maximum

Overload Rating:
  0.5 to 2.5KVA:
    110% for 15 minutes
    150% for 5 seconds
    200% for 5 cycles
  5KVA and above:
    125% for 20 minutes
    150% for 10 seconds
    200% for 10 cycles
Inverter Efficiency at Full Load:
  0.5 to 2.5KVA: 75% minimum
  5KVA to 15KVA: 80% minimum
  20KVA and above: 85% minimum

STANDARD INSTRUMENTS:
  DC Voltmeter, AC Voltmeter,
  Output AC Ammeter—5KVA & above
STANDARD INDICATORS:
  Input Power On
  Low DC
  Bypass Switch Position
  Fuse(s) Open—5KVA & above
  Battery Operation
  Overheat—5KVA & above
  Overload
CONSTRUCTION:
  In accordance with applicable NEMA standards and the National Electric Code (NEC).
ENVIRONMENT:
  Operating Temperature: 0 to 40°C
  Humidity: to 95%

STANDARD MODELS

SINGLE-PHASE UPS

MODEL	RATING VA	SIZE-INCHES H x W x D	WEIGHT-POUNDS
UPS-501-1*	500	7x19x19	132
UPS-102-1*	1000	12.25x19x19	244
UPS-172-1	1750	12.25x19x19	220
UPS-252-1	2500	14x19x19	260
UPS-502-1	5000	60.5x43x17.5	1200
UPS-103-1	10000	72.5x54x19	2000
UPS-203-1	20000	80x60x24	2800

THREE-PHASE UPS

MODEL	RATING VA	SIZE-INCHES H x W x D	WEIGHT-POUNDS
UPS-502-3	5000	60.5x43x17.5	1400
UPS-103-3	10000	72.5x54x19	2200
UPS-153-3	15000	76.5x54x19	2500
UPS-253-3	25000	80x102**x26	3200
UPS-373-3	37500	80x102**x26	4700

125VDC INPUT INVERTERS

MODEL	RATING VA	SIZE-INCHES H x W x D	WEIGHT-POUNDS
INV-102	1000	12.25x19x19	190
INV-252	2500	14x19x19	230
INV-502	5000	72x37x19	900
INV-103	10000	78x44x19	1400
INV-203	20000	80x54x24	2000

Includes 10-Minute Internal Battery Bank. Separate external batteries must be purchased with other models or for long-term operation of the UPS 501-1 & 102-1.

**Shipped in 2 sections

Note: Elgar has a complete line of 50Hz UPS Models. Consult your representative.

ELGAR CORPORATION®

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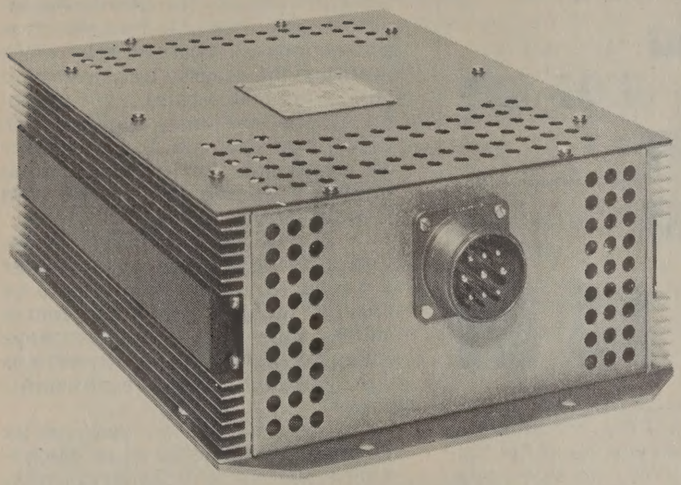
FLITE-TRONICS 60 Hz & 400 Hz STATIC INVERTERS



Other Inverters Available:

- Model PC-14B(A) 125 VA
- Model PC-15BC( ) 250 VA
- Model PC-15H ( ) 300 VA
- Model PC-17 600 VA

Environmental specifications of the above models, same as PC-17A

- 12 VDC to 24 VDC Converters
- 24 VDC to 12 VDC Converters
- Three Phase Converters Model PH-3ϕ-400

For applications requiring greater than 750 VA of continuous power, the Flite-Tronics' Model PC-17A Inverter can be paralleled as necessary to double, triple, or quadruple the output power of a single unit. This is simply done by phase locking the oscillator in the PC-17A. Malfunction of a single unit when connected in this manner will not damage the other units in parallel. Each unit has its own overload protection. Each device is capable of self-preservation.

SPECIFICATIONS MODEL PC-17A (750 VA) STATIC INVERTER

INPUT VOLTAGE:
28 VDC ±2.0 VDC

INPUT CURRENT:
39A — full load
1.5A — no load

OUTPUT VOLTAGES:
115 VAC +5% −7%
26 VAC +5% −7%

OUTPUT FREQUENCY:
400 Hz ±1%

OUTPUT POWER:
750 VA continuous for 115 VAC output
150 VA continuous for 26 VAC output

NOTE: Total continuous output power 750 VA.

OUTPUT WAVEFORM:
Sine Wave, Single Phase

HARMONIC DISTORTION:
7% maximum (Typically 3%)

POWER FACTOR:
.8 to −.95

ALTITUDE:
45,000 feet

EFFICIENCY:
70% typical

TEMPERATURE:
−65°F to 160°F

WEIGHT:
16.2 lbs.

SIZE:
Width 8½″
Length 12″
Height 4 1/16″

INPUT OVERVOLTAGE:
Withstands 130% overvoltage (37 VDC) for five minutes minimum while delivering full rated 750 VA output power. Output voltage under this condition 115 VAC +5% −7%.

EMISSION RFI:
Radiated & Conducted . . . 90KC to 1000MC.

Far below levels specified in Appendix A of RTCA Paper 120-61/DO-108 Category "A".

HUMIDITY:
Greater than 95% for ten days, temperature cycled between 75°F to 160°F.

VIBRATION:
Tested to withstand in three directions:

.08 DA	5-15 Hz
.036 DA	15-70 Hz
10 G's	70-500 Hz

SHOCK:
To withstand at least 10 G's for 11 milliseconds in three directions.

OVERLOAD CAPABILITY:
Deliver 150% of rated output current at rated output voltage for a duration of not less than 5 minutes (i.e., 900 volt amp load).

INPUT VOLTAGE PROTECTION:
Unit withstands transients of 88 volts lasting 1 millisecond on the 28.0 VDC input line.

EXCESSIVE OVERLOAD & OUTPUT SHORT CIRCUIT:
Withstands without damage or degradation loads exceeding 150% nominal to an output short circuit. Unit delivers rated output on removal of above condition.

SPECIFICATIONS MODEL PC-16 STATIC INVERTER

POWER OUTPUT:
250 VA Continuous
150% Overload 5 minutes
pf — .8 to 1.0

VOLTAGE INPUT:
1. 28 VDC ±2 Volts
2. Withstands 88 Volt Transient for 1 Millisecond

INPUT CURRENT:
14 Amp — full load
1 Amp — no load

FREQUENCY:
60 HZ ±1 Hz

VOLTAGE OUTPUT:
115 VAC RMS +5% −7%

AMPLITUDE DISTORTION:
Less than 7%

WAVE FORM:
Sine Wave

PHASE:
Single

SHORT CIRCUIT
Withstand for 1 minute or longer

TEMPERATURE:
−65°F to +160°F

ALTITUDE:
45,000 Ft.

WEIGHT:
16 lbs.

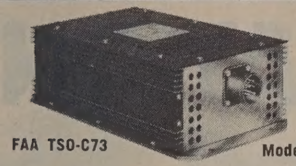
SIZE:
7½″ x 12″ x 4″ overall dimensions

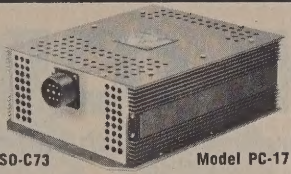
For application requiring greater than 250 VA of continuous power Model PC-16 can be paralleled to double or triple the output power of a single unit.

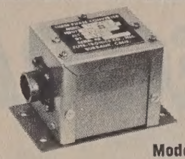
FLITE-TRONICS, CO., INC.

Attention: Marketing Dept. E-1
3314 Burton Avenue, Burbank, Calif. 91504 U.S.A.
Phone: (213) 849-1483 Telex: 69-1487

FLITE-TRONICS 400 Hz INVERTERS & 3-PHASE CONVERTER


FAA TSO-C73
Model PC-15BC ( )


FAA TSO-C73
Model PC-17


Model PH-3φ-400

PC-15BC ( ) TSO'D (250 VA) STATIC INVERTER

SPECIFICATIONS:

INPUT VOLTAGE:
28.0VDC ±2VDC, operates electrically down to 20VDC.

INPUT CURRENT:
13.2A Full Load
.75A No Load

OUTPUT VOLTAGE:
115VAC rms +5% −7%
26VAC +5% −7%

OUTPUT FREQUENCY:
400Hz ±1%

OUTPUT POWER:
250VA @ 115VAC and 75VA @ 26VAC. Total load not to exceed 250VA

OUTPUT CONFIGURATION:
1 Phase Sine Wave

HARMONIC DISTORTION:
Typically 3% (7% max)

POWER FACTOR:
.8 to 1.0

ALTITUDE:
45,000 feet

EFFICIENCY:
70% typical

TEMPERATURE:
−65°F. to 160°F.

WEIGHT:
7.5 lbs.

DIMENSIONS:
W6″ L10⅝″ H3 7/32″

INPUT OVERVOLTAGE:
Withstand 130% input overvoltage for 5 minutes while supplying full rated VA output power. Output voltage under this condition 115VAC +5% −7%.

OVERLOAD CAPACITY:
Capable of 150% output current overload for at least 5 minutes.

INPUT VOLTAGE PROTECTION:
Inverter withstands transients of 88 volts lasting 1 millisecond on the 28.0VDC input line.

EXCESSIVE OVERLOAD AND OUTPUT SHORT CIRCUITS
Withstand without damage or degradation loads exceeding 150% of rated output to an output short circuit. Inverter delivers rated output on removal of above condition.

HUMIDITY:
Tested to greater than 95% for ten days, temperature was cycled between 75°F. to 160°F.

VIBRATION:
Tested to withstand in three directions:

.08 DA	5-15 Hz
.036 DA	15-70 Hz
10 G's	70-500 Hz

SHOCK:
Tested to withstand at least 10 G's for 11 milliseconds in three directions.

EMISSION RFI:
Radiated and conducted . . .90 KC to 1000 MC, far below specification limits of RTCA Paper 120-61/DO-108, Appendix A.

PC-17 TSO'D (600 VA) STATIC INVERTER

SPECIFICATIONS:

INPUT VOLTAGE:
28.0VDC ±2VDC, operates electrically down to 20.0VDC.

INPUT CURRENT:
31 Amps full load
1¼A no load typical

OUTPUT VOLTAGE:
115VAC +5% −7%
26VAC +5% −7%

OUTPUT FREQUENCY:
400 Hz ±1%

OUTPUT POWER:
600VA @ 115VAC and 125VA @ 26VAC. Total load not to exceed 600VA.

OUTPUT CONFIGURATION:
Sine Wave, Single Phase

HARMONIC DISTORTION:
Typically 3% (7% max)

POWER FACTOR:
.8 to −.95

ALTITUDE:
45,000 feet

EFFICIENCY:
70% typical

TEMPERATURE:
−65°F. to 160°F.

WEIGHT:
14.6 lbs.

DIMENSIONS:
W8½″ L12″ H4 1/16″

INPUT OVERVOLTAGE:
Withstand 130% input overvoltage for 5 minutes while supplying full rated VA output power. Output voltage under this condition 115VAC +5% −7%.

OVERLOAD CAPACITY:
Capable of 150% output current overload for at least 5 minutes.

INPUT VOLTAGE PROTECTION:
Inverter withstands transients of 88 volts lasting 1 millisecond on the 28.0VDC input line.

EXCESSIVE OVERLOAD AND OUTPUT SHORT CIRCUITS:
Withstand without damage or degradation loads exceeding 150% of rated output to an output short circuit. Inverter delivers rated output on removal of overload condition.

HUMIDITY:
Tested to greater than 95% for ten days, temperature was cycled between 75°F. to 160°F.

VIBRATION:
Tested to withstand in three directions:

.08 DA	5-15 Hz
.036 DA	15-70 Hz
10 G's	70-500 Hz

SHOCK:
Tested to withstand at least 10 G's for 11 milliseconds in three directions.

EMISSION RFI:
Radiated and conducted . . . 90 KC to 1000MC, far below specification limits of RTCA Paper 120-61/DO-108, Appendix A.

PH-3φ-400 THREE PHASE CONVERTER

Flite-Tronics Co., Inc. introduces a **three phase converter** Model PH-3φ-400, for use with Flite-Tronics' 400 Hz static inverters.

The PH-3φ-400 is designed to convert two Flite-Tronics' inverters into a 115VAC, 400 Hz DELTA three phase power source with 60 degrees between phases. A transformer can be used to realize 120 degrees between phases. The PH-3φ-400 will also convert three inverters into a WYE 115/200VAC, 400 Hz three phase operation.

SPECIFICATIONS:

INPUT:
28VDC at .15 Amp. max.

FREQUENCY:
400 Hz

FUNCTION:

DELTA CONFIGURATION

2 Each Inverters	Output VAC	Phase Angle	Total Power
PC-15BC ( )	115	60°	500VA
PC-17	115	60°	1200VA
PC-17A	115	60°	1500VA

WYE CONFIGURATION

3 Each Inverters	Output VAC	Phase Angle	Total Power
PC-15BC ( )	115/200	120°	750VA
PC-17	115/200	120°	1800VA
PC-17A	115/200	120°	2250VA

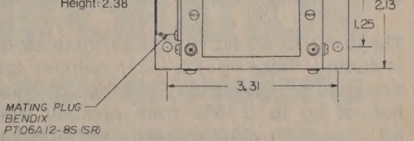
ENVIRONMENTAL:
Designed to meet RTCA paper DO-138 Category A

TEMPERATURE:
−55°C. to 71°C.

ALTITUDE:
50,000 feet

SIZE IN INCHES:
L3¾″ W2⅛″ H2⅜″

WEIGHT:
0.5 lbs.



FLITE-TRONICS, co., inc.

Attention: Marketing Dept. E-1
3314 Burton Avenue, Burbank, Calif. 91504 U.S.A.
Phone: (213) 849-1483 Telex: 69-1487

NOBRUSH® FREQUENCY GEORATOR CORPORATION

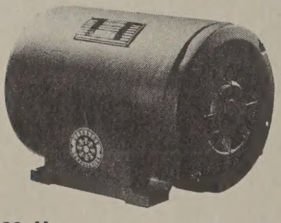
Celebrating our 25th anniversary

PERMANENT MAGNET GENERATOR DESIGN

"NoBrush" Motor Generators and Frequency Converters are efficient, compact, dependable, quiet running units for powering all types of electronic systems and electrical equipment. The heart of each "NoBrush" power system is a "NoBrush" permanent magnet generator which features a cast aluminum rotor designed to give superior voltage stability. • A typical "NoBrush" generator is mounted with a high quality induction or synduction motor within a single aluminum alloy shell. • Oversize pre-lubricated ball bearings sealed for life, coupled with the absence of brushes, commutators or slip rings, insure long-term maintenance-free operation. • Georator brushless permanent magnet generators are noted for their compact construction, ruggedness, ability to withstand short circuits, and excellent wave form. • All Georator power systems whether utilized for frequency conversion or basic power requirements, provide true "line isolation and stabilization" for protecting sensitive electronic systems from momentary power interruptions, switching transients, brown outs, or voltage spikes.

PERMANENT MAGNET FEATURES:

- ☐ *Line Isolation and Stabilization*
- ☐ *Stable Output Voltage*
- ☐ *High Overload Capacity*
- ☐ *Withstands Short Circuits*
- ☐ *Extremely Low R. F. Noise*
- ☐ *Minimum Maintenance*
- ☐ *Lightweight*
- ☐ *Low Audible Noise*
- ☐ *Cool Operation*
- ☐ *Operates in Adverse Environments*

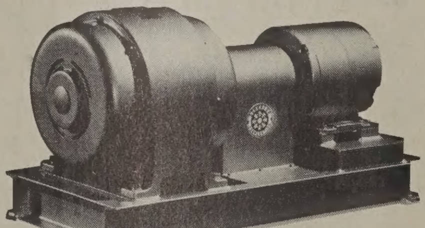


60 TO 60 Hz LINE ISOLATOR SERIES 30 UNIT SHELL

This small isolator stabilizer Motor-Generator offers full line isolation for small power requirements up to 1 KVA. Permanent magnet field generator coupled with the high inertia of the rotating system assures maximum electrical isolation between line and load. The rugged unit shell construction gives long, maintenance-free operation.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
35-118	0.35	1/1	115/230	115/230	14.5"/14.0"/110 lbs.
30-194	0.5	3/1	115/230	230/460	14.8"/16.1"/120 lbs.
30-198	0.5	1/1	115/230	115/230	14.8"/16.1"/120 lbs.
30-195	1.0	3/3	120/208	230/460	14.8"/16.1"/130 lbs.
30-199	1.0	1/3	120/208	115/230	14.8"/16.1"/130 lbs.

These 60 to 60 Hz brushless generators, including those in the next column are designed to accept long term input variation of up to ±15% from nominal with no change in output. Inertia stabilization allows these units to absorb input line transients of as much as 30% for as long as 500 milliseconds with less than 1% change in output.

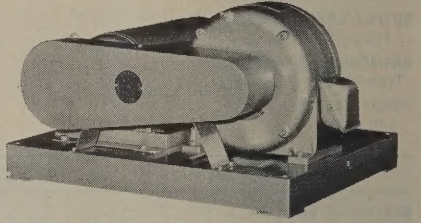


60 TO 60 Hz ISOLATOR STABILIZER SERIES 37 IN LINE

Larger Motor Generators in ratings up to 25 KVA are also available to provide full line isolation and distortion free power to protect electronic equipment from power line excursions and momentary power loss.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
37-015	1.5	3/1	115/230	220/440	18.3"/34"/300 lbs.
37-118	1.5	1/1	115/230	230	18.3"/34"/315 lbs.
37-130	2.5	3/3	120/208	220/440	18.3"/34"/215 lbs.
37-133	2.5	1/3	120/208	230	18.3"/34"/400 lbs.
37-070	2.5	3/1	115/230	220/440	18.3"/34"/335 lbs.
37-134	2.5	1/1	115/230	230	18.3"/34"/400 lbs.
37-123	5.0	3/3	120/208	220/440	18.3"/38"/410 lbs.
37-AAA	6.25	3/1	120/240	220/440	26.0"/48"/650 lbs.
37-129	12.5	3/1	120/240	230/460	29.0"/62"/910 lbs.
37-135	12.5	3/3	120/208	230/460	29.0"/62"/910 lbs.
37-136	18.75	3/3	120/240	230/460	37.5"/70"/1300 lbs.
37-137	18.75	3/1	120/208	230/460	29.0"/63"/1000 lbs.
37-138	25	3/3	120/240	230/460	37.5"/72"/1550 lbs.
37-139	25	3/1	120/208	230/460	29.0"/65"/1230 lbs.

Series 37 Data Sheets containing detailed specifications are available upon request.



50 TO 60 Hz and 60 TO 50 Hz FREQUENCY CONVERTERS

These ruggedly built, belt driven, motor-generator sets are mounted on a sturdy steel frame base. Units in the 0.5 to 5 KVA power range are designed around the highly efficient NoBrush Permanent Magnet Generator. Units in the 6.25 to 25 KVA power range have brushless rotating rectifier type generators with voltage regulators, to provide ±1% output voltage regulation. These motor-generators provide frequency conversion, basic power, and superior line isolation and stabilization for exported and imported electrical and electronic equipment.

50 to 60 Hz

Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-110	2.0	1/1	115/230	420
37-151	2.5	3/1	115/230	420
37-109	5.0	3/3	120/208	465
37-177	6.25	3/1	115/230	750
37-184	12.5	3/1	115-120/230-240	1,050
37-xxx	25.0	3/3	208-240/416-480	1,550

60 to 50 Hz

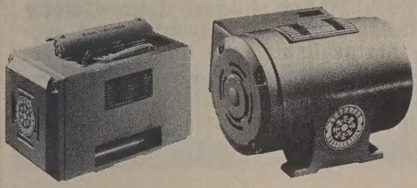
Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-105	0.5	1/1	115/230	230
37-102	1.5	1/1	115/220	400
37-111	1.5	3/1	115/230	400
37-095	2.5	3/1	115/230	440
37-197	6.25	3/1	115/230	750
37-180	12.5	3/3	220/440	1,000
37-170	12.5	3/1	115-120/230-240	1,100
37-192	25.0	3/1	208-240/230-240	1,580

Universal 50/60 to 60/50 Hz

Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-116	1.5	3/1	115/230	380
37-112	2.5/1.5	3/3-1	115/200 & 115	400

CONVERTERS & GENERATORS

The simplest, most rugged, most dependable power source.

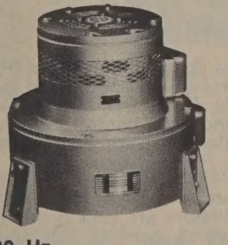


60 TO 400 Hz FREQUENCY CONVERTERS SERIES 30 UNIT SHELL

A highly compact, brushless, Motor Generator Set for conversion of 50 or 60 Hz power to 400 Hz or higher frequencies. Generator and Motor Rotors are pressed on a common shaft, with shielded ball bearing at ends of shaft, all contained within an aluminum alloy shell.

Model No.	KVA Rating	Phase In/Out	Output Voltages Full Load *	Input Voltage **	Dimensions H"/L"/Weight
30-021	0.15	1/1	115/200	115/230	8"/11"/40 lbs.
30-001	0.25	1/1	115	115/230	8"/11"/43 lbs.
30-004	0.25	1/3	115/200	115/230	8"/11"/43 lbs.
30-002	0.5	1/1	115	115/230	8"/11"/51 lbs.
30-005	0.5	1/3	115/200	115/230	8"/11"/51 lbs.
30-016	0.5	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-006	0.75	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-003	1.0	1/1	115	115/230	12¼"/15¼"/118 lbs.
30-025	1.0	1/3	115/200	115/230	12¼"/15¼"/107 lbs.
30-007	2.0	1/3	115/200	115/230	12¼"/15¼"/137 lbs.
30-020	2.0	3/3	115/200	208-220/440	12¼"/15¼"/121 lbs.
30-029	2.5	3/3	115/200	208-220/440	12¼"/15¼"/153 lbs.

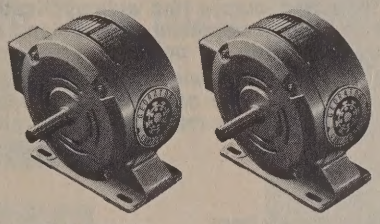
- ☐ Other Generator Outputs Available: 120, 180, 280, 360, and 840 Hz
- ☐ Other Standard and Non-Standard Voltages.
- ☐ Exact 400 Hz Output.
- ☐ DC Outputs at Low or High Voltage.



60 TO 400 Hz FREQUENCY CONVERTER SERIES 33 VERTICAL

High quality induction motor is close coupled to a famous "NoBrush" generator for a really outstanding unit. Very compact, with high power to weight and size ratio. Available variations include: 50 Hz Input; Standard and Non-Standard AC output voltages; DC outputs at low or high voltage; and other output frequencies.

Model No.	KVA Rating	Phase In/Out	Dimensions Diameter	Height	Weight
33-001	2.5	3/1	20.5"	18.3"	173 lbs.
33-002	3.5	3/1	20.5"	18.3"	178 lbs.
33-003	5.0	3/1	20.5"	18.3"	273 lbs.
33-004	5.0	3/3	20.5"	18.3"	250 lbs.
33-005	7.5	3/3	20.5"	19.5"	259 lbs.
33-006	10.0	3/3	20.5"	19.5"	340 lbs.
33-102	15.0	3/3	24.0"	24.2"	485 lbs.
30-120	25.0	3/3	23.0"	26.5"	1,213 lbs.



ALTERNATORS PERMANENT MAGNET

The original, revolutionary, "NoBrush" generator. Permanent magnets yield stability, reproducibility, ruggedness and virtually zero R.F. noise. Available in large variety of ratings, frequencies and voltages. Supplementary windings with rectifiers available for D.C. output.

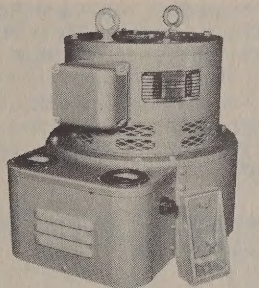
400 Hz ALTERNATORS

Model No.	KVA Rating	Phase Out	Speed RPM	Dimensions H"/L"/Weight
36-001	0.25	1	3428	8¼"/4 1/16"/17 lbs.
36-003	0.5	1	3428	8¼"/4 1/16"/22 lbs.
36-030	0.5	3	3428	8¼"/4 1/16"/21½ lbs.
36-006	1.0	1	1714	12 3/16"/4 9/16"/35½ lbs.
36-007	1.0	3	1714	13 3/16"/4 9/16"/35½ lbs.
36-008	2.0	3	1714	13 3/16"/4 9/16"/45 lbs.
36-009	2.5	1	1714	17¼"/6¾"/105 lbs.
36-010	5.0	1	1714	17¼"/6¾"/137 lbs.
36-011	5.0	3	1714	17¼"/6¾"/103½ lbs.
36-012	7.5	3	1714	17¼"/6¾"/120 lbs.
36-013	10.0	3	1714	17¼"/6¾"/135 lbs.
36-151	15.0	3	1714	25"/11.2"/310 lbs.
36-152	25.0	3	1714	25.3"/17"/730 lbs.

- ☐ Alternator Frequencies Available Include:
  50, 60, 120, 180, 240, 300, 360, 420, 840 Hz.
- ☐ All Units are Available with:
  - Standard and Non-Standard AC Voltages.
  - Multiple DC Outputs/Low Voltage taps.
  - Special Housings for Flange Mountings.
- ☐ Separate ROTORS and STATORS can be provided for OEM Applications.
- ☐ Permanent Magnet Alternators for: Pilot Excitors—Field Flashing—Tachometers—Control Applications—Aircraft.

LIGHTWEIGHT 400 Hz ENGINE-GENERATORS

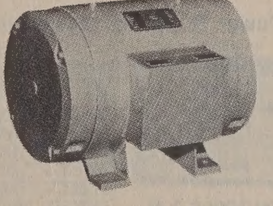
Lightweight portable 400 Hz permanent magnet engine generators are available with 1 ϕ or 3 ϕ outputs from 0.5 KVA to 2.0 KVA. Choice of outputs include 400 Hz, or combination of AC and DC output, or entire output rectified to single or dual DC output.



VOLTAGE REGULATED 60 TO 400 Hz FREQUENCY CONVERTERS

This new, Series 39, Regulated, Vertical Frequency Converter combines the "NoBrush" permanent magnet generator together with control windings and simplified sensing electronics, to provide both the traditional "Brushless" rugged design and a closely regulated 400 Hz power system. Voltage regulation is ± 1.5% no load to full load, 0.8 to 1.0 power factor, with a voltage adjustment feature of ± 5%.

Model No.	KVA Rating	Voltage Output	Voltage Regulation	Phase In/Out
39-001	5	120/208	± 1.5%	3/3
39-002	5	115/230	± 1.5%	3/1



60 TO 180 Hz, 360 Hz, 840 Hz FREQUENCY CONVERTERS FOR HIGH FREQUENCY TOOLS, MOTORS, AND LIGHTING

These frequency converters are available for powering high frequency metal-working tools, wood-working tools, motors, and lighting systems. The highly dependable, minimum maintenance, PERMANENT MAGNET BRUSHLESS DESIGNS are available in many ratings up to: 5 KVA for 180 Hz applications; 10 KVA for 360 Hz applications; and 30 KVA for 840 Hz applications.

GEORATOR CORPORATION

Makers of NOBRUSH® power systems

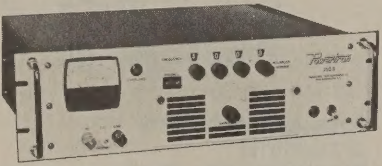
9016 PRINCE WILLIAM STREET MANASSAS, VIRGINIA 22110
TELEPHONE: (703) 368-2101

Celebrating our 25th anniversary

Powertron SOLID STATE AC POWER SUPPLIES

The Powertron AC Power Supplies provide stable, low distortion, AC power at frequencies within the audio frequency spectrum. These highly reliable and versatile power sources find wide application in calibration and test stations, motor drives, gyro wheel supplies, laboratory use, military component testing, and operating foreign equipment. These supplies may be used whenever it is necessary to provide AC power at a frequency not available from the power lines.

The various supplies feature all solid state construction, wide operating frequency range, low distortion, and a wide variety of output voltages and impedances. The units are designed to be used in modular form so that a single unit can provide single phase output, and two or three units may be used to provide two phase or three phase outputs respectively.



AMPLIFIER SPECIFICATIONS

(Series 250S, Illustrated)

Output Circuit:
Single phase, isolated (Ground terminal is provided for optional grounding of output.)

Output Power:
250 VA

Load Power Factor:
.7 Lead through .7 Lag for full power output. Useable to .2 at reduced power.

Output Voltage Range:
0-130 V RMS (An output connector provided at the rear of the unit may readily be reconnected to provide optimum power output at other voltages. Ranges available are 0-260 V, 0-190 V, 0-130 V, 0-90 V, 0-75 V, 0-67 V, 0-60 V, 0-38 V, 0-30 V, and 0-17 V.

Output Frequency Range:
45 Hz to 10,000 Hz for full power out. 20 Hz to 20,000 Hz at reduced power.

Output Distortion:
0.1% mid band

Load Regulation:
Factory set to ±0.5% mid band (A control is provided for zero regulation adjustment over most of frequency range.)

Line Regulation:
±0.1% for ±5% line change.

Transient Response:
50 Microseconds.

Hum Level:
80 db approx. below rated output voltage.

Thermal Overload Protection:
Output transistors protected by thermal cutout circuit.

Short Circuit Protection:
Output may be shorted indefinitely without damage to unit.

External Amplifier Input:
An input connector is provided at the rear of the unit when it is desired to drive the amplifier from an external source. Model XA-1 plug-in Module is required for this mode of operation.

External Sync. Input:
An input connector is provided at the rear when it is desired to synchronize the plug in oscillator with an external frequency source.

Convenience Outlets:
Two convenience outlets controlled by the power switch are provided at the rear of the unit. These permit single control operation of one or two additional amplifiers when 2ø or 3ø outputs are required. When not used for this purpose, the outlets may also be used to turn on auxiliary equipment which is mounted in the same test console.

Meter:
A voltmeter with range of 0-150 V RMS is provided to monitor the output voltage.

Input Power:
115 V or 230 V, 50-60 Hz (400 Hz input available).

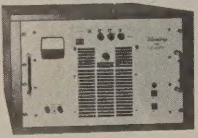
Ambient Temperature Range:
0° C to 55° C.

Dimensions:
5¼ x 19″ Rack Panel x 14″ Deep.

Weight:
75 Lbs. Approx.

The ordering designations listed below are for convenience of specifying the components required for various power supply configurations. To select an appropriate unit for your requirements first determine which category, 1-phase, 2-phase, or 3-phase, is most suitable to your intended load. Then use the ordering designation adjacent to the required output power within that category. For the complete ordering designation replace the asterisk with the ordering code letters of the plug-in-oscillator listed

1ø Power Supplies (For Use with Single Phase Loads)

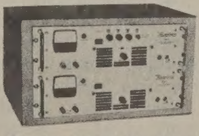


Model 1000S-1-N

Ordering Designation	Total Output Power	Output Voltage Range	Input
80S-1- *	80VA	17, 30, 38, 60, 67, 75, 90, **130**, 190, 260	1-Phase **115**, 230
250S-1- *	250VA		
500S-1- *	500VA	35, 60, 75, 120, **135**, 150, 180, 260, 380	
750S-1- *	750VA	50, 90, **115**, 180, 200, 225, 270, 390	
1000S-1- *	1KVA	65, 76, **130**, 140, 150, 260, 300	3-Phase, Line to Line 190, **208**, 225, 380, 450
1500S-1- *	1.5KVA		
2000S-1- *	2KVA	**130**, 150, 260, 280, 300	
3000S-1- *	3KVA		

2ø - 3ø (Open Delta) Power Supplies

(For use with 2ø loads and 3ø, 3 wire Delta loads.

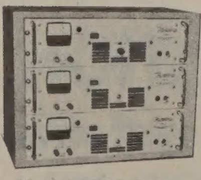


Model 500S-23-MM

Ordering Designation	Total Output Power	Output Voltage Range	Input
160S-23- *	160VA	17, 30, 38, 60, 67, 75, 90, **130**, 190, 260•	1-Phase **115**, 230
500S-23- *	500VA		
1000S-23- *	1KVA	35, 60, 75, 120, **135**, 150, 180, 260, 380	
2000S-23- *	2KVA	65, 76, **130**, 140, 150, 260, 300	3-Phase, Line to Line 190, **208**, 225, 240, 380, 450
3000S-23- *	3KVA		
4000S-23- *	4KVA	**130**, 150, 260, 280, 300	
6000S-23- *	6KVA		

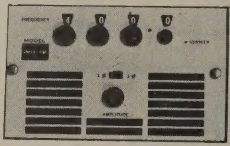
3ø Wye-Delta Power Supplies

(For use with 3ø, 4 wire wye loads or 3ø, 3 wire, Delta Loads.



Model 750S-3-AA

Ordering Designation	Total Output Power	Output Voltage Ranges (line to neutral)	Input
240S-3- *	240VA	17, 30, 38, 60, 67, 75, 90, **130**, 190, 260	1-Phase **115**, 230
750S-3- *	750VA		
1500S-3- *	1.5KVA	35, 60, 75, 120, **135**, 150, 180, 260, 380	
3000S-3- *	3KVA	65, 76, **130**, 140, 150, 260, 300	3-Phase, Line to Line 190, **208**, 225, 240, 380, 450
4500S-3- *	4.5KVA		
6000S-3- *	6KVA	**130**, 150, 260, 280, 300	
9000S-3- *	9KVA		



PLUG-IN OSCILLATORS

Single phase (1ø) and polyphase (Pø) oscillators are available for both fixed frequency and variable frequency output. A coarse and fine concentric control is included on each oscillator panel for precise amplitude adjustment. Polyphase oscillators include a switch on the front panel which provides either two-phase or three-phase output. All plug-in oscillators are provided with Sync. capability which permits locking-in their output frequency with an external source of the same nominal frequency.

CODE		FREQUENCY	ACCURACY
Single Phase	Poly Phase		
A	AA	400 Hz	0.1%
B	BB	60 Hz	0.1%
C	CC	Specify	0.1%
D	DD	Specify	0.01%
E	EE	Specify	0.001%
K	KK	10 Hz - 10 KHz	1.0%
L	LL	10 Hz - 100 Hz	1.0%
M	MM	100 Hz - 1 KHz	1.0%
N	NN	350 Hz - 450 Hz	0.25%
P	PP	300 Hz - 500 Hz	0.25%
Q	QQ	1 KHz - 10 KHz	1.0%

WRITE FOR CATALOG 969

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Phone (516) 883-1700

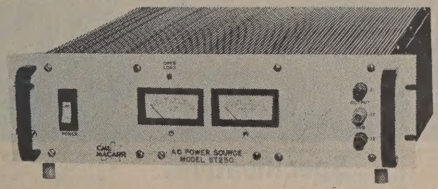
CML® MACARR™
POWER SUPPORT EQUIPMENT

NEW! SYNAMP® solid state AC power sources synthesized sine wave NOW IN STOCK!!

single phase 50-60-400 Hz three phase

- High Efficiency 75% Typical
- Rack Mount Construction
- Versatility — may be used as a Frequency Converter or Precision AC Power Source
- Output Voltage Range: 105-130VAC
- Output Frequency Range: 45-460 Hz at Full Rated Output
- Modular Power Transistor Assemblies

ST series 250VA to 4000VA



MODEL ST250-41VA

MODEL	OUTPUT POWER VA	INPUT	DIMENSIONS H x W x D	SHIPPING WEIGHT
ST250	250	115/230 1ϕ 47-63 Hz	5¼ x 19 x 20	60 lbs.
ST500	500	115/230 1ϕ 47-63 Hz	5¼ x 19 x 20.5	70 lbs.
ST1000	1000	115/230 1ϕ 47-63 Hz	8¾ x 19 x 21.5	85 lbs.
ST2000	2000	208/230 3ϕ 47-63 Hz	8¾ x 19 x 21.5	95 lbs.
ST4000	4000	208/230 3ϕ 47-63 Hz	21 x 19 x 21.5	150 lbs.

TT series 750VA to 12000VA

MODEL	OUTPUT POWER VA	INPUT	DIMENSIONS H x W x D	SHIPPING WEIGHT
TT750	750	115/230 1ϕ 47-63 Hz	8¾ x 19 x 20	75 lbs.
TT1500	1500	208/230 3ϕ 47-63 Hz	8¾ x 19 x 20	95 lbs.
TT3000	3000	208/230 3ϕ 47-63 Hz	14 x 19 x 20	150 lbs.
TT6000	6000	208/230 3ϕ 47-63 Hz	17 x 19 x 20	225 lbs.
TT12000	12000	208/230 3ϕ 47-63 Hz	32 x 19 x 20	340 lbs.

Single Phase and Two Phase Output

Available at Extra Cost

Standard 3 phase power supplies may be used to provide a 2 phase output at ⅔ of rated power. An internal selector switch internally provides either 90 degrees or 120 degrees phase separation for 2 or 3 phases respectively.

Standard 3 phase power supplies may be used to provide a 1 phase output of 57% of rated power over an adjustable range of 105-130 volts.

Specifications

OUTPUT CONFIGURATION: Single phase — two wire isolated. Three phase — four wire WYE with floating neutral or delta.

INPUT CONFIGURATION: 115/230 ±10% 1ϕ 47-63 Hz all models thru 1KVA, others 208/230 ±10% 3ϕ 47-63 Hz. Special voltages available at slight extra cost.

OUTPUT VOLTAGE: Single phase, 105-130V @ full power. Three phase, 105-130V/185-225V line to line or line to neutral @ full power.

VOLTAGE ADJUSTMENT: Single phase units, internally adjustable. Optional front panel mounted. Three phase units, standard front panel mounted.

PHASE DISPLACEMENTS: Three phase units 3% maximum.

LOAD POWER FACTOR: .7 lead or lag at rated output.

EFFICIENCY: 75% typical.

VOLTAGE REGULATION: ±1% with ±10% line, ±1% load.

FREQUENCY STABILITY: .25% standard, options to .001%.

RESPONSE TIME: Less than 200 milliseconds at 60 Hz and 100 milliseconds at 400 Hz.

HARMONIC DISTORTION: 4% maximum at no load, 2% at full load.

AMBIENT TEMPERATURE: −20° to 50°C.

TEMPERATURE STABILITY: Voltage .01% per degree C typical. Frequency .05% per degree C typical.

CONTROLS AND METERS: All models 500VA and up include panel voltmeter and ammeter. Variable frequency models have front panel mounted frequency control dial.

PROTECTION: Input line circuit breaker. Current limit on output. Circuit breaker available at extra cost.

TERMINATIONS: Output on front and rear. Input on rear mounted barrier strip.

CONSTRUCTION: Standard 19″ rack mount with full dust covers. Bench adaptors available at extra cost. Add (-C) to Model No.

FINISH: Front panels finished in satin finish aluminum with black marking. Chassis surfaces are protected by clear irridite.

Ordering Information

To specify give model number and option code number as shown below. For example: 500VA single phase 45-66 Hz, Model ST500-01 Add (-VA) for Voltmeter and Ammeter on Model ST250.

Frequency	Code	Mode
45-66 Hz	-01	variable
320-460 Hz	-02	variable
45-66 Hz and 320-460 Hz	-03	2 range variable
50 Hz	-50	fixed
60 Hz	-60	fixed
400 Hz	-41	fixed

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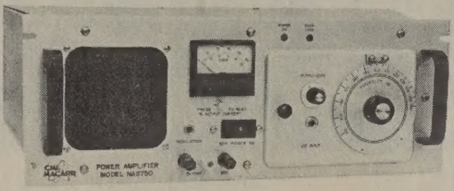
NEW!

SOLID STATE WIDE BAND AC POWER SUPPLIES—45-10KHz Single Phase and Three Phase NOW IN STOCK!!

NAS series 200VA to 1KVA

Single Phase



MODEL NAS-750-1/SSG15A

MODEL	OUTPUT POWER VA	INPUT POWER	DIMENSIONS H x W x D	SHIPPING WEIGHT
NAS-200	200	115/230 1ϕ 47-63 Hz	7 x 19 x 16	60 lbs.
NAS-300	300	115/230 1ϕ 47-63 Hz	7 x 19 x 16	90 lbs.
NAS-500	500	115/230 1ϕ 47-63 Hz	7 x 19 x 17	95 lbs.
NAS-750	750	115/230 1ϕ 47-63 Hz	7 x 19 x 19	105 lbs.
NAS-1000	1000	208/230 3ϕ 47-63 Hz	12¼ x 19 x 19	210 lbs.

TAS series 500VA to 3KVA

Three Phase

MODEL	OUTPUT POWER VA	INPUT POWER	DIMENSIONS H x W x D	SHIPPING WEIGHT
TAS-500	500	115/230 3ϕ 47-63 Hz	8¾ x 19 x 19	130 lbs.
TAS-1500	1500	208/230 3ϕ 47-63 Hz	14 x 19 x 19	275 lbs.
TAS-2000	2000	208/230 3ϕ 47-63 Hz	14 x 19 x 19	325 lbs.
TAS-3000	3000	208/230 3ϕ 47-63 Hz	20 x 19 x 19	450 lbs.

Plug-In Oscillators

Frequency	1ϕ	3ϕ	Frequency Stability			
			.25	.1	.01	.001
400	SSG14	SSG34	A	B	—	—
400	STG14	STG34	—	—	E	G
50	SSG11	SSG31	A	B	—	—
50	STG11	STG31	—	—	E	G
60	SSG12	SSG32	A	B	—	—
60	STG12	STG32	—	—	E	G
45-70	SSG13	SSG33	A	B	—	—
350-450	SSG15	SSG35	A	B	—	—
300-2 kHz	SSG16	SSG36	A	B	—	—
45-6 kHz	SSG17	SSG37	A	B	—	—
45-10 kHz	SSG10	SSG30	A	B	—	—

- Plug-In Oscillators
- Low Harmonic Distortion
- Outputs 0-65, 0-130, 260V available
- Minimum Package Sizes 200VA in 5¼" high standard rack space
- Response time 50 microseconds
- Frequency stability .25% to .001%

Specifications

OUTPUT CONFIGURATION: Single phase two wire isolated; three phase four wire.

OUTPUT VOLTAGE: Single phase: 105-130V standard @ full power; Add (-1). Optional 65, 130, 260V w/automatic range voltmeter; Add (-2) to model no. Three phase: 105-130/185-225V line to line or Wye or delta loads.

PROTECTION: Current overload with automatic reset.

LOAD POWER FACTOR: .7 lead or lag.

HARMONIC DISTORTION: Less than .5%, 45-10 KHz @ full load. Less than 1% with plug-in oscillator.

REGULATION: ±.25% with ±10% input line variation ±1.0% NF-FL.

NOISE LEVEL: 70 db below rated output.

OPERATING TEMPERATURE: −20°C to 40°C.

TEMPERATURE STABILITY: Voltage .01% per degree C typical. Frequency .05% per degree C typical.

METERS: Models 500 VA and up include panel mounted output voltmeters. Optional at extra cost on lower power models. Add (-V) to model no.

CONTROLS: Output voltage and frequency potentiometer mounted on plug in oscillator panels where required.

CONSTRUCTION: Standard 19" rack mount with full dust covers. Bench adaptors available at extra cost.

FINISH: Front panels finished in satin finish aluminum with black marking. Chassis surfaces are protected by clear irridite.

Single Phase and Two Phase Output

Standard 3 phase power supplies may be used to provide a 2 phase output at ⅔ of rated power. An internal selector switch internally provides either 90 degrees or 120 degrees phase separation for 2 or 3 phases respectively.

Standard 3 phase power supplies may be used to provide a 1 phase output of 57% of rated power over an adjustable range of 105-130 volts.

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CML MACARR®

POWER SUPPORT EQUIPMENT

single phase AC power supplies

NS series 70VA to 350VA

OUTPUT VOLTAGE: Adjustable 0-125 Volts; full power available at output of 110-125 Volts.

MODEL	OUTPUT POWER VOLT-AMPERES	DIMENSIONS* H x W x D	WEIGHT (APPROX.) LBS.
**NS70	70	7″ x 19″ x 14″	53
**NS120	120	7″ x 19″ x 14″	57
**NS175	175	7″ x 19″ x 14″	60
NS350	350	8¾″ x 19″ x 20¾″	115

* Dimensions apply to standard rack mount models. Add ¾″ to height if bench adapters are included. **Voltmeter optional

NA series 500VA to 15KVA

OUTPUT VOLTAGE: Adjustable 0-125 Volts; full power available at output of 110-125 Volts.

MODEL	OUTPUT POWER—VA	INPUT	DIMENSIONS* H x W x D	WT. (APPROX.) LBS.
N500A	500	REPLACED BY OUR NEW SOLID STATE SERIES		
N750B	750			
N1000A	1,000	208/230V, 3φ 57-65 Hz	14″ x 19″ x 20½″	270
N750A	750	208/230V, 3φ 47-65 Hz	14″ x 19″ x 20½″	260
N1500A	1,500	208/230V, 3φ 57-65 Hz	22¾″ x 19″ x 17″	315
N2000A	2,000	208/230V, 3φ 57-65 Hz	22¾″ x 19″ x 17″	325
N5000A	5,000	208/230V, 3φ 57-65 Hz	51″ x 24″ x 24″	850
N15000A	15,000	208/230V, 3φ 57-65 Hz	47″ x 68″ x 24″	1600

* 500VA to 2000VA units are standard rack mount models. Add ¾″ to height if bench adapters are included. 5000VA and 15000VA units are cabinet models.

three phase AC power supplies

TA series 300VA to 20KVA

MODEL	φ OUTPUT POWER—VA	INPUT	DIMENSIONS H	W	D	WT. APROX. LBS.
T300B	300					
T500	500	REPLACED BY OUR NEW SOLID STATE SERIES				
T750	750					
T1200	1,200					
T1750	1,750	208/230V, 3φ, 47-65 Hz	14	19	20½	365
T2500A	2,500	208/230V, 3φ, 47-65 Hz	14	19	20½	365
T5000	5,000	208/230V, 3φ, 47-65 Hz	45	24	24	950
T10000	10,000	208/230V, 3φ, 57-65 Hz	78	35	36	1650
T15000	15,000	208/230V, 3φ, 57-65 Hz	78	35	36	1700
T20000	20,000	208/230V, 3φ, 57-65 Hz	78	35	36	1900

NS Series Oscillators**

	OUTPUT FREQUENCY	FREQUENCY STABILITY ±0.25%	±0.1%	±0.01%	±0.001%
		SUFFIX #			
Fixed	400 Hz	—4A	—4B	—4E	—4G
	800 Hz	—8A	—8B	—8E	—8G
	50 Hz	—1A	—1B	—1E	Special Order
	60 Hz	—2A	—2B	—2E	
Adjustable	350-450 Hz	—5A	—5B	X	X
	45-70 Hz	—3A	—3B	X	X
	300-2,000 Hz	—6A	—6B	X	X
	45-6,000 Hz	—7A	X	X	X

AUDIO AMPLIFIER ONLY: Each model is also available as an audio power amplifier only (without a built-in oscillator) with a full power range of 45-6,000 Hz. All standard models include an input signal jack for use with external signal source. Specify the Basic Power Supply Models and suffix # (—JA) if oscillator is not required.

NA Series Oscillators***

	OUTPUT FREQUENCY	FREQUENCY STABILITY ±0.25%	±0.1%	±0.01%	±0.001%
		MODEL #			
Fixed	400 Hz	SG-14A	SG-14B	SG-14E	SG-14G
	800 Hz	SG-18A	SG-18B	SG-18E	SG-18G
	60 Hz	SG-12A	SG-12B	SG-12E	Special Order
	50 Hz	SG-11A	SG-11B	SG-11E	
Adjustable	350-450 Hz	SG-15A	SG-15B	X	X
	45-70 Hz	SG-13A	SG-13B	X	X
	300-2,000 Hz	SG-16A	SG-16B	X	X
	45-6,000 Hz	SG-17A	X	X	X
	45-6,000 Hz	EXTERNAL SIGNAL ADAPTER Model SA-2			

***All Plug-in Oscillators are provided with a jack for external signal drive.

Single Phase & Two Phase Output

Standard 3 phase amplifiers may be used to provide a 2 phase output at ⅔ of rated output power. Special plug-in oscillators are available with selectable 90° or 120° phase separation for 2 phases or 3 phase operation respectively.

Standard 3 phase amplifiers may be used to provide a single phase output at 57% of rated output power over an adjustable voltage range of 110-125 volts.

Specifications

OUTPUT CONFIGURATION: Three Phase, 4 wire wye, neutral floating.

OUTPUT VOLTAGE: 0-125 Volts line-to-line and 0-217 Volts line-to-line; both sets of terminals are presented at output. Full power available at output of 110-125 volts and 190-217 volts. Master gain control and phase 2 and 3 trim controls provided on front panel.

OUTPUT POWER: Rated output power for each model is shown in chart. Maximum power per phase is ⅓ of 3φ output.

LOAD POWER FACTOR: 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.

FREQUENCY RANGE: Each amplifier model is rated at full power 45-6,000 Hz except for the models T15000A and T20000A which have a 300-500 Hz full power range. The operating output frequency range is determined by the particular plug-in oscillator which is used.

HARMONIC DISTORTION: Less than 3% over the entire 45 6,000 Hz amplifier range; less than 1%, 300-1000 Hz.

HUM AND NOISE: 60 db below maximum output voltage.

OUTPUT PHASE SEPARATION: 120 ±1° for fixed frequency models as well as 350-450 Hz models. 120 ±2° for 45-70 and 300-2,000 Hz models. 120 ±3° for 45-6,000 Hz models.

CONSTRUCTION: Models rated 300VA to 2500VA are standard 19″ rack mount units with full dust covers. Bench adapters available as accessories for these models; specify suffix (—C). Side support is recommended for rack mount models. Slides are available as optional accessories; specify suffix (—S). 5VA-20KVA models are furnished complete in cabinet enclosure.

A PRODUCT LINE OF

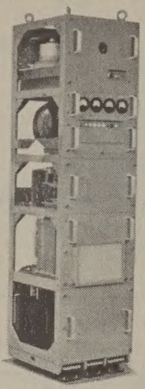
MARINE ELECTRIC RPD INC.

DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

CML MACARR®
POWER SUPPORT EQUIPMENT

wide band power amplifiers for audio and ultrasonic testing

SPG series 1KVA to 100KVA



MODEL S5K
PASSES THROUGH
A STANDARD
SUBMARINE HATCH

MODEL	OUTPUT POWER KVA	LOAD POWER FACTOR RANGE AT RATED KVA	STANDARD OUTPUT IMPEDANCE TAPS OHMS	DIMENSIONS* H x W x D (APPROX.)	WEIGHT (APPROX.) LBS.	TYPE OF COOLING
A1K	1	±0.4 to Unity	4/16/36/64/144/576	22¾″ x 19″ x 20½″	345	
A2K	2	±0.4 to Unity	4/16/36/64/144/576	22¾″ x 19″ x 17″	400	
S2K	2	±0.4 to Unity	4/16/36/64/144/576	22¾″ x 17″ x 17″	400	
A3K	3	±0.1 to Unity	4/16/36/64/144/576	53″ x 27″ x 26″	750	
S5K	5	±0.4 to Unity	16/64/256	68″ x 17″ x 17″	800	
B5K	5	±0.1 to Unity	8/32/72/128/288/1152	45″ x 24″ x 24″	850	
A10K	10	±0.1 to Unity	16/64/144/256/576/2304	47″ x 68″ x 24″	1,700	FORCED AIR
A20K	20	±0.3 to Unity	16/64/144/256/576	47″ x 68″ x 24″	2,100	
VA30K	30	±0.1 to Unity	16/64/144/256/576	72″ x 72″ x 36″	3,000	
VA50K	50	±0.4 to Unity	16/64/144/256/576	72″ x 72″ x 36″	4,200	WATER COOLED
VA100K	100	±0.1 to Unity	16/64/144/256	2 sections, ea. 90″ x 72″ x 57″	9,400	

* Model A1K and A2K are standard 19″ rack mount units; bench adapters available on special order. All other models are furnished complete in cabinet enclosures. Models A3K, S5K and B5K include casters. Models S2K and S5K are designed to go through a 25″ standard submarine hatch.

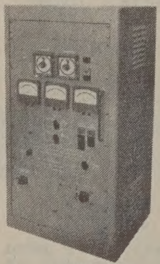
Specifications

FREQUENCY RESPONSE: ±0.5 db, 100-10,000 Hz; Model A3K ±0.5 db, 200-15,000 Hz. Other frequency ranges between 5 Hz and 100 KHz available on a custom basis.

HARMONIC DISTORTION: Less than 3% over rated frequency range; less than 1.5% midband.

HUM & NOISE: At least 60 db below rated tap voltage.

battery service and analysis equipment



MODEL 505-50

Specifications

MODEL	12-30.1-101	505-50	403KA3A
Input Power	115/230V, 1ϕ, 60 Hz	230V, 1ϕ, 60 Hz	115V, 1ϕ, 60 Hz
Output Charge	35A @ 35V	50A @ 6V/12V/24V	5A @ 50V per channel
Output Discharge	35A @ 35V	40A @ 28.5V	45A @ 24V
Charge Channels	1	4	2
Discharge Channels	1	1	1
Type of Charge:			
Constant Current	Yes	Yes	Yes
Constant Potential	Yes	Yes	Yes
Modified Constant Potential	Yes	Yes	Yes
Pulse Charge	No	Yes	No
Analyzer	Yes	Yes	No
Size H x W x D (Approx.)	21″ x 27″ x 15¼″	42″ x 22″ x 18″	43″ x 22″ x 18″
Weight (Approx.)	225 lbs.	250 lbs.	235 lbs.

helicopter starting high current-low voltage DC supplies

MODELS 28-UP MOBILE POWER SUPPLIES FOR AIRCRAFT

- Mobile — extremely rugged and reliable.
- Good load regulation, low ripple.
- All units feature heavy intermittent load capability.
- Easily maneuvered... large units have pneumatic tires.
- Weatherproof construction for outdoor duty.

MODEL:		28-50 UP	28-100 UP	28-200 UP	28-300 UP	28-400 UPA	28-400 UPB	28-600 UP	28-800 UP	28-1000 UP
INPUT:	V	115/230	220/440	220/440	220..440	220/440	220/440	440	440	400
	ϕ	1	3	3	3	3	3	3	3	3
	A	20/10	10/5	20/10	30/15	40/20	40/20	30	40	50
NOMINAL OUTPUT CONTINUOUS	V	28	28	28	28	28	28	28	28	28
	A	50	100	200	300	400	400	600	800	1000
INTERMITTENT: OUTPUT		3 min. 65A	3 min. 125A	3 min. 250A	3 min. 375A	3 min. 500A	3 min. 500A	3 min. 750A	3 min. 1200A	3 min. 1500A
		3 sec. 200A	3 sec. 400A	3 sec. 800A	3 sec. 1200A	3 sec. 1600A	3 sec. 1600A	3 sec. 2400A	3 sec. 2900A	3 sec. 3500A

A PRODUCT LINE OF

MARINE ELECTRIC RPD INC.

DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
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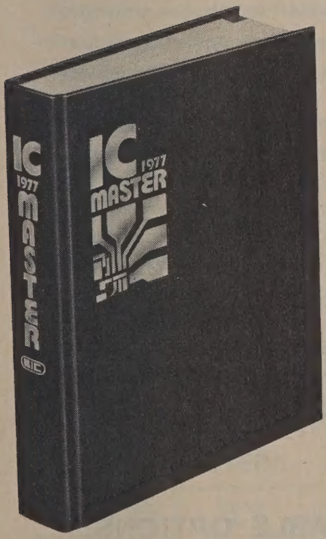
WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

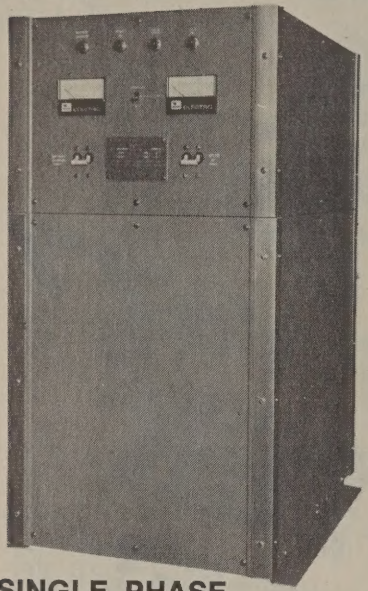
The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

1φ UNINTERRUPTIBLE 3φ POWER SYSTEMS



The Nova Uninterruptible Power System is a solid state system designed to provide uninterrupted A.C. power to critical loads. Systems 2.5 KVA and up carry a THREE YEAR WARRANTY!

Nova high efficiency systems, 85% typical, minimize battery requirements. Nova systems utilize smaller battery systems than those used to power comparable competitive systems.

Small size and relatively light weight minimize floor space and floor loading.

Deliveries for many systems range from stock to 30 days.

SINGLE PHASE

KVA	MODEL	DIMENSIONS W	D	H	WT.
1	11-1K60-*	17	24	12½	170
2.5	11-2.5K60-*	17	24	31	350
5	11-5K60-*	17	24	31	410
7.5	11-7.5K60-*	22	30	48	550
10	11-10K60-*	22	30	48	750
15	11-15K60-*	44	30	64	1060
20	11-20K60-*	44	30	64	1500

THREE PHASE

KVA	MODEL	DIMENSIONS W	D	H	WT.
5	11-5K-3/6-*	17	24	56	650
7.5	11-7.5K-3/6-*	34	24	42	730
10	11-10K-3/6-*	34	24	42	810
15	11-15K-3/6-*	44	30	64	1050
20	11-20K-3/6-*	44	30	64	1600
30	11-30K-3/6-*	66	30	64	2200

*Add standby time to model number (10 mins. = 10M; 2 hours = 2H).
All weights and dimensions excluding batteries.
For 50 Hz. models change model numbers as follows:
"60" in model no. to "50" or "3/6" to "3/5".

SPECIFICATIONS:

Input: 115, 230 480 VAC, 1φ or 3φ (others)
Frequency: 60 Hz., 50 Hz.
Voltage Regulation: ±1%
Frequency Regulation: ±0.15%
Power Factor Range: 0.7 lead to lag

Distortion: Less than 5% THD
Efficiency: 85% typical
Temperature: −20° to +50°C
Current Limited
Thermal Protected

AVAILABLE OPTIONS:

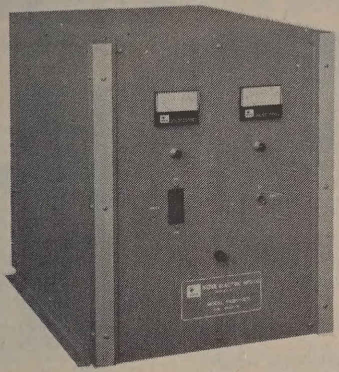
- Alarms and alarm contacts
- Solid State or Electro-Mechanical Transfer Switch
- Manual Bypass
- Meters
- Extended Back-up Time

1φ FREQUENCY CHANGERS 3φ

125 VA to 30 KVA, 1φ and 3φ
115 VAC, 220 VAC, 240 VAC, others
Sine Wave Output — 50, 60, 400 Hz.
Specifications same as Inverters on opposite page.

NOVA ELECTRIC MANUFACTURING CO.
Dept. EM, 263 Hillside Avenue
Nutley, New Jersey 07110 / (201) NO 1-3434

NOVA SINE WAVE FIXED FREQUENCY INVERTERS 50 • 60 • 400 Hz



All Items on
GSA Schedule
Contact
GS-005-04791

SPECIFICATIONS:

Output:

Voltage: 115/230 VAC 1ϕ (others) 115/200, 3ϕ (others)

Voltage Regulation: ±1% for line or load

Voltage Adjustment Range: ±10% of nominal

Frequency Regulation: ±0.15% for line and load

Frequency Adjustment Range: ±5% of nominal

Frequency/Temperature Coefficient: 0.01% per °C.

Transient Response: less than 50 mSec for 100% Load Change

Maximum Distortion: less than 5%

Efficiency: 75% (except 12 and 24 volt models) 90%-2.5 KVA and up

Load Power Factor: .7 lead or lag

CIRCUIT PROTECTION:

Reverse input polarity protection

Short circuit protection

Output automatic current limited

Thermal protected

THREE PHASE INVERTERS

60 Hz.* INVERTERS

Output VA	Input VDC	Model No.	Input Amps	Weight		Size
				Lb.	Kg.	
5000	48 120	5K-3/6-48 5K-3/6-120	118 46	410	186	42 x 17 x 24
7500	24 48 120 240	7.5K-3/6-24 7.5K-3/6-48 7.5K-3/6-120 7.5K-3/6-240	480 240 66 33	615	280	63 x 17 x 24
10000	48 120 240	10K-3/6-48 10K-3/6-120 10K-3/6-240	260 95 46	530	241	42 x 17 x 24
15000	48 120 240	15K-3/6-48 15K-3/6-120 15K-3/6-240	276 138 69	800	364	63 x 17 x 24
20000	120 240	20K-3/6-120 20K-3/6-240	184 92	1100	500	32 x 44 x 30
30000	120 240	30K-3/6-120 30K-3/6-240	285 143	1650	750	32 x 66 x 30

*Also available in 50 Hz. and 400 Hz. models. Change 3/16 to 3/5 or 3/4.

OTHER FEATURES:

Operating Temperature: −20°C. to +50°C.

Adaptable for rack mounting

Three phase inverters may be operated with unbalanced loads

SINGLE PHASE INVERTERS

60 Hz.* INVERTERS

Output VA	Input VDC	Model No.	Input Amps	Weight		Size
				Lb.	Kg.	
125	12 24 48 120	1260-12 1260-24 1260-48 1260-120	17.4 8.0 3.7 1.1	19	8.6	5¼ x 6½ x 9¾
250	12 24 48 120	2560-12 2560-24 2560-48 2560-120	35 16 7.5 2.2	37	16.8	6⅞ x 9 x 13¼
500	12 24 48 120	5060-12 5060-24 5060-48 5060-120	70 32 15 4.4	60	27.3	6⅞ x 11¼ x 14¼
1000	12 24 48 120	1K60-12 1K60-24 1K60-48 1K60-120	140 64 30 9	125 100	56.8 45.5	8⅝ x 17 x 17 8⅝ x 13¾ x 16
1500	24 48 120	1.5K60-24 1.5K60-48 1.5K60-120	96 45 13.3	145	65.9	12¼ x 17 x 24
2000	24 48 120	2K60-24 2K60-48 2K60-120	128 60 17.8	200	90.9	12¼ x 17 x 24
2500	24 48 120	2.5K60-24 2.5K60-48 2.5K60-120	140 60 30	250	114	21 x 17 x 24
5000	48 120	5K60-48 5K60-120	118 46	265	120	21 x 17 x 24
7500	120 240	7.5K60-120 7.5K60-240	69 35	405	185	32 x 22 x 30
10000	120 240	10K60-120 10K60-240	92 46	550	250	32 x 22 x 30

*50 Hz. models, change "60" to "50" in model no.

400 Hz. INVERTERS

125	12 24	12400-12 12400-24	17.4 8	14	6.4	5¼ x 6½ x 9¾
250	12 24	25400-12 25400-24	35.0 16	25	11.4	6⅞ x 9 x 13¼
500	12 24	50400-12 50400-24	70 32	45	20.5	6⅞ x 11¼ x 14¼
1000	12 24	1K400-12 1K400-24	140 64	70	31.8	6⅞ x 11¼ x 14¼
1500	24	1.5K400-24	96	115	52.3	12¼ x 17 x 24
2000	24	2K400-24	128	140	63.6	12¼ x 17 x 24
2500	24	2.5K400-24	175	160	72.7	21 x 17 x 24
5000	120	5K400-120	46	205	93.2	21 x 17 x 24
10000	120	10K400-120	92	405	184	32 x 22 x 30

Nova

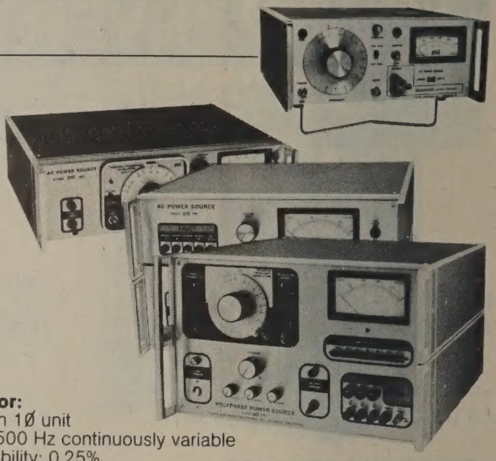
NOVA ELECTRIC MANUFACTURING CO.
Dept. EM, 263 Hillside Avenue
Nutley, New Jersey 07110 / (201) NO 1-3434

PACIFIC A.C. POWER SOURCES

FREQUENCY CHANGERS / LINE CONDITIONERS

LIGHTWEIGHT PORTABLES / 250 VA-1.5 KVA

laboratory bench-top units / ***D Series***



MODEL 105-D

MODEL 315

PACIFIC D Series units are lightweight, versatile, and fully instrumented for laboratory use. Units exhibit low acoustic noise, cooled by forced air with intake and exhaust on rear panel (250 A exhaust on bottom). Models are attractively styled in brown vinyl, aluminum cabinets. Rack mount tabs are available for all units.

PERFORMANCE SPECIFICATIONS:

Output Voltage: Variable 0-125 vrms. Three phase units are variable 0-125 vrms line-to-neutral 3 phase WYE. Other voltages, or 30 DELTA connection, available as options.

Output Current: Each unit rated for continuous operation at maximum current (see derating curve on page 2).

Peak Current: Each unit delivers peak current of about 250% rated rms current when driving non-linear (rectifier-capacitor power supply) load, without clipping voltage waveform.

Response Time: 50 microseconds

Frequency Range: 20-2,000 Hz full power.

Bandwidth: 10 KHz small signal (typical).

Power Factor: Any (see derating curve).

Isolation: Fully isolated (floating) output.

Load Regulation: 0.75% max.

Line Regulation: 0.25% max.

Distortion: 0.75% max.

Line Conditioning: 80 db common mode rejection. Internal storage eliminates most short duration line transients (see curve on back page).

Hum and Noise: 0.25% max.

Overload Protection: Fuses plus electronic current limiting into external shorts or surge type loads, recovery is automatic.

Panel Metering: Panel meters read volts to 3%, amps to 6% of I max (250-A is metered for volts only). Three phase units meter line-to-line volts, line-to-neutral volts, amps in each leg.

Efficiency: 60% max.

Internal Oscillator:
Standard in each 10 unit
Range: 47 to 500 Hz continuously variable
Frequency Stability: 0.25%
Standard in each 30 unit
Range: 47 to 500 Hz continuously variable
Frequency Stability: 0.25%
Plus three selectable fixed frequencies of 1% accuracy, 0.02% stability. Frequencies set to 50, 60, and 400 Hz, unless otherwise specified.
Oscillators with non-standard frequency range, or precision fixed frequencies, available on request.

External Input: External signal input with 100 v/v sensitivity standard on single phase units. Available as option on 30 units.

Phase Angles Accuracy (three phase units only): Each 30 machine produces three power vectors separated in phase angle by 120° (Std. 30 power), 90°, or 0°. Phase angles are maintained to ±1°.

Temp Range: 0-45°C operating, −25 to +85°C storage.

Overtemp Protection: Turns off unit (except for cooling fan) when internal temperatures exceed limits. Operation resumes automatically.

Input Power: 105-125v, 47-63 Hz 10 is standard for models 250-A, 105-D and 110-D. 210-250V is standard for all other models. Any unit can be connected for 110 or 220 volt input. Options available for very low line (below 105 volts) or for 400 Hz input.

BENCH-TOP/*Series D*

- **250 VA to 1.5 KVA IN COMPACT, ULTRA-LIGHTWEIGHT PORTABLES**
- **FULL POWER CONTROL AND PANEL METERING**
- **FIT STANDARD RACKS AND CHASSIS: RACK MOUNT TABS AVAILABLE FOR ALL MODELS**
- **HANDSOME STYLING IN ALUMINUM CABINETS WITH BROWN VINYL PANELS**

D SERIES

Model	VA	Output Current Amps	Phase	Size* HxWxD	Weight Lbs.
250-A	250	2	1	5¼x12x13	30
105-D	500	4	1	5¼x17x13	40
110-D	1 KVA	8	1	10½x17x17	80
315	1.5 KVA	4 per Leg	3	10½x17x17	55

**dimensions shown in inches*

ECONOMY/*SERIES H*

"H" series power sources are designed for fixed parameter, OEM applications. Power circuits are virtually identical to the "D" series units. Units have minimal panel controls, no panel meters, and are housed in economy styled, rack-mount cabinets. All of the "D" series specifications apply except that panel controls are restricted to: ON-OFF CONTROL input circuit breaker, or switch plus fuse; AMPLITUDE−0 to 125 VRMS by panel screwdriver adjustment; INPUT FUSE; OUTPUT LAMP−Indicates presence of output power. Internal oscillator is factory set to user specified frequency. Frequency stability is 0.02%/10 hrs., 0.10%/30 days. Amplitude stability is 1% 30 days.

- **HIGH-RELIABILITY PERFORMANCE IN COMPACT, RACK-MOUNT UNITS**
- **FACTORY-SET INTERNAL OSCILLATOR TO USER FREQUENCY**
- **FREQUENCY STABILITY 0.02%-10 HRS., 0.10%-30 DAYS**
- **AMPLITUDE STABILITY 1%-30 DAYS**

H SERIES

Model	VA	Output Current Amps	Phase	Size HxWxD	Weight Lbs.
250-H	250	2	1	5¼x12x13	30
105-H	500	4	1	5¼x19x17	40
110-H	1 KVA	8	1	10½x19x17	80
315-H	1.5 KVA	4 per Leg	3	10½x17x17	55

PACIFIC

PHONE: (213) 573-1686 / *CALL TOLL-FREE (Outside Calif.)* 800-423-4151
PACIFIC ELECTRONIC ENTERPRISES / 2643 No. San Gabriel Blvd., Rosemead, CA 91770

A.C. POWER SOURCES PACIFIC

WORLD LEADER IN A.C. POWER SYSTEMS TECHNOLOGY

MULTI-KVA POWER SYSTEMS / 2 KVA & UP

*single and 3-phase units/**M Series***

Series M machines cover the range of 2 to 27 KVA single or three phase. All Series M machines are assembled from building blocks of self-contained 1 KVA Power Amplifier Modules, and can therefore be configured in a large variety of forms. Three phase machines with added capacity in one leg for single phase loads are a common variation, as are machines with both WYE and DELTA output simultaneously available.

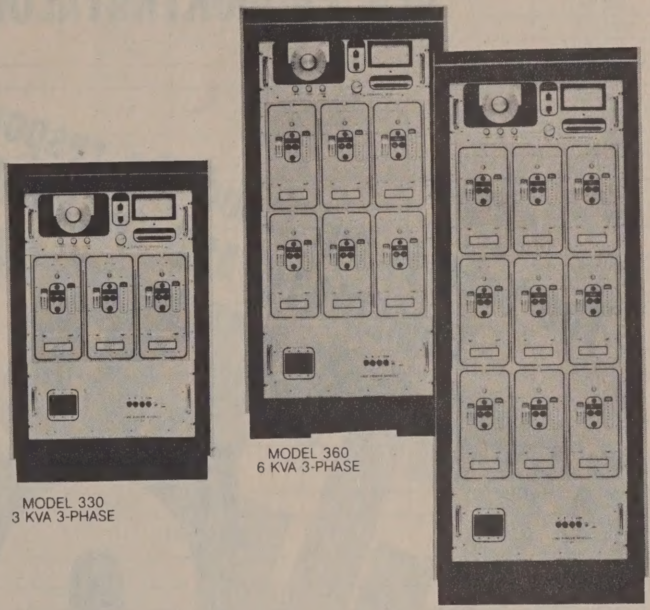
Units may be provided in single phase/three phase convertible machines. To obtain any variant form only the common Control Module is changed–the Power Amplifier Modules employed are always the same.

POWER AMPLIFIER MODULE

Each 1 KVA Power Amplifier is a small lightweight and easily installed Module (5x12" panel dimensions, weight is 30 lbs). Each module has completely redundant circuitry, its own internal power supply, fail-safe disconnects, thermal cutout and output ON/OFF control. Since each module is totally isolated, it can be connected in three phase configurations. Also, any of the three phase legs can consist of any number of modules in parallel for added power capacity. There is no limit to the number of modules which can be paralleled.

Each module is equipped with "self-healing"* output stage which disconnects output transistors which may have randomly failed. Each module has a special input circuit so that failure anywhere within the module cannot load input signals and cannot prevent operation of other modules.

Systems using multiple parallel modules can attain unprecedented reliability levels.



MODEL 330
3 KVA 3-PHASE

MODEL 360
6 KVA 3-PHASE

MODEL 390
9 KVA 3-PHASE

PERFORMANCE SPECIFICATIONS:

Output Voltage (1Ø): Variable 0-125 vrms. Other voltages available.

Output Voltage (3Ø): 0-125 volts line-to-neutral 3Ø WYE, 3Ø DELTA and/or other voltages are also available to user.

Output Current: Each unit is rated for continuous operation at the specified maximum current (see derating curve page 2). Rated current is 8 amps times the number of modules in parallel.

Peak Current: Maximum peak current available at the crests of the sine wave is approximately 20 amps times the number of modules in parallel.

Response Time: 50 microseconds.

Frequency Range: 20-2,000 Hz. Full Power.

Bandwidth: 10 KHz small signal (typical).

Power Factor: Any (see derating curve).

Isolation: Fully isolated (floating) output.

Load Regulation: 0.25% Max.

Line Regulation: 0.1% Max.

Distortion: 0.75% Max.

Line Conditioning: 80 db common mode rejection.

Line Surge: Special circuits prevent excessive line surge during turn on.

Hum and Noise: 0.25% Max.

Output Protection: Fuses plus current limiting with automatic recovery.

Panel Metering: Fully metered for volts (±3%) and amps (±6% of maximum current).

Efficiency: 60% Max (varies with P.F. and output voltage).

Internal Oscillator: Same as "D" Series.

External Input: Same as "D" Series.

Phase Angles/Accuracy: Same as "D" Series.

Temp Range: 0-45°C inlet air temp.

Cooling: Each 1KVA module has individual forced air cooling. Intake and exhaust are at the rear.

Input Power: User may designate any of the following inputs available as standard configuration:
- Form A–
  240 V 3Ø DELTA 50-60 Hz.
- Form B–
  120 V 3Ø DELTA 50-60 Hz.
- Form C–
  120/208 V 3Ø WYE 50-60 Hz.
- Form D–
  440 Volts 3Ø DELTA 50-60 Hz.

The following standard forms are available at additional cost:
- Form E–220 V 1Ø 50-60 Hz.
- Form F–110 V 1Ø 50-60 Hz.
- Form G–400 Hz. input.
- Form H–DC input.

Unless otherwise specified all series M units are delivered with Form A input connection.

SINGLE PHASE OUTPUT SYSTEMS

Model	VA	Amps	Dimensions HxWxD	Weight Lbs.
120	2 KVA	16	36x23x27	210
130	3 KVA	24	36x23x27	240
160	6 KVA	48	56x23x27	400
190	9 KVA	72	72x23x27	550

3 PHASE OUTPUT SYSTEMS

Model	VA	Amps Per Leg	Dimensions HxWxD	Weight Lbs.
330	3 KVA	8	36x23x27	240
360	6 KVA	16	56x23x27	400
390	9 KVA	24	72x23x27	550

Base price of 10 and 30 units includes cabinet enclosures with casters for portability.

Overtemp Protection: Each individual module turns off with internal overtemp. When OFF, load may be absorbed by other modules operating in parallel. Recovery is automatic.

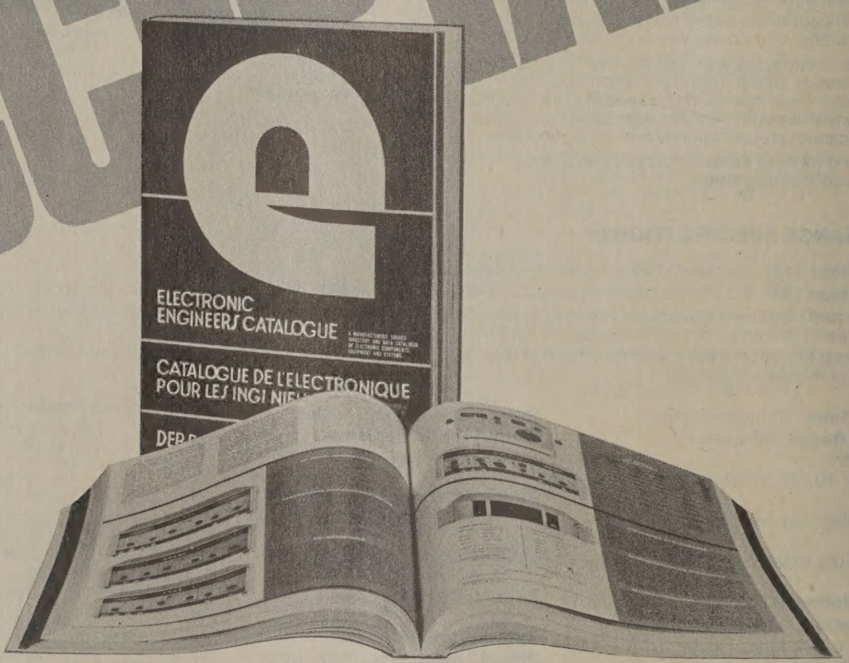
PHONE: (213) 573-1686 / *CALL TOLL-FREE (Outside Calif.)* 800-423-4151
PACIFIC ELECTRONIC ENTERPRISES / 2643 No. San Gabriel Blvd., Rosemead, CA 91770

PACIFIC

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...
IMMEDIATE AND OVERWHELMING

ACCEPTANCE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ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGI NI
DER

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

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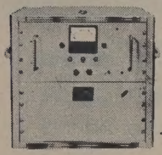
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

STABILINE® automatic VOLTAGE REGULATORS

TYPE IES9101

TYPE EMT10228


TYPE EMT4115B

Deliver a constant output voltage regardless of variations in input voltage or changes in line current. Types available from 0.25 to 275 kva. Submit specifications for ratings desired but not given in the charts. Input voltage ranges shown are at nominal output voltage; input range shifts with output voltage setting.

EMT SERIES — Electro Mechanical Transistorized types with virtually zero waveform distortion, 47-63 hertz frequency range, very low internal impedance, negligible phase shift and efficiency approximately 99%. Rated accuracy ±.75% for all line voltage or load current variations within unit stated range. Insensitive to load magnitude and power factor; no effect on system power factor.

EMS SERIES — Electro Mechanical Transistorized types for heavier load requirements. Same operating characteristics as EMT Series. Units with letter I before first digit in type number have individual control for each line-to-neutral voltage.

EMK SERIES — Electro Mechanical Transistorized types providing faster correction times than other electromechanical models.

IES SERIES — Instantaneous Electronic Solid-State types having extremely fast correction, no moving parts. Will maintain output voltage within a 100 millivolt rms band for any combination of rated input voltage and/or load from 1.0 to 0 power factor lagging. Efficiency to 95%. All units have provision for remote sensing and have plug-in solid-state circuit boards.

MILITARIZED — Meet requirements of applicable military specifications. Type EMTH41007MH is 3½ x 6 x 4½"; type EM4108MCR fits standard 19" relay rack. Accuracy ±1.0%.

STABILINE®

Full Range REGULATOR CONTROLLERS

Designed for use with any motor-driven POWERSTAT Variable Transformer to provide full range regulation of a-c voltage, a-c current or d-c voltage. Output voltage will remain within a 2-volt band when used with 120 volt units and a 4-volt band when used with 240 volt models. Output current can be maintained within ±1% of maximum current setting with user supplied current transformer and Superior Electric transformer T6340. Type FR501DC and user supplied d-c power will provide regulated d-c voltage.

THE SUPERIOR ELECTRIC COMPANY

1000 MIDDLE STREET, BRISTOL, CONN. 06010
PHONE: (203) 582-9561

EMT SERIES

NOMINAL OUTPUT VOLTAGE	OUTPUT VOLTAGE (ADJUSTABLE)	INPUT VOLTAGE RANGE‡‡	MAXIMUM OUTPUT AMPERES	RATED OUTPUT KVA	CORRECTION RATE AT 60 HERTZ (SECONDS/VOLT)	TYPE
50/60 HERTZ, SINGLE PHASE OPERATION						
115	110-120	95-135	20	2.3	0.075	EMT4102B†
			57	6.6	0.075	EMT4106C§
		90-115	52	6.0	0.12	EMT10228
		105-125	114	13.0	0.15	EMT4112B§*
		95-135	144	16.6	0.125	EMT4115B
120¶	110-120	108-137	35	4.2	0.10	EMT4104B††
230‡	220-240	195-255	36	8.3	0.083	EMT4207B
			93	21.4	0.083	EMT4220
		205-250	130	29.9	0.111	EMT4228C
240‡¶	220-240	228-256	35	8.4	0.10	EMT4104B††
460	440-480	400-520	20	9.2	0.041	EMT4407B
			45	20.7	0.041	EMT4418B
50/60 HERTZ, THREE PHASE OPERATION						
230‡	220-240	195-255	33	13.1	0.083	EMT6210YB
			48	19.1	0.083	EMT6215YB
			63	25.1	0.083	EMT6220YB
			145	57.8	0.25	EMT6245YB
			188	74.9	0.25	EMT6270DB
460	440-480	400-520	18	14.3	0.041	EMT6412YB
			24	19.1	0.041	EMT6417YB
			35	27.9	0.041	EMT6425YB
			75	59.8	0.125	EMT6450YB
			100	75.0	0.125	EMT6475YB
		420-500	148	118	0.188	EMT64100YB

EMS SERIES

60 HERTZ, SINGLE PHASE, 2-WIRE						
115	110-120	103.5-126.5	833	100	0.55	EMS41100
230‡	220-240	218.5-241.5	435	100	0.22	EMS42100‡
50/60 HERTZ, SINGLE PHASE, 3-WIRE, INDIVIDUAL LINE CONTROL						
240/120	230-250/115-125	204-276/102-138	104	25.0	.03/.06	EMS14225
			250	60.0	.03/.06	EMS14260
	220-240/110-120	228-252/114-126	417	100	.10/.21	EMS142100
50/60 HERTZ, THREE PHASE, SINGLE CONTROL						
230‡	220-240	203-257	339	135	0.28	EMS62135Y‡
460	440-480	445-495	230	180	0.30	EMS64180Y
			347	275	0.30	EMS64275Y
50/60 CYCLE, THREE PHASE, INDIVIDUAL LINE CONTROL						
208/120	191-217/115-125	177-239/102-138	250	90.0	.08/.14	EMS16290Y
		165-233/95-135	525	190	.37/.22	EMS162190Y

EMK SERIES

50/60 CYCLE, SINGLE PHASE						
115	110-120	95-135	23	2.6	0.02	EMK4105†
		105-125	46	5.3	0.04	

IES SERIES

50 OR 60 CYCLE ±10%, SINGLE PHASE						
115	110-120	95-135**	4.4	0.5	—	IES91005
			8.7	1.0	—	IES9101
			26.1	3.0	—	IES9103
			52.2	6.0	—	IES9106
			130	15.0	—	IES9115
230	220-240	195-255**	13	3.0	—	IES9203
			26.1	6.0	—	IES9206
			65	15.0	—	IES9215

MILITARIZED TYPES

45-66 HERTZ, SINGLE PHASE						
120	115-125	105-135	66.6	8.0	0.10	EM4108MCR
380-420 HERTZ, SINGLE PHASE						
115	115	103.5-126.5	6	0.69	0.13▲	EMTH41007MH

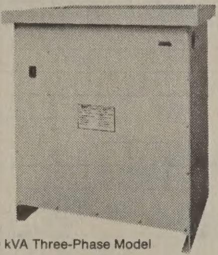
▲At 400 Hertz
†Also available as rack model (suffix R when ordering).
¶For 60 Hertz operation only.
*Can also be operated on an input range of 95 to 135 volts with a rating of 57 amperes, 6.6 kva and a correction rate of 0.075 seconds per volt.
§Also available as rack (suffix R when ordering) or wall mounted (suffix W when ordering) models.
‡Unit can be converted for 208 volt operation by simple tap changes. Input and output voltage ranges change proportionally.
**At nominal output. Shifts with output voltage setting but not proportionally.
††Also available in open construction (suffix U) and with screened and enclosed (suffix UT) construction.
‡‡At nominal output. Shifts proportionally with output voltage setting.

SHORT FORM CATALOG

TOPAZ SOLUTIONS TO POWER PROBLEMS
ELECTRONICS
3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

98% EFFICIENT AC LINE REGULATORS

500 VA to 100 kVA



100 kVA Three-Phase Model

FEATURES

- **Saves Energy**
- **98% Efficiency**
- **Fast Response**
- **Low Distortion**
- **Small Size**
- **Low Cost**

TOPAZ AC LINE REGULATORS SAVE MONEY SIX WAYS:

- Lower Purchase Cost…more product features and benefits for the dollar
- Lower Operating Costs…98% efficiency from no load to full load provides significant dollar savings by minimizing power losses
- Lower Installation Cost…less than 1/4 the size and weight of most regulators… requiring less installation manpower and floor space
- Lower Feeder Hardware Cost…negligible effect on power factor eliminates need to oversize input circuit breakers and other feeder hardware to handle additional reactive kVA generated by other regulators
- Lower Air Conditioning Costs…other ac line regulators generate up to nine times more heat losses…air conditioning power demand is substantially reduced when using Topaz regulators permitting installation of smaller, less expensive air conditioning equipment
- Lower Power Factor Correction Costs…the high input power factor of Topaz regulators results in improved overall plant power factor and reduces the need for expensive power factor correction equipment

SERIES 73000 AC LINE REGULATORS are intended for use in installations requiring close regulation of power lines subject to normal operating fluctuations. Output voltage is regulated to within ±3.3% of nominal.

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
SINGLE-PHASE MODELS					
73198	0.8	115	105-125	15/7	A
73199	1.5	115	105-125	20/9	A
73102	2	115	105-125	25/11	B
73202	2	220	202-239	30/14	H
73302	2	230	211-250	30/14	H
73402	2	240	220-260	30/14	H
73104	4	115	105-125	35/16	C
73204	4	220	202-239	43/20	I
73304	4	230	211-250	43/20	I
73404	4	240	220-260	43/20	I
73108	8	115	105-125	60/27	G
73208	8	220	202-239	64/29	J
73308	8	230	211-250	64/29	J
73408	8	240	220-260	64/29	J
73216	16	220	202-239	108/49	G
73316	16	230	211-250	108/49	G
73416	16	240	220-260	108/49	G

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
THREE-PHASE MODELS (WYE INPUT, WYE OUTPUT)					
73506	6	115L/N	105-125	85/38	P
73606	6	220L/N	202-239	100/45	Q
73706	6	240L/N	220-260	100/45	Q
73512	12	115L/N	105-125	115/52	K
73612	12	220L/N	202-239	140/64	R
73712	12	240L/N	220-260	140/64	R
73524	24	115L/N	105-125	190/86	O
73624	24	220L/N	202-239	200/91	S
73724	24	240L/N	220-260	200/91	S
73648	48	220L/N	202-239	335/152	O
73748	48	240L/N	220-260	335/152	O
73550	50	120L/N	111-130	600/272	T
73850	50	277L/N	255-300	600/272	T
73575	75	120L/N	111-130	900/408	T
73875	75	277L/N	255-300	900/408	T
73580	100	120L/N	111-130	1200/544	T
73880	100	277L/N	255-300	1200/544	T

SERIES 75000 AC LINE REGULATORS are intended for use on power lines subject to severe fluctuations and moderate brownout conditions. Output voltage is regulated to within ±5% of nominal.

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
SINGLE-PHASE MODELS					
75197	0.7	120	96-126	21/10	A
75199	1.3	120	96-126	29/13	A
75101	1.5	120	96-126	25/11	B
75201	1.5	220	176-231	25/11	U
75102	2.5	120	96-126	40/18	C
75202	2.5	220	176-231	40/18	D
75302	2.5	230	184-242	40/18	D
75402	2.5	240	192-252	40/18	D
75105	5	120	96-126	50/23	E
75205	5	220	176-231	50/23	F
75305	5	230	184-242	50/23	F
75405	5	240	192-252	50/23	F
75110	10	120	96-126	75/34	G
75210	10	220	176-231	75/34	G
75310	10	230	184-242	75/34	G
75410	10	240	192-252	75/34	G
75220	20	220	176-231	108/49	G
75320	20	230	184-242	108/49	G
75420	20	240	192-252	108/49	G

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
THREE-PHASE MODELS (WYE INPUT, WYE OUTPUT)					
75507	7.5	120L/N	96-126	130/59	K
75607	7.5	220L/N	176-231	130/59	L
75707	7.5	240L/N	192-252	130/59	L
75515	15	120L/N	96-126	160/73	M
75615	15	220L/N	176-231	160/73	N
75715	15	240L/N	192-252	160/73	N
75530	30	120L/N	96-126	235/107	O
75630	30	220L/N	176-231	235/107	O
75730	30	240L/N	292-252	235/107	O
75550	50	120L/N	96-126	900/408	T
75850	50	277L/N	220-290	900/408	T
75660	60	220L/N	176-231	335/152	O
75760	60	240L/N	192-252	335/152	O
75575	75	120L/N	96-126	1200/544	T
75875	75	277L/N	220-290	1200/544	T
75580	100	120L/N	96-126	1500/680	T
75880	100	277L/N	220-290	1500/680	T

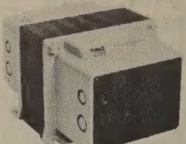
SERIES 77000 AC LINE REGULATORS are intended for use on power lines subject to severe brownout conditions. Output voltage is regulated to within ±7% of nominal.

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
SINGLE-PHASE MODELS					
77196	0.6	117	85-125	21/10	A
77199	1.2	117	85-125	30/14	A
77101	1	117	85-125	25/11	B
77201	1	220	160-235	25/11	U
77102	2	117	85-125	40/18	C
77202	2	220	160-235	40/18	D
77302	2	230	167-246	40/18	D
77402	2	240	175-255	40/18	D
77104	4	117	85-125	50/23	E
77204	4	220	160-235	50/23	F
77304	4	230	167-246	50/23	F
77404	4	240	175-255	50/23	F
77108	8	117	85-125	75/34	G
77208	8	220	160-235	75/34	G
77308	8	230	167-246	75/34	G
77408	8	240	175-255	75/34	G
77216	16	220	160-235	108/49	G
77316	16	230	167-246	108/49	G
77416	16	240	175-255	108/49	G

PART NO.	POWER kVA	OUTPUT VAC	INPUT VAC	WEIGHT (lbs./kg.)	SIZE
THREE-PHASE MODELS (WYE INPUT, WYE QUTPUT)					
77506	6	117L/N	85-125	130/59	K
77606	6	220L/N	160-235	130/59	L
77706	6	240L/N	175-255	130/59	L
77512	12	117L/N	85-125	160/73	M
77612	12	220L/N	160-235	160/73	N
77712	12	240L/N	175-255	160/73	N
77524	24	117L/N	85-125	235/107	O
77624	24	220L/N	160-235	235/107	O
77724	24	240L/N	175-255	235/107	O
77648	48	220L/N	160-235	335/152	O
77748	48	240L/N	175-255	335/152	O
77550	50	120L/N	88-128	900/408	T
77850	50	277L/N	202-296	900/408	T
77575	75	120L/N	88-128	1200/544	T
77875	75	277L/N	202-296	1200/544	T
77580	100	120L/N	88-128	1500/680	T
77880	100	277L/N	202-296	1500/680	T

Topaz line regulators are the smallest, lightest, most efficient, distortion-free devices commercially available for regulating ac power. Problems of low efficiency, wasted power and frequency sensitivity inherent in ferroresonant devices have been eliminated in these regulators.

1.5 kVA Single-Phase Model



4 kVA Single-Phase Model

FEATURES AND BENEFITS

ENERGY SAVINGS

The design of Topaz AC Line Regulators is directed toward one of the most serious problems in line voltage regulation…that of wasted power. The 98% efficiency of Topaz AC Line Regulators reduces the amount of energy consumed in the regulation process and also reduces the cost of associated equipment, including feeder hardware (on larger units) and air conditioning.

FAST RESPONSE

Topaz AC Line Regulators respond to voltage fluctuations much faster than most other voltage regulators. Sensing circuitry constantly monitors line voltage and corrects for changes in less than one cycle of the operating frequency.

LOW DISTORTION

Most commercially available line regulators distort the output waveform by as much as five percent and many types cause distortion on the input power line. Distortion can adversely affect sensitive loads. Topaz regulators add less than 0.1% distortion.

INPUT POWER FACTOR

Topaz AC Line Regulators have a negligible effect on power factor. They reflect, almost exactly, the power factor of the load. All other line regulation techniques, with the exception of the motor driven variable autotransformer, have a substantial detrimental effect on power factor.

WIDE INPUT FREQUENCY RANGE

Topaz AC Line Regulators operate over a broad range of input frequencies (47-63 Hz). In contrast, ferroresonant regulators are highly sensitive to input frequency fluctuations and stop regulating when outside their narrow frequency range.

SIZE AND WEIGHT

Topaz AC Line Regulators are approximately ¼ the size and weight of ferroresonant transformers, facilitating handling and requiring minimal installation space.

TYPICAL EQUIPMENT AND SYSTEMS USING TOPAZ AC LINE REGULATORS

- Computers
- Video and Audio Equipment
- Instrumentation
- Communications Equipment
- Medical Monitoring Systems
- Process Control
- Utility Power Control Rooms
- Computerized POS Systems
- Life Support Systems
- Mobile Broadcasting Equipment

SPECIFICATIONS

Line Voltage Regulation:
±3.3% maximum for series 73000
±5% maximum for series 75000
±7% maximum for series 77000

Efficiency:
98% minimum

Operating Temperature:
0°C to 50°C

Temperature Coefficient:
0.05%/°C maximum

Output Distortion:
No spike; adds less than 0.1% Total Harmonic Distortion

Response Time:
1 cycle maximum

Operating Frequency:
47-63 Hz, sine wave

Load Regulation:
Less than 1% from no load to full load

SIZES (Inches/Centimeters)

	HEIGHT		WIDTH		DEPTH	
	(in.)	(cm.)	(in.)	(cm.)	(in.)	(cm.)
A	5.25	13	7.5	19	12.0	30
B	6.31	16	8.38	21	9.0	23
C	6.31	16	8.38	21	10.0	25
D	6.31	16	8.38	21	10.25	26
E	6.31	16	8.38	21	11.0	28
F	6.31	16	8.38	21	11.5	29
G	18.0	46	14.0	36	9.0	23
H	6.31	16	8.38	21	11.88	30
I	6.31	16	8.38	21	12.75	32
J	6.31	16	8.38	21	15.5	39
K	7.88	20	29.5	75	13.0	33
L	7.88	20	29.5	75	13.25	34
M	7.88	20	29.5	75	14.0	36
N	7.88	20	29.5	75	14.5	37
O	18.0	46	49.25	125	10.5	27
P	7.88	20	29.5	75	12.0	30
Q	7.88	20	29.5	75	14.9	38
R	7.88	20	29.5	75	15.75	40
S	7.88	20	29.5	75	18.5	47
T	47.0	119	42.0	107	28.0	71
U	6.31	16	8.38	21	9.31	24

SHORT FORM CATALOG page 2

TOPAZ SOLUTIONS TO POWER PROBLEMS
ELECTRONICS
3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

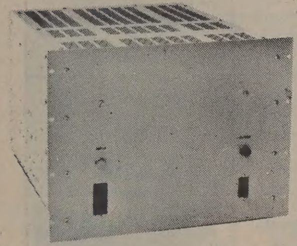
DC to AC SINE WAVE INVERTERS FREQUENCY CONVERTERS

200 VA to 30 kVA

GZ & FZ SERIES

Input Protection:
High and low voltage
Reverse polarity
Static Regulation:
Line Regulation: ±1% maximum for line variations between low line and high line, at half load.
Load Regulation: ±2% maximum for load variations between no load and full load, at nominal line.

Frequency Stability:
±0.5% of fixed frequency; ±0.01% optional
Output Protection:
Overload and short circuit
Total Harmonic Distortion:
Less than 5% at full load and nominal line
Operating Temperature:
-10° C to +55° C
Inverter Efficiency:
Typically 70% at full load



GX & FX SERIES

Input Protection:
High and low voltage and reverse polarity
Static Regulation:
Line Regulation: ±1% maximum for line variations between low line and high line, at half load.
Load Regulation: ±2% maximum for load variations between no load and full load, at nominal line.

Frequency Stability:
±0.5% of fixed frequency; ±0.05% optional
Output Protection:
Overload and short circuit
Total Harmonic Distortion:
Less than 5% at full load and nominal line
Operating Temperature:
-10° C to +55° C
Inverter Efficiency:
Typically 75% at full load
Recovery Time:
50 milliseconds for 20% load change

INPUT SPECIFICATIONS:

Nominal Input Voltage	Product Series	Voltage Range
12/24 VDC	GZ	11 to 15 or 22 to 30
28 VDC	GZ	24 to 32
48 VDC	All	42 to 56
125 VDC	All	105 to 140
250 VDC	GX	210 to 280
115 VAC	FZ	100 to 125
115 VAC	FX	105 to 125
208 V, 3ϕ	FX	190 to 225
230 VAC	FZ & FX	200 to 250
240 V, 3 ϕ	FX	220 to 260

INPUT FREQUENCY RANGES:

FZ	45 to 500 Hz (50 and 60 Hz Models)
FZ	45 to 65 Hz (400 Hz Models)
FX	48 to 420 Hz

SIZES (Inches)

Code	Height	Width	Depth	Code	Height	Width	Depth
C	7	19	13	K	21	19	21
D	7	19	18½	L	62	23¼	31
E	14	19	13	M	83¼	23¼	31
F	14	19	21	N	62	69¼	31
G	14	19	18½	O	62	93	31

OPTIONS AND ACCESSORIES

- Precision frequency control
- External frequency and phase synchronization
- Voltage and/or current meters
- Automatic restart
- Static transfer switches

INVERTERS

Output VA	Product Series	Input Voltage	Output Frequency	Output Voltage	Size	Weight (Lbs.)
50 Hz Output Inverters, Single-phase						
200	GZ	12/24, 28, 48 or 125*	50	115/230	C	39
400	GZ	12/24, 28, 48 or 125*	50	115/230	C	65
800	GZ	12/24, 28, 48 or 125*	50	115/230	C	95
1,600	GZ	12/24 or 28*	50	115/230	E	190
2,000	GX	48 or 125*	50	115 or 230*	F	185
2,400	GZ	12/24 or 28*	50	115/230	J	285
4,000	GX	48 or 125*	50	115 or 230*	K	265
8,000	GX	125 or 250*	50	115 or 230*	L	700
50 Hz Output Inverters, Three-phase						
6,000	GX	48 or 125*	50	400	L	630
12,000	GX	125	50	400	M	895
24,000	GX	250	50	400	N	2100
60 Hz Output Inverters, Single-phase						
250	GZ	12/24, 28, 48 or 125*	60	115	C	39
500	GZ	12/24, 28, 48, 125*	60	115	C	65
1,000	GZ	12/24, 28, 48, 125* (250)	60	115 or 115/230*	C[D]	95
1,500	GZ	12/24, 28, 48 or 125*	60	115	E	160
2,000	GZ	12/24 or 28*	60	115 or 115/230*	E	190
2,500	GX	48 or 125*	60	115 or 230*	F	185
3,000	GZ	12/24 or 28*	60	115 or 115/230*	J	285
5,000	GX	48 or 125*	60	115 or 230*	K	265
10,000	GX	125 or 250*	60	115 or 230*	L	700
60 Hz Output Inverters, Three–phase						
7,500	GX	48 or 125*	60	208 or 400*	L	630
15,000	GX	125	60	208 or 400*	M	895
30,000	GX	250	60	208 or 400*	N	2100
400 Hz Output Inverters, Single-phase						
250	GZ	12/24, 28	400	115	C	29
500	GZ	12/24, 28	400	115	C	45
1,000	GZ	12/24, 28	400	115	C	55
2,000	GZ	12/24 or 28*	400	115	E	110
2,500	GX	125	400	115	F	130
3,000	GZ	12/24 or 28**	400	115	J	165
5,000	GX	125	400	115	K	185
10,000	GX	125	400	115	L	505
400 Hz Output Inverters, Three-phase						
7,500	GX	125	400	200Y/115	L	465
15,000	GX	125	400	200Y/115	M	655

*Specify with order.
☐All three-phase outputs are wye connected. Output voltages are 208Y/120VAC and 400Y/230VAC respectively for models with output voltages listed as 208VAC and 400VAC.

FREQUENCY CONVERTERS

Output VA	Product Series	Input Voltage	Output Frequency	Output Voltage	Size	Weight (Lbs.)
50 Hz Output Frequency Converters, Single-phase						
200	FZ	115	50	115/230	C	45
200	FZ	230	50	115/230	C	58
400	FZ	115	50	115/230	D	73
400	FZ	230	50	115/230	D	86
800	FZ	115	50	115/230	D	110
800	FZ	230	50	115/230	D	135
1,600	FZ	115	50	115/230	G	220
1,600	FZ	230	50	115/230	G	270
2,000	FX	115, 208, 230 or 240*	50	115 or 230*	F	240
2,400	FZ	115	50	115/230	H	330
2,400	FZ	230	50	115/230	H	405
4,000	FX	115, 208, 230 or 240*	50	115 or 230*	K	325
8,000	FX	115, 208, 230 or 240*	50	115 or 230*	L	850
50 Hz Output Frequency Converters, Three-phase						
6,000	FX	115, 208, 230 or 240*	50	400	L	800
12,000	FX	208, 230 or 240*	50	400	M	1075
24,000	FX	208 or 240*	50	400	O	2550
60 Hz Output Frequency Converters, Single-phase						
250	FZ	115	60	115	C	45
250	FZ	230	60	115	C	58
500	FZ	115	60	115	D	73
500	FZ	230	60	115	D	86
1,000	FZ	115	60	115 or 115/230*	D	110
1,000	FZ	230	60	115 or 115/230*	D	135
2,000	FZ	115	60	115 or 115/230*	G	220
2,000	FZ	230	60	115 or 115/230*	G	270
2,500	FX	115, 208, 230 or 240*	60	115 or 230*	F	240
3,000	FZ	115	60	115 or 115/230*	H	330
3,000	FZ	230	60	115 or 115/230*	H	405
5,000	FX	115, 208, 230 or 240*	60	115 or 230*	K	325
10,000	FX	115, 208, 230 or 240*	60	115 or 230*	L	850
60 Hz Output Frequency Converters, Three-phase						
7,500	FX	115, 208. 230 or 240*	60	208 or 400*	L	800
15,000	FX	208, 230 or 240*	60	208 or 400*	M	1075
30,000	FX	208 or 240*	60	208 or 400*	O	2750
400 Hz Output Frequency Converters, Single-phase						
250	FZ	115	400	115	C	35
250	FZ	230	400	115	C	48
500	FZ	115	400	115	D	53
500	FZ	230	400	115	D	66
1,000	FZ	115	400	115	D	70
1,000	FZ	230	400	115	D	95
2,000	FZ	115	400	115	G	140
2,000	FZ	230	400	115	G	190
2,500	FX	115, 208, 230 or 240*	400	115	F	165
3,000	FZ	115	400	115	H	210
3,000	FZ	230	400	115	H	285
5,000	FX	115, 208, 230 or 240*	400	115	K	260
10,000	FX	208, 230 or 240*	400	115	L	650
400 Hz Output Frequency Converters, Three-phase						
7,500	FX	115, 208, 230 or 240*	400	200Y/115	L	550
15,000	FX	208, 230 or 240*	400	200Y/115	M	900
30,000	FX	208 or 240*	400	200Y/115	O	2000

POWERMAKER INVERTERS

Versatile 300 VA, 60 Hz square wave inverter. Models available for operation from 12 VDC, 24 VDC and 48 VDC. 50 Hz models available.

AUTOMATIC POWER SYSTEM
TOPAZ

Model Number	Input Voltage
315-B-12	12VDC
315-B-24	24VDC
315-B-48	48VDC

SHORT FORM CATALOG page 3

TOPAZ SOLUTIONS TO POWER PROBLEMS
ELECTRONICS
3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

UNINTERRUPTIBLE POWER SYSTEMS

300 VA to 15 kVA

SPECIFICATIONS:

INVERTER OUTPUT

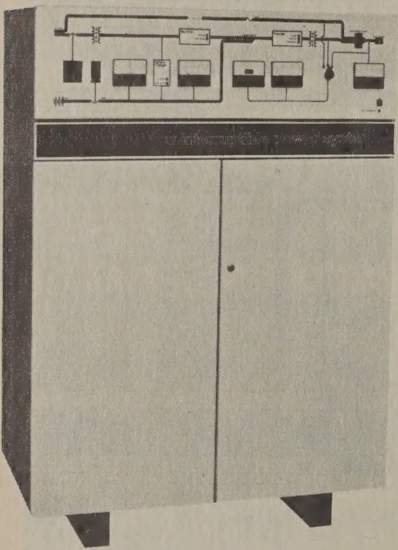
Sinusoidal, with 5% total harmonic distortion.
10% voltage overshoot/undershoot for 20% instantaneous load change.

PROTECTION

Input power has fuse or circuit breaker protection.
Undervoltage protection on all inverters.
Reverse polarity protection on all inverters.
Current limiting on all chargers.
Overload and short-circuit protection on all inverters.

AUTOMATIC LOAD TRANSFER

25 millisecond transfer (typical). Panel light indicates that load is powered by the ac line.
4 millisecond switch optional most models.



81000 SERIES 3 kVA-15 kVA
NEMA Type 2 Enclosures

82000 SERIES 500 VA-1500 VA
Rack Mount Type

SQUARE WAVE 300 VA

STANDARD MODELS

Output Power (VA)	System Part Number	Input		Output			Freq. Hz	Battery	Full load Backup Time	Recharge Time or Battery Charging Current	Size (Inches)	Approximate Weight
		Vac	Phase	Vac	Phase	Current						
500	3151-1	115	1	115	1	4.3A	60	Internal 72V (Note 1)	12 minutes minimum 15 minutes typical	Half charge in 3 hours	19″ rack mount 12.25″ H. 19″ D.	140 lbs.
	3151-5	115	1	115	1	4.3A	60	Internal 72V (Note 1)	55 minutes minimum 65 minutes typical	Half charge in 3 hours	19″ rack mount 12.25″ H. 19″ D.	190 lbs.
	82195	115	1	115	1	4.3A	60	External 72V (Note 2)	Dependent on batteries	6 Amperes	19″ rack mount 8.75″ H. 20″ D.	100 lbs. Plus batteries
1,000	3152-9	115	1	115	1	8.7A	60	Internal 72V (Note 1)	6 minutes minimum 7 minutes typical	Half charge in 3 hours	19″ rack mount 12.25″ H. 19″ D.	170 lbs.
	3152-1	115	1	115	1	8.7A	60	Internal 72V (Note 1)	25 minutes minimum 35 minutes typical	Half charge in 3 hours	19″ rack mount 12.25″ H. 19″ D.	210 lbs.
	82101	115	1	115	1	8.7A	60	External 72V (Note 2)	Dependent on batteries	6 Amperes	19″ rack mount 8.75″ H. 20″ D.	125 lbs. Plus batteries
1,500	82102	115	1	115	1	13.0A	60	External 72V (Note 2)	Dependent on batteries	12 Amperes	19″ rack mount 8.75″ H. 20″ D.	146 lbs. Plus batteries
2,000	2517-1	115	1	115	1	17.4A	60	External 120V (Note 2)	Dependent on batteries	5 Amperes	19″ rack mount 14″ H. 21″ D.	235 lbs. Plus batteries
3,000	2534-1	115	1	115	1	26.0A	60	External 48V (Note 2)	Dependent on batteries	25 Amperes	Cabinet with casters 37″ H. 24″ W. 27″ D.	425 lbs. Plus batteries
	2534-2	230	1	230	1	13.0A	60					
	2534-3	115	1	115	1	26.0A	60	External 120V (Note 2)		10 Amperes		
	2534-4	230	1	230	1	13.0A	60					
	81103	120	1	120	1	25.0A	60	External 120V (Note 2)	Dependent on batteries	8 Amperes	NEMA Type 2 Enclosure 60″ H. 42″ W. 24″ D.	800 lbs. Plus batteries
	81403	240	1	240	1	13.0A	60					
	81203	220	1	220	1	13.6A	50					
5,000	2520-1	115	1	115	1	43.5A	60	External 120V (Note 2)	Dependent on batteries	20 Amperes	Cabinet 55″ H. 24″ W. 25″ D.	700 lbs. Plus batteries
	2520-2	230	1	230	1	21.7A	60					
	81105	120	1	120	1	42.0A	60	External 120V (Note 2)	Dependent on batteries	12 Amperes	NEMA Type 2 Enclosure 60″ H. 42″ W. 24″ D.	950 lbs. Plus batteries
	81405	240	1	240	1	21.0A	60					
	81205	220	1	220	1	22.7A	50					
7,500	81507	208Y/120	3	120	1	65.0A	60	External 120V (Note 2)	Dependent on batteries	18 Amperes	NEMA Type 2 Enclosure 60″ H. 42″ W. 24″ D.	1200 lbs. Plus batteries
	81407	240	1	240	1	32.5A	60					
10,000	81510	208Y/120	3	120	1	83.0A	60	External 120V (Note 2)	Dependent on batteries	24 Amperes	NEMA Type 2 Enclosure 72″ H. 52″ W. 24″ D.	1500 lbs. Plus batteries
	81410	240	1	240	1	42.0A	60					
	81210	220	1	220	1	45.4A	50					
	81610	380Y/220	3	220	1	45.4A	50					
15,000	81515	208Y/120	3	120	1	125.0A	60	External 120V (Note 2)	Dependent on batteries	36 Amperes	NEMA Type 2 Enclosure 72″ H. 52″ W. 24″ D.	1800 lbs. Plus batteries
	81415	240	1	240	1	63.0A	60					
	81215	220	1	220	1	68.2A	50					
	81615	380Y/220	3	220	1	68.2A	50					

Notes: 1. Sealed internal batteries are supplied as part of this model. External batteries may be connected in parallel with the internal batteries, thus extending the backup and recharge times. Battery information is available on request.
2. External batteries are not supplied with the basic system. External batteries may be procured from Topaz with the basic system or purchased from another source.
3. Backup times for internal batteries are specified for 25°C operation. Shorter times can be expected at lower temperatures.

ALSO AVAILABLE: Low Cost 300 VA Models

300	9234*	120	1	120	1	2.6A	60	External 12V (Note 2)	Dependent on battery	3 Amperes	7″ H. 7″ W. 5.5″ D.	13 lbs. Plus battery
300	2645-1*	120	1	120	1	2.6A	60	Internal	10 minutes minimum 12 minutes typical	24 hours full charge	9.5″ H. 8.5″ W. 16.0″ D.	36 lbs.
300	2645-2*	120	1	120	1	2.6A	60	Internal	27 minutes minimum 35 minutes typical	24 hours full charge	9.5″ H. 8.5″ W. 16.0″ D.	53 lbs.

*The 300VA models are square wave output, off-line forward transfer UPS. They are low cost alternatives for many less critical applications. They contain no meters.

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LG 66
February 1977
Supersedes LG 63

TOPAZ SOLUTIONS TO POWER PROBLEMS
ELECTRONICS

3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

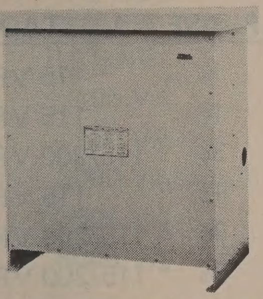
ULTRA-ISOLATION NOISE-SUPPRESSION TRANSFORMERS

125 VA to 130 kVA

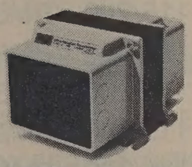
PROTECT SENSITIVE EQUIPMENT FROM POWER LINE NOISE

Featuring:

- **Clean, Noise-Free Power Output**
- **Unique Triple Box Shielded Design**
- **Low Coupling Capacitance**
- **Guaranteed Performance**
- **Topaz Quality**



ENCASED TYPE, available in 75 to 130 kVA ratings, three-phase



ENDBELL TYPE, available in ratings from 125 VA through 5 kVA single phase

LINE CORD/RECEPTACLE TYPE, available in ratings from 125 VA through 2.4 kVA

APPLICATIONS

- Isolating sensitive equipment from noisy power lines
- Isolating noisy equipment from sensitive equipment sharing the same power line
- Minimizing common-mode noise
- Minimizing transverse-mode noise resulting from common-mode noise at the input
- Complete electrostatic shielding

Many of today's electronic equipment and systems are sensitive to line voltage transients and spikes caused by utility feeder switching, lightning, air conditioning and other sources of noise. Topaz Ultra-Isolation Transformers prevent these transients from reaching sensitive equipment. A unique box shielding technique reduces capacitive coupling from primary to secondary to less than 0.0005 picofarads. This low capacitive coupling provides a common-mode noise rejection ratio of over ten million to one.

A full line of single-phase and three-phase models is available from 125 VA to 130 kVA. Topaz Ultra-Isolation Transformers may be used alone or in conjunction with Topaz AC Line Regulators.

TYPICAL EQUIPMENT AND SYSTEMS USING TOPAZ ULTRA-ISOLATION TRANSFORMERS

- Computers and Computer Peripherals
- Instrumentation
- Process Control
- Digital Communications
- Telemetry
- Audio and Video Recording

STANDARD ULTRA-ISOLATION TRANSFORMERS

SINGLE-PHASE MODELS—All Topaz standard endbell type and encased type Ultra-Isolation Transformers are manufactured with dual-voltage primary and secondary windings and are rated for operation at either 50 or 60 Hz. For maximum versatility, the dual-voltage windings permit hookup in any combination of the listed voltages—one to one, step-up or step-down. Single-phase transformers are available in three styles:

TERMINAL STYLE: Available in all power ratings. Transformers are supplied with terminals or lugs for direct-wired installations. Wiring instructions are included with each transformer.

LINE CORD/RECEPTACLE STYLE: Available on models with power ratings through 2.5 kVA. Transformers are supplied prewired in a 120 V-120 V configuration. There is a plug on the six foot input line cord and a standard 120V receptacle on the secondary.

125 VA through 500 VA models have a NEMA 5-15P plug attached to the input cord and a NEMA 5-15R output receptacle.

1 kVA models have a NEMA 5-15P input plug and a duplex NEMA 5-15R output receptacle.

2.4 kVA models are limited to 20 amperes input and have a NEMA L5.20P twist lock input plug and a duplex NEMA 5-15R output receptacle.

THREE-PHASE MODELS— Standards models are available prewired for specified operating voltages.

NON-STANDARD ULTRA-ISOLATION TRANSFORMERS—The following list includes all standard transformers. Transformers can be designed and manufactured to suit a full range of special requirements. Please contact Topaz for additional information.

Typical Specifications: Standard 50/60 Hz Single-Phase Models

Common-Mode Noise Attenuation: .005 pF—126 dB; .001 pF—140 dB; .0005 pF—146 dB

DC Isolation: 1000 megohms winding-to-winding and winding-to-ground

Dielectric Strength: 1000 VAC minimum

Electromagnetic Noise: Less than 0.11 Gauss (20 dB) at 18″ distance

Operating Voltages: To 110% of nominal

Operating Frequency: 50/60 Hz

Other Models Available: 400 Hz

POWER RATING	PRIMARY VAC (Nominal)	SECONDARY VAC (Nominal)	FREQ. Hz	PART NUMBERS						% Reg.**	DIMENSIONS (inches/centimeters)					APPROX. WEIGHT (lbs/kg)
				TERMINAL STYLE			LINE CORD/RECEPTACLE STYLE				H	W	D	MW	MD	
				EFFECTIVE COUPLING CAPACITANCE			EFFECTIVE COUPLING CAPACITANCE									
				.005 pF	.001 pF	.0005 pF	.005 pF	.001 pF	.0005 pF		in. cm.	in. cm.	in. cm.	in. cm.	in. cm.	
SINGLE-PHASE MODELS																
125 VA	120/240	120/240	50/60	91091-11	91091-21	91091-31	91091-12	91091-22	91091-32	3	4.4/11	7.0/18	7.9/20	6.2/16	2.6/7	11.5/5
250 VA	120/240	120/240	50/60	91092-11	91092-21	91092-31	91092-12	91092-22	91092-32	3	4.4/11	7.0/18	8.2/21	6.2/16	3.0/8	14.0/6
500 VA	120/240	120/240	50/60	91095-11	91095-21	91095-31	91095-12	91095-22	91095-32	3	4.4/11	7.0/18	9.4/24	6.2/16	4.0/10	20.5/9
1 kVA	120/240	120/240	50/60	91001-11	91001-21	91001-31	91001-12	91001-22	91001-32	3	6.3/16	8.4/21	10.0/25	7.2/18	3.5/9	38.0/17
△2.5 kVA	120/240	120/240	50/60	91002-11	91002-21	91002-31	91002-12	91002-22	91002-32	3.5	6.3/16	8.4/21	11.8/30	7.2/18	5.2/13	57.5/26
5 kVA	120/240	120/240	50/60	91005-11	91005-21	91005-31				3	6.3/16	8.4/21	14.2/36	7.2/18	5.2/13	90.5/41
5 kVA	240/480	120/240	50/60	91105-11	91105-21	91105-31				3	6.3/16	8.4/21	14.2/36	7.2/18	6.0/15	90.5/41
10 kVA	240/480	120/240	50/60	93110-11	93110-21	93110-31				4	22.8/58	15.1/38	14.1/36			222/101
15 kVA	240/480	120/240	50/60	93115-11	93115-21	93115-31				4	22.8/58	15.1/38	14.1/36			269/122
20 kVA	240/480	120/240	50/60	93120-11	93120-21	93120-31				3	22.8/58	15.1/38	14.1/36			332/151
THREE-PHASE MODELS																
3 kVA	208Y/120	208Y/120	50/60	91403-11	91403-21	91403-31				3	7.8/20	34.6/88	10.0/25	33.1/84	3.8/10	139/63
3 kVA	240	208Y/120	50/60	91503-11	91503-21	91503-31				3	7.8/20	34.6/88	10.0/25	33.1/84	3.8/10	139/63
7.5 kVA	208Y/120	208Y/120	50/60	91407-11	91407-21	91407-31				3.5	7.8/20	34.6/88	11.8/30	33.1/84	5.5/14	198/90
7.5 kVA	240	208Y/120	50/60	91507-11	91507-21	91507-31				3.5	7.8/20	34.6/88	11.8/30	33.1/84	5.5/14	198/90
15 kVA	208Y/120	208Y/120	50/60	91415-11	91415-21	91415-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
15 kVA	240	208Y/120	50/60	91515-11	91515-21	91515-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
15 kVA	480	208Y/120	50/60	91615-11	91615-21	91615-31				3	7.8/20	34.6/88	14.2/36	33.1/84	8.0/20	296/134
30 kVA	208Y/120	208Y/120	50/60	93430-11	93430-21	93430-31				4	23.8/60	53.0/135	14.1/36			766/347
30 kVA	240	208Y/120	50/60	93530-11	93530-21	93530-31				4	23.8/60	53.0/135	14.1/36			766/347
30 kVA	480	208Y/120	50/60	93630-11	93630-21	93630-31				4	23.8/60	53.0/135	14.1/36			766/347
45 kVA	208Y/120	208Y/120	50/60	93445-11	93445-21	93445-31				4	23.8/60	53.0/135	14.1/36			928/421
45 kVA	240	208Y/120	50/60	93545-11	93545-21	93545-31				4	23.8/60	53.0/135	14.1/36			928/421
45 kVA	480	208Y/120	50/60	93645-11	93645-21	93645-31				4	23.8/60	53.0/135	14.1/36			928/421
75 kVA	208	208Y/120	60	94775-11	94775-21	94775-31				2	47.0/119	42.0/107	28.0/71			1160/526
75 kVA	240	208Y/120	60	94575-11	94575-21	94575-31				2	47.0/119	42.0/107	28.0/71			1160/526
75 kVA	480	208Y/120	60	94675-11	94675-21	94675-31				2	47.0/119	42.0/107	28.0/71			1160/526
100 kVA	208	208Y/120	60	94780-11	94780-21	94780-31				2	47.0/119	42.0/107	28.0/71			1469/666
100 kVA	240	208Y/120	60	94580-11	94580-21	94580-31				2	47.0/119	42.0/107	28.0/71			1469/666
100 kVA	480	208Y/120	60	94680-11	94680-21	94680-31				2	47.0/119	42.0/107	28.0/71			1469/666
130 kVA	208	208Y/120	60	94785-11	94785-21	94785-31				2	47.0/119	42.0/107	28.0/71			1820/826
130 kVA	240	208Y/120	60	94585-11	94585-21	94585-31				2	47.0/119	42.0/107	28.0/71			1820/826
130 kVA	480	208Y/120	60	94685-11	94685-21	94685-31				2	47.0/119	42.0/107	28.0/71			1820/826

**Regulation is specified in percent voltage change from no load to full resistive load.
△ Line Cord/Receptacle Type Rated 20A Maximum (2.4 kVA)

Printed in U.S.A.

Unitron

FREQUENCY CONVERTERS
1 KA to 75 KVA SINE WAVE
50/60 Hz to 400 Hz

Unitron

GENERAL SPECIFICATIONS

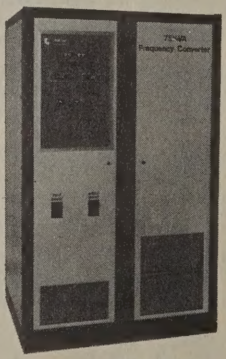
POWER RATING	INPUT PHASE & VOLTAGE		OUTPUT PHASE & VOLTAGE	
1.0 KVA	1ϕ	115 VRMS	1ϕ	* 115 VRMS
2.0 KVA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
2.5 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
3.5 KVA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
5.0 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
7.5 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
10.0 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
12.5 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
15.0 KVA	3ϕ	115/200 VRMS	3ϕ	* 115/200 VRMS
50.0 KVA	3ϕ	* 115/200 VRMS	3ϕ	* 115/200 VRMS
67.5 KVA	3ϕ	* 115/200 VRMS	3ϕ	* 115/200 VRMS
75.0 KVA	3ϕ	* 115/200 VRMS	3ϕ	* 115/200 VRMS

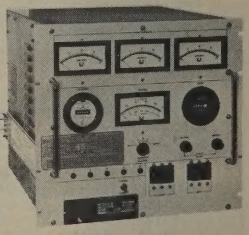
* Available in other standard voltages

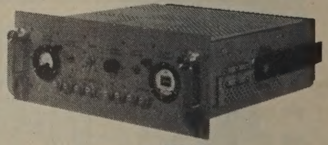
Unitron has supplied its products and services to meet the requirements of virtually every type of power application existing in todays world of modern technology, from commercial applications to the most exacting military requirements.

FEATURES:

- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTED
- LIGHT WEIGHT
- RFI PROTECTION
- HIGH EFFICIENCY
- LOW DISTORTION
- LOW AUDIO NOISE
- LONG MAINTENANCE FREE OPERATION
- SHORT CIRCUIT & OVERLOAD PROTECTION


75 KVA


5.0 KVA


1 KVA

APPLICATIONS:

SHIPBOARD ■ SHELTERS ■ GROUND SUPPORT ■ SIMULATORS ■ AVIONICS TEST & REPAIR ■ LABORATORIES ■ Wherever precision power is required.

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UPS Systems / Inverters / Frequency Converters

Unitron

FREQUENCY CONVERTERS
400 to 8000 VA SINE WAVE
400 Hz to 60 Hz

Unitron

GENERAL SPECIFICATIONS

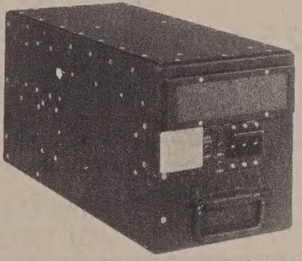
POWER RATING	INPUT		OUTPUT	
	PHASE	VOLTAGE	PHASE	VOLTAGE
400 VA	3φ	115/200 VRMS	1φ	115 VRMS
750 VA	3φ	115/200 VRMS	1φ	115 VRMS
* 2000 VA	3φ	115/200 VRMS	1φ	115 VRMS
* 3500 VA	3φ	115/200 VRMS	1φ	115 VRMS
8000 VA	3φ	115/200 VRMS	1φ	115 VRMS

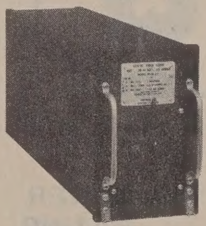
* Available in 50 Hz output

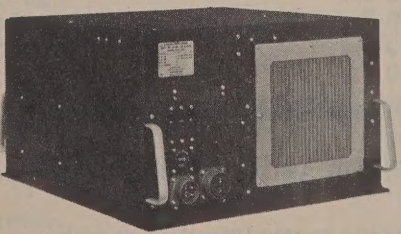
UNITRON IS THE LEADING MFG. OF 400 TO 60 Hz FREQUENCY CONVERTERS, WITH EXPERIENCE **EXCEEDING 18,000,000 HOURS OF FIELD OPERATION** IN AIRBORNE ☐ SHIPBOARD ☐ TRANSPORTABLE SHELTERS & GROUND POWER ENVIRONMENTS.

FEATURES:

- ■ **MIL SPECIFICATIONS (Standard power)**
- ■ **FEDERAL & NATIONAL STOCK LISTED**
- ■ **LIGHT WEIGHT**
- ■ **LOW DISTORTION**
- ■ **PRECISE FREQUENCY**
- ■ **FULLY PROTECTED**
- ■ **SINE WAVE OUTPUT**
- ■ **HIGH EFFICIENCY**
- ■ **LOW AUDIO NOISE**
- ■ **SELF COOLED**
- ■ **LONG MAINTENANCE FREE OPERATION**
- ■ **2000 + NOW IN AIRBORNE OPERATION**
- ■ **HIGH RELIABILITY**
- ■ **LOW COST**


3.5 KVA


400 VA


8.0 KVA

APPLICATIONS: AIRBORNE ■ COMPUTERS ■ VIDEO SYS. ■ TELETYPE ■ CONVIENCE ITEMS ■ MOVIE PROJECTOR ■ RECORDERS ■ TRASH COMPACTORS ■ TEST EQUIPMENT ■ DATA ACQUISTION ■ ETC. ■ **SHIPBOARD ■ GROUND & AIR TRANSPORTABLE SHELTERS ■ FLYING LABORATORIES ■ MEDICAL EVACUATION** ■ THERMAL BLANKETS ■ EKG'S ■ BREATHING APPARATUS ■ LIFE SUPPORT ■

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UPS Systems / Inverters / Frequency Converters

Unitron

STATIC INVERTERS
250 to 3600 VA SINE WAVE
28 VDC to 60 Hz

Unitron

GENERAL SPECIFICATIONS

POWER RATING	INPUT VOLTAGE	OUTPUT PHASE	OUTPUT VOLTAGE
250 VA	24–32 VDC	1ϕ	115 VRMS
500 VA	24–32 VDC	1ϕ	115 VRMS
2000 VA	24–32 VDC	1ϕ	115 VRMS
3600 VA	24–32 VDC	1ϕ	115 VRMS

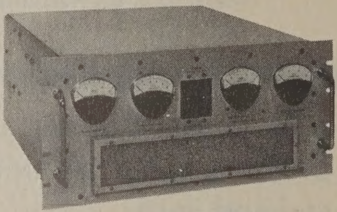
APPLICATIONS:

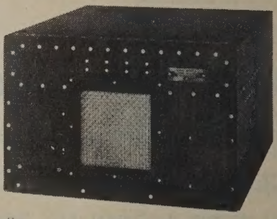
AIRBORNE ☐ SHIPBOARD ☐ MOBILE ☐ FLYING LABORATORIES ☐ MEDICAL EVACUATION

These instruments provide an excellent source of 60 Hz power for cryptographic machines—teletypes—recorders and various test equipment.

FEATURES:

- MIL SPECIFICATIONS
- FEDERAL & NATIONAL STOCK LISTED
- HIGH EFFICIENCY
- LOW DISTORTION
- FULLY PROTECTED
- RFI PROTECTION
- LOW AUDIO NOISE
- LONG MAINTENANCE FREE OPERATION


2000 VA


3600 VA

Unitron

STATIC INVERTERS
125 to 3000 VA SINE WAVE OUTPUT
28 VDC to 400 Hz

Unitron

GENERAL SPECIFICATIONS

POWER RATING	INPUT VOLTAGE	OUTPUT PHASE	OUTPUT VOLTAGE
125 VA	24–32 VDC	1ϕ	115 VRMS
250 VA	24–32 VDC	1ϕ	115 VRMS
500 VA	24–32 VDC	1ϕ	115 VRMS
750 VA	24–32 VDC	3ϕ	115 VRMS
3000 VA	24–32 VDC	3ϕ	115 VRMS

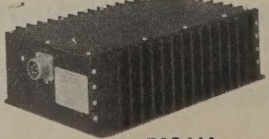
APPLICATIONS:

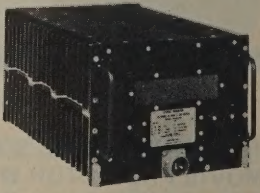
AIRBORNE ☐ SHIPBOARD ☐ MOBILE ☐ Wherever 400 Hz is required from dc buss.

FEATURES:

- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTED
- HIGH EFFICIENCY
- LOW AUDIO NOISE
- LOW DISTORTION
- RFI PROTECTION
- STABLE OUTPUT VOLTAGE & FREQUENCY
- LIGHT WEIGHT
- FULLY PROTECTED
- LONG MAINTENANCE FREE OPERATION

250 VA


500 VA


750 VA

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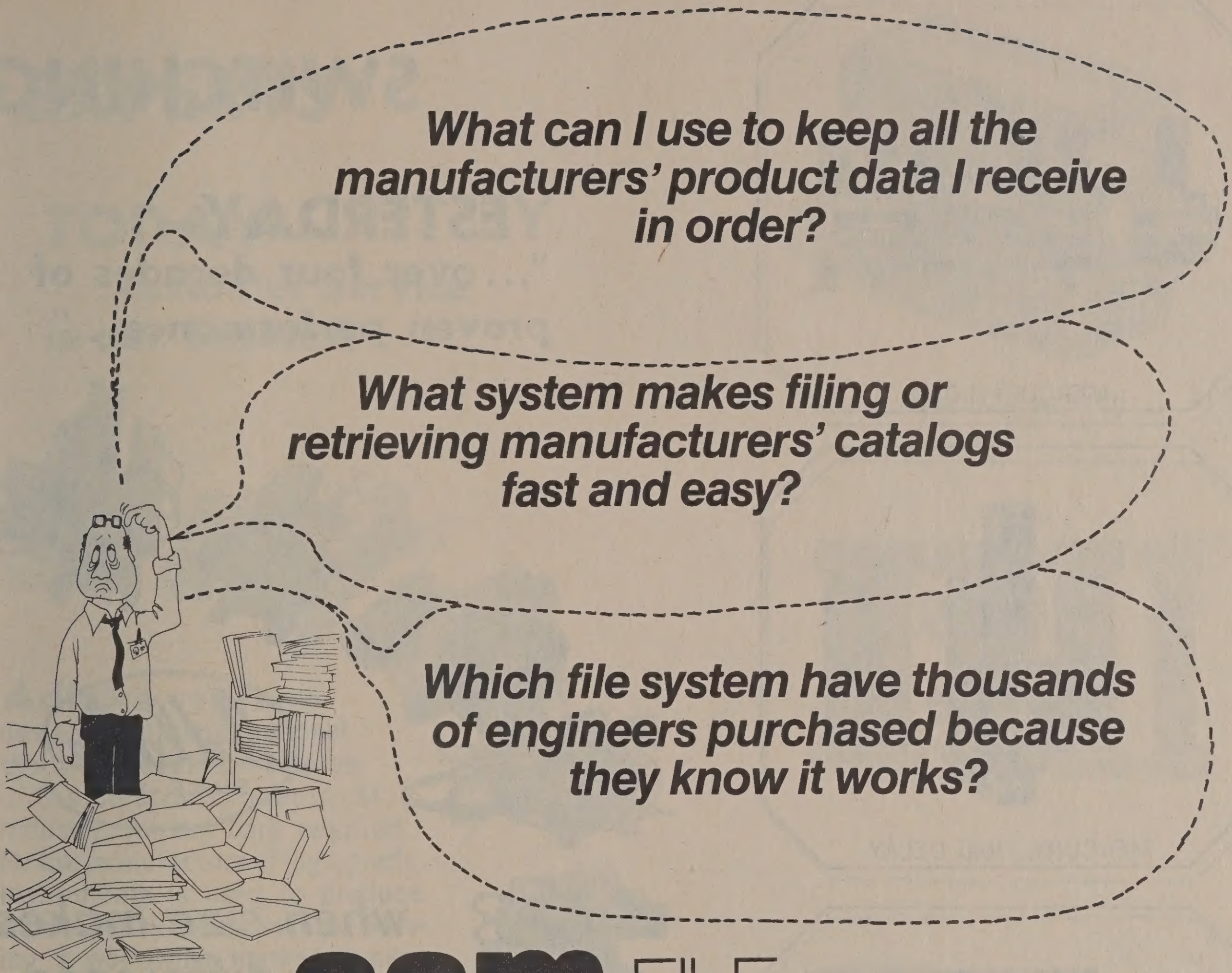
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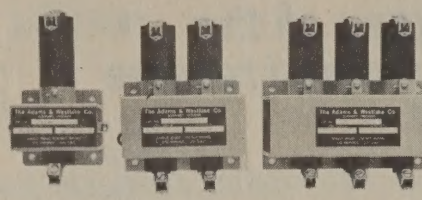
The Adams & Westlake Co.
The Adams & Westlake Co.
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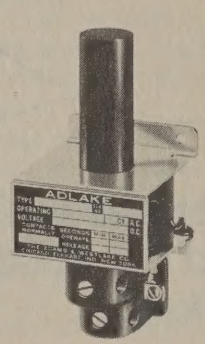
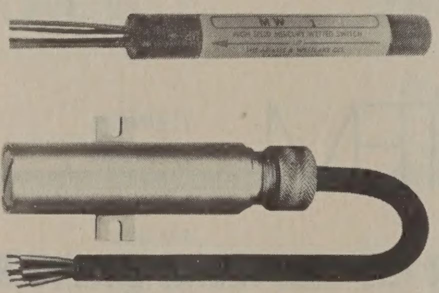
MERCURY LOAD


ADLAKE
TYPE
OPERATING VOLTAGE
CONTACTS NORMALLY
SECONDS
OPERATE
RELEASE
A.C.
D.C.
THE ADAMS & WESTLAKE CO.

MERCURY TIME DELAY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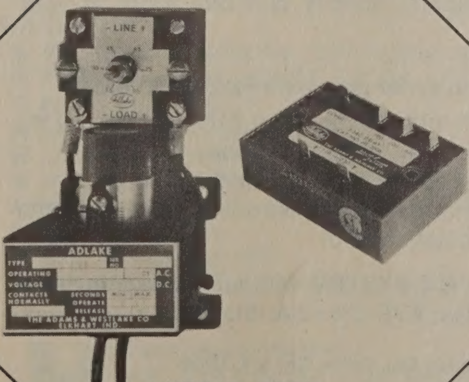
PROXIMITY SWITCH


LINE
LOAD
ADLAKE
TYPE
OPERATING
VOLTAGE
CONTACTS NORMALLY
SECONDS
OPERATE
RELEASE
A.C.
D.C.
THE ADAMS & WESTLAKE CO. ELKHART, IND.

HYBRID SSR's

SWITCHING

YESTERDAY—

"...over four decades of proven performance..."

Adlake
SINCE 1857

when size makes the difference

—Adlake— makes the size

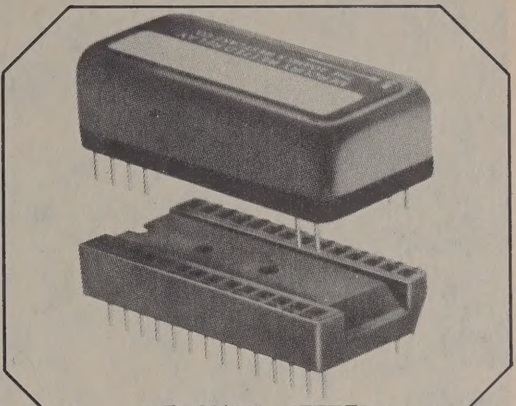
TOMORROW—

"...innovative mercury and solid state technology..."

EXPERTS

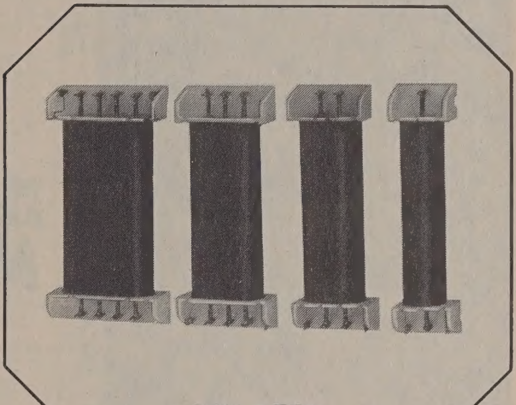
TODAY—

"...customer service is our business..."

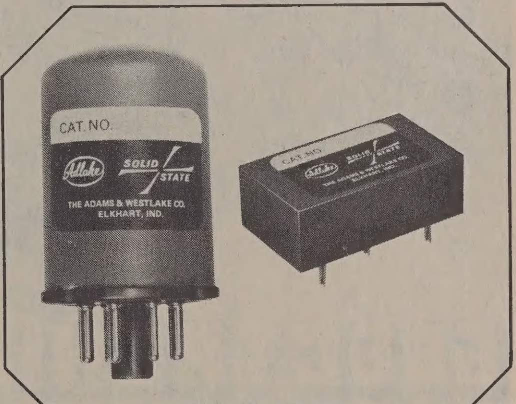


MERCURY WETTED

Adlake relays are designed and built to meet the most exacting demands of the electronic/electrical industry. All the care required for the manufacture of high-grade instruments is used to produce Adlake relay components. Serving a worldwide market through manufacturer's representatives and franchise distributors, the Adams and Westlake Company is ready to supply you with the superior features of long life and quality in relay components.

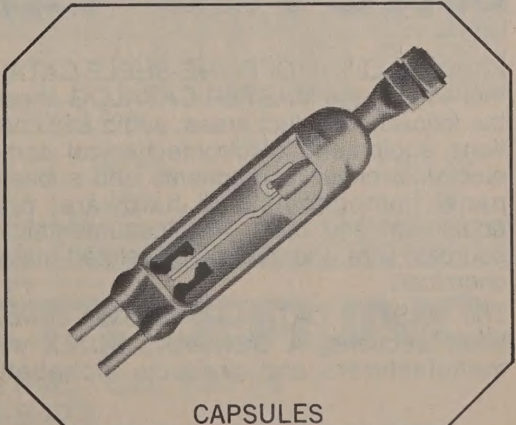


DRY REED



SOLID STATE

The Adams & Westlake Company
1025 N. Michigan Street
Elkhart, Indiana 46514
(219) 264-1141
TELEX 25-8458



CAPSULES

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THE ELECTRONIC DISTRIBUTORS MASTER CATALOG
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FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

YESTERDAY'S RADIO MASTER IS TODAY'S

ELECTRONIC DISTRIBUTORS MASTER CATALOG

Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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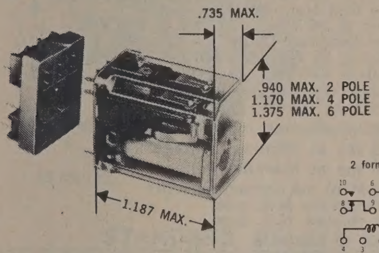
Miniature General Purpose Relays/AZ420 Series

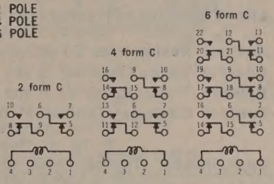
Up to 6PDT Contacts — Dry Circuit to 5 Amp

General purpose miniature relays in plastic dust cover — Interchangeable with other comb-actuated relays — Combination solder and plug-in terminals.

UL-version listed under UL Component Recognition File 43203A
CSA File LR 36664



WIRING DIAGRAM



VIEW TOWARD TERMINALS

ELECTRICAL SPECIFICATIONS

Contact Rating: Noninductive load
Light Duty (Code L): Fine silver goldplated — low level to 2 amps @ 26 VDC or 1 amp @ 115 VAC
Heavy Duty (Code H): Silver cadmium oxide — 5 amp @ 26 VDC or Electrical: 10^6 at rated load
Other contact material available

Life Expectancy: Mechanical Operations: 10^8
Electrical: 10^6 at rated load

Contact Resistance: 50 milliohms max. initially
200 milliohms at end of life

Operate Time: At nominal coil voltage or current $\leq$ 8ms

Release Time: At nominal coil voltage or current $\leq$ 3ms

Contact Bounce: At 10 ma contact current:
2ms typ. at operate, N.O. contacts
3ms typ. at release, N.C. contacts

Dielectric Strength: 1000 Vrms; 500 Vrms across contact gap

Insulation Resistance: 10,000 megohms minimum @ 25°C, 100 VDC, 50% RH; Special insulation with 10^{14} ohms available

Coil Temperature: Max. 105°C (220°F)
Max. continuous coil dissipation 2.3W at 20°C.

Ambient Temperature
Operating: −55°C (−72°F) to 80°C (175°F) @ nominal operating voltage
Storage: −55°C (−72°F) to 105°C (220°F)

Vibration: Operating: .062 DA @ 5-55 Hz; 10 g @ 55-110 Hz
Non-Operating: 10 g @ 5-500 Hz

Shock: Operating: 20 g @ 11ms
Non-Operating: 30 g @ 11ms

Weight: 23 to 35 grams (approx. 1 oz.)

SOCKET ORDER INFORMATION

AZ Type	Description	Use With	Contacts
ST 140-A1	Socket	AZ 420	DPDT
ST 342-A1	Right Angle for PC		DPDT
ST 349-A1	Right Angle for PC		DPDT
ST 140-1	Retainer		DPDT
ST 141-A1	Socket	AZ 421	4PDT
ST 343-A1	Right Angle for PC		4PDT
ST 350-A1	Right Angle for PC		4PDT
ST 141-1	Retainer		4PDT
ST 345-A1	Socket	AZ 431	6PDT
ST 354-A1	Right Angle for PC		6PDT
ST 345-1	Retainer		6PDT
ST 140-2	Ground Clip for all	All	

Order socket, retainer and grounding clip (if desired) by separate part numbers. To specify sockets with gold plated terminals, substitute -A2 for -A1.

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

RELAY ORDER INFORMATION

1. Select basic relay type from Table I
2. Add coil code from Table IIa, b, c, or d
3. Add contact code from Table III
4. Add —US for UL and CSA versions after P/N

FOR EXAMPLE AZ 431 — 80 — 1L
Plug-in type, 6 pole — AZ 431
24 VDC, 430 ohm coil resistance — 80
6 PDT contacts single, light duty — 1L

Table I — Basic Types

Mounting	Configuration 2 Pole	4 Pole	6 Pole
Plug-in/Solder	AZ 420	AZ 421	AZ 431
PC Terminals	AZ 428	AZ 429	AZ 439

Table IIa — Standard DC Voltage Version

Nom. Coil VDC	Must Oper. (Pick-up Max.) VDC	2 or 4 Form C or D Contacts			6 Form C Contacts		
		Max. Cont. VDC	Resist. Ohms ±10%	Coil Code	Max. Cont. VDC	Resist. Ohms ±10%	Coil Code
3	2.25	5	14	21	4.5	11	22
6	4.5	10	52	15	7	25	18
12	9	19	185	1011	14	90	13
18	13	29	430	80	22	230	10
20	16	34	600	08	26	360	09
24	18	37	700	70	29	430	80
26	21	44	1K	07	34	600	08
48	36	70	2.5K	56	59	1.8K	06
72	54	105	5.8K	40	83	3.6K	05
115	86	170	15K	035	130	9K	04

All Values at 20°C.

Table IIb — Sensitive DC Voltage Version

Nom. Coil VDC	Must Oper. VDC	2 Form C or D		4 Form C or D		6 Form A, B or C	
		Resist. Ohms	Coil Code	Resist. Ohms	Coil Code	Resist. Ohms	Coil Code
3	2.25	50	V 15	30	V 18	20	V 19
6	4.5	200	V 10	110	V 12	80	V 13
12	9.0	800	V 70	450	V 80	320	V 09
24	18.0	3.2K	V 50	1.8K	V 05	1.2K	V 60
48	36.0	13K	V 04	7.5K	V 40	5.2K	V 045
72	54.0	28K	V 30	16K	V 035	13K	V 04
115	86.0	50K	V 02	40K	V 025	30K	V 03

Max. Continuous Coil Dissipation 2.3W at 20°C.

Table IIc — Sensitive DC Current Version

Coil Resist. Ohms ±10%	Coil Code	Must Operate Current (mA) 2 Form C or D Pick-up 85mW	4 Form C or D Pick-up 175mW	6 Form A, B or C Pick-up 250mW	Max. Coil Current mA
1K	C 07	8.5	13	16	46
2.5K	C 56	5.4	8.3	10	29
5K	C 045	4.1	6.2	7.2	20
10K	C 408	3.1	4.5	5.0	14
15K	C 035	2.4	3.5	4.2	12
30K	C 03	1.7	2.5	2.9	8.4

Table IId — Standard AC Voltage Version

Nom. Coil VAC	Must Oper. (Pick-up Max.) VAC	Max. Cont. VAC	2 Form C Contacts		4 Form C Contacts	
			Appr. AC Resist.	Coil Code	Appr. AC Resist.	Coil Code
6	5	7.2	75	W16	33	W20
12	9	14.5	300	W11	120	W14
24	18	30	835	W08	480	W09
48	36	60	3.8K	W06	1.9K	W07
115	86	130	15K	W035	11K	W04

Table III — Contact Code

Contact Arrangement	Contact Type Light Duty 1mA to 2 Amp Single Silver Gold Plated	Light Duty Dry Cir. to 2 Amp Bifurcated Silver Gold Plated	Heavy Duty 100mA to 5 Amp Single Silver Cadmium
2 Form C	4L	40L	4H
4 or 6 Form C	1L	10L	1H

*7.5 Amp contacts available.

AMERICAN ZETTLER, INC.
DEPT. EM, 16881 HALE AVE., IRVINE, CA 92714
PHONE (714) 540-4190, TELEX 67-8472

THINPAK® Miniature Relays/AZ1530 Series

Up to 4PDT Contacts — 1, 2 or 5 Amp

For PC Board Mounting — 0.6″ center-to-center
Sealed plastic dust cover on 1 and 2 pole relay.

The AZ miniature THINPAK relay has been designed for applications with either demanding space limitations, such as 0.6″ center-to-center PC card mounting, or operating requirements that cannot be met by reed relays or conventional contact type relays. The high pressure 1, 2, or 5 amp contacts enables the unit to switch capacitance or lamp loads with current spikes that would normally weld the contacts of reed relays. The high sensitivity, long life and insulation resistance of more than 10^{10} ohms makes it an ideal unit for galvanic separation between electronic circuits.

The 1 and 2 pole relays have a plastic dust cover ultrasonically welded to the baseplate to protect the inside from flux and cleaning agents during machine soldering and spray or vapor cleaning.
UL Component Recognition File E43203A

Contact Rating: Noninductive load

Light Duty: (1 Amp)	Fine silver goldplated 1 Amp @ 26 VDC or 0.5 Amp @ 115 VAC
Medium Duty: (2 Amp)	Silver Cadmium-Oxide 2 Amp @ 26 VDC or 1 Amp @ 115 VAC
Heavy Duty: (5 Amp)	Silver Cadmium-Oxide 5 Amp @ 26 VDC or 3 Amp @ 115 VAC or 2 Amp @ 220 VAC

Life Expectancy: Mechanical Operations: 10^7
Operations at Rated Load: 10^6

Contact Resistance: 50 milliohms max. initially

Operate Time: (Typical) 5 ms at Nominal Voltage

Release Time: (Typical) 6 ms at Nominal Voltage

Contact Bounce: (Typical) at 10 mA contact current:
2 ms at operate N.O. side
6 ms at release N.C. side

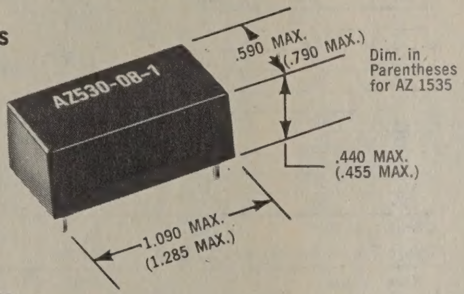
Capacitance: (Typical)

N.C. to Movable	0.6 pF
N.O. to Movable	0.9 pF
contact to coil	12 pF

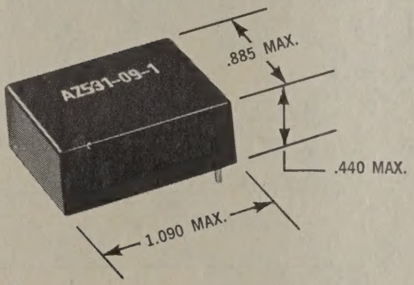
Dielectric Strength:	AZ 1530, 1531	AZ 1535	AZ 521
Contact — Contact	500 Vrms	1000 Vrms	500 Vrms
Contact — Coil	500 Vrms	2500 Vrms	500 Vrms

Insulation Resistance: 10,000 Megohms min. @ 20°C 100 VDC, 50% RH

SPDT Contacts



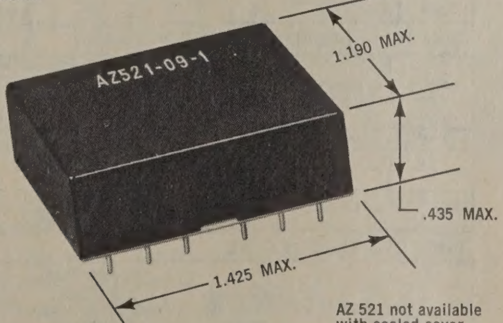
DPDT Contacts



Nom. Coil VDC	Max. Contin. VDC	Resist. Ohm ±10%	Must Operate		Contact	Order No.
			mA	VDC		
5	9.5	64	50	3.5	SPDT 1 Amp	AZ 1530-12-1
6	11	90	42	4.1		AZ 1530-11-1
12	21	310	23	7.7		AZ 1530-08-1
24	36	950	13	14	SPDT 1 Amp	AZ 1530-06-1
48	79	4,500	6.3	31		AZ 1530-04-1
100	140	14,000	3.5	55		AZ 1530-03-1
5	7.0	35	93	3.6	SPDT 2 Amp	AZ 1530-14-2
6	9.5	64	69	4.9		AZ 1530-12-2
12	16	200	41	9.0		AZ 1530-09-2
24	36	950	18	19	SPDT 2 Amp	AZ 1530-06-2
48	64	3,000	11	35		AZ 1530-045-2
100	140	14,000	4.8	75		AZ 1530-03-2
5	7.5	29	123	3.6	SPDT 5 Amp	AZ 1535-16-2
6	8.5	37	110	4.5		AZ 1535-15-2
12	16	125	61	8.5		AZ 1535-11-2
24	30	440	33	16	SPDT 5 Amp	AZ 1535-08-2
48	63	1,930	16	33		AZ 1535-055-2
100	147	10,500	7.2	83		AZ 1535-035-2
6	10	60	68	4.5	DPDT 1 Amp	AZ 1531-13-1
12	21	260	34	9.7		AZ 1531-09-1
24	34	670	21	16		AZ 1531-07-1
48	80	3,800	9.0	38	DPDT 1 Amp	AZ 1531-045-1
60	100	6,000	7.2	47		AZ 1531-04-1
100	180	19,000	4.0	48		AZ 1531-03-1
6	9	45	96	4.7	DPDT 2 Amp	AZ 1531-14-2
12	17	170	49	9.2		AZ 1531-10-2
24	34	670	25	19		AZ 1531-07-2
48	66	2,500	13	36	DPDT 2 Amp	AZ 1531-05-2
60	80	3,800	11	46		AZ 1531-045-2
100	130	10,000	7.0	76		AZ 1531-035-2

All values at 20°C

4PDT Contacts



AZ 521 not available with sealed cover

Nom. Coil VDC	Max. Contin. VDC	Resist. Ohms ±10%	Must Operate		Contacts	2 Amp Contacts Order No.
			mA	VDC		
6	9	52	75	4.3	4PDT	AZ 521-13-1
12	18	210	39	9.0		AZ 521-09-1
15	23	340	30	11		AZ 521-08-1
20	30	570	23	15		AZ 521-07-1
24	41	1,050	17	19	4PDT	AZ 521-06-1
48	72	3,200	10	36		AZ 521-045-1
60	90	5,100	8.0	45		AZ 521-04-1
110	160	16,000	4.5	79		AZ 521-03-1

VDC Coil Nom.	VDC Contin. Max.	Resist. Ohms ±10%	Must Operate		Con-tact	2 Amp Bifurcated Contacts Order No.	3 Amp Contacts Order No.
			mA	VDC			
6	8	38	108	4.4	4PDT	AZ 521-14-10	AZ 521-14-2
12	15	145	57	9.1		AZ 521-10-10	AZ 521-10-2
24	30	570	29	18		AZ 521-07-10	AZ 521-07-2
48	60	2,200	15	36	4PDT	AZ 521-05-10	AZ 521-05-2
60	72	3,200	13	44		AZ 521-045-10	AZ 521-045-2
110	160	16,000	5.6	99		AZ 521-03-10	AZ 521-03-2

All values at 20°C

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

AMERICAN ZETTLER, INC.
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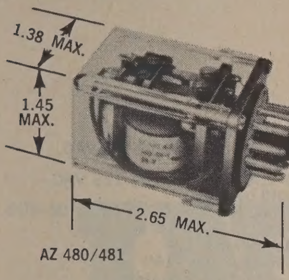
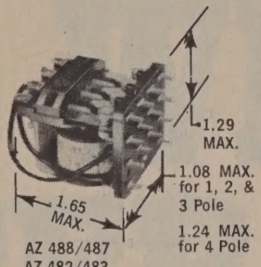
General Purpose Relays/AZ480 Series

Up to 4PDT Contacts — 10 Amp

U/L Recognized (File No. E44211)



AZ 480/481



AZ 488/487
AZ 482/483

AZ 480 relays are available in either an open or plastic enclosed version. The open relay, with either solder or PC terminals, can be mounted with an attached base plate or with a 6-32 tapped hole in the core. It also can be supplied with a 6-32 mounting stud and locating tab. The relay enclosed in a plastic dust-cover is available either as a plug-in version with octal type socket (8 or 11 pins), or with PC terminals.

Contact Rating: 10 amp @ 115 volts AC 60 Hz non inductive
Contact Material: Silver-cadmium-oxide
Contact Arrangement: 1, 2, 3 and 4 form C (up to 4PDT)
Life Expectancy: Mechanical: 10 million operations
Rated Load: ¼ million operations
Dielectric Strength: 1500 Vrms
500 Vrms across contact gap
Insulation Resistance: 100 megohms minimum
Coil Voltage: To 280 volts AC
Coil Power: Nominal — DC: 1.2 watts — AC: 2.5 VA
Max. Continuous Dissipation: 2.5 watts @ 35°C (95°F) ambient temperature

STANDARD RELAYS AC-ACTUATED

Coil Specifications					Order Number			
Voltage, VAC			Nom. Current (mA)	Con-tact	Open*		Enclosed	
Nom.	Max.	Min.			Wire Terminals	PC Terminals	Octal Plug In	PC Terminals
6AC	9	5	410	SPDT	AZ 483-2-1	AZ 487-2-1	AZ 481-2-1	AZ 487S-2-1
12AC	19	10	205	SPDT	AZ 483-3-1	AZ 487-3-1	AZ 481-3-1	AZ 487S-3-1
24AC	37	21	100	SPDT	AZ 483-4-1	AZ 487-4-1	AZ 481-4-1	AZ 487S-4-1
120AC	184	102	20	SPDT	AZ 483-7-1	AZ 487-7-1	AZ 481-7-1	AZ 487S-7-1
220AC	280	187	11	SPDT	AZ 483-9-1	AZ 487-9-1	AZ 481-9-1	AZ 487S-9-1
6AC	9	5	410	DPDT	AZ 483-2-2	AZ 487-2-2	AZ 481-2-2	AZ 487S-2-2
12AC	19	10	205	DPDT	AZ 483-3-2	AZ 487-3-2	AZ 481-3-2	AZ 487S-3-2
24AC	37	21	100	DPDT	AZ 483-4-2	AZ 487-4-2	AZ 481-4-2	AZ 487S-4-2
120AC	184	102	20	DPDT	AZ 483-7-2	AZ 487-7-2	AZ 481-7-2	AZ 487S-7-2
220AC	280	187	11	DPDT	AZ 483-9-2	AZ 487-9-2	AZ 481-9-2	AZ 487S-9-2
6AC	9	5	410	3PDT	AZ 483-2-3	AZ 487-2-3	AZ 481-2-3	AZ 487S-2-3
12AC	19	10	205	3PDT	AZ 483-3-3	AZ 487-3-3	AZ 481-3-3	AZ 487S-3-3
24AC	37	21	100	3PDT	AZ 483-4-3	AZ 487-4-3	AZ 481-4-3	AZ 487S-4-3
120AC	184	102	20	3PDT	AZ 483-7-3	AZ 487 7-3	AZ 481-7-3	AZ 487S-7-3
220AC	280	187	11	3PDT	AZ 483-9-3	AZ 487-9-3	AZ 481-9-3	AZ 487S-9-3
6AC	9	5	410	4PDT	AZ 483-2-8	AZ 487-2-8		AZ 487S-2-4
12AC	19	10	205	4PDT	AZ 483-3-8	AZ 487-3-8		AZ 487S-3-4
24AC	37	21	100	4PDT	AZ 483-4-8	AZ 487-4-8		AZ 487S-4-4
120AC	184	102	20	4PDT	AZ 483-7-8	AZ 487-7-8		AZ 487S-7-4
220AC	280	187	11	4PDT	AZ 483-9-8	AZ 487-9-8		AZ 487S-9-4

STANDARD RELAYS DC-ACTUATED

Coil Specifications					Order Number			
Voltage, VDC			Resist. (Ohms) ±10%	Con-tact	Open*		Enclosed	
Nom.	Max.	Min.			Wire Terminals	PC Terminals	Octal Plug In	PC Terminals
6DC	9	4.5	32	SPDT	AZ 482-2-1	AZ 488-2-1	AZ 480-2-1	AZ 488S-2-1
12DC	19	9	130	SPDT	AZ 482-3-1	AZ 488-3-1	AZ 480-3-1	AZ 488S-3-1
24DC	37	18	500	SPDT	AZ 482-4-1	AZ 488-4-1	AZ 480-4-1	AZ 488S-4-1
48DC	75	36	2,100	SPDT	AZ 482-6-1	AZ 488-6-1	AZ 480-6-1	AZ 488S-6-1
110DC	165	83	10,500	SPDT	AZ 482-9-1	AZ 488-9-1	AZ 480-9-1	AZ 488S-9-1
6DC	9	4.5	32	DPDT	AZ 482-2-2	AZ 488-2-2	AZ 480-2-2	AZ 488S-2-2
12DC	19	9	130	DPDT	AZ 482-3-2	AZ 488-3-2	AZ 480-3-2	AZ 488S-3-2
24DC	37	18	500	DPDT	AZ 482-4-2	AZ 488-4-2	AZ 480-4-2	AZ 488S-4-2
48DC	75	36	2,100	DPDT	AZ 482-6-2	AZ 488-6-2	AZ 480-6-2	AZ 488S-6-2
110DC	165	83	10,500	DPDT	AZ 482-9-2	AZ 488-9-2	AZ 480-9-2	AZ 488S-9-2
6DC	9	4.5	32	3PDT	AZ 482-2-3	AZ 488-2-3	AZ 480-2-3	AZ 488S-2-3
12DC	19	9	130	3PDT	AZ 482-3-3	AZ 488-3-3	AZ 480-3-3	AZ 488S-3-3
24DC	37	18	500	3PDT	AZ 482-4-3	AZ 488-4-3	AZ 480-4-3	AZ 488S-4-3
48DC	75	36	2,100	3PDT	AZ 482-6-3	AZ 488-6-3	AZ 480-6-3	AZ 488S-6-3
110DC	165	83	10,500	3PDT	AZ 482-9-3	AZ 488-9-3	AZ 480-9-3	AZ 488S-9-3
6DC	9	4.5	32	4PDT	AZ 482-2-8	AZ 488-2-8		AZ 488S-2-4
12DC	19	9	130	4PDT	AZ 482-3-8	AZ 488-3-8		AZ-488S-3-4
24DC	37	18	500	4PDT	AZ 482-4-8	AZ 488-4-8		AZ 488S-4-4
48DC	75	36	2,100	4PDT	AZ 482-6-8	AZ 488-6-8		AZ 488S-6-4
110DC	165	83	10,500	4PDT	AZ 482-9-8	AZ 488-9-8		AZ 488S-9-4

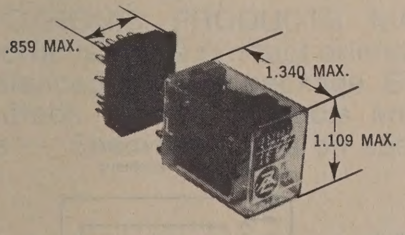
* Also available with #6-32 UNC-2A mounting stud and locating tab (add letter "A" to part no.) or with #6-32 UNC-2B tapped core and locating tab (add Letter "B" to part no.) Add letter "U" to above P/N for UL Approved Versions.

Miniature AC, DC Relays/TEC1300 Series

4PDT Contacts — 5 Amp

U/L Recognized (File No. E45020) / CSA File No. 31387

The miniature relay series 1300 with AC or DC coils and 4PDT contacts, available with either plug-in or PC terminals, is ideally suited for use in alarm systems, communications, and data processing equipment.



Contact Rating: Resistive Load 5 amp at 26 VDC or 115 VAC*

Contact Material: Silver gold plated. Other contact material available

Contact Arrangement: 4 form C (4PDT)

Life Expectancy: Mechanical Operations: 10^8

Electrical Operations: At Rated Load: 5 x 10^4
At 3 Amp 26 VDC or 115 VAC: 10^6

Dielectric Strength: 1500 Vrms; 500 Vrms across contact gap

Insulation Resistance: 1500 Megohms min. @ 20°C, 100 VDC, 50% RH

Coil Power at 20°C:
AC: 1.20 Va nom. ; 2 Va max. continuous
DC: .90 Watts nom.; 2 Watts max. continuous

Coil Temperature: Max. 105°C

Weight: Approx. 42 gr. (1.5 oz)

Terminals: Solder lug/plug-in or PC on relay
Solder lug or PC on socket

Enclosure: Clear, high impact polycarbonate cover

STANDARD RELAYS AC ACTUATED

Coil Specifications			Nom. Curr. (Average (mA)	Order No.	
Voltage VAC				Plug in Terminals	PC Terminals
Nom.	Max.	Min.			
6VAC	7.1	5.1	200	1309-4191	1309-4193
12VAC	14.2	10.2	100	1309-4291	1309-4293
24VAC	28.5	20.4	50	1309-4391	1309-4393
36VAC	42	30.6	33	1309-4491	1309-4493
48VAC	57	40.8	25	1309-4591	1309-4593
60VAC	71	51	20	1309-4691	1309-4693
115VAC	130	94	11	1309-4791	1309-4793
127VAC	150	108	9.5	1309-4891	1309-4893

STANDARD RELAYS DC ACTUATED

Coil Specifications				Order No.	
Voltage VDC			Resistance (ohms) ±10%	Plug in Terminals	PC Terminals
Nom.	Max.	Min.			
6VDC	8	4.5	40	1309-8191	1309-8193
12VDC	16	9	160	1309-8291	1309-8293
24VDC	32	18	650	1309-8391	1309-8393
36VDC	48	27	1400	1309-8491	1309-8493
48VDC	64	36	2600	1309-8591	1309-8593
60VDC	80	45	3600	1309-8691	1309-8693
110VDC	146	83	13000	1309-8791	1309-8793

All data at 20°C
ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SOCKET ORDER INFORMATION:

Pierced Solder Terminals:	ROF14
PC Terminals:	RS14
Retainer for Relay:	HF163

AMERICAN ZETTLER, INC.

DEPT. EM, 16881 HALE AVE., IRVINE, CA 92714
PHONE (714) 540-4190, TELEX 67-8472

THINPAK® Miniature Relays/AZ1630 Series Magnetic Latching

Up to DPDT Contacts — Dry Circuit to 2 Amp

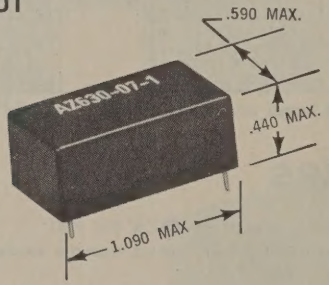
For PC Board Mounting — 0.6″ center-to-center.
Sealed Plastic Dust Cover.

The THINPAK Series AZ 1630 magnetic latching relay, is a miniature memory relay which can be operated with an impulse of more than 10 ms and store the information indefinitely without power consumption. This makes it an ideal component for economical low-bit memory systems such as that needed for tool machines, elevators, packaging and vending machines, aircraft and car simulators, etc. The construction of the relay and selection of materials assures that the status of the relay cannot be changed by mechanical vibrations or shock, up to specified limitations. The N.O. side of the contact closes after energizing the operating coil with a DC pulse. The contact switches to the opposite position by energizing the release coil. In standard versions, both coils use the same operating voltage, which allows energizing and de-energizing the relay from the same voltage source. The high pressure 1 or 2 amp contact enables the unit to switch capacitance or lamp loads with current spikes that would normally weld the contacts of a reed relay. The high insulation resistance of more than 10^{10} ohms and the low contact resistance of less than 50 mΩ make it ideal for galvanic separation between electronic circuits.

The relays have a plastic dust cover ultrasonically welded to the baseplate to protect the inside from flux and cleaning agents during machine soldering and spray or vapor cleaning. Cleaning by immersion is not recommended.

Contact Rating:	Noninductive load.
Light Duty:	(Fine silver goldplated.) 1 Amp @ 26 VDC or 0.5 Amp @ 115 VAC.
Medium Duty:	(Silver cadmium oxide.) 2 Amps @ 26 VDC or 1 Amp @ 115 VAC.
Dry Circuit:	(Silver hard gold overlay.) Dry circuit or low level to 0.2 Amp @ 26 VDC or AC.
Life Expectancy:	Mechanical Operations: 10^5 Operations at Rated Load: 10^6.
Contact Resistance:	50 milliohms maximum initially.
Operate Time: (Typical)	3 ms at nominal voltage.
Release Time: (Typical)	2 ms at nominal voltage.
Contact Bounce: (Typical)	At 10 mA contact current: 2 ms at operate N.O. side. 4 ms at reset N.C. side.
Capacitance: (Typical)	N.C. to movable 0.6 pF. N.O. to movable 0.9pF. Contact to coil 12 pF.
Dielectric Strength:	Contact-to-contact 500 Vrms. Contact-to-coil 500 Vrms.
Insulation Resistance:	10,000 megohms min. @ 20°C. 100 VDC, 50% RH.
Coil Temperature:	Maximum 105°C (220°F).
Ambient Temperature: Operating:	(at intermittent duty 20 sec. maximum on time. 100 sec. minimum off time). −5°C (23°F) to 40°C (104°F).
Storage:	−55°C (−72°F) to 105°C (220°F).
Vibration:	0.062 DA @ 10.55 Hz. 10 g @ 55-300 Hz.
Shock:	30 g.

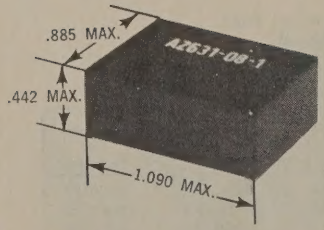
SPDT



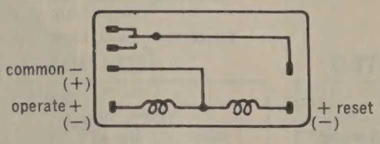
Coil Specifications						Order Number		
Operate or Reset VDC			Resistance Ohm ±10%					
Nom.	Max.	Min.	Operate	Reset	Contact	1 Amp Contacts	2 Amp Contacts	Dry Circuit Contacts
6	6.6	4.8	30	40	SPDT	AZ 1630-14-1	AZ 1630-14-2	AZ 1630-14-3
12	13.2	9.5	112	125		AZ 1630-10-1	AZ 1630-10-2	AZ 1630-10-3
24	26.4	19	400	1,120		AZ 1630-70-1	AZ 1630-70-2	AZ 1630-70-3
48	53	38	1,650	1,650		AZ 1630-05-1	AZ 1630-05-2	AZ 1630-05-3
60	66	48	2,100	3,500		AZ 1630-045-1	AZ 1630-045-2	AZ 1630-045-3
6	6.6	4.8	17.5	42	DPDT	AZ 1631-16-1	AZ 1631-16-2	AZ 1631-16-3
12	13.2	9.5	65	95		AZ 1631-12-1	AZ 1631-12-2	AZ 1631-12-3
24	26.4	19	270	640		AZ 1631-08-1	AZ 1631-08-2	AZ 1631-08-3
48	53	38	1,050	1,050		AZ 1631-06-1	AZ 1631-06-2	AZ 1631-16-3
60	66	48	1,650	3,600		AZ 1631-05-1	AZ 1631-05-2	AZ 1631-05-3

All values at 20°C

DPDT

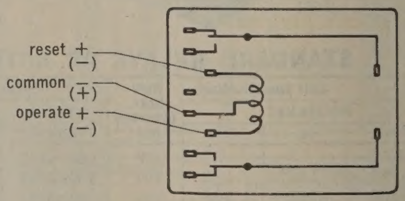


WIRING DIAGRAM AZ 1630
(View Toward Terminals)



Reset Position Shown

WIRING DIAGRAM AZ 1631
(View Toward Terminals)



Reset Position Shown

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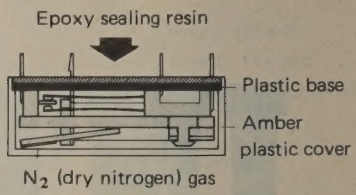
Amber Relays NFE, KE, HCE

What is the Amber Relay?

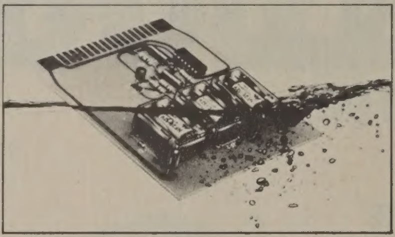
The NF, K and HC relay lines have found wide use and have proven their reliability over the past years. Nevertheless, certain applications have been restricted because of environmental factors, or because of printed circuit board fabrication processes employed. After much research and testing, the sealed versions of these relays have been developed; the Amber Relay line. These relays, with their high density seal and inert atmosphere considerably broaden the range of applications and can improve the reliability of your product at a reasonable cost.

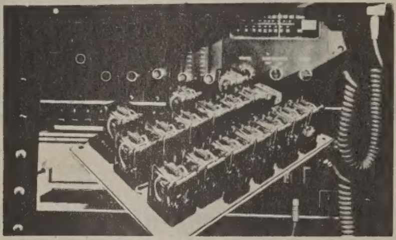
Sealed construction

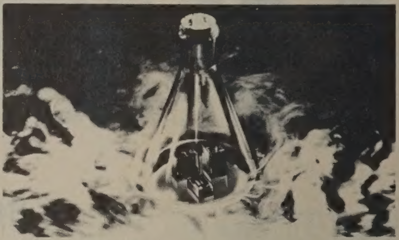


Major Features

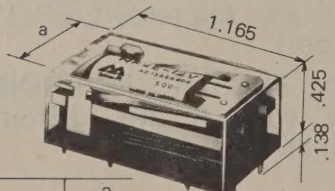
1. Solution to PC board soldering and cleaning problems-costly hand soldering eliminated.
2. Highly stable contact resistance maintained, even after long periods of idle use.
3. Adverse environments—where sealed amber relays perform outstandingly!







Types and Data



	a
NF2E	.772
NF4E	.953

NFE type

Type		Coils			Contacts		Sugg. List Price
		Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
NF2E—	5V	5VDC	90	278	2C	2	$4.80
	6V	6	137	260			4.80
	12V	12	500	290			4.80
	24V	24	2,000	290			4.80
	48V	48	7,000	330			5.60
	60V	60	9,700	370			6.60
NF4E—	5V	5VDC	53	472	4C	2	$5.70
	6V	6	90	400			5.70
	12V	12	330	440			5.70
	24V	24	1,200	480			5.70
	48V	48	4,200	550			6.30
	60V	60	7,000	510			7.60

Note: 1. MBB types available. 2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

K2E—	3V-1	3VDC	28	320	2C	2	$4.60
(K2ET*)	6V-1	6	110	330			4.60
	12V-1	12	530	270			4.60
	24V-1	24	1,700	340			4.60
	48V-1	48	7,600	300			5.30
	110V-1	110	16,000	760			6.80

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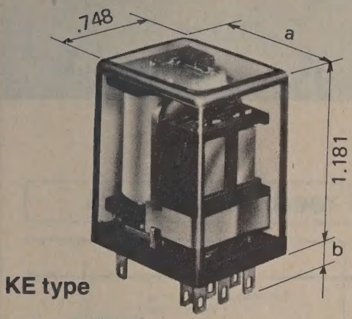
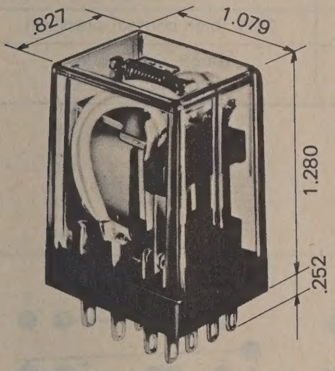
(213) 775-3512
Telex: 69-1712



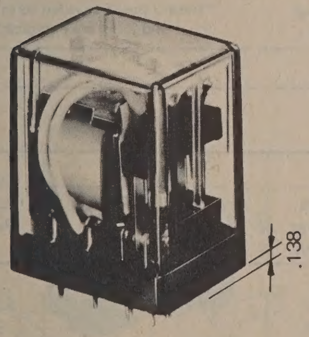
KE type

	a
K2E	.929
K4E	1.157
K6E	1.370

	b
Plug-in	.236
P/C board	.157



HCE plug-in type



HCE P/C board type

Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrangement	Rating (A)	
K2E— 3V-9	3VDC	10	900	2C	2	$4.60
(K2ET*) 6V-9	6	52	690			4.60
12V-9	12	185	780			4.60
24V-9	24	700	820			4.60
48V-9	48	2,500	920			5.30
115V-9	115	15,000	880			6.80
K4E— 3V-1	3VDC	18	500	4C	2	$5.30
(K4ET*) 6V-1	6	58	620			5.30
12V-1	12	250	580			5.30
24V-1	24	890	650			5.30
48V-1	48	3,200	720			5.80
110V-1	110	16,000	760			7.50
K4E— 3V-9	3VDC	10	900	4C	2	$5.30
(K4ET*) 6V-9	6	52	690			5.30
12V-9	12	185	780			5.30
24V-9	24	700	820			5.30
48V-9	48	2,500	920			5.80
115V-9	115	15,000	880			7.50
K6E— 6V-9	6VDC	25	1,440	6C	2	$7.30
(K6ET*) 12V-9	12	90	1,600			7.30
24V-9	24	430	1,340			7.30
48V-9	48	1,500	1,540			7.40
115V-9	115	9,000	1,340			8.40

Note: 1. T*: Denotes PC terminal relay.
2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

Type	Voltage	Res. (Ω)	Nom. Power (mW)	Arrangement	Rating (A)	Sugg. List Price
HC1E— 6VDC	6VDC	40	approx. 900	1C	5	$4.30
(HC1E-P*) 12VDC	12	160				4.30
24VDC	24	650				4.30
48VDC	48	2,600				4.30
110VDC	110	11,000				4.90
HC1E— 6VAC	6VAC		approx. 1,200	1C	5	$4.30
(HC1E-P*) 12VAC	12					4.30
24VAC	24					4.30
48VAC	48					4.30
115VAC	115					4.90
240VAC	240					5.60
HC2E— 6VDC	6VDC	40	approx. 900	2C	3	$4.90
(HC2E-P*) 12VDC	12	160				4.90
24VDC	24	650				4.90
48VDC	48	2,600				4.90
110VDC	110	11,000				5.50
HC2E— 6VAC	6VAC		approx. 1,200	2C	3	$4.90
(HC2E-P*) 12VAC	12					4.90
24VAC	24					4.90
48VAC	48					4.90
115VAC	115					5.50
240VAC	240					6.20
HC4E— 6VDC	6VDC	40	approx. 900	4C	2	$5.50
(HC4E-P*) 12VDC	12	160				5.50
24VDC	24	650				5.50
48VDC	48	2,600				5.50
110VDC	110	11,000				6.10
HP4E— 6VAC	6VAC		approx. 1,200	4C	2	$5.50
(HP4E-P*) 12VAC	12					5.50
24VAC	24					5.50
48VAC	48					5.50
115VAC	115					6.10
240VAC	240					6.80

Note: 1. P*: Denotes PC terminal relay.
2. Standard packing → Carton: 20 pcs./Case: 200 or 800 pcs.

Note: 1. Top mounting (TM) types are available.
2. Standard relays' sockets meet amber relays.

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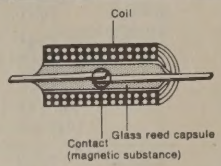
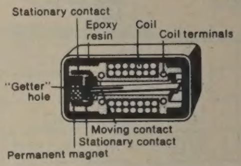
R Relays

New kind of high speed SPDT reed relay

- High speed — up to 500 cycle/sec. operations
- Long life (mechanical) — more than 10^9 operations
- Large contact capacity — 1A 20VDC (power)
- Low operating power —
  80mW (Single side stable)
  40mW (Bistable 1 coil)
- Latching type available

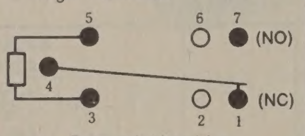
Differences between General reed and R relays

	General reed relays	R relays
Structure	 Coil Glass reed capsule Contact (magnetic substance)	 Stationary contact Epoxy resin Coil Coil terminals "Getter" hole Moving contact Stationary contact Permanent magnet
Contact arrangement	1NC or 1NO contact	1NC contact
Contact capacity	5 to 10W	20W (high contact pressure)
Operating function	Single side stable	Single side stable Latching

Wiring diagram

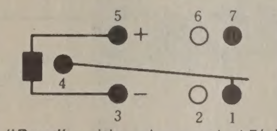
(Terminal View)
▮: Energized coil ▯: De-energized coil

1. Single side stable


5
6
7
(NO)
4
3
2
1
(NC)

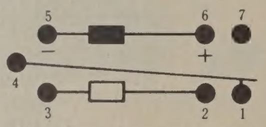
De-energized position

2. Latching: 1 coil latching

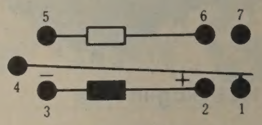


"Reset" position when terminal 5(+) and 3 (−) are energized.

3. Latching: 2 coil latching

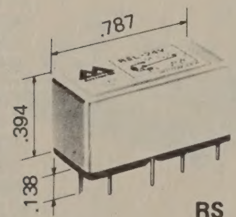


"Reset" position when terminal 5 (−) and 6 (+) are energized.

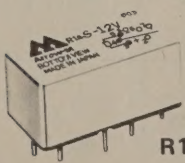


"Reset" position when terminal 3 (−) and 2 (+) are energized.

Types and Data



RS



R1A

Type		Coils			Contacts		Sugg. List Price
		Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
Single side stable							
RS—	5VDC	5VDC	170	147	1C	1	$3.90
	6VDC	6	220	164			3.90
	12VDC	12	890	162			3.90
	24VDC	24	2,000	288			3.90
	48VDC	48	8,000	221			6.60
RS—D*—	5VDC	5VDC	170	147	1C	Min. 100μ	$3.90
	6VDC	6	220	164			3.90
	12VDC	12	890	162			3.90
	24VDC	24	2,000	288			3.90
	48VDC	48	8,000	221			6.60
R1a—S—	5VDC	5VDC	170	147	1a	1	$3.10
	6VDC	6	220	164			3.10
	12VDC	12	890	162			3.10
	24VDC	24	2,000	288			3.10
	48VDC	48	8,000	221			5.80

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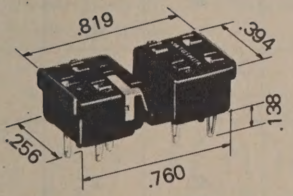
Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange- ment	Rating (A)	
R1a–SD*– 5VDC	5VDC	170	147	1a	Min. 100μ	$3.10
6VDC	6	220	167			3.10
12VDC	12	890	162			3.10
24VDC	24	2,000	288			3.10
48VDC	48	8,000	221			5.80
1 coil latching						
RSL– 5VDC	5VDC	340	74	1C	1	$3.90
6VDC	6	450	80			3.90
12VDC	12	1,500	96			3.90
24VDC	24	6,000	96			4.90
48VDC	48	12,000	147			7.50
RSLD*– 5VDC	5VDC	340	74	1C	Min. 100μ	$3.90
6VDC	6	450	80			3.90
12VDC	12	1,500	96			3.90
24VDC	24	6,000	96			4.90
48VDC	48	12,000	147			7.50
RSL–1a– 5VDC	5VDC	340	74	1a	1	$3.10
6VDC	6	450	80			3.10
12VDC	12	1,500	96			3.10
24VDC	24	6,000	96			4.10
48VDC	48	12,000	147			6.70
RSLD*–1a– 5VDC	5VDC	340	74	1a	Min. 100μ	$3.10
6VDC	6	450	80			3.10
12VDC	12	1,500	96			3.10
24VDC	24	6,000	96			4.10
48VDC	48	12,000	147			6.70
2 coil latching						
RSL2– 5VDC	5VDC	170	147	1C	1	$4.60
6VDC	6	225	160			4.60
12VDC	12	650	230			4.60
24VDC	24	2,700	213			5.60
48VDC	48	6,500	321			8.20
RSL2D*– 5VDC	5VDC	170	147	1C	Min. 100μ	$4.60
6VDC	6	225	160			4.60
12VDC	12	650	230			4.60
24VDC	24	2,700	213			5.60
48VDC	48	6,500	321			8.20
RSL2–1a– 5VDC	5VDC	170	147	1a	1	$3.80
6VDC	6	225	160			3.80
12VDC	12	650	230			3.80
24VDC	24	2,700	213			4.80
48VDC	48	6,500	321			7.40
RSL2D*–1a– 5VDC	5VDC	170	147	1a	Min. 100μ	$3.80
6VDC	6	225	160			3.80
12VDC	12	650	230			3.80
24VDC	24	2,700	213			4.80
48VDC	48	6,500	321			7.40

Note: 1. D*: Denotes dry-circuit types.
2. Standard packing → Carton 50 pcs./Case 500 pcs.



R Socket

R Socket

R–PS	$0.80

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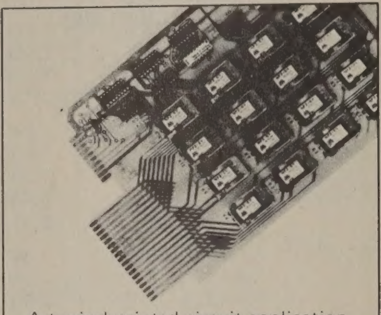
NF Relays

Flatpack with high sensitivity and reliability

- Low profile — stands only .402 inches high
  Ideal for high packaging density
- High sensitivity — Minimum operating
  NF2/140mW, NF4/235mW
- UL, VDE recognized
- Variety of available lines —
  Sealed Amber types
  MBB (Form D) contact types
  High breakdown voltage types for transient protection — 1,000 Vrms between open contacts, contact sets

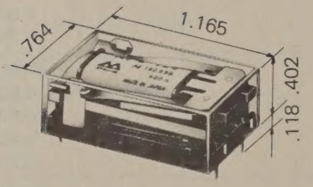


A typical printed circuit application for microwave communication as designed by Granger Associates.

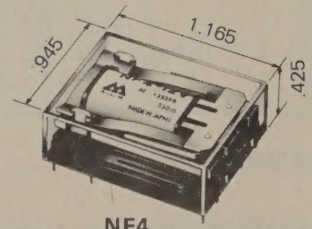
Typical Applications

NF relays are widely acceptable in applications where small size and high sensitivity are requirements. Such applications include:

Electronic equipment, Household applications, Alarm systems, Office machines, Communication equipment, Measuring equipment, Remote control systems, General control circuits, Machine tools, Industrial machinery, etc.



NF2



NF4

Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange- ment	Rating (A)	
NF2— 5V	5VDC	90	278	2C	2	$4.20
6V	6	137	260			4.20
12V	12	500	290			4.20
24V	24	2,000	290			4.20
48V	48	7,000	330			5.00
60V	60	9,700	370			6.00
NF4— 5V	5VDC	53	472	4C	2	$5.10
6V	6	90	400			5.10
12V	12	330	440			5.10
24V	24	1,200	480			5.10
48V	48	4,200	550			5.70
60V	60	7,000	510			7.00
NF2—2M—5V	5VDC	90	278	2C —2D	2	$4.50
6V	6	137	260			4.50
12V	12	500	290			4.50
24V	24	2,000	290			4.50
48V	48	7,000	330			5.30
60V	60	9,700	370			6.30
NF4—2M—5V	5VDC	53	472	4C —2D	2	$5.40
6V	6	90	400			5.40
12V	12	330	440			5.40
24V	24	1,200	480			5.40
48V	48	4,200	550			6.00
60V	60	7,000	510			7.30
NF4—4M—5V	5VDC	53	472	4C —4D	2	$5.60
6V	6	90	400			5.60
12V	12	330	440			5.60
24V	24	1,200	480			5.60
48V	48	4,200	550			6.20
60V	60	7,000	510			7.50

Note: Standard packing → Carton: 20 pcs./Case: 200 pcs.

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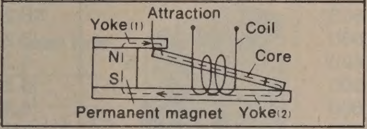
NC Relays

TTL compatible 5 AMP DIL relays

- Space saver — Flatpack and Lean line
- High contact capacity — 5A 250V AC
- Low operating power — 2C, 230 mW 4C, 460 mW (Single side stable)
- Soldering flux inflow prevented by terminal location
- Latching type available
- High breakdown voltage for transient protection — 1,000 Vrms between open contacts, contact sets
- Patented in U.S.A. Patent No. 3950718

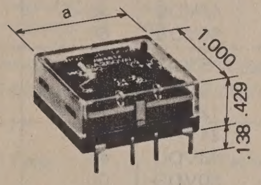
Magnetic Structure



NC relays are constructed in a manner which makes the most efficient use of the magnetic forces inherent to the relay. No springs or other mechanical devices are employed to transfer contacts: all forces are magnetic, either attracting or repelling, so that no external force must be overcome for transfer. Power requirements are thereby reduced and contact release simplified. The result is greater sensitivity and reliability plus longer life.

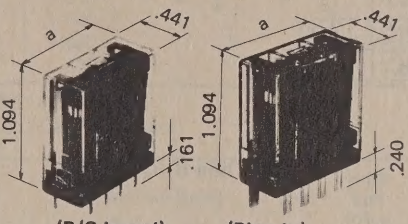
Two Space Savibg form!

—Flatpack—



	a
2C	1.000
4C	1.500

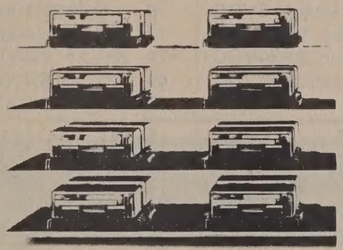
—Lean line—



(P/C board) (Plug-in)

	a
2C	1.000
4C	1.500

For compact card-rack mounting



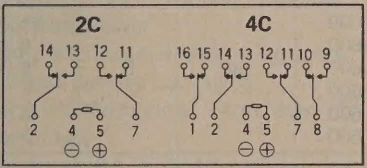
For high packaging density

Wiring Diagram

(Top view)

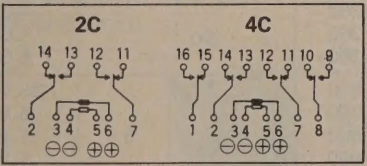
▭ De-energized coil ▬ Energized coil

1. Single side stable



De-energized position

2. 2 coil latching



"Reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

Ordering Nomenclature

Ex. NC 2 J P L2 — 6VDC

Number of contacts: 2, 4C

Shape: Nil = Lean line
J = Flatpack

Terminal arrangement:
Nil = plug-in
P = For P/C board

Operation function:
Nil = single side stable
L2 = 2 coil latching

Coil voltage:
5, 6, 12, 24, 48, 60 VDC

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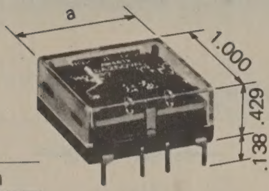
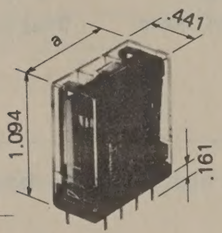
Types and Data

Flatpack



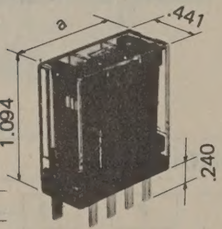
	a
2C	1.000
4C	1.500

Lean line (P/C board)



	a
2C	1.000
4C	1.500

Lean line (Plug-in)



	a
2C	1.000
4C	1.500

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrangement	Rating (A)	
NC2–JP– 5VDC	5VDC	69.4	360	2C	5	$4.00
6VDC	6	100	360			4.00
12VDC	12	400	360			4.00
24VDC	24	1,600	360			4.00
48VDC	48	6,400	360			4.60
60VDC	60	10,000	360			5.50
NC4–JP– 5VDC	5VDC	34.7	720	4C	5	$4.70
6VDC	6	50	720			4.70
12VDC	12	200	720			4.70
24VDC	24	800	720			4.70
48VDC	48	3,200	720			5.40
60VDC	60	5,000	720			6.30
NC2–JPL2– 5VDC	5VDC	31.3	800	2C	5	$5.10
6VDC	6	45	800			5.10
12VDC	12	180	800			5.10
24VDC	24	720	800			5.10
48VDC	48	2,880	800			5.70
60VDC	60	4,500	800			6.60
NC4–JPL2– 5VDC	5VDC	15.6	1,600	4C	5	$6.20
6VDC	6	22.5	1,600			6.20
12VDC	12	90	1,600			6.20
24VDC	24	360	1,600			6.20
48VDC	48	1,440	1,600			6.90
60VDC	60	2,250	1,600			7.80
NC2–P– 5VDC	5VDC	69.4	360	2C	5	$4.00
6VDC	6	100	360			4.00
12VDC	12	400	360			4.00
24VDC	24	1,600	360			4.00
48VDC	48	6,400	360			4.60
60VDC	60	10,000	360			5.50
NC4–P– 5VDC	5VDC	34.7	720	4C	5	$4.70
6VDC	6	50	720			4.70
12VDC	12	200	720			4.70
24VDC	24	800	720			4.70
48VDC	48	3,200	720			5.40
60VDC	60	5,000	720			6.30
NC2–PL2– 5VDC	5VDC	31.3	800	2C	5	$5.10
6VDC	6	45	800			5.10
12VDC	12	180	800			5.10
24VDC	24	720	800			5.10
48VDC	48	2,880	800			5.70
60VDC	60	4,500	800			6.60
NC4–PL2– 5VDC	5VDC	15.6	1,600	4C	5	$6.20
6VDC	6	22.5	1,600			6.20
12VDC	12	90	1,600			6.20
24VDC	24	360	1,600			6.20
48VDC	48	1,440	1,600			6.90
60VDC	60	2,250	1,600			7.80
NC2– 5VDC	5VDC	69.4	360	2C	5	$4.00
6VDC	6	100	360			4.00
12VDC	12	400	360			4.00
24VDC	24	1,600	360			4.00
48VDC	48	6,400	360			4.60
60VDC	60	10,000	360			5.50
NC2–L2– 5VDC	5VDC	31.3	800	2C	5	$5.10
6VDC	6	45	800			5.10
12VDC	12	180	800			5.10
24VDC	24	720	800			5.10
48VDC	48	2,880	800			5.70
60VDC	60	4,500	800			6.60

Note: Standard packing → Carton: 20 pcs./Case: 200 pcs.

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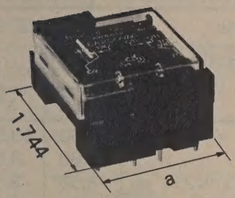
Types and Data

Type		Coils			Contacts		Sugg. List Price
		Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
NC4—	5VDC	5VDC	34.7	720	4C	5	$4.70
	6VDC	6	50	720			4.70
	12VDC	12	200	720			4.70
	24VDC	24	800	720			4.70
	48VDC	48	3,200	720			5.40
	60VDC	60	5,000	720			6.30
NC4—L2—	5VDC	5VDC	15.6	1,600	4C	5	$6.20
	6VDC	6	22.5	1,600			6.20
	12VDC	12	90	1,600			6.20
	24VDC	24	360	1,600			6.20
	48VDC	48	1,440	1,600			6.90
	60VDC	60	2,250	1,600			7.80



	a
NC2-	1.000
NC4-	1.575

For Flatpack

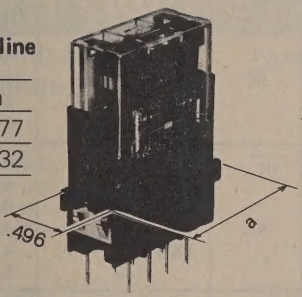
Note: 1. These new relays will be available in April, 1977.
2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

Accessories

Type	Terminals	Mating Relay	Sugg. List Price
NC2-JPS	P/C board	NC2-JP	$0.70
NC4-JPS	P/C board	NC4-JP	0.90
NC2-JPL2S	P/C board	NC2-JPL2	0.75
NC4-JPL2S	P/C board	NC4-JPL2	0.95
NC2-PS	P/C board	NC2-P	$0.70
NC4-PS	P/C board	NC4-P	0.90
NC2-SS	Solder	NC2	0.70
NC4-SS	Solder	NC4	0.90
NC2-L2PS	P/C board	NC2-PL2	0.75
NC4-L2PS	P/C board	NC4-PL2	0.95
NC2-L2SS	Solder	NC2-L2	0.75
NC4-L2SS	Solder	NC4-L2	0.95

For Lean line

	a
NC2-	1.177
NC4-	1.732

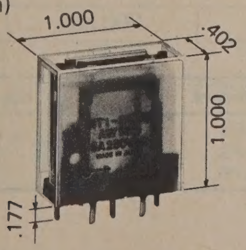


NEW

NT Relays

Vertical flat power relays

- High contact capacity up to 5A 250VAC
- Sensitive relay — 140mW (DC) low operating power
- Compact size-small mounting space for high density packaging
- Long life-Mechanical: more than 10^7 operations
  Electrical (5A 250VAC resistive): more than 2×10^5 operations
- International terminal pitch — .100 inch (2.54 mm)



Types and Data

Type		Coils			Contacts		Sugg. List Price
		Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
NT1—	6VDC	6VDC	130	280	1C	5A	$2.90
	12VDC	12	500	290			2.90
	24VDC	24	2,000	290			2.90
	48VDC	48	8,000	290			3.30
NT1—	6VAC	6VAC		0.75VA	1C	5A	$3.00
	12VAC	12					3.00
	24VAC	24					3.00
	48VAC	48					3.00
	115VAC	115					3.30

Note: Standard packing → Carton: 50 pcs./Case: 500 pcs.

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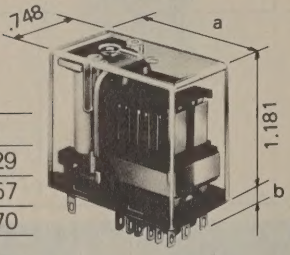
K Relays

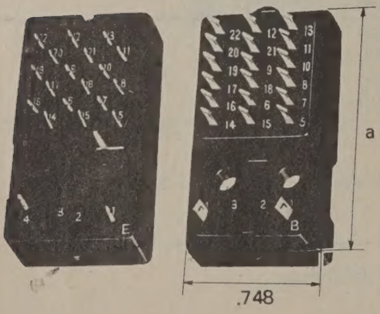
Uniquely designed highly sensitive relays

- Interchangeable with existing cradle relays
- 100 times more reliable through simplified design and bifurcated contacts
- Extra long life (mechanical) — more than 10^8 operations (electrical 1A 30W) — more than 10^7 operations
- Patented highly sensitive magnetic system
- Sealed Amber types available
- UL, CSA, VDE recognized.



	a
K2	.929
K4	1.157
K6	1.370

	b
Plug-in	.236
P/C board	.157



	a
K2	.953
K4	1.181
K6	1.394

Types and Data

Type	Coils			Contacts		Sugg. List Price	
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	K	KY
K2— 3V-1	3VDC	28	320			$3.60	$3.50
(K2T*) 6V-1	6	110	330			3.60	3.50
(K2Y″) 12V-1	12	530	270		(K2, K2T)	3.60	3.50
(K2YT*) 24V-1	24	1,700	340	2C	2	3.60	3.50
48V-1	48	7,600	300		(K2Y, K2YT)	4.30	4.20
110V-1	110	16,000	760		3	5.80	5.70
K2— 3V-9	3VDC	10	900			$3.60	$3.50
(K2T*) 6V-9	6	52	690			3.60	3.50
(K2Y″) 12V-9	12	185	780		(K2, K2T)	3.60	3.50
(K2YT*) 24V-9	24	700	820	2C	2	3.60	3.50
48V-9	48	2,500	920		(K2Y, K2YT)	4.30	4.20
115V-9	115	15,000	880		3	5.80	5.70
K4— 3V-1	3VDC	18	500			$4.30	$4.10
(K4T*) 6V-1	6	58	620			4.30	4.10
(K4Y″) 12V-1	12	250	580		(K4, K4T)	4.30	4.10
(K4YT*) 24V-1	24	890	650	4C	2	4.30	4.10
48V-1	48	3,200	720		(K4Y, K4YT)	4.80	4.60
110V-1	110	16,000	760		3	6.50	6.30
K4— 3V-9	3VDC	10	900			$4.30	$4.10
(K4T*) 6V-9	6	52	690			4.30	4.10
(K4Y″) 12V-9	12	185	780		(K4, K4T)	4.30	4.10
(K4YT*) 24V-9	24	700	820	4C	2	4.30	4.10
48V-9	48	2,500	920		(K4Y, K4YT)	4.80	4.60
115V-9	115	15,000	880		3	6.50	6.30
K6— 6V-9	6VDC	25	1,440			$6.30	$5.60
(K6T*) 12V-9	12	90	1,600		(K6, K6T)	6.30	5.60
(K6Y″) 24V-9	24	430	1,340	6C	2	6.30	5.60
(K6YT*) 48V-9	48	1,500	1,540		(K6, K6YT)	6.40	5.70
115V-9	115	9,000	1,340		3	7.40	6.70
K2F— 6V-9	6VDC	52	690			$4.10	
(K2FT*) 12V-9	12	185	780			4.10	
24V-9	24	700	820	2C	5	4.10	
48V-9	48	2,500	920			4.20	
115V-9	115	15,000	880			6.40	
K2A— 6V	6VAC	17	0.6VA			$5.10	$5.10
(K2AT*) 12V	12	69	0.7		(K2A, K2AT)	5.10	5.10
(K2Y″) 24V	24	260	0.6	2C	2	5.10	5.10
(K2YAT*) 48V	48	1,100	0.7		(K2YA, K2YAT)	5.30	5.30
110V	110	6,100	0.7		3	6.10	6.10
220V	220	22,600	1.1			7.30	7.30

Note: 1. T*: Denotes PC terminal relay.
2. Y″: Denotes 3 Amp. contact realy.
3. MBB contact (Form D) types are available.
4. Standard packing:

	K2, K4	K6
Carton	50 pcs.	20 pcs.
Case	200 pcs.	200 pcs.

Sockets

Plug-in	PC terminal	Sugg. List Price
K2-SS	K2-PS	$0.60
K4-SS	K4-PS	0.80
K6-SS	K6-PS	1.00

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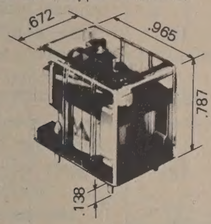
HT Relays

Economical, high reliability subminiature relay

- For low level load applications — Stabilized and low contact resistance
- Small size for use in limited space
- UL, CSA, VDE recognized
- Extra sensitive types available.



Types and Data

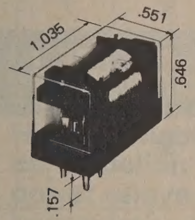
Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
HT–C– 3VDC	3VDC	11	800	1C	2	$1.90
6VDC	6	45				1.90
12VDC	12	180				1.90
24VDC	24	720				1.90
48VDC	48	3,200				2.30
HT–C– 6VDC-1	6VDC	100	360	1C	2	$2.10
12VDC-1	12	400				2.10
24VDC-1	24	1,600				2.10

Note: 1. AgCdO contact types are available.
2. Standard packing → Carton: 100 pcs./Case: 500 pcs. or 2,000 pcs.

HA Relays

Cost saving flux tight subminiature PC board relays

- Compact construction
- Sensitive — very low operating power
- Soldering flux inflow prevented by mold construction
- Contact capacity — 3A 250VAC, 30VDC



Types and Data

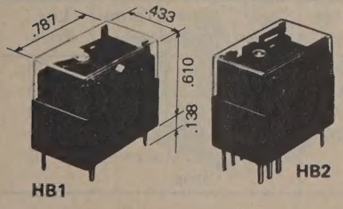
Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
HA1–DC 3VDC	3VDC	25	360	1C	3	$1.70
5VDC	5	69	360			1.70
6VDC	6	100	360			1.70
9VDC	9	225	360			1.70
12VDC	12	400	360			1.70
24VDC	24	1,600	360			1.70
48VDC	48	6,400	360			1.70
HA1–AV 6VAC	6VAC	—	0.9VA	1C	3	$1.70
12VAC	12	—	0.9VA			1.70
24VAC	24	—	0.9VA			1.70
48VAC	48	—	0.9VA			1.70
115VAC	115	—	0.9VA			1.90

Note: Standard packing → Carton: 100 pcs./Case: 500 pcs.

HB Relays

Cost saving flux tight subminiature DIP relays

- Small size for increased packaging density
- Sensitive — very low operating power
- Soldering flux inflow prevented by molded construction
- Simple mechanism for stable quality — just 7 piece parts
- DIP — matching 16 pin IC socket
- Contact capacity — 1A 125VAC, 2A 30VDC



Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
HB1– 3V	3VDC	25	360	1C	2A	$1.40
5V	5	69	360			1.40
6V	6	100	360			1.40
12V	12	400	360			1.40
24V	24	1,600	360			1.40
48V	48	6,000	384			1.60
HB2– 3V	3VDC	15.6	576	2C	2A	$2.20
5V	5	43.4	576			2.20
6V	6	62.5	576			2.20
12V	12	250	576			2.20
24V	24	1,000	576			2.20
48V	48	4,000	576			2.40

Note: Standard packing → Carton: 100 pcs./Case: 500 pcs.

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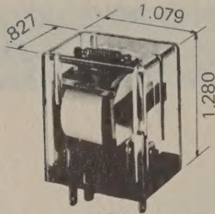
HC Relays

Highly qualified miniature relays for wider applications

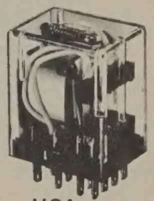
- Interchangeable with comparable relays.
- Extra long life — more than 10^8 mechanical operations.
- 4 types of contact arrangement — 4C (5A 250VAC), 3C (7A 250VAC), 2C (7A 250VAC), 1C (10A 250VAC)
- UL, CSA, VDE recognized.



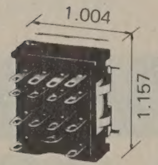
HC1

HC2

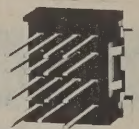
HC3



HC4

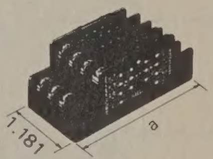


HC4-SS



HC4-WS

HC4-PS



HC-HSF

	a
HC-HSF	2.323
HC2-SF	1.575
HC3-HSF	2.638

Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrange-ment	Rating (A)	
HC1— 6VDC	6VDC	40	approx. 900	1C	10	$3.30
(HC1-P*) 12VDC	12	160				3.30
24VDC	24	650				3.30
48VDC	48	2,600				3.30
110VDC	110	11,000				3.90
HC1— 6VAC	6VAC		approx. 1,200	1C	10	$3.30
(HC1-P*) 12VAC	12					3.30
24VAC	24					3.30
48VAC	48					3.30
115VAC	115					3.90
240VAC	240					4.60
HC2— 6VDC	6VDC	40	approx. 900	2C	7	$3.90
(HC2-P*) 12VDC	12	160				3.90
24VDC	24	650				3.90
48VDC	48	2,600				3.90
110VDC	110	11,000				4.50
HC2— 6VAC	6VAC		approx. 1,200	2C	7	$3.90
(HC2-P*) 12VAC	12					3.90
24VAC	24					3.90
48VAC	48					3.90
115VAC	115					4.50
240VAC	240					5.20
HC3— 6VDC	6VDC	40	approx. 900	3C	7	$4.20
(HC3-P*) 12VDC	12	160				4.20
24VDC	24	650				4.20
48VDC	48	2,600				4.20
110VDC	110	11,000				4.80
HC3— 6VAC	6VAC		approx. 1,200	3C	7	$4.20
(HC3-P*) 12VAC	12					4.20
24VAC	24					4.20
48VAC	48					4.20
115VAC	115					4.80
240VAC	240					5.50
HC4— 6VDC	6VDC	40	approx. 900	4C	5	$4.50
(HC4-P*) 12VDC	12	160				4.50
24VDC	24	650				4.50
48VDC	48	2,600				4.50
110VDC	110	11,000				5.10
HC4— 6VAC	6VAC		approx. 1,200	4C	5	$4.50
(HC4-P*) 12VAC	12					4.50
24VAC	24					4.50
48VAC	48					4.50
115VAC	115					5.10
240VAC	240					5.80

Note: 1. P*: Denotes PC terminal relay.
2. Top mounting (TM) types and lamp-wired types are available.
3. Standard packing → Carton: 20 pcs./Case: 200 pcs. or 800 pcs.

HC Sockets

Socket for Soldering	List Price	Socket for P/C board	List Price	Socket for Wrapping	List Price	Screw Terminal Socket	List Price
HC1-SS	$0.60	HC1-SS	$0.60	HC1-WS	$1.40	HC-HSF	$2.90
HC2-SS	0.65	HC2-SS	0.65	HC2-WS	1.50	HC2-SF	1.80
HC3-SS	0.70	HC3-SS	0.70	HC3-WS	1.60	HC3-HSF	2.40
HC4-SS	0.75	HC4-SS	0.75	HC4-WS	1.70	HC Bracket	0.10
						HC Mounting Strip	2.10

Arrow-M
Member of Matsushita Group

Arrow-M Corporation
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

Mid-Western Office:
600 E. Higgins Rd.
Elk Grove Village, ILL. 60007
(312) 593-8535
Telex: 28-3427

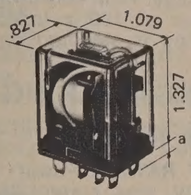
Western Office:
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

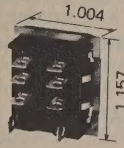
HL Relays

10 AMP space saving power relays

- High switching capacity in a compact size —
  SPDT (15A 125VAC),
  DPDT (10A 250VAC)
- High quality assured through advanced manufacturing techniques —
  Integral molding, Heat riveting and Spot welding
- Long life — Mechanical : more than 10^8 operations (DC), more than $5x10^7$ operations (AC)
  Electrical: more than $5x10^5$ operations
- UL recognized.

	a
Plug-in	.250
P/C board	.138





Types and Data

Type	Coils			Contacts		Sugg. List Price
	Voltage	Res. (Ω)	Nom. Power (mW)	Arrangement	Rating (A)	
HL1— 6VDC	6VDC	40	approx. 900	1C	15	$3.60
(HL1-P*) 12VDC	12	160				3.60
24VDC	24	650				3.60
48VDC	48	2,600				3.60
110VDC	110	11,000				4.00
HL1— 6VAC	6VAC		approx. 1,200VA	1C	15	$3.60
(HL1-P*) 12VAC	12					3.60
24VAC	24					3.60
48VAC	48					3.60
115VAC	115					4.00
240VAC	240					4.70
HL2— 6VDC	6VDC	40	approx. 900	2C	10	$4.10
(HL2-P*) 12VDC	12	160				4.10
24VDC	24	650				4.10
48VDC	48	2,600				4.10
110VDC	110	11,000				4.50
HL2— 6VAC	6VAC		approx. 1,200VA	2C	10	$4.10
(HL2-P*) 12VAC	12					4.10
24VAC	24					4.10
48VAC	48					4.10
115VAC	115					4.50
240VAC	240					5.20

Note: 1. P*: Denotes PC terminal relay.
2. Top mounting (TM) types are available.
3. Standard packing → Carton: 20 pcs./Case: 200 pcs.

HL Socket

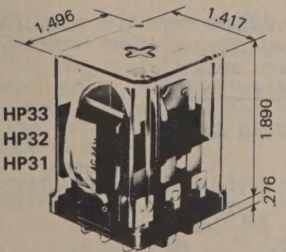
Plug-in	PC terminal	Sugg. List Price
HL1-SS	HL1-PS	$0.60
HL2-SS	HL2-PS	0.65

Note: HL1-PS and HL2-PS will be available in July, 1977.

HP Relays

Highly reliable construction 10 AMP power relays

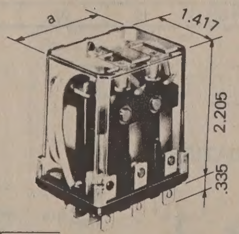
- Interchangeable with existing models
- Longer life insured by screwless assembly —
  Simplified and non-loosening molding blocks of contact spring holder and terminal base.
- High quality insured by mass production with excellent manufacturing technique
  Integral molding, Heat-riveting and Spot welding
- Versatile application of terminal for plug-in, soldering and Q.C. terminals.
- UL, CSA recognized.



HG Relays

Compact, large capacity relays for AC, DC application

- Up to 20A 250VAC resistive load, 1.5 KW 3 phase 220VAC motor load
- Available with plug-in, solder or QC terminals (Faston 250)
- UL, CSA recognized.

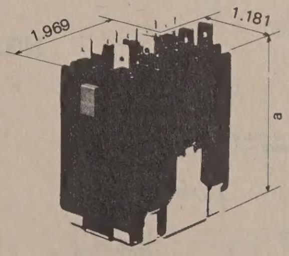


	a
HG2	1.389
HG3	1.966
HG4	2.607

VC Relays

Compact, easy maintenance heavy duty power relay

- Control air conditioners, office machines, heaters and appliances
- Large capacity: 1.5 KW 1 phase through 3.7 KW 3 phase 240V AC motor
- Multipositional Snap-mounting
- Lever action mechanism
- UL, CSA recognized.



	a
VC15, VC10, VC20A	2.241
VC15S	2.480

Arrow-M
Member of Matsushita Group

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250 Sheffield St.
Mountainside, N.J. 07092
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Suites 300 & 301
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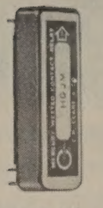
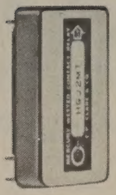
(213) 775-3512
Telex: 69-1712

MERCURY-WETTED CONTACT RELAYS
HGJM HIGH SPEED MODULAR RELAYS

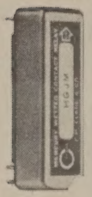


HGJM

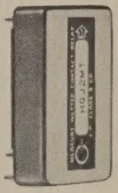


HGJ2MT

LOW PROFILE



HGJM



HGJ2MT

HIGH SENSITIVITY

HGJM

Clare HGJM relays have established new industry standards for quiet, fast and stable operation. HGJM Series SPDT relays have the 100VA load and multi-billion operation reliability characteristic of our HGSM and are recommended for all new applications.

Noise levels are less than 10μV at 5ms after coil energization (10kHz bandwidth). The relays are stable to 200Hz, with on and off times down to 2.5ms. The 1 Form C contact will switch μV, nanoampere loads to 2A or 500V loads (100VA max, ac or dc). The relays are offered in 0.400″ height high sensitivity models and 0.350″ height low profile versions. Both mount on staggered 0.100″ PCB grid patterns. The low profile models permit 0.5″ board centers.

HGJ2MT

Clare HGJ2MT relays feature the same outstanding electrical characteristics as the HGJM relays in a DPDT (2 Form C) package. High sensitivity HGJ2MT relays have common open time durations of 50μs at 100Hz for capacitor transfer technique applications. Electrostatic shielding is standard on all models.

Stock Part No.	Rec. Nominal Coil Voltage (Vdc)	Coil Res. ±10% at 25°C (Ohms)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Typical Relay Ind. (mH)	List Price
SPDT LOW PROFILE SINGLE-SIDE-STABLE							
HGJM 51131 J00	5.0	68	2.7	.58	11	7.4	$15.15
HGJM 51131 N00	12	375	6.5	1.4	26	45	15.15
HGJM 51131 R00	24	1425	13	2.7	50	155	15.15
HGJM 51131 V00	48	6100	25	5.4	103	690	15.15
SPDT HIGH SENSITIVITY SINGLE-SIDE-STABLE							
HGJM 51111 K00	5.0	125	2.9	.61	15	34	$14.45
HGJM 51111 P00	12	685	7.1	1.5	35	161	14.45
HGJM 51111 T00	24	2650	14	3.0	68	630	14.45
HGJM 51111 W00	48	9850	29	6.0	125	2100	14.45
DPDT LOW PROFILE SINGLE-SIDE-STABLE WITH SHIELD							
HGJ2MT 51231 E00	5.0	27	2.6	.54	9.7	2.1	$28.20
HGJ2MT 51231 K00	12	230	6.7	1.4	28	24	28.20
HGJ2MT 51231 N00	24	750	12	2.4	53	90	28.20
HGJ2MT 51231 R00	48	2850	23	4.8	101	307	28.20
DPDT HIGH SENSITIVITY SINGLE-SIDE-STABLE WITH SHIELD (COMMON OPEN TIME)							
HGJ2MT 54211 G00	5.0	55	2.6	.55	14	11	$27.10
HGJ2MT 54211 L00	12	370	6.7	1.4	36	75	27.10
HGJ2MT 54211 P00	24	1370	13	2.7	69	277	27.10

Part No.	Rec. Nominal Coil Voltage (Vdc)	Coil Res. ±10% (Ohms)	Set Volt., Either Wind. (Vdc)	Reset Volt., Either Wind. (Vdc)	Max. Volt., One Wind. Only (Vdc)	Typ. Relay Ind. (mH)	List Price
SPDT HIGH SENSITIVITY BISTABLE (DOUBLE WOUND COIL)							
HGJM 52112 N00	5.0	205/205	+3.1	−3.1	19	26	**$14.45**

ENGINEERING DATA

HGJM & HGJ2MT

CONTACT RATING: Power 100VA, max. voltage 500V, max. current 2A, max., (5A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 12 to 25 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10^{10} operations (with proper contact protection)

TIMING:

Operate — 1.25ms, max., at nominal coil voltage

Release — 1.25ms, max. with nominal voltage coil suppression

BREAKDOWN VOLTAGE: 1,000V rms 60Hz min. between all mutually insulated terminals, except between windings of double wound coils, 200Vdc

INSULATION RESISTANCE (OFF Impedance): HGJM Series, Standard Value 100 megohms. Available, 100,000 megohms — HGJ2MT Series, Standard Value, 10,000 megohms. Available 100,000 megohms (Measured across open contacts at 25°C, 40% relative humidity)

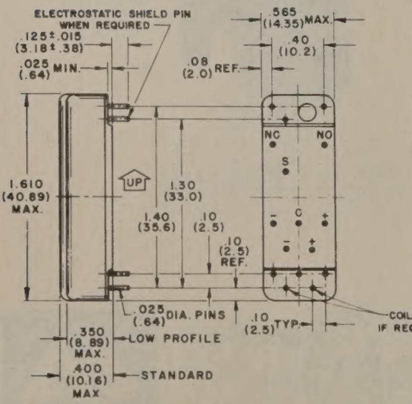
Vibration (non-operating) — 10-500Hz, 0.06″ d.a. or 5g's, whichever is less.

Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave

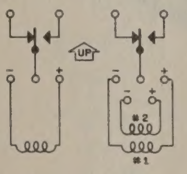
Temperature (operating) — −38.8° to +85°C

HGJM

DIMENSIONS

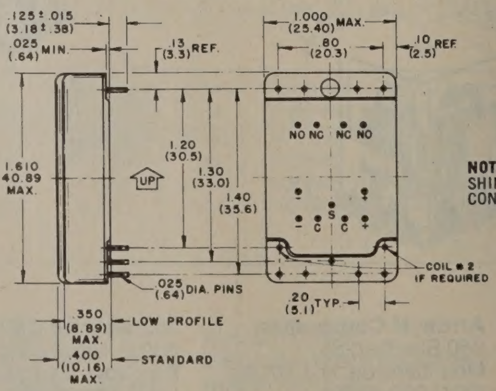

ELECTROSTATIC SHIELD PIN WHEN REQUIRED
.125±.015 (3.18±.38)
.025 (.64) MIN.
.565 (14.35) MAX.
.40 (10.2)
.08 (2.0) REF.
NC
NO
S
C
1.610 (40.89) MAX.
UP
1.30 (33.0)
1.40 (35.6)
.10 (2.5)
.10 (2.5) REF.
.025 (.64) DIA. PINS
.10 (2.5) TYP.
COIL #2 IF REQUIRED
.350 (8.89) MAX.
LOW PROFILE
.400 (10.16) MAX
STANDARD

SCHEMATICS

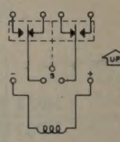


HGJ2MT

DIMENSIONS


.125±.015 (3.18±.38)
.025 (.64) MIN.
.13 (3.3) REF.
1.000 (25.40) MAX.
.80 (20.3)
.10 (2.5) REF
NO NC NC NO
1.20 (30.5)
1.610 40.89 MAX.
UP
1.30 (33.0)
1.40 (35.6)
S
C C
COIL #2 IF REQUIRED
.025 (.64) DIA. PINS
.20 (5.1) TYP.
.350 (8.89) MAX.
LOW PROFILE
.400 (10.16) MAX.
STANDARD

SCHEMATIC



NOTE:
SHIELD PIN ALSO
CONNECTED TO COVER

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3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

MERCURY-WETTED CONTACT RELAYS

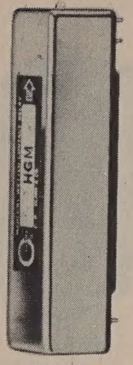
HGM, HG2M HEAVY DUTY MODULAR RELAYS

HGM

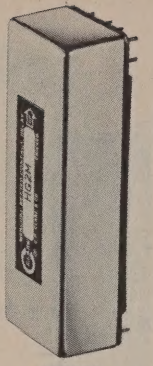
HGM relays are Clare standard HG switch capsules in module form. They have heavy duty contacts but are excellent for low level signals. The standard HG switch in the HGM is not polarity sensitive. Contacts are SPDT make-before-break rated at 5 amps, 500 Volts. 250VA maximum. Life expectancy is 20 x 10⁹ at specified ratings.

HG2M

HG2M has he same characteristics as the HGM but contains 2 capsules to give you double-pole, double-throw configuration make-before-break. This results in saving space and cost over single element units.



HGM



HG2M

Stock Part No.	Rec. Nom. Coil Voltage (dc)	Coil Resistance ±10%	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	List Price
HGM 1005	9	40	5.24	1.9	12.6	$15.55
HGM 1008	15	150	8.75	3.1	24	15.55
HGM 1002	28	450	16.3	5.9	42	15.55
HGM 1001	36	750	21.0	7.3	55	15.55
HGM 1012	48	1100	27.1	9.8	66	15.55
HG2M 1007	12	90	8.2	2.2	19	$21.15
HG2M 1008	24	350	16.2	4.6	37	21.15
H2GM 1020	30	580	20.7	5.9	48	21.15
HG2M 1026	48	1250	31.8	9.0	70	21.15

ENGINEERING DATA

HGM & HG2M

CONTACT RATING: Power 250VA, max. voltage 500V, max. current 5A, max., (10A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 15 to 40 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10¹⁰ operations (with proper contact protection)

TIMING: HGM

Operate — 4.0ms, max., at nominal coil voltage

Release — 4.0ms, max., with nominal voltage coil suppression

TIMING: HG2M

Operate — 6.5ms, max., at nominal coil voltage

Release — 6.5ms, max., with nominal voltage coil suppression

BREAKDOWN VOLTAGE: 1000Vac, rms, 60Hz between all mutually insulated terminals

ENVIRONMENTAL:

Vibration (non-operating) — 10-500Hz, 0.06″ d.a. or 10g's, whichever is less.

Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave

Temperature (operating) — −38.8° to +85°C

HGX SWITCH CAPSULE

HGX-1004

Mercury-wetted switch capsule is sealed in glass and pressurized with hydrogen. To make it safe and practical to use with permanent magnets, the switch is potted in an impregnated paper tube.

Five No. 22 gauge lead wires project 12″ from the tube. The wires are color coded to facilitate identification. Red, normally open; black, normally closed; yellow, armature contacts. An arrow on the decal shows the proper mounting position. The decal is located on the most sensitive side of the switch.

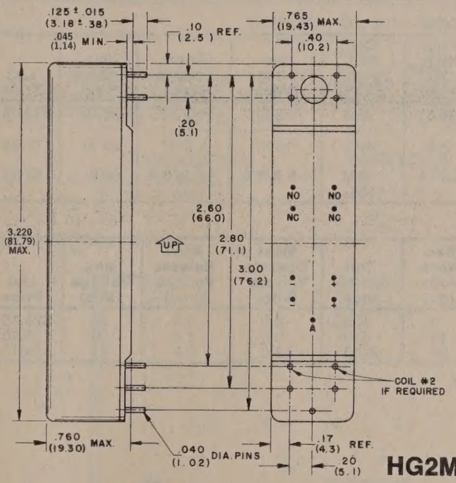
The HGX-1004 is capable of handling the same contact load (5 amps maximum, 500 volts maximum, 250VA) as the HG relay. Contact protection is required.

This device finds use as a limit switch, float switch, stepping switch, pulse generator, and time base, or in other applications where it may be actuated by a permanent magnet.

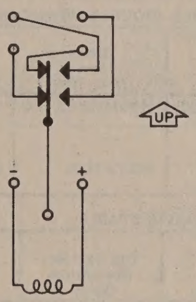
HGX1004 .... List $9.05

HGM

DIMENSIONS

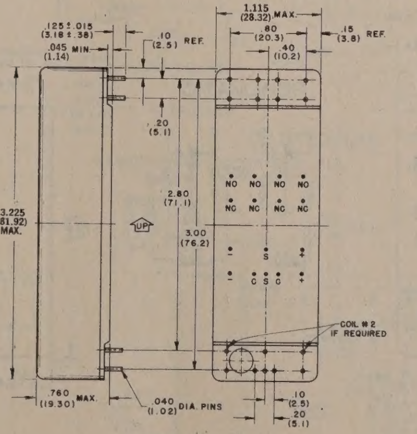

.125 ± .015
(3.18 ± .38)
.045 (1.14) MIN.
.10 (2.5) REF.
.765 (19.43) MAX.
.40 (10.2)
.20 (5.1)
2.60 (66.0)
2.80 (71.1)
3.00 (76.2)
3.220 (81.79) MAX.
UP
NO
NO
NC
NC
−
+
−
+
A
COIL #2 IF REQUIRED
.760 (19.30) MAX.
.040 (1.02) DIA. PINS
.17 (4.3) REF.
.20 (5.1)

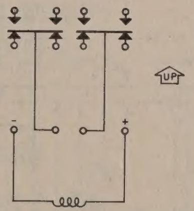
SCHEMATIC



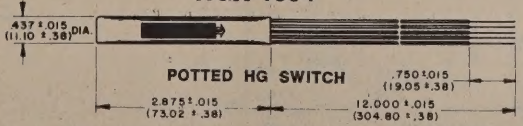
HG2M

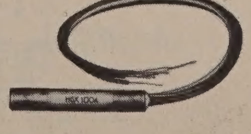
SCHEMATIC


1.115 (28.32) MAX.
.125 ± .015 (3.18 ± .38)
.045 MIN. (1.14)
.10 (2.5) REF.
.80 (20.3)
.15 (3.8) REF.
.40 (10.2)
.20 (5.1)
2.80 (71.1)
3.00 (76.2)
3.225 (81.92) MAX.
UP
NO
NO
NO
NO
NC
NC
NC
NC
−
S
+
−
C
S
C
+
COIL # 2 IF REQUIRED
.760 (19.30) MAX.
.040 (1.02) DIA. PINS
.10 (2.5)
.20 (5.1)



HGX-1004


.437 ± .015 (11.10 ± .38) DIA.
POTTED HG SWITCH
.750 ± .015 (19.05 ± .38)
2.875 ± .015 (73.02 ± .38)
12.000 ± .015 (304.80 ± .38)



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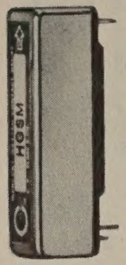
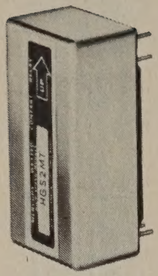
MERCURY-WETTED CONTACT RELAYS

HGSM, HGS2MT MODULAR RELAYS



HGSM



HGS2MT

HGSM

Clare HGSM relays are PCB mount models with 2A or 500V (100VA max.) switching capabilities. The HGSM series SPDT relay is recommended for replacement applications only. New applications should specify the faster HGJM series with the same load switching capabilities, life expectancy and lower noise. The HGSM package is .640 high and mounts on staggered 0.100″ grid patterns.

HGS2MT

Clare HGS2MT relays have the same ratings and life expectancy as the HGSM series in a DPDT model. The HGS2MT relay is also recommended for replacement purposes only. HGJ2MT relays are recommended for all new applications requiring 100VA (per pole) switching capabilities in DPDT configurations.

SPDT SINGLE-SIDE-STABLE

Stock Form D Part No.	Stock Form C Part No.	Rec. Nom. Coil Vdc	Coil Res. (Ohms) ±10%	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	List Price
HGSM 1008	HGSM 5008	5	115	3.8	0.62	15.1	$13.35
HGSM 1009	HGSM 5035	12	275	5.2	0.84	23.4	13.35
HGSM 1010	HGSM 5009	15	450	6.4	1.0	30.0	13.35
HGSM 1011	HGSM 5010	18	675	8.6	1.4	36.7	13.35
HGSM 1002	HGSM 5011	24	940	10.5	1.7	43.3	13.35
HGSM 1001	HGSM 5001	30	1425	13	2.1	53.4	13.35
HGSM 1003	HGSM 5064	48	2400	20.6	3.2	69.2	13.35
HGSM 1005	HGSM 5021	6	65	2.7	0.45	11.4	13.35
HGSM 1007	—	9	90	3.8	0.61	13.4	13.35
—	HGSM 5002	36	1950	17.6	2.6	62.4	13.35

SPDT BISTABLE (DOUBLE WOUND COIL)

Stock Form D Part No.	Stock Form C Part No.	Rec. Nom. Coil (Vdc)	Coil Res. (Ohms) ±10%	Set Voltage (Vdc)	Reset Voltage (Vdc)	Max. Voltage (Vdc)	List Price
HGSM 12112 N00	HGSM 52112 N00	6/6	325/ 325	+2.5*	−2.5*	26.0†	$13.35
HGSM 1063	—	9/9	460/ 460	+3.9*	−3.9*	30.3†	13.35
HGSM 1016	HGSM 5003	20/14	1100/ 1100	+8.8/6.9	−8.8/6.9	46.9	13.35

DPDT SINGLE-SIDE-STABLE

Form C New Part No.	Old Part No. (Reference Only)	Rec. Nom. Volts (dc)	Coil Resistance	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	List Price
HGS2MT51111F00	HGS2MT5001	6	130	3.0	0.5	20	$25.10
HGS2MT51111J00	HGS2MT5008	12	520	6.0	1.0	39	25.10
HGS2MT51111M00	HGS2MT5009	24	2200	12.0	2.0	81	25.10

* Either winding † One winding only

ENGINEERING DATA

HGSM & HGS2MT

CONTACT RATING: Power 100VA, max. voltage 500V, max. current 2A, max., (5A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 12 to 25 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10^{10} operations (with proper contact protection)

TIMING:

Operate — 2.0ms, max., at nominal coil voltage

Release — 2.0ms, max., with nominal voltage coil suppression

BREAKDOWN VOLTAGE: 1000Vac, rms, 60Hz between all mutually insulated terminals

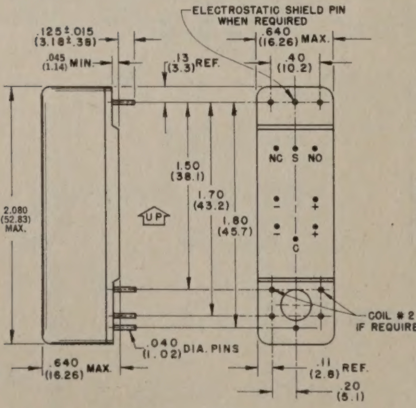
ENVIRONMENTAL:

Vibration (non-operating) — 10-500Hz, 0.06″ d.a. or 10g's, whichever is less.

Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave

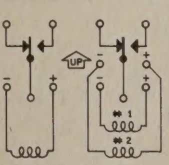
Temperature (operating) — −38.8° to +85°C

HGSM

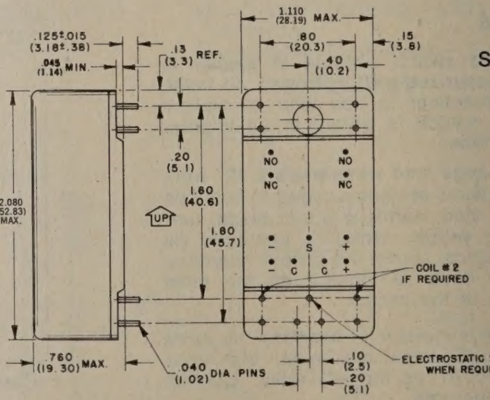

ELECTROSTATIC SHIELD PIN WHEN REQUIRED
.125±.015 (3.18±.38)
.640 (16.26) MAX.
.045 (1.14) MIN.
.13 (3.3) REF.
.40 (10.2)
NC S NO
1.50 (38.1)
1.70 (43.2)
1.80 (45.7)
2.080 (52.83) MAX.
UP
C
COIL # 2 IF REQUIRED
.040 (1.02) DIA. PINS
.640 (16.26) MAX.
.11 (2.8) REF.
.20 (5.1)

DIMENSIONS

SCHEMATIC

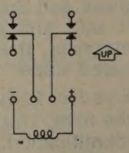


HGS2MT


1.110 (28.19) MAX.
.125±.015 (3.18±.38)
.80 (20.3)
.15 (3.8)
.13 (3.3) REF.
.045 (1.14) MIN.
.40 (10.2)
.20 (5.1)
NO NC NO NC
1.60 (40.6)
1.80 (45.7)
2.080 (52.83) MAX.
UP
− S +
− C C +
COIL # 2 IF REQUIRED
.760 (19.30) MAX.
.040 (1.02) DIA. PINS
.10 (2.5)
.20 (5.1)
ELECTROSTATIC SHIELD PIN WHEN REQUIRED

DIMENSIONS

SCHEMATIC



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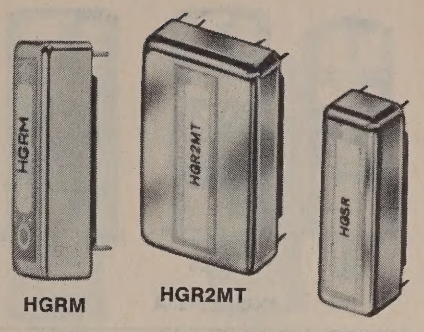
MERCURY-WETTED CONTACT RELAYS
HGRM/HGR2MT, HGSR MODULAR RELAYS

These time proven standard mercury-wetted contact relays have 100VA, 500V or 2A maximum load characteristics and multi-billion operation reliability are still available for replacement purposes. They are not recommended for new applications because of the limited speed (125Hz). The economical HGJM relays with the same 100VA load and life characteristics plus faster, quieter operation and the popular staggered 0.100″ grid mounting pattern are recommended for all new applications. The packages stand 0.400″ high. Note the differences in the pin spacing between the HGRM and HGSR relays.


HGRM
HGR2MT
HGSR
HGRM
HGR2MT
HGSR

ENGINEERING DATA
HGRM/HGR2MT & HGSR

CONTACTS:
10000 Series — Form D (spdt, make-before-break)
50000 Series — Form C (spdt, break-before-make)

CONTACT RATING: Switched Load: 2A max. 500 volts max. 100VA max. (5A max. carry only) with proper contact protection.

COILS: Coil Resistance — Single wound up to 9000 ohms. Double wound up to 4500 ohms per winding. Maximum Dissipation: HGSR is 1.75 watts; HGR2MT is 3.5 watts. continuous at 25°C. Temperature rise is 35°C per watt at 25°C ambient.

OPERATING CHARACTERISTICS: Operating Sensitivity — Bi-Stable, 20mw either winding of double wound coil. Single-Side-Stable, 40mw single wound coil. Single-Side-Stable, 80mw either winding of double wound coil.

CONTACT CIRCUIT RESISTANCE: 12 to 25 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10^{10} operations (with proper contact protection)

TIMING:
Operate — 1.8ms, max. at nominal coil voltage
Release — 1.8ms, max. with nominal voltage coil suppression

BREAKDOWN VOLTAGE: 1000Vac, rms, 60Hz between all mutually insulated terminals

ENVIRONMENTAL:
Vibration (non-operating) — 10-500Hz, 0.06″ d.a. or 10g's, whichever is less.
Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave
Temperature (operating) — −38.8° to 85°C

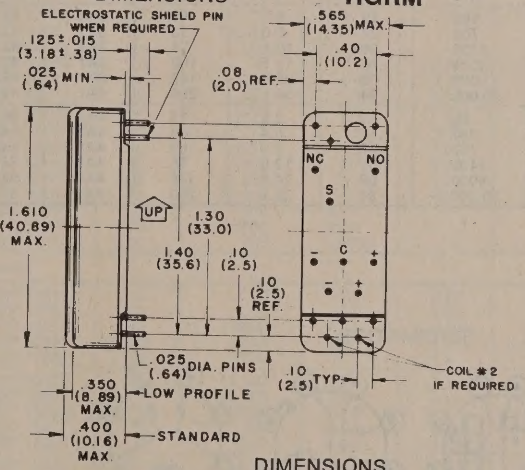
Single-Side-Stable

Stock Part Number		Nom. Coil Voltage (Vdc)	Coil Resist. ±10% (Ohms)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	List Price
1 Form D	1 Form C						
HGSR11111H00	HGSR51111H00	4	50	1.4	0.35	9.4	$13.40
HGSR11111K00	HGSR51111K00	6	125	2.3	0.56	15	13.40
HGSR11111M00	HGSR51111M00	10	325	3.8	0.95	24	13.40
HGSR11111Q00	HGSR51111Q00	20	1125	7.2	1.8	44	13.40
HGSR11111V00	HGSR51111V00	48	6100	17	4.3	103	13.40
HGRM11111J00	HGRM51111J00	5	70	1.8	0.44	11	13.40
HGRM11111K00	HGRM51111K00	6	125	2.3	0.56	15	13.40
HGRM11111N00	HGRM51111N00	12	435	4.6	1.1	28	13.40
HGRM11111R00	HGRM51111R00	24	1750	8.8	2.2	55	13.40
	2 Form C						
	HGR2MT5001	6	55.5	2.5	0.6	14	25.10
	HGR2MT5002	12	250	5.0	1.25	30	25.10
	HGR2MT5003	24	870	10	2.5	56	25.10
	HGR2MT5004	48	3500	20	5.0	110	25.10

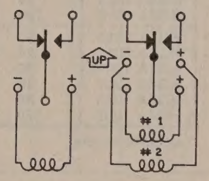
Bistable, Double Wound Coil

Stock Part Number		Nom. Coil Voltage (Vdc)	Coil Resist. ±10% (Ohms)	Set Either Winding (Vdc)	Reset Either Winding (Vdc)	Max. Voltage (Vdc)	List Price
1 Form D	1 Form C						
HGRM12112M00	HGRM52112M00	5	155/155	+1.9	−1.9	16	$13.40

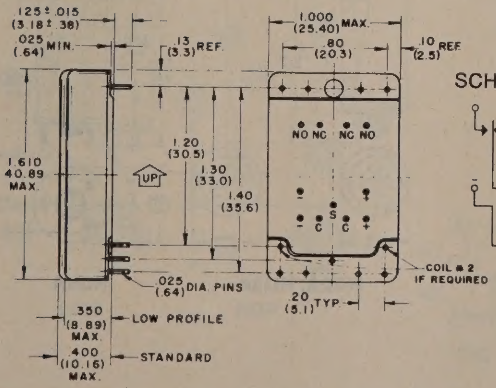
DIMENSIONS **HGRM**


ELECTROSTATIC SHIELD PIN WHEN REQUIRED
.125±.015 (3.18±.38)
.025 (.64) MIN.
.565 (14.35) MAX.
.40 (10.2)
.08 (2.0) REF.
1.610 (40.89) MAX.
UP
1.30 (33.0)
1.40 (35.6)
.10 (2.5)
.10 (2.5) REF.
NC
NO
S
C
.025 (.64) DIA. PINS
.10 (2.5) TYP.
COIL #2 IF REQUIRED
.350 (8.89) MAX. LOW PROFILE
.400 (10.16) MAX. STANDARD

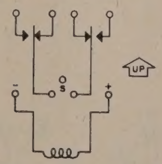
SCHEMATICS



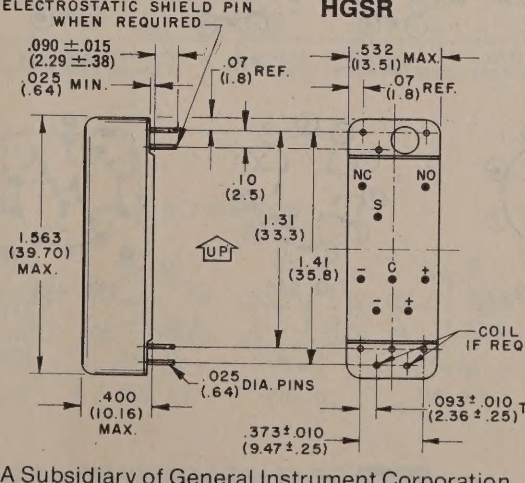
DIMENSIONS **HGR2MT**


.125±.015 (3.18±.38)
.025 (.64) MIN.
.13 (3.3) REF.
1.000 (25.40) MAX.
.80 (20.3)
.10 (2.5) REF.
1.610 40.89 MAX.
UP
1.20 (30.5)
1.30 (33.0)
1.40 (35.6)
NO NC NC NO
S
C C
.025 (.64) DIA. PINS
COIL #2 IF REQUIRED
.20 (5.1) TYP.
.350 (8.89) MAX LOW PROFILE
.400 (10.16) MAX. STANDARD

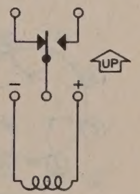
SCHEMATIC



DIMENSIONS **HGSR**


ELECTROSTATIC SHIELD PIN WHEN REQUIRED
.090 ±.015 (2.29 ±.38)
.025 (.64) MIN.
.07 (1.8) REF.
.532 (13.51) MAX.
.07 (1.8) REF.
.10 (2.5)
1.31 (33.3)
1.41 (35.8)
1.563 (39.70) MAX.
UP
NC
NO
S
C
COIL #2 IF REQUIRED
.025 (.64) DIA. PINS
.400 (10.16) MAX.
.093±.010 (2.36±.25) TYP.
.373±.010 (9.47±.25)

SCHEMATIC



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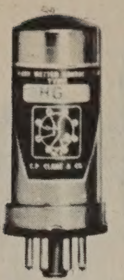
MERCURY-WETTED CONTACT RELAYS

HG, HG2A, HG3A, HG4A PLUG-IN RELAYS


HG

HG2A, HG3A

HG4A

HG SERIES

Clare HG, HG2A, HG3A and HG4A heavy duty mercury-wetted contact relays offer 1, 2, 3 or 4 Form D packages respectively in standard industrial plug-in styles. The entire series feature heavy duty 250VA, 500V or 5A per pole maximum ratings for rugged loads. The entire relay series is polarity insensitive. Plated steel covers provide excellent mechanical protection and electrical shielding.

Stock Part No.	Rec. Nom. Coil (Vdc)	Coil Resistance ±10%	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Base Figure	List Price
HG							
HG 1019	5	40	2.9	1.1	11	4	$20.00
HG 1012	10	130	5.4	2.0	20	4	20.00
HG 1026	18	500	11	3.9	39	1	20.00
HG 1004	24	700	15	5.2	45	1	20.00
HG 1051	24	700	15	5.2	45	4	20.00
HG 1043	28	1000	17	5.9	55	1	20.00
HG 1001	48	2500	28	9.9	87	1	20.00
HG 1002	56	4000	33	11.9	110	1	12.25
HG 1017	56	4000	33	11.9	110	4	20.00
HG 1009	80	7000	45	16.3	145	1	20.00
HG 1011	100	11,000	61	22	180	1	20.00
HG 1024	160	25,000	94	34	275	1	20.00
HG 1003†	42/75	700/3300	25/47	8.6/15	46/99	2	20.00
HG2A 1008	9	50	6	2.1	14	2A2	32.45
HG2A 1042	15	140	10	3.5	24	2A1	32.45
HG2A 1003	22	315	15	5.2	36	2A2	32.45
HG2A 1017	26	500	19	6.5	45	2A2	32.45
HG2A 1009	32	700	24	8.0	53	2A1	32.45
HG2A 1002	32	700	24	8.0	53	2A2	32.45
HG2A 1015	42	1250	30	10.4	71	2A2	32.45
HG2A 1068	64	2500	46	15.7	100	2A1	32.45
HG2A 1001	84	5000	62	21.3	142	2A1	32.45
HG2A 1004	84	5000	62	21.3	142	2A2	32.45
HG2A 1013	120	10,000	94	34.1	200	2A2	32.45
HG3A 1004	22	315	15	5.2	36	3A1	42.10
HG3A 1006	26	500	19	6.5	45	3A1	42.10
HG3A 1002	32	700	24	8.0	53	3A1	42.10
HG3A 1008	42	1250	30	10.4	71	3A1	42.10
HG3A 1005	64	2500	46	15.7	100	3A1	42.10
HG3A 1003	84	5000	62	21.3	142	3A1	42.10
HG3A 1010	120	10,000	94	34.1	200	3A1	42.10
HG4A 1013	10	65	7.2	2.5	16	4A1	54.10
HG4A 1011	24	390	18	6.4	40	4A1	54.10
HG4A 1001	36	700	27	9.6	53	4A1	54.10
HG4A 1007	48	1400	35	12.5	75	4A1	54.10
HG4A 1003	95	4000	69	24.3	126	4A1	54.10
HG4A 1006	120	10,000	94	33.5	200	4A1	54.10

† Double Wound

ENGINEERING DATA

HG SERIES

CONTACT RATING: Power 250VA, max. voltage 500V, max. current 5A, max., (10A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 20 to 50 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10^{10} operations (with proper contact protection)

TIMING: Depending on relay configuration and coil drive

Operate — 2 to 10ms

Release — 2 to 8ms

BREAKDOWN VOLTAGE: 1000Vac, rms, 60Hz between mutually insulated terminals

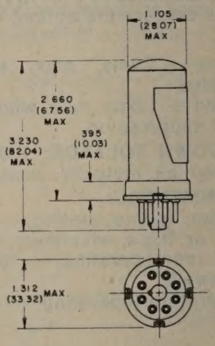
ENVIRONMENTAL:

Vibration (non-operating) — 10-500Hz, 0.06" d.a. or 10g's, whichever is less.

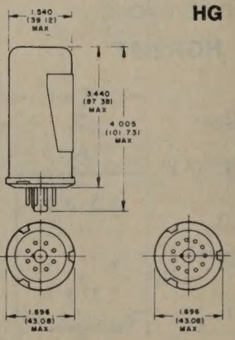
Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave

Temperature (operating) — −38.8° to +85°C

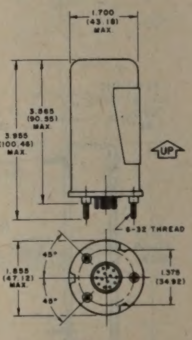
DIMENSIONS



HG



HG2A, HG3A



HG4A

SCHEMATICS

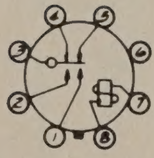


FIG. 1

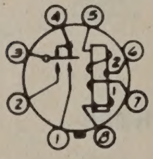


FIG. 2

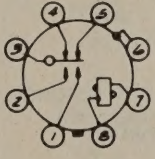


FIG. 4

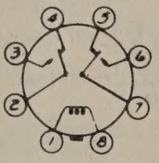


FIG. 2A1

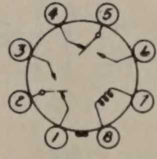


FIG. 2A2

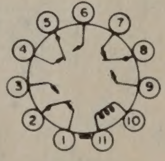


FIG. 3A1

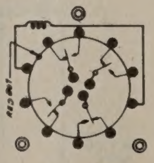


FIG. 4A1

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MERCURY-WETTED CONTACT RELAYS

HGS, HGP OCTAL PLUG RELAYS

HGS

HGP

HGS

HGS Mercury wetted relay offer increased speed and reliability along with high sensitivity. HGS 1000 Series provide SPDT make-before-break and HGS 5000 Series provides SPDT break-before-make. Both are rated at 2 amps, 500 Volts, 100VA max. Standard design available only in single element assemblies, they come in the following, single-side-stable, bistable and chopper. Life expectancy is 20 x 10⁹ at specified ratings.

HGP

HGP is similar to the HG Series except for the inclusion of permanent magnets making a slight increase in height. Magnets provide increased sensitivity. Contacts are SPDT make-before-break rated at 5 amps, 500 Volts, 250VA maximum. Life expectancy is 20 x 10⁹ at specified rating.

ENGINEERING DATA

HGS

CONTACT RATING: Power 100VA, max. voltage 500V, max. current 2A, max., (5A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 20 to 40 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10¹⁰ operations (with proper contact protection)

TIMING:
Operate — 2.75ms, max. at nominal coil voltage
Release — 2.75ms, max. with nominal voltage coil suppression

HGP

CONTACT RATING: Power 250VA, max. voltage 500V, max. current 5A, max., (10A max. carry only) with proper contact protection

CONTACT CIRCUIT RESISTANCE: 20 to 50 milliohms, stable within ±2 milliohms over life

LIFE EXPECTANCY: 2 x 10¹⁰ operations (with proper contact protection)

HGS & HGP

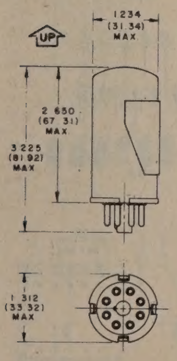
BREAKDOWN VOLTAGE: 1000Vac, rms 60Hz between mutually insulated terminals

ENVIRONMENTAL:
Vibration (non-operating) — 10-500Hz, 0.06″ d.a. or 10g's, whichever is less.
Shock (non-operating) — 30g's, 11 ±1ms ½ sinewave
Temperature (operating) — −38.8° to +85°C

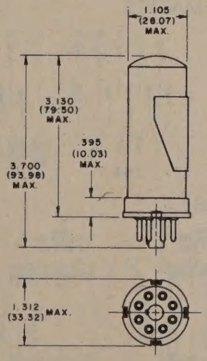
Stock Part No.	Rec. Nom. Coil (Vdc)	Coil Resistance ±10%	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Base Figure	List Price
HGS							
HGS 1015‡	2	90	.63	0.09	13	S1	$16.55
HGS 1045‡	4	350	1.4	0.19	26	S1	16.55
HGS 1018‡	5	500	1.6	0.22	31	S1	16.55
HGS 1009‡	6	500	1.9	0.37	34	S1	16.55
HGS 1046‡	8	700	2.2	0.31	37	S1	16.55
HGS 1014‡	9	1000	2.4	0.34	44	S1	16.55
HGS 1019†*	8/8	1100/1100	±2.2	—	47	S3	16.55
HGS 1010‡	9	1900	3.3	0.67	61	S1	16.55
HGS 1006‡	10	2500	3.9	0.38	70	S1	16.55
HGS 1005‡	16	4000	5.5	0.90	90	S1	16.55
HGS 1048‡	24	4000	8.4	3.6	90	S4	16.55
HGS 1016‡	22	7000	6.7	0.88	118	S1	16.55
HGS 1017‡	32	11,000	8.7	1.2	148	S1	16.55
HGS 1113*	5	1000	±1.4	—	45	S1	16.55
HGS 1114*	8	2500	±2.3	—	70	S1	16.55
HGS 1026*	10	4000	±2.1	—	90	S1	16.55
HGS 1056*	12	7000	±3.7	—	118	S1	16.55
HGS 1096*	24	25,000	±8.0	—	223	S1	16.55
HGS 1004§	—	600	6.3Vac	—	—	S1	16.55
HGS 5009‡	1.0	40	.43	0.06	8.9	S1	16.55
HGS 5011‡	4	350	1.4	0.19	26	S1	16.55
HGS 5031‡	6	600	1.9	0.37	34	S1	16.55
HGS 5015‡	9	1000	2.4	0.34	44	S1	16.55
HGS 5003‡	10	2500	3.9	0.38	70	S1	16.55
HGS 5008‡	16	4000	5.5	0.90	90	S5▲	16.55
HGS 5014‡	22	7000	6.7	0.88	118	S1	16.55
HGS 5047‡	32	11,000	8.7	1.2	148	S1	16.55
HGS 5016‡	32	25,000	14.3	2.0	224	S1	16.55
HGS 5006*	5	1000	±1.4	—	45	S1	16.55
HGS 5004*	10	4000	±2.1	—	90	S1	16.55
HGS 5017§	—	600	6.3Vac	—	—	S1	16.55
HGP							
HGP 1001‡	3	90	1.6	0.10	16	1	$21.75
HGP 1005‡	12	1000	6.2	0.36	55	1	21.75
HGP 1002‡	28	4000	13	0.86	110	1	21.75
HGP 1008‡	42	4000	21	6.1	110	1	21.75
HGP 1055‡	36	7000	17	1.2	145	1	21.75
HGP 1052‡	48	11,000	23	2.1	180	1	21.75
HGP 1050‡	75	25,000	36	3.4	275	1	21.75
HGP 1006‡†	24/48	700/3300	11/21	11.8	46/99	3	21.75
HGP 1047*	4	600	+2.2	−2.2	43	1	21.75
HGP 1003*	12	4000	+6.6	−2.6	110	1	21.75
HGP 1012†*	8/16	700/3300	+4.6/8.7	−4.6/8.7	46/99	3	21.75
HGP 1031†*	28/28	7500/7500	+14/14	−14/14	150/150	3	21.75
HGP 1028§	—	500	6.3Vac	—	—	4	21.75
HGP 1009§	—	4000	18.5Vac	—	—	4	21.75

† Double Wound. ‡ Single-Side-Stable. * Bi-Stable. § Chopper. †* Double Wound Bi-Stable.
‡† Single-Side-Stable Double Wound. ▲ S5 same as S1 except pin 6 connected to case.

DIMENSIONS



HGS



HGP

SCHEMATICS

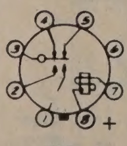


FIG. 1

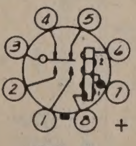


FIG. 3

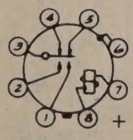


FIG. 4

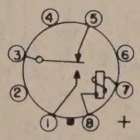


FIG. S1

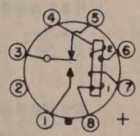


FIG. S3

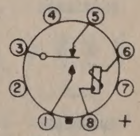
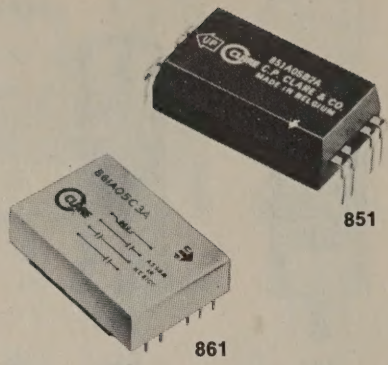


FIG. S4

C. P. CLARE & COMPANY • A Subsidiary of General Instrument Corporation
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

MERCURY-WETTED REED RELAYS

851 MOLDED AND 861 METAL COVERED RELAYS


851A05B2A
C P CLARE & CO.
MADE IN BELGIUM
861A05C3A
851
861

851 SERIES

Clare's 851 relay series represents new design dimensions and offers freedom in the solution of switching problems. They provide billion operation bounce-free mercury-wetted switching performance, load handling capability from signal-level to 50VA, multipole flexibility, epoxy molded construction, and a cost approaching dry reed relays. 851 series relays are designed for printed circuit board mounting.

861 SERIES

Clare 861 series Mercury-Wetted Microclareed relays are superior when compared to dry reed relays of the same size. The relay has a reliable reed capsule with a no-bounce mercury-wetted armature. You obtain some of the mercury-wetted contact relay advantages at a slight price premium over dry reed relays.

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate (Vdc)	Must Release (Vdc)	Maximum Voltage (Vdc)	Coil Resistance (Ohms ±10%)	List Price
851 EPOXY MOLDED RELAYS							
852A05B1A	1A	5	3.75	0.5	15	120	$6.30
851A12B1A		12	9	1.3	31	490	6.30
851A24B1A		24	18	2.6	61	1870	6.70
851A05B2A	2A	5	3.75	0.4	9	32	8.55
851A12B2A		12	9	0.9	23	184	8.55
851A24B2A		24	18	2.0	47	744	8.90
851A05B4A	4A	5	3.75	0.4	9	20	13.00
851A12B4A		12	9	1.0	23	126	13.00
851A24B4A		24	18	2.1	47	510	13.35
861 METAL COVERED RELAYS							
861A05C1A	1A	5	3.75	0.15	10	95	$6.30
861A12C1A		12	9	0.7	18	405	6.30
861A24C1A		24	18	1.4	36	2210	6.70
861A05C2A	2A	5	3.75	0.15	7.5	55	8.55
861A12C2A		12	9	0.7	18	250	8.55
861A24C2A		24	18	1.4	36	1000	8.90
861A05C3A	3A	5	3.75	0.15	7.5	46	10.75
861A12C3A		12	9	0.7	18	325	10.75
861A24C3A		24	18	1.4	28	810	11.15
861A05C4A	4A	5	3.75	0.15	7.5	31	13.00
861A12C4A		12	9	0.7	18	200	13.00
861A24C4A		24	18	1.4	28	600	13.35
861A05C5A	5A	5	3.75	0.15	7.5	22	15.20
861A12C5A		12	9	0.7	18	150	15.20
861A24C5A		24	18	1.4	28	420	15.60

ENGINEERING DATA

851 AND 861 SERIES

CONTACT RATING (Resistive load with proper contact protection):
Power — 50VA max.
Voltage — 350Vdc or peak ac max.
Current — 1 ampere, max., switched
3 amperes, max., carry only

CONTACT RESISTANCE (ON Impedance): 50 milliohms maximum, ±2 milliohms throughout life

INSULATION RESISTANCE (OFF Impedance): 500 megohms over open contacts, 10,000 megohms between coil and contacts at 100Vdc, +25°C, 20-50% relative humidity

DRAIN TIME: 30 seconds after reaching upright vertical position plus at least one no-load operation to clear the contacts

BREAKDOWN VOLTAGE: 1000V, rms, 50/60Hz or 1400Vdc between all mutually insulated terminals

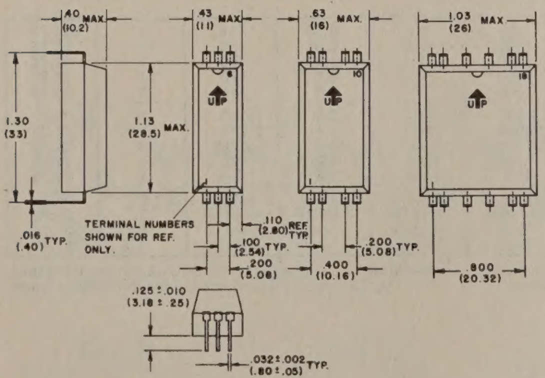
OPERATING TIME: 3 milliseconds, maximum (No bounce on closure)

RELEASE TIME: 3 milliseconds, maximum with nominal clamping

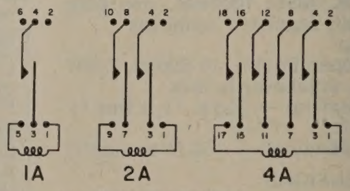
ENVIRONMENTAL:
Vibration — 10-500Hz, 0.06″ double amplitude or 10g's (non-operating)
Shock — 30g's, 11 ±1ms, ½ sinewave (non-operating)
Temperature — −38.8° to +65°C (operating)

LIFE EXPECTANCY (With proper contact protection): 20 x 10^6 operations at max. contact rating

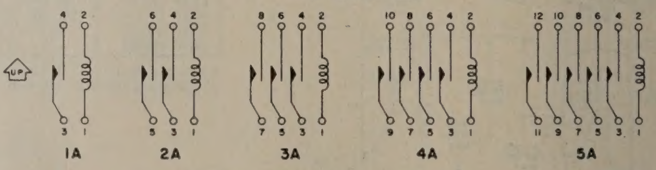
851 DIMENSIONS


.40 MAX (10.2)
.43 MAX (11)
.63 MAX. (16)
1.03 MAX (26)
1.30 (33)
1.13 (28.5) MAX.
UP
6
10
18
1
.016 (.40) TYP.
TERMINAL NUMBERS SHOWN FOR REF. ONLY.
.110 (2.80) REF TYP.
.100 (2.54) TYP.
.200 (5.08)
.400 (10.16)
.200 (5.08) TYP.
.800 (20.32)
.125 ±.010 (3.18 ±.25)
.032±.002 (.80±.05) TYP.

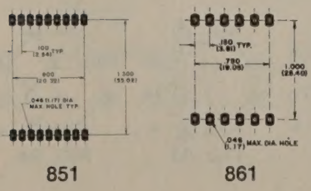
851 SCHEMATICS


6 4 2
5 3 1
1A
10 8 4 2
9 7 3 1
2A
18 16 12 8 4 2
17 15 11 7 3 1
4A

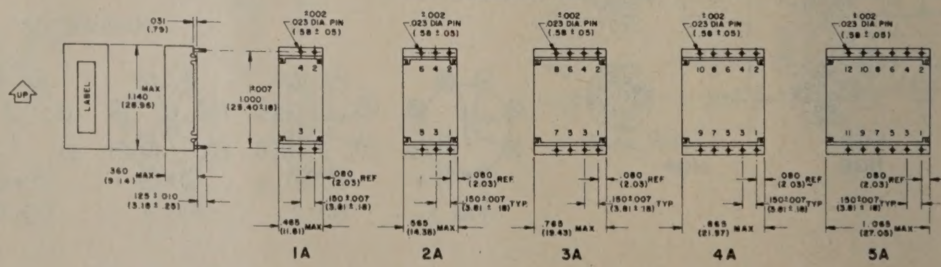
861 SCHEMATICS


UP
4 2
3 1
1A
6 4 2
5 3 1
2A
8 6 4 2
7 5 3 1
3A
10 8 6 4 2
9 7 5 3 1
4A
12 10 8 6 4 2
11 9 7 5 3 1
5A

PAD LAYOUTS


.100 (2.54) TYP
.800 (20.32)
1.300 (33.02)
.046 (1.17) DIA MAX. HOLE TYP
851
.150 (3.81) TYP.
.750 (19.05)
1.000 (25.40)
.046 (1.17) MAX. DIA. HOLE
861

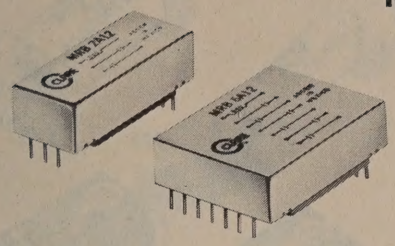
861 DIMENSIONS


UP
.031 (.79)
LABEL
MAX 1.140 (28.96)
±.007 1.000 (25.40±.18)
.360 (9.14) MAX
.125 ±.010 (3.18 ±.25)
±.002 .023 DIA. PIN (.58 ±.05)
.080 (2.03) REF
.150 ±.007 (3.81 ±.18) TYP
.465 (11.81) MAX
.565 (14.35) MAX
.765 (19.43) MAX
.865 (21.97) MAX
1.065 (27.05) MAX
1A
2A
3A
4A
5A

C P. CLARE & COMPANY • A Subsidiary of General Instrument Corporation
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

DRY REED RELAYS

MRB METAL COVERED MICROCLAREED® RELAYS



Clare's MRB Microreed relays offer versatile signal level to 10VA switching capabilities, total input/output isolation, 800 microsecond typical switching speeds in the miniature sized relay family.

The MRB relays operate with coil power requirements as low as 10 milliwatts. The ultra-reliable operation will exceed 100 x 10⁶ operations at signal level loads or 10 x 10⁶ operations at the rated load.

Optional MRB relays are available in 3 or 5 Form A, 2 Form B, 3 or 4 Form C. 1A latching or 2A latching and 2A2B contact forms. UL recognized versions in all but Form C are available as listed in UL File E43775. The relays have molded epoxy bases with stamped metal covers and convenient 1.000″ x 0.100″ grid mounting centers for printed circuit board mounting. This low profile package will mount on 0.5″ PCB centers. Electrostatic shielding is available. 1.000″ x 0.150″ grid mounting models are available in 1 to 5 Form A versions. Consult the factory for details.

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Maximum Voltage (Vdc)	Coil Resis. (Ohms ±10% @ 25°C)	List Price
MRB 1A05	1A	5	3.75	0.15	15	225	$2.65
MRB 1A06		6	4.5	0.15	18	340	2.65
MRB 1A12		12	9	0.7	36	1400	2.65
MRB 1A24		24	18	1.4	60	4340	3.00
MRB 2A05	2A	5	3.75	0.15	11	105	3.75
MRB 2A06		6	4.5	0.15	14	180	3.75
MRB 2A12		12	9	0.7	26	730	3.75
MRB 2A24		24	18	1.4	48	2500	4.10
MRB 4A05	4A	5	3.75	0.15	9	60	5.95
MRB 4A06		6	4.5	0.15	11	100	5.95
MRB 4A12		12	9	0.7	18	275	5.95
MRB 4A24		24	18	1.4	36	1090	6.30
MRB 6A05	6A	5	3.75	0.15	7	32	8.15
MRB 6A06		6	4.5	0.15	9	50	8.15
MRB 6A12		12	9	0.7	18	210	8.15
MRB 6A24		24	18	1.4	36	900	8.50
MRB 1B05	1B	5	3.75	0.4	7.5	300	3.75
MRB 1B06		6	4.5	0.5	9	450	3.75
MRB 1B12		12	9	1	18	1240	3.75
MRB 1B24		24	18	2	36	5800	4.10
MRB 1N05	1A1B	5	3.75	0.4	7.5	50	4.85
MRB 1N06		6	4.5	0.5	9	82	4.85
MRB 1N12		12	9	1	18	230	4.85
MRB 1N24		24	18	2	36	900	5.20
922A05C1C	1C	5	3.75	0.4	20	200	5.95
922A06C1C		6	4.5	0.5	25	270	5.95
922A12C1C		12	9	1	45	1080	5.95
922A24C1C		24	18	2	93	4320	6.30
922A05C2C	2C	5	3.75	0.4	16	100	10.35
922A06C2C		6	4.5	0.5	21	145	10.35
922A12C2C		12	9	1	32	630	10.35
922A24C2C		24	18	2	75	2520	10.70

ENGINEERING DATA

CONTACT RATINGS (Resistive load):
Power — Form A/B 10VA max. Form C 3VA max.
Voltage — Form A/B 200 Vdc or peak ac, max. Form C 28 Vdc or peak ac, max.
Current — Form A/B 0.75 amperes, switched, max. Form C 0.25 amperes, switched, max. Form A/B 2.0 amperes, carry only, max. Form C 1.5 amperes, carry only, max.

CONTACT RESISTANCE: (ON Impedance): Initial: 200 milliohms max., measured at 10mA, 1000Hz

LIFE EXPECTANCY: 100 x 10⁶ operations at signal levels. 10 x 10⁶ operations at full rated load

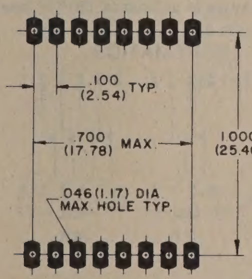
TYPICAL OPERATE TIME: Less than 800μs including bounce

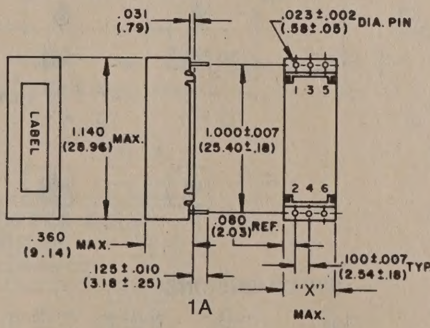
TYPICAL RELEASE TIME: As low as 90μs. Less than 500μs with nominal zener clamping. All release times dependent upon contact forms and coil drive.

BREAKDOWN VOLTAGE: 250Vac, rms, 60Hz across open contacts or 350Vdc max.

INSULATION RESISTANCE (OFF Impedance): 10^{10} ohms min. at 100Vdc +25°C, 40% rel. hum.

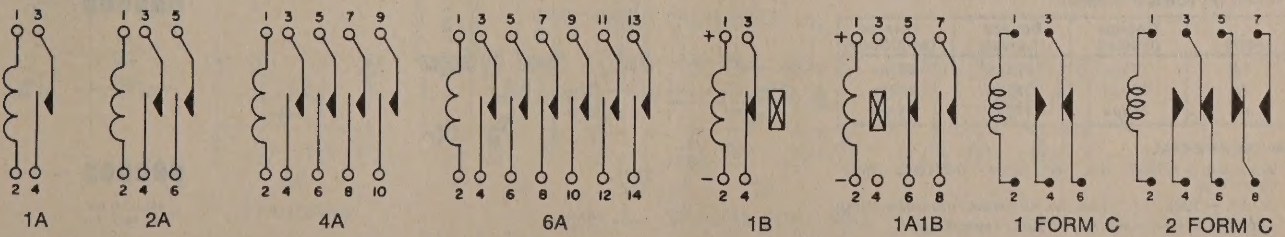
ENVIRONMENTAL (Operating): Vibration: 0.06″ d.a. or 10g's, 10-2000Hz. Shock: 20g's, 11 ±1ms, ½ sinewave. Temperature: −40°C to +85°C





Contact Form	"X"
1A	.365
2A, 1B, 1C	.465
1A1B, 2C	.565
4A	.665
6A	.865

SCHEMATICS



1A 2A 4A 6A 1B 1A1B 1 FORM C 2 FORM C

C. P. CLARE & COMPANY • A Subsidiary of General Instrument Corporation
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

DRY REED RELAYS

925 OPEN TYPE AND 951 MOLDED RELAYS

925 SERIES

Clare's new 925 series dry reed relays utilize an economical open type construction and the reliable Microclareed® miniature dry reed switch which gives up to 10 million operations at rated load. The relay frame is formed in a single molded piece for greater strength and rigidity. The relays are available in 1 Form A, 2 Form A and 1 Form B contact arrangements with 5/6, 12, or 24Vdc coils.

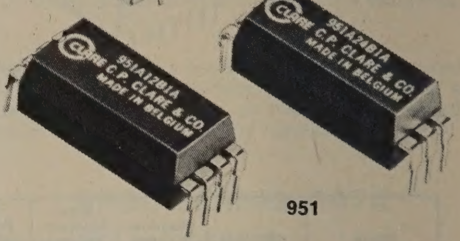
951 SERIES

The Clare 951 series dry reed relays offer signal level to 10VA switching capabilities, standard contact arrangements of 1, 2 and 4 Form A configurations, total input/output isolation, and rugged epoxy molded construction. Clare manufactured capsules and their demonstrated switching reliability provide 100 million operations at signal-level loads or 5 million operations at rated loads.

UL Recognized
File No. E43775A

925A05C1A
925A05C2A
CLARE

925


951A12B1A
C.P. CLARE & CO.
MADE IN BELGIUM
951A24B1A
C.P. CLARE & CO.
MADE IN BELGIUM

951

ENGINEERING DATA

925 SERIES

CONTACT RATING (Resistive load):
Power — 10VA, max.
Voltage — 200Vdc, max.
Current — 0.75 ampere, switched, max.
2.0 amperes, carry only, max.

CONTACT RESISTANCE (ON Impedance): 250 milliohms, max. initial total circuit, measured at 10mA, 1000Hz

LIFE EXPECTANCY: 100 x 10^6 operations at signal levels, 10 x 10^6 operations at full rated load

INSULATION RESISTANCE (OFF Impedance): 10^{10} ohms min. between all insulated points at 100Vdc, +25°C, 40% relative humidity

DIELECTRIC WITHSTANDING VOLTAGE: 250Vac, rms, 60Hz across open contacts or 350 Vdc max. 500 Vdc all other mutually insulated points.

TIMING (At nominal voltage):
Operate — Less than one millisecond including bounce
Release — Less than one millisecond with nominal voltage zener clamping

ENVIRONMENTAL (Operating): Temperature — −40° to +85°C

PHYSICAL:
Mounting — Any position
Contact — Rhodium over gold
Terminals — Solderable

951 SERIES

CONTACT RATING (Resistive load):
Power — 10VA, max.
Voltage — 150Vdc, or peak ac, max.
Current — 0.75 ampere, switched, max.
1.0 ampere, carry only, max.

CONTACT RESISTANCE (ON Impedance): 200 milliohms, max. initial

LIFE EXPECTANCY: 100 x 10^6 operations at signal levels, 5 x 10^6 operations at 750mA, 12Vdc, resistive, 5 x 10^5 operations at 360mA, 28Vdc, resistive

INSULATION RESISTANCE (OFF Impedance): 10,000 megohms between all insulated points at 100Vdc, +25°C, 20-50% relative humidity

CAPACITANCE: 0.6pF across open contacts, 1.4pF open contacts to coil, 2.5pF closed contacts to coil

DIELECTRIC WITHSTANDING VOLTAGE: 175Vac, rms, 50/60Hz or 250Vdc across open contacts, 1000Vac, 50/60Hz or 1400Vdc all other points

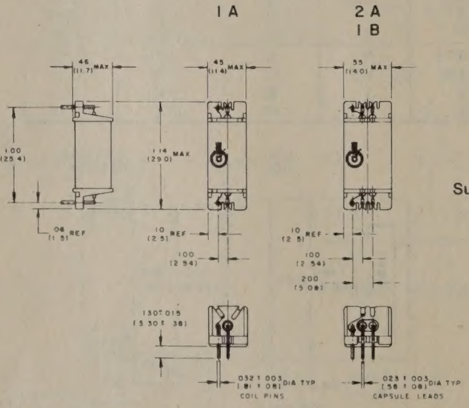
TIMING (At nominal voltage):

Form	Operate (typical)	Bounce (typical)	Release (with diode)
1A	175µs	120µs	250µs
2A	250µs	120µs	250µs
4A	350µs	120µs	250µs

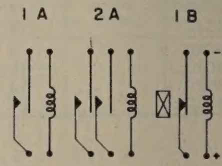
ENVIRONMENTAL:
Vibration — 0.125″ d.a. or 20g's, 0-5000Hz (non-operating)
Shock — 100g, 11 ±1ms, ½ sinewave (non-operating)
Temperature — −40° to +105°C (operating)

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate (Vdc)	Must Release (Vdc)	Max. Voltage (Vdc)	Coil Resistance (Ohms, ±10%)	List Price
925							
925A05C1A	1A	5/6	3.75	0.35	10	260	$1.65
925A12C1A		12	9	0.7	18	800	1.65
925A24C1A		24	18	1.4	36	2670	1.65
925A05C2A	2A	5/6	3.75	0.35	10	200	2.25
925A12C2A		12	9	0.7	18	800	2.25
925A24C2A		24	18	1.4	36	3050	2.25
925A05C1B	1B	5/6	3.75	0.35	9	200	2.25
925A12C1B		12	9	0.7	18	800	2.25
925A24C1B		24	18	1.4	36	3050	2.25
951							
951A05B1A	1A	5	3.75	0.4	16	190	$2.65
951A12B1A		12	8.6	1.0	39	1150	2.65
951A24B1A		24	17.1	2.0	74	4200	3.00
951A05B2A	2A	5	3.75	0.4	12	105	3.75
951A12B2A		12	8.6	1.0	31	630	3.75
951A24B2A		24	17.1	2.0	59	2300	4.10
951A05B4A	4A	5	3.75	0.3	11	60	5.95
951A12B4A		12	9.2	0.9	28	370	5.95
951A24B4A		24	18	1.5	56	1400	6.30

925 DIMENSIONS

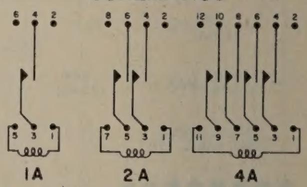

I A
2 A
I B
.46 (11.7) MAX
.45 (11.4) MAX
.55 (14.0) MAX
1.00 (25.4)
1.14 (29.0) MAX
.06 (1.5) REF
.10 (2.5) REF
.10 (2.5) REF
.100 (2.54)
.100 (2.54)
.200 (5.08)
.130 ± .015 (3.30 ± .38)
.032 ± .003 (.81 ± .08) DIA TYP
COIL PINS
.023 ± .003 (.58 ± .08) DIA TYP
CAPSULE LEADS

SCHEMATICS

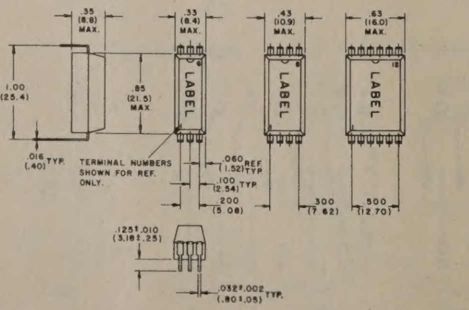


Suggested hole size in pc boards .051″ (1.3mm)

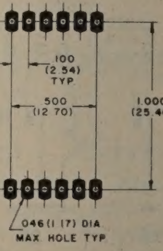
SCHEMATICS


6 4 2
5 3 1
IA
8 6 4 2
7 5 3 1
2 A
12 10 8 6 4 2
11 9 7 5 3 1
4A

951 DIMENSIONS


.35 (8.8) MAX.
.33 (8.4) MAX.
.43 (10.9) MAX.
.63 (16.0) MAX.
1.00 (25.4)
.85 (21.5) MAX.
LABEL
LABEL
LABEL
6
6
12
.016 (.40) TYP.
TERMINAL NUMBERS SHOWN FOR REF. ONLY.
.060 (1.52) REF TYP
.100 (2.54) TYP
.200 (5.08)
.300 (7.62)
.500 (12.70)
.125 ± .010 (3.18 ± .25)
.032 ± .002 (.80 ± .05) TYP.

PAD LAYOUT


.100 (2.54) TYP
.500 (12.70)
1.000 (25.40)
.046 (1.17) DIA MAX HOLE TYP

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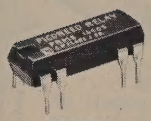
DRY REED RELAYS

PRME EPOXY MOLDED PICOREED® DIP RELAYS



PRME

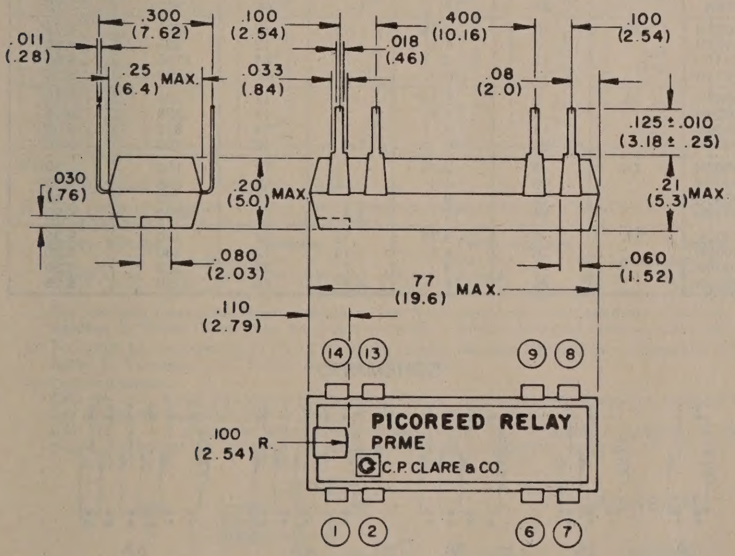
Clare's new dual-in-line package PRME Picoreed relay represents a significant addition to the mincrominiature Picoreed relay family packaging. The relays feature 600 microsecond typical response times, signal level to 10VA switching capabilities, total input/output isolation, epoxy molded consruction and an IC compatible TO-116 DIP package. Traditional Clare reliability gives 100 x 10^6 operations at signal level loads or 5 x 10^6 operations at the rated load.

The PRME one Form A switching arrangement is compatible with most DTL/TTL drive IC's. The coil draws only 13 milliamperes from standard 5 volt logic supplies. Low contact noise and low thermal emf characteristics make the PRME ideal for electronic process control equipment and low level switching applications.

The 0.180″ height optimizes the industry trend toward high density packaging by allowing PRME mounting on 0.375″ PCB centers compatible with IC components. The PRME adapts to either automatic insertion equipment techniques for direct PCB mounting on 0.30″ x 0.100″ grid patterns or to mounting in standard 14 pin DIP sockets.

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Coil Resis. (Ohms ±10%)	List Price
PRME 1A005	1A	5	3.75	0.9	15	380	$3.30
PRME 1A006	Standard	6	4.5	0.9	15	380	3.30
PRME 1A012		12	9	2	18	530	3.30
PRME 1A024		24	18	4	32	2000	3.30
PRME 1A005A	1A	5	3.75	0.9	15	380	3.85
PRME 1A006A	Electrostatic	6	4.5	0.9	15	380	3.85
PRME 1A012A	shield between	12	9	2	18	530	3.85
PRME 1A024A	coil and capsule	24	18	4	32	2000	3.85
PRME 1A005B	1A	5	3.75	0.9	15	380	4.40
PRME 1A006B	Diode between	6	4.5	0.9	15	380	4.40
PRME 1A012B	pins 6 and 9;	12	9	2	18	530	4.40
PRME 1A024B	cathode to pin 6	24	18	4	32	2000	4.95
PRME 1A005C	1A	5	3.75	0.9	15	380	4.95
PRME 1A006C	Both	6	4.5	0.9	15	380	4.95
PRME 1A012C	electrostatic	12	9	2	18	530	4.95
PRME 1A024C	shield and diode	24	18	4	32	2000	4.95

DIMENSIONS



ENGINEERING DATA

PRME

CONTACT RATING (Resistive Load):
Power — 10VA max.
Voltage — 100Vdc or peak ac max.
Current — .5 ampere max., switched. 2.0 amperes, carry only, max.

CONTACT RESISTANCE (ON Impedance): Initial: 200 milliohms max., measured at 10mA, 1000Hz

LIFE EXPECTANCY: 100 x 10^6 operations at signal levels. 5 x 10^6 operations at full rated load

TYPICAL OPERATE TIME: As low as 600μs including bounce

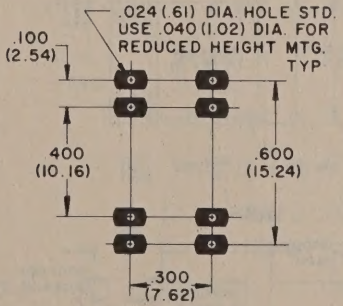
TYPICAL RELEASE TIME: 100μs with nominal coil drive and diode suppression.

BREAKDOWN VOLTAGE: 175Vac, rms, 60Hz across open contacts or 250Vdc, max. 500Vdc all other mutually insulated points

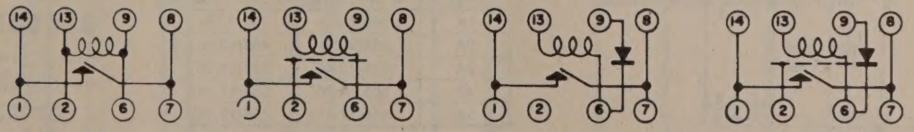
INSULATION RESISTANCE (OFF Impedance): 10^{10} ohms min. at 100Vdc +25°C, 40% rel. hum.

ENVIRONMENTAL (Operating):
Vibration — 0.125″ d.a. or 20g's 10-5000Hz.
Shock — 100g's, 8 ±1ms, ½ sinewave.
Temperature — −40° to +85°C

PCB PAD LAYOUT



TOP VIEW SCHEMATICS



1A STANDARD

1A 1A 1A SPECIAL FEATURES

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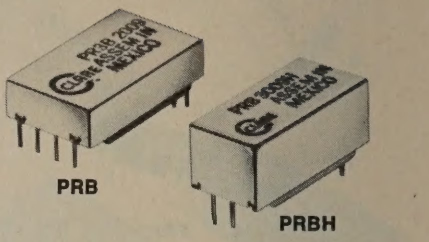
DRY REED RELAYS
PRB, PRBH METAL COVERED PICOREED® RELAYS



Clare's micro-miniature PRB and PRBH series Picoreed relays offer signal level to 10VA switching characteristics, power requirements ranging from 48 to 500 milliwatts (dependent on relay configuration) and operate times typically less than 500 microseconds in economical space saving packages. The low profile PRB series permits 0.375″ PCB mounting centers and the high sensitivity PRBH series will mount on 0.5″ PCB centers.

The 5 volt PRB/PRBH relays are fully compatible with the standard 5 volt DTL/TTL logic families and will solve many interface application problems. Both series have molded epoxy bases with stamped metal covers and mount on 0.70″ x 0.100″ grid patterns. The PRB low profile models are also available in 6 Form A, 1B and 1A1B contact configurations. Electrostatic shielding is available.

ENGINEERING DATA

PRB & PRBH

CONTACT RATING (Resistive load):
Power — 10VA, max.
Voltage — 100Vdc or peak ac, max.
Current — .5 ampere, switched, max. 2 amperes, carry only max.

CONTACT RESISTANCE (ON Impedance): Initial — 200 milliohms max., measured at 10mA, 1000Hz

LIFE EXPECTANCY: 100 x 10^6 operations at signal levels. 5 x 10^6 operations at full rated load

TYPICAL OPERATE TIME: As low as 500μs including bounce

TYPICAL RELEASE TIME: 60μs unsuppressed. 300μs with diode suppression.

BREAKDOWN VOLTAGE: 175Vac, rms, 60Hz across open contacts or 250Vdc, max. 500Vdc all other mutually insulated points.

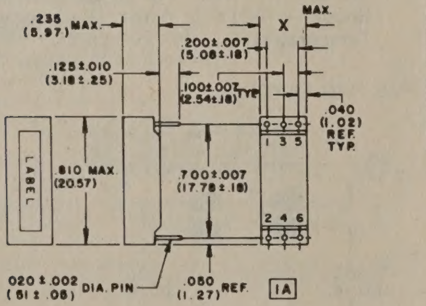
INSULATION RESISTANCE (OFF Impedance): 10^{10} ohms min. at 100Vdc +25°C, 40% rel. hum.

ENVIRONMENTAL (Operating):
Vibration — 0.06″ d.a. or 20g's, 10-5000Hz
Shock — 100g's, 11 ±1ms, ½ sinewave
Temperature — −40° to +85°C

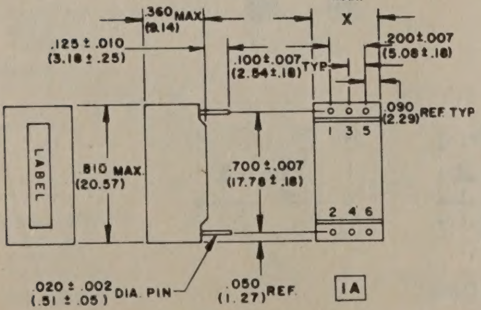
Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Coil Resis. (Ohms ±10%)	List Price
LOW PROFILE PRB SERIES							
PRB 3510	1A	5	3.75	.15	12	385	$3.35
PRB 2510		6	4.5	.15	12	385	3.05
PRB 2513		12	9	.7	24	1200	3.05
PRB 2516		24	18	1.4	48	5380	3.35
PR2B 3007	2A	5	3.75	.15	12	135	4.75
PR2B 2007		6	4.5	.15	12	135	4.40
PR2B 2011		12	9	.7	24	740	4.40
PR2B 2014		24	18	1.4	48	3040	4.75
PR3B 3006	3A	5	3.75	.15	10	115	6.15
PR3B 2006		6	4.5	.15	10	115	5.80
PR3B 2009		12	9	.7	22	480	5.80
PR3B 2013		24	18	1.4	46	2250	6.15
PR4B 3005	4A	5	3.75	.15	10	90	7.50
PR4B 2005		6	4.5	.15	10	90	7.15
PR4B 2008		12	9	.7	22	350	7.15
PR4B 2012		24	18	1.4	46	1860	7.50
PR5B 3005	5A	5	3.75	.15	10	105	8.90
PR5B 2005		6	4.5	.15	10	105	8.55
PR5B 2008		12	9	.7	22	420	8.55
PR5B 2011		24	18	1.4	46	1420	8.90
HIGH SENSITIVITY PRBH SERIES							
PRB 3009H	1A	5	3.75	.15	12	535	$3.75
PRB 2009H		6	4.5	.15	12	535	3.30
PRB 2013H		12	9	.7	24	2870	3.30
PRB 2016H		24	18	1.4	48	11,900	3.75
PR2B 3007H	2A	5	3.75	.15	12	295	4.75
PR2B 2007H		6	4.5	.15	12	295	4.65
PR2B 2010H		12	9	.7	24	1180	4.65
PR2B 2013H		24	18	1.4	48	3780	5.15
PR3B 3006H	3A	5	3.75	.15	12	230	6.15
PR3B 2006H		6	4.5	.15	12	230	6.05
PR3B 2009H		12	9	.7	24	875	6.05
PR3B 2013H		24	18	1.4	48	4700	6.50
PR4B 3005H	4A	5	3.75	.15	12	155	7.90
PR4B 2005H		6	4.5	.15	12	155	7.15
PR4B 2008H		12	9	.7	24	660	7.15
PR4B 2012H		24	18	1.4	48	3620	7.90
PR5B 3005H	5A	5	3.75	.15	12	180	9.25
PR5B 2005H		6	4.5	.15	12	180	8.80
PR5B 2008H		12	9	.7	24	770	8.80
PR5B 2011H		24	18	1.4	48	3150	9.25

DIMENSIONS

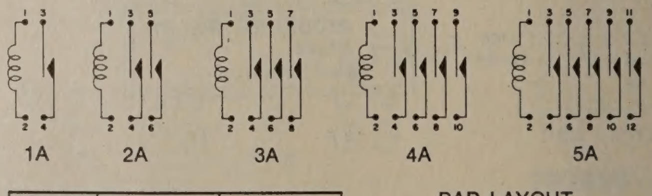
PRB


.235 (5.97) MAX.
MAX.
X
.200±.007 (5.08±.18)
.125±.010 (3.18±.25)
.100±.007 (2.54±.18) TYP
.040 (1.02) REF. TYP.
LABEL
.810 MAX. (20.57)
.700±.007 (17.78±.18)
1 3 5
2 4 6
020±.002 (.51±.05) DIA. PIN
.050 (1.27) REF.
1A

PRBH

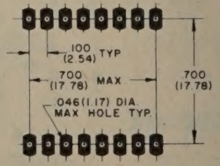

.360 MAX (9.14)
MAX.
X
.125±.010 (3.18±.25)
.100±.007 (2.54±.18) TYP
.200±.007 (5.08±.18)
.090 (2.29) REF TYP
1 3 5
2 4 6
LABEL
.810 MAX. (20.57)
.700±.007 (17.78±.18)
.020±.002 (.51±.05) DIA. PIN
.050 (1.27) REF.
1A

SCHEMATIC


1 3
2 4
1A
1 3 5
2 4 6
2A
1 3 5 7
2 4 6 8
3A
1 3 5 7 9
2 4 6 8 10
4A
1 3 5 7 9 11
2 4 6 8 10 12
5A

Contact Form	X Dim. PRB	X Dim. PRBH
1A	.285(7.24)	.385(9.78)
2A	.385(9.78)	.485(12.40)
3A	.485(12.40)	.585(14.86)
4A	.585(14.86)	.685(17.40)
5A	.685(17.40)	.785(19.94)

PAD LAYOUT


100 (2.54) TYP
700 (17.78) MAX
700 (17.78)
046(1.17) DIA. MAX HOLE TYP.

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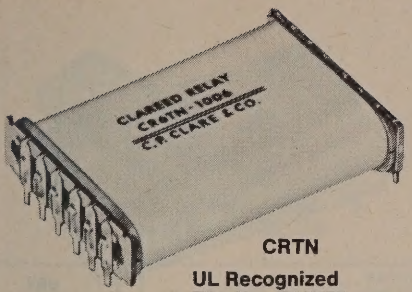
CRTN SERIES CLAREED® DRY REED RELAYS



CRTN

UL Recognized File No. E43775

Clare's economical CRTN standard size reed relays offer signal level to 15VA power handling capabilities, total input/output isolation, and low milisecond switching speeds. CRTN relays are direct replacements for our CRT series relays. Like all Clare reed relays, they are immune to false operation and are insensitive to overload transients that affect solid state devices. Clareed relays are rated for millions of reliable, trouble free operations. Optional CRTN series contact configurations are 3 & 5 Form A, 1B or 2B, 1C or 2C, and 1A latching or 2A latching. Special relays are available with up to twelve contacts. UL recognized versions of our 1 to 12 Form A relays are available as listed in UL File E43775. The relays feature open assembly construction and PCB 2.5″ x .218″ grid mounting centers.

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)	Max. Voltage (Vdc)	Coil Resis. (Ohms ±10%)	List Price
CRTN 1007	1A	6	4.5	0.6	20	160	$3.70
CRTN 1010		12	9	1.2	35	600	3.70
CRTN 1013		24	18	2.5	75	2500	4.70
CRTN 1016		48	36	4.8	150	9450	6.30
CR2TN 1004	2A	6	4.5	0.5	18	90	4.70
CR2TN 1007		12	9	1.1	35	350	4.70
CR2TN 1010		24	18	2.2	65	1400	5.80
CR2TN 1013		48	36	4.4	130	5400	7.35
CR4TN 1104	4A	6	4.5	0.4	13	35	6.80
CR4TN 1107		12	9	0.8	26	135	6.80
CR4TN 1110		24	18	1.7	53	545	7.90
CR4TN 1113		48	36	3.4	105	2200	9.45
CR6TN 1003	6A	6	4.5	0.4	15	31	8.90
CR6TN 1006		12	9	0.9	30	120	8.90
CR6TN 1009		24	18	1.9	60	510	10.00
CR6TN 1012		48	36	3.8	115	1900	11.55
CRTN 1020	1B	6	4.5	0.5	15	90	6.30
CRTN 1023		12	9	1.0	25	350	6.30
CRTN 1026		24	18	2.2	55	1400	7.40
CRTN 1029		48	36	4.4	110	5400	9.10
CR2TN 1019	2B	6	4.5	0.3	9	45	7.40
CR2TN 1022		12	9	0.6	20	180	7.40
CR2TN 1025		24	18	1.2	35	690	8.55
CR2TN 1028		48	36	2.6	80	2950	10.25
CRTN 1040	1AL	6	4.5	−4.5	−14.5	410-410†	10.25
CRTN 1040		12	9	−9	−29	410-410†	10.25
CRTN 1040		24	18	−18	−58	410-410†	10.25
CRTN 1040		48	36	−36	−115	410-410†	10.25
CR2TN 1073	2AL	6	4.5	−4.5	−13.4	220-220†	11.35
CR2TN 1073		12	9	−9	−27	220-220†	11.35
CR2TN 1073		24	18	−18	−54	220-220†	11.35
CR2TN 1073		48	36	−36	−108	220-220†	11.35
CR2TN 1035	1C	6	4.5	0.4	8	28	8.00
CR2TN 1038		12	9	0.8	16	110	8.00
CR2TN 1041		24	18	1.8	32	455	9.10
CR2TN 1044		48	36	3.6	64	1840	10.80
CR4TN 1002	2C	6	4.5	0.2	7	17	10.80
CR4TN 1005		12	9	0.4	14	65	10.80
CR4TN 1008		24	18	0.8	28	250	12.00
CR4TN 1011		48	36	1.7	56	1000	13.65

NOTES:

1. Pin numbers are for reference only.

†2. The following lists of external series limiting resistors for each winding are recommended to limit coil current to the specified values.

Form	Voltage	Resistor	Form	Voltage	Resistor
1AL	12	410 ohms, ¼ W	2AL	12	220 ohms, ¼ W
(15mA)	24	1230 ohms, ¼ W (½ W cont. duty)	(28mA)	24	660 ohms, ½ W
	48	2870 ohms, ½ W (1W cont. duty)		48	1540 ohms, 1W (2W cont. duty)

For latching relays the Must Operate or Set Pulse must be 2 milliseconds minimum. The Must Release or Reset Pulse must be 5 milliseconds minimum to avoid false contact reclosure.

3. To order UL recognized (1 to 12 Form A) relays, replace the product designator TN with the letter U. Example: CR3TN1011 becomes CR3U1011.

4. Coil Indicators:
   Coil No. 1 — A red dot above the terminal center line indicates a positive terminal and a red dot below the terminal center line indicates a negative terminal.
   Coil No. 2 — A green dot above the terminal center line indicates a positive terminal and a green dot below the terminal center line indicates a negative terminal.

ENGINEERING DATA

CRTN

CONTACT RATING (Resistive load):
Power — 15VA, max.
Voltage — 250 volts dc or peak ac, max.
Current — 1 ampere, switched, max. 5 amperes, carry only, max.

CONTACT RESISTANCE (ON Impedance): Initial — 70 milliohms max., measured at 100mA, 1000Hz

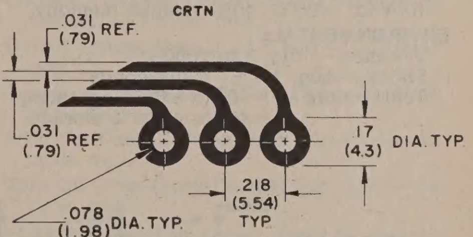
LIFE EXPECTANCY: 100 x 10^6 operations at signal levels. 20 x 10^6 operations at full rated load

TYPICAL OPERATE TIME: Less than 4.0ms including bounce

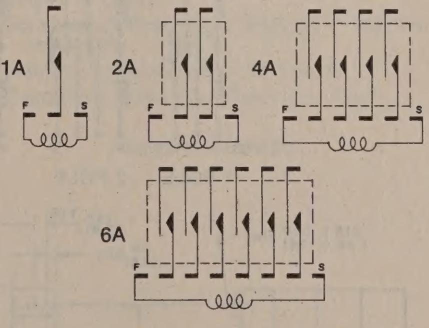
BREAKDOWN VOLTAGE: 500Vac, rms, 60Hz across open contacts or 750Vdc, max.

INSULATION RESISTANCE (OFF Impedance): 10^{10} ohms min. at 100Vdc +25°C, 40% rel. hum.

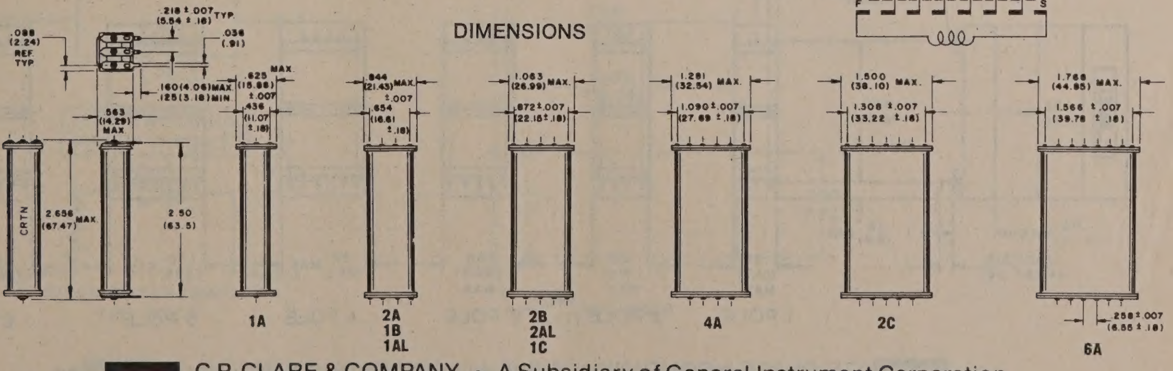
ENVIRONMENTAL (Operating):
Vibration — 0.06″ d.a. or 10g's, 10-750Hz
Shock — 30g's, 11 ±1ms, ½ sinewave
Temperature — −65° to +85°C



SCHEMATICS



DIMENSIONS



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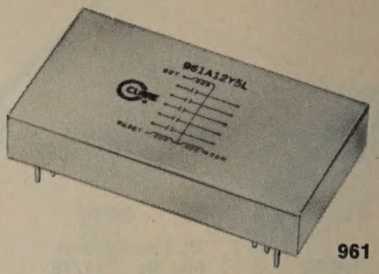
DRY REED RELAYS

961 MAGNETIC LATCHING RELAYS



961

Clare's 961 series Self-Latching Relays offer proven reed reliability plus bistable switching in one through six pole configurations. The heart of the relay is a new self-latching switch that provides the magnetic memory function without the external biasing magnets used in conventional latching relays.

The relays are designed to operate on the recommended one millisecond pulse at the specified nominal voltage. The pulse duration is limited only by coil heating and may be as long as one second. The 961 series relays are not subject to the over-drive limitations of conventional latching reed devices. Once pulsed into a set (closed) or reset (open) state, the relay will remain in that state until the opposite mode is selected.

ENGINEERING DATA

CONTACT FORMS: 1, 2, 3, 4, 5 or 6 poles, self-latching.

CONTACT RATING: 5VA, max., switched, 250Vac, max., switched, .5A, max., switched, 1.0A, max. carry

CONTACT RESISTANCE (Initial): 100 milli-ohms, max.

LIFE EXPECTANCY: 5 x 10^6 operations at 24Vdc, 200mA, switched 10^7 operations at 48Vdc, 100mA, carry only, 10^8 operations at signal levels

SET/RESET PULSE DURATION: 0.5 millisecond min., at nominal voltage, 1.0 millisecond pulse recommended

SET TIME: 1.5 millisecond max., including bounce

RESET TIME: 0.1 millisecond max.

DIELECTRIC WITHSTANDING VOLTAGE: 600 Vdc min. across contacts, 150Vdc max. between coils, 1000Vdc min. contacts to coil and all points to cover.

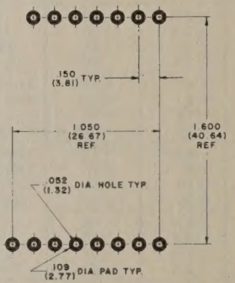
INSULATION RESISTANCE: 10^9 ohms min. at 100Vdc, +25°C, 40% relative humidity

ENVIRONMENTAL:
Vibration — 10g, 2 to 2000Hz
Shock — 50g, 11 ±1 milliseconds
Temperature — −10° to +85°C operating
−40° to +105°C storage

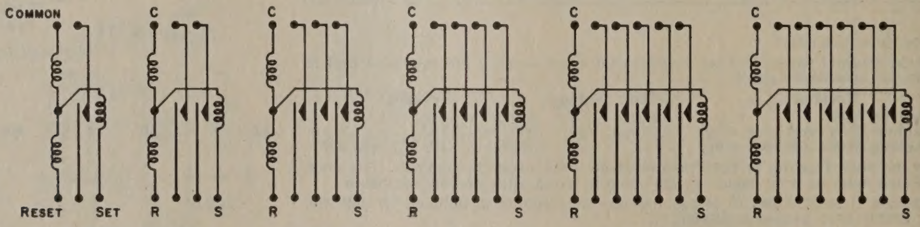
Stock Part No.	Number of Poles	Nominal Set/Reset Voltage (Vdc)	Must Set/Reset Voltage with 1ms pulse (Vdc)	Coil Resistance (Ohms, ±10%)	List Price
961A06Y1L	1	6	4.8	55	$5.50
961A12Y1L		12	9.6	210	5.50
961A06Y2L	2	6	4.8	33	6.75
961A12Y2L		12	9.6	130	6.75
961A06Y3L	3	6	4.8	25	8.00
961A12Y3L		12	9.6	100	8.00
961A06Y4L	4	6	4.8	19	9.25
961A12Y4L		12	9.6	75	9.25
961A06Y5L	5	6	4.8	15	10.50
961A12Y5L		12	9.6	55	10.50
961A06Y6L	6	6	4.8	9.5	11.75
961A12Y6L		12	9.6	45	11.75

PAD LAYOUT

Top View

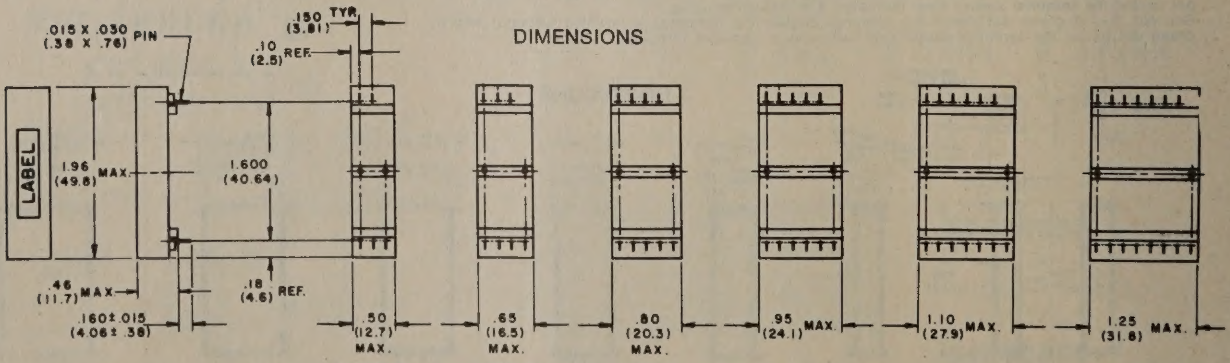

.150 (3.81) TYP.
1.050 (26.67) REF
1.600 (40.64) REF
.052 (1.32) DIA. HOLE TYP.
.109 (2.77) DIA. PAD TYP.

SCHEMATICS


COMMON
C
C
C
C
C
RESET
SET
R
S
R
S
R
S
R
S
R
S

1 POLE 2 POLE 3 POLE 4 POLE 5 POLE 6 POLE

DIMENSIONS


.015 X .030 (.38 X .76) PIN
.150 TYP. (3.81)
.10 (2.5) REF.
LABEL
1.96 (49.8) MAX.
1.600 (40.64)
.46 (11.7) MAX.
.18 (4.6) REF.
.160±.015 (4.06±.38)
.50 (12.7) MAX.
.65 (16.5) MAX.
.80 (20.3) MAX.
.95 (24.1) MAX.
1.10 (27.9) MAX.
1.25 (31.8) MAX.

1 POLE 2 POLE 3 POLE 4 POLE 5 POLE 6 POLE

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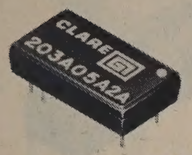
SOLID STATE RELAYS

203 ¾ AMPERE AC RELAYS


CLARE
203A05A2A

203 **UL Recognized File No. E61258**

Clare's ¾ ampere 203 Solid State AC Relay has a switching load of 240Vac at 0.35 power factor. It features zero crossing synchronous switching and opto-isolation that withstands 2000Vac. 7½ ampere peak one-cycle surge rating. The 203 relay will switch solenoid, motor starter, incandescent loads and telecommunication ringer frequency loads with ease and reliability. Compact DIP package has pin mounting for standard pc boards.

Part Number	Contact Form	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	Load..Voltage Range (Vac)
203A05A2A	SPST-N.O.	4.0	1.0	6.3-240

ENGINEERING DATA

INPUT: Nominal — +4.0 to 6.5Vdc

OUTPUT (Max. Ratings):

Repetitive Peak Offstate Voltage (Note 5) — ±400Vdc

RMS Load Voltage — 140/240Vac

RMS Output Current — 0.750A

Peak One-Cycle Surge Current — 7.50A

Peak One-Second Surge Current — 3.75A

STORAGE TEMPERATURE: −40° to +125°C

OPERATING TEMPERATURE: 0° to +85°C

INPUT:

Pickup Voltage (Must operate) — 4.0Vdc max.

Dropout Voltage (Must release) — 1.0Vdc min.

Input Current (V_{input} = +4.5Vdc) — 12.0mAdc max.

OUTPUT:

RMS Load Voltage — 6.3Vac min., 140/240 Vac max.

RMS Load Current — 10mAac min., 750mAac max.

Load Power Factor — 0.35 min., 1.0 max.

Load Frequency — 15Hz min., 63 Hz max.

Offstate Leakage Current (Load Voltage @ 240Vac) — 7mAac max.

Output Voltage Drop (I_{Load}) = ¾ A — 1.2V peak max.

Source Voltage (At 1st Turn On) — ±10Vac peak max.

Turn On Time (Zero Voltage Turn On) — ½ cycle max.

Turn Off Time (Zero Current Turn Off) — ½ cycle max.

ISOLATION (Input to output, input to case or output to case):

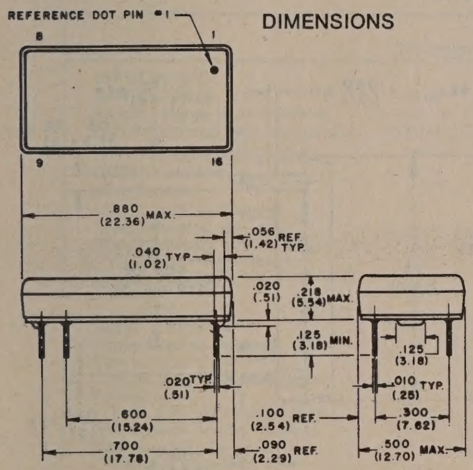
Dieletcric Withstanding Voltage — 2000Vac, rms, min.

Insulation Resistance — 10^{10} ohms

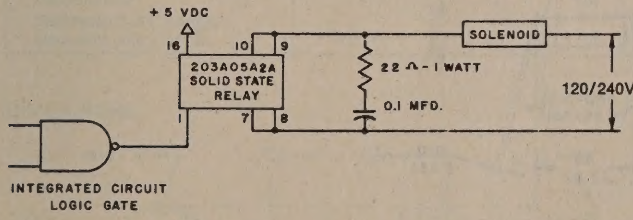
Capacitance (Input to Output) — 10pF

List Price $16.00

DIMENSIONS


REFERENCE DOT PIN #1
8
1
9
16
.880 (22.36) MAX
.056 (1.42) REF TYP
.040 (1.02) TYP
.020 (.51)
.218 (5.54) MAX
.125 (3.18) MIN.
.125 (3.18)
.020 TYP (.51)
.010 TYP (.25)
.600 (15.24)
.100 (2.54) REF
.300 (7.62)
.700 (17.78)
.090 (2.29) REF
.500 (12.70) MAX

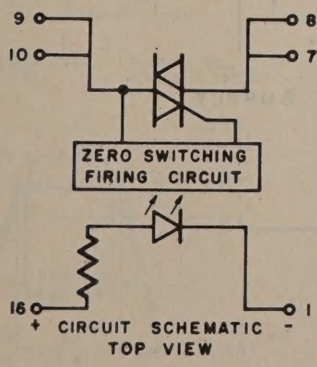
CIRCUIT SCHEMATIC & APPLICATION


+5 VDC
16
10
9
203A05A2A SOLID STATE RELAY
1
7
8
SOLENOID
22 Ω - 1 WATT
0.1 MFD.
120/240VAC
INTEGRATED CIRCUIT LOGIC GATE

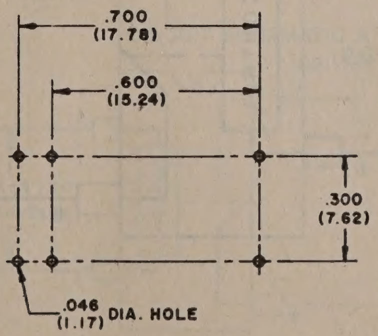
TYPICAL APPLICATION OF 203A05A2A SOLID STATE RELAY

NOTE: An external RC filter such as the 22 ohm resistor and the 0.1MFD capacitor shown above is recommended when driving inductive loads.

RELAY SCHEMATIC


9
10
8
7
ZERO SWITCHING FIRING CIRCUIT
16
1
+ CIRCUIT SCHEMATIC -
TOP VIEW

PAD LAYOUT


.700 (17.78)
.600 (15.24)
.300 (7.62)
.046 (1.17) DIA. HOLE

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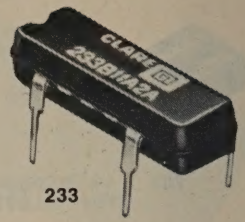
SOLID STATE DIP RELAYS

233 DC DIP RELAYS

The small 233 Solid State DIP Relays give you a choice of dc switching: 60 volts at 400mA or 250 volts at 100mA. Provides pure solid state features. Fast, 1 microsecond response time, compatibility with 5V digital logic, total input/output isolation. Standard 14 pin dual in-line package. Ideal for isolated line, lamp drivers and data couplers.


CLARE
233B11A2A

233

ENGINEERING DATA

INPUT at 25°C:
Control Voltage — 3.8Vdc min., 10Vdc max.
Pickup Voltage(Must operate) — 3.8Vdc max.
Dropout Voltage (Must release) — 0.4Vdc min.
Input Current at 5Vdc — 9mA typ., 15mA max.

ISOLATION (Input to Output):
Dielectric Withstanding Voltage (60Hz) — 1500Vac (p-p) min.
Insulation Resistance — 10^9 ohms min.
Capacitance — 5pF max.

TEMPERATURE RANGE (Operating and Storage): −20°C min., +100°C max.

OUTPUT at 25°C:

233B11A1B
Output Voltage — 60Vdc max.
Output Current at 5V Input — 200mA max.
Output Current at 10V input — 400mA max.
Capacitance Across Contacts — 15pF max.

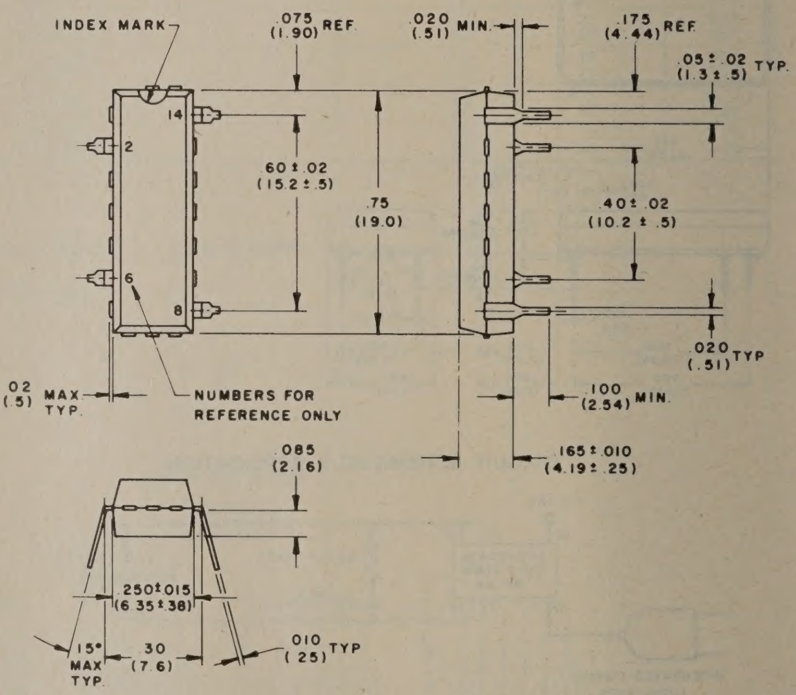
233B11A2A
Output Voltage — 250Vdc max.
Output Current at 5V Input — 50mA max.
Output Current at 10V Input — 100mA max.
Capacitance Across Contacts — 40pF max.

233B11A1B & 233B11A2A
Drive Frequency (100 ohm resistive load) — 30KHz max.
Offstate Leakage Current @ 100% Rated Output Voltage — 60μA
Contact "On" Voltage @ 100% Rated Output Voltage, 10Vdc Input Voltage — 1.5Vdc
Rise Time $V_L = 20V$, $R_L = 100$ ohms, $V_{in} = 5V$ — 1.0μs
Fall Time $V_L = 20V$, $R_L = 100$ ohms, $V_{in} = 5V$ — 5.0μs

Note: All engineering data subject to change without notice.

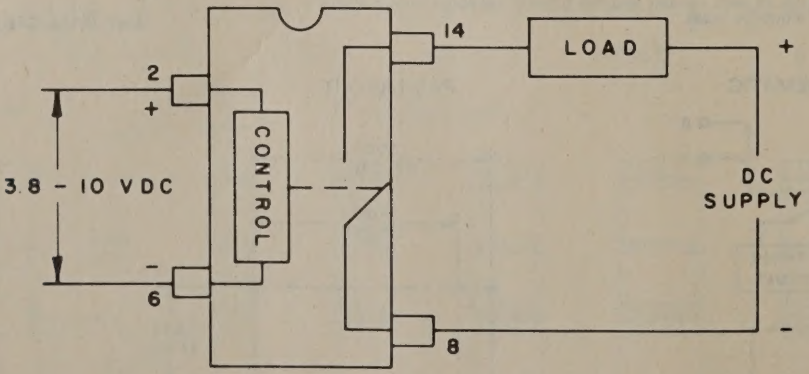
Stock Part No.	Contact Form	Input Voltage (Vdc)	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	Output Voltage (Vdc)	Output Current (mA)	List Price
233B11A1B	SPST (N.O.)	3.8-10	3.8	0.4	60	400	$10.50
233B11A2A	SPST (N.O.)	3.8-10	3.8	0.4	250	100	13.00

DIMENSIONS


INDEX MARK
.075 (1.90) REF.
.020 (.51) MIN.
.175 (4.44) REF.
.05 ± .02 (1.3 ± .5) TYP.
14
2
6
8
.60 ± .02 (15.2 ± .5)
.75 (19.0)
.40 ± .02 (10.2 ± .5)
.020 (.51) TYP
.02 (.5) MAX TYP.
NUMBERS FOR REFERENCE ONLY
.100 (2.54) MIN.
.085 (2.16)
.165 ± .010 (4.19 ± .25)
.250 ± .015 (6.35 ± .38)
15° MAX TYP.
.30 (7.6)
.010 (.25) TYP

CIRCUIT SCHEMATIC

Top View


14
LOAD
+
2
+
3.8 - 10 VDC
CONTROL
DC SUPPLY
−
6
−
8

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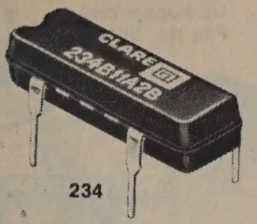

CLARE
234B11A2B

234

SOLID STATE DIP RELAYS
234 AC/DC DIP RELAYS

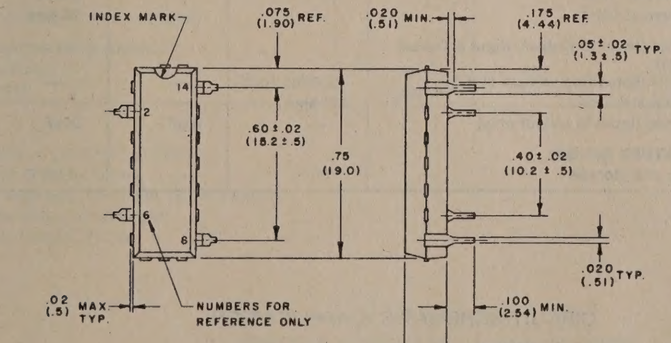
Clare's small 234 Solid State DIP relays provide pure solid state features: Fast 10 microsecond response time, compatibility with 5V digital logic, bipolar ouput, total input/output isolation. Standard 14 pin dual in-line package. Ideal for isolated line and lamp drivers, data couplers, and analog-transducer signal switching.

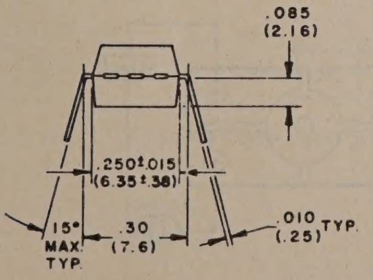
Stock Part No.	Contact Form	Input Voltage (Vdc)	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	Peak Output Current A ac/dc	Peak Output Voltage ac/dc	List Price
234B11A1A	SPST (N.O.)	3.8-6	3.8	0.4	.005	±5V	$15.50
234B11A2B	SPST (N.O.)	3.8-10	3.8	0.4	.08	±50V	10.50

ENGINEERING DATA

	234B11A1A			234B11A2B		
	Minimum	Typical	Maximum	Minimum	Typical	Maximum
INPUT at 25°C:						
Control voltage	3.8Vdc	—	6Vdc	3.8Vdc	—	10Vdc
Pickup voltage (Must operate)	—	—	3.8Vdc	—	—	3.8Vdc
Dropout voltage (Must release)	0.4Vdc	—	—	0.4Vdc	—	—
Input current at 5 Vdc input	—	15mAdc	18mAdc	—	18mAdc	22mAdc
OUTPUT at 25°C:						
Load voltage	—	—	±5V peak	—	—	±50V peak
Load current at 5V input	—	—	±5mA peak	—	—	±40mA peak
Load current at 10V input	—	—	—	—	—	±80mA peak
Drive frequency (1K ohm resistive load)	—	30KHz	—	—	100KHz	—
Offstate leakage current —						
at ±25V	—	—	.01μA	—	—	.006μA
at ±50V	—	—	—	—	—	60μA
Offset voltage	—	±100μV	±150μV	—	±1.0mV	±5.0mV
Contact on resistance	—	12 ohms	15 ohms	—	2.0 ohms	5.0 ohms
Turn on time V_{in} = 5V V_L = 20V R_L = 1000 ohms	—	10μs	—	—	—	1.0μs
Turn off time V_L = 20V R_L = 1000 ohms	—	8μs	—	—	8μs	10μs
Capacitance across contacts	—	7pF	10pF	—	7pF	10pF
Maximum surge across contacts (See Note 3)	—	—	—	—	—	0.1 Joule
ISOLATION (input to output):						
Dielectric withstanding voltage 60Hz	750V peak	—	—	750V peak	—	—
Insulation resistance	10^9 ohms	—	—	10^9 ohms	—	—
Capacitance	—	—	5pF	—	—	5pF
TEMPERATURE RANGE:						
Operating and storage	−20°C	—	100°C	−20°C	—	100°C

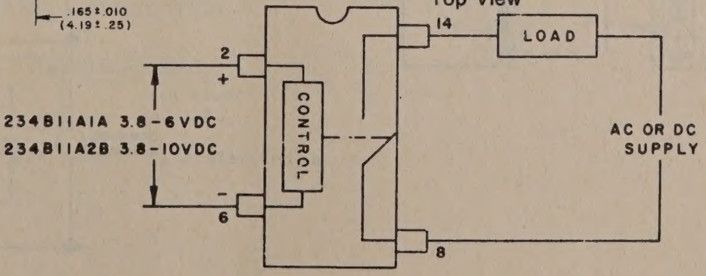
DIMENSIONS


INDEX MARK
.075 (1.90) REF.
.020 (.51) MIN.
.175 (4.44) REF.
.05±.02 (1.3±.5) TYP.
14
2
6
8
.60±.02 (15.2±.5)
.75 (19.0)
.40±.02 (10.2±.5)
.020 (.51) TYP.
.02 (.5) MAX TYP.
NUMBERS FOR REFERENCE ONLY
.100 (2.54) MIN.
.165±.010 (4.19±.25)


.085 (2.16)
.250±.015 (6.35±.38)
15° MAX. TYP.
.30 (7.6)
.010 (.25) TYP.

CIRCUIT SCHEMATIC & APPLICATION

Top View


14
LOAD
2
+
CONTROL
234B11A1A 3.8-6VDC
234B11A2B 3.8-10VDC
AC OR DC SUPPLY
−
6
8

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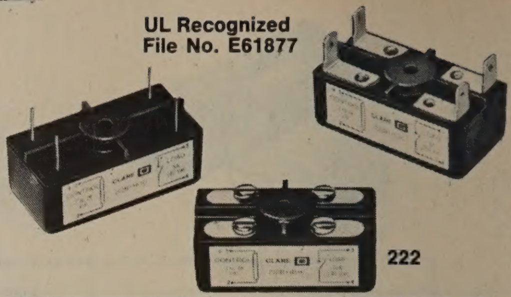
SOLID STATE RELAYS
222 MODULAR AC RELAYS

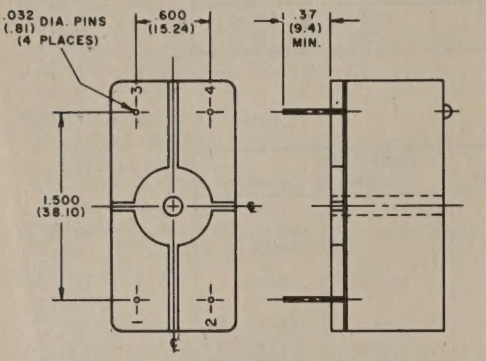
UL Recognized
File No. E61877

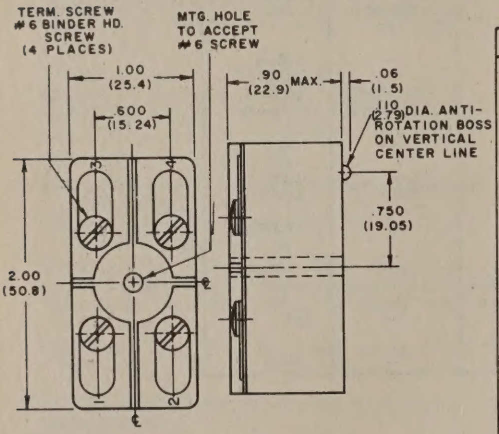


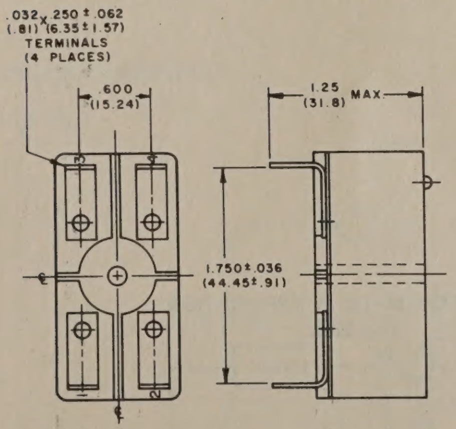
Clare's 222 series AC Solid State Relays have heavy duty switching capabilities with 5 or 10 ampere ratings at 140 or 250Vac. The optoisolator provides total input/output isolation and the sensitive input is fully compatible with DTL/TTL logic. The 222 series relays are ideally suited for computer peripheral, process control and inductive load applications. One cycle surge is 1000% of rated current. Choice of .032 pins, quick connect or screw terminals.

UL Recognized under File E61877.

DIMENSIONS


.032 (.81) DIA. PINS (4 PLACES)
.600 (15.24)
.37 (9.4) MIN.
1.500 (38.10)
3
4
1
2
℄


TERM. SCREW #6 BINDER HD. SCREW (4 PLACES)
MTG. HOLE TO ACCEPT #6 SCREW
1.00 (25.4)
.600 (15.24)
.90 (22.9) MAX.
.06 (1.5)
.110 (2.79) DIA. ANTI-ROTATION BOSS ON VERTICAL CENTER LINE
.750 (19.05)
2.00 (50.8)
3
1
2
℄

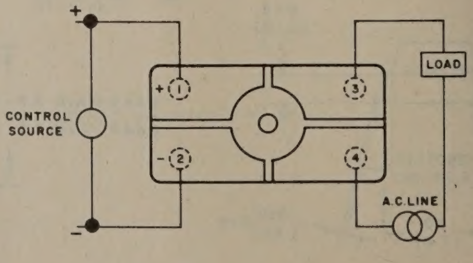

.032 x .250 ± .062 (.81) x (6.35 ± 1.57) TERMINALS (4 PLACES)
.600 (15.24)
1.25 (31.8) MAX.
1.750 ± .036 (44.45 ± .91)
3
2
℄

Part No.	Contact Form	Input Voltage (Vdc)	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	RMS Output Current (A)	RMS Output Voltage (Vac)	Terminal	Prices
222B11A1C	SPST Nor-mally Open	3-28	3.0	1.0	5	140	.032 pins	$22.00
222B11A2C		3-28	3.0	1.0	5	250	.032 pins	24.00
222B11A1E		3-28	3.0	1.0	10	140	.032 pins	23.00
222B11A2E		3-28	3.0	1.0	10	250	.032 pins	25.00
222B11B1C		3-28	3.0	1.0	5	140	screw terminal	22.00
222B11B2C		3-28	3.0	1.0	5	250	screw terminal	24.00
222B11B1E		3-28	3.0	1.0	10	140	screw terminal	23.00
222B11B2E		3-28	3.0	1.0	10	250	screw terminal	25.00
222B11C1C		3-28	3.0	1.0	5	140	quick connect	22.00
222B11C2C		3-28	3.0	1.0	5	250	quick connect	24.00
222B11C1E		3-28	3.0	1.0	10	140	quick connect	23.00
222B11C2E		3-28	3.0	1.0	10	250	quick connect	25.00

ENGINEERING DATA

	Minimum	Typical	Maximum
INPUT at 25°C:			
Control voltage	3Vdc	—	28Vdc
Pickup voltage (must operate)	—	—	3.0Vdc
Dropout voltage (must release)	0.8Vdc	1.0Vdc	—
Input current at 5Vdc input	—	5mAdc	6mAdc
Input current at 28Vdc input	—	35mAdc	—
OUTPUT at 25°C:			
RMS load voltage	12Vac	—	140 or 250Vac
RMS load current	.05A	—	5 or 10A
One cycle surge current	—	—	10 times rated current
Repetitive peak offstate voltage (140V rating)	—	—	200V peak
Repetitive peak offstate voltage (250V rating)	—	—	400V peak
Output transient immunity (dv/dt)	100V/µs	200V/µs	—
Frequency range	47Hz	—	70Hz
Offstate leakage current @ 140V (140V rating)	—	—	8mAac
Offstate leakage current @ 250V (250V rating)	—	—	13mAac
Load voltage at turn on	—	±12V peak	—
Turn on time at 60Hz	—	—	8.3ms
Turn off time at 60Hz	—	—	16.6ms
ISOLATION (Input to Output, Input & Output to Case):			
Dielectric withstanding voltage (60Hz)	1500Vac(RMS)	—	—
Insulation resistance	10^9 ohm	—	—
Capacitance (input to output only)	—	10pF	20pF
TEMPERATURE RANGE:			
Operating and storage	−30°C	—	+80°C

CIRCUIT SCHEMATIC & APPLICATION


+
−
CONTROL SOURCE
+1
−2
3
4
LOAD
A.C.LINE

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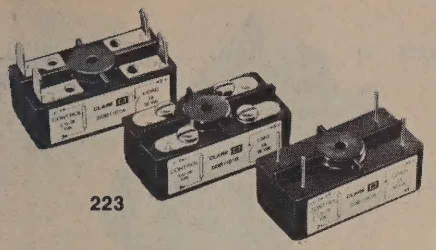
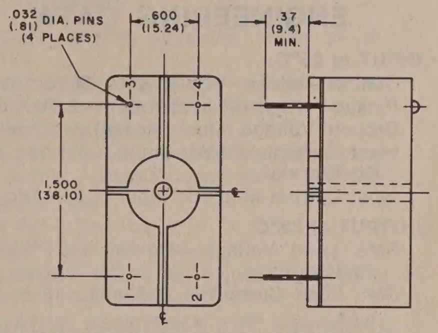


SOLID STATE RELAYS
223 MODULAR DC RELAYS

Clare's SPST (N.O.) 223 Series DC Solid State Relays have fast 100 micro-second switching capabilities with 2 or 5 ampere ratings at 50Vdc. The optoisolator provides total input/output isolation and the sensitive input is fully compatible with DTL/TTL logic. The 223 series relays are ideally suited for motor and servo controllers in process control and machine tool applications.

Part No.	Contact Form	Input Voltage (Vdc)	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	Output Current (A)	Output Voltage (Vdc)	Terminal	Prices
223B11A1A		3-28	3.0	1.0	2	50	.032 pins	$25.00
223B11A1B	SPST	3-28	3.0	1.0	5	50	.032 pins	30.00
223B11B1A	Nor-	3-28	3.0	1.0	2	50	screw terminal	25.00
223B11B1B	mally	3-28	3.0	1.0	5	50	screw terminal	30.00
223B11C1A	Open	3-28	3.0	1.0	2	50	quick connect	25.00
223B11C1B		3-28	3.0	1.0	5	50	quick connect	30.00

DIMENSIONS

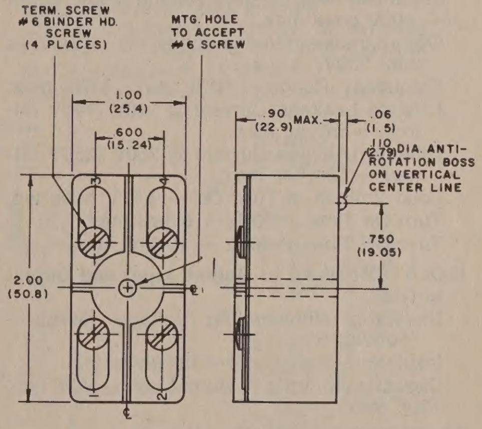

.032 (.81) DIA. PINS (4 PLACES)
.600 (15.24)
.37 (9.4) MIN.
1.500 (38.10)
1
2
3
4
℄

ENGINEERING DATA

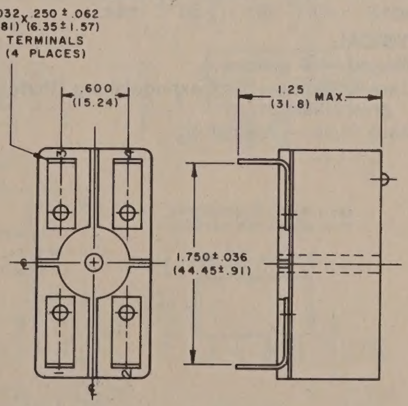
	Minimum	Typical	Maximum
INPUT at 25°C:			
Control voltage	3Vdc	—	28Vdc
Pickup voltage (must operate)	—	—	3.0Vdc
Dropout voltage (must release)	0.8Vdc	—	—
Input current at 5Vdc input	—	5mA	5.5mA
Input dead band	—	0.5Vdc	—

OUTPUT at 25°C	— —	223B11A1A Maximum	223B11A1B Maximum
Output voltage		50Vdc	50Vdc
Output current	—	2A	5A
Offstate leakage current @ 50V	—	10mA	15mA
Contact "On" voltage @ 100% rated output	—	2Vdc	2Vdc
Turn On Time Delay 5V input max. output voltage	—	25μsec	25μsec
Rise time 5V input max. output voltage	—	75μsec	75μsec
Turn Off Time Delay 5V input max. output voltage	—	200μsec	200μsec
Fall time 5V input max. output voltage		200μsec	200μsec

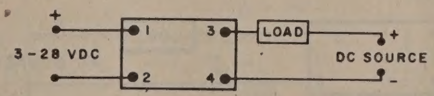
ISOLATION:	Minimum	Typical	Maximum
Dielectric withstanding voltage (60Hz)	1500Vac (RMS)	—	—
Insulation resistance	10^9 ohms	—	—
Capacitance (input to output)	—	—	15pF
TEMPERATURE RANGE:			
Operating	−40°C	—	+80°C
Storage	−55°C	—	+100°C


TERM. SCREW #6 BINDER HD. SCREW (4 PLACES)
MTG. HOLE TO ACCEPT #6 SCREW
1.00 (25.4)
.600 (15.24)
.90 (22.9) MAX.
.06 (1.5)
.110 (2.79) DIA. ANTI-ROTATION BOSS ON VERTICAL CENTER LINE
.750 (19.05)
2.00 (50.8)
1
2
3
4
℄

PHYSICAL SPECIFICATIONS:
Weight: 3 oz. maximum
Case Material: Aluminum, black anodized
Header Material: Phenolic
Encapsulation: Epoxy


.032 (.81) x .250 ± .062 (6.35 ± 1.57) TERMINALS (4 PLACES)
.600 (15.24)
1.25 (31.8) MAX.
1.750 ± .036 (44.45 ± .91)
1
2
3
4
℄

CIRCUIT SCHEMATIC & APPLICATION


+
−
3-28 VDC
1
2
3
4
LOAD
+
DC SOURCE
−

TYPICAL APPLICATION OF 223 SERIES SOLID STATE RELAY

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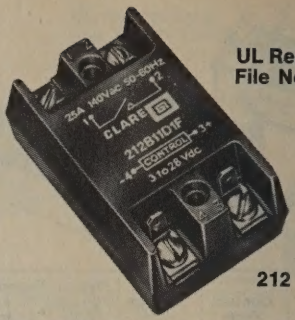
SOLID STATE RELAYS

212 HEAVY DUTY AC RELAYS


25A 140Vac 50-60Hz
1
2
CLARE
212B11D1F
4 CONTROL 3
3 to 28 Vdc

212

UL Recognized
File No. E61258

Clare's 212 AC Solid State Relay has heavy duty switching capabilities with 10 or 25 ampere ratings at 140 or 250Vac. Control voltage of 3 to 28Vdc. One cycle surge current rating is 1000%. The opto-isolator provides total input/output isolation and the sensitive input is fully compatible with DTL/TTL logic. Zero crossing synchronous switching. The 212 relay is ideally suited for computer peripheral, process control and inductive load applications. Every relay features both quick-connect and screw-type terminals. UL recognized under File E61258, as Electronic Motor Controllers.

ENGINEERING DATA

INPUT at 25°C:
- Control Voltage — 3Vdc min., 28Vdc max.
- Pickup Voltage (Must operate) — 3.0Vdc max.
- Dropout Voltage (Must release) — 1.0 min.
- Input Current at 5Vdc Input — 4mAdc typ., 6mAdc max.
- Input Current at 28Vdc Input — 35mAdc typ.

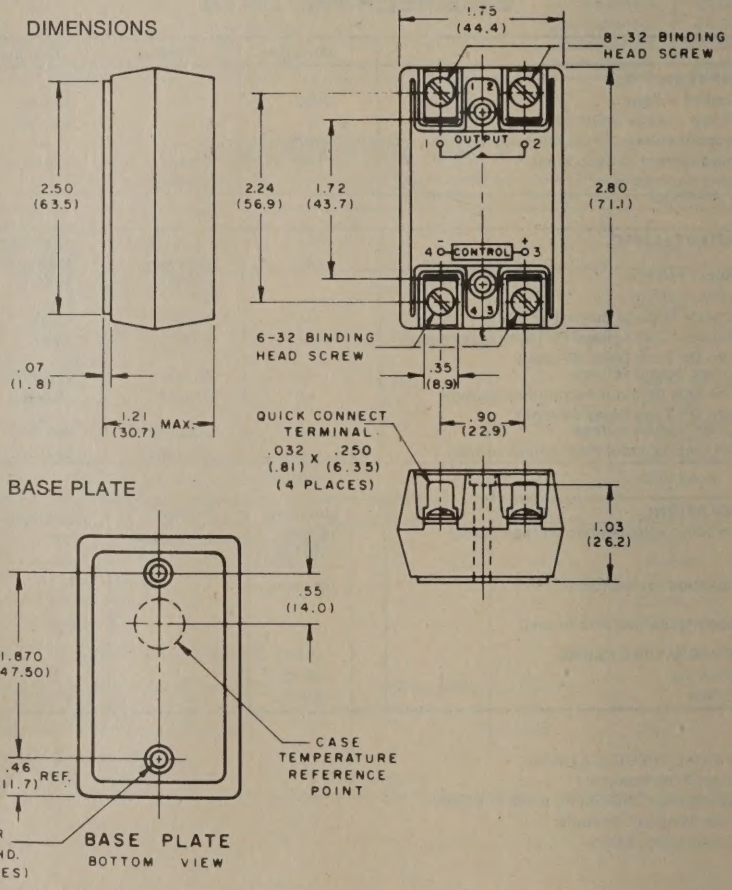
OUTPUT at 25°C:
- RMS Load Voltage — 12Vac min., 140 or 250Vac max.
- RMS Load Current — .05A min., 10 or 25A max.
- Repetitive Peak Offstate Voltage (140V rating) — 200V peak max.
- Repetitive Peak Offstate Voltage (250V rating) — 400V peak max.
- Output transient immunity (dv/dt) — 100V/μs min. 200V/μs typ.
- Frequency Range — 50Hz min., 70Hz max.
- Offstate Leakage Current @ 140V (140V rating) — 8mAac max.
- Offstate Leakage Current @ 250V (250V rating) — 13mAac max.
- Load Voltage at Turn On — ±12V peak typ.
- Turn On Time at 60Hz — 8.3ms max.
- Turn Off Time at 60Hz — 16.6ms max.

ISOLATION (Input to Output, Input and Output to Case):
- Dielectric Withstanding Voltage (60Hz) — 1500Vac min.
- Insulation Resistance — 10^9 ohms min.
- Capacitance Input to Output only — 8pF typ., 10pF max.

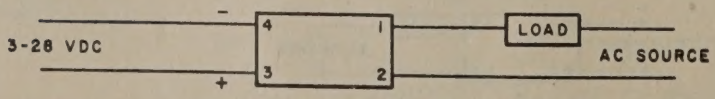
TEMPERATURE RANGE (Operating and Storage): −40°C min., +80°C max.

PHYSICAL:
- Weight — 4 ounces
- Case Material — Self extinguishing Charcoal grey plastic
- Base Plate — Aluminum

Stock Part No.	Contact Form	Input Voltage (Vdc)	Pickup Voltage (Vdc)	Dropout Voltage (Vdc)	RMS Output Current (A)	RMS Output Voltage (Vac)	List Price
212B11D1E	SPST (N.O.)	3-28	3.0	1.0	10	140	$23.00
212B11D2E	SPST (N.O.)	3-28	3.0	1.0	10	250	25.00
212B11D1F	SPST (N.O.)	3-28	3.0	1.0	25	140	29.00
212B11D2F.	SPST (N.O.)	3-28	3.0	1.0	25	250	32.00


DIMENSIONS
1.75
(44.4)
8-32 BINDING HEAD SCREW
1 OUTPUT 2
2.50
(63.5)
2.24
(56.9)
1.72
(43.7)
2.80
(71.1)
4 CONTROL 3
−
+
6-32 BINDING HEAD SCREW
.07
(1.8)
.35
(8.9)
1.21
(30.7)
MAX.
QUICK CONNECT TERMINAL
.032 x .250
(.81) (6.35)
(4 PLACES)
.90
(22.9)
1.03
(26.2)
BASE PLATE
.55
(14.0)
1.870
(47.50)
CASE TEMPERATURE REFERENCE POINT
.46
(11.7)
REF.
CLEARANCE FOR #8 FILLISTER HD. SCREW (2 HOLES)
BASE PLATE
BOTTOM VIEW

CIRCUIT SCHEMATIC & APPLICATION


3-28 VDC
−
+
4
3
1
2
LOAD
AC SOURCE

TYPICAL APPLICATION OF 212 SERIES SOLID STATE RELAY

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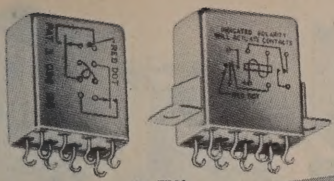
MINIATURE/INDUSTRIAL CRYSTAL CAN RELAYS

F, FW FULL SIZE AND HF, HFW HALF SIZE RELAYS



F, FW

C.P. CLARE & CO.
HF 1201 D00

HF, HFW

Clare provides full and half-size crystal can relays of unusual versatility, capable of reliable long life operation under adverse environments. The relays are available in both solder seal versions (F & HF) and welded seal models (FW & HFW). These relays are ideal for use in industrial application as well as military and aerospace. Relays employ a rigid frame to maintain permanent alignment of all elements. Contact arrangements are 2 form C. These relays are manufactured to meet Mil-R-5757 requirements.

Stock Part No.		Nom. Volt. (dc)	Coil Res. ±10% (Ohms)	Contacts		Terminal Type	Enclosure	List Price
Welded Header	Soldered Header			Arrangement	Rating (Amps)			
FW	**F**							
FW1111G00	RP7631G12	26.5	675	DPDT	2	Solder Hook	Side Plate Mtg	$11.35
	RP7632G1	26.5	675	DPDT	2	Solder Hook	Std. Ear Brkts.	11.35
	RP7633G4	26.5	675	DPDT	2	Solder Hook	Stud Mtg. Top	11.35
	RP7640G1	26.5	675	DPDT	2	Solder Hook	Stud Mtg. Side	11.35
FW1201G00	RP7641G8	26.5	675	DPDT	2	3/16″ Plug in	Plain Case	11.35
	RP7641G2	26.5	675	DPDT	2	3″ Leads	Plain Case	11.35
	RP9809G1	26.5	675	DPDT	2	3/16″ Plug in	Std. Ear Brkts.	11.35
——	RP9817G1	26.5	675	DPDT	2	Solder Hook	Std. Ear Brkts.	11.35
FW1106G02*	——	26.5	675	DPDT	2	Solder Hook	Std. Ear Brkts.	12.70
HFW	**HF**							
HFW1201D00	HF1201D00	26.5	1250	DPDT	2	3/16″ Plug in	Plain Case	$12.80
HFW1201K01†	——	26.5	700	DPDT	2	3/16″ Plug in	Plain Case	14.20
——	HF1201K00	26.5	700	DPDT	2	3/16″ Plug in	Plain Case	$12.80

QPL Part Numbers * M5757/10-141 † M5757/9-003

ENGINEERING DATA

F(W) & HF(W)

CONTACT RATING (Resistive load): 2A at 28Vdc

CONTACT RESISTANCE (ON Impedance): 50 milliohms max. at 6Vdc, 100mA

LIFE EXPECTANCY:
F & FW — 250,000 operations at rated load.
HF & HFW — 100,000 operations at rated load

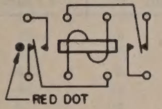
OPERATE TIME:
F & FW — 5ms max.
HF & HFW — 4ms max.

BREAKDOWN VOLTAGE: 1000Vac, rms, 60Hz between all terminals and case

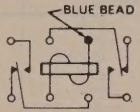
INSULATION RESISTANCE (OFF Impedance): 1000 megohms min.

ENVIRONMENTAL:
Vibration — (Plain case models)
F & FW - 10-3000Hz, 0.125 d.a. or 30g peak
HF & HFW - 5-2000Hz, 0.125 d.a. or 30g peak
Shock — 65g peak, 11 ±1ms
Temperature Range — −65° to +125°C

F, FW



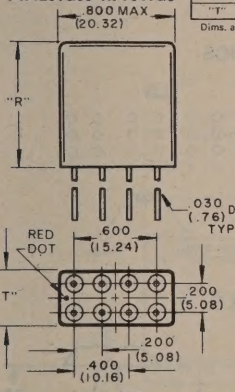
HF, HFW



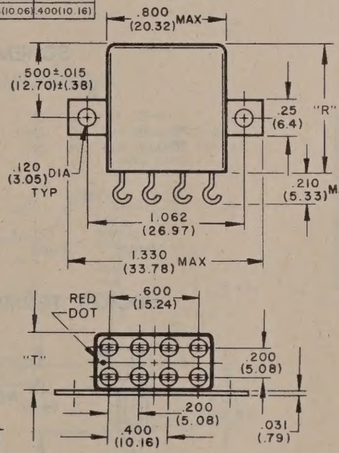
RP7641G2
FW1201G00 RP7641G8

Dim.	F	FW
"R"	.875(22.22)	.900(22.86)
"T"	.396(10.06)	.400(10.16)

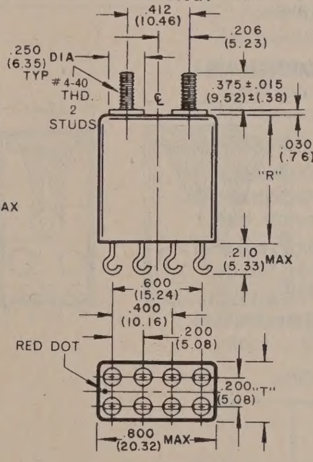
Dims. are max


.800 MAX (20.32)
"R"
.030 (.76) DIA TYP
RED DOT
.600 (15.24)
"T"
.200 (5.08)
.200 (5.08)
.400 (10.16)

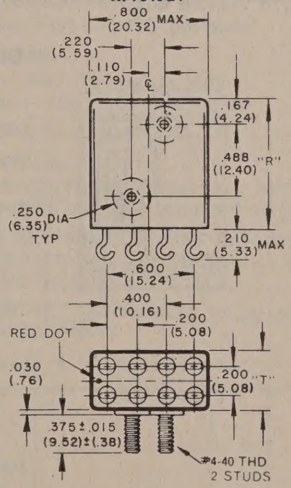
FW1111G00
RP7631G12


.800 (20.32) MAX
.500±.015 (12.70)±(.38)
.25 (6.4)
"R"
.120 (3.05) DIA TYP
.210 (5.33) MAX
1.062 (26.97)
1.330 (33.78) MAX
RED DOT
.600 (15.24)
"T"
.200 (5.08)
.200 (5.08)
.400 (10.16)
.031 (.79)

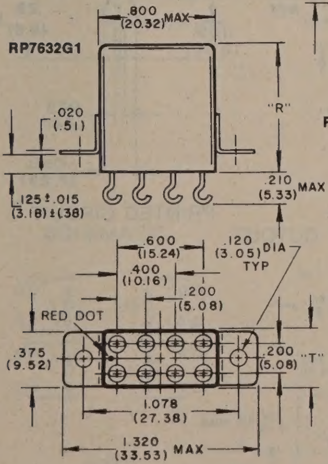
RP7633G4


.412 (10.46)
.206 (5.23)
.250 (6.35) DIA TYP
#4-40 THD. 2 STUDS
.375±.015 (9.52)±(.38)
℄
.030 (.76)
"R"
.210 (5.33) MAX
.600 (15.24)
.400 (10.16)
.200 (5.08)
RED DOT
.200 (5.08) "T"
.800 (20.32) MAX

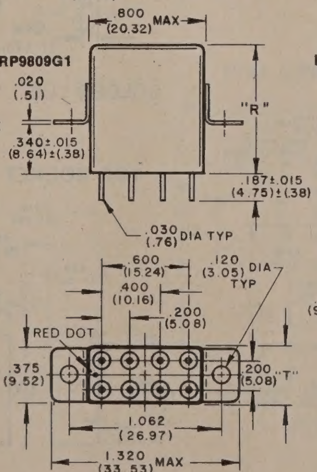
RP7640G1


.800 (20.32) MAX
.220 (5.59)
.110 (2.79)
℄
.167 (4.24)
.488 (12.40)
"R"
.250 (6.35) DIA TYP
.210 (5.33) MAX
.600 (15.24)
.400 (10.16)
.200 (5.08)
RED DOT
.030 (.76)
.200 (5.08) "T"
.375±.015 (9.52)±(.38)
#4-40 THD 2 STUDS

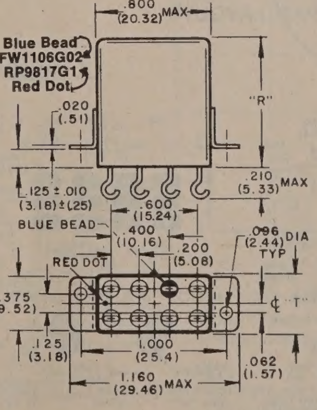
RP7632G1


.800 (20.32) MAX
.020 (.51)
"R"
.210 (5.33) MAX
.125±.015 (3.18)±(.38)
.600 (15.24)
.120 (3.05) DIA TYP
.400 (10.16)
.200 (5.08)
RED DOT
.375 (9.52)
.200 (5.08) "T"
1.078 (27.38)
1.320 (33.53) MAX

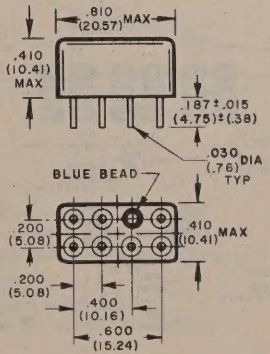
RP9809G1


.800 (20.32) MAX
.020 (.51)
"R"
.340±.015 (8.64)±(.38)
.187±.015 (4.75)±(.38)
.030 (.76) DIA TYP
.600 (15.24)
.120 (3.05) DIA TYP
.400 (10.16)
.200 (5.08)
RED DOT
.375 (9.52)
.200 (5.08) "T"
1.062 (26.97)
1.320 (33.53) MAX

Blue Bead
FW1106G02*
RP9817G1
Red Dot


.800 (20.32) MAX
.020 (.51)
"R"
.210 (5.33) MAX
.125±.010 (3.18)±(.25)
.600 (15.24)
BLUE BEAD
.400 (10.16)
.200 (5.08)
.096 (2.44) DIA TYP
RED DOT
.375 (9.52)
℄ "T"
.125 (3.18)
1.000 (25.4)
.062 (1.57)
1.160 (29.46) MAX

HFW1201D00 HF1201D00
HFW1201K01 HF1201K00


.810 (20.57) MAX
.410 (10.41) MAX
.187±.015 (4.75)±(.38)
.030 (.76) DIA TYP
BLUE BEAD
.200 (5.08)
.410 (10.41) MAX
.200 (5.08)
.400 (10.16)
.600 (15.24)

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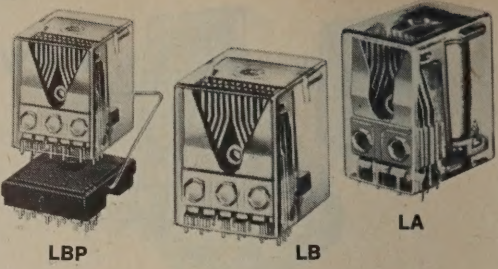
MODERN TELEPHONE RELAYS

LA, LB, LBP MINIATURE COVERED RELAYS

Designed for the user who must have high quality at a reasonable price. The LA relays have 4PDT contacts and the LB/LBP relays have 6PDT contacts. These miniature relays have extraordinary switching capacity and versatility for their size. Contacts rated 2 amps at 28Vdc. LA/LB Series is for direct P.C.B mounting; and the LBP Series is for direct plug into socket mounting. These relays are ideal components for industrial and telecommunications applications.



ENGINEERING DATA

LA/LB SERIES

CONTACT RATING (Resistive load): 2A at 28Vdc

CONTACT MATERIAL: Palladium alloy, with Gold alloy overlay on bifurcated make and break springs.

CONTACT RESISTANCE (ON Impedance): 100 milliohms max. initial

LIFE EXPECTANCY: 100,000 operations at rated load min. 100,000,000 operations mechanical life min.

OPERATE TIME: 10-25ms typical

RELEASE TIME: 5ms max.

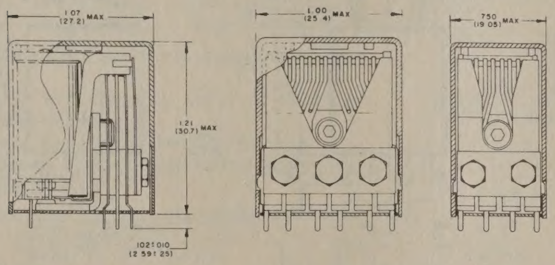
BREAKDOWN VOLTAGE: 500Vac, rms, 60Hz between all mutually insulated points

INSULATION RESISTANCE (OFF Impedance): 500K megohms min. at 25°C, 50% rel. hum.

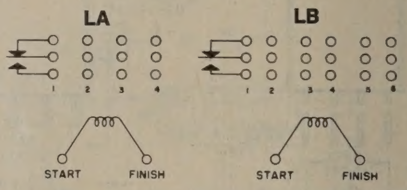
ENVIRONMENTAL (Operating, 10μs max. contact chatter):
Vibration — 5-55Hz, 10g's
Shock — 15g's, 11ms, ½ sinewave

Stock Part No.	Volts (dc)	Coil Resistance ±10%	Contact Form	List Price
LB0060A00, LBP0060A00	6	35	6 Form C	$4.95
LB0060B00, LBP0060B00	12	130	6 Form C	4.95
LB0060H00, LBP0060H00	15	200	6 Form C	4.95
LB0060C00, LBP0060C00	18	330	6 Form C	4.95
LB0060D00, LBP0060D00	24	590	6 Form C	4.95
LB0060K00, LBP0060K00	30	915	6 Form C	4.95
LB0060J00, LBP0060J00	36	1150	6 Form C	4.95
LB0060N00, LBP0060N00	48	2100	6 Form C	4.95
LB0060M00, LBP0060M00	60	3000	6 Form C	4.95
RP15450G5 Socket, Solder Lug for LBP w/Cover Clip			See Cat. 501 for socket dimensions	2.00
RP15450G6 Socket, PCB for LBP w/Cover Clip				2.00
LA0040A00	6	35	4 Form C	4.50
LA0040B00	12	130	4 Form C	4.50
LA0040D00	24	590	4 Form C	4.50
LA0040K00	30	915	4 Form C	4.50
LA0040N00	48	2100	4 Form C	4.50
LA0040M00	60	3000	4 Form C	4.50

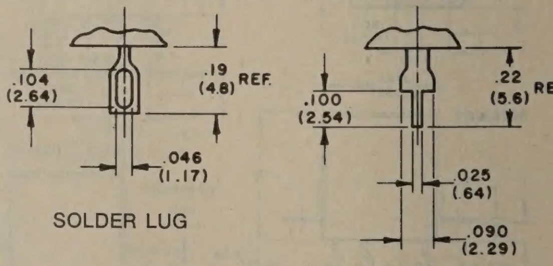
DIMENSIONS


1.07 (27.2) MAX
1.00 (25.4) MAX
.750 (19.05) MAX
1.21 (30.7) MAX
.102±.010 (2.59±.25)

SCHEMATICS


LA
LB
1
2
3
4
5
6
START
FINISH
START
FINISH

SOCKET TERMINALS

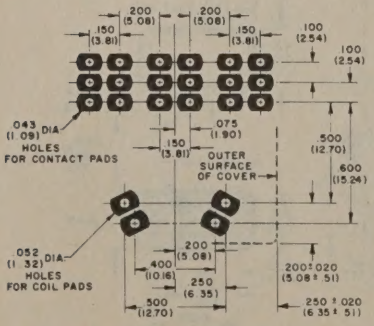

.104 (2.64)
.19 (4.8) REF.
.046 (1.17)
.100 (2.54)
.22 (5.6) REF.
.025 (.64)
.090 (2.29)

SOLDER LUG

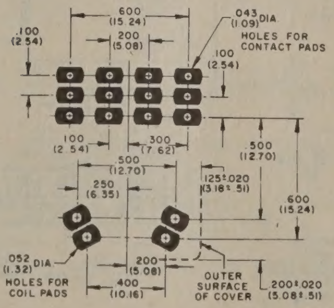
PRINTED CIRCUIT

PAD LAYOUTS

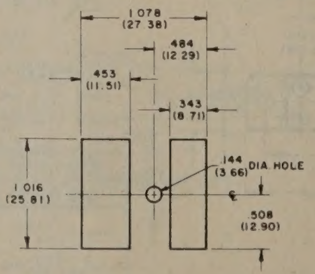
LB RELAY & LBP SOCKET


.200 (5.08)
.200 (5.08)
.150 (3.81)
.150 (3.81)
.100 (2.54)
.100 (2.54)
.043 (1.09) DIA HOLES FOR CONTACT PADS
.075 (1.90)
.150 (3.81)
OUTER SURFACE OF COVER
.500 (12.70)
.600 (15.24)
.052 (1.32) DIA HOLES FOR COIL PADS
.200 (5.08)
.400 (10.16)
.250 (6.35)
.500 (12.70)
.200±.020 (5.08±.51)
.250±.020 (6.35±.51)

LA RELAY


.600 (15.24)
.043 (1.09) DIA HOLES FOR CONTACT PADS
.100 (2.54)
.200 (5.08)
.100 (2.54)
.100 (2.54)
.300 (7.62)
.500 (12.70)
.500 (12.70)
.125±.020 (3.18±.51)
.250 (6.35)
.600 (15.24)
.052 (1.32) DIA HOLES FOR COIL PADS
.200 (5.08)
.400 (10.16)
OUTER SURFACE OF COVER
.200±.020 (5.08±.51)

LBP SOCKET CUTOUT


1.078 (27.38)
.484 (12.29)
.453 (11.51)
.343 (8.71)
.144 (3.66) DIA HOLE
1.016 (25.81)
.508 (12.90)

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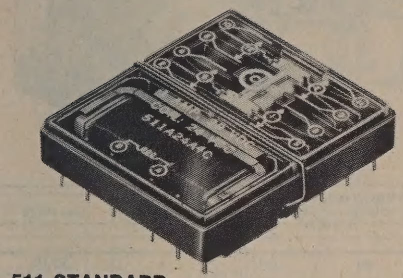
MODERN TELEPHONE RELAYS

511 LOW PROFILE RELAYS



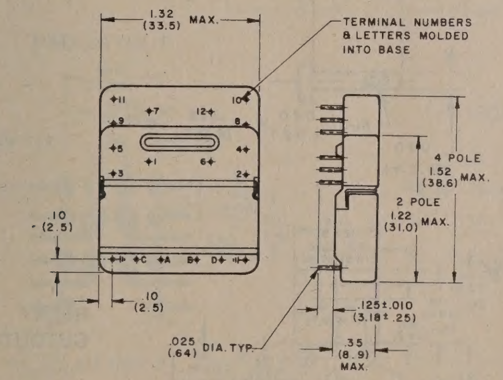
511 STANDARD

Clare's new 511 series Modern Telephone relays offer reliable low level to 1 ampere switching capabilities in 2 and 4 Form C or D models. The low profile package is only 0.35" (8.9mm) high and allows PCB mounting on standard 0.5 inch (12.7mm) centers.

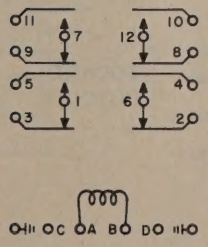
The 511 series enclosures feature an amber polycarbonate dust cover and a molded base of thermosetting electrical grade plastic material. This box type base with molded-in terminal pins fully protects the inside of the relay during wave soldering and subsequent partial immersion cleaning operations.

Stock Part No.	Contact Form	Nominal Voltage (Vdc)	Must Operate (Vdc)	Must Release (Vdc)	Coil Resistance (Ohms ±10%)	List Price
511A06A2C	2C	6	4.5	0.6	40	$4.95
511A12A2C	2C	12	9.0	1.2	175	4.95
511A24A2C	2C	24	18.0	2.4	700	4.95
511A48A2C	2C	48	36.0	4.8	2370	5.20
511A06A4C	4C	6	4.5	0.6	25	7.25
511A12A4C	4C	12	9.0	1.2	100	7.25
511A24A4C	4C	24	18.0	2.4	435	7.25
511A48A4C	4C	48	36.0	4.8	1800	7.50

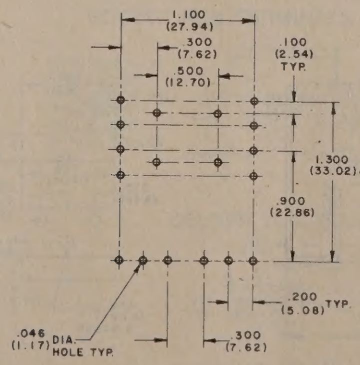
DIMENSIONS


1.32 (33.5) MAX.
TERMINAL NUMBERS & LETTERS MOLDED INTO BASE
11
7
12
10
9
8
5
4
1
6
3
2
.10 (2.5)
C
A
B
D
.10 (2.5)
4 POLE
1.52 (38.6) MAX.
2 POLE
1.22 (31.0) MAX.
.125±.010 (3.18±.25)
.025 (.64) DIA. TYP.
.35 (8.9) MAX.

SCHEMATIC


11
7
10
12
9
8
5
4
1
6
3
2
C
A
B
D

PAD LAYOUT


1.100 (27.94)
.300 (7.62)
.100 (2.54) TYP.
.500 (12.70)
1.300 (33.02)
.900 (22.86)
.200 (5.08) TYP.
.046 (1.17) DIA. HOLE TYP.
.300 (7.62)

ENGINEERING DATA

CONTACT ARRANGEMENT: 2 or 4 Form C (Bifurcated) Standard. 2 or 4 Form D (Bifurcated) or Form C/D combinations are optional

CONTACT RATING (Resistive load at 25°C)

Current	Voltage	Life (Operations)
1.0A	28Vdc	5,000,000
1.0A	48Vdc	500,000
.1A	48Vdc	50,000,000
.5A	115Vac, 50/60Hz	750,000

COIL DATA (at 25°C):

Voltage — 6, 12, 24, 48Vdc

Power — 2.4 watts max. continuous, 1.3 watts nom., (typical), 0.8 watts pickup, (typical)

Temperature Rise — 34°C per watt

LIFE EXPECTANCY:

Electrical — See Contact ratings

Mechanical — 100 x 10^6 operations

OPERATE TIME: See chart

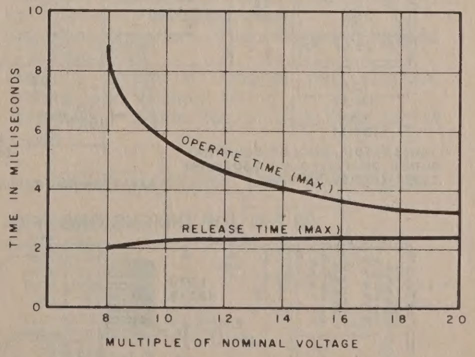
RELEASE TIME: See chart

BREAKDOWN VOLTAGE: 500Vac, rms, 50/60Hz min. between all mutually insulated elements

INSULATION RESISTANCE (OFF Impedance): 50,000 megohms min. at 500Vdc, +25°C, 50% relative humidity

ENVIRONMENTAL: Temperature range (operating) −45° to +65°C

OPERATE & RELEASE TIMES



CONTACT BOUNCE:

Normally open at operate — 3.0ms maximum

Normally closed at release — 10.0ms maximum

Notes:

1. Coils are not suppressed
2. Contact bounce not included in operate and release times

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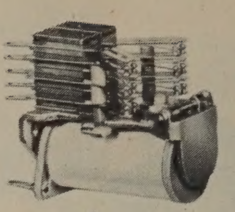
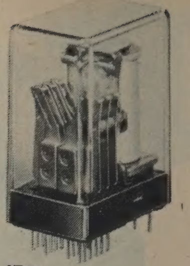
TELEPHONE TYPE RELAYS
J, JDP OPEN TYPE RELAYS

J & JDP relays are compact telephone type relays for applications ranging from simple switching in alarm circuits to complex computer functions. Contact combinations of 4, 6 & 8 pole double throw are rated 4A at 120Vac, 60Hz or 30Vdc resistive. Mechanical life exceeds 70 x 10^6 operations.

Type J relays are open type construction for direct chassis mounting. Series JDP relays are furnished with a socket with solder lug terminals and a dust cover enclosure.


J


JDP

ENGINEERING DATA

J & JDP

CONTACT RATING (Resistive load): 4A at 120Vac, 60Hz or 30Vdc

CONTACT MATERIAL: Twin Palladium — silver alloy (bifurcated make-and-break springs)

CONTACT RESISTANCE: 100 milliohms max. initial

LIFE EXPECTANCY: 1 x 10^6 operations min. at 4A, 30Vdc load, mechanical life 70 x 10^6 operations

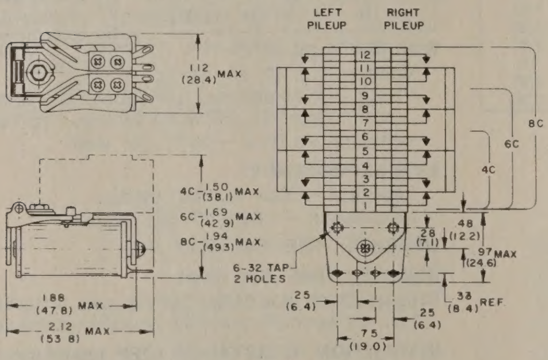
OPERATE TIME: 10-40ms typical

RELEASE TIME (Coil unsuppressed): 1-10ms typical

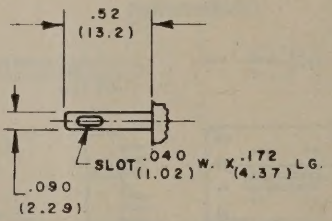
BREAKDOWN VOLTAGE: 1000Vac, 60Hz

Stock Part No.	Nominal Volts (dc)	Coil Resistance ±10%	Contact Form	Figure	List Price
J SERIES					
J124C24	12	80	4PDT	A	$9.05
J126C24	12	50	6PDT	A	10.45
J128C24	12	50	8PDT	A	12.15
J244C24	24	500	4PDT	A	9.25
J246C24	24	300	6PDT	A	10.85
J248C24	24	200	8PDT	A	12.35
J484C24	48	1300	4PDT	A	9.65
J486C24	48	1000	6PDT	A	11.20
J488C24	48	800	8PDT	A	12.85
J1104C24	110	6500	4PDT	A	10.20
J1106C24	110	5000	6PDT	A	11.70
J1108C24	110	3600	8PDT	A	13.45
JDP SERIES					
JDP124C24	12	80	4PDT	B1	9.85
JDP126C24	12	50	6PDT	B2	11.75
JDP128C24	12	50	8PDT	B2	13.40
JDP244C24	24	500	4PDT	B1	10.13
JDP246C24	24	300	6PDT	B2	12.00
JDP248C24	24	200	8PDT	B2	13.65
JDP484C24	48	1300	4PDT	B1	10.55
JDP486C24	48	1000	6PDT	B2	12.40
JDP488C24	48	800	8PDT	B2	14.05
JDP1104C24	110	6500	4PDT	B1	11.10
JDP1106C24	110	5000	6PDT	B2	13.00
JDP1108C24	110	3600	8PDT	B2	14.50

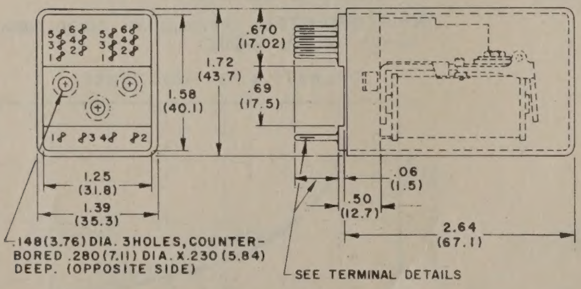
J DIMENSIONS (FIG. A)

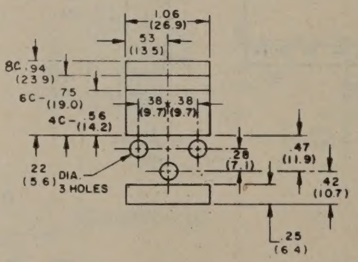

LEFT PILEUP
RIGHT PILEUP
1.12 (28.4) MAX
4C-1.50 (38.1) MAX
6C-1.69 (42.9) MAX
8C-1.94 (49.3) MAX
6-32 TAP 2 HOLES
1.88 (47.8) MAX
2.12 (53.8) MAX
8C
6C
4C
.48 (12.2)
.28 (7.1)
.97 MAX (24.6)
.25 (6.4)
.25 (6.4)
.33 (8.4) REF
.75 (19.0)

JDP SOCKET TERMINAL


.52 (13.2)
SLOT .040 (1.02) W. X .172 (4.37) LG.
.090 (2.29)

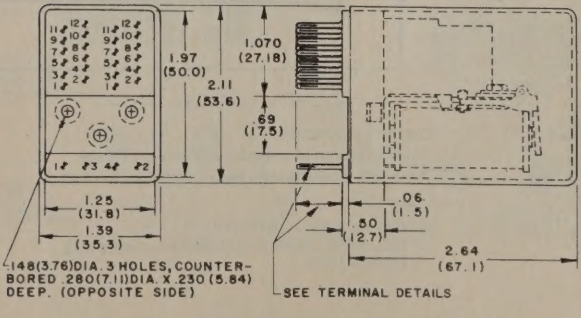
16 PIN JDP DIMENSIONS (FIG. B1)

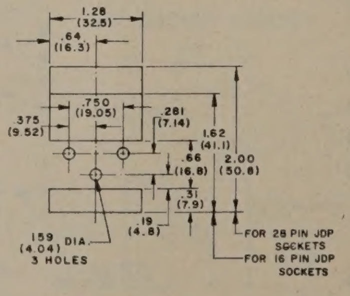

.670 (17.02)
1.72 (43.7)
1.58 (40.1)
.69 (17.5)
1.25 (31.8)
1.39 (35.3)
.06 (1.5)
.50 (12.7)
2.64 (67.1)
.148(3.76) DIA. 3HOLES, COUNTER-BORED .280(7.11) DIA. X .230 (5.84) DEEP. (OPPOSITE SIDE)
SEE TERMINAL DETAILS


1.06 (26.9)
.53 (13.5)
8C .94 (23.9)
6C .75 (19.0)
4C .56 (14.2)
.38 (9.7)
.38 (9.7)
.28 (7.1)
.47 (11.9)
.42 (10.7)
.22 (5.6) DIA. 3 HOLES
.25 (6.4)

RELAY CUTOUTS

28 PIN JDP DIMENSIONS (FIG. B2)


1.97 (50.0)
1.070 (27.18)
2.11 (53.6)
.69 (17.5)
1.25 (31.8)
1.39 (35.3)
.06 (1.5)
.50 (12.7)
2.64 (67.1)
.148(3.76)DIA. 3 HOLES, COUNTER-BORED .280(7.11)DIA. X .230 (5.84) DEEP. (OPPOSITE SIDE)
SEE TERMINAL DETAILS


1.28 (32.5)
.64 (16.3)
.750 (19.05)
.375 (9.52)
.281 (7.14)
1.62 (41.1)
.66 (16.8)
2.00 (50.8)
.31 (7.9)
.19 (4.8)
.159 (4.04) DIA. 3 HOLES
FOR 28 PIN JDP SOCKETS
FOR 16 PIN JDP SOCKETS

SOCKET CUTOUTS

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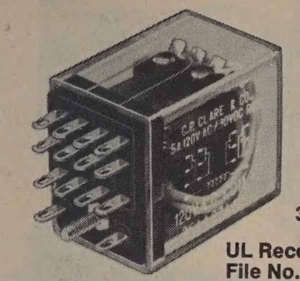
GENERAL PURPOSE RELAYS

354 MINIATURE 4-POLE RELAYS



354

UL Recognized File No. E47012

The 354 relay handles motor, lamp and solenoid switching requirements in everything from vending machines to disc drive applications. They also switch signal levels in intercoms, two-way radios and small telephone exchanges plus input multiplexing in control systems.

The options make it all possible. Contact ratings up to 5 amperes, ac or dc coils, plus solder lug/plug-in, taper tab or pcb terminals. The relays have UL recognition, File E47012, as Magnetic Motor Controllers for use in industrial applications.

Stock Part No.	Terminal Type	Nominal Coil	Contact Material	Coil Resist. ±10%	Must Operate	Must Release	List Prices
354A12A2C 354A14A2C 354A17A2C	Plug-in/ Solder	12Vdc 24Vdc 110Vdc	Silver	160 ±10% 650 ±10% 11000 ±10%	9.0Vdc 18.0Vdc 82.5Vdc	1.2Vdc 2.4Vdc 11.0Vdc	$5.90 5.90 6.75
354A12A1C 354A14A1C	Plug-in/ Solder	12Vdc 24Vdc	Silver Cad. Oxide	160 ±10% 650 ±10%	9.0Vdc 18.0Vdc	1.2Vdc 2.4Vdc	6.05 6.05
354A14B2C	PCB	24Vdc	Silver	650 ±10%	18.0Vdc	2.4Vdc	5.90
354A24A2C 354A27A2C	Plug-in/ Solder	24Vac 120Vac	Silver	157 ±15% 4100 ±15%	20.4Vac 102.0Vac	7.2Vac 36.0Vac	6.75 7.30
354A24A1C 354A27A1C	Plug-in/ Solder	24Vac 120Vac	Silver Cad. Oxide	157 ±15% 4100 ±15%	20.4Vac 102.0Vac	7.2Vac 36.0Vac	6.95 7.45

ENGINEERING DATA

CONTACT RATINGS:

Contact Types	Ratings
Gold Flashed Silver Button	3A at 30Vdc or 120Vac resistive or 1/10 H.P. at 120Vac
Gold Flashed Silver Cadmium Oxide Button	5A at 30Vdc or 120Vac resistive or ⅛ H.P. at 120Vac

LIFE EXPECTANCY:
Electrical — 100,000 operations min. at rated load
Mechanical — 50 million operations

TYPICAL OPERATE TIME:
Operate — 20 milliseconds max., not including bounce
Release — 10 milliseconds max., dc not including bounce. 15 ms max. ac

BREAKDOWN VOLTAGE: 700 Vac, rms, 60Hz min. between open contacts, 1500Vac, rms, 60Hz between all other mutually insulated elements

INSULATION RESISTANCE (OFF Impedance): 1000 megohms min., at 500Vdc, +25°C, 50% relative humidity

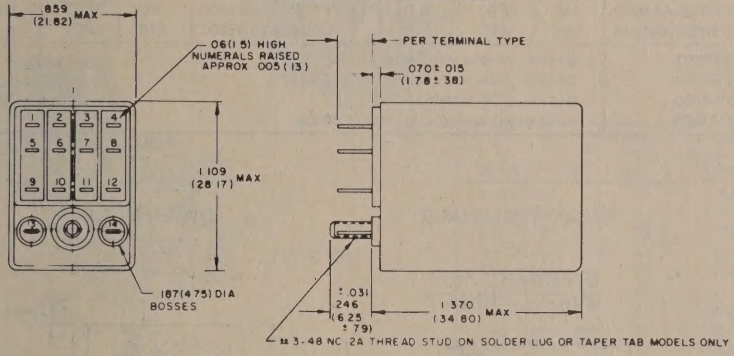
CONTACT RESISTANCE (ON Impedance): 50 milliohms max. initially

U.L. RECOGNITION: File Number E47012 under Bulletins 508 "Industrial Control Equipment", 114 "Office Appliances and Business Equipment", 478 "Electronic Data Processing Units and Systems" and 751 "Vending and Amusement Machines"

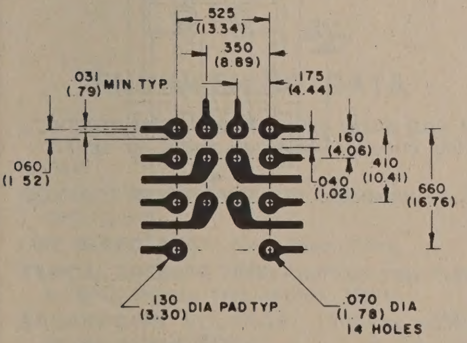
ENVIRONMENTAL:
Vibration — 6g's 10 to 55Hz (operating test, no contact chatter, hard mounted, 10 microsecond detection level)
Shock — 20g's, 11 ±1ms, ½ sinewave (non-operating test, no mechanical damage)
Temperature Range — −45° to +50°C ac models: −45° to +65°C dc models

PHYSICAL:
Weight — Approx. 1.5 oz.
Enclosure — Polycarbonate
Insulating Material — High dielectric molded plastic resin
Marking — Nominal voltage, part number, schematic, contact rating
Terminals — Solder lug/plug-in, taper tab or pcb

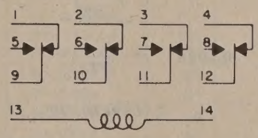
RELAY DIMENSIONS


.859 (21.82) MAX
.06(1.5) HIGH NUMERALS RAISED APPROX .005(.13)
PER TERMINAL TYPE
.070± .015 (1.78±.38)
1.109 (28.17) MAX
.187(4.75) DIA BOSSES
±.031 .246 (6.25 ±.79)
1.370 (34.80) MAX
#3-48 NC-2A THREAD STUD ON SOLDER LUG OR TAPER TAB MODELS ONLY

PAD LAYOUT


.525 (13.34)
.350 (8.89)
.031 (.79) MIN. TYP.
.175 (4.44)
.060 (1.52)
.160 (4.06)
.410 (10.41)
.040 (1.02)
.660 (16.76)
.130 (3.30) DIA PAD TYP.
.070 (1.78) DIA 14 HOLES

SCHEMATIC


1
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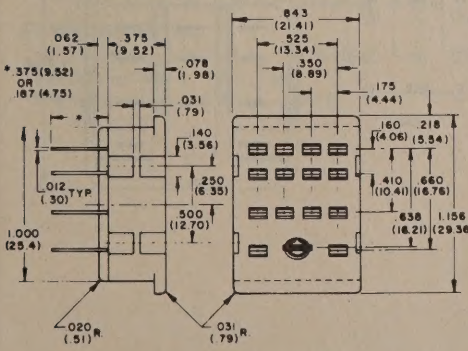
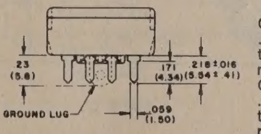
13
14

SOCKETS


.843 (21.41)
.062 (1.57)
.375 (9.52)
.525 (13.34)
.350 (8.89)
.078 (1.98)
*.375(9.52) OR .187(4.75)
.175 (4.44)
.031 (.79)
.140 (3.56)
.160 (4.06)
.218 (5.54)
.012 (.30) TYP.
.250 (6.35)
.410 (10.41)
.660 (16.76)
.500 (12.70)
.638 (16.21)
1.156 (29.36)
1.000 (25.4)
.020 (.51) R.
.031 (.79) R.

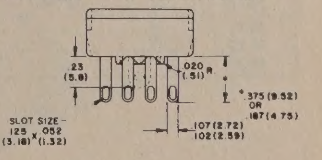
SOCKET PCB TERMINALS

GPS 1003 — PCB socket with ground lug
GPS 1005 — PCB socket without ground lug


.23 (5.8)
.171 (4.34)
.218±.016 (5.54±.41)
GROUND LUG
.059 (1.50)

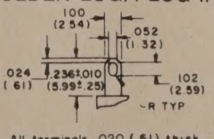
SOCKET SOLDER LUG TERMINALS

GPS 1001 — .375(9.52) terminals with retaining spring
GPS 1002 — .187(4.75) terminals with retaining spring


.23 (5.8)
.020 (.51) R
*.375 (9.52) OR .187 (4.75)
SLOT SIZE .125 x .052 (3.18) (1.32)
.107 (2.72)
.102 (2.59)

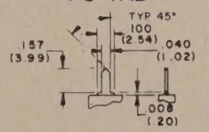
RELAY TERMINALS

SOLDER LUG/PLUG-IN


.100 (2.54)
.052 (1.32)
.024 (.61)
.236±.010 (5.99±.25)
.102 (2.59)
R TYP

All terminals .020 (.51) thick

PC TAB

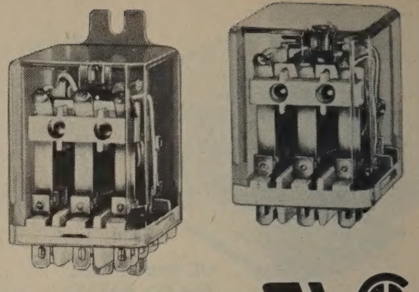

TYP 45°
.100 (2.54)
.157 (3.99)
.040 (1.02)
.008 (.20)

C. P. CLARE & COMPANY • A Subsidiary of General Instrument Corporation
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

GENERAL PURPOSE RELAYS

GP3 HEAVY DUTY RELAYS

The GP3 (Lexan® dust cover) Relays are UL recognized (UL File E47012) and CSA certified as Magnetic Motor Controllers. The rugged AC or DC relays are available in SPDT, DPDT and 3PDT configurations with Gold flashed Silver Cadmium Oxide contacts rated at 10 amperes at 28Vdc resistive or 120/150Vac, .8 power factor. The GP3 plain case models are available with matching molded nylon sockets for plug-in applications. The GP3 bracket case model is available for direct chassis mounting only. Mechanical life expectancy is 10 million operations, electrical life 100,000 operations minimum at rated load .187″ quick connect terminals are standard.



UL Recognized
File No. E47012

Stock Part No.	Coil Voltage	Contacts	List Price
AC (50/60Hz)			
GP3R221AA0000	6	DPDT	$5.95
GP3R221AA1000	12	DPDT	5.95
GP3R221AA2000	24	DPDT	5.95
GP3R221AA3000	48	DPDT	5.95
GP3R221AA6000	120	DPDT	5.95
GP3R221AA7000	240	DPDT	6.55
GP3R231AA0000	6	3PDT	6.70
GP3R231AA1000	12	3PDT	6.70
GP3R231AA2000	24	3PDT	6.70
GP3R231AA3000	48	3PDT	6.70
GP3R231AA6000	120	3PDT	6.70
GP3R231AA7000	240	3PDT	7.35

Stock Part No.	Coil Voltage	Contacts	List Price
DC			
GP3R221AD0000	6	DPDT	$5.30
GP3R221AD1000	12	DPDT	5.30
GP3R221AD2000	24	DPDT	5.30
GP3R221AD3000	48	DPDT	5.30
GP3R221AD4000	90	DPDT	5.95
GP3R221AD5000	110	DPDT	6.10
GP3R231AD0000	6	3PDT	$6.10
GP3R231AD1000	12	3PDT	6.10
GP3R231AD2000	24	3PDT	6.10
GP3R231AD3000	48	3PDT	6.10
GP3R231AD4000	90	3PDT	6.55
GP3R231AD5000	110	3PDT	6.70

GPS3001	Socket, solder terminals	1.00
GPS3002	Socket, quick-connect terminals (.187″)	1.10
GPS3003	Socket, PCB terminals	1.10
GPA3050	Hold down spring clip, box of 50 ea.	6.80

ENGINEERING DATA

GP3

CONTACT RATING: 10 amperes at 28Vdc resistive or 120/150Vac, .8 power factor. 6 amperes at 240/300Vac, .8 power factor. ⅓ hp at 120Vac, ½ hp at 240Vac

CONTACT RESISTANCE: Initial — 50 milliohms max. at rated current

LIFE EXPECTANCY:
Electrical — 100,000 operations minimum at rated load
Mechanical — 10,000,000 operations

OPERATE TIME: 15ms typical

RELEASE TIME: 11ms typical

BREAKDOWN VOLTAGE: 600Vac, rms, 60Hz minimum between open contacts. 1600Vac, rms, 60Hz all other mutually insulated elements

INSULATION RESISTANCE: 1000 megohms minimum at 500Vdc

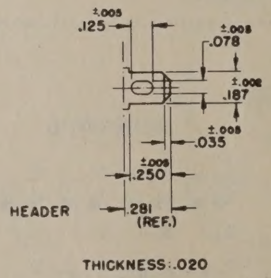
ENVIRONMENTAL:
Vibration — 0.1″ d.a. or 10g, 10 to 55Hz (operating)
Shock — 15g for 11 ±1ms (non-operating)
Temperature Range — −45° to +45°C (AC) 3 pole. −45° to +70°C (DC). −45° to +55°C (AC) 2 pole

OPTIONS:
BRACKET CASE — To order, change 8th character from "A" to "N". Example — GP3R231AA2000 becomes GP3R231NA2000. No charge.

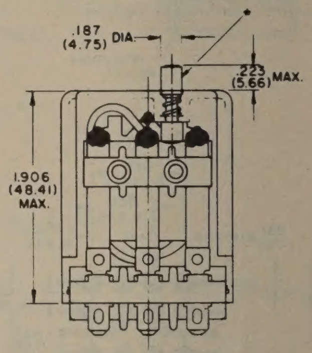
NOTE: Options include neon indicator lamp, external push-to-test button, various mounting modifications and .205″ quick-connect or pcb terminals. Contact your local Clare Sales Office for details.

RELAY TERMINALS

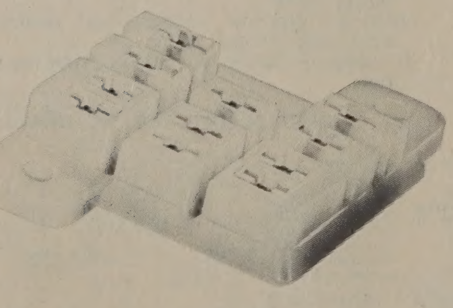
STANDARD .187″ QUICK-CONNECT



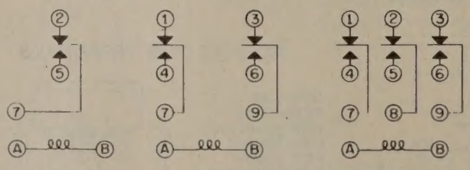
DIMENSIONS



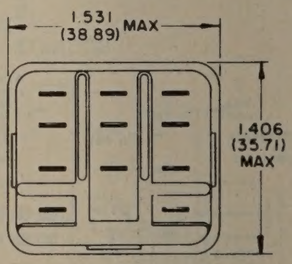
SOCKET



SCHEMATICS



1 FORM "C" 2 FORM "C" 3 FORM "C"



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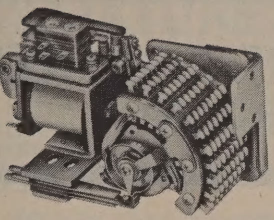
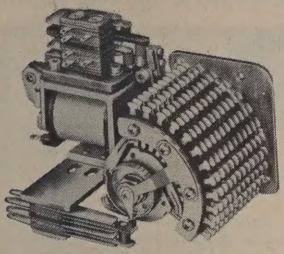
STEPPING SWITCHES

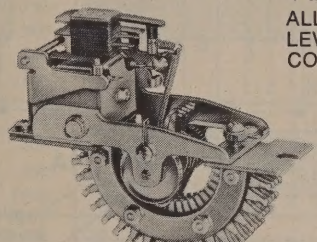
210, 211, 20, 26 SEQUENTIAL SWITCHING



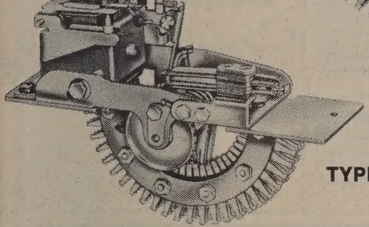
TYPE 210



TYPE 211



TYPE 20



TYPE 26

Clare stepping switches offer an economical alternative to solid state switching. Multiplexing, counting and sequencing problems are easily solved by providing the most working capacity in the smallest space. Clare stepping switches allow you to select, interrupt or change connections in a succession of circuits in response to current pulses.

Type 210 offers 3, 6 and 12 levels of 10 points with a life expectancy of 100 million steps at 12 levels. Contacts are rated 0.1A at 115Vac or 30Vdc resistive with a 3A carry rating. Operate time is approx. 20ms at 25°C and release time is 10ms. Solder lug terminals are standard.

Type 211 has the same electrical characteristics as the type 210 but in 3, 6, and 12 levels of 11 points.

Type 20 offers 4 and 8 levels of 20 points with a life expectancy of 180 million steps at 8 levels. Contacts are rated 0.1A at 115Vac or 30Vdc resistive with a 3A carry rating. Operate time is approx. 20ms at 25°C and release time is approx. 10ms at 25°C. Solder lug terminals are standard.

Type 26 has the same electrical characteristics as the type 20 but is offered in 4 and 8 levels of 26 points or 6 levels of 52 points.

ALL SWITCHES LISTED HAVE 1 BRIDGING LEVEL WITH THE REMAINING LEVELS BEING NON-BRIDGING. 2C OFF-NORMAL AND 2C INTERRUPTER CONTACTS ARE STANDARD.

Stock Part No.	Nom. Volt. (dc)	Coil Resistance (ohms±)	Levels	Points	Dimensions H	Dimensions W	Dimensions D	List Price
210-2403A	24	24	3	10	2¾	4 5/16	1 19/64	$30.00
210-2406A	24	24	6	10	2¾	4 5/16	1 13/16	34.30
210-2412A	24	20	12	10	2¾	4 5/16	2 13/16	55.70
210-4803A	48	100	3	10	2¾	4 5/16	1 19/64	30.00
210-4806A	48	100	6	10	2¾	4 5/16	1 13/16	34.30
210-4812A	48	70	12	10	2¾	4 5/16	2 13/16	55.70
210-11003A	110	600	3	10	2¾	4 5/16	1 19/64	30.60
210-11006A	110	600	6	10	2¾	4 5/16	1 13/16	34.95
210-11012A	110	400	12	10	2¾	4 5/16	2 13/16	56.30
211-2403A	24	24	3	11	2¾	4 5/16	1 19/64	30.00
211-2406A	24	24	6	11	2¾	4 5/16	1 13/16	34.30
211-2412A	24	20	12	11	2¾	4 5/16	2 13/16	55.70
211-4803A	48	100	3	11	2¾	4 5/16	1 19/64	30.00
211-4806A	48	100	6	11	2¾	4 5/16	1 13/16	34.30
211-4812A	48	70	12	11	2¾	4 5/16	2 13/16	55.70
211-11003A	110	600	3	11	2¾	4 5/16	1 19/64	30.60
211-11006A	110	600	6	11	2¾	4 5/16	1 13/16	34.95
211-11012A	110	400	12	11	2¾	4 5/16	2 13/16	56.30
20-2404A	24	35	4	20	4⅝	5 5/16	2⅛	42.80
20-2408A	24	35	8	20	4⅝	5 5/16	2⅛	53.90
20-4804A	48	100	4	20	4⅝	5 5/16	2⅛	42.80
20-4808A	48	100	8	20	4⅝	5 5/16	2⅛	53.90
20-11004A	110	600	4	20	4⅝	5 5/16	2⅛	43.45
20-11008A	110	600	8	20	4⅝	5 5/16	2⅛	54.50
26-2404A	24	35	4	26	4⅞	6 9/16	2½	44.65
26-2408A	24	35	8	26	4⅞	6 9/16	2½	55.10
26-4804A	48	100	4	26	4⅞	6 9/16	2½	44.65
26-4808A	48	100	8	26	4⅞	6 9/16	2½	55.10
26-11004A	110	600	4	26	4⅞	6 9/16	2½	45.30
26-11008A	110	600	8	26	4⅞	6 9/16	2½	55.70
26-11026A	110	600	6	52	4⅞	6 9/16	2¾	69.80
RP8047G4	Rectifier Unit							15.35
RP9466	Standard Lubrication Kit							10.80
RP11375	Tool Kit							54.00

ENGINEERING DATA

CONTACT RATINGS (Resistive load): 0.1A at 115Vac or 30Vdc switched, 3A carry only, max.

CONTACT RESISTANCE (ON Impedance): 0.15 ohm typical

LIFE EXPECTANCY: (See description)

TYPICAL OPERATE TIME: Approximately 20ms at 25°C, release time approx. 10ms

BREAKDOWN VOLTAGE: 1000Vac, 60Hz across open contacts

INSULATION RESISTANCE (OFF Impedance): 10^{11} ohms at 500Vdc between levels

ENVIRONMENTAL:

Vibration — 0.06″ d.a., 10-55Hz

Shock — 30g's, 11 ±1ms

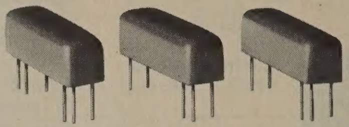
Temperature — 0°C to +85°C

C. P. CLARE & COMPANY • A Subsidiary of General Instrument Corporation
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

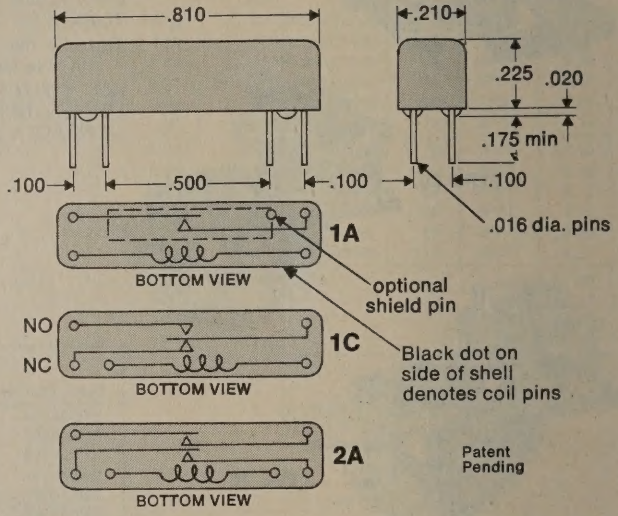
MICRO-MINIATURE REED RELAYS
Series CR-2200

Coto's micro-miniature CR-2200 series reed relays offer the same versatility, dependability and switching capabilities as the larger "miniature" relays . . . yet in a package ⅓ smaller than a "DIP". A wide variety of contact types are available to meet most micro-miniature switching needs. Coto utilizes premium grade reed switches exclusively. The relays are encapsulated and thoroughly tested by the most modern and sophisticated techniques. Again, the finest quality . . . from Coto.

- Relay occupies only .17 sq. in. of PC Board space . . . smaller than a DIP!
- Wide variety of contact types to meet most switching applications
- A choice of coil resistances at each voltage
- All relays are epoxy encapsulated in a magnetically shielded can, which has been coated with a bright, chemically resistant and insulating epoxy.
- Electrostatic shielding available
- Less than 500 microsecond switching speed typical on most models



Shown actual size



Patent Pending

Relay Contact Type	Model Number and Coil Voltage	Initial Contact Resist. Ohms Max.	Contact Rating Watts Max.	Switch Volts DC Max.	Switch Amps Max. Resist.	Breakdown Volts DC Min.	Available Coils #	Electrostatic shield avail.
1A Standard	CR-2203 -5, 12	.150	10	100	.5	250	2, 3, 4	A
1A* High Reliability	CR-2204 -5, 12	.100	10	200	.5	250	2, 3, 4	A
1C Standard	CR-2211 -5, 12	.150	3	100	.250	200	2, 3	N/A
1A** Mercury Wet	CR-2220 -5, 12	.100	3	28	.100	1000	1	A
1A High Voltage Standard	CR-2231 -5, 12	.150	10	300	.5	400	2, 3	N/A
2A Standard	CR-2253 -5, 12	.150	10	100	.5	250	2, 3	N/A

*High reliability relays are run-in and tested for dynamic contact resistance. This relay is recommended for low-level loads.

**Consult factory for availibility. Mercury wet relay may be mounted in any position.

Specifications subject to change without notice.

OPERATING PARAMETERS @ 25°C		
Nominal Volts	5	12
Must Operate Volts	3.7	9.0
Must Release Volts	0.4	1.0
Coil #1 Resistance Ohms	60	370
Coil #2 Resistance Ohms	150	900
Coil #3 Resistance Ohms	230	1500
Coil #4 Resistance Ohms	370	—

Insulation Resistance 10^{10} Ohms min @ 100VDC, 25°C, 40% Rel. Humidity

ORDERING INFORMATION

CR — 22XX — XX — XX

MODEL No.

COIL VOLTAGE

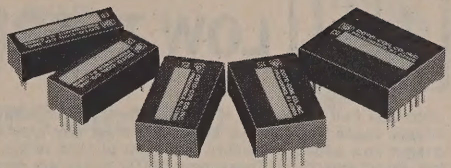
"1" — COIL #1
"2" — COIL #2
"3" — COIL #3
"4" — COIL #4

"0" — no electro-static shield
"1" — electro-static shield

Coto's staff of reed relay specialists will be pleased to assist you in designing and specifying the proper relay for any special application. Write for information on our complete line of stock reed relays.

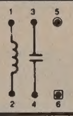
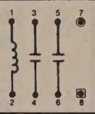
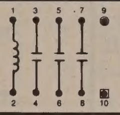
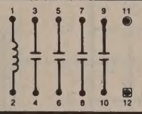
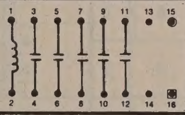
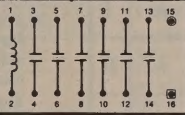
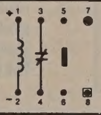
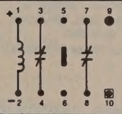
COTO-COIL COMPANY, INC.
Dept. EM, 57 Pavilion Ave., Providence, R. I. 02905 • Telephone (401) 467-4777

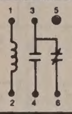
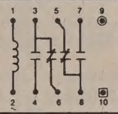
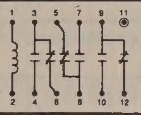
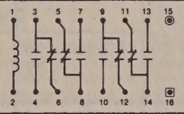
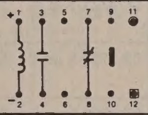
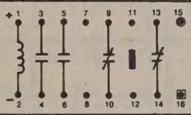
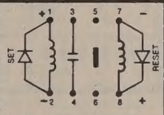
MINIATURE REED RELAYS
Series CR-2000 • • 1″ x .100″ Grid



DESCRIPTION Coto-Coil's Series CR-2000 is a new family of relays which have a pin termination on the popular 1″ x .100″ grid pattern. They are economical and available with a large variety of options (see reverse side).

The CR-2000 can be completely epoxy-encapsulated in a phenolic shell for maximum environmental protection and high insulation resistance. They are also available in a covered but non-encapsulated form for maximum economy.

Contact Form	Nominal Volts	mW	Res. Ohms ±10% @ 25°C	PART NO.	DWG.	Pin Diagram Bottom View
1A	5	125	175	CR-2001-5	A	
	6		300	-6		
	12		1100	-12		
	24		4200	-24		
2A	5	230	100	CR-2002-5	B	
	6		150	-6		
	12		640	-12		
	24		2450	-24		
3A	5	350	65	CR-2003-5	C	
	6		100	-6		
	12		490	-12		
	24		1550	-24		
4A	5	475	55	CR-2004-5	D	
	6		80	-6		
	12		315	-12		
	24		1350	-24		
5A	5	525	45	CR-2005-5	E	
	6		73	-6		
	12		275	-12		
	24		1100	-24		
6A	5	525	45	CR-2006-5	E	
	6		73	-6		
	12		275	-12		
	24		1100	-24		
1B *	5	125	100	CR-2021-5	B	
	6		150	-6		
	12		640	-12		
	24		2450	-24		
2B *	5	350	65	CR-2022-5	C	
	6		100	-6		
	12		490	-12		
	24		1550	-24		

Contact Form	Nominal Volts	mW	Res. Ohms ±10% @ 25°C	PART NO.	DWG.	Pin Diagram Bottom View
1C	5	125	175	CR-2041-5	A	
	6		300	-6		
	12		1100	-12		
	24		4200	-24		
2C	5	350	65	CR-2042-5	C	
	6		100	-6		
	12		490	-12		
	24		1550	-24		
3C	5	475	55	CR-2043-5	D	
	6		80	-6		
	12		315	-12		
	24		1350	-24		
4C	5	525	45	CR-2044-5	E	
	6		73	-6		
	12		275	-12		
	24		1100	-24		
1A 1B *‡	5	475	55	CR-2060-5	D	
	6		80	-6		
	12		315	-12		
	24		1350	-24		
2A 2B *‡	5	525	45	CR-2061-5	E	
	6		73	-6		
	12		275	-12		
	24		1100	-24		
1A Latch *	5	65	550/550	CR-2052-5	B	
	6			-6		
	12			-12		
	24			-24		

External Resistors to limit coil current

Nominal Volts	12	24
Ohms (¼ watt)	500	1500

Internal diode suppression standard

◉ Electro-static shield pin ▣ Alternate coil pin * These relays contain bias magnets and correct input polarity must be observed. Magnetic shield standard.

‡ Break before make not guaranteed.

RELAY SPECS:

Nominal Operating Volts	5	6	12	24
Must Operate Volts	3.75	4.5	9	18
Must Release Volts	0.4	0.5	1.0	2.0

NOTE: Measurements taken at 25°C. Max. coil volts are 50% greater than nom. volts for 10 min.

ISOLATION RESISTANCE

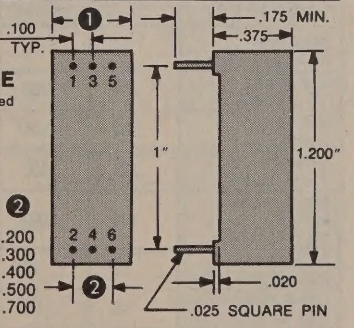
10^9 ohms minimum — non-encapsulated

10^{12} ohms minimum — encapsulated

100VDC, 25°C, 40% relative humidity. Measured between coil & contact and contact & contact.

SWITCH SPECIFICATIONS	Form A & B	Form C
Contact Rating — DC	10 watts max.	3 watts max.
Switching Voltage — DC or peak AC	200 volts max.	28 volts max.
Maximum Current — DC or peak AC — Resistive	0.500 amps	0.250 amps
Initial Contact Resistance	0.2 ohms max.	0.2 ohms max.
Breakdown Voltage — DC or peak AC	250 volts min.	200 volts min.
Actuating Time — average — incl. Bounce	1.5 milliseconds	1.5 milliseconds
Release Time	1.0 millisecond	2.0 milliseconds
Life expectancy	100x10⁶ operations at signal level; 10x10⁶ operations at rated load	

DRAWINGS	❶	❷
A	.410	.200
B	.510	.300
C	.660	.400
D	.760	.500
E	.990	.700



AVAILABLE OPTIONS

- Relay — non-encapsulated — for economy
- Relay — encapsulated — for maximum protection and high insulation resistance
- Electro-static shield and/or magnetic shield
- Breakdown volts DC or peak AC — 1000 volts minimum
- High-reliability relays which have been conditioned by a special run-in and dynamic testing
- Other relay sensitivities and operating voltages

ORDERING INFORMATION

CR — 20XX — XX — XXXX

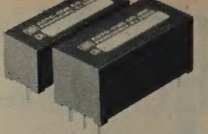
MODEL No.
COIL VOLTAGE
"0" — not encapsulated
"1" — encapsulated
"0" — no magnetic shield
"1" — magnetic shield
"0" — no electro-static shield
"1" — electro-static shield
"0" — standard
"1" — high reliability

If all options are "0" omit last four digits.

Specifications subject to change without notice

LOW THERMAL EMF REED RELAYS

Series CR-3200



Coto-Coil has developed a unique new method* that virtually eliminates offsets caused by thermal emf's in almost any type of reed switch. This design now allows the entire spectrum of reed relays to be used for very low signal switching. These new COTO relays are especially designed for scanning low-level analog and digital signals, multiplexing, data acquisition, and automatic testing of components and systems. They offer all the advantages of an encapsulated reed relay, such as high isolation, speed and long lifetime under practically any environmental conditions, in addition to a very low and stable offset.

*Patented

COTO's new line of low-offset relays is offered with a large variety of contact combinations, switch types and thermal offset ratings, in order to meet each customer's requirement with maximum performance at a minimum cost. The relays are encapsulated in an epoxy-filled shell, and the offsets that are present are remarkably independent of ambient temperature and external environment.

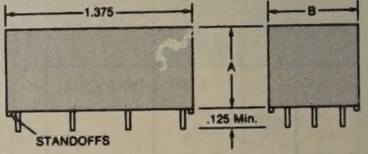
RELAYS	MODEL NO	COIL (Nominal)			CONTACT FORMS	THERMAL EMF RATINGS*	PIN CONFIG.	PKG.
		VOLT. (volts)	RESIS. (ohms)	POWER (watts)				
Dry Miniature	CR-3201-5 or -6 -12	5 or 6 12	1000 4000	.035	1A	5, 7, 8	A	I
	CR-3202-5 or -6 -12	5 or 6 12	450 2200	.075	2A	5, 7, 8, 9	B	I
	CR-3203-5 or -6 -12	5 or 6 12	350 1750	.100	3A	7, 8, 9	C	II
	CR-3204-5 or -6 -12	5 or 6 12	450 2200	.075	1B	5, 7, 8, 9	A	I
	CR-3205-5 or -6 -12	5 or 6 12	350 1750	.100	2B	7, 8, 9	B	II
	CR-3206-5 or -6 -12	5 or 6 12	350 1750	.100	1A1B	7, 8, 9	B	II
	CR-3207-5 or -6 -12	5 or 6 12	780/780 3000/3000 Bifilar	.045	Single Pole Latch	4, 7	D	I
	CR-3250-5 or -6 -12	5 or 6 12	350 1750	.100	3A (2 low therm. 1 high ")	5, 7, 8, 9	C	II
High Voltage Miniature	CR-3221-5 or -6 -12	5 or 6 12	450 2200	.075	1A	8, 9	A	I
	CR-3222-5 or -6 -12	5 or 6 12	325 1200	.120	2A	8, 9	B	I
	CR-3223-5 or -6 -12	5 or 6 12	450 2200	.075	1B	8, 9	A	I
Hg Wet Miniature	CR-3231-5 or -6 -12	5 or 6 12	150 600	.240	1A	9	A	II
	CR-3232-5 or -6 -12	5 or 6 12	90 350	.400	2A	9	B	II
	CR-3233-5 or -6 -12	5 or 6 12	90 350	.400	1B	9	A	II

*Thermal Offset Ratings Per Switch:

4 <200nV	8 <3μV
5 <500nV	9 <5μV
7 <1μV	0 <100μV

Thermal offset measurements are made across each switch, except in Relays 3202, 3205, 3250, 3222 and 3232 where measurements are made differentially between the two low-thermal switches.

NOTES:
1) All relays are magnetically shielded.
2) Unless otherwise specified, all relays are electrostatically shielded.
3) Isolation resistance of 10^{10} or 10^{12} ohms is available.



Package I: 1.375 x .500(A) x .500(B)

Package II: 1.375 x .600(A) x .650(B)

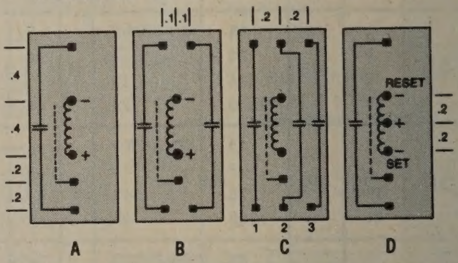
Shield and switch pins are .025" square, tinned copper.

Coil pins are .036" dia., nickel copper.

Pin pattern is centered within the case by ±.010".

Relays are encapsulated in a phenolic case, epoxy-filled.

PACKAGE and PIN CONFIGURATION (Bottom View)



Relays 3204, 3205, 3206, 3223 and 3233 contain a bias magnet, and coil polarity shown above must be observed.

Mercury-wetted Relays 3231, 3232 and 3233 must be mounted vertically with the arrow pointing up and shield pin at the bottom.

Switches 2 and 3 in Diagram C are the low-thermal switches in Relay 3250.

CONTACTS	DRY	HIGH VOLTAGE	MERCURY WET
Max. Power (Volt-Amps)	10	10	28
Max. Voltage (DC or Peak AC)	200	1000	100
Max. Current (Amps)	.500	.500*	1.0
Initial Contact Resis. (Ohms)	.300	.300	.300
Min. Breakdown Voltage (DC or Peak AC)	300	1000	800
Isolation Resis. (Ohms)	10^{10}	10^{10}	10^{10}
Operate Time (Typ. —msec)	1.5	1.5	2.0
Release Time (Typ. —msec)	.2	.2	.5
Average Life at Full Rating (# operations)	50x10^6	50x10^6	100x10^6

*0.010 Amperes max. @ 1000 VDC

INSULATION RESISTANCE
10^{10} ohms minimum at 100VDC, +25°C, 50% relative humidity between all isolated pins. 10^{12} ohms is also available.

CAPACITANCE
The contact-to-contact capacitance for low thermal contacts is approximately 2.0pf. This value is composed of 0.2pf from the reed contacts and 1.8pf from the low thermal offset circuitry. With the electrostatic shield the contact-to-coil capacitance is typically 2.0pf.

MUST OPERATE and RELEASE VOLTAGES
Must-operate voltages at 25°C:
5v relay — 3.8; 6v relay — 4.5; 12v relay — 9.0
Must-release voltages at 25°C:
5v relay — 0.4; 6v relay — 0.5; 12v relay — 1.0

INITIAL CONTACT RESISTANCE
The maximum initial contact resistance for each contact is 0.3 ohms. Typically the initial contact resistance measures to be 0.250 ohms and is composed of 0.070 ohms from the reed contacts and 0.180 ohms from the low thermal offset circuitry.

TESTING and RELIABILITY
The low thermal emf reed relays are most commonly used under essentially dry circuit conditions. For these low-level loads the life of a clean contamination-free switch can exceed 500 million operations. In order to assure the highest possible reliability each switch and completed relay is subjected to an extensive series of cycling and dynamic testing. In addition each isolated pin is checked against every other pin for insulation resistance at the rated breakdown voltage. Finally a thermal offset test at the rated voltage is performed.

THERMAL TESTING. Care must be exercised in setting up in-house testing procedures for measuring thermal offsets of the CR-3200 relays. Without properly designed test circuitry and instrumentation, far greater thermal EMF offsets can be generated external to the relay than internally. Coto's engineering department will be pleased to assist in recommending testing circuitry and components for Q/C testing.

EFFECT OF AMBIENT TEMPERATURES. One of the specific design features of the CR-3200 low thermal relay is its exceptional stability with ambient temperature changes. For the purpose of rating, all standard CR-3200 relays are tested at a nominal 25°C ambient. However, temperature excursions from 0°C to 50°C will result in no more than a 500 nanovolt offset change in a 1μV rated relay.

Specifications subject to change without notice

ORDERING INFORMATION

CR — XXXX — XX — XXX

Model No.
Coil Voltage
Thermal
Contact Isolation (Ohms)
10^{10} — Suffix "0"
10^{12} — Suffix "1"
Electrostatic Shield
Include — Suffix "1"
Omit — Suffix "0"

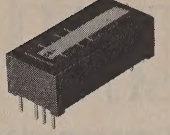
To order a COTO LOW THERMAL RELAY a part number can be assembled from the data sheet to describe the desired parameters as shown above. EXAMPLE: Typical part number for a 5 volt relay, 1 Form A with 1 μV offset, 10^{12} isolation and electrostatic shield: CR-3201-5-711.

Specifications subject to change without notice.

COTO-COIL COMPANY, INC.

Dept. EM, 57 Pavilion Ave., Providence, R. I. 02905 • Telephone (401) 467-4777

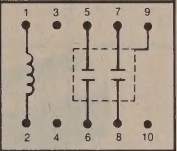
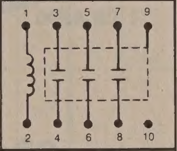
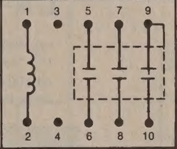
LOW THERMAL EMF REED RELAYS FOR LOW-LEVEL DATA ACQUISITION SYSTEMS

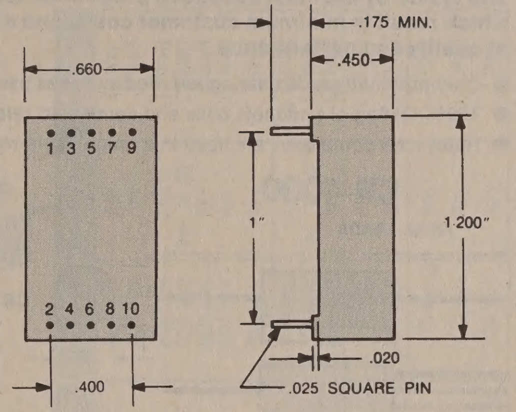


SERIES CR-3300

After many years as the leading supplier of ultra-low thermal EMF relays for low-level data acquisition systems, Coto has now developed a new generation of low thermal EMF reed relays. The CR-3300 series relays utilize a new simpler design that reduces the cost, while increasing the performance and reliability of the relays.

The CR-3300 relays are designed especially as input devices for data acquisition systems. These systems, along with process controllers and monitors, datascanners, multiplexers and digital and analog multipoint recorders, often require as many as 1000 input relays in one system which must switch signals to 1 microvolt resolution in an industrial environment. These applications require ultra-high reliability, low and stable thermal offset voltage, superior packaging and high control/signal circuit isolation. The CR-3300 relays are designed to meet these requirements and more, at a reasonable cost.

CONTACT FORM	Model Number	Nominal Coil VDC	Coil Res. Ohms ±10%	Must Operate VDC	Must Release VDC	Pin. Dia. Bottom View
2A	CR-3302-5	5	350	3.8	0.4	
	CR-3302-12	12	2000	9.0	1.0	
3A	CR-3350-5	5	350	3.8	0.4	
	CR-3350-12	12	2000	9.0	1.0	
3A	CR-3360-5	5	350	3.8	0.4	
	CR-3360-12	12	2000	9.0	1.0	



Pin 9 is the electrostatic shield pin.
NOTE: For Model CR-3360 the 3rd non-low thermal switch (9-10) is connected in common with the electrostatic shield at Pin 9.

Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches.

PACKAGING

Relays are epoxy encapsulated in a flame-retardant polyester case (SE-O rated). The reed switches are coated with a silicone rubber to provide a stress-free encapsulation.
Tinned electrolytic copper pins minimize thermal EMF junctions at the PC Board connections.
The coil and coil terminations are well isolated from the switches and shield which provide a minimum of 1500 VRMS isolation between control and signal circuits.
All relays are magnetically shielded.
Unused terminals are omitted.

PARAMETER		TEST CONDITIONS	VALUE
Max. Switch Voltage		DC/Peak AC	200 Volts
Max. Switch Current		DC/Peak AC Resistive	500 mA
Max. Carry Current			2.0 Amps
Max. Contact Rating		DC Resistive	10 Watts
Life Expectancy		At Signal Level	100 x 10^6 Cyc.
		At Rated Load	10 x 10^6 Cyc.
Static Contact Resistance (Initial)		0.050 Volt, 10 mA Contact Load	0.100 Ohms Max.
Dynamic Contact Resistance (Initial)		0.5 Volt, 50 mA Load 100 hz, 1.5 msec after coil energized	0.200 Ohms Max.
Insulation Resistance		Between all isolated pins @ 100 V, 25 deg. C, 40% relative humidity.	10^{10} ohms min. (10^{12} ohms avail.)
Open Contact Capacitance		Shield Floating	1.0 pf Typ.
		Shield as Guard	0.4 pf Typ.
Contact to Shield Capacitance		Contacts Open	1.5 pf Typ.
		Shield & Coil shorted together	1.5 pf Typ.
Dielectric Strength (Minimum)	Between Contacts	DC/Peak AC Static Conditions	250 Volts
	Contacts to Shield		500 Volts
	Contacts and Shield to Coil	AC VRMS	1500 Volts
Operating Time (Including Bounce)		At Nominal Voltage 30 hz Sq. wave	1.0 msec Typ.
Release Time		Zener Diode Clamp Coil Suppression	100 μsec Typ.

THERMAL EMF

RATINGS. The thermal EMF is specified differentially between the two low thermal EMF switches (pins 5-6 and 7-8). This measurement is made by shorting pins 5 and 7 with a copper shunt and connecting a microvolt meter across pins 6 and 8. The CR-3300 relays are available with maximum differential thermal EMF ratings of either 10 μV, 5 μV, 3 μV or 1 μV. The ratings are determined by 100% testing and sorting according to the thermal EMF's measured after the coil has been energized for 15 minutes at its nominal voltage.

EFFECT OF AMBIENT TEMPERATURE. CR-3300 relays are exceptionally stable with ambient temperature changes. For the purpose of rating, the thermal EMF is measured at a nominal 25 degrees C ambient. Slow temperature excursions from 0 degrees C to 50 degrees C should result in no more than a 1 μV thermal EMF variation. External heat sources which create thermal gradients in the relay may cause larger variations and should be avoided.

COIL POWER AND DUTY CYCLE. The thermal EMF of the CR-3300 relays is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode the thermal EMF will be proportional to the coil duty cycle. Thus a 5 μV relay operated at a 10% duty cycle will normally exhibit less than a 1 μV offset.

TESTING. Care must be exercised in testing the thermal EMF of the CR-3300 relays. Large errors in the thermal EMF readings may be introduced by an improperly designed test set up. The connections to the copper switch pins should be made with 4 identical low mass connectors and lead wires. Care should be taken to avoid all external thermal gradients. Pure copper wire and connections should be used throughout. Coto's engineering department will be pleased to assist in recommending thermal EMF test procedures.

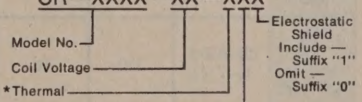
ENVIRONMENTAL RATINGS

Storage Temperature: —50 to +100°C
Operating Temperature: —20 to +70°C
NOTE: (The must operate and must release voltages and the coil resistance are specified at 25 degrees C. These values vary by approximately 0.4%/degrees C as the ambient temperature varies).
Vibration: 20 g's to 2000 hz
Shock: 50 g's

TESTING AND RELIABILITY

All relays utilize premium quality, contamination free reed switches with rhodium contacts. In order to assure the highest possible reliability each switch and completed relay is subjected to an extensive series of cycling and dynamic testing. In addition each isolated pin is checked against every other pin for insulation resistance at the rated breakdown voltage. Finally a thermal EMF test at the rated voltage is performed.

ORDERING INFORMATION



*<10 μV—Suffix 1
< 5 μV—Suffix 9
< 3 μV—Suffix 8
< 1 μV—Suffix 7

Contact Isolation (Ohms)
10^{10} — Suffix "0"
10^{12} — Suffix "1"

To order a COTO LOW THERMAL RELAY a part number can be assembled from the data sheet to describe the desired parameters as shown above.

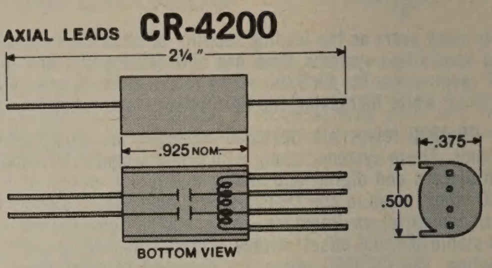
Specifications subject to change without notice.

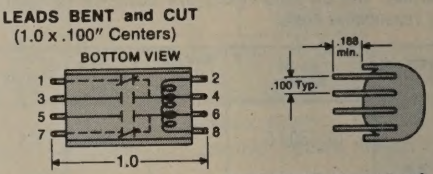
COTO-COIL COMPANY, INC.
57 Pavilion Avenue
Providence, R. I. 02905
Telephone (401) 467-4777

High Quality Low-Cost REED RELAYS Series CR-4000 CR-4200

These new uniquely-designed reed relays are manufactured and tested by the most advanced production techniques, which result in minimum customer costs, and a high standard of quality and performance.

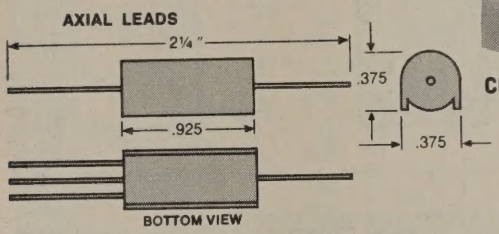
- Only premium grade catalogued reed switches used throughout
- 100% testing of switches, coils and completed relays
- Relays are completely encased in a tough flame-retardant shell.

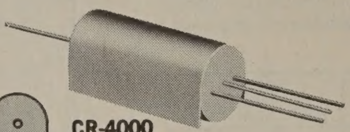

AXIAL LEADS CR-4200
2¼"
.925 NOM.
.375
.500
BOTTOM VIEW

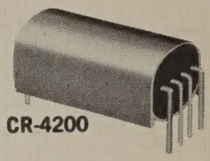

LEADS BENT and CUT
(1.0 x .100" Centers)
BOTTOM VIEW
1
3
5
7
2
4
6
8
1.0
.188 min.
.100 Typ.

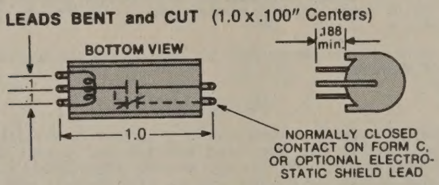
Pins 1 & 7 — Normally Closed Contacts on 2 Form C
Pin 1 — Optional Electrostatic Shield Terminal on Form A and Form B Relays
Pin 2 — Positive Coil Terminal to Actuate 1 Form B or to Set Latch Relay
Pins 3 & 4 — 1 Form B or Latch Contact Terminals

CR-4000


AXIAL LEADS
2¼"
.925
.375
.375
BOTTOM VIEW






LEADS BENT and CUT (1.0 x .100" Centers)
BOTTOM VIEW
.1
.1
1.0
.188 min.
NORMALLY CLOSED CONTACT ON FORM C, OR OPTIONAL ELECTRO-STATIC SHIELD LEAD

CR-4000

Insulation Resistance
10^9 Ohms min
@ 100VDC, 25°C,
40% Rel. Humidity

OPERATING PARAMETERS @ 25°C				
Nominal Volts	5	6	12	24
Must Operate Volts	3.7	4.5	9.0	18.0
Must Release Volts	0.4	0.5	1.0	2.0
Standard Coil Resistance Ohms	65	105	500	1800
High Sensitivity Coil Resistance Ohms	175	300	1000	4000

Relay Contact Type	Model Number and Coil Voltage	Initial Contact Resist. Ohms Max.	Contact Rating Watts Max.	Switch Volts DC Max.	Switch Amps Max. Resist.	Break-down Volts DC Min.
1A Low Cost	CR-4002-5, 6, 12, 24	.500	10	100	.5	250
1A Standard	CR-4003-5, 6, 12, 24	.150	10	100	.5	300
1A High Reliability	CR-4004-5, 6, 12, 24	.100	10	200	.5	300
1C Low Cost	CR-4010-5, 6, 12, 24	.500	3	28	.110	250
1C Standard	CR-4011-5, 6, 12, 24	.150	3	28	.250	250
1A* Mercury Wet	CR-4020-5, 6, 12, 24	.050	28	100	1.0	1000
1A High Voltage Low Cost	CR-4030-5, 6, 12, 24	.150	10	240 VAC	.5	600
1A High Voltage Standard	CR-4031-5, 6, 12, 24	.150	10	500	.5	1000

*Standard coil only. Mount Hg Wet relay vertically with coil leads down.

CR-4200

Insulation Resistance
10^9 Ohms min
@ 100VDC, 25°C,
40% Rel. Humidity

OPERATING PARAMETERS @ 25°C				
Nominal Volts	5	6	12	24
Must Operate Volts	3.7	4.5	9.0	18.0
Must Release Volts	0.4	0.5	1.0	2.0
Standard Coil Resistance Ohms	60	100	400	1600
High Sensitivity Coil Resistance Ohms	150	250	1000	4000

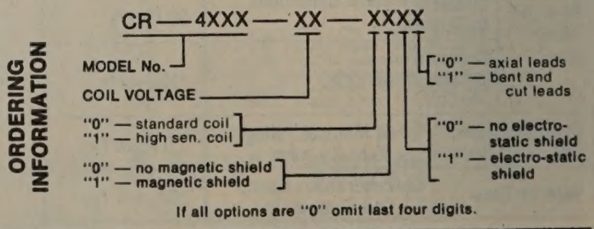
Relay Contact Type	Model Number and Coil Voltage	Initial Contact Resist. Ohms Max.	Contact Rating Watts Max.	Switch Volts DC Max.	Switch Amps Max. Resist.	Break-down Volts DC Min.
2A Low Cost	CR-4202-5, 6, 12, 24	.500	10	100	.5	250
2A Standard	CR-4203-5, 6, 12, 24	.150	10	200	.5	300
2A High Reliability	CR-4204-5, 6, 12, 24	.100	10	200	.5	300
2C Standard	CR-4211-5, 6, 12, 24	.150	3	28	.250	250
2A High Voltage Low Cost	CR-4230-5, 6, 12, 24	.150	10	240 VAC	.5	600
2A High Voltage Standard	CR-4231-5, 6, 12, 24	.150	10	1000	.5	1200
1B Standard	CR-4240-5 6, 12, 24	.150	10	200	.5	300
1A Latch Single Coil	CR-4245-5, 6, 12, 24	.200	10	200	.5	300

1. Available with 1000 ohm coil only.
2. External series limiting resistance recommended:
   5 or 6V — None 12V — 1000 ohms 24V — 3000 ohms
3. Coil polarity must be reversed to set and reset latch.
4. External coil suppression recommended for proper latch operation.

Specifications subject to change without notice.

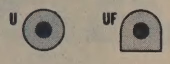
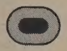
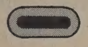
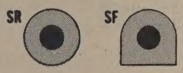
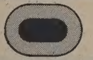
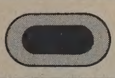
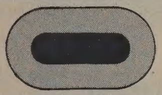
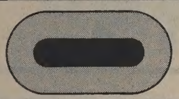
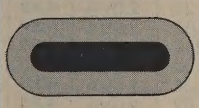
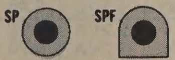
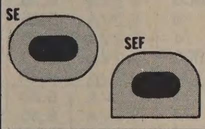
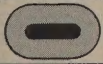
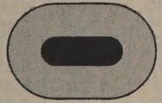
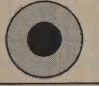
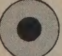
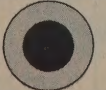
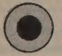
COTO-COIL COMPANY, INC.
Dept. EM, 57 Pavilion Avenue
Providence, R.I. 02905
Telephone (401) 467-4777

ORDERING INFORMATION


CR — 4XXX — XX — XXXX
MODEL No.
COIL VOLTAGE
"0" — standard coil
"1" — high sen. coil
"0" — no magnetic shield
"1" — magnetic shield
"0" — axial leads
"1" — bent and cut leads
"0" — no electro-static shield
"1" — electro-static shield

If all options are "0" omit last four digits.

COTO REED COILS

	END DRAWING (Actual Size)	TYPE	DIMENSIONS Nominal	D.C. VOLTS	RESIS. Ohms Nominal	COIL CURRENT mA	mW Nominal	AMP/TURNS Nominal	REED SWITCHES No. REEDS	REED TYPES	CONTACT FORMS
MINIATURE	 U UF	U UF	OD .375 Lg .800 ID .140 Ht .437 Wd .375 Lg .800 ID .140	6 12 24 32 48	150 625 2500 4000 8600	40 20 9.6 8 5.5	240	125	1 1	1 or 2 3	1A 1C
		UD	Ht .375 Wd .500 Lg .800 ID .140 x .287	6 12 24 32 48	86 350 1320 2250 5500	69.7 34 18 14.2 8	400	125	3 2 2 2 2 2	1 1 1 1 2 3	3A 2B* 1A & 1B* 1C* 2A 2C
		UT	Ht .350 Wd .710 Lg .725 ID .130 x .500	6 12 24 32 48	85 340 1300 2550 5300	70.5 35.2 18.4 12.5 9	420	105	6 5 5 5 4 4 4	1 1 1 1 1 2 3	6A 5A 4A & 1B* 3A & 2B* 4B* 4A 4C
MICRO MINIATURE		UM	OD .300 Lg .400 ID .090	3 6 12 24	55 215 850 3500	55 28 14 7	170	70	1	7	1A
		UMM	OD .290 Lg .435 ID .112	3 6 12 24	55 215 850 3500	55 28 14 7	170	70	1	8 or 9	1A or 1C
		UMD	Ht. .200 Wd .315 Lg .450 ID .071x .168	3 6 12 24	40 150 600 2400	75 40 20 10	240	70	1 2 1	8 8 8 & 9	1B* 2A 1A & 1C
STANDARD	 SR SF	SR SF	OD .500 Lg 2.00 ID .220 Ht .500 Wd .500 Lg 2.00 ID .220	6 12 24 32 48	113 450 1650 2840 5890	53 26.5 14.5 11 8.2	330	200	1 1	4 or 5 6	1A 1C
		SD	Ht .500 Wd .720 Lg 2.00 ID .220 x .440	6 12 24 32 48	84 335 1290 2165 5700	66 36 18.5 15 8.5	430	200	1 2 2 2	4 or 5 4, 5, 6 5 & 6 4 & 6	1B* 2A or 2C 1A & 1C 1A & 1C
		SG3	Ht .500 Wd 1.00 Lg 2.00 ID .220 x .660	6 12 24 32 48	52 205 850 1430 3800	86 58.5 28 22 13	700	210	2 3	4 or 5 4, 5, 6	2B* 1B & 1A* 3A or 3C 1A & 2C 2A & 1C
		SH4	Ht .750 Wd 1.375 Lg 2.00 ID .220 x .800	6 12 24 32 48	40 160 650 1090 2500	150 75 37 29.4 19	900	260	4 3	4, 5, 6 4 or 5	4A or 4C 1A & 3C 2A & 2C 3A & 1C 2B & 1A* 1B & 2A*
		SJ5	Ht .750 Wd 1.500 Lg 2.00 ID .220 x 1.020	6 12 24 32 48	33 130 520 830 1950	182 92 46 38 24	1150	280	5 4	4, 5, 6 4 or 5	5A or 5C 1A & 4C 2A & 3C 3A & 2C 4A & 1C 2B & 2A* 1B & 3A*
		SK6	Ht .750 Wd 1.750 Lg 2.00 ID .220 x 1.220	6 12 24 32 48	25 100 400 680 1575	240 120 60 47 30	1450	310	6 5	4, 5, 6 4 or 5	6A or 6C 1A & 5C 2A & 4C 3A & 3C 4A & 2C 5A & 1C 4B* 2B & 3A* 1B & 4A*
COMPACT	 SP SPF	SP SPF	OD .470 Lg 1.450 ID .220 Ht .500 Wd .470 Lg 1.450 ID .220	6 12 24 32 48	150 600 2400 4000 9200	40.6 20 10 8 5.2	250	150	1	5 or 6	1A or 1C
	 SE SEF	SE SEF	Ht .625 Wd .812 Lg 1.450 ID .220 x .450 Ht .655 Wd .812 Lg 1.450 ID .220 x .450	6 12 24 32 48	117 433 1610 2740 7200	51 28 14.9 11.6 6.7	350	160	2 1 2	5 or 6 5 5 & 6	2A or 2C 1B* 1A & 1C
		T	Ht .500 Wd .875 Lg .690 ID .136 x .490	6 12 24 32 48	100 400 1600 2800 5800	60 30 15 11.4 8.2	350	125	6 5 4	1 1 2 or 3	6A 5A 4A or 4C
		UH	Ht .875 Wd 1.375 Lg .718 ID .250x .750	6 12 24 32 48	45 180 720 1400 2640	133 67 33 23 18	800	200	Combinations to 23 12	1 2	23A 12A or 12C
OTHER		SA	OD .700 Lg 1.187 ID .320	6 12 24 32 48	65 255 965 1810 3660	92 47 25 17.6 13	575	200	Jumbo Reed Swt. Coil		
		S	OD .562 Lg 2.00 ID .220	6 12 24 32 48	105 360 1400 1930 5150	57 33 17 16.5 9.5	400	250	1 1	4 or 5 6	1A 1C
		M	OD .843 Lg 2.00 ID .468	6 12 24 32 48	50 175 820 1400 3120	120 69 29 23 15	700	250	3 Drive Coil for High Voltage Reed Switches—Above 10KV (Order with Bore Bushing)	4, 5, 6	3A or 3C
		SPH	OD .470 Lg 1.450 ID .220	6 12 24 32 48	70 260 1070 1690 4000	86 46 23 19 12	575	225	Drive Coil for High Voltage Reed Switches—To 10KV		

COTO REED COILS

*Bias Magnet Required

COTO REED SWITCHES

TYPES	CONTACTS	CONT. FORM w/magnet bias	GLASS DIAMETER	GLASS LENGTH	MOUNTING POSITION	NOM. POWER RATING
1	Dry Form A High Frequency A	Form B —	.090 Max .090 Max	.800 Max .800 Max	Any Any	10 Watt .3 Watt
2	Dry Form A Hg/Wet A Low Thermal A High Isolation A	Form B Form B — —	.130 Max .130 Max .130 Max .130 Max	.800 Max .800 Max .800 Max .800 Max	Any Vert to 30° Any Any	10 Watt 28 Watt .3 Watt 10 Watt
3	Dry Form C	—	.130 Max	.800 Max	Any	3 Watt
4	Dry Form A Hg/Wet A High Voltage	Form B Form B Form B	.210 Max .210 Max .210 Max	1.950 Max 1.950 Max 1.950 Max	Any Vert to 30° Any	To 450 Watt 50 Watt 50 Watt
5	Dry Form A	Form B	.210 Max	1.425 Max	Any	To 100 Watt
6	Dry Form C	—	.218 Max	1.562 Max	Any	To 20 Watt
7	Dry Form A	Form B	.090 Max	.375 Max	Any	.3 Watt
8	Dry Form A	Form B	.070 Max	.470 Max	Any	3 Watt
9	Dry Form C	—	.070 x .110 Max	.435 Max	Any	.1 Watt

Dimensions subject to change without notice.

The above listing of magnetic reed switches does not constitute a complete listing of all switches commercially available to fit Coto Coil reed relay coils. It does indicate the most common types and sizes manufactured by various companies. Coto's sales department will be pleased to assist you in recommending a source for your switch requirements or supplying the complete relay for your application.

COTO-COIL COMPANY, INC.

Dept. EM, 57 Pavilion Avenue
Providence, R.I. 02905
Telephone (401) 467-4777

DELTROL CONTROLS

Makers of RELAYS, SOLENOIDS and TIMERS

A Division of Deltrol Corp, 2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871

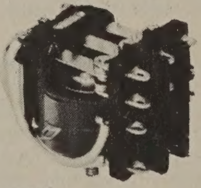
SALES REPRESENTATIVES

Alabama, Deltrol Controls, 414-671-6800
Alaska, Components West, Inc., 503-643-5588
Arizona, Cummings & Associates, 213-340-6035
Arkansas, Weisler & Associates, Inc., 314-428-3934
California (No.), Cummings & Associates, 408-247-8656
California (So.), Cummings & Associates, 213-340-6035
Colorado, Cummings & Associates, 303-455-6860
Connecticut, Sands Company, 203-628-4363
Delaware, Naudain Associates, 609-235-1801
Florida, Jack Krutek & Associates, 305-941-6544
Georgia, Deltrol Controls, 414-671-6800
Hawaii, Aloha Associates, 808-941-1574
Idaho, Components West, Inc., 503-643-5588
Illinois (No.), Deltrol Controls, 312-498-1208
Illinois (So.), Weisler & Associates, Inc., 314-428-3934
Indiana (No.), Walter W. Bieberich, Inc., 219-432-2537
Indiana (So.), Walter W. Bieberich, Inc., 812-945-3187
Iowa, Kenco Co., 612-645-7717
Kansas, Weisler & Associates, Inc., 314-428-3934
Kentucky, Walter W. Bieberich, Inc., 812-945-3187
Louisiana, Ray—May, 214-276-5214
Maine, Sands Company, 203-628-4363
Maryland, Naudain Associates, 301-442-2270
Massachusetts, Sands Company, 203-628-4363
Michigan, Kent & Associates, 313-651-1890
Minnesota, Kenco Company, 612-645-7717
Mississippi, Ray—May, 214-276-5214
Missouri, Weisler & Associates, Inc., 314-428-3934
Montana, Components West, Inc., 503-643-5588
Nebraska, Kenco Company, 612-645-7717
Nevada, Cummings & Associates, 213-340-6035
New Hampshire, Sands Company, 203-628-4363
New Jersey (No.), Coughlin Associates, Inc., 516-799-7743
New Jersey (So.), Naudain Associates, 609-235-1801
New Mexico, Cummings & Associates, 213-340-6035
New York (Metro), Coughlin Associates, Inc., 516-799-7743
New York (Upper), Deltrol Controls, 716-473-3340
North Carolina, Deltrol Controls, 414-671-6800
North Dakota, Kenco Company, 612-645-7717
Ohio (No.), Nationwide Component Reps, Inc., 216-562-9666
Ohio (So.), Nationwide Component Reps, Inc., 513-294-2303
Oklahoma, Weisler & Associates, Inc., 314-428-3934
Oregon, Components West, Inc., 503-643-5588
Pennsylvania, Naudain Associates, 609-235-1801
Rhode Island, Sands Company, 203-628-4363
South Carolina, Deltrol Controls, 414-671-6800
South Dakota, Kenco Company, 612-645-7717
Tennessee, Deltrol Controls, 414-671-6800
Texas, Ray—May, 214-276-5214
Texas (SW), Cummings & Associates, 213-340-6035
Utah, Cummings & Associates, 303-455-6860
Vermont, Sands Company, 203-628-4363
Virginia, Naudain Associates, 301-442-2270
Washington, Components West, Inc., 206-243-2133
West Virginia, Nationwide Component Reps, Inc., 513-294-2303
Wisconsin, F.C. DuBois Associates, 414-774-3100
Wyoming, Cummings & Associates, 303-455-6860

DELTROL CONTROLS RELAYS

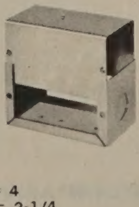
100U/101U SERIES

Small general purpose relay for light power load applications, such as other relays, solenoids and small motors. Continuous duty operation. 5 amp contacts: 1/8" dia. 10 amp contacts: 3/16" dia. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Mounting: No. 6-32 stud and locating tab. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).



L = 1-7/8
W = 1-1/2
H = 1-9/32

20061-81	100U	SPDT	5A	12VAC	21	2.0VA	4.80
20061-82	100U	SPDT	5A	24VAC	82	2.0VA	4.80
20061-84	100U	SPDT	5A	120VAC	2,250	2.0VA	4.80
20061-85	100U	SPDT	5A	240VAC	9,100	2.0VA	5.40
20062-81	101U	SPDT	10A	12VAC	21	2.0VA	4.85
20062-82	101U	SPDT	10A	24VAC	82	2.0VA	4.85
20062-84	101U	SPDT	10A	120VAC	2,250	2.0VA	4.85
20062-85	101U	SPDT	10A	240VAC	9,100	2.0VA	5.45
20063-81	100U	DPDT	5A	12VAC	19	2.2VA	5.75
20063-82	100U	DPDT	5A	24VAC	74	2.2VA	5.75
20063-84	100U	DPDT	5A	120VAC	1,800	2.2VA	5.75
20063-85	100U	DPDT	5A	240VAC	6,800	2.2VA	6.25
20064-81	101U	DPDT	10A	12VAC	19	2.2VA	5.85
20064-82	101U	DPDT	10A	24VAC	74	2.2VA	5.85
20064-84	101U	DPDT	10A	120VAC	1,800	2.2VA	5.85
20064-85	101U	DPDT	10A	240VAC	6,800	2.2VA	6.35
20065-81	100U	3PDT	5A	12VAC	19	2.2VA	6.40
20065-82	100U	3PDT	5A	24VAC	74	2.2VA	6.40
20065-84	100U	3PDT	5A	120VAC	1,800	2.2VA	6.40
20065-85	100U	3PDT	5A	240VAC	6,800	2.2VA	7.00
20066-81	101U	3PDT	10A	12VAC	19	2.2VA	6.50
20066-82	101U	3PDT	10A	24VAC	74	2.2VA	6.50
20066-84	101U	3PDT	10A	120VAC	1,800	2.2VA	6.50
20066-85	101U	3PDT	10A	240VAC	6,800	2.2VA	7.15
20067-81	100U	SPDT	5A	12VDC	120	1.2W	4.65
20067-82	100U	SPDT	5A	24VDC	472	1.2W	4.65
20067-84	100U	SPDT	5A	110VDC	10,000	1.2W	5.45
20068-81	101U	SPDT	10A	12VDC	120	1.2W	4.70
20068-82	101U	SPDT	10A	24VDC	472	1.2W	4.70
20068-84	101U	SPDT	10A	110VDC	10,000	1.2W	5.50
20069-81	100U	DPDT	5A	12VDC	120	1.2W	5.00
20069-82	100U	DPDT	5A	24VDC	472	1.2W	5.00
20069-84	100U	DPDT	5A	110VDC	10,000	1.2W	5.90
20070-81	101U	DPDT	10A	12VDC	120	1.2W	5.20
20070-82	101U	DPDT	10A	24VDC	472	1.2W	5.20
20070-84	101U	DPDT	10A	110VDC	10,000	1.2W	6.10
20071-81	100U	3PDT	5A	12VDC	120	1.2W	6.05
20071-82	100U	3PDT	5A	24VDC	472	1.2W	6.05
20071-84	100U	3PDT	5A	110VDC	10,000	1.2W	6.90
20072-81	101U	3PDT	10A	12VDC	120	1.2W	6.35
20072-82	101U	3PDT	10A	24VDC	472	1.2W	6.35
20072-84	101U	3PDT	10A	110VDC	10,000	1.2W	7.05



B-4 DUST COVER

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates following relay series 100, 100D/100F, 100RF, 100T, 100U/101U, 110, 120 and 130.

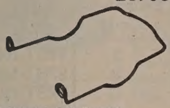
(S/N 20256-80) List $2.65

L = 4
W = 2-1/4
H = 2-1/4

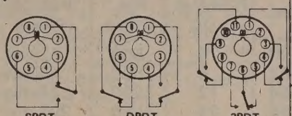
105 SERIES

General purpose plug-in relay for continuous duty operation. Eight and 11-pin plugs for up to 3PDT configuration. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Add $ .40 to list for 105G neoprene gasket version. Plastic Cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

L = 1-3/8
W = 1-3/8
H = 2

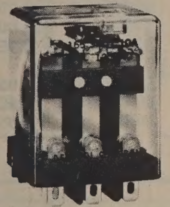


B-3 HOLD DOWN SPRING
(S/N 20171-00) $0.16 Net Any Qty.



BASE DIAGRAMS FOR 105 SERIES

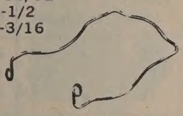
20105-84	105	SPDT	5A	120VAC	2,250	2.0VA	8.05
20106-82	105	SPDT	10A	24VAC	82	2.0VA	8.35
20106-84	105	SPDT	10A	120VAC	2,250	2.0VA	8.35
20107-82	105	DPDT	5A	24VAC	74	2.2VA	8.95
20107-84	105	DPDT	5A	120VAC	1,800	2.2VA	8.95
20108-80	105	DPDT	10A	6VAC	4.7	2.0VA	9.25
20108-81	105	DPDT	10A	12VAC	19	2.0VA	9.25
20108-82	105	DPDT	10A	24VAC	74	2.0VA	9.25
20108-84	105	DPDT	10A	120VAC	1,800	2.0VA	9.25
20108-85	105	DPDT	10A	240VAC	6,800	2.0VA	9.85
20109-84	105	3PDT	5A	120VAC	1,800	2.2VA	11.15
20109-85	105	3PDT	5A	240VAC	6,800	2.2VA	11.70
20110-80	105	3PDT	10A	6VAC	4.7	2.2VA	11.50
20110-81	105	3PDT	10A	12VAC	19	2.2VA	11.50
20110-82	105	3PDT	10A	24VAC	74	2.2VA	11.50
20110-84	105	3PDT	10A	120VAC	1,800	2.2VA	11.50
20110-85	105	3PDT	10A	240VAC	6,800	2.2VA	12.15
20112-81	105	SPDT	10A	12VDC	120	1.2W	8.25
20112-82	105	SPDT	10A	24VDC	472	1.2W	8.25
20113-81	105	DPDT	5A	12VDC	120	1.2W	8.90
20113-82	105	DPDT	5A	24VDC	472	1.2W	8.90
20114-80	105	DPDT	10A	6VDC	30	1.2W	9.20
20114-81	105	DPDT	10A	12VDC	120	1.2W	9.20
20114-82	105	DPDT	10A	24VDC	472	1.2W	9.20
20114-83	105	DPDT	10A	48VDC	1,800	1.2W	9.75
20114-84	105	DPDT	10A	110VDC	10,000	1.2W	10.10
20116-81	105	3PDT	10A	12VDC	120	1.2W	11.40
20116-82	105	3PDT	10A	24VDC	472	1.2W	11.40
20116-83	105	3PDT	10A	48VDC	1,800	1.2W	11.95
20116-84	105	3PDT	10A	110VDC	10,000	1.2W	12.30



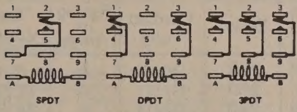
165/166 SERIES

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. 5 amp contacts: 1/8'' dia. 10 amp contacts: 3/16'' dia. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.

L = 1-13/32
W = 1-1/2
H = 2-3/16



165 HOLD DOWN SPRING
S/N 20902-00 $ .16 ea. any qty.

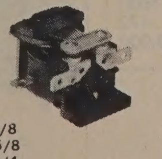


WIRING DIAGRAM FOR 165/166 SERIES

20324-84	165	DPDT	5A	120VAC	1,800	2.2VA	6.00
20307-82	166	DPDT	10A	24VAC	74	2.2VA	6.20
20307-84	166	DPDT	10A	120VAC	1,800	2.2VA	6.20
20307-85	166	DPDT	10A	240VAC	6,800	2.2VA	6.85
20308-82	166	3PDT	10A	24VAC	74	2.2VA	6.90
20308-84	166	3PDT	10A	120VAC	1,800	2.2VA	6.90
20308-85	166	3PDT	10A	240VAC	6,800	2.2VA	7.55
20309-81	166	SPDT	10A	12VDC	120	1.2W	5.05
20310-80	166	DPDT	10A	6VDC	30	1.2W	5.60
20310-81	166	DPDT	10A	12VDC	120	1.2W	5.60
20310-82	166	DPDT	10A	24VDC	472	1.2W	5.60
20310-84	166	DPDT	10A	110VDC	10,000	1.2W	6.35
20328-82	165	3PDT	5A	24VDC	472	1.2W	6.25
20311-81	166	3PDT	10A	12VDC	120	1.2W	6.40
20311-82	166	3PDT	10A	24VDC	472	1.2W	6.40
20311-84	166	3PDT	10A	110VDC	10,000	1.2W	7.15

SOCKETS – 165/166 SERIES

20312-82	3PDT	SOLDER TERMINALS	.88
20313-82	3PDT	.187 QUICK-CONNECT TERMINALS	1.35
20314-82	3PDT	PRINTED CIRCUIT TERMINALS	1.04
20395-82	3PDT	BARRIER TYPE .187 QC TERMINALS	1.55



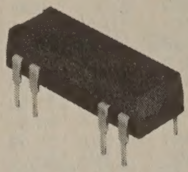
170 SERIES

Medium duty relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Ratings: (SPST-NO-DM): 25 amp, 1 hp, 120 VAC; Contacts: Silver cadmium oxide, gold flashed. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

L = 1-7/8
W = 1-5/8
H = 1-1/4

Stock No.	Series	Contact Poles	Rating in Amps	Coil Voltage/ Current	Resistance (Ohms)	Nominal Coil Power	List Price
20392-83	170	SPST-	25A	120VAC	1,100	4.7VA	5.80
20394-82	170	NO-DM	25A	24VDC	288	2W	5.45

DELTROL CONTROLS RELAYS

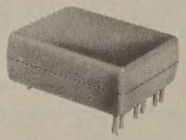


230 SERIES

Standard 14 pin Dual In-line Package Reed Relay. Interface with RTC, DTC, TTL and HTL logic. IC compatible. Exhibits high thermal stability. Coil voltage to 24VDC. Contacts SPST-NO, DPST-NO, or SPDT.

W = 1/4
D = 7/32
L = 3/4

Stock No.	Nominal VDC	Res. Ohms	Pick Up Power	Sensitivity Code	Contact	List Price
20755-80	5	500	32 mw	S	SPST-NO	3.40
20755-82	6	500	46 mw	S	SPST-NO	3.40
20755-84	12	1250	74 mw	G	SPST-NO	3.40
20755-86	24	1250	295 mw	W	SPST-NO	3.40
20756-80	5	200	80 mw	G	DPST-NO	6.20
20756-81	6	200	115 mw	G	DPST-NO	6.20
20756-82	12	500	184 mw	G	DPST-NO	6.20
20756-83	24	1200	307 mw	L	DPST-NO	6.20
20757-80	5	200	80 mw	S	SPDT	5.10
20757-82	6	200	115 mw	S	SPDT	5.10
20757-84	12	500	184 mw	G	SPDT	5.10
20757-85	24	1250	295 mw	L	SPDT	5.10

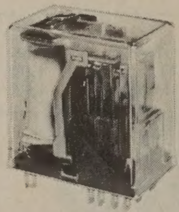


240 SERIES

Miniature low profile, general purpose SPDT or DPDT printed circuit DC relay. Can be driven from TTL circuits. Ultrasonically welded case protects contacts. Contact Material: silver alloy, gold-flashed. Contact Rating: 2 amps @ 28VDC standard adjustment.

W = 7/8 (DPDT)
19/32 (SPDT)
D = 27/64
L = 1-3/32

Stock No.	Volts	Resistance Ohms	Coil	Contacts Poles	List Price
20760-80	5VDC	43	Non-Sensitive	SPDT	2.90
20760-82	12VDC	200		SPDT	2.90
20760-83	24VDC	950		SPDT	3.05
20761-80	5VDC	32	Non-Sensitive	DPDT	3.75
20761-82	12VDC	170		DPDT	3.75
20761-83	24VDC	670		DPDT	3.85
20762-80	5VDC	64	Sensitive	SPDT	3.00
20762-82	12VDC	310		SPDT	3.00
20762-83	24VDC	950		SPDT	3.15
20763-80	5VDC	42	Sensitive	DPDT	3.95
20763-82	12VDC	260		DPDT	3.95
20763-83	24VDC	690		DPDT	4.05

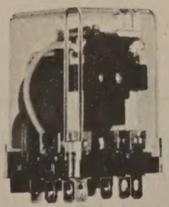


250 SERIES

Miniature general purpose cradle relay. DPDT, 4PDT or 6PDT configuration rated 2 or 5 amps @ 28VDC/120VAC. Signal input as low as 10 mW. Contact Resistance: 50 milliohms maximum. Terminals: printed circuit pins or solder type. Coil Treatment: tape wrapped.

W = 61/64
D = 49/64
L = 1-3/16

Stock No.	Series	Contact Poles	Rating in Amps	Coil Voltage	Resistance	Coil Power	List Price
20770-80	250	DPDT	5	6VDC	52	700MW	4.00
20770-81	250	DPDT	5	12VDC	185	700MW	4.00
20770-82	250	DPDT	5	24VDC	700	700MW	4.00
20771-80	250	4DPT	5	6VDC	52	700MW	4.55
20771-81	250	4DPT	5	12VDC	185	700MW	4.55
20771-82	250	4DPT	5	24VDC	700	700MW	4.55
20772-80	250	6DPT	5	6VDC	25	1.4W	5.95
20772-81	250	6DPT	5	12VDC	90	1.4W	5.95
20772-82	250	6DPT	5	24VDC	430	1.4W	5.95
20773-80	250P	DPDT	5	6VDC	52	700MW	4.00
20773-81	250P	DPDT	5	12VDC	185	700MW	4.00
20773-82	250P	DPDT	5	24VDC	700	700MW	4.00
20774-80	250P	4DPT	5	6VDC	52	700MW	4.55
20774-81	250P	4DPT	5	12VDC	185	700MW	4.55
20774-82	250P	4DPT	5	24VDC	700	700MW	4.55
20775-80	250P	6DPT	5	6VDC	25	1.4W	5.95
20775-81	250P	6DPT	5	12VDC	90	1.4W	5.95
20775-82	250P	6DPT	5	24VDC	430	1.4W	5.95

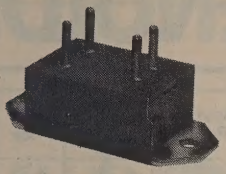


W = 1-1/2
D = 1-7/16
H = 2-1/2

268 SERIES

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. 15 amp contacts: 1/4" dia. Contact material: silver, cadium oxide. Recognized under the components program of Underwriter's Laboratories, Inc., File No. E37066; and CSA recognized.

20683-84	268	SPDT	15A	120VAC	1800	2.0VA	6.40
20684-82	268	DPDT	15A	24VAC	74	2.2VA	6.80
20684-84	268	DPDT	15A	120VAC	1800	2.2VA	6.80
20686-82	268	DPDT	15A	24VDC	472	1.2W	6.20
20686-84	268	DPDT	15A	110VDC	10,000	1.2W	7.05

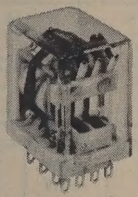


W = 43/64
D = 5/8
L = 1-1/2

270 SERIES

Miniature solid state relay designed to switch low to medium current AC loads from low level logic signals. Current loads from 50 mA to 7 amps. Operates from AC or DC (opto-isolator LED for DC inputs; incandescent for low voltage AC inputs; neon for 120 VAC input). Continuous Current: 1.5 Amps RMS @ 25° C. with integral heat sink; 7 amps RMS at 25° C. with Std. TO-3 style heat sinks.

Stock No.	Input		Output		List Price
	Volts	Current	Volts	Current	
20758-82	5DC	15MA	120VAC	7A	7.00
20758-86	12DC	15MA	120VAC	7A	7.00
20758-83	5DC	15MA	240VAC	7A	8.00
20758-87	12DC	15MA	240VAC	7A	8.00
20759-82	5DC	15MA	120VAC	7A	7.00
20759-86	12DC	15MA	120VAC	7A	7.00
20759-83	5DC	15MA	240VAC	7A	8.00
20759-87	12DC	15MA	240VAC	7A	8.00



L = 1-7/32
W - 55/64
H = 1-7/64

280 SERIES MINIATURE RELAYS

SOCKET FOR 280/290 SERIES

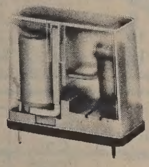
20614-80 Solder Term.
20615-80 PC Term.
$0.65 net each.

HOLD DOWN SPRING
21089-00 List $0.16

Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

Stock No.	Series	Contact Poles	Rating in Amps	Coil Voltage/ Current	Resistance (Ohms)	Nominal Coil Power	List Price
20751-83	280*	4PDT	5A	24VDC	650	0.9W	6.40
20753-83	280P	4PDT	5A	24VDC	650	0.9W	6.40
20751-85	280*	4PDT	5A	110VDC	11,000	0.9W	7.30
20753-85	280P	4PDT	5A	110VDC	11,000	0.9W	7.30
20752-84	280*	4PDT	5A	120VAC	3,900	1.2VA	7.50
20754-84	280P	4PDT	5A	120VAC	3,900	1.2VA	7.50

P = Printed-Circuit Term. * = Solder Term

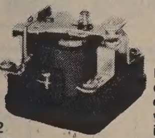


W = 1-3/16
D = 1/2
H = 1

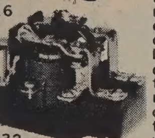
404/405 SERIES

Plastic covered, miniature, high current printed circuit relay. Continuous duty operation. Provides up to 6 amp switching capability. 2 amp contacts: (stationary) silver; (moveable) silver. 6 amp contacts: (stationary) silver; (moveable) silver cadium oxide. Recognized under the components program of Underwriter's Laboratories, Inc., file no. E37066

Stock No.	Series	Contact Poles	Rating in Amps	Coil Voltage Current	Resistance (Ohms)	Nominal Coil Power	List Price
20692-83	404	SPDT	2A	12VDC	280	.514W	3.20
20692-84	404	SPDT	2A	24VDC	1100	.524W	3.20
20693-83	405	SPDT	6A	12VDC	280	.514W	3.30
20693-84	405	SPDT	6A	24VDC	1100	.524W	3.30



L = 2-1/2
W = 2-1/2
H = 2-3/16

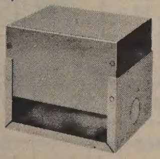


L = 3-11/32
W = 2-1/2
H = 2-3/8

900 SERIES

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture, has a cleaner appearance. Long life, rugged construction. Rating: 25 amps, 1-½ hp, 120/240 VAC. Contacts: 5/16" dia. silver cadmium oxide, gold-flashed. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).

20237-82	900	SPST-NO	30A	24VAC	12	9.5VA	6.05
20237-83	900	SPST-NO	30A	120VAC	290	9.5VA	6.05
20238-82	900	SPST NO-DM	30A	24VAC	12	9.5VA	6.15
20238-83	900		30A	120VAC	290	9.5VA	6.15
20238-84	900		30A	240VAC	1,200	9.5VA	6.70
20239-82	900	SPDT	30A	24VAC	12	9.5VA	6.40
20239-83	900	SPDT	30A	120VAC	290	9.5VA	6.40
20239-84	900	SPDT	30A	240VAC	1,200	9.5VA	7.00
20240-82	900	DPST-NO	30A	24VAC	12	9.5VA	7.35
20240-83	900	DPST-NO	30A	120VAC	290	9.5VA	7.35
20240-84	900	DPST-NO	30A	240VAC	1,200	9.5VA	7.70
20241-82	900	DPDT	30A	24VAC	12	9.5VA	9.10
20241-83	900	DPDT	30A	120VAC	290	9.5VA	9.10
20241-84	900	DPDT	30A	240VAC	1,200	9.5VA	9.80
20242-82	900	SPST NO-DM	30A	24VDC	290	2W	6.15
20242-84	900		30A	110VDC	6,050	2W	7.00
20243-81	900	SPDT	30A	12VDC	72	2W	6.40
20243-84	900	SPDT	30A	110VDC	6,050	2W	7.25
20244-81	900	DPST-NO	30A	12VDC	72	2W	7.15
20244-82	900	DPST-NO	30A	24VDC	290	2W	7.15
20245-81	900	DPDT	30A	12VDC	72	2W	9.10
20245-82	900	DPDT	30A	24VDC	290	2W	9.10
20245-84	900	DPDT	30A	110VDC	6,050	2W	10.00



L = 5
W = 4
H = 3

B-5 DUST COVER

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

(S/N 20257-80) List $3.75

DELTROL CONTROLS CLAPPER

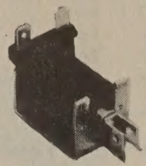
L = 1-1/2
W = 1-1/4
H = 1-1/4 +
mtg. stud

100 C CLAPPER

Medium duty, long life clapper mechanism with adjustable stop. Provided with 6-32 mounting stud and locator key and two threaded adaptor mounting bolts.

Stock No.	Coil Voltage/ Current	Resistance (Ohms)	Approx. Coil Power	List Price
20013-84	120VAC	1,800	2.2VA	2.80
20014-81	12VDC	120	1.2W	2.60
20014-82	24VDC	472	1.2W	2.60

DELTROL CONTROLS SOLENOIDS



C-6 PULL TYPE

Low cost, low power solenoid for applications such as appliances, vending machines, and automobiles. Molded nylon coil for fungus and moisture resistance. Terminals molded into the coil for extra strength, virtually eliminating open coils. Available with optional buzz trimmer that eliminates AC hum.

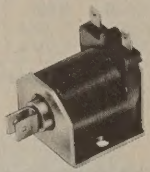
L = 1-1/8
W = 55/64
H = 1-17/64

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.

Stock No.	Volts/ Type	Duty	Approx. Amps	Approx. Resist.	Approx. Coil Power	List Price
53685-83	24VDC	Cont.	.19	129	4.7W	3.25
53686-83	24VDC	Int.	.50	48	12W	3.25
53687-94	120VAC	Cont.	.05	778	6.2VA	3.25
53688-94	120VAC	Int.	.11	487	19VA	3.25

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	7	3	2	1-1/2
DC Int.	15	8	5	3-1/2
AC Cont.	10	7	5	4
AC Int.	21	13	11	8



C-7 PULL TYPE

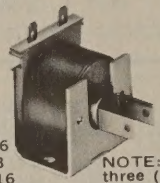
L= 1-9/64
W = 1-1/16
H = 1-13/32

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

53634-83	24VDC	Cont.	.27	88	6.6W	3.55
53635-83	24VDC	Int.	.48	50	11W	3.55
53637-94	120VAC	Cont.	.08	390	9VA	3.55
53638-94	120VAC	Int.	.21	181	24VA	3.55

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	19	8	5	3
DC Int.	28	12	8	5
AC Cont.	17	12	10	8
AC Int.	30	22	19	17



TYPE C-9 PULL TYPE

Medium power solenoid for volume applications where low cost is essential. Standard construction includes a nylon plunger guide for long operational life.

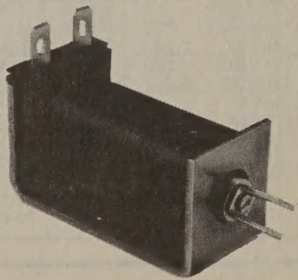
L = 1- 1/16
W = 1- 3/8
H = 1-13/16

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Approx. Amps	Approx. Resist.	Approx. Coil Power	List Price
53676-83	24VDC	Cont.	.35	69	8.4W	3.95
53677-83	24VDC	Int.	.65	37	15.6	3.95
53673-94	120VAC	Cont.	.11	256	13VA	3.95
53674-94	120VAC	Int.	.32	101	32VA	3.95

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
AC Cont.	20	15	14	13	9
AC Int.	37	30	26	24	16
DC Cont.	22	15	10-1/2	8	2-1/2
DC Int.	35	25	18	13-1/2	4-1/2



TYPE C-15 PULL TYPE

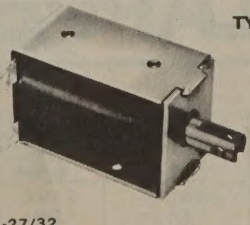
L = 1-3/4
W = 27/32
H = 59/64 (1-25/64 max.)

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

53679-94	120VAC	Cont.	.1	235	12VA	4.60
53680-94	120VAC	Int.	.2	140	24VA	4.60
53682-83	24VDC	Cont.	.28	86	6.7W	4.40
53683-83	24VDC	Int.	.7	34	17 W	4.40

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2
AC Cont.	15	11	10	9-1/2	9	8-1/2
AC Int.	24	17	15	14	13-1/2	12-1/2
DC Cont.	26	13	11	7-1/2	4	3
DC Int.	39	30	24	18	11	7-1/2



TYPE D-18 PULL TYPE

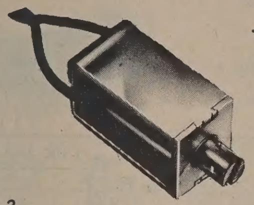
L = 1-27/32
W = 15/16
H = 1-3/16

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

53593-81	12VDC	Cont.	.67	18	8W	4.10
53593-83	24VDC	Cont.	.33	72	8W	4.10
53594-81	12VDC	Int.	1.5	8	18W	4.10
53594-83	24VDC	Int.	.75	32	18W	4.10
53591-94	120VAC	Cont.	0.1	200	12VA	4.15
53592-94	120VAC	Int.	0.35	85	42VA	4.15

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	38	28	16	11	4	3
DC Int.	55	40	24	22	10	6
AC Cont.	14	12	9	8	7	6
AC Int.	45	25	20	18	15	14



TYPE D-30 PULL TYPE

L = 2
W = 1
H = 1-7/32

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts Type	Duty	Approx. Amps.	Approx. Resist.	Approx. Coil Power	List Price
51002-81	12VDC	Cont.	.61	20	7.2W	4.70
51002-83	24VDC	Cont.	.30	80	7.2W	4.70
51002-93	115VDC	Cont.	.06	1,850	7.2W	4.75
50025-81	12VDC	Int.	1.6	8	19W	4.70
50025-83	24VDC	Int.	.8	30	19W	4.70
50025-93	115VDC	Int.	.17	700	19W	4.75
51038-94	120VAC	Cont.	.08	404	9.5VA	4.75
50010-94	120VAC	Int.	.20	165	25VA	4.75

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	31-1/4	19-3/4	13-3/4	10-1/4	3-1/4	1-1/4
DC Int.	85	70	58	38	12	4
AC Cont.	9	7	5	4-1/2	4	3
AC Int.	21	15	13	12	10	6

TYPE D-45 PULL TYPE

L = 2
W = 1-7/16
H = 1-5/8

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

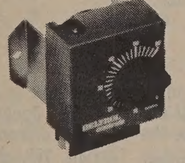
51000-81	12VDC	Cont.	.84	14	10W	7.00
51000-83	24VDC	Cont.	.42	58	10W	7.00
51000-93	115VDC	Cont.	.09	1,330	10W	7.05
50027-81	12VDC	Int.	2.2	6	26W	7.00
50027-83	24VDC	Int.	1.2	22	26W	7.00
50027-93	115VDC	Int.	.22	510	26W	7.05
51045-94	120VAC	Cont.	.13	176	14VA	7.00
50012-94	120VAC	Int.	.37	61	45VA	7.00

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	68	52	42	30	10	4
DC Int.	95	80	70	58	20	8
AC Cont.	14	10	9	8	7	6
AC Int.	38	30	26	22	18	16

DELTROL CONTROLS TIMERS

SERIES 700 AUTOMATIC RESET TIMER (INTERVAL)

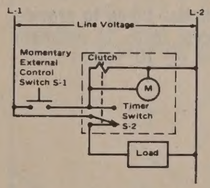


Unit has adjustable time cycle and features interval timing cycles up to six hours. Switch contact and terminal specifications are the same as Series 600.

L = 3-7/32
W = 3-3/8
D = 2-17/32
Mounting Centers = 2-7/8

Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E19033).

46396-81	701-00B	0.4 Sec.	10 Sec.	120VAC 60HZ	**18.40**
46398-81	701-00D	0.8 Sec.	20 Sec.	120VAC 60HZ	**18.40**
46400-81	701-00F	2.4 Sec.	60 Sec.	120VAC 60HZ	**18.40**
46401-81	701-00G	12 Sec.	5 Min.	120VAC 60H7	**18.40**
46404-81	701-00J	48 Sec.	20 Min.	120VAC 60HZ	**18.40**
46405-81	701-00K	72 Sec.	30 Min.	120VAC 60HZ	**18.40**
46406-81	701-00L	144 Sec.	60 Min.	120VAC 60HZ	**18.40**



DELTROL
controls
Division Of Deltrol Corp

2745 S. 19th Street, Milwaukee, Wisconsin 53215
Phone (414) 671-6800, Telex 2-6871

Douglas Randall reed relays

KIDDE

DIVISION OF WALTER KIDDE & COMPANY, INC. • 6 PAWCATUCK AVE., PAWCATUCK, CONN. 02891 • (203) 599-1750

new UL RECOGNIZED REED RELAYS
FILE NO. E/54552; C.C. NRNT2

Fig.	Part No.	Nom. Volt.	DCR Ohms ±10%	Contact Rating
1 & A	377455 377885 377886	6 12-19 24	250 1200 4000	10W, .5A or 200VDC 120VAC @ .275 Amp Use for gating triacs @ 120VAC
1 & B	377472 375388 377471	6 12-19 24	250 1200 4000	
1 & C	377327 377806 377807	5 12 24	250 1000 4000	240VAC @ .040 Amp Use for gating triacs @ 240VAC
2 & D	377307 377410 377201	6 12 24	175 700 2880	3A @ 17VDC 1A @ 100VDC .3A @ 300VAC For inductive AC loads up to the ratings shown.
3	377808 377809 377810 373350	6 12 24 48	250 1000 2150 2150	10W, .5A or 500VDC 240VAC @ .040 Amp Use for triac gating @ 240VAC

FIRST TIME

1. Form C Hg Switches, p 3464 and p 3467.
2. All Position Hg Wet Relays, p 3464 and p 3467.
3. Six Form A or Four Form C for MG Series, p 3466.

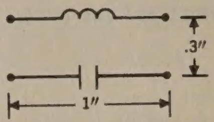


Fig. A

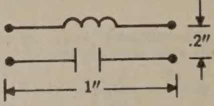


Fig. B

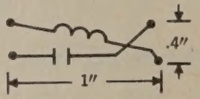


Fig. C

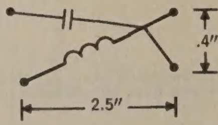


Fig. D

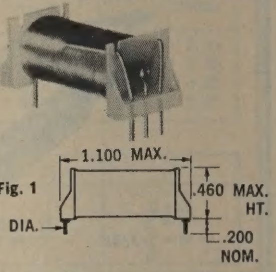


Fig. 1

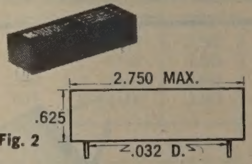


Fig. 2

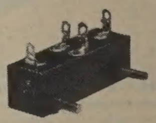
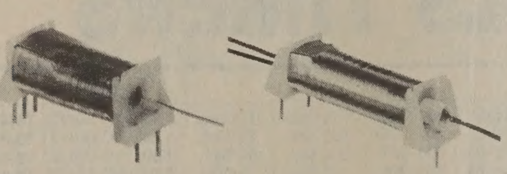


Fig. 3

SPECIAL DESIGNS

HIGH INSULATION RESISTANCE RELAYS

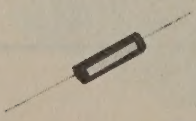


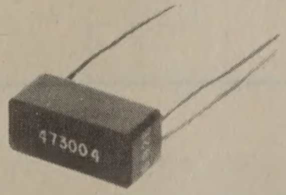
Two typical designs are shown above:

A — A miniature reed relay with a floating lead to maintain high IR.

B — This is a relay using Form A and Form B switches timed to provide a Form C (break before make) function with flying leads to maintain 10^{13} ohms. Up to 5 Form A contacts are available @ 10^{13} ohms.

PROXIMITY SWITCHES
FORM B

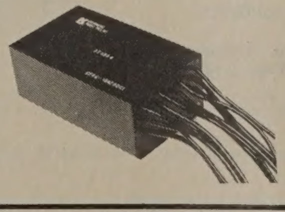




This is a Form B switch and magnet assembly, .7″ L x .150″ Sq. The normally closed switch opens, when approached by an ⅛″ Sq. steel rod.

Epoxy molded switch and magnet assemblies are available in many sizes, contact ratings and terminal arrangements.

SPECIAL HIGH VOLTAGE RELAY

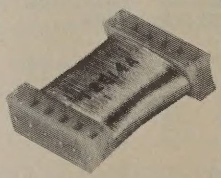


This relay has three separate coils, each containing a 5,000VDC and a 10,000VDC switch. The package is molded with a flame retardant epoxy and constructed to withstand 15,000VDC between the switches and all other conductors. The relay is 3⅞″ L x 2⅜″ W x 1½″ H.

Douglas Randall makes custom designed relays to solve difficult problems. A few models are shown below to illustrate the variety of variations available. Special molding techniques make it possible to manufacture unusual sizes, shapes and terminal arrangements with low tooling costs.

The electrical variations possible with Reed Relays are practically limitless.
Douglas Randall will gladly review your applications and offer rapid engineering and prototype service.

SNAP-IN RELAYS



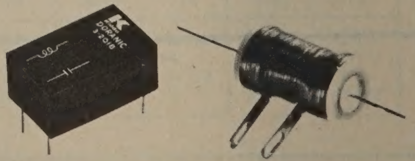
This 4 pole relay mounts in Berg-clips, like the Series SI on page 3466. Douglas Randall can now duplicate the following discontinued IBM models:

1 — Position: 766040, 766042, 766059, 766060, 766065, 766068 and 766086

2 — Position: 766043, 766044, 766057, 766067, 766072 and 766087

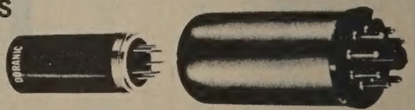
4 — Position: 766046, 766047, 766066, 766071 and 766079

HIGH SENSITIVITY RELAYS



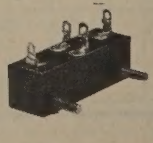
The relays shown will operate at 10 MW coil power.

PLUG-IN RELAYS



Reed relays are easily adapted to standard style headers for socket mounting.

SPECIAL TERMINALS AND MOUNTING SCREWS



The relay shown has terminals to accept #16 lead wire and mounting screws. Entire package is epoxy encapsulated for mechanical strength.

Douglas Randall reed relays KIDDE

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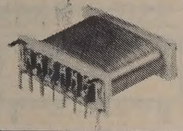
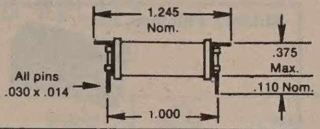
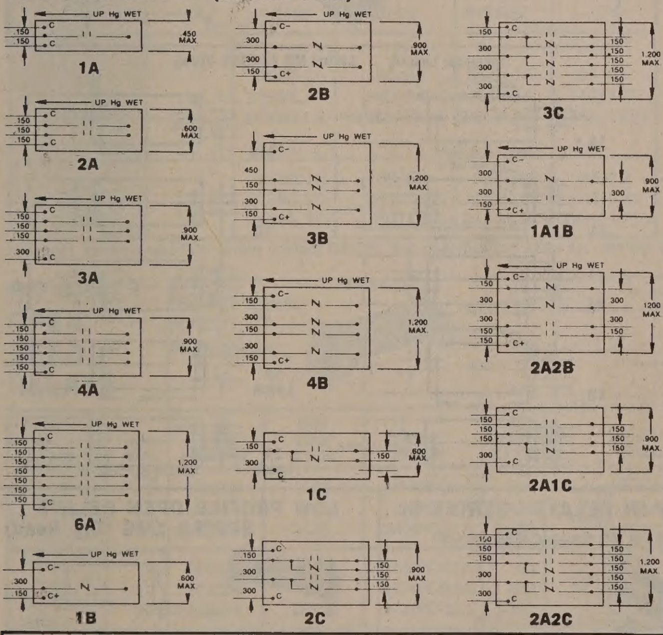
LOW PROFILE—LP, HgLP SERIES




1.245 Nom.
.375 Max.
All pins .030 x .014
.110 Nom.
1.000

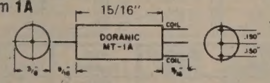
Form	Nominal Voltage	Part Number	DCR Ohms ±10%	Form	Part Number	DCR Ohms ±10%
1A	6 12 24	6LP1A 12LP1A 24LP1A	240 950 3800	4B	6LP4B 12LP4B 24LP4B	45 180 700
2A	6 12 24	6LP2A 12LP2A 24LP2A	155 625 2500	1C	6LP1C 12LP1C 24LP1C	155 625 2500
3A	6 12 24	6LP3A 12LP3A 24LP3A	80 325 1300	2C	6LP2C 12LP2C 24LP2C	80 325 1300
4A	6 12 24	6LP4A 12LP4A 24LP4A	80 325 1300	3C	6LP3C 12LP3C 24LP3C	45 180 700
6A	6 12 24	6LP6A 12LP6A 24LP6A	45 180 700	1A1B	6LP1A1B 12LP1A1B 24LP1A1B	80 325 1300
1B	6 12 24	6LP1B 12LP1B 24LP1B	155 625 2500	2A2B	6LP2A2B 12LP2A2B 24LP2A2B	45 180 700
2B	6 12 24	6LP2B 12LP2B 24LP2B	80 325 1300	2A1C	6LP2A1C 12LP2A1C 24LP2A1C	80 325 1300
3B	6 12 24	6LP3B 12LP3B 24LP3B	45 180 700	2A2C	6LP2A2C 12LP2A2C 24LP2A2C	45 180 700

TERMINAL LAYOUT (Bottom View)

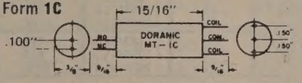

UP Hg WET
1A
2B
3C
2A
3B
1A1B
3A
4B
2A2B
4A
6A
1C
2A1C
1B
2C
2A2C
.450 MAX
.600 MAX
.900 MAX
1.200 MAX
.150
.300
.450
C
C+
C-

TUBULAR RELAYS — Series MT

Form 1A


15/16"
DORANIC MT-1A
COIL
.150"

Form 1C


15/16"
.100"
NO
NC
DORANIC MT-1C
COIL
.150"

Form	Nominal Voltage	Part Number	DCR Ohms ±10%
1A	6 12 24	6MT1A 12MT1A 24MT1A	185 750 3000
1C	6 12 24	6MT1C 12MT1C 24MT1C	185 750 3000

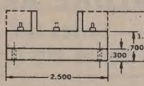
OPERATING DATA — Series LP, HgLP, MT

Must Operate — 70% Nominal Voltage
Must Release — 10% Nominal Voltage
Maximum Voltage —
  Form A and C — 200% Nominal
  Form B and Latching — 130% Nominal
Duty — Continuous

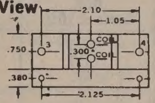
NOTES

Magnetic shields standard on Form B Relays. Optional on Form A and Form C Relays. 1000VDC switches (to 2000VDC breakdown) available on Form A and Form B Dry Reed Relays.

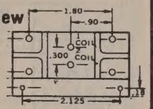
HIGH VOLTAGE RELAYS — HV SERIES


1.200
.700
.300
2.500

1A or 1B Top View


2.10
1.05
.750
.380
3
4
.300
COIL
2.125

2A Top View


1.80
.90
.300
COIL
2.125

Form	Nom. Volt.	Part Number	DCR Ohms ±10%
1A (1B*)	6 12 24	6HV1A 12HV1A 24HV1A	25 100 400
2A	6 12 24	6HV2A 12HV2A 24HV2A	20 80 320

OPTION:
* Relays available in Form B up to 7,500V.

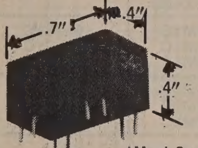
Note: To order, specify as follows: 6HV1A 35 is a 6HV1A relay with 3,500VDC switch.

CONTACT DATA

Series	Maximum Resistive Rating			Breakdown Voltage (min.)	Initial Resistance
35	3,500VDC	3.0A	50W	5,000VDC	.100 Ohms
75	7,500VDC	3.0A	50W	10,000VDC	.100 Ohms
100	10,000VDC	3.0A	50W	12,500VDC	.100 Ohms

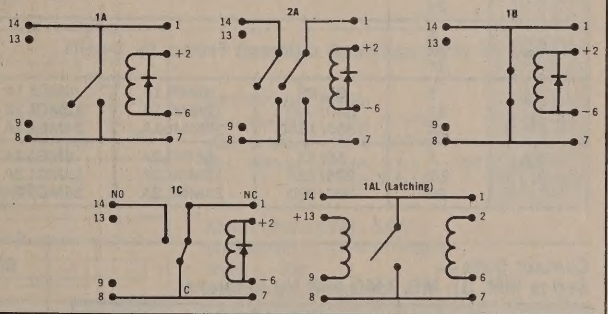
DIP MOLDED RELAYS SERIES DI

Contact Rating
Form 1A, 2A, 1B:
  10W, .25A, 100VDC
Form 1C: 3W, .25A, 28VDC
Form 1AL: 3W, .1A, 28VDC



Contact Arrangement	Nominal† Voltage	DCR Ohms ±10%	Part Number
1A	5 12 24	500 500 2200	5DI1A 12DI1A 24DI1A
2A	5 12 24	150 500 1200	5DI2A 12DI2A 24DI12A
1B	5 12 24	500 1200 2200	5DI1B 12DI1B 24DI1B
1C	5 12 24	200 500 1200	5DI1C 12DI1C 24DI1C
1AL	5 12 24	450/450 450/450 1000/1000	5DI1AL 12DI1AL 24DI1AL

†Must Operate — 75% Nominal — Must Release — 10% Nominal.


1A
2A
1B
1C
1AL (Latching)
NO
NC
C
14
13
1
2
+2
-6
6
9
8
7
+13

CONTACT DATA — Series LP, MT and Hg Versions

Contact Type	Contact Rating Form A	Contact Rating Form B	Contact Rating Form C
Dry	10W 12VA .5A 250VDC .15Ω*	10W 12VA .5A 250VDC .15Ω*	3W 4VA .25A 28VDC .2Ω*
Hg Wet	28W — 1A 1000VDC .05Ω*	28W — 1A 1000VDC .05Ω*	14W — .5A 1000VDC .05Ω*
All Position Hg Wet	3W 2.5VA .25A 1000VDC .05Ω*	— — — — —	— — — — —

*Initial Resistance

ENVIRONMENTAL DATA-- Series LP, MT and Hg Versions

Temperature	Vibration	Shock
−20°C to 65°C	35g to 2000cps	50g

Douglas Randall reed relays

KIDDE

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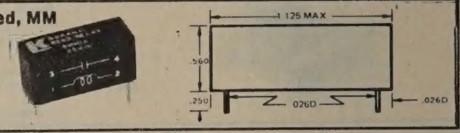
MINIATURE REED RELAYS

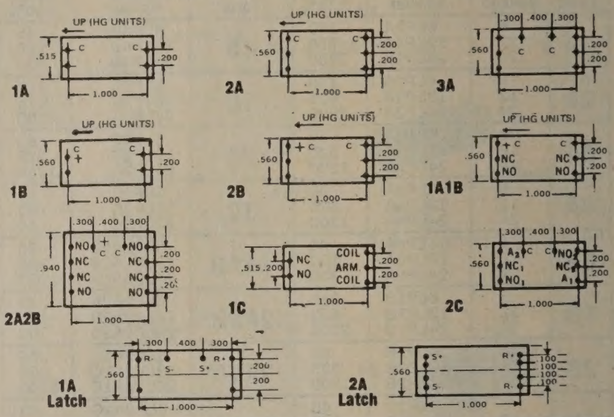
Molded — Series MM Dry, HgM Mercury Wet
Open — Series MG Dry Reed, HgMG Mercury Wet

Form	Nominal Voltage	DCR Ohms ±10%	MM Series Part Number	MG Series Part Number
1A	6 12 24	250 1000 4000	6MM1A 12MM1A 24MM1A	6MG1A 12MG1A 24MG1A
2A	6 12 24	170 675 2700	6MM2A 12MM2A 24MM2A	6MG2A 12MG2A 24MG2A
3A	6 12 24	110 450 1800	6MM3A 12MM3A 24MM3A	6MG3A 12MG3A 24MG3A
4A	6 12 24	Consult Factory for Details		
5A	6 12 24	Consult Factory for Details		
6A	6 12 24	Consult Factory for Details		
1B	6 12 24	170 675 2700	6MM1B 12MM1B 24MM1B	6MG1B 12MG1B 24MG1B
2B	6 12 24	110 450 1800	6MM2B 12MM2B 24MM2B	6MG2B 12MG2B 24MG2B
1A1B	6 12 24	110 450 1800	6MM1A1B 12MM1A1B 24MM1A1B	6MG1A1B 12MG1A1B 24MG1A1B
2A2B	6 12 24	50 200 800	6MM2A2B 12MM2A2B 24MM2A2B	
1C	6 12 24	250 1000 4000	6MM1C 12MM1C 24MM1C	6MG1C 12MG1C 24MG1C
2C	6 12 24	170 675 2700	6MM2C 12MM2C 24MM2C	6MG2C 12MG2C 24MG2C
3C	6 12 24	Consult Factory for Details		
* 4C	6 12 24	Consult Factory for Details		
1A Latch	6 12 24	85/85 340/340 1350/1350	6MML1A 12MML1A 24MML1A	6MGL1A 12MGL1A 24MGL1A
2A Latch	6 12 24	55/55 225/225 900/900	6MML2A 12MML2A 24MML2A	6MGL2A 12MGL2A 24MGL2A

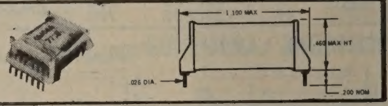
Miniature Molded, MM


1.125 MAX
.560
.250
.026D
.026D

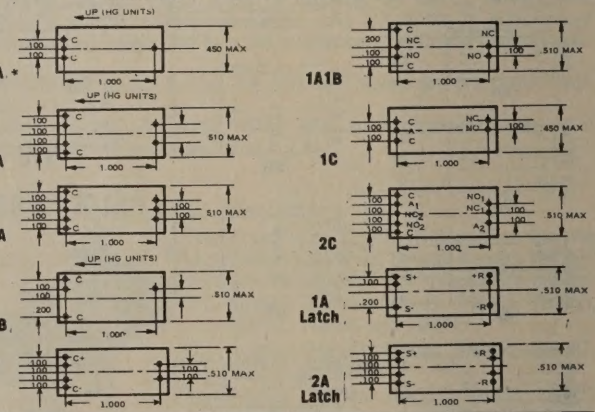
Terminal Layout **Series MM (Bottom View)**


1A
2A
3A
1B
2B
1A1B
2A2B
1C
2C
1A Latch
2A Latch
UP (HG UNITS)
C
NC
NO
COIL
ARM
1.000
.560
.515
.200
.300
.400
.940
.100

Miniature Open, MG


1.100 MAX
.460 MAX HT
.026 DIA.
.200 NOM

Terminal Layout **Series MG (Bottom View)**


1A *
2A
3A
1B
1A1B
1C
2C
1A Latch
2A Latch
UP (HG UNITS)
.450 MAX
.510 MAX
1.000
.100
.200

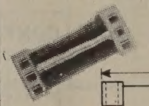
Contact Data — Series MM, SI, MG, XMG and Hg Versions

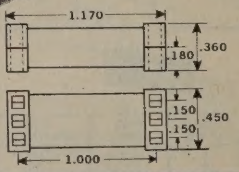
Contact Type	Contact Rating Form A	Contact Rating Form B	Contact Rating Form C
Dry	10W 12VA .5A 250VDC .15Ω*	10W 12VA .5A 250VDC .15Ω*	3W 3VA .25A 100VDC .2Ω*
Hg Wet	28W — 1A 1000VDC .05Ω*	28W — 1A 1000VDC .05Ω*	14W 14VA .5A 1000VDC .05Ω*
All Position Hg Wet	3W 2.5VA .25A 1000VDC .05Ω*	— — — — —	— — — — —

* Initial Resistance

SNAP-IN RELAYS SERIES SI

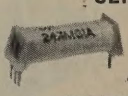
For use with BERG-PAC 45590 terminals

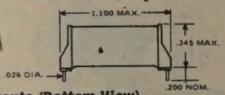



1.170
.180
.360
.150
.150
.450
1.000

Form	Nominal Voltage	Part Number	DCR Ohms ±10%
1A	6 12 24	6SI1A 12SI1A 24SI1A	250 1000 4000

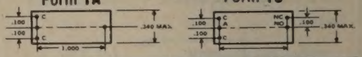
LOW PROFILE OPEN RELAYS SERIES XMG (Dry Reed)




1.100 MAX.
.345 MAX.
.026 DIA.
.200 NOM.

Terminal Layouts (Bottom View)

Form 1A Form 1C


C
C
A
NC
NO
.100
.100
.340 MAX.
1.000

Form	Nominal Voltage	Part Number	DCR Ohms ±10%
1A*	6 12 24	6XMG1A 12XMG1A 24XMG1A	168 675 2700
1C*	6 12 24	6XMG1C 12XMG1C 24XMG1C	168 675 2700

Note: Nylon Cover Available.
* Hg wet switches available.

NOTES

1. E/M shields std. all Series MM and all Form B and Form L.
2. E/S shields optional.
3. 1000VDC switches available all Form A and B relays.
4. Premium run-in switches available all models.
5. Ultra sensitive relays available.
6. Series MML/1A, MML/2A have internal diodes.
7. Series MM available up to 8 Form A, 4 Form C.

OPERATING DATA — All Series

Must Operate — 70% Nominal
Must Release — 10% Nominal
Maximum Voltage —
Form A and C — 200% Nominal
Form B and Latching — 130% Nominal
Environmental Data: −20°C to +65°C; vibration 35g to 2000cps; shock, 30g.

Douglas Randall reed relays KIDDE

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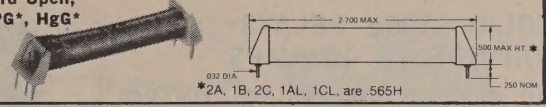
STANDARD SIZE REED RELAYS

Molded — Series SM, HP*, Hg*
Open — Series SG, HPG*, HgG*

		SM Series	Molded	SG Series	Open
Form	**Nominal Voltage**	**Part Number**	**DCR Ohms ±10%**	**Part Number**	**DCR Ohms ±10%**
1A	6 12 24	6SM1A 12SM1A 24SM1A	180 725 2900	6SG1A 12SG1A 24SG1A	180 720 2880
2A	6 12 24	6SM2A 12SM2A 24SM2A	175 700 2750	6SG2A 12SG2A 24SG2A	110 440 1760
1B	6 12 24	6SM1B 12SM1B 24SM1B	175 700 2750	6SG1B 12SG1B 24SG1B	110 440 1760
2B	6 12 24	6SM2B 12SM2B 24SM2B	140 550 2200		
1C	6 12 24	6SM1C 12SM1C 24SM1C	180 725 2900	6SG1C 12SG1C 24SG1C	180 720 2880
2C	6 12 24	6SM2C 12SM2C 24SM2C	175 700 2750	6SG2C 12SG2C 24SG2C	110 440 1760
1A Latch	6 12 24	6SML1A 12SML1A 24SML1A	85/85 340/340 1350/1350	6SGL1A 12SGL1A 24SGL1A	85/85 340/340 1350/1350
1C Latch	6 12 24	6SML1C 12SML1C 24SML1C	85/85 340/340 1350/1350	6SGL1C 12SGL1C 24SGL1C	85/85 340/340 1350/1350

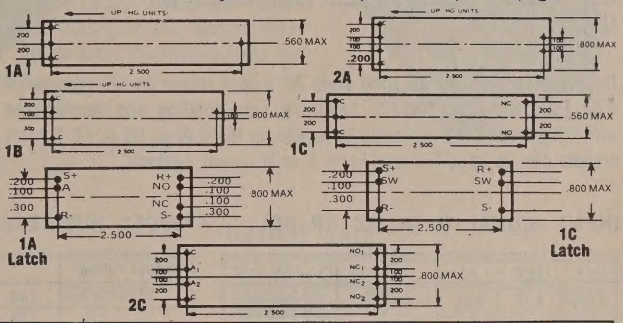
*For part numbers and DCR values contact factory. See specification table for contact ratings.

Standard Open, SG, HPG*, HgG*

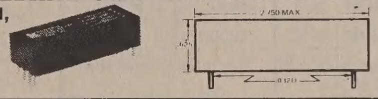


*2A, 1B, 2C, 1AL, 1CL, are .565H

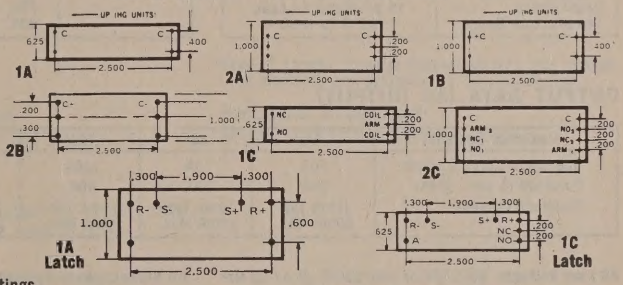
Terminal Layout Series SG (Bottom View) — HPG, HgG



Standard Molded, SM, HP*, Hg*

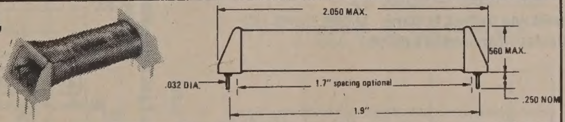


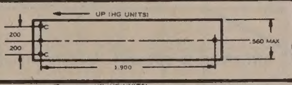
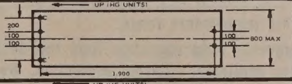
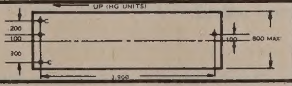
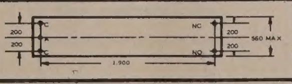
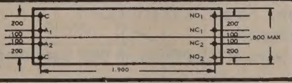
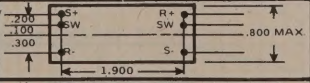
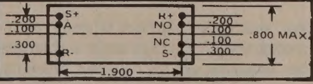
Terminal Layout Series SM (Bottom View)



COMPACT OPEN REED RELAYS

CG Dry Reed, HPCG*, High Power



Form	Nom. Volt.	Part Number	DCR Ohms ±10%	Part Number	DCR Ohms ±10%	Terminal Layout (Bottom View)
1A	6 12 24	6CG1A 12CG1A 24CG1A	165 660 2640	6HPCG1A 12HPCG1A 24HPCG1A	105 420 1680	
2A	6 12 24	6CG2A 12CG2A 24CG2A	100 400 1600	6HPCG2A 12HPCG2A 24HPCG2A	65 260 1040	
1B	6 12 24	6CG1B 12CG1B 24CG1B	100 400 1600	6HPCG1B 12HPCG1B 24HPCG1B	65 260 1040	
1C	6 12 24	6CG1C 12CG1C 24CG1C	165 660 2640	6HPCG1C 12HPCG1C 24HPCG1C	105 420 1680	
2C	6 12 24	6CG2C 12CG2C 24CG2C	100 400 1600	6HPCG2C 12HPCG2C 24HPCG2C	65 260 1040	
1A Latch	6 12 24	6CGL1A 12CGL1A 24CGL1A	60/60 250/250 1000/1000			
1C Latch	6 12 24	6CGL1C 12CGL1C 24CGL1C	60/60 250/250 1000/1000			

Common Specifications, All Series

OPERATING DATA
Must Operate — 70% Nominal
Must Release — 10% Nominal
Max. Voltage — Form A & C — 200% Nominal
Form B & Latch — 130% Nominal

ENVIRONMENTAL DATA
Temperature — 20°C to +65°C
Shock — 30g
Vibration — 35g to 2000 Hz

CONTACT RATINGS
Series SM, SG, CG (Standard)

Form	Max. Res. Load	Initial Contact Resistance
A & B C	15W, 1.0A, 400VDC 10W, .5A, 200VDC	.100Ω .150Ω

Series HG*, HgG* (Mercury Wet)

A & B	50W, 3.0A, 400VDC	.050Ω

Series HP*, HPG*, HPCG*

Form	Suffix	Max. Res. Load	Initial Contact Resistance
A & B	−25	25W, 1.0A, 1000VDC	.100Ω
A & B	−50	50W, 3.0A, 1000VDC	—
A & B	−100	110VA, 3.0A, 110VAC	—
C	—	20W, 1.5A, 500VDC	.200Ω

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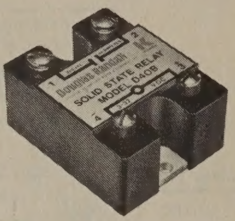
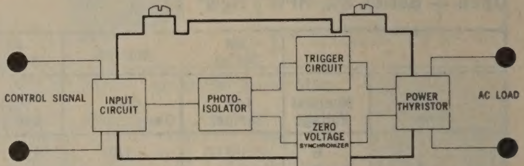
SOLID STATE RELAYS RATINGS TO 40 AMPS

AC OUTPUT / DC OR AC CONTROL UL RECOGNIZED / FILE NO. E60556 / C.C. NMFT2





Douglas Randall's line of solid state AC output relays are UL recognized (File E60556 / C.C. NMFT2). Featuring opto-isolation and zero-voltage switching models are available to handle up to 40 Amp. DC or AC control signals can be specified and Form A or B output contact.

INPUT SIGNAL DATA (AC OR DC)

	DC	AC
Range	3-32V[5]	90-240VAC (80-140VDC)
Must Operate	3VDC	90VDC (80VDC)
Must Release	1VDC	10VAC (10VDC)
Input Impedance	1000Ω Min., 40KΩ Min.	
Isolation		
Signal to Load	1500V, $10^{10}\Omega$ DC	
Signal to Base	1500V, $10^{10}\Omega$ DC	
Capacitance	15 pF Signal to Load	
Temperature Range	−30°C to +80°C	

MODEL NUMBERS (NOTE 4)

Output Rating		DC Signal	AC Signal
90-140VAC	4A	D04A	A04A
	8A	D08A	A08A
	12A	D12A	A12A
	25A	D25A	A25A
	40A	D40A	A40A
200-280VAC	4A	D04B	A04B
	8A	D08B	A08B
	12A	D12B	A12B
	25A	D25B	A25B
	40A	D40B	A40B

OUTPUT DATA (AC OUTPUT)

Maximum Current	4A	8A	12A	25A	40A
One Cycle Surge Current	50A	75A	100A	250A	400A
Overload (1 sec., RMS)	25A	35A	40A	40A	75A
Minimum Current	10mA Typ. 20mA Max.	10mA Typ. 20mA Max.	10mA Typ. 20mA Max.	10mA Typ. 25mA Max.	10mA Typ. 25mA Max.

AC Line Voltage: 90/140V or 200/280V[1] @ 47-63 Hz[2]
Voltage Drop @ Rated Current: 1.6V Max.
Typical Turn-on Voltage: 5V
Response Time (DC Signal): ½ Cycle Max.
dv/dt[6] Off State: 5V/μsec
Commutating: 100V/μsec

Off State Leakage Current:
90/140VAC — 4.5mA Typ.
200/280VAC — 5.5mA Typ.
Isolation Output to Base: 1500V, $10^{10}\Omega$ DC[3]
Contact Form: SPST (NO)[4]

NOTES AND OPTIONS

1. Special wide range models can be made which will switch loads from 18V to 140V. These relays can handle either 24VAC or 120VAC loads.
2. Special models are available which switch loads at 400 Hz.
3. 2500VAC isolation can be supplied on request.
4. Form A (SPST-NO) relays are standard. Form B (SPST-NC) switching is optional. Models incorporating this feature are designated by NC. e.g. A40B-NC.
5. All DC models are TTL compatible over the full operating temperature range.
6. All relays incorporate an RC snubber network which prevents false operation from transients up to the dv/dt level shown. More severe transients may require additional external protection. We will review your application and recommend the additional protection needed.

MECHANICAL SPECIFICATIONS

Size: 2¼"L x 1¾"W x 1⅛" maximum.

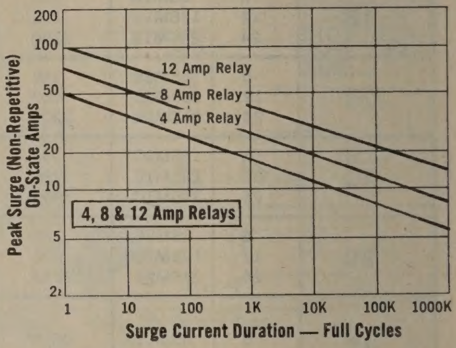
Weight: 4 ounces maximum.

Termination: Standard Models — Control Signal: 6-32 screws. Output: 8-32 screws.
Standard Models are furnished with ¼" Quick Connect adapters.
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory for details.

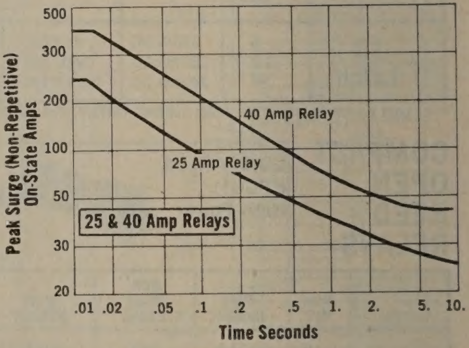
SPECIAL DESIGNS

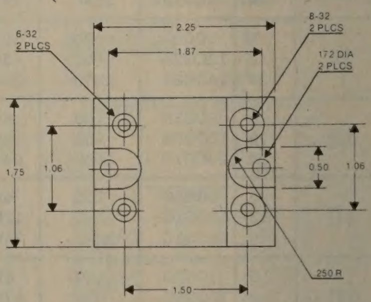
Douglas Randall has designed many special solid state relays, such as a polarized, latching, SPDT unit which will switch 12A at 28VDC. We also have the capability of making special package sizes and terminal arrangements for our solid state relays at moderate tool cost. Your inquiries will be reviewed promptly.

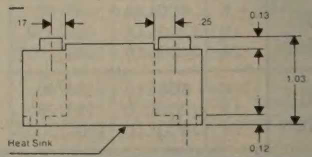
SURGE CURRENT VS TIME



SURGE CURRENT VS TIME

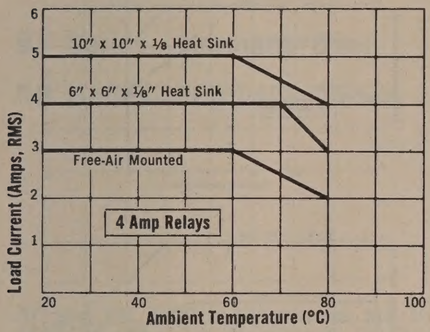


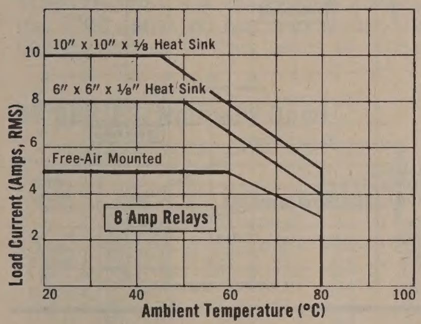


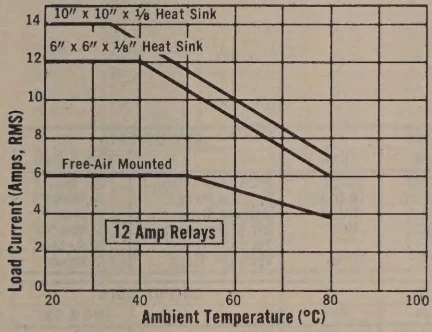


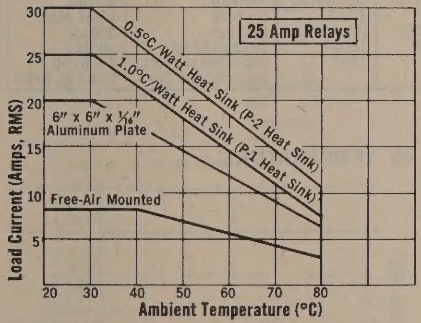
AC OUTPUT (Cont'd)

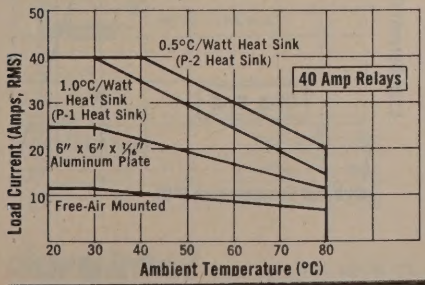
LOAD CURRENT VS TEMPERATURE











PROPORTIONAL CONTROLS

AC OUTPUT / RESISTOR CONTROL*

Douglas Randall Proportional Control Modules provide a variable AC output voltage to loads up to 15 Amps. They are solid state, full wave SCR phase angle control units, which offer a reliable, compact method of controlling motors, heaters, incandescent lamps, and other AC devices. Standard models vary the output from 0% to 90%.

INPUT*

Variable Resistor (150,000Ω, 1 watt) — For 120VAC
Variable Resistor (1 Megohm, 1/2 watt) — For 240VAC

MODEL NUMBERS

Output Voltage	90-130VAC			200-240VAC		
Model Number	R05A	R10A	R15A	R05B	R10B	R15B
Current	5A	10A	15A	5A	10A	15A

OUTPUT DATA

Maximum Current	5A	10A	15A
One Cycle Surge Current	50A	75A	100A
Overload (1 sec., RMS)	25A	45A	65A
Minimum Current	.040A	.040A	.040A
AC Line Voltage	90/130V or 200/240V @ 47-63Hz		

OPTIONS

Preset Minimum/Maximum:
Set internally at the factory to any value in the control range.

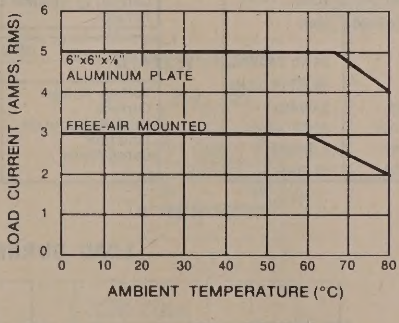
Preset Output:
Not variable — fixed output is preset internally to any value in the control range.

*Special designs can be driven by DC signals.

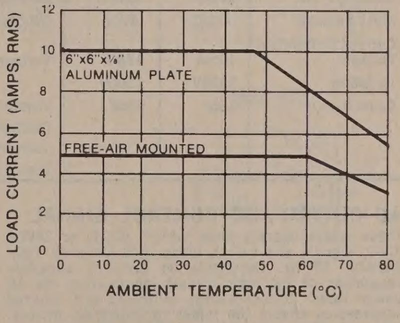
Special Ranges, Control Potentiometers and 400 Hz Load Controls are available as special designs.

Mechanical Arrangement:
See AC output relays opposite page.

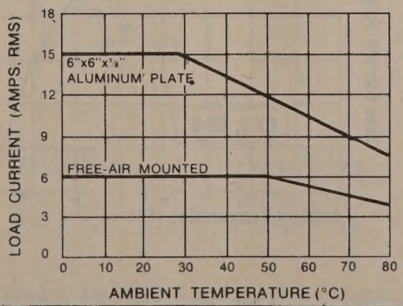
LOAD CURRENT vs TEMPERATURE
5 AMP CONTROLLERS



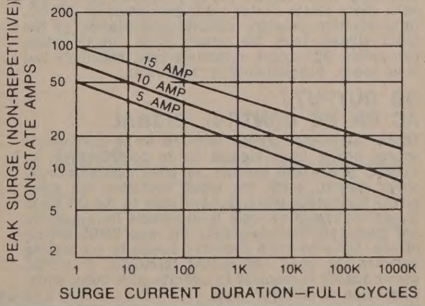
LOAD CURRENT vs TEMPERATURE
10 AMP CONTROLLERS



LOAD CURRENT vs TEMPERATURE
15 AMP CONTROLLERS



SURGE CURRENT vs TIME
5, 10, 15 AMP CONTROLLERS



Douglas Randall solid state components KIDDE

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SOLID STATE RELAYS SERIES K

DC OUTPUT / DC CONTROL SIGNAL

Douglas Randall Series K are SPST (NO) relays which will switch loads of 4, 8 or 12 Amps @ 2-32VDC or 2-55VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc free switching makes these relays suitable for hazardous atmospheres.

MODEL NUMBERS

Output Voltage*	Current	Model
2-32VDC	4 Amp	K04A
	8 Amp	K08A
	12 Amp	K12A
2-55VDC	4 Amp	K04B
	8 Amp	K08B
	12 Amp	K12B

*Inductive loads must be diode suppressed.

INPUT SIGNAL DATA

Range	3-32VDC
Must Operate	3VDC
Must Release	1VDC
Input Impedance	1000Ω Min.
Isolation	
Signal to Load	1500V
Signal to Base	1500V
Temperature	−30°C to +80°C

MECHANICAL ARRANGEMENT

See AC output relays on page 2144

OUTPUT DATA

Continuous Current	4A, 8A, or 12A
DC Line Voltage	2-32VDC or 2-55VDC
Off State Leakage	10mA DC
Turn On Time	50 Micro Sec.
Turn Off Time	500 Micro Sec.
Voltage Drop @ Rate Current	1.5VDC Max.
Isolation Load to Base	1500V

SIZE:
2¼L x 1¾W x 1⅛H Max.

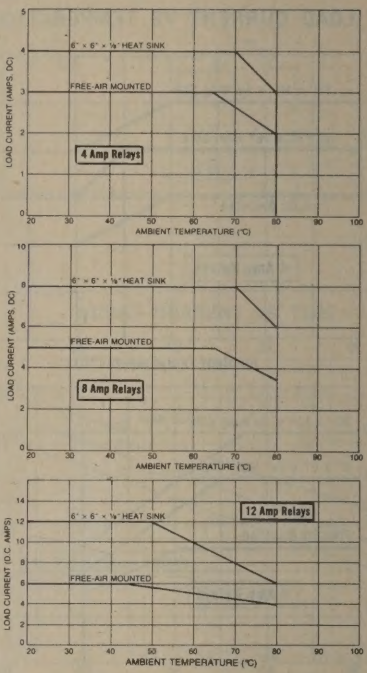
WEIGHT:
4 Ounces Max.

TERMINATION:
Standard Models —
Control Signal:
6-32 Screws
Output:
8-32 Screws

Standard Models are furnished with ¼″ Quick Connect adapters.

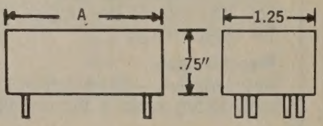
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory for details.

LOAD CURRENT VS TEMPERATURE



SOLID STATE RELAYS — SERIES CV

PC MOUNTED —



INPUT DATA			OUTPUT DATA	
	CV1	CV2		CV1 & CV2
Nominal Voltage	5.5VDC	28VDC	Current	3A RMS
Voltage Range	4-10VDC	10-32VDC	Surge Current	80A Peak
Must Operate	4VDC	10VDC	Minimum Current	10mA
Must Release	.4VDC	.4VDC	Off State Leakage	8mA
Current @ Nominal Voltage	10mA	18mA	Voltage	24 to 240VAC
Isolation	1500V	1500V		@ 47 to 63 Hz
Capacitance	15pF	15pF	Voltage Drop	2.0VAC
			Offstate dv/dt	100V/µsec.
			Turn On Time	8.3msec.
			Turn Off Time	16 msec.

INPUT DATA			OUTPUT DATA	
	CV3	CV6		CV3 & CV6
Nominal Voltage	5.5VDC	28VDC	Maximum Current	3A DC
Voltage Range	4-10VDC	10-32VDC	Voltage Range	4-55VDC
Must Operate	4VDC	10VDC	Voltage Drop	1.6VDC
Must Release	.4VDC	.4VDC	Off State Leakage	10mA DC
Current @ Nominal Voltage	10mA	18mA	Turn On Time	500µsec.
			Turn Off Time	1.5msec.

INPUT DATA			OUTPUT DATA	
	CV4	CV5		CV4 & CV5
Voltage Range	10-55VDC	90-130VAC	Voltage	30VDC
Current	10mA	10mA	Current	16mA Max.
Must Not Operate	3mADC	.8mA RMS	Leakage	100µA
Isolation	1500V	1500V	Voltage Drop	.4VDC
Capacitance	10pF	10pF	Logic Supply Volt.	4-5-6VDC
			Logic Supply Cur.	10mA @ 6VDC

AC OUTPUT / DC CONTROL SIGNAL

These relays operate from 5.5VDC (CV-1) or 28VDC (CV-2) signals and switch loads to 3 Amps @ 120/240VAC, 60 Hz. Opto-Isolation provides complete separation of the logic circuit inputs from the AC power loads. Zero-Crossover switching and internal suppression enable the relays to switch AC motors, motor starters, solenoids and lamp loads. Dimension A is 2.00″ max.

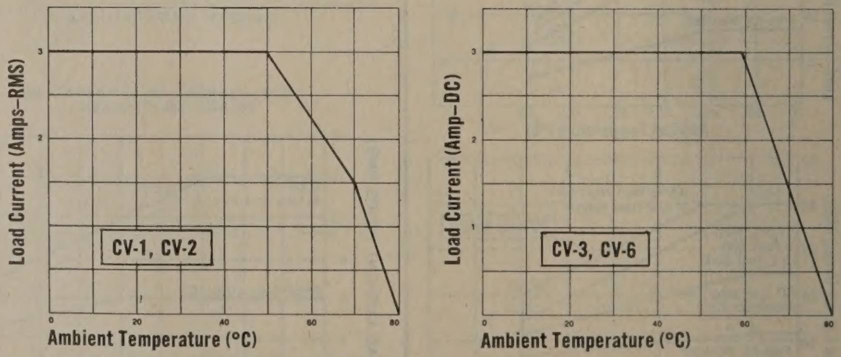
DC OUTPUT / DC CONTROL SIGNAL

Operating from 5.5VDC (CV-3) or 28VDC (CV-6) signals, these relays switch loads to 3 Amps @ 55VDC. Opto-Isolation provides complete decoupling of the input signals from the power loads. These relays can switch DC motors, motor starters, solenoids and lamp loads. Dimension A is 2.00″ max.

DC OUTPUT / AC OR DC CONTROL SIGNAL

These relays (sometimes referred to as converters) accept power level signals up to 55VDC (CV-4) or 120VAC (CV-5) and provide an open collector transistor output. When the input terminals are energized, the output transistor switches to the ON state (saurated) providing logic level signals for all standard purposes, including DTL, TTL and CMOS among others. Opto-Isolation provides complete decoupling between the input and output terminals. A ±5VDC power supply is required to operate with these units. Dimension A is 1.25″ max.

LOAD CURRENT VS TEMPERATURE

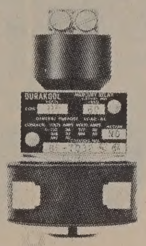


GENERAL PURPOSE RELAYS—35 AMP

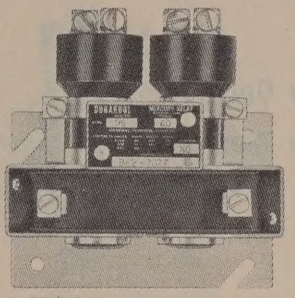
UL CSA

BF Series—Normally Open

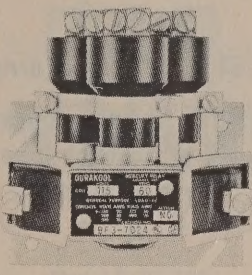
BB Series—Normally Closed



Model BF7000



Model BF2 7000



Model BF3 7000

BF and BB 7000 series devices are U.L. listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than the 7000 series do not carry either U.L. or C.S.A. listings. Contact ratings for this series of relays are shown on page 3475. Lug-type terminations on the top and bottom of the contact types and/or leaded versions are also available; consult the factory office for part numbers. Many other AC and DC coil voltages are available.

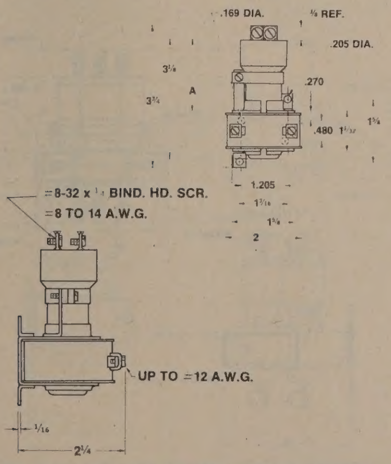
BF SERIES/Normally Open

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.O.	BF-7031	24V60Hz	3.2	.228	5.47	36
	BF-7032	120V60Hz	2.5	.047	5.64	915
	BF-7033	208V60Hz	2.7	.025	5.20	3100
	BF-7034	240V60Hz	2.4	.022	5.28	3700
	BF-7035	277V60Hz	2.4	.019	5.26	5410
	BF-7036	480V60Hz	2.7	.011	5.28	14700
	BF-7058	12VDC	2.7	.210	—	57
	BF-7046	24VDC	2.7	.110	—	230
Two Form "A" D.P.S.T. N.O.	BF2-7026	24V60Hz	5.3	.450	10.8	15
	BF2-7027	120V60Hz	4.9	.098	11.8	350
	BF2-7028	208V60Hz	5.5	.065	13.5	960
	BF2-7029	240V60Hz	4.8	.049	11.8	1400
	BF2-7030	277V60Hz	4.6	.040	11.1	2300
	BF2-7031	480V60Hz	4.8	.025	11.8	5600
	BF2-7041	12VDC	6.0	.500	—	24
	BF2-7032	24VDC	6.1	.255	—	95
Three Form "A" 3P.S.T. N.O.	BF3-7023	24V60Hz	9.0	.941	22.6	5
	BF3-7024	120V60Hz	8.7	.200	24.0	135
	BF3-7025	208V60Hz	8.2	.110	22.9	480
	BF3-7026	240V60Hz	7.8	.102	24.5	520
	BF3-7027	277V60Hz	7.0	.078	21.6	830
	BF3-7028	480V60Hz	7.8	.050	24.0	2100
	BF3-7037	12VDC	11.0	.940	—	13
	BF3-7038	24VDC	11.0	.470	—	51

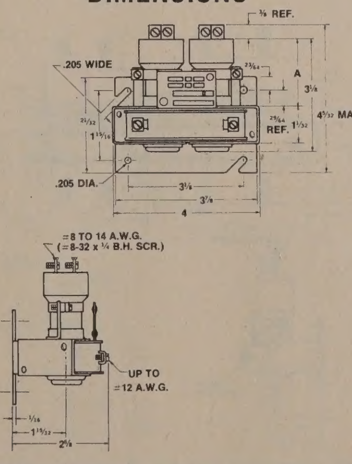
BB SERIES/Normally Closed

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.C.	BB-7001	24V60Hz	2.5	.204	4.90	36
	BB-7002	120V60Hz	2.0	.039	4.68	915
	BB-7003	208V60Hz	2.2	.023	4.78	3100
	BB-7004	240V60Hz	2.0	.019	4.56	3700
	BB-7005	277V60Hz	2.0	.017	4.71	5410
	BB-7006	480V60Hz	2.0	.010	4.80	14700
	BB-7027	12VDC	2.7	.220	—	57
	BB-7007	24VDC	2.7	.110	—	230
Two Form "B" D.P.S.T. N.C.	BB2-2001	24V60Hz	4.0	.390	9.36	15
	BB2-2020	120V60Hz	4.3	.09	10.80	350
	BB2-2002	208V60Hz	4.8	.06	12.50	960
	BB2-2023	240V60Hz	3.8	.042	10.08	1400
	BB2-2024	277V60Hz	3.8	.035	9.70	2300
	BB2-2003	480V60Hz	4.0	.021	10.08	5600
	BB2-2018	12VDC	6.0	.50	—	24
	BB2-2004	24VDC	6.1	.225	—	95
Three Form "B" 3P.S.T. N.C.	BB3-2008	24V60Hz	7.7	.910	21.84	5.0
	BB3-2002	120V60Hz	7.4	.175	21.0	135
	BB3-2009	208V60Hz	6.8	.095	19.76	480
	BB3-2010	240V60Hz	6.4	.090	21.6	520
	BB3-2011	277V60Hz	6.2	.070	19.39	830
	BB3-2012	480V60Hz	7.0	.045	21.6	2100
	BB3-2013	12VDC	11.0	1.00	—	12.8
	BB3-2014	24VDC	11.0	.470	—	51

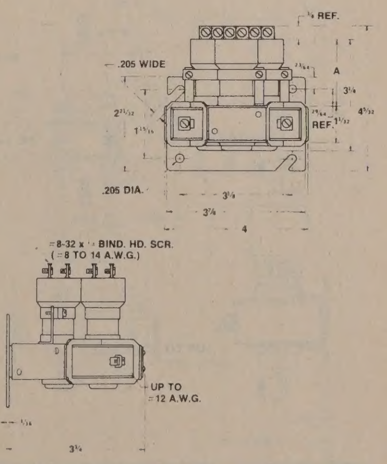
DIMENSIONS


.169 DIA.
1/8 REF.
.205 DIA.
3 1/8
3 3/4
A
.270
.480
1 1/32
1 5/8
1.205
1 7/16
1 5/8
2
#8-32 x 1/4 BIND. HD. SCR.
#8 TO 14 A.W.G.
UP TO #12 A.W.G.
1/16
2 1/4

CATALOG DESIGNATION	A 60 Hz	DC
BF	$1\frac{55}{64}$	$1\frac{47}{64}$
BB	$1\frac{9}{32}$	$1\frac{3}{8}$


1/8 REF.
.205 WIDE
23/64
A
3 1/8
4 5/32 MAX.
2 1/32
1 15/16
29/64 REF.
1 1/32
.205 DIA.
3 1/8
3 7/8
4
#8 TO 14 A.W.G.
(#8-32 x 1/4 B.H. SCR.)
UP TO #12 A.W.G.
1/16
1 15/32
2 5/8

CATALOG DESIGNATION	A 60 Hz	DC
BF2	$1\frac{55}{64}$	$1\frac{47}{64}$
BB2	$1\frac{9}{32}$	$1\frac{3}{8}$


1/8 REF.
.205 WIDE
23/64
A
3 1/8
4 5/32
2 21/32
1 15/16
29/64 REF.
1 1/32
.205 DIA.
3 1/8
3 7/8
4
#8-32 x 1/4 BIND. HD. SCR.
(#8 TO 14 A.W.G.)
UP TO #12 A.W.G.
1/16
3 1/4

CATALOG DESIGNATION	A 60 Hz	DC
BF3	$1\frac{55}{64}$	$1\frac{47}{64}$
BB3	$1\frac{9}{32}$	$1\frac{3}{8}$

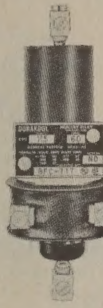
durakool®

CONTACTORS—60 AMP

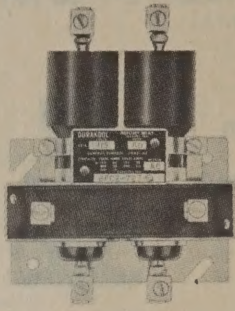
UL CSA

BFC Series—Normally Open

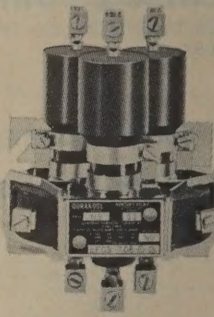
BBC Series—Normally Closed



Model BFC700



Model BFC2 700



Model BFC3 700

BFC and BBC 700 series devices are listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on page 3475. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

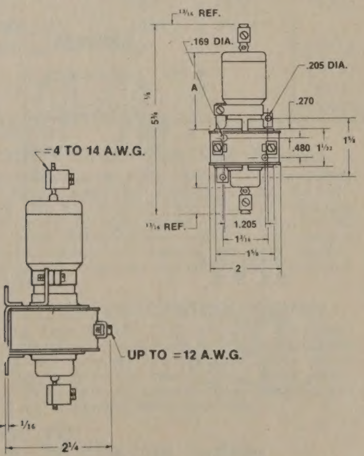
BFC SERIES/Normally Open

Con-tacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.O.	BFC-716	24V60Hz	4.0	.275	6.60	36
	BFC-717	120V60Hz	3.0	.054	6.48	915
	BFC-718	208V60Hz	3.5	.030	6.24	3100
	BFC-719	240V60Hz	3.0	.028	6.72	3700
	BFC-720	277V60Hz	3.2	.022	6.10	5410
	BFC-721	480V60Hz	3.5	.015	7.20	14700
	BFC-730	12VDC	2.7	.210	—	57
	BFC-722	24VDC	2.7	.110	—	230
Two Form "A" D.P.S.T. N.O.	BFC2-726	24V60Hz	6.3	.535	12.8	15
	BFC2-727	120V60Hz	5.8	.110	13.2	350
	BFC2-728	208V60Hz	5.8	.067	13.9	960
	BFC2-729	240V60Hz	5.6	.055	13.2	1400
	BFC2-730	277V60Hz	5.2	.044	12.2	2300
	BFC2-731	480V60Hz	5.8	.028	13.4	5600
	BFC2-741	12VDC	6.0	.500	—	24
	BFC2-733	24VDC	6.1	.255	—	95
Three Form "A" 3P.S.T. N.O.	BFC3-707	24V60Hz	10.7	1.13	27.1	5
	BFC3-708	120V60Hz	10.5	.230	27.6	135
	BFC3-709	208V60Hz	10.0	.128	26.6	480
	BFC3-710	240V60Hz	9.2	.118	28.3	520
	BFC3-711	277V60Hz	10.5	.082	22.7	830
	BFC3-712	480V60Hz	10.5	.059	28.3	2100
	BFC3-720	12VDC	11.3	.938	—	13
	BFC3-721	24VDC	11.0	.470	—	51

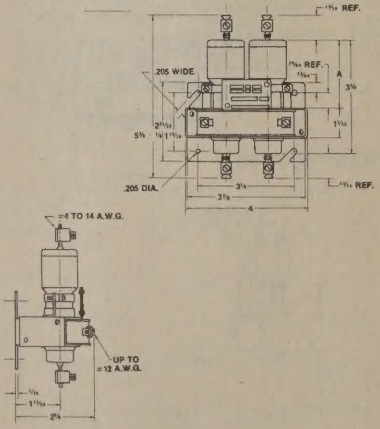
BBC SERIES/Normally Closed

Con-tacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "B" S.P.S.T. N.C.	BBC-701	24V60Hz	3.4	.242	5.81	36
	BBC-702	120V60Hz	2.6	.048	5.76	915
	BBC-703	208V60Hz	2.8	.028	5.82	3100
	BBC-704	240V60Hz	2.6	.024	5.76	3700
	BBC-705	277V60Hz	2.6	.020	5.54	5410
	BBC-706	480V60Hz	2.4	.012	5.76	14700
	BBC-719	12VDC	2.5	.210	—	57
	BBC-707	24VDC	2.7	.110	—	230
Two Form "B" D.P.S.T. N.C.	BBC2-309	24V60Hz	5.2	.480	11.52	15
	BBC2-305	120V60Hz	5.3	.105	12.6	350
	BBC2-310	208V60Hz	5.8	.096	19.97	960
	BBC2-306	240V60Hz	5.0	.052	12.48	1400
	BBC2-311	277V60Hz	5.0	.043	11.91	2300
	BBC2-312	480V60Hz	5.0	.026	12.48	5600
	BBC2-313	12VDC	6.0	.500	—	24
	BBC2-308	24VDC	6.1	.255	—	95
Three Form "B" 3P.S.T.	BBC3-308	24V60Hz	8.8	1.040	24.96	5.0
	BBC3-303	120V60Hz	8.5	.200	24.0	135
	BBC3-309	208V60Hz	7.6	.108	22.46	480
	BBC3-306	240V60Hz	7.6	.100	24.0	520
	BBC3-310	277V60Hz	7.4	.080	22.16	830
	BBC3-311	480V60Hz	8.0	.048	23.0	2100
	BBC3-312	12VDC	11.0	1.00	—	12.8
	BBC3-313	24VDC	11.0	.470	—	51

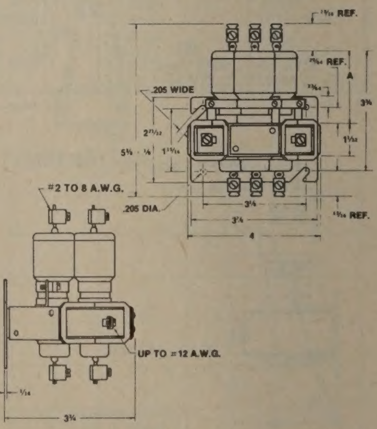
DIMENSIONS



CATALOG DESIGNATION	A 60 Hz	DC
BFC	2⁵⁄₁₆	2⁹⁄₆₄
BBC	1³⁷⁄₆₄	1⅝



CATALOG DESIGNATION	A 60 Hz	DC
BFC2	2⁵⁄₁₆	2⁹⁄₆₄
BBC2	1³⁷⁄₆₄	1⅝



CATALOG DESIGNATION	A 60 Hz	DC
BFC3	2⁵⁄₁₆	2⁹⁄₆₄
BBC3	1³⁷⁄₆₄	1⅝

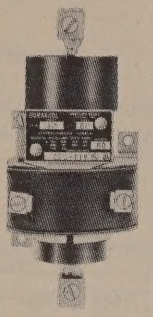
durakool®

CONTACTORS—100 AMP

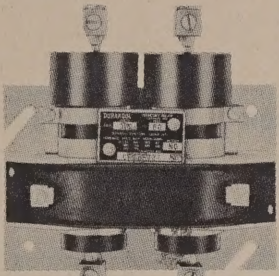
UL CSA

CFC Series—Normally Open

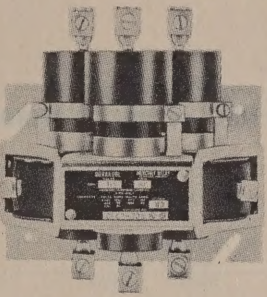
CBC Series—Normally Closed



Model CFC 700



Model CFC2 700



Model CFC3 700

CFC and CBC 700 Series devices are listed under file #E35126 and CSA file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on page 3475. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

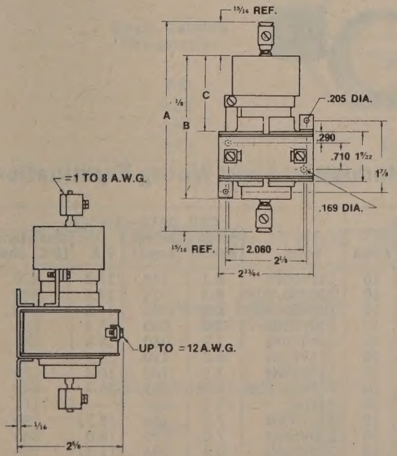
CFC SERIES/Normally Open

Con-tacts	Part #	Volts	COIL DATA—TYPICAL			
			Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "A" S.P.S.T. N.O.	CFC-717	24V60Hz	9.0	.820	19.7	7.1
	CFC-718	120V60Hz	8.0	.170	20.4	180
	CFC-719	208V60Hz	8.2	.098	20.4	600
	CFC-720	240V60Hz	8.0	.085	20.4	680
	CFC-721	277V60Hz	8.0	.070	19.4	1000
	CFC-722	480V60Hz	8.0	.045	21.6	2700
	CFC-731	12VDC	5.4	.445	—	27
	CFC-723	24VDC	5.3	.220	—	111
Two Form "A" D.P.S.T. N.O.	CFC2-726	24V60Hz	16.6	1.85	44.4	2.8
	CFC2-727	120V60Hz	15.6	.380	45.6	66
	CFC2-728	208V60Hz	19.6	.246	51.2	165
	CFC2-729	240V60Hz	17.0	.190	45.6	260
	CFC2-730	277V60Hz	17.0	.180	49.9	430
	CFC2-731	480V60Hz	17.0	.095	45.6	1100
	CFC2-741	12VDC	14.4	1.20	—	10
	CFC2-733	24VDC	14.4	.600	—	40
Three Form "A" 3P.S.T. N.O.	CFC3-707	24V60Hz	29.0	3.40	81.6	1.04
	CFC3-708	120V60Hz	28.0	.700	84.0	27
	CFC3-709	208V60Hz	28.8	.380	79.0	100
	CFC3-710	240V60Hz	29.0	.350	84.0	110
	CFC3-711	277V60Hz	29.0	.300	83.1	150
	CFC3-712	480V60Hz	29.0	.180	86.4	440
	CFC3-720	12VDC	14.4	1.20	—	10
	CFC3-721	24VDC	14.4	.600	—	40

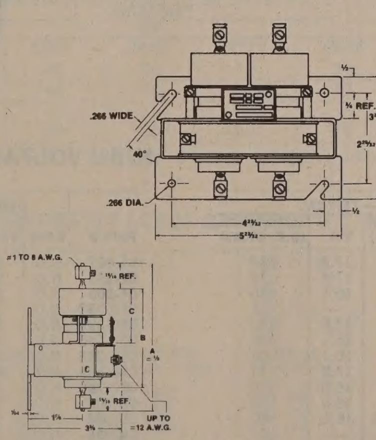
CBC SERIES/Normally Closed

Con-tacts	Part #	Volts	COIL DATA—TYPICAL			
			Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "B" S.P.S.T. N.C.	CBC-701	24V60Hz	7.0	.770	18.4	7.1
	CBC-702	120V60Hz	6.6	.150	18.0	180
	CBC-703	208V60Hz	7.0	.085	17.7	600
	CBC-704	240V60Hz	7.0	.075	18.0	680
	CBC-705	277V60Hz	7.0	.065	18.0	1000
	CBC-706	480V60Hz	7.0	.038	18.2	2700
	CBC-719	12VDC	5.4	.455	—	27
	CBC-707	24VDC	5.3	.220	—	111
Two Form "B" D.P.S.T. N.C.	CBC2-315	24V60Hz	14.8	1.660	39.84	2.8
	CBC2-309	120V60Hz	14.2	.365	43.80	66
	CBC2-316	208V60Hz	16.6	.244	50.75	165
	CBC2-306	240V60Hz	17.0	.188	45.12	260
	CBC2-317	277V60Hz	17.0	.170	47.09	430
	CBC2-313	480V60Hz	17.0	.094	45.12	1100
	CBC2-318	12VDC	14.5	1.20	—	10
	CBC2-319	24VDC	14.4	.600	—	40
Three Form "B" D.P.S.T. N.C.	CBC3-307	24V60Hz	27.0	3.16	75.84	1.04
	CBC3-304	120V60Hz	21.2	.64	76.80	27
	CBC3-308	208V60Hz	22.8	.36	74.88	100
	CBC3-306	240V60Hz	21.2	.32	76.80	110
	CBC3-309	277V60Hz	21.2	.29	80.33	150
	CBC3-305	480V60Hz	21.2	.16	76.80	440
	CBC3-310	12VDC	14.5	1.20	—	10
	CBC3-311	24VDC	14.4	.600	—	40

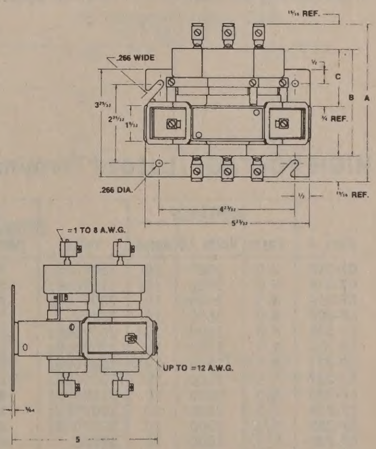
DIMENSIONS



CATALOG DESIGNATION	A	B	C	
			60 Hz	DC
CFC	5 9/16	3 3/4	1 61/64	1 11/16
CBC	5 13/16	4 1/64	1 9/64	1 11/32



CATALOG DESIGNATION	A	B	C	
			60 Hz	DC
CFC2	5 9/16	3 3/4	1 61/64	1 11/16
CBC2	5 13/16	4 1/64	1 9/64	1 11/32



CATALOG DESIGNATION	A	B	C	
			60 Hz	DC
CFC3	5 9/16	3 3/4	1 61/64	1 11/16
CBC3	5 13/16	4 1/64	1 9/64	1 11/32

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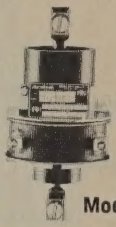
Contactors—150 Amp

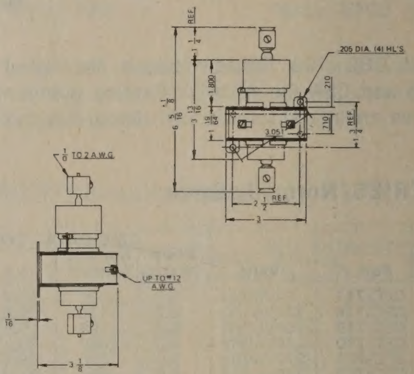


Model DFC

DFC Series—Normally Open

Contact ratings for this series of contactors are shown on page 3475.

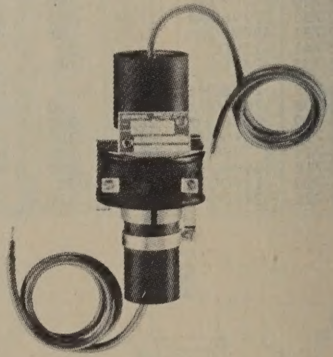
DIMENSIONS



DFC SERIES/Normally Open

Con-tacts	Part #	Volts	Coil Data—Typical Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "A" S.P.S.T. N.O.	DFC-307	24V60Hz	16.5	1.631	39.14	2.5
	DFC-301	120V60Hz	16.5	.347	41.64	65
	DFC-304	208V60Hz	16.5	.200	41.60	221
	DFC-303	240V60Hz	16.5	.174	41.76	260
	DFC-305	277V60Hz	16.5	.142	39.33	400
	DFC-306	480V60Hz	16.5	.087	41.76	1040
	DFC-313	12VDC	8.9	.738	—	16
	DFC-310	24VDC	8.9	.369	—	65

High Voltage Contactors—2500-3500 V



Durakool High Voltage Units are available in either leaded or industrial field termination types. Operating voil voltages other than part numbers shown are available. Contact factory engineering personnel for special application assistance.

HIGH VOLTAGE/Leaded Terminations

Part #	CONTACTS Form	Volts AC	Amps	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
CF-215	N.O.	2500	10	230V60Hz	8.1	.074	17.8	680
CF-216	N.O.	2500	10	115V60Hz	8.1	.148	17.8	170
CF-219	N.O.	2500	10	230V50Hz	8.0	.070	16.1	680
CF-226	N.O.	2500	10	24VDC	5.5	.230	—	111
CF-229	N.O.	2500	10	230V60Hz	8.1	.074	17.8	680
CF-230	N.O.	2500	10	230V50Hz	8.0	.070	16.1	680
CF-231	N.O.	2500	10	208V50Hz	8.0	.077	16.1	600
CF-232	N.O.	2500	10	115V60Hz	8.1	.148	17.8	170
CF-233	N.O.	2500	10	115V50Hz	8.0	.143	16.5	170
CF-234	N.O.	2500	10	100V50Hz	8.0	.165	16.5	150
CF-235	N.O.	2500	10	200V50Hz	8.0	.0805	16.1	580
CF-238	N.O.	2500	10	48VDC	6.0	.115	—	440
CB-215	N.C.	2500	10	230V60Hz	7.0	.075	18.0	680
CB-218	N.C.	2500	10	115V60Hz	7.0	.156	18.72	180
CB-221	N.C.	2500	10	24VDC	5.3	.220	—	108
CB-222	N.C.	2500	10	230V50Hz	6.9	.078	18.0	680
CB-223	N.C.	2500	10	230V60Hz	7.0	.075	18.0	680
CB-224	N.C.	2500	10	115V60Hz	7.0	.156	18.72	180
CB-225	N.C.	2500	10	115V50Hz	6.9	.156	18.0	180

HIGH VOLTAGE/Industrial Field Wiring Terminations

Part #	CONTACTS Form	Volts AC	Amps	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
CF-302	N.O.	2500	10	115V60Hz	8.1	.148	17.8	170
CF-303	N.O.	2500	10	230V50/60Hz	8.1	.074	17.8	680
CF-305	N.O.	2500	10	115V50/60Hz	8.1	.148	17.8	170
CFC-387	N.O.	3500	10	230V60Hz	8.0	.085	20.4	680
CFC-389	N.O.	3500	10	230V50Hz	7.9	.080	18.4	680
CFC-390	N.O.	3500	10	115V60Hz	8.0	.170	20.4	180
CFC-392	N.O.	3500	10	115V50Hz	7.9	.160	18.4	170
CFC-395	N.O.	3500	10	230V50/60Hz	8.0	.085	20.4	680
CFC-396	N.O.	3500	10	24VDC	5.3	.220	—	111
CB-302	N.C.	2500	10	115V60Hz	7.0	.156	18.72	180
CB-303	N.C.	2500	10	230V60Hz	7.0	.075	18.0	680
CB-305	N.C.	2500	10	115V50Hz	6.9	.154	17.71	180
CBC-333	N.C.	3500	10	115V60Hz	6.6	.150	18.0	180
CBC-335	N.C.	3500	10	230V60Hz	7.0	.075	18.0	680
CBC-336	N.C.	3500	10	200V50Hz	6.9	.089	17.8	640
CBC-339	N.C.	3500	10	48VDC	5.2	.109	—	440

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RELAY AND CONTACTOR DATA

CONTACT RATINGS/PER POLE—See appropriate chart

LIFE EXPECTANCY

Mechanical Life	25 million minimum
General Purpose Load	8 million minimum
OPERATE TIME	80 milliseconds typical
RELEASE TIME	100/120 milliseconds typical

Electrical Ratings Per Pole—Non U.L. & CSA listed devices

ELECTRICAL RATINGS OF NORMALLY OPEN CONTACTORS

Basic Catalog Designation	GENERAL PURPOSE LOAD RATINGS Amperes*								Lamp Load a 120V 60 Hz		AC Motor Ratings in HP Single Phase	
	AC						DC					
	120V	208V	240V	277V	480V	600V	120V	240V	Amp	KW	120V	240V
BF	35	35	30	30	30	30	25	15	30	4	2	3
BFC	60	60	60	60	60	60	30	20	60	6.6	3	5
CF	80	68	65	63	50	40	35	25	75	8	5	7½
CFC	100	92	90	88	75	70	50	30	100	10	7½	10
DFC	150	140	135	130	120	110	—	—				

**Inrush Current—Approx. 150% of values shown ***Any AC-DC Coil voltage available.

ELECTRICAL RATINGS OF NORMALLY CLOSED CONTACTORS

Basic Catalog Designation	GENERAL PURPOSE LOAD RATINGS Amperes*								Lamp Load a 120V 60 Hz		AC Motor Ratings in HP Single Phase	
	AC						DC					
	120V	208V	240V	277V	480V	600V	120V	240V	Amp	KW	120V	240V
BB	30	22	20	18	10	8	20	10	20	2.5	1½	2
BBC	60	47	45	45	35	25	30	20	55	6.6	3	5
CB	80	68	65	63	50	40	35	25	75	8	5	7½
CBC	100	92	90	88	75	70	50	30	90	10	7½	10

**Inrush Current—Approx. 150% of values shown ***Any AC-DC Coil voltage available.

The below listed ratings apply to all U.L. and C.S.A. listed devices Series BF & BB 7000 BFC & BBC 700; CF & CB 700 and CFC & CBC 700 Series.

ELECTRICAL RATINGS OF NORMALLY OPEN CONTACTORS

Basic Catalog Designation	GENERAL PURPOSE LOAD RATINGS Amperes* AC					UL Tungsten Lamp Load at 120V 60 Hz	
	120V	208V	240V	277V	480V	Amp	KW
BF	30	30	30	30	30	30	4
BFC	60	60	60	60	60	60	6.6
CF	80	65	65	55	50	75	8
CFC	100	90	90	60	60	100	10

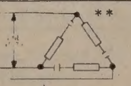
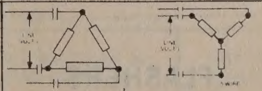
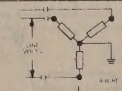
**Inrush Current—Approx. 150% of values shown ***Any AC-DC Coil voltage available.

ELECTRICAL RATINGS OF NORMALLY CLOSED CONTACTORS

Basic Catalog Designation	GENERAL PURPOSE LOAD RATINGS Amperes* AC					UL Tungsten Lamp Load at 120V 60 Hz	
	120V	208V	240V	277V	480V	Amp	KW
BB	30	22	20	18	10	—	—
BBC	60	45	45	45	35	55	6.6
CB	—	—	—	—	—	—	—
CBC	100	90	90	60	60	90	10

**Inrush Current—Approx. 150% of values shown ***Any AC-DC Coil voltage available.

K.W. RATINGS FOR 3-PHASE BALANCED HEATER LOADS BASED ON U.L. LISTED AMPS

3-PHASE CONTACTOR IN CIRCUIT		 **					
Catalog Designation	Line Volts	Amps Per Pole	Total KW Heater Load	Amps Per Pole	Total KW Heater Load	Amps Per Pole	Total KW Heater Load
BF3	208	30	18.7	30	10.8	30	10.8
	240	30	21.6	30	12.4	30	12.4
	480	20	28.8	20	16.6	30	24.9
BFC3	208	50	31.2	50	17.9	60	21.5
	240	50	36.0	50	20.7	50	20.7
	480	40	57.6	40	33.2	50	41.5
CFC3	208	90	55.1	90	32.3	100	35.9
	240	90	64.8	90	37.3	90	37.3
	480	60	86.4	60	49.8	60	49.8

**Interrupting device for line voltage required. Ratings subject to change without notice.

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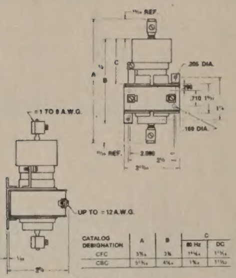
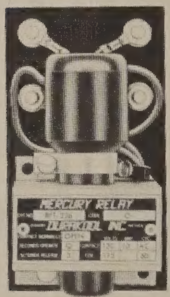
TIME DELAY RELAYS

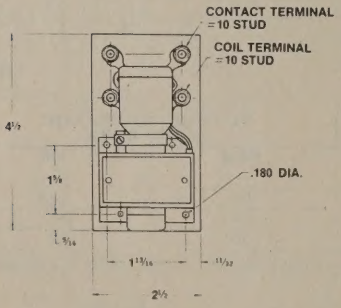


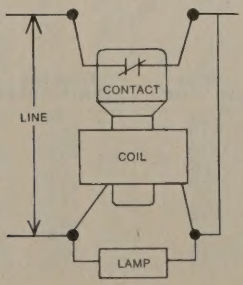
All Durakool time delay relays feature the advantages of mercury to mercury contacts in stainless steel hermetically sealed contact tubes. Release delay functions are performed without the necessity of auxiliary external switches. All catalog numbers shown are U.L. listed bracket mount types; panel mount and cased versions are also available. Virtually hundreds of additional timing ranges and AC/DC operating coil voltages are available.

SERIES TIMER	FORM CONTACT	TIMING MODE OF OPERATION	G.P. LOAD RATINGS AC AMPERES		
			120V	240V	480V
BFT	N.O.	Quick Operate—Timed Release	20	15	10
BFU	N.O.	Timed Operate—Timed Release	15	10	6
BFU	N.O.	Timed Operate—Quick Release	15	10	6
BBT	N.C.	Quick Operate—Timed Release	15	10	6
BBU	N.C.	Timed Operate—Timed Release	15	10	6

Operating Coil Voltage	Part Number and Time Delay					Coil Data		
	½ sec.	1 sec.	3 sec.	5 sec.	10 sec.	(Watts)	Current (Amps)	Resistance (DC Ohms)
BFT SERIES/Quick Operate—Timed Release								
24/60	BFT-7009	BFT-7021	BFT-7041	BFT-7053	BFT-7069	3.8	3.3	23
120/60	BFT-7010	BFT-7022	BFT-7042	BFT-7054	BFT-7070	3.8	.064	580
240/60	BFT-7011	BFT-7023	BFT-7043	BFT-7055	BFT-7071	3.8	.033	2400
480/60	BFT-7012	BFT-7024	BFT-7044	BFT-7056	BFT-7072	3.9	.017	9600
BFU SERIES/Timed Operate—Timed Release								
24/60	BFU-7005	BFU-7013	BFU-7029	BFU-7041	BFU-7057	2.2	.178	36
120/60	BFU-7006	BFU-7014	BFU-7030	BFU-7042	BFU-7058	2.9	.045	902
240/60	BFU-7007	BFU-7015	BFU-7031	BFU-7043	BFU-7059	2.8	.022	3700
480/60	BFU-7008	BFU-7016	BFU-7032	BFU-7044	BFU-7060	2.7	.010	15000
BFV SERIES/Timed Operate—Quick Release								
24/60	BFV-7009	BFV-7017	BFV-7041	BVF-7053	BFV-7069	2.4	.195	36
120/60	BFV-7010	BFV-7018	BFV-7042	BFV-7054	BFV-7070	2.7	.043	902
240/60	BFV-7011	BFV-7019	BFV-7043	BFV-7055	BFV-7071	2.7	.022	3700
480/60	BFV-7012	BFV-7020	BFV-7044	BFV-7056	BFV-7072	2.8	.012	1500
BBU SERIES/Timed Operate—Timed Release								
24/60	BBU-7005	BBU-7013	BBU-7029	BBU-7037	BBU-7049	2.8	.200	36
120/60	BBU-7006	BBU-7014	BBU-7030	BBU-7038	BBU-7050	3.2	.047	902
240/60	BBU-7007	BBU-7015	BBU-7031	BBU-7039	BBU-7051	3.2	.024	3700
480/60	BBU-7008	BBU-7016	BBU-7032	BBU-7040	BBU-7052	3.3	.013	15000
BBT SERIES—Quick Operate—Timed Release								
	½ sec.	¾ sec.	1 sec.	1½ sec.	2 sec.			
24/60	BBT-7001	BBT-7005	BBT-7009	BBT-7013	BBT-7017	3.8	.350	23
120/60	BBT-7002	BBT-7006	BBT-7010	BBT-7014	BBT-7018	3.9	.065	580
240/60	BBT-7003	BBT-7007	BBT-7011	BBT-7015	BBT-7019	3.8	.033	2400
480/60	BBT-7004	BBT-7008	BBT-7012	BBT-7016	BBT-7020	3.9	.016	9600







FLASHERS

Durakool BBU Timers function as self-energized recycling flashers when connected as shown above. Flashing cycles can be provided from 15 flashes to 200 flashes per minute in both AC and DC operating coil voltages.

durakool inc., 1010 N. MAIN ST. • ELKHART, IND. 46514 • 219/264-1116 • TELEX—25-8482

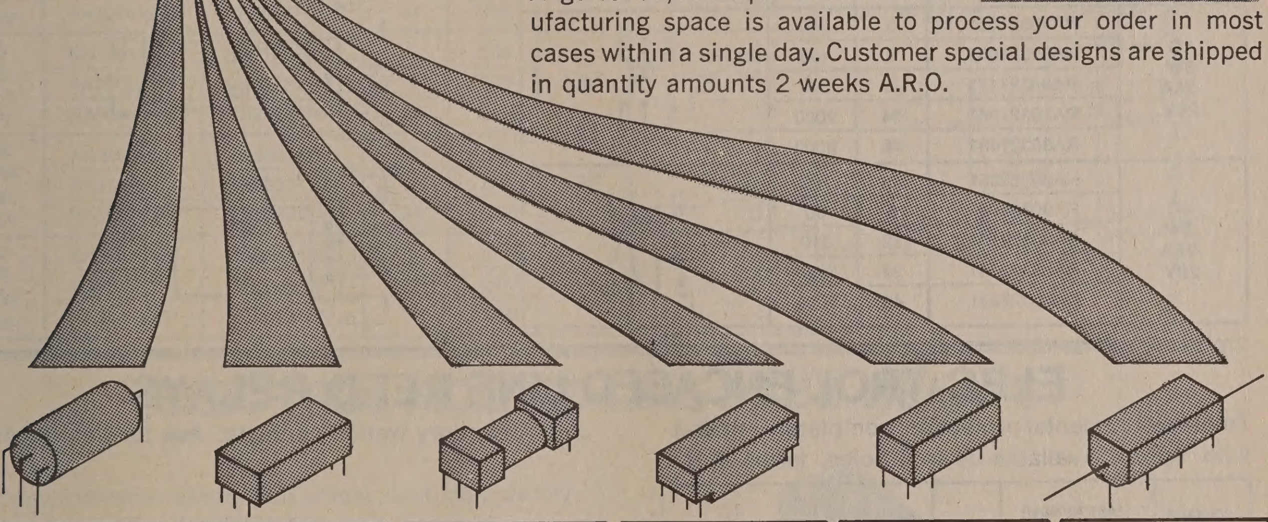
EAC

ELECTRONIC APPLICATIONS COMPANY

4918 SANTA ANITA AVENUE
EL MONTE, CALIFORNIA 91734

INNOVATIVE RELAY DESIGNS SINCE 1959

This ultra modern facility of EAC is located in the industrial hub of Los Angeles. 30,000 square feet of manufacturing space is available to process your order in most cases within a single day. Customer special designs are shipped in quantity amounts 2 weeks A.R.O.



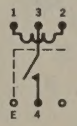
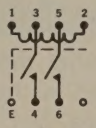
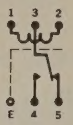
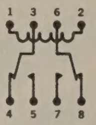
TUBULAR	MOLDED	LITTLE GEM	JENCO Division of EAC	DIP REPLACEMENT Pin Compatible	CUSTOMER SPECIAL DESIGN
Highest volume production. Magnetic shield. Lowest cost. Same day shipment from stock. 1A to 3A, 1C to 2C, Latch, Mercury, High Voltage.	PCB mounting. Vacuum impregnation of polyamide epoxy. Highest reliability. Highest insulation resistance. 1A to 6A, 1C to 3C, Latch, Mercury, High Voltage.	PCB mounting. Open frame. Magnetic shield, encapsulated. .1 and .15 pin spacing is standard. 1A to 6A, 1C to 3C, Latch Mercury, High Voltage.	EAC acquired the Jenco line in 1974. Manufacturers of fine, high performance relays. All Jenco relays are readily available from EAC/Jenco stock.	These relays are available in all competitive configurations. Because of their inherent higher reliability, they are slightly larger than the standard DIP relay.	Design your own relay. Any pin configuration, any size, any shape, any degree of reliability. Use our EAC Application Questionnaire.
Highest overall performance for most competitive cost.	Pricing consistent with reliability requirements. See Catalog, or call EAC.	1 Form A under .75 @ 2500 pcs. 2 Form A under 1.00 @ 5000 pcs.	Jenco has relays to switch 25kv. Reliability is inherent with EAC/Jenco.	Call us for price quotations. Relay reliability is not large or expensive.	Price is **very** competitive. Tell us our limits and your requirements.

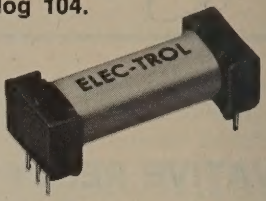
FREE CATALOGS ARE AVAILABLE BY REQUEST. TELEPHONE, TWX OR WRITE TO US OF YOUR NEEDS.

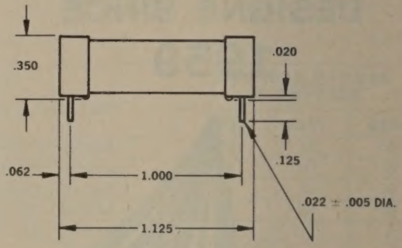
TELEPHONE 213/442-3212
TWX 910/587-3351

ELEC-TROL OPEN LINE REED RELAYS

High performance at a remarkably low cost where the environment is not severe. Available up to 6 poles, forms A, B, C and A mercury wetted contacts. **Ask for Catalog 104.**

CONTACT FORM	PART NUMBER .100″ TERMINAL SPACING	COIL V.D.C.	COIL RES. (ohms) @ 20°C	CIRCUIT DIAGRAM (Top View of Relay)
1A 10W .5A 200V	RA30311051	5	500	
	RA30311061	6	125	
	RA30311121	12	500	
	RA30311241	24	2000	
	RA30311481	48	8000	
2A 10W .5A 200V	RA30312051	5	200	
	RA30312061	6	110	
	RA30312121	12	440	
	RA30312241	24	1750	
	RA30312481	48	7000	
1C 3W .25A 28V	RA30321051	5	500	
	RA30321061	6	125	
	RA30321121	12	500	
	RA30321241	24	2000	
	RA30321481	48	8000	
2C 3W .25A 28V	RA30322051	5	200	
	RA30322061	6	80	
	RA30322121	12	310	
	RA30322241	24	1250	
	RA30322481	48	5000	

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.022 ± .005 DIA.
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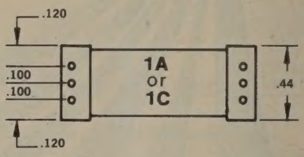
.120
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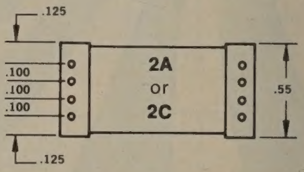
.125
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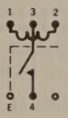
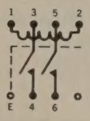
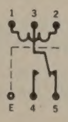
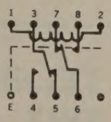
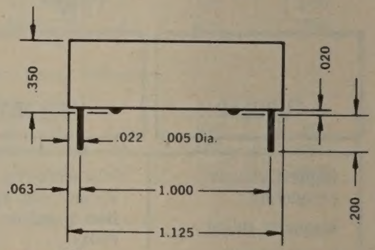
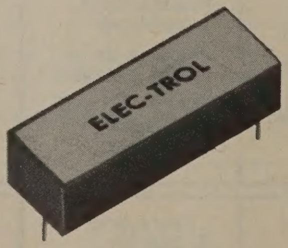
or
2C
.55
.125

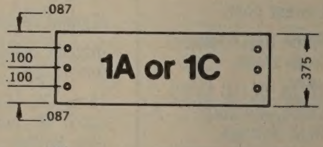
ELEC-TROL ENCASED LINE REED RELAYS

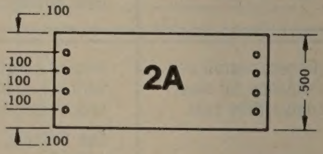
Total environmental protection, completely sealed with epoxy. Available up to 6 poles, forms A, B, C and A mercury wetted contacts. **Ask for Catalog 105.**

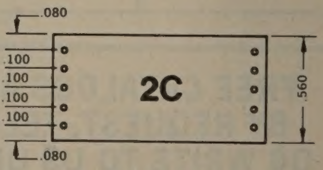
CONTACT FORM and RATING	PART NUMBER .100″ TERMINAL SPACING	COIL V.D.C.	COIL RES. (ohms) @ 20°C	CIRCUIT DIAGRAM (Top View of Relay)
1A 10W .5A 200V	RA30551051	5	500	
	RA30551061	6	125	
	RA30551121	12	500	
	RA30551241	24	2000	
	RA30551481	48	8000	
2A 10W .5A 200V	RA30552051	5	250	
	RA30552061	6	110	
	RA30552121	12	440	
	RA30552241	24	1750	
	RA30552481	48	7000	
1C 3W .25A 28V	RA30571051	5	500	
	RA30571061	6	125	
	RA30571121	12	500	
	RA30571241	24	2000	
	RA30571481	48	8000	
2C 3W .25A 28V	RA30572051	5	250	
	RA30572061	6	80	
	RA30572121	12	310	
	RA30572241	24	1250	
	RA30572481	48	5000	


.350
.020
.022
.005 Dia.
.063
1.000
1.125
.200



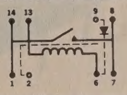
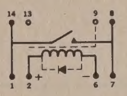
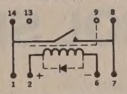
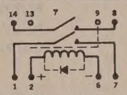
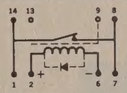
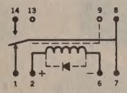

.087
.100
.100
1A or 1C
.375
.087

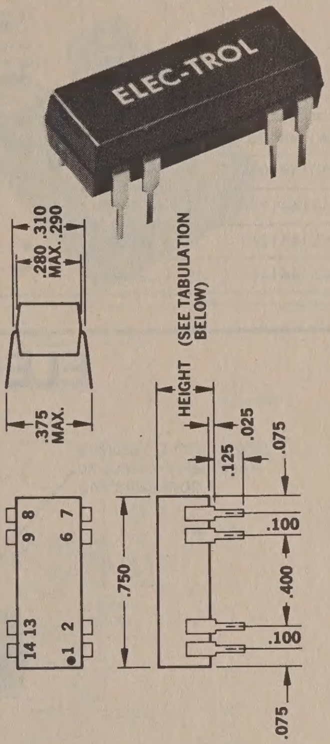

.100
.100
.100
.100
2A
.500
.100


.080
.100
.100
.100
.100
2C
.560
.080

ELEC-TROL DIP REED RELAYS

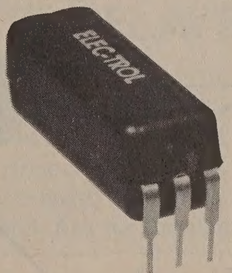
Standard 8 and 14 pin DIP packages suited for insertion in 14 pin DIP sockets or printed circuit boards. Can be driven directly by TTL. Available in 35 different style models, 1A, 2A, 1B, 1C and 1A mercury wetted contacts. **Ask for Catalog 103.**

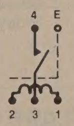
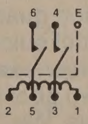
CONTACT FORM + RATING	PART NUMBER		COIL V.D.C.	COIL RES. (ohms) @ 20°C	HEIGHT	CIRCUIT DIAGRAM (Top View of Relay)
	NO DIODE	WITH DIODE				
1A 3W .11A 28V	RA30921051	RA31201051	5	500	.225″	
	RA30921121	RA31201121	12	500		
	RA30921241	RA31201241	24	1400		
	RA30381051	RA30391051	5	500	.225″	
	RA30381061	RA30391061	6	500		
	RA30381121	RA30391121	12	500		
	RA30381241	RA30391241	24	1400		
1A 10W .5A 100V	RA30451051	RA30461051	5	500	.275″	
	RA30451121	RA30461121	12	500		
	RA30451241	RA30461241	24	2150		
2A 3W .11A 28V	RA30982051	RA31232051	5	200	.275″	
	RA30982121	RA31232121	12	500		
	RA30982241	RA31232241	24	2150		
1B 10W .5A 100V	RA30511051	RA30521051	5	500	.275″	
	RA30511121	RA30521121	12	500		
	RA30511241	RA30521241	24	2150		
1C 3W .25A 28V	RA30421051	RA30441051	5	200	.275″	
	RA30421121	RA30441121	12	500		
	RA30421241	RA30441241	24	2000		

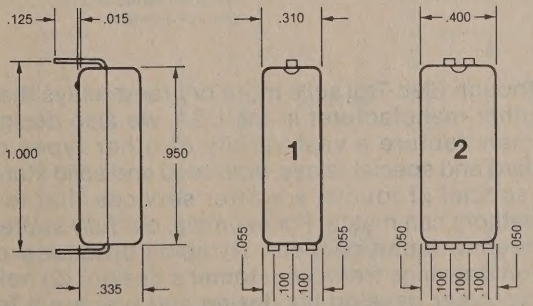


ELEC-TROL MOLDED-LINE REED RELAYS

Total environmental protection at low cost, completely molded in epoxy. Available in 1 and 2 form A contacts. **Ask for Catalog 114.**



CONTACT FORM	PART NUMBER	COIL V.D.C.	COIL RES. (ohms) @ 20°C	CIRCUIT DIAGRAM (Top View of Relay)
1A 10W .5A 200V	RA31571051	5	500	
	RA31571061	6	125	
	RA31571121	12	500	
	RA31571241	24	2000	
	RA31571481	48	8000	
2A 10W .5A 200V	RA31572051	5	250	
	RA31572061	6	110	
	RA31572121	12	440	
	RA31572241	24	1750	
	RA31572481	48	7000	

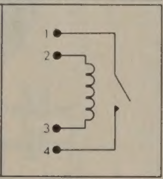


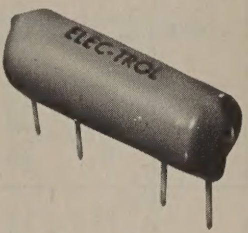
ELEC-TROL, INC.

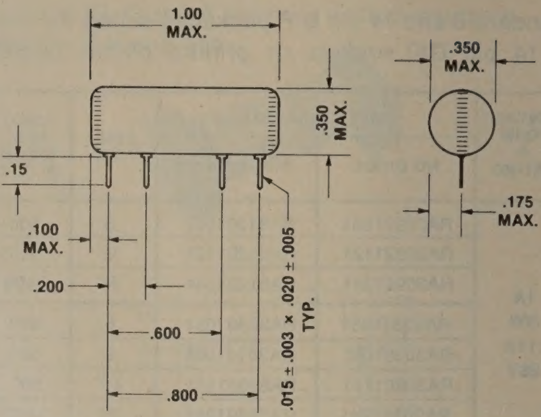
26477 NO. GOLDEN VALLEY ROAD • SAUGUS, CALIFORNIA 91350
TELEPHONE: (805) 252-8330, (213) 788-7292 • TWX: 910-336-1556

ELEC-TROL BLUE BOY REED RELAYS

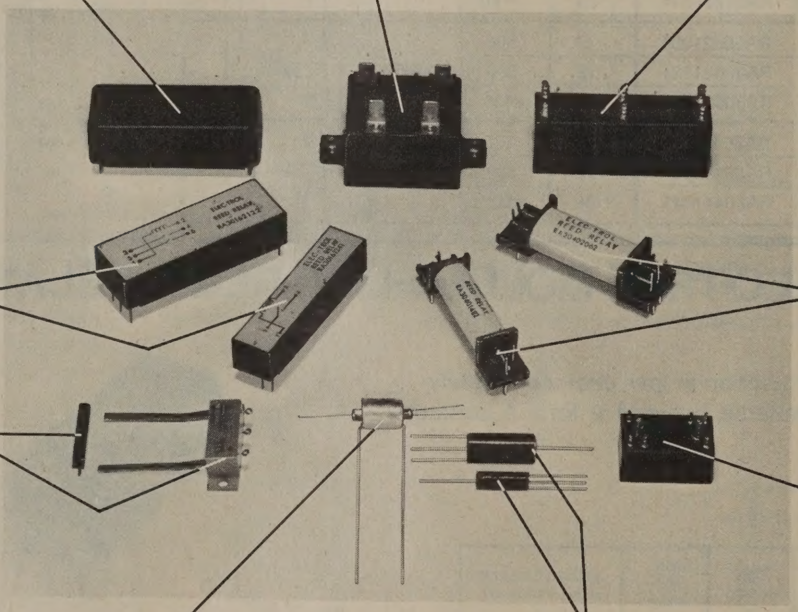
Low cost, rock hard epoxy coated reed relays available with general purpose or logic level 10w, 1 form A contact. **Ask for Catalog 112.**

PART NUMBER	COIL V.D.C.	COIL RES. (OHMS) @ 20°C	CIRCUIT DIAGRAM (TOP VIEW OF RELAY)
RA31441051	5	500	
RA31441061	6	125	
RA31441121	12	500	
RA31441241	24	2000	
RA31441481	48	8000	





ELEC-TROL SPECIAL PRODUCTS



1-pole Form C Latching Reed Relay with up to 20W switching

Hybrid Relay with reed relay input and triac output

High Voltage Form A Reed Relay available in 1 & 2 poles with up to 7500V switching

Sealed Reed Relays available in up to 6 poles, Form A or C with up to 50W switching

Open Line Reed Relays available in up to 4 poles, with up to 50W switching

Reed Switch and Coil for proximity detection

2-pole Form A Current Sensing Reed Relay for circuit protection

High Isolation Reed Relay with 10^{15} ohms isolation between coil and reed switch

Typical 1-pole, Form A, Small Axial Lead Reed Relays

Although Elec-Trol sells more dry reed relays than any other manufacturer in the USA, we also design and manufacture a vast variety of other types of standard and special relays, both reed and solid state.

In special products, we offer services that few competitors can match. For example, our fully staffed engineering department can: (1) rapidly produce production drawings from a customer's design; (2) help the customer develop his design and prepare it for production; or (3) assume full responsibility for the complete design to meet the customer's application needs.

Also with in-house ability of designing and making all our own molds and production tools and the high volume throughput capability of our two manufacturing facilities–we can deliver large or small production quantities of a customer's specially designed product quickly and on schedule at competitive prices.

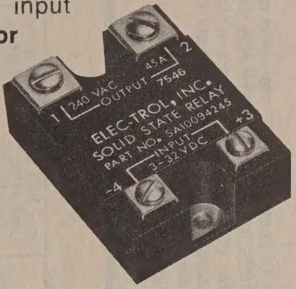
A few examples of typical custom products are shown above: but if you don't see the one you want, ask us. We'll make it.

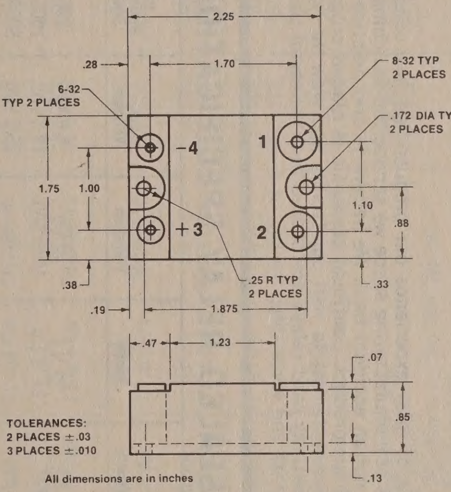
If you have a relay requirement that cannot be met by standard products, send us your specifications or information regarding your application. An Elec-Trol Special is often the answer.

ELEC-TROL SOLID STATE RELAYS

PART NUMBER	INPUT VOLTAGE	OUTPUT SWITCHING ABILITY	
		MAX. CURRENT (AMPS)	LINE VOLTAGE (VRMS)
SA10094103	3-32 VDC	3	120
SA10094106	3-32 VDC	6	
SA10094110	3-32 VDC	10	
SA10094125	3-32 VDC	25	
SA10094145	3-32 VDC	45	
SA10094203	3-32 VDC	3	240
SA10094206	3-32 VDC	6	
SA10094210	3-32 VDC	10	
SA10094225	3-32 VDC	25	
SA10094245	3-32 VDC	45	
SA10094408	3-32 VDC	8	480
SA10094412	3-32 VDC	12	
SA10094425	3-32 VDC	25	
SA10109103	90-280 VRMS	3	120
SA10109106	90-280 VRMS	6	
SA10109110	90-280 VRMS	10	
SA10109125	90-280 VRMS	25	
SA10109145	90-280 VRMS	45	
SA10109203	90-280 VRMS	3	240
SA10109206	90-280 VRMS	6	
SA10109210	90-280 VRMS	10	
SA10109225	90-280 VRMS	25	
SA10109245	90-280 VRMS	45	
SA10109408	90-280 VRMS	8	480
SA10109412	90-280 VRMS	12	
SA10109425	90-280 VRMS	25	

AC and DC input models switch. 120, 240 or 440 VRMS, 3 to 45 amps and can be driven directly by TTL. All feature zero crossover switching and photo isolation between input and output. **Ask for Catalog 113.**


240 VAC
OUTPUT
45A
7546
ELEC-TROL, INC.
SOLID STATE RELAY
PART NO. SA10094245
INPUT
3-32 VDC
1
2
-4
+3


2.25
.28
1.70
6-32
TYP 2 PLACES
8-32 TYP
2 PLACES
.172 DIA TYP
2 PLACES
-4
1
+3
2
1.75
1.00
1.10
.88
.38
.25 R TYP
2 PLACES
.33
.19
1.875
.47
1.23
.07
.85
.13

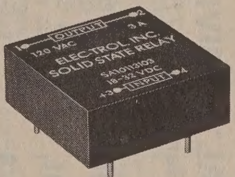
TOLERANCES:
2 PLACES ±.03
3 PLACES ±.010

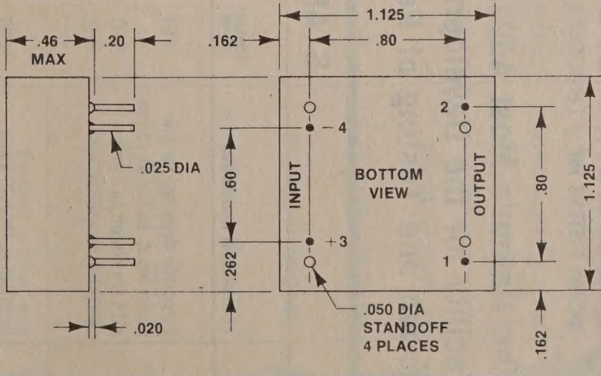
All dimensions are in inches

ELEC-TROL PCB SOLID STATE RELAYS

PART NUMBER	INPUT VOLTAGE	OUTPUT SWITCHING ABILITY	
		MAX. CURRENT (AMPS)	LINE VOLTAGE (VRMS)
SA10111101	3-8	1.5	120
SA10111103	3-8	3.0	
SA10111201	3-8	1.5	240
SA10111203	3-8	3.0	
SA10112101	8-18	1.5	120
SA10112103	8-18	3.0	
SA10112201	8-18	1.5	240
SA10112203	8-18	3.0	
SA10113101	18-32	1.5	120
SA10113103	18-32	3.0	
SA10113201	18-32	1.5	240
SA10113203	18-32	3.0	

DC input with output switching 120 or 240 VRMS at 1.5 or 3 amps. Mounts directly on printed circuit board, can be driven directly by TTL, has zero crossover switching and photo isolation. **Ask for Catalog 115.**


OUTPUT
120 VAC
3A
ELEC-TROL, INC.
SOLID STATE RELAY
SA10111103
INPUT


1.125
.46
MAX
.20
.162
.80
.025 DIA
.60
.262
INPUT
BOTTOM VIEW
OUTPUT
2
-4
+3
1
.80
1.125
.020
.050 DIA
STANDOFF
4 PLACES
.162

ELEC-TROL, INC.

26477 NO. GOLDEN VALLEY ROAD•SAUGUS, CALIFORNIA 91350
TELEPHONE: (805) 252-8330, (213) 788-7292 • TWX: 910-336-1556

ELECTRONIC SPECIALTY DIVISION

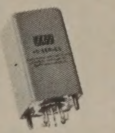
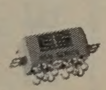
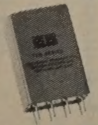
DATRON SYSTEMS INC. / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230 / (Area Code 503) 665-0121 / TWX 910-469-8782

The Nation's Most Advanced Facility for the Development, Production and Testing of Relays

With over 20 years of relay experience our product line now consists of more than 20 standard relays. Within the 67,000 square feet of manufacturing space we service the switching needs for major military and industrial accounts. Quality Control is not an accident here. We believe in and practice total control of all factors which could affect the end quality of our product. Continual emphasis is placed on utilizing state-of-the-art in new designs. We encourage all of our customers to visit our facility and view the operation first hand.

Electronic Specialty reed relays are offered in a variety of package and switch configurations to allow wide design flexibility and versatility.

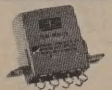
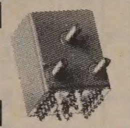
STANDARD HERMETIC SEALED RELAY SPECIFICATION

	General Information	Contact Form	Contact Rating	Size	Sensitivity	Shock	Vibration	Coil Voltage	Coil Resistance ±10%	Max. Pick Up/ Latch Voltage/ Current @ +25°C	Min. Drop Out Voltage/ Current @ +25°C	Operate Time Max.	Release Time Max.
40 	Especially designed for low power input, as low as 15 mw, with dry circuit to 5 amps switching capability.	1PDT or 2PDT	Dry circuit to 5 Amp 28 VDC Resistive	.970 x .970 x 1.781	20 mw 1PDT 40 mw 2PDT	50 G's 11 ±1.0 ms	10 G's 40 to 500 Hz	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14 MADC 6.3 MADC 2.8 MADC	5 MADC 2.3 MADC 1.0 MADC	35.0 ms	15.0 ms
50	Qualified to M5757/9 and M39016/6.	2PDT	D/C to 2A 28 VDC Resistive	.4 x .41 x .800	250 mw Pick Up	100 G's 10 ms ±2.0 ms	30 G's 56 to 3000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	40 Ohms 150 Ohms 700 Ohms	3.0 VDC 6.0 VDC 13.0 VDC	0.6 VDC 1.2 VDC 2.3 VDC	4.0 ms	4.0 ms
55N 	½ size sensitive latching relay qualified to M5757/76, all dash numbers.	2PDT	D/C to 2A 28 VDC Resistive	.4 x .41 x .800	90 mw Latch/Reset	100 G's 10 ms ±2.0 ms	30 G's 56 to 3000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	100 Ohms 500 Ohms 1800 Ohms	3.0 VDC 6.7 VDC 12.7 VDC	N/A	5 ms	N/A
68N	Crystal can "Lazy S" header.	2PDT	D/C to 2A 28 VDC Resistive	.359 x .797 x .875	300 mw Pick Up	20 G's 10 ±2 Amps	30 G's 56 to 3000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	35 Ohms 140 Ohms 552 Ohms	3.2 VDC 6.5 VDC 13.0 VDC	0.5 VDC 1.1 VDC 2.3 VDC	5 ms	5 ms
71N 	Sensitive crystal can relay.	2PDT	D/C to 2A 28 VDC Resistive	.4 x .8 x 1.280	40 mw Pick Up	50 G's 10 ±2 ms	10 G's 10 to 500 Hz	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14.2 MADC 6.3 MADC 2.8 MADC	1.42 MADC 0.63 MADC 0.28 MADC	15 ms	10 ms
72N	Micro miniature sensitive flat pack relay.	2PDT	D/C to 2A 28 VDC Resistive	.46 x .8 x 1.390	40 mw Pick Up	50 G's 11 ±1.0 ms	20 G's 56 to 2000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14.2 MADC 6.3 MADC 2.8 MADC	1.42 MADC 0.63 MADC 0.28 MADC	15 ms	10 ms

ELECTRONIC SPECIALTY DIVISION

DATRON SYSTEMS INC. / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230 / (Area Code 503) 665-0121 / TWX 910-469-8782

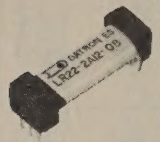
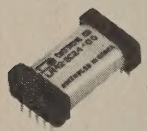
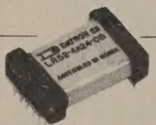
STANDARD HERMETIC SEALED RELAY SPECIFICATION

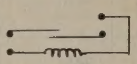
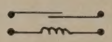
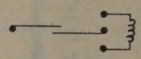
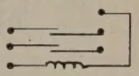
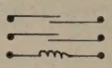
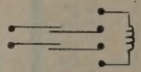
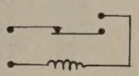
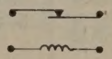
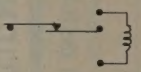
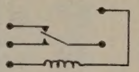
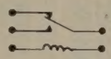
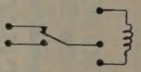
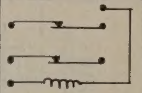
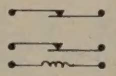
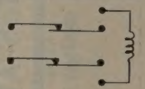
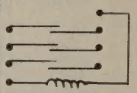
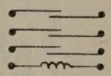
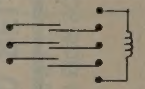
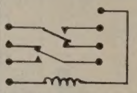
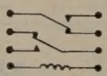
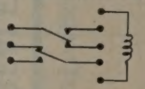
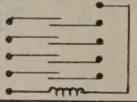
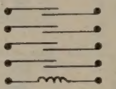
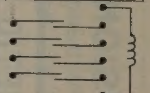
	General Information	Contact Form	Contact Rating	Size	Sensitivity	Shock	Vibration	Coil Voltage	Coil Resistance ±10%	Max. Pick Up Latch Voltage Current @ ±25°C	Min. Drop Out Voltage/ Current @ 25°C	Operate Time Max.	Release Time Max.
77R	Crystal can. Sensitive latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4 x .8 x .875	90 mw Latch/Reset	50 G's 11 ±1 ms	30 G's 56-2000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	100 Ohms 500 Ohms 1800 Ohms	3.0 VDC 6.7 VDC 12.7 VDC	N/A	5 ms	5 ms
79N 	Crystal can. Non-latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4 x .8 x .875	250 mw Pick Up	100 G's 11 ±2 ms	20 G's 56-2000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	35 Ohms 140 Ohms 600 Ohms	3.0 VDC 5.9 VDC 12.5 VDC	0.3 VDC 0.6 VDC 1.5 VDC	5 ms	5 ms
80N	Sensitive — double seal construction. Coils are in hermetically sealed compartments, separate from contact chamber.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.41 x .915 x 1.281	40 mw Pick Up	50 G's 11 ±1 ms	20 G's 56-2000 Hz	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14.2 MADC 6.3 MADC 2.8 MADC	1.42 MADC 0.63 MADC 0.28 MADC	15 ms	10 ms
90N	90N Series — Non-latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.602 x 1.032 x 1.278	80 mw Pick Up	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	500 Ohms 2000 Ohms	12.6 MADC 6.3 MADC	1.26 MADC 0.63 MADC	20 ms	5 ms
92N	92N Series — Latching				80 mw Latch/Reset	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	500 Ohms 2000 Ohms	6.3 VDC 12.6 VDC	N/A	9 ms	N/A
93	93 Series — Non-latching.	2PDT	10 Amps 28 VDC Resistive	.515 x 1.032 x 1.300	500 mw Pick Up	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	65 Ohms 300 Ohms	5.8 VDC 12.5 VDC	1.1 VDC 2.3 VDC	7 ms	3 ms
94	94 Series — Latching.				150 mw Latch/Reset	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	240 Ohms 1000 Ohms	6.0 VDC 12.3 VDC	N/A	10 ms	N/A
100N 	100N Series — Non-latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.852 x 1.032 x 1.278	150 mw Pick Up	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms	27.4 MADC 12.2 MADC	2.74 MADC 1.22 MADC	18 ms	5 ms
102N	102N Series — Latching.				150 mw Latch/Reset	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	250 Ohms 1000 Ohms	6.1 VDC 12.3 VDC	N/A	8 ms	N/A
103	103 Series — Non-latching.	4PDT	10 Amps 28 VDC Resistive	.852 x 1.032 x 1.3	1000 mw Pick Up	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	32 Ohms 150 Ohms	5.8 VDC 12.5 VDC	1.1 VDC 2.3 VDC	8 ms	5 ms
104	104 Series — Latching.				300 mw Latch/Reset	50 G's 11 ±1 ms	20 G's 56-2000 Hz	12.0 VDC 26.5 VDC	125 Ohms 500 Ohms	6.1 VDC 12.3 VDC	N/A	9 ms	N/A
F/H	Miniature coaxial relays with 8" min. RG178 B/U cables attached.	1PDT RF Plus Auxiliary 1PDT or 2PDT RF	RF to 1.5 Amps 50 Watt Max.	Frequency Range to 500 MHz. VSWR — 1:1.1 Typical. Characteristic Impedance — 50 Ohm Typical. Cross Talk — 50 dB Typical.				12.0 VDC 26.5 VDC	140 Ohms 600 Ohms	5.9 VDC 12.5 VDC	1.0 VDC 2.3 VDC	5 ms	5 ms
	Welded sealing.							12.0 VDC 26.5 VDC	150 Ohms 700 Ohms	6.0 VDC 13.0 VDC	1.2 VDC 2.3 VDC	5 ms	5 ms

ELECTRONIC SPECIALTY DIVISION

DATRON SYSTEMS INC. / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230 / (Area Code 503) 665-0121 / TWX 910-469-8782

STANDARD REED RELAY

Contact Form	Coil VDC	Coil Resistance ±10% @ 25°C	Pick Up Voltage @ 25°C	Dim. A	Part Number	Circuit Diagram Top View	Part Number	Circuit Diagram Top View	Part Number	Circuit Diagram Top View
1A	5	180	4.0	.375	LR11-1A05-0B		LR12-1A05-0B		LR13-1A05-0B	
	6	270	4.8	.375	LR11-1A06-0B		LR12-1A06-0B		LR13-1A06-0B	
	12	1500	9.6	.375	LR11-1A12-0B		LR12-1A12-0B		LR13-1A12-0B	
	24	3500	19.2	.375	LR11-1A24-0B		LR12-1A24-0B		LR13-1A24-0B	
2A	5	100	4.0	.475	LR21-2A05-0B		LR22-2A05-0B		LR23-2A05-0B	
	6	150	4.8	.475	LR21-2A06-0B		LR22-2A06-0B		LR23-2A06-0B	
	12	750	9.6	.475	LR21-2A12-0B		LR22-2A12-0B		LR23-2A12-0B	
	24	3000	19.2	.475	LR21-2A24-0B		LR22-2A24-0B		LR23-2A24-0B	
1B	5	100	4.0	.475	LR21-1B05-0B		LR22-1B05-0B		LR23-1B05-0B	
	6	150	4.8	.475	LR21-1B06-0B		LR22-1B06-0B		LR23-1B06-0B	
	12	750	9.6	.475	LR21-1B12-0B		LR22-1B12-0B		LR23-1B12-0B	
	24	3000	19.2	.475	LR21-1B24-0B		LR22-1B24-0B		LR23-1B24-0B	
1C	5	100	4.0	.475	LR21-1C05-0G		LR22-1C05-0G		LR23-1C05-0G	
	6	150	4.8	.475	LR21-1C06-0G		LR22-1C06-0G		LR23-1C06-0G	
	12	750	9.6	.475	LR21-1C12-0G		LR22-1C12-0G		LR23-1C12-0G	
	24	3000	19.2	.475	LR21-1C24-0G		LR22-1C24-0G		LR23-1C24-0G	
2B	5	50	4.0	.675	LR41-2B05-0B		LR42-2B05-0B		LR43-2B05-0B	
	6	100	4.8	.675	LR41-2B06-0B		LR42-2B06-0B		LR43-2B06-0B	
	12	380	9.6	.675	LR41-2B12-0B		LR42-2B12-0B		LR43-2B12-0B	
	24	1600	19.2	.675	LR41-2B24-0B		LR42-2B24-0B		LR43-2B24-0B	
3A	5	50	4.0	.675	LR41-3A05-0B		LR42-3A05-0B		LR43-3A05-0B	
	6	100	4.8	.675	LR41-3A06-0B		LR42-3A06-0B		LR43-3A06-0B	
	12	380	9.6	.675	LR41-3A12-0B		LR42-3A12-0B		LR43-3A12-0B	
	24	1600	19.2	.675	LR41-3A24-0B		LR42-3A24-0B		LR43-3A24-0B	
2C	5	50	4.0	.675	LR41-2C05-0G		LR42-2C05-0G		LR43-2C05-0G	
	6	100	4.8	.675	LR41-2C06-0G		LR42-2C06-0G		LR43-2C06-0G	
	12	380	9.6	.675	LR41-2C12-0G		LR42-2C12-0G		LR43-2C12-0G	
	24	1600	19.2	.675	LR41-2C24-0G		LR42-2C24-0G		LR43-2C24-0G	
4A	5	26	4.0	.775	LR51-4A05-0B		LR52-4A05-0B		LR53-4A05-0B	
	6	45	4.8	.775	LR51-4A06-0B		LR52-4A06-0B		LR53-4A06-0B	
	12	200	9.6	.775	LR51-4A12-0B		LR52-4A12-0B		LR53-4A12-0B	
	24	1100	19.2	.775	LR51-4A24-0B		LR52-4A24-0B		LR53-4A24-0B	

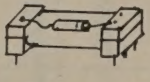
LR RELAY — Switching and Load Characteristics

The standard switches (Options B and G) are recommended for general use. Low level switching applications require other instrument grade switches (Options C and H) or mercury wetted contacts (Option E).

Switch Option	Contact Configuration	Description	Maximum Resistive Contact Rating VA	Amps	VDC	Initial Contact Resistance Ohms	Average/ Minimum Breakdown Voltage VDC	Typical Times in Milliseconds OP	OP Bounce	REL	REL Bounce
B	Form A Form B	Standard	10	.50	200	.100	400 / 275	.45	.35	.75	.35
C	Form A Form B	Instrument Grade (Low Level)	10	.50	200	.100	300 / 250	.70	.35	.75	.35
D	Form A	High Voltage Switching	10	.50	500	.100	1500 / 1350	.90	.45	—	—
E	Form A	Mercury Wetted Contacts (Zero Bounce)	50	2.0	100	.050	2000 / 1500	2.50	0.00	1.70	—
G	Form C Form B	Standard	3	.25	28	.150	300 / 250	.35	.60	.30	1.40
H	Form C Form B	Instrument Grade (Low Level)	3	.25	28	.150	300 / 250	.35	.60	.30	1.40

RELAY OPTIONS:

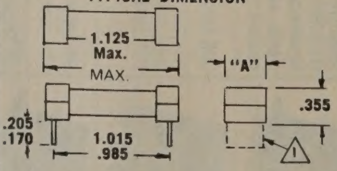
1. Electromagnetic shielding
2. Electrostatic shielding
3. Diode (Top mounted thus: LR1, LR2 mounted; internal LR3, LR4, LR5.)



SWITCH OPTIONS:

	Type	Description
1.	B & G	Standard: .5A, 10W, Form A; .25A, 3W, Form C
2.	C & H	Low level dry switch, instrument grade
3.	E	Mercury wetted contacts
4.	D	Hi voltage switching

TYPICAL DIMENSION



△1 Terminal pin spacing is on .1" grid. Standard terminals are .025 diameter tin coated copper for coil and .022 diameter tin or gold plated "Alloy 52" for switch terminals.

LR REED RELAY SPECIFICATIONS:

Characteristics: @ 25°C
Coil Resistance: ±10% of nominal.
Maximum Pull In: 80% of Nominal Voltage.
Minimum Drop-Out: 8% of Nominal Voltage.
Coil Voltage: Available in 5, 6, 12 & 24 VDC. See table for nominal resistance values.
Temperature Range: Operating . . . −40° to +85°C (−40° to +185°F).
Storage . . . −40° to +105°C (−40° to +220°F).

DEFINITION OF PART NUMBER

See detail sheets for detail explanation.

LR 5 2-4A 12-0B *

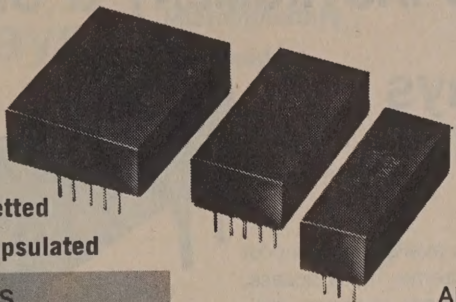
- Reed switch type B thru H.
- Shielding Options:
  - 0 - Basic Relay.
  - 1 - Electromagnetic shielding.
  - 2 - Electrostatic shielding.
  - 3 - Electromagnetic and electrostatic shielding.
- Nominal coil voltage (expressed as two digits).
- Switch configuration.
- Coil terminal location (top view):
  - 1. Diagonal. 2. Side. 3. End.
- Relay width:
  - 1 - .375 Max. 2 - .475 Max.
  - 3 - .575 Max. 4 - .675 Max.
  - 5 - .775 Max.
- Basic Series::
  - 1.25 max. long by .355 max. high.

* D added to the P/N indicates a suppression diode.
* L added to the P/N indicates 390 coil option available on LR1*-1A05-0B or LR1*-1A05-0C.

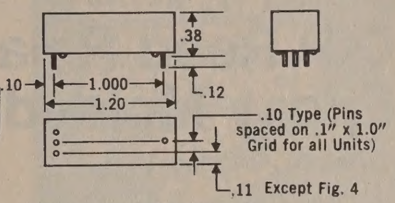
ELECTRONIC INSTRUMENT & SPECIALTY CORP.

Miniature Reed Relays

- .10″ x 1.00″ Grid
- Dry Reed
- Mercury Wetted
- Epoxy Encapsulated



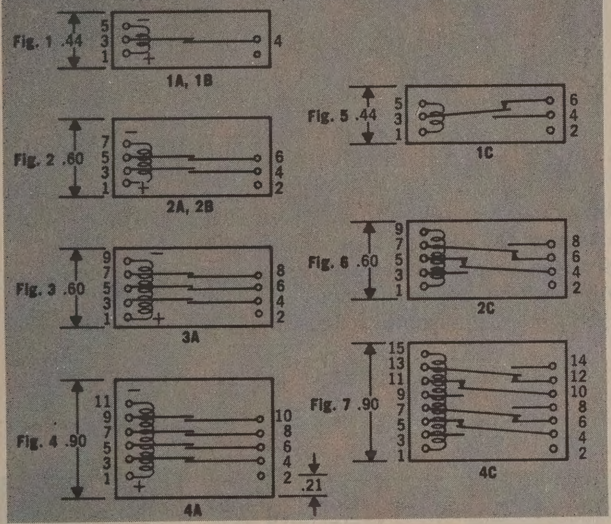
Dimensions Typical of all Units



Pins are .022/.027 Dia. Tinned

SCHEMATICS/DIMENSIONS

Note: All Views are Top of Unit — Pins on Bottom



OPTIONS

For Electrostatic Shield, add Suffix S (connected to Pin #2)
For Magnetic Shield, add Suffix H

CONTACT RATING

Dry Reed, Form A, B:

½ amp. max., 200 volts max. with 10 watts power limitation. Initial contact resistance .10 ohm max. Breakdown voltage 300 volts min.

DRY Reed, Form C:

¼ amp. max., 28 volts max. with 3 watts power limitation. Initial contact resistance .15 ohm max. Breakdown voltage 250 volts min.

Mercury Wetted Form A:

2 amp max., 100 volts max. with 50 watts power limitation. Initial contact resistance .05 ohm max. Breakdown voltage 1000 volts min.

GENERAL SPECIFICATIONS

Switching Speed, Typical*	Operate Time	Release Time	Bounce Time
Dry Reed, Form A	.5 ms	.1 ms	.2 ms
Dry Reed, Form B	.2 ms	.2 ms	.3 ms
Dry Reed, Form C	.5 ms	.1 ms	N.O. .5 ms N.C. 1.5 ms
Mercury Wetted, Form A	2.0 ms	2.0 ms	.0 ms

Insulation Resistance:
Greater than 1 × 10¹⁰ ohms, except Form C (1 × 10⁹) at 100 VDC 40% rel. hum.

Life Expectancy:
100 x 10⁶ operations at low level
10 x 10⁶ at rated load
Mercury Wetted 10 X higher

Operate Temperature: −30°C to +65°C

Storage Temperature: −55°C to +85°C

* Consult factory or local representative for performance details.

ALL VALUES AT 20°C

DRY REED

Cat. No.	Contact Form	Volts	Coil Resist. ±10%	Max. Pull-in	Min. Drop-out	Fig.	Price 100 Qty.
MS1A05	1A	5	100	4.0	.8	1	2.19
MS1A06		6	125	4.8	.9		
MS1A12		12	500	9.6	1.8		
MS1A24		24	2000	19.2	3.6		
MS2A05	2A	5	85	4.0	.8	2	3.19
MS2A06		6	110	4.8	.9		
MS2A12		12	440	9.6	1.8		
MS2A24		24	1750	19.2	3.6		
MS3A05	3A	5	65	4.0	.8	3	3.97
MS3A06		6	85	4.8	.9		
MS3A12		12	340	9.6	1.8		
MS3A24		24	1350	19.2	3.6		
MS4A05	4A	5	45	4.0	.8	4	4.75
MS4A06		6	60	4.8	.9		
MS4A12		12	250	9.6	1.8		
MS4A24		24	1000	19.2	3.6		
MS1B05	1B	5	100	4.0	.8	1	2.94
MS1B06		6	125	4.8	.9		
MS1B12		12	500	9.6	1.8		
MS1B24		24	2000	19.2	3.6		
MS2B05	2B	5	85	4.0	.8	2	3.68
MS2B06		6	110	4.8	.9		
MS2B12		12	440	9.6	1.8		
MS2B24		24	1750	19.2	3.6		
MS1C05	1C	5	100	4.0	.8	5	4.47
MS1C06		6	125	4.8	.9		
MS1C12		12	500	9.6	1.8		
MS1C24		24	2000	19.2	3.6		
MS2C05	2C	5	60	4.0	.8	6	7.46
MS2C06		6	80	4.8	.9		
MS2C12		12	310	9.6	1.8		
MS2C24		24	1250	19.2	3.6		
MS4C05	4C	5	22	4.0	.8	7	13.36
MS4C06		6	30	4.8	.9		
MS4C12		12	125	9.6	1.8		
MS4C24		24	500	19.2	3.6		

†MERCURY WETTED

Cat. No.	Contact Form	Volts	Coil Resist. ±10%	Max. Pull-in	Min. Drop-out	Fig.	Price 100 Qty.
MS1A05M	1A	5	70	4.0	.8	1	4.60
MS1A06M		6	95	4.8	.9		
MS1A12M		12	375	9.6	1.8		
MS1A24M		24	1500	19.2	3.6		
MS2A05M	2A	5	45	4.0	.8	2	7.04
MS2A06M		6	60	4.8	.9		
MS2A12M		12	250	9.6	1.8		
MS2A24M		24	1000	19.2	3.6		
MS4A05M	4A	5	18	4.0	.8	4	12.54
MS4A06M		6	25	4.8	.9		
MS4A12M		12	100	9.6	1.8		
MS4A24M		24	400	19.2	3.6		

Prices and specifications subject to change without notice.

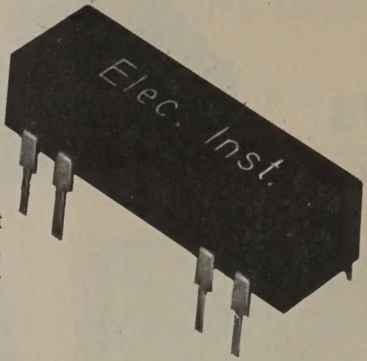
† Must be mounted vertically. Coil pins at bottom.

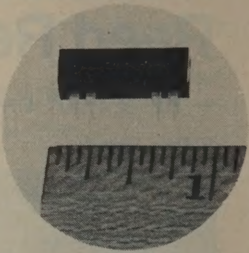
42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300

ELECTRONIC INSTRUMENT & SPECIALTY CORP.

DIP Reed Relays Epoxy Molded

Form 1A, 2A, and 1C





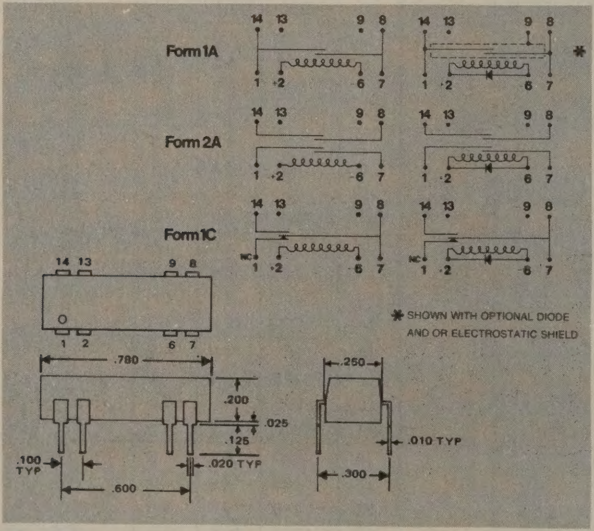
ACTUAL SIZE

Now high-performance DIP reed relays available in low-cost Lead-Frame configuration. Offering extremely easy access, these superbly engineered relays are made to provide reliable, trouble-free operation at inexpensive prices.

- **Low Profile**
- **Automatic Insertion**
- **Improved Accessibility**
- **Driven Directly from TTL & DTL Logic**

Electronic Instrument and Specialty Corporation is a leading producer of reed relays for industrial and commercial applications. EI&S Corp. assures highest quality and superior performance from all reed relays under the most demanding conditions.

Contact Rating:	Form 1A Form 2A	Form 1C
Amp. max. DC	½	¼
Volts max. DC	100	28
Ohm max. initial contact resistance	.150	.200
Watts max. DC power limitation	10	3
Volts min. DC breakdown voltage	250	200



ALL VALUES AT 20°C

Cat. No.	Volts	Coil Resist. ±10%	Max. Pull-In	Min. Drop-Out	Price 100 Qty.
DL1A05	5	500	3.8	.8	$1.98
DL1A06	6	500	4.8	.9	1.98
DL1A12	12	1000	9.6	1.8	2.23
DL1A24	24	1500	19.2	3.6	2.40
DL2A05	5	200	3.8	.8	3.12
DL2A06	6	200	4.8	.9	3.12
DL2A12	12	500	9.6	1.8	3.32
DL2A24	24	2150	19.2	3.6	3.64
DL1C05	5	200	3.8	.8	3.82
DL1C06	6	200	4.8	.9	3.82
DL1C12	12	600	9.6	1.8	4.09
DL1C24	24	1500	19.2	3.6	4.35

Prices and specifications subject to change without notice.

OPTIONS:

Coil Pins @ 6 & 13 - add suffix C

For Electrostatic Shield, Form A only add Suffix S (connected to pin #9)

For Diode across coil, add suffix D (Pin #2 positive; Pin #6 negative)

	Form 1A	Form 2A	Form 1C
Operating Time, Typical	.350 ms	.500 ms	.500 ms
Release Time, Typical	.100 ms	.100 ms	.100 ms
Bounce Time, Typical	.150 ms	.150 ms	.500 ms
Insulation Resistance, Ohms min.	10^{10}	10^{10}	10^{9}
Operate Temperature	−30°C to +65°C		
Storage Temperature	-55°C to +100°C		
Life Expectancy @ low level	100×10^{6}	100×10^{6}	50×10^{6}
@ rated load	10×10^{6}	10×10^{6}	5×10^{6}

CALL FOR ENGINEERING ASSISTANCE & FREE CATALOG!

617/438·5300

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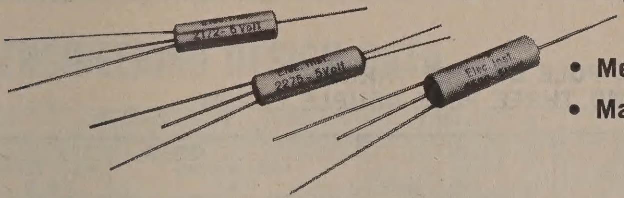
ELECTRONIC INSTRUMENT & SPECIALTY CORP.

Axial Reed Relays



- Microminiature
- Dry Reed
- Mercury Wetted
- Magnetically Shielded

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SCHEMATICS/DIMENSIONS

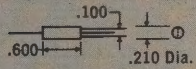


Fig. 1

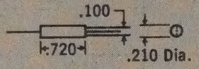


Fig. 2

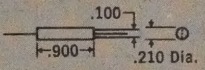


Fig. 3

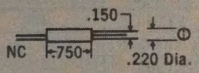


Fig. 4

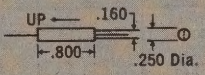


Fig. 5

GENERAL SPECIFICATIONS

Speed, Typical*	Operate Time (excluding bounce)	Release Time
Dry Reed, Form 1A	.2 to .5 ms	.1 ms
Dry Reed, Form 1C (N.O.)	.4 ms	.1 ms
Mercury Wetted, Form 1A	2 ms	2 ms

Insulation Resistance: 1 x 10^{11} ohms min., except Form C (1 x 10^{10})

Life Expectancy: 100 x 10^6 operations at low level; 10 x 10^6 at rated load, Mercury Wetted 10 X higher

Operate Temperature: 0°C to +65°C

Storage Temperature: −55°C to +85°C

*Consult factory for performance details.

OPTIONS

For Electrostatic Shield, add Suffix S

Cat. No.	2160S			2160R				2172				2190				2275				2580			
Dimensions	Fig. 1			Fig. 1				Fig. 2				Fig. 3				Fig. 4				Fig. 5			
Contact Type	DRY REED																			Mercury Wetted			
Contact Arrangement	1A			1A				1A				1A				1C				1A			
Nominal Voltage	5	6	12	5	6	12	24	5	6	12	24	5	6	12	24	5	6	12	24	5	6	12	24
Coil Resist., Ohms	750	1000	3800	375	500	2100	4800	400	630	2800	5500	400	630	2800	5500	240	325	1200	5000	105	105	400	1700
Contact Ratings																							
Current, Max.	10 ma			10 ma				¼ amp.				½ amp.				¼ amp.				1 amp.			
Voltage, Max.	28 volts			28 volts				100 volts				200 volts				28 volts				100 volts			
Power, Max.	.3 watts			.3 watts				10 watts				10 watts				3 watts				28 watts			
Initial Contact Resistance Max.	.200 ohms			.200 ohms				.150 ohms				.100 ohms				.150 ohms				.050 ohms			
Price 100 Qty., $	4.21	4.21	4.84	3.66	3.66	4.21	5.49	3.66	3.66	4.21	5.49	3.66	3.66	4.21	5.49	5.68	5.68	6.24	7.37	4.64	4.64	5.21	6.41
Pull-in Voltage Max. @ 20°C	80% of nominal voltage																						
Drop-out Voltage Min. @ 20°C	15% of nominal voltage																						

Prices subject to change without notice.

ORDERING INFORMATION

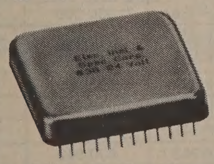
To order, specify Catalog Number, Coil Voltage and Optional Electrostatic Shield if required.

Example:	2160S	12	S
	Catalog Number	Coil Voltage	Electrostatic Shield

SPECIAL PURPOSE RELAYS

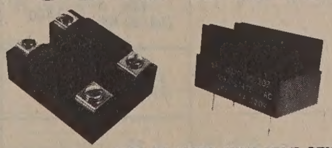
Electronic Instrument has produced a wide assortment of tailored relays beyond its standard lines. Some of these styles are shown below and are available with almost off-the-shelf delivery. If your requirement is not a standard, send us your specifications and let us prove our capability to produce the relay for your application at economical prices.

MULTIPLE FLAT PACK



Relay designed to permit 0.5 inch PC board stacking; will insert easily in standard contact strip.

Solid State AC Relays



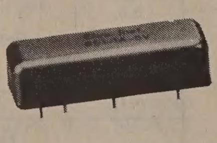
- Optoelectronic Isolation
- Requires Little Power; TTL; MOS Logic or even a Photocell Provides Ample Power
- Zero Voltage Crossover
- Contacts AC SPST (Normally Open)

1 TO 25 AMPS AVAILABLE SEND FOR COMPLETE LITERATURE

VRM (MERCURY-WETTED VERTICAL)

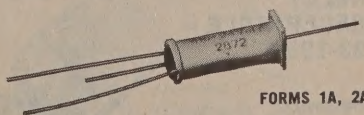
Solution to problems encountered when printed circuit boards must be mounted horizontally — yet require stable contact resistance with no bounce.

HIGH TEMPERATURE



A wide selection of high temperature relays capable of operating up to 150°C are available.

LOW COST



FORMS 1A, 2A, 1B

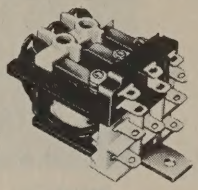
Axial Leads
Size: ⅜ dia. x ⅞ long (bobbin) Form 1A only
Rating: ½ amp., 200 VDC, 10 watts

42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300

ESSEX STANCOR A.C. D.C. GENERAL PURPOSE RELAYS

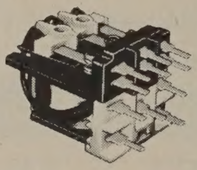
TYPE 93 SOLDER TERMINALS

FIGURE 1



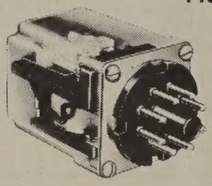
TYPE 93 PRINTED CIRCUIT

FIGURE 2



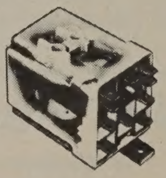
TYPE 93P 8 & 11 PIN PLUG-IN

FIGURE 3



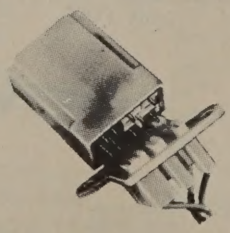
TYPE 93Q 3/16" QUICK CONNECT

FIGURE 4



TYPE 93 RELAY RECEPTACLE 93-185-1

Hardware Included



SINGLE POLE DOUBLE THROW
TWO AND THREE POLE DOUBLE THROW

Coil Voltage	D.C. Resistance in Ohms @ 25°C	Contact Form	Open Type		
			Solder Terminals (Fig.1)		Printed Circuit (Fig. 2)
			10 Amp. Button Contacts	5 Amp. Cross-Bar Contacts	5 Amp. Cross-Bar Contacts
			Catalog Number	Catalog Number	Catalog Number
24 (50/60 Hz)	55	1PDT	93-904 •	93-934 •	*93-964 •
		2PDT	93-905	93-935 •	*93-965 •
		3PDT	93-906 •	93-936 •	*93-966 •
120 (50/60 Hz)	1400	1PDT	93-907 •	93-937 •	*93-967 •
		2PDT	93-908	93-938 •	*93-968 •
		3PDT	93-909	93-939 •	*93-969 •
208/240 (50/60 Hz)	4850	1PDT	93-910 •	93-940 •	—
		2PDT	93-911	93-941 •	—
		3PDT	93-912	93-942 •	—
12 D.C.	96	1PDT	93-916 •	93-946 •	*93-976
		2PDT	93-917 •	93-947 •	*93-977 •
		3PDT	93-918 •	93-948 •	*93-978 •
24 D.C.	384	1PDT	93-919 •	93-949 •	*93-979 •
		2PDT	93-920 •	93-950 •	*93-980 •
		3PDT	93-921 •	93-951 •	*93-981 •

The STANCOR Type 93 relays are used in vending machines, heating, air conditioning, business machines, control panels, appliances, data processing equipment, office machines, communications systems and instruments.

The coil bobbin and contact terminal block are molded plastic and are resistant to arc tracking. The contact terminal allows - (a) easy insertion and removal of connectors, (b) stresses caused by wiring hook-up cannot change relay adjustment. The contact springs are molded as an integral assembly and give excellent stability in all environmental conditions. The armature contact springs are connected to the terminals by flexible insulated leads welded to the terminals. Connections for the contacts and coil are located on the front of the relay.

Solder terminal type has combined front, single hole screw and stud mounting. Printed circuit* type may be controlled by SCR if firing angle is no more than 10 degrees.

The plug-in relay has high impact case and standard pin connections.

Quick connect type designed for front mounting or polarized socket mounting. Use 93-185-1 socket kit. Relay has .20 x .187 terminals. UL & CSA recognized under Component Recognition Program.

Coil Voltage	D.C. Resistance in Ohms @ 25°C	Contact Form	Enclosed Type			
			Plug-In (Fig.3)		Quick Connect Terminals (Fig. 4)	
			10 Amp. Button Contacts	5 Amp. Cross-Bar Contacts	10 Amp. Button Contacts	5 Amp. Cross-Bar Contacts
			Catalog Number	Catalog Number	Catalog Number	Catalog Number
24 (50/60 Hz)	55	1PDT	93P-904 •	93P-934 •	93Q-904	93Q-934
		2PDT	93P-905 •	93P-935	93Q-905	93Q-935 •
		3PDT	93P-906 •	93P-936 •	93Q-906	93Q-936 •
120 (50/60 Hz)	1400	1PDT	93P-907 •	93P-937 •	93Q-907	93Q-937 •
		2PDT	93P-908	93P-938	93Q-908	93Q-938
		3PDT	93P-909	93P-939 •	93Q-909	93Q-939
208/240 (50/60 Hz)	4850	1PDT	93P-910 •	93P-940 •	93Q-910 •	93Q-940 •
		2PDT	93P-911	93P-941 •	93Q-911 •	93Q-941 •
		3PDT	93P-912 •	93P-942 •	93Q-912	93Q-942 •
12 D.C.	96	1PDT	93P-916 •	93P-946 •	93Q-916 •	93Q-946 •
		2PDT	93P-917	93P-947 •	93Q-917 •	93Q-947 •
		3PDT	93P-918	93P-948 •	93Q-918 •	93Q-948 •
24 D.C.	384	1PDT	93P-919 •	93P-949 •	93Q-919 •	93Q-949 •
		2PDT	93P-920	93P-950	93Q-920	93Q-950 •
		3PDT	93P-921 •	93P-951 •	93Q-921	93Q-951 •

CONTACT RATINGS

A.C. CURRENT					D.C. CURRENT	
A.C. Voltage	Fine Silver Button		Gold-Alloy Cross Bar		Button	Cross Bar
	Inductive	Resistive	Inductive	Resistive	@ 28 V.D.C.	@ 28 V.D.C.
120	10FL 30LRA	10 Amp.	1/10 H.P.	5 Amp.	5 Amp. Resistive	5 Amp. Resistive
240	5FL 15LRA	5 Amp.	1/10 H.P.	3 Amp.	Consult Factory on U.L. and C.S.A.	

•Available until stock is depleted.

ENGINEERING DESIGN DATA

A.C. Type	Magnet Coil Rating (Volt Amperes)			Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Inrush	Sealed Nom.	Sealed Max.	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
93	4.5	3.0	4	85%	110%	1500	1000	1500	Fine Silver	Gold Alloy‡	100,000†	6	10,000,000	60	160

D.C. Type	Coil Rating	Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Nominal Magnetic Coil Rating (Watts)	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
93	1.5	75%	110%	1500	1000	1500	Fine Silver	Gold Alloy‡	100,000	6	10,000,000	60	160

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

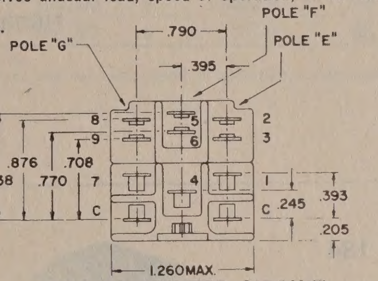
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

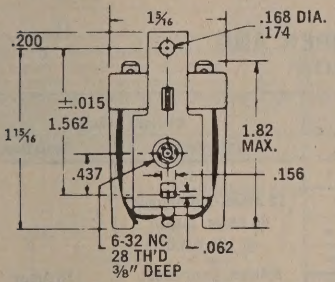
‡ Cross-bar contacts.

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
93	E12139	LR13360-31

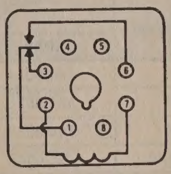
* U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (not standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.


POLE "F"
.790
POLE "G"
POLE "E"
.395
8
9
5
6
2
3
.876
.708
.938
.770
7
4
C
C
.245
.393
.205
1.260MAX.

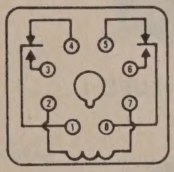
TYPE 93 PRINTED CIRCUIT


1⁵⁄₁₆
.168 DIA.
.174
.200
±.015
1.562
1¹³⁄₁₆
1.82
MAX.
.437
.156
6-32 NC
28 TH'D
⅜" DEEP
.062

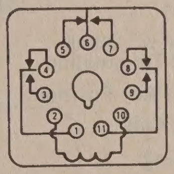
TYPE 93 SOLDER TERMINAL



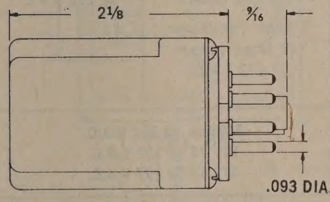
93P ONE POLE



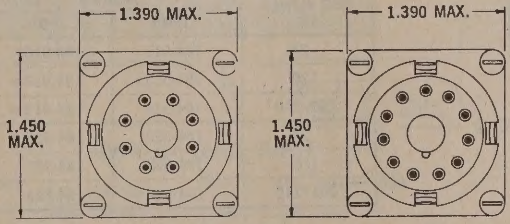
93P 2 POLE


5
6
7
4
8
3
9
2
10
1
11

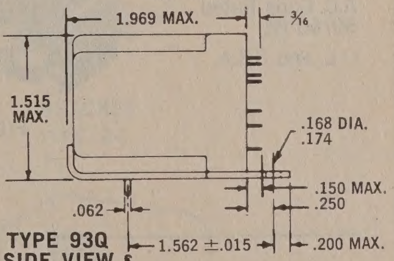
93P 3 POLE


2⅛
⁹⁄₁₆
.093 DIA.

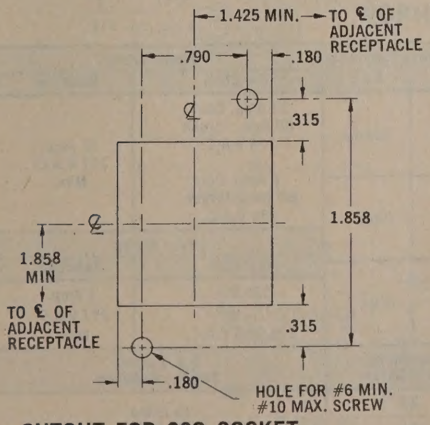
TYPE 93 PLUG-IN SIDE VIEW


1.390 MAX.
1.450
MAX.
1.390 MAX.
1.450
MAX.

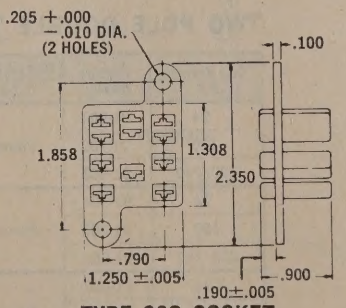
TYPE 93 PLUG-IN OCTAL BASE / 11 PIN BASE


1.969 MAX.
³⁄₁₆
1.515
MAX.
.168 DIA.
.174
.150 MAX.
.250
.062
1.562 ±.015
.200 MAX.

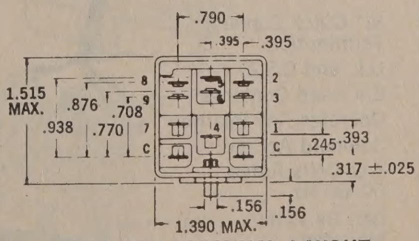
TYPE 93Q SIDE VIEW ℄


1.425 MIN. TO ℄ OF ADJACENT RECEPTACLE
.790
.180
℄
.315
1.858
1.858
MIN
TO ℄ OF ADJACENT RECEPTACLE
℄
.315
.180
HOLE FOR #6 MIN.
#10 MAX. SCREW

CUTOUT FOR 93Q SOCKET


.205 +.000
−.010 DIA.
(2 HOLES)
.100
1.858
1.308
2.350
.790
1.250 ±.005
.190±.005
.900

TYPE 93Q SOCKET


.790
.395
.395
1.515
MAX.
.876
8
.708
.938
.770
7
C
2
3
4
C
.245
.393
.317 ±.025
.156
.156
1.390 MAX.

TYPE 93Q TERMINAL LAYOUT

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

TERMINAL AND POLE CONFIGURATION

Pole Form	Coil		Pole "E"			Pole "F"			Pole "G"		
			Com.	N.C.	N.O.	Com.	N.C.	N.O.	Com.	N.C.	N.O.
SP., D.T.	C	C				4	5	6			
2P., D.T.	C	C	1	2	3				7	8	9
3P., D.T.	C	C	1	2	3	4	5	6	7	8	9

ESSEX STANCOR A.C. D.C. GENERAL PURPOSE RELAYS

TYPE 84

Totally Enclosed
Low Cost
Screw or ¼″ Quick Connect Termination (Except 6 V.A.C. in Screw Type only)
Operates Any Position
Isolated Coil
I Mounting Bracket
A.C. Coils Rated 50/60 Hz
U.L. and C.S.A.

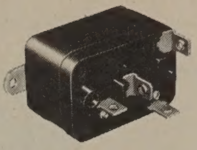


FIGURE 1

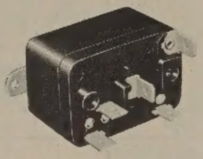


FIGURE 2

SINGLE POLE NORMALLY OPEN AND SINGLE POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number Figure 1		Contact Rating 125/250 V.A.C.	
	1PNO	1PDT	Inductive	Resistive
6	84-901	84-905 •	N.O. 8 Amps. Continuous 25 Amps. Inrush D.T. 8 Amps. Continuous 18 Amps. Inrush	N.O. 16 Amps. Continuous D.T. 8 Amps. Continuous
24	84-902	84-906		
120	84-903	84-907		
230/240	84-904	84-908		
Coil Voltage A.C.	**Catalog Number Figure 2**			
	1PNO	**1PDT**		
24	84-912	84-916		
120	84-913	84-917		
230/240	84-914	84-918		
24	84-922	84-926	3 Amps. @ 125 V.A.C. or 1.5 Amps. @ 250 V.A.C. Pilot Duty	
120	84-923	84-927		
230/240	84-924 •	84-928		

Coil Voltage D.C.	Resistance in Ohms @ 25°C	Catalog Number Figure 1	D.C. Contact Rating Inductive	
			Voltage	Current
12	90	84D-902	12	3 Amp.
24	280	84D-903	24	1.5 Amp.

TYPE 184

Totally Enclosed
Low Cost
Screw or ¼″ Quick Connect Termination
Operates Any Position
Isolated Coil
I Mounting Bracket
A.C. Coils Rated 50/60 Hz
U.L. and C.S.A.

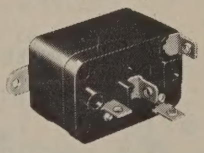


FIGURE 1

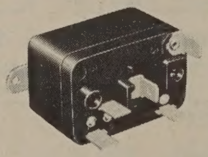


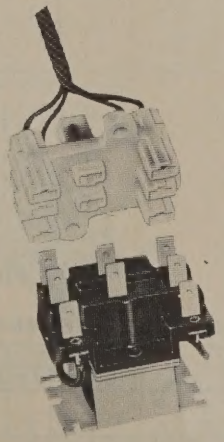
FIGURE 2

SINGLE POLE NORMALLY OPEN AND SINGLE POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number Figure 1		Contact Rating	
	1PNO	1PDT	Inductive	Resistive
6	184-901 •	184-905 •	12 Amps. Continuous 60 Amps. Inrush @ 125 V.A.C. 8 Amps. Continuous 48 Amps. Inrush @ 250 V.A.C. 7 Amps. Continuous 42 Amps. Inrush @ 277 V.A.C.	18 Amps. Continuous @ 277 V.A.C.
24	184-902	184-906		
120	184-903	184-907 •		
208/240	184-904 •	184-908 •		
Coil Voltage A.C.	**Catalog Number Figure 2**			
	1PNO	**1PDT**		
24	184-912	184-916		
120	184-913 •	184-917 •		
208/240	184-914	184-918 •		
24	184-922	184-926 •	3 Amps. @ 277 V.A.C. 125 VA @ 125 V.A.C. 277 VA @ 277 V.A.C.	
120	184-923	184-927		
208/240	184-924 •	184-928		

TYPE 91

¼″ Quick Connect Termination
U.L. and C.S.A.
Enclosed Contacts
Operates Any Position
Solenoid Action
A.C. Coils Rated 50/60 Hz
Can Be Panel Mounted
Separate 91-180-1 Socket and Terminal Kit



TWO POLE DOUBLE THROW

Coil Voltage A.C.	Catalog Number	Circuit Rating Terminals		Power Rating	
		1-2-3	4-5-6	Inductive	Resistive
24	91-901	Power	Power	12 Amp. Cont. 60 Amp. Inrush 125 V.A.C. 6 Amp. Cont. 35 Amp. Inrush 250 V.A.C.	15 Amp. 277 V.A.C. Max.
120	91-902				
230/240	91-903				
24	91-904 •	Power	Pilot		
120	91-905				
230/240	91-906			**Pilot Rating**	
				Inductive	**Resistive**
24	91-907	Pilot	Pilot	125 V.A. 1/10 H.P. 125/250 V.A.C.	3 Amp. 277 V.A.C. Max.
120	91-908 •				
230/240	91-909 •				

Coil Voltage D.C.	Catalog Number	Resistance in Ohms @ 25°C	D.C. Contact Rating - Resistive
12	91D-912	23	10 Amps. @ 32 V. Max.
24	91D-913	102	

•Available until stock is depleted.

ESSEX STANCOR

ENGINEERING DESIGN DATA

A.C. Type	Magnet Coil Rating (Volt Amperes) Inrush	Sealed Nom.	Sealed Max.	Operation in % of Nom. Coil Rating Pick-up	Max.* Safe Operate	Breakdown Voltage All Terminals-60 Hz RMS Opposite Polarity	Open Contacts Same Polarity	To Ground	Contact Material Power	Pilot	Electrical Life Oper. At Rated Load	Oper. Per Min.	Mechanical Life§ Oper. At No Load	Oper. Per Min.	Max. Oper. Amb. °F
84	4	2.8	3	85%	110%	1500	1000	1500	Silver Alloy	Fine Silver	100,000†	6	1,000,000	60	140
91	22	8	10	85%	110%	1500	1000	1500	Fine Silver	Gold Alloy‡	100,000†	6	750,000	60	130
184	4	2.8	3	85%	110%	1500	1000	1500	Silver Alloy	Fine Silver	100,000†	6	1,000,000	60	150

D.C. Type	Coil Rating Nominal Magnetic Coil Rating (Watts)	Operation in % of Nom. Coil Rating Pick-up	Max.* Safe Operate	Breakdown Voltage All Terminals-60 Hz RMS Opposite Polarity	Open Contacts Same Polarity	To Ground	Contact Material Power	Pilot	Electrical Life Oper. At Rated Load	Oper. Per Min.	Mechanical Life§ Oper. At No Load	Oper. Per Min.	Max. Oper. Amb. °F
84D	3	75%	110%	1500	1000	1500	—	Silver Alloy	100,000	6	1,000,000	60	140
91D	6.5	75%	110%	1500	1000	1500	Fine Silver	—	100,000	6	750,000	60	140

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

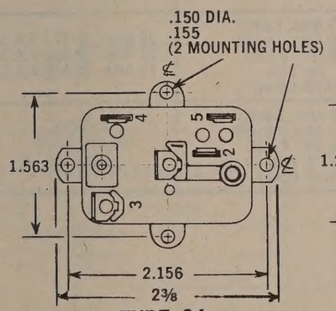
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

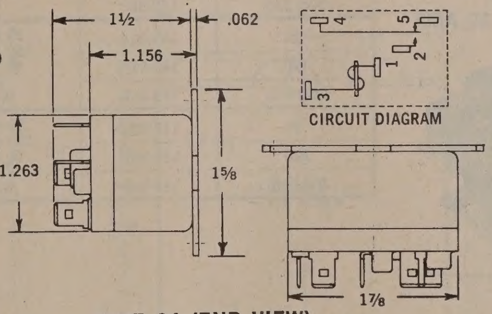
‡ Cross-bar contacts.

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
84	E12139 or E22381	LR13360
84 & 184	E12139	LR13360
91	E12139	LR13360

* U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (not standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.

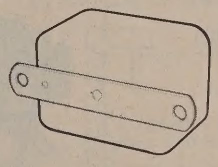

.150 DIA.
.155
(2 MOUNTING HOLES)
℄
℄
1.563
4
5
1
2
3
2.156
2⅜

TYPE 84

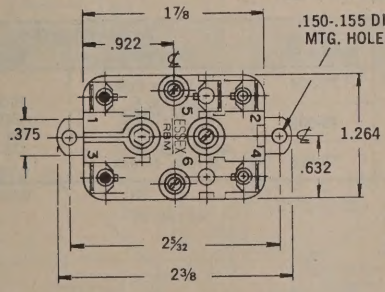

1½
.062
1.156
1.263
1⅝
1⅞
4
5
1
2
3

CIRCUIT DIAGRAM

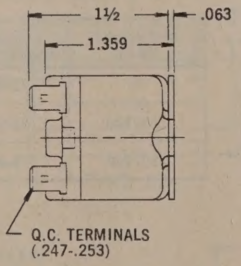
TYPE 84 (END VIEW)



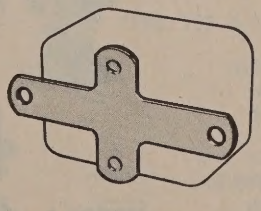
I-BRACKET
TYPE 84


1⅞
.922
.150-.155 DIA.
MTG. HOLES
℄
℄
.375
1.264
.632
1
2
3
4
5
6
ESSEX
RBM
2⁵⁄₃₂
2⅜

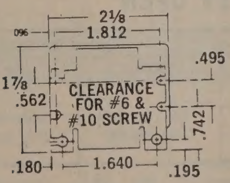
TYPE 184


1½
.063
1.359
Q.C. TERMINALS
(.247-.253)

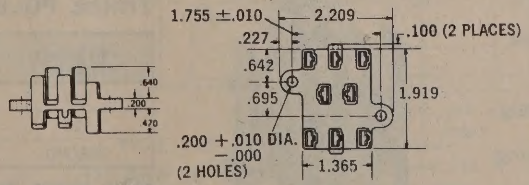
TYPE 184



(END BRACKET)
TYPE 184


2⅛
096
1.812
.495
1⅞
.562
CLEARANCE
FOR #6 &
#10 SCREW
.742
.180
1.640
.195

TYPE 91


.640
.200
.470
1.755 ±.010
2.209
.227
.100 (2 PLACES)
.642
.695
1.919
.200 +.010 −.000 DIA.
(2 HOLES)
1.365

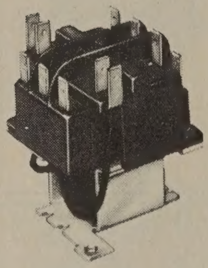
TYPE 91 SOCKET

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR A.C. D.C. GENERAL PURPOSE RELAYS

TYPE 192

¼" Quick Connect Termination
U.L. and C.S.A
Enclosed Contacts
Operates Any Position
Solenoid Action
Manual Operating Button
A.C. Coils Rated 50/60 Hz



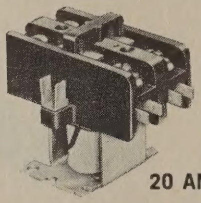
THREE POLE DOUBLE THROW

<table>
<tr><th rowspan="2">Coil Voltage A.C.</th><th rowspan="2">Catalog Number</th><th colspan="3">Circuit Rating Terminals</th><th colspan="2">Power Rating</th></tr>
<tr><th>1-2-3</th><th>4-5-6</th><th>7-8-9</th><th>Inductive</th><th>Resistive</th></tr>
<tr><td>24</td><td>192-901</td><td rowspan="3">Power</td><td rowspan="3">Power</td><td rowspan="3">Power</td><td rowspan="3">12 Amp. Cont.
60 Amp. Inrush
125 V.A.C.
6 Amp. Cont.
35 Amp. Inrush
250 V.A.C.</td><td rowspan="3">15 Amp.
277 V.A.C.
Max.</td></tr>
<tr><td>120</td><td>192-902</td></tr>
<tr><td>230/240</td><td>192-903</td></tr>
<tr><td>24</td><td>192-904 •</td><td rowspan="3">Power</td><td rowspan="3">Pilot</td><td rowspan="3">Power</td><th colspan="2">Pilot Rating</th></tr>
<tr><td>120</td><td>192-905 •</td><th>Inductive</th><th>Resistive</th></tr>
<tr><td>230/240</td><td>192-906 •</td><td>125 V.A
1/10 H.P.
125/250 V.A.C.</td><td>3 Amp.
277 V.A.C.
Max.</td></tr>
<tr><th>Coil Voltage D.C.</th><th>Catalog Number</th><th colspan="3">Resistance in Ohms @ 25°</th><th colspan="2">D.C. Contact Rating - Resistive</th></tr>
<tr><td>12</td><td>192D-912</td><td colspan="3">26</td><td colspan="2" rowspan="2">10 Amps.
@ 32 V. Max.</td></tr>
<tr><td>24</td><td>192D-913</td><td colspan="3">104</td></tr>
</table>

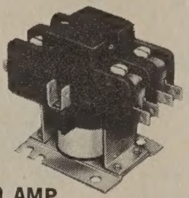
A.C. POWER CONTACTORS

TYPE 143

Straight-Thru Wiring
Low Cost
¼" Auxiliary Quick-Connect Terminals
U.L. and C.S.A.
Screw Power Terminals For #10 Solid Wire Max.
25 & 30 Amp Units Have Cover (Adds ¼" to Height)
Double-Make Contacts
Small Size



20 AMP



25-30 AMP

TWO POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating Inductive	Contact Rating Resistive
24	143-901	20 Amp. Cont. 100 Amp. Inrush @ 277 V.A.C. Per Pole	25 Amp. @ 277 V.A.C. 15 Amp. @ 480 V.A.C. 10 Amp. @ 600 V.A.C.
120	143-902		
208/240	143-903		
24	143-914	25 Amp. Cont. 150 Amp. Inrush @ 277 V.A.C. Per Pole With Cover	35 Amp. @ 277 V.A.C. 21 Amp. @ 480 V.A.C. 15 Amp. @ 600 V.A.C.
120	143-915		
208/240	143-916		
24	143-906•	30 Amp. Cont. 150 Amp. Inrush @ 277 V.A.C. Per Pole With Cover	35 Amp. @ 600 V.A.C. Per Pole With Cover
120	143-907		
208/240	143-908•		

TYPE 75

Contact Cover
Screw Power Termination
#8 Solid Wire Max.
Low Wattage Coil
13" Lead Wire or Quick Connect Coil Terminals
Hardware Included in Boxed Units Only

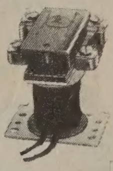


FIGURE 1

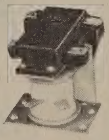


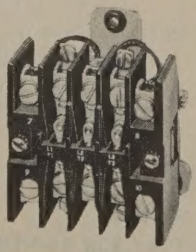
FIGURE 2

TWO POLE NORMALLY OPEN

Coil Voltage (60 Hz)	Catalog Number Fig. 1	Catalog Number Fig. 2	Contact Rating (A.C.) Inductive	Contact Rating (A.C.) Resistive
24	75-901	75-904	1 H.P. Per Pole 115/230 V.	25 Amp. 240 V. Per Pole .75 P.F.
115/120	75-902	75-905	2 Pole Rating 2 H.P. — 230 V. or 18 Amp. Cont. 90 Amp. Inrush	
230/240	75-903	75-906		

TYPE 85

Screw Terminals
#8 Solid Wire Max.
Double Make Contacts
¼" Auxiliary Wiring Terminals
Straight-Thru Wiring
Hi-Dielectric Materials



THREE POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.) — Inductive 250 V.	480 V.	600 V.
24	85-901	25A. Cont. 150A Inrush	15A. Cont. 90A. Inrush	12.5A. Cont. 75A. Inrush
120	85-902			
208/240	85-903			

No kiss position. Mounts any position.

•Available until stock is depleted.

ENGINEERING DESIGN DATA

A.C. Type	Magnet Coil Rating (Volt Amperes)			Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Inrush	Sealed Nom.	Sealed Max.	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
75	16	10	12	85%	110%	1500	1000	1500	Silver Alloy	—	100,000†	6	1,000,000	60	140
85	90	19	23	85%	110%	2200	2200	2200	Silver Alloy	—	100,000	6	500,000	10	130
143	24	8.9	12	85%	110%	1500	1000	1500	Silver Alloy	—	100,000†	6	500,000	60	150
192	24	8.9	12	85%	110%	1500	1000	1500	Fine Silver	Gold Alloy‡	100,000†	3	750,000	30	130

D.C. Type	Coil Rating	Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Nominal Magnetic Coil Rating (Watts)	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
192D	7	75%	110%	1500	1000	1500	Fine Silver	—	100,000	6	750,000	60	140

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

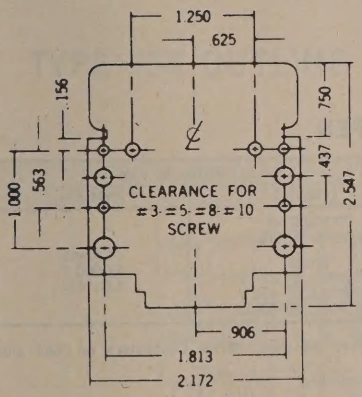
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

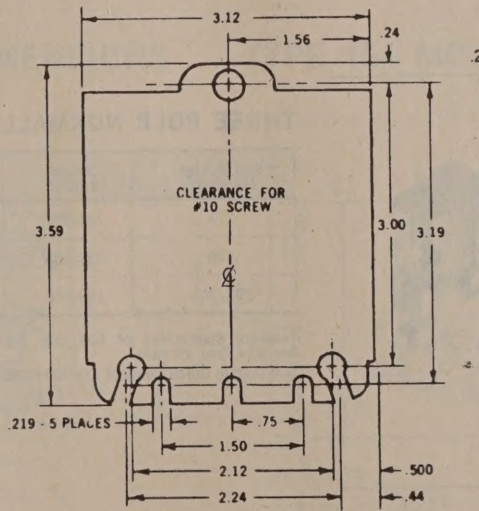
‡ Cross-bar contacts.

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
75	E12139	LR133360-14, -15
143	E12139	LR13360-45
192	E12139	LR13360-35

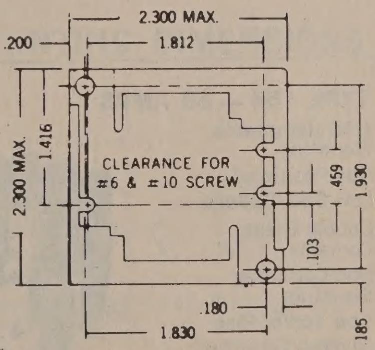
* U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (not standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.


1.250
625
.156
750
.563
1.000
1.437
2.547
CLEARANCE FOR
#3-#5-#8-#10
SCREW
906
1.813
2.172

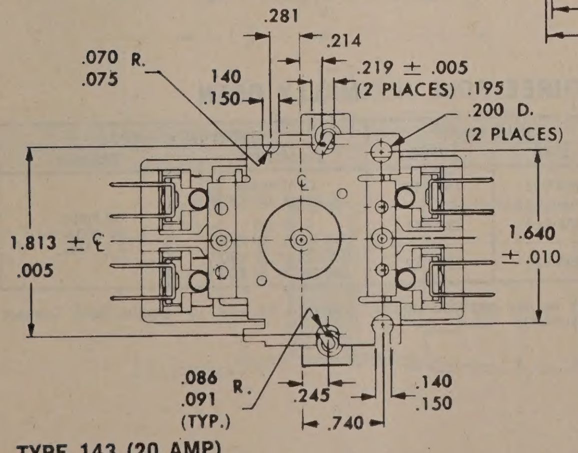
TYPE 75


3.12
1.56
.24
CLEARANCE FOR
#10 SCREW
3.59
3.00
3.19
.219 - 5 PLACES
.75
1.50
2.12
2.24
.500
.44

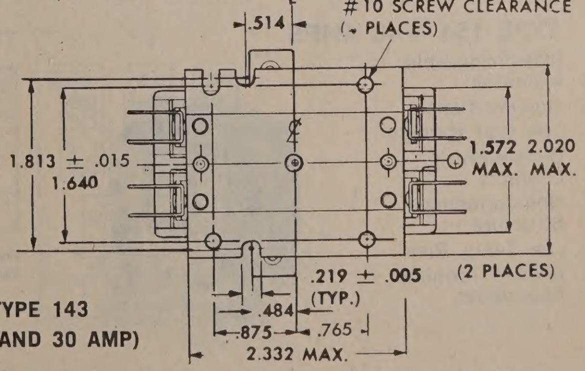
TYPE 85


2.300 MAX.
.200
1.812
2.300 MAX.
1.416
CLEARANCE FOR
#6 & #10 SCREW
.459
1.930
.103
.180
1.830
.185

TYPE 192 & 192D


.281
.214
.070 R.
.075
140
.150
.219 ± .005
(2 PLACES)
.195
.200 D.
(2 PLACES)
1.813 ±
.005
1.640
± .010
.086
.091
R.
(TYP.)
.245
.140
.150
.740

TYPE 143 (20 AMP)


.514
#10 SCREW CLEARANCE
(4 PLACES)
1.813 ± .015
1.640
1.572
MAX.
2.020
MAX.
.219 ± .005
(TYP.)
(2 PLACES)
.484
.875
.765
2.332 MAX.

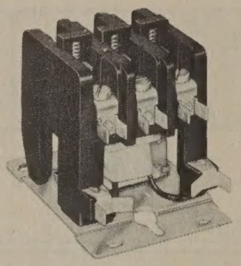
TYPE 143
(25 AND 30 AMP)

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR A.C. POWER CONTACTORS

TYPE 154 — 20 AMPS

- Interchangeable Mounting
- Non-Positional
- Low Coil Wattage
- Double-Break Contacts
- Non-Corroding Structure
- Low Temp. Rise
- Riveted Terminal Assemblies



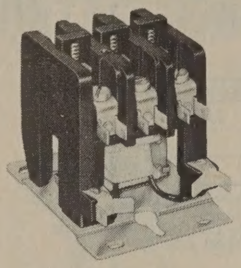
THREE POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating Per Pole	
		Inductive	Resistive
24	154-901	Continuous 20 Amps. @ 600 V. Inrush 120 Amps. @ 277 V. 100 Amps. @ 480 V. 80 Amps. @ 600 V.	30 Amps @ 600 V. A.C. Max.
120	154-902		
208/240	154-903		

Screw Connectors line and load sides for #14 thru #8 wire. ¼″ Double Quick Connect auxiliary and coil terminals.

TYPE 154 — 25 AMPS

- Interchangeable Mounting
- Non-Positional
- Low Coil Wattage
- Double-Break Contacts
- Non-Corroding Structure
- Low Temp. Rise
- Riveted Terminal Assemblies



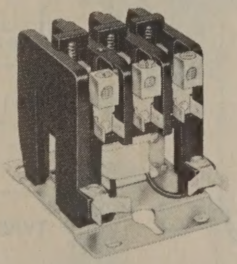
THREE POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating Per Pole	
		Inductive	Resistive
24	154-904	Continuous 25 Amps. @ 600 V. Inrush 150 Amps. @ 277 V. 125 Amps. @ 480 V. 100 Amps. @ 600 V.	35 Amps. @ 600 V. A.C. Max.
120	154-905		
208/240	154-906		

Screw Connectors line and load sides for #14 thru #8 wire. ¼″ Double Quick Connect auxiliary and coil terminals.

TYPE 154 — 30 AMPS

- Interchangeable Mounting
- Non-Positional
- Low Coil Wattage
- Double-Break Contacts
- Non-Corroding Structure
- Low Temp. Rise
- Riveted Terminal Assemblies



THREE POLE NORMALLY OPEN

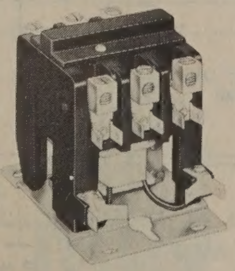
Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating Per Pole	
		Inductive	Resistive
24	154-907	Continuous 30 Amps. @ 600 V. Inrush 180 Amps. @ 277 V. 150 Amps. @ 480 V. 120 Amps. @ 600 V.	40 Amps. @ 600 V. A.C. Max.
120	154-908		
208/240	154-909		

Pressure Connectors on line side for #14 thru #4 wire. Screw Connectors on load side. For #14 thru #8 wire.

¼″ Double Quick Connect auxiliary and coil terminals.

TYPE 154 — 40 AMPS

- Interchangeable Mounting
- Non-Positional
- Low Coil Wattage
- Double-Break Contacts
- Non-Corroding Structure
- Low Temp. Rise
- Riveted Terminal Assemblies



TWO AND THREE POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number		Contact Rating Per Pole	
	2PNO	3PNO	Inductive	Resistive
24	154-913	154-910	Continuous 40 Amps. @ 600 V. Inrush 240 Amps. @ 277 V. 200 Amps. @ 480 V. 160 Amps. @ 600 V.	50 Amps. @ 600 V. A.C. Max.
120	154-914	154-911		
208/240	154-915	154-912		

Pressure Connectors on line and load side for #14 thru #4 wire. ¼″ Double Quick Connect auxiliary and coil terminals.

ENGINEERING DESIGN DATA

A.C. Tyne	Magnet Coil Rating (Volt Amperes)			Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Inrush	Sealed Nom.	Sealed Max.	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
154	80	6.5	7.5	85%	110%	1500	1000	1500	Silver Alloy	—	100,000†	6	500,000	30	155

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
154	E12139	LR13360

* U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (not standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.

CONSTRUCTION FEATURES

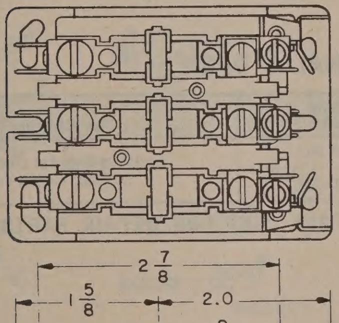
Interchangeable Mounting — The base plate of the 154 series contactors has been designed to provide mounting ease when replacing virtually any competitive contactor on the market.

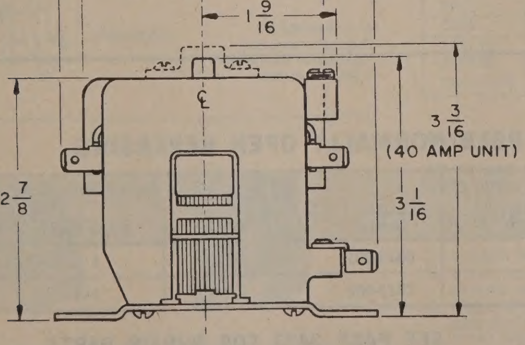
Non-Position Sensitive — The spring-actuated armature mechanism of the 154 contactor allows you to mount the contactor in any convenient mounting position . . . a great help in designing control boxes for today's compact equipment.

Low Coil Wattage — The efficient magnetic design and advanced materials used in the 154 give you the advantage of low coil wattage without sacrificing the mechanical power needed for long, reliable life at rated load. Low coil wattage is especially important when contactors are controlled by 24 V. NEC Class 2 circuits. Low wattage allows you to optimize transformer size/cost requirements.

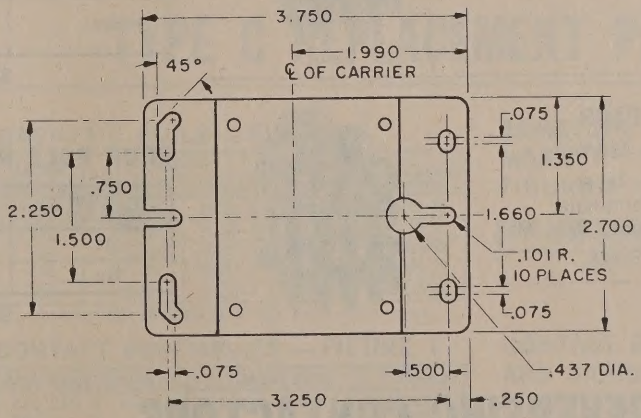
Double-Break Contact Action — The contact structure and double-break action of the 154, along with oversize contacts and contact cover (standard on 40 ampere version), provide superior reliability and life at full rated load. The 154 will reliably deliver life equivalent to 20 years of cycling at full rated load on a central air conditioning system.

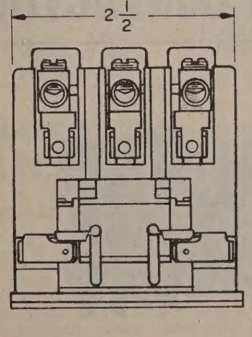
TYPE 154 OUTLINE DIMENSIONS





TYPE 154 MOUNTING DIMENSIONS





CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR A.C. INDUSTRIAL CONTACTORS

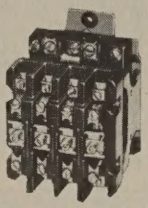
UNIQUE DESIGN PERMITS COMMON BASE, COIL & MAGNET FOR CONTACTOR RATINGS FROM 10 TO 50 AMPERES • DOUBLE BREAK "NO-KISS" CONTACT ACTION • REPLACEABLE CONTACTS & COIL • EPOXY SEALED MOLDED MAGNET COIL HOUSING • LAMINATED CORROSION RESISTANT E-TYPE MAGNET & SELF-ALIGNING ARMATURE • HI-DIELECTRIC ARC RESISTANT MOLDED CONTACT BLOCK & CARRIER • 50/60 CYCLE MAGNET COIL • RESILIENT MOUNTING

TYPE C10

10 Amp. 600 Volts

Pressure Type
Power Terminals
#8 Solid Wire Max.

All Contacts Convert
to N.C. See Page 3497



FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.)		
		Voltage	Horsepower	
			Single Phase	Three Phase
110	C10-902	120	½	¾
		240	¾	1
		600	1	1
220	C10-903	Resistive		
		10 Amp. 600 V. Max. (Per Pole)		

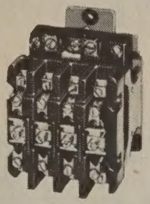
SEE PAGE 3497 FOR REPAIR PARTS

TYPE C15

15 Amp. 600 Volts

Pressure Type
Power Terminals
#8 Solid Wire Max.

All Contacts Convert
to N.C. See Page 3497



FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.)		
		Voltage	Horsepower	
			Single Phase	Three Phase
110	C15-902	120	1	1½
		240	1½	2
		600	1½	2
220	C15-903	Resistive		
		15 Amp. 600 V. Max. (Per Pole)		

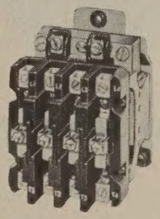
SEE PAGE 3497 FOR REPAIR PARTS

TYPE C30

30 Amp .600 Volts

Pressure Type
Power Terminals
#8 Solid Wire Max.

Size: 3⅝" x 2¾" x 3⅜"



FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.)		
		Voltage	Horsepower	
			Single Phase	Three Phase
110	C30-902	120	2	3
		240	3	7½
		600	5	10
220	C30-903	Resistive		
		30 Amp. 600 V. Max. (Per Pole)		

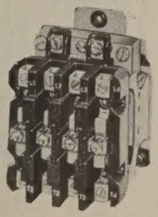
SEE PAGE 3497 FOR REPAIR PARTS

TYPE C50R

50 Amp. 480 Volts

Pressure Type
Power Terminals
#6 Stranded Wire Max.

Double Break



FOUR POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.)
110	C50R-902	Resistive Only For Electric Heating 50 Amp. — 480 Volt Max.
220	C50R-903	

SEE PAGE 3497 FOR REPAIR PARTS

A.C. REVERSING CONTACTORS

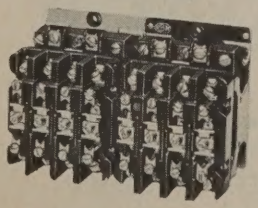
TYPE CR15

15 Amp. 600 Volt

Pressure Type
Power Terminals
#8 Solid Wire Max.

All Contacts Convert
to N.C. See Page 3497

Double Break
Contacts



FOUR POLE NORMALLY OPEN REVERSING

Coil Voltage (50/60 Hz)	Catalog Number	Contact Rating (A.C.)		
		Voltage	Horsepower	
			Single Phase	Three Phase
110	CR15-901	120	1	1½
220	CR15-902	240	1½	2

SEE PAGE 3497 FOR REPAIR PARTS

ENGINEERING DESIGN DATA

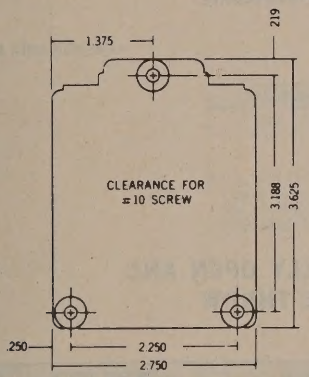
A.C. Type	Magnet Coil Rating (Volt Amperes)			Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Inrush	Sealed Nom.	Sealed Max.	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
C	90	18	21	85%	110%	2200	2200	2200	Silver Alloy	—	100,000†	6	1,000,000	10	130
CR	90	18	21	85%	110%	2200	2200	2200	Silver Alloy	—	100,000†	6	1,000,000	10	130

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

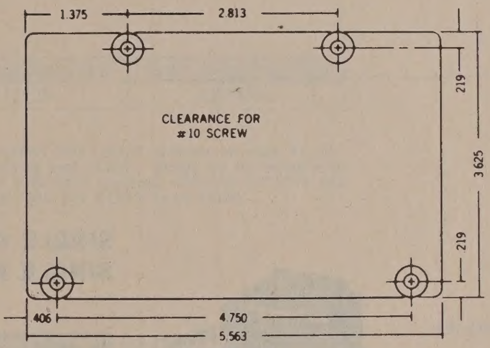
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

BASE MOUNTING DIMENSIONS



TYPE C



TYPE CR

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

TYPE C REPLACEMENT PARTS

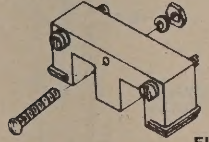


FIGURE 3

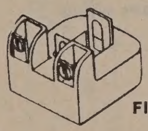


FIGURE 4

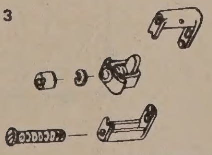


FIGURE 1 *

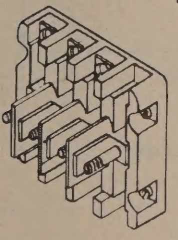
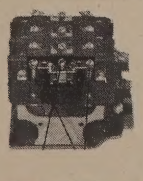
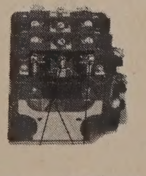


FIGURE 2

* 4 Movable — 8 Stationary per kit. Reversing contactors require two kits.



Normally Open



Normally Closed

MAGNETIC COILS — FIGURE 4

Voltage (50/60 Hz)	Standard†		Special†	
	Catalog No.	Replaces	Catalog No.	Replaces
24	MC-901	45225-5	MC-911	45225-35
110	MC-902	45225-1	MC-912	45225-31
220	MC-903	45225-2	MC-913	45225-32
440	MC-904	45225-3	MC-914	45225-33
550	MC-905	45225-4	MC-915	45225-34

† Do not substitute standard for special coils or vice versa.

CONTACT ASSEMBLIES — FIGURE 1

Used on Type	Catalog No.	Contact Rating	Replaces
C10, C15, CR15	CA-901	15 Amp. - 4 Pole	45997-3 45997-4
C50R	CA-903	50 Amp. - 4 Pole Resistive	45997-22
109153 109400 C30, CR30	CA-904	30 Amp. - 4 Pole 50 Amp. - 2 Pole 30 Amp. - 4 Pole	45997-16 45997-20 45997-5

ARMATURE AND MAGNET FIGURE 3

Catalog No.
RP-901

CONTACT BLOCK AND CARRIER FIGURE 2

4 Pole Catalog No.	5 Pole Catalog No.
RP-902	RP-903

CONVERSION INSTRUCTIONS

All 10 and 15 ampere contact assemblies on standard type C contactors are normally open. To convert to normally closed, use screwdriver. No special parts needed.

1. Remove movable contact assembly and lock washer by backing off terminal nut "A".
2. Loosen screws "B" and remove stationary contact assemblies.
3. Invert movable contact assembly, and replace on contactor with flat "I" spring resting on contact block. Contacts facing out.
4. Remove screws "B" from, and reinsert into opposite end of, stationary contact assembly. Re-install stationary contact assemblies, holding contacts in alignment with movable contacts while tightening screws.

ESSEX STANCOR A.C. POWER RELAYS

TYPE 129

Double-Break Contacts
Totally Enclosed
Hi-Impact Case
Screw or ¼″ Quick Connect Termination
Hardware Included
U.L. and C.S.A.
Non-Positional

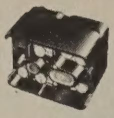


FIGURE 1

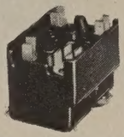


FIGURE 2

SINGLE POLE NORMALLY OPEN AND SINGLE POLE DOUBLE THROW

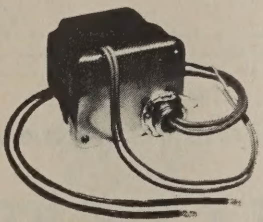
Coil Voltage (50/60 Hz)	Catalog Number				Contact Rating 250 V.A.C. Max.	
	Figure 1		Figure 2			
	1PNO	1PDT†	1PNO	1PDT†	Inductive	Resistive
6	•129-901	129-905			18 Amp. Continuous 1 H.P. - 125 V. 2 H.P. - 250 V. Single Phase	18 Amp. Continuous
24	129-902	129-906	129-911	•129-914		
120	129-903	129-907	129-912	•129-915		
208/230	129-904	129-908	•129-913	•129-916		

† All contact terminals must be wired same polarity.

•Available until stock is depleted.

TYPE 129AR

Totally Enclosed
Hi-Impact Case
Double-Break Contacts
Easy to Mount
U.L. and C.S.A.
Pre-Wired
No Enclosure Required
Low Cost



SINGLE POLE NORMALLY OPEN AND SINGLE POLE DOUBLE THROW

Coil Voltage (50/60 Hz)	Catalog Number		Contact Rating — 250 V.A.C. Max.	
	1PNO	1PDT†	Inductive	Resistive
24	129AR-901	•129AR-904	18 Amp. Continuous 1 H.P. - 120 V. 1½ H.P. - 250 V. Single Phase	18 Amp. Continuous
120	129AR-902	•129AR-905		
208/230	•129AR-903	•129AR-906		

FIT ANY ½″ KNOCK-OUT. MEETS STANDARD CODE REQUIREMENTS.
Underwriters Lab. white card listed. File E121139D 184N13. 13, 7/17/63.
Aluminum die-cast base and bushing. High impact phenolic enclosure.
Locknuts and position locking washer included. Color coded 8″ lead wires.

† All contact terminals must be wired same polarity.

ENGINEERING DESIGN DATA

A.C. Type	Magnet Coil Rating (Volt Amperes) Inrush	Sealed Nom.	Sealed Max.	Operation in % of Nom. Coil Rating Pick-up	Max.* Safe Operate	Breakdown Voltage All Terminals-60 Hz RMS Opposite Polarity	Open Contacts Same Polarity	To Ground	Contact Material Power	Pilot	Electrical Life Oper. At Rated Load	Oper. Per Min.	Mechanical Life§ Oper. At No Load	Oper. Per Min.	Max. Oper. Amb. °F
129	10	4.5	5	85%	110%	1500	1000	1500	Silver Alloy	—	100,000	6	500,000	60	130
129AR	10	4.5	5	85%	110%	1500	1000	1500	Silver Alloy	—	100,000†	3	500,000	60	130

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

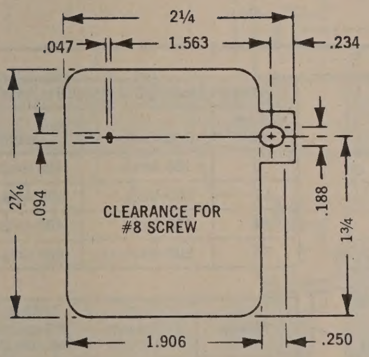
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.

† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).

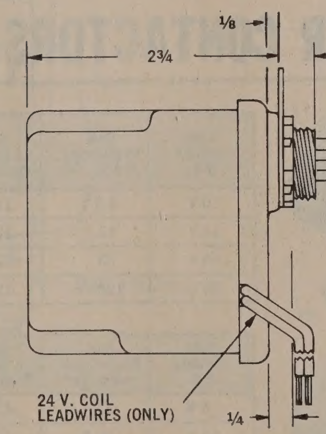
STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
129, 129AR	E12139	LR13360

* U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (not standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.

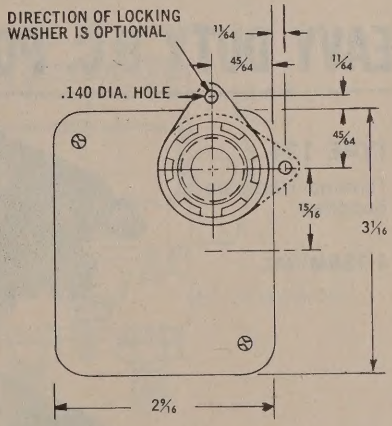
OUTLINE DIMENSIONS


2¼
.047
1.563
.234
2 7/16
.094
CLEARANCE FOR
#8 SCREW
.188
1¾
1.906
.250

TYPE 129


1/8
2¾
7/16
24 V. COIL
LEADWIRES (ONLY)
1/4

TYPE 129AR (SIDE VIEW)


DIRECTION OF LOCKING
WASHER IS OPTIONAL
11/64
45/64
11/64
.140 DIA. HOLE
45/64
15/16
3 1/16
2 9/16

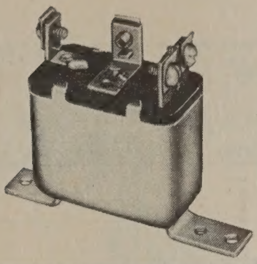
TYPE 129AR

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR D.C. POWER RELAYS

TYPE 60

Metal Case
Totally Enclosed
Isolated Coil
Screw Terminals
Screws Included
Low Cost

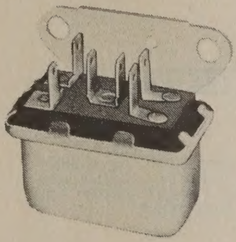


SINGLE POLE NORMALLY OPEN

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Rating D.C. Inductive Voltage	Contact Rating D.C. Inductive Current
6	11	60-901	6	15 Amp.
12	35	60-902	12	15 Amp.
24	160	60-903	24	7.5 Amp.

TYPE 150

Metal Case
Totally Enclosed
Isolated Coil
Side Bracket
¼″ Quick-Connect Termination
Hardware Included in Boxed Units Only
Low Cost



SINGLE POLE NORMALLY OPEN

D.C. Coil Voltage	Resistance in Ohms	Catalog Number	Contact Rating Voltage	Contact Rating Current
6	11	150-901	6	25 Amp.
12	43	150-902	12	25 Amp.
24	190	150-903	24	12 Amp.

SINGLE POLE DOUBLE THROW

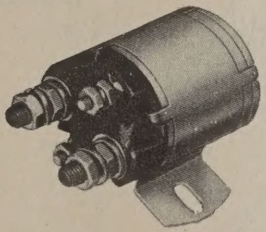
D.C. Coil Voltage	Resistance in Ohms	Catalog Number	Contact Rating Voltage	Contact Rating Current
6	11	150-904	6	15 Amp.
12	43	150-905	12	15 Amp.
24	190	150-906	24	7.5 Amp.

HEAVY DUTY D.C. POWER CONTACTORS

TYPE 124

Terminal Hardware Supplied

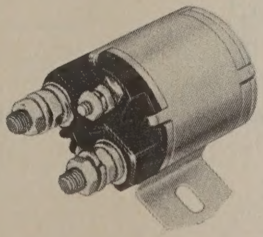
4 TERMINAL



Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 4 Terminal Isolated Coil
6 V	3.3	124-901
12 V	13.2	124-902
24 V	53	124-903
36 V	120	124-904

Voltage DC	Contact Rating D.C. Inductive Load Continuous	Contact Rating D.C. Inductive Load Inrush
6	100 Amps.	400 Amps.
12	100 Amps.	400 Amps.
24	100 Amps.	400 Amps.
36	100 Amps.	400 Amps.

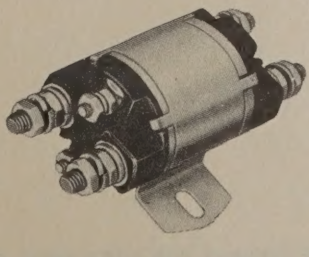
3 TERMINAL



Coil Voltage D.C.	Coil Resistance +8% 25°	SPNO 3 Terminal Grounded Coil
6 V	3.3	124-905
12 V	13.2	124-906
24 V	53	124-907
36 V	120	124-908

Coil Voltage D.C.	Coil Resistance +8% 25°	SPDT 6 Terminal Isolated Coil
6 V	3.3	124-909
12 V	13.2	124-910
24 V	53	124-911
36 V	120	124-912

6 TERMINAL



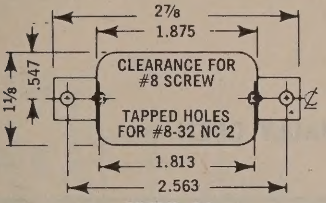
- Max. Pick-Up 70% rated coil voltage
- Design Ambient −40°C to +65°C.
- Maximum Continuous coil watts: 12 @ rated voltage.
- Recommended Mounting Position: Unit in vertical plane with coil terminals up. Horizontal plane is acceptable.
- Design meets U.L. 583 Industrial Truck Standard. Dust and splash proof cover.
- Application: Controlling D.C. starting motors on gasoline engine driven auxiliaries. Battery charging power circuits, motor reversing circuits as found in winch applications.
- The 124 is also applicable where ruggedness and high current capacity is required for D.C. mobile equipment such as: in-plant lifts, industrial equipment, recreational vehicles - golf carts, camp trailers, motor homes.

ENGINEERING DESIGN DATA

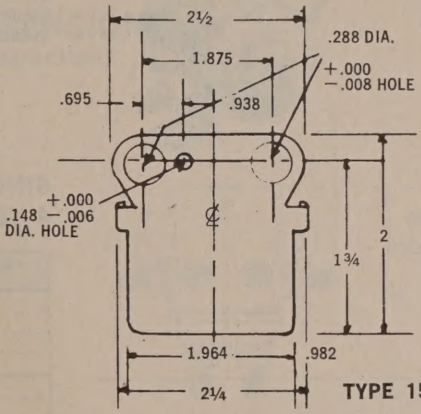
D.C. Type	Coil Rating	Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Nominal Magnetic Coil Rating (Watts)	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
60	2	75%	110%	1000	1000	1000	Fine Silver	—	100,000	4	250,000	4	122
150	3	75%	110%	500	500	500	Silver Alloy	—	500,000	12	1,000,000	12	122

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

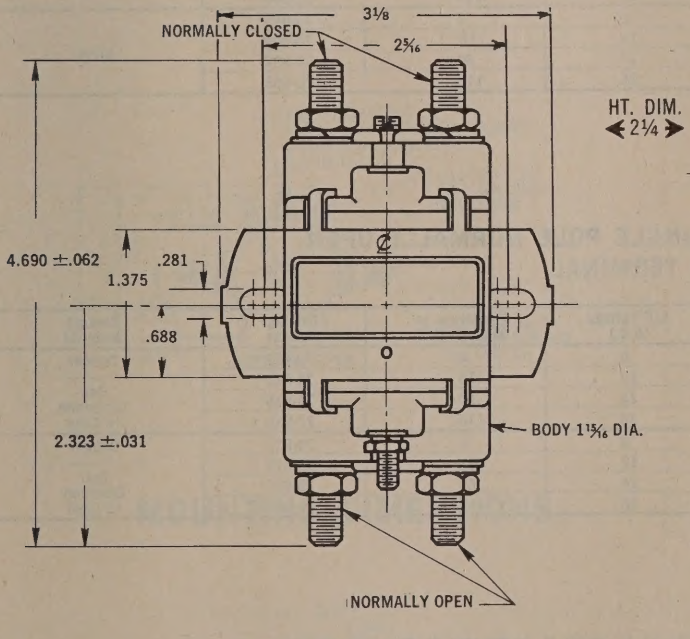
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio environmental or operating conditions. Electric life substantially greater when operated below rated load.


2⅞
1.875
CLEARANCE FOR #8 SCREW
TAPPED HOLES FOR #8-32 NC 2
1⅛
.547
1.813
2.563

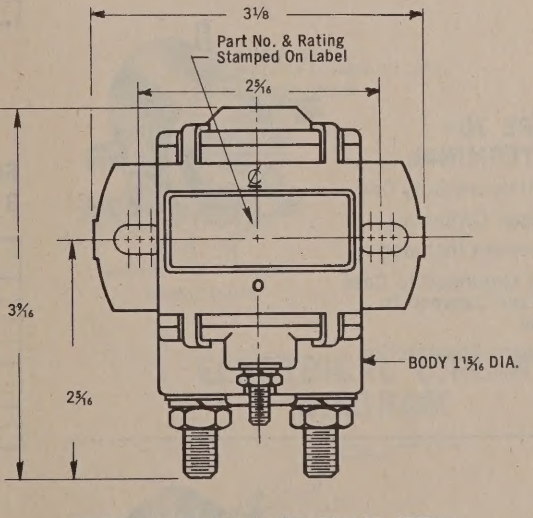
TYPE 60


2½
.288 DIA.
1.875
+.000 −.008 HOLE
.695
.938
+.000
.148 −.006
DIA. HOLE
2
1¾
1.964
.982
2¼

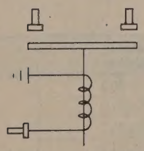
TYPE 150 SIDE VIEW


3⅛
NORMALLY CLOSED
2⁵⁄₁₆
HT. DIM.
2¼
4.690 ±.062
.281
1.375
.688
2.323 ±.031
BODY 1¹⁵⁄₁₆ DIA.
NORMALLY OPEN

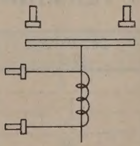
TYPE 124 6 TERMINAL TYPE


3⅛
Part No. & Rating Stamped On Label
2⁵⁄₁₆
3³⁄₁₆
2⁵⁄₁₆
BODY 1¹⁵⁄₁₆ DIA.

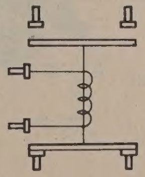
TYPE 124 & 3 & 4 TERMINAL TYPES



NORMALLY OPEN CIRCUIT DIAGRAM
One Side of Coil Grounded to Case (3 Terminals)



NORMALLY OPEN CIRCUIT DIAGRAM
Coil Entirely Isolated (4 Terminals)



DOUBLE THROW CIRCUIT DIAGRAM
Coil Entirely Isolated (6 Terminals)

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

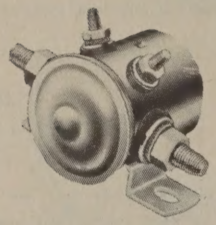
ESSEX STANCOR D.C. POWER CONTACTORS

CONTACT RATING

D.C. INDUCTIVE LOAD — 36 V. MAX.

Voltage (D.C.)	Normally Open		Normally Closed	
	Continuous	Inrush	Continuous	Inrush
6	80 Amp.	300 Amp.	60 Amp.	100 Amp.
12	80 Amp.	150 Amp.	60 Amp.	60 Amp.
24-36	50 Amp.	50 Amp.	30 Amp.	30 Amp.

NON-TURNING STUDS
DRAWN STEEL DUST PROOF ENCLOSURE
COPPER STUD POWER & COIL TERMINALS
DOUBLE BREAK ROTATING DISC MOVABLE CONTACT
SOLENOID ACTUATED
SUGGESTED MOUNTING — CAP DOWN

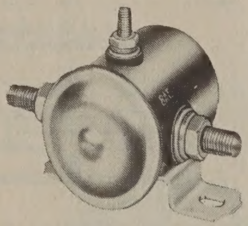


TYPE 70
4 TERMINAL

- Isolated Coil
- Silver or Copper Contacts
- Hardware Included
- Continuous Duty Coil
- Ease In Wiring

SINGLE POLE NORMALLY OPEN
4 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-901	Copper
12	16	70-902	
24	60	70-903	
36	114	70-904	
6	4	70-905	Silver
12	16	70-906	
24	60	70-907	
36	114	70-908	

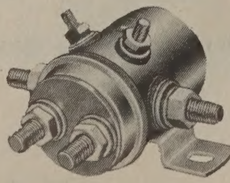


TYPE 70
3 TERMINAL

- Continuous Duty Coil
- Copper Contacts
- Hardware Included
- Coil Grounded to Case or Coil Common to Load
- Rugged Construction

SINGLE POLE NORMALLY OPEN
3 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-913	Copper Coil Grounded to Case
12	16	70-914	
24	60	70-915	
36	114	70-916 •	
6	4	70-917	Copper Coil Common to Load
12	16	70-918	
24	60	70-919	
36	114	70-920 •	



TYPE 70
6 TERMINAL

- Continuous Duty Coil
- Isolated Coil
- Hardware Included
- Choice of 2 Types Contacts

SINGLE POLE DOUBLE THROW
6 TERMINAL

Coil Voltage (D.C.)	Resistance in Ohms @ 25°C	Catalog Number	Contact Material
6	4	70-909	N.O. and N.C. Silver
12	16	70-910	
24	60	70-911	
36	114	70-912	
6	4	70-921 •	• N.O. Copper and N.C. Silver
12	16	70-922	
24	60	70-923	
36	114	70-924 •	

• Available until stock is depleted.

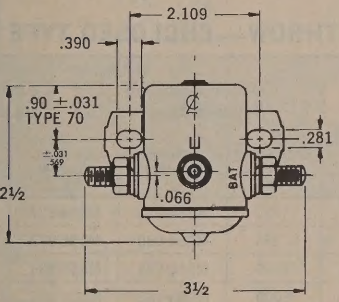
ENGINEERING DESIGN DATA

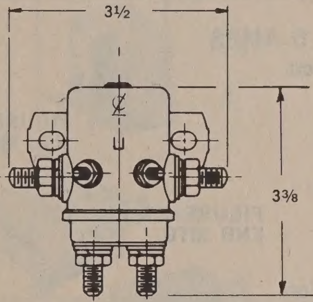
D.C. Type	Coil Rating	Operation in % of Nom. Coil Rating		Breakdown Voltage All Terminals-60 Hz RMS			Contact Material		Electrical Life		Mechanical Life§		Max. Oper. Amb. °F
	Nominal Magnetic Coil Rating (Watts)	Pick-up	Max.* Safe Operate	Opposite Polarity	Open Contacts Same Polarity	To Ground	Power	Pilot	Oper. At Rated Load	Oper. Per Min.	Oper. At No Load	Oper. Per Min.	
70	9	75%	110%	500	500	500	Copper or Silver	—	100,000	4	250,000	4	122

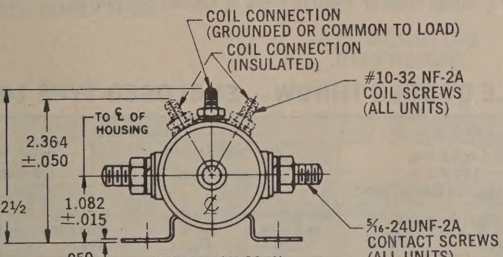
* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.

§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions .Electric life substantially greater when operated below rated load.

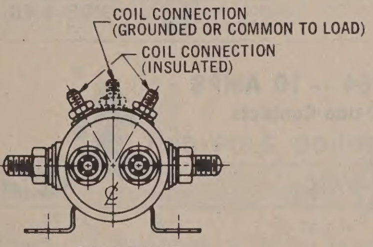
OUTLINE DIMENSIONS
(Not for Construction)


2.109
.390
.90 ±.031
TYPE 70
±.031
.569
.281
2½
.066
BAT
3½



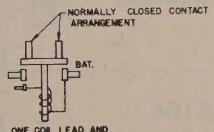

COIL CONNECTION
(GROUNDED OR COMMON TO LOAD)
COIL CONNECTION
(INSULATED)
#10-32 NF-2A
COIL SCREWS
(ALL UNITS)
TO ℄ OF HOUSING
2.364
±.050
2½
1.082
±.015
.050
⁵⁄₁₆-24UNF-2A
CONTACT SCREWS
(ALL UNITS)

NORMALLY OPEN

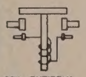

COIL CONNECTION
(GROUNDED OR COMMON TO LOAD)
COIL CONNECTION
(INSULATED)

DOUBLE THROW

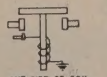
ELECTRICAL CIRCUIT DIAGRAM


NORMALLY CLOSED CONTACT ARRANGEMENT
BAT.

ONE COIL LEAD AND ONE N.O. LOAD TERMINAL COMMON

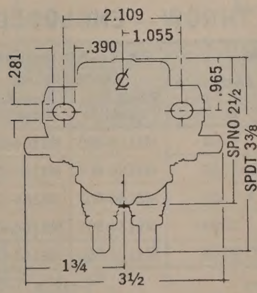


COIL ENTIRELY INSULATED



ONE SIDE OF COIL GROUNDED TO CASE

MOUNTING DIMENSIONS


2.109
1.055
.390
.281
.965
2½
SPNO 2½
SPDT 3⅜
1¾
3½

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR MINIATURE D.C. SENSITIVE RELAYS

TYPE MS64 — 3 AMPS

Gold Alloy Contacts

Printed Circuit Terminals or Bracket Mounting
U.L. & C.S.A.
Long Life
Isolated Contacts
Low Cost
Snap-on Cover
Molded Construction
Size: 1⁷⁄₃₂″ x ¾″ x 1⁷⁄₃₂″
P.C. Mounting

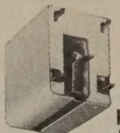


FIGURE 1
P.C. MTG.

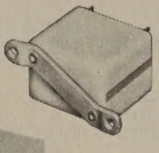


FIGURE 2
END MTG.

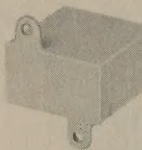


FIGURE 3
SIDE MTG.

SINGLE POLE DOUBLE THROW—ENCLOSED TYPE 3 AMPS

Contact Rating	Coil Power	
3 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.050 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C						
Nominal Voltage or Current‡	Max. Pick-up† Voltage	Max. Pick-up† Current	Resistance in Ohms ±10%	Catalog Number Fig. 1	Catalog Number Fig. 2	Catalog Number Fig. 3
5 V.	3.75 V.	13.4 MA.	280	MS64-900	MS64-910	MS64-915
6 V.	4.5 V.	11.3 MA.	400	MS64-901	MS64-911	MS64-916
12 V.	9.0 V.	5.6 MA.	1600	MS64-902	MS64-912	MS64-917
24 V.	18.0 V.	2.8 MA.	6500	MS64-903	MS64-913	MS64-918
3 MA.	23.0 V.	2.3 MA.	10000	MS64-904	MS64-914	MS64-919

D.O. Approx. 35% of PU.
†Calculated from nominal coil resistance.
‡ May be used over a voltage range of +200 to −6% of nominal coil voltage.

TYPE MS64 — 5 AMPS

Silver Alloy Contacts

Printed Circuit Terminals or Bracket Mounting
U.L. & C.S.A.
Long Life
Isolated Contacts
Low Cost
Snap-on Cover
Molded Construction
Size: 1⁷⁄₃₂″ x ¾″ x 1⁷⁄₃₂″
P.C. Mounting

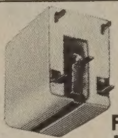


FIGURE 1
P.C. MTG.

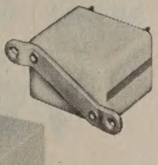


FIGURE 2
END MTG.

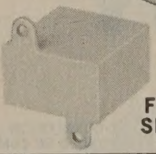


FIGURE 3
SIDE MTG.

SINGLE POLE DOUBLE THROW—ENCLOSED TYPE 5 AMPS

Contact Rating	Coil Power	
5 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.060 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C						
Nominal Voltage or Current‡	Max. Pick-up† Voltage	Max. Pick-up† Current	Resistance in Ohms ±10%	Catalog Number Fig. 1	Catalog Number Fig. 2	Catalog Number Fig. 3
5 V.	3.75 V.	17.0 MA.	220	MS64-936	MS64-937	MS64-938
6 V.	4.5 V.	12.9 MA.	350	MS64-930	MS64-933	MS64-939
12 V.	9.0 V.	6.9 MA.	1300	MS64-931	MS64-934	MS64-940
24 V.	18.0 V.	3.6 MA.	5000	MS64-932	MS64-935	MS64-941

D.O. Approx. 35% of PU.
†Calculated from nominal coil resistance.
‡ May be used over a voltage range of +200 to −6% of nominal coil voltage.

TYPE MS64 — 10 AMPS

Silver Cad-Oxide Contacts

Printed Circuit Terminals or Bracket Mounting
U.L. & C.S.A.
Long Life
Isolated Contacts
Low Cost
Snap-on Cover
Molded Construction
Size: 1⁷⁄₃₂″ x ¾″ x 1⁷⁄₃₂″
P.C. Mounting

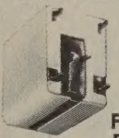


FIGURE 1
P.C. MTG.

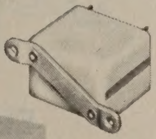


FIGURE 2
END MTG.

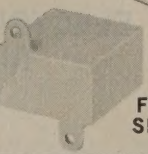


FIGURE 3
SIDE MTG.

SINGLE POLE DOUBLE THROW—ENCLOSED TYPE 10 AMPS

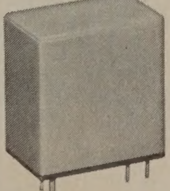
Contact Rating	Coil Power	
10 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.060 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C						
Nominal Voltage or Current‡	Max. Pick-up† Voltage	Max. Pick-up† Current	Resistance in Ohms ±10%	Catalog Number Fig. 1	Catalog Number Fig. 2	Catalog Number Fig. 3
5 V.	3.75 V.	26.8 MA.	140	MS64-950	MS64-954	MS64-958
6 V.	4.5 V.	22.5 MA.	200	MS64-951	MS64-955	MS64-959
12 V.	9.0 V.	11.1 MA.	810	MS64-952	MS64-956	MS64-960
24 V.	18.0 V.	5.6 MA.	3240	MS64-953	MS64-957	MS64-961

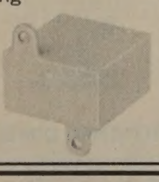
D.O. Approx. 35% of PU.
† Calculated from nominal coil resistance.
‡ May be used over a voltage range of +200 to −6% of nominal coil voltage.

TYPE MS164

2 Amp and 5 Amp
Printed Circuit Terminals
Molded Construction
Isolated Contacts
Snap-on Cover
Long Life
Low Cost
Size: 1¼″ x ¾″ x 1⁵⁄₁₆″
P.C. Mounting



P.C. MTG.
FIGURE 1



SIDE MTG.
FIGURE 2

TWO POLE DOUBLE THROW — ENCLOSED TYPE

D.C. Magnet Coil At 25°C				Fig. 1—P.C. Mounting		Fig. 2—Side Mounting	
				Contact Rating — 28 V.D.C. - 115 V.A.C.			
Voltage Nominal	Max. Pick-up† Voltage	Max. Pick-up† Current	Resistance in Ohms ±10%	2 Amp Non-Inductive	5 Amp. Non-Inductive	2 Amp. Non-Inductive	5 Amp. Non-Inductive
5 V.	3.75 V.	39.9 MA.	94	MS164-900	MS164-920	MS164-905	MS164-925
6 V.	4.5 V.	34.6 MA.	130	MS164-901	MS164-921	MS164-906	MS164-926
12 V.	9.0 V.	18.0 MA.	500	MS164-902	MS164-922	MS164-907	MS164-927
18 V.	13.5 V.	10.4 MA.	1300	MS164-903	MS164-923	MS164-908	MS164-928
24 V.	18.0 V.	8.2 MA.	2200	MS164-904	MS164-924	MS164-909	MS164-929

Min. Operate Power: 150 milliwatts
Max. Operate Power: 1 Watt or operate range voltage +200% to −6% of nominal coil volts.
Mechanical Life: 25,000,000
Contacts: 2 Amp. — Gold Alloy Crossbar
5 Amp. — Silver Alloy Button
† Based on nominal coil resistance

ENGINEERING DESIGN DATA

TYPE MS64 SINGLE POLE DOUBLE THROW

Electrical Life					Mechanical Life	Operate Time (Incl. Bounce)	Vibration	Shock	Operating Ambient
NON-IND.	0.5 Amp.	2.0 Amp.	5.0 Amp.	10.0 Amp.	50,000,000 at 180 Operations per Minute (No Load)	20 Milliseconds	2G 10-50 Cycles	2G Operate 10G Non-Operate	−40°C to +85°C
NO. OPER.	1,000,000	100,000	100,000	30,000					

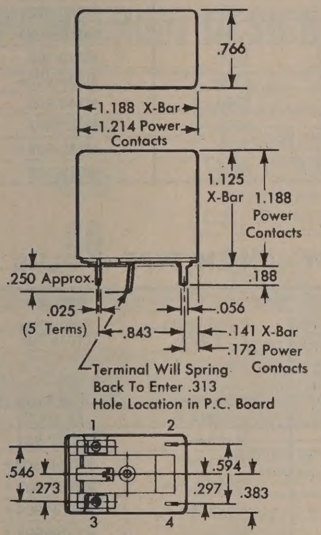

.766
1.188 X-Bar
1.214 Power Contacts
1.125 X-Bar
1.188 Power Contacts
.250 Approx.
.188
.025
(5 Terms)
.056
.843
.141 X-Bar
.172 Power Contacts
Terminal Will Spring Back To Enter .313 Hole Location in P.C. Board
1
2
3
4
.546
.273
.594
.297
.383

FIG. 1
P.C. MOUNTING

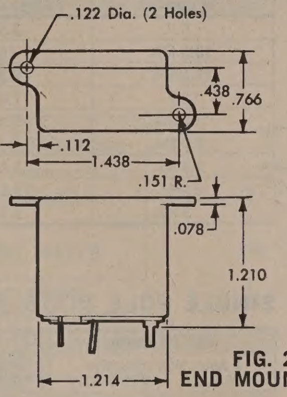

.122 Dia. (2 Holes)
.438
.766
.112
1.438
.151 R.
.078
1.210
1.214

FIG. 2
END MOUNTING

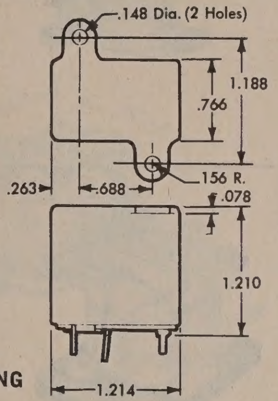
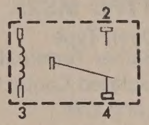
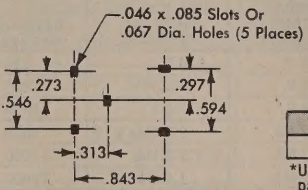

.148 Dia. (2 Holes)
1.188
.766
.156 R.
.263
.688
.078
1.210
1.214

FIG. 3
SIDE MOUNTING



CIRCUIT DIAGRAM


.046 x .085 Slots Or .067 Dia. Holes (5 Places)
.273
.546
.297
.594
.313
.843

P.C. MOUNTING DIMENSIONS

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
64	E47311	LR13360-55

*U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (nut standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.

TYPE MS164 TWO POLE DOUBLE THROW

Electrical Life				Mechanical Life	Operate Time (Incl. Bounce)	Vibration	Shock	Operating Ambient
NON-INDUCTIVE LOAD	0.5 Amp.	2.0 Amp.	5.0 Amp.	25,000,000 at 180 Operations per Minute (No Load)	20 Milliseconds	2G 10-50 Cycles	2G Operate 10G Non-Operate	−40°C to +85°C
NUMBER OPERATIONS	1,000,000	100,000	100,000					

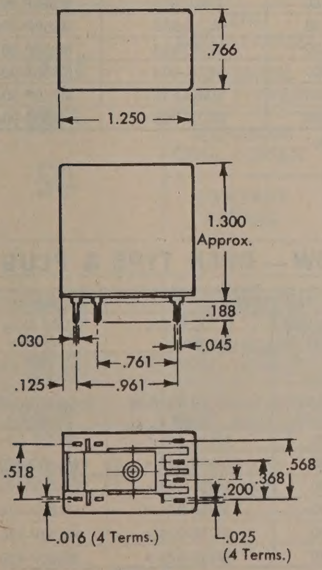

.766
1.250
1.300 Approx.
.188
.030
.045
.761
.125
.961
.518
.568
.368
.200
.016 (4 Terms.)
.025 (4 Terms.)

FIG. 1
P.C. MOUNTING

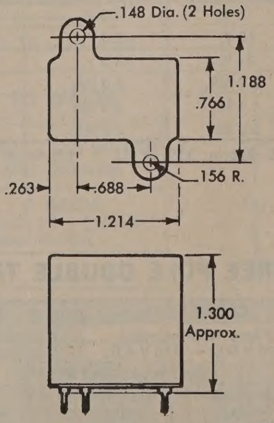
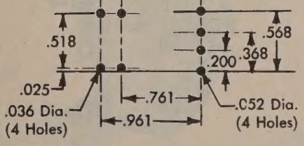
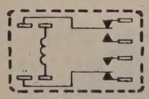

.148 Dia. (2 Holes)
1.188
.766
.156 R.
.263
.688
1.214
1.300 Approx.

FIG. 2
SIDE MOUNTING


.518
.568
.368
.200
.025
.036 Dia. (4 Holes)
.761
.961
.052 Dia. (4 Holes)

P.C. MOUNTING DIMENSIONS



CIRCUIT DIAGRAM

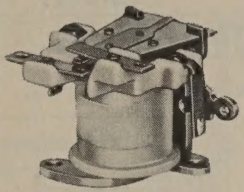
NOTE:
10 AMP CONTACTS ARE AVAILABLE IN TYPE MS164. CONSULT FACTORY.

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR MINIATURE D.C. SENSITIVE RELAYS

TYPE MS40

Solder Terminals
Very Sensitive
Molded Construction
4-40 Mounting
Armature Common to Frame
Long Life
Low Cost
Gold Alloy Contacts



SINGLE POLE DOUBLE THROW — OPEN TYPE

Contact Rating		Coil Power	
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.		Minimum Required	0.050 Watts
		Maximum Capacity	1.0 Watts
D.C. Magnet Coil At 25°C			
Nominal Voltage or Current	Max. Pick-up Voltage or Current	Resistance in Ohms ±10%	Catalog Number
6 V.	3.5 V.	250	MS40-901
13.5 MA.	10 MA.	500	MS40-902
11.0 MA.	8.2 MA.	750	MS40-903•
12 V.	7.0 V.	1000	MS40-904
7.7 MA.	5.8 MA.	1500	MS40-905•
6.0 MA.	4.5 MA.	2500	MS40-906
4.3 MA.	3.2 MA.	5000	MS40-907
24 V.	19.5 V.	7500	MS40-908•
3 MA.	2.3 MA.	10000	MS40-909

TYPE MS25

Open Type
Solder Terminals
Isolated Contacts
Long Life
Low Cost

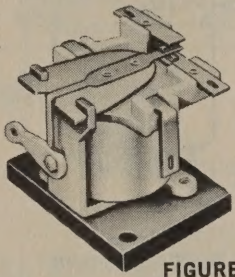


FIGURE 1

TYPE MS25P

Plug In —
Standard 8 Pin Base
Isolated Contacts
Long Life
Low Cost
Plug In — Zytel 101 Nylon Case
Molded Construction

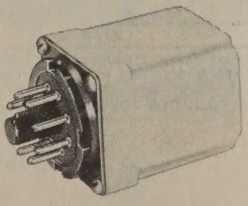


FIGURE 2

SINGLE POLE DOUBLE THROW — OPEN TYPE & PLUG IN

Contact Rating	Coil Power			Contacts
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required Maximum Capacity		0.040 Watts 1.5 Watts	Gold Alloy Cross Bar
D.C. Magnet Coil At 25°C				
Nominal Voltage or Current	Max. Pick-up Voltage or Current*	Resistance in Ohms†	Catalog Number Figure 1	Catalog Number Figure 2
6 V.	4.5 V.	510	MS25-901	MS25P-901 •
12 V.	9.0 V.	2025	MS25-902	MS25P-902 •
24 V.	18.0 V.	8100	MS25-903 •	MS25P-903 •
3.7 MA.	2.8 MA.	5000	MS25-904 •	MS25P-904 •
2.7 MA.	2.0 MA.	10000	MS25-905 •	MS25P-905 •
2.1 MA.	1.6 MA.	15000	MS25-906 •	MS25P-906 •

* D.O. Approx. 35% of PU. † Nominal ±10%.

TYPE MS50

Open Type
Solder Terminals
Isolated Contacts
Long Life
Low Cost

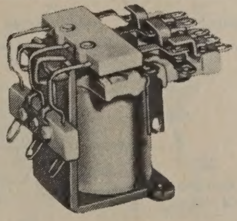


FIGURE 3

TYPE MS50P

Plug In —
Standard 11 Pin Base
Isolated Contacts
Long Life
Low Cost
Plug In — Zytel 101 Nylon Case
Molded Construction

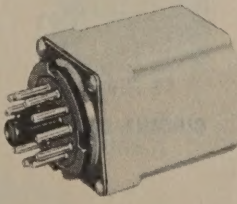


FIGURE 4

TWO POLE DOUBLE THROW — OPEN TYPE & PLUG IN

Contact Rating	Coil Power			Contacts
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required Maximum Capacity		0.125 Watts 1.5 Watts	Gold Alloy Cross Bar
D.C. Magnet Coil At 25°C				
Nominal Voltage or Current	Max. Pick-up Voltage or Current*	Resistance in Ohms†	Catalog Number Figure 3	Catalog Number Figure 4
6 V.	4.5 V.	160	MS50-901	MS50P-901
12 V.	9.0 V.	650	MS50-902	MS50P-902
24 V.	18.0 V.	2600	MS50-903	MS50P-903
6.7 MA.	5.0 MA.	5000	MS50-904 •	MS50P-904 •
4.7 MA.	3.5 MA.	10000	MS50-905 •	MS50P-905 •
3.9 MA.	2.9 MA.	15000	MS50-906 •	MS50P-906 •

* D.O. Approx. 35% of PU. † Nominal ±10%.

THREE POLE DOUBLE THROW — OPEN TYPE & PLUG IN

Contact Rating	Coil Power			Contacts
2 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required Maximum Capacity		0.200 Watts 1.5 Watts	Gold Alloy Cross Bar
D.C. Magnet Coil At 25°C				
Nominal Voltage or Current	Max. Pick-up Voltage or Current*	Resistance in Ohms†	Catalog Number Figure 3	Catalog Number Figure 4
6 V.	4.5 V.	100	MS50-921 •	MS50P-921 •
12 V.	9.0 V.	400	MS50-922 •	MS50P-922 •
24 V.	18.0 V.	1600	MS50-923 •	MS50P-923 •
8.5 MA.	6.4 MA.	5000	MS50-924 •	MS50P-924 •
6.0 MA.	4.5 MA.	10000	MS50-925 •	MS50P-925 •
4.9 MA.	3.7 MA.	15000	MS50-926 •	MS50P-926 •

* D.O. Approx. 35% of PU. † Nominal ±10%.

•Available until stock is depleted

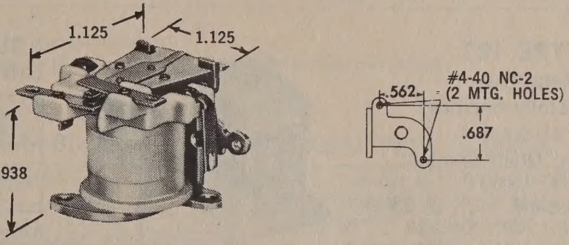
ESSEX STANCOR

SINGLE POLE DOUBLE THROW — TWO POLE DOUBLE THROW — THREE POLE DOUBLE THROW

Electrical Life				Mechanical Life	Operate Time (Incl. Bounce)	Vibration	Shock	Operating Ambient
NON-INDUCTIVE LOAD	0.5 Amp.	1.0 Amp.	2.0 Amp.	50,000,000 At 180 Operations Per Minute (No Load)	20 Milliseconds	2G 10-50 Cycles	2G Operate 10G Non-Operate	−40°C to +85°C
NUMBER OPERATIONS	1,000,000	200,000	100,000					

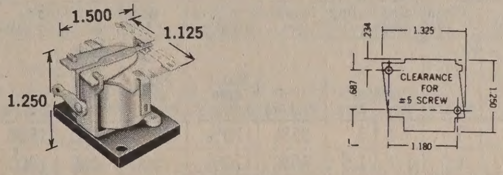
ENGINEERING DESIGN DATA

TYPE MS 40	COIL RESISTANCE	TO 10,000 ohms
	MAXIMUM COIL POWER	1 WATT
	MINIMUM COIL POWER	.050 WATTS
	CONTACT RATING	2 AMPS 28 Volts DC or 115 Volts AC non-inductive.


1.125
1.125
.938
#4-40 NC-2
(2 MTG. HOLES)
.562
.687

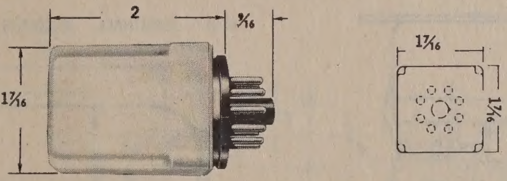
TYPE MS40

TYPE MS 25	COIL RESISTANCE	TO 15,000 ohms
	MAXIMUM COIL POWER	1.5 WATTS
	MINIMUM COIL POWER	.040 WATTS (single pole)
	CONTACT RATING	2 AMPS 28 Volts DC or 115 Volts AC non-inductive.


1.500
1.125
1.250
1.325
.234
.687
CLEARANCE FOR ±5 SCREW
1.250
1.180

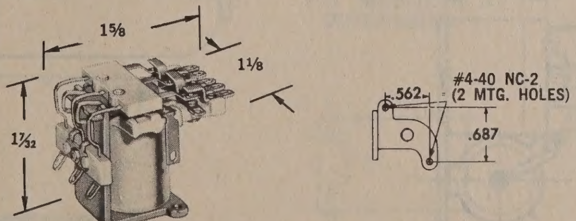
TYPE MS25

TYPE MS 25 PLUG-IN	COIL RESISTANCE	TO 15,000 ohms
	MAXIMUM COIL POWER	1.5 WATTS
	MINIMUM COIL POWER	.040 WATTS (single pole)
	CONTACT RATING	2 AMPS 28 Volts DC or 115 Volts AC non-inductive.


2
9/16
1 7/16
1 7/16
1 7/16

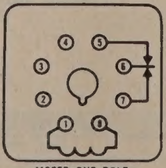
MS25P AND MS50P

TYPE MS 50	COIL RESISTANCE	TO 15,000 ohms
	MAXIMUM COIL POWER	1.5 WATTS
	MINIMUM COIL POWER	(DPDT).125 WATTS 3PDT .200 Watts
	CONTACT RATING	2 AMPS 28 Volts DC or 115 Volts AC non-inductive.

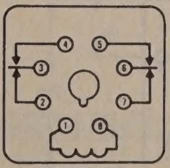

1 5/8
1 1/8
1 7/32
#4-40 NC-2
(2 MTG. HOLES)
.562
.687

TYPE MS50

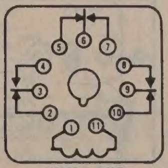
TYPE MS 50 PLUG-IN	COIL RESISTANCE	TO 15,000 ohms
	MAXIMUM COIL POWER	1.5 WATTS
	MINIMUM COIL POWER	(DPDT).125 WATTS 3PDT .200 Watts
	CONTACT RATING	2 AMPS 28 Volts DC or 115 Volts AC non-inductive.



MS25P ONE POLE



MS50P 2 POLE


1
2
3
4
5
6
7
8
9
10
11

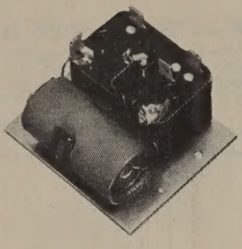
MS50P 3 POLE

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR A.C. TIME DELAY RELAYS

TYPE 84T

Fixed Timing
¼″ Quick-Connect Termination
Wiring Terminals Included in Boxed Units Only
Totally Enclosed
Approx. Reset Time 4 Seconds
Size: 2⅝″ x 2¼″ x 1½″

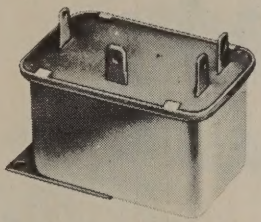


RECTIFIER/CAPACITOR TYPE SINGLE POLE DOUBLE THROW

Coil (50/60 Hz)	Contact Action Delay After Coil Energized	Contact Action Delay After Coil De-Energized	Catalog Number	Time Delay in Seconds ±25%	Contact Rating (A.C.) Inductive
115/120	X		84TE-902	2	3 Amp. 125 V. 1.5 Amp. 250 V. Continuous
230/240	X		84TE-903	2	
115/120		X	84TD-902	2	
230/240		X	84TD-903 •	2	

TYPE 187

Metal Case
Totally Enclosed
Flat Bracket
¼″ Quick-Connect Termination
Repeat ±2% @ 25°C and Nom. Voltage
Size: 3¼″ x 1¾″ x 2¼″



SOLID STATE — FIELD ADJUSTABLE TYPE SINGLE POLE NORMALLY OPEN

Coil Voltage (50/60 Hz)	Time Delay on Pick-up	Catalog Number	Contact Rating Inductive
24 V.	.5 - 90 seconds	187-901	1 Amp. @ 120 V.A.C.
120 V.	.5 - 90 seconds	187-902	

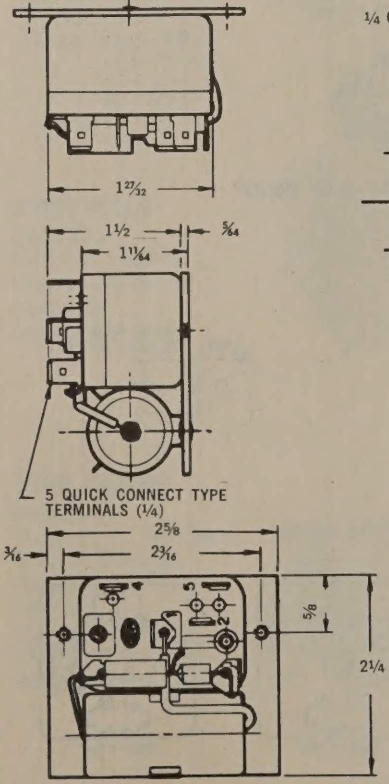
Hidden trimming resistor for tamper-proof field timing adjustment. Reset time 100 M.S. Can use Types 93, 84, 91, 92, 129, 143 or 75 as slave relay. Hardware included in boxed units only.

• Available until stock is depleted.

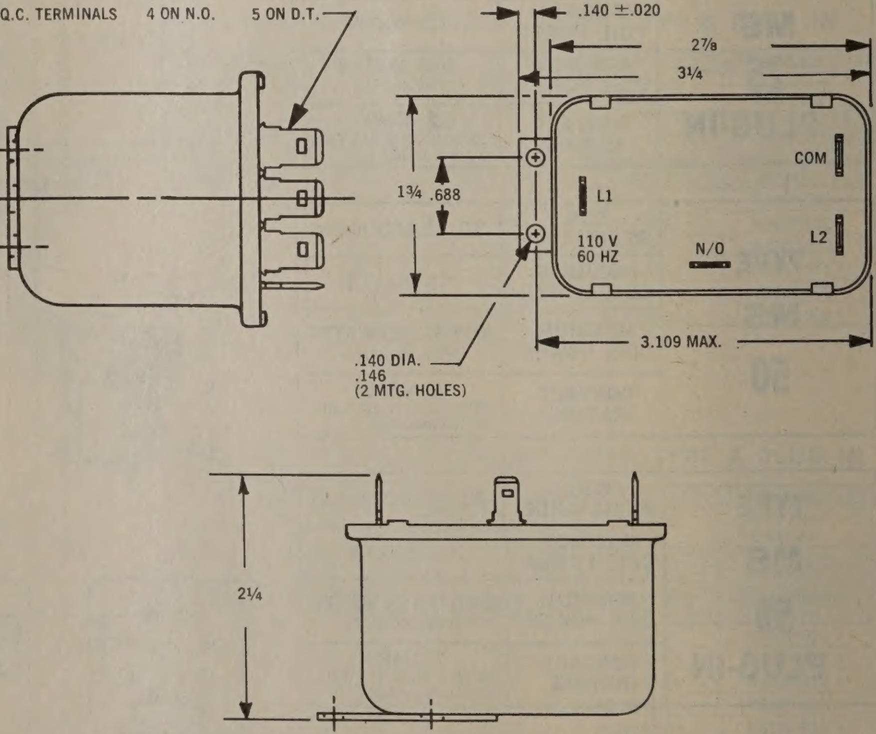
ENGINEERING DESIGN DATA

A.C. Type	Magnet Coil Rating (Volt Amperes) Inrush	Magnet Coil Rating (Volt Amperes) Sealed Nom.	Magnet Coil Rating (Volt Amperes) Sealed Max.	Operation in % of Nom. Coil Rating Pick-up	Operation in % of Nom. Coil Rating Max.* Safe Operate	Breakdown Voltage All Terminals-60 Hz RMS Opposite Polarity	Breakdown Voltage All Terminals-60 Hz RMS Open Contacts Same Polarity	Breakdown Voltage All Terminals-60 Hz RMS To Ground	Contact Material Power	Contact Material Pilot	Electrical Life Oper. At Rated Load	Electrical Life Oper. Per Min.	Mechanical Life§ Oper. At No Load	Mechanical Life§ Oper. Per Min.	Max. Oper. Amb. °F
84T	9	2.8	3	85%	110%	1500	1000	1500	—	Gold Alloy	100,000	6	1,000,000	60	140
187	1.3	1.3	1.5	85%	110%	1000	1000	1000	—	Silver Alloy	100,000†	6	10,000,000	60	150

* Magnet coils designed for continuous duty. Do not operate at rate higher than indicated under Mechanical Life.
§ Based on steady state test under laboratory environmental conditions. Consult factory if application involves unusual load, speed of operation, off-on ratio, environmental or operating conditions. Electric life substantially greater when operated below rated load.
† Load tests — making inrush ratings (0.4 to 0.5 P.F.) — breaking 125% continuous rating (0.65 to 0.8 P.F.).



TYPE 84TD/TE



TYPE 187

CONSULT FACTORY FOR ADDITIONAL DIMENSIONAL DATA.

ESSEX STANCOR

MINIATURE D.C. SENSITIVE BI-STABLE RELAYS

TYPE MS188 — 3 AMPS

Gold Alloy Contacts

- Printed Circuit Terminals or Bracket Mounting
- U.L. & C.S.A.
- Long Life
- Isolated Contacts
- Low Cost
- Snap-on Cover
- Molded Construction

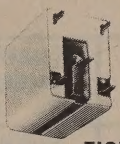


FIGURE 1

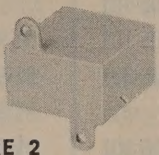


FIGURE 2

SINGLE POLE BI-STABLE — ENCLOSED TYPE 3 AMPS

Contact Rating	Coil Power	
3 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.290 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C					
Nominal Voltage or Current‡	Max. Pick-up†		Resistance in Ohms ±10%	Catalog Number Fig. 1	Catalog Number Fig. 2
	Voltage	Current			
6 V.	4.5 V.	64.3 MA.	70	MS188-901	MS188-911
12 V.	9.0 V.	32.1 MA.	280	MS188-902	MS188-912
24 V.	18.0 V.	16.4 MA.	1100	MS188-903	MS188-913

D.O. Approx. 35% of PU.

† Calculated from nominal coil resistance.

‡ May be used over a voltage range of +200 to −6% of nominal coil voltage.

TYPE MS188 — 5 AMPS

Silver Cad-Oxide Contacts

- Printed Circuit Terminals or Bracket Mounting
- U.L. & C.S.A.
- Long Life
- Isolated Contacts
- Low Cost
- Snap-on Cover
- Molded Construction

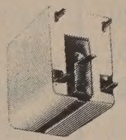


FIGURE 1

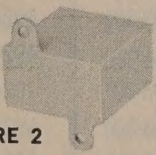


FIGURE 2

SINGLE POLE BI-STABLE — ENCLOSED TYPE 5 AMPS

Contact Rating	Coil Power	
5 Amp. Non-Inductive 28 V.D.C. — 115 V.A.C.	Minimum Required	0.290 Watts
	Maximum Capacity	1.0 Watts

D.C. Magnet Coil At 25°C					
Nominal Voltage or Current‡	Max. Pick-up†		Resistance in Ohms ±10%	Catalog Number Fig. 1	Catalog Number Fig. 2
	Voltage	Current			
6 V.	4.5 V.	64.3 MA.	70	MS188-904	MS188-914
12 V.	9.0 V.	32.1 MA.	280	MS188-905	MS188-915
24 V.	18.0 V.	16.4 MA.	1100	MS188-906	MS188-916

D.O. Approx. 35% of PU.

† Calculated from nominal coil resistance.

‡ May be used over a voltage range of +200 to −6% of nominal coil voltage.

OPERATION DESCRIPTION

The 188 relay is a single pole On-Off miniature Bi-stable device. When coil power is applied, the contacts are open. When coil power is removed, the contacts will alternately close or be held open.

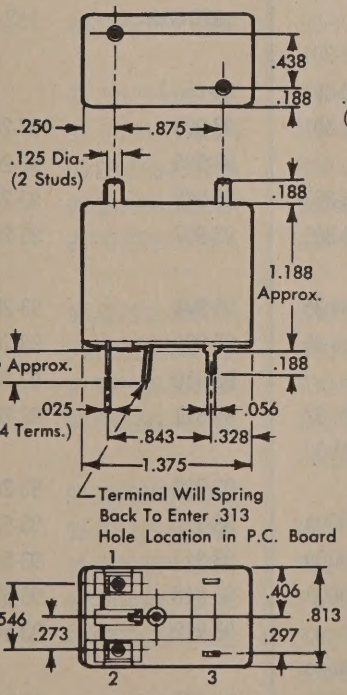

.438
.188
.250
.875
.125 Dia.
(2 Studs)
.188
1.188
Approx.
.250 Approx.
.188
.025
(4 Terms.)
.056
.843
.328
1.375
Terminal Will Spring
Back To Enter .313
Hole Location in P.C. Board
1
.406
.813
.546
.273
.297
2
3

FIGURE 1
PRINTED CIRCUIT
OR
STUD MOUNTING
(Mount With Speed Nut)
Nylon Cover

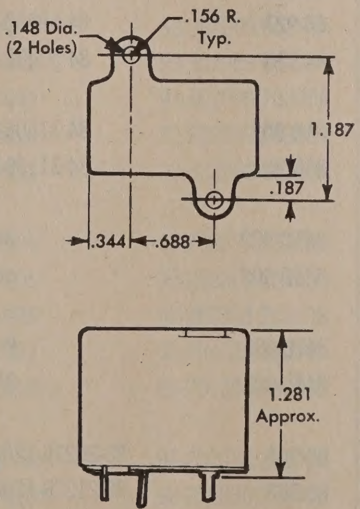
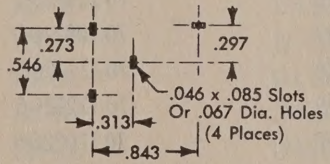
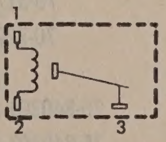

.148 Dia.
(2 Holes)
.156 R.
Typ.
1.187
.187
.344
.688
1.281
Approx.

FIGURE 2
SIDE MOUNTING
Nylon Cover


.273
.546
.297
.046 x .085 Slots
Or .067 Dia. Holes
(4 Places)
.313
.843

P.C. MOUNTING DIMENSIONS



CIRCUIT DIAGRAM

STANCOR Type	*U.L. Recognition File #	*C.S.A. Recognition File #
188	E47311	LR13360-55

*U.L. and C.S.A. listing covers production part number stamped on relay. Production part number (nut standard catalog part number) should be submitted with file number. We will supply report date when required. CONSULT FACTORY FOR POSSIBLE U.L. AND C.S.A. RECOGNITION FOR OTHER THAN ABOVE.

PART NUMBERS

ESSEX STANCOR

Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
60-901	60-108025-0
60-902	60-111025-0
60-903	60-117025-0
70-901	70-108224-5
70-902	70-111224-5
70-903	70-117224-5
70-904	70-120224-5
70-905	70-108221-5
70-906	70-111221-5
70-907	70-117221-5
70-908	70-120221-5
70-909	70-308221-5
70-910	70-311221-5
70-911	70-317221-5
70-912	70-320221-5
70-913	70-108225-5
70-914	70-111225-6
70-915	70-117225-5
70-916	70-120225-5
70-917	70-108226-5
70-918	70-111226-5
70-919	70-117226-5
70-920	70-120226-5
70-921	70-308224-5
70-922	70-311224-5
70-923	70-317224-5
70-924	70-320224-5
75-901	75-840301-2906A
75-902	75-840301-2910A
75-903	75-840301-2913A
75-904	75-250301-2506A
75-905	75-250301-2510A
75-906	75-250301-2513A
84-901	84-20405-101
84-902	84-20105-101
84-903	84-20205-101
84-904	84-20305-101
84-905	84-20406-301
84-906	84-20106-301
84-907	84-20206-301
84-908	84-20306-301
84-912	84-20102-101
84-913	84-20202-101
84-914	84-20302-101
84-916	84-20103-301
84-917	84-20203-301
84-918	84-20303-301
84-922	84-50102-101
84-923	84-50202-101
84-924	84-50302-101
84-926	84-50103-301
84-927	84-59203-301
84-928	84-50303-301
84D-902	84-31506-301
84D-903	84-31106-301
84TD-902	84-35
84TD-903	84-36
84TE-902	84-32
84TE-903	84-33
85-901	85-20226-12000A
85-902	85-21226-12000A
85-903	85-23226-12000A
91-180-1	None
91-901	91-132006-13000
91-902	91-131006-13000
91-903	91-133006-13000
91-904	91-192006-13000
91-905	91-191006-13000
91-906	91-193006-13000
91-907	91-192006-19000
91-908	91-191006-19000
91-909	91-193006-19000
91D-912	91-227004-22000
91D-913	91-222004-22000
192-901	192-321111-11607
192-902	192-311111-11607
192-903	192-331111-11607
192-904	192-321177-11607
192-905	192-311177-11607
192-906	192-331177-11607
192D-912	192-373333-33507
192D-913	192-323333-33507
93-153-1	None
93-904	93-202030-13300B
93-905	93-202303-13300B
93-906	93-202333-13300B
93-907	93-201030-13000B
93-908	93-201303-13000B
93-909	93-201333-13000B
93-910	93-203030-13000B
93-911	93-203303-13000B
93-912	93-203333-13000B
93-916	93-507030-13300B
93-917	93-507303-13300B
93-918	93-507333-13300B
93-919	93-502030-13300B
93-920	93-502303-13300B
93-921	93-502333-13300B
93-934	93-202090-13300A

ESSEX STANCOR PART NUMBERS

Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
93-935	93-202909-13300A
93-936	93-202999-13300A
93-937	93-201090-13000A
93-938	93-201909-13000A
93-939	93-201999-13000A
93-940	93-203090-13000A
93-941	93-203909-13000A
93-942	93-203999-13000A
93-946	93-507090-13300A
93-947	93-507090-13300A
93-948	93-507999-13300A
93-949	93-502909-13300A
93-950	93-502909-13300A
93-951	93-502999-13300A
93-964	93-202909-30300A
93-965	93-202909-30300A
93-966	93-202999-30300A
93-967	93-201090-30000A
93-968	93-201909-30000A
93-969	93-201999-30000A
93-976	93-507090-30300A
93-977	93-507909-30300A
93-978	93-507999-30300A
93-979	93-502090-30300A
93-980	93-502909-30300A
93-981	93-502999-30300A
93P-904	93-202030-70300B
93P-905	93-202303-60300B
93P-906	93-202333-90300B
93P-907	93-201030-70000B
93P-908	93-201303-60000B
93P-909	93-201333-90000B
93P-910	93-203030-70000B
93P-911	93-203303-60000B
93P-912	93-203333-90000B
93P-916	93-507030-70300B
93P-917	93-507303-60300B
93P-918	93-507333-90300B
93P-919	93-502030-70300B
93P-920	93-502303-60300B
93P-921	93-502333-90300B
93P-934	93-202090-70300A
93P-935	93-202909-60300A
93P-936	93-202999-90300A
93P-937	93-201090-70000A
93P-938	93-201909-60000A
93P-939	93-201999-90000A
93P-940	93-203090-70000A
93P-941	93-203909-60000A
93P-942	93-203999-90000A
93P-946	93-507090-70300A
93P-947	93-507909-60300A
93P-948	93-507999-90300A
93P-949	93-502090-70300A
93P-950	93-502909-60300A
93P-951	93-502999-90300A
93Q-904	93-202030-25300B
93Q-905	93-202303-25300B
93Q-906	93-202333-25300B
93Q-907	93-201030-25000B
93Q-908	93-201303-25000B
93Q-909	93-201333-25000B
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93Q-918	93-507333-25300B
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93Q-935	93-202909-25300A
93Q-936	93-202999-25300A
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93Q-938	93-201909-25000A
93Q-939	93-201999-25000A
93Q-940	93-203090-25000A
93Q-941	93-203909-25000A
93Q-942	93-203999-25000A
93Q-946	93-507090-25300A
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93Q-950	93-502909-25300A
93Q-951	93-502999-25300A
124-901	124-102111
124-902	124-105111
124-903	124-114111
124-904	124-117111
124-905	124-102211
124-906	124-105211
124-907	124-114211
124-908	124-117211
124-909	124-302111
124-910	124-305111
124-911	124-314111
124-912	124-317111
129-901	129990-1220
129-902	129115-6880Z
129-903	129115-6810Z
129-904	129115-6840Z

PART NUMBERS

ESSEX STANCOR

Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
129-905	129990-1230
129-906	129117-5480Z
129-907	129117-5410Z
129-908	129117-5430Z
129-911	129115-7180Z
129-912	129115-7110Z
129-913	129115-7130Z
129-914	129117-6780Z
129-915	129117-6710Z
129-916	129117-6730Z
129AR-901	129515-3180Z
129AR-902	129505-3110Z
129AR-903	129505-3130Z
129AR-904	129517-5380Z
129AR-905	129507-5310Z
129AR-906	129507-5330Z
143-901	143-121520-14400A
143-902	143-121120-14400A
143-903	143-121220-14400A
143-906	143-721520-14400A
143-907	143-721120-14400A
143-908	143-721220-14400A
143-914	143-621520-14400A
143-915	143-621120-14400A
143-916	143-621220-14400A
150-901	150-13
150-902	150-10
150-903	150-20
150-904	150-19
150-905	150-8
150-906	150-9
154-901	154-112221-52000A
154-902	154-112221-12000A
154-903	154-112221-22000A

Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
154-904	154-212221-52000A
154-905	154-212221-12000A
154-906	154-212221-22000A
154-907	154-342221-52000A
154-908	154-342221-12000A
154-909	154-342221-22000A
154-910	154-422221-52100A
154-911	154-422221-12100A
154-912	154-422221-22100A
154-913	154-422021-52100D
154-914	154-422021-12100D
154-915	154-422021-22100D
184-901	184-20405-101
184-902	184-20105-101
184-903	184-20205-101
184-904	184-20305-101
184-905	184-20406-301
184-906	184-20106-301
184-907	184-20206-301
184-908	184-20306-301
184-912	184-20102-101
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184-914	184-20302-101
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184-918	184-20303-301
184-922	184-50102-101
184-923	184-50202-101
184-924	184-50302-101
184-926	184-50103-301
184-927	184-50203-301
184-928	184-50303-301
187-901	187-290201-1
187-902	187-290201-3

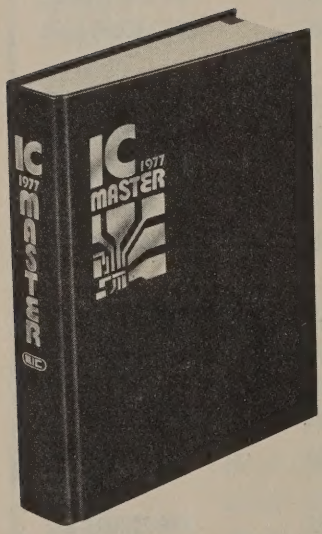
Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
CA-901	45997-23
CA-903	45997-30
CA-904	45997-29
C10-902	109214-101
C10-903	109214-102
C15-902	109202-101
C15-903	109202-102
C30-902	109196-101
C30-903	109196-102
C50R-902	109423-701
C50R-903	109423-702
CR15-901	109203-101
CR15-902	109203-102
MC-901	45225-5
MC-902	45225-1
MC-903	45225-2
MC-904	45225-3
MC-905	45225-4
MC-911	45225-35
MC-912	45225-31
MC-913	45225-32
MC-914	45225-33
MC-915	45225-34
MS25-901	62-981
MS25-902	62-982
MS25-903	62-983
MS25-904	62-984
MS25-905	62-985
MS25-906	62-986
MS25P-901	62-551
MS25P-902	62-552

ESSEX STANCOR PART NUMBERS

Essex/Stancor Catalog No.	Essex/Stancor Production Part No.	Essex/Stancor Catalog No.	Essex/Stancor Production Part No.	Essex/Stancor Catalog No.	Essex/Stancor Production Part No.
MS25P-903	62-553	MS64-910	64-612293-102	MS164-901	164-321203-1102
MS25P-904	62-554	MS64-911	64-612083-102	MS164-902	164-321205-1102
MS25P-905	62-555	MS64-912	64-612133-102	MS164-903	164-321207-1102
MS25P-906	62-556	MS64-913	64-612123-102	MS164-904	164-321209-1102
		MS64-914	64-612143-102		
MS40-901	61-360			MS164-905	164-321212-2102
MS40-902	61-361	MS64-915	64-612292-192	MS164-906	164-321203-2102
MS40-903	61-362	MS64-916	64-612082-102	MS164-907	164-321205-2102
MS40-904	61-363	MS64-917	64-612132-102	MS164-908	164-321207-2102
MS40-905	61-364	MS64-918	64-612122-102	MS164-909	164-321209-2102
		MS64-919	64-612142-102		
MS40-906	61-365			MS164-920	164-352412-1102
MS40-907	61-366	MS64-930	64-654261-102	MS164-921	164-352403-1102
MS40-908	61-367	MS64-931	64-654241-102	MS164-922	164-352405-1102
MS40-909	61-368	MS64-932	64-654271-102	MS164-923	164-352407-1102
		MS64-933	64-654263-102	MS164-924	164-352409-1102
MS50-901	62-931	MS64-934	64-654243-102		
MS50-902	62-932			MS164-925	164-352412-2102
MS50-903	62-933	MS64-935	64-654273-102	MS164-926	164-352403-2102
MS50-904	62-934	MS64-936	64-654281-102	MS164-927	164-352405-2102
MS50-905	62-935	MS64-937	64-654283-102	MS164-928	164-352407-2102
		MS64-938	64-654282-102	MS164-929	164-352409-2102
MS50-906	62-936	MS64-939	64-654262-102		
MS50-921	62-941			MS188-901	188-212081-102
MS50-922	62-942	MS64-940	64-654242-102	MS188-902	188-212071-102
MS50-923	62-943	MS64-941	64-654272-102	MS188-903	188-212091-102
MS50-924	62-944	MS64-950	64-363301-102	MS188-904	188-223081-102
		MS64-951	64-363171-102	MS188-905	188-223071-102
MS50-925	62-945	MS64-952	64-363311-102		
MS50-926	62-946			MS188-906	188-223091-102
		MS64-953	64-363321-102	MS188-911	188-212082-102
MS50P-901	62-561	MS64-954	64-363303-102	MS188-912	188-212072-102
MS50P-902	62-562	MS64-955	64-363173-102	MS188-913	188-212092-102
MS50P-903	62-563	MS64-956	64-363313-102	MS188-914	188-223082-102
MS50P-904	62-564	MS64-957	64-363323-102		
MS50P-905	62-565			MS188-915	188-223072-102
		MS64-958	64-363302-102	MS188-916	188-223092-102
MS64-900	64-612291-102	MS64-959	64-363172-102		
MS64-901	64-612081-102	MS64-960	64-363312-102	RP-901	45997-32
MS64-902	64-612131-102	MS64-961	64-363322-102	RP-902	45997-31
MS64-903	64-612121-102			RP-903	45997-33
MS64-904	64-612141-102	MS164-900	164-321212-1102		

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

MERCURY FILM RELAYS

- OPERATE IN ALL POSITIONS
- TWO BILLION CYCLE RELIABILITY
- NO CONTACT BOUNCE
- STABLE CONTACT RESISTANCE

Often engineers are not satisfied with the performance of dry reed relays. Mercury relays offer superior life, reliability and contact resistance stability. Unfortunately they operate in only one position — straight up.

Mercury film relays solve this problem. The Series M relay offers the user all of the benefits of mercury relays, yet they operate in all mounting positions.

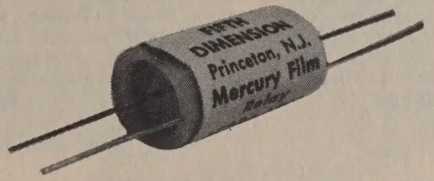
The Series M is reliable. Tests on over 100 units have established that the Mean Cycle Between Failures exceed 2.0 Billion operations. The Series M has long life. One customer has accumulated over 11 Billion operations per contact without failure. Contact bounce is not observed. Seldom will contact resistance change by more than 0.015 ohms over life. Both low level and power loads are reliably switched.

Broken, cracked, or stressed glass switching capsules are a primary cause of early life relay failures. The Series M and Series E feature the LC2 switching chamber. This is a patented device built not of glass but of a rugged welded hermetically sealed metal construction. The LC2 has only one moving part. An armature spring responds to the magnetic field of the coil and closes on the stationary contact. In doing so two mercury films are merged to present a near perfect signal conducting path. No pools of mercury slosh about in the contact chamber. All inside metal walls are wetted with a film of mercury. The surface tension and wetting force so tenaciously hold the mercury films in place that gravitational forces have no effect on operation. Yet these mercury films are free to communicate throughout a system which renews and reheals the relay contacts with each operation.

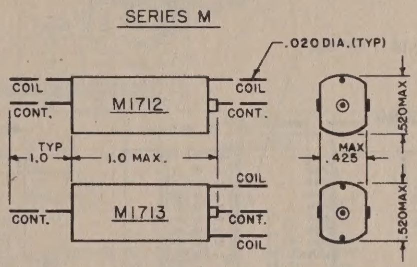
Two mercury film relays are described on this page. The Series M is an open frame relay with flexible transistor type axial leads. It is designed to be completely functional yet low in cost.

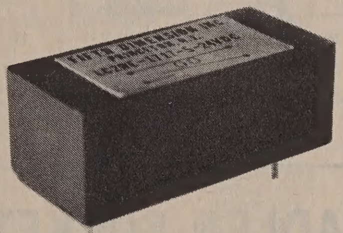
The Series E is a tough completely encapsulated relay with PCB pins formed for the popular 1.0 inch by 0.10 or 0.15 inch grid spacing. The Series E is a relay built to take punishment mechanically, electrically and environmentally.

For engineering information and test data on our complete family of LC2 Switches and Relays contact the factory.

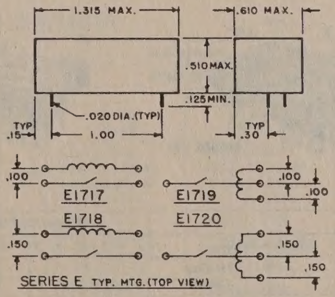


SERIES M





SERIES E



SPECIFICATIONS

	250 mw COIL	500 mw COIL
Contact Form	'A'(1)	'A'(1)
Life	Indefinite	Indefinite
Reliability (MCBF)	$>2 \times 10^9$(2)	$>2 \times 10^9$(2)
Rated Contact Load (DC)	5V; 2 amps 24V, 1 amp 200V; 0.1 amps	5V; 2 amps 24V, 1 amp 200V; 0.1 amps
Contact Resistance	0.15 ohms	0.15 ohms
Contact Res. Stability	±0.015 ohms	±0.015 ohms
Contact Breakdown	1250 vac(3)	1250 vac(3)
Coil Resistance		
5 VDC	100 ohms	50 ohms
12 VDC	575 ohms	288 ohms
24 VDC	2300 ohms	1150 ohms
Operate Time	4.0 ms	3.5 ms
Release Time	4.0 ms	3.5 ms
Contact Bounce	None	None

NOTES: (1) Contact factory for Form B; Form C; and latching models.
(2) Based upon tests conducted on over 100 units tested to over 3.4×10^{10} operations.
(3) Contact factory for higher voltage models.

ORDERING INFORMATION

X — XXXX — X — XX — X

MODEL
M-1712, M-1713
E-1717, E-1718, E-1719, E-1720

POWER
2-250MW, 5-500MW

MAGNETIC SHIELD
1 — NO, 2 — (YES)

COIL VOLTAGE
5 — 5 VDC
12 — 12 VDC
24 — 24 VDC

EXAMPLE: M-1712-2-5-1

FIFTH DIMENSION INC.

5-D
707 ALEXANDER ROAD • PRINCETON, NEW JERSEY 08540
TELEPHONE: (609) 452-1200 • TWX: 510-685-2387

GOULD **ALLIED CONTROL**
Gould Inc., Controls & Systems Division
100 Relay Road, Plantsville, Connecticut 06479
Telephone (203) 621-6771

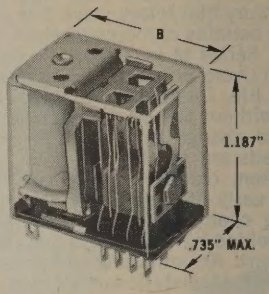
CRADLE® SERIES RELAYS

DIMENSION B	
2C	.937
4C	1.172
6C	1.391
8C	1.594

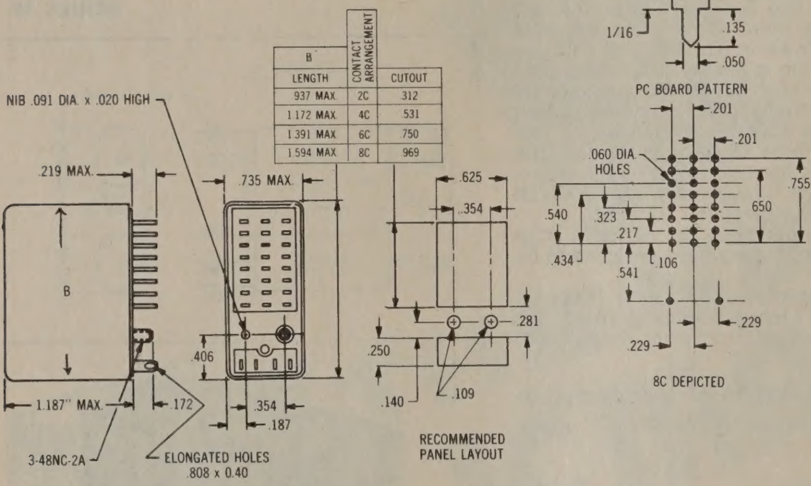
T154/T163 industrial relays with versatile mounting means including solder, printed circuit board and socket options. (Refer to Socket Guide) Sensitivity selection to match applications ranging from 20 to 140mW per pole. Contact selection to meet load switching requirements. U/L Recognized File #E206041.

Voltage relays adjusted for maximum pickup of 75% of nominal coil voltage.

Weight: 1.0 to 6.0 ounces.

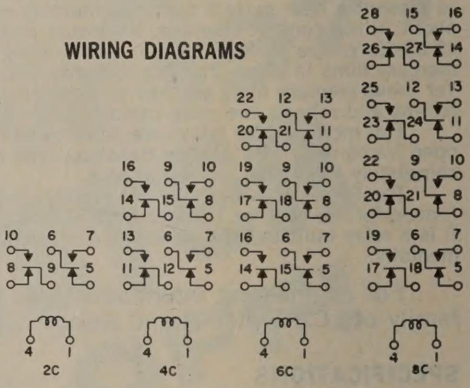

B
1.187"
.735" MAX.

DETAILED DIMENSIONS


NIB .091 DIA. x .020 HIGH
.219 MAX.
.735 MAX.
B
.406
1.187" MAX.
.172
.354
.187
3-48NC-2A
ELONGATED HOLES .808 x 0.40
.625
.354
.281
.250
.140
.109
RECOMMENDED PANEL LAYOUT
TYPE P TERMINAL
1/16
.135
.050
PC BOARD PATTERN
.201
.201
.060 DIA. HOLES
.755
.540
.323
.650
.217
.434
.106
.541
.229
.229
8C DEPICTED

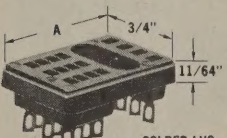
B LENGTH	CONTACT ARRANGEMENT	CUTOUT
.937 MAX.	2C	.312
1.172 MAX.	4C	.531
1.391 MAX.	6C	.750
1.594 MAX.	8C	.969

WIRING DIAGRAMS

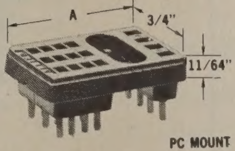

28 15 16
26 27 14
25 12 13
23 24 11
22 12 13
20 21 11
22 9 10
20 21 8
16 9 10
14 15 8
19 9 10
17 18 8
10 6 7
8 9 5
13 6 7
11 12 5
16 6 7
14 15 5
19 6 7
17 18 5
4 1
2C
4C
6C
8C

CIRCUIT DIAGRAMS-UNENERGIZED

CRADLE® SOCKETS AND HARDWARE



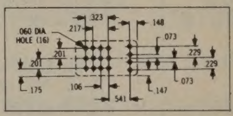
SOLDER LUG



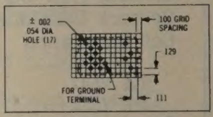
PC MOUNT

Dimensions	
Poles	A
2 Pole	31/32"
4 Pole	1-13/64"
6 Pole	1-13/32"
8 Pole	1-41/64"

TYPICAL
PC MOUNT
TERMINAL LAYOUT
(for 4-POLE)


.060 DIA. HOLE (16)
.323
.217
.148
.073
.201
.229
.229
.201
.175
.106
.541
.147
.073

TYPICAL
.1 x .1 GRID
TERMINAL LAYOUT
(for 4-POLE)


± .002
.054 DIA. HOLE (17)
.100 GRID SPACING
.129
FOR GROUND TERMINAL
.111

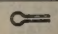
		Without Hold Down Spring		With Hold Down Spring	
Selection Guide		New Cat. No.	Superseded Cat. No.	New Cat. No.	Superseded Cat. No.
	Terminal Options	0211-011-	30054-	0211-012-	30055-
2 Pole	Solder Lug	-001-000	-1	**-001-000**	**-1**
	PC Mount	-005-000	-5	**-005-000**	**-5**
	.1 x .1 Grid	-003-000	-3	-003-000	-3
List Price Per 20		$11.50	$11.50	$12.50	$12.50
4 Pole	Solder Lug Special*	-008-000	-8	**-008-00**	**-8**
	Solder Lug	-002-000	-2	**-002-00**	**-2**
	PC Mount	-006-000	-6	**-006-000**	**-6**
	.1 x .1 Grid	-004-000	-4	-004-00	-4
List Price Per 20		$15.50	$15.50	$16.50	$16.50
6 Pole	Solder Lug	-020-000	-20	**-020-000**	**-20**
	PC Mount	-024-000	-24	**-024-000**	**-24**
	.1 x .1 Grid	-028-000	-28	-028-000	-28
List Price per 20		$20.50	$20.50	$21.50	$21.50
8 Pole	Solder Lug	-030-000	-30	**-030-000**	**-30**
	PC Mount	-031-000	-31	-031-000	-31
	.1 x .1 Grid	-032-000	-32	-032-000	-32
List Price Per 20		$27.50	$27.50	$28.50	$28.50

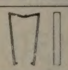
These sockets have longer than standard center terminals. Cost per 20 is $18.50 and $19.50 without and with hold down spring respectively.

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised distributors.

* Prices subject to change without notice.

Individual Parts

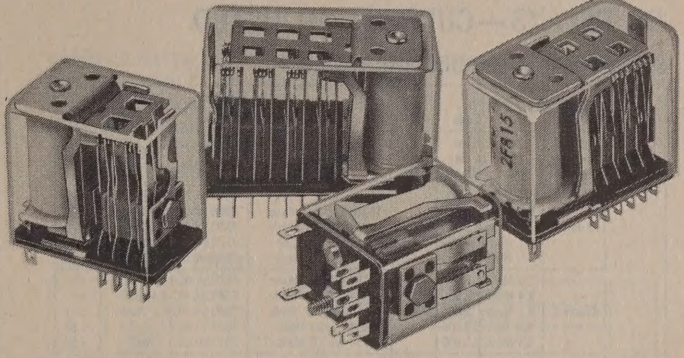
PART NAME	PART NO.	DIAGRAM	LIST PRICE
GROUND WIRE For Solder and standard spaced printed circuit	30052-1 **(0256-002-001)**	 to be inserted into socket recess under mounting screw head	$1.80 per 20
GROUND WIRE for .100 grid spaced printed circuit sockets	30174-1 **(0256-003-001)**	to be inserted into socket recess	$2.80 per 20

FOR	RETAINER PART NO.	DIAGRAM	LIST PRICE
2 Pole	30040-1 **(0228-001-001)**	to be inserted into recesses on narrow sides of sockets	$1.80 per 20
4 Pole	30040-2 **(0228-001-002)**		
6 Pole	30040-3 **(0228-001-003)**		
8 Pole	0330-031-001 Flat Retainer		$2.80 per 20

U/L Recognized File #E-20604

CRADLE® SERIES RELAYS

DC RELAYS—VOLTAGE ADJUSTED



STANDARD/SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	6VDC	52	690mW	T154-2C-6VDC	TP154-2C-6VDC	$3.88
		12VDC	185		**T154-2C-12VDC**	**TP154-2C-12VDC**	3.88
		24VDC	700		**T154-2C-24VDC**	**TP154-2C-24VDC**	3.88
		48VDC	2,500		T154-2C-48VDC	TP154-2C-48VDC	3.88
		115VDC	15,000		T154-2C-115VDC	TP154-2C-115VDC	6.19
	4Form C	6VDC	52	690mW	T154-4C-6VDC	TP154-4C-6VDC	4.30
		12VDC	185		**T154-4C-12VDC**	**TP154-4C-12VDC**	4.30
		24VDC	700		**T154-4C-24VDC**	**TP154-4C-24VDC**	4.30
		28VDC	2,500		T154-4C-48VDC	TP154-4C-48VDC	4.30
		115VDC	15,000		T154-4C-115VDC	TP154-4C-115VDC	6.56
	6Form C	6VDC	25	1.4W	T154-6C-6VDC	TP154-6C-6VDC	5.56
		12VDC	90		**T154-6C-12VDC**	**TP154-6C-12VDC**	5.56
		24VDC	430		**T154-6C-24VDC**	**TP154-6C-24VDC**	5.56
		48VDC	1,550		T154-6C-48VDC	TP154-6C-48VDC	5.56
		115VDC	9,000		T154-6C-115VDC	TP154-6C-115VDC	6.56
	8Form C	6VDC	20	1.9W	T154-8C-6VDC	TP154-8C-6VDC	8.55
		12VDC	75		**T154-8C-12VDC**	**TP154-8C-12VDC**	8.55
		24VDC	430		**T154-8C-24VDC**	**TP154-8C-24VDC**	8.55
		48VDC	1.275		T154-8C-48VDC	TP154-8C-48VDC	8.55
		115VDC	9,000		T154-8C-115VDC	TP154-8C-115VDC	9.55
5 Amp	2Form C	6VDC	52	690mW	TF154-2C-6VDC	TFP154-2C-6VDC	4.04
		12VDC	185		**TF154-2C-12VDC**	**TFP154-2C-12VDC**	4.04
		24VDC	700		**TF154-2C-24VDC**	**TFP154-2C-24VDC**	4.04
		48VDC	2,500		TF154-2C-48VDC	TFP154-2C-48VDC	4.04
		115VDC	15,000		TF154-2C-115VDC	TFP154-2C-115VDC	6.30
	4Form C	6VDC	52	690mW	TF154-4C-6VDC	TFP154-4C-6VDC	4.56
		12VDC	185		**TF154-4C-12VDC**	**TFP154-4C-12VDC**	4.56
		24VDC	700		**TF154-4C-24VDC**	**TFP154-4C-24VDC**	4.56
		48VDC	2,500		TF154-4C-48VDC	TFP154-4C-48VDC	4.56
		115VDC	15,000		TF154-4C-115VDC	TFP154-4C-115VDC	6.87
	6Form C	6VDC	25	1.4W	TF154-6C-6VDC	TFP154-6C-6VDC	6.03
		12VDC	90		**TF154-6C-12VDC**	**TFP154-6C-12VDC**	6.03
		24VDC	430		**TF154-6C-24VDC**	**TFP154-6C-24VDC**	6.03
		48VDC	1,550		TF154-6C-48VDC	TFP154-6C-48VDC	6.03
		115VDC	9,000		TF154-6C-115VDC	TFP154-6C-115VDC	7.03
	8Form C	6VDC	20	1.9W	TF154-8C-6VDC	TFP154-8C-6VDC	9.18
		12VDC	75		**TF154-8C-12VDC**	**TFP154-8C-12VDC**	9.18
		24VDC	430		**TF154-8C-24VDC**	**TFP154-8C-24VDC**	9.18
		48VDC	1,275		TF154-8C-48VDC	TFP154-8C-48VDC	9.18
		115VDC	9,000		TF154-8C-115VDC	TFP154-8C-115VDC	10.18

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

STANDARD/BIFURCATED CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	6VDC	52	690mW	T163-2C-6VDC	TP163-2C-6VDC	$4.35
		12VDC	185		**T163-2C-12VDC**	**TP163-2C-12VDC**	4.35
		24VDC	700		**T163-2C-24VDC**	**TP163-2C-24VDC**	4.35
		48VDC	2,500		T163-2C-48VDC	TP163-2C-48VDC	4.35
		115VDC	15,000		T163-2C-115VDC	TP163-2C-115VDC	6.61
	4Form C	6VDC	52	690mW	T163-4C-6VDC	TP163-4C-6VDC	4.88
		12VDC	185		**T163-4C-12VDC**	**TP163-4C-12VDC**	4.88
		24VDC	700		**T163-4C-24VDC**	**TP163-4C-24VDC**	4.88
		48VDC	2,500		T163-4C-48VDC	TP163-4C-48VDC	4.88
		115VDC	15,000		T163-4C-115VDC	TP163-4C-115VDC	7.14
	6Form C	6VDC	25	1.4W	T163-6C-6VDC	TP163-6C-6VDC	6.30
		12VDC	90		**T163-6C-12VDC**	**TP163-6C-12VDC**	6.30
		24VDC	430		**T163-6C-24VDC**	**TP163-6C-24VDC**	6.30
		48VDC	1,550		T163-6C-48VDC	TP163-6C-48VDC	6.30
		115VDC	9,000		T163-6C-115VDC	TP163-6C-115VDC	7.19
	8Form C	6VDC	20	1.9W	T163-8C-6VDC	TP163-8C-6VDC	9.29
		12VDC	75		**T163-8C-12VDC**	**TP163-8C-12VDC**	9.29
		24VDC	430		**T163-8C-24VDC**	**TP164-8C-24VDC**	9.29
		48VDC	1,275		T163-8C-48VDC	TP163-8C-48VDC	9.29
		115VDC	9,000		T163-8C-115VDC	TP163-8C-115VDC	10.29

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

SENSITIVE/SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	6VDC	185	100mW	TS154-2C-6VDC	TSP154-2C-6VDC	$4.25
		12VDC	800		**TS154-2C-12VDC**	**TSP154-2C-12VDC**	4.25
		24VDC	3,200		**TS154-2C-24VDC**	**TSP154-2C-24VDC**	4.77
		48VDC	13,000		TS154-2C-48VDC	TSP154-2C-48VDC	6.51
	4Form C	6VDC	110	175mW	TS154-4C-6VDC	TSP154-4C-6VDC	4.67
		12VDC	430		**TS154-4C-12VDC**	**TSP154-4C-12VDC**	4.67
		24VDC	1,800		**TS154-4C-24VDC**	**TSP154-4C-24VDC**	4.67
		48VDC	7,500		TS154-4C-48VDC	TSP154-4C-48VDC	5.67
	6Form C	6VDC	75	250mW	TS154-6C-6VDC	TSP154-6C-6VDC	6.03
		12VDC	350		**TS154-6C-12VDC**	**TSP154-6C-12VDC**	6.03
		24VDC	1,275		**TS154-6C-24VDC**	**TSP154-6C-24VDC**	6.03
		48VDC	5,200		TS154-6C-48VDC	TSP154-6C-48VDC	6.56
	8Form C	6VDC	52	400mW	TS154-8C-6VDC	TSP154-8C-6VDC	9.08
		12VDC	190		**TS154-8C-12VDC**	**TSP154-8C-12VDC**	9.08
		24VDC	800		**TS154-8C-24VDC**	**TSP154-8C-24VDC**	9.08
		48VDC	3,200		TS154-8C-48VDC	TSP154-8C-48VDC	9.66

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

SENSITIVE/BIFURCATED CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	6VDC	185	100mW	TS163-2C-6VDC	TSP163-2C-6VDC	$4.67
		12VDC	800		**TS163-2C-12VDC**	**TSP163-2C-12VDC**	4.67
		24VDC	3,200		**TS163-2C-24VDC**	**TSP163-2C-24VDC**	4.67
		48VDC	13,000		TS163-2C-48VDC	TSP163-2C-48VDC	6.98
	4Form C	6VDC	110	175mW	TS163-4C-6VDC	TSP163-4C-6VDC	5.25
		12VDC	430		**TS163-4C-12VDC**	**TSP163-4C-12VDC**	5.25
		24VDC	1,800		**TS163-4C-24VDC**	**TSP163-4C-24VDC**	5.25
		48VDC	7,500		TS163-4C-48VDC	TSP163-4C-48VDC	6.24
	6Form C	6VDC	75	250mW	TS163-6C-6VDC	TSP163-6C-6VDC	6.61
		12VDC	350		**TS163-6C-12VDC**	**TSP163-6C-12VDC**	6.61
		24VDC	1,275		**TS163-6C-24VDC**	**TSP163-6C-24VDC**	6.61
		48VDC	5,200		TS163-6C-48VDC	TSP163-6C-48VDC	7.29
	8Form C	6VDC	52	400mW	TS163-8C-6VDC	TSP163-8C-6VDC	9.81
		12VDC	190		**TS163-8C-12VDC**	**TSP163-8C-12VDC**	9.81
		24VDC	800		**TS163-8C-24VDC**	**TSP163-8C-24VDC**	9.81
		48VDC	3,200		TS163-8C-48VDC	TSP163-8C-48VDC	10.34

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

ULTRA-SENSITIVE RELAYS/SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
1 Amp	2Form C	6VDC	500	40mW	TSS154-2C-6VDC	TSSP154-2C-6VDC	$4.56
		12VDC	2,000		TSS154-2C-12VDC	TSSP154-2C-12VDC	4.56
		24VDC	7,500		**TSS154-2C-24VDC**	**TSSP154-2C-24VDC**	5.56
	4Form C	6VDC	250	80mW	TSS154-4C-6VDC	TSSP154-4C-6VDC	5.67
		12VDC	1,000		TSS154-4C-12VDC	TSSP154-4C-12VDC	5.67
		24VDC	3,700		**TSS154-4C-24VDC**	**TSSP154-4C-24VDC**	6.24

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

* Prices subject to change without notice.

ULTRA-SENSITIVE RELAYS/BIFURCATED CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers Mounting Style		List Price
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
1 Amp	2Form C	6VDC	500	40mW	TSS163-2C-6VDC	TSSP163-2C-6VDC	$4.98
		12VDC	2,000		TSS163-2C-12VDC	TSSP163-2C-12VDC	4.98
		24VDC	7,500		**TSS163-2C-24VDC**	**TSSP163-2C-24VDC**	6.03
	4Form C	6VDC	250	80mW	TSS163-4C-6VDC	TSSP163-4C-6VDC	6.24
		12VDC	1,000		TSS163-4C-12VDC	TSSP163-4C-12VDC	6.24
		24VDC	3,700		**TSS163-4C-24VDC**	**TSSP163-4C-24VDC**	6.82

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

GOULD **ALLIED CONTROL**
Gould Inc., Controls & Systems Division
100 Relay Road, Plantsville, Connecticut 06479
Telephone (203) 621-6771

CRADLE® SERIES RELAYS (CONT'D.)

DC RELAYS—CURRENT ADJUSTED

SENSITIVE/SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	8.5 Madc	1,000	85mW	TS154-2C-8.5 Madc	TSP154-2C-8.5 Madc	$4.20
		5.8 Madc	2,500		**TS154-2C-5.8 Madc**	**TSP154-2C-5.8 Madc**	4.20
		4.1 Madc	5,000		**TS154-2C-4.1 Madc**	**TSP154-2C-4.1 Madc**	4.77
		3.1 Madc	10,000		TS154-2C-3.1 Madc	TSP154-2C-3.1 Madc	5.19
		2.6 Madc	15,000		TS154-2C-2.6 Madc	TSP154-2C-2.6 Madc	6.45
	4Form C	13.0 Madc	1,000	175mW	TS154-4C-13.0 Madc	TSP154-4C-13.0 Madc	4.62
		8.4 Madc	2,500		**TS154-4C-8.4 Madc**	**TSP154-4C-8.4 Madc**	4.62
		6.2 Madc	5,000		**TS154-4C-6.2 Madc**	**TSP154-4C-6.2 Madc**	5.19
		4.5 Madc	10,000		TS154-4C-4.5 Madc	TSP154-4C-4.5 Madc	5.61
		3.5 Madc	15,000		TS154-4C-3.5 Madc	TSP154-4C-3.5 Madc	6.93
	6Form C	16.0 Madc	1,000	250mW	TS154-6C-16.0 Madc	TSP154-6C-16.0 Madc	5.98
		10.0 Madc	2,500		**TS154-6C-10.0 Madc**	**TSP154-6C-10.0 Madc**	5.98
		7.2 Madc	5,000		**TS154-6C-7.2 Madc**	**TSP154-6C-7.2 Madc**	6.51
		5.0 Madc	10,000		TS154-6C-5.0 Madc	TSP154-6C-5.0 Madc	6.98
		4.2 Madc	15,000		TS154-6C-4.2 Madc	TSP154-6C-4.0 Madc	8.24
	8Form C	20.0 Madc	1,000	400mW	TS154-8C-20.0 Madc	TSP154-8C-20.0 Madc	9.03
		13.0 Madc	2,500		**TS154-8C-13.0 Madc**	**TSP154-8C-13.0 Madc**	9.03
		9.0 Madc	5,000		**TS154-8C-9.0 Madc**	**TSP154-8C-9.0 Madc**	9.60
		6.4 Madc	10,000		TS154-8C-6.4 Madc	TSP154-8C-6.4 Madc	10.02
		5.3 Madc	15,000		TS154-8C-5.3 Madc	TSP154-8C-5.3 Madc	11.34

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

ULTRA-SENSITIVE/SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
1 Amp	2Form C	6.5 Madc	1,000	40mW	TSS154-2C-6.5 Madc	TSSP154-2C-6.5 Madc	$4.51
		4.1 Madc	2,500		**TSS154-2C-4.1 Madc**	**TSSP154-2C-4.1 Madc**	4.51
		2.9 Madc	5,000		**TSS154-2C-2.9 Madc**	**TSSP154-2C-2.9 Madc**	5.09
		2.0 Madc	10,000		TSS154-2C-2.0 Madc	TSSP154-2C-2.0 Madc	5.51
		1.7 Madc	15,000		TSS154-2C-1.7 Madc	TSSP154-2C-1.7 Madc	6.82
	4Form C	9.0 Madc	1,000	80mW	TSS154-4C-9.0 Madc	TSSP154-4C-9.0 Madc	5.61
		5.8 Madc	2,500		**TSS154-4C-5.8 Madc**	**TSSP154-4C-5.8 Madc**	5.61
		4.1 Madc	5,000		**TSS154-4C-4.1 Madc**	**TSSP154-4C-4.1 Madc**	6.19
		3.0 Madc	10,000		TSS154-4C-3.0 Madc	TSSP154-4C-3.0 Madc	6.61
		2.4 Madc	15,000		TSS154-4C-2.4 Madc	TSSP154-4C-2.4 Madc	7.92

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

AC RELAYS—VOLTAGE ADJUSTED

SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2PDT	6VAC	14	1.3VA	T154-2C-6VAC	TP154-2C-6VAC	$4.77
		12VAC	65	1.3VA	T154-2C-12VAC	TP154-2C-12VAC	4.77
		24VAC	280	1.3VA	T154-2C-24VAC	TP154-2C-24VAC	4.77
		48VAC	1,250	1.3VA	T154-2C-48VAC	T154-2C-48VAC	4.77
		115VAC	6,000	1.3VA	**T154-2C-115VAC**	**TP154-2C-115VAC**	4.77
		220VAC	15,000	2.2VA	T154-2C-220VAC	TP154-2C-220VAC	5.35
	4PDT	6VAC	14	1.3VA	T154-4C-6VAC	TP154-4C-6VAC	5.46
		12VAC	65	1.3VA	T154-4C-12VAC	TP154-4C-12VAC	5.46
		24VAC	280	1.3VA	T154-4C-24VAC	TP154-4C-24VAC	5.46
		48VAC	1,250	1.3VA	T154-4C-48VAC	TP154-4C-48VAC	5.46
		115VAC	6,000	1.3VA	**T154-4C-115VAC**	**TP154-4C-115VAC**	5.46
		220VAC	15,000	2.2VA	T154-4C-220VAC	TP154-4C-220VAC	6.03
5 Amp	2PDT	6VAC	14	1.3VA	TF154-2C-6VAC	TFP154-2C-6VAC	4.93
		12VAC	65	1.3VA	TF154-2C-12VAC	TFP154-2C-12VAC	4.93
		24VAC	280	1.3VA	TF154-2C-24VAC	TFP154-2C-24VAC	4.93
		48VAC	1,250	1.3VA	TF154-2C-48VAC	TFP154-2C-48VAC	4.93
		115VAC	6,000	1.3VA	**TF154-2C-115VAC**	**TFP154-2C-115VAC**	4.93
		220VAC	15,000	2.2VA	TF154-2C-220VAC	TFP154-2C-220VAC	5.46

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

SENSITIVE/BIFURCATED CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	8.5 Madc	1,000	85mW	TS163-2C-8.5 Madc	TSP163-2C-8.5 Madc	$4.62
		5.8 Madc	2,500		**TS163-2C-5.8 Madc**	**TSP163-2C-5.8 Madc**	4.62
		4.1 Madc	5,000		**TS163-2C-4.1 Madc**	**TSP163-2C-4.1 Madc**	5.19
		3.1 Madc	10,000		TS163-2C-3.1 Madc	TSP163-2C-3.1 Madc	5.61
		2.6 Madc	15,000		TS163-2C-2.6 Madc	TSP163-2C-2.6 Madc	6.93
	4Form C	13.0 Madc	1,000	175mW	TS163-4C-13.0 Madc	TSP163-4C-13.0 Madc	5.19
		8.4 Madc	2,500		**TS163-4C-8.4 Madc**	**TSP163-4C-8.4 Madc**	5.19
		6.2 Madc	5,000		**TS163-4C-6.2 Madc**	**TSP163-4C-6.2 Madc**	5.72
		4.5 Madc	10,000		TS163-4C-4.5 Madc	TSP163-4C-4.5 Madc	6.19
		3.5 Madc	15,000		TS163-4C-3.5 Madc	TSP163-4C-3.5 Madc	7.45
	6Form C	16.0 Madc	1,000	250mW	TS163-6C-16.0 Madc	TSP163-6C-16.0 Madc	6.56
		10.0 Madc	2,500		**TS163-6C-10.0 Madc**	**TSP163-6C-10.0 Madc**	6.56
		7.2 Madc	5,000		**TS163-6C-7.2 Madc**	**TSP163-6C-7.2 Madc**	7.14
		5.0 Madc	10,000		TS163-6C-5.0 Madc	TSP163-6C-5.0 Madc	7.56
		4.2 Madc	15,000		TS163-6C-4.2 Madc	TSP163-6C-4.2 Madc	8.87
	8Form C	20.0 Madc	1,000	400mW	TS163-8C-20.0 Madc	TSP163-8C-20.0 Madc	9.76
		13.0 Madc	2,500		**TS163-8C-13.0 Madc**	**TSP163-8C-13.0 Madc**	9.76
		9.0 Madc	5,000		**TS163-8C-9.0 Madc**	**TSP163-8C-9.0 Madc**	10.29
		6.4 Madc	10,000		TS163-8C-6.4 Madc	TSP163-8C-6.4 Madc	10.76
		5.3 Madc	15,000		TS163-8C-5.3 Madc	TSP163-8C-5.3 Madc	12.02

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

ULTRA-SENSITIVE/BIFURCATED CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
1 Amp	2Form C	6.5 Madc	1,000	40mW	TSS163-2C-6.5 Madc	TSSP163-2C-6.5 Madc	$4.93
		4.1 Madc	2,500		**TSS163-2C-4.1 Madc**	**TSSP163-2C-4.1 Madc**	4.93
		2.9 Madc	5,000		**TSS163-2C-2.9 Madc**	**TSSP163-2C-2.9 Madc**	5.51
		2.0 Madc	10,000		TSS163-2C-2.0 Madc	TSSP163-2C-2.0 Madc	5.98
		1.7 Madc	15,000		TSS163-2C-1.7 Madc	TSSP163-2C-1.7 Madc	7.24
	4Form C	9.0 Madc	1,000	80mW	TSS163-4C-9.0 Madc	TSSP163-4C-9.0 Madc	6.24
		5.8 Madc	2,500		**TSS163-4C-5.8 Madc**	**TSSP163-4C-5.8 Madc**	6.24
		4.1 Madc	5,000		**TSS163-4C-4.1 Madc**	**TSSP163-4C-4.1 Madc**	6.77
		3.0 Madc	10,000		TSS163-4C-3.0 Madc	TSSP163-4C-3.0 Madc	7.19
		2.4 Madc	15,000		TSS163-4C-2.4 Madc	TSSP163-4C-2.4 Madc	8.45

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised Distributors.

SINGLE POINT CONTACTS (Cont.)

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
5 Amp	4PDT	6VAC	14	1.3VA	TF154-4C-6VAC	TFP154-4C-6VAC	$5.67
		12VAC	65	1.3VA	TF154-4C-12VAC	TFP154-4C-12VAC	5.67
		24VAC	280	1.3VA	TF154-4C-24VAC	TFP154-4C-24VAC	5.67
		48VAC	1,250	1.3VA	TF154-4C-48VAC	TFP154-4C-48VAC	5.67
		115VAC	6,000	1.3VA	**TF154-4C-115VAC**	**TFP154-4C-115VAC**	5.67
		220VAC	15,000	2.2VA	TF154-4C-220VAC	TFP154-4C-220VAC	6.24

BIFURCATED CONTACTS

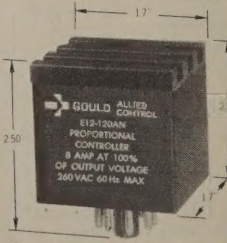
2 Amp	2PDT	6VAC	14	1.3VA	T163-2C-6VAC	—	5.25
		12VAC	65	1.3VA	T163-2C-12VAC	—	5.25
		24VAC	280	1.3VA	T163-2C-24VAC	—	5.25
		48VAC	1,250	1.3VA	T163-2C-48VAC	—	5.25
		115VAC	6,000	1.3VA	**T163-2C-115VAC**	—	5.25
		220VAC	15,000	2.2VA	T163-2C-220VAC	—	5.82
	4PDT	6VAC	14	1.3VA	T163-4C-6VAC	—	6.03
		12VAC	65	1.3VA	T163-4C-12VAC	—	6.03
		24VAC	280	1.3VA	T163-4C-24VAC	—	6.03
		48VAC	1,250	1.3VA	T163-4C-48VAC	—	6.03
		115VAC	6,000	1.3VA	**T163-4C-115VAC**	—	6.03
		220VAC	15,000	2.2VA	T163-4C-220VAC	—	6.56

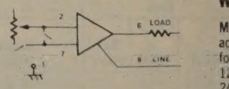
* Prices subject to change without notice.

SOLID STATE PRODUCTS

PROPORTIONAL CONTROLLER—SERIES E12

Type E12 solid state proportional controllers control loads up to 8 amperes. When terminal pins 2 and 7 of the octal plug connector are shorted, the unit provides 100% output voltage. When a resistance is substituted for the short the unit will provide as low as 10% full output voltage. By varying the resistance, the output voltage can be varied from 10% to 100% of the full line voltage. This is especially useful for dimming lamps, controlling heaters, and controlling motor speeds.





Wiring Diagram

Maximum resistance across Pins 2 & 7 for minimum output
120V line, 250K, ½ watt
240V line, 500K, ½ watt

Catalog Number	E12-120AN
Max. Load Current	8 Amp
Output Voltage	260 VAC
List Price	$21.20

SEE PAGE 3520 FOR OTHERS

GOULD **ALLIED CONTROL**

Gould Inc., Controls & Systems Division
100 Relay Road, Plantsville, Connecticut 06479
Telephone (203) 621-6771

CRADLE® SERIES/MAGNETIC LATCH RELAYS

T351/T362 Bi-Stable and Magnetic Latch industrial relays. Single or Dual Coil construction. Versatile mounting means, including solder, printed circuit board and socket options. (Refer to Socket Guide). Contact selection to meet Load Switching Requirements. **T351** has single point contacts. The **T362** has bifurcated contacts. Dimensions and appearance are same as for 2C and 4C cradle relays, see page 1.1686

Input voltage: standard 12 and 24 VDC. Other voltages available on request.

U/L Recognized File #E-20604

Weight: 1.5 to 4.0 ounces.

DC RELAYS—VOLTAGE ADJUSTED

SINGLE COIL

SINGLE POINT CONTACTS

Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	12VDC	166	300mW	T351-2C-12VDC	TP351-2C-12VDC	$5.77
		24VDC	630		**T351-2C-24VDC**	**TP351-2C-24VDC**	5.77
	4Form C	12VDC	166	300mW	T351-4C-12VDC	TP351-4C-12VDC	6.35
		24VDC	630		**T351-4C-24VDC**	**TP351-4C-24VDC**	6.35
5 Amp	2Form C	12VDC	166	300mW	TF351-2C-12VDC	TFP351-2C-12VDC	5.88
		24VDC	630		**TF351-2C-24VDC**	**TFP351-2C-24VDC**	5.88
	4Form C	12VDC	166	300mW	TF351-4C-12VDC	TFP351-4C-12VDC	6.61
		24VDC	630		**T351-4C-24VDC**	**TFP351-4C-24VDC**	6.61

BIFURCATED CONTACTS

2 Amp	2Form C	12VDC	166	300mW	T362-2C-12VDC	TP362-2C-12VDC	6.24
		24VDC	630		**T362-2C-24VDC**	**TP362-2C-24VDC**	6.24
	4Form C	12VDC	166	300mW	T362-4C-12VDC	TP362-4C-12VDC	7.24
		24VDC	630		**T362-4C-24VDC**	**TP362-4C-24VDC**	7.24

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised distributors.

* Prices subject to change without notice.

DUAL COIL

SINGLE POINT CONTACTS

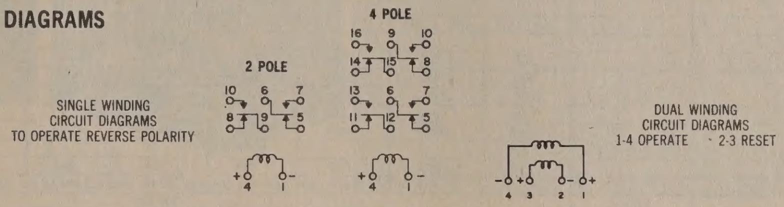
Contact Rating	Contact Arrangement	Coils			Catalog Numbers		List Price
					Mounting Style		
		Input	Res. in Ohms	Nom. Power	Solder/ Plug-In	PC Mount	
2 Amp	2Form C	2/12VDC	134/134	600mW	T351-2C-2/12VDC	TP351-2C-2/12VDC	$6.93
		2/24VDC	485/485		**T351-2C-2/24VDC**	**TP351-2C-2/24VDC**	6.93
	4Form C	2/12VDC	134/134	600mW	T351-4C-2/12VDC	TP351-4C-2/12VDC	7.24
		2/24VDC	485/484		**T351-4C-2/24VDC**	**TP351-4C-2/24VDC**	7.24
5 Amp	2Form C	2/12VDC	134/134	600mW	TF351-2C-2/12VDC	TFP351-2C-2/12VDC	7.03
		2/24VDC	485/485		**TF351-2C-2/24VDC**	**TFT351-2C-2/24VDC**	7.03
	4Form C	2/12VDC	134/134	600mW	TF351-4C-2/12VDC	TFP351-4C-2/12VDC	7.77
		2/24VDC	485/485		**TF351-4C-2/24VDC**	**TFP351-4C-2/24VDC**	7.77

BIFURCATED CONTACTS

2 Amp	2Form C	2/12VDC	134/134	600mW	T362-2C-2/12VDC	TP362-2C-2/12VDC	7.35
		2/24VDC	485/485		**T362-2C-2/24VDC**	**TP362-2C-2/24VDC**	7.35
	4Form C	2/12VDC	134/134	600mW	T362-4C-2/12VDC	TP362-4C-2/12VDC	8.34
		2/24VDC	485/485		**T362-4C-2/24VDC**	**TP362-4C-2/24VDC**	8.34

Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised distributors.

MAGNETIC LATCH WIRING DIAGRAMS (Reset Position Shown)



MINIATURE PC RELAYS—SERIES MPC/MPCS

These miniature pc board mounted relays feature low profile high density packaging with unique hingeless armature for longlife, gold plated silver contacts for switching low level up to 2 amperes (50 watts maximum per pole). Interlocking housing provides maximum protection from contamination and increases reliability. The standard version MPC is available in 1, 2 and 4 pole configurations. The sensitive version MPCS has a 1-pole or 2-pole configuration.

Relays are adjusted for:

Pickup—Maximum—75% of Nominal Coil Voltage.

Drop-out—Minimum—10% of pickup maximum.

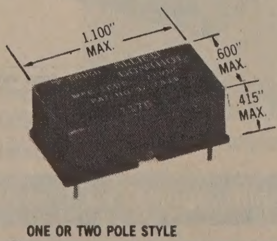
Maximum Power Dissipation 1.3 watts at 25°C.

Weight 8 to 11 grams.

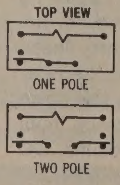
Resistive Contact Rating	Contact Arrangement	MPC STANDARD					MPCS SENSITIVE			
		Input	Res. in Ohms	Nom. Power	Catalog Number	List Price	Res. in Ohms	Nom. Power	Catalog Number	List Price
2 Amp @ 28 VDC	SPDT	5VDC	35	400mW	MPC-1C-5VDC	$2.94	80	160mW	MPCS-1C-5VDC	$3.15
		6VDC	50		**MPC-1C-6VDC**	2.94	125		**MPCS-1C-6VDC**	3.15
		12VDC	200		**MPC-1C-12VDC**	2.94	500		**MPCS-1C-12VDC**	3.15
		24VDC	800		**MPC-1C-24VDC**	3.09	2,000		**MPCS-1C-24VDC**	3.31
		48VDC	3,200		MPC-1C-48VDC	3.09	8,000		MPCS-1C-48VDC	3.62
	DPDT	5VDC	35	400mW	MPC-2C-5VDC	3.88	80	160mW	MPCS-2C-5VDC	4.15
		6VDC	50		**MPC-2C-6VDC**	3.88	125		**MPCS-2C-6VDC**	4.15
		12VDC	200		**MPC-2C-12VDC**	3.88	500		**MPCS-2C-12VDC**	4.15
		24VDC	800		**MPC-2C-24VDC**	3.99	2,000		**MPCS-2C-24VDC**	4.27
		48VDC	3,200		**MPC-2C-48VDC**	3.99	8,000		**MPCS-2C-48VDC**	4.70
	4PDT	5VDC	26	550mW	MPC-4C-5VDC	4.72				
		6VDC	38		**MPC-4C-6VDC**	4.72				
		12VDC	150		**MPC-4C-12VDC**	4.72				
		24VDC	600		**MPC-4C-24VDC**	4.78				
		48VDC	2,400		**MPC-4C-48VDC**	4.78				

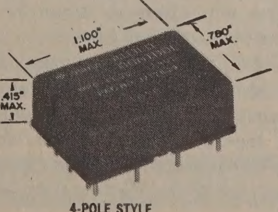
Note: **Bold Type** indicates relays normally stocked by all Gould-Allied Control franchised distributors.

* Prices subject to change without notice.

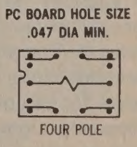


ONE OR TWO POLE STYLE





4-POLE STYLE

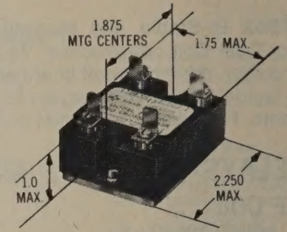


GOULD ALLIED CONTROL

Gould Inc., Controls & Systems Division
100 Relay Road, Plantsville, Connecticut 06479
Telephone (203) 621-6771

SOLID STATE PRODUCTS/SOLID STATE RELAYS

OPTO ISOLATED POWER RELAYS—SERIES E-3



This new line of solid state relays offer the following advanced design concepts for flexible application.

ZERO VOLTAGE SWITCHING—All Series E-3 Power Relays are designed for True Zero Voltage switching. Power is applied to load at zero-voltage cross-over. Power is removed from load at zero-current cross-over.

HIGH NOISE IMMUNITY—Gould—Allied Control has virtually eliminated misfiring due to RFI transients. Our testing shows the Series E-3 Power Relay to be superior to competitive units under identical test conditions.

HIGH IN-RUSH CAPABILITIES—The Series E-3 Solid State Power Relay has been tested to and is guaranteed to meet in-rush loads of 1000% of rated current.

PHOTO-ISOLATED—Input-Output circuitry is isolated by the use of latest state of the art technology. The use of light emitting diode and the photo detector provide circuit isolation of 1560 VAC.

INTEGRATED CIRCUIT COMPATABLE—The Series E-3 Solid State Relay operates directly from and is compatable with the computer age integrated technology allowing a wide range of design applications.

SIGNAL VERSATILITY—The Series E-3 Solid State Power Relay is available in three input signal models allowing wide versatility in application selection.

ONE MODEL FOR ALL OUTPUT VOLTAGES—One model of the Series E-3 Solid State Relay is used to cover all commonly used voltages providing the user with a single model inventory in commercial applications. (Output voltage: 80 to 280 VAC, 47-63 Hz).

SELECTION GUIDE

Max. Load Current	Control Signal Range	Catalog No.		List Price
		Form A Contact	Form B Contact	
10 Amp 25 Amp 40 Amp	3-32 VDC	E3-10D-1A E3-25D-1A E3-40D-1A	E3-10D-1B E3-25D-1B E3-40D-1B	$24.75 33.88 47.12
10 Amp 25 Amp 40 Amp	20-28 VAC	E3-10A-0A E3-25A-0A E3-40A-0A	E3-10A-0B E3-25A-0B E3-40A-0B	26.25 35.38 48.62
10 Amp 25 Amp 40 Amp	100-135 VAC	E3-10A-4A E3-25A-4A E3-40A-4A	E3-10A-4B E3-25A-4B E3-40A-4B	26.25 35.38 48.62

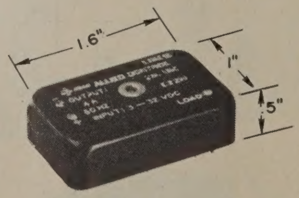
* Prices subject to change without notice.

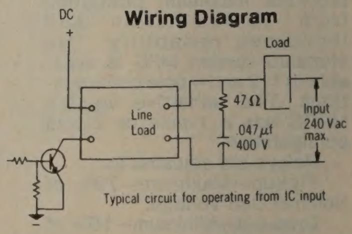
ELECTRICAL SPECIFICATIONS

		Model Numbers E3-																	
		10D1		25D1		40D1		10A0		25A0		40A0		10A4		25A4		40A4	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
A. CONTACT SIDE (OUTPUT)																			
Contact Arrangement (SPST)		NO	NC	NO	NC	NO	NC	NO	NC	NO	NC	NO	NC	NO	NC	NO	NC	NO	NC
AC Line Operation		100-280 VAC 47-63 Hz																	
Max. Load Current I max.		10A		25A		40A		10A		25A		40A		10A		25A		40A	
One Cycle Surge (non repetitive) on state current	50 Hz	90A		200A		350A		90A		200A		350A		90A		200A		350A	
	60 Hz	100A		250A		400A		100A		250A		400A		100A		250A		400A	
Max. Contact Voltage Drop at I max.		1.6V		2V		2V		1.6V		2V		2V		1.6V		2V		2V	
Max. Holding Current	Tc = +25°C	50mA		60mA		60mA		50mA		60mA		60mA		50mA		60mA		60mA	
	Tc = −30°C	90mA						90mA						90mA					
Off State Leakage Current		2mA		4mA		4mA		2mA		4mA		4mA		2mA		4mA		4mA	
Response Time						Max. ½ cycle (next zero crossing): 60 Hz: max. 8.3 ms; 50 Hz: max. 10 ms													
Input to Output Isolation	Voltage	2500 VDC																	
	Resist	10(11) ohms at 500 VDC																	
B. SIGNAL SIDE (INPUT)																			
Control Signal Range				3-32 VDC						20-28 VAC						100-135 VAC			
Pick Up Voltage				3.0 VDC max.						18 VAC max.						90 VAC max.			
Drop Out Voltage				1.0 VDC min.						10 VAC min.						10 VAC min.			
Input Impedance				2200 ohms						10k ohms						40k ohms			
Operating Temperature Range										−30 to + 80°C									
Storage Temperature Range										−40 to +125°C									

SOLID STATE PRODUCTS/SOLID STATE RELAYS

PRINTED CIRCUIT, 4 AMP, SINGLE POLE—SERIES E22





Typical circuit for operating from IC input

Type E22 miniature solid state relays are full-wave power switches which control either resistive or inductive ac loads up to 4 amperes. They control over the full wave cycle, beginning onehalf cycle after initial turn-on. When input is removed, the relay de-energizes the load when the current crosses zero. These features virtually eliminate electrical noise, and make the relay ideal for use on computer logic circuit boards having low noise immunity. Light emitting diode and photo detector provide input output isolation, thereby eliminating interfacing problems. DC input relay models are reverse polarity protected as well.

Input Voltage	Catalog Number	Output
DC		
3-32VDC	E22N	260VAC 4 Amp 50-60 Hz

List Price $16.60

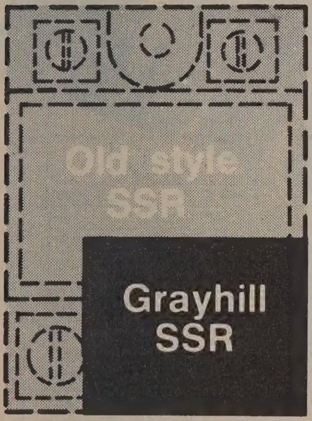
SOLID STATE RELAYS

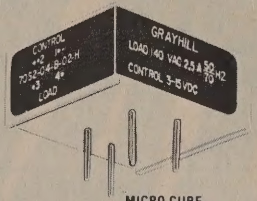
Grayhill INC

- LOAD SWITCHING BY SOLID STATE DEVICE ELIMINATES CONTACT DETERIORATION
- EXTREMELY LONG LIFE, VIRTUALLY ELIMINATES REPLACEMENT
- DESIGNED-IN TRANSIENT AND OVER-VOLTAGE PROTECTION
- RELIABLE SWITCHING OF INDUCTIVE LOADS
- SUPERIOR HEAT TRANSFER CHARACTERISTICS PROVIDES SMALL SIZE PER AMPERAGE CAPACITY

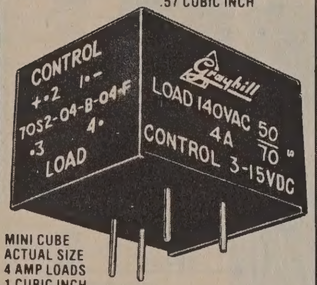
- ■ OPTICALLY (LED) ISOLATED SOLID STATE RELAYS
- ■ DC CONTROL OF AC LOADS
- ■ NO EXTERNAL DRIVE OR CURRENT LIMITING CIRCUITRY REQUIRED
- ■ DIRECTLY COMPATIBLE WITH LOGIC CIRCUITRY
- ■ SWITCHES 0.25 TO 15 AMP LOAD CURRENT
- ■ ZERO VOLTAGE TURN-ON DESIGNED-IN

SPACE SAVERS: GRAYHILL MICRO-CUBE AND MINI-CUBE


Old style SSR
Grayhill SSR


CONTROL
+2 1-
70S2-04-B-02-H
•3 4•
LOAD
GRAYHILL
LOAD 140 VAC 2.5 A 50/70 HZ
CONTROL 3-15 VDC

MICRO CUBE
ACTUAL SIZE
2.5 AMP LOADS
.57 CUBIC INCH

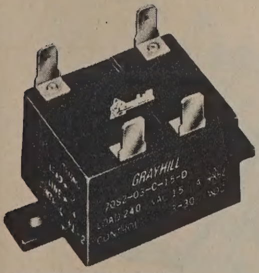

CONTROL
+•2 1•-
70S2-04-B-04-F
4•
•3
LOAD
Grayhill
LOAD 140VAC 4A 50/70
CONTROL 3-15VDC

MINI CUBE
ACTUAL SIZE
4 AMP LOADS
1 CUBIC INCH

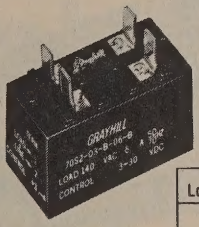
CONTROL "POWER" LOADS FROM "LOGIC" CIRCUITS WITH GRAYHILL PC MOUNTABLE SOLID STATE RELAYS... SIZED TO FIT THE LOAD

Load Voltage 50 to 140 VAC	Load Voltage 100 to 240 VAC	Control Voltage Range VDC	Part No.	PRICES: 1-9	10-24	25-49	50-99
X		3-15	70S2-04-B-04-F	$21.00	$18.27	$16.80	$14.70
X		14-30	70S2-05-B-04-F	21.00	18.27	16.80	14.70
	X	3-15	70S2-04-C-04-F	21.00	18.27	16.80	14.70
	X	14-30	70S2-05-C-04-F	21.00	18.27	16.80	14.70
X		3-15	70S2-04-B-02-H	21.00	18.27	16.80	14.70
	X	3-15	70S2-04-C-02-H	21.00	18.27	16.80	14.70

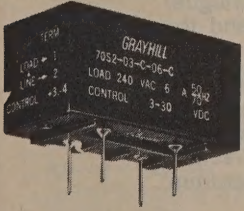
PLUS A VARIETY OF STANDARD, COMMERCIAL AND PC MOUNT PACKAGES


GRAYHILL
70S2-03-C-15-D
LOAD 240 VAC 15
CONTROL 3-30 VDC

COMMERCIAL PACKAGE
Approx. 2.8" x 1.5⅝ x 1.4"


GRAYHILL
70S2-03-B-06-B
LOAD 140 VAC 6 A 50/70 HZ
CONTROL 3-30 VDC

STANDARD PACKAGE
Approx. 2.1" x 1.1" x 1.4"


TERM
LOAD 1
LINE 2
CONTROL +3 4
GRAYHILL
70S2-03-C-06-C
LOAD 240 VAC 6 A 50/70 HZ
CONTROL 3-30 VDC

PC MOUNT PACKAGE — 6 AMP MAX.
Approx. 2.1" x 1.1" x 1.4"

SCREW TERMINAL APAPTER FOR TAB TERMINALS

Part No. SC906-1	6-32 Thread
Part No. SC906-2	8-32 Thread
Unit Price	$0.45

UL RECOGNIZED

Control Voltage: 3 to 30 VDC
Load Voltage: 50 to 140 VAC
Or 100 to 240 VAC

Control Current: 2 to 20 MA
Load Current: 0.25 to 15 AMPS

Load Voltage VAC 50 to 140	100 to 240	Load Current Amps .25 to 6	.25 to 10	.25 to 15	PACKAGE Taper Tab Std.	Comm.	PC Mount	UL File No.	Part No.	Unit Price
X		X					X	E58632	70S2-03-B-06-C	$24.85
X		X			X			E58632	70S2-03-B-06-B	24.85
X		X				X		E58632	70S2-03-B-06-D	23.95
X			X		X			E58632	70S2-03-B-10-B	26.80
X			X			X		E58632	70S2-03-B-10-D	25.90
X				X	X			E58632	70S2-03-B-15-B	29.90
X				X		X		E58632	70S2-03-B-15-D	29.00
	X	X					X	E58632	70S2-03-C-06-C	27.80
	X	X			X			E58632	70S2-03-C-06-B	27.80
	X	X				X		E58632	70S2-03-C-06-D	25.30
	X		X		X			E58632	70S2-03-C-10-B	29.05
	X		X			X		E58632	70S2-03-C-10-D	27.05
	X			X	X			E58632	70S2-03-C-15-B	33.90
	X			X		X		E58632	70S2-03-C-15-D	31.90

Transformer Isolated and Hybrid Solid State Relays also available.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

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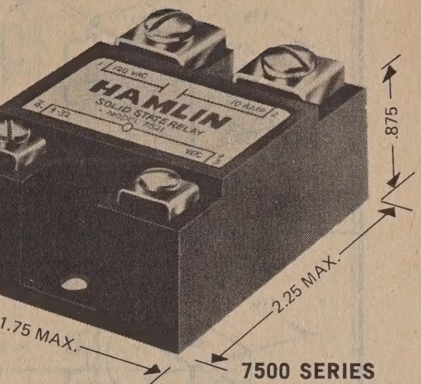
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

OPTO-ISOLATED SOLID-STATE RELAYS 2½ to 40 amps

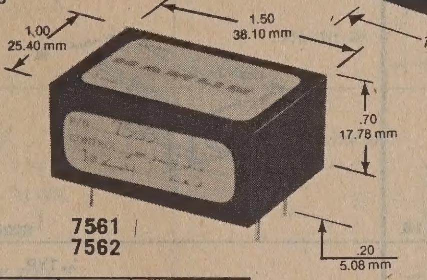
Solid-state relays ready for your circuit design. PCB or surface mounted units designed to switch inductive, capacitive or resistive loads up to 40 amps.

Special features:

- Optically coupled
- Zero voltage synchronous switching
- 1500 VAC isolation
- 2½ — 40 Ampere rating
- PCB mount or lug terminals
- Epoxy encapsulation
- 120 or 240 VAC switching capability.



7500 SERIES

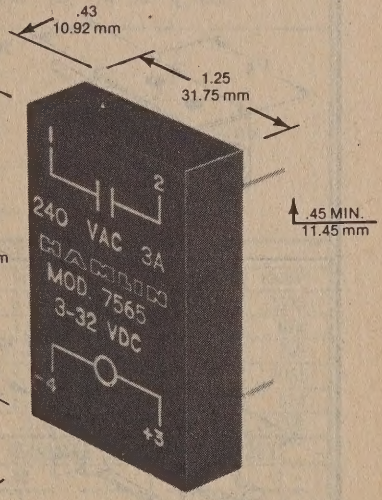


7561
7562

Model	AC Line Voltage 47 to 63 Hz	Peak Reflective Blocking Voltage Max.	Line Current Max. #	One Cycle Surge (60 Hz) Max.	List Price 1-9
7561	120 VAC (24-140 VAC)†	200	2½ RMS	80	$16.60
7562	240 VAC (24-280 VAC)†	400	2½ RMS	80	17.70
7564	120 VAC (24-140 VAC)†	200	3 RMS	80	16.60
7565	240 VAC (24-280 VAC)†	400	3 RMS	80	17.70
7511	120 VAC (24-140 VAC)†	200	5 RMS	80	17.35
7512	240 VAC (24-280 VAC)†	400	5 RMS	80	18.50
7521	120 VAC (24-140 VAC)†	200	10 RMS	100	18.65
7522	240 VAC (24-280 VAC)†	400	10 RMS	100	20.30
7531	120 VAC (24-140 VAC)†	200	25 RMS	100	24.00
7532	240 VAC (24-280 VAC)†	400	25 RMS	100	26.00
7551	120 VAC (24-140 VAC)†	200	40 RMS	100	37.75
7552	240 VAC (24-280 VAC)†	400	40 RMS	100	46.40

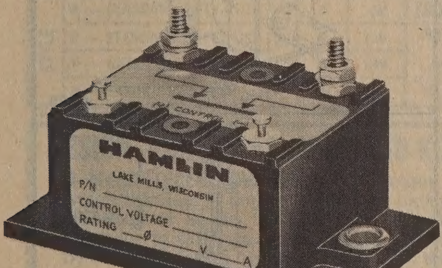
† Low voltage operation results in some waveform distortion.
‡ At 40°C — derated at higher temperature.

NOTE: Control signal options: A - 90-280 VAC, 80-140 VDC. D - 3-32 VDC Resistive input. F - 32 VDC FET Current limited input.

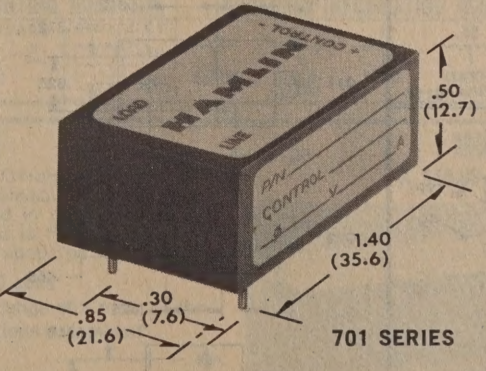


7564-7565

UL Underwiters Laboratories, Inc. Recognized Component mark File
#61761
E47258



723 SERIES



701 SERIES

HYBRID SOLID-STATE RELAYS 1½ to 6 amps

PCB or surface mounted units capable of controlling inductive, capacitive, high-inrush or resistive loads.

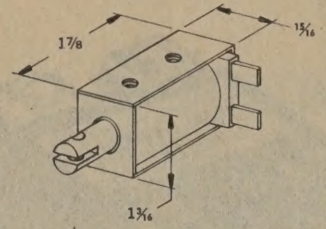
Special features:

- 1500 VAC isolation
- On/off switching
- 1½ — 6 amps rating
- PCB mounting or lug terminals
- Epoxy encapsulation
- 120 or 240 VAC switching capability

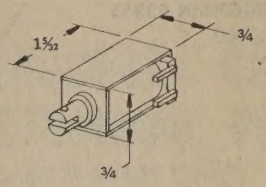
Output and General Specifications		Basic Model Numbers			
		723-11-A 733-11-A	723-12-A 733-12-A	701-11-A	701-12-A
AC Line Voltage, 50/60 Hz.		120V RMS	240V RMS	120V RMS	240V RMS
Blocking Voltage, Max.		200V Peak	400V Peak	200V Peak	400V Peak
On-State Voltage Drop @ Rated Current, Max.		2.2V Peak		2.2V Peak	
Load Current, Max.		6 Amps RMS		1.5 Amps RMS	
One Cycle Surge Current, Non-Repet., Max.		60 Amps Peak		15 Amps Peak	
One Second Overload Current, Max.		24 Amps Peak		6 Amps Peak	
Off-State Leakage Current, Max.		6 MA RMS	11 MA RMS	6 MA RMS	11 MA RMS
Operate Time, Max.	On/Off Switching	1 Millisecond		1 Millisecond	
	Zero Voltage Switching	1 Cycle of the AC Line			
Release Time, Max.	On/Off Switching	½ Cycle of the AC Line		½ Cycle of the AC Line	
	Zero Voltage Switching	1 Cycle of the AC Line			
Isolation, Min.		1500V RMS to Heatsink and Control Circuit			

TO ORDER: Substitute control option for letter A in basic model number; 3 = 12-28 VDC, 5 = 3-13 VDC.

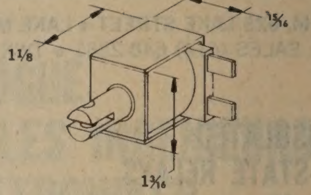
SERIES "G" SOLENOIDS


1⅞
15/16
1 3/16

G11A



G22A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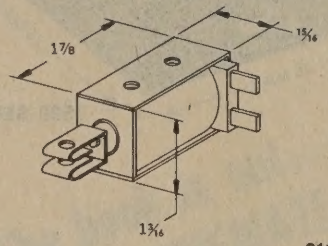
1 3/16

G28A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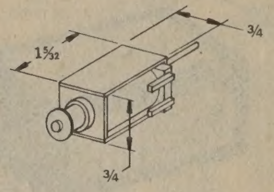
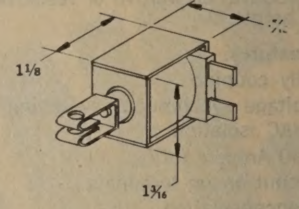
1 3/16

G11B



G22P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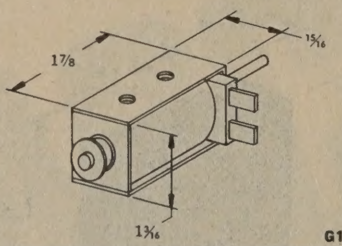
1 3/16

G28B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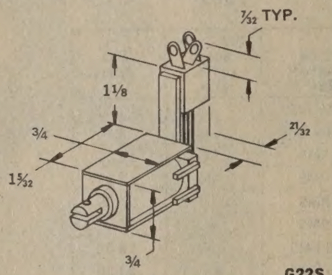
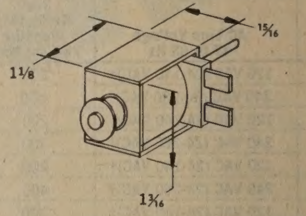
15/16
1 3/16

G11P


7/32 TYP.
1⅛
21/32
3/4
1 5/32
3/4

G22S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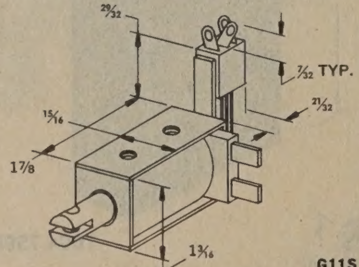
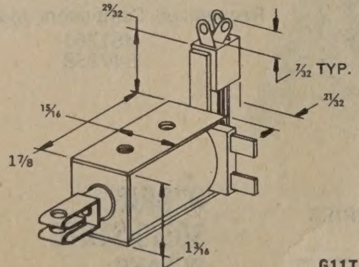
15/16
1 3/16

G28P


29/32
7/32 TYP.
21/32
15/16
1⅞
1 3/16

G11S


29/32
7/32 TYP.
21/32
15/16
1⅞
1 3/16

G11T

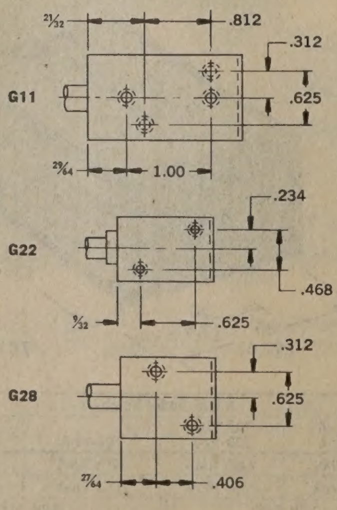
COIL RESISTANCE @ 25°C (OHMS)

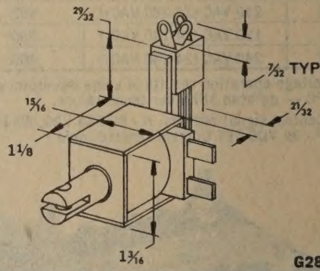
Duty Cycle		6VDC	12VDC	24VDC	120VDC
1	100%	4.5	18	72	1800
2	50/25%	2	8	31	800
3	10%	0.67	2.67	10.67	266

COIL RESISTANCE @ 25°C (OHMS)

Duty Cycle		6VDC	12VDC	24VDC	120VDC
1	100%	9	36	144	3600
2	50/25%	4	16	64	1600
3	10%	1.33	5.32	21.3	532

MOUNTING DIMENSIONS


21/32
.812
.312
G11
.625
29/64
1.00
.234
G22
.468
9/32
.625
.312
G28
.625
27/64
.406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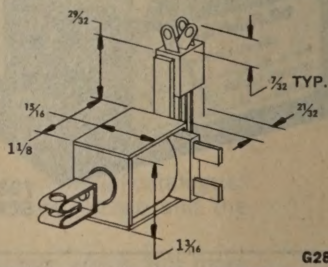
7/32 TYP.
21/32
15/16
1⅛
1 3/16

G28S


29/32
7/32 TYP.
21/32
15/16
1⅛
1 3/16

G28T

COIL RESISTANCE @ 25°C (OHMS)

Duty Cycle		6VDC	12VDC	24VDC	120VDC
1	100%	7.7	27	104	2600
2	50/25%	3.3	13	50	1300
3	10%	1.14	4	15.4	385

STYLE

- A — PULL TYPE, MACHINED HOLE & SLOT
- B — PULL TYPE, SPRING CLIP.
- P — PUSH TYPE
- S — SWITCH TYPE, MACHINED HOLE & SLOT.
- T — SWITCH TYPE, SPRING CLIP.

ORDERING INFORMATION (EXAMPLE IS P/N G28A24D1)

G	28	A	24	D	1
SERIES	SIZE	STYLE	VOLTAGE	DC	DUTY CYCLE

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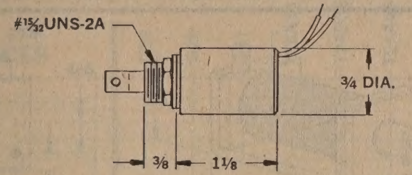
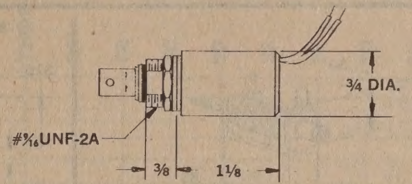
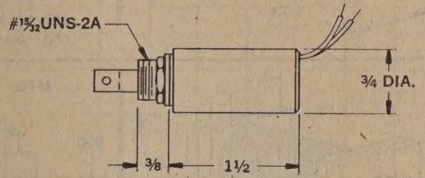
SERIES T24 TUBULAR SOLENOIDS


#15/32UNS-2A
3/4 DIA.
3/8
1 1/8

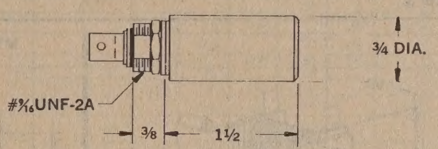
T24A36


3/4 DIA.
#9/16UNF-2A
3/8
1 1/8

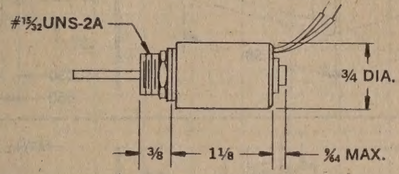
T24C36


#15/32UNS-2A
3/4 DIA.
3/8
1 1/2

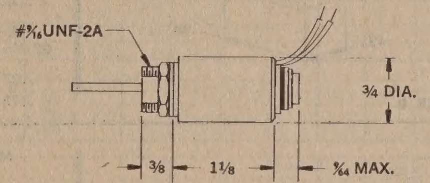
T24A48


3/4 DIA.
#9/16UNF-2A
3/8
1 1/2

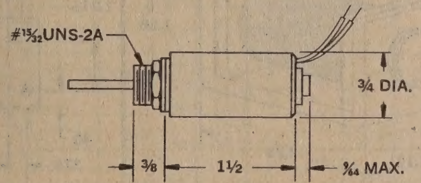
T24C48


#15/32UNS-2A
3/4 DIA.
3/8
1 1/8
9/64 MAX.

T24B36


#9/16UNF-2A
3/4 DIA.
3/8
1 1/8
9/64 MAX.

T24D36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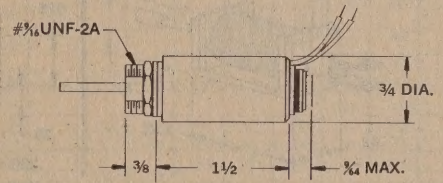
3/4 DIA.
3/8
1 1/2
9/64 MAX.

T24B48


#9/16UNF-2A
3/4 DIA.
3/8
1 1/2
9/64 MAX.

T24D48

	COIL RESISTANCE @ 25°C (OHMS)					
Model	**Duty Cycle**		**6VDC**	**12VDC**	**24VDC**	**120VDC**
T24A36 & T24B36	1	100%	10.4	41.8	164	4125
	2	50/25%	5.29	21.2	84.7	2115
	3	10%	1.84	7.36	29.4	736
T24A48 & T24B48	1	100%	8.87	36.8	142	3570
	2	50/25%	4.39	17.5	70.3	1760
	3	10%	2	6	24	600

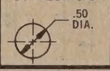
	COIL RESISTANCE @ 25°C (OHMS)					
Model	**Duty Cycle**		**6VDC**	**12VDC**	**24VDC**	**120VDC**
T24C36 & T24D36	1	100%	6.74	26.96	108	2695
	2	50/25%	1.68	6.74	27	674
	3	10%	.674	2.69	10.78	269
T24C48 & T24D48	1	100%	5.14	20.5	82.5	2055
	2	50/25%	1.28	5.14	20.9	514
	3	10%	.514	20.5	8.25	206

STYLE	
A	STANDARD DUTY PULL.
B	STANDARD DUTY PUSH.
C	EXTRA DUTY PULL.
D	EXTRA DUTY PUSH.

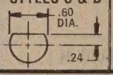
VOLT. CODE	
1	6V
2	12V
3	24V
4	120V

MOUNTING HOLE DIM.

STYLES A & B



STYLES C & D



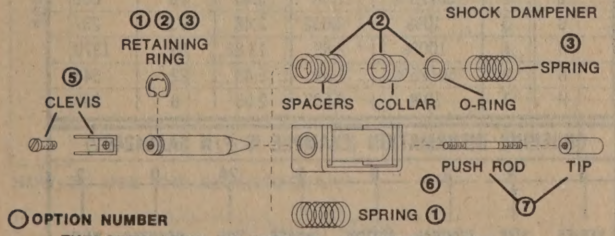
ORDERING INFORMATION (EXAMPLE IS P/N T24A483D1)

T	24	A	48	3	D	1
SERIES	DIA. IN 32NDS	STYLE	LENGTH IN 32NDS	COIL VOLTAGE	DENOTES DC	DUTY CYCLE

DESIGN ENGINEERS SOLENOID KIT

A MAGNETEC INNOVATION . . . A unique C-frame Solenoid Kit which the design engineer will find indispensable. The **192 combinations** of Series 'S' Solenoids included in the kit allow the engineer to go from initial design concept to final specification by simply tailoring his own . . . right on the spot! The Kit includes:

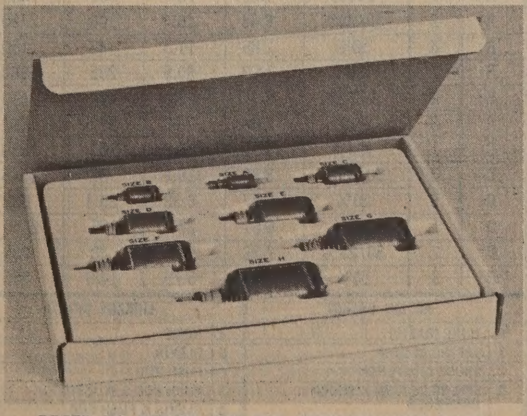
- 8 solenoid sizes
- 6 linkage options
- 4 action options
- 24VDC coils
- force range of 8 oz to 14 lbs
- all options assembled


①②③
RETAINING RING
⑤
CLEVIS
②
SHOCK DAMPENER
③
SPRING
SPACERS
COLLAR
O-RING
PUSH ROD
TIP
⑥
⑦
SPRING ①
○ OPTION NUMBER

EXPLODED VIEW OF TYPICAL SOLENOID IN KIT

MODEL SK-2

A $48.00 VALUE FOR $24.95



REFER TO SERIES "S" FOR PERFORMANCE DATA.

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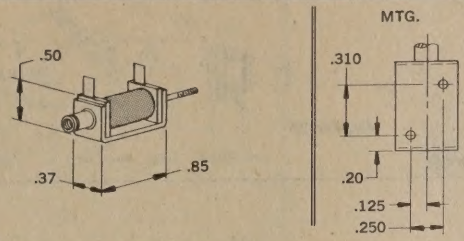
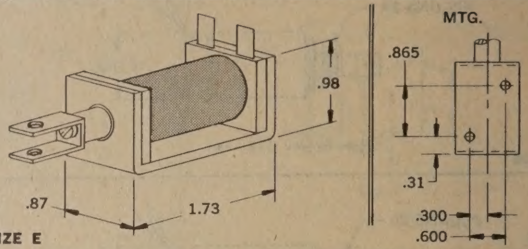
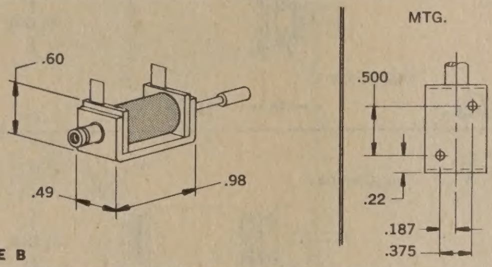
SERIES "S" SOLENOIDS
2300 STANDARD COMBINATIONS


.50
.37
.85
MTG.
.310
.20
.125
.250

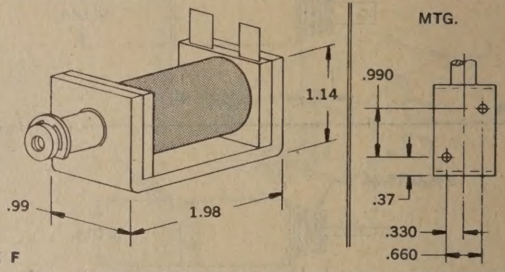
SIZE A


.98
.87
1.73
MTG.
.865
.31
.300
.600

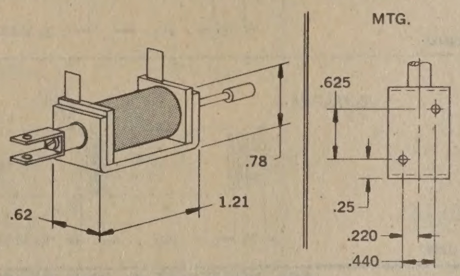
SIZE E


.60
.49
.98
MTG.
.500
.22
.187
.375

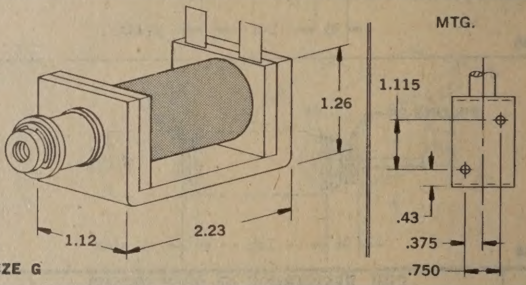
SIZE B


1.14
.99
1.98
MTG.
.990
.37
.330
.660

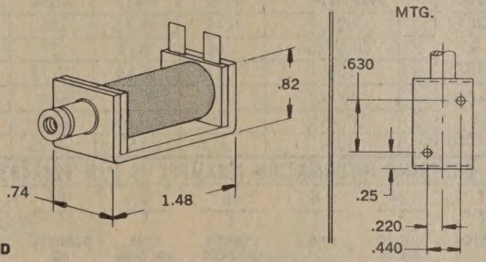
SIZE F


.78
.62
1.21
MTG.
.625
.25
.220
.440

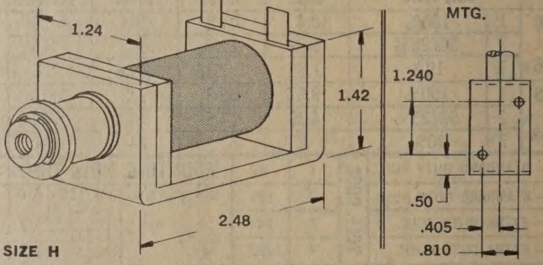
SIZE C


1.26
1.12
2.23
MTG.
1.115
.43
.375
.750

SIZE G


.82
.74
1.48
MTG.
.630
.25
.220
.440

SIZE D


1.24
1.42
2.48
MTG.
1.240
.50
.405
.810

SIZE H

COIL RESISTANCE @ 25°C (OHMS)

Size	Duty Cycle		6VDC	12VDC	24VDC	120VDC
A	1	100%	18.5	78	300	7480
A	2	50/25%	6.48	26.4	106	2790
A	3	10%	2.85	11.3	46	1130
B	1	100%	14.3	60.5	235	5980
B	2	50/25%	5.74	22.8	92	2410
B	3	10%	2.04	7.98	32.5	883
C	1	100%	9.72	38.8	160	4180
C	2	50/25%	3.88	16.1	62	1545
C	3	10%	1.57	6.32	25.4	632
D	1	100%	6.61	27	105	2540
D	2	50/25%	2.33	9.24	38	955
D	3	10%	0.936	3.75	14.6	366

COIL RESISTANCE @ 25°C (OHMS)

Size	Duty Cycle		6VDC	12VDC	24VDC	120VDC
E	1	100%	7.02	23.3	95.8	2335
E	2	50/25%	2.76	8.54	35	851
E	3	10%	0.845	3.41	13.1	323
F	1	100%	4.68	18.7	75	1885
F	2	50/25%	1.89	7.65	30	709
F	3	10%	0.733	2.98	11.9	293
G	1	100%	3.95	16.3	65	1630
G	2	50/25%	1.58	6.45	26	666
G	3	10%	0.602	2.48	9.2	237
H	1	100%	2.89	13.82	55	1370
H	2	50/25%	1.39	5.43	22	545
H	3	10%	0.503	2.05	8	200

ACTION OPTION

0	NONE (BASIC)
1	SPRING RETURN
2.	SHOCK DAMPENER
3	SPRING RETURN & SHOCK DAMPENER

LINKAGE OPTION

4	NONE
5	CLEVIS
6	PUSH ROD
7	PUSH ROD & PLASTIC TIP
8	CLEVIS & PUSH ROD
9	CLEVIS, PUSH ROD & PLASTIC TIP

ORDERING INFORMATION (EXAMPLE IS P/N SAA0424D2)

S	A	A	0	4	24	D	2
SERIES	SIZE	CONICAL PLUNGER	ACTION OPTION	LINKAGE OPTION	COIL VOLTAGE	DENOTES DC	DUTY CYCLE

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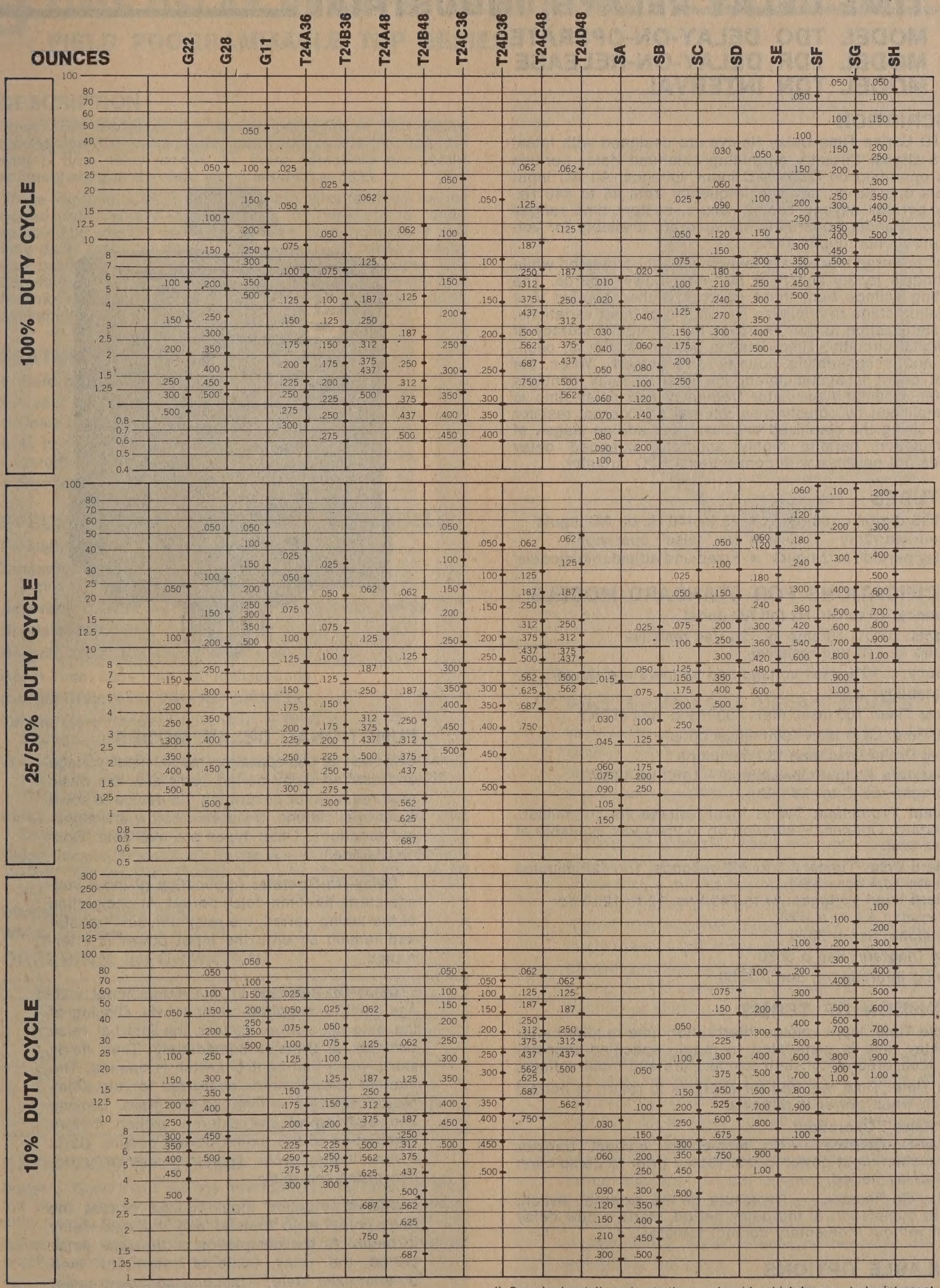
SELECTOGRAPH

FORCE vs. STROKE



HOW TO USE THE SELECTOGRAPH

1) Calculate — Duty Cycle = $\frac{\text{"on time"}}{\text{"on time"} + \text{"off time"}}$ x 100.

2) Select graph covering duty cycle nearest that of application.

3) Locate required force on vertical axis.

4) Scan horizontally and note those solenoids which have a stroke intercept both above and closest to the force line being scanned.

5) Refer to product description and select the type that best meets physical requirement.

6) Using a coil voltage of 6, 12, 24 or 120VDC, determine Magnetec part number.

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TIME DELAY RELAYS, INDUSTRIAL

MODEL TDO DELAY-ON-OPERATE
MODEL TDR DELAY-ON-RELEASE
MODEL TDN INTERVAL

DESCRIPTION

The TD Series Time Delay Relays are designed with latest CMOS Digital Circuitry permitting extended delay periods when operating on DC or AC input voltages. All AC input models operate on any line frequency from 45 to 440 Hz. Delay periods beyond two (2) hours, custom time ranges and non-standard operating voltages are available for volume production applications.

All DC powered models are reverse polarity protected while AC models rectify and filter the input power source. The resulting voltage from these sources is then applied to a regulating stage to minimize the effects of input variations. This stabilization further improves the inherent accuracy of the digital circuitry. Time delay is produced with an oscillator and accumulating counter arrangement. When the preset count is accumulated, the internal relay contacts transfer. Changing oscillator frequency and delay time is accomplished by adjusting an internal or external resistor value. Using the stabilized oscillator and adding stages of accumulation permits highly accurate extended delay periods not possible with conventional R/C circuitry.

FEATURES

- CMOS digital circuitry
- 1 year warranty
- Delay periods to 2 hours
- 45 to 440 Hz on AC inputs
- No "false" operation*
- Fixed and adjustable models

SPECIFICATIONS FOR STANDARD MODELS

Frequency: 45 to 440 Hz (all AC units)

Contacts: DPDT, 10 amp @ 120 Vac resistive
5 amp @ 240 Vac resistive

Accuracy: ±10% over voltage and temperature range

Repeatability: ±2%

Recycle Time: 100 msec max. 300 msec max (TDN)

Reset Time: Less than 100 milliseconds

Current Drain: Less than 150 milliamps

Temperature Range: Operational −10°C to +55°C
Storage −55°C to +85°C

Transient Protection: Twice input voltage for 1 millisec. standard. Optional Protection up to 2500 Vac available at extra cost.

Standard Delay Times: 0.3 to 300 seconds, 1 to 120 minutes (see charts 1 & 2 on p 3530)

Standard Input Voltages: 24 to 240 Vac, 12 to 120 Vdc (see charts 1 & 2 on p 3530)

Dimensions: See p 3530

Wiring Diagram: See p 3530

Ordering Information: See p 3530

DEFINITION OF TERMS

Recycle Time: Input voltage interruption time required after the delay time is completed to regain specified repeatability. Measured at constant temperature and input voltage.

Reset Time: Time required for contacts to return to normal position when power is removed.

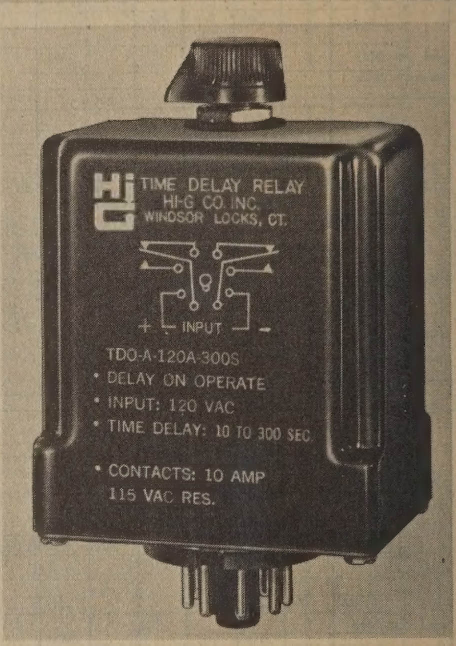
***No "False" Operation:**

Delay-On-Operate — No momentary contact transfer occurs when input power is interrupted prior to completion of the delay period.

Delay-On-Release — Reclosure of the external switch, prior to completion of the delay period, starts a new delay period without momentary contact transfer.

AVAILABLE OPTIONS

- Repeatability — ±1%
- Accuracy — ±5%
- Input voltage as required
- Delay times beyond 2 hours
- Specialized functions



FUNCTIONAL DELAY MODES

Selection of the operating mode, input voltage and desired delay period completes the basic requirements for describing the device to solve most applications. Described below are standard functions. Other types are available. Contact factory.

Delay-On-Operate: Application of input voltage starts the time delay period. At completion of the timing period, the relay contacts transfer and remain so until the input power is interrupted.

Delay-On-Release: In this mode, input voltage must be supplied continuously. Closing of the external control causes the internal relay contacts to transfer immediately. Time delay starts when that control switch is opened. The internal relay remains energized for the delay period selected — then de-energizes. Closing and opening of the external switch, before completion of the timing period occurs, starts a new timing cycle without momentarily de-energizing the relay.

Interval: Applied input voltage causes the relay contacts to transfer and the time delay to begin. At the completion of the time delay period the relay contacts return to their de-energized state. A second contact transfer and time delay period is initiated by interrupting the input voltage for at least the minimum recycle time stated.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

TIME DELAY RELAYS, INDUSTRIAL

FIELD PROGRAMMABLE TDP SERIES

DESCRIPTION

Each TDP Model in this series performs in two Delay modes, operates on multiple input voltages and functions on several time delay ranges. All these selections are easily accomplished in the field as detailed on p 3530.

These versatile CMOS Digital Timers, programmed as required, will replace a multiplicity of conventional units selected by specific operating voltage, functional mode and time delay range. In addition to obvious R&D uses, production products designed with the TDP Series devices will benefit by providing component standardization, permit low inventory levels and at the same time enhançe spare parts availability.

FEATURES

- Field programmable
- 1 year warranty
- Delay periods to 2 hours
- 45 to 440 Hz on AC inputs
- CMOS digital circuitry
- No "false" operation*

SPECIFICATIONS FOR STANDARD MODELS

Frequency: 45 to 440 Hz (all AC units)

Contacts: DPDT, 10 amp @ 120 Vac resistive
5 amp @ 240 Vac resistive

Accuracy: ±10% over voltage and temperature range

Repeatability: ±2%

Recycle Time: 100 milliseconds max.

Reset Time: Less than 100 milliseconds

Current Drain: Less than 150 milliamps

Temperature Range: Operational −10°C to +55°C
Storage −40°C to +85°C

Transient Protection: Twice input voltage for 1 millisec. standard. Optional Protection up to 2500 Vac available at extra cost.

Delay Functions: Programmable, Delay-On-Operate and Delay-On-Release

Delay Ranges (selectable): Range A — 0.3 to 10, 3 to 80 and 10 to 300 seconds; **Range B** — 1 to 15, 2 to 30, 4 to 60 and 8 to 120 minutes

Dimensions: See p 3530

Wiring Diagram: See p 3530

ORDERING INFORMATION

Model	Delay Range	Operating Voltages ±10%
TDP-5	A	12 Vdc and 24 Vdc
TDP-1	A	24 Vac, 24 Vdc and 120 Vac
TDP-2	A	120 Vac and 240 Vac
TDP-6	B	12 Vdc and 24 Vdc
TDP-3	B	24 Vac, 24 Vdc and 120 Vac
TDP-4	B	120 Vac and 240 Vac

DEFINITION OF TERMS

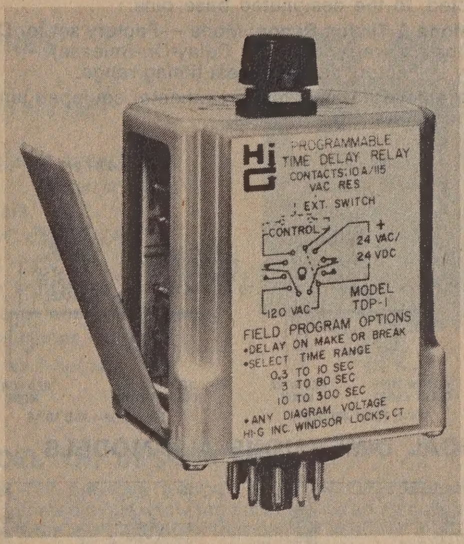
Recycle Time: Input voltage interruption time required after the delay time is completed to regain specified repeatability. Measured at constant temperature and input voltage.

Reset Time: Time required for contacts to return to normal position when power is removed.

***No "False" Operation:**

Delay-On-Operate — No momentary contact transfer occurs when input power is interrupted prior to completion of the delay period.

Delay-On-Release — Reclosure of the external switch, prior to completion of the delay period, starts a new delay period without momentary contact transfer.



PROGRAMMABLE DELAY MODES

In addition to selecting operating voltage and desired delay range, the function (mode) may be programmed. Complete programming details are shown on p 3530. Choice of operating functional modes are:

Delay-On-Operate: Application of input voltage starts the time delay period. At completion of the timing period, the relay contacts transfer and remain so until the input power is interrupted. The external control switch is not normally used in this mode, however, making and breaking of this switch after completion of the timing period provides a convenient alternate method of starting a new timing cycle without interrupting input power.

Delay-On-Release: In this mode, input voltage must be supplied continuously. Closing of the external control causes the internal relay contacts to transfer immediately. Time delay starts when that control switch is opened. The internal relay remains energized for the delay period selected — then de-energizes. Closing and opening of the external switch, before completion of the timing period occurs, starts a new timing cycle without momentarily de-energizing the relay.

TIME DELAY RELAYS, INDUSTRIAL
TDO, TDR, TDN, AND TDP SERIES (cont'd)

SERIES TDP Additional Data — See p 3529 for description

PROGRAMMING INSTRUCTIONS

Operating Voltage: Connect the single operating voltage selected, to the designated base pins.

Delay Mode & Timing Range: Mode — Factory set for Delay-On-Operate (re-program for Delay-On-Release). Delay — Factory set for lowest timing range.

Re-programming: Relocate the connector equipped jumpers as shown (see Fig. #1 & #2).

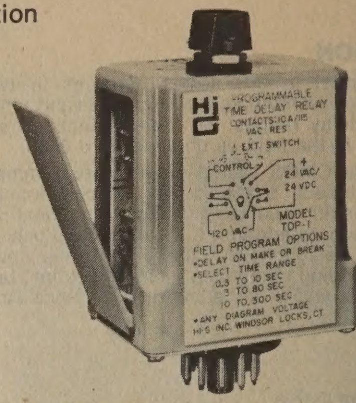
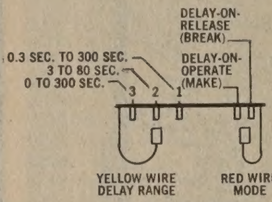

PROGRAMMABLE
TIME DELAY RELAY
CONTACTS:10A/115
VAC RES
EXT. SWITCH
CONTROL
+
24 VAC/
24 VDC
MODEL
TDP-1
120 VAC
FIELD PROGRAM OPTIONS
•DELAY ON MAKE OR BREAK
•SELECT TIME RANGE
0.3 TO 10 SEC
3 TO 80 SEC
10 TO 300 SEC
•ANY DIAGRAM VOLTAGE
HI-G INC. WINDSOR LOCKS, CT

FIGURE 1

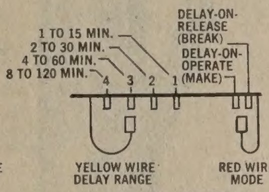
0.3 SEC. TO 300 SEC.


DELAY-ON-RELEASE (BREAK)
0.3 SEC. TO 300 SEC.
3 TO 80 SEC.
0 TO 300 SEC.
DELAY-ON-OPERATE (MAKE)
3
2
1
YELLOW WIRE DELAY RANGE
RED WIRE MODE

TDP-1, TDP-2 AND TDP-5

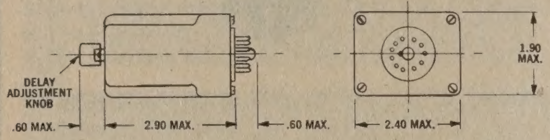
FIGURE 2

1 MIN. TO 120 MIN.


DELAY-ON-RELEASE (BREAK)
1 TO 15 MIN.
2 TO 30 MIN.
4 TO 60 MIN.
8 TO 120 MIN.
DELAY-ON-OPERATE (MAKE)
4
3
2
1
YELLOW WIRE DELAY RANGE
RED WIRE MODE

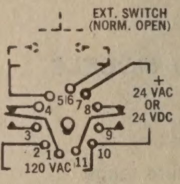
TDP-3, TDP-4 AND TDP-6

PHYSICAL DIMENSIONS ALL MODELS

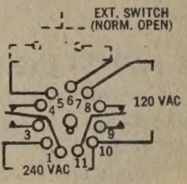

DELAY ADJUSTMENT KNOB
.60 MAX.
2.90 MAX.
.60 MAX.
2.40 MAX.
1.90 MAX.

WIRING DIAGRAMS

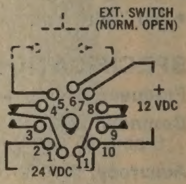
To select desired operating voltage, wire socket pins as shown. Wire for one voltage only.


EXT. SWITCH (NORM. OPEN)
+
24 VAC OR 24 VDC
120 VAC
1
2
3
4
5
6
7
8
9
10
11

TDP-1 AND TDP-3


EXT. SWITCH (NORM. OPEN)
120 VAC
240 VAC
1
3
4
5
6
7
8
9
10
11

TDP-2 AND TDP-4


EXT. SWITCH (NORM. OPEN)
+
12 VDC
24 VDC
1
2
3
4
5
6
7
8
9
10
11

TDP-5 AND TDP-6

SERIES TDO, TDR, TDN — See p 3528 for description

STANDARD CHARACTERISTICS

Chart 1

Standard Delay Periods*		
Factory Fixed TDO-F, TDR-F, TDN-F		Knob Adjustable TDO-A and TDR-A
Secs.	Mins.	
	1	0.3 to 10 sec.
10	2	3 to 80 sec.
30	3	10 to 300 sec.
60	5	1 to 15 min.
120	10	2 to 30 min.
180	15	4 to 60 min.
300	30	8 to 120 min.
	60	

Chart 2

External Control* TDO-E, TDR-E, TDN-E	
Delay Ranges*	Approx. External† Resistor Values
0.3 to 10 sec.	2 Meg Ohms For Max. Delay 0 Ohms Min. Delay
3 to 80 sec.	
10 to 300 sec.	
1 to 15 min.	
2 to 30 min.	
4 to 60 min.	
8 to 120 min.	

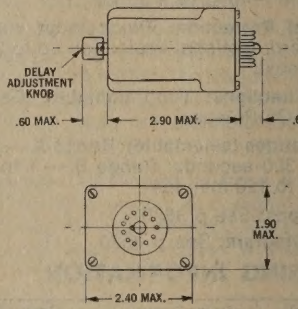
Chart 3

Standard Input Voltages ±10%*	
AC Inputs	DC Inputs
24	12
120	24
240	48
	125

* Contact Factory for other Delay Periods, Ranges, and Voltages.

† Time vs resistance is a linear function. (½ max. resistor value achieves mid range time delay)

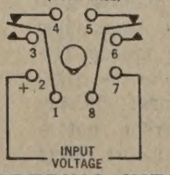
DIMENSIONS, 8- AND 11-PIN MODELS

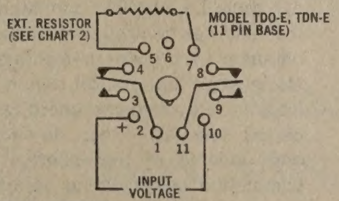

DELAY ADJUSTMENT KNOB
.60 MAX.
2.90 MAX.
.60 MAX.
1.90 MAX.
2.40 MAX.

WIRING DIAGRAMS

DELAY-ON-OPERATE/INTERVAL

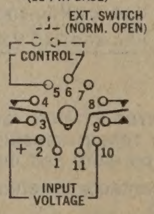
MODELS TDO-A AND TDO-F, TDN-A AND TDN-F (8 PIN BASE)

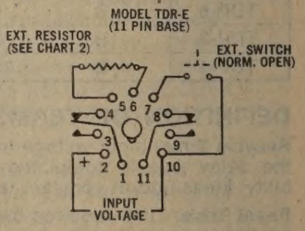

1
2
3
4
5
6
7
8
+
INPUT VOLTAGE


EXT. RESISTOR (SEE CHART 2)
MODEL TDO-E, TDN-E (11 PIN BASE)
1
2
3
4
5
6
7
8
9
10
11
+
INPUT VOLTAGE

DELAY-ON-RELEASE

MODELS TDR-A AND TDR-F (11 PIN BASE)


EXT. SWITCH (NORM. OPEN)
CONTROL
1
2
3
4
5
6
7
8
9
10
11
+
INPUT VOLTAGE


EXT. RESISTOR (SEE CHART 2)
MODEL TDR-E (11 PIN BASE)
EXT. SWITCH (NORM. OPEN)
1
2
3
4
5
6
7
8
9
10
11
+
INPUT VOLTAGE

ORDERING INFORMATION

TD R — A — 240 A — 300 S

Series — TD

O - Operate
R - Release
N - Interval

A - Adjustable
F - Fixed
E - Ext. Res. Adj.

Voltage — 240

A - AC
D - DC

Fixed Delay or Adjustable Max. — 300

S - Seconds
M - Minutes
H - Hours

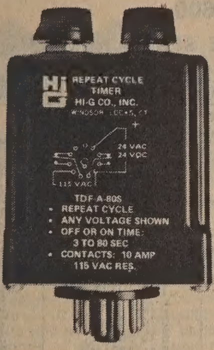
Typical part number: TDR-A-240A-300S

This part number defines a delay-on-release model with an adjustable range of 10 to 300 seconds and an input voltage of 240 VAC, 45 to 440 Hz.

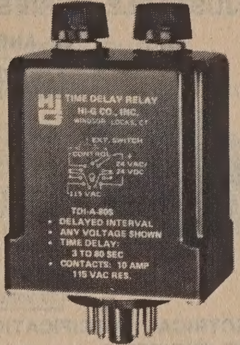
HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

TIME DELAY RELAYS, INDUSTRIAL

REPEAT CYCLE


REPEAT CYCLE
TIMER
HI-G CO., INC.
WINDSOR LOCKS, CT
+
24 VAC
24 VDC
115 VAC
TDF-A-80S
• REPEAT CYCLE
• ANY VOLTAGE SHOWN
• OFF OR ON TIME:
3 TO 80 SEC
• CONTACTS: 10 AMP
115 VAC RES.

DELAYED INTERVAL


TIME DELAY RELAY
HI-G CO., INC.
WINDSOR LOCKS, CT
EXT. SWITCH
CONTROL
+
24 VAC/
24 VDC
115 VAC
TDI-A-80S
• DELAYED INTERVAL
• ANY VOLTAGE SHOWN
• TIME DELAY:
3 TO 80 SEC
• CONTACTS: 10 AMP
115 VAC RES.

COMMON FEATURES

- CMOS digital circuitry.
- AC versions operate 45 to 440 Hz.
- Non interacting controls.
- Transient and reverse polarity protection.
- No false operation.
- DPDT 10 amp res. contacts.
- **INPUT:** 24 VAC or 24 VDC or 120 VAC.
- **TEMPERATURE RANGE:** −10°C to +55°C.
- **ACCURACY:** ±10% over temp./volt range.
- **REPEATABILITY:** ±2% over temp./volt range.
- **CURRENT DRAIN:** 150 milliamps maximum.
- **TIMING AVAILABLE:** Up to 2 hours.

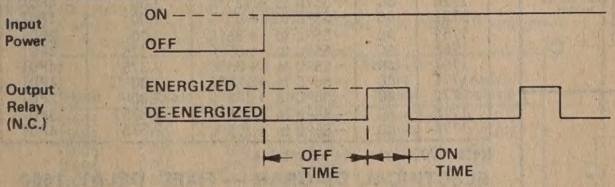
MODEL TDF DESCRIPTION

Model TDF provides continuous OFF/ON cycling. Socket wiring selects any one of the **three** input voltages that can be used for input power. Application of this power always starts the knob adjustable OFF period first. The ON period follows with its duration controlled by the second knob. OFF/ON adjustments are independent and do not interact. Standard units operate within a single time range from the three choices shown below. For delay ranges to 2 hours or beyond, mixed timing ranges and fixed timing versions — consult the factory.

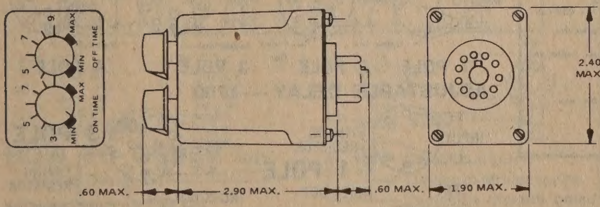
TIME RANGES:

Range 1 — 0.3 to 10 seconds.
Range 2 — 3 to 80 seconds.
Range 3 — 10 to 300 seconds.

LOGIC DIAGRAM


Input
Power
ON
OFF
Output
Relay
(N.C.)
ENERGIZED
DE-ENERGIZED
OFF
TIME
ON
TIME

DIMENSIONS (IN INCHES)


9
7
5
3
MAX
MIN
OFF TIME
MAX
MIN
ON TIME
2.40
MAX.
.60 MAX.
2.90 MAX.
.60 MAX.
1.90 MAX.

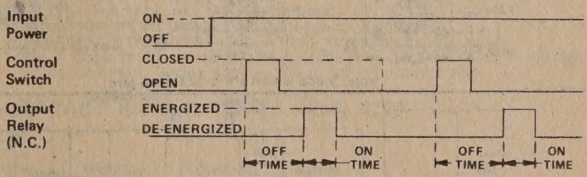
MODEL TDI DESCRIPTION

Model TDI provides a single OFF/ON/OFF sequence for each initiated cycle. How the socket is wired selects any one of the **three** input voltages that can be used for input power which is applied continuously. Each cycle is initiated by a momentary or maintained external contact closure which always starts the knob adjustable OFF period first. A knob adjustable ON period follows and then goes OFF again to complete the cycle. The OFF/ON controls are independent and do not interact. Standard units operate within a single time range from the three choices shown below. For delay ranges to 2 hours or beyond, mixed timing ranges and fixed timing versions — consult the factory.

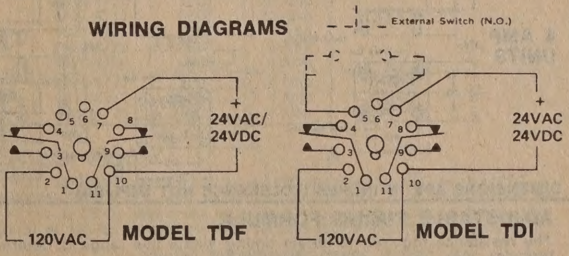
TIME RANGES:

Range 1 — 0.3 to 10 seconds.
Range 2 — 3 to 80 seconds.
Range 3 — 10 to 300 seconds.

LOGIC DIAGRAM


Input
Power
ON
OFF
Control
Switch
CLOSED
OPEN
Output
Relay
(N.C.)
ENERGIZED
DE-ENERGIZED
OFF
TIME
ON
TIME
OFF
TIME
ON
TIME

WIRING DIAGRAMS


External Switch (N.O.)
+
24VAC/
24VDC
1
2
3
4
5
6
7
8
9
10
11
120VAC
MODEL TDF
+
24VAC
24VDC
120VAC
MODEL TDI

ORDERING INFORMATION

TD I — **A** — **300** **S**

Series

I - Delayed Interval
F - Flasher

A - Adjustable
F - Fixed

Max. Time

M - Milliseconds
S - Seconds
H - Hours

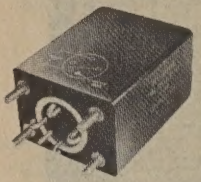
Typical Part Number: TDI-A-300S. This part number defines the delayed interval model with adjustable ranges of 10 to 300 seconds. Each unit operates on any one of the **three** voltages shown. Ranges may not be mixed. For fixed times, consult the factory.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

TIME DELAY RELAYS, HERMETIC SEAL

DELAY-ON-OPERATE

ADJUSTABLE SERIES 1700



4 AND 10 AMPERES RATING CHART

Type	DC, 10 Amp	AC or DC, 4 Amp
Input Voltages	18 to 31 VDC, unregulated	DC Units, 18 to 31 volts, Unregulated AC Units, 105 to 125 volts, Specify 400 Hz or 60 Hz
Delay Time	50 millisecond to 240 seconds (Adj.) 50 millisecond to 600 seconds (Fixed)	
Contact Rating at 30 Volts DC	10 amps, Resistive 5 amps, Inductive	4 amperes, Resistive
Contact Configuration	1, 2 Poles, double-throw	1-, 2-, 3- and 4-pole, double throw
Current Drain at 25°C at 28 Volts DC	135 ma maximum	1-pole: 100 ma maximum; 2-pole: 150 ma maximum; 3 and 4 pole: 200 ma max.

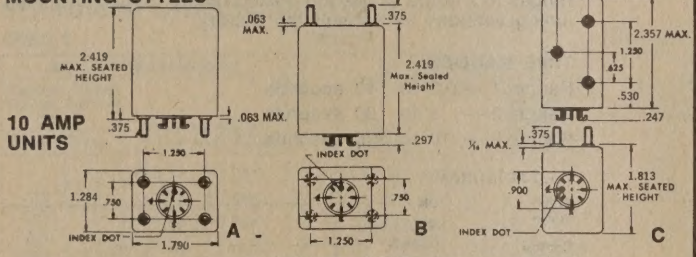
ELECTRICAL SPECIFICATIONS

INPUT VOLTAGES: Refer to above chart.
DELAY TIMES: 50 milliseconds to 240 seconds adjustable, 600 seconds fixed. Delays to 2 hours available.
FUNCTION: Delay on operate.
TIMING TOLERANCE: ±10% or 10 milliseconds standard. ±5% available.
RECYCLE TIME: 10 msec. (DC), 50 msec. (AC).
RECOVERY TIME: 10 msec. (DC), 50 msec. (AC).
RESET TIME: 10 milliseconds maximum for DC units and 40 milliseconds maximum for AC units.

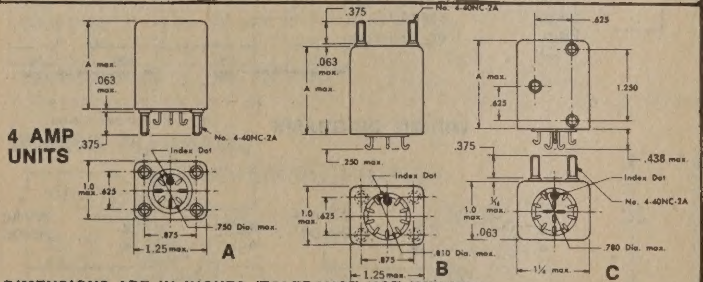
ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE: −55°C to +85°C or −55°C to +125°C.
VIBRATION: 20 G's; 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 millisecond duration.
INSULATION RESISTANCE: 1000 megohms at 500 volts DC, all terminals to case.
DIELECTRIC STRENGTH: 1000 volts RMS, 60 Hz, all terminals to case.
SEALING: Hermetic, 1.3 inches mercury.
LIFE: 100,000 operations minimum.

MOUNTING STYLES


10 AMP UNITS
2.419 MAX. SEATED HEIGHT
.063 MAX.
.375
2.419 Max. Seated Height
.297
1.250
1.284
.750
INDEX DOT
1.790
A
INDEX DOT
.750
1.250
B
.625
2.357 MAX.
1.250
.625
.530
.247
¼ MAX.
.375
.900
1.813 MAX. SEATED HEIGHT
INDEX DOT
C

Note: Studs shown are 6-32 thread size


4 AMP UNITS
A max.
.063 max.
No. 4-40NC-2A
.375
Index Dot
1.0 max.
.625
.750 Dia. max.
.875
1.25 max.
A
.375
No. 4-40NC-2A
.063 max.
A max.
.250 max.
Index Dot
1.0 max.
.625
.810 Dia. max.
.875
1.25 max.
B
.625
A max.
.625
1.250
.375
.438 max.
Index Dot
No. 4-40NC-2A
1.0 max.
¼ max.
.063
.780 Dia. max.
1¼ max.
C

DIMENSIONS ARE IN INCHES (TOLERANCE NOT IMPLIED)

ADJUSTABLE TIMING FORMULA

The resistance required to obtain timing within this range is determined by using the formula:

Rx = 400K (T/T max.) −40K
Rx = External Res. in OHMS
T = Desired time in seconds
T max. = Maximum time (code)

A high quality deposited carbon ±1%, .1w (min.) resistor is recommended for external resistance.

FIXED SERIES 1600

10 AMPERE MODULE SERIES NUMBER — TABLE

Series	Function	Contact Arrangement
1610	Fixed	1PDT
1611	Fixed	2PDT

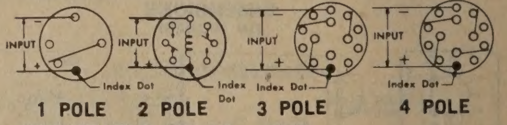
Series	Contact Arrangement	Adjustable Range	Timing Code
1710	1PDT	.1 to 1.0 sec.	1001
1711	1PDT	.5 to 5 sec.	5001
1712	1PDT	1.0 to 10 sec.	1002
1713	1PDT	5 to 50 sec.	5002
1714	1PDT	18 to 180 sec.	1803
1715	2PDT	.1 to 1.0 sec.	1001
1716	2PDT	.5 to 5 sec.	5001
1717	2PDT	1.0 to 10 sec.	1002
1718	2PDT	5 to 50 sec.	5002
1719	2PDT	18 to 180 sec.	1803

4 AMPERE MODULE SERIES NUMBER — FIXED & ADJUSTABLE TABLE

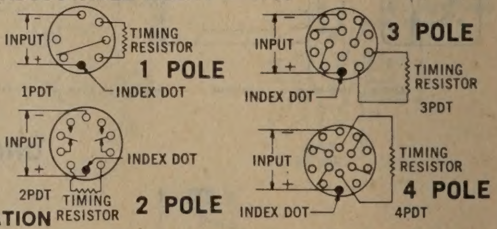
Series	Input	Temperature Range	Housing Length (Dim. "A")	Contact Arrangement
1601	DC	−55°C to +85°C	1.656	1PDT
1602	DC	−55°C to. +85°C	1.656	2PDT
1603	DC	−55°C to +85°C	2.00	3PDT
1604	DC	−55°C to +85°C	2.00	4PDT
1621	DC	−55°C to +125°C	1.656	1PDT
1622	DC	−55°C to +125°C	1.656	2PDT
1623	DC	−55°C to +125°C	2.00	3PDT
1624	DC	−55°C to +125°C	2.00	4PDT
1651	AC	−55°C to +85°C	2.00	1PDT
1652	AC	−55°C to +85°C	2.00	2PDT
1653	AC	−55°C to +85°C	2.375	3PDT
1654	AC	−55°C to +85°C	2.375	4PDT
1671	AC	−55°C to +125°C	2.00	1PDT
1672	AC	−55°C to +125°C	2.00	2PDT
1673	AC	−55°C to +125°C	2.375	3PDT
1674	AC	−55°C to +125°C	2.375	4PDT
1701	DC	−55°C to +85°C	1.656	1PDT
1702	DC	−55°C to +85°C	1.656	2PDT
1703	DC	−55°C to +85°C	2.00	3PDT
1704	DC	−55°C to +85°C	2.00	4PDT
1721	DC	−55°C to +125°C	1.656	1PDT
1722	DC	−55°C to +125°C	1.656	2PDT
1723	DC	−55°C to +125°C	2.00	3PDT
1724	DC	−55°C to +125°C	2.00	4PDT
1751	AC	−55°C to +85°C	2.00	1PDT
1752	AC	−55°C to +85°C	2.00	2PDT
1753	AC	−55°C to +85°C	2.375	3PDT
1754	AC	−55°C to +85°C	2.375	4PDT
1771	AC	−55°C to +125°C	2.00	1PDT
1772	AC	−55°C to +125°C	2.00	2PDT
1773	AC	−55°C to +125°C	2.375	3PDT
1774	AC	−55°C to +125°C	2.375	4PDT

Note: 1700 series are adjustable.

ELECTRICAL DIAGRAM — FIXED DELAY 1600


INPUT
−
+
Index Dot
1 POLE
INPUT
Index Dot
2 POLE
INPUT
Index Dot
3 POLE
INPUT
Index Dot
4 POLE

ADJUSTABLE DELAY — 1700


INPUT
−
+
TIMING RESISTOR
1 POLE
1PDT
INDEX DOT
INPUT
3 POLE
TIMING RESISTOR
INDEX DOT
3PDT
INPUT
INDEX DOT
2PDT
TIMING RESISTOR
2 POLE
INPUT
TIMING RESISTOR
4 POLE
INDEX DOT
4PDT

DETERMINATION OF MODULE PART NUMBER — ORDERING INFORMATION

Hi-G Adjustable Time Delay Modules cover one decade, e.g., 62 milliseconds to 620 milliseconds; you may select any decade that best suits your application within the range of 50 milliseconds to 240 seconds. (Of course, longer ranges are available on special order.) The upper decade limit is $T_{max.}$ in the timing formula and is the timing code number in the part number described in the following paragraph.

The part number for a Hi-G Time Delay Module consists of three elements: The series number (from the Table), a letter signifying mounting style, and the timing code number. The timing code number consists of four digits and gives the time in milliseconds. The first three digits are the significant figures and the last digit is the number of zeroes following the significant figures; thus, 50 milliseconds would be coded 0500, 1.1 seconds would read 1101, and 1 minute (60 seconds) would be 6002.

A typical part number for an adjustable timing module is 1722-C-1102; this is a DC unit in the −55°C to +125°C temperature range with a 2PDT contact arrangement, in a Style C mounting, and with a time delay range of 1.1 to 11 seconds.

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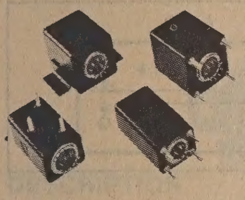
TIME DELAY RELAYS, HERMETIC SEAL

DELAY-ON-RELEASE

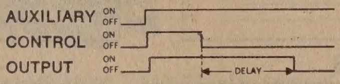
FIXED SERIES **5600**

ADJUSTABLE SERIES **5700**



FUNCTION

Apply auxiliary power. Upon application of control power, the output will energize. Remove control power and initiate delay period.



ELECTRICAL PARAMETERS

INPUT: Units will not be damaged by reverse application of input voltage.
Auxiliary — 18 - 31 VDC; 105 - 125 VAC; 400 Hz.
Control — 10 - 31 VDC. Ground common to aux. power line.
10 volts minimum must be applied for a minimum duration of 20 milliseconds to energize output and arm the timing circuit.

DELAY TIMES: Overall, 50 msec to 240 msec (ADJ), 600 msec (FIXED). Units rated to 10 amperes, min. delay 100 msec, max. 2 hrs. available.

TIMING TOLERANCE: ±10% standard, ±5% available.

CURRENT DRAIN: (at 25°C at 28 VDC).
Control Line — 15 ma typical, 25 ma maximum.
Auxiliary — De-energized (after completion of delay period) 25 ma Energized (see Tabulation).

Configuration	2 & 5 Amp	10 Amp
1PDT	100 ma	150 ma
2PDT	150 ma	240 ma

RESPONSE TIME:
Operate — Rated 2 and 5 amp, 10 msec max. 10 amp, 20 msec max.
Recycle — 10 msec (DC); 50 msec (AC).
Reset — 20 msec maximum.

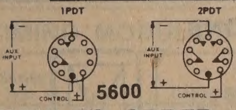
CONTACT RATINGS:

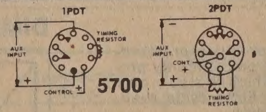
Specified Rating	Amperes at 30 VDC Res	Amperes at 30 VDC Ind	Amperes at 115 V 400 Hz Res	Amperes at 115 V 400 Hz Ind
2 amps	2	1	1	0.3
5 amps	5	1.5	3	1
10 amps	10	5	5	3

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE: −55°C to +85°C or −55°C to +125°C.
VIBRATION: 10-20,000 Hz at 20G except 10 amp rated units 15G.
SHOCK: 50G 11 ±1 millisecond.
INSULATION RESISTANCE: 1000 Megohms minimum at 500 VDC.
DIELECTRIC STRENGTH: 1000V RMS, 60 Hz at Sea Level. All terminals tied together to case, and across open contacts.
SEALING: Hermetic 1.3 inches mercury.
LIFE: 2 and 5 amp rated - 100,000 operations minimum. 10 amp rated - 50,000 operations minimum.

Series Fixed	Series Adjustable	Contact Configuration	Rating	Temperature Range	Available Enclosure
5601	5701	1PDT	2 Amp	−55°C to +85°C	A-C-D-E
5602	5702	2PDT	2 Amp		A-C-D-E
5605	5705	1PDT	5 Amp		D-E
5606	5706	2PDT	5 Amp		D-E
5610	5710	1PDT	10 Amp		D-E
5611	5711	2PDT	10 Amp		D-E
5621	5721	1PDT	2 Amp	−55°C to +125°C	A-C-D-E
5622	5722	2PDT	2 Amp		A-C-D-E
5625	5725	1PDT	5 Amp		D-E
5626	5726	2PDT	5 Amp		D-E



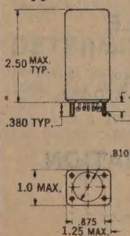


HOW TO ORDER

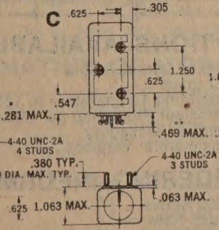
5621 — A 1003
1003 — Zeros Multiplier
Timing in Milliseconds
Enclosure Style
5621 — Series Designator

MOUNTING STYLES

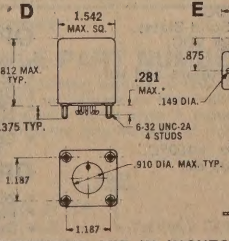
A



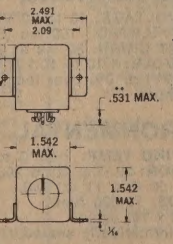
C



D



E



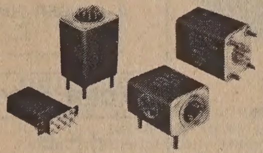
NOTE: TOLERANCES NOT IMPLIED DIMENSIONS ARE IN INCHES

INTERVAL

FIXED SERIES **4600** (RELAY OUTPUT)

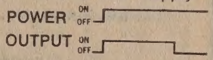
ADJUSTABLE SERIES **4700** (RELAY OUTPUT)

FIXED SERIES **4800** (SOLID STATE OUTPUT)



FUNCTION

Apply power and the output will energize. After time out, the output will revert to de-energized state. Remove and reapply power to recycle.



HOW TO ORDER

4610 / 4710 / 4801 — 2 B — 1003
Series
Header (4800 only)
Mounting
Time in millisec. Also, max. time on adjustable (4700) with min. a decade lower.
Zeros Multiplier

Schematics and mounting styles of Series 4600 and 4700 are same as Series 1600 and 1700. Similarly, Series 4800 is same as Series 2400 except output (no. of terminals).

SERIES 4600, 4700, 4800
ELECTRICAL SPECIFICATIONS

INPUT VOLTAGE: 18-31 VDC. AC units 105-125 VAC 400 Hz DC units will not be damaged by reverse application of input voltage.
DELAY TIMES: 100 milliseconds to 300 sec. Series 4800 — See Table.
TIMING TOLERANCE: ±10% standard, ±5% available.
OPERATE TIME: 4 amp rated units: 7 ms maximum. 10 amp rated units: 15 ms maximum. Series 4800 — 100 microseconds maximum.
CURRENT DRAIN: Steady state (after time-out). 75 ma maximum at 28 VDC at 25°C. See tabulation for current drain during time-out. Series 4800 — 25 ma maximum + actual load.
RECYCLE TIME: 0.5% maximum of the specified delay time.
CONTACT RATING: See tabulation. Choice of ratings. 10 amps resistive, 5 amps inductive at 28 VDC, 115 VAC, 400 Hz, or 4 amps resistive, 1 amp inductive at 28 VDC. 2 amps resistive, 1 amp inductive at 115 VAC, 400 Hz.

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE: −55°C to +125°C or −55°C to +85°C.
VIBRATION: 20 G's 10-2000 Hz.
SHOCK: 50 G's 11 ms. Duration.
SEALING: Hermetic. 1.3 inches mercury.
INSULATION RESISTANCE: 1000 Megohms at 500 VDC.
DIELECTRIC STRENGTH: 1000 V RMS, 60 Hz at Sea Level.
LIFE: 4 amps rated — 100,000 operations min. 10 amp rated — 50,000 operations min. Series 4800 — Over 10^6 operations min.

CONTACT RATING SERIES 4600, 4700

Type	Series	Contacts	Rating
DC	4610-4710	1PDT	10 Amp
	4611-4711	2PDT	10 Amp
	4621-4721	1PDT	4 Amp
	4622-4722	2PDT	4 Amp
	4624-4724	4PDT	4 Amp
AC	4671-4771	1PDT	4 Amp
	4672-4772	2PDT	4 Amp
	4674-4774	4PDT	4 Amp

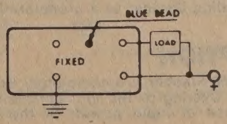
SERIES 4800

OUTPUT: SPST-NO rated 0.5 amp at 25°C derating to 250 ma at 125°C.
FORWARD DROP: 1.0 volt maximum at .5 amps, .3 volts maximum at 150 ma at 25°C. Maximum leakage 10 microamps (in non-conducting state) at 125°C. Inductive loads require diode suppression externally.

TIMING TEMPERATURE RANGE, SERIES 4800

Series	Timing Range	Temperature Range
4801	10 ms. to 50 sec.	−55°C to +85°C
4802	51 sec. to 100 sec.	−55°C to +85°C
4851	10 ms. to 40 sec.	−55°C to +125°C
4852	41 sec. to 80 sec.	−55°C to +125°C

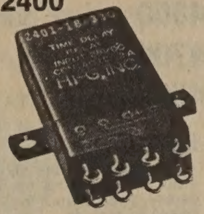
SERIES 4800 SCHEMATIC



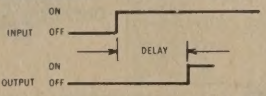
TIME DELAY RELAYS, MINIATURE (HERMETIC)

DELAY-ON-OPERATE

SERIES 2400



TIMING DIAGRAM — Delay-On-Operate



FEATURES

The Series 2400 Time Delay Relay combines a solid-state timing circuit and a Hi-G relay in a package only slightly longer than a standard crystal-case housing. This combination provides the current-carrying capacity and the environmental immunity of Hi-G's electro-mechanical relays with the long life and quick response of electronic circuits.

Delays from 50 milliseconds up to 600 seconds can be specified for this rugged DC timing module. The solid-state circuit has a voltage regulator circuit that permits the use of unregulated power sources.

HOW TO ORDER

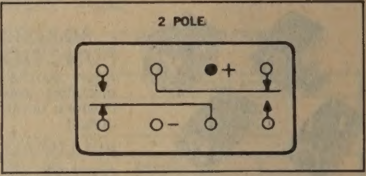
The part number for a Hi-G miniature time delay module consists of four elements: the series number, the header style, the mounting style, and the timing code number. The timing code number consists of four digits and gives the time in milliseconds. The first three digits are the significant figures and the last digit is the number of zeroes following the significant figures; thus, 0500 would be 50 milliseconds, 1101 is the code for 1.1 seconds, and 5002 would be 50 seconds. A typical part number for the Hi-G miniature delay module is 2401-1A-1102; this is a time delay module designed to operate in the −55°C to +85°C temperature range, hook terminals, style A mounting, providing a delay of 11 seconds. Specify 2402 for +125°C.

```
2401      1A      1102
  |       ||        └── TIMING CODE
  |       |└──────── MOUNTING STYLE
SERIES    └────── HEADER STYLE
```

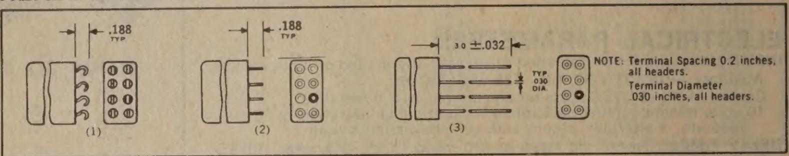
AVAILABLE OPTIONS

1. POWER INTERRUPTION ZERO VOLTS FOR 100 MILLISECONDS.
2. LONGER TIME DELAYS.

ELECTRICAL DIAGRAM

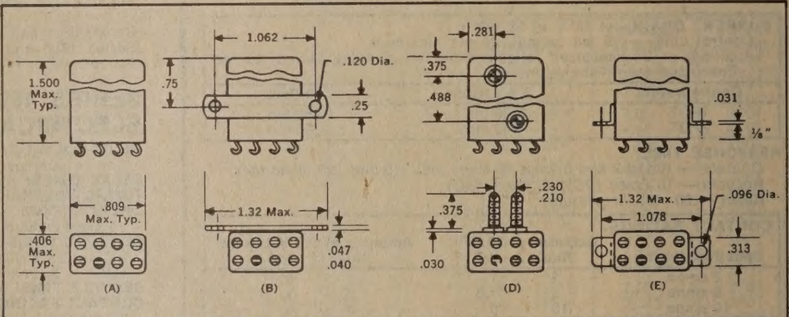


HEADER STYLES



NOTE: Terminal Spacing 0.2 inches, all headers.
Terminal Diameter .030 inches, all headers.

MOUNTING STYLES



DIMENSIONS ARE IN INCHES Note: Studs shown are 4-40 Thread Size. NOTE: TOLERANCES NOT IMPLIED

ELECTRICAL SPECIFICATIONS

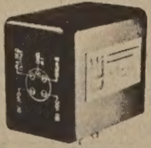
INPUT VOLTAGE: 18 to 31 VDC. Reverse polarity protection provided.
DELAY TIME: 50 milliseconds to 120 seconds Delay-on-make.
TIMING TOLERANCE: ±10% standard, ±5% available.
RESET TIME: 10 milliseconds maximum.
RECYCLE TIME: 10 milliseconds.
RECOVERY TIME: 20 milliseconds.
CONTACT RATING: 2 amps resistive at 30 VDC or 0.125 amp at 115 V, 400 Hz.
TRANSIENT PROTECTION: 80 VDC for 50 milliseconds.
CONTACT ARRANGEMENT: 2-pole, double-throw.
CURRENT DRAIN: 85 ma maximum at 31 VDC (25°C).

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE: 2401 Series −55°C to +85°C. 2402 Series −55°C to +125°C.
VIBRATION: 20 G's, 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 milliseconds duration.
INSULATION RESISTANCE: 1000 megohms at 500 VDC, all terminals to case.
DIELECTRIC STRENGTH: 500 V RMS, 60 Hz, terminals to case.
SEALING: Hermetic, 1.3 inches mercury.
LIFE: 50,000 operations minimum.
WEIGHT: 1.2 oz. maximum.

FLASHER

SERIES 2600



APPLICATION

The Hi-G Series 2600 Flasher can be used wherever warning or indicating light, navigation or position lights, panel or control lights must be operated with a maximum of reliability in severe environments. The Series 2600 can also be used to interrupt Tone Generators or other Signaling Devices at a predetermined frequency.

DESCRIPTION

The Series 2600 Flasher is a completely Solid-State Device. Cycling of the unit commences with application of input power, or the unit can be actuated by a control line when standby power is available. Electronic circuitry provides a precise flash rate which is stable over a wide temperature range. Flash cycle available from 30 to 600 per minute.

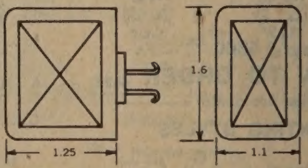
ELECTRICAL SPECIFICATIONS

INPUT VOLTAGE: 18 to 32 VDC.
OUTPUT: S.P.N.O., 100 ma (Solid-State).
CURRENT DRAIN: 30 ma at 28 VDC.
DUTY CYCLE: 1:10 to 10:1.
STABILITY: ±10% over temperature and voltage input.

ENVIRONMENTAL

OPERATING TEMP: −55°C to +100°C.
VIBRATION: 20 G's, 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 MS.
ALTITUDE: 70,000 feet.
LIFE: 10 x 10⁶ cycles.
CASE: Hermetically sealed.

DIMENSIONS



OPTIONS AVAILABLE

- Higher Output Rating
- AC Input
- Operating Temperature to 125°C
- Transient Protection per MIL-STD-704
- Smaller Packaging
- Commercial Versions

ORDERING INFORMATION

- 2600 Series
- Flash Rate
- Duty Cycle

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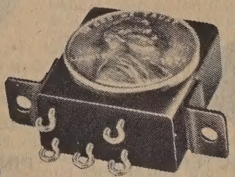
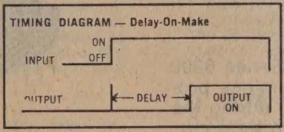
TIMING MODULES, CRYSTAL CAN/DUAL-IN-LINE

DELAY-ON-OPERATE

CRYSTAL CAN SERIES 1800, 1900





DESCRIPTION

The 1800 and 1900 Series are all Solid-State Timers that offer excellent reliability over a useful life well in excess of one million operations. Each unit is hermetically sealed and encapsulated with a standard crystal-can header.

SERIES CHART

Type	Delay Times	Recycle Time (Millisec.)	Output	Max. Forward Leakage
1800	10 ms to 600 sec. Factory Set	10	300 ma @ 25°C	10
1900	10 ms to 240 sec. Adjustable	10	Fwd. drop 2.5V max.	Microamp

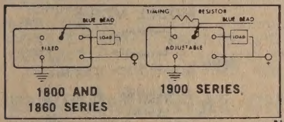
ELECTRICAL SPECIFICATIONS

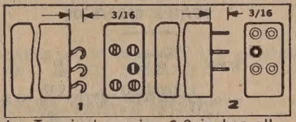
INPUT VOLTAGE: 18 to 31 VDC.
TIMING TOLERANCE: ±10% or 10 milliseconds standard, ±5% available.
RECOVERY TIME: 20 milliseconds maximum.
RECYCLE TIME: 10 milliseconds maximum.
OUTPUT DERATING FOR 125°C: Derated to .100 amp.

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE: −55°C to +125°C.
VIBRATION: 20 G's, 10 to 2000 Hz.
SHOCK: 100 G's, 11 ±1 milliseconds duration.
INSULATION RESISTANCE: 1000 megohms at 500 VDC, all terminals to case.
DIELECTRIC STRENGTH: 500 V RMS, 60 Hz, all terminals to case.
SEALING: Hermetic, 1.3 inches mercury.
LIFE: Over 1,000,000 operations.

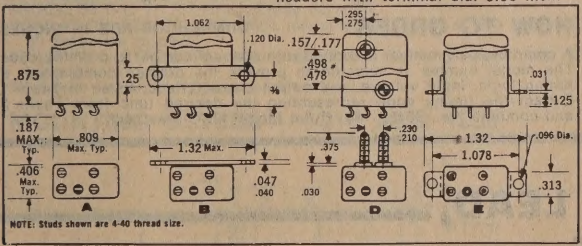
ELECTRICAL DIAGRAMS — HEADER STYLES





MOUNTING STYLES

Note: Terminal spacing 0.2 inches all headers with terminal dia. 0.03 inch.



NOTE: Studs shown are 4-40 thread size.

TIMING MODULE TYPES

Series Type	Type	Timing Range	Temperature Range	Housing Length (Dim. "A")
1801	Fixed	10 ms to 600 sec.	−55°C to +85°C	.875″
1851	Fixed	10 ms to 600 sec.	−55°C to +125°C	.875″
1901	Adjust.*	10 ms to 240 sec.	−55°C to +85°C	.875″
1951	Adjust.*	10 ms to 240 sec.	−55°C to +125°C	.875″

*Refer to Model 1700 for Adjustable Timing Formula.

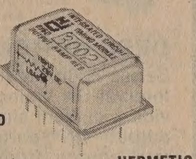
DETERMINATION OF MODULE PART NUMBER

A typical part number for the Hi-G Solid-State Timing Module is 1801-1A-1002; this is a fixed timing module designed to operate in the −55°C to +85°C temperature range, with hook terminals and a style A mounting, and a delay of 10 seconds. (See Dual-In-Line information, at right, for timing code construction.)

1801 — **1A** — **1002**
SERIES
MOUNTING STYLE
HEADER STYLE
TIMING CODE

MIL-R-83726/13 SERIES 6001
DUAL-IN-LINE SERIES 6100, 6150 FIXED
6110, 6160 ADJUSTABLE

ENCAPSULATED



HERMETIC

DESCRIPTION

Thick-film hybrid circuitry makes these units very compact and trouble free. Two packaging styles are available. Series 6150 and 6001 are housed in a hermetically sealed metal case. Model 6001 is QPL approved per MIL-R-83726/13. A lower cost, epoxy encapsulated, plastic shell package is provided with Series 6100. All units have a terminal footprint .1″ x .3″ grid, compatible with Dual-In-Line mounting patterns. Model Numbers 6155 and 6105 are TTL compatible. All units have an SCR output device and a life in excess of 1 million operations. Time delays from 50 ms to 600 sec. are standard.

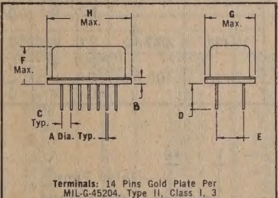
ELECTRICAL CHARACTERISTICS

INPUT VOLTAGE: Table I.
CURRENT DRAIN: 10 ma max. plus load current.
OUTPUT RATING: Encapsulated .25 Amp derated to .1 Amp at +85°C. Hermetic .3 Amp derated to .1 Amp at +125°C. Min. Load required is 10 ma.
FORWARD DROP: 2.5 VDC max. at +25°C.
OUTPUT SWITCH: SPNO Solid-State. Models 6155/6105 TTL Compatible.
TIME RANGES: 0.05 to 600 seconds.

ENVIRONMENTAL CHARACTERISTICS

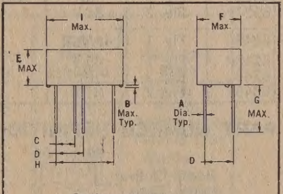
TEMPERATURE RANGE:
Encapsulated −55°C to +85°C. Hermetic −55°C to +125°C.
VIBRATION: 20 G's, 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 millisecond duration.
LIFE: 1,000,000 cycles minimum.

DIMENSIONS



Terminals: 14 Pins Gold Plate Per MIL-G-45204. Type II, Class I, 3 Terminals For Circuit Connections.
Unit Weight: .4 oz. (12 grms).

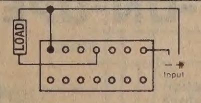
	A	B	C	D	E	F	G	H
Inches	.018	.06	.100	.28	.300	.42	.58	.920
mm	,46	1,52	2,54	7,11	7,62	10,67	14,73	23,37



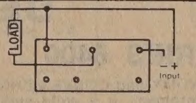
Terminals: Gold Plated.
Unit Weight: .2 oz. (6 grms).

	A	B	C	D	E	F	G	H	I
Inches	.018	.03	.200	.300	.376	.475	.50	.600	.815
mm	.46	.76	5.08	7,62	9,55	12,06	12,70	15,24	20,70

WIRING DIAGRAMS



SERIES 6150/6001



SERIES 6100

DETERMINATION OF MODULE PART NUMBER

Timing Code Determination: The timing code consists of four digits and denotes time in milliseconds. The first three digits are significant figures and the last digit is the number of zeros to follow. Thus 100 milliseconds is coded 1000; 1.1 seconds is 1101 (1100 milliseconds); and 60 seconds is 6002 (60,000 milliseconds).

Example:

6100 — 6002
MODEL NUMBER
TIMING CODE

This number designates a Solid-State Output Timer with 60 seconds (60,000 milliseconds) time delay operating at 28 VDC.

TIMING MODULES, DUAL-IN-LINE PACKAGE

SERIES 6200
DELAY-ON-OPERATE

SERIES 6300
INTERVAL

SERIES MCG-5
LOGIC NORMALIZER

DESCRIPTION

Series 6200 provides a Delay-On-Operate and Series 6300 Interval-On timing function. Standard output versions provide a current sink to the negative load terminal during the output "ON" period. Similarly, "P" versions provide a current source from the positive input terminal during the output "ON" period. Model MCG-5 provides a one shot (Interval) low level sink for 0.5 seconds.

GENERAL SPECIFICATIONS

DELAY ACCURACY: ±10% over temperature and voltage range.
REPEATABILITY: ±2%.
RECYCLE TIME: 100 milliseconds maximum.
DELAY SET POINT: Fixed — No external components required.
Adjustable — External resistor required.
OUTPUT: SPST-NO — Solid-state.
Standard Model — Switches to minus input.
P Characteristic — Switches to plus input.
TEMPERATURE RANGE: 0°C to +71°C.
TERMINALS: Tin Dipped Phosphorous Bronze.
CASE MATERIAL: Diallylphthalate.

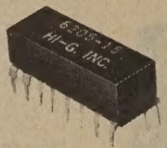
TABLE 1

Model No.	Timing Logic Diagram	V_{cc} Nominal Range	I_{cc} Current Drain	I_o Load Current Min.	I_o Load Current Max.	V_f (Typ.) Forward Drop	Pin Out
MCG-5*	Fig. 2	**5 VDC** 4.5 V to 5.5 V	25 ma Max.	N/A	20 ma	0.25 V	A
6205*	Fig. 1			*Models with Internal 2K Pull-up Res.		0.25 V	B
6205P	Fig. 1					0.7 V	B
6305*	Fig. 2					0.25 V	B
6305P	Fig. 2					0.7 V	B
6212	Fig. 1	**12 VDC**	10 ma Max.	10 ma	200 ma	2.0 V	C
6212P	Fig. 1	10 V to 14 V		N/A	100 ma	0-7 V	C
6312	Fig. 2					0-7 V	C
6312P	Fig. 2					0-7 V	C
6224	Fig. 1	**24 VDC**		10 ma	200 ma	2.0 V	C
6224P	Fig. 1	18 V to 31 V		N/A	100 ma	0-7 V	C
6324	Fig. 2					0-7 V	C
6324P	Fig. 2					0-7 V	C
6248	Fig. 1	**48 VDC**		10 ma	200 ma	2.0 V	C
6248P	Fig. 1	45 V to 51 V		N/A	100 ma	0-7 V	C
6348	Fig. 2					0-7 V	C
6348P	Fig. 2					0-7 V	C

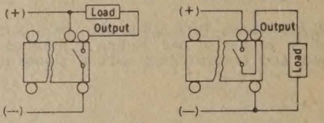
PART NUMBER DEFINITION

62 05 P — 1 10

62 — Basic Output Logic Type
05 — Input Voltage
P — Switching Characteristic (no letter denotes standard switching characteristic)
1 — Timing Mode
10 — Delay Time



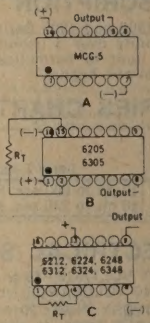
OUTPUT CHARACTERISTICS



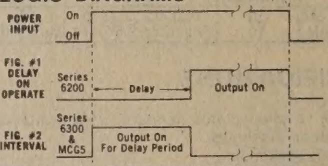
Load Sinking
Standard

Load Sourcing
"P" Version

PIN OUT DIAGRAMS



LOGIC DIAGRAMS



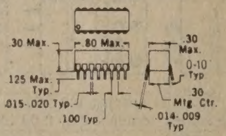
TIMING DESIGNATIONS — TABLE 2

TIME (Seconds)	0.5	1.0	3.0	5.0	10	30	0.30
TIMING CODE	105	11	13	15	110	130	230

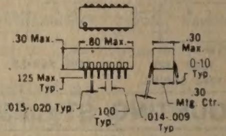
TIMING CODE 230 — Provides a device that may be adjusted using external resistance, over an approximate range of 15-30 milliseconds to 30 seconds. Lower Limit R_T is restricted to 5K minimum. With less resistance, erratic or no time-out may result. 600-700K approximate, will provide a 30 second delay, with intermediate, resistance vs. time, being a linear relationship.

PHYSICAL DIMENSIONS

SERIES 6200/6300



MODEL MCG-5



DIMENSIONS ARE IN INCHES

HOW TO ORDER

A complete part number is formed with a model number and timing code. The model number is selected to provide the desired combination of timing logic, input voltage, and output characteristic, listed in Table 1. Extract the timing code representing the desired time from Table 2, and combine. i.e., 6348P-130. Order Model MCG-5 as such.

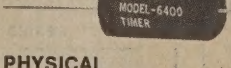
TIMING MODULES, AXIAL LEAD, DELAY-ON-OPERATE

SERIES 6400

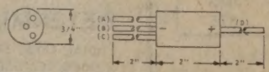
ECONOMY and CONVENIENCE of installation are foremost in a solid-state, two and four lead, cylindrical cased timer, providing a DELAY-ON-OPERATE control function. Fixed and adjustable models.

FEATURES

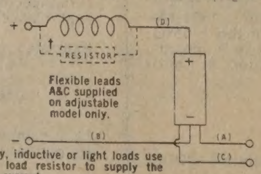
INPUT VOLTAGES: 6 VDC, 12 VDC, 24 VDC, and 48 VDC.
FIXED DELAY TIMES: 1.0, 5.0, 10, 30, and 60 seconds.
ADJUSTABLE MODELS: .05 seconds to max. specified delay which is 90 seconds.
SERIES: Connected with load.
ACCURACY: ±10% (over temperature range).
REPEATABILITY: ±2%.
OUTPUT RATING (Inductive): 2.0 amps at the rated input voltage.
PROTECTION: Reverse polarity.
OPERATING TEMP. RANGE: 32°F to +125°F.



PHYSICAL



WIRING DIAGRAM



Flexible leads A&C supplied on adjustable model only.

†For relay, inductive or light loads use parallel load resistor to supply the holding current.

HOW TO ORDER

Form a part number by the following method, using code numbers shown in the tabulation below.

64XX — XX — XX X

BASIC NUMBER
A* = Adjustable

Input Voltage (VDC)	Output Rating (Amp)	Physical Configuration	Delay Time (Sec.)
6 = 06 12 = 12 24 = 24 48 = 48	D = 2.0	A = Wire Leads 18 AWG	1 = 1.0 5 = 5.0 10 = 10 30 = 30 60 = 60

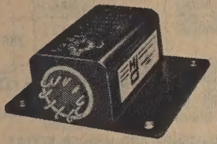
*Approximately 1.5 meg for max. delay.

EXAMPLE PART NUMBER: 6424-DA-5 = A 24 VDC timer with a 5 second delay time.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

SENSORS/MONITORS/DETECTORS: VOLTAGE, PHASE, FREQUENCY

AC AND DC VOLTAGE 1300 SERIES



FEATURES

DC SENSOR — SERIES 1310

The Hi-G 1310 Series DC Voltage Sensor is essentially a voltage monitoring device operating a snap-action transistor circuit with low drift and inherent temperature compensation. This device will either open or close a circuit when a predetermined voltage is present at the input. By using a Hi-G electro-mechanical relay as the output of the voltage sensor, a positive switching action can be achieved with very close difference between pull-in and drop-out voltages.

AC SENSOR — SERIES 1350

The Hi-G 1350 Series AC Voltage Sensor energizes a relay when the monitored power line voltage reaches a predetermined level. This rugged unit with reliable solid state design, provides precise, repeatable operation over a wide temperature range.

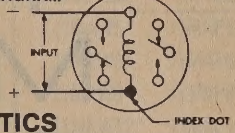
The input voltage is fed into a temperature compensated comparator circuit. When the input reaches the pre-set level, transistor amplifiers switch the output relay. This output may control any external devices, process, or warning system to protect expensive equipment.

The units for both series are potted and hermetically sealed and are designed to meet the environmental requirements of airborne applications. The following are available for both the 1310 and 1350:

STANDARD OPTIONS

1. Solid-State Output.
2. Two Stage Sensing (Voltage Band).
3. Up to 10 Amp Relay Output.
4. 3 Phase AC Version Available.
5. Controlled Drop-out Differential.
6. Operate with Auxiliary Control Voltage.

ELECTRICAL DIAGRAM



PART TYPE CHARACTERISTICS

Specification	Part Number	
	1310	1350
Pull-in Voltage	5 to 150 VDC	5 to 440 VAC
Smallest Increment	0.1 Volt	50, 60 or 400 Hz
Drop-out Voltage (Rel. to Pull-in)	−0, +0.5 Volts	1.0 Volt +0, −3.0 Volts
Current Drain @ 25°C	15 ma Max.	100 ma Max.

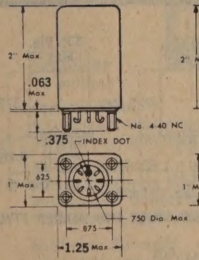
ELECTRICAL SPECIFICATIONS

ACCURACY: ±2½% of set point over temperature range.
MAXIMUM ALLOWABLE APPLIED VOLTAGE: 150% of specified pull-in voltage.
AUXILIARY VOTAGE: None required.
OPERATE AND RELEASE TIMES: 50 milliseconds maximum over the temperature range.
LIFE: 100,000 operations minimum.
CONTACT ARRANGEMENTS: 2PDT.
CONTACT RATING: 2 amperes resistive at 30 volts DC; 0.3 amperes resistive at 115 volts RMS, 400 Hz.

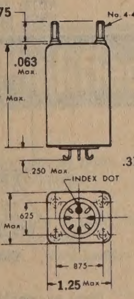
ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE: −55°C to +125°C.
VIBRATION: 20 G's, 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 milliseconds duration.
INSULATION RESISTANCE: 1000 megohms minimum at 500 volts DC, all terminals to case.
DIELECTRIC STRENGTH: 1000 volts RMS, 60 Hz at sea level, all terminals to case.
SEALING: Hermetic, 1.3 inches of mercury.

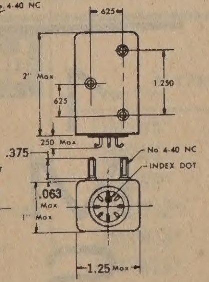
MOUNTING STYLES — 1310 AND 1350



A



B



C

DIMENSIONS ARE IN INCHES

HOW TO ORDER

1310 — Type
2 — 2PDT
A — Mounting Style
24.5 — Pull-in Voltage

PHASE SENSOR 1400 SERIES

TWO STANDARD TYPES

P TYPE FOR STATIC LOAD

With line voltages and frequency within operating limits, P-Type units will energize only when output phase are in sequence A - B - C. They will de-energize only when power is removed. The P-Type unit is best suited to applications where static loads are used and where regenerated voltage will not be present if a phase opens.

Q TYPE FOR MOTOR LOADS

Q-Type units perform the same function as the P-Type since they will energize only when input phases are in sequence A - B - C. In addition, the units will de-energize when any phase is disconnected or grounded provided the voltage input to the unit is below 50% of the nominal phase-to-phase voltage input. Q-Type units are suitable for motor loads where a regenerated voltage is produced.

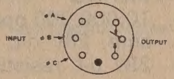
NO NEUTRAL CONNECTION

Neither P- or Q-Type units require connection to neutral leg.
For high-current applications, phase sensors are used with slave relays having heavy duty contact ratings.
For applications having special requirements as to voltage, frequency, contact arrangements, and ratings, consult the factory.

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE: −55°C to +85°C.
VIBRATION: 200 G's, 10 to 2000 Hz.
SHOCK: 50 G's, 11 ±1 millisecond.
INSULATION RESISTANCE: 1000 megohms minimum at 500 volts DC, all terminals to case.
DIELECTRIC STRENGTH: 1000 volts RMS, 60 Hz, at sea level, all terminals to case.

ELECTRICAL SPECIFICATIONS



OPERATE TIME: 50 milliseconds maximum.
RELEASE TIME: 100 milliseconds maximum.
CONTACTS: 1PDT.
CONTACT RATING: 2 amperes resistive at 30 volts DC. 0.5 ampere inductive at 30 volts DC. 0.25 ampere resistive or inductive at 115 volts, 60 or 400 Hz.

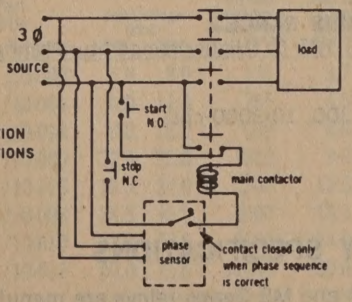
STANDARD MODELS

Basic Model No.	Load Type	Line to Line Voltage ±10%	Frequency ±10%	Max. Power Required	Mounting Style
1407	P	115 V	60 Hz	4 Watts	Similar to 4 Amp. 1600 Series Catalog Type
1408	P	115 V	400 Hz	4 Watts	
1409	P	208 V	60 Hz	6 Watts	
1410	P	208 V	400 Hz	6 Watts	
1437	Q	115 V	60 Hz	6 Watts	Similar to 10 Amp. 1600 Series Catalog Type
1438	Q	115 V	400 Hz	6 Watts	
1439	Q	208 V	60 Hz	9 Watts	
1440	Q	208 V	400 Hz	9 Watts	

HOW TO ORDER

1408 — Type
-1 — Output 1PDT
A — Mounting

TYPICAL APPLICATION CONNECTIONS



FREQUENCY SENSOR 7000 SERIES
SINGLE OR DOUBLE SENSE POINT
60 Hz TO 400 Hz
CONSULT THE FACTORY

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

TO-5 SERIES RELAY

Qualified MIL-R-39016

GENERAL SPECIFICATIONS

CONTACT CAPABILITIES

RATING
10,000,000 operations at low level. 1,000,000 operations at 0.5 amp, 28V d-c resistive load. 100,000 operations at 1.0 amp, 28V d-c resistive load.

CONTACT RESISTANCE
0.1 ohm maximum before life (measured ⅛" from header). 0.15 ohm maximum after life at maximum rated current (measured ⅛" from header).

CONTACT BOUNCE
1.5 milliseconds maximum

OVERLOAD
2 amps at 28V d-c for 100 operations minimum

INSULATION RESISTANCE
10,000 megohms minimum between mutually insulated terminals

ENCLOSURE
Hermetically sealed. All welded.

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE
—65°C to +125°C. (Higher temperature ratings on special order)

VIBRATION
.06" DA or 30G, 10-3000 cps.

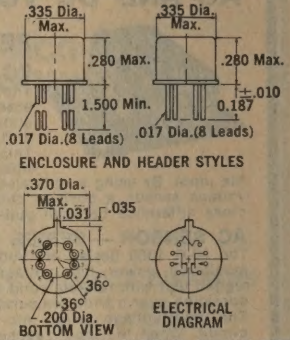
SHOCK
75 G's

MILITARY SPECIFICATIONS

All Hi-G MA and MS Series relays are manufactured in accordance with Military Specification MIL-R-39016 and its applicable detail specification. Level "L" or "M" Qualification available.

MA

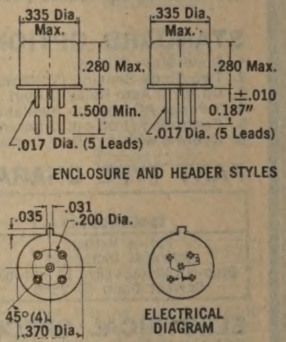
DPDT CONTACTS


.335 Dia. Max.
.280 Max.
1.500 Min.
.017 Dia.(8 Leads)
.335 Dia. Max.
.280 Max.
±.010
0.187
.017 Dia.(8 Leads)
ENCLOSURE AND HEADER STYLES
.370 Dia. Max.
.031
.035
36°
36°
.200 Dia.
BOTTOM VIEW
ELECTRICAL DIAGRAM

NOTE: TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.

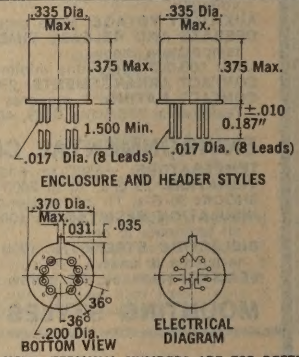
1MA

SPDT CONTACTS


.335 Dia. Max.
.280 Max.
1.500 Min.
.017 Dia. (5 Leads)
.335 Dia. Max.
.280 Max.
±.010
0.187"
.017 Dia. (5 Leads)
ENCLOSURE AND HEADER STYLES
.035
.031
.200 Dia.
45°(4)
.370 Dia.
ELECTRICAL DIAGRAM

MS

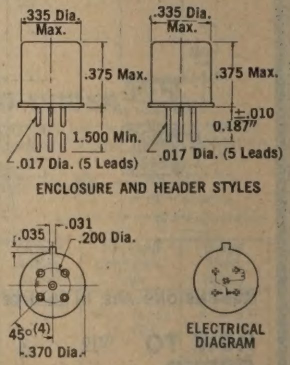
DPDT CONTACTS


.335 Dia. Max.
.375 Max.
1.500 Min.
.017 Dia. (8 Leads)
.335 Dia. Max.
.375 Max.
±.010
0.187"
.017 Dia. (8 Leads)
ENCLOSURE AND HEADER STYLES
.370 Dia. Max.
.031
.035
36°
36°
.200 Dia.
BOTTOM VIEW
ELECTRICAL DIAGRAM

NOTE: TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.

1MS

SPDT CONTACTS


.335 Dia. Max.
.375 Max.
1.500 Min.
.017 Dia. (5 Leads)
.335 Dia. Max.
.375 Max.
±.010
0.187"
.017 Dia. (5 Leads)
ENCLOSURE AND HEADER STYLES
.035
.031
.200 Dia.
45°(4)
.370 Dia.
ELECTRICAL DIAGRAM

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

Qualified

Sensitivity: 130 milliwatts

Operate Time: 2.5 milliseconds maximum at nom. coil voltage over temperature range.

Release Time: 1.5 milliseconds maximum at nom. coil voltage over temperature range. With diode suppression 4.0 millisec.

Dielectric Strength: 500V RMS 60 cycles at sea level
125V RMS 60 cycles at 70,000 feet

Weight: 0.07 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

Hi-G Part No.		Military Part MIL-R-39016		Coil Voltage (VDC)		DC Coil Resistance Ohms ±10% @ 25°C	Pull In Voltage (VDC)	Drop Out Voltage (VDC)**	
Wire Term.	Pin Term.	Wire Term.	Pin Term.	Nom.	Max.		Max.**	Max.	Min.
JMAW5*	JMAP5*	/9-001	/9-007	5.0	5.8	50	3.5	2.3	0.14
JMAW6*	JMAP6*	/9-002	/9-008	6.0	8.0	98	4.5	3.2	0.18
JMAW9*	JMAP9*	/9-003	/9-009	9.0	12.0	220	6.8	4.9	0.35
JMAW12*	JMAP12*	/9-004	/9-010	12.0	16.0	390	9.0	6.5	0.41
JMAW18*	JMAP18*	/9-005	/9-011	18.0	24.0	880	13.5	10.0	0.59
JMAW26*	JMAP26*	/9-006	/9-012	26.5	32.0	1560	18.0	13.0	0.89

* Add Failure Rate designation ** Over temperature range

Qualified

Sensitivity: 100 milliwatts

Operate Time: 2.0 milliseconds maximum at nom. coil voltage over temperature range.

Release Time: 2.0 milliseconds maximum at nom. coil voltage over temperature range. With diode suppression 4.0 millisec.

Dielectric Strength: 500V RMS 60 cycles at sea level
300V RMS 60 cycles at 70,000 feet

Weight: 0.06 ounce with leads trimmed at ⅛", add 0.02 ounce for leads

Hi-G Part No.		Military Part MIL-R-39016		Coil Voltage (VDC)		DC Coil Resistance Ohms ±10% @ 25°C	Pull In Voltage (VDC)	Drop Out Voltage (VDC)**	
Wire Term.	Pin Term.	Wire Term.	Pin Term.	Nom.	Max.		Max.**	Max.	Min.
J1MAW5*	J1MAP5*	/7-001	/7-002	5.0	6.0	63	3.7	2.4	0.15
J1MAW6*	J1MAP6*	/7-003	/7-004	6.0	8.0	125	4.5	2.8	0.18
J1MAW9*	J1MAP9*	/7-005	/7-006	9.0	12.0	280	6.8	4.2	0.35
J1MAW12*	J1MAP12*	/7-007	/7-008	12.0	16.0	500	9.0	5.6	0.40
J1MAW18*	J1MAP18*	/7-009	/7-010	18.0	24.0	1130	13.5	8.4	0.58
J1MAW26*	J1MAP26*	/7-011	/7-012	26.5	32.0	2000	18.0	10.4	0.89

* Add Failure Rate designation ** Over temperature range

Qualified

Sensitivity: 60 milliwatts

Operate Time: 4.0 milliseconds maximum at nom. coil voltage over temperature range.

Release Time: 2.0 milliseconds maximum at nom. coil voltage over temperature range. With diode suppression 7.5 millisec.

Dielectric Strength: 500V RMS 60 cycles at sea level
125V RMS 60 cycles at 70,000 feet

Weight: 0.10 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

Hi-G Part No.		Military Part MIL-R-39016		Coil Voltage (VDC)		DC Coil Resistance Ohms ±10% @ 25°C	Pull In Voltage (VDC)	Drop Out Voltage (VDC)**	
Wire Term.	Pin Term.	Wire Term.	Pin Term.	Nom.	Max.		Max.**	Max.	Min.
JMSW5*	JMSP5*	/11-001	/11-002	5.0	7.5	100	3.5	2.5	0.12
JMSW6*	JMSP6*	/11-003	/11-004	6.0	10.0	200	4.5	3.2	0.18
JMSW9*	JMSP9*	/11-013	/11-014	9.0	15.0	400	6.8	4.9	0.35
JMSW12*	JMSP12*	/11-005	/11-006	12.0	20.0	850	9.0	6.5	0.41
JMSW18*	JMSP18*	/11-015	/11-016	18.0	30.0	1600	13.5	10.0	0.59
JMSW26*	JMSP26*	/11-007	/11-008	26.5	40.0	3300	18.0	13.0	0.89
JMSW36*	JMSP36*	/11-009	/11-010	36.0	57.0	6500	27.0	19.0	1.25
JMSW48*	JMSP48*	/11-011	/11-012	48.0	75.0	11000	36.0	26.0	1.60

* Add Failure Rate designation ** Over temperature range

Qualified

Sensitivity: 40 milliwatts

Operate Time: 4.0 milliseconds maximum at nom. coil voltage over temperature range

Release Time: 2.5 milliseconds maximum at nom. coil voltage over temperature range With diode suppression 7.5 millisec.

Dielectric Strength: 500V RMS 60 cycles at sea level
300V RMS 60 cycles at 70,000 feet

Weight: .08 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

Hi-G Part No.		Military Part MIL-R-39016		Coil Voltage (VDC)		DC Coil Resistance Ohms ±10% @ 25°C	Pull In Voltage (VDC)	Drop Out Voltage (VDC)**	
Wire Term.	Pin Term.	Wire Term.	Pin Term.	Nom.	Max.		Max.**	Max.	Min.
J1MSW5*	J1MSP5*	/10-001	/10-002	5.0	8.0	125	3.7	2.0	0.15
J1MSW6*	J1MSP6*	/10-003	/10-004	6.0	11.0	255	4.5	2.8	0.18
J1MSW9*	J1MSP9*	/10-013	/10-014	9.0	12.0	630	6.8	4.2	0.35
J1MSW12*	J1MSP12*	/10-005	/10-006	12.0	22.0	1025	9.0	5.6	0.40
J1MSW18*	J1MSP18*	/10-015	/10-016	18.0	24.0	2300	13.5	8.4	0.58
J1MSW26*	J1MSP26*	/10-007	/10-008	26.5	45.0	4000	18.0	10.4	0.89
J1MSW32*	J1MSP32*	/10-009	/10-010	32.0	57.0	6500	24.0	15.0	1.0
J1MSW40*	J1MSP40*	/10-011	/10-012	40.0	75.0	11000	30.0	18.7	1.3

* Add Failure Rate designation ** Over temperature range

Ordering Information: Standard items may be ordered by part number shown. For variation consult factory.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

HI G TO5 HYBRID RELAYS

GENERAL SPECIFICATIONS

RATING: 10,000,000 operations at low level. 1,000,000 operations at 0.5 amp, 28V d-c resistive load. 100,000 operations at 1.0 amp, 28V d-c resistive load.

CONTACT RESISTANCE: 0.1 ohm maximum before life (measured ⅛″ from header). 0.2 ohm maximum after life at maximum rated current (measured ⅛″ from header).

CONTACT BOUNCE: 1.5 milliseconds maximum.

OVERLOAD: 2 amps at 28V d-c for 100 operations minimum.

INSULATION RESISTANCE: 10,000 megohms minimum between mutually insulated terminals.

ENCLOSURE: Hermetically sealed. All welded.

TEMPERATURE RANGE: −65°C to +125°C.

VIBRATION: .06″ DA or 30G, 10-3000 cps.

SHOCK: 80G's for 11 milliseconds.

DIODE CHARACTERISTICS 25°C: PIV 100V min.

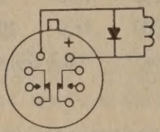
MAXIMUM COIL TRANSIENT:
Transistor Coil Drive: 1.0V Suppression: 2.0V

TRANSISTOR CHARACTERISTICS 25°C:
Emitter-Base Voltage: 6V max.
Collector-Base Breakdown Voltage: 80V min. @ 100 μa.

SUPPRESSION

Each of Hi-G's relays are available with an integrated coil suppression diode to provide inhibitation of the inductive arc voltage produced by the coil.

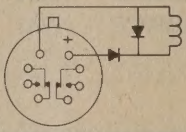
TYPE "D"



SUPPRESSION/STEERING

The addition of a series diode to the suppressed coil circuit provides the added advantage of polarity reversal protection and the elimination of diode damage.

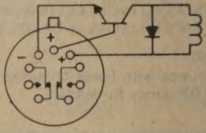
TYPE "DD"



TRANSISTOR DRIVEN

The addition of an internal transistor coil drive provides increased operating sensitivity, high isolation while retaining the high level switching capability of the contacts.

TYPE "T"



ORDERING INFORMATION

MAW D — 26

Series — MAW
D — Diode Suppression
DD — Supression/Steering
T — Transistor Driven
Coil Voltage — 26

MILITARY DESIGNATION

39016/X-XXX*

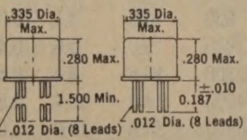
Basic Specification — 39016
Type — X
Voltage & Pin Configuration — XXX
* Failure Rate "L" or "M"

Qualified

All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by reference pages 3546 and 3547 in this Volume.

SUPPRESSED	SUPPRESSION/STEERING	TRANSISTOR DRIVEN
Type "D"	Type "DD"	Type "T"
MAWD-5	MAWDD-5	MAWT-5
M39016/15-006*	M39016/20-001*	M28776/1-001*

MAW SERIES DPDT



See p. 3549 for pin and schematic diagrams.

OPERATE TIME: 2.5 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Coil Suppression — 4.0 milliseconds maximum at nom. coil voltage over temperature range.

DIELECTRIC STRENGTH: 500V RMS 60 cycles at sea level. 125V RMS 60 cycles at 70,000 feet.

WEIGHT: 0.07 ounce with leads trimmed to ⅛″, add 0.02 ounce for leads.

Relay Part No.	MAW-5			MAW-6			MAW-9			MAW-12			MAW-18			MAW-26		
Type	D	DD	T	D	DD	T	D	DD	T	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	5 VDC			6 VDC			9 VDC			12 VDC			18 VDC			26.5 VDC		
Coil Resistance ± 10%	50	39	50	98	78	98	220	220	220	390	390	390	880	880	880	1560	1560	1560
Pull-in (max.) VDC	3.5	3.9		4.5	5.2		6.8	7.8		9.0	10.0		13.5	14.5		18.0	19.0	
Base Current to turn-on (min.) MADC			3.00			2.04			1.36			1.03			0.68			0.50
Drop-out (max.) VDC	2.3	2.3		3.2	3.2		4.9	4.9		6.5	6.5		10.0	10.0		13.0	13.0	13.0

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

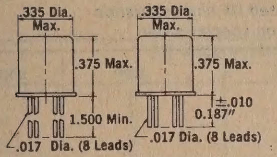
TO5 HYBRID RELAYS

Qualified

All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by referencing pages 3546 and 3547 in this Volume.

SUPPRESSED	SUPPRESSION/STEERING	TRANSISTOR DRIVEN
Type "D"	Type "DD"	Type "T"
MSWD-5	MSWDD-5	MSWT-5
M39016/16-001*	M39016/21-001*	M28776/3-001*

MSW SERIES SENSITIVE DPDT



See p. 3549 for pin and schematic diagrams.

OPERATE TIME: 4.0 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Coil Suppression — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

DIELECTRIC STRENGTH: 500V RMS 60 cycles at sea level. 125V RMS 60 cycles at 70,000 feet.

WEIGHT: 0.10 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

Relay Part No.	MSW-5			MSW-6			MSW-9			MSW-12		
Type	D	DD	T	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	5 VDC			6 VDC			9 VDC			12 VDC		
Coil Resistance ±10%	100	64	100	200	125	200	400	400	400	850	850	850
Pull-in (max.) VDC	3.5	3.6		4.5	4.8		6.8	8.0		9.0	11.0	
Base Current to turn-on (min.) MADC			1.50			1.0			0.75			0.47
Drop-out (max.) VDC	2.5	2.5		3.2	3.2		4.9	4.9		6.5	6.5	

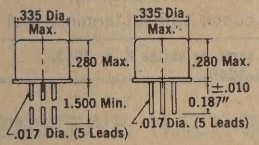
Relay Part No.	MSW-18			MSW-26			MSW-36			MSW-48		
Type	D	DD	T	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	18 VDC			26.5 VDC			36 VDC			48 VDC		
Coil Resistance ±10%	1600	1600	1600	3300	3300	3300	6500	6500	6500	11000	11000	11000
Pull-in (max.) VDC	13.5	14.5		18.0	19.0		27.0	27.0		36.0	36.0	
Base Current to turn-on (min.) MADC			0.38			0.24			0.17			0.13
Drop-out (max.) VDC	10.0	10.0		13.0	13.0		19.0	19.0		26.0	26.0	

Qualified

All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by referencing pages 3546 and 3547 in this Volume.

SUPPRESSED	SUPPRESSION/STEERING	TRANSISTOR DRIVEN
Type "D"	Type "DD"	Type "T"
1MAWD-5	1MAWDD-5	1MAWT-5
M39016/23-001*	M39016/24-001*	M28776/5-001*

1MAW SERIES SPDT



See p. 3549 for pin and schematic diagrams.

OPERATE TIME: 2.0 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Coil Suppression — 4.0 milliseconds maximum at nom. coil voltage over temperature range.

DIELECTRIC STRENGTH: 500V RMS 60 cycles at sea level. 300V RMS 60 cycles at 70,000 feet.

WEIGHT: 0.06 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

Relay Part No.	1MAW-5			1MAW-6			-MAW-9		
Type	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	5 VDC			6 VDC			9 VDC		
Coil Resistance ± 10%	63	50	63	125	98	125	280	280	280
Pull-in (max.) VDC	3.7	3.9		4.5	5.2		6.8	7.8	
Base Current to turn-on (min.) MADC			2.38			1.60			1.07
Drop-out (max.) VDC	2.4	2.4		2.8	2.8		4.2	4.2	

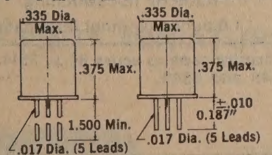
Relay Part No.	1MAW-12			1MAW-18			1MAW-26		
Type	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	12 VDC			18 VDC			26.5 VDC		
Coil Resistance ± 10%	500	500	500	1130	1130	1130	2000	2000	2000
Pull-in (max.) VDC	9.0	10.0		13.5	14.5		18.0	19.0	
Base Current to turn-on (min.) MADC			0.80			0.53			0.40
Drop-out (max.) VDC	5.6	5.6		8.4	8.4		10.4	10.4	

Qualified

All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by reference pages 3546 and 3547 in this Volume.

SUPPRESSED	SUPPRESSION/STEERING	TRANSISTOR DRIVEN
Type "D"	Type "DD"	Type "T"
1MSWD-5	1MSWDD-5	1MSWT-5
M39016/25-001*	M39016/26-001*	M28776/4-001*

1MSW SERIES SENSITIVE SPDT



See p. 3549 for pin and schematic diagrams.

OPERATE TIME: 4.0 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

RELEASE TIME: Coil Suppression — 7.5 milliseconds maximum at nom. coil voltage over temperature range.

DIELECTRIC STRENGTH: 500V RMS 60 cycles at sea level. 300V RMS 60 cycles at 70,000 feet.

WEIGHT: 0.08 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

Relay Part No.	1MSW-5			1MSW-6			1MSW-9			1MSW-12		
Type	D	DD	T	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	5 VDC			6 VDC			9 VDC			12 VDC		
Coil Resistance ±10%	125	100	125	255	200	255	630	630	630	1025	1025	1025
Pull-in (max.) VDC	3.7	3.8		4.5	4.8		6.8	7.8		9.0	10.0	
Base Current to turn-on (min.) MADC			1.20			0.78			0.48			0.39
Drop-out (max.) VDC	2.0	2.0		2.8	2.8		4.2	4.2		5.6	5.6	

Relay Part No.	1MSW-18			1MSW-26			1MSW-32			1MSW-40		
Type	D	DD	T	D	DD	T	D	DD	T	D	DD	T
Coil Nominal	18 VDC			26.5 VDC			36 VDC			48 VDC		
Coil Resistance ±10%	2300	2300	2300	4000	4000	4000	6500	6500	6500	11000	11000	11000
Pull-in (max.) VDC	13.5	14.5		18.0	19.0		24.0	24.0		30.0	30.0	
Base Current to turn-on (min.) MADC			0.26			0.20			0.16			0.13
Drop-out (max.) VDC	8.4	8.4		10.4	10.4		15.0	15.0		18.7	18.7	

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

CRYSTAL CAN RELAYS

RADIO FREQUENCY RELAYS

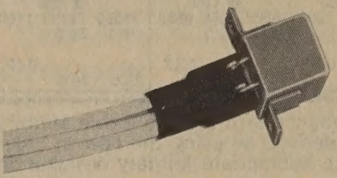
RF contacts are terminated with RG-196/U Teflon insulated coaxial cable, 6″ in length. Other lengths, types of cable, or coaxial connector terminations available on special order. These relays meet or exceed the applicable portions of MIL-R-5757 and MIL-S-3928.

RADIO FREQUENCY CHARACTERISTICS

Frequency Range	0 - 500 MHz*
Voltage Standing Wave Ratio (VSWR)	<1.1:1 typical
Insertion Loss	0.16db typical
Characteristic Impedance	50 ohms†
Crosstalk	−50db typical

** Usable to 1000 MHz with reduced RF characteristics*
† Other impedances available on special order

DICE CUBE RADIO FREQUENCY RELAY — SERIES RFC PRODUCT BULLETIN 159

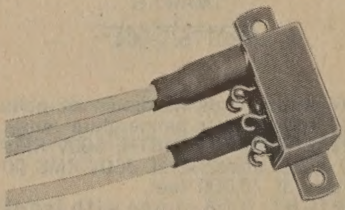


Operate Power 150 mW

Relay Type	RFC
Size	0.5-inch cube
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.3 ounce (without terminations)

Housing details on p. 3548 and 3549.

HALF SIZE CRYSTAL-CAN RADIO FREQUENCY RELAY— SERIES RFK PRODUCT BULLETIN 156

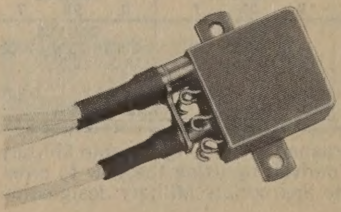


Operate Power 250 mW

Relay Type	RFK
Size	.4 x .8 x .4 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.37 ounce (without terminations)

NOTE: Electrical characteristics & housing same as series K p. 3543.
Housing details on p. 3548 and 3549.

CRYSTAL-CAN RADIO FREQUENCY RELAY — SERIES RFB PRODUCT BULLETIN 157

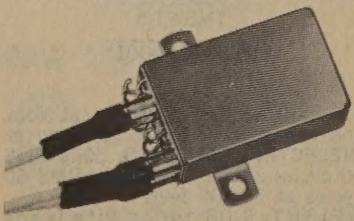


Operate Power 250 mW

Relay Type	RFB
Size	.875 x .800 x .400 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	0.95 ounce (without terminations)

NOTE: Electrical characteristics & housing same as series B p. 3544.
Housing details on p. 3548 and 3549.

HIGH SENSITIVITY RADIO FREQUENCY RELAY — SERIES RFBC PRODUCT BULLETIN 158



Operate Power 40 mW

Relay Type	RFBC
Size	1.275 x .800 x .400 inch
Contact Rating	200 watts RF cold switching 75 watts RF hot switching
Maximum Weight	1.0 ounce (without terminations)

NOTE: Electrical characteristics & housing same as series BC p. 3544.
Housing details on p. 3548 and 3549.

ENVIRONMENTAL CHARACTERISTICS FOR STANDARD CRYSTAL CAN SERIES

Life: 100,000 operations at 125°C and rated load.
Temperature: −65°C to +125°C, operating.
Vibration: 10 to 2000 Hz, 20G min.
Shock: 100 G
Sealing: Hermetic, to 80,000′

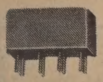
Insulation Resistance: 1000 megohms min., except coil-to-case at high temperature 500 megohms min.

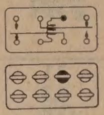
Dielectric Strength: Contacts-to-case: 1000 volts rms, 60 Hz, mutually insulated terminals: 500 volts rms standard.

CRYSTAL CAN RELAYS

.150 GRID RELAY — SERIES G Product Bulletin 95

Qualified





CONTACT RATING

- 1 ampere resistive at 30 volts DC max.
- 0.125 amperes resistive at 115 volts RMS, 400 Hz, case grounded.
- Low level 0 to 0.1 ampere at 50 mV DC or AC.
- 2 ampere resistive at 30 volts DC max. (50,000 operations min.).

VIBRATION: 0.5″ DA from 5-34 Hz, 30G from 34-3000 Hz, 10μs max. contact opening.

Voltage Code	Coil Voltage (VDC)		DC Coil Resistance (Ohm ±10% @ 25°C)	Max. Pull-in Voltage (VDC)		Min. Drop-out Voltage (VDC)	
	Nom.	Max.		25°C	125°C	25°C	−65°C
105	5	7	44	2.4	3.3	0.26	0.16
106	6	8	56	2.7	3.8	0.30	0.18
109	9	12	140	4.4	6.0	0.5	0.3
112	12	16	210	5.4	7.4	0.60	0.36
118	18	24	650	9.5	12.8	1.0	0.6
126	26.5	35	1350	13.5	18.0	1.50	0.9
136	36	46	2245	17.1	23.0	1.9	1.2

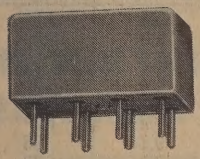
Housing details on p. 3548 and 3549.

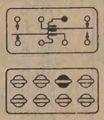
HALF-SIZE CRYSTAL CAN RELAY — SERIES 2K Product Bulletin 102

Qualified

CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded and dry circuit.





ALL WELDED CONSTRUCTION

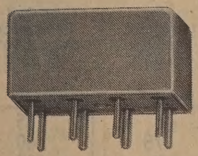
Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.25	.35	40
112	12	14.4	6.5	.75	150
126	26.5	32	13.5	1.5	675

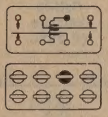
Housing details on p. 3548 and 3549.

SENSITIVE HALF-SIZE 2 AMP RELAY — SERIES KA Product Bulletin 110

CONTACT RATING

- Low level — dry circuit.
- 2.0 ampere resistive at 30 volts DC
- 1.0 ampere resistive, 115 volts RMS, 400 Hz.
- 0.3 ampere resistive at 115 volts RMS, 60 Hz.
- 0.75 ampere inductive at 30 volts DC





VIBRATION: 20G, 10-2000 Hz.

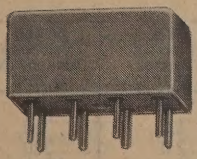
Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	Effective DC Coil Resistance ±10% @ 25°C
106	6	7.2	3.6	.35	130
112	12	14.4	7.2	.7	518
126	26.5	32.0	14.4	1.4	2075
148	48	57.6	28.8	2.8	8300

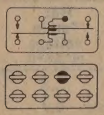
Housing details on p. 3548 and 3549.

HALF-PINT® MINIATURE 4 AMP RELAY — SERIES 2HA Product Bulletin 100

CONTACT RATING

4 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded.





Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.4	.35	40
112	12	14.4	6.5	.75	150
126	26.5	32	13.0	1.5	600

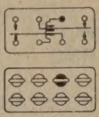
Housing details on p. 3548 and 3549.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

CRYSTAL CAN RELAYS

2 AMP CRYSTAL CAN RELAY — SERIES 2B Product Bulletin 120

Qualified



CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded and dry circuit.

NOTE: BR types for operation at 60 to 400 Hz with specifications shown. Units may be used at higher frequencies, but individual values of voltage may change.

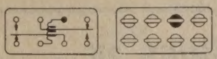
2-pole units only available as standard catalog item.

Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
2B (DC Only, 2-Pole Only)					
106	6	7.2	3.1	.5	40
112	12	14.4	6.3	.75	160
126	26.5	32	13.0	1.5	675
148	48	58	25.0	2.5	2500
176	76	90	35.0	3.0	5000
2BR (AC Only, 2-Pole Only)					
126	26.5	32	15	2	600
148	48	58	28	3	2000
176	76	90	44	4	5000
215	115	125	66	5	10000

Housing details on p. 3548 and 3549.

CURRENT SENSITIVE CRYSTAL CAN RELAY — 40 mW — SERIES BC Product Bulletin 135

Qualified



CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded.

2BC RELAY — DPDT — 40 mW						1 BC RELAY — SPDT — 25 mW			
Voltage Code	Coil Res. @ 25°C	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min. D.O. Current (mA)	Nominal Coil Voltage (VDC)	Nominal Coil Current (mA)	Max P.I. Current (mA)	Min. D.O. Current (mA)
101	20	1.8	89.2	44.6	4.5	1.4	70.6	35.3	3.5
102	30	2.2	73.0	36.5	3.7	1.8	57.6	28.8	2.9
103	50	2.8	56.6	28.3	2.8	2.2	44.6	22.3	2.3
104	75	3.5	46.2	23.1	2.3	2.8	36.6	18.3	1.8
105	100	4.0	40.0	20.0	2.0	3.2	31.6	15.8	1.6
106	200	5.7	28.4	14.2	1.4	4.5	22.4	11.2	1.2
107	300	7.0	23.0	11.5	1.2	5.5	18.2	9.1	.90
109	500	9.0	17.8	8.9	.90	7.1	14.2	7.1	.70
112	875	12.0	13.5	6.8	.70	9.4	10.7	5.4	.54
113	1000	12.6	12.6	6.5	.60	10.0	10.0	5.0	.50
118	2000	18.0	8.9	4.5	.50	14.2	7.1	3.6	.36
120	2500	20.0	8.0	4.0	.40	15.8	6.3	3.2	.32
128	5000	28.0	5.6	2.8	.30	22.5	4.5	2.3	.23
135	8000	36.0	4.5	2.3	.23	29.0	3.6	1.8	.18
140	10000	40.0	4.0	2.0	.20	32.0	3.2	1.6	.16

Housing details on p. 3548 and 3549.

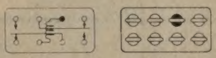
5 AMP CRYSTAL CAN RELAYS

	Sensitivity	Height	Product Bulletin
SERIES 2BCN	280 MW	.900″	120A
SERIES 2BN	80 MW	1.281″	135A

CONTACT RATING

5 amperes resistive at 30 volts DC, 3 ampere resistive at 115 volts RMS, 400 Hz, case grounded; 2 ampere resistive at 115 volts RMS, 60 Hz, case grounded.

NOTE: For AC operation BNR types are available on request.

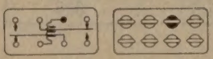


Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
SERIES 2BN					
106	6	7.2	3.1	.5	35
112	12	14.4	6.3	.75	140
126	26.5	32	13.0	1.5	600
148	48	58	25.0	2.5	2200
176	76	90	35.0	3.0	4400
SERIES 2BCN					
106	6	54.5	27.3	3.0	110
112	12	26.7	13.4	1.4	450
128	28	11.2	5.6	.6	2500
140	40	8.0	4.0	.4	5000

Housing details on p. 3548 and 3549.

10 AMP CRYSTAL CAN RELAY — SERIES T Product Bulletin 150

Qualified



CONTACT RATING

Standard rating 10 amperes resistive at 30 VDC, 5 amperes resistive at 115 V or 115 V, 400 Hz, case grounded.

Voltage Code	Nominal DC Coil Voltage	Max. Continuous Coil Voltage	Max. Pull-in Voltage @ 25°C	Min. Drop-out Voltage @ 25°C	DC Coil Resistance Ohms ±10% @ 25°C
106	6	7.2	3.3	.5	22
112	12	14.4	6.7	1.0	90
126	26.5	32	13.0	2.0	330
215	115	125	63.0	5	7500

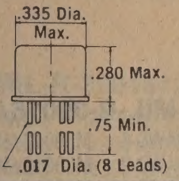
Housing details on p. 3548 and 3549.

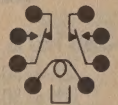
HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

INDUSTRIAL TO5 SERIES

- **Standard Version**
- **Sensitive Version**

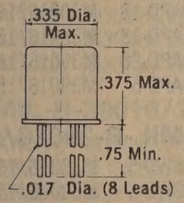
CAW SERIES DPDT

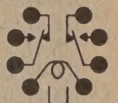




Relay Part No.	CAW-5	CAW-6	CAW-9	CAW-12	CAW-18	CAW-26
Coil Nominal	5VDC	6VDC	9VDC	12VDC	18VDC	26.5VDC
Coil Resistance ±10%	50	100	200	390	880	1560
Pull-in (max.) VDC	3.0	4.3	6.0	8.5	12.8	17.0

CSW SERIES DPDT





Relay Part No.	CSW-5	CSW-6	CSW-9	CSW-12	CSW-18	CSW-26
Coil Nominal	5VDC	6VDC	9VDC	12VDC	18VDC	26.5VDC
Coil Resistance ±10%	100	200	400	850	1600	3300
Pull-in (max.) VDC	3.0	4.3	6.0	8.5	12.8	17.0

The Hi-G CA & CS Series relays are manufactured to the same exacting standards as its Military counterpart. Each relay boasts an all welded construction to afford hermeticity of seal and insurance of chamber cleanliness. This low price TO5 type relay will comply to all of your switching requirements between dry circuit and 1.0 ampere.

GENERAL SPECIFICATIONS

OPERATE POWER: CA Series, 185mw; CS Series, 90mw.

OPERATE TIME: CA, 4.0ms; CS, 6.0ms @ nominal volt.

RELEASE TIME: CA, 3.0ms; CS, 3.0ms.

DIELECTRIC STRENGTH: 350VRMS 60 Hz.

INSULATION RESISTANCE: 1,000 Megohms min.

VIBRATION: .06" DA 10-55 Hz, 10G to 500 Hz.

SHOCK: 30G Mil-Std 202 Method 213.

TEMPERATURE −55° to +71°C.

LIFE: 10,000,000 ops, mechanical,
1,000,000 ops, 0.5A 28VDC
100,000 ops, 1.0A 28VDC

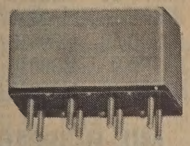
WEIGHT: CA-0.08 oz., CS-0.15 oz.

ORDERING INFORMATION

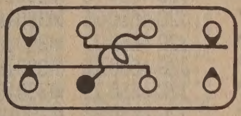
CAW — 26
Series — Coil Voltage

Also available with diode suppressed coil or Transistor Driver. Add D or T to Series.

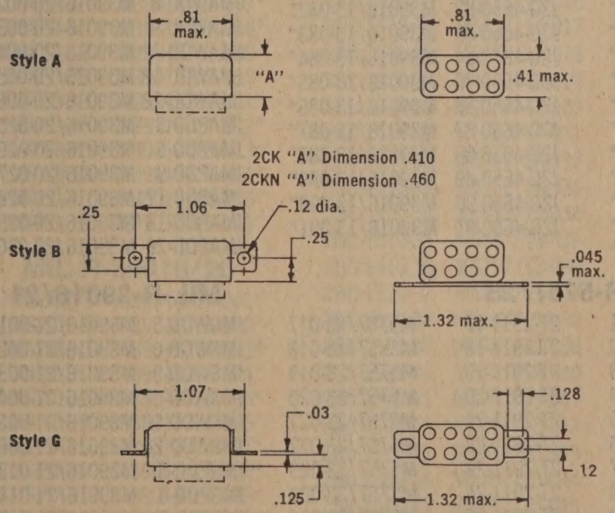
INDUSTRIAL 2 AMP AND 5 AMP - 2CK AND 2CKN SERIES



2 Form C

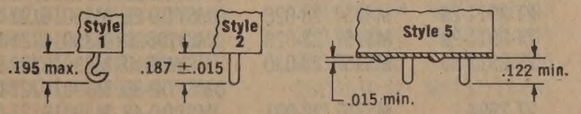


Enclosure Styles



2CK "A" Dimension .410
2CKN "A" Dimension .460

Terminal Styles



GENERAL SPECIFICATIONS

OPERATE POWER: 2CK 350mw max.
2CKN 725mw max.

OPERATE TIME: 2CK 4.0ms max.
2CKN 5.0ms max.

RELEASE TIME: 2CK 2.0ms max.
2CKN 3.0ms max.

TEMPERATURE: −55°C to +85°C

DIELECTRIC STRENGTH: 500VRMS all points

INSULATION RESISTANCE: 1000 megohms min.

VIBRATION: 10G 10-500 Hz

SHOCK: 50G 11ms

ELECTRICAL SPECIFICATIONS

2CK

Voltage Code	106	112	124	136	148
Nom. Coil Voltg	6 VDC	12 VDC	24 VDC	36 VDC	48 VDC
Nom. Coil Resist.	55	218	870	1960	3480
Max. Pickup Volt.	4.4 VDC	8.7 VDC	17.5 VDC	26.0 VDC	35.0 VDC

2CKN

Voltage Code	106	112	124	148	215
Nom. Coil Volt.	6 VDC	12 VDC	24 VDC	48 VDC	110 VDC
Nom. Coil Resist. ±10% at 25°C	25	100	400	1600	8500
Max. Pickup Volt.	4.3 VDC	8.5 VDC	17.0 VDC	34.0 VDC	75.2 VDC

SWITCHING SPECIFICATIONS

CONFIGURATION: 2 Form C - DPDT

LOAD RATING: 2CK Low Level, 2.0 Amp Resistive 30 VDC,
0.5 Amp 115 VAC 60-400 Hz
2CKN 5.0 Amp Resistive 30 VDC,
3.0 Amp Resistive 115 VRMS 400 Hz.

SWITCHING LIFE: 250,000 operations minimum at maximum rated load

CONTACT RESISTANCE: 2CK 0.05 ohms max. initial at rated load
2CKN 100 millivolts max. initial max. rated load

ORDERING INFORMATION

2CK or 2CKN — 1 A — 124
Series — Voltage Code
Terminal — Enclosure

QPL PRODUCTS

qualified to the requirements of MIL-R-39016 MIL-R-28776 MIL-R-5757

MIL-R-39016/7

J1MAW-5	M39016/7-001*
J1MAP-5	M39016/7-002*
J1MAW-6	M39016/7-003*
J1MAP-6	M39016/7-004*
J1MAW-9	M39016/7-005*
J1MAP-9	M39016/7-006*
J1MAW-12	M39016/7-007*
J1MAP-12	M39016/7-008*
J1MAW-18	M39016/7-009*
J1MAP-18	M39016/7-010*
J1MAW-26	M39016/7-011*
J1MAP-26	M39016/7-012*

MIL-R-39016/9

JMAW-5	M39016/9-001*
JMAW-6	M39016/9-002*
JMAW-9	M39016/9-003*
JMAW-12	M39016/9-004*
JMAW-18	M39016/9-005*
JMAW-26	M39016/9-006*
JMAP-5	M39016/9-007*
JMAP-6	M39016/9-008*
JMAP-9	M39016/9-009*
JMAP-12	M39016/9-010*
JMAP-18	M39016/9-011*
JMAP-26	M39016/9-012*
JMAW-30	M39016/9-049*
JMAP-30	M39016/9-050*

MIL-R-39016/10

J1MSW-5	M39016/10-001*
J1MSP-5	M39016/10-002*
J1MSW-6	M39016/10-003*
J1MSP-6	M39016/10-004*
J1MSW-12	M39016/10-005*
J1MSP-12	M39016/10-006*
J1MSW-26	M39016/10-007*
J1MSP-26	M39016/10-008*
J1MSW-32	M39016/10-009*
J1MSP-32	M39016/10-010*
J1MSW-40	M39016/10-011*
J1MSP-40	M39016/10-012*
J1MSW-9	M39016/10-013*
J1MSP-9	M39016/10-014*
J1MSW-18	M39016/10-015*
J1MSP-18	M39016/10-016*

MIL-R-39016/11

JMSW-5	M39016/11-001*
JMSP-5	M39016/11-002*
JMSW-6	M39016/11-003*
JMSP-6	M39016/11-004*
JMSW-12	M39016/11-005*
JMSP-12	M39016/11-006*
JMSW-26	M39016/11-007*
JMSP-26	M39016/11-008*
JMSW-36	M39016/11-009*
JMSP-36	M39016/11-010*
JMSW-48	M39016/11-011*
JMSP-48	M39016/11-012*
JMSW-9	M39016/11-013*
JMSP-9	M39016/11-014*
JMSW-18	M39016/11-015*
JMSP-18	M39016/11-016*

MIL-R-39016/6

J2K-4730-104	M39016/6-104*	J2K-4730-204	M39016/6-204*
J2K-4730-105	M39016/6-105*	J2K-4730-205	M39016/6-205*
J2K-4730-106	M39016/6-106*	J2K-4730-206	M39016/6-206*
J2K-4730-107	M39016/6-107*	J2K-4730-207	M39016/6-207*
J2K-4730-108	M39016/6-108*	J2K-4730-208	M39016/6-208*
J2K-4730-109	M39016/6-109*	J2K-4730-209	M39016/6-209*
J2K-4730-110	M39016/6-110*	J2K-4730-210	M39016/6-210*
J2K-4730-111	M39016/6-111*	J2K-4730-211	M39016/6-211*
J2K-4730-112	M39016/6-112*	J2K-4730-212	M39016/6-212*
J2K-4730-113	M39016/6-113*	J2K-4730-213	M39016/6-213*
J2K-4730-114	M39016/6-114*	J2K-4730-214	M39016/6-214*
J2K-4730-115	M39016/6-115*	J2K-4730-215	M39016/6-215*
J2K-4730-116	M39016/6-116*	J2K-4730-216	M39016/6-216*
J2K-4730-117	M39016/6-117*	J2K-4730-217	M39016/6-217*
J2K-4730-118	M39016/6-118*	J2K-4730-218	M39016/6-218*
J2K-4730-119	M39016/6-119*	J2K-4730-219	M39016/6-219*
J2K-4730-120	M39016/6-120*	J2K-4730-220	M39016/6-220*
J2K-4730-121	M39016/6-121*	J2K-4730-221	M39016/6-221*
J2K-4730-122	M39016/6-122*	J2K-4730-222	M39016/6-222*
J2K-4730-123	M39016/6-123*	J2K-4730-223	M39016/6-223*
J2K-4730-124	M39016/6-124*	J2K-4730-224	M39016/6-224*
J2K-4730-125	M39016/6-125*	J2K-4730-225	M39016/6-225*
J2K-4730-126	M39016/6-126*	J2K-4730-226	M39016/6-226*
J2K-4730-127	M39016/6-127*	J2K-4730-227	M39016/6-227*

MIL-R-39016/13

J2G-4650-55	M39016/13-055*	J2G-4650-74	M39016/13-074*
J2G-4650-56	M39016/13-056*	J2G-4650-75	M39016/13-075*
J2G-4650-57	M39016/13-057*	J2G-4650-76	M39016/13-076*
J2G-4650-58	M39016/13-058*	J2G-4650-77	M39016/13-077*
J2G-4650-59	M39016/13-059*	J2G-4650-78	M39016/13-078*
J2G-4650-60	M39016/13-060*	J2G-4650-79	M39016/13-079*
J2G-4650-61	M39016/13-061*	J2G-4650-80	M39016/13-080*
J2G-4650-62	M39016/13-062*	J2G-4650-81	M39016/13-081*
J2G-4650-63	M39016/13-063*	J2G-4650-82	M39016/13-082*
J2G-4650-64	M39016/13-064*	J2G-4650-83	M39016/13-083*
J2G-4650-65	M39016/13-065*	J2G-4650-84	M39016/13-084*
J2G-4650-66	M39016/13-066*	J2G-4650-85	M39016/13-085*
J2G-4650-67	M39016/13-067*	J2G-4650-86	M39016/13-086*
J2G-4650-68	M39016/13-068*	J2G-4650-87	M39016/13-087*
J2G-4650-69	M39016/13-069*	J2G-4650-88	M39016/13-088*
J2G-4650-70	M39016/13-070*	J2G-4650-89	M39016/13-089*
J2G-4650-71	M39016/13-071*	J2G-4650-90	M39016/13-090*
J2G-4650-72	M39016/13-072*	J2G-4650-91	M39016/13-091*
J2G-4650-73	M39016/13-073*		

MIL-R-5757/23

2T-2911-1	M5757/23-001	2T-2911-17	M5757/23-017
2T-2911-2	M5757/23-002	2T-2911-18	M5757/23-018
2T-2911-3	M5757/23-003	2T-2911-19	M5757/23-019
2T-2911-4	M5757/23-004	2T-2911-20	M5757/23-020
2T-2911-5	M5757/23-005	2T-2911-21	M5757/23-021
2T-2911-6	M5757/23-006	2T-2911-22	M5757/23-022
2T-2911-7	M5757/23-007	2T-2911-23	M5757/23-023
2T-2911-8	M5757/23-008	2T-2911-24	M5757/23-024
2T-2911-9	M5757/23-009	2T-2911-25	M5757/23-025
2T-2911-10	M5757/23-010	2T-2911-26	M5757/23-026
2T-2911-11	M5757/23-011	2T-2911-27	M5757/23-027
2T-2911-12	M5757/23-012	2T-2911-28	M5757/23-028
2T-2911-13	M5757/23-013	2T-2911-29	M5757/23-029
2T-2911-14	M5757/23-014	2T-2911-30	M5757/23-030
2T-2911-15	M5757/23-015		
2T-2911-16	M5757/23-016	2T-2994-1	M5757/28-001

MIL-R-39016/15

JMAWD-6	M39016/15-001*
JMAWD-9	M39016/15-002*
JMAWD-12	M39016/15-003*
JMAWD-18	M39016/15-004*
JMAWD-26	M39016/15-005*
JMAWD-5	M39016/15-006*
JMAPD-6	M39016/15-017*
JMAPD-9	M39016/15-018*
JMAPD-12	M39016/15-019*
JMAPD-18	M39016/15-020*
JMAPD-26	M39016/15-021*
JMAPD-5	M39016/15-022*

MIL-R-39016/16

JMSWD-5	M39016/16-001*
JMSWD-6	M39016/16-002*
JMSWD-12	M39016/16-003*
JMSWD-26	M39016/16-004*
JMSWD-36	M39016/16-005*
JMSWD-48	M39016/16-006*
JMSWD-9	M39016/16-007*
JMSWD-18	M39016/16-008*
JMSPD-5	M39016/16-009*
JMSPD-6	M39016/16-010*
JMSPD-12	M39016/16-011*
JMSPD-26	M39016/16-012*
JMSPD-36	M39016/16-013*
JMSPD-48	M39016/16-014*
JMSPD-9	M39016/16-015*
JMSPD-18	M39016/16-016*

MIL-R-39016/20

JMAWDD-5	M39016/20-001*
JMAWDD-6	M39016/20-002*
JMAWDD-9	M39016/20-003*
JMAWDD-12	M39016/20-004*
JMAWDD-18	M39016/20-005*
JMAWDD-26	M39016/20-006*
JMAPDD-5	M39016/20-025*
JMAPDD-6	M39016/20-026*
JMAPDD-9	M39016/20-027*
JMAPDD-12	M39016/20-028*
JMAPDD-18	M39016/20-029*
JMAPDD-26	M39016/20-030*

MIL-R-39016/21

JMSWDD-5	M39016/21-001*
JMSWDD-6	M39016/21-002*
JMSWDD-9	M39016/21-003*
JMSWDD-12	M39016/21-004*
JMSWDD-18	M39016/21-005*
JMSWDD-26	M39016/21-006*
JMSPDD-5	M39016/21-013*
JMSPDD-6	M39016/21-014*
JMSPDD-9	M39016/21-015*
JMSPDD-12	M39016/21-016*
JMSPDD-18	M39016/21-017*
JMSPDD-26	M39016/21-018*
JMSWDD-36	M39016/21-025*
JMSWDD-48	M39016/21-026*
JMSPDD-36	M39016/21-027*
JMSPDD-48	M39016/21-028*

* Add Applicable Failure Rate Level.

HI-G CO., INC. 580 SPRING STREET, WINDSOR LOCKS, CONN. 06096 / PHONE: (203) 623-2481 / TWX: 710-420-0592

QPL PRODUCTS

qualified to the requirements of MIL-R-39016 MIL-R-28776 MIL-R-5757

MIL-R-39016/23

J1MAWD-5	M39016/23-001*
J1MAWD-6	M39016/23-002*
J1MAWD-9	M39016/23-003*
J1MAWD-12	M39016/23-004*
J1MAWD-18	M39016/23-005*
J1MAWD-26	M39016/23-006*
J1MAPD-5	M39016/23-007*
J1MAPD-6	M39016/23-008*
J1MAPD-9	M39016/23-009*
J1MAPD-12	M39016/23-010*
J1MAPD-18	M39016/23-011*
J1MAPD-26	M39016/23-012*

MIL-R-39016/24

J1MAWDD-5	M39016/24-001*
J1MAWDD-6	M39016/24-002*
J1MAWDD-9	M39016/24-003*
J1MAWDD-12	M39016/24-004*
J1MAWDD-18	M39016/24-005*
J1MAWDD-26	M39016/24-006*
J1MAPDD-5	M39016/24-007*
J1MAPDD-6	M39016/24-008*
J1MAPDD-9	M39016/24-009*
J1MAPDD-12	M39016/24-010*
J1MAPDD-18	M39016/24-011*
J1MAPDD-26	M39016/24-012*

MIL-R-39016/25

J1MSWD-5	M39016/25-001*
J1MSWD-6	M39016/25-002*
J1MSWD-12	M39016/25-003*
J1MSWD-26	M39016/25-004*
J1MSWD-32	M39016/25-005*
J1MSWD-40	M39016/25-006*
J1MSPD-5	M39016/25-007*
J1MSPD-6	M39016/25-008*
J1MSPD-12	M39016/25-009*
J1MSPD-26	M39016/25-010*
J1MSPD-32	M39016/25-011*
J1MSPD-40	M39016/25-012*
J1MSWD-9	M39016/25-013*
J1MSWD-18	M39016/25-014*
J1MSPD-9	M39016/25-015*
J1MSPD-18	M39016/25-016*

MIL-R-39016/26

J1MSWDD-5	M39016/26-001*
J1MSWDD-6	M39016/26-002*
J1MSWDD-12	M39016/26-003*
J1MSWDD-26	M39016/26-004*
J1MSWDD-32	M39016/26-005*
J1MSWDD-40	M39016/26-006*
J1MSPDD-5	M39016/26-007*
J1MSPDD-6	M39016/26-008*
J1MSPDD-12	M39016/26-009*
J1MSPDD-26	M39016/26-010*
J1MSPDD-32	M39016/26-011*
J1MSPDD-40	M39016/26-012*
J1MSWDD-9	M39016/26-013*
J1MSWDD-18	M39016/26-014*
J1MSPDD-9	M39016/26-015*
J1MSPDD-18	M39016/26-016*

MIL-R-5757/10

2B-1506-1	M5757/10-001	2B-1506-25	M5757/10-025
2B-1506-2	M5757/10-002	2B-1506-26	M5757/10-026
2B-1506-3	M5757/10-003	2B-1506-27	M5757/10-027
2B-1506-4	M5757/10-004	2B-1506-28	M5757/10-028
2B-1506-5	M5757/10-005	2B-1506-29	M5757/10-029
2B-1506-6	M5757/10-006	2B-1506-30	M5757/10-030
2B-1506-7	M5757/10-007	2B-1506-31	M5757/10-031
2B-1506-8	M5757/10-008	2B-1506-32	M5757/10-032
2B-1506-9	M5757/10-009	2B-1506-33	M5757/10-033
2B-1506-10	M5757/10-010	2B-1506-34	M5757/10-034
2B-1506-11	M5757/10-011	2B-1506-35	M5757/10-035
2B-1506-12	M5757/10-012	2B-1506-36	M5757/10-036
2B-1506-13	M5757/10-013	2B-1506-37	M5757/10-037
2B-1506-14	M5757/10-014	2B-1506-38	M5757/10-038
2B-1506-15	M5757/10-015	2B-1506-39	M5757/10-039
2B-1506-16	M5757/10-016	2B-1506-40	M5757/10-040
2B-1506-17	M5757/10-017	2B-1506-41	M5757/10-041
2B-1506-18	M5757/10-018	2B-1506-42	M5757/10-042
2B-1506-19	M5757/10-019	2B-1506-43	M5757/10-043
2B-1506-20	M5757/10-020	2B-1506-44	M5757/10-044
2B-1506-21	M5757/10-021	2B-1506-52	M5757/10-052
2B-1506-22	M5757/10-022	2B-1506-53	M5757/10-053
2B-1506-23	M5757/10-023	2B-1506-54	M5757/10-054
2B-1506-24	M5757/10-024	2B-1506-141	M5757/10-141

MIL-R-5757/13

2BC-1501-11	M5757/13-011	2BC-1510-52	M5757/13-052
2BC-1510-12	M5757/13-012	2BC-1510-53	M5757/13-053
2BC-1510-13	M5757/13-013	2BC-1510-54	M5757/13-054
2BC-1510-14	M5757/13-014	2BC-1510-55	M5757/13-055
2BC-1510-15	M5757/13-015	2BC-1510-56	M5757/13-056
2BC-1510-16	M5757/13-016	2BC-1510-57	M5757/13-057
2BC-1510-17	M5757/13-017	2BC-1510-58	M5757/13-058
2BC-1510-18	M5757/13-018	2BC-1510-59	M5757/13-059
2BC-1510-19	M5757/13-019	2BC-1510-60	M5757/13-060
2BC-1510-20	M5757/13-020	2BC-1510-61	M5757/13-061
2BC-1510-31	M5757/13-031	2BC-1510-62	M5757/13-062
2BC-1510-32	M5757/13-032	2BC-1510-63	M5757/13-063
2BC-1510-33	M5757/13-033	2BC-1510-64	M5757/13-064
2BC-1510-34	M5757/13-034	2BC-1510-65	M5757/13-065
2BC-1510-35	M5757/13-035	2BC-1510-66	M5757/13-066
2BC-1510-36	M5757/13-036	2BC-1510-67	M5757/13-067
2BC-1510-37	M5757/13-037	2BC-1510-68	M5757/13-068
2BC-1510-38	M5757/13-038	2BC-1510-69	M5757/13-069
2BC-1510-39	M5757/13-039	2BC-1510-70	M5757/13-070
2BC-1510-40	M5757/13-040	2BC-1510-72	M5757/13-072
2BC-1510-41	M5757/13-041	2BC-1510-73	M5757/13-073
2BC-1510-42	M5757/13-042	2BC-1510-74	M5757/13-074
2BC-1510-43	M5757/13-043	2BC-1510-75	M5757/13-075
2BC-1510-44	M5757/13-044	2BC-1510-76	M5757/13-076
2BC-1510-45	M5757/13-045	2BC-1510-77	M5757/13-077
2BC-1510-46	M5757/13-046	2BC-1510-78	M5757/13-078
2BC-1510-47	M5757/13-047	2BC-1510-79	M5757/13-079
2BC-1510-48	M5757/13-048	2BC-1510-80	M5757/13-080
2BC-1510-49	M5757/13-049	2BC-1510-81	M5757/13-081
2BC-1510-50	M5757/13-050	2BC-1510-82	M5757/13-082
2BC-1510-51	M5757/13-051		

MIL-R-28776/1

JMAWT-5	M28776/1-001*
JMAWT-6	M28776/1-002*
JMAWT-9	M28776/1-003*
JMAWT-12	M28776/1-004*
JMAWT-18	M28776/1-005*
JMAWT-26	M28776/1-006*
JMAPT-5	M28776/1-007*
JMAPT-6	M28776/1-008*
JMAPT-9	M28776/1-009*
JMAPT-12	M28776/1-010*
JMAPT-18	M28776/1-011*
JMAPT-26	M28776/1-012*

MIL-R-28776/3

JMSWT-5	M28776/3-001*
JMSWT-6	M28776/3-002*
JMSWT-9	M28776/3-003*
JMSWT-12	M28776/3-004*
JMSWT-18	M28776/3-005*
JMSWT-26	M28776/3-006*
JMSWT-36	M28776/3-007*
JMSWT-48	M28776/3-008*
JMSPT-5	M28776/3-009*
JMSPT-6	M28776/3-010*
JMSPT-9	M28776/3-011*
JMSPT-12	M28776/3-012*
JMSPT-18	M28776/3-013*
JMSPT-26	M28776/3-014*
JMSPT-36	M28776/3-015*
JMSPT-48	M28776/3-016*

MIL-R-28776/4

J1MSWT-5	M28776/4-001*
J1MSWT-6	M28776/4-002*
J1MSWT-9	M28776/4-003*
J1MSWT-12	M28776/4-004*
J1MSWT-18	M28776/4-005*
J1MSWT-26	M28776/4-006*
J1MSWT-32	M28776/4-007*
J1MSWT-40	M28776/4-008*
J1MSPT-5	M28776/4-009*
J1MSPT-6	M28776/4-010*
J1MSPT-9	M28776/4-011*
J1MSPT-12	M28776/4-012*
J1MSPT-18	M28776/4-013*
J1MSPT-26	M28776/4-014*
J1MSPT-32	M28776/4-015*
J1MSPT-40	M28776/4-016*

MIL-R-28776/5

J1MAWT-5	M28776/5-001*
J1MAWT-6	M28776/5-002*
J1MAWT-9	M28776/5-003*
J1MAWT-12	M28776/5-004*
J1MAWT-18	M28776/5-005*
J1MAWT-26	M28776/5-006*
J1MAPT-5	M28776/5-007*
J1MAPT-6	M28776/5-008*
J1MAPT-9	M28776/5-009*
J1MAPT-12	M28776/5-010*
J1MAPT-18	M28776/5-011*
J1MAPT-26	M28776/5-012*

* Add Applicable Failure Rate Level.

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CRYSTAL CAN RELAYS

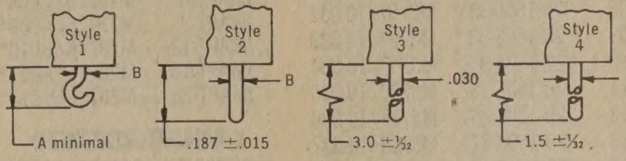
HOW TO ORDER BY PART NUMBER

2BC	—	1	A	—	128
Series		Terminal Style	Enclosure Style		Voltage Code

Variations of Terminals and Enclosure styles are available from the factory on special order.

Q.P.L. PRODUCTS MAY BE ORDERED BY THEIR MILITARY TYPE DESIGNATION USING THE APPROPRIATE DASH NUMBER.

Terminal Styles


Style 1
B
A minimal
Style 2
B
.187 ±.015
Style 3
.030
3.0 ±1/32
Style 4
.030
1.5 ±1/32

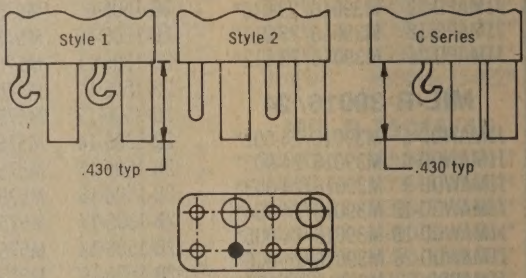
Styles 1 & 2
Available for all relay series

	A	B
G Series	.130″	.030″
T Series	.250″	.050″
4B Series	.250″	.030″
All others	.187″	.030″

Style 3
Not Available
T Series
KL Series

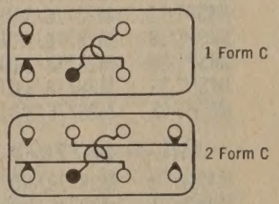
Style 4
Not Available
T Series
KL Series
BN Series
BCN Series
G Series

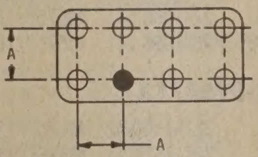
Radio Frequency Relays


Style 1
Style 2
C Series
.430 typ
.430 typ

Schematics & Terminal Locations

Basic

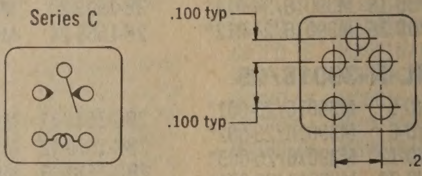

1 Form C
2 Form C



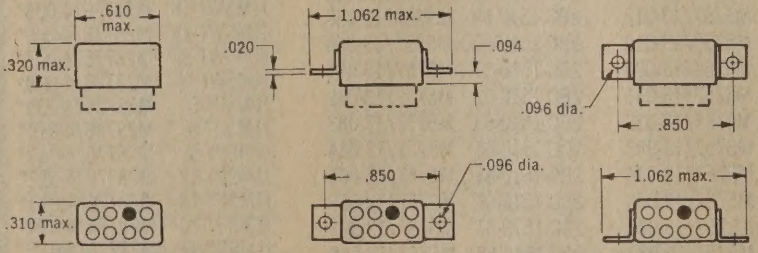
DIM. A
G Series .150 typ
All others .200 typ

RFC Series

Series C

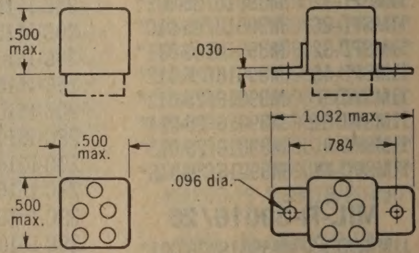

.100 typ
.100 typ
.200 typ

G Series Enclosures


.610 max.
.320 max.
.310 max.
1.062 max.
.020
.094
.096 dia.
.850
.850
.096 dia.
1.062 max.

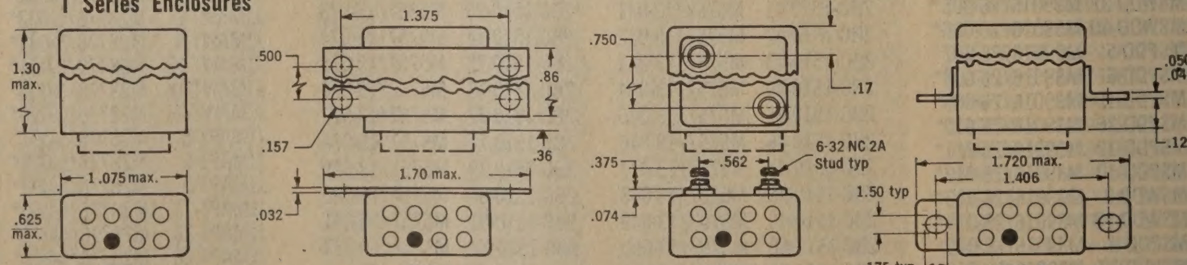
Style A **Style B** **Style C**

RFC Series Enclosures


.500 max.
.500 max.
.500 max.
.030
1.032 max.
.784
.096 dia.

Style A **Style B**

T Series Enclosures


1.30 max.
1.075 max.
.625 max.
1.375
.500
.86
.157
.36
1.70 max.
.032
.750
.17
.375
.562
6-32 NC 2A Stud typ
.074
.050
.040
.12
1.720 max.
1.406
1.50 typ
.175 typ

Style A **Style B** **Style C** **Style D**

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CRYSTAL CAN RELAYS

Crystal Can Enclosures

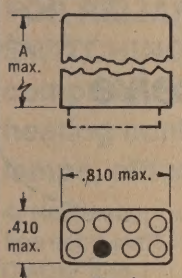

A max.
.810 max.
.410 max.

Fig. 1

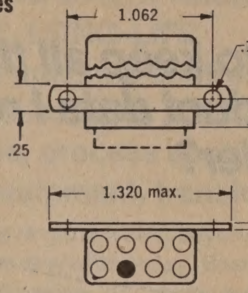

1.062
.120 dia.
B
.25
1.320 max.
.045
.040

Fig. 2

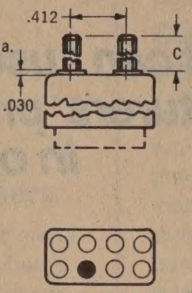


Fig. 3

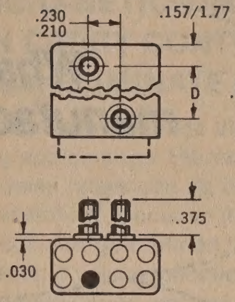

.230
.210
.157/1.77
D
.375
.030

Fig. 4

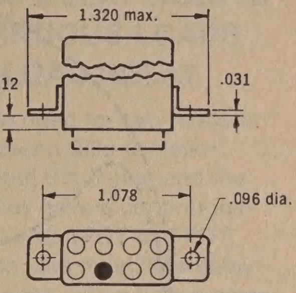

1.320 max.
.12
.031
1.078
.096 dia.

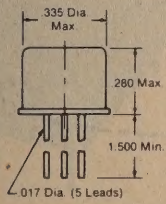
Fig. 5

Relay Series	Enclosure Style					Dimensions			
	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5	A	B	C	D
B, BK, BN, BNR, BR, RFB	Style A	Style B	Style C	Style D	Style E	.900	.370	.375	.498 .478
BC, BCN, RFBC	Style A	Style B	Style C	Style D	Style E	1.281	.370	.375	.885 .865
K, RFK	Style A	Style B	*	NA	Style C	.410	.250	*	*
HA	Style A	Style B	*	NA	Style C	.450	.250	*	*
KA	Style A	Style B	Style D	NA	Style C	.510	.250	.313	*

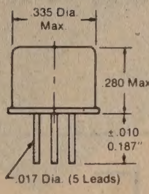
Notes: Stud thread size 4-40 NC 2A * Available special order NA — Not Available

TO-5 SERIES RELAY

Series MA Enclosure

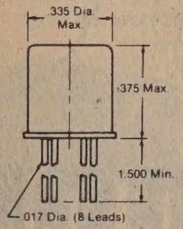

.335 Dia. Max.
.280 Max.
1.500 Min.
.017 Dia. (5 Leads)

Wire Terminal

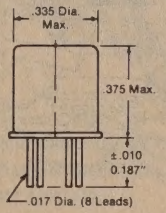

.335 Dia. Max.
.280 Max.
±.010
0.187"
.017 Dia. (5 Leads)

Pin Terminal

Series MS Enclosure

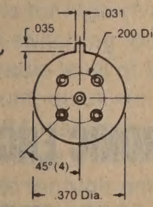

.335 Dia. Max.
.375 Max.
1.500 Min.
.017 Dia. (8 Leads)

Wire Terminal

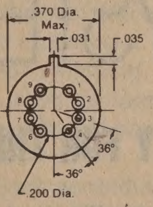

.335 Dia. Max.
.375 Max.
±.010
0.187"
.017 Dia. (8 Leads)

Pin Terminal

Header SPDT contacts


.031
.035
.200 Dia.
45° (4)
.370 Dia.

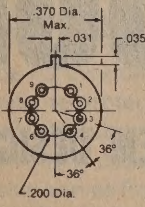
Basic and Suppressed


.370 Dia. Max.
.031
.035
36°
36°
.200 Dia.

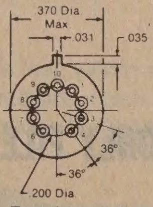
Transistor Driven

NOTE: Terminal numbers are for reference only and do not appear on part.

Header DPDT contacts


.370 Dia. Max.
.031
.035
36°
36°
.200 Dia.

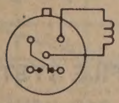
Basic and Suppressed


.370 Dia. Max.
.031
.035
36°
36°
.200 Dia.

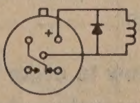
Transistor Driven

NOTE: Terminal numbers are for reference only and do not appear on part.

Electrical Diagram SPDT contacts



Basic



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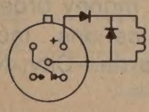

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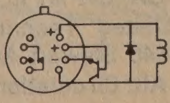
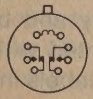


Transistor Driven

Schematics are viewed from terminals

Electrical Diagram DPDT contacts



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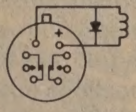

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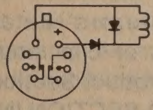

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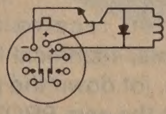

Transistor Driven

Schematics are viewed from terminals

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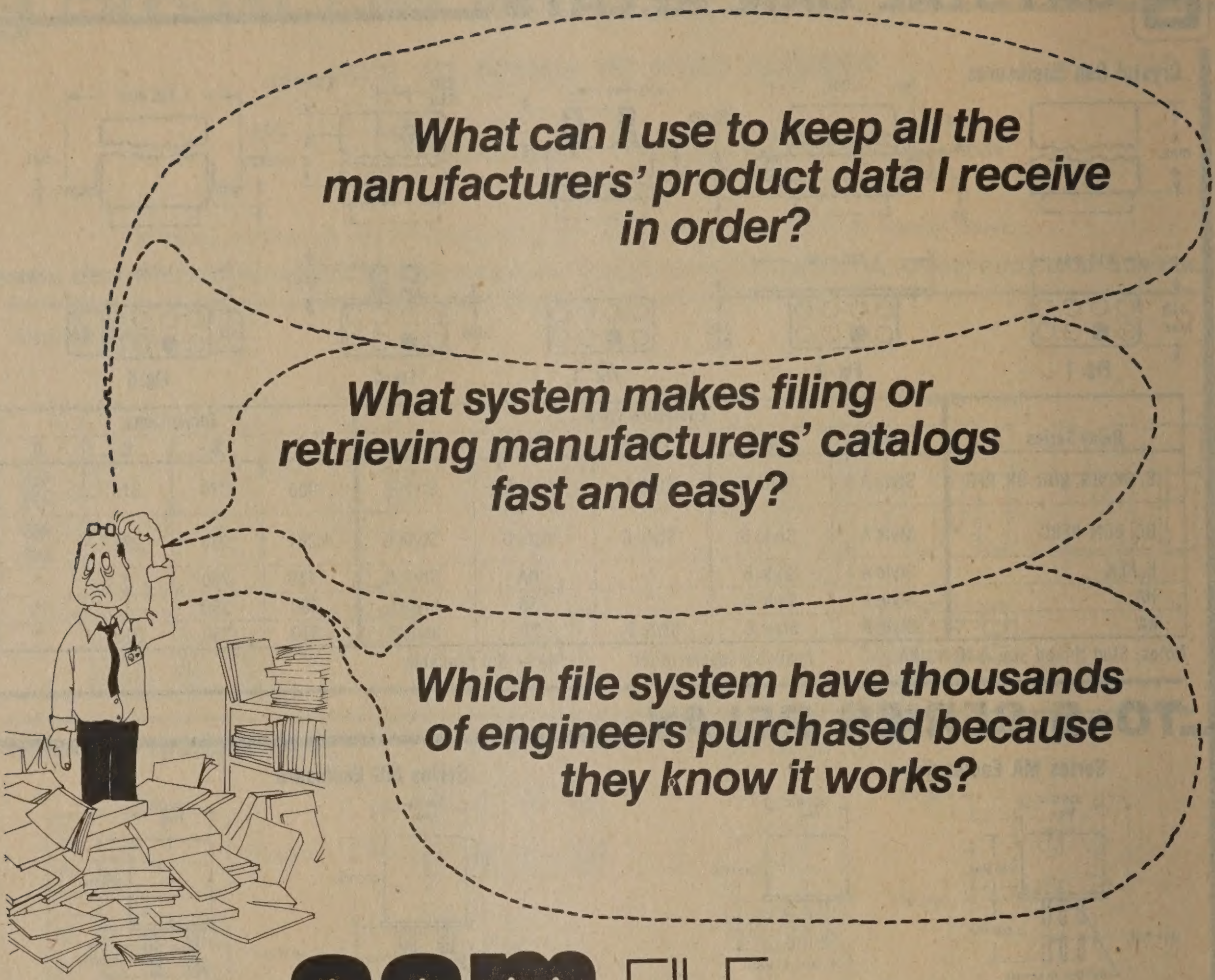
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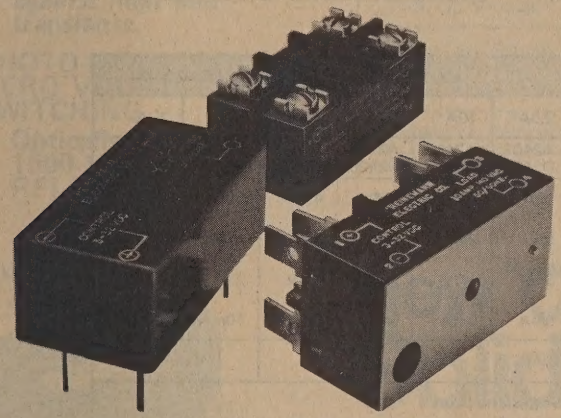
HEiNEMANN

FAIL-SAFE SOLID-STATE RELAYS FOR RELIABLE, LONG-LIFE SWITCHING of machine controls, computer controls, traffic controls, heating controls, process controls, lamps, office equipment, transformers

At Heinemann, we have gone a step beyond the many fine solid-state relays available today. Besides being CMOS- and TTL-compatible, our relays are *fail-safe.*

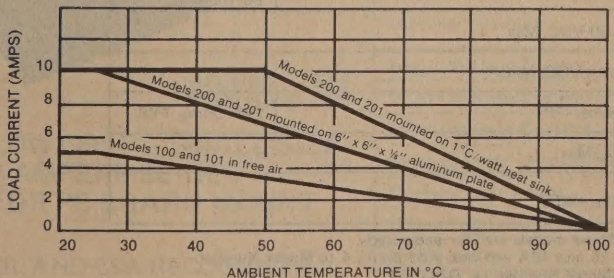
A unique combination of snubber network, fusible-link protector, and an overdesigned triac in each Heinemann relay prevents catastrophic systems failures common in other solid-state relay installations.

New and completely encapsulated for mounting in any position even in the worst conditions of moisture and vibration, Heinemann relays represent the industry's highest attainment in AC switching technology for loads up to 10 amperes. Two types, three mounting styles: Zero-voltage switching available for high rfi and emr resistance; non-zero-voltage switching for applications requiring a measurable level of load energy for switching. PC-mount, quick-on connectors, or screw terminals. 5A or 10A maximum load current, with DC control input voltage from 3 to 32V.



Derate for high ambient conditions according to Fig. 1. Complete information in new Bulletin Q-5401.

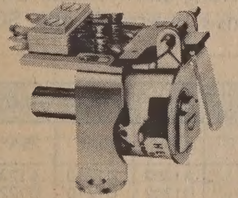
FIGURE 1—MAX. LOAD CURRENT VS. AMBIENT TEMPERATURE



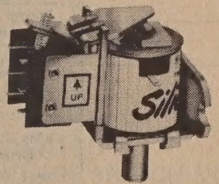
SILIC-O-NETIC TIME-DELAY RELAYS CAN CARRY CONTINUOUS LOADS TO 5A, ELIMINATE LOAD RELAY

You can often eliminate the need for two relays in timing applications. Heinemann Silic-O-Netic® time-delay relays can do both the timing and the load switching, because they have a continuous-duty coil and gold-plated 5-amp SPDT or DPDT contacts. If your application, like most time-delay relay applications, can manage with a timing accuracy of ±50% of the delay period, one of the three Heinemann Silic-O-Netic relays would be an economical and reliable choice for you.

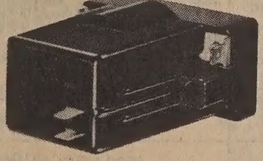
Available in a range of sixteen time delays from ¼ sec to 120 sec. Complete information in Bulletin 5006.



Type A—open frame, greatest economy for appliances and other mass-produced equipment.



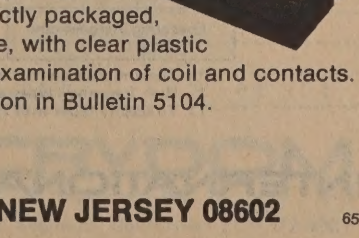
Type B—open frame with enclosed snap-action contacts for protection against contamination.



Type C—enclosed in durable phenolic case; quick-on terminals for both coil and contact circuits.

HEINEMANN OVERLOAD RELAYS FOR CLOSE-TOLERANCE MOTOR PROTECTION

The Type PJ overload relay acts fast, within close tolerances, to protect modern motors which are designed with running current close to locked-rotor current. A choice of three delay curves from slow trip (3 to 9 sec at 450% rated load) to fast trip (0.6 to 2.5 sec at 150% rated load). UL listed for AC motor running current to 65A at voltages up to 600VAC. Compactly packaged, stackable, dust-free, with clear plastic cover to facilitate examination of coil and contacts. Complete information in Bulletin 5104.

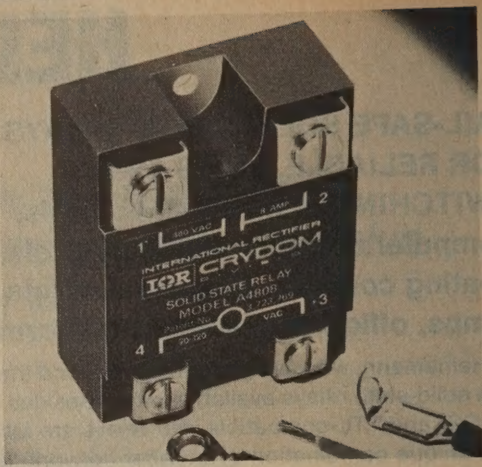


We keep you out of trouble.

HEiNEMANN ELECTRIC COMPANY **TRENTON, NEW JERSEY 08602**

6543

SCR Output Solid-State Relays



Whenever you want one-source savings on solid-state power relays, come to Crydom -- the originator (U.S. patent no. 3,723,769) of what has become the industry standard. We offer the broadest line available, 20 models in all, all in the same field-proven, functional package. They're UL recognized and CSA certified too. Among their outstanding features are • Complete Photo-isolation • Zero-Voltage Switching • 4-Way Terminals Silent Operation • Computer Compatible Inputs • No Inductive Load or Lamp Derating • Ultra-long and Reliable Life under High Shock/Vibration conditions • Inverse Parallel SCR Output.

LINE VOLTAGE (VAC)	FULL-LOAD CURRENT RATING (AMPS)					
	2.5	8	10	12	25	40
120	D1202 A1202		D1210 A1210		D1225 A1225	D1240 A1240
240	D2402 A2402		D2410 A2410		D2425 A2425	D2440 A2440
480		D4808 A4808		D4812 A4812		

AC Line Voltage 47-63Hz†	100-140 VAC				200-280 VAC				340-480 VAC	
Max. Load Current (See Curves)	2.5A*	10A*	25A*	40A	2.5A*	10A*	25A*	40A	8A**	12A
Model Numbers AC Control DC Control	A1202 D1202	A1210 D1210	A1225 D1225	A1240 D1240	A2402 D2402	A2410 D2410	A2425 D2425	A2440 D2440	A4808 D4808	A4812 D4812
One-Cycle Surge RMS (See Curve)	15A	80A	175A	450A	15A	80A	175A	450A	50A	60A
Overload: 1 Sec. RMS Current	5A	24A	40A	80A	5A	24A	40A	80A	17A	20A
Max. Contact Voltage Drop @Rated Current	3.5V	1.6V	1.6V	1.6V	3.5V	1.6V	1.6V	1.6V	2.0V	2.0V
Max. "Off-State" Leakage Current	4mA	4mA	4mA	5mA	5mA	5mA	5mA	5mA	10mA	10mA
Min. Current to Maintain "On"	20mA								40mA	
Response Time: DC Signal	Max. ½ Cycle (next zero-cross); no bounce									
Isolation††	1500 VAC; 10^{10} Ohms DC, Input-Output; Input-Base									
dv/dt	100 V/usec, Min.								20 V/usec, Min.	
DC Input Models (Models with "D" Prefix)										
Control Signal Range (Reverse Polarity Protected)	3-32 VDC								3-20 VDC	
Pick-up (-30°C to +80°C)	3.0 VDC, Max.									
Drop-out (-30°C to +80°C)	1.0 VDC, Min.									
Input Impedance (See Curve)	1500 Ohms, TYP.								500 Ohms, TYP.	
AC Input Models (Models with "A" Prefix)										
Control Signal Range	90 to 280 VAC or 80 to 140 VDC								90-120 VAC or 80-100 VDC	
Pick-up (-30°C to +80°C)	90 VAC or 80 VDC, Max.									
Drop-out (-30°C to +80°C)	10 VAC or 10 VDC, Min.									
Input Impedance	40K Ohms, TYP.								12K Ohms, TYP.	
Weight	4 oz., Max.									
Operating Temperature Range	-30°C to +80°C									

* These models are UL recognized and CSA certified. ** These models are UL recognized.

† High frequency types at 400Hz ±10% are available in 10, 25 and 40A versions. Add prefix 4 to Model Number.

†† To specify types with 2,500 Volt isolation add suffix–1 to Model Number, i.e. D2410–1.

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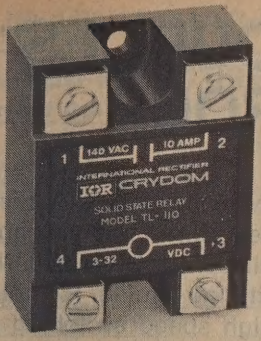
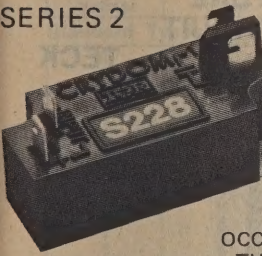


Triac Output Solid-State Relays

- **ECONOMICAL TRIAC OUTPUT**
  Low-cost single output features internal snubbers for high dv/dt applications.
- **HI-VOLTAGE PROTECTION**
  500-volt minimum breakdown voltage protects against high line transients.
- **PHOTO-ISOLATED, ZERO VOLTAGE SWITCHING**
  Optically coupled for 1500 VAC isolation and RFI suppresion.

SPECIFICATIONS	MODEL NUMBERS					
	TL105	TL110	TL125	TL205	TL210	TL225
Voltage Range (47-63 Hz)	24-140 VAC			48-280 VAC		
Load Current	5A	10A	25A	5A	10A	25A
Peak Surge Current	50A	100A	250A	50A	100A	250A
Non-Repetitive Peak Voltage	300V			500V		
Off-State Current	8mA RMS Maximum					
Dielectric Strength	1500 VAC					
dv/dt	100V/μsec.					
Input Voltage Range	0 to ±32 VDC					
Pick-Up Voltage	+3.0 VDC, Max.					
Drop-Out Voltage	1.0 VDC, Min.					
Input Impedance, Typical	1400 Ohms					
Operating Temperature Range	−30°C to +80°C					
Dimensions	2.25″ x 1.75″ x 0.87″					

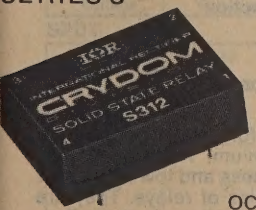
SERIES 2



OCCUPIES LESS THAN I CU. IN.

- **LOW COST — SMALL SIZE 8 AMPERE SERIES FOR PANEL MOUNT**

SERIES 3



OCCUPIES LESS THAN 0.4 CU. IN.

- **LOW COST — SMALL SIZE 2 AMPERE SERIES FOR PC BOARD MOUNT**
- **UL AND CSA RECOGNIZED**

New "Challenger" Solid-State Relays

PHOTO-ISOLATED ZERO VOLTAGE SWITCHING

SPECIFICATIONS	SERIES 2 MODELS		SERIES 3 MODELS	
	S218	S228	S312	S322
Voltage Range (47-63 Hz)	20-140 VAC	40-280 VAC	20-140 VAC	40-280 VAC
Load Current @ 40°C, Ambient	8 Amperes		2 Amperes	
Non-Repetitive Peak Voltage	300V	500V	300V	500V
Non-Repetitive Surge (1 Cycle)	120 Amperes Peak		55 Amperes Peak	
dv/dt	100V/μsec. Min.		100V/μsec. Min.	
dv/dt (Commutating)	5V/μsec. Min.		20V/μsec. Min.	
Zero Turn-On Voltage	15V	30V	15V	30V
Off-State Current	5 mA, Max.		1 mA, Max.	
Internal Snubber	Yes		Order Model 3012	Order Model 3022
Input Voltage Range	0 to ±8 VDC			
Must Operate Voltage (Pick-Up)	+3.5 VDC			
Must Operate Current, Max.	12 Milliamps DC			
Must Release Voltage (Drop-Out)	+1.0 VDC			
Dielectric Strength	1500 VAC			
Operating Temperature Range	−30°C to +80°C			
Dimensions	1.75″ x 0.85″ x 0.83″		1.2″ x 0.8″ x 0.4″	

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YOUR WORLD OF RELAY RESOURCES IS AT ITT COMPONENTS GROUP

At ITT Components Group we are proud of our worldwide resources. 2,000 people . . . one million square feet of manufacturing space . . . throughout seven countries. We manufacture and market the most modern and most reliable relays and they are available to you from one location.

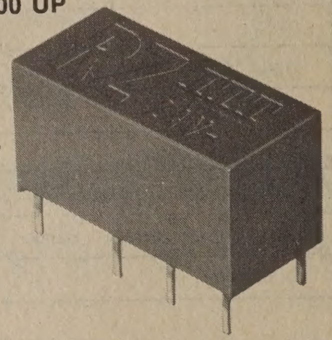
The ITT name — known the globe over — sets our very high standards. Our R&D facilities provide the latest in materials and switching techniques assuring the highest reliability at the most economical cost.

On this page and the five following. we present some highlights from our relay line. First two pages: specifications of our subminiature PCB relays. Next two pages: printed-circuit, low-profile PZ relays designed especially for high speed switching applications in logic, control, and communications equipment. Last two pages: Type 24/25 cradle relays which are available in single, bifurcated, and heavy duty versions.

1A DUAL-IN-LINE RELAYS

$1.50
100 UP

- **2 Form C Crossbar Contacts**
- **Dual-In-Line Configuration**
- **Low Profile, Printed Circuit or DIP Socket**
- **Molded Construction Ideal for Flow-Solder**
- **Automated Assembly and Test**



RZ

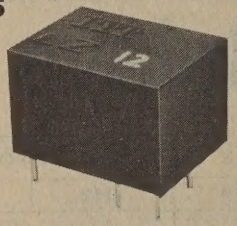
ITT Components Group is a powerhouse of relay resources. And here is our smallest powerhouse — the RZ relay. This subminiature dual-in-line printed circuit board relay, a significant advancement in relay state-of-the-art, has a unique symmetrical layout in a DIP package and a 2 Form C (DPDT) design with single silver cross--bar contacts which provides switching characteristics of 1A, 30W, or 50VA. Size? The RZ stands only 0.433 inches above the board.

That's a lot of power in a little package.

3A SUB-MINIATURE PRINTED CIRCUIT RELAYS

LZ

$1.05
100 UP



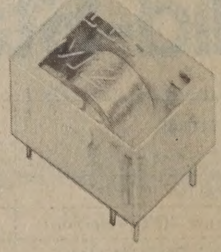
- **Low Cost, Low Profile**
- **Vibration and Shock Resistant**
- **Printed Circuit Mounting (0.1 in.)**
- **Sub-miniature Size**
- **Designed to Satisfy UL and CSA Requirements**
- **Dust-Free Enclosure**
- **Low Level to 3A**

The LZ miniature printed circuit relays are specifically designed to withstand high shock and vibration conditions. These 3A, 1 Form C relays, have been designed for mounting on standard printed circuit boards and are sealed to help prevent soldering and cleaning problems.

1A SUB-MINIATURE PRINTED CIRCUIT RELAYS

MZ

$1.00
100 UP



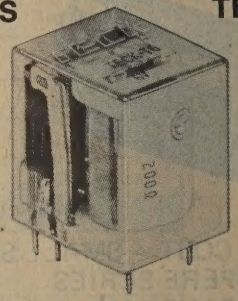
- **1 Form C General Purpose**
- **Dual-In-Line Configuration**
- **Gold Contacts for Low-Level Loads GS Contacts for Normal Loads**
- **Improved Shock and Vibration Characteristics**
- **Miniature Size — 0.4″ Height**
- **Dust-Free Enclosure**
- **Economical/Low Cost**

The MZ series of sub-miniature dual-in-line relays are ideal for current cost conscious engineers for design of low profile printed circuit equipment requiring speed, reliability and repeatability. They are available with 1 Form C (SPDT) crossbar contacts either low level or standard 1A (for 2 Form C see TECK specifications). Efficient design for shock and vibration applications. They are provided with a dust-free enclosure.

0.5A MINIATURE PRINTED CIRCUIT RELAYS

TECK

$1.70
100 UP



- **Miniature 2 Form C**
- **Rugged Construction**
- **High Reliability**
- **Low Cost**
- **Dust-Free Enclosure**

The TECK series printed circuit relays are ideally suited for applications where space is at a premium. Their small size, reliability, ruggedness and low cost make them a unique series of relays. They are available in a variety of contact configurations with SPDT and DPDT bifurcated contacts standard, and all types come standard with a dust-free enclosure.

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Components ITT

SUB-MINIATURE PRINTED CIRCUIT BOARD RELAYS

1A SUB-MINIATURE PRINTED CIRCUIT RELAYS

MZ

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage*	Maximum Continuous Voltage	Coil Resistance ±10% Ohms	Ordering Code	
				Au Overlay Ag Pd Base	Au/Ag
1.5	1.05	1.65	5	MZ1.5HG	MZ1.5H
3	2.1	3.3	20	MZ3HG	MZ3H
5	3.5	5.5	56	M5ZHG	MZ5H
6	4.2	6.6	80	MZ6HG	MZ6H
9	6.3	9.9	180	MZ9HG	MZ9H
12	8.4	13.2	320	MZ12HG	MZ12H
24	16.8	26.4	1280	MZ24HG	MZ24H

Ultra Sensitive Types

1.5	1.05	1.65	12	MZ1.5HS	—
3	2.1	3.3	45	MZ3HS	—
5	3.5	5.5	120	MZ5HS	—
6	4.2	6.6	180	MZ6HS	—
9	6.3	9.9	400	MZ9HS	—
12	8.4	13.2	700	MZ12HS	—
24	16.8	26.4	2800	MZ24HS	—

* Must release voltage is 10% of nominal.

CONTACT DATA

LOAD — Switched power: 25W, 100VA. **Switched current:** 1A. **Switched voltage:** 24VDC, 100VAC.

LIFE — Electrical expectancy: 1x10^6 operations @ 80mVDC, 50μA-MZHG series. 5x10^5 operations @ 24VDC, 1A-MZH series. **Mechanical expectancy:** 10x10^6 operations minimum.

CONTACT RESISTANCE — 100mΩ.

OPERATE AND RELEASE TIME — Operate time approximate): 3ms. **Release time (approximate):** 2ms.

INSULATION RESISTANCE — $>$5MΩ.

CONTACT MATERIAL — 50μA type: Gold overlay, silver palladium. **0.5A-1A Type:** Silver 90%, Gold 10%.

CONTACT FORM: 1 Form C.

COIL DATA

POWER CONSUMPTION @ 20°C — Coils at nominal voltage: 0.45W.

CONTINUOUS COIL POWER — Maximum allowable @ 20°C: 1W. **@ 50°C:** 0.48W.

1A DUAL-IN-LINE RELAYS

RZ

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage*	Maximum Continuous Voltage	Coil Resistance ±10% Ohms	Ordering Code
4.5	3.2	6.9	36	RZ-4.5
6	4.3	8.9	60	RZ-6
12	8.4	19.2	280	RZ-12
24	17.3	36.6	1070	RZ-24

* Must release voltage is 10% of nominal.

CONTACT DATA

LOAD — Switched power: 50VA. **Switched current:** 1A. **Switched voltage:** 125VAC, 150VDC.

LIFE — Electrical expectancy: 60VDC/20W: 1x10^6 operations. 60VAC/20W: 1.5x10^6 operations. **Mechanical expectancy:** 1x10^7 operations.

CONTACT RESISTANCE — $\leq$50mΩ.

OPERATE AND RELEASE TIME — Operate time: $\leq$6ms. **Release time:** $\leq$3ms.

INSULATION RESISTANCE — 100MΩ.

CONTACT MATERIAL — Crossbar - silver.

CONTACT FORM — 2 Form C.

COIL DATA

POWER CONSUMPTION — Coils at nominal voltage: 515 to 600mW.

CONTINUOUS COIL POWER — Maximum allowable @ 20°C: 1050mW. **@ 40°C:** 840mW. **@ 55°C:** 680mW.

3A SUB-MINIATURE PRINTED CIRCUIT RELAYS

LZ

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10% Ohms	Ordering Code*
Standard Types				
5	4.0	5.5	56	LZ-5
6	4.8	6.6	80	LZ-6
9	7.2	9.9	180	LZ-9
12	9.6	13.2	320	LZ-12
24	19.2	26.4	1280	LZ-24
48	38.4	52.8	3800	LZ-48
High Sensitive Types				
5	4.0	5.5	80	LZS-5
6	4.8	6.6	110	LZS-6
9	7.2	9.9	250	LZS-9
12	9.6	13.2	440	LZS-12
24	19.2	26.4	1780	LZS-24

* For bifurcated contacts (Silver Palladium Gold Overlay) add "W" to ordering code.

CONTACT DATA

LOAD — Switched power: 90W, 300VA. **Switched current:** 3A. **Switched voltage:** 24VDC, 100VAC.

LIFE — Electrical expectancy: 1x10^5 operations at 3A, 100VAC. 5 x 10^5 operations at 3A, 24VDC. **Mechanical expectancy:** 20x10^6 operations.

CONTACT RESISTANCE — 100mΩ.

OPERATE AND RELEASE TIME — Operate time: 5ms typical. **Release time:** 3ms typical.

INSULATION RESISTANCE — 250MΩ.

CONTACT MATERIAL — Single: Silver/Gold overlay. **Bifurcated:** Silver Palladium Gold overlay.

CONTACT FORM — 1 Form C (for 2 Form C see TECK specifications).

COIL DATA

POWER CONSUMPTION — Coils at nominal voltage @ 20°C: 450mW for standard type. 330mW for high sensitive type.

CONTINUOUS COIL POWER — Maximum allowable @ 20°C: 1.5W.

0.5A MINIATURE PRINTED CIRCUIT RELAYS

TECK

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10% Ohms	Ordering Code
SPDT				
1.5	.85	1.65	12	TECK-T1.5
3	1.7	3.3	50	TECK-T3
6	3.5	6.6	200	TECK-T6
9	5.0	9.9	400	TECK-T9
12	7.5	13.0	800	TECK-T12
24	14.0	27.0	2500	TECK-T24
DPDT				
1.5	.91	1.65	8	TECK-TT1.5
3	1.7	3.3	30	TECK-TT3
6	3.6	6.6	125	TECK-TT6
9	5.2	9.9	250	TECK-TT9
12	7.5	13.0	500	TECK-TT12
24	13.8	27.0	1500	TECK-TT24

CONTACT DATA

LOAD — Switched power: 50VA. **Switched current:** .5A. **Switched voltage:** 100V.

LIFE — Electrical expectancy: 20x10^6 operations. **Mechanical expectancy:** 50x10^6 operations.

CONTACT RESISTANCE — 50mΩ (typical).

OPERATE AND RELEASE TIME — Operate time: 7ms. **Release time:** 3ms.

INSULATION RESISTANCE — $>$50MΩ.

CONTACT MATERIAL — Gold/silver, PGS and Pt contacts available.

CONTACT FORM — TECK-T: SPDT. **TECK-TT:** DPDT.

COIL DATA

POWER CONSUMPTION — Coils at nominal voltage: 0.15W.

CONTINUOUS COIL POWER — Maximum allowable: 1.75W.

YOUR WORLD OF RELAY RESOURCES

SUB-MINIATURE PRINTED CIRCUIT BOARD RELAYS

Description		Series
Mini-cube	DPDT	PZSM
$<$0.1 in.^{3}	SPDT	MZ
DIP relay	DPDT	RZ
Power-cube	SPDT	LZ

MINIATURE TELEPHONE PRINTED CIRCUIT BOARD RELAYS

Description		Series
Long life,	DPDT, 4PDT	PZ2, 4, 6
high reliability	6PDT	
Interchangeable	LA/LB	MR10, 11

INSTRUMENTATION AND COMMUNICATION RELAYS

Description		Series
Sensitive-compact	DPDT	TECK
Superior Cradle	DPDT, 4PDT	Type 24, 25
Sensitive	SPDT	PL6

INDUSTRIAL AC/DC RELAYS

Description		Series
GP (KH type)	DPDT, 4PDT	ITT-2, 4
DC & AC GP	DPDT, 3PDT	RM83-86
DC & AC GP	Octal base	Series 24
GP (KUP type)	Square base plug-in	Series 30
DC & AC Motor Control	Open power	Series 29

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Components ITT

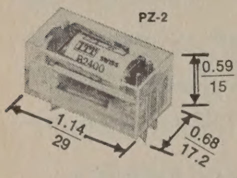
PRINTED CIRCUIT MINIATURE RELAYS

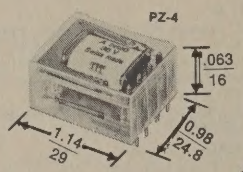
PZ-2 PZ-4 PZ-6

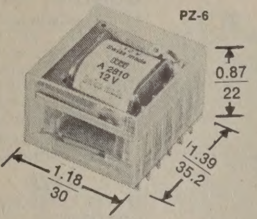
These low profile relays were designed especially for printed circuit applications utilizing standard pulse communication techniques. They are also available in latching versions as well as in subminiature packages. Contacts are gold and silver alloys to insure specified contact resistance over full life. Totally automated production eliminates human error and guarantees all parameters. Their polycarbonate case is designed to be used with or without top cover. There are more than 70 standard types. All are UL Recognized (File E57102).

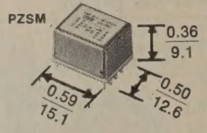
PZSM

- 15 Years Proven Telecommunications Experience
- Switch 1A in 1.7 Cubic Centimeter
- Subminiature Size — Height 0.36″
- High Reliability
- 2 Form C in 0.1 Cubic Inch
- Operates From IC Logic and Standard DC Voltages
- 0.1 Inch Grid Spacing
- Printed Circuit Board Application
- Less Than 0.3in² on PC Board
- Standard Flow-Solder Techniques









ALL DIMENSIONS IN INCHES / MM

GENERAL SPECIFICATIONS

Coil Data — Standard Relays

Nominal Voltage	Coil Resistance ±10% Ohms	Ordering Code AgPd Contacts*	Ordering Code Au/Ag Contacts†
PZ-2‡			
6	60	A2400	A2405
12	210	A2410	A2415
18	500	A2412	A2417
24	850	A2420	A2425
36	1600	A2430	A2435
48	3000	A2440	A2445
PZ-4‡			
6	40	A2640	A2645
12	210	A2600	A2605
18	500	A2612	A2617
24	850	A2610	A2615
36	1600	A2620	A2625
48	3000	A2630	A2635
60	4800	A2650	A2655
PZ-6‡			
6	66	A2800	A2805
12	270	A2810	A2815
18	520	A2812	A2817
24	900	A2820	A2825
36	1900	A2830	A2835
48	3600	A2840	A2845
60	6100	A2850	A2855

PZSM

Nominal Voltage	Pull-In Voltage	Coil Resistance ±5% Ohms	Au/Ag Contacts† Ordering Code
5	3.0	142	PZSM—D1005
6	3.6	142	PZSM—D1006
12	7.2	845	PZSM—D1012
24	14.4	2980	PZSM—D1024

* Silver Palladium alloy, 70% Silver, 30% Palladium
† Gold/Silver alloy, 80% Gold, 20% Silver
‡ Available in Remanent latch versions designed for pulse applications

CONTACT DATA

Load		
Switched power	PZ-2, 4, 6	30VA
	PZSM	12VA
Switched current	PZ-2, 4, 6	1A
	PZSM	0.5A
Switched voltage	PZ-2, 4, 6	120V
	PZSM	100V
Life		
Electrical expectancy	PZ-2, 4, 6 @ 0.5A, 30V	10 x 10⁶ oper.
	PZSM @ 6VA	1 x 10⁶ oper.
Mechanical expectancy	PZ-2, 4, 6	200 x 10⁶ oper.
	PZSM	200 x 10⁶ oper.
Contact Resistance		
	PZ-2, 4, 6	40 mΩ
	PZSM	50 mΩ
Operate & Release Time		
Operate (including bounce)	PZ-2, 4, 6	10 ms
	PZSM	3.5 ms
Release	PZ-2, 4, 6	2.5 ms
	PZSM	1.5 ms

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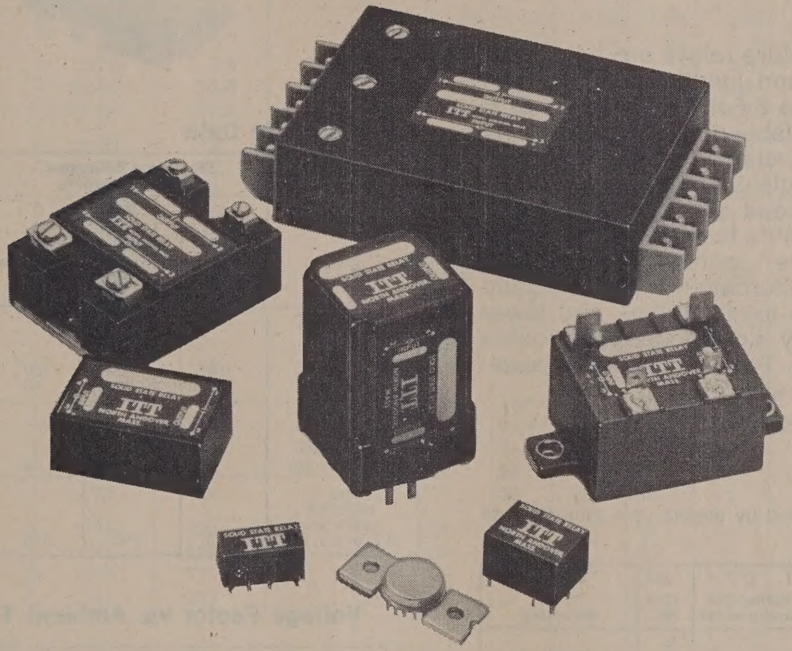
Components ITT

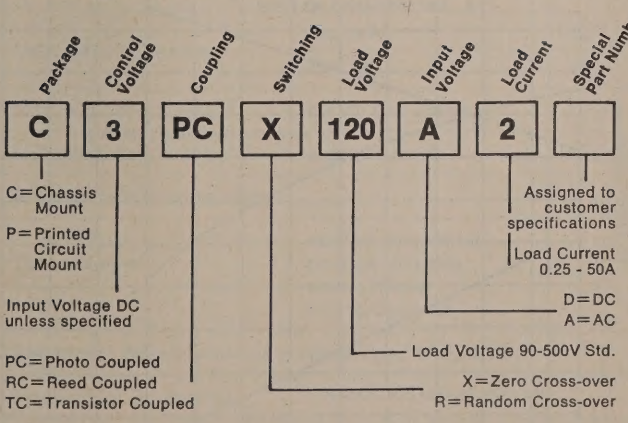
SOLID STATE RELAYS

- 70 Models in 12 Package Styles
- 1A to 40A in AC and DC Versions
- All Internal Triacs and SCRs Are Triple Tested and Selected
- Smallest Packages Consistent With Thermal Considerations

It takes an EMR expert, like ITT Components Group, to translate your switching and isolation needs into solid state technology. We offer built-in snubbers, unique heat dissipation systems for high surge capability, and true zero cross-over circuitry. You can choose from photo, transistor and reed coupling. And you can build your own part number from the chart below and order a solid state relay customized to your own requirements. Or choose a standard ITT solid state relay from any of the types listed in the Basic Cross Reference chart. Either way you get the reliability and long life which makes our SSRs an excellent alternative to electromechanical relays.



Ordering Codes


Package
Control Voltage
Coupling
Switching
Load Voltage
Input Voltage
Load Current
Special Part Number
C
3
PC
X
120
A
2
C=Chassis Mount
P=Printed Circuit Mount
Input Voltage DC unless specified
PC=Photo Coupled
RC=Reed Coupled
TC=Transistor Coupled
Assigned to customer specifications
Load Current 0.25 - 50A
D=DC
A=AC
Load Voltage 90-500V Std.
X=Zero Cross-over
R=Random Cross-over

Example: **C12PCX120A2**
The above code signifies a chassis mount, photo coupled SSR with input voltage of 3 VDC, load voltage of 120VAC, designed for zero cross-over in an AC application. Load current is 2A.

Basic Cross Reference Chart

ITT Components Group	Crydom	Opto 22	Teledyne	ERI	Hamlin	Gordos' Grigsby-Barton
C3PCX120D2.5	D1202	120D3		S505-SJ202		
C3PCX120D10	D1210	120D10	611-17	S505-SJ210	7521	GB15210
C3PCX120D25	D1225	120D25	611-11	S505-SJ225	7531	GB15225
C3PCX120D45	D1240	120D45	611-15	S505-SJ240	7551	GB15240
C3PCX240D2.5	D2402	240D3		S505-SJ402		
C3PCX240D10	D2410	240D10	611-18	S505-SJ410	7522	GB15410
C3PCX240D25	D2425	240D25	611-12	S505-SJ425	7532	GB15425
C3PCX240D40	D2440	240D45	611-16	S505-SJ440	7552	GB15440
C3PCX330D2.5			611-18H	S505-SJ602		
C3PCX330D10			611-12H	S505-SJ610		
C3PCX330D25			611-16H	S505-SJ625		
C3PCX330D40				S505-SJ640		
C3PCX480D10	D4808E D4812	480D10		S505-SJ12010		

Consult factory for other combinations of package, voltage, current, etc.

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Components ITT

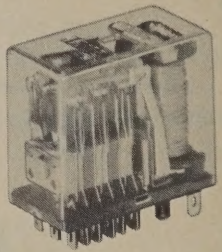
MINIATURE RELAYS

24/25/26

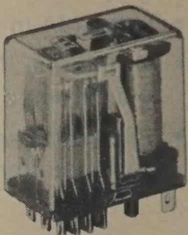
- **One Piece Core and Yoke** giving improved magnetic efficiency and stability
- **One Piece Bobbin and Terminal** gives rigid coil terminations
- **Polycarbonate Insulation** — negligible moisture absorption ensuring stability of spring-set adjustment
- **Underwriters Laboratories Recognized (#E57102)**

Type 24

Type 26



Type 25



ITT Type 24/25/26 miniature relays are fully interchangeable in form fit and function with all well known cradle types. 2, 4 & 6 Form C is standard; 2, 4 or 6 Form A or B is available on request. A variety of contact materials is available in single and twin light duty. Heavy duty single contacts are available; these are listed in the Load and Life Data table. Several options are available to meet different load requirements. Single silver contacts are excellent for loads up to 2A. Twin (bifurcated) contacts should be used for carrying low loads, 100mA and lower (dry circuits). Heavy duty single cadminum oxide contacts give 5A ratings. Twin contacts are available in gold alloy or fine silver.

Load and Life Data

	Single and Bifurcated Contact Materials			Heavy Duty Contact Materials	
	A Silver	B Gold Nickel Alloy 95%:5%	C Silver/ Palladium Alloy 40%:60%	D Large Diameter Heavy Duty Silver	E Silver/ Cadmium-Oxide for Inductive Loads
Max. switched power a.c. (VA) d.c. (W)	100 30	40 20	100 50	250 100	500 100
Max. switched current a.c. or d.c. (A)	2	2	2	5	5
Max. switched voltage a.c. or d.c. (V)	110	110	110	250	250

Ordering Codes

ITT Miniature relays are ordered by means of a picture code for standard cataloged items:

A. Frame Size	B Contact Material	C Spring-Set Arrangement	D Coil No.	E Mounting
24 (small) 25 (medium) 26 (large)	A. Silver B. Gold/Nickel 95%:5% C. Silver/Palladium 40%:60% D. Large diameter heavy duty silver E. Silver cadmium-oxide for inductive loads	0. Single 1. Bifurcated 2. Two 4. Four 6. Six C. Form C	See Standard Coil and Contact Combination Table	C. Plug-in 3-48 NC stud E. Direct PC without ground G. 0.1 in. direct PC without ground

Example

25 A 14C 09 G

G: 0.1 in. direct PC without ground

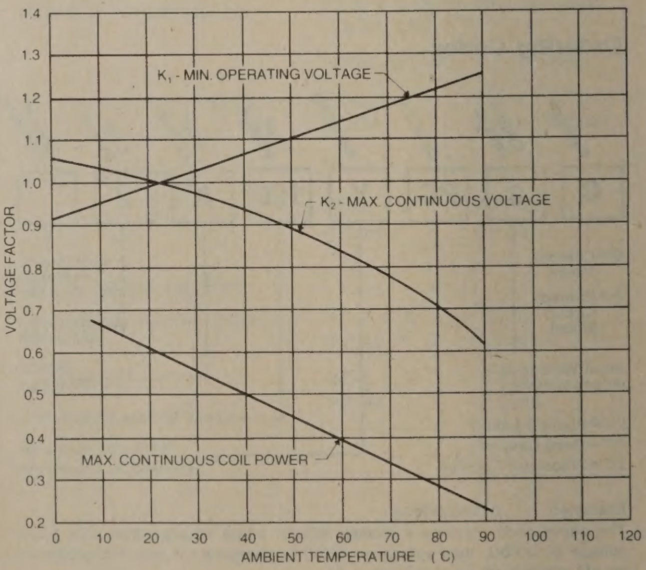
09: Coil voltage 5.4-10.6VDC

14C: Bifurcated contacts, four Form C

A: Silver

25: Medium size relay

Voltage Factor vs. Ambient Temperature



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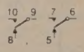
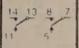
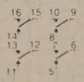
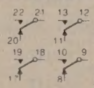
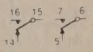
Components ITT

MINIATURE RELAYS

24/25/26

STANDARD COIL AND CONTACT COMBINATIONS (20°C)

Relay Size Box A of Code					24			25				26		
Contacts & Springset Code			Single		A02C				A04C			A06C		
			Bifurcated			A12C				A14C			A16C	
			Heavy Duty				D02C	D02C			D04C			D06C
STANDARD COIL PARAMETERS														
Coil Number	Coil Resistance	Tolerance (%)	Max. Volts at 20°C	Nominal Voltage	Minimum Voltages at 20°C									
01	1.3	±10	1.7		0.38	0.57	0.57	0.57	0.57	0.85	0.85	0.76	0.95	0.95
02	3	±10	2.5		0.58	0.88	0.88	0.88	0.88	1.32	1.32	1.17	1.47	1.47
03	4.5	±10	3.1		0.69	1.04	1.04	1.04	1.04	1.56	1.56	1.39	1.74	1.74
04	5	±10	3.3		0.72	1.08	1.08	1.08	1.08	1.62	1.62	1.44	1.80	1.80
05	8.2	±10	4.2		0.94	1.42	1.42	1.42	1.42	2.13	2.13	1.90	2.37	2.37
06	14	±10	5.5		1.25	1.88	1.88	1.88	1.88	2.82	2.82	2.51	3.10	3.10
07	15	±10	5.7		1.29	1.94	1.94	1.94	1.94	2.91	2.91	2.59	3.23	3.23
08	**28**	**±10**	**7.8**	**6†**	1.8	2.7	2.7	2.7	2.7	4.0	4.0	**3.6**	**4.5**	**4.5**
09	**52**	**±10**	**10.6**	**6**	**2.4**	**3.6**	**3.6**	**3.6**	**3.6**	**5.4**	**5.4**	4.8	6.0	6.0
10	58	±10	11.2		2.6	3.9	3.9	3.9	3.9	5.8	5.8	5.2	6.5	6.5
11	**90**	**±10**	**14**	**12†**	3.2	4.8	4.8	4.8	4.8	7.3	7.3	**6.5**	**8.1**	**8.1**
12	110	±10	15		3.5	5.3	5.3	5.3	5.3	8.0	8.0	7.1	8.9	8.9
13	150	±10	18		4.2	6.3	6.3	6.3	6.3	9.4	9.4	8.4	10.5	10.5
14	**185**	**±10**	**20**	**12**	**4.9**	**7.4**	**7.4**	**7.4**	**7.4**	**11.1**	**11.1**	9.9	12.3	12.3
15	220	±10	22		5.1	7.6	7.6	7.6	7.6	11.5	11.5	10.2	12.7	12.7
16	280	±10	25		5.9	8.9	8.9	8.9	8.9	13.4	13.4	11.9	14.8	14.8
17	325	±10	27		6.2	9.2	9.2	9.2	9.2	13.8	13.8	12.3	15.4	15.4
18	**430**	**±10**	**31**	**24†**	7.0	10.5	10.5	10.5	10.5	15.8	15.8	**14.1**	**17.5**	**17.5**
19	530	±10	34		8.0	12.1	12.1	12.1	12.1	18.1	18.1	16.1	20	20
20	**700**	**±10**	**39**	**24**	**9.8**	**14.7**	**14.7**	**14.7**	**14.7**	**22**	**22**	19.5	24	24
21	890	±10	44		10.7	16.1	16.1	16.1	16.1	24	24	21	26	26
22	**1250**	**±10**	**52**	**36**	**12.9**	**19.4**	**19.4**	**19.4**	**19.4**	**29**	**29**	26	32	32
23	**1700**	**±10**	**61**	**48†**	14.2	21	21	21	21	32	32	**29**	**36**	**36**
24	**2500**	**±15**	**72**	**48**	**18.8**	**28**	**28**	**28**	**28**	**42**	**42**	36	45	45
25	3300	±15	82		20	30	30	30	30	45	45	40	50	50
26	5800	±15	109		30	44	44	44	44	67	67	59	74	74
27	7600	±15	125		33	50	50	50	50	75	75	67	83	83
28	15000	±15	175		55	82	82	82	82	124	124	110	138	138
29	20900	±15	207		58	87	87	87	87	131	131	117	146	146

Contact terminations. The numbers correspond to those on relay base.											
Max. switched power*	a.c. (VA)	100	100	250	250	100	100	250	100	100	250
	d.c. (W)	30	30	100	100	30	30	100	30	30	100
Max. switched current*	a.c. or d.c. (A)	2	2	5	5	2	2	5	2	2	5
Max. switched voltage*	a.c. or d.c. (V)	110	110	250	250	110	110	250	110	110	250
Ambient temperature range		−40°C to +80°C									
Test voltages	contact to contact contact to frame coil to frame coil to contacts	1000 V r.m.s. 50Hz									
Electrical Life—Operations at Rated Load 1A@28VDC		10 x 10⁶									
Mechanical Operations		100 x 10⁶									
Contact Resistance		50mΩ									

* The above contact ratings are for standard Silver contacts. If other contact materials are required for specialized applications consult the table, Load and Life data.

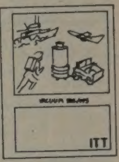
† 6 changeover relays.

Bold type — U.S. Industry standard coils.

vacuum relays

ITT Jennings manufactures Vacuum and Gas Relays to exacting standards for use in transferring high voltage circuits. They are available in voltage ranges up to 30 KVAC, with up to 75 A. current ratings, and with operating frequencies through the VHF band. These relays are widely used in airborne, mobile and marine communications where their characteristics are particularly desirable. They have high operating speeds, withstand high voltages and carry heavy currents with high reliability ... without developing high contact resistance or generating electrical noise. The majority of applications for these relays includes the switching of antennas, frequency bands, transmit/receive modes, power circuits and elements in pulse forming networks.

Engineering information on the use of vacuum relays for DC, AC, and RF switching as well as special capacitive circuits in included in this 16-page catalog. Specifications on various relays are organized for ease in selecting the best unit for your applications.



RF4A

RF5A

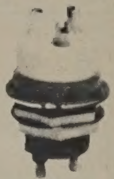
RD5B

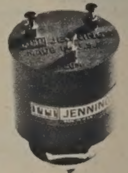
RS8

RJ8A

RF1D

RF1J


RJ1A


RJ1H

RF3A

RF3C

RJ2B

RB1D

RB1E

RF10B

RE6B

RB7A

RGD1,5

		Rated Operating Voltage			Continuous Current			Contact Capacity		Contact Resist-ance	Operate Time	Release Time	Coil Resist-ance
Relay Type	Contact Arrangement	DC or 60 Hz (KV Peak)	2.5 MHz (KV Peak)	16 MHz (KV Peak)	DC or 60 Hz (Amps RMS)	2.5 MHz (Amps RMS)	16 MHz (Amps RMS)	Open Contact to Ground (pF)	Between Open Contacts (pF)	(Max.) Ohms	(Max.) (MS)	(Max.) (MS)	26.5 V ±10% (Ohms)
Single Pole, Single Throw													
RF4A	SPST N/C	10	7	6	30	25	15	2.5	4.0	.015	18	18	156
RF5A	SPST N/C	7.5	7.5	7	8/12	10	5	1.6	2.0	.020	12	12	920
RD5A/6A	SPST N/O/N/C	15	12	10	15	10	6	1.0	0.5	.010	18	8	265
RD5B/6B	SPST N/O/N/C	15	12	10	15	10	6	1.0	0.5	.010	18	8	265
RS8/10	SPST N/O/N/C	30	28	25	75	35	22	1.5	0.7	.003	30	10	120
RJ8A	SPST N/O	30 (60 Hz)	28	25	110	60	40	1.0	1.3	.003	30	10	120
Single Pole, Double Throw													
RF1D/E	SPDT	4	2	2	8	6	4	2.0	1.6	.020	10	10	920
RF1J	SPDT Latch	4	2	2	8	6	4	2.5	2.5	.020	10	n/a	18.3
RJ1A	SPDT	5	2.5	2	18	14	9	2.5	2.0	.010	8	8	335
RJ1H*	SPDT	5 (DC)	hot brk.	n/a	3	hot brk.	n/a	n/a	n/a	.030	6	6	335
RF3A	SPDT	10	7	6	30	25	15	2.5	4.0	.015	18	18	156
RF3C	SPDT	11 (60 Hz)	7	6	30	25	15	2.5	4.0	.015	10	10	12
RJ2B/C	SPDT	15	10	8	50	30	17.5	1.0	0.5	.012	18	9	270
RB1D/H	SPDT	18/15	10	8	15	10	6	1.0	0.5	.012	18	8/9	265/270
RB1E/J	SPDT	18/15	10	8	15	10	6	1.0	0.5	.012	18	8/9	265/270
RF10B	SPDT	20	13	10	75	22	15	1.5	0.5	.012	30	10	225
RE6B	SPDT	30	20	15	25	13	8	2.5	1.0	.010	25	10	120
Multi-Pole, Double Throw													
RB7A/B	DPDT	9	4	3	14	9	4	2.0	1.0	.020	15	5	270
RB3	DPDT	15/8[2]	10/5[2]	8/4[2]	30	10	6	2.5	1.0	.010	20	8	120
RB2A	DPDT	22	15	10	20	12	6	2.5	1.0	.010	20	10	225
RB4	4PDT	17	12	10	20	10	6	2.5	1.0	.010	45	10	131
RGD1, 5*	DPDT	18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	17	17	25 @ 12 Volts
RGD6*	DPDT	14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	20	20	18 @ 12 Volts

* Defibrilator Relay

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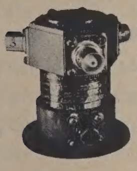
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

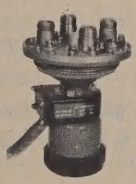
vacuum coaxial relays

ITT Jennings manufactures a broad line of coaxial relays for use where circuit currents must be contained completely within a coax system. Vacuum coaxial relays have high power handling capabilities at frequencies up to 1.7 GHz. Inert gas filled switches offer advantages where power levels are low and maximum system flexibility demands modular, stackable configurations.

These relays and switches have characteristics that are well suited to airborne, marine and mobile communication systems, as well as fixed installations. These characteristics include: ● Low insertion loss and VSWR ● High RF power capability ● High isolation ● Fast operation ● Low, stable contact resistance ● No noise generation or IM distortion ● Extreme high reliability combined with ruggedness for high altitude or heavy vibration environments ● Small size and lightweight for their power handling capacity ● Wide band-pass characteristics. Typical applications for these units might include multiple antenna-transmit switching systems such as high speed switching from omnidirectional to directional antennas, transmit-receive switching, and where tunable elements are to be switched in transmitter and receivers. Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

This 16-page catalog describes in detail the complete line of vacuum coaxial relays, including crossover types designed for use in HF and VHF matrix crossbar systems. Also listed are a variety of fittings for assembling crossbar networks using 1-5/8, 3-1/8 and 6-1/8" lines. Typical crossbar switching matrices are described.


RC41

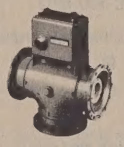

RC53

RC5

RC6

RC10

RC21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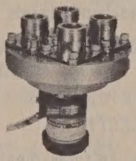
RC54

MODEL NUMBER	RC41	RC53	RC5	RC6	RC10	RC21	RC31	RC54
POWER RATING	3 KW CW at 30 MHz	4 KW CW at 30 MHz	25 KW CW at 30 MHz	25 KW CW at 30 MHz	90 KW CW at 30 MHz	90 KW CW at 30 MHz 2 MW PEAK Spec Order RC26/RC27	325 KW CW at 30 MHz	7.5 KW CW at 30 MHz
FREQUENCY RANGE	0 to 500 MHz	0 to 600 MHz	0 to 100 MHz	0 to 400MHz	0 to 100 MHz	0 to 500 MHz	0 to 150MHz	0 to 600 MHz
VSWR WITH RESPECT TO 50 OHMS	1.1:1 Max.	1.1:1 Max.	1.02:1 Max. to 30 MHz 1.05:1 Max. to 60 MHz	1.1:1 Max. to 150 MHz	1.02:1 Max. to 30 MHz 1.05:1 Max. to 60 MHz	1.15:1 Max. to 500 MHz	1.15:1 Max.	1.1:1 Max.
CROSSTALK	Greater than 30 dB isolation at 300 MHz	Greater than 75 dB isolation at 30 MHz	Greater than 70 dB isolation at 30 MHz	Greater than 65 dB isolation at 30 MHz	Greater than 65 dB isolation at 30 MHz	Greater than 60 dB isolation at 30 MHz	Greater than 57 dB isolation at 30 MHz	Greater than 53 dB isolation at 500 MHz
INSERTION LOSS	0.1 dB Max.	0.1 dB Max.	0.02 dB Max.	0.01 dB Max.	0.02 dB Max.	0.05 dB Max.	0.01 dB Max.	0.01 dB Max.
COIL RESISTANCE ±10% 26.5 VDC COIL	265 Ohms	18 Ohms	18.8 Ohms	15.4 Ohms	8.3 Ohms	4.8 Ohms	7.8 Ohms	19 Ohms
CONTACT CONFIGURATION	SPDT	2 pole, 2 position crossover transfer	SPST	SPDT	SPST	SPDT	SPDT	DPDT
LINE/CONNECTOR SIZE	C	SC	1⅝"	1⅝"	3⅛"	3⅛"	6⅛"	LC
ACTUATION	Non-latching continuous duty coil	Permanent magnet latching	Permanent magnet latching	Permanent magnet latching	Permanent magnet latching	Permanent magnet latching	Permanent magnet latching	Permanent magnet latching
OPERATE TIME	25 Millisecs Max.	15 Millisecs Typ. 30 Millisecs Max.	15 Millisecs Typ. 30 Millisecs Max.	50 Millisecs Max.	15 Millisecs Typ. 30 Millisecs Max.	40 Millisecs Max.	50 Millisecs Max.	30 Millisecs Max.
WEIGHT	14.5 oz.	2 lbs., 12 oz.	1 lb., 13 oz.	8 lbs.	3 lbs., 12 oz.	14 lbs.	48 lbs., 8 oz.	6 lbs., 8 oz.

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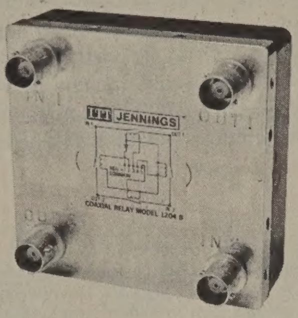
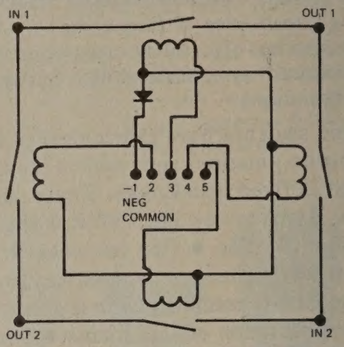
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

2 x 2 high isolation coaxial switches

2RC1204 SERIES





APPLICATIONS

- Switch wideband signals, DC-300 MHz.
- Electrically controlled switching in circuits requiring high isolation (such as IF video circuits) or very high isolation (such as RF video circuits.)
- CATV and CCTV.
- Computer controlled measuring systems.
- Non-duplication switching in RF head-end networks.
- Communications Systems.

FEATURES

- Minimum open circuit leakage over entire frequency range.
- Broadband frequency response — DC to 300 MHz range.
- Universal mounting design for panels, railings or brackets.
- Control connector adaptable to flexible ribbon for stripline or PC board interface.
- Rugged two-part housing — aluminum die casting and molded polycarbonate cover.
- Silver-plated signal paths shielded for maximum EMI protection.
- Reed switch elements hermetically sealed in nitrogen atmosphere.
- Rhodium-plated contacts prevent "sticking" due to feedback currents or dry circuit operation.
- DC coils are diode protected against effects of transients or use of wrong polarity.
- DC coils can be independently controlled or sequenced in pairs.

Specifications	Model 1204	
Bandwidth	DC — 300 MHz	
VSWR	Model "BH"	Model "B"
(max)	1.5	1.5
(typ)	1.25	1.25
Insertion Loss (typ)	1.0 dB	0.8 dB
Isolation (min)	−70 dB	−45 dB
Impedance	75 ohms	
RF Power, CW (nom)	3 Watts	
RF Peak Voltage	250 V	

Specifications	Model 1204
Switching Time (max)	1 millisecond
Control Viltage (nom)	12-28 VDC
Connector Type	BNC (Quick Disconnect)
Mounting	Any Position
Life	20×10^6
Temperature Range	
Operating	−55 to +75°C (−67 to +167°F)
Storage	−65 to +85°C (−85 to +185°F)

OPTIONS AVAILABLE

Control Voltage
6 or 48 VDC

Configuration	Isolation	Model Number
2 x 2	High (−45 dB)	1204B
2 x 2	Very High (−70 dB)	1204BH

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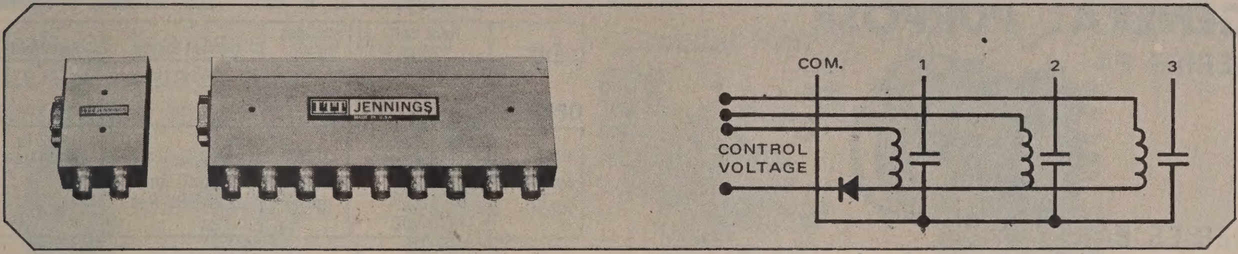
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

coaxial switch modules

RC1100 SERIES



APPLICATIONS

- Electrically controlled switching of wideband signals, DC—300 MHz.
- Design of complex switching circuits such as SP42T, 9P3T and other unusual switching trees.
- CATV and CCTV distribution switching.
- Telemetry and data handling networks.
- Satellite communications.
- Microwave trunks (base band and IFF frequency).
- Automatic switching of computer controlled measuring systems.
- Network analyzing digital pulse information.

FEATURES

- One to eight throws.
- Sealed RF contacts for long life, stable contact resistance.
- Designed for over 1800 switchings/day for 30 years.
- Special contact material prevents "sticking" due to feedback currents or dry circuit operation.
- DC coils are diode protected against effects of transient voltages or use of wrong polarity.
- All-aluminum flatpack housing is easily stacked to provide multi-pole, multi-throw operation.
- Low RF leakage input and output assured up to 300 MHz.

Specifications	Model 1100
Bandwidth (1x1, 1x2, 1x3)	DC — 300 MHz
(1x4)	DC — 250 MHz
(1x5, 1x6, 1x7, 1x8)	DC — 100 MHz
VSWR (typ)	
@ 50 MHz	1.1:1
100 MHz	1.25:1
300 MHz	1.50:1
Insertion Loss (typ)	
@ 50 MHz	.25 dB
100 MHz	.30 dB
300 MHz	.50 dB
Isolation (typ)	
@ 50 MHz	−45 dB
100 MHz	−50 dB
300 MHz	−30 dB

Specifications	Model 1100
Impedance	50 or 75 ohms
RF Power, CW (nom)	10 Watts
RF Peak Voltage	250 VDC
Switching Time (max)	1 millisecond
Control Voltage (nom)	12-28 VDC
Connector Type	BNC (Quick Disconnect)
Mounting	Any Position
Life	20 x 10⁶
Temperature Range	
Operating	−55 to 75°C (−67 to 167°F)
Storage	−65 to 85°C (−85 to 185°F)

OPTIONS AVAILABLE
Control Voltage
6 or 48 VDC

	Model Numbers	
	Non-Latching	
Configuration	50-Ohm	75-Ohm
1 x 1	RC1101A	RC1101B
1 x 2	RC1102A	RC1102B
1 x 3	RC1103A	RC1103B
1 x 4	RC1104A	RC1104B
1 x 5	RC1105A	
1 x 6	RC1106A	
1 x 7	RC1107A	
1 x 8	RC1108A	

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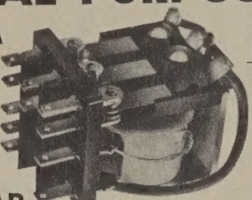
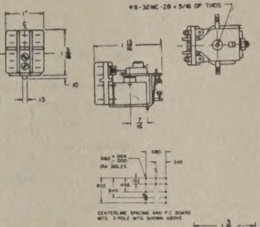
KURMAN RELAYS INC.
DEPT. EM / 120 WILBUR PLACE / BOHEMIA, N.Y. 11716
(516) 567-0009

RELAYS

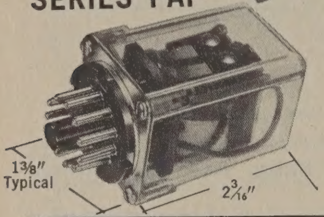
GENERAL PURPOSE

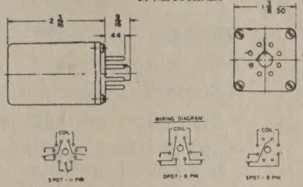
SERIES PA





SERIES PAP





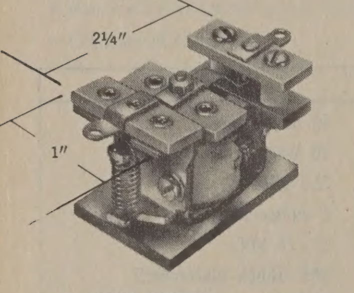
Type*	Nom. Coil Voltage	Contact Arrang.	Contact Rating	Sensitivity
OPEN				
PA-1C- PA-2C- PA-3C-	6, 12, 24 115 VAC or 6, 12, 24 110 VDC	SPDT DPDT 3PDT	Available in 5 or 10 Amp at 28 VDC Res.	2.2 to 3.0 VA 1.4 W
DUST COVERED				
PAP-1C- PAP-2C- PAP-3C-	6, 12, 24 115 VAC or 6, 12, 24 110 VDC	SPDT DPDT 3PDT	Available in 5 or 10 Amp at 28 VDC Res.	2.2 to 3.0 VA 1.4 W

*Add Suffix "T" for 10 Amp Contacts i.e., PAT-1C-Desired Coil

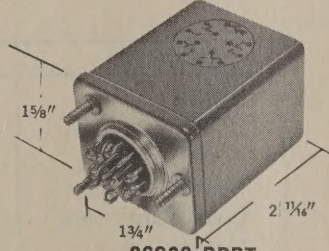
POWER RELAYS

SERIES 26

Per MIL-R-5757



261C SPDT

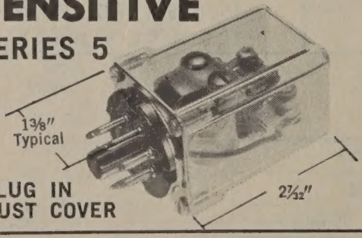


26S20 DPDT
HERM. SEAL

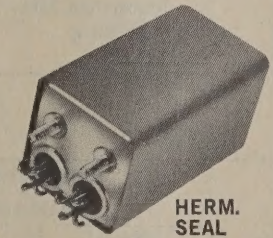
Type*	Nom. Coil Voltage	Contact Arrang.	Contact Rating	Sensitivity
OPEN				
26-1C- 26-2C- 26-3C- 26-4C-	6, 12, 24 115 VAC or 6, 12, 24 110 VDC	SPDT DPDT 3PDT 4PDT	Available in 10, 20 or 30 Amp at 28 VDC Res.	4 VA .5 W
DUST COVERED				
26D-1C- 26D-2C- 26D-3C-	6, 12, 24 115 VAC or 6, 12, 24 110 VDC	SPDT DPDT 3PDT	Available in 10 or 20 Amp at 28 VDC Res.	4 VA .5 W
HERMETICALLY SEALED				
26S-1C- 26S-2C- 26S-3C-	6, 12, 24 115 VAC or 6, 12, 24 110 VDC	SPDT DPDT 3PDT	Available in 10 or 20 Amp at 28 VDC Res.	4 VA .5 W

SENSITIVE

SERIES 5



PLUG IN
DUST COVER



HERM.
SEAL

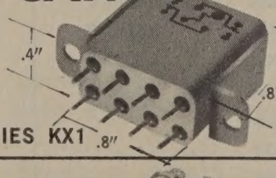
Type*	Nom. Coil Voltage	Contact Arrang.	Contact Rating	Sensitivity
51C- 52C- 53C- 54C- 55C- 56C-	Available in Voltage and Current Adjustments Coil Res. From .03 to 20K Ohms AC & DC	SPDT DPDT 3PDT 4PDT 5PDT 6PDT	2 Amp 5 Amp Res. at 28 VDC or 115 VAC	10 MW** 100 MW/Pole 100 MW/Pole 100 MW/Pole 100 MW/Pole 100 MW/Pole

Add Suffix D = Dust Covered S = Hermetically Sealed
**Also Available in 5 MW and 50 MW/Pole Sensitivity

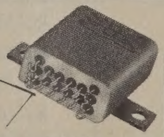
CRYSTAL CAN

SERIES KX

Per MIL-R-5757



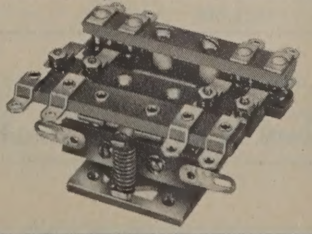
SERIES KX1



SERIES KX4

Type*	Nom. Coil Voltage	Contact Arrang.	Contact Rating	Sensitivity
KX1- KX4-	6, 12, 24 VDC	DPDT 4PDT	2 Amp Res., 1 Amp Inductive (28 VDC)	100 MW
KX3- KX5-	40 MW Sensitivity	DPDT 4PDT		40 MW

CUSTOM RELAYS



In addition to the relays listed on this page many other standard relays in each relay category are available. For your special relay applications, KURMAN recognizes your needs. To this end we have oriented our efforts toward serving your custom requirements. Our technical staff is eager to assist you. Service reliability and 50 YEARS of experience will attest to why knowledgeable people use KURMAN RELAYS.

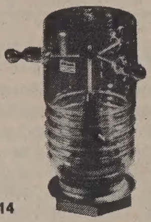
Send for more information, BETTER YET CALL US.

Let Kilovac turn you on!

Or off, as the case may be, KILOVAC relays offer the following outstanding features:

HC-1

KM-14


H-25

- Ratings to over 100 KV
- Long Life — one million plus operations
- Light Weight — as little as 1 oz.
- Non-oxidizing contacts
- Fast-Operate Time — 10 ms typical
- High Dielectric, smaller size per voltage/current rating

1. RELIABILITY

In the right application, with the KILOVAC relay selected to do a specific job, millions of cycles of mechanical life are possible with little or no degradation in performance specifications.

2. VACUUM IS THE OPTIMUM DIELECTRIC

It affords isolation of approximately 2000 volts per .001 inch of contact gap. (A vacuum relay is a high voltage insulator and a low loss conductor). When breaking a load, vaporized metal from the contacts creates a high pressure area which rapidly expands the ionized metal vapor into the low pressure area surrounding the contacts. The result is a phenomenon termed "arc blowout." By this limit on arc time, contacts are subjected to less erosion and have longer life.

3. THE VACUUM "SELF-PUMPING" FEATURE

When the ionized metal vapor expands, as described above, it entraps gas molecules on the inner relay envelope, maintaining or even increasing the vacuum level.

4. LOW AND STABLE CONTACT RESISTANCE

This varies from cycle to cycle in conventional relays but remains stable over the life of a vacuum relay. This is due to: cleanliness of parts, lack of oxidation or contamination, and use of non-magnetic materials in the contact area. No contact maintenance required.

5. FAST OPERATE TIME

Short contact travel and low mass contacts mean faster operate time and a lower coil power drain.

6. SMALLER SIZE AND WEIGHT

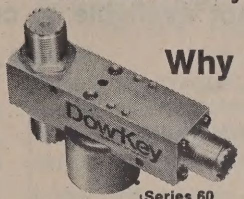
Due to small contact gap and short contact travel made possible by a vacuum dielectric, package size and weight are reduced.

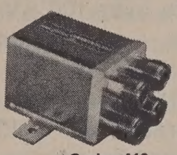
7. SAFETY

Contacts are sealed within the vacuum envelope, switching in explosive atmospheres may be safely accomplished.

Coaxial Relays: Hz to GHz

Why Use Dow-Key?


Series 60


Series 412

- Coaxial Relays
- Vacuum Coaxial Relays
- Microwave Coaxial Relays

In recent years coaxial relay and microwave switch applications have expanded in number and increased in operating frequency. For 30 years, Dow-Key has been a pioneer in these trends by introducing new higher frequency, higher power, more versatile devices while maintaining its recognized standards of quality and performance.

Dow-Key relays continue to provide high isolation, low VSWR and insertion loss, along with reliable operation over a wide range of severe environments and broad frequency ranges. Options are available to fit your system. You can select RF power capacity, operating voltage, failsafe or latching, and standard and special RF connectors.

You should also consider Dow-Key **vacuum** coaxial relays. They combine the unique high power/high voltage capability of a vacuum relay with the RF performance of a coaxial relay. Look to Dow-Key to fill your requirements for rapid, reliable, low loss coaxial switching in a wide range of applications including:

COMMUNICATIONS

- Satellite terminals.
- Transmit-receive switching to common antenna, grounding of receiver to protect against burn out, switching of one transmitter to one of many antennas.
- Manual and remote multi-antenna switching, many antennas to one transmitter.
- Insertion of amplifiers into circuit.
- Switching of broadband carriers from failed to standby circuits.
- Matrix switching of multiple receivers.
- Transmit power sampling.
- Transmitters to multiple antennas.
- Transfer-crossover of transmitter-antenna or receiver-antenna pairs.
- RF self test.

CATV/CCTV

- Non-duplication switching RF head ends.
- Tone signal switching remote program control.
- Hospital video systems.
- Channel select, programming control.
- Closed circuit switching such as classroom TV teaching.
- Studio video signal switching.
- Switching of remote surveillance cameras to single monitor.

LABORATORY

- Switching between reference and unknown test circuits.
- Switching with high accuracy of fixed attenuators in and out of circuit.
- Multi-source monitor and test.

TELEPHONE

- Elimination of manual patch boards for carrier I.F. switching.
- Standby channel select (matrix type for complex routing).

Whether your need is for SPDT, transfer, or multiposition, whatever your actuator voltage, no matter what RF connector your system employs, Dow-Key has a standard relay or can adapt one in surprisingly short time.

Please call a Dow-Key applications engineer and let him lead you out of the coaxial relay wilderness.

Kilovac®
CORPORATION

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
Kilovac Vacuum Relays • **Dow-Key** Coaxial Relays

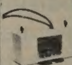
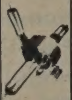
Kilovac Vacuum Relays

KILOVAC vacuum relays (ceramic or glass) are specified by design engineers for performance and reliability not available in conventional relays:

- Ratings to over 100 KV
- Long Life — one million plus operations
- Light Weight — as little as 1 oz.
- Non-oxidizing contacts
- Fast-Operate Time — 10 ms typical
- High Dielectric, smaller size per voltage/current rating

* **KILOVAC High Voltage/Medical Relays**

Since 1964 Kilovac Corporation has delivered thousands of high voltage relays especially developed for heart defibrillators (both hospital and portable models). DPDT relays (P/N KM-15 and KM-14) are used as "patient" switches; SPST versions (P/N KM-6 and H-4), used for dump/abort safety discharge. Highly qualified application engineering assistance is at your disposal.

												
KILOVAC TYPE	**HC-1‡**	**KC-2‡**	**KC-3‡**	**KM-14**	**KC-10‡**	**KC-20‡**	**KM-15**	**HVS-1**	**KC-27**	**H-4**	**KM-6**	**H-35**
Contact arrangement	SPDT	SPDT	SPDT **	DPDT	SPDT	SPST, N.O.	DPDT	SPDT	SPST*** N.C.	SPDT	SPST, N.C.	SPDT
Rated operating voltage (KV dc or 60 Hz peak)	2.5	15	8	7.5	15	28	8	17	120	5	10	35
Test voltage (KV dc)	5	18	11	14	20	30	18	22	140	7.5	12	40
Continuous current, contacts closed, max. (amps dc or 60 Hz RMS)	18	50	25	30	75	110	10	7	30	10	5	10
Max. current at rated voltage switching under load (amps dc)*	0.5	0.5	0.1	5	0.1	0.1	5.0	3.0	N/A	5.0	2.0	5.0
Contact resistance, max. (ohms)	0.010	0.012	0.015	0.100	0.012	0.005	0.100	0.015	.030	0.02	0.035	0.015
Operating time, max. (ms)	6	18	18	20	35	30	25	25	30	10	10	30
Coil resistance (ohms ±10% @ 25°C)	335	265	220	12	225	120	65	128	24	250	100	50
Coil voltage (Vdc, nominal)	26.5	26.5	26.5	12	26.5	26.5	40	26.5	26.5	26.5	12	26.5
Nominal dimensions (inches)	¾D x 1½H	1⅝D x 2⅜H	¾D x 2¾H	2D x 3H	1⅝D x 4⅝H	1⅝D x 3¾H	2½D x 3⅝H	4¾L x 5H	1¼D x 6H	1⅞L x ⅞H	2¼L x 1¹⁄₁₆H	8¼L x 5¼H
Nominal weight (oz)	1	3	2.5	10	16	10	12	15	9	1	3	15
Mounting style†	thr'ded base	flange base	flange base	foot bracket	flange base	thr'ded base	flanged base	foot bracket	thr'ded base	flange base	foot bracket	foot bracket

TYPICAL APPLICATIONS

General purpose high voltage	●	●	●		●	●		●	●	●	●	●
Communications	●	●	●		●	●		●		●		●
Radar/ECM/Avionics	●	●	●		●	●		●	●	●	●	●
Laser systems	●	●	●		●	●		●	●		●	
* Medical: Heart defibrillators				●			●			●	●	

* All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings. **Also available in latching version

† Other styles available.

‡ Ceramic envelope.

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. . . in ceramic or glass

KILOVAC High Voltage Relays Mean . . .

VACUUM RELAY RELIABILITY means short contact travel, low contact mass, contacts free of oxides and pitting and minimum contact bounce. These long-life reliability features are made possible only because of operation in a high vacuum dielectric. Vacuum technology has made high reliability, long life high voltage switching practical, with considerable savings in space and weight. Developed for high voltage, high peak current applications, Kilovac relays are well suited and widely used in medical electronics, radar, communications, pulse forming networks, ECM, sonar, antenna switching and antenna couplers, microwave systems and switching in explosive atmospheres. Kilovac's broad line and "Quick Reaction Time" is geared to your most critical delivery schedule. We have the high vacuum experience, design and production capability to provide special modifications of our standard off-the-shelf designs in unbelievably short order.

HIGH VOLTAGE ISOLATION: 2000 volts per mil of contact gap with predictable, repeatable isolation well in excess of rated values.

LOW AND STABLE CONTACT RESISTANCE: 0.015 ohms typical with no contact oxidation or maintenance.

FAST SWITCHING TIME: 10 ms typical, due to small contact gap and short armature travel.

LONG LIFE: Millions of cycles with minimum degradation in electrical performance.

Any one of these standard features will justify your selection of KILOVAC vacuum relays. KILOVAC design and years of production experience permits immediate off-the-shelf delivery from a broad product line with voltages up to 100 KV. Special modifications quickly provided.

KILOVAC TYPE	**H-8**	**H-9**	**H-11/S2**	**H-12**	**H-14**	**H-16**	**H-17**	**H-18**	**H-19**	**H-23‡**	**H-25/S10**	**H-26**
Contact arrangement	SPDT	SPST, N.C.	SPST, N.O.	SPDT	DPDT	DPDT	SPDT	DPDT	DPDT	SPST, N.C.	SPDT	4PDT
Rated operating voltage (KV dc or 60 Hz peak)	15	15	9	8	12	12	25	8	20	30	50	15
Test voltage (KV dc)	20	20	12	12	15	15	30	10	25	35	60	17
Continuous current, contacts closed, max. (amps dc or 60 Hz RMS)	15	15	15	15	30	30	30	10	30	30	30	30
Max. current at rated voltage switching under load (amps dc)*	0.5	0.5	0.1	0.1	0.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1
Contact resistance, max. (ohms)	0.015	0.015	0.015	0.015	0.015	0.030	0.015	0.020	0.015	0.015	0.015	0.020
Operating time, max. (ms)	15	15	18	18	20	20	25	15	40	30	60	30
Coil resistance (ohms ±10% @ 25°C)	265	265	250	250	120	120	120	265	225	120	120	120
Coil voltage (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal dimensions (inches)	1D x 3H	1¼D x 2¾H	1D x 1⅝H	1D x 1¾H	1¼D x 2¾H	1D x 3¼H	2D x 3½H	1D x 2H	2D x 3¼H	2D x 3¾H	3D x 7½H	2D x 4H
Nominal weight (oz)	3	3	2	2	8	5	5	4	7	7	30	16
Mounting style†	thr'ded base	solder flange	thr'ded base	thr'ded base	thr'ded base	thr'ded base	flange base	thr'ded base	thr'ded base	thr'ded base	thr'ded base	thr'ded base

TYPICAL APPLICATIONS

	H-8	H-9	H-11/S2	H-12	H-14	H-16	H-17	H-18	H-19	H-23‡	H-25/S10	H-26
General purpose high voltage	●	●	●	●	●	●	●	●	●	●	●	●
Communications	●	●	●	●	●	●	●	●	●	●	●	●
Radar/ECM/Avionics	●	●	●	●	●	●	●	●	●	●		●
Nuclear instrumentation	●	●			●	●	●		●	●	●	

* All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings.

† Other styles available.

‡ H-24, same spec as H-23, except H-24 is SPST, N.O.

**Ceramic envelope

***Base grounded

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DowKey Coaxial Relays

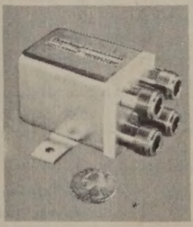
Let Kilovac's Dow-Key Division solve your RF switching problems — whether simple or complex — at frequencies from Hz to GHz. Dow-Key coaxial relays provide low insertion loss, low VSWR, fast operating times, wide range of power capabilities, connector options and operating voltages. Write or call for your Dow-Key catalog today!

Product Class	Dow-Key Series	Application			Contacts	Connector	Features	Frequency	(2) Typical CW Power (in KW)
		Comm.	ECM	CATV CCTV					
General Purpose R.F. Switching	60 (4)	●		●	SPDT Remote	N & UHF	Extremely Rugged	450 MHz	750 W
	61	●		●		BNC	Small Package	450 MHz	100 W
	77 (4)	●		●		F & BNC	Low Cost	(3)	150 W @ 50 MHz 75 W @ 1 GHz
	163/164	●		●		BNC	High Reliability	(3)	(3)
	169	●		●		F & BNC	Low Level	(3)	(3)
	260 (4)	●		●	DPDT Remote	UHF & BNC	Broad Power Range	450 MHz	1
	78 (4)	●		●	Manual	UHF & BNC	Multi-position	0 to 500 MHz	1.5 KW @ 50 MHz 1 KW @ 100-400 MHz
	71/72 (4)	●		●	Multi-position Remote	UHF	High Power	Up to 500 MHz	1 KW @ 200 MHz 750 W @ 500 MHz
	74	●		●		BNC, TNC, SMA	Multi-position	2 GHz	
Vacuum Coaxial Relays	196	●			SPDT	SC, TNC	Bypass- (Vacuum)	400 MHz	1
	310	●			SPDT	N HN C SC BNC TNC	High Power Small Size	60 MHz 400 MHz	3 1
	311	●			DPDT			60 MHz 400 MHz	3 1
	312	●			Bypass			60 MHz 400 MHz	3 1
	313	●			XFR			60 MHz 400 MHz	3 1
	220	●			SPDT	RF	Medium Power	250 MHz	1
High Performance High Isolation Microwave Coaxial Relays (3)	401	●	●	●	SPDT	SMA	Broadband Microwave Performance (3)	DC-12 GHz	See Note (2)
	402	●	●	●	SPDT	N			
	411	●	●	●	XFR	SMA			
	412	●	●	●	XFR	N			
Other Special Purpose RF Relays [Illustrative only; see (3)]	150	●			SPDT	(3)	(3)	1120 MHz	(2)
	175	●				BNC, TNC	Programmable Remote Attenuator	1200 MHz	(2)
	186		●		SPDT	⅞ EIA	High Power	400 MHz	1
	223	●			SPDT		Make Before Break Latching	400 MHz	120 W
	324	●			SPDT	N	70,000 Ft.	400 MHz	

Series 400 — REMOTE COAXIAL RELAYS

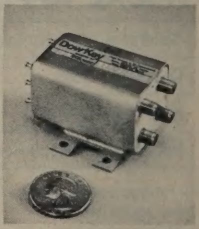
The Dow-Key Series 400 microwave coaxial relays are designed to meet all requirements for high reliability, high performance, broadband coaxial RF switching. These relays are designed for use with cable and connector sizes of your choice.

Series 400 coaxial relays provide excellent electrical characteristics over frequency ranges of DC to GHz and can be optimized for maximum performance at any narrower band of interest. The relays are designed to provide a wide variety of optional RF and power connectors.


Series 412

Series 401

Series 402


Series 411

DowKey®
DIV. OF KILOVAC CORPORATION

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Kilovac Vacuum Relays • **Dow-Key** Coaxial Relays

...Hz to GHz

DOW-KEY coaxial relays may provide:

- Excellent VSWR • Very low insertion loss
- Resistor terminated inputs (optional)
- Vacuum switch elements for high power capacity
- Special contact arrangements to meet isolation loss requirements.
- Auxiliary switches for associated circuit control
- Multitude of connectors and coil voltages

VSWR Max.	Impedance Ohms	(1) Size (L x W x H) Inches	Approx. Weight (Oz.)
1.1	50	3.65 x 1.16 x 2.5	10
1.05		1.56 x .64 x 1.19	4.5
(3)	50/75	1.88 x .68 x 2.2	3
(3)	50	1.31 x 1.38 x 1.38	4
(3)	50/75	1.44 x .63 x 1.03	3.5
1.05	50	3.00 x 1.75 x 1.9	12
1.3		3 Dia. x 1.0	10
1.06 @ 50 MHz 1.3 @ 500 MHz		71 = 5.75 Dia. x 2.75 72 = 4.0 x 2.62 x 3.5	71 = 48 72 = 24
1.3		3 Dia. x 1.75	15
1.1	50		
(3)	50	1.68 x 1.25 x 2	8
(3)		3.36 x 1.25 x 2	12
(3)		2.12 x 1.25 x 2	12
(3)		1.73 x 1.25 x 2	12
1.15			4
(3)	50	1.3 x .5 x 1.5	1.5
	50/75	2.65 x 1.09 x 2.07	4
	50	1.3 x 1.3 x 2	4.5
	50/75	1.75 x 1.75 x 2.6	8
1.25	50	1.63 x 1.42 x .53	6
(3)	50	3.95 x 1.34 x 2.93	16
1.13	50	7.0 x 1.75 x 3.62	5 Lbs.
1.1	50	4.0 x 1.2 x 3.5	(3)
1.1	50	2.7 x 1.32 x 1.32	(3)

(1) Not including connectors.
(2) For max. power consult factory.
(3) Refer to general catalog or consult factory
(4) Refer to following page for additional details.

HOW TO SELECT COAXIAL RELAYS

DON'T select precision connectors when the system and/or frequency does not require it.

DO specify nominal coil voltage and operating current.

DO specify basic function, i.e., SPDT, DPDT, etc., and whether or not external auxiliary contacts are required. If in doubt of function, supply a circuit diagram.

DO specify impedance. This is generally 50 ohms but many 50 ohm relays can be used in 75 ohm circuits with negligible discontinuity because electrical length of the relays is short at frequencies normally used at that impedance.

DO specify whether or not the unused part of the relay is shorted to ground, not shorted or resistor-terminated and the resistor values.

DO specify RF power requirements.

DON'T specify higher power than needed.

WHAT DOW-KEY NEEDS TO KNOW FROM YOU

CIRCUITS AND LOADS

Many times when relays fail to perform up to specification, it is due to lack of proper consideration of:

A. The VSWR of the load.
B. Required isolation between outputs and how it can be achieved.
C. Peak vs. average power and how phase affects max. voltage and current.
D. Ratings do not include hot switching.

The conditions listed above cannot be generalized, but must be considered unique to each application. It is therefore imperative that we be completely informed when selecting a relay for hot switching.

OPERATE TIME

Operate time of the relay is primarily a function of the coil power, since it requires in excess of 50% of the total switching time to build up the coil field sufficiently to initiate relay operation. To reduce the relay operate time, various means are available:

A. Increase coil current (Power).
B. Apply higher than normal voltage pulse to coil.
C. Lower voltage isolation requirements. (A smaller contact gap permits faster contact transfer time.)

With a combination of the above modifications operate times as fast as 500 microseconds are possible with specific types of relays.

LIFE (MECHANICAL)

Relay life takes in all the foregoing considerations. It is necessary to define life, usually in terms of end-of-life set of performance parameters. Terms like "Mean Time Between Failure" are frequently meaningless unless failure points are defined, and unless conditions of load, rate of operation, duty cycle, coil power and other parameters are specified. Test data on file indicates typical mechanical life will range in excess of one million cycles of operations.

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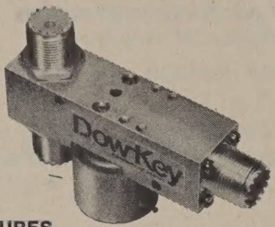
Kilovac® / DowKey

CORPORATION DIVISION OF KILOVAC CORPORATION

SERIES 60 SPDT

REMOTE COAXIAL RELAY



FEATURES

The Series 60 are remotely operated, ruggedly constructed, SPDT coaxial relays designed for operation to one KW. They are available with or without two Form C auxiliary contacts. For transmit-receive applications, they are available with a special high-isolation "G" connector at the NC or receive position. The G connector increases the isolation to greater than −100 dB at frequencies up to 500 MHz, but reduces the power rating of the normally-closed connector to 20 watts. G connectors will increase VSWR above 400 MHz. Data given for the Series 60 is applicable only when used in a 50-ohm transmission line. UHF connectors are not recommended above 400 MHz. Standard coils are 12 Vdc (48 ohms), 26 Vdc (245 ohms) and 115 Vac (5000 ohms). Other voltages are available on special order at a slight premium price or in minimum-order quantities.

SPECIFICATIONS

Operating Time .... 25 ms. Max.
Auxiliary Contact Rating .... 5 Amps., 115 Vac

MECHANICAL DATA

Life Expectancy .... 1,000,000 cycles
Weight .... 10 oz. Approx.
Finish: R.F. Contacts .... Gold Plated Fine Silver
Auxiliary Contacts .. Gold Plated Fine Silver

CONNECTORS AND PART NUMBERS

Connector Type	Std. SPDT	With Aux. Contacts	With NC "G" Conn.	With 2C Aux. & NC "G"
UHF	60-XX04	60-XX0442	60-XX28	60-XX2842
N	60-XX01	60-XX0142	60-XX25	60-XX2542

In the above data, the "XX" following the hyphen represents the coil voltage. When ordering, replace the XX with the appropriate coil number, as follows:

22 = 12 Vdc 23 = 26 Vdc 26 = 115 Vac

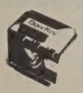
COAXIAL SWITCHES

78 SERIES MULTI-POSITION TYPES

Manually operated switches with true coaxial switching members (not wafer switches). Useful frequency range 0-500 MHz. RF power rating: 1.5 KW at 50 MHz, 1 KW at 100 through 400 MHz. Impedance: 50 ohms. Body size: 3" dia. x 1". Weight: 10 oz.

Dow-Key Model	Conn. Type	Description
78-0204	UHF	SPDT
78-0304	UHF	SP 3-Pos.
78-0404	UHF	SP 4-Pos.
78-0604	UHF	SP 6-Pos.
78-0302	BNC	SP 3-Pos.
78-0602	BNC	SP 6-Pos.
78-0702	BNC	DPDT

71/72 SERIES MULTI-POSITION TYPES

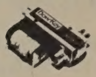


Weatherproofed high power switches for switching antennas, transmitters or receivers up to 500 MHz. Power rating: 1 KW at 200 MHz, 750 W at 500 MHz. VSWR: 1.06 at 50 MHz, 1.3 at 500 MHz. Impedance: 50 ohms. Body Size: 72 Series, 4" x 3.5" x 2.62"; 71 Series, 5.75" dia. x 2.75".

Dow-Key Model	Conn. Type	Description	Coil Volt.
71-220401	UHF	6-Pos. Shorting	12 Vdc
71-220402	UHF	6-Pos. Non-Shorting	12 Vdc
71-230401	UHF	6-Pos. Shorting	26 Vdc
71-230402	UHF	6-Pos. Non-Shorting	26 Vdc
71-260401	UHF	6-Pos. Shorting	115 Vac
71-260402	UHF	6-Pos. Non-Shorting	115 Vac
72-220401	UHF	3-Pos. Shorting	12 Vdc
72-220402	UHF	3-Pos. Non-Shorting	12 Vdc
72-230401	UHF	3-Pos. Shorting	26 Vdc
72-230402	UHF	3-Pos. Non-Shorting	26 Vdc
72-260401	UHF	3-Pos. Shorting	115 Vac
72-260402	UHF	3-Pos. Non-Shorting	115 Vac

COAXIAL RELAYS

77 SERIES SPDT TYPES



Medium-size, light weight, low-priced coaxial relays for industrial and military uses. Available with or without one Form C auxiliary contacts. Power rating: 150 W at 50 MHz, 75 W at 1 GHz. Body size: 1.88" x 0.75". Weight: 3 oz.

Dow-Key Model	Conn. Type	Coil Volt.	With 1 Form C Aux. Contacts
77-2202	BNC	12 Vdc	No
77-220232	BNC	12 Vdc	Yes
77-2302	BNC	26 Vdc	No
77-230232	BNC	26 Vdc	Yes
77-2602	BNC	115 Vac	No
77-260232	BNC	115 Vac	Yes
77-2232	F	12 Vdc	No
77-223232	F	12 Vdc	Yes
77-2332	F	26 Vdc	No
77-233232	F	26 Vdc	Yes
77-2632	F	115 Vac	No
77-263232	F	115 Vac	Yes

260/260B SERIES DPDT TYPES

The 260 Series are standard DPDT relays with six terminals. The 260B Series are by-pass relays with an internal connection between the NC contacts, leaving only four terminals. RF ratings and specifications are the same as 60 Series. Body size: 3" x 1.75" x 0.88". Weight: 12 oz.

Dow-Key Model	Conn. Type	Coil Volt.	With 2 Form C Aux. Contacts
260-2204	UHF	12 Vdc	No
260-220442	UHF	12 Vdc	Yes
260-2304	UHF	26 Vdc	No
260-230442	UHF	26 Vdc	Yes
260-2604	UHF	115 Vac	No
260-260442	UHF	115 Vac	Yes
260-2202	BNC	12 Vdc	No
260-220242	BNC	12 Vdc	Yes
260-2302	BNC	26 Vdc	No
260-230242	BNC	26 Vdc	Yes
269-2602	BNC	115 Vac	No
260-260242	BNC	115 Vac	Yes
260B-2304	UHF	26 Vdc	No
260B-230442	UHF	26 Vdc	Yes
260B-2604	UHF	115 Vac	No
260B-260442	UHF	115 Vac	Yes
260B-2302	BNC	26 Vdc	No
260B-230242	BNC	26 Vdc	Yes
260B-2602	BNC	115 Vac	No
260B-260242	BNC	115 Vac	Yes

Other coil voltages and connector types are available for Dow-Key relays; contact factory.

Kilovac CORPORATION . . . small enough to be responsive, large enough to be responsible.

Kilovac Corporation, of which Dow-Key is a division, manufactures a broad line of high-voltage vacuum relays, with voltage ratings up to 100 KV, for use in radio frequency communications, medical instruments, industrial electronics, radar, sonar and space systems.

Kilovac's high vacuum technology has made possible smaller and lighter relays than previously available for high-voltage switching.

Designed for switching radio frequency circuits employing coaxial transmission lines, Dow-Key relays provide high efficiency with low SWR and excellent isolation. The relays are available in a variety of coil voltages and currents, power ratings, connector types and switching modes.

SPECIALS

These pages cover only the standard, most popular Kilovac/Dow-Key relays. We manufacture many more products than shown, and invite your inquiries.

Kilovac/Dow-Key offers the original equipment manufacturer a diverse background of designing and producing special relays to exacting specifications.

Latching relays, hermetically sealed relays and a wide variety of switching arrangements, non-standard connectors, attached cables of various types (with or without connectors) and special coils are available.

Your inquiries regarding relays designed to your specifications will receive prompt attention from our Engineering and Marketing Departments.

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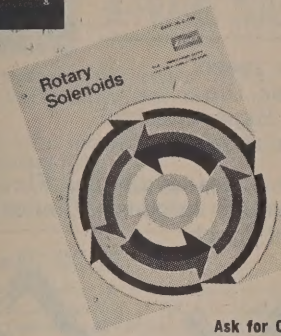
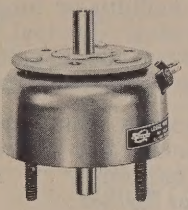
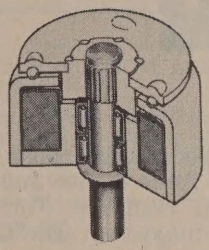
LEDEX

ROTARY SOLENOIDS



Ask for Catalog C-1000





230 stock models for quick prototype starts
Fast, direct rotary action

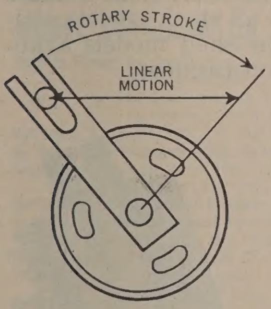
Ledex Rotary Solenoids step, turn, pull, push, index, hammer, punch or trigger — whenever there's a need for fast and dependable direct rotary action. Known for high force-to-size, ability to resist shock. Family of 8 basic sizes with right and left hand strokes from 25 to 95 degrees. Torque to 117 pound-inches. Wide choice of stock models offer economy and quick starts on prototypes. LIFE: 100,000,000 actuations with special endurance engineered models.

GROSS TORQUE IN POUND-INCHES

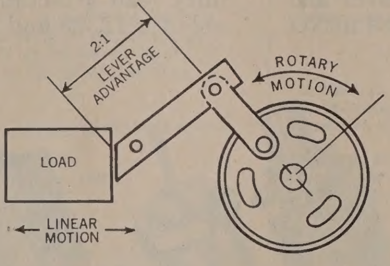
Rotary Stroke			25°		35°		45°		67½°		95°	
Duty Cycle			1/10	1/20	1/10	1/20	1/10	1/20	1/10	1/20	1/10	1/20
Size	Diam. (in.)	Ht. (in.)										
1E	1	5/8	.8	1.1			.43	.62				
2E	1⅛	21/32	1.4	1.7	1.1	1.3	.72	.89				
3B*	1 5/16	7/8	2.7	3.2	2.0	2.3	1.4	1.7	.65	.8		
3E		51/64	2.7	3.2	2.0	2.3	1.44	1.8	.70	.89		
4E	1 9/16	61/64	4.5	5.2	3.1	3.5	2.6	3.1	1.6	1.9	1.0	1.2
5B*	1⅞	1 13/64	8.3	10.0	6.9	8.3	5.0	6.0	3.3	4.0	1.6	1.9
5S		1 3/64	12.1	13.2	7.8	9.2	6.3	6.9	3.9	4.9	1.9	2.6
6S	2¼	1 27/64	27.8	30.6	18.6	20.5	11.0	12.1	8.8	9.7	5.2	5.7
7S	2¾	1 55/64	42.4	46.6	38.0	42.0	29.8	32.8	17.5	19.3	10.5	11.6
8S	3⅜	2 5/16	98.0	117	64.0	77.0	54.0	65.0	29.0	35.0	17.0	20.0

* 3B and 5B have random wound coils; all other are precision wound.

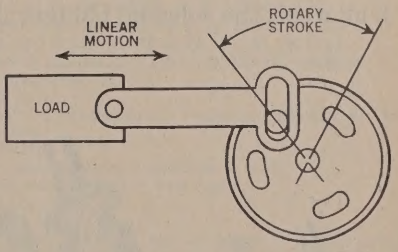
Rotary Solenoid as a Linear Actuator For Longer Strokes



SHAFT BAR LINK



ARMATURE LEVER



ARMATURE DRIVE PIN

When the stroke length is beyond the range of Ledex straight pull solenoids, a rotary solenoid may be the best solution.

Ledex rotary solenoids have raceways coined in the armature and stator. With precision ball bearings riding on inclined raceways, the solenoid provides direct, almost friction-free rotary motion. In the beginning of the stroke, where the output of a linear solenoid is low, the raceways are steep. Toward the closed end, where the magnetic attraction reaches maximum force, the raceways taper off. The effect is to evenly distribute the force.

Ledex solenoids can help you get a lot of work done in places where you don't have much room. We make both push/pull and rotary solenoids in a wide variety of shapes and sizes to solve just about any actuating problem you have.

Call Ledex when you need a lot of power in a small space to push, pull, turn, twist, step, index, hammer, punch or trigger. For a quick start on your prototype, choose from 230 different stock model designs. Or, send details and we'll custom design a space-saving solenoid for you.

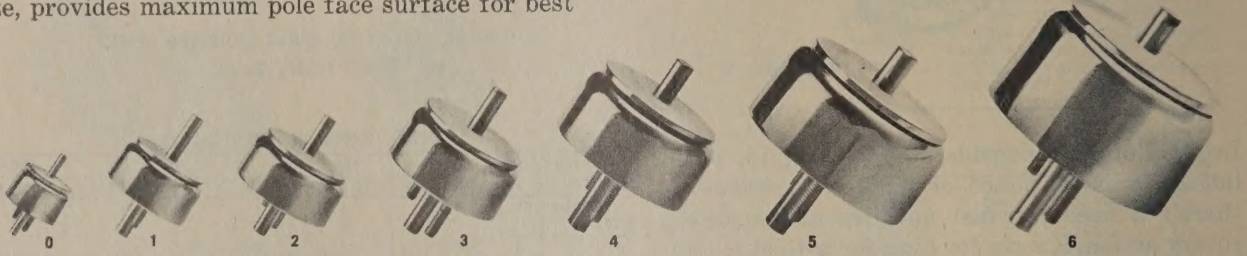
LEDEX

LEDEX INC.
DEPT. EM, 126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

PUSH & PULL SOLENOIDS

You name the job.
Short, medium or long stroke. High speed.
Tight space. Unusual load. Ledex has the
solenoid for you, usually on the shelf. Expert design
assistance for your toughest custom requirements.

Pancake shaped Ledex push/pull solenoids are built for high force to size and fast response. Better than 10ms response. Form factor minimizes size, provides maximum pole face surface for best efficiency. Two types available. Flat face is for short stroke, rapid response. Conical face gives more mid-range punch.



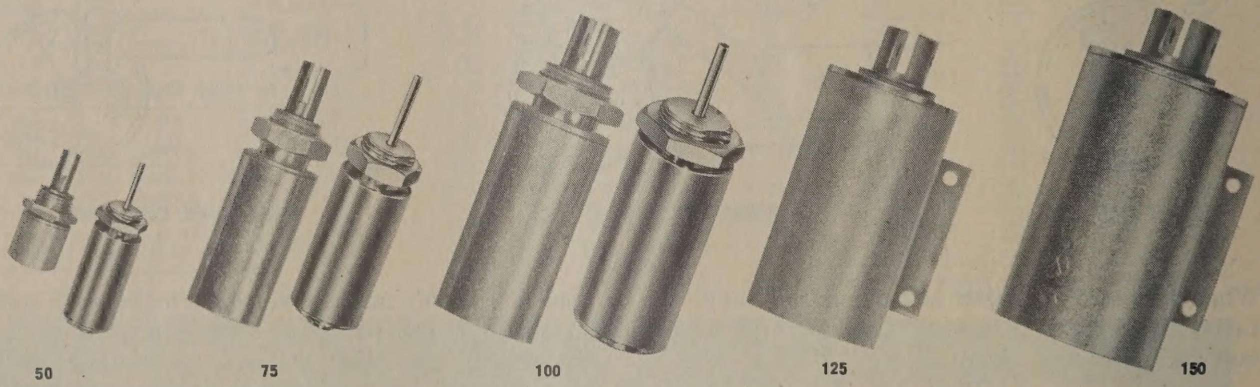
TYPICAL OUTPUT, 1/10 DUTY

MODEL	0		1		2		3		4		5		6		7*	8*
SIZE	.75″D x ½″		1″D x 17/32″		1.2″D x 27/64″		1.3″D x 11/16″		1.6″D x 55/64″		1.9″D x 1 1/64″		2.3″D x 1 21/64″		2.75″D x 1 33/64″	3.375″D x 1 27/32″
	Conical Face	Flat Face	Conical Face	Flat Face	Conical Face	Flat Face	Conical Face	Flat Face	Conical Face	Flat Face	Conical Face	Flat Face	Conical Face	Flat Face	Flat Face	Flat Face
Stroke (Inches)	.020	—	.020	.010	.020	.010	.020	.010	.020	.010	.020	.010	.020	—	.010	.010
Force (Pounds)	4.4	—	7.8	17	11	23	16	35	17	55	35	110	85	—	320	430
Stroke (Inches)	.120	—	.120	.060	.120	.060	.120	.060	.200	.100	.250	.100	.250	—	.400	.440
Force (Pounds)	1	—	2.4	3.3	3.3	4.5	8	10	6	12	16	20	52	—	15	25
Weight	1½ oz.		1½ oz.		2¼ oz.		3¾ oz.		6 oz.		10 oz.		1 lb., 5½ oz.		2 lb. 4 oz.	4 lb. 3 oz.

(For detail performance curves, ask for Catalog C-1100)

*Not shown

Quality engineered for efficiency and long term dependability, the Ledex long stroke solenoid has a built-in impact cushion pad to absorb energy at the end of the power stroke. For smooth travel and long wear, the solenoid plunger is electroless nickel plated. It rides in a smooth bushing track designed for positive alignment and low friction. Slotted and cross drilled plungers on all stock models simplify load attachment. Off-the-shelf models available for 12, 28 and 100 VDC operations.



TYPICAL OUTPUT 1/10 DUTY

Model	Size 50		Size 75	Size 100	Size 125	Size 150
Size	½″D x ½″	½″D x 1″	¾″D x 1½″	1″D x 2″	1¼″D x 2¼″	1½″ x 2½″
Force, .050 Stroke	4.5 oz.	15 oz.	3 lbs.	7 lbs.	11.5 lbs.	16.5 lbs.
Force, .750 Stroke	—	—	.6 lbs	2 lbs.	4 lbs.	7 lbs.
Shaft Diameter, pull	.187″	.187″	.312″	.437″	.500″	.625″
Shaft Diameter, push	.062″	.062″	.094″	.125″	—	—
Mounting	Thr'd Bushing	Thr'd Bushing	Thr'd Bushing	Thr'd Bushing	Saddle	Saddle
Weight	14 grams	24 grams	3 oz.	6¾ oz.	9 oz.	1 lb. ½ oz.

When it comes to actuating, Ledex has both the people and products to give you the quickest and best solution. There's a wide choice of stock models for a fast start on your prototype. And our expert application staff is always glad to custom engineer to your exact stroke, force, speed and size requirements. Other models (not shown) are available on made-to-order basis with force outputs in excess of 350 pounds. Ask for Catalog C-1100.

LEDEX INC.
DEPT. EM, 126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

D-FRAME SOLENOID

Ledex D-Frame solenoids offer several benefits. The simplified design allows construction methods that result in a more cost effective product.

All solenoids provided with quick connect terminals for fast hook-up. Leads can be provided if desired.

Load attachment through slotted and cross drilled electroless nickel plated plunger for simplified attachment and longer life.

The plunger cavity is an integral part of the bobbin which is constructed of glass filled nylon to meet or exceed class "B" NEMA standard insulation requirements.

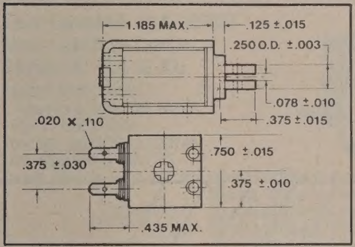
The frame is cadmium plated with a supplementary dichromate treatment for added corrosion resistance. Multiple, tapped mounting holes provide for easy installation and interchangeability.

MODEL L6-22 AC OR DC

Holding Force: DC Continuous* @ 24 VDC cold 35 oz. @ 24 VDC hot 32 oz.
DC Intermittent* @ 24 VDC cold 37 oz. @ 24 VDC hot 35 oz.
AC Continuous @ 120 VAC cold 9 oz. @ 120 VAC hot 6 oz.
AC Intermittent @ 120 VAC cold 8 oz. @ 120 VAC hot 7 oz.

Voltages: 6, 12, 24, 120 VAC or DC.
AC Operating Frequency: Std. 60 Hz.
Insulation Material: Class "B" (130°C) standard UL recognized materials used in construction.
Dielectric Strength: 1000 V (RMS).
Termination: Quick connect terminals standard.
Pull Type Operation: Standard. Made to order — Push Type.
Plunger Mass: 6.3 grams (.22 ozs.).
Total Mass: 48.2 grams (1.70 ozs.).

*Duty Cycle: $f = \dfrac{\text{“on” time}}{\text{“on” time + “off” time}}$ (“on” time = length of longest pulse during one cycle; not to exceed 300 sec.)



POWER REQUIREMENTS

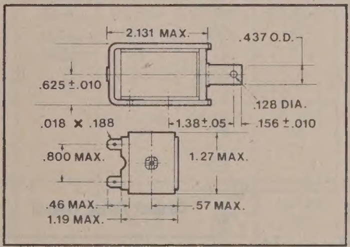
Duty Cycle	AC	DC
Intermittent f = ¼	9VA	8.5W
Continuous f = 1	5.5VA	4.0W
Life @ 25°C & 50% of full stroke	5 x 10⁶	

MODEL L25-11H AC OR DC

Holding Force: DC Continuous* @ 24 VDC cold 7 lbs. @ 24 VDC hot 5 lbs.
DC Intermittent* @ 24 VDC cold 8 lbs. @ 24 VDC hot 5½ lbs.
AC Continuous @ 120 VAC cold 59 oz. @ 120 VAC hot 50 oz.
AC Intermittent @ 120 VAC cold 90 oz. @ 120 VAC hot 85 oz.

Voltages: 6, 12, 24, 120, 240 VAC or DC.
AC Operating Frequency: Std. 60 Hz.
Insulation Material: Class "B" (130°C) standard UL recognized materials used in construction.
Dielectric Strength: 1000 V (RMS).
Termination: Quick connect terminals standard. Available — Leads.
Pull Type Operation: Standard. Made to order — Push Type.
Plunger Mass: 43 grams (1.50 ozs.).
Total Mass: 177 grams (6.25 ozs.).

*Duty Cycle: $f = \dfrac{\text{“on” time}}{\text{“on” time + “off” time}}$ (“on” time = length of longest pulse during one cycle; not to exceed 300 sec.)



POWER REQUIREMENTS

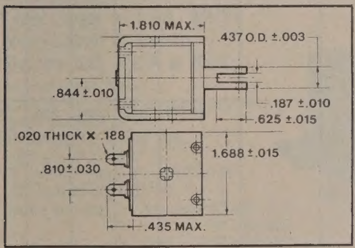
Duty Cycle	AC	DC
Intermittent f = ¼	40VA	19.5W
Continuous f = 1	16VA	8.5W
Life @ 25°C & 50% of full stroke	1 x 10⁷	

MODEL L44-02H AC OR DC

Holding Force: DC Continuous* @ 24 VDC cold 144 oz. @ 24 VDC hot 133 oz.
DC Intermittent* @ 24 VDC cold 180 oz. @ 24 VDC hot 158 oz.
AC Continuous @ 120 VAC cold 60 oz. @ 120 VAC hot 55 oz.
AC Intermittent @ 120 VAC cold 75 oz. @ 120 VAC hot 70 oz.

Voltages: 6, 12, 24, 120, 240 VAC or DC.
AC Operating Frequency: Std. 60 Hz.
Insulation Material: Class "B" (130°C) standard UL recognized materials used in construction.
Dielectric Strength: 1000 V (RMS).
Termination: Quick connect terminals standard. Available — Leads.
Pull Type Operation: Standard. Made to order — Push Type.
Plunger Mass: 35 grams (1.25 ozs.).
Total Mass: 368 grams (13 ozs.).

*Duty Cycle: $f = \dfrac{\text{“on” time}}{\text{“on” time + “off” time}}$ (“on” time = length of longest pulse during one cycle; not to exceed 300 sec.)



POWER REQUIREMENTS

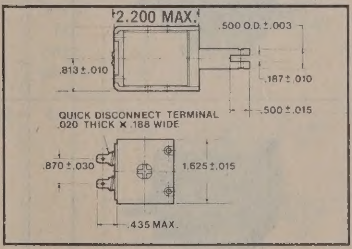
Duty Cycle	AC	DC
Intermittent f = ¼	66VA	31W
Continuous f = 1	16.5VA	10W
Life @ 25°C & 50% of full stroke	20 x 10⁶	

MODEL L51-04H AC OR DC

Holding Force: DC Continuous* @ 24 VDC cold 176 oz. @ 24 VDC hot 152 oz.
DC Intermittent* @ 24 VDC cold 260 oz. @ 24 VDC hot 250 oz.
AC Continuous @ 120 VAC cold 50 oz. @ 120 VAC hot 43 oz.
AC Intermittent @ 120 VAC cold 110 oz. @ 120 VAC hot 88 oz.

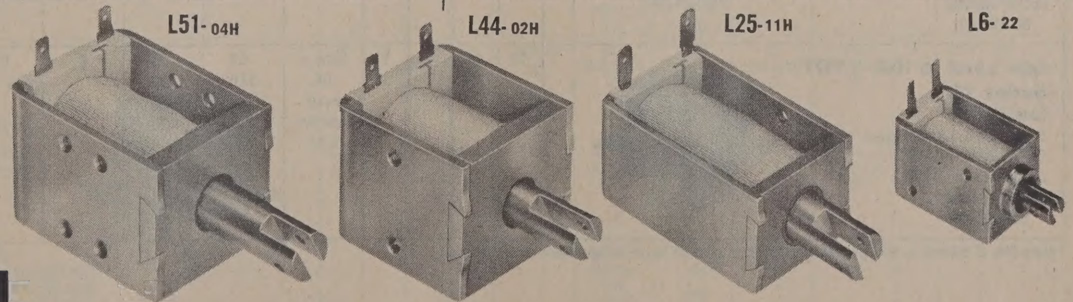
Voltages: 6, 12, 24, 120, 240 VAC or DC.
AC Operating Frequency: Std. 60 Hz.
Insulation Material: Class "B" (130°C) standard UL recognized materials used in construction.
Dielectric Strength: 1000 V (RMS).
Termination: Quick connect terminals standard. Available — Leads.
Pull Type Operation: Standard. Made to order — Push Type.
Plunger Mass: 66 grams (2.3 ozs.).
Total Mass: 425 grams (15 ozs.).

*Duty Cycle: $f = \dfrac{\text{“on” time}}{\text{“on” time + “off” time}}$ (“on” time = length of longest pulse during one cycle; not to exceed 300 sec.)



POWER REQUIREMENTS

Duty Cycle	AC	DC
Intermittent f = ¼	171VA	36W
Continuous f = 1	31VA	12W
Life @ 25°C & 50% of full stroke	5 x 10⁶	



LEDEX INC.
DEPT. EM, 126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

SUBMINIATURE RELAYS

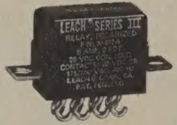
Leach subminiature relays have set the industry standards for technology and reliability for decades. With their proven high performance in the most demanding applications, they are ideal for your critical subsea, shipboard, ground-based and aerospace applications.

Our Balanced Force™ subminiature relays are rugged, high-environment relays for applications where size, weight and reliability are important. For systems where size and weight are critical, our Series III subminiature relays are the smallest, lightest aircraft relays made with their contact ratings, and are 40% the size and weight of our J and K Series relays, yet offer the same high performance. Both relay types are available in a variety of termination, mounting and operating configurations.

Subminiature Relays Dry Circuit to 10 Amps

LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	Contact Rating (Amps)												
	28 VDC				115, 400 Hz, 3Φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
	Resistive	Inductive	Motor	Lamp									
Low Level to 5A, 2PDT **Series X** Series III design, 5 mounting & 3 terminal types. 0.810"x 0.410"x 0.640". Designed to MIL-R-6106. Sockets available: SO-1064-001 	5	3	2	1	Same as DC except inductive is 5A	6.0 12.0 28.0 48.0 VDC	30 125 500 1600	4	4	0.5	200†	30†	.56 (16)
Low Level to 5A, 4PDT **Series Y** Series III design, 5 mounting & 3 terminal types. 0.810"x 0.810"x 0.640". Designed to MIL-R-6106. Sockets available: SO-1066-001 LEACH SERIES III	5	3	2	1	Same as DC except inductive is 5A	6.0 12.0 28.0 48.0 VDC	25 100 400 1275	6	6	0.5	200†	30†	.95 (27)
Low Level to 10A, 3 PDT **Series YC** Series III design, 5 mounting & 3 terminal types. 0.810"x 0.810"x 0.640". Designed to MIL-R-6106. Sockets available: SO-1065-001 LEACH SERIES III	10	6	4	2	Same as DC except inductive is 8A	6.0 12.0 28.0 48.0 VDC	25 100 400 1275	6	6	1.0	200†	30†	.99 (28)

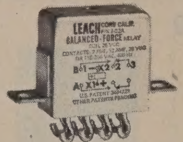
†At the time of publication, testing is being performed to establish higher ratings. Please contact factory.

Subminiature Relays Dry Circuit to 25 Amps (Cont'd)

LEACH®
RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

Low Level to 12A, 2PDT Non-Latch & Latch Series J, JA & JL



Balanced Force* design,
4 mounting & 3 terminal types.
DC - 1.015" x 0.515" x 1.000"
AC - 1.015" x 0.515" x 1.125"
Non-Latch applicable to MS27401
Latch applicable to MS27744.
Sockets available: DC, Non-Latch SO-1049-8309(#16 Crimp)
SO-1049-8526(#20 Crimp)
AC-115VAC SO-1049-8772(#16 Crimp)
28VAC SO-1049-8774(#16 Crimp)
DC, Latch SO-1055-8690(#16 Crimp)

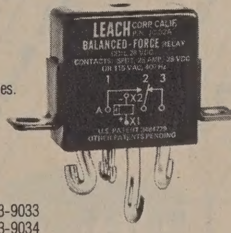
Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115, 400 Hz, 3φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
DC Coil 12	8	4	2	Same as DC Rating	DC Non-Latch 6 12 28	DC Non-Latch 20 80 320	DC Non-Latch 10	DC Non-Latch 10	1	200	200	DC Coil 1.4 (40)
AC Coil 10					DC Latch 6 12 28	DC Latch 38 150 600	DC Latch 10	DC Latch N/A				
					AC Coil (400 Hz) 115/28 (60 Hz) 115/28	AC Coil I, Max .240 .040 .100 .024	AC Coil 15	AC Coil 50				AC Coil 1.6 (46)

Low Level to 12A, 4PDT Non-Latch & Latch Series K, KA & KL

Balanced Force* design,
4 mounting & 3 terminal types.
1.015" x 1.015" x 1.000".
Non-Latch applicable to MS27400
Latch applicable to MS27745
Sockets available: DC, Non-Latch SO-1048-8308(#16 Crimp)
SO-1048-8518(#20 Crimp)
AC-115VAC SO-1048-8776(#16 Crimp)
28VAC SO-1048-8779(#16 Crimp)
DC, Latch SO-1056-8691(#16 Crimp)

Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115, 400 Hz, 3φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
DC Coil 12	8	4	2	Same as DC Rating	DC Non-Latch 6 12 28	DC Non-Latch 18 70 290	DC Non-Latch 15	DC Non-Latch 15		200	30	DC Coil 2.5 (71)
AC Coil 10					DC Latch 6 12 28	DC Latch 28 112 450	DC Latch 15	DC Latch N/A				
					AC Coil (400 Hz) 115/28 (60 Hz) 115/28	AC Coil I, Max .225 .040 .120 .028	AC Coil 20	AC Coil 50				AC Coil 2.7 (77)

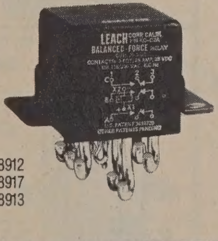
Low Level to 25A, 1 PDT Non-Latch & Latch Series JC, JCA & JCL** JS & JSA***



Balanced Force* design,
50 ADC & 80A, 400 Hz overload capabilities.
JS Series 20A overload capabilities.
Special Models available.
3 mounting & 2 terminal types.
DC-1.015" x 0.515" x 1.000"
AC-1.015" x 0.515" x 1.125".
Applicable MS, MIL-R-6106.
Sockets available: DC, Non-Latch SO-1063-9033
AC SO-1063-9034
DC, Latch SO-1063-9036

Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115, 400 Hz, 3φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
**JC, JCA & JCL					DC Non-Latch 6 12 28	DC Non-Latch 20 80 320	DC Non-Latch 10	DC Non-Latch 10	1	200	30	1.7 (48)
25	12	10	5	Same as DC Rating								
***JS & JSA Series Only 115V, 60 Hz Case Grounded					DC Latch 6 12 28	DC Latch 38 150 600	DC Latch 10	DC Latch N/A				
10	10	8	4	N/A	AC Coil (400 Hz) 115 (60 Hz) 115	AC Coil I, Max .040 .024	AC Coil 20	AC Coil 50				

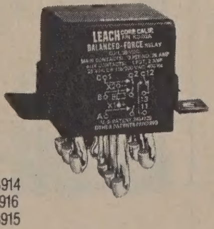
Low Level to 25A, 3PDT Non-Latch & Latch Series KC, KCA & KCL



Balanced Force* design.
50ADC & 80A, 400 Hz overload capabilities.
Special Models available.
3 mounting & 2 terminal types.
1.015" x 1.015" x 1.000".
DC, Non-Latch applicable to MS27743.
Latch applicable to MS27742.
Sockets available: DC, Non-Latch SO-1057-8912
AC SO-1062-8917
DC, Latch SO-1058-8913

Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115, 400 Hz, 3φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
25	12	10	5	Same as DC except inductive 15A	DC Non-Latch 6 12 28	DC Non-Latch 18 70 290	DC Non-Latch 15	DC Non-Latch 15	1	200	30	3.0 (85)
					DC Latch 6 12 28	DC Latch 28 112 450	DC Latch 15	DC Latch N/A				
					AC Coil (400 Hz) 115 (60 Hz) 115	AC Coil I, Max .040 .028	AC Coil 20	AC Coil 50				

Low Level to 25A 3PST/NO, 2A 1PDT Aux. Non-Latch & Latch Series KD, KDA & KDL



Balanced Force* design. Same design as the Series KC with added auxiliary pole.
Special Models available.
3 mounting & 2 terminal types.
DC, Non-Latch applicable to MIL-R-6106/13.
Latch applicable to MIL-R-6106/12.
Sockets available: DC, Non-Latch SO-1059-8914
AC SO-1061-8916
DC, Latch SO-1060-8915

Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115, 400 Hz, 3φ Resistive (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s)—(Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, Oz. (Grams)
25	12	10	5	Same as DC except inductive 15A	DC Non-Latch 6 12 28	DC Non-Latch 18 70 290	DC Non-Latch 15	DC Non-Latch 15	1 Aux 4	200	30	DC Coil 2.9 (82)
Aux 2	Aux 1		Aux 0.5		DC Latch 6 12 28	DC Latch 28 112 450	DC Latch 15	DC Latch N/A				
					AC Coil (400 Hz) 115 (60 HZ) 115	AC Coil I, Max .040 .028	AC Coil 20	AC Coil 50				AC Coil 3.0 (85)

*Patented and T.M. Leach Corp.

POWER AND CONTROL RELAYS

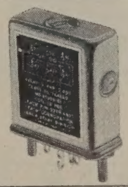
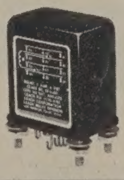
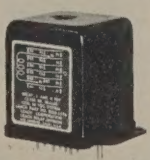
Leach power and control relays have been used for decades in commercial and military aircraft, trucks and buses, ships and tanks—any application that calls for proven durability, high performance and long life.

To ensure that you get the right relay for your application, our power and control relays are available in a broad range of configurations. You can choose from various terminal and mounting styles, dust and moisture resistant and hermetically-sealed enclosures, and a variety of operating ratings and characteristics.

Power and Control Relays

LEACH®
RELAY DIVISION

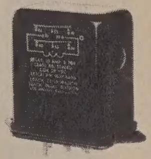
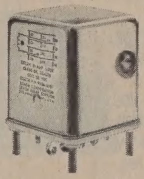
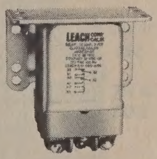
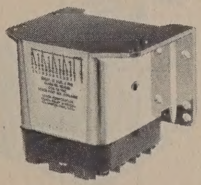
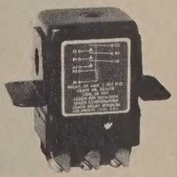
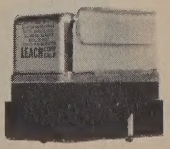
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	Contact Rating (Amps) 28 VDC Resistive	Contact Rating (Amps) 28 VDC Inductive	Contact Rating (Amps) 28 VDC Motor	Contact Rating (Amps) 28 VDC Lamp	Resistive 115/200VAC, 3φ (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Lbs.
5 Amp, 2PDT **Series 9229** **Series 9235; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC 400 Hz. 1.750"x 1.531"x .687". Applicable to MS25395 & MS25455 	5	3	1.5	.8	N/A	—	9229 248Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 55- 2000	25	.18
							9235 310Ω		DC Coils .020	N.A.				.20
5 Amp, 4PDT **Series 9220** **Series 9228; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC 400 Hz. 1.750"x 1.531"x 1.032". Applicable to MS25267 & MS25467. 	5	3	1.5	.8	N/A	—	9220 248Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 55- 2000	25	.30
							9228 200Ω		DC Coils .020	N.A.				.30
5 Amp, 6PDT **Series 9226** **Series 9223; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC, 400 Hz. 1.812"x 1.531"x 1.531". Applicable to MS25269 & MS25469. 	5	3	1.5	.8	N/A	—	9226 180Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 55- 2000	25	.40
							9223 200Ω		DC Coils .020	N.A.				.67

Power and Control Relays

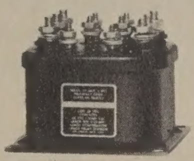
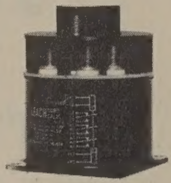
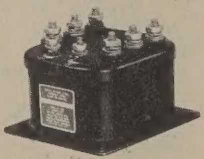
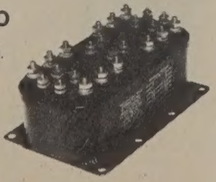
LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	Contact Rating (Amps)													
	28 VDC													
	Resistive	Inductive	Motor	Lamp	Resistive 115/200VAC, 3Φ (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Lbs.
10 Amp, 2PDT **Series 9227** **Series 9237; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.781″ x 1.531″ x 1.032″. Applicable to MS25273 & MS25466. 	10	6	4	2	Same as DC	—	9227 175Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 55- 2000	25	.30
							9237 200Ω		DC Coils .020	N.A.				.30
10 Amp, 4PDT **Series 9224** **Series 9225; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.812″ x 1.531″ x 1.531″. Applicable to MS25271 & MS25461. 	10	6	4	2	10 Same as DC	—	9224 110Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 55- 2000	25	.43
							9225 200Ω		DC Coils .020	N.A.				.40
10 Amp, 2PDT **Series 9330** Contact rating @ 28 VDC or 115 VAC, 400 Hz. 1.781″ x 1.531″ x 1.032″. Applicable to MS24149 	10	10	6	2	10 Same as DC	—	160Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .020	AC Coils .050 DC Coils .020	.002	10 15- 1500	25	.30
									DC Coils .020					.30
15 Amp, 4PDT **Series 9274** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.80″ x 2.06″ x 2.06″ Applicable to MS24568. 	10	10	6	3	15 Same as DC	—	92Ω	28 VDC 115 VAC, 400 Hz, 60 Hz	AC Coils .025 DC Coils .025	AC Coils .050 DC Coils .020	N.O. .003 N.C. .005	10 1000- 2000	50	.73
20 Amp **Series 9324—3PST/NO** 12A, 115 VAC, 60 Hz. 1.47″ x 2.50″ x 2.40″. Applicable to MS27418. 	20	15	20	10	20	3PST/NO	160	28 VDC; 115 VAC, 400 Hz; 60 Hz	AC Coils .025 DC Coils .020	AC Coils .050 DC Coils .010	.002	10 55 1500 Hz	25	.60
20 Amp **Series 9325—3PDT/NO** Mechanical interlock version of 9324. 3.71″ x 3.00″ x 3.20″. Applicable to MS27706 	20	20	20	10	20	3PDT/NO	160	28 VDC; 115 VAC, 400 Hz; 60 Hz	AC Coils .025 DC Coils .020	AC Coils .050 DC Coils .010	.005	10 55 1500 Hz	25	1.4

Power and Control Relays

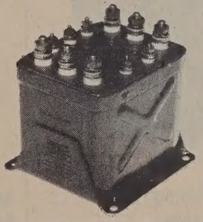
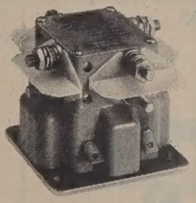
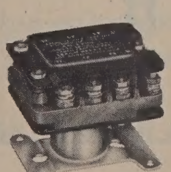
LEACH®
RELAY DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	Contact Rating (Amps)													
	28 VDC													
	Resistive	Inductive	Motor	Lamp	Resistive 115/200VAC, 3Φ (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Oz./Lbs.
25 Amp **Series 9123—3PST/NO**  50g shock, 15g vibration. Auxiliary 5 amp contacts available. 3.30"x 3.73"x 2.50". Repairable models available. Applicable to MS27997.	25	25	25	N/A	25	3PST/NO	50	28 VDC; 115 VAC, 400/60 Hz	.025	AC Coils .050 DC Coils .010	.002	15 55 1500 Hz	50	1.25
50 Amp **Series "H"** Auxiliary contacts 5 amps. Repairable models available. Basic unit: 2.50" Dia. x 3.13". Applicable to MS27751.	25	15	15	10	50	3PDT 3PDT SPST/NO Aux. 3PST/NO SPST/NO SPST/NC Aux.	6VDC 12Ω 12VDC, 50Ω 28 VDC, 200Ω 115 VAC, .09A	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	.050	.025	.003	10 70 1000 Hz	50	13.5 Oz.
50 Amp **Series "HC"** **Center-Off** Repairable models available. Basic unit: 2.50" Dia. x 3.13". Applicable to MS27750.	25	15	15	10	50	3PDT	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω	6, 12, 28 VDC	.035	.025	.003	10 70 1000 Hz	50	14.0 Oz.
50 Amp **Series "HL"** **Magnetic Latch**  Repairable models available. Basic unit: 2.50" Dia. x 3.13". Applicable to MS27749.	25	15	15	10	50	3PDT	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω	6, 12, 28 VDC	.035	—	.003	10 70 1000 Hz	50	14.0 Oz
50 Amp **Series 9124—3PST/NO**  50g shock, 15g vibration. Auxiliary 5 amp contacts available. Applicable to MS27222. 3.30"x 3.73"x 2.50". Repairable models available.	50	50	50	N/A	50	3PST/NO	50	28 VDC; 115 VAC, 400/60 Hz	.025	AC Coils .050 DC Coils .010	.002	15 55 1500 Hz	50	1.25
50 Amp **Series 9125—6PST/NO**  Mechanical interlock version of 9124. Design to MIL-R-6106. Aux. 5 amp contacts available. 6.21"x 3.80"x 2.70".	50	50	50	N/A	50	6PST/NO	50	28 VDC; 115 VAC, 400/60 Hz	.030	AC Coils .050 DC Coils .010	.002	10 70 1500 Hz	50	2.90

Power and Control Relays

LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	Contact Rating (Amps)													
	28 VDC													
	Resistive	Inductive	Motor	Lamp	Resistive 115/200VAC, 3φ (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, Oz./Lbs.
120 Amp Series "Z" Auxiliary contacts-5 amp. available in many models of contact. Configuration-consult factory. Available in repairable models. Design to MIL-R-6106. Basic unit: 3.65" Dia. x 4.28". 	50	30	30	N/A	120	3PDT 3PST/NO 3PST/NO SPST/NO SPST/NC Aux. 3PDT W/SPST/NO or SPST/NC Aux.	6 VDC, 1.2 A 12 VDC, .6 A 28 VDC, .31 A 115 VAC, .12 A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	.060	.040	.004	10 70 1000 Hz	15	2.0 lb.
100 Amp Series "ZC" Center-Off Repairable models available. Design to MIL-R-6106. Basic unit: 3.65" Dia. x 4.28". 	50	30	30	N/A	100	3PDT 3PST	6 VDC, .8 A 12 VDC, .4 A 28 VDC, .23 A 115 VAC, .09 A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	.060	.040	.004	10 70 1000 Hz	15	2.0 lb.
120 Amp Series "ZL" Magnetic Latch Repairable models available. Design to MIL-R-6106. Basic unit: 3.65" Dia. x 4.28". 	50	30	30	N/A	120	3PDT	28 VDC, .215 A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	.060	N/A	.004	10 70 1000 Hz	15	2.0 lb.
100 Amp Series 9213 Sealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts form 5 amps. Design to MIL-R-6106". 	100	100	100	N/A	100	3PST/NO 4PST/NO	44.5	28 VDC; 115 VAC, 400 Hz; 115 VAC, 60 Hz	AC Coils .040 DC Coils .030	AC Coils .060 DC Coils .020	.010	10 55 1500 Hz	25	2.7
25 to 100 Amp Series 9207 Unsealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts from 5 amps. Design to MIL-R-6106. 	100	100	100	N/A	100	3PST/NO 4PST/NO	44.5	28 VDC; 115 VAC, 400 Hz 115 VAC; 60 Hz	.030	AC Coils .050 DC Coils .020	.010	10 55 500 Hz	50	1.6
25 to 400 Amp Solenoid Type Power Contactors 1PST, 2PST Types shown: 3PST/NO, 25 amps. Design to MIL-R-6106. 	7064: 25 50 7264: 200 7401: 400	25 50 100 100	25 50 200 400	N/A 25 N/A N/A	N/A N/A N/A N/A	3PST/NO 1PDT 1PST/NO 1PST/NO 1PST/NO	Varying	28 VDC	.040	.015	N/A	2 250 500 Hz	25	2.6

ELECTRONIC TIME DELAYS AND SENSORS

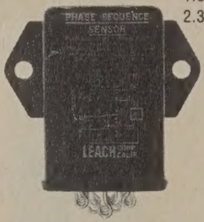
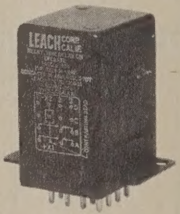
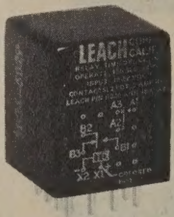
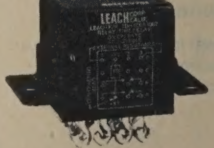
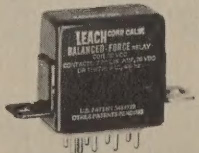
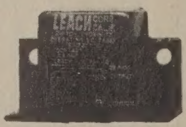
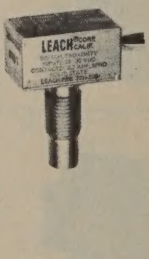
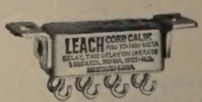
To simplify systems interfacing and integration, we have a complete custom facility for the design and production of timing and sensing systems.

They are available with Leach MIL-Standard relays or special solid state outputs, manufactured with discrete circuitry or thick film hybrids manufactured to MIL-STD-883, Class B requirements.

In addition to the standard products shown below, we can provide:

- —Combinations of voltage, frequency and phase sequence detection with built-in time delays for systems monitoring.
- —Solid state relays with up to 3PNO contacts and ratings up to 25 amperes to MIL-STD-704 power requirements.
- —Relay drivers for multiplex interface and isolation, conforming to MIL-R-28776.
- —Solid state switching devices, ac and dc motor controllers, circuit breakers, current sensors and remote power controllers.

Electronic Time Delays and Sensors

ENCLOSURE TYPES				
TYPE 10 1.5"x 1.5"x 1.8" MATING SOCKET: SO-1021-7127	TYPE 10 1.5"x 1.5"x 2.3"  MATING SOCKET: SO-1021-7127 (SENSORS)	TYPE 20 1.2"x 1.0"x 1.8"  MATING SOCKET: SO-1048-8308	TYPE 30 1.0"x 1.0"x 1.3"  MATING SOCKET: SO-1048-8308	TYPE K  MATING SOCKET: SO-1048-8308
TYPE 40 1.0"x 0.5"x 1.1"  MATING SOCKET: SO-1049-8309	TYPE 01 2.1"x 0.8"x 1.3" 	TYPE 02 2.1"x 1.0"x 1.0" 	TYPE 03 	TYPE E (HALF SIZE XTAL CAN) 0.8"x 0.4"x 0.4" 

Electronic Time Delays and Sensors

LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

	LEACH Series Number	Enclosure Types Available	Timing Range (1)	Accuracy (1)	Contact Configuration	Contact Ratings	Temperature Range	Input Voltage (MIL-STD-704A)	Applicable MIL-R-83726 Slash Sheet
Time Delay Relays									
Time Delay On Operate*									
Relay Output*	R300	10, 20, 30	0.1 SEC TO 300 SEC	±2% TO ±10%	2PDT 4PDT	2 AND 10 AMP	−55°C TO +125°C	18VDC TO 32VDC	3, 14
Solid State Output	S300	20, 30, 40			SPNO	0.25A			
Hybrid/Relay	TDH-8000	K	.05-500 SEC	±10%	2PDT	10 AMP			
Time Delay On Release Positive Or Negative Control									
Relay Output*	R400	10, 20, 30	100MS TO 300 SEC	±2% TO ±10%	1PDT 3PDT	2 AND 10 AMP			4, 12
Solid State Output	S400	20, 30			SPNO	0.25A			
Hybrid/Relay	TDH-8000	K	.05-500 SEC	±10%	2PDT	10 AMP			
Hybrid Construction*									
Time Delay On Operate*	S5100	1/2 XTAL CAN	50MS TO 500 SEC						20, 21
Repeat Cycle Timer*	S5200								22
Voltage, Frequency, and Phase Sensors									
DC, Relay Output	V110	10	N/A	±2% TO ±10%	2PDT AND 4PDT	2 AND 10 AMP	−55°C TO +125°C	18VDC TO 32VDC	N/A
AC Undervoltage, Relay Output	V210							90VAC TO 124VAC 400 Hz	
AC Overvoltage, Relay Output	V310								
AC Frequency, Relay Output	F410								
AC Phase Sequence, Relay Output	P510			N/A					
Proximity Sensors									
Solid State Output (2)	PS100	01 02 03	N/A	±.03″	SPNO SPNC SPNO	0.20A	−55°C TO +125°C	18VDC TO 32VDC	N/A

(1) EXTENDED TIMING RANGES AND GREATER ACCURACIES ARE AVAILABLE ON SPECIAL ORDER

(2) AVAILABLE FOR BOTH FERROUS AND NON FERROUS TARGET SENSING
SHORT CIRCUIT PROTECTION AVAILABLE
PACKAGES FOR MULTIPLE SENSORS AND HIGHER OUTPUT RATINGS ON SPECIAL ORDER

***TIME DELAY UNITS AVAILABLE QUALIFIED TO MIL-R-83726**

Liberty Controls for Solenoids and

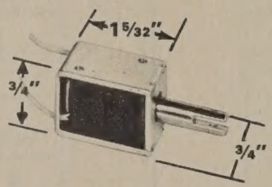
SOLENOIDS

Liberty Controls Inc. has a full line of both C frame and solid frame solenoids which can be tailored to fit your needs. These shown below are some of the standard lines which cover a variety of applications. Each size is shown as pull solenoids and are complimented by a push type with similar force characteristics. Plungers and plunger stops are made from magnetic steels and annealed after machining for maximum efficiency.

The duty cycle ratings are very important in a solenoid application and continuous duty units should be used whenever possible for safest operation. When the force requirements exceed the capabilities of a continuous rated coil, it is essential to give us complete information regarding the intended duty cycle and power source limitations so that we can design and manufacture the best coil for your application. A good rule of thumb is that if the unit is going to be "on" for four (4) minutes or longer, a continuous duty coil should be used. Let us suggest the appropriate coil for duty cycles less than this four minutes.

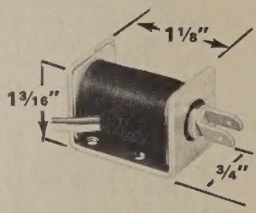
Remember, these solenoids shown are just a few examples of our line, and we encourage you to contact us about your specific requirements.

TYPE 60



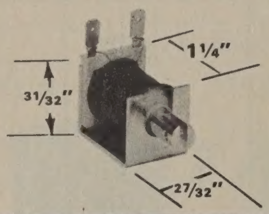
This solid frame solenoid has many light industrial and business machine applications. It is provided with solder, 3/16" quick connect terminals or leads. It has improved efficiency in this small size because it is a solid frame design.

TYPE 61



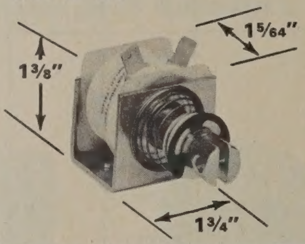
This C frame unit is designed for cost efficiency required in vending machines, slide projectors, automotive actuators and similar applications where volume is high and cost is a prime consideration. It is most often provided with ¼" quick connect terminals, but leads are available.

TYPE L-24



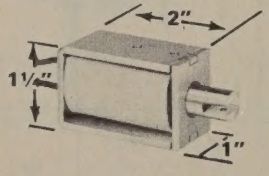
This C frame design is similar to the 61 but slightly larger and is designed for longer life. Its applications fall into the light industrial, business equipment, and calculator areas. It is readily interchangeable with other competitive solenoids and can be provided with several varieties of termination.

TYPE 62



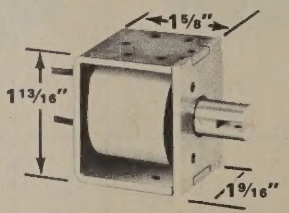
This C frame unit is larger than any of the above described C frames and is used widely in cash drawer applications where a large pull force is required on a pulse duty basis. It is compact and very efficient for this application. Again various terminations are available.

TYPE 82



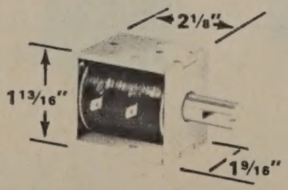
This solid frame solenoid is a medium force unit that has excellent magnetic circuit design. It is used in medium industrial applications where a longer stroke is required. It has been applied in door latch mechanisms and similar applications where side loading is a significant factor. Various terminations are available.

TYPE 88



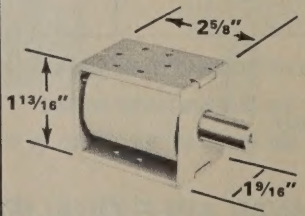
This solid frame unit is the smallest in a series of medium to heavy duty applications. It is used primarily in industrial applications where a short stroke is desired and space requirements are limited. These are used in computer peripheral devices for head loading, write disable indicator retractors, and other similar needs.

TYPE 89



This solid frame unit is the next stop up from the 88 in longer stroke capabilities. Many of the same applications would apply here as in the 88, but generally the force is required over a slightly longer distance. This unit uses a brass plunger sleeve for longer life and better support in side loaded applications.

TYPE 90



This solid frame solenoid is the largest of our standard line and is the longest in the 88, 89, 90 Series. As can be seen from the force characteristics curves on the adjacent page, this solenoid has the longest force distance ability. As with the whole series, the various terminations are available.

Liberty Controls, Inc. 500 Brookforest Avenue, Shorewood, Illinois 60431 815/725-2241

General Purpose Relays you can rely on

FORCE CHARACTERISTICS OF SOLENOIDS

Distance From Stop in Inches

	1/8		1/4		3/8		1/2		5/8	
TYPE	Cont.	Int.	Cont.	Int.	Cont.	Int.	Cont.	Int.	Cont.	Int.
60 AC	*4	6	2	3.5	1	2	.5	1	—	—
DC	4	6	.5	2	—	1.5	—	.5	—	—
61 AC	6	14	4	8	3	6	2.5	5	—	3
DC	4	12	2	8	1	3	—	1	—	—
L-24 AC	7	11	5.5	8	5	7	3.5	6	2	3
DC	8	23	3	9	1.5	5	1	3	—	—
62 AC	15	36	13	32	11	28	8	20	3	10
DC	15	45	9	27	6	18	3	9	1	3
82 AC	13	21	6	12	3	9	1	7	—	6
DC	20	48	10	32	6	20	4	11	2	6
88 AC	14	40	9	24	4	16	3	12	—	8
DC	40	140	14	100	7	40	3	20	—	10
89 AC	14	40	9	28	5	24	4	20	2	18
DC	40	140	14	105	8	60	5	40	2	26
90 AC	14	40	9	28	5	24	4	22	3	20
DC	64	140	27	107	12	70	6	50	3	35

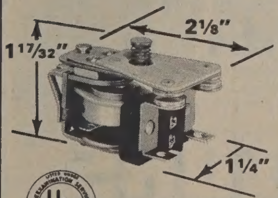
* Force in Ounces

GENERAL PURPOSE TYPE RELAYS

Liberty Controls has an outstanding reputation for its line of General Purpose Relays. These relays perform dependably in many diverse applications including light to medium switching and plate circuit operations, in process controls and communication equipment. More recently many of these types of relays have been used as safety features on power equipment, such as, line monitoring for stray currents, discharging voltage on shutdown, and equipment shutdown through fault detection.

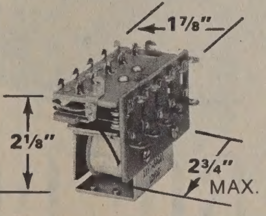
A wide variety of contact arrangements and ratings are available in our general purpose relay family. Minimum contact pressures of 25 grams are maintained on the smaller relays while the larger power relays perform at upwards of 200 grams contact pressure. Standard contacts are made of Silver Cadmium Oxide for low resistance qualities and then gold flashed to prevent corrosion and retard pitting which generally occurs with inductive loads.

SERIES 250



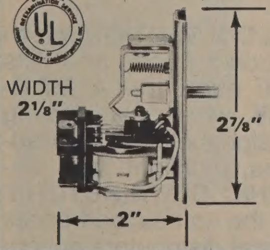
ELECTRICAL CHARACTERISTICS:
CONTACTS: Rated at 25 amps @ 120-240 VAC resistive and 1 HP @ 120-240 VAC. ACTION: SPST Normally open, double break. OPERATING VOLTAGES: 6, 12, 24, 115, 203 VAC; 6, 12, 24, 110 VDC. TERMINALS: 1/4" quick connect for contacts, 3/16" quick connect for coil. MOUNTING: Frame drilled and tapped for one (1) 6-32 screw and locating tab. Optional with 5/16" X 6-32 stud and w/o locating tab. SPECIAL: Available with 5 amps SPDT auxiliary switch.

SERIES 630



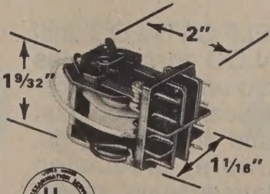
ELECTRICAL CHARACTERISTICS:
CONTACTS: Rated at 15 amps. 120V 60 Hz. resistive using gold plated silver contacts as standard. ACTION: DPDT thru 5PDT. OPERATING VOLTAGES: 6, 12, 24, 48, 115, 230 VAC; 3, 6, 12, 24, 48, 110 VDC. TERMINALS: Solder or screw type. MOUNTING: Frame drilled and tapped for four (4) 6-32 screws. SPECIAL: Available in ST normally open or normally closed action. Also provided in 8, 12, and 18 pin Jones Plug or 8, 12 and 20 pin octal type plug.

SERIES 218



ELECTRICAL CHARACTERISTICS:
CONTACTS: Rated at 5 or 10 amps using silver cadmium oxide as standard. ACTION: SPST thru 3PDT. OPERATING VOLTAGES: 6, 12, 24, 115, 230 VAC; 5, 6, 24, 110 VDC. TERMINALS: Combination 3/16" quick connect, or solder, or printed circuit type. MOUNTING: 2 holes 10-32 tapped in front plate as shown or 6-32 tapped hole in base of relay. APPLICATION: This relay is typically used in safety circuits and unit shutdown circuits where a pulse to the coil will operate the relay and then the unit bar to be released manually through the reset button.

SERIES 210



ELECTRICAL CHARACTERISTICS:
CONTACTS: Rated at 5 or 10 amps using silver cadmium oxide as standard. U/L approved. ACTION: SPOT thru 3PDT. OPERATING VOLTAGES: 6, 12, 24, 115, 230 VAC; 6, 12, 24, 110 VDC. TERMINALS: Tab, solder, or printed circuit type. MOUNTING: Frame drilled and tapped for one (1) 6-32 screw and locating tab. Optional with 5/16" X 6-32 stud and w/o locating tab. SPECIAL: Available with SPST normally open or normally closed action. Also available as a manual reset or latching relay. Special plate circuit coils can be provided.

Liberty Controls, Inc. 500 Brookforest Avenue, Shorewood, Illinois 60431 815/725-2241

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THE MASTER CATALOG
THE ELECTRONIC DISTRIBUTORS
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MASTER CATALOG
FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

YESTERDAY'S RADIO MASTER IS TODAY'S

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Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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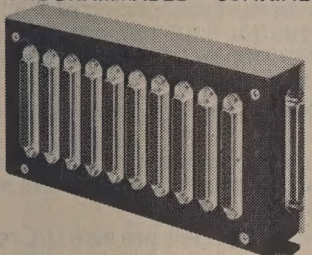
MATRIX

SYSTEMS CORPORATION
9411 Lurline Avenue • Chatsworth, California 91311
(213) 882-2008 TWX #910-494-4975

COAXIAL SWITCHING SYSTEMS

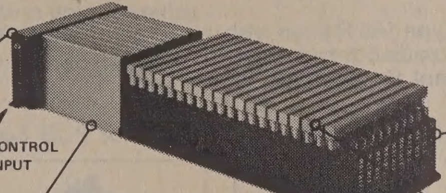
PROGRAMMABLE – COAXIAL RELAY MATRIX



MODEL 6310 DECODE MODULE

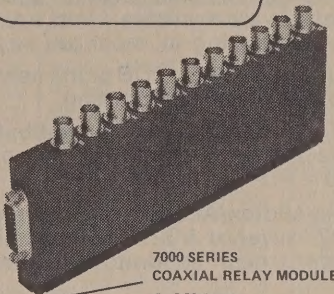
- Computer controllable
- 16 bit parallel or ASCII input
- TTL/DTL compatible
- Decodes 200 switchpoints
- Expandable

MODULAR ASSEMBLY



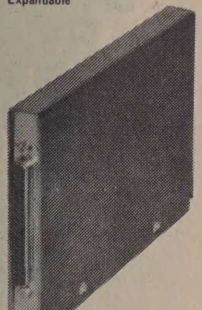
CONTROL INPUT

TYPICAL CONFIGURATION
(10 x 20 MATRIX)



7000 SERIES COAXIAL RELAY MODULE

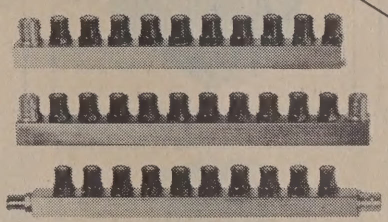
- 2-20 throws
- 106 dB isolation @ 100 MHz
- 100 watt switching
- DC-300 MHz
- Switched shield
- Self terminating
- 50 or 75 ohm
- Machined housing
- 28 V control



6100 SERIES LOGIC MODULE

- Controls 2-20 switchpoints
- TTL/DTL compatible
- X - Y addressable
- 28 VDC control output
- Latching
- J - K flipflops
- Hex gate drivers

PUSH-ON CROSS STRAP



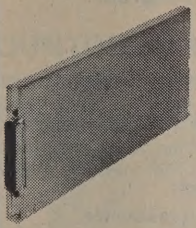
9100 SERIES

9200 SERIES

9300 SERIES

CROSS STRAPS INTERCONNECT COAXIAL RELAYS TO FORM CROSSBAR CONFIGURATION.

TWO WIRE AUDIO RELAY MODULE

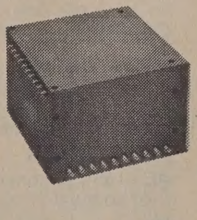


FEATURES:

- Programmable
- Two pole-twenty throw
- Contains four independent two pole, five throw relays
- Dry reed or mercury wetted contacts available
- Independent control
- Compatible with 6100 series latching and drive module
- May be connected in a 2 x 10 or 4 x 5 matrix configuration
- Reed switches easily accessible
- 28 V control

MODEL 6157

10 x 10 VIDEO RELAY MATRIX

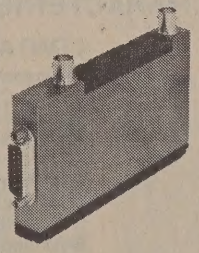


FEATURES:

- Any of ten inputs may be connected to any of ten outputs
- Computer programmable
- Random addressable
- Low VSWR
- Signal circuits isolated from control circuitry
- Switchpoints individually field replaceable
- Stripline construction
- SMA connectors
- 28 V control

MODEL 6160

PROGRAMMABLE COAXIAL ATTENUATOR

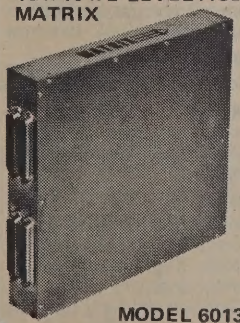


FEATURES:

- 0 - 63 dB Range
- One dB steps - .5 dB optional
- Pure six bit binary control
- Low VSWR
- Continuous shield continuity
- Signal circuits isolated from control circuitry
- Attenuator elements field replaceable
- Compatible with 6100 series latching logic
- 28 V control

MODEL 6152

10 x 10 x 2 LEVEL AUDIO RELAY MATRIX

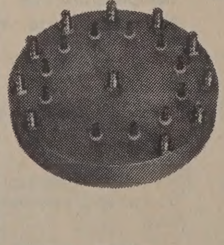


FEATURES:

- Random access
- Balanced switching
- Flexible format
- 1 ms switching
- Scanner capability
- Programmable
- DC - 100 KHz
- 28 V control

MODEL 6013

RADIAL RELAY

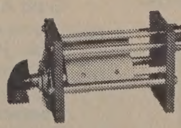


FEATURES:

- 10 throws
- Matched port to port delay
- Low VSWR
- 5 VDC control
- 50 ohm
- Machined housing
- Coaxical construction
- SMA connectors

MODEL 6210

R.F. ROTARY SWITCH



FEATURES:

- Two throw
- Center off
- Self terminating
- 50 or 75 ohm
- Hermetically sealed contacts
- Panel mount
- BNC connectors
- Low VSWR
- High Isolation

MODEL 6172

Matrix Systems Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF, Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (213) 882-2008

MIDTEX Type 156 4PDT

Miniature 5 Ampere
Industrial Relay
U/L & CSA Recognized

The Type 156 4PDT Relay is a compact and versatile industrial relay. Low level switching gold contacts, universal gold flashed silver, or silver cadmium oxide power contacts are available. Units are dust covered. Terminals are solder/plug-in, taper tab or printed circuit.

Various solder, PCB or the new solderless wrap sockets provide versatile mounting.

Type 156 options are pushbutton actuators, opposite pole barriers, indicator lamps, special mounting brackets and 2 PDT contacts.

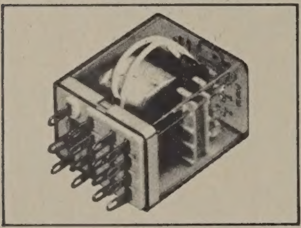
All Midtex/AEMCO dust covered Type 156 Relays with 3/32" silver or 3/32" silver cadmium oxide contacts have Underwriters' Laboratories Component Recognition for Motor Controllers through 240 VAC in accordance with Underwriters' Laboratories Standard 508 "Industrial Control Equipment." They provide through air spacing of 1/16" minimum and over-surface spacing of 1/8" minimum, and are recognized for 1/10 horsepower motor control applications at 120/240 VAC. Opposite polarity on adjacent poles U/L is also available.

Sockets are constructed to meet U/L requirements for these ratings.

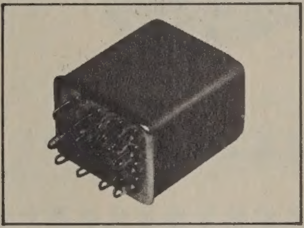
The gold alloy and palladium contact models meet the same spacing and insulation requirements, but are meant for lighter contact loads.

Certain hermetically sealed models are also U/L recognized.

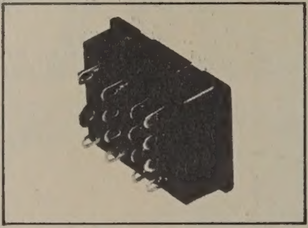
Dust Covered



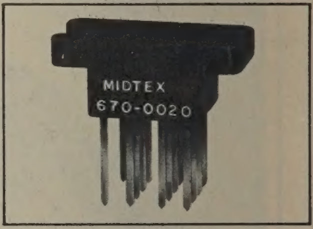
Hermetically Sealed

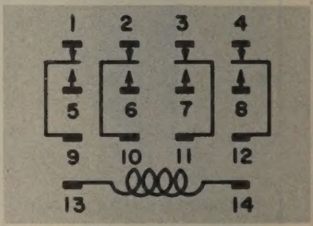


Solder or PCB Socket



Solderless Wrap Socket





Wiring Diagram

ELECTRICAL CHARACTERISTICS

CONTACTS:

Arrangement
4 Form C (4PDT)

Material
3/32" Silver (Gold Flash)
3/32" Silver Cadmium Oxide
Gold Alloy & Palladium Cross Bar
3/32" Palladium & Gold Alloy Buttons
Gold Alloy, Silver & Palladium Bifurcated

Rating
3/32" Silver (Gold Flash)*
3 amp, 28 VDC/120VAC 80% pf
1/10 hp, 120/240 VAC
3/32" Silver Cadmium Oxide*
5 amp, 28 VDC/120 VAC 80% pf
1/10 hp, 120/240 VAC
Gold Alloy Cross Bar
Low level/2 amps 28 VDC
3/32" Palladium
3 amp, 28 VDC/120 VAC
*(U/L Recognized)

Contact resistance
Initial 0.05 ohm max. After life 0.100 ohm max. (Measured at rated current)

Life expectancy
Mechanical—In excess of 50 million operations
Electrical—100,000 operations at rated loads

COILS:

Voltage ratings
6 to 240 VAC 50/60 Hz.
6 to 110 VDC
(See Part Number Table)

Pick-up voltage
AC — 85% of nominal, DC — 75% of nominal

Power ratings
Nominal
AC 1.2 VA
DC 0.9 Watts
Maximum continuous
AC 2.0 VA
DC 2.0 Watts

Temperature rise
Nominal voltage
AC 35°C
DC 33°C
25% overvoltage
AC 65°C
DC 45°C

Duty cycle
Rated for continuous duty operation at 25% overvoltage

GENERAL:

Dielectric breakdown
Greater than 500 VAC RMS 60 Hz across open contacts
Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements

Insulation resistance
1500 Megohms minimum at 500 VDC

Timing values
13 MS max. operate make time
10 MS max. release make time
(Nominal voltage, no coil suppression)

Insulating material
Molded alkyd (glass reinforced)

Weight (approximate)
1-1/2 ounces (dust cover)
1-5/8 ounces (hermetically sealed)

Marking
Midtex/AEMCO name, part number, nominal voltage, wiring diagram and pin designation are standard. Customer marking optional.

MIDTEX INC. 1650 TOWER BLVD. • NORTH MANKATO, MINNESOTA 56001 • (507) 625-6521 • TWX: 910-565-2244

Type 156 cont.

STANDARD PART NUMBERS AND COIL CHARACTERISTICS

COIL		RELAY TYPE	CLEAR DUST COVER SOLDER/PLUG IN TERMINALS			NYLON DUST COVER PRINTED CIRCUIT TERMINALS			CLEAR DUST COVER TAPER TAB TERMINALS			HERMETICALLY SEALED SOLDER/PLUG-IN TERMINALS		
RESISTANCE (Ohms ±10%)	NOMINAL VOLTAGE		SILVER (gold flash)	SILVER CAD. OX. (gold flash)	GOLD ALLOY	SILVER (gold flash)	SILVER CAD. OX. (gold flash)	GOLD ALLOY	SILVER (gold flash)	SILVER CAD. OX. (gold flash)	GOLD ALLOY	SILVER (gold flash)	SILVER CAD. OX. (gold flash)	GOLD ALLOY
40	6	156–	14A100	14A200	14A300	24A100	24A200	24A300	34A100	34A200	34A300	44A100	44A200	44A300
160	V 12		14B100*	14B200	14B300	24B100	24B200	24B300	34B100	34B200	34B300	44B100	44B200	44B200
650	D 24		14C100*	14C200	14C300	24C100	24C200	24C300	34C100	34C200	34C300	44C100	44C200	44C300
2600	C 48		14D100	14D200	14D300	24D100	24D200	24D300	34D100	34D200	34D300	44D100	44D200	44D300
9000	90		14E100	14E200	14E300	24E100	24E200	24E300	34E100	34E200	34E300	44E100	44E200	44E300
11000	110		14F100	14F200	14F300	24F100	24F200	24F300	34F100	34F200	34F300	44F100	44F200	44F300
10	6	156–	14N100	14N200	14N300	24N100	24N200	24N300	34N100	34N200	34N300	44N100	44N200	44N300
40	V 12		14P100	14P200	14P300	24P100	24P200	24P300	34P100	34P200	34P300	44P100	44P200	44P300
155	A 24		14Q100*	14Q200	14Q300	24Q100	24Q200	24Q300	34Q100	34Q200	34Q300	44Q100	44Q200	44Q300
670	C 48		14R100	14R200	14R300	24R100	24R200	24R300	34R100	34R200	34R300	44R100	44R200	44R300
3900	120		14T100*	14T200	14T300	24T100	24T200	24T300	34T100	34T200	34T300	44T100	44T200	44T300
14900	240		14U100	14U200	14U300	24U100	24U200	24U300	34U100	34U200	34U300	44U100	44U200	44U300

* Stock Item
Standard Models in Stock

SOCKETS:

670-0001 3/16" solder terminals
670-0002 3/8" solder terminals
670-0003 PCB terminals
670-0020 solderless wrap

ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE

Operating: —45°C to +75°C
Storage: —65°C to +100°C

SHOCK

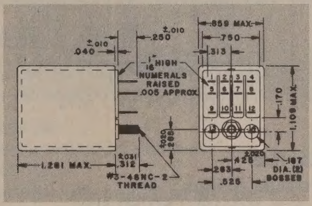
15 g's, 11 ± 1 ms, ½ sinewave (non operating test, no mechanical damage)

VIBRATION

0.1" DA or 10 g's, 10 to 55 Hz operating test, no contact chatter, hard mounted, 1 microsecond detection level)

ENCLOSURES

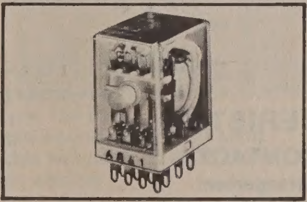
Dust Cover



±.010
.250
.040
±.010
.859 MAX.
.750
.313
1/8 HIGH NUMERALS RAISED .005 APPROX.
.170
1.109 MAX.
1.281 MAX.
±.031
.312
.263
.425
±.020
.187 DIA. (2) BOSSES
#3-48NC-2 THREAD
.525

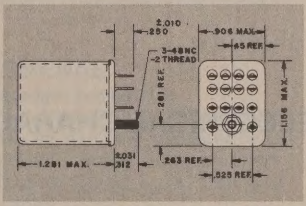
Clear polycarbonate standard on models with solder/plug-in terminals. Natural nylon standard on models with PCB terminals.

Pushbutton



Push-to-actuate button provides versatile feature for system maintenance and checkout.

Hermetically sealed

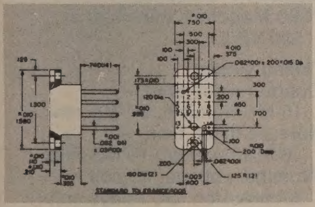


±.010
.250
.906 MAX.
.45 REF.
3-48NC 2 THREAD
.281 REF.
1.156 MAX.
1.281 MAX.
±.031
.312
.263 REF.
.525 REF.

Glass to metal compression header. Lusterless gray enamel finish. Not U/L recognized.

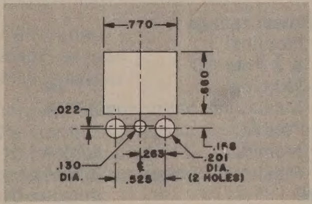
MOUNTING

Solderless Wrap Socket



Models 156-1, -4
For interconnection economies. Up to 3 individual connections per terminal, 20-26 AWG

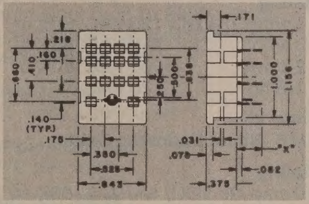
Direct chassis



.770
.860
.022
.130 DIA.
.263
.525
.188
.201 DIA. (2 HOLES)

Models 156 -1, -3, -4
For wired connection reliability.

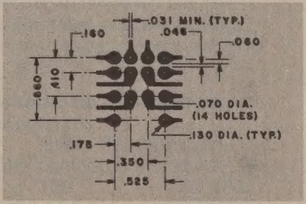
Plug-in



.171
.219
.160
.860
.410
.140 (TYP.)
.175
.350
.525
.843
.031
.078
.375
"X"
.062
1.000

Models 156 -1, -4*
For ease of installation and replacement in severe duty applications.

Printed circuit board



.031 MIN. (TYP.)
.160
.046
.060
.860
.410
.070 DIA. (14 HOLES)
.130 DIA. (TYP.)
.175
.350
.525

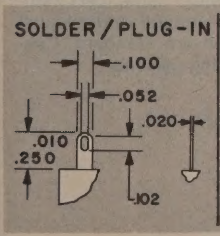
Model 156-2
For the economy inherent in PCB systems.

See part number table

TERMINALS

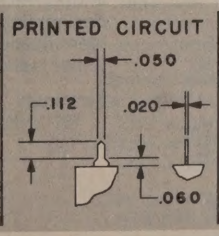
Relay

Model 156-1



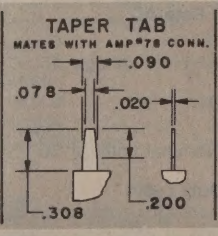
SOLDER/PLUG-IN
.100
.052
.020
.010
.250
.102

Model 156-2



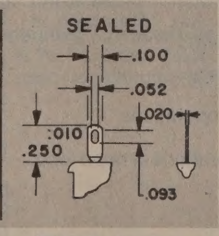
PRINTED CIRCUIT
.050
.112
.020
.060

Model 156-3



TAPER TAB
MATES WITH AMP®78 CONN.
.090
.078
.020
.308
.200

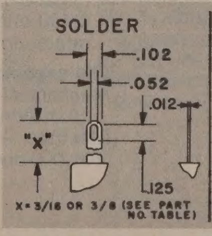
Model 156-4



SEALED
.100
.052
.020
.010
.250
.093

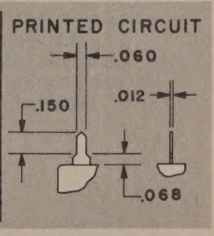
Socket

P/N 670-0001,2



SOLDER
.102
.052
.012
"X"
.125
X=3/16 OR 3/8 (SEE PART NO. TABLE)

P/N 680-0003



PRINTED CIRCUIT
.060
.150
.012
.068

Standard terminal finish is fused electro-tin.

***#731R chassis punch available from Greenlee Tool Co., Rockford, Illinois*

MIDTEX INC. 1650 TOWER BLVD. • NORTH MANKATO, MINNESOTA 56001 • (507) 625-6521 • TWX: 910-565-2244

MIDTEX Type 157 1, 2 & 3PDT

Open & Dust Covered
5 & 10 Amp
Industrial Relay
U/L & CSA Recognized.

The Type 157 3PDT Relay is a rugged power driver, offering superior 3/16" through air and 3/8" over-surface spacing. An interlocked frame and contact block prevents contact misalignment during plug-in. Open or dust covered. The relay is available with neon bulb indicator lamps and push-to-operate buttons.

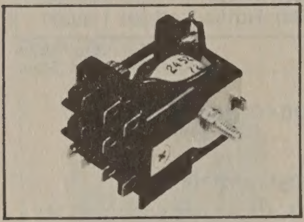
A magnetic latching version provides a unique switchable core, which cannot be falsely latched.

All Midtex/AEMCO catalog Type 157 Relays, except magnetic latching, have Underwriters' Laboratories Component Recognition as Motor Controllers through 600 VAC in accordance with U/L Standard 508 "Industrial Control Equipment." They provide through air spacing of 3/16" minimum and over-surface spacing of 3/8" minimum and are recognized for 1/2 HP motor controller applications at 240/480/600 VAC (1/3 HP at 120 VAC).

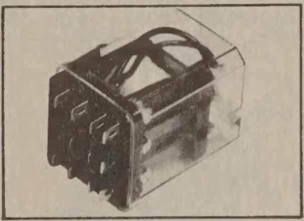
Sockets are constructed to meet U/L requirements for these ratings, except the P/C board socket.

Chassis mounted open relays must employ 1/32" additional insulation between mounting surface and relay, to insure 1/2" over-surface and through air to the mounting surface.

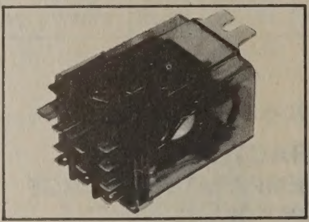
Open



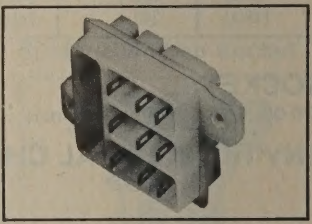
Dust cover



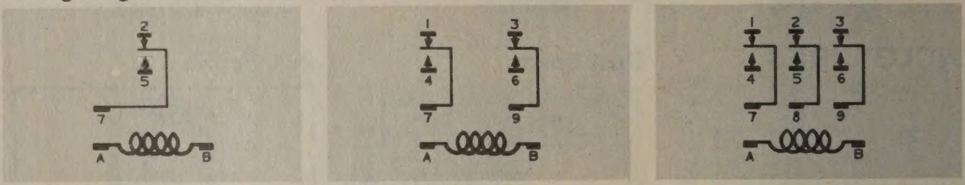
Flanged dust cover



Socket



Wiring diagrams



ELECTRICAL CHARACTERISTICS

CONTACTS

Arrangement
1, 2, and 3 Form C
(1, 2 & 3PDT)

Material
1/8" Fine Silver
(Gold Flash)

Rating

5 amp, 28 VDC/120 VAC, 80% pf	
3 amp	240 VAC, 80% pf
2 amp	600 VAC, 80% pf
1/8 hp	120 VAC

Material
3/16" Silver Cadmium Oxide

Rating

10 amp, 28 VDC/120 VAC, 80% pf	
1/3 hp	120 VAC
10 amp	240 VAC, 80% pf
1/2 hp	240 VAC
3 amp	480/600 VAC, 80% pf
1/2 hp	480/600 VAC

Contact resistance
Initial 0.05 ohm max. After life 0.100 ohm max. (Measured at rated current).

Life expectancy
Mechanical —
10 million operations.
Electrical —
100,000 operations at rated load.

COILS

Voltage ratings
6 to 240 VAC 50/60 Hz.
6 to 110 VDC.
(See Part Number Table).

Pick-up voltage
AC — 85% of nominal.
DC — 75% of nominal.

***Power ratings**
Nominal

1 & 2 Pole AC	
Nominal	1.7 VA
Maximum continuous	2.7 VA
3 Pole AC	
Nominal	2.0 VA
Maximum continuous	3.1 VA
DC	
Nominal	1.2 Watts
Maximum continuous	1.9 Watts

Temperature rise

1 & 2 Pole AC

	Open	Enc.
Nominal voltage	30° C	40° C

3 Pole AC

	Open	Enc.
Nominal voltage	45° C	55° C

DC

	Open	Enc.
Nominal voltage	30° C	40° C

Duty cycle
Rated for continuous duty operation at 25% overvoltage.

GENERAL

Dielectric breakdown
Greater than 750 VAC, RMS 60 Hz across open contacts.
Greater than 2500 VAC, RMS 60 Hz all other mutually insulted elements.

Insulation resistance
1000 Megohms minimum at 500 VDC.

Timing values
Operate make time —
15 MS nominal, 20 MS max.
Release make time —
6 MS nominal, 10 MS max.
(Nominal voltage, no coil suppression, DC relays only).

Insulating material
Phenolic

Weight (approximate)
Open relay 2.3 ounces.
Enclosed relay 3.0 ounces.

Marking
Midtex/AEMCO name, part number, nominal voltage, and terminal identification are standard. Customer marking optional.

Terminals
187" NEMA QDC
PCB

MIDTEX INC. 1650 TOWER BLVD. • NORTH MANKATO, MINNESOTA 56001 • (507) 625-6521 • TWX: 910-565-2244

MIDTEX
Type 159, 160, 166 1PDT

Mercury-Wetted Contact Relay SPDT Printed Circuit Module

The Mercury-Wetted Contact Relay is one of the most reliable relays on the market, and is used extensively in telephone communications, process computer interface, or any critical application requiring billions of operations life, stable contact resistance and faster than 2 millisecond operate speeds.

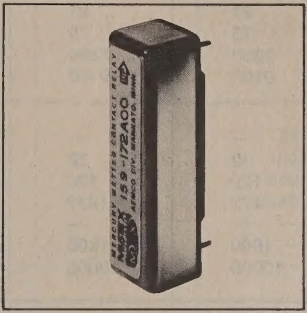
The type 159, 160 and 166 utilize a 2 ampere contact, Form C or Form D (specify) contact action.

See Midtex Engineering Bulletin 159/160 for proper contact protection requirements. Mounting within 30° of vertical required.

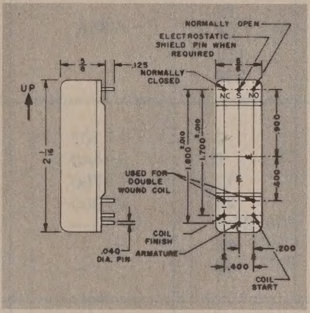
The adjustments available on the Type 159 and 160 Mercury-Wetted Relays are single-side-stable, bi-stable, or 1% dynamic balanced polar. The balanced polar adjustments provide less than 1% distortion in Neutral and Polar Telegraphy and Pulse Data Transmission applications. The low profile Type 166 is available in single-side-stable or bi-stable adjustments.

All types have single or dual coils, depending upon the requirement.

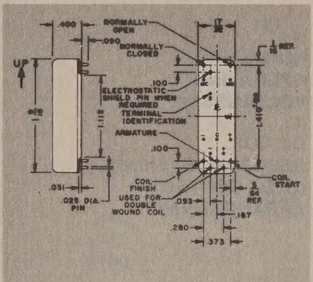
OUTLINE DIMENSIONS



TYPE 159


NORMALLY OPEN
ELECTROSTATIC SHIELD PIN WHEN REQUIRED
5/8
.125
NORMALLY CLOSED
UP
NC S NO
2 1/16
1.800 ±.010
1.700 ±.010
.900
.400
USED FOR DOUBLE WOUND COIL
COIL FINISH
.040 DIA. PIN
ARMATURE
.200
.400
COIL START

TYPE 160 and 166*


.400
NORMALLY OPEN
.090
NORMALLY CLOSED
17/32
1/16 REF.
UP
.100
ELECTROSTATIC SHIELD PIN WHEN REQUIRED
TERMINAL IDENTIFICATION
1.118
1.410
ARMATURE
.100
COIL FINISH
.031
.025 DIA. PIN
USED FOR DOUBLE WOUND COIL
.093
5/64 REF.
COIL START
.187
.280
.373

*Type 166 is 0.340" high

ELECTRICAL CHARACTERISTICS

CONTACTS

SPDT (Form C or Form D)

Material

Mercury-wetted platinum contacts

Hermetically sealed in an inert atmosphere

Rating

Switched Load:
2 amperes max
500 volts max
100 VA max

Carry Load:
5 amperes max
Not switched

Inrush Load:
20 amperes average for 10 microseconds
4 amperes average for 10 seconds
2 amperes average for 100 seconds

(NOTE: Suitable contact protection, must be provided.)

Bridging and transfer time

When operated by a single DC pulse, the bridging or transfer time will be greater than 50 microseconds but less than 500 microseconds.

Contact resistance

14 milliohms typical, 20 milliohms max

Stable within ±2 milliohms throughout life.

Life expectancy

1 billion operations minimum at rated load

COILS

Coil resistance

Type 159 Relay

Single wound up to 8600 ohms

Double wound up to 4275 ohms per winding

Power ratings

2 watts continuous

Temperature rise

30° C per watt

Type 160 Relay

Single wound up to 9000 ohms

Double wound up to 4500 ohms per winding

Power ratings

1.75 watts continuous

Temperature rise

35° C per watt

Type 166 Relay

Single wound up to 6100 ohms

Double wound up to 3000 ohms per winding

Power ratings

1.75 watts continuous

Temperature rise

35° C per watt

Operating characteristics

See Part Number Tables for specific operating parameters

GENERAL

Dielectric breakdown

Greater than 1000 VAC RMS 60 Hz all mutually insulated elements, except between windings of Bifilar Coils (See Coil Table).

Insulation resistance

1000 Megohms minimum at 500 VDC

Interelectrode capacitance

The capacitance across the switch capsule without external wires is approximately 1.5 pf.

Approximate capacitances in picofarads

Relay De-energized

	159	160-166
Open contact to armature	2.0 to 3.0	2.5 to 3.0
Open contact to coil	2.5 to 3.5	2.5 to 3.0
Armature to coil	7.5 to 9.0	7.0 to 9.0

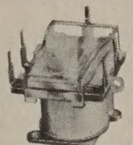
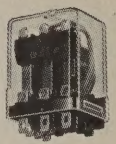
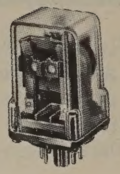
Shielding

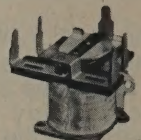
The module cover provides magnetic shielding.

An electrostatic shield between the switch element and the coil is also available.

MIDTEX INC. 1650 TOWER BLVD. • NORTH MANKATO, MINNESOTA 56001 • (507) 625-6521 • TWX: 910-565-2244

GUIDE TO GENERAL PURPOSE

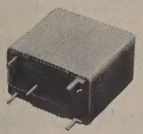
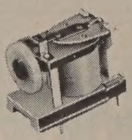
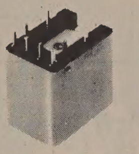
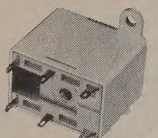




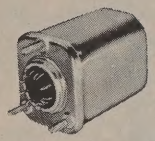
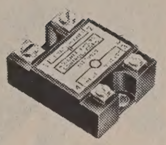


SERIES			10	12	13	14	19
CONTACTS		FORM	SPDT	1-3PDT	1-3PDT	1-3PDT	SPDT
		AMPS	3	10	6 or 10	10	10
		VOLTS	28DC	28DC/115AC	28DC/115AC	28DC/115AC	28DC/115AC
NOMINAL OPERATING VOLTAGES & DC COIL RESISTANCE (ohms) (SPDT CONTACT ARRANGEMENT)	AC	6	N/A	6	6	2.5	N/A
		12		21	21	10	
		24		75	75	36	
		115		2250	2250	1000	
		230		9100	9100	4000	
	DC	3	107	—	—	—	27
		6	440	32	32	32	107
		12	1760	120	120	120	440
		24	7000	472	472	472	1760
		26.5	—	—	—	—	—
		48	—	1800	1800	1800	—
		110	—	10000	10000	10000	—
TERMINALS		SOLDER	X	X	X	X	X
		PC	X	X	X	—	X
		OCTAL PLUG	—	See Note	X	See Note	—
MAX. OPERATE TIME (ms)			10	15	15	15	15
MAX. RELEASE TIME (ms)			5	10	10	10	5
MINIMUM LIFE (Operations)			100,000	100,000	100,000	100,000	100,000
DIELECTRIC STRENGTH (VRMS min.)			1000	1250	1250	1250	1000
TEMPERATURE RANGE			−55°C TO +85°C	−45°C TO +85°C	−45°C TO +85°C	−45°C TO +85°C	−55°C TO +85°C
WEIGHT (ozs.)		WITH COVER	N/A	3.0	3.0	N/A	N/A
		WITHOUT COVER	1	2.5	2.0	2.5	1.0
HERMETICALLY SEALED			NO	NO	NO	NO	NO
PHYSICAL SIZE (inches)		L x W x H	1.031 X 1.062 X .968	1.531 X 1.406 X 2.206	1.375 X 1.375 X 2.187	1.750 X 1.281 X 1.406	1.187 X 1.137 X 1.162
U/L RECOGNIZED			YES	YES	YES	PENDING	NO

NOTE: .1875" Faston Connector used in Series 12, 14
.110" x .025 Faston Connector (Contacts) — Series 39
.110" x .016 Faston Connector (Coils) — Series 39
Two #8-32 and two #6-32 Screw Terminals — Series 512
Two .250 x .032 and two .187 x .032 Quick Connect Terminals — Series 513

AND SOLID STATE RELAYS

27	28	29	38	39	54	57	512/513
SPDT 3 28DC/115AC	SPDT 3 to 10 28DC/115AC	SP 3 or 10 28DC/115AC	DPDT 3 28DC/115AC	2PNO or DT 10 28DC/115AC	2-4PDT 3 to 10 28DC 115/400AC	2-4PDT 3-10 28DC 115/400AC	SOLID STATE SPNO 10 115AC
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13 50 200 800 — — —	107 440 1760 7000 — — —	27 107 440 1760 — — —	26 102 410 1640 — — —	11 44 175 700 — — —	— 27 108 — 430 1800 7200	— 28 111 — 450 1750 9100	Control Voltage 3-30VDC
— X —	— X —	— X —	— X —	X — See Note	X X —	X — X	— — See Note
10	10	20	15	15	15	25	8.3
5	5	20	5	10	10	10	8.3
100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,000,000
1000	1000	1000	500	1500	1000	1000	1500
−45°C TO +85°C	−55°C TO +85°C	−55°C TO +85°C	−55°C TO +85°C	−45°C TO +85°C	−55°C TO +85°C	−55 C TO +85 C	−30°C TO +100°C
0.5 N/A	1.0 N/A	1.2 N/A	1.0 N/A	2 N/A	3.5 1.7	5 3	4 —
NO	NO	NO	NO	NO	YES	YES	NO
.97 X .67 X .81	1.219 X .755 X 1.188	1.460 X .785 X 1.188	1.219 X .781 X 1.188	1.609 X 1.093 X 1.407	1.922 X 1.344 X .953	1.438 X 1.656 X 2.984	2.25 X 1.75 X .87
YES	YES	YES	YES	SOME MODELS	NO	NO	NO

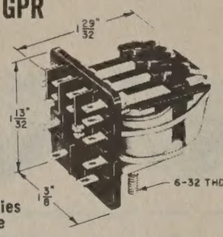
Additional data and literature on request. Write today.

NORTH AMERICAN PHILIPS CONTROLS CORP.

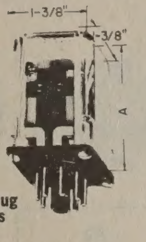
Frederick, Md, 21701 • (301) 663-5141

OHMITE® electro-mechanical relays

MODEL GPR



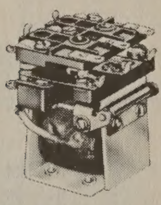
GPR Series 4-Pole

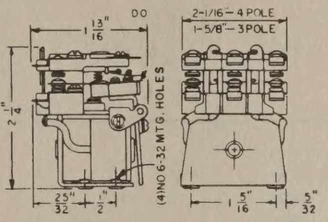


For Octal Plug GPR Series

Simple, rugged, low cost relays handling substantial power for small size. Uncomplicated design provides unusual flexibility for making and changing connection and mounting.

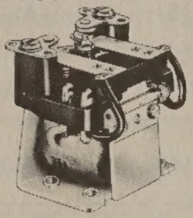
MODEL DO

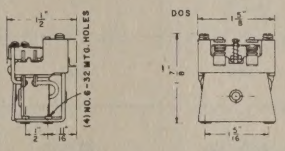




Particularly adaptable to aircraft and mobile equipment applications where severe shock and vibration are encountered. Design of molded parts around contact arms protects against mechanical injury. Stocked in 3-pole or 4-pole type, and also in hermetic enclosures and in latching types.

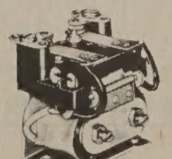
MODEL DOS

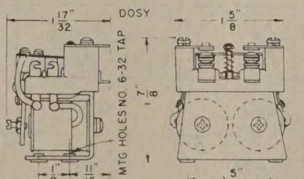




Wide application, general purpose relay, compact and lightweight. Handles loads usually demanded of much larger relays. Meets rigorous aircraft relay standards.

SENSITIVE MODEL DOSY





Similar in construction to Model DOS relay but equipped with twin coils for increased sensitivity. The DOSY relay is adaptable to a wide range of electronic control applications such as plate circuit controls, or as overload or underload controls in D.C. circuits to signal attainment of predetermined current levels.

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX

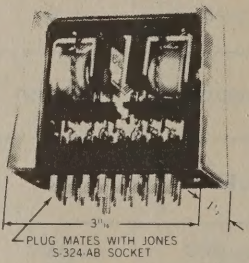
SPECIFICATIONS

	Coil Data				
Model	GPR	DO	DOS	GPR Latching	DOSY
6 VAC	.334-650 Amps	2.33 Amps	.890 Amps	.650 Amps	Maximum Pull In Current = 5 MA to 11 MA
12 VAC	.167-.309 Amps	1.28 Amps	.460 Amps	.309 Amps	
24 VAC	.084-.155 Amps	5.7 Amps	.269 Amps	.155 Amps	
115 VAC	.0174-.0325 Amps	1.10 Amps	.043 Amps	.0325 Amps	
230 VAC	.007-.0147 Amps	.070 Amps	.030 Amps	.0147 Amps	
6 VDC	.230 Amps	.487 Amps	.450 Amps	.350 Amps	
12 VDC	.114 Amps	.231 Amps	.210 Amps	.185 Amps	
24 VDC	.060 Amps	.105 Amps	.105 Amps	.093 Amps	
110 VDC	.011 Amps	.022 Amps	.022 Amps	.022 Amps	
220 VDC	——	.014 Amps	.013 Amps	——	
Coil AC Wattage	1.6-2.4 W.	6 W.	3 W.	1.6-2.4 W.	1 W.
DC	1.4 W.	3 W.	2.5 W.	2.4 W.	1 W.

Maximum Contact Arrangement	4PDT	4PDT	DPDT	6PDT	DPDT
Contact Rating	5 Amp & 10 Amp	10 Amp & 20 Amp	15 Amp & 25 Amp	5 Amp	15 Amp
Weight (Unenclosed)	2.5-3.5 oz.	5-6 oz.	4 oz.	7 oz.	4.5 oz.
Enclosures Available	Yes	Yes	Yes	Yes	No

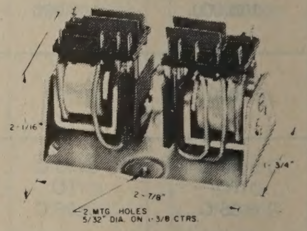
MANY MODELS ARE UL RECOGNIZED AND CSA LISTED

MODEL GPR LATCHING RELAYS

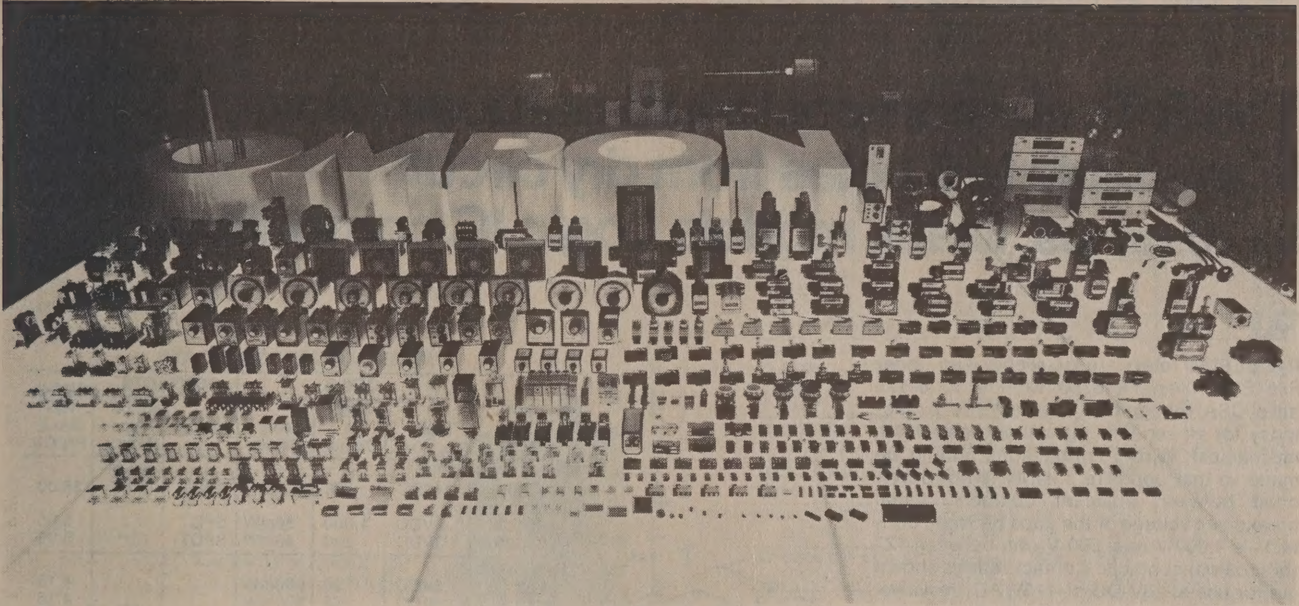


Enclosed Latching Relay

Relay 6PDT Latching



Latching relays consist of two GPR relays with armatures linked so that the n.o. contacts of one are mechanically latched in closed position when, and after, this relay is energized. When 2nd relay is energized, first relay restores and latches 2nd. Permits switching of twice the number of circuits and holding without coil current.



Omron manufactures a broad line of quality control components and devices. Allow Omron to satisfy your needs.
Write for more information.

Relays
- General Purpose
- Hermetically Sealed
- Subminiature
- Power
- Reed
- Solid-State
- Special Purpose
  - Impulse
  - Stepping
  - Latching
  - Time Delay

Switches
- General Purpose Snap-action
- Miniature Snap-action
- Subminiature Snap-action
- Special Purpose Snap-action
- Diecast limit
- Enclosed limit
- Multiple limit
- Manual input devices

Timers
- Synchronous Motor
- Solid-State
- Pneumatic

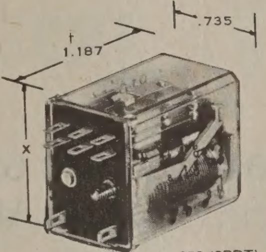
See list of distributors under Manufacturers Listings.

OMRON

Omron Electronics Inc.
233 S. Wacker Drive
Chicago, Illinois 60604
Phone: (312) 876-0800

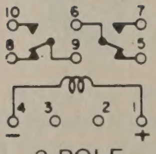
The R10, our compact multi-purpose relay, is available to 8 poles from dry circuit to 10 amps. Many models Logic IC compatible.

R10 SERIES relays are UL recognized under File E42810 and E46750. Models to 6PDT have CSA recognition. Contact life expectancy for all series is 10 million operations, mechanical. Wiring connections should be made so that opposite polarity is not developed between adjacent contacts. Initial breakdown voltage of the gaps between contacts is 1,000 V rms; 500 V rms between "Z" (bifurcated) contacts. Contact ratings shown are for use at 28V DC or 115V AC, resistive. Maximum current is shown in parenthesis. "E1" relays have .012" x .080 x .210" long solder terminals with #3-48 mounting stud. "V" relays are DC voltage actuated. Pickup is approximately 75% of rated coil voltage. Dropout is 10% minimum. "J" relays are current actuated (DC). Maximum pickup is listed in "Input" column. "SS" relays are sensitive DC voltage actuated. Maximum pickup power of SPDT R10 — SS1.0K and — SS220 is 20 mW DC @ 25°C. Weight is 0.8 to 1.4 oz.

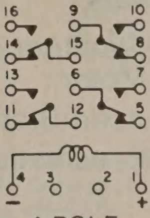


R10-E1

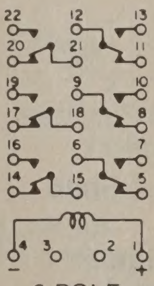
X = .950 (2PDT)
1.165 (4PDT)
†1.500 R10S



2 POLE



4 POLE



6 POLE

R10 SERIES TYPICAL CONTACT LIFE FOR SWITCHING RESISTIVE LOADS AT 25°C

Current	Voltage	Contacts	Adjustment	Life (Operations)
10.0 Amp*	115 vac. 60 Hz	W	V	2.5 x 10^4
10.0 Amp	28 vdc	W	V	5 x 10^4
5.0 Amp*	115 vac. 60 Hz	X	V	5 x 10^4
5.0 Amp	28 vdc	X	V	5 x 10^4
2.0 Amp	28 vdc	Y, Z	V	1.5 x 10^6
2.0 Amp	28 vdc	Y, Z	S, J	6 x 10^5
1.0 Amp	28 vdc	Y, Z	V, S, J	12 x 10^6
100 ma	28 vdc, 115 vac	Y, Z	V, S, J	1 x 10^8
50 ma	6 vdc	Z	V, J	5 x 10^7

*Use ungrounded frame for AC loads 5 amps and above.

GENERAL PURPOSE RELAYS

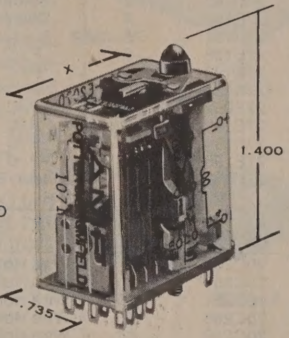
TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Typ. (Max.)	
R10-E1-W4						
-V700	24VDC	700	820mW	4PDT	• 7.5 (10)*	$6.00
R10-E1-Y1						
-SS1.0K	6VDC	1,000	36mW	SPDT	• 2 (3)*	5.05
-SS220	3VDC	220	40mW	SPDT		5.05
R10-E1-Y2						
-V28	5VDC	28	900mW	2PDT	•* 2 (3)	4.15
-V52	6VDC	52	690mW			4.15
-V185	12VDC	185	770mW			4.15
-V700	24VDC	700	820mW			4.15
-V2.5K	48VDC	2,500	920mW			4.15
-V15.0K	115VDC	15,000	880mW			6.55
R10-E1-Y4						
-V52	6VDC	52	690mW	4PDT	•* 2 (3)	4.55
-V185	12VDC	185	770mW			4.55
-V700	24VDC	700	802mW			4.55
-V2.5K	48VDC	2,500	920mW			4.55
-V15.0K	115VDC	15,000	880mW			6.95
R10-E1-Y6						
-V25	6VDC	25	1.4W	6PDT	•* 2 (3)	5.95
-V90	12VDC	90	1.6W			5.95
-V430	24VDC	430	1.3W			5.95
-V1.5K	48VDC	1,500	1.5W			5.95
-V9.0K	115VDC	9,000	1.5W			7.00
R10-E1-X2						
-V28	5VDC	28	900mW	2PDT	•* 5 (7.5)	4.30
-V52	6VDC	52	690mW			4.30
-V185	12VDC	185	770mW			4.30
-V700	24VDC	700	802mW			4.30
-V2.5K	48VDC	2,500	920mW			4.30
-V15.0K	115VDC	15,000	880mW			6.70
R10-E1-X4						
-V52	6VDC	52	690mW	4PDT	•* 5 (7.5)	4.85
-V185	12VDC	185	770mW			4.85
-V700	24VDC	700	820mW			4.85
-V2.5K	48VDC	2,500	920mW			4.85
-V15.0K	115VDC	15,000	880mW			7.25
R10-E1-X6						
-V25	6VDC	25	1.4W	6PDT	•* 5 (7.5)	6.40
-V90	12VDC	90	1.6W			6.40
-V430	24VDC	430	1.3W			6.40
-V1.5K	48VDC	1,500	1.5W			6.40
-V9.0K	115VDC	9,000	1.5W			7.40
R10-E1-W2						
-V185	12VDC	185	770mW	2PDT	•* 7.5 (10)	4.95
-V700	24VDC	700	820mW			4.95
R10-E1-Z2						
-V52	6VDC	52	690mW	2PDT	•* 0.1 (2)	4.60
-V185	12VDC	185	770mW			4.60
-V700	24VDC	700	820mW			4.60
-V2.5K	48VDC	2,500	920mW			4.60
-V15.0K	115VDC	15,000	880mW			7.00
R10-E1-Z4						
-V52	6VDC	52	690mW	4PDT	•* 0.1 (2)	5.20
-V185	12VDC	185	770mW			5.20
-V700	24VDC	700	820mW			5.20
-V2.5K	48VDC	2,500	920mW			5.20
-V15.0K	115VDC	15,000	880mW			7.60
R10-E1-Z6						
-V25	6VDC	25	1.4W	6PDT	•* 0.1 (2)	6.75
-V90	12VDC	90	1.6W			6.75
-V430	24VDC	430	1.3W			6.75
-V1.5K	48VDC	1,500	1.5W			6.75
-V9.0K	115VDC	9,000	1.5W			7.80

• Denotes U/L
* Denotes CSA

POTTER & BRUMFIELD RELAYS

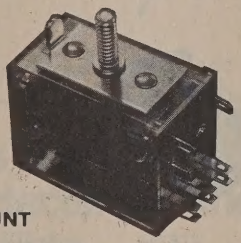
R10L SERIES Has a light emitting diode (LED) indicator. LED produces highly visible red light when relay coil is energized. Especially useful when troubleshooting an instrument, equipment, or system. LED has long operating life and high reliability. Other operating characteristics same as standard R10 Series relays. LED is available on relays with coils up to 48 volts DC. Relays fit standard R10 Series sockets.

Note: Observe polarity indicated when wiring R10L- with LED.



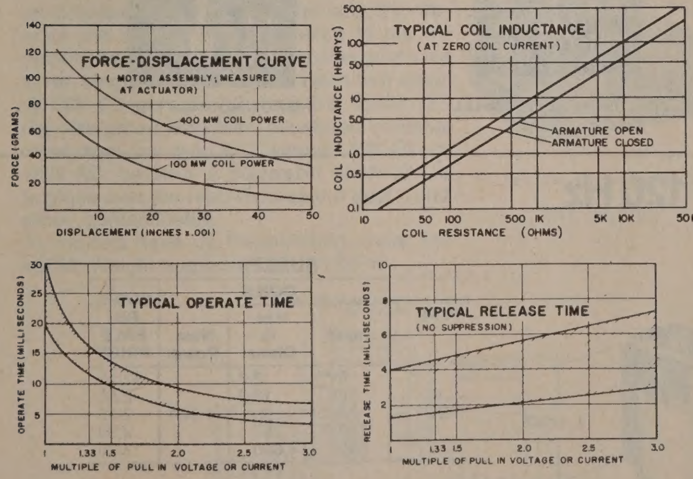
X= FROM .95 (2 POLE) TO 1.580 MAX. (8 POLE)

R10-E6 is a standard R10-E1 (solder terminals) fitted with a bracket on the narrow side of its case for chassis mounting. The bracket has one #6-32 x .375" stud and one locating tab on .437" centers.



R10 E6
BRACKET MOUNT

R10 PERFORMANCE GRAPHS



GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Typ. (Max.)	
R10-E1-Y2						
-J2.5K	5.8mA	2,500	85mW	2PDT ●*	2 (3)	$ 4.50
-J5.0K	4.1mA	5,000	84mW			5.10
-J10.0K	3.1mA	10,000	96mW			5.50
R10-E1-Y4						
-J2.5K	8.4mA	2,500	176mW	4PDT ●*	2 (3)	4.95
-J5.0K	6.2mA	5,000	192mW			5.55
-J10.0K	4.5mA	10,000	200mW			6.00
R10-E1-Z4						
-J1.0K	13.0mA	1,000	170mW	4PDT ●*	0.1 (2)	5.60
-J2.5K	8.4mA	2,500	176mW			5.60
-J5.0K	6.2mA	5,000	192mW			6.20
R10-E1-X2 -115VAC	115VAC	(Diodes) (2)9.0K	3VA	2PDT ●*	5 (7.5)	7.10
R10-E1-X4 -115VAC	115VAC	(Diodes) (2)9.0K	3VA	4PDT ●*	5 (7.5)	8.60
R10-E1-X6 -115VAC	115VAC	(Diodes) (2)7.5K	3VA	6PDT ●*	5 (7.5)	11.95
R10-E1-X8 -115VAC	115VAC	(Diodes) (2)7.5K	3VA	8PDT ●	5 (7.5)	14.40
R10-E2						
-W2-V700	24VDC	700	820mW	DPDT ●*	7.5 (10)	4.95
-X2-V28	5VDC	28	900mW	2PDT ●*	5 (7.5)	4.30
-X2-V700	24VDC	700	820mW			4.30
-Y2-V28	5VDC	28	900mW	2PDT ●*	2 (3)	4.15
-Y2-V185	12VDC	185	770mW			4.15
-Y2-V700	24VDC	700	820mW			4.15
-Y4-V185	12VDC	185	770mW	4PDT ●*	2 (3)	4.55
-Y4-V700	24VDC	700	820mW			4.55
-Y6-V90	12VDC	90	1.6W	6PDT ●*	2 (3)	5.95
-Y6-V430	24VDC	430	1.3W			5.95
-Y6-V1.5K	48VDC	1500	1.5W			5.95
-Z4-V185	12VDC	185	770mW	4PDT ●*	0.1 (2)	5.20
-Z4-V700	24VDC	700	820mW			5.20
-Z4-J2.5K	8.4mA	2500	176mW	4PDT ●*	0.1 (2)	5.60
-Z4-J5.0K	6.2mA	5000	192mW			6.20
-Z6-V90	12VDC	90	1.6W	6PDT ●*	0.1 (2)	6.75
-Z6-V430	24VDC	430	1.3W			6.75
-Z6-V1.5K	48VDC	1500	1.5W			6.75
R10L-E1						
-X2-V185	12VDC	185	770mW	2PDT	5 (7.5)	8.20
-X2-V700	24VDC	700	820mW			8.20
-X4-V185	12VDC	185	770mW	4PDT	5 (7.5)	8.75
-X4-V700	24V.DC	700	820mW			8.75
-X4-V2.5K	48VDC	2500	920mW			8.75
-X6-V430	24VDC	430	1.3W	6PDT	5 (7.5)	10.30
-Y2-V52	6VDC	52	690mW	2PDT	2 (3)	8.05
-Y2-V185	12VDC	185	770mW			8.05
-Y2-V700	24VDC	700	820mW			8.05
-Y2-V2.5K	48VDC	2500	920mW			8.05
-Y4-V52	6VDC	52	690mW	4PDT	2 (3)	8.45
-Y4-V185	12VDC	185	770mW			8.45
-Y4-V700	24VDC	700	820mW			8.45
-Y6-V430	24VDC	430	1.3W	6PDT	2 (3)	9.85
-Z4-V700	24VDC	700	820mW	4PDT	0.1 (2)	9.10
R10L-E2						
-Y2-V185	12VDC	185	770mW	2PDT	2 (3)	8.05
-Y4-V700	24VDC	700	820mW	4PDT	2 (3)	8.45
R10-E6-						
X2-V52	6VDC	52	690mW	2PDT	5 (7.5)	$4.65
-V185	12VDC	185	770mW	2PDT	5 (7.5)	4.65
-V700	24VDC	700	820mW	2PDT	5 (7.5)	4.65
-115V	115VAC	9.0 K	3VA	2PDT	5 (7.5)	7.45
X4-V185	12VDC	185	770mW	4PDT	5 (7.5)	5.25
-V700	24VDC	700	820mW	4PDT	5 (7.5)	5.25
-115V	115VAC	9.0 K	3VA	4PDT	5 (7.5)	8.95
Y2-V185	12VDC	185	770mW	2PDT	2 (3)	4.50
-V700	24VDC	700	820mW	2PDT	2 (3)	4.50
Y4-V185	12VDC	185	770mW	4PDT	2 (3)	4.95
-V700	24VDC	700	770mW	4PDT	2 (3)	4.95

• Denotes U/L
* Denotes CSA

POTTER & BRUMFIELD RELAYS

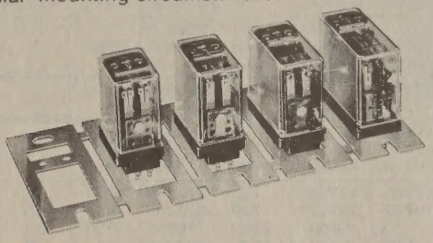
R10 sockets for chassis, PC board, strip or panel mounting multiply your design options.

MOUNTING STRIP FOR R10-R15 RELAYS
Contains twenty pre-punched break-away mounting plates stamped from .064" aluminum. Designed to simplify mounting one or more R10, R12, R13, R14, or R15 relays on chassis or racks. Each individual plate accepts a 2, 4, 6, or 8 pole solder terminal relay or socket.

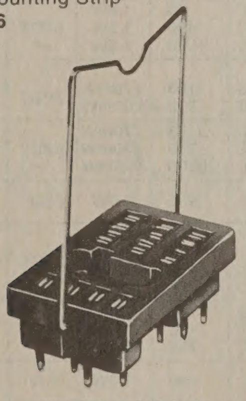
When a socket is used, it is held in place by one #3-48 screw and nut in the hole provided. Or, the relay may be mounted without a socket by inserting its mounting stud through the hole in the plate and fastening a #3-48 nut on relay stud.

Single plates may be mounted over a rectangular hole measuring 1.62" x .750" maximum or a 1.62" round hole.

For rack or panel installation, the entire 20-piece strip (approx. 24" long) may be mounted. Reinforcing of the strip may be required depending on the number of plates used and the particular mounting circumstances.



R10 Mounting Strip
37D556 **LIST $2.73**



WIRE HOLD-DOWN SPRING

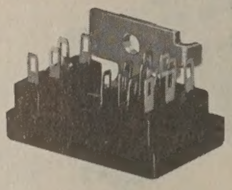
SOCKETS FOR R10 SERIES

Part No.	No. Of Poles	Terminal	Grounding Provision	Hold Down Spring*	List Price
27E125	2	Solder	Strip	20C249	$ .62
27E126	4	Solder	Strip	20C250	.79
27E127	6	Solder	Strip	20C251	1.01
27E211	8	Solder	Strip	20C266	1.55
27E162	2	Solder	None	20C249	.62
27E163	4	Solder	None	20C250	.79
27E164	6	Solder	None	20C251	.96
27E128	2	P/C	Strip	20C249	.62
27E129	4	P/C	Strip	20C250	.79
27E130	6	P/C	Strip	20C251	1.22
27E254	8	P/C	Strip	20C266	1.55
27E193	2	P/C	Terminal	20C249	.62
27E194	4	P/C	Terminal	20C250	.79
27E195	6	P/C	Terminal	20C251	1.22
27E152	4	Solder/Bkt.Mt.	Strip	20C250	1.11

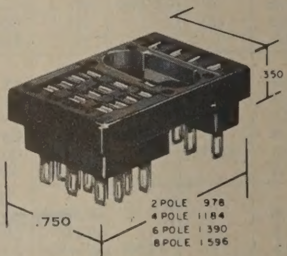
Part No.	No. of Poles	Description	List Price
20C249	2	Wire Hold Down Spring	.07
20C250	4	Wire Hold Down Spring	.07
20C251	6	Wire Hold Down Spring	.07
20C266	8	Wire Hold Down Spring	.07
20C259	All	Wire Hold Down Strap (P/C only)	.07
20C300	2	Wire Hold Down Spring for 2 pole R10S only	.09
20C301	4	Wire Hold Down Spring for 4 pole R10S only	.09

NOTE: Sockets with grounding provision not recommended for currents of 5 amps AC and above.

*Not included with socket.

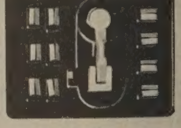


27E152



R10 RELAY SOCKET

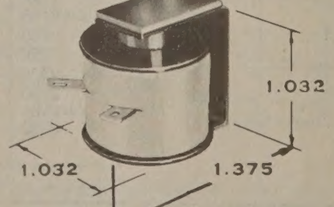
GROUNDING TERMINAL



GROUNDING STRIP

BU buzzer provides dependable 120 Hz signal source.

BU BUZZER AC operated coil with a spring steel armature which buzzes when coil is energized. Used extensively in test equipment, laboratories and a host of other applications where a small light weight, dependable buzzer is required. Recognized under the Component Program of Underwriters' Laboratories, Inc. (File No. S1154). Weight: 1⅝ ozs. Mounting: No. 6-32 tapped core.



BUZZER

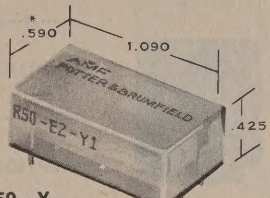
TYPE	COILS			SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	
• BU	6V	2.7	4.6VA	$2.55
	12V	13.2		2.55
	24V	50		2.55
	120V	1,250		2.55
	240V	4,600		3.20

• Denotes U/L

Our lowest cost general purpose PC board relay, the R50, switches up to 6 amps.

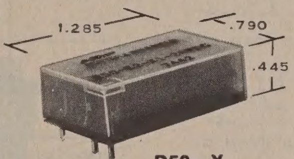
R50-Y1 and Y2 relays seat .425″ high for use on printed circuit boards spaced as close together as 0.6″ center-to-center. Nominal pick-up power for R50-Y1 is 330 mW DC; for the R50S-Y1, 160 mW DC; for the R50-Y2, 410 mW DC; for the R50S-Y2, 290 mW DC; and for the R50-X1 from 450 to 562 mW DC. Pickup is approximately 75% of rated coil voltage. Dropout is 5% minimum. All models are covered with a molded polyester case and have gold-plated pc terminals spaced on a 0.1″ grid. Contact life expectancy at rated load is 500,000 operations, minimum. All models are U/L recognized.

Contact rating: R50, 2 amps @ 28V DC or 1 amp @ 120 AC resistive. R50S, 1 amp @ 28V DC or 0.5 amp @ 120V AC resistive. R50-X1, 5 amps @ 28V DC or 2.5 amps @ 120V AC resistive. Approximate weight: R50-Y1, 0.3 oz.; R50-Y2 and R50-X1, 0.5 oz.



R50—Y

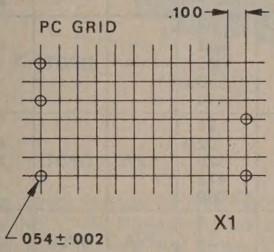
*.590 SPDT *.885 DPDT

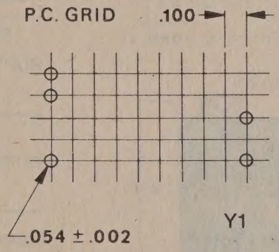


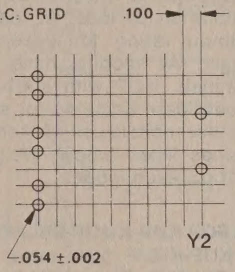
R50—X

GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input VDC	Res. in Ohms.	Nom. Power	Arrang.	Amps. Typ. (Max.)	
R50-E2-Y1	5V	43	580mW	SPDT	• 2 (3)	$2.95
	6V	47	770mW			2.95
	12V	200	720mW			2.95
	24V	950	610mW			3.10
	48V	3000	765mW			3.60
R50-E2-Y2	5V	32	780mW	DPDT	• 2 (3)	3.90
	6V	45	800mW			3.90
	12V	170	845mW			3.90
	24V	670	860mW			4.00
	48V	2500	920mW			4.65
R50-E2-X1	5V	25	1.0W	SPDT	• 5 (6)	3.50
	6V	37	1.0W			3.50
	12V	125	1.1W			3.50
	24V	440	1.3W			3.65
R50S-E2-Y1	5V	64	390mW	SPDT	• 1 (2)	2.85
	6V	66	545mW			2.85
	12V	330	435mW			2.85
	24V	950	600mW			3.00
R50S-E2-Y2	5V	42	590mW	DPDT	• 1 (2)	3.70
	6V	60	600mW			3.70
	12V	260	555mW			3.70
	24V	670	860mW			3.80





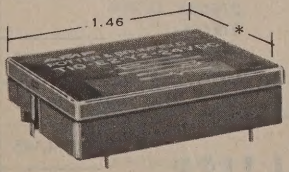


Low-profile T10 relays feature 4 amp permissive-make contacts. And they are TTL buffer compatible.

T10 is a DC operated relay only .425″ high, allowing printed circuit boards to be mounted on 0.6″ centers. It has permissive-make contacts noted for low bounce and long life. Operate and release times are each 15 ms, including bounce. Suffix "Y" denotes gold-clad silver, single-button contacts rated to 3 amps @ 28V DC or 120V AC, resistive. Suffix "Z" denotes gold-clad silver, bifurcated contacts rated from low level to 1 amp @ 60V DC or 120V AC, resistive. A polyester cover snaps in place over the relay to keep out dust and other contaminates.

All models have UL Recognition under file 46750. Weight is approximately 1.06 oz.

* 2PDT 1.22
4PDT 1.52
6PDT 1.82



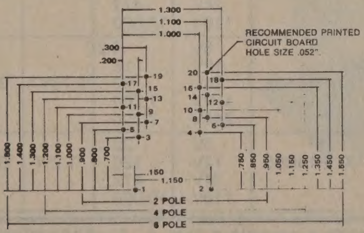
SEATED HEIGHT .425 MAX.

T10 SERIES

GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input VDC	Res. in Ohms.	Nom. Power	Arrang.	Amps. Typ. (Max.)	
T10-E2-Y2	5	54	460mW	DPDT	• 3 (4)	$4.20
	6	77	470mW			4.20
	12	310	465mW			4.20
	24	1200	480mW			4.20
	48	4800	480mW			4.85
T10-E2-Z2	5	54	460mW	DPDT	• 1 (2)	4.65
	6	77	470mW			4.65
	12	310	465mW			4.65
	24	1200	480mW			4.65
	48	4800	480mW			5.30
T10-E2-Y4	6	48	750mW	4PDT	• 3 (4)	4.75
	12	190	760mW			4.75
	24	769	750mW			4.75
	48	3050	755mW			5.35
T10-E2-Z4	6	48	750mW	4PDT	• 1 (2)	5.40
	12	190	760mW			5.40
	24	769	750mW			5.40
	48	3050	755mW			6.00
T10-E2-Y6	6	31	1.2W	6PDT	3 • (4)	6.40
	12	122	1.2W			6.40
	24	480	1.2W			6.40
	48	1900	1.2W			7.90
T10-E2-Z6	6	31	1.2W	6PDT	1 • (2)	7.20
	12	122	1.2W			7.20
	24	480	1.2W			7.20
	48	1900	1.2W			8.70

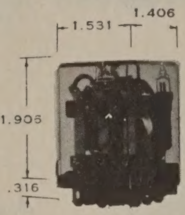
PRINTED CIRCUIT BOARD HOLE LAYOUT
BOTTOM VIEW



• Denotes U/L

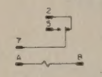
POTTER & BRUMFIELD RELAYS

Now, KU relays are available with 5 volt coils—operate from the same 5 volt source used to drive T^{2}L circuits.

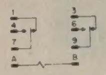


KUP-KUMP relays have polycarbonate dust cover, are UL Recognized under file E22575, and CSA Listed under file 15734. Models with suffix "25" have push-to-test button to manually actuate contacts for circuit testing. Models with suffix "35" have highly visible neon lamp to indicate coil power. Models with suffix "45" have both button and lamp.

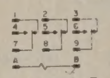
Contact ratings of all KUP models are for duty at either 28V DC or 240V AC, 80% PF. Power rating of 10 amp contacts is ¼ HP, 120V AC; and ⅓ HP, 240V AC, 80% PF. The 5 amp contacts are rated 1/10 HP, 120V AC; and ¼ HP, 240V AC, 80% PF.



1 FORM C

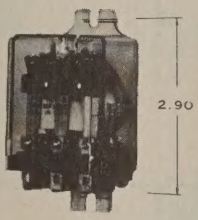


2 FORM C



3 FORM C

KUMP contacts are rated 15 amps, 277V AC, 80% PF; ¼ HP, 120V AC; and ⅓ HP, 240V AC. Contact life expectancy for both relay series is 10 million operations, mechanical, and 100,000 operations at full load. At loads of less than maximum rating, life expectancy rises accordingly. All models have .187" QC/solder terminals. KUP with suffix "55" has bracket mount case unsuited for socket mounting. All other models use sockets and hold-down springs listed below. Weight is approximately 3 oz. each model.

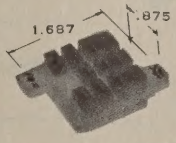


SOCKETS FOR KUP-KUMP RELAYS

For mounting KUP-KUMP plain case, KUA, KUL, and KUR RELAYS; CL and CU time delays. All sockets are UL Recognized for 10 amps at 240V AC.

SPDT/DPDT/3PDT pierced solder terminal socket rated 10 amps. Molded nylon; has two .165" dia. mounting holes.

27E043 **LIST $ .95**



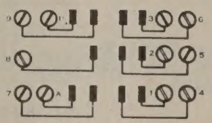
27E043
27E046
27E067

SPDT/DPDT/3PDT printed circuit terminal, 10 amp socket accepts. .186" relay terminals. Molded nylon; has two .165" dia. mounting holes.

27E046 **LIST $1.11**

SPDT/DPDT/3PDT .187" quick-connect terminal socket rated 10 amps. Molded nylon; has two .187" dia. mounting holes.

27E067 **LIST $1.48**

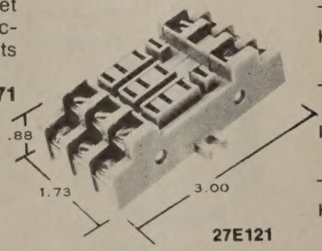


Hold-down spring will accommodate machine screws or rivets.

20C228 **LIST $ .21**

SPDT/DPDT/3PDT screw terminal socket rated 10 amps. Molded polycarbonate; accepts .187" relay terminals; mounting slots accept #6 screws.

27E121 **LIST $4.71**



27E121

GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rat-ing	
KUMP11A18	6V	6	2VA	DPDT	*• 15	$6.90
	12V	24				6.90
	24V	85				6.90
	120V	2,250				6.90
	240V	9,110				7.55
KUMP11D18	5V	21	1.2W	DPDT	•* 15	6.30
	6V	32.1				6.30
	12V	120				6.30
	24V	472				6.30
	110V	10,000				7.05
KUP5A15	6V	5.1	2VA	SPDT	•* 10	5.30
	12V	21				5.30
	24V	85				5.30
	120V	2,250				5.30
	240V	9,110				5.95
KUP5D15	5V	21	1.2W	SPDT	•* 10	5.10
	6V	32.1				5.10
	12V	120				5.10
	24V	472				5.10
	110V	10,000				5.85
KUP11A11	120V	2,250	2VA	DPDT	* •5	6.20
KUP11D11	24V	472	1.2W	DPDT	* •5	5.60
KUP11A15	6V	6	2VA	DPDT	•* 10	6.30
	12V	24				6.30
	24V	85				6.30
	120V	2,250				6.30
	240V	9,110				6.95
KUP11D15	5V	21	1.2W	DPDT	•* 10	5.70
	6V	32.1				5.70
	12V	120				5.70
	24V	472				5.70
	110V	10,000				6:45
KUP11A35	6V	6	2VA	DPDT	10*•	7.40
	12V	24				7.40
	24V	85				7.40
	120V	2,250				7.40
KUP11D35	12V	120	1.2W	DPDT	10*•	7.50
	24V	472				7.50
	110V	10,000				8.25
KUP14A11	120V	2,250	2.75VA	3PDT	*• 5	6.90
KUP14A15	6V	4.2	2.75VA	3PDT	•* 10	7.00
	12V	18				7.00
	24V	72				7.00
	120V	1,700				7.00
	240V	7,200				7.65
KUP14D15	6V	32.1	1.2W	3PDT	•* 10	6.50
	12V	120				6.50
	24V	472				6.50
	110V	10,000				7.25
KUP14A25	120V	1,700	2,75VA	3PDT	10*•	7.60
KUP14A35	120V	1,700	2.75VA	3PDT	10*•	8.10
KUP14A45	120V	1,700	2.75VA	3PDT	10*•	9.25
KUP5A55	120V	2,250	2VA	SPDT	*•10	5.40
KUP5D55	24V	472	1.2W	SPDT	*•10	5.20
KUP11A55	24V	85	2VA	DPDT	*•10	6.40
	120V	2,250				6.40
KUP11D55	6V	32.1	1.2W	DPDT	•* 10	5.80
	12V	120				5.80
	24V	472				5.80
	110V	10,000				6.55
KUP14A55	6V	4.2	2.75VA	3PDT	•* 10	7.10
	12V	18				7.10
	24V	72				7.10
	120V	1,700				7.10
	240V	7,200				7.75
KUP14D55	6V	32.1	1.2W	3PDT	•* 10	6.60
	12V	120				6.60
	24V	472				6.60
	110V	10,000				7.35

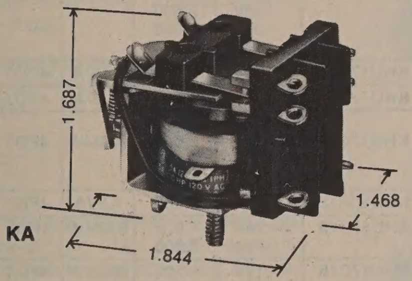
• Denotes U/L
* Denotes CSA

POTTER & BRUMFIELD PAGE 8

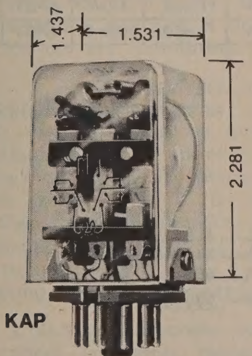
A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

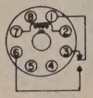
POTTER & BRUMFIELD RELAYS

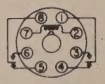
KA and KAP SERIES Small, low cost, highly efficient general purpose relays for handling light power loads such as small motors, solenoids and other relays, and general automation work. All KA and KAP relays have CSA listing (File No. LR-15734) and carry U/L component recognition (File No. E22575). Mechanical life expectancy: 10 million operations. Duty: Continuous. Contact rating: suffix AG and DG, 10 amps @ 120 VAC or 6 amps @ 240 VAC; suffix AY and DY, 5 amps @ 120 VAC or 3 amps @ 240 VAC. "G" suffix indicates silver-cadmium oxide.

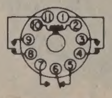


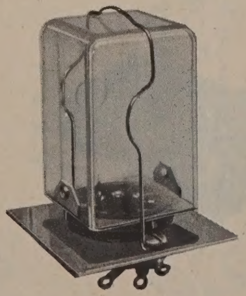
The KA is the open version of this series. Mounting: One No. 6-32 threaded stud and locating tab on .438 centers. Wt: 2 ozs. The KAP is the enclosed model and is protected by a clear polycarbonate dust cover. Terminals: 8 or 11-pin plug. Weight: 3 ozs.




KAP5


KAP11


KAP14



KAP HOLD-DOWN SPRING

Hold-down spring will accommodate machine screws or rivets.

20C206 **LIST $.19**

GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
KA5AY	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	SPDT	●* 5	$4.85 4.85 4.85 4.85 5.45
KA5AG	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	SPDT	●* 10	4.90 4.90 4.90 4.90 5.50
KA5DY	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	SPDT	●* 5	4.70 4.70 4.70 5.50
KA5DG	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	SPDT	●* 10	4.75 4.75 4.75 5.55
KA11AY	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	DPDT	●* 5	5.85 5.85 5.85 5.85 6.35
KA11AG	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	DPDT	●* 10	5.95 5.95 5.95 5.95 6.45
KA11DY	6V 12V 24V 48V 110V	32.1 120 472 1,800 10,000	1.2W	DPDT	●* 5	5.10 5.10 5.10 5.50 6.00
KA11DG	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	DPDT	●* 10	5.30 5.30 5.30 6.20
KA14AY	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	3PDT	●* 5	6.50 6.50 6.50 6.50 7.10
KA14AG	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	3PDT	●* 10	6.60 6.60 6.60 6.60 7.25
KA14DY	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	3PDT	●* 5	6.65 6.65 6.65 7.00
KA14DG	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	3PDT	●* 10	6.45 6.45 6.45 7.15
KAP5AG	24V 120V	85 2,250	2VA	SPDT	●* 10	8.30 8.30
KAP5DG	24V 110V	472 10,000	1.2W	SPDT	●* 10	8.05 9.10
KAP11AY	24V 120V 240V	85 2,250 9,110	2VA	DPDT	●* 5	9.10 9.10 9.60
KAP11AG	6V 24V 120V	6 85 2,250	2VA	DPDT	●* 10	9.25 9.25 9.25
KAP11DG	24V 110V	472 10,000	1.2W	DPDT	●* 10	9.20 10.10
KAP11DY	12V 24V 110V	120 472 10,000	1.2W	DPDT	●* 5	9.05 9.05 9.95
KAP14AY	24V 120V 240V	85 2,250 9,110	2VA	3PDT	●* 5	11.25 11.25 11.70
KAP14AG	24V 120V	85 2,250	1.2W	3PDT	●* 10	11.40 11.40
KAP14DG	24V 110V	472 10,000	1.2W	3PDT	●* 10	11.35 12.25
KAP14DY	12V 24V 110V	120 472 10,000	1.2W	3PDT	●* 5	11.15 11.15 11.95

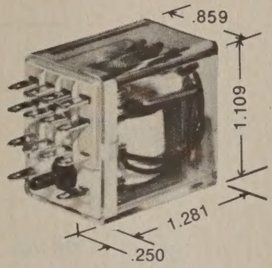
● Denotes U/L
* Denotes CSA

POTTER & BRUMFIELD PAGE 9 A—Alternating Current, e.g. PRD3**A**
D—Direct Current, e.g. PRD3**D**

POTTER & BRUMFIELD RELAYS

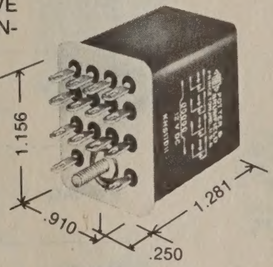
KH series relays switch to eight circuits from low level to 3 amps in little more than one cubic inch.

KHU/KHS SERIES small, rugged 4PDT relays are available for AC or DC operation. KHU relays are recognized under the Component Program of UL and CSA. KHU has clear polycarbonate dust cover; KHS is hermetically sealed in metal enclosure. Relays are designed to meet exacting requirements of data processing, computer and process control applications. Various contacts available: suffix "1" denotes gold-flashed silver rated 3 amps @ 30V DC or 120V AC, resistive; suffix "2" denotes silver-cadmium oxide rated 3 amperes; suffix "3" indicates gold alloy contacts for low level to 1.0 amp applications; suffix "6" indicates gold overlay on silver, bifuracted contacts rated 1 amp @ 30V DC, resistive, or 120V AC. Suffix "N" denotes a neon lamp in parallel with the coil to provide visual indication that power is reaching the coil. Mounting: Solder terminals with No. 3-48 stud .312" long. All relays fit sockets (below) with printed circuit or solder lug terminals. Weight without sockets: KHU 1.12 oz.; KHS 1.63 oz.



KHU

NOTE, KHS RELAYS SHOULD NOT HAVE FRAMES GROUNDED WITHOUT CONSULTING FACTORY FOR LOAD LEVELS.



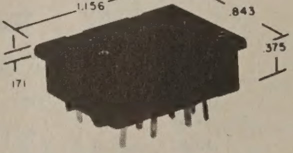
KHS

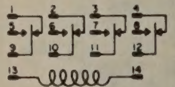
SOCKETS

KHS, KHU relays and CD-31 time delays

4PDT solder terminal sockets 27E006 and socket retainer 24A032.

27E006	**LIST $.75**
24A032	**LIST $.05**





4PDT printed circuit terminal socket.

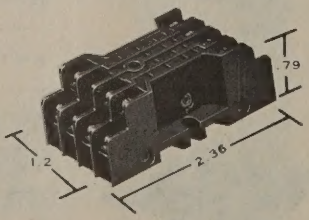
27E007	**LIST $.78**

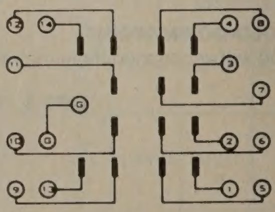
Hold-down spring.

20C217	**LIST $.14**

4PDT screw terminal socket rated 5 amperes. No hold-down spring required.

27E166	**LIST $7.21**





GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rat-ing	
KHU17A11	6V 12V 24V 120V	10.5 43 160 3,900	1.2VA	4PDT	•* 3	$7.60 7.60 7.60 7.80
KHU17A11N	120V	3,900	1.2VA	4PDT	*•3	10.05
KHU17D11	5V 6V 12V 24V 48V 90V 110V	28 40 160 650 2,600 9,000 11,000	900MW	4PDT	•* 3	6.60 6.60 6.60 6.60 6.80 7.55 7.55
KHU17D11N	120V	11,000	1.2VA	4PDT	*•3	9.80
KHU17A12	120V	3,900	1.2VA	4PDT	*•3	7.85
KHU17D12	12V 24V 48V 110V	160 650 2,600 11,000	900MW	4PDT	3*	6.55 6.55 6.75 7.50
KHU17A13	120V	3,900	1.2VA	4PDT	1*	20.30
KHU17D13	24V 48V	650 2,600	900MW	4PDT	1*	19.10 19.30
KHU17D16	12V 24V	160 650	900MW	4PDT	•* 1	9.25 9.25
KHS17A11†	6V 12V 24V 120V	10.5 43 160 3,900	1.2VA	4PDT	3	13.30 13.30 13.30 13.50
KHS17A12†	120V	3,900	1.2VA	4PDT	3	13.25
KHS17A13†	120V	3,900	1.2VA	4PDT	3	23.00
KHS17D11†	6V 12V 24V 110V	40 160 650 11,000	900MW	4PDT	3	12.30 12.30 12.30 13.25
KHS17D12†	24V 110V	650 11,000	900MW 1.0W	4PDT 4PDT	3 3	11.30 13.20
KHS17D13†	24V	650	900mW	4PDT	2	21.80

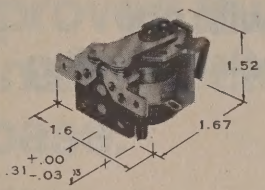
SPECIFY COIL VOLTAGE OR RESISTANCE WHEN ORDERING

• Denotes U/L † Sealed Relay
* Denotes CSA

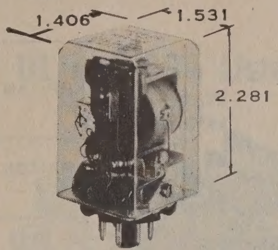
A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

POTTER & BRUMFIELD RELAYS

KR3-H SERIES Ruggedly constructed but of small size, KR3-H is a heavy duty relay especially designed for applications where limited space is a factor. Its heavy duty copper-alloy movable contact carrier has twin silver-cadmium oxide contacts rated 20 amps @ 120V AC 60 Hz, resistive, or 28V DC; 1 HP 120/240V 60 Hz. Contact arrangement is 1 Form X (SPST-NO-DM) only. Terminals: suitable for .250" quick connect, also solder; for contacts: solder only for coil. Size: 1.6" x 1.671" x 1.52". Seated height: 1.21". Mounting: One No. 6-32 stud and locating tab on .437" center. Weight: 2 ozs.



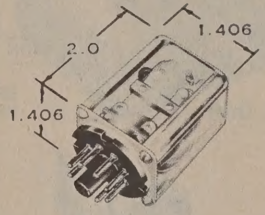
KRP3-H SERIES All electrical specifications listed above for the KR3-H series relays apply to the KRP3-H. However, the KRP3-H is enclosed in a clear polycarbonate dust cover and features an octal plug-in base. Weight: Approximately 3 ozs.



KRP3-H Hold-Down Spring

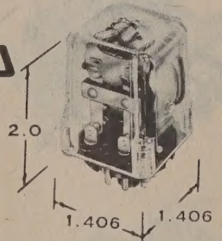
Hold-down spring will accommodate machine screws or rivets.

20C206 **LIST $.19**

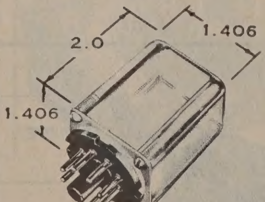


KR11-E and KR14-E SERIES Hermetically sealed in a metal can. Has octal-type plug and gold-flashed silver contacts rated 5 amps @ 120V AC, 80% P.F., or 28V DC, resistive. Suffix "G" denotes silver cadmium oxide contacts rated 10 amps @ 120V AC, 80% P.F., or 28V DC, resistive.

KRP SERIES Versatile, multi-contact arrangement. Enclosed in a clear polycarbonate dust cover. Standard 8-pin octal-type plug. for KRP5 and KRP11, 11-pin for KRP-14. Weight: Approx. 3 ozs. Contacts: 5 amp, Gold flashed silver, 10 amp silver-cadmium oxide. See KCP-KRP hold-down spring for special mounting applications. See KRP-N indicator lamp relay for current monitoring applications.



KRP-N INDICATOR **LAMP RELAY** A general purpose relay incorporating a lamp to indicate current or voltage availability in power circuit. Contacts: Silver-cadmium oxide rated 10 amps. Enclosures: Clear, polycarbonate dust cover. Mounting: Standard octal plug. Weight: Approximately 3 ozs. Hold-down spring (Please see Page 10).



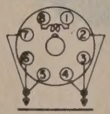
"P" Case is a clear polycarbonate case for mounting rectifiers, capacitors, resistors or other components. Octal type termination. 8 pin, 35D070. 11 pin, 35D072. Comes with four screws. Weight: 0.5 oz.

35D070 **LIST $.84**
35D072 **LIST $1.01**

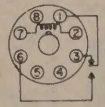
Hold-down spring for "P" Case, and KRP series relays will accommodate machine screws or rivets.

20C176 **LIST $.21**

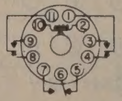
KRP3AH



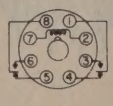
KRP5



KRP14



KRP11



GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
KR3AH	12V 24V 120V	21 85 2,250	2VA	SPST-NO-DM	20	$6.00 6.00 6.00
KR3DH	12V 24V 110V	120 472 10,000	1.2W	SPST-NO-DM	20	5.85 5.85 6.60
KR11AE†	120V	2,250	2VA	DPDT	5	20.05
KR11AGE†	120V	2,250	2VA	DPDT	10	20.25
KR11DE†	24V	472	1.2W	DPDT	5	18.45
KR11DGE†	24V	472	1.2W	DPDT	10	19.05
KR14AGE†	120V	2,250	2VA	3PDT	10	27.10
KRP3AH	12V 24V 120V	21 85 2,250	2VA	SPST-NO-DM	20	9.45 9.45 9.45
KRP3DH	12V 24V 110V	120 472 10,000	1.2W	SPST-NO-DM	20	9.20 9.20 10.10
KRP5A	6V 12V 24V 120V	6 21 85 2,250	2VA	SPDT	•5	8.05 8.05 8.05 8.05
KRP5AG	6V 12V 24V 120V	6 21 85 2,250	2VA	SPDT	•10	8.40 8.40 8.40 8.40
KRP5D	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	SPDT	•5	8.00 8.00 8.00 9.00
KRP5DG	6V 12V 24V 110V	32.1 120 472 10,000	1.2W	SPDT	•10	8.30 8.30 8.30 9.20
KRP11A	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	DPDT	•5	9.05 9.05 9.05 9.05 9.60
KRP11AG	6V 12V 24V 120V 240V	6 12 85 2,250 9,110	2VA	DPDT	•10	9.35 9.35 9.35 9.35 9.95
KRP11D	6V 12V 24V 48V 110V	32.1 120 472 1,800 10,000	1.2W	DPDT	•5	9.00 9.00 9.00 9.45 9.90
KRP11DG	6V 12V 24V 48V 110V	32.1 120 472 1,800 10,000	1.2W	DPDT	•10	9.30 9.30 9.30 9.85 10.20
KRP14A	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	3PDT	•5	11.25 11.25 11.25 11.25 11.75
KRP14AG	6V 12V 24V 120V 240V	6 21 85 2,250 9,110	2VA	3PDT	•10	11.60 11.60 11.60 11.60 12.25
KRP14D	6V 12V 24V 48V 110V	32.1 120 472 1,800 10,000	1.2W	3PDT	•5	11.15 11.15 11.15 11.55 11.95
KRP14DG	6V 12V 24V 48V 110V	32.1 120 472 1,800 10,000	1.2W	3PDT	•10	11.50 11.50 11.50 12.05 12.40

• Denotes U/L

POTTER & BRUMFIELD PAGE 12 A—Alternating Current, e.g. PRD3**A**
D—Direct Current, e.g. PRD3**D**

POTTER & BRUMFIELD RELAYS

A screwdriver is all you need for quick mounting of many P&B relays with our screw terminal sockets and track mounting system.

OCTAL-STYLE SOCKETS

For KRP, KRP3-H, KAP, KBP, KCP, EBT, and EBA relays; CD-21, CD-38, CH, CK, and CR time delays; and CS sensor.

Molded polycarbonate, 8-pin screw terminal socket, rated 10 amperes.
27E122 **LIST $2.97**

Molded polycarbonate, 11-pin screw terminal socket, rated 10 amperes.
27E123 **LIST $4.45**

TRACK MOUNT SYSTEM FOR SOCKETS

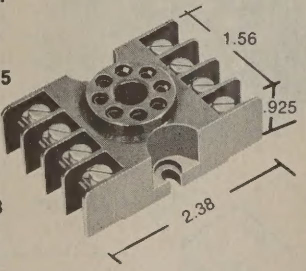
Extruded aluminum, three-foot section with slotted holes on 6″ centers for #8 screws.
24A064 **NET $2.33**

Plastic clip for mounting sockets 27E122 and 27E123, above, and socket 27E166, page 4. Two clips required per socket.
24A072 **NET $ .12**

Aluminum retainer with #6-40 tapped hole for mounting sockets 27E121 (page 7), 27E122, 27E123, and 27E166. Includes one #6-40 x ¹³⁄₃₂″ screw. Two retainers and screws required per socket.
24A071 **NET $ .08**

Plastic twist-clip requires no screws; will mount 27E121 only. Two required per socket.
24A067 **NET $ .11**

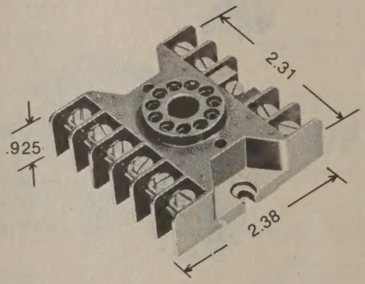
Stainless steel hold-down clip restricts movement of relay mounted in socket 27E121 Two clips required per socket.
20C253 **NET $ .10**

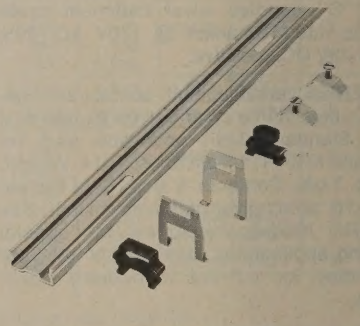


GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom: Power	Arrang.	Amps. Rating	
KRP11AN	6V	6	2VA	DPDT	•10	$10.70
	12V	21				10.70
	24V	85				10.70
	120V	2,250				10.70
	240V	9,110				11.30
KRP11DN	6V	32.1	1.2W	DPDT	•10	10.55
	12V	120				10.55
	24V	472				10.55
	110V	10,000				11.50
KRP14AN	6V	6	2VA	3PDT	•10	13.00
	12V	21				13.00
	24V	85				13.00
	120V	2.250				13.00
	240V	9,110				13.60
KRP14DN	24V	472	1.2W	3PDT	•10	12.85

SPECIFY COIL VOLTAGE OR RESISTANCE WHEN ORDERING





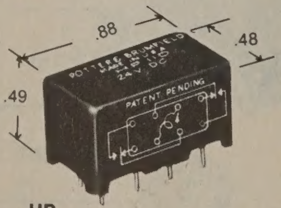
TRACK MOUNT SYSTEM

HP SERIES is recommended for applications such as TV cameras, dictating machines, desk top computers, copying machines, etc. Contacts are rated 0.3-2 amps @ 28 VDC, resistive; 0.1-0.5 amp @ 120 VAC @ 25°C. Circuit board or socket mounting. Encased in a nylon heat-sealed (non-hermetic) cover. Terminals on a .2″ grid. Weight: 3 oz.

HPS SERIES Hermetically sealed HP above. HPS is designed for reliable performance in logic circuits or where prolonged submersion of pc boards in cleaning solvents may be required. Recommended for use in applications requiring more critical specifications than HP relay provides. HP socket may be used for mounting. Sealed metal enclosed relay weighs .25 oz.

HP SERIES SOCKETS

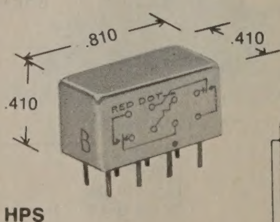
(For HP, HPS and HCM relays)
DPDT solder terminal sockets 27E062 and socket retainer 24A051.
27E062 **LIST $1.01**
24A051 **LIST $ .16**



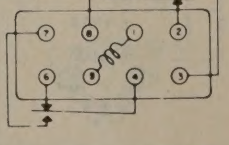
HP

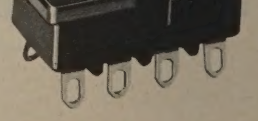
GENERAL PURPOSE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
HP11D	5V	39	.662W	DPDT	2	$11.05
	6V	55				11.05
	12V	218				11.05
	24V	870				11.05
	48V	3,480				11.50
HPS11D	12V	218	.662W	DPDT	2	12.75
	24V	870				12.75



HPS





● Denotes U/L

POTTER & BRUMFIELD PAGE 13 A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

America's most popular 30-amp relay improved three ways! Supported terminals, enclosed coil, tough phenolic base.

Direct replacement for famous PR Series

The PRD is a UL-CSA listed, heavy duty power relay designed for high inrush current applications such as motor starting and incandescent lamp loads. This relay is an improved design of our PR Series. It has reinforced screw terminals which virtually eliminates the risk of terminal breakage when the relay is installed. Also, the coil of the PRD is housed in a protective plastic enclosure to minimize the possibility of damage to the coil.

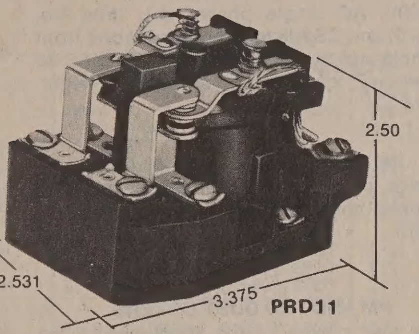
Model for model, PRD is directly interchangeable with the PR. For example, a PRD7AYO replaces a PR7AYO; same size, mounting holes, and electrical characteristics. PRD has a life expectancy of 100,000 operations at full load. Contact life increases when operated at reduced loads or with appropriate arc suppression. The floating movable contact carrier provides excellent pressure and wipe between contact surfaces, thus keeping voltage drop to a minimum between mating contacts.

Model PRDA11AYA has a miniature snap-action switch with SPDT contacts rated 5 amps at 120V AC. All models mount using two .188" dia. holes on 1.875" centers.

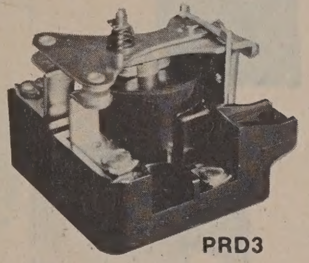
Weight is 11 oz. maximum. For relay enclosure, see PRD Dust Cover on next page.

UL and CSA Listed

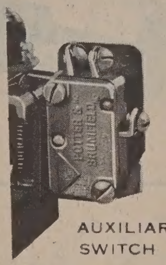
UL File E22575
CSA File 15734



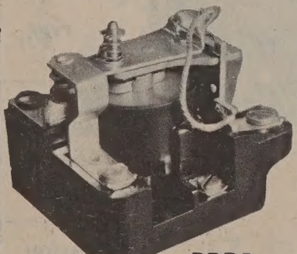
PRD11



PRD3



AUXILIARY SWITCH



PRD5

PRD IS IC LOGIC COMPATIBLE
PRD relays with 12V DC or 24V DC coils are compatible with IC drivers used to terminate logic boards. The 12V DC coil requires 170 mA; the 24V DC coil, just 84mA. When being driven directly by an IC such as TTL or CMOS with driver, the coil of the PRD must be paralleled with signal diode to allow coil back-emf to recirculate through the coil.

PRD RELAYS LISTED BY UL AND CSA

Type	Suffix		Contact Rating
	AC	DC	
PRD 1, 3, or 5	AY	DY	25 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC
PRD 7 or 11	AY	DY	25 amps @ 240 V AC, 20 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC.
PRD 7 or 11	AG		30 amps @ 240 V AC, 20 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC, 10 amps @ 600 V AC, resistive.

POWER RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rat-ing	
PRD1AYO	24V	12	9.8VA	SPST-NO	*● 25	$ 5.90
	120V	290				5.90
PRD3AYO	6V	.86	9.8VA	SPST-NO-DM	*● 25	6.10
	12V	3.2				6.10
	24V	12				6.10
	120V	290				6.10
	208V	850				6.30
	240V	1,200				6.30
PRD3DYO	5V	12.5	2W	SPST-NO-DM	*● 25	5.65
	6V	18				5.65
	12V	71				5.65
	24V	288				5.65
	110V	6,050				6.40
PRD5AYO	6V	.86	9.8VA	SPDT	*● 25	6.60
	12V	3.2				6.60
	24V	12				6.60
	120V	290				6.60
	208V	850				6.80
	240V	1,200				6.80
PRD5DYO	5V	12.5	2W	SPDT	*● 25	6.15
	6V	18				6.15
	12V	71				6.15
	24V	288				6.15
	110V	6,050				6.90
PRD7AGO	120V	290	9.8VA	DPST-NO	30●*	7.50
PRD7AYO	6V	.86	9.8VA	DPST-NO	*● 25	7.45
	12V	3.2				7.45
	24V	12				7.45
	120V	290				7.45
	208V	850				7.65
	240V	1,200				7.65
PRD7DYO	5V	12.5	2W	DPST-NO	*● 25	7.00
	6V	18				7.00
	12V	71				7.00
	24V	288				7.00
	110V	6,050				7.75
PRD11AGO	120V	290	9.8VA	DPDT	30●*	9.75
PRD11AYO	6V	.86	9.8VA	DPDT	*● 25	9.00
	12V	3.2				9.00
	24V	12				9.00
	120V	290				9.00
	208V	850				9.20
	240V	1,200				9.20
	480V	4,500				11.80
PRDA11AYA	12V	3.2	9.8VA	DPDT & SPDT	*● 25	13.60
	24V	12				13.60
	120V	290				13.60
	240V	1,200				13.80
PRD11DYO	5V	12.5	2W	DPDT	*● 25	8.55
	6V	18				8.55
	12V	71				8.55
	24V	288				8.55
	110V	6,050				9.30

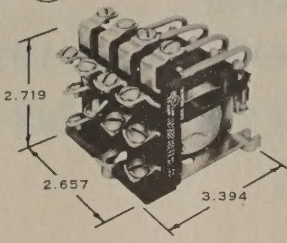
● Denotes U/L
* Denotes CSA

POTTER & BRUMFIELD PAGE 15

A—Alternating Current, e.g. PRD3**A**
D—Direct Current, e.g. PRD3**D**

POTTER & BRUMFIELD RELAYS

PM SERIES A compact 4PDT power relay for polyphase and heavy duty switching applications. Screw terminals. (PMT has .250″ quick-connect terminals.) Has silver-cadmium oxide contacts rated at 25 amps at 240V, 50/60 Hz resistive AC, 1 HP per movable arm at 120V or 240V, AC single phase, U/L (File No. E22575) and CSA listed. Mounts by one front key-hole and two rear channel slots for 8-32 screws on 2″ x 2.5″ triangular centers. Weight: 14 ozs.



POWER RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
PM17AY	6V	.37	14VA	4PDT	*• 25	$19.55
	12V	1.4				19.55
	24V	5				19.55
	120V	120				19.55
	240V	587				19.65
PM17AY	480V	1,790	14VA	4PDT	•25	21.00
PM17DY	6V	8.2	4.4W	4PDT	*• 25	16.80
	12V	33				16.80
	24V	132				16.80
	110V	2,760				18.30
PMT17AY	24V	5	13VA	4PDT	*• 25	18.00
	120V	120	15VA			18.00

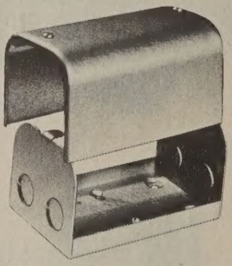
PM SERIES ADAPTOR PLATE

Adaptor plate for mounting PM on PRD mounting holes.

37B370 **LIST $ .43**

PM AND PRD DUST COVERS

These dust covers have a sheet metal base with knockout for .5″ dia. conduit and a cover fitted with two screws. Finished in gray. Mounting: three #10 holes on 1.875″ x 4.125″ centers. Approx. weight: 1 lb.



PM: 35D227
L: 5.313 MAX.
W: 3.812 MAX.
H: 3.812 MAX.

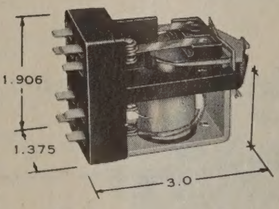
PR: 35D013
L: 5.312 MAX.
W: 3.375 MAX.
H: 3.125 MAX.

Metal dust cover for PM series only.
35D227 **LIST $6.36**

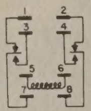
Plastic dust cover for PM series only.
35D203 **LIST $1.11**

Metal dust cover for PRD series only.
35D013 **LIST $5.25**

AB and ABC SERIES are UL/CSA recognized. For applications requiring long life and quiet operation. Available for AC and DC operation, these relays have a mechanical life expectancy in excess of three million operations. All models have silver contacts and .250″ quick-connect terminals. Screw terminal adaptors are available. AB is open; ABC is enclosed in a non-hermetic, heavy metal dust cover. Contact rating: "H" style contacts, 15 amps @ 277 VAC, ¾ H.P., 120/250 VAC; "Y" style contacts, 10 amps @ 120 VAC, or 5 amps @ 240 VAC resistive. Mounting: AB, two 8-32 tapped holes on 1.250″ centers. ABC, one ⅜″ x 8-32 metal stud and locating tab on .562″ centers. Approximate weight: AB, 5 oz.; ABC, 7 oz.

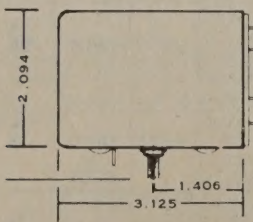


AB

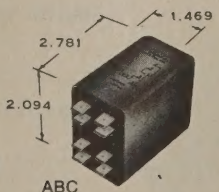


POWER RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
AB11AH	6V	1.3	6.4VA	DPDT	•* 15	$9.10
	24V	23				9.10
	120V	510				9.10
	240V	2,050				9.70
AB11AY	24V	23	6.4VA	DPDT	•* 10	9.25
	120V	510				9.25
	240V	2,050				9.75
AB11DH	12V	72	2W	DPDT	•* 15	9.55
	24V	288				9.55
	110V	6,050				10.30
AB11DY	12V	72	2W	DPDT	•* 10	9.80
	24V	288				9.80
	110V	6,050				10.25
ABC11AH	6V	1.3	6.4VA	DPDT	•* 15	9.95
	24V	23				9.95
	120V	510				9.95
	240V	2,050				10.45
ABC11AY	24V	23	6.4VA	DPDT	•* 10	10.15
	120V	510				10.15
	240V	2,050				10.65
ABC11DH	6V	18	2W	DPDT	•* 15	10.45
	12V	72				10.45
	24V	288				10.45
	110V	6,050				11.10
ABC11DY	12V	72	2W	DPDT	•* 10	10.70
	24V	288				10.70



ABC



ABC

• Denotes U/L
* Denotes CSA

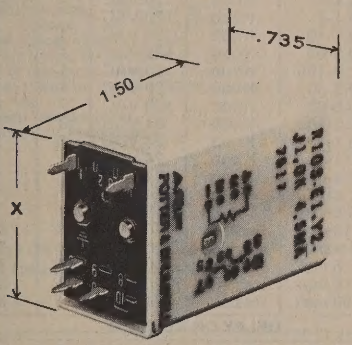
POTTER & BRUMFIELD PAGE 16

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

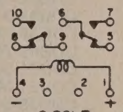
The R10S is a 2 mA, sensitive, general purpose relay for direct drive from CMOS, TTL, I²L, ECL and HTL.

R10S SERIES relays are very sensitive, current-actuated DC relays for direct drive by DTL, TTL, ECL, and HTL. UL and CSA are pending. Available in solder (E1), and pc board (E2) termination. Maximum pickup current is listed in "Input" column. Weight is 0.8 to 1.4 oz.

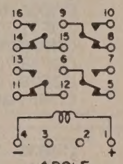
See page 5 for Socket Information.



X = .950 (2PDT)
1.165 (4PDT)



2 POLE



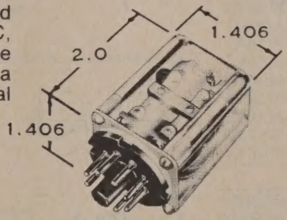
4 POLE

SENSITIVE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Typ. (Max.)	
R10S-E1-Y1						
-J1.0K	3.2mA	1,000	10mW	SPDT	2 (3)	$4.50
-J2.5K	2.0mA	2,500	10mW	SPDT	2 (3)	4.50
-J5.0K	1.4mA	5,000	10mW	SPDT	2 (3)	5.55
R10S-E1-Y2						
-J1.0K	4.5mA	1,000	20mW	2PDT	2 (3)	4.50
-J2.5K	2.9mA	2,500	20mW	2PDT	2 (3)	4.50
-J5.0K	2.0mA	5,000	20mW	2PDT	2 (3)	5.55
R10S-E1-Y4						
-J1.0K	6.5mA	1,000	40mW	4PDT	2 (3)	5.20
R10S-E2-Y1						
-J1.0K	3.2mA	1,000	10mW	SPDT	2 (3)	4.50
-J2.5K	2.0mA	2,500	10mW	SPDT	2 (3)	4.50
-J5.0K	1.4mA	5,000	10mW	SPDT	2 (3)	5.55
R10S-E2-Y2						
-J2.5K	2.9mA	2,500	20mW	2PDT	2 (3)	4.50
R10S-E2-Y4						
-J1.0K	6.5mA	1,000	40mW	4PDT	2 (3)	5.20

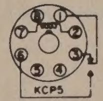
Other R10 relays on pages 3-5.

KCP SERIES Low cost DC sensitive relay enclosed in clear polycarbonate cover. Sensitivity 125 mw single pole; 250 mw double pole: 375 mw three pole. Mounting: Standard octal plug-in type. Eight pin for KCP5 and KCP11. Eleven pin for KCP14. Contacts: Gold flashed silver, 2 amps @ 30V DC or 120V AC, resistive. Weight: Approximately 3 ozs. Use KRP hold-down spring when vibration is a factor or when using inverted or horizontal mounting. (See page12)

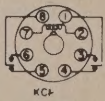


SENSITIVE RELAYS

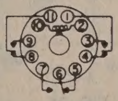
TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
KCP5	7.2mA	2,500	125mW	SPDT	2	$ 8.70
	5.0mA	5,000				8.80
	3.6mA	10,000				9.40
KCP11	10 mA	2,500	250mW	DPDT	2	9.25
	7.2mA	5,000				9.40
	5.0mA	10,000				10.05
KCP14	12.3mA	2,500	375mW	3PDT	2	11.40
	8.7mA	5,000				11.55
	6.1mA	10,000				12.20



KCP5

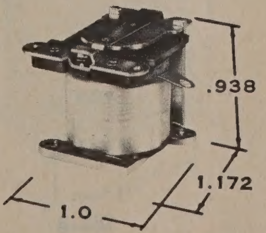


KCP11



KCP14

RS SERIES (In both voltage and current actuated models.) 60 mw sensitivity. Low-cost, small, lightweight, sensitive relay for radiosonde, light dimmer and model applications. Mounting: Two No. 4-40 tapped holes on diagonal .75" x .625" centers. Contacts: Bar palladium rated 2 amps @ 28V DC or 120V AC resistive. Weight: 1.5 oz.



SENSITIVE RELAYS

TYPE	COILS			CONTACTS		SUGG. RE-SALE PRICE
	Input	Res. in Ohms.	Nom. Power	Arrang.	Amps. Rating	
RS5D	6V	335	110mW	SPDT	2	$6.95
	12V	1,350	110mW			6.95
	5mA	2,500	60mW			7.05
	3.5mA	5,000	60mW			7.35
	2.5mA	10,000	60mW			8.00

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

POTTER & BRUMFIELD RELAYS

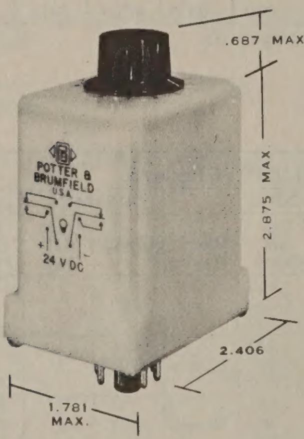
The industry's broadest line of time delay relays and timing modules!

THE CD SERIES is available in delay on operate or release for use with an external relay. There are four cases styles: The CD-21 is designed for use with an external KRP relay. The CD-31 is designed for use with an external KHP relay. The CD-38 has an internal 10 amp DPDT relay and the CD-45 is designed for use with an external PRD relay.

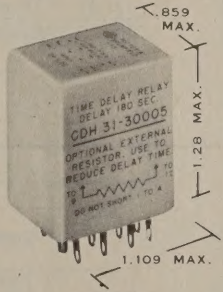
Tolerance: ±5%. For Knob Adj. versions see Dial Scale. Res. Adj. (low end): Min. specified or less. (For AC units add ± ½ cycle 60 Hz.)
Delta Time: ±5%. (For AC units add ±1 cycle 60 Hz.)
Repeatability: ±1% for 38 style. All others ±2% (For AC units add ±1 cycle 60 Hz.)
Temperature Range: Operating: − 40°C to + 55°C.
Storage: − 55°C to + 85°C.
Dial Scale: Time in seconds, calibrated:

Setting	Tolerance*
Maximum	±5% of specified maximum
Minimum	Specified minimum or less
Other	±10% full scale

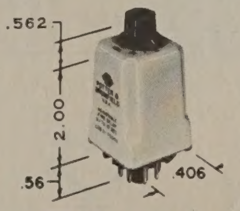
Release Time: 45 milliseconds typical; 60 milliseconds maximum.
Recycle Time: Less than 60 milliseconds for CD-38 units (internal shorting contact); 2.0 seconds for CD-21, CD-31, and CD-45 units (no shorting contact).
Transient Protection: 1000V, all 120V AC units except CD-31 style.
Polarity Protection: Yes.
Timing Cycle Interrupt Transfer: None.


.687 MAX
2.875 MAX
2.406
1.781 MAX.
POTTER & BRUMFIELD USA
24 VDC

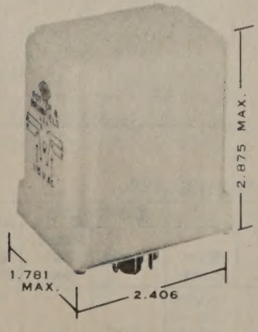
CDD-38


.859 MAX.
1.28 MAX.
1.109 MAX.
TIME DELAY RELAY
DELAY 180 SEC
CDH 31-30005
OPTIONAL EXTERNAL RESISTOR. USE TO REDUCE DELAY TIME
DO NOT SHORT

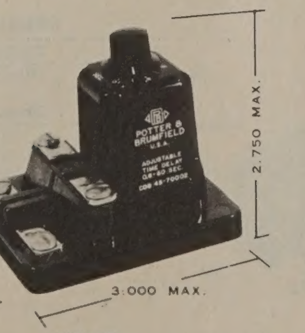
CD-31


.562
2.00
.56
.406

CD-21


2.875 MAX.
1.781 MAX.
2.406

CDA-38


2.750 MAX.
3.000 MAX.
POTTER & BRUMFIELD U.S.A.
ADJUSTABLE TIME DELAY

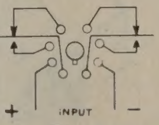
CD-45

SOLID STATE/EMR TIME DELAY RELAYS

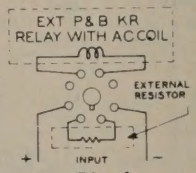
TYPE	Time Delay in Seconds	Method of Control	Input Voltage	Dia. No.	Notes	SUGG. RE-SALE PRICE
DELAY ON OPERATE						
CDA38-70012	1.0	Fixed	120 VAC	1	1	$49.15
CDB21-70001	1.8-180	Knob	120 VAC	4	2	48.10
CDB21-70003	0.1-10	Knob	120 VAC	4	2	48.10
CDB38-30001	0.1-10	Knob	24 VAC	1	1	54.40
CDB38-30002	0.6-6	Knob	24 VAC	1	1	54.40
CDB38-70001	0.1-1	Knob	120 VAC	1	1	54.40
CDB38-70002	0.1-5	Knob	120 VAC	1	1	54.40
CDB38-70003	0.1-10	Knob	120 VAC	1	1	54.40
CDB38-70004	0.6-60	Knob	120 VAC	1	1	54.40
CDB38-70005	1.8-180	Knob	120 VAC	1	1	54.40
CDB38-70006	0.3-30	Knob	120 VAC	1	1	54.40
CDB45-70002	0.6-60	Knob	120 VAC	7	6	46.10
CDD21-30001	1.8-180	Knob	24 VDC	3	3	47.70
CDD21-30003	0.1-10	Knob	24 VDC	3	3	47.70
CDD38-30003	0.1-10	Knob	24 VDC	1	1	51.60
CDD38-30004	0.6-60	Knob	24 VDC	1	1	51.60
CDD38-30005	1.8-180	Knob	24 VDC	1	1	51.60
CDD38-40002	0.6-60	Knob	48 VDC	1	1	51.60
CDF31-70003	10 max.	Resistor	120 VAC	8	11 & 12*	48.35
CDF38-70001	1 max.	Resistor	120 VAC	2	1 & 9*	50.60
CDF38-70002	5 max.	Resistor	120 VAC	2	1 & 10*	50.60
CDF38-70003	10 max.	Resistor	120 VAC	2	1 & 12*	50.60
CDH31-30005	180 max.	Resistor	24 VDC	9	4 & 14	48.35
DELAY ON RELEASE						
CDB38-70012	0.6-60	Knob	120 VAC	5	1	65.00
CDB38-70014	0.1-10	Knob	120 VAC	5	1	65.00
CDB38-70015	1.8-180	Knob	120 VAC	5	1	65.00
CDD38-30008	1.8-180	Knob	24 VDC	5	1	61.35
CDD38-30012	0.6-60	Knob	24 VDC	5	1	61.35
CDD38-30014	0.1-10	Knob	24 VDC	5	1	61.35

NOTE: See page 38 for Socket Ordering Information and explanation of timing fuctions and notes

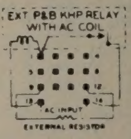
WIRING DIAGRAMS
(Disregard DC polarity
for AC relays)



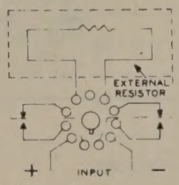
Dia. 1


EXT P&B KR
RELAY WITH AC COIL
EXTERNAL RESISTOR
+
INPUT
−

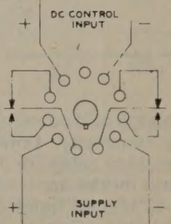
Dia. 4


EXT P&B KHP RELAY WITH AC COIL
AC INPUT
EXTERNAL RESISTOR

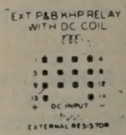
Dia. 8


EXTERNAL RESISTOR
+
INPUT
−

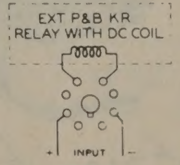
Dia. 2


+
DC CONTROL INPUT
−
+
SUPPLY INPUT
−

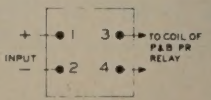
Dia. 5


EXT P&B KHP RELAY WITH DC COIL
DC INPUT
EXTERNAL RESISTOR

Dia. 9


EXT P&B KR
RELAY WITH DC COIL
+
INPUT
−

Dia. 3


+
1
3
TO COIL OF P&B PR RELAY
INPUT
−
2
4

Dia. 7

---

* External resistor (not furnished) for maximum time. Recommend ¼ watt minimum resistor.

POTTER & BRUMFIELD RELAYS

CG SERIES

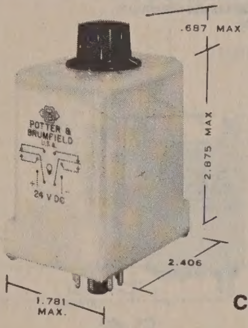
CG Series relays are available in time delay on operate, or interval on. They feature a C/MOS integrated circuit controlling a DPDT relay having contacts rated 10 amps @ 120V AC, or 5 amps @ 240V AC resistive. Repeatability, including first cycle of operation, is typically .01% for DC units, and 0.1% for AC units. The delay time provided by the IC network is not normally affected by voltage transients encountered in industrial applications. The relay contacts will not transfer if timing cycle is momentarily interrupted. Weight is approximately 8 ozs.

Repeatability (including first cycle of operation): AC: 0.1% typical, ±0.5% maximum, but not less than ±16 msec. DC: 0.05% typical; ±1% maximum, but not less than ±3 msec.
Tolerance: +10% —0% of max. specified at high end. +0% —10% of min. specified at low end.
Not less than ±16 ms for AC units and ±10 ms for DC, all units.
Dial Scale: In seconds or minutes, reference only.
Delta Time: ±2% typical, ±5% max.
Temperature Range: Operating; —10°C to +55°C.
Storage; —40°C to +85°C.
Release Time: 30 ms typical, 45 ms maximum.
Recycle Time: AC: ms typical; 60 ms maximum.
DC: 30 ms typical; 45 ms maximum.
Transient Protection: 1,000V on all 120 & 240 VAC units
Polarity Protection: Yes.
Timing Cycle Interrupt Transfer: None.
Weight: Approximately 8 oz. (226.64 gm.)

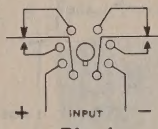
NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes

SOLID STATE/EMR TIME DELAY RELAYS

TYPE	Time Delay in Seconds	Method of Control	Input Voltage	Dia. No.	Notes	SUGG. RE-SALE PRICE
DELAY ON OPERATE						
CGB38-70010M	1.0- 10 Min	Knob	120 VAC	1	1	$61.30
CGB38-70050M	5.0- 50 Min	Knob	120 VAC	1	1	61.30
CGB38-70100M	10-100 Min	Knob	120 VAC	1	1	61.30
CGD38-30010M	1.0- 10 Min	Knob	24 VDC	1	1	58.15
CGD38-30050M	5.0- 50 Min	Knob	24 VDC	1	1	58.15
CGD38-30100M	10-100 Min	Knob	24 VDC	1	1	58.15
INTERVAL ON						
CGB38-79010M	1.0- 10 Min	Knob	120 VAC	1	1	61.30
CGB38-79050M	5.0- 50 Min	Knob	120 VAC	1	1	61.30
CGB38-79100M	10-100 Min	Knob	120 VAC	1	1	61.30
CGD38-39010M	1.0- 10 Min	Knob	24 VDC	1	1	58.15
CGD38-39050M	5.0- 50 Min	Knob	24 VDC	1	1	58.15
CGD38-39100M	10-100 Min	Knob	24 VDC	1	1	58.15



CG-38

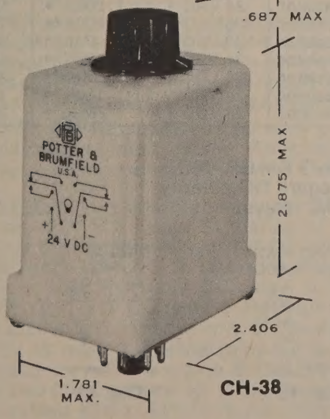


Dia. 1

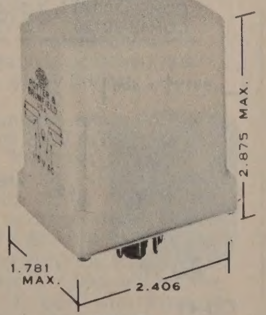
CH SERIES

The CH series is intended for a wide range of industrial applications where economy is of greater interest than highly critical performance. It is available in two types: Knob-adjustable with the relay in the same enclosure as the solid state unit. The second type has a fixed time delay period that is set at the factory and cannot be modified; its case has no knob. The CH series is available for time delay on either operate or on release.

Tolerance:
Knob Adj. units: —0 +20% of maximum specified @ high end; minimum specified, or less, @ low end.
Others: ±5%.
(For AC units add ±½ cycle 60 Hz.)
Delta Time: ±10%. (For AC units add ±1 cycle 60 Hz.)
Repeatability: ±2%. (For AC units add ±1 cycle 60 Hz.)
Temperature Range: Operating: —10°C to +55°C.
Storage: —55°C to +85°C.
Contact Rating: DPDT 10 amps @ 120V AC 60 Hz.
Dial Scale: Reference only.
Release Time: 125 milliseconds typical: 200 milliseconds maximum.
Recycle Time: 125 milliseconds typical: 200 milliseconds maximum.
Transient Protection: 1000V, all 120V AC units.
Polarity Protection: Yes.
Timing Cycle Interrupt Transfer: Contacts may transfer momentarily if timing interval is interrupted.



CH-38



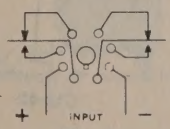
CH-38

SOLID STATE/EMR TIME DELAY RELAYS

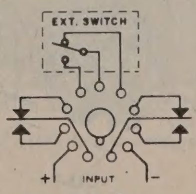
TYPE	Time Delay in Seconds	Method of Control	Input Voltage	Dia. No.	Notes	SUGG. RE-SALE PRICE
DELAY ON OPERATE						
CHA38-70001	10	Fixed	120 VAC**	1	1	$23.30
CHB38-30001	1.0-10	Knob	24 VAC	1	1	24.50
CHB38-30003	1.0-180	Knob	24 VAC	1	1	24.50
CHB38-70001	1.0-10	Knob	120 VAC**	1	1	24.50
CHB38-70002	1.0-60	Knob	120 VAC**	1	1	24.50
CHB38-70003	1.8-180	Knob	120 VAC**	1	1	24.50
CHB38-80001	1.0-10	Knob	**240 VAC	1	1	25.90
CHD38-30001	1.0-10	Knob	24 VDC	1	1	23.35
CHD38-30003	1.0-180	Knob	24 VDC	1	1	23.35
DELAY ON RELEASE						
CHB38-30011	1.0-10	Knob	24 VAC	6	1 & 13	32.25
CHB38-70011	1.0-10	Knob	120 VAC**	6	1 & 13	30.60
CHB38-70012	1.0-60	Knob	120 VAC**	6	1 & 13	31.45
CHB38-70013	1.0-180	Knob	120 VAC**	6	1 & 13	30.95
CHD38-30011	1.0-10	Knob	24 VDC	6	1 & 13	32.15
CHD38-30013	1.0-180	Knob	24 VDC	6	1 & 13	31.45
INTERVAL ON						
CHB38-70021	1.0-10	Knob	**120 VAC	1	1	29.50
CHB38-70022	1.0-60	Knob	**120 VAC	1	1	31.10
CHB38-70023	1.0-180	Knob	**120 VAC	1	1	29.75
CHD38-30021	1.0-10	Knob	24 VDC	1	1	31.00

NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes

WIRING DIAGRAMS
(Disregard DC polarity
for AC relays)



Dia. 1



Dia. 6

**Not recommended for continuous duty.

POTTER & BRUMFIELD RELAYS

CL SERIES

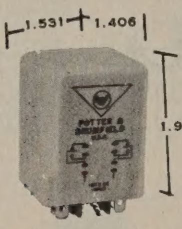
Designed for delay on operate the CL Series is similar to the CU with the exception that they don't have timing cycle interrupt transfer and will time to 0.1 second. These solid state time delays are ideal for AC or DC applications. A DPDT KU relay rated 10 amperes is mounted in the same enclosure, forming a compact assembly. CL relays are enclosed in yellow polycarbonate dust covers and are available in three types: fixed, resistor adjustable and knob adjustable. Plug-in/quick-connect terminals facilitate handling and hook-up.

Tolerance:
Knob Adj. Types: −0 +20% of maximum specified @ high end; minimum specified, or less, @ low end.
Res. Adj.: ±10% high end; min. spec. or less at low end.
Fixed: ±5%.
(For AC units add ±½ cycle 60 Hz.)
Repeatability: ±3%. (For AC units add ±1 cycle 60 Hz.)
Temperature Range: Operating: −10°C to +40°C.
Storage: −55°C to +85°C.
Contact Rating: DPDT 10 amps @ 120V AC 60 Hz.
Dial Scale: Reference only.
Release Time: 100 milliseconds typical; 150 milliseconds maximum.
Recycle Time: 100 milliseconds typical; 150 milliseconds maximum.
Transient Protection: 1,000V on all 120V AC units.
Polarity Protection: Yes.
Timing Cycle Interrupt Transfer: None.

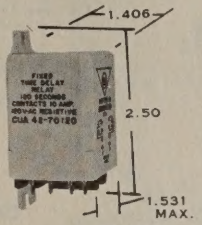
SOLID STATE/EMR TIME DELAY RELAYS

TYPE	Time Delay in Seconds	Method of Control	Input Voltage	Dia. No.	Notes	SUGG. RE-SALE PRICE
		DELAY ON OPERATE				
CLA41-70010	10	Fixed	120 VAC	10	1•	$21.35
CLB51-30010	0.1-10	Knob	24 VAC	10	1•	25.75
CLB51-70010	0.1-10	Knob	120 VAC	10	1•	25.25
CLB51-70120	1.2-120	Knob	120 VAC	10	1•	26.20
CLF41-70010	0.1-10	Resistor	120 VAC	11	200K*•	23.25
CLF42-70010	0.1-10	Resistor	120 VAC	11	200K*	23.25
CLH41-30010	0.1-10	Resistor	24 VDC	11	160K*•	23.25

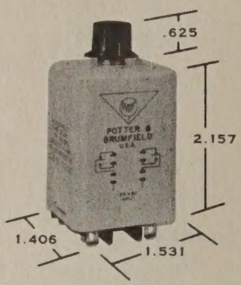
NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes



CL-41



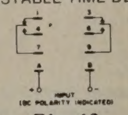
CL-42



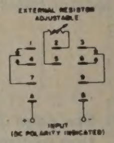
CL-51

WIRING DIAGRAMS
(Disregard DC polarity
for AC relays)

FIXED AND KNOB
ADJUSTABLE TIME DELAY



Dia. 10



Dia. 11

CU SERIES

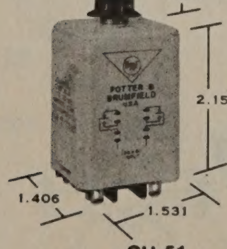
CU Series relays are available in three types: Fixed time delay, adjustable with an external resistor, and knob adjustable with a reference scale. For minimum time (on external resistor types) terminals 2 and 5 must be shorted together . For maximum time, the listed resistor must be connected between terminals 2 and 5. For intermediate values, a lesser value resistor or a potentiometer is used. Either fixed or resistor adjustable models can be furnished in two types of enclosures with the relay mounted in the same case as the solid state circuit. All CU Series contain DPDT relay of the KUP series listed on Page 8.

Tolerance:
Knob Adj. Types: −0 +20% of maximum specified @ high end; minimum specified, or less, @ low end.
Adj. types: ±10%.
(For AC units add ±½ cycle 60 Hz.)
Repeatability: ±3%. (For AC units add ±1 cycle 60 Hz.)
Temperature Range: Operating: −10°C +40°C.
Storage: −55°C to + 85°C.
Contact Rating: DPDT 10 amps @ 28V DC resistive or 120V AC 60 Hz, 80% PF.
Dial Scale: Reference only.
Release Time: 150 milliseconds typical; 225 milliseconds maximum.
Recycle Time: 150 milliseconds typical; 225 milliseconds maximum.
Transient Protection: 1,000V on all 120V AC units.
Polarity Protection: Yes.
Timing Cycle Interrupt Transfer: Contacts may transfer momentarily if timing cycle is interrupted.

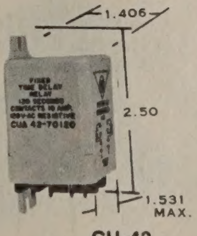
NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes

SOLID STATE/EMR TIME DELAY RELAYS

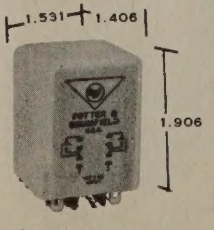
TYPE	Time Delay in Seconds	Method of Control	Input Voltage	Dia. No.	Notes	SUGG. RE-SALE PRICE
		DELAY ON OPERATE				
CUA41-30010	10	Fixed	24 VAC	10	1•	$17.55
CUA41-70001	1.0	Fixed	120 VAC	10	1•	17.55
CUA41-70005	5	Fixed	120 VAC	10	1	17.55
CUA41-70010	10	Fixed	120 VAC	10	1•	17.55
CUA41-70120	120	Fixed	120 VAC	10	1•	19.45
CUA42-30010	10	Fixed	24 VAC	10	1•	17.55
CUA42-70010	10	Fixed	120 VAC	10	1•	17.55
CUA42-70120	120	Fixed	120 VAC	10	1•	19.45
CUB51-70010	1.0-10	Knob	120 VAC	10	1•	21.20
CUB51-70120	1.0-120	Knob	120 VAC	10	1	22.00
CUC41-30010	10	Fixed	24 VDC	10	1•	17.55
CUC41-30120	120	Fixed	24 VDC	10	1•	19.45
CUC42-30010	10	Fixed	24 VDC	10	1•	17.55
CUC42-30120	120	Fixed	24 VDC	10	1•	19.45
CUF41-30010	1.0-10	Resistor	24 VAC	11	200K*•	18.50
CUF41-70010	1.0-10	Resistor	120 VAC	11	200K*•	18.50
CUF41-70030	1.0-30	Resistor	120 VAC	11	600K*•	19.10
CUF41-70120	1.0-120	Resistor	120 VAC	11	2.4Meg*•	20.10
CUF42-30010	1.0-10	Resistor	24 VAC	11	200K*•	18.50
CUF42-70010	1.0-10	Resistor	120 VAC	11	200K*•	18.50
CUF42-70120	1.0-120	Resistor	120 VAC	11	2.4Meg*•	20.10
CUH41-30010	1.0-10	Resistor	24 VDC	11	160K*•	18.50
CUH41-30120	1.0-120	Resistor	24 VDC	11	2Meg*•	20.10
CUH42-30010	1.0-10	Resistor	24 VDC	11	160K*•	18.50
CUH42-30120	1.0-120	Resistor	24 VDC	11	2Meg*•	20.10



CU-51



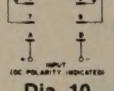
CU-42



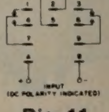
CU-41

WIRING DIAGRAMS
(Disregard DC polarity
for AC relays)

FIXED AND KNOB
ADJUSTABLE TIME DELAY



Dia. 10



Dia. 11

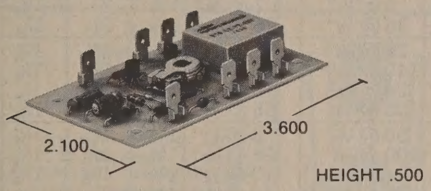
• Denotes U/L

* External resistor (not furnished) for maximum time. Recommend ¼ watt minimum resistor.

R16—our lowest cost time delay relay assembly.

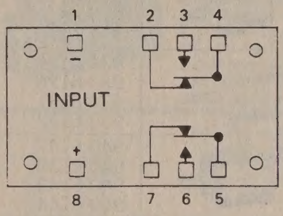
R16 time delay on operate is available in the timing range of 2.0 to 30 seconds. A potentiometer is used to set the timing values. All components are mounted on a .062″ G10 glass/epoxy printed circuit board having .250″ quick-connect termination. Contacts have a life expectancy in excess of 10 million operations, mechanical, and at least 100,000 operations at full load @ 28V DC. The relay has a polyester cover ultrasonically welded to its base to keep out dust and contaminates. Cleaning by immersion is not recommended. The board mounts with #6 screws. Relay contacts will not transfer if timing cycle is interrupted.

Tolerance: Potentiometer adjust—set to any range, within specified range.
Delta Time: ±10%.
Recycle Time: 100 ms for 95% recovery.
Timing Cycle Interrupt Transfer: For AC inputs—momentary.
Temperature:
  Operating; −10°C to +55°C.
  Storage; −40°C to +85°C.
Mounting: Four clearance holes for #6 screws.
Weight: 1.5 oz. approximately.
Transient Protection: 100V for 100 μsec.
Repeatability: ±3% max.
Polarity Protection: Yes.



SOLID STATE/EMR TIME ASSEMBLY

TYPE	Time Delay in Seconds	CONTACTS			Diagram Number	SUGG. RE-SALE PRICE
		Input Voltage	Arrange.	Amps. Typ. (Max.)		
DELAY ON OPERATE						
R16-30A-24A-Y2	2.0-30	24 VAC	DPDT	2 (3)	19	$11.35
R16-30A-120A-Y2	2.0-30	120 VAC	DPDT	2 (3)	19	12.40



Dia. 19
No socket used.

Time Delay Relay Socket Ordering Information

Diagrams 1–6 incl: Use any standard octal-style socket. For screw terminal sockets, see page 13.

Diagram 7: No socket used.

Diagrams 8–9: Use any KH Series socket listed on page 10.

Diagrams 10–11: Use any KU Series socket listed on page 8.

Diagram 19: No socket used.

Diagrams 20–21: PC board termination.

Timing functions and notes

DELAY ON OPERATE — The delay period begins when input voltage is applied. The relay will remain de-energized until the end of the delay period, at which time it energizes and operates the output contacts. Reset is accomplished by removal of the input voltage.

INTERVAL ON — The relay operates immediately upon application of input voltage. At the end of the adjustable, predetermined interval the relay drops out, even though input voltage may still be applied. It will remain dropped out until re-application of input voltage. Reset is accomplished by removal of input voltage.

DELAY ON RELEASE — The relay operates immediately upon application of input voltage. When input voltage is removed, the relay remains energized until the end of the delay period.

NOTES: 1. Has internal relay with DPDT contacts rated at 10 amperes, 120V AC; except CU Series, 10 amps @ 250V AC. **2.** Use with Potter & Brumfield relay KRP5AG-120V AC, KRP11AG-120V AC or KRP14AG-120V AC. **3.** Use with KRP5DG-24V DC, KRP11DG-24V DC, or KRP14DG-24V DC relay. **4.** Use with Potter & Brumfield KHP17D11-24V DC relay. **5.** Resistor shown in diagrams 12, 13 and 14 applies to CJH series only. **6.** Use w/Potter & Brumfield PRD11AY-120V AC relay. **7.** Internal relay contacts rated at 10 VA. **8.** Use 750K resistor for maximum time. **9.** Use 33K resistor for ½ maximum time. **10.** Use 200K resistor for ½ maximum time. **11.** Use with Potter & Brumfield KHP17A11-120V AC relay. **12.** Use 400K resistor for ½ maximum time. **14.** Use 1.6 meg. resistor for ½ maximum time.

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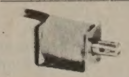
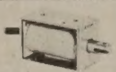
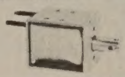
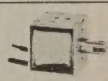
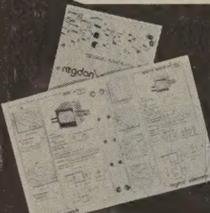
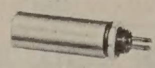
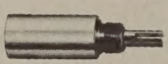
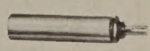
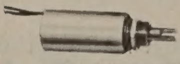
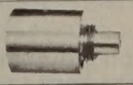
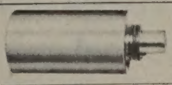
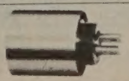
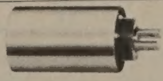
BOX-FRAME SOLENOIDS	TYPE	VOLTS	DUTY	OHMS	FORCES AND STROKES ounces @ inches (min.)	(max.)	BODY inches H	x L	x W	PRICE 1-24
	312-6005	24VDC	Cont.	144	22 @ 1/32"	2 @ 1/4"	3/4	1 5/32	3/4	$3.40
	312-6006	24VDC	Int.	60	28 @ 1/32"	4 @ 1/4"	3/4	1 5/32	3/4	3.40
	312-6011	120VAC	Cont.	390	12 @ 1/32"	2.5 @ 1/4"	3/4	1 5/32	3/4	3.75
	312-6012	120VAC	Int.	100	20 @ 1/32"	4 @ 1/4"	3/4	1 5/32	3/4	3.75
	5U5-6053	24VDC	Cont.	114	14 @ 1/16"	2.5 @ 3/8"	15/16	1 1/4	27/32	3.95
	5U5-6054	24VDC	Int.	52	27 @ 1/16"	5 @ 3/8"	15/16	1 1/4	27/32	3.95
	5U5-6059	120VAC	Cont.	500	10 @ 1/16"	4.5 @ 3/8"	15/16	1 1/4	27/32	3.95
	5U5-6060	120VAC	Int.	310	17 @ 1/16"	8.5 @ 3/8"	15/16	1 1/4	27/32	3.95
	5U7-6065	24VDC	Cont.	85	15 @ 1/8"	3 @ 1/2"	15/16	1 3/4	27/32	3.95
	5U7-6066	24VDC	Int.	33	32 @ 1/8"	7 @ 1/2"	15/16	1 3/4	27/32	3.95
	5U7-6071	120VAC	Cont.	250	11 @ 1/8"	7.5 @ 1/2"	15/16	1 3/4	27/32	4.20
	5U7-6072	120VAC	Int.	140	18 @ 1/8"	12 @ 1/2"	15/16	1 3/4	27/32	4.20
	809-6101	24VDC	Cont.	104	12 @ 1/8"	2 @ 1/2"	1 3/16	1 1/8	15/16	3.65
	809-6102	24VDC	Int.	50	22 @ 1/8"	3 @ 1/2"	1 3/16	1 1/8	15/16	3.65
	809-6107	120VAC	Cont.	400	12 @ 1/8"	5 @ 1/2"	1 3/16	1 1/8	15/16	3.95
	809-6108	120VAC	Int.	220	24 @ 1/8"	7 @ 1/2"	1 3/16	1 1/8	15/16	3.95
	827-6113	24VDC	Cont.	72	24 @ 1/8"	4 @ 5/8"	1 3/16	1 7/8	15/16	4.10
	827-6114	24VDC	Int.	32	40 @ 1/8"	8 @ 5/8"	1 3/16	1 7/8	15/16	4.10
	827-6119	120VAC	Cont.	200	12 @ 1/8"	6 @ 5/8"	1 3/16	1 7/8	15/16	4.10
	827-6120	120VAC	Int.	85	20 @ 1/8"	13 @ 5/8"	1 3/16	1 7/8	15/16	4.10
	930-6125	24VDC	Cont.	54	63 @ 1/8"	7 @ 3/4"	1 5/8	2	1 7/16	7.00
	930-6126	24VDC	Int.	15	113 @ 1/8"	25 @ 3/4"	1 5/8	2	1 7/16	7.00
	630-6131	120VAC	Cont.	133	8 @ 1/8"	7 @ 3/4"	1 5/8	2	1 7/16	7.00
	930-6132	120VAC	Int.	37	36 @ 1/8"	26 @ 3/4"	1 5/8	2	1 7/16	7.00
	940-6137	24VDC	Cont.	50	78 @ 1/8"	8 @ 3/4"	1 5/8	2 3/16	1 7/16	7.50
	940-6138	24VDC	Int.	15	140 @ 1/8"	18 @ 3/4"	1 5/8	2 3/16	1 7/16	7.50
	940-6143	120VAC	Cont.	53	24 @ 1/8"	15 @ 3/4"	1 5/8	2 3/16	1 7/16	7.50
	940-6144	120VAC	Int.	15	100 @ 1/8"	65 @ 3/4"	1 5/8	2 3/16	1 7/16	7.50
	960-6149	24VDC	Cont.	58	50 @ 1/8"	8 @ 1/2"	1 5/8	1 9/16	1 7/16	6.00
	960-6150	24VDC	Int.	21	100 @ 1/8"	18 @ 1/2"	1 5/8	1 9/16	1 7/16	6.00
	960-6155	120VAC	Cont.	166	14 @ 1/8"	10 @ 1/2"	1 5/8	1 9/16	1 7/16	5.90
	960-6156	120VAC	Int.	60	45 @ 1/8"	30 @ 1/2"	1 5/8	1 9/16	1 7/16	5.90
	970-6161	24VDC	Cont.	58	65 @ 1/8"	9 @ 1/2"	1 5/8	1 25/32	1 7/16	7.00
	970-6162	24VDC	Int.	20	120 @ 1/8"	24 @ 1/2"	1 5/8	1 25/32	1 7/16	7.00
	970-6167	120VAC	Cont.	100	22 @ 1/8"	16 @ 1/2"	1 5/8	1 25/32	1 7/16	7.00
	970-6168	120VAC	Int.	125	85 @ 1/8"	58 @ 1/2"	1 5/8	1 25/32	1 7/16	7.00



Specifications on request. Sales Representatives in major cities.

regdon \ solenoids
CORPORATION

3715 GRAND BLVD / BROOKFIELD IL 60513 / 312/485-5152

TUBULAR SOLENOIDS	TYPE	VOLTS	DUTY	OHMS	FORCES AND STROKES ounces @ inches (min.)	(max.)	BODY inches Length	x Dia.	PRICE 1-24
	R7X9-6171	12VDC	Cont.	80	5 @ 1/32"	1.2 @ 5/32"	1 1/8	7/16	$4.85
	R7X9-6172	12VDC	Int.	14	9 @ 1/32"	2.5 @ 5/32"	1 1/8	7/16	4.60
	R7X9-6173	24VDC	Cont.	260	5 @ 1/32"	1.2 @ 5/32"	1 1/8	7/16	4.85
	R7X9-6174	24VDC	Int.	57	9 @ 1/32"	2.5 @ 5/32"	1 1/8	7/16	4.60
	R8X7-6181	12VDC	Cont.	55	2.5 @ 1/16"	1 @ 3/16"	7/8	1/2	4.95
	R8X7-6182	12VDC	Int.	20	6 @ 1/16"	1.5 @ 3/16"	7/8	1/2	4.70
	R8X7-6183	24VDC	Cont.	240	2.5 @ 1/16"	1 @ 3/16"	7/8	1/2	4.95
	R8X7-6184	24VDC	Int.	80	6 @ 1/16"	1.5 @ 3/16"	7/8	1/2	4.70
	R8X12-6191	12VDC	Cont.	40	7 @ 1/32"	1.5 @ 1/4"	1 1/2	1/2	5.00
	R8X12-6192	12VDC	Int.	10	14 @ 1/32"	4 @ 1/4"	1 1/2	1/2	4.90
	R8X12-6193	24VDC	Cont.	160	7 @ 1/32"	1.5 @ 1/4"	1 1/2	1/2	5.00
	R8X12-6194	24VDC	Int.	38	14 @ 1/32"	4 @ 1/4"	1 1/2	1/2	4.90
	R8X16-6203	24VDC	Cont.	145	2.8 @ 1/8"	1.5 @ 3/4"	2	1/2	5.40
	R8X16-6204	24VDC	Int.	24	7 @ 1/8"	4 @ 3/4"	2	1/2	5.40
	R12X12-6211	12VDC	Cont.	41	6.5 @ 1/8"	1.2 @ 5/8"	1 1/2	3/4	5.40
	R12X12-6212	12VDC	Int.	6	20 @ 1/8"	6 @ 5/8"	1 1/2	3/4	5.40
	R12X12-6213	24VDC	Cont.	165	6.5 @ 1/8"	1.2 @ 5/8"	1 1/2	3/4	5.40
	R12X12-6214	24VDC	Int.	25	20 @ 1/8"	6 @ 5/8"	1 1/2	3/4	5.40
	R16X9-6221	12VDC	Cont.	36	22 @ 1/16"	2.5 @ 1/2"	1 1/8	1	5.80
	R16X9-6222	12VDC	Int.	8	33 @ 1/16"	4 @ 1/2"	1 1/8	1	5.70
	R16X9-6223	24VDC	Cont.	145	22 @ 1/16"	2.5 @ 1/2"	1 1/8	1	5.80
	R16X9-6224	24VDC	Int.	30	33 @ 1/16"	4 @ 1/2"	1 1/8	1	5.70
	R16X16-6231	12VDC	Cont.	26	21 @ 1/8"	6.5 @ 5/8"	2	1	6.25
	R16X16-6232	12VDC	Int.	3.8	56 @ 1/8"	20 @ 5/8"	2	1	6.25
	R16X16-6233	24VDC	Cont.	105	21 @ 1/8"	6.5 @ 5/8"	2	1	6.25
	R16X16-6234	24VDC	Int.	15	56 @ 1/8"	20 @ 5/8"	2	1	6.25
	R24X13-6243	24VDC	Cont.	85	50 @ 1/8"	5 @ 5/8"	1 5/8	1 1/2	8.50
	R24X13-6243	24VDC	Int.	14	150 @ 1/8"	20 @ 5/8"	1 5/8	1 1/2	8.50
	R23X19-6253	24VDC	Cont.	59	80 @ 1/8"	8 @ 1"	2 3/8	1 1/2	9.00
	R24X19-6253	24VDC	Int.	10	140 @ 1/8"	32 @ 1"	2 3/8	1 1/2	9.00

HIGH VOLTAGE DEVICES

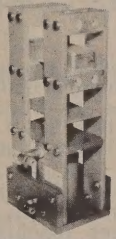
RELAYS
SWITCHES
MEASUREMENT
CONTROL UNITS
ENERGY STORAGE
SAFETY AND ACCESSORIES

AC
DC
RF
PULSE
1 KV TO 600 KV
ELECTRONIC AND POWER

HV RELAYS E SERIES

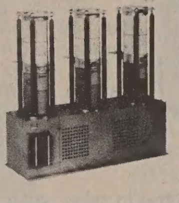
HV relays of the air insulated type both for low and high current. This series has ratings from 1 to 600 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300 KV. Single or multipole. NO, NC and DT. Auxiliary contacts optional on all types. Extended life and tungsten contacts also for high current closing.

HIGH CURRENT SWITCHES G SERIES



Models are available over 20,000 amps continuous, and over 500,000 amps pulse, with voltage ratings of 6 volts to 300 KV peak test. Many are air cylinder or motor operated for high contact force.

VACUUM CONTACTORS CIRCUIT BREAKERS

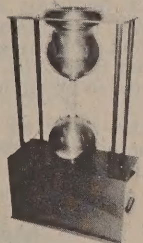


Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 5 to 200 KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 10,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capacitor discharge.

HV ROTARY SWITCHES R SERIES

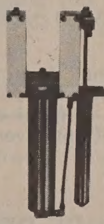
Ratings from 5 to 100 KV, 1 to 500 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

HV GROUNDING RELAYS D SERIES



Extra high voltage low corona grounding relays of the air insulated type. Ratings up to 600 KV peak at 100 amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return.

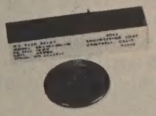
HV RF SWITCHES RF SERIES



For RF applications, low loss G-7 Silicone glass insulation and non-magnetic materials are used. Switches available up to 50 MHz. 1 to 50 KV, 1 to 800 amps. Air or hydraulic, and spring actuated.

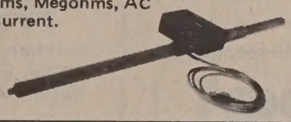
HV REED RELAYS

Reed relays from 5,000 to 30,000 volts with current carrying capabilities 1 ma to 3 amps continuous. Actuator voltages from 6 V to 230 V AC or DC are available. Over 10 million operations. With terminals or fully insulated HV leads.



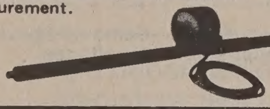
HV DIGITAL PROBE VMDP SERIES

HV Safety Probes for any Digital Display or VTVM. Also available complete with large 4½ - digit display 0.1% to 5% AC/DC accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. Shielded. 0.0001 V to 200 KV. 0.05% accuracy basic, with DCV, ACV, Ohms, Megohms, AC and DC Current.



Hi-Z™ HV VOLTMETERS SAFE POWER LINE USE AC - DC

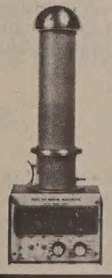
Fully safe portable, all solid state, 2% to 5% accuracy. Taut band shielded high voltage measurement with minimum circuit loading. 0.0001 V to 240 KV AC and DC. Ideal for use with Elbow capacitance tap voltage test points. For cable test point or direct line voltage and phasing, or differential measurement.



SOLENOID DRIVERS ENERGY STORAGE UNITS

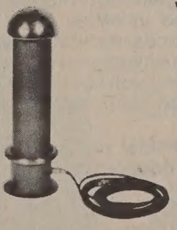
For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

HV DIGITAL MULTIMETER



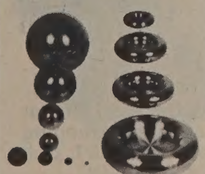
Easy to read, 4½-digit display; 0.05% basic accuracy. 0.0001 volt to 450 KV. Battery/AC with charger. Recorder and scope outputs. DC, AC PK, AC RMS average, AC RMS true, RF to 250 MHz, ohms, megohms, AC and DC current, Peak Memory. Removable Digital Multimeter. Panel mounting optional.

HV VOLTAGE DIVIDERS



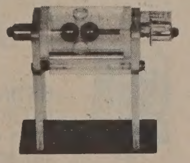
Precision compensated resistance-capacitance voltage dividers for 30 KV to 450 KV, DC to 1 MHz or to 0.2 USEC rise time pulse. 1,000/1 ratio matched to 1 megohm, 20 to 50 pf display or recorder, or as required. Accuracy and stability 0.1% to 3%.

TOROIDS, SPHERES, CORONA SHIELDS



Geometrically designed to avoid excessive voltage gradients at connecting points and other areas needing shielding or balancing of electrostatic fields to increase withstand voltage and minimize corona. Diameters are to international standard metric sizes.

HV ADJUSTABLE SPARK GAPS



Non-melting carbon spheres, 1 cm to 10 cm and heavy wall aluminum spheres, 10 cm and above. Dust tight transparent covers used 1 KV to 88 KV. Open style to 670 KV. Direct reading micrometer type calibrating device.

HV Safety Grounding Interlocks Grounding Rods, Safety Devices, Specialties.

Let us quote on specific items. Most relays are available NO NC, SPDT, and LATCHING, with 115 V 60 Hz actuators. Other voltages and frequencies available.

WRITE FOR CATALOG

ROSS ENGINEERING CORP.

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CAMPBELL, CALIF. 95008
PHONE (408) 377-4621

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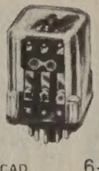
SCHRACK RELAYS

low cost • immediate delivery • highest quality

GENERAL PURPOSE RELAYS — INDUSTRIAL

CA

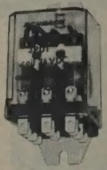


CAD

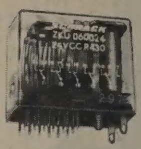
CA—A dependable, robust unit, similar to CAD series except open frame. Supplied with pierced .110 faston terminals for soldering or quick connect-disconnect P.C. terminals optional Coil voltage from 6—230 VAC. 50/60 cycle. 6—110 VDC.

CAD—A compact, plug-in relay with dust cover. Available with 1, 2, or 3 PDT contacts rated at 5 or 10 amps. The 8 or 11 pin base mates with any standard tube socket. Coil voltage from 6-230 VAC. 50/60 cycle, and 6—110 VDC.

RM—A small, low cost relay supplied with pierced .187 faston terminals for plug-in, soldering, or quick connect-disconnect application. Dust cover, plain style, for socket applications, or with slotted flanges on both ends of dust cover to permit bracket mounting directly to chassis. Sockets, neon lamps, test button available. U.L. recognized. File #E38891. **DPDT unit for 15 amp use.** 3 PDT unit for 10 amps.



ZKU—A dependable miniature general purpose relay for control circuits, automatic control systems and electronic devices requiring compact relay design and high reliability. Available with plug-in, solder or PCB terminals and 2, 4, or 6 Form C fine silver (gold flashed) contacts rated at 3 amps. Contact size: .078 O.D. Coil voltages from 6-110 VDC. Enclosed in dust cover, and can be mounted in any position.



ZLU—Same as above, only sil-cad. oxide contacts rated at 5 amps. Contact size: .100 O.D.

MINIATURE RELAYS

RA—A 4 PDT, U.L. recognized, miniature general purpose relay with gold flashed 3 amp contacts. Coil voltage from 6-220 VAC and 6-110 VDC. Available as plug-in unit to any one of 3 different socket types, with solder lugs or standard P.C. terminals. Enclosed in dust cover. Various contact materials available.

RAX—Same as above except U.L. recognized for opposite polarity voltages.

RU101—A SPDT low cost miniature relay built to meet stringent automotive Q.C. specifications. Widely used in office machines, alarm systems and appliances. Available for PCB mounting with Form C fine silver (gold diffused) contacts rated at 10 amps. Coil voltages from 3-110 VDC. Enclosed with snap-on nylon dust cover.

RU115—A miniature low profile relay with an unusually high rated breaking capacity of 10 amps at 2200 VA. The 1 Form C relay contact is rated @ 6 amps, 250 VAC continuous duty. Can be mounted in any position. Coil voltages from 5-110 VDC. Dimensions: $1\frac{1}{8}$'' long x $\frac{3}{4}$'' wide x $\frac{1}{2}$'' high, in clear dust cover for PCB mounting.

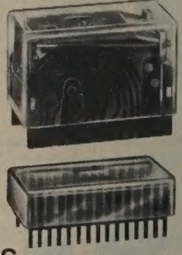
ZL880—A smaller relay than the RU101, available for PCB mounting. 1 Form C fine silver (gold flashed) contacts, rated at 6 amps at 250 VAC. Relay requires less power consumption than our RU115. Coil voltages from 3-110 VDC. Can be supplied with 2 coils - bifiliar winding; 2 coils - different coil resistances; or 2 coils - equal coil resistances. Low cost.

MAGNETIC LATCHING

CRD/CRF—A single coil magnetic latching relay similar in base design to the CAD or CAF series, CRD has octal or 11 pin base CRF pierced .110 faston terminals for soldering or quick connect-disconnect applications P.C. terminals can be furnished. Since no parts are subject to wear or friction, longer life is obtainable than with the mechanical latching relay. DPDT and 3PDT available at 10 amps. Enclosed in dust cover; aluminum dust cover optional with CRF type.

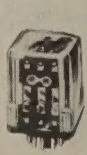
RR—Miniature version of the above, but furnished as 4PDT with 3 amp contact rating. Same physical size as RA relay. Enclosed in dust cover.

STEPPING SWITCHES



RTM—A miniature plug-in, high speed stepping switch ideal for use where economy of space and price is important. 2 pole 10 or 2 pole 12 position, gold plated contacts mate with socket which terminates on printed circuit spacing. Coil voltage from 12 to 110 VDC. Enclosed in dust cover. Dimensions: $1\frac{5}{8}$'' L x $\frac{13}{16}$'' W x $\frac{15}{16}$'' H.

SENSITIVE RELAYS



CSD/CMD—Mechanical construction similar to CA or CAD types but with sensitivity ranging from 40-300 MW and 250 MVA. Max. 3PDT. Coil voltage from 5-200 VAC and 4.9-100 VDC.

A complete variety of relay dust covers, plugs and sockets.

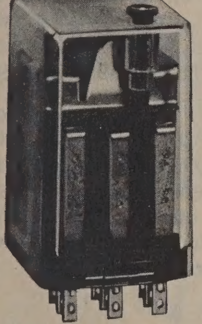
Write for catalogs and discount schedules.

SCHRACK ELECTRICAL SALES CORPORATION 1140 BROADWAY, NEW YORK, N.Y. 10001

General Purpose Relays

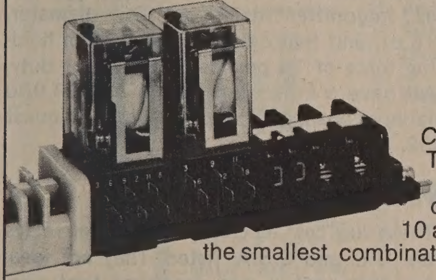
Type K

Extended relay life.
New standard of reliability.

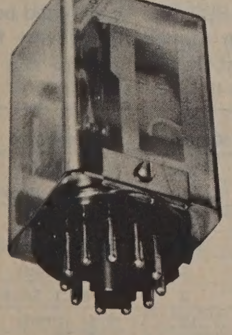


Variety of terminations. 2PDT or 3PDT. AC or DC operation. 10 amp contacts. Options include pilot light and manual operator.

Socket Mounted Version
The Type K general purpose relay is designed for multi-pole switching below 150 volts. Its small size makes it perfect for industrial or commercial control equipment. Troublesome solder connections and pigtail wires have been eliminated to give you an extremely reliable device.



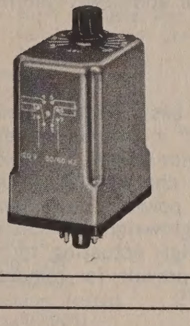
Compact Mounting
Takes up less than 3 square inches of panel space . . . 10 amp relay/socket the smallest combination on the market.



Tube-Type Version
Designed to fit all standard 8 or 11 pin sockets. Interchangeable with other tube-type general purpose relays.

Type J Timing Relay

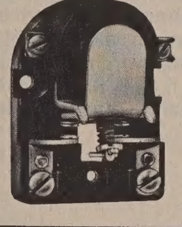
Integral Type K relay and solid state timing circuit.



Solid state timing relays give ±1% accuracy. .05 to 180 sec. knob adjustable, factory fixed or external resistor adjustable. 150 volt. 10 amp DPDT output contacts. Plug-in tube-type mount.

Type C

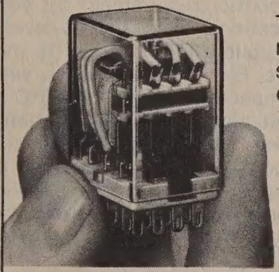
Most available relay.
Low cost.



600 volts maximum. Rated up to 1½ HP. 1 or 2 poles. Stocked by over 400 distributors.

Type R

the dependable miniature relay.



The new Type R miniature relay from Square D is very small, but very superior. It is designed to deliver reliable performance over an extremely long life.

It is the only one to offer all this:

1. Quality inspection and testing before shipment for dependable operation from the start.
2. A standard polarity barrier between each pole which allows the relay to be used where opposite polarity is present on adjacent poles.
3. A complete line of relays and sockets—and we mean complete—which makes the Type R ideal in a wide variety of applications.

In addition you get: 4 poles; double-throw contacts; 5 amp rating at 120VAC; an optional manual operator and a pilot light.

World Wide Distribution
For complete listings, prices and application data, contact your nearby Square D field office.
Or, write Square D Company, Dept. SA,
Milwaukee, Wisconsin 53201.

SQUARE D COMPANY
Wherever Electricity is Distributed and Controlled

OAK Industries Inc.

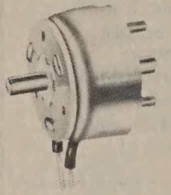
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: 815 • 459 • 5000 ■ TWX: 910 • 634 • 3353 ■ TELEX: 72 • 2447

A COMPLETE LINE OF SOLENOIDS

ROTARY • ROTARY STEPPING SWITCHES • MAGTON HIGH RELIABILITY • LINEAR • TUBULAR-FLAT PACK • LAMINATED FRAME • BOX FRAME • OPEN FRAME

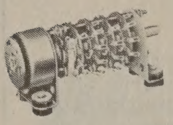
No matter what type of solenoid is best for your requirements, you'll find that Oak can supply it, because Oak makes them all! Contact the Oak field sales office listed in the directory section of **eem**, or your Oak distributor, for additional information or detailed catalogs.

ROTARY SOLENOIDS



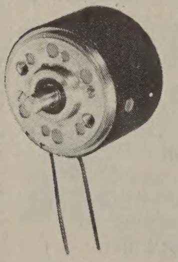
There are eight basic sizes available, from 1.156″ to 2.312″ in diameter. They can be supplied in a wide range of strokes, pulse times and other characteristics, depending on torque and power requirements. They are compact, lightweight devices, as compared to the high actuating torques and flexibility they provide for remote switching. Request Forms SP472 - SP479

ROTARY STEPPING SWITCHES



Using the eight sizes of rotary solenoids and combining them with Oak rotary switches results in an almost unlimited selection of stepping switches. As many as 60 poles, in 2, 3, 4, 5, 6, 8, 9, 10, 12, 16, 18, 20 and 24 throws can be provided. Request Form SP-228.

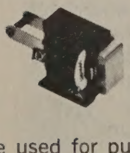
MAGTON* HIGH RELIABILITY ROTARY SOLENOIDS



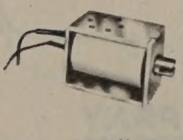
These unique rotary solenoids have an essentially unlimited life-approaching 100,000,000 operations. They will withstand the most rigid tests and will meet or exceed every quality control requirement for your severest applications. There are no levers, balls, cams or rollers to contribute to mechanical failure. Four standard series, with an ambient temperature range of −55°C to +80°C are suitable for most applications. Higher operating temperature coils, special mountings and assemblies and certification to government or military specifications can be supplied. Request Form F-980.

* Oak Industries Inc. is exclusive representative for Magnuson Engineers, Inc.

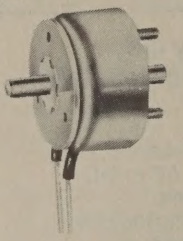
LINEAR SOLENOIDS



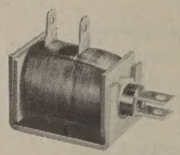
LAMINATED FRAME: These AC solenoids have a voltage range of 6 to 460 VAC, current range of 0.3 to 12 amperes. Maximum stroke is 1″, maximum force is 34 pounds at 10% duty cycle. They are designed for a 60°C temperature rise with continuous operation, 85°C for intermittent duty and can be used for push or pull. Request Form F-794. **Available for immediate delivery from Oak distributors.**



BOX FRAME: Designed for medium force and stroke applications, these low cost solenoids are produced in 9 basic sizes for both AC and DC operation. Weights range from 1½ to 20 oz., with coil watts at 25°C from 3 W to 15 W. Highly efficient design provides optimum combinations of pull and stroke for all standard AC and DC voltages. Request Bulletin F-656. **Available for immediate delivery from Oak distributors.**

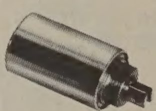


FLAT PACK: A full line of compact, highly efficient, steel enclosed solenoids that develop a very high force in relation to other sizes; for push or pull DC operation. Five basic types from 1.516″ to 2.312″ in diameter provide forces up to 85 pounds and strokes up to 0.400″ with speeds as fast as 2 milliseconds. Special shafts and retainers available. Request Forms F-926 to F-930.



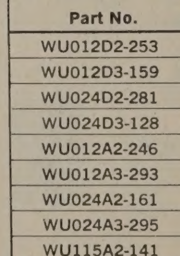
OPEN FRAME: These economical solenoids are ideal for both AC and DC applications involving limited power and stroke requirements. They are intended for operations requiring up to 20 ounces. Request Form F-971. **Available for immediate delivery from Oak distributors.**

TUBULAR SOLENOIDS



High efficiency solenoids for DC operation provide high force in a minimum of space. The Oak standard line consists of nine sizes, from a 7⁄16″ diameter unit weighing only ½ oz. with a maximum holding force of 18 oz., intermittent duty, to a 1½″ diameter, 18 oz. unit that develops a maximum holding force of 16 pounds, intermittent duty. All have a minimum life of 10,000,000 cycles and are available as push, pull or spring return. Request Forms F-428 to F-432.

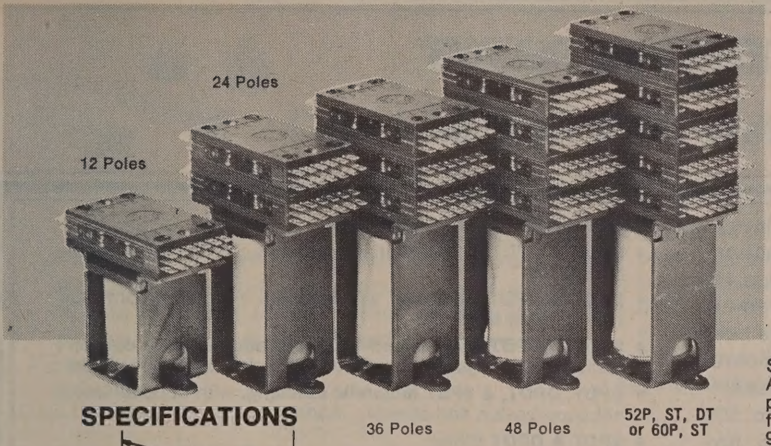
TYPE "W" POWER RELAYS



These low cost, enclosed 25A power relays are U.L. and C.S.A. listed. They are ideal for automation and machine tool control, motor starting and heater circuits. A holding circuit type is also available. Minimum life expectancy is 100,000 cycles. Request Form F-889. The types listed below are **available for immediate delivery from selected Oak distributors.**

Part No.	Coil Nominal Volts	Coil Ohms	Mounting
WU012D2-253	12 VDC	50	Side (Stud)
WU012D3-159	12 VDC	50	WPS-C1 Socket
WU024D2-281	24 VDC	200	Side (Stud)
WU024D3-128	24 VDC	200	WPS-C1 Socket
WU012A2-246	12 VAC	4	Side (Stud)
WU012A3-293	12 VAC	4	WPS-C1 Socket
WU024A2-161	24 VAC	14	Side (Stud)
WU024A3-295	24 VAC	14	WPS-C1 Socket
WU115A2-141	115 VAC	250	Side (Stud)
WU115A3-099	115 VAC	250	WPS-C1 Socket
WU220A2-140	220 VAC	1000	Side (Stud)
WU220A3-108	220 VAC	1000	WPS-C1 Socket
WHU115A4-367**	115 VAC	250	WPS-C4 Socket
WHU220A4-326**	220 VAC	1000	WPS-C4 Socket

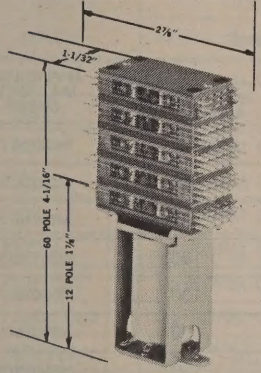
** With holding circuit.



T-bar® RELAYS for Multipole High Density Switching

Switch from 4 to 60 circuits with only one T-Bar Relay. Available in configurations of 4, 8, 12, 24, 36, 48 and 52 poles with "A" or "C" contacts and 60 poles with "A" form contacts. For low level applications specify the 901 Series. For general purpose applications specify the 801 Series.

SPECIFICATIONS



Contacts:	Series 800—general purpose gold plated Series 900—low-level bifurcated gold plated
Contact Rating:	Series 800—5 amps max. resistive to 150 watts Series 900—1 amp max. resistive to 50 watts
Life Expectancy: at 20 CPM	Series 800—30,000,000 mechanical (latching limited to 1,000,000) 20,000,000 @ 100 mw 100,000 @ 5 amps 28 VDC Series 900—30,000,000 mechanical 20,000,000 @ 100 mw 100,000 @ 1 amp at 28 VDC
Contact Resistance:	20 milliohms typical
Ambient Temperatures:	—55° to plus 85°C
Terminals:	Mate with T-Bar Connectors
Dielectric Strength:	1000 VRMS @ 60 cycles/sec. (higher available)
Insulation Resistance:	5000 megohms min. (higher available)

Power @ 25°C:

Poles	Form	Watts
4, 8 or 12	A, B or C	3
24	A, B or C	3.4
36	A, B or C	5.2
48	A	5.2
48	B or C	6.5
52	A, B or C	6.5
60	A	6.5
4, 8 or 12	D	3.4
24	D	5.2
36	D	6.5

NOTE: On all latching standard pulse coil power is 6 watts, except on bifilar coils, which is 10 watts.

Operate and Release Time Typical (at nominal voltage 25°C):

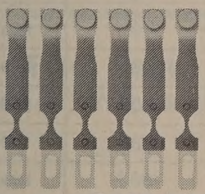
Operate (Refer to factory for faster operation):
4, 8 or 12 poles: 15 MS max.
24 poles: 25 MS max.
36 poles: 30 MX max.
48 poles: 35 MX max.
52 or 60 poles: 45 MS max.
For latching types: latch and unlatch times are 15 MS typical, all sizes.

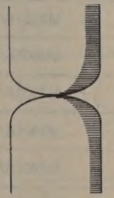
Release: 5 MS typical

Contact Bounce:
2 MS typical N.O. contacts
6 MS typical N.C. contacts
4 MS typical for latching units (both ways)

Take your choice of 2 contacts!

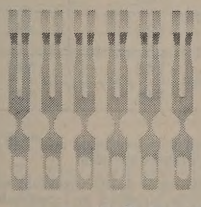
800 SERIES
for reliable General Purpose Switching





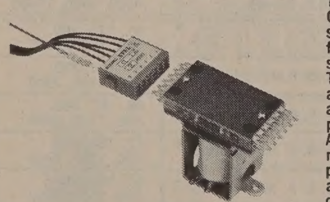
The 800 Series contact is a highly reliable gold-plated button contact. With its high contact pressure and positive wiping action, it is used in control type applications and in general purpose switching, such as relays, valves, lamps, etc. Contact Rating: up to 5 AMPS max.

900 SERIES
for reliable Low Level Switching



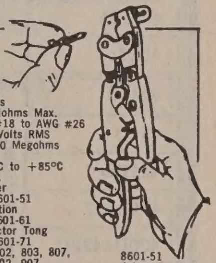
The 900 Series DATA-RITE™ contact has the reliability of a bifurcated contact with the added feature of two degrees of wiping action. The unique EDGE-TO-DOME contact guarantees a clean surface, which is critical for low level signals. The 900 Series is typically used in computer I/O signals; voice and data-grade communications; thermocouple and strain gauge outputs; all low level switching, whenever reliability is a premium, or whenever slight variations in contact resistance cannot be tolerated. Contact Rating: Microvolts up to 1 AMP max.

T-BAR CONNECTORS



The T-Bar Series 88601 Connector has been specifically designed for use with T-Bar switches and relays. The connector contacts are crimp type which are snapped into a plastic insulator block. After installation, connectors are held in place against shock and vibration by use of a retaining clip.

Current Carrying Capacity	5 Amps
Contact Resistance	5 Milliohms Max.
Wire Accommodated	AWG #18 to AWG #26
Dielectric Strength	1000 Volts RMS
Insulation Resistance	100,000 Megohms Min.
Ambient Temperature	—55°C to +85°C
Weight	0.3 Oz.
Recommended Tools	Crimper P/N 8601-51 Extraction P/N 8601-61 Connector Tong P/N 8601-71
Use 88601 With	801, 802, 803, 807, 901, 902, 907



8601-51 Crimping Tool

HOW TO ORDER

1. Specify Series **2.** Specify Number of Poles and Contact Form **3.** If A Relay, Specify Coil Voltage

Don't forget to order the mating T-Bar Series 88601 Connector! One for each 6 poles.

901 — **12 C** — **24**

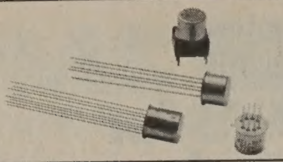
SERIES	Application	No. of Poles	Contact Form*	Actuating Mechanism	Coil Voltage
801	General Purpose	4 to 52 60 Pole Unit "A" Form Only	"A" or "C"	CONTINUOUS DUTY COIL	6, 12, 24, 28, 48, 110 VDC 115 VAC
901	Low Level				
807	General Purpose	12 to 52	"C"	MAGNETIC LATCHING COIL (Pulse to latch, pulse in opposite polarity to unlatch.)	6, 12, 24, 28, 48, 110 VDC
907	Low Level				

*Form "A"— normally open contacts. Form "C"— double throw, break-before-make.

Manufactured under 1 or more of the following patents: 3206990, 3226508, 3689856.
®"T-Bar"—Reg. T.M.

T-bar INCORPORATED
SWITCHING COMPONENTS DIV. 141 Danbury Road, Wilton, Conn. 06897 • (203) 762-8351

Bob Paul 4944



TELEDYNE RELAYS

Military TO-5 Relays

The most versatile line of subminiature relays in the industry. Featuring all welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low inter-contact capacitance provide RF switching capability up to 500 MHZ. Most models qualified to MIL-R-39016, levels "L" and "M", or MIL-R-28776.

Available in following versions:

- **SPDT & DPDT,** with optional internal suppression and steering diodes
- **SPDT & DPDT Sensitive,** with optional internal suppression and steering diodes
- **SPDT & DPDT Hybrid** (both standard and sensitive coil versions) with internal transistor driver and suppression diode
- **SPDT, DPDT, & 4PST Magnetic Latching,** with optional internal suppression and steering diodes
- **SPDT & DPDT Bifilar**

Special models available on request.

SERIES*		CONTACT DATA		COIL DATA			APPLICABLE MIL. SPEC. SHEET
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	MUST-OPERATE POWER (MW)	
411		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	100	M39016/7
411D		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	100	M39016/23
411DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	100	M39016/24
411T		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	100	M28776/5
412		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130	M39016/9
412D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130	M39016/15
412DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	130	M39016/20
412T		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130	M28776/1
431	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	40	M39016/10
431D		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	40	M39016/25
431DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	40	M39016/26
431T		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	40	M28776/4
432		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	60	M39016/11
432D		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	60	M39016/16
432DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	60	M39016/21
432T		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	60	M28776/3
421	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	100	M39016/8
421D		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	100	M39016/27
421DD		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	100	M39016/28
420/422		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	100	M39016/12
420D/422D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	100	M39016/29
420DD/422DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130. 2000	100	M39016/30
424A		4 FORM A	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	125	NA
424AD		4 FORM A	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500. 1130, 2000	125	NA
441	BI-FILAR	1 FORM C	1	6, 12, 26.5	90, 360, 1450	145	NA
442		2 FORM C	1	6, 12, 26.5	90, 360, 1450	145	NA

General Specifications:
Contact Resistance: 0.1Ω max. initial/0.2Ω max. after life at max. load
Life: 100,000 operations @ max. rated contact load (life expectancy 10^7 operations at low level)
Temperature: −65°C to +125°C
Vibration: 30 g's to 3000 Hz.
Shock: 80 g's for 11 ms. (some maglatch models higher)

Terminal and Spreader Pad Options:

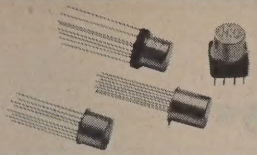
1. Standard terminal lengths: 1.5" (38.10 mm) wire leads or .187" (4.75 mm) pins (pin versions designed for use with plug-in sockets)
2. All models except 411 & 431 series (including D & DD versions) and 441 series can be supplied with spreader pads installed and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards; P/N 192-59 designed for use with standard DIP sockets.

*Suffix D denotes internal suppression diode, DD suppression & steering diodes, and T transistor driver & suppression diode.

TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 • Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.



TELEDYNE RELAYS

Commercial/Industrial TO-5 Relays

Low cost versions of DPDT MIL qualified TO-5 relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability up to 500 MHz.

Available in following versions:

- **DPDT,** with optional internal suppression diode
- **DPDT Sensitive,** with optional internal suppression diode
- **DPDT Hybrid** (both standard and sensitive coil versions) with internal transistor driver and suppression diode
- **DPDT Magnetic Latching,** with optional internal suppression diodes

Special models available on request.

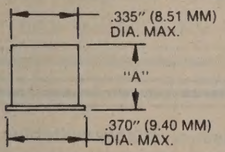
SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	MUST-OPERATE POWER (MW)
712	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 100, 220, 390, 880, 1560	185
712D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 100, 220, 390, 880, 1560	185
712TN	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 100, 220, 390, 880, 1560	185
732	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	90
732D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	90
732TN	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	90
732-1000*	2 FORM C	1	12	940	60
732D-1000*	2 FORM C	1	12	940	60
720/722	2 FORM C MAGLATCH	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	125
720D/722D	2 FORM C MAGLATCH	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	125

Spreader Pad Options:
All models can be supplied with spreader pad mounted and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards; P/N 192-59 designed for use with standard DIP sockets.

*Ultra-sensitive 732-1000 series designed specifically for use in battery-operated radio transceivers.

General Specifications:
Contact Resistance: .100 Ω initial/.200 Ω max. after life at max. load
Life: 100,000 operations at max. rated load (life expectancy 10^7 operations at low level loads)
Temperature: −55°C to +71°C (operating)

TO-5 Relay Case Dimensions



RELAY SERIES	"A" DIM.	
	INCHES	MM
411 412	.265	6.74
421 420/422 712 720/722	.275	6.99
424A	.325	8.26
431 432 441 442 732	.375	9.53

Spreader Pads for TO-5 Relays

Preform and spread leads to grid patterns compatible with printed circuit board layouts and DIP sockets, with minimum additional profile height.

P/N 192-10

- Preforms and spreads leads to .200" X .300" grid at .100" spacing
- Serves as spacer and insulator for printed circuit board applications
- Simplifies insertion of leads into printed circuit boards
- Reduces stress on glass seals
- Aids visual inspection of solder flow
- Fits all TO-5 relays except 411, 424A, and 431 series (including D and DD versions) and 441 series. (See Note 2)

P/N 192-59

- Preforms and spreads leads to .300" grid at .100" spacing
- Designed for use with standard DIP sockets
- Fits the following TO-5 relay series: 412, 421, and 432 (including D and DD versions), 712 and 732 (including D versions), 411T, 431T, and 442 (See Notes 3 and 5)

P/N 192-67

- Preforms and spreads leads to .200" X .300" grid at .100" spacing
- Fits the following TO-5 relay series: 411 and 431 (including D and DD versions), 441 and 424A (See Note 4)

Notes:

1. Relays can be supplied with spreader pads installed and cemented in place.
2. To order relays with 192-10 spreader pads installed, add M to part number (for example: 412D-26 with 192-10 pad installed is 412DM-26).
3. To order relays with 192-59 spreader pads installed, add M2 to part number (for example: 412D-26 with 192-59 pad installed is 412DM2-26). Leads are trimmed to .130" below pad for plugging directly into DIP sockets.
4. To order relays with 192-67 spreader pads installed, add M3 to part number (for example: 412D-26 with 192-67 pad installed is 412DM3-26).
5. Relays with 9 or 10 pins may be mounted on 192-59 spreader pad, but will not plug into standard DIP sockets.
6. Material: Diallyl Phthalate.

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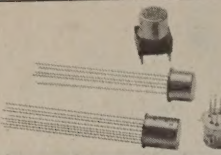


TELEDYNE RELAYS

High Environmental Military TO-5 Relays

412H Series — High Temperature (200°C)

Designed for reliable operation in elevated ambient temperatures up to 200°C. Special material selection and processing eliminate contact contamination and mechanical malfunctioning resulting from ambient temperature conditions in excess of maximum military temperature limits. Meets requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	MUST-OPERATE POWER (MW)
412H	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130

412K Series — High Shock (4000 g's / .5 ms)

Designed to withstand shock levels up to 4000 g's/.5 millisecond duration. Special material selection and construction details provide assurance that critical elements of relay structure and mechanism will not be permanently displaced or damaged as a result of extremely high g level shocks. Meets requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	MUST-OPERATE POWER (MW)
412K	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	250

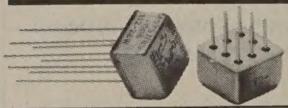
412V Series — High Vibration (250 g's)

Designed to withstand vibration levels up to 250 g's sinusoidal up to 2000 Hz. Magnetic circuit prevents contact opening (chatter) in excess of 10 microseconds under vibration or shock conditions. Meets requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	MUST-OPERATE POWER (MW)
412V	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	170

Notes (apply to all high environmental TO-5 relays):

1. Unless otherwise specified relays are supplied with 1.500″ (38.10 mm) leads. For .187″ (4.75 mm) pin versions, add "S" to part number (i.e. 412H-26 becomes 412HS-26).
2. Screened hi-rel versions are available on special order and can be supplied to meet the requirements of NASA MSFC Spec. 40M 37496 or NASA GSFC Spec. S-311-P-2(06).
3. All series can be supplied with spreader pads installed and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards; P/N 192-59 designed for use with standard DIP sockets.



Centigrid® Military Relays

The smallest subminiature relay available. Low profile, .230" (5.72 mm) high by .370" (9.40 mm) square, with .100" grid spaced leads. Features all welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low inter-contact capacitance provide RF switching capability up to 500 MHz. All models qualified to MIL-R-39016, levels "L" and "M."

SERIES*	CONTACT DATA		COIL DATA			APPLICABLE MIL. SPEC.
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE	MUST-OPERATE POWER (MW)	
112	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130	M39016/17
112D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	130	M39016/18
112DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	130	M39016/19

General Specifications:

Contact Resistance: 0.1Ω max. initial; 0.2 Ω max. after life at max. load.
Life: 100,000 operations @ max. rated contact load (life expectancy 10^7 operations at low level)
Temperature: −65°C to +125°C
Vibration: 30 g's to 3000 Hz.
Shock: 75 g's for 6 msec. min.

***NOTE:** Suffix D denotes internal suppression diode, suffix DD suppression and steering diodes.

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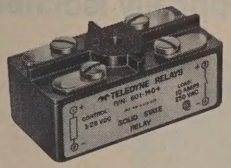
TELEDYNE RELAYS
Solid State AC Relays

601-1400 Series — Optically Isolated



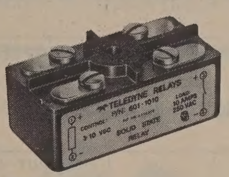
UL Recognized — File #59547

CSA Certified — File #31043

Solid state AC relays featuring LED optical isolation and synchronous/zero voltage turn-on. Available in 5 or 10 Amp steady state current ratings for 120 or 250 Volt loads (with peak ratings up to 600V). SPST, normally open. Choice of logic compatible 3-28 VDC or 90-250 VAC input. The versatile package design of the 601-1400 series provides choice of screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board applications. 1" (25.4mm) × 2" (50.8mm) × .9" (22.9mm) package size makes it the smallest 10 Amp solid state relay available.

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT (LOAD) CURRENT RATING & PART NUMBERS	
	CONTINUOUS VAC (RMS)	TRANSIENT VAC (PEAK)	5 AMP	10 AMP
3-28 VDC	140	200	601-1401	601-1402
	250	400	601-1403	601-1404
	250	600	601-1403H	601-1404H
90-250 VAC	140	200	601-1411	601-1412
	250	400	601-1413	601-1414

601-1000 Series — Transformer Isolated



Transformer isolated version of the 601-1400 Series. High input/output isolation (1500V/10⁹ Ohms) achieved through magnetic coupling. Asynchronous turn-on; zero current turn-off. SPST, available in 3 and 10 Amp ratings for 120 or 250 Volt loads. Features "adaptive" package design, providing choice of either screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board mounting.

UL Recognized — File #E47991

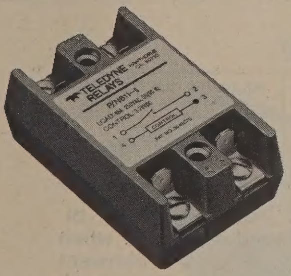
CSA Certified — File #31043

INPUT (CONTROL) VOLTAGE RANGE	OUTPUT CURRENT RATING AND PART NUMBERS	
	3 AMP	10 AMP
3-10 VDC	601-1007	601-1010
6-32 VDC	601-1017	601-1020
60-140 VAC	601-1027	601-1030

Basic part number provides screw terminals.
Add suffix "P" for PC board pins, "Q" for quick disconnect terminals.

611 Series — Optically Isolated

High power solid state AC relays, available in 10, 15, 25 and 40 Amp ratings, for 120 and 250 Volt loads (with peak ratings up to 600V). Features LED optical isolation and synchronous/zero voltage switching. High output dv/dt immunity -200 Volts/µsec. typical. Choice of logic compatible 3-28 VDC or 90-250 VAC input. Provided with multipurpose screw and quick-disconnect terminals.



UL Recognized — File #E55197

CSA Certified — File #31043

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT CURRENT RATING AND PART NUMBERS			
	CONTINUOUS (RMS)	TRANSIENT (PEAK)	10 AMP	15 AMP	25 AMP	40 AMP
3-28 VDC	140	200	611-7	611-3	611-1	611-5
	250	400	611-8	611-4	611-2	611-6
	250	600	611-8H	611-4H	611-2H	611-6H
90-250 VAC	140	200	611-17	611-13	611-11	611-15
	250	400	611-18	611-14	611-12	611-16
	250	600	611-18H	611-14H	611-12H	611-16H

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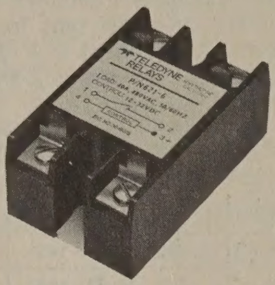
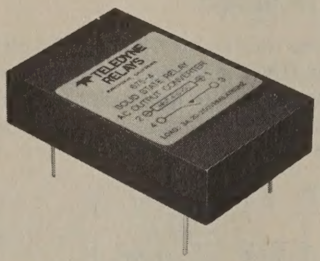
Solid State AC Relays



621 Series — High Voltage, Optically Isolated

Solid State AC Relays featuring 3750VRMS optical isolation and synchronous/zero voltage turn-on. Available in 15, 25, and 40 Amp steady state current ratings for 480 Volt loads (with peak ratings up to 800V). SPST, normally open. Choice of logic compatible 3-14 or 12-32 VDC input. Package design provides multi-purpose screw and quick-disconnect terminals. Designed to meet safety requirements of UL, CSA, VDE and IEC.

INPUT VOLTAGE RANGE	OUTPUT (LOAD) CURRENT RATING & PART NUMBERS		
	15 AMP	25 AMP	40 AMP
3-14 VDC	621-1	621-3	621-5
12-32 VDC	621-2	621-4	621-6



675 Series — Low Profile PC Board Relays

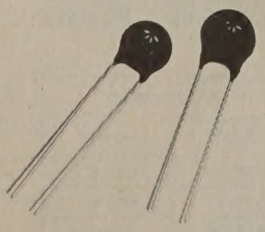
Optically isolated solid state AC relays featuring low profile package for PC board mounting. Maximum steady state load rating 3A/250VRMS. SPST, normally open. Control inputs are compatible with both low and high level logic systems.

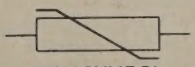
INPUT VOLTAGE RANGE	PART NUMBER	OUTPUT VOLTAGE RATING	
		CONTINUOUS (RMS)	TRANSIENT PEAK
4-10 VDC	675-4	250 VAC	400 VAC
	675-4H		600 VAC
10-32 VDC	675-5		400 VAC
	675-5H		600 VAC

UL Recognized — File #E55197
CSA Certified - File #LR31043-5

Metal Oxide Varistors (MOV)

970 Series





MOV SYMBOL

Teledyne 970 Series Metal Oxide Varistors (MOVs) are characterized specifically for use with Teledyne solid state AC relays and I/O converter modules for protection against high voltage transients that are prevalent on AC lines. MOVs are bi-directional voltage sensitive devices that assume a low impedance state when their design voltage threshold is exceeded. As such, they perform a transient voltage clipping or suppression function on the AC line similar to back-to-back zener diodes and are ideal for circuit protection use from the standpoint of performance, economy and ease of installation.

PART NUMBER	TRANSIENT (PEAK) RATING OF RELAY	MAXIMUM CONTINUOUS LINE VOLTAGE (RMS)
970-1	400 VAC	140 VAC
970-2	600 VAC	250 VAC

(Consult factory for information regarding MOVs with higher ratings.)

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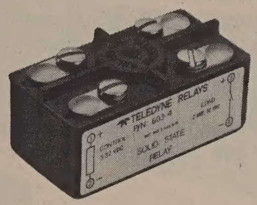
TELEDYNE RELAYS
Solid State DC Relays

603 Series — Optically Isolated



Solid state DC relays featuring LED optical isolation. SPST, normally open. Available in 2 and 5 Amp steady state current ratings, up to 250 VDC. DC control inputs are compatible with both low and high level logic systems. As an added option, controlled rise and fall time is offered to limit in-rush currents for lamp loads and switching transients for inductive loads. Package configuration provides either screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board mounting.

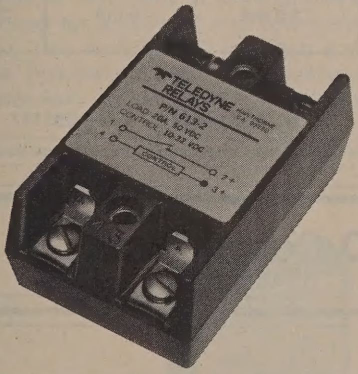
Size: 1" (25.4mm) X 2" (50.8mm) X .9" (22.9mm).

INPUT VOLTAGE RANGE	OUTPUT (LOAD) VOLTAGE RATING (VDC)	OUTPUT CURRENT RATING AND PART NUMBERS	
		2 Amp	5 Amp
3-32 VDC	50	603-1	603-2
4-10 VDC	250		603-3
10-32 VDC	250		603-4
90-250 VAC	50	603-11	603-12
3-32 VDC	50	603-21	603-22
		WITH CONTROLLED RISE AND FALL TIME	

Notes:

1. 603-3 and -4 utilize transformer isolation.
2. Basic P/N provides screw terminals. Add suffix "P" for PC board solder pins, suffix "Q" for quick disconnect terminals.

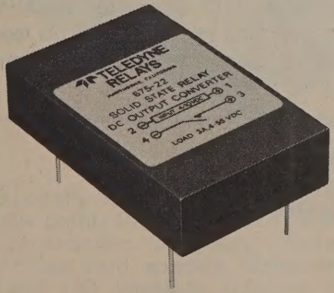
613 Series — High Current, Transformer Isolated



High current solid state DC relays featuring transformer isolation for low off-state leakage. SPST, normally open. 20A/50VDC maximum steady state load rating. Control inputs are compatible with both low and high level logic systems. Package design provides multipurpose screw and quick-disconnect terminals.

INPUT VOLTAGE RANGE	PART NUMBERS
4-10 VDC	613-1
10-32 VDC	613-2

675 Series — Low Profile PC Board Relays



Optically isolated solid state DC relays featuring low profile package for PC board mounting. 3A/55VDC maximum steady state load rating. SPST, normally open. Control inputs are compatible with both low and high level logic systems.

INPUT VOLTAGE RANGE	PART NUMBERS
4-10 VDC	675-22
10-32 VDC	675-23

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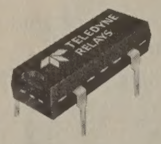
TELEDYNE RELAYS

SERENDIP® Commercial/Industrial DIP Solid State Relays



Subminiature solid state relays in standard TO-116 DIP packages. Featuring all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 volts/10^9 Ohms). Six models available providing choice of output: bipolar (AC or DC), AC (triac), and DC (transistor). Bipolar (640/644 series) and DC (643 series) are direct pin-for-pin replacements for standard DIP reed relays.

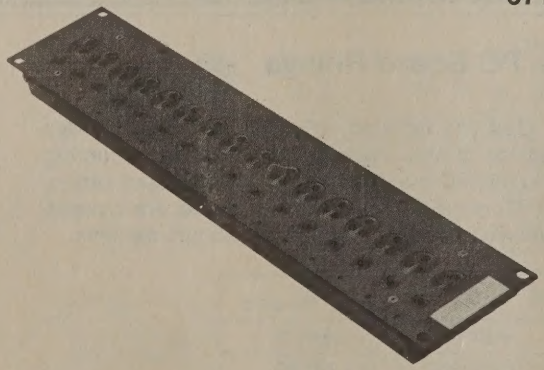
	INPUT DATA		OUTPUT (LOAD) RATINGS			
				CURRENT		
PART NUMBER	VOLTAGE (VDC)	MAX. CURRENT (MADC @ 5V)	AC/DC	@ 10V INPUT	@ 5V INPUT	VOLTAGE
640-1	3.8 - 10	22	BIPOLAR (AC or DC)	±80 mA	±40 mA	±50 V PEAK
641-1*	4 - 10	15	AC	0.5 A (Note 1)	0.5 A (Note 1)	140 V RMS
641-2*	4 - 10	15	AC	0.5 A (Note 1)	0.5 A (Note 1)	250 V RMS
643-1	3.8 - 10	15	DC	400 mA	200 mA	60 V DC
643-2	3.8 - 10	15	DC	100 mA	50 mA	250 V DC
644-1	3.8 - 6	18	BIPOLAR (AC or DC) (Note 2)	±5 mA	±5 mA	±5 V PEAK

Notes:
1. 1 Amp with standard DIP heat sink (Thermalloy P/N 6007A, or equivalent).
2. Features low offset voltage (100 microvolts typical).

***UL Recognized — File #E55197**

Mounting Panel For 671 I/O Converters

671P Series



Custom designed mounting panel for Teledyne 671 Series Solid State I/O Converter Modules. Fits standard 19″ rack and accepts up to 16 modules. Panel contains integral interconnect wiring for logic circuitry.

(See page 9 for description of 671 Series I/O Converter Modules.)

PART NUMBERING
- 671P-2 Rear mounted connector
- 671P-4 Top mounted connector

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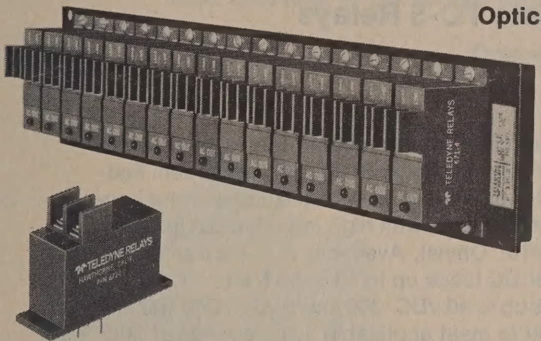
TELEDYNE RELAYS
Solid State AC & DC I/O Converters

671 Series — Panel Mounted
Optically Isolated



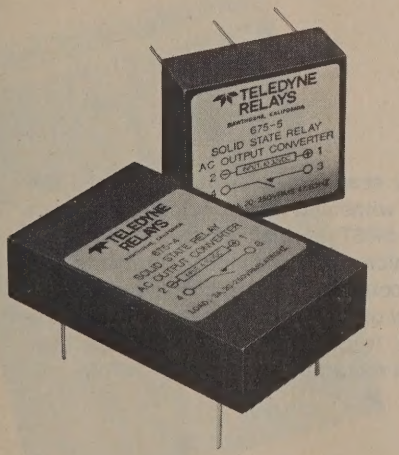
Designed for use in programmable controllers, computerized process control systems, machine tool controls, etc. All solid state circuitry — optically isolated — with high transient and noise immunity to withstand severe industrial environments without false triggering. Unique single circuit modular package design with logic terminals physically isolated from power wiring and high barriered power terminals providing for side by side panel mounting, thus eliminating the need for additional interconnecting terminal strips. This modular I/O interface concept facilitates installation and maintenance and offers substantially greater system flexibility when compared to conventional multicircuit PC card systems. Integral LED status indicators are included for easy troubleshooting. There are 9 different converter modules in the series as shown on the table.

P/N	DESCRIPTION	RATINGS
671-1	AC Input Converter	130 VAC Input
671-11	AC Input Converter	250 VAC Input
671-4	AC Output Converter (400V Peak Output Rating)	4-10 VDC Input 3 amps/250 VAC Output
671-4H	AC Output Converter (600V Peak Output Rating)	4-10 VDC Input 3 amps/250 VAC Output
671-5	AC Output Converter (400V Peak Output Rating)	10-32 VDC Input 3 amps/250 VAC Output
671-5H	AC Output Converter (600V Peak Output Rating)	10-32 VDC Input 3 amps/250 VAC Output
671-21	DC Input Converter	10-32 VDC Input
671-22	DC Output Converter	4-10 VDC Input 3 amps/55 VDC Output
671-23	DC Output Converter	10-32 VDC Input 3 amps/55 VDC Output

Notes:

1. AC Converters are color-coded Blue; DC Converters are color-coded Red.
2. For additional information on Series 671P Mounting Panel, see page 8.

675 Series — PC Board Mounted
Optically Isolated



PC board concept facilitates installation and maintenance. Utilizes all solid state circuitry — optically isolated — with high transient and noise immunity. There are 9 different converter modules in the series as shown on the table.

Functionally identical to 671 Series but featuring low profile PC board compatible potted module construction for greater packaging density and close card spacing. Designed to replace discrete I/O interface circuitry, this modular

P/N	DESCRIPTION	RATINGS
675-1	AC Input Converter	130 VAC Input
675-11	AC Input Converter	250 VAC Input
675-4	AC Output Converter (400V Peak Output Rating)	4-10 VDC Input 3 amps/250 VAC Output
675-4H	AC Output Converter (600V Peak Output Rating)	4-10 VDC Input 3 amps/250 VAC Output
675-5	AC Output Converter (400V Peak Output Rating)	10-32 VDC Input 3 amps/250 VAC Output
675-5H	AC Output Converter (600V Peak Output Rating)	10-32 VDC Input 3 amps/250 VAC Output
675-21	DC Input Converter	10-32 VDC Input
675-22	DC Output Converter	4-10 VDC Input 3 amps/55 VDC Output
675-23	DC Output Converter	10-32 VDC Input 3 amps/55 VDC Output

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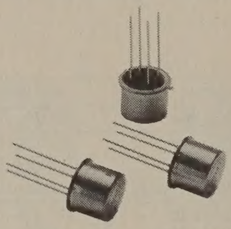
Military Solid State Relays

M640 Series Solid State TO-5 Relays

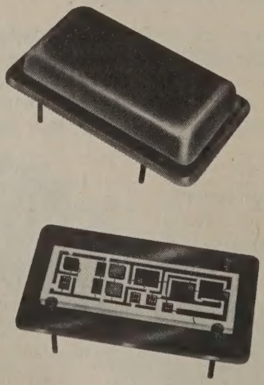


Hermetically sealed subminiature solid state relays in TO-5 package. SPST, normally open. Features all solid state circuitry utilizing hybrid microcircuit techniques, with high input/output isolation (1000 V/10^9 Ohms). Available with bipolar output for AC or DC loads up to 40 V/60 Ma or DC output for loads up to 40 VDC/300 Ma or 250 VDC/100 Ma. Designed to meet applicable requirements of MIL-STD-883 and MIL-R-28750/5, /6, and /7.

PART NUMBER	OUTPUT RATING
M640-1	40 V/60 MA (bipolar, AC or DC)
M643-1	40 VDC/300 MA
M643-2	250 VDC/100 MA

Model 683-1 — 600 MA/50 VDC Solid State DC Relay

Optically Isolated



Hermetically sealed in a low profile metal DIP enclosure to withstand Military and Aerospace environments. SPST, normally open. Features constant current microcircuit for input control and dual photo-voltaic couplers for high output current, together with low off-state leakage. Snap-action prevents damage from slowly ramped inputs. Designed to meet requirements of MIL-R-28750.

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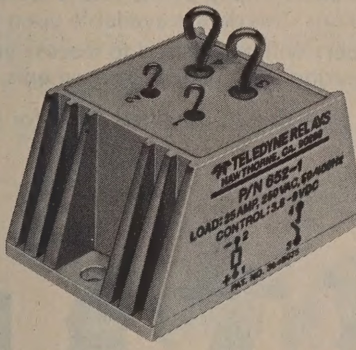
TELEDYNE RELAYS

Military Solid State Relays

652 Series — 25 Amp/250 VAC Solid State AC Relays

Optically Isolated


TELEDYNE RELAYS
HAWTHORNE, CA. 90250
P/N 652-1
LOAD: 25 AMP, 250VAC, 45-440Hz
CONTROL: 3.8-9VDC
PAT. NO.

Hermetically sealed in a thermally efficient aluminium case to withstand Military and Aerospace environments. SPST, normally open. Features output switching by means of inverse/parallel SCRs for reliable operation over frequency range of 45-440Hz. Logic compatible drive circuit precludes need for external relay drivers. Synchronous/zero voltage turn-on to minimize RFI. Designed to meet the requirements of MIL-R-28750, and to operate within all categories of MIL-STD-704A Aircraft Power Limits.

INPUT VOLTAGE RANGE	PART NUMBERS
3.8- 9 VDC	652-1
9-32 VDC	652-3

Solid State Relay Applications
HANDBOOK
TELEDYNE RELAYS

SSR APPLICATIONS HANDBOOK

A comprehensive 24-page engineering guide to the selection and application of solid state relays. Available on request from Teledyne Relays.

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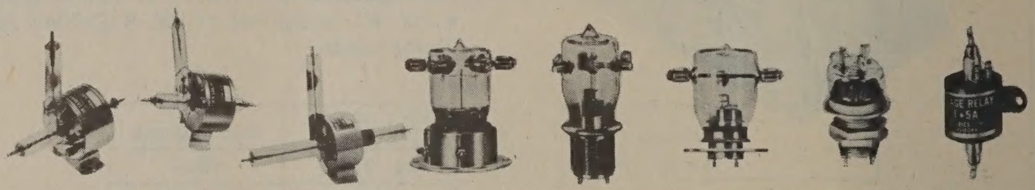
VACUUM RELAYS

TORR . . . the famous name in vacuum

Torr Laboratories, Inc. is a major manufacturer of high voltage high vacuum relays in America today. Torr produces a broad line of high voltage relays from the low power to the megawatt range. Standard relays are available from stock. Special items and modifications are available for rapid delivery.

Torr supplies high voltage, high vacuum relays on an international basis for applications in sonar, telemetry, radar pulse networks, RF equipment, high voltage power supplies, electromedical devices and many other systems. Flexible manufacturing and research facilities provide quick reaction from the development of a special relay design to the final production product. Many of the relays shown meet MIL specifications. This data is available upon request.

- Our engineers will be pleased to discuss your specific engineering and system requirements.
- Relays are available to qualified users for test and evaluation.



TORR TYPE	TVS-1	TMR-9	T-35	TB2A	T8T	T8R	TCR-1G	T5A
Contact Arrangement	SPDT, Form C	SPDT, Form C	SPDT, Form C	DPDT, Form 2C	SPDT, Form C	SPDT, Form C	SPDT, Form C	SPST, Form A or B
Operating Voltage (peak) DC or 60 Hz	17.5 KV	17.5 KV	35 KV	13.0, air 20 KV, oil	17.0 KV, air 26 KV, oil	26 KV, air 35 KV, oil	5.0 KV, air 15 KV, oil	5.5 KV
Test Voltage (peak)	22.5 KV	27.0 KV	45 KV, air 55 KV, oil	15.0, air 25.0, oil	18 KV, air 28 KV, oil	30 KV, air	5.0 KV	10 KV
Max. Contact Resistance (ohms)	.012	.012	.015	.010	.010	.012	.010	.010
Total Operate Time (milliseconds)	15	15	15	15	12	12	4	10
Total Release Time (milliseconds)	15	15	15	10	10	10	4	10
Coil Voltages[2] Available	26.5 VDC 117.0 VAC	40.0 VDC	26.5 VDC 117.0 VAC	26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC	26.5 VDC
Coil Resistance (ohms) ±10% @ 25°C	128.0 (DC) 2000 (AC)	65	50 (DC) 2000 (AC)	225	265	120	330	250
Continuous Current (amps) RMS — 60 cps	9.0	10.0	10.0	25	15	25[1]	20.0	5.0
Nominal Weight (oz.)	7.0	7.0	10	5.0	4.0	4.0	1.0	1.0
Nominal Size (inches)	4¾ x 3¾	4½ x 3¼	7½ x 5½	1¼ x 3	1⅛ x 2¾	2 x 3½	1 x 1¼	¾ x 2
Mounting Style[3]	with or without foot bracket	foot bracket	foot bracket	threaded style	threaded style	flange style	threaded style	foot bracket
Typical Application	AC, DC, Pulse	Medical-Defibrillator, AC, DC, Pulse	AC, DC, Pulse	RF, AC, DC, Pulse	RF, AC, DC, Pulse Airborne	RF, AC, DC, Pulse	RF, AC, DC, Pulse Airborne	AC, DC, Pulse Airborne
Shock	30G — 11 ms	30G — 11 ms	10G — 11 ms	30G — 11 ms	30G — 11 ms	30G — 11 ms	55G — 11 ms	50G — 11 ms
Vibration	10G — 55 cps	10G — 55 cps	10G — 55 cps	5G, 55 — 2000 cps 10G, 55 — 500 cps	10G — 500 cps 5G — 2000 cps	10G — 400 cps	10G — 2000 cps	10G — 55 cps 5G — 1500 cps

TORR LABORATORIES, INC. *— Subsidiary* ***Xonics, Inc.***

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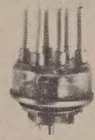
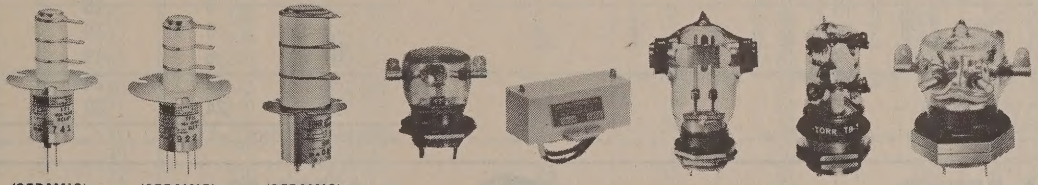
VACUUM RELAYS

TORR HIGH VACUUM RELAY ADVANTAGES

- HANDLE HIGH PEAK CURRENTS
- LONG LIFE WITHOUT CONTACT DEGRADATION
- ALL RELAYS VACUUMIZED TO BETTER THAN 10^{-9} TORR
- EXCELLENT FOR SEVERE ENVIRONMENTS
- IDEAL FOR HIGH DENSITY PACKAGING
- FAST RECOVERY FROM OVERLOADS



The Torr TMR-12 high-voltage relay was designed primarily for use in DC defibrillators. This new proprietary design is half the size and weight of typical defibrillator relays such as the TMR-10 shown in the inset below. This novel design does not require external protection to prevent breakage. It also has built-in re-entrant insulators which greatly improves arc resistance and external arc-over characteristics. The other electrical characteristics are the same as the TMR-10. The low contact bounce characteristics and small size makes this unit ideal for both portable and stationary defibrillator systems. Send for technical product data sheet.



(CERAMIC) (CERAMIC) (CERAMIC)

TORR TYPE	TF1	TF-1L	TF2	T-11	T6G-M	TMR-10	TB-3	T-12
Contact Arrangement	SPDT, Form C	SPDT, Latch	SPDT, Form C	SPST, Form A	SPST, Form A or B	DPDT, Form 2C	DPDT, Form 2C	DPDT, Form 2C
Operating Voltage (peak) DC or 60 Hz	5.0 KV	5.0 KV	8.0 KV	12.5 KV, air 20.0 KV, oil	10 KV, DC	8.0 KV, DC	12 KV, air 17 KV, oil	9.0 KV, air 20 KV, oil
Test Voltage (peak)	6.0 KV	6.0 KV	12.0 KV	15.0 KV, air 22.0 KV, oil	12 KV, DC	17.0 KV, DC	15 KV, air 20 KV, oil	12.0 KV, air 22.0 KV, oil
Max. Contact Resistance (ohms)	.015	.015	.012	.012	.025 ohms	.5 ohms	.010	.010
Total Operate Time (milliseconds)	6.0	1.5	12	13.0	10 ms	25 MS & 17 MS @ 40 VDC	20.0	15.0
Total Release Time (milliseconds)	6.0	1.5	12	13.0	10 ms	20 MS	8.0	8.0
Coil Voltages[2] Available	26.5 VDC	26.5 VDC, Pulse	26.5 VDC	26.5	12 VDC	40 VDC	26.5	26.5
Coil Resistance (ohms) ±10% @ 25°C	330	10-20 ohms	220	250	100 ohms	65[2]	120	268
Continuous Current (amps) RMS — 60 cps	8.0	4.0 @ 16 MHz	15 @ 15 MHz	15.0	5.0 amps DC	30 amps	30.0	15.0
Nominal Weight (oz.)	1.0	1.0	2.0	2.0	3.0	16.0	5.0	2.0
Nominal Size (inches)	1.65 x .500	1.65 x .500	2.30 x .750	1 x 1 13/16	2 1/4 x 1 1/16 H	3 x 3.5	1 1/2 x 3 5/16	1.5 x 2.0
Mounting Style[3]	flange style	flange style	flange style	threaded style	foot bracket	flange style	threaded style	threaded style
Typical Application	AC, DC, UHF	AC, DC, UHF	AC, DC, UHF	RF, DC, Pulse Airborne	Condenser Discharge for Defilbrillator	Medical-Defibrillator	RF, DC, Pulse	RF, DC, Pulse Airborne
Shock	50G — 11 ms	50G — 11 ms	50G	30G — 11 ms	20 G — 11 ms	30G — 11 ms	30G — 11 ms	30G — 11 ms
Vibration	10G — 2000 cps	10G — 2000 cps	10G — 1000 cps	10G—500 cps 5G—2000 cps	5G — 500 cps	10G — 55 cps	10G—500 cps	10G—500 cps 5G—2000 cps

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[1] Consult Torr data sheet for higher frequency values
[2] Any coil voltage available by request
[3] Other mounting styles available

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TORR
LABORATORIES, INC.

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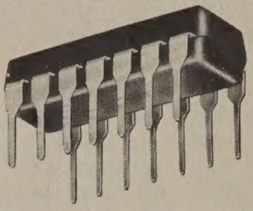
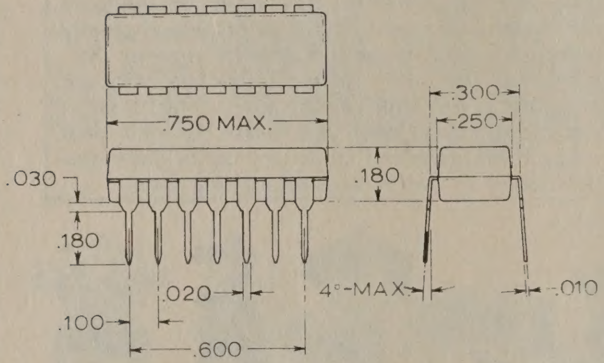
WABASH RELAY & ELECTRONICS DIVISION

DIP PACKAGE DRY REED RELAYS

814 SERIES





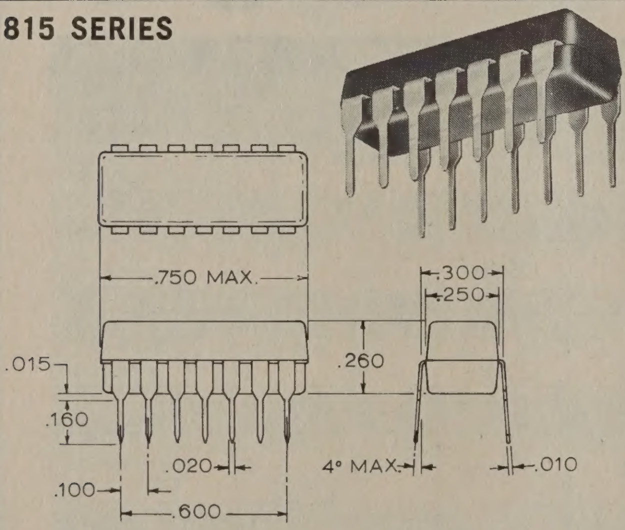
The 814 Series offers dry reed reliability and total isolation in a low profile IC type package, with DTL/TTL compatible coil drive available in most configurations.

SPECIFICATIONS — Contact Rating: 28 VDC or 0.110 Amps (switching); 3 watts; 200 milliohms max. initial contact resistance; 200 Volt pk. bkdn. **Temperature:** −55°C to +105°C. **Shock:** 100G max., 8±1 mSec. ½ wave. **Vibration:** 20G @ 10-5000 Hz. **Insulation Resistance:** 10^{10} Ohms min. **Capacitance:** 0.2 pf. **Operate Time (Typical):** to 0.5 mSec. **Release Time (Typical):** 0.1 mSec. **Life Expectancy:** 50 x 10^6 operations at signal level; 1 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	5	16	365	814-101
	5	19	500	814-102
	6	19	500	814-103
	12	24	800	814-104
	24	30	1,250	814-105

▲Measured at 25°C.

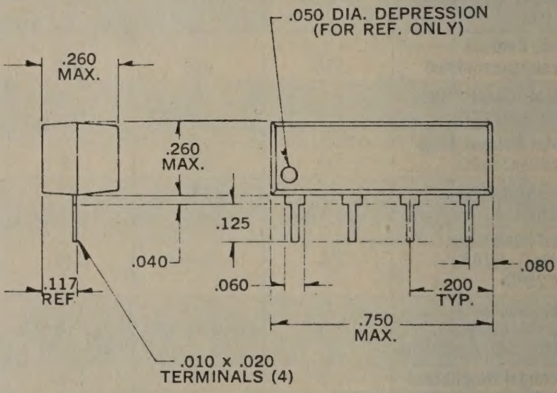
815 SERIES



The 815 Series, with a profile slightly higher than the 814, offers increased versatility while maintaining the DIP package approach to hi-density printed circuit applications. Standard part numbers listed are subject to specifications shown for the 814 Series, however, the 815 has the capacity to offer dry reed switches to ½ Amp rating plus up to a 100 VDC max. switching voltage. Optional features include diode suppression, magnetic shielding and electrostatic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Ohms ±10%▲	Part Number
1A	5	14	200	815-101
	5	19	500	815-102
	12	19	500	815-103
	24	40	2,150	815-104
2A	5	14	200	815-201
	12	19	500	815-202
	24	38	2,000	815-203
1B	5	14	200	815-221
	12	16	500	815-222
	24	32	2,000	815-223
1C	5	8	80	815-241
	12	19	500	815-242
	24	38	2,000	815-243

816 SERIES



The 816 Series SIP (Single Inline Package) provides the power handling capabilities of the 815 DIP while taking up less printed circuit board space. Standard part numbers listed are subject to specifications shown for the 814 Series; however, the 816 has the capacity to offer dry reed switches to 0.5 amp rating. Optional features include diode suppression and magnetic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10%▲	Part Number
1A SPST NO	5	14	200	816-101
	5	19	500	816-102
	12	19	500	816-103
	24	40	2,150	816-104
1B SPST NC	5	7	200	816-221
	12	16	500	816-222
	24	32	2,000	816-223

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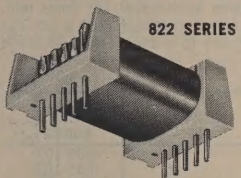
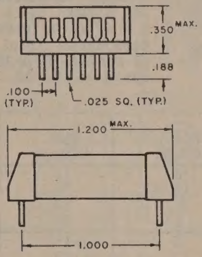
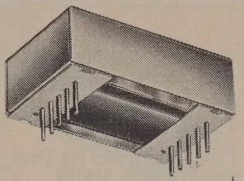
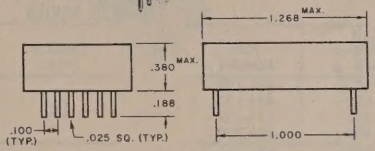
WABASH RELAY & ELECTRONICS DIVISION

MINIATURE DRY REED RELAYS
822 / 823 SERIES


822 SERIES




823 SERIES



SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

822 SERIES

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	16	200	822-102
	12	33	800	822-103
	24	67	3,200	822-104
	5	26	500	822-110
2A	6	16	200	822-202
	12	33	800	822-203
	24	67	3,200	822-204
3A	6	10	75	822-302
	12	21	300	822-303
	24	42	1,200	822-304
4A	6	10	75	822-402
	12	21	300	822-403
	24	42	1,200	822-404
1B†	6	8	200	822-211
	12	16	800	822-212
	24	32	3,200	822-213
2B†	6	8	200	822-311
	12	16	800	822-312
	24	32	3.200	822-313
1A1B†	6	9	60	822-324
	12	18	240	822-325
	24	36	960	822-326
1C† (1A1B guarantee break-before-make)	6	8	60	822-316
	12	16	240	822-317
	24	32	960	822-318
1A‡ (magnetic latch)	6	12	300	822-222
	6	12	300	
	12	24	1,200	822-223
	12	24	1,200	
	24	48	4,800	822-224
	24	48	4,800	
2A‡ (magnetic latch)	6	12	300	822-332
	6	12	300	
	12	24	1,200	822-333
	12	24	1,200	
	24	48	4,000	822-334
	24	48	4,000	

823 SERIES

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	16	200	823-102
	12	33	800	823-103
	24	67	3,200	823-104
	5	26	500	823-110
2A	6	16	200	823-202
	12	33	800	823-203
	24	67	3,200	823-204
3A	6	10	75	823-302
	12	21	300	823-303
	24	42	1,200	823-304
4A	6	10	75	823-402
	12	21	300	823-403
	24	42	1,200	823-404
1B†	6	8	200	823-211
	12	16	800	823-212
	24	32	3,200	823-213
2B†	6	8	200	823-311
	12	16	800	823-312
	24	32	3,200	823-313
1A1B†	6	9	60	823-324
	12	18	240	823-325
	24	36	960	823-326
1C† (1A1B guarantee break-before-make)	6	8	60	823-316
	12	16	240	823-317
	24	32	960	823-318
1A‡ (magnetic latch)	6	12	300	823-222
	6	12	300	
	12	24	1,200	823-223
	12	24	1,200	
	24	48	4,800	823-224
	24	48	4,800	
2A‡ (magnetic latch)	6	12	300	823-332
	6	12	300	
	12	24	1,200	823-333
	12	24	1,200	
	24	48	4,000	823-334
	24	48	4,000	

Note: Complete electrical data available on request.

822 Series relays can be provided that are recognized under the Component Program of Underwriters Laboratories, Inc. Please consult factory for more information.

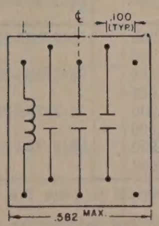
Special Coil Terminations available — consult factory.

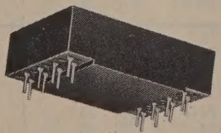
▲ Measured at 25°C.

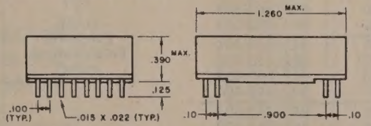
† All relays containing magnets for Form B operation (including the break-before-make 1C) are polarity sensitive and correct polarity must be observed. Dot on relays indicates positive terminal.

‡ A positive voltage must be applied to either dot terminal to close the contact(s) of a latch relay.
A negative voltage must be applied to either dot terminal to open the contact(s) of a latch relay.

824 SERIES RR







The 824 Series miniature reed relay is available in 1 pole through 6 pole standard configurations of forms A, B, or C, offering staggered pin spacing to minimize PC board space required. (3A pinout illustrated.) Call Wabash Relay for complete details.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

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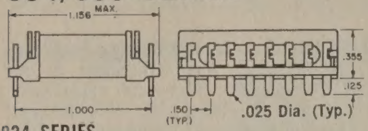
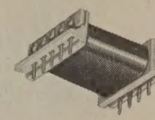
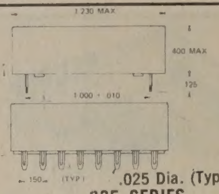
WABASH RELAY & ELECTRONICS DIVISION

MINIATURE DRY REED RELAYS
834/835 SERIES*







SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

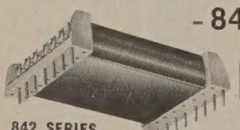
834 SERIES

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	16	200	834-102
	12	33	800	834-103
	24	67	3,200	834-104
	5	26	500	834-106
2A	6	16	200	834-202
	12	33	800	834-203
	24	67	3,200	834-204
3A	6	10	75	834-302
	12	21	300	834-303
	24	42	1,200	834-304
4A	6	10	75	834-402
	12	21	300	834-403
	24	42	1,200	834-404
5A	6	10	75	834-502
	12	21	300	834-503
	24	42	1,200	834-504
6A	6	10	75	834-602
	12	21	300	834-603
	24	42	1,200	834-604
1B†	6	8	200	834-212
	12	16	800	834-213
	24	32	3,200	834-214
2B†	6	8	200	834-222
	12	16	800	834-223
	24	32	3,200	834-224
1A1B†	6	8	60	834-332
	12	16	240	834-333
	24	32	960	834-334
1C† (1A1B guarantee break-before-make)	6	8	60	834-342
	12	16	240	834-343
	24	32	960	834-344
1A‡ (magnetic latch)	6	12	300	834-272
	6	12	300	
	12	24	1,200	834-273
	12	24	1,200	
	24	48	4,800	834-274
	24	48	4,800	
2A‡ (magnetic latch)	6	12	300	834-382
	6	12	300	
	12	24	1,200	834-383
	12	24	1,200	
	24	48	4,800	834-384
	24	48	4,800	

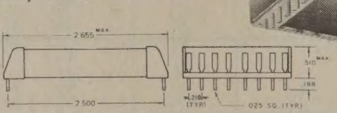
835 SERIES

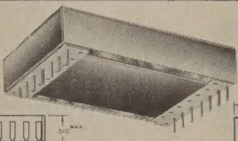
Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	16	200	835-102
	12	33	800	835-103
	24	67	3,200	835-104
	5	26	500	835-106
2A	6	16	200	835-202
	12	33	800	835-203
	24	67	3,200	835-204
3A	6	10	75	835-302
	12	21	300	835-303
	24	42	1,200	835-304
4A	6	10	75	835-402
	12	21	300	835-403
	24	42	1,200	835-404
5A	6	10	75	835-502
	12	21	300	835-503
	24	42	1,200	835-504
6A	6	10	75	835-602
	12	21	300	835-603
	24	42	1,200	835-604
1B†	6	8	200	835-212
	12	16	800	835-213
	24	32	3,200	835-214
2B†	6	8	200	835-222
	12	16	800	835-223
	24	32	3,200	835-224
1A1B†	6	8	60	835-332
	12	16	240	835-333
	24	32	960	835-334
1C† (1A1B guarantee break-before-make)	6	8	60	835-342
	12	16	240	835-343
	24	32	960	835-344
1A‡ (magnetic latch)	6	12	300	835-272
	6	12	300	
	12	24	1,200	835-273
	12	24	1,200	
	24	48	4,800	835-274
	24	48	4,800	
2A‡ (magnetic latch)	6	12	300	835-382
	6	12	300	
	12	24	1,200	835-383
	12	24	1,200	
	24	48	4,800	835-384
	24	48	4,800	

STANDARD REED RELAYS
-842/843 SERIES

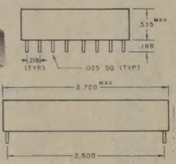


842 SERIES





843 SERIES



SPECIFICATIONS — Contact Ratings: 150 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 50 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 100 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.
Available to 12 form A. True form C also available.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	22	150	842/843-101
	12	45	600	842/843-102
	24	90	2,400	842/843-103
	48	175	9,000	842/843-104
2A	6	20	100	842/843-201
	12	41	400	842/843-202
	24	82	1,600	842/843-203
	48	165	6,400	842/843-204
3A	6	15	50	842/843-301
	12	30	200	842/843-302
	24	60	800	842/843-303
	48	121	3,200	842/843-304
4A	6	16	50	842/843-401
	12	33	200	842/843-402
	24	66	800	842/843-403
	48	132	3,200	842/843-404
5A	6	12	25	842/843-501
	12	24	100	842/843-502
	24	48	400	842/843-503
	48	97	1,600	842/843-504
6A	6	14	25	842/843-601
	12	28	100	842/843-602
	24	56	400	842/843-603
	48	112	1,600	842/843-604

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1B†	6	9	100	842/843-209
	12	18	400	842/843-211
	24	36	1,600	842/843-213
	48	72	6,400	842/843-215
2B†	6	9	100	842/843-309
	12	18	400	842/843-313
	24	36	1,600	842/843-317
	48	72	6,400	842/843-321
1C† (1A1B guarantee break-before-make)	6	9	100	842/843-311
	12	18	400	842/843-315
	24	36	1,600	842/843-319
	48	72	6,400	842/843-323
1A‡ (magnetic latch)	6	9	200	842/843-221
	6	9	200	
	12	18	800	842/843-222
	12	18	800	
	24	36	3,200	842/843-223
	24	36	3,200	
	48	72	4,500	842/843-224
	48	72	4,500	

▲ Measured at 25°C.

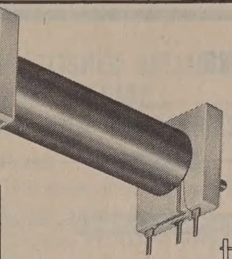
†All relays containing magnets for Form B operation (including the break-before-make 1C) are polarity sensitive and correct polarity must be observed. Dot on relays indicates positive terminal.

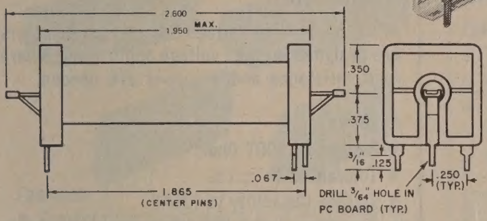
‡A positive voltage must be applied to either dot terminal to close the contact(s) of a latch relay.
A negative voltage must be applied to either dot terminal to open the contact(s) of a latch relay.

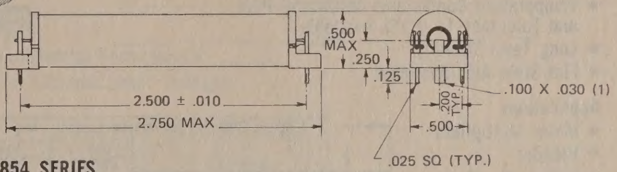
wabash Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722

WABASH RELAY & ELECTRONICS DIVISION

852 / 854 SERIES







852 SERIES

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	8	74	852-306
	12	16	290	852-312
	24	33	1,200	852-324

▲ Measured at 25°C.

854 SERIES

Contact Form	Nom. Voltage	Max. Voltage	Coil Resistance ±10% ▲	Part Number
1A	6	18	100	854-101
	12	36	415	854-102
	24	72	1,700	854-103

▲ Measured at 25°C.

ECONOMISER REED RELAYS 862-866 SERIES

CONTACT RATINGS (MAXIMUM)

SPECIFICATIONS — Voltage: 200 VDC, 150 VAC. **Current (Switch):** .5 Amp. **Current (Carry):** 3 Amps. **Power (DC):** 10 Watts. **Power (AC Suppressed):** 25 Volt-Amps. **Resistance (Initial):** 200 Milliohms. **Peak Breakdown Voltage:** 300 Volts.

OPERATING PARAMETERS

SPECIFICATIONS — Temperature: −40°C to 105°C. **Shock:** 50G max., 11 ±1 msec. **Vibration:** 20G max. at 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** .5 Picofarad.

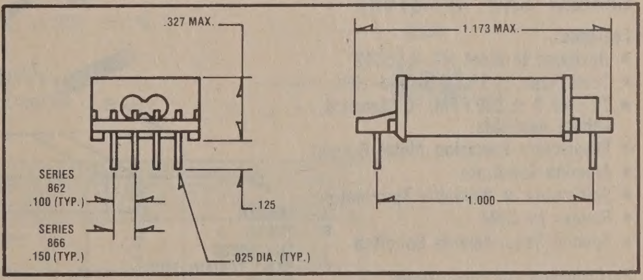
Nominal Coil Voltage	5.0	12.0	24.0
Must Operate Voltage*	3.8	9.6	19.2
Must Release Voltage*	.5	.9	1.9

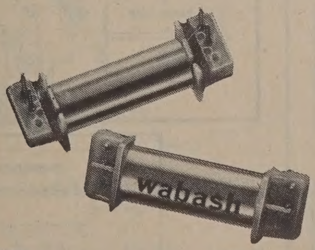
Operate Time (Typ): 0.5 Milliseconds. **Release Time (Typ Unsuppressed):** 0.1 Milliseconds.

Note: All 862 and 866 Series Reed Relays are magnetically shielded unless specified by customer.
*At 25°C.

LIFE AND RELIABILITY*

Load	End-of-Life Criteria	Life
Rated Power	Weld or Greater of 2% of Load Resistance or 2 Ohms	20×10^6
High Intermediate	Weld or Greater of 2% of Load Resistance or 2 Ohms	20×10^6
Low Intermediate	Weld or 5% of Load Resistance	50×10^6
Low Level	Weld or 10% of Load Resistance	100×10^6





862 SERIES

Contact Form	Nominal Voltage	Maximum Voltage	Coil Resistance ±10%*	Nominal Power (mW)	Part Number
1A	5/6	22	500	50/72	862-101
	12/15	25	800	180/281	862-102
	24	40	2000	288	862-103
2A	5/6	14	200	125/180	862-201
	12/15	29	800	180/281	862-202
	24	46	2000	288	862-203

*At 25°C.

866 SERIES

Contact Form	Nominal Voltage	Maximum Voltage	Coil Resistance ±10%*	Nominal Power (mW)	Part Number
1A	5/6	22	500	50/72	866-101
	12/15	25	800	180/281	866-102
	24	40	2000	288	866-103
2A	5/6	14	200	125/180	866-201
	12/15	29	800	180/201	866-202
	24	46	2000	288	866-203

ELECTRONIC ACI COMPONENTS

AMERICAN COMPONENTS, INC.

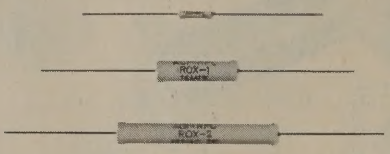
SUBSIDIARY OF insilco

DEPT. EM, 8th AVENUE AT HARRY ST. / P.O. BOX 152 / CONSHOHOCKEN, PA. 19428
TELEPHONE (215) 825-6200 / TWX 510-660-9268

HIGH VOLTAGE, HIGH RANGE METAL OXIDE RESISTORS

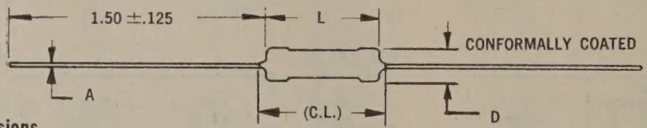
Features

- Ranges to 20G ohms
- Voltages to 30KV
- Power Capability to 6.0 Watts
- Silicone or Epoxy Protective Coatings
- Temperature Coefficients to 0 ±50 PPM and Tolerance to ±1% Available
- Long Term Stability
- Flat Style Also Available



Applications

- Meter Multipliers
- Bleeder
- Voltage Dividers
- Dropping and Filter


1.50 ±.125
L
CONFORMALLY COATED
A
(C.L.)
D

Performance and Dimensions

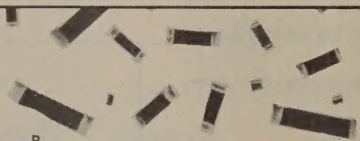
ACI Type	Resistance Range (Ohms)	Standard Toler-ance ±%	Power Rating (Watts) @ 125°C	Voltage Rating	Temperature Coefficient vs. Range: T.C. PPM /°C	Temperature Coefficient vs. Range: Range	Dimensions In Inches: Body Length (L Max.)	Dimensions In Inches: Body Dia. (D Max.)	Dimensions In Inches: Max. Clean Lead Length (C.L.)	Dimensions In Inches: Lead Gage (A)
ROX-¾ or ROX-¾E	1.0K to 4.0G	2, 5	1.5 0.75	5.0KV	100 200 400	1.0K to 200M 205M to 1.5G 1.54G to 4.0G	0.820	0.285	0.884	20 AWG .032
ROX-1 or ROX-1E	1.0K to 5.0G	2, 5	2.0 1.0	7.5KV	100 200 400	1.0K to 300M 301M to 2.0G 2.05G to 5.0G	1.070	0.285	1.134	20 AWG .032
ROX-1½ or ROX-1½E	1.5K to 7.5G	2, 5	2.5 1.5	11.0KV	100 200 400	1.5K to 400M 402M to 3.0G 3.01G to 7.5G	1.570	0.285	1.634	20 AWG .032
ROX-2 or ROX-2E	2.0K to 10.0G	2, 5	3.0 2.0	15.0KV	100 200 400	2.0K to 500M 511M to 4.0G 4.02G to 10.0G	2.070	0.285	2.134	20 AWG .032
ROX-3 or ROX-3E	3.0K to 15.0G	2, 5	5.0 3.0	22.5KV	100 200 400	3.0K to 750M 768M to 6.0G 6.04G to 15.0G	3.070	0.285	3.134	20 AWG .032
ROX-4 or ROX-4E	4.0K to 20.0G	2, 5	6.0 4.0	30.0KV	100 200 400	4.0K to 1.0G 1.02G to 8.0G 8.06G to 20.0G	4.070	0.285	4.134	20 AWG .032

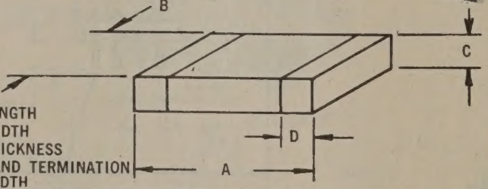
Leads are OFHC tinned copper. $K = x\ 10^3$; $M = x\ 10^6$; $G = x\ 10^9$; $T = x\ 10^{12}$

CERMET CHIP RESISTORS

Features

- Designed to Meet MIL-R-55342
- Tolerances of 1%, 5% and 10%
- TC's of 0 ±200 PPM/°C Standard — Others Available
- Proprietary Precision Metal Cermet
- Alumina Substrate
- Solderable or Weldable Terminations
- Ranges to 1.0M
- Special Requirements Solicited





A — LENGTH
B — WIDTH
C — THICKNESS
D — BAND TERMINATION WIDTH

Performance and Dimensions

ACI Type	Mil Type	Mil Char.	ACI T.C. Code	ACI Resistance Range (Ohms)	Rating (Watts) @ 70°C	Voltage Rating (Volts)	Dimensions in Inches: Body Length (A)	Dimensions in Inches: Body Width (B)	Dimensions in Inches: Body Thick-ness (C)	Termination: Band Width (D)	Termination: Material Code
CRC-10	RM 050	L	C-4	5 to 100K	0.050	40	0.050 +.011 −.005	0.050 ±.005	0.025 ±.005	0.010 +.005 −.000	C, R
CRC-20	RM 1005	L	C-4	10 to 200K	0.100	40	0.100 +.011 −.005	0.050 ±.005	0.025 ±.005	0.010 ±.005	C, R
CRC-25	RM 1505	L	C-4	10 to 500K	0.150	40	0.150 +.011 −.005	0.050 ±.005	0.025 ±.005	0.010 ±.005	C, R
CRC-30	—	—	C-4	25 to 300K	0.150	40	0.200 ±.005	0.050 ±.005	0.025 ±.005	0.010 ±.005	C, R
CRC-35	RM 2208	L	C-4	10 to 1.0M	0.225	40	0.225 +.011 −.005	0.075 ±.005	0.025 ±.005	0.010 ±.005	C, R
CRC-40	—	—	C-4	50 to 500K	0.300	40	0.400 ±.005	0.100 ±.005	0.025 ±.005	0.010 ±.005	C, R

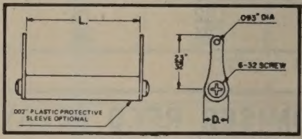
**Maximum termination thickness is 0.040.
Material Codes: C = Solderable, Weldable
R = Wrap Around Solderable, Pretinned

HIGH VOLTAGE CARBON FILM RESISTORS

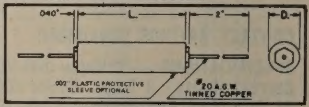
ACI's line of High Voltage Carbon Film Resistors are designed for high voltage applications where high resistance and/or power are needed.

Features

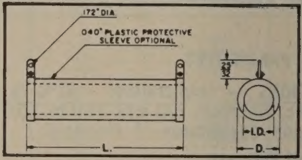
- Ranges to 100T Ohm
- Tolerances to ±1%
- Voltage Capability to 125KV
- Numerous Styles and Interconnect Capability
- Types Available for High Frequency Applications
- Power Ratings to 100 Watts
- Military Styles Available (MIL-R-14293)


L.
.093" DIA
23/32"
6-32 SCREW
.002" PLASTIC PROTECTIVE SLEEVE OPTIONAL
D.

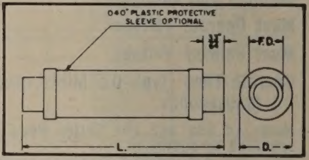
STYLE A


.040"
L.
2"
D.
.002" PLASTIC PROTECTIVE SLEEVE OPTIONAL
#20 A.G.W. TINNED COPPER

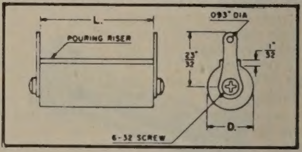
STYLE B


.172" DIA
.040" PLASTIC PROTECTIVE SLEEVE OPTIONAL
23/32"
I.D.
L.
D.

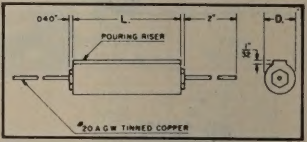
STYLE C


.040" PLASTIC PROTECTIVE SLEEVE OPTIONAL
F.D.
L.
D.

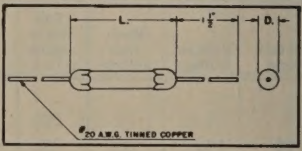
STYLE D


L.
POURING RISER
.093" DIA
23/32"
1/32"
D.
6-32 SCREW

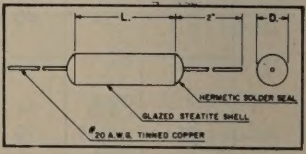
STYLE E


.040"
L.
2"
D.
POURING RISER
1/32"
#20 A.G.W. TINNED COPPER

STYLE G


L.
1 1/2"
D.
#20 A.W.G. TINNED COPPER

STYLE J


L.
2"
D.
HERMETIC SOLDER SEAL
GLAZED STEATITE SHELL
#20 A.W.G. TINNED COPPER

STYLE K

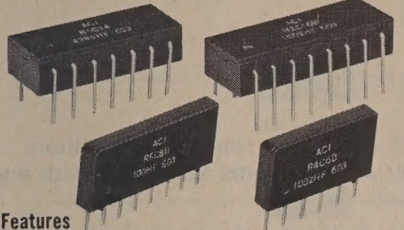
ELECTRONIC ACI COMPONENTS

AMERICAN COMPONENTS, INC.

SUBSIDIARY OF insilco

DEPT. EM, 8th AVENUE AT HARRY ST. / P.O. BOX 152 / CONSHOHOCKEN, PA. 19428
TELEPHONE (215) 825-6200 / TWX 510-660-9268

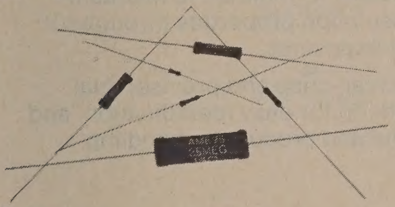
PRECISION DUAL-IN-LINE AND SINGLE-IN-LINE RESISTOR NETWORKS



Features

- Temperature Coefficients to 0 ±10 PPM/°C
- Tolerances to ±0.1%
- Resistance Range 49.9 Ohms to 200K Ohms
- Temperature Range −55°C to +125°C
- Reduces Inventory Count — Equipment Size

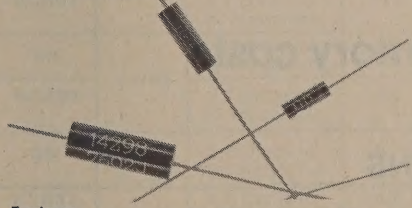
AME HIGH RANGE CONFORMAL COATED METAL FILM RESISTORS



Features

- Ranges to 50 Megohm
- Tolerances to ±0.1%, with ±1.0% Standard
- Shelf Life Aging of Less Than 0.1% per Year Typical
- Noble-Met® Film with Inherently Low Noise
- Sizes from $^1/_{20}$ Watt to 1.0 watt
- Meet or Exceed Requirements of MIL-R-10509 and MIL-R-55182

UAR* PRECISION METAL FILM RESISTORS



Features

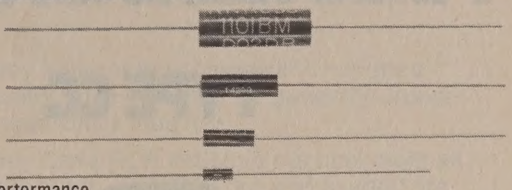
- Temperature Coefficients of 0 ±5 PPM Standard
- Tolerances to ±0.1%
- Range from 20 OHM to 1 Megohm
- Operating Temperature Range −20°C. to +85°C.
- Temperature Coefficient and Tolerance Matching
- Replacements for Precision Wirewounds

*Ultra Accurate Resistors

Typical Performance

Load Life: 1000 hrs. @ 85°C	.03% △R
Temp. Cycle: −55°C to +85°C	.02% △R
Humidity: MIL Std. 202, Method 106	.02% △R
Noise Index	<.05 μV/V
Voltage Coefficient	.02 PPM/Volt
Short Term Overload: 2.5x Rated Volt, 5 Sec.	.05% △R
Low Temp. Operation: −65°C @ Rated Load	.02% △R

ESTABLISHED RELIABILITY PRECISION METAL FILM RESISTORS — TO MIL-R-55182 RNC, RNR, RNN SERIES



Features

- Tolerances of ±1%, ±.5%, ±.1%
- S Failure Rate Level
- Extended Resistance Ranges
- Molded for Optimum Environmental Performance
- Solid Core Construction for Extreme Sheer Strength

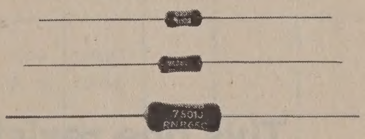
MIL-R-55182 Tolerance	Temperature Coefficient MIL Code	ACI Code	TC Value
B = ±0.1%	J	C-3	0 ± 25 PPM/°C
D = ±0.5%	H	C-2	0 ± 50 PPM/°C
F = ±1.0%	K	C-1	0 ±100 PPM/°C

Characteristics

Mil Type	ACI Type	Mil Approved T.C. Char.	Mil Approved Resistance Range (Ohms)	Mil Power Rating (Watts) @ 125°C	Mil Voltage Rating (Volts)	Dimensions in Inches Body Length (L)	Body Dia. (D)	Lead Length (C)	Lead Dia. (A)	Wire Gage
RNC 50 RNN 50	EE-1/20	H, J, K	10 to 604K	1/20	200	0.150 ±.010	0.065 ±.005	1.00 ±.062	0.016 ±.0015	26 AWG .016
RNC 55 RNN 55	EE-1/10	H, J, K	10 to 1.21M	1/10	200	0.270 ±.010	0.095 ±.005	1.50 ±.125	0.025 ±.002	22 AWG .025
RNC 60 RNN 60	EE-1/8	H, J, K	10 to 3.01M	1/8	250	0.398 ±.015	0.128 ±.010	1.50 ±.125	0.025 ±.002	22 AWG .025
RNC 65 RNN 65	EE-1/4	H, J, K	10 to 6.26M	1/4	300	0.588 ±.015	0.203 ±.010	1.50 ±.125	0.025 ±.002	22 AWG .025
RNC 70 RNN 70	EE-1/2	H, J, K	10 to 15M	1/2	350	0.718 ±.015	0.258 ±.010	1.50 ±.125	0.032 ±.002	20 AWG .032
RNC 75 RNN 75	EE-1	J	10 to 5.0	1.0	750	1.098 ±.015	0.393 ±.010	1.50 ±.125	0.032 ±.002	20 AWG .032

Leads are OFHC copper. Nickel and gold plated dumet leads available. Consult factory.

HERMETICALLY SEALED* PRECISION METAL FILM RESISTORS — TO MIL-R-55182



Features

- Tolerances of ±1.0%, ±.5%, ±.1%
- S Failure Rate Level
- Special Dielectric Coating
- Ceramic Sleeve Construction

*Patent Pending

MIL-R-55182 Tolerance	Temperature Coefficient MIL Code	ACI Code	TC Value
B = ±0.1%	E	C-3	0 ±25 PPM/°C
D = ±0.5%	C	C-2	0 ±50 PPM/°C
F = ±1.0%			

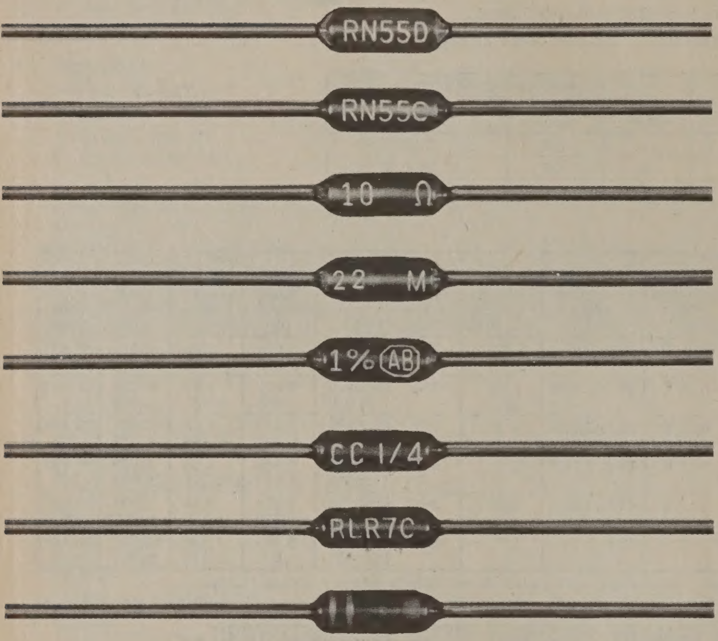
Characteristics

Mil Type	ACI Type	Mil Approved T.C. Char.	Mil Approved Resistance Range (Ohms)	Mil Power Rating (Watts) @ 125°C	Mil Voltage Rating (Volts)	Dimensions in Inches Body Length (L)	Body Dia. (D)	Max. Clean Lead Length C.L.	Lead Length	Lead Gage
RNC 50	SE-1/20	C, E	10 to 100K	1/20	200	0.180 ±.020	0.070 ±.010	0.225	.984 ±1.125	26 AWG .016
RNC 55	SE-1/10	C, E	24.9 to 200K	1/10	200	0.265 +.020 −.010	0.130 +.010 −.005	0.345	1.50 ±.125	22 AWG .025
RNC 60	SE-1/8	C, E	24.9 to 499K	1/8	250	0.315 +.020 −.002	0.150 +.010 −.005	0.395	1.50 ±.125	22 AWG .025
RNC 65	SE-1/4	C, E	24.9 to 1.0M	1/4	300	0.540 +.020 −.004	0.215 +.010 −.005	0.620	1.50 ±.125	22 AWG .025
RNC 70	SE-1/2	C, E	24.9 to 1.5M	1/2	350	0.800 ±.020	0.300 ±.015	0.925	1.50 ±.125	20 AWG .032

Leads are OFHC tinned copper.

Allen-Bradley Cermet Film Fixed Resistors

TYPE CC



Capless design provides a reliable termination that does away with problems associated with end cap construction.

Leads are designed for both soldering and welding to give you freedom of choice about attachment, and long term storage capability.

Cores are high purity alumina with outstanding physical and thermal properties to reduce the incidence of fractures.

Coating is specially formulated to maintain outstanding insulation properties throughout environmental exposures.

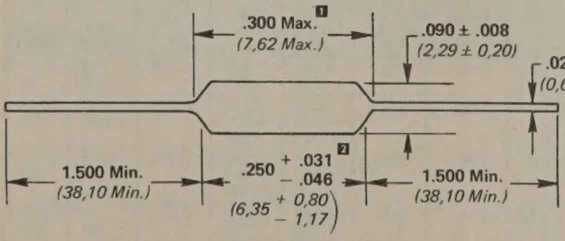
Markings are clear, crisp and precise; dual resistance marking for easy identification, and durable to withstand production handling.

For more information request Publication EC33.

This one resistor can shrink your inventory costs

DIMENSIONS

Basic dimensions in inches. Dimensions shown in *ITALICS* are in millimeters.



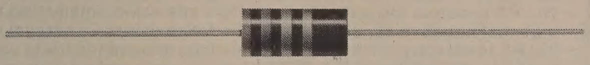
1 Maximum length is "clean lead" to "clean lead"

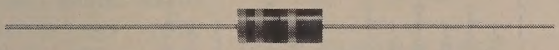
2 The end of the body is that point at which the body diameter equals .038 *(0,97)*

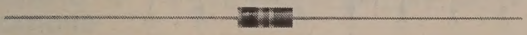
SPECIFICATIONS

Resistance Range	10 Ohms to 22 Megohms
Power Rating	0.125 watt @ 125°C 0.25 watt @ 70°C 0.5 watt @ 70°C (250V Max.)
TCR	50 PPM and 100 PPM
Tolerance	0.5% and 1%
Approved	RN55C 0.5%, 1% MIL-R-10509F RN55D 1%, MIL-R-10509F RLR07 1%, 2% MIL-R-39017C

Allen-Bradley Hot-Molded Fixed Resistors


HB—RCR42


GB—RCR32


EB—RCR20

CB—RCR07

BB—RCR05

Allen-Bradley hot-molded composition resistors are high quality units intended for general purpose use in the electronics industry.

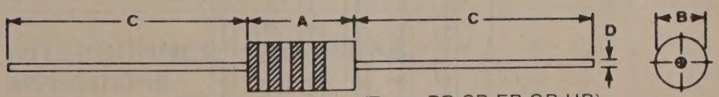
Allen-Bradley Style RCR resistors not only meet all requirements of MIL-R-39008 but also exceed the S level (best level) of Established Reliability of 0.001% failure rate per 1000 hours. And only Allen-Bradley resistors are available in S level reliability in all five wattage sizes over the entire resistance range. The S reliability level is indicated by a yellow 5th color band on the resistor body.

Metal-clad hot-molded resistors (Types GM and HM) are fitted with metal clamps which surround the major portion of the resistor. The metal clamps provide rigid mounting and efficient heat transfer from the resistors to the metal chassis or panels on which they are mounted.

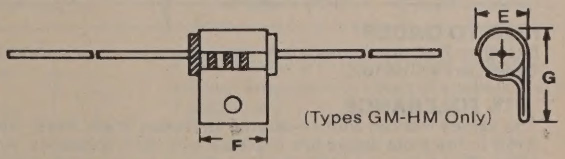
For more information request Publication EC21.

SPECIFICATIONS

Type	Power at 70°C	Resistance Range	Tolerance	Voltage Rating (RMS)	Maximum Ambient Temperature	Dimensions in Inches (millimeters)						
						A	B	C	D	E	F	G
BB	⅛ watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	150V	+130°C	0.145 (3,68)	0.062 (1,59)	1.000 (25,40)	0.015 (0,38)			
RCR05		2.7 Ohms to 22 Megohms	±5, 10%									
CB	¼ watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	250V	+150°C	0.250 (6,35)	0.090 (2,29)	1.500 (38,10)	0.025 (0,64)			
RCR07		2.7 Ohms to 22 Megohms	±5, 10%									
EB	½ watt	1.0 Ohm to 100 Megohms	±5, 10, 20%	350V		0.375 (9,52)	0.140 (3,56)	1.500 (38,10)	0.033 (0,84)			
RCR20		2.7 Ohms to 22 Megohms	±5, 10%									
GB	1 watt	2.7 Ohms to 100 Megohms	±5, 10, 20%	500V		0.562 (14,29)	0.225 (5,72)	1.500 (38,10)	0.041 (1,04)			
RCR32		2.7 Ohms to 22 Megohms	±5, 10%									
HB	2 watts	10 Ohms to 100 Megohms	±5, 10, 20%	750V		0.688 (17,46)	0.312 (7,94)	1.500 (38,10)	0.045 (1,14)			
RCR42		10 Ohms to 22 Megohms	±5, 10%	500V								
GM	3 watts	2.7 Ohms to 22 Megohms	±5% ±10%	500V		0.562 (14,29)	0.225 (5,72)	1.500 (38,10)	0.041 (1,04)	0.305 (7,75)	0.438 (11,11)	0.656 (16,67)
HM	4 watts	10 Ohms to 22 Megohms		750V		0.688 (17,46)	0.312 (7,94)	1.500 (38,10)	0.045 (1,14)	0.391 (9,92)	0.562 (14,29)	0.766 (19,45)



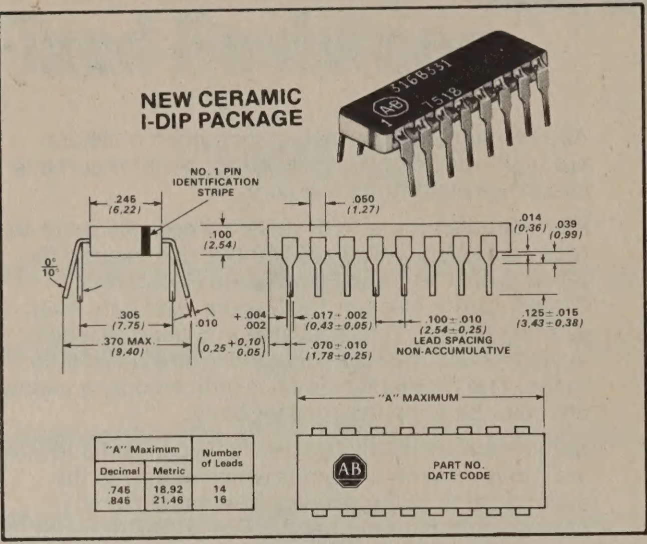
(Types BB-CB-EB-GB-HB)



(Types GM-HM Only)

Allen-Bradley Resistor Networks

CERMET DIP RESISTOR NETWORKS

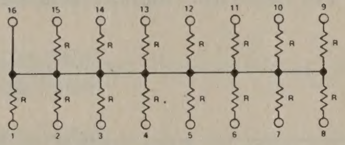

NEW CERAMIC
I-DIP PACKAGE
316B331
AB
1518
NO. 1 PIN
IDENTIFICATION
STRIPE
.245 (6,22)
.050 (1,27)
.100 (2,54)
.014 (0,36)
.039 (0,99)
0° 10°
.305 (7,75)
.370 MAX. (9,40)
.010
+.004 .002
(0,25 +0,10 0,05)
.017 ± .002 (0,43 ± 0,05)
.070 ± .010 (1,78 ± 0,25)
.100 ± .010 (2,54 ± 0,25)
LEAD SPACING
NON-ACCUMULATIVE
.125 ± .015 (3,43 ± 0,38)
"A" MAXIMUM
AB
PART NO.
DATE CODE

"A" Maximum		Number of Leads
Decimal	Metric	
.745	18,92	14
.845	21,46	16

STANDARD NETWORKS • PULL-UP PULL-DOWN • TERMINATION

APPLICATIONS:

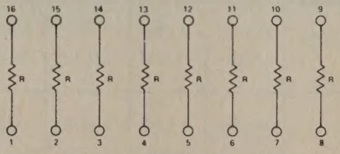
- Pull-up array for unused TTL gates
- Parallel high speed circuitry
- Wired OR configurations
- Pull-down applications
- TTL-MOS interfacing
- Digital pulse squaring


16
15
14
13
12
11
10
9
R
1
2
3
4
5
6
7
8

314A — 14 pin DIP, 13 resistors
316A — 16 pin DIP, 15 resistors

APPLICATIONS:

- Transmission line termination
- Power gate pull-up
- Current limiting
- Logic level translation


16
15
14
13
12
11
10
9
R
1
2
3
4
5
6
7
8

314B — 14 pin DIP, 7 resistors
316B — 16 pin DIP, 8 resistors

STANDARD RESISTANCE VALUES— SERIES 314A, 314B, 316A, 316B

R (OHMS), ±2% TOLERANCE						
22	91	390	1600	6200	27K	120K
24	100*	430	1800	6800*	30K	150K*
27	110	470*	2000	7500	33K*	180K
30	120	510	2200*	8200	36K	220K*
33	130	560	2400	9100	39K	270K
36	150*	620	2700	10K*	43K	330K*
39	160	680*	3000	11K	47K*	390K
43	180	750	3300*	12K	51K	470K*
47	200	820	3600	13K	56K	560K
51	220*	910	3900	15K*	62K	680K*
56	240	1000*	4300	16K	68K*	1M*
62	270	1100	4700*	18K	75K	
68	300	1200	5100	20K	82K	
75	330*	1300	5600	22K*	91K	
82	360	1500*	6000	24K	100K*	

HOW TO ORDER

Example: Require Series 314A with resistance value=1000Ω.
Order part #314A102.

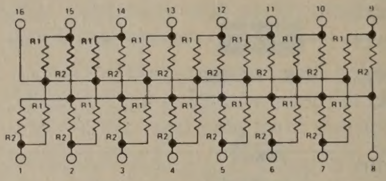
± 1% TOLERANCE

The values marked with an asterisk of Series 314A, 314B, 316A and 316B in the table above are available with ±1% tolerance. Add the letter "F" on the end of the part number to indicate the optional ±1% tolerance.

STANDARD NETWORKS • PARALLEL • TERMINATION

APPLICATIONS:

Series 314E and 316E networks are used in digital IC logic circuits and are especially suited for ECL and TTL applications. For ECL applications the network's circuit configuration serves a dual purpose. The R2 resistors are pull-down resistors and are normally tied to the most negative supply voltage. The R1 resistors, in parallel with the R2 resistors, provide the characteristic impedance for proper transmission line matching. In TTL logic the networks are used in pulse squaring applications.


16
15
14
13
12
11
10
9
R1
R2
1
2
3
4
5
6
7
8

314E—14 pin DIP
316E—16 pin DIP

STANDARD RESISTANCE VALUES— SERIES 314E and 316E

R1/R2	Characteristic Impedance Z_o	R1/R2	Characteristic Impedance Z_o
81/130	50	220/330	132
120/200	75	330/390	179
90/660	80	330/470	194
130/210	80	330/680	222
160/260	100	1.5K/3.3K	1.03K
220/270	121	3K/6.2K	2.02K
180/390	123		

HOW TO ORDER

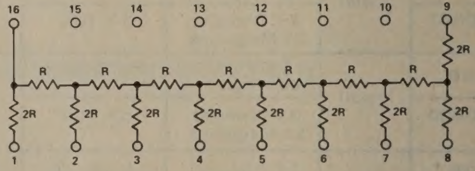
Example: Require Series 316E with characteristic impedance=50Ω.
Order part #316E810131.

8 BIT R/2R LADDER NETWORKS

APPLICATIONS:

- Designed for use with D/A and A/D convertors with bipolar or CMOS switches.

Part No.	R Value
316L08253	25K
316L08503	50K
316L08104	100K


16
15
14
13
12
11
10
9
2R
R
2R
1
2
3
4
5
6
7
8

316L08

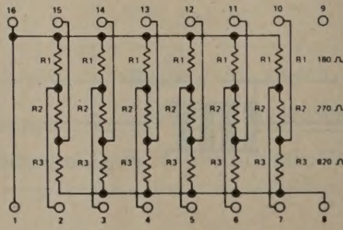
HOW TO ORDER

Example: Require Series 316L08 with 100K ladder impedance.
Order part #316L08104.

STANDARD TTL TO ECL TRANSLATOR NETWORK

APPLICATIONS:

- Series 316T110 provides TTL to ECL translation.
- Contains six TTL to ECL translators.


16
15
14
13
12
11
10
9
R1
R1 180 Ω
R2
R2 270 Ω
R3
R3 820 Ω
1
2
3
4
5
6
7
8

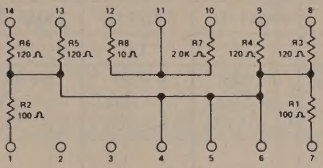
316T110

STANDARD NETWORKS • SENSE AMP • INTERFACE

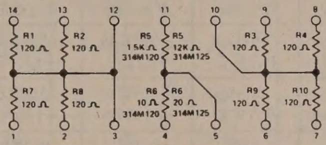
APPLICATION:

- Designed for use with 7520 series core memory sense amplifiers.
- Series 314M110 combines a threshold setting divider with balanced sense line termination and far end termination of two sense lines.
- Series 314M120 and 314M125 combine threshold setting dividers with four sense line termination. Following resistor values provide different threshold setting:

Resistor	314M120	314M125
R5	1.5KΩ	12KΩ
R6	10Ω	20Ω


14
13
12
11
10
9
8
R6 120 Ω
R5 120 Ω
R8 10 Ω
R7 2.0K Ω
R4 120 Ω
R3 120 Ω
R2 100 Ω
R1 100 Ω
1
2
3
4
5
6
7

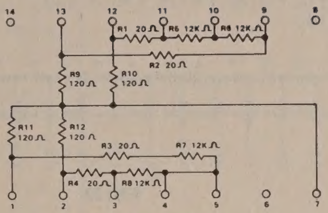
314M110


14
13
12
11
10
9
8
R1 120 Ω
R2 120 Ω
R5 1.5K Ω 314M120
R5 12K Ω 314M125
R3 120 Ω
R4 120 Ω
R7 120 Ω
R8 120 Ω
R6 10 Ω 314M120
R6 20 Ω 314M125
R9 120 Ω
R10 120 Ω
1
2
3
4
5
6
7

314M120 or 314M125

APPLICATIONS:

- Series 314M130 designed for use with μA711 dual voltage comparator in core memory sense amplifier applications.
- Combines four threshold dividers with balanced termination of two lines.


14
13
12
11
10
9
8
R1 20 Ω
R6 12K Ω
R8 12K Ω
R2 20 Ω
R9 120 Ω
R10 120 Ω
R11 120 Ω
R12 120 Ω
R3 20 Ω
R7 12K Ω
R4 20 Ω
R8 12K Ω
1
2
3
4
5
6
7

314M130

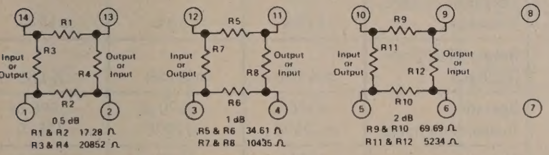
STANDARD "O" PAD (BALANCED π) ATTENUATORS

APPLICATIONS:

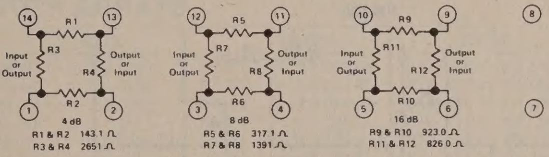
These networks are used primarily in the communications industry where a fixed voltage attenuation is required with impedance matching. Voltage attenuation in steps of 0.5 dB from 0.5 dB to 31.5 dB can be obtained from the Series 314Z networks by the use of one "O" pad, or by placing two or more in series. For example, 20 dB is obtained by placing the 4 dB and 16 dB sections in series.

SPECIFICATIONS:

Characteristic Impedance	600 ohms
Attenuation Tolerance (dB)	±1%
Attenuation Change Due to Temperature	±1% Additional
Resistor Tolerance	±1%
Temperature Coefficient of Resistance	±200 ppm/°C
Power Dissipation Rating at 40°C	150 mw per Attenuator
Frequency Response	Flat to 1 MHz
Operating Temperature	0°C to +70°C


14
13
R1
R3
Input or Output
R4
Output or Input
R2
1
2
0.5 dB
R1 & R2 17.28 Ω
R3 & R4 20852 Ω
12
11
R5
R7
Input or Output
R8
Output or Input
R6
3
4
1 dB
R5 & R6 34.61 Ω
R7 & R8 10435 Ω
10
9
R9
R11
Input or Output
R12
Output or Input
R10
5
6
2 dB
R9 & R10 69.69 Ω
R11 & R12 5234 Ω
8
7

314Z1001


14
13
R1
R3
Input or Output
R4
Output or Input
R2
1
2
4 dB
R1 & R2 143.1 Ω
R3 & R4 2651 Ω
12
11
R5
R7
Input or Output
R8
Output or Input
R6
3
4
8 dB
R5 & R6 317.1 Ω
R7 & R8 1391 Ω
10
9
R9
R11
Input or Output
R12
Output or Input
R10
5
6
16 dB
R9 & R10 923.0 Ω
R11 & R12 826.0 Ω
8
7

314Z1002

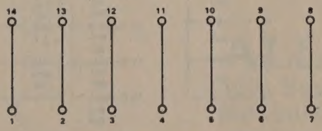
STANDARD NETWORK SPECIFICATIONS

Standard Network	Resistor Tolerance	Temperature Coefficient of Resistance (ppm/°C)	Power Dissipation Rating (Up to 70°C Ambient)	Operating Temperature Range	Resistance Ratios
314A	±2%	±100	125 mw/resistor 1.6 watt/package	−55°C to +125°C	——————
314B			250 mw/resistor 1.6 watt/package		
316A			125 mw/resistor 1.8 watt/package		
316B			250 mw/resistor 1.8 watt/package		
314E	±2%	±100	125 mw/resistor 1.6 watt/package	−55°C to +125°C	——————
316E			125 mw/resistor 1.8 watt/package		
316L08	±2%	±100	50 mw/resistor 1.8 watt/package	0°C to +70°C	±½ LSB from 0°C to +70°C
314M110	±2% ±5% (R8 only)	±200	500 mw/resistor (R1 & R2) 100 mw/resistor (R3 through R8)	0°C to +70°C	R3/R4 ±1.5% R5/R6 ±1.5% R7/R8 ±2%
314M120	±2% ±5% (R6 only)	±100	100 mw/resistor	0°C to +70°C	R1/R2 R3/R4 R5/R6 ±1.5% R7/R8 R9/R10
314M125					
314M130	±2%	±200	100 mw/resistor	0°C to +70°C	——————
316T110	±2%	±200	125 mw/resistor	0°C to +70°C	——————

INTERCONNECT NETWORKS

APPLICATIONS:

- Shorting
- Matrix interconnections


14
13
12
11
10
9
8
1
2
3
4
5
6
7

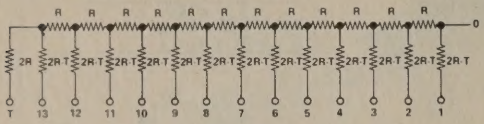
314B000 — 14 pin DIP

- Also available in 16 pin DIP as 316B000.
- Other interconnect network configurations available.

PRECISION THIN FILM NETWORKS

R/2R BINARY CODE LADDER NETWORKS

Ladder networks with fewer bits using the basic schematic of the FN132 are FN114, FN123, FN125, FN131, and FN160.

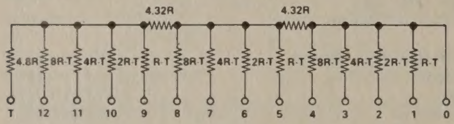

R
2R
2R·T
R·T
T
13
12
11
10
9
8
7
6
5
4
3
2
1
0

FN132

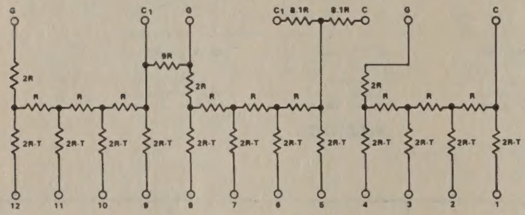
Part Number	FN114 (1)	FN123 (1)	FN125 (2)	FN131	FN132	FN160
Number of Bits	12	10	10	10	13	10
Ladder Resistance Value (R)	R=200K $T_{1\text{-}2}$=500Ω $T_{3\text{-}12}$=550Ω	R=50K $T_{1\text{-}2}$=500Ω $T_{3\text{-}10}$=550Ω	R=50K $T_{1\text{-}2}$=200Ω $T_{3\text{-}10}$=550Ω	R=10K T=0	R=5K T=0	R=5K T=0
Ladder Resistance Tolerance	±10%	±10%	±10%	±10%	±10%	±10%
Network Full Scale Accuracy	±½ LSB	±½ LSB	±½ LSB	±½ LSB	±½ LSB	±½ LSB
Operating Temperature Range	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C
Storage Temperature Range	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C
Operating Voltage Range	±100V Maximum	±70V Maximum	±70V Maximum	±30V Maximum	±20V Maximum	±20V Maximum

(1) May be used with Fairchild 3750/3751 IC
(2) May be used with Fairchild 3750 IC

1-2-4-8 BCD CODE LADDER NETWORKS


4.32R
4.32R
4.8R
8R·T
4R·T
2R·T
R·T
T
12
11
10
9
8
7
6
5
4
3
2
1
0

FN130


G
C₁
G
C₁ 8.1R
8.1R C
G
C
8R
2R
R
2R·T
12
11
10
9
8
7
6
5
4
3
2
1

FN128 and FN129

APPLICATIONS:

- All ladders—A/D and D/A conversion.

Part Number	FN128 (1)	FN129 (1)	FN130
Number of Bits	12	12	12
Ladder Resistance Value (R)	R=50K $T_{1\text{-}2}$=500Ω $T_{3\text{-}12}$=500Ω	R=100K $T_{1\text{-}2}$=500Ω $T_{3\text{-}12}$=550Ω	R=10K T=0
Ladder Resistance Tolerance	±10%	±10%	±10%
Network Full Scale Accuracy	±½ LSB	±½ LSB	±½ LSB
Operating Temperature Range	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C
Storage Temperature Range	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C
Operating Voltage Range	±100V Maximum	±140V Maximum	±20V Maximum

(1) May be used with Fairchild 3750/3751 IC

VOLTAGE DIVIDER NETWORK

(Decade Attenuator)

APPLICATIONS:

- FN207—Input attenuation and range selection in digital instrumentation, particularly in digital voltmeters and multimeters.

Resistance Tolerance on Total Resistance (R_T) at +25°C: $R_T = R_1 + R_2 + R_3 + R_4 + R_5 = 10$ Megohms ±0.05%.

Ratio Tolerance at +25°C and from 0 to 1000 volts:

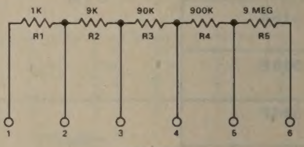
$$\frac{R_1 + R_2 + R_3 + R_4}{R_T} = \frac{1 \text{ Megohm}}{10 \text{ Megohms}} = 0.1 \pm 0.03\%$$

$$\frac{R_1 + R_2 + R_3}{R_T} = \frac{100 \text{ K ohms}}{10 \text{ Megohms}} = 0.01 \pm 0.03\%$$

$$\frac{R_1 + R_2}{R_T} = \frac{10 \text{ K ohms}}{10 \text{ Megohms}} = 0.001 \pm 0.03\%$$

$$\frac{R_1}{R_T} = \frac{1 \text{ K ohm}}{10 \text{ Megohms}} = 0.0001 \pm 0.03\%$$

Temperature Coefficient of Resistance	±25 ppm/°C
TCR Tracking	±5 ppm/°C
Operating Voltage (between pins 1 & 6)	1000 volts max.
Operating Temperature	0°C to +70°C
Storage Temperature	−65°C to +175°C


1K
9K
90K
900K
9 MEG
R1
R2
R3
R4
R5
1
2
3
4
5
6

FN207

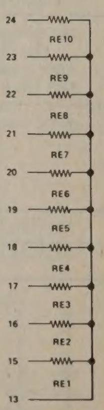
CURRENT SUMMING NETWORKS PRECISION RESISTOR ARRAYS

APPLICATIONS:

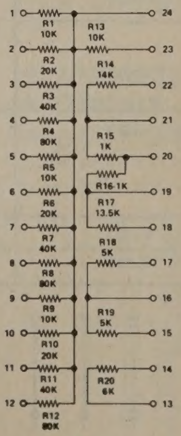
- A/D and D/A conversion.
- FN111*—10 bit binary operation.
- FN112*—3 place BCD operation (0 to 399).
- FN215—12 bit conversion—designed for use with Fairchild μA9650 IC.
- FN226**
- FN227**

*Both designed for use with Fairchild μA722 IC.

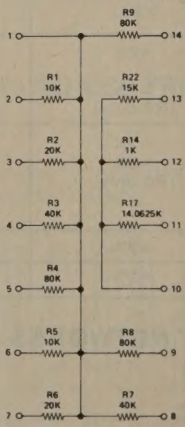
**Both designed for use with Intersil ICL 8018, 8019, 8020 IC's. FN226 gives 8 bit conversion. FN226 plus FN227 gives 12 bit conversion.


24
RE10
23
RE9
22
RE8
21
RE7
20
RE6
19
RE5
18
RE4
17
RE3
16
RE2
15
RE1
13

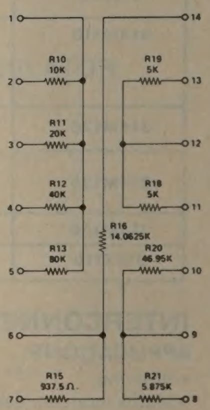
FN111 and FN112


1
R1 10K
2
R2 20K
3
R3 40K
4
R4 80K
5
R5 10K
6
R6 20K
7
R7 40K
8
R8 80K
9
R9 10K
10
R10 20K
11
R11 40K
12
R12 80K
24
R13 10K
23
R14 14K
22
21
R15 1K
20
R16 1K
19
R17 13.5K
18
R18 5K
17
16
R19 5K
15
R20 6K
14
13

FN215


R9 80K
1
14
R1 10K
2
R22 15K
13
R2 20K
3
R14 1K
12
R3 40K
4
R17 14.0625K
11
R4 80K
5
10
R5 10K
6
R8 80K
9
R6 20K
7
R7 40K
8

FN226


1
14
R10 10K
2
R19 5K
13
R11 20K
3
12
R12 40K
4
R18 5K
11
R16 14.0625K
R13 80K
5
R20 46.95K
10
6
9
R15 937.5Ω
7
R21 5.875K
8

FN227

CURRENT SUMMING NETWORKS

Part Number		FN111				FN112			
Terminal Number	Resistor Number (Rej)	Nominal Resistance (K ohm)	Nominal Ratio (Rej/Rei)	Max. Ratio Tolerance % At 25°C	Max. Ratio Temp. Coeff. (PPM/°C)	Nominal Resistance (K ohm)	Nominal Ratio (Rej/Rei)	Max. Ratio Tolerance % At 25°C	Max. Ratio Temp. Coeff. (PPM/°C)
15	RE1	2.547	1.000	±10% Absolute	±5.0	2.547	1.000	±10% Absolute	±20
16	RE2	5.094	2.000	±0.02	±5.0	5.094	2.000	±0.02	±5.0
17	RE3	10.245	4.022	±0.05	±10	6.379	2.5045	±0.02	±5.0
18	RE4	20.60	8.088	±0.10	±20	12.83	5.036	±0.05	±10
19	RE5	41.43	16.265	±0.20	±20	25.80	10.13	±0.10	±20
20	RE6	81.93	32.17	±0.20	±50	51.03	20.03	±0.20	±50
21	RE7	163.4	64.16	±0.50	±100	63.36	24.88	±0.50	±100
22	RE8	325.7	127.9	±1.0	±200	126.3	49.57	±1.0	±200
23	RE9	644.9	253.2	±2.0	±500	250.1	98.17	±1.0	±200
24	RE10	1275.0	500.8	±2.0	±500	495.0	194.3	±2.0	±500

PRECISION RESISTOR ARRAYS

Part Number	FN215	FN226	FN227
Tolerance Resistance matching or ratio	R2/R1 = ±0.005% R3/R1 = ±0.01% R4/R1 = ±0.02% R5/R1 = ±1.0% R6/R5 = ±0.05% R7/R5 = ±0.1% R8/R5 = ±0.02% R9/R1 = ±1.0% R10/R9 = ±0.5% R11/R9 = ±1.0% R12/R9 = ±2.0% R13/R1 = ±0.2%	R2/R1 = ±0.0122% R3/R1 = ±0.0244% R4/R1 = ±0.0488% R5/R1 = ±0.096% R6/R1 = ±0.195% R7/R1 = ±0.391% R8/R1 = ±0.781% R9/R1 = ±0.1% R17/R14 = ±0.1% R22/R14 = ±0.5%	R11/R10 = ±1.0% R12/R10 = ±1.0% R13/R10 = ±1.0% R16/R15 = ±1.0% R19/R18 = ±0.1% R21/R20 = ±0.1%
Tolerance Absolute	R14&R17 = ±0.5% R15&R16 = ±1.0% R18&R19 = ±0.1% R20 = ±1.0%	R1 = ±0.1% R14 = ±1.0%	R10 = ±0.5% R15 = ±1.0% R18 = ±0.5% R20 = ±0.5%
Temperature coefficient of resistance	±25 PPM/°C	±25 PPM/°C	±25 PPM/°C
Temperature coefficient of resistance tracking	±5 PPM/°C	±5 PPM/°C	±5 PPM/°C
Power rating each resistor up to +125°C	50MW	50MW	50MW
Operating temperature range	−55°C to +125°C	0°C to +70°C	0°C to +70°C
Storage temperature range	−65°C to +175°C	−65°C to +175°C	−65°C to +175°C

CUSTOM RESISTOR NETWORKS

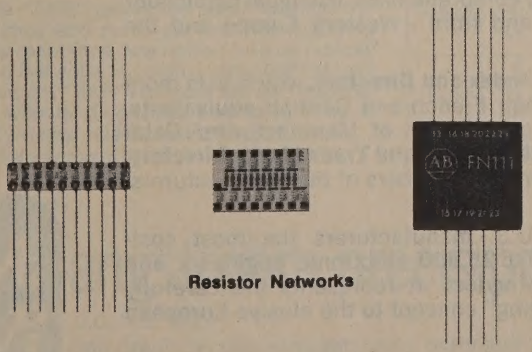
n addition to the standard cermet and precision thin film resistor networks listed on these pages, custom networks can be designed to meet a specific need. For more information on custom resistor network capabilities ask for these publications:

Cermet resistor networks—
A-B Publication 5840.

Thin film resistor networks—
A-B Publication 5800.

PACKAGES

- Modified flat pack (Diallyl phthalate epoxy material)
- Conformal coated
- Chip



Resistor Networks

ALLEN-BRADLEY
1201 South Second Street
Milwaukee, Wisconsin 53204

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IMMEDIATE AND OVERWHELMING

ACCEPTANCE

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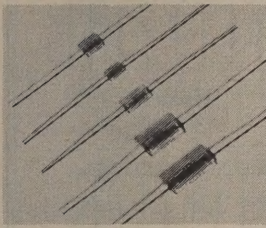
PRECISION METAL FILM RESISTORS

Hermetically Sealed per MIL-R-55182 Characteristics C and E
Hermetic Glass-to-Metal Seal — Failure Rates M (1%) thru S (0.001%)



FEATURES

- High stability
- Hermetic enclosure
- Inert gas environment
- In accordance with MIL-R-55182, Styles RNR and RNN
- Extended life and reliability
- 1/10, ⅛, ¼, ½ watt sizes (5 case sizes)

APPLICATIONS

Aerospace, military, oceanography . . . wherever the application or environment demands the ultimate in resistor reliability, Angstrohm's hermetically sealed metal film resistors are unquestionably first-choice. The HN glass-to-metal hermetic seal protects the resistance element from virtually any adverse environmental influence, and will withstand in excess of 3,000 p.s.i. external pressure without leakage.

SPECIFICATIONS

MIL-Specifications: RNR/RNN style resistors are designed to exceed the requirements of MIL-R-55182 for characteristics C and E.

Power Rating: All RNR/RNN resistors are based on full rated load at an ambient of 125°C.

Resistance Tolerances: The standard resistance tolerances are ±1.0% (F), ±.5% (D), and ±.1% (B) per Q.P.L. 55182. Consult factory for tighter tolerances and special matching.

Resistance Values: See Table 1 for range of resistance values. Standard values can be obtained from the resistance decade shown in Table. 2.

Derating: For ambients above 125°C, see Derating Curve.

Applied voltage shall not exceed $\sqrt{PR}$. See Table 1.

RATINGS AND DIMENSIONS

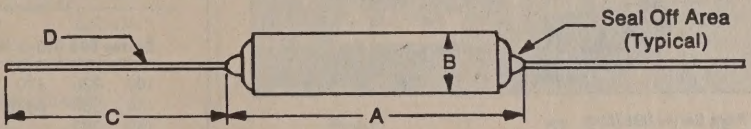
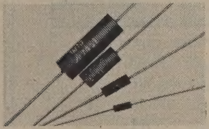


TABLE 1

Designations		Watt Rating @125°C	Volts Max.	Resistance Range in Ohms†		Approx. Dimensions (in inches)				Weight GMS (approx.)
MIL-55182 Style*	Angstrohm Style			Min.	Max.	A Max.	B Dia. Max.	C Nom.	D AWG	
RNR/RNN55	HN55	1/10	200	10	1.21 Meg.	.281	.112	1.50	#22	.314
RNR/RNN57	HN57	⅛	200	49.9	200K	.325	.150	1.25	#24	.317
RNR/RNN60	HN60	⅛	250	10	2.49 Meg.	.437	.150	1.50	#22	.485
RNR/RNN65	HN65	¼	300	24.9	4.99 Meg.	.655	.250	1.50	#22	.950
RNR/RNN70	HN70	½	350	49.9	7.50 Meg.	.796	.250	1.50	#20	1.300

*See Lead options under "Characteristics" below.
† Consult Factory for extended ranges.

series SAR* precision metal film resistors

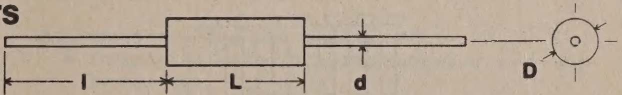


Angstrohm "SAR" thin metal film resistors are designed for hi-reliability, hi-precision, and long life applications and exceed the specifications and performance requirements of MIL-R-55182 and MIL-R-10509. The latest state-of-the-art materials and methods are utilized in their manufacture including improved metal film deposition technology, laser helixing, special moisture resistant undercoatings and flame retardent vacuum transfer molding.

The "SAR" resistor is ideal for high frequency and pulse applications requiring low reactance, low noise (−40 db typical) and low voltage coefficients (.02PPM/volt typical). "SAR" resistors are also capable of withstanding pulse overloads of up to fifty times rated power for 500 msec.

* Super Accurate Resistor

SPECIFICATIONS



Type	TC Code T-XX	Temperature Coefficient	TC Temp. Span	Power Rating @ 125°	Max. Voltage Rating	Resistance Range Min.-Max.	Tolerances Avail.±%	Dimensions
SAR25	9	±25PPM/°C	−55°C to 165°C	1/20W	200V	49.9-150K	.01 thru 1.0	L=.160±.010 D=.065±.005 l=1.0±.062 d=.016 #26 AWG
	10	±15PPM/°C	−20°C to 85°C			49.9-100K		
	13	±10PPM/°C	−20°C to 85°C			49.9-100K		
	16	± 5PPM/°C	−20°C to 85°C			49.9-49.9K		
SAR51	9	±25PPM/°C	−55°C to 165°C	1/10W	250V	49.9-402K	.01 thru 1.0	L=.270±.010 D=.097±.005 l=1.50±.125 d=.025 #22 AWG
	10	±15PPM/°C	−20°C to 85°C			49.9-301K		
	13	±10PPM/°C	−20°C to 85°C			49.9-249K		
	16	± 5PPM/°C	−20°C to 85°C			49.9-150K		
SAR60	9	±25PPM/°C	−55°C to 165°C	⅛W	300V	49.9-1.21 Meg.	.01 thru 1.0	L=.375±.010 D=.155±.005 l=1.50±.125 d=.025 #22 AWG
	10	±15PPM/°C	−20°C to 85°C			49.9-1.0 Meg.		
	13	±10PPM/°C	−20°C to 85°C			49.9-750K		
	16	± 5PPM/°C	−20°C to 85°C			49.9-499K		
SAR65	9	±25PPM/°C	−55°C to 165°C	¼W	500V	49.9-2.5 Meg.	.01 thru 1.0	L=.645±.010 D=.220±.005 l=1.50±.125 d=.025 #22 AWG
	10	±15PPM/°C	−20°C to 85°C			49.9-2.0 Meg.		
	13	±10PPM/°C	−20°C to 85°C			49.9-1.0 Meg.		
	16	± 5PPM/°C	−20°C to 85°C			49.9-1.0 Meg.		

Tolerance matching to .001% and TC matching to 5PPM/°C are also available.

angstrohm precision, inc.
p.o. box 1827
one precision place/hagerstown, maryland 21740
telephone: 301-739-8722 twx: 710-853-6834

BECKMAN®

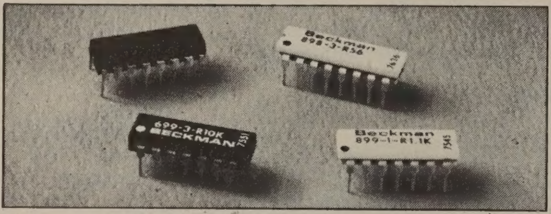
Save time, space and money with . . . RESNET™

THICK and THIN FILM RESISTOR NETWORKS

Beckman RESNET™ thick or thin film dual in-line, thick film single in-line, flatpack and custom resistor networks consist of various resistor configurations packaged in standard 14- and 16-pin DIPs, 6-, 8- and 10-pin SIPs, and 14- lead flatpacks. All offer:

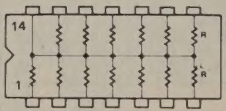
- Significant reduction of "on the board" costs
- Space savings over individual resistors
- Significant reduction of procurement, inventory and quality control costs.
- Compatibility with automatic insertion equipment

DIP RESISTOR NETWORKS

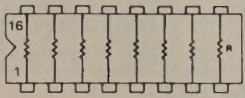


Thick Film Series 899/898

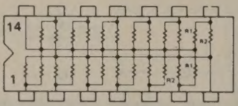
- 14-pin (899) and 16-pin (898) configurations
- Automatic insertion compatible
- Thick film reliability and performance
- ±2% (or ±2 ohms) resistance tolerance
- 0.15W (898/899-1, -5) or 0.250W (898/899-3) resistor power rating (+25° C)



899-1-R
13 resistors



898-3-R
8 resistors



899-5-R/R
Line Terminators

Series 899 Stock Resistance Values (ohms)

22	56	150	360	750	1.8K	4.3K	9.1K	22K
24	62	160	390	820	2K	4.7K	10K	33K
27	68	180	430	910	2.2K	5.1K	11K	47K
30	75	200	470	1K	2.4K	5.6K	12K	68K
33	82	220	500†	1.1K	2.7K	6K	13K	100K
36	91	240	510	1.2K	3K	6.2K	15K	150K
39	100	270	560	1.3K	3.3K	6.8K	16K	220K
43	110	300	620	1.5K	3.6K	7.5K	18K	330K*
47	120	330	680	1.6K	3.9K	8.2K	20K	470K*
51	130							

†899-1 only *899-3 only

Similar values available for Series 898-1 and 898-3

Series 899/898-5 Stock Resistance Values (R_1/R_2) (ohms)

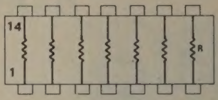
180/390	220/270	220/330	330/390	330/470

Also available:
3K/6.2K IEEE STD-488-1975 Digital Interface Specification.

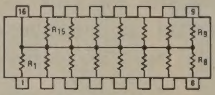
Precision Thin Film Series 698/699

If your application requirements call for greater circuit stability than unmatched individual discrete resistors and tighter accuracy tolerances than thick film resistor networks, consider our precision film resistor networks. Series 698 and 699 feature:

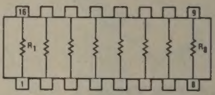
- Low cost—from 65¢ at 1,000 piece price
- ±5 ppm/°C tracking
- Absolute resistance tolerance options from ±0.1% to ±1.0%
- ±50 ppm/°C tempco
- −40dB max. noise
- Negligible resistance voltco



699-3-R-X
7 resistors



698-1-R-X
15 resistors



698-3-R-X
8 resistors

Series 698 Stock Resistance Values

100	220	470	1.0K	2.0K*	3.3K	6.2K*	7.5K*	15K	47K†
110	330	680*	1.5K	2.2K	4.7K	6.8K	10K	22K	100K
150	390*								

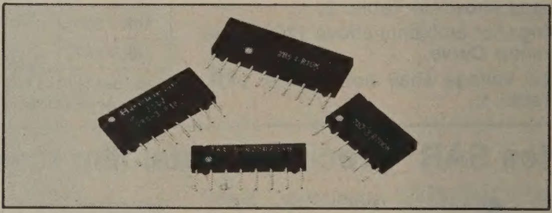
*698-1 only †698-3 only

Series 699 Stock Resistance Values

100	200	500	1K	2K	5K	10K	20K	50K	100K

Other standard resistance values between 100Ω and 100K are available on request. Non-standard values can be supplied on special order.

SIP RESISTOR NETWORKS

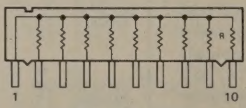


High Power Series 783/784/785

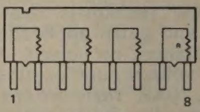
- 8-pin and new 6- and 10-pin configurations
- Automatic insertion compatible
- ±2% (or ±2 ohms) resistance tolerance
- 0.17W to 0.5W resistor power rating (+25° C)

Low-Profile Series 764

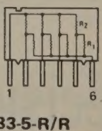
- 8-pin low-profile package — 0.200" (5,08mm) max. height
- Automatic insertion compatible
- ±2% (or ±2 ohms) resistance tolerance
- 0.180W (764-1), 0.200W (764-3), 0.125W (764-5) resistor power rating (+25° C)



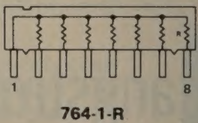
785-1-R
9 resistors



784-3-R
4 resistors



783-5-R/R
Line Terminators



764-1-R
7 resistors

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RESNET™
THICK and THIN FILM RESISTOR NETWORKS

Series 764/783/784/785-1 Stock Resistance Values (ohms)

33	100	390	1K	3K	8.2K	33K
39	120	470	1.2K	3.3K	10K	39K
47	150	500	1.5K	3.9K	12K	47K
50	180	510	1.8K	4.7K	15K	56K
56	220	560	2K	5.6K	18K	68K
68	270	680	2.2K	6K	22K	82K
82	330	820	2.7K	6.8K	27K	100K

Series 764/783/784/785-3 Stock Resistance Values (ohms)

22	56	180	470	3.3K	22K
33	68	220	680	4.7K	33K
39	100	270	1K	6.8K	47K
47	120	330	1.5K	10K	68K
50	150	390	2.2K	15K	100K

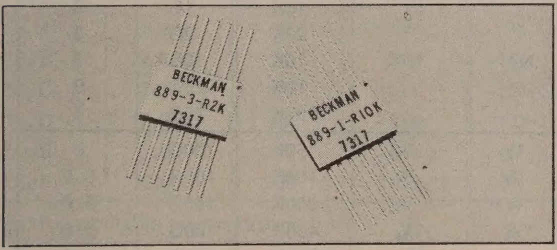
Series 764/783/784/785-5 Stock Resistance Values (R_1/R_2) (ohms)

81/130	162/260	220/330	330/470
121/195	180/390	330/390	

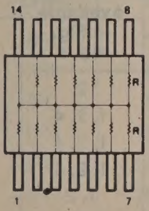
Also available:
3K/6.2K IEEE STD-488-1975 Digital Interface Specification.

How to Order: List DIP, SIP or Flatpack Model number, add dash version, and desired resistance value. Example: 1500 ohm, 14-pin network with 13 resistors (Series 899-1), order 899-1-R1.5K.

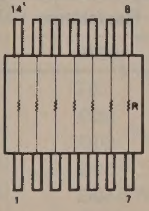
FLATPACKS


BECKMAN
889-3-R2K
7317
BECKMAN
889-1-R10K
7317

Series 889
- Lowest profile (0.065″/1,651 mm max.) for critical board height and multilayer applications
- ±2% (or ±2 ohms) resistance tolerance
- 0.6W package power rating
- 0.150W (889-1), 0.250W (889-3) resistor power rating (+25°C)



889-1
13 resistors



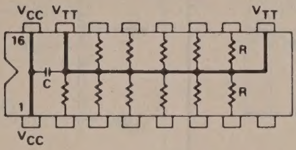
889-3
7 resistors

Series 889 Stock Resistance Values (ohms)

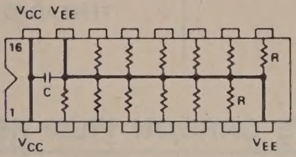
1K	2K	3.3K	4.7K	10K

STANDARD ECL TERMINATORS

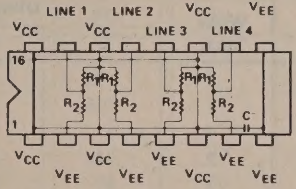
Series 898 16-Pin ECL Terminator DIPs
- Resistance tolerance: ±2% (or ± 2Ω)
- Resistor power rating: operation at T_A = 85°C without heat/sinking
- Capacitor tolerance: +40%, –20%
- Capacitor voltage rating: 25V
- Temperature range: –30°C to +85°C


V_{CC}
V_{TT}
V_{TT}
16
R
C
R
1
V_{CC}

898-41
–20 Volt Terminators
R= 50Ω, 68Ω, 75Ω, and 100Ω


V_{CC}
V_{EE}
16
R
C
R
1
V_{CC}
V_{EE}

898-42
–5.2 Volt Terminators
R= 510Ω

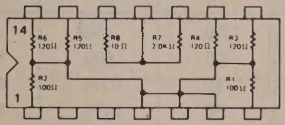

LINE 1
LINE 2
V_{CC}
V_{EE}
V_{CC}
V_{CC}
LINE 3
LINE 4
16
R_1
R_2
C
1
V_{CC}
V_{CC}
V_{EE}
V_{EE}
V_{EE}
V_{EE}
V_{CC}
V_{EE}

898-43
Thevenin Equivalent Terminators

Model	R1	R2
898-43-250	81 Ω	130 Ω
898-43-275	121 Ω	195 Ω
898-43-2100	162 Ω	260 Ω

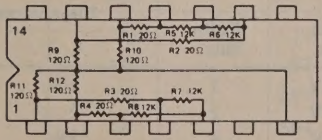
STANDARD DIP INTERFACE NETWORKS

Model 899-17 14-Pin Sense Amp Terminator
- Designed for 7520 series sense amps
- Resistor tempco: ±300 p/10^6 per °C
- Temperature range: 0°C to + 70°C


14
R6 120Ω
R5 120Ω
R8 10Ω
R7 2.0K Ω
R4 120Ω
R3 120Ω
R2 100Ω
R1 100Ω
1

899-17
Sense Line Terminator
For 7520 Series Sense AMP

Model 899-19 14-Pin Sense Amp Terminator
- Designed for use in 711 dual comparator sense amp configuration
- Resistance tolerance: ±2%
- Threshold voltage: 2mV ±1mV
- $+V_{ADJ}$: 20V max.
- Temperature range: 0°C to +70°C


14
R1 20Ω
R5 12K
R6 12K
R9 120Ω
R10 120Ω
R2 20Ω
R11 120Ω
R12 120Ω
R3 20Ω
R7 12K
R4 20Ω
R8 12K
1

899-19
Sense Line Terminator
For μA711

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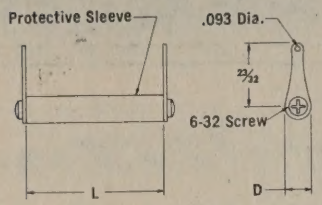
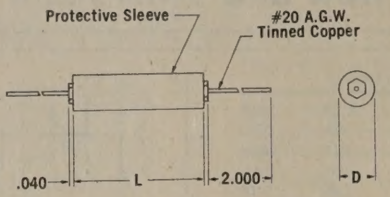


RADIAL LUG

FIG. 1

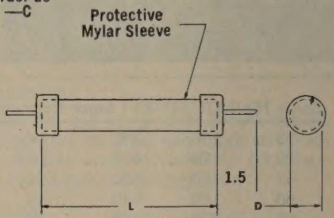
Order as —W



THREADED AXIAL WIRE LEAD

FIG. 2

Order as —C



CAPPED AXIAL WIRE LEAD

FIG. 3

HIGH VOLTAGE CARBON FILM RESISTORS

Type	Volts Max.	Watts Max.	Dimensions — Inches				Ohms		Available In Fig. No.'s
			L	D	ID	FD	Min.	Max.	
CFA	2,500	.5	¾	¼	NA	NA	10K	1G	2
CFB	5,000	1	1½	¼			20K	2G	2
CFC	3,500	1	1	5/16			10K	10G	1, 2, 4
CFD	10,000	2	1¾	5/16			10K	25G	1, 2, 4
CFE	15,000	3	3	5/16			20K	25G	1, 2, 4
CFF	30,000	5	5½	5/16			40K	25G	1, 2, 4
CFG	15,000	4	2½	9/16			20K	25G	1, 2
CFH	25,000	6	4	9/16			40K	25G	1, 2
CFJ	40,000	10	6½	9/16			70K	25G	1, 2
NFA	2,500	.5	¾	¼	NA	NA	10K	1G	3
NFB	5,000	1	1½	¼			20K	2G	3
NFC	3,500	1	1	5/16			10K	10G	3
NFD	10,000	2	1¾	5/16			10K	25G	3
NFE	15,000	3	3	5/16			20K	25G	3
*CJA	25 KV	10	4½	¾	½	—	50K	100G	5
*CJB	35 KV	20	6½	1⅛	¾	13/16	100K	100G	5, 6
*CJC	65 KV	30	10½	1⅛	¾	13/16	200K	100G	5, 6
*CJD	90 KV	60	14½	1½	1⅛	1 9/64	400K	100G	5, 6
*CJE	40 KV	35	6½	2	1 9/16	1 9/64	300K	100G	5, 6
*CJF	125 KV	100	18½	2	1 9/16	1 9/64	700K	100G	5, 6

*Sleeving available on request.

Standard Tolerances are 15%, 10%, 5% and 3%.

PRECISION TOLERANCE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions — Inches		Resistance Value (Max.)		Available In Fig. No.'s
			L	D	±2%	±1%	
MP-1	5 KV	1	1½	¼	2G	1G	2
MP-2	10 KV	2	2	5/16	20G	5G	1, 2, 4
MP-4	20 KV	4	3½	5/16	50G	10G	1, 2, 4
MP-6	30 KV	6	6	5/16	50G	10G	1, 2, 4
MP-8	30 KV	8	5	9/16	50G	10G	1, 2
MP-10	60 KV	10	11	5/16	50G	10G	1, 2, 4
MP-12	50 KV	12	8	9/16	50G	10G	1, 2
MP-20	80 KV	20	13	9/16	50G	10G	1, 2
SP-1	5 KV	1	1½	¼	100G	25G	2
SP-2	10 KV	2	2	5/16	100G	25G	1, 2, 4
SP-4	20 KV	4	3½	5/16	100G	25G	1, 2, 4
SP-6	30 KV	6	6	5/16	100G	25G	1, 2, 4
SP-8	30 KV	8	5	9/16	100G	25G	1, 2
SP-10	60 KV	10	11	5/16	100G	25G	1, 2, 4
SP-12	50 KV	12	8	9/16	100G	25G	1, 2
SP-20	80 KV	20	13	9/16	100G	25G	1, 2

NOTE: Megohm equals 10^6, Gigohm equals 10^9, Teraohm equals 10^{12}.

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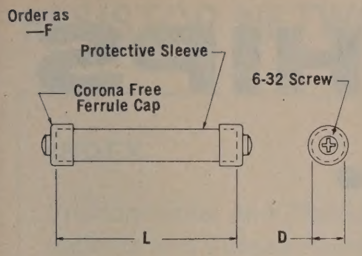
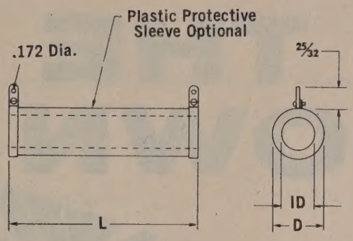


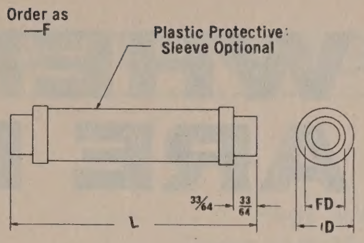
FERRULE CAP

FIG. 4



RADIAL BAND

FIG. 5



FERRULED ENDS

FIG. 6

HIGH FREQUENCY RESISTORS

Type	Volts Max.	Watts Max.	Dimensions — Inches				Ohms		Available In Fig. No.'s
			L	D	ID	FD	Min.	Max.	
SFA	400	.5	¾	¼	NA	NA	20	20M	2
SFB	800	1	1½	¼			25	40M	2
SFC	500	1	1	5/16			20	25M	1, 2, 4
SFD	1,000	2	1¾	5/16			25	50M	1, 2, 4
SFE	2,000	3	3	5/16			35	100M	1, 2, 4
SFF	3,700	5	5½	5/16			60	100M	1, 2, 4
SFG	1,500	4	2½	9/16			20	50M	1, 2
SFH	2,800	6	4	9/16			25	75M	1, 2
SFJ	4,500	10	6½	9/16			40	100M	1, 2
*SJA	3,000	10	4½	¾	½	—	20	50M	5
*SJB	4,000	20	6½	1⅛	¾	13/16	20	50M	5, 6
*SJC	7,000	30	10½	1⅛	¾	13/16	30	100M	5, 6
*SJD	10,000	60	14½	1½	1⅛	1 9/64	35	100M	5, 6
*SJE	4,500	35	6½	2	1 9/16	1 9/64	20	35M	5, 6
*SJF	12,500	100	18½	2	1 9/16	1 9/64	30	100M	5, 6

*Sleeving available on request.

HIGH MEGOHM RESISTORS

Type	Volts Max.	Watts Max.	Dimensions — Inches		Ohms		Available In Fig. No.'s
			L	D	Min.	Max.	
HFA	2,500	.5	¾	¼	1M	1T	2
HFB	5,000	1	1½	¼	1M	5T	2
HFC	3,500	1	1	5/16	1M	25T	1, 2, 4
HFD	10,000	2	1¾	5/16	1M	50T	1, 2, 4
HFE	15,000	3	3	5/16	1M	100T	1, 2, 4
HFF	30,000	5	5½	5/16	1M	100T	1, 2, 4
HFG	15,000	4	2½	9/16	1M	100T	1, 2
HFH	25,000	6	4	9/16	1M	100T	1, 2
HFJ	40,000	10	6½	9/16	1M	100T	1, 2

Standard Tolerances are 20%, 15%, 10% and 5% for the SF and SJ Series and 10%, 5% and 3% for the HF Series.

Resistors of greater than 10G, are provided with special coating to minimize effects of handling and humidity, no change in diameter.

All Dimensional Tolerances ±1/64 or 1% whichever is greater.

If units are to be operated near maximum limits, at elevated ambient, or in a coolant, order resistors without sleeving.

Special values or configurations are available upon request from Beman Manufacturing, Inc.

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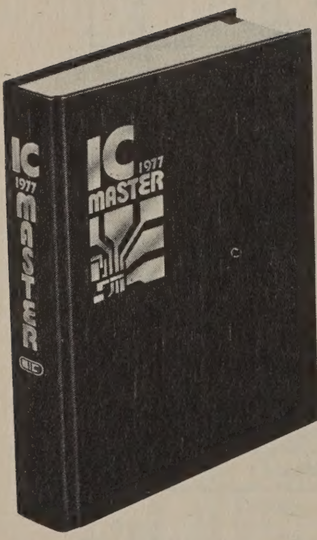

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- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
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RESISTOR NETWORKS

BOURNS®

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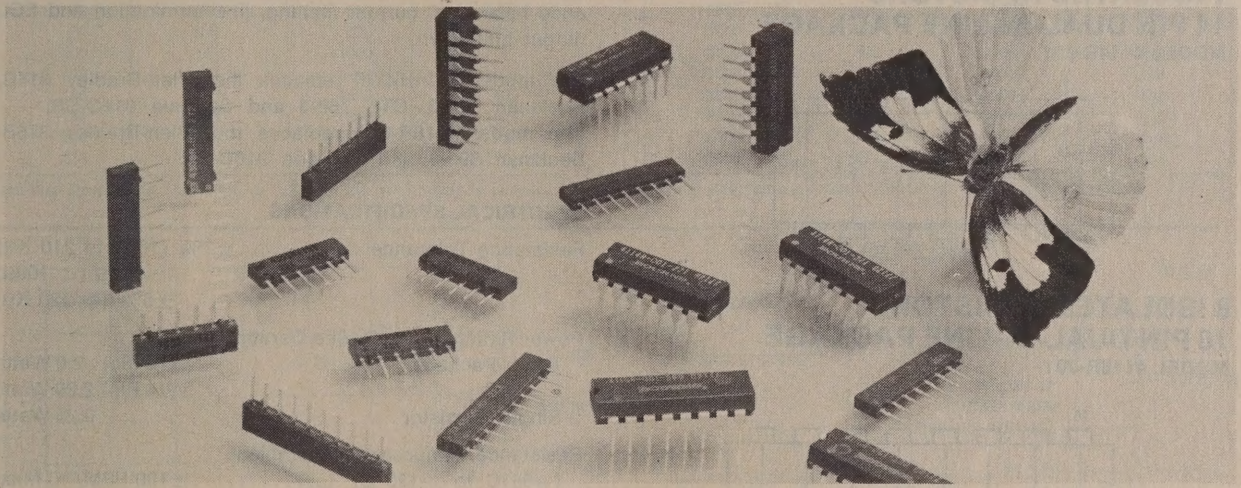
Isolated and Bussed Resistor Circuits .... Pages 3648-3649
ECL Terminators .... Pages 3650-3651
Special Purpose Circuits .... Pages 3652-3653
SIP Networks .... Pages 3654-3655



ELECTRICAL

Resistance Range	
Standard	33Ω to 220KΩ
Special	10Ω to 1 MegΩ
Resistance Temperature Coefficient (−55°C to +125°C)	±250 ppm/°C (except as noted)
Short Time Overload (2.5 × Rated Voltage, 5 sec)	±0.25% Max. ΔR

ENVIRONMENTAL/PERFORMANCE

Test (Per MIL-R-83401 except as noted)	Max. ΔR
Load-Life	±1.0%
Mechanical Shock	±0.25%
Moisture Resistance	±0.25% (41xx series) ±0.50% (43xx series)
Resistance to Soldering Heat (MIL-STD-202E, Meth. 210A, Cond. C, Proc. 2)	±0.25%
Terminal Strength	±0.25%
Terminal Shock	±0.25% (41xx series) ±0.50% (43xx series)
Vibration	±0.25%
Insulation Resistance	10,000 MegΩ Minimum
Dielectric Withstanding Voltage	Meets Requirements of MIL-R-83401
Lead Solderability	
Solvent Resistance	

BOURNS INC. TRIMPOT PRODUCTS DIVISION
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DIP RESISTOR NETWORKS

ISOLATED AND BUSSED RESISTOR CIRCUITS

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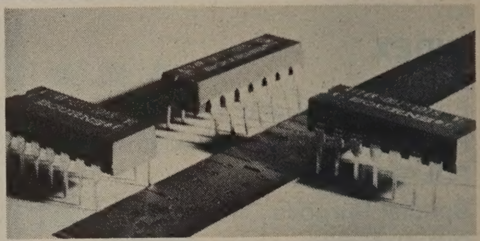
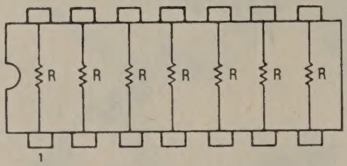
FEATURES

- *Reduces P.C. board space*
- *Reduces total assembly costs*
- *Standard DIP package is compatible with automatic insertion equipment*
- *Krimp-Joint™ construction for extra reliability*



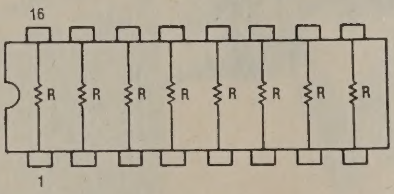
7 ISOLATED RESISTORS 14 PIN DUAL-IN-LINE PACKAGE

MODEL 4114R-001



8 ISOLATED RESISTORS 16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116R-001



Typical applications include power gate pull-up, impedance balancing, current limiting, line termination and ECL output pull-down.

The model 4114R-001 replaces the Allen-Bradley 314B, Beckman 899-3, CTS 760-3 and Sprague 914C-SR.
The model 4116R-001 replaces the Allen-Bradley 316B, Beckman 898-3 and Sprague 916C-SR.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance . . . . ±2% (100Ω to 210 KΩ)
±2Ω (< 100Ω)
±5% (> 220 KΩ)

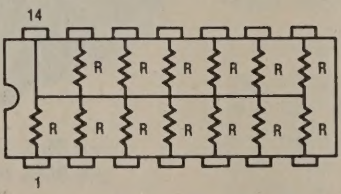
Power Rating @ 25°C (See Derating Curve)
Total Package . . . . (14 Pin) 2.0 Watts
(16 Pin) 2.25 Watts
Single Resistor . . . . 0.25 Watts

Resistance Temperature Coefficient
(−55°C to +125°C) . . . . ±100 PPM/°C Max.

---

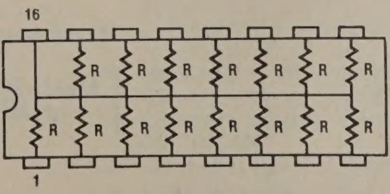
13 RESISTORS, PIN 14 COMMON 14 PIN DUAL-IN-LINE PACKAGE

MODEL 4114R-002



15 RESISTORS, PIN 16 COMMON 16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116R-002



Typical applications include open collector pull-up, paralley pull-up, wired OR pull-up, TTL input pull-down, MOS Memory pull-up and pull-down, unused gate pull-up, power driver pull-up.

The model 4114R-002 replaces the Allen-Bradley 314A, Beckman 899-1, CTS 760-1 and Sprague 914C-PE.
The model 4116R-002 replaces the Allen-Bradley 316A, Beckman 898-1, CTS 761-1 and Sprague 916C-PE.

ELECTRICAL SPECIFICATION

Resistance Tolerance . . . . ±2% (100Ω to 210 KΩ)
±2Ω (< 100Ω)
±5% (> 220 KΩ)

Power Rating @ 25°C (See Derating Curve)
Total Package . . . . (14 Pin) 2.0 Watts
(16 Pin) 2.25 Watts
Single Resistor . . . . 0.125 Watts

Resistance Temperature Coefficient
(−55°C to +125°C) . . . . ±100 PPM/°C Max.

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DIP RESISTOR NETWORKS

ISOLATED AND BUSSED RESISTOR CIRCUITS

BOURNS®

HOW TO ORDER

Example—A 16-pin, 15-resistor DIP network, 22K ohms per resistor is Model 4116R-002-223. The last three digits are the code for the resistance value—the first two digits designate the significant numbers (22), and the last digit gives the number of zeros that follow (3). So, -223 translates to 22,000 ohms.

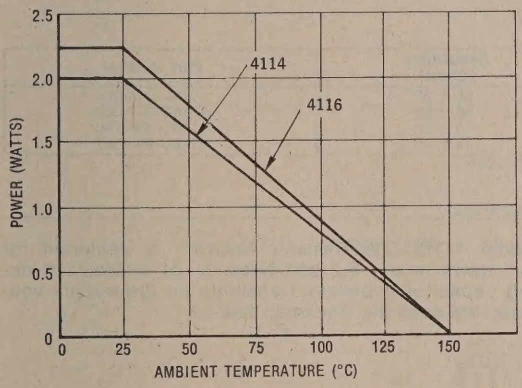
STANDARD RESISTANCES

Resistance (ohms)	Resistance Code	Resistance (ohms)	Resistance Code
33	-330	330	-331
39	-390	390	-391
47	-470	470	-471
56	-560	560	-561
68	-680	680	-681
82	-820	820	-821
100	-101	1000	-102
120	-121	1200	-122
150	-151	1500	-152
180	-181	1800	-182
220	-221	2000	-202
270	-271	2200	-222

Standard Resistance Tolerance is ±2% or 2Ω, Whichever Is Larger

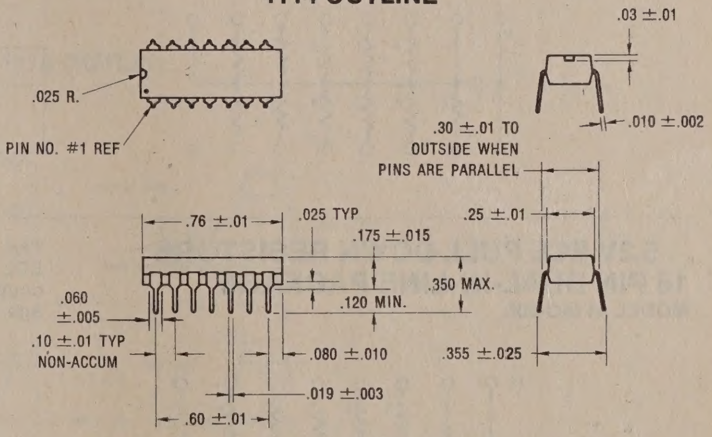
Resistance (ohms)	Resistance Code	Resistance (ohms)	Resistance Code
2700	-272	27000	-273
3300	-332	33000	-333
3900	-392	39000	-393
4700	-472	47000	-473
5600	-562	56000	-563
6800	-682	68000	-683
8200	-822	82000	-823
10000	-103	100000	-104
12000	-123	120000	-124
15000	-153	150000	-154
18000	-183	180000	-184
22000	-223	220000	-224

Special Resistances From 10 Ohms to 1 Megohm Are Available

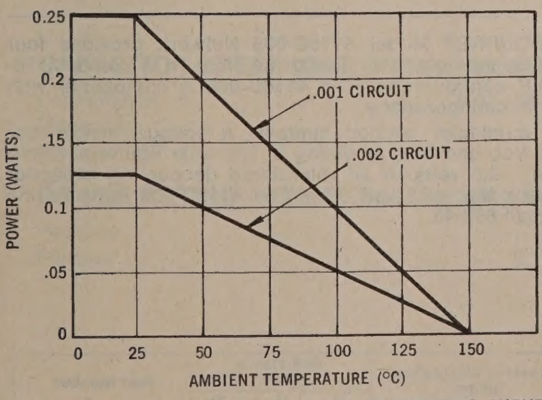


PACKAGE POWER-TEMPERATURE DERATING CURVE

4114 OUTLINE

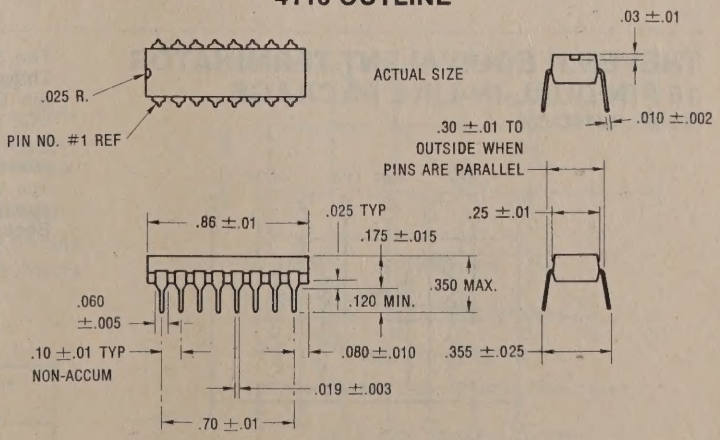


.03 ±.01
.025 R.
PIN NO. #1 REF
.010 ±.002
.30 ±.01 TO
OUTSIDE WHEN
PINS ARE PARALLEL
.76 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.120 MIN.
.060
±.005
.10 ±.01 TYP
NON-ACCUM
.080 ±.010
.355 ±.025
.019 ±.003
.60 ±.01



SINGLE RESISTOR POWER-TEMPERATURE DERATING CURVE

4116 OUTLINE



.03 ±.01
ACTUAL SIZE
.025 R.
PIN NO. #1 REF
.010 ±.002
.30 ±.01 TO
OUTSIDE WHEN
PINS ARE PARALLEL
.86 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.120 MIN.
.060
±.005
.10 ±.01 TYP
NON-ACCUM
.080 ±.010
.355 ±.025
.019 ±.003
.70 ±.01

Specifications are subject to change without notice.

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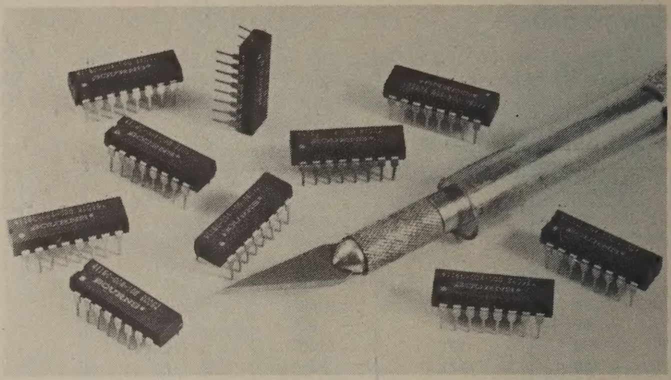
DIP RESISTOR NETWORKS

**ECL TERMINATORS WITH
DECOUPLING CAPACITOR**

BOURNS®

FEATURES

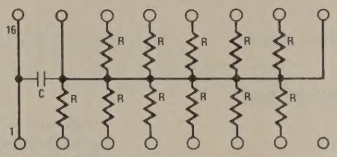
- *Reduces P.C. board space*
- *Reduces total assembly costs*
- *Standard DIP package is compatible with automatic insertion equipment*
- *Uniform performance characteristics*
- *Compatible with ECL pin configurations*
- *Krimp-Joint™ construction for extra reliability*



—2.0 VOLT ECL TERMINATOR 16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116C-004

The BOURNS® Model 4116C-004 Resistor Network is designed for ECL line termination to a —2.0 volt buss. An .01 microfarad decoupling capacitor bypasses transients between supply voltages. Replaces the Beckman 898-41.

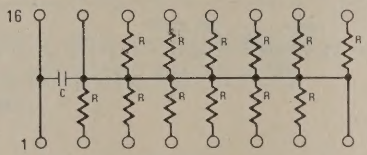


Resistance (Ohms)	Part Number
50 ± 2Ω	4116C-004-500
68 ± 2Ω	4116C-004-680
75 ± 2Ω	4116C-004-750
100 ± 2Ω	4116C-004-101

—5.2V ECL PULL DOWN RESISTORS 16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116C-005

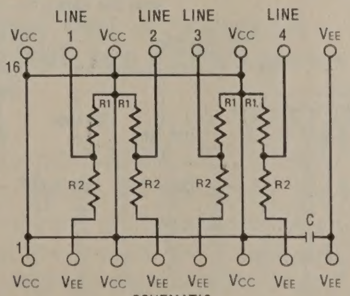
The Model 4116C-005 Resistor Network is designed for ECL pull down to a —5.2 volt buss. A .01 microfarad decoupling capacitor bypasses transients on the supply voltage buss. Replaces the Beckman 898-42.



Resistance (Ohms)	Part Number
510 ± 2%	4116C-005-511

THEVENIN EQUIVALENT TERMINATOR 16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116C-006



SCHEMATIC

The BOURNS® Model 4116C-006 Network provides four Thevenin equivalent terminator sections in a compact 16-pin DIP configuration. The 4116C-006 is compatible with ECL pin configurations.

Each terminator section contains a voltage divider between Vcc and Vee providing a Thevenin equivalent voltage of —2.0 volts. A .01 microfarad decoupling capacitor bypasses the —5.2 volt buss. The 4116C-006 replaces the Beckman 898-43.

Thevenin Impedance (ohms)	Resistance (ohms)		Part Number
	R_1	R_2	
50 ± 2Ω	81	130	4116C-006-500
75	121	195	4116C-006-750
100	162	260	4116C-006-101

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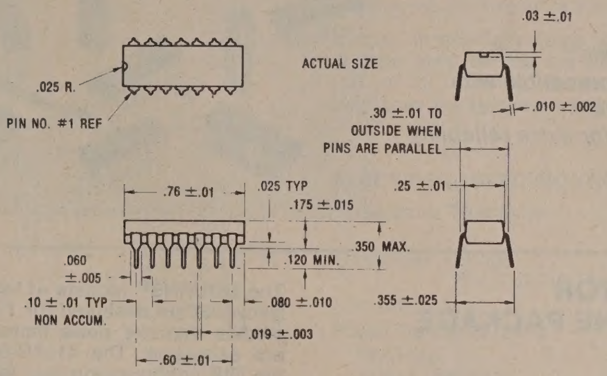
DIP RESISTOR NETWORKS

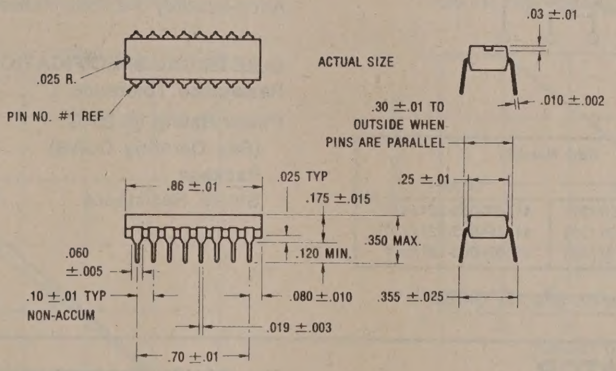
ECL TERMINATORS WITH DECOUPLING CAPACITOR

BOURNS®

4114 OUTLINE


.03 ±.01
ACTUAL SIZE
.025 R.
PIN NO. #1 REF
.010 ±.002
.30 ±.01 TO OUTSIDE WHEN PINS ARE PARALLEL
.76 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.060 ±.005
.120 MIN.
.10 ± .01 TYP NON ACCUM.
.080 ±.010
.355 ±.025
.019 ±.003
.60 ±.01

4116 OUTLINE

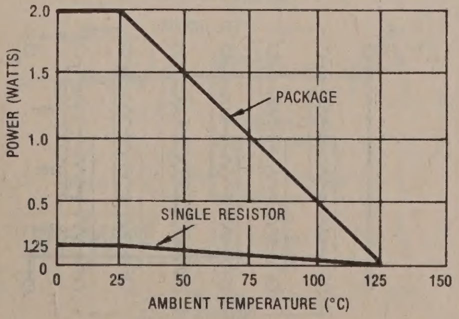

.03 ±.01
ACTUAL SIZE
.025 R.
PIN NO. #1 REF
.010 ±.002
.30 ±.01 TO OUTSIDE WHEN PINS ARE PARALLEL
.86 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.060 ±.005
.120 MIN.
.10 ±.01 TYP NON-ACCUM
.080 ±.010
.355 ±.025
.019 ±.003
.70 ±.01

CAPACITOR SPECIFICATIONS (all models)

Capacitance	0.01 μfd ± 20%
Dissipation Factor	3% Max.
Voltage Rating	25V Max.

POWER RATING @ 25°C (See Derating Curve)

Package	2.0 Watts
Resistor	0.125 Watts



POWER-TEMPERATURE DERATING CURVE

(ALL ECL TERMINATORS)

Specs are subject to change without notice

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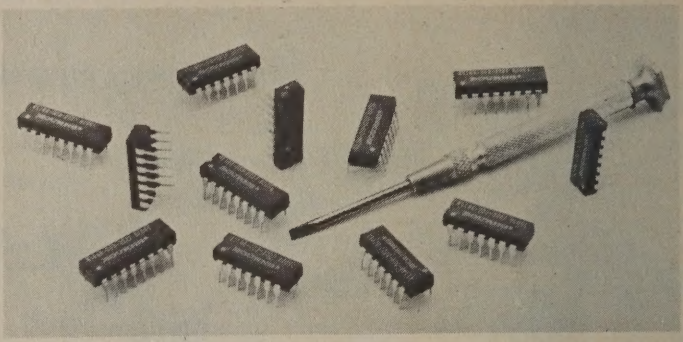
DIP RESISTOR NETWORKS

SPECIAL PURPOSE CIRCUITS

BOURNS®

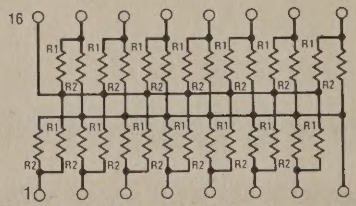
FEATURES

- *Reduces P.C. board space*
- *Reduces total assembly costs*
- *Standard DIP package is compatible with automatic insertion equipment*
- *Krimp-Joint™ construction for extra reliability*



DUAL LINE TERMINATOR
14/16 PIN DUAL IN-LINE PACKAGE

MODEL 4114R-003
MODEL 4116R-003



The BOURNS® Models 4114R-003 and 4116R-003 Resistor Networks are designed for TTL dual line termination. These models improve noise immunity where capacitive effects are excessive. The 4114R-003 network is a standard 14 pin DIP configuration and terminates 12 lines. The 4116R-003 is a 16 pin DIP configuration and terminates 14 lines.

The dual terminators consist of 24 (4114R-) or 28 (4116R-) thick film resistors. Pins 7 (or 8) and 14 (or 16) are common for ground and power respectively. Each series-pair of resistors is connected between the common lines. The center of these resistor pair are connected to input terminals. Replaces the Beckman 899/898-5, the CTS 760/761-5, the Sprague 914/916C-5TR networks, and the Allen-Bradley 34E/36E networks.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance .... ±5%

Power Rating @ 25°C

	4114R-003	4116R-003
(See Derating Curve)		
Package	2.0 Watts	2.25 Watts
Single Resistance	0.125 Watts	0.125 Watts

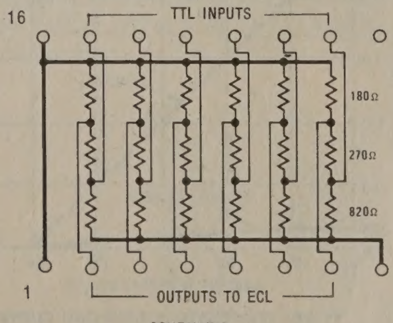
STANDARD RESISTANCES

Resistance (ohms)		Part Number	
R_1	R_2	14 pin	16 pin
220	270	4114R-003-221/271	4116R-003-221/271
220	330	4114R-003-221/331	4116R-003-221/331
180	390	4114R-003-181/391	4116R-003-181/391

OTHER RESISTOR VALUES AVAILABLE ON SPECIAL ORDER.

TTL TO ECL TRANSLATOR
16 PIN DUAL-IN-LINE PACKAGE

MODEL 4116R-008



SCHEMATIC

The BOURNS® Model 4116R-008 Resistor Network provides translation from TTL to ECL integrated circuit logic. It is packaged in a standard 16 pin DIP configuration, with 18 thick film resistors interconnected as illustrated.

The translator design assumes both TTL and ECL are operating between a +5 volt power supply and ground. Six line capacity is provided in the 16 pin configuration. Replaces the Beckman 898-45 and the CTS 761-45.

PERFORMANCE SPECIFICATIONS

Resistance Tolerance .... ±2%

Power Rating V @ 25°C (See Derating Curve)

V @ 25°C

Package .... 2.0 Watts

Single Resistor .... 0.125 Watts

STANDARD RESISTANCES

Resistance (ohms)			Part Number
R_1	R_2	R_3	
180	270	820	4116R-008-001

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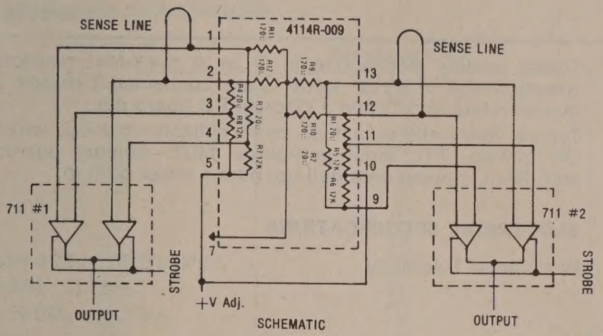
DIP RESISTOR NETWORKS

SPECIAL PURPOSE CIRCUITS

BOURNS®

711 DUAL COMPARATOR TERMINAL 14 PIN DUAL-IN-LINE PACKAGE

MODEL 4114R-009


SENSE LINE
1
2
3
4
5
7
4114R-009
R11 120Ω
R12 120Ω
R9 120Ω
R10 120Ω
R4 20Ω
R8 12K
R3 20Ω
R7 12K
R1 20Ω
R5 12K
R6 12K
R2 20Ω
13
12
11
10
9
SENSE LINE
711 #1
711 #2
STROBE
STROBE
+V Adj.
OUTPUT
OUTPUT

SCHEMATIC

BOURNS® Model 4114R-009 Resistor Network is designed to provide threshold reference settings and balanced sense line termination for two 711 dual comparators . . . in core memory sense sense amplifier applications. The 4114R-009 is packaged in a compact 14 pin DIP configuration, utilizing Bourns ultra-reliable Krimp-Joint™ termination design.

In use, threshold voltage settings are established by the voltage drop across the 20 ohm resistors (20mv. at + V adj. of 12.14 volts). Sense line termination is 120 ohms. Replaces the Beckman 899 19 and the CTS 760-19.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance ....Pins 7 to 10 and 5 to 7 = 6.07K ±2%

Threshold Voltage ....20 ±1.0 MV

Pin 7 at 0V; Pins 5 and 10 at 12.14 OV ±10 MV

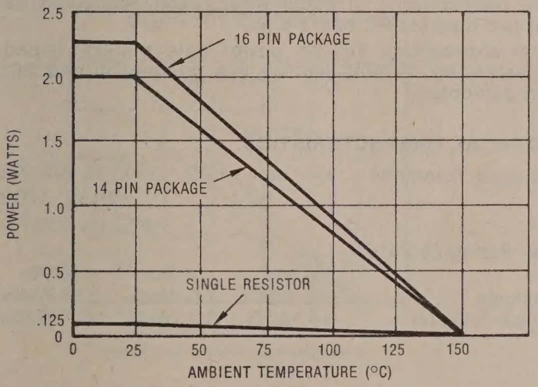
+V Adj. .... 20V Max.

Power Rating @ 25°C

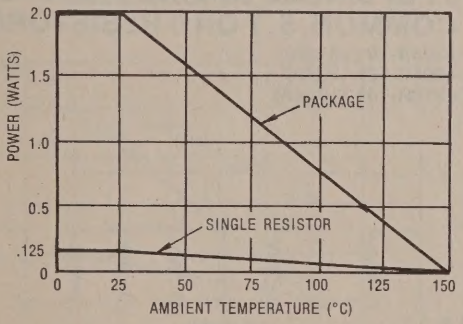
Package ....1.00 Watts

Single Resistor ....0.080 Watts

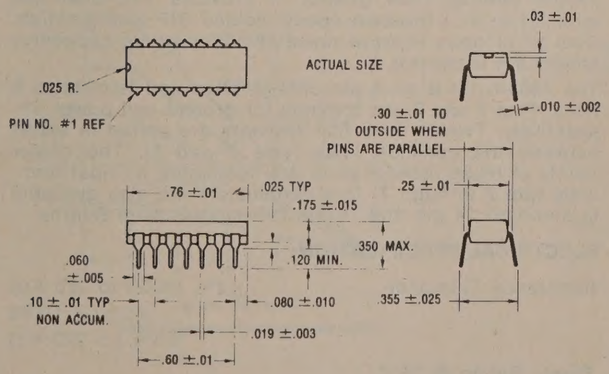
MODEL 4116R-003 MODEL 4114R-003 POWER-TEMPERATURE DERATING CURVE



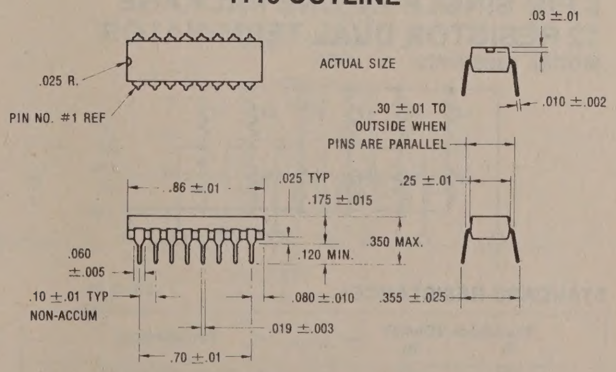
MODEL 4116R-008 POWER-TEMPERATURE DERATING CURVE



4114 OUTLINE


.025 R.
PIN NO. #1 REF
ACTUAL SIZE
.03 ±.01
.30 ±.01 TO
OUTSIDE WHEN
PINS ARE PARALLEL
.010 ±.002
.76 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.060
±.005
.120 MIN.
.10 ± .01 TYP
NON ACCUM.
.080 ±.010
.355 ±.025
.019 ±.003
.60 ±.01

4116 OUTLINE


.025 R.
PIN NO. #1 REF
ACTUAL SIZE
.03 ±.01
.30 ±.01 TO
OUTSIDE WHEN
PINS ARE PARALLEL
.010 ±.002
.86 ±.01
.025 TYP
.175 ±.015
.25 ±.01
.350 MAX.
.060
±.005
.120 MIN.
.10 ±.01 TYP
NON-ACCUM
.080 ±.010
.355 ±.025
.019 ±.003
.70 ±.01

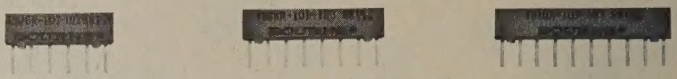
Specifications are subject to change without notice.

SIP RESISTOR NETWORKS

BOURNS®

FEATURES

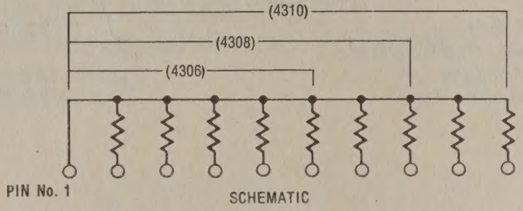
- *Low profile compatible with DIPS*
- *Reduces P.C. board space*
- *Reduces total assembly costs*
- *Proven automatic insertion capability*



ACTUAL SIZE

6, 8, OR 10 PIN SINGLE-IN-LINE PACKAGE 3, 4, OR 5 ISOLATED RESISTORS

MODEL 4306R-102 (6 pin)
MODEL 4308R-102 (8 pin)
MODEL 4310R-102 (10 pin)



SCHEMATIC

These models incorporate 5, 7, or 9 thick-film resistors (respectively) of equal value, each connected between a common bus (pin 1) and a discrete PC board pin.

Typical applications include open collector pull-up, wired OR pull-up, TTL input pull-down, MOS memory pull-up and down, unused gate pull-up, power driver pull-up.

ELECTRICAL SPECIFICATIONS

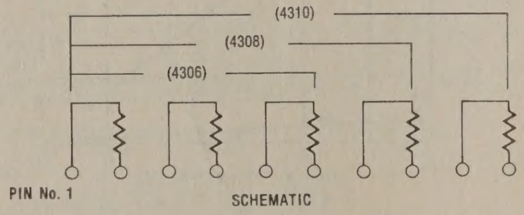
Resistance Tolerance ....±2% (100Ω to 220 KΩ)
±2Ω (< 100Ω)
±5% (> 220 KΩ)

Power Rating @ 25°C

	6 Pin	8 Pin	10 Pin
Package	0.75 Watts	1.0 Watts	1.25 Watts
Single Resistor	0.2 Watts	0.2 Watts	0.2 Watts

6, 8, 10 PIN SINGLE-IN-LINE PACKAGE PIN 1 COMMON, 5, 7 OR 9 RESISTORS

MODEL 4306R-101 (6 pin)
MODEL 4308R-101 (8 pin)
MODEL 4310R-101 (10 pin)



SCHEMATIC

These models incorporate 3, 4, or 5 isolated thick-film resistors (respectively) of equal value, each connected between two discrete PC board pins.

Typical applications include power gate pull-up, impedance balancing, current limiting, line termination and ECL output pull-down.

ELECTRICAL CHARACTERISTICS

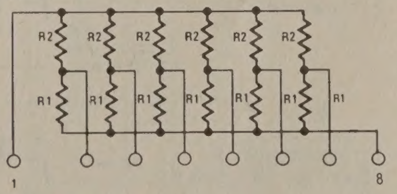
Resistance Tolerance ....±2% (100Ω to 220 KΩ)
±2Ω (< 100Ω)
±5% (> 220 KΩ)

Power Rating @ 25°C

	6 Pin	8 Pin	10 Pin
Package	0.75 Watts	1.0 Watts	1.25 Watts
Single Resistor	0.3 Watts	0.3 Watts	0.3 Watts

8 PIN SINGLE-IN-LINE PACKAGE 12 RESISTOR DUAL TERMINATOR

MODEL 4308R-103



STANDARD RESISTANCES

Resistance (Ohms) R₁	R₂	Part Number
180	390	4308R-103-181/391
220	270	4308R-103-221/271
220	330	4308R-103-221/331

Special resistance values are available.

The Model 4308R-103 Molded Resistor Network is a unique offering from Bourns. It provides TTL dual line termination in a low-cost epoxy molded, SIP configuration. Dual terminators improve noise immunity where capacitive effects are excessive.

The 4308R-103 is an 8 pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick film resistors are paired in series between the common lines (pins 1 and 8). The center points of these resistor pairs are connected to input terminals (pin 2 through 7) Dual terminators are also available in standard 14 pin and 16 pin DIP models from Bourns.

ELECTRICAL SPECIFICATION

Resistance Tolerance ....±2% (100Ω to 220 KΩ)
±2Ω (< 100Ω)
±5% (> 220 KΩ)

Power Rating @ 25°C
Package ....1.0 Watts
Resistor Pair ....0.25 Watts

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SIP RESISTOR NETWORKS

BOURNS®

HOW TO ORDER

Example—An 8-pin, 12-resistor SIP Dual Terminator, with 220 ohms and 330 ohms values would be designed as: Model 4308R-103-221/331. The set(s) of 3 digits following the model number are the codes for resistance value—the first two digits designate the significant numbers (22) and (33) respectively, and the last digit gives the number of zeroes that follow (1). So, -221 translates to 220 ohms and 331 to 330 ohms.

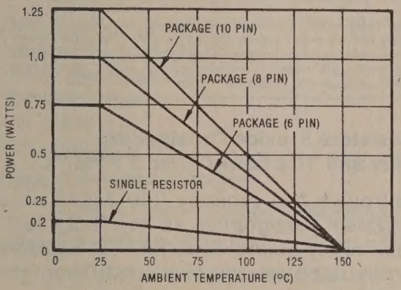
STANDARD RESISTANCES

Resistance (ohms)	Resistance Code
33	-330
39	-390
47	-470
56	-560
68	-680
82	-820
100	-101
120	-121
150	-151
180	-181
220	-221
270	-271
330	-331
390	-391
470	-471
560	-561
680	-681
820	-821
1000	-102
1200	-122
1500	-152
1800	-182
2000	-202
2200	-222

Resistance (ohms)	Resistance Code
2700	-272
3300	-332
3900	-392
4700	-472
5600	-562
6800	-682
8200	-822
10000	-103
12000	-123
15000	-153
18000	-183
22000	-223
27000	-273
33000	-333
39000	-393
47000	-473
56000	-563
68000	-683
82000	-823
100000	-104
120000	-124
150000	-154
180000	-184
220000	-224

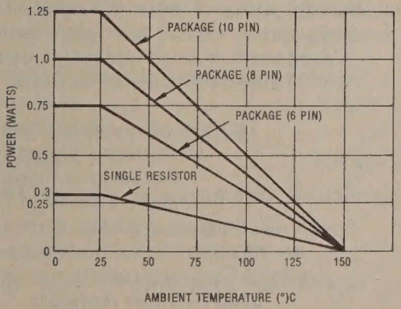
Special resistances from 10 ohms to 1 megohm are available.

MODELS 4306R-101
4308R-101/4310R-101



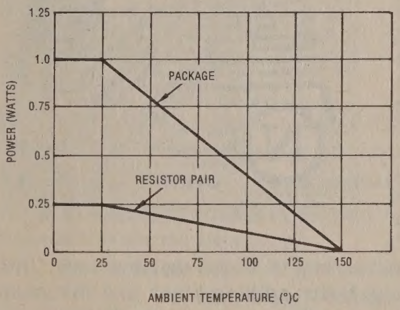
POWER-TEMPERATURE DERATING CURVE

MODELS 4306R-102
4308R-102/4310R-102

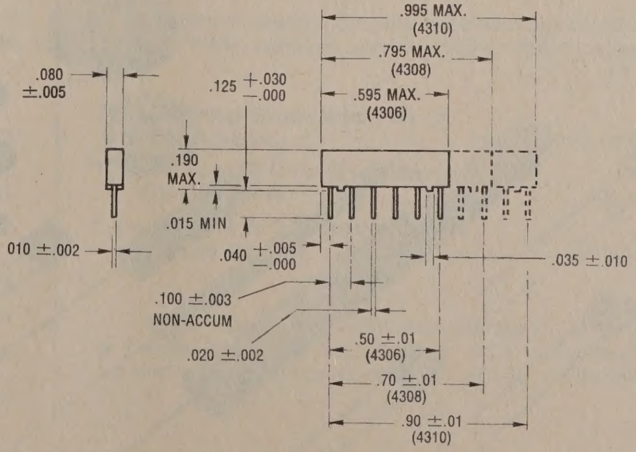


POWER-TEMPERATURE DERATING CURVE

MODEL 4308R-103



POWER-TEMPERATURE DERATING CURVE



Specifications are subject to change without notice.

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5415

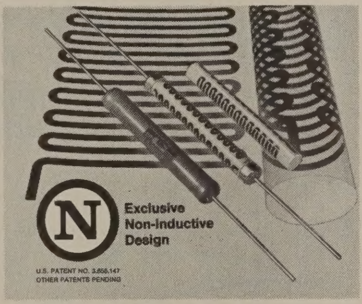
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Power Film Resistors

In 1962 Caddock Electronics introduced their axial lead resistors constructed with Micronox® resistance films. This advanced resistor technology has produced an extensive line of precision resistors with a combination of performance advantages:

- **Higher Power Ratings** — up to five times higher than other resistor technologies.
- **Higher Operating Temperatures** — up to +275°C.
- **Higher Resistance Values** — up to 10 times higher than other types of high precision resistors with matched temperature coefficients and standard configurations.
- **Exceptional Extended-Life Stability** — typically better than 0.01% per 1000 hours in extended life.
- **Improved Temperature Characteristics and Stability** — with lower temperature coefficients and closer TC matching.
- **Non-Inductive Design for Wide-Band, High Frequency Applications.**

Caddock's Exclusive Non-Inductive Design is also available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



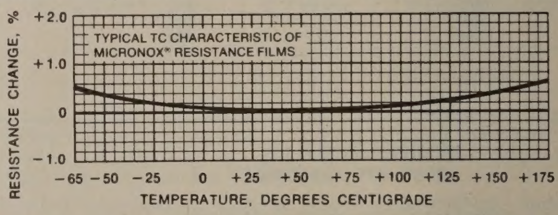
The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

To achieve these many performance advantages, special complex-oxide film resistance materials have been developed by Caddock that include resistivities as low as 35 ohms/square and as high as 400,000 ohms/square to provide resistors that cover an exceptionally wide range of values, sizes and power ratings.

The unique structure of these materials also provides excellent long-term stability and exceptional insensitivity to high temperature and thermal shock.

Micronox® Film Resistors Include Special TC Characteristics for Improved Circuit Temperature Stability.

Inherent in the parabolic shape of the Micronox® TC curve is a temperature 'band' where the TC slope is effectively 'zero.' This unique 'zero TC' characteristic can provide an immediate improvement in circuit stability in many applications.



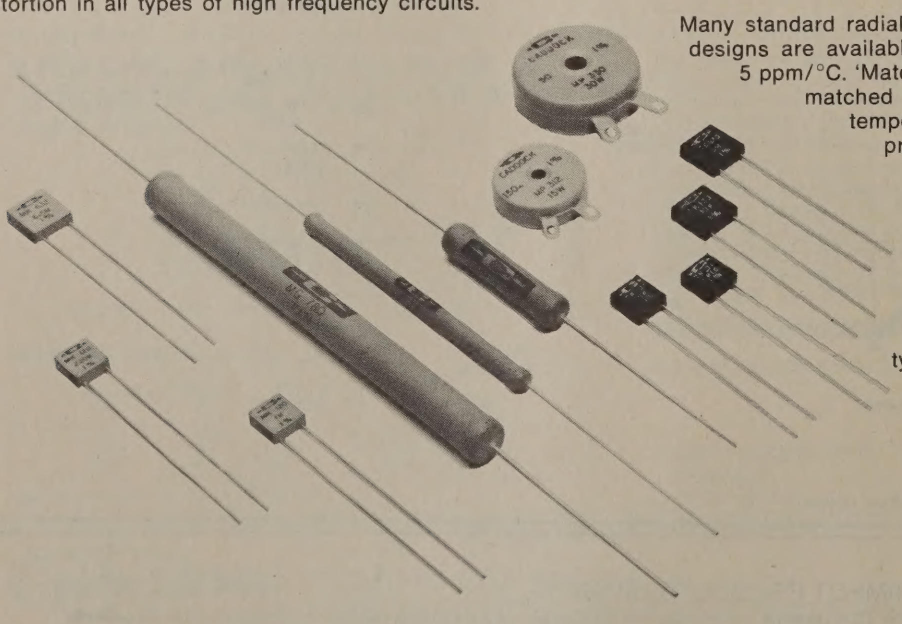
- The shape of this typical TC curve will vary slightly with resistivity.
- Micronox® resistors made with the same resistivity film can be matched to within 2 ppm/°C.
- Resistors made with widely differing resistivity films can be matched to within 10 ppm/°C.
- The tolerance on curve position, with respect to the reference point at 25°C, is defined by the individual specification of 50 ppm/°C or 80 ppm/°C from −15°C to +105°C.

Tetrinox™ Film Resistors Provide Outstanding Load-Life Stability and TCs Lower Than 5 PPM/°C.

Caddock Electronics has recently introduced an advanced resistive system designated as the T-System™. Resistors using this highly stable, ultra-low TC resistance film are being widely used in advanced instrumentation, control, communication and computer systems.

Many standard radial-lead and single-in-line resistor designs are available with TCs of 10 ppm/°C and 5 ppm/°C. 'Matched-pair' resistor sets with TCs matched to within 1 ppm/°C over wide temperature limits are also being produced in large quantities using Tetrinox™ resistance films.

To completely describe the advantages of each of the various types of resistors listed in this catalog, we have provided an introduction to the two basic types of Caddock resistance films used in these resistors. The accompanying index will assist you in locating the model that is right for your application.



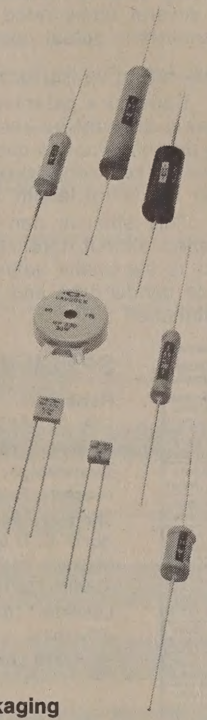
High Performance Power Film Resistors

CADDOCK

HIGH PERFORMANCE FILM RESISTORS

Two complex-oxide resistance films provide this high performance.

Micronox® Resistance Films



Caddock Micronox® resistance films are unsurpassed in the production of precision resistors that combine —

- **High Power Ratings** — to 30 watts.
- **High Voltage Ratings** — to 30,000 volts.
- **High Stability** — as close as 0.01% per 1000 hours in extended life.
- **High Operating Temperatures** — up to +275°C.
- **A Wide Range of Resistance Values In Many Sizes** — from .5 ohms to 2000 Megohms.

These performance advantages make Caddock Micronox® film resistors ideal for use in many types of electronic circuitry, including —

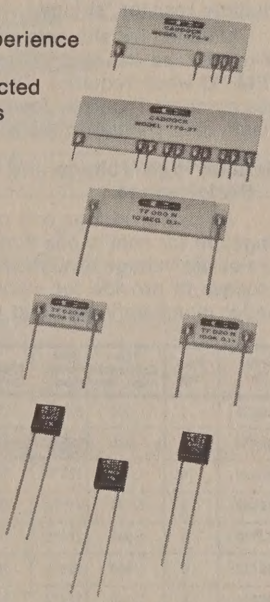
- **Voltage Reference Circuits**
- **High Power Density Packaging**
- **Precision Feedback Circuits**
- **Matched TC Resistor Pairs**
- **High Current Summing Circuits**

Index to Caddock Micronox® Film Resistors

Performance specifications and detailed dimensional information on the many types of Caddock Micronox® film resistors are included on the following pages:

Type MG and MH Precision High-Voltage Resistors ....Pages 3658 and 3659
Type MS and MR Power Film Resistors ....Pages 3660 and 3661
Type ML and MM Precision Film Resistors ....Page 3662
Type MP Chassis Mounted Power Film Resistors ....Page 3663
Type MV Low-R Power Film Resistors........Page 3664
Custom Resistive Devices........Page 3665
Type MK Low Cost Precision Film Resistors ....Pages 3666 and 3667

Tetrinox™ Resistance Films



Building on 15 years of experience with our unique complete-oxide technology, Caddock has perfected the T-System™ resistance films that combine these special advantages:

- **Ultra-Low Temperature Coefficient** — standard to less than 10 PPM/°C, and specials to less than 5 PPM/°C.
- **Ultra-Precision** — with tolerances as tight as 0.05%.
- **High Resistance Range** — with values to 10 Megohms in a miniature package.
- **Ultra-Stable in Loadlife** — stability to within ±0.05% per 2000 hours.

This special combination of advantages make Caddock Tetrinox™ film resistors the optimum choice in many high stability applications —

- **Input Voltage Dividers in Precision Instrumentation**
- **Precision Voltage Reference Circuits.**
- **Decade Resistance Networks.**
- **Ultra-Low Power Precision Circuitry.**
- **Ultra-Stable Voltage Dividers.**

Index to Caddock Tetrinox™ Film Resistors

Technical descriptions and specifications on Caddock Tetrinox™ film resistors are included on these pages:

Type TK Temp-Stable Precision Film Resistors ....Pages 3668 and 3669
Type TF Low TC Ultra-Precision Film Resistors. ....Page 3670
Type 1776 Precision Decade Resistor Voltage Dividers ....Page 3671

If you should need additional information on any type of Caddock resistor, please call or write to our engineering and manufacturing offices in Riverside, California.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG & MH Precision High-Voltage Resistors

Type MG and MH Precision High Voltage Resistors have been proven through many years of use in critical applications in airborne computers, manned space vehicles, geophysical instruments, and medical electronics where long term reliability and stability are of utmost importance.

With values as high as 2000 Megohms in a single resistor, operation at very high voltages can now be accomplished without the need for expensive, space-consuming multiple resistor 'strings.'

Matched resistor sets are available over a wide range of ratios, and the ratio TC can be matched as close as 2 PPM/°C when required. These resistor sets are ideal for use as control voltage feedback divider networks in precision high voltage supplies.

Special High-Voltage and High-Voltage Pulse Performance

All power ratings and maximum working voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

These resistors can be factory-conditioned to withstand up to 60% higher maximum working voltage, provided power ratings are not exceeded. (For this higher rating specify —15, example: MG750N—15. Overload and overvoltage ratings do not apply to —15 resistors.)

Type MG and MH resistors have also found wide use in pulse and current limiting applications where high voltage levels are encountered. To meet these special conditions, Caddock has facilities for pre-stressing resistors to several times rated working voltage as a means of establishing actual operating performance.

Non-Inductive Performance

Caddock's patented Exclusive Non-Inductive Design uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

This efficient non-inductive construction is accomplished without derating of any performance advantages, and is especially valuable in pulse applications where wide bandwidths and excellent pulse fidelity must be maintained.

Model No.	Wattage	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation
						Min.	Max.	A	B	C	
MG650	.5	600	225°C	750	80	200Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal
MG655	.5	600	225°C	750	80	200Ω	8 Meg	.313 ±.030	.109 ±.015	.025 ±.002	Silicone Conformal
MG660	.6	1,000	225°C	750	80	400Ω	10 Meg	.500 ±.030	.094 ±.015	.025 ±.002	Silicone Conformal
MG680	.8	2,000	225°C	750	80	600Ω	20 Meg	.750 ±.030	.094 ±.015	.025 ±.002	Silicone Conformal
MG710	1.0	4,000	225°C	750	80	800Ω	50 Meg	1.000 ±.040	.094 ±.015	.025 ±.002	Silicone Conformal
MG712	.6	1,000	225°C	750	80	800Ω	20 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal
MG714	1.0	1,000	225°C	750	80	200Ω	20 Meg	.562 ±.060	.150 ±.030	.032 ±.002	Silicone Conformal
MG715	1.0	2,000	225°C	750	80	400Ω	50 Meg	.750 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal
MG716	1.5	4,000	225°C	750	80	600Ω	75 Meg	1.000 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal
MG717	1.5	2,000	225°C	750	80	600Ω	75 Meg	.710 ±.050	.240 ±.015	.040 ±.002	Silicone Conformal
MG720	2.0	6,000	225°C	750	80	1K	150 Meg	1.500 ±.080	.140 ±.030	.025 ±.002	Silicone Conformal
MG721	2.0	4,000	225°C	750	80	200Ω	100 Meg	1.000 ±.050	.240 ±.030	.040 ±.002	Silicone Conformal
MG725	2.5	10,000	225°C	750	80	1.5K	200 Meg	2.000 ±.080	.140 ±.030	.025 ±.002	Silicone Conformal
MG730	3.0	6,000	225°C	1000	80	500Ω	250 Meg	1.500 ±.080	.240 ±.030	.040 ±.002	Silicone Conformal
MG735	3.6	10,000	225°C	1000	80	750Ω	300 Meg	2.000 ±.080	.240 ±.030	.040 ±.002	Silicone Conformal
MG745	5.0	15,000	225°C	1000	80	1K	500 Meg	3.000 ±.100	.240 ±.030	.040 ±.002	Silicone Conformal
MG750	5.0	10,000	225°C	1000	80	400Ω	500 Meg	2.125 ±.060	.315 ±.030	.040 ±.002	Silicone Conformal
MG780	7.5	15,000	225°C	1000	80	600Ω	750 Meg	3.125 ±.060	.315 ±.030	.040 ±.002	Silicone Conformal
MG785	8.0	20,000	225°C	1000	80	800Ω	1000 Meg	4.000 ±.120	.315 ±.030	.040 ±.002	Silicone Conformal
MG810	10.0	25,000	225°C	1000	80	1K	1250 Meg	5.000 ±.120	.315 ±.030	.040 ±.002	Silicone Conformal
MG812	12.5	30,000	225°C	1000	80	1.2K	1500 Meg	6.000 ±.120	.315 ±.030	.040 ±.002	Silicone Conformal
MG815	15.0	30,000	225°C	1000	80	1K	2000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002	Silicone Conformal
MH651	.5	600	225°C	750	80	200Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded
MH661	.6	1,000	225°C	2000	80	400Ω	10 Meg	.500 ±.030	.114 ±.010	.025 ±.002	Black Molded
MH681	.8	2,000	225°C	2000	80	600Ω	20 Meg	.750 ±.030	.114 ±.010	.025 ±.002	Black Molded
MH682	.8	800	225°C	1000	80	200Ω	20 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Black Molded
MH713	1.0	4,000	225°C	2000	80	800Ω	50 Meg	1.000 ±.030	.114 ±.010	.025 ±.002	Black Molded
		Type MH with special shielding, designed to eliminate degradation due to corona.									
MH711	1.0	2,000	225°C	2000	80	800Ω	50 Meg	1.200 ±.040	.220 ±.015	.025 ±.002	Black Molded

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

SPECIFICATIONS

Resistance Tolerance: ±1% (tolerances to .1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overvoltage: 1.5 times working voltage for 5 seconds, R shift .8% max.

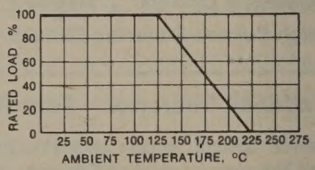
Thermal Shock: MIL-STD-202, method 107, cond. C, R shift .5% max.

Moisture Resistance: MIL-STD-202, method 106, R shift .8% max.

Loadlife: 1000 hours at rated power, R shift .8% max.

Standard Lead Material: Gold Plated Dumet

DERATING CURVE



Exclusive Non-Inductive Design
U.S. PATENT NO. 3,858,147
OTHER PATENTS PENDING

Non-Inductive construction available in most models. Specify with N suffix on Model No.

CADDOCK
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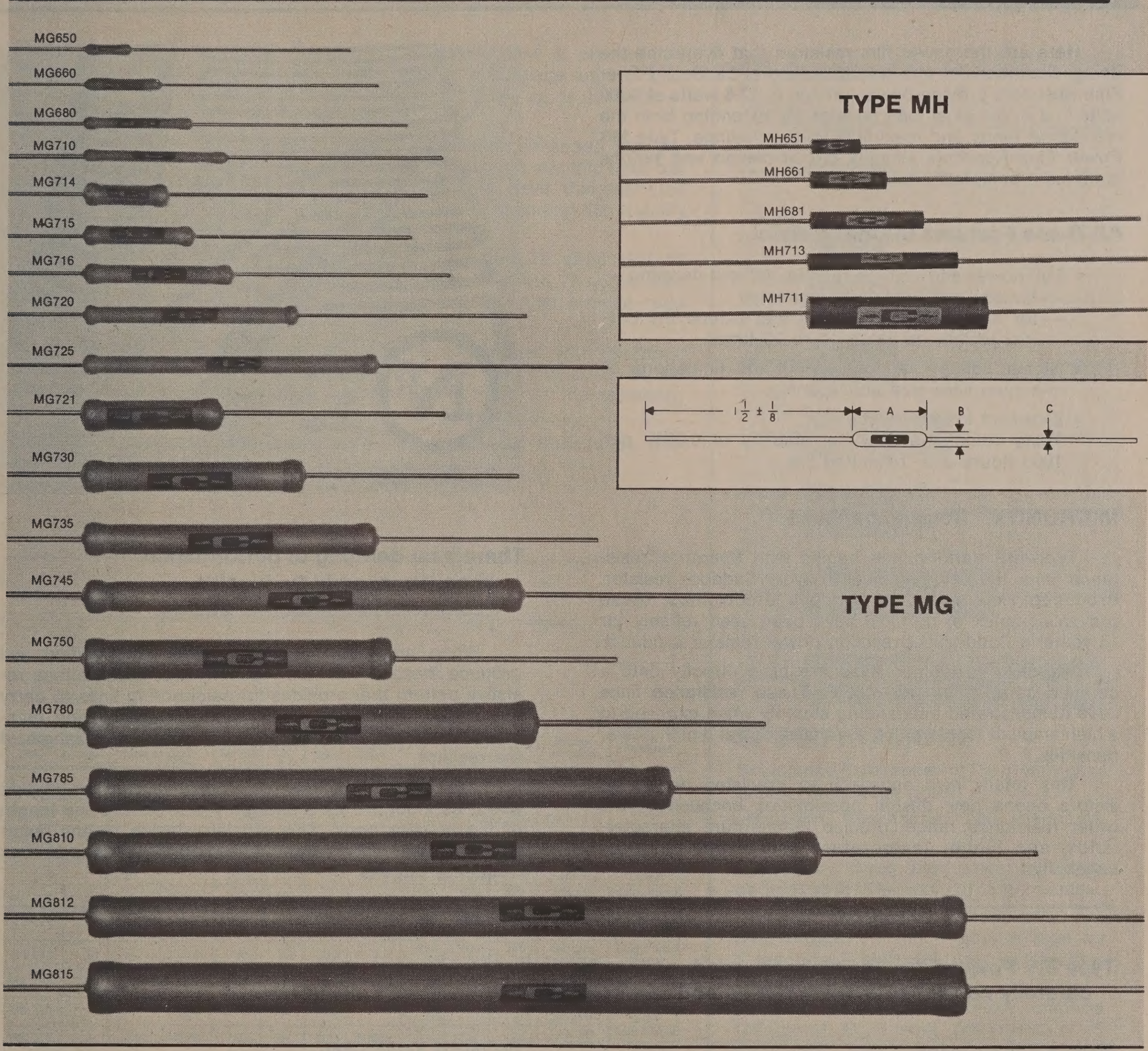
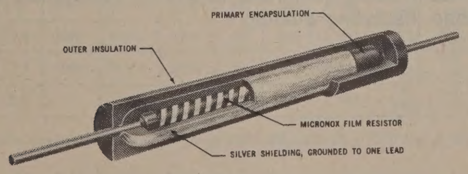
Type MG & MH Precision High-Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS


MG650
MG660
MG680
MG710
MG714
MG715
MG716
MG720
MG725
MG721
MG730
MG735
MG745
MG750
MG780
MG785
MG810
MG812
MG815
TYPE MH
MH651
MH661
MH681
MH713
MH711
1 1/2 ± 1/8
A
B
C
TYPE MG

Exclusive Shielded Resistor

Model MH711, designed for extremely high voltage applications in very high resistance strings. This resistor remains exceptionally stable since shielding prevents film degradation from the corona developed in high voltage fields.


PRIMARY ENCAPSULATION
OUTER INSULATION
MICRONOX FILM RESISTOR
SILVER SHIELDING, GROUNDED TO ONE LEAD

Matched Resistor Sets with Tight Ratio Tolerances and TC Tracking.

Sets of Matched Type MG and MH resistors are available with ratios held as close as 0.05% over the range of ratios from 1:1 to 1:100,000 for use in voltage dividers, reference networks, feedback networks, and current summing networks.

The ratio TC of these matched resistor sets can be held as close as 2 ppm/°C over the temperature range from −15°C to +105°C.

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CADDOCK

HIGH PERFORMANCE FILM RESISTORS

Type MR & MS Power Film Resistors

Here are the power film resistors that overcome the design limitations of wire-wound resistors! Caddock Power Film Resistors provide power ratings to 12.5 watts at 6000 volts in a single axial lead resistor. By extending both the resistance range and maximum voltage ratings, Type MS Power Film Resistors simplify circuit design and reduce equipment complexity and cost.

All These Features in One Resistor

- Full power and voltage ratings, without derating —
  - — for non-inductive performance
  - — for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability. Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

MICRONOX ® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 15 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400°F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This totally new approach to precision power resistors opens new design possibilities because of the wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.

N Exclusive Non-Inductive Design

U.S. PATENT NO. 3,858,147
OTHER PATENTS PENDING

There's no derating of performance when you specify Caddock's Exclusive Non-Inductive Design.

When non-inductive performance is specified, we produce these power film resistors with a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Type MS Power Film Resistors are produced under carefully controlled manufacturing and test procedures.

Manufacturing Control

Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

Type MS Resistors receive quality surveillance which reaches from incoming raw materials to your packaged resistors in the shipping area. And our QC system has been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG, MH and MK represent an identical combination of materials — aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

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Type MS & MR Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

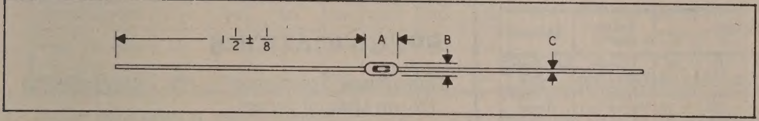
Type MS High Performance Power Film Resistors have a proven performance history in industrial, computer, military and space applications. This unique line now includes higher power ratings — up to 15 watts — and resistance values to 30 Megohms.

These exceptional resistors also provide outstanding extended life stability. In annual reliability tests where 2000 hour load-life stability data has been established, Type MS Power Film Resistors have demonstrated typical stability well within 0.1% per 1000 hours and extended life stability of 0.05% per 1000 hours.

Temperature coefficients are also low, with the standard TC of 50 PPM/°C available in all models of the Type MS Power Film Resistor. They can also be supplied on special order in matched resistor sets that provide ratio tracking with varying temperature to within 2 PPM/°C.

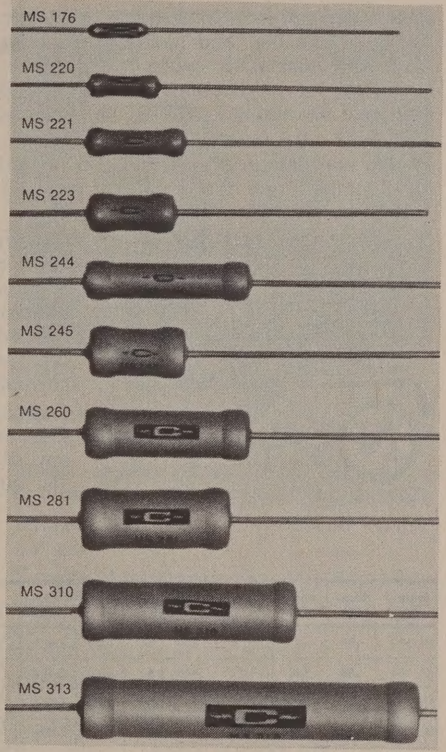
All of the Type MS Power Film Resistors are constructed with Micronox* resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated dumet axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Non-inductive construction is available in most models. Specify by adding "N" suffix to Model Number.



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation	Leadwire
						Min.	Max.	A	B	C		
MR 129	.25	200	275°C	500	150	10Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	10Ω	1 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	20Ω	3 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	10Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated Dumet
MS 150	.5	—	275°C	500	50	10Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated Dumet
MS 151	.5	300	275°C	750	50	10Ω	2 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 175	.75	—	275°C	750	50	10Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 176	.75	500	275°C	750	50	20Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 210	1.0	—	275°C	750	50	20Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 214	1.0	500	275°C	750	50	20Ω	5 Meg	.313 ±.030	.109 ±.015	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 220	2.0	1000	275°C	800	50	20Ω	10 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MS 221	3.0	1000	275°C	800	50	30Ω	10 Meg	.575 ±.050	.165 ±.030	.030 ±.002	Silicone Conformal	Gold Plated Dumet
MS 223	3.0	800	275°C	1000	50	10Ω	4 Meg	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 244	4.0	2000	275°C	1000	50	30Ω	15 Meg	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 245	4.0	800	275°C	1000	50	10Ω	6 Meg	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 260	6.0	2000	275°C	1000	50	20Ω	15 Meg	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 281	8.0	2000	275°C	1000	50	10Ω	8 Meg	.910 ±.060	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 310	10.0	4500	275°C	1000	50	30Ω	20 Meg	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 313	12.5	6000	275°C	1000	50	50Ω	30 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MS 315	15.0	—	275°C	1000	50	50Ω	1 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C



SPECIFICATIONS

Resistance Tolerance: ±1% (tolerances to .1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overload: 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

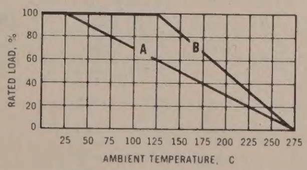
Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, method 107, cond. C, R shift .5% max., or .5 ohms max., whichever is greater.

Moisture Resistance: MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, R shift .5% max., or .5 ohms max., whichever is greater.

DERATING CURVE



A—all MS models except MS126, MS151, MS176
B—all MR models, and MS126, MS151, MS176

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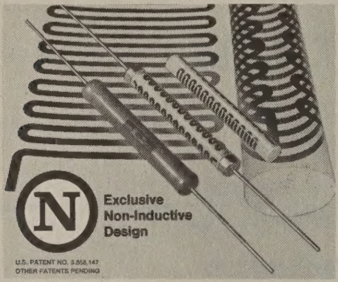
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type ML & MM Precision Film Resistors

Type ML and MM resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275°C and both the Type ML and the Type MM have temperature coefficients of only 50 PPM/°C over the range from −15°C to +105°C.



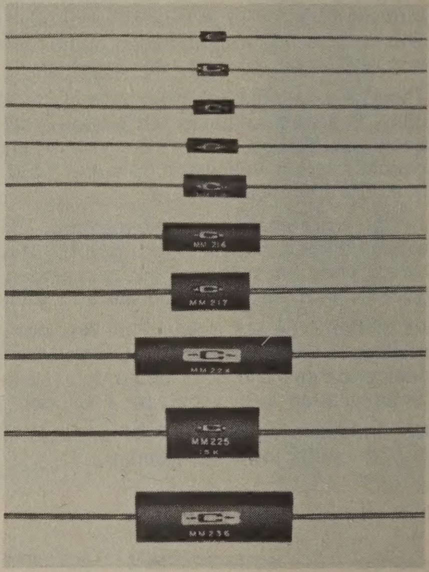
Construction includes Micronox* resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Caddock's Exclusive Non-Inductive Performance can also be specified for any of these resistors by adding the "N" suffix to the model number.

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions				Encapsulation	Leadwire
						Min.	Max.	A	B	C	D		
ML 103	.06	—	175°C	300	50	10Ω	250 K	.110 ±.005	.050 ±.005	.016 ±.001	1.00 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 131	.4	500	175°C	750	50	50Ω	1 Meg	.313 ±.020	.094 ±.006	.025 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 181	.6	600	175°C	750	50	50Ω	5 Meg	.400 ±.020	.150 ±.010	.025 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 212	1.0	1000	175°C	1000	50	30Ω	10 Meg	.625 ±.030	.190 ±.020	.030 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 213	1.0	800	175°C	1500	50	10Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 218	1.25	2000	175°C	1500	50	30Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 219	1.25	800	175°C	2000	50	10Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
ML 226	2.0	2000	175°C	2000	50	20Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	1.50 ±.12	Transfer Molded Type	Gold Plated Dumet
MM 112	.12	200	275°C	400	50	10Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 125	.25	200	275°C	500	50	10Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 152	.4	300	275°C	750	50	10Ω	2 Meg	.250 ±.020	.094 ±.006	.025 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 177	.6	500	275°C	750	50	20Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 215	1.0	800	275°C	1000	50	10Ω	10 Meg	.400 ±.020	.150 ±.010	.025 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 216	1.5	1000	275°C	1000	50	30Ω	10 Meg	.625 ±.030	.190 ±.020	.030 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 217	1.5	800	275°C	1500	50	10Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 224	2.0	2000	275°C	1500	50	30Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 225	2.0	800	275°C	2000	50	10Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet
MM 236	3.0	2000	275°C	2000	50	20Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	1.50 ±.12	Black Molded Type	Gold Plated Dumet

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

*Micronox is a registered trademark of Caddock Electronics, Inc.



SPECIFICATIONS

Resistance Tolerance: ±1% (tolerances to .1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overload: 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

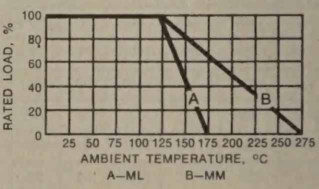
Overvoltage: 1.5 times max. voltage for .5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, method 107, cond. B, R shift .2% max., or .5 ohms max., whichever is greater.

Moisture Resistance: MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, R shift .5% max., or .5 ohms, whichever is greater.

DERATING CURVE



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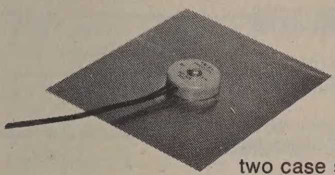
Type MP Chassis Mounted Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

With Non-Inductive Performance.

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, these unique resistors provide increased packaging densities in many types of electronic equipment.



15 and 30 watt ratings are available in two case sizes that permit through-bolt attachment to the chassis or other heat conducting surface. The molded silicone case encapsulates the resistor assembly to meet the requirements of the most stringent environmental specifications.

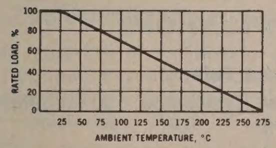
The outstanding stability of the Type MP Power Film Resistors has been demonstrated in a 5½ year, 50,000 hour program of continuous load-life testing. Extended life stability during these full-power tests was better than 0.01% per 1000 hours!

Model No.	Power Rating†	Max. Voltage	Diel. Str.	High Temp. TC‡	Resistance Range		Dimensions				Terminals
					Min.	Max.	A	B	C	D	
MP311	15 Watts	300	600	50	50Ω	200 K	.600	.188	—	.092	12″ Min Teflon Leads 26AWG 7x34
MP312	15 Watts	300	600	50	10Ω	200 K	.600	.188	.185	.092	Gold Plated Solder Lugs
MP329	30 Watts	450	1000	50	50Ω	200 K	.850	.250	—	.142	12″ Min Teflon Leads 22AWG 7x30
MP330	30 Watts	450	1000	50	10Ω	200 K	.850	.250	.250	.142	Gold Plated Solder Lugs

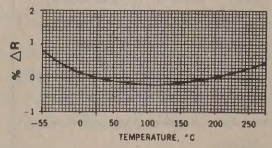
† Power rating based on chassis mounting with MP 311 and MP 312 on a 6″ x 4″ x 2″ x .040″ aluminum chassis and the MP 329 and MP 330 on a 5″ x 7″ x 2″ x .040″ aluminum chassis.

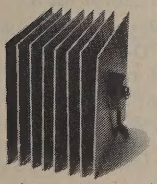
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally —85 ppm/°C at —55°C. See typical R-T curve.)

DERATING CURVE



TYPICAL R-T CURVE

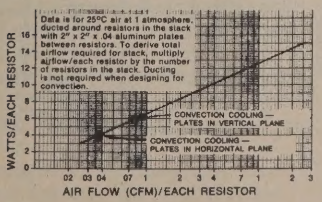




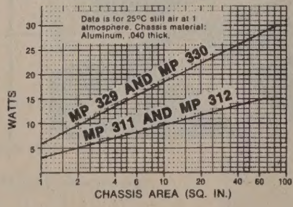
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

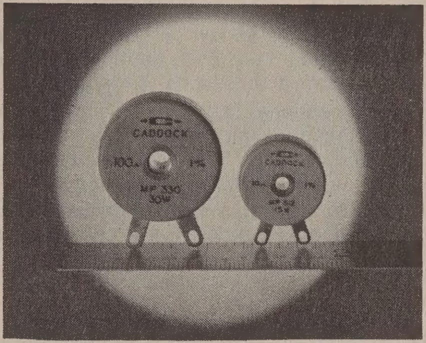
POWER RATING
FOR STACKED MP311 & 312 POWER RESISTORS



POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS



U.S. Patent No's 3,636,493 and 3,649,944 Other patents pending.



SPECIFICATIONS

Resistance Tolerance: ±1% standard (Other tolerances on special order.)

Insulation Resistance: 10,000 Megohms, dry. Method — Mil-R-18546D, para. 4.6.8.

Solderability: Per Mil-R-18546D, para. 3.7, para. 4.6.4.

Terminal Strength: Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test). Max. △R, .2% or .2Ω, whichever is greater.

Thermal Shock: Per Mil-R-18546D, para. 4.6.9, max. △R, .5% or .2Ω, whichever is greater.

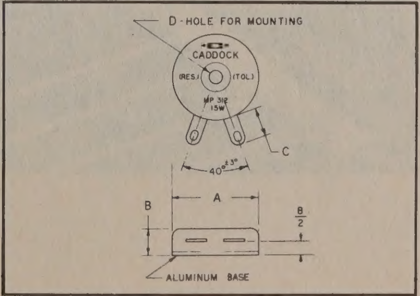
Momentary Overload: 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. Max. △R, .5% or .2Ω, whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106B, less steps 7a and 7b, max. △R, .5% or .2Ω, whichever is greater.

Life: Per Mil-R-18546D, para. 4.6.12, 1,000 hrs., Max. △R, 1% or .2Ω, whichever is greater.

Shock, Medium Impact: 50G, per Mil-Std-202, Method 205, Cond. C.

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. B, Max. △R .2% or .2Ω, whichever is greater, through shock and vibration sequence.



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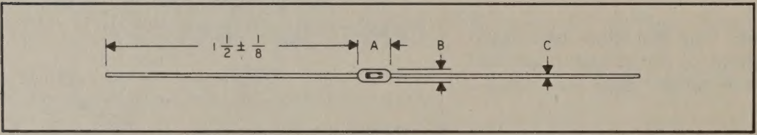
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MV
Low-R Power Film Resistors

Type MV resistors extend the advantages of Caddock Micronox* resistance films to values as low as 0.5 ohms in a unique non-inductive design. The multiple-path resistance pattern distributes the currents evenly throughout the resistor and reduces the inductance to an absolute minimum.

The exceptional stability of Caddock Micronox* resistors — produced by firing these complex oxide films onto solid ceramic substrates — provides power ratings as high as 10 watts in a compact axial lead configuration that features excellent overload ratings.

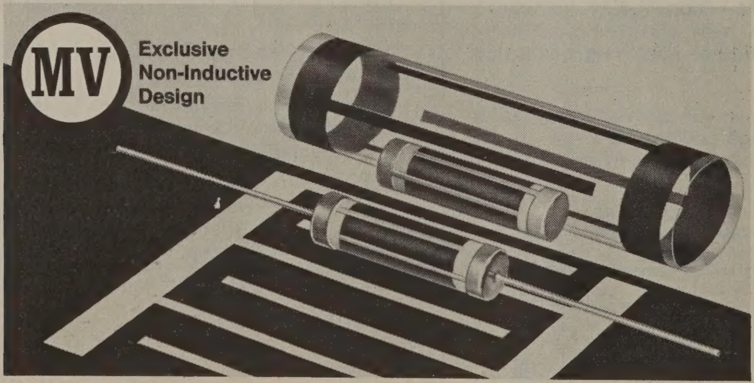
Type MV resistors are ideal for use in high frequency circuits where close resistance tolerances and excellent long-term stability are required.

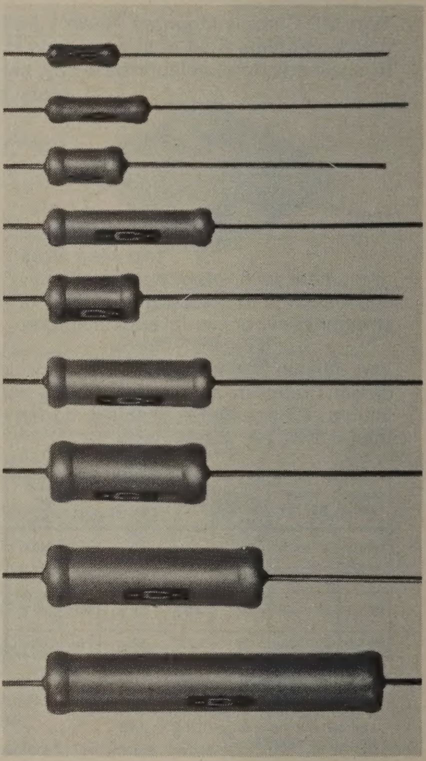


*Micronox is a registered trademark of Caddock Electronics, Inc.

Model No.	Watt-age	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encap-sulation	Leadwire
					Min.	Max.	A	B	C		
MV217	1.5	275°C	800	100	5Ω	100Ω	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated Dumet
MV227	2.0	275°C	800	100	5Ω	100Ω	.575 ±.050	.165 ±.030	.030 ±.002	Silicone Conformal	Gold Plated Dumet
MV228	2.0	275°C	1000	100	3Ω	100Ω	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV233	3.0	275°C	1000	100	2Ω	100Ω	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV234	3.0	275°C	1000	100	3Ω	100Ω	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV251	4.0	275°C	1000	100	1Ω	100Ω	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV261	6.0	275°C	1000	100	1Ω	100Ω	.910 ±.060	.350 ±.030	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV280	8.0	275°C	1000	100	1Ω	100Ω	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet
MV311	10.0	275°C	1000	100	.5Ω	100Ω	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated Dumet

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C





SPECIFICATIONS

Resistance Tolerance: ±1%.

Insulation Resistance: 100 megohms, minimum.

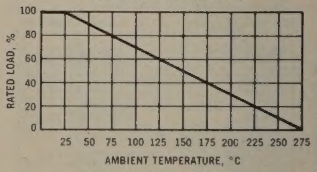
Overload: 5 times rated power for 5 seconds, R shift 1% max.

Thermal Shock: MIL-STD-202, method 107, cond. C, R shift 1% max.

Moisture Resistance: MIL-STD-202, method 106, R shift 1% max.

Loadlife: 1000 hours at rated power, R shift 1% max.

DERATING CURVE



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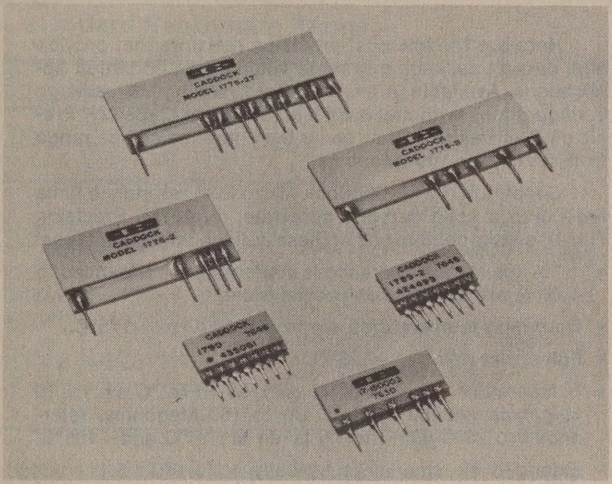
Custom Resistive Devices

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

For the ultimate in resistor network performance, Caddock produces many types of custom resistive networks with an unsurpassed combination of advantages:

- **High Resistance Ratios** — from 1-to-1 up to 1,000,000-to-1!
- **High Transient Handling Capability** — up to 100 times higher than the rated power level!
- **Extended Resistance Range** — from 1 ohm to 5000 Megohms.
- **Tight Resistance Tolerances** — to 0.05%.
- **Tight Ratio Tolerances** — to 0.025%.
- **Close Ratio Tracking** — to 5 PPM/°C from −15°C to +105°C.
- **Exceptional Resistor Stability** — as close as 0.01% per 1000 hours in extended life.

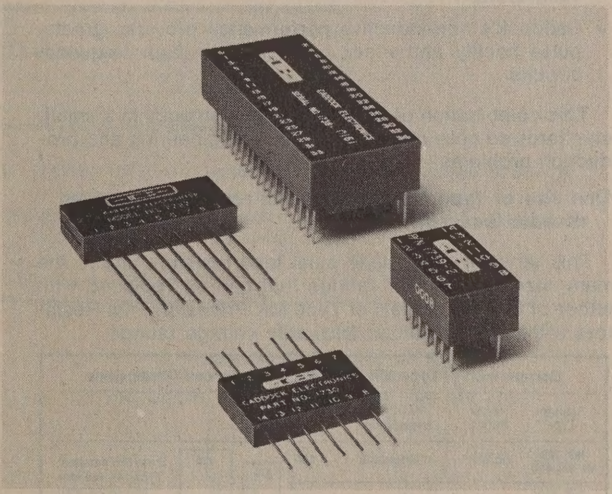
This combination of advantages in one resistor network often provides a practical — **and immediate** — means for improving the performance and specifications of electronic circuitry and equipment without any changes in the design!



Special Multi-Lead Encapsulated Packaging for Complex Resistor Networks.

When circuit requirements make multi-resistor packaging necessary, Caddock can produce specially configured resistor networks with custom lead arrangements.

These custom resistor networks are completely encapsulated to withstand extreme environmental conditions, including shock, vibration, thermal shock and temperatures in the range from −65°C to +275°C.

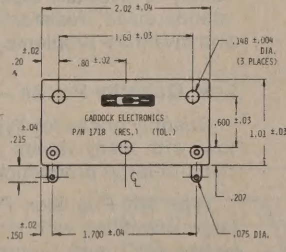


Model 1718 Multi-Megohm Film Resistors With Exclusive Modular Stacking Design.

This Multi-Megohms Resistor is designed to provide a low profile non-inductive high resistance value with precise resistance-temperature characteristics. These are especially useful in high resistance voltage dividers where fast response is important.

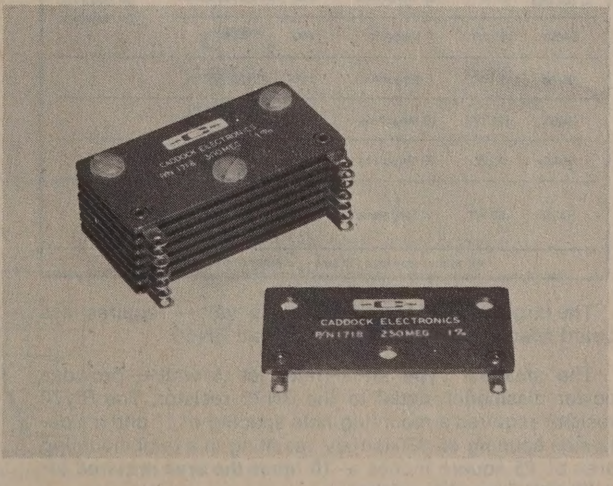
SPECIFICATIONS

Resistance Range: 1 meg-333 meg
Power Rating: 3 Watts @ 25°C
Max. Working Voltage: 12000 Volts
Resistance Tolerance: ±1% (Tolerances 0.2% on special order)
Terminal Material: Gold Plated Copper
Encapsulation: Conformal Coating
Insulation Resistance: 100,000 Megs, Min. when mounted
Temperature Coefficient: ±80 PPM/°C Referenced to 25°C, ΔR taken at −15°C and +105°C
Thermal Shock: Mil-Std 202, Method 107 R shift .5% Max.
Loadlife: 1000 hours at rated power R shift .8% Max.
Mounting: Three 6-32 Nylon Screws with Standoff Spacers, .050 Thick, Supplied with unit
Operating Temperature: −55°C to +125°C



Substrate .054± .01 Thick.

.09± .01 Thick Including Lug.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Low Cost Precision Film Resistors

With Resistance Range Extended to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

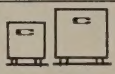
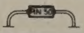
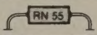
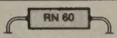
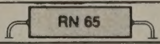
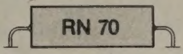
- ±1% resistance tolerance is standard and tolerances to ±0.1% are available on special order.
- Operating temperatures are from −55°C to +175°C.
- Full power rating at +125°C.
- Temperature Coefficient is only 50 PPM/°C up to 10 Megohms and 80 PPM/°C up to 100 Megohms, referenced to 25°C with the ΔR taken at −15°C and +105°C.
- Extended life stability is typically better than 0.1% per 1000 hours.
- Caddock's non-inductive performance provides greater pulse fidelity and wider bandwidths in high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistors can replace many sizes of radial lead resistors.

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

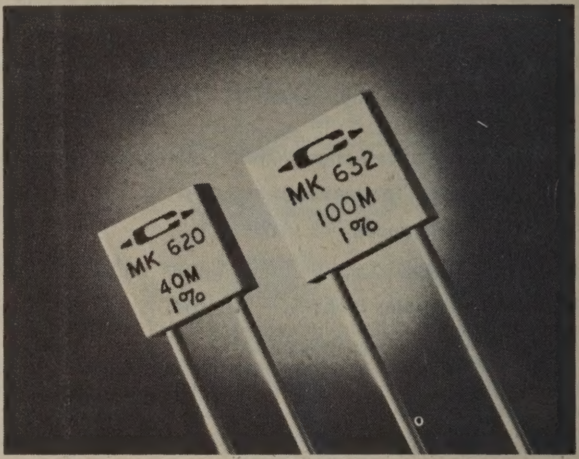
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing		
MK 120 or MK 620	**.50 WT.**	**40 Megohms**	**.150**		Even the smallest Type MK resistor can replace all of these RN type resistors.
MK 132 or MK 632	**.75 WT.**	**100 Megohms**	**.200**		
RN50	.05 WT	1 Megohm	.400		
RN 55	.10 WT	5 Megohms	.500		
RN60	.125 WT	10 Megohms	.625		
RN65	.25 WT	20 Megohms	.875		
RN70	.50 WT	40 Megohms	1.000		

All outline drawings full size — dimensions in inches.

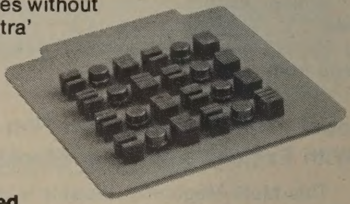
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN 50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN 70 resistor. The RN 70 resistor requires a mounting hole spacing of 1″ and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving 'extra' space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, 'standardized' resistor type, unit prices can be lowered and inventory problems simplified.

Low Quantity Prices — Fast Delivery

Quantity prices for Type MK Precision Film Resistors are low, with many values priced under 30 cents each in medium-to-large production orders.

Type MK Precision Film Resistors can be delivered in large quantities with normal delivery schedules of 4 to 6 weeks ARO, and prototype quantities can usually be delivered from stock.

A pricing schedule for all values and models of Type MK Precision Film Resistors is available upon request. For specific price and delivery information call or write to the main offices of Caddock Electronics in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

Type MK Low Cost Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors — Standard Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/ °C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 120	.5	200	175°C	300	50	30 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 132	.75	400	175 C	400	50	10 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (tolerance to ±.1% on special order).

Operating Temperature: −55°C to 175°C.

Overload: 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.

Loadlife: 1000 hours at rated power, R shift .4%, max., or .2 ohms, whichever is greater.

Insulation Resistance: 10,000 Megohms, minimum.

Type MK Precision Film Resistors — Extended Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/ °C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 620	.5	200	175°C	300	80	2 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).

Operating Temperature: −55°C to 175°C.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, R shift .5% max.

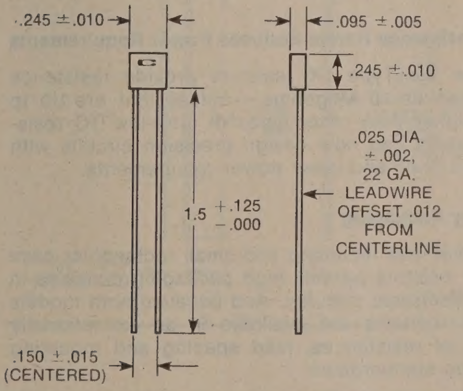
Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max.

Loadlife: 1000 hours at rated power, R shift .5% max.

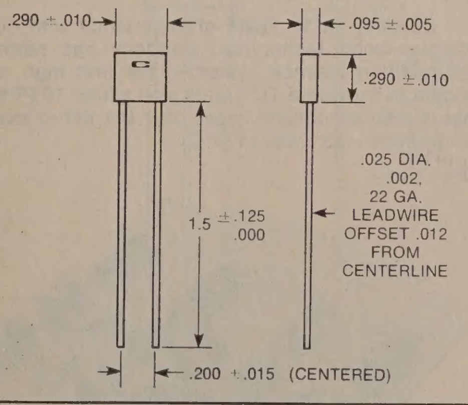
Insulation Resistance: 10,000 Megohms, minimum.

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Case "A"
Model MK 120 and MK 620

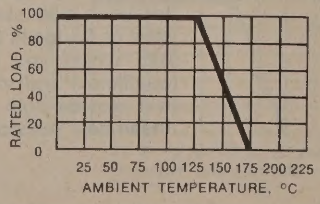


Case "B"
Model MK 132 and MK 632



ALL DIMENSIONS IN INCHES

DERATING CURVE



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

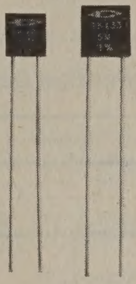
Type TK Temp-Stable Precision Film Resistors

With Temperature Coefficients of Less Than 10 PPM/°C.

Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Temp-Stable Precision Film Resistors with the Tetrinox™ resistance system.**

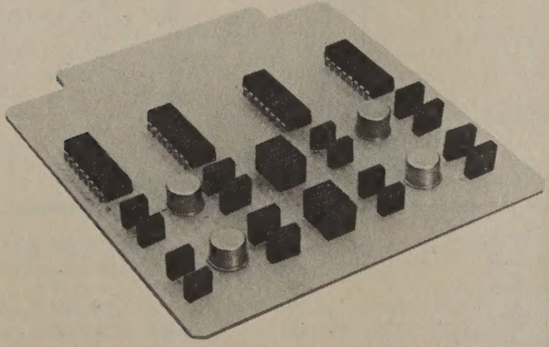
Type TK Temp-Stable Precision Film Resistors provide a combination of performance advantages never before available in a resistive component:

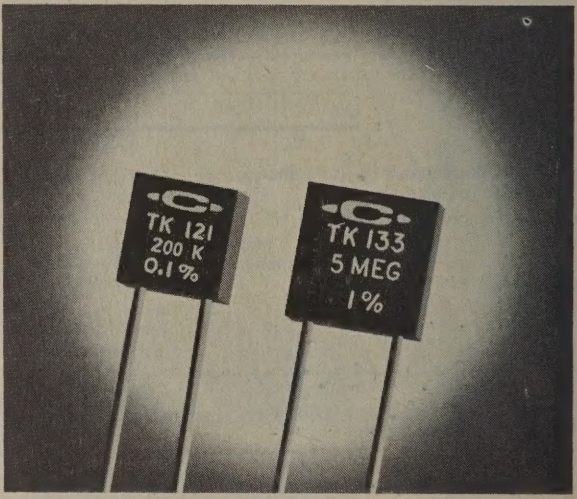
- **Temperature Stability** — better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** — better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** — from 1000 ohms to 10 Megohms.
- **Precision Tolerances** — ±1% is standard, and tolerances as close as ±0.01% are available.
- **Wide Operating Temperature Range**—from −55°C to +175°C.
- **Small Size** — with two miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** — with power ratings of .3 watt and .4 watt in molded cases, the largest of which is a standard CK 06 package.
- **Highest Performance-to-Cost Ratio** — with many values priced below $1.50 each in 100 lot quantities.



(Photos show resistors full size)

Building on 15 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox™ resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from −55°C to +125°C.





The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 10 PPM/°C temperature coefficient provides ratio tracking of less than 20 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

High Density Packaging

The radial lead mounting and small rectangular case of Type TK resistors permits high packaging densities in low profile electronic circuitry. And because both models of Type TK resistors are available in an exceptionally wide range of resistances, lead spacing and mounting space can be standardized.

For additional information on the Type TK resistors for your high stability circuits, contact the engineering staff of Caddock Electronics in Riverside, California. They can assist you in determining the exact temperature coefficient and tolerances your application requires, and will provide both evaluation and production quantities of these new resistors on fast-delivery schedules.

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ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

Type TK Temp-Stable Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Model No.	TC ppm/°C	Wattage @125°C	Max Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
TK121	10	.3	200	175°C	300	1K	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK133	10	.4	300	175°C	400	1K	10 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Selected TCs available to 5 ppm/°C.
5 ppm/°C resistors are marked with an additional silver dot.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.01% on special order.)

Absolute Temperature Coefficient: ±10 PPM/°C from −55°C to +125°C. (Selected TCs available to 5 PPM/°C.)

Operating Temperature: −55°C to +175°C.

Load Life:* 2000 hours at +125°C, R Shift less than ±0.05%.

Shelf Life: Typically 25 PPM/year.

Insulation Resistance: 10,000 Megohms, minimum.

Overload:* 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times rated maximum working voltage, R shift less than ±0.05%.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, R Shift less than ±0.05%.

Low Temperature Operation:* R Shift less than ±0.02%.

Dielectric Withstanding Voltage:* R Shift less than ±0.02%.

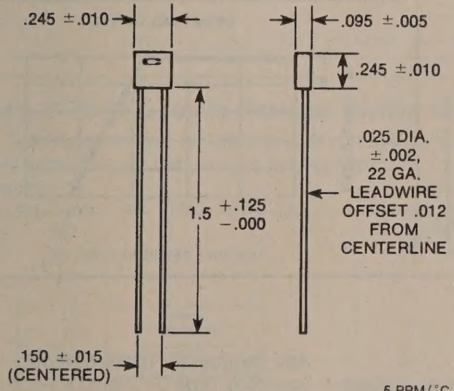
Moisture Resistance:* Mil-Std-202, Method 106, R Shift less than ±0.05%.

Vibration:* R Shift less than ±0.02%.

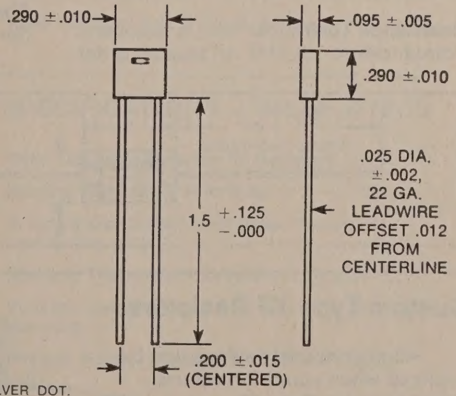
Shock:* R Shift less than ±0.01%.

*All test methods per specifications and procedures of Mil-R-55182/9.

Case "A"
Model TK 121


.245 ±.010
.095 ±.005
.245 ±.010
.025 DIA.
±.002,
22 GA.
LEADWIRE
OFFSET .012
FROM
CENTERLINE
1.5 +.125 −.000
.150 ±.015
(CENTERED)

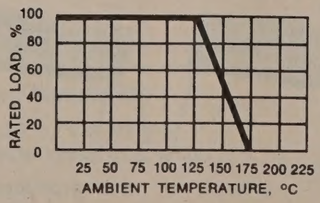
Case "B"
Model TK 133


.290 ±.010
.095 ±.005
.290 ±.010
.025 DIA.
±.002,
22 GA.
LEADWIRE
OFFSET .012
FROM
CENTERLINE
1.5 +.125 −.000
.200 ±.015
(CENTERED)

ALL DIMENSIONS IN INCHES

5 PPM/°C RESISTORS ARE MARKED WITH A SILVER DOT.

DERATING CURVE



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ELECTRONICS, INCORPORATED
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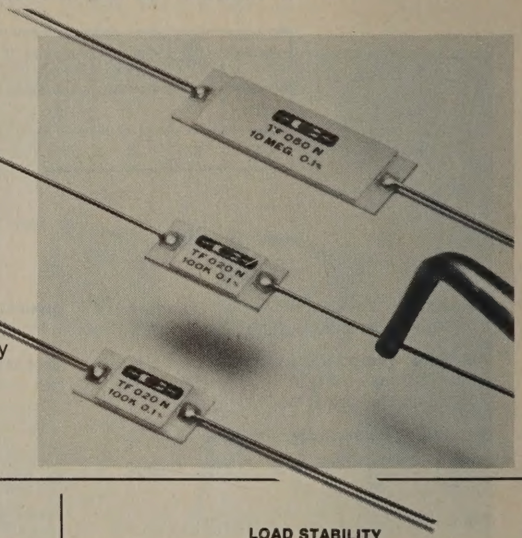
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TF Low TC Ultra-Precision Film Resistors

A cost-effective replacement for wire-wound resistors.



- **Ultra-Precision** — Resistance tolerance of ±0.1% is standard. Tolerances to ±0.01% are available.
- **Resistance Values** — 1 kohm to 10 Megohms.
- **Low Temperature Coefficient** — Less than 15 ppm/°C.
- **Non-Inductive Performance** — For greater pulse fidelity and wider bandwidths.

Type TF precision resistors employ the new Caddock Tetrinox™ resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors.

A whole new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.

The result: You receive resistors with the highest performance — in quantity — at the lowest cost!

Standard Type TF Resistors

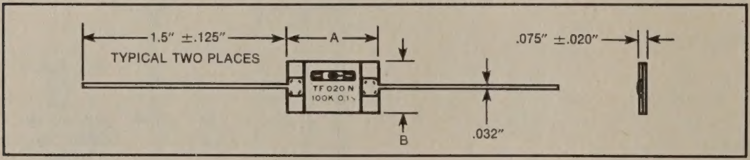
Model No.	Wattage @ 70°C	Maximum Continuous Oper. Voltage	TC ppm/°C	Resistance		Dimensions		Leadwire
				Min.	Max.	A	B	
TF020N	.33	300	15	1 K	2 Meg	.75 ±.020	.375 ±.020	Tinned Copper
TF050N	.75	1400	15	10 K	10 Meg	1.5 ±.020	.50 ±.020	Tinned Copper

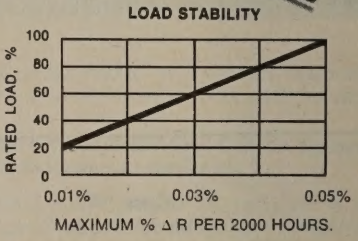
Absolute Temperature Coefficient: ±15 PPM/°C from −55°C to +105°C., referenced to +25°C.

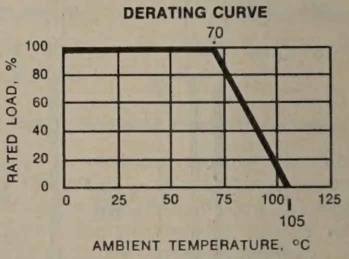
Resistance Tolerance: ±0.1% standard. Tolerances to ±0.01% on special order.

Storage Temperature: −55°C to +105°C.

Shelf Life: Typically 50 PPM per year.



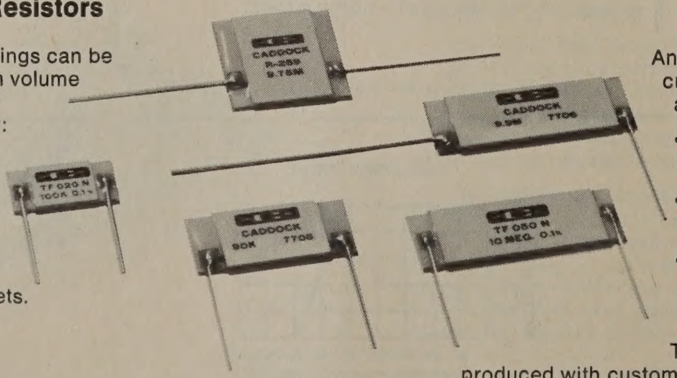




Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- Resistance values to 25 Megohms.
- TCs of 10 ppm/°C. 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 25 ppm per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

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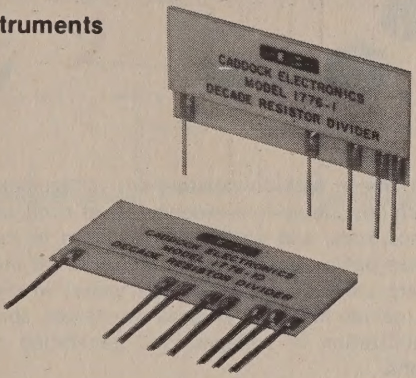
Type 1776 Precision Decade Resistor Voltage Dividers

CADDOCK

HIGH PERFORMANCE FILM RESISTORS

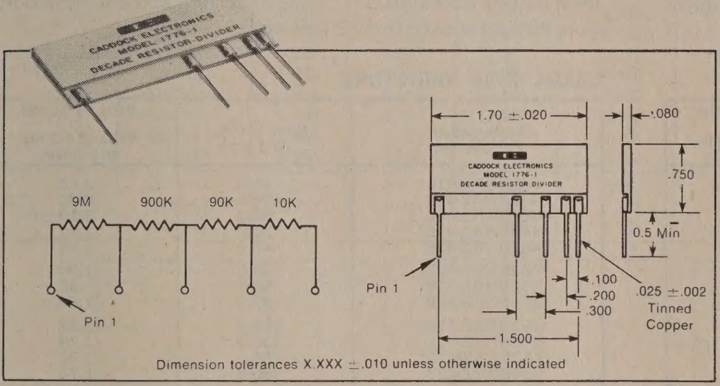
Input-Dividers for Multimeters and Other Range Switching Instruments


CADDOCK ELECTRONICS
MODEL 1776-1
DECADE RESISTOR DIVIDER
CADDOCK ELECTRONICS
MODEL 1776-10
DECADE RESISTOR DIVIDER

This new edge mount precision decade resistor voltage divider takes less board space and offers more performance than selected discrete resistor sets and thin film networks:

- **Ratio Stability of 0.01% per 6 months.**
- **Ratio temperature coefficient 10 ppm/°C.**
- **Ratio voltage coefficient less than 0.02 ppm/volt.**
- **Voltage rating of 1200 volts continuous and 2000 volts momentary.**
- **Utilizes Tetrinox™ Temp-Stable Resistance Film.**

Model 1776-1 Decade Resistor Divider with Resistors in Series


CADDOCK ELECTRONICS
MODEL 1776-1
DECADE RESISTOR DIVIDER
9M
900K
90K
10K
Pin 1
1.70 ±.020
.080
.750
0.5 Min
Pin 1
.100
.200
.300
.025 ±.002
Tinned
Copper
1.500

Dimension tolerances X.XXX ±.010 unless otherwise indicated

SPECIFICATIONS — Model 1776-1

Ratio Tolerance Between All Resistors: ±0.05%.

Nominal Resistance Tolerance: ±0.25%.

Temperature Coefficient of Ratio: 10 ppm/°C from 0°C to +70°C.

Absolute Temperature Coefficient: 30 ppm/°C.

Voltage Coefficient of Ratio: Less than 0.02 ppm/volt.

Voltage Rating of Resistor Network: 1200 volts.

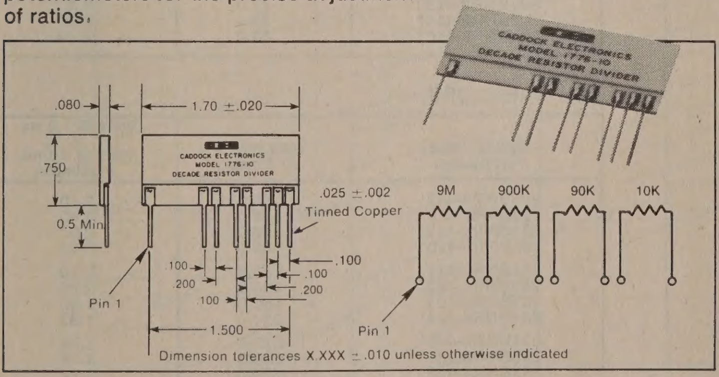
Overvoltage: 2000 volts for 10 seconds will produce a ratio change of less than 0.01%.

Storage Temperature: −55°C to +105°C.

Ratio Stability: 0.01% per 6 months.

Model 1776-10 Decade Resistor Divider with Resistors Isolated

The resistors are isolated in this voltage divider to allow for the use of potentiometers for the precise adjustment of ratios.


CADDOCK ELECTRONICS
MODEL 1776-10
DECADE RESISTOR DIVIDER
.080
1.70 ±.020
.750
0.5 Min
.025 ±.002
Tinned Copper
.100
.200
.100
.100
.200
.100
Pin 1
1.500
9M
900K
90K
10K
Pin 1

Dimension tolerances X.XXX ±.010 unless otherwise indicated

SPECIFICATIONS — Model 1776-10

Ratio Tolerance Between All Resistors: ±.1%.

Nominal Resistance Tolerance: +0, −0.5%.

Temperature Coefficient of Ratio: 10 ppm/°C from 0°C to +70°C.

Absolute Temperature Coefficient: 30 ppm/°C.

Voltage Coefficient of Ratio: Less than 0.02 ppm/volt.

Voltage Rating of Resistor Network: 1200 volts.

Overvoltage: 2000 volts for 10 seconds will produce a ratio change of less than 0.01%.

Storage Temperature: −55°C to +105°C.

Ratio Stability: 0.01% per 6 months.

Custom Resistor Divider or Gain Setting Networks

Please contact the engineering staff at Caddock if there are requirements for special resistance values, special ratios or special package requirements.

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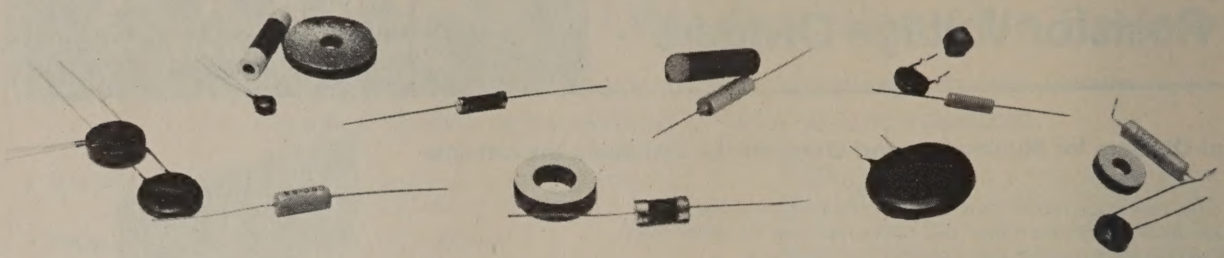
CARBORUNDUM® VARISTORS



Carborundum silicon carbide varistors are voltage-dependent resistors which are offered in a wide variety of configurations, including discs, rods, and washers. In addition to the sizes shown on these pages, rods are available up to 18 inches in length, washers are available up to 3½ inches in diameter. Typical uses include limitation of peak discharges, spike suppression, stabilization of voltages, and generation of non-linear functions.

Varistors are specified by the voltage measured across them, suitably toleranced, at some constant current. The slope of the voltage-current characteristic is most often given by the maximum voltage ratio for two specified currents.

In general the characteristic for a varistor may be approximated by the equation:

$$i = Ke^n$$

where i and e are instantaneous current and voltage respectively, K is a proportionality constant, and n is an exponent applicable in the range in which the varistor is used: most often it is between 3 and 5.

The silicon carbide varistor is a "forgiving" component. When hit by a voltage surge, the energy is absorbed throughout its body, not at a junction. A voltage surge beyond the design level causes substantial increase in current and energy absorption, but not a catastrophic failure.

SMALL DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
432BNR2-406*	6.8	2.70
432BNR2-407	8.2	2.60
432BNR2-408*	10.0	2.50
432BNR2-409	12.0	2.35
432BNR2-410	15.0	2.20
432BNR2-411	18.0	2.10
432BNR2-412	22.0	2.00
432BNR2-413	27.0	1.90
432BNR2-414	33.0	1.84
432BNR2-416	47.0	1.80
432BNR2-418	68.0	1.76
432BNR2-420	100.0	1.72
379BNR2-410*	15.0	2.50
379BNR2-412*	22.0	2.40
379BNR2-414*	33.0	2.30
379BNR2-415	39.0	2.20
379BNR2-416*	47.0	2.10
379BNR2-417	56.0	2.00
379BNR2-418*	68.0	1.95
379BNR2-419	82.0	1.90
379BNR2-420*	100.0	1.84
379BNR2-421	120.0	1.78
379BNR2-422*	150.0	1.74
379BNR2-423	180.0	1.70
328BNR2-400	2.2	3.60
328BNR2-401	2.7	3.40
328BNR2-402*	3.3	3.20
328BNR2-403	3.9	3.00
328BNR2-404*	4.7	2.80
328BNR2-405	5.6	2.60
328BNR2-406	6.8	2.50
328BNR2-407	8.2	2.40
328BNR2-408	10.0	2.30
328BNR2-409	12.0	2.20
328BNR2-410	15.0	2.10
328BNR2-411	18.0	2.00
328BNR2-412	22.0	1.95
328BNR2-413	27.0	1.90
328BNR2-414	33.0	1.85
328BNR2-416	47.0	1.76

Varistors marked with an asterisk (*) are carried by Carborundum distributors.

LARGE DISC VARISTORS

Carborundum Part Number	Volts ±10% @ 5.0 ma.	Volts @ 5.0 ma. ÷ Volts @ 0.5 ma. (maximum)
463BNR2-410	15.0	2.40
463BNR2-412	22.0	2.20
463BNR2-414	33.0	2.10
463BNR2-415	39.0	2.02
463BNR2-416	47.0	1.98
463BNR2-417	56.0	1.94
463BNR2-418*	68.0	1.90
463BNR2-419	82.0	1.86
463BNR2-420*	100.0	1.82
463BNR2-421	120.0	1.78
463BNR2-422*	150.0	1.74
463BNR2-423	180.0	1.70
927BNR2-408*	10.0	2.90
927BNR2-409	12.0	2.80
927BNR2-410*	15.0	2.70
927BNR2-411	18.0	2.60
927BNR2-412*	22.0	2.50
927BNR2-413	27.0	2.40
927BNR2-414*	33.0	2.30
927BNR2-416*	47.0	2.20

ROD VARISTORS

Carborundum Part Number	Volts ±10% @ 1.0 ma.	Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum)
233BNR4-417	56.0	2.50
233BNR4-418*	68.0	2.40
233BNR4-419	82.0	2.30
233BNR4-420*	100.0	2.20
233BNR4-421	120.0	2.10
233BNR4-422*	150.0	2.00
233BNR4-423	180.0	1.90
233BNR4-424*	220.0	1.82
233BNR4-425	270.0	1.78
233BNR4-426*	330.0	1.76
233BNR4-428	470.0	1.74
233BNR4-430	680.0	1.70
234BNR4-426	330.0	2.00
234BNR4-427	390.0	1.90
234BNR4-428*	470.0	1.80
234BNR4-429	560.0	1.77
234BNR4-430*	680.0	1.74
234BNR4-431	820.0	1.70
234BNR4-432*	1000.0	1.68

The Carborundum Company, Graphite Products Division, Post Office Box 339,
Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

CARBORUNDUM® VARISTORS

Standard varistors described below have a 10% tolerance on voltage. Also available: leadless discs and rods, voltages specified at intermediate values or at other currents, and voltage tolerances of ±15% and ±20%. Available at extra cost: voltage tolerances of ±5% and ±7%, color coding, and special coatings.

Standard disc varistors have a black flame-retardant PVC coating. Also available: Glyptal coating and kinked leads for printed circuit board insertion.

Standard rod varistors have a blue epoxy coating. Available at extra cost: formed leads for printed circuit board insertion.

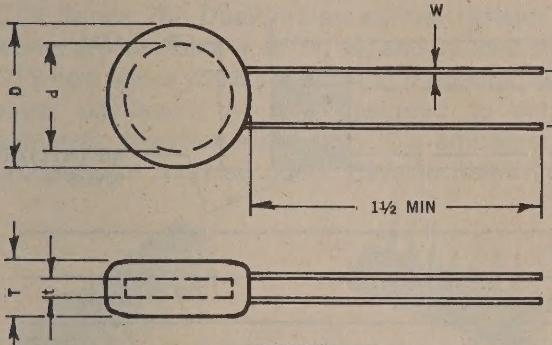


FIGURE 1

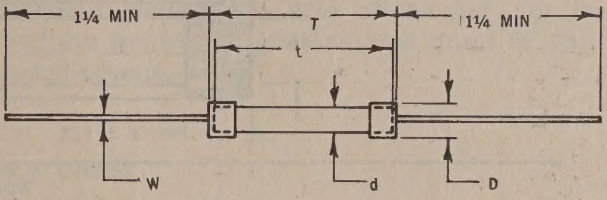
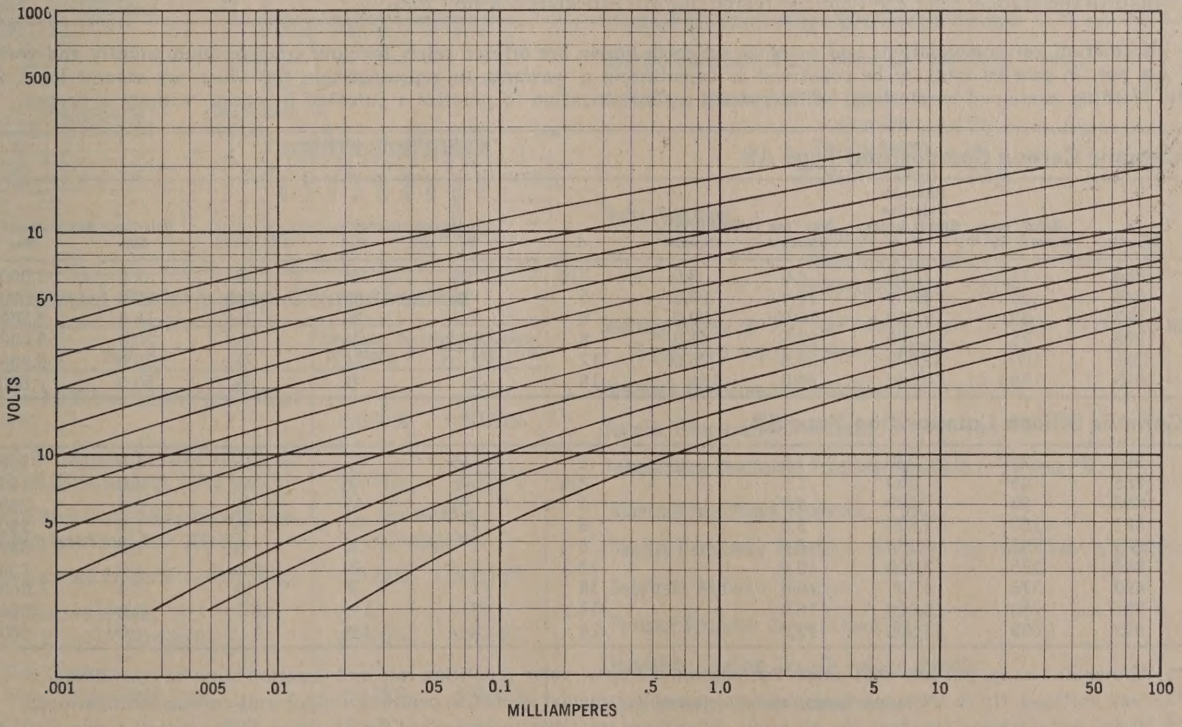


FIGURE 2

	Carborundum Style Number	d ±.030	t ±.030	D max.	T max.	w nom.	s nom.	Peak Voltage	Power Watts	"Curve Factors" Voltage	Current
DISC STYLES (figure 1)	551BNR2-	0.250	0.062	0.400	0.350	0.020	0.125	100	0.250	0.5	0.25
	432BNR2-	0.500	0.062	0.650	0.350	0.032	0.250	100	0.500	0.5	1.0
	379BNR2-	0.500	0.125	0.650	0.400	0.032	0.250	200	0.500	1.0	1.0
	328BNR2-	0.750	0.062	0.900	0.350	0.032	0.375	100	0.750	0.5	2.2
	925BNR2-	0.750	0.100	0.900	0.380	0.032	0.375	150	0.750	0.8	2.2
	613BNR2-	0.750	0.125	0.900	0.400	0.032	0.375	200	0.750	1.0	2.2
	923BNR2-	1.000	0.100	1.150	0.380	0.040	0.375	150	1.500	0.8	4.0
	463BNR2-	1.000	0.125	1.150	0.400	0.040	0.375	200	1.500	1.0	4.0
	927BNR2-	1.250	0.100	1.400	0.380	0.040	0.375	150	2.250	0.8	6.2
ROD STYLES (figure 2)	231BNR4-	0.156	0.625	0.250	0.812	0.032	—	800	0.750	5.0	0.1
	233BNR4-	0.250	0.625	0.375	0.812	0.032	—	800	1.000	5.0	0.25
	234BNR4-	0.250	1.000	0.375	1.188	0.032	—	1500	1.500	8.0	0.25



These curves are plotted for a family of variously rated 379BNR2- varistors. The characteristics of other varistor styles are of similar shape, and they can be approximated by using the "curve factors" shown in the above chart. To do this, multiply the voltages on the ordinate by the voltage curve factor for the style chosen, and multiply the currents on the abscissa by the current curve factor. For a type 233BNR4- varistor, for example, the 10.0 volt, 4.0 milliampere point on the chart would be read as 50.0 volts, 1.0 milliamperes.

CARBORUNDUM

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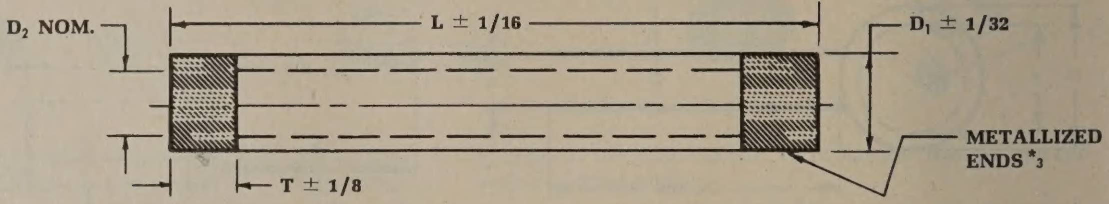
CARBORUNDUM NON-INDUCTIVE POWER RESISTORS

GLOBAR®
Non-Inductive Resistor



Specifications

	Type AS	Type SP
Tolerances	Standard 10%, 5% and 20% available	Same
Load-life	Max 5% after 1,000 hrs. at rated load	Same
Short time overload (10 times rated. Power 5 seconds on—90 seconds off.)	2% change	Same
Temperature coefficent	−50°C to +230°C ± .075%/°C max	−55°C to +350°C ± .075%/°C max
Voltage coefficient	Max 1%/kilovolt per inch effective length	Same
Max operating temperature	230°C	350°C
Density	2.5 grams/CM³	2.2 grams/CM³
Specific heat	.15-.30 cal/gram/°C	.15-.30 cal/gram/°C
De-rating	Linearly to 0° watts @ 230°C	Linearly to 0° watts @ 350°C
Moisture resistance: Max 2.5% change tested per Mil Std 202B, Method 103		Same

The information, recommendations and opinions set forth herein are offered solely for your consideration, inquiry and verification, and are not, in part or total, to be construed as constituting a warranty or representation for which we assume legal responsibility. Nothing contained herein is to be interpreted as authorization to practice a patented invention without a license.

Ceramic Carbon Composition Type AS

Type No.	Rated Power Watts @ 40° C	Allowable Injection Energy Joules *₁	Max Peak Voltage (KV) *₂ Standard	Special	Dimensions (inches) L	D₁	D₂	T	Resistance Range (ohms) *₄ Min	Max
885	15	2,500	4.0	8.0	2½	¾	½	½	7.5	1,000
886	30	5,000	10.0	20.0	5	¾	½	⅝	20.0	2,500
887	50	15,000	15.0	30.0	6	1	¾	½	15.0	2,500
888	75	20 000	22.5	45.0	8	1	¾	⅞	20.0	3,000
889	100	35,000	37.5	75.0	12	1	¾	⅞	30.0	5,000
890	150	50,000	60.0	120	18	1	¾	⅞	50.0	7,500

Ceramic Silicon Composition Type SP

Type No.	Rated Power Watts @ 40° C	Allowable Injection Energy Joules *₁	Max Peak Voltage (KV) *₂ Standard	Special	Dimensions (inches) L	D₁	D₂	T	Resistance Range (ohms) *₄ Min	Max
884	22.5	200	1.5		2	½	7/32	¼	1.0	150
885	45	250	1.5		2½	¾	½	½	1.0	100
886	90	500	4.0		5	¾	½	⅝	1.0	250
887	150	1,600	5.0		6	1	¾	½	1.0	250
888	190	2,100	6.0		8	1	¾	⅞	1.0	330
889	275	3,200	10.0		12	1	¾	⅞	1.0	700
890	375	4,200	16.0		18	1	¾	⅞	1.0	1,000
891	750	15,000	16.0		18	2	1½	1	1.0	350
892	1,000	17,500	22.0		24	2	1½	1	1.0	500

*1. Allowable energy per one shot pulse. For continuous duty, pulse repetition rate and duration must be considered.

*2. Peak voltages. Up to 100% increase can be obtained by special dielectric coatings and/or anti-corona terminations.

*3. Nickel metallization standard for AS types. Aluminum metallization standard for SP types. Other metallization available upon request; example: copper, solder-tinned copper or silver.

*4. Refer values other than shown to the plant for special quotation.

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CARBORUNDUM

CTS OF BERNE, INC.

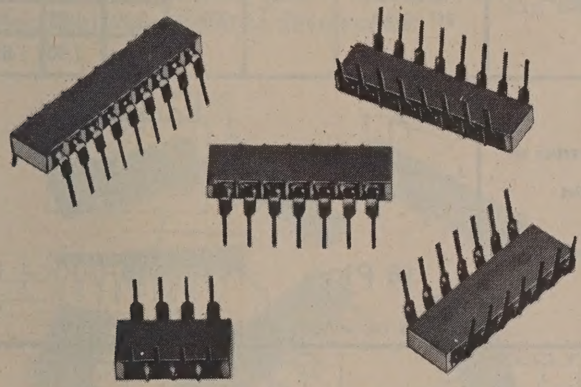
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

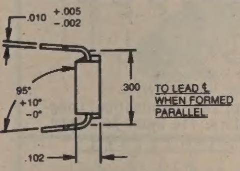
WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

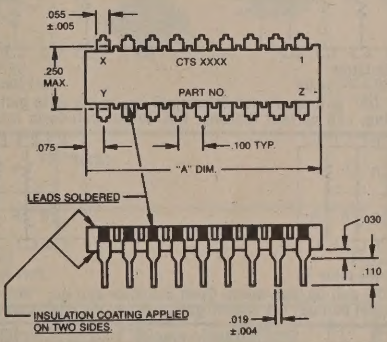
DUAL-IN-LINE CERMET RESISTOR NETWORKS

CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

CTS Series 760 Dual-In-Line cermet resistor networks are available in 8, 14, 16, and 18 lead styles. CTS now offers you a choice of four popular space-saver packages. All are designed to simplify automatic insertion along with IC's and other DIP products for reduced costs. Easy to hand mount, too. Available without cover coat, so you can trim for circuit balance in your own plant. Choose from standard circuits available off-the-shelf for immediate delivery or custom designed to your specifications.







NO. OF PINS	"A" DIM	PIN DESIGNATION		
		X	Y	Z
8	.450	4	5	8
14	.750	7	8	14
16	.850	8	9	16
18	.950	9	10	18

GEN. TOL. ±.010

Environmental Performance Characteristics

Test	Allowable Resistance Change CTS Max△ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.50%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.25%	±0.10%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.25%	±0.10%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.25%	±0.03%
Effect of Soldering: 63/37 solder, 246°C, 2 sec.	±0.25%	±0.05%

FEATURES:

- Low height profile
- .100″ lead spacing
- High overload capabilities
- 8, 14, 16 & 18 pin constructions
- Compatible with automatic insertion equipment
- 2 watt power capabilities
- Reduced insertion time
- Available with capacitors and/or active devices*

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: 8, 14, 16, and 18 pin dual-in-line modules on .100″ lead centers.

Standard Resistance Range: 22Ω through 1 MegΩ.

Special Resistance Range: Below 22Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):

50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ — 2.5%

Ratio Matching:

50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ — ±5%

Wattage Rating @ 70°C per module: 8 pin - .75 watt; 14 pin - 1.5 watts; 16 pin - 1.75 watts; 18 pin - 2.0 watts.

Standard Temperature Coefficient: ±300 ppm/°C.

Special Temperature Coefficient: to ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: ±1% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 63/37 Tin/Lead.

Lead Strength: 5# pull.

*** Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.**

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

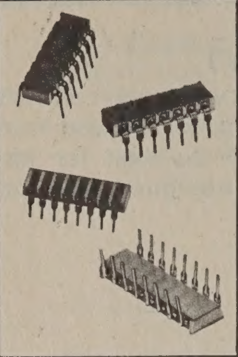
CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART INDIANA

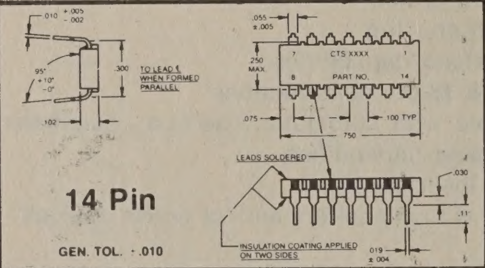
WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

DUAL-IN-LINE CERMET RESISTOR NETWORKS

760 SERIES 14/16 LEAD DUAL-IN-LINE CERMET RESISTOR NETWORKS



CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	Standard TC	TC Tracking	Prices 1-99	Prices 100-499	Prices 500-999
760-3	14 Pin Module on .100" x .300" DIP Centers	Cermet	22Ω-220KΩ* ±2%	1.5 @ 70°C per module	±300 ppm/°C	50 ppm/°C	$1.15	$ .93	$ .66
760-1							1.20	.95	.68
760-5							2.15	1.75	1.25
760-19							2.20	1.78	1.43
761-3	16 Pin Module on .100" x .300" DIP Centers	Cermet	68Ω-470KΩ* ±2%	1.75 @ 70°C per module	±300 ppm/°C	50 ppm/°C	$1.20	$ .95	$ .68
761-1							1.25	.98	.70
761-5							2.30	1.88	1.34
761-45							2.40	1.90	1.65

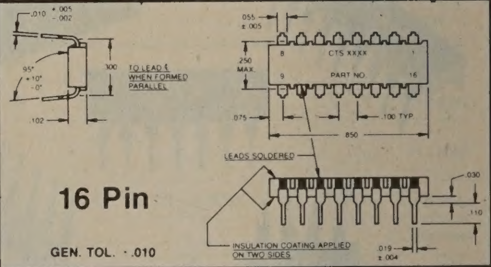


14 Pin

GEN. TOL. ±.010

FEATURES:

- Low cost automatic insertion and handling
- High overload capabilities
- Low height profile
- Package compatibility with monolithic packages
- .100" lead spacing



16 Pin

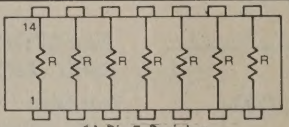
GEN. TOL. ±.010

STANDARD "OFF THE SHELF" PART NUMBERS

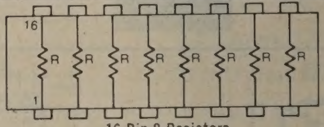
Resistance Value, Tolerance	14 Pin 7 Resistor	14 Pin 13 Resistor
22Ω ±2%	760-3-R22Ω	
39Ω ±2%	760-3-R39Ω	
68Ω ±2%	760-3-R68Ω	760-1-R68Ω
75Ω ±2%		760-1-R75Ω
100Ω ±2%	760-3-R100Ω	760-1-R100Ω
110Ω ±2%	760-3-R110Ω	
150Ω ±2%	760-3-R150Ω	760-1-R150Ω
220Ω ±2%	760-3-R220Ω	760-1-R220Ω
330Ω ±2%	760-3-R330Ω	760-1-R330Ω
390Ω ±2%		760-1-R390Ω
470Ω ±2%	760-3-R470Ω	760-1-R470Ω
500Ω ±2%	760-3-R500Ω	760-1-R500Ω
680Ω ±2%	760-3-R680Ω	760-1-R680Ω
1KΩ ±2%	760-3-R1KΩ	760-1-R1KΩ
1.5KΩ ±2%	760-3-R1.5KΩ	760-1-R1.5KΩ
1.8KΩ ±2%	760-3-R1.8KΩ	
2KΩ ±2%		760-1-R2KΩ
2.2KΩ ±2%	760-3-R2.2KΩ	760-1-R2.2KΩ
2.4KΩ ±2%		760-1-R2.4KΩ
3KΩ ±2%		760-1-R3KΩ
3.3KΩ ±2%	760-3-R3.3KΩ	760-1-R3.3KΩ
4.7KΩ ±2%	760-3-R4.7KΩ	760-1-R4.7KΩ
5KΩ ±2%		760-1-R5KΩ
5.6KΩ ±2%		760-1-R5.6KΩ
6KΩ ±2%	760-3-R6KΩ	760-1-R6KΩ
6.8KΩ ±2%	760-3-R6.8KΩ	760-1-R6.8KΩ
7.5KΩ ±2%		760-1-R7.5KΩ
9.1KΩ ±2%		760-1-R9.1KΩ
10KΩ ±2%	760-3-R10KΩ	760-1-R10KΩ
12KΩ ±2%		760-1-R12KΩ
15KΩ ±2%	760-3-R15KΩ	760-1-R15KΩ
22KΩ ±2%	760-3-R22KΩ	760-1-R22KΩ
33KΩ ±2%	760-3-R33KΩ	760-1-R33KΩ
47KΩ ±2%	760-3-R47KΩ	760-1-R47KΩ
68KΩ ±2%	760-3-R68KΩ	760-1-R68KΩ
75KΩ ±2%	760-3-R75KΩ	
100KΩ ±2%	760-3-R100KΩ	760-1-R100KΩ
150KΩ ±2%	760-3-R150KΩ	760-1-R150KΩ
180KΩ ±2%		760-1-R180KΩ
220KΩ ±2%	760-3-R220KΩ	760-1-R220KΩ

Resistance Value, Tolerance	16 Pin 8 Resistor	16 Pin 15 Resistor
68Ω ±2%	761-3-R68Ω	761-1-R68Ω
87.5Ω ±2%	761-3-R87.5Ω	
100Ω ±2%	761-3-R100Ω	761-1-R100Ω
110Ω ±2%	761-3-R110Ω	
150Ω ±2%	761-3-R150Ω	761-1-R150Ω
220Ω ±2%	761-3-R220Ω	761-1-R220Ω
330Ω ±2%	761-3-R330Ω	761-1-R330Ω
470Ω ±2%	761-3-R470Ω	761-1-R470Ω
500Ω ±2%		761-1-R500Ω
680Ω ±2%	761-3-R680Ω	761-1-R680Ω
1KΩ ±2%	761-3-R1KΩ	761-1-R1KΩ
1.5KΩ ±2%	761-3-R1.5KΩ	761-1-R1.5KΩ
2KΩ ±2%	761-3-R2KΩ	761-1-R2KΩ
2.2KΩ ±2%	761-3-R2.2KΩ	761-1-R2.2KΩ
3.3KΩ ±2%	761-3-R3.3KΩ	761-1-R3.3KΩ
4.7KΩ ±2%	761-3-R4.7KΩ	761-1-R4.7KΩ
5.6KΩ ±2%		761-1-R5.6KΩ
6KΩ ±2%		761-1-R6KΩ
6.8KΩ ±2%	761-3-R6.8KΩ	761-1-R6.8KΩ
10KΩ ±2%	761-3-R10KΩ	761-1-R10KΩ
15KΩ ±2%	761-3-R15KΩ	761-1-R15KΩ
22KΩ ±2%	761-3-R22KΩ	761-1-R22KΩ
33KΩ ±2%	761-3-R33KΩ	761-1-R33KΩ
47KΩ ±2%	761-3-R47KΩ	761-1-R47KΩ
50KΩ ±2%	761-3-R50KΩ	761-1-R50KΩ
68KΩ ±2%	761-3-R68KΩ	761-1-R68KΩ
100KΩ ±2%	761-3-R100KΩ	761-1-R100KΩ
150KΩ ±2%	761-3-R150KΩ	761-1-R150KΩ
220KΩ ±2%	761-3-R220KΩ	761-1-R220KΩ
470KΩ ±2%	761-3-R470KΩ	

*NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

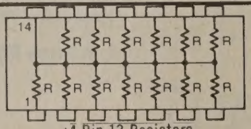


14 Pin-7 Resistors
Part Number 760-3-R+value

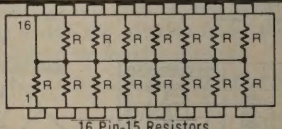


16 Pin-8 Resistors
Part Number 761-3-R+value

APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.

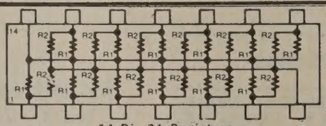


14 Pin-13 Resistors
Part Number 760-1-R+value

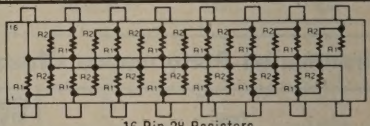


16 Pin-15 Resistors
Part Number 761-1-R+value

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.



14 Pin-24 Resistors
Part Number 760-5-R+values



16 Pin-28 Resistors
Part Number 761-5-R+values

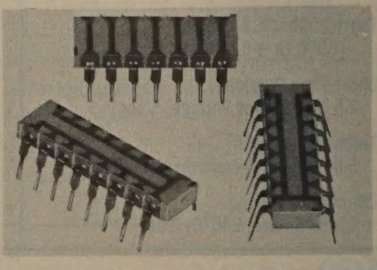
Resistance Values R1/R2	Part Numbers	
220Ω/270Ω	760-5-R220/270	761-5-R220/270
220Ω/330Ω	760-5-R220/330	761-5-R220/330
1.5K/3.3K	760-5-R1.5/3.3K	761-5-R1.5K/3.3K

Other combinations available upon request

Pulse Squaring TTL Terminators

CTS 760-5 networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

CONDUCTOR MODULES



Eliminate time consuming installation of jumper wires.

Density of Jumpers:
Depending on number of pins, screened on both sides of substrate. Built to customer specifications and requirements.

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

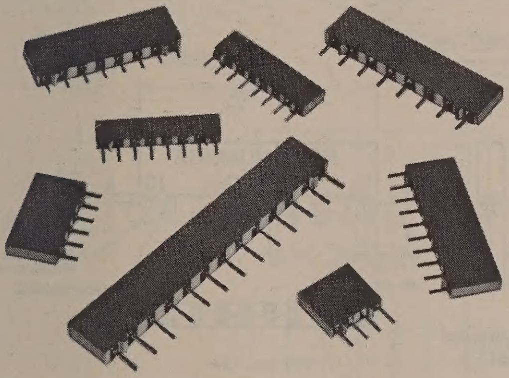
CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

CTS . . . Leader in the field of **Low Profile** space-saving Cermet Resistor Modules. Readily recognizable because of the familiar CTS Blue.

As is well illustrated, these modules have been specifically designed to save space.

So if you want to reduce the size of your design or add more complex circuitry without increasing size, CTS rates top consideration.

Most appealing is the fact that "The Little Blue Brick" is an extensive "Off The Shelf" item with CTS.



750 Series

Environmental Performance Characteristics

For units less than .340″ high, refer to page 8 for performance characteristics. Test	Allowable Resistance Change CTS Max△ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.40%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.10%	±0.04%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.10%	±0.03%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.10%	±0.03%
Effect of Soldering: 63/37 solder, 246°C, 2 sec.	±0.10%	±0.05%

FEATURES:

- Compact edge mount modules
- Ultra high stability and reliability
- Automatic insertion capabilities
- Reduced insertion time
- Fewer items to inventory
- Space savings over individual resistors
- Available with capacitors and/or active devices*
- Available with .100″, .125″ and .150″ lead centers

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: Cermet thick film single-in-line resistor networks.

Standard Resistance Range: 33Ω through 1 MegΩ.

Special Resistance Range: Below 33Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ —2.5%

Ratio Matching:
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ —±5%

Standard Temperature Coefficient: ±250 ppm/°C.

Special Temperature Coefficient: ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: to ±0.5% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 63/37 Tin/Lead.

Lead Strength: 5# pull.

Wattage Rating @ 70°C (see chart below).

Lead Centers	Ht. of Module (Max.)	Number of Pins 2	4	5	6	7	8	9	10	11	12	13
.100	(.187)	.25	—	—	—	.7	.8	—	—	—	—	—
.100	(.250)	—	—	—	.9	—	1.1	—	1.5	—	—	—
.100	(.350)	—	.7	—	1.0	—	1.3	—	2.0	2.3	—	—
.125	(.187)	—	—	.6	—	—	1.0	—	—	—	—	—
.125	(.350)	.5	1.0	—	1.5	—	2.0	—	2.5	—	3.0	—
.150	(.340)	—	1.3	1.7	2.0	2.3	2.6	3.0	3.3	3.6	4.0	4.3

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

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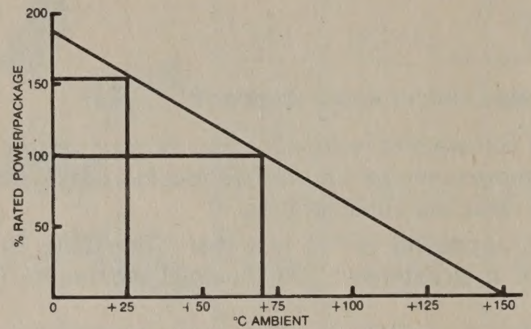
CTS OF BERNE, INC.

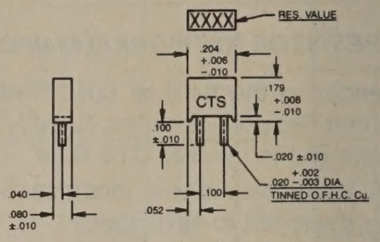
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

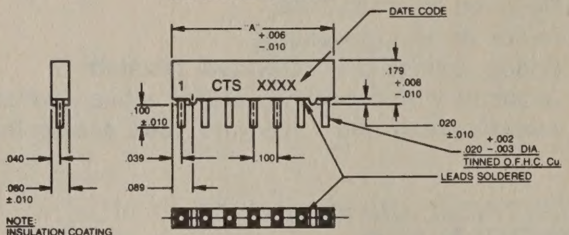


TYPICAL DERATING CURVE FOR CTS 750 SERIES


XXXX
RES. VALUE
.204
+.006
−.010
CTS
.179
+.008
−.010
.100
±.010
.020 ±.010
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.040
.080
±.010
.100
.052

GEN. TOL. ±.005

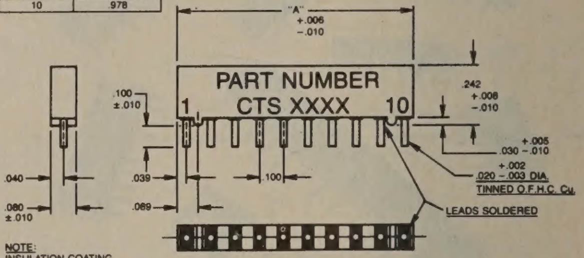
NO. OF PINS	"A" DIMENSION
7	.678
8	.778


DATE CODE
"A"
+.006
−.010
1 CTS XXXX
.179
+.008
−.010
.100
±.010
.020
±.010
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.040
.039
.100
LEADS SOLDERED
.080
±.010
.089

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.

GEN. TOL. ±.005

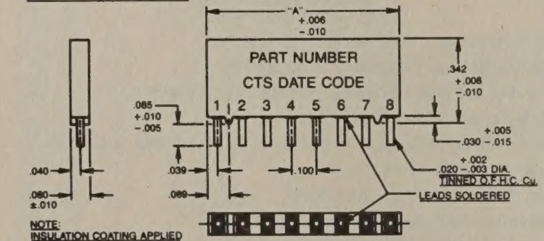
NO. OF PINS	"A" DIMENSION
6	.578
8	.778
10	.978


"A"
+.006
−.010
PART NUMBER
1 CTS XXXX 10
.242
+.008
−.010
.100
±.010
+.005
.030 −.010
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.040
.039
.100
.080
±.010
.089
LEADS SOLDERED

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.

GEN. TOL. ±.005

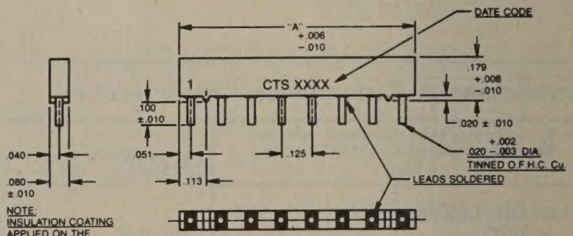
NO. OF PINS	"A" DIMENSION
4	.378
6	.578
8	.778
10	.978
11	1.078


"A"
+.006
−.010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
.342
+.008
−.010
.085
+.010
−.005
+.005
.030 −.015
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.040
.039
.100
.080
±.010
.089
LEADS SOLDERED

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

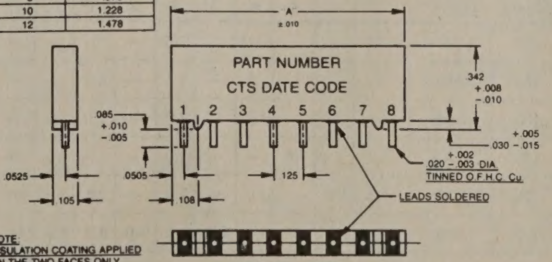
NO. OF PINS	"A" DIMENSION
5	.603
8	.978


DATE CODE
"A"
+.006
−.010
1 CTS XXXX
.179
+.008
−.010
.100
±.010
.020 ± .010
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.040
.051
.125
.080
±.010
.113
LEADS SOLDERED

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.

GEN. TOL. ±.005

NO. OF PINS	"A" DIMENSION
2	.228
4	.478
6	.728
8	.978
10	1.228
12	1.478

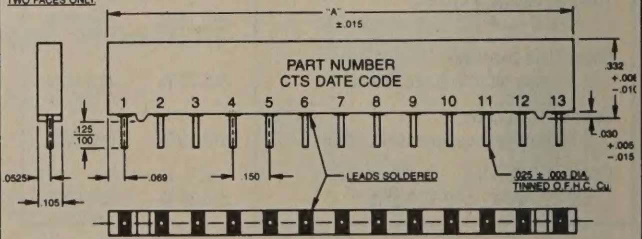

"A"
±.010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
.342
+.008
−.010
.085
+.010
−.005
+.005
.030 −.015
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
.0525
.0505
.125
.105
.108
LEADS SOLDERED

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

NO. OF PINS	"A" DIMENSION	NO. OF PINS	"A" DIMENSION
4	.588	9	1.338
5	.738	10	1.488
6	.888	11	1.638
7	1.038	12	1.788
8	1.188	13	1.938

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.


"A"
±.015
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8 9 10 11 12 13
.332
+.006
−.010
.125
.100
.030
+.005
−.015
.0525
.069
.150
.105
LEADS SOLDERED
.025 ± .003 DIA.
TINNED O.F.H.C. Cu.

GEN. TOL: ±.005

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

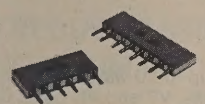
CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

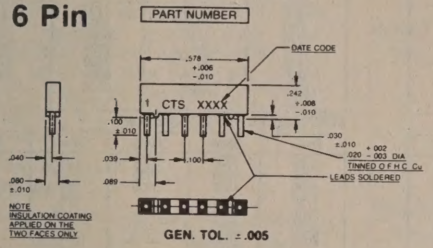
750 SERIES SINGLE-IN-LINE CERMET RESISTOR NETWORKS

SINGLE-IN-LINE CERMET RESISTOR NETWORKS



CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	Standard TC	TC Tracking	Prices 1-99	Prices 100-499	Prices 500-999
750-63	6 and 8 Pin Single In-Line Module on .100″ Lead Centers	Cermet	33Ω-470KΩ* ±2%	6 Pin-.9 watt 8 Pin-1.1 watt @ 70°C per module	±250 ppm/°C	50 ppm/°C	$.80	$.62	$.38
750-61							.85	.65	.40
750-83							.90	.68	.41
750-81							.95	.75	.45

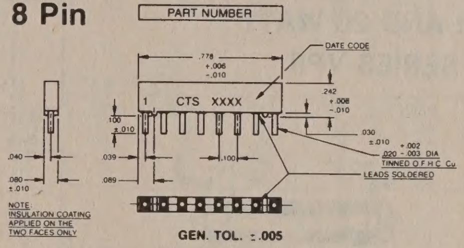
6 Pin

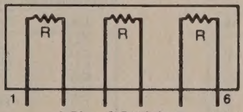

PART NUMBER
DATE CODE
.578
+.006
-.010
1 CTS XXXX
.242
+.008
-.010
.100
±.010
.030
±.010
+.002
.020 -.003 DIA
TINNED O F H C Cu
LEADS SOLDERED
.040
.039
.100
.080
±.010
.089
NOTE
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY
GEN. TOL. ±.005

FEATURES:

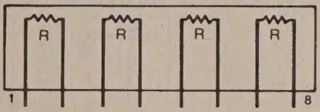
- **Low-Profile construction**
- **.100″ lead spacing**
- **High reliability**
- **Alumina substrate**
- **Low cost automatic insertion and handling**

8 Pin

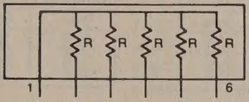

PART NUMBER
DATE CODE
.778
+.006
-.010
1 CTS XXXX
.242
+.008
-.010
.100
±.010
.030
±.010
+.002
.020 -.003 DIA
TINNED O F H C Cu
LEADS SOLDERED
.040
.039
.100
.080
±.010
.089
NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY
GEN. TOL. ±.005



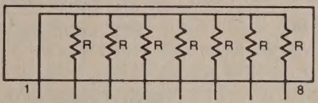
6 Pin—3 Resistors
Part Number 750-63-R+Value



8 Pin—4 Resistors
Part Number 750-83-R+Value



6 Pin—5 Resistors
Part Number 750-61-R+Value



8 Pin—7 Resistors
Part Number 750-81-R+Value

STANDARD "OFF THE SHELF" PART NUMBERS

Resistance Value, Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin, 4 Resistor	8 Pin, 7 Resistor
33Ω ±2%	750-63-R33Ω	750-61-R33Ω	750-83-R33Ω	750-81-R33Ω
68Ω ±2%	750-63-R68Ω	—	750-83-R68Ω	—
100Ω ±2%	750-63-R100Ω	750-61-R100Ω	750-83-R100Ω	750-81-R100Ω
150Ω ±2%	750-63-R150Ω	750-61-R150Ω	750-83-R150Ω	750-81-R150Ω
180Ω ±2%	—	—	—	750-81-R180Ω
220Ω ±2%	750-63-R220Ω	750-61-R220Ω	750-83-R220Ω	750-81-R220Ω
330Ω ±2%	750-63-R330Ω	750-61-R330Ω	750-83-R330Ω	750-81-R330Ω
470Ω ±2%	750-63-R470Ω	750-61-R470Ω	750-83-R470Ω	750-81-R470Ω
500Ω ±2%	—	750-61-R500Ω	—	750-81-R500Ω
680Ω ±2%	750-63-R680Ω	750-61-R680Ω	750-83-R680Ω	750-81-R680Ω
1KΩ ±2%	750-63-R1KΩ	750-61-R1KΩ	750-83-R1KΩ	750-81-R1KΩ
1.5KΩ ±2%	750-63-R1.5KΩ	750-61-R1.5KΩ	750-83-R1.5KΩ	750-81-R1.5KΩ
2KΩ ±2%	750-63-R2KΩ	750-61-R2KΩ	750-83-R2KΩ	750-81-R2KΩ
2.2KΩ ±2%	750-63-R2.2KΩ	750-61-R2.2KΩ	750-83-R2.2KΩ	750-81-R2.2KΩ
3.3KΩ ±2%	750-63-R3.3KΩ	750-61-R3.3KΩ	750-83-R3.3KΩ	750-81-R3.3KΩ
4.7KΩ ±2%	750-63-R4.7KΩ	750-61-R4.7KΩ	750-83-R4.7KΩ	750-81-R4.7KΩ
6.8KΩ ±2%	750-63-R6.8KΩ	750-61-R6.8KΩ	750-83-R6.8KΩ	750-81-R6.8KΩ
10KΩ ±2%	750-63-R10KΩ	750-61-R10KΩ	750-83-R10KΩ	750-81-R10KΩ
15KΩ ±2%	750-63-R15KΩ	750-61-R15KΩ	750-83-R15KΩ	750-81-R15KΩ
22KΩ ±2%	750-63-R22KΩ	750-61-R22KΩ	750-83-R22KΩ	750-81-R22KΩ
33KΩ ±2%	750-63-R33KΩ	750-61-R33KΩ	750-83-R33KΩ	750-81-R33KΩ
47KΩ ±2%	750-63-R47KΩ	750-61-R47KΩ	750-83-R47KΩ	750-81-R47KΩ
68KΩ ±2%	750-63-R68KΩ	750-61-R68KΩ	750-83-R68KΩ	750-81-R68KΩ
100KΩ ±2%	750-63-R100KΩ	750-61-R100KΩ	750-83-R100KΩ	750-81-R100KΩ
150KΩ ±2%	750-63-R150KΩ	750-61-R150KΩ	750-83-R150KΩ	750-81-R150KΩ
220KΩ ±2%	750-63-R220KΩ	750-61-R220KΩ	750-83-R220KΩ	750-81-R220KΩ
470KΩ ±2%	750-63-R470KΩ	750-61-R470KΩ	750-83-R470KΩ	750-81-R470KΩ

*NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

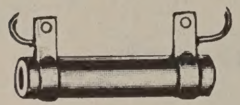
CLAROSTAT POWER RESISTORS

FIXED RESISTORS TUBULAR

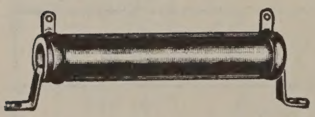
VITREOUS ENAMEL/GREENOHM V™

Vitreous enamel, wirewound power resistors are engineered to meet highest quality specifications. Wire windings are finest grade resistance alloy. Designed for utmost reliability and stability under adverse conditions. Teal green enamel finish withstands over-heating without peeling or cracking. Tolerance, ±5% except values under 1 ohm, ±10%. VPR types (up to 20 watts) have wire lead and lug terminals. VP and VK types (25 watts and up) have lug terminals, and mounting bracket.

LUG AND LEAD 8, 12 AND 20 WATT —SERIES VPR



LUG ONLY 25 TO 225 WATT —SERIES VP AND VK



8-WATT SERIES VPR-5-F CORE 1" x 5/16"

Ohms	Ohms	Ohms	Ohms
1	12	50	300
1.5	15	75	350
2	20	100	400
3	25	125	450
4	30	150	500
5	35	200	600
7.5	40	225	700
10		250	

12-WATT SERIES VPR-10-F CORE 1-3/4" x 5/16"

Ohms	Ohms	Ohms	Ohms	Ohms
0.4	5	30	200	500
1	7.5	35	225	600
1.2	10	40	250	700
1.3	12	50	300	750
1.5	15	75	350	800
2	20	100	400	900
3	25	125	450	1000
4		150		1100

20-WATT SERIES VPR-20-H CORE 2" x 7/16"

Ohms	Ohms	Ohms	Ohms	Ohms
0.4	75	350	850	1850
0.6	100	400	1000	2000
0.8	150	500	1200	2250
5	200	650	1250	2400
10	250	700	1500	2500
25	300	750	1750	2750
50		800		3000

25-WATT SERIES VP-25-K CORE 2" x 9/16"

Ohms	Ohms	Ohms	Ohms	Ohms
1	5	50	200	800
2	10	75	250	1000
3	15	100	500	1500
4	25	150	750	2000

50-WATT SERIES VP-50-K CORE 4" x 9/16"

Ohms	Ohms	Ohms	Ohms	Ohms
1	10	100	400	1000
2	25	150	500	1250
3	50	200	750	1500
4	75	250	800	2000
5		300		2500

100-WATT SERIES-VK-100N CORE 6-1/2" x 3/4"

Ohms	Ohms	Ohms	Ohms	Ohms
1	5	75	200	750
2	10	100	250	1000
3	25	125	300	1500
4	50	150	500	2000

175-WATT SERIES VK-160-W CORE 8-1/2" x 1-1/8"

Ohms	Ohms	Ohms	Ohms	Ohms
1	5	50	150	750
2	10	75	250	1000
3	25	100	500	1500
4		125		2000

225-WATT SERIES VK-200-W CORE 10-1/2" x 1-1/8"

Ohms	Ohms	Ohms	Ohms	Ohms
1	5	50	200	750
2	10	75	250	1000
3	25	100	500	1500
4		150		2000

STANDARD PK: 10 PER CARTON

Ohms	Ohms	Ohms	Ohms
750	1750	4500	12.5K
800	2000	5000	15K
900	2250	6000	17.5K
1000	2500	7000	20K
1100	3000	7500	22.5K
1200	3500	8000	25K
1250	4000	9000	
1500		10K	

STANDARD PK: 10 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms
1200	3000	8000	13.5K	25K
1250	3500	8500	14.3K	30K
1500	4000	9000	15K	35K
1750	4500	10K	16K	40K
2000	5000	11K	17.5K	45K
2250	6000	12K	18K	50K
2500	7000	12.5K	20K	
	7500		22.5K	

STANDARD PK: 5 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms
3500	7500	25K	55K	90K
4000	8000	30K	60K	95K
4500	9000	35K	65K	100K
5000	10K	40K	70K	
6000	12.5K	45K	75K	
7000	15K	50K	80K	
	20K		85K	

STANDARD PK: 1 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms
2500	5000	12K	30K	60K
3000	6000	15K	35K	70K
3500	7500	20K	40K	80K
4000	10K	25K	50K	100K

Ohms	Ohms	Ohms	Ohms	Ohms
3000	7500	20K	50K	175K
4000	8000	25K	75K	200K
5000	10K	30K	100K	225K
600	12K	35K	125K	250K
	15K		150K	

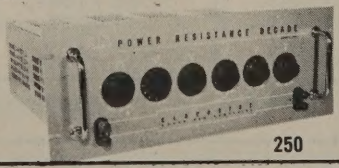
Ohms	Ohms	Ohms	Ohms	Ohms
2500	7500	25K	60K	
3000	10K	30K	75K	
4000	15K	40K	100K	
5000	20K	50K		

Ohms	Ohms	Ohms	Ohms	Ohms
2500	7500	25K	50K	
3000	10K	30K	60K	
5000	15K	40K	75K	
	20K		100K	

Ohms	Ohms	Ohms	Ohms	Ohms
2500	7500	20K	40K	100K
3000	10K	25K	50K	
5000	12K	30K	60K	
	15K		75K	

POWER RESISTOR DECADE BOX

240C



250

The Resistance Decade Box, Model 240-C for bench use — Model 250 for rack mounting, provides any resistance from 1 to 999,999 ohms for working circuits at the flip of a switch. Six front-panel dials enable selection in 1 ohm increments, the total value being read directly from the dial. Each decade has a power rating of 225 watts maximum, 1,000 Vdc or 660 Vac maximum.

Resistance changing switches are of the type that prevent a resistance breakdown between steps, thus protecting delicate meters and measuring instruments in the circuit. Knobs indicate the resistance value being used at a glance.

Clarostat GREENOHM Power Resistors are used throughout. These components are wire-wound power resistors on ceramic tubes and coated with an exclusive Clarostat vitreous enamel providing the most rugged, long-lasting, trouble-free power resistor available. The resistors are mounted in rigid metal supports. Overall length: 240C: 13″ long x 8½″ deep x 5¾″ high, weight 11½ lbs. 250: 19″ long x 13¾″ deep x 7″ high (fits in standard 19″ relay rack, weight 18½ lbs.

Suggested Uses: Resistance determination, Load Resistance, Meter Multiplier, Calibrating Meters, providing any desired ohmage as a universal power resistor.

Decade No.	1	2	3	4	5	6
Max. Current Rating (amps)	5	1.5	.5	.15	0.5	.005
Resistance Tolerance	5%	2%	2%	2%	2%	2%

CLAROSTAT MFG. CO., INC. / DEPT. EM / DOVER, N.H. 03820 / TEL: (603) 742-1120 / TWX: 510-297-4455

CLAROSTAT POWER RESISTORS

ADJUSTABLE RESISTORS

VITREOUS ENAMEL/ GREENOHM V™

Same construction as Greenohm V fixed resistors. Tolerance: ±10%. **Core Size:** VP-10-FA, 1-3/4" x 5/16" dia.; VP-25-KA, 2" x 9/16" dia.; VP-50-KA, 4" x 9/16" dia.; VP-75-KA, 6" x 9/16" dia.; VK-100-NA, 6-1/2" x 3/4" dia.; VK-160-WA, 8-1/2" x 1-1/8" dia.; VK-200-WA, 10-1/2" x 1-1/8" dia.

STOCK VALUES

12 TO 75-WATT

12-WATT SERIES VP-10-FA   Standard Pk: 1 Per Carton

Ohms	Ohms	Ohms	Ohms	Ohms
1	50	500	2500	8000
2	75	600	3000	8500
3	100	750	3500	9000
5	150	800	4000	10K
7.5	200	1000	4500	
10	250	1250	5000	
15	300	1500	6000	
20	350	2000	7000	
25	400	2250	7500	

25-WATT SERIES VP-25-KA

Ohms	Ohms	Ohms	Ohms	Ohms
1	50	750	3500	9000
2	75	800	4000	10K
3	100	1000	4500	12K
5	150	1250	5000	15K
7.5	200	1500	6000	20K
10	250	2000	7000	25K
15	300	2250	7200	
20	400	2500	7500	
25	500	3000	8000	

50-WATT SERIES VP-50-KA

Ohms	Ohms	Ohms	Ohms	Ohms
1	100	1250	6000	25K
2	150	1500	7000	30K
3	200	2000	7200	35K
4	250	2250	7500	40K
5	300	2500	8000	50K
10	400	3000	9000	60K
20	500	3500	10K	75K
25	750	4000	12K	80K
50	800	4500	15K	100K
75	1000	5000	20K	

75-WATT SERIES VP-75-KA

Ohms	Ohms	Ohms	Ohms	Ohms
1	200	2000	7200	35K
2	250	2250	7500	40K
3	300	2500	8000	45K
4	400	3000	9000	50K
5	500	3500	10K	60K
10	750	4000	12K	80K
15	800	4500	15K	100K
25	1000	5000	20K	
50	1250	6000	25K	
100	1500	7000	30K	

100 TO 225-WATT

100-WATT SERIES VK-100-NA

Ohms	Ohms	Ohms	Ohms	Ohms
1	25	400	3500	40K
2	50	500	5000	50K
3	100	750	10K	75K
4	150	1000	15K	100K
5	200	1500	20K	
10	250	2000	25K	
15	300	2500	30K	

175-WATT SERIES VK-160-WA

Ohms	Ohms	Ohms	Ohms	Ohms
1	10	250	5000	30K
2	25	500	10K	40K
3	50	1000	15K	50K
4	100	1500	20K	75K
5	150	2500	25K	100K

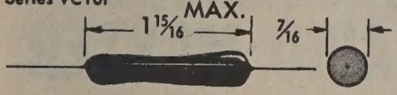
225-WATT SERIES VK-200-WA

Ohms	Ohms	Ohms	Ohms	Ohms
1	20	200	2500	30K
2	25	250	5000	40K
3	50	300	10K	50K
4	75	500	15K	75K
5	100	1000	20K	100K
10	150	1500	25K	

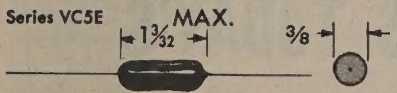
FIXED RESISTORS AXIAL LEAD

AXIAL LEAD 3.25, 6.5 AND 11 WATTS —SERIES VC

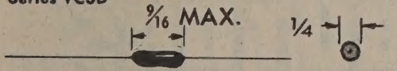
Series VC10F



Series VC5E



Series VC3D



Lead Length: 1½"   **Lead Diameter: .032**

Axial lead resistors are particularly adapted to printed circuit, terminal board, and point-to-point wiring applications. These resistors save considerable space because of the elimination of mounting brackets and terminal lugs. Standard resistance tolerance is ±5% for 1 ohm and higher and tolerance below 1 ohm is ±10%. Finished with Clarostat's new vitreous shade of teal green.

3.25-WATT SERIES VC3D

Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
1	10	27	50	125	270
1.5	12	30	56	150	300
2	15	33	68	180	330
3	18	35	75	200	350
4	20	39	82	220	390
5	22	40	100	225	400
7.5	25	47	120	250	450

STANDARD PK: 10 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
470	800	1.5K	2.7K	4.7K	8K
500	820	1.75K	3K	5K	8.2K
560	900	1.8K	3.3K	5.6K	9K
600	1K	2K	3.5K	6K	10K
680	1.1K	2.2K	3.9K	6.6K	
700	1.2K	2.25K	4K	7K	
750	1.25K	2.5K	4.5K	7.5K	

6.5-WATT SERIES VC5E

Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
1	12	30	68	180	350
1.5	15	33	75	200	390
2	18	35	82	220	400
3	20	39	100	225	450
4	22	40	120	250	470
5	25	47	125	270	500
7.5	27	50	150	300	560
10		56		330	

STANDARD PK: 10 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
600	1.1K	2.2K	4K	7K	17.5K
680	1.2K	2.25K	4.5K	7.5K	18K
700	1.25K	2.5K	4.7K	8K	20K
750	1.5K	2.7K	5K	8.2K	22K
800	1.75K	3K	5.6K	9K	22.5K
820	1.8K	3.3K	6K	10K	25K
900	2K	3.5K	6.8K	12.5K	
1K		3.9K		15K	

11-WATT SERIES VC10F

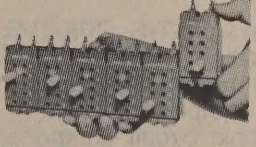
Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
1	12	30	68	180	350	600
1.5	15	33	75	200	390	680
2	18	35	82	220	400	700
3	20	39	100	225	450	750
4	22	40	120	250	470	800
5	25	47	125	270	500	820
7.5	27	50	150	300	560	900
10		56		330		1K

STANDARD PK: 10 PER CARTON

Ohms	Ohms	Ohms	Ohms	Ohms	Ohms	Ohms
1.1K	2.2K	4K	7K	12K	20K	39K
1.2K	2.25K	4.5K	7.5K	12.5K	22K	40K
1.25K	2.5K	4.7K	8K	13.5K	22.5K	45K
1.5K	2.7K	5K	8.2K	15K	25K	47K
1.75K	3K	5.6K	8.5K	16K	27K	50K
1.8K	3.3K	6K	9K	17.5K	30K	
2K	3.5K	6.8K	10K	18K	33K	
	3.9K		11K		35K	

PRECISION RESISTANCE DECADE BOX

MINIATURIZED CLARO-DEC



The most flexible innovation yet in precision resistance decade boxes, the Claro-Dec serves many applications with all the versatility needed for the job. Claro-Decs (within established parameters of current) are used whenever accurate steps of resistance values between .1 ohms and 900K ohms, ±1%* are required. Selection of desired steps of resistance is accomplished by insertion of a banana plug into the proper, marked front panel hole on the unit. Individual or multiple Claro-Dec units are flush panel or breadboard mounted with equal ease. Units may be physically ganged by sliding the molded-in tongue-and-groove together and electrically series connected with a supplied wire jumper or accessory banana plug.

Model	Total Res. of Decade (Ohms)	Resistance Per Step (Ohms)	Accuracy (+C)*	Maximum Current
260-1	0.9	0.1	±5%	1 Amp
260-2	9	1.0	±1%	350 Ma
260-3	90	10	±1%	100 Ma
260-4	900	100	±1%	35 Ma
260-5	9K	1K	±1%	10 Ma
260-6	90K	10K	±1%	3.5 Ma
260-7	900K	100K	±1%	1.0 Ma

*C-Contact resistance, .005-.03 ohms, typical, .01 ohms.

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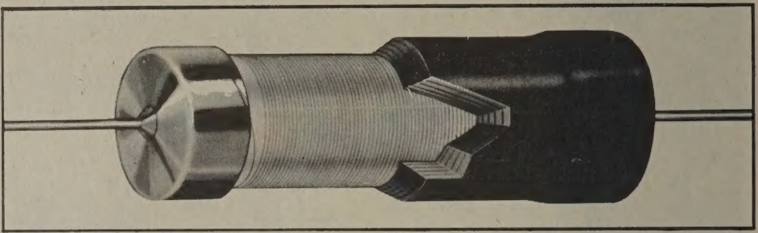
PRECISION WIREWOUND QUICK REFERENCE GUIDE



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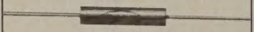
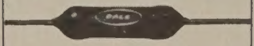
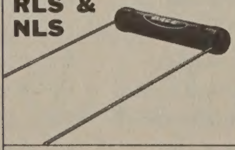
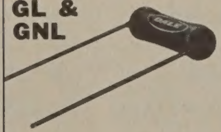
Coatings, housings, wire, cores—in each of these areas Dale has made definite contributions to the state of the art in precision wirewound resistors. Coupled with this are Dale-developed procedures in materials procurement and quality control which have established a constant high level of production excellence. The result is a comprehensive, reliable—and very competitive—line of standard resistors *plus* amazing flexibility in adapting to your special requirements. Examine this catalog, then give us a call—we are ready to help you.

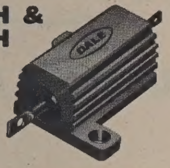
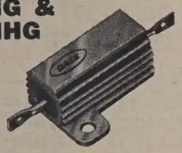
PRECISION POWER WIREWOUND

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL. SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS**
			DALE	MIL.	
RS & NS Molded Coated	Silicone coated and molded precision power wirewound resistor with outstanding stability and performance under severe environmental conditions. NS = Non-Inductive Counterpart	MIL-R-26E (Char. U & V)	RS-1A RS-2B RS-2C-23 RS-5-69 RS-5-70 RS-10-38 RS-10-39	RW-70 RW-79 RW-69 RW-74 RW-67 RW-78 RW-68	**Power:** .25, .4, .75, 1.0, 1.1, 2.5, 3, 3.25, 4, 5, 7 and 10 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1%, 3%, 5%
		MIL-R-23379	RS-1A RS-2C-23 RS-5 RS-10	RWP-18 RWP-20 RWP-21 RWP-23	
G & GN  Molded  Coated	Silicone coated and molded precision power wirewound resistor, utilizing beryllium oxide core for exceptional power-size ratio and stability. GN = Non-Inductive Counterpart	MIL-R-26E (Char. U & V) MIL-R-26C (Char. G & V)	G-1 G-3 G-5C G-10 G-15	RW-81 RW-80 RW-69 RW-67 RW-68	**Power:** 1, 1.5, 2.25, 4.0, 4.5, 5, 6, 7, 10 and 15 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1%, 3%, 5%
		MIL-R-23379	G-1 G-3 G-5C-2 G-10 G-15	RWP-17 RWP-19 RWP-20 RWP-21 RWP-23	
RLS & NLS 	Silicone coated precision power wirewound resistor with radial leads for printed circuit board mounting. NLS = Non-Inductive Counterpart	MIL-R-26E MIL-R-26C MIL-R-23379 (performance only)	No Mil. Models of this physical configuration		**Power:** 1.0, 1.1, 2.5, 3, 3.25, 4, 5, 7 and 10 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1%, 3%, and 5%
GL & GNL 	Silicone coated precision power wirewound resistor with beryllium oxide core. Radial leads for printed circuit board mounting. GNL = Non-Inductive Counterpart	MIL-R-26E MIL-R-26C MIL-R-23379 (performance only)	No Mil. Models of this physical configuration		**Power:** 2.25, 4, 4.5, 5, 6, 7, 10 and 15 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1%, 3%, 5%
LVR 	Silicone molded precision power wirewound resistor with extremely low resistance values and T.C.	None	No Mil. Models of this physical configuration		**Power:** 2, 5, 10 watt sizes **Resistance Range:** .008 to .800Ω, depending on size and tolerance **Resistance Tolerance:** 1%, 3%, 5%, 10%

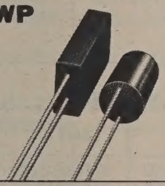
**This chart is intended to serve as a guide only, and listing does not indicate or imply qualification where equivalent Mil. types are shown Consult QPL or Dale representative for specific qualification information.*

*****Standard resistance ranges are shown. Consult factory for extended ranges.***

PRECISION POWER WIREWOUND (continued)

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL. SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS**
			DALE	MIL.	
RH & NH 	Precision power wirewound resistor designed to utilize maximum heat-sink effect of chassis mounting. Element is located inside aluminum housing. NH = Non-Inductive Counterpart	MIL-R-18546	* RH-5 RH-10 RH-25 RH-50 RH-100 RH-250 *Same series in NH styles	RE-60 RE-65 RE-70 RE-75 RE-77 RE-80	**Power:** 7.5, 12.5, 25, 50, 100 and 250 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1% and 3%
HG & NHG 	Precision power wirewound resistor with beryllium oxide core for exceptional power-size ratio and stability; designed to utilize maximum heat-sink effect of chassis mounting. NHG = Non-Inductive Counterpart	MIL-R-18546	* HG-5 HG-10 HG-25 HG-50 *Same series in NHG styles	RE-60 RE-65 RE-70 RE-75	**Power:** 15, 20, 35 and 50 watt sizes **Resistance Range:** .1Ω to 273KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1% and 3%
PH	Precision power wirewound resistor designed to mount through hole in chassis and utilize maximum heat-sink effect of chassis. Several terminal configurations available.	MIL-R-18546 (performance only)	No Mil. Models of this physical configuration		**Power:** 10, 25, 50 and 100 watt sizes **Resistance Range:** .1Ω to 95.2KΩ, depending on size and tolerance **Resistance Tolerance:** .05%, .10%, .25%, .5%, 1% and 3%

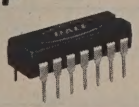
PRECISION BOBBIN WIREWOUND

WWA	Epoxy-molded precision bobbin (non-inductive) wirewound resistor with high stability and low T.C.; offers excellent moisture protection and low noise.	MIL-R-93	WWA-23 WWA-24 WWA-26 WWA-36 WWA-38 WWA-48 WWA-412 WWA-416	RB-56 RB-55 RB-54 RB-53 RB-52 RB-57 RB-58 RB-59	**Power:** .1, .125, .15, .20, .25, .33, .50, .75, .875 and 1 watt sizes **Resistance Range:** .1Ω to 23 Meg., depending on size and tolerance **Resistance Tolerance:** .05%, .1%, .25%, .5% and 1% are standard; special tolerances to .005% available
WWP 	Rectangular or round miniature epoxy-molded precision bobbin (non-inductive) wirewound resistors. High stability and low T.C. Excellent moisture protection and low noise. High resistance per unit volume.	MIL-R-93	WWP-225	RB-71	**Power:** 1/8 and 1/4 watt sizes **Resistance Range:** .1Ω to 1.5 Meg., depending on size and tolerance **Resistance Tolerance:** .02%, .05%, .1%, .25%, .5% and 1% are standard; special tolerances to .005% available

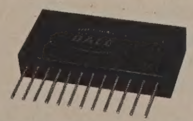
WIREWOUND CUSTOM FUSE RESISTOR

CFR	Hermetically sealed custom fuse resistor. Performs function of resistor and series fuse with predictable fusing times.	None	None	**Power:** 1/4, 1/2, 3/4, 1-1/2 and 2-1/2 watt sizes **Resistance Range:** .1Ω to 7.4KΩ, depending on fusing and wattage requirements **Fusing Times:** 1 millisecond to 1 second

WIREWOUND NETWORKS

WDP 	Molded 14-pin dual in-line package containing up to 7 precision wirewound resistors	None	None	**Power:** 3.5 watts max. (up to .5 watts/resistor) **Resistance Range:** 1Ω to 900Ω per resistor **Resistance Tolerance:** 1% to 5%

SPECIAL PURPOSE WIREWOUNDS

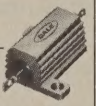
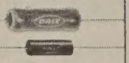
	Dale can furnish hundreds of special design variations for wirewound resistors. Special packaging, leads, resistance characteristics, pre-conditioning, matching and many other modifications can be supplied to your specifications.

DALE®

ESTABLISHED RELIABILITY QUICK REFERENCE GUIDE

Produced under strictest fabricating and testing conditions. Backed by nearly a decade of experience in development and production of established reliability components. Capabilities include flexible reliability programs tailored to your specific needs.

WIREWOUND STYLES

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPECS.	CONDENSED DALE SPECIFICATIONS		EQUIV. MIL. TYPES**		
			POWER (WATTS)	RESISTANCE RANGE (OHMS)	MIL.	DALE	
ARH 	Established reliability power wirewound resistors designed to utilize maximum heat-sink effect of chassis mounting.	MIL-R-39009 Standard Resistance Tolerance=1%	5	1 to 1.65K	RER40	ARH-5-13	ENH-5
			10	1 to 2.8K	RER45	ARH-10-13	ENH-10
			20	1 to 6.04K	RER50	ARH-25-13	ENH-25
			30	1 to 19.6K	RER55	ARH-50-13	ENH-50
ERH **ENH**	ARH documented failure rate better than 0.01%/1000 hours. ERH & ENH documented failure rate better than 1%/1000 hours. ENH=non-inductive style.		5	.1 to 3.32K	RER60	ARH-5	ERH-5
			10	.1 to 5.62K	RER65	ARH-10	ERH-10
			20	.1 to 12.1K	RER70	ARH-25	ERH-25
			30	.1 to 39.2K	RER75	ARH-50	ERH-50
ARS **AGS** 	Established reliability power wirewound resistors. Documented failure rate better than 0.01%/1000 hours.	MIL-R-39007 Standard Resistance Tolerance=1%	2*	.1 to 16.2K	RWR71S	ARS-2-60	
			2	.1 to 16.2K	RWR71W	ARS-2-61	
			5*	.1 to 12.1K	RWR74S	ARS-5-60	ESS-5
			5	.1 to 12.1K	RWR74W	ARS-5-61	ESW-5
			10*	.1 to 40K	RWR78S	ARS-10-60	ESS-10
			10	.1 to 40K	RWR78W	ARS-10-61	ESW-10
			2*	.1 to 3.16K	RWR80S	AGS-3-60	EGS-3
			2	.1 to 3.16K	RWR80W	AGS-3-61	EGW-3
ESS ESW **EGS EGW** **ESN EGN**	ESS, EGS, ESN & EGN–Solderable leads. ESW & EGW–Weldable leads. ARS, ESS & ESW–Alumina core. AGS, EGS, & EGW–Beryllium oxide core.		1*	.1 to 1K	RWR81S	AGS-1-60	EGS-1
			1	.1 to 1K	RWR81W	AGS-1-61	EGW-1
			1.5	.1 to 1300	RWR82S	AGS-2-60	EGS-2
			1.5	.1 to 1300	RWR82W	AGS-2-61	EGW-2
			7*	.1 to 12,400	RWR84S	AGS-10-60	EGS-10
			7	.1 to 12,400	RWR84W	AGS-10-61	EGW-10
			3*	.1 to 4120	RWR89S	AGS-5-60	ESS-2B
			3	.1 to 4120	RWR89W	AGS-5-61	ESW-2B

FILM STYLES

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPECS.	CONDENSED DALE SPECIFICATIONS		EQUIV. MIL. TYPES**		
			POWER (WATTS)	RESISTANCE RANGE (OHMS)	MIL.		DALE
EMF	Established reliability epoxy molded metal film resistor. Documented failure rate better than .001%/1000 hours.	MIL-R-55182	1/20	10 to 796K	RNR50	RNC50	EMF50-100
			1/10	10 to 1.21 Meg.	RNR55	RNC55	EMF55-1 or -100
			1/8	10 to 1.00 Meg.	RNR60	RNC60	EMF60-1 or -100
			1/4	30.1 to 1.00 Meg.	RNR65	RNC65	EMF65-1
			1/2	49.9 to 2.49 Meg.	RNR70	RNC70	EMF70-1
			1	24.9 to 4.02 Meg.			EMF75
EMF	Established reliability epoxy molded or coated metal film resistor for higher tolerance applications.	MIL-R-39017	1/8	10 to 300K	RLR-05		EMF 50-10
			1/8	10 to 2.49 Meg.	RLR-07		ERL-07
			1/2	4.3 to 3.01 Meg.	RLR-20		ERL-20

TRIMMER POTENTIOMETERS

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPECS.	CONDENSED DALE SPECIFICATIONS		EQUIV. MIL. TYPES**	
			POWER (WATTS)	RESISTANCE RANGE (OHMS)	MIL.	DALE
1800	Established reliability trimmer available with printed circuit pins or stranded teflon leads.	MIL-R-39015 M (1%) and P (.1%) levels	3/4	10 to 20K	RTR-12	1880 1897

Non-inductive styles (ARS-X-118, AGS-X-118, ESN-X, EGN-X) available (RWRXXN)

***This chart is intended to serve as a guide only, and listing does not indicate or imply qualification where equivalent Mil. types are shown. Consult QPL or Dale representative for specific qualification information.*

For complete information, contact:

DALE ELECTRONICS, INC.
Box 609, Columbus, Nebraska 68601.
Phone: 402-564-3131

DALE®

INDUSTRIAL WIREWOUND POWER RESISTORS SILICONE COATED

QUICK REFERENCE GUIDE

For complete information, contact:

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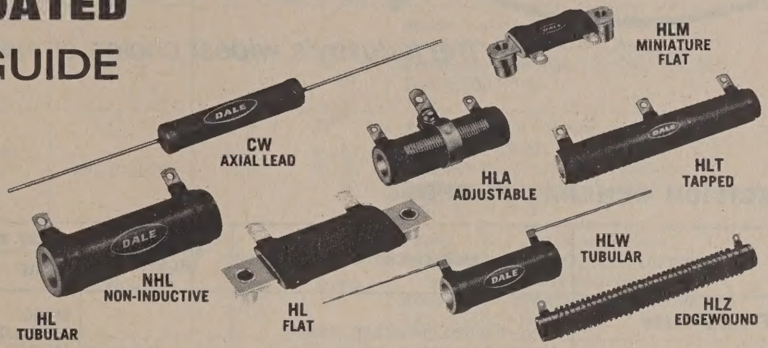


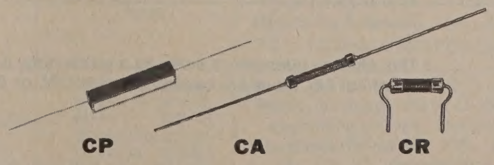
TYPE	APPLICATION	APPLICABLE* MIL SPEC AND TYPES	WATTAGE RATING	RESISTANCE RANGE	CORE SIZES	TERMINALS	MOUNTINGS	TOLERANCE
HL Flat	For limited space requiring high power-to-size ratio. Vertical or horizontal stacking.	MIL-R-26 RW-20 thru RW-24	30-95 watts	.1 ohm to 550K ohms	Length 1¼ to 6″	Lugs	Thru mount with spacers	±5% (10% below 1 ohm)
HLM Miniature Flat	For limited space, high power-to-size requirements particularly in high vibration areas.	None	10-20 watts	.1 ohm to 65K ohms	Length 3/4 to 2-1/16″	Lugs	Thru mount with spacers	±5% (10% below 1 ohm)
HL Tubular	General purpose wirewound resistors with a broad power range.	MIL-R-26 RW-29, 30, 31, 32, 33, 35, 36, 37 38, 47	5-225 watts	.1 ohm to 1.6 Megohms	O.D. 1/4 to 1-1/8″ Length 1-10½″	Lugs	Push-in bracket or thru-bolt	±5% (10% below 1 ohm)
HLW Tubular	General application where terminal wires are required for direct electrical connection	None	3-20 watts	.1 ohm to 90K ohms	O.D. 13/64 to 7/16″ Length 7/16″ to 2″	Lugs with terminal wires	Terminals, thru-bolt or push-in bracket	±5% (10% below 1 ohm)
HLA Adjustable	For resistance or voltage adjustment	MIL-R-19365C RX-29, 32, 33, 35, 36 37, 38, 47	12-225 watts	1 ohm to 100K ohms	O.D. 5/16 to 1-1/8″ Length 1½ to 10½″	Lugs	Push-in bracket or thru-bolt	±5%
HLT Tapped	For voltage divider networks	MIL-R-26 RW-22, 23, 24, 33, 35, 36, 37, 38, 47	11-225 watts	.1 ohm to 1.1 Megohms	O.D. 5/16 to 1-1/8″ Length 1½ to 10½″	Lugs	Push-in bracket or thru-bolt	±10% each section (±10% total)
CW Axial Lead	Axial leads. For applications requiring high performance at low cost	MIL-R-26 RW-67, 68, 69	2.5-13 watts	.1 ohm to 100K ohms	Body Dia. .188 to .375″ Body Length .500 to 1.781″ Leads 1.5 to 2″	Leads	Terminals	±3%, ±5% (10% below 1 ohm
NHL Non-Inductive	High frequency circuits and applications requiring low inductive effect and minimum distributed capacity	None	5-225 watts	1 ohm to 90K ohms	O.D. 1/4 to 1-1/8″ Length 1-10½″	Lugs or Leads	Push-in bracket or thru-bolt	±5%
HLZ Edge-wound	For heavy duty requirements where space is at a premium High thermal capacity.	None	35-375 watts	.05 ohm to 32 ohms	O.D. 9/16 to 1-1/8″ Length 2 to 10-1/2″	Lugs	Push-in bracket or thru-bolt	±10%

***Note:** This chart is intended to serve as a guide only. Listings shown here or anywhere in this catalog do not indicate or imply qualification where equivalent Mil types are shown. Consult QPL or Dale representative for specific qualification information.

POWER WIREWOUND RESISTORS

High quality, premium grade resistance wire wound onto a woven fibreglass core.

Three types of low-cost resistors for kitchen appliances, automotive devices and entertainment devices.

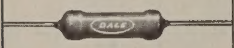
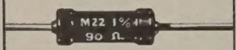
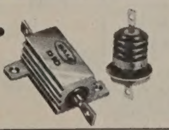


DALE®

FILM RESISTORS QUICK REFERENCE GUIDE

The industry's widest choice of metal, carbon and tin oxide styles.

PRECISION GENERAL PURPOSE

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS
			DALE	MIL.	
MF MIL-R-10509	Epoxy-molded metal film resistor designed to meet a variety of military and commercial applications; combines high stability with low noise and offers exceptional moisture protection.	MIL-R-10509F (Char. C, D and E)	MF50 MF-1/10 MF-1/8 MF-1/4 MFS-1/2 MF-1 MF-2	RN-50 RN-55 RN-60 RN-65 RN-70 RN-75 RN-80	**Power:** 1/20, 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes **Resistance Range:** 10Ω to 10 Meg., depending on size and T.C. **Resistance Tolerance:** .1%, .25%, .5%, 1% **T.C.:** ±25, ±50, ±100, ±150 PPM standard
CMF MIL-R-10509	Designed to meet a variety of military and commercial applications. Epoxy roll coated. Flame retardant coating.	MIL-R-10509	CMF-55 CMF-60 CMF-65	RN-55 RN-60 RN-65	**Power:** 1/10, 1/8, 1/4 watt sizes **Resistance Range:** 10Ω to 2 Meg., depending on size and T.C. **Resistance Tolerance:** .1%, .25%, .5%, 1% **T.C.:** ±25, ±50, ±100, ±150, ±200 PPM standard
CMF MIL-R-22684	Metal film resistor with flame retardant epoxy coating. Designed to meet a variety of military and commercial applications; combines high stability, low noise, high power vs. small size and low cost.	MIL-R-22684	CMF-07 CMF-20	RL-07 RL-20	**Power:** 1/4 and 1/2 watt sizes **Resistance Range:** 4.3Ω to 470KΩ depending on size and T.C. **Resistance Tolerance:** 2%, 5% **T.C.:** ±200 PPM standard
MFF & CMF 	Metal film resistors with flame retardant epoxy coating. Meet electrical requirements of MIL-R-10509 and MIL-R-22684.	MIL-R-10509 MIL-R-22684 (reference only)	CMF-1/10 MFF-1/8 CMF-1/8 MFF-1/4 MFF-1/2 CMF-1/4 MFF-1 MFF-2	None	**Power:** 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes **Resistance Range:** 10Ω to 10 Meg., depending on size and tolerance **Resistance Tolerance:** 5%, 2%, 1%, .5%, .25%, .1% **T.C.:** ±25, ±50, ±100, ±150, ±200 PPM standard
M (High Value) 	High value (to 100 Meg.) metal film resistor. Multi-layer protective coating.	None	M20 M22 M13 M14	None	**Power:** 1/8, 1/4, 1/2, 1, 2 watt sizes **Resistance Range:** 10Ω to 100 Meg., depending on size and tolerance **Resistance Tolerance:** .5%, 1% standard **T.C.:** ±100, ±150 PPM standard
MC	Epoxy molded carbon film resistor, designed to meet a variety of military and commercial applications; offers exceptional moisture protection.	MIL-R-10509F (Char. B & D)	MC-1/10 MC-1/8 MC-1/4 MCS-1/2 MC-1 MC-2	RN-55 RN-60 RN-65 RN-70 RN-75 RN-80	**Power:** 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes **Resistance Range:** 1Ω to 125 Meg., depending on size and tolerance **Resistance Tolerance:** .5%, 1%, 2%
DC	Epoxy roll-coated carbon film resistor; offers small physical size and low cost performance.	MIL-R-10509D (Char. X, also Char. B performance)	DC-1/10 DC-1/8 DC-1/4 DCS-1/2 DC-1 DC-2	– – RN-10 RN-20 RN-25 RN-30	**Power:** 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes **Resistance Range:** 1Ω to 125 Meg., depending on size and tolerance **Resistance Tolerance:** .5%, 1%, 2%
D & P 	Precision power film resistors molded into an aluminum housing for complete environmental protection and high stability. Mount to or through chassis. Wide resistance range, low reactance at high frequencies.	None	D5 D10 D15 P8 P8A	None	**Power:** D=4, 8, 12 watt sizes. P=8 watts **Resistance Range:** 50Ω to 2.6 Meg., depending on size **Resistance Tolerance:** 1% and 2% standard

** This chart is intended to serve as a guide only, and listing does not indicate or imply qualification where equivalent Mil. types are shown. Consult QPL or Dale representative for specific qualification information.*

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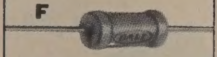
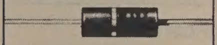
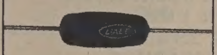
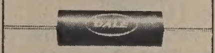
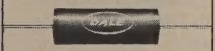
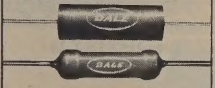
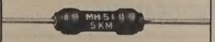
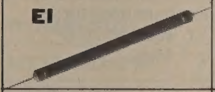
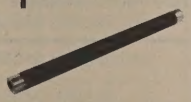
DALE ELECTRONICS, INC., Box 74, Norfolk, Nebraska 68701 • Phone: 402-371-0080

INDUSTRIAL GENERAL PURPOSE

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS
			DALE	MIL.	
F 	Flameproof power film resistor with high power/size ratio.	None	F69	None	**Power:** 3 watts **Resistance Range:** 5Ω to 1 Meg. **Resistance Tolerance:** 1%, 2%, 5%, 10% **T.C.:** ±200 PPM
F07 **F20** 	Miniature molded oxide resistor. Meets MIL-R-22684 requirements. Ideal replacement for 5% carbon composition types.	MIL-R-22684	F07 F20	RL-07 RL-20	**Power:** 1/4 and 1/2 watt sizes **Resistance Range:** 10Ω to 470KΩ, depending on size and tolerance **Resistance Tolerance:** 2% and 5% standard. **T.C.:** ±200 PPM
FP 	Power oxide resistor with flame retardant coating. Excellent ability to withstand overloads.	None	FP32 FP33 FP34 FP35	None	**Power:** 4, 6, 8 and 10 watt sizes. **Resistance Range:** 100 to 68KΩ, depending on size and tolerance **Resistance Tolerance:** 5%, 10% standard **T.C.:** ±350 PPM

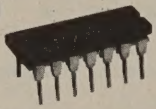
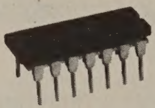
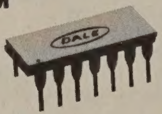
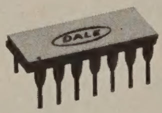
SPECIAL PURPOSE

HMF 	Epoxy-molded metal film resistor; combines high resistance and precision characteristics.	MIL-R-10509F (performance only)	HMF50 HMF-1/10 HMF-1/8 HMF-1/4 HMF-1/2 HMF-1	None	**Power:** 1/20, 1/10, 1/8, 1/4, 1/2, and 1 watt sizes **Resistance Range:** 100KΩ to 30 Meg., depending on size and T.C. **Resistance Tolerance:** ±1% standard **T.C.:** ±25, ±50, ±100, ±150 PPM standard
LMF 	Epoxy-molded metal film resistor; combines low resistance and precision characteristics.	MIL-R-10509F (performance only)	LMF-1/10 LMF-1/8 LMF-1/4 LMF-1/2	None	**Power:** 1/10, 1/8, 1/4 and 1/2 watt sizes **Resistance Range:** 1Ω to 30Ω, depending on size and T.C. **Resistance Tolerance:** ±1% standard **T.C.:** ±50, ±100, ±150 PPM standard
Low T.C. 	Standard Low T.C.'s on MF, MFF and CMF styles, retaining outstanding features of each.	MIL-R-10509F (performance only)	CMF-1/10 MFF-1/8 MF-1/8 CMF-1/8 MFF-1/4 MF-1/4 MFF-1/2 MFS-1/2	None	**Power:** 1/8, 1/4 and 1/2 watt sizes **Resistance Range:** 30.1Ω to 750KΩ, depending on size and T.C. **Resistance Tolerance:** .1%, .25%, .5%, 1% **T.C.:** ±10, ±15, ±20 PPM standard
A **(Low Value)**	Ultra low value metal oxide resistor. Molded and coated styles meet environmental specifications of MIL-R-22684.	None	A20 A31 A32	None	**Power:** 1/2, 2 and 3 watt-sizes **Resistance Range:** 0.27Ω to 27Ω, depending on size and tolerance **Resistance Tolerance:** 1%, 2%, 5% standard **T.C.:** From <200 PPM to < 500 PPM
MH51 **MH52** **M51** 	Ultra high value resistor—to 1,000KM with superior stability and consistent voltage coefficient. M51 hermetically sealed in glass; others protected by polyolefin sleeve.	None	None		**Power:** 1/4 and 1/2 watt sizes **Resistance Range:** 10M to 1,000KM, depending on size and tolerance **Resistance Tolerance:** 1%, 2%, 5%, 10% and 20% **T.C.:** ±1200, ±1500 and ±1800 PPM
EI 	High voltage metal film resistor combining high resistance and power capabilities.	None	EI1510 EI1511	None	**Power:** 5 watts **Resistance Range:** 100Ω to 20K Meg. **Resistance Tolerance:** .5%, 1%, 2%, 5%, 10%, 20%
I 	High frequency load resistor for applications involving high power, high accuracy RF measurements.	None	None		**Power** (Free Air Rating): 2, 10, 40 and 120 watt sizes **Resistance Range:** 25Ω to 300Ω, depending on size and tolerance **Resistance Tolerance:** 2% and 5% standard **T.C.:** 250 PPM maximum
F43 **F44**	Very high voltage resistor designed for pulse loading and surge discharge.	None	None		**Power:** 1/2 and 1 watt sizes **Resistance Range:** 2 Meg. to 10,000 Meg., depending on size and tolerance **Resistance Tolerance:** 2%, 5%, 10% **T.C.:** –1200 to –2000 PPM typical
F53D **F535D** **F54D**	High voltage industrial grade resistor. Protected by polyolefin sleeve.	None	None		**Power:** 1, 1-1/2 and 2 watt sizes **Resistance Range:** 2 Meg. to 1,000 Meg. depending on size and tolerance **Resistance Tolerance:** 10% and 20% standard **T.C.:** –1200 to –1500 PPM typical
MFH & DCH	Type MFH=Metal Film Type DCH=Carbon Film Designed to meet a variety of military and commercial applications.	MIL-R-10509	MFH-1/10 MFH-1/4 MFH-1 DCH-1/10 DCH-1/4 DCH-1	RN-55 RN-60 RN-75 RN-55 RN-60 RN-75	**Power:** 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes **Resistance Range:** 2Ω to 15 Meg., depending on type, size and tolerance **Resistance Tolerance:** .10%, .25%, .5%, 1%, 2%, depending on type

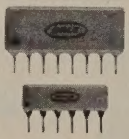
DALE® RESISTOR NETWORKS QUICK REFERENCE GUIDE

THICK FILM, DIP, SIP and FLAT PACK STYLES

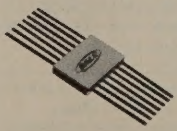
DIP STYLES

TYPE	BASIC DESCRIPTION	NO. OF PINS	CONDENSED SPECIFICATIONS
CDM 	DIP style with flat ceramic top. Epoxy coating. Suitable for automatic insertion. Designed to meet MIL-R-83401.	14, 16	**Power Rating:** .20 watt maximum/resistor; maximum/package = 1.6 watts at 70°C **Resistance Range:** 10Ω to 1 Meg. **Tolerance:** ±1%, ±2%, ±5%, ±10% **T.C.:** ±300 PPM/°C, ±100 PPM/°C
LDP 	DIP style with epoxy coating between ceramic sandwich. Suitable for automatic insertion.	14, 16, 18	**Power Rating:** .20 watt maximum/resistor; maximum/package = 2.70 watts (18-01) at 70°C **Resistance Range:** 10Ω to 1 Meg. **Tolerance:** ±1%, ±2%, ±5%, ±10%, ±20% **T.C.** ±250 PPM/°C, ±100 PPM/°C available
SDM 	DIP style with sandwich-type construction. Designed to meet MIL-R-83401. 100% conditioning per Group A.	14, 16	**Power Rating:** .20 watt maximum/resistor; maximum/package = 1.6 watts at 70°C **Resistance Range:** 10Ω to 1 Meg., depending on tolerance **Tolerance:** ±1%, ±2%, ±5% **T.C.** ±300 PPM/°C, ±100 PPM/°C
SDP 	DIP style with sandwich-type construction. Compact resistor circuits for up to 28 resistors. Ideal for special requirements since both top and bottom ceramics are available for circuit design.	14, 16, 18	**Power Rating:** .20 watt maximum/resistor; maximum/package = 2.70 watts (18-01) at 70°C **Resistance Range:** 10Ω to 1 Meg., depending on tolerance **Tolerance:** ±1%, ±2%, ±5%, ±10%, ±20% **T.C.:** ±250 PPM/°C, ±100 PPM/°C available

SIP STYLES

TYPE	BASIC DESCRIPTION	NO. OF PINS	CONDENSED SPECIFICATIONS
CSP 	Single in-line packages with flame retardant epoxy coating. Built-in standoffs. Choice of .250" or .350" maximum seated height. Lead spacings .100" and .125".	6, 8, 10	**Power Rating:** .20 watt maximum/resistor; maximum/package = 1.6 watts at 70°C **Resistance Range:** 10Ω to 1 Meg., depending on tolerance **Tolerance:** ±1%, ±2%, ±5%, ±10%, ±20% **T.C.:** ±250 PPM/°C, ±100 PPM/°C available

FLAT PACK STYLES

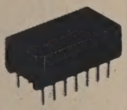
TYPE	BASIC DESCRIPTION	NO. OF PINS	CONDENSED SPECIFICATIONS
DFM, DFP 	Compact, thick film flat pack. Designed to meet MIL-R-83401. DFM has 100% conditioning per Group A. Ceramic enclosure. Two internal configurations provide 7 or 13 resistors.	14	**Power Rating:** Depending on configuration, .05 watt or .025 watt/resistor (DFM). .2 watt or .1 watt/resistor (DFP). Maximum/package = .65 watt (DFP); .45 watt (DFM). **Resistance Range:** 10Ω to 1 Meg., depending on tolerance **Tolerance:** ±1%, ±2%, ±5% **T.C.:** ±300 PPM/°C, ±250 PPM/°C, ±100 PPM/°C

CHIP RESISTORS and DISCRETE NETWORKS

CHIP RESISTORS

TYPE	BASIC DESCRIPTION	NO. OF PINS	CONDENSED SPECIFICATIONS
RC, RCW	Thick film chip resistor with choice of sizes to allow wide design flexibility in hybrid circuitry.	None	**Power Rating:** 75, 100, 150 and 300 mw **Resistance Range:** 2Ω to 15 Meg. **Tolerance:** ±1%, ±2%, ±5%, ±10%, ±20% **T.C.:** ±250 PPM/°C

DISCRETE NETWORKS

TYPE	BASIC DESCRIPTION	NO. OF PINS	CONDENSED SPECIFICATIONS
SPR-ARO 	DIP style with up to 11 discrete resistive elements. For use where tight tolerance and low temperature coefficient are required. Meets functional requirements of MIL-R-10509 and MIL-R-55182.	14, 16	**Power Rating:** .1 watt maximum/resistor; maximum/package = 1 watt **Resistance Range:** 10Ω to 400KΩ **Tolerance:** ±.05% to 5% **T.C.:** ±10 PPM/°C to ±200 PPM/°C
SPECIALS	Discrete precision wirewound and film resistors packaged to your requirements and providing broad flexibility in meeting electrical and physical requirements.		

REJECTION FILTER

	Low cost, small size. In 50, 60, 150 Hz models. Moderate attenuation. Plastic case.

MIL-R-83401 CHARACTERISTICS SUMMARY

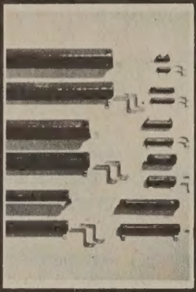
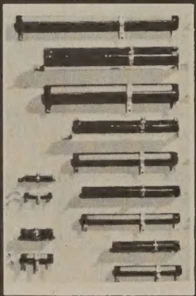
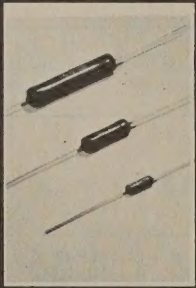
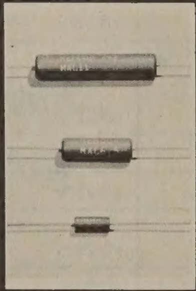
MILITARY STYLE	CHAR. H	CHAR. K	CHAR. M
RZ010 (M8340101)	——	SDM14, CDM14	SDM14, CDM14
RZ020 (M8340102)	——	SDM16, CDM16	SDM16, CDM16
RZ030 (M8340103)	——	DFM14	DFM14
RZ040 (M8340104)	——	SIP06A EQUIV.	SIP06A EQUIV.
RZ050 (M8340105)	——	SIP08A EQUIV.	SIP08A EQUIV.
Resistance Temp. Characteristic	±50	±100	±300
Max. Ambient Temp. at Rated Wattage	70°C	70°C	70°C
Max. Ambient Temp. at Zero Power	125°C	125°C	125°C

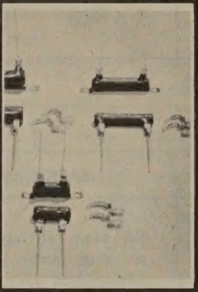
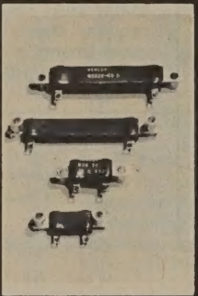
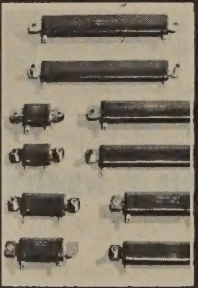
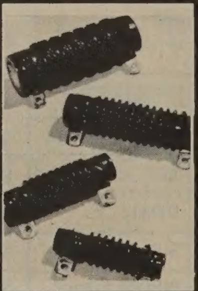
ENVIRONMENTAL TEST	CHAR. H MIL. MAX.	CHAR. K MIL. MAX.	CHAR. M MIL. MAX.
Thermal Shock	+0.25%	+0.50%	+0.50%
Power Conditioning	+0.50%	+0.50%	+0.50%
Low Temperature Operation	+0.10%	+0.25%	+0.50%
Short Time Overload	+0.10%	+0.25%	+0.50%
Terminal Strength	+0.25%	+0.25%	+0.25%
Resistance to Soldering Heat	+0.10%	+0.25%	+0.25%
Moisture Resistance	+0.40%	+0.50%	+0.50%
Shock	+0.25%	+0.25%	+0.25%
Vibration	+0.25%	+0.25%	+0.25%
Life	+0.50%	+0.50%	+2.0%
High Temp. Exposure	+0.20%	+0.50%	+1.0%
Low Temp. Exposure	+0.10%	+0.25%	+0.50%
Insulation Resistance	10,000 MegΩ	10,000 MegΩ	10,000 MegΩ
Resistance Tolerance	0.1(B), 0.5(D) 1.0(F)	0.5(D), 1.0(F) 2.0(G)	1.0(F), 2.0(G) 5.0(J)

For complete information, contact
DALE ELECTRONICS, INC.
Box 74, Norfolk, Nebraska 68701 • Phone 402-371-0080

E-SYSTEMS INC.
Memcor Division

WIRE WOUND RESISTORS

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
TYPE **FR** VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5 10 20 25 50 100 160 200	25K 50K 100K 100K 250K 100K 100K 100K	1 x 5/16 1¾ x 5/16 2 x 7/16 2 x 9/16 4 x 9/16 6½ x ¾ 8½ x 1⅛ 10½ x 1⅛
TYPE **AR** VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10 25 50 75 100 160 200	10K 25K 50K 50K 100K 100K 100K	1¾ x 5/16 2 x 9/16 4 x 9/16 6 x 9/16 6½ x ¾ 8½ x 1⅛ 10½ x 1⅛
TYPE **VL** VITREOUS ENAMEL AXIAL LEADS		3 5 10	10K 25K 50K	7/32 x 17/32 5/16 x 1 1/64 ⅜ x 1 25/32
TYPE **ML** MOLDED SILICONE AXIAL LEADS		1 2 3 6.5 11	2500 3500 10K 80.6K 200K	.125 x .437 .205 x .590 .242 x .525 .375 x .917 .375 x 1.828

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
TYPE **FR** w/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8 10-12 20	25K 50K 100K	1 x 5/16 1¾ x 5/16 2 x 7/16
TYPE **MZ** VITREOUS ENAMEL MIDGET OVALS WITH TABS		10 20	5000 25K	⅜ x 5/32 ⅜ x 5/32
TYPE **ZR** VITREOUS ENAMEL OVALS TAB TERMINAL		30 40 55	10K 15K 25K	5/16 x 1 5/16 x 1 5/16 x 1
TYPE **RR** VITREOUS ENAMEL EDGEWOUND WITH TABS		40 90 100 160 150 300 500 750 1500	1.8 3 2.5 5.5 6.0 13 36 40 100	2 x 9/16 4 x 9/16 3½ x ¾ 6 x ¾ 5 x 1 8½ x 1⅛ 10½ x 1⅝ 12 x 2½ 20 x 2½

E-SYSTEMS INC.

Memcor Division
DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

MEMCOR Components represent the cumulative design and production knowledge gained during 30 years experience in the industry.

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GENERAL RESISTANCE COMPONENTS

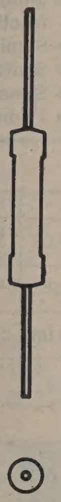
RESISTIVE COMPONENTS

POWER WIREWOUND RESISTORS, MIL-R-26/ MIL-R-39007 STYLES:

The POWER-OHM™ Series of silicone coated wirewound power resistors provides highly reliable continuous operation under the rigorous conditions of the appropriate Mil specs. Tinned copperweld leads are standard; weldable leads can be furnished.

Standard types are shown below; all other popular styles are available, including non-inductive types and a full range of sizes and power ratings using beryllium oxide cores. Consult the factory or your local representative.

Be sure to request a Power-Ohm price list, which shows quantity pricing for both stock and non-stock resistance values in ±0.05% to ±5% tolerances.



GEN. RES. TYPE	MIL TYPE*	POWER RATING (W) U .05% to 5%	V 3%, 5%	MAX. R(Ω)*	NOMINAL DIMENSIONS INCHES Dia.	Long	mm Dia.	Long	AWG Leads
PR11	RW(R)70U	1.0	1.25	10k	.094	.406	2.5	10	#24
PR22	RW(R)69V	2.5	3.25	33k	.218	.500	5.5	13	#18
PR33	RW(R)79U	3.0	3.75	25k	.187	.560	5	14	#20
PR44		3.25	4.75	42k	.188	.843	5	21	#20
PR55		4.0	5.5	47k	.250	.718	6.5	18	#18
PR66	RW(R)74U	5.0	6.5	90k	.312	.875	8	22	#18
PR77	RW(R)67V	5.0	6.5	95k	.312	.953	8	24	#18
PR88		7.0	9.0	155k	.312	1.234	8	31	#18
PR99	RW(R)78U/68V	10	13	275k	.375	1.796	9.5	46	#18

**Minimum resistance 100 milliohms typ.; both lower and higher values are available in most types. Mil specs limit maximum R to lower values than those shown. Maximum R available in non-inductive types is typically ½ of the values shown here.*

PRECISION WIREWOUND RESISTORS, MIL-R-93/MIL-R-39005 STYLES:

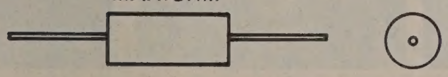
Several of our popular types of precision wirewound resistors are listed below (many other form factors are available); request detailed electrical and mechanical specifications.

Most types are stocked in "standard" resistance values; any can be ordered in special values to suit your needs. Tolerances normally offered are: ±0.1%, ±0.025%, and ±0.01% (also ±0.005% in most types), with other accuracies furnished as required.

Be sure to ask for price lists covering the types in which you are interested; they show quantity pricing for both "standard" and other values.

Higher resistance values than those shown can be achieved in each type; please consult the factory or your local representative.

ECONISTOR
MINIOHM
MAXIOHM



SQUARISTOR

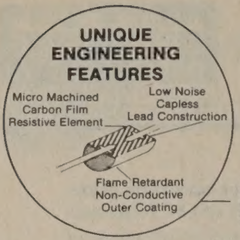
PLUGINSTOR

GENERAL RESISTANCE TRADEMARK	GEN. RES. TYPE	MAX. R(Ω)	NOMINAL DIMENSIONS INCHES	mm	Leads, AWG
ECONISTOR	8E16	700k	¼ dia x ½	6.5 x 13	Axial #22
"	8E24	1 Meg	¼ dia x ¾	6.5 x 19	Axial #20
MINIOHM	5E10	300k	5/32 dia x 5/16	4 x 8	Axial #24
SQUARISTOR	GR102	250k	0.295x0.1x0.32h	7.5x2.5x8	PC mtg #22
PLUGINSTOR	8P10	400k	¼ dia x 5/16 h	6.5 x 8	PC mtg #22
"	8P13	400k	¼ dia x 13/32 h	6.5 x 10	PC mtg #22
MAXIOHM	12E32	3.5 Meg	3/8 dia x 1	9.5 x 25	Axial #20
"	16E32	5 Meg	½ dia x 1	13 x 25	Axial #20

OTHER COMPONENT PRODUCTS INCLUDE:

Custom-designed networks, both active and passive, to fit your particular requirements. These products range from cold junction compensators to DC-DC converters as accurate as ±0.0025%. Consult the factory or your local representative.

GENERAL RESISTANCE, INC.
75 Haven Avenue
Mt. Vernon, New York 10553
(914) 699-8010 / TWX 710-562-0199


UNIQUE
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FEATURES
Micro Machined Carbon Film Resistive Element
Low Noise Capless Lead Construction
Flame Retardant Non-Conductive Outer Coating

CAPLESS CONSTRUCTION
ideally suited to
HI DENSITY board population.
Permits close to
the shoulder bends.

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2% CARBON FILM RESISTORS
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- Ceramic Caps. Discs, Feed Thru
- Ferrites
- Meters
- Motors, fractional H.P.
- Semi Conductors
- Switches
- Speakers
- Trimmer Pots

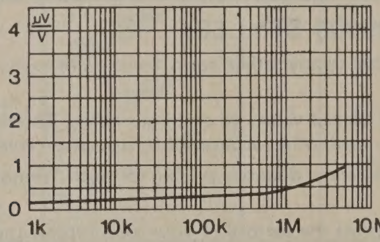
FEATURES

- △ High Stability
- △ Lowest Noise
- △ Smallest Dimensions
- △ Capless Design
- △ Meets MIL Specifications
- △ Extremely Long Life
- △ Produced And Checked By Automatic Equipment
- △ Failure Rate Less Than 10^8/Hour (MTTF More Than 10^8)
- △ Solderability as per MIL-STD-202
- △ Insulation Resistance Higher Than 10^9 Ohms
- △ Terminal Strength > 8 Lbs.
- △ Equivalents: MIL R-10509, MIL R-39, MIL R-11
- △ Color Code: MIL-STD-129
- △ Available With Weldable Leads

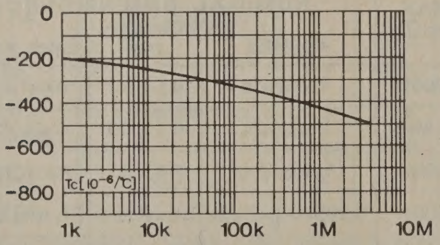
SPECIFICATIONS

TYPE	A	b	a	L_1	L_4	d	D	L
UPM ¼ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.236 + 0.039	1.457 ± 0.039	0.024	0.091 ± 0.08	$3.15^{+0.118}_{-0.079}$
UPM ¼ W (MM)	85-1	6	5 ± 0.2	6 + 1	37 ± 1	0.6	2.3 ± 0.2	80^{+3}_{-2}
UPM ½ W (INCHES)	3.35-0.039	0.236	0.197 ± 0.08	0.315 + 0.039	1.457 ± 0.039	0.027	0.111 ± 0.08	$3.15^{+0.118}_{-0.079}$
UPM ½ W (MM)	85-1	6	5 ± 0.2	8 + 1	36 ± 1	0.7	2.8 ± 0.2	80^{+3}_{-2}

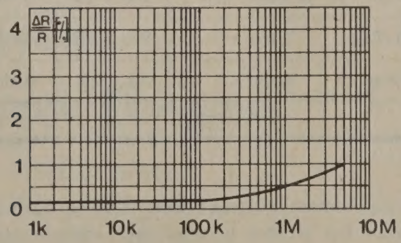
Current noise

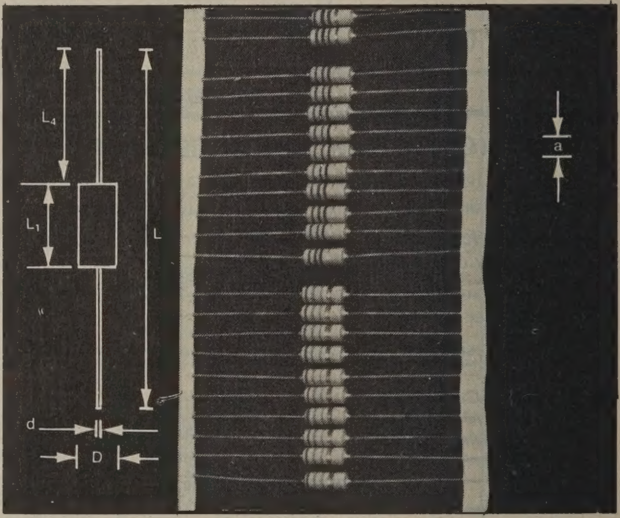


Temperature coefficient



Humidity





INCLUDE RESISTANCE RANGES

Wattage	Tolerance	Range
¼	5%	4.7Ω — 1 MegΩ
	2%	10Ω — 300KΩ
½	5%	4.7Ω — 4.7 MegΩ
	2%	10Ω — 1 MegΩ

MIL R-11 EQUIVALENT	MIL R-10509 EQUIVALENT
RC 07 and RC 12	RN 65 cat. b,d
RC 20 and RC 22	RN 70 cat. b,d

	MAX. Δ RES.
Humidity (Steady State)	± 1.00%
Life	± 1.00
Short Time Overload	± 0.50
After Soldering	± 0.25
Thermal Shock	± 0.25
Twist	± 0.25
Vibration	± 0.25

ISL PRODUCTS LTD. — EXCLUSIVE REPRESENTATIVES FOR ISKRA IN NORTH AMERICA
DEPT. EM / 50 WERMAN COURT / PLAINVIEW, NEW YORK 11803 / (516) 694-2686

KRL electronics, inc.

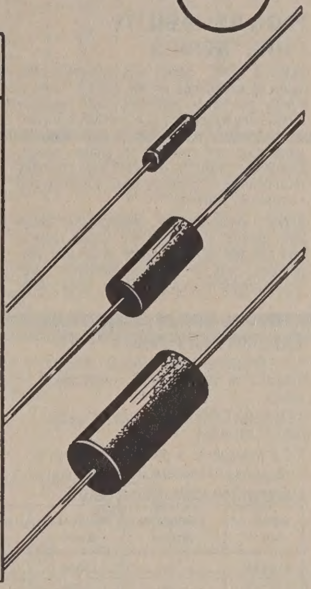
28 Bridge Street • Manchester, New Hampshire 03101
Tel. (603) 668-3210 • TWX (710) 220-1662

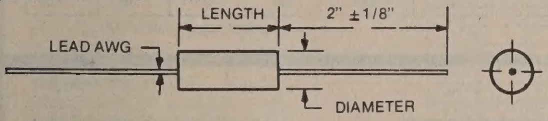
KRL Precision Wire Wound . . . Axial Lead Resistors

500 SERIES

KRL STYLE	MIL-R-93	MIL-R-39005	DIMENSIONS LENGTH ±.015	DIAMETER ±.015	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
532			.200	.100	24	.025	.050	100	100K
†533			.260	.100	24	.050	.100	100	150K
†534			.300	.100	22	.050	.100	100	150K
†535			.250	.125	22	.065	.125	150	300K
536			.312	.125	22	.075	.150	200	400K
537			.375	.125	22	.100	.200	200	500K
†538			.375	.187	22	.125	.250	300	600K
†540		RBR-74	.500	.187	22	.175	.350	300	1Meg
550		RBR-75	.295	.250	22	.125	.250	200	900K
555	RB-56	RBR-56	.375	.250	20	.175	.350	300	1Meg
†560	RB-55	RBR-55	.500	.250	20	.250	.500	400	2Meg
†565	RB-54	RBR-54	.750	.250	20	.375	.750	500	3.5Meg
570	RB-53	RBR-53	.750	.375	20	.450	.900	600	4Meg
575	RB-52	RBR-52	1.00	.375	20	.750	1.50	750	5Meg
578			.500	.500	20	.330	.660	400	2Meg
580	RB-57	RBR-57	1.00	.500	20	.850	1.75	850	10Meg
585	RB-58		1.50	.500	20	1.00	2.00	1.5KV	15Meg

†Indicates Most Popular Types.





TOLERANCES AVAILABLE:

Absolute accuracy for— 1. Precision Resistors from ±5% to ±.0025%
2. Power Resistors from ±10% to ±.01%
Ratio Matching in resistor sets available as close as ±.001%

TEMPERATURE COEFFICIENTS:

1. Standard temperature coefficient is ±10PPM/°C, slightly higher for low ohmic values.
2. Temperature coefficients are avialable as low as ±1PPM/°C, over a limited range.
3. T.C. Matching available as close as ±0.5PPM/°C at +25°C for matched sets.
4. T.C. TRACKING available as close as ±1PPM/°C over a limited range.
5. Special temperature coefficients available from +80PPM/°C to +6000PPM/°C.

STABILITY:

Precision Resistors— 0.001% for the first year, 0.0025% over a three year period.
Power Resistors— 0.003% for the first year, 0.005% over a three year period.

ENVIRONMENTAL REQUIREMENTS:

All KRL wire wound resistors meet or exceed the requirements of—
1. MIL-R-93 and MIL-R-39005 for Precision Resistors
2. MIL-R-26, MIL-R-39007 and MIL-R-18546 for Power Resistors.

KRL Economy Line Resistors

EC SERIES

KRL STYLE	DIMENSIONS LENGTH ±.062	DIAMETER ±.032	LEAD AWG‡	POWER in WATTS COMM	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
EC-10	.390	.100	24	.50	150	100K
EC-12	.530	.100	24	.50	150	120K
†EC-20	.390	.140	20	1.0	200	100K
†EC-22	.530	.140	20	1.2	200	120K
†EC-30	.390	.187	20	1.5	250	100K
†EC-32	.530	.187	20	1.7	250	150K
†EC-34	.560	.187	20	1.8	250	150K
EC-36	.812	.187	20	2.0	300	240K
†EC-40	.500	.250	20	2.0	300	200K
EC-42	.625	.250	20	2.5	300	220K
EC-45	.812	.250	20	2.7	350	250K
EC-50	.875	.312	18	2.8	350	300K
EC-55	1.00	.312	18	3.0	350	500K

†Indicates Most Popular Types

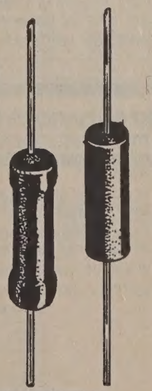
‡Lead diameter may vary by one gauge, depending on requirement.

KRL WIRE WOUND POWER RESISTORS:

P SERIES

KRL STYLE	MIL-R-26	MIL-R-39007	WATTAGE RATING		MAX. WORKING VOLTAGE(2)		MAXIMUM RESISTANCE IN OHMS(3)	DIMENSIONS LENGTH ±.062	DIAMETER ±.032	LEAD AWG(1)
			U	V	U	V				
P-½ A			.5	1.0	18	20	3.4K	.250	.094	24
P-½			.75	1.2	30	35	4.5K	.280	.094	24
P-1A	RW-70		1.0	1.5	50	55	10K	.406	.094	24
P-1B			1.1	1.6	62	67	12K	.530	.094	24
P-1C			1.0	1.5	28	33	5K	.330	.094	24
†P-2			1.5	2.0	72	79	10K	.385	.187	20
†P-2A	RW-79		3.0	3.75	135	148	22K	.560	.187	20
P-2B		RWR-71	3.25	4.75	185	220	42K	.812	.187	20
†P-2C			3.0	3.5	138	157	32K	.500	.250	20
†P-2D	RW-69		2.5	3.0	135	148	20K	.500	.187	20
†P-3			4.0	5.5	210	250	45K	.625	.250	20
†P-5	RW-74	RWR-74	5.0	6.0	325	375	90K	.875 ± .094	.312 ± .062	18
P-6	RW-67		6.0	6.5	360	400	95K	1.000 ± .094	.312 ± .062	18
P-7			7.0	8.0	360	400	100K	1.200 ± .094	.312 ± .062	18
P-7A	RW-55		7.5	9.0	510	580	150K	1.375 ± .094	.375 ± .062	18
†P-10			10.0	13.0	800	930	250K	1.815 ± .094	.375 ± .062	18
P-10A	RW-78	RWR-78	10.0	12.0	800	930	240K	1.780 ± .094	.375 ± .062	18
†P-10B	RW-68		10.5	14.0	800	930	275K	1.875 ± .094	.375 ± .062	18

†Indicates Most Popular Types.



CHARACTERISTIC V: Coated resistors are available in 3% and 5% tolerance only.

CHARACTERISTIC U: Coated or Molded resistors are available in any tolerance.

KELVIN Precision Wire-wound Resistors, Power Resistors & Resistor Networks

Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series was generated after years of experience on the Polaris, Gemini, Apollo and other important high reliability missile and space programs. Kelvin has combined the many and varied parameters of these programs into a single resistor series, designed to meet the stringent high reliability requirements of many of today's military and commercial systems.

Kelvin's reliability goal, through the design and controls of the "HRL" Series resistor and the use of acceptance inspection procedures, was to produce precision wire-wound resistors having failure rates better than .0005%/1000 hours at a 90% confidence level. Present level is .00064%/1000 hours at a 60% confidence level.

All "HRL" resistors have a documented history. This includes traceability from the spool analysis of the resistance wire, through each phase of the production operation to the finished product. Each resistor is screened to eliminate INFANT MORTALITY. This consists of a 100 hour burn in at full rated power at 125°C and a short time overload at twice the rated power. Other tests are conducted as outlined in Bulletin HR 02449, which presents the complete procedure and methods approach for production of "HRL" resistors.

KELVIN TYPE	WATTAGE*	RESISTANCE MAXIMUM**	DIA. ± .015	LENGTH ± .032	MAXIMUM VOLTS	LEAD DIA.	MIL-R-39005
HRL-20	.08	25K	.187	.375	150 V	#22	
HRL-991	.125	150K	.250	.312	150 V	#22	RBR-71
HRL-1009	.125	316K	.250	.295	150 V	#22	RBR-75
HRL-1097	.125	90K	.193†	.500	150 V	#22	RBR-74
HRL-417	.125	220K	.250	.343	150 V	#20	RBR-56
HRL-467	.150	332K	.250	.500	200 V	#20	RBR-55
HRL-334	.200	500K	.375	.500	300 V	#20	
HRL-812	.250	562K	.250	.750	300 V	#20	RBR-54
HRL-815	.333	1.1 meg	.375	.750	300 V	#20	RBR-53
HRL-1100	.500	600K	.312	.812	300 V	#20	RBR-76
HRL-254	.500	1.21 meg	.375	1.000	600 V	#20	RBR-52
HRL-27	.750	6.42 meg	.500	1.000	600 V	#20	RBR-57

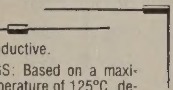
† ± .010 Tolerance

SUB-MINIATURE TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.



WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

COMBINATION AXIAL-RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
315-PAR	.05	100K	.080	.375	100	#24
303-PAR	.05	100K	.125	.250	100	#24
162-PAR	.10	200K	.125	.375	100	#22
158-PAR	.15	700K	.187	.375	100	#22

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ·1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-00	.05	100K	.080	.375	100	#24
1788-P	.04	50K	.100	.225	75	#24
460-P	.06	100K	.100	.281	100	#24
301-P	.05	175K	.125	.250	100	#24
EP-01	.10	200K	.125	.375	100	#22
470-P	.10	500K	.160	.500	100	#24
EP-20	.15	700K	.187	.375	200	#22
304-P	.15	500K	.250	.250	100	#22
430-P	.15	600K	.250	.312	100	#20
417-P	.20	700K	.250	.343	100	#20

PRINTED CIRCUIT TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

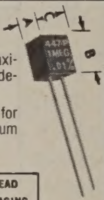
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



HIGH DENSITY PACKAGING

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	SIZE ±.020			MAX. VOLTS	LEAD DIA.	LEAD SPACING
			A	B	C			
446-P	.250	2 Meg.	.140"	.270"	.500"	100	#20	.250
447-P	.125	1 Meg.	.140"	.270"	.250"	100	#20	.125

STANDARD PRINTED CIRCUIT

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.	LEAD SPACING
252-P	.15	375K	.250	.250	100	#22	.150
176-P	.15	450K	.250	.312	100	#22	.150
178-P	.20	650K	.250	.400	200	#22	.150
277-P	.20	700K	.250	.437	200	#22	.150
471-P	.25	750K	.250	.500	300	#22	.150
177-P	.30	850K	.312	.500	400	#22	.200
179-P	.30	1.1M	.375	.500	400	#22	.200
155-P	.50	3.0M	.500	.625	400	#20	.250

HIGH STABILITY SERIES

LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations.

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±10 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

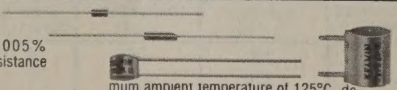
*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
OA	.15	560K	.187	.375	300	#22
OB	.25	1.2 Meg.	.250	.500	300	#22
OC	.33	2.2 Meg.	.250	.750	400	#22
OD	.33	2.4 Meg.	.375	.500	300	#20
OE	.50	3.6 Meg.	.375	.828	400	#20
OF	.60	5.2 Meg.	.375	1.000	400	#20
OG	.50	4.0 Meg.	.500	.500	400	#20
OH	.60	6.4 Meg.	.500	.625	400	#20
OJ	1.00	8.0 Meg.	.500	1.000	800	#20
OK	1.50	10.0 Meg.	.500	1.500	900	#20
OL	1.75	10.5 Meg.	.500	1.750	900	#20
OM	2.00	13.0 Meg.	.500	2.000	1200	#20

STANDARD TYPES



TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

*All Lug Types available with #20 gauge radial leads (except EP-22) by specifying letter "R" after type number.

LUG and RADIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ·1/32	LENGTH ·1/32	MAX. VOLTS	TERMINAL TYPE+	MOUNTING HOLE
EP-22	.10	350K	.312	.250	100	#24 x 2" (Wire Lead)	#2
346-P	.25	1.0M	.375	.440	150	Lug	#4
264-P	.33	1.5M	.375	.500	300	Lug	#4
EP-09	.50	4.0M	.500	.500	400	Lug	#6
263-P	.50	4.0M	.625	.500	400	Lug	#6
EP-15	.60	5.0M	.500	.625	400	Lug	#6
EP-16	1.00	6.5M	.500	1.000	800	Lug	#6
EP-30	1.50	10.0M	.500	1.500	900	Lug	#6

AXIAL-WIRE LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
EP-21	.25	1.5 Meg.	.250	.500	400	#22
467-P	.25	1.5 Meg.	.250	.500	400	#20
EP-23	.33	2.75 Meg.	.250	.750	400	#22
812-P	.33	2.75 Meg.	.250	.750	400	#20
363-P	.40	3.0 Meg.	.250	1.000	400	#22
334-P	.33	3.0 Meg.	.375	.500	300	#20
815-P	.50	4.5 Meg.	.375	.750	600	#20
EP-24	.50	4.5 Meg.	.375	.828	600	#20
EP-25	.50	5.0 Meg.	.500	.500	400	#20
254-P	.60	6.5 Meg.	.375	1.000	800	#20
EP-26	.60	8.0 Meg.	.500	.625	400	#20
EP-27	1.00	10.0 Meg.	.500	1.000	800	#20
EP-28	1.50	12.0 Meg.	.500	1.500	900	#20
366-P	1.75	13.0 Meg.	.500	1.750	900	#20
EP-29	2.00	15.0 Meg.	.500	2.000	1200	#20

CATALOG #763 COVERS ALL PRODUCTS SHOWN ON THIS PAGE

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (213) 782-6662

FAST RISE TIME APPLICATIONS

''RT'' style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. ''RT'' resistors can be supplied with rise times as low as 25 nanoseconds (from 10% to 90% of peak pulse amplitude at 100 KC), depending on resistance values and physical configurations. See Catalog #763

TOLERANCES: 1% through .005% available on most types and resistance values.

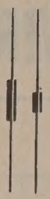
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

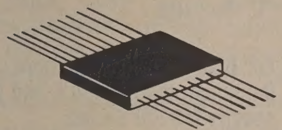
**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



AXIAL LEAD

KELVIN TYPE	COMMERCIAL WATTAGE*	RESISTANCE MAX.**	DIA. ±1/64	LENGTH ±1/32	MAX. VOLTS	LEAD DIA.
RTA	.15	560 K	.187	.375	300	#22
RTB	.25	1.2 Meg.	.250	.500	400	#22
RTC	.33	2.2 Meg.	.250	.750	400	#22
RTD	.33	2.4 Meg.	.375	.500	300	#20
RTE	.50	3.6 Meg.	.375	.828	400	#20
RTF	.60	5.2 Meg.	.375	1.000	400	#20
RTG	.50	4.0 Meg.	.500	.500	400	#20
RTH	.60	6.4 Meg.	.500	.625	400	#20
RTJ	1.00	8.0 Meg.	.500	1.000	800	#20
RTK	1.50	10.0 Meg.	.500	1.500	900	#20
RTL	1.75	10.5 Meg.	.500	1.750	900	#20
RTM	2.00	13.0 Meg.	.500	2.000	1200	#20

RESISTOR NETWORKS



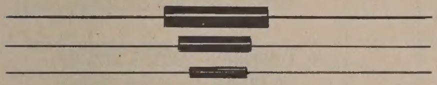
Kelvin develops and produces, to customer requirements, packaged resistor networks for use as voltage dividers, analog to digital converters, summing and integrator networks, binary resistive networks, R-2R ladders and special configurations.

Standard resistor networks in two series (R-2R and BCD) are available from catalog specifications. The potting, encapsulation and physical size flexibility of Kelvin resistors and case production techniques makes it possible to offer custome built units to exact customer requirements at reasonable prices. Our engineering department will review your requirements and submit price quotation and technical notes. 12 page Bulletin LN-37 available on request.

Electrical Characteristics Available: Nominal resistance ratio tolerance to ±.002% (DC). Resistance VDR ratio tolerances as close as .0005% (DC). Long term resistance ratio stabilities to ±.001% peryear. Low reactances to provide rise times as low as 25 nanoseconds. Temperature coefficients of resistors to track as close as 0.5 ppm/°C. from −55°C to +125°C.

SERIES KM MOLDED, POWER RESISTORS

Series KM are general purpose, reliable power resistors designed to be used where heat sinks are not available or not desired. These resistors are extremely stable for their size as compared to film types. Series KM are considered to have the lowest dollar per watt cost of precision resistors. Send for Bulletin K-1.



TOLERANCES: 0.025% through 5.0%

TEMPERATURE COEFFICIENT:

±20 PPM/°C (170 ohms and above)
±30 PPM/°C (10 to 170 ohms)
±50 PPM/°C (1 to 9.99 ohms)
±90 PPM/°C (below 1 ohm)

T.C.s to 5 PPM/°C available depending on size and value.

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add ''N'' to part number. Example: KMN025.

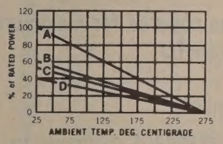
KELVIN PART NUMBER	WATTAGE G & U 275°C	WATTAGE V 350°C	DC Working Voltage	Maximum Resistance	SIZE and TOLERANCES Length	SIZE and TOLERANCES Diameter	Lead Length (±0.125)	Lead Diameter (AWG)	Equivalent Military Styles MIL-R-26E
KM025	0.40	0.60	35	3.5K	0.250±.015	0.078±.015	1.5 in.	24	
KM050	0.75	1.0	50	7.0K	0.312±.015	0.078±.015	1.5 in.	24	
KM100	1.0	1.5	75	10.0K	0.422±.015	0.093±.015	1.5 in.	24	RW70
KM200	2.0	2.5	200	15.0K	0.490±.015	0.150±.015	1.5 in.	22	
KM250	2.5	3.0	200	30.0K	0.500±.031	0.218±.015	1.5 in.	20	RW69
KM300	3.0	3.75	150	25.0K	0.560±.031	0.187±.015	1.5 in.	20	RW79
KM301	3.3	4.8	200	42.0K	0.812±.031	0.187±.015	1.5 in.	20	
KM350	4.0	5.5	200	47.0K	0.625±.031	0.250±.015	2.0 in.	18	
KM500	5.0	6.5	400	95.0K	0.875±.031	0.312±.031	2.0 in.	18	RW67/RW74
KM700	7.0	9.0	600	150K	1.218±.031	0.312±.031	2.0 in.	18	
KM1000	10.0	13.0	1000	275K	1.780±.031	0.375±.031	2.0 in.	18	RW68/RW78

SERIES KC CHASSIS MOUNT POWER RESISTORS

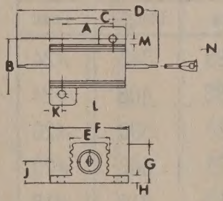
DERATING CURVES

Derating is required for reduced chassis mounting area and high ambient temperatures.

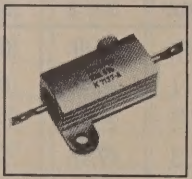
Curves:



A — When mounted on proper aluminum chassis:
48 sq. inches 0.040 aluminum for KC500 and KC1000
70 sq. inches 0.040 aluminum for KC2500
144 sq. inches 0.040 aluminum for KC5000



B — Unmounted KC500 and KC1000
C — Unmounted KC2500
D — Unmounted KC5000



Designed to provide maximum heat dissipation through heat sink and finned case configuration. Ideally suited where large amounts of power must be dissipated and small size is important. Capable of maintaining their precision tolerance in wattage ratings up to 50 watts. Send for Bulletin K-3.

TOLERANCES: 0.05% through 5.0%

TEMPERATURE COEFFICIENT:

±20 PPM/°C (170 ohms and above)
±30 PPM/°C (10 to 170 ohms)
±50 PPM/°C (1 to 170 ohms)

T.C.s tc 5 PPM/°C available depending on size and value.

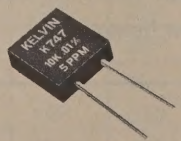
NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add ''N'' to part number. Example: KCN500.

KELVIN PART NUMBER	Watts	DC Working Voltage	Max. Res.	SIZE and TOLERANCES A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±0.10	L ±.005	M ±.015	N ±.005	Mtg. Screw Size	MIL-R-18546
KC500	7.0	165	20K	0.444	0.490	0.600	1.125	0.334	0.646	0.320	0.065	0.133	0.078	0.093	0.078	0.050	#2	RE60
KC1000	12	275	30K	0.562	0.625	0.750	1.375	0.425	0.812	0.400	0.075	0.190	0.093	0.093	0.093	0.086	#2	RE65
KC2500	25	560	75K	0.719	0.781	1.062	1.938	0.525	1.080	0.550	0.088	0.280	0.171	0.125	0.115	0.086	#4	RE70
KC5000	50	1300	200K	1.563	0.844	1.969	2.781	0.615	1.150	0.615	0.085	0.307	0.203	0.125	0.115	0.086	#4	RE75

K747 WIRE WOUND RESISTOR

Lead Size:	#22 (.025) solder coated brass
Lead Spacing ℄ to ℄:	.150'' (±.010)
Wattage:	.3 watts
Voltage:	200 volts
Resistance Range:	.5Ω to 400KΩ
Resistance Tolerance:	1% thru .005%
Temperature Coefficient:	±5 PPM standard (0-85°C). Available to 1 PPM
TC Tracking:	Available to ±1 PPM/°C
Stability:	25 PPM/year
Rise Time:	25 nanoseconds
Noise:	Not measurable on commercially available equipment.
Environmental:	Exceeds all requirements of MIL-R-39005.

Designed specifically to interchange with Bulk Metal* film resistors. Comparable performance characteristics show the K747 resistor to be superior in almost all instances. Send for Bulletin K747 for complete specification details.



SIZE: .320±.020 H.
.295±.010 L.
.100±.015 W

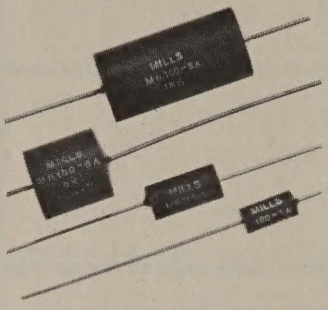
*''Bulk Metal'' is a trademark of Vishay Intertechnology, Inc.

Kelvin pioneered the close tolerance, close temperature coefficient and excellent long term stability wire-wound resistor. State-of-the-art manufacturing techniques and superior testing capabilities yield the ultimate in quality at a competitive price. Please contact your nearest Kelvin representative or the factory direct for further details.

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (213) 782-6662

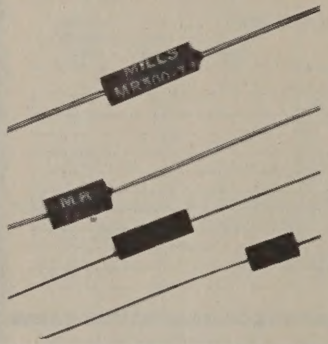
MILLS PRECISION WIREWOUND RESISTORS

STANDARDS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

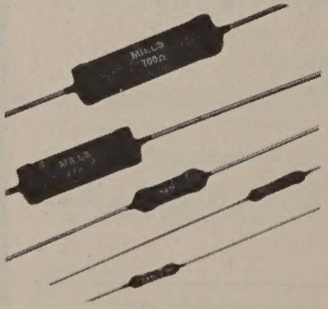
MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

- Lead Configuration:
  "A" after Part No. 1 Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.
- Tolerance: .005% and up; to .002% in some cases.
- Metric sizes available, ask for our Metric Flyer.

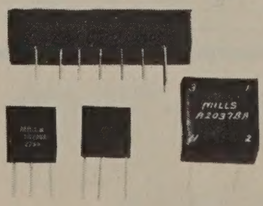
PRECISION POWER WIREWOUND RESISTORS



Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½-A	½	4.9K	.093	.343	#24
MRP-1-A	1	10.4K	.093	.406	#24
MRP-2-A	2	25K	.187	.500	#20
MRP-3-A	3	47.1K	.187	.562	#20
MRP-5-A	5	90K	.250	.812	#18

- To 20 watts.
- Silicone covered for maximum heat transfer.
- Tolerance:
  1% is standard, available to .05%.
- Ask for our Precision Power Flyer.

NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases;
  Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

MILLS RESISTOR COMPANY

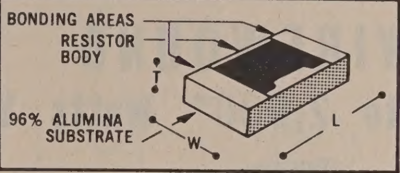
DEPT. EM, 3840 CATALINA ST., LOS ALAMITOS, CA 90720 (213) 598-2454 (714) 827-2500

MSI
MINI-SYSTEMS, INC.
20 David Road, North Attleboro, MA 02761
TELEPHONE: (617) 695-0206 • TWX NO. 710-348-0564

PRECISION THICK FILM CHIP RESISTORS

Mini-Systems has the widest selection of standard chip resistors tailored to fit assorted end uses including several Hi-Rel programs.

In hybrid construction many have found it cheaper, quicker, and easier to use Mini-Systems chip resistors for prototypes, production runs, "odd" high or low values, unique match and/or track specs, "tweak" or trim functions, and cross-overs. Size reduction and repairs are easily accomplished with MSI chip resistors. All resistors are designed to meet MIL-R-55342 requirements.

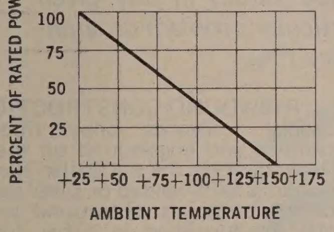


DESIGN GUIDELINES

NOTES:

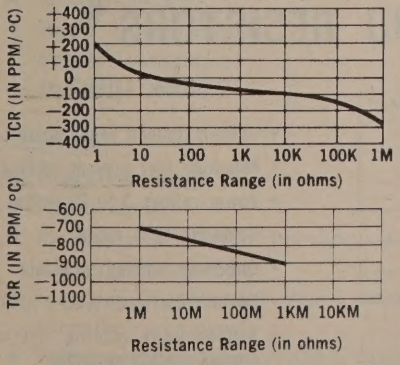
- Tolerances available: 1, 2, 5, 10, 20% for most resistance values.
- Delivery: stock to two (2) weeks.
- All types are available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder-tinned (SN-62).
- Wire bond resistors have gold end-metalization optimized for wire bonding.

POWER DERATING CURVE



TEMPERATURE COEFFICIENT OF RESISTANCE

Actual TCR varies ±150 PPM/°C from typical, depending on geometry, materials and processing.



* Available in SN-62 Solder Tinned Version

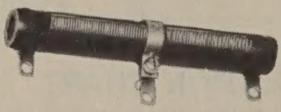
CHIP RESISTOR SELECTION CHART

	LENGTH (L) TYPICAL (INCHES)	WIDTH (W) TYPICAL (INCHES)	THICKNESS (T) TYPICAL (INCHES)	PDIS RATING 25°C FREE AIR (MILLIWATTS)	OHMIC RANGE	TYPE
FLIP-R® SOLDER TINNED	.050	.050	.013	125	1Ω to 100MΩ	MSR-4
	.100	.025	.013	100	10Ω to 1000MΩ	MSR-5
	.075	.050	.019	200	1Ω to 100MΩ	MSR-13
	.100	.050	.019	250	1Ω to 100MΩ	MSR-9
	.100	.100	.019	500	1Ω to 100MΩ	MSR-7
	.125	.244	.029	2000	1Ω to 100MΩ	MSR-14
	.244	.125	.029	2000	1Ω to 100MΩ	MSR-17
	1.000	.100	.029	4000	1Ω to 100MΩ	MSR-11
	.050	.040	.013	100	1Ω to 100MΩ	MSR-19
	.150	.050	.029	300	1Ω to 100MΩ	MSR-24
	.393	.192	.029	2000	1Ω to 100MΩ	MSR-32
	.496	.100	.029	2000	1Ω to 100MΩ	MSR-22
	.494	.243	.029	4000	1Ω to 100MΩ	MSR-30
	.661	.326	.029	8000	1Ω to 100MΩ	MSR-28
	.661	.494	.029	12000	1Ω to 100MΩ	MSR-26
WIRE BOND RESISTORS GOLD ELECTRODES	.035	.035	.011	50	1Ω to 75MΩ	MSR-10
	.050	.050	.011	125	1Ω to 100MΩ	MSR-2
	.100	.025	.011	100	10Ω to 1000MΩ	MSR-3
	.075	.050	.017	200	1Ω to 100MΩ	MSR-12
	.100	.050	.017	250	1Ω to 100MΩ	MSR-8
	.100	.100	.017	500	1Ω to 100MΩ	MSR-6
	.125	.244	.027	2000	1Ω to 100MΩ	MSR-15
	.244	.125	.027	2000	1Ω to 100MΩ	MSR-16
	.050	.040	.011	100	1Ω to 100MΩ	MSR-18
	.150	.050	.027	300	1Ω to 100MΩ	MSR-23
	.393	.192	.027	2000	1Ω to 100MΩ	MSR-31
	.494	.243	.027	4000	1Ω to 100MΩ	MSR-29
	.661	.326	.027	8000	1Ω to 100MΩ	MSR-27
	.661	.494	.027	12000	1Ω to 100MΩ	MSR-25
* WRAP AROUND PLATINUM GOLD TERMINATIONS	.057	.052	.014	125	1Ω to 100MΩ	WA-4
	.110	.102	.020	500	1Ω to 100MΩ	WA-7
	.110	.052	.020	250	1Ω to 100MΩ	WA-9
	.083	.052	.020	200	1Ω to 100MΩ	WA-13
	.057	.042	.014	100	1Ω to 100MΩ	WA-19
	.160	.052	.020	300	1Ω to 100MΩ	WA-24

MRC MILWAUKEE
RESISTOR CORPORATION
700 WEST VIRGINIA STREET, MILWAUKEE, WI. 53204
Telephone: (414) 271-9900

WIREWOUND POWER RESISTORS

8 to 2,000* Watts Vitreous Enamel, Silicone or Cement Coated



★ STANDARD RESISTORS: 8 THROUGH 225 WATTS .... 8, 12, 20, 25, 50, 100 and 225 Watt, Vitreous Enamel in both FIXED and ADJUSTABLE (except 8 and 20 watt adjustable) are stocked in many ohmic values......*WRITE FOR STOCK LIST.......*

CUSTOM RESISTORS

36 additional wattage ratings are available with different core diameters and lengths. Non-Inductive, Tapped, Live Bracket, Porcelain Bushings, Printed Circuit Board and other specialty items are also manufactured to customer specifications.

MILWAUKEE will satisfy your resistor requirements with custom values, tolerances, temp. coefficient, sizes and coatings easily with it's engineering capabilites and production facilities.

TERMINALS

All 8, 12 and 20 watt fixed resistors are standard with 1½" tinned leads. They are also available with conventional lug terminals. 12 watt adjustable and 25 watt through225 watt fixed and adjustable have lug type terminals. Single and double quick connect and many other special types of terminals are also available.

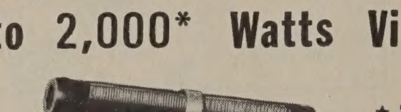
MOUNTING

Spring clips, vertical through bolts and horizontal "L" brackets are available for all 8 through 225 watt sizes.

Ferrule mountings, special spring clips, mica washers, terminal hardware and other accessories are also available.

WRITE FOR OUR CATALOG
WITH SPECIFICATIONS FOR
VARIOUS MOUNTING OPTIONS

RIBWOUND RESISTORS 40–2,000 WATTS



MILWAUKEE RIBWOUND RESISTORS ARE UNIQUE. . . . . The eveness of the crimping allows us to wind considerably higher ohmic values in any given wattage...........*If you have a particular problem or application - please contact our factory !*

APPLICATIONS

Particularly useful where high energy is to be dissipated in the lower ohmic values†. With it's ability to operate at higher temperatures - the ribwound is about ½ the size of the equivalent round wire resistor. Mounting options are the same as for wirewound.

† = MILWAUKEE'S EXCLUSIVE WINDING TECHNIQUES ALLOW AT LEAST 3 TIMES THE OHMIC VALUE MAXIMUM AS ARE NORMALLY AVAILABLE COMPETITIVELY !

COATINGS

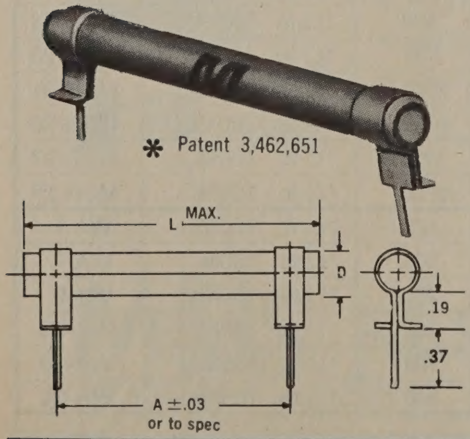
MILWAUKEE'S variety of coatings is particularly convenient for the manufacture of resistors for use in special atmospheres . . . .

LET US KNOW OF YOUR
SPECIAL REQUIREMENTS

RIBWOUND CONSTRUCTION

Special resistance alloy ribbon is crimped and edgewound on the core. Depending on the particular alloy, the ribbon is spot-welded or silver soldered to the terminals. Ribwound resistors may be furnished in either fixed or adustable type and can be cement coated. Several 300 watt values are stocked. All other sizes are made to order.

PCB PRINTED CIRCUIT BOARD RESISTORS *



FIXED PCB'S

WATTS	L	A	D	MAX. OHMS*
3	1	0.6	13/64	10,700
5	1¼	0.9	13/64	19,800
7	1⅝	1.3	13/64	32,000
10	2.1	1.7	13/64	44,000
15	2.1	1.7	5/16	68,000
20	2½	2.2	5/16	91,000

ADJUSTABLE PCB'S

WATTS	L	A	D	MAX. OHMS*
15	2	1.7	5/16	20,000
20	2½	2.2	5/16	27,000

*For higher ohms, consult factory.

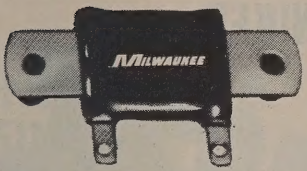
FEATURES

- Built-in standoff keeps board cool.
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Complete OHM range.
- One-piece, welded terminals
- Rectangular leads .020 x .040 in.
- Silicon base coating. Vitreous enamel coating available.
- Standard tolerance ±5%.
- 20 PPM upon request.

MRC | MILWAUKEE RESISTOR CORPORATION

700 WEST VIRGINIA STREET, MILWAUKEE, WI. 53204
Telephone: (414) 271-9900

OVALS

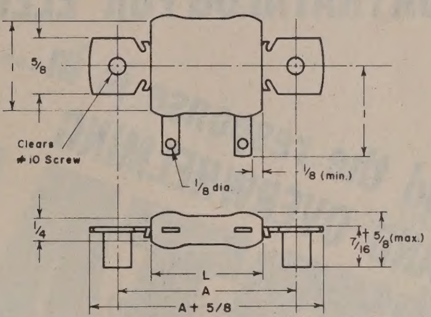


OVAL RESISTORS are for use where space saving is desired and where the use of the 'Heat Sink' function of the metal chassis, rack or panel may be employed. Resistance tolerance of ±5% is standard except on low resistance and multi-tapped units. **COATINGS** of vitreous enamel or silicone base are offered.

OVALS are available in regular or miniature sizes; an original development of MILWAUKEE Resistor.

Additional miniature oval core sizes are available increasing the possibility of taps and isolated sections. Other intermediate sizes are also available. Only regular ovals are available as adjustables.

REGULAR

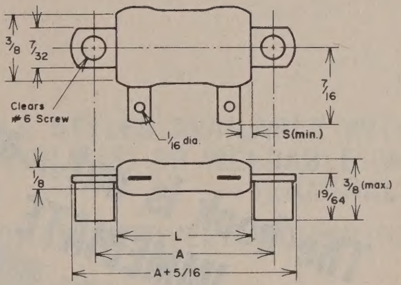


† 7/16" is standard.

WATTS†	OHMS	DIMENSIONS	
		A	L
30	1.3 - 7,300	2"	1 1/4"
40	.23 - 19,000	2 3/4"	2"
55	.17 - 41,000	4 1/4"	3 1/2"
70	.25 - 60,000	5 1/2"	4 3/4"
95	.32 - 78,000	6 3/4"	6"

†Rating based on mounting on steel panel 10" x 10" x .040".

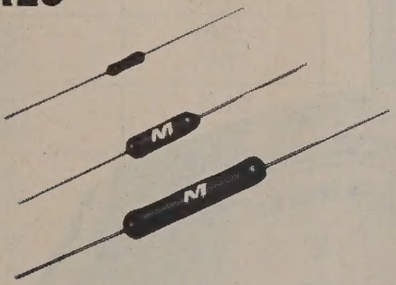
MINIATURE



WATTS*	OHMS	DIMENSIONS		
		A	L	S
10	.03 - 10,000	1"	3/4"	1/16"
15	.04 - 17,000	1 1/4"	1"	1/16"
20	.11 - 69,000	2 5/16"	2"	1/16"

*Rating based on mounting on steel panel 10" x 10" x .040.".

AXIALS



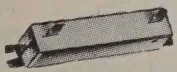
APPLICATIONS
- Electronic Circuitry
- Printed Circuits
- Radio, Television and Sound Reproduction
- Miniature Controls

CONSTRUCTION
- Wire Wound on Ceramic Core
- All Welded
- Vitreouse or Silicone Base Coating

FEATURES
- Rugged yet small.
- Highly stable.
- Matched expansion in core caps and coating for temperature stability.
- Standard 5% tolerance over 1 ohm, available in closer tolerances on request.
- Wattage ratings based on 325°C rise at 25°C ambient.
- Standard Sizes—3, 6.5, 11 watts.
- Leads Hot Tin Dipped.

Available in a variety of sizes from 1 watt through 11 watts on request.

METAL CASE *

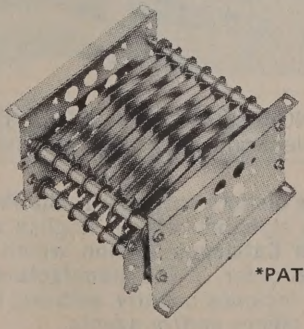


*PATENT 3,581,266

High Heat Sink—flush mounting dissipates heat.
20 to 100 Watts — higher on Specials
Quick Connect or Screw Terminals
Save: Space -First Cost- Assembly Cost

WRITE FOR ADDITIONAL INFORMATION

GRIDS *



Stud or Deck Mounted, MILWAUKEE'S patented grid system assures maximum heat dissipation & cooling.

*PATENT 3,212,045

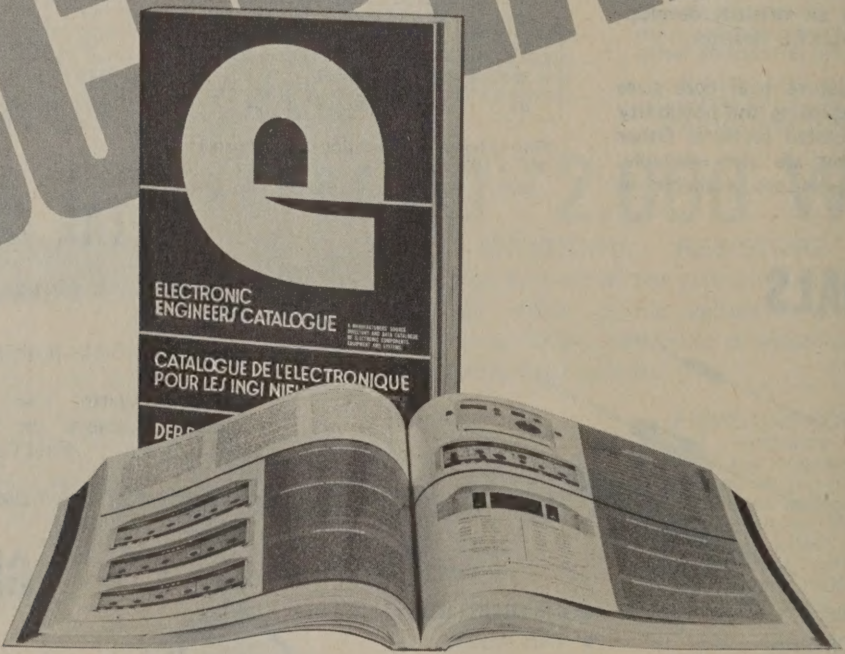
Pre-formed grid elements assure unidirectional stress motion. Custom design and construction features are most economical utilizing the exclusive MILWAUKEE patented grid system.

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

SAGE/NYTRONICS RESISTORS

INDUSTRY'S FINEST RESISTORS

ALL STYLES AVAILABLE WITH SOLDERABLE (S) OR WELDABLE (W) TERMINALS

ALSO: NON-INDUCTIVELY WOUND (N)

MIL-R-39007
ESTABLISHED RELIABILITY
FAILURE RATES M, P, AND R .01%/1000 HRS.
RESISTANCE TOLERANCE ±1%
TEMPERATURE COEFFICIENT:
±20 PPM/°C MAX. 10Ω AND HIGHER
±50 PPM/°C MAX. 1Ω TO 10Ω
±90 PPM/°C MAX. .1Ω TO 1Ω

TYPE DESIGNATIONS

MIL STYLE	DETAIL SPEC. NO.	SAGE STYLE	MIL WATTS @ 25°C	AVAILABLE RESISTANCE RANGE
RWR80S RWR80W	/8E /8E	1009SM 1007SM	2	.10Ω to 2.67K
RWR81S RWR81W	/9C /9C	259SM 257SM	1	.10Ω to 1.0K
RWR89S RWR89W	/11C /11C	1249SM 1247SM	3	.10Ω to 4.12K
RWR84S RWR84W	/10C /10C	1509SM 1507SM	7	.10Ω to 12.4K
RWR71S RWR71W	/5D /5D	1259SP 1257SP	2	.10Ω to 16.2K
RWR74S RWR74W	/6C /6C	1509SP 1507SP	5	.10Ω to 12.1K
RWR78S RWR78W	/7C /7C	1709SP 1707SP	10	.10Ω to 39.2K

EXAMPLE PART DESIGNATION:

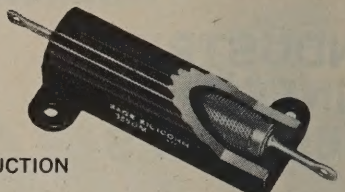
RWR-74	S	49R9	F	R
BODY STYLE	TERMINALS S — SOLDERABLE W — WELDABLE N — NON-INDUCTIVE	NOMINAL RES., Ω. THREE SIGNIFICANT DIGITS PLUS FOURTH INDICATING NUMBER OF ZEROES. BELOW 100Ω, R-DECIMAL AND FOLLOWING DIGITS ARE SIGNIFICANT.	TOLERANCE ±1%	LIFE FAILURE RATE

Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

SAGE/NYTRONICS RESISTORS

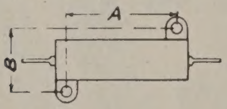
INDUSTRY'S FINEST RESISTORS . . . Commercial, Military, High Reliability

TYPE M METAL CLAD CHASSIS MOUNT RESISTORS


TYPE M CONSTRUCTION

Aluminum housed resistors for heat sink mounting. Meet or exceed requirements of MIL-R-18546D. Dielectric strength to 2500 volts rms.

All dimensions are inches nominal. Complete specifications available on request.



STYLE	Rating Watts	A	B	Max. Resistance Ω Regular Winding	Max. Resistance Ω Non-Induct.
3105M	8	.444	.490	24,000	8,400
3010M	14	.562	.625	30,000	10,500
3225M	25	.719	.781	71,000	25,000
3550M	50	1.562	.844	230,000	80,000

M suffix designates regular single layer wind.
NM suffix designates non-inductive wind.

TYPE MB HIGH WATTAGE

BERYLLIUM OXIDE CORES

STYLE	RATED WATTS 25°C ambient chassis mounted	RATED WATTS 25°C ambient free air
3105 MB NMB	15	6
3010 MB NMB	20	8
3225 MB NMB	35	14
3550 MB NMB	50	20

MB suffix designates regular single layer wind, NMB non-inductive wind.

MIL-R-26E TYPE DESIGNATIONS

EXAMPLE:

RW69	V	471
Body Style	Characteristic, V only (350°C max.)	Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is significant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE (Single layer wound .00175 min. wire dia.	DEFINED OHMIC RANGE .001 Min. Wire Dia.
RW55V	1900S	7	.1—5100	
RW56V	1950S	14	.1—9100	
RW67V	1550S	6.5	.1—3600	.1—8200
RW68V	1700S	11	.1—8200	.1—20K
RW69V	1200S	3	.1—910	.1—2K

EXAMPLE:

RW70	U	49R9	F
Body Style	Characteristic, U only (275°C max.)	Nominal resistance, Ω. Three significant digits plus fourth indicating number of zeros. Below 10CΩR decimal and following digits are significant.	Tolerance ±% B = .1% D = .5% F = 1.0%

TC: ±30 ppm/°C 10Ω and above
±50 ppm/°C 1Ω to 10Ω
±90 ppm/°C below 1Ω

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE Min.	DEFINED OHMIC RANGE Max. for .001" wire (Navy)	DEFINED OHMIC RANGE Max. for .0008" wire (all other)
RW70U	1000S	1	——	.1	1210	3160
RW74U	1500S	5	300	.1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	.1	3570	10500
RW80U	1000SB	2	——	.1	1240	3160
RW81U	250SB	1	25	.1	649	——

MIL-R-18546D TYPE DESIGNATIONS

Example:

RE65	G	1001
Style	Characteristic, 275°C Max. G for regular inductive winding N for non-inductive winding	Nominal resistance, Ω. ±1% only. Three significant digits plus fourth indicating number of zeros. Below 100Ω R = decimal and following digits are significant.

T.C. ±30 ppm/°C 2000Ω and above
±50 ppm/°C under 2000Ω

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE Min.	DEFINED OHMIC RANGE Max. (.001 wire)
RE60G	3105M	5	.1	3320
RE60N	3105NM	5	1.0	1650
RE65G	3010M	10	.1	5620
RE65N	3010NM	10	1.0	2800
RE70G	3225M	20	.1	12100
RE70N	3225NM	20	1.0	6040
RE75G	3550M	30	.1	39200
RE75N	3550NM	30	1.0	19600

CONSIDER THESE RESISTOR FEATURES:

- Wattage Rating, ½ to 50 watts
- T.C. 20 ppm/°C or 10 ppm/°C
- 1000 volt rms body insulation
- Characteristic U or V wattage rating: to 275°C or 350°C
- Power load life stability <.5%/1000 hours
- Weldable leads when specified
- Non-inductive winding when specified

Nytronics Components Group, Inc.
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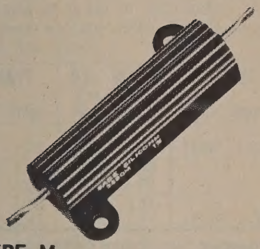
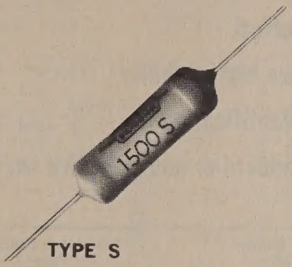
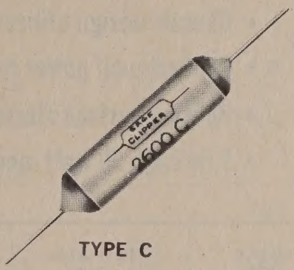
SAGE/NYTRONICS RESISTORS


TYPE M


TYPE S


TYPE C

TYPC C CLIPPER METAL SHEATHED RESISTORS

Similar in all respects to Type S, fully insulated plus addition of metal sleeve for heat sink mounting in spring clip holders.
Full heat sink rating.

TYPE S, NS SILICONE COATED POWER RESISTORS

Meet or exceed MIL-R-26E requirements.
N designates non-inductive.

STYLE	Rating Watts		STYLE	Char.U Rating Watts	Nominal Size Length*	Nominal Size Dia.**	Lead Dia.	Maximum Standard Range, Ω Regular Winding	Maximum Standard Range, Ω Non-Inductive	
	Full heat sink rating		100S	1	.400	.094	.020	8400	3000	MINIATURE SERIES
			200S	2	.400	.125	.020	11000	3900	
			300S	3	.400	.187	.020	15000	5300	
			250S	.5	.250	.078	.020	3800	1350	
			500S	.8	.312	.078	.020	5000	1750	
			750S	1	.531	.094	.020	12000	4200	
			1000S	1	.406	.094	.020	8400	3000	
			1100S	2	.500	.125	.032	15000	5500	
2200C	6	→	1200S	3	.500	.187	.032	20000	7000	REGULAR S SERIES
			1240S	3	.562	.187	.032	24000	8400	
2250C	6	→	1250S	3	.812	.187	.032	40000	14000	
			1300S	3	.625	.250	.040	30000	10500	
			1500S	5	.875	.312	.040	71000	25000	
2550C	11	→	1550S	5	1.000	.312	.040	88000	31000	
2600C	14	→	1600S	7	1.219	.312	.040	114000	40000	
			1700S	10	1.781	.375	.040	230000	80000	
			1900S	10	1.375	.431	.040	210000	73000	
			1950S	11	2.000	.431	.040	314000	110000	

Min. Res. Tol. Available is ±1% on the NS Styles.

*On 100S, 200S and 300S L is max.
*On 250S, 500S and 750S L is ±.031.
*On all others L is ±.062.
**On 250S and 500S D is ±.016.
**On all others D is ±.031.
**For styles 1100S or smaller add .016 for non-inductive (NS) types or ohmic values less than 0.1 ohms.

SAGE SILICOHM® fixed wirewound units are not ordinary power resistors. They provide remarkable miniaturization vs required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with Mil-R-93 resistors.

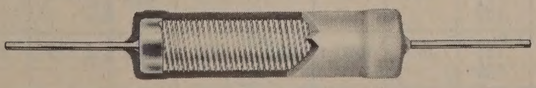
TYPE SB & NSB HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

STANDARD SOLDERABLE LEADS	RATED WATTS G	RATED WATTS V	Approx. Grams WEIGHT
250SB	1	1.5	.18
500SB	1.5	2	.28
1000SB	2.25	2.75	.32
1200SB	3.5	4.5	1.0
1240SB	4	5	1.1
1250SB	4.5	6	1.2
1300SB	6	8	1.8
1500SB	7	9	3.6
1600SB	9	12	4.2
1700SB	14	18	7.3

TYPE S CONSTRUCTION

Showing ceramic core, spaced single layer winding, welded to stainless steel cap, and multiple layer coating.

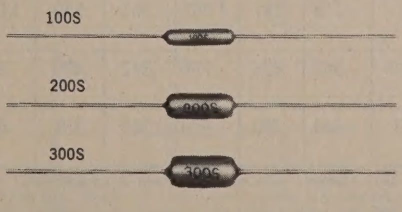
Copperweld leads 60/40 Hot Solder Dip. Lead Length 2″ ±1/16 *
is supplied on all sizes unless otherwise
specified on purchase order.



*Except 250S and 500S Styles, which are 1½″ minimum.

MINIATURE TYPE S "CORDWOOD" SERIES

1, 2, 3 watt .4 inch body length



OHMITE® series 89 metal-mite™ resistors

FEATURES

- Molded construction
- Screw type mounting on housing
- Chassis design utilizes heat-sink effect
- Conventional power ratings produce high stability
- Housing surface allows for easy identification
- 5 through 50 watt models with standard or non-inductive winding

OHMITE Type	MIL-R-18546 Type	Power Rating* Watts OHMITE**	MIL	Resistance Ranges (Ohms) 1% Tolerance	Standard Temperature Coefficient Value Ranges (Ohms) ±90 ppm	±50 ppm	±20 ppm
8905S	RE60G	7.5(5)	5	.1-24.9K	.1-.99	1-9.99	10-24.9K
8910S	RE65G	12.5(10)	10	.1-49.9K	.1-.99	1-9.99	10-49.9K
8925S	RE70G	25	20	.1-100K	.1-.99	1-9.99	10-100K
8950S	RE75G	50	30	.1-301K	.1-.99	1-9.99	10-301K

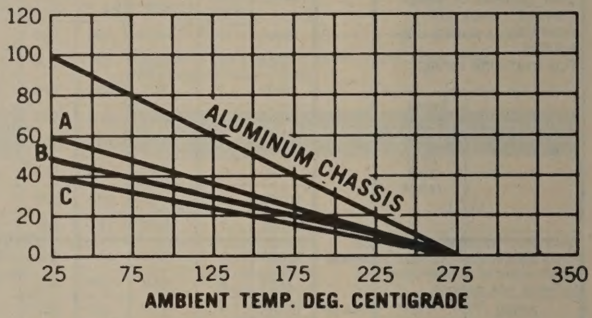
*Rating is based on chassis mounting area and stability proper heat sink.
4 x 6 x 2 x .040 aluminum chassis for 5 and 10 watt units
5 x 7 x 2 x .040 aluminum chassis for 25 watt units
12 x 12 x .059 aluminum panel for 50 watt units

**Types 8905 and 8910 will be stamped with wattages shown in parentheses but will be stamped with higher ratings upon customer request.

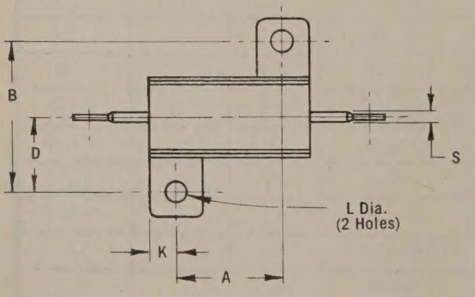
DERATING

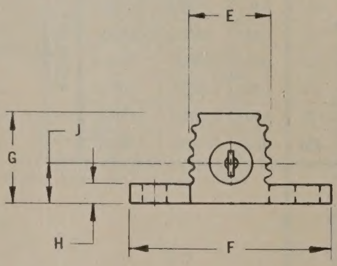
Series 89 resistors have an operating temperature range of −55°C to 275°C. Derating is required for reduced chassis mounting area and high ambient temperatures. The following curves apply to operation of unmounted resistors:

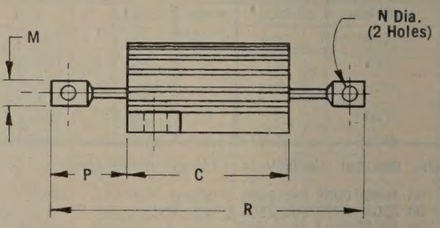
A = 5 and 10 watt units
B = 25 watt units
C = 50 watt units



DIMENSIONS





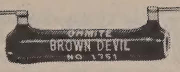


OHMITE MIL	Watts† Watts	A ±.005	B ±.005	C ±.031	D ±.0025	E ±.015	F ±.015	G ±.015	H ±.010	J ±.015	K ±.010	L ±.005	M Min.	N ±.005	P ±.062	R ±.062	S Min. AWG
8950 RE75	50 30	1.563	.844	1.968	.422	.630	1.140	.610	.088	.260	.196	.125	.140	.086	.438	2.781	12
8925 RE70	25 20	.719	.781	1.062	.391	.550	1.080	.546	.088	.231	.172	.125	.140	.086	.438	1.938	12
8910 RE65	12.5(10) 10	.562	.625	.750	.312	.420	.800	.390	.075	.165 .183	.093	.093	.140	.086	.312	1.375	12
8905 RE60	7.5(5) 5	.444	.490	.600	.245	.334	.646	.320	.065	.133 .156	.078	.093	.085	.050	.266	1.125	16

†Types 8905 and 8910 stamped with wattage shown in parenthesis.

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® type 200 *brown devil®* fixed resistors



SERIES 200

BROWN DEVIL® (Type 200) resistors, are vitreous enameled, wirewound units long famous for ruggedness and durability in small power resistors. With the emphasis towards miniaturization and the current industry trend towards higher operating temperatures, Ohmite has been able to increase the ratings on two Brown Devil sizes. The 5 watt size is now rated **8 watts** and the 10 watt size is now rated **12 watts**. The 20 watt unit retains the same rating. The higher ratings may be confidently applied to any 5 or 10 watt unit now in the possession of users or distributors. At this time also, to meet the demand for lower wattage units, Ohmite introduces two, new, small stock sizes — 3 and 5¼ watts.

Standard resistance tolerance is ±5% for values 1 ohm or higher; ±10% for values below 1 ohm. Tinned leads 1½" long: 3 and 5¼ watt, 20 AWG; 8, 12 and 20 watt, 18 AWG.

DIMENSIONS & WEIGHTS

Rating	3W	5¼W	8W	12W	20W
Core Dimen.	7/16x.21D	5/8x1/4D	1x5/16D	1¾x5/16D	2x7/16D
Weight (lbs.)	.003	.005	.01	.015	.03

Ohms	3 WATT Cat. No.[1]	Amps.	5¼ WATT Cat. No.[1]	Amps.	8 WATT Cat. No.[1]	Amps.	12 WATT Cat. No.[1]	Amps.	20 WATT Cat. No.[1]	Amps.
0.5							**1700A**	4.90	**1800A**	6.32
1.0	**2712**	1.73	**2822**	2.29	**1500**	2.83	**1701**	3.46	**1802A**	4.47
1.1	(2713)	1.65	(2823)	2.19						
1.2	(2714)	1.58	(2824)	2.09						
1.3	(2715)	1.52	(2825)	2.01						
1.5	(2716)	1.41	2826	1.87	**1500B**	2.30	1704	2.82		
1.6	(2717)	1.37	(2827)	1.81						
1.8	2718	1.29	(2828)	1.71						
2.0	2719	1.22	**2829**	1.62	**1501**	2.00	**1705**	2.45	**1802B**	3.16
2.2	(2720)	1.17	(2830)	1.54						
2.4	(2721)	1.12	2831	1.48						
2.7	2722	1.05	2832	1.39						
3.0	2723	1.00	2833	1.32	1502	1.63	**1706**	2.00	**1802C**	2.58
3.3	2724	.95	2834	1.24						
3.6	2725	.91	2835	1.21						
3.9	(2726)	.88	2836	1.16						
4.0					**1503**	1.41	**1707**	1.73	1802D	2.24
4.3	2727	.83	2837	1.10						
4.7	(2728)	.80	2838	1.06						
5.0					**1504**	1.26	**1708**	1.54	**1803**	2.00
5.1	2729	.77	**2839**	1.01						
5.6	(2730)	.73	2840	.97						
6.2	2731	.69	2841	.92						
6.8	(2732)	.66	(2842)	.88						
7.5	2733	.63	2843	.84	**1505**	1.00	**1709**	1.26		
8.2	2734	.60	2844	.80						
9.1	(2735)	.57	(2845)	.76						
10	2736	.55	**2846**	.72	**1506**	.89	**1710**	1.09	**1804**	1.41
11	(2737)	.52	(2847)	.69						
12	(2738)	.50	2848	.66	1507	.81	1711	1.00		
13	(2739)	.48	(2849)	.64						
15	2740	.45	**2850**	.59	**1508**	.73	**1712**	.89		
16	(2741)	.43	2851	.57						
18	2742	.42	(2852)	.54						
20	2743	.39	2853	.51	**1509**	.63	**1713**	.77		
22	2744	.37	2854	.49						
24	2745	.35	2855	.47						
25					**1510**	.56	**1714**	.69	**1805**	.89
27	(2746)	.33	2856	.44						
30	2747	.32	**2857**	.42	1511	.51	**1715**	.63		
33	(2748)	.30	2858	.40						
35					**1512**	.47	1716	.58		
36	(2749)	.29	2859	.38						
39	2750	.28	2860	.37						
40					**1513**	.44	**1717**	.54		
43	(2751)	.26	2861	.35						
47	2752	.25	2862	.33						
50					**1514**	.40	**1718**	.49	**1806**	.63
51	2753	.24	2863	.32						
56	2754	.23	2864	.31						
62	2755	.22	2865	.29						
68	2756	.21	2866	.28						
75	2757	.20	2867	.27	**1515**	.32	**1719**	.40	**1807**	.52
82	(2758)	.19	2868	.25						
91	(2759)	.18	2869	.24						
100	2760	.17	**2870**	.23	**1516**	.28	**1720**	.34	**1808**	.45
110	(2761)	.16	2871	.22						
120	2762	.16	2872	.21						
125					**1517**	.25	**1721**	.31		
130	(2763)	.15	(2873)	.20						
150	2764	.14	**2874**	.19	**1518**	.23	**1722**	.28	**1809**	.36
160	(2765)	.14	2875	.18						
180	2766	.13	**2876**	.17						
200	**2767**	.12	**2877**	.16	**1519**	.20	**1723**	.24	**1810**	.32
220	2768	.12	2878	.16						
225					1520	.18	1724	.23		
240	2769	.11	2879	.15						
250					**1521**	.17	**1725**	.22	**1811**	.28
270	2770	.11	2880	.14						
300	2771	.10	**2881**	.13	**1522**	.16	**1726**	.20	**1812**	.26
330	2772	.095	**2882**	.12						
350					1523	.15	1727	.18	1813	.24
360	2773	.091	2883	.12						
390	(2774)	.088	2884	.12						
400					**1524**	.14	1728	.17	1814	.22
430	(2775)	.083	2885	.11						
450					1525	.13	1729	.16		
470	2776	.080	2886	.11						

Ohms	3 WATT Cat. No.[1]	Amps.	5¼ WATT Cat. No.[1]	Amps.	8 WATT Cat. No.[1]	Amps.	12 WATT Cat. No.[1]	Amps.	20 WATT Cat. No.[1]	Amps.
500					**1526**	.12	**1730**	.15	**1815**	.20
510	2777	.077	**2887**	.10						
560	2778	.073	2888	.097						
600					**1527**	.11	**1731**	.14		
620	(2779)	.070	2889	.092						
650									**1816**	.18
680	2780	.067	2890	.088						
700					1528	.11	1732	.13	1817	.17
750	2781	.063	2891	.084	1529	.10	**1733**	.12	**1818**	.16
800					1530	.10	1734	.12	1819	.15
820	2782	.060	2892	.080						
900					1531	.094	**1735**	.11	1820A	.15
910	**2783**	.057	2893	.076						
1000	2784	.055	**2894**	.072	**1532**	.089	**1736**	.11	**1821**	.14
1100	(2785)	.052	2895	.069	1533	.085	(1737)	.10		
1200	2786	.050	2896	.066	1534	.081	**1738**	.10	**1822**	.13
1250					1535	.080	1739	.097	1823	.12
1300	(2787)	.048	2897	.063						
1500	2788	.045	**2898**	.059	**1536**	.073	**1740**	.089	**1824**	.12
1600	(2789)	.043	(2899)	.057						
1750					1537	.067	1741	.082	1825	.11
1800	(2790)	.042	2900	.050						
2000	2791	.039	2901	.047	**1538**	.063	**1742**	.077	**1827**	.10
2200	2792	.037	2902	.045						
2250					**1539**	.059	**1743**	.073	1828	.094
2400	(2793)	.035	2903	.043						
2500					**1540**	.056	**1744**	.069	**1830**	.089
2700	2794	.033	2904	.041						
2750									1831	.085
3000	2795	.032	**2905**	.039	**1541**	.046	**1745**	.063	**1832**	.081
3300	2796	.030	2906	.037						
3500					1542	.043	**1746**	.058	1833	.075
3600	(2797)	.029	2907	.035						
3900	2798	.028	2908	.034						
4000					**1543**	.040	**1747**	.054	**1834**	.070
4300	(2799)	.026	(2909)	.032						
4500					1544	.038	**1748**	.051	1835	.066
4700	2800	.025	2910	.031						
5000					**1545**	.036	**1749**	.049	**1836**	.063
5100	(2801)	.024	**2911**	.030						
5600	(2802)	.023	2912	.028						
6000					**1546**	.033	**1750**	.044	**1837**	.057
6200	(2803)	.022	2913	.027						
6800	(2804)	.021	2914	.026						
7000					**1547**	.030	1751	.041	1838	.053
7500	(2805)	.020	2915	.025	1548	.029	**1752**	.036	1839	.051
8000					1549	.029	**1753**	.035	1840	.050
8200	2806	.019	2916	.023						
8500							(1754)	.034		
9000					1550	.027	1754A	.033	(1840A)	.047
9100	(2807)	.018	(2917)	.022						
10K	**2808**	.016	**2918**	.021	**1551**	.026	**1755**	.032	**1841**	.043
11K			(2919)	.020			(1756)	.030		
12K			2920	.019			1757	.029		
12.5K					1552	.023	1758	.028	1842	.032
13K			2921	.019						
13.5K							1759	.027		
15K			2922	.017	**1553**	.021	**1761**	.026	1843	.029
16K			2923	.017			1762	.025		
17.5K					1554	.019	1763	.024		
18K			2924	.016			1764	.024		
20K			**2925**	.014	1555	.018	**1765**	.022	1844	.026
22.5K					1556	.017	1766	.021		
25K					1557	.015	**1767**	.020	1845	.023
30K							**1768**	.018	1846	.021
35K							**1769**	.017	1847	.019
40K							**1770**	.016	1848	.018
45K							1771	.015	(1849)	.017
50K							**1772**	.014	1850	.016
55K									(1851)	.015
60K									1852	.015
65K									1853	.014
70K									(1854)	.014
75K									(1855)	.013
80K									(1856)	.013
85K									(1857)	.012
90K									(1858)	.012
95K									(1859)	.012
100K									**1860**	.011

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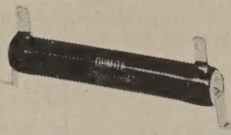
[1] **Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items in** LIGHT FACE **print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.**

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® type 270 vitreous enameled fixed resistors



SERIES 270

These lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel — the time-proved standard covering that is the best conductor of heat for a material which must also be a good electrical insulator.

Resistance tolerance is ±5% for values 1 ohm or higher; ±10% below 1 ohm.

Wattage ratings are for use in free air. When resistors are mounted in closed spaces or where the circulation of air is restricted, they should not be used at more than one-half rating. Currents and voltages for reduced ratings can be obtained by multiplying full rating by the following factors: 75% load = .86, 66% = .81, 50% = .71, 33% = .57, 25% = .50.

Mounting brackets are automatically supplied in individual unit packs; supplied only when specified in bulk pack orders. See page ??, "Mounting Brackets for Tubular Resistors" to specify other brackets.

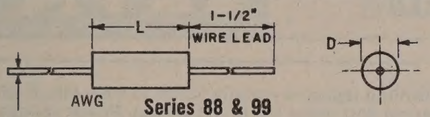
12 WATT Free air rating to 5600 Ohms Core: 1¾"x5/16" Mtg. Ctr: 2 3/16"—Av. Wt. .02 lb. Std. Mtg. Brkt.: Cat. No. 5		
Ohms Resist.	Catalog No.[1]	Max. Amps.
.51	**3723**	4.86
1.0	**3730**	3.46
1.5	3734	2.83
2.2	3738	2.34
3.3	3742	1.91
4.7	3746	1.60
6.8	3750	1.33
10	**3754**	1.10
12	3756	1.00
15	3758	.89
18	3760	.82
22	3762	.74
27	3764	.67
33	3766	.60
39	3768	.55
47	3770	.53
56	3772	.46
68	3774	.42
82	3776	.38
100	**3778**	.35
120	3780	.32
150	3782	.28
180	3784	.26
220	3786	.23
270	3788	.21
330	3790	.19
390	3792	.18
470	3794	.16
560	3796	.15
680	3798	.13
820	3880	.12
1,000	3802	.11
1,200	3804	.10
1,500	**3806**	.089
1,800	3808	.082
2,200	3810	.074
2,700	3812	.067
3,300	3814	.060
3,900	3816	.055
4,700	**3818**	.051
5,600	3820	.046
6,800	3822	.038
8,200	3824	.035
10,000	**3826**	.032
12,000	3828	.029
15,000	**3830**	.026
18,000	(3832)	.024
22,000	3834	.021
27,000	3836	.019
33,000	(3838)	.017
39,000	(3840)	.016
47,000	(3842)	.015
51,000	3843	.014

	25 WATT Free air rating to 12,000 Ohms Core: 2"x9/16" Mtg. Ctr: 2¾"— Av. Wt. .05 lb. Std. Mtg. Brkt.: No. 9		**50 WATT** Free air rating to 25,000 Ohms Core: 4"x9/16" Mtg. Ctr: 4¾"— Av. Wt. .09 lb. Std. Mtg. Brkt.: No. 9		**100 WATT** Free air rating to 60,000 Ohms Core: 6½"x¾" Mtg. Ctr: 7⅜"— Av. Wt. .20 lb. Std. Mtg. Brkt.: No. 12		**175 WATT** Free air rating for All Values Core: 8½"x1⅛" Mtg. Ctr: 9⅜"— Av. Wt. .50 lb. Std. Mtg. Brkt.: No. 18		**225 WATT** Free air rating for All Values Core: 10½"x1⅛" Mtg. Ctr: 11⅜"— Av. Wt. .62 lb. Std. Mtg. Brkt.: No. 18	
Ohms Resist.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.
1	**0200J**	5.00	**0400J**	7.07	**0600C**	10.00	**0700C**	13.2	**0900C**	15.00
2	**0200K**	3.54	**0400K**	5.00	**0600D**	7.07	0700D	9.35	**0900D**	10.60
3	**0200L**	2.88	**0400L**	4.07	**0600E**	5.77	0700E	7.63	**0900E**	8.67
4	0200N	2.50	0400N	3.53	**0600F**	5.00	(0700F)	6.6	0900F	7.50
5	**0200A**	2.24	**0400A**	3.16	**0600A**	4.47	**0700A**	5.92	**0900A**	6.72
10	**0200B**	1.58	**0400B**	2.23	**0600B**	3.16	0700B	4.18	**0900B**	4.74
15	**0200R**	1.29								
25	**0200C**	1.00	**0400C**	1.41	**0601**	2.00	**0701**	2.64	**0901**	3.00
50	**0200D**	.71	**0400D**	1.00	**0602**	1.41	**0702**	1.87	**0902**	2.12
75	**0200E**	.58	**0400E**	.82	**0603**	1.15	0703	1.52	**0903**	1.73
100	**0200F**	.50	**0400F**	.71	**0604**	1.00	**0704**	1.32	**0904**	1.50
125					0604B	.90	0704B	1.18		
150	**0200G**	.41	0400G	.58	**0605**	.82	0705	1.08	**0905**	1.25
200	**0200H**	.35	**0400H**	.50						
250	**0201**	.32	**0401**	.45	**0606**	.63	**0706**	.84	**0906**	.95
500	**0202**	.22	**0402**	.32	**0607**	.45	0707	.59	**0907**	.67
750	**0203**	.18	0403	.26	0608	.37	0708	.48	0908	.55
800	**0204**	.17	0404	.25						
1,000	**0205**	.16	**0405**	.22	**0609**	.32	0709	.42	**0909**	.47
1,500	**0206**	.13	0406	.18	0610	.26	(0710)	.34	0910	.39
2,000	**0207**	.12	0407	.16	0611	.22	0711	.30	**0911**	.34
2,500	0208	.10	0408	.14	**0612**	.20	(0712)	.26	0912	.30
3,000	**0209**	.091	0409	.13	0613	.18	(0713)	.24	0913	.27
3,500	0210	.084								
4,000	0211	.079	0410	.11						
5,000	**0212**	.070	**0411**	.10	0614	.14	0714	.19	**0914**	.21
6,000	0213	.064								
7,500	0214	.057	0412	.081	0615	.12	(0175)	.15	0915	.17
8,000			0413	.079						
10,000	**0215**	.050	**0414**	.071	0616	.10	0716	.13	**0916**	.15
12,000	0216	.045	0415	.064						
15,000	**0217**	.036	0416	.057	0617	.081	(0717)	.11	0917	.13
20,000	0218	.031	0417	.050	0618	.071	0718	.094	0918	.11
25,000	**0219**	.028	0418	.045	0619	.063	0719	.083	0919	.095
30,000	0220	.026			0620	.058	(0720)	.076	0920	.087
35,000	(0221)	.024	0419	.032						
40,000	0222	.022			0621	.050	0721	.066	0921	.075
50,000	0224	.019	0420	.026	**0622**	.045	(0722)	.059	**0922**	.067
60,000	0225	.016			0623	.041	(0723)	.054	0923	.061
70,000	0226	.013								
75,000			0421	.021	0624	.032	(0724)	.048	0924	.055
80,000	0227	.012								
100,000	**0229**	.0094	0422	.018	**0625**	.028	0725	.042	**0925**	.047
125,000			0423	.017						
150,000			0424	.015						
175,000			(0425)	.014						
200,000			0426	.012						
250,000			0428	.010						

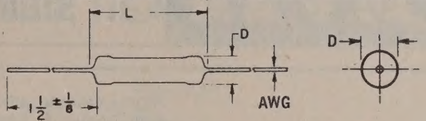
Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® wirewound resistors / axial lead and pc series



Series 88 & 99



Series 22, 44, 56 & 57

OHMITE WIRE WOUND AXIAL LEAD RESISTORS

All of Ohmite's axial lead resistors feature a high quality resistance wire, single layer wound on a cylindrical ceramic core, and welded to metallic end caps. The leads are solder coated, weldable wire 1½" long. Specific mechanical and electrical parameters are listed in appropriate descriptions and tables for the individual Series below.

AXIAL LEAD WIREWOUND RESISTOR SPECIFYING GUIDE

WATTS	VITREOUS ENAMEL — Molded — SERIES 99 5% Tolerance (1%-10% Available) T.C. ±30 ppm/°C Typical					WATTS	VITREOUS ENAMEL — Conformal — SERIES 22 5% Tolerance (1%-10% Available) T.C. ±30 ppm/°C Typical					WATTS	FLAMEPROOF CERAMIC — Conformal — SERIES 57 CERON® 5% Tolerance (1%-10% Available) T.C. ±30 ppm/°C Typical				
			Maximum						Maximum						Maximum		
	Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 mm Ga.		Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 mm Ga.		Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 Ga. mm
1.5	995-1A	.1-6.65K	.437/11.1	.140/3.6	24	1	221	.1-2.5K	.406/10.3	.156/4	22	1	571	1.0-3K	.406/10.3	.156/4	22
2.25	995-2A	.1-6.49K	.390/9.9	.219/5.6	20	2	222	.1-3.9K	.406/10.3	.219/5.6	20	2	572	1.0-4K	.406/10.3	.219/5.6	20
3.25	995-3A	.1-22.1K	.562/14.3	.234/5.9	20	3	223	.1-10K	.562/14.3	.250/6.4	20	3	573	1.0-12K	.562/14.3	.234/5.9	20
5	995-5B	.1-53.6K	.953/24.2	.234/5.9	20	5	225	.1-30K	1.000/25.4	.250/6.4	20	5	575	1.0-30K	1.000/25.4	.234/5.9	20
6.5	995-5A	.1-80.6K	.937/23.8	.343/8.7	20	6	226	.1-35K	1.031/26.2	.343/8.7	20	6					
9	995-7A	.1-118K	1.233/31.3	.343/8.7	20	7	227	.1-40K	1.250/31.8	.343/8.7	20	7	577	1.0-50K	1.094/27.8	.343/8.7	20
11	995-10A	.1-187K	1.796/45.6	.343/8.7	20	10						10	570	1.0-60K	1.813/46.1	.343/8.7	20
						11	220P	.5-60K	1.938/49.2	.343/8.7		11					
						15						15					

WATTS	SILICONE CERAMIC — Conformal — SERIES 44 OHMICONE® 5% Tolerance (0.05%-10% Available) T.C. ±20 ppm/°C Typical					WATTS	SILICONE CERAMIC — Conformal — SERIES 56 BERYLLIA-CORE ACRASIL® 1% Tolerance (.05%-5% Available) T.C. ±20 ppm/°C Typical					WATTS	SILICONE CERAMIC — Molded — SERIES 88 RITEOHM® 1% Tolerance (.05%-10% Available) T.C. ±20 ppm/°C Typical				
			Maximum						Maximum						Maximum		
	Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 mm Ga.		Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 mm Ga.		Type	Res. Range	Length ("/mm)	Dia. ("/mm)	Leads 1.5"/ 38.1 mm Ga.
1	441	.5-4K	.437/9.4	.125/3.2	22	1	561	.5-3K	.281/7.1	.098/2.5	24	1	884-1A	.1-10K	.437/11.1	.125/3.2	24
2	442	.1-4K	.406/10.3	.219/5.6	20	2	562	.5-10K	.437/11.1	.124/3.1	24	2	884-2	.1-10K	.395/10	.208/5.3	20
3	443	.1-15K	.563/14.3	.250/6.4	20	3						3	884-3	.1-34K	.562/14.3	.250/6.4	20
5	445	.1-60K	.937/23.8	.343/8.7	18	5	565	.1-25K	.624/15.8	.218/5.5	20	5	884-5	.1-124K	.937/23.8	.343/8.7	18
6						6	566	.1-35K	.687/17.4	.281/7.1	18	6					
7	447	.1-80K	1.250/31.8	.343/8.7	18	7	567	1.0-75K	.937/23.8	.343/8.7	18	7	884-7	.1-178K	1.238/31.4	.343/8.7	18
10	440	.1-150K	1.843/46.8	.406/10.3	18	10	560	1.0-125K	1.280/32.5	.343/8.7	18	10	884-10	.1-301K	1.843/46.8	.363/9.2	18
11						11						11					
15						15	560P	1.5-250K	1.843/46.8	.406/10.3	18	15					

HOW TO ORDER

MOLDED — For Series 88 and 99, specify style, resistance and tolerance.
CONFORMAL — Specify these Product Numbers:

56 1 S R5000 J

OHM E SERIES NUMBER
This identifies the basic resistor construction.

WATTAGE
1 = 1W 5 = 5W
2 = 2W 6 = 6W
3 = 3W 7 = 7W
4 = 4W 0 = 10W or more

MISCELLANEOUS SPECIFICATIONS
S = Standard winding
N = Non-inductive winding
P = Standard winding with actual wattage rating more than indicated
T = Non-inductive winding with actual wattage rating more than indicated

TOLERANCE
A = ±.05%
B = ±.1%
W = ±.125%
C = ±.25%
D = ±.5%
} Not available for non-inductive types
F = ±1%
G = ±2%
H = ±3%
J = ±5%

RESISTANCE VALUE

Resistance value is identified by four digits and one letter.
Resistance is expressed in ohms with the letter "R" signifying a decimal point. "R" is used in all resistance values lower than 1000 ohms. The letter "K" indicates multiples of 1000 ohms.

This chart provides all basic data needed to specify the right axial lead wirewound resistor for your circuit application. Refer to application guide to select the proper resistor based on your key specifying parameters.

VITREOUS ENAMEL

Series 99
Hi-Heat Dissipation
Molded Construction
MIL-R-26

Series 99 & 22
Severe Humidity Protection
Resistant to All Solvents
Industrial Applications

FLAMEPROOF CERAMIC

Series 57
Flameproof
Severe Environments
Immune to Fungus Growth
High Overland Design

SILICONE CERAMIC

Series 88
Molded Construction

Series 56
MIL-R-39007

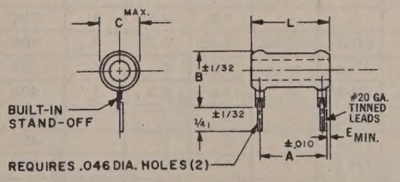
Series 44, 88 & 56
Low TC
Close Tolerance
High Heat Dissipation
Industrial Applications

Series 88 & 56
High Stability
Small Size/
High Heat Dissipation

Ohmite can supply resistors for applications requiring high reliability performance characteristics per MIL-R-39007.

- Meets MIL-R-26 Where Applicable
- Popular Values of Series 88, 99 and 44 Available from Stock
- Lead Taping Available
- Higher and Lower Resistance Values other Than Those Listed Above are Available. Consult Factory.

RADIAL LEAD RESISTORS FOR P.C. BOARDS



Resistance Element: Resistance wire single layer wound on a tubular ceramic core and welded to lug bands.

Terminals: Radial, wire leads welded to lugs on centers to fit standard 0.1 inch matrix boards. Built-in standoff.

Coating: Vitreous enamel or Ohmicone (silicone-ceramic).

Marking: Ohmite code and resistance value (ohms) on top opposite leads.

Tolerances: Vitreous (Type 270) ±5%, 1 ohm and higher — ±10%, below 1 ohm. For closer tolerances, specify Type 474 (Ohmicone).

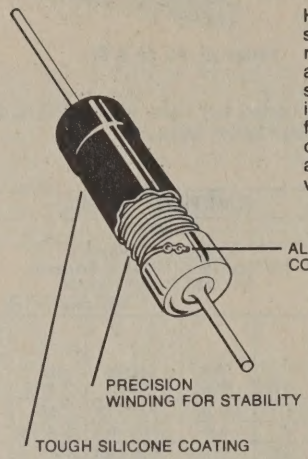
Temperature Coefficient: Less than 260 PPM/°C — Lower temperature coefficient available in Type 474 (Ohmicone).

Rated Watts @ 25°C	Dimensions				
	A ±.010	B ±1/32	C Max.	E Min.	L ±1/64
3	.300	.429	9/32	1/32	7/16
5¼	.500	.469	5/16	1/32	5/8

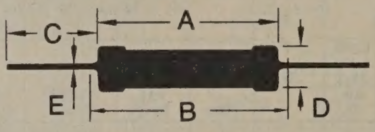
OHMITE MFG. CO.. a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OMI

POWER WIREWOUND RESISTORS
SILICONE COATED



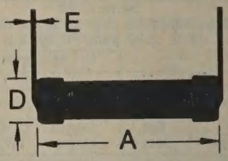
Highly reliable, silicone coated, precision wirewound resistors manufactured to meet MIL-R-26 specifications. Available with axial leads (T series) and radial leads (TR series). Power ratings range from ½ to 15 watts and resistance ranges from .05 ohms to 275K ohms. Resistance tolerances from .05% to 5% (1% standard). Temperature coefficient of resistance 2PPM up (20PPM, standard). F Series resistors—at ratings from 1 to 15 watts—offer greatly increased power ratings over conventional resistors of equivalent size. F Series are available in resistance ranges from 0.1 ohm to 250K ohms. Both T and F Series resistors have an operating temperature range of −55°C to 275°C (characteristic U) or to 350° (characteristic V). Derating is required for high ambient temperatures. T and F Series are also available with non-inductive windings. (maximum value for non-inductive type is 50% of values for standard resistors)



DIMENSIONS FOR

SERIES **T** & SERIES **F**

(AXIAL LEADS)



DIMENSIONS FOR

TR, FR

(RADIAL LEADS)

OMI TYPE		MIL TYPE	OMI WATTAGE RATING		RESISTANCE RANGE		MAX. WORKING VOLTAGE*		MAX. WEIGHT Grams	PHYSICAL DIMENSIONS				
			U 275°C	V 350°C	Min.	Max.	U	V		A	B	C	D	E
T-½A	–	–	.4	–	.5	3.4K	18	–	.21	.210 ± .015	.265	1.500	.078 ± .015	.020
T-½	–	–	.75	–	.5	7.5K	31	–	.30	.330 ± .015	.390	1.500	.078 ± .015	.020
T-1A	TR-1A	RW-70U	1.0	1.25	.1	10K	50	55	.36	.406 ± .031	.437	1.500	.093 ± .031	.020
T-1B	TR-1B	–	1.1	1.30	.1	12K	62	67	.40	.530 ± .015	.590	1.500	.093 ± .031	.020
T-1C	–	–	1.0	–	.1	5K	28	33	.33	.265 ± .015	.335	1.500	.093 ± .031	.020
T-2	–	–	1.5	–	.1	10K	72	79	.95	.343 ± .015	.410	1.500	.187 ± .031	.032
T-2A	TR-2A	RW-79U	3.0	3.75	.1	22K	135	148	.70	.560 ± .062	.622	1.500	.187 ± .031	.032
T-2B	TR-2B	–	3.0	–	.1	40K	170	200	.92	.812 ± .062	.890	1.500	.188 ± .031	.032
T-2C	TR-2C	RW-69V	2.5	3.00	.05	32K	138	157	1.5	.500 ± .062	.593	2.000	.218 ± .032	.040
T-3	TR-3	–	4.0	5.50	.05	40K	210	250	2.3	.625 ± .062	.765	2.000	.250 ± .032	.040
T-5	TR-5	RW-74U	5.0	6.00	.05	90K	300	365	4.3	.875 ± .062	.937	2.000	.312 ± .031	.040
T-6	–	–	6.0	6.50	.05	95K	330	376	4.8	1.000 ± .094	1.094	2.000	.312 ± .031	.040
T-7	TR-7	–	7.0	8.00	.05	100K	350	390	5.2	1.185 ± .062	1.247	2.000	.312 ± .031	.040
T-7A	–	RW-55V	7.0	9.00	.05	150K	504	576	7.0	1.375 ± .094	1.469	2.000	.469 ± .094	.040
T-10	TR-10	RW-78U	10.0	11.00	.05	250K	788	898	9.0	1.780 ± .062	1.842	2.000	.375 ± .031	.040
T-10A	–	–	10.5	14.00	.05	275K	799	911	10.0	1.925 ± .062	2.094	2.000	.375 ± .062	.040
T-15	–	–	15.0	18.00	.1	275K	1000	1000	11.5	2.125 ± .094	2.200	2.000	.469 ± .094	.040
F-1	–	RW-81U	1.0	1.5	1	3.4K	29	35	.21	.250 ± .031	.265	1.500	.078 ± .015	.020
F-2	–	–	1.5	2.0	1	7.5K	42	48	.21	.312 ± .015	.327	1.500	.078 ± .015	.020
F-3	FR-3	RW-80U	2.25	2.75	.1	10K	74	81	.36	.406 ± .031	.437	1.500	.093 ± .032	.020
F-5	FR-5	–	4.0	5	.1	22K	153	170	.80	.562 ± .062	.640	1.500	.188 ± .032	.032
F-5A	FR-5A	–	4.5	6.5	.1	40K	214	257	.96	.812 ± .062	.890	1.500	.188 ± .032	.032
F-5C	FR-5C	–	5	7	.1	32K	194	230	1.5	.500 ± .062	.593	2.000	.218 ± .032	.040
F-6	FR-6	–	6	8	.1	40K	258	298	2.3	.625 ± .062	.765	2.000	.250 ± .032	.040
F-10	FR-10	–	7	10	.1	90K	390	467	4.3	.875 ± .062	1.000	2.000	.312 ± .032	.040
F-12	FR-12	–	10	12	.1	100K	607	665	5.2	1.218 ± .062	1.281	2.000	.312 ± .032	.040
F-15	FR-15	–	15	18	.1	250K	979	1072	9.0	1.780 ± .062	1.875	2.000	.375 ± .032	.040

* Maximum working voltage determined at .0008 dia. wire.

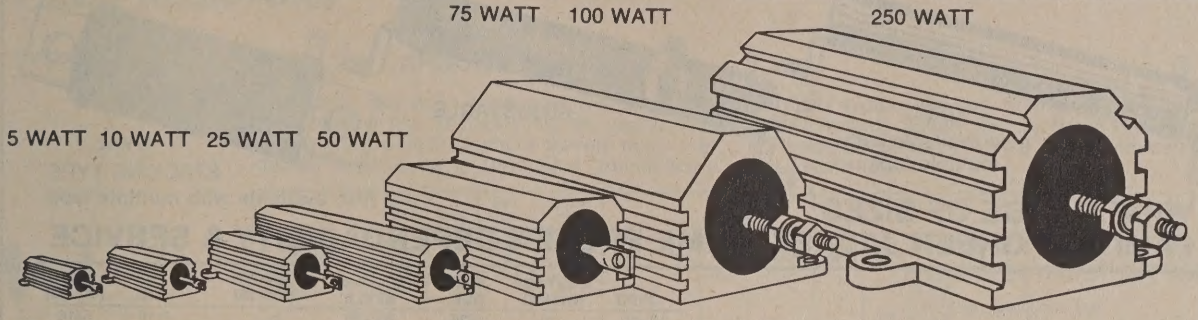
402/551-5100

OMTRONICS MFG., INC.
a division of Hirsch & Associates, Inc.

2420 S. 60TH ST.
OMAHA, NE. 68106

OMI

POWER WIREWOUND RESISTORS
ALUMINUM HOUSED, HEAT SINK TYPE


75 WATT
100 WATT
250 WATT
5 WATT
10 WATT
25 WATT
50 WATT

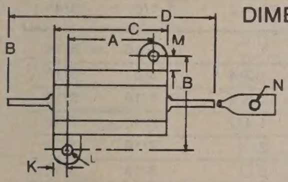
HT Models are anodized, aluminim-housed, precision wire-wound resistors, designed to chassis mount for maximum heat dissipation. They are manufactured to meet or exceed MIL-R-18546 specifications. Seven sizes: 5 to 250 watts (mounted), resistance ranges from .1 ohm to 250K, depending on size. Tolerances —1% standard —.05% available. Temperature coefficient from 2PPM up. (20PPM, standard).

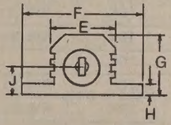
HF Models are identical in dimensions, resistance ranges, tolerance and temperature coefficients with those of the HT Series, but offer a great increase in their power ratings.
All HT and HF resistors are available with non-inductive windings (maximum value for non-inductive type is 50% of value for standard resistors).

OMI TYPE		MIL TYPE	Power Rating (Watts)*			Resistance Range		Max. Working Voltage		Max. Weight Grams
			HF (OMI)	HT	MIL	MIN.	MAX.	HF	HT	
HT-5	HF-5	RE-60	15	5	5	.1	22K	220	160	3
HT-10	HF-10	RE-65	20	10	10	.1	47K	340	265	7
HT-25	HF-25	RE-70	35	25	20	.1	90K	650	550	14
HT-50	HF-50	RE-75	50	50	30	.1	250K	1400	1250	29
HT-75				75		.1	75K		1500	120
HT-100		RE-77		100	75	.1	50K		1900	400
HT-250		RE-80		250	120	.1	75K		2500	800

*HT and HF resistors have an operating temperature range of −55°C to +275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures.

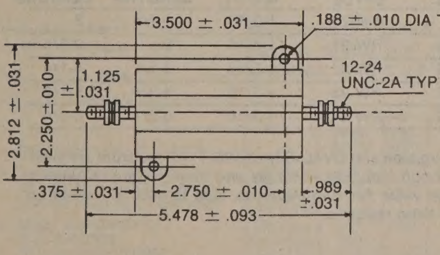
DIMENSIONS –5 thru 75 WATT MODELS

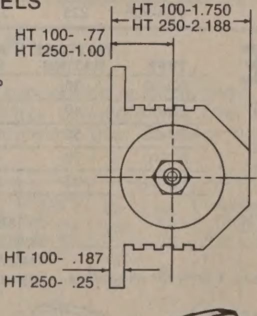


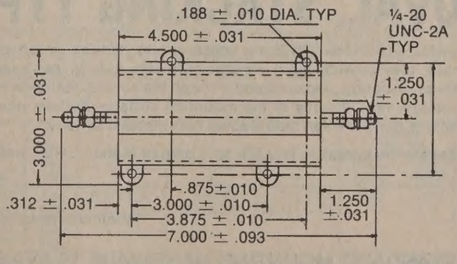


TYPE		A	B	C	D	E	F	G	H	J	K	L	M	N
HT-5	HF-5	.444 ±.005	.490 ±.005	.600 ±.031	1.125 ±.062	.334 ±.015	.646 ±.015	.320 ±.015	.065 ±.010	.140 ±.010	.078 ±.010	.093 ±.005	.078 ±.015	.050 ±.005
HT-10	HF-10	.562 ±.005	.625 ±.005	.750 ±.031	1.375 ±.062	.430 ±.015	.800 ±.015	.400 ±.015	.075 ±.010	.190 ±.010	.093 ±.010	.093 ±.015	.102 ±.015	.086 ±.005
HT-25	HF-25	.719 ±.005	.781 ±.005	1.062 ±.031	1.938 ±.062	.530 ±.015	1.080 ±.015	.560 ±.015	.085 ±.010	.260 ±.010	.172 ±.010	.125 ±005	.115 ±.015	.086 ±.005
HT-50	HF-50	1.563 ±.005	.844 ±.005	1.968 ±.031	2.781 ±.062	.615 ±.015	1.140 ±.015	.615 ±.015	.085 ±.010	.300 ±.010	.196 ±.010	.125 ±.005	.107 ±.015	.086 ±.005
HT-75		2.125 ±.010	1.500 ±.010	2.500 ±.031	3.750 ±.093	1.125 ±.031	1.875 ±.031	1.125 ±.031	.125 ±.015	.625 ±.015	.187 ±.015	.172 ±.005	.187 ±.015	.095 ±.005

DIMENSIONS –100 WATT & 250 WATT MODELS


3.500 ± .031
.188 ± .010 DIA TYP
12-24 UNC-2A TYP
1.125 ±.031
2.812 ± .031
2.250 ±.010
.375 ± .031
2.750 ± .010
.989 ±.031
5.478 ± .093


HT 100-1.750
HT 250-2.188
HT 100- .77
HT 250-1.00
HT 100- .187
HT 250- .25

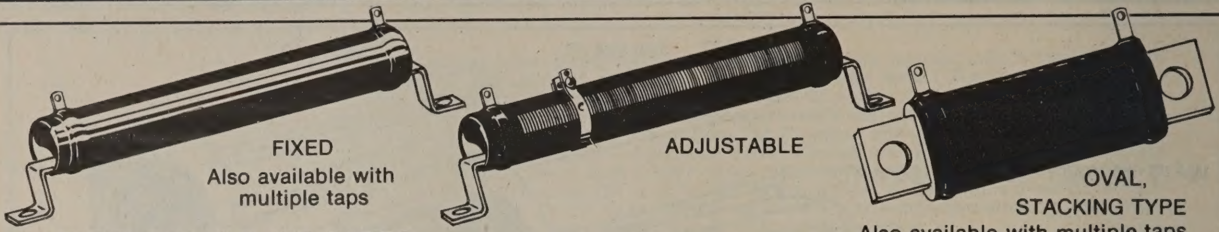

.188 ± .010 DIA. TYP
¼-20 UNC-2A TYP
4.500 ± .031
1.250 ± .031
3.000 ± .031
.875±.010
.312 ± .031
3.000 ± .010
3.875 ± .010
7.000 ± .093
1.250 ±.031

402/551-5100

OMTRONICS MFG., INC. **2420 S. 60TH ST.** **OMAHA, NE. 68106**
a division of Hirsch & Associates, Inc.

OMI

POWER WIREWOUND RESISTORS VITREOUS ENAMEL JACKET


FIXED
Also available with multiple taps
ADJUSTABLE
OVAL, STACKING TYPE
Also available with multiple taps

WIDE RANGE OF SIZES
FAMILIAR GREEN JACKET • TIME PROVEN DEPENDABILITY & SERVICE

FIXED

FIXED type vitreous enamel resistors are wire-wound on high quality ceramic cores, protected and insulated by the familiar green vitreous enamel jacket that is outstanding as an insulator and heat conductor.

Reduce maximum res. 50% for non-inductive winding. Resistance tolerance is 5% on 1 ohm or higher; ±10% below 1 ohm.

TYPE	WATTAGE RATING	MAX. RES.	MIL-R-26 STYLE	LENGTH (±1/16)	O.D.	I.D. (±1/32)
VL-10	10	22K	RW-30	1	7/16	5/16
VL-11	11	25K	RW-29	1-3/4	3/8	3/16
VL-12	12	50K	-	1-3/4	5/16	3/16
VL-15	15	50K	RW-31	1-1/2	7/16	5/16
VL-20	20	80K	RW-32	2	7/16	5/16
VL-25	25	100K	-	2	9/16	5/16
VL-26	26	100K	RW-33	3	7/16	5/16
VL-50	50	100K	-	4	9/16	5/16
VL-51	51	100K	-	3-1/2	3/4	1/2
VL-60	60	100K	RW-35	4	3/4	1/2
VL-65	65	100K	-	4-1/2	3/4	1/2
VL-80	80	100K	RW-36	4	1-1/8	3/4
VL-100	100	100K	-	6-1/2	3/4	1/2
VL-120	120	100K	RW-37	6	1-1/8	3/4
VL-130	130	100K	-	6-1/2	1-1/8	3/4
VL-160	160	100K	RW-38	8	1-1/8	3/4
VL-175	175	100K	-	8-1/2	1-1/8	3/4
VL-225	225	100K	RW-47	10-1/2	1-1/8	3/4

ADJUSTABLE

ADJUSTABLE type make ideal voltage dividers in transmitters, rectifiers and similar equipment both original and replacement. Also handy for obtaining odd resistance values. Standard wattage rating applies only when entire resistance is in the circuit. Power is reduced proportionately by the position of the adjustable lug.

Resistance tolerance is 10% of total resistance value.

TYPE	WATTAGE RATING	MAX. RES.	MIL-R-26 STYLE	LENGTH (±1/16)	O.D.	I.D. (±1/32)
VLA-10	10	10K	RW-30	1	7/16	5/16
VLA-11	11	10K	RW-29	1-3/4	3/8	3/16
VLA-12	12	10K	-	1-3/4	5/16	3/16
VLA-15	15	10K	RW-31	1-1/2	7/16	5/16
VLA-20	20	10K	RW-32	2	7/16	5/16
VLA-25	25	25K	-	2	9/16	5/16
VLA-26	26	25K	RW-33	3	7/16	5/16
VLA-50	50	100K	-	4	9/16	5/16
VLA-51	51	100K	-	3-1/2	3/4	1/2
VLA-60	60	100K	RW-35	4	3/4	1/2
VLA-65	65	100K	-	4-1/2	3/4	1/2
VLA-80	80	100K	RW-36	4	1-1/8	3/4
VLA-100	100	100K	-	6-1/2	3/4	1/2
VLA-120	120	100K	RW-37	6	1-1/8	3/4
VLA-130	130	100K	-	6-1/2	1-1/8	3/4
VLA-160	160	100K	RW-38	8	1-1/8	3/4
VLA-175	175	100K	-	8-1/2	1-1/8	3/4
VLA-225	225	100K	RW-47	10-1/2	1-1/8	3/4

OVAL, STACKING TYPE

OVAL, STACKING TYPE are space savers. Wound on an oval core, they provide more wattage with less bulk in less space. Metal mounting pieces extend through the core to distribute and conduct heat directly to the mounting surface. Reduce power ratings by 15% when mounted on non-metallic surface.

Resistance tolerance is ±5% on 1 ohm or higher; ±10% below 1 ohm.

TYPE	WATTAGE RATING	MAX. RES.	MIL-R-26 STYLE	WIDTH	CORE LENGTHS	MOUNTING CENTERS
FO-30	30	10K	RW-20	1-3/16	1-1/4	2
FO-40	40	25K	RW-21	1-3/16	2	2-3/4
FO-55	55	30K	RW-22	1-3/16	3-1/2	4-1/4
FO-70	70	40K	RW-23	1-3/16	4-3/4	5-1/2
FO-95	95	55K	RW-24	1-3/16	6-3/4	6-3/4

*Minimum resistance is .1 ohm for all models.

**FIXED lug type and OVAL, STACKING TYPE resistors are available with *non-inductive windings and multiple taps.* Maximum resistance value for non-inductive type is 50% of values for standard fixed resistors.

STANDARD MOUNTING HARDWARE IS AVAILABLE

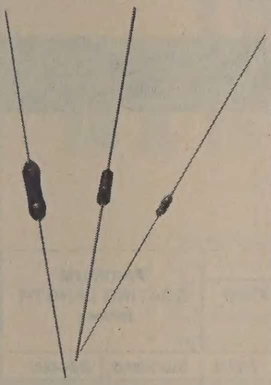
402/551-5100

OMTRONICS MFG., INC.
a division of Hirsch & Associates, Inc.
2420 S. 60TH ST.
OMAHA, NE. 68106

Panasonic

FIXED RESISTORS

TYPE ERD (⅛, ¼ & ½ W) CARBON FILM



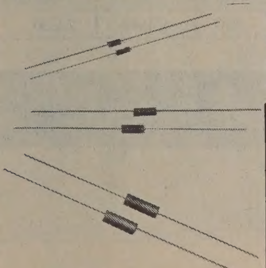
- Small size
- High stability
- High reliability
- Low noise
- Low temp. coefficient
- 1%, 2%, 5% tolerance

Panasonic has been producing the most reliable carbon film resistors for 45 years. This background, plus 20 years of modern mass producing experience in producing conventional standard types, has led to these new miniature standard carbon film resistors — which are unequalled for reliability and performance characteristics.

Type No. (Feature)	Power Rating (W) @ 70°C	Max. RCWV (Note 1)	Max. Overload Voltage	Dielectric Withstanding Voltage	Res. Tol. (%)	Resistance Range (Ω)		Std. Res. Values	No. of Color Bands	Dimensions: mm (inch)			Equivalent Type No.	
						Min.	Max.			L	D	d	DIN 44051	MIL-R-11
ERD-10T (Standard)	0.125 (⅛)	150V	300V	300V AC	J (±5)	4.7	150K	E-24	4	$3.70^{+0.40}_{-0.30}$ $.145^{+.016}_{-.012}$	1.60±0.20 (.063±.008)	0.40±0.05 (.016±.002)	0204	RC05
ERD-25T (Standard)	0.25 (¼)	300V	600V	500V AC	J (±5)	4.7	1.0M	E-24	4	$6.35^{+0.65}_{-0.38}$	$2.30^{+0.50}_{-0.30}$	0.60±0.05	0207	RC07
					G (±2)	4.7	270K	E-48	5					
ERD-25F (Flame Retardant)	0.25 (¼)	300V	600V	350V AC	J (±5)	4.7	1.0M	E-24	4	$.250^{+.025}_{-.015}$	$.090^{+.020}_{-.012}$	(.024±.002)		
ERD-33T (Standard)	0.33 (⅓)	300V	600V	700V AC	J (±5)	4.7	1.0M	E-24	4	$9.00^{+1.00}_{-0.50}$	$2.80^{+0.50}_{-0.30}$	0.65±0.05	0309	
					G (±2)	4.7	270K	E-48	5					
ERD-33F (Flame Retardant)	0.33 (⅓)	300V	600V	500V AC	J (±5)	4.7	1.0M	E-24	4	$.354^{+.039}_{-.020}$	$.110^{+.039}_{-.012}$	(.026±.002)		
ERD-50T (Standard)	0.50 (½)	350V	700V	700V AC	J (±5)	4.7	1.0M	E-24	4	9.50±.050	$3.50^{+0.50}_{-0.30}$	0.60±0.05	0414	RC20
					G (±2)	4.7	470K	E-48	5					
ERD-50F (Flame Retardant)	0.50 (½)	350V	700V	500V AC	J (±5)	4.7	1.0M	E-24	4	(.375±.020)	$.138^{+.020}_{-.012}$	(.024±.002)		

Note 1: Rated Continuous Working Voltage (RCWV) shall be determined from
$\text{RCWV} = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$, or Max. RCWV listed above, whichever less.

TYPE ERC (⅛, ¼ & ½ W) CARBON COMPOSITION



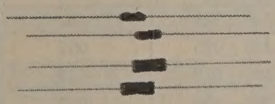
- Full range of standard values — from 2.2 ohms to 22 megohms
- Special high values on request
- High reliability
- Rugged construction
- Uniform quality

Panasonic has been producing carbon composition resistors for over 26 years. Our carbon composition types are now being produced by a hot-molding process on automatic machines recently developed and used only by Panasonic. These resistors, when used as specified, will not open-circuit nor exhibit erratic changes in value.

Type No.	Power Rating (W) @ 70°C	Max. RCWV (Note 1)	Max. Overload Voltage	Dielectric Withstanding Voltage	Res. Tol. (%)	Resistance Range (Ω)		Std. Res. Values	Dimensions: mm (inch)			Equivalent Type No.
						Min.	Max.		L	D	d	MIL-R-11
ERC-18G	⅛	150V	200V	300 VAC @ Sea Level 200 VAC @ 87 mm Hg	J (±5) K (±10) M (±20)	10Ω	1MΩ	E-24 E-12 E-6	3.70±0.30 (.145±.015)	1.57±0.10 (.062±.004)	0.38±0.12 (.016±.005)	RC05
ERC-14G	¼	250V	400V	500 VAC @ Sea Level 325 VAC @ 87 mm Hg	J (±5) K (±10) M (±20)	2.2Ω	22MΩ	E-24 E-12 E-6	6.40±0.70 (.250±.031)	2.29±0.20 (.090±.008)	0.64±0.12 (.025±.005)	RC07
ERC-12G	½	350V	700V	700 VAC @ Sea Level 450 VAC @ 87 mm Hg	J (±5) K (±10) M (±20)	2.2Ω	22MΩ	E-24 E-12 E-6	$9.50^{+1.00}_{-0.80}$ $.375^{+.041}_{-.031}$	3.50±0.30 (.138±.023)	0.78±0.12 (.031±.005)	RC20

Note 1: Rated Continuous Working Voltage (RCWV) shall be determined from
$\text{RCWV} = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$, or Max. RCWV listed above, whichever less.

TYPE ERO (¼ & ½ W) METAL FILM



- Standard tolerance: 1%
- Temperature coefficient of 100 ppm (CKF Series) and 50 ppm (CHF Series)
- Meet standards of MIL-R-10509 (RN-60 and RN-65)
- Excellent humidity characteristics
- Solvent proof coating

With over 16 years of experience in mass producing metal film resistive elements and over 2 billion hours of component use, Panasonic has been able to lead the way in producing the new, small-size, standard metal film resistors essential for meeting MIL specs.

Type No. (Feature)	Power Rating (W) @ 70°C	Max. RCWV (Note 1)	Max. Overload Voltage	Dielectric Withstanding Voltage	TCR (ppm/°C)	Res. Tol. (%)	Resistance Range (Ω)		Std. Res. Values	Dimensions: mm (inch)			Equivalent Type No.	
							Min.	Max.		L	D	d	MIL-R-22684	MIL-R-10509
ERO-25CK (Standard)	0.25 (¼)	250V	500V	500V	100	1 0.5	10.0 10.0	562K 562K	E-96 E-96	6.30±0.50 (.250±.020)	2.30±0.50 (.090±.020)	0.60±0.05 (0.24±.002)	RL07	RN55
ERO-25CH (Standard)	0.25 (¼)	250V	500V	500V	50	1 0.5	49.9 49.9	301K 301K	E-96 E-96					
ERO-50CK (Standard)	0.50 (½)	350V	700V	700V	100	1 0.5	20.0 20.0	2.00M 2.00M	E-96 E-96	9.50±0.50 (.375±.020)	3.50±0.50 (.138±.020)	0.60±0.05 (.024±.002)	RL20	RN60
ERO-50CH (Standard)	0.50 (½)	350V	700V	700V	50	1 0.5	49.9 49.9	1.00M 1.00M	E-96 E-96					

Note 1: Rated Continuous Working Voltage (RCWV) shall be determined from
$\text{RCWV} = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$, or Max. RCWV listed above, whichever less.

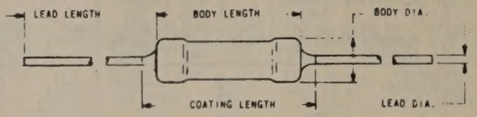
Panasonic/ MATSUSHITA ELECTRIC CORPORATION OF AMERICA / ELECTRONIC COMPONENTS DIVISION
DEPT. EM, ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000
OUR TECHNOLOGY IS ALL AROUND YOU

SETTING NEW STANDARDS IN RELIABILITY

The following 4 pages are a condensed version of Pyrofilm's product line. Should you desire detailed information, contact your Pyrofilm representative or the factory.

METAL FILM RESISTORS

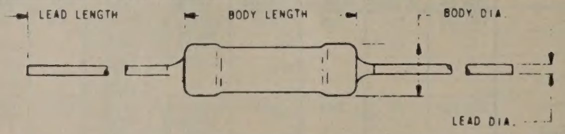
CONFORMAL COATED



PYRO-FILM	MIL-R-10509	PHYSICAL AND ELECTRICAL CHARACTERISTICS RATING Watts		RESISTANCE RANGE		VOLTAGE to 1M	BODY DIMENSIONS Inches		LEAD DIMENSIONS Inches			MAXIMUM COATING LENGTH Inches	
		MIL	Com.	Min.	Max.		Diameter	Length	Dia.	Length	AWG	Standard	Special
PME 45	—	—	1/20	25 Ω	200K	200	.047 ± .010	0.125 ± .020	.010	1	#30	.160	—
PME50	RN50*	1/20	1/8	10 Ω	1M	200	.060 ± .015 - .010	.150 ± .020	.016	1	#26	.200	.172
PME55	RN55*	1/10	1/8	10 Ω	4M	250	.095 ± .015	.250 ± .031	.025	1½	#22	.360	.281
PME60	RN60*	1/8	1/4	49 Ω	10M	300	.105 ± .015	.390 ± .015	.025	1½	#22	.475	.406
PME62	—	—	1/4	500 Ω	20M	1,500	.105 ± .015	0.510 ± .031	.025	1½	#22	.600	.530
PME64	—	—	1/4	500 Ω	30M	2,500	.105 ± .015	0.970 ± .031	.025	1½	#22	1.070	.985
PME65	RN65*	1/4	1/2	49 Ω	20M	400	.156 ± .015	.580 ± .031	.025	1½	#22	.650	.600
PME70	RN70*	1/2	1	24 Ω	40M	700	.230 ± .015	.730 ± .031	.032	1½	#20	.830	.730
PME75	RN75*	1	2	49 Ω	50M	1,000	.365 ± .015	1.050 ± .031	.032	1½	#20	1.165	1.081
PME80	RN80	2	2	100 Ω	70M	5,000	.365 ± .015	2.175 ± .031	.032	1½	#20	2.290	2.206

THICK FILM RESISTORS

HIGH VOLTAGE CONFORMAL COATED



PYROLFILM TYPE	WATTS MAX	VOLTAGE MAX	RESISTANCE RANGE*	BODY DIMENSIONS - INCHES LENGTH	DIAMETER	LEAD DIAM INCHES
PVC55	1/8	250	10K - 50M	.250 ±.031	.105 ±.015	.025
PVC60	1/4	500	10K - 100M	.375 ±.031	.125 ±.020	.025
PVC62	1/4	500	10K - 200M	.510 ±.031	.125 ±.020	.025
PVC64	1/4	1000	10K - 500M	.970 ±.031	.125 ±.020	.025
PVC70	1	5KV	10K - 500M	.750 ±.050	.295 ±.025	.032
PVC100	1.5	10KV	10K - 1000M	1.040 ±.050	.295 ±.025	.032
PVC175	3	17.5KV	20K - 1000M	1.800 ±.050	.295 ±.025	.032
PVC200	3	20KV	20K - 1000M	2.050 ±.050	.295 ±.025	.032
PVC300	3.75	30KV	35K - 1000M	3.050 ±.050	.295 ±.025	.032
PVC400	5.25	40KV	50K - 1000M	3.980 ±.050	.295 ±.025	.032

*Extended values are available consult factory.

Also available in thick film — Chips, Radial Lead Flatso™, Networks

For **CUSTOM NETWORKS** consult Pyrofilm Application Engineers.

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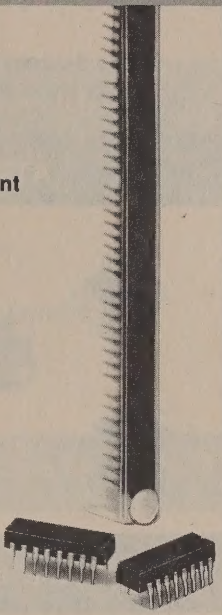
SETTING NEW STANDARDS IN RELIABILITY

Thick Film Resistors

14 & 16 PIN

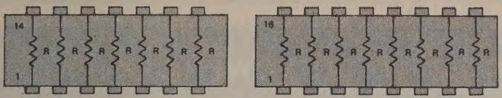
- Packaging is compatible with automatic insertion equipment
- Reduces space and reduces costs



Applications

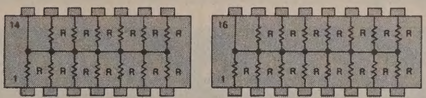
- Power Gate Pull-up
- Line Terminations
- LED Current Limiting
- ECL Output Pull-down
- Impedance Balancing
- TTL Input Pull-down
- Open Collector Pull-up
- MOS/Rom Pull-up/Pull-down
- Power Driver Pull-up
- "Wired OR" Pull-up

Schematic A



14 PIN 16 PIN

Schematic B



14 PIN 16 PIN

PD 14 — A and PD 14 — B Standard Resistance Values

22	47	100	220	470	1.0K	2.2K	4.7K	9.1K	20K
24	51	110	240	510	1.1K	2.4K	5.1K	10K	22K
27	56	120	270	560	1.2K	2.7K	5.6K	11K	33K
30	62	130	300	620	1.3K	3.0K	6.0K	12K	47K
33	68	150	330	680	1.5K	3.3K	6.2K	13K	68K
36	75	160	360	750	1.6K	3.6K	6.8K	15K	100K
39	82	180	390	820	1.8K	3.9K	7.5K	16K	
43	91	200	430	910	2.0K	4.3K	8.2K	18K	

Standard Tolerance ±2% (<100Ω ±.5Ω)

PD 16 — A and PD 16 — B Standard Resistance Values

62	220	1.5K	6.0K	33.0K
68	330	2.0K	6.8K	47.0K
100	470	2.2K	10.0K	68.0K
110	680	3.3K	15.0K	100.0K
150	1.0K	4.7K	22.0K	

Standard Tolerance ±2% (<100Ω ±.5Ω)

STANDARD PRODUCT SPECIFICATIONS

Resistance Range .... 10 ohms to 1 meg ohm

Tolerance .... Letter designation for ordering
  Standard 2% .... G
  Special 5% .... J
  Special 1% .... F
  Special .5% .... D

Max. number of resistors per Dip available 28

Power Rating .... 1.75W Total per DIP at 70°C
  Max. power per resistor .125W for standard circuits

Temperature Coefficient Track .... Typical 50 PPM/°C
  Special 25 PPM/°C

Temperature Coefficient
of resistance .... Letter designation for ordering
  Standard — 0 ± 300PPM/°C .... M
  Special — 0 ± 200PPM/°C L
  Special — 0 ± 100PPM/°C .... K

Tolerance Ratio Match .... As low as .5%

Voltage Ratings .... 100 V max. per resistor,
  2000 V max. per DIP package for special circuits

Operating Temperature Range ...... −55°C to +125°C

Encapsulation .... epoxy transfer molded

ORDERING INFORMATION

Basic Model Number	Number of Pins	Temp. Coeff.	Resistance Value	Tolerance	Schematic
PD		M	220Ω	G	A

For **CUSTOM NETWORKS** consult Pyrofilm Application Engineers.

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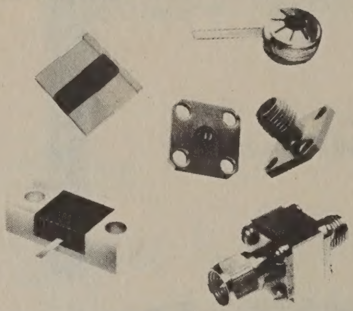
SETTING NEW STANDARDS IN RELIABILITY

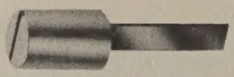
The devices shown are only a representative sample of what is available.
Data sheets that show the full product line will be provided upon request.

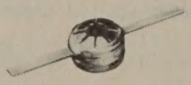
ATTENUATORS 2-20 DB UP TO 50 WATTS POWER DISSIPATION



PSA PILLSHAPE	DC-4 GHz	1.25
PCA THIN FILM CHIP	4-8 GHz	1.35
PFA SMA-FLANGE	8-12 GHz	1.50
PPA FLANGE MOUNTED POWER	DC-1 GHz	1.15
	1-2.5 GHz	1.35
CXAS SMA COAXIAL	2.5-4 GHz	1.50

TERMINATIONS, RESISTORS, & CAPACITORS UP TO 20 WATTS POWER DISSIPATION





		Frequency	**VSWR**
PCL CARTRIDGE™	3 watts	DC-4 GHz	1.10
PCL CARTRIDGE™	15 watts	4-8 GHz	1.20
PFT FLANGE		8-12.4 GHz	1.30
		12.4-18 GHz	1.35
PMS STUD MOUNTED TERMINATION		DC-4 GHz	1.35
PMS STUD MOUNTED RESISTOR			

	Ground Plane Spacing
PST PILLSHAPE*	.125
PSR PILLSHAPE RESISTOR	.250
PSC PILLSHAPE CAPACITOR	.062

*Available with VSWR of 1.35 up to 18 GHz.

COAXIAL CONDUCTION COOLED LOADS UP TO 200 WATTS POWER DISSIPATION

PCX-050-15-F or M	15 watts
PCS-050-200-F or M	200 watts

Available at intermediate power ratings and with other connectors.

For **CUSTOM NETWORKS** consult Pyrofilm Application Engineers.

Setting New Standards in Reliability

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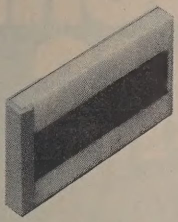
SETTING NEW STANDARDS IN RELIABILITY

HIGH POWERED CHIP RESISTORS UP TO 1000 WATTS POWER DISSIPATION

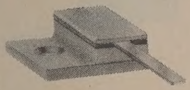


PPC 100-200A-G-*-2	*up to 500Ω
PPC 1000-1000A-X-*-2	*up to 500Ω

Other configurations available in intermediate sizes and power ratings.

*Resistance valve

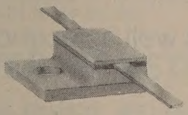
FLANGE MOUNTED TERMINATIONS UP TO 800 WATTS POWER DISSIPATION



PPT 515-20-3	20 watts
PPT 1900-800-3	800 watts

Available in intermediate sizes and power ratings.

FLANGE MOUNTED RESISTORS UP TO 800 WATTS POWER DISSIPATION



PPR 515-20-3	20 watts
PPR 1900-800-3	800 watts

Available in intermediate sizes and power ratings.

ALSO AVAILABLE

- Custom designed microwave and stripline components
- Thin film low power chips
- Rods, discs and T pads
- High power rods, disc, and T pads

For **CUSTOM NETWORKS** consult Pyrofilm Application Engineers.

Setting New Standards in Reliability

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PRC
PRECISION
WIREWOUND
RESISTORS

PRC CONTINUES A TRADITION IN PRECISION WIREWOUND RESISTORS WITH...

- **Low-priced/space-saver Type TX:**
  Hundreds of physical sizes for Commercial/Industrial applications in any ohmic value desired.
- **Best-selling high precision Type SX:**
  Military types in any resistance value as well as *higher* or *lower* values and TCR Characteristics beyond the MIL limits.
- **Ultra high precision Type HR:**
  Excellent time stability for matched tolerances and TCR Characteristics as well as economical single or multiple secondary standards.
- **Sub-miniature precision power Type SM:**
  Any ohmic value to ±0.05% tolerance, especially inexpensive low shunt values in 2 or 4 terminal designs to 10 watts.
- **Standard Mil style lug and radial lead Bobbin Types:**
  Ideal as exact interchangeable parts for replacement specs or production quantities.
- **Resistance-temperature devices (RTD's):**
  Any resistance and positive TCR Char. combination for temperature compensation or sensing from +20ppm to +0.6% change in resistance per degree C. Also, devices are furnished either uncoated, coated or encapsulated into a metal sheath to meet your physical requirements exactly.

PRC

WRITE OR TELEPHONE FOR PRICE, DELIVERY AND ENGINEERING INFORMATION REQUIRED.

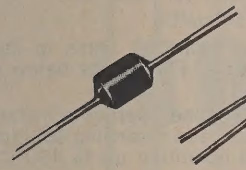
PRECISION RESISTOR CO., INC.
109 U.S. Highway #22 | Hillside, New Jersey 07205 | Telephone: (201) 926-3036

AMF
RCL Electronics

RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

established reliability wire-wound resistors

PRECISION RESISTORS / PER MIL R-39005



Resistance Tolerances Available: .01%, .02%, .05%, .10%, 1.0%.
If solderable leads are required use Suffix L.
If weldable leads are required use Suffix U.

RCL Type No.	Mil-R-39907 Type	DIMENSIONS Diam. ±.015	DIMENSIONS Length +.020 −.032	Mil Watt	Max. Volts	Max. Mil Res.	MILLIMETERS Diam. ±0.4	MILLIMETERS Length +0.5 −0.8
7009-ER	RBR 56	.250	.344	0.125	150	220K	6.3	8.7
7010-ER	RBR 55	.250	.500	0.15	200	332K	6.3	12.7
7020-ER	RBR 54	.250	.750	0.250	300	562K	6.3	19.05
7030-ER	RBR 53	.375	.750	0.33	400	1.1 Meg.	9.5	19.05
7040-ER	RBR 52	.375	1.000	0.50	600	1.210 Meg.	9.5	25.4

Lead Length: 1½″ min. (38.1mm min.). **Lead Diameter:** #20 AWG .032″ (0.8mm).

4060-ER	RBR 71	.250 ±.031	.312 ±.031	0.125	150	150K	6.3 ±0.8	8.0 ±0.8

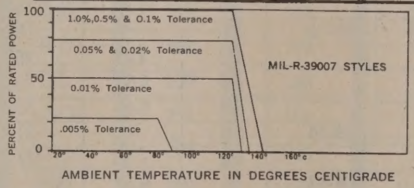
Standard Temperature Coefficient: ±20 PPM/°C.

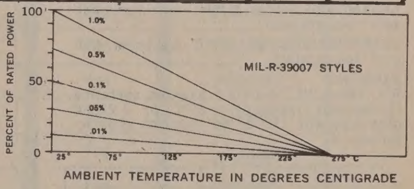
POWER RESISTORS / PER MIL R-39007

RCL Type No.	MIL-R-399005 Type	DIMENSIONS Diam. ±.031	DIMENSIONS Length ±.062	Wattage Rating	Max. Resist.	Lead Diam. AWG	MILLIMETERS Diam. ±0.8	MILLIMETERS Length ±1.6
T-2B-71-ER	RWR 71	.188	.812	2.0	16.2K	#20	4.8	20.0
T-5-74-ER	RWR 74	.312	.875	5.0	12.1K	#18	8.0	22.2
B-1-ER	RWR 81	.085 ±.020	.250 ±.032	1.0	1K	#24	2.2 ±0.12	2.4 ±0.8
B-3-ER	RWR 80	.094	.406 ±.032	2.0	2.67K	#24	2.4	11.5 ±0.8
B-5-ER	RWR 89	.187	.560	3.0	4.12K	#20	4.8	14.2
T10-78-ER	RWR 78	.375	1.780	10	39.2K	.040	9.53	45.21
B-2-ER	RWR 82	.078 ±.016	.312 ±.016	1.5	1.3K	.020	1.98	7.92
B-10-ER	RWR 84	.312 ±.031	.875 ±.062	7	12.4K	.040	7.92	22.23

Resistance Tolerances Available: .1%, .5%, 1.0%.
Lead Length: 1½″ minimum.
Standard Coefficient: ±20 PPM/°C.
Non Inductive Winding: Add Suffix N. (divide maximum resistance values by 2)
If solderable leads are required use Suffix S.
If weldable leads are required use Suffix W.

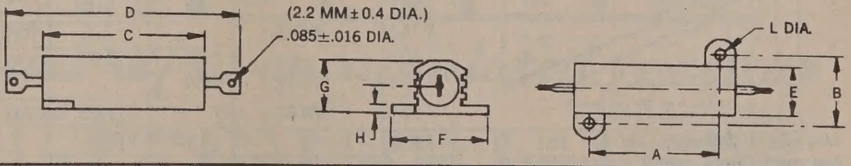
A completely controlled process is used for the manufacture of established reliability units. Every unit is documented and traceable with quality control data. A 100 hour burn-in at rated wattage is performed. Failure rates test results are available.





POWER RESISTORS / MIL R-39009

ESTABLISHED RELIABILITY ALUMINUM HOUSED POWER RESISTORS



RCL Type No.	Mil-R-39009 Type No.	Power Rating* (Watts) RCL	Power Rating* (Watts) Mil	Min. Resistance	Max. Resistance	Max. Working Voltage	Max. Weight (Grams)
ALN5 ER	RER-40	7.5	5	1Ω	16.5 K	113.2	3.3
AL5 ER	RER-60	7.5	5	.1Ω	33.2 K	160.0	3.0
ALN10 ER	RER-45	12.5	10	1Ω	28 K	187.3	8.8
AL10 ER	RER-65	12.5	10	.1Ω	56.2 K	265.0	8.0
ALN25 ER	RER-65	25.0	20	1Ω	60.4 K	388.8	16.5
AL25 ER	RER-70	25.0	20	.1Ω	121 K	550.0	16.0
ALN50 ER	RER-55	50.0	30	1Ω	196 K	883.7	35.5
AL50 ER	RER-75	50.0	30	.1Ω	392 K	1250.0	35.0

* Rating based on chassis mounting.

DIMENSIONS IN INCHES

RCL Type No.	*	**	A	B	C	D	E	F	G	H	L	Mil-R-39009 Type No.
Tolerance			±.005	±.005	±.032	±.062	±.015	±.015	±.015	±.010	±.005	
ALN5 ER	X		.445	.490	.600	1.125	.335	.645	.321	.065	.094	RER-40
AL5 ER		X										RER-60
ALN10 ER	X		.562	.625	.750	1.375	.420	.795	.400	.074	.094	RER-45
AL10 ER		X										RER-65
ALN25 ER	X		.720	.780	1.060	1.940	.530	1.075	.560	.087	.125	RER-50
AL25 ER		X										RER-70
ALN50 ER	X		1.562	.845	1.970	2.780	.615	1.135	.615	.087	.125	RER-55
AL50 ER		X										RER-75

* Indicates Non-Inductively Wound ** Indicates Inductively Wound

APPLICABLE MIL-SPECIFICATIONS
MIL-R-39009: Meets or exceeds military specifiications covering aluminum housed, chassis-mounted resistors.

Dielectric Strength:
1000 Volts AC on AL-5 AL-10
2500 Volts AC on AL-25, AL-50

Insulation Resistance:
10,000 megohms minimum dry.

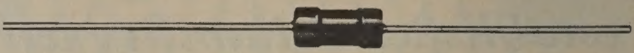
AMF

RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

RCL Electronics

SERIES T

silicone coated axial power wire-wound resistors



General Specifications Available:

☐ **Standard Temperature Coefficient:**
Standard T.C.:

±20 PPM/°C. 500Ω up	±30 PPM/°C 10Ω to 499Ω
±50 PPM/°C 1Ω to 9.9Ω	±90 PPM/°C below 1Ω

Lower ohmic values require higher T.C.'s, consult factory for information on specific applications.
Consult factory for lower temperature coefficient requirements.

☐ **Tolerance:** ±1.0% is standard. Closer tolerances available. Closer tolerances may necessitate lowering maximum resistance; consult factory for specifics.

☐ **Wattage Range:** ½ watts to 14 watts.

☐ **Standard Resistance Values:** From 0.1 ohms to maximum values as stated in table. For values below 0.1 ohms consult factory.

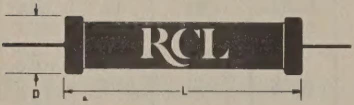
☐ **Coating:** RCL's proprietary silicone coating withstands moisture, salt water immersion, and cleansing solutions. It will withstand continuous operation up to 400°C.

☐ **Leads:** Tinned copperweld is standard.

☐ **Dielectric Strength:** 500 VAC for T-½A through T-1C, 1000 VAC for all others.

☐ **Insulation Resistance:** 5000 Megohms minimum at 100 volts D.C.

☐ **Wide Temperature Range:** From −65°C to +275°C (Characteristic U) or +350° (Characteristic V).

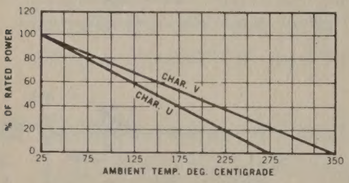


POWER RATINGS:
The RCL "T" Series has two power ratings, depending on operating temperature and stability requirements:

CHARACTERISTIC U: 275°C maximum hot-spot temperature.

CHARACTERISTIC V: 350°C maximum hot-spot temperature.

DERATING:
RCL Series "T" resistors have an operating temperature range of −65°C to +275°C (Characteristic U), or to +350°C (Characteristic V).



Ultra-fast delivery for prototypes and initial production needs.

RCL TYPE	MIL-R 26 E TYPE	WATTAGE RATING		DIMENSIONS		MAX. RESISTANCE		LEAD DIAM.
		U	V	DIA. ±.031*	LEN. ±.062*	RCL MAX.	MIL-R 26 E MAX.	
T-½A		.4		.078	.220	2.5K		#24
T-½		.75		.078	.330	7.5K		#24
T-1A		1.0	1.25	.093	.406	10K		#24
T-1A-70	RW-70	1.0		.094	.406 ±.031	10K	3.16K	#24
T-1B		1.1	1.30	.093	.530	12K		#24
T-1C		1.0		.093	.280	5K		#24
T-2		1.5		.156	.343	10K		#20
T-2A		3.0	3.75	.187	.500	22K		#20
T-2A-69	RW-69		3.00	.188 ±.063	.500 ±.063	22K	2.K	#20
T-2B		3.0	3.75	.188	.812	40K		#20
T-2B-79	RW-79	3.0		.187	.560	22K	10.5K	#20
T-2C		3.0	3.25	.250	.500	40K		#18
T-3		4.0	5.5	.250	.625	45K		#18
T-5		5.0	6.5	.312	.875	91K		#18
T-5-74	RW-74	5.0		.312	.875	91K	38.3K	#18
T-6		6.0	7.5	.312	1.000	95K		#18
T-6-67	RW-67		6.5	.313 ±.063	1.000 ±.094	95K	8.2K	#20
T-7		7.0	9.00	.312	1.185	100K		#18
T-7A		7.0	9.00	.375	1.375	150K		#18
T-7A-55	RW-55		7.00	.469 ±.094	1.375 ±.094	150K	5.1K	#20
T-10		10.0	13.00	.375	1.812	250K		#18
T-10-78	RW-78	10.0		.375	1.780	260K	90.9K	#18
T-10-68	RW-68		11.00	.344 ±.094	$1.875^{+.063}_{-.125}$	265K	20K	#20
T-10A		10.5	14.00	.375	1.925	275K		#18
T-10-A-56	RW-56		14.00	.469 ±.094	2.000 ±.094	275K	9.1K	#20

Lead Length: 1¼" (32mm) minimum

* Tolerance applies to all types unless otherwise indicated.

BERYLLIUM OXIDE CORE WIRE-WOUND RESISTORS

For maximum heat dissipation . . . in smaller sizes. (All specifications same as above . . . Series T.)

RCL Type	MIL-R-26E	Rated Wattage		Dimensions Diameter Inches	Diameter mm	Length Inches	Length mm	Lead Diameter		Max. Resistance	
		U	V	±.032	±.08 mm	±.062	±1.6 mm	AWG	mm	MIL	RCL
B-1	RW-81	1	—	.085 ±.020	2.2 ±0.5	.250 ±.032	6.4 ±0.8	#24	0.5	1K	3.4K
B-2	—	1.5	2	.078	2	.312	7.9	#24	0.5	—	7.5K
B-3	RW-80	2	—	.094	2.4	.406 ±.032	10.3 ±0.8	#24	0.5	3.16K	10.0K
B-5	—	4	5	.188	4.8	.562	14.3	#20	0.8	—	25K
B-5A	—	4.5	6.5	.188	4.8	.812	20.6	#20	0.8	—	42K
B-5C	—	5	7	.218	5.5	.500	12.7	#18	1	—	32K
B-6	—	6	8	.250	6.4	.625	15.9	#18	1	—	50K
B-10	—	7	10	.312	7.9	.875	22.2	#18	1	—	95K
B-12	—	10	12	.312	7.9	1.218	31	#18	1	—	154K
B-15	—	15	18	.375	9.5	1.780	45.2	#18	1	—	273K

Lead length 1¼" (32mm) Minimum.

NON-INDUCTIVE WINDING AVAILABLE FOR SERIES "T" OR "B"

☐ For non-inductive winding add prefix "N".

1. Divide maximum resistance values by two.
2. Multiply maximum working voltage by .707.
3. Where possible, specify maximum inductance or capacitance allowable at a specific frequency.

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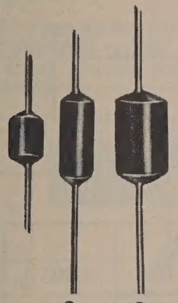
low-cost wire-wound resistors for commercial/industrial applications



RCL Commercial line — low cost, precision wire wound resistors for test equipment, instruments, industrial controls, communications equipment. All the benefits of wire wounds — low T.C., high stability, close tolerance.

- Price competitive with comparable metal film resistors
- Standard T.C. = ±10 PPM/°C
- Special T.C.'s available on request
- High temperature epoxy coating provides moisture protection
- Lead Length: 1½" (38.1mm) minimum
- Wattage rating at 60°C ambient; derated to zero at 105°C
- Low noise
- Molded-in leads for structural strength
- Tolerance Available: ±1.%, 0.5%
- Non-inductive winding available on special order

Style Number	Wattage* Rating	Min. Res.	Max. Res.	Bobbin Diameter ±.031	Bobbin Length ±.0625	Lead Diam. AWG
E-10	.1	0.1 ohm	6K	.1875	.375	#22
E-20	.25	0.1 ohm	13K	.1875	.5	#22
E-30	.5	0.1 ohm	25K	.25	.75	#20

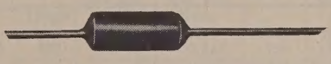
subminiature wire-wound resistors

These extremely small, encapsulated resistors meet and exceed the specifications of MIL-R-93. Special RCL techniques also allow the production of custom sizes at minimal cost to the customer.

Tolerances available: from ±1.0% to ±0.001%.

Temperature coefficient: Standard is ±10 PPM/°C.

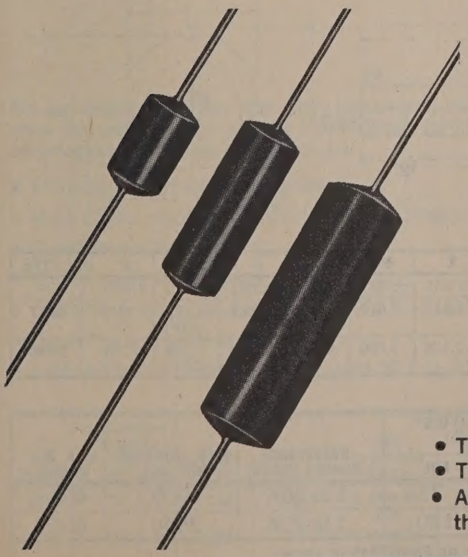
Temperature coefficients available as low as ±2 PPM/°C.



RCL Type	Dia. Inches (±.016)	Length Inches (±.032)	Max. Watts	Max. Volts	Max. Res. .001 Wire (25.4μ)	Max. Res. .0005 Wire (12.7μ)	Non-inductive	Lead Diam. (Length 1½" Min.)
7001	.100	.200	0.05	75	10K	—	No	#26AWG
7002	.110	.220	0.1	100	10K	100K	No	#24AWG
7003	.100	.260	0.05	100	10K	150K	No	#24AWG
7004	.100	.300	0.05	100	10K	250K	Yes	#24AWG
7005	.125	.250	0.1	100	10K	300K	Yes	#22AWG
7006	.125	.312	0.1	100	16K	350K	Yes	#22AWG
7007	.1875	.375	0.125	200	60K	700K	Yes	#22AWG
7008	.250	.250	0.150	100	100K	1 Meg.	Yes	#22AWG
7009	.250	.343	0.25	200	127K	1.4 Meg.	Yes	#20AWG
7010	.250	.500	0.33	400	226K	3 Meg.	Yes	#20AWG

Maximum wattage rating is at 25° C through 125° C

miniature axial lead w/w encapsulated resistors



Lead Length: 1½" Min. #20 AWG **Non-Inductive Winding**

Type	MIL-R-93 Type	Dia. In. (±.015)	Lgth In. ±.031	Maximum Watts	MIL Wattage	Maximum Volts	Max. Res. .001 Wire
7009	RB-56	.25	.343	0.25	0.125	200	127K
7010	RB-55	.25	.5	0.33	0.15	400	226K
7020	RB-54	.25	.75	0.50	0.25	400	511K
7030	RB-53	.375	.75	0.60	0.33	400	750K
7040	RB-52	.375	1.0	1.00	0.50	800	1.5 Meg.
7044	—	.5	.5	0.50	—	400	1 Meg.
7045	—	.5	.625	0.60	—	400	1 Meg.
7045A	—	.437	.625	0.60	—	400	650K
7050	RB-57	.5	1.0	1.25	0.75	800	2 Meg.
7050A	—	.437	1.0	1.25	—	800	1.5 Meg.
7060	RB-58	.5	1.5	1.50	1.0	900	3 Meg.
7070	RB-59	.5	2	2.00	1.25	1,200	5 Meg.

Maximum wattage rating is from −55° C to +125° C.

MILITARY SPECIFICATIONS

- These standard sizes meet the physical dimensions of MIL-R-93.
- Test data and approval information available.
- All RCL types meet or exceed the electrical and environmental characteristics of this specification.

INDUSTRY'S BEST DELIVERY

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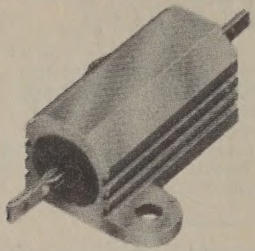
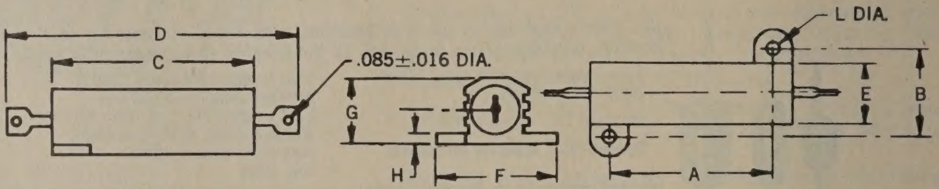
aluminum housed wire-wound power resistors





TYPE	A	B	C	D	E	F	G	H	L	MIL-Type
Tol.	±.005	±.005	±.032	±.062	±.015	±.015	±.015	±.010	±.005	—
AL-5	.445	.490	.600	1.125	.335	.645	.321	.065	.094	RE-60
AL-10	.562	.625	.750	1.375	.420	.795	.400	.074	.094	RE-65
AL-25	.720	.780	1.060	1.940	.530	1.075	.560	.087	.125	RE-70
AL-50	1.562	.845	1.970	2.780	.615	1.135	.615	.087	.125	RE-75

FEATURES

- Molded and welded construction
- Screw mounts on chassis
- Exceptionally high stability at all conventional power ratings
- Utilizes heat-sink effect of chassis
- Clearly marked on top surface of housing for ease of identification after mounting
- Exceeds MIL-R-18546
- Complete protection against environment

NON INDUCTIVE STYLES: (Series "AL" and "ALB") The same physical and electrical specifications are available with non-inductive winding. They are identified by adding the letter N after the AL identification.

RCL TYPE	MIL-R-18546 TYPE	POWER RATING* (WATTS) RCL	MIL	RESISTANCE RANGES (OHMS)	MAX. WORKING VOLTAGE	MAX. WT. GRAMS
AL-5	RE-60G	7.5	5	.01 to 24.5K	160	3
AL-10	RE-65G	12.5	10	.01 to 47.1K	265	6
AL-25	RE-70G	25	20	.01 to 95.2K	550	14
AL-50	RE-75G	50	30	.01 to 273K	1250	29

* Rating based on chassis mounting.

BERYLLIUM OXIDE CORES FOR GREATER HEAT DISSIPATION

RCL TYPE	MIL-R-18546 TYPE	POWER RATING* (WATTS) RCL	MIL	RESISTANCE RANGES (OHMS)	MAX. WORKING VOLTAGE	MAX. WT. GRAMS
ALB-5	RE-60	15	5	.01 to 24.5K	220	3
ALB-10	RE-65	20	10	.01 to 47.1K	340	6
ALB-25	RE-70	35	20	.01 to 95.2K	650	14
ALB-50	RE-75	50	30	.01 to 273K	1400	29

* Rating based on chassis mounting.

MATERIAL

Core: Steatite, or Alumina Ceramic.

Resistance Wire: Nichrome wire (800Ω/CMF) is standard; other alloys used when required.

End Caps: Stainless steel.

Sealant: Molded construction.

Housing: Anodized Aluminum.

Terminals: Tinned copperweld.

Flame Retardant Construction: Available on special order.

POWER RATING

Both AL-100 and AL-250 Series ratings based on the following requirements:

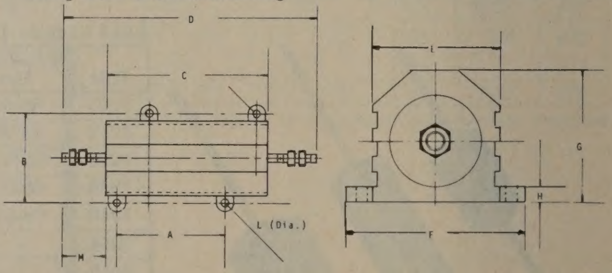
A. 275°C maximum internal hotspot temperature.

B. 1% maximum △R in 1000 hour load life.

C. Proper heat sink: 12" x 12" x .125 Aluminum Panel.

D. Derating:

1. Operating temperature range of −55°C to +275°C.
2. Derating is required for reduced chassis mounting area and for high ambient temperatures.



ELECTRICAL SPECIFICATIONS

Tolerance: ±1.0% is standard. Available to ±.05%. Closer tolerances may necessitate lowering maximum resistance. Consult RCL for specifics.

Standard T.C.:
±20 PPM/°C. 500Ω up
±30 PPM/°C. 10Ω to 499Ω
±50 PPM/°C 1Ω to 9.9Ω
±90 PPM/°C. below 1Ω

Lower ohmic values require higher T.C.'s. Consult factory for information on specific applications.

Dielectric Strength: 5500 VAC on AL-100 and AL-250.

Insulation Resistance: 10,000 megohms minimum dry.

Dimensions

TYPE	A	B	C	D	E	F	G	H	L	M	MIL TYPE
Tol.	±.010	±.010	±.031	±.093	±.031	±.031	±.031	±.031	±.010	±.031	—
AL-100	2.750	2.250	3.500	5.478	1.812	2.812	1.750	.187	.188 (TYP)	.989	RE77
AL-250	3.000	2.500	4.500	7.000	2.125	3.000	2.188	.250	.188 (TYP)	1.250	RE80

RCL TYPE	MIL-R-18546D TYPE	POWER RATING* (WATTS) RCL	MIL	RESISTANCE RANGES (OHMS)	MAX. WORKING VOLTAGE	MAX. WT. GRAMS
AL-100	RE-77G	100	75	.1 to 50K	1900	400
AL-250	RE-80G	250	120	.1 to 75K	2500	800

* Rate based on chassis mounting. See information on Power Rating below.

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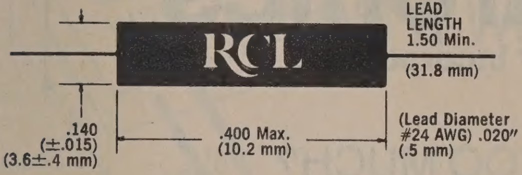
precision wire-wound fuse resistors

NOW . . . a dual-purpose device that performs the functions of acting both as a precision wirewound resistor and a fuse. Precisely controlled characteristics . . . stable accurate resistance . . . allows precise control of fusing point and time lag.

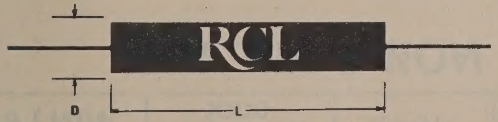


GENERAL SPECIFICATIONS ON 500 SERIES
Resistance Range: 0.2Ω-200Ω
Resistance Tolerance: 10%, Std, 5% and 2% available
Blow Characteristics: Consult factory
Steady-State Conditions: Consult factory
Operating Temperature: −55°C to +150°C
Temperature Coefficient: ±50 PPM/°C Max

CONSTRUCTION FEATURES
- Single Fusing Element — All Welded Connections
- Ceramic Shell — Air Encapsulation
- Meets or Exceeds MIL-R-26 Environmental Conditions-Specifications
- Intrinsically Safe — Ceramic Bobbin — Single Layer Wound

RCL designs and manufactures standard (F500 series) and special fuse-resistors to customer requirements. The fuse resistor acts both as a precision wirewound resistor and as a fusing element with precisely controlled characteristics.
- Affords protection for semiconductor devices
- Reduces the number of discrete components required
- Eliminates fire hazard and circuit board damage due to overheated components
- Eliminates unnecessary blowing due to transient conditions

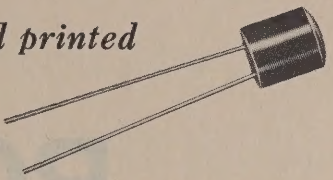
RCL high positive TC resistors



RCL has developed its own proprietary special alloy resistance wire which gives the unusually high positive TC of silicon, together with the basic advantages of resistance wire which are:
- Provides temperature compensation.
- Much greater stability for digital and linear integrated circuits.
- Closer resistance tolerances.
- Broader range of resistance values.
- Operating temperature range from −55°C to +150°C.
- Derated to zero watts at 150°C.
- Lead length 1½″(±⅛″; mm lead length 38.1 (±3.2mm).

RCL Type #	Competitive 'SENSISTOR' Type #	Diam. ±.015	Length ±.015	RCL Resistance Range	'SENSITOR' Resistance Range	Lead Diam. AWG.
8000	TM ⅛	.140	.406	1 Ohm to 10K	10 Ohms to 6K	#22
8001	TM ¼	.200	.585	1 Ohm to 20K	10 Ohms to 10K	#22

RCL wire-wound printed circuit resistors



△ All welded construction.

△ All resistor wire terminations are made at the top of the resistor rather than at the bottom. This does the following:
a. protects the joints from damage when submerged in a solder bath.
b. by placing these joints as far away as possible from the solder bath, the body acts as a heat sink and thus these terminations are given additional protection.
c. this design generally applies to values of 2K and above.

△ Custom designs on special order.

△ Different lead spacing can be furnished on request.

△ Non-inductive winding available.

RCL Type	MIL-R-93D Type	Dia. (± .025)	Length (± .032)	Max. Res. Using .001 (25.4μ)	Max. Res. Using .0006 (15.2μ)	Wattage	Standard Lead Spacing (±.010)	Lead Diam. (AWG)
4060	RB-71	.25	.312	100K	500K	.250	.200	#22
4061	—	.25	.375	160K	800K	.250	.200	#22
4062	—	.25	.437	160K	800K	.250	.200	#22
4063	—	.375	.375	185K	1 Meg.	.333	.200	#20
4064	—	.375	.437	250K	1.3 Meg.	.333	.200	#20
4065	RB-70	.375	.5	301K	1.5 Meg.	.333	.200	#20
4066	—	.437	.375	450K	2 Meg.	.400	.300	#20
4067	—	.437	.437	600K	3 Meg.	.400	.300	#20
4068	—	.437	.5	700K	3.5 Meg.	.400	.300	#20

Lead Length 1¼″ Minimum. Tinned, weldable leads.

special temperature coefficient wire wound resistors

- Applications include transistor circuits, zener diode temperature compensation, temperature measuring devices.
- Available in a range of temperature coefficients from −50 PPM/°C. to +6,000 PPM/°C.
- Values range from 10 ohms to 5 megohms.
- All available with axial or printed circuit leads.
- Available in all physical sizes.
- All meet applicable paragraphs of Mil-R-93D.

SPECIAL TEMPERATURE COEFFICIENTS AVAILABLE.

COLD RANGE		HEAT RANGE		R FACTOR
−55°C to +25°C		+25°C to +105°C		Multiply Max. R by
−50	±20	−50	±20	1.00
−30	±10	−30	±10	1.00
±3		±3		1.00
±5		±5		1.00
±10		±10		1.00
±20		±20		1.00
+95	±20	+85	±20	.80
+110	±10	+100	±10	.80
+120	±10	+110	±10	.75
+150	±30	+150	±30	.85
+180	±20	+180	±20	.80
+280	±30	+280	±30	.25
+380	±40	+400	±40	.70
+700	±200	+650	±200	.60
+850	±80	+850	±80	.60
+1100	±100	+1050	±100	.50
+1250	±100	+1150	±100	.50
+1500	±200	+1450	±200	.55
+2600	±200	+2550	±200	.50
+3400	±300	+3600	±300	.36
+4000	±400	+4500	±400	.10
+5000	±300	+6000	±300	.05

Above TC's refer to .001 (25.4μ) minimum wire diameter. Some alloys available in sizes as low as .0007 (18μ)

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WIN With RCL Electronics

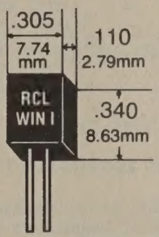
A Division of AMF Incorporated

*"Bulk Metal Film" COST TOO MUCH?
**"AR-40 Metal Film"—SLOW DELIVERY?
LO-RESISTANCE PROBLEMS—Both Types?

RCL Presents THE WINNERS CHOICE!

FOR SIZE

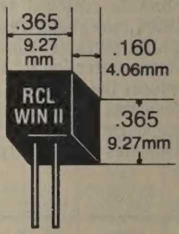
WIN I



Approximated Actual Size

FOR COST & WIDE RANGE

WIN II



Approximated Actual Size

EITHER WAY YOU WIN!

Check These Standard Characteristics:

- △ **T.C.:** STD is ± 5 PPM — Available to 2 PPM (0 To + 85°C)
- △ **RANGE:** 0.1 Ω To 500K (See Table).
- △ **TOLERANCE:** .01% To 10% (See Table)
- △ **STABILITY:** .0025% MAX/Year.
- △ **T.C. TRACKING:** To 1 PPM.
- △ **RELIABILITY:** Built on the same lines as MIL-R-39005, demonstrating minimum reliability of .001%/1000 Hrs.

NOW COMPARE:

	"AR-40"	BULK METAL FILM	WIN I & II
RESISTANCE RANGE	20 Ω To 100K	30 Ω To 75K	0.1 Ω To 125 K (I) 0.1 Ω To 500 K (II)
TOLERANCE	To .01%	To .005%	To ± 0.01%
TEMPERATURE COEFFICIENT	To ± 2 PPM (0 To + 85°C)	To ± 1 PPM (0 To + 85°C)	To ± 2 PPM (0 To + 85°C)
T.C. TRACKING	?	To 1.5 PPM	To ± 1 PPM
STABILITY/YEAR	.0015%	.0025%	.0025%
RISE TIME	?	1 nSec.	Up To 25 nSec. Avail. (Val. Dependent) Consult Factory
PRICE & DELIVERY	$??? $	$??? $	YOU WIN!!

* Each Reference to Bulk Metal Film Resistors Is To A Trademarked Product of Vishay Intertechnology, Inc.

** Each Reference to AR-40 Metal Film Resistors Is To A Trademarked Product of TRW/IRC, Inc.

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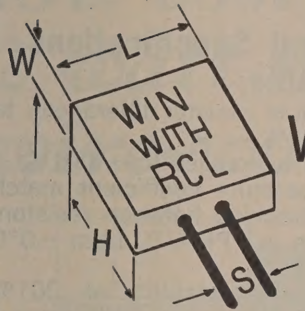

WIN I & WIN II Technical Specifications

TABLE I

	WIN I	WIN II
WATTAGE	.3W AT 85°C	.3W AT 85°C
VOLTAGE	200 VDC	200 VDC
RESISTANCE RANGE	25 Ω To 125K	0.1 Ω To 500K
TOLERANCE	See Table II	See Table II
TEMPERATURE COEFF.	See Table II	See Table II
T.C. TRACKING	To ± 1 PPM	To ± 1 PPM
STABILITY	25PPM/YEAR	25 PPM/YEAR
RISE TIME	Up To 25 nSec. Available on Request. Consult Factory	
NOISE	Not measurable on comm. equip.	Not measurable on comm. equip.
ENVIRONMENTAL	Exceeds limits of MIL-R-39005	Exceeds limits of MIL-R-39005
LEAD SPACING (S)*	.150 ± .010 3.81 ± .254 (mm)	.150 ± .010 3.81 ± .254 (mm)
SIZE (MAXIMUM)	H= .320 L= .305 W= .110 H=8.12mm L=7.74mm W=2.79mm	H= .365 L= .365 W= .160 H=9.27mm L=9.27mm W=4.06mm

* Leads are #22 (0.25) Tinned Copperweld or Tinned Alloy 180 for both WIN I & II

TABLE II

RESISTANCE RANGE	CLOSEST TOLERANCE AVAIL.		CLOSEST T.C. AVAIL. (0 To + 85°C)	
	WIN I	WIN II	WIN I	WIN II
0.1 Ω To .99 Ω	N.A.	± 10%	N.A.	± 90 PPM
1.0 Ω To 24.9 Ω	N.A.	± 3%	N.A.	± 30 PPM
25 Ω To 99.9 Ω	± 0.25%	± 0.25%	± 5 PPM	± 5 PPM
100 Ω To 199 Ω	± 0.1%	± 0.1%	± 5 PPM	± 5 PPM
200 Ω To 499 Ω	± 0.05%	± 0.05%	± 3 PPM	± 3 PPM
500 Ω To 699 Ω	± 0.02%	± 0.02%	± 3 PPM	± 3 PPM
700 Ω To 999.9 Ω	± 0.01%	± 0.01%	± 3 PPM	± 3 PPM
1K To 125K	± 0.01%	± 0.01%	± 2 PPM	± 2 PPM
125K To 500K	N.A.	± 0.01%	N.A.	± 2 PPM

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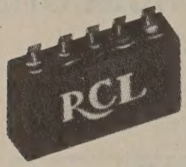
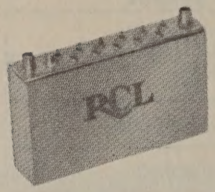
precision resistance networks





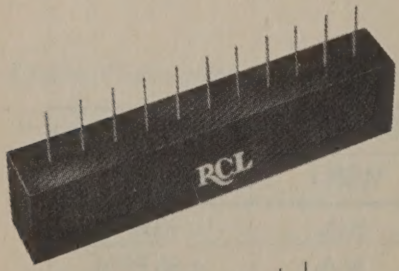
RCL designs, develops and produces packaged resistance networks to individual customer requirements.

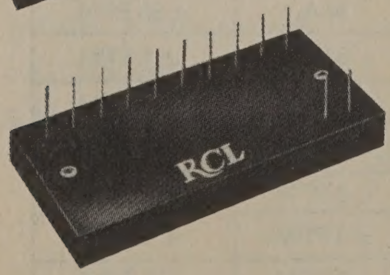
A high degree of sophisticated packaging plus miniaturization techniques are available from RCL's network engineering specialists. Typical custom designed networks are shown here.

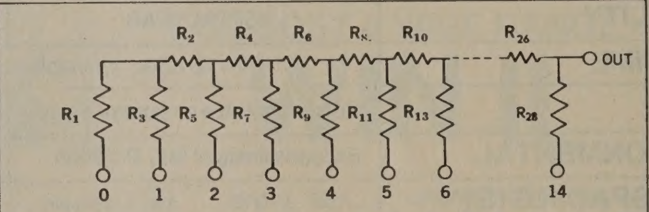
General Specifications Available:

- Absolute resistor tolerances to ±.002%
- Ratio tolerances to ±.001%
- Temperature coefficient match and tracking between resistors within ±1 PPM/°C from −0°C to +85°C
- Long term stability of .001% the first year and .002% over a three year period
- Low reactance and rise times as low as .02 microseconds
- AC resistance match at frequency determined by user
- In AC converter networks, capacitance can be matched to 0.01 MMFD with a shielded network.

ladder and summing networks





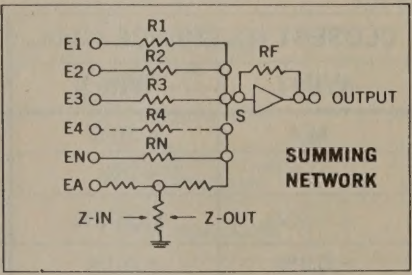


Resistors: R_1, R_3, R_5, R_7, R_9, R_{11}, R_{13}, R_{15}, R_{17}, R_{19}, R_{21}, R_{23}, R_{25}, R_{27}, R_{28}; each = 2R

Resistors: R_2, R_4, R_6, R_8, R_{10}, R_{12}, R_{14}, R_{16}, R_{18}, R_{20}, R_{22}, R_{24}, R_{26}; each = R

RCL makes available ladder networks in both standard and miniaturized versions

- Maximum total error less than ½ of the smallest word input combinations
- Modular construction
- Interchangeable sub-assemblies



General Specifications Available:

- Ambient operating temperature range . . . −55°C to +125°C
- Error . . . Under .50 of the least significant bit for every input combination
- Resistance Values: 500Ω to 100K
- Output accuracy to ±.01% and ±2 PPM/°C
- Up to 14 bits available
- Wire Wound precision resistors of matched characteristics result in high stability

If you have a network problem, send us your complete specifications for a prompt and detailed proposal.

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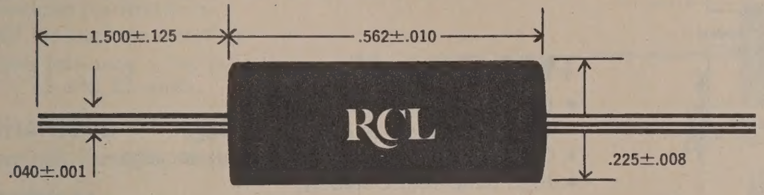
low cost 2 watt molded wire-wound resistors



TYPE BWR

A general purpose, extremely economical wire wound resistor. Type BWR covers three different wattage requirements in one size resistor.

BWR resistors offer wire wound stability, negligible noise and no catastrophic failures for 2, 1 and ½ watt applications. Significant cost savings may be obtained over Fixed Composition Resistors in the categories of 1 watt 5% tolerance, 2 watt 5% and 10% tolerances.

PERFORMANCE CHARACTERISTICS

REQUIREMENT	TYPICAL BWR R LESS THAN	MAXIMUM BWR △R
Temperature Coefficient 0.1Ω - 0.16Ω	+0.08%/°C	+0.1%/°C
0.10Ω - 0.62Ω	+0.06%/°C	+0.08%/°C
0.68Ω - 2400Ω	±0.02%/°C	±0.04%/°C
Low Temperature Operation	±1.5%	±3%
Temperature Cycling (−55°C to +125°C)	±1.5%	±5%
Moisture Resistance	±3%	±5%
Short Time Overload (8 Watts)	±1.5%	±4%
Load Life	±5%	±10%
Terminal Strength	±1%	±2%
Resistance to Soldering Heat	±2%	±4%
Shock	±0.5%	±2%
High Frequency Vibration	±1%	±2%

"Typical △R less than" is defined as the maximum △R to be expected in 95% of the population of a distribution.

NOTES:

1. Because of inaccuracies common in measuring low resistance values, an allowance of 0.01Ω should be added to the %△R limits.
2. Test conditions are as specified in MIL-R-11 and MIL-STD-202 except where shown in parenthesis.
3. For indication of approximate inductance values, consult factory.

SPECIFICATIONS

MIL-R-11 Style Equivalent for Physical Size Only: RC32

Resistance, Standard: 0.10Ω thru 2400Ω.

Resistance Tolerances, Standard: ±5%, ±10%.

Power Rating: 2 watts @ 70°C
1 watt @ 115°C
½ watt @ 137°C; derating to 0 @ 160°C

Maximum Continuous Working Voltage: $\sqrt{PR}$

Minimum Insulation Resistance — Dry: 10,000 Megohms

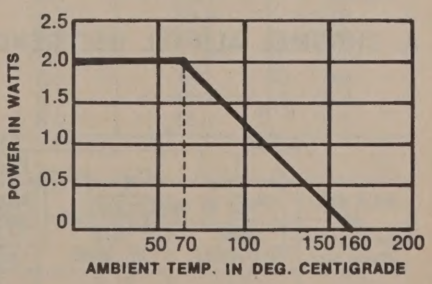
Minimum Insulation Resistance — Wet: 100 Megohms

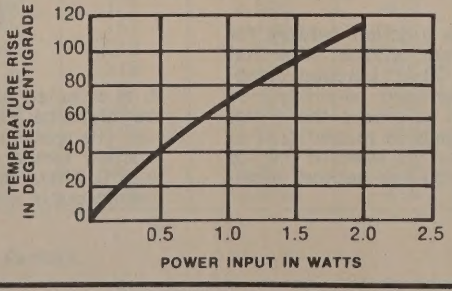
Minimum Dielectric Withstanding Voltage: Atmospheric Pressure 1000 Volts R.M.S.; Reduced Pressure 625 Volts R.M.S.

Hot Spot Temperature Rise at 2 Watts: 115°C

Current Noise: Negligible

DERATING CURVE TEMPERATURE — POWER





SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD

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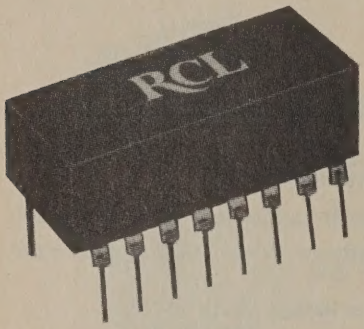
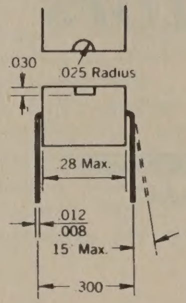
wire-wound networks (dual-in line package)



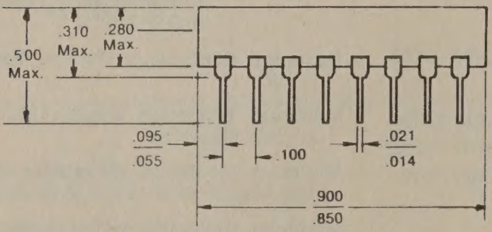


TYPE DPW 16

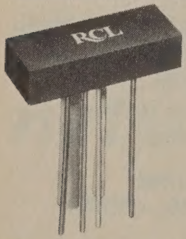
- Designed for automatic insertion
- Up to 8 resistors in a 16-pin package
- Optimum heat dissipation in small package
- High temperature stability
- Precision tolerance and T.C.

ELECTRICAL SPECIFICATIONS

Power Rating: 4 watts (up to .5 watts/resistor)
Resistance Range: .5Ω to 1.000Ω per resistor
Temperature Coefficient Match: 10 PPM/°C Standard Available to 2.5 PPM/°C
Tolerance: 1% Standard Available to .05%
Temperature Coefficient: 10Ω to 1000Ω ±20 PPM/°C
.5Ω to 9.9Ω ±50 PPM/°C
Tolerance Match: .05%
Dielectric Strength: 500 VAC
Insulation Resistance: 1000 Megohms minimum.
100 Megohms minimum after moisture test



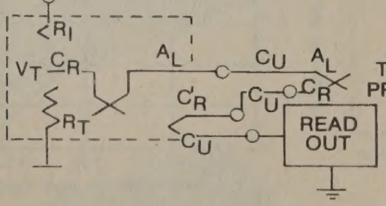
Also available in 14 pin standard DIP configuration (Up to 7 resistors). Specify DPW 14, DPW 14A, DPW 14B.



thermocouple reference junctions

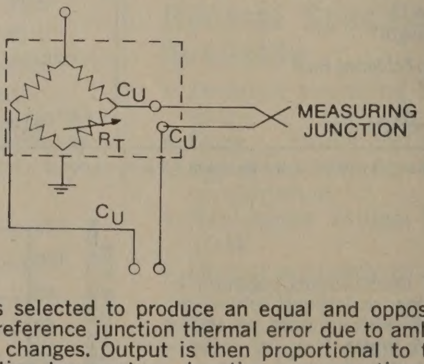
Reference junctions are necessary to make accurate temperature measurements with thermocouples. Ice baths or boiling water are most commonly used in laboratory tests. Since baths are inconvenient and impractical in equipment or field work, several alternate methods are used. RCL engineers and manufactures electronic reference junctions providing stable and accurate reference points for intricate temperature measuring systems.

A. CHROMEL ALUMEL REFERENCE NETWORK



Configuration A: Typical of a reference junction network for chromel alumel thermocouple. R_T is made with an alloy that varies the V_T exactly opposite to the CR-AL junction establishing a zero voltage effect due to ambient conditions, so that the measuring junction reference is always the initial desired temperature. The read out voltage is proportional to test probe temperature. This eliminates the need of the ice bath reference. Use of copper leads with the network eliminates secondary thermal errors.

B. BRIDGE REFERENCE JUNCTION



R_T is selected to produce an equal and opposite voltage to the reference junction thermal error due to ambient temperature changes. Output is then proportional to the measuring junction temperature. Junction compensations are practical to .5°C. These methods allow compensation of most common thermocouple junctions.

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RCL *special series of "black jack" conformal vitreous*

- Extremely rugged vitreous construction for military and aerospace circuit applications.
- Special RCL rugged coating protects against extreme humidity and temperature cycling.
- All-welded construction.
- Ideal for machine insertion.

Standard tolerance ±5% in wattage ratings of 1, 2, 2.5, 3, 5, 6, 7, 9, 11 and 12 watts.

MECHANICAL

☐ **Terminal Strength:** Meets or exceeds MIL-R-26.

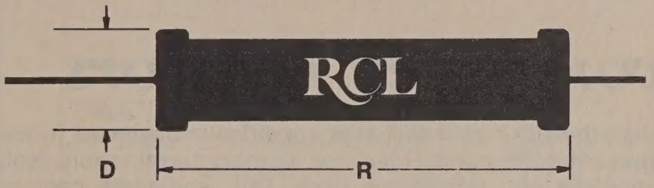
ELECTRICAL

☐ **Tolerance:** ±5% std.; ±1% to ±10% available.
☐ **Temperature Coefficient:** 0 ±30ppm/°C typical for 10Ω or greater.
☐ **Wattage:** See Table.
☐ **Inductance:** Varies with number of turns and wire size, Std. units have single layer winding. Non-inductive (Aryton-Perry) windings available.

MATERIALS

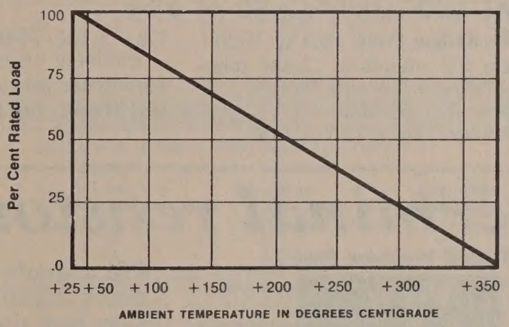
☐ **Core:** Ceramic, resistant to thermal shock and wide variations in temperature.
☐ **Resistance Element:** High grade resistance alloy wire, single layer winding. Leads and resistance element welded to metal end caps.
☐ **Coating:** Consistent, uniform, high performance black vitreous enamel.
☐ **Leads:** Solder coated.

ENAMEL AXIAL LEAD WIRE-WOUND RESISTORS



DERATING

Wattage ratings are based on 25°C Free Air Rating. For higher ambient temperatures, use derating chart.



SERIES V

RCL STYLE	WATTAGE RATING	MAX. RESISTANCE	DIMENSIONS IN INCHES MAX. DIAM. (D)	DIMENSIONS IN INCHES MAX. LENGTH (L)	LEAD DIAM.* AWG (1¼" Min. Lead Length)	DIMENSIONS IN MM MAX. DIAM. (D)	DIMENSIONS IN MM MAX. LENGTH (L)	LEAD DIAM. MM. (31.73mm Min. Lead Length)
V1	1	2.5K	.156	.406	#22	4	10.3	0.65
V2	2	3.9K	.219	.406	#20	5.6	10.3	0.8
V2A	2.5	10K	.234	.500	#20	5.6	12.7	0.8
V3	3	10K	.250	.562	#20	6.4	14.3	0.8
V5	5	30K	.250	1.000	#20	6.4	25.4	0.8
V6	6	35K	.343	1.031	#20	8.7	26.2	0.8
V6A	6	20K	.315	.807	#20	8.0	20.5	0.8
V7	7	40K	.343	1.250	#20	8.7	31.8	0.8
V9	9	60K	.315	1.500	#20	8.0	38.1	0.8
V11	11	60K	.343	1.938	#20	8.7	49.2	0.8
V12	12	100K	.315	2.100	#20	8.0	53.5	0.8

SERIES VT

RCL STYLE	WATTAGE RATING	MIL-R-26 SIZE EQUIVALENT (REF ONLY)	MAX. RESISTANCE	DIMENSIONS IN INCHES MAX. DIAM. (D)	DIMENSIONS IN INCHES MAX. LENGTH (L)	LEAD DIAM.* AWG (1¼" Min. Lead Length)	DIMENSIONS IN MM MAX. DIAM. (D)	DIMENSIONS IN MM MAX. LENGTH (L)	LEAD DIAM. MM. (31.73mm Min. Lead Length)
VT1A	1.5	RW70	8K	.125	.500	#24	3.17	12.7	0.5
VT2	2.0	—	8K	.187	.425	#20	4.8	10.8	0.8
VT2A	2.5	RW69	18K	.218	.600	#20	5.5	15.2	0.8
VT2B-79	3.0	RW79	20K	.218	.650	#20	5.5	16.6	0.8
VT2C	3.5	—	30K	.281	.600	#18	7.14	15.2	1.0
VT3	4.0	—	35K	.281	.750	#18	7.14	19.04	1.0
VT5	5.0	RW74	75K	.344	1.000	#18	8.7	25.4	1.0
VT6	7.0	RW67	80K	.344	1.150	#18	8.7	29	1.0
VT7	9.0	—	90K	.344	1.300	#18	8.7	32	1.0
VT10	12.0	RW78	125K	.406	2.000	#18	10.3	50.8	1.0

* Other Sizes Available

For Other Sizes and Wattage Ratings Consult Factory.

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RCL Electronics

special products

RCL engineers have designed and produced thousands of unique products to meet special customer applications. Shown are a few typical examples. RCL has an application engineering group directed toward solving and producing unusual products to fit custom requirements. Our capabilities include extended resistance ranges, extremely low reactance, low thermal EMF and special configuration.

computer resistors

High-density power resistors specifically designed to meet demanding space requirements. Ideal for memory termination. Isolates line drive impulses and terminates lines. RCL engineers can meet all design requirements by adapting nearly any type of configuration.
Particularly suited to very low resistance requirements for interface with integrated circuitry.

POWER RATING: 23 WATTS WHEN MOUNTED ON HEAT SINK MAINTAINED AT 75°C.

Resistance Range: From .01Ω to 100Ω.

Tolerances: 5% standard. Closer tolerances available. Consult factory.

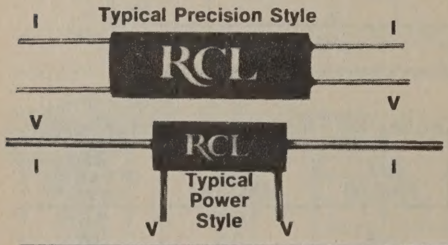
Dimensions: .5 x .5 x .062.
(Millimeters: 12.7 x 12.7 x 1.6)

T.C.: ±100 PPM/°C. Closer tolerances available on request.

Terminals: Wire leads.

Max. Temp.: (on open side) 125°C.

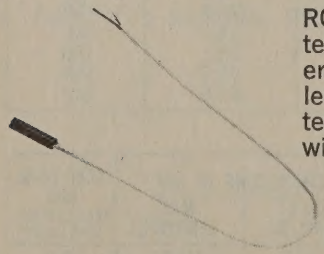
4-terminal resistors



RCL manufactures 4-Terminal Resistor assemblies in both precision and power styles. They are used in current sensing circuits primarily with low resistance values to minimize the effects of lead resistance and lead temperature coefficient. This unique construction is essential for tight tolerance low value resistors where lead material characteristics are critical.

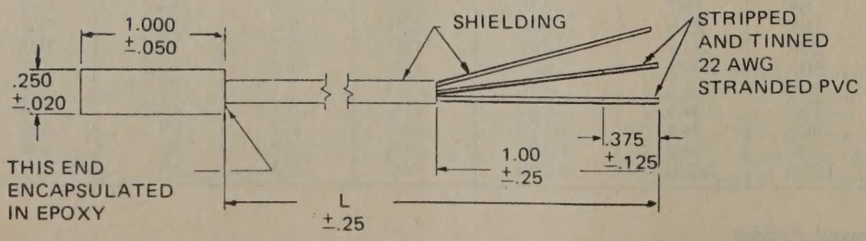
To order, specify "4-Terminal Construction" with any RCL Resistor Series 7000 (Precision Styles) or Series "T" (Power Styles).
Consult factory for application details or special packaging configurations.

molded temperature compensators



RCL offers a standard line of epoxy encapsulated sensing resistors for temperature compensating applications. The standard resistance tolerance ±5% with tighter tolerances available on special order. Cable lengths from 2.0″ to 48.0″ are available with 6.0″ standard. Operating temperature range is −55°C to +125°C. Repeatability of tempco within a given lot is ±100 PPM.

RCL Style	Resistance Range	PPM/°C Average Tempco 0°C - 100°C
TC35	10Ω - 50KΩ	3500 ±350
TC45	10Ω - 10KΩ	4500 ±450
TC55	10Ω - 5KΩ	5500 ±550



Add Dept. EM to address to tell them you saw it in eem

Over 30 Years' Buyer Preference Prove Our Ohmic Capability, Versatility

AXIAL LEAD

No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
3 AX	3	0.1- 10,000	¼ max. x 9/16
5 AX	5	0.1- 30,000	11/32 max. x 1 1/16
10 AX	10	0.1- 50,000	13/32 max. x 1 5/16

MIL-R-26 AXIAL LEAD

No.	Watts	Resistance Min. Max.	Dimensions O.D. x Lgth.
RW67V	6.5	0.10- 3,600	11/32 x 1 1/16
RW68V	11	0.10- 8,200	13/32 x 1 5/16
RW69V	3	0.10- 910	¼ x 9/16

Silicone-base coated, moisture-resistant.
TC = O ± 20 ppm/°C, 10 ohms and above.
Commercial equivalents available.

FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1 M	5	0.1- 11,000	5/16 x 1
1¾ M	10	0.1- 50,000	5/16 x 1¾
2 E	20	0.25-100,000	7/16 x 2
2 B	25	0.25-100,000	9/16 x 2
4 B	50	0.5-175,000	9/16 x 4
6½ C	100	1.0-300,000	¾ x 6½
8½ R	160	1.0-300,000	1⅛ x 8½
10½ R	200	1.0-400,000	1⅛ x 10½

MIL-R-26 FIXED LUG

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
RW29V	11	0.10- 5,600	7/16 x 1¾
RW30V	11	0.10- 2,700	9/16 x 1
RW31V	14	0.10- 6,800	9/16 x 1½
RW32V	17	0.10-10,000	9/16 x 2
RW33V	26	0.10-18,000	9/16 x 3
RW35V	55	0.10-43,000	29/32 x 4

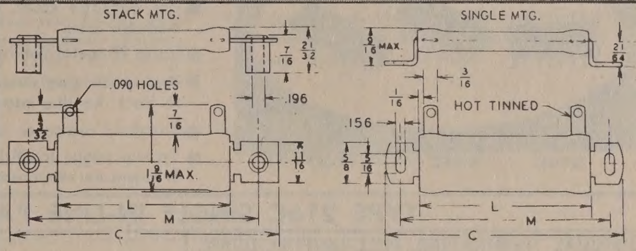
ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
1¾ MA	10	1.0- 10,000	5/16 x 1¾
2 BA	25	1.0- 25,000	9/16 x 2
4 BA	50	1.0-100,000	9/16 x 4
6 BA	75	1.0-100,000	9/16 x 6
6½ CA	100	1.0-100,000	¾ x 6½
8½ RA	160	1.0-100,000	1⅛ x 8½
10½ RA	200	1.0-100,000	1⅛ x 10½

MIL-R-19365 ADJUSTABLE

No.	Wattage	Resistance Min.-Max.	Max. Dimensions O.D. x Lgth.
RX29V	11	1- 470	7/16 x 1¾
RX32V	17	1- 910	9/16 x 2
RX33V	26	1-1,500	9/16 x 3
RX35V	55	1-3,600	29/32 x 4

FLAT OVAL



Watts* Free Air	Core—L	Min. Ohms	Max. Ohms	Mounting	C	M
30	1¼	0.1	10K	Single Stack	2⅛ 2½	1¾ 2
40	2	0.2	30K	Single Stack	2⅞ 3¼	2½ 2¾
55	3½	0.3	60K	Single Stack	4⅜ 4¾	4 4¼
65	4¾	0.4	85K	Single Stack	5⅝ 6	5¼ 5½
75	6	0.5	100K	Single Stack	6⅞ 7¼	6½ 6¾

MINIATURE, FLAT OVAL

Construction similar to above large size resistors.

WATTS* Free Air	Min. Ohms	Max. Ohms
10	1.0	15 K
15	1.0	25 K
20	1.0	50 K

Write for Bulletin RMF 5.0/1068

*Ratings of large and miniature, flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.

RIBBON-WOUND RESISTORS

Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.	Watts	Core Size D	Core Size L	Ohms Min. Res.	Ohms Max. Res.
400	1⅛	11¼	0.24	18.00	135	¾	5	0.06	4.25
375	1⅛	10½	0.22	16.50	105	¾	4	0.04	3.00
300	1⅛	8½	0.17	13.00	100	¾	3½	0.03	2.40
240	1⅛	6½	0.11	8.20	135	9/16	6	0.06	5.50
185	1⅛	5	0.09	6.40	105	9/16	5	0.05	3.65
180	¾	6½	0.08	6.00	90	9/16	4	0.04	2.75

Available with adjustable tap bands or with tapped windings.

NON-INDUCTIVE RESISTORS: for high frequency power circuits. Available in all fixed-lug types, 10 watts and larger. Standard tolerances: ±10%.

RESISTANCE TOLERANCES: Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

Write For Complete Catalog

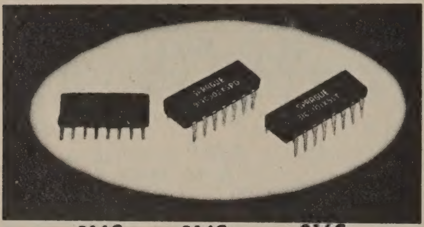
resistors, inc.

CUSTOM DESIGNING,
ENGINEERING, MANUFACTURING

5226 West 26th Street, Chicago, Illinois 60650
Area Code: 312 OLympic 2-7555

SPRAGUE RESISTORS

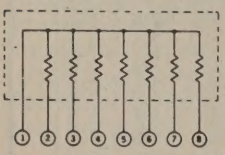
SIP and DIP METANET® PRECISION RESISTOR NETWORKS



- Designed for use in signal and data processing applications where repetitive resistance values and patterns are required.
- Cut package count, reduce equipment size, minimize costs.
- Up to 28 metal-film resistors on ceramic base.
- High packaging density – Fewer components to stock, handle, inspect, install.
- Standard resistance tolerance, ±2%.†
- Typical temp. coefficient, with 250 ppm/°C. Tracking between resistors, ±50 ppm/°C.
- Type 216C has single in-line configuration for vertical installation on high-density boards. Continuous total power dissipation is 1.5W at +25 C. Derating is linear to +150 C.
- Types 914C and 916C have dual in-line packages compatible with ICs. Continuous power dissipation at 25 C is 3W and 3.5W, respectively. Derating is linear to +150 C.
- Cat. No. Series ending in PE and SR available to 500KΩ on special order.
- For data on Type 216C, see Bulletin 7041. For data on 914C/916C, see Bulletin 7042.

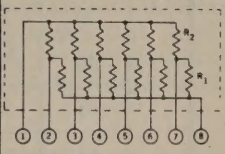
TYPE 216C SINGLE IN-LINE PACKAGE (.125″ W. x .350″ H. x 1.000″ L.)

INDIVIDUAL TERMINATING, PULL-UP/PULL-DOWN, AND INTERFACE NETWORKS



R(Ω)	Cat. No.*
50	216CH500X2LT
100	216CH101X2LT
200	216CH201X2PD
500	216CH501X2PD
1000	216CH102X2PD
2000	216CH202X2PD
3000	216CH302X2PD
4000	216CH402X2PD
5000	216CH502X2PD

DUAL TERMINATING NETWORKS



R₁(Ω)	R₂(Ω)	Cat. No.	R₁(Ω)	R₂(Ω)	Cat. No.
50	200	216CH400X2TR	194	312	216CH121X2TR
81	130	216CH500X2TR	220	330	216CH131X2TR
90	660	216CH800X2TR	243	390	216CH151X2TRA
103	182	216CH660X2TR	250	375	216CH151X2TR
121	195	216CH750X2TR	330	390	216CH181X2TR
130	208	216CH800X2TRA	330	470	216CH191X2TR
146	234	216CH900X2TR	330	680	216CH221X2TRA
162	260	216CH101X2TR	390	500	216CH221X2TR

TYPE 914C, 916C DUAL IN-LINE PACKAGE (.260″ W. x .200″ H. x .755″ L. for 914C, .855″ L. for 916C)

FIG. 1

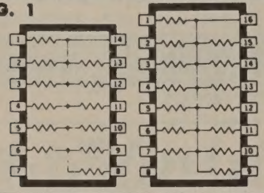


FIG. 2

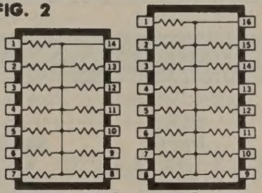


FIG. 3

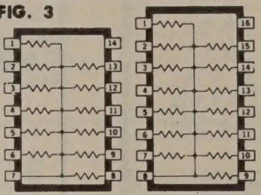


FIG. 4

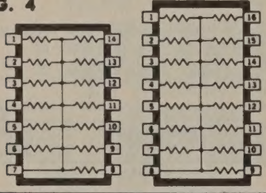


FIG. 5

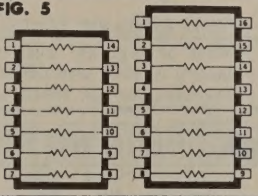
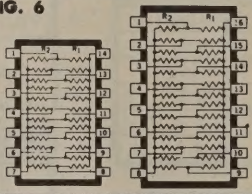


FIG. 6



PULL-UP/PULL-DOWN AND INTERFACE NETWORKS

Fig.	R(Ω)	Catalog Number 14-pin	16-pin
1	200	914C201X2PD	916C201X2PD
1	500	914C501X2PD	916C501X2PD
1	1000	914C102X2PD	916C102X2PD
1	2000	914C202X2PD	916C202X2PD
1	3000	914C302X2PD	916C302X2PD
1	4000	914C402X2PD	916C402X2PD
1	5000	914C502X2PD	916C502X2PD
2	68	914C680X2PE	916C680X2PE
2	100	914C101X2PE	916C101X2PE
2	150	914C151X2PE	916C151X2PE
2	200	914C201X2PE	916C201X2PE
2	220	914C221X2PE	916C221X2PE
2	330	914C331X2PE	916C331X2PE
2	470	914C471X2PE	916C471X2PE
2	500	914C501X2PE	916C501X2PE
2	680	914C681X2PE	916C681X2PE
1	1000	914C102X2PE	916C102X2PE
2	1500	914C152X2PE	916C152X2PE
2	2000	914C202X2PE	916C202X2PE
2	2200	914C222X2PE	916C222X2PE
2	3300	914C332X2PE	916C332X2PE
2	4700	914C472X2PE	916C472X2PE
2	5600	914C562X2PE	916C562X2PE
2	6000	914C602X2PE	916C602X2PE
2	6800	914C682X2PE	916C682X2PE
2	10000	914C103X2PE	916C103X2PE
2	15000	914C153X2PE	916C153X2PE
2	22000	914C223X2PE	916C223X2PE
2	33000	914C333X2PE	916C333X2PE
2	47000	914C473X2PE	916C473X2PE
2	68000	914C683X2PE	916C683X2PE
2	100000	914C104X2PE	916C104X2PE

INDIVIDUAL TERMINATING NETWORKS

Fig.	R(Ω)	14-pin	16-pin
3	50	914C500X2LT	916C500X2LT
3	100	914C101X2LT	916C101X2LT
3	200	914C201X2LT	916C201X2LT
3	500	914C501X2LT	916C501X2LT
4	50	914C500X2LU	916C500X2LU
4	68	914C680X2LU	916C680X2LU
4	100	914C101X2LU	916C101X2LU
4	200	914C201X2LU	916C201X2LU
4	220	914C221X2LU	916C221X2LU
4	330	914C331X2LU	916C331X2LU
4	470	914C471X2LU	916C471X2LU
4	500	914C501X2LU	916C501X2LU

MULTIPLE ISOLATED RESISTORS

Fig.	R(Ω)	Catalog Number 14-pin	16-pin
5	50	914C500X2SR	916C500X2SR
5	62	914C620X2SR	916C620X2SR
5	68	914C680X2SR	916C680X2SR
5	100	914C101X2SR	916C101X2SR
5	150	914C151X2SR	916C151X2SR
5	200	914C201X2SR	916C201X2SR
5	220	914C221X2SR	916C221X2SR
5	330	914C331X2SR	916C331X2SR
5	470	914C471X2SR	916C471X2SR
5	500	914C501X2SR	916C501X2SR
5	680	914C681X2SR	916C681X2SR
5	1000	914C102X2SR	916C102X2SR
5	1500	914C152X2SR	916C152X2SR
5	2000	914C202X2SR	916C202X2SR
5	2200	914C222X2SR	916C222X2SR
5	3300	914C332X2SR	916C332X2SR
5	4700	914C472X2SR	914C472X2SR
5	6800	914C682X2SR	916C682X2SR
5	10000	914C103X2SR	916C103X2SR
5	15000	914C153X2SR	916C153X2SR
5	22000	914C223X2SR	916C223X2SR
5	33000	914C333X2SR	916C333X2SR
5	47000	914C473X2SR	916C473X2SR
5	68000	914C683X2SR	916C683X2SR
5	100000	914C104X2SR	916C104X2SR

DUAL TERMINATING NETWORKS

Fig.	R₁	R₂	Catalog Number	
6	50	200	914C400X2TR	916C400X2TR
6	81	130	914C500X2TR	916C500X2TR
6	90	660	914C800X2TR	916C800X2TR
6	103	182	914C660X2TR	916C660X2TR
6	121	195	914C750X2TR	916C750X2TR
6	130	208	914C800X2TRA	916C800X2TRA
6	146	234	914C900X2TR	916C900X2TR
6	162	260	914C101X2TR	916C101X2TR
6	194	312	914C121X2TR	916C121X2TR
6	220	330	914C131X2TR	916C131X2TR
6	243	390	914C151X2TRA	916C151X2TRA
6	250	375	914C151X2TR	916C151X2TR
6	330	390	914C181X2TR	916C181X2TR
6	330	470	914C191X2TR	916C191X2TR
6	330	680	914C221X2TRA	916C221X2TRA
6	390	500	914C221X2TR	916C221X2TR

†All standard resistor networks shown with ±2% resistance tolerance. For ±5% tolerance (available at lower cost) change "2" to "5" after "X" in catalog number.

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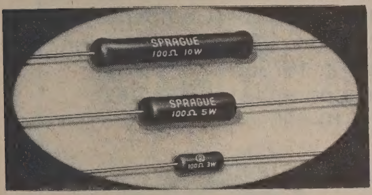
SPRAGUE RESISTORS

BLUE JACKET® VITREOUS-ENAMEL WIREWOUND RESISTORS



- Matched Coefficient of Expansion Allows Uniform Expansion of Vitreous Enamel Coating, Ceramic Base, and End Caps, Eliminating Crazing, Cracks, and Protects From Fumes and Humidity
- Standard Resistance Tolerance: ±5%
- Improved Minified Resistors Designed for Thorough Reliability and Stability Under Extreme Operating Conditions
- Windings and Leads Welded to End-Caps for Superior Mechanical Strength

Ohms	CATALOG NUMBER 239E 1 WATT 1/8" x 3/8"	240E 2 WATTS 3/16" x 3/8"	242E 3 WATTS 13/64" x 17/32"	243E 5 WATTS 13/64" x 15/16"	244E* 7 WATTS 5/16" x 1"	247E 10 WATTS 5/16" x 1 3/4"
1	239E1R05	240E1R05	242E1R05	243E1R05*	244E1R05	247E1R05
1.2	239E1R25	——	——	——	——	——
1.5	239E1R55	240E1R55*	242E1R55	243E1R55	244E1R55*	247E1R55
1.8	239E1R85	——	——	——	——	——
2	239E2R05	240E2R05	242E2R05	243E2R05	244E2R05*	247E2R05
2.2	239E2R25	——	——	——	——	——
2.7	239E2R27	——	——	——	——	——
3	239E3R05	240E3R05	242E3R05	243E3R05	244E3R05*	247E3R05
3.3	239E3R35	——	——	——	——	——
3.9	239E3R95	——	——	——	——	——
4	239E4R05	240E4R05	242E4R05	243E4R05	244E4R05*	247E4R05
4.7	239E4R75	——	——	——	——	——
5	239E5R05	240E5R05	242E5R05	243E5R05	244E5R05*	247E5R05
5.6	239E5R65	——	——	——	——	——
6.8	239E6R85	——	——	——	——	——
7.5	239E7R55	240E7R55	242E7R55	243E7R55	244E7R55*	247E7R55
8.2	239E8R25*	——	——	——	——	——
10	239E1005	240E1005	242E1005	243E1005	244E1005*	247E1005
12	239E1205	240E1205	242E1205	243E1205	244E1205*	247E1205
15	239E1505	240E1505	242E1505	243E1505	244E1505*	247E1505
18	239E1805	240E1805*	242E1805	——	——	——
20	239E2005	240E2005	242E2005	243E2005	244E2005*	247E2005
22	239E2205	240E2205	242E2205	——	——	——
25	239E2505*	240E2505	242E2505	243E2505	244E2505*	247E2505
27	239E2705*	240E2705	242E2705	——	——	——
30	239E3005	240E3005	242E3005	243E3005	244E3005*	247E3005
33	239E3305	240E3305*	242E3305	——	——	——
35	——	——	——	243E3505	244E3505*	247E3505
39	239E3905*	240E3905	242E3905	——	——	——
40	239E4005*	240E4005*	242E4005	243E4005	244E4005*	247E4005
47	239E4705*	240E4705	242E4705	——	——	——
50	239E5005	240E5005*	242E5005	243E5005	244E5005*	247E5005
56	239E5605	240E5605*	242E5605	——	——	——
68	239E6805	240E6805	242E6805	——	——	——
75	239E7505	240E7505*	242E7505	243E7505	244E7505*	247E7505
82	239E8205	240E8205*	242E8205	——	——	——
100	239E1015	240E1015	242E1015	243E1015	244E1015*	247E1015
120	239E1215	240E1215	242E1215	244E1215	244E1215*	247E1215
150	239E1515	240E1515	242E1515	243E1515	244E1515*	247E1515
180	239E1815	240E1815	242E1815	——	——	——
200	239E2015	240E2015	242E2015	243E2015	244E2015*	247E2015
220	239E2215	240E2215	242E2215	243E2215	244E2215*	247E2215
250	239E2515	240E2515	242E2515	243E2515	244E2515*	247E2515
270	239E2715	240E2715	242E2715	——	——	——
300	239E3015	240E3015	242E3015	243E3015	244E3015*	247E3015
330	239E3315	240E3315	242E3315	——	——	——
350	——	——	——	243E3515	244E3515*	247E3515
390	239E3915	240E3915*	242E3915	——	——	——
400	239E4015*	240E4015*	242E4015	243E4015	244E4015*	247E4015
450	——	——	——	243E4515	——	——
470	239E4715	240E4715	242E4715	——	——	——
500	239E5015	240E5015	242E5015	243E5015	244E5015*	247E5015
560	239E5615	240E5615*	242E5615	——	——	——
600	239E6015	240E6015*	242E6015	243E6015	244E6015*	247E6015
680	239E6815*	240E6815*	242E6815	——	——	——
700	239E7015	240E7015	242E7015	243E7015	244E7015*	247E7015
750	——	——	——	243E7515	244E7515*	247E7515
800	239E8015	240E8015*	242E8015	243E8015	244E8015*	247E8015
820	239E8215	240E8215	242E8215	——	——	——
900	239E9015*	240E9015*	242E9015	243E9015	244E9015*	247E9015
1000	239E1025	240E1025	242E1025	243E1025	244E1025*	247E1025
1100	——	——	——	243E1125	244E1125*	247E1125
1200	239E1225	240E1225	242E1225	243E1225	244E1225*	247E1225
1400	239E1425*	240E1425*	242E1425*	243E1425	244E1425*	247E1425
1500	239E1525	240E1525	242E1525	243E1525	244E1525*	247E1525
1800	239E1825*	240E1825*	242E1825	243E1825	244E1825*	247E1825
2000	239E2025	240E2025	242E2025	243E2025	244E2025*	247E2025
2200	239E2225	240E2225	242E2225	243E2225	244E2225*	247E2225
2500	239E2525	240E2525*	242E2525	243E2525	244E2525*	247E2525
2700	——	240E2725*	242E2725	——	——	——
3000	——	240E3025*	242E3025	243E3025	244E3025*	247E3025
3300	——	240E3325*	242E3325	——	244E3325*	247E3325
3500	——	240E3525*	——	243E3525	244E3525*	247E3525
3900	——	240E3925*	242E3925	——	244E3925*	247E3925*
4000	——	——	242E4025	243E4025	244E4025*	247E4025
4200	——	——	——	——	244E4225*	——
4500	——	——	——	243E4525	244E4525*	247E4525
4700	——	——	242E4725	——	——	——
5000	——	——	242E5025	243E5025	244E5025*	247E5025
5600	——	——	242E5625	——	——	——
6000	——	——	242E6025	243E6025	244E6025*	247E6025
6800	——	——	242E6825	——	——	——
7000	——	——	——	243E7025	244E7025*	247E7025
7500	——	——	242E7525	243E7525	244E7525*	247E7525
8000	——	——	242E8025	243E8025	244E8025*	247E8025
8200	——	——	242E8225	——	——	——
9000	——	——	242E9025	243E9025	244E9025*	247E9025*
10000	——	——	242E1035	243E1035	244E1035*	247E1035
11000	——	——	——	——	244E1135*	247E1135*
12000	——	——	——	243E1235	244E1235*	247E1235
14000	——	——	——	243E1435	244E1435*	247E1435*
15000	——	——	——	243E1535	244E1535*	247E1535
16000	——	——	——	——	244E1635*	247E1635*
17000	——	——	——	——	244E1735*	——
18000	——	——	——	243E1835	244E1835*	247E1835
20000	——	——	——	243E2035	244E2035*	247E2035
22000	——	——	——	243E2235	244E2235*	247E2235
25000	——	——	——	243E2535	244E2535*	247E2535
30000	——	——	——	243E3035	244E3035*	247E3035
35000	——	——	——	——	244E3535*	247E3535*
40000	——	——	——	——	244E4035*	247E4035
45000	——	——	——	——	——	247E4535*
50000	——	——	——	——	——	247E5035
55000	——	——	——	——	——	247E5535*

*Available until present stocks are exhausted.

EEM-58--EIAT

Sizes subject to change without notice.

Stackpole Fixed-Composition Resistors

Since the earliest days of radio, Stackpole fixed-compositon resistors have been continually updated and improved. They are among the most reliable and widely used components available for commercial, industrial, and military applications.

Stackpole's commercial-type resistors meet the requirements of MIL-STD-202, Method 208, and our military type far exceeds the stringent requirements of MIL-R-39008. We are qualified by the military to S level of established reliability, which specifies 0.001% failure rate per 1000 hours.

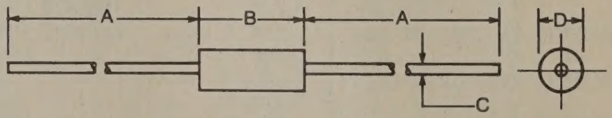
Stackpole resistors are 100% tested, which enables you to cut your inspection costs. Solderability, load life, and humidity-temperature characteristic checks insure constant control of quality. The result is uniformity, plus reliability.

To secure additional information, request Stackpole Bulletin 80-101.
Stackpole Carbon Company,
Electronic Components Division,
Kane, Pa. 16735.
Or telephone: (814) 837-7000.
TWX: 510-695-8404.

SPECIFICATIONS

Type	Power at 70° C	Resistance Range*	Tolerance	Voltage Rating (RMS)	Maximum Ambient Temperature	Dimensions in Inches (millimeters)			
						A	B	C	D
RC07	¼ watt	10 ohms to 1 megohm	±5, 10, 20%	250 V	+150° C	1.500 (38,10)	0.250 (6,35)	0.025 (0,64)	0.090 (2,29)
RCR07		10 ohms to 1 megohm	±5, 10%						
RC20	½ watt	10 ohms to 100 megohms	±5, 10, 20%	350 V		1.500 (38,10)	0.375 (9,52)	0.032 (0,84)	0.140 (3,56)
RCR20		10 ohms to 22 megohms	±5, 10%						
RC32	1 watt	10 ohms to 100 megohms	±5, 10, 20%	500 V		1,500 (38,10)	0.562 (14,29)	0.040 (1,04)	0.225 (5,72)
RCR32		10 ohms to 22 megohms	±5, 10%						
RC42	2 watts	10 ohms to 22 megohms	±5, 10, 20%	750 V		1.500 (38,10)	0.688 (17,46)	0.045 (1,14)	0.318 (7,94)
RCR42		10 ohms to 22 megohms	±5, 10%	500 V					

*Consult factory for values under 10 ohms and over 100 megohms.



Carbon-Film Resistors

Stackpole carbon-film resistors offer reliable performance in both commercial and industrial applications where high stability and uniformity of characteristics are required. Interchangeable in size with composition resistors, they are compatible with commercially available automatic sequencing and insertion equipment.

Stackpole carbon-film resistors are available in bulk package, strip package, cut and formed, and lead tape reel. See our Bulletin 86-100.

To obtain additional information, write Stackpole Carbon Company, Electronic Components Division, Kane, Pa. 16735 • Telephone: (814) 837-7000. TWX: 510-695-8404.

SPECIFICATIONS

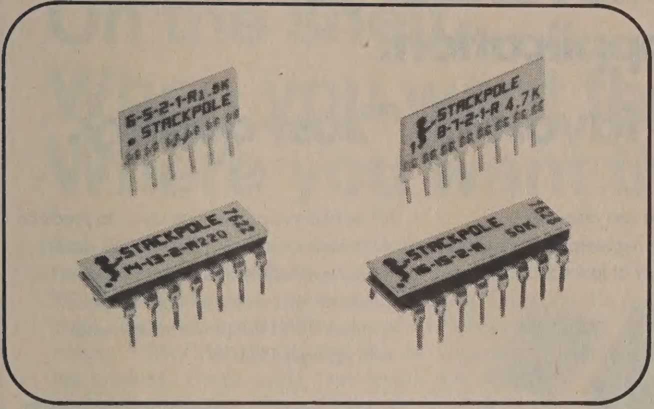
Max. Power Rating	Tolerance	Resistance Range*	Voltage Rating	Operating Temp. Range	Maximum Dimensions in Inches (Millimeters)			
					A	B	C	D
¼ watt	±2, 5%	10 ohms to 1 megohm	250 V	-55°C to 150°C	1.102 ± 0.039 (28 ± 1)	0.265 ± 0.015 (6.7 ± 0.4)	0.024 ± 0.001 (0.61 ± 0.03)	0.091 ± 0.008 (2.3 ± 0.2)

*Consult factory for values under 10 ohms and over 1 megohm.

STACKPOLE®
the revolutionary resistor people.

STACKPOLE

SIP & DIP Thick Film Resistor Networks



- High reliability thick film resistors
- Strong 96% alumina substrate
- .100″ (2.54mm) terminal spacing
- Wide selection of resistance values
- Fast delivery
- DIP packages interchangeable with TO-116 package
- DIP packages compatable with standard IC automatic insertion equipment
- Meets or exceeds physical outline requirements of MIL-STD. 202E for resistor networks

Performance Specifications

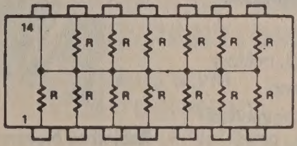
Resistance Tolerance		±2%
Resistance Temperature Coefficient	−55°C to 125°C	<±100PPM/°C (±.01%/°C)
Resistance Voltage Coefficient		0.02%/V Typ.
Power Rating		
Single Resistor (+70°C Case)		0.250 W (7 & 8 Resistor) 0.125 W (All others)
Total Package (+70°C Case)		14 lead 1.5 W 16 lead 1.75 W
Resistance Temperature Coefficient Tracking		<50ppm/°C max. (.005%/°C)
Operating Temperature Range		−55°C to +125°C
Storage Temperature Range		−65°C to +150°C

Maximum rated voltage is 300.

Mechanical Specifications

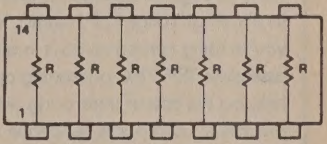
- Substrate Material — 96% Alumina Ceramic
- Lead Material — Copper/Tin Lead Plating
- Conductive Material — Palladium Silver
- Resistive Material — Ruthenium Birox
- Lead Solderability — Meets Req. of MIL-STD. 202E and MIL-STD. 883, Method 2003

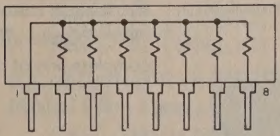
Standard Configurations



14 or 16 Lead DIPS

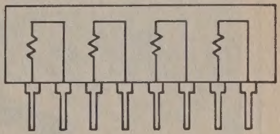
14 or 16 Lead DIPS





4 to 12 Lead SIPS

4 to 12 Lead SIPS



Custom Networks

Special resistance values and combinations available for specific applications. Please contact factory for quotation.

Distribution

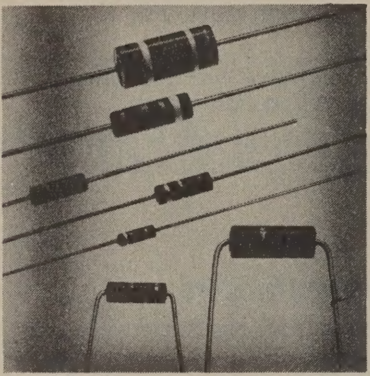
Many standard values available from your local Stackpole Distributor for immediate delivery.

STACKPOLE
COMPONENTS COMPANY
DEPT. EM, P.O. BOX 14466, RALEIGH, N.C. 27610 • PHONE (919) 828-6201 • TWX 510-928-0520

TRW IRC RESISTORS

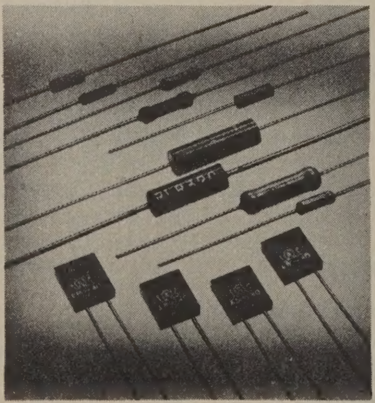
You get exactly the resistor you need for your application.

No compromises. No "favorites." Just quality.



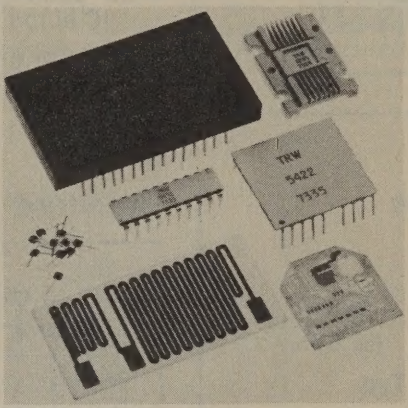
Carbon comp.

Billions used in consumer, industrial, military applications. TRW/IRC carbon comp. capability ranges from standard commercial types through established reliability RCR's, to ultra-high range (10^{11} ohms). Where you're using carbon comp.'s in automated assembly, TRW/IRC packaging options can help cut the cost of interfacing with your machines. Card packs, lead tape reels, cut and formed leads...we'll be glad to explore the potential economies with you.



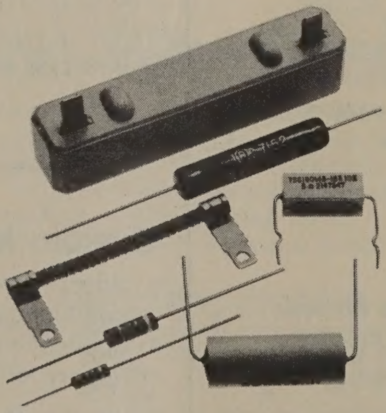
Metal Film

TRW/IRC has brought the state of the art in thin-film to a performance level equaling high-stability wirewounds. Capabilities include resistors with tolerances to ± 0.01% and ± 3 PPM T.C. ...high-rel units... precision subminiatures...and, of course the popular RN's. You can also look at alloy films offering high-temperature and high-voltage capability at low cost.



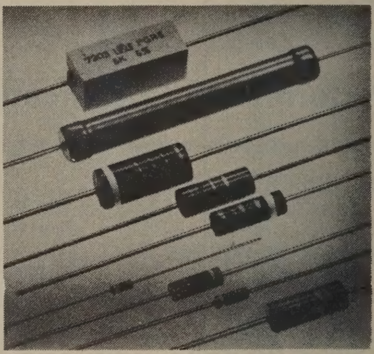
Resistive Networks

Advanced resistor technology here. These IC compatible, precision tantalum-film circuits provide inherent low noise, excellent stability, and hermetic performance without hermetic cost. Tolerances from 5% to 0.05% available in custom designs.
TRW/IRC also offers the industry's most complete line of discrete fixed resistors.



Wirewound

The line starts with molded wirewound resistors—"space-savers" that bridge the cost-performance gap between composition resistors and precision wirewounds.
It proceeds to standard, non-insulated types for appliance/automotive use...to precision subminiatures offering high power density... to low cost fusible, flameproof units for consumer and industrial applications... to tubular and flat power wirewounds with ratings to 250 W.



Metal Glaze™

This is TRW/IRC's thick-film technology—for all types of low power resistor applications. Metal Glaze is widely accepted for its built-in power handling reliability, resistance range, and cost effectiveness. Numerous standard and special designs—precision, semi-precision, flameproof, high-rel, high-voltage.

All types...all technologies... one source

To wrap it up, TRW/IRC offers you the most complete line of fixed resistors in the business, with many of the popular types available from one source— your local TRW/IRC distributor. Having a direct pipeline to each of our plants, he can give you fast delivery.

Contact your local TRW sales office for application assistance, custom designs, and special engineering help when you need it. TRW/IRC Resistors, an Electronic Components Division of TRW, Inc. Plants at Boone, N.C., Burlington, Iowa, Corpus Christi, Texas and Philadelphia, Pa. Write TRW/IRC Resistors, 401 N. Broad St., Philadelphia, Pa. 19108. Or call (215) 923-8230.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 401 N. BROAD ST., PHILADELPHIA, PA. 19108 (215) 922-8900

TRW IRC RESISTORS

TRW/IRC RESISTORS

On the shelf. . . When you want them. Where you want them.

The TRW/IRC resistors listed in the table below are those usually carried in stock by our distributors. They're the resistors you're most likely to need, or at least, need in a hurry. When you do, chances are your nearby TRW/IRC distributor can fill your order from his shelves. Other parts and styles are available as well, although not always from stock. Ask your distributor, he'll be happy to discuss your special local stock needs with you.

GENERAL PURPOSE RESISTOR

Carbon Composition MIL-R-39008

RCR07—¼ w
RCR20—½ w
RCR32—1 w

Molded Wirewound

BWH—2w
BW-20—1w

RN GENERAL PURPOSE SEMI PRECISION AND PRECISION METAL GLAZE™ RESISTORS

MIL-R-22684 Type RL

RL07—RG07
RL20—RG20
RL32—RG32
RL42—RG42

MIL-R-10509 Type RN

RN55D—T0-55
RN60D—T0-60
RN65D—T0-65
RN55C—T2-55
RN60C—T2-60
RN65C—T2-65

MIL-R-39017 Type RLR*

RLR07—RGR07
RLR20—RGR20
RLR32—RGR32
RLR42—RGR42

MIL-R-11 Style Equivalents

RC05—RG-⅛
RC07—RG-¼

M & C SERIES HIGH STABILITY METAL FILM RESISTORS

MIL-R-10509 Style

CCA-T0 (RN60D)
CCA-T2 (RN60C)
CCB-T0 (RN65D)
CCB-T2 (RN65C)
CEA-T0 (RN55D)
CEA-T2 (RN55C)
CEC-T0
CEC-T2
MMC-T0 (RN50D)
MMC-T2 (RN50C)

Established Reliability— Metal Film Resistors MIL-R-55182

RNC/RNR50K
RNC/RNR50H
RNC/RNR55K
RNC/RNR55H
RNC/RNR60K
RNC/RNR60H
RNC/RNR65K
RNC/RNR65H

---

*Including new Rev. C which specifies ±1% & 2% tol., ±100 ppm T.C.

DISTRIBUTOR OPERATION, TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW, INC.,
401 N. BROAD ST., PHILA., PA. 19108 (215) 923-8230

GENERAL PURPOSE MOLDED CARBON COMPOSITION RESISTORS (RC & RCR)

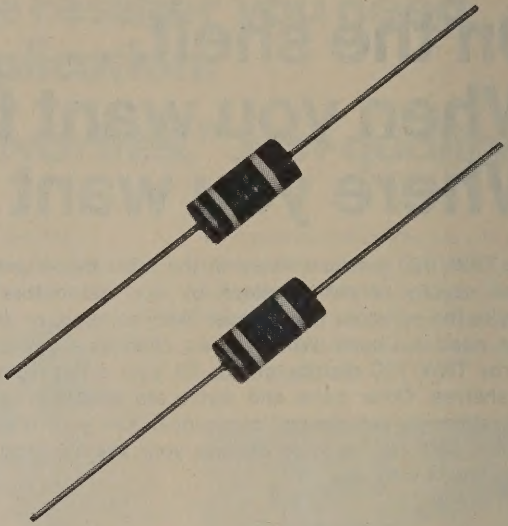
Performance advantages include **strong** lead assemblies. TRW's ribbed shoulder leads are **deeply** imbedded in the molding, defy twisting or pull-out.

TRW leads feature a uniform surface—thanks to an exclusive alloy electroplating process (no hot dipping). You'll find no lumps or voids to degrade solderability.

Moisture protection is another TRW feature. With the element thermally bonded to glass body and embedded in TRW's Selectrez™ mold jacket, you get a more than 50% boost in moisture protection.

TRW carbon comp.'s also offer outstanding high-temperature characteristics. This results from the resistance element's being bonded to the glass substrate at 500°C, plus the internal heat-sinking action of the talon lead construction.

Altogether, these features—plus superior high-frequency characteristics (see facing page)—mean a top quality resistor with outstanding reliability.



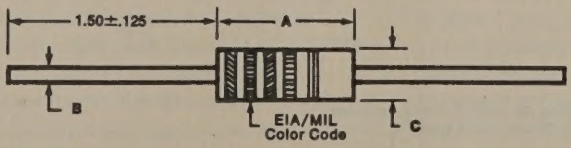
TRW TYPE	GBT-¼	GBT-½	GBT-1
MIL-R-11 Style	RC07	RC20	RC32
MIL-R-39008 Style	RCR07	RCR20	RCR32
MIL-R-39008 Failure Rate Level	S	S	S
Resistance, Standard	2.7 ohms thru 22 Megohms	2.7 ohms thru 22 Megohms	2.7 ohms thru 22 Megohms
Resistance, Special (Non Mil)		24 Megohms thru 100 Gigaohms	——
Tolerances, Standard	±5%, ±10%, ±20%	±5%, ±10%, ±20%	±5%, ±10%, ±20%
Power Rating	¼-watt @ 70°C	½-watt @ 70°C	1-watt @ 70°C
Maximum Continuous Working Voltage	250 Volts	350 Volts	500 Volts
Minimum Insulation Resistance—Dry	10,000 Megohms	10,000 Megohms	10,000 Megohms
Wet	100 Megohms	100 Megohms	100 Megohms
Minimum Dielectric Withstanding Voltage Atmospheric	500 Volts, R.M.S.	700 Volts, R.M.S.	1000 Volts, R.M.S.
Reduced	325 Volts, R.M.S.	450 Volts, R.M.S.	625 Volts, R.M.S.
Shunt Capacitance (Avg.)	0.15 pF	0.175 pF	0.25 pF
Load Life-Typical △R Less Than*	±4%	±6%	±6%

Resistance-Temperature Characteristic	Typical △R Less Than* From 25°C Reference					
Nominal Resistance (Ohms)	GBT¼ @ −55°C	GBT¼ @ +105°C	GBT-½ @ −55°C	GBT-½ @ +105°C	GBT-1 @ −55°C	GBT-1 @ +105°C
1K and Under	±2%	±2%	±4.5%	±2.5%	±5%	±4%
1.1K to 10K	+8%	±3%	+7%	−2.5%	+8%	−4%
11K to 100K	+9%	−4%	+9%	−3.5%	+9%	−4%
110K to 1Meg	+10%	−5%	+10%	−3.5%	+11%	−4%
1.1Meg to 10Meg	+11%	−5%	+11%	−3.5%	+11%	−4%
11Meg to 22Meg	+11%	−5%	+11%	−3.5%	+11%	−4%

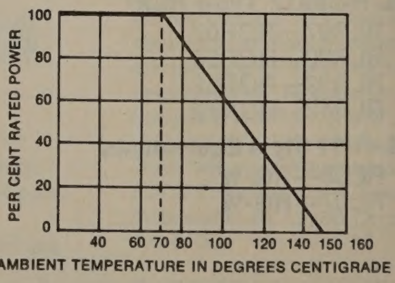
*"Typical △R Less than" is defined as the maximum △R to be expected in 95% of the population of △ distribution.

DIMENSIONS

	A	B	C
GBT-¼	.250±.015	.025±.001	.090±.008
GBT-½	.390±.010	.031±.001	.140±.008
GBT-1	.562±.010	.040±.001	.225±.008

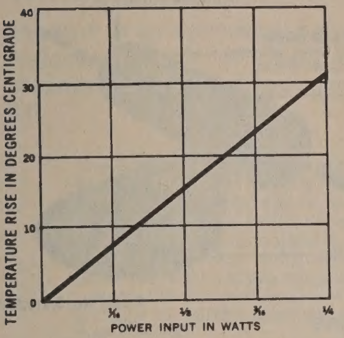


DERATING CURVE TEMPERATURE—POWER

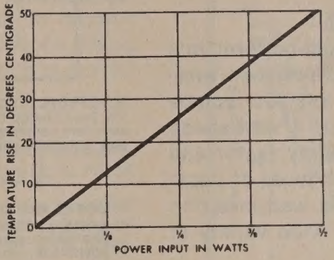


TRW IRC RESISTORS

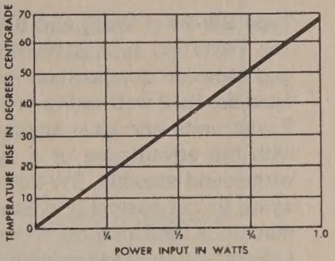
SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD



GBT¼



GBT½



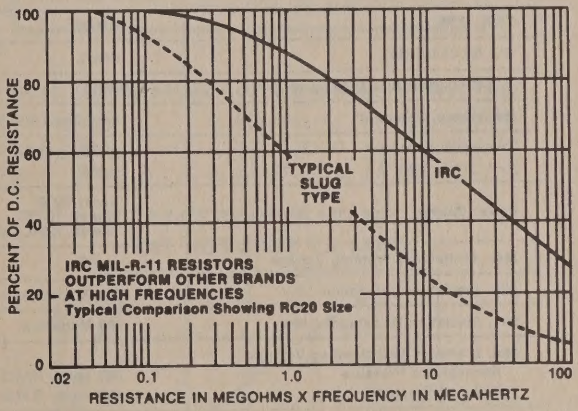
GBT1

Superior high frequency characteristics

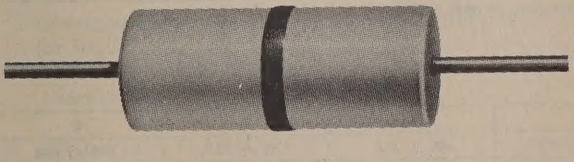
The best high frequency characteristics in a fixed composition resistor are achieved when the ratio of cross-sectional area to resistor length is minimized. TRW/IRC's element has the smallest cross section and fewest carbon binder contacts of any carbon composition resistors.

The low mass resistance element assures low shunt capacitance and superior performance at high frequencies. In high frequency equipment, this results in better pulse shaping with less broadening and truncation and faster response.

TRW/IRC resistors significantly outperform other brands, as shown on the chart.



ZEROHM Molded Jumper Wires



Molded jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a P.C. Board.

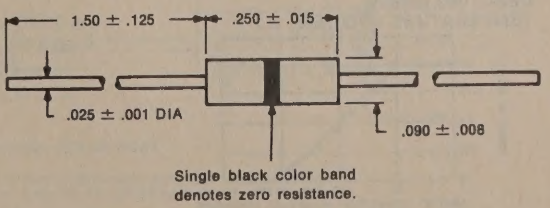
Generally they are used for the following reasons:

- —Inability to connect two points on a P.C. Board due to other circuit paths which must be crossed over.
- —An after-the-fact design change that requires new point connections.
- —Circuit tuning by changing point connections.

TRW's molded jumper wires offer a quick simple solution to these problems. They are especially suited for automatic machine insertion on lead tape or available in all packaging styles including pre-cut and formed for manual insertion.

SPECIFICATIONS

Maximum resistance	0.01 Ω
Lead material	30/70 tin/lead solder-coated copper wire.
Body material	Electrical grade, high performance, molding compound
Min. Insulation resistance—Dry	10,000 meg Ω
Wet	100 meg Ω
Min. Dielectric withstanding voltage	
Atmospheric	500V RMS
Reduced	325V RMS
Insulation flammability	Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.



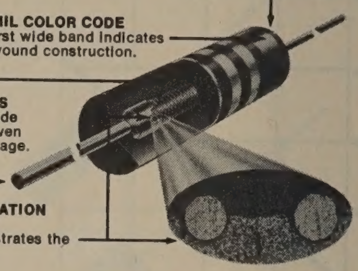
Single black color band denotes zero resistance.

TRW *IRC RESISTORS*

GENERAL PURPOSE WIREWOUND MOLDED RESISTORS

Type BW-20 (1 Watt) and BWH (2 Watt)

The TRW/IRC Type BWH bridges the cost-performance gap between composition resistors and premium wirewounds. Its 2 watt rating in 1-watt size lets you replace 2 watt units and save space, or use it in 1 watt space with the advantages of a two-times safety factor and wirewound stability. BW-20s come in six types of packaging to cut assembly costs. They fit ½ watt inserting machines, and can be ordered with a wide variety of cut-and-formed lead configurations.



ALLOY RESISTANCE WIRE
Continuously wound on a fiberglass core for greater uniformity and extremely low inductances.

HEAVY MOLD JACKET
Exclusive phenolic plastic jacket provides superior strength and moisture protection.

EIA/MIL COLOR CODE
The first wide band indicates wire-wound construction.

ELECTROPLATED LEADS
Tin/lead coated to provide excellent solderability even after extended shelf storage.

HOT CLAMP TERMINATION
Actual unretouched photomicrograph illustrates the positive termination, inherent stability.

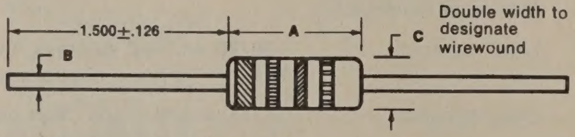
Patent No. 3,319,210

GENERAL PURPOSE WIREWOUND MOLDED RESISTORS

TRW TYPE	BW-20	BWH
EIA RS-344 Style	CRU1	CRU2
MIL-R-11 Style Size Equivalent	RC20	RC32
Resistance, Standard	0.24 Ohms thru 750 Ohms*	0.10 Ohms thru 2400 Ohms*
Tolerance, Standard Special	±5%, ±10% ±2%	±5%, ±10%
Power Rating	1-watt 50°C ½-watt 100°C ¼-watt 125°C, derating to 0 @ 160°C	2-watts @ 70°C 1-watt @ 115°C ½-watt @ 137°C, derating to 0 @ 160°C
Max. Continuous Working Voltage	√ PR	√ PR
Min. Insulation Resistance—Dry	10,000 Megohms	10,000 Megohms
Min. Insulation Resistance—Wet	100 Megohms	100 Megohms
Min. Dielectric Withstanding Voltage Atmospheric Pressure Reduced Pressure	 700 Volts, R.M.S. 450 Volts, R.M.S.	 1000 Volts, R.M.S. 625 Volts, R.M.S.
Hot Spot Temp. Rise at 1-Watt	100°C	115°C
Current Noise	Negligible	Negligible
Marking	Standard EIA/MIL Color Code (double width first band)	Standard EIA/MIL Color Code (double width first band)

*See page 7 for decade values

See fusible, flameproof versions on next page

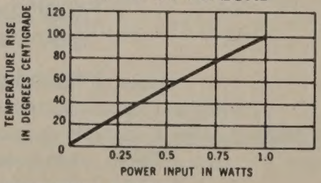


	A	B	C
BW-20	.390 ± .010	.032 ± .001	.140 ± .008
BWH	.562 ± .010	.040 ± .001	.225 ± .008

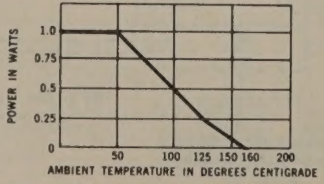
Typical BW-20 Δ R Less Than**

Load Life (50°C) ±3%

SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD



DERATING CURVE TEMPERATURE—POWER



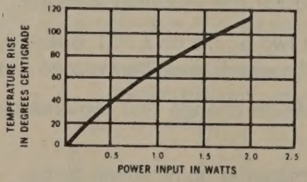
Temperature Coefficient†
0.24 Ohms-0.62 Ohms
0.68 Ohms-750 Ohms

±0.025% / °C
±0.010% / °C
respectively

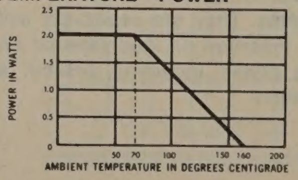
Typical BWH Δ R Less Than**

Load Life ±5%

SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD



DERATING CURVE TEMPERATURE—POWER



Temperature Coefficient†
0.1 Ohms-0.16 Ohms
0.18 Ohms-0.62 Ohms
0.68 Ohms-2400 Ohms

±0.08% / °C
±0.06% / °C
±0.02% / °C
respectively

**Typical ΔR Less Than is defined as the maximum ΔR to be expected in 95% of the population of a distribution.

†Special TC available

BWF FLAMEPROOF FUSIBLE WIREWOUND RESISTOR

The BWF is an economical fusible/flameproof resistor designed to handle ½, 1 and 2 watt applications where dependable circuit and equipment protection is essential.

The BWF has predictable overload *Fusing* Characteristics and is *Flameproof* under fault conditions up to 1000X rated power. (1000V maximum).

Rated at 2 watts and physically a 1 watt size, the BWF provides space savings and is suited for lead forming or automatic insertion equipment on reels of 2000 units. Other packaging styles are available.

Note: BW-20F now available. Rated at 1 watt in ½ watt package for failsafe applications requiring a smaller size than the BWF.

TRW-BT348 FLAMEPROOF RESISTOR SPECIFICATION HIGHLIGHTS

1. INSTANTANEOUS OVERLOAD

   Overloads from 0 to 15 minutes duration. From 4X to 1000X rated power, (or 1000V, whichever is smaller)
   —No flaming of resistor
   —A paper tissue (Kimwipe #900-S) shall not ignite when resting across or beneath the unit.

2. DYNAMIC OVERLOAD

   Wattage increased at 100% increments of rated power every 2 seconds, (after a 1 minute warmup at rated power).
   —Same as 1 above.

3. CURRENT LIMITING

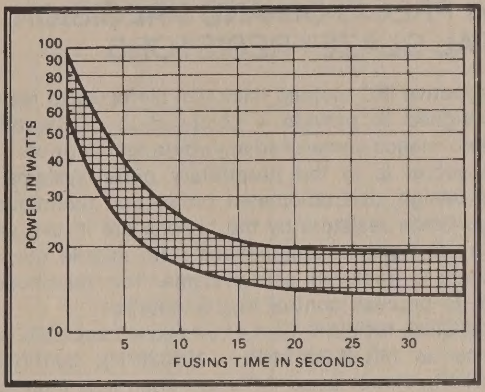
   Overload applied as in 1. Up to 1000X rated power (or 1000V).
   —Current shall limit to less than 1% of the ohms law value.

4. INSULATION FLAMMABILITY

   Resistor insulation is self extinguishing after externally applied flame is removed.
   —Extinguishes within 10 seconds.
   —Smoking is considered acceptable.

● Equiv. to E.I.A. RS-344	CRU2
● Size Equiv. to MIL-R-11	RC32
● Power Rating @ 70°C	2 Watts
● Resistance Range Minimum	0.10Ω
Maximum	.100Ω
● Purchase Tolerance	5%, 10%
● Maximum Continuous Voltage	√PR
● Loadlife: 2 watts @ 70°C	Max. ΔR±10%
● Min. Dielectric Strength	
Atmospheric Pressure	1000V RMS
Reduced Pressure	625V RMS
● Min. Insulation Resistance	
Dry	10K MegΩ
Wet	100K MegΩ

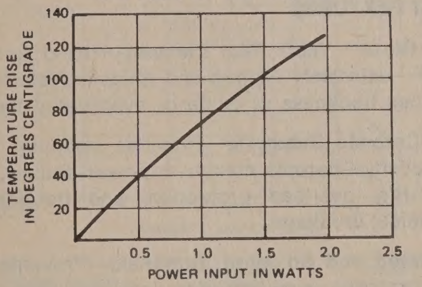
Typical Fusing Characteristics



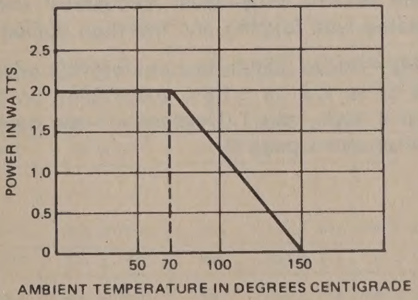
TYPICAL TEMPERATURE COEFFICIENT or ΔR Less Than

0.1Ω — 0.16Ω	+800 PPM/°C	or	+0.08%/°C
0.18Ω — 0.68Ω	+600 PPM/°C	or	+0.06%/°C
0.75Ω — 100Ω	±200 PPM/°C	or	±0.02%/°C

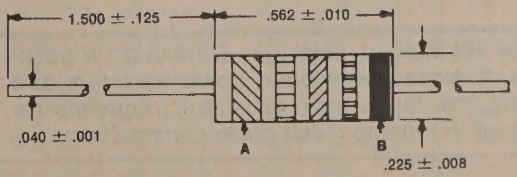
SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD



TEMPERATURE CURVE RECOMMENDED POWER DERATING



MARKING AND DIMENSIONS



EIA/MIL COLOR CODE

A = First significant figure is a double width band to designate wirewound

B = Flameproof designator—Blue marking

TRW IRC RESISTORS

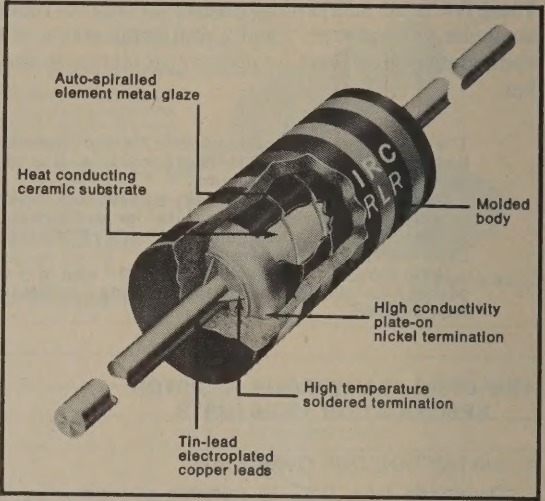
RG GENERAL PURPOSE SEMI PRECISION AND PRECISION METAL GLAZE™ RESISTORS

Cost effective IRC molded thick film Metal Glaze resistors are designed to provide a combination of ruggedness and performance unmatched anywhere for the price.

The secret is in the proprietary glaze systems, the unique design, and automated production techniques.

Metal Glaze resistors by the billions are in use worldwide, in all types of applications from missile guidance computers to truck anti skid systems, from telephone receivers to process control instrumentation.

Metal Glaze resistors meet or far exceed such MIL specifications as MIL-R-22684(RL), 10509(RN), 39017(RLR), 55182(RNR). Power Load ΔR's are often less than ±1%, even after 10,000 hours—equivalent to years of equipment life. And these units remain within tolerances even after extended periods of shelf or equipment storage.

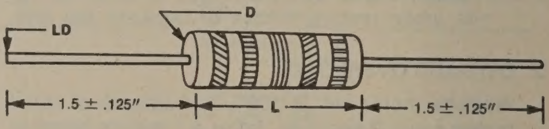

Auto-spiralled element metal glaze
Heat conducting ceramic substrate
IRC
RLR
Molded body
High conductivity plate-on nickel termination
High temperature soldered termination
Tin-lead electroplated copper leads

PRODUCT FEATURES

- **Metal Glaze™ Thick Film Element**—Fused to core at 2000°F—extremely rugged and reliable system—up to 100 times thickness of oxide or evaporated films.
- **Solid Ceramic Substrate**—Provides optimum thermal conductivity—permits maximum power density, lowest T.C. ΔR's, overload protection, and freedom from mechanical breakage.
- **End-Plated and Soldered Terminals**—Prevents movement, provides excellent electrical and thermal contact. Withstands 20 lb. pull for 5 seconds.
- **Uniform Molded Body**—Best mechanical strength for automated lead forming and insertion equipment.
- **Stability**—Above built-in features provide design tolerances of as low as ±1.5% (depending on purchase tolerance, style, and T.C. selection—see design tolerance discussion, page 6).

DIMENSIONS—See Table

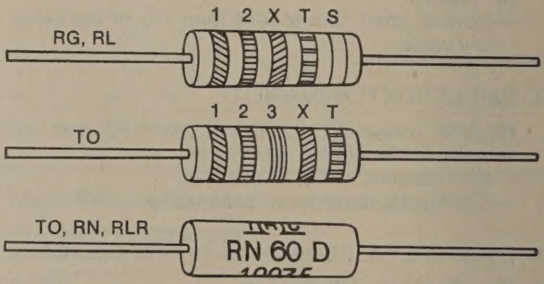
Body Configuration—Molded



IDENTIFICATION

Metal Glaze resistors can be provided with color bands or alpha-numeric printing.

See Table next page for marking by style.



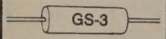
1, 2, 3 = Significant Figures
X = Multiplier
T = Tolerance
S = White Solderable Band (RL)

New! 3W molded, axial lead GS-3 in a 1W package. Replaces wirewound power resistors and offers low temp. rise, excellent frequency response in reliable metal glaze construction.

Black = 0
Brown = 1
Red = 2
Orange = 3
Yellow = 4

Green = 5
Blue = 6
Violet = 7
Gray = 8
White = 9

Brown = ±1% Tol.
Red = ±2% Tol.
Gold = ±5% Tol.
Silver = ±10% Tol.

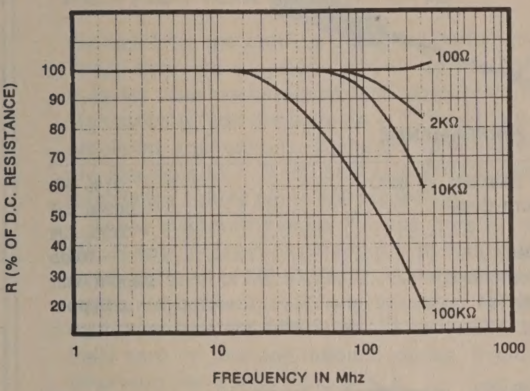
	IRC TYPE	MIL STYLE	MIL RANGE	IRC RANGE	TOL %	TC	POWER RATING	VOLTAGE RATING	DIMENSIONS L	D	LD
 GS-3	GS-3	—	—	10-2.1M	1,2,5	50,100	1W@125°C, 3W@25°C	1000V	.515±.01	.225±.008	.032±.002

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

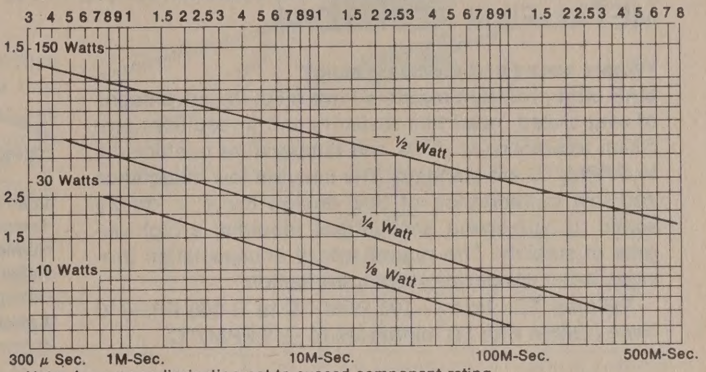
TRW IRC RESISTORS

HIGH FREQUENCY CHARACTERISTICS

RG ¼W SIZE



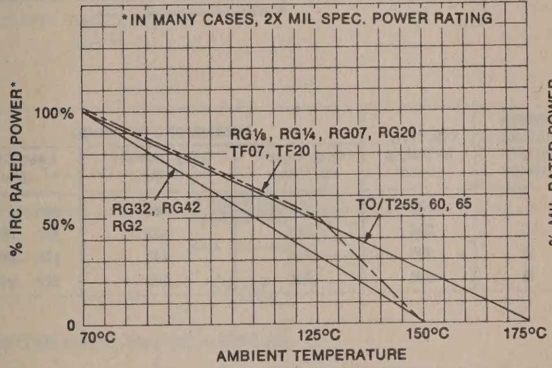
RG PULSE OR SURGE POWER RATING:
MAXIMUM APPLIED POWER/PULSE ON TIME



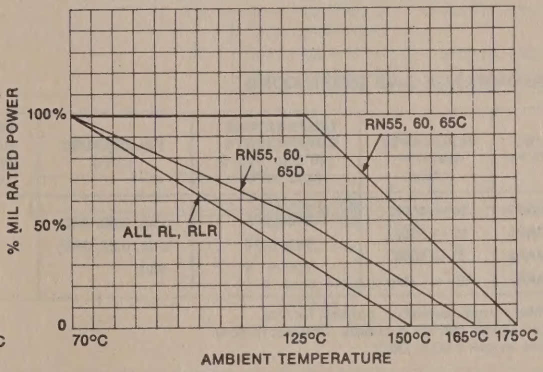
Note: Avg power dissipation not to exceed component rating

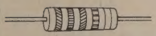
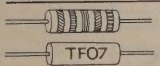
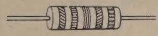
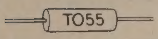
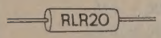
SPECIFICATIONS

COMMERCIAL POWER DERATING—METAL GLAZE
(SEE SPECIFICATION TABLE BELOW)



MIL SPECIFICATION POWER DERATING
(SEE SPECIFICATION TABLE BELOW)



CLASSIFICATION/ CONFIGURATION	IRC TYPE	MIL STYLE	MIL RANGE (Ω)	IRC RANGE (Ω)	TOL. ±%	T.C. (±ppm/°C)	POWER RATING[4] IRC	POWER RATING[4] MIL	VOLTAGE RATING (v)	DIMENSIONS L (in.)	DIMENSIONS D (in.)	DIMENSIONS LD (in.)
GENERAL PURPOSE AND SEMI-PRECISION	RG⅛	RC05[1]	—	10 – 150K	5	200	¼W @ 70°C	⅛W @ 70°C	200	.150 ± .01	.066 ± .008	.016 ± .002[5]
	RG¼	RC07[1]	—	6.2 – 1M	5	200	½W @ 70°C	¼W @ 70°C	250	.250 ± .015	.090 ± .008	.025 ± .001
	RG07	RL07	51 – 150K	10 – 620K	2, 5	200	½W @ 70°C	¼W @ 70°C	250	.250 ± .015	.090 ± .008	.025 ± .001
	RG20	RL20	4.3 – 470K	4.3 – 1M	2, 5	200	1W @ 70°C	½W @ 70°C	350	.390 ± .010	.140 ± .008	.032 ± .002
	RG32	RL32	10 – 1M	10 – 1M	2, 5	200	1W @ 70°C	1W @ 70°C	500	.562 ± .031	.190 ± .008	.040 ± .002
	RG42	RL42	10 – 1.5M	10 – 1.5M	2, 5	200	2W @ 70°C	2W @ 70°C	500	.688 ± .040	.318 ± .018	.045 ± .002
Color Banded	RG2	RC42[1]	—	10 – 1.5M	5	200	2W @ 70°C	2W @ 70°C	500	.688 ± .040	.318 ± .018	.045 ± .002
	TF07	RL07[1]	—	1 – 10	1, 2, 5	100	½W @ 70°C	¼W @ 70°C	250	.250 ± .015	.090 ± .008	.025 ± .001
LOW RESISTANCE Banded or Stamped	TF20	RL20[1]	—	1 – 10	1, 2, 5	100	¾W @ 70°C	½W @ 70°C	350	.390 ± .010	.140 ± .008	.032 ± .002
	T055	RN55D	10 – 301K	10 – 499K	1[3]	100[3]	½W @ 70°C	⅛W @ 70°C	200	.250 ± .015	.090 ± .008	.025 ± .001
PRECISION	T255	RN55C	49.9 – 100K	10 – 499K	1[3]	50[3]	¼W @ 70°C	1/10W @ 125°C	200	.250 ± .015	.090 ± .008	.025 ± .001
	T060	RN60D	10 – 1M	10 – 1M	1[3]	100[3]	¾W @ 70°C	¼W @ 70°C	300	.390 ± .010	.140 ± .008	.025 ± .001
	T260	RN60C	49.9 – 499K	10 – 1M	1[3]	50[3]	½W@70°C	⅛W @ 125°C	250	.390 ± .010	.140 ± .008	.025 ± .001
	T065	RN65D	10 – 1M	10 – 1M	1[3]	100[3]	1W@70°C	½W @ 70°C	350	.562 ± .031	.190 ± .008	.025 ± .001
Banded or Stamped	T265	RN65C	49.9 – 348K	10 – 1M	1[3]	50[3]	½W @ 70°C	¼W @ 125°C	300	.562 ± .031	.190 ± .008	.025 ± .001
	RGR07	RLR07/R[2]	10 – 470K	10 – 470K	1, 2	100	¼W @ 70°C	¼W @ 70°C	250	.250 ± .015	.090 ± .008	.025 ± .001
	RGR20	RLR20/R[2]	4.3 – 1M	4.3 – 1M	1, 2	100	½W @ 70°C	½W @ 70°C	350	.390 ± .010	.140 ± .008	.032 ± .002
	RGR32	RLR32/P[2]	10 – 1M	10 – 1M	1, 2	100	1W @ 70°C	1W @ 70°C	500	.562 ± .031	.190 ± .008	.040 ± .002
ESTABLISHED RELIABILITY	RGR42	RLR42/M[2]	10 – 1.5M	10 – 1.5M	1, 2	100	2W @ 70°C	2W @ 70°C	500	.688 ± .040	.318 ± .018	.045 ± .002

[1] Not QPL listed

[2] Failure rate symbol

[3] See pp. 9–10 for close tolerance & TC

[4] See power derating curves above

[5] 1.00 ± .125 lead length

TRW/IRC RESISTORS. AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

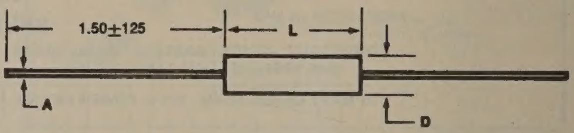
MAR ULTRA PRECISION, NON-INDUCTIVE METAL FILM RESISTORS

"Where speed and precision count"
MAR ultra-precision resistors have all of the advantages of evaporated metal film resistors and in addition, precision tolerances to .01% and temperature coefficients to 5 PPM/°C are standard. The inherent low inductance and low capacitance of this design make it ideally suited to high-speed applications requiring a high degree of stability. The rugged epoxy encapsulation provides excellent environmental protection.

Tailored TCs from —100 PPM/°C to +150 PPM/°C are available with TC tolerances to ± 5 PPM/°C.

TYPICAL PERFORMANCE

Load Life 1000 hrs. @ 85°C	.01% ΔR
Temperature Cycle	.002% ΔR
Humidity	.02% ΔR
Noise Index	−40 db
Voltage Coefficient	.02ppm/volt
1 year shelf life	±15 ppm



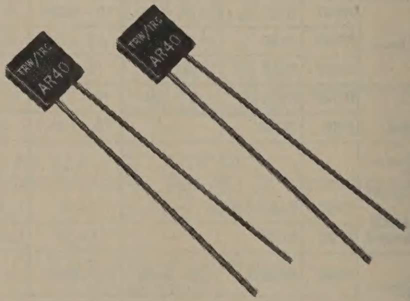
PERFORMANCE AND DIMENSIONS

IRC TYPE	RESISTANCE RANGE* (Ohms)	TEMPERATURE COEFFICIENTS −20°C to +85°C (±ppm/°C)	TOLERANCES (±%)	POWER RATING** @ 85°C (Watts)	VOLTAGE RATINGS (Volts)	DIMENSIONS IN INCHES Body Length (L Max.)	DIMENSIONS IN INCHES Body Diameter (D Max.)	DIMENSIONS IN INCHES Lead Gage (A)
MAR3	20 — 100K	T10 = 15 T13 = 10 T16 = 5	1.00, 0.50, 0.25, 0.10, 0.05, 0.02, 0.01	1/20	200	.191	.082	#26 .016†
MAR5	20 — 250K			1/10	250	.281	.102	#22 .025
MAR6	20 — 500K			1/8	300	.425	.155	#22 .025
MAR7	20 — 1 Meg			1/4	500	.650	.195	#22 .025

*Wider ranges available, contact factory.
**High power ratings available. Contact factory.
†Lead length 1.00 ± .062.

AR40 ULTRA-PRECISION METAL FILM RESISTORS

The AR40 ultra-precision metal film resistor is designed to satisfy those critical design requirements where virtually zero temperature coefficient, stability and absolute accuracy are needed. Temperature coefficients of ± 5 PPM/°C and ± 2 PPM/°C are standard. Standard tolerances are available to .01%. The radial lead design and small case size require a minimum of printed circuit board space. Proven end cap termination assures essentially no degradation during normal circuit board insertion practices.



PERFORMANCE AND DIMENSIONS

TCR CLASS.	STANDARD TEMP. COEFF. (°C)	RESISTANCE RANGE* (Ohms)	STANDARD TOLERANCE (±%)	WATTAGE 85°C	DIMENSIONS IN INCHES	
T-18	2 ppm 0 to 60°C 5 ppm −55 to 125°C	20 to 100K	.01, .02, .05, .10, .25, .50, 1.00	.3 watts	Height	.320 ± .020
					Length	.295 ± .010
					Width	.100 ± .010
T-16	5ppm 0 to 60°C 10 ppm −55 to 125°C				Lead spacing	.150 ± .010
					Lead gage #22	.0253**

*Wider ranges available, contact factory.
**Lead Length 1.00 minimum

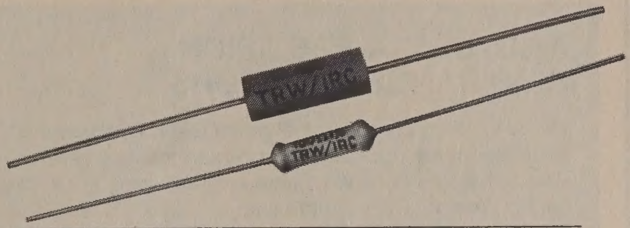
TRW IRC RESISTORS

M&C SERIES HIGH STABILITY METAL FILM RESISTORS

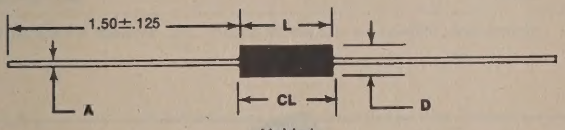
Evolved from the industry's original metal film process. These resistors are manufactured to the tightest controls for best performance with respect to low noise, high stability, and the ultimate in TCs and tolerances for precision applications. Standard tolerances and TCs are available to ± 0.1% and ±25 PPM°C respectively. Resistance values are to 100 megohms.

These evaporated metal film resistors will exceed all MIL-R-specification requirements, including the highest reliability level of MIL-R-55182. Voltage coefficient when measured between 1/10 and full rated voltage is typically less than 0.5 PPM/Volt for all values and essentially zero for low and medium values. Typical △ R for long term life is less than .04%.

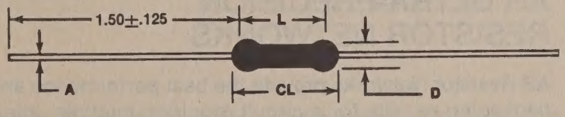
The design concept of these resistors offer high strength characteristics for potting applications and automatic insertion.



MIL-R-55182 Char.	IRC T.C. Code	Temperature Coefficient	Temperature Span
K	T0	0±100PPM/°C	−55°C to +165°C
H.	T2	0±50PPM/°C	−55°C to +175°C
J	T9	0±25PPM/°C	−55°C to +175°C
	T3	0 to +100PPM/°C	−55°C to +165°C
	T4	0 to −100PPM/°C	−55°C to +165°C
	T5	0±25PPM/°C	+25°C to +145°C
	T6	0 to +50PPM/°C	−55°C to +165°C
	T7	0 to −50PPM/°C	−55°C to +165°C
	T8	0±25PPM/°C	+25°C to +165°C
		0±35PPM/°C	−55°C to +25°C
	TR	0 to +100PPM/°C 0 to −250PPM/°C	−55°C to +165°C
	TE	0 to +100PPM/°C 0 to −500PPM/°C	−55°C to +165°C



Molded
Style M



Conformally Coated
Style C

PERFORMANCE AND DIMENSIONS

IRC TYPE	MIL TYPE	RNR MIL CHAR	IRC T.C. CODE	MIL RESISTANCE RANGE (Ohms)	IRC RESISTANCE RANGE (Ohms)	MIL POWER RATING (Watts) 70°C	MIL POWER RATING (Watts) 125°C	MIL VOLTAGE RATING (Volts)	DIMENSION IN INCHES Body Length (L)	Body Diameter (D)	Max. Clean Lead Length (CL)	Lead Gage (A)	BODY STYLE
MMC	RNR50 RN50+	K H, J	T0 T2, T9	10-100K 49.9-100K	10-3.2 MEG 49.9-1.1 MEG	⅛	1/20	200	.150±.020	.065±.010	.200	#26** .016	C
CEA	RN55+	— —	T0 T2, T9	— —	10-6.5 MEG 30.1-2.3 MEG	⅛	1/10	200	.250±.031	.090±.010	.325	#22 .0253	C
CCM	RNR55 RN55+	K H, J	T0 T2, T9	20-200K 49.9-200K	20-6.3 MEG 30.1-2.2 MEG	⅛	1/10	200	.250±.031	.088±.010	.325	#22 .0253	C
MCM	—	— —	T0 T2, T9	— —	20-301K 30.1-301K	⅛	1/10	200	.250±.031	.093±.005	.310	#22 .0253	M
CCA	RNR60 RN60+	K H, J	T0 T2, T9	24.9-499K 49.9-499K	10-13 MEG 49.9-4.5 MEG	¼	⅛	250	.400±.031	.140±.020	.540	#22 .0253	C
MEA	RN60+	— —	T0 T2, T9	— —	10-6.5 MEG 30.1-2.3 MEG	¼	⅛	250	.406±.015	.130±.010	.545	#22 .0253	M
MEB	RN65+	— —	T0 T2, T9	— —	10-13 MEG 49.9-4.5 MEG	½	¼	300	.594±.015	.203±.015	.733	#22 .0253	M
CCB	RNR65 RN65+	K H, J	T0 T2, T9	24.9-1 Meg 49.9-1 Meg	10-24 MEG 49.9-8.4 MEG	½	¼	300	.594±.031	.180±.020	.734	#22 .0253	C
MEC	RN70+	— —	T0 T2, T9	— —	10-24 MEG 24.9-8.4 MEG	¾	½	350	.719±.020	.261±.020	.863	#20 .032	M
CEC	—	— —	T0 T2, T9	— —	10-24 MEG 49.9-8.4 MEG	1	½	350	.594±.031	.180±.020	.734	#20 .032	C
MEF	RN75+	— —	T0 T2, T9	— —	49.9-55.5 MEG 49.9-19.5 MEG	1	1	500	1.105±.020	.395±.020	1.253	#20 .032	M
MEH	RN80+	— —	T0 T2, T9	— —	100-148 MEG 100-52 MEG	2		750	2.254±.020	.395±.020	2.378	#20. 032	M

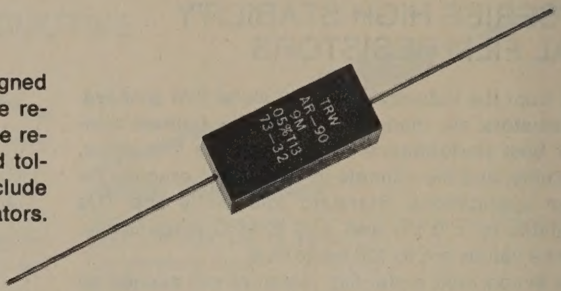
*Gold plated Dumet leads. 100" ± .062" **Lead length, 1.00" ± .062"

TRW/IRC RESISTORS. AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 887, BURLINGTON, IOWA 52601 (319) 754-8491

TRW IRC RESISTORS

AR 90 ULTRA-PRECISION HIGH RANGE RESISTORS

The AR90 ultra precision metal film resistor is designed to satisfy those critical design requirements where resistance values between 1 meg Ω and 10 meg Ω are required. Temperature coefficients to 5 PPM/°C and tolerances to .05% are standard. Applications include ultra precision voltage dividers and input attenuators.



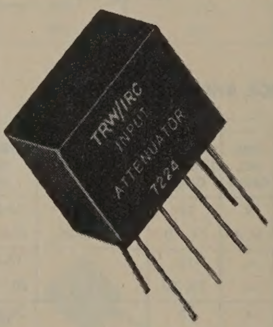
PERFORMANCE AND DIMENSIONS

IRC TYPE	RESISTANCE RANGE* (ohms)	TEMPERATURE COEFFICIENTS −20°C to +85°C (± PPM/°C)	TOLERANCES	POWER RATING	VOLTAGE RATING	BODY DIMENSIONS (IN.)			
						LENGTH	DEPTH	HEIGHT	LEAD
AR90	1M − 10M	T10 = 5 T13 = 10 T16 = 15	1.0, 0.5, 0.25, 0.1, 0.05	.5W	1000	1.0	0.4	0.4	#22

*Wider ranges available. Contact factory.

AR ULTRA-PRECISION RESISTOR NETWORKS

AR Resistor Networks provide the best performance and packaging density for a circuit requiring multiple, interdependent precision resistors. The rugged epoxy encapsulation provides maximum environmental protection. AR networks are designed to specific circuit requirements using one of the standard sizes available or special sizes where required.

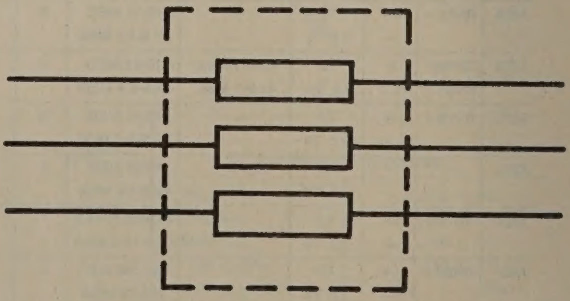


Features include:
- Lower Effective Cost
- High Density Packaging
- Ratio Matching to 0.005%
- Resistors thermally tied together
- Deliveries comparable to discretes
- All-welded construction
- TC Matching to ±1 PPM/°C

AR MATCHED RESISTOR SETS

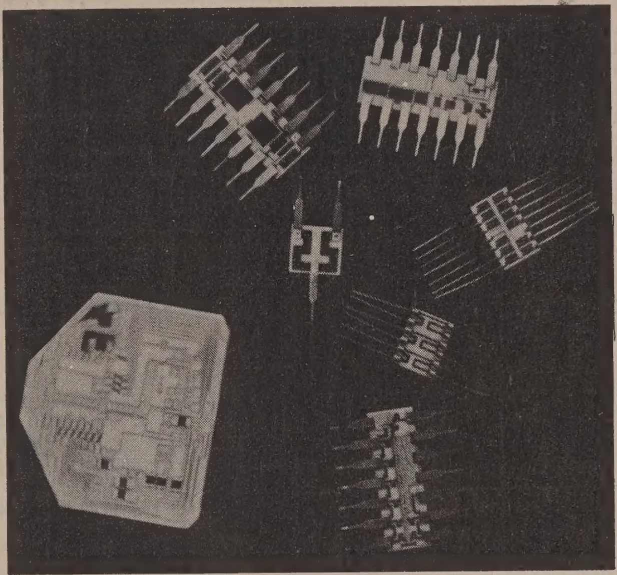
AR Matched Resistor Sets provide ultra-precision resistor performance at the lowest possible cost. Tolerance matching to 0.005% and TC matching to 1 PPM/°C can be specified.

Any TRW/IRC metal film resistors may be obtained as matched sets. The AR series, MAR and AR40 styles are recommended for the most precise tolerance and TC matching requirements.



TRW IRC RESISTORS

TaNFilm™ PRECISION FILM RESISTOR NETWORKS



TRW/IRC TaNFilm precision subminiature resistor networks are made of sputtered tantalum nitride, using proprietary equipment and processes.

TaNFilm is inherently resistant to electrolytic attack, since each resistor is passivated with an anodized surface layer. The processes used in manufacture allow routine tolerances of 0.1% and make tolerances of 0.05% economically feasible. The continuous sputtering process makes TaNFilm very uniform, so resistors track over the full temperature range to a few parts per million. Many hours of test data allow accurate performance prediction. A variety of networks are available, and others can be fabricated to your packaging requirements. Standard configurations are the DIP sandwich pack shown on page 16, and TO-88 type flat packs.

TYPICAL TaNFilm Design CRITERIA[1]

Resistance Value	50Ω to 100,000Ω	Drift	≤0.25% per year
Tolerance	±0.05% to ±1.0%	Noise	≤−25dB
TCR	−100±25 ppm/°C	Voltage Coefficient	≤5 ppm/V
TCR Tracking	to 5 ppm/°C	Series Inductance	≤5 nH
Settling Time	to 20nSec.	Shunt Capacitance	≤0.1 pF

[1] These are not absolute units. Contact factory for your specific requirements.

RESISTOR NETWORKS DUAL IN-LINE PACKAGE

TRW/IRC TaNFilm* resistor networks utilize a Tantalum Nitride resistor film deposited on a high alumina ceramic substrate. Units are molded in standard TO-116 DIP form-factor with 14 and 16 pin terminations.

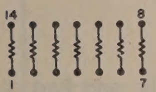
Styles

9989 = 7 resistors of equal value, 14 pin DIP
9999 = 8 resistors of equal value, 16 pin DIP
9987 = 13 resistors of equal value, 14 pin DIP
9998 = 15 resistors of equal value, 16 pin DIP

Resistance Values

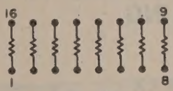
Types 9987 and 9998
50Ω to 50KΩ

Types 9989 and 9999
50Ω to 100KΩ



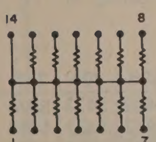
TYPE 9989

7 Resistors
14 Pin DIP



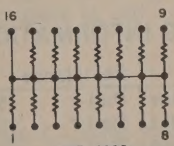
TYPE 9999

8 Resistors
16 Pin DIP



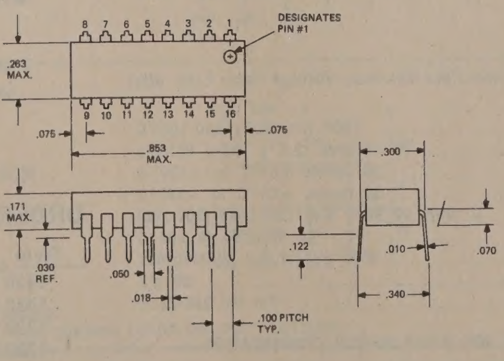
TYPE 9987

13 Resistors
14 Pin DIP

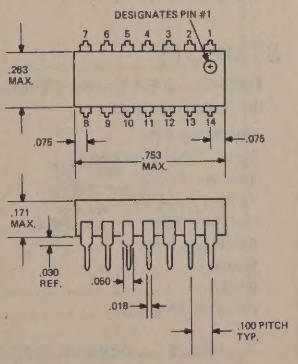


TYPE 9998

15 Resistors
16 PIN DIP


8 7 6 5 4 3 2 1
DESIGNATES PIN #1
.263 MAX.
9 10 11 12 13 14 15 16
.075
.075
.853 MAX.
.171 MAX.
.030 REF.
.050
.018
.100 PITCH TYP.
.300
.122
.010
.070
.340

16 PIN DIP


DESIGNATES PIN #1
7 6 5 4 3 2 1
.263 MAX.
8 9 10 11 12 13 14
.075
.075
.753 MAX.
.171 MAX.
.030 REF.
.050
.018
.100 PITCH TYP.

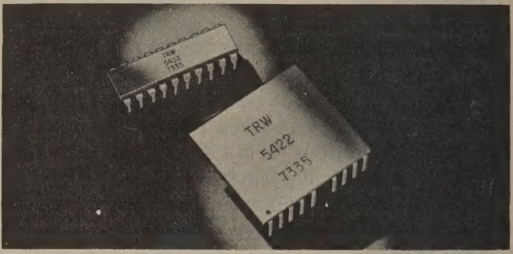
14 PIN DIP

*Trademark of TRW INC. for its Tantalum Nitride Film.

TRW IRC RESISTORS

TANFILM© R-2R LADDERS

- 12 BIT RESOLUTION
- FULL MIL PERFORMANCE
- TWO PACKAGE STYLES
- FOUR RESISTANCE VALUES
- 12 BIT OR 10 BIT ACCURACY



DESIGN

These 12 Bit R-2R Ladders feature the inherent passivation, low noise and premium performance of TaNFilm. They provide ±½ LSB accuracy over the full mil temperature range (−55 to +125°C) and retain this accuracy after long operating life in extreme environments. Unlike competitive devices this military grade performance demands no price premium. TaNFilm networks provide hermetic performance without the cost and disadvantages of hermetic sealing, because the tantalum nitride film is anodically passivated.

Resistors are sputtered tantalum nitride on 99.5% Alumina ceramic and are anodically passivated. Interconnections are 99.9% pure gold and the gold plated leads are welded to the interconnection film. Complete absence of silver and solder provides absolute insurance against silver and tin migration. The 5430 series features standard dual in-line packaging with rugged, gold plated, copper alloy, shouldered leads for ease of insertion. The 5420 series has two rows of leads .900" apart and is pin compatible with Beckman 811 series networks. The 5200 series are identical with the 5400 except for accuracy.

CIRCUIT AND APPLICATION

The circuit and pinout diagram is shown on the right. The characteristic "R" value may be 5K, 10K, 20K or 25K. Other values may be provided on special order. Standard switch compensation of 5 ohms is built into the four most significant bits. This also may be changed on special order. Three extra application resistors are provided for bipolar operation, Op Amp feedback or output attenuation. Switch or offset compensation may be provided in these resistors if required.

SPECIFICATIONS:

Ladder Resistance Values (R)	5K, 10K, 20K, 25K
Ladder Resistance Tolerance	±1%
Maximum Input Voltage	20V
Settling Time (to 0.1% of final value)	100n sec.
External Switch Compensation (Note 1)	5Ω
Temperature Range	−55° to 125°C
Ladder Voltage Accuracy	P/N 5200 is ±488 ppm; 5400 is ±122 ppm
Application Resistor Voltage Ratio	P/N 5200 is ±488 ppm; 5400 is ±122 ppm
Lead Material	Gold Plated Copper Alloy

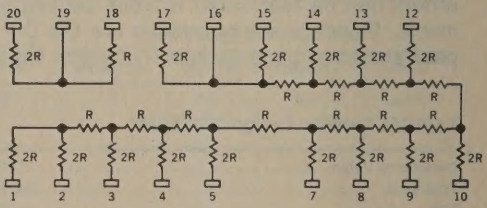
STABILITY

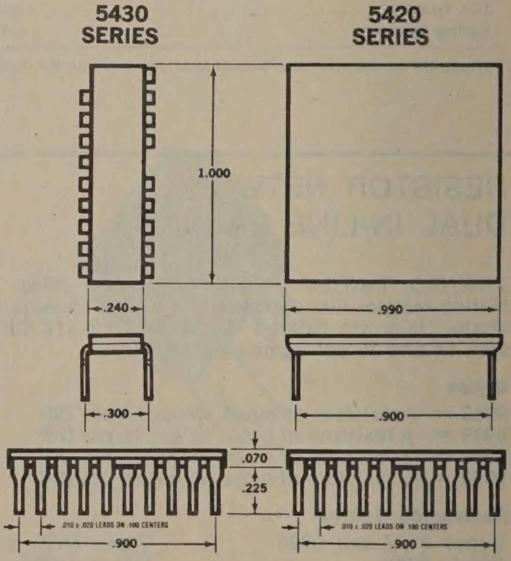
TaNFilm 12 Bit Ladders Exhibit specified Maximum Voltage Ratio Error after the following tests:

Operating Life	1000 Hrs. Full Load 100°C
Short Time Overload	10 Seconds 2.5 x Rated Voltage
Thermal Shock	10 Cycles −65°C to +150°C
Temperature Cycling	10 Cycles −65°C to +150°C
Moisture Cycle - Load/Polar	10 Days 90/98% R.H. Full Load (202-106)
Soldering Heat	10 Seconds @ 260°C
Shock	3000 g's for 0.2 Milliseconds
Vibration	20 g's
Terminal Strength	Per Mil 202-211B

NOTE 1 — CONSULT FACTORY FOR OTHER SWITCH COMPENSATION

CIRCUIT DIAGRAM





MARKING

TRW 5XXX	⟵ Mfg. and Part #
5K – 5R	⟵ Resistance & Switch R
7332	⟵ Date Code

ORDERING INFORMATION

Style	Resistance	5K	10K	20K	25K
5420 Series	Part #	5421	5422	5423	5424
5430 Series	Part #	5431	5432	5433	5434
5220 Series	Part #	5221	5222	5223	5224
5230 Series	Part #	5231	5232	5233	5234

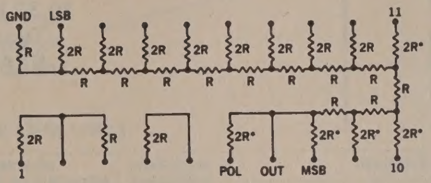
TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

TRW IRC RESISTORS

TANFILM® R-2R LADDERS

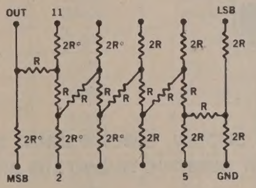
PART & DESCRIPTION | **CIRCUIT** | **PACKAGE**

5512 12 BIT R=10K
5516 12 BIT R=2K
Accuracy ½ LSB
*—15Ω SWITCH RESISTANCE


GND
LSB
11
R
2R
2R*
R
2R
2R*
1
POL
OUT
MSB
10

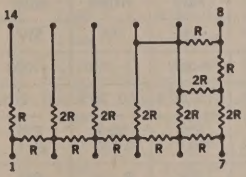
20 PIN D.I.P.

5445 10 BIT 1/8 LSB (12 BIT ACCURACY)
5245 10 BIT ½ LSB (10 BIT ACCURACY)
5045 10 BIT 2 LSB (8 BIT ACCURACY)
R=50K
*—150Ω SWITCH RESISTANCE


OUT
11
LSB
2R°
2R
R
2R°
2R
MSB
2
5
GND

12 PIN D.I.P.

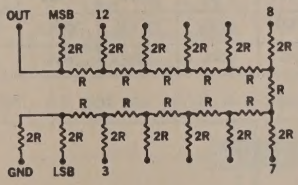
1045 8 BIT CURRENT SUMMING LADDER
R=500Ω
RATIO ACCURACY .25% BALANCED


14
8
R
2R
R
R
2R
2R
R
1
7

14 PIN D.I.P.

---

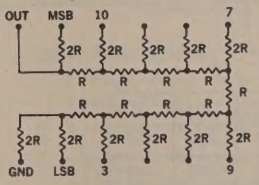
12 BXXE* 12 BIT R=5K, 25K, 50K
ACCURACY ½ LSB
SWITCH COMPENSATION AVAILABLE


OUT
MSB
12
8
2R
R
R
2R
GND
LSB
3
7

14 PIN FLAT PACK .370" x .250"

---

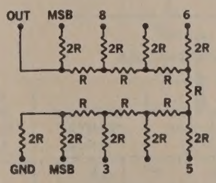
10 BXXE* 10 BIT R=5K, 25K, 50K
ACCURACY ½ LSB
SWITCH COMPENSATION AVAILABLE


OUT
MSB
10
7
2R
R
R
2R
GND
LSB
3
9

12 PIN FLAT PACK .320" x .250"

---

8 BXXE* 8 BIT R=5K, 25K, 50K
ACCURACY ½ LSB


OUT
MSB
8
6
2R
R
R
2R
GND
MSB
3
5

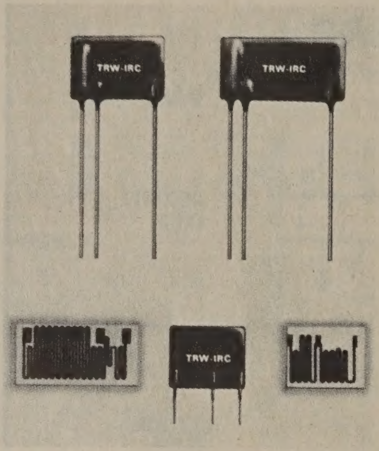
10 PIN FLAT PACK .270" x .250"

*XX INDICATES R VALUE — 05=5K, 25=25K, 50=50K
NOTE: D.I.P. LEADS ON .100 CENTERS, FLAT PACK RIBBON LEADS ON .050" CENTERS

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

TRW *IRC RESISTORS*

THICK FILM-HIGH VOLTAGE DIVIDERS

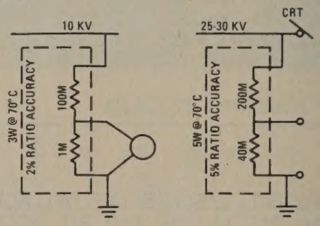


TRW-IRC "RD" series high voltage resistors feature voltage ratios, ratio tolerance and stability characteristics previously unavailable in high voltage resistors.

Resistance ratios to 10,000:1 and voltage ratings to 30 KV are now standard.

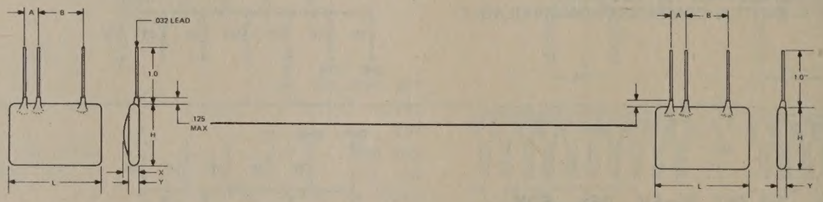
Typical Color tv application.

EXAMPLES:



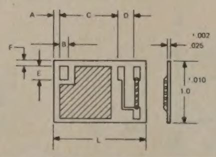
For CRT, high voltage power supply, electrostatic copiers and other high voltage applications, type "RD" resistors are available in ceramic substrate and encapsulated versions; the latter is P.C. board compatible.

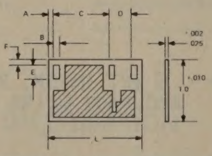
	RD2	RD2A	RD3	RD3A	RD5	RD5A	XRD2	XRD2A	XRD3	XRD3A	XRD5	XRD5A
Power Rating	2W	2W	3W	3W	5W	5W	2W	2W	3W	3W	5W	5W
Resistance Range (MΩ)	.5–500	.5–200	1–300	1–750	1–1000	1–1000	.5–200	.5–200	1–300	1–750	1–1000	1–1000
Resistance Tolerance	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%	±10, 20%
Ratios Available (R_1/R_2)	1:1 10:1	25:1 10,000:1	2:1 25:1	25:1 10,000:1	2:1 25:1	25:1 10,000:1	1:1 10:1	25:1 10,000:1	2:1 25:1	25:1 10,000:1	2:1 25:1	25:1 10,000:1
Ratio Tolerance	5%	5%	5%	2, 5%	5%	2, 5%	5%	5%	2, 5%	2, 5%	5%	2, 5%
TCR (PPM/°C)	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400
Voltage Rating	10 KV	10 KV	20 KV	20 KV	30 KV	30 KV	10 KV	10 KV	20 KV	20 KV	30 KV	30 KV
1000 Hour Load ΔR	±3%	±3%	±3%	±3%	±3%	±3%	±3%	±3%	±3%	±3%	±3%	±3%



	A	B	L	H	X	Y
RD2A*	.175	.576	1.10	1.10	.225	.150
RD3A	.232	.935	1.60	1.10	.225	.150
RD5A	.232	1.385	2.10	1.10	.225	.150

	A	B	L	H	Y
RD2*	.201	.549	1.10	1.10	.150
RD3	.452	.658	1.60	1.10	.150
RD5	.424	1.186	1.20	1.10	.150





	A	B	C	D	E	F	L
XRD2A*	.062	.125	.576	.175	.250	.062	1.000
XRD3A	.100	.125	.935	.232	.250	.062	1.500
XRD5A	.125	.125	1.385	.232	.250	.062	2.000

	A	B	C	D	E	F	L
XRD2*	.062	.125	.549	.201	.250	.062	1.000
XRD3	.125	.140	.658	.452	.250	.062	1.500
XRD5	.125	.140	1.186	.424	.250	.062	2.000

*ALL TOLERANCES ARE WITHIN ±.03125

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

TRW IRC RESISTORS

MV GENERAL PURPOSE HIGH VOLTAGE RESISTORS

TRW/IRC
MVX-T172

MV resistors are designed for high voltage requirements where high resistance and power are needed. TRW/IRC's exclusive composition film type resistance coating is applied in helical form on a ceramic tube to provide a conducting tube of long effective length.

MV resistors are particularly suited for voltmeter multipliers, bleeders, electrostatic filters, X-ray equipment, probes, voltage dividers, TV high voltage circuits, and similar applications.

WITH LUG TERMINALS, COLLOIDAL SILVER TERMINALS OR AXIAL LEADS

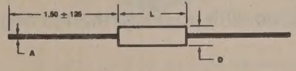
IRC TYPE	TERMINAL TYPE	POWER RATING (Watts)	PEAK VOLTAGE RATING* (KV)	MINIMUM AVAILABLE RESISTANCE ±10% or ±20% Tolerance	MINIMUM AVAILABLE RESISTANCE ±5% Tolerance	MAXIMUM AVAILABLE RESIST-ANCE (Megs)	DIMENSIONS IN INCHES Resistor Body Length	DIMENSIONS IN INCHES Resistor Body Diameter	DIMENSIONS IN INCHES Ceramic Inside Diameter	Widths of Silver Bands #15 Term.
MVC-1	‡**	1	3.5	10K	100K	1,000	1.00±.03	.31±.03	Thd. #6-32	N/A
MVC-2	‡**	2	7.5	25K	100K	1,000	1.75±.03	.31±.03	Thd. #6-32	N/A
MVC-3	‡**	3	15.0	100K	100K	1,000	3.00±.03	.31±.03	Thd. #6-32	N/A
MVC-5	‡**	5	30.0	100K	200K	1,000	5.50±.06	.31±.03	Thd. #6-32	N/A
MVX-½	Axial Leads	½	1.5	100K	100K	250	.69±.03	.25±.03	N/A	N/A
MVX-1	Axial Leads	1	3.5	100K	100K	1,000	1.00±.03	.25±.03	N/A	N/A
MVX-1½	Axial Leads	1.5	7.5	100K	100K	1,000	1.57±.03	.25±.03	N/A	N/A
MVX-2	Axial Leads	2	10.0	100K	100K	1,000	2.00±.03	.25±.03	N/A	N/A
MVX-3	Axial Leads	3	15.0	100K	100K	1,000	3.00±.06	.25±.03	N/A	N/A
MVH-2	‡	4	15.0	100K	150K	1,000	2.50±.06	.56±.03	Thd. #6-32	N/A
MVH-4	‡	6	25.0	100K	400K	1,000	4.00±.06	.56±.03	Thd. #6-32	N/A
MVF	12, 15	2	5.0	25K	100K	1,000	1.75±.03	.31±.03	.19±.03	.38±.03
MVP	12, 15, 16, 17	10	15.0	100K	400K	1,000	4.50±.06	.75±.03	.50±.03	.56±.06
MVA	15, 16, 17	20	25.0	200K	1.0meg	1,000	3.50±.06	1.12±.03	.75±.03	.56±.06
MVO	15, 16, 17	30	50.0	400K	2.0meg	1,000	10.5±.06	1.12±.03	.75±.03	.56±.06
MVQ	15, 17	50	50.0	500K	3.5meg	1,000	10.5±.12	2.00±.05	1.56±.03	.88±.06
MVR	15, 17	90	100.0	1meg	7.0meg	1,000	18.5±.12	2.00±.05	1.56±.03	.88±.06

‡Solder lug or screw mounted
*Rated continuous working voltage determined by $E = \sqrt{PR}$
E should not exceed value listed in column above
**Also available with axial leads

E = Max. continuous votage
P = Power in watts
R = Resistance in ohms

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

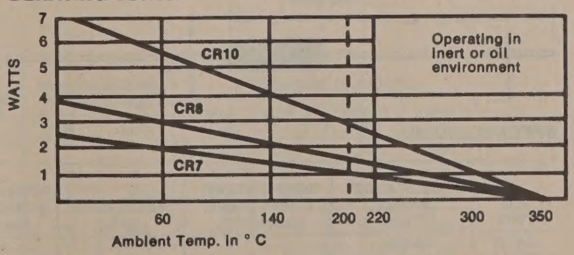
CR SEMI-PRECISION CARBON ALLOY RESISTORS HIGH TEMPERATURE/HIGH VOLTAGE



CR resistors are economically priced, high-voltage/high-temperature resistors developed for ballast and bleeder applications. This resistor series was originally designed to operate in inert, vacuum, or oil environments. Construction is completely inorganic with no outgassing, and these uncoated carbon alloy resistors will withstand an open flame of 1600°F.

CR resistors are currently being manufactured in three sizes. Other sizes and protective coatings are available upon request.

DERATING CURVE



PERFORMANCE AND DIMENSIONS

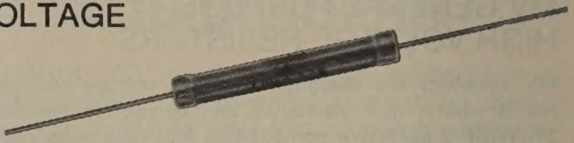
IRC TYPE	RESISTANCE RANGE (Ohms)	TOLERANCE (±%)	OPERATING TEMPERATURE (°C)	POWER RATING @ 200°C* (Watts)	VOLTAGE RATING* (Volts)	DIMENSIONS IN INCHES Body Length (L Max.)	DIMENSIONS IN INCHES Body Diameter (D Max.)	DIMENSIONS IN INCHES Lead Gage (A)
CR6	1Ω—5 Meg	2-5	−65 to ±350	.5	1,000	.342	.095	#22 .025
CR7	500—25 Meg	5	−65 to +350	1	8,000	.580	.157	#20 .032
CR8	1K—50 Meg	5	−65 to +350	1.5	12,500	.938	.157	#20 .032
CR9	2K—100 Meg	5	−65 to ±350	2	12,500	.938	.300	#20 .032
CR10	2K—200 Meg	5	−65 to +350	3	15,000	2.125	.328	#20 .032

*Voltage and wattage dependent on resistance, operating temperature and environment (i.e. Oil, Air, Vacuum, Inert, etc.)

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

TRW IRC RESISTORS

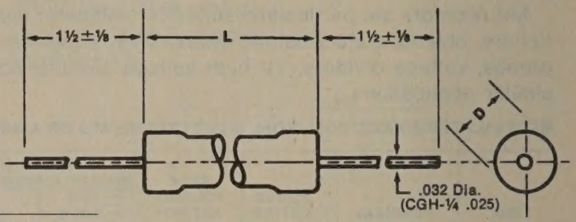
CGH PRECISION HIGH RANGE, HIGH VOLTAGE METAL GLAZE RESISTORS



The CGH resistor uses the superior qualities of precision thick film, fired at high temperatures on an extremely stable ceramic substrate. This results in a resistor capable of operating in high ambient temperatures and with excellent high voltage load stability.

CGH resistors are particularly suited for precision high voltage and high impedance applications, such as voltage multipliers, X-ray equipment, and high voltage power supplies where precision tolerances and TCs are required.

DIMENSIONS:



SPECIFICATIONS

TRW TYPE	Power Rating @ 110°C (Watts)	VOLTAGE RATING (Volts)	RESISTANCE RANGE (Ohms)	T.C.*
CGH-¼	¼	1,000	301K-20 Meg ohms	T0,T2
CGH-½	½	1,500	500K-40 Meg ohms	T0,T2
CGH-1	1	3,500	1 Meg-100 Meg ohms	T0,T2
CGH-2	2	5,000	1 Meg-200 Meg ohms	T0,T2
CGH-3	3	10,000	1 Meg-300 Meg ohms	T0,T2
CGH-5	5	15,000	1 Meg-500 Meg ohms	T0,T2

*T0 = ±100 PPM, T2 = ±50 PPM. ±200 PPM also available.

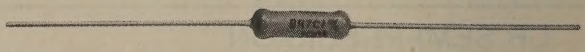
TRW TYPE	Dimensions in Inches	
	Body Length* (L)	Body Diameter (D)
CGH-¼	0.250 ± .031	0.088 ± .010
CGH-½	0.375 ± .031	0.138 ± .016
CGH-1	0.690 ± .062	0.297 ± .031
CGH-2	1.060 ± .062	0.297 ± .031
CGH-3	2.062 ± .062	0.297 ± .031
CGH-5	3.062 ± .062	0.297 ± .031

*Clean lead length, add .125" to max (L).

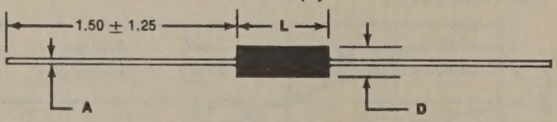
TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

BR HIGH POWER DENSITY PRECISION THIN FILM RESISTORS

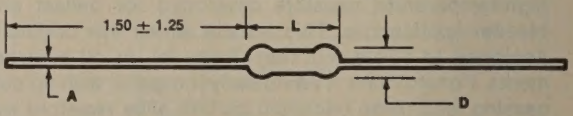
The BR series precision metal film power resistors offer an excellent power-to-size ratio, high frequency response, and exceptionally stable performance. They have power ratings 50% to 100% greater for a given size than formerly was available in metal films. This increased capability is obtained with no performance degradation.



Molded (M)



Conformally Coated (C)



SPECIFICATIONS

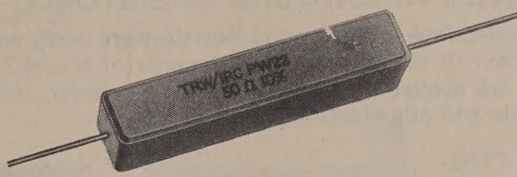
IRC TYPE	RESISTANCE RANGE (Ohms)	TEMPERATURE COEFFICIENT (±ppm/°C)	TOLERANCE (±%)	POWER RATING @ 25°C* (Watts) See Note 4	VOLTAGE RATING (Volts)	DIMENSIONS IN INCHES		
						Body Length (L Max.)	Body Diameter (D Max.)	Lead Gage (A)
BR-3C	10-25K	25, 50, 100	1, 0.5, 0.25, 0.1	1	200	.152±.020	.065±.010	#26 .016
BR-4C	20-100K			1½	300	.250±.031	.088±.010	#22 .0253
BR-4M	20-100K			1½	300	.250±.031	.093±.005	#22 .0253
BR-5M	10-500K			2	300	.406±.015	.130±.010	#22 .0253
BR-7C	10-1Meg			3	525	.594±.031	.180±.020	#20 .032
BR-7M	10-1Meg			3	525	.719±.020	.261±.020	#20 .032
BR-9C	10-5Meg			5	750	.960±.031	.310±.020	#20 .032
BR-9M	10-5Meg			5	750	1.105±.020	.395±.020	#20 .032

NOTES: 1. Derated power rating by 50% for ±0.1% tolerance. 2. BR-3C lead length 1.00±.062. 3. Molded units (M) are flame proof. 4. Power rating and derating is dependent on mounting conditions. Consult factory for mounting information.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

TRW IRC RESISTORS

PW GENERAL PURPOSE FIREPROOF POWER RESISTORS



Type PW resistors are available in eight ratings: 2, 3, 5, 7, 10, 15, 22 to 50 watts. All resistors are inorganically constructed and will not support combustion. Available in standard, fusible, and positive T.C. variations.

SPECIFICATIONS

IRC TYPE	POWER RATING (Watts)	RESISTANCE Min.* (Ohms)	RESISTANCE Max. (Ohms)	STANDARD TEMPERATURE COEFFICIENT (−55°C to +275°C) 0.06%/°C (Ohms)	STANDARD TEMPERATURE COEFFICIENT (−55°C to +275°C) 0.03%/°C (Ohms)	SPECIAL TEMPERATURE COEFFICIENTS +0.55%/°C (Ohms)	SPECIAL TEMPERATURE COEFFICIENTS +0.45%/°C (Ohms)	SPECIAL TEMPERATURE COEFFICIENTS +0.26%/°C (Ohms)
PW1	1	0.18	2.2K	0.18 to 0.56	0.62 to 2.2K	0.1 to 27	0.24 to 120	0.82 to 110
PW2	2	0.18	2.4K	0.18 to 0.62	0.68 to 2.4K	0.1 to 30	0.24 to 130	0.82 to 120
PW3	3	0.1	7.5K	0.1 to 0.27	0.3 to 7.5K	0.1 to 56	01. to 270	0.20 to 270
PW5	5	0.1	8.2K	0.1 to 0.36	0.39 to 8.2K	0.1 to 68	0.1 to 300	0.24 to 300
PW7	7	0.1	18K	0.1 to 0.56	0.62 to 18K	0.1 to 150	0.15 to 680	0.51 to 670
PW10	10	0.18	30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	0.82 to 1100
PW15	15	0.18	30K	0.18 to 0.91	1.0 to 30K	0.1 to 240	0.24 to 1100	0.82 to 1100
PW22	22	0.27	12K	0.27 to 1.3	1.3 to 12K	0.15 to 360	0.36 to 1800	1.25 to 1800

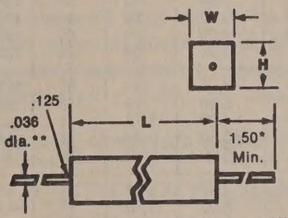
*Consult IRC for lower ranges

Tolerance: ±5% and ±10% (standard) tolerances on Standard Temperature Coefficient Resistors. Ranges below 1 ohm available in ±10% tolerance only. PW-1 ±10% tolerance only.

Dimensions in Inches ±.03

Type	L	W	H
PW1	.58	.25	.25
PW2	.69	.25	.25
PW3	.88	.31	.31
PW5	.88	.38	.35
PW7	1.39	.38	.35
PW10	1.88	.38	.35
PW15	1.88	.50	.50
PW22	2.50	.50	.50

Note: Type PW-50 chassis mounted unit also available. Contact factory.

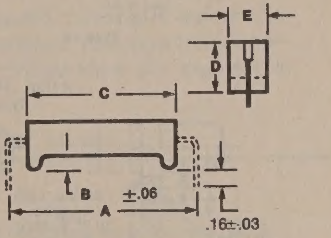


*1.44 min. on PW2 **.032 dia. on PW2
Add .125 for clean lead length
PW22 lead dia. = .040.

Recommended Mtg. Dimensions

Type	A	B	C	D	E
PW-2A	1.00	.06	.69	.31	.25
PW-3A	1.25	.06	.88	.38	.31
PW-5A	1.25	.06	.88	.41	.38
PW-7A	1.75	.12	1.39	.47	.38
PW-10A	2.25	.12	1.88	.47	.38
PW-15A	2.25	.12	1.88	.63	.50

Standard parts are supplied with straight axial leads. Consult factory for available configurations for printed circuit mounting.

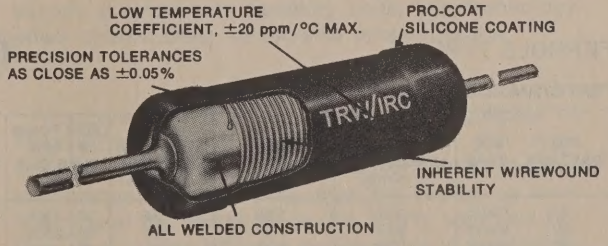


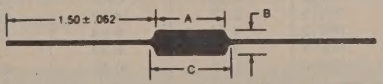
(PW-2A .18±.03)

AS MINIATURE PRECISION POWER WIREWOUND RESISTORS

Type AS resistors expand circuit design limits significantly by carrying full power even at 125°C ambient. These resistors meet MIL Characteristic V (MIL-R-26) with an allowable 350°C hot spot.

Available in standard and non-inductive windings. Additional options include special stabilization, matching, varnish top-coat, hot tinned leads. Special AS resistors furnished as Hi-Rel functional fuses.





SPECIFICATIONS

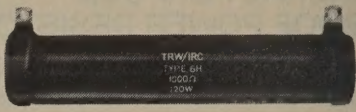
IRC TYPE	STYLES MIL-R-26	IRC POWER RATING 350°C Max. HOT SPOT (Watts) 125°C	IRC POWER RATING 350°C Max. HOT SPOT (Watts) 25°C	COMMERCIAL RANGE (Ohms) Min.	COMMERCIAL RANGE (Ohms) Max.	VOLTAGE RATING (Volts)	NON-INDUCTIVE RANGE (Ohms) Min.	NON-INDUCTIVE RANGE (Ohms) Max.	DIMENSIONS IN INCHES DIM. A ±.032	DIMENSIONS IN INCHES DIM. B ±.032	DIMENSIONS IN INCHES DIM. C MAX.	DIMENSIONS IN INCHES LEAD DIA.
AS-¼		0.25	0.5	1.0	3.4K	70	*	*	.250	.062	.312	.020
AS-½		0.5	1	0.5	6K	100	*	*	.312	.062	.375	.020
AS-1		1	2	0.1	7.5K	130	0.1	3.8K	.375	.093	.450	.020
AS-2**	RW69V RW79U	2	3	0.1	20K	140	0.5	10K	.500	.218	.625	.032
AS-2A		2.5	4	0.1	42.1K	300	0.5	21K	.812	.187	.937	.032
AS-2B		3	4	0.1	24K	185	0.5	12K	.562	.187	.687	.032
AS-3		3	5	0.1	30K	200	0.5	15K	.687	.250	.812	.040
AS-5	RW74U RW67V	5	7	0.1	60K	400	0.8	30K	.875	.312	1.000	.040
AS-7		7	9	0.1	90K	600	1.0	45K	1.250	.312	1.375	.040
AS-10	RW68V RW78U	10	14	0.1	175K	1000	3.0	50K	1.812	.375	1.937	.040
ASC-10	RW55V	7	10	0.1	90K	600	1.0	45K	1.375	.468	1.468	.040
ASC-15	RW56V	10	15	0.1	175K	1000	3.0	50K	2.000	.468	2.093	.040

*Inductance on AS-¼ and AS-½ is less than 1μH at 1 MHz. Tolerance available, ±5, 3, 1, and >0.1%
**AS-2 also available in shorter AS2C version. (L=.469, D=.125, .032 lead dia.)

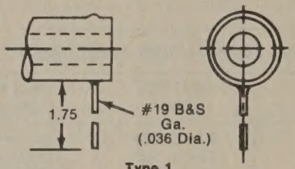
TRW IRC RESISTORS

POWER WIREWOUND RESISTORS

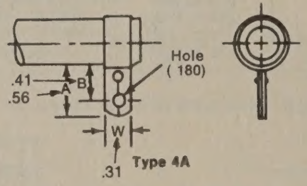
TRW/IRC Power Wirewound Resistors are designed to meet or exceed the requirements of MIL-R-26 and are available in a wide range of tubular, flat, ferrule and adjustable styles.


TRW/IRC
TYPE 6H
1000Ω
120W

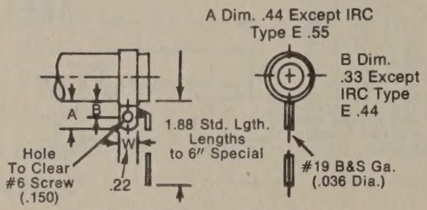
LUG TYPE


1.75
#19 B&S Ga. (.036 Dia.)

Type 1


Hole (180)
.41
.56
A
B
W
.31

Type 4A


A Dim. .44 Except IRC Type E .55
B Dim. .33 Except IRC Type E .44
A
B
W
1.88 Std. Lgth. Lengths to 6″ Special
Hole To Clear #6 Screw (.150)
.22
#19 B&S Ga. (.036 Dia.)

Type 12A (no lead) Type 13A (with lead)

NOTE: Non-inductive, tapped, and adjustable resistors also are available.

PERFORMANCE AND SPECIFICATIONS

IRC WATTAGE	IRC TYPE	MIL Equiv.	CORE DIMENSION Length In Inches	O.D. In Inches	I.D. In Inches	TERMINALS Std.	Special	RESISTANCE RANGE (ohms)
4	⅞A		.88	.31	.19	12A	1*, 13A	0.10– 10K
5	1A		1.00	.31	.19	13A	1**, 12A	0.10– 15K
12	1¾A	RW29	1.75	.31	.19	13A†	1, 12A	0.10– 50K
12	1C	RW30	1.00	.44	.27	12A	1, 13A	0.10– 20K
15	1½C	RW31	1.50	.44	.27	12A	1, 13A	0.10– 50K
20	2C	RW32	2.00	.44	.27	13A†	1,12A	0.10– 80K
25	2D		2.00	.56	.38	12A	1, 4A, 13A	0.10–100K
26	3C	RW33	3.00	.44	.27	12A	1, 13A	0.10–150K
30	2½D		2.50	.56	.38	12A	1,4A, 13A	0.10–150K
35	3D		3.00	.56	.38	12A	1,4A, 13A	0.10–200K
45	3E		3.00	.75	.50	12A	4A, 13A	0.15–250K
50	3½E		3.50	.75	.50	12A	4A, 13A	0.20–300K
50	4D		4.00	.56	.38	12A	1,4A, 13A	0.20–300K
60	4E	RW35	4.00	.75	.50	12A	4A, 13A	0.20–350K
60	5D		5.00	.56	.38	12A	1,4A, 13A	0.25–400K
65	4½E		4.50	.75	.50	12A	4A, 13A	0.25–400K
75	5E		5.00	.75	.50	12A	4A, 13A	0.27–450K
80	4H	RW36	4.00	1.12	.75	4A	—	0.30–525K
100	6½E		6.50	.75	.50	12A	4A, 13A	0.36–600K
120	6H	RW37	6.00	1.12	.75	4A	—	0.47–850K
130	6½H		6.50	1.12	.75	4A	—	0.56–900K
160	8H	RW38	8.00	1.12	.75	4A	—	0.68–1.15 Meg.
175	8½H		8.50	1.12	.75	4A	—	0.75–1.25 Meg.
225	10½H	RW47	10.50	1.12	.75	4A	—	0.91– 1.5 Meg.
250	12H		12.00	1.12	.75	4A	—	1.00–1.75 Meg.

*6 Watts **8 Watts †12A std. on adjustable type

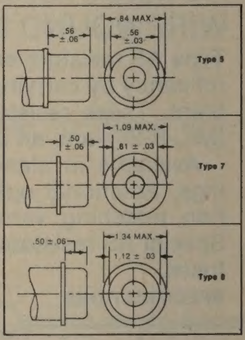
FERRULE TYPE

TRW/IRC 7603
TYPE RW 13
50Ω
96W

PERFORMANCE AND SPECIFICATIONS

IRC WATTAGE	IRC TYPE	OVERALL LENGTH ±.19 In Inches	BODY LENGTH ±.06 In Inches	MAX. SHOULDER DIAMETER* In Inches	FITS FORM #1 STD. FUSE CLIP	FERRULE TERMINALS	MIN. OHMS	MAX. OHMS (.00175 WIRE)	MAX. OHMS (.001 WIRE)
20	RW16	2.38	1.38	.84	30A.250V.	5	0.1	9K	45K
30	RW15	2.94	1.94	.84	30A.250V.	5	0.1	16K	78K
60	RW14	4.56	3.44	1.09	60A.250V.	7	0.2	48K	230K
75	RW13	5.12	4.12	1.09	60A.250V.	7	0.2	60K	290K
130	RW12	7.44	6.44	1.34	60A.600V.	8	0.47	125K	620K
175	RW11	9.63	8.63	1.34	60A.600V.	8	0.75	175K	850K
215	RW10	11.44	10.44	1.34	60A.600V.	8	0.82	210K	1050K

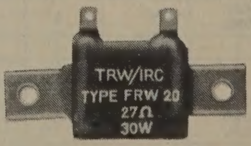
*Body diameter is always less than shoulder diameter.


.84 MAX.
.56 ± .06
.56 ± .03
Type 5
1.09 MAX.
.50 ± .06
.81 ± .03
Type 7
1.34 MAX.
.50 ± .06
1.12 ± .03
Type 8

OVAL TYPE

PERFORMANCE AND SPECIFICATIONS

IRC WATTAGE	IRC TYPE	POWER RATING MIL Equiv.	Watts	DIMENSIONS IN INCHES Mounting Centers	Core Length	RESISTANCE RANGE (ohms)
30	FRW-20	RW20	21	2.00	1.25	0.1 15K
40	FRW-21	RW21	31	2.75	2.00	0.1 35K
55	FRW-22	RW22	53	4.25	3.50	0.20 75K
70	FRW-23	RW23	68	5.50	4.75	0.25 110K
95	FRW-24	RW24	91	6.75	6.00	0.35 140K


TRW/IRC
TYPE FRW 20
27Ω
30W

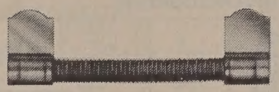
NOTE: Stack-mounted resistors must be derated to limit the hotspot cf the hottest unit to 350°C. For more efficient ventilation, resistors should be mounted with their flat sides (short axis) on a vertical axis.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

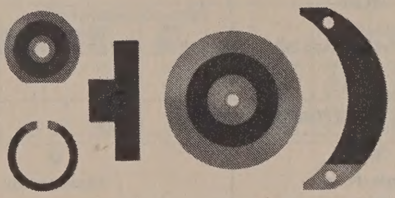
TRW IRC RESISTORS

AW COMMERCIAL WIREWOUND RESISTORS

Type AW resistors are available in a wide range of configurations to meet low-cost, high volume applications in the automotive and appliance fields. A range of terminal styles is available, and others can be made to user specifications at a nominal cost. Power ratings are 4.5 watts per inch between mounting centers on the standard AW, and 6 watts per inch between mounting centers on the Hi-Wattage AW resistor.



CONCENTRIC DISCS and STRIPS



Concentric discs and strips are available in power ratings of up to 1 watt per square inch. These resistors are carbon composition film screen on various flat substrates. Available 20Ω-100KΩ/sq. Standard tolerances are ± 20%.

Disc resistors are die stamped from resistance strips. Inner and outer rings of colloidal silver are applied to provide contact with coaxial line fixtures. Special configurations and tolerances to ± 10% are available. Applications are variable speed controls in automotive and appliance products, antenna rotor controls wherever a low cost special configuration pot element is required in quantity.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

TRW/IRC APPLICATION/DESIGN CAPABILITY

It is impossible to describe in this catalog all the product variations available from TRW/IRC Resistors. Selected TC's, special tolerances, fixed rise times . . . the unique configurations variations are limited only by our mutual ability to work together.

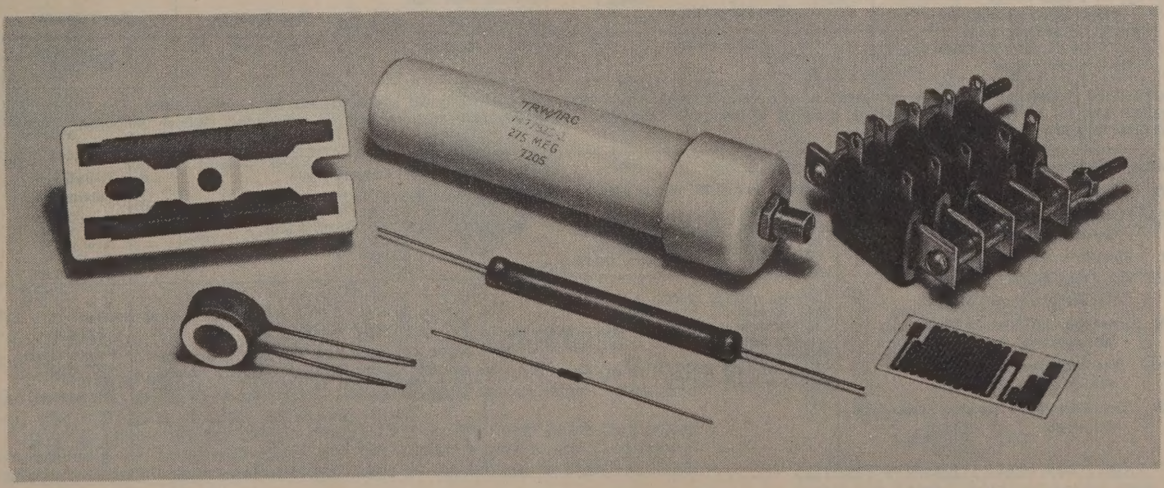
Beyond this, TRW also offers an application/design capability second to none in the industry—and ready to meet virtually any resistive need you might have.

This technology embraces both thin and thick metal film, networks, wirewounds, high-voltage and ultra-precision resistors. In thin-film, for example, it includes tolerance and TC matching down to .01% and 5 PPM/°C respectively. In thick-film, it includes design capabilities in subminiature, tubular substrates — for relays, LED's, and connector applications. In wirewound resistors and assemblies, it includes specialized TC's, fusible units, and custom configurations.

Too, TRW technology also takes in high-precision tantalum-nitride networks. Because of the high circuit density possible with tantalum units, this technology offers opportunities for extreme miniaturization.

* * *

The foregoing scarcely touches the highlights of TRW/IRC's application/design capability. But most important, whatever your performance, configuration or environmental problem, we urge that you let us work with you at the **design** stage. It's at this point, we believe, that we can offer the greatest help in application and cost effectiveness.



TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 401 N. BROAD ST., PHILADELPHIA, PA. 19108 (215) 922-8900

TRW IRC RESISTORS

MIL SPEC DEFINITIONS, TERMINOLOGY

MIL—R—11 (RC) RC07GF153K

RC07	GF	153	K
Style/Power (See Tables 1 and 2)	"G" = 70°C Max. ambient temperature for full load operation. "F" = Temperature Coefficient which varies (with resistance) from ±625 ppm/°C to ±3100 ppm/°C.	Resistance First 2 digits significant, 3rd digit "number of zeros." 153 = 15,000Ω	Tolerance (See Table 4) K = ± 10%

MIL—R—22684 (RL) RL07SI53J

RL07	S	153	J
Style/Power (See Tables 1 and 2)	Terminal (Lead) "S" = Solderable	Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω	Tolerance (See Table 4) J = ±5%

MIL—R—10509 (RN) RN60D1003F

RN60	D	1003	F
Style/Power (See Tables 1 and 2)	Characteristic (See Table 3) D = ±100 ppm/°C	Resistance First 3 digits significant, 4th digit "number of zeros." 1003 = 100,000Ω	Tolerance (See Table 4) F = ±1%

MIL—R—26 (RW)—Numbering System Complex (See MIL spec) RW55U49R9F

RW55	U	49R9	F
Style/Power Size/ Construction	Max. "Hot Spot," derating temperature, insulation resistance and moisture resistance. "U" or "V" characteristic.	Resistance 3 or 4 digits depending on the TC, tolerance, etc. "U" char. has 4 "V" char. has 3	Tolerance (See Table 4) Only applicable to "U" char.

MIL—R—39008 (RCR) RCR07G153JS

RCR07	G	153	J	S
Style/Power (See Tables 1 and 2)	Characteristic "G" indicates a max. ambient temperature of 70°C for full load operation, and a TC which varies (with resistance) from ±625 ppm/°C to ±1900 ppm/°C.	Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω	Tolerance (See Table 4) J = ±5%	Failure Rate (See Table 5) S = .001%/ 1000 hours

MIL—R—39017 (RLR) RLR07C153GR

RLR07	C	153	G	R
Style/Power (See Tables 1 and 2)	Terminal (Lead) "C" = Solderable/Weldable	Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω	Tolerance (See Table 4) G = ±2%	Failure Rate (See Table 5) R = ±0.1%/ 1000 hours

MIL—R—55182 (RNR) RNR60H1003FS

RNR60	H	1003	F	S
Style, Terminal and Power (See Tables 1 and 2) RNR = Solderable Leads RNC = Solderable/Weldable Leads RNN = Nickel Leads	Characteristic (See Table 3) H = ±50 ppm/°C	Resistance First 3 digits significant, 4th digit "no. of zeros." 1003 = 100,000Ω	Tolerance (See Table 4) F = ±1%	Failure Rate (See Table 5) S = .001%/ 1000 hours

NOTE: The Established Reliability specifications (i.e., MIL-R-39008, MIL-R-39017, and MIL-R-55182) supersede MIL-R-11, MIL-R-22684, and MIL-R-10509 respectively, for all *new* design. Resistors qualified to the three Established Reliability specifications may be substituted, without limitation, wherever the older MIL devices are specified.

TABLE 1—Resistor Style

RC	Fixed Composition Resistor (MIL-R-11)
RCR	Fixed Composition Resistor, Established Reliability (MIL-R-39008)
RL	Fixed Film Resistor (MIL-R-22684)
RLR	Fixed Film Resistor, Established Reliability (MIL-R-39017)
RN	Fixed Resistor, High Stability (MIL-R-10509)
RNR	Fixed Film Resistor, Established Reliability (MIL-R-55182)
RW	Fixed Wirewound Resistor, Power Type (MIL-R-26)

TABLE 2—
Size/Power @ 70° unless otherwise stated)

05—⅛ watt 07—¼ watt 20—½ watt 32—1 watt 42—2 watt	MIL-R-11 (RC) MIL-R-39008 (RCR) MIL-R-22684 (RL) MIL-R-39017 (RLR)
50—1/20 watt (@ 125°C) 55—⅛ watt 60—¼ watt 65—½ watt 70—¾ watt 75—1 watt (@ 125°C) 80—2 watt (@ 125°C)	MIL-R-10509 (RN) MIL-R-55182 (RNR)

TABLE 3—Characteristic

B = ±500 ppm/°C C = ± 50 ppm/°C (T2) D = ±200, 500 ppm/°C (T0) E = ± 25 ppm/°C (T9) F = ± 50 ppm/°C	MIL-R-10509 (RN)
H = ± 50 ppm/°C (T2) J = ± 25 ppm/°C (T9) K = ±100 ppm/°C (T0)	MIL-R-55182 (RNR)

NOTE: RL and RLR resistors are ±200 ppm/°C. There is no temperature coefficient designation in the RL numbering system.

TABLE 4—
Tolerance

K = ±10%
J = ±5%
G = ±2%
F = ±1%
D = ±0.5%
C = ±0.25%
B = ±0.10%

TABLE 5—
Failure Rate 1000 Hours (60% Confidence)

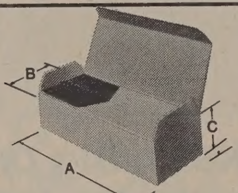
M = 1.0%
P = 0.1%
R = .01%
S = .001%

TRW IRC RESISTORS

PACKAGING STYLES

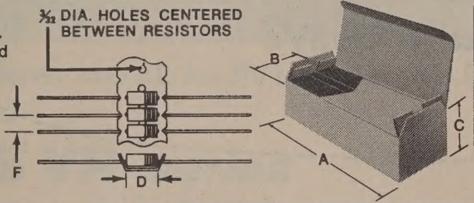
Consult factory for standard package available for the resistor of your choice.

Oriented Bulk: Preferred by manufacturers with their own feeding or taping arrangements. Resistors are axially oriented.



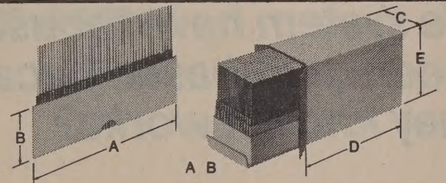
Type	Wattage	Standard Quantity Per Box	A	B	C
GBT-¼	¼	2500	10 7/16″	3 11/16″	1 5/16″
GBT-½	½	2000	10 7/16″	4 1/8″	2 5/16″
GBT-½V	½	2000	10 7/16″	4 1/8″	2 5/16″
GBT-1	1	1000	10 9/16″	4 ¼″	2 11/16″
BW-20	1	2000	10 7/16″	4 1/8″	2 5/16″
BWH	2	1000	10 9/16″	4 ¼″	2 11/16″

Grip Strip® A TRW exclusive. Resistors are held without adhesive in strips for ease of handling and counting.



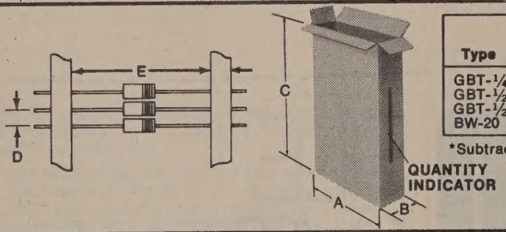
Type	Wattage	Standard Per Box	Quantity Per Strip	A	B		D	F
GBT-½	½	1000	50	10 7/16″	4 1/8″	2 5/16″	.182″	7/16″
GBT-½V	½	1000	50	10 7/16″	4 1/8″	2 5/16″	.182″	7/16″
GBT-1	1	1000	40	12″	4 5/16″	4″	.260″	9/16″
BW-20	1	1000	50	10 7/16″	4 1/8″	2 5/16″	.182″	7/16″
BWH	2	1000	40	12″	4 5/16″	4″	.260″	9/16″

Corrugated Card Pack: Resistors are inserted into the flutes of corrugated cards.



Type	Wattage	Standard Quantity Per Box	Quantity Per Strip	A	B	C	D	E
GBT-¼	¼	1000	50	6 3/8″	1½″	2 13/16″	6 7/8″	3½″
GBT-½	½	1000	50	8 1/8″	1½″	3 11/16″	8 5/8″	3 5/8″
BW-20	1	1000	50	8½″	1½″	3 11/16″	8 5/8″	3 5/8″

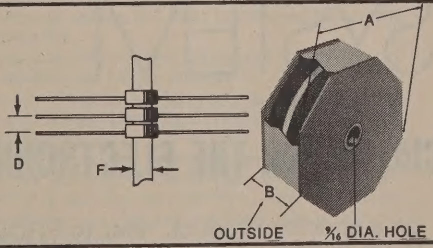
Ammo-Pak®: 10,000 resistor package is a continous lead tape belt. Each lead of the resistor is held between two sets of pressure sensitive tape.



Type	Wattage	Standard Quantity Per Box	A*	B*	C**	D ±.015″	E ±1/16″	F
GBT-¼	½	10,000	10 3/16″	3¾″	9¾″	.200″	2 1/16″	¼″
GBT-½V	½	10,000	12½″	4″	19″	.200″	2 1/16″	¼″
GBT-½	½	10,000	12½″	4″	19″	.200″	2 1/16″	¼′
BW-20	1	10,000	12½″	4″	19″	.200″	2 1/16″	¼″

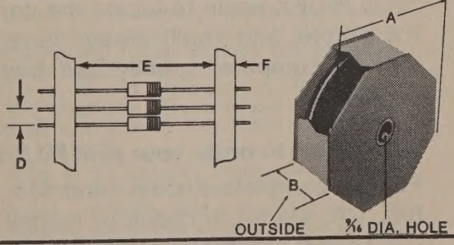
*Subtract ¼″ (**subtract ½″) for inside carton dimensions.

Body Tape Reel: Each resistor body is held by a pressure sensitve tape.



Type	Wattage	Standard Quantity Per Reel	A (Across Corners) Max.	B Max.	D	F
GBT-¼	¼	2500	6½″	3 5/8″	.105″	3/16″
GBT-¼	¼	5000	9¾″	3 5/8″	.105″	3/16″
GBT-½	½	2500	9¾″	3 13/16″	.158″	¼″
GBT-½	½	5000	13½″	3 13/16″	.158″	¼″
GBT-½V	½	2500	9¾″	3 13/16″	.158″	¼″
GBT-½V	½	5000	13½″	3 13/16″	.158″	¼″
GBT1	1	2000	13½″	3 13/16″	.260″	3/8″
BW-20	1	2500	9¾″	3 13/16″	.158″	¼″
BW-20	1	5000	13½″	3 13/16″	.158″	¼″
BWH	2	2000	13½″	3 13/16″	.260″	3/8″

Lead Tape Reel: Each resistor lead is held between two sets of pressure sensitive tape.



Type	Wattage	Standard Quantity Per Reel	A (Across Corners) Max.	B Max.	D ±.015″	E ±1/16″	F
GBT-¼	¼	2500	10 7/8″	3 13/16″	.200″	2 1/16″	¼″
GBT-¼	¼	5000	13½″	3 13/16″	.200″	2 1/16″	¼″
GBT-½	½	2500	10 7/8″	3 13/16″	.200″	2 1/16″	¼″
GBT-½V	½	2500	10 7/8″	3 13/16″	.200″	2 1/16″	¼″
GBT-½	½	5000	13½″	3 13/16″	.200″	2 1/16″	¼″
GBT-1	1	2000	13½″	3 13/16″	.375″	2 7/8″	¼″
BW-20	1	2500	10 7/8″	3 13/16″	.200″	2 1/16″	¼″
BW-20	1	5000	13½″	3 13/16″	.200″	2 1/16″	¼″
BWH	2	2000	13½″	3 13/16″	.375″	2 7/8″	¼″

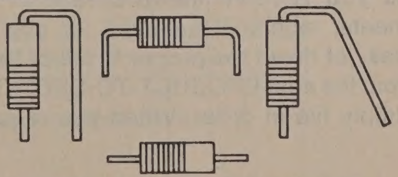
*Other spacing available.

Cut and formed leads

TRW/IRC offers the widest selection of pre-cut and formed units in the industry.

Purchasing of pre-cut units offers the user very significant savings in labor and assembly, as well as savings in valuable plant space, since units take only half the space of other packaging styles.

Drawings shown are for carbon composition types. These packaging styles are available for many wirewound and film resistors with some dimensional variations. Consult your sales representative or the factory for specifications, availability and costs.

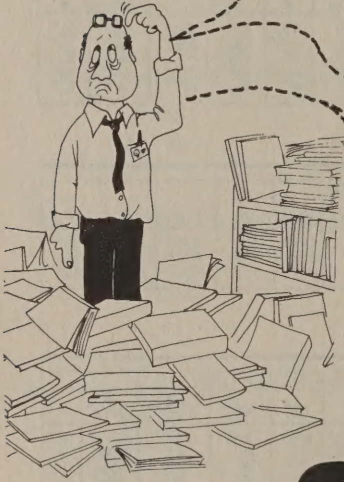


CUT AND FORMED LEADS AVAILABLE
CONTACT FACTORY FOR DIMENSIONS

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 401 N. BROAD ST., PHILADELPHIA, PA. 19108 (215) 922-8900

What can I use to keep all the manufacturers' product data I receive in order?

What system makes filing or retrieving manufacturers' catalogs fast and easy?



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TEL LABS

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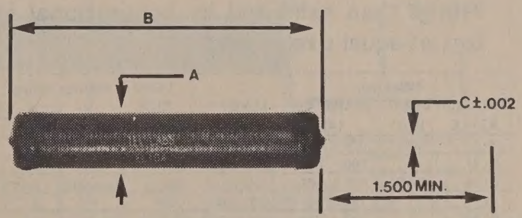
154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

TYPE VR series vitreous power



An essential factor for reliable resistor performance is in the protection that the resistor's enclosure provides to its relatively fragile resistance element.

This protection must withstand the mechanical conditions of handling in use, the thermal effects of the resistor operation under adverse situations and the chemical environments imposed during assembly or life. Additionally, it functions as the medium through which the heat is extracted from the element and dissipated.

A ceramic enclosure affords the ultimate in this type of protection for a wirewound power resistor.

The hard, smooth vitreous surface resists the effects of severe abrasion and rough handling during circuit assembly and through-out life.

Overloads can be sustained without damage to the enclosure because the assembly has already been subjected to red-heat when this coating was applied. There is no attendant flame or burning on severe overload, since there is no organic material to burn.

Both this high temperature capability and the good thermal conductivity of the ceramic material combine to allow higher temperature operation and higher wattage ratings for resistors with this coating as an enclosure. The high heat conductivity of this ceramic in direct contact with the individual turns of the resistance wire provides an excellent transfer of the heat generated in the wire. There is no thermal insulation to cause hot spots.

The inert character of the ceramic coating provides the resistor with a resistance to chemical conditions, which avoids environmental corrosion, and affords solvent resistance during cleaning operations after circuit assembly. The resistor's marking is also an inert ceramic material so that identification is permanent under all conditions.

Style	Watts @ 325°C Temp. Rise	DIMENSIONS		RESISTANCE		LEAD SIZE	
		Diameter "A"	Length "B"	Min.	Max.	Length	Diameter
VR1	1.0	.093″±.031″ 2.36mm±.78	.406″±.031″ 10.31mm ±.78	1.0Ω	1.3KΩ	1.5″ 38.1mm	.020″ .5mm
VR2	2.0	.187″±.031″ 4.75mm±.78	.375″±.062″ 9.25mm±1.57	1.0Ω	1.2KΩ	1.5″ 38.1mm	.032″ .81mm
VR3	3.0	.187″±.031″ 4.75mm±.78	.500″±.062″ 12.7mm±1.57	1.0Ω	3KΩ	1.5″ 38.1mm	.032″ .81mm
VR5	5.0	.187″±.031″ 4.75mm±.78	.937″±.062″ 23.8mm±1.57	1.0Ω	6KΩ	1.5″ 38.1mm	.032″ .81mm
VR7	7.0	.312″±.062″ 7.92mm±1.57	1.000″±.062″ 25.4mm±1.57	1.0Ω	10KΩ	1.5″ 38.1mm	.032″ .81mm
VR10	10.0	.312″±.062″ 7.92mm±1.57	1.750″±.062″ 44.45mm±1.57	1.0Ω	17.5K	1.5″ 38.1mm	.032″ .81mm
VR12	12.5	.375″±.062″ 9.52mm±1.57	1.750″±.062″ 44.45mm±1.57	1.0Ω	43KΩ	1.5″ 38.1mm	.032″ .81mm

Tolerances: 5% for 1Ω and higher. 1% available on special request in most cases. 10% for values below 1Ω.

Temperature coefficient: 30PPM for 10Ω and higher. Below 10Ω, 90PPM. Special T.C.'s are available.

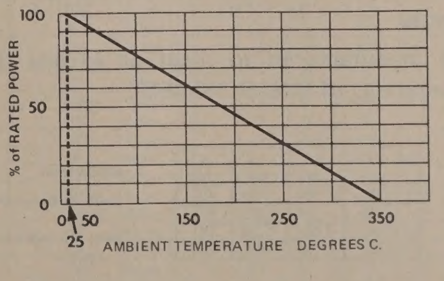
Dielectric strength: 1000 volts AC on 2 watt and higher. 500 volts AC on 1 watt.

Wattages: 1 watt to 12.5 watts @ 25°C ambient. Derated to 0 @ 375°C.

Inductance: Varies with each resistance value and size. Contact factory for information. Non-inductive resistors available.

Welded construction.

Meets or exceeds MIL-R-26



We do just one thing, and one thing well!

TEL LABS

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154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

Beryllium Oxide Core

Use of beryllium core allows greater power ratings than exhibited by conventional resistors of equal size.

TEL LABS STYLE	MIL DESIG. (RW)	DIAMETER (A)	LENGTH (B)	LEAD SIZE (C)	Wattage Rating U 275° C	Wattage Rating V 350° C	Maximum Resistance MIL	Maximum Resistance TEL LABS
BL1	RW81	.078 ± .015	.265 ± .015	.020	1	1.5	649^	3.4K
BL2		.090 ± .031	.395 ± .031	.020	1.5	2	– – –	4.9K
BL3	RW80	.090 ± .031	.395 ± .031	.020	2.25	2.75	3.16K	10.2K
BL4		.187 ± .031	.625 ± .062	.032	4	5	– – –	25.0K
BL4A		.187 ± .031	.825 ± .062	.032	4.5	6.5	– – –	42.2K
BL5		.250 ± .031	.500 ± .062	.032 - .040	5	7	– – –	33.0K
BL6		.250 ± .031	.625 ± .062	.032 - .040	6	8	– – –	47.0K
BL7		.300 ± .062	.950 ± .093	.032 - .040	7	10	– – –	96.0K
BL10		.300 ± .062	1.218 ± .093	.032 - .040	10	12	– – –	155.0K
BL10A		.350 ± .062	1.815 ± .093	.040	15	18	– – –	275.0K

Same derating as shown on opposite page.

Units are manufactured using stainless steel end caps, all welded construction and high quality resistance wire.

Coating is of high quality silicone to withstand high temperature operation.

Standard tolerances and temperature coefficient as well as specials are available.

Units are supplied with axial leads.

Non-Inductive (Aryton-Perry) specify as "BLN". Maximum resistance (per chart below) would have to be divided by two.

TYPE EH chassis mount aluminum housed

All welded construction

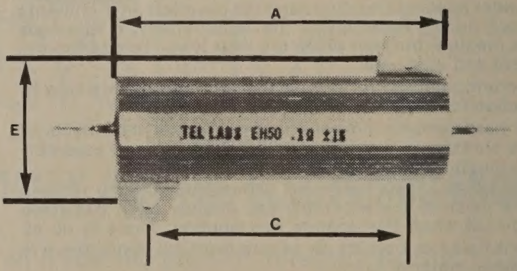
Special molding compound and process assures positive transfer of heat to the case and mounting chassis.

Resistance ranges — per chart below and lower values upon investigation.

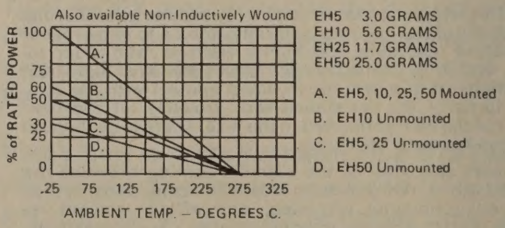
Tolerances — .01% thru 5% — close tolerances on low ohms per application only.

For Non-Inductive, add "N" to style number. Maximum resistance value must be decreased by at least one half of maximum value listed in chart.

Units manufactured to meet or exceed the requirements of MIL-R-18546D.



Also available Non-Inductively Wound



EH5 3.0 GRAMS
EH10 5.6 GRAMS
EH25 11.7 GRAMS
EH50 25.0 GRAMS

TEL LABS STYLE	A ±.031	C ±.005	E ±.005
EH5	.600	.444	.490
EH10	.750	.562	.625
EH25	1.062	.718	.781
EH50	1.937	1.562	.843

MOUNTING

EH25, 50 5x7x2 Aluminum Chassis
EH5, 10 4x6x2 Aluminum Chassis

TEL LABS STYLE (Anodyzed)	WATTAGE Mounted	WATTAGE Unmounted	RESISTANCE RANGE 1% - 5%	TEMP. COEFFICIENT ±50 PPM	TEMP. COEFFICIENT ±20 PPM
EH5	8W	4W	0.1Ω to 22K	0.1Ω to 30Ω	OVER 30Ω
EH10	10W	6W	0.1Ω to 40K	0.1Ω to 50Ω	OVER 50Ω
EH25	25W	10W	0.1Ω to 70K	0.1Ω to 100Ω	OVER 100Ω
EH50	50W	12W	0.1Ω to 250K	0.1Ω to 300Ω	OVER 300Ω

Meets or exceeds MIL R-18546D.

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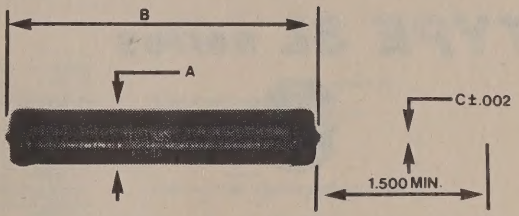
154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

TYPE EL silicone power

MEET OR EXCEEDS MIL-R-26



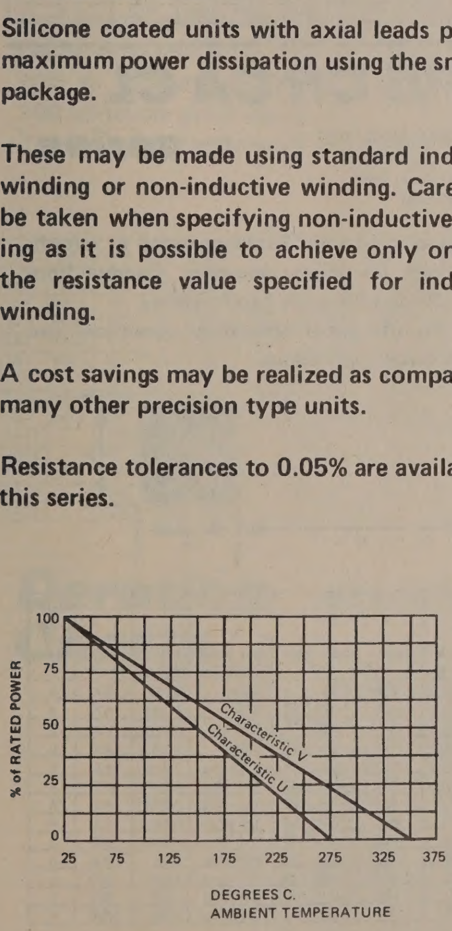
Silicone coated units with axial leads provide maximum power dissipation using the smallest package.

These may be made using standard inductive winding or non-inductive winding. Care must be taken when specifying non-inductive winding as it is possible to achieve only one half the resistance value specified for inductive winding.

A cost savings may be realized as compared to many other precision type units.

Resistance tolerances to 0.05% are available in this series.

Tel Labs Style	Mil Desig. (RW)	Diameter (A)	Length (B)	Lead Size (C)	Wattage 275°C	350°C	Radial Leads (special)	Radial Leads Size
EL¼		.090±.031	.215±.031	.020	0.5W	1.0W	Yes	–
EL½		.090±.031	.280±.031	.020	0.5W	1.0W	Yes	.020
EL1A	RW70	.090±.031	.395±.031	.020	1.0W	1.25W	Yes	.020
EL1B		.090±.031	.530±.031	.020	1.0W	1.25W	Yes	.020
EL1C		.135±.031	.335±.031	.025	1.0W	2.0W	No	–
EL2		.250±.031	.625±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2A		.187±.031	.825±.062	.032	3.25W	4.5W	Yes	.032
EL2B		.187±.031	.625±.062	.032	3.0W	3.5W	Yes	.032
EL2C		.250±.031	.562±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2D		.250±.031	.500±.062	.032-.040	3.0W	4.0W	Yes	.032
EL2E	RW59, 69	.195±.031	.500±.062	.025	2.5W	3.5W	No	–
EL2F		.187±.031	.500±.062	.032	2.5W	3.0W	Yes	.032
EL2G		.187±.031	.430±.062	.032	2.5W	3.0W	Yes	.032
EL2H		.187±.031	.385±.062	.032	2.5W	3.0W	Yes	.032
EL21	RW79	.195±.031	.560±.062	.032	3.0W	3.5W	Yes	.032
EL3		.295±.031	.500±.062	.032-.040	3.0W	4.0W	Yes	.032
EL5	RW74	.290±.062	.925±.093	.032-.040	5.0W	6.0W	Yes	.032
EL5A	RW57, 67	.350±.062	1.000±.093	.032-.040	5.0W	6.5W	Yes	.032
EL7		.290±.062	1.200±.093	.032-.040	5.0W	6.5W	Yes	.032
EL7A		.350±.062	1.360±.093	.032-.040	5.0W	7.0W	Yes	.032
EL10A	RW58, 68	.350±.062	1.815±.093	.040	10.0W	12.0W	Yes	.032



STYLE	RESISTANCE 0.05% 0.1% 0.25% 0.5%	RESISTANCE 1% 2% 3% 5%	NORMAL TEMPERATURE COEFFICIENT ± 90 PPM	± 50 PPM	± 30 PPM	± 20 PPM
EL¼	10^ - 950^	1^ - 3.4K	Below 1^	1^ to 6.9^	7^ to 999^	1K - 3.5K
EL½	10^ - 1K	1^ - 7K	Below 1^	1^ to 9.9^	10^ to 799^	800^ - 7K
EL1A	1^ - 2K	.1^ - 10K	Below 1^	1^ to 9.9^	10^ to 999^	1K - 10K
EL1B	1^ - 4K	.1^ - 12K	Below 1^	1^ to 0.9^	10^ to 1.34K	1.35K - 12K
EL1C	1^ - 2K	.1^ - 10K	Below 1^	1^ to 9.9^	10^ to 999^	1K - 10K
EL2	1^ - 12K	.1^ - 40K	Below 1^	1^ to 9.9^	10^ to 4.69K	4.7K - 40K
EL2A	1^ - 10K	.1^ - 35K	Below 1^	1^ to 9.9^	10^ to 3.49K	3.5K - 35K
EL2B	1^ - 8K	.1^ - 30K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 30K
EL2C	1^ - 8K	.1^ - 30K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 30K
EL2D	1^ - 7.5K	.1^ - 27K	Below 1^	1^ to 9.9^	10^ to 2.49K	2.5K - 27K
EL2E	1^ - 8K	.1^ - 30K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 30K
EL2F	1^ - 4K	.1^ - 20K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 20K
EL2G	1^ - 2K	.1^ - 10K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 10K
EL2H	1^ - 2K	.1^ - 9K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 9K
EL21	1^ - 8K	.1^ - 30K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 30K
EL3	1^ - 8.3K	.1^ - 30.5K	Below 1^	1^ to 9.9^	10^ to 2.99K	3.0K - 30.5K
EL5	.5^ - 22K	.1^ - 70K	Below 1^	1^ to 9.9^	10^ to 7.49K	7.5K - 70K
EL5A	.5^ - 35K	.1^ - 90K	Below 1^	1^ to 9.9^	10^ to 8.39K	8.4K - 90K
EL7	.5^ - 35K	.1^ - 90K	Below 1^	1^ to 9.9^	10^ to 8.24K	8.25K - 90K
EL7A	.5^ - 45K	.1^ - 100K	Below 1^	1^ to 9.9^	10^ to 9.99K	10K - 100K
EL10A	.5^ - 75K	.1^ - 275K	Below 1^	1^ to 9.9^	10^ to 30.99K	31K - 175K

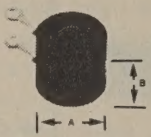
We do just one thing, and one thing well!

TEL LABS

PRECISIONPRECISIONPRECISION

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel.(603) 625-8994

TYPE SL series



MIL R 93D DESIG.	TEL LABS STYLE	A ± .015	B ± .031	MAX. VALUE MIL.	MAX. VALUE COMM.	WATTAGE MIL.	WATTAGE COMM.	MAX. V. MIL.	MAX. V. COMM.	HOLE CLEARANCE SCREW #
	SL21	.500	.500		350K	0.25W	0.5W	300	600	6
RB16	SL31	.500	.687	1 MEG.	1.5 MEG.	0.33W	0.6W		600	6
RB17	SL50	.562	1.000	2 MEG.	3.5 MEG.	0.5W	1.0W	600	1200	6
RB18	SL60	.750	1.250	3.01 MEG.	4.25 MEG.	0.75W	1.5W	600	1200	6
RB19	SL70	.906	2.125	6.03 MEG.	10 MEG.	1.0W	2.0W	900	2400	6

Conformal and Shell encapsulated

Excellent under critical environmental conditions Available with .032 Leads. Specify Letter "X" after style (SL21X)

Temperature Coefficients from 0±20 PPM°C to 0±5 PPM/ °C

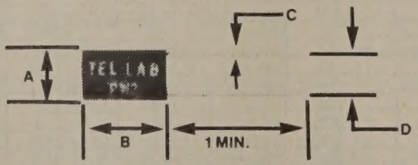
Matching in sets to 2 PPM

NonInductively Wound

Stabilities available on a production basis to 0.005%/year.

TYPE PW series

Conformal and Shell Encapsulated. Designed Specifically for Printed Circuit Applications. Temperature coefficients from 0±20 PPM to 0±5 PPM Matching to 2 PPM. Inductive or Noninductive Winding. Stabilities available on a production basis to 0.005%/year.

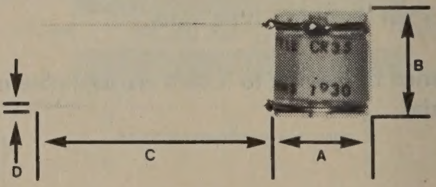


Mil R 93D Desig.	Tel Labs Style	A ± .015	B ± .032	C	D ± .015	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. V. Mil.	MAX. V. Comm.
RB71	PW1	.250	.312	.025	.200	100K	125K	.125W	.15W		300
	PW2	.250	.406	.025	.200		175K		.2W		600
RB70	PW20	.375	.500	.032	.200, .250	301K	375K	.250W	.33W	150	600
	PW40	.468	.625	.032	.250, .300		500K		.3W		600
	PW31	.500	.625	.032	.250, .300		1.75 Meg		.6W		600
	PW10	.406	1.250	.032	.250, .300		1.0 Meg		1.0W		1200
	PW50	.531	1.000	.032	.250, .300		3.0 Meg		1.0W		1200

TYPE CR CA CL series

CERAMIC CORE RESISTORS
"CR" Ceramic Radial Leads
"CA" Ceramic Axial Leads
"CL" Ceramic Lugs

Ceramic spool type unit. Windings sealed in varnish. Hole provided for screw mounting. Operate from -65°C to 105°C. Inherently good stability. Excellent for use under laboratory conditions and most commercial applications.



Style	Diameter A ±.015	Length B ±.031	Lead Diam. D	Max Value (.0005 Wire)	Wattage	Max. V	Hole (clearance) Screw #
CR16	.250	.250	0.20	100K	0.1W	200	0
CR1	.250	.406	.020-0.25	400K	0.15W	400	2
CR23	.281	.343	.020-.025	250K	0.15W	200	2
CR18	.343	.312	.020-.025	400K	0.2W	200	6
CR2	.250	.687	.020-.025	1.25 Meg.	0.25W	400	0
CR20	.375	.437	.020-.032	1.0 Meg.	0.25W	200	4
CR25	.500	.437	.025-.032	1.5 Meg.	0.33W	400	6
CR27	.375	.656	.025-.032	1.5 Meg.	0.5W	400	4
CR31	.500	.625	.025-.032	3.0 Meg.	0.5W	400	6
CR35	.500	.562	.025-.032	3.25 Meg.	0.5W	400	6
CR53	.500	1.000	.025-.032	6.0 Meg.	1.0W	800	6
CR60	.750	1.250	.025-.032	6.0 Meg.	1.5W	800	6
CR71	.812	2.093	.025-.032	20.0 Meg.	2.5W	1600	6

1. All units above may be supplied with Axial Leads, specify "CA".
2. Lugs may be supplied on the following; CL25, CL31, CL35, CL53, CL60, CL71

We do just one thing, and one thing well!

TEL LABS

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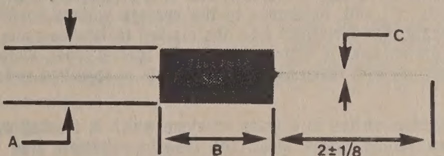
154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

TYPE SA epoxy

DESIGNED TO MEET OR EXCEED MILR93D

All units represented may be modified for minimum inductance and capacitive effects at frequencies above the audio range. Rise and decay time characteristics are measured from 10% to 90% of peak pulse amplitude with a 100 kilocycle pulse input. Temperature coefficients are available to 0 ± 4PPM/ °C. and T.C. matches are available to 2PPM/°C.

Stabilities of 0.005% per year are available on a production basis.



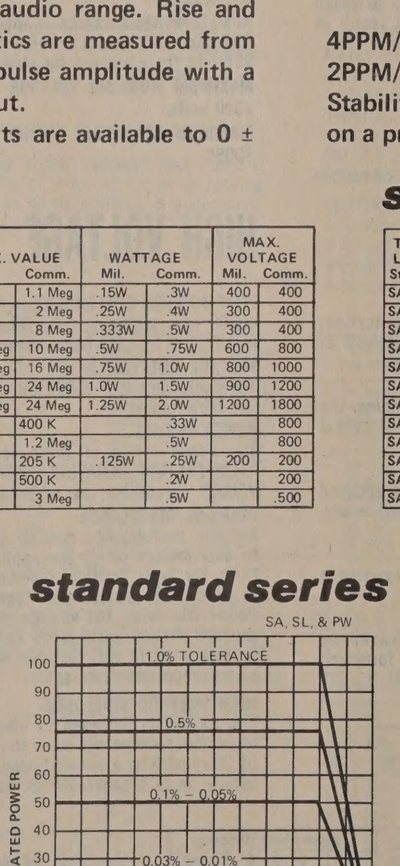
Tel Labs Style	Mil R93D Desig.	Diam. A ± .015	Length B ± .031	Lead Diam. C.	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. VOLTAGE Mil.	MAX. VOLTAGE Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.750	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.000	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200
SA18		.500	.500	.032		3 Meg		.5W		.500

subminiatures

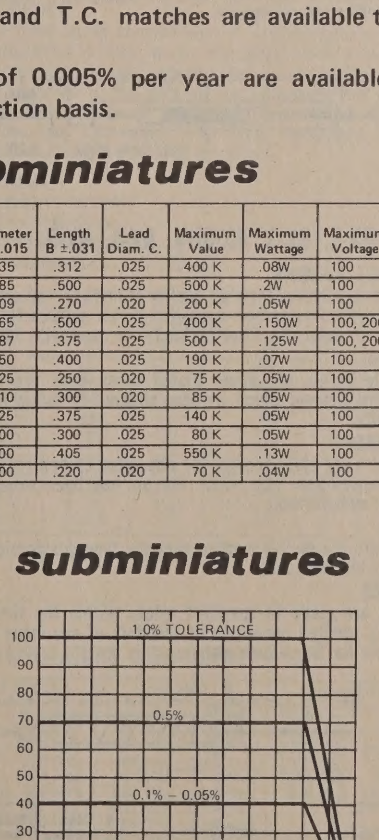
Tel Labs Style	Diameter A ±.015	Length B ±.031	Lead Diam. C.	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400 K	.08W	100
SA10	.185	.500	.025	500 K	.2W	100
SA17	.109	.270	.020	200 K	.05W	100
SA20	.165	.500	.025	400 K	.150W	100, 200
SA21	.187	.375	.025	500 K	.125W	100, 200
SA22	.150	.400	.025	190 K	.07W	100
SA24	.125	.250	.020	75 K	.05W	100
SA25	.110	.300	.020	85 K	.05W	100
SA26	.125	.375	.025	140 K	.05W	100
SA29	.100	.300	.025	80 K	.05W	100
SA30	.200	.405	.025	550 K	.13W	100
SA31	.100	.220	.020	70 K	.04W	100

Derating Charts

standard series



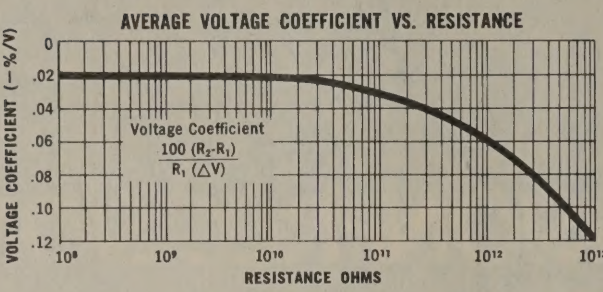
subminiatures



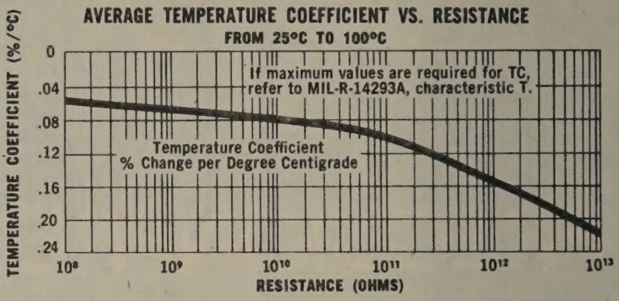
We do just one thing, and one thing well!

VICTOREEN PRECISION GLASS-ENCAPSULATED RESISTORS
HIGH RESISTANCE

AVERAGE VOLTAGE COEFFICIENT VS. RESISTANCE



AVERAGE TEMPERATURE COEFFICIENT VS. RESISTANCE
FROM 25°C TO 100°C

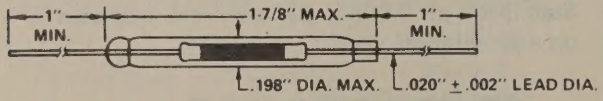


TYPE RX-1 HI-MEG RESISTORS

Victoreen HI-MEG resistors were originally designed for use in electrometer circuits where a high order of performance is required. HI-MEG resistors achieve a high degree of accuracy and stability, and operate at this high level for a long period of time. The HI-MEGs are manufactured in accordance with MIL-R-14293A, characteristic T, and therefore are measured at 20 volts ±1 volt. Reference to the average voltage coefficient curve will indicate that deviations from the marked resistance value may be encountered when used at higher voltages. By special order, Victoreen can supply resistors with resistance measurements at specified voltages.

GLASS SEAL

HI-MEGS are vacuum sealed in a glass envelope which is treated with a special silicone varnish which keeps the resistor relatively free from the effects of moisture. Care should be exercised however, to avoid contamination in handling, such as fingerprints, which might result in reduced effective resistance.



POWER RATING

The power rating for any HI-MEG resistor is equal to one divided by the resistance in megohms.

ELEMENT

The resistor element is a carbon coated glass rod, the ends of which are banded with silver to obtain the best electrical contact. Wire leads extend from the ends of the element.

NOISE

The noise level is negligible for most uses.

RESISTANCE

HI-MEG resistors are available in values from 10^7 to 10^{14} ohms.

TOLERANCE

HI-MEG resistors can be supplied in the following tolerances: 1% below 10^{12} ohms, 2% and 5% below 10^{13} ohms, and 10% over the entire range. Refer to the price list for standard tolerance availability.

MAXIMUM WORKING VOLTAGE

1000 volts.

MAXIMUM OPERATING AMBIENT TEMPERATURE

100°C.

TYPES RX-2, RX-3, RX-3HV, RX-4, RX-5

RESISTANCE ELEMENT

Ceramic rod, selected for high quality of composition and surface texture, has pure crystaline carbon deposited on its surface through pyrolysis of hydrocarbon vapor. No filler or binder is used with the carbon.

TERMINALS

Contact terminals are silver plated brass caps securely gripping the ends of the element which are also silvered to obtain the best electrical conductivity.

GLASS SEALS

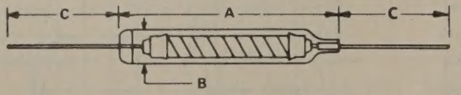
All resistors are glass-sealed. The deposited carbon resistors are encased in glass envelopes from which the air has been exhausted and a dry, inert gas substituted.

MARKING

All resistors are plainly marked with the type designation, the resistance value and the tolerance.

TOLERANCE

Resistors are made to specified values within the limits shown in the data table. Limited quantities of resistors of any value can be furnished from stock for immediate delivery.



HIGH VOLTAGE • HIGH WATTAGE

TEMPERATURE COEFFICIENT

±500 ppm maximum over temperature range −55°C to +125°C. TCR is effected by resistance value and resistor type.

VOLTAGE COEFFICIENT

The coefficient is −.0002 for all types and values of resistors listed in the table below.

POWER RATING

The power rating of these resistors should be determined from the "TEMPERATURE DERATING CURVES" and/or the "POWER VS. RESISTANCE VALUE" curves for the particular application.

CRITICAL RESISTANCE

Resistor performance may be adversely affected by (1) overheating due to overwattage or (2) the application of excessive voltage. Since $W = E^2/R$, the term "critical resistance" applies to that value of resistance at which both maximum voltage and maximum wattage may be applied. Below this value, the voltage must be limited to that voltage which will produce the maximum rated wattage; above this value, the wattage must be restricted to that wattage which will be produced by the application of maximum rated voltage.

HIGH VOLTAGE SHIELDING

The RX-3HV is designed to meet the difficult requirements encountered when the resistor operates at more than 10 kv above ground. Examples of this would be a resistor used as a series filter in a high voltage power supply or as bleeder strings across such supplies.

Type	Watts Max.	Resistance			Max. Working Voltage	Tolerance %	Max. Temp. °C	Dimensions (Inches)			
		Min.	Critical	Max.				A Max.	B Max.	C Min.	Lead Diam.
RX-2	1	500K	9 Meg	50 Meg	3000	1, 2, 5	125	2	.413	1½	.022 ±.005
RX-3	3	1 Meg	33 Meg	200 Meg	10,000	1, 2, 5	125	3 1/16	.413	1½	.022 ±.005
RX-3HV	2	1K	50 Meg	200 Meg	10,000	1, 2, 5	125	3 1/16	.413	1½	.022 ±.005
RX-4	5	200 Ohm	128K	1 Meg	800	1, 2, 5	200	2	.413	1½	.022 ±.005
RX-5	10	200 Ohm	400K	2 Meg	2000	1, 2, 5	200	3 1/16	.413	1½	.022 ±.005

*1% tolerance available only below 1 meg.

Write: Victoreen Instrument Division
10101
Woodland
Avenue,
Cleveland,
Ohio 44104

VICTOREEN

SG SHELLER-GLOBE CORPORATION

VICTOREEN HIGH VOLTAGE METAL OXIDE RESISTORS (MOX SERIES)

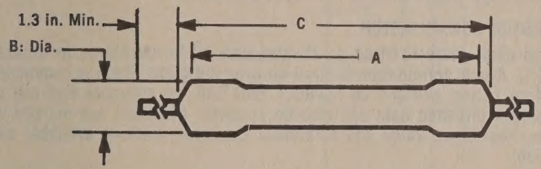
- **WIDE RESISTANCE RANGE—10 K OHMS TO 5000 MEGOHMS**
- **TOLERANCE TO 1%**
- **POWER RATINGS TO 12.5 WATTS**
- **FULL LOAD STABILITY BETTER THAN ±1% FOR 2000 HOURS AT 70°C**
- **FULL PROTECTION AGAINST ROUGH HANDLING AND ENVIRONMENTAL EXTREMES**
- **EXCELLENT HIGH VOLTAGE, HIGH TEMPERATURE AND HIGH FREQUENCY OPERATION**

SPECIFICATIONS:

The following test specifications of Mil Std. 202 are applicable to these resistors.

(1) **MOISTURE RESISTANCE:** Method 103B, △R .25% max. Test condition B.
(2) **TEMPERATURE CYCLING:** Method 102A test condition C, △R .2%.
(3) **DIELECTRIC WITHSTANDING:** Method 301, 750 volts, △R .25%.
(4) **INSULATION RESISTANCE:** Method 302 test conditions A or B. 10,000 megs dry.
(5) **SHOCK:** Method 205D test condition C, △R .25%.
(6) **VIBRATION:** Method 204B test condition D, △R .2%.
(7) **RESISTANCE TO SOLVENTS:** Method 215.
(8) **TERMINAL STRENGTH:** Method 211A test conditions A and D, △R .25%.

There are no Mil specs specifically written to cover Mox type film resistors. However, the following are useful as reference documents.
Mil-R-10509F Mil-R-22684B Mil-R-39017A Mil-R-55182D



These resistors are capable of dissipating higher wattages than rated if ambient temperatures are lower than 70°C or if forced air or oil cooling is employed. This additional capability can be determined in accordance with the temperature rise and the derating curves.

For design of high-voltage, highly-stable miniaturized electronic networks and equipment, the new MOX resistors have all the ingredients you need for ultra-critical applications. For instance, MOX resistors are a fraction the size of conventional types . . . 100 ppm TCR or less to 2500 megohm; stability better than ±2% for 1,000 hours at full load. In addition, typical quantech noise at 20 megohms is less than 1.5 microvolt/volt. All these characteristics combine to provide extremely-rugged and highly-stable resistor configurations that are virtually immune to environmental extremes. MOX resistors where power and voltage to size ratios are critical.

VOLTAGE RANGE

Below critical resistance values, the voltage is limited by the wattage rating of the resistor. Application of the power formula $E^2=WR$ will indicate the permissible maximum voltage. (Refer to Table I for additional data.)

TEMPERATURE COEFFICIENT

In accordance with Table II, the temperature range for calculating temperature coefficients is —55°C to 125°C.

WATTAGE RATING

Wattage ratings calculated on the basis of 70°C ambient temperature. MOX Series A resistors are derated to zero watts at 220°C.

VOLTAGE COEFFICIENT

Voltage coefficient depends on a number of resistor parameters, the most influential of which is resistor value. In general, the higher the resistance value, the higher the voltage coefficient. Victoreen tries to maintain a maximum voltage coefficient of 5 ppm/volt over the complete voltage range of the resistor.

STABILITY

Full load drift (rated wattage at 70°C) is less than 1% in 2000 hours. Shelf or dry circuit drift is less than .1% per year.

RESISTOR CONSTRUCTION

Metal oxide glaze fired on an alumina core at temperature in excess of 800°C. A gold termination is fired on over the glaze which accommodates a close fitting, pressed on welded cap and lead assembly. Standard lead materials are as specified in the data section. Alternate end caps containing a 6-32 threaded hole can be provided for the MOX-1A through the MOX-5A series. Resistors are marked with Type, Resistance Value and Tolerance. Customer marking available as an option.

COATING—Epoxy Resin

- Resists most industrial solvents.
- Excellent moisture resistance.
- High dielectric and low outgassing.
- Maximum hot spot temperature of 220°C.

TABLE I — RESISTOR SPECIFICATIONS

Model	Resistance Range	Power @ 70°C	Max. (1) Volt	TOLERANCE	Critical Resistance	Max. Temp.	Dimensions A	Dimensions B	Dimensions C	Lead	Derating Curve
MOX 400A	100K - 2,500 Meg	.25	1,000	(2).5,1,2,5,10	4 Meg	180°C	.540	.165	.600	D	A
MOX 750A	100K - 5,000 Meg	.5	2,000	(2).5,1,2,5,10	8 Meg	180°C	.860	.165	.920	D	A
MOX 1125A	100K - 10,000 Meg	1	5,000	(2).5,1,2,5,10	25 Meg	180°C	1.250	.165	1.310	D	A
MOX 401	100K - 2,500 Meg	.5	1,500	(2) 1,2,5,10	4.5 Meg	220°C	.540	.165	.600	C	B
MOX 701	100K - 5,000 Meg	1	2,500	(2) 1,2,5,10	6.25 Meg	220°C	.860	.165	.920	C	B
MOX 1101	100K - 10,000 Meg	1.5	6,000	(2) 1,2,5,10	24 Meg	220°C	1.250	.165	1.310	C	B
MOX 1A	10K - 1,000 Meg	2.5	7,500	1,2,5	22 Meg	220°C	1.122	.310	(3) 1.340	C	B
MOX 2A	20K - 2,000 Meg	5.0	15,000	1,2,5	45 Meg	220°C	2.122	.310	(3) 2.340	C	B
MOX 3A	30K - 3,000 Meg	7.5	22,500	1,2,5	67 Meg	220°C	3.122	.310	(3) 3.340	C	B
MOX 4A	40K - 4,000 Meg	10.0	30,000	1,2,5	90 Meg	220°C	4.122	.310	(3) 4.340	C	B
MOX 5A	50K - 5,000 Meg	12.5	37,500	1,2,5	112 Meg	220°C	5.122	.310	(3) 5.340	C	B

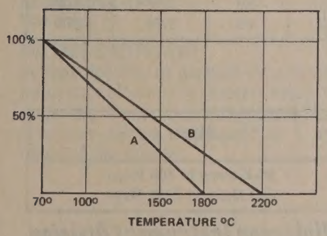
Lead Code: D = .020 Tinned Dumet; C = .032 Tinned Copper

(1) Applicable above critical resistance.

(2) MOX — 400A: Below 1000 megohms .5%, 1%, 2% & 5%; 1000 megohms and above, 2%, 5% & 10%.
MOX — 750A: Below 2000 megohms .5%, 1%; 2% & 5%; 2000 megohms and above, 2%, 5% & 10%.
MOX — 1125A: Below 3000 megohms .5%, 1%, 2% & 5%; 3000 megohms and above, 2%, 5% & 10%.

(3) Length of the resistor when fitted with ferrule end caps with No. 6-32 tapped hole.

Temperature Derating Curve



Temperature Rise Above Ambient vs. % of Rated Wattage

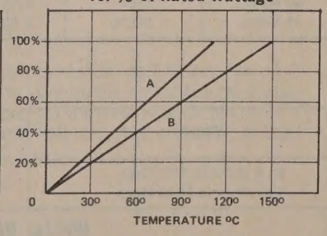


TABLE II — TEMPERATURE COEFFICIENT

Model	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX 400A	100K - 300 Meg	300 Meg - 1000 Meg	1000 Meg - 2500 Meg
MOX 750A	100K - 600 Meg	600 Meg - 2000 Meg	2000 Meg - 5000 Meg
MOX 1125A	100K - 1000 Meg	1000 Meg - 3000 Meg	3000 Meg - 10,000 Meg
MOX 401	100K - 200 Meg	200 Meg - 1000 Meg	1000 Meg - 2500 Meg
MOX 701	100K - 400 Meg	400 Meg - 2000 Meg	2000 Meg - 5000 Meg
MOX 1101	100K - 600 Meg	600 Meg - 3000 Meg	3000 Meg - 10,000 Meg
MOX 1A	10K - 500 Meg	500 Meg - 1000 Meg	—
MOX 2A	20K - 1000 Meg	1000 Meg - 2000 Meg	—
MOX 3A	30K - 1500 Meg	1500 Meg - 3000 Meg	—
MOX 4A	40K - 2000 Meg	2000 Meg - 4000 Meg	—
MOX 5A	50K - 2500 Meg	2500 Meg - 5000 Meg	—

Write: Victoreen Instrument Division

VICTOREEN
10101
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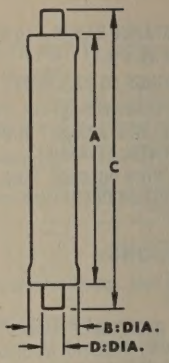
Cleveland,
Ohio 44104

SHELLER-GLOBE CORPORATION

VICTOREEN POWER-MOX RESISTORS

- **WIDE RESISTANCE RANGE—20 K OHMS TO 7000 MEGOHMS**
- **TOLERANCE TO 1%**
- **POWER RATINGS TO 45 WATTS**
- **FULL LOAD STABILITY BETTER THAN ±2% FOR 2000 HOURS AT 25°C**
- **FULL PROTECTION AGAINST ROUGH HANDLING AND ENVIRONMENTAL EXTREMES**
- **EXCELLENT HIGH VOLTAGE, HIGH TEMPERATURE AND HIGH FREQUENCY OPERATION**



SPECIFICATIONS:

The following test specifications of Mil Std. 202 are applicable to these resistors.

(1) MOISTURE RESISTANCE:
Method 103B, △R .25% max. Test condition B.
(2) TEMPERATURE CYCLING:
Method 102A test condition C, △R .2%.
(3) DIELECTRIC WITHSTANDING:
Method 301, 750 volts, △R .25%
(4) INSULATION RESISTANCE:
Method 302 test conditions A or B, 10,000 megs dry.
(5) RESISTANCE TO SOLVENTS: Method 215.

There are no Mil specs specifically written to cover Mox type film resistors. However, the following are useful as reference documents.

Mil-R-10509F   Mil-R-22684B   Mil-R-39017A   Mil-R-55182D

Power-Mox resistors are available in a range of resistance values, voltage and power ratings which will handle most high voltage applications. From 20kV to 45kV, their high voltage parameters are unexcelled.

VOLTAGE RANGE

Below critical resistance values, the voltage is limited by the wattage rating of the resistor. Application of the power formula $E^2=WR$, will indicate the permissible maximum voltage. (Refer to Table I for additional data.)

VOLTAGE COEFFICIENT

Voltage coefficient depends on a number of resistor parameters, the most influential of which is resistor value. In general, the higher the resistance value, the higher the voltage coefficient. Victoreen tries to maintain a maximum voltage coefficient of 5 ppm/volt over the complete voltage range of the resistor.

WATTAGE RATING

Wattage ratings are calculated on the basis of 25°C ambient temperature. Power Mox resistors are derated to zero watts at 180°C.

TEMPERATURE COEFFICIENT

In accordance with Table II, the temperature range for calculating temperature coefficients is −55°C to 125°C.

STABILITY

Full load drift (rated wattage at 25°C) is less than 2% in 2000 hours. Shelf or dry circuit drift is less than .1% per year.

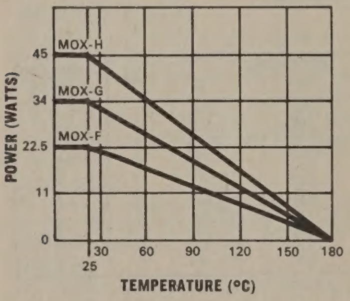
RESISTOR CONSTRUCTION

Metal oxide glaze fired on an alumina core at temperatures in excess of 800°C. A gold termination is fired on over the glaze which accommodates a close fitting, pressed on FERRULE END CAP. An alternate end cap containing a threaded hole can also be supplied. Resistors are marked with Type, Resistance Value and Tolerance. Customer marking available as an option.

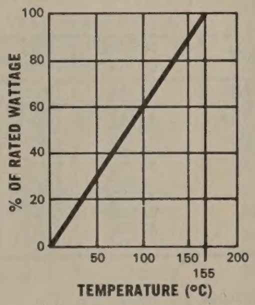
COATING—Epoxy Resin

- Resists most industrial solvents.
- Excellent moisture resistance.
- High dielectric and low outgassing.
- Maximum hot spot temperature of 180°C.

TEMPERATURE DERATING CURVE



TEMPERATURE RISE ABOVE AMBIENT VS. % OF RATED WATTAGE



These resistors are capable of dissipating higher wattages than rated if ambient temperatures are lower than 25°C or if forced air or oil cooling is employed. This additional capability can be determined in accordance with the temperature rise and the derating curves.

TABLE I—RESISTOR SPECIFICATIONS

Model	Resistance Range	Power Rating @ 25°C	(1) Max. Oper. Volts	Available Tolerance	Critical Resistance	Max. Surface Temperature	Maximum Dimensions (Inches)			
							A	B	C	D
MOX-F	20K—3000 Megs	22.5W	20KV	1, 2 & 5%	18 Megs	180°C	3.12	.89	3.96	.400
MOX-G	20K—5000 Megs	34W	30KV	1, 2 & 5%	27 Megs	180°C	4.62	.89	5.46	.400
MOX-H	20K—7000 Megs	45W	45KV	1, 2 & 5%	45 Megs	180°C	6.12	.89	6.96	.400

(1) Applicable above critical resistance

TABLE II—TEMPERATURE COEFFICIENT

Standard Temperature Coefficient	MOX-F	MOX-G	MOX-H
±100 ppm	200 K ohms to 300 Megs	20 K ohms to 500 Megs	20 K ohms to 700 Megs
±300 ppm	300 Megs to 3000 Megs	500 Megs to 5000 Megs	700 Megs to 7000 Megs

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VICTOREEN SLIM-MOX SERIES RESISTORS
HIGH VOLTAGE METAL OXIDE RESISTORS

- WIDE RESISTANCE RANGE — 1 TO 5000 MEGOHMS
- POWER RATING — TO 5 WATTS
- VOLTAGE RATING — 18kV
- FULL LOAD STABILITY — TYPICALLY BETTER THAN ±1% FOR 1000 HOURS AT 70°C
- EXCELLENT HIGH VOLTAGE, HIGH TEMPERATURE
- NONINDUCTIVE DESIGN

TEST SPECIFICATIONS

The following test specifications of Mil Std. 202 are applicable to these resistors.

(1) MOISTURE RESISTANCE:
Method 103B, △R .25% max. Test condition B.

(2) TEMPERATURE CYCLING:
Method 102A test condition C, △R .25%.

(3) DIELECTRIC WITHSTANDING:
Method 301, 750 volts, △R .25%.

(4) INSULATION RESISTANCE:
Method 302 test conditions A or B, 10,000 megs dry.

(5) SHOCK: Method 205D test condition C, △F .25%.

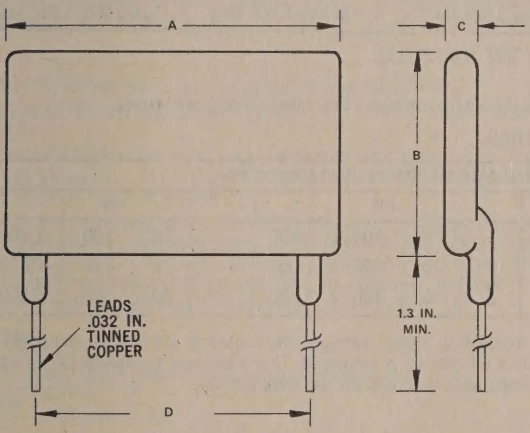
(6) VIBRATION: Method 204B test condition D, △R .2%.

(7) RESISTANCE TO SOLVENTS: Method 215.

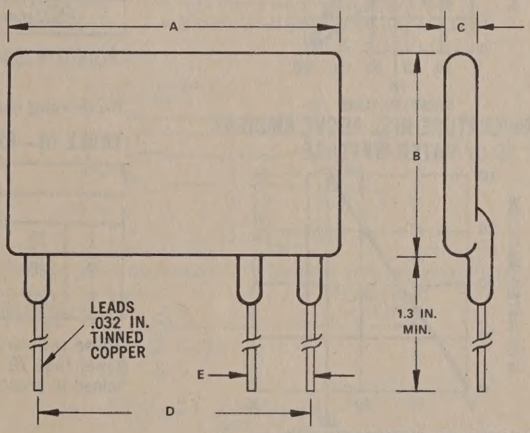
(8) TERMINAL STRENGTH:
Method 211A test conditions A and D, △R .25%.

There are no Mil specs specifically written to cover Mox type film resistors. However, the following are useful as reference documents.
Mil-R-10509F Mil-R-22684B Mil-R-39017A Mil-R-55182D

SLIM-MOX PROFILE*



DIVIDER-MOX PROFILE*



*REFERENCE TABLES I AND IV FOR DIMENSIONS

Victoreen Metal Oxide Glaze Resistors are the culmination of years of experience in the manufacture of resistors for many special applications requiring precision and reliability. The MOX resistive element is composed of highly stable metal oxides in a special glass matrix fired on high alumina substrates at temperatures in excess of 800°C. The end product is a highly stable resistor that gives improved parameters in all important areas including stability, temperature coefficients, voltage coefficients and power handling capability.

For design of high voltage, highly stable miniturized electronic networks and equipment, the new SLIM-MOX resistors have all the ingredients you need for ultra-critical applications. For instance, SLIM-MOX resistors are a fraction the size of conventional types; 100 ppm TCR or less to 300 megohms, stability better than ±1% for 1000 hours at full load, low voltage coefficient less than 5 ppm/volt. All these characteristics combine to provide extremely rugged and highly stable resistor configurations that are virtually immune to environmental extremes.

RESISTANCE RANGE
See Table I.

VOLTAGE COEFFICIENT
Voltage coefficient depends on a number of resistor parameters, the most influential of which is resistor value. In general, the higher the resistance value the higher the voltage coefficient. Victoreen tries to maintain a maximum voltage coefficient of 5 ppm/volt over the complete voltage range of the resistor.

COATING
Excellent environmental protection is afforded SLIM-MOX resistors, through the use of a conformal epoxy coating, that is moisture resistant and resists most industrial solvents. This coating has excellent high temperature properties allowing a maximum hot spot temperature of 150°C. It is compatible with most commonly used potting compounds, offers high dielectric and low outgassing properties.

STABILITY
Full load drift (rated wattage at 70°C) is typically ±1% in 1000 hours. Shelf life or dry circuit drift is less than 0.1% per year.

VOLTAGE RANGE
In accordance with Table I, except below critical resistance values, the voltage is limited by the wattage rating of the resistor. Application of the power formula $E^2=WR$, will indicate the permissible maximum voltage.

TEMPERATURE COEFFICIENT
In accordance with Table II. The temperature range for calculating temperature coefficients is —55°C to +125°C.

WATTAGE RATING
Wattage ratings are calculated on the basis of 70° ambient temperature and derated to zero watts at 150°C. See temperature rise and derating curves. See Table I for ratings.

RESISTOR CONSTRUCTION
Metal oxide glaze on a solid alumina substrate. Leads are tinned copper.

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VICTOREEN SLIM-MOX SERIES RESISTORS

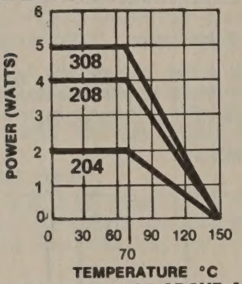
SLIM-MOX RESISTOR DATA

TABLE I—RESISTOR SPECIFICATIONS

Model	Resistance Range	Critical Resistance	Power Rating at 70°C	Maximum* Operating Volts	Available Tolerances	Max. Surface Temp.	Max. Dimensions Inches A	B	C	D
SLIM-MOX 204	1M-5,000M	50M	2W	10,000V	1% 2%	150°C	1.08	.59	.145	.92
SLIM-MOX 208	2M-5,000M	56M	4W	15,000V	5% 10%		2.08	.59		1.92
SLIM-MOX 308	5M-5,000M	64M	5W	18,000V	15%		2.08	.84		1.92

*Applicable above critical resistance.

TEMPERATURE DERATING CURVE



TEMPERATURE RISE ABOVE AMBIENT VS. % OF RATED WATTAGE

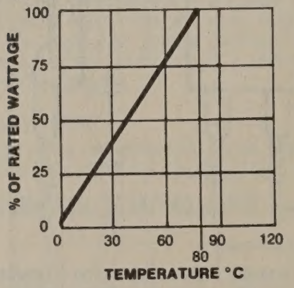


TABLE II—TEMPERATURE COEFFICIENT

Standard Temperature Coefficient (ppm/°C)	SLIM-MOX 204	SLIM-MOX 208	SLIM-MOX 308
±100 ppm	1 Meg-100 Meg	2 Meg-200 Meg	3 Meg-300 Meg
±250 ppm	100 Meg-1,000 Meg	200 Meg-2,000 Meg	300 Meg-3,000 Meg
±500 ppm	1,000 Meg-5,000 Meg	2,000 Meg-5,000 Meg	3,000 Meg-5,000 Meg

The following resistance values are available from stock as "15% tolerance standard" values.

TABLE III—RESISTANCE VALUES

STANDARD RESISTANCE VALUES (Megohms)											
204				208				308			
1	10	100	1,000	—	10	100	1,000	—	10	100	1,000
2	20	200	2,000	2	20	200	2,000	—	20	200	2,000
5	50	500	5,000	5	50	500	5,000	5	50	500	5,000

These resistors are capable of dissipating higher wattages than rated if ambient temperatures are lower than 70°C or if forced air or oil cooling is employed. This additional capability can be determined in accordance with the temperature rise and the derating curves.

TABLE IV—DIVIDER RESISTOR SPECIFICATIONS

Model	Resistance Range ±5%	Available Ratio	Ratio TOL.*	Power @ 70°C	Max. Volt.	Max. Temp.	Dimensions (Max.) A	B	C	D	E
SLIM-MOX 204RD	500K-5000M	1:1-2000:1	1 & 3	1.5	10KV	180°C	1.08	.59	.145	.92	.12
SLIM-MOX 208RD	1M-5000M	1:1-4000:1	1 & 3	3.0	15KV	180°C	2.08	.59	.145	1.92	.22
SLIM-MOX 308RD	2M-5000M	1:1-4000:1	1 & 3	4.5	20KV	180°C	2.08	.84	.145	1.92	.22

*204RD—1% through 1000:1, 3% above 1000:1
208RD & 308RD 1% through 2000:1, 3% above 2000:1.

TRACKING

SLIM-MOX Dividers track to within 25 ppm over combined effects of T.C. and V.C.

TABLE V—TEMPERATURE COEFFICIENT (DIVIDER SERIES)

Standard Temperature Coefficient (ppm/°C)	SLIM-MOX 204RD	SLIM-MOX 208RD	SLIM-MOX 308RD
±100 ppm	.5 Meg-100 Meg	1 Meg-200 Meg	2 Meg-300 Meg
±250 ppm	100 Meg-1,000 Meg	200 Meg-2,000 Meg	300 Meg-3,000 Meg
±500 ppm	1,000 Meg-5,000 Meg	2,000 Meg-5,000 Meg	3,000 Meg-5,000 Meg

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VICTOREEN DIVIDER-MOX RESISTORS

Victoreen DIVIDER-MOX represents an advanced concept in the area of high voltage resistive divider networks. Through the use of an unique manufacturing process, Victoreen is able to produce a divider network utilizing the basic information available to the design engineer. The effects of T-C matching, V-C, self generated heat and other hard to define and control variables are minimized. The following basic information will enable us to supply a divider tailored to your application.

A) Total resistance value of the divider.
B) Input Voltage
C) Output voltage and tolerance
D) Output voltage stability over operating temperature extremes (expressed in percent allowable change)

The limits of each of the above parameters are listed below.

RESISTANCE RANGE

See Table I. In order to enhance output voltage stability the total resistance to the divider should be as high as possible in order to minimize self-heating.

VOLTAGE RANGE

Below critical resistance values, the voltage is limited by the wattage rating of the resistor. Application of the power formula $E^2 = WR$ will indicate the permissible maximum voltage. (Refer to Table I for additional data.)

WATTAGE RATING

Wattage ratings are calculated on the basis of 70°C ambient temperature. DIVIDER-MOX resistors are derated to zero watts at 180°C.

INPUT/OUTPUT VOLTAGE RATIOS

As indicated in Table I, any ratio between the maximum and minimum specified is available, except for those maximum ratios that exceed our manufacturing limitations.

INPUT VOLTAGE

Maximum in accordance with Table I. Minimum consistent with Input/output voltage ratios.

OUTPUT VOLTAGE

Determined only by input voltage limitations and Input/Output voltage ratios. The best available tolerance is 1%.

OUTPUT VOLTAGE STABILITY

This is the parameter which really defines the precision of a divider and is expressed in terms of percent allowable change over the operating temperature range. Stability is dependent on a number of factors including power dissipation and operating temperature range. While Victoreen DIVIDER-MOX resistors are capable of operating over the full range of characteristics indicated, if power dissipation is limited to 10% of the maximum values indicated, (not an unreasonable figure since most dividers are high resistance devices) stabilities of .1% are obtainable. Operation at higher wattage levels will effect initial (turn-on) stability and additional time must be allowed for the divider to reach temperature equilibrium.

OPERATING TEMPERATURE RANGE

The normal maximum operating temperature extremes used to calculate output voltage stability are −55°C to +125°C. Generally speaking, narrower extremes means better stability, wider extremes, of course, sacrifice stability.

DIVIDER CONSTRUCTION

A single high alumina core is utilized with a metal oxide resistive element. The end terminations are gold and accommodate close fitting, pressed on welded cap and lead assemblies. The third terminal is mechanically fastened to a gold termination and the whole assembly is epoxy coated with the same high quality material used on other MOX resistors. Threaded end caps available on MAXI-MOX are available on DIVIDER-MOX as well. Resistors are marked with Type, Resistance Value and Tolerance. Customer marking available as an option.

COATING Epoxy Resin

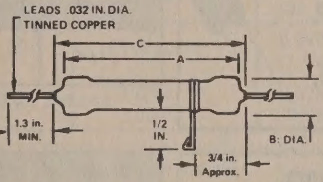
- Resists most industrial solvents
- Excellent moisture resistance
- High dielectric and low outgassing
- Maximum hot spot temperature of 180°C

SELECTING THE PROPER VICTOREEN DIVIDER

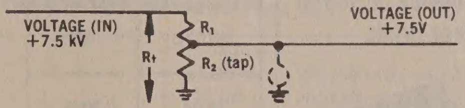
1. Select the proper divider based on input voltage limitations.
2. Determine that the input/output voltage ratio falls within the specified limits.
3. Choose the highest possible divider resistance value commensurate with circuit parameters, the wattage limitations of the divider, and within the specified resistance range.
4. Divide the resistance value selected by the input/output voltage ratio to obtain the tap resistance value. If this is greater than the minimum tap resistance for the divider selected, the divider can be fabricated. If the tap resistance value is less than the minimum, the divider resistance must be increased or other parameters adjusted.

EXAMPLE:

1. MOX-2RD; 7.5 kV.
   Input voltage cannot exceed 7.5 kV (maximum operating volts).
2. Output Required; 7.5V.
   $\frac{7.500\text{V}}{7.5\text{V}} = \text{1/0 ratio } 1000{:}1.$
   (Ratio limits from 500-5000 maximum permissible).
3. Total Divider resistance selected. Resistance selected 100MΩ (resistance range 5 Megs to 500 Megs).
   Wattage Limitation; 1.5W.
   High Stability Wattage; .15W or less.
   $W = \frac{E^2}{R} = \frac{(7.5 \times 10^3)^2 \text{ volts}}{1 \times 10^8 \text{ ohms}} = 56.25 \times 10^{-2} = .5625$
   Wattage does not fall within high stability power rating. However, it does not exceed maximum power rating of 1.5 watts.



4. To select the proper tap resistance, the following formula applies. (Figure 1).



$$R2 = \frac{V\,(\text{Out})}{V\,(\text{In})} \times R_t = \frac{7.5\text{V}}{7500\text{V}} \times 100 \text{ Megs}$$
$$= \frac{1}{1000} \times 100 \text{ Megs} \quad R2 = {}^*100 \text{ k}\Omega$$

*This value must be greater than stated minimum tap resistances of:
MOX-2RD — 10kΩ MOX-4RD — 20kΩ
MOX-3RD — 15kΩ MOX-5RD — 25kΩ

5. Measurement.
   When testing MOX-RD Dividers with low impedance meters please note:

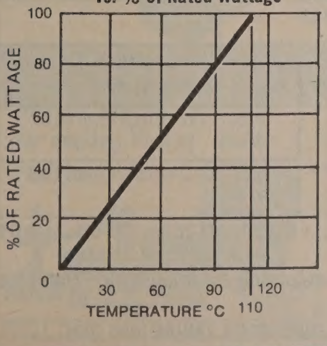
$$V\,(\text{Out}) = V\,(\text{In}) \times \frac{R2 \text{ (parallel with R meter)}}{R1 + R2 \text{ (parallel with R meter)}}$$

TABLE I—RESISTOR SPECIFICATIONS

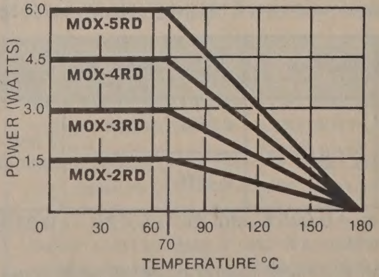
Model	(1)Resistance Range	(2)Power Rating @ 70°C	High Stability Power Rating(3)	(4)Max. Oper. Volts	Input/Output Voltage Ratio		Critical Resistance	Minimum Tap Resistance	Maximum Dimensions (Inches)		
					Min.	Max.			A	B	C
MOX-2RD	5 - 500 Megs	1.5W	0.15W	7.5 kV	500	5,000	37.5 Megs	10K ohms	2.140	.345	2.20
MOX-3RD	4.5-1000 Megs	3.0W	0.30W	15 kV	300	10,000	75 Megs	15K ohms	3.140	.345	3.20
MOX-4RD	6 -1500 Megs	4.5W	0.45W	22.5 kV	300	10,000	112.5 Megs	20K ohms	4.140	.345	4.20
MOX-5RD	7.5-2000 Megs	6.0W	0.60W	30 kV	300	10,000	150 Megs	25K ohms	5.140	.345	5.20

(1) Minimum total divider resistance dependent on maximum input/output voltage ratio.
(2) Derated to 0 watts @ 180°C.
(3) Recommended maximum power dissipation for highest stability.
(4) Applicable above critical resistance.

Temperature Rise Above Ambient vs. % of Rated Wattage



Temperature Derating Curve



These resistors are capable of dissipating higher wattages than rated if ambient temperatures are lower than 70°C or if forced air or oil cooling is employed. This additional capability can be determined in accordance with the temperature rise and the derating curves.

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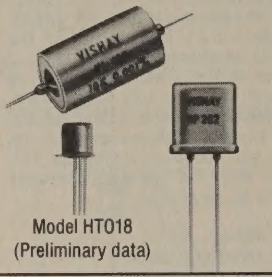
VISHAY
RESISTIVE SYSTEMS GROUP

Precision resistive components selection guide

VISHAY RESISTIVE SYSTEMS GROUP • 63 LINCOLN HIGHWAY, MALVERN, PA 19355 • Phone (215) 644-1300 • TWX 510-668-8944

Hermetically-sealed resistors, metrology and laboratory grade



Model HT018
(Preliminary data)

MODEL NUMBER	RESISTANCE (OHMS)	TOLERANCE[1]	POWER @25°C	TCR[2]	TCR TRACKING[2]	DIMENSIONS (excluding leads) (inch) (mm)
HA412	5-100k	Std. tol. available: ±0.001%, ±0.0025%, ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%	0.30W	+1 ppm ±1.5 ppm/°C from 0°C to +25°C; −1 ppm ±1.5 ppm/°C from +25°C to +60°C	3 ppm/°C standard	0.625 (15.875) L x 0.375 (9.525) Dia.
HA414	5-200k		0.50W			1.000 (25.400) L x 0.375 (9.525) Dia.
HA512	5-300k		0.75W			0.625 (15.875) L x 0.500 (12.700) Dia.
HA516	5-600k		1.50W			1.000 (25.400) L x 0.500 (12.700) Dia.
HA518	5-1M		2.50W			1.500 (38.100) L x 0.500 (12.700) Dia.
HP202	5-100k		0.30W			0.430 (10.922) x 0.435 (11.049) x 0.185 (4.699); lead spacing 0.150 (3.810)
HP231* (ruggedized)	5-100k		0.30W @ 85°C	0±5 ppm/°C from −55°C to +125°C	3 ppm/°C	0.430 (10.922) x 0.435 (11.049) x 0.185 (4.699); lead spacing 0.150 (3.810)
HT018	50-30k	±0.01%*	0.05W @125°C	0±10 ppm/°C max.	—	0.210 (5.334) H x 0.230 (5.842) Dia. (std. T018 case)

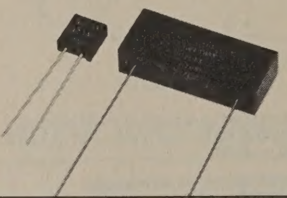
*Tightest tolerance for HP-231: ±0.0025%; for HT018: ±0.01%.

Established-reliability resistors, ERMIL style RNC90Y (Mil-R-55182/9, Char. Y)

MODEL NUMBER	RESISTANCE (OHMS)	TOLERANCE[1]	POWER @125°C	TCR[2] (−55°C to +125°C)	TCR TRACKING[2]	DIMENSIONS (excluding leads) (inch) (mm) HxLxW
S444	1-100k	To ±0.005%*	0.30W	0±5 ppm/°C	3 ppm/°C standard	0.350 (8.890) x 0.310 (7.874) x 0.110 (2.794); lead spacing 0.150 (3.810)

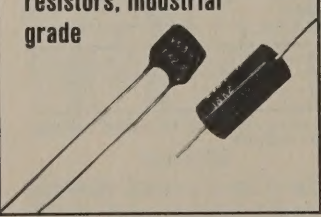
*Std. tol. ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1.0%

Precision resistors, high-performance industrial and aerospace grade



MODEL NUMBER	RESISTANCE (OHMS)	TOLERANCE[1]	POWER @125°C	TCR[2] (−55°C to +125°C)	TCR TRACKING[2]	DIMENSIONS (excluding leads) (inch) (mm) HxLxW
S102C	1-100k	Std. tol. available: ±0.005%, ±0.01%, ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1.0%	0.30W	0±5 ppm/°C	3 ppm/°C standard	0.320 (8.128) x 0.295 (7.493) x 0.100 (2.540); lead spacing 0.150 (3.810)
S104	1-200k		0.50W			0.520 (13.208) x 0.565 (14.351) x 0.150 (3.810); lead spacing 0.400 (10.160)
S105	1-300k		0.75W			0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810); lead spacing 0.650 (16.510)
S106C	0.5-600k		1.00W			0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223); lead spacing 0.900 (22.860)

Value-engineered resistors, industrial grade



MODEL NUMBER	RESISTANCE (OHMS)	TOLERANCE[1]	POWER @60°C	TCR[2] (−55°C to +125°C)	TCR TRACKING[2]	DIMENSIONS (excluding leads) (inch) (mm) HxLxW
V53-1	5-75k	Std. tol. avail.: ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1.0%, ±5.0%	0.30W	0±10 ppm/°C	6 ppm/°C standard	0.375 (9.525) x 0.375 (9.525) x 0.200 (5.080); radial lead spacing 0.150 (3.810)
M53	30-75k		0.50W			0.750 (19.050) L x 0.375 (9.525) Dia. (axial leads)
M55	20-50k		0.25W			0.500 (12,700) L x 0.250 (6.350) Dia. (axial leads)
S102SP	10-100k*	±0.5% (±1.0% EOL)	0.3W @125°C		—	0.375 (9.525) x 0.320 (8.128) x 0.120 (3.048); radial lead spacing 0.150 (3.810)

*Available only in standard values per E192 list (Table IV), Mil-R-55182.

Microchip resistors for hybrid microcircuits

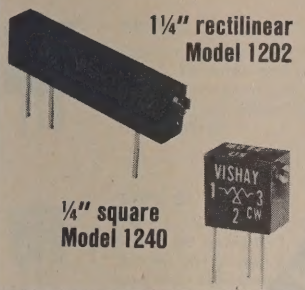
MODEL NUMBER	RESISTANCE (OHMS)	TOLERANCE[1]	POWER @70°C	TCR[2] (−55°C to +150°C)	TCR TRACKING[2]	CHIP DIMENSIONS (inch) (mm) LxWxT
V5X5	4.87Ω-5.11k	To ±0.005%*	0.05W	0±5 ppm/°C	3 ppm/°C standard	0.050 (1.270) x 0.050 (1.270) x 0.017 (0.432)
V15X5	42.2Ω-15.4k		0.10W			0.150 (3.810) x 0.050 (1.270) x 0.017 (0.432)

*User-calibratable to ±0.005%; std. tol. ±0.02%, ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1.0%, ±5.0%, ±10.0%

[1] Recognized measurement limitations impose restrictions on practical tolerance attainable when selecting low-resistance-value resistors. Consult factory for exact limits.

[2] TCR characteristics, including tracking, are standard down to 100Ω. Consult factory for details on resistance values less than 100Ω.

Precision trimming potentiometers



1¼″ rectilinear Model 1202

¼″ square Model 1240

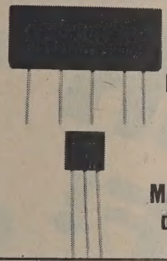
MODEL NUMBER	RESISTANCE (OHMS)	POWER @85°C	TCR (−55°C to +150°C)	NO. OF TURNS	DIMENSIONS (excluding leads) HxLxW (inch) (mm) AND TERMINATION STYLES
1202 RJR12 style	5, 10, 20, 50, 100, 200, 250, 500, 1k, 2k, 5k, 10k, 20k All values ±5% or ±10%	0.50W	0±10 ppm/°C end-to-end	25±2	0.325 (8.255) x 1.250 (31.750) x 0.195 (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads
1240 RJR26 style	5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k All values ±5%	0.25W	0±10 ppm/°C end-to-end	21±2	Type X: Edge-mount, side-adjust; Type W: Edge-mount, top-adjust 0.250 (6.350) x 0.250 (6.350) x 0.175 (4.445) Type P: Flat-mount, side-adjust 0.175 (4.445) x 0.250 (6.350) x 0.250 (6.350)

Standard unitized circuits

Voltage dividers
Attenuators
BCD decades

Parallel config.

Mini volt. dividers



MODEL NUMBER[1]	NO. OF RESISTORS	R VALUE OF EACH RESISTOR[2]	TOL. RATIO BETW. RESISTORS @25°C	TCR RATIO BETW. RESISTORS (−55°C to +125°C)	DIMENSIONS (excluding leads) HxLxW (inch) (mm)
300190,1	2	100Ω-100kΩ	±1.0%, ±0.5%, ±0.1%, ±0.05%, ±0.02%, ±0.01%, ±0.005%	3 ppm/°C	0.520 (13.208) x 0.565 (14.351) x 0.150 (3.810)
300192, 3,4	3	100Ω-100kΩ		3 ppm/°C	0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810)
300195,6, 7,8,9	4	100Ω-100kΩ		3 ppm/°C	0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223)
300210	3	100Ω-100kΩ		3 ppm/°C	0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810)
300211, 12	4	100Ω-100kΩ		3 ppm/°C	0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223)
300144	2 (1 chip)	100Ω-40kΩ[3]		1 ppm/°C	0.320 (8.128) x 0.295 (7.493) x 0.100 (2.540)
300145	4 (2 chips)	100Ω-40kΩ[3]		1 ppm/°C, 3 ppm/°C[4]	0.375 (9.525) x 0.375 (9.525) x 0.200 (5.080)

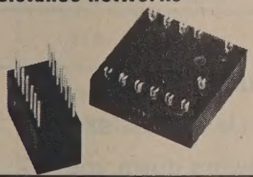
[1] Standardized circuits used throughout, with individual R values selected by user. For the 300144 and 300145 models, standard R ratio sets are available in addition to standard circuits. Consult factory for details.

[2] Resistance values below 100Ω are available. Consult factory.

[3] 40kΩ is the maximum resistance value per chip, and is divided between the two resistors on the chip.

[4] 1 ppm/°C between resistors R1 and R2 and between R3 and R4; 3 ppm/°C for all resistors as a set.

Standard and custom resistance networks



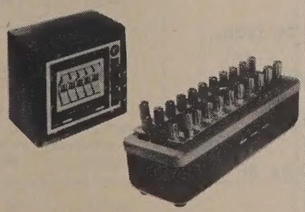
CUSTOM AND STANDARD BINARY LADDER NETWORKS, BCD LADDERS, ETC.

- Up to 16 bits
- ½ LSB to ±0.001 full-scale accuracy
- 25-ppm total impedance stability over 3 years

Besides designing completely custom precision networks to your most demanding specifications, Vishay offers standard binary R-2R ladder networks in 4-bit to 16-bit configurations (voltage-fed) with resistance values from 100 ohms to 50kΩ; 2R to 100kΩ.

Three basic package styles: **Profile 500,** 0.750″ (19.05mm) W x 0.500″ (12.70mm) H; **Profile 375,** 1.230″ (31.242mm) W x 0.365″ (9.271mm) H. Lengths dependent on number of bits: min. 0.700″ (17.78mm) for 4-bit Profile 500 to 2.14″ (54.356mm) for 16-bit ladder; min. 0.730″ (18.542mm) for Profile 375 to 2.59″ (65.786mm) for 15-bit package. **Profile 200,** 1.0″ (25.4mm) W x 1.0″ (25.4mm) L x 0.200″ (5.08mm) H only.

Decade resistance boxes, standards



DECADE RESISTANCE BOXES AND PANEL-MOUNTING MODULES

- Min. increment per step 0.01Ω
- ±0.005% accuracy at the terminals
- Long-term stability 5ppm/yr or 20ppm/yr

Lightweight benchtop decade box built with high-precision Vishay resistors; smallest size available with 7-digit resolution (less than one-third the size of other units). Also available for front-of-panel or back-of-panel mounting with terminals on front or rear.

RESISTANCE DECADE TRANSFER STANDARD

- Calibratable to 1ppm with 5ppm/yr stability
- Setting accuracy of ±0.001% with stability of 5 ppm/yr.

For calibrating resistance bridges, decades, voltage dividers, resistance networks. Made with hermetic-seal Vishay resistors, TCR of 0±1ppm/°C; 11 resistors in each of four models. All resistors "float," permitting series, parallel, and series-parallel combinations from 1/11 to 11 x the basic individual resistance value.

In-plant station for making Vishay resistors

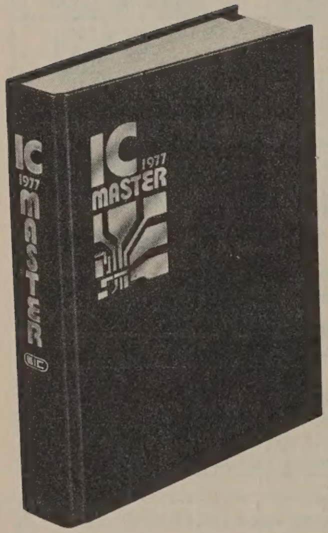
BENCHTOP STATION FOR CALIBRATING AND ENCAPSULATING VISHAY RESISTORS IN YOUR OWN PLANT

Model 290424 (115V 60Hz) or **Model 290425** (220V 50Hz) gives you a complete facility for obtaining custom resistors of Vishay quality within your own plant or laboratory. Ideal for breadboarding, prototype, and even for production runs.

Select a Vishay resistor chip of a resistance value closest to the final value you want. Then calibrate according to simple instructions provided, to tolerances as close as ±0.005%. Make resistors of any value from 2Ω to 100kΩ. Call for further information.

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
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- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

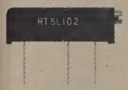
United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

Allen-Bradley Trimming Potentiometers

TYPE E:
Cermet, single turn, 0.5W at 70°C, 10 ohms to 2 megs, ±10%, pin terminals, 13 types, top and side adjustment, linear taper.

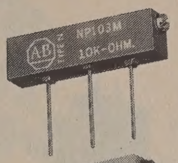
TYPE S:
Cermet, single turn, 0.5W at 85°C, 50 ohms to 1 meg, ±10%, pin terminals, top and side adjustment, linear taper.

TYPE A:
Cermet, single turn, 0.5W at 85°C, 10 ohms to 2 megs, ±10%, pin terminals, top and side adjustment, 6 types, linear taper.

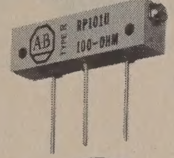


TYPE RT:
Cermet, 20 turns, 0.75W at 70°C, 10 ohms to 2 megs, ±10%, pin terminals, 8 types, linear taper, .250 inch or .340 inch high types. Clear housing also available in any of the lead configurations.

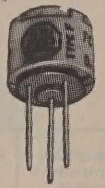
TYPE D:
Cermet, single turn, 0.5W at 70°C, 10 ohms to 2 megs, ±20%, pin terminals, 8 types, top and side adjustment, linear taper.



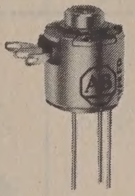
TYPE N.
Hot-molded composition, 25 turns, 0.33W at 50°C, 100 ohms to 2.5 megs, ±10% and ±20%, pin terminals, linear taper.



TYPE R:
Hot-molded composition, 25 turns, 0.25W at 70°C, 100 ohms to 2.5 megs, ±10% and ±20%, pin or solder lug terminals, linear taper.



TYPE F:
Hot-molded composition, single turn, 0.25W at 70°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, top and side adjustment, 5 standard tapers.

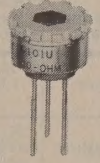


TYPE FD:
Dual version of Type F; front section: solder lug only, rear:pin or lug. Well suited for Bridged-T or L-pad attenuator applications.

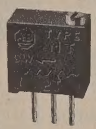
TYPE 90:
Cermet, single turn, 0.5W at 70°C, 100 ohms to 2 megs, ±20%, pin terminals, top and side adjustment, linear taper.

TYPE BT:
An all plastic version of the Type FD for excellent performance at high frequencies. Two terminal configurations available. Also well suited for Bridged-T or L-pad attenuator applications.

TYPE O:
Hot-molded composition, single turn, 0.4W at 70°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, 5 standard tapers.



TYPE Y:
Hot-molded composition, single turn, 0.25W at 50°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, 5 types, top and side adjustment, 5 standard tapers.



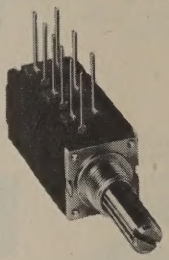
TYPE MT:
Cermet, 20 turns, 0.5W at 70°C, 10 ohms to 2 megs, ±10%, pin terminals, 7 types, top and side adjustment, linear taper.

SPECIFICATIONS

Type	Publication Number	Resistance Element and Adjustment Turns	Resistance Range and Tolerance	Power Rating	Voltage Rating (RMS or DC)	Operating Temperature Range	Terminal Types	Case Dimensions in Inches (millimeters)	Enclosure
E	5219	Cermet Single Turn	10 Ohms to 2 Megohms ±10%	0.5 Watt @ 70°C	300V	−55°C to +125°C	Pin	0.375 (9,52) Square by 0.197 (5,00) Thick	Immersion Sealed
D	5240		10 Ohms to 2 Megohms ±20%	0.5 Watt @ 70°C		−55°C to +125°C		0.375 (9,52) Diameter	Dust and Splash Resistant
90	5242		10 Ohms to 2 Megohms ±20%	0.5 Watt @ 70°C	200V	−55°C to +125°C		L 0.466 (11,85) W 0.393 (10,0) D 0.228 (5.8)	Open Frame
S	5208		50 Ohms to 1 Megohm ±10%	0.5 Watt @ 85°C	300V	−65°C to +150°C		0.375 (9,52) Diameter by 0.375 (9,52)	Immersion Sealed
A	5238		10 Ohms to 2 Megohms ±10%	0.5 Watt @ 85°C		−55°C to +150°C		0.250 (6,35) Diameter by 0.125 (3,18)	
MT	5241	Cermet 20 Turn	100 Ohms to 2 Megohms ±20%	1W @ 40°C .5W @ 70°C		−55°C to +125°C		0.375 (9.52) Square by 0.218 (5,54) Thick	
RT	5237		10 Ohms to 2 Megohms ±10%	0.75 Watt @ 70°C		−65°C to +125°C		L 0.750 (19,05) W 0.190 (4,83) H 0.250 (6,35) or H 0.340 (8,64)	
N	5206	Composition 25 Turn	100 Ohms to 2.5 Megohms ±10%, ±20%	0.33 Watt @ 50°C		−55°C to +100°C		L 1.250 (31,75) H 0.359 (9,13) W 0.250 (6,35)	
R	5205			0.25 Watt @ 70°C		−55°C to +125°C	Pin or Solder Lug		
F	5234	Composition Single Turn	100 Ohms to 5 Megohms ±10%, ±20%	0.25 Watt @ 70°C	350V	−55°C to +120°C	Pin or Solder Lug	0.500 (12,70) Diameter by 0.531 (13,49)	
FD	5231						Front: Lug Rear: Lug or Pin	0.500 (12,70) Diameter by 0.688 (17,46)	
BT	5236			Consult Factory		−40°C to +120°C	Front: 3 Lugs Rear: 3 Pins or Front: 2 Pins Rear: 2 Pins	0.500 (12,70) Diameter by 0.535 (13,59)	Dust and Splash Resistant
O	5235			0.4 Watt @ 70°C	350V	−55°C to +150°C	Pin or Solder Lug	0.500 (12,70) Diameter by 0.531 (13,49)	Immersion Sealed
Y	5209			0.25 Watt @ 50°C		−55°C to +100°C	Pin or Solder Lug	0.500 (12,70) Diameter by 0.359 (9,13)	Dust and Splash Resistant

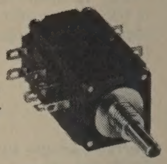
Allen-Bradley Variable Resistors

SERIES 70 MOD POT®: Modular design innovated by Allen-Bradley offers almost unlimited combinations: single, dual, triple or quadruple sections. Options include PC or solder lug terminals, variety of switches, vernier drives, concentric shafts, hot-molded composition, cermet or conductive plastic resistance elements.



SERIES 72 MOD POT®: Similar to Series 70, except the case, bushing and shaft are non-metallic. Available in single or dual combination only.

SERIES 73 MOD POT®: Another version of Series 70 for applications that require single or dual section controls.

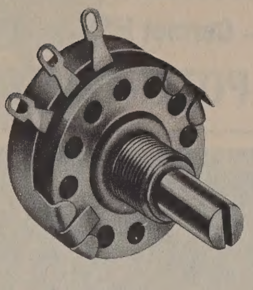


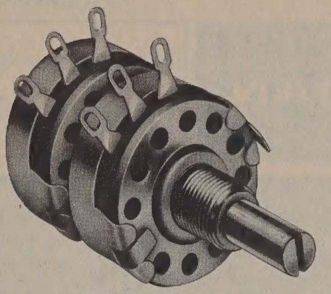
SPECIFICATIONS

Type	Publication Number	Resistance Element	Resistance Range and Tolerance	Power Rating (Linear Taper)	Voltage Rating (RMS or DC)	Operating Temperature Range	Number of Sections Available	Case Dimensions in Inches (millimeters)	Enclosure
70	5217	Cermet	100 Ohms to 1 Megohm ±10%	2.0 Watts @ 70°C	350 V	−55°C to +150°C	1, 2, 3 or 4	Lug terminal: 0.594 *(15.08)* Deep Pin terminal: 0.625 *(15.88)* Square (Single Section)	Dust and Splash Resistant
		Composition	50 Ohms to 10 Megohms ±10%, ±20%	1.0 Watt @ 70°C		−55°C to +120°C			
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70°C					
72	5217	Cermet	100 Ohms to 1 Megohm ±10%	1.0 Watt @ 70°C		−55°C to +100°C	1 or 2		
		Composition	50 Ohms to 10 Megohms ±10%, ±20%	0.5 Watt @ 70°C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%	0.25 Watt @ 70°C					
73	5217	Cermet	100 Ohms to 1 Megohm ±10%	2.0 Watts @ 70°C		−55°C to +120°C			
		Composition	50 Ohms to 10 Megohms ±10%, ±20%	0.75 Watt @ 70°C 1.0 Watt @ 40°C					
		Conductive Plastic	100 Ohms to 1 Megohm ±10%, ±20%	0.5 Watt @ 70°C					
J(RV 4)	5200	Composition	50 Ohms to 5 Megohms ±10%, ±20%	2.25 Watts @ 70°C	500V	−55°C to +120°C	1, 2 or 3	0.625 *(15,88)* Deep by 1.156 *(29,36)* Diameter (Single Section) [1]	
EJ	5230			2.25 Watts @ 70°C			1 or 2		
K	5222			3.0 Watts @ 70°C		−55°C to +150°C	1, 2 or 3		
G(RV 6)	5201		100 Ohms to 5 Megohms ±10%, ±20%	0.5 Watt @ 70°C	350V	−55°C to +120°C	1	For G, L and W: 0.469 *(11,91)* Deep For GD: 0.547 *(13,89)* Deep For WR: 0.422 *(10,72)* Deep by 0.500 *(12,70)* Diameter Above dimensions for types G and WR do not include the available switch option [1]	Immersion Sealed
GD	5213						2		
L	5233			0.8 Watt @ 70°C		−55°C to +150°C	1		
W	5212			0.5 Watt @ 70°C		−55°C to +120°C			Dust and Splash Resistant
WR	5220			0.5 Watt @ 70°C					Immersion Sealed
SP	5216	Cermet	50 Ohms to 1 Megohm ±10% (5% available)	1.0 Watt @ 70°C	300V	−65°C to +150°C		0.438 *(11,11)* Deep by 0.375 *(9,52)* Diameter	
M	5239	Conductive Plastic	100 Ohms to 1 Megohm ±20%	0.1 Watt @ 40°C	90V	−25°C to +100°C	1 or 2	0.394 *(10.0)* Cubed All Versions	Dust and Splash Resistant

[1] All depth dimensions are maximum.

TYPE J (RV 4):
Standard of the industry for quality. Hot-molded composition, 50 ohm to 5 megs, ±10% and ±20% (special values to 1000 megs available), 2.25W at 70°C, single, dual, triple sections available. Switch for single or dual sections.

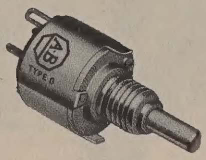


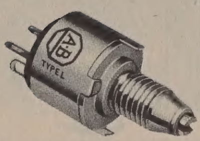


TYPE EJ:
Extra long life version of the Type J with rotational life exceeding one million rotations, single or dual configurations. Slip clutch available.

TYPE K:
A 3.0W at 70°C version of the popular Type J.

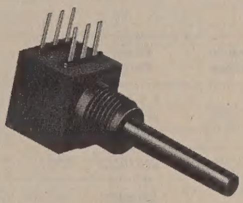
TYPE G (RV6):
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70°C, single section available with or without SPST switch.

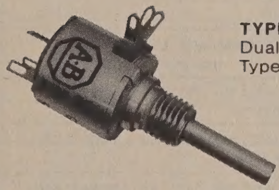




TYPE L:
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.8W at 70°C, single section.

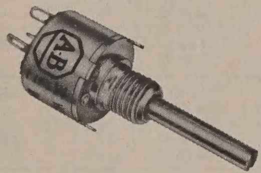
TYPE M:
Miniature conductive plastic, 100 ohms to 1 meg, ±20%, 0.1W at 40°C, single and dual sections available with or without SPDT switch. 5 terminal options. Non-metallic case, bushing and shaft.



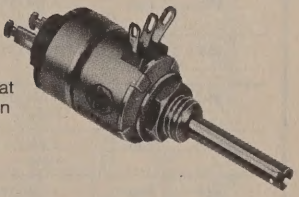


TYPE GD:
Dual section version of Type G.

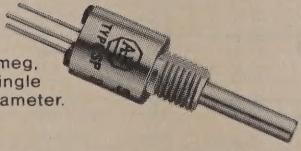
TYPE W:
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70°C, single section.



TYPE WR:
Radial-lead version of Type W. Available with or without switch. Switch versions offer contacts that close at start of clockwise rotation (TYPE WRS) or with switch with contacts that close at start of counter-clockwise rotation (TYPE WRH).



TYPE SP:
Cermet, 50 ohms to 1 meg, ±10%, 1.0W at 70°C, single section. Only ⅜ inch diameter.



Standard options for most types include linear and non-linear tapers, a variety of shafts, bushings, shaft endings, shaft lengths, and hardware.

Types GD, J and the multi-section MOD POT® with composition tracks are well suited for attenuator applications.

A-B
QUALITY
ALLEN-BRADLEY
Electronics Division
Milwaukee, Wisconsin 53204

BECKMAN®

Military — Cermet HELITRIM®

TRIMMING POTENTIOMETERS

Helitrim® POTENTIOMETER
HELIPOT DIVISION OF
BECKMAN INSTRUMENTS, INC.
FULLERTON, CALIF.–TORONTO, CANADA
Helitrim®
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6

Beckman Model	Mounting Style	Dimensions - L x W x H inch (mm)	No. of Turns	Resistance Range	Resistance Tolerance	Power Rating	Temp. Range	Tempco $(p/10^6/^\circ C$	Price		
									1-99	100-199	200-499
50	Lead	1 1/4 (31,8) x .297 (7,54) x 5/16 (7,95) high temp.	32	10Ω-2 meg	±10% <50Ω, ±20%	1.5 watts at 125°C	-65° to 200°C	±100	$8.19	$7.58	$6.66
53	Pins	1 1/4 (31,8) x .292 (7,42) x 19/64 (7,54) high temp.	32	10Ω-2 meg	±10% <50Ω, ±20%	1.5 watts at 125°C	-65° to 200°C	±100	7.50	7.13	6.75
54	Lug	1 1/4 (31,8) x .292 (7,42) x 19/64 (7,54) high temp.	32	10Ω-2 meg	±10% <50Ω, ±20%	1.5 watts at 125°C	65° to 200°C	±100	7.50	7.13	6.75
55L	Lead	1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74)	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	-65° to 175°C	±100	5.94	5.50	5.10
55P	Pins	1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74)	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	-65° to 175°C	±100	5.94	5.50	5.10
55S	Lug	1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74)	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	65° to 175°C	±100	5.94	5.50	5.10
56L	Lead	1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	-65° to 175°C	±100	5.94	5.50	5.10
56P	Pins	1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	-65° to 175°C	±100	5.94	5.50	5.10
58P	Pins	1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12Y	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	-65° to 175°C	±100	5.94	5.50	5.10
58S	Lug	1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12Y	22	10Ω-2 meg	±10% <50Ω, ±20%	1 watt at 85°C	65° to 175°C	±100	5.94	5.50	5.10
61P	Pins	1/4 (6,35) Dia. x 1/4 (6,35) Top Adj RJ50	1	10Ω-1 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	-65° to 150°C	±100	5.94	5.50	5.10
61PA	Pins (TO-5)	9/32 (7,14) Sq. x 3/8 (9,53) Side Adjust	1	10Ω-1 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	-65° to 150°C	±100	7.50	7.13	6.75
61M	Pins (TO-5)	3/8 (9,53) Sq. x .240 (6,10) Top Adjust	1	10Ω-1 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	-65° to 150°C	±100	7.50	7.13	6.75
63P	Pins (TO-5)	3/8 (9,53) Sq. x 3/16 (4,76) Side Adj RJ24	20	10Ω-2 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	65° to 150°C	±100	7.27	6.74	6.25
63W	Edge Pins	3/8 (9,53) x .240 (6,10) x .410 (10,4) Top Adj RJ24	20	10Ω-2 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	-65° to 150°C	±100	7.27	6.74	6.25
63X	Edge Pins	3/8 (9,53) x .240 (6,10) x .410 (10,4) Side Adj RJ24	20	10Ω-2 meg	±10% <100Ω, ±20% >500KΩ, ±20%	0.5 watt at 85°C	65° to 150°C	±100	7.27	6.74	6.25
64P	Pins (TO-5)	1/4 (6,35) Sq. x .170 (4,318)	22	10Ω-1 meg	+10%	0.25 watt at 85°C	-65° to 150°C	±100	5.71	5.29	4.91

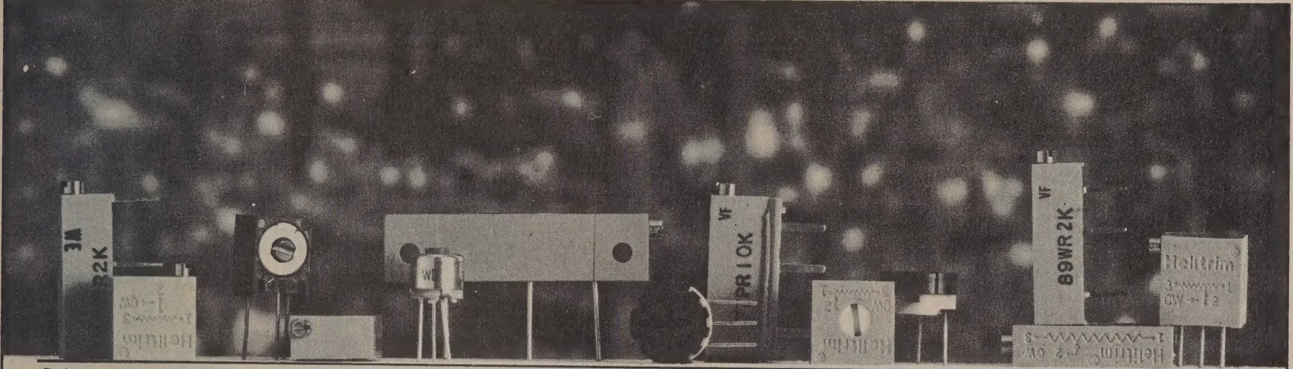
Notes:
1. Standard resistance values (ohms): 10, 20, 50, 100, 500, 1K, 5K, 10K, 20K, 25K, 50K, 100K, 200K, 250K, 500K, 1 meg, 2 meg.
2. All Helipot cermet trimming potentiometers have essentially infinite resolution.
3. Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

Industrial — Cermet HELITRIM®
TRIMMING POTENTIOMETERS



Beckman Model	Description (Adjustment — Pin Style)	Dimensions - L x W x H inch (mm)	No. of Turns	Resistance Range (Ω)	Rt Tol. (Note 1)	Power Rating (watts)	Max. Temp. (°C)	Tempco (p/10⁶/°C)	Prices		
									1-99	100-199	200-499
62P	Top adj; pins	1/4 (6,35) Dia. x 1/4 (6,35)	1	10-1 meg	±10%	0.5 at 70° C	125	±100	$2.27	$1.83	$1.65
62PA	Side adj; TO-5 pins	9/32 (7,14) x .290 (7,37) x 3/8 (9,53)	1	10-1 meg	±10%	0.5 at 70° C	125	±100	3.38	2.73	2.46
62PH	Top thumbwheel adj-pins	1/4 (6,35) Dia. x 5/16 (7,94)	1	10-1 meg	±10%	0.5 at 70° C	125	±100	3.38	2.73	2.46
62M	Top adj; TO-5 pins	1/4 (6,35) Dia. x 1/4 (6,35)	1	10-1 meg	±10%	0.5 at 70° C	125	±100	2.27	1.83	1.65
66P	Side adj; TO-5 pins	3/8 (9,53) Sq. x .200 (5,08)	20	10-2 meg	±10%	0.5 at 25° C	125	±100	3.82	3.54	3.28
66W	Top adj; edge pins	3/8 (9,53) x .200 (5,08) x .41 (10,4)	20	10-2 meg	±10%	0.5 at 25° C	125	±100	3.82	3.54	3.28
66X	Side adj; edge pins	3/8 (9,53) x .200 (5,08) x .41 (10,4)	20	10-2 meg	±10%	0.5 at 25° C	125	±100	3.82	3.54	3.28
68P	Side adj; TO-5 pins	3/8 (9,53) Sq. x .245	18	10-2 meg	±10%	0.5 at 70° C	125	±100	1.73	1.39	1.26
68X	Side adj; In-line pins	3/8 (9,53) Sq. x .245	18	10-2 meg	±10%	0.5 at 70° C	125	±100	1.73	1.39	1.26
68W	Top adj; In-line pins	3/8 (9,53) Sq. x .245	18	10-2 meg	±10%	0.5 at 70° C	125	±100	1.73	1.39	1.26
72P	Top adj; TO-5 pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72PL	Top adj; In-line pins	3/8 (9.53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72PX	Top adj; edge pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72PM	Top adj; wide pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72RPX*	Top adj; edge pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72RX*	Side adj; TO-5 pins	3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72RXL*	Side adj; In-line pins	3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72RXW*	Top adj; In-line pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72XW	Top adj; In-line pins	3/8 (9,53) Sq. x 3/16 (4,76)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72XL	Side adj; In-line pins	3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
72X	Side adj; TO-5 pins	3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53)	1	10-2 meg	±10%	0.5 at 70° C	125	±100	.83	.67	.61
76P	End adj; RJ11 pins	3/4 (19,1) x .190 (4,83) x .340 (8,64)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	2.83	2.28	2.06
77P	End adj; .2" (5,08) pin space	3/4 (19,1) x .280 (7,11) x .360 (9,14)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	2.83	2.28	2.06
78L	End adj; leads	1-1/4 (31,8) x .195 (4,95) x .320 (8,13)	22	10-2 meg	±10%	0.75 at 70° C	125	±100	3.24	3.00	2.78
78P	End adj; .1" (2,54) pin space	1-1/4 (31,8) x .195 (4,95) x .320 (8,13)	22	10-2 meg	±10%	0.75 at 70° C	125	±100	3.24	3.00	2.78
78S	End adj; .1" (2,54) pin space	1-1/4 (31,8) x .195 (4,95) x .320 (8,13)	22	10-2 meg	±10%	0.75 at 70° C	125	±100	3.24	3.00	2.78
79P	End adj; .1" (2,54) pin space	3/4 (19,1) x .190 (4,83) x .360 (9,14)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	2.83	2.28	2.06
82P	Top adj; pins	1/4 (6,35) Dia. x .150 (3,81)	1	10-1 meg	±10%	0.5 at 70° C	125	±100	1.73	1.39	1.26
82PA	Side adj; TO-5	.280 x .185 x .360	1	10-1 meg	±10%	0.5 at 70° C	125	±100	2.59	2.09	1.89
86P	End adj; TO-116	3/4 (19,05) x 1/4 (6,35) x .200 (5,08)	18	10-2 meg	±10%	0.5 at 25° C	105	±100	4.05	3.75	3.48
89P	End adj; .1" (2,54) pin space	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	125	±100	1.19	.96	.86
89PH†	End adj; .1" (2,54) pin space	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	1.19	.96	.86
89W	End adj; .2" (5,08) pin space	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	125	±100	1.19	.96	.86
89WH†	End adj; .2" (5,08) pin space	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	1.19	.96	.86
89X	End adj; RJ11 pins	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	125	±100	1.19	.96	.86
89XH†	End adj; RJ11 pins	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	105	±100	1.19	.96	.86
89Y	End adj; In-line	3/4 (19,05) x .190 (4,83) x 1/4 (6,35)	15	10-2 meg	±10%	0.75 at 25° C	125	±100	1.19	.96	.86
91A	Top adj; In-line .1" (2,54) pins	3/8 (9,53) Dia. x .200 (5,08)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91B	Top adj; TO-5 pins	3/8 (9,53) Dia. x 1/4 (6,35)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91C	Top adj; .172" (4,36) x .156" (3,96) pin space	3/8 (9,53) Dia. x 1/4 (6,35)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91D	Top adj; In-line .172" (4,36) pins	3/8 (9,53) Dia. x 1/4 (6,35)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91E	Top adj; .4" (10,16) x .1" (2,54) pin space	3/8 (9,53) Dia. x 1/4 (6,35)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91S	Side adj; .150" (3,81) pin space	3/8 (9,53) x 1/4 (6,35) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91T	Side adj; TO-5 pins	3/8 (9,53) x .345 (8,76) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91V	Side adj; .172" (4,36) x .156" (3,96) pin space	3/8 (9,53) x .400 (10,2) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91W	Side adj; In-line .1" (2,54) pins	3/8 (9,53) x 1/4 (6,35) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91X	Side adj; TO-5 pins	3/8 (9,53) x .345 (8,76) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91Y	Side adj; .172" (4,36) x .156" (3,96) pin space	3/8 (9,53) x .400 (10,2) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42
91Z	Side adj; In-line .172" (4,36) pins	3/8 (9,53) x 1/4 (6,35) x .385 (9,78)	1	10-2 meg	±20%	0.5 at 40° C	125	±100	.58	.46	.42

*Reverse rotation models.

†High profile models.

Notes:

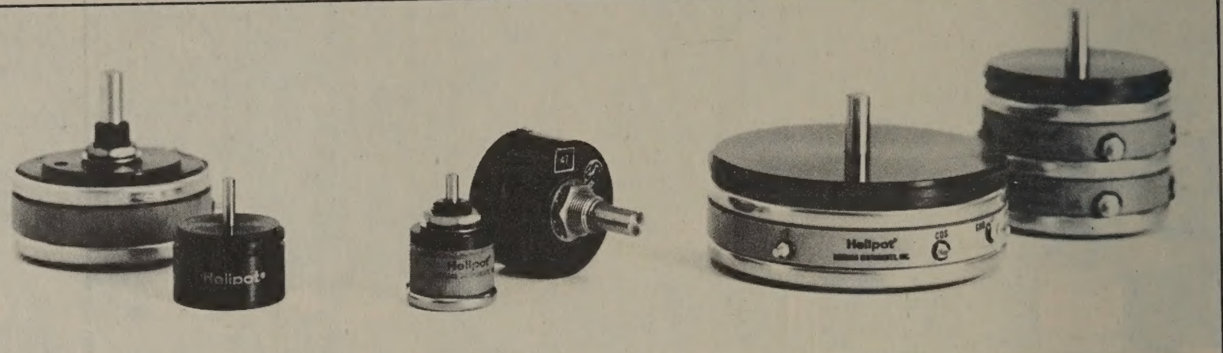
1. Resistance tolerances shown as ±10% are for resistence values >100Ω and <500KΩ. Other values are ±20%.
2. All Helipot cermet trimming potentiometers have essentially infinite resolution.
3. Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

Single-turn (wirewound cermet, conductive plastic & hybrid) HELIPOT®
PRECISION POTENTIOMETERS



Single-turn

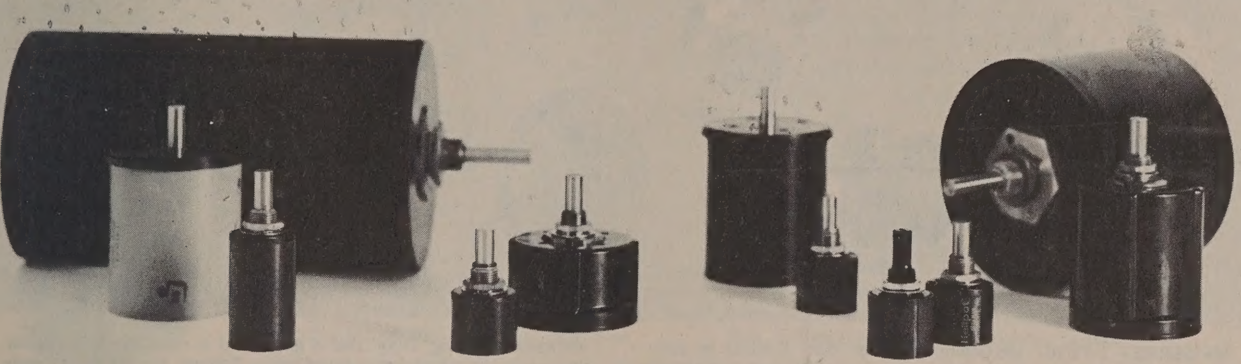
Housing Diameter	Resistance Element	Beckman Model Number	Mounting Type	Bearing Type	Range of Resistence Values (ohms)	Min. Practical Independent Linearity* (± %)	Power Rating (Watts at °C)	Starting Torque (max., oz.-in.)	Number of Cups	Ambient Temperature Range (°C)
7/8" .875" (22,225mm)	Wire	TP	Bushing	Ball	186-15K	0.2	1.25-70	0.1	4	−65 to 125
	Wire	TSP	Servo	Ball	186-15K	0.2	1.25-70	0.1	4	−65 to 125
	Wire	5101	Bushing	Sleeve	186-116K	0.25	0.75-40	0.2	4	−25 to 85
	Wire	5103	Servo	Ball	186-116K	0.25	0.75-40	0.2	4	−25 to 85
	Cermet	6103	Servo	Ball	150-1 meg	0.3	3.0-85	0.5	4	−65 to 150
	C.P.	6153	Servo	Ball	1K-50K	0.15	1.0-70	0.5	4	−65 to 125
	C.P.	6173	Servo	Ball	2K-200K	0.15	4.0-70	0.5	4	−65 to 125
	C.P.	6186	Bushing	Sleeve	1K-100K	0.5	1.0-70	1.0	1	−65 to 125
	Hybrid	8201	Bushing	Sleeve	500-10K	0.50	0.75-40	0.2	2	−25 to 85
	Hybrid	8203	Servo	Ball	500-10K	0.50	0.75-40	0.2	2	−25 to 85
1-1/16" 1.062" (26,988mm)	Wire	5211	Bushing	Sleeve	25-25K	0.15	1.0-40	0.4	4	−25 to 85
	Wire	5212	Servo	Sleeve	25-25K	0.15	1.0-40	0.4	4	−25 to 85
	Wire	5213	Servo	Ball	25-25K	0.15	1.0-40	0.3	4	−25 to 85
	Cermet	6213	Servo	Ball	100-1 meg	0.25	5.0-85	0.5	4	−65 to 150
	C.P.	6263	Servo	Ball	1K-10K	0.15	1.5-70	0.5	4	−65 to 125
	C.P.	6273	Servo	Ball	2K-200K	0.15	5.0-70	0.5	4	−65 to 125
1-5/16" 1.312" (33,338mm)	Wire	5311	Bushing	Sleeve	10-44.6K	0.5	2.0-40	1.0	1	−25 to 85
	Cermet	3301	Bushing	Sleeve	1K-1 meg	0.3	0.75-65	1.0	1	−25 to 105
	Cermet	6301	Bushing	Ball	250-1 meg	0.25	6.0-85	0.7	1	−65 to 150
	Cermet	6303	Servo	Ball	250-1 meg	0.25	6.0-85	0.7	1	−65 to 150
	C.P.	3351	Bushing	Sleeve	1K-10K	0.25	0.75-65	1.0	1	−25 to 105
	C.P.	3371	Bushing	Sleeve	2K-390K	0.25	1.0-65	1.0	1	−25 to 105
	C.P.	6351	Bushing	Ball	1K-10K	0.1	2.0-70	0.7	1	−65 to 125
	C.P.	6353	Servo	Ball	1K-10K	0.1	2.0-70	0.7	1	−65 to 125
1-7/16" 1.438" (36,512mm)	Wire	5401	Bushing	Sleeve	25-50K	0.15	2.0-40	1.6	4	−65 to 125
	Wire	5402	Servo	Sleeve	25-50K	0.15	2.0-70	1.6	4	−65 to 125
	Wire	5403	Servo	Ball	25-50K	0.15	2.0-70	0.6	4	−65 to 125
	Wire	5404	Pilot	Sleeve	25-50K	0.15	2.0-70	1.6	4	−65 to 125
	Wire	5405	Pilot	Ball	25-50K	0.15	2.0-70	0.6	4	−65 to 125
2" 2.000" (50,800mm)	Wire	5611	Bushing	Sleeve	15-80K	0.10	3.5-70	1.5	4	−65 to 125
	Wire	5612	Servo	Sleeve	15-80K	0.10	3.5-70	1.5	4	−65 to 125
	Wire	5613	Servo	Ball	15-80K	0.10	3.5-70	0.8	4	−65 to 125
	Wire	5614	Pilot	Sleeve	15-80K	0.10	3.5-70	1.5	4	−65 to 125
	Wire	5615	Pilot	Ball	15-80K	0.10	3.5-70	0.8	4	−65 to 125
	Wire	5616	Pilot/Servo	Sleeve	15-80K	0.10	3.5-70	1.5	4	−65 to 125
	Wire	5617	Pilot/Servo	Ball	15-80K	0.10	3.5-70	0.8	4	−65 to 125
	Cermet	6601	Bushing	Ball	250-1 meg	0.15	10.0-85	1.5	4	−65 to 150
	Cermet	6603	Servo	Ball	250-1 meg	0.15	10.0-85	1.5	4	−65 to 150
	C.P.	6651	Bushing	Ball	1K-10K	0.1	2.5-70	1.5	4	−65 to 125
	C.P.	6653	Servo	Ball	1K-10K	0.1	2.5-70	1.5	4	−65 to 125
	C.P.	6671	Bushing	Ball	2K-336K	0.1	8.0-70	1.5	4	−65 to 125
	C.P.	6673	Servo	Ball	2K-336K	0.1	8.0-70	1.5	4	−65 to 125
2" 2.000" (50,800mm)	Hybrid	8211	Bushing	Sleeve	1K-25K	F.Q.	3.5-70	1.5	2	−65 to 125
	Hybrid	8212	Servo	Sleeve	1K-25K	F.Q.	3.5-70	1.5	2	−65 to 125
	Hybrid	8213	Servo	Ball	1K-25K	F.Q.	3.5-70	0.8	2	−65 to 125
3" 3.000" (76,200mm)	Wire	5711	Bushing	Sleeve	25-145K	0.075	5.0-40	1.5	4	−65 to 85
	Wire	5712	Servo	Sleeve	25-145K	0.075	5.0-40	1.5	4	−65 to 85
	Wire	5713	Servo	Ball	25-145K	0.075	5.0-40	1.3	4	−65 to 85
	Wire	5714	Pilot	Sleeve	25-145K	0.075	5.0-40	1.5	4	−65 to 85
	Wire	5715	Pilot	Ball	25-145K	0.075	5.0-40	1.3	4	−65 to 85

*Values listed are available on special order. Standard Independent Linearity for all Helipot single-turn precision potentiometers is ±0.5%.
LEGEND TO ABBREVIATIONS: **C.P.**—Conductive Plastic. **Pilot**—3 hole/pilot mount. **Pilot/Servo**—Servo/3 hole pilot mount. **FQ**—Factory quote.
All specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

Multi-turn (wirewound & hybrids) HELIPOT®
PRECISION POTENTIOMETERS



Multi-turn

Housing Diameter	Number of Turns	Resistance Element	Beckman Model Number	Mounting Type	Bearing Type	Range of Resistance Values (ohms)	Standard Independent Linearity (± %)	Min. Practical Independent Linearity (± %)	Power Rating (watts at °C)	Starting Torque (max., oz.-in.)	Ambient Temperature Range (°C)
7/8" .875" (22,225mm)	3	Wire	7363	Servo	Ball	3-32.3K	0.25	0.15	1.5 at 70	0.6	−65 to 125
		Wire	7366	Bushing	Sleeve	3-32.3K	0.25	0.15	1.5 at 70	0.8	−65 to 125
	5	Wire	7463	Servo	Ball	5-53.8K	0.25	0.15	1.5 at 70	0.6	−65 to 125
		Wire	7466	Bushing	Sleeve	5-53.8K	0.25	0.15	1.5 at 70	0.8	−65 to 125
	10	Wire	7216	Bushing	Sleeve	10-125K	0.25	0.05	1.5 at 40	0.6	−65 to 85
		Wire	7221	Bushing	Sleeve	10-125K	0.25	0.05	2.0 at 25	0.6	−65 to 85
		Wire	7223	Servo	Ball	10-125K	0.25	0.05	2.0 at 70	0.6	−65 to 125
		Wire	7246	Bushing	Sleeve	10-125K	0.25	F.Q.	2.0 at 25	2.0	−25 to 85
		Wire	7263	Servo	Ball	10-107.8K	0.20	0.05	2.0 at 70	0.6	−65 to 125
		Wire	7266	Bushing	Sleeve	10-107.8K	0.20	0.05	2.0 at 70	0.8	−65 to 125
		Wire	7276	Bushing	Sleeve	100-100K	0.25	0.075	2.0 at 25	1.5	−25 to 105
		Wire	7281	Bushing	Sleeve	100-100K	0.25	0.075	2 at 70	0.8	−55 to 125
		Wire	7286	Bushing	Sleeve	100-100K	0.25	0.075	2 at 70	0.8	−55 to 125
		Hybrid	8103	Servo	Ball	1K-100K	0.25	F.Q.	2.0 at 70	0.6	−65 to 125
		Hybrid	8106	Bushing	Sleeve	1K-100K	0.25	F.Q.	2.0 at 70	0.8	−65 to 125
		Hybrid	8136	Bushing	Sleeve	1K-100K	0.25	F.Q.	2.0 at 25	1.5	−25 to 105
		Hybrid	8141	Bushing	Sleeve	1K-100K	0.25	F.Q.	2 at 70	0.8	−55 to 125
		Hybrid	8146	Bushing	Sleeve	1K-100K	0.25	F.Q.	2 at 70	0.8	−55 to 125
1-13/16" 1.812" (46,038mm)	3	Wire	C	Bushing	Sleeve	5-194.7K	0.50	0.10	3.0 at 40	3.0	−65 to 85
		Wire	9301	Bushing	Sleeve	30-192.6K	0.25	0.04	3.0 at 70	1.3	−65 to 125
		Wire	9303	Servo	Ball	30-192.6K	0.25	0.04	3.0 at 70	1.3	−65 to 125
	10	Wire	A	Bushing	Sleeve	10-648K	0.25	0.05	5.0 at 40	3.0	−65 to 85
		Wire	7601	Bushing	Sleeve	100-650K	0.15	0.025	5.0 at 70	1.3	−65 to 125
		Wire	7603	Servo	Ball	100-650K	0.15	0.025	5.0 at 70	1.3	−65 to 125
3-5/16" 3.312" (84,138mm)	15	Wire	B	Bushing	Sleeve	40-2 meg	0.5	0.035	10.0 at 40	2.7	−65 to 85
		Wire	BS	Servo	Sleeve	40-2 meg	0.5	0.035	10.0 at 40	2.7	−65 to 85
		Wire	BSP	Servo	Ball	40-2 meg	0.5	0.035	10.0 at 40	2.7	−65 to 85
	25	Wire	D	Bushing	Sleeve	60-3.312 meg	0.5	0.035	15.0 at 40	3.5	−65 to 85
		Wire	DSP	Servo	Ball	60-3.312 meg	0.5	0.035	15.0 at 40	3.5	−65 to 85
	40	Wire	E	Bushing	Sleeve	125-5.3 meg	0.5	0.035	20.0 at 40	3.5	−65 to 85
		Wire	ESP	Servo	Ball	125-5.3 meg	0.5	0.035	20.0 at 40	3.5	−65 to 85

F.Q.—Factory Quote. All specifications subject to change without notice.

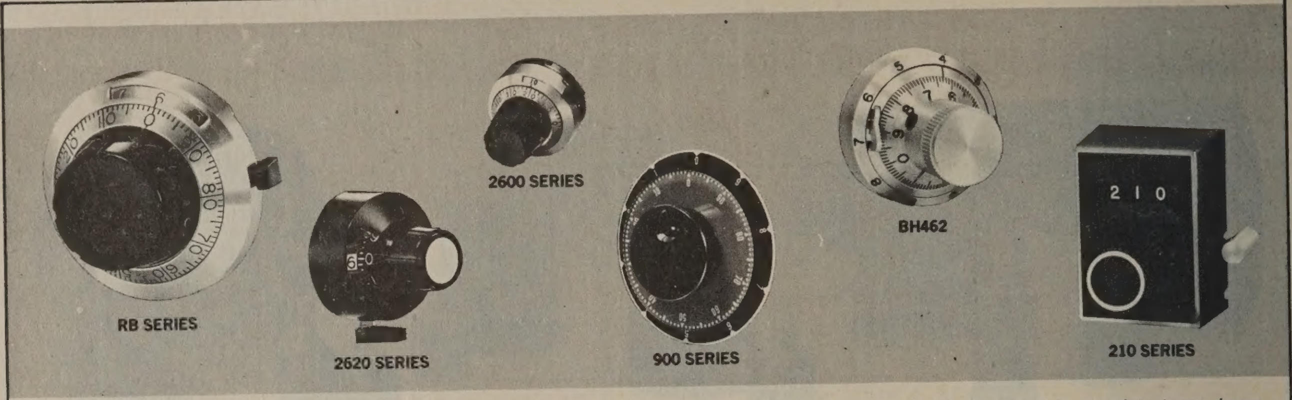
BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

Duodial® & Digidial®

TURNS-COUNTING DIALS



RB SERIES—1-13/16" (46,04mm) diameter dials finished in satin chrome with black-filled numerals and divisions (RBD has matte black finish and white-filled numerals and divisions). Built-in vibration-proof locking mechanism—knob and locking lever cap made of black nylon. Models can be used with most potentiometers, or other device, having from 1 to 15 mechanical turns.

2600/2610 SERIES—Miniature 7/8" (22,23mm) diameter versions of the RB Series. Ideally suited for applications where panel space is limited. Primarily for use with 7/8" (22,23mm) diameter multi-turn potentiometers but can be used with devices of any size having from 1 to 15 mechanical turns. All models have satin chrome finish, black-filled numerals and divisions, vibration-proof locking mechanism with black nylon cap, and black nylon knob. Series 2610 has 100 divisions.

2620 SERIES—Compact 1" (25,4mm) diameter provides panel space savings while retaining excellent readability. White numerals on black background for fiftieths of a turn, and black numerals on white background for full turns. May be used with devices with from 1 to 10 adjustment turns. Positive locking mechanism prevents accidental changes of setting, due to vibration or sudden shock. Rugged black housing and knob help assure long life and carefree operation. Model 2621 is designed for mounting on 1/8" (3,17mm) shafts, Models 2626 and 2627 mount on ¼" (6,35mm) shafts.

900 SERIES—Ideally suited to applications where precise settings and readability are required. 4¾" (12,07cm) diameter permits greater accuracy of setting. Outer dial is graduated in complete turns, inner vernier dial is graduated in hundredths. Settings can be made easily to three significant figures and estimated accurately to a fourth. For rapid changing of settings, an eccentric finger-hole is provided in the adjustment knob. The inner vernier dial and knob are made of plastic to eliminate body capacitance which might affect the setting. Since the knob is connected to the potentiometer shaft, backlash is thereby eliminated.

BH SERIES — Models BH462 and BH1462 offer quality appearance and reliable performance. High contrast black numerals on a clear anodized aluminum or grey plastic background allow ease of readability in either high or low ambient lighting. The primary dial is rigidly fixed to the shaft eliminating backlash. Ten complete turns of adjustment offer a full range of settings from 000 to 999. Combining precision features with attractive design are good reasons to use Beckman's Model BH462 and BH1462 on your next application.

210 SERIES—Miniature dials that have the same distinctive styling as the 205 Series, yet occupy less than 50% of the panel area. Their small size and excellent readability make them an ideal choice for use with potentiometers having a 1-13/16" (46,04mm) diameter or less. They have die cast zinc case finish with matte black enamel. Brushed aluminum locking lever prevents accidental movement and can be actuated without disturbing the setting.

Prices and specifications subject to change without notice.

	DUODIAL® and BH MODELS												DIGITAL® MODELS	
	RB RBC RBD	RBJ	2611 2601	2606 2616 2607 2617	2621	2626 2627	BH462	BH1462	901	902	903	904	210	211
Counting Capacity, max. turns	15				10					15	25	40	10	
Diameter, nominal (Duodials)	1 13/16" (46,04mm)		7/8" (22,23mm)		1" (25,4mm)				4 3/4" (12,07cm)				Not Applicable	
Height (Digidials)	Not Applicable												1 21/32" (42,1mm)	
Width (Digidials)	Not Applicable												1 7/32" (31,0mm)	
Depth, from panel face	1" (25,4mm)		.791" (20,09mm)	29/32" (23,01mm)	.938" (23,82mm)		1.000" (25,4mm)	1.125" (28,6mm)	1 1/32" (26,2mm)				1 9/32" (32,5mm)	
For Shaft diameter	1/4" (6,35mm)	1/8" (3,17mm)		1/4" (6,35mm)	1/8" (3,17mm)	1/4" (6,35mm)							1/4" (6,35mm)	1/8" (3,17mm)
Max. Shaft extension (from panel face)	13/16" (20,63mm)		43/64" (17,06mm)	25/32" (19,84mm)	.816" (20,72mm)		.800" (20,32mm)	.875" (22,22mm)	23/32" (18,25mm)				7/8" (22,22mm)	
Min. Shaft extension (from panel face)	9/16" (14,28mm)		15/32" (11,90mm)	37/64" (14,68mm)	.620" (15,74mm)		.600" (15,24mm)	.675" (17,14mm)	15/32" (11,90mm)				17/32" (13,49mm)	
Fore Bushing, thread	3/8-32-NEF	1/4-32-NEF		3/8-32-NEF	1/4-32-NEF	3/8-32-NEF				1/2-32-NS			3/8-32-NEF	1/4-32-NEF
Max. Bushing extension (from panel face)	13/32" (10,31mm)	19/64" (7,54mm)	.270" (6,85mm)	19/64" (7,54mm)	.335" (8,50mm)		.297" (7,54mm)		1/4" (6,35mm)				5/32" (3,96mm)	
Locking Mechanism	Positive Action						Positive Detent		Positive Action				Friction Type	
Price (1-9 Qty.)	RB =$6.65 RBC, RBD =$10.00	$41.00	2601=$8.00 2611=$6.95	2606=$7.75 2607=$8.25 2616=$6.75 2617=$7.20	$5.00	2626=$4.75 2627=$5.25	BH462=$8.66 BH1462=$7.02		$35.00				$15.75	$15.75

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION

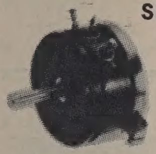
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

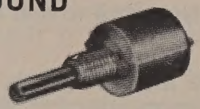
Bowmar
BOWMAR/TIC, Inc.

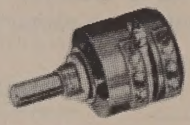
Dept. EM, 850 Lawrence Drive
Newbury Park, California 91320
Phone: (805) 498-2161/TWX 910-336-1265

PRECISION POTENTIOMETERS

SINGLE TURN WIREWOUND


SERVO POT
(PVR11)


ROTARY TRIMMER
(RV 1/2)


PANEL CONTROL
(TP09)

ALL MODELS MEET OR EXCEED MIL-R-12934

Precision Servo Pots
Size: 05, 09, 11, 15, 18, 20 & 30
Standard Resistance Ranges: 200 ohms to 250 K ohms
Wattage Ratings: 1, 1.5, 2, 3, and 4 watts
(approx. 1 watt per inch of diameter)
Rt TOL: ±5% standard, ±1% special
Linearity: to ±0.25%

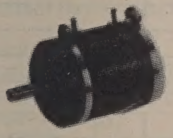
SINGLE TURN CONDUCTIVE PLASTIC

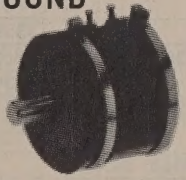
Conductive Plastic Pots®
Size: 09, 11, 15, 18, 20 & 30
Rt TOL: 10% standard, 4% special
Life: 50,000,000 revolutions
Taps located within ±2°, ±1° optional

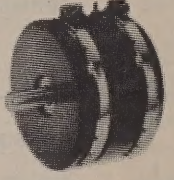
Linear or special functions
Multiple ganging with independent phasing
Standard Resistance Ranges: 500 ohms to 250 K ohms
Power Rating: 1.0 watt to 2.5 watts @ 70°C
Linearity: ±0.5% to 0.03%
Res. Temp. Coefficient: 300 ppm/°C max.

ALL MEET OR EXCEED MIL-R-19 SPECIFICATIONS

MULTI-TURN WIRE WOUND


09 Series
3, 5, 10 & 20 Turn

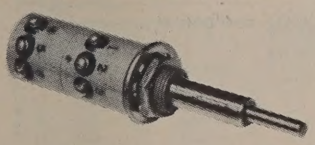

18 Series
3, 5, &10 Turn


20 Series
3, 5, & 10 Turn

Sizes: 09, 18, 20, —3, 5, 10, 20 Turn Potentiometers
Multiple-cup ganging with independent phasing
All welded internal connections
250 to 500 K ohms
Rt TOL: ±5% standard, ±1% optional
Multiple taps
Wattage up to 4 watts
(approx. 1.5 watts per inch of diameter)
Linearity: to ±.015%
Temperature Coefficient: 0.002%/°C

ALL MODELS TESTED TO MEET OR EXCEED ML-R-12934

CONCENTRIC SHAFTS 2 GANG MINIATURE

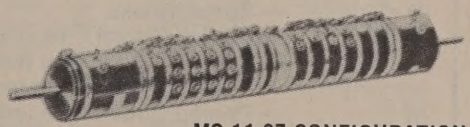


A new series of miniature 2-gang potentiometers with aerospace quality and performance capability, the Series PVR05, is now available to the engineer beset with space and weight restrictions. Dual concentric shafts allow independent operation of each gang. Smooth 3 oz. in. friction torque on each shaft provides adjustment stability. Mechanical stop strengths of 80 oz. in. prevents damage to the unit.

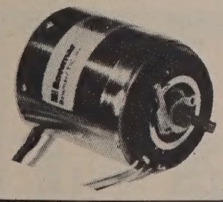
All this is available in a .625″ dia. x 1.500″ long unit weighing only 1 oz. (28 gms). A slightly longer unit (1.750″) weighing 1.16 oz. (33 gms) with a switch and detent operated by the rear potentiometer shaft is also available. The detent torque is a crisp 10 oz. in. for positive feel. Price and delivery varies with the many design variations of the new series.

VARI (F)UNCTION MODULES

Unitized Pot-Clutch Modules consisting of potentiometers, clutches, spring returns, synchro, brake combinations on an in line module.


MC 11-37 CONFIGURATION

DC TORQUER CP POTENTIOMETER COMBINATION



Temperature Coefficient: 300 ppm/°C max.
Standard Resistance Ranges: 500 ohms to 250 K ohms
Mechanical Angle: Continuous or limited
Power: .25 watt @ 125°C (potentiometer element only)
Accuracy: ±.25% independent linearity
Operational Temperature Range: —60°F to +250°F
Operational Altitude: 0 feet to 45,000 feet
Life: 30,000,000 cycles min.
Starting Torque: .2 in. oz. (max)
Output Potentiometer Smoothness: Per MIL-R-39203 0.1%
Condition C
Motor Input Voltage: 6 VDC—other voltages available

DESIGNED TO MEET OR EXCEED ENVIRONMENT TESTS CONDUCTED IN ACCORDANCE WITH MIL-R-5272

CUSTOM DESIGNED POTENTIOMETERS AND ROTATING COMPONENTS TO MEET SPECIAL REQUIREMENTS

Non-linear and Special Functions
Hostile Environments
Extended Life
Miniaturization
Vari (f)unction Packages

TRIMMING POTENTIOMETERS

TRIMPOT® ADJUSTMENT POTENTIOMETER

BOURNS®

SELECTION GUIDE INDEX

For details on specific models look under the applicable element type, size to find models described on previous pages.

RECTANGULAR MULTI-TURN

LENGTH	COMMERCIAL MODEL	INDUSTRIAL MODEL	MIL-SPEC MODEL
WIREWOUND			
1¼"	271/3/5	200 260 3057	RT12, RTR12
1"	3067	3070 220	RT10
¾"	3005		
CERMET			
1¼"		3059	RJ12, RJR12
¾"	3006 3009 3069	3099(DIP)	RJR32
½"		3082	RJR28
CARBON			
1¼"	272/4/6		

SQUARE MULTI-TURN

LENGTH	COMMERCIAL MODEL	INDUSTRIAL MODEL	MIL-SPEC MODEL
WIREWOUND			
½"	3255	3250	RT22, RTR22
⅜"		3280 3290	RT24, RTR24
¼"		3260	RT26
CERMET			
½"		3252	RJ22
⅜"	3299	3282, 3292	RJ24, RJR24
¼"		3262	RJ26, RJR26

SINGLE-TURN

LENGTH	COMMERCIAL MODEL	INDUSTRIAL MODEL	MIL-SPEC MODEL
WIREWOUND			
½"	3345		
5/16"	3305	3300	
CERMET			
½"		3359	
⅜"	3386	3352	
5/16"		3339†	
¼"	3326, 3329		RJ50
CARBON			
½"	3353, 3355		

†4 Turn Adjustment

PART NUMBERING SYSTEM

3006 P - 1 - 102 M

MODEL — 3006

TERMINAL TYPE see key below — P

CATALOG ITEM 2 or 3 digits indicate a special — 1

RESISTANCE CODE see below — 102

PANEL MOUNT if applicable — M

KEY TO TERMINAL TYPES

J	— Solder Hooks
L	— Insulated Stranded Leads
S	— Solder Hooks
P,T,Y	— Printed Circuit Pins (flat mounting)
H	— Printed Circuit Pins (see individual model catalog sheet for details)
W	— Printed Circuit Pins (edge mounting)
W-66 or X	— Printed Circuit Pins (edge mounting, side adjustment for worm gear units only)

Model 3386 only:

H,S,W	— Printed Circuit Pins (edge mounting)
P,R,T,K*,F*	— Printed Circuit Pins (flat mounting)*
D	— Printed Circuit Pins (DIP socket spacing)

NOTE: All models except 3352, 3353, 3355, 3359 are sealed against sand and dust

RESISTANCES

The following values are standard if they fall within limits listed for individual models. Other resistances available on special order.

WIREWOUND	CERMET	CARBON	CODE
50	10		100
20	20		200
50	50		500
100	100	100	101
200	200		201
		250	251
500	500	500	501
1K	1K	1K	102
2K	2K		202
		2.5K	252
5K	5K	5K	502

WIREWOUND	CERMET	CARBON	CODE
10K	10K	10K	103
20K	20K		203
		25K	253
50K	50K	50K	503
100K	100K	100K	104
	200K		204
		250K	254
	500K	500K	504
	1 Meg.	1 Meg	105
	2 Meg.	2 Meg.	205
		2.5 Meg	255
	5 Meg.	5 Meg	505

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

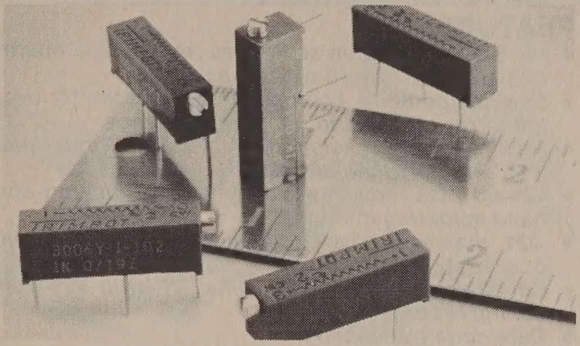
MODEL 3006*

COMMERCIAL TRIMPOT® POTENTIOMETER
CERMET ELEMENT

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Low cost.*
- *Low PC board profile, only ¼" off the board.*
- *Stable cermet element offers continuous resolution.*
- *High power rating: 0.75 watt at 70°C.*
- *Low temperature coefficient: 100 ppm/°C over −55° to +125°C temperature range.*
- *Sealed to MIL-R-22097 standard; withstands industrial cleaning processes.*
- *16 independent wiper contacts assure excellent setability.*
- *Wiper assembly idles at both ends of travel eliminating the possibility of damage from forced adjustment.*



** Patent No. 3,659,245*

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart on front) . . . . . 10 to 2,000,000 ohms
Resistance Tolerance . . . . ±10% standard, closer tolerances available
Absolute Minimum Resistance . . . . 3.0% or 1.0 ohm, whichever is greater
Continuity . . . . Maintained for full mechanical range
Insulation Resistance: 500 volts DC . . . . 100 megohms minimum
Contact Resistance Variation, Maximum . . . . 3 ohms or 3%, whichever is greater
Resolution . . . . Infinite
Setability (Voltage Divider) 0.02%

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
25°C . . . . 1.25 watt
70°C . . . . 0.75 watt
125°C . . . . 0.25 watt
Operating Temperature Range . . . . −55° to +125°C
Temperature Coefficient . . . . ±100 ppm/°C all resistances maximum
Humidity, MIL-STD-202, Method 106 . . . . 20 megohms minimum insulation resistance after removal from chamber
Seal . . . . . . Meets immersion requirements of MIL-R-22097
Vibration 20Gs
Contact Bounce . . . . 0.1 millisecond maximum
Wiper Shift, Maximum 2.0%
Shock 50Gs
Contact Bounce and Wiper Shift . . . . . . Same as vibration
Load Life . . . . 1,000 hours 0.75 watt at 70°C
Mechanical Life . . . . 200 cycles without discontinuity
Dielectric Strength
Room Conditions . . . . 1,000 volts AC
80,000 feet (0.8" hg) . . . . 250 volts AC

PHYSICAL CHARACTERISTICS

Shaft Torque . . . . 5.0 oz.-in. maximum
Markings . . . . Manufacturer's name or symbol, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)
Appearance . . . . Legible markings, no physical defects
Mechanical Adjustment . . . . 15 turns nominal
Mechanical Stops . . . . Wiper assembly idles
Weight . . . . Approximately 0.1 oz.
Terminals . . . . Solderable pins

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

RESISTANCE (OHMS)	PART NUMBERS* PRINTED CIRCUIT PINS 3006P	3006W	3006Y
10	3006P-1-100	3006W-1-100	3006Y-1-100
20	3006P-1-200	3006W-1-200	3006Y-1-200
50	3006P-1-500	3006W-1-500	3006Y-1-500
100	3006P-1-101	3006W-1-101	3006Y-1-101
200	3006P-1-201	3006W-1-201	3006Y-1-201
500	3006P-1-501	3006W-1-501	3006Y-1-501
1,000	3006P-1-102	3006W-1-102	3006Y-1-102
2,000	3006P-1-202	3006W-1-202	3006Y-1-202
5,000	3006P-1-502	3006W-1-502	3006Y-1-502

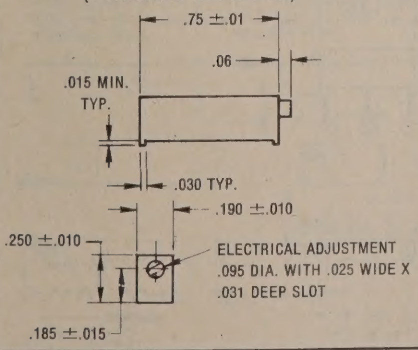
SPECIAL RESISTANCES AVAILABLE FROM 10 TO 5,000,000 OHMS.

RESISTANCE (OHMS)	PART NUMBERS* PRINTED CIRCUIT PINS 3006P	3006W	3006Y
10,000	3006P-1-103	3006W-1-103	3006Y-1-103
20,000	3006P-1-203	3006W-1-203	3006Y-1-203
50,000	3006P-1-503	3006W-1-503	3006Y-1-503
100,000	3006P-1-104	3006W-1-104	3006Y-1-104
200,000	3006P-1-204	3006W-1-204	3006Y-1-204
500,000	3006P-1-504	3006W-1-504	3006Y-1-504
1,000,000	3006P-1-105	3006W-1-105	3006Y-1-105
2.000.000	3006P-1-205	3006W-1-205	3006Y-1-205

**The last three digits of the part number represent the resistance in standard code.*

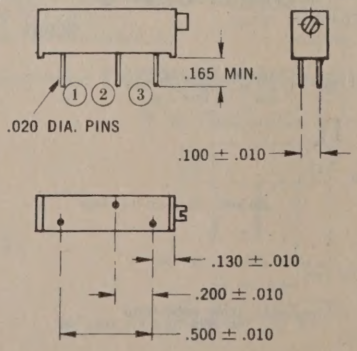
DIMENSIONS

3006 BASIC DIMENSIONS
(Terminals not shown)

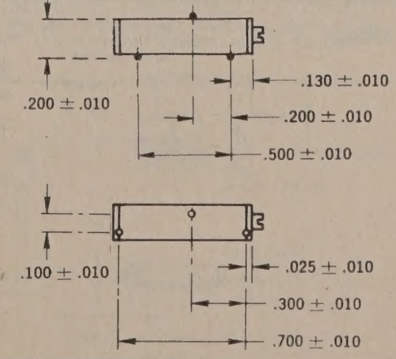


TERMINAL DIMENSIONS

3006P



3006W



BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

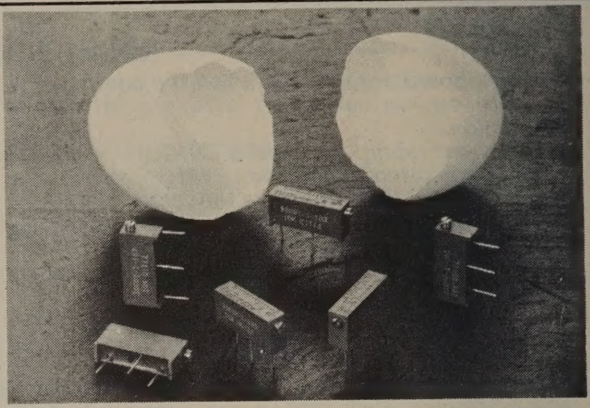
MODEL 3009

COMMERCIAL E-Z-TRIM® POTENTIOMETER
CERMET ELEMENT

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Mil-Spec immersion seal gives trouble-free operation after P.C. board processes.*
- *Low temperature coefficient: ±100 ppm/°C over entire resistance and temperature range.*
- *Stable, infinite resolution PALIRIUM® Cermet element and outstanding ±0.05% setability.*
- *Tinned pins for compatibility with automated and hand soldering methods.*
- *.021 diameter pins alleviate complicated circuit board fabrication.*
- *Space-saving size: .75" x .19" x .35" with RJ11 pin configuration.*
- *Date code traceability.*
- *Wiper assembly idles at both ends of travel, preventing damage from forced adjustment.*



SPECIFICATIONS

ELECTRICIAL CHARACTERISTICS

Standard Rsistance Range (see chart on front) .... 10 ohms to 2 megohm
Resistance Tolerance* .... ±10% standard, closer tolerances available
Absolute Minimum Resistance* .... 2.0% or 1.0 ohm, whichever is greater
Continuity* .... Maintained for full mechanical range
Insulation Resistance, 500 volts DC .... 100 megohms minimum
Resolution .... Infinite

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
25°C .... 0.75 watt
125°C .... 0 watt
Operating Temperature Range .... −55 to +125°C
Temperature Coefficient .... ±100 ppm/°C all resistances maximum
Humidity, MIL-STD-202, Method 106 .... 20 megohms minimum insulation resistance after removal from chamber
Seal* .... Mil-Spec immersion
Vibration 20G
Contact Bounce .... 0.1 millisecond maximum
Wiper Shift, maximum 2.0%
Shock 50G
Contact Bounce and Wiper Shift ..... Same as Vibration
Load Life .... 1000 Hours 0.75 watt at 25°C
Mechanical Life .... 200 cycles without discontinuity
Dielectric Strength
Room Conditions .... 1000 volts AC
80,000 feet (0.8" hg) .... 250 volts AC

PHYSICAL CHARACTERISTICS

Shaft Torque* .... 5.0 oz.-in. maximum
Markings* .... Manufacturer's name, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)
Appearance* ...... Legible markings, no physical defects
Mechanical adjustment* .... 20 turns nominal
Mechanical Stops* .... Wiper assembly idles
Weight .... Approximately 0.1 oz.
Terminals .... Printed circuit pins

* Inspection Note: 100% or statistical sampling inspection performed to insure highest quality.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

RESISTANCE (OHMS)	PART NUMBERS*	
	3009 PRINTED CIRCUIT PINS	3009Y PRINTED CIRCUIT PINS
10	3009P-1-100	3009Y-1-100
20	3009P-1-200	3009Y-1-200
50	3009P-1-500	3009Y-1-500
100	3009P-1-101	3009Y-1-101
200	3009P-1-201	3009Y-1-201
500	3009P-1-501	3009Y-1-501
1,000	3009P-1-102	3009Y-1-102
2,000	3009P-1-202	3009Y-1-202
5,000	3009P-1-502	3009Y-1-502

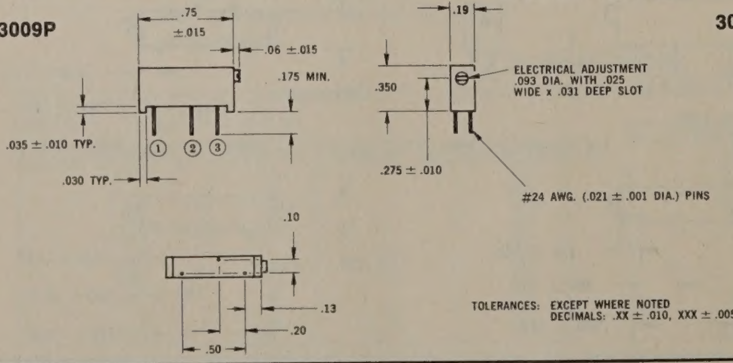
SPECIAL RESISTANCES AVAILABLE FROM 10 OHMS TO 2 MEGOHM

RESISTANCE (OHMS)	PART NUMBERS*	
	3009 PRINTED CIRCUIT PINS	3009Y PRINTED CIRCUIT PINS
10,000	3009P-1-103	3009Y-1-103
20,000	3009P-1-203	3009Y-1-203
50,000	3009P-1-503	3009Y-1-503
100,000	3009P-1-104	3009Y-1-104
200,000	3009P-1-204	3009Y-1-204
500,000	3009P-1-504	3009Y-1-504
1,000,000	3009P-1-105	3009Y-1-105
2,000,000	3009P-1-205	3009Y-1-205

**The last three digits of the part number represent the resistance in standard code.*

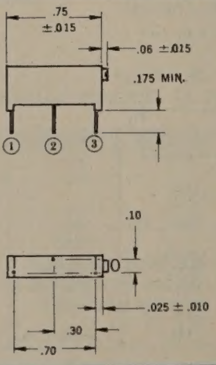
DIMENSIONS

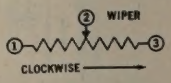
3009P


.75
±.015
.06 ±.015
.175 MIN.
.035 ± .010 TYP.
①
②
③
.030 TYP.
.19
.350
.275 ± .010
ELECTRICAL ADJUSTMENT .093 DIA. WITH .025 WIDE x .031 DEEP SLOT
#24 AWG. (.021 ± .001 DIA.) PINS
.10
.13
.20
.50

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX ± .010, XXX ± .005

3009Y





BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

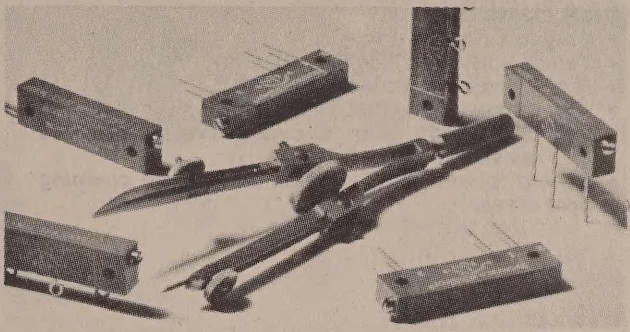
MODEL 3059

POTENTIOMETER—1¼″ LONG
INDUSTRIAL—CERMET

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Meets or exceeds all requirements of MIL-R-22097, Characteristics C, F, Style RJ12 and MIL-R-39035, Style RJR12*
- *Complete resistance range: 10 ohms to 2 megohm*
- *High operating temperature (150°C)*
- *High power dissipation 1.0 watt at 70°C*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range .... 10 ohms to 2 megohm
Resistance Tolerance .... ±10% standard, closer tolerances available
Absolute Minimum Resistance .... 2 ohms maximum
Continuity .... Maintained for full mechanical range
Insulation Resistance, 500 volts DC .... 1000 megohms minimum
Contact Resistance Variation, Maximum .. 3 ohms or 3.0%, whichever is greater
Adjustability*
  Voltage Ratio .... ±0.05%
  Resistance .... ±0.10%

ENVIRONMENTAL CHARACTERISTICS

Power Ratings
  70°C .... 1.0 watt or 400 volts maximum
  150°C .... 0 watt
Operating Temperature Range .... −55 to +150°C
Temperature Coefficient Maximum .... ±100 ppm/°C all resistances
Humidity, MIL-R-22097 .... 100 megohms minimum insulation resistance afterremoval from chamber
Vibration MIL-R-22097, 20G
  Contact Bounce .... 0.1 millisecond maximum
  Wiper Shift, Maximum .... 1.0% voltage ratio
Shock MIL-R-22097, 50G
  Contact Bounce and Wiper Shift ..... Same as Vibration

Salt Spray .... Meets MIL-STD-202, Method 101A
Load Life .... 1000 hours per MIL-R-22097
  Resistance Shift, Maximum 2.0%
Mechanical Life .... 200 cycles without discontinuity
Dielectric Strength MIL-R-22097
  Room Conditions .... 900 volts AC
  70,000 feet .... 350 volts AC

PHYSICAL CHARACTERISTICS

Immersion Leak Test .... No leaks
Shaft Torque .... 5.0 oz.-in. maximum
Markings .... Manufacturer's name, wiring diagram, date code, resistance and manufacturer's part number. (Customer's part number optional)
Appearance .... Legible markings, no physical defects
Mechanical Adjustment .... 22 ±5 turns
Mechanical Stops .... Wiper assembly idles
Weight .... Approximately 0.1 oz.
Terminals:
  L ...... Teflon-insulated, standard leads, 30 AWG (0.024) O.D.) 7 strands/38 AWG
  P, Y .... Solderable circuit pins
  J .... Solderable solder lugs

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

STANDARD RESISTANCES

RESISTANCE (OHMS)	PART NUMBERS*			
	3059L STRANDED INSULATED LEAD WIRES	3059P PRINTED CIRCUIT PINS	3059Y PRINTED CIRCUIT PINS	3059J SOLDER LUGS
10	3059L-1-100	3059P-1-100	3059Y-1-100	3059J-1-100
20	3059L-1-200	3059P-1-200	3059Y-1-200	3059J-1-200
50	3059L-1-500	3059P-1-500	3059Y-1-500	3059J-1-500
100	3059L-1-101	3059P-1-101	3059Y-1-101	3059J-1-101
200	3059L-1-201	3059P-1-201	3059Y-1-201	3059J-1-201
500	3059L-1-501	3059P-1-501	3059Y-1-501	3059J-1-501
1,000	3059L-1-102	3059P-1-102	3059Y-1-102	3059J-1-102
2,000	3059L-1-202	3059P-1-202	3059Y-1-202	3059J-1-202
5,000	3059L-1-502	3059P-1-502	3059Y-1-502	3059J-1-502

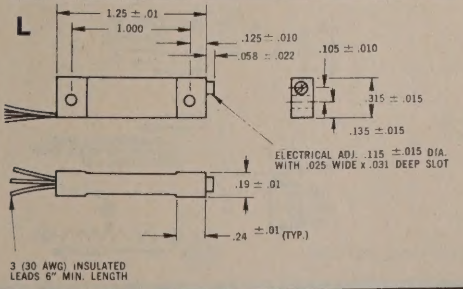
SPECIAL RESISTANCES AVAILABLE FROM 10 OHMS TO 2 MEGOHM.
** The last three digits of the part number represent the resistance in standard code.*

RESISTANCE (OHMS)	PART NUMBERS*			
	3059L STRANDED INSULATED LEAD WIRES	3059P PRINTED CIRCUIT PINS	3059Y PRINTED CIRCUIT PINS	3059J SOLDER LUGS
10,000	3059L-1-103	3059P-1-103	3059Y-1-103	3059J-1-103
20,000	3059L-1-203	3059P-1-203	3059Y-1-203	3059J-1-203
50,000	3059L-1-503	3059P-1-503	3059Y-1-503	3059J-1-503
100,000	3059L-1-104	3059P-1-104	3059Y-1-104	3059J-1-104
200,000	3059L-1-204	3059P-1-204	3059Y-1-204	3059J-1-204
500,000	3059L-1-504	3059P-1-504	3059Y-1-504	3059J-1-504
750,000	3059L-1-754	3059P-1-754	3059Y-1-754	3059J-1-754
1,000,000	3059L-1-105	3059P-1-105	3059Y-1-105	3059J-1-105
2,000,000	3059L-1-205	3059P-1-205	3059Y-1-205	3059J-1-205

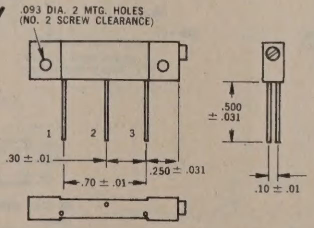
NOTE: Panel Mount Model 3059 available with leads or solder lugs. When ordering, add "M" to part number. Example: 3059L-1-203M.

DIMENSIONS

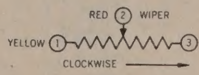
L


1.25 ± .01
1.000
.125 ± .010
.058 ± .022
.105 ± .010
.315 ± .015
.135 ± .015
ELECTRICAL ADJ. .115 ±.015 DIA. WITH .025 WIDE x .031 DEEP SLOT
.19 ± .01
.24 ±.01 (TYP.)
3 (30 AWG) INSULATED LEADS 6" MIN. LENGTH

Y



TOLERANCES:
.XX = ± .015
.XXX = ± .005
EXCEPT WHERE NOTED



BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

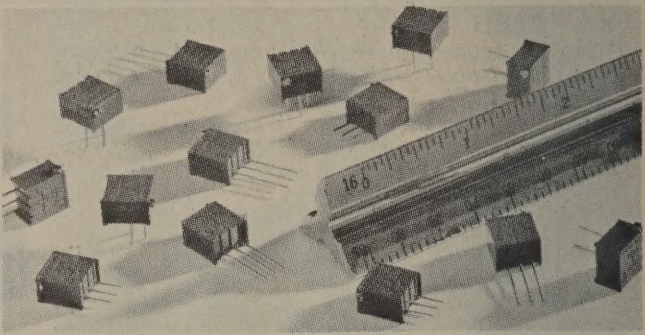
MODEL 3299

COMMERCIAL CERMET POTENTIOMETER
⅜" SQUARE

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Very low cost.*
- *Typical CRV of 3% (1% available)*
- *High power rating: ½ watt @ 70°C.*
- *Small size: .375" x .395" x .240" high.*
- *Low T.C.: ±100 ppm/°C over entire temperature and resistance range.*
- *Sealed to withstand wave-soldering and cleaning processes.*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart on front) .... 10Ω to 1,000,000 ohms
Resistance Tolerance .... ±10% standard, closer tolerances available
Absolute Minimum Resistance .....5 ohms, all resistances
Continuity .... Maintained for full mechanical range
Insulation Resistance, 500 volts DC .... 1,000 megohms minimum
Contact Resistance Variation Maximum .... 3 ohms or 3%, whichever is greater. Consult factory for 1%

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
70°C .... 0.5 watt or 300 volts maximum
125°C .... .0 watt
Operating Temperature Range .... —55° to +125°C
Temperature Coefficient per MIL-R-22097 .. ±100 ppm/°C maximum all resistances
Moisture Resistance, MIL-STD-202D, Method 103B ..... 10 megohms minimum insulation resistance after removal from chamber
Seal .... Withstands industrial cleaning processes
Vibration .... Exceeds MIL-R-22097, 20Gs
Contact Bounce .... 0.1 millisecond maximum
Wiper Shift Maximum .... 1.0% voltage ratio
Shock .... Exceeds MIL-R-22097, 100Gs
Contact Bounce and Wiper Shift ..... Same as vibration
Salt Spray .... Meets MIL-R-22097
Load Life .... 1,000 hours per MIL-R-22097
Resistance Shift, maximum 3%
Mechanical Life .... 200 cycles without discontinuity
Dielectric Strength MIL-R-22097
Room Conditions .... 900 volts AC minimum
70,000 feet.................... 350 volts AC minimum

PHYSICAL CHARACTERISTICS

Shaft Torque .... 3 oz.-in. maximum
Markings .... Manufacturer's name, wiring diagram, date code, resistance and manufacturer's model number (customer's part number optional)
Mechanical Adjustment .... 25 ±5 turns
Mechanical Stops .... Wiper assembly idles
Weight .... Approximately .04 oz.
Terminals:
P, X, W .... Solderable printed circuit pins
Mounting .... Mount by printed circuit pins
Specification Note: Closer performance tolerances can be supplied upon request.
Specifications are subject to change without notice.

STANDARD RESISTANCES

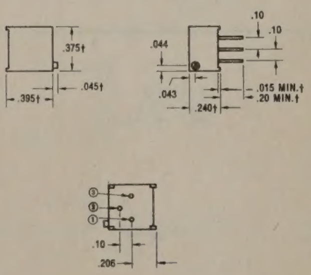
RESISTANCE (OHMS)	PART NUMBERS*		
	3299P PRINTED CIRCUIT PINS	3299W PRINTED CIRCUIT PINS	3299X PRINTED CIRCUIT PINS
10	3299P-1-100	3299W-1-100	3299X-1-100
20	3299P-1-200	3299W-1-200	3299X-1-200
50	3299P-1-500	3299W-1-500	3299X-1-500
100	3299P-1-101	3299W-1-101	3299X-1-101
200	3299P-1-201	3299W-1-201	3299X-1-201
500	3299P-1-501	3299W-1-501	3299X-1-501
1,000	3299P-1-102	3299W-1-102	3299X-1-102
2,000	3299P-1-202	3299W-1-202	3299X-1-202
5,000	3299P-1-502	3299W-1-502	3299X-1-502

RESISTANCE (OHMS)	PART NUMBERS*		
	3299P PRINTED CIRCUIT PINS	3299W PRINTED CIRCUIT PINS	3299X PRINTED CIRCUIT PINS
10,000	3299P-1-103	3299W-1-103	3299X-1-103
20,000	3299P-1-203	3299W-1-203	3299X-1-203
50,000	3299P-1-503	3299W-1-503	3299X-1-503
100,000	3299P-1-104	3299W-1-104	3299X-1-104
200,000	3299P-1-204	3299W-1-204	3299X-1-204
500,000	3299P-1-504	3299W-1-504	3299X-1-504
1,000,000	3299P-1-105	3299W-1-105	3299X-1-105
2,000,000	3399P-1-205	3299W-1-205	3299X-1-205
5,000,000	3299P-1-505	3299W-1-505	3299X-1-505

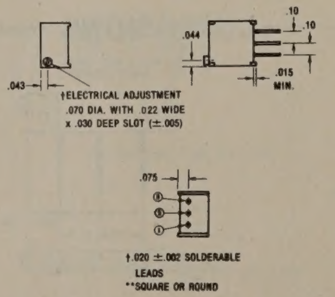
**The last three digits of the part number represent the resistance in standard code.*

DIMENSIONS

3299P



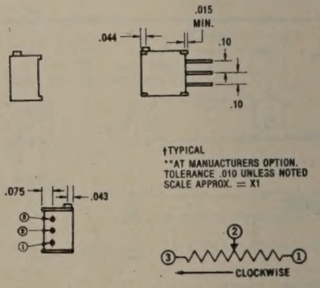
3299W



†ELECTRICAL ADJUSTMENT .070 DIA. WITH .022 WIDE x .030 DEEP SLOT (±.005)

†.020 ±.002 SOLDERABLE LEADS
**SQUARE OR ROUND

3299X



†TYPICAL
**AT MANUACTURERS OPTION.
TOLERANCE .010 UNLESS NOTED
SCALE APPROX. = X1

BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

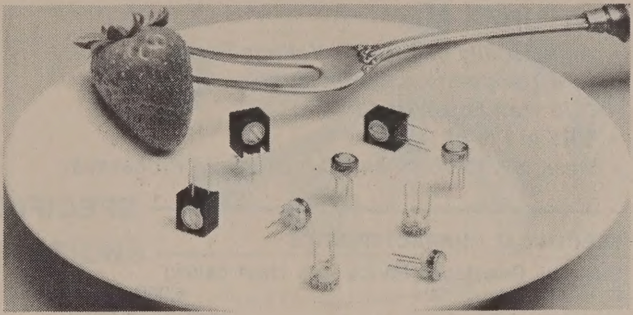
MODEL 3329

SINGLE TURN, COMMERCIAL
CERMET ELEMENT

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Low cost commercial Cermet single turn capable of meeting MIL-R-22097.*
- *Space saving size: 0.25" dia. x 0.18" high.*
- *Low temperature coefficient: ±100 ppm/°C over entire temperature and resistance range.*
- *0.5 watt power rating at 85°C.*
- *Extended temperature range: —55° to +150°C.*
- *Sealed to withstand any wave soldering and immersion cleaning process.*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart on front) . . 10 ohms to 1 megohm
Resistance Tolerance . . . . 20% standard, closer tolerances available
Absolute Minimum Resistance . . . . 2 ohms
Continuity . . . . Maintained for full mechanical range
Contact Resistance Variation Maximum . . . . 3 ohms or 3%, whichever is greater
Insulation Resistance, 500 volts DC . . . . 1,000 megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
85°C . . . . 0.5 watt
150°C . . . . 0 watt
Operating Temperature Range . . . . —55° to +150°C
Temperature Coefficient . . . . Maximum ±100 ppm/°C all resistances
Humidity, MIL-STD-202, Method 103 . . . . 10 megohms minimum insulation resistance after removal from chamber
Vibration . . . . Exceeds MIL-R-22097, 30G
Contact Bounce . . . . 0.1 millisecond maximum
Shock . . . . Exceeds MIL-R-22097, 100G
Contact Bounce . . . . Same as Vibration
Salt Spray . . . . Meets MIL-R-22097
Load Life . . . . 1,000 hours per MIL-R-22097
Mechanical Life . . . . 200 cycles without discontinuity
Effective Electrical Rotation . . . . 240° nominal
Dielectric Strength MIL-R-22097
Room Conditions . . . . 600 volts AC minimum

PHYSICAL CHARACTERISTICS

(85°C) Immersion Leak Test . . . . No leaks
Markings . . . . Date code, resistance, and manufacturer's model number
Appearance . . . . Legible markings, no physical defects
Mechanical Stops . . . . Solid
Shaft Torque . . . . 5.0 oz.-in. maximum
Weight . . . . Approximately 0.08 oz.
Terminals H.P.W. . . . . Tinned Pins

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

RESISTANCE (OHMS)	PART NUMBERS*		
10	3329H-1-100	3329P-1-100	3329W-1-100
20	3329H-1-200	3329P-1-200	3329W-1-200
50	3329H-1-500	3329P-1-500	3329W-1-500
100	3329H-1-101	3329P-1-101	3329W-1-101
200	3329H-1-201	3329P-1-201	3339W-1-201
500	3329H-1-501	3329P-1-501	3329W-1-501
1K	3329H-1-102	3329P-1-102	3329W-1-102
2K	3329H-1-202	3329P-1-202	3329W-1-202

SPECIAL RESISTANCES AVAILABLE FROM 10 OHMS TO 2 MEGOHMS.

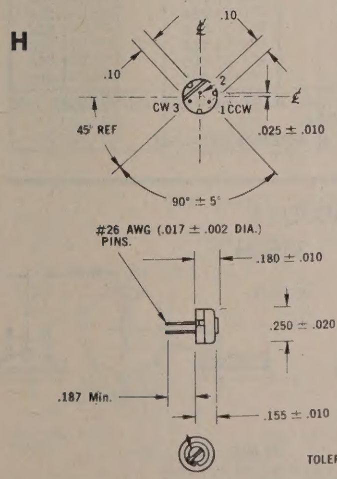
RESISTANCE (OHMS)	PART NUMBERS*		
5K	3329H-1-502	3329P-1-502	3329W-1-502
10K	3329H-1-103	3329P-1-103	3329W-1-103
20K	3329H-1-203	3329P-1-203	3329W-1-203
50K	3329H-1-503	3329P-1-503	3329W-1-503
100K	3329H-1-104	3329P-1-104	3329W-1-104
200K	3329H-1-204	3329P-1-204	3329W-1-204
500K	3329H-1-504	3329P-1-504	3329W-1-504
1 Meg	3329H-1-105	3329P-1-105	3329W-1-105

**The last three digits of the part number represent the resistance in standard code.*

DIMENSIONS

3329

H



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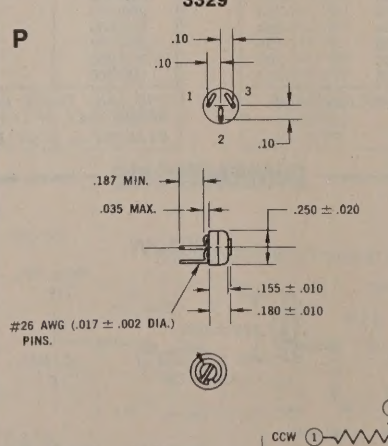
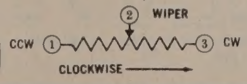


TOLERANCE: EXCEPT WHERE NOTED : .XX ± .010, .XXX ± .005



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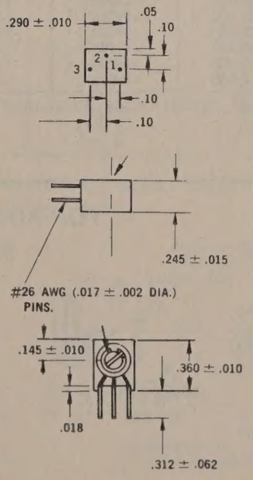


BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

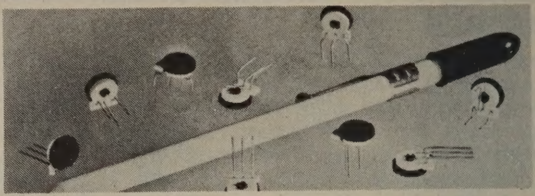
MODEL 3352

COMMERCIAL, CERMET VARIABLE RESISTOR
⅜" DIAMETER

BOURNS® VARIABLE RESISTOR
BOURNS®

FEATURES

- *Adjustability of ±0.05% Voltage Ratio.*
- *Low Temperature Coefficient of ±100 ppm/°C.*
- *0.75 Watt Power at 40°C.*
- *CRV is 1% of 1 ohm.*
- *Designed to Withstand Circuit Board Processes.*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart below) ..... 10 to 5,000,000 ohms

Resistance Tolerance .... 20% standard, closer tolerances available

Absolute Minimum Resistance .... 2 ohms maximum

Adjustability:*
Voltage Ratio .... ± 0.05%
Resistance .... ± 0.10%

Contact Resistance Variation .... 1 ohm or 1%, whichever is greater

Insulation Resistance, 500 volts DC ...... 1,000 megohms minimum

PHYSICAL CHARACTERISTICS

Markings .... Resistance value and manufacturer's model number

Mechanical Stops .... Solid

Shaft Torque .... 5.0 oz.-in. maximum

Weight .... Approximately 0.01 oz.

Terminals .... .020 in. Dia. Solderable Pins

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
40°C (250 VAC Maximum) .... 0.75 watt
85°C .... 0.50 watt
125°C .... 0 watt

Operating Temperature Range .... −55° to +125°C

Temperature Coefficient .... ± 100 ppm/°C

Humidity, MIL-STD-202, Method 103 .... 10 megohms minimum resistance after removal from chamber

Vibration .... Exceeds MIL-R-22097, 30Gs
Contact Bounce .... 0.1 millisecond maximum

Shock .... Exceeds MIL-R-22097, 100Gs
Contact Bounce .... 0.1 millisecond maximum

Load Life .... 1,000 hours per MIL-R-22097
Resistance Shift Maximum 3%

Mechanical Life .... 200 cycles without discontinuity

Effective Electrical Rotation .... 205° ± 10°

Dielectric Strength MIL-R-22097
Sea Level .... 500 volts AC minimum

*The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

Resistance (Ohms)	SIDE ADJUST PART NUMBER*			
	3352H	3352K	3352V	3352W
10	-1-100	-1-100	-1-100	-1-100
20	-1-200	-1-200	-1-200	-1-200
50	-1-500	-1-500	-1-500	-1-500
100	-1-101	-1-101	-1-101	-1-101
200	-1-201	-1-201	-1-201	-1-201
500	-1-501	-1-501	-1-501	-1-501
1,000	-1-102	-1-102	-1-102	-1-102
2,000	-1-202	-1-202	-1-202	-1-202
5,000	-1-502	-1-502	-1-502	-1-502
10,000	-1-103	-1-103	-1-103	-1-103
20,000	-1-203	-1-203	-1-203	-1-203
25,000	-1-253	-1-253	-1-253	-1-253
50,000	-1-503	-1-503	-1-503	-1-503
100,000	-1-104	-1-104	-1-104	-1-104
200,000	-1-204	-1-204	-1-204	-1-204
250,000	-1-254	-1-254	-1-254	-1-254
500,000	-1-504	-1-504	-1-504	-1-504
1,000,000	-1-105	-1-105	-1-105	-1-105
2,000,000	-1-205	-1-205	-1-205	-1-205
5,000,000	-1-505	-1-505	-1-505	-1-505

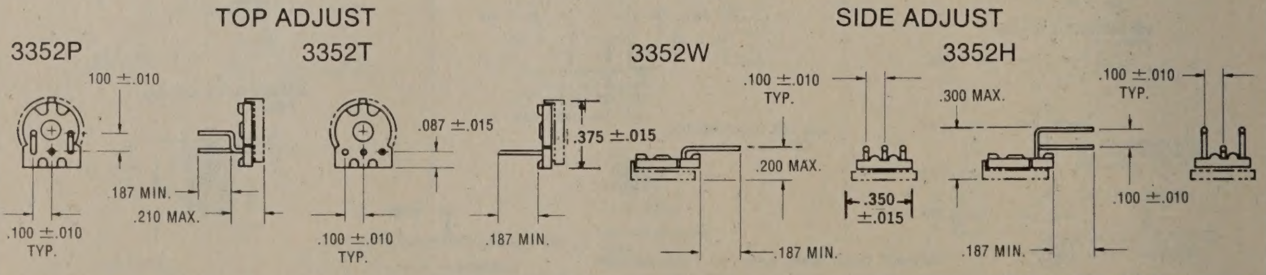
SPECIAL RESISTANCES AVAILABLE FROM 10 TO 5,000,000 OHMS.

Resistance (Ohms)	TOP ADJUST PART NUMBER*		
	3352E	3352P	3352T
10	-1-100	-1-100	-1-100
20	-1-200	-1-200	-1-200
50	-1-500	-1-500	-1-500
100	-1-101	-1-101	-1-101
200	-1-201	-1-201	-1-201
500	-1-501	-1-501	-1-501
1,000	-1-102	-1-102	-1-102
2,000	-1-202	-1-202	-1-202
5,000	-1-502	-1-502	-1-502
10,000	-1-103	-1-103	-1-103
20,000	-1-203	-1-203	-1-203
25,000	-1-253	-1-253	-1-253
50,000	-1-503	-1-503	-1-503
100,000	-1-104	-1-104	-1-104
200,000	-1-204	-1-204	-1-204
250,000	-1-254	-1-254	-1-254
500,000	-1-504	-1-504	-1-504
1,000,000	-1-105	-1-105	-1-105
2,000,000	-1-205	-1-205	-1-205
5,000,000	-1-505	-1-505	-1-505

**THE LAST THREE DIGITS OF THE PART NUMBER REPRESENT THE RESISTANCE IN STANDARD CODE.*

EXAMPLE — COMPLETE PART NUMBER: 3352T-1-101.

DIMENSIONS



BOURNS INC. TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5050

MODEL 3355

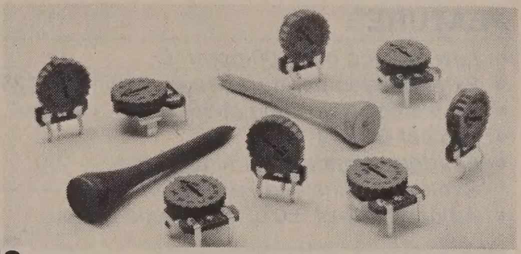
SINGLE TURN CONDUCTIVE PLASTIC
ECONOMY TRIMMER

TRIMPOT® ADJUSTMENT POTENTIOMETER

BOURNS®

FEATURES

- *Available from 100 ohms to 5 megohms.*
- *Resistance tolerance ±20%.*
- *Rated 0.25 watt maximum at 70°C.*
- *Tempco less than ±500 PPM/°C.*
- *Flame retardant construction meets UL94V-1.*
- *Integral thumbwheel is standard.*
- *Board wash capability.*
- *Adjustability 0.1%.*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart below) . . . 100 ohms to 5 megohms
Resistance Tolerance . . . . ± 20%
Adjustability:*
  Voltage Ratio . . . . ± 0.1% maximum
  Resistance . . . . ± 0.2% maximum
Contact Resistance Variation . . . . 1% maximum
Absolute Minimum Resistance . . . . 2 ohms maximum
Effective Electrical Angle . . . . 240° ± 10°
Voltage Coefficient . . . . .08% / Volt maximum

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
  25°C . . . . 0.50 watt
  70°C . . . . 0.25 watt
  100°C . . . . 0 watt
Operating Temperature Range . . . . 0°C to 100°C
Temperature Coefficient . . . . 500 PPM/°C maximum
Humidity, 24 hours at 95% RH . . . . Resistance shift ±7.5% maximum
Vibration . . . . 30 g's
  Contact Bounce . . . . 0.1 millisecond maximum
Shock . . . . 100 g's
  Contact Bounce . . . . 0.1 millisecond maximum
Load Life . . . . 100 hours, 70°C, ¼ W.
  Resistance Shift . . . . ± 5% maximum
Mechanical Life . . . . 200 Cycles without discontinuity
Flammability . . . . Meets UL 94V-1
Solvent Resistance . . . . Withstands most cleaning solvents and detergents
  Resistance Shift . . . . ± 5% maximum

PHYSICAL CHARACTERISTICS

Mechanical Rotation . . . . 260° ± 10°
Markings . . . . Manufacturer's name, model number, resistance value
Appearance . . . . Legible markings, no physical defects
Mechanical Stops . . . . Solid
Adjustment Torque . . . . 3 oz.-in. maximum
Weight . . . . Approximately 1.3 grams
Terminals . . . . Solderable snap-in pins

*The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

Blue is the standard color on all adjustment wheels. Optional colors (available only on the Standard Thumbwheel style) are: Black, White, Violet, Green, Yellow, Orange, Red and Brown. Consult the factory for ordering these optional colors.

Specification Note: Closer performance tolerances can be supplied upon request.
Specifications are subject to change without notice.

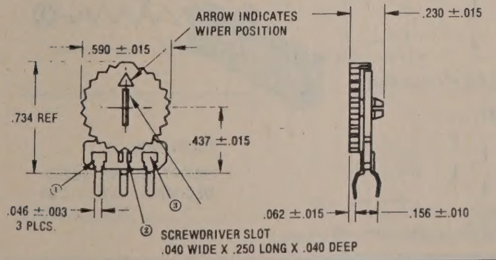
STANDARD RESISTANCES

TOP ADJUSTMENT Part Numbers			
Resistance (ohms)	**Standard Thumbwheel**	**Optional Thumbwheel with Hex**	**Optional Smooth Wheel**
	3355U-	3355U-	3355U-
100	1-101	1-101TH	1-101S
250	1-251	1-251TH	1-251S
500	1-501	1-501TH	1-501S
1,000	1-102	1-102TH	1-102S
2,500	1-252	1-252TH	1-252S
5,000	1-502	1-502TH	1-502S
10,000	1-103	1-103TH	1-103S
25,000	1-253	1-253TH	1-253S
50,000	1-503	1-503TH	1-503S
100,000	1-104	1-104TH	1-104S
250,000	1-254	1-254TH	1-254S
500,000	1-504	1-504TH	1-504S
1,000,000	1-105	1-105TH	1-105S
2,500,000	1-255	1-255TH	1-255S
5,000,000	1-505	1-505TH	1-505S

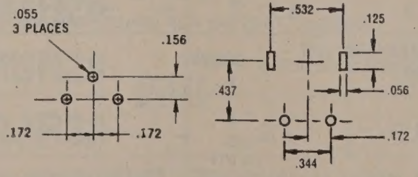
SIDE ADJUSTMENT Part Numbers			
Resistance (ohms)	**Standard Thumbwheel**	**Optional Thumbwheel with Hex**	**Optional Smooth Wheel**
	3355X-	3355X-	3355X-
100	1-101	1-101TH	1-101S
250	1-251	1-251TH	1-251S
500	1-501	1-501TH	1-501S
1,000	1-102	1-102TH	1-102S
2,500	1-252	1-252TH	1-252S
5,000	1-502	1-502TH	1-502S
10,000	1-103	1-103TH	1-103S
25,000	1-253	1-253TH	1-253S
50,000	1-503	1-503TH	1-503S
100,000	1-104	1-104TH	1-104S
250,000	1-254	1-254TH	1-254S
500,000	1-504	1-504TH	1-504S
1,000,000	1-105	1-105TH	1-105S
2,500,000	1-255	1-255TH	1-255S
5,000,000	1-505	1-505TH	1-505S

DIMENSIONS

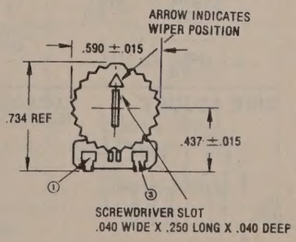
SIDE ADJUST 3355X


ARROW INDICATES WIPER POSITION
.230 ±.015
.590 ±.015
.734 REF
.437 ±.015
①
②
③
.046 ±.003 3 PLCS.
.062 ±.015
.156 ±.010
② SCREWDRIVER SLOT .040 WIDE X .250 LONG X .040 DEEP

SUGGESTED CIRCUIT BOARD PATTERNS



TOP ADJUST 3355U


ARROW INDICATES WIPER POSITION
.590 ±.015
.734 REF
.437 ±.015
①
③
SCREWDRIVER SLOT .040 WIDE X .250 LONG X .040 DEEP

BOURNS INC

TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5050

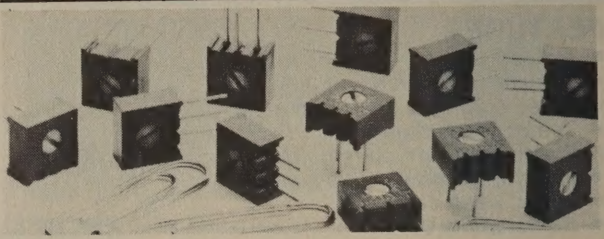
MODEL 3386

COMMERCIAL, CERMET POTENTIOMETER
⅜" SQUARE

BOURNS® ADJUSTMENT POTENTIOMETER
BOURNS®

FEATURES

- *Low tempco of ±100 ppm/°C*
- *Extended temperature range: −55° to +125°C*
- *0.5 watt power rating at 85°C*
- *Typical CRV of 1%*
- *Fourteen standard terminal styles*
- *Sealed to withstand immersion*
- *Adjustability of ±0.03% Voltage Ratio*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range (see chart below) .... 10 to 2,000,000 ohms
Resistance Tolerance* .... 10% standard, closer tolerances available
Absolute Minimum Resistance* .... 2 ohms maximum
Adjustability:
  Voltage Ratio .... ±0.03%
  Resistance .... ±0.10%
Contact Resistance Variation* .... 1 ohm or 1% maximum whichever is greater
Insulation Resistance, 500 volts DC .... 1,000 megohms minimum

PHYSICAL CHARACTERISTICS

Seal* .... MIL-R-22097 immersion
Markings* .... Date code, resistance value, and model number
Appearance* ...... Legible markings, no physical defects
Mechanical Stops .... Solid
Shaft Torque .... 5.0 oz.-in. maximum
Weight .... Approximately 0.03 oz.
Terminals .... .020 in. Dia. Solderable Pins

*Inspection Note: Applicable 100% or statistical sampling inspection performed to insure highest quality.

ENVIRONMENTAL CHARACTERISTICS

Power Ratings:
  85°C (300 VAC Maximum) .... 0.5 watt
  125°C .... 0 watt
Operating Temperature Range .... −55° to +125°C
Temperature Coefficient .... ±100 ppm/°C
Humidity, MIL-STD-202, Method 103 .... 10 megohms minimum insulation resistance after removal from chamber
Vibration .... Exceeds MIL-R-22097, 30Gs
  Contact Bounce .... 0.1 millisecond maximum
Shock .... Exceeds MIL-R-22097, 100Gs
  Contact Bounce .... 0.1 millisecond maximum
Load Life .... 1,000 hours per MIL-R-22097
  Resistance Shift maximum 3%
Mechanical Life .... 200 cycles without discontinuity
Effective Electrical Rotation .... 280° ±15°
Mechanical Rotation .... 310° ±15°
Dielectric Strength MIL-R-22097
  Room Conditions .... 900 volts AC minimum

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

STANDARD RESISTANCES

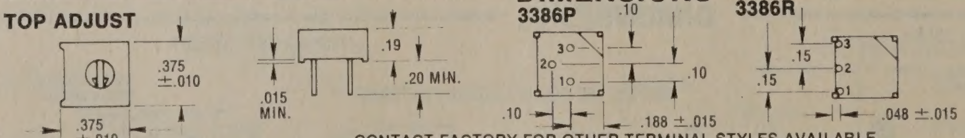
RESISTANCE (OHMS)	SIDE ADJUST PART NUMBER*									TOP ADJUST PART NUMBER*				
	TO-5		.150" IN-LINE			.100" IN-LINE		.200 GRID		TO-5	.150" IN-LINE		100" IN-LINE	TRI-ANGULAR
	3386H-	3386X-	3386S-	3386J-	3386B-	3386W-	3386C-	3386F-	3386Y-	3386P-	3386R-	3386M-	3386T-	3386K-
10	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100	-1-100
20	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200	-1-200
50	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500	-1-500
100	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101	-1-101
200	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201	-1-201
500	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501	-1-501
1,000	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102	-1-102
2,000	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202	-1-202
5,000	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502	-1-502
10,000	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103	-1-103
20,000	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203	-1-203
25,000	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253	-1-253
50,000	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503	-1-503
100,000	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104	-1-104
200,000	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204	-1-204
250,000	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254	-1-254
500,000	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504	-1-504
1,000,000	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105	-1-105
2,000,000	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205	-1-205

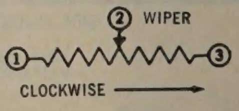
SPECIAL RESISTANCES AVAILABLE FROM 10 TO 2,000,000 OHMS

**THE LAST THREE DIGITS OF THE PART NUMBER REPRESENT THE RESISTANCE IN STANDARD CODE.*
EXAMPLE—COMPLETE PART NUMBER: 3386H-1-101

DIMENSIONS

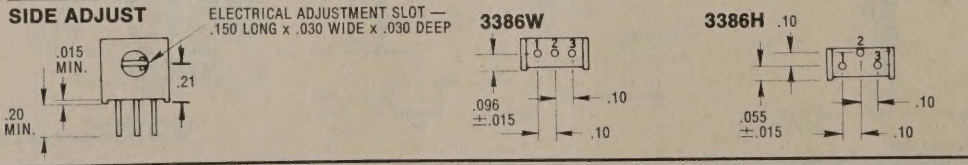
TOP ADJUST





CONTACT FACTORY FOR OTHER TERMINAL STYLES AVAILABLE.

SIDE ADJUST



TOLERANCE:
EXCEPT WHERE NOTED
DECIMALS: .XX ± .010
.XXX ± .005

BOURNS INC

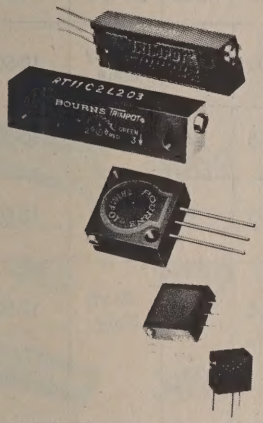
TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

MIL-SPEC TRIMMERS

TRIMPOT® ADJUSTMENT POTENTIOMETER

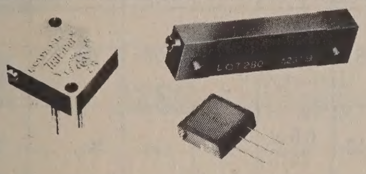
BOURNS®

MIL-R-27208



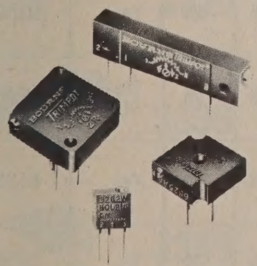
Qualified Styles	Qualified Terminals	Charac-teristics	Qualified Resistances Ω
RT10	L,P	C2	100Ω-10K
RT12	L,P,Y	C2	10Ω-20K
RT22	L	C2	50Ω-20K
	P,W,X	C2	50Ω-20K
RT24	L,P,W,X	C2	10Ω-10K
RT26	W,X	C2	10Ω-5K

MIL-R-39015



RTR12	L,P,Y	D	10Ω-10K-20K
RTR22	L,P,W,X	D	500Ω-10K-20K
RTR24	P,W,X	D	500Ω-10K

MIL-R-22097



RJ12	L,P,Y	C,F	10Ω-1 Meg.
RJ22	L,P,W,X	C,F	10Ω-1 Meg.
RJ24	L,P,W,X	C,F	10Ω-1 Meg.
RJ26	P,W,X	C,F	10Ω-1 Meg.

MIL-R-39035

RJR12	L,Y	C,F	10Ω-1 Meg.
RJR24	P,W,X	C,F	200Ω-1 Meg.
RJR26	P,W,X	F	10Ω-1 Meg.
RJR28	P	C,F	10Ω-2 Meg.
RJR32	D	C,F	10Ω-2 Meg.

PRODUCT PHOTOGRAPHS ARE APPROXIMATELY THREE QUARTERS ACTUAL SIZE

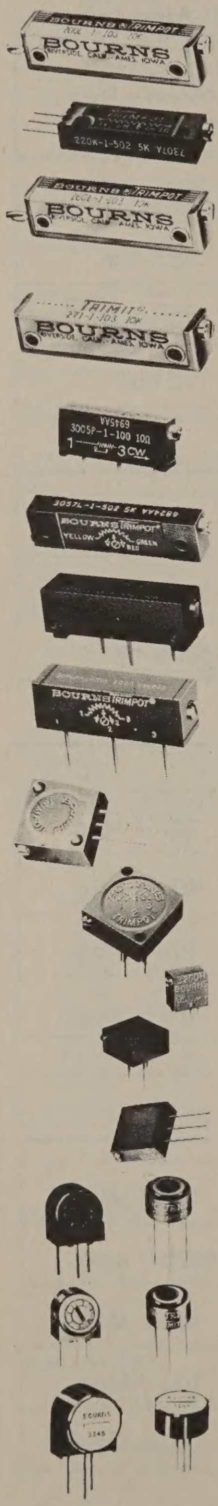
BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

WIREWOUND TRIMMING POTENTIOMETERS

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

Choose wirebound units for high power, stability and low temperature coefficient.



	Description	Dimensions H x W x L	Terminals	Res. Tol. (%)	Power (Watt) at 70°C	Max. Temp. °C	Nom. Adj. Turns	Humidity Mil Spec	Standard Resistances Ω
200	Low Cost TRIMPOT® Potentiometer	.32x.28x1.25	L,S,P	±10	0.5	105	25	Steady State	10-50K
220	High Temperature (RT 10)	.32x.18x1.00	L,W,P	±5	1.0	175	15	Yes	10-30K
260	High Temperature	.32x.28x1.25	L,S,P	±10	1.0	175	25	Steady State	10-50K
271 273 275	Commercial TRIMIT® Potentiometer	.32x.28x1.25	L S P	±10	0.50 at 70°C	105	25	Steady State	10-50K
3005	Sealed Commercial E-Z-TRIM® Potentiometer	.31x.17x.75	P	±10	1.0 at 40°C	125	20	Steady State	10-50K
3057	High Temperature Humidity Proof (RTR 12 level M, P, (RT 12)	.32x.19x1.25	L,P,Y,J	±5	1.0	150	22	Yes	10-100K
3067	Commercial E-Z-TRIM® Potentiometer	.35x.28x1.00	S,P	±10	0.5 at 25°C	85	15	No	50-20K
*3070	High Power Fine Resolution	.31x.31x1.06 .36x.31x1.06	L,S,H P	±5	1.5	175	10	Yes	100-50K
3250	Humidity Proof High Temperature (RT 22)	.19x.50x.50 .22x.50x.50	L P,W W66	±5	1.0	175	25	Yes	10-50K
3255	Commercial TRIMPOT® Potentiometer	.19x.50x.50 .22x.50x.50	L P,W W66	±5	1.0 at 50°C	150	25	Steady State	10-50K
3260	Humidity Proof High Temperature (RT 26)	.25x.25x.17	H,W	±5	0.2	175	11	Yes	10-25K
3280	Humidity Proof High Temperature	.203x.375x.375	L,P,W W66	±5	1.0	175	25	Yes	10-50K
3290	Humidity Proof High Temperature (RT 24)	.150x.375x.375	L,W,H P	±5	1.0	175	25	Yes	10-50K
3300	Humidity Proof Single-Turn High Temperature	.37x.31x.25 .31 dia.x.18 .31 dia.x.46	W P S	±5	0.5	175	300°	Yes	10-25K
3305	Sealed Commercial TRIMIT® Potentiometer	.375x.31x.26 .31 dia.x.19	W P	±5	0.5 at 70°C	125	280°	Steady State	10-25K
3345	Potentiometer Industrial TRIMPOT®	.45 dia.x.235 .525x.45x.285	P W	±5	1.0	150	1	Yes	10-50K

PRODUCT PHOTOGRAPHS ARE APPROXIMATELY THREE QUARTERS ACTUAL SIZE

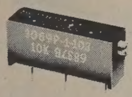
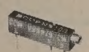
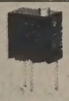
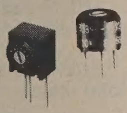
**NOT STOCKED BY DISTRIBUTORS*

BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

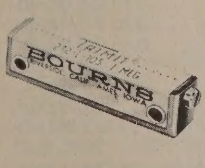
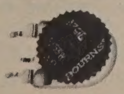
CERMET TRIMMING POTENTIOMETERS

TRIMPOT® ADJUSTMENT POTENTIOMETER
BOURNS®

Choose cermet units for good adjustability, stability, resistance range and good high frequency performance.

	Description	Dimensions H x W x L	Terminals	Res. Tol. (%)	Power (Watt) at 70°C	Max. °C Temp.	Nom. Adj. Turns	Humidity Mil Spec	Standard Resistances Ω
 **3069**	Commercial E-Z-TRIM® Potentiometer	.35x.25x.75	P	±10	0.75 at 25°C	125	20	Yes	10-2 Meg
 **3082**	Humidity Proof Cermet	.10x.15x.50	P	±10	0.3 at 85°C	150	10	Yes	10-2 Meg
3099	Dual In-Line Package	.25x.19x.75	P	±10	1.0	150	20	Yes	10-2 Meg
3252	High Performance Humidity Proof (RJ 22) (RJR 22)	.50x.50x.22	L,P,W,X	±10	1.0	150	23	Yes	10-2 Meg
 **3262**	Humidity Proof High Temperature (RJ 26) (RJR 26)	.25x.25x.17	P,W,X	±10	0.25 at 85°C	175	12	Yes	10-1 Meg
3292	Thin Line Cermet (RJ 24)	.375x.375x.15	L,P,W,X	±10	0.5 at 85°C	175	22	Yes	10-1 Meg
3329	Commercial Cermet	.250 dia.x.155	P,H	±10	0.5 at 85°C	150	240°	Yes	10-1 Meg
 **3339**	Four-Turn Adjustment	.300 dia.x.25	P,H,W	±10	0.5 at 85°C	150	4	Yes	10-1 Meg
3359	Commercial Cermet	7/16" dia.	P,W	±20	0.5 at 40°C	125	270°	No	100-2 Meg

RESISTON® CARBON TRIMMING POTENTIOMETERS

 **272** **274** **276**	Commercial TRIMIT® RESISTALOY® Element Potentiometer	.32x.28x1.25	L S P	±20	0.20 at 25°C	105	25	No	5K-5 Meg
 **3353**	Carbon Element	19/32" dia.	P,W	±20	1/3 at 60°C	100	300°	No	500-5 Meg

BOURNS INC

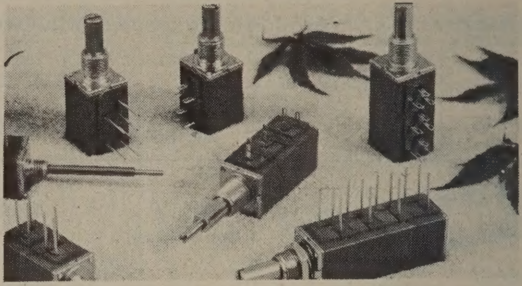
TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5050

MODEL 81/82

BOURNS®

MODULAR POTENTIOMETER SINGLE OR MULTIPLE ⅝" SQUARE SECTIONS BUSHING MOUNT CERMET AND/OR CONDUCTIVE PLASTIC ELEMENTS

BOURNS® Model 81/82 MODULAR potentiometer combines the design versatility of advanced modular construction with factory assembled reliability and quality assurance. The net result is a consistently high quality ⅝" square panel potentiometer that can be delivered in single or multiple section configurations to suit your specific application . . . from off-the-shelf components . . . at low cost. The Model 81/82's unique shaft torque control feature provides a smooth, high quality feel that will enhance the "human engineering appeal" of your equipment. This feature enables Bourns to produce a panel potentiometer that has a remarkably consistent feel (torque range only .3 to 2.0 oz.-in.) from unit-to-unit . . . regardless of the number of modules ganged on a single shaft.



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS	CONDUCTIVE PLASTIC	CERMET
Standard Resistance Range		
(Tapers A, B, H & E)	(B & E) 250 to 5,000,000 ohms	(A & H) 50 to 5,000,000 ohms
(Tapers C, D, F & G)	(D & G) 1000 to 2,500,000 ohms	(C & F) 1000 to 2,500,000 ohms
Resistance Tolerance	±20% standard (B, D & G tapers) ±10% available (E taper)	±10% Standard (A, C and F tapers) ±5% Available (H taper)
Independent Linearity	(B & E tapers) ±5%	(A & H tapers) ±5%
Absolute Minimum Resistance	2 ohms	2 ohms
Continuity	Maintained for full mechanical angle	Maintained for full mechanical angle
Theoretical Electrical Travel	240° ±5°	240° ±6°
Maximum Contact Resistance Variation (Tapers A, B, H & E)	(B & E) ±1% or 3Ω, whichever is greater	(A & H) ±1% or 3Ω, whichever is greater
(Tapers C, D, F & G)	(D & G) ....±2%	(C & F) .....± 2%
Resolution	Infinite	Infinite
Dielectric Strength	MIL-R-23285	MIL-R-23285
Sea Level	1000 Volts RMS	1000 Volts RMS
70,000 Ft.	500 Volts RMS	500 Volts RMS
Insulation Resistance (500 Volts DC)	1000 Megohms	1000 Megohms
Power Rating at 70°C		
Single Section	1 watt	2 Watts
Multiple Section	.5 Watts/Section	1 Watt/Section

ENVIRONMENTAL CHARACTERISTICS	CONDUCTIVE PLASTIC	CERMET
Temperature Range	−65° to +125°C	−65° to +150°C
Temperature Coefficient Over Temperature Range	±1000 ppm/°C	±150 ppm/°C
Vibration, 15 G's (Single Section)	MIL-R-23285	MIL-R-23285
Maximum Wiper Shift	5% of total resistance	5% of total resistance
Maximum Total Resistance Shift	±2%	±2%
Shock, 30 G's (Single Section)	MIL-R-23285	MIL-R-23285
Maximum Wiper Shift	5% of total resistance	5% of total resistance
Maximum Total Resistance Shift	±2%	±2%
Load Life	1000 Hrs.	1000 Hrs.
Maximum Total Resistance Shift	±10%	±5%
Rotational Life	100,000 Cycles	100,000 Cycles
Maximum Total Resistance Shift	10 ohms or ±12%	10 ohms or ±10%
Moisture Resistance		
Maximum Total Resistance Shift	±10%	±5%

MECHANICAL CHARACTERISTICS	CONDUCTIVE PLASTIC	CERMET
Shaft Torque		
Single Section (A & B Bushing)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Single Section (C & E Bushing)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Dual Section (All Bushings)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Triple Section (All Bushings)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Quadruple Section (All Bushings)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Shaft Locking Torque with Locknut @ 10 lb. in. (B & E Bushing)	20 oz.-in.	20 oz.-in.
Stop Strength	4 lbs.-in.	4 lbs.-in.
Total Mechanical Travel	300° ±5°	300° ±5°
Weight (Single Section)	21 Gms. max.	21 Gms. max.
Each Additional Section	6 Gms. max.	6 Gms. max.
Terminals	① Printed circuit terminals or solder lugs	
Markings	Manufacturer's symbol, wiring diagram, date code, resistance, manufacturer's P/N	

①Model 81/82 performance not guaranteed after being subjected to printed circuit board cleaning procedures.

BOURNS TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 81/82

MODULAR POTENTIOMETER SINGLE OR MULTIPLE ⅝″ SQUARE SECTIONS
BUSHING MOUNT CERMET AND/OR CONDUCTIVE PLASTIC ELEMENTS

BOURNS®

PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery. Unshaded areas are available on special order and are not normally stocked.

MODEL TYPE & TERMINAL STYLE

81	CONTROL, P.C.
82	CONTROL, LUGS

NO. OF SECTIONS

1	SINGLE SECTION
2	DUAL SECTION
3	TRIPLE SECTION
4	QUADRUPLE

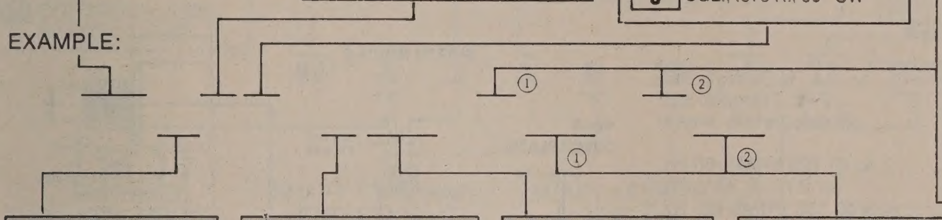
ANTI-ROTATION LUG OPTIONS ④

A	SGL., .305 R., 90° CW
D	NO LUG
E	SGL., .531 R., 90° CW
H	SGL., .437 R., 90° CW
J	SGL., .375 R., 90° CW

TYPE OF ELEMENT, TAPER & TOL. ④

A	LINEAR, Cermet, ±10%
B	LINEAR, C-P, ±20%
C	CW AUDIO, Cermet, ±10%
D	CW AUDIO, C-P, ±20%
E	LINEAR, C-P, ±10%
F	CCW AUDIO, Cermet, ±10%
G	CCW AUDIO, C-P, ±20%
H	LINEAR, CERMET, ±5%

EXAMPLE:



BUSHING STYLE & SIZE		SHAFT TYPE AND END STYLE ④		SHAFT LENGTH FMS ③
A	Plain ⅜″ D. x ⅜″ L.	B	Single. Slotted. ¼″ D.	16 20 24 28
		C	Single, Flatted	24
		G	Dual Concentric, ¼″ D. Outer Plain End ⅛″ D. Inner	36
B	Locking ⅜″ D. x ½″ L.	B	Single. Slotted. ¼″ D.	20
C	Plain ¼″ D. x ¼″ L.	E	Single, Slotted. ⅛″ D.	12 16 20 24 28
		F	Single, Flatted	24
		K	Dual Concentric, ⅛″ D. Outer Plain End ⁵⁄₆₄″ D. Inner	32
E	Locking ¼″ D. x ½″ L.	E	Single. Slotted. ⅛″ D.	20

RESISTANCE CODE — VALUE ④

* 03 — 50	13 — 5K	23 — 500K
* 05 — 100	15 — 10K	25 — 1 Meg
07 — 250	17 — 25K	26 — 2.5 Meg
08 — 500	18 — 50K	27 — 5 Meg
10 — 1K	20 — 100K	
12 — 2.5K	22 — 250K	

* Available in Cermet only

NOTES:

1. Taper and Resistance Code for 1st Section.
2. Taper and Resistance Code for 2nd Section.
3. Shaft length code is based on the number of ¹⁄₃₂″ increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is ⅜″ less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are available on special order. Consult factory for details.

MOUNTING HARDWARE

PART NO. AND DESCRIPTION	BUSHING STYLE			
	A	B	C	E
H-36-1 FLAT WASHER			X	X
H-36-2 FLAT WASHER	X	X		
H-37-1 LOCKWASHER			X	X
H-37-2 LOCKWASHER	X	X		
H-38-1 MOUNTING NUT			X	X
H-38-2 MOUNTING NUT	X	X		
H-38-3 LOCKNUT				X
H-38-4 LOCKNUT		X		

NOTE: Hardware indicated by shaded areas is normally supplied with unit. Other hardware may be ordered separately. Hardware bulk packaged with units.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 85/86

MODEL 81/82 MODULAR POTENTIOMETER WITH ROTARY SWITCH MODULE (Pat. Pend.)

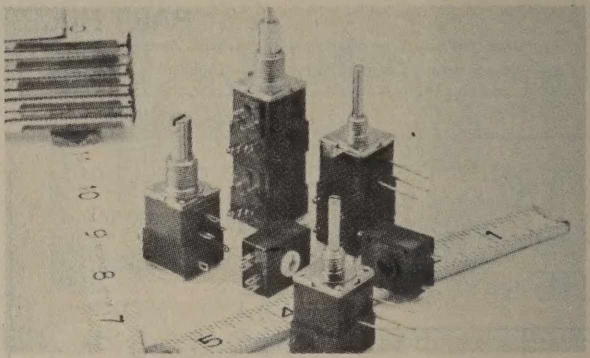
BOURNS®

The Bourns® Model 81/82 "Modular" Potentiometers are available with optional rotary switch modules for applications where integral "on-off" function control is desired. The combination is designated the Model 85/86.

Switch modules may be ganged behind a primary potentiometer module in any combination of up to three switches and/ or secondary potentiometer modules.

A positive action "non-tease" detent design with low actuation torque, compliments the smooth feel of the Model 81/82 Potentiometer.

Contacts of fine silver with gold overlay provide exceptionally low contact resistance for reliable operation in low level analog or logic circuits.



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Contacts	
DPST	N.O./N.C. Std.
DPDT	2 Pr. Transfer-Std. (Break before make)
Power Rating (Resistive Load)	
DPST	2 A. @ 125 VRMS-60 Hz. or 2 A. @ 28 V. DC
DPDT	1 A @ 125 VRMS-60 Hz. or 1 A. @ 28 C. DC
Dielectric Strength	
Sea Level	1000 VRMS-minimum
Insulation Resistance	1000 megohms
Contact Resistance (.1 V. DC-1 ma.)	10 milliohms maximum
Contact Bounce	5 milliseconds maximum

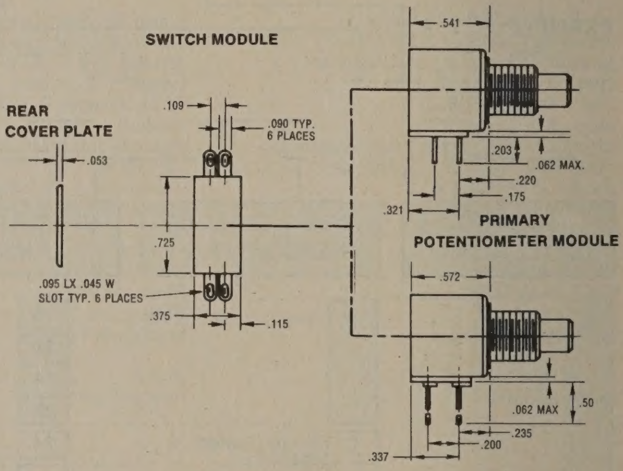
MECHANICAL CHARACTERISTICS

Detent Actuating Torque (Each Section-Switch Module only)	3-7 oz.-in.
Shaft Torque (Out of Detent, 2-4 Module Assembly)	0.5-2 oz.-in.
Detent	CW or CCW-Std.
Actuation Angle	20° ±5%
Contacts	Fine Silver with Gold Overlay
Terminals	Solder Lug only
Standard Orientation	In-Line with Control Terminals
Optional	Rotated 90° CCW from Standard
Terminal Strength (Before and After Soldering Heat Exposure)	2 lb. minimum

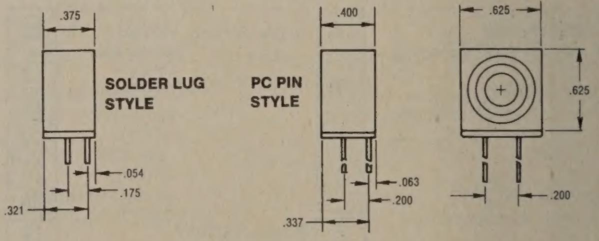
ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	0°C to +70°C
Power Rating	As Specified
Contact Resistance	10 milliohms maximum
Actuating Torque (SW. only)	3-7 oz.-in.
Exposure Temperature Range	—65°C to +125°C
Vibration 8 G's (Dual Section)	44-2000 Hz.
Contact Resistance	10 milliohms maximum
Contact Bounce	0.1 millisecond maximum
Shock, 20 G's (Dual Section)	
Contact Resistance	10 milliohms maximum
Contact Bounce	0.1 millisecond maximum
Rotational Life (50% Duty Cycle @ Rated Power Load)	25,000 Cycles
Actuating Torque (SW only)	2-7 oz.-in.
Moisture Resistance	MIL-STD-202, Method 106
Contact Resistance	10 milliohms maximum
Insulation Resistance (After 24 Hours @ Room Temperature)	100 megohms minimum
Housing Material	High Temperature, Flame Retardant Thermosetting Plastic

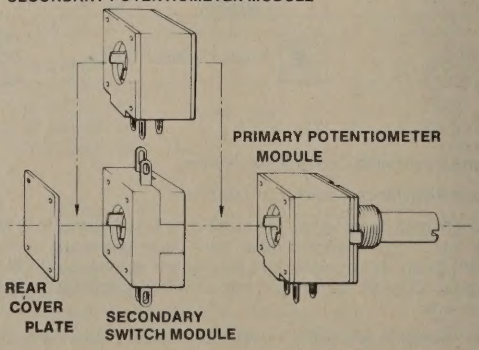
Note: Refer to Model 81/82 for potentiometer specifications


SWITCH MODULE
REAR COVER PLATE
.053
.109
.090 TYP. 6 PLACES
.725
.095 LX .045 W SLOT TYP. 6 PLACES
.375
.115
.541
.203
.062 MAX.
.220
.175
.321
PRIMARY POTENTIOMETER MODULE
.572
.062 MAX
.50
.235
.200
.337

SECONDARY POTENTIOMETER MODULE


.375
SOLDER LUG STYLE
.054
.175
.321
.400
PC PIN STYLE
.063
.200
.337
.625
.625
.200

SECONDARY POTENTIOMETER MODULE


PRIMARY POTENTIOMETER MODULE
REAR COVER PLATE
SECONDARY SWITCH MODULE

BOURNS TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 85/86

MODEL 81/82 MODULAR POTENTIOMETER WITH ROTARY SWITCH MODULE (Pat. Pend.)

BOURNS®

PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery. Unshaded areas are available on special order and are not normally stocked.

86 A 2 A B 28 A 22 / R50

NO. OF SECTIONS

Code	Description
2	DUAL SECTION
3	TRIPLE SECTION
4	QUADRUPLE

MODEL TYPE & TERMINAL STYLE

Code	Description
85	CONTROL - PC PINS SWITCH-LUGS
86	CONTROL - LUGS SWITCH - LUGS

ANTI-ROTATION LUG OPTIONS ①

Code	Description
A	SGL., .305 R., 90° CW
D	NO LUG
E	SGL., .531 R., 90° CW
H	SGL., .437 R., 90° CW
J	SGL., .375 R., 90° CW

TYPE OF ELEMENT, TAPER & TOL.④

Code	Description
A	LINEAR, Cermet, ±10%
B	LINEAR, C-P, ±20%
C	CW AUDIO, Cermet, ±10%
D	CW AUDIO, C-P. ±20%
E	LINEAR, C-P, ±10%
F	CCW AUDIO, Cermet, ±10%
G	CCW AUDIO, C-P, ±20%
H	LINEAR, CERMET, ±5%

BUSHING STYLE & SIZE / SHAFT TYPE AND END STYLE④ / SHAFT LENGTH FMS③

BUSHING STYLE & SIZE		SHAFT TYPE AND END STYLE④		SHAFT LENGTH FMS③
A	Plain 3/8" D. x 3/8" L.	B	Single. Slotted. 1/4" D.	16 20 24 28
		C	Single, Flatted	24
		G	Dual Concentric, 1/4" D. Outer 1/8" D. Inner Plain End	36
B	Locking 3/8" D. x 1/2" L.	B	Single. Slotted, 1/4" D.	20
C	Plain 1/4" D. x 1/4" L.	E	Single, Slotted, 1/8" D.	12 16 20 24 28
		F	Single, Flatted	24
		K	Dual Concentric, 1/8" D. Outer 5/64" D. Inner Plain End	32
E	Locking 1/4" D. x 1/2" L.	E	Single, Slotted, 1/8" D.	20

RESISTANCE CODE—VALUE④

Code	Value	Code	Value	Code	Value
*03	50	13	5K	23	500K
*05	100	15	10K	25	1 Meg
07	250	17	25K	26	2.5Meg
08	500	18	50K	27	5 Meg
10	1K	20	100K		
12	2.5K	22	250K		

* Available in Cermet only
Audio tapers available from 1K ohm to 2.5 megohm only.

SWITCH CODE AND DESCRIPTION

Code	Description
R50	DPST, N.O./N.C., CW DETENT, IN-LINE TERM.
R51	DPST, N.O./N.C., CCW DETENT, IN-LINE TERM.
R52	DPST, 2 N.O., CW DETENT, IN-LINE TERM.
R53	DPST, 2 N.O., CCW DETENT, IN-LINE TERM.
R54	DPST, 2 N.C., CW DETENT, IN-LINE TERM.
R55	DPST, 2 N.C., CCW DETENT, IN-LINE TERM.
R56	DPST, N.O./N.C., CW DETENT, HOR. TERM.
R57	DPST, N.O./N.C., CCW DETENT, HOR. TERM.
R58	DPST, 2 N.O., CW DETENT, HOR. TERM.
R59	DPST, 2 N.O., CCW DETENT, HOR. TERM.
R60	DPST, 2 N.C., CW DETENT, HOR. TERM.
R61	DPST, 2 N.C., CCW DETENT, HOR. TERM.
R70	DPDT, CW DETENT, IN-LINE TERM.
R71	DPDT, CCW DETENT, IN-LINE TERM.
R72	DPDT, CW DETENT, HOR. TERM.
R73	DPDT, CCW DETENT, HOR. TERM.

NOTES:

1. Taper and Resistance Code for 1st Section.
2. Switch Code for 2nd Section. See back page for Switch Code and description of switches available as special option.
3. Shaft length code is based on the number of 1/32" increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is 3/8" less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are on special order. Consult factory for details.

Specifications are subject to change without notice.

Specification Note: Closer performance tolerances can be supplied upon request.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 87/88

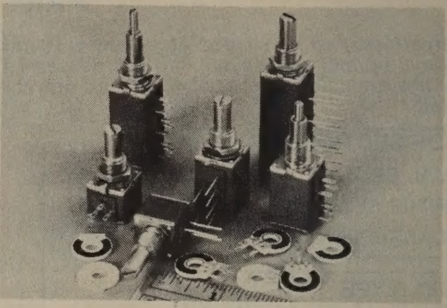
SEMI-PRECISION/MODULAR POTENTIOMETER/SINGLE OR MULTIPLE ⅝" SQUARE SECTIONS BUSHING MOUNT/CERMET AND/OR CONDUCTIVE PLASTIC ELEMENTS

BOURNS®

The BOURNS® Model 87/88 semi-precision modular potentiometer is a unique new control designed to fill the performance and price gap between low-cost industrial controls and single-turn precision potentiometers.

The 87/88 is available with either cermet or conductive plastic resistive elements with a zero-based linearity as low as 2% standard or 1% optional. This linearity will satisfy the more exacting requirements of applications where the output of the equipment must be related to a front panel control (dial) setting.

An exclusive shaft torque control feature provides a remarkably consistent feel (torque range of only .3 to 2.0 oz.-in.) from unit-to-unit, regardless of the number of modules ganged on a single shaft.



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS	CONDUCTIVE PLASTIC	CERMET
Standard Resistance Range	250 to 2,500,000 ohms	250 to 2,500,000 ohms
Resistance Tolerance	±5%	±3%
Zero Base Linearity	Standard ±2.0%	Standard ±2.5%
	Optional ±1.0%	Optional ±1.5%
Absolute Minimum Resistance	2 ohms	2 ohms
Continuity	Maintained for full mechanical angle	Maintained for full mechanical angle
Theoretical Electrical Travel	240° ±5°	240° ±6°
Maximum Contact Resistance Variation	±1%	±1.5%
Resolution	Infinite	Infinite
Dielectric Strength	MIL-R-23285	MIL-R-23285
Sea Level	1000 Volts RMS	1000 Volts RMS
70,000 Ft.	500 Volts RMS	500 Volts RMS
Insulation Resistance (500 Volts DC)	1000 Megohms	1000 Megohms
Power Rating at 70°C		
Single Section	1 Watt	2 Watts
Multiple Section	.5 Watts/Section	1 Watt/Section
Roll-on, Roll-off	.2% max	.5% max.
ENVIRONMENTAL CHARACTERISTICS	**CONDUCTIVE PLASTIC**	**CERMET**
Temperature Range	−55° to +125°C	−65° to +125°C
Temperature Coefficient Over Temperature Range	(250 to 750K) ±1000 ppm/°C (1 meg to 2.5 meg) ±1200 ppm/°C	(All resistance) ±150 ppm/°C
Vibration, 15 G's (Single Section)	MIL-R-23285	MIL-R-23285
Maximum Wiper Shift	5% of total resistance	5% of total resistance
Maximum Total Resistance Shift	±2%	±2%
Shock, 30 G's (Single Section)	MIL-R-23285	MIL-R-23285
Maximum Wiper Shift	5% of total resistance	5% of total resistance
Maximum Total Resistance Shift	±2%	±2%
Load Life	1000 Hrs.	1000 Hrs.
Maximum Total Resistance Shift	±10%	±5%
Rotational Life	100,000 Cycles	100,000 Cycles
Maximum Total Resistance Shift	10 ohms or ±12%	10 ohms or ±10%
Moisture Resistance		
Maximum Total Resistance Shift	±10%	±10%
MECHANICAL CHARACTERISTICS	**CONDUCTIVE PLASTIC**	**CERMET**
Shaft Torque		
Single or Dual Section (A & B Bushing)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Single or Dual Section (C & E Bushing)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Triple Section (All Bushings)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Quadruple Section (All Bushings)	.3 to 2.0 oz.-in.	.3 to 2.0 oz.-in.
Shaft Locking Torque with Locknut @ 10 lb. in. (B & E Bushing)	20 oz.-in.	20 oz.-in.
Stop Strength	4 lbs.-in.	4 lbs.-in.
Total Mechanical Travel	300° ±5°	300° ±5°
Weight (Single Section)	21 Gms. max.	21 Gms. max.
Each Additional Section	6 Gms. max.	6 Gms. max.
Terminals	①Printed circuit terminals or solder lugs	
Markings	Manufacturer's symbol, wiring diagram, date code, resistance, manufacturer's P/N	

①Model 87/88 performance not guaranteed after being subjected to printed circuit board cleaning procedures.

BOURNS INC. TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 87/88

SEMI-PRECISION/MODULAR POTENTIOMETER/SINGLE OR MULTIPLE ⅝" SQUARE SECTIONS BUSHING MOUNT/CERMET AND/OR CONDUCTIVE PLASTIC ELEMENTS

BOURNS®

PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery. Unshaded areas are available on special order and are not normally stocked.

87 A 2 A B 28 L① 10 L② 18

NO. OF SECTIONS
- 1 SINGLE SECTION
- 2 DUAL SECTION
- 3 TRIPLE SECTION
- 4 QUADRUPLE

MODEL TYPE & TERMINAL STYLE
- 87 CONTROL, P.C.
- 88 CONTROL, LUGS

ANTI-ROTATION LUG OPTIONS ③
- A SGL., .305 R., 90° CW
- D NO LUG
- E SGL., .531 R., 90° CW
- H SGL., .437 R., 90° CW
- J SGL., .375 R., 90° CW

TYPE OF SEMI-PRECISION ELEMENT TAPER & TOL. ④
- L LINEAR, C.P. ±5% Tol.
- M LINEAR, CERMET ±3% Tol.

BUSHING STYLE & SIZE		SHAFT TYPE AND END STYLE④		SHAFT LENGTH FMS③
A	Plain ⅜" D. x ⅜" L.	B	Single. Slotted. ¼" D.	16 20 24 28
		C	Single, Flatted	24
		G	Dual Concentric, ¼" D. Outer Plain End ⅛" D. Inner	36
B	Locking ⅜" D. x ½" L.	B	Single. Slotted. ¼" D.	20
C	Plain ¼" D. x ¼" L.	E	Single. Slotted. ⅛" D.	12 16 20 24 28
		F	Single, Flatted	24
		K	Dual Concentric, ⅛" D. Outer Plain End ⁵⁄₆₄" D. Inner	32
E	Locking ¼" D. x ½" L.	E	Single. Slotted. ⅛" D.	20

RESISTANCE CODE—VALUE④

07—250
08—500
10—1K
12—2.5K
13—5K
15—10K
17—25K
18—50K
20—100K
22—250K
23—500K
25—1 Meg
26—2.5 Meg

NOTES:

1. Taper and Resistance Code for 1st Section.
2. Taper and Resistance Code for 2nd Section.
3. Shaft length code is based on the number of $\frac{1}{32}$" increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is ⅜" less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are available on special order. Consult factory for details.

Specifications are subject to change without notice.
Specification Note: Closer performance tolerances can be supplied upon request.

MOUNTING HARDWARE

PART NO. AND DESCRIPTION	BUSHING STYLE A	B	C	E
H-36-1 FLAT WASHER			X	X
H-36-2 FLAT WASHER	X	X		
H-37-1 LOCKWASHER			X	X
H-37-2 LOCKWASHER	X	X		
H-38-1 MOUNTING NUT			X	X
H-38-2 MOUNTING NUT	X	X		
H-38-3 LOCKNUT				X
H-38-4 LOCKNUT		X		

NOTE: Hardware indicated by shaded areas is normally supplied with unit. Other hardware may be ordered separately. Hardware bulk packaged with units.

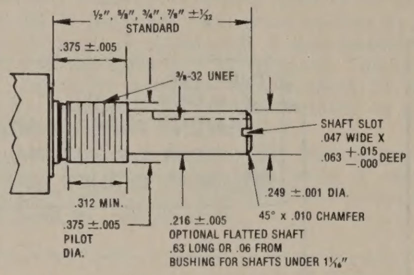
BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MECHANICAL DIMENSIONS

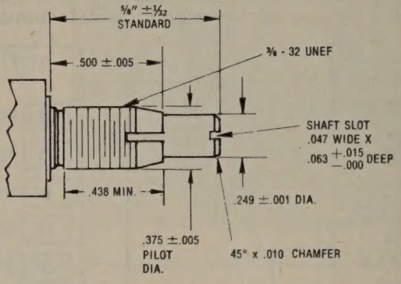
MODEL 81/82
SINGLE TURN POTENTIOMETERS WITH 1-4 SECTIONS

BOURNS®

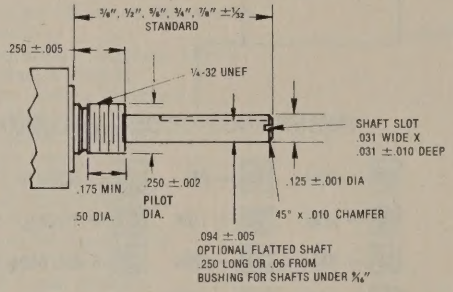
"A" BUSHING
⅜" DIA. PLAIN—SINGLE SHAFT


½", ⅝", ¾", ⅞" ±1/32
STANDARD
.375 ±.005
⅜-32 UNEF
SHAFT SLOT
.047 WIDE X
.063 +.015 −.000 DEEP
.312 MIN.
.249 ±.001 DIA.
.375 ±.005
PILOT
DIA.
.216 ±.005
OPTIONAL FLATTED SHAFT
.63 LONG OR .06 FROM
BUSHING FOR SHAFTS UNDER 1 1/16"
45° x .010 CHAMFER

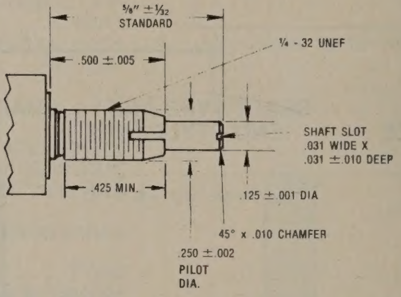
"B" BUSHING
⅜" DIA. LOCKING—SINGLE SHAFT


⅝" ±1/32
STANDARD
.500 ±.005
⅜ - 32 UNEF
SHAFT SLOT
.047 WIDE X
.063 +.015 −.000 DEEP
.438 MIN.
.249 ±.001 DIA.
.375 ±.005
PILOT
DIA.
45° x .010 CHAMFER

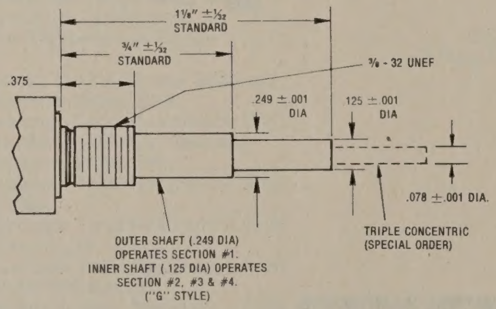
"C" BUSHING
¼" DIA. PLAIN—SINGLE SHAFT


⅜", ½", ⅝", ¾", ⅞" ±1/32
STANDARD
.250 ±.005
¼-32 UNEF
SHAFT SLOT
.031 WIDE X
.031 ±.010 DEEP
.175 MIN.
.250 ±.002
PILOT
DIA.
.125 ±.001 DIA
.50 DIA.
45° x .010 CHAMFER
.094 ±.005
OPTIONAL FLATTED SHAFT
.250 LONG OR .06 FROM
BUSHING FOR SHAFTS UNDER 9/16"

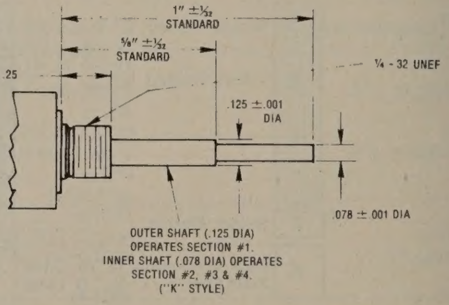
"E" BUSHING
¼" DIA. LOCKING—SINGLE SHAFT


⅝" ±1/32
STANDARD
¼ - 32 UNEF
.500 ±.005
SHAFT SLOT
.031 WIDE X
.031 ±.010 DEEP
.425 MIN.
.125 ±.001 DIA
45° x .010 CHAMFER
.250 ±.002
PILOT
DIA.

"A" BUSHING
⅜" DIA. PLAIN—CONCENTRIC SHAFT

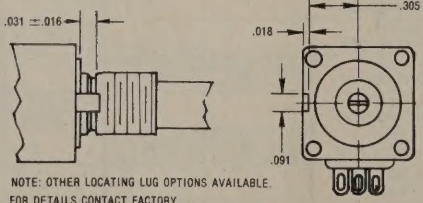

1⅛" ±1/32
STANDARD
¾" ±1/32
STANDARD
⅜ - 32 UNEF
.375
.249 ±.001
DIA
125 ±.001
DIA
.078 ±.001 DIA.
OUTER SHAFT (.249 DIA)
OPERATES SECTION #1.
INNER SHAFT (.125 DIA) OPERATES
SECTION #2, #3 & #4.
("G" STYLE)
TRIPLE CONCENTRIC
(SPECIAL ORDER)

"C" BUSHING
¼" DIA. PLAIN—CONCENTRIC SHAFT


1" ±1/32
STANDARD
⅝" ±1/32
STANDARD
¼ - 32 UNEF
.25
.125 ±.001
DIA
.078 ±.001 DIA
OUTER SHAFT (.125 DIA)
OPERATES SECTION #1.
INNER SHAFT (.078 DIA) OPERATES
SECTION #2, #3 & #4.
("K" STYLE)

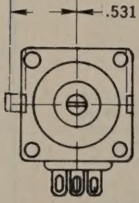
LOCATING LUG OPTIONS

A — SGL. .305R. 90° CW (STD.)

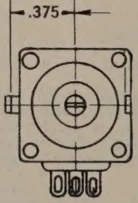

.031 ±.016
.305
.018
.091

NOTE: OTHER LOCATING LUG OPTIONS AVAILABLE.
FOR DETAILS CONTACT FACTORY

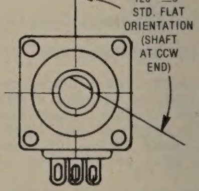
E — SGL. .531 R. 90° CW



J — SGL. .375 R. 90° CW



OPTIONAL FLATTED SHAFT ORIENTATION


120° ±5°
STD. FLAT
ORIENTATION
(SHAFT
AT CCW
END)

NOTE: OTHER LOCATING LUG OPTIONS AVAILABLE.
FOR DETAILS CONTACT FACTORY

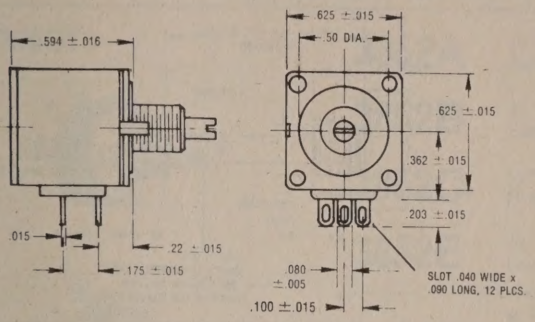
BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MECHANICAL DIMENSIONS

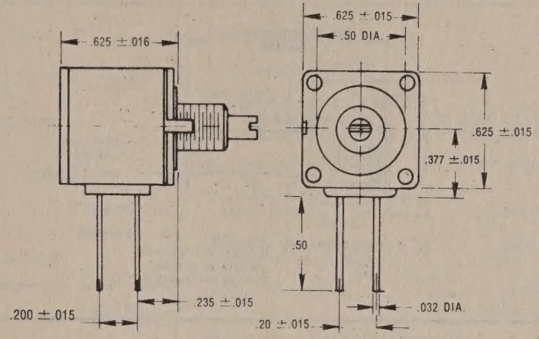
MODEL 81/82

BOURNS®

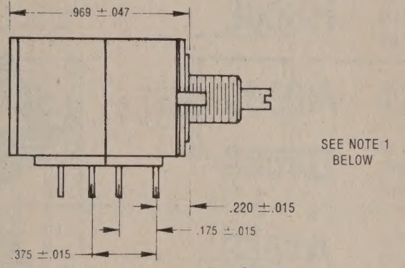
SINGLE UNIT — LUGS **MODEL 82**


.594 ±.016
.015
.22 ±.015
.175 ±.015
.625 ±.015
.50 DIA.
.625 ±.015
.362 ±.015
.203 ±.015
.080 ±.005
.100 ±.015
SLOT .040 WIDE x .090 LONG, 12 PLCS.

SINGLE UNIT — PC PINS **MODEL 81**

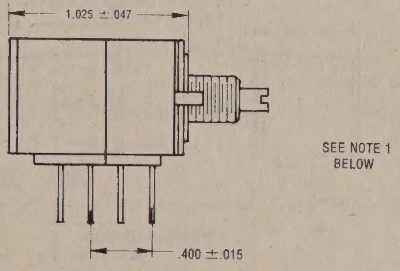

.625 ±.016
.625 ±.015
.50 DIA.
.625 ±.015
.377 ±.015
.50
.235 ±.015
.200 ±.015
.032 DIA.
.20 ±.015

DUAL UNIT — LUGS


.969 ±.047
.220 ±.015
.175 ±.015
.375 ±.015

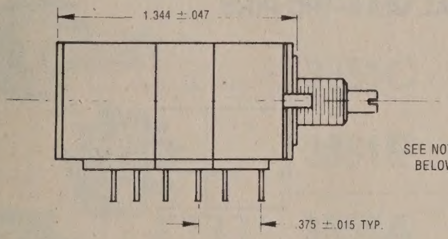
SEE NOTE 1 BELOW

DUAL UNIT — PC PINS


1.025 ±.047
.400 ±.015

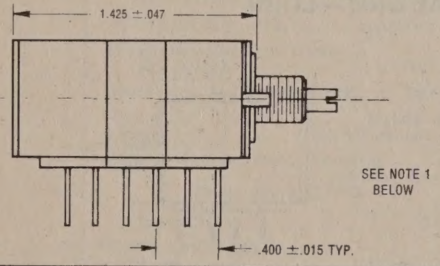
SEE NOTE 1 BELOW

TRIPLE UNIT — LUGS


1.344 ±.047
.375 ±.015 TYP.

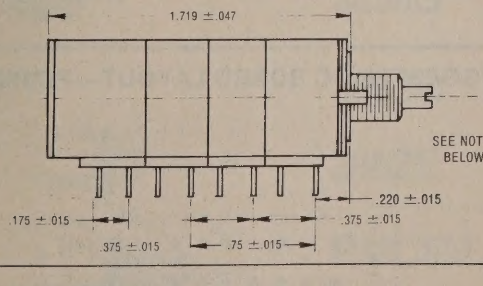
SEE NOTE 1 BELOW

TRIPLE UNIT — PC PINS


1.425 ±.047
.400 ±.015 TYP.

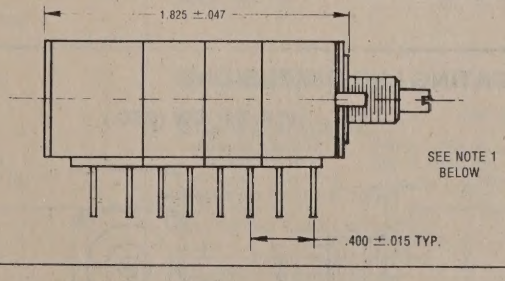
SEE NOTE 1 BELOW

QUAD UNIT — LUGS


1.719 ±.047
.220 ±.015
.175 ±.015
.375 ±.015
.375 ±.015
.75 ±.015

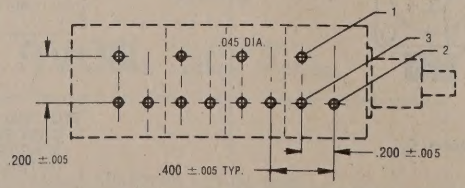
SEE NOTE 1 BELOW

QUAD UNIT — PC PINS


1.825 ±.047
.400 ±.015 TYP.

SEE NOTE 1 BELOW

SUGGESTED PC BOARD LAYOUT — PC PINS


1
3
2
.045 DIA.
.200 ±.005
.400 ±.005 TYP.
.200 ±.005

NOTE 1: For concentric shaft styles add .100 spacer between module(s) driven by inner shaft and those driven by outer shaft.

BOURNS INC. TRIMPOT PRODUCTS DIVISION
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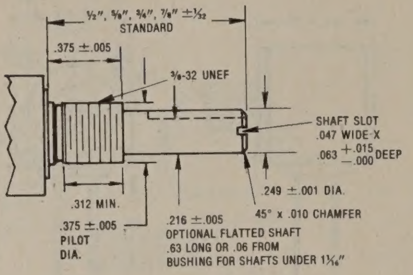
MECHANICAL DIMENSIONS

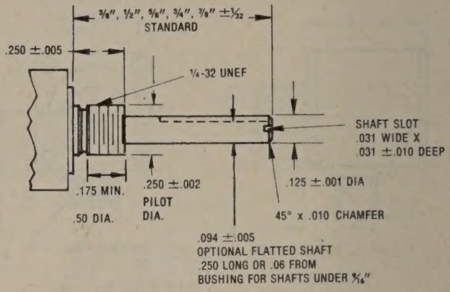
MODEL 87/88

BOURNS®

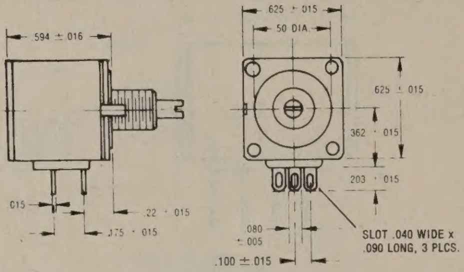
"A" BUSHING
⅜" DIA. PLAIN—SINGLE SHAFT


½", ⅝", ¾", ⅞" ±1/32
STANDARD
.375 ±.005
⅜-32 UNEF
SHAFT SLOT
.047 WIDE X
.063 +.015 −.000 DEEP
.249 ±.001 DIA.
45° x .010 CHAMFER
.312 MIN.
.375 ±.005
PILOT
DIA.
.216 ±.005
OPTIONAL FLATTED SHAFT
.63 LONG OR .06 FROM
BUSHING FOR SHAFTS UNDER 1 1/16"

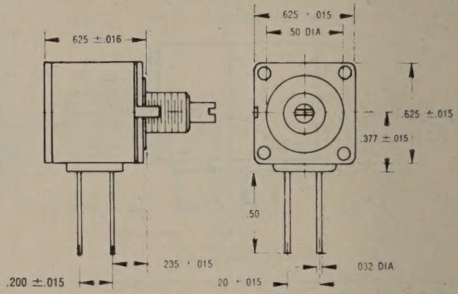
"C" BUSHING
¼" DIA. PLAIN—SINGLE SHAFT


⅜", ½", ⅝", ¾", ⅞" ±1/32
STANDARD
.250 ±.005
¼-32 UNEF
SHAFT SLOT
.031 WIDE X
.031 ±.010 DEEP
.175 MIN.
.50 DIA.
.250 ±.002
PILOT
DIA.
.125 ±.001 DIA
45° x .010 CHAMFER
.094 ±.005
OPTIONAL FLATTED SHAFT
.250 LONG OR .06 FROM
BUSHING FOR SHAFTS UNDER 9/16"

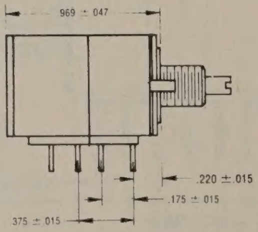
SINGLE UNIT—LUGS
MODEL 88


.594 ± .016
015
.22 ± .015
.175 ± .015
.625 ± .015
.50 DIA
.625 ± .015
.362 ± .015
.203 ± .015
.080
± .005
.100 ± .015
SLOT .040 WIDE x
.090 LONG, 3 PLCS.

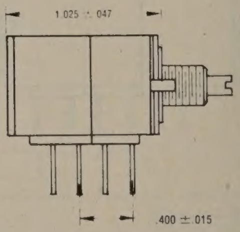
SINGLE UNIT—PC PINS
MODEL 87


.625 ±.016
.625 ± .015
.50 DIA
.625 ±.015
.377 ± .015
.50
.235 ± .015
.200 ±.015
.032 DIA
.20 ± .015

DUAL UNIT—LUGS

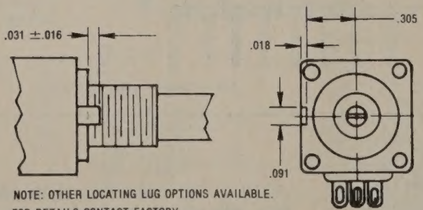

.969 ± .047
.220 ±.015
.175 ± .015
.375 ± .015

DUAL UNIT—PC PINS


1.025 ± .047
.400 ±.015

LOCATING LUG DIMENSIONS

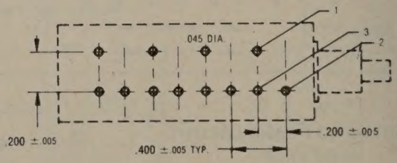
A—SGL. .305R. 90° CW (STD.)


.031 ±.016
.305
.018
.091

NOTE: OTHER LOCATING LUG OPTIONS AVAILABLE.
FOR DETAILS CONTACT FACTORY

NOTE: OTHER LOCATING LUG OPTIONS AVAILABLE.
FOR DETAILS CONTACT FACTORY

SUGGESTED PC BOARD LAYOUT—PC PINS


1
3
2
.045 DIA
.200 ± .005
.200 ± .005
.400 ± .005 TYP.

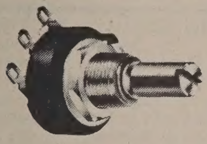
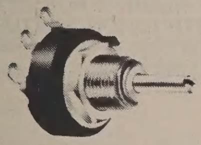
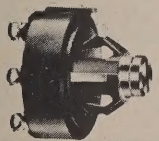
(BOTTOM VIEW—SINGLE SHAFT UNIT)
CONCENTRIC SHAFT—ADD .100
SPACER BETWEEN INNER AND
OUTER SHAFT MODULES

NOTE: See Model 81/82 Catalog for mechanical dimensions not shown.

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

BOURNS®

	MODEL	DESCRIPTION	
CERMET	**3852A**	3/8" D. x 3/8" L. Bushing	
	3852B	3/8" D. x 1/2" L. Locking Bushing	
	3852C	1/4" D. x 1/4" L. Bushing	
	3852E	1/4" D. x 3/8" L. Locking Bushing	
	3856A	3/8" D. x 3/8" L. Bushing 1/4" Shaft Dia.	3¾ Turns
	3856H	3/8" D. x 3/8" L. Bushing 1/8" Shaft Dia.	3¾ Turns
	3859A	3/8" D. x 3/8" L. Plastic Bushing	
	3859B	3/8" D. x 1/4" L. Plastic Snap-in Bushing	

SIGNIFICANT SPECIFICATIONS

¾" DIAMETER

Body Depth .... ¼"

Standard Resistance Range:
(Tapers A and H) .....50 to 5,000,000 ohms
(Tapers C and F) ...1,000 to 2,500,000 ohms

Resistance Tolerance ....±10% standard

Theoretical Electrical Travel
(3852 & 3859) ....240° ±10°

Mechanical Angle (3852 & 3859) ...280° ±5°
(3856 No stops) ....1350° ±50°

Continuity ....Maintained for full mechanical angle

Max. Contact Resistance Variation .....±3% of total resistance

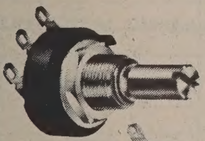
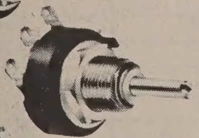
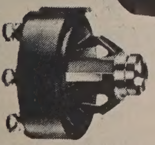
Power rating at 70°C
(Tapers A and H) ....2 watts
(Tapers C and F) ....1 watt

Operating Temperature
Range .....—65° to +150°C (3852 & 3856)
—65° to +125°C (3859)

Temperature Coefficient ......±150 ppm/°C

Rotational Life ....50,000 cycles

	MODEL	DESCRIPTION
CONDUCTIVE PLASTIC	**3851A**	3/8" D. x 3/8" L. Bushing
	3851B	3/8" D. x 1/2" L. Locking Bushing
	3851C	1/4" D. x 1/4" L. Bushing
	3851E	1/4" D. x 3/8" L. Locking Bushing
	3858A	3/8" D. x 3/8" L. Plastic Bushing
	3858B	3/8" D. x 1/4" L. Plastic Snap-in Bushing

¾" DIAMETER

Body Depth .... ¼"

Standard Resistance Range:
(Tapers B and E) ...1,000 to 100,000 ohms
(Tapers D and G) ....2,000 to 50,000 ohms

Resistance Tolerance ....±20% standard

Theoretical Electrical Travel
(3851 & 3858) ....240° ±10°

Mechanical Angle (3851 & 3858) ...280° ±5°

Continuity ....Maintained for full mechanical angle

Max. Contact Resistance Variation .....±1% of total resistance

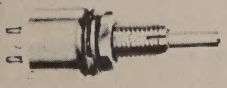
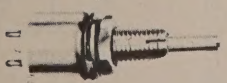
Power Rating at 70°C:
(Tapers B and E) ....1 watt
(Tapers D and G) ....0.5 watt

Operating Temperature
Range ....—65° to +125°C

Temperature Coefficient ....±1,000 ppm/°C

Rotational Life ....100,000 cycles

	MODEL	DESCRIPTION
CERMET	**3862C**	1/4" D. x 1/4" L. Bushing
	3862E	1/4" D. x 1/2" L. Locking Bushing
	RVC6N	1/4" Diameter Non-Locking Bushing
	RVC6L	1/4" Diameter Locking Bushing

½" DIAMETER

Body Depth ....453" ±.016
Standard Resistance Range:
(Tapers A and H) ....100 to 5,000,000 ohms
(Tapers C and F) ....500 to 2,500,000 ohms
Resistance Tolerance ....±10% standard
Theoretical Electrical Travel .....260° ±10°
Mechanical Angle ....295° ±3°
Max. Contact Resistance Variation .....±3% of total resistance
Power Rating at 125°C:
(Tapers A and H) ....1 watt
(Tapers C and F) ....0.5 watt
Operating Temperature
Range ....—65° to +175°C
Temperature Coefficient ......±150 ppm/°C
Standard Resistance Range ...1,000 ohms to 5,000,000 ohms
Resistance Tolerance ....±10% standard
Power Rating ....½ watt at +125°C
Operating Temperature
Range ....—65°C to +175°C

PRODUCT PHOTOGRAPHS ARE APPROXIMATELY THREE QUARTERS ACTUAL SIZE
FOR STYLES OTHER THAN THOSE ILLUSTRATED, SEE MODEL DESCRIPTIONS ABOVE.

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

PRECISION POTENTIOMETERS

BOURNS®

STANDARD PRECISION POTENTIOMETERS

PART NUMBERING SYSTEM

3400—S—1 102

MODEL NUMBER — 3400

STANDARD FUNCTION — S

RESISTANCE CODE — 1
(3 or 4 digits see below)

PART NUMBER FOR STANDARD CONSTRUCTION FEATURES — 102
(For exceptions and special optional features see below)

OPTIONAL FEATURES (Substitute for single digit part number)	PART NUMBER	3400	3500	3509	3510	3520	3540	3541	3543	3545	3700	3501	3507	3707	STANDARD RESISTANCES (Refer to limits for each model) OHMS	CODE
High Torque Feature (2 to 8 oz.-in.)	16	X	X	X	X	X	X	X	X	X		X	X		10	100
TR Tolerance ±1.0%	31	X		X	X	X	X		X	X	X		X	X	25	250
TR Tolerance ±1.0%	32		X												50	500
TR Tolerance ±5.0%	36											X			100	101
Linearity ±0.1% Min. Res. 300Ω	40	X		X	X	X	X				X		X		200	201
Linearity ±0.1% Min. Res. 300Ω	42		X												500	501
Linearity ±.05% Min. Res. 1KΩ	41	X													1,000	102
Linearity ±.05% Min. Res. 1KΩ	43		X												2,000	202
Linearity ±.25%	45				X	X					X	X		X	5,000	502
Center Tap	50											X			10,000	103
Center Tap	51	X			X	X	X		X	X	X		X	X	20,000	203
Center Tap	52		X	X											50,000	503
⅛″ Shaft, ¼″ Bushing	70		X			X	X	X	X	X			X		100,000	104
¼″ Shaft, ⅜″ Bushing	71				X										125,000	1253
Split Lock Bushing	72				X						X			X	150,000	154
Split Lock Bushing	77		X			X	X	X	X	X		X	X		200,000	204
⅞″ Shaft Length Beyond Bushing	73	X	X	X	X	X	X	X	X	X	X	X	X	X	250,000	254
⅝″ Shaft Length Beyond Bushing	74	X	X	X	X	X	X	X	X	X	X	X	X	X	500,000	504
¾″ Shaft Length Beyond Bushing	75	X	X	X	X	X	X	X	X	X	X	X	X	X	1,000,000	105
1″ Shaft Length Beyond Bushing	76	X	X	X	X	X	X	X	X	X	X	X	X	X	2,000.000	205
Shaft Flat	80		X		X	X	X	X	X	X		X	X		5,000,000	505
Non-Turn Pin	90		X													
Non-Turn Pin	91				X	X	X	X	X	X		X				
2-Cup Assembly	135	X	X		X	X	X	X	X	X		X				

EXCEPTIONS TO STANDARD CONSTRUCTION 3509S-8-RC has stainless steel shaft, metal bushing. 3509S-7-RC has stainless steel shaft, plastic bushing. 3509S-9-RC has plastic shaft, metal bushing.

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5122

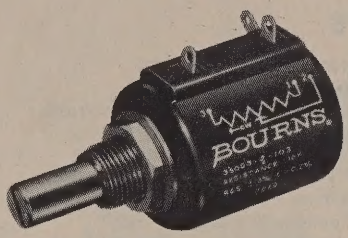
MODEL 3500

⅞" DIAMETER 10-TURN BUSHING MOUNT
WIREWOUND ELEMENT

PRECISION POTENTIOMETER
BOURNS®

FEATURES

- *0.20% linearity (standard)*
- *20% longer resistance element in a compact housing only 1.00" long*
- *Extended temperature range −65 to +125°C*
- *Housing high temperature, moisture resistant thermosetting plastic.*
- *SILVERWELD® termination eliminates vulnerable single wire termination.*
- *Performance of Model 3500 is guaranteed by the Bourns Reliability Assurance Program which includes individual inspection to published electrical and physical characteristics*
- *Custom design capability is available to satisfy your most demanding and difficult special requirements.*



STANDARD SPECIFICATIONS

THE SPECIFICATIONS LISTED BELOW ARE FOR THE STANDARD MODEL. MODIFICATIONS OF ALL TYPES (MECHANICAL, ELECTRICAL AND ENVIRONMENTAL) CAN BE CUSTOM ENGINEERED TO YOUR SPECIFIC REQUIREMENTS.

ELECTRICAL CHARACTERISTICS

Resistance Range	50 ohms to 500K ohms
Resistance Tolerance	±3%
Linearity (Independent)	±0.20%
Resolution	See Standard Resistance Table
Effective Electrical Angle	3600° (+10°/−0°)
Absolute Minimum Resistance	1.0 ohm or 0.1%, whichever is greater
Noise	100 ohms ENR maximum
Power Rating	
70°C	2.0 watts
125°C	.0 watt
Dielectric Strength	MIL-R-12934
Room Conditions	1500 volts AC minimum
70,000 feet (0.8" hg.)	400 volts AC minimum
Insulation Resistance 500 volts DC	1000 megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Temperature Range	−65 to +125°C
Temperature Coefficient of Wire [1]	20 ppm/°C maximum
Humidity	MIL-R-12934 humidity cycling
Vibration	MIL-R-12934, 20G
Wiper Bounce	0.1 millisecond maximum
Wiper Shift	0.1% maximum
Shock	MIL-R-12934, 100G
Wiper Bounce and Wiper Shift	Same as Vibration
Load Life	MIL-R-12934, 1000 hours
Resistance Shift	2.0% maximum
Sand and Dust	MIL-E-5272
Fungus	MIL-E-5272
Salt Spray	MIL-R-12934

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	3600° (+10°/−0°)
Shaft Runout	.002 in. T.I.R.
Lateral Runout	.005 in. T.I.R.
Pilot Diameter Runout	.002 in. T.I.R.
Shaft End Play	.005 in. T.I.R.
Shaft Radial Play	.003 in. T.I.R.
Rotational Life [1]	2,000,000 shaft revolutions
Stop Strength	96 oz.-in. maximum
Ganging	2 cups maximum
Torque	0.6 oz.-in. maximum Add 75% for additional cup
Weight	Approximately 1.0 oz.
Terminals	Gold-plated solder lugs
Markings	Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and data code.

NOTES:

[1] Consult manufacturer for complete specification details for resistance below 200 ohms and above 125K ohms.

Specification Note: Closer performance tolerances can be supplied upon request.

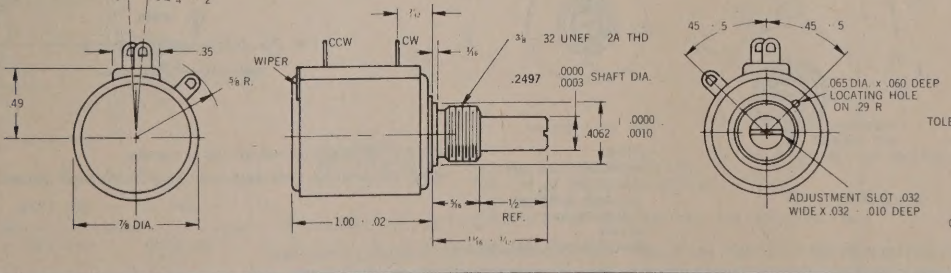
Specifications are subject to change without notice.

STANDARD RESISTANCES

Resistance (ohms)	Part Number*	Resolution (percent)
50	3500S-2-500	.049
100	3500S-2-101	.045
200	3500S-2-201	.037
500	3500S-2-501	.028
1,000	3500S-2-102	.022
2,000	3500S-2-202	.019
5,000	3500S-2-502	.014
10,000	3500S-2-103	.016
20,000	3500S-2-203	.013
30,000	3500S-2-303	.010
50,000	3500S-2-503	.009
75,000	3500S-2-753	.008
100,000	3500S-2-104	.007
125,000	3500S-2-1253	.007
150,000	3500S-2-154	.007
200,000	3500S-2-204	.006
250,000	3500S-2-254	.006
500,000	3500S-2-504	.005

* The last three or four digits of the part number represent the resistance in standard code.

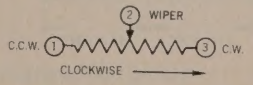
DIMENSIONS



4 · 2
.35
⅝ R.
.49
⅞ DIA.
WIPER
CCW
CW
7⁄32
1⁄16
⅜ 32 UNEF 2A THD
.2497 .0000 .0003 SHAFT DIA.
.4062 .0000 .0010
5⁄16
½ REF.
1.00 · .02
11⁄16 · 1⁄32
45 · 5
45 · 5
.065 DIA. x .060 DEEP LOCATING HOLE ON .29 R
ADJUSTMENT SLOT .032 WIDE X .032 · .010 DEEP

NOTE .
LOCKWASHER AND HEX NUT TO BE SUPPLIED WITH EACH UNIT.

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX · .010, XXX · .005
FRACTIONS: · 1⁄64



BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 3540

⅞" DIAMETER 10-TURN BUSHING MOUNT WIREWOUND ELEMENT

PRECISION POTENTIOMETER

BOURNS®

FEATURES

- *Small size: extends ¾" behind panel*
- *High performance at low cost*
- *Unique, rugged, mechanically locked construction*
- *Direct terminal-to-element, SILVERWELD® bond eliminates vulnerable multi-joint connections*
- *Linearity: 0.25%*
- *Temperature Range: —55°C to +125°C*
- *NEW! Factory options available:*
  - *2 section unit with single or concentric shafts*
  - *Anti Rotation Lug*

STANDARD SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Resistance Range	100 ohms to 100K ohms
Resistance Tolerance	±5%
Linearity (Independent)	±0.25%
Resolution	See Standard Resistance Table
Effective Electrical Angle	3600° (+10°/—0°)
Absolute Minimum Resistance	1.0 ohm or 0.1%, whichever is greater
Noise	100 ohms ENR maximum
Power Rating	
70°C	2.0 watts
125°C	0 watt
Second Section (-135 or -468)	1.5 watts at 70°C
Dielectric Strength	MIL-R-12934
Sea level	1000 volts AC minimum
Insulation Resistance 500 volts DC	1000 megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Temperature Range	—55°C to +125°C
Temperature Coefficient of Wire 1	20 ppm/°C maximum
Vibration	MIL-R-12934, 15G
Wiper Bounce	0.1 millisecond maximum
Shock	MIL-R-12934, 50G
Wiper Bounce	0.1 millisecond maximum
Load Life	MIL-R-12934, 1000 hours
Resistance Shift	2.0% maximum

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	3600° (+10°/—0°)
Shaft Runout	.003 in. T.I.R.
Lateral Runout	.005 in. T.I.R.
Pilot Diameter Runout	.003 in. T.I.R.
Shaft End Play	.010 in. T.I.R.
Shaft Radial Play	.003 in. T.I.R.
Rotational Life 1	1,000,000 shaft revolutions
Stop Strength	75 oz.-in. minimum
Torque	0.5 oz.-in. maximum
Weight	Approximately .75 oz.
Terminals	Gold-plated solder lugs
Markings	Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and date code.

NOTES:

1 Consult manufacturer for complete specification details, for resistance below 200 ohms.

Specification Note: Closer performance tolerances can be supplied upon request.

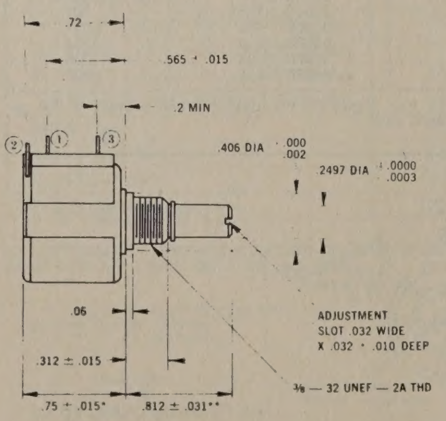
Specifications are subject to change without notice.

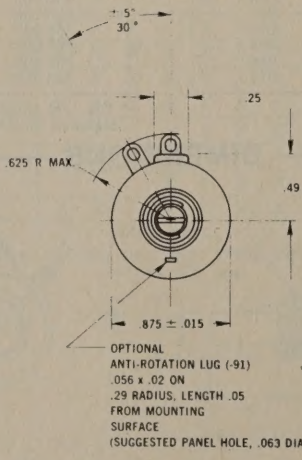
STANDARD RESISTANCES

Resistance (ohms)	Part Number*	Resolution (percent)
100	3540S-1-101	.061
200	3540S-1-201	.038
500	3540S-1-501	.031
1,000	3540S-1-102	.025
2,000	3540S-1-202	.022
5,000	3540S-1-502	.017
10,000	3540S-1-103	.018
20,000	3540S-1-203	.016
50,000	3540S-1-503	.010
100,000	3540S-1-104	.009

*The last three or four digits of the part number represent the resistance in standard code.

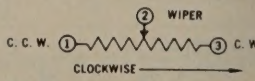
DIMENSIONS





NOTE:
LOCKWASHER AND HEX NUT SUPPLIED.

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX ± .010, .XXX ± .005



*ADD .745" FOR SECOND SECTION (3540-135 or 3540-468)

**ADD .5" FOR .1248" DIA. INNER (REAR SECTION) CONCENTRIC SHAFT (3540-468)

BOURNS TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

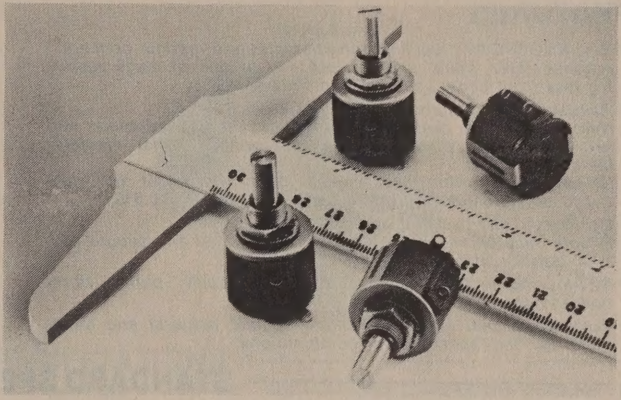
MODEL 3541

10-TURN, HYBRITRON™ POTENTIOMETER
⅞" DIAMETER, BUSHING MOUNT

PRECISION POTENTIOMETER
BOURNS®

FEATURES

- *HYBRITRON™ conductive plastic-on-wirewound element*
- *Compact size: ⅞" diameter, ¾" depth*
- *Rotational life: 5,000,000 shaft revolutions*
- *Rugged, mechanically locked construction*
- *Linearity: 0.25%*
- *Temperature range: —55°C to +125°C*
- *Options available include: 2 section unit with common or concentric shafts and anti-rotation lug*
- *Temperature coefficient ±100 ppm*



Bourns has wedded the best features of both wirewound and conductive plastic resistance elements in a new composite we call HYBRITRON™. The result is a precision potentiometer with exceptionally long life and infinite resolution . . . PLUS a low temperature coefficient and good stability. This hybrid element is used in Bourns new Model 3541 10-turn unit.

The 3541 employs Bourns exclusive SILVERWELD® direct, terminal-to-element bond for the ultimate in reliability.

STANDARD SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Resistance Range	1K ohms to 100K ohms
Resistance Tolerance	±10%
Linearity (Independent) 1	±0.25%
Resolution	Essentially infinite
Effective Electrical Angle	3600° (+10°/—0°)
Output Smoothness	0.015% maximum
Power Rating	
70°C	2.0 watts
125°C	0 watt
Second Section (-135 or -468)	1.5 watts at 70°C
Dielectric Strength	MIL-R-39023
Sea Level	1000 volts AC minimum
Insulation Resistance 500 volts DC	1000 megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Temperature Range	—55°C to +125°C
Temperature Coefficient	±100 ppm/°C maximum
Vibration	MIL-R-39023 15G
Wiper Bounce	0.1 millisecond maximum
Shock	MIL-R-39023, 50G
Wiper Bounce	0.1 millisecond maximum
Load Life	MIL-R-39023, 1000 hours
Resistance Shift	5.0% maximum

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	3600° (+10°/—0°)
Shaft Runout	.003 in. T.I.R.
Lateral Runout	.005 in. T.I.R.
Pilot Diameter Runout	.003 in. T.I.R.
Shaft End Play	.010 in. T.I.R.
Shaft Radial Play	.003 in. T.I.R.
Rotational Life 1	5,000,000 shaft revolutions
Stop Strength	75 oz.-in. minimum
Torque 2	0.5 oz.-in. maximum
Weight 2	Approximately .80 oz.
Terminals	Solder lugs
Markings	Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and date code.

NOTES:
1 From 1% to 99% VR output.
2 Single Unit specification.
Specification Note: Closer performance tolerances can be supplied upon request.
Specifications are subject to change without notice.

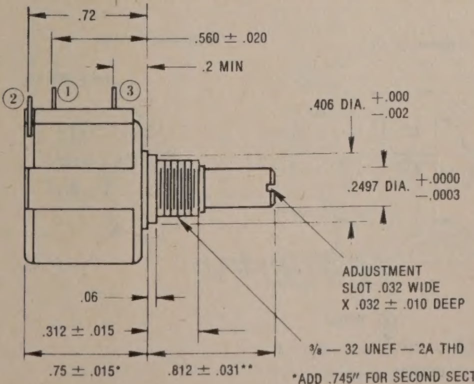
STANDARD RESISTANCES

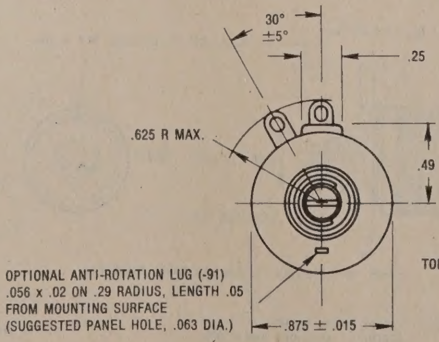
Resistance (ohms)	Part Number*
1,000	3541S-1-102
2,000	3541S-1-202
5,000	3541S-1-502
10,000	3541S-1-103
20,000	3541S-1-203
50,000	3541S-1-503
100,000	3541S-1-104

*The last three or four digits of the part number represent the resistance in standard code.

COMMON MODIFICATIONS:	ORDER PART NUMBER:
Anti Rotation Lug	3541S-91-RC
Two sections with common shaft	3541S-135-RC/RC
Two sections with concentric shafts	3541S-468-RC/RC

DIMENSIONS




30° ±5°
.25
.625 R MAX.
.49
OPTIONAL ANTI-ROTATION LUG (-91)
.056 x .02 ON .29 RADIUS, LENGTH .05
FROM MOUNTING SURFACE
(SUGGESTED PANEL HOLE, .063 DIA.)
.875 ± .015

NOTE:
LOCKWASHER AND HEX NUT SUPPLIED

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX ± .010, .XXX ± .005

*ADD .745" FOR SECOND SECTION (3541-135 or 3541-468) **ADD .5" FOR .1248" DIA. INNER (REAR SECTION) CONCENTRIC SHAFT (3541-468)

BOURNS INC. TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

MODEL 3600

PRECISION POTENTIOMETER

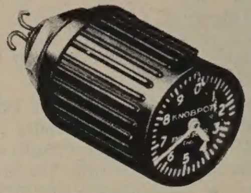
BOURNS®

KNOBPOT® POTENTIOMETER ¾" DIAMETER 10-TURN BUSHING MOUNT WIREWOUND ELEMENT

FEATURES

- *New KNOBPOT® precision potentiometer and readout concept.* Potentiometer, knob, and readout dial in one package requiring less front panel space than most dials alone.*
- *Readability, Repeatability, and Phasing.*
  New clock face readout provides excellent readability and setting accuracy previously available only in larger diameter dials.
  (Repeatability, within 0.1% voltage ratio. Phasing of dial readout to potentiometer performed at factory within ±0.5%).
- *Mounting: Only two drill holes required.*
  Simple installation—place unit in drilled panel and secure with lockwasher and nut.
- *Self-locking feature provides excellent stability during vibration and shock.*
- *Customized Dial Face Capability—Special numeral and increment marking, special color combinations.*

Actual Size



STANDARD SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range	100 ohms to 250K ohms
Resistance Tolerance*	±5%
Accuracy (correlation of dial reading to output)	±0.5% voltage ratio
Repeatability of dial reading	0.1% voltage ratio
Resolution	See Standard Resistance Table
Effective Electrical Angle	3600° Normal
Absolute Minimum Resistance*	1 ohm or 0.1%, whichever is greater
Noise During Adjustment*	100 ohms ENR maximum
Power Ratings:	
25°C	1.5 watt
85°C	0 watt
Dielectric Strength	MIL-STD-202
Room Conditions	1000 volts AC
70,000 feet	400 volts AC

ENVIRONMENTAL CHARACTERISTICS

Temperature Range	−65 to +85°C
Temperature Coefficient of Resistance Wire ①	20 ppm/°C maximum
Humidity	MIL-STD-202, Method 103
Vibration	MIL-R-12934, 10G
Wiper Bounce	0.1 millisecond maximum
Wiper Shift	0.2% maximum.
Shock	MIL-R-12934, 50G
Wiper Bounce and Wiper Shift	Same as Vibration
Load Life	1000 hours
Resistance Shift, Maximum	2.0%
Sand and Dust	MIL-E-5272
Salt Spray	MIL-R-12934
Fungus	MIL-E-5272

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	3600° (+20°/−0°)
Rotational Life ①	200,000 dial revolutions
Stop Strength	20 in.-oz.
Torque, in.-oz.	0.75 minimum, 5.0 maximum (starting) 5.0 maximum (running)
Weight	0.6 oz.
Marking*	Manufacturer's name, part number, resistance value and date code.

* Inspection Note: Applicable 100% or statistical sampling inspection performed to insure highest quality.

① Consult manufacturer for complete specification details for resistances below 1000 ohms and above 100k ohms.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

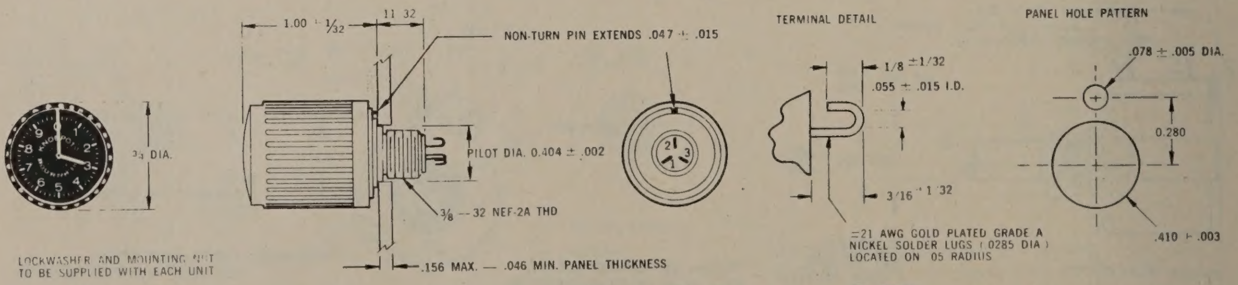
STANDARD RESISTANCES

Resistance (Ohms)	Part Numbers**	Resolution (Percent)
100	3600S-1-101	.040
200	3600S-1-201	.040
500	3600S-1-501	.035
1,000	3600S-1-102	.029
2,000	3600S-1-202	.030
5,000	3600S-1-502	.023
10,000	3600S-1-103	.019
20,000	3600S-1-203	.015
50,000	3600S-1-503	.011
100,000	3600S-1-104	.009
200,000	3600S-1-204	.008
250,000	3600S-1-254	.007

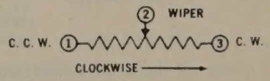
* Patent No. 3,069,646

** The last three digits of the part number represent the resistance in standard code.

DIMENSIONS


¾ DIA.
LOCKWASHER AND MOUNTING NUT TO BE SUPPLIED WITH EACH UNIT
1.00 ± 1⁄32
11⁄32
NON-TURN PIN EXTENDS .047 ± .015
PILOT DIA. 0.404 ± .002
⅜ -- 32 NEF-2A THD
.156 MAX. — .046 MIN. PANEL THICKNESS
2
3
1
TERMINAL DETAIL
1/8 ±1/32
.055 ± .015 I.D.
3/16 ± 1/32
≈21 AWG GOLD PLATED GRADE A NICKEL SOLDER LUGS (.0285 DIA.) LOCATED ON .05 RADIUS
PANEL HOLE PATTERN
.078 ± .005 DIA.
0.280
.410 ± .003

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX ± .010, XXX ± .005
FRACTIONS: ± 1⁄64



BOURNS INC

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MODEL 3610

PRECISION POTENTIOMETER

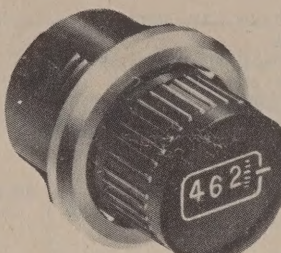
BOURNS®

DIGITAL KNOBPOT® POTENTIOMETER 7/8" DIAMETER, 10-TURN, SNAP-IN MOUNTING WIREWOUND ELEMENT

FEATURES

- *Integral digital readout, knob and potentiometer.*
- *The high accuracy of this model is enhanced by excellent visual readability. Numbers are as easy to read as those on much larger readout devices.*
- *Saves space 2 ways: a small diameter of only 7/8", an extension behind the panel of less than 7/8".*
- *Guaranteed accuracy: a premounted, prephased assembly with maximum possible error between electrical output and dial reading specified at ±.5% for all resistances. This error is the combination of terminal base linearity and dial accuracy.*
- *Simple to install: new snap-in mounting cup saves time and labor and provides a shock-resistant mounting.*
- *Recessed lens offers protection from breakage, especially during installation.*
- *Specials, such as custom knobs, readout faces, higher accuracies and a handy removal tool are readily available. Consult any Bourns sales office.*

Actual Size



STANDARD SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range ....100 to 250,000 ohms
Resistance Tolerance ....±5%
Accuracy (correlation of dial reading to output) ....±0.5% voltage ratio
Repeatability of dial reading ....0.1% voltage ratio
Resolution ....See standard resistance table
Effective Electrical Angle ....3600° nominal
Absolute Minimum Resistance ....1 ohm or 0.1%, whichever is greater
Noise During Adjustment ....100 ohms ENR maximum
Power Ratings:
25°C ....1.5 watts
85°C ....0 watt
Dielectric Strength MIL-STD-202
Room Conditions ....1,000 volts AC
70,000 feet ....400 volts AC

ENVIRONMENTAL CHARACTERISTICS

Temperature Range ....—25° to +85°C
Temperature Coefficient of Resistance Wire ① ....20 ppm/°C maximum
Humidity ....MIL-STD-202, Method 103 B, Cond. B
Vibration MIL-R-12934, 10Gs
Wiper Bounce ....0.1 millisecond maximum
Wiper Shift ....0.2% maximum
Shock MIL-R-12934, 50Gs
Wiper Bounce and Wiper Shift ....Same as vibration
Load Life ....1,000 hours
Resistance Shift, Maximum 2.0%

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle ....3600° (+20°/—0°)
Rotational Life ① ....50,000 dial revolutions
Stop Strength ....20 oz.-in.
Torque, oz.-in. ....1 minimum, 7 maximum (starting)
7 maximum (running)
Weight ....0.7 oz.
Marking ....Manufacturer's name, part number, resistance value and date code.

①Consult manufacturer for complete specification details for resistances below 1000 ohms and above 100k ohms.
Specification Note: Closer performance tolerances can be supplied upon request.
Specifications are subject to change without notice.

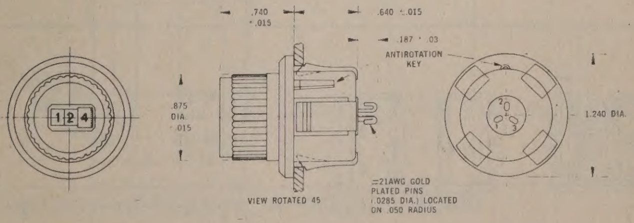
STANDARD RESISTANCES

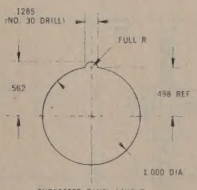
Resistance (Ohms)	Part Numbers*	Resolution (Percent)
100	3610S-1-101	.046
200	3610S-1-201	.046
500	3610S-1-501	.041
1,000	3610S-1-102	.034
2,000	3610S-1-202	.034
5,000	3610S-1-502	.028

Resistance (Ohms)	Part Numbers*	Resolution (Percent)
10,000	3610S-1-103	.022
20,000	3610S-1-202	.018
50,000	3610S-1-503	.014
100,000	3610S-1-104	.011
200,000	3610S-1-204	.009
250,000	3610S-1-254	.009

* The last three digits of the part number represent the resistance in standard code.

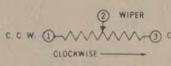
DIMENSIONS





SUGGESTED PANEL LAYOUT

NOTES
1. SNAP-IN MOUNTING CUP ACCOMODATES PANEL THICKNESS .025 THRU .078 NO. 22GA THRU NO. 14 GA AND .125



TOLERANCES: EXCEPT WHERE NOTED
DECIMALS .xx ± .015
.xxx ± .005

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MODEL 3680

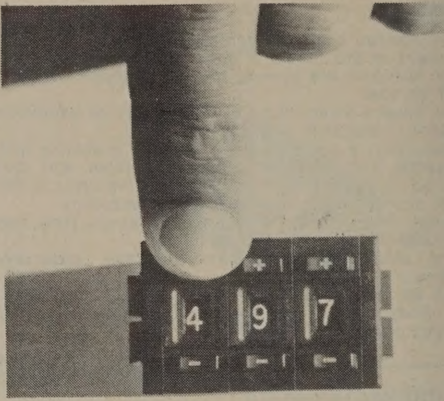
PRECISION POTENTIOMETER

BOURNS®

KNOBPOT® DIGITAL POTENTIOMETER SNAP-IN MOUNTING PUSHBUTTON ACTION, CERMET ELEMENTS 0.1% RESOLUTION

FEATURES

- *0% to 100% capability by 0.1% steps*
- *In-Line Digital readout*
- *Accuracy (Dial Reading to Output Ratio) ±0.5% full scale*
- *Convenient snap-in mounting with bezel*
- *Stable Bourns proprietary built-in Cermet Resistors*
- *Small panel space*
- *Rear solder lug terminals fit AMP series 110 receptacles (dual purpose solderable)*
- *100 PPM/°C tempco*
- *2 watts power rating*
- *1K-1 Megohms standard total resistance range*
- *Temperature range −25°C to +85°C*
- *Rectangular to match other panel components*



STANDARD SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Standard Resistance Range	1K ohms to 1 megohm
Resistance Tolerance	±1.0%
Absolute Minimum Resitance	3 ohms or .2% of total resistance whichever is greater
Resolution	0.1%
Insulation Resistance @ 500 VDC	1000 megohms min.
Power	2 watts at 25°C 0 watts at 85°C
Dielectric Strength @ Sea Level	1,000volts AC
Accuracy (Dial Reading to Output)	±.5% of full scale
Repeatability of Dial Reading	±0.1% of full scale

ENVIRONMENTAL CHARACTERISTICS

Temperature Range	−25°C to +85°C
Vibration @ 10G	
Contact Bounce	0.1 millisecond maximum
Wiper Shift	0.2% voltage ratio
Shock @ 50G	Same as vibration
Load Life @ 1,000 Hours	
Total Resistance Shift	±2.0%

MECHANICAL AND PHYSICAL CHARACTERISTICS

Life	100,000 button operations/decade
Weight	Approximately .78 oz.
Terminals .11 wide x .016 thick	Tinned solder lugs for 3 #20 AWG wires
Marking	Manufacturer's name, wiring diagram, part number, resistance value, date code
Readout Marking	11 positions, left and center digits 0-9-9; right digit 0-10

1 A momentary decrease of 1% in total resistance occurs only when the least significant digit is transferred directly between the 0 and 10 positions.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

Resistance (Ohms)	Part Numbers**
1,000	3680S-1-102
2,000	3680S-1-202
5,000	3680S-1-502
10,000	3680S-1-103
100,000	3680S-1-104
1,000,000	3680S-1-105

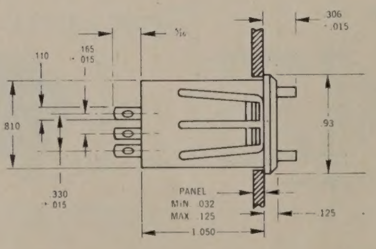
** The last three digits of the part number represent the resistance in standard code. For special resistances & functions, consult factory.

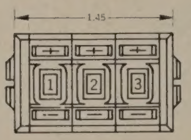
If you're designing panels with precision data entry or set-point controls, consider the BOURNS Model 3680 KNOBPOT® Digital Potentiometer . . . another innovative product from Bourns.

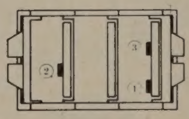
The 3680 integrates a precision incremental decade potentiometer with an easy-to-read digital display, AND a speedy pushbutton control action. It is handsome, accurate, and a "snap" to install.

Everything is INSIDE the Model 3680 . . . no resistors or mini-PC boards are required . . . nothing clutters the back of the unit to steal precious space.

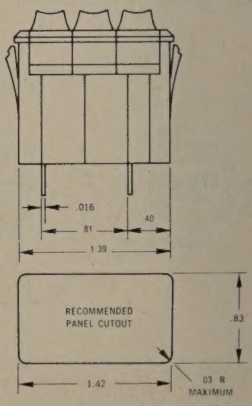
DIMENSIONS







TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: XX ± .010
XXX ± .005
FRACTIONS: ± 1/64



BOURNS INC

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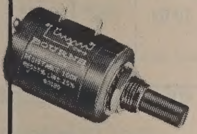
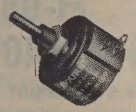
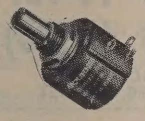
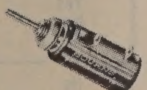
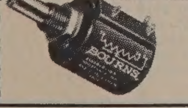
OTHER AVAILABLE PRECISION POTENTIOMETERS

PRECISION POTENTIOMETER
BOURNS®

WIREWOUND SPECIFICATIONS

Model	Resistances	Resistance Tolerance	Linearity, Independent	Electrical and Mechanical Rotation	Mechanical Life	Power	Maximum Temperature Range	Size (dia. x length)	Maximum Ganging	Shock	Vibration
3400 1 13/16" DIA. 10 TURNS	100Ω-250K 500K	±3%	±0.15%	3600° (+4°/—0°)	2,000,000 Rev.	5W at 40°C	—65° to +105°C	1 13/16" x 1¾"	2 cups	50 Gs	10 Gs
 **3509** ⅞" DIA. 10 TURNS	50Ω-100K	±5%	±0.25%	3600° (+10°/–2°)	1,000,000 Rev.	2W at 25°C	—55 to +105°C	⅞" x 1⅛"	NA	50 Gs	10 Gs
 **3510** ⅞" DIA. 3 TURNS	25Ω-50K 100K	±3%	±0.3%	1080° (+10°/—0°)	600,000 Rev.	1W at 70°C	—65° to +125°C	⅞" x 9/16"	2 cups	100 Gs	20 Gs
 **3520** ⅞" DIA. 5 TURNS	25Ω-75K 100K, 250K	±3%	±0.3%	1800° (+10°/—0°)	1,000,000 Rev.	1.5W at 70°C	—65° to +125°C	⅞" x 11/16"	2 cups	100 Gs	20 Gs
3543 ⅞" DIA. 3 TURNS	20Ω-50K	±5%	±0.25%	1080° (+10°/—0°)	300,000 Rev.	1W at 70°C	—55° to +125°C	⅞" x ¾"	2 cups	50 Gs	15 Gs
3545 ⅞" DIA. 5 TURNS	50Ω-50K	±5%	±0.25%	1800° (+10°/—0°)	500,000 Rev.	1.5 W at 70°C	—55° to +125°C	⅞" x ¾"	2 cups	50 Gs	15 Gs
 **3700** ½" DIA. 10 TURNS	50Ω-100K	±5%	±0.5%	3600° (+20°/—0°)	1,000,000 Rev.	1W at 70°C	—65° to +125°C	½" x 1"	NA	100 Gs	20 Gs
3707 ½" DIA. 10 TURNS	100Ω-100K	±5%	±1.0%	3600° (+20°/—0°)	200,000 Rev.	1W at 40°C	—55° to +105°C	½" x 1"	NA	50 Gs	10 Gs

CONDUCTIVE PLASTIC SPECIFICATIONS

Model	Resistances	Resistance Tolerance	Linearity, Independent	Electrical and Mechanical Rotation	Mechanical Life	Power	Maximum Temperature Range	Size (dia. x length)	Maximum Ganging	Shock	Vibration
 **3501** ⅞" DIA. 10 TURNS	1K-500K 1, 2, 4 Meg	±10%	±0.5%	3600° (+10°/—2°)	4,000,000 Rev. Minimum	2W at 70°C	—55° to +105°C	⅞" x 1"	2 cups	100 Gs	20 Gs

BOURNS INC TRIMPOT PRODUCTS DIVISION
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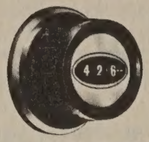
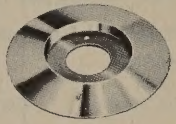
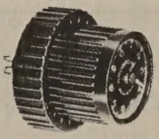
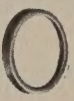
OTHER AVAILABLE PRECISION POTENTIOMETERS

PRECISION POTENTIOMETER
BOURNS®

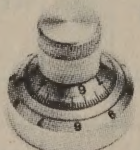
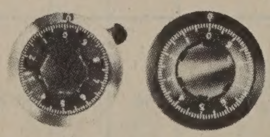
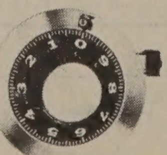
KNOBPOT® POTENTIOMETERS

	KNOBPOT® Model	Resistance (Ohms)	Tolerance (%)	Dial Acc. % VR	Dial Repeat-ability % VR	Electrical Rotation	Mechan-ical Life (Rev)	Watts Power at 25°C	Maximum Operating Temp. Range	Shock	Vibration	Length FMS	Length Overall
	3640 1¼" DIA., 10-TURN DIGITAL READOUT WIREWOUND	100-100K	±3	±0.1	±0.05	3,600° Nominal	200,000	2.5	−65° to +85°C	50 Gs	10 Gs	1½"	2⅓₂"
	**3650** 1¼" DIA., 10-TURN DIGITAL READOUT WIREWOUND	100-100K	±3	±0.1	±0.05	3,600° Nominal	200,000	2.5	−25° to +85°C	50 Gs	10 Gs	29/32"	2 15/32"

ACCESSORIES FOR KNOBPOT® POTENTIOMETERS

	H-361 (3610) REMOVAL TOOL		**H-95 (3600) H-98 (3640)** STAINLESS STEEL SKIRT
	**H-97 (3640) H-103 (3600)** PLASTIC SLIP-OVER FRICTION BRAKE		**H-105 (3640) H-107 (3600)** FLAT FACE RECESS MOUNTING BRACKET
	**H-93 (3600) H-99 (3640)** SNAP-ON COLOR RINGS*		**H-106 (3640) H-108 (3600)** BEVELED FACE RECESS MOUNTING BRACKET

TURNS-COUNTING DIALS

		Part No.	Body Finish	Shaft Diameter (Inches)	Brake
	**H-400 SERIES** 1" DIAMETER	H-411	Black	¼	No
		H-412	Black	¼	Yes
		H-461	Clear	¼	No
		H-462	Clear	¼	Yes
		H-421	Black	⅛	No
		H-422	Black	⅛	Yes
		H-471	Clear	⅛	No
		H-472	Clear	⅛	Yes
	**H-490 SERIES** 1" DIAMETER	H-491-1	Clear	3/32	No
		H-492-1	Clear	3/32	Yes
		H-493-1	Black	3/32	No
		H-494-1	Black	3/32	Yes
		H-491-2	Clear	⅛	No
		H-492-2	Clear	⅛	Yes
		H-493-2	Black	⅛	No
		H-494-2	Black	⅛	Yes
		H-491-3	Clear	¼	No
		H-492-3	Clear	¼	Yes
		H-493-3	Black	¼	No
		H-494-3	Black	¼	Yes
	**H-510 SERIES** 1⅜" DIAMETER	H-510-1	Clear	⅛	Yes
		H-510-2	Clear	⅛	Yes

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

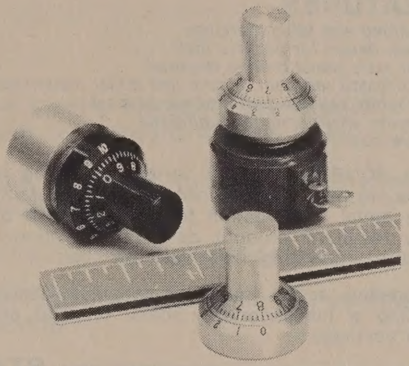
MODEL H-700

TURNS COUNTING DIAL
¾″ DIAMETER, 10-TURN

BOURNS®

FEATURES

- *Markings are machine engraved*
- *Cam detent for positive lock*
- *No extra panel drilling required*
- *Corrosion resistant, all-metal construction assures reliable performance in rugged environmental applications*



SPECIFICATIONS

MECHANICAL AND PHYSICAL CHARACTERISTICS

Number of Turns 10
Dial Divisions 50
Readability-Ten Turns .1 Part in 500
Torque—Running, While Mounted . . .2.0 oz.-in. maximum
Markings . . . . .H-721 White On Black Background
H-771 Black On Aluminum Background
Set Screw Tightening Torque . . . . . . .2.0 in. lbs. maximum

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

ENVIRONMENTAL CHARACTERISTICS

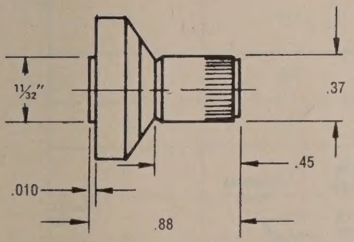
Operating Temperature Range . . . .−15°C to +85°C
Mechanical Life . . . . .10,000 cycles
Humidity-No Damage . . . . .96 hours @ 95% RH

SHAFT AND BUSHING REQUIREMENTS

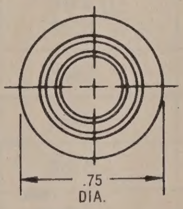
Shaft Extension Beyond Panel . . . . .600 minimum
.800 maximum
Bushing Extension Beyond Panel . . . . .225 maximum
(Including Shaft C Ring where applicable)

PART NUMBER	BODY FINISH	BRAKE	SHAFT DIA.
H-721	BLACK	NO	⅛″
H-771	CLEAR	NO	⅛″

DIMENSIONS



TOL. ±.015

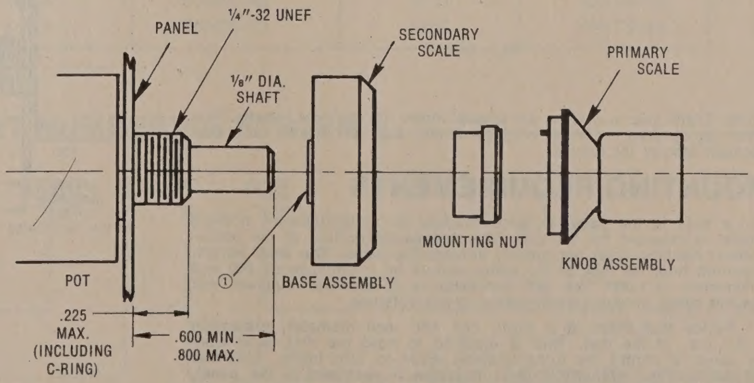


Note: Dials also available on special order for 3/32″ dia. shafts. They may be ordered in black or clear finish. Consult factory for details.

MOUNTING REQUIREMENTS

Drill a hole in the panel to accommodate the potentiometer; nothing special is required for the dial. The unthreaded portion of the potentiometer bushing must not project through the panel. The shaft length, measured from the face of the panel, should be a minimum of .600 and a maximum of .800. The .600 dimension is an absolute minimum and in some cases optimum performance is not obtained.

1 Notice that there is a short, 11/32″ diameter, projection at the rear of the dial. This is required to hold the dial away from the panel to permit the turns-counting scale to turn freely. This dial will not function properly if this projection can fall through the panel. Suggested panel hole diameter is .281.



BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5122

MODEL H-1400

TURNS COUNTING DIAL
1" DIAMETER, 10-TURN

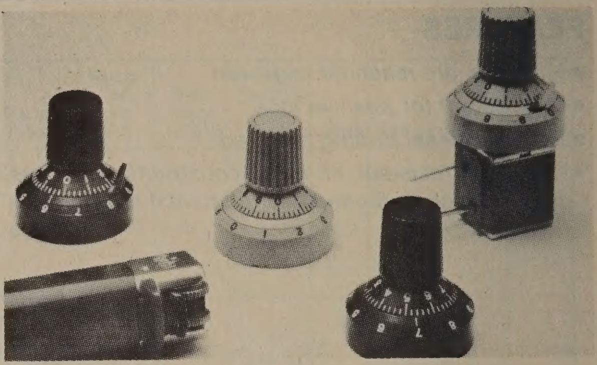
BOURNS®

FEATURES

- *Molded and filled markings*
- *Cam detent for positive lock*
- *No extra panel drilling required*
- *Corrosion resistant, plastic and metal construction*
- *Smooth, reliable performance in most severe environmental conditions*
- *Low cost*

The BOURNS® H-1400 series of analog turns counting dials are precision engineered and manufactured of plastic and metal construction for best balance of quality/cost. The resultant product delivers exceptional smoothness, accuracy and long life at very low cost.

A positive action transfer mechanism assures perfect indexing of the secondary scale. Transfer points are quiet and accurate.



STANDARD SPECIFICATIONS

MECHANICAL AND PHYSICAL CHARACTERISTICS

Number of Turns	10
Dial Divisions	50
Readability—Ten Turns	2 parts in 1000
Torque—Running, While Mounted	2.0 oz.-in. maximum
—With Brake Engaged	5.0 oz.-in. minimum
Markings	(H-1411, H-1412, H-1421 & H-1422) White on Black Background (H-1461, H-1462, H-1471 & H-1472) Black on Gray Background
Set Screw Tightening Torque	2.0 in. lbs. maximum

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	—15°C to +70°C
Mechanical Life	10,000 cycles
Humidity—No Damage	96 hr. @ 95% RH

SHAFT AND BUSHING REQUIREMENTS

Shaft Extension Beyond Panel	.675 minimum .875 maximum
Bushing Extension Beyond Panel (Including Shaft C-Ring where applicable)	.297 maximum

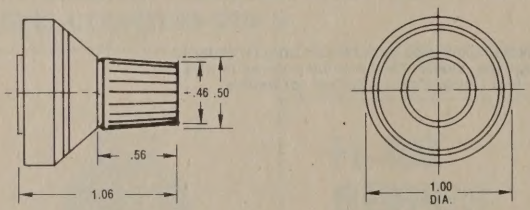
Specification Note: Closer performance tolerances can be supplied upon request.
Specifications are subject to change without notice.

STANDARD STYLES

PART NUMBER	BODY FINISH	BRAKE	SHAFT DIA.
H-1411	BLACK	NO	¼″
H-1412	BLACK	YES	¼″
H-1461	GRAY	NO	¼″
H-1462	GRAY	YES	¼″

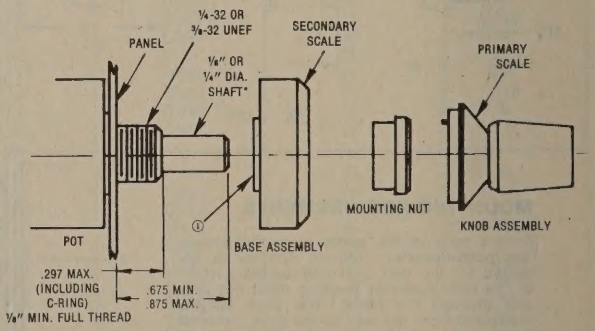
PART NUMBER	BODY FINISH	BRAKE	SHAFT DIA.
H-1421	BLACK	NO	⅛″
H-1422	BLACK	YES	⅛″
H-1471	GRAY	NO	⅛″
H-1472	GRAY	YES	⅛″

DIMENSIONS



TOL. ±.015

*Note: Dials also available on special order for 3/32″ dia. shafts. They may be ordered in black or gray finish, with or without a brake. Consult factory for details.



MOUNTING REQUIREMENTS

Drill a hole in the panel to accommodate the potentiometer; nothing special is required for the dial. The unthreaded portion of the potentiometer bushing must not project through the panel. The shaft length, measured from the face of the panel, should be a minimum of .600 and a maximum of 1.000. The .600 dimension is an absolute minimum and in some cases optimum performance is not obtained.

1 Notice that there is a short, one half inch diameter, projection at the rear of the dial. This is required to hold the dial away from the panel to permit the turns-counting scale to turn freely. This dial will not function properly if this projection is recessed in the panel. Suggested panel hole diameter is 0.406 for ⅜″ dia. bushings, and .281″ diameter for ¼″ bushings.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE, RIVERSIDE, CALIFORNIA 92507 • PHONE 714 781-5122

HIGH PRECISION POTENTIOMETERS

PRECISION ROTARY PRODUCTS
BOURNS®

CUSTOM PRECISION POTENTIOMETERS

Bourns also produces a wide variety of precision potentiometers for exacting applications in industrial and military markets. These models are specifically designed for extensive custom modifications to fit a broad range of unique applications. They include:

1. B-LINE™ single-turn precision potentiometers with aluminum housing. Potentiometers in this series are in diameters of ⅞″, 1 1/16″ and 2″, bushing or servo mount. Wire-wound, and conductive plastic elements are available in each size — 12 standard models in all.
2. Single-turn precision potentiometers with plastic housing.
3. Servo-mount multi-turn potentiometers.
4. Non-linear function potentiometers, available in most models.

SELECTION GUIDE

HIGH PERFORMANCE PRECISION POTENTIOMETERS

(suitable for special modification to meet exacting customer requirements)

NUMBER OF TURNS	DIAMETER	WIREWOUND MODEL NO.		NON-WIREWOUND MODEL NO.	
				CONDUCTIVE PLASTIC	
		SERVO	BUSHING	SERVO	BUSHING
1	⅞″	3580 (1) 3585 (1) 6530	3530 (1) 3535 (1) 6630	3584 6534 6537 6538	3534 6634 6637 6638
1	1 1/16″	3485 (1) 6540	3435 (1) 6640	3484 6544	3434 6644
1	1 5/16″		6657		
1	2″	3465 (1) 6570	3415 (1) 6670	3464 6574	3414 6674
1	3″	3495	3445		
3	⅞″	3560	3560S-93	3561	3561S-93
5	⅞″	3570	3570S-93	3571	3571S-93
10	½″ ⅞″ 2″	3750 3550 3450	 3550S-93 3450S-93	3751 3551 3451	 3551S-93 3451S-93

(1) QPL PER MIL-R-12934
See Detailed Specifications on pages

PART NUMBERING SYSTEM

3580 S—1—102

MODEL NUMBER
STANDARD FUNCTION
RESISTANCE CODE (3 or 4 digits)
PART NUMBER FOR STANDARD CONSTRUCTION FEATURES

BOURNS INC TRIMPOT PRODUCTS DIVISION
1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

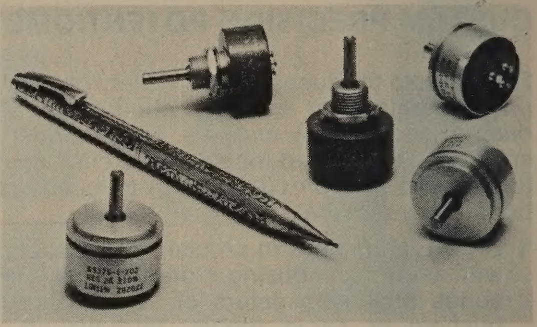
MODEL 6537/ SERVO MOUNT
MODEL 6637/ BUSHING MOUNT

HIGH PRECISION POTENTIOMETER
BOURNS®

⅞" DIAMETER, SINGLE-TURN POTENTIOMETER
CONDUCTIVE PLASTIC ELEMENT

FEATURES

- *Infinite resolution element*
- *Standard linearity: 1.0%; special linearities available*
- *Extended temperature range: —65°C to +125°C*
- *Output smoothness: 0.1% standard*
- *Custom design capability available*
- *Molded-in rear terminals*
- *Precious metal contact*
- *Fire retardant high temperature thermoset plastic housing (bushing)*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Resistance Range	1K ohm to 100K ohm
Resistance Tolerance	±10%
Linearity (Independent) Standard	±1%
Resolution	Essentially infinite
Effective Electrical Angle	340° ±3°
End Voltage	0.5% maximum
Output Smoothness	0.1%
Power Rating:	
70°C	1 Watt
125°C	0 Watt
Dielectric Strength—Sea Level	750 VAC minimum
Insulation Resistance, 500 VDC	500 Megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	—65°C to +125°C
Vibration (Contact Bounce 0.1 millisecond maximum)	15G
Shock (Contact Bounce 0.1 millisecond maximum)	50G

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	Continuous
Backlash	0.1° maximum
Shaft Runout	0.005 T.I.R.
Shaft End Play	0.005 T.I.R.
Shaft Radial Play	0.005 T.I.R.
Pilot Diameter Runout (Servo)	0.0025 T.I.R.
Lateral Runout (Servo)	0.003 T.I.R.
Rotational Life	10,000,000 shaft revolutions
Torque (Starting and Running)	0.50 oz.-in. maximum
Terminals	Rear terminals turret type

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

RESISTANCE (OHMS)	PART NUMBER*	
	SERVO MOUNT	BUSHING MOUNT
1K	6537S-1-102	6637S-1-102
2K	6537S-1-202	6637S-1-202
5K	6537S-1-502	6637S-1-502
10K	6537S-1-103	6637S-1-103
20K	6537S-1-203	6637S-1-203

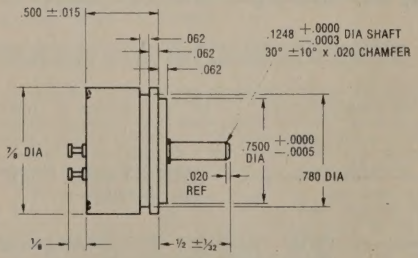
RESISTANCE (OHMS)	PART NUMBER*	
	SERVO MOUNT	BUSHING MOUNT
50K	6537S-1-503	6637S-1-503
100K	6537S-1-104	6637S-1-104

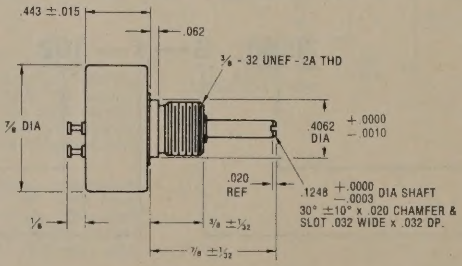
** The last three digits of the part number represent the resistance in standard code.*

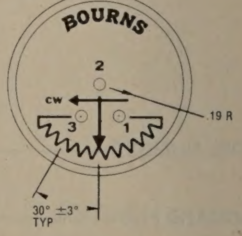
OPTIONAL SPECIAL FEATURES

- Front shaft extensions
- Shaft flats, slots, grooves and special shaft diameter
- Special servo or bushing lids
- Sleeve bearings or ball bearing (servo)
- Mechanical stops
- High torque
- Low torque
- Anti-rotation pin
- Special electrical angles
- Special linearity tolerances
- Special resistances
- Special resistance tolerances
- Center tap
- Voltage or resistance shorts

DIMENSIONS







BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

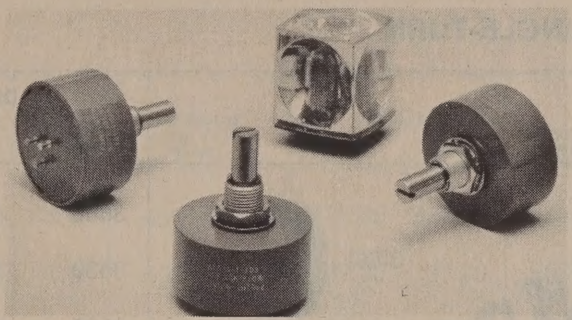
MODEL 6657 / BUSHING MOUNT

1⅜₆" DIAMETER, SINGLE-TURN POTENTIOMETER
CONDUCTIVE PLASTIC ELEMENT

HIGH PRECISION POTENTIOMETER
BOURNS®

FEATURES

- *Infinite resolution element*
- *Standard linearity: 1.0%; special linearities available*
- *Extended temperature range: —65° to +125°C*
- *Output smoothness: 0.1% standard*
- *Custom design capability available*
- *Molded-in rear terminals*



SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Resistance Range	1K ohm to 100K ohm
Resistance Tolerance	±10%
Linearity (Independent) Standard	±1%
Resolution	Essentially infinite
Effective Electrical Angle	340° ±3°
End Voltage	0.5% maximum
Output Smoothness	0.1%
Power Rating:	
70°C	1.5 Watt
125°C	0 Watt
Dielectric Strength—Sea Level	750 VAC minimum
Insulation Resistance, 500 VDC	1000 Megohms minimum

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	—65°C to +125°C
Vibration (Contact Bounce 0.1 millisecond maximum)	15G
Shock (Contact Bounce 0.1 millisecond maximum)	50G

MECHANICAL AND PHYSICAL CHARACTERISTICS

Mechanical Angle	Continuous
Backlash	0.1° maximum
Shaft Runout	0.001 T.I.R.
Shaft End Play	0.005 T.I.R.
Shaft Radial Play	0.003 T.I.R.
Rotational Life	10,000,000 shaft revolutions
Torque (Starting and Running)	0.50 oz.-in. maximum
Terminals	Rear terminals turret type

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

STANDARD RESISTANCES

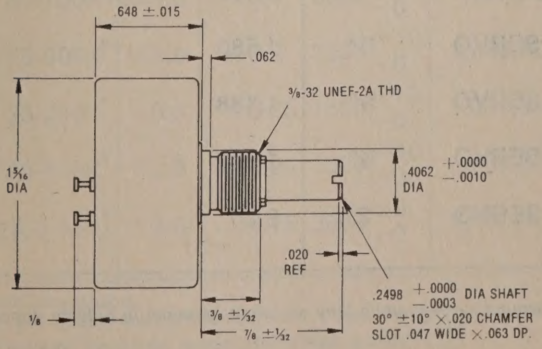
RESISTANCE (OHMS)	PART NUMBER* BUSHING MOUNT
1 K	6657S-1-102
2 K	6657S-1-202
5 K	6657S-1-502
10 K	6657S-1-103
20 K	6657S-1-203
50 K	6657S-1-503
100 K	6657S-1-104

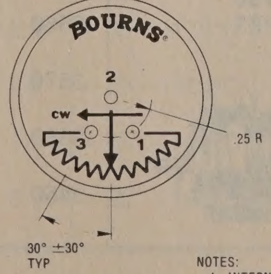
**The last three digits of the part number represent the resistance in standard code.*

OPTIONAL SPECIAL FEATURES

- Front and rear shaft extensions
- Shaft flats, slots, grooves and special shaft diameter
- Special bushing lids
- Mechanical stops
- High torque
- Low torque
- Anti-rotation pin
- Special electrical angles
- Special linearity tolerances
- Special resistances
- Special resistance tolerances
- Center tap (within linearity tolerance)
- Voltage or resistance shorts
- Nonlinear functions

DIMENSIONS





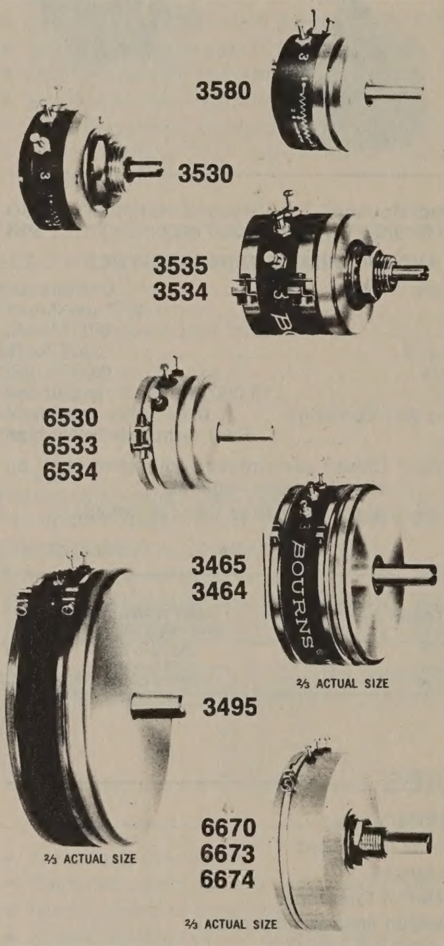
NOTES:
1. INTERNAL TOOTH LOCK WASHER .605 ±.010 O.D. X .022 THK. AND HEX NUT .5 ACROSS FLATS X .093 THK. TO BE SUPPLIED WITH EACH UNIT.

BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

WIREWOUND HIGH PRECISION POTENTIOMETERS

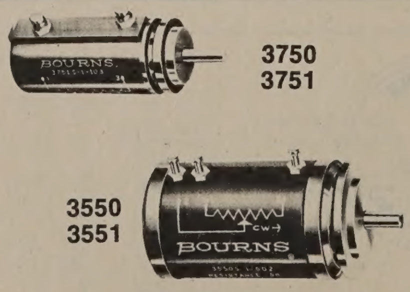
BOURNS®

SINGLE-TURN


3580
3530
3535
3534
6530
6533
6534
3465
3464
BOURNS
⅔ ACTUAL SIZE
3495
⅔ ACTUAL SIZE
6670
6673
6674
⅔ ACTUAL SIZE

DESCRIPTION MODEL NUMBER	TYPE OF MOUNT	NOMINAL DIAMETER	HOUSING LENGTH FMS	BUSHING DIMENSION	NOM. SHAFT DIA. X LENGTH FMS
3580	SERVO	⅞″	.606	N/A	⅛ x ½
3530	BUSHING	⅞″	.487	⅜-32	⅛ x ½
3585	SERVO	⅞″	.681	N/A	⅛ x ½
3535	BUSHING	⅞″	.681	⅜-32	⅛ x ½
3485	SERVO	1 1/16″	.681	N/A	⅛ x ⅞
3435	BUSHING	1 1/16″	.681	⅜-32	⅛ x ⅞
3465	SERVO	2″	.826	N/A	¼ x ⅝
3415	BUSHING	2″	.846	⅜-32	¼ x ⅞
3495	SERVO	3″	.826	N/A	¼ x ⅝
3445	BUSHING	3″	.846	½-32	¼ x ⅞
6530	SERVO	⅞″	.475	N/A	⅛ x ½
6630	BUSHING	⅞″	.475	⅜-32	⅛ x ½
6540	SERVO	1 1/16″	.475	N/A	⅛ x ½
6640	BUSHING	1 1/16″	.475	⅜-32	⅛ x 13/16
6570	SERVO	2″	.600	N/A	¼ x ⅝
6670	BUSHING	2″	.600	⅜-32	¼ x ⅞

MULTITURN


BOURNS
3750
3751
3550
3551
CW
BOURNS

MODEL NUMBER	TYPE OF MOUNT	NOMINAL DIAMETER	HOUSING LENGTH FMS	BUSHING DIMENSION	NOM. SHAFT DIA. X LENGTH FMS
3750	SERVO	½″	1.188	N/A	3/32 x ⅜
3550	SERVO	⅞″	1.580	*	⅛ x ⅜
3570	SERVO	⅞″	1.188	*	⅛ x ⅜
3560	SERVO	⅞″	1.047	*	⅛ x ⅜
3450	SERVO	2″	2.25	*	¼ x ⅝

Note: *Illustrations used above may apply to wirewound or non-wirewound models since they are often identical in outside appearance. The numbers beside them indicate the models that are applicable.*

BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

BOURNS®

LENGTH ADDED EACH EXTRA CUP	STANDARD RESISTANCE RANGE Ω	RESIST-ANCE TOL. (%)	INDEPEN-DENT LINEARITY (%)	ELEC-TRICAL** ROTA-TION (°)	MECHANICAL LIFE IN SHAFT REV.	POWER IN WATTS AT 70°C	MAXIMUM OPER. TEMP. RANGE	PRICES		MODEL NUMBER
								1-4	25-49	
N/A	25-50K	±3.0	±0.5	350 ±2	2,000,000	1.0	−65° +125°C	$33.95	$27.75	3580
N/A	25-50K	±3.0	±0.5	350 ±2	1,000,000	1.0	−65° +125°C	32.00	26.20	3530
.405	25-50K	±3.0	±0.5	350 ±2	2,000,000	1.0	−65° +125°C	29.20	23.35	3585
.405	25-50K	±3.0	±0.5	350 ±2	2,000,000	1.0	−65° +125°C	23.70	21.60	3535
.405	50-50K	±3.0	±0.5	350 ±2	2,000,000	1.5	−65° +125°C	29.70	24.50	3485
.405	50-50K	±3.0	±0.5	350 ±2	2,000,000	1.5	−65° +125°C	28.90	23.65	3435
.500	50-100K	±3.0	±0.3	350 ±2	1,000,000	4.0	−65° +125°C	29.40	26.70	3465
.500	50-100K	±3.0	±0.3	350 ±2	1,000,000	4.0	−65° +125°C	27.95	25.30	3415
.500	100-200K	±3.0	±0.25	350 ±2	1,000,000	6.0	−65° +125°C	50.75	46.20	3495
.500	100-200K	±3.0	±0.25	350 ±2	1,000,000	6.0	−65° +125°C	50.75	46.20	3445
.200	50-20K	±3.0	±0.5	350 ±2	2,000,000	1.0	−65° +150°C	33.75	28.00	6530
.200	50-20K	±3.0	±0.5	350 ±2	2,000,000	1.0	−65° +150°C	33.75	28.00	6630
.200	50-50K	±3.0	±0.5	350 ±2	2,000,000	1.5	−65° +150°C	33.75	28.00	6540
.200	50-50K	±3.0	±0.5	350 ±2	2,000,000	1.5	−65° +150°C	33.75	28.00	6640
.200	50-100K	±3.0	±0.3	350 ±2	2,000,000	4.0	−65° +150°C	35.05	31.65	6570
.200	50-100K	±3.0	±0.3	350 ±2	2,000,000	4.0	−65° +150°C	35.05	31.65	6670
N/A	50-100K	±5.0	±0.5	3600^{+20}_{-0}	1,000,000	1.0	−65° +125°C	37.40	29.75	3750
1.23	50-500K	±3.0	±0.2	3600^{+10}_{-0}	2,000,000	2.5	−65° +125°C	27.10	24.10	3550
.868	25-250K	±3.0	±0.25	1800^{+10}_{-0}	1,000,000	2.0	−65° +125°C	27.10	24.10	3570
.725	25-100K	±3.0	±0.25	1080^{+10}_{-0}	600,000	1.5	−65° +125°C	27.10	24.10	3560
1.75	1K-1 Meg	±3.0	±0.15	3600^{+3}_{-0}	2,000,000	5.0	−65° +125°C	44.95	41.30	3450

** Bushing Mount available*

*** All single turn models are continuous rotation. Mechanical stops available on request. Mechanical rotation on multiturn models is same as electrical rotation except for model 3450 which is 3600°* $^{+10}_{-0}$

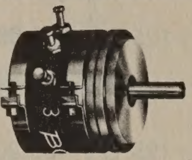
BOURNS INC

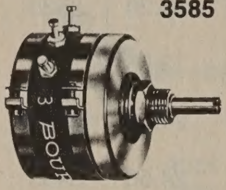
TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

NON-WIREWOUND HIGH PRECISION POTENTIOMETERS

BOURNS®

SINGLE-TURN


3584
3585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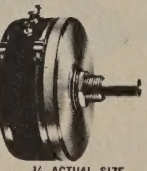
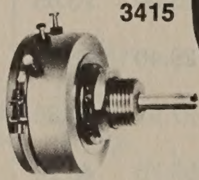
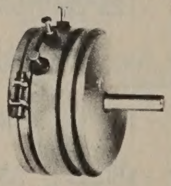
3435


3414
3415

½ ACTUAL SIZE


6640
6644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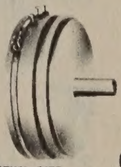
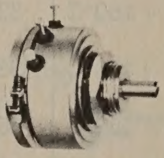
6544

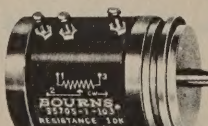

6570
6574

½ ACTUAL SIZE


6630
6634

DESCRIPTION MODEL NUMBER	TYPE OF MOUNT	TYPE OF ELEMENT	NOMINAL DIAMETER	HOUSING LENGTH FMS	BUSHING DIMENSION	NOM. SHAFT DIA. X LENGTH FMS
3584	SERVO	CONDUCTIVE PLASTIC	⅞"	.681	N/A	⅛ x ½
3534	BUSHING		⅞"	.681	⅜-32	⅛ x ½
3484	SERVO		1¹⁄₁₆"	.681	N/A	⅛ x ⅞
3434	BUSHING		1¹⁄₁₆"	.681	⅜-32	⅛ x ⅞
3464	SERVO		2"	.826	N/A	¼ x ⅝
3414	BUSHING		2"	.846	⅜-32	¼ x ⅞
6534	SERVO	CONDUCTIVE PLASTIC	⅞"	.475	N/A	⅛ x ½
6634	BUSHING		⅞"	.475	⅜-32	⅛ x ½
6544	SERVO		1¹⁄₁₆"	.475	N/A	⅛ x ½
6644	BUSHING		1¹⁄₁₆"	.475	⅜-32	⅛ x ¹³⁄₁₆
6574	SERVO		2"	.600	N/A	¼ x ⅝
6674	BUSHING		2"	.600	⅜-32	¼ x ⅞

MULTITURN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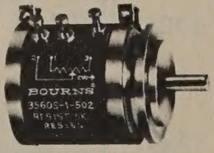
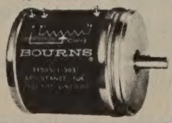

3561
3560

½ ACTUAL SIZE


3451
3450

MODEL NUMBER	TYPE OF MOUNT	TYPE OF ELEMENT	NOMINAL DIAMETER	HOUSING LENGTH FMS	BUSHING DIMENSION	NOM. SHAFT DIA. X LENGTH FMS
3751	SERVO	CONDUCTIVE PLASTIC	½"	1.188	N/A	³⁄₃₂ x ⅜
3551	SERVO		⅞"	1.580	*	⅛ x ⅜
3571	SERVO		⅞"	1.188	*	⅛ x ⅜
3561	SERVO		⅞"	1.047	*	⅛ x ⅜
3451	SERVO		2"	2.25	*	¼ x ⅝

Note: Illustrations used above may apply to wirewound or non-wirewound models since they are often identical in outside appearance. The numbers beside them indicate the models that are applicable.

BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

BOURNS®

LENGTH ADDED EACH EXTRA CUP	STANDARD RESISTANCE RANGE Ω	RESIST-ANCE TOL. (%)	INDEPEN-DENT LINEARITY (%)	ELEC-TRICAL** ROTA-TION (°)	MECHANICAL LIFE IN SHAFT REV.	POWER IN WATTS AT 70°C	MAXIMUM OPER. TEMP. RANGE	PRICES 1-4	PRICES 25-49	MODEL NUMBER
.405	1K-100K	±10	±0.5	320 ±3	25,000,000	1.0	−65° +125°C	$50.00	$43.50	3584
.405	1K-100K	±10	±0.5	320 ±3	25,000,000	1.0	−65° +125°C	50.00	43.50	3534
.405	1K-100K	±10	±0.5	340 ±3	25,000,000	1.25	−65° +125°C	50.00	45.00	3484
.405	1K-100K	±10	±0.5	340 ±3	25,000,000	1.25	−65° +125°C	50.00	45.00	3434
.500	1K-100K	±10	±0.25	350 ±2	25,000,000	2.0	−65° +125°C	55.00	48.50	3464
.500	1K-100K	±10	±0.25	350 ±2	25,000,000	2.0	−65° +125°C	55.00	48.50	3414
.200	1K-100K	±10	±0.5	320 ±3	25,000,000	1.0	−65° +125°C	40.00	34.00	6534
.200	1K-100K	±10	±0.5	320 ±3	25,000,000	1.0	−65° +125°C	40.00	34.00	6634
.200	1K-100K	±10	±0.5	340 ±3	25,000,000	1.25	−65° +125°C	40.00	34.00	6544
.200	1K-100K	±10	±0.5	340 ±3	25,000,000	1.25	−65° +125°C	40.00	34.00	6644
.200	1K-100K	±10	±0.25	350 ±2	25,000,000	2.0	−65° +125°C	40.00	34.00	6574
.200	1K-100K	±10	±0.25	350 ±2	25,000,000	2.0	−65° +125°C	40.00	34.00	6674
N/A	1K-500K	±10	±0.5	3600^{+20}_{-2}	10,000,000	1.0	−55° +105°C	49.50	40.50	3751
1.23	1K-1Meg	±10	±0.5	3600^{+10}_{-0}	10,000,000	2.0	−55° +105°C	38.50	31.50	3551
.868	500-500K	±10	±0.5	1800^{+10}_{-2}	5,000,000	1.5	−55° +105°C	28.60	23.40	3571
.725	500-200K	±10	±0.5	1080^{+10}_{-2}	3,000,000	1.0	−55° +105°C	27.50	22.50	3561
1.75	2K-1Meg	±10	±0.5	3600^{+5}_{-0}	10,000,000	5.0	−55° +105°C	55.00	45.00	3451

** Bushing Mount available*

*** All single turn models are continuous rotation. Mechanical stops available on request. Mechanical rotation on multiturn models is same as electrical rotation except for models 3571, 3561, and 3451 which are 1800 $^{+10}_{-0}$, 1080 $^{+10}_{-0}$ and 3600 $^{+10}_{-0}$ respectively.*

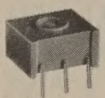
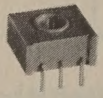
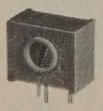
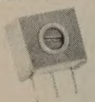
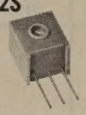
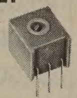
BOURNS INC TRIMPOT PRODUCTS DIVISION
DEPT. EM/1200 COLUMBIA AVENUE/RIVERSIDE, CALIFORNIA 92507/PHONE 714 781-5200

CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

WORLD LEADER IN CERMET RESISTOR TECHNOLOGY

INDUSTRIAL CERMET POTS & TRIMMERS

CTS Series	Description	Data Sheet	Resistance Range	Unit Price		
				1-9	10-24	25-49
550R	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ⅜″ FMS Shaft: ⅞″ FMS x .250″ dia., slotted	3550 D	50 Ω-1 Meg Ω	3.14	2.62	2.15
550S	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ⅜″ FMS Shaft: 2″ FMS x .250″ dia.	3550 D	50 Ω-1 Meg Ω	3.15	2.63	2.16
550LT	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ½″ FMS, locking Shaft: ⅝″ FMS x .250″ dia., slotted	3550 D	50 Ω-1 Meg Ω	3.21	2.69	2.22
345	Power: ¾ @ 25°C ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .250 dia. x .180 No. of Turns: 1	3345	50 Ω-500 KΩ	1.67	1.58	1.47
363 	Power: 1 @ 25°C ½ @ 85°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .434″ x .360″ x .255″ No. of Turns: 1 .150″ lead spacing Side or top adjust terminal form	3360 H	50 Ω-1 Meg Ω	1.52	1.42	1.35
364 	Power: 1 @ 25°C ½ @ 85°C Max. Temp.: 125°C Resist. Tol: ±20% Dim.: .434″ x .360″ x .230″ No. of Turns: 1 .125″ lead spacing Side or top adjust terminal form	3360 H	50 Ω-1 Meg Ω	1.52	1.42	1.35
365 	Power: 1 @ 25°C ½ @ 85°C Max. Temp.: 125°C Resist. Tol: ±20% Dim.: .434″ x .360″ x .255″ No. of Turns: 1 .100″ lead spacing Terminals S, T, X, Y & U available	3360 H	50 Ω-1 Meg Ω	1.53	1.43	1.36
360S 	Power: ½ @ 85°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .434 x .360 x .298 No. of Turns: 1 .150″ Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
360T	Power: ½ @ 85°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .434 x .360 x .298 No. of Turns: 1 .150″ Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
362S 	Power: ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .312 x .355 x .300 No. of Turns: 1 .100″ Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
362T 	Power: ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .312 x .355 x .300 No. of Turns: 1 .100″ Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
362X	Power: ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .312 x .355 x .300 No. of Turns: 1 TO-5 Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
362Y	Power: ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .312 x .355 x .300 No. of Turns: 1 TO-5 Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
362U	Power: ½ @ 85°C Max. Temp: 150°C Resist. Tol: ±20% Dim.: .312 x .355 x .300 No. of Turns: 1 .200″ Lead Spacing	3360 G	50 Ω-1 Meg Ω	1.52	1.42	1.35
375E	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .100″ Lead Spacing Cent. Term.: .400	3375	50 Ω-1 Meg Ω	1.49	1.39	1.32
375V	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .172″ Lead Spacing Cent. Term.: .156	3375	50 Ω-1 Meg Ω	1.49	1.39	1.32
375S	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .100″ Lead Spacing	3375	50 Ω-1 Meg Ω	1.47	1.37	1.30
375T	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .100″ Lead Spacing	3375	50 Ω-1 Meg Ω	1.47	1.37	1.30
375X	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .100″ Lead Spacing TO-5 Lead Spacing	3375	50 Ω-1 Meg Ω	1.47	1.37	1.30
375Y	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370 dia. x .150 .100″ Lead Spacing TO-5 Lead Spacing	3375	50 Ω-1 Meg Ω	1.48	1.38	1.31

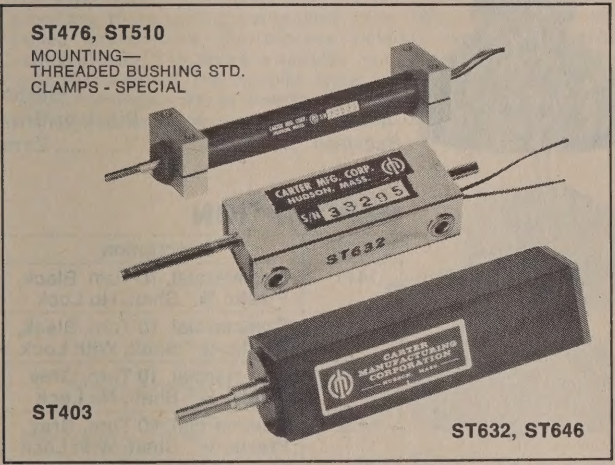
ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

CARTER POTENTIOMETERS

RECTILINEAR / WIRE WOUND / CONDUCTIVE PLASTIC

Carter Manufacturing Corp. is an organization of engineers and craftsmen specializing in the unusual in potentiometers and switch engineering and their manufacture. Since our founding in 1955 we have developed full capability in wire wound and conductive plastic potentiometers. We welcome the opportunity to work with you for your unique requirements as well as standard commercial or mil types.

RECTILINEAR POTENTIOMETERS / WIRE OR CONDUCTIVE PLASTIC

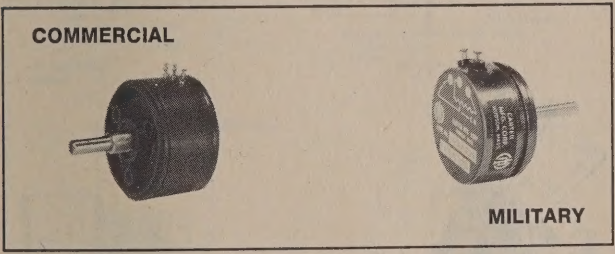

ST476, ST510
MOUNTING—
THREADED BUSHING STD.
CLAMPS - SPECIAL
CARTER MFG. CORP. HUDSON, MASS.
S/N 33295
ST632
CARTER MANUFACTURING CORPORATION
ST403
ST632, ST646

Carter manufactures many custom variations of rectilinear potentiometers. When requesting quotations please specify stroke, resistance, linearity, any taps, any switching, environmental requirements and quantity.

Wire wound and conductive plastic elements can also be furnished for special requirements.

Type	Size	Stroke	Res.Ω	Std. Lin.	Spl. Lin.	Elements	Watts 125°
ST476	½″ Dia.	To 8″	50K/″ Max.	2% / Stroke	.25% / Stroke	1 or 2	1
ST510	¾″ Dia.	To 12″	100K/″ Max.	2% / Stroke	.25% / Stroke	1 or 2	1.5
ST403	1¼″ x 1¼″	To 36″	150K/″ Max.	2% / Stroke	.25% / Stroke	1 or 2	2
ST632	5⁄16″ x ½″	To 4″	60K/″ Max.	2% / Stroke	.25% / Stroke	1	.25
ST646	½″ x ½″	To 6″	50K/″ Max.	2% / Stroke	.25% / Stroke	1 or 2	1

WIRE WOUND / CONDUCTIVE PLASTIC / SINGLE TURN POTENTIOMETERS MILITARY / COMMERCIAL


COMMERCIAL
MILITARY

GENERAL SPECIFICATIONS

Resistance Tolerance: WW ±5%, C/P ±10% Std. (Spl. avail.).

Function Angles: Spl. available.

Rotation: WW with stops, continuous available.
C/P continuous, stops available.

Taps: WW taps to single turn of wire with positive elimination of failure.
C/P taps of low resistance or zero width available.

Power Rating: To zero watts at 150°C.

Ambient Temp.: −65°C to +125°C std. (to 150°C available).

MIL STANDARDS / WIRE WOUND

Size	½″	⅞″	1 1⁄16″	1 7⁄16″	1⅝″	1¾″	2″	3″
Type	120	118	223	157	136	160	119	236
Mil. Size	05	09	11	15	17	18	20	30
Function Angle	320°	320°	320°	320°	320°	320°	350°	350°
Std. Lin.	±.5%	±.4%	±.3%	±.25%	±.2%	±.18%	±.15%	±.1%
Spl. Lin.	±.3%	±.25%	±.2%	±.1%	±.1%	±.09%	±.09%	±.07%
Max. Res.	75KΩ	100KΩ	100KΩ	150KΩ	150KΩ	175KΩ	200KΩ	500KΩ
Watts	2	3	3.5	4	4	4	4.5	5

MIL STANDARDS / CONDUCTIVE PLASTIC

Size	½″	⅞″	1 1⁄16″	1 7⁄16″	1⅝″	1¾″	2″	3″
Type	CP120	CP118	CP223	CP157	CP136	CP160	CP119	CP236
Mil. Size	05	09	11	15	17	18	20	30
Function Angle	320°	340°	340°	345°	345°	345°	345°	345°
Std. Lin.	±.7%	±.5%	±.5%	±.4%	±.4%	±.35%	±.3%	±.25%
Spl. Lin.	±.3%	±.15%	±.15%	±.1%	±.1%	±.07%	±.06%	±.03%
Max. Res.	60KΩ	100KΩ	150KΩ	150KΩ	175KΩ	200KΩ	250KΩ	400KΩ
Watts	1	1.4	1.6	2	2.2	2.6	3	5

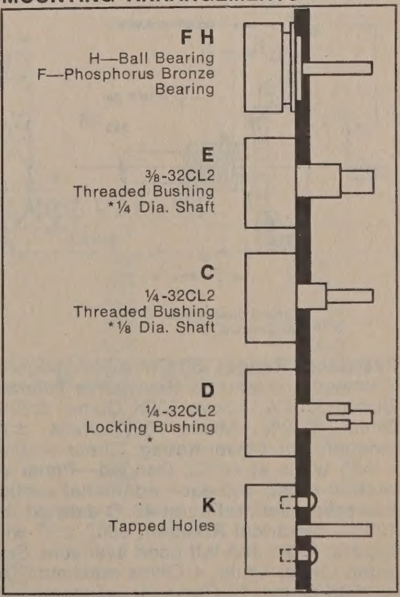
COMMERCIAL PLASTIC HOUSING / WIRE WOUND

Size	2″	3″
Type	508	511
Mil. Size	—	—
Function Angle	320°	320°
Std. Lin.	±.25%	±.25%
Spl. Lin.	±.2%	±.2%
Max. Res.	250KΩ	500KΩ
Watts	3	5

CONDUCTIVE PLASTIC

Size	2″	3″
Type	CP508	CP511
Mil. Size	—	—
Function Angle	345°	345°
Std. Lin.	±1%	±.7%
Spl. Lin.	±.5%	±.25%
Max. Res.	250KΩ	400KΩ
Watts	3	5

MOUNTING ARRANGEMENTS

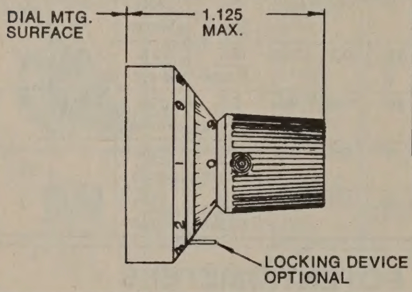

F H
H—Ball Bearing
F—Phosphorus Bronze Bearing
E
⅜-32CL2
Threaded Bushing
*¼ Dia. Shaft
C
¼-32CL2
Threaded Bushing
*⅛ Dia. Shaft
D
¼-32CL2
Locking Bushing
K
Tapped Holes

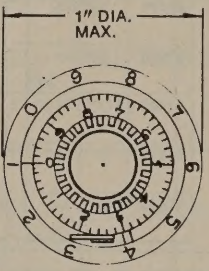
CARTER MANUFACTURING CORPORATION
DEPT. EM, SUGAR ROAD • BOLTON, MASSACHUSETTS 01740 • TELEPHONE (617) 779-5501

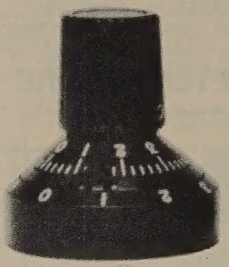
CLAROSTAT NEW PRODUCTS

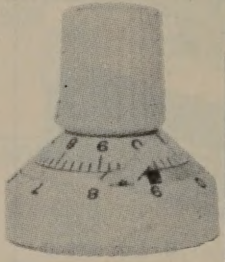
ECONOMY MODEL CLARODIALS SERIES 1400 TEN TURN CONCENTRIC SCALE DIALS

Newest member of the popular Clarodial family of concentric dials for multi-turn potentiometers is the Series 1400. Requiring only one inch of panel space, the Series 1400 is offered in the more economical molded plastic construction at substantial savings. Performance parameters of the Clarodial 400 Series are met or exceeded by the Series 1400. Available in colors black or gray, with or without brake.









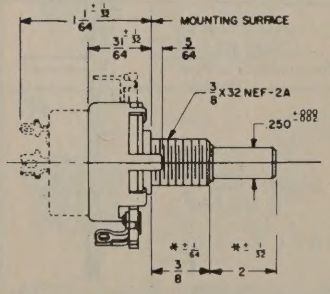
Material	Plastic
Color	Black or Gray
Backlash	Zero

DESCRIPTION

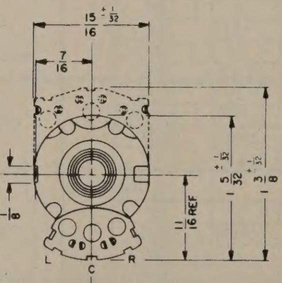
Cat. No.	Description
1411	Commercial, 10 Turn, Black, Plastic ¼" Shaft, No Lock
1412	Commercial, 10 Turn, Black, Plastic ¼" Shaft, With Lock
1461	Commercial, 10 Turn, Gray, Plastic ¼" Shaft, No Lock
1462	Commercial, 10 Turn, Gray, Plastic ¼" Shaft, With Lock

0.5 WATT/SPECIAL ORDER SERIES 470

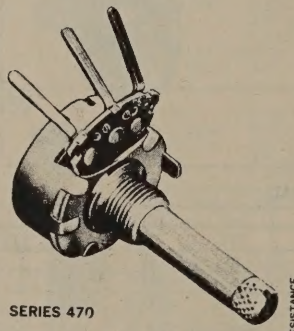
Series 470 is an extremely versatile family of high-quality potentiometers. Its multiple configurations and adaptability to any mounting requirements have established its wide use in industry. Particularly, the Series 470 is applicable to radio, television instrumentation and audio work where low noise, close linearity and long rotational life are required. The Series 470 offers a reliable, homogeneous and strain-free conductive plastic resistive element with 2% dynamic noise and 5% independent linearity.



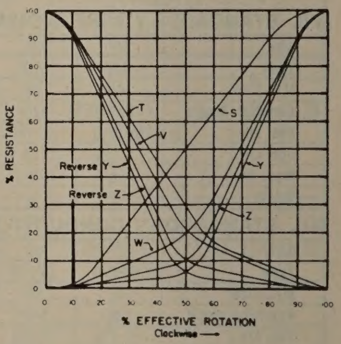
Typical dimensions for Series 470



Many variations available



SERIES 470



Resistance Range: 150 Ohms to 5 megohms linear; 1K Ohms to 2.5 megohms tapered. **Resistance Tolerance:** Linear up to 550K Ohms, ±10%. Above 500K Ohms, ±20%, Tapers up to 100K Ohms, ±10%, Above 100K Ohms, ±20%. **Linearity:** ±5% Independent. **Power Rating:** Linear—0.5 watts at 40°C., Tapered −0.25 watts at 40°C., Ganged—Panel section is ¾ of single section rating and each additional section is ⅔ of single section rating. Full rating at 40°C derated linearly to zero watts at 120°C. **Electrical Rotation:** 300° ±5° with and without switch. **Tapers:** Right and left hand available. See Chart A. **End Resistance:** Linear Units; 4 Ohms maximum for total resistances up to 250K Ohms, 10 Ohms for resistances 250K Ohms and above. **Dielectric Strength:** 1000 Vac for 60 Seconds at 760 mm Hg., 450 Vac for 60 Seconds at 86 mm Hg. **Working Voltage:** 500 Vdc maximum but power not to exceed rating. **Noise:** 2% of total resistance. 1% available. **Insulation Resistance:** 50 megohms minimum. **Mechanical Rotation:** 300° ±5° without switch, 330° ±5° with switch, standard. **Stop Torque:** 8 lb.-in. minimum, Standard, 10 lb.-in., minimum, Special. **Operating Torque Range:** Standard bushing each section 0.5 to 6 oz.-in. High torque 6 to 20 oz.-in. Locking bushing 30 oz.-in. minimum with jam nut tightened to 10 lb-in. **Weight:** .069 lb. **Life:** 50,000 cycles (500 cycles locking bushing types) 10 cycles per minute maximum. **Operating Temperature Range:** −55°C to +120°C. SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE. Note: The Series 470 is available on special order only.

CLAROSTAT MFG. CO., INC. / DEPT. EM / DOVER, N.H. 03820 / TEL: (603) 742-1120 / TWX: 510-297-4455

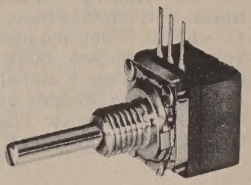
CLAROSTAT CERMET POTENTIOMETERS

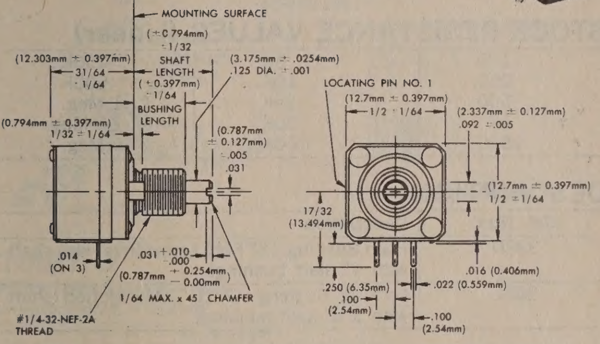
BUSHING MOUNTED

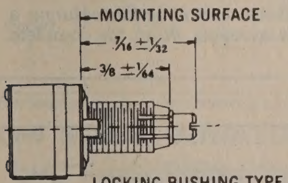
1/2" SQUARE MODULAR 1 WATT

SERIES 389

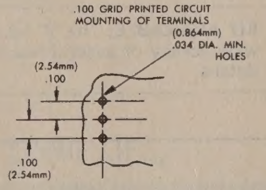
The series 389 is a completely new potentiometer with characteristics exceeding those costing many times more. Manufactured in a controlled environment, the process includes exclusive Clarostat TempMaturing™ to insure a reliable, homogeneous and strain-free resistance element. The modular design allowing free interchange of resistive elements. These potentiometers are manufactured to meet MIL-R-94C specifications where applicable.




MOUNTING SURFACE
(±0.794mm)
±1/32
SHAFT LENGTH
(12.303mm ± 0.397mm)
31/64
±1/64
(±0.397mm)
±1/64
BUSHING LENGTH
(0.794mm ± 0.397mm)
1/32 ± 1/64
(3.175mm ± .0254mm)
.125 DIA. ± .001
(0.787mm ± 0.127mm)
±.005
.031
.014
(ON 3)
.031 +.010 −.000
(0.787mm +0.254mm −0.00mm)
1/64 MAX. x 45 CHAMFER
#1/4-32-NEF-2A THREAD
LOCATING PIN NO. 1
(12.7mm ± 0.397mm)
1/2 ± 1/64
(2.337mm ± 0.127mm)
.092 ±.005
(12.7mm ± 0.397mm)
1/2 ±1/64
17/32
(13.494mm)
.016 (0.406mm)
.250 (6.35mm)
.022 (0.559mm)
.100
(2.54mm)
.100
(2.54mm)


MOUNTING SURFACE
7/16 ± 1/32
3/8 ± 1/64

LOCKING BUSHING TYPE


.100 GRID PRINTED CIRCUIT MOUNTING OF TERMINALS
(0.864mm)
.034 DIA. MIN. HOLES
(2.54mm)
.100
.100
(2.54mm)

STOCK RESISTANCE VALUES

389N, 389L LINEAR		
100	5K	250K
250	10K	500K
500	25K	1 Meg.
1K	50K	2.5 Meg.
2500	100K	5 Meg.
Z—Taper 389N-Z		
100	5K	250K
250	10K	500K
500	25K	1 Meg.
1K	50K	
2500	100K	

SPECIFICATIONS

Resistance Tolerance: ±10%. **Electrical and Mechanical Rotation:** 295° ±5°. **Effective Rotation:** 250° ±5°. **End Resistance:** 4Ω max. linear. **Dielectric Strength:** 900 VAC for 60 Sec. ATM. **Working Voltage:** 350 Vdc across terminals. **Dynamic Noise:** 3% total resistance. **Static Noise:** 100Ω/sq is −24 DB, 10K Ω/sq is −9 DB, 100K Ω/sq is +1 DB. **Linearity (Independent):** ±5%. **Voltage Coefficient:** .008%/volt (max.). **Rotational Life:** 25,000 cycles. **Power Rating:** 1 watt at 85°C. **Torque Range:** .2 to 4.5 oz.-in. **Operating Temperature:** −55°C to +150°C. **Stop Torque:** 3 lb.-in. **Weight:** .018 lb. (typical). **Functional Output:** Linear or tapered. **Insulation Resistance:** 100 Meg per MIL std 202. **Resolution:** Infinite. **Corrosion Resistant:** Yes. **Terminal Style:** PC pins.

Cat. No.	Description
389N	Plain Bushing (3/4" FMS screwdriver slotted shaft with 1/4" plain bushing)
389L	Locking Bushing (7/16" FMS screwdriver slotted shaft with 3/8" locking bushing)
389N-Z*	Z—taper. Same as 389N mounting (see pg. 2484)

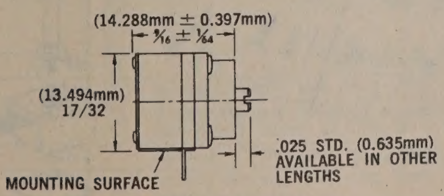
*For complete catalog number add resistance value from chart between N- and -Z.

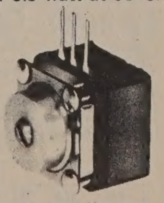
BUSHINGLESS PC MOUNTED

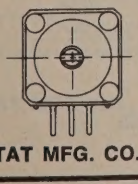
1/2 WATT SERIES 389-5

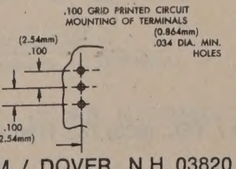
CAT. NO. 389-5 and 389-5-Z

The potentiometer 389-5 and 389-5-Z are similar in characteristics to the 389 Series (see above). However, they are designed for bushingless mounting on a PC board and have a flush screwdriver slot for adjustment. Check the appropriate specifications for the 389 series. Note that 389-5 and 389-5-Z have power ratings of 0.5 watt at 85°C.


(14.288mm ± 0.397mm)
9/16 ± 1/64
(13.494mm)
17/32
.025 STD. (0.635mm)
AVAILABLE IN OTHER LENGTHS
MOUNTING SURFACE






.100 GRID PRINTED CIRCUIT MOUNTING OF TERMINALS
(0.864mm)
.034 DIA. MIN. HOLES
(2.54mm)
.100
.100
(2.54mm)

STOCK RESISTANCE VALUES

389-5	(Linear)	
100	5K	250K
250	10K	500K
500	25K	1 Meg.
1K	50K	2.5 Meg.
2500	100K	5 Meg.
389-5-Z*	**(Z Taper)** (see pg. 2484)	
100	5K	250K
250	10K	500K
500	25K	1 Meg.
1K	50K	
2500	100K	

*For complete catalog number add resistance value from chart between 5-and-Z eg 389-5-100-Z.

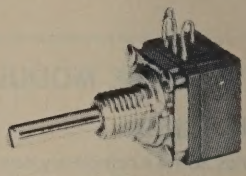
SPECIFICATIONS

(see 389 Series above)

CLAROSTAT MFG. CO., INC. / DEPT. EM / DOVER, N.H. 03820 / TEL: (603) 742-1120 / TWX: 510-297-4455

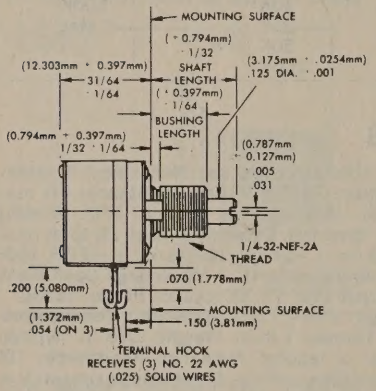
CLAROSTAT THICK FILM CONDUCTIVE PLASTIC (CARBON) POTENTIOMETERS

BUSHING MOUNTED

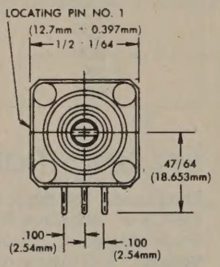


½" SQUARE MODULAR/0.5 WATT
SERIES 388

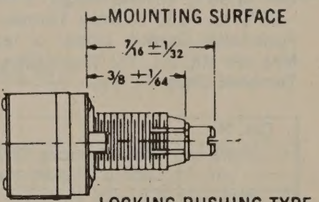
The series 388 is a completely new potentiometer with characteristics exceeding those costing many times more. Manufactured in a controlled environment, the process includes exclusive Clarostat TempMaturing™ to insure a reliable, homogeneous and strain-free resistance element. The modular design allowing free interchange of resistive elements. The potentiometers are manufactured to meet MIL-R-94C specifications where applicable.



MOUNTING SURFACE
(± 0.794mm)
± 1/32
SHAFT LENGTH
(3.175mm ± .0254mm)
.125 DIA. ± .001
(12.303mm ± 0.397mm)
31/64 ± 1/64
(± 0.397mm) ± 1/64
BUSHING LENGTH
(0.794mm ± 0.397mm)
1/32 ± 1/64
(0.787mm ± 0.127mm)
± .005
.031
1/4-32-NEF-2A THREAD
.070 (1.778mm)
.200 (5.080mm)
MOUNTING SURFACE
(1.372mm)
.054 (ON 3)
.150 (3.81mm)
TERMINAL HOOK RECEIVES (3) NO. 22 AWG (.025) SOLID WIRES



LOCATING PIN NO. 1
(12.7mm ± 0.397mm)
1/2 ± 1/64
47/64
(18.653mm)
.100
(2.54mm)
.100
(2.54mm)



MOUNTING SURFACE
7/16 ± 1/32
3/8 ± 1/64

LOCKING BUSHING TYPE

SPECIFICATIONS

Resistance Tolerance: ±10% up to 500K, ±20% above. **Electrical and Mechanical Rotation:** 295° ± 5°. **Effective Rotation:** 265° ± 5°. **End Resistance:** 4 Ω max. linear. **Dielectric Strength:** 750 VAC for 60 sec atm. **Working Voltage:** 350 Vdc across terminals. **Dynamic Noise:** 1.5% total resistance. **Static Noise:** to 30K Ω: −20 DB, 100K Ω: −12 DB, 1 Meg and over: + 3 DB. **Linearity (Independent):** ±5%. **Voltage Coefficient:** .008%/volt (max.). **Rotational Life:** 50,000 cycles. **Power Rating:** .5 watt at 70°C. **Torque Range:** .2 to 4.5 oz.-in. **Stop Torque:** 3 lb. in. **Weight:** .018 lb. (typical). **Functional Output:** Linear. **Insulation Resistance:** 1,000 Meg per MIL std. 202. **Resolution:** Infinite. **Corrosion Resistant:** Yes. **Terminal Style:** Hook.

STOCK RESISTANCE VALUES (Linear)

100 250 500 1K 2500	5K 10K 25K 50K 100K	250K 500K 1 Meg. 2.5 Meg. 5 Meg.

DESCRIPTION

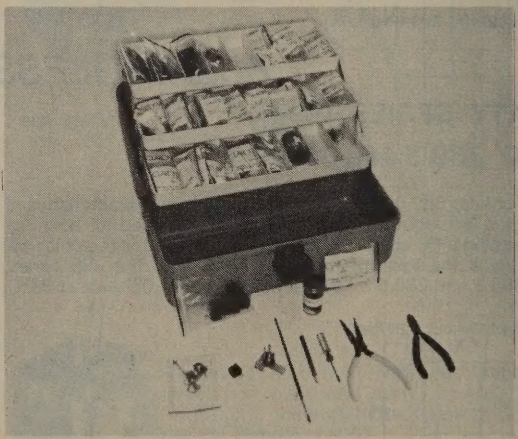
Cat. Nos.	Description
388N	Plain Bushing. (¾" FMS screwdriver slot shaft with ¼" plain bushing)
388L	Locking Bushing. (7/16" FMS slotted shaft with 3/8" split bushing)

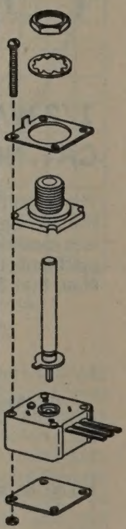
KIT AVAILABLE: The 'A' kit, a versatile prototype kit featuring a wide variety of assemblies, is now available. Write for complete details.

THE "A KIT" BY CLAROSTAT

NEW

The all new, prototype-oriented "A Kit" provides an economical answer to many breadboarding problems. Parts, individually packaged and identified to simplify selection and reordering. Assembles up to 30 single or dual Series 388 modular potentiometers for either panel-mount or printed circuit applications. The Series 388 module is ½" square and designed for mounting on a .100" grid; suitable for DIP insertion. Control element is rated .5 watts at 70°C. **Resistance Tolerance:** ±10%. **Independent Linearity:** ±5%. Each module contains a popular resistance value, ranging from 100 ohms to 2.5 megohms. Element is constructed of conductive plastic for extremely quiet performance. The "A Kit" contains shafts, bushings, lubricant, an assembly jig, pliers, screwdriver, and an assembly manual.
Clarostat "A Kit" — Net Each **$89.95**



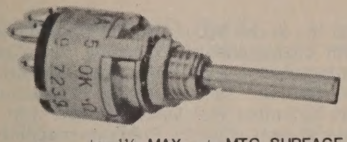


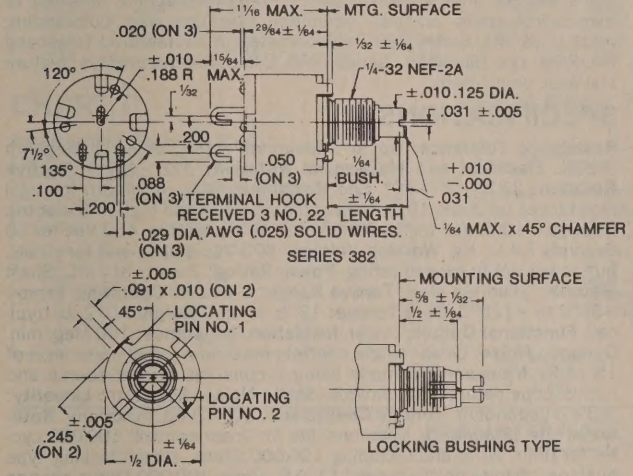
CLAROSTAT MFG. CO., INC. / DEPT. EM / DOVER, N.H. 03820 / TEL: (603) 742-1120 / TWX: 510-297-4455

CLAROSTAT THICK FILM CONDUCTIVE PLASTIC (CARBON) POTENTIOMETERS

BUSHING MOUNTED

LOW NOISE, MIL GRADE (RV6) 0.5 WATT—SERIES RV6




1¹⁄₁₆ MAX.
MTG. SURFACE
.020 (ON 3)
²⁹⁄₆₄ ± ¹⁄₆₄
¹⁄₃₂ ± ¹⁄₆₄
±.010
¹⁵⁄₆₄
120°
.188 R MAX.
¼-32 NEF-2A
¹⁄₃₂
±.010 .125 DIA.
.031 ±.005
.200
7½°
135°
.050
(ON 3)
¹⁄₆₄ BUSH.
+.010 −.000
.100
.088 (ON 3)
TERMINAL HOOK RECEIVED 3 NO. 22 AWG (.025) SOLID WIRES.
± ¹⁄₆₄ LENGTH
.031
.200
.029 DIA. (ON 3)
¹⁄₆₄ MAX. x 45° CHAMFER
SERIES 382
±.005
.091 x .010 (ON 2)
45°
LOCATING PIN NO. 1
MOUNTING SURFACE
⅝ ± ¹⁄₃₂
½ ± ¹⁄₆₄
LOCATING PIN NO. 2
±.005
.245 (ON 2)
± ¹⁄₆₄
½ DIA.
LOCKING BUSHING TYPE

Series RV6 are high-resolution, highly stable potentiometers for applications requiring miniaturization and reliability. Test equipment, industrial instrumentation, military communications and missiles are some of the areas in which this series meets requirements successfully. Commercial version is Series 382 available on special order. Military version Type 63C.

SPECIFICATIONS

Resistance Tolerance: ±10%. **Power Rating:** 0.5 watt at 70°C. Derated to zero power at 120°C. **Electrical and Mechanical Rotation:** 295° ±5°. **End Resistance:** 5Ω max. up to 750Ω. 10Ω max. above 750Ω. **Functional Output:** Linear. **Dielectric Strength:** 750 Vac for 60 Seconds at ATM. 350 Vac for 60 Seconds 3.44 in. Hg. **Working Voltage:** 350 Vdc maximum, but power not to exceed rating.

CAT. NO's. AND STOCK VALUES
RV6N AND RV6L

RV6NAY						RV6LAY			
—SD			—SL			—SA		—SD	
101A	103A	254A	101A	103A	254A	101A	503A	101A	253A
251A	153A	504A	251A	153A	504A	251A	104A	251A	503A
501A	253A	105A	501A	253A	105A	501A	154A	501A	104A
102A	503A	205B	102A	503A		102A	254A	102A	154A
252A	104A	505B	252A	104A		252A	504A	252A	254A
502A	154A		502A	154A		502A	105A	502A	504A
						103A	205B	103A	105A
						153A	505B	153A	
						253A			

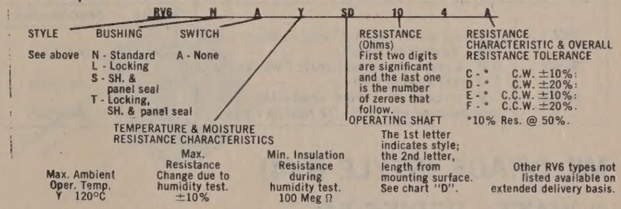
CHART D
OPERATING SHAFT—RV6
Configuration S—Slotted

	Shaft Length*	
Symbol	With ¼" Bushing N or S	With ½" Bushing L or T
A	5/8	5/8
D	7/8	7/8
L	3/8	—

*Shaft lengths measured from mounting surface.

ORDERING INFORMATION

RV6 per MIL-R-94 - 0.5 WATT CARBON POTENTIOMETERS



RV6 N A Y SD 10 4 A

STYLE
See above

BUSHING
N - Standard
L - Locking
S - SH. & panel seal
T - Locking, SH. & panel seal

SWITCH
A - None

TEMPERATURE & MOISTURE RESISTANCE CHARACTERISTICS

Max. Ambient Oper. Temp.	Max. Resistance Change due to humidity test.	Min. Insulation Resistance during humidity test.
Y 120°C	±10%	100 Meg Ω

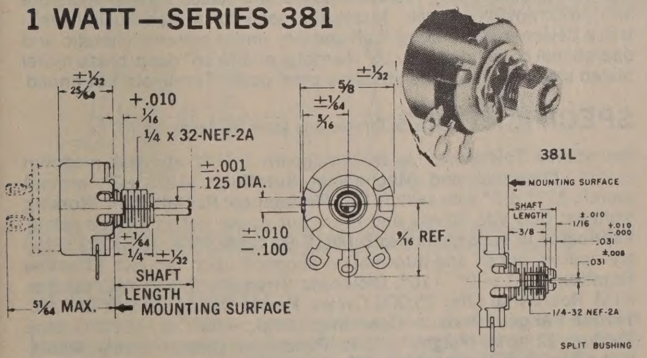
OPERATING SHAFT
The 1st letter indicates style; the 2nd letter, length from mounting surface. See chart "D".

RESISTANCE (Ohms)
First two digits are significant and the last one is the number of zeroes that follow.

RESISTANCE CHARACTERISTIC & OVERALL RESISTANCE TOLERANCE
C - * C.W. ±10%:
D - * C.W. ±20%:
E - * C.C.W. ±10%:
F - * C.C.W. ±20%.
*10% Res. @ 50%.

Other RV6 types not listed available on extended delivery basis.

LOW NOISE, MINIATURE, LONG LIFE, 1 WATT—SERIES 381


±¹⁄₃₂
²⁵⁄₆₄
+.010 −¹⁄₁₆
¼ x 32-NEF-2A
±.001 .125 DIA.
±¹⁄₆₄
¼—±¹⁄₃₂ SHAFT LENGTH
⁵¹⁄₆₄ MAX.
MOUNTING SURFACE
⅝
±¹⁄₃₂
±¹⁄₆₄
⁵⁄₁₆
±.010 —.100
⁹⁄₁₆ REF.
381L
MOUNTING SURFACE
SHAFT LENGTH
3/8
±.010 −1/16
+.010 −.000
.031
±.008 .031
1/4-32 NEF-2A
SPLIT BUSHING

Cat. No.	Description
381N	Bushing, Plain, ¼" long. Shaft, ¾" long. FMS SD slotted.
381NS	Bushing (same as 381N) but equipped with a factory attached SPST switch. 1a, 125V (ac or dc).
*381N-Z	Bushing—Z-Taper (see pg. 2484)
381L	Locking Bushing, 3/8" long. Shaft, 7/16" long. FMS screwdriver slotted.
D381N	Dual ganged Bushing and shaft same as 381N.

*Note: Insert Resistance value between N and Z for complete Catalog No. eg. 381N-10K-Z.

Series 381, The "Quiet One" is a completely new potentiometer with characteristics exceeding those costing many times more. Manufactured in a controlled environment, the process includes exclusive Clarostat Temp-Maturing(TM) to insure a reliable, homogeneous and strainfree resistance element with 1% dynamic noise and 5% independent linearity. Precision-machine finishing of mechanical parts ensures smoother operation and outstanding mechanical life. Series 381 Potentiometers manufactured to MIL-R-94 specification.

SPECIFICATIONS

Resistance Tolerance: Linear, up to 500KΩ ±10%, above 500KΩ ±20%. Tapers, up to 100KΩ ±10%, above 100KΩ ±20%. **Power Rating (Watts):** 1 watt maximum continuous power rating for linear taper, but voltage not to exceed rating. Full rating at 70°C, derated linearly to zero watts at 120°C. Derate all non-linear tapers by multiplying wattage rating by 0.5. **Mechanical and Electrical Rotation:** 300° ±5° without switch, 325° ±5° with switch. **Dynamic Noise:** Linear single controls maximum initial noise level of 1% of total resistance. Measurement made using a constant current source and oscilloscope detection technique. **Linearity:** ±5% Independent. **Working Voltage:** 350 Vdc across end terminals, but power not to exceed rating. **Effective Rotation:** 270° +0° −10°. **Tapers:** Yes. **Dielectric Strength:** 1,000 VAC for 60 Sec. ATM. **Torque Range:** 0.2-6 oz.-in. **Stop Torque:** 6 lb. min. **Weight:** .017 lb. typical. **Functional Output:** Linear or Taper (see Catalog No's.). **Insulation resistance:** 1,000 Meg Min. **Corrosion Resistant:** Yes.

STOCK VALUES

381N, 381NS, 381L LINEAR			DUAL D381N POTENTIOMETERS			TAPERED 381N-Z POTENTIOMETERS		
100	5K	250K	500	5K	50K	10K		250K
250	10K	500K	1000	10K	100K	25K	"Z"	500K
500	25K	1 Meg		25K		50K	Taper	1 Meg
1000	50K	2.5 Meg		Linear		100K		
2500	100K	5 Meg						

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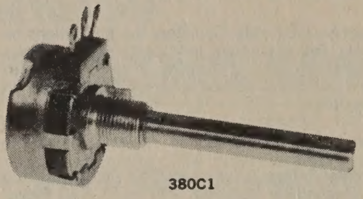
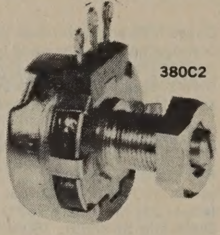
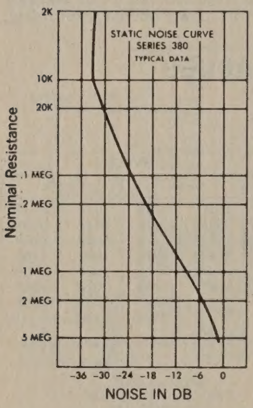
CLAROSTAT THICK FILM CONDUCTIVE PLASTIC (CARBON) POTENTIOMETERS

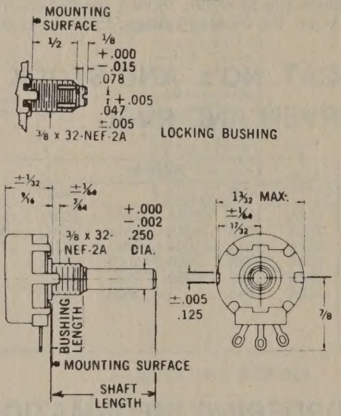
BUSHING MOUNTED

LOW NOISE, LONG LIFE 2 WATT—SERIES 380


380C1


380C2





Cat. No.	Description	Cross Reference	
		Ohmite	Allen-Bradley
380C1	2" round shaft FMS; 3/8" long bushing with 3/8 x 32-NEF-2A thread.	CU	JAIN200P
380C2	5/8" screwdriver slotted shaft FMS; with a 1/2" split locking bushing.	CLU	JAIL040S
380C3	7/8" screwdriver slotted shaft FMS; 3/8" long bushing with 3/8 x 32-NEF-2A thread.	CMU	JAIN056S

Like the Series 381 the Series 380 is a "Quiet One". A completely new potentiometer with characteristics exceeding those costing many times more. Manufactured in a controlled environment, the process includes exclusive Clarostat Temp-Maturing(TM) to insure a reliable, homogeneous and strainfree resistance element with 1% dynamic noise and 5% independent linearity. Precision-machine finishing of mechanical parts ensures smoother operation and outstanding mechanical life. Series 380 Potentiometers manufactured to exceed MIL-R-94 specifications. Series 380 C-line Potentiometers feature stainless steel shafts.

SPECIFICATIONS

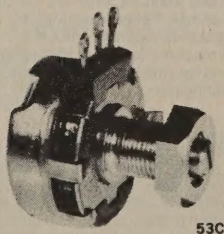
Resistance Tolerance: Up to 1 Megohm ±10%, above 1 Megohm ±20%. **Electrical and Mechanical Rotation:** 312° ±3°. **Effective Rotation:** 270° –0° +10°. **End Resistance:** 4Ω maximum for total resistances up 250K, 10Ω for resistances 250K and higher. **Dielectric Strength:** 1000 Vac for 60 Seconds at ATM pressure. 450 Vac for 60 Seconds 3.4 in. Hg. **Working Voltage:** 500 Vdc across end terminals, but power not to exceed rating. **Power Rating:** 2 watts at 70°C. **Shaft Material:** Stainless steel. **Torque Range:** 1-4 oz.-in. **Operating Temp.:** −55°C to +120°C. **Stop Torque:** 12 lb. in min. **Weight:** .072 lb. (typical). **Functional Output:** Linear. **Insulation Resistance:** 100 Meg. min. **Dynamic Noise:** Linear single controls maximum initial noise level of 1% of Rt. Measurement made using a constant current source and oscilloscope detection technique. **Static Noise:** See Chart. **Linearity:** ±5% Independent. **Voltage Coefficient:** .005%/Volt. maximum. **Rotational Life (Standard):** Rotational life for linear control; 100,000 cycles for units up to and including 100,000 Ohms, except locking type bushing, change not to exceed 5%ΔR, above 100,000 Ohms change not to exceed 10%ΔR.

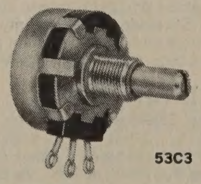
STOCK VALUES

RESISTANCE OHMS (All Units Linear Taper)						
50	750	3500	20K	100K	500K	2.5 Meg
100	1000	5000	25K	150K	750K	3 Meg
150	1500	7500	35K	200K	1 Meg	3.5 Meg
250	2000	10K	50K	250K	1.5 Meg	4 Meg
350	2500	15K	75K	350K	2 Meg	5 Meg
500						

MIL GRADE (STYLE RV4)

2 WATT—SERIES 53


53C2


53C3

Cat. No.	Description
53C1	2" round shaft FMS; 3/8" long bushing with 3/8 x 32-NEF-2A thread.
53C2	5/8" screwdriver slotted shaft FMS; with a 1/2" split locking bushing.
53C3	7/8" screwdriver slotted shaft FMS; 3/8" long bushing with 3/8 x 32-NEF-2A thread.
53C1SW	Unsealed version of 53C1 available for use with field assembled switches. Order as 53C1 SW see table 1 for switch ordering.
53C1-Z	Same as 53C1 but with Z taper (see chart pg. 2484)
53C1-RZ	Same as 53C1 but with Reversed Z taper (see chart pg. 2484)
D53C1	Dual ganged. Bushing and shaft same as 53C1.
RV4N	MIL equivalent of Series 53 with plain bushing (see table next page).
RV4L	MIL equivalent of Series 53 with shaft lock bushing (see table next page).

	TABLE 1 SWITCHES FOR 53C1 SW ONLY
Cat. No.	Description
53-10	SPST—3A-125 Vac
53-20	DPST—3A-125 Vac
53-21	(Mod.) DPST—3A-125 Vac/dc

A 2-watt potentiometer totally enclosed and sealed against moisture and other environmentals. Meets the need for a high quality resistance device incorporating high-stability under extreme climatic and operational conditions. 1-1/16" diameter and 9/16" deep, brass nickel plated shaft, bushing and stainless steel cover. Terminals, hot tinned.

SPECIFICATIONS (Dimensions same as Series 380)

Resistance Tolerance: Up to 1 megohm ±10%, above 1 megohm ±20%. **Electrical and Mechanical Rotation:** 312° ±3° without switch, 333° ±3° with switch. **End Resistance:** Per MIL-R-94. **Working Voltage:** 500 Vdc across end term, but power not to exceed rating. **Fabricated in accordance with MIL-R-94 Style RV4.** Items not listed are special, prices and information supplied upon request. **Effective Rotation:** 270° −0° +10°. **Dielectric Strength:** 1,000 VAC, 60 Sec. ATM. **Rotational Life:** 25,000 Cycles. **Power Rating:** 2 watt at 70°C. **Torque Range:** 1-4 oz.-in. **Operating Temp.:** −55°C to +120°C. **Stop Torque:** 12 lb.-in. **Weight:** .072 lb. **Functional Output:** Linear. **Insulationg Resistance:** Per MIL-R-94C. **Corrosion Resistant:** MIL-R-94C.

STOCK VALUES

53C1, 53C2, 53C3 Linear					Dual D53C1	Z-Taper 53C1-Z		Reversed Z-Taper 53C1-RZ
50	1500	20K	250K	3 Meg	10K	500	150K	10K
100	2000	25K	350K	3.5 Meg	25K	1K	200K	25K
150	2500	35K	500K	4 Meg	50K	2.5K	250K	50K
250	3500	50K	750K	5 Meg	100K	5K	500K	100K
350	5000	75K	1 Meg	7.5 Meg	250K	10K	750K	250K
500	7500	100K	1.5 Meg	10 Meg	500K	15K	1 Meg	500K
750	10K	150K	2 Meg		1 Meg	20K	2 Meg	
1000	15K	200K	2.5 Meg			25K	2.5 Meg	
						50K	5 Meg	
						100K		

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CLAROSTAT THICK FILM CONDUCTIVE PLASTIC (CARBON) POTENTIOMETERS

BUSHING MOUNTED

SERIES 53 (CONTINUED)

CAT. NO. RV4N AND RV4L

RV4NAYSB		RV4NAYSD				RV4NAYSK		RV4LAYSA				RV4LAYSD	
101A	503A	500A	152A	353A	754A	101A	503A	500A	152A	353A	754A	101A	503A
251A	104A	101A	252A	503A	105A	251A	104A	101A	252A	503A	105A	251A	104A
501A	254A	151A	352A	753A	155B	501A	254A	151A	352A	753A	155B	501A	254A
102A	504A	251A	502A	104A	205B	102A	504A	251A	502A	104A	205B	102A	504A
252A	105A	351A	752A	154A	255B	252A	105A	351A	752A	154A	255B	252A	105A
502A	255B	501A	103A	254A	355B	502A	255B	501A	103A	254A	355B	502A	255B
103A	505B	751A	153A	354A	505B	103A	505B	751A	153A	354A	505B	103A	505B
253A		102A	253A	504A		253A		102A	253A	504A		253A	

CHART C

OPERATING SHAFT—RV4
Configuration S—Slotted

Symbol	Shaft Length*	
	With 3/8" Bushing N & S	With 1/2" Bushing L & T
A	—	5/8
B	1/2	—
D	7/8	7/8
G	1-1/4	—
J	2	—
K	2-1/2	—

ORDERING INFORMATION (RV4)

RV4 N A Y SD 10 4 A

STYLE
See above

BUSHING
N - Standard
L - Locking
S - Shaft & panel seal
T - Locking, SH. & panel seal

SWITCH
A - None

TEMPERATURE & MOISTURE RESISTANCE CHARACTERISTICS

Max. Ambient Oper. Temp.	Max. Resistance Change due to humidity test.	Min. Insulation Resistance during humidity test.
Y 120°C	±10%	100 Meg Ω

OPERATING SHAFT
The 1st letter indicates style; the 2nd letter, length from mounting surface. See chart "C".

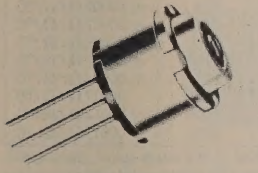
RESISTANCE (Ohms)
First two digits are significant and the last one is the number of zeroes that follow.

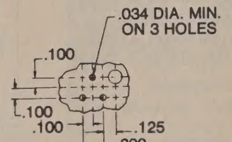
RESISTANCE CHARACTERISTIC & OVERALL RESISTANCE TOLERANCE
A linear ±10%
B linear ±20%
C - * C.W. ±10%:
D - * C.W. ±20%:
E - * C.C.W. ±10%:
F - * C.C.W. ±20%:
*10% Res. @ 50%.

Other RV4 types not listed available on extended delivery basis.

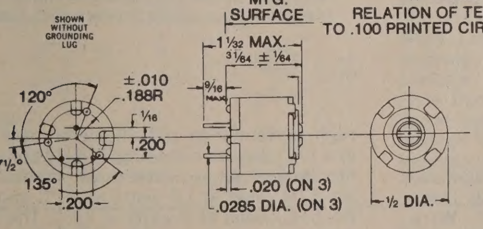
BUSHINGLESS PC MOUNTED

LOW NOISE, HIGH STABILITY .25 WATT SERIES 382-5





RELATION OF TERMINALS TO .100 PRINTED CIRCUIT BOARD



Cat. No. 382-5 is designed specifically for application on printed circuit boards, this new configuration permits extremely close board-to-board spacing.

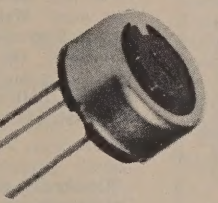
SPECIFICATIONS

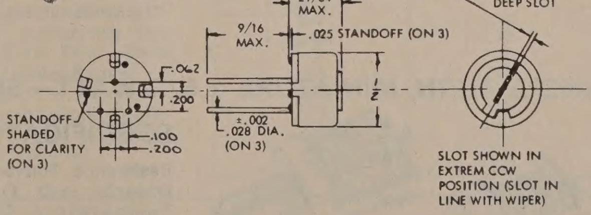
Power Rating: .25 watt at 70°C. Derated to zero power at 120°C. **Working Voltage:** 350 Vdc across end terminals, but power not to exceed rating. **Resistance Tolerance:** ±10%. **Mechanical and Electrical Rotation:** 295° ±3°. **Dielectric Strength:** 750 Vac between terminals and ground for 1 minute. **Torque:** 0.5 to 3 oz. in. **Effective Rotation:** 265° +0° −10°. **Dynamic Noise:** 3% max. **Linearity (Independent):** ±5%. **Voltage Coefficient:** .008%/volt (max.) **Rotational Life:** 5,000 cycles. **Operating Temp.:** −55°C to +120°C. **Stop Torque:** 3 lb. in. min. **Functional Output:** Linear. **End Resistance:** 4Ω max. to 250K 10Ω max. above 250K.

STOCK VALUES—RESISTANCE OHMS

100	2.5K	25K	200K
250	5K	50K	250K
500	10K	100K	500K
1K	15K	150K	1 Meg

LOW NOISE, HIGH STABILITY, ECONOMY .375 WATT—SERIES 383-5




21/64 MAX.
1/32 x 5/32 x 1/32 DEEP SLOT
9/16 MAX.
.025 STANDOFF (ON 3)
.062
.200
1/2
STANDOFF SHADED FOR CLARITY (ON 3)
.100
.200
±.002
.028 DIA.
(ON 3)
SLOT SHOWN IN EXTREM CCW POSITION (SLOT IN LINE WITH WIPER)

Cat. No. 383-5 is a new, high-resolution, highly stable potentiometer for applications requiring miniaturization and reliability.

SPECIFICATIONS

Resistance Range: 100 ohms to 2.5 megohms linear, only. **Resistance Tolerance:** ±20%. **Power Rating (Watts):** .375 watt maximum continuous. power rating for linear tapers, but voltage not to exceed rating. Full rating at 70°C derated linearly to zero watts at 120°C. **Linearity:** ±10% independent. **End Resistance:** Linear 15 ohms maximum. **Dielectric Strength:** 750 Vac for 60 Seconds at ATM. 350 Vac for 60 Seconds 3.44 in H.g. **Working Voltage:** 350 Vdc maximum, but power not to exceed rating. **Mechanical Rotation:** 295° ±5°. **Stop Torque:** 2 in. lbs. maximum. **Torque Range:** 0.5 to 4 oz. in. **Max. No. of Sections:** One. **Weight:** .004 lbs.

STOCK VALUES—RESISTANCE OHMS

100	2.5K	25K	200K
250	5K	50K	250K
500	10K	100K	500K
1K	15K	150K	1 Meg

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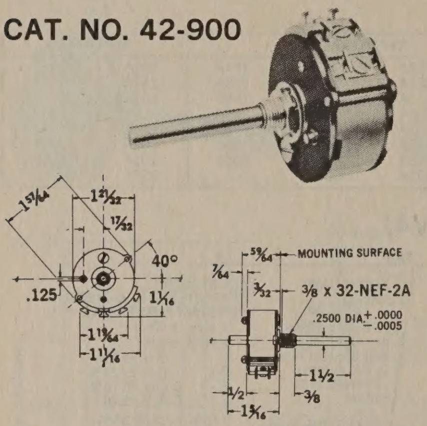
CLAROSTAT WIREWOUND POTENTIOMETERS

PRECISION POTENTIOMETERS

SINGLE TURN, 3 WATT—SERIES 42

CAT. NO. 42-900


1 57/64
1 21/32
17/32
40°
.125
1 1/16
1 19/64
1 11/16
59/64
MOUNTING SURFACE
7/64
3/32
3/8 x 32-NEF-2A
.2500 DIA. +.0000 −.0005
1 1/2
1/2
3/8
1 5/16

SPECIFICATIONS

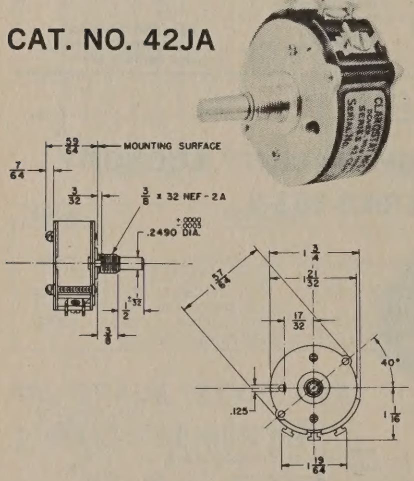
Resistance Tolerance: ±5%. **Functional Output:** Linear. **Tap:** 50% Applied Voltage ±Lin. Tol. **Power Dissipation*:** 3 watts at 40°C. **Effective Rotation:** 300°. **Mechanical Rotation:** 320 ±3 with stop 360° cont. without stop. **Electrical Rotation:** 320° ±3° with stop, 340° ±3° without stop. **Torque:** 3 oz. in. max. **Stop Torque:** 8 lb. in max. **Ambient Temperature:** 105°C max. **Life**:** 250,000 max. cycles. **Speed of Rotation:** 90 RPM max. **Rotor Inertia:** 4.4 approx. gmcm^2 per wiper. **Weight:** 3.2 approx. oz. **Working Voltage:** 350V. **Tapers:** Linear. **Hardware Supplied:** Yes. **Corrosion Resistant:** Yes. **Shaft Material:** Stainless steel. **Shaft Length/Style:** 1-7/8" (from mtg. surface)/Plain. **Bushing Length/Style:** 3/8" (from mtg. surface)/Plain. **Additional Description:** Rear shaft extension.

Used and approved by the millions. Extra tap affords greater electrical versatility. Shaft extension through rear of unit.

Stock Values Res. Ohms	*** Terminal Linearity	Resolution 100/ Total Turns	Temperature Coefficient of Wire
100,000	±0.25%	.053%	±.00002Ω/Ω/°C
50,000	±0.25%	.056%	±.00002Ω/Ω/°C
20,000	±0.25%	.105%	±.00002Ω/Ω/°C
10,000	±0.25%	.125%	±.00002Ω/Ω/°C
5,000	±0.25%	.167%	±.00002Ω/Ω/°C
2,500	±0.25%	.148%	±.00002Ω/Ω/°C
1,000	±0.50%	.191%	±.00002Ω/Ω/°C
500	±0.50%	.174%	.00017Ω/Ω/°C
100	±0.50%	.351%	.00017Ω/Ω/°C
50	±0.50%	.435%	.00017Ω/Ω/°C

***The maximum deviation of the actual output characteristic from a straight reference line extending between zero and the total applied voltage over the actual effective rotation.

CAT. NO. 42JA


59/64
MOUNTING SURFACE
7/64
3/32
3/8 x 32 NEF - 2A
+.0000 −.0005
.2490 DIA.
1/2 ±1/32
3/8
1 3/4
1 21/32
1 57/64
17/32
40°
.125
1 1/16
1 19/64

SPECIFICATIONS

Resistance Tolerance: ±5%. **Functional Output:** Linear. **Power Dissipation*:** 3 watts at 40°C. **Effective Rotation:** 310° nom. **Electrical Rotation:** 330 ±5°. **Mechanical Rotation:** 360° cont. **Torque:** 3 oz. in. max. **Ambient Temperature:** 105°C max. **Life**:** 250,000 max. cycles. **Speed of Rotation:** 90 RPM max. **Rotor Inertia:** 4.4 approx. gmcm^2 per wiper. **Weight:** 3.2 approx. oz. **Tapers:** Linear. **Corrosion Resistant:** Yes. **Hardware Supplied:** Yes. **Shaft Length/Style:** 7/8 (from mtg. surface)/Plain. **Bushing Length/Style:** 3/8 (from mtg. surface)/Plain. **Shaft Material:** Stainless steel.

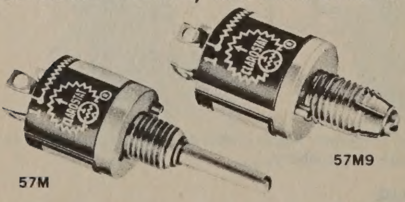
*Derated to zero power at 105°C.
**Depends on design parameters.

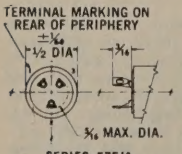
All the same fine qualities and performance tolerances of the Cat. No. 42-900, with the exception of the additional tap, and shaft extension. The ideal unit for extra-dependable potentiometer requirements.

Stock Values Res. Ohms	*** Absolute Linearity	Resolution 100/ Total Turns	Temperature Coefficient of Wire
50,000	±0.5%	.074%	±.00002Ω/Ω/°C
20,000	±0.5%	.10%	±.00002Ω/Ω/°C
10,000	±0.5%	.12%	±.00002Ω/Ω/°C
5,000	±0.5%	.17%	±.00002Ω/Ω/°C
2,500	±0.5%	.14%	±.00002Ω/Ω/°C
1,000	±0.5%	.19%	±.00002Ω/Ω/°C
500	±0.5%	.18%	.00017Ω/Ω/°C
100	±0.1%	.28%	.00017Ω/Ω/°C
50	±1.0%	.35%	.00017Ω/Ω/°C

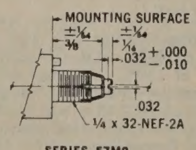
***The maximum deviation of the actual output characteristic from a straight reference line extending between zero and the total applied voltage over the theoretical effect rotation.

SINGLE TURN, MINIATURE 1.5/2 WATT—SERIES 57



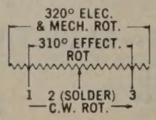

TERMINAL MARKING ON REAR OF PERIPHERY
±1/64
1/2 DIA
3/16
5/16 MAX. DIA.

SERIES 57EJA
(PLAIN BUSHING)
SERIES 57EJB
(LOCKING BUSHING)
GLASS SEALED
TERMINAL BOARD


MOUNTING SURFACE
±1/64
3/8
±1/64
1/16
.032 +.000 −.010
.032
1/4 x 32-NEF-2A

SERIES 57M9
LOCKING BUSHING
MOUNTING

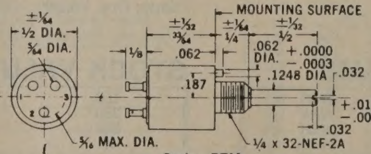
*Mounted per MIL-R-19.
57M derated
to zero power at 125°C.
57EJ derated
to zero power at 150°C.


320° ELEC. & MECH. ROT.
310° EFFECT. ROT
1
2 (SOLDER)
3
C.W. ROT.

SCHEMATIC

SPECIFICATIONS

Resistance Tolerance: ±5%. **Independent Linearity:** ±2%. **Functional Output:** Linear. **Temperature Coefficient of Wire:** ±.00002Ω/Ω/°C. **Effective Rotation:** 300° ±5°. **Electrical and Mechanical Rotation:** 320° ±5°. **Power Rating *57M:** 1.5 watts at 40°C. **Power Rating 57EJ:** 2 watts at 70°C. **Dielectric Strength:** 1000 Vac. **Torque:** 6 oz. in. max. **Locking Bushing:** 20 oz. in. min. Torque with Locking Nut tightened to 8 lb. in. **Stop Torque:** 3 lb. in. **Shaft Seal:** Yes. **Weight Approximate:** .25 oz. **Housing:** Corrosion Resistance, per QQ-M-151. **Shaft:** Centerless Ground, Stainless Steel.


±1/64
1/2 DIA.
5/64 DIA.
5/16 MAX. DIA.
1/8
±1/32
33/64
.062
MOUNTING SURFACE
±1/64
1/4
±1/32
1/2
.062 DIA. +.0000 −.0003
.1248 DIA
.187
.032
+.010 −.000
.032
1/4 x 32-NEF-2A

Series 57M
Plain Bushing

High performance potentiometer packaged in a 1/2" diameter housing. Quality construction throughout. Available in two models; Cat No. 57M rated at 1.5 watts at 40°C and Cat. No. 57EJ rated at 2 watts at 70°C. The high-temperature Cat. No. 57EJ features glass-sealed terminals. Both units are corrosion resistant.

Stock Values Res. Ohms	Resolution 100/Total Turns	Stock Values Res. Ohms	Resolution 100/Total Turns
50	.91%	5,000	.30%
100	.70%	10,000	.26%
200	.58%	20,000	.19%
500	.43%	50,000	.16%
1,000	.35%		

Cat. No.	Description
57M	Plain bushing (3/4" shaft length with 1/4" bushing length (FMS)
57M9	Locking bushing (7/16" shaft length with 3/8" bushing length FMS)
57EJA	Glass seal terminations: Plain bushing (as above)
57EJB	Glass seal terminations: Locking bushing (as above)

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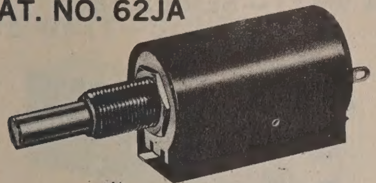
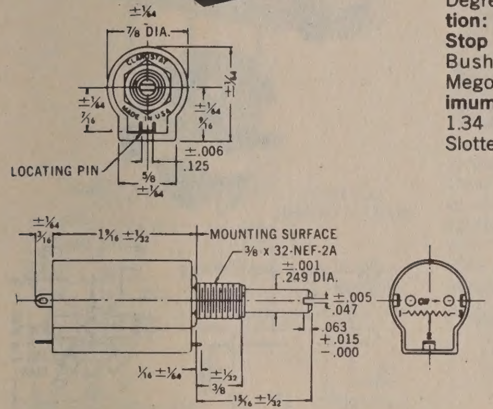
CLAROSTAT WIREWOUND POTENTIOMETERS

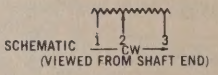
PRECISION POTENTIOMETERS

TEN TURN 2 WATT—SERIES 62

CAT. NO. 62JA




±1/64
7/8 DIA.
±1/64
±1/64
7/16
±1/64
9/16
±.006
.125
LOCATING PIN
5/8
±1/64
±1/64
3/16
1 9/16 ±1/32
MOUNTING SURFACE
3/8 x 32-NEF-2A
±.001
.249 DIA.
±.005
.047
.063
+.015
−.000
1/16 ±1/64
±1/32
3/8
1 5/16 ±1/32


SCHEMATIC
1
2
CW
3
(VIEWED FROM SHAFT END)

SPECIFICATIONS

Resistance Tolerance: ±5%. **Functional Output:** Linear. **Absolute Linearity*:** ±0.25%. **Power Dissipation**:** 2 Watts at 25°C. **Temperature Coefficient of Wire:** ±.000020Ω/Ω/°C. **Dielectric Strength:** 1000 Vac. **Effective Rotation:** 3600 Nom. Degrees. **Electrical and Mechanical Rotation:** 3600 +10° −0°. **Torque:** 3 oz. in. max. **Stop Torque:** 50 oz. in. **Bearings:** Sleeve Bushing. **Insulation Resistance:** 1000 Megohms. **Life:** 100,000 Shaft Rev's. **Maximum Speed of Rotation:** 60 RPM. **Weight:** 1.34 oz. **Shaft Length/Style:** 15/16" FMS/Slotted. **Bushing Length/Style:** 3/8"/Plain.

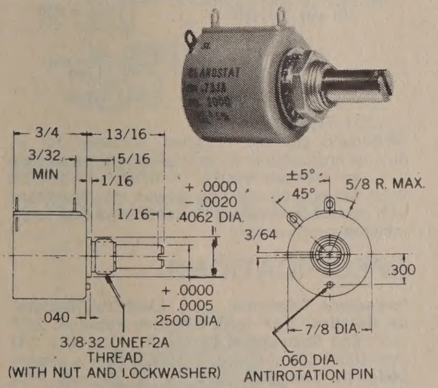
Opens new application areas for the inherent advantages of multi-turn potentiometer design. A precise 10-turn potentiometer offering electrical operating characteristics comparable to units costing far more. The Series 62 was designed specifically for the industrial instrumentation market, based upon the setability and resolution of a quality ten-turn potentiometer including better instrument control and settings for all types of electronic equipment.

Stock Values	Resolution %	Stock Values	Resolution %
100,000	.012	2,500	.022
50,000	.013	2,000	.023
30,000	.016	1,000	.030
25,000	.017	500	.036
20,000	.019	250	.038
10,000	.024	200	.048
5,000	.026	100	.062

*For 250Ω, 200Ω and 100Ω the linearity is ±0.5% absolute.
**Derated Zero Power at 85°C.

TEN TURN, MINIATURE 2 WATT—SERIES 73

CAT. NO. 73JA


3/4
13/16
3/32
MIN
5/16
1/16
1/16
+ .0000
− .0020
.4062 DIA.
+ .0000
− .0005
.2500 DIA.
.040
3/8-32 UNEF-2A
THREAD
(WITH NUT AND LOCKWASHER)
±5°
45°
5/8 R. MAX.
3/64
.300
7/8 DIA.
.060 DIA.
ANTIROTATION PIN

SPECIFICATIONS

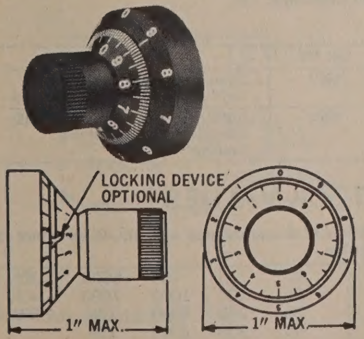
Resistance Tolerance: ±5%. **Electrical/Mechanical Rotation:** 3600 +10° −0°. **Effective Rotation:** 3600 Nom. **End Resistance:** .3% of total res. or 1 ohm whichever is greater. **Dielectric Strength:** 1,000 volts RMS. **Working Voltage:** 500 V max. **Noise (Enr.):** 100 ohms max. **Linearity (Independent):** .25%. **Rotational Life (Max.):** 500,000 cycles. **Power Rating:** 2 watt at 70°. **Shaft Length/Style:** 1/2" screwdriver slot. **Bushing Length/Style:** 5/16 Plain. **Shaft Material:** Stainless steel. **Torque Range:** 1.5 oz. in. max. **Stop Torque** 50 oz. in. min. **Functional Output:** Linear. **Temperature Coefficient of Wire:** ±20 ppm/°C max. **Insulation Resistance:** 1,000 meg at 500V DC.

This series has brought the ten-turn potentiometer down in size, down in price and down in wear-outs. Only ¾" body length, priced less than $4.00 in quantity, and a rotational life of 500,000 cycles.

STOCK VALUES

Standard Resistance Values (Ω)	Resolution (%)
100	0.055
200	0.037
500	0.030
1K	0.025
2K	0.021
5K	0.020
10K	0.017
20K	0.015
25K	0.013
50K	0.011
100K	0.009

CLARODIALS
TEN TURN CONCENTRIC SCALE DIALS


LOCKING DEVICE
OPTIONAL
1" MAX.
1" MAX.

Calibrated dials designed for multi-turn potentiometers up to ten turns or other rotary devices. Requires only one inch of panel space. The knob attaches directly to the shaft, and the body of the dial is mounted rigidly to the panel. Therefore, accurate readings with a ratio of 1,000 to one for ten turns are provided with zero backlash and reading error.

Material is anodized aluminum.

Mounting requirements 1/4" shaft and 3/8" 32-NEF-2A bushing.

Adapter available for 1/8" diameter shaft.

Cat. No.	Description
411	Commercial 10 Turn, Black Anodize 1/4" Shaft, No Lock
412	Commercial 10 Turn, Black Anodize 1/4" Shaft, With Lock
461	Commercial 10 Turn, Clear Anodize 1/4" Shaft, No Lock
462	Commercial 10 Turn, Clear Anodize 1/4" Shaft, With Lock

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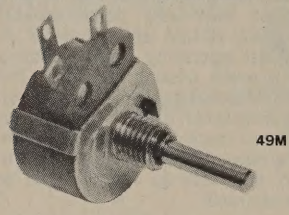
CLAROSTAT WIREWOUND POTENTIOMETERS

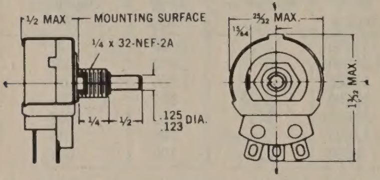
INDUSTRIAL GRADE POTENTIOMETERS

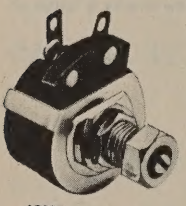
INDUSTRIAL CONTROLS

1.5 WATT—SERIES 49

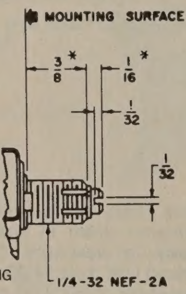


49M


½ MAX
MOUNTING SURFACE
¼ x 32-NEF-2A
¼
½
.125
.123 DIA.
25⁄32 MAX.
15⁄64
1³⁄32 MAX.



49M9


MOUNTING SURFACE
3/8 *
1/16 *
1/32
1/32
1/4-32 NEF-2A

OPTIONAL LOCKING BUSHING
JAM NUT SUPPLIED

Tens of thousands of these miniaturized potentiometers have proved the outstanding dependability and performance of the unit. It provides space-savings and electrical performance required in many critical electronic assemblies. Ideal for trimmer requirements for high resolution.

SPECIFICATIONS

Power Rating: 1.5 watts at 40°C, or .005 watt per degree of effective rotation maximum. Derated linearly to zero power at 125°C. **Working Voltage:** 175 volts maximum. **Resistance Tolerance:** ±5%. **Minimum End Resistance:** 1 to 15Ω, 5% of total resistance. Over 15Ω, 3% of total resistance. **Functional Output:** Linear. **Shaft Seal Available:** Yes. **Max. No. of Sections:** 3. **Dielectric Strength:** 1,000 VAC for 60 sec. (ATM). **Stop Torque:** 3 in. lb. (max.). **Effective Rotation:** 300° ±5°. **Mechanical and Electrical Rotation:** 300° ±5°. **Voltage Breakdown:** 100 Vac for 1 minute between terminals and ground. **Torque:** .3 to 6 oz. in. Locking type bushing: 20 oz. in. minimum with jam nut tightened to 10 lb. in. **Typical Weight:** .02 lb. **Insulation Resistance:** 100 Meg (min.).

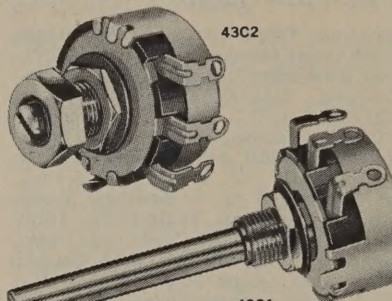
Cat. No.	Description
49M	1/8" round shaft, 3/4" FMS long, with a 1/4" x 32-NEF-2A mounting bushing 1/4" long.
49M9	1/8" diameter x 7/16" FMS long screwdriver slotted shaft with a 1/4" x 32-NEF-2A, 3/8" long locking type bushing.

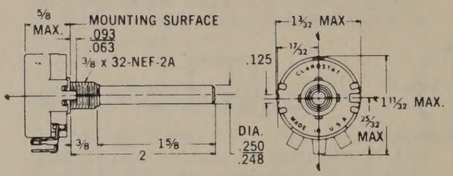
STOCK VALUES—

Fabricated in accordance with MIL-R-19 where applicable.

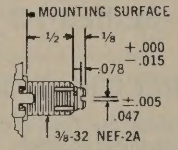
5	50	250	1500	7500
10	100	500	2K	10K
20	150	750	2500	15K
25	200	1K	5K	20K

2 WATT—SERIES 43C




5⁄8 MAX.
MOUNTING SURFACE
.093
.063
3⁄8 x 32-NEF-2A
3⁄8
1⁵⁄8
2
DIA.
.250
.248
1³⁄32 MAX
17⁄32
.125
1¹¹⁄32 MAX.
25⁄32 MAX
CLAROSTAT
MADE U.S.A.

OPTIONAL LOCKING BUSHING
JAM NUT SUPPLIED


MOUNTING SURFACE
½
⅛
+.000
−.015
.078
±.005
.047
3⁄8-32 NEF-2A

Wirewound controls designed primarily for industrial applications. All exposed metal parts have corrosion resistant finishes. Terminals have suitable finish for ease of soldering. Covers are close-fitting with no cutouts resulting in practically a dust-proof, moisture-proof control.

SPECIFICATIONS

Weight: 0.2 lb. (typical). **Functional Output:** Linear. **Insulation Resistance:** 100 Meg (min.). **Corrosion Resistant:** Yes. **Resistance Tolerance:** ±5%. **Effective Rotation:** 280° ±5°. **Electrical and Mechanical Rotation:** 300° ±5°. **Independent Linearity:** ±2%. **End Resistance:** 1 to 50Ω-0.3Ω, 51 to 100Ω-0.5Ω. Over 100Ω-0.2% of total or 1Ω, whichever is greater. **Working Voltage:** 310 Vdc maximum.

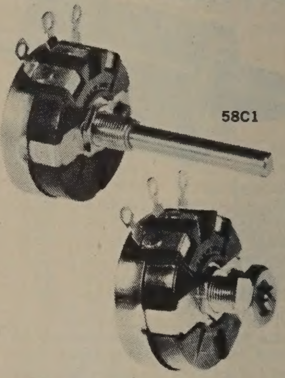
Cat. No.	Description
43C1	2" round shaft FMS; 3/8" long bushing with 3/8-32-NEF-2A thread.
43C2	5/8" FMS screwdriver slotted shaft FMS; with a 1/2" split locking bushing.

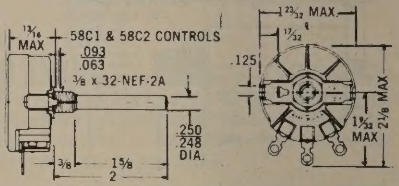
STOCK VALUES

Fabricated in accordance with MIL-R-19 where applicable.

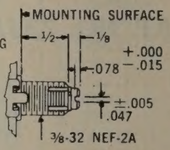
5	75	500	4000	30K
10	100	750	5000	40K
20	150	1000	7500	50K
25	200	1500	10K	
30	250	2000	15K	
40	300	2500	20K	
50	400	3000	25K	

4 WATT—SERIES 58C




13⁄16 MAX
58C1 & 58C2 CONTROLS
.093
.063
3⁄8 x 32-NEF-2A
.250
.248
DIA.
3⁄8
1⁵⁄8
2
1²³⁄32 MAX.
17⁄32
.125
1⁹⁄32 MAX
2⅛ MAX

OPTIONAL LOCKING BUSHING
JAM NUT SUPPLIED


MOUNTING SURFACE
½
⅛
+.000
−.015
.078
±.005
.047
3⁄8-32 NEF-2A

Wirewound controls designed primarily for industrial applications. All exposed metal parts have corrosion resistant finishes. Terminals have suitable finish for ease of soldering. Covers are close-fitting with no cutouts resulting in practically a dust-proof, moisture-proof control.

SPECIFICATIONS

Resistance Tolerance: ±5%. **Electrical/Mechanical Rotation:** 300° ±5°. **Effective Rotation:** 280° ±5°. **End Resistance:** 1-50Ω .3Ω 51-100Ω .5Ω over 100Ω .2% of total or 1Ω whichever is greater. **Dielectric Strength:** 1,000 vac 60 seconds ATM. **Working Voltage:** 350 Vdc max. **Linearity (Independent):** ±1%. **Mil Spec Reference:** MIL-R-19. **Element Material:** Wire. **Power Rating:** 4 watt at 40°C. **Torque Range:** 0.5-6 oz. in. **Stop Torque:** 8 in. lbs. max. **Insulation Resistance:** 100 meg. min. **Corrosion Resistant:** Yes.

Cat. No.	Description
58C1	2" round shaft FMS; 3/8" long bushing with 3/8-32 NEF-2A thread.
58C2	5/8" screwdriver slotted shaft FMS; with a 1/2" long split locking bushing.

STOCK VALUES

Fabricated in accordance with MIL-R-19 where applicable.

1	20	75	750	5000	30K
2	25	100	1000	7500	40K
4	30	200	1500	10K	50K
6	40	300	2000	15K	
10	50	400	2500	20K	
15	60	500	3000	25K	

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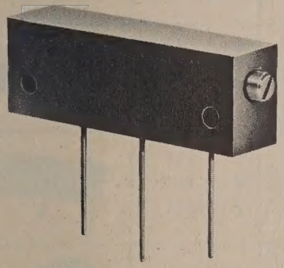
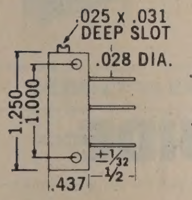
CLAROSTAT WIREWOUND POTENTIOMETERS

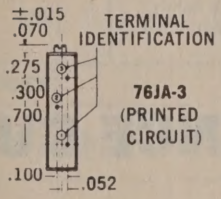
TRIMMING POTENTIOMETERS

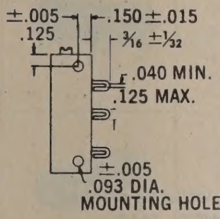
MINIATURE MULTITURN

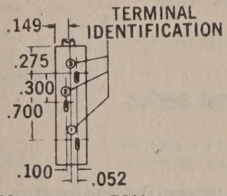
.75 WATT—SERIES 76









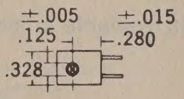


76JA-2
(SOLDER LUG)

SPECIFICATIONS

Power Rating: 3/4 watts at 85°C derated to zero power at 150°. **Resistance Tolerance:** ±5%. **Temperature Coefficient:** ±.0040%/°C. **Absolute Minimum End Resistance:** 0.25% of total resistance maximum or 1Ω. **Electrical/Mechanical Rotation:** 11.5 turns with declutching. **Static Noise (Enr):** 100 ohms (max.) **Stop Torque:** Slip clutch. **Functional Output:** Linear. **Insulation Resistance:** 1,000 Meg (min.). **End Resistance or Over-Travel Resistance:** Maximum increase in resistance to 10% of total resistance. **Effective Rotation:** 11 turns ±1/4 turn. **Torque:** .1 to 8 oz. in. **Dielectric Strength:** 1000V RMS for 1 minute at atmospheric pressure. **Weight:** 0.16 oz. approx.

Cat. No.	Description
76JA-2	Solder Lug Termination
76JA-3	PC Termination



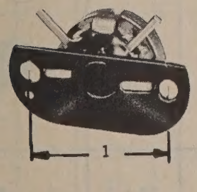
Super Setability! ... made possible through 10 times the resolution ever offered in this popular trimmer configuration. A new approach has made it possible to incorporate approximately 15 times greater winding length. The net result to the user is greater setability on the production line and in the field. Trimming costs in critical circuits drop. Performance of the circuit improves. The package shrinks in size when the Series 76 replaces other high resolution trimmers of several times the size. Panel mounting assembly available.

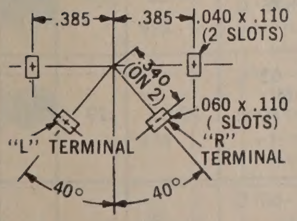
Stock Values Resistance-Ohms	Nom. Resolution %	Stock Values Resistance-Ohms	Nom. Resolution %
100	0.1	5,000	0.05
200	0.09	10,000	0.04
500	0.08	*20,000	0.036
1,000	0.075		
2,000	0.06		

*(.001 Wire Min.)

BUSHINGLESS

2 WATT—SERIES U39





Universal "Humdinger" Control 2W. Wire-Wound Series U39 is a shaftless potentiometer with the contact arm grounded to the housing. The design of terminals and mounting tabs, meets the following requirements: Above chassis mounting, as a potentiometer or rheostat; printed circuit mounting, as a potentiometer or rheostat. The terminal layout meets the popular industry standards. A fiber adapter plate is furnished with each control for above chassis mounting. Series U39 is ideally suited for radio and television requirements, as well as many industrial applications. Resistance tolerance ±20%. Linear only.

SPECIFICATIONS

Resistance Tolerance: ±20%. **Effective Rotation:** 220° ±5°. **Power Rating:** 2 watts at 40°C. **Terminals:** PC mount. **Torque Range:** 2-10 oz.-in. **Stop Torque:** 3 in.-lbs. max. **Weight:** .009 lb. (typical). **Functional Output:** Linear. **Insulation Resistance:** Ground to case.

Cat. No.	Total Res. Ohms	Cat. No.	Total Res. Ohms	Cat. No.	Total Res. Ohms
U39-1.5	1.5	U39-300	300	U39-1500	1500
U39-5	5	U39-500	500	U39-2000	2000
U39-8	8	*U39-500-100	500	*U39-2000-100	2000
U39-15	15	U39-600	600	U39-3000	3000
U39-50	50	U39-650	650	*U39-3000-700	3000
U39-75	75	U39-700	700	U39-4000	4000
U39-100	100	*U39-700-200	700	*U39-4000-350	4000
U39-125	125	U39-800	800	*U39-4000-1000	4000
U39-150	150	*U39-800-50	800	U39-5000	5000
U39-175	175	U39-1000	1000		
U39-200	200	*U39-1000-100	1000		

*with bias resistance (U39B).

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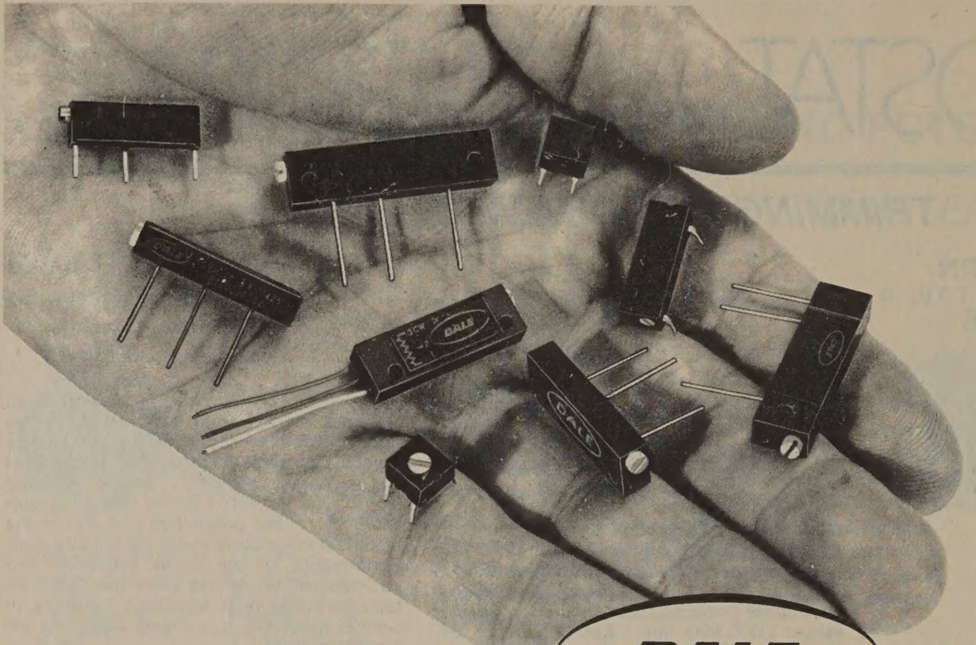


DALE®

T-POT QUICK REFERENCE GUIDE

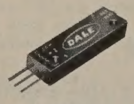
- New space-saving low profile models with cermet and wirewound elements
- Mil models including E-Rel
- Panel mount models available in most series

For complete information, write or phone:

DALE ELECTRONICS, INC.,
Box 609, Columbus, NE 68601 • Phone: 402-564-3131

MILITARY GRADE TRIMMER POTENTIOMETERS

(High Temperature, Precision)

ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
 RT-10**	691 680 697* 692*	1 1 2 2	• Alternate position Printed Circuit Pins 22 AWG • Printed Circuit Pins 22 AWG • 28 AWG Stranded Teflon Leads • 26 AWG Solid Leads	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	15±2	.18	.32	1.00
RT-11**	1287 1288* 1299*	1 2 1	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • Spade Type Solder Lug	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	25±2	.28	.31	1.25
RT-12**	1680 1697* 1692* 1690*	1 2 2 2	• Printed Circuit Pins 21 AWG • Stranded Teflon Leads 28 AWG • 22 AWG Solid Wire • Solder Lug	10 ohms to 100K ohms ±5%	1 watt at 70° C, derated to 0 at 175° C	−65° C to 175° C	22±3	.19	.32	1.25
RTR-12	1880 1897	3 3	• Printed Circuit Pins, Gold Plated Nickel • 28 AWG Stranded Teflon Insulated Leads	10 ohms to 20K ohms ±5%	.75 watt at 85° C, derated to 0 at 150° C	−65° C to 150° C	22±3	.19	.32	1.25

†SEAL TYPE IDENTIFICATION

*Indicates model is also available in Panel Mount version.

**10 ohms to 20K ohms.

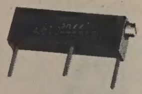
1. Immersion proof per MIL-R-27208
2. Humidity proof per MIL-STD-202, Method 106
3. Sealed per MIL-R-39015
4. Humidity proof per MIL-STD-202, Method 103, Condition B
5. Immersion proof—sealed for board washing, leak tested in 70° C water
6. Immersion proof per MIL-R-22097

COMMERCIAL/INDUSTRIAL GRADE POTENTIOMETERS

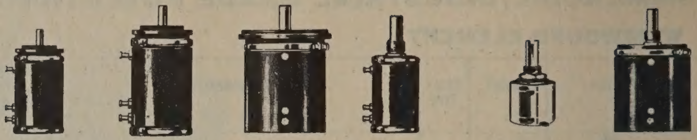
WIREWOUND ELEMENT

ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
	2187 2188* 2199*	4 4 4	• Printed Circuit Pins 21 AWG • Stranded Vinyl Leads 28 AWG • Spade Type Solder Lug	10 ohms to 100K ohms ±10%	1 watt at 70° C, derated to 0 at 125° C	−65° C to 125° C	25±2	.31	.28	1.25
	2387 2317 2389 2319	4 5 4 5	} Printed Circuit Terminals } Hook-type Solder Lugs	10 ohms to 50K ohms ±10%	0.5 watt at 25° C, derated to 0 at 105° C	−55° C to 105° C	15 turns nominal	.36	.28	1.00
	2487 2417	4 5	} Printed Circuit Terminals	10 ohms to 50K ohms ±10%	1 watt at 40° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75
	721 *723 724	5 5 5	} Printed Circuit Terminals	10 ohms to 50K ohms ±10%	1.0 watt at 70° C, derated to 0 at 150° C	−65° C to 150° C	25 turns nominal	.25	.165	.75
	727 729	5 5	} Printed Circuit Terminals, machine insertable } Printed Circuit Terminals, hand insertable	10 ohms to 50K ohms ±10%	1 watt at 70° C, derated to 0 at 150° C	−65° C to 150°C	25 turns nominal	.19	.25	.75

CERMET ELEMENT

ILLUSTRATION	MODEL	SEAL† TYPE	CONFIGURATION	STANDARD RESISTANCE & TOLERANCE	POWER RATING	OPERATING TEMP. RANGE	ADJUSTMENT TURNS	HEIGHT	WIDTH	LENGTH
	781 *783 784 785	5 5 5 5	} Printed Circuit Terminals	10 ohms to 2 Megohms ±10%	1 watt at 70° C, derated to 0 at 125° C	−55° C to 125° C	25 turns nominal	.25	.165	.75
	787 789	5 5	} Printed Circuit Terminals, machine insertable } Printed Circuit Terminals, hand insertable	10 ohms to 2 Megohms ±10%	1 watt at 70° C, derated to 0 at 125° C	−55° C to 125° C	25 turns nominal	.19	.25	.75
	8487 8417	4 5	} Printed Circuit Terminals	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	.75 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	20 turns nominal	.31	.16	.75
	817	6	• Printed Circuit Pins 26 AWG	10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values	.3 watt at 85° C, derated to 0 at 150° C	−65° C to 150° C	10 turns nominal	.15	.10	.50
	85 85A	5 5	• Printed Circuit Terminals, machine insertable • Printed Circuit Terminals, hand insertable	10 ohms to 1 Megohm ±20%	.5 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	12 turns nominal	.19	.265	.28
	87 87A	5 5	• Printed Circuit Terminals, machine insertable • Printed Circuit Terminals, hand insertable	10 ohms to 1 Megohm ±20%	.5 watt at 25° C, derated to 0 at 125° C	−55° C to 125° C	Single turn	.19	.265	.28
	101T 102T 190T 100TX 150TX 100SX 150SX 101SX 100T 150T 100S 101S 150S	5	• Printed Circuit Terminals for top and side adjustment	10 ohms to 2 Megohms ±10%	.5 watt at 85°C, derated to 0 at 125°C	−55°C to 125°C	Single Turn	.19	.375	.375

DUNCAN ELECTRONICS
SUBSIDIARY
SYSTRON DONNER



3200 7/8" dia.(3) 3500 1 1/16" dia. 3700 2" dia. 3230 7/8" dia. 3250 7/8" dia. 3600 1¾" dia.

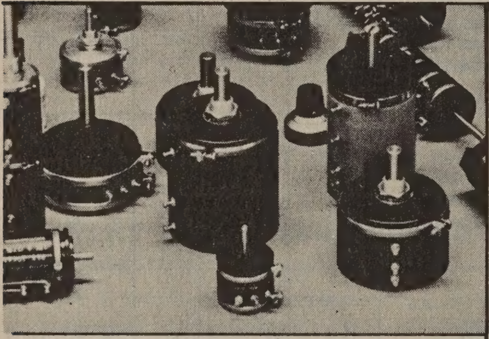
DUNCAN precision wirewound multi-turn potentiometers

	MILITARY			COMMERCIAL		
ELECTRICAL	3200	3500	3700	3230	3250	3600
Electrical Travel	3600° +4° /-0°	3600° +1° /-0°	3600° +1° /-0°	3600° +10° /-0°	3600° +10° /-0°	3600° +4° /-0°
Normal Resistance Range (Ohms)	100-100K	100-200K	100-300K	100-100K	100-100K	100-300K
Resistance Tolerance: Std.	±3%	±3%	3±%	±3%	±5%	±3%
Power Rating (Watts)	2.5	5	7	2.5	2	7
Linearity: Std.	±0.25%	±0.15%	±0.1%	±0.25%	±.25%	±0.25%
Noise, ENR Max. (Ohms)	100	100	100	100	100	100
Insulation Resistance (Meg. Ohms)	1,000	1,000	1,000	1,000	1,000	1,000
Tempco of Pot, Maximum	.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C
MECHANICAL						
Mechanical Travel Turns	10(1)	10(1)	10(2)	10	10(1)	10(2)
Mechanical Life, Revolutions	2,000,000	2,000,000	2,000,000	2,000,000	500,000	2,000,000
Ganged Cups, Maximum	2	2	2	N/A	N/A	2
Taps, Maximum Number	46	110	135	46	N/A	135
Weight (oz): Single Cup	1.3	4.0	4.5	1.3	0.5	3.7
Torque: Start/Run Bushing	0.5/0.5	N/A	1.5/1.2	0.6/0.5	1.0/1.0	1.5/1.2
(oz-in) Start/Run Servo	0.5/0.4	1.0/0.8	1.2/0.8	N/A	N/A	N/A
ENVIRONMENTAL						
Temperature Range (°C), Std.	-65 to +125	-65 to +125	-65 to +125	-55 to + 105	-25 to + 85	-55 to + 105
Meets MIL-R-12934 For: Shock	Yes	Yes	Yes	N/A (4)	N/A	N/A (4)
Humidity	Yes	Yes	Yes	N/A (4)	N/A	N/A (4)
Vibration	Yes	Yes	Yes	N/A (4)	N/A	N/A (4)

(1) Also available in 3- & 5-turn rotation.
(2) Also available in 3-turn rotation.
(3) Also available in ¾" diameter.

(4) Environmental specs for commercial pots: enclosed construction, 10G at 2,000 cycles vibration, 50G shock.

N/A means not applicable.



HYBRID POTENTIOMETERS

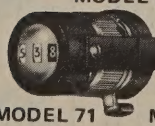
Duncan has developed a unique process for coating wirewound resistance elements with a narrow track of RESOLON® conductive plastic. This combines the best features of each element type, resulting in the temperature stability of wire and the long life and essentially infinite resolution of conductive plastic. These new elements can be made available in all listed models of precision potentiometers, both linear and non-linear and single- and multi-turn.

HYBRID SERIES (Corresponding Wirewound Series)	NO. OF TURNS	RESISTANCE RANGE MIN. Ω	MAX. Ω	*ROTATIONAL LIFE (SHAFT REVOLUTIONS X10⁶)	END VOLTAGE %	OUTPUT SMOOTHNESS %	** TEMPCO ppm/°C
2200 (1200)	1	200	10K	10	.75	.10	±70
2300 (1300)	1	200	15K	10	.6	.09	±70
2500 (1500)	1	500	20K	10	.5	.08	±70
2600 (1600)	1	500	25K	10	.3	.07	±70
2700 (1700)	1	500	30K	10	.2	.06	±70
2800 (1800)	1	750	50K	10	.2	.05	±70
4200 (3200)	10	1K	100K	5	.2	.015	±70
	5	1K	50K	5	.3	.04	±70
	3	500	30K	5	.5	.06	±70
4500 (3500)	10	3K	200K	5	.1	.01	±70
	5	1.5K	100K	5	.2	.02	±70
	3	1K	60K	5	.3	.03	±70
4600 (3600)	10	5K	250K	5	.1	.008	±70
	3	1K	75K	5	.2	.015	±70
4700 (3700)	10	5K	250K	5	.1	.008	±70
	3	1K	75K	5	.2	.015	±70
PIXIEPOT							
4250 (3250)	10	1K	100K	2	.2	.015	±150

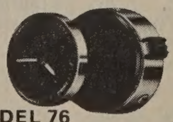
*Applicable to ball bearing types only (except for Pixiepot) **Closer tolerances available on order

Miniature Turns-Counting DIALS

MODEL 61



MODEL 71



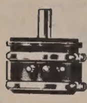
MODEL 76

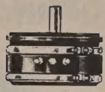
Precision designed dials enable accurate positioning of multi-turn devices. Despite compact size, all dials afford optimum readability from any angle and feature positive-action locks. They require minimum in panel drilling and mounting hardware. Write for complete specs on all models.

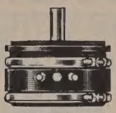
DUNCAN ELECTRONICS 2865 FAIRVIEW ROAD, COSTA MESA, CALIFORNIA 92626 (714) 545-8261 • TWX: 910-595-1128

1200 ⅞" dia.

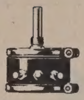
1300 1 1/16" dia.


1500 1 7/16" dia.


1600 1¾" dia.


1700 2" dia.

1800 3" dia.

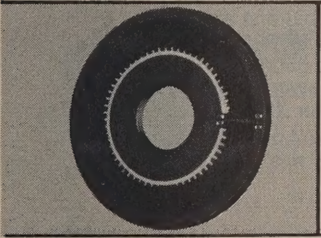

1230 ⅞" dia.

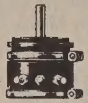
1630 1¾" dia.

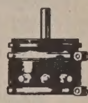
DUNCAN precision wirewound single-turn potentiometers

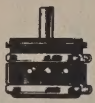
MILITARY						COMMERCIAL	
1200	1300	1500	1600	1700	1800	1230	1630
354° ±2°	354° ±2°	354° ±2°	354° ±1°	356° ±1°	358° ±1°	354° ±2°	354° ±2°
100-20K	100-30K	100-50K	100-50K	100-60K	100-100K	100-20K	100-50K
+5%	±5%	±3%	±3%	±3%	±3%	±5%	±5%
1.25	2	3	4	5	7	1.25	4
±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
100	100	100	100	100	100	100	100
1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C	.007%/°C
1	1	1	1	1	1	1	1
2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
6	6	8	8	8	8	6	6
9	9	19	24	26	41	9	24
0.6	0.8	2.2	2.8	3.3	6.5	0.6	3.0
0.2/0.2	0.2/0.2	1.3/0.9	1.4/1.0	1.5/1.1	1.7/1.3	0.3/0.3	2.0/1.5
0.1/0.1	0.15/0.15	0.6/0.4	0.7/0.5	0.8/0.6	1.0/0.8	N/A	N/A
—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125	—55 to + 105	—55 to + 105
Yes	Yes	Yes	Yes	Yes	Yes	N/A (4)	N/A (4)
Yes	Yes	Yes	Yes	Yes	Yes	N/A (4)	N/A (4)
Yes	Yes	Yes	Yes	Yes	Yes	N/A (4)	N/A (4)

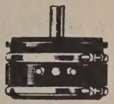
Note: Lockwasher & Hex Nut supplied with all Bushing Models.

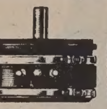


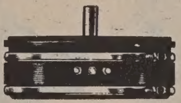

1220 ⅞" dia.


1320 1 1/16" dia.


1520 1 7/16" dia.


1620 1¾" dia.


1720 2" dia.


1820 3" dia.

RESOLON® conductive plastic single-turn potentiometers

MILITARY

ELECTRICAL	1220	1320	1520	1620	1720	1820
Theoretical Electrical Travel (1)	320°	320°	340°	340°	350°	350°
Normal Resistance Range (Ohms)	1K-20K	1K-30K	1K-50K	1K-75K	1K-100K	1K-125K
Extended Resistance Range (Ohms)	500-75K	500-100K	500-125K	750-135K	750-150K	1K-250K
Resistance Tolerance: Standard	10%	10%	10%	10%	10%	10%
Best Practical	2%	2%	2%	2%	2%	2%
Power Rating (Watts) (2)	0.5	0.75	1.0	1.5	2.0	3.0
Linearity: Standard	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
Best Practical	±0.2%	±0.15%	±0.10%	±.075%	±.05%	±.04%
Output Smoothness	0.1% of Total Applied Voltage					
Insulation Resistance (Meg Ohms)	1,000	1,000	1,000	1,000	1,000	1,000
Dielectric, Volts RMS	1,000	1,000	1,000	1,000	1,000	1,000
Voltage Across Terminals, Max., DC	400	400	400	400	400	400
Tempco of Pot, Maximum	—.03%/°C	—.03%/°C	—.03%/°C	—.03%/°C	—.03%/°C	—.03%/°C
MECHANICAL						
Mechanical Travel	360° Continuous					
Mechanical Life, Revolutions	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
Ganged Cups, Maximum	6	6	8	8	8	8
Taps, Maximum Number	9	9	19	24	26	41
Moment of Inertia (gm-cm^2)	0.2	0.2	4.0	4.5	5.0	8.5
Weight (oz): Single Cup	0.6	0.8	2.2	2.8	3.3	6.5
Each Additional Cup	0.2	0.5	0.7	0.7	1.0	1.4
Stop Strength (oz-in)	N/A	N/A	N/A	N/A	N/A	N/A
Torque (oz-in): Starting, Servo	0.1	0.15	0.6	0.7	0.8	1.0
Running, Servo	0.1	0.15	0.4	0.5	0.6	0.8
ENVIRONMENTAL						
Temperature Range (°C) Standard	—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125	—65 to + 125
Meets MIL-R-39023 for: Humidity	Yes	Yes	Yes	Yes	Yes	Yes
Vibration	Yes	Yes	Yes	Yes	Yes	Yes
Shock	Yes	Yes	Yes	Yes	Yes	Yes

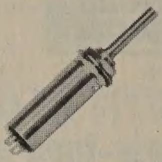
(1) Greater angles available.
(2) Rated at 60°C. Derated linearly to zero at 125°C.

PRECISION POTENTIOMETERS/DIALS

MULTI-TURNS

850

MW10

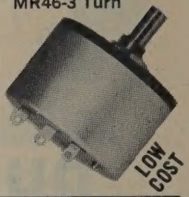


MW20

MW20PC

MW46-10 Turn

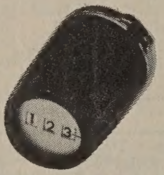
MR46-3 Turn



Model No.	No. of Turns	Resistance Range-Ohms[1] [2] [3]	Resistance Tolerance	Max. Power Rating-Watts	Independent Linearity[3]	Mech. Life (Shaft Revolutions)[3]	Nom. Size in Inches[3] [4] (Dia. x Lg.)	50 Piece Unit Price[3] [5]
850	3, 5, 10	25-200K	±5%	2	±.25%	500,000	.875 x .750	$4.28
MW10	10	20-20K	±5%	1.5	<5K = ±.5% ≥5K = ±.4%	200,000	.400 x 1.00	18.34
MW20	5, 10	10-150K	±3%	2, 3	±.25%	2,000,000	.812 x 1.00	8.64
MW25	3, 5, 10	10-200K	±3%	2, 3, 5	±.3%	2,000,000	.984 x 1.5	8.47
MW36	10	10-100K	±3%	6	±.3%	2,000,000	1.5 x 2.0	9.87
MW46	3, 5, 10	2-300K	±3%	3, 5, 10	±.3%	2,000,000	1.812 x 2.00	13.30
MR46	3, 5, 10	.5-300K	±5%	3, 5, 10	<5K = ±.4% ≥5K = ±.3%	2,000,000	1.812 x 2.25	9.47

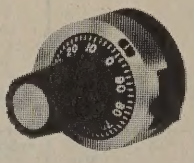
DIALS

1″ Dia.



DA10

7/8″ Dia

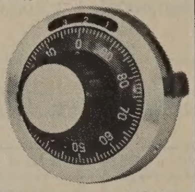


MF-20

1 3/16″ Dia.

MD-30

1 13/16″ Dia.



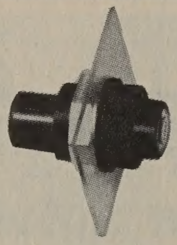
MF-46

50 PIECE UNIT PRICE

DA10	$7.90
MF-20	5.53
MD-30	3.92
MF-46	7.44

POT/DIAL COMBINATION

1.5″ Dia. x 2.5″ Lg.



Side View

Front View

POT/DIGITAL DIAL COMBINATION: WITH OR WITHOUT LOCK

Featuring the DA10 Digital Dial and a choice of two Precision Multi-Turn Potentiometers.

Model DA850 — With Model 850 Multi-Turn Pot.

Model DA20 — With Model MW20 Multi-Turn Pot. Mounting Hole 1.25″ Dia. or 32mm Dia.

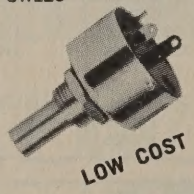
Price DA850 — 10 Turn, With Lock

1-9 pcs. $19.95 10-49 pcs. $19.59

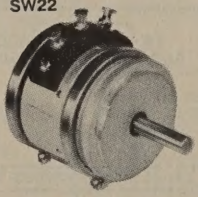
50-99 pcs. $18.55

SINGLE TURN — WIREWOUND[6]

SW22C

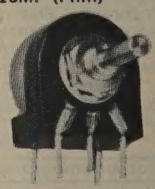


SW22



SW45

16MP (Film)



Model No.	Nom. Dia. Inches[4]	Resistance Range-Ohms[1]	Resistance Tolerance (Standard)	Independent Linearity (Standard)	Max. Power Rating-Watts	Electrical Angle	Mechanical[7] Angle	Starting Torque Max.	50 Piece Unit Price[5]
SW22C	.866	10- 20K	±3%	±.5%	1W	320°	Contin.	.7 oz. in.	$5.64
SW22	.866	10- 20K	±3%	±.5%	1W	350°	Contin.	.3 oz. in.	18.12
SW30	1.140	10- 40K	±3%	±.5%	1W	350°	Contin.	.4 oz. in.	18.98
SW45	1.614	10- 60K	±3%	<5K = ±.5% >5K = ±.4%	2W	350°	Contin.	.8 oz. in.	20.79
SW50	1.968	10- 80K	±3%	<5K = ±.5% >5K = ±.4%	2.5W	350°	Contin.	1.111 oz. in.	22.08
SW80	3.00	20-140K	±3%	<5K = ±.5% >5K = ±.4%	3W	350°	Contin.	1.7 oz. in.	31.68
16MP	.63	2- 10K	10%	±3%	.5W	260°	290°	.277 oz. in.	3.65

[1] Extended resistance range available.
[2] Model MR46, from .5 to 20Ω is slide-wire.
[3] 3 and 5 turn not specified.
[4] All units available in metric sizes.
[5] Some resistance values are priced higher.
[6] All single turn pots available in cermet film. Contact factory for specs. and prices.
[7] Stops available.

Terms: 1%-10, Net 30 days. F.O.B.: Oceanside, CA

Delivery: Stock to 6 weeks maximum.

NON-LINEAR FUNCTIONS AVAILABLE — LOW-TORQUE SINGLE TURNS AVAILABLE

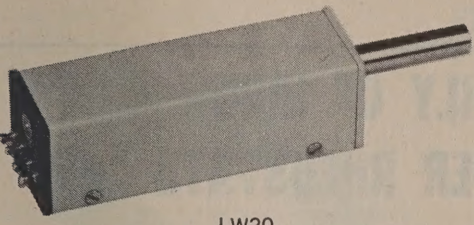
ELECTRO TECHNIQUES, INC.

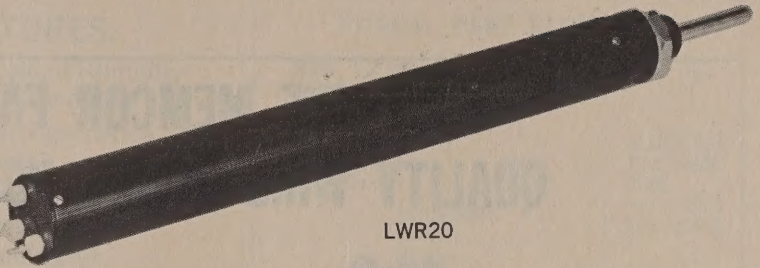
215 VIA DEL NORTE, OCEANSIDE, CA 92054

TEL: (714) 757-7770
TWX: 910-322-1396

SPECIAL POTENTIOMETERS

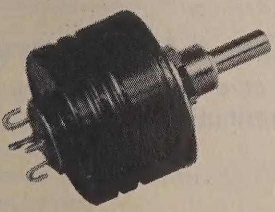
LINEAR-MOTION POTENTIOMETERS (WIREWOUND)


LW20


LWR20

Model No.	Resistance (Ohms)	Linearity	Mechanical Stroke (Inches)	Electrical Stroke (Inches)	Shaft Dia. (Inches)	Size (Inches)	1-19 Price
LWR10-30	15 to 10K	±.7%	1.260	1.181	.118	½ Dia. x 3⅜ Lg.	$46.00
LWR10-50	50 to 20K	±.7%	2.047	1.968	.118	½ Dia. x 4³⁄₁₆ Lg.	49.50
LWR10-100	50 to 40K	±.5%	4.015	3.937	.118	½ Dia. x 6⅛ Lg.	52.75
LW20-15	8 to 50K	±2.0%	.590	.590	³⁄₁₆	.790 Sq. x 2 Lg.	30.00
LW20-30	15 to 10K	±1.5%	1.180	1.180	³⁄₁₆	.790 Sq. x 2⅝ Lg.	35.00
LW20-50	25 to 15K	±1.0%	1.968	1.968	³⁄₁₆	.790 Sq. x 3⅜ Lg.	43.00
LW20-100	50 to 30K	±.7%	3.937	3.937	³⁄₁₆	.790 Sq. x 5⁵⁄₁₆ Lg.	53.00
LWR20-50	25 to 20K	±.4%	2.087	1.968	³⁄₁₆	.790 Dia. x 3⅜ Lg.	49.50
LWR20-100	50 to 40K	±.4%	4.055	3.937	³⁄₁₆	.790 Dia. x 4³⁄₁₆ Lg.	52.75
LWR20-200	100 to 80K	±.4%	7.992	7.874	³⁄₁₆	.790 Dia. x 11¼ Lg.	98.60
LW30-50	25 to 20K	±.4%	1.968	1.968	³⁄₁₆	1¼ Sq. x 4¾ Lg.	56.00
LW30-100	50 to 40K	±.4%	3.937	3.937	³⁄₁₆	1¼ Sq. x 6¾ Lg.	65.70
LW50-300	200 to 50K	±.4%	11.812	11.812	.315	2 Sq. x 15¾ Lg.	200.00
LW50-500	500 to 150K	±.4%	19.687	19.687	.315	2 Sq. x 23⅝ Lg.	325.00
LW50-1000	500 to 300K	±.4%	39.375	39.375	.315	2 Sq. x 47¼ Lg.	600.00

OIL-FILLED POTENTIOMETERS (WIREWOUND AND FILM)


SO-30

Electro-Techniques offers a complete line of **standard** oil-filled potentiometers for applications in corrosive and contaminated atmospheres requiring long load life.

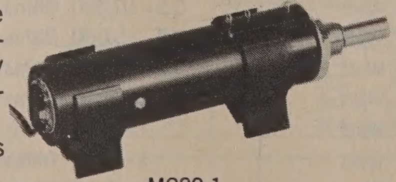
Consult our factory for the type of oil filled potentiometer required for upgrading your reliability.

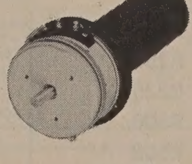
LO10

MOTOR-CONTROLLED POTENTIOMETERS (MULTI-TURN AND SINGLE-TURN)

Electro Techniques offers for the first time a complete line of motor-controlled potentiometers with motor operating currents low enough to respond accurately from operational amplifier outputs.

All Electro Techniques rotary potentiometers may be motorized for your applications.


MC20-1


MC45-1

MOTORS AVAILABLE

DC Voltages: 1½, 2, 3, 6, 12, 24, 30
RPM: 6000 to 20,000
Gear Ratios: 3.1/1 to 980,000/1
Torque: Up to 85 oz. in.

EXAMPLE

Model MC20-1 with 6 volt DC motor (19,000 RPM) with 1670/1 gear train operates at approx. 11 mA current, and clutches at approx. 20 mA. Potentiometer turns 10 RPM. Size: ⅞" dia. x 3½" long.

NOTES

Models MC20-1 and MC45-1 shown above includes motor, gear train, clutching coupler, and potentiometer assembled by Electro Techniques.

Specifications subject to change without notice.

TEL: (714) 757-7770
TWX: 910-322-1396

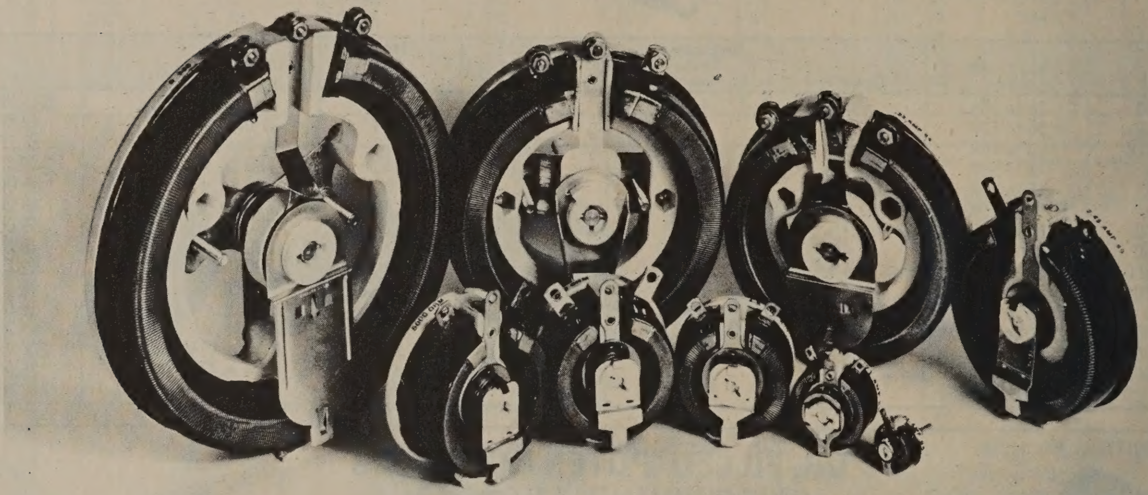
215 VIA DEL NORTE, OCEANSIDE, CA 92054

ELECTRO TECHNIQUES, INC.

E-SYSTEMS INC.
Memcor Division

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	⅞″	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 9/16″	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16″	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾″	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛″	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4″	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5″	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6″	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8″	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12″	10.0 Lbs.

E-SYSTEMS INC.

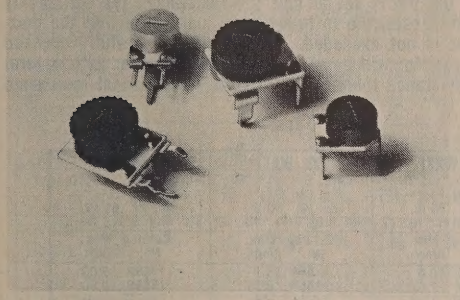
Memcor Division
DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

muRata
CORPORATION
OF AMERICA

Subminiature Trimming Potentiometers



FEATURES:

- Excellent Humidity Characteristics
- Wide Resistance Ranges
- Non-combustible Design
- Economical
- Miniature Size
- Resistant to Adverse Environments

TYPICAL PART NUMBERING

RVA 1214 X — X — XXX — X

MODEL
RVA=Carbon
RVG=Cermet

ADJUSTMENT
V=Vert.,
H=Hor.

KNOB
COLOR*

RESISTANCE
CODE

RESISTANCE
TOLERANCE
CODE
N= ±30%,
M= ±20%

* 1, red; 2, green; 3, blue; 4, yellow; 5, white; 6, orange; 7, natural; 8, brown; 9, gray; 10, black.

Type RVA-0911

1/5 Watt

SPECIFICATIONS

Tolerance: ±30%, ±20%
Power Rating: ⅕ Watt
Maximum Working Volts: 250 VDC
Taper: Linear
PC Mounting: Vertical or Horizontal
Typical Dimensions: .354″ W x .433″ L x .236″ D

STANDARD RESISTANCES

Resistance and Resistance Code									
Res.	**Code**	**Res.**	**Code**	**Res.**	**Code**	**Res.**	**Code**	**Res.**	**Code**
1KΩ	102	5KΩ	502	25KΩ	253	200KΩ	204	1MΩ	105
2KΩ	202	10KΩ	103	50KΩ	503	300KΩ	304	2MΩ	205
3KΩ	302	20KΩ	203	100KΩ	104	500KΩ	504		

Type RVA-1214

1/3 Watt

SPECIFICATIONS

Tolerance: ±30%, ±20%
Power Rating: ⅓ Watt
Maximum Working Volts: 350 VDC
Taper: Linear
PC Mounting: Vertical or Horizontal
Typical Dimensions: .472″ W x .571″ L x .291″ H

STANDARD RESISTANCES

Res.	Code	Res.	Code	Res.	Code
100Ω	101	3KΩ	302	100KΩ	104
200Ω	201	5KΩ	502	200KΩ	204
300Ω	301	10KΩ	103	300KΩ	304
500Ω	501	20KΩ	203	500KΩ	504
1KΩ	102	30KΩ	303	1MΩ	105
2KΩ	202	50KΩ	503	2MΩ	205

Type RVG-0911

1/2 Watt CERMET

SPECIFICATIONS

Tolerance: ±20%
Power Rating: ½ Watt
Maximum Working Volts: 350 VDC
Taper: Linear
PC Mounting: Vertical or Horizontal
Typical Dimensions: .354″ W x .433″ L x .236″ D

STANDARD RESISTANCES

Resistance and Resistance Code							
Res.	**Code**	**Res.**	**Code**	**Res.**	**Code**	**Res.**	**Code**
500Ω	501	5KΩ	502	50KΩ	503	500KΩ	504
1KΩ	102	10KΩ	103	100KΩ	104	1MΩ	105
2KΩ	202	20KΩ	203	200KΩ	204		
3KΩ	302	25KΩ	253	300KΩ	304		

Type RVG-1214

1 Watt CERMET

SPECIFICATIONS

Tolerance: ±20%
Power Rating: 1 Watt
Maximum Working Volts: 500 VDC
Taper: Linear
PC Mounting: Vertical or Horizontal
Typical Dimensions: .472″ W x .571″ L x .291″ H

STANDARD RESISTANCES

Res.	Code	Res.	Code	Res.	Code	Res.	Code
500Ω	501	5KΩ	502	50KΩ	503	500KΩ	504
1KΩ	102	10KΩ	103	100KΩ	104	1MΩ	105
2KΩ	202	20KΩ	203	200KΩ	204		
3KΩ	302	30KΩ	303	300KΩ	304		

muRata
CORPORATION
OF AMERICA

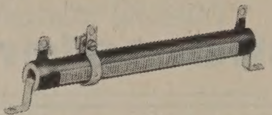
DEPT. EM, 1148 FRANKLIN ROAD, S.E.
MARIETTA, GEORGIA 30067
PHONE: (404) 422-9777

TELEX: 54-2329
TWX: 810-763-4723

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

OHMITE® dividohm® type 210 adjustable vitreous enameled resistors

SERIES 210



"Dividohm" resistors make ideal voltage dividers for original equipment and replacement in transmitters, rectifiers and other apparatus. Such tapped "bleeders" are made by using one or more adjustable lugs, as required. "Dividohms" are also handy for obtaining odd resistance values, for adjusting circuits, and for use on equipment which must be set to meet various line voltages.

"Dividohm" resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact to any wire in this strip is made by an embossed contact on the adjustable lug (supplied).

WATT RATING: **The stated wattage rating applies only when the entire resistance is in the circuit.** When the adjustable lug is set at an intermediate point, the wattage rating is reduced in approximately the same proportion, i.e., if the lug is set at half the resistance, the wattage is reduced by one-half. A safe rule to follow is to make sure that the maximum rated current is not exceeded. This should be carefully checked particularly if the resistor will be used as a voltage divider with several adjustable lugs. Resistance tolerance is ±10% for the total resistance value.

	12 WATT Core: 1¾"x5/16"D. Mtg. Ctr: 2 5/16"— Av. Wt. .02 lb. Std. Mtg. Brkt.* No. 5		**25 WATT** Core: 2"x9/16"D. Mtg. Ctr: 2¾"— Av. Wt. .05 lb. Std. Mtg. Brkt.* No. 9		**50 WATT** Core: 4"x9/16"D. Mtg. Ctr: 4¾"— Av. Wt. .09 lb. Std. Mtg. Brkt.* No. 9		**75 WATT** Core: 6"x9/16"D. Mtg. Ctr: 6¾"— Av. Wt. .15 lb. Std. Mtg. Brkt.* No. 9		**100 WATT** Core: 6½"x¾"D. Mtg. Ctr: 7⅜"— Av. Wt. .20 lb. Std. Mtg. Brkt.* No. 12		**175 WATT** Core: 8½"x1⅛"D. Mtg. Ctr: 9⅜"— Av. Wt. .50 lb. Std. Mtg. Brkt.* No. 18		**225 WATT** Core: 10½"x1⅛"D. Mtg. Ctr: 11⅜"— Av. Wt. .62 lb. Std. Mtg. Brkt.* No. 18	
Resist. Ohms	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.	Catalog No.[1]	Max. Amps.
1	**1001**	3.46	**0360**	5.00	**0560A**	7.07	0769A	8.66	**0956A**	10.0	1156A	13.2	**1356A**	15.00
2	1002	2.45	**0360B**	3.54	**0560B**	5.00	0769B	6.12	**0956B**	7.07	1156B	9.35	**1356B**	10.60
3	1003	2.00	0361	2.88	0560C	4.07	0769C	5.00	**0956C**	5.77	1156C	7.63	**1356C**	8.67
4					0560D	3.53	0769D	4.33	**0956D**	5.00	1156D	6.60	**1356D**	7.50
5	**1004**	1.54	**0362**	2.24	**0560**	3.16	0769	3.87	**0956**	4.47	1156	5.92	**1356**	6.72
7.5	1005	1.26	0362B	1.82										
10	**1006**	1.09	**0363**	1.58	**0561**	2.23	0770	2.74	**0957**	3.16	**1157**	4.18	**1357**	4.74
15	1007	.89	0364	1.29			0771	2.24						
20	1008	.77	**0364B**	1.12										
25	**1009**	.69	**0365**	1.00	**0562**	1.41	0772	1.73	**0958**	2.00	**1158**	2.64	**1358**	3.00
50	**1010**	.49	**0366**	.71	**0563**	1.00	0773	1.22	**0959**	1.41	1159	1.87	**1359**	2.12
75	**1011**	.40	**0367**	.58	**0564**	.82								
100	**1012**	.34	**0368**	.50	**0565**	.71	0774	.86	**0960**	1.00	**1160**	1.32	**1360**	1.50
150	**1013**	.28	0369	.41	**0566**	.58								
200	**1014**	.24	0370	.35	**0567**	.50	0774B	.61						
250	1015	.22	**0371**	.32	**0568**	.45	0775	.55	**0960B**	.63	1160B	.84	**1360B**	.95
300	1016	.20	**0371B**	.29	0568B	.41	**0775B**	.50						
350	1017	.18												
400	1018	.17	0371C	.25	0568C	.35	0775C	.43						
500	**1019**	.15	**0372**	.22	**0569**	.32	0776	.39	**0961**	.45	1161	.59	**1361**	.67.
600	1020	.14												
750	**1021**	.13	0373	.18	0570	.26	0777	.32						
800	1022	.12	0374	.17	0571	.25	(0777B)	.30						
1000	**1023**	.11	**0375**	.16	**0572**	.22	0778	.27	**0962**	.32	1162	.42	**1362**	.47
1250	1024	.098	0375B	.14	0572B	.20	0778B	.24						
1500	**1025**	.089	0376	.13	0573	.18	0779	.22	0962B	.26	1162B	.34	**1362B**	.39
2000	**1026**	.077	**0377**	.12	0574	.16	0780	.19						
2250	1027	.073	0377B	.11	(0574B)	.15	(0780B)	.18						
2500	**1028**	.069	**0378**	.10	0575	.14	(0781)	.17	**0963**	.20	1163	.26	**1363**	.30
3000	1029	.063	0379	.091	0576	.13	(0781B)	.16						
3500	1030	.058	0380	.084	0576B	.12	(0782)	.15						
4000	1031	.055	0381	.079	0577	.11	0782B	.14						
4500	1032	.052	0381B	.074	0577B	.10	(0782C)	.13						
5000	**1033**	.049	**0382**	.070	0578	.10	0783	.12	0964	.14	1164	.19	**1364**	.21
6000	1034	.045	0383	.064	0578B	.091	(0783B)	.11						
7000	1035	.042	0383B	.060	0578C	.084	(0783C)	.10						
7500	1036	.040	0384	.057	0579	.081	(0784)	.10						
8000	1037	.039	0384B	.055	0580	.079	(0784B)	.096						
8500	(1038)	.037												
9000	1039	.036	0384C	.052	(0580B)	.074	(0784C)	.091						
10000	**1040**	.035	0385	.050	0581	.071	0785	.086	0965	.10	1165	.13	**1365**	.15
12000			0386	.042	0582	.064	(0785B)	.079						
15000			0387	.036	0583	.057	(0786)	.070	0966	.081	(1166)	.11	1366	.13
20000			0388	.031	0584	.050	(0787)	.061	0967	.071	(1167)	.094	1367	.11
25000			0389	.028	0585	.045	0788	.054	0968	.063	(1168)	.083	1368	.095
30000					0586	.036	(0789)	.050	(0969)	.058	(1169)	.076	(1359)	.087
35000							(0790)	.046						
40000					0587	.029	(0791)	.043	0970	.050	(1170)	.066	1370	.075
45000							(0792)	.035						
50000					0588	.026	(0793)	.033	0971	.045	(1171)	.059	1371	.067
60000					(0589)	.024	(0794)	.030						
75000									(0972)	.032	(1172)	.048	1372	.055
80000					0590	.021	(0795)	.026						
100000					0591	.018	(0796)	.023	0973	.028	1173	.042	1373	.047

*** Mounting brackets are automatically supplied in individual unit packs; supplied only when specified in bulk packs.**

[1] Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.

adjustable lugs

One "Screw Driver Type Adjustable Lug" is supplied with each unit. Lugs with a silver contact button can be ordered from the table shown below.

MOVING THE LUGS: Lugs always should be loosened completely before moving and not moved except while the current is off, in order to protect the exposed wire from mechanical or electrical injury and to protect the operator from dangerous voltages.

STANDARD

Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
5/16	2115	1058	—	—
9/16	2121	0358	2122	0359
¾	2125	1958	2126	1959
1⅛	2133	2158	2134	2159

With SILVER CONTACT BUTTONS

Core Diam. Inches	Screw Driver Type New Cat. No.	Screw Driver Type Old Cat. No.	Bakelite Knob Type New Cat. No.	Bakelite Knob Type Old Cat. No.
5/16	2116	2161	—	—
9/16	2123	2164	2124	2165
¾	2127	2166	2128	2167
1⅛	2135	2170	2136	2171

This adjustable lug, while is illustrated at left, features two advantages — ease of adjustment and less chance of damaging the resistance wire while moving lugs. Available for 1⅛" cores.
Catalog No. **2160**

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

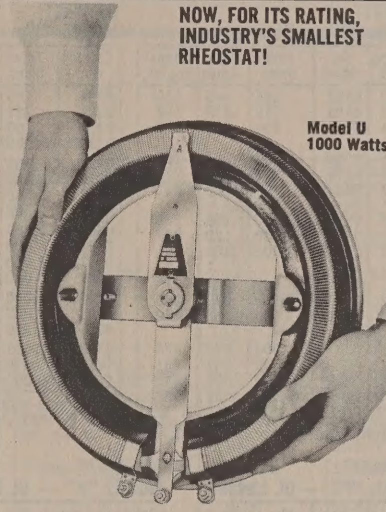
OHMITE® vitreous enameled rheostats (potentiometers)

Now, Ohmite offers TWELVE sizes in its line of famous rheostats.

In all Ohmite rheostats, the resistance wire is wound on a solid ceramic core. The turns are locked in place with tough, protective vitreous enamel or Ohmicone® silicone ceramic. Pivoted, universal action mounting of the brush, assures perfect contact. Metal-graphite contact brushes, varied to fit current and resistance, insure good contact with negligible wear of the wire. Terminals at each end of the winding permit connection of the unit as a potentiometer.

Model C
7½ Watts

NOW, FOR ITS RATING, INDUSTRY'S SMALLEST RHEOSTAT!



Model U
1000 Watts

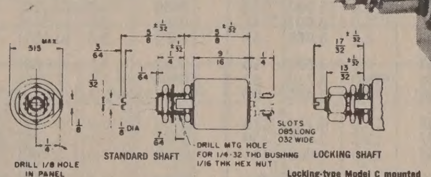
Dimensions and Other Parameters	Mod. C Encl.	Model E Unencl.	Model E Encl.	Model H	Model J	Model G	Model K	Model L	Model P	Model N	Model R	Model T	Model U
Rated Watts	7½	12½		25	50	75	100	150	225	300	500	750	1000
Resistance Range - Ohms	10 to 5,000	1 to 15,000		1 to 25,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	0.5 to 50,000	1 to 30,000	1 to 50,000	1 to 20,000	1 to 15,000	1 to 20,000
Overall Diameter	.515	7/8	1 3/64	1 9/16	2 5/16	2 3/4	3 1/8	4	5	6	8	10	12
Overall Depth Behind Panel	7/8	11/16	1 5/32	1 3/8	1 3/8	1 3/4	1 3/4	2	2 1/8	2 3/8	2 1/8	3	3
Weight - Lbs.	.017	.037	.053	0.19	0.32	0.52	0.64	1.1	2	2.6	4	7.6	10
Mtg. Centers (Dimension "M")	(Single-Hole Mounting)								7/8	1 3/16	1½	1 7/8	3

MODEL "C" — 7½ WATT* — STANDARD & LOCKING SHAFT

Ohms	Amps	Standard Shaft Catalog No.[1]	Locking Shaft Catalog No.[1]
10	.86	4908	4948
15	.71	4909	(4949)
25	.55	4910	(4950)
35	.46	(4911)	(4951)
50	.39	4912	(4952)
75	.32	(4913)	(4953)
100	.27	4914	4954
150	.22	(4915)	(4955)
200	.19	4916	(4956)

Ohms	Amps	Standard Shaft Catalog No.[1]	Locking Shaft Catalog No.[1]
250	.17	4917	(4957)
350	.15	4918	4958
500	.12	4919	(4959)
750	.10	(4920)	(4960)
1000	.086	4921	4961
1500	.071	(4922)	(4962)
2500	.055	(4923)	4963
3500	.046	(4924)	(4964)
5000	.039	4925	4965

*Rating on metal panel — unit is silicone-ceramic coated.



.515 MAX
3/64
1/8
DRILL 1/8 HOLE IN PANEL
STANDARD SHAFT
DRILL MTG HOLE FOR 1/4-32 THD BUSHING 1/16 THK HEX NUT
SLOTS .085 LONG .032 WIDE
LOCKING SHAFT

Locking-type Model C mounted in socket on panel. Solder terminals fit transistor socket.

MODEL C ENCLOSED

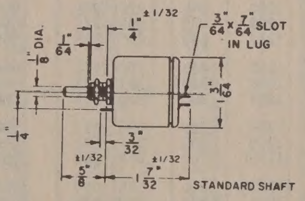
MODEL "E" — 12½ WATT* — UNENCLOSED & ENCLOSED

Total Ohms	Max. Amps	Steps Appr.	Unenclosed Standard Shaft Cat. No.[1]	Unenclosed Locking Shaft Cat. No.[1]	Enclosed Std. Shaft Cat. No.
1	3.53	32	**0101**	L0101	(W0101)
2	2.50	28	**0102**	L0102	(W0102
2.5	2.24	31	(0102A)	(L0102A)	(W0102A)
3	2.04	33	0103	L0103	(W0103)
5	1.58	61	0103A	L0103A	(W0103A)
6	1.44	58	**0104**	L0104	(W0104)
8	1.25	61	**0105**	L0105	(W0105)
10	1.12	76	**0106**	L0106	(W0106)
15	.91	64	0107	L0107	(W0107)
25	.71	67	**0108**	L0108	(W0108)
35	.60	73	**0109**	L0109	(W0109)
50	.50	83	**0110**	L0110	(W0110)
75	.41	101	**0111**	L0111	(W0111)
100	.35	106	**0112**	L0112	(W0112)
125	.32	132	**0113**	L0113	(W0113)
150	.29	125	0113A	L0113A	(W0113A)

Total Ohms	Max. Amps	Steps Appr.	Unenclosed Standard Shaft Cat. No.[1]	Unenclosed Locking Shaft Cat. No.[1]	Enclosed Std. Shaft Cat. No.
175	.27	146	**0114**	L0114	(W0114)
200	.25	132	0114A	L0114A	(W0114A)
250	.22	128	**0115**	L0115	(W0115)
350	.19	149	**0116**	L0116	(W0116)
500	.16	213	**0117**	L0117	(W0117)
750	.13	193	**0118**	L0118	(W0118)
1,000	.11	257	**0119**	L0119	(W0119)
1,500	.091	255	**0120**	L0120	(W0120)
2,500	.071	277	**0121**	L0121	(W0121)
3,500	.060	313	**0122†**	L0122†	(W0122)†
5,000	.050	355	**0123†**	L0123†	(W0123)†
7,500	.041‡	299	4190†	L4190†	(W4190)†
10,000	.035‡	398	**4191†**	L4191†	(W4191)†
12,500	.031‡	434	(4192)†	(L4192)†	(W4192)†
15,000	.029‡	521	4193†	L4193†	(W4193)†

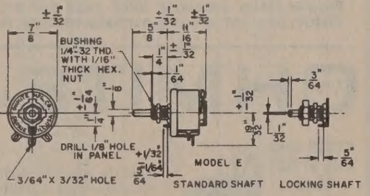
*Rating on metal panel. †Silicone-ceramic coating. ‡7.5KΩ = 305V. max; 10KΩ, 12.5KΩ, and 15KΩ = 350V. max.

MODEL E ENCLOSED



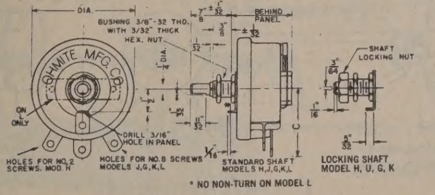
±1/32
1/4"
3/64" x 7/64" SLOT IN LUG
1/8" DIA.
1/64
3/32
±1/32
±1/32
5/8
1 7/32
STANDARD SHAFT

MODEL E UNENCLOSED



7/8" ±1/32
BUSHING 1/4-32 THD. WITH 1/16" THICK HEX. NUT
DRILL 1/8" HOLE IN PANEL
3/64" X 3/32" HOLE
MODEL E
STANDARD SHAFT
LOCKING SHAFT
5/64

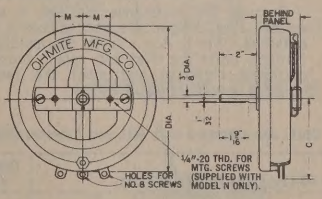
MODELS H, J, G, K, L*



DIA.
BUSHING 3/8"-32 THD. WITH 3/32" THICK HEX. NUT
BEHIND PANEL
OHMITE MFG. CO.
ON L ONLY
SHAFT LOCKING NUT
DRILL 3/16" HOLE IN PANEL
HOLES FOR NO. 2 SCREWS. MOD. H
HOLES FOR NO. 8 SCREWS MODELS J,G,K,L
STANDARD SHAFT MODELS H,J,G,K,L
LOCKING SHAFT MODEL H, U, G, K

* NO NON-TURN ON MODEL L

MODELS P, N, R, T, U



M
BEHIND PANEL
OHMITE MFG. CO.
2"
DIA
9/16
C
¼"-20 THD. FOR MTG. SCREWS (SUPPLIED WITH MODEL N ONLY).
HOLES FOR NO. 8 SCREWS

25 WATT
MODEL "H" — UL Listed

Locking Shaft	Std. Shaft	Total Ohms	Max. Amps	Steps Approx.
L0140	**0140**	1	5.000	30
L0141	**0141**	2	3.540	30
L0142	**0142**	3	2.880	31
L0143	**0143**	6	2.040	50
L0144	**0144**	8	1.770	53
L0145	**0145**	10	1.580	52
L0146	**0146**	15	1.290	67
L0147	**0147**	25	1.000	89
L0148	**0148**	35	.845	98
L0149	**0149**	50	.707	80
L0150	**0150**	75	.575	107
L0151	**0151**	100	.500	142

50 WATT
MODEL "J" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0308	0.5	10.000	24
0309	1	7.070	44
0310	2	5.000	43
0311	4	3.530	42
0312	6	2.880	45
0313	8	2.500	43
0314	12	2.040	86
0315	16	1.760	91
0316	22	1.500	100
0317	35	1.190	125
0318	50	1.000	112
0319	80	.790	143
0320	125	.630	176

75 WATT
MODEL "G" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
1100	0.5	12.300	27
(1101)	1	8.660	27
1102	2	6.120	30
1103	3	5.000	28
1104	5	3.880	53
1105	7.5	3.160	50
1106	10	2.740	53
1107	16	2.170	91
1108	25	1.730	113
1109	50	1.230	142

100 WATT
MODEL "K" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0440	0.5	14.100	33
0441	1	10.000	33
0442	2	7.070	32
0443	3	5.750	39
0444	5	4.470	57
0445	7.5	3.650	60
0446	10	3.160	57
0447	16	2.500	88
0448	25	2.000	109
0449	50	1.410	137

150 WATT
MODEL "L" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0524	0.5	17.300	29
0525	1	12.300	41
0526	2	8.650	40
0527	3	7.070	42
0528	5	5.480	44
0529	7.5	4.470	75
0530	10	3.880	79
0531	15	3.163	75
0532	25	2.450	120
0533	35	2.070	133
0534	50	1.735	151

Continued on next page

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OHMITE® vitreous enameled rheostats (potentiometers)

25 WATT MODEL "H" — UL Listed

Locking Shaft	Std. Shaft	Total Ohms	Max. Amps	Steps Approx.
L0152	**0152**	125	.445	139
L0153	**0153**	175	.373	154
L0154	**0154**	250	.316	177
L0155	**0155**	350	.267	197
L0156	**0156**	500	.222	220
L0157	**0157**	750	.182	261
L0158	**0158**	1,000	.155	278
L0159	**0159**	1,500	.129	267
L0160	**0160**	2,500	.100	341
L0161	**0161**	3,500	.084	315
L0162	**0162**	5,000	.070	355
L4200	4200†	7,500	.058	439
L4201†	**4201†**	10,000	.050	476
L4202†	4202†	15,000	.041	431
L4203†	**4203†**	20,000	.035	422
L4204†	**4204†**	25,000	.032	527

†Silicone-ceramic coating, 500V max. for 10KΩ and above. Not UL listed.

50 WATT MODEL "J" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0321	150	.575	170
0322	225	.470	199
0323	300	.408	211
0324	500	.316	284
0325	800	.250	282
0326	1,000	.224	352
0327	1,600	.176	355
0328	2,500	.141	449
0329	3,500	.119	496
0330	5,000	.100	459
0331	8,000	.079	576
0332	10,000	.070	565
4210†	15,000	.058	568
4211†	20,000	.050	599
4212†	25,000	.045	573
4213†	30,000	.041	688
(4214†)	40,000	.035	673
4215†	50,000	.032	842

†Silicone-ceramic coating. 750V max. for 15KΩ and above. Not UL listed.

75 WATT MODEL "G" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
1110	75	1.000	134
1111	100	.866	178
1112	200	.612	180
1113	300	.500	211
1114	400	.433	223
1115	500	.388	279
(1116)	750	.316	338
1117	1,000	.274	356
(1118)	1,500	.224	420
1119	2,000	.194	443
(1120)	2,500	.173	441
(1121)	5,000	.123	564
(1122)	7,500	.100	547
1123	10,000	.087	572

100 WATT MODEL "K" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0450	75	1.150	163
0451	100	1.000	172
0452	200	.707	216
0453	300	.575	261
0454	400	.500	272
0455	500	.447	269
0456	750	.365	326
0457	1,000	.316	343
0458	1,500	.258	404
0459	2,000	.224	426
0460	2,500	.200	426
0461	5,000	.141	543
0462	7,500	.115	528
0463	10,000	.100	704

150 WATT MODEL "L" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0535	75	1.415	179
0536	100	1.225	190
0537	150	1.000	225
0538	200	.865	239
0539	250	.775	236
0540	350	.655	265
0541	500	.548	296
0542	750	.447	352
0543	1,250	.346	473
0544	1,800	.288	537
0545	2,250	.259	529
0546	3,000	.224	558
0547	4,500	.182	667
0548	7,500	.141	714
0549	10,000	.122	952

225 WATT MODEL "P" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
(1250)	1.0	15.000	42
1251	2.0	10.600	41
1252	3.0	8.660	61
(1253)	4.0	7.500	58
1254	5.0	6.710	57
(1255)	7.5	5.490	60
1256	10.0	4.740	115
1257	15.0	3.870	108
1258	25.0	3.000	114
1259	50.0	2.120	218
1260	75.0	1.730	206
1261	100	1.500	275
1262	150	1.220	259
1263	200	1.060	345
1264	300	.866	326
1265	400	.750	342
1266	700	.567	483
1267	900	.500	484
1268	1,200	.433	513
1269	1,500	.387	641
(1270)	1,750	.358	603
(1270A)	2,000	.336	690
1271	2,500	.300	679

300 WATT MODEL "N" — UL Listed

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0650	1.0	17.320	56
0651	2.0	12.240	51
0652	3.0	10.000	51
0653	4.0	8.660	77
0654	5.0	7.750	76
0655	7.5	6.320	72
0656	10.0	5.480	76
0657	15.0	4.470	144
0658	25.0	3.460	134
0659	50.0	2.450	230
0660	75.0	2.000	275
0661	100	1.730	288
0662	150	1.410	345
0663	200	1.220	364
0664	300	1.000	433
0665	400	.866	456
0666	700	.655	500
0667	900	.578	517
0668	1,200	.500	541
0669	1,500	.447	676
(0670)	1,750	.414	625
(0670A)	2,000	.387	714
0671	2,500	.346	720

500 WATT MODEL "R"

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
0849	1.0	22.300	56
0850	1.5	18.200	71
(0851)	2.0	15.800	75
(0852)	2.5	14.100	78
0853	3.0	12.900	79
0854	4.0	11.200	74
0855	5.0	10.000	104
0856	8.0	7.900	104
0857	12.5	6.300	115
0858	16.0	5.600	186
0859	25.0	4.470	205
0860	40.0	3.540	206
0872	50.0	3.160	205
0861	80.0	2.520	316
0862	125	2.000	388
0863	175	1.690	434
0864	250	1.410	490
0865	325	1.240	505
0866	500	1.000	614
0867	750	.817	735
0868	1,000	.707	769
0869	1,500	.577	932
(0870)	2,000	.500	971
0871	2,500	.447	962

750 WATT MODEL "T"

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
1300	1.0	27.400	72
(1301)	1.5	22.300	72
(1302)	2.0	19.400	96
(1303)	2.5	17.300	101
(1304)	3.0	15.800	96
(1305)	4.0	13.600	94
1306	5.0	12.200	104
1307	8.0	9.650	100
(1308)	10.0	8.650	139
(1309)	12.5	7.750	138
1310	16.0	6.820	139
1311	25.0	5.470	137
1312	50.0	3.870	246
(1313)	80.0	3.060	381
1314	100	2.740	376
1315	160	2.170	476
1316	200	1.940	469
1317	300	1.580	562
1318	400	1.370	593
1319	600	1.117	705
1320	750	1.000	694
1321	1,200	.791	889
(1322)	1,800	.646	1,050
(1322A)	2,000	.610	935
(1323)	2,500	.547	1,170

1000 WATT MODEL "U"

Catalog No.[1]	Total Ohms	Max. Amps	Steps Approx.
1450	1.0	31.600	91
1451	1.5	25.800	90
1452	2.0	22.400	90
1453	2.5	20.000	127
1454	3.0	18.300	114
1455	4.0	15.800	120
1456	5.0	14.100	124
1457	8.0	11.200	118
1458	10.0	10.000	117
(1459)	12.5	8.950	163
1460	16.0	7.900	166
1461	25.0	6.330	162
1462	50.0	4.470	327
1463	75.0	3.650	307
1464	100	3.160	446
1465	175	2.390	490
1466	225	2.110	630
1467	300	1.830	661
1468	400	1.580	704
1469	500	1.410	695
1470	750	1.150	828
1471	1,000	1.000	870
1472	1,500	.816	1,040
1473	2,500	.633	1,100

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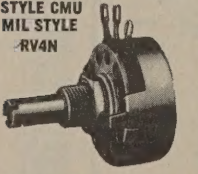
[1] **Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.**

OHMITE® molded composition potentiometers

STYLE CMU
MIL STYLE
RV4N



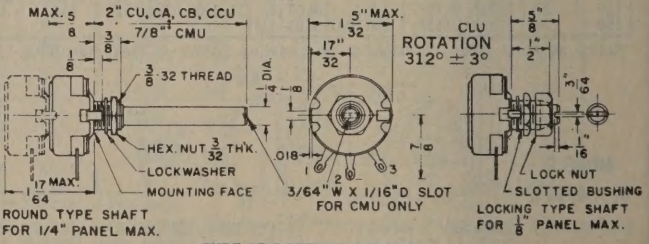
Ohmite molded composition potentiometers (Type AB) provide high quality and dependable performance.

Because the resistance element is a thick, solid-molded ring, longer life and smoother operation are obtained. This is due also to the molded composition contact. Units are dust and splash proof, fungus and corrosion resistant and meet the requirements of military specification MIL-R-94.

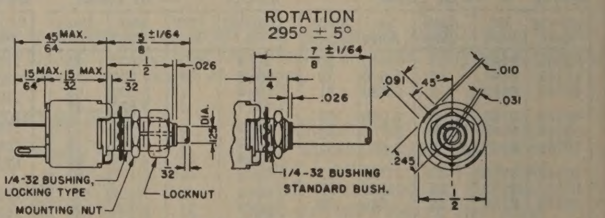
STOCK "POTS" — MIL Units are stamped with MIL and Commercial Designations.

	Type AB (1 5/32" Dia.) Rated 2 Watts						Type AS (1/2" Dia.) Rated 1/2 Watt	
	Single Unit 7/8" Shaft	Single Unit 2" Shaft			Locking	Dual	Miniature Locking	Miniature 7/8" Shaft
Resist.	Style CMU (Linear) Comm. & MIL	Style CU (Linear)	Style CA (CW log)	Style CB (CCW log)	Style CLU (Linear) Comm. & MIL	Style CCU (Linear)	Style AS (Linear) Comm. & MIL	Style ASM (Linear) Comm. & MIL
Range or Limited Ohmic Values	50 to 5.0 Meg.	50 to 5.0 Meg.	0.1 Meg. .25 Meg. .5 Meg. 1.0 Meg. 2.5 Meg.	10,000 25,000 50,000	50 to 5.0 Meg.	10,000 25,000 50,000 1.0 Meg. .25 Meg. .5 Meg. 1.0 Meg.	50 to 5.0 Meg.	50 to 5.0 Meg.
Weight	.064 lb.	.084 lb.			.070 lb.	.123 lb.	.017 lb.	.017 lb.

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX



TYPE AB POTENTIOMETERS



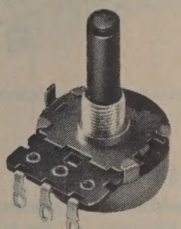
TYPE AS POTENTIOMETERS

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

Panasonic

VARIABLE RESISTORS

METAL OR INSULATED SHAFT SERIES



24mm (15/16") dia. metal shaft single variable resistor, with or without rotary switch

AMERICAN STANDARD

	Shape	Shaft	Type	Part No.
24mm Dia. (15/16" Dia.)	Single	Metal	Standard	EVD-AO
			TV Rating SW	EVD-AA
			Center Tap	EVD-RO
		Insulating	Standard	EVD-NO
			TV Rating SW	EVD-NA
			Wire Wrap	EVD-QO
			TV Rating SW	EVD-QA
			Pull-Push SW	EVD-MO
		Metal	TV Rating Pull-Push SW	EVD-MA
			Push-Push SW	EVD-40
	Tandem	Metal	P.C.B. Twist-Tabs	EWF-KF
			P.C.B.	EWF-KO

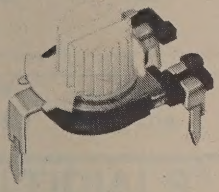
STANDARD

	Shape	Shaft	Type	Part No.
24mm Dia.	Single	Metal	Standard	EVC-BO
			Center Tap	EVE-DO
			P.C.B.	EVC-TO
			Pull-Push SW	EVC-MO
		Insulating	Pull-Push SW	EVV-FO

STANDARD (Cont'd)

	Shape	Shaft	Type	Part No.
24mm Dia.	Tandem	Metal	2 Gang	EWF-PO
			2 Gang P.C.B.	EWF-N2
			2 Gang 2 Shaft	EWF-AO
			2 Gang 2 Shaft, P.C.B.	EWF-B2
	Quadruple		4 Gang	EWI-PO
			4 Gang, P.C.B.	EWI-NO
			4 Gang, P.C.B. 2 Shaft	EWI-A2
	Single	Insulating	Focus Control	EVM-R5G
16mm Dia.	Single	Metal	Standard	EVH-CO
		Insulating	Insulating	EVH-GO
			Snap-Action	EVH-LO
	Tandem	Metal	Standard	EWK-DO
		Insulating	Insulating	EWK-BO
		Metal	2 Shaft	EWK-AO
	Triple	Metal	2 Shaft	EWK-F1
			3 Shaft	EWK-XO
	Quadruple		1 Shaft	EWK-TO
			3 Shaft	EWK-XB

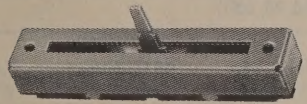
PRESET SERIES



14mm (35/64") high power, 3-terminal, stand-up preset variable resistor

	Diameter	Description	Series	Resistance Range (ohms)	Tol. (%)	Rated Power (W)
PHONETIC BASE	6mm (6/25")	stand-up	EVN-AOA	200 ≈ 2M	±30	0.1
	6mm	lay-down	EVN-A5A	200 ≈ 2M	±30	0.1
	6mm	stand-up	EVN-BOA	200 ≈ 2M	±30	0.1
	8mm (5/16")	stand-up	EVN-JOA	300 ≈ 2M	±30	0.1
	8mm	stand-up	EVN-KOA	300 ≈ 2M	±30	0.1
	8mm	lay-down	EVN-K4A	300 ≈ 2M	±30	0.1
	10mm (25/64")	stand-up, w/o knob	EVL-TOA	200 ≈ 2M	±20	0.1
	10mm	w/knob	EVL-WOA	200 ≈ 2M	±20	0.1
	10mm	stand-up, w/o knob	EVL-SOA	200 ≈ 2M	±20	0.1
	10mm	w/knob	EVL-VOA	200 ≈ 2M	±20	0.1
	10mm	lay-down, w/o knob	EVL-S3A	200 ≈ 2M	±20	0.1
	10mm	w/knob	EVL-V3A	200 ≈ 2M	±20	0.1
	10mm	dust-proof, stand-up	EVL-R3A	300 ≈ 2M	±20	0.15
	10mm	dust-proof	EVL-R6A	300 ≈ 2M	±20	0.15
HIGH POWER	10mm (25/64")	stand-up, w/o knob	EVT-T3A	200 ≈ 2M	±20	0.25
	10mm	w/knob	EVT-W3A	200 ≈ 2M	±20	0.25
	10mm	stand-up, w/o knob	EVT-SOA	200 ≈ 2M	±20	0.25
	10mm	w/knob	EVT-VOA	200 ≈ 2M	±20	0.25
	10mm	lay-down, w/o knob	EVT-S3A	200 ≈ 2M	±20	0.25
	10mm	lay down, w/knob	EVT-V3A	200 ≈ 2M	±20	0.25
	10mm	stand-up, w/knob	EVL-QOA	200 ≈ 2M	±20	0.25
	10mm	lay-down, w/knob	EVL-Q1A	200 ≈ 2M	±20	0.25
	10mm	with knob	EVL-NOA	200 ≈ 2M	±20	0.25
	10mm	w/o knob	EVL-N1A	200 ≈ 2M	±20	0.25
	14mm (35/64")	stand-up, w/knob	EVT-J6A	500 ≈ 2M	±20	0.5
	14mm	lay-down, w/knob	EVT-81A	500 ≈ 2M	±20	0.5
CERAMIC	15mm (3/5")	stand-up, w/knob	EVT-XOA	200 ≈ 2M	±20	0.5
	15mm	lay-down, w/knob	EVT-X3A	200 ≈ 2M	±20	0.5
CERMET	10mm (25/64")	dust-proof, stand-up	EVM-HOG	100 ≈ 2M	±20	0.5
	10mm	dust-proof, lay-down	EVM-H1G	100 ≈ 2M	±20	0.5
	6mm (6/25")	stand-up	EVM-FOG	100 ≈ 2M	±30	0.1
	6mm	stand-up	EVM-F1G	100 ≈ 2M	±30	0.1
	6mm	lay-down	EVM-F7G	100 ≈ 2M	±30	0.1
WIRE WOUND	19mm (3/4")	lay-down, w/o knob	EVW-QOA	10 ≈ 1K	±10	1.5, 2, 3
	19mm	lay-down, w/knob	EVW-Q1A	10 ≈ 1K	±10	1.5, 2, 3

LINEAR ACTUATED SERIES

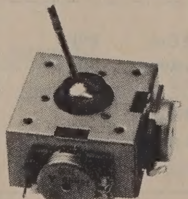


45mm (1⅘") single linear actuated variable resistor

Stroke	Shape	Type	P/N
20mm	Single	Standard	EVA-LOA
		P.C.B.	EVA-LOP
		Thin Type, P.C.B.	EVA-HOP
30mm	Single	Standard	EVA-QOA
		P.C.B.	EVA-QOP
		Thin Type	EVA-VOA
		Thin, P.C.B.	EVA-VOP
		Slender Type	EVA-TOI
		Slender, P.C.B.	EVA-TOA
		Flat Type	EVA-KOA
45mm	Single	Standard	EVA-ROA
60mm	Single	Standard	EVA-SOA
		P.C.B.	EVA-SOP

Stroke	Shape	Type	P/N
20mm	Tandem	Standard	EVB-LOA
		P.C.B.	EVB-LOP
30mm	Tandem	Standard	EVB-FOA
		P.C.B.	EVB-FOP
		Thin Type	EVB-VOA
		Thin, P.C.B.	EVB-VOP
		Flat Type	EVB-KOA
45mm	Tandem	Standard	EVB-AOA
		Standard	EVB-GOA
60mm	Tandem	Standard	EVB-SOA
		Standard	EVB-BOA
45mm	Quadruple	Standard	EVB-EOA
30mm	Quadruple	Standard	EVB-DOA

JOYSTICK SERIES



Multishaft control, level operation variable resistor

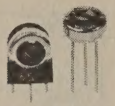
Type EVX-P2A variable resistor has a lever to operate four single or tandem variable resistors at the same time, and is ideal for use as the balance of 4-channel stereo-audio sets or as part of the dimmer functions.

Panasonic / MATSUSHITA ELECTRIC CORPORATION OF AMERICA / ELECTRONIC COMPONENTS DIVISION
DEPT. EM, ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000
OUR TECHNOLOGY IS ALL AROUND YOU

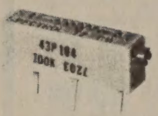
Spectrol

CERMET TRIMMING POTENTIOMETERS

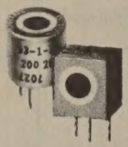
Actual size



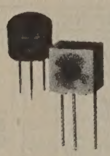
Model 65



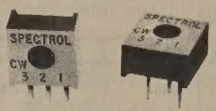
Model 43



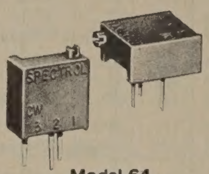
Model 53



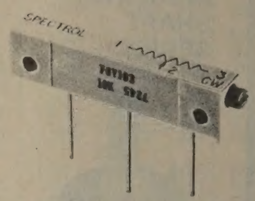
Model 62



Model 63



Model 64



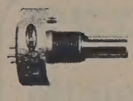
Model 70

MODEL NO.	NOMINAL SIZE (INCHES)	NOM. ADJ. TURNS	TERMINAL[1] STYLE	RESISTANCE TOLERANCE	MAXIMUM POWER RATING (WATTS)	TEMPCO (PPM/° C)	STANDARD RESISTANCE RANGE (OHMS)	U.S. 50 PC. UNIT PRICE
43	0.75 Long	20	PC	±10%	0.75 @ 25° C	±100 (100 Ω–2 Meg) 0 to +200 (10, 20, 50Ω)	10 Ω–2 Meg.	1.15
53	0.34 Dia. Top Adjust 0.31 x 0.34 Side Adjust	240°	PC	±20% (±10 Available)	0.5 @ 85° C	±100 (100 Ω– 1 Meg) 0 to +200 (10, 20, 50Ω)	10 Ω– 1 Meg.	1.59
62	0.25 Dia. Top Adjust 0.24 x 0.18 Side Adjust	220°	PC	±20% (±10 Available)	0.75 @ 25° C	±100 (100 Ω– 1 Meg) 0 to +200 (10, 20, 50Ω)	10 Ω– 1 Meg.	1.45
63	0.38 Square	270°	PC	±20%	0.5 @ 70° C	±100 (100 Ω–2 Meg) 0 to +250 (10, 20, 50 Ω)	10 Ω–2 Meg.	0.70
64	0.38 Square	25	PC	± 20%	0.5 @ 70° C	± 100 (100Ω–2 Meg) 0 to +250 (10, 20, 50Ω)	10 Ω–2 Meg.	1.46
65	0.25 Dia. Top Adjust 0.25 x 0.32 Side Adjust	240°	PC	±20% (±10 Available)	0.5 @ 70° C	±100 (100 Ω– 1 Meg) 0 to +200 (10, 20, 50Ω)	10 Ω–2 Meg.	1.24 1.68
70	1.25 Long	22	L, PC, SH	±10%	1.0 @ 85° C	±100 (100Ω –2 Meg) 0 to +200 (10, 20, 50Ω)	10Ω –1 Meg.	1.79

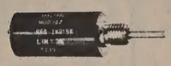
Spectrol

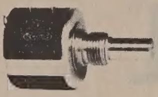
PRECISION POTENTIOMETERS

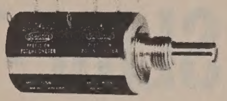
All units shown ½ actual size


Model 152

Model 152 (Servo)


Model 162


Model 534


Model 534 (2 Section)

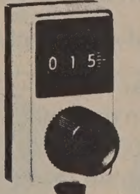
MODEL NO.	NOMINAL DIA[2] (INCHES)	RESISTANCE RANGE (OHMS)	STANDARD RESISTANCE TOLERANCE	LINEARITY TOLERANCE STANDARD	LINEARITY TOLERANCE BEST PRACTICAL[1]	MAXIMUM POWER RATING (WATTS)	MOUNTING AVAILABLE	U.S. 50 PC. UNIT PRICE
152	.875	5 to 40K	± 3% (±5% below 50Ω)	5Ω to 500 Ω ± 1.0% 500Ω and above ± 0.5%	±.35%	2.0 @ 40° C	Bushing Servo	6.00 8.95
533	.875	5 to 60K	± 5%	±.25%	±.15%	1.0 @ 70° C	Bushing Servo	5.80 5.80
535	.875	5 to 100K	± 5%	±.25%	±.10%	1.5 @ 70° C	Bushing Servo	5.80 5.80
162	.500	100 to 105K	± 5%	±.30%	±.15%	2.0 @ 40° C	162 Bushing 164 Servo	10.20 13.20
534	.875	10 to 200K	± 5%	±.25%	±.075%	2.0 @ 70° C	Bushing Servo	5.05 10.55

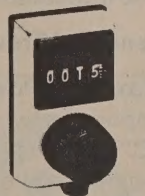
MULTIDIALS®

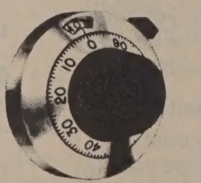
All units shown ½ actual size

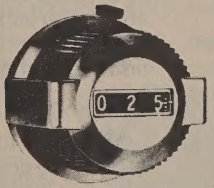
Model 11

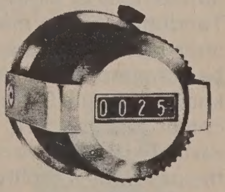
Model 16


Model 18-1-11


Model 15-2-11


Model 21


Model 25-1-13


Model 25-4-13

MODEL NO.	NOMINAL DIA. (INCHES)	NUMBER OF TURNS	MINOR SCALE DIVISION	SHAFT BORE (INCHES)	FINISH	U.S. 50 PC. UNIT PRICE
11-1-11	1.000	11	1/50 Turn	.250	Satin Chrome ■	7.30
18-1-11	H 1.750 W 1.000	10 (3 Digit)	1/500 Turn	.250	Satin Chrome	9.70
15-2-11	H 1.750 W 1.000	100 (4 Digit)	1/500 Turn	.250	Satin Chrome	12.00
16-1-11	.875	15	1/50 Turn	.250	Clear Anodized	6.15
21-1-11	1.812	15	1/100 Turn	.250	Satin Chrome ■	7.05
25-1-13	1.812	11 (3 Digit)	1/500 Turn	.250	Satin Chrome	17.50
25-4-13	1.812	100 (4 Digit)	1/500 Turn	.250	Satin Chrome	18.90

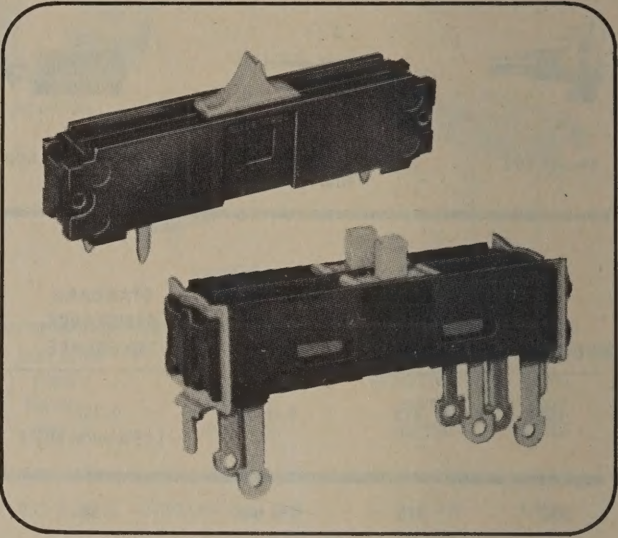
All prices subject to change without notice.

STACKPOLE®

COMPONENTS COMPANY Dept. EM, P.O. Box M, Farmville, Va. 23901 • Phone (804) 392-4111 • TWX 710-874-3710

SLIDE-TROL®

Space-Age Concept in Variable Resistor Design



Compact, low-cost, flexible for a wide range of applications

Space-saving SLIDE-TROL often is the most efficient as well as the most economical answer to design and manufacturing problems. Featuring linear motion, it's the latest concept in variable-resistor design by Stackpole. Already in use in countless applications such as lighting, appliances, entertainment products and electronic instruments, time-proven SLIDE-TROL is ready and waiting to be applied to your new product.

SLIDE-TROL FEATURES

Design Flexibility

Units can be mounted horizontally or sideways. Tandems—two or more units locked together—can be actuated with a single knob. Versatile SLIDE-TROL can be the standard variable resistor throughout the product—simplifying parts control and assembly.

Compact, Lightweight

Weighs only a little more than half as much as a standard rotary control—means lower shipping costs for components or end product.

Design Appeal

Attractive SLIDE-TROL can be worked into almost any control-panel design with minimum effort. Sleek-appearing control knobs are unobtrusive, yet come in colors useful for decoration or identification.

Quality Construction

Don't let the low cost of SLIDE-TROL confuse you. Advanced design with patented features, along with modern manufacturing techniques, has resulted in the high quality that has made Stackpole famous. Compare SLIDE-TROL spec for spec with other variable resistors; see for yourself.

SLIDE-TROL APPLICATIONS

Ideal for: Office equipment • electronic organs • light dimmers • television • auto radios • electric guitars • tape recorders • electric ranges • electronic instruments • tuners and amplifiers • speed controls

Electrical Specifications

Resistance Range

Linear—100 ohms to 10 megohms
Modified tapers—250 ohms to 5 megohms
Special tapers, values—consult Stackpole
Standard tolerance—±30%
Special tolerances—consult Stackpole
Tapers—per EIA Standard RS-303

Switches—not available as integral part of SLIDE-TROL. Use independent Stackpole slide or rocker switch.

Length of Travel—1.25 inches

Maximum Power Rating—rheostat-connected load applied between terminals "A" and "B," with "B" at "C" terminal (1000 hours, 50°C maximum ambient, maximum allowable resistive change 10%):

- ☐ 1.5 watts—values under 500 ohms
- ☐ 1.25 watts—values from 500 to 5000 ohms
- ☐ 1.0 watt—values above 5000 ohms

Derate to 80% of maximum power for long-term reliability.

Maximum Operating Voltage

Across "A" and "C" terminals—1000 vdc (load not to exceed safe wattage rating)

Dielectric Withstanding Voltage

(between variable-resistor terminals and dead-metal parts, for one minute):

Minimum, bracket mounted—1500 rms, 60 Hz

PLEASE CONTACT FACTORY OR YOUR AREA REPRESENTATIVE FOR MORE INFORMATION.

STACKPOLE®

COMPONENTS COMPANY Dept. EM, P.O. Box M, Farmville, Va. 23901 • Phone (804) 392-4111 • TWX 710-874-3710

SERIES 20 MINIPOTS®

Miniature, P.C.-Mounting Trimmer Potentiometers

A Complete Line of .600-Diameter, Single-Section Minipots for Horizontal or Vertical P.C. Mounting

The value of quality design and materials — the economy of precise, automated manufacture — the proper balance of these factors means you can have an added measure of confidence when you specify Stackpole's Minipot trimmers. You know you'll get Stackpole reliability at low cost, without having to sacrifice long-term performance. That's a good feeling when you're trying to design a quality electronic product to sell at a competitive price. It's one of the good reasons why engineers have been specifying Stackpole variable resistors since 1932.

All types are available with knob featuring: finger adjust; screwdriver through-slot or hex hole for easy accessibility from either side of the control.

Stabalite® resistive elements ensure long-term, drift-free performance, even in adverse environments, and require minimum derating. Lifetime construction permits operation between −30°C and +100°C. Shelf life is virtually unlimited.

Commercial-grade knob and insulator are standard — flammability-grade knob and insulator are available.

Electrical Specifications

Overall Resistance Range

100 ohms through 10 megohms

For non-standard resistance values, tolerances, or other design parameters for special applications, consult Stackpole.

Maximum Power Rating

(To 50°C ambient temperature, free air, derate linearly to 0 watts @ 100°C ambient)

5K ohms or less—.3 watts

Over 5K ohms—.25 watts

Residual Resistance (Hopoff)

0.1% of nominal overall resistance or per EIA Standard RS-303, whichever is greater

Overall Resistance Tolerance

±30% for 100 ohms through 5 megohms

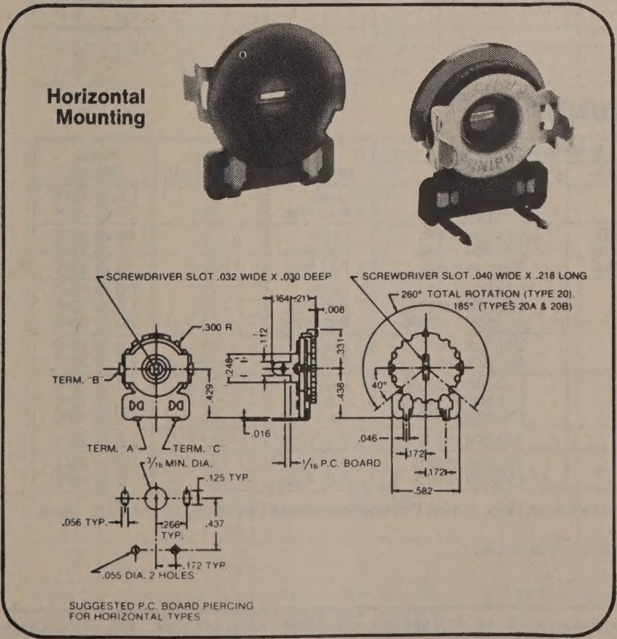
±40% over 5 megohms

Maximum Operating Voltage

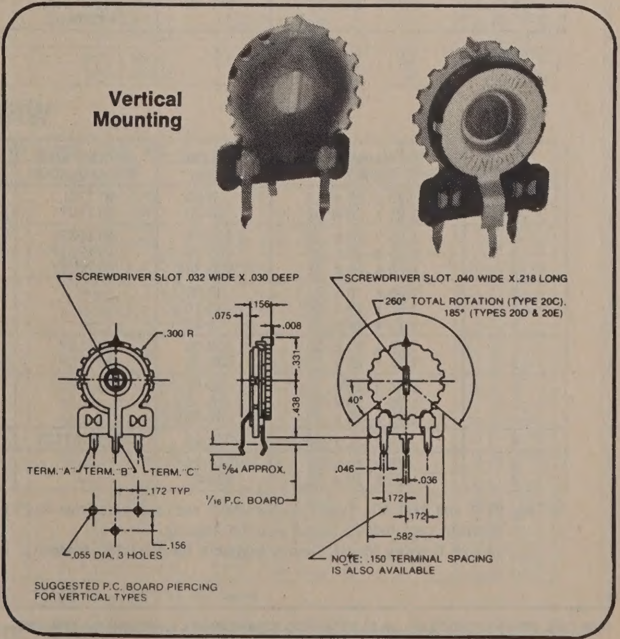
(Load not to exceed safe wattage rating)

All Minipots—500 vdc

Horizontal Mounting


SCREWDRIVER SLOT .032 WIDE X .030 DEEP
SCREWDRIVER SLOT .040 WIDE X .218 LONG
260° TOTAL ROTATION (TYPE 20).
185° (TYPES 20A & 20B)
.164
.21
.008
.300 R
.112
.331
.248
TERM. "B"
.429
.438
40°
.016
.046
TERM. "A"
TERM. "C"
.172
3/16 MIN. DIA.
1/16 P.C. BOARD
.172
.125 TYP.
.582
.056 TYP.
.266 TYP.
.437
.172 TYP.
.055 DIA. 2 HOLES
SUGGESTED P.C. BOARD PIERCING FOR HORIZONTAL TYPES

Vertical Mounting

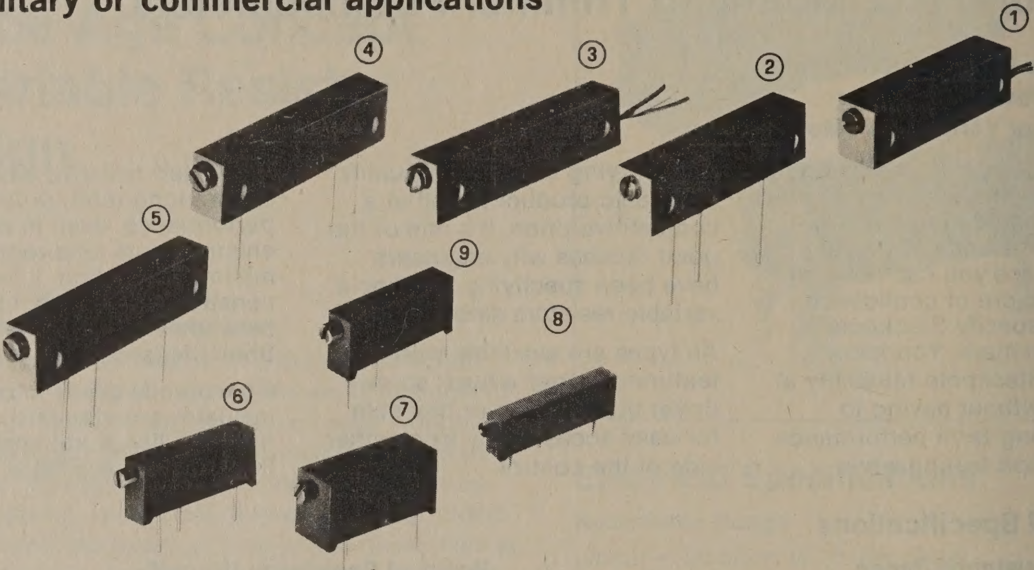

SCREWDRIVER SLOT .032 WIDE X .030 DEEP
SCREWDRIVER SLOT .040 WIDE X .218 LONG
260° TOTAL ROTATION (TYPE 20C).
185° (TYPES 20D & 20E)
.156
.075
.008
.300 R
.331
40°
.438
TERM. "A"
TERM. "B"
TERM. "C"
5/64 APPROX.
.046
.036
.172 TYP
1/16 P.C. BOARD
.172
.172
.582
.156
.055 DIA. 3 HOLES
NOTE: .150 TERMINAL SPACING IS ALSO AVAILABLE
SUGGESTED P.C. BOARD PIERCING FOR VERTICAL TYPES

PLEASE CONTACT FACTORY OR YOUR AREA REPRESENTATIVE FOR MORE INFORMATION.

TRW IRC POTENTIOMETERS

CIRCUITRIM® RECTANGULAR TRIMMER POTENTIOMETERS

CERMET (Non-wirewound) or Wirewound provide the widest choice for military or commercial applications



Available from TRW/IRC Distributors

CERMET (Non-wirewound) TRW/IRC Metal Glaze®

Illus.	Package L x W x H	TRW/IRC Type	Military Style or Designation	Resistance Ranges ±10% Std.		Terminals	Adjust Turns (Nom)	Power (Watts)
				MIL-Qual.	TRW/IRC			
3	1.25 x .19 x .32	450-00	RJ12L	10Ω-1 MegΩ	10Ω-1 MegΩ	Leads	22	.75 @ 85°C
4	1.25 x .19 x .32	450-10	RJ12P	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins	22	.75 @ 85°C
5	1.25 x .19 x .32	450-20	RJ12Y	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins	22	.75 @ 85°C
3	1.25 x .19 x .34	45-00	—	—	100Ω-1 MegΩ ±20%	Leads	22	.75 @ 70°C
4	1.25 x .19 x .34	45-10	—	—	100Ω-1 MegΩ ±20%	P.C. Pins	22	.75 @ 70°C
5	1.25 x .19 x .34	45-20	—	—	100Ω-1 MegΩ ±20%	P.C. Pins	22	.75 @ 70°C
6	.75 x .16 x .31	960-20	—	—	10Ω-1 MegΩ	P.C. Pins	20	.75 @ 25°C
7	.75 x .27 x .35	980-20	—	—	10Ω-1 MegΩ	P.C. Pins	20	.75 @ 25°C
9	.75 x .16 x .31	989-20	(RJ11P Pin Placement)	—	10Ω-1 MegΩ	P.C. Pins	20	.75 @ 25°C

WIREWOUND

Illus.	Package L x W x H	TRW/IRC Type	Military Style or Designation	Resistance Ranges		Terminals	Adjust Turns (Nom)	Power (Watts)
				MIL-Qual.	TRW/IRC			
1	1.25 x .28 x .32	60-00	RT11CL	—	10Ω-50K ±10%	Leads	22	1.0 @ 70°C
2	1.25 x .28 x .32	60-20	RT11CP	—	10Ω-50K ±10%	P.C. Pins	22	1.0 @ 70°C
3	1.25 x .19 x .32	400-00	RT12C2L	100Ω-20K	10Ω-50K ±5%	Leads	22	.75 @ 85°C
4	1.25 x .19 x .32	400-10	RT12C2P	100Ω-20K	10Ω-50K ±5%	P.C. Pins	22	.75 @ 85°C
5	1.25 x .19 x .32	400-20	RT12C2Y	100Ω-20K	10Ω-50K ±5%	P.C. Pins	22	.75 @ 85°C
3	1.25 x .19 x .34	40-00	—	—	10Ω-50KΩ ±10%	Leads	22	1.0 @ 50°C
4	1.25 x .19 x .34	40-10	—	—	10Ω-50KΩ ±10%	P.C. Pins	22	1.0 @ 50°C
5	1.25 x .19 x .34	40-20	—	—	10Ω-50KΩ ±10%	P.C. Pins	22	1.0 @ 50°C
1	1.25 x .28 x .32	600-00	RT11CP	—	10Ω-50K ±5%	Leads	22	1.0 @ 70°C
2	1.25 x .28 x .32	600-20	RT11CP	—	10Ω-50K ±5%	P.C. Pins	22	1.0 @ 70°C
1	1.25 x .19 x .32	60-00	—	—	10Ω-50KΩ ±10%	Leads	22	1.0 @ 70°C
2	1.25 x .19 x .32	60-10	—	—	10Ω-50KΩ ±10%	P.C. Pins	22	1.0 @ 70°C
—	1.25 x .19 x .32	60-201	—	—	10Ω-50KΩ ±10%	Hook Pins	22	1.0 @ 70°C
8	1″ x .31 x .16	901-20	RT11P-RT12Y	—	10Ω-50K ±5%	P.C. Pins	28	1.0 @ 70°C
6	.75 x .16 x .31	910-20	—	—	10Ω-20K ±10%	P.C. Pins	20	1.0 @ 40°C
7	.75 x .27 x .35	930-20	—	—	10Ω-20K ±10%	P.C. Pins	20	1.0 @ 40°C

NOTES: RT11 and RJ11 Mil. Type Trimmers have been removed from Gov't and Mil. Procurement Lists. Future Procurement should call for RT12 and RJ12 Types.
Trimmer Type 989-20 has .7 x .1 Pin Spacing.
#12-28 Bushing Mount Fixture available for all 1.25″ trimmers. #10-32 used on Type 901-60.

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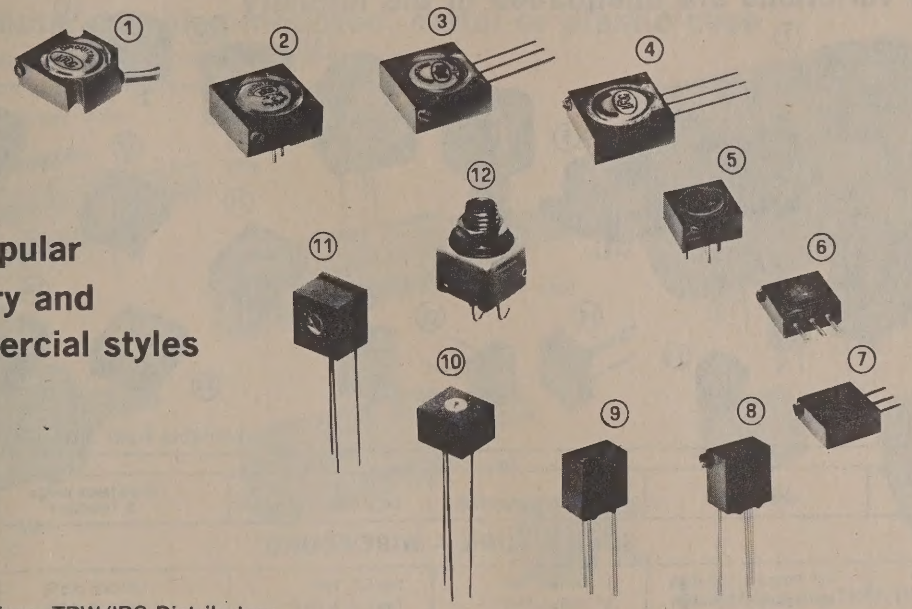
TRW IRC POTENTIOMETERS

CIRCUITRIM® SQUARE AND CUBE MULTI-TURN TRIMMERS

All popular military and commercial styles



Available from TRW/IRC Distributors

CERMET (Non-wirewound) TRW/IRC Metal Glaze®

Illus.	Package L x W x H		TRW/IRC Type	Military Style or Designation	Resistance Ranges ±10%***		Terminals	Adjust Turns (Nom)	Power (Watts)
					MIL-Qual.	IRC			
1	½″	.5 x .5 x .19	255-00	RJ22CL	10Ω-1 MegΩ	10Ω-1 MegΩ	Leads	25	.75 @ 70°C
2		.5 x .5 x .22	255-10	RJ22CP	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins Bottom	25	.75 @ 70°C
3		.5 x .5 x .19	255-207*	RJ22CX	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins Edge	25	.75 @ 70°C
4		.5 x .5 x .19	255-208*	RJ22CW	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins Edge	25	.75 @ 70°C
1	½″	.5 x .5 x .19	25-00	—	—	100Ω-1 MegΩ ±20%	Leads	25	.75 @ 70°C
2		.5 x .5 x .22	25-10	—	—	100Ω-1 MegΩ ±20%	P.C. Pins Bottom	25	.75 @ 70°C
3		.5 x .5 x .19	25-207*	—	—	100Ω-1 MegΩ ±20%	P.C. Pins Edge	25	.75 @ 70°C
4		.5 x .5 x .19	25-208*	—	—	100Ω-1 MegΩ ±20%	P.C. Pins Edge	25	.75 @ 70°C
5	⅜″	.375 x .375 x .195	750-10	RJ24CP	10Ω-1 MegΩ	10Ω-1 MegΩ	P.C. Pins Bottom	19	.5 @ 70°C
6		.375 x .375 x .21	750-207*	RJ24X	—	10Ω-1 MegΩ	P.C. Pins Edge	19	.5 @ 70°C
7		.375 x .375 x .21	750-208*	RJ24W	—	10Ω-1 MegΩ	P.C. Pins Edge	19	.5 @ 70°C
5	⅜″	.375 x .375 x .195	75-10	—	—	100-1 MegΩ	P.C. Pins Bottom	19	.5 @ 70°C
6		.375 x .375 x .21	75-207*	—	—	100-1 MegΩ	P.C. Pins Edge	19	.5 @ 70°C
7		.375 x .375 x .21	75-208*	—	—	100-1 MegΩ	P.C. Pins Edge	19	.5 @ 70°C
8	5/16″	.312 x .312 x .19	850-20	—	—	10Ω-1 MegΩ	P.C. Pins Edge	13	.3 @ 70°C
9		.312 x .312 x .19	850-208	—	—	10Ω-1 MegΩ	P.C. Pins Edge	13	.3 @ 70°C

WIREWOUND

Illus.	Package L x W x H		TRW/IRC Type	Military Style or Designation	Resistance Ranges ±5% Std.		Terminals	Adjust Turns (Nom)	Power (Watts)
					MIL-Qual.	IRC			
1	½″	.5 x .5 x .19	205-00	RT22C2L	50Ω-20K	10Ω-50K	Leads	25	1.0 @ 70°C
2		.5 x .5 x .22	205-10	RT22C2P	50Ω-20K	10Ω-50K	P.C. Pins Bottom	25	1.0 @ 70°C
3		.5 x .5 x .19	205-207*	RT22C2X	50Ω-20K	10Ω-50K	P.C. Pins Edge	25	1.0 @ 70°C
4		.5 x .5 x .19	205-208*	RT22C2W	50Ω-20K	10Ω-50K	P.C. Pins Edge	25	1.0 @ 70°C
1	½″	.5 x .5 x .19	20-00	—	—	50Ω-20KΩ ±10%	Leads	25	1.0 @ 50°C
2		.5 x .5 x .22	20-10	—	—	50Ω-20KΩ ±10%	P.C. Pins Bottom	25	1.0 @ 50°C
3		.5 x .5 x .19	20-207*	—	—	50Ω-20KΩ ±10%	P.C. Pins Edge	25	1.0 @ 50°C
4		.5 x .5 x .19	20-208*	—	—	50Ω-20KΩ ±10%	P.C. Pins Edge	25	1.0 @ 50°C
5	⅜″	.375 x .375 x .195	700-10	RT22C2P	10Ω-10K	10Ω-20K	P.C. Pins Bottom	21	.75 @ 70°C
6		.375 x .375 x .21	700-207*	RT22X	—	10Ω-20K	P.C. Pins Edge	21	.75 @ 70°C
7		.375 x .375 x .21	700-208*	RT22W	—	10Ω-20K	P.C. Pins Edge	21	.75 @ 70°C
5	⅜″	.375 x .375 x .195	70-10	—	—	50Ω-20KΩ ±10%	P.C. Pins Bottom	21	.75 @ 70°C
6		.375 x .375 x .21	70-207*	—	—	50Ω-20KΩ ±10%	P.C. Pins Edge	21	.75 @ 70°C
7		.375 x .375 x .21	70-208*	—	—	50Ω-20KΩ ±10%	P.C. Pins Edge	21	.75 @ 70°C
12		.375 x .375 x .340	320**	—	—	50Ω-20K	Hook Pins Rear	1	1.0 @ 60°C
12	⅜″	.375 x .375 x .340	32	—	—	50Ω-20KΩ ±10%	Hook Pins Rear	1	1.0 @ 60°C
8	5/16″	.312 x .312 x .19	800-20	—	—	10Ω-20K	P.C. Pins Edge	15	.6 @ 70°C
9		.312 x .312 x .19	800-208*	—	—	10Ω-20K	P.C. Pins Edge	15	.6 @ 70°C
10		.312 x .312 x .234	300	—	—	50Ω-20K	P.C. Pins Bottom	1	.6 @ 60°C
11		.312 x .296 x .344	310	—	—	50Ω-20K	P.C. Pins Edge	1	1.0 @ 60°C
10	5/16″	.312 x .312 x .234	30	—	—	50Ω-20KΩ ±10%	P.C. Pins Bottom	1	0.5 @ 60°C
11		.312 x .312 x .344	31	—	—	50Ω-20KΩ ±10%	P.C. Pins Edge	1	0.5 @ 60°C

*Suffix 207 denotes Lead Screw Location 90° from Pins. **#10-32 bushing on Type 320. ***Unless otherwise indicated.
Suffix 208 denotes Lead Screw Location 180° from Pins.

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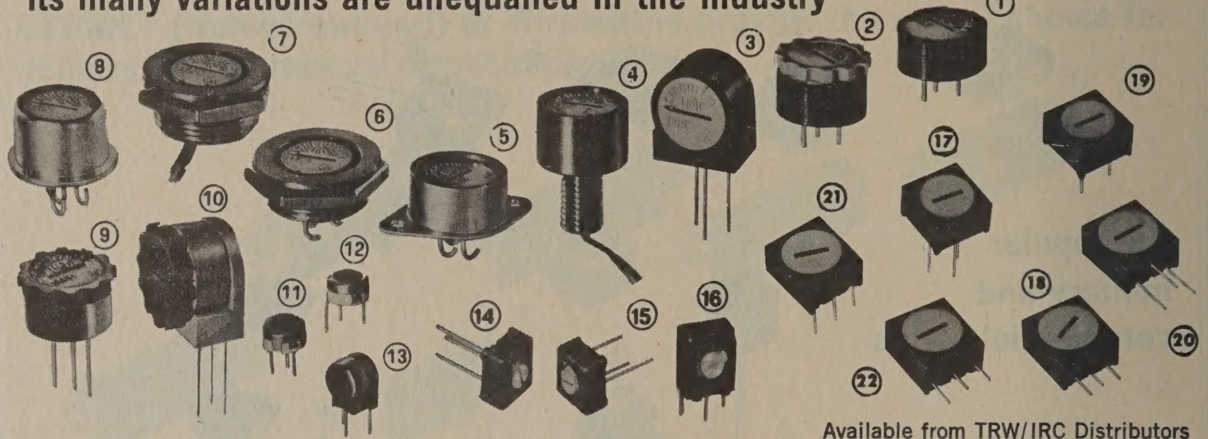
TRW IRC POTENTIOMETERS

CIRCUITRIM® 100 — The World's most experienced — Most versatile ¼″ and ½″ SINGLE TURN TRIMMERS

its many variations are unequalled in the industry



Available from TRW/IRC Distributors

Illus.	TRW/IRC Type***	Description	Pin Spacing & Mounting	Adjustment Control	Resistance Range & Tolerance	Power (Watts)

SINGLE TURN — WIREWOUND

Illus.	TRW/IRC Type***	Description	Pin Spacing & Mounting	Adjustment Control	Resistance Range & Tolerance	Power (Watts)
1	100*	½″ Round x .235 High	.1″ Radius, Flat	Top S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
2	110	½″ Round x .325 High	.1″ Radius, Flat	Top S.D. & Knob	10Ω-50K ±5%	1.0 @ 70°C
3	106-2	½″ Wide x .56 High	.1″ Radius, Vertical	Side S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
4	108-4	½″ Wide x .56 High	.1″ Radius, Vertical	Side S.D. & Knob	10Ω-50K ±5%	1.0 @ 70°C
5	101-5	½″ Round x .265 High	.1″ Radius, Flange	Top S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
6	102-5	¾″ Round x .250 Deep	.1″ Radius, Flush	Top S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
7	103-6	¾″ Round x .315 Deep	10″ Leads, Flush	Top S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
8	118-7	½″ Round x .312 High	10″ Leads, Flat	Top S.D. Slot	10Ω-50K ±5%	1.0 @ 70°C
9	500	½″ Round x .325 High	.1″ Radius, Flat	Top S.D. & Knob	10Ω-50K ±5%	1.0 @ 70°C
10	506	½″ Wide x .56 High	.1″ Radius, Vertical	Top S.D. & Knob	10Ω-50K ±5%	1.0 @ 70°C

SINGLE TURN — METAL GLAZE® — CERMET

Illus.	TRW/IRC Type***	Description	Pin Spacing & Mounting	Adjustment Control	Resistance Range & Tolerance	Power (Watts)
1	150*	½″ Round x .235 High	.1″ Radius, Flat	Top S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
2	160	½″ Round x .325 High	.1″ Radius, Flat	Top S.D. & Knob	10Ω-2 MegΩ ±10%	.75 @ 70°C
3	156-2	½″ Wide x .56 High	.1″ Radius, Vertical	Side S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
4	158-4	½″ Wide x .56 High	.1″ Radius, Vertical	Side S.D. & Knob	10Ω-2 MegΩ ±10%	.75 @ 70°C
5	151-5	½″ Round x .265 High	.1″ Radius, Flange	Top S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
6	152-5	¾″ Round x .250 Deep	.1″ Radius, Flush	Top S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
7	103-6	¾″ Round x .315 Deep	10″ Leads, Flush	Top S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
8	118-7	½″ Round x .312 High	10″ Leads, Flat	Top S.D. Slot	10Ω-2 MegΩ ±10%	.75 @ 70°C
9	550	½″ Round x .235 High	.1″ Radius, Flat	Top S.D. & Knob	10Ω-2 MegΩ ±30%	.75 @ 70°C
10	556	½″ Wide x .56 High	.1″ Radius, Vertical	Side S.D. & Knob	10Ω-2 MegΩ ±30%	.75 @ 70°C
17	76-10	⅜″ Square x .28 High	.1″ Radius, Flat	Top S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C
18	76-30	⅜″ Square x .28 High	.2″ Radius, Flat	Top S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C
19	76-50**	⅜″ Square x .28 High	.15 Inline, Flat	Top S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C
20	76-20**	.2 x .37 x .42 High	.10 Inline, Vertical	Side S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C
21	76-40**	.2 x .37 x .42 High	.10 Radius, Vertical	Side S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C
22	76-70**	.2 x .37 x .42 High	.15 Inline, Vertical	Side S.D. Slot	100Ω-1 MegΩ ±10%	.5 @ 70°C

**Also available with C.W. rotation.
***Available with 0.5W @ 85°C rating, testing to MIL-R-22097 as 760 Series, all styles.

¼″ SINGLE TURN METAL GLAZE® — CERMET

Illus.	TRW/IRC Type***	Description	Pin Spacing & Mounting	Adjustment Control	Resistance Range & Tolerance	Power (Watts)
11	170*	¼″ Round x .17 High	.1″ Radius, Flat	Top S.D. Slot	10Ω-1 MegΩ ±20%	.5 @ 85°C
12	171	¼″ Round x .18 High	.1″ Radius, Flat	Top S.D. Slot	10Ω-1 MegΩ ±20%	.5 @ 85°C
13	172	¼″ Wide x .31 High	.1″ Radius, Vertical	Side S.D. Slot	10Ω-1 MegΩ ±20%	.5 @ 85°C
14	180	¼″ Square x .18 High	.1″ Radius Flat	Top S.D. Slot	100Ω-1 MegΩ	.5 @ 70°C
15	181	¼″ Square x .18 High	.1″ Centers Flat	Top S.D. Slot	100Ω-1 MegΩ	.5 @ 70°C
16	182	¼″ Square x .312 High	.1″ Centers Flat	Side S.D. Slot	100Ω-1 MegΩ	.5 @ 70°C

*Basic Mechanical/Electrical Components for these respective series. Mounting variations and type and location of adjustment controls provide versatility and change in model numbering.

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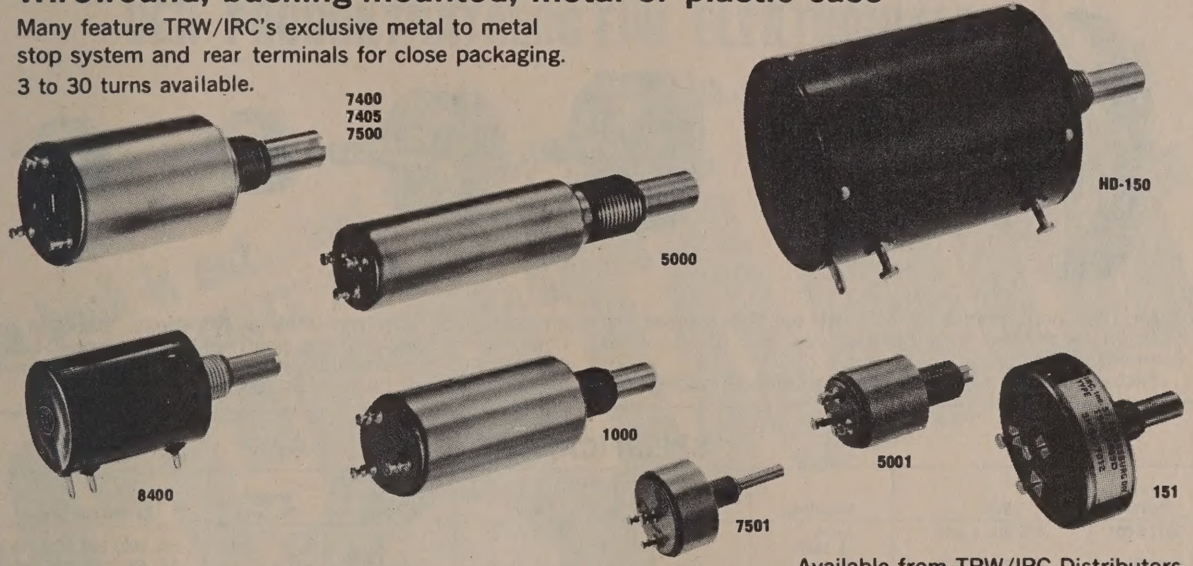
TRW IRC POTENTIOMETERS

PRECISION SINGLE TURN and MULTI-TURN POTENTIOMETERS

Wirewound, bushing-mounted, metal or plastic case

Many feature TRW/IRC's exclusive metal to metal stop system and rear terminals for close packaging. 3 to 30 turns available.



Available from TRW/IRC Distributors

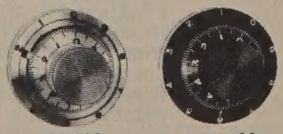
Specifications	Type 5000 ½″ Dia. Metal Case	Type 5001 ½″ Dia. Metal Case	Type 7400 ¾″ Dia. Metal Case	Type 7405 ¾″ Dia. Metal Case	Type 7500 ¾″ Dia. Metal Case
Electrical					
Resistance Range & Tol.	25Ω-100K ±5%	10Ω-50K ±5%	100Ω-100K ±5%	100Ω-50K ±5%	50Ω-250K ±5%
Power Rating	1.5W @ 40°C	2.0W @ 40°C	3.0W @ 40°C	2.0W @ 40°C	3.0W @ 40°C
Operating Temp. Range	−55°C to +125°C	−65°C to +150°C	−65°C to +125°C	−65°C to +125°C	−55°C to +125°C
Linearity (Indep., Std.)	±5%	±5%	±0.25%	±0.5%	±.25%
Rotation	3600° +4° −0°	320° ±5°	3600° +6° −0°	1800° +6° −0°	3600° +4° −0°
Mechanical					
Dimensions (Dia. x L.B.P.)	½″ x 1 39/64″	½″ x ½″	¾″ x 1¼″	¾″ x 15/16″	¾″ x 1 21/32″
Bushing (Dia. x L.)	⅜″ x ½″	¼″ x ⅜″	⅜″ x 7/16″	⅜″ x 7/16″	⅜″ x ½″
Shaft (Dia. x L.)	¼″ x ½″	⅛″ x ⅛″	¼″ x ½″	¼″ x ½″	¼″ x ½″
Rotation	3600° +4° −0°	320° ±5°	3600° +6° −0°	1800° +6° −0°	3600° +4° −0°

Specifications	Type 7501 ¾″ Dia. Metal Case	Type 1000 1″ Dia. Metal Case	Type 8400 ⅞″ Dia. Phenolic Case	Type HD-150 1½″ Dia. Phenolic Case	Type 151 1½″ Dia. Metal Case
Electrical					
Resistance Range & Tol.	50Ω-75K ±5%	500Ω-200K ±5%	25Ω-100K ±5%	500Ω-600K ±5%	100Ω-100K ±5%
Power Rating	2.25W @ 40°C	3.0W @ 40°C	3.0W @ 40°C	5.0W @ 40°C	3.5W @ 40°C
Operating Temp. Range	−65°C to +150°C	−55°C to +125°C	−55°C to +105°C	−55°C to +100°C	−65°C to +150°C
Linearity (Indep., Std.)	±1%	±0.5%	±.25%	±3%	±0.5%
Rotation	345° ±5°	3600° +4° −0°	3600° +10° −0°	3600° +4° −0°	350° ±5°
Mechanical					
Dimensions (Dia. x L.B.P.)	¾″ x ⅜″	1″ x 1 11/32″	⅞″ x 1⅛″	1½″ x 2.0″	1½″ x ½″
Bushing (Dia. x L.)	¼″ x ⅜″	⅜″ x ½″	⅜″ x 5/16″	⅜″ x 5/16″	⅜″ x ½″
Shaft (Dia. x L.)	¼″ x ½″	¼″ x ½″	¼″ x ½″	¼″ x ½″	¼″ x ½″
Rotation	Cont.	3600° +4° −0° Available in 2 to 15 Turns	3600° +15° −0° Also Avail. In 3 & 5 Turns	3600° +4° −0° Also Avail. in 3 & 5 Turns	Cont.

Note: Consult factory for Shaft and Bushing Modifications, Center Taps, Intermediate Turns, best Practical Resistance and Linearity Tolerances and Moisture or Hermetic Sealing.

REVODEX® TURNS COUNTING DIALS

Eliminate reading errors.



RD-400 Series 1″ Dia. 10 Turns

RDK-400 Series 1″ Dia. 15 Turns

Revodex® Dials are adaptable to all IRC Precision Potentiometers without need for extra panel holes. Life tested for one quarter million cycles. Available in black or clear anodized finish, with or without lock.

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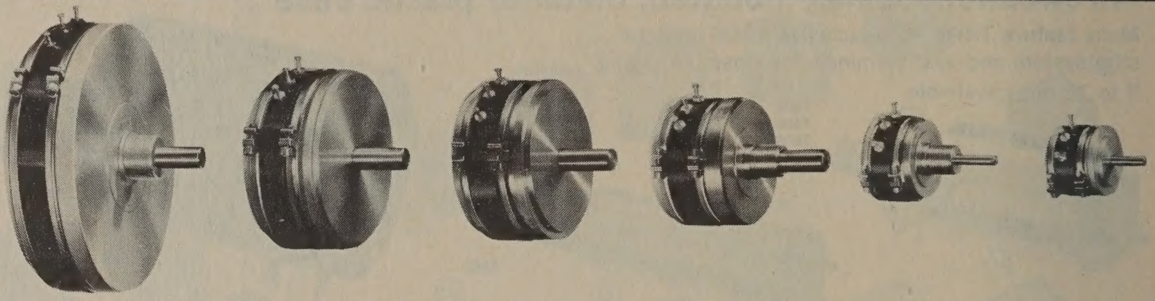
TRW IRC POTENTIOMETERS

PRECISION POTENTIOMETERS
7/8″ to 3″ Diameter 1 to 6 Watts



These high performance devices will equal or exceed the appropriate military specifications, as well as those of competitive devices.

Factory services will supply a wide range of mechanical, electrical and environmental modifications. Standard options include special shafts, shaft seals, stops, anti-rotation pins . . . multicup assembly, voltage taps, 1% T.R. tolerance and independent linearity as low as 0.1%.

SPECIFICATIONS

Mfr's Model	Size	Mounting	Linearity*	Power	Torque Starting/ Running	Weight Oz. (gm)	Resistance Range
0871-0001	.875 Dia. x .620	Servo ⅛ Shaft	±.5	1W @ 70°C	0.15	0.6	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
0871-0002	.875 Dia. x .645	Bushing ⅛ Shaft	±.5	1W @ 70°C	0.15	0.6	
1061-0001	1.062 Dia. x .67	Servo ⅛ Shaft	±.5	1.5W @ 70°C	0.15	0.8	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
1061-0002	1.062 Dia. x .645	Bushing ⅛ Shaft	±.5	1.5W @ 70°C	0.15	0.8	
1441-0001	1.437 Dia. x .800	Servo ¼ Shaft	±.5	2W @ 70°C	0.5	1.7	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
1441-0002	1.437 Dia. x .850	Bushing ¼ Shaft	±.5	2W @ 70°C	0.5	1.7	
1751-0001	1.750 Dia. x .800	Servo ¼ Shaft	±.25	2.5W @ 70°C	0.5	2.2	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
1751-0002	1.750 Dia. x .850	Bushing ¼ Shaft	±.25	2.5W @ 70°C	0.5	2.3	
2001-0001	2.00 Dia. x .800	Servo ¼ Shaft	±.25	4W @ 70°C	0.5	3	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
2001-0002	2.00 Dia. x .850	Bushing ¼ Shaft	±.25	4W @ 70°C	0.5	3	
3001-0001	3.00 Dia. x .800	Servo ¼ Shaft	±.25	6W @ 70°C	0.5	5.5	50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K
3001-0002	3.00 Dia. x .850	Bushing ¼ Shaft	±.25	6W @ 70°C	0.5	5.3	

% RESOLUTION

Model	50Ω	100Ω	200Ω	500Ω	1KΩ	2KΩ	5KΩ	10KΩ	20KΩ	50KΩ	100KΩ
0871	.361	.292	.233	.173	.152	.149	.107	.090	.070	.059	—
1061	.301	.231	.188	.140	.115	.131	.106	.085	.067	.052	—
1441	.253	.201	.172	.143	.106	.087	.093	.072	.058	.044	—
1751	.228	.179	.137	.113	.097	.076	.081	.071	.047	.039	—
2001	—	.177	.138	.111	.089	.066	.071	.065	.044	.033	.027
3001	—	.125	.099	.076	.062	.050	.038	.041	.033	.027	.025

ELECTRICAL CHARACTERISTICS

Resistance Tolerance: ±3%
Effective Electrical Angle: 350° ±2°
End Settings: 1Ω or 0.1% whichever is greater
Noise Ohms ENR: 100 maximum
Dielectric Strength: MIL-R-12934
Sea Level: 1,000 volts AC minimum
Insulation Resistance, 500 volts DC: 1,000 megohms min.

MECHANICAL & PHYSICAL CHARACTERISTICS

Mechanical Angle: Continuous
Shaft Runout: .001 in. (.025mm) T.I.R.
Shaft End Play: .005 in. (.127mm) T.I.R.
Shaft Radial Play: .002 in. (.051mm) T.I.R.
Pilot Surface Runout: .0015 in. (.0381mm) T.I.R.
Lateral Runout: .002 in. (.051mm) T.I.R.
Rotational Life: 1,000,000 shaft revolutions

MECHANICAL & PHYSICAL CHARACTERISTICS (Cont'd)

Moment of Inertia: 16.0 gm cm²
Ganging: 15 cups maximum
Terminals: Gold plated turrets

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range: −65°C to 125°C
Temperature Coefficient of Wire: 20 ppm/°C maximum
Humidity: MIL-R-12934, humidity cycling
Vibration: MIL-R-12934, high frequency
Wiper Bounce: 0.1 millisecond maximum
Wiper Shift: 1.0% maximum
Shock: MIL-R-12934, 100G
Wiper Bounce and Wiper Shift: Same as vibration
Rotational Load Life: MIL-R-12934 par. 4.6.20.2, 1,000 hrs.
Resistance Shift: 5.0% maximum
Salt Spray: MIL-R-12934

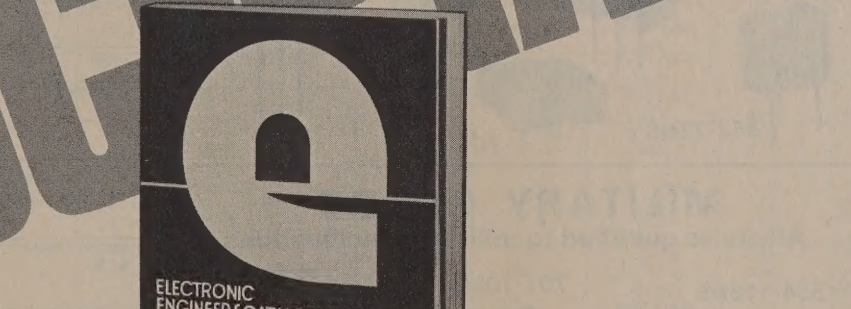
TRW/IRC POTENTIOMETERS, an ELECTRONIC COMPONENTS DIVISION OF TRW INC. 2801 — 72nd St. North, ST. PETERSBURG, FLA. 33733 (813) 347-2181 TWX 810-863-0357

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe and the United Kingdom. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

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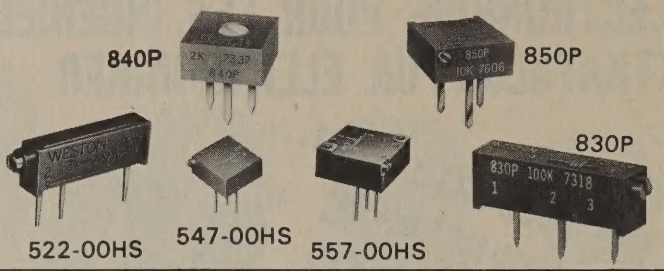
Schlumberger

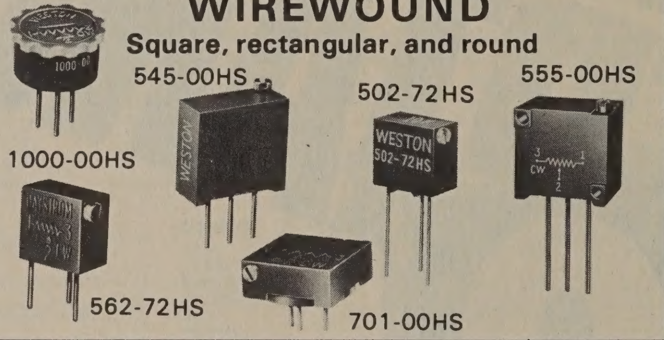
WESTON COMPONENTS & CONTROLS
A Division of Sangamo Weston, Inc.
Archbald, Pa. 18403
Tel. (717) 876-1500
TWX 510 656-2902
Telex 83-1873

WESTON

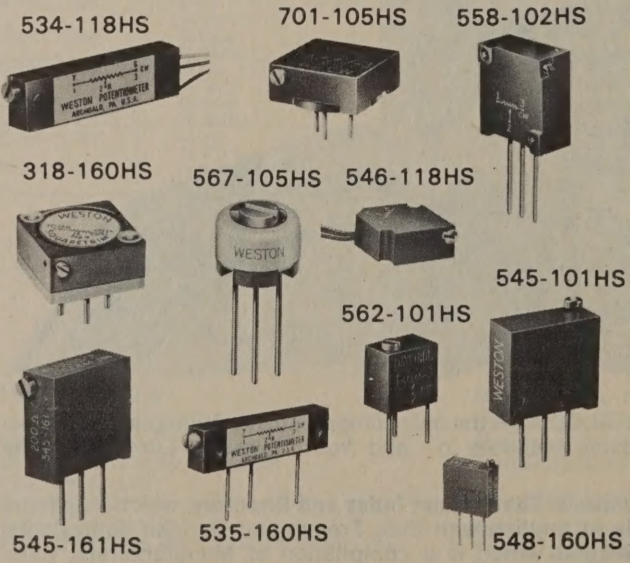
GENERAL PURPOSE CERMET
Square, rectangular, and round


840P
850P
830P
522-00HS
547-00HS
557-00HS

GENERAL PURPOSE WIREWOUND
Square, rectangular, and round


1000-00HS
545-00HS
502-72HS
555-00HS
562-72HS
701-00HS

MILITARY GRADE
All styles qualified to military specifications


534-118HS
701-105HS
558-102HS
318-160HS
567-105HS
546-118HS
545-101HS
562-101HS
545-161HS
535-160HS
548-160HS

NOTES:
- All units are humidity resistant per MIL-STD-202, Method 106.
- Model 1000 & 567-105HS contain solid stops. All other units are manufactured with slip clutch (wiper idles) for mechanical protection.

DESCRIPTION	MODEL	TERM.
¾" Rect. Comm.	830P †	P
⅜" Sq. Comm.	840P †	P
⅜" Sq. Comm.	850P †	P
½" Rect.	522-00HS	P
⅜" Sq	546-00HS	L
	547-00HS	P
	548-00HS	W
	548-72HS	X
½" Sq.	556-00HS	L
	557-00HS	P
	558-00HS	W
	558-72HS	X
½" Round	1000-00HS	P
	1000-67HS	P
⅜" Sq.	543-00HS	L
	544-00HS	P
	545-00HS	W
	545-72HS	X
½" Sq.	553-00HS	L
	555-00HS	W
	555-72HS	X
¼" Sq.	561-00HS	P
	562-00HS	W
	562-72HS	X
½" Sq.	701-00HS	P
5/16" Sq.	501-00HS	P
	502-00HS	W
	502-72HS	X
MIL-R-27208/8 1¼" Rect.	534-118HS	L
	535-105HS	P
	539-105HS	Y
MIL-R-27208/9 ⅜" Sq.	543-118HS	L
	544-105HS	P
	545-101HS	W
	545-102HS	X
MIL-R-27208/4 ½" Sq.	553-118HS	L
	555-101HS	W
	555-102HS	X
	701-105HS	P
MIL-R-27208/10 ¼" Sq.	561-105HS	P
	562-101HS	W
	562-102HS	X
MIL-R-22097/4 Char. "F" ⅜" Sq.	546-118HS	L
	547-105HS	P
	548-101HS	W
	548-102HS	X
	'C' Characteristic also available	
MIL-R-22097/3 Char. "C" ½" Sq.	556-118HS	L
	557-105HS	P
	558-101HS	W
	558-102HS	X
MIL-R-22097/6 ¼" Round Char. "C"	567-105HS	P
MIL-R-39015/1 1¼" Rect.	534-160HS	L
	535-160HS	P
	539-160HS	Y
MIL-R-39015/2 ½" Sq.	313-160HS	L
	318-160HS	P
	701-160HS	P
	555-160HS	W
	555-161HS	W
MIL-R-39015/3 ⅜" Sq.	543-160HS	L
	544-160HS	P
	545-160HS	W
	545-161HS	X
MIL-R-39035/2 ⅜" Sq.	546-160HS	L
	547-160HS	P
	548-160HS	W
	548-161HS	X

Prices and specifications subject to change without notice.

TRIMMERS

SANGAMO WESTON
Schlumberger

MILIT. DESIG.	TURNS	SIZES L W T	POWER RATING (W)	T.C. + PPM/°C	RES. TOL. %	RES. RANGE (OHMS)		PRICES	
							1-9	10-24	25-49
N.A. † Other Models available.	15	.75 x .25 x .19 Consult Factory.	.75 @ 70°C	100	10%	10 - 2 Meg.	1.35	1.28	1.26
N.A. † Other Models available.	1	.375 x .375 x .188 Consult Factory.	.5 @ 70°C	100	10%	10 - 2 Meg.	.75	.69	.64
N.A. † Other Models available.	22	.375 x .375 x .187 Consult Factory.	.5 @ 70°C	100	10%	10 - 2 Meg.	1.49	1.44	1.34
	10	.50 x .17 x .10	3 @ 85°C	100	10%	100 - 1 Meg.	3.63	3.48	3.22
N.A.	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x 170	.5 @ 85°C	100	10%	10 - 1 Meg.	5.25	5.02	4.77
N.A.	35	.500 x .500 x .187 .500 x .500 x .200 .535 x .500 x .220 .535 x .500 x .220	.5 @ 85°C	100	10%	50 - 1 Meg.	5.05	4.72	4.32
N.A.	1	.50 Diam. x .310	1 @ 70°C	50	5%	10 - 15K 20K - 35K 50K	2.60 2.86 3.15	2.30 2.53 2.78	2.09 2.30 2.53
N.A.	1	.500 Diam. x .240	1 @ 70°C	50	5%	10 - 15K 20K - 35K 50K	2.50 2.75 3.03	2.20 2.42 2.66	1.99 2.19 2.41
N.A.	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x .170	1 @ 70°C	50	5%	10 - 10K 20K 50K	5.25 5.75 6.25	5.02 5.52 6.02	4.77 5.27 5.77
N.A.	35	.500 x .500 x .187 .535 x .500 x .220 .535 x .500 x .220	1 @ 70°C	50	5%	10 - 15K 20K - 25K 50K	5.48 5.67 5.85	5.10 5.29 5.48	4.73 4.92 5.10
N.A.	13	.250 x .250 x .170	.25 @ 70°C	50	5%	10 - 5K 10K - 20K 25K	6.50 7.50 8.50	6.18 7.18 8.18	5.85 6.85 7.85
N.A.	37	.500 x .500 x .230	1 @ 70°C	50	5%	10 - 15K 20K	5.48 5.67	5.10 5.29	4.73 4.92
N.A.	15	.312 x .312 x .175	.6 @ 70°C	70	5%	10 - 10K 20K	5.27 6.03	4.73 5.49	4.20 4.96
		.312 x .312 x .200 .312 x .312 x .190				10 - 10K 20K	3.62 4.15	3.26 3.78	2.89 3.41
RT12C2L RT12C2P RT12C2Y	24	1.25 x .315 x .190 1.25 x .315 x .190 1.25 x .325 x .195	.75 @ 85°C	50	5%	10 - 10K 20K 50K* 100K*	5.40 5.69 6.50 7.50	4.78 5.27 6.00 7.16	4.47 4.94 5.61 6.50
RT24C2L RT24C2P RT24C2W RT24C2X	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x .170	.75 @ 85°C	50	5%	10 - 10K 20K* - 25K* 10 - 10K 20K* - 25K*	7.36 8.05 6.40 7.00	6.69 7.27 5.82 6.32	6.19 6.76 5.38 5.88
RT22C2L RT22C2W	35 35	.500 x .500 x .187 .535 x .500 x .220	.75 @ 85°C	50	5%	50 - 10K 20K	5.41 5.95	5.11 5.62	4.84 5.34
RT22C2X RT22C2P	35 37	.535 x .500 x .220 .500 x .500 x .230				50 - 10K 20K	4.70 5.17	4.44 4.89	4.21 4.64
RT26C2P RT26C2W RT26C2X	13	.250 x .250 x .170 .250 x .250 x .170 .250 x .250 x .170	.25 @ 85°C	50	5%	10 - 5K 10K* - 20K* 25K*	6.60 7.60 8.60	6.28 7.28 8.28	5.95 6.95 7.95
RJ24FL RJ24FP RJ24FW RJ24FX	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x .170	.50 @ 85°C	100	10%	50 - 1 Meg.	6.15	5.89	5.60
RJ22CL RJ22CP RJ22CW RJ22CX	35	.500 x .500 x .187 .500 x .500 x .220 .535 x .500 x .220 .535 x .500 x .220	.5 @ 85°C	100	10%	200 - 1 Meg.	5.59	5.23	4.81
RJ50CP	1	.260 Diam. x .210	.25 @ 85°C	250	10%	10 - 1 Meg.	5.39	4.95	4.62
RTR12DL RTR12DP RTR12DY	24	1.25 x .315 x .190 1.25 x .315 x .190 1.25 x .325 x .195	.75 @ 85°C	50	5%	100 - 20K 50K*	13.75 14.85	12.65 13.75	11.55 12.65
				RTR12DL-M & P Level Failure Rate; RTR12DP & RTR12DY-M Level Failure Rate					
RTR22DL RTR22DP	45	.500 x .500 x .187 .500 x .500 x .255	.75 @ 85°C	50	5%	200 - 10K 20K M, P Level Failure Rate	10.24 11.29	9.71 10.76	9.19 10.24
						200 - 10K 20K R Level Failure Rate	14.03 15.13	12.93 14.03	11.83 12.93
RTR22DP	37	.500 x .500 x .230	.75 @ 85°C	50	5%	10 - 10K 20K M, P Level Failure Rate	10.24 11.29	9.71 10.76	9.19 10.24
RTR22DW RTR22DX	35 35	.535 x .500 x .220 .535 x .500 x .220	.75 @ 85°C	50	5%	100 - 10K 20K M, P Level Failure Rate	10.24 11.29	9.71 10.76	9.19 10.24
RTR24DL RTR24DP RTR24DW RTR24DX	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x .170	.75 @ 85°C	50	5%	10 - 100** 200 - 10K 20K* - 25K* 50K*	8.20 8.20 9.84 11.48	7.50 7.50 9.00 10.50	6.70 6.70 8.04 9.38
				RTR24DP - M & P Level Failure Rate; RTR24DL, RTR24DW, RTR24DX - M Level Failure Rate					
RJR24CL RJR24CP RJR24CW RJR24CX	25	.375 x .375 x .150 .375 x .375 x .170 .417 x .375 x .170 .417 x .375 x .170	.5W @ 85°C	250	10%	10 - 1 Meg.	11.30	10.50	10.00
				(Char. "C" - 10 ohms thru 1 Meg.)		(Char. "F" 100 ohms thru 100K) - M & P Level Failure Rate			

*Non-Standard military value

**Non-QPL Resistance values

HEATSINKS

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OVER 260 SHAPES Largest selection of extruded heatsinks. Write or call for Catalog #77

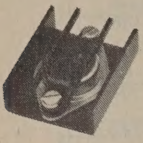


FIG. A

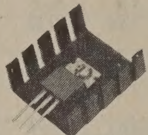


FIG. B

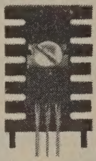
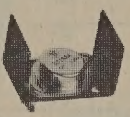


FIG. C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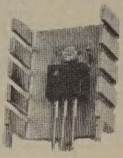
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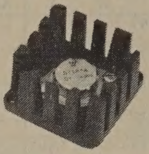
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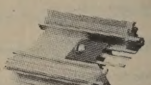
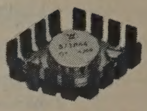


FIG. G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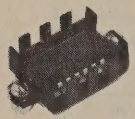
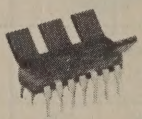


FIG. I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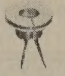
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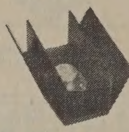
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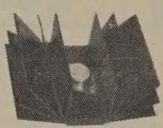
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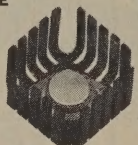
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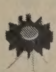
FIG. O

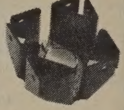
FIG. P

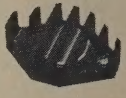
FIG. Q

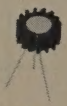
FIG. R

SERIES 5100 Popular 2 piece heat sink designed for circuit board mounting. The top and the base may be ordered separately.

Part Number	Figure	For Case Style	Size, Inches			TR °C/W
			L	W	H	
5166B	A	TO-66	1-32	.89	.609	14
5166C	A	TO-66	1.32	.89	.609	14
5166B (Base)	A	TO-66	1.32	.89	.609	16

SERIES 5200 Designed to maximize heat transfer unitizing a 2 piece heat sink. Black anodized base may be ordered with a gold chromate uninsulated top where electrical contact is needed.

5203B	A	TO-3	1.53	1.25	.515	12
5203C	A	TO-3	1.53	1.25	.515	12
5203B (Case)	A	TO-3	1.53	1.25	.515	14

SERIES 5300 Lightweight heat sink for plastic power semiconductors. The 5307 accommodates one device, and the 5306 accommodates one or two devices. Excellent for circuit board applications.

5306B	B	Blank	1.18	1.00	0.50	19
5306B-13	B	Two Holes (Plastic Power)	1.18	1.00	0.50	19
5307B	B	Blank	0.71	1.00	0.50	25
5307B-14	B	Two Holes (Plastic Power)	0.71	1.00	0.50	25

SERIES 5425 & 5632 Low cost — space saving, vertically mounted heat sink for plastic power semiconductors. Nickel plated units are available where soldering of mounting tabs are desired.

5425B	C	Plastic Power	1.41	0.88	0.25	22.0
5425C	C	Plastic Power	1.41	0.88	0.25	25.0
5425D	C	Plastic Power	1.41	0.88	0.25	31.0
5632B	C	Plastic Power	2.19	1.38	0.50	8.8
5632D	C	Plastic Power	2.19	1.38	0.50	9.7
5634B	C	Plastic Power	2.19	1.38	0.50	8.8
5634D	C	Plastic Power	2.19	1.38	0.50	9.7

SERIES 5500 Low cost cooling for TO-3 or TO-66 case styles.

5531B-3	D	TO-3	1.00	1.63	1.0	13
5531C-3	D	TO-3	1.00	1.63	1.0	13
5531B-66	D	TO-66	1.00	1.63	1.0	13
5531C-66	D	TO-66	1.00	1.63	1.0	13

SERIES 5600 Vertically mounted — low cost — heat sink for plastic power transistors, Triacs, and SCR's. Mounting tabs designed for either soldering (nickel finish) or bending.

5630B	E	Plastic Power (One Slot)	1.38	1.00	0.500	10
5630C	E	Plastic Power (One Slot)	1.38	1.00	0.500	11
5630D	E	Plastic Power (One Slot)	1.38	1.00	0.500	14

SERIES 5000 Series 5000 is ideal for circuit board applications where space is a premium. It provides free circulation of air from all sides and accepts all popular semiconductors case styles.

5000-005-TO-3	F	TO-3	1.81	1.81	0.50	7.3
5000-0075-TO-3	F	TO-3	1.81	1.81	0.75	6.1
5000-010-TO-3	F	TO-3	1.81	1.81	1.00	5.4
5000-0125-TO-3	F	TO-3	1.81	1.81	1.25	5.0

SERIES 60130 The new Series 60130 heat sink was specifically designed for the tab mount plastic case type semiconductor. Available with pins for circuit board solder mount or without pins for a self-threading screw mount. Longer lengths available upon request.

60130-010	G	Plastic Power (3 Holes)	1.0	1.38	0.50	13.6
60130-010-P	G	Plastic Power (3 Holes)	1.0	1.38	0.50	13.6
60130-015	G	Plastic Power (3 Holes)	1.5	1.38	0.50	12.0
60130-015-P	G	Plastic Power (3 Holes)	1.5	1.38	0.50	12.0

SERIES 5013 Minimum amount of board space required and at a very low cost.

5013B	H	TO-3	1.88	1.40	0.50	14.0
5014B	H	TO-3	1.88	1.40	0.75	12.0
5015B	H	TO-3	1.88	1.40	1.00	10.0
5016B	H	TO-3	1.88	1.40	1.25	8.0

SERIES 5007 Two piece interated circuit package heat sink removes heat from both top and bottom. Designed for 14 and 16 pin dual in line up to 0.82″ in length.

Part Number	Figure	For Case Style	Size, Inches			TR °C/W
			L	W	H	
5007A	I	IC's 14 and 16 Pins	1.24	0.75		28

SERIES 5010 One piece heat sink for 14 and 16 pin integrated circuit package. Bonded with AAVID's Ther-O-Bond 1500 for maximum thermal efficiency.

5010B	J	IC's 14 and 16 Pins	0.75	0.604	.177	35
5010C	J	IC's 14 and 16 Pins	0.75	0.604	.177	38

SERIES 3225 Low cost heat sink that is easy to install.

Part Number	Figure	For Case Style	Size, Inches		TR °C/W
			Dia.	H	
3225B	K	TO-5	0.75	0.40	50
3225C	K	TO-5	0.75	0.40	
3226B	K	TO-5	0.75	0.40	60
3226C	K	TO-5	0.75	0.40	

SERIES 60495R & 60150R Extruded heat sink designed for minimum amount of mounting space. The Model 60150R incorporates the highly efficient radial fin design.

60495R-3B	L	Blank	3.0	1.39 (Base)	1.50	2.8
60495R-3B-H1	L	TO-3	3.0	1.39 (Base)	1.50	2.8
60150R-3B	M	Blank	3.0	3.96	1.60	1.7
60150R-3B-H1	M	TO-3	3.0	3.96	1.60	1.7

SERIES 5051 High performance — economical 5051 thru 5059. One piece heat sink for TO-3 and TO-66 devices, saves additional labor and cost by allowing device and sink to be mounted with same hardware.

5051B	N	TO-3	1.78	1.78	0.50	6.9
5052B	N	TO-3	1.78	1.78	0.75	6.3
5053B	N	TO-3	1.78	1.78	1.00	5.7
5054B	N	TO-3	1.78	1.78	1.25	5.3
5056B	N	TO-66	1.78	1.78	0.50	6.9
5057B	N	TO-66	1.78	1.78	0.75	6.3
5058B	N	TO-66	1.78	1.78	1.00	5.7
5059B	N	TO-66	1.78	1.78	1.25	5.3

SERIES 3230-5 The 3230-5 heat sink provides extra surface area for cooling. May be secured using boss which clears a 4-40 screw.

Part Number	Figure	For Case Style	Size, Inches		TR °C/W
			Dia.	H	
3230B-5	O	TO-5	0.75	0.25	43
3230C-5	O	TO-5	0.75	0.25	

SERIES 5690 Highest power dissipation per unit cost.

5690B-3	P	TO-3	1.83	1.83	1.31	4.5
5690B-66	P	TO-66	1.83	1.83	1.31	4.5

SERIES 5423 Space saving — clamps over the TO-3 case using virtually no additional board space.

5423	Q	TO-3	1.56	1.06	0.50	85
5425	Q	TO-3	1.56	1.06	0.75	63
5427	Q	TO-3	1.56	1.06	1.00	

SERIES 3201 Low cost TO-5 heat sink provides a very high ratio of heat dissipation to volume occupied. Ideal for components card applications.

Part Number	Figure	For Case Style	Size, Inches		TR °C/W
			Dia.	H	
3201B	R	TO-5	0.50	0.25	65

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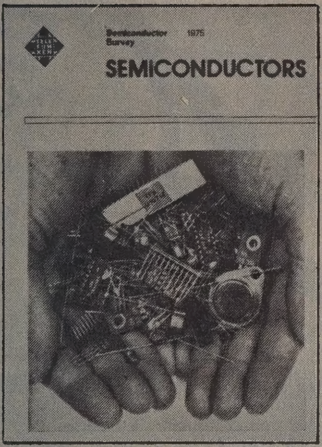
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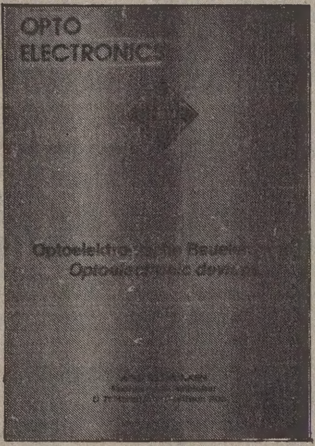
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DELCO'S NEW 25-AMPERE HIGH VOLTAGE DARLINGTONS WITH THE SPEED AND ENERGY CAPABILITY YOU ASKED FOR.

Good news for motor speed control designers who have expressed a need to upgrade horsepower ratings. The 25-ampere gain of these new Darlingtons permits increased horsepower ratings of existing AC motor speed control systems and a reduction in paralleling in new designs. However, grouping of t_{off} is available for current sharing in designs with parallel Darlingtons. A speed-up diode is built into the DTS-4074 and DTS- 4075 permitting data sheet t_f typicals of 1.0 μs. Drive circuit techniques involving $I_{B2} \geqq 2$ A and a Baker clamp produce t_f typicals in the 0.4-0.6 μs range for the DTS-4066, DTS-4067, DTS-4074, and DTS-4075.

Our experience with tolerances, faults, transients, and start-stall conditions in most systems convinces us that these Darlingtons have the right trade-off between speed and peak power handling capability. Note the greater than 10 kVA region of the reverse bias safe operating graph. All this, and you still get Delco's traditional solid copper TO-3 hermetic package that has a conservative 0.75°C/W thermal resistance.

These Darlingtons are already in high volume production and are available on distributor shelves. Prices, applications literature, and data sheets from your nearest Delco sales office or Delco distributor can complete the story on these new Darlingtons.

MAJOR PARAMETER LIMITS

Type	h_{FE} @25A	h_{FE} @10A	V_{CEO} (sus)	V_{CE} (sat) @20A	I_{CEO} @600V
DTS-4066	5	75	350V	3.5V	0.25mA
DTS-4067	10	150	350V	2.0V	0.25mA
DTS-4074	5	75	350V	3.5V	0.25mA
DTS-4075	10	150	350V	2.0V	0.25mA

TYPICAL SWITCHING

	DTS-4066 DTS-4067	DTS-4074 DTS-4075
t_r	0.5μs	0.5μs
t_s	5.0μs	3.2μs
t_f	4.5μs	1.0μs

NPN triple diffused silicon Darlingtons are packaged in solid copper cases conforming to JEDEC TO-3 outline dimensions.

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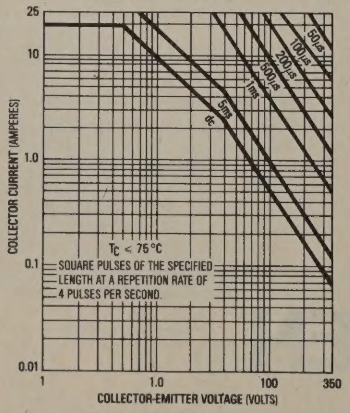

Features of Delco's new DTS-4066, 4067, 4074, 4075 Darlingtons.

☐ Upgrade existing motor speed control horsepower r

☐ Reduce need for paralleling in new systems.

☐ Offer switching speed improvements over our earlier types.

☐ Achieve greater than 10 kVA peak power dissipation.

☐ Available with t_{off} grouping.

☐ Delco hermetic copper package with 0.75°C/W.

☐ Currently in high volume production.

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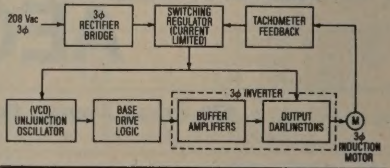
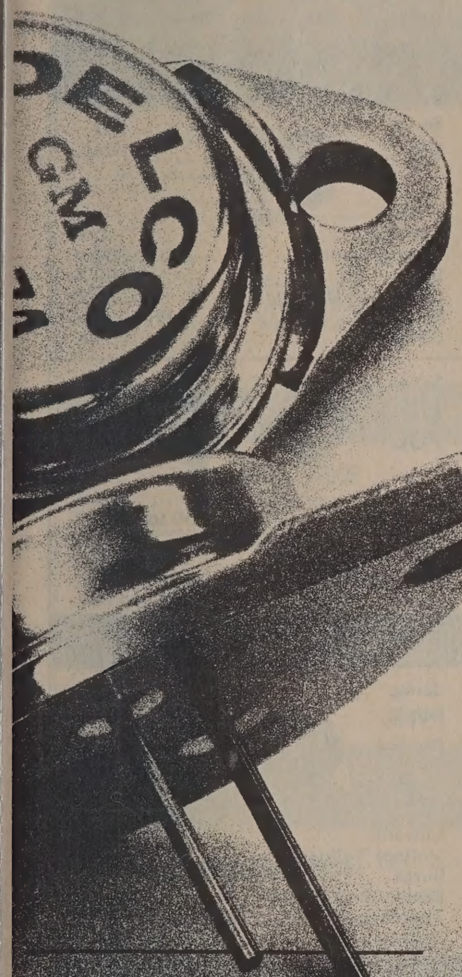
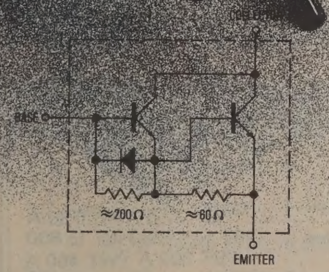
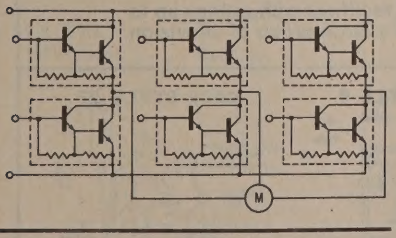






SPEED-UP DIODE USED ON DTS-4074/4075 ONLY

3ϕ DARLINGTON INVERTER DTS-4066-4067



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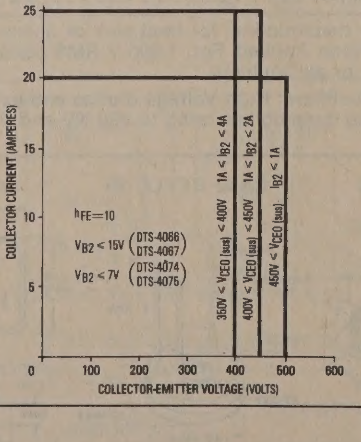

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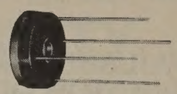

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Current	6 A
Voltage Ratings	50 to 800 V
Surge	100 A
Dimension Drawing	26
Terminals	Wire Leads
Series	PM

Series
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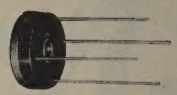

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Current	10 A
Voltage Ratings	50 to 800 V
Surge	150 A
Dimension Drawing	26
Terminals	Wire Leads
Series	PK

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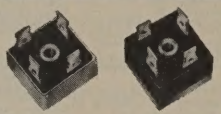
PK-F

12 Amp.

Current	12 A
Voltage Ratings	50 to 800 V
Surge	150 A
Dimension Drawing	27
Terminals	.250 Quick Connect
Series	PK-F

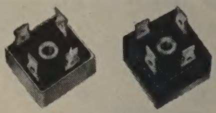
Series
PA
PAL



15 Amp.

Current	15 A
Voltage Ratings	50 to 1000 V
Surge	200 A
Dimension Drawing	3 and 4
Terminals	.250 Quick Connect
Series	PA and PAL

Series
PB
PBL



25 Amp.

Current	25 A
Voltage Ratings	50 to 1000 V
Surge	300 A
Dimension Drawing	3 and 4
Terminals	.250 Quick Connect
Series	PB and PBL

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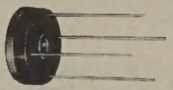
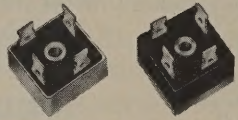


8 Amp.

Current	8 A
Voltage Ratings	50 to 800 V
Surge	125 A
Dimension Drawing	26
Terminals	Wire Leads
Series	PKR

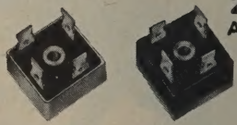
Series
PBR
PBRL



15 Amp.

Current	15 A
Voltage Ratings	50 to 1000 V
Surge	200 A
Dimension Drawing	3 and 4
Terminals	.250 Quick Connect
Series	PBR and PBRL

Series
PWR
PWRL



25 Amp.

Current	25 A
Voltage Ratings	50 to 800 V
Surge	350 A
Dimension Drawing	3 and 4
Terminals	.250 Quick Connect
Series	PWR and PWRL

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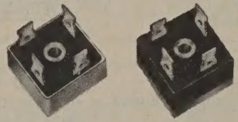
Series
PW
PWL



30 Amp.

Current	30 A
Voltage Ratings	50 to 800 V
Surge	400 A
Dimension Drawing	3 and 4
Terminals	.250 Quick Connect
Series	PW and PWL

Series
PZ

30 Amp.

Current	30 A
Voltage Ratings	50 to 400 V
Surge	1000 A
Dimension Drawing	3
Terminals	.250 Quick Connect
Series	PZ

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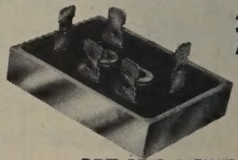
PBT
&
PWT



30 Amp.

Current	PBT 27.5 A PWT 30 A
Volt. Rate	PBT to 1000 PWT to 800
Surge	PBT 300 A PWT 400 A
Dimension Drawing	9
Terminals	.250 Quick Connect
Series	PBT & PWT

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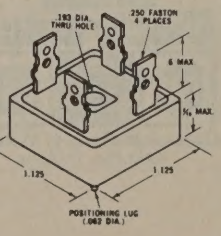
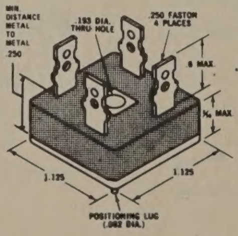
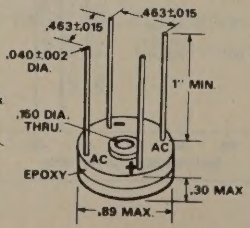

.193 DIA
THRU HOLE
.250 FASTON
4 PLACES
6 MAX
¾ MAX
1.125
1.125
POSITIONING LUG
(.062 DIA.)

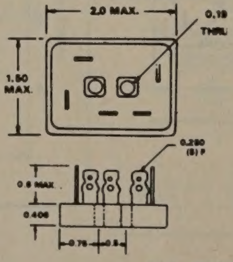
CASE STYLE 4


MIN.
DISTANCE
METAL
TO
METAL
.250
.193 DIA.
THRU HOLE
.250 FASTON
4 PLACES
6 MAX
¾ MAX
1.125
1.125
POSITIONING LUG
(.062 DIA.)

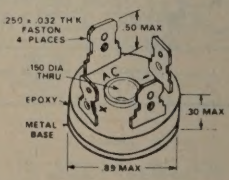
CASE STYLE 26


.463±.015
.463±.015
.040±.002
DIA.
1" MIN.
.150 DIA.
THRU.
AC
AC
EPOXY
.30 MAX
.89 MAX.

CASE STYLE 9


2.0 MAX.
0.19
THRU
1.50
MAX.
0.250
(8) P
0.8 MAX
0.400
0.75
0.5

CASE STYLE 27


.250 x .032 THK
FASTON
4 PLACES
.50 MAX
.150 DIA
THRU
AC
EPOXY
METAL
BASE
.30 MAX
.89 MAX

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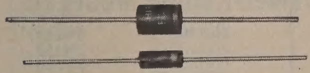
STANDARD RECOVERY DIODES

LOW VOLTAGE

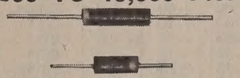


Series	A	PRV	Case
MC	1	800 to 1500	11
HAB	3	50 to 1000	12
HIB	3	800 to 1200	16

HIGH VOLTAGE 1000 TO 6000 PRV

Series	mA	PRV	Case
EF	500	1000 to 2000	11
EG	350	2000 to 3000	11
EH	250	3000 to 4000	11
EK	150	4000 to 6000	11
LK	50	1000 to 6000	11

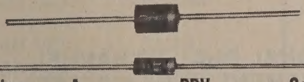
HIGH VOLTAGE 7000 TO 15,000 PRV



Series	mA	PRV	Case
AM	125	7000 to 8000	13
AP	100	9000 to 10,000	13
AR	80	11,000 to 12,000	13
VT	25	10,000 to 15,000	16A

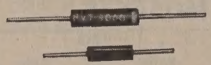
FAST RECOVERY DIODES

LOW VOLTAGE 150/250 ns



Series	A	PRV	Case
RC	1	50 to 1000	11
RAB	3	50 to 1000	12
RJB	3	50 to 800	16
RWB	5	50 to 800	16

HIGH VOLTAGE 300 ns

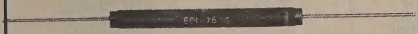


Series	mA	PRV	Case
DR	25	3000 to 12,000	15
DL	25	3000 to 12,000	31
RVT	25	10,000 to 15,000	16A

HIGH VOLTAGE 250/200 ns

Series	mA	PRV	Case
RF	500	1000 to 2000	11
RAG	350	2000 to 3000	13
RK	150	4000 to 6000	11
RAM	125	7000 to 8000	13
RAP	100	9000 to 10,000	13
RAR	80	11,000 to 12,000	13

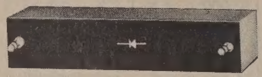
CARTRIDGES



Series	mA	KV	Case
BCD	100	8 to 50	24
NTD	200/250	8 to 50	23
LHC	5/25	8 to 40	22
RTD*	100	8 to 50	22
RHC*	5/25	8 to 40	22

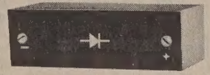
*Fast Recovery Types

PACKS



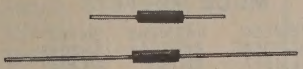
Series		KV	Case
KVF	500mA	5 to 25	17
KVP	.75/1A	5 to 50	19
KVO	1A	5 to 12	18
KHP	2.50/2.25A	5 to 50	20/21

FAST RECOVERY PACKS



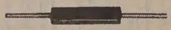
Series	A	KV	ns	Case
RVP	.7/.9	5 to 50	300	19
RHP	2.50/2.25	5 to 50	300	20/21

TV DIODES



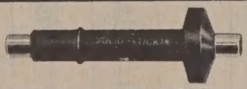
FOR MULTIPLIERS

Series	KV	mA @ °C	ns	Case
TR12	12	2.5 @ 75	300	15
QR12	12	2.5 @ 85	100	15
TL12	12	2.5 @ 75	300	31
QL12	12	2.5 @ 85	100	31



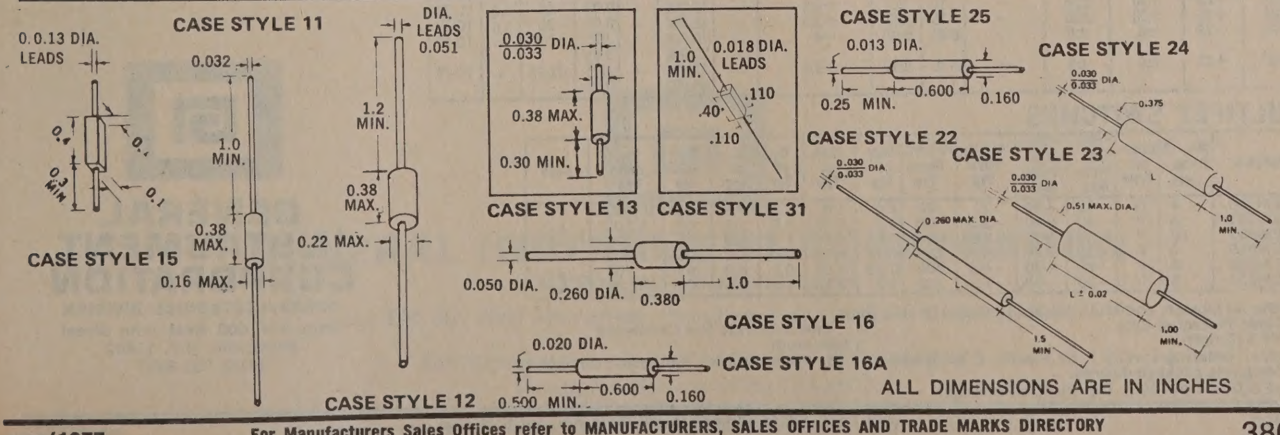
FOR BLACK/WHITE

Series	KV	mA @ °C	ns	Case
TR22	22	2.5 @ 75	300	25
TR30	30	1.7 @ 75	300	25



FOR HALF-WAVE

Series	KV	mA @ °C	ns
TVS	30	2 @ 85	300
TVSL	30	2 @ 85	300
R12C	45	2 @ 85	300


CASE STYLE 11
0.0.13 DIA.
LEADS
0.4
0.1
0.3 MIN
0.1
CASE STYLE 15
0.032
1.0
MIN.
0.38
MAX.
0.16 MAX.
DIA.
LEADS
0.051
1.2
MIN.
0.38
MAX.
0.22 MAX.
CASE STYLE 12
0.030
0.033
DIA.
0.38 MAX.
0.30 MIN.
CASE STYLE 13
1.0
MIN.
0.018 DIA.
LEADS
.110
.40
.110
CASE STYLE 31
0.050 DIA.
0.260 DIA.
0.380
1.0
CASE STYLE 16
0.020 DIA.
0.500 MIN.
0.600
0.160
CASE STYLE 16A
CASE STYLE 25
0.013 DIA.
0.25 MIN.
0.600
0.160
CASE STYLE 24
0.030
0.033
DIA.
0.375
L
1.0
MIN.
CASE STYLE 22
0.030
0.033
DIA
0.260 MAX. DIA.
L
1.5
MIN
CASE STYLE 23
0.030
0.033
DIA
0.51 MAX. DIA.
L ± 0.02
1.00
MIN.

ALL DIMENSIONS ARE IN INCHES

P-CHANNEL ENHANCEMENT MODE MOSFETS

Part No.	$V_{(BR)DSS}$ Volts Min	$V_{(BR)GSS}$ Volts Min	I_{DSS} nA Typ	I_{GSSF} nA Typ	$V_{GS(th)}$ Volts Min/Max	$r_{DS(on)}$ Ohms Typ	Y_{fs} µmho Typ	C_{iss} pF Typ	C_{rss} pF Typ	Case
*MEM511	−30	−30	−0.5	−0.05*	−3/−6	150	2,500	3.5	2.5	TO-72
*MEM517	−30	−25	−0.8	−0.15*	−2.5/−5	35	12,000	10.0	10.0	TO-33
MEM520	−30	−40	−0.5	−0.03pA	−3/−6	150	2,500	3.0	2.5	TO-72
*MEM560	−35	−35	−1.0	−0.1*	−1.5/−3	100	3,500	7.5	1.5	TO-72
MEM561	−30	−50	−1.0	−0.05pA	−1.5/−3	100	3,500	7.5	3.0	TO-72
*MEM575	−25	−25	−1.0	−0.2*	−1/−3.5	13	15,000	45.0	15.0	TO-72
*MEM803	−20	−20	−3.0	−0.2*	−2/−6.5	200	1,000	4.5	4.0	TO-72
MEM804	−30	−40	−2.0	−0.1pA	−1.5/−3	175	3,000	7.0	3.0	TO-72
MEM806	−40	−40	−1.0	−0.1pA	−2.0/−5.5	150	2,800	4.5	1.0	TO-72
*MEM807	−40	−40	−0.5	−0.1*	−2.0/−5.5	150	2,800	4.5	1.0	TO-72
*MEM814	−35	−35	−1.0	−0.1*	−1.5/−3.0	80	3,500	6.0	1.0	TO-72
*MEM816	−30	−30	−5.0	−0.2*	−2.0/−5.0	150	3,000	6.0	3.5	▲
MEM817	−45	±200	−0.1	−0.05pA	−2.5/−6.5	150	2,000	3.5	1.2	TO-72
MEM823	−35	±200	−0.1	−0.05pA	−2.5/−5.6	150	2,000	3.5	1.2	TO-18
MEM824	−30	−30	−0.5	−0.05pA	−2.5/−5.0	150	3,000	8.0	3.0	TO-72
2N3608	−25	−25	−1.0	−0.1pA	−4/−6	150	2,000	4.0	3.5	TO-33
*2N4353	−30	−30	−0.5	−0.1*	−3/−5	125	3,000	6.0	3.0	TO-72
3N145	−30	−50	−1.0	−1.0	−2.0/6.0	600	—	0.1	0.5	TO-72
3N146	−30	−50	−1.0	−.1	−2.0/6.0	600	—	0.1	0.5	TO-72
3N155	−35	−50	−0.4	−5.0	−1.5/−3.2	250	—	2.5	0.7	TO-72
3N156	−35	−50	−0.5	−5.0	−3.0/−5.0	300	—	2.5	0.7	TO-72
3N157	−35	−50	−0.5	−5.0	−1.5/−3.2	—	2,500	2.5	0.7	TO-72
3N158	−35	−50	−0.5	−5.0	−3.0/−5.0	—	2,500	2.5	0.7	TO-72
3N160	−25	−25	−5.0	−5.0pA	−1.5/−5.0	75	4,500	5.0	2.0	TO-72
3N163	−40	−40	−0.1	−.01	−2.0/−5.0	200	3,000	2.0	0.7	TO-72
3N173	−40	−40	−8.0	−0.3	−2.0/−5.0	300	3,000	3.0	0.8	TO-72
*3N179	−60	−45	−0.3	−0.2*	−4/−6	800	850	0.4	0.3	TO-72
*3N182	−30	−25	−1.0	−0.2*	−2.5/−5	40	10,000	12.0	7.0	TO-72
*3N185	−30	−30	−1.0	−0.1*	−1.5/−3	125	3,000	8.0	4.0	TO-72
*3N218	−25	−25	−0.1	−0.2*	−1.0/−3.5	−15	15,000	45.0	15.0	TO-72

ADDITIONAL P-CHANNEL ENHANCEMENT MODE MOSFETS

MEM511C
MEM517A
MEM517B
MEM517C
MEM520C
MEM556
MEM556C
MEM560C
MEM561C
MEM806A
MEM807A
2N4065
2N4120
2N4352
3N149
3N150
3N155A
3N156A
3N157A
3N158A
3N161
3N162
3N164
3N167
3N168
3N172
3N174
3N178
3N180
3N181
3N183
3N184
3N186

DUAL P-CHANNEL ENHANCEMENT MODE MOSFETS

Part No.	$V_{(BR)DSS}$ Volts Max.	I_{GSSF} nA Typ	$V_{GS(th)}$ Volts Min/Max	$r_{DS(on)}$ Ohms Typ	Y_{fs} µmho Typ	C_{gs} pF Typ	C_{rss} pF Typ	Y_{fs} Ratio Typ	$\Delta\|V_{G1S}-V_{G2S}$ mV Typ	Case
*MEM550	−30	−0.1*	−3/−6	250	1500	1.1	1.1	0.85	70	TO-77
MEM551	−30	−0.03pA	−3/−6	250	1000	1.1	1.1	0.9	70	TO-77
*MEM954A	−30	−0.03*	−2.0/−5.0	100	1000	2.0	1.5	0.95	15	TO-77
MEM955A	−35	−0.02pA	−2.0/−5.0	100	1000	2.0	1.5	0.95	15	TO-77
2N3609	−25	−0.02	−4.0/−6.0	450	1000	—	1.0	1.0	100	TO-77
2N4066	−30	−0.5	−3/−6	300	2900	4.0	0.6	0.85	100	TO-76
2N4067	−30	−0.5	−3/−6	125	4200	4.0	0.6	0.6	70	TO-76

ADDITIONAL DUAL P-CHANNEL ENHANCEMENT MODE MOSFETS

MEM550C
MEM551C
MEM954
MEM954B
MEM955
MEM955B
3N147
3N148
3N151
3N165
3N166
3N188
3N189
3N190
3N191
3N207
3N208

N-CHANNEL ENHANCEMENT MODE MOSFETS

Part No.	BV_{DSS} Max Volts	$V_{(BR)GSS}$ Volts Max	I_{DSS} nA Typ	I_{GSSF} nA Typ	$I_{D(on)}$ mA Typ	$V_{GS(th)}$ Volts Min/Max	$r_{DS(on)}$ Ohms Typ	Y_{fs} µmho Typ	C_{iss} pF Typ	C_{rss} pF Typ	Case
MEM562	20	±30	1	1pA	15	0.5/4	150	2,500	3	0.3	TO-72
MEM563	20	±30	1	1pA	40	0.5/4	40	5.000	4	0.3	TO-72
*MEM660	20	+30	—	—	60	−0.3/−4	30△	10,000	4.5	0.3	TO-72
*MEM711	25	±30	1	0.1*	40	0.5/1.5	50	3,000	4.5	0.5	TO-72
*MEM712	25	±30	1	.01	40	0.5/2.0	50	2,500	4.5	0.5	▲
3N169	25	±35	10	0.01	8mA	0.5/1.5	150	4,000	5	1.3	TO-72
3N176	25	±30	3	30pA	20	1/2.5	200	2,000	4	0.4	TO-72
3N242	20	±30	1	.01*	40	1/2.0	50	3,000	4.5	0.5	TO-72

ADDITIONAL N-CHANNEL ENHANCEMENT MODE MOSFETS

MEM562
MEM563
MEM712A
MEM713
2N4038
2N4351
3N170
3N171
3N175
3N177

N-CHANNEL DEPLETION MODE MOSFETS

Part No.	$V_{(BR)DS}$ Volts Max	$V_{(BR)G1S}$ Volts Max	$V_{(BR)G2S}$ Volts Max	$V_{(BR)DG}$ Max Volts	I_{DSS} mA Typ	I_{GSS} nA Typ	$V_{GS(off)}$ Volts Min/Max	$r_{DS(on)}$ Ohms Typ	Y_{fs} µmho Typ	C_{iss} pF Typ	C_{rss} pF Typ	Hi Freq G_{ps} dB Typ	Hi Freq NF dB Typ	Case
*MEM610	+25	±6	±6	—	10	50X	−6	—	17,000	5.0	0.03	25	4.5	TO-72
*MEM616	+25	±6	±6	+31	10	20*	−1.5G1−4.0G2	—	18,000	5.4	0.02	18	3.0	TO-72
*MEM617	+20	±6	±6	+31	6	20	−1.0G1−4.0G2	—	4,000	6.0	0.02	17	3.0	TO-72
*MEM618	+20	±6	±6	+31	10	20*	−1.5G1−4.0G2	—	14,000	5.1	0.02	30	2.5	TO-72
*MEM630	+25	±6	±6	+25	6	20*	−4.0G1−2.0G2	—	14,000	6	0.03		2.5	▲
*MEM631	+25	±6	±6	+25	10	20*	−4.0G1−3.0G2	—	16,000	6	0.03		3.5	▲
*MEM632	+25	±6	±6	+25	6	20*	−4.0G1−2.0G2	—	—	6	0.03			▲
*MEM636	+25	±6	±6	—	4-30	50X	−4	—	18,000	5.4	0.02	21	2.5	▲
*MEM637	+25	±6	±6	—	2-20	50X	−4	—	4,400	6.0	—	18	—	▲
*MEM638	+25	±6	±6	—	3-20	50X	−4	—	14,000	5.1	0.02	30	—	▲
*MEM639	+25	±6	±6	—	10	50X	−6	—	17,000	5.0	0.03	25	4.5	▲
*MEM655	+20	±6	—	+30/−6	4	±10*	−/−4△	30	10,000	4	0.32	22	2.5	TO-72
*MEM660	±20	+30/−20	—	+30/−20	3	A*	−.3/−4△	30	10,000	4.5	0.30	—	—	TO-72
MEM667	+20	±100	—	3	—	.05pA	−4△	—	2,000	2.0	0.3	—	—	TO-72
MEM670	+20	±100	—	3	—	.05pA	−4△	—	2,000	2.0	0.3	—	—	TO-18
*MEM680	+25	±6	±6	—	4-30	50X	−4	—	18,000	5.4	0.02	21	2.5	TO-72
*MEM681	+25	±6	±6	—	2-20	50X	−4	—	4,400	6.0	—	18	—	TO-72
*MEM682	+25	±6	±6	—	3-20	50X	−4	—	14,000	5.1	0.02	30	—	TO-72
*MEM683	+25	±6	±6	—	2-25	50X	−4	—	18,000	4.0	4.0	22	2.2	TO-72
*3N200	+20	−6/+3	−6/+3	—	5	30	−3.0	—	15,000	6.0	0.02	12.5	4.5	TO-72
*3N201	+25	±30	±30	—	15	±7	−3.5	—	13,000	—	0.02	18	—	TO-72
*3N202	+25	±30	±30	—	15	±7	−3.5	—	13,000	—	0.02	18	4.0	TO-72
*3N203	+25	±30	±30	—	15	±7	−3.5	—	12,000	—	0.02	25	5.0	TO-72
*3N205	+25	±6	±6	—	6-40	±10	−4	—	10,000	—	.005	17-28	—	TO-72
*3N212	+27	±6	±6	—	6-40	±10	−5.5	—	22,000 17,000 40,000	—	0.03 .005 0.05	21-26	—	TO-72

ADDITIONAL N-CHANNEL DEPLETION MODE MOSFETS

MEM554
MEM554C
MEM557
MEM557C
MEM564C
MEM571C
MEM614
MEM615A
MEM633
MEM656A
MEM688
MEM689
3N139
3N142
3N143
3N153
3N154
3N159
3N187
3N192
3N193
3N203A
3N204
3N206
3N211
3N213
3N214
3N215
3N216
3N217

MULTIFET SWITCHES

Part No.	No. of Channels	Channel Type	$V_{(BR)DSS}$ Volts Max	$V_{(BR)GSS}$ Volts Max	$V_{GS(th)}$ Volts Typ	$r_{DS(on)}$ Ohms Typ	I_{DSS} nA Typ	I_{GSS} nA Typ	C_{gs} pF Typ	C_{rss} pF Typ	C_{oss} pF Typ	Y_{fs} µmho Typ	Case
*MEM780	4	N	+12	+30	△	20	2.0	1.0	0.5	0.3	.05	12,000	**
*MEM851	4	P	−40	−40	−2.5	65	0.2	0.05	2.0	1.5	.05	3,500	**
*MEM853	10	P	−30	−30	−2.0	100	0.2	0.10	1.5	1.0	.05	3,500	**
*MEM855	6	P	−30	−30	−4.0	150	0.2	0.10	3.0	1.9	.05	2,500	**
*MEM856	6	P	−80	−80	−4.0	700	0.05	0.05	0.2	0.2	.05	700	**
*MEM857	8	P	−30	−30	−2.0	100	0.2	0.10	1.5	1.0	.05	3,500	**

NOTES: All Mosfets and Multifets are available in chip form.
* Diode Protected Gate
△ VGS (Cutoff)
A ± 2nA Substrate Not Connected
X Maximum
** When ordering specify P for Plastic, D for Ceramic, F for Flatpack after the device number to designate package desired.
▲ µFetII is 4 pin Min. Dip Plastic Package.

GENERAL INSTRUMENT CORPORATION
MICROELECTRONICS DIVISION
Dept. EM, 600 West John Street
Hicksville, N.Y. 11802
(516) 733-3037

MOSFET & MULTIFET CROSS REFERENCE GUIDE

Part No.	G.I. Equivalent
2N3608	2N3608
2N3609	2N3609
2N4038	2N4038
2N4065	2N4065
2N4066	2N4066
2N4067	2N4067
2N4351	2N4351
2N4352	2N4352
2N4353	2N4353
3N128	3N128
3N138	3N138
3N139	3N139
3N141	3N141
3N142	3N142
3N143	3N143
3N145	3N145
3N146	3N146
3N147	3N147
3N148	3N148
3N149	3N149
3N150	3N150
3N151	3N151
3N152	3N152
3N153	3N153
3N154	3N154
3N155	3N155
3N155A	3N155A
3N156	3N156
3N157	3N157
3N157A	3N157A
3N158	3N158
3N158A	3N158A
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3N191	3N191
3N192	3N192
3N193	3N193
3N200	3N200
3N201	3N201
3N202	3N202
3N203	3N203
3N203A	3N203A
3N204	3N204
3N205	3N205
3N206	3N206
3N207	3N207
3N208	3N208
3N211	3N211
3N212	3N212
3N213	3N213
3N214	3N214
3N215	3N215
3N216	3N216
3N217	3N217
3N218	3N218
3N242	3N242
3SK45	680-003
40467A	557-041
40468A	571-015
40559A	557-042
40600	616-056
40601	617-020
40602	618-013
40603	616-057
40604	617-021
40673	616-027
40819	616-045
40820	616-043
40821	617-069
40822	616-028
40823	617-010
40841	616-037
AM2009D	MEM855D
AM2009F	MEM855F
AM2009CD	MEM855P
DD09K	MEM807
DD10K	MEM807
DD11K	MEM807
DD12J	MEM517A
DD13K	MEM517
FT610	MEM616
FT701	MEM954
FT703	MEM807
FT704	MEM556C
IT1700	MEM660
IT1701	MEM807
IT1702	MEM807
IT1750	MEM563
IT2700	MEM954
IT2701	MEM955
M100	MEM562
M101	MEM562
M103	MEM811
M104	MEM811
M106	MEM807
M107	MEM807
M108	MEM807
M113	MEM807
M114	MEM807
M116	MEM660
M117	MEM660
M163	MEM806A
M164	MEM806
M511	MEM807
M511A	MEM807
MFE120	616-041
MFE121	616-042
MFE122	617-014
MFE130	616-058
MFE131	616-059
MFE132	617-023
MFE823	MEM823
MFE824	MEM667
MFE3001	557-043
MFE3002	MEM710
MFE3003	MEM815
MFE3004	665-002
MFE3005	557-044
MFE3006	554-012
MFE3007	554-013
MFE3008	617-022
MFE3020	MEM807
MFE3021	MEM807
MPF120	MEM620
MPF121	MEM621
MPF122	MEM622
MPF130	MEM630
MPF131	MEM631
MPF132	MEM632
MX02D	MEM855F
MX52D	MEM855F
UC1700	MEM806
UC1764	MEM806
UC2766	MEM955
SD5010	MEM550
SD5011	MEM551

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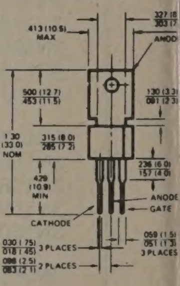
SILICON CONTROLLED RECTIFIERS—4 to 470 Amps (RMS)

$I_{T(RMS)}$ (A)	4.0	8.0	25	35	80	110	110	110	235	470
$I_{T(AV)}$ (A) @ Max. T_C = (°C)	2.55 @ 30°	5.1 @ 85°	16 @ 95°	22.3 @ 35°	50 @ 87°	70 @62°	70 @62°	70 @ 80°	150 @ 85°	300 @ 75°
Max. I_{GT} @ 25°C (mA)	0.2	25	25	40	110	70	70	150	150	150
dv/dt (V/µs)	8 typ.	50 min.	20 typ	10 min.	25 min.	20	20	200 min.	200 min.	100 min.
Case Style	A-2	TO-220AB	TO-203AA	TO-48	TO-65	TO-94	A-14	TO-94	TO-93	TO-118
PRV										
15 Volts	IR106Q1	–	–	–	–			–	–	–
25 Volts	–	–	IR32U	–	–			–	–	–
30 Volts	IR106Y1	–	–	–	–			–	–	–
50 Volts	IR106F1	IR122F	IR32F	16RC5A	50RCS5			–	–	–
100 Volts	IR106A1	IR122A	IR32A	16RC10A	50RCS10			–	–	–
200 Volts	IR106B1	IR122B	IR32B	16RC20A	50RCS20			–	–	–
300 Volts	IR106C1	IR122C	IR32C	16RC30A	50RCS30	71RC30AS60	72RC30AS60	71RA30	151RA30	300RA30
400 Volts	IR106D1	IR122D	IR32D	16RC40A	50RCS40			71RA40	151RA40	300RA40
500 Volts	–	–	–	16RC50A	50RCS50			71RA50	151RA50	300RA50
600 Volts	–	–	–	16RC60A	50RCS60	71RC60AS50	72RC60AS50	71RA60	151RA60	300RA60
700 Volts	–		–	–	50RCS70	71RC80AS50	72RC80AS50	–	–	–
800 Volts	–	–	–	16RC80A	50RCS80			71RA80	151RA80	300RA80
900 Volts	–	–	–	–	50RCS90			–	–	–
1000 Volts	–	–	–	16RC100A	50RCS100			71RA100	151RA100	300RA100
1100 Volts	–	–	–	16RC110A	50RCS110			71RA110	151RA110	300RA110
1200 Volts	–	–	–	16RC120A	50RCS120			71RA120	151RA120	300RA120
1300 Volts	–	–	–	–	–			71RA130	151RA130	300RA130
1400 Volts	–	–	–	–	–			71RA140	151RA140	300RA140
1500 Volts	–	–	–	–	–			71RA150	151RA150	300RA150
1600 Volts	–	–	–	–	–			71RA160	151RA160	300RA160
1700 Volts	–	–	–	–	–			–	–	300RA170

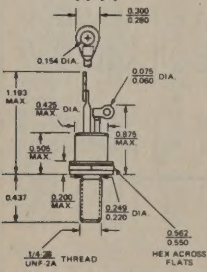
SILICON RECTIFIERS—1 to 300 Amps (AV)

$I_{F(AV)}$ (A) @ Max. T_C (°C)	1 @ 75°	1 @ 75°	1.5 @ 40°	2 @ 100°	3 @ 125°	6 @ 95°	16	40 @ 140°	70 @ 125°	150 @ 150°	300 @ 120°
I_{FSM} – (A) Surge	30	50	50	50	150	400	300	500	1,200	3,000	5,000
Case Style	DO-41	DO-39	DO-39	DO-39	C-12	C-15	DO-4	DO-5	DO-5	DO-8	DO-9
PRV											
50 Volts	1N4001	–	1N4816	–	–	60S05	16F5	40HF5	–	–	–
100 Volts	1N4002	10D1	1N4817	20D1	30S1	60S1	16F10	40HF10	70H10A	150K10A	300U10A
150 Volts	–	–	–	–	–	–	16F15	40HF15	70H15A	150K15A	300U15A
200 Volts	1N4003	10D2	1N4818	20D2	30S2	60S2	16F20	40HF20	70H20A	150K20A	300U20A
250 Volts	–	–	–	–	–	–		–	70H25A	150K25A	300U25A
300 Volts	–	10D3	1N4819	20D3	30S3	60S3	16F30	40HF30	70H30A	150K30A	300U30A
400 Volts	1N4004	10D4	1N4820	20D4	30S4	60S4	16F40	40HF40	70H40A	150K40A	300U40A
500 Volts	–	10D5	1N4821	20D5	30S5	60S5	16F50	40HF50	70H50A	150K50A	300U50A
600 Volts	1N4005	10D6	1N4822	20D6	30S6	60S6	16F60	40HF60	70H60A	150K60A	300U60A
700 Volts	–	–	1N5052	–	–	–		40HF70	70H70A	150K70A	300U70A
800 Volts	1N4006	10D8	1N5053	20D8	30S8	60S8	16F80	40HF80	70H80A	150K80A	300U80A
900 Volts	–	–	–	–	–	–		40HF90	70H90A	150K90A	300U90A
1000 Volts	1N4007	10D10	1N5054	20D10	30S10	60S10	16F100	40HF100	70H100A	150K100A	300U100A
1200 Volts	–	–	–	–	–	–		–	–	150K120A	300U120A

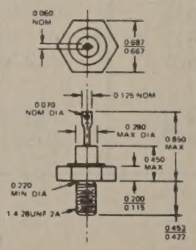
A-2(1)


413 (10.5) MAX
.327 (8
.303 (7
ANOD
.500 (12.7) / .453 (11.5)
.130 (3.3) / .091 (2.3)
1.30 (33.0) NOM
.315 (8.0) / .285 (7.2)
.236 (6.0) / .157 (4.0)
.429 (10.9) MIN
ANODE
GATE
CATHODE
.030 (.75) / .018 (.45) 3 PLACES
.098 (2.5) / .083 (2.1) 2 PLACES
.059 (1.5) / .051 (1.3) 3 PLACES

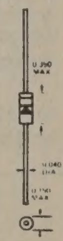
A-14


0.300 / 0.280
0.154 DIA.
0.075 / 0.060 DIA.
1.193 MAX
0.425 MAX DIA.
0.875 MAX
0.505 MAX
0.437
0.200 MAX
0.249 / 0.220 DIA.
0.562 / 0.550 HEX ACROSS FLATS
1/4-28 UNF-2A THREAD

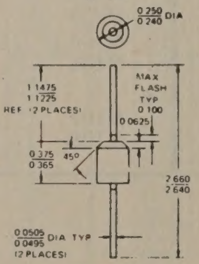
C-8


0.060 NOM
0.687 / 0.667
0.125 NOM
0.070 NOM DIA
0.290 MAX DIA
0.850 MAX
0.450 MAX
0.220 MIN DIA
0.200 / 0.115
1/4 28UNF 2A
0.453 / 0.472

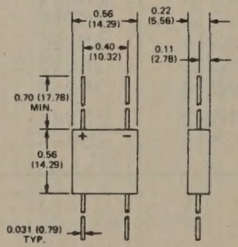
C-12


0.390 MAX
0.040 DIA

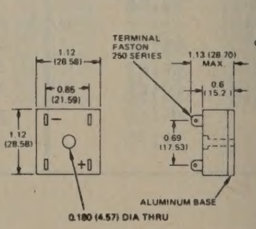
C-15


0.250 / 0.240 DIA
1.1475 / 1.1225 REF (2 PLACES)
MAX FLASH TYP 0.100
0.0625
0.375 / 0.365
45°
2.660 / 2.640
0.0505 / 0.0495 DIA TYP (2 PLACES)

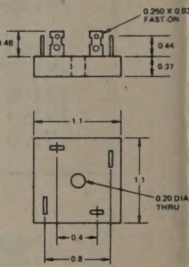
D-2


0.56 (14.29)
0.22 (5.56)
0.40 (10.32)
0.11 (2.78)
0.70 (17.78) MIN.
+
–
0.56 (14.29)
0.031 (0.79) TYP.

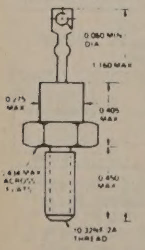
D-17A


1.12 (28.58)
TERMINAL FASTON 250 SERIES
1.13 (28.70) MAX
0.85 (21.59)
0.6 (15.2)
1.12 (28.58)
0.69 (17.53)
–
+
ALUMINUM BASE
0.180 (4.57) DIA THRU

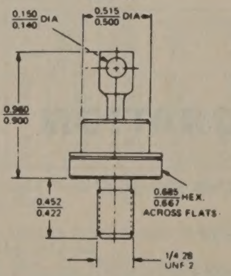
D-31


0.250 X 0.03
FAST-ON
0.48
0.44
0.37
1.1
1.1
0.20 DIA THRU
0.4
0.8

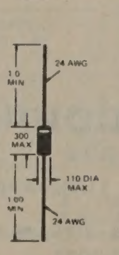
DO-4


0.060 MIN DIA
1.160 MAX
0.275 MAX
0.405 MAX
0.434 MAX ACROSS FLATS
0.450 MAX
10-32NF-2A THREAD

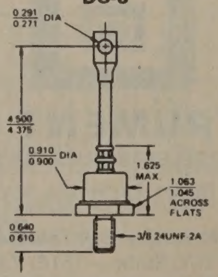
DO-5


0.150 / 0.140 DIA
0.515 / 0.500 DIA
0.980 / 0.900
0.685 / 0.667 HEX. ACROSS FLATS
0.452 / 0.422
1/4 28 UNF 2

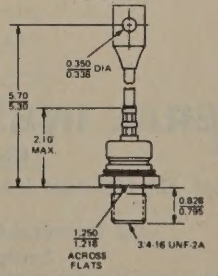
DO-7


1.0 MIN
24 AWG
.300 MAX
.110 DIA MAX
1.00 MIN
24 AWG

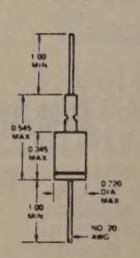
DO-8


0.291 / 0.271 DIA
4.500 / 4.375
0.910 / 0.900 DIA
1.625 MAX
1.063 / 1.045 ACROSS FLATS
0.640 / 0.610
3/8 24UNF 2A

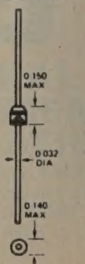
DO-9


0.350 / 0.338 DIA
5.70 / 5.30
2.10 MAX.
0.828 / 0.795
1.250 / 1.218 ACROSS FLATS
3/4-16 UNF-2A

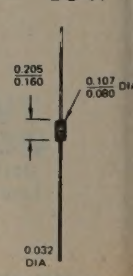
DO-13


1.00 MIN
0.545 MAX
0.345 MAX
0.220 DIA MAX
1.00 MIN
NO. 20 AWG

DO-39


0.150 MAX
0.032 DIA
0.140 MAX

DO-41


0.205 / 0.160
0.107 / 0.080 DI
0.032 DIA

ZENER VOLTAGE REGULATORS

Power Rating	400mW 50°C T_A		400mW 25°C T_A		500mW 75°C T_A		1W 25°C T_A		1W 50°C T_A		5W 50°C T_L		10W 75°C T_C		50W 75°C T_C	
Case Style	DO-7 ①		DO-7 ②		DO-7 ②		DO-13 ②		DO-41 ①		C-12 ②		DO-4 ②③		C-8 ②③	
V_Z ④	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)	Part No.	I_{ZT} (mA)
2.4	1N4370	20	–	–	1N5221	20	–	–	–	–	–	–	–	–	–	–
2.7	1N4371	20	–	–	1N5223	20	–	–	–	–	–	–	–	–	–	–
3.0	1N4372	20	–	–	1N5225	20	–	–	–	–	–	–	–	–	–	–
3.3	1N746	20	–	–	1N5226	20	–	–	1N4728	76	1N5333	380	–	–	–	–
3.6	1N747	20	–	–	1N5227	20	–	–	1N4729	69	1N5334	350	–	–	–	–
3.9	1N748	20	–	–	1N5228	20	–	–	1N4730	64	1N5335	320	–	–	1N4549	3200
4.3	1N749	20	–	–	1N5229	20	–	–	1N4731	58	1N5336	290	–	–	1N4550	2900
4.7	1N750	20	–	–	1N5230	20	–	–	1N4732	53	1N5337	260	–	–	1N4551	2650
5.1	1N751	20	–	–	1N5231	20	–	–	1N4733	49	1N5338	240	–	–	1N4552	2450
5.6	1N752	20	–	–	1N5232	20	–	–	1N4734	45	1N5339	220	–	–	1N4553	2250
(6.0)	–	–	–	–	1N5233	20	–	–	–	–	1N5340	200	–	–	–	–
6.2	1N753	20	–	–	1N5234	20	–	–	1N4735	41	1N5341	200	–	–	1N4554	2000
6.8 ⑤	1N754	20	1N957	18.5	1N5235	20	1N3016	37	1N4736	37	1N5342	175	1N2970	370	1N3305	1850
6.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1N4555	1850
7.5 ⑥	1N755	20	1N958	16.5	1N5236	20	1N3017	34	1N4737	34	1N5343	175	1N2971	335	1N3306	1700
7.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1N4556	1650
8.2	1N756	20	1N959	15.0	1N5237	20	1N3018	31	1N4738	31	1N5344	150	1N2972	305	1N3307	1500
(8.7)	–	–	–	–	1N5238	20	–	–	–	–	1N5345	150	–	–	–	–
9.1	1N757	20	1N960	14.0	1N5239	20	1N3019	28	1N4739	28	1N5346	150	1N2973	275	1N3308	1370
10	1N758	20	1N961	12.5	1N5240	20	1N3020	25	1N4740	25	1N5347	125	1N2974	250	1N3309	1200
11	–	–	1N962	11.5	1N5241	20	1N3021	23	1N4741	23	1N5348	125	1N2975	230	1N3310	1100
12	1N759	20	1N963	10.5	1N5242	20	1N3022	21	1N4742	21	1N5349	100	1N2976	210	1N3311	1000
13	–	–	1N964	9.5	1N5243	9.5	1N3023	19	1N4743	19	1N5350	100	1N2977	190	1N3312	960
(14)	–	–	–	–	1N5244	9.0	–	–	–	–	1N5351	100	1N2978	180	1N3313	890
15	–	–	1N965	8.5	1N5245	8.5	1N3024	17	1N4744	17	1N5352	75	1N2979	170	1N3314	830
16	–	–	1N966	7.8	1N5246	7.8	1N3025	15.5	1N4745	15.5	1N5353	75	1N2980	155	1N3315	780
(17)	–	–	–	–	1N5247	7.4	–	–	–	–	1N5354	70	1N2981	145	1N3316	740
18	–	–	1N967	7.0	1N5248	7.0	1N3026	14.0	1N4746	14.0	1N5355	65	1N2982	140	1N3317	700
(19)	–	–	–	–	1N5249	6.6	–	–	–	–	1N5356	65	1N2983	130	1N3318	660
20	–	–	1N968	6.2	1N5250	6.2	1N3027	12.5	1N4747	12.5	1N5357	65	1N2984	125	1N3319	630
22	–	–	1N969	5.6	1N5251	5.6	1N3028	11.5	1N4748	11.5	1N5358	50	1N2985	115	1N3320	570
24	–	–	1N970	5.2	1N5252	5.2	1N3029	10.5	1N4749	10.5	1N5359	50	1N2986	105	1N3321	520
(25)	–	–	–	–	1N5253	5.0	–	–	–	–	1N5360	50	1N2987	100	1N3322	500
27	–	–	1N971	4.6	1N5254	4.6	1N3030	9.5	1N4750	9.5	1N5361	50	1N2988	95	1N3323	460
(28)	–	–	–	–	1N5255	4.5	–	–	–	–	1N5362	50	–	–	–	–
30	–	–	1N972	4.2	1N5256	4.2	1N3031	8.5	1N4751	8.5	1N5363	40	1N2989	85	1N3324	420
33	–	–	1N973	3.8	1N5257	3.8	1N3032	7.5	1N4752	7.5	1N5364	40	1N2990	85	1N3325	380
36	–	–	1N974	3.4	1N5258	3.4	1N3033	7.0	1N4753	7.0	1N5365	30	1N2991	70	1N3326	350
39	–	–	1N975	3.2	1N5259	3.2	1N3034	6.5	1N4754	6.5	1N5366	30	1N2992	65	1N3327	320
43	–	–	1N976	3.0	1N5260	3.0	1N3035	6.0	1N4755	6.0	1N5367	30	1N2993	60	1N3328	290
47	–	–	1N977	2.7	1N5261	2.7	1N3036	5.5	1N4756	5.5	1N5368	25	1N2995	55	1N3330	270
51	–	–	1N978	2.5	1N5262	2.5	1N3037	5.0	1N4757	5.0	1N5369	25	1N2997	50	1N3332	245
56	–	–	1N979	2.2	1N5263	2.2	1N3038	4.5	1N4758	4.5	1N5370	20	1N2999	45	1N3334	220
62	–	–	1N980	2.0	1N5265	2.0	1N3039	4.0	1N4759	4.0	1N5372	20	1N3000	40	1N3335	200
68	–	–	1N981	1.8	1N5266	1.8	1N3040	3.7	1N4760	3.7	1N5373	20	1N3001	37	1N3336	180
75	–	–	1N982	1.7	1N5267	1.7	1N3041	3.3	1N4761	3.3	1N5374	20	1N3002	33	1N3337	170
82	–	–	1N983	1.5	1N5268	1.5	1N3042	3.0	1N4762	3.0	1N5375	15	1N3003	30	1N3338	150
(87)	–	–	–	–	1N5269	1.4	–	–	–	–	1N5376	15	–	–	–	–
91	–	–	1N984	1.4	1N5270	1.4	1N3043	2.8	1N4763	2.8	1N5377	15	1N3004	28	1N3339	140
100	–	–	1N985	1.3	1N5271	1.3	1N3044	2.5	1N4764	2.5	1N5378	12	1N3005	25	1N3340	120
110	–	–	–	–	–	–	1N3045	2.3	1ZT110	2.3	–	–	1N3007	23	–	–
120	–	–	–	–	–	–	1N3046	2.0	1ZT120	2.0	–	–	1N3008	20	–	–
130	–	–	–	–	–	–	1N3047	1.9	1ZT130	1.9	–	–	1N3009	19	–	–
(140)	–	–	–	–	–	–	–	–	–	–	–	–	1N3010	18	–	–
150	–	–	–	–	–	–	1N3048	1.7	1ZT150	1.7	–	–	1N3011	17	–	–
160	–	–	–	–	–	–	1N3049	1.6	1ZT160	1.6	–	–	1N3012	16	–	–
180	–	–	–	–	–	–	1N3050	1.4	1ZT180	1.4	–	–	1N3014	14	–	–
200	–	–	–	–	–	–	1N3051	1.2	1ZT200	1.2	–	–	1N3015	12	–	–

① Basic = 10%, "A" = 5% ② Basic = 20%, "A" = 10%, "B" = 5% ③ "R" = Cathode to stud. ④ Contact factory for other available voltages. ⑤ Also available, 50W 1N4555. ⑥ Also available, 50W 1N4456.

TEMPERATURE COMPENSATED VOLTAGE REFERENCES

Power Rating (mW)	V_Z – Zener Voltage (V)	I_{ZT} – Test Current (mA)	Z_Z – Zener Impedance (Ω) @ I_{ZT}	Case Style	Coefficient (%/°C)	IR Part No.
400	5.9-6.5	7.5	15	DO-7	0.01 0.005 0.002 0.001 0.0005	1N821 1N823 1N825 1N827 1N829
500	8.55-9.45	7.5	20	DO-7	0.01 0.005 0.002 0.001 0.0005	1N935 1N936 1N937 1N938 1N939

SINGLE PHASE BRIDGES

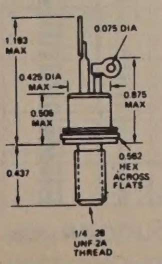
DC Output Current (A)	1.8	2.2	7.5	10	15	25	30	40	50
@ °C	T_A 50°C	T_A 50°C	T_C 75°C	T_C 75°C	T_C 75°C	T_C 75°C	T_C 75°C	T_C 75°C	T_C 75°C
I_{FSM} (A)	50	50	75	100	150	300	350	500	600
Case Style	D-2	D-2	D-31	D-31	D-31	D-31	D-31	D-17A	D-17A
V_{RRM} (V)									
50	–	–	75JB05L	100JB05L	150JB05L	250JB05L	300JB05L	400JB05L	500JB05L
100	–	–	75JB1L	100JB1L	150JB1L	250JB1L	300JB1L	400JB1L	500JB1L
200	18DB2A	22DB2A	75JB2L	100JB2L	150JB2L	250JB2L	300JB2L	400JB2L	500JB2L
300	18DB3A	22DB3A	75JB3L	100JB3L	150JB3L	250JB3L	300JB3L	400JB3L	500JB3L
400	18DB4A	22DB4A	75JB4L	100JB4L	150JB4L	250JB4L	300JB4L	400JB4L	500JB4L
500	18DB5A	22DB5A	75JB5L	100JB5L	150JB5L	250JB5L	300JB5L	400JB5L	500JB5L
600	18DB6A	22DB6A	75JB6L	100JB6L	150JB6L	250JB6L	300JB6L	400JB6L	500JB6L
700	18DB7A	22DB7A	–	–	–	–	–	–	–
800	18DB8A	22DB8A	–	–	–	–	–	–	–
1000	18DB10A	22DB10A	–	–	–	–	–	–	–

KLIP-SELS – Transient Voltage Suppressors

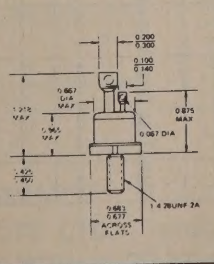
Device Voltage Rating (V)	Transient Voltage Rating (V)	Max. Rated RMS Operating Voltage (V)	For Individual Rectifier Rated Thru 3 Amp	For Individual Rectifier Rated Thru 16 Amp	For Individual Rectifier Rated Thru 60 Amp	For Individual Rectifier Rated Thru 250 Amp
100	150	60	KV2DTM	KZ2DTM	–	–
100	150	52	KV2DTF	KZ2DTF	KSA2DAF	KSL2DAF
150	250	90	KV3DTM	KZ3DTM	–	–
150	250	78	KV3DTM	KZ3DTF	KSA3DAF	KSL3DAF
300	360	120	KV4DTM	KZ4DTM	–	–
300	360	150	KV5DTM	KZ5DTM	–	–
300	360	130	KV5DTF	KZ5DTF	KSA5DAF	KSL5DAF

Device Voltage Rating (V)	Transient Voltage Rating (V)	Max. Rated RMS Operating Voltage (V)	For Individual Rectifier ① Rated Thru 3 Amp	For Individual Rectifier ① Rated Thru 16 Amp	For Individual Rectifier ① Rated Thru 60 Amp	For Individual Rectifier ① Rated Thru 250 Amp
500	650	234	KV9DTF	KZ9DTF	KSA9DBF	KSL9DBF
600	650	240	KV8DTM	KZ8DTM	–	–
600	800	260	KV10DTF	KZ10DTF	KSA10DAF	KSL10DAF
800	1000	364	KV14DTF	KZ14DTF	KSA14DAF	KSL14DAF
1000	1200	442	KV17DTF	KZ17DTF	KSA17DAF	KSL17DAF
1200	1600	520	KV18DTM	KZ18DTM	–	–
1200	1600	520	KV20DTF	KZ20DTF	KSA20DAF	KSL20DAF

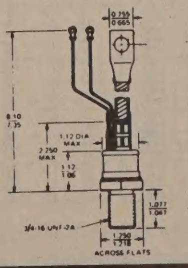
TO-48



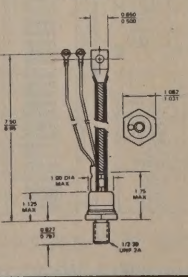
TO-65



TO-93



TO-94



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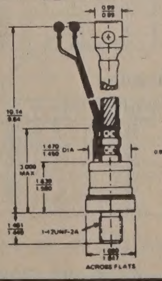
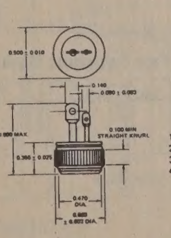
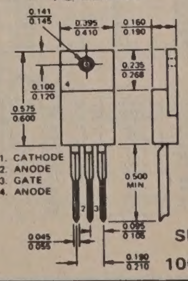


TO-203AA



TO-220AB



SPA

1004A

INTERNATIONAL RECTIFIER IOR

SEMICONDUCTOR PROTECTIVE FUSES

Max. RMS Voltage	130	250	500	600	700
Max. DC Voltage	130	210	450	550	700
Max. Arc Voltage	220	410	850	1,050	1,200
RMS Current (A)					
5	SF13X5	SF25X5	–	SF60C5	–
10	SF13X10	SF25X10	–	SF60C10	SF70P10
15	SF13X15	SF25X15	–	SF60C15	SF70P15
20	SF13X20	SF25X20	–	SF60C20	SF70P20
25	SF13X25	SF25X25	–	SF60C25	SF70P25
30	SF13X30	SF25X30	–	SF60C30	SF70P30
35	SF13X35	–	SF50P35	SF60C35	SF70P35
40	SF13X40	SF25X40	SF50P40	SF60C40	SF70P40
45	–	–	SF50P45	SF60C45	–
50	SF13X50	SF25X50	SF50P50	SF60C50	SF70P50
60	SF13X60	SF25X60	SF50P60	SF60C60	SF70P60
70	SF13X70	SF25X70	SF50P70	SF60C70	SF70P70
80	SF13X80	SF25X80	SF50P80	SF60C80	SF70P80
90	–	–	SF50P90	SF60C90	SF70P90
100	SF13X100	SF25X100	SF50P100	SF60C100	SF70P100

Max. RMS Voltage	130	250	500	600	700
Max. DC Voltage	130	210	450	550	700
Max. Arc Voltage	220	410	850	1,050	1,200
RMS Current (A)					
125	SF13X125	SF25X125	SF50P125	SF60C125	SF70P125
150	SF13X150	SF25X150	SF50P150	SF60C150	SF70P150
175	–	SF25X175	SF50P175	SF60C175	SF70P175
200	SF13X200	SF25X200	SF50P200	SF60C200	SF70P200
225	–	SF25X225	–	SF60C225	–
250	SF13X250	SF25X250	SF50P250	SF60C250	SF70P250
300	SF13X300	SF25X300	SF50P300	SF60C300	SF70P300
350	SF13X350	SF25X350	SF50P350	SF60C350	–
400	SF13X400	SF25X400	SF50P400	SF60C400	SF70P400
450	–	SF25X450	SF50P450	SF60C450	–
500	SF13X500	SF25X500	SF50P500	SF60C500	SF70P500
550	–	–	SF50P550	–	–
600	SF13X600	SF25X600	SF50P600	SF60C600	SF70P600
700	–	–	SF50P700	SF60C700	–
800	SF13X800	–	SF50P800	SF60C800	–

POWER TRANSISTORS

HIGH VOLTAGE

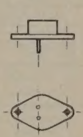
NPN High Gain Power Transistors

Part No.	I_c Peak (A)	$V_{CEO(sus)}$ Min. (V)	H_{FE} (Min./Max.)	@ I_c (A)	$V_{CEO(sat)}$ Max. (V)	@ I_c (A)	P_d (W)
IR701	4.0	600	20/–	0.15	–	–	50
IR801	5.0	700	20/–	0.2	–	–	100
2N5838	5.0	250	8/–	3.0	1.0	3.0	100
2N5839	5.0	275	10/–	2.0	1.5	2.0	100
2N5840	5.0	350	10/–	2.0	1.5	2.0	100
IR708	7.0	600	–	–	2.0	1.0	50
IR709	7.0	600	–	–	1.0	2.0	50
IR710	7.0	600	7/–	1.0	–	–	50
IR721	–	800	20/60	0.15	–	–	50
*IR660	10	200	30/90	1.0	0.8	1.0	60
*IR663	10	325	30/90	1.0	0.8	1.0	60
*IR665	10	400	30/90	1.0	0.8	1.0	60
2N3902	10	325	30/90	1.0	0.8	1.0	100
2N5157	10	400	30/90	1.0	0.8	1.0	100
IR401	10	200	20/100	0.5	0.8	0.5	100
IR413	7.0	325	20/80	0.5	0.8	0.5	100
2N5804	15	225	10/100	5.0	2.0	5.0	110
2N5805	15	300	10/100	5.0	2.0	5.0	110
2N5241	10	325	15/35	2.5	0.7	2.5	125
IR410	10	200	20/100	1.0	0.8	1.0	100
IR411	10	300	30/90	1.0	0.8	1.0	100
IR430	10	300	15/45	2.5	0.9	2.5	125
IR431	10	325	15/35	2.5	0.7	2.5	125
IR409	10	325	15/–	1.0	1.2	1.0	125
IR423	10	325	30/90	1.0	0.8	1.0	125
IR403	10	325	–	–	1.1	3.5	125
IR402	10	325	–	–	2.0	3.0	125
IR424	10	350	30/90	1.0	0.8	1.0	125
IR425	10	400	30/90	1.0	0.8	1.0	125
IR515	15	250	3.5/–	10	1.8	3.0	125
IR516	15	250	4/–	10	1.9	7.0	125
IR517	15	250	5/–	10	1.6	7.0	125
IR518	15	275	5/–	10	1.4	7.0	125
IR519	15	300	5/–	10	1.4	7.0	125

NPN Fast Switching Power Transistors

Part No.	I_c Peak (A)	$V_{CEO(sus)}$ Min. (V)	h_{FE} (Min./Max.)	@ I_c (A)	$V_{CE(sat)}$ Max (V)	@ I_c (A)	P_d (W)	$t_r/t_s/t_f$ Max (µ)
2N6542	10	300	7/35	3.0	5.0	5.0	100	7/4.0/.8
2N6543	10	400	7/35	3.0	5.0	5.0	100	7/4.0/.8
2N6306	16	250	4/–	8.0	5.0	8.0	125	6/1.6/.4
2N6307	16	300	4/–	8.0	5.0	8.0	125	6/1.6/.4
2N6544	16	300	7/35	5.0	5.0	8.0	125	1/4.0/1
2N6308	16	350	3/–	8.0	5.0	8.0	125	6/1.6/.4
2N6545	16	400	7/35	5.0	5.0	8.0	125	1/4.0/1
2N6573	15	250	5/–	10	5.0	10	125	9/2.5/.7
2N6574	15	275	5/–	10	5.0	10	125	9/2.5/.7
2N6575	15	300	5/–	10	5.0	10	125	9/2.5/.7
2N6249	30	200	10/50	10	1.5	10	175	2/3.5/1
2N6250	30	275	8/50	10	1.5	10	175	1/3.5/1
2N6251	30	350	6/50	10	1.5	10	175	2/3.5/1
2N6546	30	300	6/30	10	5.0	15	175	7/4.0/.8
2N6547	30	400	6/30	10	5.0	15	175	7/4.0/.8

TO-3


TO-66

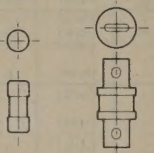
CASE STYLES. All power transistors are TO-3 case except: * = TO66, ** = H-1 case.

NPN High Gain Darlingtons

Part No.	I_c Peak (A)	$V_{CEO(sus)}$ Min. (V)	H_{FE} (Min./Max.)	@ I_c (A)	$V_{CEO(sat)}$ Max. (V)	@ I_c (A)	P_d (W)
IR1010	15	80	200/–	10	1.8	5.0	100
IR1020	15	80	500/–	10	1.5	5.0	100
*IR5251	15	350	10/–	10	2.0	10	100
*IR5252	15	400	10/–	10	2.0	10	100
*IR5253	15	450	10/–	10	2.0	10	100
IR4039	20	300	5/–	15	5.0	15	100
IR4041	20	300	8/–	15	2.2	15	100
*IR5000	20	300	15/–	15	1.8	15	125
IR4040	20	325	8/–	15	2.0	15	125
IR4045	20	325	15/–	15	1.2	5.0	125
*IR5001	20	350	15/–	15	1.8	15	125
IR4050	20	350	8/–	15	2.0	15	125
IR4055	20	350	15/–	15	1.8	15	125
IR4059	20	350	5/–	15	5.0	15	100
IR4061	20	350	8/–	15	2.2	15	100
*IR5002	20	400	15/–	15	1.8	15	125
IR4060	20	400	8/–	15	2.0	15	125
IR4065	20	400	15/–	15	1.8	15	125
*IR5063	20	500	8/–	20	2.0	15	125
*IR5064	20	600	8/–	15	2.0	10	125
*IR5065	20	750	4/–	15	2.0	10	125
*IR5066	20	900	5/–	12	2.0	10	125
*IR5060	25	300	40/–	15	2.0	20	125
*IR5061	25	350	40/–	15	2.0	20	125
*IR5062	25	400	40/–	15	2.0	20	125

NPN Fast Switching Darlingtons

Part No.	I_c Peak (A)	$V_{CEO(sus)}$ Min. (V)	h_{FE} (Min./Max.)	@ I_c (A)	$V_{CE(sat)}$ Max. (V)	@ I_c (A)	P_d (W)	$t_r/t_s/t_f$ Max. (µ)
IR6251	15	350	100/–	5.0	2.0	10	100	.25/2.5/1
IR6252	15	400	100/–	5.0	2.0	10	100	.25/2.5/1
IR6253	15	450	100/–	5.0	2.0	10	100	.25/2.5/1
IR6000	20	300	60/–	10	1.8	15	125	.4/2.5/1
IR6001	20	350	60/–	10	1.8	15	125	.4/2.5/1
IR6002	20	400	60/–	10	1.8	15	125	.4/2.5/1
IR6060	25	300	40/–	15	2.0	20	125	.4/2.5/1
IR6061	25	350	40/–	15	2.0	20	125	.4/2.5/1
IR6062	25	400	40/–	15	2.0	20	125	.4/2.5/1


SF60X5 to 30

SF60X35 to 600

EPITAXIAL BASE

NPN/PNP Discrete Power Transistors

Types	Polarity	I_c Peak (A)	$V_{CEO(sus)}$ V_{min}	h_{FE} Min.	@ I_c (A)	@ V_{CE} (V)	t_r µsec.	t_s µsec.	t_f µsec.	P_d (W)	IR Data Sheet
2N3055	NPN	15	60	5	10	1.1	–	–	–	115	9.039
2N3713	NPN	10	60	15	3	4	0.7	1.0	0.8	150	9.040
2N3714	NPN	10	80	15	3	4	0.7	1.0	0.8	150	9.040
2N3715	NPN	10	60	30	3	4	0.7	1.0	0.8	150	9.040
2N3716	NPN	10	80	30	3	4	0.7	1.0	0.8	150	9.040
2N3771	NPN	60	40	5	30	4	0.7	1.0	0.8	200	9.055
2N3772	NPN	50	60	5	20	3	0.7	1.0	0.8	200	9.055
2N3773	NPN	30	140	15	8	4	0.7	1.0	0.8	150	9.057
2N3789	PNP	10	60	15	3	4	0.7	1.0	0.8	150	9.040
2N3790	PNP	10	80	15	3	4	0.7	1.0	0.8	150	9.040
2N3791	PNP	10	60	30	3	4	0.7	1.0	0.8	150	9.040
2N3792	PNP	10	80	30	3	4	0.7	1.0	0.8	150	9.040
2N4398	PNP	50	40	5	30	4	0.4	1.5	0.6	200	9.033
2N4399	PNP	50	60	5	30	4	0.4	1.5	0.6	200	9.033
2N5301	NPN	50	40	5	30	3	1.0	2.0	1.0	200	9.033
2N5302	NPN	50	60	5	30	3	1.0	2.0	1.0	200	9.033
2N5303	NPN	50	80	5	20	2	1.0	2.0	1.0	200	9.033
2N5629	NPN	20	100	4	16	2	–	–	–	200	9.037
2N5630	NPN	20	120	4	16	2	–	–	–	200	9.037
2N5631	NPN	20	140	4	16	2	–	–	–	200	9.037
2N5632	NPN	15	100	5	10	1.0	–	–	–	150	9.045
2N5633	NPN	15	120	5	10	1.0	–	–	–	150	9.045
2N5634	NPN	15	140	5	10	1.0	–	–	–	150	9.045
**2N5683	PNP	70	60	5	50	5	–	–	–	300	9.056
**2N5684	PNP	70	80	5	50	5	–	–	–	300	9.056
**2N5685	NPN	70	60	5	50	5	–	–	–	300	9.056
**2N5686	NPN	70	80	5	50	5	–	–	–	300	9.056
2N5745	PNP	50	80	5	20	2	1.0	2.0	1.0	200	9.033
2N5758	NPN	10	100	25	3	1.0	–	–	–	150	9.042
2N5759	NPN	10	120	20	3	1.0	–	–	–	150	9.042
2N5760	NPN	10	140	15	3	1.0	–	–	–	150	9.042
2N5875	PNP	20	60	4	10	1.0	0.7	1.0	0.8	150	9.043
2N5876	PNP	20	80	4	10	1.0	0.7	1.0	0.8	150	9.043
2N5877	NPN	20	60	4	10	1.0	0.7	1.0	0.8	150	9.043
2N5878	NPN	20	80	4	10	1.0	0.7	1.0	0.8	150	9.043
2N5879	PNP	30	60	4	15	1.0	0.7	1.0	0.8	160	9.044
2N5880	PNP	30	80	4	15	1.0	0.7	1.0	0.8	160	9.044
2N5881	NPN	30	60	4	15	1.0	0.7	1.0	0.8	160	9.044
2N5882	NPN	30	80	4	15	1.0	0.7	1.0	0.8	160	9.044
2N5883	PNP	50	60	4	25	4	0.7	1.0	0.8	200	9.032
2N5884	PNP	50	80	4	25	4	0.7	1.0	0.8	200	9.032
2N5885	NPN	50	60	4	25	4	0.7	1.0	0.8	200	9.032
2N5886	NPN	50	80	4	25	4	0.7	1.0	0.8	200	9.032
2N6029	PNP	20	100	4	16	2	–	–	–	200	9.037
2N6030	PNP	20	120	4	16	2	–	–	–	200	9.037
2N6031	PNP	20	140	4	16	2	–	–	–	200	9.037
2N6226	PNP	10	100	25	3	1.0	–	–	–	150	9.042
2N6227	PNP	10	130	20	3	1.0	–	–	–	150	9.042
2N6228	PNP	10	140	15	3	1.0	–	–	–	150	9.042
2N6229	PNP	15	100	15	3	1.0	–	–	–	150	9.045
2N6230	PNP	15	120	15	3	1.0	–	–	–	150	9.045
2N6231	PNP	15	140	15	3	1.0	–	–	–	150	9.045
2N6246	PNP	20	60	60	5	15	–	–	–	125	9.041
2N6247	PNP	20	80	80	5	15	–	–	–	125	9.041
2N6248	PNP	15	100	100	5	10	–	–	–	125	9.041
2N6469	PNP	20	40	5	15	1.3	–	–	–	125	9.041
2N6470	NPN	20	40	5	15	1.3	–	–	–	125	9.041
2N6471	NPN	20	60	5	15	1.3	–	–	–	125	9.041
2N6472	NPN	20	80	5	15	1.3	–	–	–	125	9.041
2N6609	PNP	50	140	15	8	4	–	–	–	200	9.057
IR802	NPN	30	90	10	15	0.8	–	–	–	200	9.034
IR3771	NPN	60	40	5	30	4	0.7	1.0	0.8	200	9.035
IR3772	NPN	50	60	5	20	3	0.7	1.0	0.8	200	9.035
IR3773	NPN	50	140	5	16	2	1.5	2.0	1.8	200	9.036
IR4502	PNP	30	90	10	15	0.8	–	–	–	200	9.034
IR6302	PNP	30	120	5	16	2	1.5	2.0	1.8	200	9.036

NPN/PNP Discrete Power Darlingtons

Types	Polarity	I_c Peak (A)	$V_{CEO(sus)}$ V_{min}	h_{FE} Min.	@ I_c (A)	@ V_{CE} (V)	P_d (W)	IR Data Sheet
IR640	NPN	15	60	500	10	4	175	9.051
IR641	NPN	15	80	500	10	4	175	9.051
IR642	NPN	15	100	500	10	4	175	9.051
IR645	PNP	15	60	500	10	4	175	9.051
IR646	PNP	15	80	500	10	4	175	9.051
IR647	PNP	15	100	500	10	4	175	9.051
IR900	PNP	10	60	1000	3	3	90	9.054
IR901	PNP	10	60	1000	3	3	90	9.054
IR1000	NPN	10	80	1000	3	3	90	9.054
IR1001	NPN	10	80	1000	3	3	90	9.054
IR1010	NPN	15	80	200	10	5	100	9.018
IR1020	NPN	15	80	500	10	5	100	9.018
IR2500	PNP	15	60	1000	5	3	150	9.050
IR2501	PNP	15	80	1000	5	3	150	9.050
IR3000	NPN	15	60	1000	5	3	150	9.050
IR3001	NPN	15	80	1000	5	3	150	9.050
2N6050	PNP	20	60	750	6	3	150	9.049
2N6051	PNP	20	80	750	6	3	150	9.049
2N6052	PNP	20	100	750	6	3	150	9.049
2N6053	PNP	16	60	750	4	3	100	9.053
2N6054	PNP	16	80	750	4	3	100	9.053
2N6055	NPN	16	60	750	4	3	100	9.053
2N6056	NPN	16	80	750	4	3	100	9.053
2N6057	NPN	20	60	750	6	3	150	9.049
2N6058	NPN	20	80	750	6	3	150	9.049
2N6059	NPN	20	100	750	6	3	150	9.049
2N6282	NPN	40	60	750	10	3	160	9.048
2N6283	NPN	40	80	750	10	3	160	9.048
2N6284	NPN	40	100	750	10	3	160	9.048
2N6285	PNP	40	60	750	10	3	160	9.048
2N6286	PNP	40	80	750	10	3	160	9.048
2N6287	PNP	40	100	750	10	3	160	9.048
2N6383	NPN	15	40	1000	5	3	100	9.052
2N6384	NPN	15	60	1000	5	3	100	9.052
2N6385	NPN	15	80	1000	5	3	100	9.052
*2N6534	NPN	15	80	100	8	3	36	9.059
*2N6535	NPN	15	100	100	8	3	36	9.059
*2N6536	NPN	15	100	100	8	3	36	9.059
*2N6537	NPN	15	120	100	8	3	36	9.059

SPA 1004B

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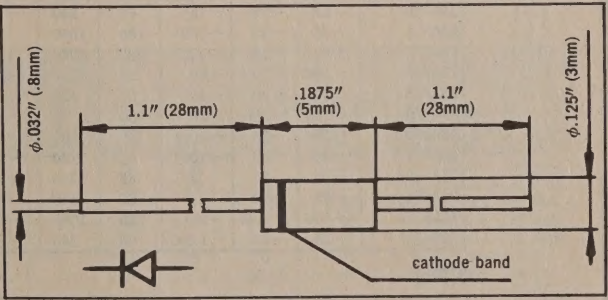
MAXIMUM RATINGS

Rating	Symbol	Unit	1N4001	1N4002	1N4003	1N4004	1N4005	1N4006	1N4007
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	U_{RRM} U_{RM} U_R	V	50	100	200	400	600	800	1000
Non-Repetitive Peak Reverse Voltage 10 ms (Halfwave, Single Phase 50 Hz Peak)	U_{RSM}	V	(100)* 60	(150)* 120	(300)* 240	(600)* 480	(900)* 720	(1200)* 1000	(1500)* 1200
RMS Voltage	U_{RMS}	V	35	70	140	280	420	560	700
Average Rectified Forward Current (Single Phase, Resistive Load 50 Hz)	I_o	A		1.0					
Non-Repetitive Peak Current (Surge Current, 1 Cycle for 10 ms)	I_{FSM}	A		50					
Operating Temperature	T_{op}	°C		−65 to +175					
Storage Temperature	T_{STG}	°C		−65 to +175					

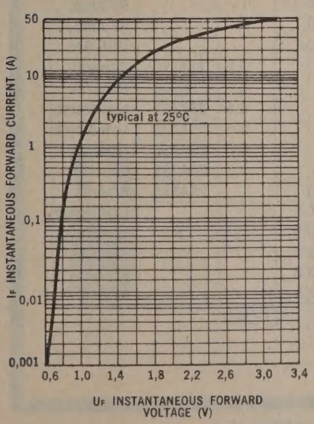
**Available on special request*

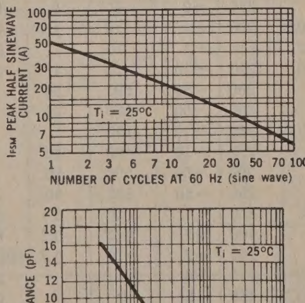
ELECTRICAL CHARACTERISTICS

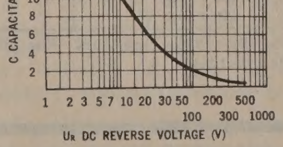
Characteristics and Conditions	Symbol	Unit	?Head?
Max. Instantaneous Forward Voltage Drop (I_F = 1,0A T_j = 25°C)	U_{FWD}	V	1.1
Max. Reverse Current at U_{RRM} (T_j = 25°C)	I_R	μA	10
Max. Reverse Current at U_{RRM} (T_j = 100°C)	I_R	μA	50
Typical Thermal Resistance Junction to Ambient (Mounting Method A)	R_{TH}	°C/W	85

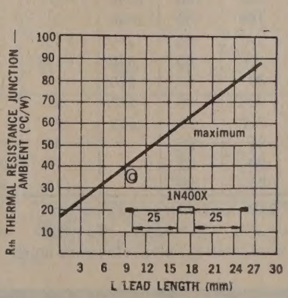


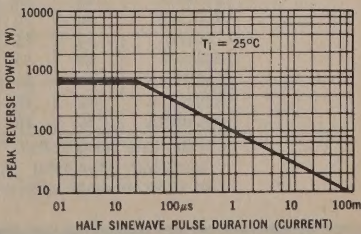
CHARACTERISTIC CURVES











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GERMANIUM TRANSISTORS — METAL PACKAGE

PNP (Ta = 25°C)

Type No.	Package Style	BV_{CBO} (V)	BV_{EBO} (V)	P_C (mW)	I_C (mA)	H_{FE} @ I_E Min/Max	H_{FE} @ I_E (mA)	f* (MHz)	I_{CBO} (μA)
2SA100	TO-1	−40	−0.7	60	−10	80/-	1.0	10 b	−16
2SA101	TO-1	−40	−0.7	60	−10	12/-	1.0		−16
2SA102	TO-1	−40	−0.7	60	−10	12/40	1.0	20 b	−16
2SA103	TO-1	−40	−0.7	60	−10	25/50	1.0	30 b	−16
2SB171	TO-1	−30		125	−100	40/85	1.0	0.7 C	−12
2SB172	TO-1	−32	−10	125	−300	35/63			−12
2SB173	TO-1	−30		125	−100	40/220	1.0	0.7 C	−12
2SB175	TO-1	−30		125	−100	55/360	1.0	0.7 C	−12
2SB176	TO-1	−32	−10	125	−300	57/140			−12
2SB324	TO-1	−32	−10	650 H	−1A	50/295	.50	0.01 C	−10
2SB475	TO-1	−25	−6	150	−500	46/334	150		−20
2SB627	TO-8	−40	−10	13W	−10A	100/-	3A		
2SB476	TO-39	−20	−10	6W	−2A	40/-	2A	0.3 t	−500
2SB476W	TO-39	−20	−10	6W	−2A	100/-	2A	0.3 t	−500
2SB493	TO-8	−40	−14	9W	−5A	40/-	3A	0.3 t	−1mA
2SB493W	TO-8	−40	−14	9W	−5A	60/-	3A	0.3 t	−1mA
2SB449	TO-3	−50	−20	22.5W	−3.5A	25/165	1.0A	1.01 T	−3mA
2SB473	TO-3	−32	−10	4.3W	−1.5A	40/305	50	1.01 T	−15
2SB481	TO-3	−32	−10	6W	−3.0A	35/170	100	0.01 C	

* T=Typical C=fae min. b=fab min. t=ft H=With 12.5cm² cooling fin

PLASTIC SILICON TRANSISTORS

TO-92 / PNP

Type No.	(Ta = 25°C) Absolute Max. Ratings			(Ta = 25°C) Electrical Characteristics										Compli-mentary Pair	Use
							f_T			Bias $V_{CE(sat)}$					
	V_{CBO} (V)	V_{CEO} V_{CER}* (V)	I_C (mA)	Min.	Max.	@ I_E I_C* (mA)	Min. (MHz)	Typ. (MHz)	@ I_E I_C* (mA)	I_C (mA)	I_B (mA)	Typ. (V)	Max. (V)		
2SA564	−25	−25	−100[1]	65	700	2		80	1	−50	−2.5	−0.3		2SC828	General
2SA564A	−45	−45	−100[1]	65	700	2		80	1	−50	−2.5	−0.3		2SC828A	General
2SA666	−25	−25	−100[1]	90	700	2		80	1	−50	−2.5	−0.3			Low Noise
2SA666A	−45	−45	−100[1]	90	700	2		80	1	−50	−2.5	−0.3			Low Noise
2SA685	−150	−150*	−50	30		−15*	40		−10*	−15	−1		−1		Switching
2SA719	−30	−25	−1A[1]	60	340	−150		200	50	50	−50		−0.6	2SC1317	General
2SA720	−60	−50	−1A[1]	60	340	−150*		200	−50	50	−50		−0.6	2SC1318	General
2SA721	−35	−35	−100[1]	180	1040	2		250	10	−100	−10		−0.6	2SC1327	Low Noise
2SA722	−55	−55	−100[1]	180	1040	2		250	10	−100	−10		−0.6	2SC1328	Low Noise
2SA749	−100	−100	−50	50		−20*	40		−10*	−50	−5		−0.3		Switching
2SA838	−30	−20	−30	50	220	1	150	300	1	−10	−1	−0.1		2SC1359	RF Amp.
2SA879	−250	−200	−70	30		−5*	50	80	10	−50	−5		−1.2		General
2SA888☆	−25	−25	−100[1]	65	700	−2*		100	1	−50	−2.5	−0.3	−0.5	2SC1849	General
2SA889☆	−45	−45	−100[1]	65	700	−2*		100	1	−50	−2.5	−0.3	−0.5	2SC1850	General
2SA890☆	−30	−25	1A[1]	60	340	−150*		200	−50	−500	−500	0.35	0.6	2SC1851	General
2SA891☆	−60	−50	1A[1]	60	340	−150*		200	−50	−500	−500	0.35	0.6	2SC1852	General
2SA921	−120	−120	−50[1]	260	1040	−2*				−30	−3		−0.6	2SC1980	Low Noise
2SB621	−30	−25	−1.5A[1]	60	340	−500*		200	50	−500	−50	−0.2	−0.4	2SD592	AF Amp.

NPN

2SC644	30	25	100[1]	180	700	−2				50	5	0.14			Low Noise
2SC828	30	25	100[1]	65	700	−2		220	−2	50	5	0.14		2SA564	General
2SC828A	45	45	100[1]	65	700	−2		220	−2	50	5	0.14		2SA564A	General
2SC829	30	20	30	40	500	−1	150	230	−1	10	1	0.1			RF Amp.
2SC1047	30	20	15	40		−1	450	650	−1	10	1	0.1			RF Amp.
2SC1215	30	20	50	25		−2	600	1200	−10	10	1	0.1			UHF Osc.
2SC1317	30	25	1A[1]	60	340	+150*		200	−50	500	50		0.6	2SA719	General
2SC1318	60	50	1A[1]	60	340	+150*		200	−50	500	50		0.6	2SA720	General
2SC1327	35	35	100[1]	180	1040	−2		250	−10	100	10		0.6	2SA721	Low Noise
2SC1328	55	55	100[1]	180	1040	−2		250	−10	100	10		0.6	2SA722	Low Noise
2SC1346	30	25	1A[1]	60	340	+150*		200	−50	500	50		0.6	2SA730	General
2SC1347	60	50	1A[1]	60	340	+150*		200	−50	500	50		0.6	2SA731	General
2SC1359	30	20	30	50	220	−1	150	300	−1	10	1	0.1		2SA838	RF Amp.
2SC1684	30	25	200[1]	90	650	2*		150	−2	10	0.3	0.5			Low Noise
2SC1685	60	50	200[1]	90	650	2*		150	−2	10	0.3	0.5			Low Noise
2SC1686▲	40	30	25	26		4*	220	330	−4	1		2.3			RF Amp.
2SC1687▲	40	25	30	38		7*	360	550	−5	1		0.8			RF Amp.
2SC1688▲	50	40	30	38		7*	360	550	−5	1		0.8			RF Amp.

☆Center Base Configuration ▲Center Emitter Configuration [1]I_{CM} [3]Rg=10KΩ [4]Tc≦125°C [5]R_{BE}≦3KΩ [6]Rg=2KΩ
[7]R_{BE}≦30KΩ [8]RG=50KΩ [9]R_{BE}=1KΩ [11]R_S=10KΩ [12]T_C=25°C [13]With a heat-sink
All TO-92 are center collector configuration unless otherwise noted

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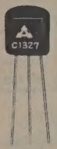
SILICON PLASTIC TRANSISTORS

TO-92 / NPN (Cont'd)



Type No.	(Ta = 25°C) Absolute Max. Ratings			(Ta = 25°C) Electrical Characteristics										Complimentary Pair	Use
	V_{CBO} (V)	V_{CEO} V_{CER}* (V)	I_C (mA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (mA)	f_T Min. (MHz)	f_T Typ. (MHz)	@ I_E I_C* (mA)	Bias $V_{CE(sat)}$ I_C (mA)	I_B (mA)	Typ. (V)	Max. (V)		
2SC1778▲	25	20	15	20		3*	600		−3						Mix. Osc.
2SC1779▲	30	20	20	25		2*	450		−2						RF Amp.
2SC1788	25	20	1A[1]	65	220	1A*		150	−50	500	50		0.6		General
2SC1789	25	18	50	20		2*	600		−10						RF Osc.
2SC1849☆	30	25	200[1]	90	650	2*		150	−2	10	0.3	0.5		2SA888	General
2SC1850☆	60	50	200[1]	90	650	2*		150	−2	10	0.3	0.5		2SA889	General
2SC1851☆	30	25	1A[1]	60	340	+150*		200	−50	500	50		0.6	2SA890	General
2SC1852☆	60	50	1A[1]	60	340	+150*		200	−50	500	20		0.6	2SA891	General
2SC1980	120	120	50[1]	260	1040	2*				3		0.6		2SA921	Low Noise
2SD592	30	25	1500[1]	60	340	500*		200	−50	50	0.2	0.4		2SB621	AF Amp.

LARGE TO-92 / PNP

Type No.	(Ta = 25°C) Absolute Max. Ratings			(Ta = 25°C) Electrical Characteristics									Complimentary Pair	Use
	V_{CBO} (V)	V_{CEO} V_{CER}* (V)	I_C (mA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (mA)	F_T Min. (MHz)	F_T Typ. (MHz)	@ I_E I_C* (mA)	Bias $V_{CE(sat)}$ I_C (mA)	I_B (mA)	Max. (V)		
2SA683	−30	−25	−1.5A[1]	60	340	−500		200	50	−500	−50	−0.4	2SC1383	General
2SA684	−60	−50	−1.5A[1]	60	340	−500		200	50	−500	−50	−0.4	2SC1384	General
2SA751[13]	−30	−25	−1.5A[1]	60	340	−500		200	50	−500	−50	−0.4	2SC1406	General
2SA752[13]	−60	−50	−1.5A[1]	60	340	−500		200	50	−500	−50	−0.4	2SC1407	General
2SA777	−80	−80	−1A[1]	65	330	−150		120	50	−500	−50	−0.4	2SC1509	AF Amp.
2SA794	−100	−100	−1A[1]	65	330	−150		120	50	500	−50	−0.4	2SC1567	AF Amp.
2SA912	−150	−150	100	65	450	−10	150	200	10	−50	−5	−1	2SC1885	AF Amp.

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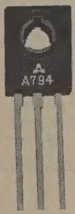
2SC1360	50	45	50	20	100	−10	300	500	−10	2	—	0.4		VIF Amp.
2SC1383	30	25	1.5A[1]	60	340	500*		200	−50	500	50	0.4	2SA751	General
2SC1384	60	50	1.5A[1]	60	340	500*		200	−50	500	50	0.4	2SA752	General
2SC1406[13]	30	25	1.5A[1]	65	330	500*		120	−50	500	50	0.4	2SA777	AF Amp.
2SC1407[13]	60	50	1.5A[1]	65	330	500*		150	−50	500	50	0.5		DC-DC Conv.
2SC1509	80	80	1A[1]	30	220	150*	50	80	−50	500	50	1.2		AF Amp.
2SC1518	25	20	1.5A[1]	65	450	500*	150	200	−50	1A	50	0.5	2SA912	AF Amp.
2SC1573	250	200	100[1]	60	340	5*		200	−10	5	—	0.4	2SA683	General
2SC1885	150	150	100[1]	60	340	10*		200	−10	5	—	0.4	2SA684	General

TO-126 / PNP



Type. No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics										Compli mentary Pair	Use
	V_{CBO} (V)	V_{CEO} V_{CES}* V_{CER}# (V)	I_C (A)	P_C (W)	I_{CBO} Max. (μA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (A)	f_T Min. (kHz)* (MHz)	f_T Typ. (kHz)* (MHz)	@ I_E I_C* (A)	Bias $V_{CE(sat)}$ I_C (A)	I_B (A)	Max. (V)		
2SA794	−100	−100	−1[1]	4[13]		65	330	−0.15*		120	0.05	−0.5	−0.05	−0.4	2SC1567	AF Amp.
2SA794A	−120	−120	−1[1]	4[13]		65	330	−0.15*		120	0.05	−0.5	−0.05	−0.4	2SC1567A	AF Amp.
2SA795	−150	−150	−0.5[1]	10[14]	−30	50		−0.01*				−0.25	−0.025	−10	2SC1565	AF Out.
2SA885	−45	−35	−1.5[1]	5[13]	−0.1	60	340	−0.5*		200	0.05	−0.5	−0.05	−0.5	2SC1846	AF Out.
2SA886	−50	−40	−3[1]	5[13]	−1	30	220	−1*		150	0.5	−2	−0.2	−1.0	2SC1847	AF Amp.
2SA900	−20	−18	−2[13]	4[12]	−1	90	470	−0.5*		200	0.05	−1.0	−0.05	−0.5	2SC1568	AF Out.
2SA914	−150	−150	−0.1[1]	1[12]	−1	65	450	−10ma*	150	200	10mA	−50mA	−5mA	−1.0	2SC1953	AF pre-Driver

NPN

2SC1501	300	300[5]#	0.15[1]	10[15]	100	30		0.01*		55	−0.02	0.1	0.01	5		General
2SC1550	250	250	0.1	10[12]	100	50	250	0.005*	70	100	−0.02	0.05	0.005	2		Video Out.
2SC1565	150	150	0.5[1]	10[14]	30	50		0.01*				0.25	0.025	10	2SA795	AF Out.
2SC1566	250	250	0.15[1]	1.2		40		0.04*	80	100	−0.01	0.1	0.01	1		Video Out.
2SC1567	100	100	1[1]	1.2		65	330	0.15*		120	−0.05	0.5	0.05	0.4	2SA794	AF Amp.
2SC1567A	120	120	1[1]	1.2		65	330	0.15*		120	−0.05	0.5	0.05	0.4	2SA794A	AF Amp.
2SC1568	18	18	2[1]	4[12]	1	65	360	0.5*		150	−0.05	1	0.05	0.5	2SA900	AF Out.
2SC1846	45	35	1.5[1]	5[13]	0.1	60	340	0.5*		200	−0.05	0.5	0.05	0.5	2SA885	AF Out.
2SC1847	50	40	3[1]	5[13]	1	30	220	1*		150	−0.5	2	0.2	1.0	2SA886	AF Amp.
2SC1953	150	150	0.1[1]	1	1	65	450	0.01*	150	200	−0.01	0.05	5mA	0.5	2SA914	AF Pre-Driver

TO-202 / PNP

2SA699	−40	−20	−3[1]	10[12]	−1	30	220	−1*		150	−0.5*	−2	−0.2	−1.0	2SC1226	AF Out.
2SA699A	−50	−40	−3[1]	10[12]	−1	30	220	−1*		150	−0.5*	−2	−0.2	−1.0	2SC1226A	AF Out.
2SA887	−70	−50	−3[1]	10[12]	−1	30		−0.1*		150	0.5	−2	−0.2	−1.2	2SC1848	AF Amp.

☆Center Base Configuration [1] I_{CM} [3] Rg=10KΩ [4] T_C≦125°C [5] R_{BE}≦3KΩ [6] Rg=2KΩ
[7] R_{BE}≦30KΩ [8] RG=50KΩ [9] R_{BE}=1KΩ [11] R_S=10KΩ [12] T_C=25° [13] With a heat-sink [14] T_C=90°C [15] T_C=70°C
All TO-92 are center collector configuration unless otherwise noted.

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PLASTIC SILICON TRANSISTORS

TO-202 / NPN (Cont'd)

Type. No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics										Compli-mentary Pair	Use
									f_T			$V_{CE(sat)}$				
	V_{CBO} (V)	V_{CEO} V_{CES}* V_{CER}# (V)	I_C (A)	P_C (W)	I_{CBO} Max. (μA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (A)	Min. (kHz)* (MHz)	Typ. (kHz)* (MHz)	@ I_E I_C* (A)	I_C (A)	I_B (A)	Max. (V)		
2SC1226	40	20	3[1]	10[12]	1	30	220	1*		150	0.5*	2	0.2	1.0	2SA699	AF Out.
2SC1226A	50	40	3[1]	10[12]	1	30	220	1*		150	0.5*	2	0.2	1.0	2SA699A	AF Out.
2SC1848	70	50	3[1]	10[12]	1	30		0.1*		150	−0.5	2	0.2	1.2	2SA887	AF Amp.

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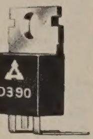
2SA748	−70	−50	−3[1]	15[12]	−1	30		−0.1*		150	−0.5*	−2	−0.2	−1.0	2SC1398	AF Out.
2SA843	−200	−150	−0.5	20[12]	−50	60	220	−400mA*				−500mA	−50mA	−1.0	2SC1683	Vert. Out.
2SA913	−150	−150	−1	15[12]		65	330	−150mA*		120	50mA	−500mA	−50mA	−0.6	2SC1913	AF Amp.
2SB512	−60	−60	−3	25[12]	−30	40		−0.1*		70*	−0.2*	−2	−0.4	−1.0	2SD365	AF Out.
2SB512A	−80	−80	−3	25[12]	−30	40		−0.1*		70*	−0.2*	−2	−0.4	−1.0	2SD365A	AF Out.
2SB513	−60	−60	−3	25[12]	−30	40		−0.1*		70*	−0.2*	−2	−0.4	−1.0	2SD366	AF Out.
2SB513A	−80	−80	−3	25[12]	−30	40		−0.1*		70*	−0.2*	−2	−0.4	−1.0	2SD366A	AF Out.
2SB604	−70	−70	−3	30[12]	−30	40	240	−0.5*		10*	−0.5*	−3	−0.3	−1.5		AF Amp.

NPN



2SC1398	70	50	3[1]	15[12]	1.0	30		0.1*		150	0.5*	2	0.2	1	2SA748	AF Out.
2SC1446	300	300[5]#	0.15[1]	10[15]	100	30		0.01*		55	−0.02	0.1	0.01	5		AF Out.
2SC1683	200	150	2[1]	20[12]	50	60	200	400mA*				0.5	50mA	1.0	2SA843	Vert. Out.
2SC1819	300	300	0.1[1]	15	100	50	250	5mA*	70	100	20mA	50mA	5mA	1.5		Chroma Out.
2SC1905	350	300	0.3[1]	15	10	30		10*	4.5		20mA	100mA	10mA	20		Hor. Out.
2SC1913	150	150	1.5[1]	1.5[12]	1	65	330	150mA*		120	0.05	0.5	0.05	0.6	2SA913	AF Amp.
2SC1929	300	270	1[1]	25[12]	10	35	330	0.1*		80	0.1*	1	0.1	5		AF Out.
2SC1974	80	80#	3.0[1]	15[15]	1*	30		1.0*		150*	0.5*					HF Out.
2SC1975	120	90#	3.0[1]	15[15]	1*	50		1.0*		150*	0.5*					HF Out.
2SD365	60	60	3	25[12]	30	40		0.1*		70*	0.2*	2	0.4	1.0	2SB512	AF Out.
2SD365A	80	80	3	25[12]	30	40		0.1*		70*	0.2*	2	0.4	1.0	2SB512A	AF Out.
2SD366	60	60	3	25[12]	30	40		0.1*		70*	0.2*	2	0.4	1.0	2SB513	AF Out.
2SD366A	80	80	3	25[12]	30	40		0.1*		70*	0.2*	2	0.4	1.0	2SB513A	AF Out.
2SD389	60	60	3	25[12]	30	40		0.1*		25*	0.2*	2	0.4	1.0		AF Out.
2SD389A	80	80	3	25[12]	30	40		0.1*		25*	0.2*	2	0.4	1.0		AF Out.
2SD390	60	60	3	25[12]	30	40		0.1*		25*	0.2*	2	0.4	1.0		AF Out.
2SD390A	80	80	3	25[12]	30	40		0.1*		25*	0.2*	2	0.4	1.0		AF Out.
2SD570	70	70	4	30[12]	30	40	240	0.5*		10	0.5*	3	0.3	1.5		AF Amp.

METAL CASE SILICON TRANSISTORS

TO-3 / PNP

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics								Compli-mentary Pair	Use
								Bias $V_{CE(sat)}$			Bias f_T			
	V_{CBO} (V)	V_{CEO} V_{CES}* V_{CER}# (V)	I_C (A)	P_C (W)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (A)	I_C (A)	I_B (A)	Max. (V)	@ I_E I_C* (A)	Typ. (kHz)* (MHz)		
2SA837	−90	−90	−4	5.0[16]	40	200	−1*	−4	−0.4	−2.0	−0.5*	10	2SC1667	AF Out.
2SA882	−130	−130	−4	100[12]	40	250	−2*	−7	−0.7	−1.5	−0.5*	7	2SC1818	AF Amp.
2SA886	−50	−40	−3[1]	5[13]	30	220	−1*	−2	−0.2	−1.0	0.5	150	2SC1847	AF Amp.
2SB625	−100	−100	−7[1]	60[12]	40	200	−1*	−5	−0.5	−2.5	−0.5*	7		AF Amp.
2SB626	−120	−120	−8[1]	80[12]	40	200	−1*	−6	−0.6	−1.5	−0.5*	6		AF Amp.

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2SC582	300	300[5]#	0.15[1]	6.5[2]	30	150	−0.05				−0.05	35		AF Out.
2SC647	80	80	5[1]	50[3]	20		0.1*	5	1.0	1.6	−0.5	43		AF Out.
2SC901	200	200*	5[1]	50[3]	14	350	5.0*	5	1.0	1.6	−0.5	50		Hor. Out.
2SC901A	250	250*	5[1]	50[3]	14	350	5.0*	5	1.0	1.6	−0.5	50		Hor. Out.
2SC1667	90	90	6[1]	5.0[3]	40	200	1.0*	4	0.4	2.0	0.5*	10	2SA837	AF Out.
2SC1818	130	130	7[1]	100[4]	40	250	2.0*	7	0.7	1.5	0.5*	7	2SA882	AF Amp.
2SD198	300	300[17]#	1[1]	25[3]	35	330	0.1*	1	0.1	5	0.1*	45		AF Out.
2SD199	800	700[19]#	0.5[1]	25[3]	25		0.02*	0.5	0.05	10	0.1*	7		Ver. Out.
2SD200	1500	1500*	2.5[1]	10[9]			2.0*	2	1.0	5				Hor. Out.
2SD200A	1500	1500*	2.5[1]	10[9]			2.0*	2	1.0	5				Hor. Out.
2SD299	1500	1500*	5[1]	16[9]	2		4.0*	4.5	2.0	10				Hor. Out.
2SD300	1500	1500*	5[1]	16[9]	3	8	2.5*	2.5	0.85	10				Hor. Out.
2SD312	800	600[20]#	1.0[1]	25[18]	25		0.02*	1	0.1	10	0.1*	5		Vert. Out.
2SD319	110	80	30[1]	100[4]	40	200	1.0*	5	0.5	2	0.5*	1		AF Out.
2SD321	250	250*	15[1]	60[3]	25	100	5.0*	5	1.0	1				Switching
2SD334	110	80	6[1]	75[4]	40	260	1.0*	5	0.5	2	0.5*	25*		AF Out.
2SD350	1500	700	11[1]	22[14]	3	8	4.0*	4.5	2	7				Switching

☆Center Base Configuration [1] I_{CM} [3] Rg=10KΩ [4] T_C≦125°C [5] R_{BE} 3KΩ [6] Rg=2KΩ
[7] R_{BE}≦30KΩ [8] RG=50KΩ [9] R_{BE}=1KΩ [11] R_S=10KΩ [12] T_C=25° [13] With a heat-sink
[14] T_C=90°C [15] T_C=70°C [16] T_C=75°C [17] R_{BE}=500Ω [18] T_C=100°C [19] R_{BE}=220Ω [20] R_{BE}=560Ω

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METAL CASE SILICON TRANSISTORS

TO-3 / NPN (Cont'd)

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics									
	V_{CBO} (V)	V_{CEO} V_{CES}* V_{CER}# (V)	I_C (A)	P_C (W)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (A)	Bias $V_{CE(sat)}$ I_B (A)	Bias $V_{CE(sat)}$ I_C (A)	Bias $V_{CE(sat)}$ Max. (V)	Bias f_T Typ. (kHz)* (MHz)	Bias f_T @ I_E I_C* (A)	Complimentary Pair	Use
2SD350A	1500	700	5	22[14]	3	15	4.0*	2	4.5	1				Hor. Out.
2SD380	1500	700	5	50[16]	5	15	5.0*	1	5	10				Switching
2SD380A	1500	650	5	50[16]	7.5	20	5*	1	5	4.5				Switching
2SD458	600	400	5	80[12]	6.5	50	5.0*	1	5	1.5				Switching
2SD517	1500	700	5[1]	16[14]	3	10	2.0*	0.75	2	5				Hor. Out.
2SD546	800	500	1	30[16]	40	200	0.02*	0.05	0.5	3	7	0.1*		Vert. Out.
2SD577	1500	1500*	5[1]	16[14]	5	15	3.0*	1	3	2.5				Hor. Out.
2SD597	100	100	5	60[12]	40	200	1.0*	0.5	5	2.5	7	0.5*		AF Amp.
2SD598	120	120	6	80[12]	40	200	1.0*	0.6	6	1.5	6	0.5*		AF Amp.

TO-66 / PNP

2SA766	−150	−150[8]#	−1.2[17]	20[13]	35	150	−0.1*	−0.1	−1	−1.0	15	0.1	2SC1450	Vert. Out.

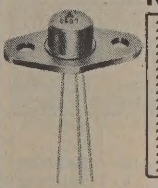
NPN

2SC582	300	300[5]#	0.15[1]	6.5[15]	30	150	−0.05				35	−0.05		AF Out.
2SC840	100	60	3[1]	20[12]	30		0.1*	0.4	2	1.5	50	−0.05		AF Out.
2SC840A	150	100	3[1]	20[12]	30		0.1*	0.4	2	1.5	50	−0.05		AF Out.
2SC1450	150	150[11]#	1.2[6]	20[10]	45	150	0.1*	0.1	1	1.0	15	−0.1	2SA766	Vert. Out.
2SD226	40	40	3[6]	25[12]	40		0.1*	0.4	2	1	25*	0.2*		AF Out.
2SD226A	60	60	3[6]	25[12]	40		0.1*	0.4	2	1	25*	0.2*		AF Out.
2SD546	800	500	1	30[16]	40	200	0.02*	0.05	0.5	3	7	0.1*		Vert. Out.

TO-39 / PNP

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics										
	V_{CBO} (V)	V_{CEO} V_{CES}* V_{CER}# (V)	I_C (A)	P_C (W)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (A)	Bias $V_{CE(sat)}$ I_C (A)	Bias $V_{CE(sat)}$ I_B (A)	Bias $V_{CE(sat)}$ Max. (V)	Bias f_T Min. (kHz)* (MHz)	Bias f_T Typ. (kHz)* (MHz)	Bias f_T I_E I_C* (A)	Complimentary Pair	Use
2SA546	−70	−60	−1	1.2[13]	30	173	−0.1*	−1	−0.1	−0.8		80	−0.05*	2SC696	General
2SA546A	−90	−80	−1	1.2[13]	30	173	−0.1*	−1	−0.1	−0.8		80	−0.05*	2SC696A	General
2SA547[6]	−70	−60	−1	10[12]	30	173	−0.1*	−1	−0.1	−0.8		80	−0.05*	2SC697	General
2SA547A[6]	−90	−80	−1	10[12]	30	173	−0.1*	−1	−0.1	−0.8		80	−0.05*	2SC697A	General

NPN



2SC696	100	60	3[1]	1.2[13]	30	173	0.1*	2	0.4	0.8	35		−0.05	2SA546	General
2SC696A	130	80	3[1]	1.2[13]	30	173	0.1*	2	0.4	0.8	35		−0.05	2SA546A	General
2SC697[5]	100	60	3	10[12]	30	173	0.1*	2	0.4	0.8	35		−0.05	2SA547	General
2SC697A[5]	130	80	3	10[12]	30	173	0.1*	2	0.4	0.8	35		−0.05	2SA547A	General
2SC731	40	20	1.0[5]	2.5[15]	20	70	0.1*				700*		−0.03		UHF Out.
2SC821	40	20	0.6[5]	2.5[15]	20	70	0.1*				350		−0.03		VHF Out.
2SC822	40	20	0.8[5]	2.5[15]	20	70	0.1*				400		−0.03		VHF Out.
2SC1303	40	20	0.5[5]	0.6[15]	20	70	0.1*				350		−0.03		VHF Out.
2SC1326	55	30	0.4[5]	5[15]		30	0.05*				700*		−0.025		UHF Out.
2SC2034	120	90#	3.0[5]	12[15]	50		1.0*				150*		0.5*		HF Out.

TO-72 / NPN

Type No.	(Ta = 25°C) Absolute Maximum Ratings			(Ta = 25°C) Electrical Characteristics									
	V_{CBO} (V)	V_{CEO} V_{CER}* (V)	I_C (mA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (mA)	f_T Min. (MHz)	f_T Max. (MHz)	I_E I_C* (mA)	Bias $V_{CE(sat)}$ I_C (mA)	Bias $V_{CE(sat)}$ I_B (mA)	Typ. (V)	Use
2SC562	40	30	25	26		−4	220	500	−4	10	1	1.5	VIF (AGC)
2SC563	40	25	25	38		−7	360	820	−5	10	1	0.15	VIF Amp.
2SC563A	40	40	25	38		−7	360	820	−5	10	1	0.15	VIF Amp.
2SC583	30	15	50[1]	25	150	2*	1000		2*				UHF Amp.
2SC761	30	20	20				450	950	−2	10	1	3	UHF Amp.
2SC947	25	20	15				400	1000	−3	10	1	0.6	UHF Mix.
2SC948	25	20	15	10		−3	700		−3	10	1	0.6	UHF Osc.
2SC1547	30	20	20	20		−3			−3				UHF Amp.

TO-18 / PNP

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics											
	V_{CBO} (V)	V_{CEO} V_{CER}* (V)	I_C (mA)	P_C (mW)	Bias I_{CBO} Max. (μA)	h_{FE} Min.	h_{FE} Max.	@ I_E I_C* (mA)	f_T Min. (MHz)	f_T Typ. (MHz)	I_E I_C* (mA)	Bias $V_{CE(sat)}$ I_C (mA)	Bias $V_{CE(sat)}$ I_B (mA)	Bias $V_{CE(sat)}$ Max. (V)	Complimentary Pair	Use
2SA550	−25	−25	−100[1]	300	−1	65	700	2		120	−1*	−50	−2.5		2SC538	General
2SA550A	−45	−45	−100[1]	300	−1	65	700	2		120	−1*	−50	−2.5		2SC538A	General

NPN

2SC538	25	25	100[1]	300	1	90	700	−2		150	−2	100	10	0.32	2SA550	General
2SC538A	45	45	100[1]	300	1	90	700	−2		150	−2	100	10	0.32	2SA550A	General
2SC645	30	20	30	140	1	40	250	1*	150	200	1	10	1			RF Amp.

☆Center Base Configuration

[1] I_{CM} [3] R_g=10KΩ [4] T_C≦125°C [5] R_{BE} 3KΩ [6] R_g=2KΩ

[7] R_{BE}≦30KΩ [8] RG=50KΩ [9] R_{BE}=1KΩ [11] R_S=10KΩ [12] T_C=25° [13] With a heat-sink

[14] T_C=90°C [15] T_C=70°C [16] T_C=75°C [17] R_{BE}=500Ω [18] T_C=100°C [19] R_{BE}=220Ω [20] R_{BE}=560Ω [21] T_C=80°C

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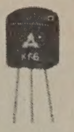
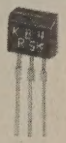
FETS





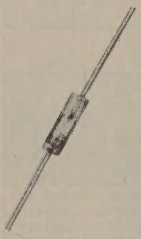
N-CHANNEL / JUNCTION FETS

Type No.	(Ta = 25°C) Absolute Maximum Ratings						(Ta = 25°C) Electrical Characteristics					NV NF*		Case Style No.
							Bias		I_{DSS}	gm				
	V_{DSO} (V)	V_{DGO} (V)	I_{DSO} (mA)	I_{DGO} (mA)	I_{GSO} (mA)	P_D (mW)	V_{DS} (V)	V_{GS} (V)	Max. (mA)	f (kHz)	Min. (μ℧)	f (KΩ)	Max. (μV)	
2SK65	12	12	2	2	2		4.5	0	0.8	1	300		4	
2SK66		−55		10		100	10	0	6.5	1	1.2m	120Hz	5dB*	TO-92
2SK83	23	25	10	10		100	5	0	12	1	1.2m	100MHz	3.5dB*	TO-92
2SK84		−55		10		100	10	0	6.5	1	1.9m	120Hz	5dB*	

METAL CAN DUAL GATE / N-CHANNEL / MOS FETS

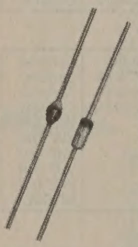
Type No.	(Ta = 25°C) Absolute Maximum Ratings					(Ta = 25°C) Electrical Characteristics							
								I_{DSS}	Y_{FS}		Max.	PG	
	V_{DS} (V)	V_{G1S} (V)	V_{G2S} (V)	I_D (mA)	P_D (mW)	V_{DS} (V)	V_{G2S} (V)	Max. (mA)	f (kHz)	Min. (m℧)	Typ.* (m℧)	f (MHz)	Min. (dB)
3SK39	20	±8	±8	24	250	10	5	24	455	7	18	200	18
3SK49	20	±8	±8	30	350	10	5	30	455		15*	200	17

DIODES



GERMANIUM DIODES

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics								Use
					I_F		I_R		Rectification Eff.				
	V_R (V)	I_F (mA)	I_{FM} (mA)	I_{surge} (mA)	V_F (V)	Min. (mA)	V_R (V)	Max. (μA)	f (MHz)	R_L (KΩ)	C_L (pF)	Min. (%)	
0A90	15	50	150	400	1	4	10	150	30	3.9	10	50	Detector
0A91	90	50	150	500	1	3	10	11					General
0A95	90	50	150	500	1	5	10	7					General
0A99	30	35	100	200	1	2	10	18	10.7	33	330	76	Detector



SILICON DIODES

Type No.	(Ta = 25°C) Absolute Maximum Ratings				(Ta = 25°C) Electrical Characteristics												Use
					I_R		V_F		C			Condition			t_{rr}		
	V_R (V)	I_F (mA)	I_{FM} P_D* (mA) (mW)	I_{surge} (t = 1sec) (mA)	V_R (V)	Max. (nA)	I_F (mA)	Max. (V)	V_R (V)	f (MHz)	Max. (pF)	V_R (V)	R_L (Ω)	$I_F \sim I_R$ (mA)	Max. (nS)		
MA26		20	20*				1.5	0.61									AVC
MA26W		30	48*				3.0	1.29									AVC
MA150	35	100	225	500	15	25	100	1.2	0	1	2.0	1	100	10~1	10		Switching
MA161	50	100	225	500	15	25	100	1.2	0	1	2.0	1	100	10~1	4		Switching
MA162	75	100	225	500	20	25	100	1.2	0	1	2.0	1	100	10~1	4		Switching

SILICON PLANAR ZENER DIODES

Type No.	(Ta = 25°C) Electrical Characteristics													
	V_F (V) I_F = 10mA		I_R (nA)		V_Z (V) I_Z = 5mA			I_Z = 5mA R_Z (Ω)		S (mV/°C) I_Z = 5mA			Cd (pF) V_R=0, f=1MHz	
	Typ.	Max.	V_R (V)	Max.	Min.	Nom.	Max.	Typ.	Max.	Min.	Typ.	Max.	Typ.	Max.
MA1047	0.8	0.9	2	3000	4.4	4.7	5.0	50	80	−3.5	−1.4	0.2	130	180
MA1051	0.8	0.9	2	2000	4.8	5.1	5.4	40	60	−2.7	−0.8	1.2	110	160
MA1056	0.8	0.9	2	1000	5.2	5.6	6.0	15	40	−2.0	1.2	2.5	95	140
MA1062	0.8	0.9	4	3000	5.8	6.2	6.6	6	10	0.4	2.3	3.7	90	130
MA1068	0.8	0.9	4	2000	6.4	6.8	7.2	6	15	1.2	3.0	4.5	85	110
MA1075	0.8	0.9	5	1000	7.0	7.5	7.9	6	15	2.5	4.0	5.3	80	100
MA1082	0.8	0.9	5	700	7.7	8.2	8.7	6	15	3.2	4.6	6.2	75	95
MA1091	0.8	0.9	6	500	8.5	9.1	9.6	6	15	3.8	5.5	7.0	70	90
MA1100	0.8	0.9	7	200	9.4	10.0	10.6	8	20	4.5	6.4	8.0	70	90
MA1110	0.8	0.9	7	100	10.4	11.0	11.6	10	20	5.4	7.4	9.0	65	85
MA1120	0.8	0.9	8	100	11.4	12.0	12.7	10	25	6.0	8.4	10.0	65	85
MA1130	0.8	0.9	9	100	12.4	13.0	14.1	10	30	7.0	9.4	11.0	60	80
MA1150	0.8	0.9	10	50	13.8	15.0	15.6	10	30	9.2	11.4	13.0	55	75
MA1160	0.8	0.9	11	50	15.3	16.0	17.1	10	40	10.4	12.4	14.0	52	75
MA1180	0.8	0.9	13	50	16.8	18.0	19.1	10	45	12.4	14.4	16.0	47	70
MA1200	0.8	0.9	14	50	18.8	20.0	21.2	15	35	14.4	16.4	18.0	36	60
MA1220	0.8	0.9	15	50	20.8	22.0	23.3	20	55	16.4	18.4	20.0	34	60
MA1240	0.8	0.9	17	50	22.8	24.0	25.6	25	70	18.4	20.4	22.0	33	55

Absolute Maximum Ratings: $I_{FAV} \cdot I_{FRM}$ = 250mA, P_D = 400mW (100μsec), P_{ZSM} = 30W, T_j = 200°C, T_{stg} = −65~+200°C

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Integrated Circuits / HALL EFFECT — LINEAR/SWITCHING TYPE

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Item	DN834 Symbol	DN834 Rating	DN834 Unit	DN835 Symbol	DN835 Rating	DN835 Unit	DN837 Symbol	DN837 Rating	DN837 Unit	DN838 Symbol	DN838 Rating	DN838 Unit
Supply Voltage	V_{CC}	0～6	V	V_{CC}	0～6	V	V_{CC}	0～6	V	V_{CC}	0～18	V
Supply Current	I_{CC}	15	mA	I_{CC}	0～15	mA	I_{CC}	15	mA	I_{CC}	8	mA
Output Voltage	V_O	6	V	V_O	6	V	V_O	0～20	V	V_O	−12	V
Output Current (value for one output)	I_O	15	mA	I_O	−15～10	mA	I_O	15	mA	I_O	−1～20	mA
Total Power Dissipation	P_D	90	mW	P_D	90	mW	P_D	90	mW	P_D	100	mW
Operating Temp.	T_{opr}	−20～+75	°C	T_{opr}	−20～+75	°C	T_{opr}	−20～+75	°C	T_{opr}	−40～+100	°C
Storage Temp. Range	T_{stg}	−55～+125	°C	T_{stg}	−55～+125	°C	T_{stg}	−55～+125	°C	T_{stg}	−55～+125	°C

*Operating 2.5mW/°C at Tz285°C

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

DN834

Item		Symbol	Conditions	Limits Min.	Limits Max.	Unit
Magnetic Flux Density	Output "H"→"L"	B (H→L)	V_{CC}=5V		750	Gauss
	Output "L"→"H"	B (L→H)	V_{CC}=5V	100		Gauss
"L" Output Voltage*		V_{OL}	V_{CC}=5V, I_{OL}=12mA, B=750 Gauss		0.4	V
"H" Output Voltage*		V_{OH}	V_{CC}=5V, I_{OH}=−100μA, B=100 Gauss	2.4		V
Short-Circuit Output Current*		$-I_{OS}$	V_{CC}=5V, V_O=0, B=0		1.34	mA
Supply Current	Output "H"	I_{CCH}	V_{CC}5V, B=0		10.0	mA
	Output "L"	I_{CCL}	V_{CC}=5V, B=750 Gauss		13.5	mA

DN835

Item	Symbol	Conditions	Min.	Max.	Unit
Offset B	Boffset	V_{CC}=5V, VQ_1=VQ_2	−350	350	Gauss
"H" Output Voltage	V_{OH}	V_{CC}=5V, I_{OH}=−10mA, B=±500 Gauss	2.4		V
"L" Output Voltage	V_{OL}	V_{CC}=5V, I_{OL}=0.1mA, B=±500 Gauss		0.5	V
"L" Output Voltage	V_{OL}	V_{CC}=5V, I_{OL}=−2mA, B=±500 Gauss		0.5	V
Supply Current	I_{CC}	V_{CC}=5V		13.5	mA

DN837

Item		Symbol	Conditions	Min.	Max.	Unit
Magnetic Flux Density	Output "H"→"L"	B (H→L)	V_{CC}=5V		750	Gauss
	Output "L"→"H"	B (L→H)	V_{CC}=5V	100		Gauss
"L" Output Voltage*		V_{OL}	V_{CC}=5V, I_{OL}=12mA, B=750 Gauss		0.4	V
"H" Output Current*		I_{OH}	V_{CC}=5V, V_O=20V, B=100 Gauss		10	μA
"H" Output Current*		I_{OH}	V_{CC}=5V, V_O=0, B=100 Gauss	−10		μA
Supply Current	Output "H"	I_{CCH}	V_{CC}=5V, B=0		6	mA
	Output "L"	I_{CCL}	V_{CC}=5V, B=750 Gauss		13.5	mA

DN838

Item	Symbol	Conditions	Min.	Max.	Unit
Magnetic Flux Density	B (H→L)	V_{CC}=12V	−250		Gauss
	B (L→H)	V_{CC}=12V		250	Gauss
"L" Output Voltage*	V_{OL}	V_{CC} = 16V, I_O = 12mA, B = −250 Gauss		0.4	V
		V_{CC} = 8V, I_O = 12mA, B = −250 Gauss		0.4	V
"H" Output Voltage*	V_{OH}	V_{CC} = 16V, I_O = −30μA, B = +250 Gauss	12		V
		V_{CC} = 8V, I_O = −30μA, B = +250 Gauss	4		V
Short-Circuit Output Current*	$-I_{OS}$	V_{CC} = 16V, V_O = 0, B = +250 Gauss	0.35	0.75	mA
Supply Current	I_{CC}	V_{CC} = 16V		5.6	mA
		V_{CC} = 8V		5.5	mA

Measurements are made for both outputs, Q1 (+ Gauss) and Q2 (− Gauss).
The direction of the current flowing into the device is defined as Plus, and that flowing out of the device is defined as Minus.

BBD

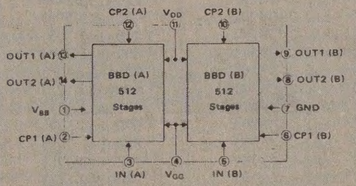
Item		Symbol	MN3001	MN3002	MN3003	MN3004	Unit
Circuit Construction	Number of BBD		Dual-512	512	Dual-64	512	Stage
	Clock Generator		External		Built-in	External	
	Output Terminal		Pair		Pair	Pair	
Operating Conditions	Drain Supply Voltage	V_{DD}	−15		−9	−15	V
	Gate Supply Voltage	V_{GG}	−14		−8	−14	V
	Back-Gate Bias Voltage	V_{BB}	+5		Not Needed	+5	V
	Clock Voltage "H"	V_{CPH}	0		0	0	V
	Clock Voltage "L"	V_{CPL}	−15		−9	−15	V
Electrical Characteristics	Input Signal Frequency	f_{in}	12 (f_{cp}=40kHz, 3dB down)				kHz (Max.)
	Input Signal Swing	V_{in}	2		0.8	1.8	Vrms (Max.)
	Insertion Loss	L_I	8.5		3.5	1.5	dB (Typ.)
	Total Harm. Distortion	THD	0.4		0.5	0.4	% (Typ.)
	Noise Level	V_N	250		100	210 (max.)	μV (Typ.)
	Signal to Noise Ratio	S/N	70		75	85	dB (Typ.)
	Signal Delay Time	t_D	51.2	25.6	6.4	25.6	msec (Max.)
Package			14-Lead Dual-In-Line Plastic Package				

OTHER TYPES AVAILABLE:

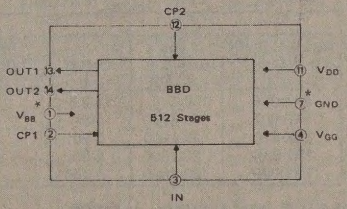
- LOW NOISE PREAMPLIFIERS
- AUDIO POWER AMPLIFIERS
- IF AMPLIFIERS
- TELEVISION CIRCUITS
- PLL CIRCUITS
- SCANNER CIRCUITS
- μP CIRCUITS

BBD

MN3001
(DUAL 512-STAGE BBD)

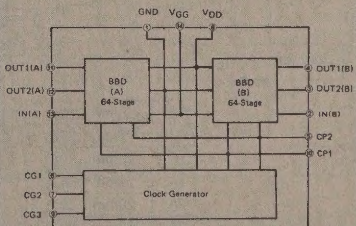


MN3002/MN3004
(512-STAGE BBD)



* MN3004 — Ground is Pin 1 V_{BB} not used.

3 DUAL 64
MN3003
(DUAL 64-STAGE BBD)



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ZNR TRANSIENT/SURGE ABSORBERS

Panasonic ZNRs are zinc oxide nonlinear resistors whose resistance changes as a function of the applied voltage. The ZNR has a bilateral and symmetrical V-I characteristic curve. Gives your circuit clamping protection in either direction. The ZNR thus provides a highly reliable and economical way to protect against repeated high voltage transients and surges such as those produced by lighting, switching surges and noise spikes.

FEATURES

- Excellent clamping voltage characteristic and fast response time (<50 nsec.) when subjected to impulse surges. Eliminates the discharge lag that is indicative of gap-type arrestors.
- Bilateral and symmetrical V-1 characteristic curve. The ZNR can, therefore, be used both in AC and DC circuits, for protection of either positive or negative transients.

STANDARD VOLT RANGE

Part Number	Varistor Voltage V_1 mA (V)	Maximum Allowable Voltage AC rms (V)	
		AC rms (V)	DC (V)
ERZ-C--DK220	22 (20-24)	14	18
ERZ-C--DK270	27 (24-30)	17	22
ERZ-C--DK330	33 (30-36)	20	26
ERZ-C--DK390	39 (35-43)	25	31
ERZ-C--DK470	47 (42-52)	30	38
ERZ-C--DK560	56 (50-62)	35	45
ERZ-C--DK680	68 (61-75)	40	56
ERZ-C--DK820	82 (74-90)	50	65
ERZ-C--DK101	100 (90-110)	60	85
ERZ-C--DK121	120 (108-132)	75	100
ERZ-C--DK151	150 (135-165)	95	125
ERZ-C--DK201	200 (185-225)	130	170
ERZ-C--DK221	220 (198-242)	140	180
ERZ-C--DK241	240 (216-264)	150	200
ERZ-C--DK271	270 (247-303)	175	225
ERZ-C--DK361	360 (324-396)	230	300
ERZ-C--DK391	390 (351-429)	250	320
ERZ-C--DK431	430 (387-473)	275	350
ERZ-C--DK471	470 (423-517)	300	385
ERZ-C--DK621	620 (558-682)	385	505
ERZ-C--DK681	680 (612-748)	420	560
ERZ-C--DK751	750 (675-825)	460	615
ERZ-C--DK781	780 (702-858)	485	640
ERZ-C--DK821	820 (738-902)	510	670
ERZ-C--DK911	910 (819-1001)	550	745
ERZ-C--DK102	1000 (900-1100)	625	825
ERZ-C--DK112	1100 (990-1210)	680	895
ERZ-C--DK182	1800 (1620-1980)	1000	1465

Part No. Prefix + Disc Size mm	Volt Range V 1mA	Energy J	Withstanding Surge (8 x 20 μsec) Current (A)	Dia.
ERZ-C05	100-470	1-2.5	100	.265-.295
ERZ-C07	100-470	2-5	250	.335-.374
ERZ-C10	22-1100	2-20	250-500	.492-.551
ERZ-C14	22-1800	1.6-80	500-1000	.630-.768
ERZ-C20	100-1800	15-160	2000	.906-1.004

PART NUMBER CODE

E R Z – C 0 7 D K 2 2 1

Common Code — ZNR A/C SERIES

Element Size

05	5mm (.197)
07	7mm (.276)
10	10mm (.394)
14	14mm (.551)
20	20mm (.787)
25	25mm (.984)
32	32mm (1.260)

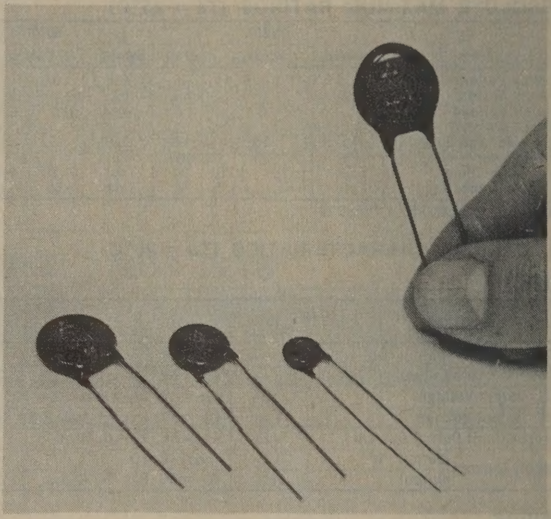
Type

D	Disc
E	Molded

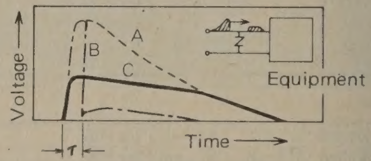
Tolerance

J	±5%
K	±10%
L	±15%

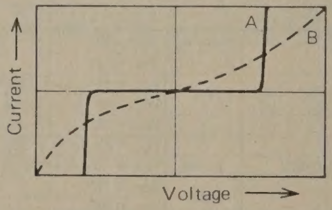
V 1mA — The first two digits are significant figures of voltage and the third one denotes number of zeros following.



IMMEDIATELY AVAILABLE FROM STOCK



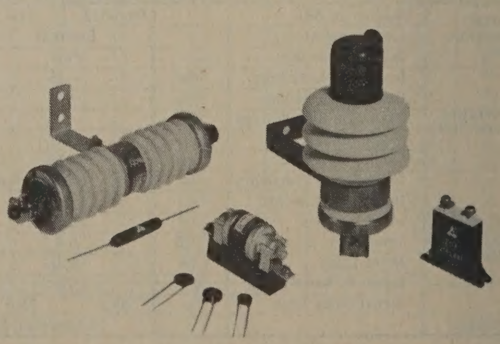
A: Original surge wave form
B: Clamping voltage using gap type arrestor
C: Clamping voltage using ZNR
τ: Discharge lag



A: ZNR
B: SiC varistor

HIGH VOLTAGE "ZNR®" SURGE ABSORBER

PRIMARY AND SECONDARY PROTECTION



Panasonic / MATSUSHITA ELECTRIC CORPORATION OF AMERICA / INDUSTRIAL DIVISION
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OUR TECHNOLOGY IS ALL AROUND YOU

DIRECTRON INDUSTRIAL SELENIUM RECTIFIERS,

FULL WAVE BRIDGE RECTIFIERS, SINGLE PHASE, RESISTIVE-INDUCTIVE LOADS

Max. Amps	18V In — 14V Out No.	Price	36V In — 28V Out No.	Price	54V In — 42V Out No.	Price	130V In — 100V Out No.	Price	160V In — 130V Out No.	Price	260V In — 200V Out No.	Price
½	A18	$1.65	A36	$2.45	A54	$3.85	A130	$ 8.25	A160	$12.10	A260	$13.45
1	B18	1.95	B36	3.55	B54	4.95	B130	13.45	B160	20.10	B260	21.45
2	C18	3.55	C36	4.95	C54	6.90	C130	16.25	C160	24.20	C260	26.65
3	D18	4.40	D36	6.90	D54	9.35	D130	21.45	D160	32.20	D260	37.65
4	E18	5.50	E36	11.00	E54	14.55	E130	33.25	E160	50.35	E260	64.35
6	F18	7.95	F36	15.70	F54	18.70	F130	45.35	F160	67.95	F260	72.05
10	G18	11.00	G36	20.10	G54	26.65	G130	53.35	G160	80.05	G260	90.75
12	H18	13.45	H36	24.20	H54	32.20	H130	61.90	H160	*	H260	104.25
15	J18	16.50	J36	30.25	J54	38.80	J130	73.95	J160	*	J260	132.00
20	K18	20.10	K36	40.15	K54	53.35	K130	106.70	K160	*	K260	192.50
24	L18	22.55	L36	46.20	L54	61.90	L130	113.85	L160	*	L260	209.00
30	M18	29.15	M36	55.85	M54	80.05	M130	*	M160	*	M260	*
36	P18	35.20	P36	69.05	P54	*	P130	*	P160	*	P260	*
50	R18	43.75	R36	85.80	R54	*	R130	217.80	R160	*	R260	*

220V Single Phase available . . . up to 1000 amps.
HALF-WAVE, CENTER-TAP, DOUBLER, TRIPLER or 3-PHASE — Quotations on request.
Minimum Order — $25.00. *Prices on Request — Quantity Discount — Prices Subject to Change

FREE CATALOG
FAST QUOTATIONS

24 HOUR SERVICE ON CUSTOM BUILT RECTIFIERS.
SEND US YOUR SAMPLES.

IN STOCK

RECTIFIER TRANSFORMERS, HIGH CURRENT CHOKES, INVERTERS;

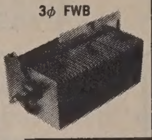
DC POWER SUPPLIES: 115V-220V Input
0-48VDC Output
Current: 0-500 Amps

Complete Secondary Facilities for Specialized Equipment.
Custom Built Transformers and Chokes.
Power Supplies to Your Specifications.

DIRECTRON ELEVATOR CONTROL RECTIFIERS

Part No.	AC Input Volts Up To	Phase	Amps	Units Required	List Prices 1 Unit	2 Units	3 Units
CD260	260	1ϕ 3ϕ	1.5 2.2	2 3	$13.20	$26.40	$39.60
DD260	260	1ϕ 3ϕ	2.2 3.3	2 3	15.40	30.80	46.20
ED260	260	1ϕ 3ϕ	3.4 5.1	2 3	18.70	37.40	56.10
FD260	260	1ϕ 3ϕ	6.6 10.	2 3	23.10	46.20	69.30
GD260	260	1ϕ 3ϕ	10. 15.	2 3	40.00	80.00	120.00
COMPACT UNIT (Double Decker)							
3D260	260	3ϕ	3.	1	41.80	—	—

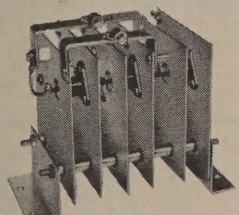
	Otis Part No.	Price List
CENTER TAP	230AV1	$22.00
	230AS1	22.00
HALF WAVE (blocking)	230AR1	6.60
	230AR3	6.60
	230AZ1	13.20
	230AZ2	13.20
1ϕ FWB	230AY3	30.00
	230AY1	45.00
3ϕ FWB	230AL1	65.00
	230AL2	22.00
	230AL3	132.00
	230AG1	99.00
	230AJ1	110.00
	230AW1	33.00
	230BA1	135.00
	230BJ3	65.00
	230BJ4	135.00
	230BJ5	132.00



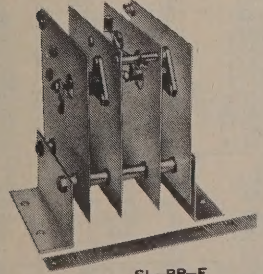
HY-A-SIL | HIGH-AMPERE SILICON RECTIFIERS

FEATURES

- High Operating Temperature, 190°C (Up to 120°C ambient)
- High Operating Voltage (Up to 600 p.i.v.)
- High Efficiency (99% compared to about 75% for selenium)
- Excellent Regulation (4% compared to about 15% for selenium)



SL—PH—F



SL—BR—F

CENTER-TAP

Stock No.	AC Input Volts Up To	DC Output Volts Up To	Max. Amps Self Cooled	Max. Amps Fan Cooled	Size & Weight	User Net Price
SI-CT-A	18-0-18	16	40	80	B	$18.75
SI-CT-B	36-0-36	32	40	80	B	24.25
SL-CT-A	18-0-18	16	50	100	B	22.00
SL-CT-B	36-0-36	32	50	100	B	27.50
SL-CT-D	72-0-72	64	50	100	B	44.00
SL-CT-F	140-0-140	125	50	100	B	54.00
SK-CT-A	18-0-18	16	100	200	C	36.50
SK-CT-B	36-0-36	32	100	200	C	42.00
SK-CT-D	72-0-72	64	100	200	C	45.25
SK-CT-F	140-0-140	125	100	200	C	58.50
SM-CT-A	18-0-18	16	200	400	D	55.00
SM-CT-B	36-0-36	32	200	400	D	72.75
SM-CT-D	72-0-72	64	200	400	D	76.00
SM-CT-F	140-0-140	125	200	400	D	92.50
SO-CT-B	36-0-36	32	400	800	E	121.00

3ϕ BRIDGE

Stock No.	AC Input Volts Up To	DC Output Volts Up To	Max. Amps Self Cooled	Max. Amps Fan Cooled	Size & Weight	User Net Price
SL-PH-A	36	48	75	150	N	$72.75
SL-PH-B	72	96	75	150	N	103.50
SL-PH-C	105	144	75	150	N	146.50
SL-PH-D	140	188	75	150	N	220.00
SL-PH-E	220	290	75	150	M	264.00
SK-PH-E	220	290	100	200	M	300.00
SM-PH-E	220	290	200	400	M	365.00
SO-PH-E	220	290	400	800	M	450.00

All above ratings based on 30°C ambient. Fan-cooled ratings based on air velocity of 1000 linear ft/minute. For resistive or inductive loads, as rated. For capacitive or battery loads, derate amperage 20%. Doublers, triplers, 3 phase half wave and 3 phase center-tap also available. Custom-built stacks, 24 hour service.

1ϕ BRIDGE

Stock No.	AC Input Volts Up To	DC Output Volts Up To	Max. Amps Self Cooled	Max. Amps Fan Cooled	Size & Weight	User Net Price
SA-BR-D	140	125	1	*	—	$11.00
SA-BR-F	280	250	1	*	—	13.25
SC-BR-D	140	125	2	*	—	13.25
SC-BR-F	280	250	2	*	—	15.50
SD-BR-A	36	32	6	12	F	22.00
SD-BR-D	140	125	6	12	F	36.50
SD-BR-F	280	250	6	12	F	47.50
SE-BR-A	36	32	10	20	G	26.50
SE-BR-D	140	125	10	20	G	44.00
SE-BR-F	280	250	10	20	G	54.00
SF-BR-A	36	32	20	40	H	29.75
SF-BR-D	140	125	20	40	H	48.50
SF-BR-F	280	250	20	40	H	58.50
SI-BR-A	36	32	40	80	J	36.50
SI-BR-B	72	64	40	80	J	44.00
SI-BR-C	105	90	40	80	J	72.75
SI-BR-D	140	125	40	80	J	77.00
SI-BR-F	280	250	40	80	J	115.50
SL-BR-A	36	32	50	100	J	40.75
SL-BR-B	72	64	50	100	J	47.50
SL-BR-D	140	125	50	100	J	84.75
SL-BR-F	280	250	50	100	J	133.00
SG-BR-A	36	32	70	140	J	48.50
SG-BR-B	72	64	70	140	J	60.50
SG-BR-D	140	125	70	140	J	97.00
SG-BR-F	280	250	70	140	J	157.50
SK-BR-A	36	32	100	200	K	72.75
SK-BR-B	72	64	100	200	K	82.50
SK-BR-D	140	125	100	200	K	110.00
SK-BR-F	280	250	100	200	K	182.00
SM-BR-A	36	32	200	400	L	121.00
SM-BR-B	72	64	200	400	L	145.50
SM-BR-D	140	125	200	400	L	220.00
SM-BR-F	280	250	200	400	L	313.50
SO-BR-B	72	64	400	800	M	330.00
SO-BR-F	280	250	400	800	M	580.00

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TELEPHONE: (516) 593-2025

SARKES TARZIAN SEMICONDUCTORS

Sarkes Tarzian Inc. offers a complete line of standard and special semiconductor diodes and assemblies.

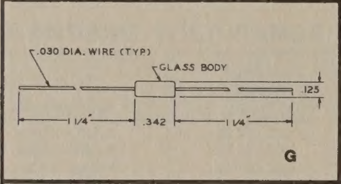
Silicon Avalanche Rectifiers
SCRs, Zener Diodes
High Voltage Rectifiers
Fast Recovery Rectifiers
Klipvolt Surge Suppressors
Selenium Rectifiers

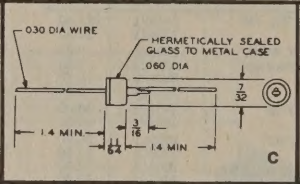
The products listed on the next 10 pages represent the most popular types that are available from stock, or on short delivery cycles through distributors.

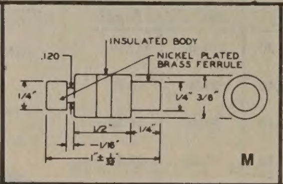
SPECIAL DESIGNS: We thrive on "special" rectifier business because our "special" engineering and production departments are experienced in short run, unique design devices. We can produce them at a price you can afford and are anxious to be of service for devices with special characteristics of packaging requirements. Contact your Tarzian sales representative or submit prints directly to our engineering department.

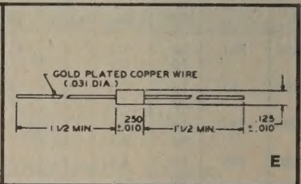
SILICON AVALANCHE RECTIFIERS 1 TO 350 AMPERES

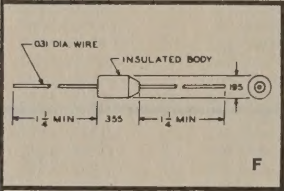
All rectifiers listed here have avalanche characteristics and surge capabilities 20-50% higher than other rectifiers of the same current rating. They can also be supplied with controlled avalanche characteristics. Large chips and high conductivity construction eliminate the need for additional surge suppression components usually required in power supply circuitry. The stud base units are normally supplied with the anode connected to the solder terminal. For anode connected to the stud, change suffix letter "P" to suffix "N" in the part number.

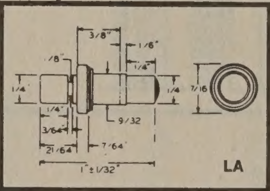

G
.030 DIA. WIRE (TYP)
GLASS BODY
.125
1 1/4"
.342
1 1/4"

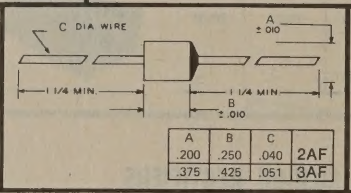

C
030 DIA WIRE
HERMETICALLY SEALED GLASS TO METAL CASE
.060 DIA
7/32
1.4 MIN
3/16
1/64
1.4 MIN


M
INSULATED BODY
.120
NICKEL PLATED BRASS FERRULE
1/4"
1/4" 3/8"
1/2"
1/4"
1/16"
1" ± 1/32"

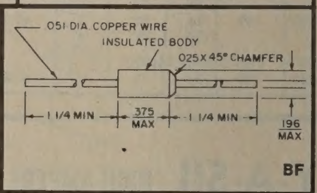

E
GOLD PLATED COPPER WIRE (.031 DIA)
1 1/2 MIN
.250 ±.010
1 1/2 MIN
.125 ±.010

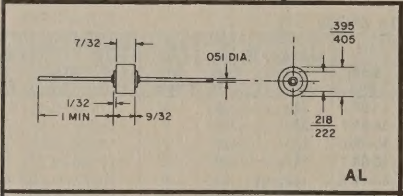

F
.031 DIA WIRE
INSULATED BODY
.195
1 1/4 MIN
.355
1 1/4 MIN

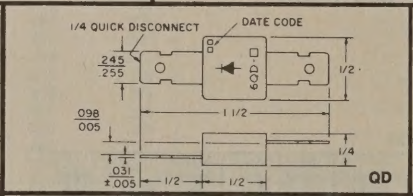

LA
3/8"
1/6"
1/8"
1/4"
1/4
1/4
7/16
1/4"
9/32
3/64
21/64
7/64
1" ± 1/32"

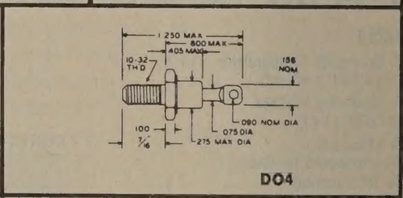

C DIA WIRE
A ±.010
1 1/4 MIN.
1 1/4 MIN
B ±.010

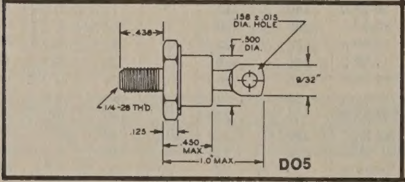
A	B	C	
.200	.250	.040	2AF
.375	.425	.051	3AF

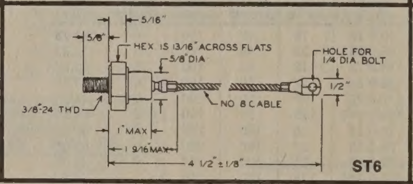

BF
.051 DIA COPPER WIRE
INSULATED BODY
.025 X 45° CHAMFER
1 1/4 MIN
.375 MAX
1 1/4 MIN
.196 MAX

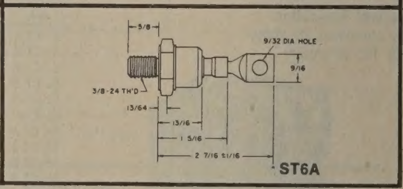

AL
7/32
.051 DIA.
.395/.405
1/32
1 MIN
9/32
.218/.222


QD
1/4 QUICK DISCONNECT
DATE CODE
.245/.255
6QD-
1/2
1 1/2
.098/.005
1/4
.031 ±.005
1/2
1/2


DO4
1.250 MAX
.800 MAX
.405 MAX
10-32 TH'D
.156 NOM
.090 NOM DIA
.100
.075 DIA
7/16
.275 MAX DIA


DO5
.438
.158 ±.015 DIA. HOLE
.500 DIA.
9/32"
1/4-28 TH'D
.125
.450 MAX
1.0" MAX


ST6
5/16"
5/8"
HEX IS 13/16" ACROSS FLATS
5/8" DIA
HOLE FOR 1/4 DIA BOLT
1/2"
3/8-24 THD
NO 8 CABLE
1" MAX
1 9/16 MAX
4 1/2" ± 1/8"


ST6A
5/8
9/32 DIA HOLE
9/16
3/8-24 TH'D
13/64
13/16
1 5/16
2 7/16 ±1/16

Rating (Amps)		1.0	1.0	1.0	1.0	1.0	2.0	2	3	3
Case Style		G	C	M	E	F	LA	2AF	3AF	BF
IFSM (amps)		50	60	70	70	70	30	60	150	150
I^2t (A^2Sec)		10.4	15	20	20	20	3.8	15	93.4	93.4
T°C (Ambient)		40	55	40	55	55	40	40	40	40
PIV	**Max. VRMS**									
100	70	G1	10C	10M	E1	F1	10LA	2AF1	3AF1	3BF1
200	140	G2	20C	20M	E2	F2	20LA	2AF2	3AF2	3BF2
300	210	G3	30C	30M	E3	F3	30LA	2AF3	3AF3	3BF3
400	280	G4	40C	M-500	E4	F4	40LA	2AF4	3AF4	3BF4
600	420	G6	60C	60M	E6	F6	60LA	2AF6	3AF6	3BF6
800	560	G8	80C	80M	E8	F8	80LA	2AF8	3AF8	3BF8
1000	700	G10	100C	100M	E10	F10	100LA	2AF10	3AF10	3BF10
1200	840	G12	120C	120M	E12	F12	120LA	2AF12	3AF12	3BF12
1400	930	G14	140C	140M	E14	F14	140LA	2AF14	3AF14	3BF14

Rating (Amps)		6	6	6	12	16	25	40	50
Case Style		AL	QD	DO4	DO4	DO4	DO5	DO5	DO5
IFSM (amps)		400	400	200	260	300	400	800	1000
I^2t (A^2Sec)		664	664	1680	280	375	664	2660	4050
T°C (Ambient)		40	40	150	150	150	135	150	150
PIV	**Max. VRMS**								
100	70	6AL1	6QD1	10H3P	ST210P	ST210E	ST310P	ST410P	ST5A10P
200	140	6AL2	6QD2	20H3P	ST220P	ST220E	ST320P	ST420P	ST5A20P
300	210	6AL3	6QD3	30H3P	ST230P	ST230E	ST330P	ST430P	ST5A30P
400	280	6AL4	6QD6	40H3P	ST240P	ST240E	ST340P	ST440P	ST5A40P
600	420	6AL6	6QD6	60H3P	ST260P	ST260E	ST360P	ST460P	ST5A60P
800	560	6AL8	6QD8	80H3P	ST280P	ST280E	ST380P	ST480P	ST5A80P
1000	700	6AL10	6QD10	100H3P	ST2100P	ST2100E	ST3100P	ST4100P	ST5A100P
1200	840	6AL12	6QD12	120H3P	ST2120P	ST2120E	ST3120P	ST4120P	ST5A120P
1400	980	6AL14	6QD14	140H3P	ST2140P	ST2140E	ST3140P	ST4140P	ST5A140P

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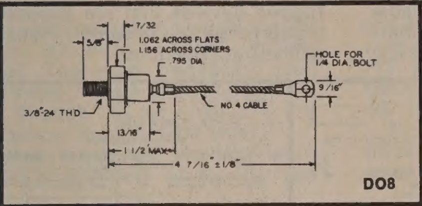
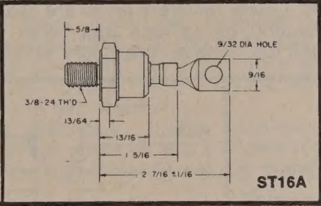
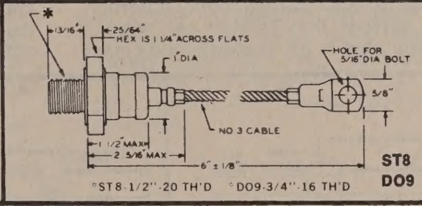
SILICON AVALANCHE RECTIFIERS (Cont.)


7/32
5/8"
1.062 ACROSS FLATS
1.156 ACROSS CORNERS
.795 DIA.
HOLE FOR 1/4 DIA. BOLT
9/16"
3/8-24 THD
NO. 4 CABLE
13/16"
1 1/2 MAX
4 7/16" ± 1/8"

DO8


5/8
9/32 DIA. HOLE
9/16
3/8-24 TH'D
13/64
13/16
1 5/16
2 7/16 ±1/16

ST16A


*
13/16"
25/64"
HEX IS 1 1/4" ACROSS FLATS
1" DIA
HOLE FOR 5/16" DIA BOLT
5/8"
NO 3 CABLE
1 1/2" MAX
2 3/16" MAX
6" ± 1/8"

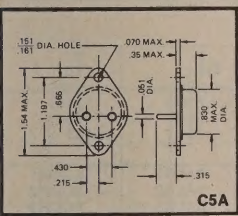
*ST8-1/2"-20 TH'D *DO9-3/4"-16 TH'D

ST8
DO9

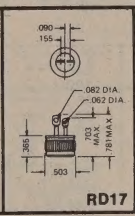
Rating (Amps)		70	100	100	160	160	250	275	350
Case Style		DO5	ST6	ST6A	DO8	ST16A	ST8	DO9	DO9
IFSM		1200	1600	1600	3000	3000	5000	5000	7000
I^2t (A^{2}Sec)		6000	10,600	10,600	37,350	37,350	105,000	103,000	203,000
Temp°C		150	150	150	150	150	150	150	150
PIV	**MAX. VRMS**								
100	70	ST1110P	ST610P	ST6A10P	ST1610P	ST16A10P	ST810P	ST910P	ST2010P
200	140	ST1120P	ST620P	ST6A20P	ST1620P	ST16A20P	ST820P	ST920P	ST2020P
300	210	ST1130P	ST630P	ST6A30P	ST1630P	ST16A30P	ST830P	ST930P	ST2030P
400	280	ST1140P	ST640P	ST6A40P	ST1640P	ST16A40P	ST840P	ST940P	ST2040P
500	350	ST1150P	ST650P	ST6A50P	ST1650P	ST16A50P	ST850P	ST950P	ST2050P
600	420	ST1160P	ST660P	ST6A60P	ST1660P	ST16A60P	ST860P	ST960P	ST2060P
800	560	ST1180P	ST680P	ST6A80P	ST1680P	ST16A80P	ST880P	ST980P	ST2080P
1000	700	ST11100P	ST6100P	ST6A100P	ST16100P	ST16A100P	ST8100P	ST9100P	ST20100P
1200	840	ST11120P	ST6120P	ST6A120P	ST16120P	ST16A120P	ST8120P	ST9120P	ST20120P
1400	980	ST11140P	ST6140P	ST6A140P	ST16140P	ST16A140P	ST8140P	ST9140P	ST20140P

SILICON CONTROLLED RECTIFIERS

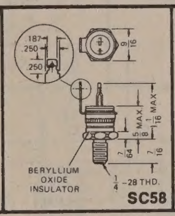
These SCRs represent only a few of the devices Tarzian can supply. Special versions, with high speed turn-on and high dv/dt characteristics are available on short delivery cycles. The most frequently used JEDEC types are listed here. Most other JEDEC types are available on special order.


.151
.161
DIA. HOLE
.070 MAX.
.35 MAX.
1.54 MAX.
1.197
.666
.051 DIA.
.830 MAX. DIA.
.430
.215
.315

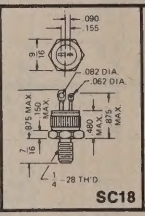
C5A


.090
.155
.082 DIA.
.062 DIA.
.365
.703 MAX.
.781 MAX.
.503

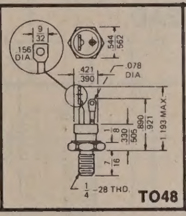
RD17


.187
.250
.250
9/16
1 MAX.
5/8
7/64
7/16
BERYLLIUM OXIDE INSULATOR
1/4 -28 THD.

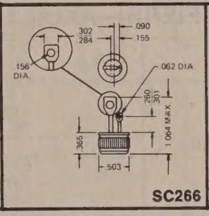
SC58


.090
.155
9/16
.082 DIA.
.062 DIA.
.875 MAX.
.150 MAX.
.480
.875 MAX.
7/16
1/4 -28 TH'D

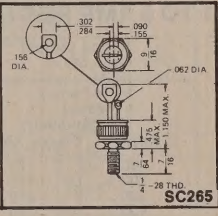
SC18


9/32
156 DIA.
.544
.562
.421
.390
.078 DIA.
1.193 MAX.
.330
.505
.890
.921
7/16
1/4 -28 THD.

TO48


.302
.284
.090
.155
.156 DIA.
.062 DIA.
.260
.301
1.064 MAX.
.365
.503

SC266


.302
.284
.090
.155
.156 DIA.
9/16
.062 DIA.
1.150 MAX.
.475 MAX.
7/64
7/16
1/4 -28 THD.

SC265

IT (RMS) Forward Currrent (Amps)			10.0	10.0	10.0	10.0	16.0	16.0	16.0	16.0	25	25	25
Case Style			RD17	C5a	SC18	T048	RD17	C5a	SC18	T048	RD17	C5a	SC18
ITSM Surge Current Amps 1 Hz (60 Hz)			125	125	125	150	150	150	150	150	200	200	200
VGT Gate Trigger Volt. @ IGT (V@ma)			3.0@40ma	3.0@40ma	3.0@40ma	3.5@150	3.0@40ma	3.0@40ma	3.0@40ma	2.5@80ma	2.5@40ma	2.5@40ma	2.5@40ma
VT @ IT On-State Voltage (volts) 25°C			2.8@50A	2.8@50A	2.8@50A	2.6@50A	2.0@50A	2.0@50A	2.0@50A	2.7@50A	1.5@50A	1.5@50A	1.5@50A
IH Holding Current (ma) 25°C			40	40	40	40	40	40	40	40.0	40.0	40.0	40.0
Max. Eff. Thermal Res. °C/W			2.0	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0	2.0
ID Max. Fwd. Leak.@VDRM@125°C			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
IR Max. Rev. Leak.@VRRM@125°C			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Vdrm	**Vrrm**	**Vsrom**											
25	25	35	10PCRA	10FCRA	10PCRSA	2N1842	16PCRA	16FCRA	16PCRSA	16TCRA	25PCRA	25FCRA	25PCRSA
50	50	75	10PCRB	10FCRB	10PCRSB	2N1843	16PCRB	16FCRB	16PCRSB	16TCRB	25PCRB	25FCRB	25PCRSB
100	100	150	10PCRC	10FCRC	10PCRSC	2N1844	16PCRC	16FCRC	16PCRSC	16TCRC	25PCRC	25FCRC	25PCRSC
150	150	225	10PCRD	10FCRD	10PCRSD	2N1845	16PCRD	16FCRD	16PCRSD	16TCRD	25PCRD	25FCRD	25PCRSD
200	200	300	10PCRE	10FCRE	10PCRSE	2N1846	16PCRE	16FCRE	16PCRSE	16TCRE	25PCRE	25FCRE	25PCRSE
250	250	350	10PCRF	10FCRF	10PCRSF	2N1847	16PCRF	16FCRF	16PCRSF	16TCRF	25PCRF	25FCRF	25PCRSF
300	300	400	10PCRG	10FCRG	10PCRSG	2N1848	16PCRG	16FCRG	16PCRSG	16TCRG	25PCRG	25FCRG	25PCRSG
400	400	500	10PCRH	10FCRH	10PCRSH	2N1849	16PCRH	16FCRH	16PCRSH	16TCRH	25PCRH	25FCRH	25PCRSH
500	500	600	10PCRI	10FCRI	10PCRSI	2N1850	16PCRI	16FCRI	16PCRSI	16TCRI	25PCRI	25FCRI	25PCRSI
600	600	700	10PCRJ	10FCRJ	10PCRSJ		16PCRJ	16FCRJ	16PCRSJ	16TCRJ	25PCRJ	25FCRJ	25PCRSJ
700	700	800	10PCRK	10FCRK	10PCRSK		16PCRK	16FCRK	16PCRSK	16TCRK	25PCRK	25FCRK	25PCRSK
800	800	900	10PCRL	10FCRL	10PCRSL		16PCRL	16FCRL	16PCRSL	16TCRL	25PCRL	25FCRL	25PCRSL

IT (RMS) Forward Currrent (Amps)			25	25	35	35	35	35	35 (16 Avg.)	35 (22 Avg.)	35 (22 Avg.)	20	20
Case Style			T048	T048	SC266	C5a	SC265	T048	T041*	RD17	SC18	RD17a*	SC18a*
ITSM Surge Current Amps 1 Hz (60 Hz)			150	200	300	300	300	250	260	350	350	240	240
VGT Gate Trigger Volt. @ IGT (V@ma)			3.0@80ma	2.0@40ma	3.0@40ma	3.0@40ma	3.0@40ma	2.5@40ma	3.5@80	3.5@80	3.5@80	2.5@40ma	2.5@40ma
VT @ IT On-State Voltage (volts) 25°C			2.3@50A	2.3@50	1.9@100A	1.5@50A	1.5@50A	2.0@50A	1.7@50	1.9@100	1.9@100	2.0@50A	2.0@50A
IH Holding Current (ma) 25°C			40.0	40	40	40	40	40	40	40	40	50	50
Max. Eff. Thermal Res. °C/W			1.0	1.0	2.0	1.0	2.0	1.0	1.0	2.0	2.0	1.5	1.7
ID Max. Fwd. Leak.@VDRM@125°C			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0
IR Max. Rev. Leak.@VRRM@125°C			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0
Vdrm	**Vrrm**	**Vsrom**											
25	25	35	2N681	25TCRA	35PCRA	35FCRA	35PCRSA	35TCRA	2N2574			2N5164	2N5168
50	50	75	2N682	25TCRB	35PCRB	35FCRB	35PCRSB	35TCRB	2N2575	2N3870	2N3896		
100	100	150	2N683	25TCRC	35PCRC	35FCRC	35PCRSC	35TCRC	2N2576				
150	150	225	2N684	25TCRD	35PCRD	35FCRD	35PCRSD	35TCRD		2N3871	2N3897	2N5165	2N5169
200	200	300	2N685	25TCRE	35PCRE	35FCRE	35PCRSE	35TCRE	2N2577				
250	250	350	2N686	25TCRF	35PCRF	35FCRF	35PCRSF	35TCRF	2N2578				
300	300	400	2N687	25TCRG	35PCRG	35FCRG	35PCRSG	35TCRG	2N2579	2N3872	2N3848	2N5166	2N5170
400	400	500	2N688	25TCRH	35PCRH	35FCRH	35PCRSH	35TCRH					
500	500	600	2N689	25TCRI	35PCRI	35FCRI	35PCRSI	35TCRI		2N3873	2N3899		
600	600	700	2N690	25TCRJ	35PCRJ	35FCRJ	35PCRSJ	35TCRJ				2N5167	2N5171
700	700	800	2N691	25TCRK	35PCRK	35FCRK	35PCRSK	35TCRK					
800	800	900	2N692	25TCRL	35PCRL	35FCRL	35PCRSL	35TCRL					

*Not illustrated

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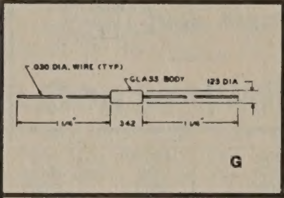
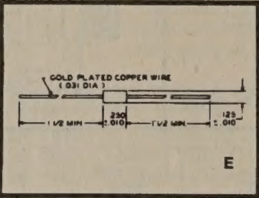
SARKES TARZIAN SEMICONDUCTORS

FAST RECOVERY RECTIFIERS

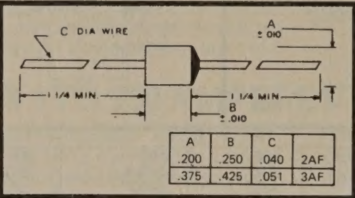
These listings represent only a portion of the devices that Tarzian can supply. Recovery time is 200 manoseconds maximum. Lower recovery times are available depending on voltage and other characteristics. These are high efficiency, rugged devices that are applicable to a broad range of consumer, industrial and military applications.


.030 DIA. WIRE (TYP)
GLASS BODY
.125 DIA
1 1/8
.342
1 1/8

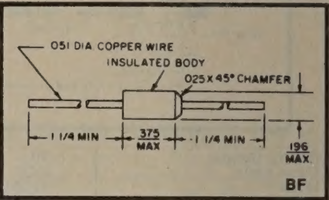
G


GOLD PLATED COPPER WIRE (.031 DIA)
1 1/2 MIN
.230 ±.010
1 1/2 MIN
.125 ±.010

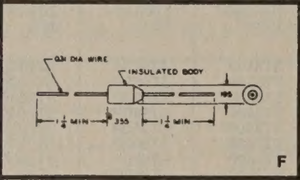
E


C DIA WIRE
A ±.010
1 1/4 MIN
1 1/4 MIN
B ±.010

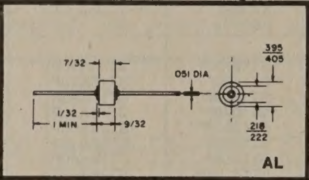
A	B	C	
.200	.250	.040	2AF
.375	.425	.051	3AF


.051 DIA COPPER WIRE
INSULATED BODY
.025 X 45° CHAMFER
1 1/4 MIN
.375 MAX
1 1/4 MIN
.196 MAX

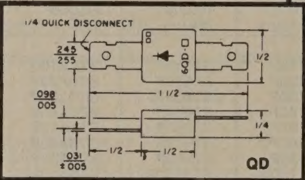
BF


.031 DIA WIRE
INSULATED BODY
.355

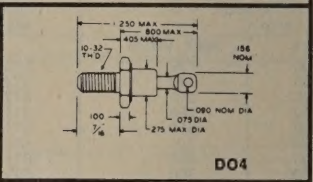
F


7/32
.051 DIA
.395
.405
1/32
1 MIN
9/32
.218
.222

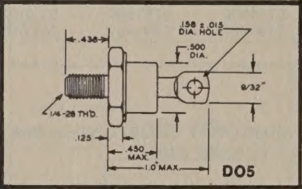
AL


1/4 QUICK DISCONNECT
.245
.255
1/2
1 1/2
.098
.005
1/4
.031 ±.005
1/2
1/2

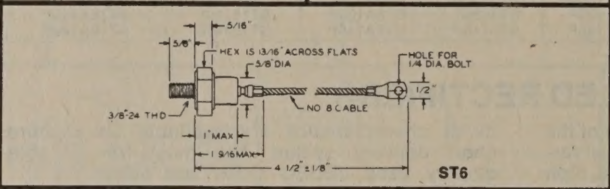
QD


.250 MAX
.800 MAX
.405 MAX
10-32 THD
.156 NOM
.100
.090 NOM DIA
.075 DIA
.275 MAX DIA

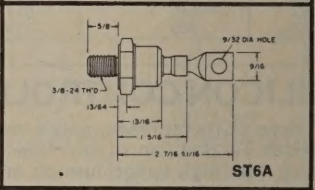
DO4


.158 ±.015 DIA. HOLE
.438
.500 DIA.
9/32"
1/4-28 THD
.125
.450 MAX
1.0" MAX.

DO5


5/16"
5/8"
HEX IS 13/16" ACROSS FLATS
5/8" DIA
HOLE FOR 1/4 DIA. BOLT
1/2"
NO 8 CABLE
3/8"-24 THD
1" MAX
1 9/16 MAX
4 1/2" ±1/8"

ST6


5/8
9/32 DIA HOLE
9/16
3/8-24 THD
13/64
13/16
1 5/16
2 7/16 ±1/16

ST6A

1 TO 6 AMP RECTIFIERS—AXIAL LEAD

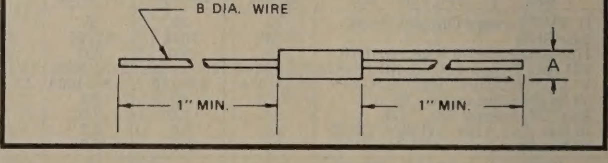
Rating (Amps) Case Style IFSM I^2t (A^2 sec.) trr (nsec) T°C (Ambient)		1.0 G 40 6.8 200 35	1.0 E 60 15 200 35	1.0 F 60 15 200 35	2 AF 50 10.4 200 35	3 AF 120 60 200 35	3 BF 120 60 200 35	6 AL 300 380 200 35	6 QD 300 380 200 35
PIV	**MAX. VRMS**								
100	70	GR1	ER1	FR1	2AFR1	3AFR1	3BFR1	6ALR1	6QDR1
200	140	GR2	ER2	FR2	2AFR2	3AFR2	3BFR2	6ALR2	6QDR2
300	210	GR3	ER3	FR3	2AFR3	3AFR3	3BFR3	6ALR3	6QDR3
400	280	GR4	ER4	FR4	2AFR4	3AFR4	3BFR4	6ALR4	6QDR4
600	420	GR6	ER6	FR6	2AFR6	3AFR6	3BFR6	6ALR6	6QDR6

6 TO 100 AMP RECTIFIERS—STUD BASE

Rating (Amps) Case Style IFSM I^2t (A^2 sec.) trr (nsec.) T°C (Case)		6 DO4 150 135 200 100	12 DO4 200 167 200 100	25 DO5 300 380 200 100	40 DO5 650 1780 200 100	50 DO5 800 2660 200 100	70 DO5 960 3850 200 100	100 ST6 1280 6900 200 100	100 ST6A 1280 6900 200 100
PIV	**MAX. VRMS**								
100	70	10HR3P	ST2FR10P	ST3FR10P	ST4FR10P	ST5AFR10P	ST11FR10P	ST6FR10P	ST6AFR10P
200	140	20HR3P	ST2FR20P	ST3FR20P	ST4FR20P	ST5AFR20P	ST11FR20P	ST6FR20P	ST6AFR20P
300	210	30HR3P	ST2FR30P	ST3FR30P	ST4FR30P	ST5AFR30P	ST11FR30P	ST6FR30P	ST6AFR30P
400	280	40HR3P	ST2FR40P	ST3FR40P	ST4FR40P	ST5AFR40P	ST11FR40P	ST6FR40P	ST6AFR40P
600	420	60HR3P	ST2FR60P	ST3FR60P	ST4FR60P	ST5AFR60P	ST11FR60P	ST6FR60P	ST6AFR60P

HIGH VOLTAGE FAST RECOVERY RECTIFIERS

These high voltage, fast recovery diodes are series connected junction devices that will provide reliable operation up to 350 mA and over 50,000 volts. Recovery time is 200 nanoseconds maximum. Rectification efficiency is excellent through 100 kHz so that they can be used in doublers, triplers, quadruplers and other applications where high efficiency at high frequency is required.


B DIA. WIRE
A
1" MIN.
1" MIN.

MAX. PIV	TYPE	Vf@ Io	Io Ma @40°C	CASE DIAM. A	CASE LENGTH	WIRE DIAM. B
1000	ER10	3	200	.125	.205	.030
1500	ER15	3	200	.125	.205	.030
2000	ER20	3	200	.125	.205	.030
2000	5BFR20	6	120	.125	.410	.030
2500	ER25	3	200	.125	.205	.030
2500	5BFR25	6	120	.125	.410	.030
3000	ER30	3	200	.125	.205	.030
3000	20AFR30	20	30	.187	.563	.020
5000	20AFR50	20	30	.187	.563	.020
6000	20AFR60	20	30	.187	.563	.020

MAX. PIV	TYPE	Vf@ Io	Io Ma @40°C	CASE DIAM. A	CASE LENGTH	WIRE DIAM. B
7000	20AFR70	20	30	.187	.563	.020
7500	10BFR75	10	70	.145	.410	.020
8000	20AFR80	20	30	.187	.563	.020
9000	20AFR90	20	30	.187	.563	.020
10000	20AFR100	20	30	.187	.563	.020
15000	45EFR150	45	25	.300	2.000	.030
20000	45EFR200	45	25	.300	2.000	.030
25000	45EFR250	45	25	.300	2.000	.030
30000	70GFR300	70	25	.300	3.000	.030
40000	70GFR400	70	25	.300	3.000	.030

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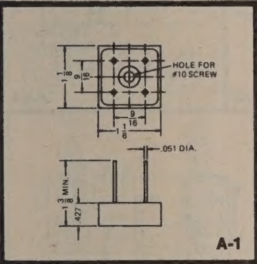
AVALANCHE SILICON BRIDGE RECTIFIER ASSEMBLIES

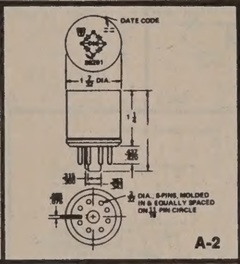
SINGLE PHASE FULL-WAVE BRIDGES

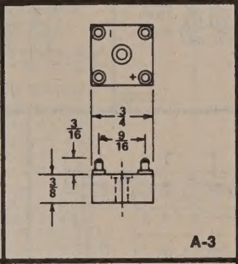
Tarzian produces the industry's largest variety of standard bridge rectifier assemblies. The most frequently used types are listed, but standard designs are available through 200 amperes and PIV characteristics through 1400 volts.

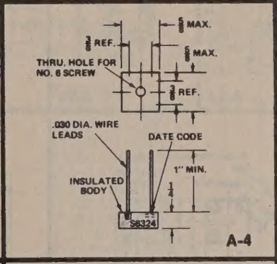
Controlled avalanche characteristics are available with any of the devices shown here. They are supplied with ranges of 200-600, 400-800 and 600-1000 PIV. For controlled avalanche units, substitute the prefix "SCA" for the prefix "S" in the part number.

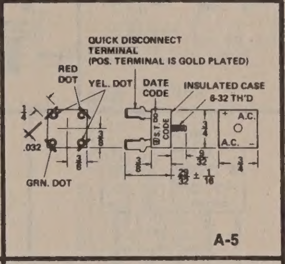
Fast recovery bridge assemblies through 500 amperes with PIV characteristics through 600 PIV can be supplied with a 200 nanosecond recovery time. To order any assembly here with fast recovery characteristics, substitute the prefix "SFR" for the prefix "S". For other types, contact the Tarzian Engineering Department.

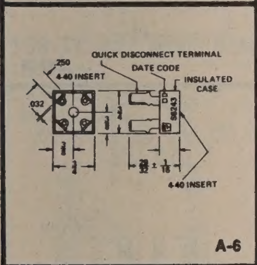

HOLE FOR #10 SCREW
.051 DIA.
MIN.
.427
A-1

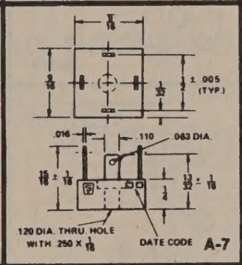

DATE CODE
S6291
DIA.
DIA. 8-PINS, MOLDED IN & EQUALLY SPACED ON PIN CIRCLE
A-2

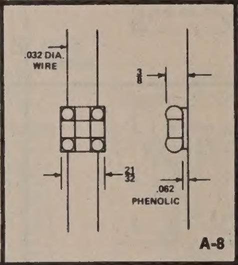

A-3

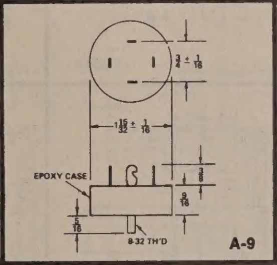

MAX.
REF.
MAX.
THRU. HOLE FOR NO. 6 SCREW
REF.
.030 DIA. WIRE LEADS
DATE CODE
1" MIN.
INSULATED BODY
S6324
A-4

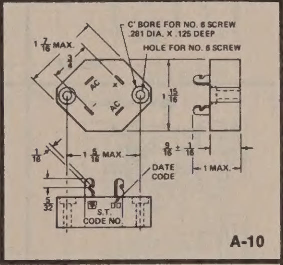

QUICK DISCONNECT TERMINAL (POS. TERMINAL IS GOLD PLATED)
RED DOT
YEL. DOT
DATE CODE
INSULATED CASE
6-32 TH'D
A.C.
A.C.
.032
S.T. CODE
GRN. DOT
A-5

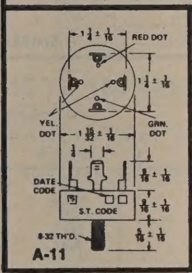

QUICK DISCONNECT TERMINAL
DATE CODE
.250
4-40 INSERT
INSULATED CASE
.032
S6243
4-40 INSERT
A-6

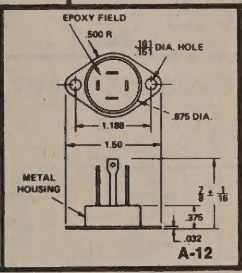

± .005 (TYP.)
.016
.110
.063 DIA.
.120 DIA. THRU. HOLE WITH .250 X
DATE CODE
A-7

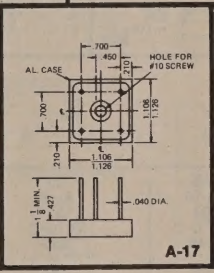

.032 DIA. WIRE
.062 PHENOLIC
A-8

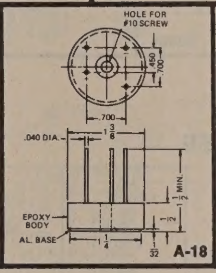

EPOXY CASE
8-32 TH'D
A-9

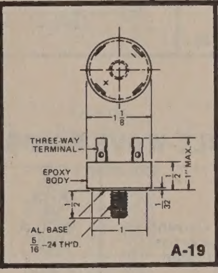

C' BORE FOR NO. 6 SCREW .281 DIA. X .125 DEEP
MAX.
HOLE FOR NO. 6 SCREW
MAX.
DATE CODE
1 MAX.
S.T. CODE NO.
A-10

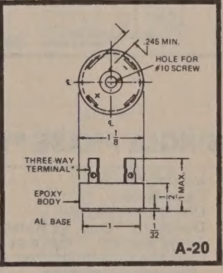

RED DOT
YEL. DOT
GRN. DOT
DATE CODE
S.T. CODE
8-32 TH'D.
A-11


EPOXY FIELD
.500 R
DIA. HOLE
.875 DIA.
1.188
1.50
METAL HOUSING
.375
.032
A-12


.700
.450
HOLE FOR #10 SCREW
AL. CASE
.210
.700
1.106 1.126
.210
1.106 1.126
MIN.
.427
.040 DIA.
A-17


HOLE FOR #10 SCREW
.450
.700
.700
.040 DIA.
MIN.
EPOXY BODY
AL. BASE
A-18


THREE-WAY TERMINAL
EPOXY BODY
MAX.
AL. BASE
-24 TH'D.
A-19


.245 MIN.
HOLE FOR #10 SCREW
THREE-WAY TERMINAL
EPOXY BODY
MAX.
AL. BASE
A-20

Maximum Amps.		1.8	2	2	2	2	2	2.5	6	6
Case Style		A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-1	A-9
Dissipation (watts)		4.0	4.4	4.4	4.4	4.4	4.4	4.4	14	12.4
Operating Temp.°C		55°C-A	55°C-A	55°C-A	55°C-A	55°C-A	140°C-A	55°C-A	80	55°C-A
Surge Current, 1 cycle peak Amps.		60	60	60	60	60	120	60	150	125
Leakage Current per leg @ rated PIV, Micro-amperes.		Not rated	10	10	10	10	10	10	50	20
Forward Voltage Drop per leg (@ amps.)		1.1 @ 1	1.1 @ 1	1.1 @ 1	1.1 @ 1	1.1 @ 1	1.1 @ 1	1.1 @ 1	1.1 @ 3	1.1 @ 3
MAX. PIV	**MAX. RMS**									
100	70	—	—	—	—	S6244-1	—	—	S7006-1	S6121
200	140	S6291	S6211	S6324-2	S6221-2	S6244-2	S6230AH	S5959	S7006-2	S6121-1
400	280	—	S6211-1	S6324-4	S6221-4	S6244-4	S6230-1AH	S5959-1	S7006-4	S6121-3
600	420	—	S6211-2	S6324-6	S6221-6	S6224-6	S6230-2AH	S5959-2	S7006-6	S6121-5
800	560	—	S6211-3	S3624-8	S6221-8	S6244-8	S6230-3AH	S5959-3	S7006-8	S6121-6
1000	700	—	S6211-4	S6324-10	S6221-10	S6244-10	S6230-4AH	S5959-4	S7006-10	S6121-7

Maximum Amps.		6	6	10	10	25	25	25	25
Case Style		A-10	A-11	A-1	A-12	A-17	A-18	A-19	A-20
Dissipation (watts)		13	12.4	23	24	57	57	57	57
Operating Temp. @ Rated Current		55°C-C	55°C-A	80	70°C-C	55°C	60°C	60°C	60°C
Surge Current, 1 cycle peak Amps.		125	125	200	260	400	400	400	400
Leakage Current per leg @ rated PIV, Micro-amperes.		20	20	50	10	100	100	100	100
Forward Voltage Drop per leg (@ amps.)		1.1 @ 3	1.1 @ 3	0.9 @ 5	1.1 @ 5	1.0 @ 12	1.0 @ 12	1.0 @ 12	1.0 @ 12
MAX. PIV	**MAX. RMS**								
100	70	S6327-1	S6325-1	S7007-1	S6323-1	S6463-1	B1DB	C1AB	D1AB
200	140	S6327-2	S6325-2	S7007-2	S6323-2	S6463-2	B2DB	C2AB	D2AB
400	280	S6327-4	S6325-4	S7007-4	S6323-4	S6463-4	B4DB	C4AB	D4AB
600	420	S6327-6	S6325-6	S7007-6	S6323-6	S6463-6	B6DB	C6AB	D6AB
800	560	S6327-8	S6325-8	S7007-8	S6323-8	S6463-8	B8DB	C8AB	D8AB
1000	700	S6327-10	S6325-10	S7007-10	S6323-10	S6463-10	B10DB	C10AB	D10AB

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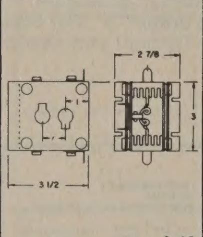
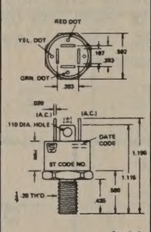
SARKES TARZIAN SEMICONDUCTORS

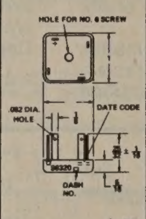
AVALANCHE SILICON BRIDGE RECTIFIER ASSEMBLIES



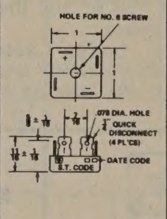
A-13


RED DOT
YEL. DOT
GRN. DOT
(A.C.)
(A.C.)
110 DIA. HOLE
DATE CODE
ST CODE NO.

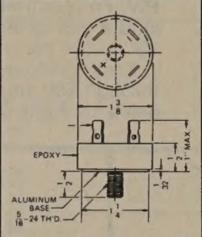
A-14


HOLE FOR NO. 6 SCREW
.082 DIA. HOLE
DATE CODE
DASH NO.

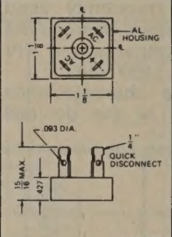
A-15


HOLE FOR NO. 6 SCREW
.078 DIA. HOLE
QUICK DISCONNECT (4 PL'CS)
S.T. CODE
DATE CODE

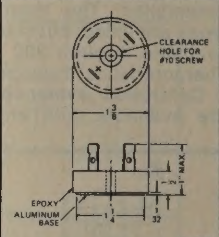
A-16


EPOXY
ALUMINUM BASE
5/16-24 TH'D.
1" MAX

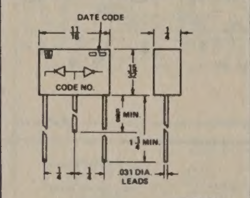
A-21


AL HOUSING
.093 DIA.
1/4" QUICK DISCONNECT

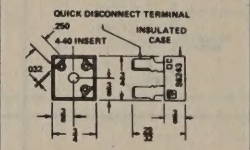
A-22


CLEARANCE HOLE FOR #10 SCREW
EPOXY
ALUMINUM BASE
1" MAX

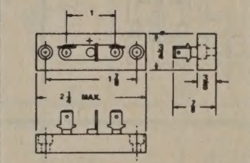
A-23


DATE CODE
CODE NO.
MIN.
MIN.
.031 DIA. LEADS

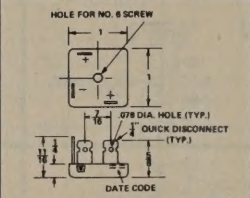
S6337


QUICK DISCONNECT TERMINAL
.250
4-40 INSERT
INSULATED CASE

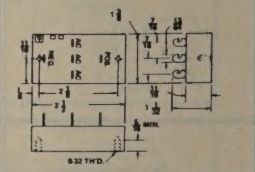
S6243



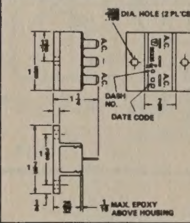
S6318


HOLE FOR NO. 6 SCREW
.078 DIA. HOLE (TYP.)
QUICK DISCONNECT (TYP.)
DATE CODE

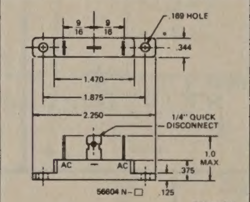
S6313



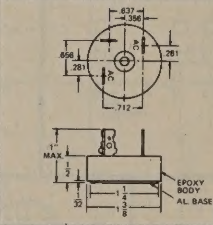
S6326


DIA. HOLE (2 PL'CS)
DASH NO.
DATE CODE
MAX. EPOXY ABOVE HOUSING

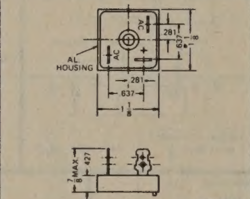
S6335


.189 HOLE
.344
1.470
1.875
2.250
1/4" QUICK DISCONNECT
1.0 MAX
.375
.125
AC
AC
56604 N-□

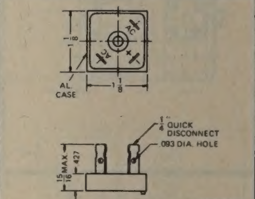
S6604


.637
.356
.656
.281
.281
.712
MAX.
EPOXY BODY
AL BASE

B-E


AL HOUSING
.281
.637
.427
MAX

S6461


AL CASE
1/4 QUICK DISCONNECT
.093 DIA. HOLE
.427
MAX

S6474

SINGLE PHASE FULL-WAVE BRIDGES

Maximum Amps.		12	12	15	25	30	30	30
Case Style		A-13	A-14	A-15	A-16	A-21	A-22	A-23
Dissipation (watts)		28	28	33	55	70	70	70
Operating Temp. @ Rated Current		100°C-A	55°C-A	40°C-C	70°C-C	60°	60°	60°
Surge Current, 1 cycle peak Amps.		250	250	240	350	400	400	400
Leakage Current per leg @ rated PIV, Micro-amperes.		20	20	20	20	100	100	100
Drop per leg Forward Voltage		1.1 @ 12	1.2 @ 6	1.1 @ 6	1.25 @ 25	1.0 @ 12	1.0 @ 12	1.0 @ 12
MAX. PIV	**MAX. RMS**							
100	70	S5745	—	S6320-1	S6314-1	A1AB	S6458-1	B1AB
400	140	S5745-1	S6240-2	S6320-2	S6314-2	A2AB	S6458-2	B2AB
400	280	S5745-3	S6240-4	S6320-4	S6314-4	A4AB	S6458-4	B4AB
600	420	S5745-5	S6240-6	S6320-6	S6314-6	A6AB	S6458-6	B6AB
800	560	S5745-6	S6240-8	S6320-8	S6314-8	A8AB	S6458-8	B8AB
1000	700	S5745-7	S6240-10	S6320-10	S6314-10	A10AB	S6458-10	B10AB

SINGLE PHASE CENTERTAP: POSITIVE, NEGATIVE OR DOUBLER

Maximum Amps.		2	2	15	25	30	33	33	33	50
Case Style		S6337	S6243	S6318	S6313	S6604	B-E	S6461	S6474	S6335
Dissipation (watts)		2.2	4.4	28	28	11	42	42	42	40
Operating Temp. @ Rated Current		125°C Case	55°C Ambient	70°C Case	125°C Ambient	55°C Case	45°C Case	45°C Case	45°C Case	60°C Case
Surge Current, 1 cycle peak Amps.		60	60	400	350	400	400	400	400	400
Leakage Current per leg @ rated PIV, Micro-amperes.		10	10	200	200	100	100	1.0	100	100
Drop per leg Forward Voltage		1.1 @ 1 Amp	1.1 @ 1 Amp	.09 @ 6 Amps	1.2 @ 25 Amps	1.0 @ 10 Amps	1.1 @ 15 Amps	1.1 @ 15 Amps	1.1 @ 15 Amps	1.1 @ 25 Amps
MAX. PIV	**MAX. RMS**									
100	70	S6337*-1	S6243*-1	S6318*-1	S6313*-1	S6604*-1	B1G*	S6461*-1	S6474*-1	S6335*-1
200	140	S6337*-2	S6243*-2	S6318*-2	S6313*-2	S6604*-2	B2G*	S6461*-2	S6474*-2	S6335*-2
400	280	S6337*-4	S6243*-4	S6318*-4	S6313*-4	S6604*-4	B4G*	S6461*-4	S6474*-4	S6335*-4
600	420	S6337*-6	S6243*-6	S6318*-6	S6313*-6	S6604*-6	B6G*	S6461*-6	S6474*-6	S6335*-6
800	560	S6337*-8	S6243*-8	S6318*-8	S6313*-8	S6604*-8	B8G*	S6461*-8	S6474*-8	S6335*-8
1000	700	S6337*-10	S6243*-10	S6318*-10	S6313*-10	S6604*-10	B10G*	S6461*-10	S6461*-10	S6335*-10

*Replace asterisk with "P," "N" or "D" to indicate Positive, Negative or Doubler.

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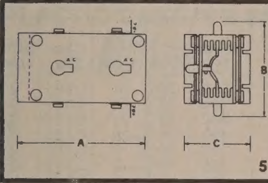
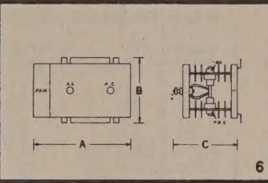
Add Dept. EM to address to tell them you saw it in eem

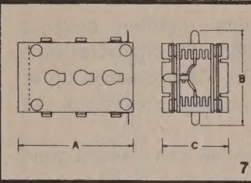
AVALANCHE BRIDGE RECTIFIER ASSEMBLIES



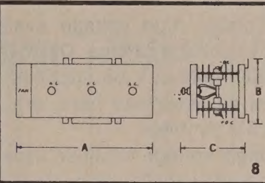
5



6



7



8

24 TO 70 AMP SINGLE PHASE ASSEMBLIES

CURRENT			24 AMP	50 AMP	70 AMP**
Dimensions overall Fig. 5			A—5½″ B—4¼″ C—2⅞″	A—5″ B—5$^{11}/_{16}$″ C—5$^{15}/_{16}$″	A—7¾″ B—5$^{1}/_{16}$″ C—5$^{15}/_{16}$″
DC OUTPUT VOLTS*	MAX. PIV	MAX. RMS VOLTS	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER
30	50	35	ST25-1B1-BBX	ST35-1B1-BBX	ST45F-1B1-BBX
60	100	70	ST210-1B1-BBX	ST310-1B1-BBX	ST410F-1B1-BBX
120	200	140	ST220-1B1-BBX	ST320-1B1-BBX	ST420F-1B1-BBX
180	300	210	ST230-1B1-BBX	ST330-1B1-BBX	ST430F-1B1-BBX
240	400	280	ST240-1B1-BBX	ST340-1B1-BBX	ST440F-1B1-BBX
300	500	350	ST250-1B1-BBX	ST350-1B1-BBX	ST450F-1B1-BBX
360	600	420	ST260-1B1-BBX	ST360-1B1-BBX	ST460F-1B1-BBX
480	800	560	ST280-1B1-BBX	ST380-1B1-BBX	ST480F-1B1-BBX
600	1000	700	ST2100-1B1-BBX	ST3100-1B1-BBX	ST4100F-1B1-BBX
720	1200	840	ST2120-1B1-BBX	ST3120-1B1-BBX	ST4120F-1B1-BBX

100 TO 400 AMP SINGLE PHASE ASSEMBLIES

CURRENT			100 AMP**	200 AMP***	320 AMP***	400 AMP***
Dimensions overall Fig. 6			A—8¾″ B—5$^{11}/_{16}$″ C—6½″	A—8¾″ B—5$^{11}/_{16}$″ C—6½″	A—8¼″ B—10½″ C—7⅝″	A—9¾″ B—10½″ C—7⅝″
DC OUTPUT VOLTS*	MAX. PIV	MAX. RMS VOLTS	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER
30	50	35	ST55F-1B1-BBX	ST65F-1B1-BBX	ST75F-1B1-BBX	ST95F-1B1-BBX
60	100	70	ST510F-1B1-BBX	ST610F-1B1-BBX	ST710F-1B1-BBX	ST910F-1B1-BBX
120	200	140	ST520F-1B1-BBX	ST620F-1B1-BBX	ST720F-1B1-BBX	ST920F-1B1-BBX
180	300	210	ST530F-1B1-BBX	ST630F-1B1-BBX	ST730F-1B1-BBX	ST930F-1B1-BBX
240	400	280	ST540F-1B1-BBX	ST640F-1B1-BBX	ST740F-1B1-BBX	ST940F-1B1-BBX
300	500	350	ST550F-1B1-BBX	ST650F-1B1-BBX	ST750F-1B1-BBX	ST950F-1B1-BBX
360	600	420	ST560F-1B1-BBX	ST660F-1B1-BBX	ST760F-1B1-BBX	ST960F-1B1-BBX
480	800	560	ST580F-1B1-BBX	ST680F-1B1-BBX	ST780F-1B1-BBX	ST980F-1B1-BBX
600	1000	700	ST5100F-1B1-BBX	ST6100F-1B1-BBX	ST100F-1B1-BBX	ST9100F-1B1-BBX
720	1200	840	ST512OF-1B1-BBX	ST6120F-1B1-BBX	ST7120F-1B1-BBX	ST9120F-1B1-BBX

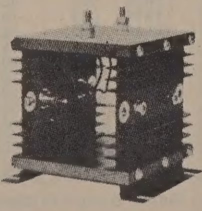
15 TO 100 AMP THREE PHASE ASSEMBLIES

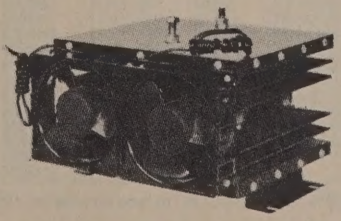
CURRENT			15 AMP	32 AMP	67.5 AMP	100 AMP**
Dimensions overall Fig. 7			A—5″ B—4⅛″ C—2⅞″	A—8″ B—4¼″ C—2⅞″	A—¼″ B—6$^{11}/_{16}$″ C—5″	A—10¾″ B—6$^{11}/_{16}$″ C—5″
VOLTS* DC OUTPUT	MAX. PIV	MAX. RMS VOLTS	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER
45	50	35		ST25-1BA1-BBX	ST35-1BA1-BBX	ST45F-1BA1-BBX
90	100	70	S-5748	ST210-1BA1-BBX	ST310-1BA1-BBX	ST410F-1BA1-BBX
185	200	140	S-5748-1	ST220-1BA1-BBX	ST320-1BA1-BBX	ST420F-1BA1-BBX
280	300	210	S-5748-2	ST230-1BA1-BBX	ST330-1BA1-BBX	ST430F-1BA1-BBX
370	400	280	S-5748-3	ST240-1BA1-BBX	ST340-1BA1-BBX	ST440F-1BA1-BBX
465	500	350	S-5748-4	ST250-1BA1-BBX	ST350-1BA1-BBX	ST450F-1BA1-BBX
560	600	420	S-5748-5	ST260-1BA1-BBX	ST360-1BA1-BBX	ST460F-1BA1-BBX
745	800	560	S-5748-6	ST280-1BA1-BBX	ST380-1BA1-BBX	ST480F-1BA1-BBX
935	1000	700	S-5748-7	ST2100-1BA1-BBX	ST3100-1BA1-BBX	ST4100F-1BA1-BBX
1120	1200	840	S-5748-8	ST2120-1BA1-BBX	ST3120-1BA1-BBX	ST4120F-1BA1-BBX

135 TO 500 AMP THREE PHASE ASSEMBLIES

CURRENT			135 AMP**	270 AMP***	420 AMP***	500 AMP***
Dimensions overall Fig. 8			A—12¼″ B—5$^{11}/_{16}$″ C—6½″	A—12¼″ B—5$^{11}/_{16}$″ C—6½″	A—11¼″ B—10½″ C—7⅝″	A—13¾″ B—10½″ C—7⅝″
DC OUTPUT VOLTS*	MAX. PIV	MAX. RMS VOLTS	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER	TYPE NUMBER
45	50	35	ST55F-1BA1-BBX	ST65F-1BA1-BBX	ST75F-1BA1-BBX	ST95F-1BA1-BBX
90	100	70	ST510F-1BA1-BBX	ST610F-1BA1-BBX	ST710F-1BA1-BBX	ST910F-1BA1-BBX
185	200	140	ST520F-1BA1-BBX	ST620F-1BA1-BBX	ST720F-1BA1-BBX	ST920F-1BA1-BBX
280	300	210	ST530F-1BA1-BBX	ST630F-1BA1-BBX	ST730F-1BA1-BBX	ST930F-1BA1-BBX
370	400	280	ST540F-1BA1-BBX	ST640F-1BA1-BBX	ST740F-1BA1-BBX	ST940F-1BA1-BBX
465	500	350	ST550F-1BA1-BBX	ST650F-1BA1-BBX	ST750F-1BA1-BBX	ST950F-1BA1-BBX
560	600	420	ST560F-1BA1-BBX	ST660F-1BA1-BBX	ST760F-1BA1-BBX	ST960F-1BA1-BBX
745	800	560	ST580F-1BA1-BBX	ST680F-1BA1-BBX	ST780F-1BA1-BBX	ST980F-1BA1-BBX
935	1000	700	ST5100F-1BA1-BBX	ST6100F-1BA1-BBX	ST7100F-1BA1-BBX	ST9100F-1BA1-BBX
1120	1200	840	ST5120F-1BA1-BBX	ST6120F-1BA1-BBX	ST7120F-1BA1-BBX	ST9120F-1BA1-BBX

*Approximate
**Forced air cooling; 500 LFM fan included.
***Forced air cooling; 1000 LFM fan included.





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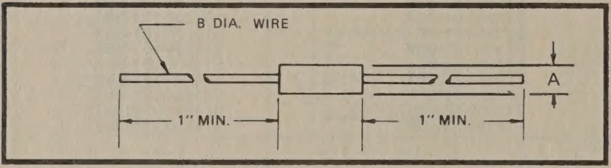
SARKES TARZIAN SEMICONDUCTORS

HIGH VOLTAGE SILICON ASSEMBLIES

Sarkes Tarzian high voltage avalanche rectifiers cover a wide range of voltage ratings. Devices with PIV characteristics up to 150,000 volts can be supplied. Standard devices up to 40,000 volts, as described here, are available from stock. All are rated at 55° Ambient.

Special high voltage rectifier assemblies can be designed and built to your specifications, along with high current, high voltage avalanche rectifiers. High current, high voltage avalanche rectifiers are also produced.

High voltage rectifiers can be supplied with fast recovery characteristics. See page 3880 for types available from stock. Special case or terminal styles are available.


B DIA. WIRE
A
1" MIN.
1" MIN.

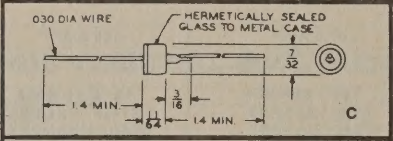
Max. PIV	Type	Io Ma @ 40°C	Vf @ Io	Ism Amps (1 Hz)	Case Dia.	Case "A" Length	Wire "B" Dia.
1,500	F15	600	3.25	20	.195	.355	.031
2,000	F20	400	3.25	20	.195	.355	.031
2,500	F25	400	3.25	20	.195	.355	.031
3,000	F30	400	3.25	20	.195	.355	.031
6,000	F60*	200	12.5	20	.195	.355	.031
7,000	F70*	200	12.5	20	.195	.355	.031
8,000	F80*	200	12.5	20	.195	.355	.031
9,000	F90*	200	12.5	20	.195	.355	.031
10,000	F100*	200	12.5	20	.195	.355	.031

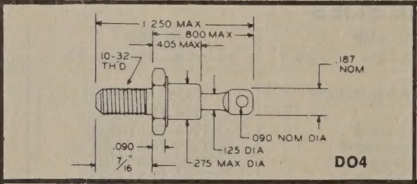
*Oil-cooled or other insulating medium

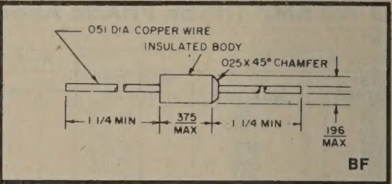
Max. PIV	Type	Vf @ Io (Volts)	Io Ma T°C	T°C	Ism Amps (1 Hz)	Case Dia.	Case "A" Length	Wire "B" Dia.
1,500	E15	3.25	600	25	20	0.125	0.250	0.031
2,000	E20	3.25	400	25	20	0.125	0.250	0.031
2,500	E25	3.25	400	25	20	0.125	0.250	0.031
3,000	E30	3.25	400	25	20	0.125	0.250	0.031
4,000	20AFS40	20	45	40	8	0.187	0.563	0.020
5,000	20AFS50	20	45	40	8	0.187	0.563	0.020
6,000	20AFS60	20	45	40	8	0.187	0.563	0.020
7,000	20AFS70	20	45	40	8	0.187	0.563	0.020
8,000	20AFS80	20	45	40	8	0.187	0.563	0.020
9,000	20AFS90	20	45	40	8	0.187	0.563	0.020
10,000	20AFS100	20	45	40	8	0.187	0.563	0.020
15,000	45EFS150	25	30	40	6	0.300	2.00	0.031
20,000	45EFS200	35	30	40	6	0.300	2.00	0.031
25,000	45EFS250	35	30	40	6	0.300	2.00	0.031
30,000	70GFS300	45	30	40	6	0.300	3.00	0.031
40,000	70GFS400	45	30	40	6	0.300	3.00	0.031

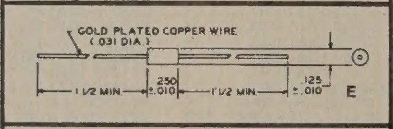
PIV Max.	Type	Vf @ Io (Volts)	Io Ma T°C	T°C	Ism Amps (1 Hz)	Case Dia.	Case "A" Length	Wire "B" Dia.
1,800	HVC180	4	250	40	30	0.375	0.562	0.031
2,400	HVC240	5	250	40	30	0.375	0.687	0.031
3,000	HVC300	6	200	40	30	0.375	0.750	0.031
4,000	HVC400	8	200	40	30	0.375	0.875	0.031
5,000	HVC500	10	200	40	30	0.375	1.00	0.031
6,000	HVC600	12	150	40	25	0.375	1.06	0.031
6,500	HVC650	13	150	40	25	0.375	1.19	0.031
7,500	HVC750	15	150	40	25	0.375	1.31	0.031
8,400	HVC840	16	100	40	25	0.375	1.37	0.031
9,600	HVC960	18	100	40	25	0.375	1.50	0.031
10,000	HVC1000	20	100	40	25	0.375	1.75	0.031
12,000	HVC1200	22	75	40	25	0.375	1.94	0.031
15,000	F150	25	75	40	20	0.300	2.00	0.031
20,000	F200	25	50	40	20	0.300	2.00	0.031
25,000	F250	35	50	40	20	0.300	2.00	0.031
30,000	F300	35	50	40	20	0.300	3.00	0.031
35,000	F350	45	25	40	20	0.300	3.00	0.031
40,000	F400	45	25	40	20	0.300	3.00	0.031

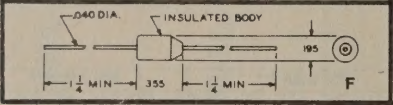
SILICON ZENER VOLTAGE REGULATIONS

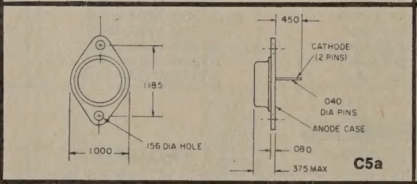

030 DIA WIRE
HERMETICALLY SEALED GLASS TO METAL CASE
7/32
1.4 MIN.
3/16
1.4 MIN.
1/64
C

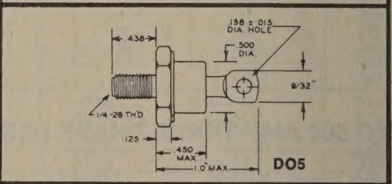

1.250 MAX
.800 MAX
.405 MAX
10-32 TH'D
.187 NOM
.090
.090 NOM DIA
.125 DIA
7/16
.275 MAX DIA
DO4


051 DIA COPPER WIRE
INSULATED BODY
025 X 45° CHAMFER
1 1/4 MIN
375 MAX
1 1/4 MIN
196 MAX
BF


GOLD PLATED COPPER WIRE (.031 DIA.)
1 1/2 MIN
.250 ±.010
1 1/2 MIN.
.125 ±.010
E


.040 DIA.
INSULATED BODY
195
1 1/4 MIN
355
1 1/4 MIN
F


.450
CATHODE (2 PINS)
1.185
.040 DIA PINS
ANODE CASE
1.000
.156 DIA HOLE
.080
.375 MAX
C5a


.438
.138 ± .015 DIA. HOLE
.500 DIA.
9/32"
1/4-28 TH'D
.125
.450 MAX
1.0" MAX
DO5

1 WATT 1TA SERIES CASE STYLE C

Tarzian Type	Zener Volt (V)	Test Current (Ma)	Dyn. Imp. (Ohms)	Jedec Type
1TA5.6	5.6	100	1.2	—
1TA6.2	6.2	100	1.5	—
1TA6.8	6.8	37	3.5	1N3016
1TA7.5	7.5	34	4.0	1N3017
1TA8.2	8.2	31	4.5	1N3018
1TA9.1	9.1	28	5.0	1N3019
1TA10	10	25	7.0	1N3020
1TA11	11	23	8.0	1N3021
1TA12	12	21	9.0	1N3022
1TA13	13	19	10	1N3023
1TA15	15	17	14	1N3024
1TA16	16	15.5	16	1N3025
1TA18	18	14	20	1N3026
1TA20	20	12.5	22	1N3027
1TA22	22	11.5	23	1N3028
1TA24	24	10.5	25	1N3029
1TA27	27	9.5	35	1N3030
1TA30	30	8.5	40	1N3031
1TA33	33	7.5	45	1N3032

Tarzian Type	Zener Volt (V)	Test Current (Ma)	Dyn. Imp. (Ohms)	Jedec Type
1TA36	36	7.0	50	1N3033
1TA39	39	6.5	60	1N3034
1TA43	43	6.0	70	1N3035
1TA47	47	5.5	80	1N3036
1TA51	51	5.0	95	1N3037
1TA56	56	4.5	110	1N3038
1TA62	62	4.0	125	1N3039
1TA68	68	3.7	150	1N3040
1TA75	75	3.3	175	1N3041
1TA82	82	3.0	200	1N3042
1TA91	91	2.8	250	1N3043
1TA100	100	2.5	350	1N3044
1TA110	110	2.3	450	1N3047
1TA120	120	2.0	550	1N3048
1TA130	130	1.9	700	1N3049
1TA150	150	1.7	1000	1N3050
1TA160	160	1.6	1100	1N3046
1TA180	180	1.4	1200	1N3045
1TA200	200	1.2	1500	1N3051

NOTES: Standard tolerance is 20%; Add Suffix "A" to type number for 10% tolerance; Suffix "B" for 5% tolerance.

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ZENER VOLTAGE REGULATORS (Cont.)

1 WATT PLASTIC CASE/VR SERIES CASE STYLE E

Tarzian Type	Breakdown Voltage (VB)	Test Current (Ma)	Dyn. Imp. (Ohms)
VR6.2	6.2	41	4
VR7.5	7.5	34	5
VR8.2	8.2	31	6
VR10	10	25	8
VR12	12	21	10
VR14	14	18	11
VR18	18	14	17
VR20	20	12.5	20
VR24	24	10.5	28
VR28	28	9.0	42
VR33	33	7.5	50
VR39	39	6.5	70
VR47	47	5.5	98
VR56	56	4.5	140
VR67	67	3.7	200
VR80	80	3.1	280
VR90	90	2.8	340
VR105	105	2.4	400
VR110	110	2.3	490
VR120	120	2.0	570
VR130	130	1.9	650
VR150	150	1.7	860
VR160	160	1.6	970
VR180	180	1.4	1200
VR200	200	1.2	1400

2 WATT PLASTIC CASE/2VR SERIES CASE STYLE F

2VR6.2	6.2	81	4
2VR7.5	7.5	67	5
2VR8.2	8.2	61	6
2VR10	10	50	8
2VR12	12	42	10
2VR14	14	35	11
2VR18	18	28	17
2VR20	20	25	20
2VR24	24	23	28
2VR28	28	18	42
2VR33	33	15	50
2VR39	39	13	70
2VR47	47	11	98
2VR56	56	8.8	140
2VR67	67	7.5	200
2VR80	80	6.2	280
2VR90	90	5.5	340
2VR105	105	4.7	400
2VR110	110	4.2	490
2VR120	120	3.8	570
2VR130	130	3.3	650
2VR150	150	3.1	860
2VR160	160	2.8	970
2VR180	180	2.5	1200
2VR200	200	2.2	1400

3 WATT PLASTIC CASE/3BZ SERIES CASE STYLE BF

3BZ6.2	6.2	250	1
3BZ7.5	7.5	250	3
3BZ8.2	8.2	100	1.5
3BZ10	10	75	5
3BZ12	12	63	5
3BZ15	15	50	8
3BZ18	18	42	11
3BZ20	20	37.5	12
3BZ24	24	30.5	5
3BZ27	27	28.5	18
3BZ33	33	22.5	18
3BZ39	39	19.5	30
3BZ47	47	16.5	40
3BZ56	56	13.5	55
3BZ68	68	11.1	75
3BZ82	82	9.0	100
3BZ91	91	8.4	125
3BZ110	110	6.9	225
3BZ120	120	6.0	275
3BZ130	130	5.7	350
3BZ150	150	5.0	500
3BZ160	160	4.8	550
3BZ180	180	4.1	600
3BZ200	200	3.7	750

10 WATT STUD MOUNT/10T SERIES CASE STYLE DO4

Tarzian Type	Zener Volt (V)	Test Current (Ma)	Dyn. Imp. (Ohms)	Jedec Type
10T5.6	5.6	1000	1	1N1803
10T6.2	6.2	1000	1	1N1804
10T6.8	6.8	1000	1	1N1805
10T7.5	7.5	1000	1	1N1806
10T8.2	8.2	1000	1	1N1807
10T9.1	9.1	500	1	1N1808
10T10	10	500	2	1N1351
10T11	11	500	2	1N1352
10T12	12	500	2	1N1353
10T13	13	500	2	1N1354
10T15	15	500	2	1N1355
10T16	16	500	3	1N1356
10T18	18	500	3	1N1356
10T20	20	150	3	1N1358
10T22	22	150	3	1N1359
10T24	24	150	3	1N1360
10T27	27	150	3	1N1361
10T30	30	150	4	1N1362
10T33	33	150	4	1N1363
10T36	36	150	5	1N1364
10T39	39	150	5	1N1365
10T43	43	150	6	1N1366
10T47	47	150	7	1N1367
10T51	51	150	8	1N1368
10T56	56	150	9	1N1369
10T62	62	50	12	1N1370
10T68	68	50	14	1N1371
10T75	75	50	20	1N1372
10T82	82	50	22	1N1373
10T91	91	50	35	1N1374
10T100	100	50	40	1N1375
10T110	110	50	47	1N1809
10T120	120	50	56	1N1810
10T130	130	50	65	1N1811
10T150	150	50	82	1N1812
10T160	160	50	93	1N1813
10T180	180	50	115	1N1814
10T200	200	50	140	1N1815

50 WATT STUD MOUNT/50T SERIES CASE STYLE DO5

Tarzian Type	Jedec Type	Tarzian Type	Jedec Type	Zener Volt (V)	Test Current (Ma)	Dyn. Imp. (Ohms)
50T6.8	1N3305	**50Z6.8**	1N2804	6.8	1850	0.2
50T6.8	1N4555	**50Z6.8**	7N4563	6.8	1850	0.16
50T7.5	1N3306	**50Z7.5**	1N2805	7.5	1700	0.3
50T7.5	1N4556	**50Z7.5**	1N4564	7.5	1650	0.24
50T8.2	1N3307	**50Z8.2**	1N2806	8.2	1500	0.4
50T9.1	1N3308	**5029.1**	1N2807	9.1	1370	0.5
50T10	1N3309	**50Z10**	1N2808	10	1200	0.6
50T11	1N3310	**50Z11**	1N2809	11	1100	0.8
50T12	1N3311	**50Z12**	1N2810	12	1000	1.0
50Z13	1N3312	**50Z13**	1N2811	13	960	1.1
50T15	1N3314	**50Z15**	1N2813	15	830	1.4
50T16	1N3315	**50Z16**	1N2814	16	780	1.6
50T18	1N3317	**50Z18**	1N2816	18	700	2.0
50T20	1N3319	**50Z20**	1N2818	20	630	2.4
50T22	1N3320	**50Z22**	1N2819	22	570	2.5
50T24	1N3321	**50Z24**	1N2820	24	520	2.6
50T27	1N3323	**50Z27**	1N2822	27	460	2.8
50T30	1N3324	**50Z30**	1N2823	30	420	3.0
50T33	1N3325	**50Z33**	1N2824	33	380	3.2

50Z SERIES/ CASE STYLE C5a

Tarzian Type	Jedec Type	Tarzian Type	Jedec Type	Zener Volt (V)	Test Current (Ma)	Dyn. Imp. (Ohms)
50T36	1N3326	**50Z36**	1N2825	36	350	3.5
50T39	1N3327	**50Z39**	1N2826	39	320	4.0
50T43	1N3328	**50Z43**	1N2827	43	290	4.5
50T45	1N3329	**50Z45**	1N2828	45	280	4.5
50T47	1N3330	**50Z47**	1N2829	47	270	5.0
50T51	1N3332	**50Z51**	1N2831	51	245	5.2
50T62	1N3335	**50Z62**	1N2833	62	200	7.0
50T68	1N3336	**50Z68**	1N2834	68	180	8.0
50T75	1N3337	**50Z75**	1N2835	75	170	9.0
50T82	1N3338	**50Z82**	1N2836	82	150	11
50T91	1N3339	**50Z91**	1N2837	91	140	15
50T100	1N3340	**50Z100**	1N2838	100	120	20
50T110	1N3342	**50Z110**	1N2840	110	110	30
50T120	1N3343	**50Z120**	1N2841	120	100	40
50T130	1N3344	**50Z130**	1N2842	130	95	50
50T150	1N3346	**50Z150**	1N2843	150	85	75
50T160	1N3347	**50Z160**	1N2844	160	80	80
50T180	1N3349	**50Z180**	1N2845	180	68	90
50T200	1N3350	**50Z200**	1N2846	200	65	100

Specifications given at 25°C. Standard tolerance is ±10%. For ±5% tolerance add suffix "A" to type number. For ±20% tolerance add suffix "B" to type number.

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SARKES TARZIAN SEMICONDUCTORS

KLIPVOLT SURGE SUPPRESSORS

Tarzian Klipvolt Selenium suppressors provide superior protection aaginst voltage transients. They turn on in a few microseconds, thus preventing destruction of semiconductor devices or circuit malfunction.

Tarzian Klipvolt suppressors are manufactured with a unique random oriented crystalline structure that distributes the current evenly over the entire cell. Destructive hot spots are eliminated providing a substantially greater margain of safety against high transient current surges that can be obtained by other devices.

Many other types of Klipvolt suppressors are available, only the more popular types are listed. Contact the factory for any unit you need that is not shown here.

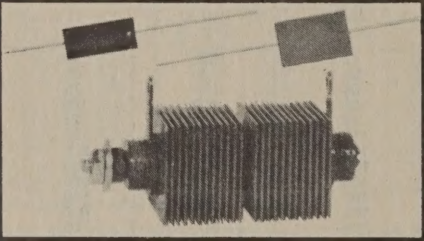
LOW CURRENT SUPPRESSORS

POLARIZED

Maximum DC Blocking Volts	Maximum Discharge Current (Amps)	SARKES TARZIAN		SEALED CONSTRUCTION	
		Type	Fig.	Type	Fig.
22	.250	S-235	1	S-235-C	3
22	.850	S-236	2	S-236-C	4
44	.250	S-237	1	S-237-C	3
44	.850	S-238	2	S-238-C	4
66	.250	S-239	1	S-239-C	3
66	.850	S-240	2	S-240-C	4
88	.250	S-241	1	S-241-C	3
88	.850	S-242	2	S-242-C	4
110	.250	S-243	1	S-243-C	3
110	.850	S-244	2	S-244-C	4
132	.250	S-245	1	S-245-C	3
132	.850	S-246	2	S-246-C	4
154	.250	S-247	1	S-247-C	3
154	.850	S-248	2	S-248-C	4

SINGLE PHASE NON-POLARIZED

Max. RMS Volts	Maximum Discharge Current (Amps)	Clamping Voltage	SARKES TARZIAN		SEALED CONSTRUCTION	
			Type	Fig.	Type	Fig.
26	.200	63	S-235	1	S-235-C	3
26	.700	63	S-236	2	S-236-C	4
52	.200	125	S-249	1	S-249-C	3
52	.700	125	S-250	2	S-250-C	4
78	.200	190	S-251	1	S-251-C	3
78	.700	190	S-252	2	S-252-C	4
104	.200	250	S-253	1	S-253-C	3
104	.700	250	S-254	2	S-254-C	4
130	.200	310	S-255	1	S-255-C	3
130	.700	310	S-256	2	S-256-C	4



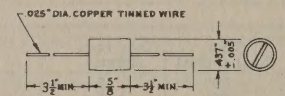


FIG. 1

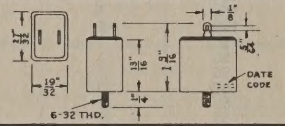


FIG. 2

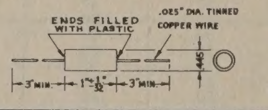


FIG. 3

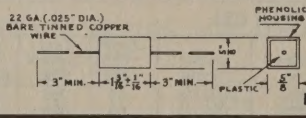


FIG. 4

LOW CURRENT AC SUPPRESSORS

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	IRM PEAK DISCHARGE CURRENT .62 AMP			IRM PEAK DISCHARGE CURRENT 2.2 AMPS		
			Length	Fig. No.	Type No.	Length	Fig. No.	Type No.
130	185	320	5/8	1	0KV26-5A5-Q	3/4	4	1KV26-5A5-Q
156	220	380	5/8	1	0KV26-5A5-Q	25/32	4	1KV26-6A6-Q
182	260	440	5/8	1	0KV26-7A7-Q	27/32	4	1KV26-7A7-Q
208	294	505	1 1/4	3	0KV26-8A8-Q	7/8	4	1KV26-8A8-Q
234	330	570	1 9/32	3	0KV26-9A9-Q	29/32	4	1KV26-9A9-Q
260	370	630	1 11/32	3	0KV26-10A10-Q	15/16	4	1KV26-10A10-Q
286	404	690	1 3/8	3	0KV26-11A11-Q	1	4	1KV26-11A11-Q
312	440	760	1 13/32	3	0KV26-12A12-Q	1 1/32	4	1KV26-12A12-Q
338	480	820	1 7/16	3	0KV26-13A13-Q	1 1/16	4	1KV26-13A13-Q
364	515	880	1 1/2	3	0KV26-14A14-Q	1 1/8	4	1KV26-14A14-Q
390	550	950	1 17/32	3	0KV26-15A15-Q	1 5/32	4	1KV26-15A15-Q

MEDIUM CURRENT AC TYPE SUPPRESSORS

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	Nominal Dimensions* A (All Types)	IRM Peak Discharge Current 5.9 Amps	IRM Peak Discharge Current 11 Amps	IRM Peak Discharge Current 19.6 Amps	IRM Peak Discharge Current 33.9 Amps
				Type No. Cell Size 1x1 H = 1 13/32	Type No. Cell Size 1 1/4x1 1/4 H = 1 3/4	Type No. Cell Size 1.6x1.6 H = 2 3/32	Type No. Cell Size 2x2 H = 2 1/2
26	36	63	1 7/16	2KV26-1A1-ZS	3KV26-1A1-ZS	4KV26-1A1-ZS	5KV26-1A1-ZS
52	72	125	1 5/8	2KV26-2A2-ZS	3KV26-2A2-ZS	4KV26-2A2-ZS	5KV26-2A2-ZS
78	110	190	1 3/4	2KV26-3A3-ZS	3KV26-3A3-ZS	4KV26-3A3-ZS	5KV26-3A3-ZS
104	147	250	1 7/8	2KV26-4A4-ZS	3KV26-4A4-ZS	4KV26-4A4-ZS	5KV26-4A4-ZS
130	185	320	2	2KV26-5A5-ZS	3KV26-5A5-ZS	4KV26-5A5-ZS	5KV26-5A5-ZS
156	220	380	2 3/4	2KV26-6A6-AS	3KV26-6A6-AS	4KV26-6A6-AS	5KV26-6A6-AS
182	260	440	2 15/16	2KV26-7A7-AS	3KV26-7A7-AS	4KV26-7A7-AS	5KV26-7A7-AS
208	294	505	3 1/16	2KV26-8A8-AS	3KV26-8A8-AS	4KV26-8A8-AS	5KV26-8A8-AS
234	330	570	3 7/32	2KV26-9A9-AS	3KV26-9A9-AS	4KV26-9A9-AS	5KV26-9A9-AS
260	370	630	3 3/8	2KV26-10A10-AS	3KV26-10A10-AS	4KV26-10A10-AS	5KV26-10A10-AS
286	404	690	3 1/2	2KV26-11A11-AS	3KV26-11A11-AS	4KV26-11A11-AS	5KV26-11A11-AS
312	440	760	3 21/32	2KV26-12A12-AS	3KV26-12A12-AS	4KV26-12A12-AS	5KV26-12A12-AS
338	480	820	3 13/16	2KV26-13A13-AS	3KV26-13A13-AS	4KV26-13A13-AS	5KV26-13A13-AS
364	515	880	3 15/16	2KV26-14A14-AS	3KV26-14A14-AS	4KV26-14A14-AS	5KV26-14A14-AS
390	550	950	4 1/16	2KV26-15A15-AS	3KV26-15A15-AS	4KV26-15A15-AS	5KV26-15A15-AS

HIGH CURRENT AC TYPE SUPPRESSORS

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	IRM PEAK DISCHARGE CURRENT 129.6 AMPS				IRM PEAK DISCHARGE CURRENT 259.6 AMPS			
			NOMINAL DIMENSIONS*				NOMINAL DIMENSIONS*			
			A	H	Cell Size	Type No.	A	H	Cell Size	Type No.
26	36	63	2 5/8	4 9/16	4x4	7KV26-1A1-ZS	2 5/8	5 13/16	5x6	10KV26-1A1-ZS
52	72	125	3	4 9/16	4x4	7KV26-2A2-ZS	3	5 13/16	5x6	10KV26-2A2-ZS
78	110	190	3 3/8	4 9/16	4x4	7KV26-3A3-ZS	3 3/8	5 13/16	5x6	10KV26-3A3-ZS
104	147	250	3 3/4	4 9/16	4x4	7KV26-4A4-ZS	3 3/4	5 13/16	5x6	10KV26-4A4-ZS
130	185	320	4 1/8	4 9/16	4x4	7KV26-5A5-ZS	4 1/8	5 13/16	5x6	10KV26-5A5-ZS
156	220	380	5 9/16	4 9/16	4x4	7KV26-6A6-AS	5 9/16	5 13/16	5x6	10KV26-6A6-AS
182	260	440	6	4 9/16	4x4	7KV26-7A7-AS	6	5 13/16	5x6	10KV26-7A7-AS
208	294	505	6 7/16	4 9/16	4x4	7KV26-8A8-AS	6 7/16	5 13/16	5x6	10KV26-8A8-AS
234	330	570	6 7/8	4 9/16	4x4	7KV26-9A9-AS	6 7/8	5 13/16	5x6	10KV26-9A9-AS
260	370	630	7 5/16	4 9/16	4x4	7KV26-10A10-AS	7 5/16	5 13/16	5x6	10KV26-10A10-AS
286	404	690	7 3/4	4 9/16	4x4	7KV26-11A11-AS	7 3/4	5 13/16	5x6	10KV26-11A11-AS
312	440	760	8 3/16	4 9/16	4x4	7KV26-12A12-AS	8 3/16	5 13/16	5x6	10KV26-12A12-AS
338	480	820	8 5/8	4 9/16	4x4	7KV26-13A13-AS	8 5/8	5 13/16	5x6	10KV26-13A13-AS
364	515	880	9 1/16	4 9/16	4x4	7KV26-14A14-AS	9 1/16	5 13/16	5x6	10KV26-14A14-AS
390	560	950	9 1/2	4 9/16	4x4	7KV26-15A15-AS	9 1/2	5 13/16	5x6	10KV26-15A15-AS

*See Fig. "O" on page 3887 of these pages for typical configurations.

SELENIUM RECTIFIERS

The industry's most extensive line of selenium rectifiers is manufactured by Tarzian by a process that results in a voltage drop that is essentially constant with time. Aging is virtually eliminated. Contact the factory for product information and prompt engineering assistance.

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KLIPVOLT SURGE SUPPRESSORS (Cont.)

LOW CURRENT DC TYPE SUPPRESSORS

IRM PEAK DISCHARGE CURRENT 250 MA			
VR DC Blocking Voltage	Length	Fig. No.	Type No.
132	5/8	1	0KV26-6A-Q
154	5/8	1	0KV26-7A-Q
176	5/8	1	0KV26-8A-Q
198	5/8	1	0KV26-9A-Q
220	5/8	1	0KV26-10A-Q
242	5/8	1	0KV26-11A-Q
264	5/8	1	0KV26-12A-Q
286	5/8	1	0KV26-13A-Q
3C8	5/8	1	0KV26-14A-Q
330	1 1/4	3	0KV26-15A-Q

IRM PEAK DISCHARGE CURRENT 850 MA			
VR DC Blocking Voltage	Length	Fig. No.	Type No.
132	3/4	4	1KV26-6A-Q
154	3/4	4	1KV26-7A-Q
176	3/4	4	1KV26-8A-Q
198	3/4	4	1KV26-9A-Q
220	3/4	4	1KV26-10A-Q
242	25/32	4	1KV26-11A-Q
264	25/32	4	1KV26-12A-Q
286	27/32	4	1KV26-13A-Q
308	27/32	4	1KV26-14A-Q
330	7/8	4	1KV26-15A-Q

MEDIUM CURRENT DC TYPE SUPPRESSORS

IRM PEAK DISCHARGE CURRENT 5.5 AMPERES			IRM PEAK DISCHARGE CURRENT 11 AMPERES	IRM PEAK DISCHARGE CURRENT 20 AMPERES	IRM PEAK DISCHARGE CURRENT 33 AMPERES
VR DC Blocking Voltage	Nominal Dimensions Fig. O	Type No. Cell Size 1x1 H = 1 13/32	Type No. Cell Size 1 1/4 x 1 1/4 H = 1 3/4	Type No. Cell Size 1.6 x 1.6 H = 2.1	Type No. Cell Size 2 x 2 H = 2 1/2
22	1 5/16	2KV26-1A-ZS	3KV26-1A-ZS	4KV26-1A-ZS	5KV26-1A-ZS
44	1 3/8	2KV26-2A-ZS	3KV26-2A-ZS	4KV26-2A-ZS	5KV26-2A-ZS
66	1 9/16	2KV26-3A-ZS	3KV26-3A-ZS	4KV26-3A-ZS	5KV26-3A-ZS
88	1 9/16	2KV26-4A-ZS	3KV26-4A-ZS	4KV26-4A-ZS	5KV26-4A-ZS
110	1 5/8	2KV26-5A-ZS	3KV26-5A-ZS	4KV26-5A-ZS	5KV26-5A-ZS
132	1 11/16	2KV26-6A-ZS	3KV26-6A-ZS	4KV26-6A-ZS	5KV26-6A-ZS
154	2 3/8	2KV26-7A-AS	3KV26-7A-AS	4KV26-7A-AS	5KV26-7A-AS
176	2 7/16	2KV26-8A-AS	3KV26-8A-AS	4KV26-8A-AS	5KV26-8A-AS
198	2 1/2	2KV26-9A-AS	3KV26-9A-AS	4KV26-9A-AS	5KV26-9A-AS
220	2 19/32	2KV26-10A-AS	3KV26-10A-AS	4KV26-10A-AS	5KV26-10A-AS
242	2 11/16	2KV26-11A-AS	3KV26-11A-AS	4KV26-11A-AS	5KV26-11A-AS
264	2 3/4	2KV26-12A-AS	3KV26-12A-AS	4KV26-12A-AS	5KV26-12A-AS
286	2 29/32	2KV26-13A-AS	3KV26-13A-AS	4KV26-13A-AS	5KV26-13A-AS
308	3	2KV26-14A-AS	3KV26-14A-AS	4KV26-14A-AS	5KV26-14A-AS
330	3 3/32	2KV26-15A-AS	3KV26-15A-AS	4KV26-15A-AS	5KV26-15A-AS

HIGH CURRENT DC TYPE SUPPRESSORS

IRM PEAK DISCHARGE CURRENT 120A AMPERES

VR DC Blocking Voltage	NOMINAL DIMENSIONS			Type No.
	A	H	Cell Size	
22	2	4 9/16	4x4	7KV26-1A-ZS
44	2 3/16	4 9/16	4x4	7KV26-2A-ZS
66	2 3/8	4 9/16	4x4	7KV26-3A-ZS
88	2 9/16	4 9/16	4x4	7KV26-4A-ZS
110	2 3/4	4 9/16	4x4	7KV26-5A-ZS
132	3	4 9/16	4x4	7KV26-6A-ZS
154	4	4 9/16	4x4	7KV26-7A-AS
176	4 3/16	4 9/16	4x4	7KV26-8A-AS
198	4 3/8	4 9/16	4x4	7KV26-9A-AS
220	4 9/16	4 9/16	4x4	7KV26-10A-AS
242	4 3/4	4 9/16	4x4	7KV26-11A-AS
264	5	4 9/16	4x4	7KV26-12A-AS
286	5 3/16	4 9/16	4x4	7KV26-13A-AS
308	5 3/8	4 9/16	4x4	7KV26-14A-AS
330	5 3/4	4 9/16	4x4	7KV26-15A-AS

IRM PEAK DISCHARGE CURRENT 225 AMPERES

VR DC Blocking Voltage	NOMINAL DIMENSIONS			Type No.
	A	H	Cell Size	
22	2	5 13/16	5x6	10KV26-1A-ZS
44	2 3/16	5 13/16	5x6	10KV26-2A-ZS
66	2 3/8	5 13/16	5x6	10KV26-3A-ZS
88	2 9/16	5 13/16	5x6	10KV26-4A-ZS
110	2 3/4	5 13/16	5x6	10KV26-5A-ZS
132	3	5 13/16	5x6	10KV26-6A-ZS
154	4	5 13/16	5x6	10KV26-7A-AS
176	4 3/16	5 13/16	5x6	10KV26-8A-AS
198	4 3/8	5 13/16	5x6	10KV26-9A-AS
220	4 9/16	5 13/16	5x6	10KV26-10A-AS
242	4 3/4	5 13/16	5x6	10KV26-11A-AS
264	5	5 13/16	5x6	10KV26-12A-AS
286	5 3/16	5 13/16	5x6	10KV26-13A-AS
308	5 3/8	5 13/16	5x6	10KV26-14A-AS
330	5 3/4	5 13/16	5x6	10KV26-15A-AS

MEDIUM CURRENT THREE PHASE AC TYPE SUPPRESSORS

IRM PEAK DISCHARGE CURRENT 5.90 AMPERES

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	NOMINAL DIMENSIONS*			Type No.
			A	H	Cell Size	
26	36	63	1 15/16	1 13/32	1x1	2KV26-1P1-ZS
52	72	125	2 13/16	1 13/32	1x1	2KV26-2P2-ZS
78	100	190	2 27/32	1 13/32	1x1	2KV26-3P3-ZS
104	147	250	3 7/16	1 13/32	1x1	2KV26-4P4-AS
130	185	320	3 7/8	1 13/32	1x1	2KV26-5P5-AS
156	220	380	4 5/16	1 13/32	1x1	2KV26-6P6-AS
182	260	440	5 7/32	1 13/32	1x1	2KV26-7P7-AS
204	294	505	5 21/32	1 13/32	1x1	2KV26-8P8-AS

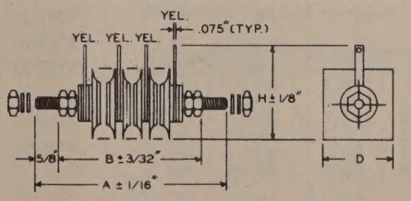
IRM PEAK DISCHARGE CURRENT 11 AMPERES

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	NOMINAL DIMENSIONS*			Type No.
			A	H	Cell Size	
26	36	63	1 15/16	1 3/4	1 1/4x1 1/4	3KV26-1P1-ZS
52	72	125	2 13/16	1 3/4	1 1/4x1 1/4	3KV26-2P2-ZS
78	100	190	2 27/32	1 3/4	1 1/4x1 1/4	3KV26-3P3-ZS
104	147	250	3 7/16	1 3/4	1 1/4x1 1/4	3KV26-4P4-AS
130	185	320	3 7/8	1 3/4	1 1/4x1 1/4	3KV26-5P5-AS
156	220	380	4 5/16	1 3/4	1 1/4x1 1/4	3KV26-6P6-AS
182	260	440	5 7/32	1 3/4	1 1/4x1 1/4	3KV26-7P7-AS
204	294	505	5 21/32	1 3/4	1 1/4x1 1/4	3KV26-8P8-AS

IRM PEAK DISCHARGE CURRENT 19.6 AMPERES

VR VRMS Volts	VRRM PIV	VC Clamping Voltage	NOMINAL DIMENSIONS*			Type No.
			A	H	Cell Size	
26	36	63	1 15/16	2.1	1.6x1.6	4KV26-1P1-ZS
52	72	125	2 13/16	2.1	1.6x1.6	4KV26-2P2-ZS
78	100	190	2 27/32	2.1	1.6x1.6	4KV26-3P3-ZS
104	147	250	3 7/16	2.1	1.6x1.6	4KV26-4P4-AS
130	185	320	3 7/8	2.1	1.6x1.6	4KV26-5P5-AS
156	220	380	4 5/16	2.1	1.6x1.6	4KV26-6P6-AS
182	260	440	5 7/32	2.1	1.6x1.6	4KV26-7P7-AS
204	294	505	5 21/32	2.1	1.6x1.6	4KV26-8P8-AS

*See Fig. O.



ZS Suffix: Bolt Construction
AS Suffix: Double Stud

FIG. O

SEMTECH CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"KW-PAC" HIGH VOLTAGE SILICON RECTIFIERS

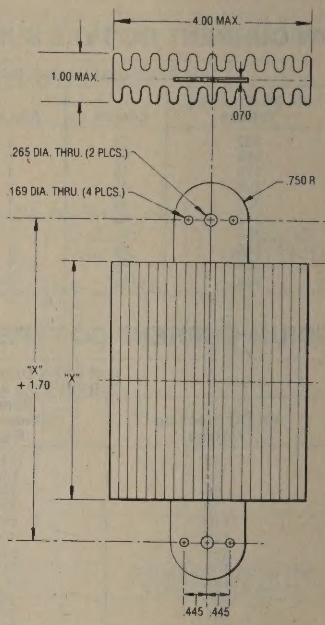
The Semtech "KW-PAC" is a new high density, high current, silicon rectifier for use in commercial, industrial and military applications. Designed and tooled to be efficiently mass produced, "KW" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits and is specifically adaptable for use in power supplies. These devices are rectangular in shape and thereby provide easy mounting in either air or oil.

"KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

Type No.	PIVkv	I_s*	V_f leg @ I_f*		NC	FA	Oil	Case DR No.
		1Cycle Surge	25°C			I_o @ 55°C		
		Amps	Volts	Amps	Amps	Amps	Amps	
S4KW3KA-1	3	600	4.4	12	8	16	20	A-1
S2KW6KA-1	6	300	8.8	6	4	8	10	A-1
S1KW12KA-1	12	150	17.6	3	2	4	5	A-1
S4KW6KA-2	6	600	8.8	12	6	12	15	A-2
S2KW12KA-2	12	300	17.6	6	3	6	7.5	A-2
S1KW24KA-2	24	150	35.2	3	1.5	3	3.8	A-2
S4KW9KA-3	9	600	13.2	12	6	12	15	A-3
S2KW18KA-3	18	300	26.4	6	3	6	7.5	A-3
S1KW36KA-3	36	150	52.8	3	1.5	3	3.8	A-3
S4KW12KA-4	12	600	17.6	12	6	12	15	A-4
S2KW24KA-4	24	300	35.2	6	3	6	7.5	A-4
S1KW48KA-4	48	150	70.4	3	1.5	3	3.8	A-4
S4KW15KA-5	15	600	22	12	6	12	15	A-5
S2KW30KA-5	30	300	44	6	3	6	7.5	A-5
S1KW60KA-5	60	150	88	3	1.5	3	3.8	A-5
S4KW18KA-6	18	600	26.4	12	6	12	15	A-6
S2KW36KA-6	36	300	52.8	6	3	6	7.5	A-6
S1KW72KA-6	72	150	105.6	3	1.5	3	3.8	A-6

LEGEND: NC Natural Convection
FA Forced Air

* tp = 8.3 ms

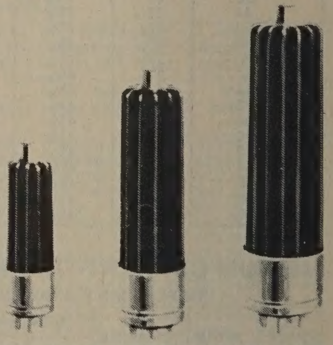


Case	"X"
A-1	4.780
A-2	7.980
A-3	11.180
A-4	14.380
A-5	17.580
A-6	20.780

"TUBE-PAC" HIGH VOLTAGE SILICON RECTIFIERS

"TUBE-PAC" is Semtech's new line of silicon, high-voltage rectifiers intended as a direct plug-in replacement part for most popular mercury-vapor and vacuum glass tube-type rectifiers.

Designed to last the life of the equipment, Semtech's "TUBE-PAC" are smaller, corona-free, dissipate heat more effectively and eliminate filament power. No special adaptors are required to use Semtech's "TUBE-PAC."



STR (SEMTECH TUBE REPLACEMENT PRECEEDS STANDARD EIA TUBE TYPE NUMBER).

GAS TUBE REPLACEMENTS

Type	PIV - KV	I_o Amp	Cathode Connection
STR3B25	4.5	0.5	1
STR3B28	10	0.5	1
STR4B32	10	1.25	1
STR249C	10	0.5	1
STR575A	15	2.5	2
STR576A	25	0.5	2
STR250R	60	0.25	2
STR253	15	0.35	2
STR577	25	0.3	2
STR593	25	0.3	1
STR615	2	2.5	1
STR635	1	6.4	3
STR672A	2.5	3.2	2

Type	PIV - KV	I_o Amp	Cathode Connection
STR816	7.5	.13	2
STR866A	10	0.5	1
STR872A	10	1.25	2
STR5544	1.5	3.2	2
STR5560	1.5	2.5	4
STR5720	1.0	2.5	4
STR6587	16	0.23	2
STR6693	15	5	2
STR6807	1.5	6.4	2
STR6808	1.5	6.4	2
STR6894	20	2.5	2

Type	PIV - KV	I_o Amp	Cathode Connection
STR6895	20	2.5	2
STR7018	2	2.5	1
STR7019	1	6.4	2
STR7454	25	6.5	1
STR7789	15	0.4	2
STR7790	20	1.0	2
STR7792	25	2.0	2
STR8008	10	1.25	2
STR8080	25	2.5	2
STR8253	20	0.25	2
STR8434	20	1.8	2
STR8435	20	1.8	2

SHOULD YOU REQUIRE A VACUUM TUBE RECTIFIER REPLACEMENT NOT LISTED, PLEASE CONTACT OUR LOCAL REPRESENTATIVE.

TECHNICAL BULLETIN H57

Semtech reserves the right to change specifications without notice.

SEMTECH CORPORATION

652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"KW-PAC" HIGH VOLTAGE CENTER TAPS - DOUBLERS

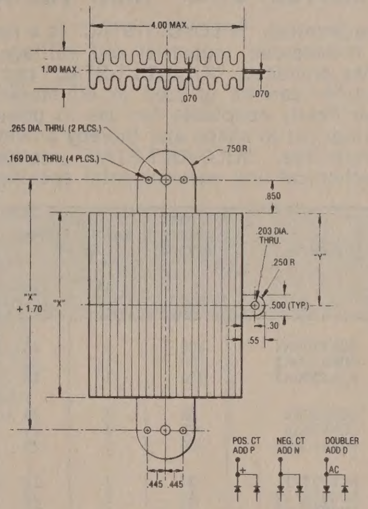
The Semtech "KW-PAC" is a new high density, high current, silicon rectifier for use in commercial, industrial and military applications. Designed and tooled to be efficiently mass produced, "KW" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits and is specifically adaptable for use in power supplies. These devices are rectangular in shape and thereby provide easy mounting in either air or oil.

"KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

		I_s*	V_f @ I_f*		NC†	FA†	Oil	
		1Cycle Surge	25°C			Io @ 55°C		Case
Type No.	PIVkv	Amps	Volts	Amps	Amps	Amps	Amps	DR No.
S4KW1.5C-1	1.5	600	2.2	12	8	16	20	C-1
S2KW3C-1	3	300	4.4	6	4	8	10	C-1
S1KW6C-1	6	150	8.8	3	2	4	5	C-1
S4KW3C-2	3	600	4.4	12	6	12	15	C-2
S2KW6C-2	6	300	8.8	6	3	6	7.5	C-2
S1KW12C-2	12	150	17.6	3	1.5	3	3.8	C-2
S4KW4.5C-3	4.5	600	6.6	12	6	12	15	C-3
S2KW9C-3	9	300	13.2	6	3	6	7.5	C-3
S1KW18C-3	18	150	26.4	3	1.5	3	3.8	C-3
S4KW6C-4	6	600	8.8	12	6	12	15	C-4
S2KW12C-4	12	300	17.6	6	3	6	7.5	C-4
S1KW24C-4	24	150	35.2	3	1.5	3	3.8	C-4
S4KW7.5C-5	7.5	600	11	12	6	12	15	C-5
S2KW15C-5	15	300	22	6	3	6	7.5	C-5
S1KW30C-5	30	150	44	3	1.5	3	3.8	C-5
S4KW9C-6	9	600	13.2	12	6	12	15	C-6
S2KW18C-6	18	300	26.4	6	3	6	7.5	C-6
S1KW36C-6	36	150	52.8	3	1.5	3	3.8	C-6

Example of Neg CT Type No. S4KW3C-2N
Legend for: Neg CT Add N
Pos CT Add P
Doubler Add D

* tp = 8.3 ms
† NC Natural Convection
FA Forced Air



Case	"X"	"Y"
C-1	4.780	2.390
C-2	7.980	3.990
C-3	11.180	5.590
C-4	14.380	7.190
C-5	17.380	8.790
C-6	20.780	10.390

"KW-PAC" HIGH VOLTAGE SILICON BRIDGE RECTIFIERS

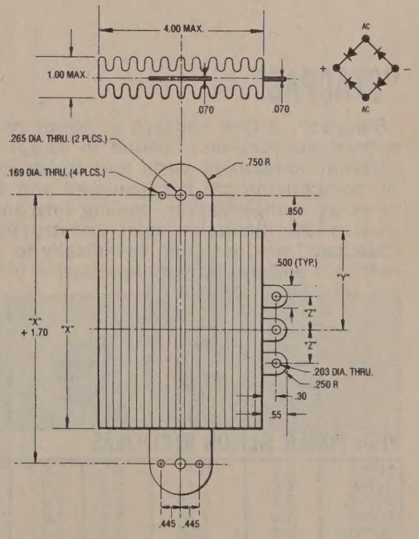
The Semtech "KW-PAC" is a new high density, high voltage, silicon bridge rectifier for use in commercial, industrial and military specifications. Designed and tooled to be efficiently mass produced, "KW" can be used economically in existing applications. The rectifier is specifically adaptable for use in power supplies. These devices are rectangle in shape and thereby provide easy mounting in either air or oil.

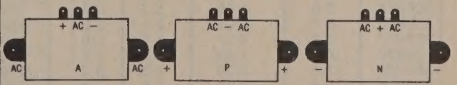
"KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

		I_s*	V_f leg @ I_f*		NC†	FA†	Oil	
		1CycleSurge	25°C			Io @ 55°C		Case
Type No.	PIVkv	Amps	Volts	Amps	Amps	Amps	Amps	DR No.
S4KW.75B-1	.75	600	1.1	12	15	30	40	B-1
S2KW1.5B-1	1.5	300	2.2	6	7.5	15	20	B-1
S1KW3B-1	3	150	4.4	3	3.8	7.5	10	B-1
S4KW1.5B-2	1.5	600	2.2	12	12	24	32	B-2
S2KW3B-2	3	300	4.4	6	6	12	16	B-2
S1KW6B-2	6	150	8.8	3	3	6	8	B-2
S4KW2.25B-3	2.25	600	3.3	12	12	24	32	B-3
S2KW4.5B-3	4.5	300	6.6	6	6	12	16	B-3
S1KW9B-3	9	150	13.2	3	3	6	8	B-3
S4KW3B-4	3	600	4.4	12	12	24	32	B-4
S2KW6B-4	6	300	8.8	6	6	12	16	B-4
S1KW12B-4	12	150	17.6	3	3	6	8	B-4
S4KW3.75B-5	3.75	600	5.5	12	12	24	32	B-5
S2KW7.5B-5	7.5	300	11.0	6	6	12	16	B-5
S1KW15B-5	15	150	22.0	3	3	6	8	B-5
S4KW4.5B-6	4.5	600	6.6	12	12	24	32	B-6
S2KW9B-6	9	300	13.2	6	6	12	16	B-6
S1KW18B-6	18	150	26.4	3	3	6	8	B-6

* tp = 8.3 ms
† NC Natural Convection
FA Forced Air

Add letter to designate open terminal polarity — example S2KW3B2-A





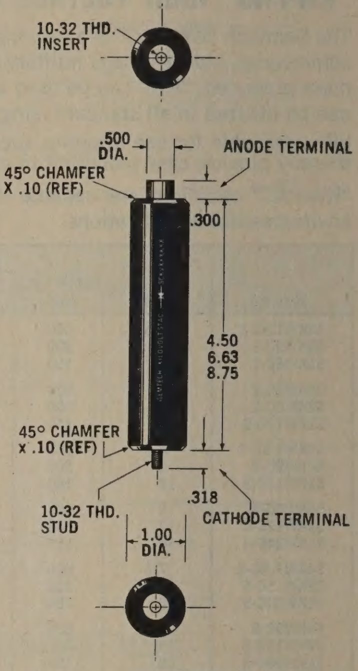
ADD LETTER TO DESIGNATE OPEN TERMINAL POLARITY — EXAMPLE: S2KW3B2-A

Case	"X"	"Y"	"Z"
B-1	4.780	2.390	.800
B-2	7.980	3.990	1.600
B-3	11.180	5.590	2.400
B-4	14.380	7.190	3.200
B-5	17.580	8.790	4.000
B-6	20.780	10.390	4.800

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"KILOVOLT-STAC" HIGH VOLTAGE SILICON RECTIFIERS

The Semtech "KILOVOLT-STAC" is a new high density, high voltage, silicon rectifier for use in commercial, industrial and military applications. Designed and tooled to be efficiently mass produced, "KILOVOLT-STAC" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits and is specifically adaptable for use in power supplies for X-ray equipment. These devices are cylindrical in shape and thereby provide easy mounting in either air or oil. Designed to be corona-free, "KILOVOLT-STAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.



Type No.	Peak Inverse Voltage	Dynamic Reverse Current @ PIV		Average Rectified Current Amps			Forward Voltage V_F	One Cycle Surge	Dimensions Inches
		µA	µA	Free Air*	600 CFM Forced Air*	Oil	Volts	tp=8.3ms	1.0 Dia.
	KV	25°C	100°C	25°C	25°C	55°C	25°C	Amps	Length
							@ 100 MA		
SCKV100K3	100	1	25	0.1	0.2	0.3	168	7.5	4.50
SCKV150K3	150	1	25	0.1	0.2	0.3	252	7.5	6.63
SCKV200K3	200	1	25	0.1	0.2	0.3	336	7.5	8.75
							@ 100 MA		
SCKV50K6	50	1	25	0.2	0.4	0.6	84	15	4.50
SCKV75K6	75	1	25	0.2	0.4	0.6	126	15	6.63
SCKV100K6	100	1	25	0.2	0.4	0.6	168	15	8.75
							@ 100 MA		
SCKV33K12	33	1	25	0.3	0.6	1.2	56	20	4.50
SCKV45K12	45	1	25	0.3	0.6	1.2	84	20	6.63
SCKV66K12	66	1	25	0.3	0.6	1.2	112	20	8.75
							@ 500 MA		
SCKV12.5K30	12.5	1	25	1.0	2.0	3.0	14	50	4.50
SCK18K30	18	1	25	1.0	2.0	3.0	21	50	6.63
SCKV25K30	25	1	25	1.0	2.0	3.0	28	50	8.75
							@ 1 AMP		
SCKV12.5K40	12.5	1	25	1.0	2.0	4.0	14	150	4.50
SCKV18K40	18	1	25	1.0	2.0	4.0	21	150	6.63
SCKV25K40	25	1	25	1.0	2.0	4.0	28	150	8.75

Operating and Storage Temperature −55°C to +150°C.

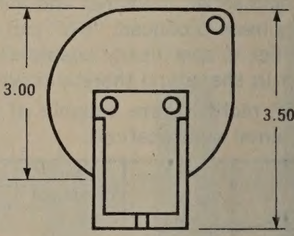
* Atmosphere and operating voltage must be consistent with length of stack.

TECHNICAL BULLETIN H60

TOLERANCE .XX ±.03
.XXX ±.020
FRACTIONAL = NOMINAL DIMENSION

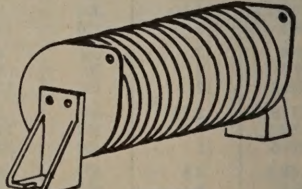
"STACPAC"

"Stacpac", a new concept in power rectifier stacks for use in high voltage, high current applications. Unique in design, "Stacpac" completely eliminates all the external component parts and solder joints usually found in devices of this type. All components are encapsulated and connected to aluminum discs, that in turn serve as compensation, cooling fins and corona protection. Internally, "Stacpac" utilizes the Semtech solid construction, double tungstaloid, silicon rectifiers. "Stacpac" was designed specifically to streamline packaging, replace multiple stud rectifiers and auxiliary compensation in high voltage, high current applications.



HIGH POWER SILICON RECTIFIERS

Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Reverse Current Per Leg @ PIV		One Cycle Surge Current	Max. Fwd. Voltage @ 3 ADC	Max. Length[1] of Ass'y.	Data Sheet No.
	KV	KV	Amps		µA		Amps	Volts		
	25°C	25°C	55°C	100°C	25°C	100°C	25°C	25°C	Inches	
SCPH2	1.0	0.7	5.5	3.0	110	200	150	2	2.74	H50
SCPH4	2.0	1.4	5.5	3.0	110	200	150	4	3.40	H50
SCPH6	3.0	2.10	5.5	3.0	110	200	150	6	4.07	H50
SCPH8	4.0	2.80	5.5	3.0	110	200	150	8	4.73	H50
SCPH10	5.0	3.50	5.5	3.0	110	200	150	10	5.39	H50
SCPH12	6.0	4.20	5.5	3.0	110	200	150	12	6.05	H50
SCPH14	7.0	4.90	5.5	3.0	110	200	150	14	6.71	H50
SCPH16	8.0	5.60	5.5	3.0	110	200	150	16	7.38	H50
SCPH18	9.0	6.30	5.5	3.0	110	200	150	18	8.04	H50
SCPH20	10.0	7.00	5.5	3.0	110	200	150	20	8.70	H50
SCPH22	11.0	7.70	5.5	3.0	110	200	150	22	9.36	H50
SCPH24	12.0	8.40	5.5	3.0	110	200	150	24	10.03	H50
SCPH26	13.0	9.10	5.5	3.0	110	200	150	26	10.69	H50
SCPH28	14.0	9.80	5.5	3.0	110	200	150	28	11.35	H50
SCPH30	15.0	10.50	5.5	3.0	110	200	150	30	12.01	H50
SCPH32	16.0	11.20	5.5	3.0	110	200	150	32	12.67	H50
SCPH34	17.0	11.90	5.5	3.0	110	200	150	34	13.33	H50
SCPH36	18.0	12.60	5.5	3.0	110	200	150	36	14.00	H50
SCPH38	19.0	13.30	5.5	3.0	110	200	150	38	14.66	H50
SCPH40	20.0	14.00	5.5	3.0	110	200	150	40	15.32	H50
SCPH42	21.0	14.70	5.5	3.0	110	200	150	42	15.98	H50
SCPH44	22.0	15.40	5.5	3.0	110	200	150	44	16.64	H50
SCPH46	23.0	16.10	5.5	3.0	110	200	150	46	17.31	H50
SCPH48	24.0	16.80	5.5	3.0	110	200	150	48	17.97	H50
SCPH50	25.0	17.50	5.5	3.0	110	200	150	50	18.63	H50



STACPAC

Mechanical Dimensions:
Width, 3 inches;
1 length includes two insulated mounting legs.

Operating and Storage Temperature, −55°C to +150°C

Note: Although mounting brackets are insulated, care must be taken to assure proper distance to ground planes.

Semtech reserves the right to change specifications without notice.

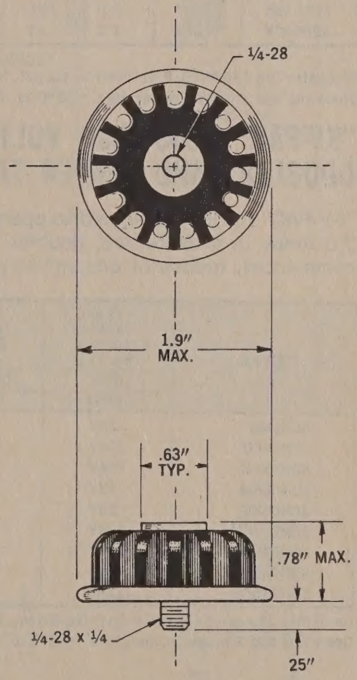
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

HIGH VOLTAGE MODULES

High voltage modules ("HVM"), a new building block approach for high voltage requirements. The devices can be stacked to provide either higher voltage assemblies or other circuit configurations such as doublers, center taps and bridges. "HVM" completely eliminates all external component parts and solder joints usually found in devices of this type. All components are encapsulated and connected to metal discs that, in turn, serve as compensation, cooling fins and corona protection. Internally. "HVM" utilizes the Semtech Metoxilite silicon rectifiers. Easy to assemble and mount, simple to screw together; meets the various circuit configurations and equipment mounting requirements.

	PIV	Average Rectified Current (Amps)			Single Cycle Surge Current	Rev. Current @ PIV		Max. Forward Voltage
Type No.	KV	Air	@ 55°C Oil	With Heat Sink	Amps @ 25°C	µA @ 25°C	µA @ 100°C	Volts
								@ 100 mA
SHVM15	15	0.5	0.5	0.5	10	1.0	25	24
SHVM12.5	12.5	0.5	0.5	0.5	10	1.0	25	20
SHVM10	10	0.5	0.5	0.5	10	1.0	25	16
SHVM7.5	7.5	0.5	0.5	0.5	10	1.0	25	12
SHVM5	5	0.5	0.5	0.5	10	1.0	25	8
SHVM2.5	2.5	0.5	0.5	0.5	10	1.0	25	4
								@ 1A
S2HVM15	15	0.8	2.0	1.5	50	1.0	25	17
S2HVM12.5	12.5	1.0	2.0	2.0	50	1.0	25	15
S2HVM10	10	1.2	2.0	2.0	50	1.0	25	12
S2HVM7.5	7.5	2.0	2.0	2.0	50	1.0	25	9
S2HVM5	5	2.0	2.0	2.0	50	1.0	25	6
S2HVM2.5	2.5	2.0	2.0	2.0	50	1.0	25	4
								@ 3A
S3HVM10	10	1.2	3.0	2.5	150	1.0	25	10
S3HVM7.5	7.5	1.5	3.0	3.0	150	1.0	25	8
S3HVM5	5	2.4	3.0	3.0	150	1.0	25	5
S3HVM2.5	2.5	3.0	3.0	3.0	150	1.0	25	3
								@ 3A
S6HVM5	5	2.4	6.0	6.0	250	2.0	50	5
S6HVM2.5	2.5	4.0	6.0	6.0	250	2.0	50	3
								@ 3A
S9HVM2.5	2.5	4.0	10.0	7.5	350	3.0	75	3

TECH BULLETIN H58



	PIV	Average Rectified Current (Amps)			Single Cycle Surge Current	Rev. Current @ PIV		Max. Forward Voltage	* Trr
Type No.	KV	Air	@ 55°C Oil	With Heat Sink	Amps @ 25°	µA @ 25°C	µA @ 100°C	Volts	n. sec
								@ 100mA	
SHVM15F	15	.350	.350	.350	6	1.0	25	30	250
SHVM12.5F	12.5	.350	.350	.350	6	1.0	25	25	250
SHVM10F	10	.350	.350	.350	6	1.0	25	20	250
SHVM7.5F	7.5	.350	.350	.350	6	1.0	25	15	250
SHVM5F	5	.350	.350	.350	6	1.0	25	10	250
SHVM2.5F	2.5	.350	.350	.350	6	1.0	25	5	250
								@ 1A	
S2HVM7.5F	7.5	0.8	2.0	1.5	25	1.0	25	18	250
S2HVM5F	5	1.2	2.0	2.0	25	1.0	25	12	250
S2HVM2.5F	2.5	2.0	2.0	2.0	25	1.0	25	6	250
								@ 3A	
S3HVM5F	5	1.2	3.0	2.5	125	1.0	25	12	250
S3HVM2.5F	2.5	2.4	3.0	3.0	125	1.0	25	6	250
								@ 3A	
S6HVM2.5F	2.5	2.4	6.0	5.0	200	2.0	50	12	250

*T_{rr} Rev. Recovery is measured on each junction prior to mfg. of ass'y.

TECH BULLETIN H58

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

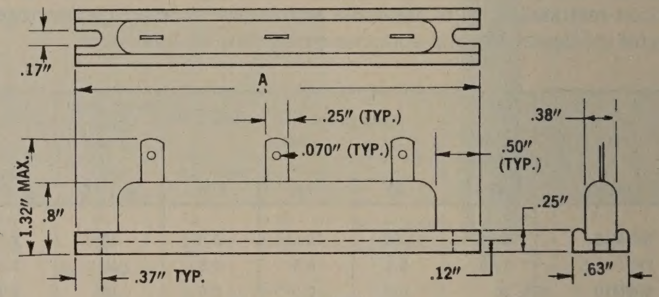
"KV-PAC" HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

New high voltage silicon rectifier assemblies in a rugged, functional design. "KV-PAC" has easy-to-use mounting slots and universal 3-way electrical connections. Designed to operate at 0.6 Amp when utilized as a half-wave rectifier and 1.2 Amps in a center-tap, doubler or bridge circuit application. Economical, for usage in commercial and industrial applications such as power supplies for the microwave ovens.

Type No.	Peak Inverse Voltage Per Leg	Avg. Rect. Curr. 55°C	Max. Forward Voltage @ 25 MA/Leg	One Cycle Surge Current	Reverse Current @ PIV	Case Length
	55°C	Mtg.	25°C	55°C	25°C	(A)
	Volts	Amps	Volts	Amps	μA	Inches
SDH10K	10KV	0.6	14	35	10	3.36
SDH15K	15KV	0.6	21	35	10	4.04
SDHC5K	5KV	1.2	7	35	10	3.36
SDHD5K	5KV	1.2	7	35	10	3.36
SDHC10K	10KV	1.2	14	35	10	4.72
SDHD10K	10KV	1.2	14	35	10	4.72
SDHC15K	15KV	1.2	21	35	10	6.09
SDHD15K	15KV	1.2	21	35	10	6.09

TECHNICAL BULLETIN MB27

On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.



Tolerance ±.030"

NOTE: UNITS SHOULD BE MOUNTED WITH SUITABLE GREASE.

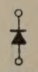
"KV-PAC" PLUS HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

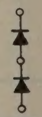
"KV-PAC" PLUS is designed to operate at 1.0 Amp when utilized as a half-wave rectifier and 2.0 Amps in a center-tap, doubler or bridge circuit application. Economical, for usage in commercial, industrial and military applications.

Type No.	Peak Inverse Voltage Per Leg	Average Rectified Current	Maximum Forward Voltage @ 500 MA/Leg	One Cycle Surge Current	Reverse Current @ PIV	Case Length
	55°C	55°C Mtg.	25°C	55°C	25°C	A
	Volts	Amps	Volts	Amps	μA	Inches
SDH5KM	5KV	1.0	7	50	1.0	3.36
SDH10KM	10KV	1.0	14	50	1.0	3.36
SDH15KM	15KV	1.0	20	50	1.0	4.04
SDHC5KM	5KV	2.0	7	50	1.0	4.72
SDHD5KM	5KV	2.0	7	50	1.0	4.72
SDHC10KM	10KV	2.0	14	50	1.0	4.72
SDHD10KM	10KV	2.0	14	50	1.0	4.72
SDHC15KM	15KV	2.0	20	50	1.0	6.09
SDHD15KM	15KV	2.0	20	50	1.0	6.09

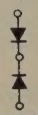
On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.

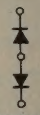
TECHNICAL BULLETIN MB34


SDH


SDHD

NOTE: SDH WITHOUT CENTER TERMINAL.


SDHC-P


SDHC-N

"KV-PAC" SR. HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

"KV-PAC" SR. is designed to operate at 2.5 Amp when utilized as a half-wave rectifier and 5 Amps in a center-tap, doubler or bridge circuit application. Economical, for usage in commercial, industrial and military applications.

Type No.	Peak Inverse Voltage Per Leg	Average Rectified Current	Maximum Forward Voltage @ 1 Amp/ Leg	One Cycle Surge Current	Reverse Current @ PIV	Case Length
	55°C	55°C Mtg.	25°C	55°C	25°C	A
	Volts	Amps	Volts	Amps	μA	Inches
SDH5KS	5KV	2.5	7	150	1.0	3.36
SDH10KS	10KV	2.5	14	150	1.0	4.04
SDHC5KS	5KV	5.0	7	150	1.0	4.72
SDHD5KS	5KV	5.0	7	150	1.0	4.72
SDHC10KS	10KV	5.0	14	150	1.0	6.09
SDHD10KS	10KV	5.0	14	150	1.0	6.09

On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.

TECHNICAL BULLETIN MB33

SEMTECH

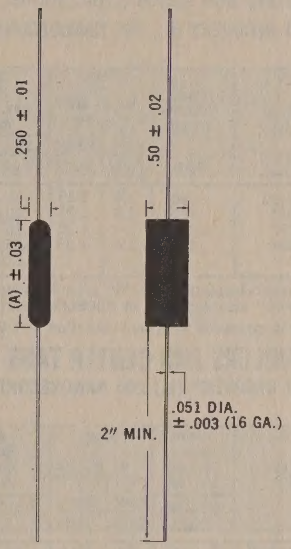
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"SLIMPAC" HIGH VOLTAGE-HIGH CURRENT SILICON RECTIFIERS

The Semtech's "Slimpac" is a new high density high voltage high current silicon rectifier for use in industrial and military applications which require small, lightweight rectifiers without compromise on the required high reliability criteria. Designed and tooled to be efficiently mass produced, "Slimpac" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits. Designed to be corona free, the unit is capable of meeting stringent electrical, mechanical, and environmental specifications.

Type No.	Peak Inverse Voltage	Average Rectified Current		One Cycle Surge Current		Reverse Current @ PIV		Max. Forward Voltage	Max. Case Size	Data Sheet No.
		55°C	100°C	25°C	100°C	25°C	100°C	25°C	(A)	
	Volts	Amps	Amps	Amps	Amps	μA	μA	500 MA	Inches	
SCH5000	5000	.5	.33	50	25	0.1	15	7	1.125	H46
SCH7500	7500	.5	.33	50	25	0.1	15	10	1.625	H46
SCH10000	10000	.5	.33	50	25	0.1	15	14	2.000	H46
SCH12500	12500	.5	.33	50	25	0.1	15	17	2.375	H46
SCH15000	15000	.5	.33	50	25	0.1	15	20	2.750	H46
SCH20000	20000	.5	.33	50	25	0.1	15	27	3.500	H46
SCH25000	25000	.5	.33	50	25	0.1	15	33	4.250	H46

H-46 & H-47 TYPES



MEDIUM RECOVERY **(t_{rr}) 1 MICROSECOND

SCHF5000	5000	.5	.33	50	25	0.1	15	7	1.125	H47
SCHF7500	7500	.5	.33	50	25	0.1	15	10	1.625	H47
SCHF10000	10000	.5	.33	50	25	0.1	15	14	2.000	H47
SCHF12500	12500	.5	.33	50	25	0.1	15	17	2.375	H47
SCHF15000	15000	.5	.33	50	25	0.1	15	20	2.750	H47
SCHF20000	20000	.5	.33	50	25	0.1	15	27	3.500	H47
SCHF25000	25000	.5	.33	50	25	0.1	15	33	4.250	H47

FAST RECOVERY **(t_{rr}) 150 NANOSECONDS

SCF2500	2500	.5	.33	25	12.5	0.1	15	6	1.125	H47
SCF5000	5000	.5	.33	25	12.5	0.1	15	12	2.000	H47
SCF7500	7500	.5	.33	25	12.5	0.1	15	18	2.750	H47
SCF10000	10000	.5	.33	25	12.5	0.1	15	24	3.500	H47
SCF12500	12500	.5	.33	25	12.5	0.1	15	30	4.250	H47

**T_{RR} Reverse Recovery is measured on each junction prior to manufacture of assembly.
0.5 Amp forward current to 1.0 Amp reverse current. Recovery time measured when rectifier recovers to .25 Amp.
Operating and storage ambient temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.

"SLIMPAC SR."

ALSO AVAILABLE IN FAST RECOVERY

Type No.	Peak Inverse Voltage	Average Rectified Current		One Cycle Surge Current		Reverse Current @ PIV		Max. Forward Voltage	Case Size	Data Sheet No.
		55°C	100°C	25°C	100°C	25°C	100°C	25°C	Inches	
	Volts	Amps	Amps	Amps	Amps	μA	μA	@ 1 Amp	A	
SCHS2500	2500	2	1.2	150	75	10	120	5	1.5	H48
SCHS5000	5000	2	1.2	150	75	10	120	10	2.5	H48
SCHS7500	7500	2	1.2	150	75	10	120	15	3.5	H48
SCHS10000	10000	2	1.2	150	75	10	120	20	4.5	H48
SCHS12500	12500	2	1.2	150	75	10	120	25	5.5	H48
SCHS15000	15000	2	1.2	150	75	10	120	30	6.5	H48

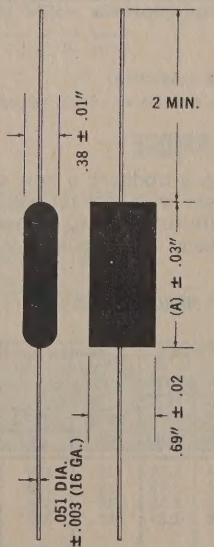
Operating and storage ambient temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.

"SLIMPAC JR."

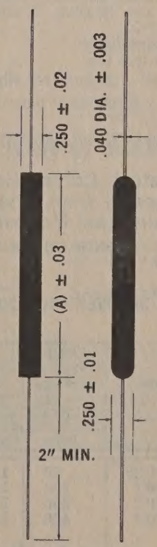
@ 50 MA

SCHJ15K	15000	.050	.030	4	2	0.1	25	20	1.5	H49
SCHJ22.5K	22500	.050	.030	4	2	0.1	25	30	2	H49
SCHJ30K	30000	.050	.030	4	2	0.1	25	40	2.5	H49
SCHJ37.5K	37500	.050	.030	4	2	0.1	25	50	3	H49
SCHJ45K	45000	.050	.030	4	2	0.1	25	60	3.5	H49

Operating and storage ambient temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.



H-48 TYPE



H-49 TYPE

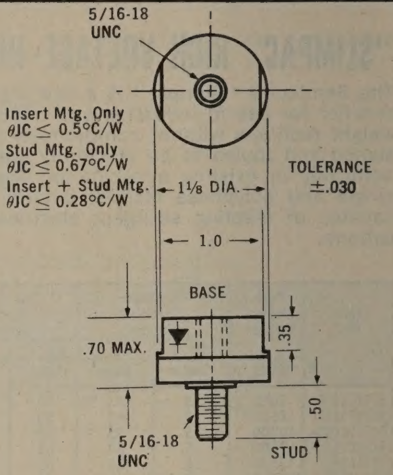
Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"CUPAC" 150 SILICON POWER RECTIFIERS

Semtech Corporation introduces "CuPac" 150, a new series of high current silicon rectifiers with fast recovery characteristics. OFHC** insert base and stud allow the internal Metoxilite rectifiers to be heat sunk from cathode, anode or both. The secondary epoxy case provides a long external leakage path necessary for P.I.V. to 600 volts.

This series has been specifically designed for high frequency, high power industrial, military and space applications.



FAST RECOVERY (t_{rr}) 200 NANOSECONDS

Type No.	Peak Inverse Voltage	Max. * V_F @ 100A T_J 25°C	Max. * V_F @ 100A T_J 100°C	Max. Static Rev. Current @ PIV 25°C	Max. Static Rev. Current @ PIV 100°C
	Volts	Volts	Volts	μA	MA
SCSF05	50	1.4	1.35	25	1
SCSF1	100	1.4	1.35	25	1
SCSF2	200	1.4	1.35	25	1
SCSF4	400	1.4	1.35	25	1

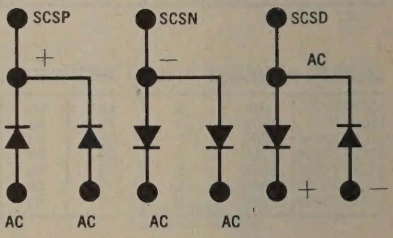
MEDIUM RECOVERY (t_{rr}) 2 MICROSECONDS

Type No.	Peak Inverse Voltage	Max. * V_F @ 100A T_J 25°C	Max. * V_F @ 100A T_J 100°C	Max. Static Rev. Current @ PIV 25°C	Max. Static Rev. Current @ PIV 100°C
	Volts	Volts	Volts	μA	MA
SCSM05	50	1.22	1.17	25	1
SCSM1	100	1.22	1.17	25	1
SCSM2	200	1.22	1.17	25	1
SCSM4	400	1.22	1.17	25	1
SCSM6	600	1.22	1.17	25	1

For reverse polarity, add "R" after Type No.
"CUPAC" also available in DOUBLERS and CENTER TAPS, 3-PHASE ½ WAVE BRIDGE

TECHNICAL BULLETIN R75

* V_F is measured at pulse I_F duration = 1.0 millisecond.



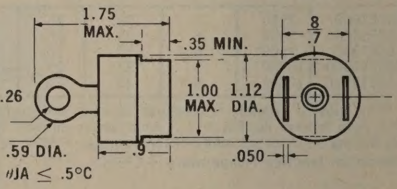
DOUBLERS AND CENTER TAPS

FAST RECOVERY (t_{rr}) 200 NANOSECONDS

Type No.	Peak Inverse Voltage Per Leg 55°C	Max. * V_F @ 50A T_J 25°C	Max. * V_F @ 50A T_J 100°C	Max. Reverse Current Per Leg 25°C	Max. Reverse Current Per Leg 100°C
	Volts	Volts	Volts	μA	μA
SCSDF05	50	1.4	1.35	13	500
SCSPF05	50	1.4	1.35	13	500
SCSNF05	50	1.4	1.35	13	500
SCSDF1	100	1.4	1.35	13	500
SCSPF1	100	1.4	1.35	13	500
SCSNF1	100	1.4	1.35	13	500
SCSDF2	200	1.4	1.35	13	500
SCSPF2	200	1.4	1.35	13	500
SCSNF2	200	1.4	1.35	13	500
SCSDF4	400	1.4	1.35	13	500
SCSPF4	400	1.4	1.35	13	500
SCSNF4	400	1.4	1.35	13	500

MEDIUM RECOVERY (t_{rr}) 2 MICROSECONDS

Type No.	Peak Inverse Voltage Per Leg 25°C	Max. * V_F @ 50A T_J 25°C	Max. * V_F @ 50A T_J 100°C	Max. Reverse Current Per Leg 25°C	Max. Reverse Current Per Leg 100°C
	Volts	Volts	Volts	μA	μA
SCSDM05	50	1.22	1.17	13	500
SCSPM05	50	1.22	1.17	13	500
SCSNM05	50	1.22	1.17	13	500
SCSDM1	100	1.22	1.17	13	500
SCSPM1	100	1.22	1.17	13	500
SCSNM1	100	1.22	1.17	13	500
SCSDM2	200	1.22	1.17	13	500
SCSPM2	200	1.22	1.17	13	500
SCSNM2	200	1.22	1.17	13	500
SCSDM4	400	1.22	1.17	13	500
SCSPM4	400	1.22	1.17	13	500
SCSNM4	400	1.22	1.17	13	500
SCSDM6	600	1.22	1.17	13	500
SCSPM6	600	1.22	1.17	13	500
SCSNM6	600	1.22	1.17	13	500



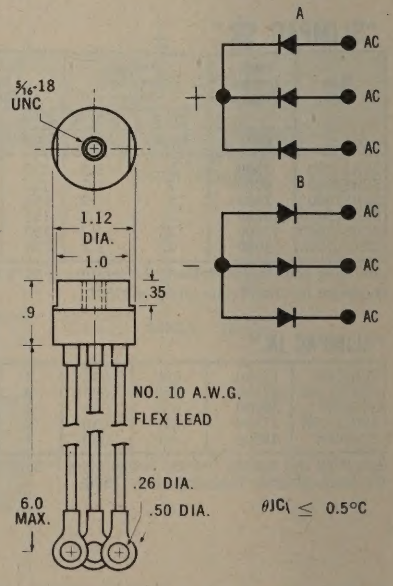
Maximum Operating & Storage Temperature —55°C to +150°C.
Mounting Torque
35-40 Inch Lbs.
**OFHC—Oxygen Free High Conductivity
* V_F is measured at pulse I_F duration = 1.0 millisecond.

TECHNICAL BULLETIN MB25

Standard part comes with No. 8 A.W.G. Flex Leads
Add letter W after Type No.
—Add Letter L after type number to specify lug type.
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp and performed on each diode prior to assembly.

3-PHASE ½ WAVE BRIDGE

Semtech Corporation introduces a new series of "CuPac" 150 high current silicon 3 phase ½ wave bridges with fast recovery characteristics. OFHC** insert base allows the internal Metoxilite rectifiers to be heat sunk. The secondary epoxy case provides a long external leakage path necessary for P.I.V. to 600 volts.



FAST RECOVERY (t_{rr}) 200 NANOSECONDS

Type No.	Peak Inverse Voltage Per Leg 25°C	Max. * V_F @ 33A T_J 25°C	Max. * V_F @ 33A T_J 100°C	Reverse Current Per Leg @ PIV 25°C	Reverse Current Per Leg @ PIV 100°C
	Volts	Volts	Volts	μA	μA
SCSHF05	50	1.4	1.35	10	350
SCSHF1	100	1.4	1.35	10	350
SCSHF2	200	1.4	1.35	10	350
SCSHF4	400	1.4	1.35	10	350

MEDIUM RECOVERY (t_{rr}) 2 MICROSECONDS

Type No.	Peak Inverse Voltage Per Leg 25°C	Max. * V_F @ 33A T_J 25°C	Max. * V_F @ 33A T_J 100°C	Reverse Current Per Leg @ PIV 25°C	Reverse Current Per Leg @ PIV 100°C
	Volts	Volts	Volts	μA	μA
SCSHM05	50	1.22	1.17	10	350
SCSHM1	100	1.22	1.17	10	350
SCSHM2	200	1.22	1.17	10	350
SCSHM4	400	1.22	1.17	10	350
SCSHM6	600	1.22	1.17	10	350

For Negative Polarity, Add "N" After Type No.

TECHNICAL BULLETIN MB26

Semtech reserves the right to change specifications without notice.

*V_F is measured at pulse I_F duration = 1.0 millisecond.

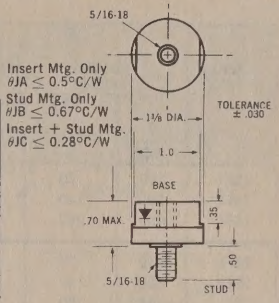
Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

CUPAC 150, LO-V FAST RECOVERY SILICON POWER RECTIFIERS

Semtech Corporation introduces "CuPac" 150, a new series of high current silicon rectifiers with fast recovery characteristics. OFHC† insert base and stud allow the internal Metoxilite rectifiers to be heat sunk from cathode, anode or both.

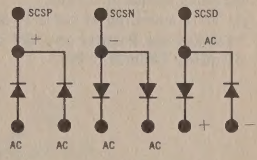
This series has been specifically designed for high frequency, high power industrial, military and space applications.



½ WAVE RECTIFIER

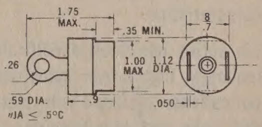
Type No. 1	PIV	IR @ PIV Per Leg		Reverse Recovery		* VF @ 20 Amps						* VF @ 60 Amps						* VF @ 100 Amps					
		25°C	100°C	Typ.	Max.	25°C		100°C		150°C		25°C		100°C		150°C		25°C		100°C		150°C	
	V	μA	MA	Nsec	Nsec	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.
SCSL03	30	25	1	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCCL05	50	25	1	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98

TECHNICAL BULLETIN MB31



DOUBLERS AND CENTER TAPS

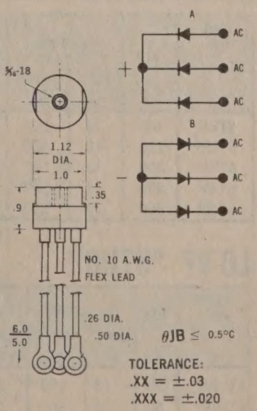
Type No. 2	PIV	IR @ PIV Per Leg		Reverse Recovery		* VF @ 10 Amps						* VF @ 30 Amps						* VF @ 50 Amps					
		25°C	100°C	Typ.	Max.	25°C		100°C		150°C		25°C		100°C		150°C		25°C		100°C		150°C	
	V	μA	μA	Nsec	Nsec	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.
SCSDL03	30	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSPL03	30	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSNL03	30	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSDL05	50	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSPL05	50	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSNL05	50	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98



TECHNICAL BULLETIN MB31

3-PHASE ½ WAVE BRIDGE

Type No. 3	PIV	IR @ PIV Per Leg		Reverse Recovery		* VF @ 5 Amps						* VF @ 15 Amps						* VF @ 25 Amps					
		25°C	100°C	Typ.	Max.	25°C		100°C		150°C		25°C		100°C		150°C		25°C		100°C		150°C	
	V	μA	μA	Nsec	Nsec	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.
SCSHL03	30	10	350	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
SCSHL05	50	10	350	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98



TOLERANCE:
.XX = ±.03
.XXX = ±.020

TECHNICAL BULLETIN MB31

Maximum Operating & Storage Temperature 150°C — Mounting Torque 35 - 40 Inch Lbs.

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.

Recovery time measured when rectifier recovers to .25 amp measured on individual rectifiers prior to assembly.

†OFHC — Oxygen Free High Conductivity

1 For Reverse Polarity, Add "R" After Type No.

2 STANDARD PART COMES WITH NO. 8 A.W.G. — FLEX LEADS, ADD LETTER W AFTER TYPE NO. — ADD LETTER L AFTER TYPE NUMBER TO SPECIFY LUG TYPE.

3 For Negative Polarity, Add "N" After Type No.

*VF is measured at pulse if duration = 1.0 millisecond.

Semtech reserves the right to change specifications without notice.

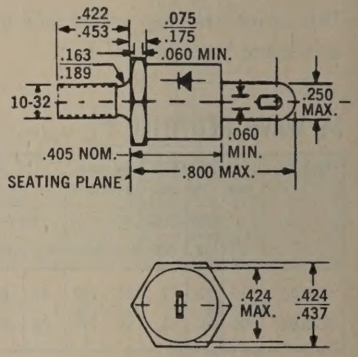
SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

FAST RECOVERY SILICON POWER RECTIFIERS

DO-4 "STUD" 150 NANOSECONDS REVERSE RECOVERY

A high efficiency fast recovery silicon power stud rectifier for high frequency applications. Ideally suited for designing high frequency switching regulators and power converters. The Fast stud rectifier is suitable for use in consumer, industrial, military and space programs.



Device Type*	Reverse Voltage		Forward Current	Reverse Current (Max.)		Instantaneous Forward Voltage (1)		1 Cycle Surge Current tp=8.3 ms	Reverse Recovery Time	Max. Thermal Imped.
			T_C=55°C	I_R		V_F @ 8 Adc			T_{rr}	
	V_R	V_{RM}(WKg)	I_O	UA dc				A (pk)	ns	θJC
	Vdc	V	A	25°C	100°C	25°C	100°C	I_F (Sureg)	Max.	°C/Watt
1SF1	100	70	8	1.0	20	1.40	1.35	125	150	6
1SF2	200	140	8	1.0	20	1.40	1.35	125	150	6
1SF4	400	280	8	1.0	20	1.40	1.35	125	150	6
						V_F @ 16 Adc				
2SF1	100	70	16	2.0	40	1.40	1.35	250	150	3
2SF2	200	140	16	2.0	40	1.40	1.35	250	150	3
2SF4	400	280	16	2.0	40	1.40	1.35	250	150	3

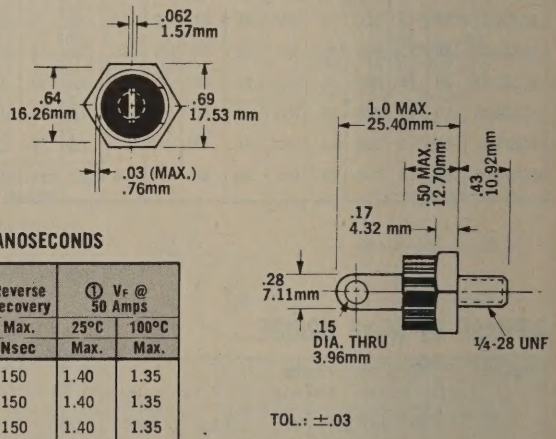
TECHNICAL BULLETIN MB51 REV A

Max. Operating and Storage Temperature −55°C to +150°C.
Mounting Torque 15-20 Lbs.
(1) V_F is measured at pulse I_F duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number.
Standard: Cathode to Base

DO-5 "STUD" SILICON POWER RECTIFIERS

Semtech Corporation introduces a new series of high current silicon stud rectifiers with fast recovery characteristics.

This series has been specifically designed for high frequency, high power industrial, military and space applications. Designed with Metoxilite rectifiers in a DO-5 base and easy-to-solder to terminal.



MEDIUM RECOVERY (t_{rr}) 2 MICROSECONDS

Type No. *	PIV	I_R @ PIV Per Leg		Reverse Recovery	① V_F @ 50 Amps	
		25°C	100°C	Max.	Max.	100°C
	V	μA	μA	μsec	25°C	Max.
ST1M	100	13	500	2.0	1.22	1.17
ST2M	200	13	500	2.0	1.22	1.17
ST3M	300	13	500	2.0	1.22	1.17
ST4M	400	13	500	2.0	1.22	1.17
ST6M	600	13	500	2.0	1.22	1.17

TECHNICAL BULLETIN MB45

FAST RECOVERY (t_{rr}) 150 NANOSECONDS

Type No. *	PIV	I_R @ PIV Per Leg		Reverse Recovery	① V_F @ 50 Amps	
		25°C	100°C	Max.	25°C	100°C
	V	μA	μA	Nsec	Max.	Max.
STF1	100	13	500	150	1.40	1.35
STF2	200	13	500	150	1.40	1.35
STF3	300	13	500	150	1.40	1.35
STF4	400	13	500	150	1.40	1.35

TECHNICAL BULLETIN MB45

LO-VF "STUD"

Type No.	PIV	I_R @ PIV		Reverse Recovery		① V_F @ 10 Amps						① V_F @ 30 Amps						① V_F @ 50 Amps					
		25°C	100°C	Typ	Max.	25°C		100°C		150°C		25°C		100°C		150°C		25°C		100°C		150°C	
	V	μA	μA	Nsec	Nsec	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.	Typ	Max.
STL03*	30	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98
STL05*	50	13	500	85	100	.86	.88	.77	.78	.72	.74	.95	.97	.88	.91	.85	.88	1.02	1.05	.97	1.00	.93	.98

TECH. BULL. MB32 (REV. A)

* For Reverse Polarity, Add "R" After Type No. Standard: Cathode to Base
Maximum Operating & Storage Temperature 150°C — Mounting Torque 35-40 Inch Lbs.
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time is measured when rectifier recovers to .25 amp.
T_{rr} Reverse Recovery is measured on each junction prior to manufacture of assembly.
Maximum thermal impedance junction to case 1.4°C/Watt.
① V_F is measured at pulse if duration = 1.0 millisecond.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

SUPER FAST RECOVERY SILICON POWER RECTIFIERS

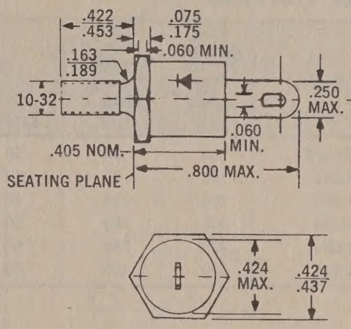
A high efficiency fast recovery silicon power stud rectifier for high frequency applications. Ideally suited for designing high frequency switching regulators and power converters. The Super-Fast stud rectifier is suitable for use in consumer, industrial, military and space programs.

DO-4 "STUD" 30 NANOSECONDS REVERSE RECOVERY

Device Type *	Reverse Voltage		Forward Current	Reverse Current (Max.)		Instantaneous Forward Voltage (1)		1 Cycle Surge Current tp= 8.3 ms	Reverse Recovery Time	Max. Thermal Imped.
				I_R		V_F @ 10 Adc				
	V_R	V_{RM} (WKg)	T_C=25°C I_O	UA dc				A(pk)	T_{rr} ns	θJC
	Vdc	V	A	25°C	100°C	25°C	100°C	I_F(Surge)	Max.	°C/ Watt
SFF05	50	35	12	10	500	1.1	.82	125	30	6
SFF10	100	70	12	10	500	1.1	.82	125	30	6
SFF15	150	105	12	10	500	1.1	.82	125	30	6
						V_F @ 20 Adc				
2SFF05	50	35	20	20	1000	1.2	1.0	250	30	3
2SFF10	100	70	20	20	1000	1.2	1.0	250	30	3
2SFF15	150	105	20	20	1000	1.2	1.0	250	30	3

TECHNICAL BULLETIN MB49 REV A

Max. Operating and Storage Temperature Range −55°C to +150°C.
Mounting Torque 15-20 Inch Lbs.
(1) V_F is measured at pulse I_F duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number.
Standard: Cathode to Base

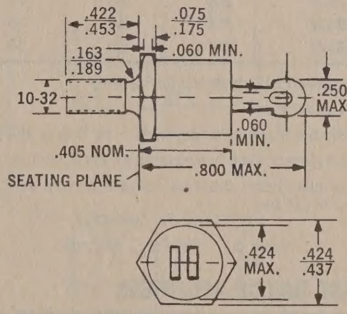

.422
.453
.075
.175
.163
.189
.060 MIN.
10-32
.250 MAX.
.060 MIN.
.405 NOM.
SEATING PLANE
.800 MAX.
.424 MAX.
.424
.437

DO-4T DOUBLERS AND CENTER TAPS
30 NANOSECONDS REVERSE RECOVERY

Device Type	Reverse Voltage		Forward Current	Reverse Current Max.-leg		Instantaneous Forward Voltage (1)		1 Cycle Surge Current tp=8.3 ms	Reverse Recovery Time
			T_C=25°C	I_R					T_{rr}
	V_R	V_{RM}(WKg)	I_O	UA dc		V_F @ 10 Amps		A(pk)	ns
	Vdc	V	A	25°C	100°C	25°C	100°C	I_F(Surge)	Max.
SNFF05	50	35	20	10	500	1.1	0.82	125	30
SNFF10	100	70	20	10	500	1.1	0.82	125	30
SNFF15	150	105	20	10	500	1.1	0.82	125	30
SPFF05	50	35	20	10	500	1.1	0.82	125	30
SPFF10	100	70	20	10	500	1.1	0.82	125	30
SPFF15	150	105	20	10	500	1.1	0.82	125	30
SDFF05	50	35	20	10	500	1.1	0.82	125	30
SNFF10	100	70	20	10	500	1.1	0.82	125	30
SDFF15	150	105	20	10	500	1.1	0.82	125	30

TECHNICAL BULLETIN MB50 REV A

Max. Operating and Storage Temperature Range −55°C to +150°C.
Mounting Torque 15-20 Inch Lbs.
Maximum thermal impedance junction to Case 3.0°C/W.
(1) V_F is measured at pulse I_F duration = 8 milliseconds max.


.422
.453
.075
.175
.163
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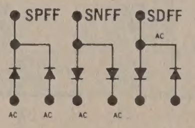
10-32
.250 MAX.
.060 MIN.
.405 NOM.
SEATING PLANE
.800 MAX.
.424 MAX.
.424
.437

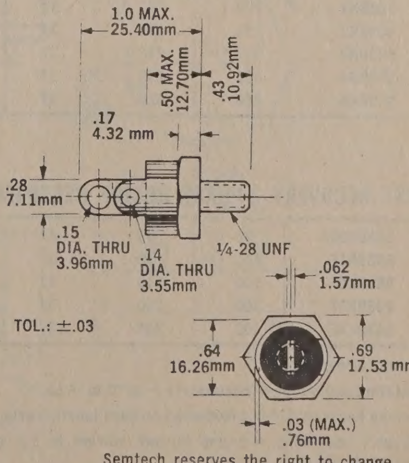

SPFF
SNFF
SDFF
AC
AC
AC
AC
AC

DO-5L "STUD" 40 NANOSECONDS REVERSE RECOVERY

Type No. *	PIV	I_R @ PIV		Max. V_F @ 10 Amps (1)			Max. V_F @ 30 Amps (1)			Max. V_F @ 50 Amps (1)			Reverse Recovery
	Volt	Milliamps		Volt			Volt			Volt			NSec
		25°C	100°C	25°C	100°C	150°C	25°C	100°C	150°C	25°C	100°C	150°C	Max.
STFF05	50	.1	3	.84	.70	.63	.96	.85	.78	1.05	.93	.90	40
STFF10	100	.1	3	.84	.70	.63	.96	.85	.78	1.05	.93	.90	40
STFF15	150	.1	3	.84	.70	.63	.96	.85	.78	1.05	.93	.90	40

TECHNICAL BULLETIN MB46 REV A

Maximum Operating and Storage Temperature 150°C.
Mounting Torque 35-40 Inch Lbs.
T_{rr} Reverse Recovery is measured on each junction prior to manufacture of assembly.
Maximum thermal impedance junction to Case 1.0°C/W.
(1) V_F is measured at pulse I_F duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number. Standard: Cathode to Base
Metric equivalents are given for general information only and are based up one inch = 25.4MM.

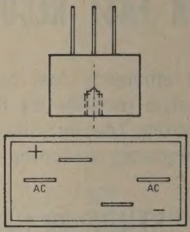

1.0 MAX.
25.40mm
.50 MAX.
12.70mm
.43
10.92mm
.17
4.32 mm
.28
7.11mm
.15
DIA. THRU
3.96mm
.14
DIA. THRU
3.55mm
¼-28 UNF
.062
1.57mm
TOL.: ±.03
.64
16.26mm
.69
17.53 mm
.03 (MAX.)
.76mm

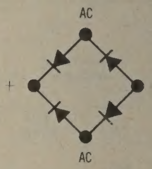
Semtech reserves the right to change specifications without notice.

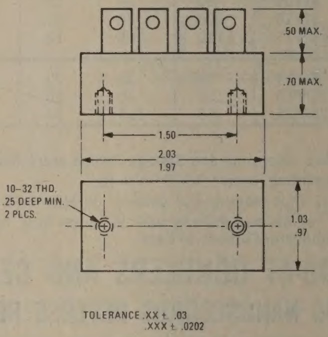
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"ALPAC® - R50" SILICON BRIDGE RECTIFIERS

"ALPAC-R50" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC-R50" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic. This construction firmly secures and insulates the internal components to temperatures above 300°C. "ALPAC-R50" is designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.







BRIDGE RECTIFIERS

Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Maximum Forward Voltage @ 10A/Leg	Reverse Current Per Leg @ PIV		One Cycle Surge Current
	Volts	Volts	Amps	Amps	Volts	µA	µA	Amps
	25°C	25°C	55°C*	100°C*	25°C	25°C	100°C	25°C
SCBK05	50	35	50	33	1.1	4	80	375
SCBK1	100	70	50	33	1.1	4	80	375
SCBK2	200	140	50	33	1.1	4	80	375
SCBK3	300	210	50	33	1.1	4	80	375
SCBK4	400	280	50	33	1.1	4	80	375
SCBK6	600	420	50	33	1.1	4	80	375

TECHNICAL BULLETIN MB39

FAST RECOVERY BRIDGE RECTIFIERS (t_{rr}) 250 NANOSECONDS

SCBK05F	50	35	50	33	1.2	4	80	375
SCBK1F	100	70	50	33	1.2	4	80	375
SCBK2F	200	140	50	33	1.2	4	80	375
SCBK3F	300	210	50	33	1.2	4	80	375
SCBK4F	400	280	50	33	1.2	4	80	375

Maximum Thermal Resistance 0.6°C/Watt.

TECHNICAL BULLETIN MB40

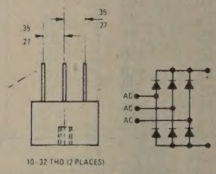
* Case Temperature.

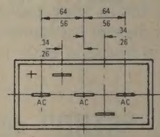
Operating and Storage Temperature −55°C to +150°C.

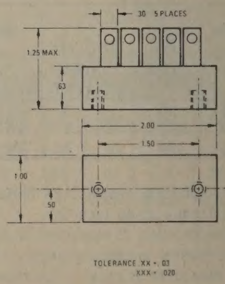
Reverse Recovery Time is measured on each junction prior to manufacture of assembly.

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.

3-PHASE BRIDGE RECTIFIERS







Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Maximum Forward Voltage @ 10A/Leg	Reverse Current Per Leg @ PIV		One Cycle Surge Current
	Volts	Volts	Amps	Amps	Volts	µA	µA	Amps
	25°C	25°C	55°C*	100°C*	25°C	25°C	100°C	25°C
SC3BK05	50	35	37	25	1.1	6	90	375
SC3BK1	100	70	37	25	1.1	6	90	375
SC3BK2	200	140	37	25	1.1	6	90	375
SC3BK3	300	210	37	25	1.1	6	90	375
SC3BK4	400	280	37	25	1.1	6	90	375
SC3BK6	600	420	37	25	1.1	6	90	375

TECHNICAL BULLETIN MB41

FAST RECOVERY 3-PHASE BRIDGE RECTIFIERS (t_{rr}) 200 NANOSECONDS

SC3BK05F	50	35	37	25	1.2	6	90	375
SC3BK1F	100	70	37	25	1.2	6	90	375
SC3BK2F	200	140	37	25	1.2	6	90	375
SC3BK3F	300	210	37	25	1.2	6	90	375
SC3BK4F	400	280	37	25	1.2	6	90	375

* Case Temperature.

TECHNICAL BULLETIN MB42

Operating and Storage Temperature −55°C to +150°C.

Reverse Recovery Time is measured on each junction prior to manufacture of assembly.

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.

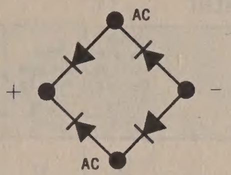
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"ALPAC-50" SILICON BRIDGE RECTIFIERS

Semtech Corporation introduces "ALPAC-50", a complete line of Single Phase, Silicon Bridge, Rectifier Circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation.

"ALPAC-50" terminals are insulated from case. Internally the device utilizes the Semtech high performance Metoxilite rectifiers. The bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.

Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Max. Forward Voltage @ 10A/Leg	Reverse Current Per Leg @ PIV		One Cycle Surge Current
*See Note	Volts	Volts	Amps		Volts	µA		Amps
	25°C	25°C	75°C†	100°C†	25°C	25°C	100°C	25°C

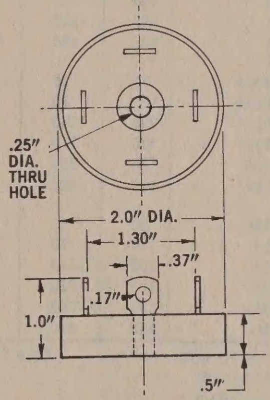


BRIDGE RECTIFIERS

SCBAR05	50	35	50	33	1.1	4	80	375
SCBAR1	100	70	50	33	1.1	4	80	375
SCBAR2	200	140	50	33	1.1	4	80	375
SCBAR3	300	210	50	33	1.1	4	80	375
SCBAR4	400	280	50	33	1.1	4	80	375
SCBAR6	600	420	50	33	1.1	4	80	375
SCBAR8	800	560	50	33	1.1	4	80	375
SCBAR10	1000	700	50	33	1.1	4	80	375

Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

TECHNICAL BULLETIN MB20



FAST RECOVERY BRIDGE RECTIFIERS (trr) 200 NANOSECONDS

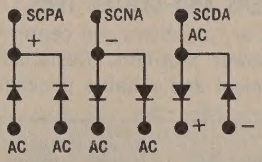
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp.

SCBAR05F	50	35	50	33	1.2	4	80	375
SCBAR1F	100	70	50	33	1.2	4	80	375
SCBAR2F	200	140	50	33	1.2	4	80	375
SCBAR3F	300	210	50	33	1.2	4	80	375
SCBAR4F	400	280	50	33	1.2	4	80	375

Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

TECHNICAL BULLETIN MB28

TERMINAL ORIENTATION

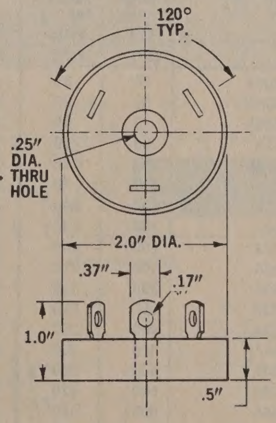


DOUBLERS AND CENTER TAPS

SCDAR05	50	35	25	16.5	1.1	4	80	375
SCDAR1	100	70	25	16.5	1.1	4	80	375
SCDAR2	200	140	25	16.5	1.1	4	80	375
SCDAR3	300	210	25	16.5	1.1	4	80	375
SCDAR4	400	280	25	16.5	1.1	4	80	375
SCDAR6	600	420	25	16.5	1.1	4	80	375
SCDAR8	800	560	25	16.5	1.1	4	80	375
SCDAR10	1000	700	25	16.5	1.1	4	80	375

TECHNICAL BULLETIN MB29

*NOTE: Part numbers noted are doublers. For center taps, substitute P for positive and N for negative in place of letter D.
Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature



FAST RECOVERY DOUBLERS AND CENTER TAPS (trr) 200 NANOSECONDS

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp.

SCDAR05F	50	35	25	16.5	1.2	4	80	375
SCDAR1F	100	70	25	16.5	1.2	4	80	375
SCDAR2F	200	140	25	16.5	1.2	4	80	375
SCDAR3F	300	210	25	16.5	1.2	4	80	375
SCDAR4F	400	280	25	16.5	1.2	4	80	375

TECHNICAL BULLETIN MB30

*NOTE: Part numbers noted are doublers. For center taps, substitute P for positive and N for negative in place of letter D.
Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

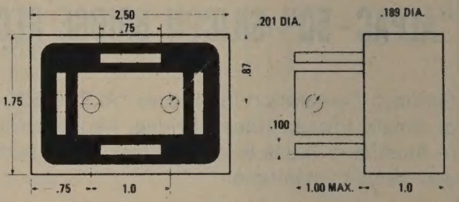
Semtech reserves the right to change specifications without notice.

SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

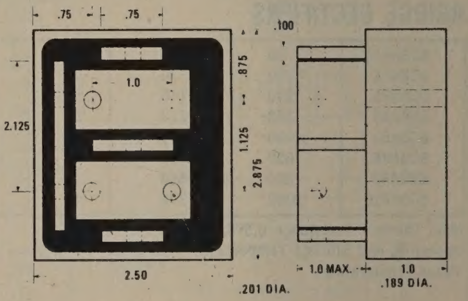
"ALPAC® SR." SILICON BRIDGE RECTIFIERS

Semtech offers a wide choice of high current silicon bridge rectifiers for military and industrial applications. Leading the "Alpac Sr." family of heavy-duty products, these bridge rectifiers incorporate high-performance, solid, double tungstaloid pin, silicon junctions, insulated terminals, and light weight, easy-to-mount aluminum cases. Aluminum cases also provide maximum thermal conductivity. "Alpac Sr." bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.



HIGH CURRENT

Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Reverse Current Per Leg @ PIV		One Cycle Surge	Data Sheet No.
	Volts	Volts	Amps	Amps	µA	µA	Amps	
	25°C	25°C	55°C†	100°C†	25°C	100°C	25°C	
1φFWB								
SCAS05A	50	35	150	80	20	300	750	MB5
SCAS1A	100	70	150	80	20	300	750	MB5
SCAS2A	200	140	150	80	20	300	750	MB5
SCAS3A	300	210	150	80	20	300	750	MB5
SCAS4A	400	280	150	80	20	300	750	MB5
SCAS6A	600	420	150	80	20	300	750	MB5
3φ½WBA								
SC3HAS05A*	50	35	250	130	10	150	750	MB5
SC3HAS1A*	100	70	250	130	10	150	750	MB5
SC3HAS2A*	200	140	250	130	10	150	750	MB5
SC3HAS3A*	300	210	250	130	10	150	750	MB5
SC3HAS4A*	400	280	250	130	10	150	750	MB5
SC3HAS6A*	600	420	250	130	10	150	750	MB5
3φFWB								
SC3AS05A	50	35	190	100	30	450	750	MB5
SC3AS1A	100	70	190	100	30	450	750	MB5
SC3AS2A	200	140	190	100	30	450	750	MB5
SC3AS3A	300	210	190	100	30	450	750	MB5
SC3AS4A	400	280	190	100	30	450	750	MB5
SC3AS6A	600	420	190	100	30	450	750	MB5

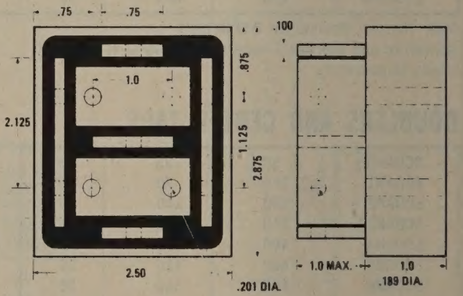


* Indicate polarity when ordering. † Case Temperature. **ALSO AVAILABLE IN FAST RECOVERY**

P — Positive Output.

N — Negative Output

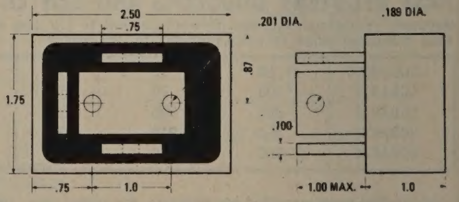
Operating and Storage Temperature −55°C to +150°C.



DOUBLERS AND CENTER TAPS

"Alpac Sr." doublers and center taps offer an integrated circuits approach to using high power rectifiers. Designed to replace stud rectifiers and provide simple, economical and reliable packaging.

Type No.	Peak Inverse Voltage Per Leg	RMS Voltage Per Leg	Average Rectified Current		Reverse Current Per Leg @ PIV		One Cycle Surge	Data Sheet No.
	Volts	Volts	Amps	Amps	µA	µA	Amps	
	25°C	25°C	55°C†	100°C†	25°C	100°C	25°C	
SCDAS05A	50	35	200	105	10	150	750	MB6
SCPAS05A	50	35	200	105	10	150	750	MB6
SCNAS05A	50	35	200	105	10	150	750	MB6
SCDAS1A	100	70	200	105	10	150	750	MB6
SCPAS1A	100	70	200	105	10	150	750	MB6
SCNAS1A	100	70	200	105	10	150	750	MB6
SCDAS2A	200	140	200	105	10	150	750	MB6
SCPAS2A	200	140	200	105	10	150	750	MB6
SCNAS2A	200	140	200	105	10	150	750	MB6
SCDAS3A	300	210	200	105	10	150	750	MB6
SCPAS3A	300	210	200	105	10	150	750	MB6
SCNAS3A	300	210	200	105	10	150	750	MB6
SCDAS4A	400	280	200	105	10	150	750	MB6
SCPAS4A	400	280	200	105	10	150	750	MB6
SCNAS4A	400	280	200	105	10	150	750	MB6
SCDAS6A	600	420	200	105	10	150	750	MB6
SCPAS6A	600	420	200	105	10	150	750	MB6
SCNAS6A	600	420	200	105	10	150	750	MB6



† Case Temperature **ALSO AVAILABLE IN FAST RECOVERY**

Operating and Storage Temperature −55°C to +150°C.

Maximum Thermal Impedance, junction to mounting surface, 0.2°C/watt.

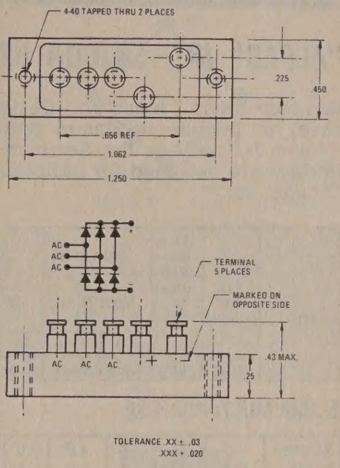
Semtech reserves the right to change specifications without notice.

SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"ALPAC® JR. - 3" 3 PHASE SILICON BRIDGE RECTIFIERS

"ALPAC JR. - 3" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC JR. - 3" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic. This construction firmly secures and insulates the internal components to temperatures above 300°C. "ALPAC JR. - 3" is designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.



Type	PIV Per Leg	Sine Wave RMS Input Volt. Max.	Average DC Output Amps TC = (case temp.)		Average DC Output Amps TA = Ambient Temp. (No Heat Sink)			Peak 1 Cycle Surge	Peak Recur-rent Surge	VF Max. Per Leg @ 1 ADC	Reverse Current (IR Max. @ PIV)	
			55°C	100°C	25°C	55°C	100°C			25°C	25°C	100°C
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	uA	uA
SC3BJ05	50	35	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75
SC3BJ1	100	70	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75
SC3BJ2	200	140	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75
SC3BJ3	300	210	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75
SC3BJ4	400	280	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75
SC3BJ6	600	420	5.5	4	2.0	1.5	1.05	50	15	1.2	3	75

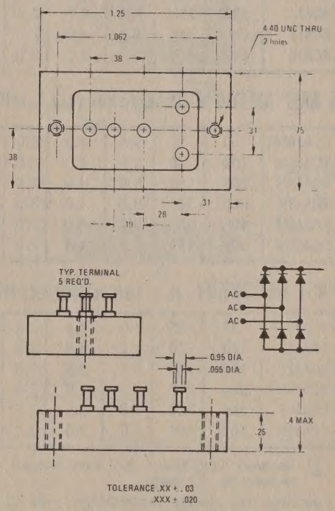
TECHNICAL BULLETIN MB35

FAST RECOVERY (t_{rr}) 150 NANOSECONDS, SC3BJ6F (T_{rr}) 250 NANOSECONDS

SC3BJ05F	50	35	5	3.5	1.5	1.05	.7	25	9	1.3	2	50
SC3BJ1F	100	70	5	3.5	1.5	1.05	.7	25	9	1.3	2	50
SC3BJ2F	200	140	5	3.5	1.5	1.05	.7	25	9	1.3	2	50
SC3BJ3F	300	210	5	3.5	1.5	1.05	.7	25	9	1.3	2	50
SC3BJ4F	400	280	5	3.5	1.5	1.05	.7	25	9	1.3	2	50
SC3BJ6F	600	420	5	3.5	1.5	1.05	.7	25	9	1.3	2	50

TECHNICAL BULLETIN MB36

"ALPAC® - 3T" 3 PHASE SILICON BRIDGE RECTIFIERS



Type	PIV Per Leg	Sine Wave RMS Input Volt. Max.	Average DC Output Amps TC = Case Temp.			Average DC Output Amps TA = Ambient Temp. (No Heat Sink)			Peak 1 Cycle Forward Surge	Peak Recurrent Forward Surge	VF Max. Per Leg @ 3 ADC	Reverse Current (IR Max. Per Leg @ PIV)	
			55°C	100°C	125°C	25°C	55°C	100°C			25°C	25°C	100°C
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA
SC3BH05	50	35	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100
SC3BH1	100	70	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100
SC3BH2	200	140	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100
SC3BH3	300	210	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100
SC3BH4	400	280	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100
SC3BH6	600	420	11	8	5.5	4.0	3.0	1.7	125	60	1.0	5	100

TECHNICAL BULLETIN MB37

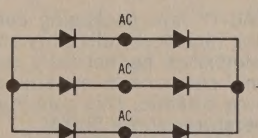
FAST RECOVERY (t_{rr}) 250 NANOSECONDS

SC3BH05F	50	35	9.5	7	5.0	3.0	2.2	1.2	125	50	1.1	5	100
SC3BH1F	100	70	9.5	7	5.0	3.0	2.2	1.2	125	50	1.1	5	100
SC3BH2F	200	140	9.5	7	5.0	3.0	2.2	1.2	125	50	1.1	5	100
SC3BH3F	300	210	9.5	7	5.0	3.0	2.2	1.2	125	50	1.1	5	100
SC3BH4F	400	280	9.5	7	5.0	3.0	2.2	1.2	125	50	1.1	5	100

Reverse Recovery Time is measured on each junction prior to manufacture of assembly. TECHNICAL BULLETIN MB38

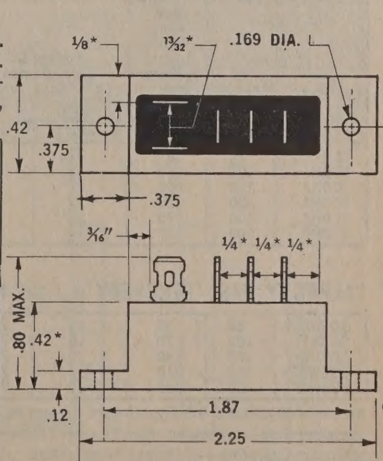
1 Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.

Maximum Operating and Storage Temperature —55°C to +150°C.



"ALPAC® - 3" 3 PHASE SILICON BRIDGE RECTIFIERS

"Alpac-3," 3-phase silicon bridge rectifiers incorporates much of the original "Alpac"... aluminum case for maximum thermal conductivity, light weight, and simple installation. Internally, "Alpac-3" utilizes the Semtech high-performance silicon junctions bonded between solid double tungstaloid pins. "Alpac-3" is well suited for utilization in power supplies, AC to DC converters and motor control circuits.



*Nominal tolerance ±.030

Type	PIV per leg	Sine Wave RMS input Volt. Max.	Average DC Output Amps TC=(case temp.) (°C)			Average DC Output Amps TA=(Amb. Temp.) (No heat Sink) (°C)			Peak 1 Cycle For-ward Surge	Peak Recur-rent For-ward Surge	VF Max. per leg @ 3ADC	Reverse Current (IR Max. @ PIV)		Data Sheet No.
			55	100	125	25	55	100			25°C	25°C	100°C	
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA	
SC3BA05	50	35	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7
SC3BA1	100	70	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7
SC3BA2	200	140	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7
SC3BA3	300	210	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7
SC3BA4	400	280	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7
SC3BA6	600	420	16.5	12	8.5	6.0	5.0	3.0	150	75	1.0	5	100	MB7

Operating and Storage temperature, —55°C to +150°C.

Maximum thermal impedance junction to mounting surface 2.5°C/WATT

Semtech reserves the right to change specifications without notice.

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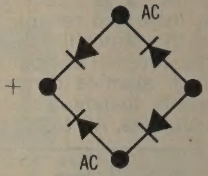
"ALPAC® JR." SILICON BRIDGE RECTIFIERS

Semtech offers "Alpac Jr." Designed in aluminum cases (turret terminals, insulated from case) to provide maximum thermal conductivity and simple installation. Internally the "Alpac Jr." utilizes the Semtech high performance solid double heat sink junctions. The bridges are designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.

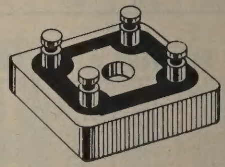


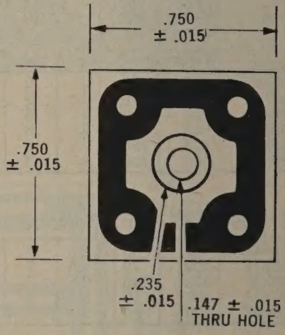
Type	PIV per leg	Sine Wave RMS input Volt. Max.	Average DC Output Amps TC= (case temp.) (°C)		Average DC Output Amps TA=Amb. Temp. (No seat Sink) (°C)			Peak 1 Cycle For-ward Surge	Peak DC Out-put (1 sec. max.)	Peak Re-cur-rent Surge	VF Max. per leg. @ 1ADC	Reverse Current (1R Max. @PIV)		Re-cov-ery Time ①	Data Sheet No.
			55	100	25	55	100		55°C		25°C	25°C	100°C	trr	
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA	µ sec.	
5 AMP MULTI-PURPOSE															
SCAJ05	50	35	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
SCAJ1	100	70	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
SCAJ2	200	140	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
SCAJ3	300	210	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
SCAJ4	400	280	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
SCAJ6	600	420	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50		MB12
5 AMP MEDIUM RECOVERY (t_{rr}) 1 MICROSECOND															
SCAJ05M	50	35	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
SCAJ1M	100	70	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
SCAJ2M	200	140	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
SCAJ3M	300	210	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
SCAJ4M	400	280	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
SCAJ6M	600	420	5.5	4.0	2.0	1.5	1.05	50	10	15	1.2	2	50	1	MB13
FAST RECOVERY (t_{rr}) 150 NANOSECONDS (EXCEPT SCAJ6F)															
SCAJ05F	50	35	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.150	MB14
SCAJ1F	100	70	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.150	MB14
SCAJ2F	200	140	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.150	MB14
SCAJ3F	300	210	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.150	MB14
SCAJ4F	400	280	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.150	MB14
SCAJ6F	600	420	5.0	3.5	1.5	1.05	.7	25		9	1.3	2	50	.250	MB14

① Recovery Conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 Amps.

Operating and Storage Temperature, —55°C to +150°.

Maximum THERMAL IMPEDANCE junction to mounting surface 5°C/Watt.





"ALPAC-T"® SILICON BRIDGE RECTIFIERS

"ALPAC-T" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC-T" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic. This construction firmly secures and insulates the internal components to temperatures above 300°C.

Type	PIV Per Leg	Sine Wave RMS Input Voltage Max.	Average DC Output Amps TC = Case Temp.		Average DC Output Amps TA = Ambient Temp. (No Heat Sink)			Peak 1 Cycle Forward Surge	Peak Recurrent Forward Surge	VF Max. Per Leg @ 3ADC	Reverse Current (IR Max. Per Leg @ PIV)	
			55°C	100°	25°C	55°C	100°			25°C	25°C	100°C
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA
SCBH05	50	35	12	9	4.0	3.0	1.7	125	60	1.0	2	50
SCBH1	100	70	12	9	4.0	3.0	1.7	125	60	1.0	2	50
SCBH2	200	140	12	9	4.0	3.0	1.7	125	60	1.0	2	50
SCBH3	300	210	12	9	4.0	3.0	1.7	125	60	1.0	2	50
SCBH4	400	280	12	9	4.0	3.0	1.7	125	60	1.0	2	50
SCBH6	600	420	12	9	4.0	3.0	1.7	125	60	1.0	2	50

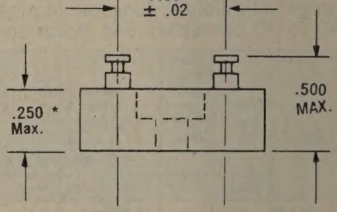
TECHNICAL BULLETIN MB-43

"ALPAC-T" FAST RECOVERY (t_{rr}) 250 NANOSECONDS

SCBH05F	50	35	10	7.5	4.0	3.0	1.7	125	60	1.1	2	50
SCBH1F	100	70	10	7.5	4.0	3.0	1.7	125	60	1.1	2	50
SCBH2F	200	140	10	7.5	4.0	3.0	1.7	125	60	1.1	2	50
SCBH3F	300	210	10	7.5	4.0	3.0	1.7	125	60	1.1	2	50
SCBH4F	400	280	10	7.5	4.0	3.0	1.7	125	60	1.1	2	50

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time is measured when rectifier recovers to .25 amp.
Maximum Operating and Storage Temperature —55°C to +150°C.

TECHNICAL BULLETIN MB-44



* SCAJ ONLY
SCBH .300 MAX.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"ALPAC"® SILICON BRIDGE RECTIFIERS

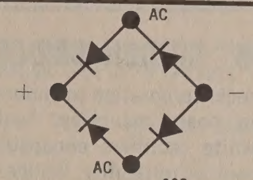
Semtech Corporation introduces "ALPAC" a complete line of Single Phase Silicon Bridge Rectifier circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation. "ALPAC" universal terminals, insulated from case, provide a 3 way electrical connection: fast disconnect, wire wrap around and hole wire insert for soldering.

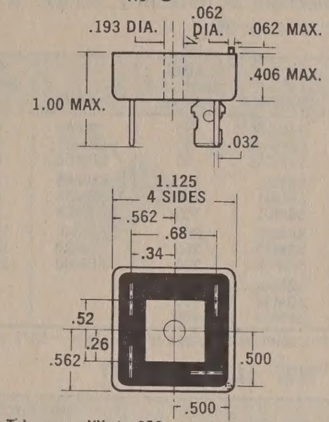
Internally the device utilizes the Semtech high performance solid double heat sink junctions designed for mechanical strength and eliminating the use of solders for improved reliability. The bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.

Type No.	PIV Per Leg	Sine Wave RMS Input Voltage Max.	Average DC Output Amps TC=Case Temp. (°C)			Average DC Output/Leg TA=Ambinet Temp. (No Heat Sink) (°C)			Peak 1 Cycle Fwd. Surge	Peak Recur-rent Fwd.	VF Max. Per Leg @ 3A DC	Reverse Current (IR Max. @ PIV) (°C)		Data Sheet No.
			55	100	125	25	55	100			25°C	25	100	
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA	
SCBA05	50	35	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3
SCBA1	100	70	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3
SCBA2	200	140	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3
SCBA3	300	210	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3
SCBA4	400	280	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3
SCBA6	600	420	17.5	12.5	9.0	6.0	5.0	3.0	150	75	1.0	5	100	MB3

Maximum thermal impedance junction to mounting surface 2.0°C/Watt.
Maximum operating and storage temperature —55°C to +150°C.

ALSO AVAILABLE IN FAST RECOVERY
TECH BULLETIN MB15





Tolerance .XX ± .030
.XXX ± .020

"ALPAC" DOUBLERS AND CENTER TAPS

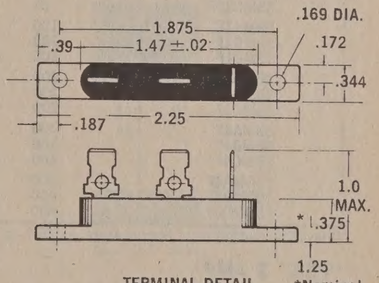
AVAILABLE IN FAST RECOVERY
TECH BULLETIN MB17 & 18

Semtech Corporation introduces "Alpac," a series of Doublers and Center taps, Rectifier circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation. "Alpac" terminals are insulated from case. The Universal Terminals provide a 3 way electrical connection: fast disconnect, wire wrap around and hole wire insert for soldering. Internally the device utilizes the Semtech high performance solid double heat sink junctions.

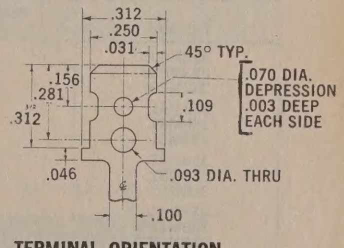
The devices are designed to replace stud rectifiers and provide simple, economical and reliable packaging.

Type No.	PIV Per Leg DC or Recur-rent	Sine Wave RMS Input Voltage Max.	Average DC Output/Leg TC=Case Temp. (°C)			Average DC Output/Leg TA=Ambient Temp. (No Heat Sink) (°C)			Peak 1 Cycle Fwd. Surge	Peak Recur-rent Fwd.	VF Max. Per Leg @ 3A DC	IR Max. Per Leg @ PIV (°C)		Data Sheet No.
			55	100	125	25	55	100			25°C	25	100	
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Volts	µA	µA	
SCDA05	50	35	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA05	50	35	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA05	50	35	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCDA1	100	70	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA1	100	70	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA1	100	70	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCDA2	200	140	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA2	200	140	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA2	200	140	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCDA3	300	210	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA3	300	210	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA3	300	210	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCDA4	400	280	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA4	400	280	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA4	400	280	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCDA6	600	420	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCPA6	600	420	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4
SCNA6	600	420	8.5	6	4.5	3	2.75	2	150	75	1.0	5	100	MB4

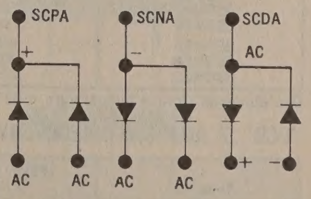
Maximum thermal impedance junction to mounting surface 5.0°C/Watt.
Maximum operating and storage temperature —55°C to +150°C. Semtech reserves the right to change specifications without notice

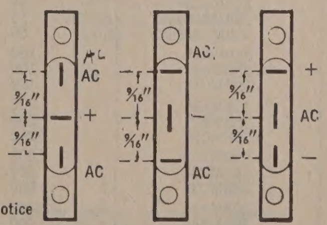


TERMINAL DETAIL *Nominal



TERMINAL ORIENTATION





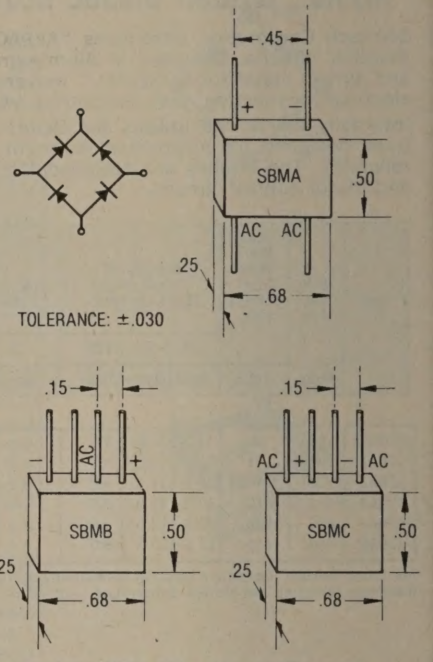
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

"PCB" SILICON BRIDGE RECTIFIERS

Semtech Corporation introduces a new series of silicon rectifier bridges designed for circuit board mounting. Features include an all-welded internal assembly with Metoxilite rectifiers encapsulated to provide dependable electrical, thermal and mechanical reliability. Bridges are designed for commercial, industrial and military applications.

Type No.	Peak Inverse Voltage	Type No.	Peak Inverse Voltage	SPECIFICATIONS	
SBMA05 SBMB05 SBMC05	50 50 50	SBMA6 SBMB6 SBMC6	600 600 600	AVERAGE RECTIFIED CURRENT @ 25°C @ 100°C	1.5 AMPS 1 AMP
SBMA1 SBMB1 SBMC1	100 100 100	SBMA8 SBMB8 SBMC8	800 800 800	MAXIMUM REVERSE CURRENT @ PIV @ 25°C @ 100°C	2 μA 50 μA
SBMA2 SBMB2 SBMC2	200 200 200	SBMA0 SBMB0 SBMC0	1000 1000 1000	MAXIMUM FORWARD VOLTS/LEG @ 1A DC, 25°C RECURRENT SURGE @ 25°C	1.2 VOLTS 10 AMPS
SBMA4 SBMB4 SBMC4	400 400 400			SINGLE SURGE @ 25°C	50 AMPS

Operating and storage temperature —55°C to +150°C



TOLERANCE: ±.030

LEADS: DIAMETER .031 ±.002, LENGTH 1.0 MIN.

"PCB" FAST RECOVERY

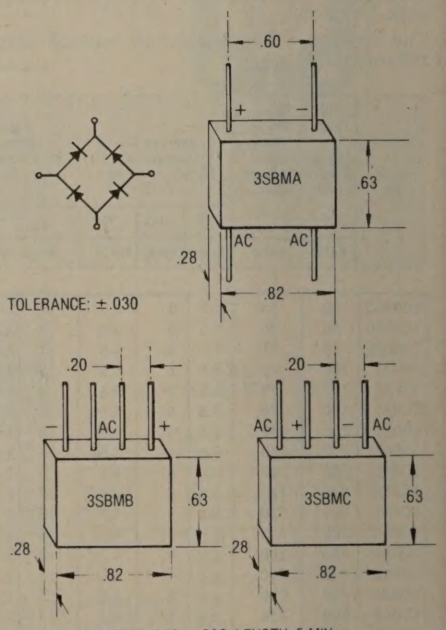
Type No.	Peak Inverse Voltage	SPECIFICATIONS	
SBMA05F SBMB05F SBMC05F	50 50 50	REVERSE RECOVERY (trr)	150 NSEC *250 NSEC
SBMA1F SBMB1F SBMC1F	100 100 100	AVERAGE RECTIFIED CURRENT @ 25°C @ 100°C	1.5 AMPS 1 AMP
SBMA2F SBMB2F SBMC2F	200 200 200	MAXIMUM REVERSE CURRENT @ PIV @ 25°C @ 100°C	2 μA 50 μA
SBMA4F SBMB4F SBMC4F	400 400 400	MAXIMUM FORWARD VOLTS/LEG @ 1A DC, 25°C RECURRENT SURGE @ 25°C	1.2 VOLTS 10 AMPS
*SBMA6F *SBMB6F *SBMC6F	600 600 600	SINGLE SURGE @ 25°C	25 AMPS

Operating and storage temperature —55°C to +150°C

"PCB" 3 AMP

Type No.	Peak Inverse Voltage	SPECIFICATIONS	
3SBMA05 3SBMB05 3SBMC05	50 50 50	AVERAGE RECTIFIED CURRENT @ 25°C @ 100°C	3 AMPS 1.5 AMPS
3SBMA1 3SBMB1 3SBMC1	100 100 100	MAXIMUM REVERSE CURRENT @ PIV @ 25°C @ 100°C	10 μA 100 μA
3SBMA2 3SBMB2 3SBMC2	200 200 200	MAXIMUM FORWARD VOLTS/LEG @ 3A DC, 25°C 800 VOLT DEVICES @ 3A DC, 25°C	1.0 VOLTS 1.1 VOLTS
3SBMA4 3SBMB4 3SBMC4	400 400 400	RECURRENT SURGE @ 25°C SINGLE SURGE @ 25°C	25 AMPS 150 AMPS
3SBMA6 3SBMB6 3SBMC6	600 600 600		
3SBMA8 3SBMB8 3SBMC8	800 800 800		

Operating and storage temperature —55°C to +150°C



TOLERANCE: ±.030

LEADS: DIAMETER .040 ±.002, LENGTH .5 MIN.

"PCB" 3 AMP FAST RECOVERY

Type No.	Peak Inverse Voltage	SPECIFICATIONS	
3SBMA05F 3SBMB05F 3SBMC05F	50 50 50	REVERSE RECOVERY (trr) AVERAGE RECTIFIED CURRENT @ 25°C	150 NSEC 3 AMPS
3SBMA1F 3SBMB1F 3SBMC1F	100 100 100	@ 100°C MAXIMUM REVERSE CURRENT @ PIV @ 25°C	1.5 AMPS 10 μA
3SBMA2F 3SBMB2F 3SBMC2F	200 200 200	@ 100°C MAXIMUM FORWARD VOLTS/LEG @ 3A DC, 25°C	100 μA 1.1 VOLTS
3SBMA3F 3SBMB3F 3SBMC3F	300 300 300	RECURRENT SURGE @ 25°C SINGLE SURGE @ 25°C	25 AMPS 150 AMPS
3SBMA4F 3SBMB4F 3SBMC4F	400 400 400		

Operating and storage temperature —55°C to +150°C

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

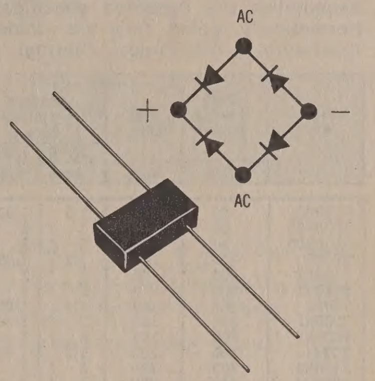
"COMPAC" BRIDGE RECTIFIERS

MULTI-PURPOSE

SOLID SILVER LEADS: DIAMETER .029 ±.002"; LENGTH 7/8" MINIMUM
OPERATING AND STORAGE TEMPERATURE −55°C TO +150°C

Sub-miniature, rugged, highly-reliable and economical, are the only adjectives necessary to describe Semtech's "Compac" silicon bridge rectifiers. Incorporating Semtech's Suprataxial silicon junctions, solid silver leads and high-temperature molding compounds, the units provide maximum mechanical, thermal and electrical reliability. These silicon bridge rectifiers will meet stringent requirements of military, industrial and consumer products applications.

SINGLE PHASE FULL WAVE BRIDGE



Type No.	Peak Inverse Voltage	Average Rectified Current		Max. Reverse Current @ PIV		Max. Fwd. Volts/Leg @ 1A DC (**100 mA DC)	Recurrent Surge	Data Sheet No.
		55°C	100°C	25°C	100°C	25°C	25°C	
	Volts	Amps	Amps	µA	µA	Volts	Amps	
SBR05	50	1.5	1.00	2	40	1.2	10	MB8
SBR1	100	1.5	1.00	2	40	1.2	10	MB8
SBR2	200	1.5	1.00	2	40	1.2	10	MB8
SBR4	400	1.5	1.00	2	40	1.2	10	MB8
SBR6	600	1.5	1.00	2	40	1.2	10	MB8
SBR8	800	1.5	1.00	2	40	1.2	10	MB8
SBR10	1000	1.5	1.00	2	40	1.2	10	MB8
SBR15	1500	.36	.24	2	40	**3.5	2.5	MB8
SBR20	2000	.36	.24	2	40	**3.5	2.5	MB8
SBR25	2500	.36	.24	2	40	**3.5	2.5	MB8
SBR30	3000	.36	.24	2	40	**3.5	2.5	MB8

MEDIUM RECOVERY

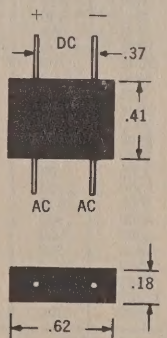
Type No.	Peak Inverse Voltage	Average Rectified Current		Max. Reverse Current @ PIV		Max. Fwd. Volts/Leg @ 1A DC	Recurrent Surge	*Reverse Recovery	Data Sheet No.
		55°C	100°C	25°C	100°C	25°C	25°C	t_{rr}	
	Volts	Amps	Amps	µA	µA	Volts	Amps	µ sec	
SBR05M	50	1.5	1.00	2	40	1.2	10	1	MB9
SBR1M	100	1.5	1.00	2	40	1.2	10	1	MB9
SBR2M	200	1.5	1.00	2	40	1.2	10	1	MB9
SBR4M	400	1.5	1.00	2	40	1.2	10	1	MB9
SBR6M	600	1.5	1.00	2	40	1.2	10	1	MB9
SBR8M	800	1.5	1.00	2	40	1.2	10	1	MB9
SBR10M	1000	1.5	1.00	2	40	1.2	10	1	MB9

FAST RECOVERY

SBR05F	50	1.0	0.65	2	40	1.3	6	.150	MB9
SBR1F	100	1.0	0.65	2	40	1.3	6	.150	MB9
SBR2F	200	1.0	0.65	2	40	1.3	6	.150	MB9
SBR4F	400	1.0	0.65	2	40	1.3	6	.150	MB9
SBR6F	600	1.0	0.65	2	40	1.3	6	.250	MB9
SBR8F	800	1.0	0.65	2	40	1.3	6	.300	MB9
SBR10F	1000	1.0	0.65	2	40	1.3	6	.500	MB9

Reverse Recovery time is measured on each junction prior to manufacture of assembly.

*Recovery Conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 Amps.

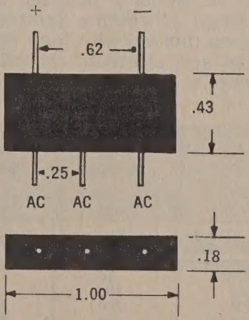


Tolerance ±.030

Lead Spacing Measured
Center to Center

"COMPAC-3" SILICON 3 PHASE

Semtech now offers a line of "Compac" sub-miniature medium power, 3-phase full wave bridge rectifiers. These units utilize Semtech's unique Suprataxial silicon junctions. Sub-miniature size makes these bridge rectifiers easy to package. Use of high temperature compounds provides excellent mechanical, thermal and electrical reliability. These silicon bridge rectifiers easily satisfy the stringent requirements of military and industrial as well as consumer applications.



Tolerance ±.03
Lead Spacing Measured
Center to Center

Type No.	Peak Inverse Voltage	Average Rectified Current		Max. Reverse Current @ PIV		Max. Fwd. Volts/Leg @ 1A DC (**100 mA DC)	Recurrent Surge	Data Sheet No.
		55°C	100°C	25°C	100°C	25°C	25°C	
	Volts	Amps	Amps	µA	µA	Volts	Amps	
S3BR05	50	2.0	1.2	3	60	1.2	10	MB11
S3BR1	100	2.0	1.2	3	60	1.2	10	MB11
S3BR2	200	2.0	1.2	3	60	1.2	10	MB11
S3BR4	400	2.0	1.2	3	60	1.2	10	MB11
S3BR6	600	2.0	1.2	3	60	1.2	10	MB11
S3BR8	800	2.0	1.2	3	60	1.2	10	MB11
S3BR10	1000	2.0	1.2	3	60	1.2	10	MB11
S3BR15	1500	0.5	0.3	3	60	**3.5	2.5	MB11
S3BR20	2000	0.5	0.3	3	60	**3.5	2.5	MB11
S3BR25	2500	0.5	0.3	3	60	**3.5	2.5	MB11
S3BR30	3000	0.5	0.3	3	60	**3.5	2.5	MB11

Can also be obtained with "Medium" and "Fast" reverse recovery characteristics up to 1000 volts. Add Suffix "M" or "F".

Semtech reserves the right to change specifications without notice.

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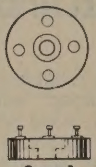
SILICON BRIDGE RECTIFIERS

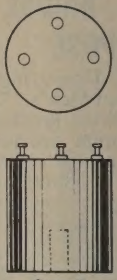
MULTI-PURPOSE OPERATING AND STORAGE TEMPERATURE —55°C TO +150°C

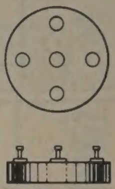
Semtech Corporation's complete line of Single Phase Full Wave Bridge Rectifier Assemblies are designed specifically for ease of mounting and assembly. These hermetically sealed units are molded with high temperature compounds to give the maximum in mechanical, thermal, and electrical reliability.

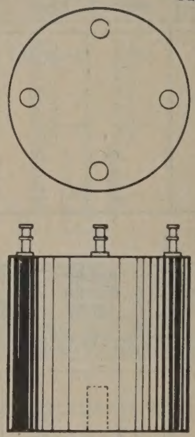
Type No.	Peak Inverse Voltage	RMS Voltage	Average Rectified Current		Recurrent Surge Current	Dimensions In Inches		Mounting Hole **Tap	Case	Data Sheet No.
			25°C	100°C	25°C			Dia.		
	Volts	Volts	Amps	Amps	Amps	Dia.	Length	Inches		
SCBR05	50	38	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR05	50	38	3 *	2 *	30	1.125	.25	.169	C	B41
5SCBR05	50	38	5 *	3 *	30	1.125	.25	.169	C	B41
SCBR1	100	70	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR1	100	70	3 *	2 *	30	1.125	.25	.169	C	B41
5SCBR1	100	70	5 *	3 *	30	1.125	.25	.169	C	B41
SCBR2	200	140	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR2	200	140	3 *	2 *	30	1.125	.25	.169	C	B41
5SCBR2	200	140	5 *	3 *	30	1.125	.25	.169	C	B41
SCBR4	400	280	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR4	400	280	3 *	2 *	30	1.125	.25	.169	C	B41
5SCBR4	400	280	5 *	3 *	30	1.125	.25	.169	C	B41
SCBR6	600	420	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR6	600	420	3 *	2 *	30	1.125	.25	.169	C	B41
5SCBR6	600	420	5 *	3 *	30	1.125	.25	.169	C	B41
SCBR8	800	560	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR8	800	560	3 *	2 *	30	1.125	.25	.169	C	B41
SCBR10	1000	700	1.5	1.05	10	.875	.25	.144	A	B41
3SCBR10	1000	700	3 *	2 *	30	1.125	.25	.169	C	B41
SCBR15	1500	1050	1.0 *	.70*	10	1.125	1.25	**10-32 x ½	B	B41
SCBR15A	1500	1050	.5	.35	2.5	1.125	.25	.169	C	B41
SCBR20	2000	1400	1.0 *	.70*	10	1.125	1.25	**10-32 x ½	B	B41
SCBR20A	2000	1400	.5	.35	2.5	1.125	.25	.169	C	B41
SCBR25	2500	1750	1.0 *	.70*	10	1.125	1.25	**10-32 x ½	B	B41
SCBR25A	2500	1750	.5	.35	2.5	1.125	.25	.169	C	B41
SCBR30	3000	2100	1.0 *	.70*	10	1.125	1.25	**10-32 x ½	B	B41
SCBR30A	3000	2100	.5	.35	2.5	1.125	.25	.169	C	B41
SCBR40	4000	2800	.5 *	.35*	10	2.00	2.00	**¼-20 x ½	D	B41
SCBR40A	4000	2800	.25	.175	1	2.00	.38	.193	E	B41
SCBR50	5000	3500	.5 *	.35*	10	2.00	2.00	**¼-20 x ½	D	B41
SCBR50A	5000	3500	.25	.175	1	2.00	.38	.193	E	B41
SCBR75	7500	5250	.5 *	.35*	10	2.00	2.00	**¼-20 x ½	D	B41
SCBR75A	7500	5250	.25	.175	1	2.00	.38	.193	E	B41
SCBR100	10000	7000	.5 *	.35*	10	2.00	2.00	**¼-20 x ½	D	B41
SCBR100A	10000	7000	.25	.175	1	2.00	.38	.193	E	B41

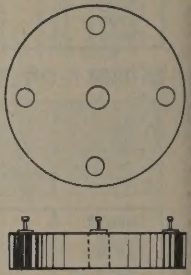
Mechanical Tolerance ±.03″
Insert or through hole mounting available.
*Note: average rectifier current rating utilizing heat sink, rating specified at mounting temperature.


Case A


Case B


Case C


Case D


Case E

TERMINAL INFORMATION

Case	Circle Dia.	Height In Inches
A	⅝	.137 max.
B	25/32	.175 max.
C (3 & 5 Amp only)	13/16	.210 max.
C (all others)	13/16	.175 max.
D	1 9/16	.350 max.
E	1 19/32	.175 max.

DATA SUBJECT TO CHANGE WITHOUT NOTICE

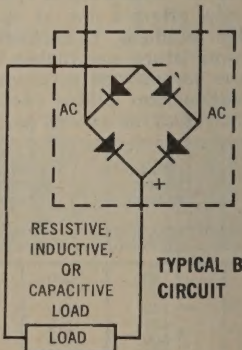
FAST RECOVERY 1½ AMP

A "Fast Recovery" silicon rectifier bridge offering improved rectification efficiency for higher frequency applications.

The Fast Recovery characteristic offers the designer new capabilities for advanced design in reducing package sizes with improved performance and higher reliability. The bridge utilizes the Semtech rugged solid internal construction hermetically sealed junctions molded with high temperature compounds to give maximum in mechanical, thermal and electrical reliability. This easy to use package was designed for use in commercial, industrial and military applications.

Type No.	Peak Inverse Voltage	RMS Voltage	Average Rectified Current		Recurrent Surge Current	Mounting Hole	CASE	Data Sheet No.
			25°C	100°C	25°C	Dia.		
	Volts	Volts	Amps	Amps	Amps	Inches		
MEDIUM RECOVERY (t_{rr}) 1 MICROSECOND ①								
SCBR05M	50	38	1.5	1.05	10	.144	A	B42
SCBR1M	100	70	1.5	1.05	10	.144	A	B42
SCBR2M	200	140	1.5	1.05	10	.144	A	B42
SCBR4M	400	280	1.5	1.05	10	.144	A	B42
SCBR6M	600	420	1.5	1.05	10	.144	A	B42
SCBR8M	800	560	1.5	1.05	10	.144	A	B42
SCBR10M	1000	700	1.5	1.05	10	.144	A	B42
FAST RECOVERY (t_{rr}) 150 NANOSECONDS ① *Trr = 250 ns.								
SCBR05F	50	38	1.5	1.05	6	.144	A	B42
SCBR1F	100	70	1.5	1.05	6	.144	A	B42
SCBR2F	200	140	1.5	1.05	6	.144	A	B42
SCBR4F	400	280	1.5	1.05	6	.144	A	B42
SCBR6F*	600	420	1.5	1.05	6	.144	A	B42

Mechanical Tolerance ±.03″
① Reverse recovery is measured on each junction prior to manuafcture of assembly. Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.



TYPICAL BRIDGE CIRCUIT

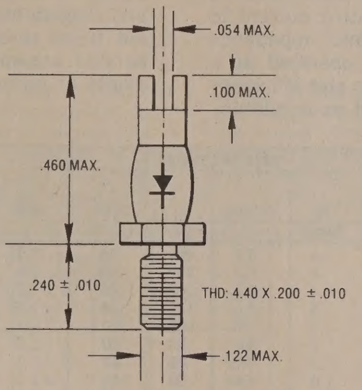
Semtech reserves the right to change specifications without notice.

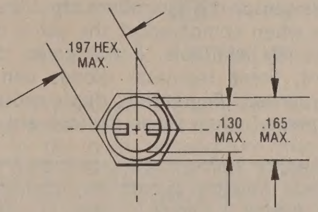
SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

METOXILITE LOW DYNAMIC IMPEDANCE MINI-STUD SILICON VOLTAGE REGULATORS

This new series of devices offers significantly lower dynamic impedance when compared at the same operating current to those presently available. For a given dynamic impedance requirement, these regulator diodes can be operated at a lower bias current. Regulation, ripple reduction and efficiency will be improved when these devices are used as regulators. Cased in Metoxilite, they provide the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case are fused directly to the high temperature metallurgically bonded assembly. This Metoxilite device exceeds requirements of current military and space program specifications.





Power Rating is 18 watts at 100°C Case derated linearly to zero at 175°C case

Thermal Impedance junction to case (Rθjc) is 4° C/W

Operating and Storage temperature range is −65°C to +175°C

Stud Torque maximum is 28 inch - ounces.

ELECTRICAL SPECIFICATIONS @ 25°C UNLESS NOTED

① Type No. ±5% Tolerance	Nominal Voltage @ I_{ZT}	Test Current I_{ZT}	Max. Reverse Leakage Current				Max. Imped. Z_Z @ I_{LT}	Max. Temp. TCBV @ T_{LT}	Max. Cont. Current I_{ZM}	② Max. Surge Current I_{ZM}
			I_R @ V_R	±5% Tol. V_R	±10% Tol. V_R	±20% Tol. V_R				
	Volts	mA	μA	Volts	Volts	Volts	Ohms	%/°C	Amps	Amps
MY6.8B	6.8	500	600	5.1	4.8	4.0	.18	.05	2.345	77
MY7.5B	7.5	500	400	5.6	5.2	4.5	.18	.06	2.098	64
MY8.2B	8.2	479	200	6.2	5.7	4.9	.18	.06	1.918	51
MY9.1B	9.1	432	100	6.8	6.4	5.4	.2	.06	1.729	48
MY10B	10	387	100	7.5	7.0	6.0	.2	.07	1.551	46
MY11B	11	352	50	8.2	7.7	6.6	.22	.07	1.410	43
MY12B	12	323	50	9.0	8.4	7.2	.25	.07	1.292	40
MY13B	13	294	50	9.8	9.1	8.0	.28	.08	1.177	37
MY15B	15	255	25	11.2	10.5	9.0	.28	.08	1.020	31
MY16B	16	239	25	12.0	11.2	10.0	.30	.08	0.956	28
MY18B	18	211	25	13.5	12.6	10.8	.30	.085	0.844	22
MY20B	20	190	10	15.0	14.0	12.0	.35	.085	0.760	16
MY22B	22	172	10	16.5	15.4	13.2	.40	.085	0.691	15
MY24B	24	157	10	18.0	16.8	14.4	.50	.09	0.629	14
MY27B	27	140	10	20.2	18.9	16.2	1.25	.09	0.560	12
MY30B	30	125	10	22.5	21.0	18.0	1.50	.09	0.503	10.6
MY33B	33	113	10	24.8	23.1	20.0	1.50	.095	0.455	9.0
MY36B	36	104	10	27.0	25.2	22.0	1.50	.095	0.416	7.3
MY39B	39	96	10	29.2	27.3	23.4	2.00	.095	0.385	6.9
MY43B	43	87	10	32.2	30.1	26.0	2.50	.095	0.349	6.5
MY47B	47	79	10	35.2	32.9	28.2	2.50	.095	0.319	6.1
MY51B	51	73	10	38.2	16.0	30.6	2.75	.095	0.294	5.7
MY56B	56	66	10	42.0	39.2	33.6	3.00	.095	0.267	5.1
MY62B	62	60	10	46.5	43.4	37.2	3.50	.100	0.240	4.5
MY68B	68	54	10	51.0	48.0	40.8	4.00	.100	0.219	3.9
MY75B	75	49	10	56.2	52.5	45.0	5.00	.100	0.198	3.2
MY82B	82	45	10	61.5	57.4	49.2	7.50	.100	0.181	3.0
MY91B	91	40	10	68.2	64.0	54.6	9.00	.100	0.163	2.8
MY100B	100	37	10	75.0	70.0	60.0	10.0	.100	0.147	2.55
MY110B	110	33	10	82.5	77.0	66.0	14.0	.100	0.135	2.35
MY120B	120	31	10	90.0	84.0	72.0	17.0	.100	0.124	2.10

Notes: ① For 10% tolerance add suffix A (i.e. MY6.8A is ±10% tol.). Non-suffix type is 20% tolerance. Cathode to stud is standard, for reverse polarity add suffix R to part number (i.e., MY6.8AR is ±10% tol. with anode to stud).

② Rating shown for ±5% tol. at 100°C case.

③ Single cycle sine-wave of 8.3 mS duration.

SEMTECH
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METOXILITE LOW DYNAMIC IMPEDANCE SILICON VOLTAGE REGULATORS

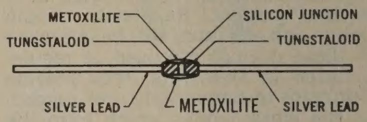
This new series of devices offers significantly lower dynamic impedance when compared at the same operating current to those presently available. For a given dynamic impedance requirement, these regulator diodes can be operated at a lower bias current. Regulation, ripple reduction and efficiency will be improved when these devices are used as regulators.

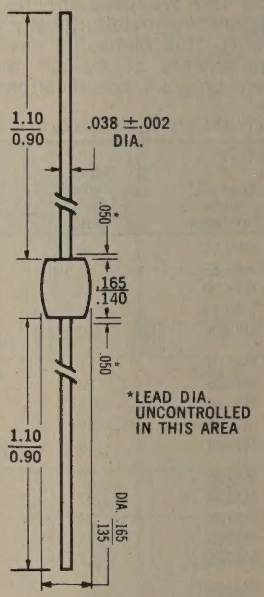
Cased in Metoxilite, they provide the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case are fused directly to the high temperature metallurgically bonded assembly. This Metoxilite device exceeds requirements of current military and space program specifications.

						Reverse Leakage			
Type No.	Nominal Voltage	Min. Break-down	Max. Voltage	I_R Test	Z_R	V_R Test	I_s	* TCBV	I_R Max.
	V	V	V	MA	Ohms	V	UA	%/°C	A
SY6.8	6.8	6.46	7.14	500	.4	5.2	600	.05	2.10
SY7.5	7.5	7.13	7.87	500	.4	5.7	400	.06	1.8
SY8.2	8.2	7.79	8.61	450	.4	6.2	200	.06	1.7
SY9.1	9.1	8.65	9.55	450	.5	6.9	100	.06	1.5
SY10	10	9.50	10.50	375	.7	7.6	100	.07	1.4
SY11	11	10.45	11.55	375	.7	8.4	50	.07	1.2
SY12	12	11.40	12.60	300	.7	9.1	50	.07	1.1
SY13	13	12.35	13.65	300	1.0	9.9	50	.08	1.0
SY15	15	14.25	15.75	225	1.0	11.4	25	.08	0.90
SY16	16	15.20	16.80	225	1.5	12.2	25	.08	0.80
SY18	18	17.10	18.90	195	1.5	13.7	25	.085	0.70
SY20	20	19.0	21.0	195	1.6	15.2	10	.085	0.69
SY22	22	20.9	23.1	150	1.7	16.7	10	.085	0.63
SY24	24	22.8	25.2	150	1.7	18.2	10	.09	0.59
SY27	27	25.7	28.3	150	1.8	20.6	10	.09	0.52
SY30	30	28.5	31.5	120	1.9	22.8	10	,09	0.47
SY33	33	31.4	34.6	120	2	25.1	10	.095	0.43
SY36	36	34.2	37.8	90	2.5	27.4	10	.095	0.39
SY39	39	37.1	40.9	90	2.5	29.7	10	.095	0.36
SY43	43	40.9	45.1	90	3	32.7	10	.095	.033
SY47	47	44.7	49.3	75	3.5	35.8	10	.095	.030
SY51	51	48.5	53.5	75	4	38.8	10	.095	0.27
SY56	56	53.2	58.8	60	4.5	42.6	10	.095	0.25
SY62	62	58.9	65.1	60	5	47.1	10	.100	0.22
SY68	68	64.6	74.1	60	7	51.7	10	.100	0.21
SY75	75	71.3	78.7	60	10	56.0	10	.100	0.18
SY82	82	77.9	86.1	45	15	62.2	10	.100	0.17
SY91	91	86.5	95.5	45	17	69.2	10	.100	0.15
SY100	100	95.0	105.0	36	20	76.0	10	.100	0.14
SY110	110	104.5	115.5	36	22	83.6	10	.100	0.12
SY120	120	114.0	126.0	30	35	91.2	10	.100	0.11

TECHNICAL BULLETIN X5

Operating and Storage Temperature −195°C to +175°C.
* Temperature coefficient of breakdown voltage.

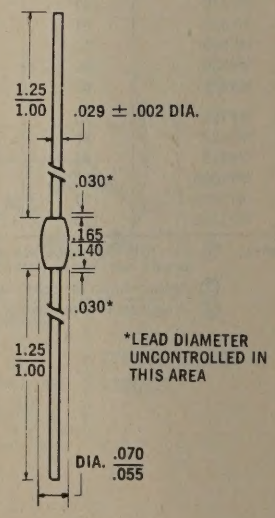




†1N5559B	6.8	6.46	7.14	37	3.5	5.2	10.0	.04	140
1N5560B	7.5	7.13	7.87	34	4.0	5.7	5.0	.04	125
1N5561B	8.2	7.79	8.61	31	4.5	6.2	5.0	.05	115
1N5562B	9.1	8.65	9.55	28	5.0	6.9	5.0	.05	105
1N5563B	10	9.50	10.50	25	7.0	7.6	1.0	.06	95
1N5565B	11	10.45	11.55	23	8.0	8.4	1.0	.07	85
1N5565B	12	11.40	12.60	21	9.0	9.1	1.0	.07	80
1N5566B	13	12.35	13.65	19	10	9.9	1.0	.07	74
1N5567B	15	14.25	15.75	17	14	11.4	1.0	.07	63
1N5568B	16	15.20	16.80	15.5	16	12.2	1.0	.07	60
1N5569B	18	17.10	18.90	14	20	13.7	1.0	.08	52
1N5570B	20	19.0	21.0	12.5	22	15.2	1.0	.08	47
1N5571B	22	20.9	23.1	11.5	23	16.7	1.0	.08	43
1N5572B	24	22.8	25.2	10.5	25	18.2	1.0	.08	40
1N5573B	27	25.7	28.3	9.5	35	20.6	1.0	.09	35
1N5574B	30	28.5	31.5	8.5	40	22.8	1.0	.09	31
1N5575B	33	31.4	34.6	7.5	45	25.1	1.0	.09	28
1N5576B	36	34.2	37.8	7.0	50	27.4	1.0	.09	26
1N5577B	39	37.1	40.9	6.5	60	29.7	1.0	.095	24
1N5578B	43	40.9	45.1	6.0	70	32.7	1.0	.095	22
1N5579B	47	44.7	49.3	5.5	80	35.8	1.0	.095	20
1N5580B	51	48.5	53.5	5.0	95	38.8	1.0	.095	18
1N5581B	56	53.2	58.8	4.5	110	42.6	1.0	.095	17
1N5582B	62	58.9	65.1	4.0	125	47.1	1.0	.095	15
1N5583B	68	64.6	74.1	3.7	150	51.7	1.0	.095	14
1N5584B	75	71.3	78.7	3.3	175	56.0	1.0	.095	12
1N5585B	82	77.9	86.1	3.0	200	62.2	1.0	.095	11
1N5586B	91	86.5	95.5	2.8	250	69.2	1.0	.095	10
1N5587B	100	95.0	105.0	2.5	350	76.0	1.0	.100	9.5
1N5588B	110	104.5	115.5	2.3	450	83.6	1.0	.100	8.5
1N5589B	120	114.0	126.0	2.0	550	91.2	1.0	.100	8.0

TECHNICAL BULLETIN X6

Operating and Storage Temperature −195°C to +175°C.
* Temperature coefficient of breakdown voltage.
Thermal resistance 23.5°C/W @ 0.375 inches.
† 10% Tolerance also available. Use letter "A" after P/N instead of letter "B".



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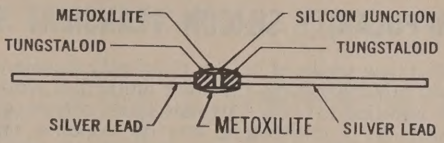
METOXILITE LOW DYNAMIC IMPEDANCE SILICON VOLTAGE REGULATORS



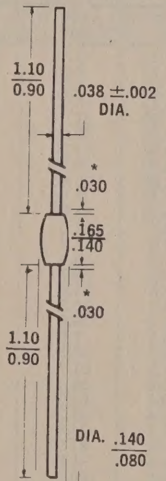
This new series of devices offers significantly lower dynamic impedance when compared at the same operating current to those presently available. For a given dynamic impedance requirement, these regulator diodes can be operated at a lower bias current. Regulation, ripple reduction and efficiency will be improved when these devices are used as regulators.

Cased in Metoxilite, they provide the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case are fused directly to the high temperature metallurgically bonded assembly. This Metoxilite device exceeds requirements of curren military and space program specifications.

Type No.	Nominal Voltage	5 Watt Min. Breakdown	Max. Voltage	I_R Test	Z_R	Reverse Leakage V_R Test	I_S	* TCBV	I_R Max.
	V	V	V	MA	Ohms	V	uA	°C	MA
SX6.8	6.8	6.46	7.14	175	.75	5.2	150	.05	700
SX7.5	7.5	7.13	7.87	175	.75	5.7	100	.06	630
SX8.2	8.2	7.79	8.61	150	.75	6.2	50	.06	580
SX9.1	9.1	8.65	9.55	150	1.0	6.9	25	.06	520
SX10	10	9.50	10.50	125	1.5	7.6	25	.07	475
SX11	11	10.45	11.55	125	1.5	8.4	10	.07	430
SX12	12	11.40	12.60	100	1.5	9.1	10	.07	395
SX13	13	12.35	13.65	100	2.0	9.9	10	.08	365
SX15	15	14.25	15.75	75	2.5	11.4	5	.08	315
SX16	16	15.20	16.80	75	2.5	12.2	5	.08	294
SX18	18	17.10	18.90	65	2.5	13.7	5	.085	264
SX20	20	19.0	21.0	65	2.5	15.2	2	.085	237
SX22	22	20.9	23.1	50	2.5	16.7	2	.085	216
SX24	24	22.8	25.2	50	3.0	18.2	2	.09	198
SX27	27	25.7	28.3	50	3.0	20.6	2	.09	176
SX30	30	28.5	31.5	40	3	22.8	2	.09	158
SX33	33	31.4	34.6	40	4	25.1	2	.035	144
SX36	36	34.2	37.8	30	5	27.4	2	.095	132
SX39	39	37.1	40.9	30	5	29.7	2	.095	132
SX43	43	40.9	45.1	30	6	32.7	2	.095	110
SX47	47	44.7	49.3	25	7	35.8	2	.095	100
SX51	51	48.5	53.5	25	8	38.8	2	.095	92
SX56	56	53.2	58.8	20	9	42.6	2	.095	84
SX62	62	58.9	65.1	20	10	47.1	2	.100	76
SX68	68	64.6	71.4	20	15	51.7	2	.100	70
SX75	75	71.3	78.7	20	20	56.0	2	.100	63
SX82	82	77.9	86.1	15	30	62.2	2	.100	58
SX91	91	86.5	95.5	15	35	69.2	2	.100	52.5
SX100	100	95.0	105.0	12	40	76.0	2	.100	47.5
SX110	110	104.5	115.0	12	55	83.6	2	.100	43
SX120	120	114.0	126.0	10	70	91.2	2	.100	39.5

TECHNICAL BULLETIN X1

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A.



*LEAD DIAMETER

UNCONTROLLED IN THIS AREA

Type No.	Nominal Voltage	Min.	Max. Voltage	I_R Test	Z_R	Reverse Leakage V_R Test	I_S	TCBV*	I_R Max.
	V	Breakdown V	V	MA	Ohms	V	UA	%/°C	MA
1N4954	6.8	6.46	7.14	175	1	5.2	300	.05	600
1N4955	7.5	7.13	7.87	175	1.5	5.7	200	.06	600
1N4956	8.2	7.79	8.61	150	1.5	6.2	100	.06	550
1N4957	9.1	8.65	9.55	150	2	6.9	50	.06	495
1N4958	10	9.50	10.50	125	2	7.6	25	.07	450
1N4959	11	10.45	11.55	125	2.5	8.4	15	.07	410
1N4960	12	11.40	12.60	100	2.5	9.1	10	.07	375
1N4961	13	12.35	13.65	100	3	9.9	10	.08	345
1N4962	15	14.25	15.75	75	3.5	11.4	5	.08	300
1N4963	16	15.20	16.80	75	3.5	12.2	5	.08	280
1N4964	18	17.10	18.90	65	4	13.7	5	.085	250
1N4965	20	19.0	21.0	65	4.5	15.2	1	.085	225
1N4966	22	20.9	23.1	50	5	16.7	1	.085	205
1N4967	24	22.8	25.2	50	5	18.2	1	.09	186
1N4968	27	25.7	28.3	50	6	20.6	1	.09	167
1N4969	30	28.5	31.5	40	8	22.8	1	.09	150
1N4970	33	31.4	34.6	40	10	25.1	1	.095	136
1N4971	36	34.2	37.8	30	11	27.4	1	.095	126
1N4972	39	37.1	40.9	30	14	29.7	1	.095	115
1N4973	43	40.9	45.1	30	20	32.7	1	.095	105
1N4974	47	44.7	49.3	25	25	35.8	1	.095	96
1N4975	51	48.5	53.5	25	27	38.8	1	.095	88
1N4976	56	53.2	58.8	20	35	42.6	1	.095	80
1N4977	62	58.9	65.1	20	42	47.1	1	.100	73
1N4978	68	64.6	71.4	20	44	51.7	1	.100	67
1N4979	75	71.3	78.7	20	45	56.0	1	.100	60
1N4980	82	77.9	86.1	15	65	62.2	1	.100	55
1N4981	91	86.5	95.5	15	75	69.2	1	.100	50
1N4982	100	95.0	105.0	12	90	76.0	1	.100	45
1N4983	110	104.5	115.5	12	125	83.6	1	.100	41
1N4984	120	114.0	126.0	10	170	91.2	1	.100	37.5

Operating and Storage Temperature −195°C to +175°C.
* Temperature coefficient of breakdown voltage

TECHNICAL BULLETIN X3

Semtech reserves the right to change specifications without notice.

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BI-POLARITY SILICON TRANSIENT SUPPRESSORS

This new series of silicon bi-polarity transient suppressors is unique in that a single device will provide voltage transient protection symetrically (i.e., provide protection for A.C. signals in addition to D.C.). This new series of devices has peak pulse power ratings of 500 or 1500 watts for 1 millisecond and its response time is effectively instantaneous (less than 1 x 10^{-12} sec.). Therefore, these versatile devices have many protection applications where large voltage transients can permanently damage voltage-sensitive components. Its response time affords protection for integrated circuits, MOS devices, hybrids, and many other voltage-sensitive components. The devices are encased in Semtech's Metoxilite, fused directly to the high temperature metallurgically bonded assembly. For use in commercial, industrial, military and space programs.

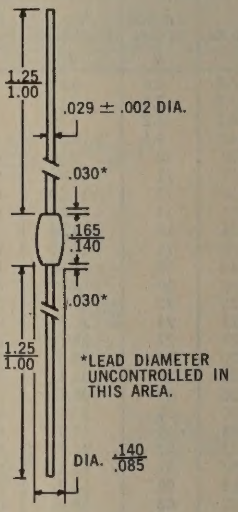
Characteristics @ 25°C applies in either direction.

Can be supplied as JAN, JANTX, or JANTXV to MIL-S-19500/516 (EL).

500 WATT PEAK PULSE POWER

Series Type	Breakdown Voltage V$_{(BR)}$		Test Current I$_T$	Working Peak Voltage V$_M$ (wkg)	Maximum Leakage Current I$_L$	Maximum Peak Surge Voltage V$_{SM}$	Maximum Peak Surge Current I$_{SM}$	Maximum Temp. Coeff. of V$_{(BR)}$
500W	Vdc Min.	Vdc Max.	Vdc	mAdc	μAdc	V(pk)	A(pk)	%/°C
1N6102	6.12	7.48	175	5.2	100	11.0	45.4	.05
1N6103	6.75	8.25	175	5.7	50	11.8	42.4	.06
1N6104	7.38	9.02	150	6.2	10	12.7	39.4	.06
1N6105	8.19	10.01	150	6.9	10	14.0	35.7	.06
1N6106	9.00	11.00	125	7.6	10	15.2	32.9	.07
1N6107	9.90	12.10	125	8.4	1	16.3	30.7	.07
1N6108	10.80	13.20	100	9.1	1	17.7	28.2	.07
1N6109	11.70	14.30	100	9.9	1	19.0	26.3	.08
1N6110	13.50	16.50	75	11.4	1	21.9	22.8	.08
1N6111	14.40	17.60	75	12.2	1	23.4	21.4	.08
1N6112	16.20	19.80	65	13.7	1	26.3	19.0	.085
1N6113	18.0	22.0	65	15.2	1	29.0	17.2	.085
1N6114	19.8	24.2	50	16.7	1	31.9	15.7	.085
1N6115	21.6	26.4	50	18.2	1	34.8	14.4	.09
1N6116	24.3	29.7	50	20.6	1	39.2	12.8	.09
1N6117	27.0	33.0	40	22.8	1	43.6	11.5	.09
1N6118	29.7	36.3	40	25.1	1	47.9	10.4	.095
1N6119	32.4	39.6	30	27.4	1	52.3	9.6	.095
1N6120	35.1	42.9	30	29.7	1	56.2	8.9	.095
1N6121	38.7	47.3	30	32.7	1	62.0	8.1	.095
1N6122	42.3	51.7	25	35.8	1	67.7	7.4	.095
1N6123	45.9	56.1	25	38.8	1	73.5	6.8	.095
1N6124	50.4	61.6	20	42.6	1	80.7	6.2	.095
1N6125	55.8	68.2	20	47.1	1	89.3	5.6	.100
1N6126	61.2	74.8	20	51.7	1	98.0	5.1	.100
1N6127	67.5	82.5	20	56.0	1	108.1	4.6	.100
1N6128	73.8	90.2	15	62.2	1	118.2	4.2	.100
1N6129	81.9	100.1	15	69.2	1	131.1	3.8	.100
1N6130	90.0	110.0	12	76.0	1	144.1	3.5	.100
1N6131	99.0	121.0	12	83.6	1	158.5	3.2	.100
1N6132	108.0	132.0	10	91.2	1	172.9	2.9	.100
1N6133	117.0	143.0	10	98.8	1	187.3	2.7	.105
1N6134	135.0	165.0	8	114.0	1	216.2	2.3	.105
1N6135	144.0	176.0	8	121.6	1	228.8	2.2	.105
1N6136	162.0	198.0	5	136.8	1	257.4	1.9	.110
1N6137	180.0	220.0	5	152.0	1	286.0	1.7	.110

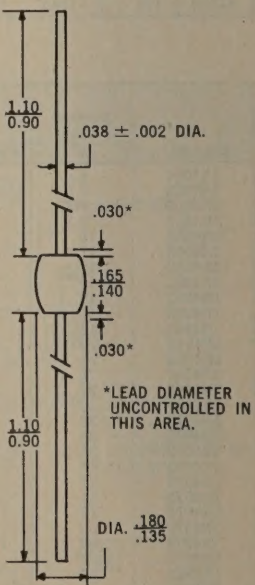
TECH BULLETIN X7



1500 WATT PEAK PULSE POWER

1N6138	6.12	7.48	175	5.2	500	11.0	136.4	.05
1N6139	6.75	8.25	175	5.7	300	11.8	127.1	.06
1N6140	7.38	9.02	150	6.2	100	12.7	118.1	.06
1N6141	8.19	10.01	150	6.9	100	14.0	107.1	.06
1N6142	9.00	11.00	125	7.6	100	15.2	98.7	.07
1N6143	9.90	12.10	125	8.4	10	16.3	92.0	.07
1N6144	10.80	13.20	100	9.1	10	17.7	84.7	.07
1N6145	11.70	14.30	100	9.9	10	19.0	78.9	.08
1N6146	13.50	16.50	75	11.4	10	21.9	68.5	.08
1N6147	14.40	17.60	75	12.2	10	23.4	64.1	.08
1N6148	16.20	19.80	65	13.7	10	26.3	57.0	.085
1N6149	18.0	22.0	65	15.2	5	29.0	51.7	.085
1N6150	19.8	24.2	50	16.7	5	31.9	47.0	.085
1N6151	21.6	26.4	50	18.2	5	34.8	43.1	.09
1N6152	24.3	29.7	50	20.6	5	39.2	38.3	.09
1N6153	27.0	33.0	40	22.8	5	43.6	34.4	.09
1N6154	29.7	36.3	40	25.1	5	47.9	31.3	.095
1N6155	32.4	39.6	30	27.4	5	52.3	28.7	.095
1N6156	35.1	42.9	30	29.7	5	56.2	26.7	.095
1N6157	38.7	47.3	30	32.7	5	62.0	24.2	.095
1N6158	42.3	51.7	25	35.8	5	67.7	22.2	.095
1N6159	45.9	56.1	25	38.8	5	73.5	20.4	.095
1N6160	50.4	61.6	20	42.6	5	80.7	18.6	.095
1N6161	55.8	68.2	20	47.1	5	89.3	16.8	.100
1N6162	61.2	74.8	20	51.7	5	98.0	15.3	.100
1N6163	67.5	82.5	20	56.0	5	108.1	13.9	.100
1N6164	73.8	90.2	15	62.2	5	118.2	12.7	.100
1N6165	81.9	100.1	15	69.2	5	131.1	11.4	.100
1N6166	90.0	110.0	12	76.0	5	144.1	10.4	.100
1N6167	99.0	121.0	12	83.6	5	158.5	9.5	.100
1N6168	108.0	132.0	10	91.2	5	172.9	8.7	.100
1N6169	117.0	143.0	10	98.8	5	187.3	8.0	.105
1N6170	135.0	165.0	8	114.0	5	216.2	6.9	.105
1N6171	144.0	176.0	8	121.6	5	228.8	6.6	.105
1N6172	162.0	198.0	5	136.8	5	257.4	5.8	.110
1N6173	180.0	220.0	5	152.0	5	286.0	5.2	.110

TECH BULLETIN X8



SEMTECH
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METOXILITE "MINISTAC" FAST RECOVERY HIGH VOLTAGE SILICON RECTIFIERS

Semtech Corporation introduces a new Sub-Sub-Miniature High Voltage Metoxilite Rectifier. Ideally suited for low current high voltage applications and multiplier circuits. Improved reverse leakage and reverse recovery parameters at elevated temperatures. A silicon multi-junction device utilizing a high temperature tungsten pin bonded construction with expansion coefficients matched. The void-free, solid monolithic technology results in corona-free operation. The Metoxilite hermetic seal meets or exceeds stringent temperature cycling and humidity requirements of military, space, industrial and consumer-product applications.

	Peak Inverse Voltage	Max. Static FWD. Voltage @ 10 mA	Average Rectified Current 25°C	① Max. Static Rev. Current @		② One Cycle Surge	③ Recovery Time	Max. Junction Cap. at 100V
				PIV 25°C	2/3 PIV 100°C			
Type No.	**Volts**	**Volts**	**mA**	**µA**	**µA**	**Amps**	**NS**	**PF**
FM50	5,000	10	25	1.0	10	2	300	2.0
FM75	7,500	10	25	1.0	10	2	300	2.0
FM100	10,000	20	10	1.0	10	2	300	1.0
FM150	15,000	20	10	1.0	10	2	300	1.0

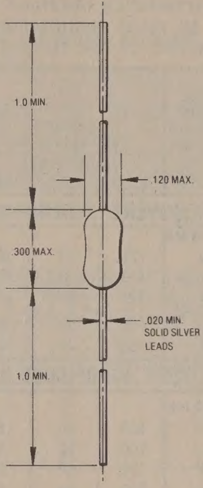
Operating Junction Temperature range: −65°C to +150°C. Storage Temperature range: −65°C to +175°C.

① At typical room lighting (50 to 75 foot candles, fluorescent type)

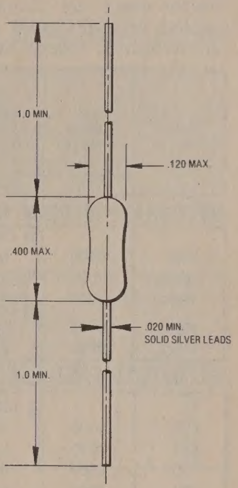
② I_{fsm} @ 8.3 ms ½ sine wave

③ Recovery conditions: 5 MA forward current to 10 MA reverse current.
Recovery time measured when rectifier recovers to 2.5 MA.

NOTE: When utilized at maximum PIV ratings subminiature high voltage rectifiers should be used in oil environment or encapsulated in epoxy or other types of conformal coatings.



FM50
FM75



FM100
FM150

METOXILITE SUB-MINIATURE HIGH VOLTAGE SILICON RECTIFIERS

Semtech Corporation introduces a new Sub-Miniature High Voltage Metoxilite Rectifier. Superior electrical characteristics are obtained through a unique internal design. A silicon multi-junction device utilizing a high temperature tungsten pin bonded construction with expansion coefficients matched. The void-free, solid monolithic technology results in corona-free operation. The Metoxilite hermetic seal meets or exceeds stringent temperature cycling and humidity requirements of military, space, industrial and consumer-product applications.

Type No.	Peak Inverse Voltage 25°C	D.C. Blocking Voltage 25°C	Avg. Rectified Current in Oil For "A" Mounting 55°C (oil)	Maximum Static Forward Voltage @ 100 mA 25°C	25°C	① Typ. Static Reverse Current @ PIV 100°C	② One Cycle Surge 25°C	Typ. Cap. @ 100 V. 1 MHz 25°C
	Volts	**Volts**	**mA**	**Volts**	**µA**	**µA**	**Amps**	**pF**
SH75	7,500	7,500	200	12	1.0	15	25	0.75
SH100	10,000	10,000	200	12	1.0	15	25	0.75

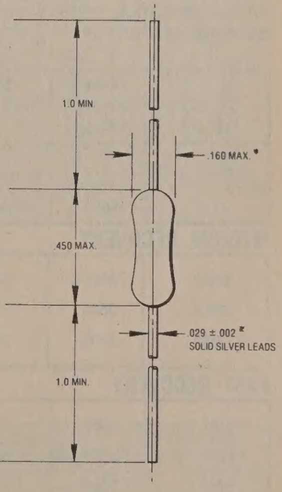
Operating Junction Temperature range: −65°C to +150°C. Storage Temperature range: −65°C to +175°C.

① At typical room lighting (50 to 75 foot candles, fluorescent type)

② I_{fsm} @ 8.3 ms ½ sine wave

③ Avalanche test 100 µA for 100 millisec. @ 25°C.

NOTE› When utilized at maximum PIV ratings sub-miniature high voltage rectifiers should be used in oil environment or encapsulated in epoxy or other types of conformal coatings.



SH75
SH100

SEMTECH

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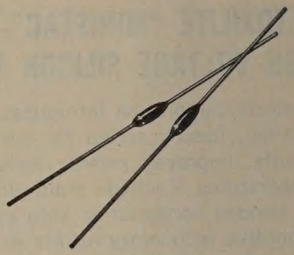
MINI-METOXILITE HIGH VOLTAGE SILICON RECTIFIERS

Semtech offers "Ministac" a sub-miniature multipurpose high voltage silicon rectifier. Better electrical characteristics obtained by Semtech's unique construction. Hermetically sealed and designed to meet requirements of military, industrial and consumer-product applications. Ideally suited for low current high voltage applications and multiplier circuits.

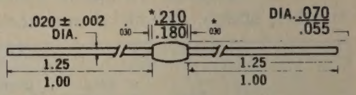


Type No.	Peak Inverse Voltage	Max. Static Forward Voltage	Average Rectified Current			Max. Static Reverse Current @ PIV		One Cycle Surge	Recurrent Surge	Max. Recovery Time ① trr	Max. Junction Capac-itance @ 100 Volts
			Milliamps			25°C	100°C				
	Volts	Volts	55°C	100°C	150°C	µAdc	µAdc	Amps	Amps	Nsec.	Picofarads
METOXILITE MEDIUM RECOVERY (OUTLINE 01)											
		@ 125 MA									
M20	2000	5	125	67	10	.100	7.0	7	1.25	2000	2.0
M30	3000	5	125	67	10	.100	7.0	7	1.25	2000	2.0
M40	4000	5	125	67	10	.100	7.0	7	1.25	2000	2.0
		@ 50 MA									
M50A	5000	6	50	25	5	.250	10.0	5	1.00	5000	2.0
M60A	6000	6	50	25	5	.250	10.0	5	1.00	5000	2.0
METOXILITE FAST RECOVERY NANOSECOND REVERSE RECOVERY (OUTLINE 01)											
		@ 100 MA									
F15	1500	5	100	50	5	.100	7.0	5	1.25	250	2.0
F20	2000	5	100	50	5	.100	7.0	5	1.25	250	2.0
F25	2500	5	100	50	5	.100	7.0	5	1.25	250	2.0
F30	3000	5	100	50	5	.250	10.0	5	1.25	250	2.0
		@ 50 MA									
F40A	4000	8	50	25	2.5	.250	10.0	2.5	.75	300	2.0
F50A	5000	8	50	25	2.5	.250	10.0	2.5	.75	300	2.0
F60A	6000	8	50	25	2.5	.250	10.0	2.5	.75	300	2.0

TECHNICAL BULLETIN R96

TECHNICAL BULLETIN R97

① Recovery conditions: 50 MA forward current to 100 MA reverse current.
Recovery time measured when rectifier recovers to 25 MA.
Operating and Storage Temperature −193.8°C to +200°C.



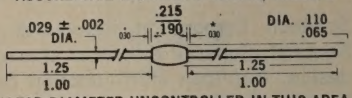
OUTLINE 01 * "A" SUFFIX PARTS .260/.220

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A

SEMTECH METOXILITE SUB-MINIATURE HIGH VOLTAGE SILICON RECTIFIERS

Available in Metoxilite, Semtech's new sub-miniature multipurpose high voltage axial lead silicon rectifier, ideally suited for small electronic package design. The Metoxilite device exceeds environmental requirements of current military and space program specifications.

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A



*LEAD DIAMETER UNCONTROLLED IN THIS AREA

Type No.	Peak Inverse Voltage	RMS (Sine Wave) Voltage	DC Blocking Voltage	Average Rectifier Current			Maximum Static Forward Voltage	Maximum Static Reverse Current @ PIV		Recurrent Surge	One Cycle Surge	*Reverse Recovery Time
							100 MA					Trr
	Volts	Volts	Volts	55°C MA	100°C MA	150°C MA	25°C Volts	25°C µA	100°C µA	Amps	Amps	Max.
MEDIUM RECOVERY												
SM20	2000	1400	2000	250	150	50	4.0	1	25	2.5	10	
SM25	2500	1750	2500	250	150	50	4.0	1	25	2.5	10	
SM30	3000	2100	3000	250	150	50	4.0	1	25	2.5	10	
FAST RECOVERY												
S15F	1500	1050	1500	250	150	50	4.0	1	25	2.5	10	300 ns
S20F	2000	1400	2000	250	150	50	4.0	1	25	2.5	10	300 ns
S25F	2500	1750	2500	250	150	50	4.0	1	25	2.5	10	300 ns

TECHNICAL BULLETIN R94

TECHNICAL BULLETIN R95

*Reverse Recovery (Trr) Conditions.
50 MA forward current to 100 MA reverse current.

Recovery time measured when rectifier recovers to 25 MA.
Operating Temperature −65°C to +175°C

Storage Temperature −193.8°C to +200°C

JAN and TX can be supplied to meet MIL-S-19500/279A

Type No.	Peak Inverse Voltage	RMS (Sine Wave) Voltage	DC Blocking Voltage	Average Rectifier Current 55°C MA	100°C MA	150°C MA	Maximum Static Forward Voltage 100 MA 25°C Volts	Maximum Static Reverse Current @ PIV 25°C µA	100°C µA	Recurrent Surge Amps	One Cycle Surge Amps	*Reverse Recovery Time Trr Max.
1N3643	1000	700	1000	250	150	—	3.5	1	20	2.5	14	—
1N3644	1500	1050	1500	250	150	—	3.5	1	20	2.5	14	—
1N3645	2000	1400	2000	250	150	—	3.5	1	20	2.5	14	—
1N3646	2500	1750	2500	250	150	—	3.5	1	20	2.5	14	—
1N3647	3000	2100	3000	250	150	—	3.5	1	20	2.5	14	—

Operating Temperature −65°C to +175°C

Storage Temperature −193.8°C to +200°C

TECHNICAL BULLETIN R55

Semtech reserves the right to change specifications without notice.

Altitude Operation (Barometric Pressure Reduced) 40,000 ft.

SEMTECH
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OTHER JAN TYPE SILICON RECTIFIERS

Semtech Corporation provides a multipurpose Hermetic Seal Silicon Rectifier incorporating advance design and engineering techniques never before available to the electronics industry at a nominal cost. This new rectifier utilizes solid internal construction with a package combining high mechanical strength, superior thermal shock resistance, rugged hermetic seal, high dielectric strength and excellent thermal conductivity properties.

REFER TO INFORMATION ON METOXILITE SILICON RECTIFIERS FOR DEVICES THAT ARE AVAILABLE TO NEW MSFC/NASA AND MILITARY SPECIFICATIONS.

GENERAL PURPOSE MIL-S-19500/286C including JAN, TX and TXV

NOTE: 1 T_{rr} 2 µsec.

Device Type	Reverse Voltage		Forward Current ①	Reverse Current Max.		Instantaneous Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time ②		Typ. Thermal Impedance ③	
			Free Air 55°	I_R		V_F @ I_F = 1.0 Adc			T_{rr}		$\theta_{i\text{-}L}$	
	V_R	V_{RM} (Wkg)		UAdc				A (pk)	µs		°C/Watt	
	Vdc	V (pk)	A	25°C	100°C	Vdc	A (pk)	I_F (Surge)	Max.	Typ.	d=0	d=.375
1N4245	200	200	1.0	1.0	25	1.2	10	50	2	1	7	33
1N4246	400	400	1.0	1.0	25	1.2	10	50	2	1	7	33
1N4247	600	600	1.0	1.0	25	1.2	10	50	2	1	7	33
1N4248	800	800	1.0	1.0	25	1.2	10	50	2	1	7	33
1N4249	1000	1000	1.0	1.0	25	1.2	10	50	2	1	7	33

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES:
① The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.
② Recovery Conditions: 0.5 amp forward current to −1.0 amp reverse current. Recovery time measured when rectifier recovers to −.25 amp. See Semtech Applications note and test procedure for details.
③ See back side of data sheet for maximum power derating curves and $\theta_{i\text{-}L}$ information.
Operating Temperature −193.8°C to +175°C.
Storage Temperature −193.8°C to +200°C.

FAST RECOVERY MIL-S-19500/359B (USAF) including JAN, TX and TXV

Device Type	Reverse Voltage		Forward Current ①	Reverse Current Max.		Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time ②		Typ. Thermal Impedance ③	
			Free Air 55°	I_R		V_F @ I_F = 1.0 Adc			T_{rr}		ns	
	V_R	V_{RM} (Wkg)		UAdc				A (pk)	ns		°C/Watt	
	Vdc	V (pk)	A	25°C	100°C	Vdc	A (pk)	I_F (Surge)	Max.	Typ.	d=0	d=.375
*1N4942	200	200	1.0	1.0	25	1.2	6	25	150	100	7	33
1N4943	300	300	1.0	1.0	25	1.2	6	25	150	100	7	33
*1N4944	400	400	1.0	1.0	25	1.2	6	25	150	100	7	33
1N4945	500	500	1.0	1.0	25	1.2	6	25	150	100	7	33
*1N4946	600	600	1.0	1.0	25	1.2	6	25	150	100	7	33
*1N4947	800	800	1.0	1.0	25	1.2	6	25	150	100	7	33
*1N4948	1000	1000	1.0	1.0	25	1.2	6	25	150	100	7	33

* Supplied as JAN or JAN-TX.

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES:
① The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.
② Recovery Conditions: 0.5 amp forward current to −1.0 amp reverse current. Recovery time measured when rectifier recovers to −.25 amp. See Semtech Applications note and test procedure for details.
③ See back side of data sheet for maximum power derating curves and $\theta_{i\text{-}L}$ information.
Operating Temperature −193.8°C to +175°C.
Storage Temperature −193.8°C to +200°C.

supplied to MIL-S-19500/279A including JAN AND TX

Type No.	V_r Peak Inverse Voltage	V_{RM} (Wkg.)	Average Rectified Current		Forward Voltage @ 1A	Max. Static Reverse Current @ PIV		*If (surge) (at:1/120 sec.)
			T_A = 100°C	T_A = 150°C	(pk)	25°C	150°C	
	V (pk)	V (pk)	MA	MA	Volts	µA	µA	Amps
1N3611	240	200	1000	300	1.1	1	300	20
1N3612	480	400	1000	300	1.1	1	300	20
1N3613	720	600	1000	300	1.1	1	300	20
1N3614	920	800	1000	300	1.1	1	300	20
1N3957	1150	1000	1000	300	1.1	1	300	20

All temperatures are local ambient, 25°C unless otherwise specified.

TECHNICAL BULLETIN R40

Operating Ambient Temperature −65°C to +175°C

Storage Temperature −65° to +200°C

Barometric Pressure, Reduced 8 mm Hg — 1N3611, 1N3612 and 1N3613; 54 mm Hg — 1N3614; 87 mm Hg — 1N3957.

*T_A = +150°C if (surge = 30 Adc) 10 surges of 8.0 msec duration each, at intervals of 1 minute. I_O = 300 mAdc.

Semtech reserves the right to change specifications without notice.

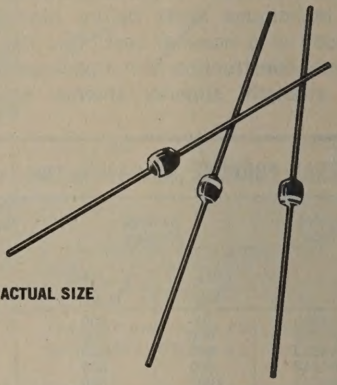
SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

METOXILITE SILICON RECTIFIERS

HIGH CURRENT AXIAL LEADS

3 AMP 55°C/NO HEAT SINK
6 AMP/MIL STANDARD 750



MEDIUM RECOVERY (t$_{rr}$) 2 MICROSECONDS

Type ①	Peak Inverse Voltage	RMS Voltage	DC Blocking Voltage	Average Rectified Current		Max. Static Forward Volt @ 3A	Max. Static Reverse Current		Recurrent Surge	One Cycle Surge	Recovery Time ②	
				55°C	100°C	25°C	25°C	100°C			Max.	Typ.
	Volts	Volts	Volts	Amps	Amps	Volts	µA	µA	Amps	Amps	µsec	µsec
3SM2	200	140	200	3	2	1.0	1	20	25	150	2	1
3SM4	400	280	400	3	2	1.0	1	20	25	150	2	1
3SM6	600	420	600	3	2	1.0	1	20	25	150	2	1
3SM8	800	560	800	3	2	1.1	1	20	25	150	2	1
3SM0	1000	700	1000	3	2	1.1	1	20	25	150	2	1

TECHNICAL BULLETIN R67

FAST RECOVERY NANOSECOND REVERSE RECOVERY

Type ①	Peak Inverse Voltage (Volts)	RMS Voltage (Volts)	DC Blocking Voltage (Volts)	Avg. Rectified Current 55°C (Amps)	Avg. Rectified Current 100°C (Amps)	Max. Static Forward Volt @ 3A 25°C (Volts)	Max. Static Reverse Current 25°C (µA)	Max. Static Reverse Current 100°C (µA)	Recurrent Surge (Amps)	One Cycle Surge (Amps)	Recovery Time Max. (µsec)	Recovery Time Typ. (µsec)
3SF1	100	70	100	3	2	1.1	1	20	25	150	.150	.100
3SF2	200	140	200	3	2	1.1	1	20	25	150	.150	.100
3SF4	400	280	400	3	2	1.1	1	20	25	150	.150	.100

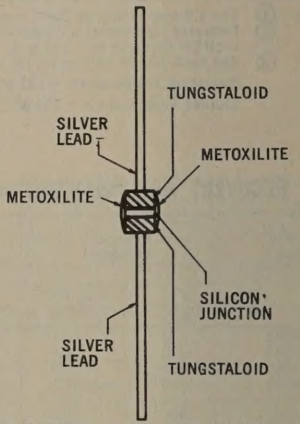
TECHNICAL BULLETIN R66

LO-VF FAST RECOVERY (t$_{rr}$) 100 NANOSECONDS

Type ①	Peak Inverse Voltage (Volts)	RMS Voltage (Volts)	DC Blocking Voltage (Volts)	Avg. Rectified Current 55°C (Amps)	Avg. Rectified Current 100°C (Amps)	Max. Static Forward Volt @ 3A 25°C (Volts)	Max. Static Reverse Current 25°C (µA)	Max. Static Reverse Current 100°C (µA)	Recurrent Surge (Amps)	One Cycle Surge (Amps)	Recovery Time Max. (µsec)	Recovery Time Typ. (µsec)
3L03	30	28	30	3	2	0.9	1	20	25	150	.100	.080
3L05	50	35	50	3	2	0.9	1	20	25	150	.100	.080

TECHNICAL BULLETIN R93

For all types on this page: THERMAL RESISTANCE from junction to heat sink θJL = 20°C/W with (d) length of lead from body to heat sink .375 inches.



LEAD MATERIAL: 99.9% PURE SILVER
IN ACCORDANCE WITH MIL-S-13282A, GRADE A

(1N) TYPE

MEDIUM RECOVERY (t$_{rr}$) 2 MICROSECONDS

Type ①	Peak Inverse Voltage (Volts)	RMS Voltage (Volts)	DC Blocking Voltage (Volts)	Avg. Rectified Current 55°C (Amps)	Avg. Rectified Current 100°C (Amps)	Max. Static Forward Volt @ 3A 25°C (Volts)	Max. Static Reverse Current 25°C (µA)	Max. Static Reverse Current 100°C (µA)	Recurrent Surge (Amps)	One Cycle Surge (Amps)	Recovery Time Max. (µsec)	Recovery Time Typ. (µsec)
1N5550	200	140	200	3	2	1.0	1	20	25	150	2	1
1N5551	400	280	400	3	2	1.0	1	20	25	150	2	1
1N5552	600	420	600	3	2	1.0	1	20	25	150	2	1
1N5553	800	560	800	3	2	1.1	1	20	25	150	2	1
1N5554	1000	700	1000	3	2	1.1	1	20	25	150	2	1

TECHNICAL BULLETIN R78

FAST RECOVERY NANOSECOND REVERSE RECOVERY

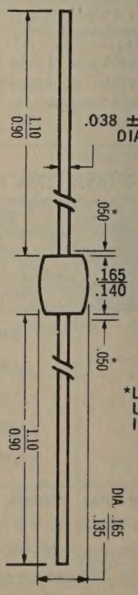
Type ①	Peak Inverse Voltage (Volts)	RMS Voltage (Volts)	DC Blocking Voltage (Volts)	Avg. Rectified Current 55°C (Amps)	Avg. Rectified Current 100°C (Amps)	Max. Static Forward Volt @ 3A 25°C (Volts)	Max. Static Reverse Current 25°C (µA)	Max. Static Reverse Current 100°C (µA)	Recurrent Surge (Amps)	One Cycle Surge (Amps)	Recovery Time Max. (µsec)	Recovery Time Typ. (µsec)
1N5415	50	35	50	3	2	1.1	1	20	25	150	.150	.100
1N5416	100	70	100	3	2	1.1	1	20	25	150	.150	.100
1N5417	200	140	200	3	2	1.1	1	20	25	150	.150	.100
1N5418	400	280	400	3	2	1.1	1	20	25	150	.150	.100
1N5419	500	350	500	3	2	1.1	1	20	25	150	.250	.200

TECHNICAL BULLETIN R79

LO-VF FAST RECOVERY

Type ①	Peak Inverse Voltage (Volts)	RMS Voltage (Volts)	DC Blocking Voltage (Volts)	Avg. Rectified Current 55°C (Amps)	Avg. Rectified Current 100°C (Amps)	Max. Static Forward Volt @ 3A 25°C (Volts)	Max. Static Reverse Current 25°C (µA)	Max. Static Reverse Current 100°C (µA)	Recurrent Surge (Amps)	One Cycle Surge (Amps)	Recovery Time Max. (µsec)	Recovery Time Typ. (µsec)
1N5835	30	28	30	3	2	0.9	1	20	25	150	.100	.080
1N5836	50	35	50	3	2	0.9	1	20	25	150	.100	.080

TECHNICAL BULLETIN R104



All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: ① Types 1N5550-54 available in accordance with MIL-S-19500/420.
Types 1N5415-19 available in accordance with MIL-S-19500/411.
Types 1N5835-36 available in accordance with MIL-S-19500/484 (EL).

② Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time measured when rectifier recovers to .25 amp.

The 3 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.

Operating and storage temperature −193.8°C to +200°C.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

METOXILITE SILICON RECTIFIERS — ALSO AVAILABLE TO NEW MSFC/NASA AND MILITARY SPECIFICATIONS (JAN, JTX AND JTXV

200 TO 1000 VOLTS
LOW REVERSE LEAKAGE
SOLID INTERNAL CONSTRUCTION
SUPERIOR THERMAL SHOCK RESISTANCE
FOR NEW PACKAGING DESIGN

A multi-purpose, high current axial lead silicon rectifier, ideally suited to maximize small electronic package designs. Metoxilite (fused metal oxides) is fused to the metallurgically bonded junction/tungsten-pin assembly forming a "tough" subminiature package. Hermetically sealed and designed to meet stringent temperature cycling, humidity and other environmental requirements per MIL-STD-750A. A general purpose rectifier for use in military, space, industrial and consumer product applications, such as: power supplies, AC to DC converters and control circuits.

Type No.	Peak Inverse Voltage	RMS Voltage	DC Blocking Voltage	Average Rectified Current		Max. Static Forward Volt @ 1A	Max. Static Reverse Current		Recur-rent Surge	One Cycle Surge	Recovery Time ①	
				55°C	100°C	25°C	25°C	100°C			Max.	Typ.
	Volts	Volts	Volts	MA	MA	Volts	UA	UA	Amps	Amps	Usec	Usec

MEDIUM RECOVERY (t$_{rr}$) 2 MICROSECONDS

S2M	200	140	200	1000	750	1.2	1	25	10	50	2	1
S4M	400	280	400	1000	750	1.2	1	25	10	50	2	1
S6M	600	420	600	1000	750	1.2	1	25	10	50	2	1
S8M	800	560	800	1000	750	1.2	1	25	10	50	2	1
S0M	1000	700	1000	1000	750	1.2	1	25	10	50	2	1

TECHNICAL BULLETIN R69

FAST RECOVERY NANOSECOND REVERSE RECOVERY

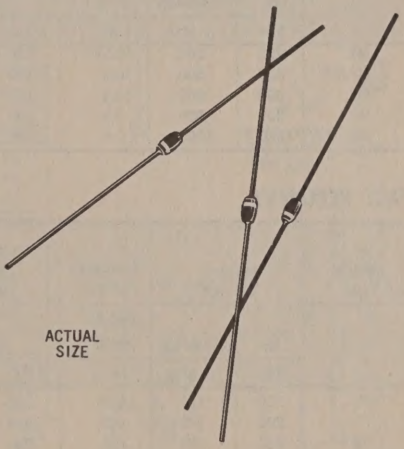
S2F	200	140	200	1000	750	1.2	1	25	6	25	.150	100
S4F	400	280	400	1000	750	1.2	1	25	6	25	.150	100
S6F	600	420	600	1000	750	1.2	1	25	6	25	.250	175
S8F	800	560	800	1000	750	1.2	1	25	6	25	.300	200
S0F	1000	700	1000	1000	750	1.2	1	25	6	25	.500	250

TECHNICAL BULLETIN R68

Operating and storage temperature —193.8°C to +200°C

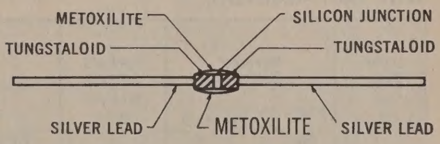
① Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current Recovery time measured when rectifier recovers to.25 amp.

1 AMP 55°C/NO HEAT SINK
3 AMP/MIL STANDARD 750


ACTUAL SIZE

(1N) TYPE

Device Type ①	Reverse Voltage		Forward Current ② Free Air	Reverse Current (Max.) I$_R$		Instan-taneous Forward Voltage V$_F$ @ I$_F$= 1.0Adc	Repetitive Surge Current	1 Cycle Surge Current tp=8.3m Sec.	Reverse Recovery Time ③ Trr		Thermal Impedance θJ—L °C/Watt	
	V$_R$	V$_{RM}$(wkg)	55°C	UAdc				A(pk)	µSec			
	Vdc	V(pk)	A	25°C	100°C	Vdc	A(pk)	I$_F$(surge)	Max.	Typ.	d=0	d=.37



MEDIUM RECOVERY (t$_{rr}$) 2 MICROSECONDS

1N5614	200	200	1.0	0.5	25	1.2	10	50	2	1	7	33
1N5616	400	400	1.0	0.5	25	1.2	10	50	2	1	7	33
1N5618	600	600	1.0	0.5	25	1.2	10	50	2	1	7	33
1N5620	800	800	1.0	0.5	25	1.2	10	50	2	1	7	33
1N5622	1000	1000	1.0	0.5	25	1.2	10	50	2	1	7	33

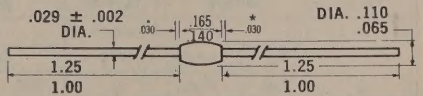
TECHNICAL BULLETIN R76

LEAD MATERIAL: 99.9% PURE SILVER
IN ACCORDANCE WITH MIL-S-13282A, GRADE A

FAST RECOVERY NANOSECOND REVERSE RECOVERY

1N5615	200	200	1.0	0.5	25	1.2	6	25	.150	.100	7	33
1N5617	400	400	1.0	0.5	25	1.2	6	25	.150	.100	7	33
1N5619	600	600	1.0	0.5	25	1.2	6	25	.250	.175	7	33
1N5621	800	800	1.0	0.5	25	1.2	6	25	.300	.200	7	33
1N5623	1000	1000	1.0	0.5	25	1.2	6	25	.500	.250	7	33

TECHNICAL BULLETIN R77



*LEAD DIAMETER UNCONTROLLED IN THIS AREA

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: ① Types 1N5614, 16, 18, 20, 22 available in accordance with MIL-S-19500/427.
Types 1N5615, 17, 19, 21, 23 available in accordance with MIL-S-19500/429.

② The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.

③ Recovery conditions: 0.5 amp forward current to —1.0 amp reverse current recovery time measured when rectifier recovers to —.25 amp. See Semtech Applications note and test procedure for details.

Operating and Storage Temperature —193.8°C to +200°C

Semtech reserves the right to change specifications without notice.

For all types on this page: THERMAL RESISTANCE from junction to heat sink θJL = 33°C/W with (d) length of lead from body to heat sink .375 inches.

SEMTECH

CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

METOXILITE LO-CURRENT SILICON RECTIFIERS

Metoxilite is Semtech's new multipurpose high current axial lead silicon rectifier, ideally suited for small electronic package design. Through utilization of new design and manufacturing techniques, the Metoxilite device provides the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case material are fused directly to the high temperature metallurgically bonded assembly. The Metoxilite device exceeds environmental requirements of current military and space program specifications. A general purpose rectifier suitable for all applications.

MEDIUM RECOVERY (t_{rr}) 2 MICROSECONDS

Device Type	Reverse Voltage		Forward Current	Reverse Current (Max.)		Instantaneous Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time 1	
			Free Air	I_R		V_F @ I_F =			Trr	
	V_R	V_{RM}(wkg)	55°C	UA dc		0.5 Adc		A (pk)	µs	
	Vdc	V (pk)	A	25°C	100°C	Vdc	A (pk)	I_F(Surge)	Max.	Typ.
M2	200	200	0.5	.100	7	1.1	5	25	2	1
M4	400	400	0.5	.100	7	1.1	5	25	2	1
M6	600	600	0.5	.100	7	1.1	5	25	2	1
M8	800	800	0.5	.100	7	1.1	5	25	2	1
M0	1000	1000	0.5	.100	7	1.1	5	25	2	1

TECHNICAL BULLETIN R99

FAST RECOVERY

Device Type	Reverse Voltage		Forward Current	Reverse Current (Max.)		Instantaneous Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time 1	
			Free Air	I_R		V_F @ I_F =			Trr	
	V_R	V_{RM}(wkg)	55°C	UA dc		0.5 Adc		A (pk)	ns	
	Vdc	V (pk)	A	25°C	100°C	Vdc	A (pk)	I_F(Surge)	Max.	Typ.
F1	100	100	0.5	.250	15	1.2	3	12.5	150	100
F2	200	200	0.5	.250	15	1.2	3	12.5	150	100
F4	400	400	0.5	.250	15	1.2	3	12.5	150	100
F5	500	500	0.5	.250	15	1.2	3	12.5	150	100

TECHNICAL BULLETIN R100

VERY FAST RECOVERY

Device Type	Reverse Voltage		Forward Cutrent	Reverse Current (Max.)		Instantaneous Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time 1
			Free Air	I_R		V_F @ I_F =			T_{rr}
	V_R	V_{RM}(wkg)	55°C	µA DC		0.5 Adc		A(pk)	ns
	Vdc	V (pk)	A	25°C	100°C	Vdc Max.	A (pk)	I_F(Surge)	Max.
T1	100	100	0.5	.250	15	1.2	3	12.5	100
T2	200	200	0.5	.250	15	1.2	3	12.5	100
T3	300	300	0.5	.250	15	1.2	3	12.5	100
T4	400	400	0.5	.250	15	1.2	3	12.5	100

TECHNICAL BULLETIN R107

(1N) TYPE

Device Type	Reverse Voltage		Forward Current	Reverse Current (Max.)		Instantaneous Forward Voltage	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3 ms	Reverse Recovery Time 1	
			Free Air	I_R		V_F @ I_F =			Trr	
	V_R	V_{RM}(wkg)	55°C	UA dc		0.5 Adc		A (pk)	µs	
	Vdc	V (pk)	A	25°C	100°C	Vdc	A (pk)	I_F(Surge)	Max.	Typ.
1N645	225	275	0.5	0.2	15	1.0	5	25	2	1
1N646	300	360	0.5	0.2	15	1.0	5	25	2	1
1N647	400	480	0.5	0.2	20	1.0	5	25	2	1
1N648	500	600	0.5	0.2	20	1.0	5	25	2	1
1N649	600	720	0.5	0.2	25	1.0	5	25	2	1

Available in JAN, JTX and JTXV 1N645-1, 1N647-1 and 1N649-1.

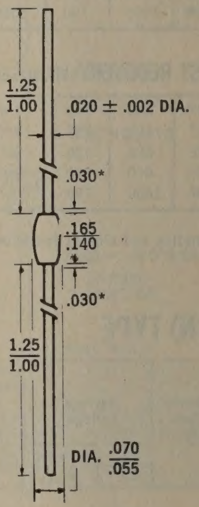
TECHNICAL BULLETIN R101

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: 1 Recovery Conditions: 0.5 amp forward current to —1.0 amp reverse current. Recovery time measured when rectifier recovers to —.25 amp. See Semtech Applications note and test procedure for details.

Operating and Storage Temperature —193.8°C to +200°C.

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A



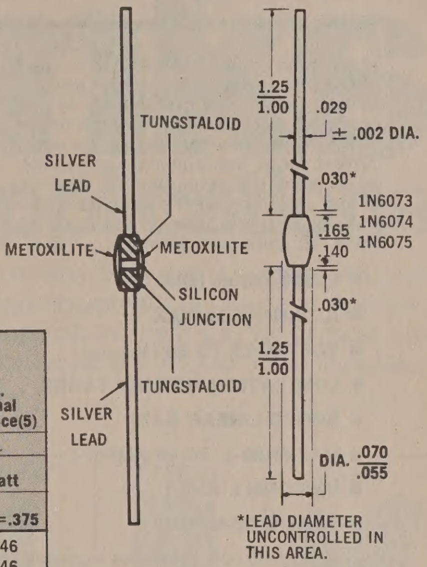
*Lead diameter uncontrolled in this area.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

METOXILITE LO-V_F SUPER-FAST RECOVERY SILICON RECTIFIERS

A high efficiency fast recovery axial lead silicon rectifier for high frequency applications. Ideally suited as core drivers and design of high frequency converters. The Semtech Metoxilite case provides the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case material are fused directly to the high temperature bonded tungstaloid pin junction assembly. The Super Fast Metoxilite is suitable for use in consumer, industrial, military and space programs.



*LEAD DIAMETER UNCONTROLLED IN THIS AREA.

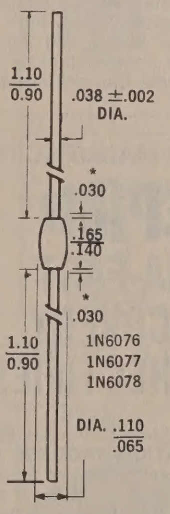
*JEDEC (EIA) REGISTERED INFORMATION
JAN, JANTX AND JTXV TO MIL-S-19500/503 (EL) ALSO AVAILABLE

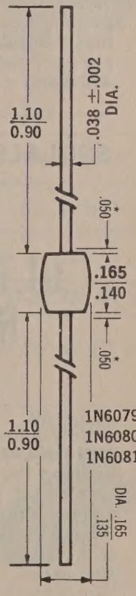
Device Type	* Reverse Voltage		Forward Current (1)	* Forward Current (2)	* Reverse Current (Max.)		Instantaneous Forward Voltage (4)	* Instantaneous Forward Voltage (4)	* Capacitance @ 12V DC	* 1 Cycle Surge Current tp= 6.3 ms	* Reverse Recovery Time (3)	* Max. Thermal Impedance(5)	
					I_R		V_F @ I_F =1.5 Adc	V_F @ I_F =9.4 A(pk)			T_{rr}	$\theta_{J\text{-}L}$	
	V_R	V_{RM} (WKg)			UAdc				Picofarads	A(pk)	ns	°C/Watt	
	Vdc	V(pk)	A	A	25°C	100°C	Vdc (Max.)	V(pk) Max.	Max.	I_F(Surge)	Max.	d=0	d=.375
1N6073	50	50	1.5	3.0	1.0	50	1.2	2.04	24	35	30	13	46
1N6074	100	100	1.5	3.0	1.0	50	1.2	2.04	24	35	30	13	46
1N6075	150	150	1.5	3.0	1.0	50	1.2	2.04	24	35	30	13	46
							3.0 Adc	18.8 A(pk)				TECHNICAL BULLETIN R111	
1N6076	50	50	3.0	6.0	5.0	100	1.2	1.76	58	75	30	8.5	25
1N6077	100	100	3.0	6.0	5.0	100	1.2	1.76	58	75	30	8.5	25
1N6078	150	150	3.0	6.0	5.0	100	1.2	1.76	58	75	30	8.5	25
							5.0 Adc	37.7 A(pk)				TECHNICAL BULLETIN R112	
1N6079	50	50	5.0	12.0	10	500	0.97	1.5	230	175	30	5	23.5
1N6080	100	100	5.0	12.0	10	500	0.97	1.5	230	175	30	5	23.5
1N6081	150	150	5.0	12.0	10	500	0.97	1.5	230	175	30	5	23.5
												TECHNICAL BULLETIN R116	

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: (1) At T_L = 25°C, .375 inches from diode body.
(2) At T_L = 70°C, 0 inches from diode body.
(3) Recovery Conditions: 0.5 amp forward current to 1.0 am reverse current. Recovery time measured when rectifier recovers to 0.25 amp. See applications note AE103 and test info sheet 900132 (B).
(4) V_F is measured at pulse I_F duration — 8.0 milliseconds max.
(5) See back side of data sheet for max. power derating curves and $\theta_{J\text{-}L}$ information.

Operating and Storage Temperature −65°C to +150°C.





METOXILITE MINI-STUD SUPER-FAST SILICON RECTIFIERS

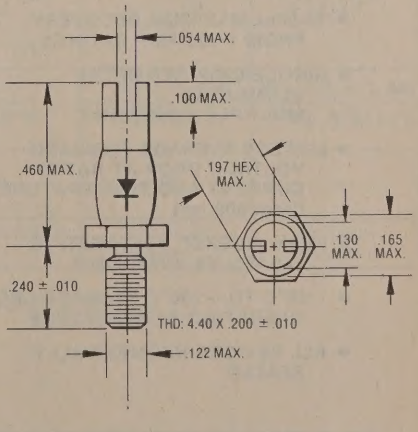
A high efficiency fast recovery axial lead silicon power rectifier for high frequency applications. Ideally suited for design of high frequency converters. The Semtech Metoxilite case provides the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case material are fused directly to the high temperature bonded tungstaloid pin-junction assembly. The super fast Metoxilite is suitable for use in consumer, industrial, military and space programs.

ELECTRICAL SPECIFICATIONS @ 25°C UNLESS NOTED

⑤ Device Type	Reverse Voltage		① Max. Avg. Forward Current	④ Max. Fwd. Voltage Drop	Max. Reverse Leakage Current I_R @ V_R		② Max. Rev. Recovery Time	Max. Cap. @ V_r=12V	③ Max. Surge Current	Max. Thermal Impedance
	V_R	V_{RM}	I_D	V_f @ 5.0A	25°C	100°C	T_{rr}	C	I_{sm}	$R\theta_{jc}$
	VDC	V(pk)	ADC	VDC	µA	µA	ns	pF	A	°C/W
MFF05	50	50	14.0	.93	10	500	30	230	175	4
MFF10	100	100	14.0	.93	10	500	30	230	175	4
MFF15	150	150	14.0	.93	10	500	30	230	175	4

NOTES: ① Avg. rectified forward current (I_O) @ stud case temperature I_C = 100°C derate linearly to zero @ 175°C case.
② Reverse recovery time (T_{rr}) @ I_f = 0.5A, I_r = 1.0A, I_{rec} = 0.25A. (See Semtech test info sheet SIS 900134.)
③ Non-repetitive sinusoidal surge @ pulse width = 8.3 mS
④ Pulse width = 8 mS
⑤ Cathode to stud is standard, for reverse polarity add suffix R to part number (i.e. MFF05R is anode to stud).

MAXIMUM RATING: Operating and storage temperature range is −65°C to +175°C.
Stud torque maximum is 28 inch-ounces



Semtech reserves the right to change specifications without notice.

EPITAXIAL POWER TRANSISTORS

. . . FOR FAST SWITCHING POWER APPLICATIONS

SSDI
POWER SEMICONDUCTORS

These high speed SSDI epitaxial base transistors feature fast turn-on and turn-off for switching efficiency at high operating frequencies. The high linear gain of these devices across the entire current range can eliminate or reduce driver transistor requirements. This line of fast-switching NPN power transistors consists of three basic series rated 10 amps, 40 amps and 90 amps.

- **t_{on} 300-600 ns MAX.**
- **$t_{(off)}$ 300-600 ns MAX.**
- **VOLTAGES TO 500 $V_{CEO(SUS)}$**
- **LOW SATURATION VOLTAGES**
- **BROAD LINEAR GAIN**
- **MAXIMUM I_C TO 90 AMPS**
- **UNIFORM t_r AND t_f**
- **f_T FROM 20-60 MHz**

$V_{CEO(SUS)}$ to 500 volts provides increased voltage safety margins; excellent S.O.A. permits applications where high forward bias peak power is required. All devices are hard solder construction to withstand extreme thermal variation.

SSDI ALSO MANUFACTURES:

EPION™

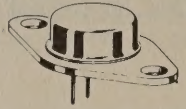
ULTRA-FAST RECOVERY RECTIFIERS

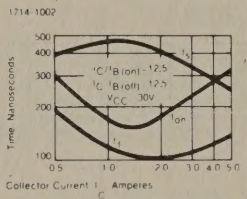
A truly unique, State-of-the-Art, **EPION™ ION-IMPLANTATION PROCESS** has enabled the development of these single-chip rectifiers, in current ratings from 1-100 AMPS, eliminating the inherent reliability problems experienced with competitive multiple-junction rectifiers.

- **10-90ns MAXIMUM RECOVERY FROM 1-100 AMP RATINGS**
- **SINGLE-CHIP GEOMETRY ELIMINATES MULTIPLE-JUNCTIONS**
- **LOWEST AVERAGE FORWARD VOLTAGE DROP AT RATED CURRENT AND TEMPERATURE (from 600 mv)**
- **PEAK INVERSE VOLTAGES TO 150 VOLTS AVAILABLE**
- **−55°C TO +200°C STORAGE AND OPERATING TEMPERATURE**
- **ALL DEVICES HERMETICALLY SEALED**

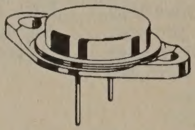
TYPICAL SWITCHING SPEEDS

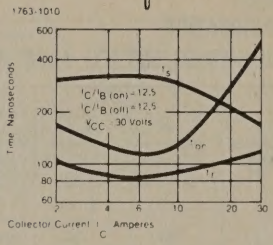
10 AMP (PEAK)
Series 1714, 1716, 1718, 1814



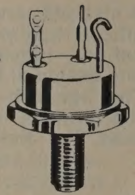


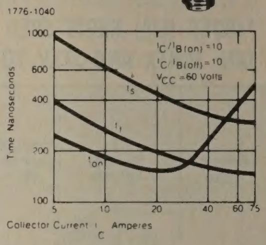
20-40 AMP (PEAK)
Series 1723, 1743, 1748, 1763, 1768, 1843





65-90 AMPS (PEAK)
Series 1756, 1776, 1781, 1856





CHARACTERISTICS

Jedec or Type No.	Pkg.	Peak Current I_C, Amps	Voltage $V_{CEO(SUS)}$	P_D @ T_C=25°C / T_C=100°C	h_{FE} @ I_C/V_{CE}	f_T typical	Additional* Features
1714	TO-66	10	40-180	44/25	20@2A/2V 20@5A/2V	60MHz	Low Cost
1716	TO-61	10	60-180	88/50	20@2A/2V 20@5A/2V	60MHz	Military Copper Base
1718	TO-111	10	60-180	58/33	20@2A/2V 20@5A/2V	60MHz	Isolated Collector Copper Base
1814	TO-66	10	200-375	44/25	20@1A/2V 20@2A/2V 20@5A/2V	50MHz	High Voltage
1723	TO-3	20	40-180	150/85	20@5A/4V 20@10A/4V	40MHz	Low Cost
2N5038	TO-3	30	90	140/80	20@12A/5V	60MHz	Low Cost
2N5039	TO-3	30	75	140/80	20@10A/5V	60MHz	Low Cost
2N5929-31	TO-3	40	80-160	175/100	20@10A/4V	40MHz	Guaranteed gain at 30 amps
2N5932-34	TO-3	40	60-140	175/100	20@20A/4V	40MHz	Guaranteed gain at 30 amps
2N5935-37	TO-3	40	80-160	175/100	20@30A/4V	40MHz	Guaranteed gain at 40 amps
1743	TO-3	40	40-180	175/100	20@10A/4V 20@20A/4V 20@30A/4V	40MHz	Guaranteed gain at 30 amps (1)
1763	TO-3	40	40-180	175/100	20@10A/2V 20@20A/2.5V 20@30A/3V	40MHz	Low Leakage Military
2N6046-48	TO-63	40	60-140	200/114	20@20A/4V	40MHz	New JEDEC Series
1748	TO-63	40	40-180	200/114	20@10A/4V 20@20A/4V 20@30A/4V	40MHz	Popular TO-63 package
2N1936	TO-63	40	60	200/150	10@10A/10V	40MHz	Low Leakage, Military
2N1937	TO-63	40	80	200/150	10@10A/10V	40MHz	Low Leakage, Military
1843	TO-3	30	200-375	175/100	20@5A/5V 15@10A/5V 10@20A/5V	25MHz	High Voltage
1776	**TO63****	75	60-180	250/150	15@40A/3V 15@60A/3V	30MHz	Low Leakage Military, Single Chip
1856	**TO63****	65	200-350	250/150	15@30A/3V 15@40A/3V	20MHz	High Voltage Single Chip

*All 20 amp and above have copper base
( ) 20@30A/4V has guaranteed gain at 40 amps

**** Also available in TO81 package**

Complete specifications and pricing on request.

SOLID STATE DEVICES, INC. SSDI

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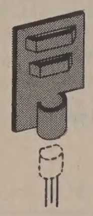
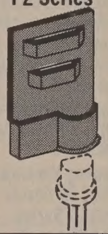
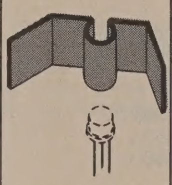
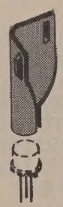
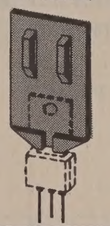
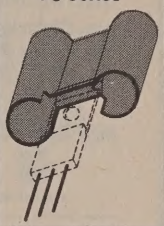
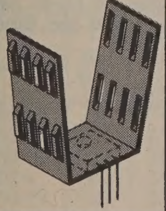
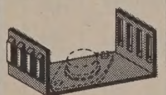
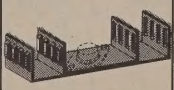
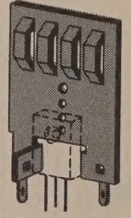
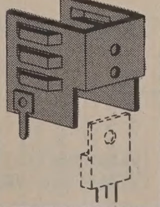
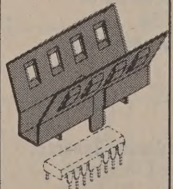
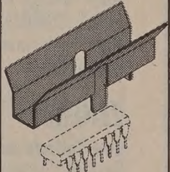
Staver...
Heat Sinks
for Transistor and I.C. applications

Staver Thermoflags® and Thermovanes® combine the principles of radiation, convection and conduction for superior heat dissipation. Four distinct benefits result: they are *lightweight* and *compact* because they provide efficient performance in smaller sizes. Simple design means they can be made on high speed production equipment at *low cost*. And they are *flexible* in application; there's a Staver heat sink available for most popular transistors and integrated circuit packages.

Thermoflags Readily adaptable to almost any space limitations.

	F1 Series	F2 Series	F5 Series	F6 Series	F7 Series	F8 Series
						
MODELS	F1-1, -3, -5, -7	F2-7	F5-5A, -5B, -5C, -5D, -7A, -7D, -8-1, -9-1	F6-1, -1L, -5, -5L	F7-1,-2,-3	F8-3, -4, -5, -6
SIZE(S)	.75"H x .50"W	.75"H x .50"W	.25"H x .62"W to 1.5"H x 1"W	1.25"H x .55"W	1.34"H x .7"W to 1.84"H x .7"W	.75 or .84" H x 1" W
THERM. RESIST. °C per WATT	68 to 72	72	24 to 57	46 to 47	38 to 40	27
CASE TYPE	TO -1, 5, 9, 18, 92, 98	All TO-92, -98.	TO-5, 9, 92	TO-1, 5, 9	TO-202, 220	TO-202, 220, 126, 127

Thermovanes For vertical or horizontal mounting, the wing design of Thermovanes is adaptable to low to high power transistors and I.C's.

	V1 & V2 Series	V3 Series	V3 Series	V4 Series	V6 Series	V7 Series	V8 Series
							
MODELS	V1-3, -5, V2-1, -5	V3-3, -5, V3-7-96, -224	V3-3-2, 5-2	V4-3-128, -3-192	V6-1, -2	V7-1, -2, -3, -4, -5	V8-1, -2, -3, -4, -5, -800
SIZE(S)	1"L & 1.19"L, 1"W & 1.19"W, 1"H or 2"H	1"W x 1.5"L x 1.1"H to 3.5"H	1.0"W x 1.5"L to 1.0"W x 3.12"L	2"H x 1.38"W to 3"H x 1.38"W	1"H x .82"W	1.35"H x 1.5"L	.43"H to .76"H x 1.5"L
THERM. RESIST. °C per WATT	8.0 to 10.8	6.4 to 9.5	5.6 and 4.5	15.1 and 12.5	20	16	24
CASE TYPE	TO-3, 8, 36, 66, 126, 127, 220AA, SGS i.c.s.	TO -3, 66, 220	TO-3, 66, 126, 220,	TO-202, 220AB, 126, 127	TO-126, 202, 220, 127	Dual In-Line Packages	Dual In-Line Packages

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TRW POWER SEMICONDUCTORS

...Serving Many Markets

TRW Power Semiconductors manufactures a line of quality products for the military, computer, industrial, avionics and automotive markets. The product line includes such power devices as high voltage Darlingtons, high current Schottky diodes, fast recovery rectifiers, and fast switching transistors. Additional quality products manufactured are varactor diodes, low voltage Avalanche zeners, low current zeners, AGC diodes, high voltage rectifiers and custom assemblies.

Among the many applications for the products are switching regulated power supplies, motor controls, electronic ignitions, instruments, and portable battery operated equipment.

TRW Power Semiconductors offers the best combination of reliability, quality control, volume production capability, utilizing the latest engineering advances and manufacturing techniques.

DARLINGTONS

High Voltage Darlington Transistors	SVT6000 thru SVT6253

SWITCHING TRANSISTORS

Power Switching Transistors	
Low Voltage NPN	2N4305, 2N4307 and SVT60-5 2N6579 thru 2N6584 2N6585 thru 2N6590 2N5326 thru 2N5331
High Voltage NPN	SVT200-10 thru SVT300-10 SVT250-5 thru SVT450-5 SVT350-3 thru SVT450-3 SVT400-12

RECTIFIER DIODES

Power Schottky Diodes	SD-41 and SD-51 IN6095 thru IN6098
Axial-Leaded Fast Recovery Rectifiers	DSR3050 thru 31000 DSR5050-51000 IN5415 thru 5420 IN5615, 5617, 5619, 5621, 5623, IN5802 thru IN5811
Ultra-Fast Power Diodes	SVD50-6 thru SVD100-6 SVD50-12 thru SVD450-12 1N5409 and 1N5410
High Voltage Rectifiers to MIL-S-19500/142A	
High Performance Rectifiers	
Microdiodes	

ZENERS

Low Voltage Avalanche Zeners	
General Purpose LVA Zeners	LVA43A thru LVA100A
High Performance LVA Zeners	LVA343A thru LVA3100A
High Performance, Low Current—250μA LVA Zeners	LVA450A thru LVA498A
LVA Zeners in Microminiature Packages	
Microminiature LVA Zeners	PD6201 thru PD6210
LVA Chips	CLVA43A thru CLVA100A
LVA Temperature Compensated Reference Elements	PS1300A thru PS1314A
High Performance Zeners	
One Watt Zener Diodes	1N4649 thru 1N4661
Low Current 50μA Zeners	1N4678 thru 1N4697 1N6082 thru 1N6091
Micro Zeners	PD6000 thru PD6014
Low Noise Zeners	1N4099 thru 1N4104 1N4614 thru 1N4627
Zener Diodes to MIL-S-19500/127F	1N4370A thru 1N4372A 1N746A thru 1N759A
Diodes to MIL-S-19500/437	1N5521B thru 1N5532B

VARACTOR DIODES

EIA Standard and JAN Varicaps	
Varactor Diodes to MIL-S-19500/329B	1N4801 thru 1N4815
EIA Low Voltage Varicaps	1N4786 thru 1N4800
Low Voltage, Low Leakage Varicaps	V7 thru V100
Low Voltage, Ultra-Low Leakage Varicaps	V900 thru V982
High Voltage Varicaps	V7E thru V100E
High Voltage, Ultra-Low Leakage Varicaps	V900E thru V982E
Tuning Varicaps	
1N5139 Series	1N5139 thru 1N5148
1N950 Series	1N950 thru 1N956
HI-Q Varicaps	
Standard HI-Q Varicaps	PC107 thru PC141
Ultra HI-Q Varicaps	PG107 thru PG347
Hyper "Q" Tuning Varicaps	1N5681 thru 1N5710
High Capacitance Varicaps	PQ1150 thru PQ2500

SPECIAL PRODUCTS

Assemblies	Zener, Schottky & Rectifiers
Diodes for AGC Application	PSV503 and PSV503A
Hybrid Chips	Zeners

CHIPS

Ask us about our hybrid chip capabilities on Power Switching Transistors, Power Switching Rectifiers, Zeners and Varicaps.

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TRW POWER SEMICONDUCTORS

DARLINGTONS

HIGH VOLTAGE DARLINGTON TRANSISTORS

This is a series of high voltage, high current Monolithic Darlington amplifiers for use in high speed power circuits. Typical applications include automotive ignitions, switching regulated power supplies and motor controls. High resistance to forward secondary breakdown has been diffused into this device family. The units are mounted in the EIA standard TO-3 package.

TO-3

Ratings and Characteristics (T_{CASE} = 25°C)

Type	Max Ratings		Min $V_{CEO(SUS)}$ Vdc	Max Collector Saturation Voltage			Min Current Gain h_{FE} @ V_{CE} = 5Vdc	Max Switching Time V_{CC} = 300Vdc				
	Max V_{CBO} Vdc	Max $I_{C(CONT)}$ Adc		$V_{CE(SAT)}$ Vdc	I_C Adc	I_B Adc		I_C Adc	$I_{B1} = I_{B2}$ Adc	t_f µsec	t_r µsec	t_s µsec
SVT6060	350	20	300	2.0	20	2.0	40 @ Ic = 10 Adc 30 @ Ic = 15 Adc	10	1.0	0.4	1.0	2.5
SVT6061	400		350									
SVT6062	450		400									
SVT6000	400	15	300	2.0	15	1.5	60 @ Ic = 5 Adc 40 @ Ic = 10 Adc	10	1.0	0.4	1.0	2.5
SVT6001	450		350									
SVT6002	500		400									
SVT6251	400	10	350	2.0	10	2.0	60 @ Ic = 3 Adc 50 @ Ic = 5 Adc	5	0.5	0.25	1.0	2.5
SVT6252	450		400									
SVT6253	500		450									

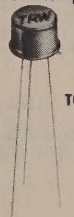
Storage Temperature: —65°C to +200°C
Junction Temperature: —50°C to +150°C

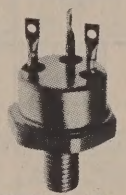
θ_{jc} — SVT60XX Series: 1.3°C/W
θ_{jc} — SVT62XX Series: 1.5°C/W

D.C. Power Dissipation: SVT60XX Series: 96W
D.C. Power Dissipation: SVT62XX Series: 84W

POWER SWITCHING TRANSISTORS

TRW's power switching transistors have been field proven in such applications as motor controls, uninterruptible power supplies, switching regulators, and converters. For efficient operation in all high speed switching applications, TRW power NPN transistors provide a superior mix of capabilities including: 60 to 450 volts V_{CEO}, 3 to 30 amp capability, fastest switching speeds on the market, highest resistance to secondary breakdown and proven high temperature reverse bias reliability.


TO-5/TO-39


TO-59 Isolated

LOW VOLTAGE NPN

Ratings and Characteristics (T_{CASE} = 25°C)

Type	Max Ratings			Max Collector Saturation Voltage			Min D.C. Current Gain			Max Switching Times					Max Ratings		Package
	Max V_{CEO} Vdc	Max V_{CBO} Vdc	Max I_C Adc	$V_{CE(sat)}$ Vdc	I_C Adc	I_B Adc	h_{FE}	V_{CE} Vdc	I_C Adc	V_{CC} Vdc	I_C Adc	$I_{B1} = I_{B2}$ Adc	t_{on} ($t_d + t_r$) µsec	t_{off} ($t_s + t_f$) µsec	P_T W	θ_{j-c} °C/W	
SVT60-5	60	60	5	1.0	5	0.5	40	2	1	30	1	0.02	0.14	0.40	11	15.0	TO-5
SVT80-5	80	80	5	1.0	5	0.5	40	2	1	30	1	0.02	0.14	0.40	11	15.0	TO-5
2N4305	80	120	5	1.0	5	0.5	50	2	1	30	1	0.02	0.2	0.70	11	15.0	TO-5
2N4307	60	100	5	1.0	5	0.5	50	2	1	30	1	0.02	0.2	0.70	11	15.0	TO-5
2N5326	80	100	5	1.0	5	0.5	50	2	1	30	1	0.02	0.2	0.70	30	5.0	TO-59 Isolated
2N5328	80	120	10	1.0	10	1.0	30	5	5	30	1	0.02	0.2	1.10	53	3.3	TO-59 Isolated
2N5329	100	120	20	1.8	20	2.0	15	5	20	21	10	0.5	0.35	1.10	116	1.5	TO-61 Isolated
2N5330	100	120	30	2.0	30	3.0	15	5	30	21	10	0.5	0.35	1.25	140	1.25	TO-61 Isolated
2N5331	100	120	30	2.0	30	3.0	15	5	30	21	10	0.5	0.35	1.25	175	1.0	TO-63

Storage Temperature: —65 to +200°C   Operating Temperature: —65 to +200°C

HIGH VOLTAGE NPN

Ratings and Characteristics (T_{CASE} = 25°C)

Type	Max Ratings			Max Collector Saturation Voltage			Min D.C. Current Gain			Max Switching Times V_{CC} = 150Vdc					Max Ratings		Package*
	Max V_{CEO} Vdc	Max V_{CBO} Vdc	Max I_C Adc	$V_{CE(sat)}$ Vdc	I_C Adc	I_B Adc	h_{FE}	V_{CE} Vdc	I_C Adc	I_C Adc	$I_{B1} = I_{B2}$ Adc	t_r µsec	t_f µsec	t_s µsec	P_T W	θ_{j-c} °C/W	
SVT200-10	200	225	20	1.5	10	1.0	15	5	10	10	1.0	0.25	0.35	1.75	140	1.25	TO-3
SVT250-5	250	275	10	1.5	5	0.5	7	3	5	5	0.5	0.30	0.50	2.00	116	1.5	TO-3
SVT250-10	250	275	20	1.5	10	1.0	15	5	10	10	1.0	0.25	0.35	1.75	140	1.25	TO-3
SVT300-5	300	325	10	1.5	5	0.5	7	3	5	5	0.5	0.50	0.50	2.00	116	1.5	TO-3
SVT300-10	300	325	20	1.5	10	1.0	15	5	10	10	1.0	0.25	0.35	1.75	140	1.25	TO-3
SVT350-3	350	375	6	1.0	3	0.6	15	5	3	3	0.6	0.4	0.5	2.00	116	1.5	TO-3
2N6579	350	450	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.50	2.00	125	1.5	TO-3
2N6585	350	450	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.50	2.00	125	1.5	TO-61I
2N6582	350	425	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO-3
2N6588	350	500	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO61I
SVT400-3	400	500	6	1.0	3	0.6	15	5	3	3	0.6	0.4	0.5	2.00	116	1.5	TO-3
2N6580	400	475	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.5	2.00	125	1.5	TO-3
2N6583	400	500	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO-3
2N6589	400	500	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO61I
2N6586	400	550	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.5	2.00	125	1.5	TO-61I
SVT400-12	400	600	15	1.0	12	2.4	10	5	12	12	2.4	0.5		2.0	150	1.2	TO-3
SVT450-3	450	550	6	1.0	3	0.6	15	5	3	3	0.6	0.4	0.5	2.00	116	1.5	TO-3
2N6581	450	450	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.5	2.00	125	1.5	TO-3
2N6587	450	450	10	1.5	5	1.0	7	3	5	5	1.0	0.50	0.5	2.00	125	1.5	TO-61I
2N6584	450	550	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO-3
2N6590	450	550	10	1.5	7	1.4	7	3	7	7	1.4	0.50	0.50	2.00	125	1.5	TO61I

Storage Temperature: —65 to +200°C
Operating Temperature: —65 to +200°C

*TO-61 Isolated and TO-63 packages are available upon request
Suffix A = TO-63
Suffix B = TO-61 Isolated
Suffix C = TO-3

TRW POWER SEMICONDUCTORS

AN ELECTRONIC COMPONENT DIVISION OF TRW INC. 14520 AVIATION BOULEVARD,
LAWNDALE, CALIFORNIA 90260 • (213) 679-4561 • TWX: 910-325-6206 • TELEX: 67-7148

TRW POWER SEMICONDUCTORS

RECTIFIER DIODES

POWER SCHOTTKY DIODES

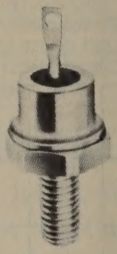
These devices are designed for operation in low voltage, high current power supplies. Improved barrier formation techniques allow operation at higher temperatures than previously possible

Electrical Characteristics ($T_{JUNCTION} = 125°C$)

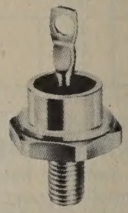
Type	Max Forward Voltage @ 30Adc Vdc	Max Forward Voltage @ 60Adc Vdc	Max Reverse Current @ 35Vdc mA	Max Thermal Impedance °C/W	Max Junction Capacitance @ —5V pF	Package
SD-41	0.55		100	2	2000	DO-4
SD-51		0.6	200	1	4000	DO-5

Type	Max Forward Voltage 25A @ 70°C	Max Forward Voltage 50A @ 70°C	Max Reverse Current 30V	Max Reverse Current 40V	Max Thermal Impedance °C/W	Max Junction Capacitance @ —1V pF	Package
IN6095	0.86V		250ma		2	6000	DO-4
IN6096	0.86V			250ma	2	6000	DO-4
IN6097		0.86V	250ma		1	7000	DO-5
IN6098		0.86V		250ma	1	7000	DO-5

Storage Temperature: —55°C to +165°C Operating Temperature: —55°C to +150°C



DO-4



DO-5 Schottky

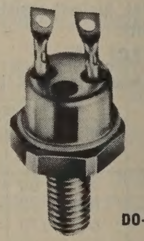
ULTRA-FAST POWER DIODES

These devices are designed for use in power control and conversion circuits where high efficiency and reliability, coupled with small size and weight are requirements. The ultra-fast switching speed provides important reliability and performance advantages in switching regulators, converters and inverters that operate at 15 to 20kHz and above.

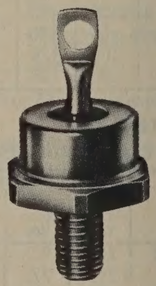
Electrical Characteristics ($T_{CASE} = 25°C$)

Type	PIV Vdc	I_F Adc	V_F @ I_F Vdc	I_R @ PIV μA	I_{SURGE} A	T_{RR} MAX nsec	$\theta_{j\text{-}c}$ °C/W	Package
SVD50-6	50	6	1.2	10	60	50	2.5	DO-4, DO-4 Isolated
SVD50-12	50	12	1.2	10	120	50	2.5	DO-4, DO-4 Isolated
SVD50-30	50	30	1.2	10	200	70	1.5	DO-5, DO-5 Isolated
SVD100-6	100	6	1.2	10	60	50	2.5	DO-4, DO-4 Isolated
SVD100-12	100	12	1.2	10	120	50	2.5	DO-4, DO-4 Isolated
SVD100-30	100	30	1.2	10	200	70	1.5	DO-5, DO-5 Isolated
IN5410	150	12	1.0	10	200	70	2.0	DO-4
IN5409	150	30	1.2	10	200	70	1.5	DO-5
SVD300-12	300	12	1.5	10	120	70	2.5	DO-4 DO-4 Isolated
SVD350-12	350	12	1.5	10	120	70	2.5	DO-4, DO-4 Isolated
SVD400-12	400	12	1.5	10	120	70	2.5	DO-4, DO-4 Isolated
SVD450-12	450	12	1.5	10	120	70	2.5	DO-4, DO-4 Isolated

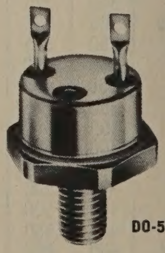
Storage Temperature: —65°C to +175°C Operating Temperature: —65°C to +175°C



DO-4 Isolated



DO-5



DO-5 Isolated

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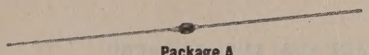
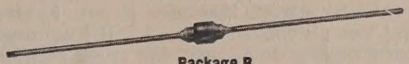
TRW POWER SEMICONDUCTORS

AXIAL-LEADED FAST RECOVERY RECTIFIERS

These devices are designed for use in power control and conversion circuits where high efficiency and low weight are desired. TRW proprietary diffusion and doping techniques make them the fastest high current rectifiers available. They are supplied in TRW double slug package in two axial leaded configurations.



Package A
For All 3 Watt Series



Package B
For All 5 Watt Series

DSR 3000X/3 WATT SERIES

TRW Part No.	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 1A
		Max	25°C	100°C		Max
	Volts	nSec	μA	μA	pFd	Volts
DSR3050X	50	7.5	5	80	125	1.0
DSR3100X	100	7.5	5	80	100	1.0
DSR3150X	150	7.5	5	80	75	1.0
DSR3200X	200	7.5	5	80	75	1.1
DSR3250X	250	15	5	80	75	1.1
DSR3300X	300	15	5	80	50	1.1
DSR3400X	400	30	10	160	50	1.5
DSR3500X	500	30	10	160	50	1.8
DSR3600X	600	50	10	160	40	1.8
DSR3700X	700	50	10	160	40	1.8
DSR3800X	800	75	10	160	40	1.8
DSR31000X	1000	100	10	160	35	1.8

Maximum recommended operating junction temp. = 150°C.
θ_{JC} <50°C/Watt (⅜″ lead).

DSR 3000F/3 WATT SERIES

TRW	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 1A
		Max	25°C	100°C		Max
Part No.	Volts	nSec	μA	μA	pFd	Volts
DSR3050F	50	15	5	80	125	1.0
DSR3100F	100	15	5	80	100	1.0
DSR3150F	150	15	5	80	75	1.0
DSR3200F	200	15	5	80	75	1.1
DSR3250F	250	30	5	80	75	1.1
DSR3300F	300	30	5	80	50	1.1

Maximum recommended operating junction temp. = 160°C.
θ_{JC} <50°C/Watt (⅜″ lead).

DSR 3000S/3 WATT SERIES

TRW Part No.	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 1A
		Max	25°C	100°C		Max
	Volts	nSec	μA	μA	pFd	Volts
DSR3050S	50	30	2	40	125	1.0
DSR3100S	100	30	2	40	100	1.0
DSR3150S	150	30	2	40	75	1.0
DSR3200S	200	30	2	40	75	1.0
DSR3250S	250	60	2	40	75	1.0

Maximum recommended operating junction temp. = 175°C.
θ_{JC} <50°C/Watt (⅜″ lead).

IN5600/3 Watt Series

JEDEC Part No.	Spec V_R (90% E_S)	½-1-¼A trr	Max I_R @ V_R		Cap. V_R = 6V	V_F @ 1A
		Max	25°C	175°C		Max
	Volts	nSec	μA	μA	pFd	Volts
IN5615	200	150	500	1.5	45	1.2
IN5617	400	150	500	1.5	35	1.2
IN5619	600	250	500	1.5	25	1.2
IN5621	800	300	500	1.5	20	1.2
IN5623	1000	500	500	1.5	15	1.2

Maximum recommended operating junction temp. = 175°C
θ_{JC} <50°C/Watt (⅜″ leads).

IN5800/3 Watt Series

JEDEC Part No.	Spec V_R (90% E_S)	.5-.5-.05A trr	Max I_R @ V_R		Cap. V_R = 10V	V_F @ 1A
		Max	24°C	100°C		Max
	Volts	nSec	μA	μA	pFd	Volts
IN5802	50	25	1.0	50	15	.875
IN5803	75	25	1.0	50	15	.875
IN5804	100	25	1.0	50	15	.875
IN5805	125	25	1.0	50	15	.875
IN5806	150	25	1.0	50	15	.875

Maximum recommended operating junction temp. = 175°C
θ_{JC} <25°C/Watt (⅜″ leads).

DSR 5000X/5 WATT SERIES

TRW Part No.	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 4A
		Max	25°C	100°C		Max
	Volts	nSec	μA	μA	pFd	Volts
DSR5050X	50	7.5	10	350	550	1.0
DSR5100X	100	7.5	10	350	450	1.0
DSR5150X	150	7.5	10	350	350	1.0
DSR5200X	200	7.5	10	350	350	1.1
DSR5250X	250	15	10	350	300	1.1
DSR5300X	300	15	10	350	250	1.1
DSR5400X	400	30	20	700	250	1.5
DSR5500X	500	30	20	700	225	1.8
DSR5600X	600	50	20	700	200	1.8
DSR5700X	700	50	20	700	200	1.8
DSR5800X	800	75	20	700	175	1.8
DSR51000X	1000	100	20	700	150	1.8

Maximum recommended operating junction temp. = 150°C.
θ_{JC} <25°C/Watt (⅜″ leads).

DSR 5000F/5 WATT SERIES

TRW Part No.	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 4A	
		Max	25°C	100°C		Nom	Nom
	Volts	nSec	μA	μA	pFd	Volts	Volts
DSR5050F	50	15	10	350	550	.82	1.0
DSR5400F	100	15	10	350	450	.84	1.0
DSR5150F	150	15	10	350	350	.86	1.0
DSR5200F	200	15	10	350	350	.88	1.1
DSR5250F	250	30	10	350	300	.90	1.1

Maximum recommended operating junction temp. = 160°C.
θ_{JC} <25°C/Watt (⅜″ leads).

DSR 5000S/5 WATT SERIES

TRW Part No.	Spec V_R (90% E_S)	½-1-¼ A trr	Max I_R @ V_R		Max C_O	V_F @ 4A	
		Max	25°C	100°C		Nom	Nom
	Volts	nSec	μA	μA	pFd	Volts	Volts
DSR5050S	50	30	5	175	550	.82	1.0
DSR5100S	100	30	5	175	450	.83	1.0
DSR5150S	150	30	5	175	350	.84	1.0
DSR5200S	200	30	5	175	350	.85	1.0
DSR5250S	250	60	5	175	300	.86	1.0
DSR5300S	300	60	5	175	250	.87	1.0

Maximum recommended operating junction temp. = 175°C.
θ_{JC} <25°C/Watt (⅜″ leads).

IN5400/5 Watt Series

JEDEC Part No.	Spec V_R (90% E_S)	½-1-¼A trr	Max I_R @ V_R		Cap. V_R = 0	V_F @ 3A
		Max	25°C	175°C		Max
	Volts	nSec	μA	μA	pFd	Volts
IN5415	50	150	1.0	1.0	200	1.1
IN5416	100	150	1.0	2.0	175	1.1
IN5417	200	150	1.0	2.0	150	1.1
IN5418	400	150	1.0	2.0	120	1.1
IN5419	500	250	1.0	2.0	110	1.1
IN5420	600	400	1.0	2.0	100	1.1

Maximum recommended operating junction temp. = 175°C
θ_{JC} <25°C/Watt (⅜″ leads).

IN5800/5 Watt Series

JEDEC Part No.	Spec V_R (90% E_S)	1-1-.1A trr	Max I_R @ V_R		Cap. V_R = 10V	V_F @ 4A
		Max	25°C	100°C		Max
	Volts	nSec	μA	μA	pFd	Volts
IN5807	50	30	5.0	150	45	.875
IN5808	75	30	5.0	150	45	.875
IN5809	100	30	5.0	150	45	.875
IN5810	125	30	5.0	150	45	.875
IN5811	150	30	5.0	150	45	.875

Maximum recommended operating junction temp. = 175°C
θ_{JC} <25°C/Watt (⅜″ leads).

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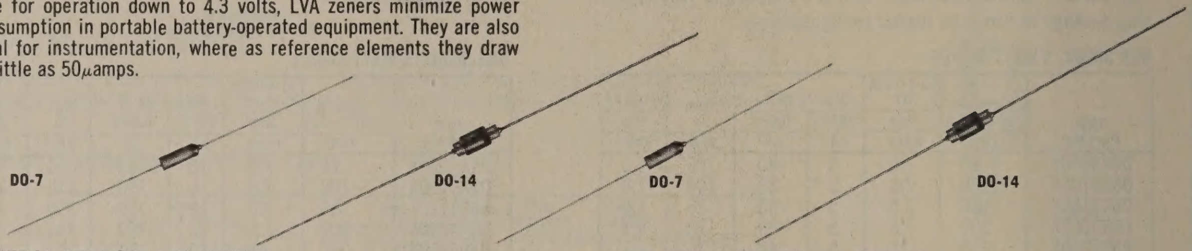
TRW POWER SEMICONDUCTORS

ZENERS

LOW VOLTAGE AVALANCHE ZENERS

LVA zeners have the sharpest knee below 10 volts. No other zener can approach their performance in the 4.3 to 10.0 volt range. Available for operation down to 4.3 volts, LVA zeners minimize power consumption in portable battery-operated equipment. They are also ideal for instrumentation, where as reference elements they draw as little as 50µamps.



GENERAL PURPOSE LVA ZENERS

Electrical Characteristics (T_{CASE} = 25°C)

Type	Nom Zener Voltage @ I_Z Vdc	Max Dynamic Impedance* Z_Z @ I_Z		Max Reverse Leakage I_R @ V_R		Max** Noise Density @ 250µA µV/√Hz
		Ohms	mA	µA	Vdc	
LVA43A	4.3	18	20	4.0	1.5	
LVA47A	4.7	15	10	4.0	2.0	4
LVA51A	5.1	15	5	0.1	2.0	4
LVA56A	5.6	40	1	0.05	3.0	4
LVA62A	6.2	50	1	0.05	4.0	4
LVA68A	6.8	50	1	0.05	5.0	4
LVA75A	7.5	100	1	0.01	6.0	4
LVA82A	8.2	100	1	0.01	6.5	4
LVA91A	9.1	100	1	0.01	8.0	4
LVA100A	10.0	100	1	0.01	9.0	4

Suffix "A" denotes ±5% V_Z tolerance, B = ±2%, C = ±1%.
V_F @ 200mA = 1.5Vdc max.
D.C. Power Dissipation: 600mW max (DO-14 package) and 400mW max (DO-7 package).
Derated linearly to zero at 175°C. 1 watt devices can be supplied upon request.
*Measured at D.C. test current with 10% A.C. superimposed (60Hz rms).
**Measured from 1000Hz to 3000Hz.

HIGH PERFORMANCE, LOW CURRENT—250µA LVA ZENERS

Electrical Characteristics (T_{CASE} = 25°C)

Type	Nom Zener Voltage @ I_Z @ 250µA Vdc	Max Dynamic Impedance Z_Z @ I_Z @ 250µA Ohms	Nom TC* @ 250µA mV/°C	Max Reverse Leakage I_R @ V_R @ 80% E_Z µAdc
LVA450A	5.0	700	0.75	10.0
LVA453A	5.3	250	1.33	5.0
LVA456A	5.6	100	1.96	1.0
LVA459A	5.9	100	2.30	0.5
LVA462A	6.2	100	2.67	0.1
LVA465A	6.5	100	3.06	0.05
LVA468A	6.8	100	3.40	0.01
LVA471A	7.1	175	3.76	0.01
LVA474A	7.4	175	4.07	0.01
LVA477A	7.7	175	4.47	0.01
LVA480A	8.0	175	4.80	0.01
LVA483A	8.3	175	5.15	0.01
LVA486A	8.6	175	5.50	0.01
LVA489A	8.9	175	5.87	0.01
LVA492A	9.2	175	6.16	0.01
LVA495A	9.5	175	6.46	0.01
LVA498A	9.8	175	6.86	0.01

Suffix "A" denotes standard tolerance 0.200Vdc from nominal, B = 0.150Vdc, C = 0.100Vdc.
*0.5mV/°C, 0 to 100°C, @ nominal zeneral voltage only.
Storage Temperature: −65°C to +200°C.
Operating Temperature: −65°C to +150°C.
D.C. Power Dissipation: 600mW max (DO-14 package) and 400mW max (DO-7 package).

HIGH PERFORMANCE LVA ZENERS

Electrical Characteristics (T_{CASE} = 25°C)

Type	Nom Zener Voltage @ I_Z Vdc	Max Dynamic Impedance* Z_Z @ I_Z		Max Reverse Leakage I_R @ V_R		Max** Noise Density @ 250µA µV/√Hz	Max Regulation	
		Ohms	mA	µA	Vdc		$\triangle V_Z$ Vdc	I_{ZL} mA
LVA343A	4.3	18	20	2.0	1.5	1	0.75	2.0
LVA347A	4.7	10	10	2.0	2.0	1	0.50	1.0
LVA351A	5.1	10	5	2.0	3.0	1	0.30	0.25
LVA356A	5.6	40	1	2.0	4.5	1	0.10	0.05
LVA362A	6.2	45	1	0.5	5.6	1	0.10	0.01
LVA368A	6.8	45	1	0.05	6.2	1	0.10	0.01
LVA375A	7.5	50	1	0.01	6.8	1	0.10	0.01
LVA382A	8.2	60	1	0.01	7.5	1	0.10	0.01
LVA391A	9.1	60	1	0.01	8.2	2	0.10	0.01
LVA3100A	10.0	60	1	0.01	9.1	2	0.10	0.01

Suffix "A" denotes ±5% V_Z tolerance, B = ±2%, C = ±1%.
V_F @ 200mA = 1.5Vdc max.
D.C. Power Dissipation: 600mW max (DO-14 package) and 400mW max (DO-7 package).
Derated linearly to zero at 175°C. 1 watt devices can be supplied upon request.
*Measured at D.C. test current with 10% A.C. superimposed (60Hz rms).
**Measured from 1000Hz to 3000Hz.

Electrical Characteristics (T_{CASE} = 25°C)

Type	Max Regulation			Max Noise Density* @ 250µA µV/√Hz	Typical Parameters		
	$\triangle E_Z$ Vdc	I Lo µAdc	I Hi mAdc		E_Z @ 10µ Vdc	I_R @ 50% E_Z nAdc	I_R @ 90% E_Z
LVA450A	0.40	100	1.0	1	4.15	70	15µAdc
LVA453A	0.20	100	1.0	1	4.9	35	7.0
LVA456A	0.10	50	1.0	1	5.45	15	3.0
LVA459A	0.10	10	1.0	1	5.85	2.5	1.0
LVA462A	0.10	10	1.0	1	6.2	0.8	0.13
LVA465A	0.10	10	1.0	1	6.5	0.15	25nAdc
LVA468A	0.10	10	1.0	1	6.8	0.10	9.0
LVA471A	0.10	10	1.0	1	7.1	<0.10	5.5
LVA474A	0.10	10	1.0	1	7.4	<0.10	3.0
LVA477A	0.10	10	1.0	1	7.7	<0.10	2.5
LVA480A	0.10	10	1.0	1	8.0	<0.10	1.8
LVA483A	0.10	10	1.0	1	8.3	<0.10	1.2
LVA486A	0.10	10	1.0	1	8.6	<0.10	0.9
LVA489A	0.10	10	1.0	2	8.9	<0.10	0.6
LVA492A	0.10	10	1.0	2	9.2	<0.10	0.5
LVA495A	0.10	10	1.0	2	9.5	<0.10	0.5
LVA498A	0.10	10	1.0	2	9.8	<0.10	0.4

Suffix "A" denotes standard tolerance 0.200Vdc from nominal, B = 0.150Vdc, C = 0.100Vdc.
*Measured from 1000Hz to 3000Hz.
Storage Temperature: −65°C to +200°C.
Operating Temperature: −65°C to +150°C.
D.C. Power Dissipation: 600mW max (DO-14 package) and 400mW max (DO-7 package).

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TRW POWER SEMICONDUCTORS

ZENER DIODES

1N5521B Thru 1N5532B
JAN and Jan-TX to MIL-S-19500/437 (USAF)

Electrical Characteristics

JEDEC Type No.	B_V Nom ±5% @ I_Z	I_Z* Test Current	Z_Z @ I_Z*	I_R @ V_R*	I_R @ V_R* @ T_A = 150°C	V_R	$\triangle B_V$* Between I_Z & I_{ZL}	I_{ZL}	N_D* @ 250µA 1KHz — 3KHz	T_C* T_1 = 25°C T_2 = 125°C	i_r* (Surge)	I_{ZM}
	Volts	mAdc	Ohms	µAdc	µAdc	Volts	Volts	mAdc	µV/√Hz	%/°C	mAdc	mAdc
1N5521B	4.3	20	18	3.0	6	1.5	0.75	2.0	0.5	−0.055 to 0.02	1400	88
1N5522B	4.7	10	22	2.0	6	2.0	0.60	1.0	0.5	−0.043 to 0.025	1270	81
1N5523B	5.1	5	26	2.0	6	2.5	0.65	0.25	0.5	±0.03	1170	75
1N5524B	5.6	3	30	2.0	4	3.5	0.30	0.25	1.0	−0.03 to 0.045	1030	68
1N5525B	6.2	1	30	1.0	4	5.0	0.20	0.01	1.0	0.05	965	61
1N5526B	6.8	1	30	1.0	5	6.2	0.10	0.01	1.0	0.052	870	56
1N5527B	7.5	1	35	0.5	5	6.8	0.05	0.01	2.0	0.058	810	51
1N5528B	8.2	1	40	0.5	5	7.5	0.05	0.01	4.0	0.062	740	46
1N5529B	9.1	1	45	0.1	5	8.2	0.05	0.01	4.0	0.068	650	42
1N5530B	10.0	1	60	0.05	5	9.1	0.10	0.01	4.0	0.075	600	38
1N5531B	11.0	1	80	0.05	5	9.9	0.20	0.01	5.0	0.075	540	35
1N5532B	12.0	1	90	0.05	5	10.8	0.20	0.01	10.0	0.080	500	32

* = Maximum limits.
V_F @ 200mA = 1.0V max.
Operating and Storage: −65°C < T_A < 200°C.
Power rating is 400mW @ T_L < 50°C, derated linearly to zero @ T_L = 200°C.
Z_Z measured with 60Hz AC = 10% I_Z.

LVA CHIPS

The LVA chip is available with 5% or tighter tolerances and is 100% tested to all electrical parameters specified. The chip is fully passivated with glass covering the junction assuring both reliability, and immunity from handling damage. A large aluminum bonding pad is provided which allows lead bonding by all present techniques. Mounting to customer's substrate may be accomplished by silicon-gold eutectic or with solder or pastes which do not exceed 425°C in their usage.

Electrical Characteristics (T_{CASE} = 25°C)

Type	Nom Zener Voltage @ I_Z Max Vdc	Max Regulation			Max Reverse Leakage I_R @ V_R	
		$\triangle V_Z$ Vdc	I_Z Low mA	I_Z Max mA	µA	Vdc
CLVA43A	4.3	0.75	2.0	20	4.0	1.5
CLVA47A	4.7	0.50	1.0	10	4.0	2.0
CLVA51A	5.1	0.30	0.25	5	0.1	2.0
CLVA56A	5.6	0.10	0.05	1	0.05	3.0
CLVA62A	6.2	0.10	0.01	1	0.05	4.0
CLVA68A	6.8	0.10	0.01	1	0.05	5.0
CLVA75A	7.5	0.10	0.01	1	0.01	6.0
CLVA82A	8.2	0.10	0.01	1	0.01	6.5
CLVA91A	9.1	0.10	0.01	1	0.01	8.0
CLVA100A	10.0	0.10	0.01	1	0.01	9.0

LVA TEMPERATURE COMPENSATED REFERENCE ELEMENTS

LVA TC Zener

These ultra-low current temperature-compensated references are designed for use in circuits requiring the lowest possible operating current, reliability and the utmost in stability under a wide range of environmental conditions. They provide a stable reference at currents as low at 50µA and temperature coefficients as low as 0.0005%/°C.

Electrical Characteristics (T_{CASE} = 25°C)

Type	Nom Zener Voltage Vdc ±5%	Zener Test Current µA	Max $\triangle V_Z$ (−55 to +100°C) Vdc	Average Temperature Coefficient %/°C	Max Dynamic Impedance Ohms
PS1300A	6.5	50	0.100	0.01	1200
PS1301A	6.5	50	0.050	0.005	1200
PS1302A	6.5	50	0.020	0.002	1200
PS1303A	6.5	50	0.010	0.001	1200
PS1304A	6.5	50	0.005	0.0005	1200
PS1305A	6.5	100	0.100	0.01	750
PS1306A	6.5	100	0.050	0.005	750
PS1307A	6.5	100	0.020	0.002	750
PS1308A	6.5	100	0.010	0.001	750
PS1309A	6.5	100	0.005	0.0005	750
PS1310A	6.5	250	0.100	0.01	400
PS1311A	6.5	250	0.050	0.005	400
PS1312A	6.5	250	0.020	0.002	400
PS1313A	6.5	250	0.010	0.001	400
PS1314A	6.5	250	0.005	0.0005	400

Dynamic impedance measured by superimposing rms A.C. current equal to 10% of zener test current at 25°C.

Suffix "A" denotes −55 to +100°C temperature range for indicated maximum $\triangle V_Z$ change. The temperature range for non-"A" types is zero to 75°C. For the non-"A" types, the $\triangle V_Z$ is half of that given for −55 to +100°C.

D.C. Power Dissipation: 500mW max at 50°C ambient. Derate 4mW/°C above 50° ambient.

Storage Temperature: −65°C to +175°C.

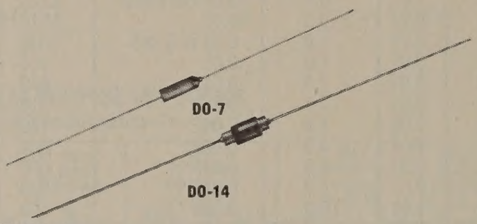
I_R max @ 80% V_Z = 0.1µA.

TRW POWER SEMICONDUCTORS

VARICAPS

EIA STANDARD AND JAN VARICAPS

These are silicon alloyed varicaps manufactured by the aluminum button alloy process and packaged in the TRW designed DO-14 package. These types are used primarily in automatic frequency control, voltage controlled oscillators, carrier amplifiers, voltage delay lines, and other applications where unusually low reverse leakage is required and moderate Q's and working voltages are acceptable. These types are recommended for military applications.



HI-Q VARICAPS

The combination of high Q, high voltage, and excellent tuning characteristics makes this series ideal for all types of electronic tuning applications. These types have also been widely used for harmonic generators (to 5 watts RF input and 1.2GHz output frequency). Available in DO-14 or DO-7 package.

STANDARD HI-Q VARICAPS

Electrical Characteristics ($T_{CASE} = 25°C$)

Type	Capacitance @ —4Vdc and 1MHz pF	Typical Capacitance Ratio C - 0.5Vdc/ C - MWV	Min. Quality Factor Q —4Vdc		Max Working Voltage Vdc
			f = 50MHz	f = 100MHz	
PC107	6.8	4.5		75	30
PC112	10.0	6.9	50		80
PC113	22.0	7.5	50		80
PC114	47.0	7.4	50		80
PC115	10.0	7.7	100		100
PC116	22.0	8.2	100		100
PC117	47.0	8.0	100		100
PC122	47.0	8.0	75		100
PC123	15.0	4.6	50		30
PC124	15.0	5.9	125		50
PC125	15.0	7.0	50		80
PC126	15.0	7.9	100		100
PC127	33.0	4.6	50		30
PC128	33.0	6.0	125		50
PC129	33.0	7.5	50		80
PC130	33.0	8.2	100		100
PC132	10.0	4.5	50		30
PC133	22.0	4.6	50		30
PC134	47.0	4.6	50		30
PC135	10.0	5.8		75	50
PC136	22.0	6.0	125		50
PC137	47.0	6.0	100		50
PC138	6.8	4.5		38	30
PC139	6.8	5.7		75	50
PC140	6.8	6.8		38	80
PC141	6.8	7.6		68	100

Forward Voltage Drop @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C DO-14 ....600mW max
D.C. Power Dissipation @ 25°C DO-7 ....400mW max
Operating Temperature ..—65°C to +150°C
Storage Temperature ..—65°C to +150°C
Case Capacitance ....0.25pF typical
Case and Lead Inductance ....5nH typical
Linear Power Derating ....4mW/°C max

Reverse Current @ MWV ....0.5µA max
Capacitance Tolerance:
Standard Device ....±20%
Suffix A ....±10%
Suffix B ....±5%
Suffix C ....±2%
Suffix D ....±1%

For DO-7 package add G to suffix. For example, PC107AG is a ±10% device in the DO-7 package. PC107B is a ±5% device in the DO-14 package.

VARACTOR DIODES TO MIL-S-19500/329B

Electrical Characteristics ($T_{CASE} = 25°C$)

Type	Capacitance @ —4Vdc and 1MHz pF	Capacitance Ratio				Max Working Voltage Vdc	Min Reverse Breakdown Voltage $I_R = 100\mu A$ Vdc
		C - 0.1Vdc/ C - 4Vdc		C - MWV/ C - 4Vdc			
		Min.	Max.	Min	Max		
1N4801	6.8	2.40	2.56	0.260	0.285	100	110
1N4802	8.2	2.42	2.58	0.257	0.283	100	110
1N4803	10.0	2.46	2.58	0.255	0.283	100	110
1N4804	12.0	2.35	2.49	0.244	0.270	100	110
1N4805	15.0	2.37	2.49	0.233	0.247	100	110
1N4806	18.0	2.36	2.48	0.242	0.254	90	99
1N4807	22.0	2.35	2.46	0.241	0.252	90	99
1N4808	27.0	2.35	2.46	0.276	0.287	65	72
1N4809	33.0	2.35	2.46	0.285	0.295	60	66
1N4810	39.0	2.34	2.44	0.295	0.306	55	61
1N4811	47.0	2.33	2.43	0.311	0.320	50	55
1N4812	56.0	2.32	2.42	0.345	0.354	40	44
1N4813	68.0	2.30	2.40	0.396	0.406	30	33
1N4814	82.0	2.26	2.36	0.481	0.491	20	22
1N4815	100.0	2.24	2.33	0.480	0.490	20	22

Forward Voltage Drop @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C ....600mW max
Operating Temperature ..—65°C to +150°C
Storage Temperature ..—65°C to +150°C
Case Capacitance ....0.25pF typical
Case and Lead Inductance ....5nH typical
Temperature Coefficient of Capacitance ($V_R = 4Vdc$, T_A) ....+0.025%/°C max

Quality Factor ($V_R = 4Vdc$, $f = 1MHz$) ..750 min
Quality Factor ($V_R = 4Vdc$, $f = 50MHz$) ..15 min
Reverse Current @ MWV ..5nA max
Reverse Current @ MVW (150°C) ....5µA max
Capacitance Tolerance:
Standard Device ....±20%
Suffix A ....±10%
Suffix B ....±5%
Suffix C ....±2%
Suffix D ....±1%

ULTRA HI-Q VARICAPS

This series of devices has been developed for applications where extremely high performance is required. The combination of square-law capacitance change characteristics and extremely high Q's makes this series ideal for high frequency harmonic generation. Suitable for military and industrial applications.

Electrical Characteristics ($T_{CASE} = 25°C$)

Type	Capacitance @ —4Vdc and 1MHz pF	Capacitance Ratio C - 2Vdc/ C - MWV		Min Quality Factor Q - 4Vdc		Max Working Voltage Vdc	Min Reverse Breakdown Voltage $I_R = 100\mu A$ Vdc
		Min	Max	f = 50 MHz	f = 100 MHz		
PG107	6.8	4.20	4.60		100	65	70
PG207	6.8	4.00	4.60		100	65	70
PG307	6.8	3.55	4.15		150	50	55
PG110	10.0	4.25	4.65		100	65	70
PG210	10.0	4.05	4.65		100	65	70
PG310	10.0	3.60	4.20		150	50	55
PG115	15.0	4.30	4.70	200		65	70
PG215	15.0	4.10	4.70	200		65	70
PG315	15.0	3.65	4.25	300		50	55
PG122	22.0	4.35	4.75	200		65	70
PG222	22.0	4.15	4.75	200		65	70
PG322	22.0	3.65	4.25	300		50	55
PG133	33.0	4.40	4.80	200		65	70
PG233	33.0	4.20	4.80	200		65	70
PG333	33.0	3.70	4.30	300		50	55
PG139	39.0	4.45	4.85	200		65	70
PG239	39.0	4.25	4.85	200		65	70
PG339	39.0	3.70	4.30	300		50	55
PG147	47.0	4.45	4.85	200		65	70
PG247	47.0	4.45	4.85	200		65	70
PG347	47.0	3.70	4.30	300		50	55

D.C. Power Dissipation @ 25°C ....400mW max
Operating Temperature ..—65°C to +150°C
Storage Temperature ..—65°C to +150°C
Case Capacitance ....0.25pF typical
Case and Lead Capacitance ....5nH typjcal

Reverse Current @ MWV ....0.5µA max
Reverse Current @ MWV (150°C) ....50µA max
Capacitance Tolerance:
Standard Device ....±20%
Suffix A ....±10%
Suffix B ....±5%

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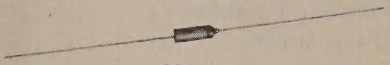
TRW POWER SEMICONDUCTORS

VARACTOR DIODES

LOW VOLTAGE, LOW LEAKAGE VARICAPS

These varicaps are recommended for various commercial and industrial applications.

Electrical Characteristics (TCASE = 25°C)



DO-7

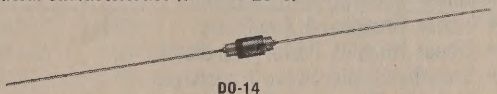
Type	Capacitance @ - 4Vdc and 1MHz pF	Typical Capacitance Ratio C - 0.5Vdc/ C - MWV	Min Quality Factor Q - 4Vdc f = 50MHz	Working Max Voltage Vdc	Min Reverse Breakdown Voltage IR = 100μA Vdc
V7	7	4.1	13	25	28
V10	10	4.1	13	25	28
V12	12	4.2	13	25	28
V15	15	4.2	13	25	28
V20	20	3.9	7	20	22
V27	27	4.0	7	20	22
V33	33	4.1	7	20	22
V39	39	4.1	7	20	22
V47	47	3.9	7	20	22
V56	56	3.5	7	15	17
V68	68	3.5	9	15	17
V82	82	3.5	9	15	17
V100	100	3.5	9	15	17

Forward Voltage Drop
 @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C:
 DO-7 ....400mW max
 DO-14 ....600mW max
Operating
 Temperature —65°C to +150°C
Storage
 Temperature .—65°C to +150°C
Case Capacitance ..0.25pF typical
Case and Lead
 Inductance ....5nH typical

Temperature Coefficient
 of Capacitance
 (VR = 4Vdc, TA)
 +0.025%/°C max
Reverse Current @ MWV ..100nA
Capacitance Tolerance:
 Standard Device ....±20%
 Suffix A ....±10%
 Suffix B ....±5%
 Suffix C ....±2%
 Suffix D ....±1%

LOW VOLTAGE, ULTRA-LOW LEAKAGE VARICAPS

Electrical Characteristics (TCASE = 25°C)



DO-14

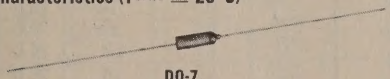
Type	Capacitance @ —4Vdc and 1MHz pF	Typical Capacitance Ratio C - 0.5Vdc/ C - MWV	Max Working Voltage Vdc	Min Reverse Breakdown Voltage Vdc IR = 100μA
V907	7	4.1	25	28
V910	10	4.1	25	28
V912	12	4.2	25	28
V915	15	4.2	25	28
V920	20	3.9	20	22
V927	27	4.0	20	22
V933	33	4.1	20	22
V939	39	4.1	20	22
V947	47	3.9	20	22
V956	56	3.5	15	17
V968	68	3.5	15	17
V982	82	3.5	15	17
V900	100	3.5	15	17

Forward Voltage Drop
 @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C:
 DO-7 ....400mW max
 DO-14 ....600mW max
Operating
 Temperature .—65°C to +150°C
Storage
 Temperature —65°C to +150°C
Case Capacitance ..0.25pF. typical
Case and Lead
 Inductance ....5nH typical
Quality Factor (VR = 4Vdc,
 f = 50MHz) ....15 min

Temperature Coefficient
 of Capacitance
 (VR = 4Vdc, TA)
 +0.025%/°C max
Reverse Current @ MWV 5nA
Capacitance Tolerance:
 Standard Device ....±20%
 Suffix A ....±10%
 Suffix B ....±5%
 Suffix C ....±2%
 Suffix D ....±1%

HIGH VOLTAGE VARICAPS

Electrical Characteristics (TCASE = 25°C)



DO-7

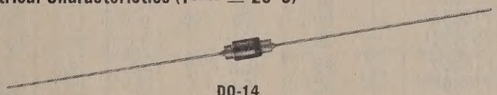
Type	Capacitance @ —4Vdc and 1 MHz pF	Typical Capacitance Ratio C - 0.5Vdc/ C - MWV	Quality Factor Q - 4Vdc f = 50MHz	Max Working Voltage Vdc	Min Reverse Reverse Breakdown Voltage IR = 100μA Vdc
V7E	7	6.9	3.0	100	110
V10E	10	6.9	3.5	100	110
V12E	12	7.5	4.0	100	110
V15E	15	7.5	4.5	100	110
V20E	20	7.9	7.0	90	99
V27E	27	7.4	7.0	65	72
V33E	33	6.5	7.0	60	66
V39E	39	6.3	7.0	55	61
V47E	47	6.1	7.0	50	55
V56E	56	5.7	7.0	40	44
V68E	68	4.6	9.0	30	33
V82E	82	4.0	9.0	20	22
V100E	100	4.0	9.0	20	22

Forward Voltage Drop
 @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C:
 DO-7 ....400mW max
 DO-14 ....600mW max
Operating
 Temperature .—65°C to +150°C
Storage
 Temperature —65°C to +150°C
Case Capacitance ..0.25pF typical
Case and Lead
 Inductance ....5nH typical

Reverse Current @ MWV ..100nA
Temperature Coefficient
 of Capacitance
 (VR = 4Vdc, TA)
 +0.025%/°C max
Capacitance Tolerance:
 Standard Device ....±20%
 Suffix A ....±10%
 Suffix B ....±5%
 Suffix C ....±2%
 Suffix D ....±1%

HIGH VOLTAGE, ULTRA-LOW LEAKAGE VARICAPS

Electrical Characteristics (TCASE = 25°C)



DO-14

Type	Capacitance @ —4Vdc and 1MHz pF	Typical Capacitance Ratio C - 0.5Vdc/ C - MWV	Max Working Voltage Vdc	Min Reverse Breakdown Voltage IR = 100μA Vdc
V907E	7	6.9	100	110
V910E	10	6.9	100	110
V912E	12	7.5	100	110
V915E	15	7.5	100	110
V920E	20	7.9	90	99
V927E	27	7.4	65	72
V933E	33	6.5	60	66
V939E	39	6.3	55	61
V947E	47	6.1	50	55
V956E	56	5.7	40	44
V968E	68	4.6	30	33
V982E	82	4.0	20	22
V900E	100	4.0	20	22

Forward Voltage Drop
 @ 100mA ....1.0Vdc max
D.C. Power Dissipation @ 25°C:
 DO-7 ....400mW max
 DO-14 ....600mW max
Operating
 Temperature .—65°C to +150°C
Storage
 Temperature —65°C to +150°C
Case Capacitance ..0.25pF typical
Case and Lead
 Inductance ....5nH typical

Reverse Current @ MWV 5nA
Temperature Coefficient
 of Capacitance
 (VR = 4Vdc, TA)
 +0.025%/°C max
Capacitance Tolerance:
 Standard Device ....±20%
 Suffix A ....±10%
 Suffix B ....±5%
 Suffix C ....±2%
 Suffix D ....±1%

TRW POWER SEMICONDUCTORS AN ELECTRONIC COMPONENT DIVISION OF TRW INC. 14520 AVIATION BOULEVARD,
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TRW RF SEMICONDUCTORS

TRW HAS THE INDUSTRY'S BROADEST LINE OF RF TRANSISTORS AND HYBRIDS

- Linear Microwave Transistors
- Linear Broadband Amplifiers
- Linear HF/SSB Power Transistors
- Broadband Microwave Transistors
- Discrete Microwave Transistors
- Navigation Band Pulse Transistors
- UHF Discrete Power Transistors
- VHF Power Transistors
- VHF Aircraft Radio Transistors (AM Service)
- UHF Broadband JO* Transistors
- CATV Hybrid Amplifiers
- CATV Discrete Transistors
- M.I.C Power Amplifiers
- Low Voltage Power Transistors
- Mobile Radio Transistors

SELECT THE FREQUENCY YOU NEED.

* Registered trademark TRW, INC. U.S. Pat. 3. 713. 006

PART NUMBER	MAX RATED FREQ. MHz	POWER OUTPUT W	GAIN dB	V_{CC} VOLTS	PACKAGE
PT8551	28	1.0	13	28.0	TO-39
PT5701	28	1.5	15	12.5	TO-39
PT8549	28	5.0	15	12.5	.380 SOE
PT9787[2]	28	8.0	14	28.0	.380 SOE F
PT9795[2]	28	15	15	12.5	.380 SOE F
PT9788[2]	28	20	14	28.0	.380 SOE F
PT9796[2]	28	30	15	12.5	.380 SOE F
PT9797[2]	28	50	15	12.5	.380 SOE F
PT9783[2]	28	50	14	28.0	.380 SOE F
PT9776[2]	28	75	13	12.5	.380 SOE F
PT9784[2]	28	75	15	12.5	.380 SOE F
PT9798[2]	28	75	15	50.0	.380 SOE F
PT9847	28	100	13	12.5	.380 SOE F
PT9785	28	100	13	12.5	.500 SOE F
PT9780	28	100	14	28.0	.500 SOE F
PT9849	28	150	13	12.5	.500 SOE F
PT9790	28	150	14	50.0	.500 SOE F
2N5070[1]	30	25	15	28.0	TO-60
2N5687	50	1.5	17	12.5	TO-39
PT8850	50	5.0	13	12.5	.380 SOE F
PT8851	50	10	12	12.5	.380 SOE F
PT8852	50	20	11	12.5	.380 SOE F
PT8853	50	35	10	12.5	.380 SOE F
PT8854	50	70	9	12.5	.380 SOE F
2N5071[1]	76	24	9	24.0	TO-60
PT8860	88	1.8	14	12.5	TO-39
PT8861[2]	88	5.0	13	12.5	.380 SOE F
PT8862[2]	88	12	12	12.5	.380 SOE F
PT8863[2]	88	20	11	12.5	.380 SOE F
ML20[7]	88	20	21	12.5	MVM
PT8864[2]	88	35	9	12.5	.380 SOE F
PT8865[2]	88	70	8	12.5	.380 SOE F
CA2875[4]	110	0.6	17.5	24.0	CA
CA416[4]	120	54dBmV	16.5	24.0	CA
CA418[4]	120	54dBmV	18.5	24.0	CA
2N5102[1]	136	15	4	24.0	TO-60
CA2830[4]	150	0.6	34	24.0	CA
PT9730[3]	150	2.5	11	13.5	.380 SOE
PT9732[3]	150	3.0	10	13.5	.380 SOE
PT9734[3]	150	6.0	8	13.5	.380 SOE
PT9731[3]	150	10	6	13.5	.380 SOE
PT9733[3]	150	15	6	13.5	.380 SOE
PT9782[2,3]	150	25	4.5	13.5	.380 SOE
MV30[7]	160	30	22	12.5	MXM
2N4427	175	1.0	10	12.5	TO-39
2N3866	175	1.0	11	28.0	TO-39
2N5913	175	1.2	12.4	12.5	TO-39
PT8870[2]	175	2.5	10	12.5	.380 SOE F
PT8871[2]	175	2.5	14	12.5	.280 SOE S
2N5589	175	3.0	8.2	12.5	.380 SOE
2N6080	175	4.0	12	12.5	.380 SOE
PT9730	175	4.0	13	28.0	.380 SOE
2N5641[1]	175	7.0	8.4	28.0	.380 SOE
PT9732	175	8.0	12	28.0	.380 SOE
2N5590	175	10	5.2	12.5	.380 SOE

PART NUMBER	MAX RATED FREQ. MHz	POWER OUTPUT W	GAIN dB	V_{CC} VOLTS	PACKAGE
PT8872[2]	175	12	11.3	12.5	.380 SOE F
2N3632[1]	175	13	6	28.0	TO-60
2N6081	175	15	6.4	12.5	.380 SOE
PT8873[2]	175	15	7.8	12.5	.380 SOE F
PT9734	175	15	11.5	28.0	.380 SOE
2N5642[1]	175	20	8.2	28.0	.380 SOE
MV20[7]	175	20	20	12.5	MVM
2N5591	175	25	4.4	12.5	.380 SOE
2N6082	175	25	6.2	12.5	.380 SOE
PT9731	175	25	10	28.0	.380 SOE
J04028	175	28	8.5	12.5	.500 J Zero
2N6083	175	30	5.7	12.5	.380 SOE
J04036	175	35	7.5	12.5	.500 J Zero
PT8874[2]	175	40	4.5	12.5	.380 SOE F
2N5643[1]	175	40	7.6	28.0	.380 SOE
J04045	175	45	6.5	12.5	.500 J Zero
PT9733	175	50	7.9	28.0	.380 SOE
J04070	175	70	5.9	12.5	.500 J Zero
J01006	175	100	7.0	28.0	.500 J Zero
PT4578[5]	200	45dBmV	3.0dB NF	12.0	TO-39
LT1001A[5]	200	45dBmV	2.0dB NF	14.0	TO-39
CA2818[4]	200	0.5	18	24.0	CA
TPV366[6]	225	0.5	16	24.0	.280 SOE
TPV394[6]	225	5.0	15	24.0	.280 SOE
TPV364[6]	225	10	9	24.0	.280 SOE
TPV375[6]	225	14	8	24.0	.500 SOE
PT4574[5]	300	45dBmV	4.0dB NF	14.0	TO-117
LT2001[5]	300	45dBmV	3.0db NF	18.0	TO-117
CA601BU[4]	300	49dBmV	31	24.0	CA
CA100[4]	300	52dBmV	16.3	24.0	CA
CA2100[4]	300	52dBmV	17	24.0	CA
CA2300[4]	300	52dbmV	22	24.0	CA
CA2600[4]	300	53.5dBmV	33.5	24.0	CA
CA200[4]	300	54.5dBmV	16.3	24.0	CA
CA2200[4]	300	54.5dBmV	17	24.0	CA
CA2301[4]	300	54.5dBmV	22	24.0	CA
CA2840[4]	300	0.5	22	24.0	CA
CA3800[4]	300	1.0	22	24.0	CA
CA2810[4]	350	0.5	33	24.0	CA
CA2800[4]	400	0.5	18	24.0	CA
CA2870[4]	400	0.5	33	24.0	CA
2N3866	400	1.0	11.2	28.0	TO-39
2N5090[1]	400	1.2	8	28.0	TO-60
PT9700	400	1.5	11	28.0	.280 SOE
PT9705	400	2.0	10	28.0	.280 SOE
2N3375[1]	400	3.0	5	28.0	TO-60
PT9701	400	4.0	10	28.0	.280 SOE
PT9703	400	10	10	28.0	.280 SOE
2N3733[1]	400	10	4	28.0	TO-60
2N5016[1]	400	15	4.7	28.0	TO-60
PT9702	400	20	7.0	28.0	.280 SOE
2N5637[1]	400	20	4.6	28.0	.280 SOE
PT9704	400	30	6.3	28.0	.280 SOE
PT9704A	400	30	7.8	28.0	.280 SOE
J02014	400	40	8.6	28.0	.500 J Zero

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TRW RF SEMICONDUCTORS

PART NUMBER	MAX RATED FREQ. MHz	POWER OUTPUT W	GAIN dB	V_{CC} VOLTS	PACKAGE
J02015	400	70	7.0	28.0	.500 J Zero
J02015A	400	70	8.4	28.0	.500 J Zero
PT8880	470	0.2	9.0	12.5	TO-39
PT8881[2]	470	1.5	10	12.5	.280 SOE S
2N5944	470	2.0	9.0	12.5	.280 SOE
PT8809[2]	470	2.0	10	12.5	.280 SOE
2N5945	470	4.0	8.0	12.5	.280 SOE
PT8810	470	5.0	8.6	12.5	.280 SOE
PT8811	470	10	6.0	12.5	.280 SOE
2N5946	470	10	6.0	12.5	.280 SOE
J03012	470	12	9.0	12.5	.500 J Zero
J03015	470	15	7.7	12.5	.500 J Zero
MX15[7]	470	15	19	12.5	MXM
J03020	470	20	7.5	12.5	.500 J Zero
J03028	470	28	6.0	12.5	.500 J Zero
J03035	470	35	4.6	12.5	.500 J Zero
J03045	470	45	5.0	12.5	.500 J Zero
J03055	470	55	4.4	12.5	.500 J Zero
J03060	470	60	3.8	12.5	.500 J Zero
LT3005[5]	500	45dbmV	45dB NF	18.0	.200 SOE
TP491[5]	500	45 dBmV	1.6dB NF	10.0	T-PACK
LT3047[5]	500	45 dBmV	1.6dB NF	10.0	TO-46
CA2820[4]	500	0.5	30	24.0	CA
2N5177[1]	500	25	5	28.0	DIA-2L
MX7.5[7]	512	7.5	18	12.5	MXM
MX12[7]	512	12	19	12.5	MXM
TPV596[6]	860	0.5	12	24.0	.280 SOE
TPV597[6]	860	1.0	11	24.0	.280 SOE
J03301[2]	866	4.5	6.5	12.5	MRB
J03401[2]	866	6.0	7.8	12.5	MRB
J03302[2]	866	15	5.7	12.5	MRB
J03402[2]	866	15	7.0	12.5	MRB
J03303[2]	866	22	5.0	12.5	MRB
J03403[2]	866	22	6.4	12.5	MRB
J03304[2]	866	30	4.8	12.5	MRB
J03404[2]	866	30	5.7	12.5	MRB
J03405[2]	866	35	5.4	12.5	MRB
J03406[2]	866	40	5.2	12.5	MRB
J03305[2]	866	42	4.5	12.5	MRB
2N4429[1]	1000	1.0	5.0	28.0	TO-117
PT8651[1]	1000	1.0	5.0	28.0	RT-3
2N4430[1]	1000	2.5	5.0	28.0	TO-129
2N5764[1]	1000	3.0	6.0	28.0	RT-3
MRA0610-3	1000	3.0	7.8	28.0	MRA
2N4431[1]	1000	5.0	5.0	28.0	TO-129
2N5765[1]	1000	5.0	6.0	28.0	RT-3
MRA0610-9	1000	9.0	7.8	28.0	MRA
MRA0610-18	1000	18	7.8	28.0	MRA
MRA0610-40	1000	40	8.0	28.0	MRA
MRP0912-25[9]	1215	25	8.0	40.0	MRA
MRP0912-75[9]	1215	75	7.0	50.0	MRA
MRP0912-150[9]	1215	150	7.0	50.0	MRP
MRP0912-250[9]	1215	250	6.0	50.0	MRP
MRA1014-2	1400	2.0	8.2	28.0	MRA
MRA1014-6	1400	6.0	7.4	28.0	MRA

PART NUMBER	MAX RATED FREQ. MHz	POWER OUTPUT W	GAIN dB	V_{CC} VOLTS	PACKAGE
MRA1014-12	1400	12	7.8	28.0	MRA
MRA1014-35	1400	35	7.0	28.0	MRA
MRA1417-2	1700	2	8.0	28.0	MRA
MRA1417-6	1700	6	7.4	28.0	MRA
MRA1417-11	1700	11	7.4	28.0	MRA
MRA1417-25	1700	25	7.0	28.0	MRA
2N5481[1]	2000	1.0	6.0	28.0	RT-3
2N5766[1]	2000	1.0	8.0	28.0	RT-3
TRW2001	2000	1.0	9.0	28.0	HLP-8
TRW52001[2,6]	2000	1.8	6.0	20.0	TW200
MRA1720-2	2000	2.0	7.6	28.0	MRA
2N5482[1]	2000	2.5	5.0	28.0	RT-3
2N5767[1]	2000	2.5	8.0	28.0	RT-3
TRW2003	2000	3.0	8.0	28.0	HLP-8
TRW52602[2,6]	2000	3.6	6.0	20.0	HLP-8
2N5483[1]	2000	5.0	4.0	28.0	RT-3
MRA1720-5	2000	5.0	6.6	28.0	MRA
2N5768[1]	2000	5.0	7.0	28.0	RT-3
TRW2005	2000	5.0	8.0	28.0	HLP-8
TRW52604[2,6]	2000	7.2	5.0	20.0	HLP-8
MRA1720-9	2000	9.0	6.5	28.0	MRA
TRW2010	2000	10	7.0	28.0	HLP-8
TRW2015	2000	15	6.0	28.0	HLP-11
TRW2020	2000	20	5.2	28.0	HLP-11
MRA1720-20	2000	20	6.0	28.0	MRA
TRW2301	2300	1.0	8.0	20.0	HLP-8
MRA2023-1.5[2,8]	2300	1.5	8.0	28.0	MRA
MRA2023-3[2,8]	2300	3.0	8.0	28.0	MRA
TRW2304	2300	4.0	8.0	20.0	HLP-8
MRA2023-6[2,8]	2300	6.0	7.0	28.0	MRA
TRW2307	2300	7.0	8.5	20.0	HLP-8
MRA2023-12[2,8]	2300	12	7.0	28.0	MRA
TRW53601[2,6]	3000	0.8	6.0	20.0	HLP-8
TRW3001	3000	1.0	7.0	28.0	HLP-8
TRW53602[2,6]	3000	1.6	5.0	20.0	HLP-8
TRW3003	3000	3.0	6.0	28.0	HLP-8
TRW3005	3000	5.0	5.0	28.0	HLP-8
TRW54601[2,6]	4000	0.5	6.0	20.0	HLP-8
TRW4001	4000	1.0	6.0	28.0	HLP-8
TRW4003	4000	3.0	6.0	28.0	HLP-8

NOTES

[1] Available but not recommended for use in new design.

[2] Package options are available.

[3] Rated for AM service.

[4] Linear Hybrid Amplifier.

[5] Low Noise Transistor.

[6] Linear Class A Transistor.

[7] Mobile Radio Hybrid Amplifier.

[8] 22V operation also available.

[9] Rated for Pulsed Power Operation.

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Thermalloy, Inc.

Post Office Box 34829 • 2021 West Valley View Lane
Dallas, TX 75234 • (214) 243-4321 • TWX: 910-860-5542

NUMBER ONE IN SEMICONDUCTOR ACCESSORIES

Heat Sinks and Semiconductor Accessories

Heat Sinks ①

DIP HEAT SINKS One piece heat sinks for 14 and 16 pin integrated circuits. 6020A clips securely into place requiring no mounting hardware or epoxy. Other styles bond to DIP with epoxy, require no extra board space, and may be added after assembly.

PART NO.	FIG.	CASE STYLE	NOMINAL SIZE			TR② °C/W
			LENGTH	WIDTH	HEIGHT	
6010B	A	DIP	.750	.604	.212	55
6011B	B	DIP	.750	.250	.190	65
6012B	B	DIP	.730	.250	.190	65
6020A	C	DIP	1.000	.725	.500	40

TO-5 ENCAPSULATING HEAT SINKS Two piece heat sinks for positive retention under shock and vibration. Top and body grip transistor flange for maximum heat transfer.

1101A	D	TO-5	.500 HEX	.390	10
2205B	E	TO-5	.812 DIA	.340	41
2211B	E	TO-5	.625 DIA	.310	49
2215B	E	TO-5	.750 DIA	.350	37

TO-5 ECONOMY PRESS-ON HEAT SINKS One piece light weight coolers. May be installed with no special tools after board assembly.

1115B	F	TO-5	.375 DIA	.400	68
1116B	F	TO-5	.351 DIA	.370	18*
1134B	G	TO-5	.750 SQ.	.187	38
1136B	G	TO-5	.750 SQ.	.375	27
2225B	H	TO-5	.750 DIA	.400	46
2226B	H	TO-5	.750 DIA	.250	54
2227B	H	TO-5	1.250 DIA	.400	21
2228B	H	TO-5	.875 DIA	.531	35
2230B-5	I	TO-5	.750 DIA	.250	48
2257R	I	TO-5	.500 DIA	.375	62

*Mounted on a 6″ x 6″ x .062 thk plate

TO-3 and TO-66 TWO PIECE CIRCUIT BOARD HEAT SINKS Top piece contacts upper surface of transistor for positive retention and optimum heat transfer. Top and base may be ordered separately, both insulated and uninsulated.

6103B	J	TO-3	1.531	1.250	.515	11
6166B	J	TO-66	1.531	1.250	.609	14.5

TO-3 and TO-66 CIRCUIT BOARD HEAT SINKS High performance one piece coolers in a variety of styles to meet your thermal and packaging requirements.

6001B-2	K	TO-3	1.810	1.810	.500	7.2
6013B	L	TO-3	1.880	1.400	.500	9.7
6017B	L	TO-66	1.550	1.040	.500	12.7
6051B	M	TO-3	1.780	1.780	.500	7.4
6056B	M	TO-66	1.780	1.780	.500	7.4
6060B &	P	TO-3 &	2.000	1.750	.375	6.5
6061B	P	TO-66	2.000	2.250	.375	5.9

PLASTIC POWER HEAT SINKS Performance and design for every plastic power requirement in both vertical and horizontal mount economy coolers. Vertical style available with tinned tabs and/or nickel plate. May be soldered directly to the board.

6025B	N	PL PWR	.875	.250	1.250	19
6030B	Q	PL PWR	1.000	.500	1.180	12
*6038B	Q	PL PWR	1.000	.500	1.180	18
6070B	R	PL PWR	1.750	.700	.375	16
6073B	S	PL PWR	.750	.750	.375	21
6106B-13	S	PL PWR	1.180	1.000	.500	17
6107B-14	S	PL PWR	.710	1.000	.500	20

*6038 Has clip

PLASTIC POWER CLIP SINKS Light weight, low cost clip-on heat sinks require no mounting hardware or special tools for assembly. These may be attached to device after board assembly and require minimum board space. Pre-black anodized.

*6041PB	U	TO-126 Case 77	.800	.268	.800	47
*6042PB	U	Case 90 Case 199	1.000	.268	.800	31
*6043PB	U	TO-220	1.000	.268	.800	35
6045B	T	TO-220	1.000	.350	.750	26
*6046PB	V	TO-202	.800	.300	.850	25
6047PB	V	TO-202	.800	.300	.850	26

*Has Locking Tab

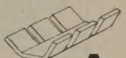
NOTES:

① Dimensions given are nominal sizes for reference only. Consult Thermalloy catalog for tolerances.

② Thermal resistance values are for natural convection.

3. Finish prefixes; "A" Hard Anodize; "B" Black Anodize; "PB" Pre-black Anodize; ("C" Gold chromate available).

Contact factory for latest issue of Thermalloy, Inc. catalog of heat sinks and accessories.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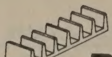
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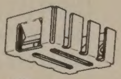
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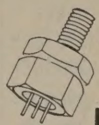
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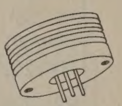
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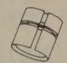
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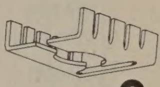
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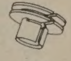
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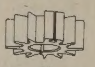
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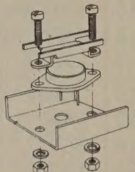
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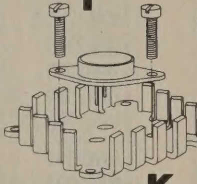
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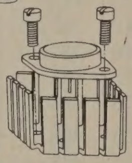
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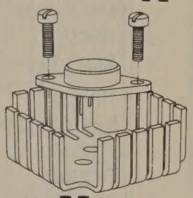
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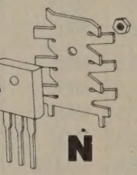
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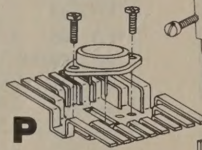
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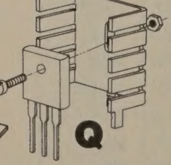
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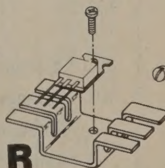
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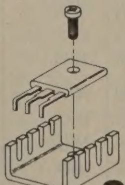
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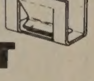
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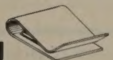
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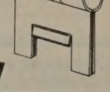
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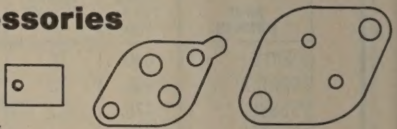
Accessories



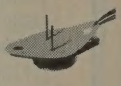
INSULATORS

CASE STYLE	MATERIAL/PART NUMBERS		
	THERMALFILM	HD ANOD ALUM	BeO
TO-3	43-03-1 & -2 43-03-3 & -4	4726A 4703A	4003
TO-5	43-05-1		4005
TO-66	43-66-1 & -2	4766A	4066
PLASTIC POWER	43-77-1 & -2 43-77-9	4777A 4778A	
WASHERS	43-02-10 43-02-25 43-02-95		B375-120-62 B470-235-40 B510-200-40

Consult Thermalloy catalog for dimensions. MIL SPEC parts available.

INSUL-COTE Insul-Cote is a neatly packaged Thermalfilm or mica insulator PRE-COATED with Thermalcote thermal grease. Available in individual packets or high volume "Ammo Pack" for use with Thermalloy's Insul-Cote dispenser. Below is a partial listing of Insul-Cote Insulators. For case style consult table above.

INSUL-COTE WITH THERMALFILM I	INSUL-COTE WITH .002/.003 MICA
43-03-1AP 43-66-1AP	56-03-2AP
43-03-2AP 43-66-2AP	56-66-2AP
43-03-3AP 43-77-2AP	56-77-2AP
43-03-4AP 43-77-9AP	

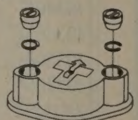


For other INSUL-COTE pre-coated insulators, individual packets, or production dispenser, consult factory.

MOUNTING PADS Prevent heat damage during soldering, facillitate board clean-up, prevent solder bridges, assure uniform device height, and simplify board repair. Designate material and color as suffix to part no. Materials: (-N) Nylon, or (-DAP) Diallyl Phthalate. Example: 7717-N RED

CASE STYLE	PART NO.	LEADS	O.D.	THK
TO-5	7717-4	4	.375	.075
	7717-5	4	.350	.125
TO-18	7717-7	4	.250	.125
	7717-18	4	.200	.100
	7717-152	3-4	.200	.045
TO-18 LEAD CONVERSION				
to TO-5	7717-44	4	.305	.125
to .150 Dia Cir	7717-93	4	.230	.055
IC LEAD	7717-107	8	.430	.130
IC LEAD CONVERSION				
.250 to .350	7717-222	8	.365	.070
.200 to .400	7717-19	8	.500	.275
EPOXY .05 in-line to TO-5	7717-2	3	.305	.125

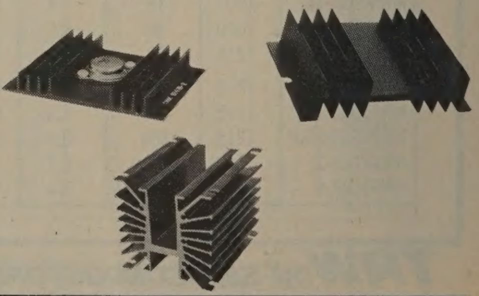
TO-3 COVER Insulating cover for TO-3 transistor includes lock washers for electrical connection of mounting screws to collector, test probe hole, and screw covers. Available in white glass filled nylon, Part No. 8903NW, or 94V.O UL APVD BLACK THERMOPLASTIC POLYESTER, Part No. 8903VB.



THERMALCOTE — a superior thermal point compound. Improves heat transfer across interface.

1 oz. tube	Part No. 249
2 oz. jar	Part No. 250
1 lb.	Part No. 251

CUSTOM FABRICATED EXTRUDED HEAT SINKS Industry standard extrusion profiles are immediately available from Thermalloy stock. Many additional shapes are available at no tooling charge on a minimum order basis.



VARO

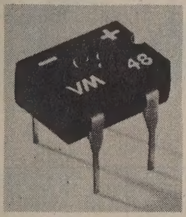
VARO SEMICONDUCTOR. INC.

DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

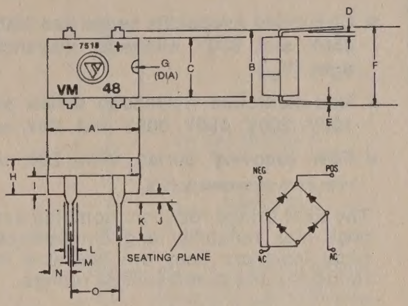
DIB

1 AMP DUAL IN-LINE BRIDGE

- **Glass-passivated diode chips**
- **Standard .10" grid DIP lead spacing 2 DIB's will fit in standard 14 pin DIP socket**
- **25V, 50V, 100V, 200V, 400V, 600V, 800V & 1000V (V_{RRM})**
- **25A peak one-half cycle surge current**



LTR	Inches	Millimeters
A	.370-.390	9.40-9.91
B	.280-.320	7.11-8.13
C	.240-.260	6.10-6.60
D	.010-.020	0.25-0.51
E	.008-.015	0.20-0.38
F	.380 Max.	9.65 Max.
G	.057-.067	1.45-1.70
H	.140-.160	3.56-4.06
I	.070-.080	1.78-2.03
J	.055 Max.	1.40 Max.
K	.120-.130	3.05-3.30
L	.040-.060	1.02-1.52
M	.016-.020	0.41-0.51
N	.080-.100	2.03-2.54
O	.190-.210	4.83-5.33

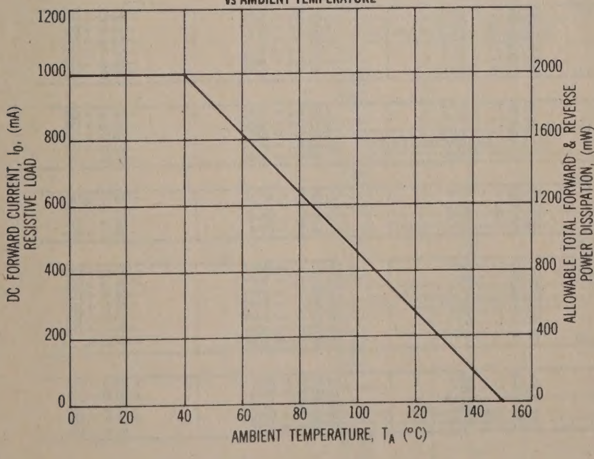


SPECIFICATIONS @ T_A = 25°C (UNLESS OTHERWISE SPECIFIED)

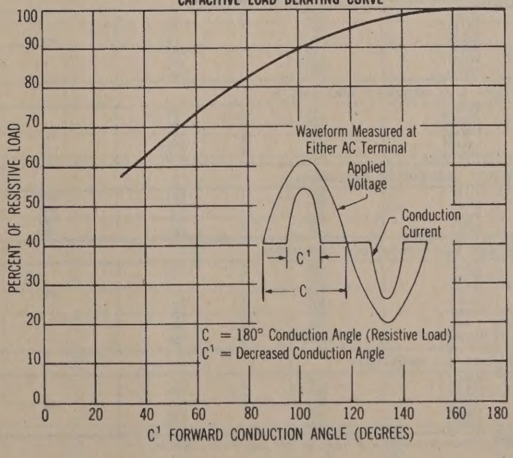
Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	RMS Reverse Voltage [$V_{R(RMS)}$] (Volts)	Peak Surge Current ½ Cycle @ 60 Hz (I_{FSM}) (Amps)	DC Fwd. Current @ T_A = 40°C (I_O) (Amps)	Junction Oper. & Stg. Temp. Range (T_J, T_{STG}) (°C)	Max. Inst. Fwd. Voltage Drop @ I_O (V_{FM}) (Volts/Leg)	Max. Rev. Current @ Rated V_{RRM} & T_A = 40°C (I_{RM}) (μA/Leg)
VM25	25	18	25	1	−50 to +150	1.2	5.0
VM08	50	35	25	1	−50 to +150	1.2	5.0
VM18	100	70	25	1	−50 to +150	1.2	5.0
VM28	200	140	25	1	−50 to +150	1.2	5.0
VM48	400	280	25	1	−50 to +150	1.2	5.0
VM68	600	420	25	1	−50 to +150	1.2	5.0
VM88	800	560	25	1	−50 to +150	1.2	5.0
VM108	1000	700	25	1	−50 to +150	1.2	5.0

Write for Data Sheet DLS051

DC FORWARD CURRENT & ALLOWABLE POWER DISSIPATION vs AMBIENT TEMPERATURE



CAPACITIVE LOAD DERATING CURVE



VARO SEMICONDUCTOR, INC.

VARO

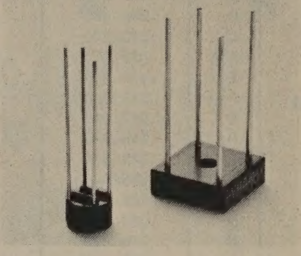
DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

EBR EPOXY BRIDGE RECTIFIERS

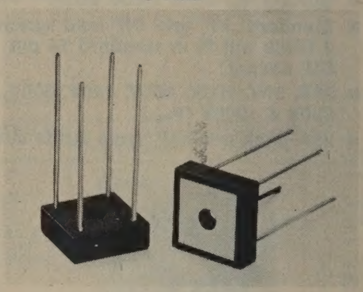
- **Controlled Avalanche series has 250V, 450V, 650V and 850V minimum avalanche voltages (V_{BR})**
- **Non-controlled Avalanche series with 50V, 100V, 200V, 400V, 600V and 800V, and 1000 (V_{RRM})**
- **Fast recovery series with 200 nanosec. max. reverse recovery (t_{rr}).**

The EBR bridge rectifiers combine economical cost, high reliability and circuit-to-case electrical isolation. They are available in a wide range of current and voltage ratings.

1 AMP 2 & 6 AMP



10 AMP



MAXIMUM RATINGS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	RMS Reverse Voltage [$V_{R(RMS)}$] (Volts)	Power Dissipation (100 µsec sq. wave) (P_{RM}) (Watts)	Peak Surge Current (½ cycle @ 60 Hz, Non-Rep) (I_{FSM}) (Amps)	DC Forward Current (I_O) (Amps)	Junction Operating Stg. Temp. Range (T_J, T_{STG}) (°C)
1 AMP CONTROLLED AVALANCHE						
VE27	200	140	200	25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE47	400	280	200	25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE67	600	420	200	25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE87	800	560	200	25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
1 AMP NON-CONTROLLED AVALANCHE						
W110	25	17	NA	25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE08	50	35		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE18	100	70		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE28	200	140		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE48	400	280		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE68	600	420		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE88	800	560		25 @ T_A = 65°C	1 @ T_A = 65°C	−50 to +150
VE108	1000	700		25 @ T_A = 65°C	1 @ T_A =65°C	−50 to +150
1 AMP FAST RECOVERY						
VE08X	50	35	NA	17 @ T_A = 40°C	1 @ T_A = 40°C	−50 to +125
VE18X	100	70		17 @ T_A = 40°C	1 @ T_A = 40°C	−50 to +125
VE28X	200	140		17 @ T_A = 40°C	1 @ T_A = 40°C	−50 to +125
VE48X	400	280		17 @ T_A = 40°C	1 @ T_A = 40°C	−50 to +125
VE68X	600	560		17 @ T_A = 40°C	1 @ T_A = 40°C	−50 to +125
2 AMP CONTROLLED AVALANCHE						
VS247 *	200	140	300	50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS447 *	400	280	300	50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS647 *	600	420	300	50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS847 *	800	560	300	50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
2 AMP NON-CONTROLLED AVALANCHE						
VS048 *	50	35	NA	50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS148 *	100	70		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS248 *	200	140		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS448 *	400	280		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS648 *	600	420		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS848 *	800	560		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
VS1048 *	1000	700		50 @ T_A = 60°C	2 @ T_A = 60°C	−50 to +150
2 AMP FAST RECOVERY						
VS048X *	50	35	NA	35 @ T_A = 45°C	2 @ T_A = 45°C	−50 to +135
VS148X *	100	70		35 @ T_A = 45°C	2 @ T_A = 45°C	−50 to +135
VS248X *	200	140		35 @ T_A = 45°C	2 @ T_A = 45°C	−50 to +135
VS448X *	400	280		35 @ T_A = 45°C	2 @ T_A = 45°C	−50 to +135
VS648X *	600	420		35 @ T_A = 45°C	2 @ T_A = 45°C	−50 to +135
6 AMP CONTROLLED AVALANCHE (See Note 1)						
VH247 *	200	140	400	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH447 *	400	280	400	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH647 *	600	420	400	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH847 *	800	560	400	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH1048 *	1000	700	400	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
6 AMP NON-CONTROLLED AVALANCHE (See Note 1)						
VH048 *	50	35	NA	100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH148 *	100	70		100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH248 *	200	140		100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH448 *	400	280		100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH648 *	600	420		100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
VH848 *	800	560		100 @ T_{HS} = 80°C	6 @ T_{HS} = 80°C	−50 to +150
5 AMP FAST RECOVERY (See Note 1)						
VH048X *	50	35	NA	65 @ T_{HS} = 60°C	5 @ T_{HS} = 60°C	−50 to +135
VH148X *	100	70		65 @ T_{HS} = 60°C	5 @ T_{HS} = 60°C	−50 to +135
VH248X *	200	140		65 @ T_{HS} = 60°C	5 @ T_{HS} = 60°C	−50 to +135
VH448X *	400	280		65 @ T_{HS} = 60°C	5 @ T_{HS} = 60°C	−50 to +135
VH648X *	600	560		65 @ T_{HS} = 60°C	5 @ T_{HS} = 60°C	−50 to +135
10 AMP CONTROLLED AVALANCHE						
VJ247	200	140	400	100 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ447	400	280	400	100 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ647	600	420	400	100 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ847	800	560	400	100 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
10 AMP NON-CONTROLLED AVALANCHE						
VJ048	50	35	NA	100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ148	100	70		100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ248	200	140		100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ448	400	280		100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ648	600	420		100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ848	800	560		100 @ T_C = 60°C	10 @ T_C = 80°C	−50 to +150
VJ1048	1000	700		100 @ T_C = 60°C	10 @ T_C = 80°C 10 @ T_C = 80°C	−50 to +150
10 AMP FAST RECOVERY						
VJ048X	50	35	NA	75 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ148X	100	70		75 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ248X	200	140		75 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ448X	400	280		75 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150
VJ648X	600	420		75 @ T_C = 60°C	10 @ T_C = 60°C	−50 to +150

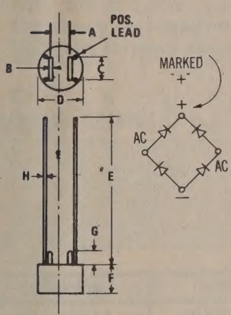
NOTE 1: Mount to heat sink as shown on next page for full rated I_O.

Asterisk indicates recognition under Component Program of Underwriter's Laboratories, Inc.

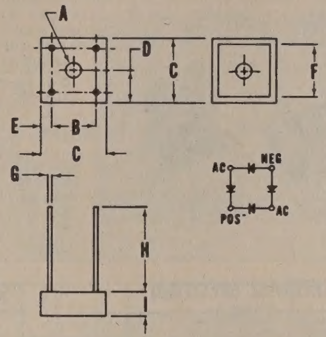
VARO SEMICONDUCTOR, INC.

VARO
DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

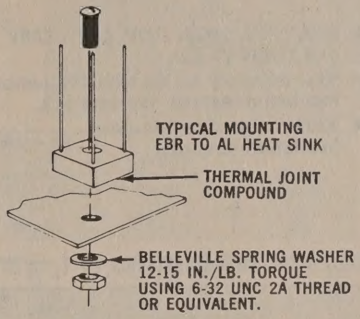
EBR EPOXY BRIDGE RECTIFIERS



1 AMP



2A, 6A & 10A


TYPICAL MOUNTING EBR TO AL HEAT SINK
THERMAL JOINT COMPOUND
BELLEVILLE SPRING WASHER 12-15 IN./LB. TORQUE USING 6-32 UNC 2A THREAD OR EQUIVALENT.

HEAT SINK MOUNTING

1 AMP

LTR	Inches	Millimeters
A	.11	2.79
B	.03	0.76
C	.185-.215	4.70-5.46
D	.33 Dia.	8.38 Dia.
E	1.0 Min.	25.4 Min.
F	.20	5.08
G	.05	1.27
H	.022-.028 Dia.	.558-.711 Dia.

2 AMP, 6 AMP, 10 AMP

LTR	Inches	Millimeters
A	.137-.167 Dia.	3.48-4.24 Dia.
B	.411-.441	10.44-11.20
C	.590-.610	14.99-15.49
D	.295-.305	7.49-7.75
E	.087	2.21
F*	.490-.510	12.45-12.95
G	.038-.042	.970-1.07
H	1.0 Min.	25.40 Min.
I	.195-.205	4.95-5.21

*On 10 Amp Only.

ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Avalanche Voltage (V_{BR})		Max. Inst. Forward Voltage Drop @ I_O (V_{FM})	Max. Reverse Current @ Rated V_{RRM} (I_{RM}) ($T_A = 40°C$)	($T_A = 150°C$)	Max. Reverse Recovery Time (t_{rr})	Write For Data Sheet Number
	Min. Volts	Max. Volts	(Volts/Leg)	(μA/Leg)	(mA/Leg)	(Nanosec.)	
1 AMP CONTROLLED AVALANCHE							
VE27	250	700	1.2	5	0.1	NA	DLS-028
VE47	450	900	1.2	5	0.1		DLS-028
VE67	650	1100	1.2	5	0.1		DLS-028
VE87	850	1300	1.2	5	0.1		DLS-028
1 AMP NON-CONTROLLED AVALANCHE							
W110	NA	NA	1.2	5	0.1	NA	DLS-028
VE08			1.2	5	0.1		DLS-028
VE18			1.2	5	0.1		DLS-028
VE28			1.2	5	0.1		DLS-028
VE48			1.2	5	0.1		DLS-028
VE68			1.2	5	0.1		DLS-028
VE88			1.2	5	0.1		DLS-028
VE108			1.2	5	0.1		DLS-028
1 AMP FAST RECOVERY (See Note 2)							
VE08X	NA	NA	1.5	10	2.0	200	DLS-043
VE18X			1.5	10	2.0	200	DLS-043
VE28X			1.5	10	2.0	200	DLS-043
VE48X			1.5	10	2.0	200	DLS-043
VE68X			1.5	10	2.0	200	DLS-043
2 AMP CONTROLLED AVALANCHE							
VS247	250	700	1.2	5	0.1	NA	DLS-021
VS447	450	900	1.2	5	0.1		DLS-021
VS647	650	1100	1.2	5	0.1		DLS-021
VS847	850	1300	1.2	5	0.1		DLS-021
2 AMP NON-CONTROLLED AVALANCHE							
VS048	NA	NA	1.2	5	0.1	NA	DLS-021
VS148			1.2	5	0.1		DLS-021
VS248			1.2	5	0.1		DLS-021
VS448			1.2	5	0.1		DLS-021
VS648			1.2	5	0.1		DLS-021
VS848			1.2	5	0.1		DLS-021
VS1048			1.2	5	0.1		DLS-021
2 AMP FAST RECOVERY (See Note 2)							
VS048X	NA	NA	1.5	10	4.0	200	DLS-044
VS148X			1.5	10	4.0	200	DLS-044
VS248X			1.5	10	4.0	200	DLS-044
VS448X			1.5	10	4.0	200	DLS-044
VS648X			1.5	10	4.0	200	DLS-044
6 AMP CONTROLLED AVALANCHE							
VH247	250	700	1.3	5	0.1	NA	DLS-029
VH447	450	900	1.3	5	0.1		DLS-029
VH647	650	1100	1.3	5	0.1		DLS-029
VH847	850	1300	1.3	5	0.1		DLS-029
6 AMP NON-CONTROLLED AVALANCHE							
VH048	NA	NA	1.3	5	0.1	NA	DLS-029
VH148			1.3	5	0.1		DLS-029
VH248			1.3	5	0.1		DLS-029
VH448			1.3	5	0.1		DLS-029
VH648			1.3	5	0.1		DLS-029
VH848			1.3	5	0.1		DLS-029
VH1048			1.3	5	0.1		DLS-029
5 AMP FAST RECOVERY (See Note 2)							
VH048X	NA	NA	1.4	10	4.0	200	DLS-040
VH148X			1.4	10	4.0	200	DLS-040
VH248X			1.4	10	4.0	200	DLS-040
VH448X			1.4	10	4.0	200	DLS-040
VH648X			1.4	10	4.0	200	DLS-040
10 AMP CONTROLLED AVALANCHE							
VJ247	250	700	1.3	5	0.1	NA	DLS-042
VJ447	450	900	1.3	5	0.1		DLS-042
VJ647	650	1100	1.3	5	0.1		DLS-042
VJ847	850	1300	1.3	5	0.1		DLS-042
10 AMP NON-CONTROLLED AVALANCHE							
VJ048	NA	NA	1.3	5	0.1	NA	DLS-042
VJ148			1.3	5	0.1		DLS-042
VJ248			1.3	5	0.1		DLS-042
VJ448			1.3	5	0.1		DLS-042
VJ648			1.3	5	0.1		DLS-042
VJ848			1.3	5	0.1		DLS-042
VJ1048			1.3	5	0.1		DLS-042
10 AMP FAST RECOVERY (See Note 2)							
VJ048X	NA	NA	1.5	10	2.0	200	DLS-046
VJ148X			1.5	10	2.0	200	DLS-046
VJ248X			1.5	10	2.0	200	DLS-046
VJ448X			1.5	10	2.0	200	DLS-046
VJ648X			1.5	10	2.0	200	DLS-046

NOTE 2: t_{rr} measured at $I_F = 1$ Amp, $I_R = 2$ Amps, Recovery to $I_{R(REC)} = .2$ Amps.

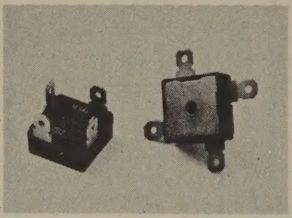
VARO SEMICONDUCTOR, INC.

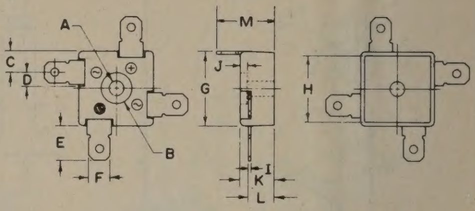
VARO
DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

EBR™

EPOXY BRIDGE RECTIFIERS
15A and 30A Single Phase, Full Wave

- 50V, 100V, 200V, 400V, 600V, 800V and 1000V (V_{RRM})
- Fast recovery series with 200 nanosec. maximum reverse recovery (t_{rr}).
- 2200V min. circuit-to-case insulation strength.





LTR	Inches	Millimeters
A	.162-.168 Dia.	4.11-4.27 Dia.
B	.345-.355 Dia.	8.76-9.02 Dia.
C	.23-.27 Typ.	5.84-6.86 Typ.
D	.138-.158 Typ.	3.51-4.01 Typ.
E	.38-.42 Typ.	9.65-10.67 Typ.
F	.245-.255 Typ.	6.22-6.48 Typ.
G	.85-.89 Sq.	21.59-22.61 Sq.
H	.76-.78 Sq.	19.30-19.81 Sq.
I	.030-.034 Typ.	.76-.86 Typ.
J	.09-.11	2.29-2.79
K	.38-.42	9.65-10.67
L	.29-.30	7.37-7.62
M	.75 Max.	19.05 Max.

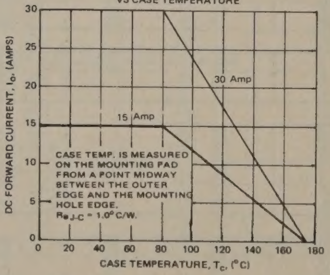
ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Avalanche Voltage (V_{BR}) (Min. Volts)	Avalanche Voltage (V_{BR}) (Max. Volts)	Max. Inst. Fwd. Voltage Drop @ I_O (V_{FM}) (Volts/Leg)	Max. Rev. Cur. @ Rated V_{RM} & $T_J = 40°C$ (I_{RM}) (µ/Leg)	Max. Rev. Cur. @ Rated V_{RM} & $T_J = 175°C$ (I_{RM}) (mA/Leg)	Max. Thermal Resist. Junction to Case ($R\theta_{J-C}$) (°C/W)	Write For Data Sheet Number
15 AMP CONTROLLED AVALANCHE							
VL247	250	700	1.4	5	0.5	1.5	DLS-054
VL447	450	900	1.4	5	0.5	1.5	DLS-054
VL647	650	1100	1.4	5	0.5	1.5	DLS-054
VL847	850	1300	1.4	5	0.5	1.5	DLS-054
15 AMP NON-CONTROLLED AVALANCHE							
VL048	NA		1.4	5	0.5	1.5	DLS-054
VL148			1.4	5	0.5	1.5	DLS-054
VL248			1.4	5	0.5	1.5	DLS-054
VL448			1.4	5	0.5	1.5	DLS-054
VL648			1.4	5	0.5	1.5	DLS-054
VL848			1.4	5	0.5	1.5	DLS-054
VL1048			1.4	5	0.5	1.5	DLS-054
30 AMP CONTROLLED AVALANCHE							
VK247	250	700	1.4	10	1.0	1.0	DLS-055
VK447	450	900	1.4	10	1.0	1.0	DLS-055
VK647	650	1100	1.4	10	1.0	1.0	DLS-055
VK847	850	1300	1.4	10	1.0	1.0	DLS-055
30 AMP NON-CONTROLLED AVALANCHE							
VK048	NA		1.4	10	1.0	1.0	DLS-055
VK148			1.4	10	1.0	1.0	DLS-055
VK248			1.4	10	1.0	1.0	DLS-055
VK448			1.4	10	1.0	1.0	DLS-055
VK648			1.4	10	1.0	1.0	DLS-055
VK848			1.4	10	1.0	1.0	DLS-055
VK1048			1.4	10	1.0	1.0	DLS-055

MAXIMUM RATINGS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

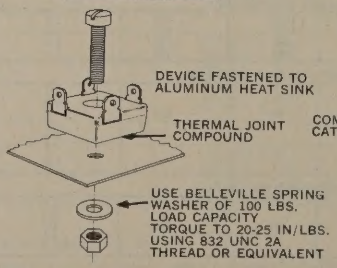
Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	RMS Reverse Voltage [$V_{R(RMS)}$] (Volts)	Power Dissipation (100 µsec square wave) (P_{RM}) (Watts)	Peak Surge Current (½ Cycle @ 60 Hz Non-Rep) (I_{FSM}) (Amps)	Peak Surge Current (1 sec @ 60 Hz & $T_C = 80°C$) (I_{FRM}) (Amps)	DC Forward Current @ $T_C = 80°C$ (I_O) (Amps)	Junction Oper & Stg. Temp. Range (T_J, T_{STG}) (°C)
15 AMP CONTROLLED AVALANCHE							
VL247	200	140	600	100	30	15	−50 to +175
VL447	400	280	600	100	30	15	−50 to +175
VL647	600	420	600	100	30	15	−50 to +175
VL847	800	560	600	100	30	15	−50 to +175
15 AMP NON-CONTROLLED AVALANCHE							
VL048	50	35	NA	100	30	15	−50 to +175
VL148	100	70		100	30	15	−50 to +175
VL248	200	140		100	30	15	−50 to +175
VL448	400	280		100	30	15	−50 to +175
VL648	600	420		100	30	15	−50 to +175
VL848	800	560		100	30	15	−50 to +175
VL1048	1000	700		100	30	15	−50 to +175
30 AMP CONTROLLED AVALANCHE							
VK247	200	140	1500	300	75	30	−50 to +175
VK447	400	280	1500	300	75	30	−50 to +175
VK647	600	420	1500	300	75	30	−50 to +175
VK847	800	560	1500	300	75	30	−50 to +175
30 AMP NON-CONTROLLED AVALANCHE							
VK048	50	35	NA	300	75	30	−50 to +175
VK148	100	70		300	75	30	−50 to +175
VK248	200	140		300	75	30	−50 to +175
VK448	400	280		300	75	30	−50 to +175
VK648	600	420		300	75	30	−50 to +175
VK848	800	560		300	75	30	−50 to +175
VK1048	1000	700		300	75	30	−50 to +175

DC FORWARD CURRENT VS CASE TEMPERATURE



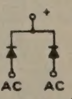
DC Forward Current at T_A=40°C and no heat sink=5 Amps.

TYPICAL MOUNTING


DEVICE FASTENED TO ALUMINUM HEAT SINK
THERMAL JOINT COMPOUND
USE BELLEVILLE SPRING WASHER OF 100 LBS. LOAD CAPACITY TORQUE TO 20-25 IN/LBS. USING 832 UNC 2A THREAD OR EQUIVALENT

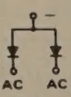
Also available in the following circuits:

COMMON CATHODE



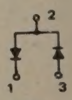
Add Suffix "A" to Part No.

COMMON ANODE



Add Suffix "B" to Part No.

DOUBLER



Add Suffix "C" to Part No.

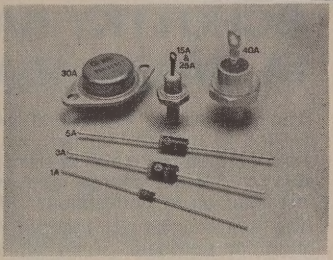
VARO
VARO SEMICONDUCTOR, INC.
P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEX. 75040 (214) 272-4551 TWX 910-860-5178

SCHOTTKY BARRIER RECTIFIERS

1A, 3A, 5A, 15A, 25A, 30A and 40A

- 20V, 30V and 40V (V_{RRM})
- Extremely fast recovery
- Very low forward voltage drop

With very low forward voltage drop and fast switching time, this family of Schottky rectifiers are ideally suited for application in low voltage computer power supplies, free-wheeling diode applications, flyback diode applications and polarity protection in high speed switching circuits.



MAXIMUM RATINGS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Peak Repetitive Reverse Voltage (V_{RRM}) (Volts)	RMS Reverse Voltage $V_{R(RMS)}$ (Volts)	Average Rectified Forward Current (I_O) (Amps)	Ambient Temp. @ Rated V_{RM} (T_A) (°C)	Peak Surge Cur. (Non-Rep) 300 μsec Pulse Width (I_{FSM}) (Amps)	Peak Surge Current (Non-Rep) ½ Cycle, 60 Hz (I_{FSM}) (Amps)	Junction Operating Temp. (T_J) (°C)	Storage Temp. (T_{STG}) (°C)
1 AMP								
VSK120	20	14	1.0	90 $R\theta_{JA} \leq 50°C/W$	100	40	−65 to +150	−65 to +150
VSK130	30	21	1.0	85	100	40	−65 to +150	−65 to +150
VSK140	40	28	1.0	80	100	40	−65 to +150	−65 to +150
							(Note 1)	
3 AMP								
VSK320	20	14	3.0	85 $R\theta_{JA} \leq 24°C/W$	250	150	−65 to +150	−65 to +150
VSK330	30	21	3.0	80	250	150	−65 to +150	−65 to +150
VSK340	40	28	3.0	75	250	150	−65 to +150	−65 to +150
							(Note 2)	
5 AMP								
VSK520	20	14	5.0	70 $R\theta_{JA} \leq 16°C/W$	500	250	−65 to +150	−65 to +150
VSK530	30	21	5.0	65	500	250	−65 to +150	−65 to +150
VSK540	40	28	5.0	60	500	250	−65 to +150	−65 to +150
							(Note 3)	
15 AMP								
VSK1520	20	14	15.0	95 $R\theta_{JA} \leq 4.5°C/W$	500	300	−65 to +150	−65 to +150
VSK1530	30	21	15.0	90	500	300	−65 to +150	−65 to +150
VSK1540	40	28	15.0	85	500	300	−65 to +150	−65 to +150
25 AMP								
VSK2520	20	14	25.0	90 $R\theta_{JA} \leq 3.5°C/W$	800	500	−65 to +150	−65 to +150
VSK2530	30	21	25.0	85	800	500	−65 to +150	−65 to +150
VSK2540	40	28	25.0	80	800	500	−65 to +150	−65 to +150
							(Note 4)	
30 AMP								
VSK3020T	20	14	30.0	95 $R\theta_{JA} \leq 4.5°C/W$	500	300	−65 to +150	−65 to +150
VSK3030T	30	21	30.0	90	500	300	−65 to +150	−65 to +150
VSK3040T	40	28	30.0	85	500	300	−65 to +150	−65 to +150
							(Note 5)	
40 AMP								
VSK4020	20	14	40.0	90 $R\theta_{JA} \leq 2.0°C/W$	800	500	−65 to +150	−65 to +150
VSK4030	30	21	40.0	85	800	500	−65 to +150	−65 to +150
VSK4040	40	28	40.0	80	800	500	−65 to +150	−65 to +150
							(Note 6)	

ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Maximum Instantaneous Forward Voltage Drop (V_F) (Volts)			Maximum Instantaneous Reverse Current @ Rated V_{RM} (Note 6) (I_R) (mA)		Write for Data Sheet Number
1 AMP						
VSK120	.350, $i_F = 0.1A$	.550, $i_F = 1A$	.850, $i_F = 3A$	1.0, $T_L = 25°C$	10, $T_L = 100°C$	DLS060
VSK130	.350, $i_F = 0.1A$	.550, $i_F = 1A$	.850, $i_F = 3A$	1.0, $T_L = 25°C$	10, $T_L = 100°C$	DLS060
VSK140	.350, $i_F = 0.1A$	.550, $i_F = 1A$	.850, $i_F = 3A$	1.0, $T_L = 25°C$	10, $T_L = 100°C$	DLS060
3 AMP						
VSK320	.400, $i_F = 1A$	.475, $i_F = 3A$	.750, $i_F = 10A$	3.0, $T_L = 25°C$	30, $T_L = 100°C$	DLS061
VSK330	.400, $i_F = 1A$	.475, $i_F = 3A$	.750, $i_F = 10A$	3.0, $T_L = 25°C$	30, $T_L = 100°C$	DLS061
VSK340	.400, $i_F = 1A$	.475, $i_F = 3A$	.750, $i_F = 10A$	3.0, $T_L = 25°C$	30, $T_L = 100°C$	DLS061
5 AMP						
VSK520	.400, $i_F = 3A$	.450, $i_F = 5A$	.625, $i_F = 15A$	10, $T_L = 25°C$	75, $T_L = 100°C$	DLS062
VSK530	.400, $i_F = 3A$	.450, $i_F = 5A$	.625, $i_F = 15A$	10, $T_L = 25°C$	75, $T_L = 100°C$	DLS062
VSK540	.400, $i_F = 3A$	.450, $i_F = 5A$	.625, $i_F = 15A$	10, $T_L = 25°C$	75, $T_L = 100°C$	DLS062
15 AMP (NOTE 7)						
VSK2520	.500, $i_F = 8A$	.600, $i_F = 15A$	1.0, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS063
VSK2530	.500, $i_F = 8A$	.600, $i_F = 15A$	1.0, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS063
VSK2540	.500, $i_F = 8A$	.600, $i_F = 15A$	1.0, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS063
25 AMP						
VSK1520	.460, $i_F = 10A$	.560, $i_F = 25A$	.960, $i_F = 75A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS076
VSK1530	.460, $i_F = 10A$	.560, $i_F = 25A$	.960, $i_F = 75A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS076
VSK1540	.460, $i_F = 10A$	.560, $i_F = 25A$	.960, $i_F = 75A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS076
30 AMP (NOTE 8)						
VSK3020T	.530, $i_F = 8A$	.640, $i_F = 15A$	1.04, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS064
VSK3030T	.530, $i_F = 8A$	.640, $i_F = 15A$	1.04, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS064
VSK3040T	.530, $i_F = 8A$	.640, $i_F = 15A$	1.04, $i_F = 45A$	10, $T_C = 25°C$	75, $T_C = 100°C$	DLS064
40 AMP (NOTE 9)						
VSK4020	.510, $i_F = 20A$	.620, $i_F = 40A$	.960, $i_F = 120A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS074
VSK4030	.510, $i_F = 20A$	.620, $i_F = 40A$	.960, $i_F = 120A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS074
VSK4040	.510, $i_F = 20A$	.620, $i_F = 40A$	.960, $i_F = 120A$	20, $T_C = 25°C$	150, $T_C = 100°C$	DLS074

NOTES:

1. $V_{RM} \leq 0.1\ V_{RM}$ Max., $R\theta_{JA} \leq 35°C/W$
2. $V_{RM} \leq 0.1\ V_{RM}$ Max., $R\theta_{JA} \leq 32°C/W$
3. $V_{RM} \leq 0.1\ V_{RM}$ Max., $R\theta_{JA} \leq 12°C/W$
4. $V_{RM} \leq 10V$ on VSK1520; $\leq 15V$ on VSK1530 or $\leq 20V$ on VSK1540, $R\theta_{JA} \leq 4.5°C/W$
5. At one-half rated V_{RRM}, $R\theta_{JA} \leq 4.5°C/W$
6. $V_{RM} \leq 10V$ on VSK4020; $\leq 15V$ on VSK4030; $\leq 20V$ on VSK4040, $R\theta_{JA} \leq 2.0°C/W$
7. Thermal Resistance, Junction-to-Case ($R\theta_{JC}$) = 2.5°C/W
8. Thermal Resistance, Junction-to-Case ($R\theta_{JC}$) = 1.5°C/W
9. Thermal Resistance, Junction-to-Case ($R\theta_{JC}$) = 1.0°C/W
10. Pulse Test: Pulse width = 300 μsec, duty cycle = 2%

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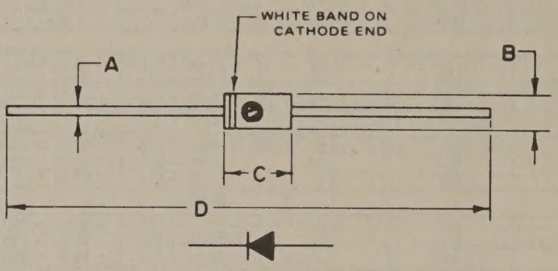
SCHOTTKY BARRIER RECTIFIERS
1A, 3A, 5A, 15A, 25A, 30A and 40A

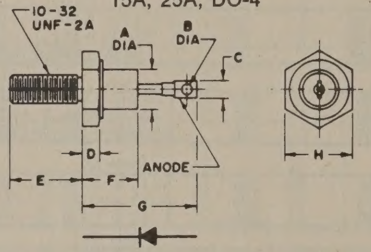
The current flow in a Schottky barrier rectifier is due to majority carrier conduction and is not affected by reverse recovery transients due to stored charge and minority carrier injection as in conventional PN diodes.

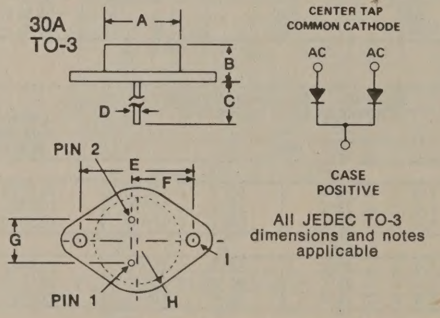
The Schottky barrier rectifier may be considered for purposes of circuit analysis, as an ideal diode in parallel with a variable capacitance equal in value to the junction capacitance.

1A, 3A, 5A

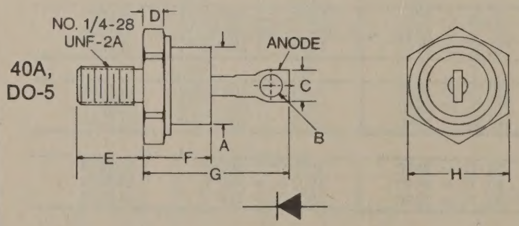

WHITE BAND ON CATHODE END
A
B
C
D

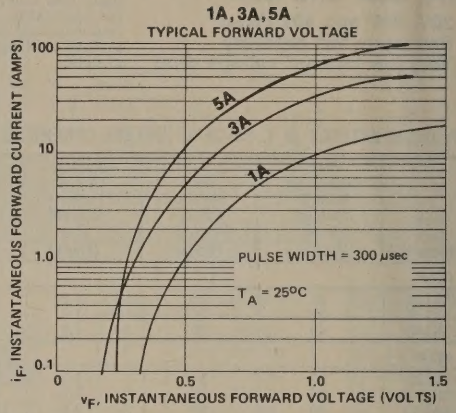
15A, 25A, DO-4

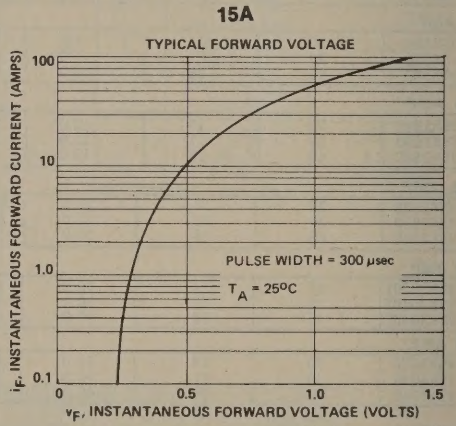

10-32 UNF-2A
A DIA
B DIA
C
D
ANODE
E
F
G
H

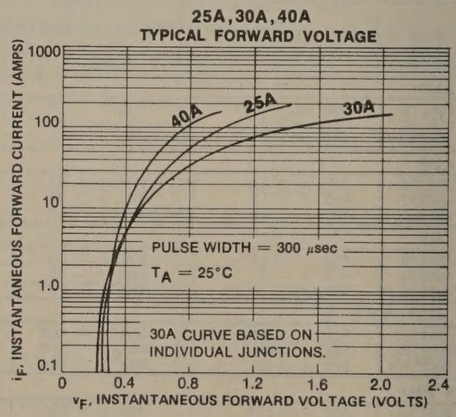

30A TO-3
A
B
C
D
CENTER TAP COMMON CATHODE
AC
AC
CASE POSITIVE
PIN 2
E
F
G
I
PIN 1
H

All JEDEC TO-3 dimensions and notes applicable


NO. 1/4-28 UNF-2A
D
ANODE
40A, DO-5
C
A
B
E
F
G
H







LTR	1A		3A & 5A		15A		25A		30A		40A	
	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
A	.030-.034 D	.76-.86 D	.048-.052 D	1.22-1.32 D	.245-.255	6.22-6.48	.350 D	8.89 D	.72 D	18.29 D	.492-.502 D	12.50-12.75 D
B	.10-.107 D	2.54-2.72 D	.20 D	5.08 D	.080 Min.	2.03 Min.	.085 D	2.16 D	.323-.342	8.20-8.69	.140 Min. D	3.56 Min. D
C	.185-.205	4.70-5.21	.38	9.65	.125 Max.	3.18 Max.	.120	3.05	.40 Min.	10.16 Min.	.225 Max.	5.72 Max.
D	.240	60.69	2.75	69.85	.075-.175	1.91-4.45	.120	3.05	.038-.043 D	.97-1.09 D	.115-.200	2.95-5.08
E	—	—	—	—	.422-.453	10.72-11.5	.430	10.92	1.180-1.194	29.97-30.33	.422-.453	10.72-11.51
F	—	—	—	—	.405 Max.	10.29 Max.	.355	9.02	.665-.675	16.69-17.15	.450 Max.	11.43 Max.
G	—	—	—	—	.820 Max.	20.83 Max.	.730	18.54	.426-.440	10.82-11.18	1.000 Max.	25.40 Max.
H	—	—	—	—	.424-.437	10.77-11.10	.431 Typ.	10.95	.525 R Max.	13.34 R Max.	.667-.687	16.94-17.45
I	—	—	—	—	—	—	—	—	.151-.161 D	3.84-4.09 D	—	—

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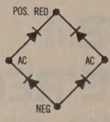
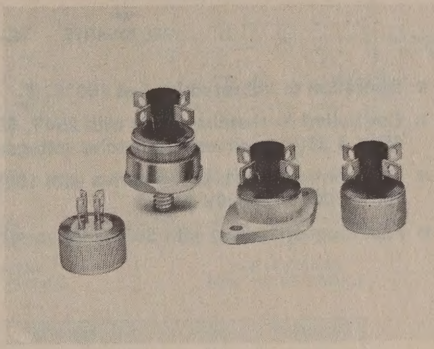


SILICON AVALANCHE INTEGRATED BRIDGE RECTIFIERS

10 AMP & 25 AMP SINGLE PHASE, FULL WAVE

- **Operation to full rated load at 100°C, T_C**
- **250V, 450V, 650V & 850V minimum avalanche voltages (V_{BR})**
- **Fast recovery series with 200 nanosec recovery time (t_{rr})**
- **2000 V minimum circuit-to-case isolation.**



The IBR offers full wave rectification in a rigidly constructed, hermetically sealed, welded package. The controlled avalanche characteristics permit the use of lower PRV safety factors for junction protection from transient over voltages. Proper heat sinking allows great flexibility in DC output current ranges.

These characteristics plus the electrically isolated case allows the IBR to be used in applications where space, current and cost requirements have previously not allowed the use of semiconductors.

Three mounting options available, press-fit, stud mount, TO-3 outline flange.

MAXIMUM RATINGS @ 60 Hz RESISTIVE AND INDUCTIVE LOAD, $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM})	RMS Reverse Voltage [$V_{R(RMS)}$]	Power Dissipation (100 μsec sq. wave) (P_{RM})	Peak Surge Current (½ cycle @ 60 Hz, Non-Rep) (I_{FSM})	DC Forward Current @ $T_C = 100°C$ (I_O)[1]	Junction Operating Stg. Temp. Range (T_J, T_{STG})
	(Volts)	(Volts)	(Watts)	(Amps)	(Amps)	(°C)
10 AMP CONTROLLED AVALANCHE						
IN4436	200	140	600	100	10	−65 to +160
IN4437	400	280	600	100	10	−65 to +160
IN4438	600	420	600	100	10	−65 to +160
IN4439	800	560	600	100	10	−65 to +160
10 AMP FAST RECOVERY (See Note 4)						
VR100X	100	70	NA	75	10	−65 to +150
VR200X	200	140		75	10	−65 to +150
VR400X	400	280		75	10	−65 to +150
VR600X	600	420		75	10	−65 to +150
25 AMP CONTROLLED AVALANCHE						
VT200	200	140	1500	250	25	−65 to +180
VT400	400	280	1500	250	25	−65 to +180
VT600	600	420	1500	250	25	−65 to +180
VT800	800	560	1500	250	25	−65 to +180
25 AMP FAST RECOVERY (See Note 4)						
VY100X	100	70	NA	150	25	−65 to +150
VY200X	200	140		150	25	−65 to +150
VY400X	400	280		150	25	−65 to +150
VY600X	600	420		150	25	−65 to +150

ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Avalanche Voltage (V_{BR})		Max. Inst. Forward Voltage Drop at I_O (V_{FM})	Max. Reverse Current @ Rated V_{RRM} & Indicated T_C (I_{RM})	Max. Reverse Recovery Time (t_{rr})[2]	Max. Thermal Res. Junction-to-Case ($R_{\theta J\text{-}C}$)	Write For Data Sheet Number
	(Min. Volts)	(Max. Volts)	(Volts/Leg)	(mA/Leg)	(nanosec.)	(°C/Watt)	
10 AMP CONTROLLED AVALANCHE							
IN4436	250	700	1.2	0.2 @ 160°C	NA	1.5	DLS-022
IN4437	450	900	1.2	0.2 @ 160°C		1.5	DLS-022
IN4438	650	1100	1.2	0.2 @ 160°C		1.5	DLS-022
IN4439	850	1300	1.2	0.2 @ 160°C		1.5	DLS-022
10 AMP FAST RECOVERY							
VR100X	NA	NA	1.5	5 @ 150°C	200	1.5	DLS-024
VR200X			1.5	5 @ 150°C	200	1.5	DLS-024
VR400X			1.5	5 @ 150°C	200	1.5	DLS-024
VR600X			1.5	5 @ 150°C	200	1.5	DLS-024
25 AMP CONTROLLED AVALANCHE							
VT200	250	700	1.5	5 @ 180°C	NA	1.0	DLS-025
VT400	450	900	1.5	5 @ 180°C		1.0	DLS-025
VT600	650	1100	1.5	5 @ 180°C		1.0	DLS-025
VT800	850	1300	1.5	5 @ 180°C		1.0	DLS-025
25 AMP FAST RECOVERY							
VY100X	NA	NA	1.8	5 @ 150°C	200	1.0	DLS-032
VY200X			1.8	5 @ 150°C	200	1.0	DLS-032
VY400X			1.8	5 @ 150°C	200	1.0	DLS-032
VY600X			1.8	5 @ 150°C	200	1.0	DLS-032

NOTE 1: Case temperature is measured on the bottom of the case within 0.125 inches of center.

NOTE 2: At $I_F = 1$ Amp, $I_R = 2$ Amps, Recovery to $I_{R(REC)} = .2$ Amps.

NOTE 3: Also see mounting adapter price adders.

NOTE 4: For V_{RM} (Non-Rep), Add 20% to device V_{RRM}.

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

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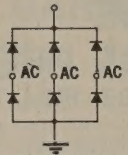
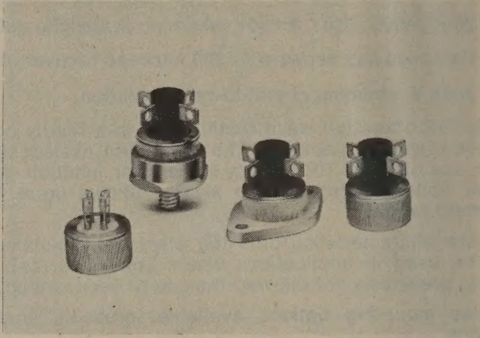


CASE NEGATIVE

SILICON AVALANCHE INTEGRATED BRIDGE RECTIFIERS

■ 15 AMP & 36 AMP THREE PHASE, FULL WAVE



- **Operation to full rated load at 100°C, T_C**
- **Controlled Avalanche series with 250V, 450V, 650V & 850V minimum avalanche voltages (V_{BR})**
- **Non-controlled avalanche series with 100V, 200V, 400V, 600V and 800V (V_{RRM})**
- **Fast recovery series with 200 nanosec recovery time (t_{rr})**

MAXIMUM RATINGS @ 60 Hz RESISTIVE AND INDUCTIVE LOAD, $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	RMS Reverse Voltage [$V_{R(RMS)}$] (Volts)	Power Dissipation (100 µsec sq. wave) (P_{RM}) (Watts)	Peak Surge Current (½ cycle @ 60 Hz, Non-Rep) (I_{FSM}) (Amps)	DC Forward Current (I_O)[1] (Amps)	Junction Operating Stg. Temp. Range (T_J, T_{STG}) (°C)
15 AMP CONTROLLED AVALANCHE						
R602	200	140	600	100	15	−65 to +160
R604	400	280	600	100	15	−65 to +160
R606	600	420	600	100	15	−65 to +160
R608	800	560	600	100	15	−65 to +160
15 AMP NON-CONTROLLED AVALANCHE						
R611	100	70	NA	100	15	−65 to +160
R612	200	140		100	15	−65 to +160
R614	400	280		100	15	−65 to +160
R616	600	420		100	15	−65 to +160
R618	800	560		100	15	−65 to +160
15 AMP FAST RECOVERY (See Note 4)						
R611X	100	70	NA	75	15	−65 to +150
R612X	200	140		75	15	−65 to +150
R614X	400	280		75	15	−65 to +150
R616X	600	420		75	15	−65 to +150
36 AMP CONTROLLED AVALANCHE						
R622	200	140	1500	250	36	−65 to +150
R624	400	280	1500	250	36	−65 to +160
R626	600	420	1500	250	36	−65 to +160
R628	800	560	1500	250	36	−65 to +160
36 AMP NON-CONTROLLED AVALANCHE						
R631	100	70	NA	250	36	−65 to +160
R632	200	140		250	36	−65 to +160
R634	400	280		250	36	−65 to +160
R636	600	420		250	36	−65 to +160
R638	800	560		250	36	−65 to +160
36 AMP FAST RECOVERY (See Note 4)						
R631X	100	70	NA	150	36	−65 to +150
R632X	200	140		150	36	−65 to +150
R634X	400	280		150	36	−65 to +150
R636X	600	420		150	36	−65 to +150

ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Avalanche Voltage (V_{BR})		Max. Inst. Forward Voltage Drop at I_O (V_{FM})	Max. Reverse Current @ Rated V_{RRM} & Indicated T_C (I_{RM})	Max. Reverse Recovery Time (t_{rr})[2]	Max. Thermal Res. Junction-to-Case ($R_{\theta J\text{-}C}$)	Write For Data Sheet Number
	(Min. Volts)	(Max. Volts)	(Volts/Leg)	(mA/Leg)	(nanosec.)	(°C/Watt)	
15 AMP CONTROLLED AVALANCHE							
R602	250	500	1.3 @ I_O = 10A	0.2 @ 160°C	NA	1.0	DLS-035
R604	450	700	1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
R606	650	900	1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
R608	850	1100	1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
15 AMP NON-CONTROLLED AVALANCHE							
R611	NA	NA	1.3 @ I_O = 10A	0.2 @ 160°C	NA	1.0	DLS-035
R612			1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
R614			1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
R616			1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
R618			1.3 @ I_O = 10A	0.2 @ 160°C		1.0	DLS-035
15 AMP FAST RECOVERY							
R611X	NA	NA	1.5 @ I_O = 10A	5 @ 150°C	200	1.0	DLS-035
R612X			1.5 @ I_O = 10A	5 @ 150°C	200	1.0	DLS-035
R614X			1.5 @ I_O = 10A	5 @ 150°C	200	1.0	DLS-035
R616X			1.5 @ I_O = 10A	5 @ 105°C	200	1.0	DLS-035
36 AMP CONTROLLED AVALANCHE							
R622	250	700	1.5 @ I_O = 25A	5 @ 180°C	NA	0.75	DLS-036
R624	450	900	1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
R626	650	1100	1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
R628	850	1300	1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
36 AMP NON-CONTROLLED AVALANCHE							
R631	NA	NA	1.5 @ I_O = 25A	5 @ 180°C	NA	0.75	DLS-036
R632			1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
R634			1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
R636			1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
R638			1.5 @ I_O = 25A	5 @ 180°C		0.75	DLS-036
36 AMP FAST RECOVERY							
R631X	NA	NA	1.8 @ I_O = 25A	5 @ 150°C	200	0.75	DLS-036
R632X			1.8 @ I_O = 25A	5 @ 150°C	200	0.75	DLS-036
R634X			1.8 @ I_O = 25A	5 @ 150°C	200	0.75	DLS-036
R636X			1.8 @ I_O = 25A	5 @ 150°C	200	0.75	DLS-036

NOTE 1: Case temperature is measured on the bottom of the case within 0.125 inches of center.
NOTE 2: At $I_F = 1$ Amp, $I_R = 2$ Amps, Recovery to $I_{R(REC)} = .2$ Amps.
NOTE 3: Also see mounting adapter price adders.
NOTE 4: For V_{RM} (Non-Rep), Add 20% to device V_{RRM}.

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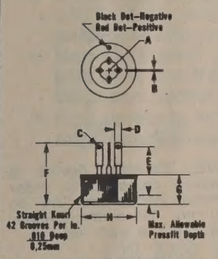
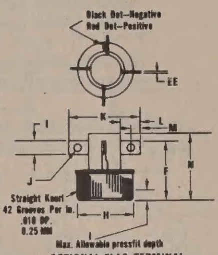
INTEGRATED BRIDGE RECTIFIERS

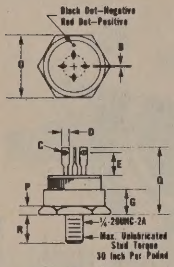
AVAILABLE CASE STYLES


Black Dot—Negative
Red Dot—Positive
A
B
C
D
E
F
G
Straight Knurl
42 Grooves Per In.
.010 Deep
0,25mm
H
I
Max. Allowable Pressfit Depth

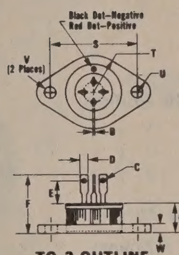
PRESS MOUNTING


Black Dot—Negative
Red Dot—Positive
EE
I
K
L
M
J
F
N
Straight Knurl
42 Grooves Per In.
.010 DP.
0.25 MM
H
Max. Allowable pressfit depth

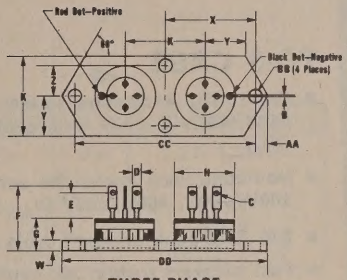
OPTIONAL FLAG TERMINAL
PRESS MOUNTING


Black Dot—Negative
Red Dot—Positive
O
B
C
D
E
P
Q
G
R
¼-20UNC-2A
Max. Unlubricated Stud Torque 30 Inch Per Pound

SINGLE STUD


Black Dot—Negative
Red Dot—Positive
S
T
V
(2 Places)
U
B
D
C
E
G
W

TO-3 OUTLINE
MOUNTING FLANGE


Red Dot—Positive
X
K
Y
60°
Black Dot—Negative
BB (4 Places)
Z
Y
B
CC
AA
D
H
C
E
F
G
W
DD

THREE PHASE,
FULL WAVE BRIDGE

Ltr.	Inches	Millimeters	Ltr.	Inches	Millimeters	Ltr.	Inches	Millimeters	Ltr.	Inches	Millimeters
A	.130R	3,30	I	.187 Typ.	4,75	Q	1.10	27,94	Y	.50	12,70
B	.018-.028 Typ.	0,46-0,71	J	.110 Dia.	2,79	R	.34-.40	8,64-10,16	Z	.375	9,53
C	.070 Dia. Typ.	1,78	K	1.0 Max.	25,4	S	1.177-1.197	29,89-30,40	AA	.164 Typ.	4,16
D	.110-.130 Typ.	2,79-3,30	L	.25 Min.	6,35	T	.525R Max.	13,33	BB	.156 Dia.	3,96
E	.290-.330	7,37-8,38	M	.125 Typ.	3,18	U	.188R Max.	4,77	CC	2.250	57,15
F	.830 Max.	21,08	N	.930 Max.	23,62	V	.151-.161 Dia.	3,83-4,08	DD	2.578	65,48
G	.390-.420	9,91-10,67	O	.875	22,23	W	.135 Max.	3,42	EE	.032 Typ.	,81
H	.7505-.7545	19,06-19,16	P	.120	3,05	X	1.125	28,57			

TO-3 Mount: Add suffix "T" to part no.
Stud Mount: Add suffix "S" to part no.

OTHER CIRCUITS AVAILABLE IN ABOVE CASE STYLES.

The circuits shown are available in the 10A and 25A; standard and fast recovery series.

Contact products sales manager for ordering information and prices.

Fig.	Type
A	Center Tap Common Cathode
B	Center Tap Common Anode
C	Three Phase Common Cathode
D	Three Phase Common Anode
E	Doubler
F	Tripler
G	Quadrupler
H	Three Phase, Full Wave Bridge*

FIG. A

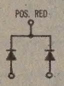


FIG. B

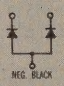


FIG. C

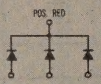


FIG. D

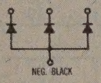


FIG. E

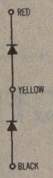

RED
YELLOW
BLACK

FIG. F

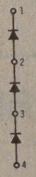


FIG. G

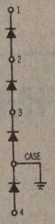
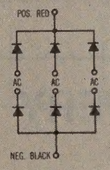


FIG. H


POS. RED
AC
AC
AC
NEG. BLACK

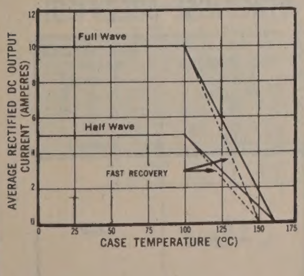
TO ORDER OPTIONAL MOUNTS OR TERMINALS

Flag Terminals: Standard .187″ flag terminals on all 25A and 36A devices. Optional at no charge on 10A and 15A devices. Specify by adding "F" to Part No.

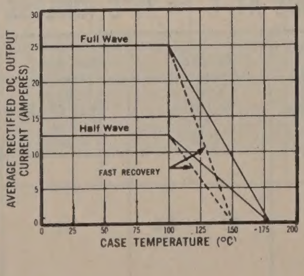
Large .250″ flag terminals optional at no charge. On 25A and 36A devices, add "L" to Part No. Example, VT200L. On 10A and 15A devices, add "L" instead of "F." Consult factory for mounting adaptor price adders.

DERATING CURVES/MAXIMUM ALLOWABLE DC OUTPUT CURRENT

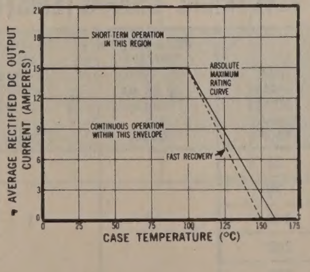
10 AMP RECTIFIERS



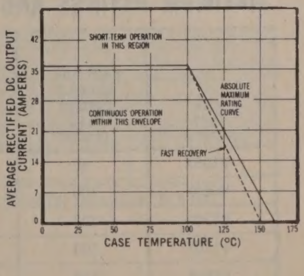
25 AMP RECTIFIERS



15 AMP, 3 PHASE, BRIDGES



36 AMP, 3 PHASE, BRIDGES



VARO

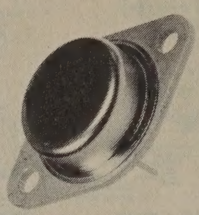
VARO SEMICONDUCTOR, INC.

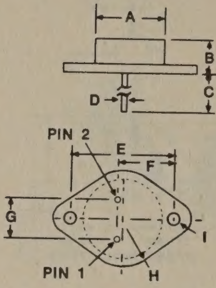
P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEX. 75040 (214) 272-4551 TWX 910-860-5178

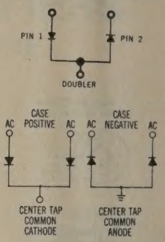
30 AMP CENTER TAPPED SILICON INTEGRATED RECTIFIER

TO-3 CASE

- **Controlled Avalanche series:** 250V, 450V & 650V min. avalanche ratings (V_{BR})
- **Non-controlled avalanche series:** 100V, 200V, 400V, 600V (V_{RRM})
- **250 Amp peak one-half cycle surge current**
- **Fast recovery series: 200 nanosec, recovery time (t_{rr})**







NOTE: Standard device is common cathode. To order common anode add "/A" to part no. To order doubler add "/E" to part no.

All JEDEC TO-3 dimensions and notes are applicable.

SPECIFICATIONS AT $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

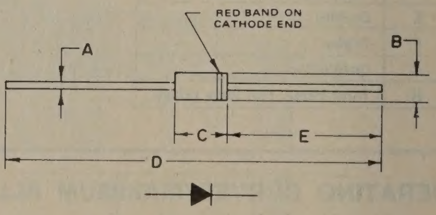
Varo Part Number	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	Avalanche Voltage (V_{BR}) (Min. Volts)	Avalanche Voltage (V_{BR}) (Max. Volts)	Peak Surge Current ½ cycle @ 60 Hz (I_{FSM}) (Amps/Leg)	DC Fwd. Current @ $I_C = 100°$ (I_O) (Amps/Leg)	Junction Oper. & Stg. Temp. Range (T_J, T_{STG}) (°C)	Max. Inst. Fwd. Voltage Drop @ I_O (V_{FM}) (Volts/Leg)	Max. Reverse Current @ Rated V_{RRM} & $T_C = 100°C$ (I_{RM}) (mA/Leg)
CONTROLLED AVALANCHE								
R702	200	250	700	250	15	−65 to +150	1.2	1.0
R704	400	450	900	250	15	−65 to +150	1.2	1.0
R706	600	650	1100	250	15	−65 to +150	1.2	1.0
NON-CONTROLLED AVALANCHE								
R711	100	NA		250	15	−65 to +150	1.2	1.0
R712	200			250	15	−65 to +150	1.2	1.0
R714	400			250	15	−65 to +150	1.2	1.0
R716	600			250	15	−65 to +150	1.2	1.0
FAST RECOVERY								
R711X	100	NA		150	15	−65 to +150	1.4	5.0
R712X	200			150	15	−65 to +150	1.4	5.0
R714X	400			150	15	−65 to +150	1.4	5.0
R716X	600			150	15	−65 to +150	1.4	5.0

LTR	Inches	mm
A	.72 Dia.	18.29 Dia.
B	.323-.342	8.20-8.69
C	.40 Min.	10.16 Min.
D	.038-.043 Dia.	.97-1.09 Dia.
E	1.180-1.194	29.97-30.33
F	.665-.675	16.89-17.15
G	.426-.440	10.82-11.18
H	.525 R Max.	13.34 R Max.
I	.151-.161 Dia.	3.84-4.09 Dia.

Write for Data Sheet DLS-048

1 AMP FAST RECOVERY TIME RECTIFIER

LTR	Inches	mm
A	.030-.034 Dia.	.76-.86 Dia.
B	.10-.107 Dia.	2.54-2.72 Dia.
C	.185-.205	4.70-5.21
D	2.40	60.96



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS AT T = 25°C (UNLESS OTHERWISE SPECIFIED)

Varo Part Number	Peak Rep. Reverse Voltage V_{RRM} (Volts)	RMS Reverse Voltage $V_{R(RMS)}$ (Volts)	Peak Surge Current ½ Cycle @ 60 Hz (non-rep) I_{FSM} (Amps)	DC Forward Current @ $T_A = 40°C$ I_O (Amps)	Junction Operating Temp. Range(1) T_J (°C)	Max. Inst. Forward Voltage Drop @ 1A V_{FM} (Volts)	Max. Reverse Current @ Rated V_{RM} I_{RM} (mA)	Max. Reverse Recovery Time @ $I_F = 1A$ $I_R = 2A$ t_{rr} (nsec.)
V105X	50	35	30	1	−50 to +150	1.1	2 @ $T_A = 125°C$	100
V110X	100	70						
V120X	200	140						
V140X	400	280						
V160X	600	420						

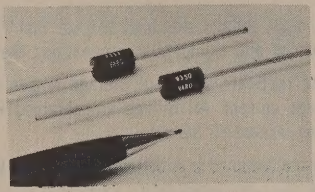
(1) T_J Max. = 125°C when V_{RRM} exceeds 200V.

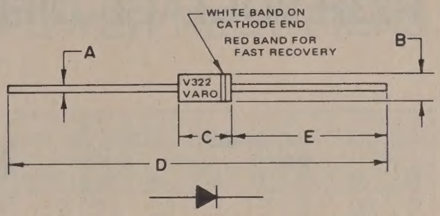
VARO SEMICONDUCTOR, INC.

DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

3 AMP AXIAL LEAD DIFFUSED SILICON RECTIFIERS

- 100A and 200A peak surge current
- Controlled avalanche series has 250V, 450V, 650V and 850V min. avalanche voltages (V_{BR})
- Non-controlled avalanche series with 50V, 100V, 200V, 400V, 600V, 800V and 1000V (V_{RRM})
- Fast recovery series with 200 nanosec. max. reverse recovery (t_{rr})





LTR	INCHES	MILLIMETERS
A	.048–.052 Dia.	1,22–1,32 Dia.
B	.20	5,08
C	.38	9,65
D	2.75	69,85
E	1.137–1.237	28,33–31,42

100 AMP PEAK SURGE RATING MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS @ $T_A = 25°C$ (UNLESS OTHERWISE SPECIFIED)

Varo Part No.	Peak Repetitive Reverse Voltage (Volts) V_{RRM}	RMS Reverse Voltage (Volts) $V_{R(RMS)}$	Power Dissipation in $V_{(BR)}$ Region For 100 μsec Sq. Wave (Watts) P_{RM}	Peak Surge Current, ½ Cycle @ 60 Hz (non-Rep) (Amps) I_{FSM}	DC Forward Current @ $T_A = 40°C$ (Amps) I_O	Junction Operating & Storage Temp. Range (°C) T_J, T_{STG}	Minimum Avalanche Voltage (Volts) $V_{(BR)}$	Maximum Avalanche Voltage (Volts) $V_{(BR)}$	Maximum Instantaneous Forward Voltage Drop @ 3 Amps (Volts) V_{FM}	Maximum Reverse Current @ Rated V_{RM} (mA) I_{RM}	Maximum Reverse Recovery Time @ $I_F = 1$ Amp $I_R = 2$ Amp (nsec) t_{rr}
CONTROLLED AVALANCHE											
V322	200	140	500	100	3	−50 to +150	250	700	1.2	0.1 @ $T_J = 150°C$	NA
V324	400	280					450	900			
V326	600	420					650	1100			
V328	800	560					850	1300			
NON-CONTROLLED AVALANCHE											
V330	50	35	NA	100	3	−50 to +150	NA	NA	1.2	0.1 @ $T_J = 150°C$	NA
V331	100	70									
V332	200	140									
V334	400	280									
V336	600	420									
V338	800	560									
V3310	1000	700									
FAST RECOVERY											
V330X	50	35	NA	75	3	−50 to +135	NA	NA	1.4	4.0 @ $T_J = 135°C$	200
V331X	100	70									
V332X	200	140									
V334X	400	280									
V336X	600	420									

Write for Data Sheet DLS-052

200 AMP PEAK SURGE RATING

CONTROLLED AVALANCHE											
V342	200	140	900	200	3	−50 to +150	250	700	1.1	0.1 @ $T_J = 150°C$	NA
V344	400	280					450	900			
V346	600	420					650	1100			
V348	800	560					850	1300			
NON-CONTROLLED AVALANCHE											
V350	50	35	NA	200	3	−50 to +150	NA	NA	1.1	0.1 @ $T_J = 150°C$	NA
V351	100	70									
V352	200	140									
V354	400	280									
V356	600	420									
V358	800	560									
V3510	1000	700									
FAST RECOVERY											
V350X	50	35	NA	150	3	−50 to +135	NA	NA	1.4	4.0 @ $T_J = 135°C$	200
V351X	100	70									
V352X	200	140									
V354X	400	280									
V356X	600	420									

Write for Data Sheet DLS-053

VARO

VARO SEMICONDUCTOR, INC.

DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

HIGH VOLTAGE DIFFUSED SILICON RECTIFIERS

VA

VB, 1N4441

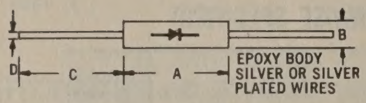
VG

Varo high voltage and high voltage fast recovery time diffused silicon rectifiers are designed for industrial and commercial applications that require high reliability at an economical cost.

These rectifiers offer high voltage ranges in minimum-sized, epoxy-encapsulated packages with low leakage current. All ratings are obtained without the use of special heat sinks or mounting techniques (except VC Series).

They are designed to withstand 500 G's shock and vibration of 100 Hz with a peak acceleration of 10 G's.

Applications: television receivers, electrostatic power supplies, electrostatic copiers, electrostatic air filters and precipitators, cathode ray tube power supplies, transmitters, and microwave ovens.



Case Style	A Pkg. Length In.	A Pkg. Length mm	B Dia. In.	B Dia. mm	C Min. Wire Length In.	C Min. Wire Length mm	D Nom. Wire Dia. In.	D Nom. Wire Dia. mm
VA	.150	3.81	.060	1.52	.400	10.16	.010	0.25
VB	.400	10.16	.100	2.54	.400	10.16	.020	0.51
VG	.600	15.24	.160	4.06	.750	19.05	.020	0.51

Electrical Characteristics (@ T_A = 25°C Unless Otherwise Specified)	Series VA & VB and 1N4441*	Series VF	Series VG	Series VC & VCX*
Max. DC Reverse Current @ PIV and 25°C, I_{RM}	$\frac{.05\mu A}{0.3\mu A^*}$	1μA	1μA	$\frac{1\mu A}{2\mu A^*}$
Max. DC Reverse Current @ PIV and 100°C/85°C*, I_{RM}	$\frac{5.0\mu A}{60\mu A^*}$	$\frac{20\mu A}{30\mu A^*}$	$\frac{20\mu A}{30\mu A^*}$	$\frac{10\mu A}{20\mu A^*}$
Max. Reverse Recovery Time, t_{rr}, Recovery to 1.0 mA	250 nanosec* (I_F = 2mA & I_R = 4mA)	250 nanosec* (I_F = 2 mA & I_R = 4 mA)	250 nanosec* (I_F = 2 mA & I_R = 4 mA)	300 nanosec* (I_F = 1A & I_R = 2A
Ambient Operating Temperature Range, T_A	$\frac{+150°C}{+85°C^*}$	−55°C to $\frac{+150°C}{+85°C^*}$	−55°C to $\frac{+150°C}{+85°C^*}$	−50°C to +125°C
Max. One-Half Cycle Surge Current, I_{FSM} @ 60 Hz	3 Amps	3 Amps	3 Amps	50 Amps 35 Amps*

*Fast Recovery Series.

SERIES VA • VB • IN4441

Part No.	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	Avg. Fwd. Current I_O @ 40°C (mA)	Max. Fwd. Voltage Drop @ 25°C & I_O V_{FM} (Volts)
VA10	1,000	50	4
VA15	1,500	50	4
VA20	2,000	50	4
VA25	2,500	50	4
VA30	3,000	25	6
VA35	3,500	25	6
VA10X	1,000	40	6
VA15X	1,500	40	6
VA20X	2,000	40	6
VA25X	2,500	20	8
VA30X	3,000	20	8
VB10	1,000	100	5
VB15	1,500	100	5
VB20	2,000	100	5
VB25	2,500	100	5
VB30	3,000	50	10
VB40	4,000	50	10
VB50	5,000	50	10
VB60	6,000	50	10
VB10X	1,000	50	6
VB15X	1,500	50	6
VB20X	2,000	50	6
VB25X	2,500	25	12
VB30X	3,000	25	12
VB40X	4,000	25	12
VB50X	5,000	25	12
1N4441	1,500	25	4

Write for Data Sheet DLS-027

SERIES VG

Part No.	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	Avg. Fwd. Current I_O @ 40°C (mA)	Max. Fwd. Voltage Drop @ 25°C & I_O V_{FM} (Volts)
VG1	1,000	100	5
VG2	2,000	100	5
VG3	3,000	100	10
VG4	4,000	50	10
VG5	5,000	50	12
VG7	7,000	50	14
VG10	10,000	25	20
VG12	12,000	25	24
VG15	15,000	10	30
VG20	20,000	10	40
VG1X	1,000	50	6
VG2X	2,000	50	6
VG3X	3,000	50	12
VG4X	4,000	25	12
VG5X	5,000	25	14
VG7X	7,000	10	16
VG10X	10,000	10	24
VG12X	12,000	5	30
VG15X	15,000	5	36
VG20X	20,000	5	50

NOTES:
1. Suffix (X) denotes Fast Recovery Series.
2. Maximum lead and terminal temperature for soldering, ⅜ inch from case, 5 seconds at 250°C.
3. If operated over 10,000 V/inch in length, devices should be immersed in oil or re-encapsulated.

Write for Data Sheet DLS-034

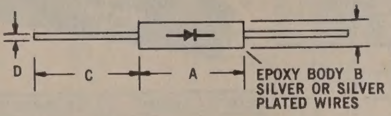
VARO

VARO SEMICONDUCTOR, INC.

DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

HIGH VOLTAGE DIFFUSED SILICON POWER RECTIFIERS

SERIES VF



Case Style	A Pkg. Length In.	A Pkg. Length mm	B Dia. In.	B Dia. mm	C Min. Wire Length In.	C Min. Wire Length mm	D Nom. Wire Dia. In.	D Nom. Wire Dia. mm
VF	1.00	25.4	.250	6.35	1.50	38.1	.032	0.81
VF*	2.00	50.8	.300	7.62	1.50	38.1	.032	0.81
VF*	3.00	76.2	.300	7.62	1.50	38.1	.032	0.81

*Ferrule End Caps Available

VARO Type No. Average Forward Current, @ T_A = 40°C, I_O			Peak Repetitive Reverse Voltage, V_{RRM} (Volts)	Max. Inst. Forward Voltage Drop @ T_A = 25°C and I_O V_{FM} (Volts)	Case Style
5mA	10mA	25mA			
VF5- 5	VF10- 5	VF25- 5	5,000	12	A
VF5- 7	VF10- 7	VF25- 7	7,000	12	A
VF5-10	VF10-10	VF25-10	10,000	18	A
VF5-12	VF10-12	VF25-12	12,000	18	A
VF5-15	VF10-15	VF25-15	15,000	35	B
VF5-20	VF10-20	VF25-20	20,000	35	B
VF5-25	VF10-25	VF25-25	25,000	35	B
VF5-30	VF10-30	VF25-30	30,000	50	C
VF5-40	VF10-40	VF25-40	40,000	50	C
VF5- 5X	VF10- 5X	VF25- 5X	5,000	15	A
VF5- 7X	VF10- 7X	VF25- 7X	7,000	15	A
VF5-10X	VF10-10X	VF25-10X	10,000	30	A
VF5-12X	VF10-12X	VF25-12X	12,000	30	A
VF5-15X	VF10-15X	VF25-15X	15,000	60	B
VF5-20X	VF10-20X	VF25-20X	20,000	60	B
VF5-25X	VF10-25X	VF25-25X	25,000	60	B
VF5-30X	VF10-30X	VF25-30X	30,000	90	C
VF5-40X	VF10-40X	VF25-40X	40,000	90	C

ELECTRICAL CHARACTERISTICS AT T = 25°C (UNLESS OTHERWISE SPECIFIED)	
Max. DC Reverse Current @ Rated V_{RRM} and 25°C, I_{RM}	1μA
Max. DC Reverse Current @ Rated V_{RRM} and $\frac{100°C}{85°C}$, I_{RM}	$\frac{20\mu A}{30\mu A^*}$
Max. Reverse Recovery Time @ I_F = 2mA and I_R = 4mA, Recovery to 1.0mA, t_{rr}	250 nanosec*
Ambient Operating Temperature Range, T_A	−55°C to $\frac{+150°C}{+85°C^*}$
Storage Temperature Range, T_{STG}	−55°C to +150°C
Max. One-Half Cycle Surge Current @ 60 Hz, I_{FSM}	3 Amps

*Fast Recovery Series

NOTES:

1. Suffix (X) denotes Fast Recovery Series.
2. Maximum lead and terminal temperature for soldering, 3/8 inch from case, 5 seconds @ 250°C.
3. If operated over 10,000 V/inch in length, devices should be immersed in oil or re-encapsulated.

WRITE FOR DATA SHEET DLS033

VARO SEMICONDUCTOR, INC.

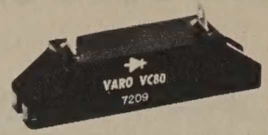
VARO

DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

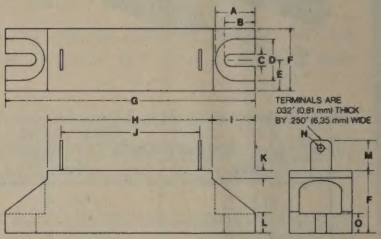
HIGH VOLTAGE DIFFUSED SILICON RECTIFIERS

SERIES VC

Part No.	Peak Rep. Reverse Voltage (V_{RRM}) (Volts)	Avg. Fwd. Current I_O @ 40°C (Amps)	Max. Fwd. Voltage Drop @ 25°C & I_O V_{FM} (Volts)
VC20	2,000	2	4
VC30	3,000	2	4
VC40	4,000	2	4
VC50	5,000	1.5	6
VC60	6,000	1.5	6
VC70	7,000	1.5	8
VC80	8,000	1	8
VC20X	2,000	2	4.8
VC30X	3,000	2	7.2
VC40X	4,000	2	9.6
VC50X	5,000	1.5	12.0
VC60X	6,000	1.5	14.4
VC70X	7,000	1.5	14.4
VC80X	8,000	1	16.8



LTR	Inches	Millimeters
A	.45-.51	11,43-12,95
B	.33-.39	8,38-9,91
C	.146-.166	3,71-4,22
D	.47-.53	11,94-13,46
E	.34-.40	8,64-10,16
F	.72-.78	18,29-19,81
G	2.96-3.02	75,18-76,71
H	1.91-2.01	48,51-51,05
I	.47-.57	11,94-14,48
J	1.64-1.74	41,66-44,20
K	.07-.13	1,78-3,30
L	.22-.28	5,59-7,11
M	.30-.42	7,62-10,67
N	.105-.115 DIA	2,67-2,92 DIA
O	.21-.27	5,33-6,86

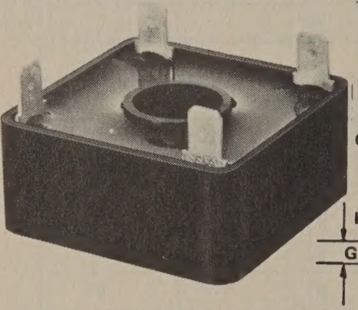


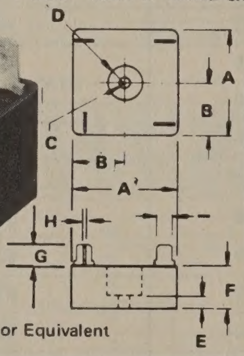
NOTES:

WRITE FOR DATA SHEET DLS030

1. Suffix (X) denotes Fast Recovery Series.
2. Maximum lead and terminal temperature for soldering, ⅜ inch from case, 5 seconds at 250°C.
3. If operated over 10,000 V/inch in length, devices should be immersed in oil or re-encapsulated.

HIGH VOLTAGE SILICON FULL WAVE BRIDGES





Terminals are .25" — 6,35mm Faston or Equivalent

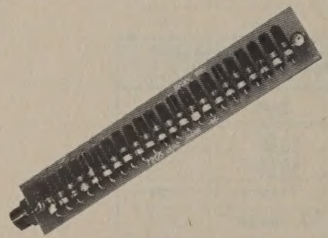
I_{FSM} Peak Surge Current, ½ Cycle @ 60 Hz	20 Amps
Storage Temperature Range	−30°C to 150°C
Operating Temperature Range	−30°C to 100°C

Part No.	V_{RRM} (kV)	Avg. Fwd. Current, I_O @ T_A = 50°C (mA)
H439	2	1500
H440	4	650
H441	6	650
H442	8	500
H443	10	500

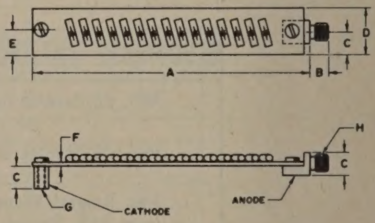
Write for Data Sheet DLS-041

LTR	Inches	Millimeters
A	1.85	46.99
B	.925	23.50
C	.187 Dia.	4.75 Dia.
D	.625 Dia.	15.88 Dia.
E	.189	4.80
F	.75	19.05
G	.35	8.89
H	.032	.813
I	.250	6.35

HIGH VOLTAGE RECTIFIERS FOR X-RAY APPARATUS



The required peak reverse voltage determines the number of individual diode packages used in series for the completed, unencapsulated rectifier. Each diode package contains a stack of controlled avalanche chips. In order to achieve the rated voltage and current, the diodes should be submerged in Shell Diala Oil AX electrical insulating oil or equivalent. The diodes used, Varo type H463 may be purchased separately.



SPECIFICATIONS

I_F Average in 55°C Oil*	220 mA Max.
I_F Peak 10 Cycles @ 60 Hz Rate	6 A Max.
Max. ½ Cycle Surge Current @ 60 Hz, Non-Rep, I_{FSM}	20 A Max.
Max. DC Reverse Current @ PRV Test, I_{RM}	1 µA Max.
Operating and Storage Temperature Range	−55°C to +125°C

*Derate linearity from 55°C to zero current @ 125°C.

LTR	Inches	Millimeters
A	6.00	152.40
B	.38	9.65
C	.50	12.70
D	1.00	25.40
E	.56	14.22
F	.094	2.39
G	#6-32 NC	*
H	.375-24 NF	*

*Closest Metric Equivalent Supplied on Request

Part No.	$V_{R(oper.)}$ (kV)	$V_{R(test)}$ (kV)	V_{FM} (Max.) I_F = 50 mA	No. of Individual Diode Packages
H466	100	125	160	16
H467	125	150	190	19
H468	150	175	220	22

All specifications at T_C = 25°C unless noted.

Write for Data Sheet DLS-047

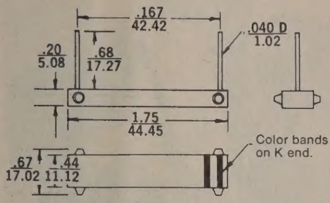
VARO SEMICONDUCTOR, INC.

VARO
DEPT. EM, P.O. BOX 676, 1000 N. SHILOH, GARLAND, TEXAS 75040 (214) 272-4551 TWX 910-860-5178

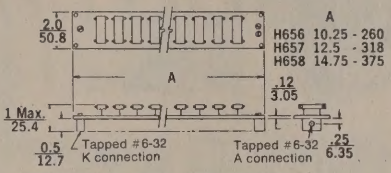
HIGH VOLTAGE RECTIFIER ASSEMBLIES FOR POLLUTION CONTROL EQUIPMENT

(PICTURED ABOVE H656 ASSEMBLY)

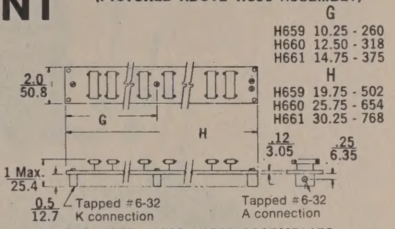
DIMENSIONS IN INCHES AND mm


.167
42.42
.040 D
1.02
.20
5.08
.68
17.27
1.75
44.45
Color bands on K end.
.67
17.02
.44
11.12

SERIES H655 SUBASSEMBLY


2.0
50.8
A
H656 10.25 - 260
H657 12.5 - 318
H658 14.75 - 375
.12
3.05
1 Max.
25.4
0.5
12.7
Tapped #6-32
K connection
Tapped #6-32
A connection
.25
6.35

SERIES H656, H657, H658 ASSEMBLIES


G
H659 10.25 - 260
H660 12.50 - 318
H661 14.75 - 375
H
H659 19.75 - 502
H660 25.75 - 654
H661 30.25 - 768
2.0
50.8
G
H
.12
3.05
.25
6.35
1 Max.
25.4
0.5
12.7
Tapped #6-32
K connection
Tapped #6-32
A connection

SERIES H659, H660, H661 ASSEMBLIES (CENTER TAPPED)

NOTE: CUSTOM ASSEMBLIES AVAILABLE FOR 100 PIECE QUANTITIES

VARO PART NO.*	PRV (Oper.) (1)	PRV (Test)	Peak Surge Current, ½ Cycle @ 60 Hz (Non-rep.)	Peak Surge Current, 10 Cycles at 60 Hz	DC Fwd. Current in 50°C 011 (1)	Avalanche Energy, 100 μsec. pulse width	Max. Inst. Fwd. Voltage Drop @ $I_F = 2A$	Max. Rev. Current @ V_R (Test)	No. Diodes per board
SYMBOL	$V_{R(oper.)}$	$V_{R(test)}$	I_{FSM}	I_{FRM}	I_o		V_{FM}	I_{RM}	
UNITS	KV	KV	Amps	Amps	Amps	Joules	Volts	μAmps	
H655	8.3	10	50	15	2	0.42	15	1	
H656	100	120	50	15	2	5.	170	1	12
H657	125	150	50	15	2	6.3	220	1	15
H658	150	180	50	15	2	7.5	260	1	18
H659	200	240	50	15	2	10.0	340	1	24
H660	250	300	50	15	2	12.6	440	1	30
H661	300	360	50	15	2	15.0	520	1	36

Note 1: To achieve Rated Current and Voltage, Diodes must be submerged in Shell Diala Oil AX Electrical Insulating Oil or Equivalent.

HIGH VOLTAGE MULTIPLIERS

APPLICATIONS: CRT terminal display systems, electrostatic power supplies, television receivers, monitors and other high voltage applications.

	Doubler (T_A = 60°C)	Tripler (T_A = 75°C)	Quad (T_A = 65°C)
DC Forward Current Output	0.25 mA	0.25 mA	0.25 mA
DC Forward Current at Focus Tap	1.5 mA	2.0 mA	2.25 mA
Input Voltage Under No Load	10KV MAX.	10KV MAX.	8KV MAX.

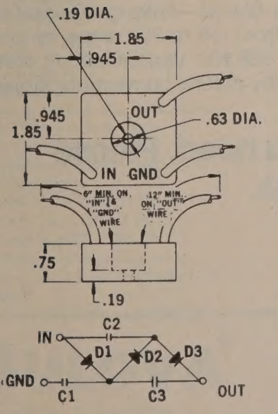
TYPICAL REGULATION AT TA = 25°C (TV TYPE GENERATOR) NOMINAL OUTPUT VOLTAGE WITH SPECIFIED PEAK-TO-PEAK MAINTAINED

	Pk to Pk	No Load	1 mA Load
Doubler — Varo P/N MH911*	10KV	19.0KV	18.0KV
Tripler — Varo P/N MH919*	8KV	24.0KV	22.0KV
Quad — Varo P/N MH353*	6KV	24.0KV	23.0KV

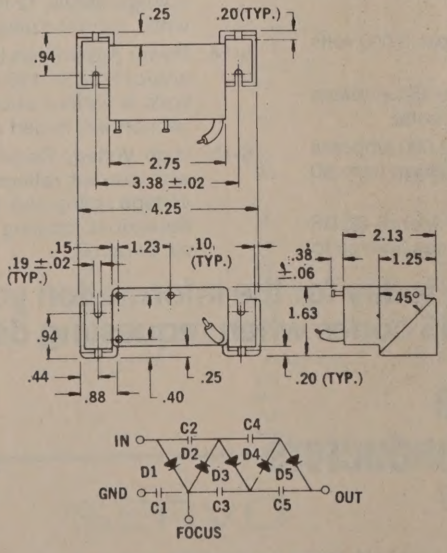
*Prices on request.

CASE STYLE AND CIRCUIT FOR:

DOUBLER

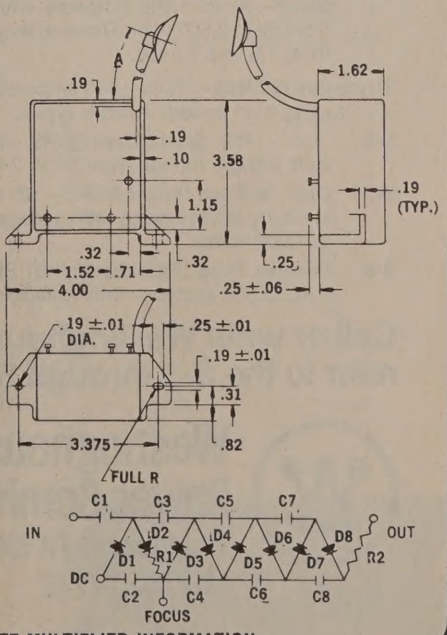

.19 DIA.
1.85
.945
.945
1.85
OUT
.63 DIA.
IN
GND
6" MIN. ON "IN" & "GND" WIRE
12" MIN. ON "OUT" WIRE
.75
.19
IN
C2
D1
D2
D3
GND
C1
C3
OUT

TRIPLER


.25
.20(TYP.)
.94
2.75
3.38 ±.02
4.25
.15
1.23
.10
(TYP.)
.19 ±.02
(TYP.)
.38
±.06
2.13
1.25
45°
1.63
.94
.44
.88
.40
.25
.20 (TYP.)
IN
C2
C4
D1
D2
D3
D4
D5
GND
C1
C3
C5
OUT
FOCUS

NOTE: ALL TYPES NOT SHOWN

QUAD


A
1.62
.19
.19
.10
3.58
1.15
.19
(TYP.)
.32
1.52
.71
.32
.25
4.00
.25 ±.06
.19 ±.01
DIA.
.25 ±.01
.19 ±.01
.31
3.375
.82
FULL R
C1
C3
C5
C7
IN
D2
D4
D6
D8
OUT
D1
R1
D3
D5
D7
R2
DC
C2
C4
C6
C8
FOCUS

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Rectifiers — 1 to 3,000 amperes, up to 4,000 volts—including fast recovery and military types.

S-1 Axial Lead Mount Rectifiers—1, 1.5 and 3 ampere ratings; 50 to 1000 volts.

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S-3 .375" - .750" Stud Mount Power Rectifiers—100 to 550 ampere current ratings; voltage ratings from 50 to 4,000 volts. Several military (JAN) series also available.

S-4 Disc Package Power Rectifiers — 300 to 3,000 amperes in four package sizes with voltage ratings from 50 to 3,000 volts.

S-5 Fast Recovery Stud Mount and Disc Package Rectifiers—80 to 1,600 amperes with voltage ratings from 50 to 2,500 volts. Reverse recovery times range from 1.5 to 5.0 μsec.

Thyristors (SCRS) — 10 to 2,000 amperes, up to 3,000 volts —including high speed, inverter types.

S-6 .250" - .750" Stud Mount SCRS—10 to 350 amperes with voltage ratings from 50 to 2,400 volts.

S-7 Disc Package Power SCRS—125 to 2,000 amperes in four package sizes with voltage ratings from 50 to 3,000 volts.

S-8 Inverter Type "Fast Switching" Stud Mount SCRS —40 to 300 amperes with voltage ratings from 50 to 1,200 volts and turn-off times from 10 to 50 μsec.

S-9 Inverter Type "Fast Switching" Disc Package SCRS —100 to 700 amperes with voltage ratings from 50 to 1,800 volts and turn-off times from 10 to 100 μsec.

S-10 Reverse Blocking Diode Thyristor (RBDT)—A two-terminal PNPN thyristor switch with high di/dt and fast turn-on capability—22 ampere stud mount and 125 ampere disc package with voltage ratings from 600 to 1,000 volts.

NPN Power Transistors — 1 to 30 amperes, up to 250 volts —industrial and "hi-rel" types.

S-11 TO-3/TO-66 NPN Transistors—1 to 30 amperes, up to 140 volts.

S-12 .250" - .312" Stud Mount NPN Transistors—6 to 30 amperes, up to 250 volts; noted for their high reliability performance.

Assemblies — .65 to 7,500 amperes, up to 688,000 volts.

S-13 Power Assemblies Utilizing Stud Mount Rectifiers and/or SCRS—Over 2,000 types in various circuit configurations, 12 to 1,670 amperes, and 50 to 2,000 volts; natural convection or forced air cooling.

S-14 Power Assemblies Utilizing Disc Package Rectifiers and/or SCRS—100 to 7,500 amperes and 50 to 3,000 volts in various circuit configurations; natural convection air, forced air, and water cooling.

S-15 High Voltage Rectifier Stacks—Fully compensated with current ratings from .65 to 324 amperes and voltage ratings up to 688 KV. Various circuit configurations; cooling is by natural convection, forced air or by oil.

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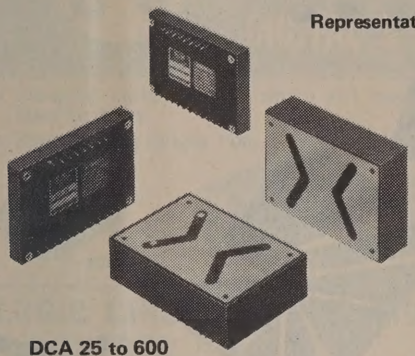
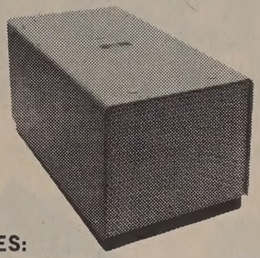

DCA 25 to 600


DCA 1000

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- Low Cost

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- Low Inertia Motors
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- Deflection Coils

SPECIFICATIONS (Nominal @ 25°C)	DCA 25	DCA 25/60	DCA 50/60	DCA 200	DCA 300	DCA 300/60
OUTPUT (at nominal power supply voltage)						
Current, Amperes Continuous	±1.25	±0.5	±1	±5	±6	±6
Voltage, peak	±20	±50	±50	±20	±20	±50
Current, Amperes peak	±1.25	±0.5	±1	±10	±15	±6
Current Limit Adjust Range, Amperes	0.4 to 1.25	0.2 to .5	0.2 to 1	0.4 to 10	0.4 to 15	0.2 to 6
INPUT						
Supply Voltage (VDC)	+28 ±3	+60 ±5	+60 ±5	+28 ±3	+28 ±3	+60 ±5
Supply Quiescent Current (ADC)	0.05	0.05	0.05	0.05	0.05	0.05
Bias Supply Voltage (VDC)	−15 ±2	−15 ±2	−15 ±2	−15 ±2	−15 ±2	−15 ±2
Bias Supply Current (MADC)	20	20	20	20	20	20
POWER AMPLIFIER PARAMETERS						
Input Impedance k ohms	10	10	10	10	10	10
Gain (adjustable)						
As voltage amplifier (V/V)	20	20	20	20	20	20
As current amplifier (A/V)	0.5	0.5	0.5	0.5	0.5	0.5
Frequency Response (kHz)						
Small signal	10	10	10	10	10	10
Full output	1	1	1	1	1	1
Output Impedance (Dynamic, ohms)	0.1	0.1	0.1	0.1	0.1	0.1
Output Offset Null (MVDC)	100	100	100	100	100	100
Offset Drift (micro V/°C)	10	10	10	10	10	10
DC Dead Band (micro volts)	±50	±50	±50	±50	±50	±50
INTERNAL DISSIPATION						
Operating Temp. Range (°C)	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +125
Continuous, at 25°C (watts)	12.5	12.5	25	100	150	150
100 Millisecond Nonrecurring	25	25	50	200	300	300
Derating for Temperature (watts/°C)	.075	.075	.15	.75	1.00	.75
WEIGHT	3 oz.	3 oz.	6 oz.	9 oz.	9 oz.	9 oz.

SPECIFICATIONS (Nominal @ 25°C)	DCA 600/60	DCA 600/100	DCA 1000-1	DCA 1000-2	DCA 1000-3
OUTPUT (at nominal power supply voltage)					
Current, Amperes Continuous	±6	±6	±15	±15	±15
Voltage, peak	±50	90	±65	±65	±65
Current, Amperes peak	±12	±6.7	±15	±15	±15
Current Limit Adjust Range, Amperes	0.2 to 12	1 to 6.7	2 to 20	1.5 to 15	1.5 to 15
INPUT					
Supply Voltage (VDC)	+60 ±5	+100, ±5	+75 ±5	+75 +5	+7 +5
Supply Quiescent Current (ADC)	0.05	0.05	0.1	0.1	0.15
Bias Supply Voltage (VDC)	−15 ±2	−15, ±2		−15 ±2	
Bias Supply Current (MADC)	20	20		20	
POWER AMPLIFIER PARAMETERS					
Input Impedance k ohms	10	10	10		
Gain (adjustable)					
As voltage amplifier (V/V)	20	20	10	10	10
As current amplifier (A/V)	0.5	0.5	2.5	2.5	2.5
Frequency Response (kHz)					
Small signal	10	10	10	10	10
Full output	1	1	1	1	1
Output Impedance (Dynamic, ohms)	0.1	0.1	0.5	0.5	0.5
Output Offset Null (MVDC)	100	100	100	100	100
Offset Drift (micro V/°C)	10	10	0.2	0.2	0.2
DC Dead Band (micro volts)	±50	±50	±50	±50	±50
PREAMPLIFIER			uA 741	uA 741	uA 741
INTERNAL DISSIPATION					
Operating Temp. Range (°C)	−55 to +125	−55 to +125	0 to 50	0 to 50	0 to 50
Continuous, at 25°C (watts)	300	300	500	500	500
100 Millisecond Nonrecurring	600	600			
Derating for Temperature (watts/°C)	2.00	2.00	20	20	20
WEIGHT	16 oz.	16 oz.	14 lbs.	14 lbs.	14 lbs.

BULOVA®

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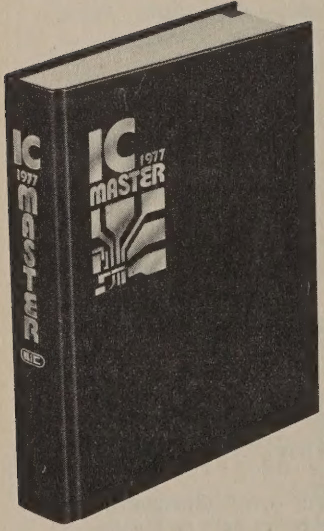

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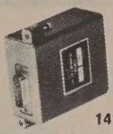
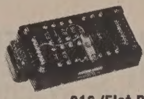

141

140

416-3


916 (Flat Pack)

980-1

LOGIC CIRCUITRY FOR MODE CONTROL

AMPLIFIERS FOR AC SERVO MOTORS

AMPLIFIERS FOR DC TORQUERS AND DC MOTORS

AMPLIFIERS FOR SERVO VALVES AND CLUTCHES

MODULATORS AND DEMODULATORS

RESOLVER BOOSTERS AND ISOLATION AMPLIFIERS

TEMPERATURE CONTROLLERS

DIGITAL • ANALOGUE CONTROL SYSTEMS

STANDARD AND CUSTOMIZED DESIGN

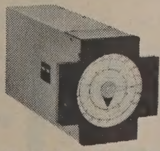
Servo Indicators
Servo Actuators
Servo Repeaters
Two Speed Servos
Servo Computers
Data Transmission Systems
Computer Interface Systems
Nuclear Control Rod Indicators
Analogue to Digital Converters
Special Control Systems
Process Controllers

- Units available which will meet applicable MIL Specifications.
- Devices designed to operate with A.C., D.C., synchro or resolver command signals.
- All units feature self-contained transistorized high reliability electronics and power supplies.
- Units now in use on numerous systems involving:

SIMULATORS	Missile Tracking	Aircraft Instrumentation
Fire Control	Ground Support	Missile Instrumentation
ASW	High Accuracy Positioning	Stable Platforms

- Special systems can be designed in accordance to your detailed specifications. CTC will also design **"Interface"** equipment to integrate major control systems.

INDICATORS

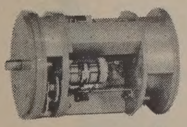

CS-109 Dual Pointer Indicator

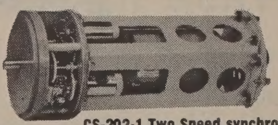
Bearing Indicator

Simulated Altimeter

Although CTC is best known for its system engineering, a most significant part of the company is in the field of CUSTOMIZING of electronics and electromechanical assemblies for control systems applications. By using off-the-shelf modules we can accomplish such MODIFICATIONS in a short time and in most cases without extra cost.

ACTUATORS

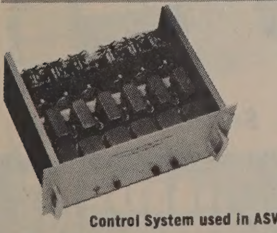

CS-202-2 300 lb. in. actuator

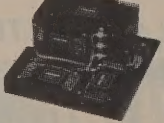

CS-202-1 Two Speed synchro high accuracy actuator

CS-198 250 oz. in. 0.1% accuracy actuator

Custom Servo Actuator

SPECIAL SYSTEMS


Control System used in ASW


Digital Control System

Dual Channel Resolver Angle Computer

SONAR SIMULATOR
Simulator Control Systems

CONTROL TECHNOLOGY CO., inc., 41-16 29TH STREET, LONG ISLAND CITY, N.Y. 11101 • (212) EMpire 1-2133

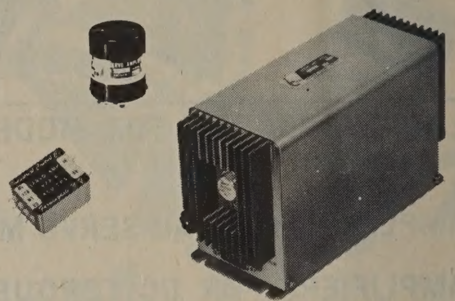
SERVO COMPONENTS

INSTRUMENTS, AMPLIFIERS and ACCESSORIES

FOR MILITARY AND INDUSTRIAL CONTROL SYSTEMS

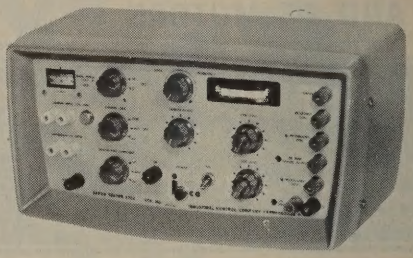
SERVO AMPLIFIERS

- DC, pot and synchro inputs
- 60 and 400 ~ outputs
- 972A (.5 cu in, 9 watts), to 1078A (1 KW DC)
- Solid-state and magnetic amplifiers



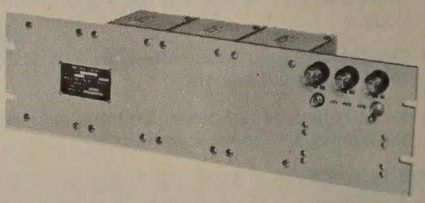
SERVO TESTERS

- 100C, general purpose use
- 103A, prod and field test
- Frequency and transient response
- For DC and AC servos



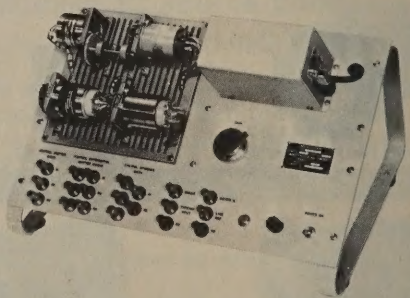
SYNCHRO AMPLIFIERS and FREQUENCY CHANGERS

- 929R, 90V./line, 400 ~ stators
- 820C, 90V./line, 60 ~ stators
- Buffer CX's from CT and TR loads
- Electromechanical and solid-state



SERVO DEMONSTRATORS

- Laboratory experiments
- Industrial training
- Synchro and pot data
- 60 and 400 ~ models



SYNCHRO DIRECTORS

- Generate 1 and 36 speed stator voltages
- Constant velocity and harmonic motion modes
- Computer programmed
- 60 and 400 ~ stator outputs

Write for Catalog of our COMPLETE Servo Line.

INDUSTRIAL CONTROL COMPANY

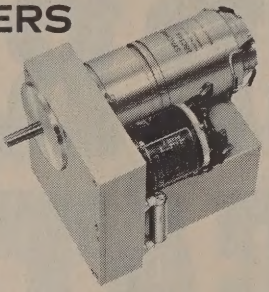
CENTRAL AVENUE AT PINELAWN • FARMINGDALE, L.I., N.Y. 11735 • 516-694-3000

SERVO SYSTEMS

STANDARD MODULES or SPECIALS

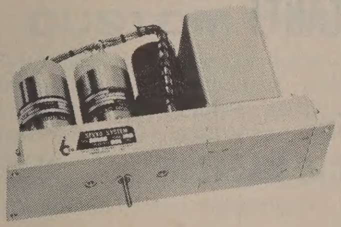
MIL-GRADE AND FAST DELIVERY

High Torque SYNCHRO REPEATERS



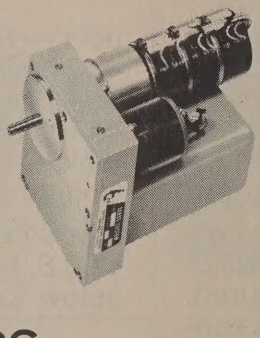
- 770 Series for 400 ~
- 847 Series for 60 ~
- 8′ error
- 300 oz in shaft torque
- 117V. line power

Two Speed SYNCHRO REPEATERS



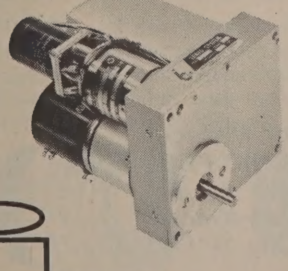
- 1038 Series for 400 ~
- 921 Series for 60 ~
- 16, 25 and 36 speed
- Shafts at high and lo speed
- 117V. line power

DC and AC POT FOLLOWERS



- 900 Series
- DC, 60 or 400 ~ inputs
- 1, 3 or 10 turn pots
- Torques to 300 oz in
- 117V. 60 or 400 ~ power

Precision DC VELOCITY SERVOS



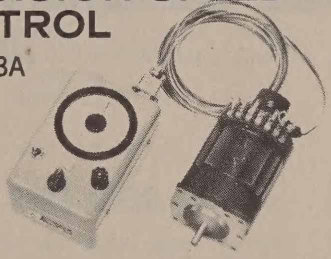
- 982 Series for 60 ~
- 983 Series for 400 ~
- ±10V. DC command
- 117V. line power
- Wide range of torques and speed

3 Axis SERVO INDICATOR

- type 909A

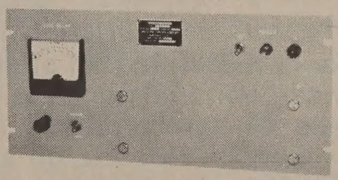
Bi-Directional PRECISION SPEED CONTROL

- type 923A



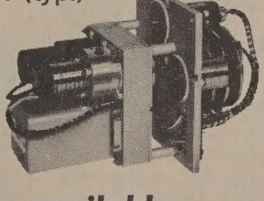
Process Control DELAYED SIGNAL GENERATOR

- type 849B



Custom Assemblies TO CUSTOMER SPECS.

- type 869A (typ.)



Modifications from Standards readily available.

INDUSTRIAL CONTROL COMPANY

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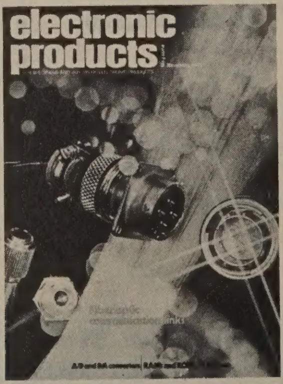

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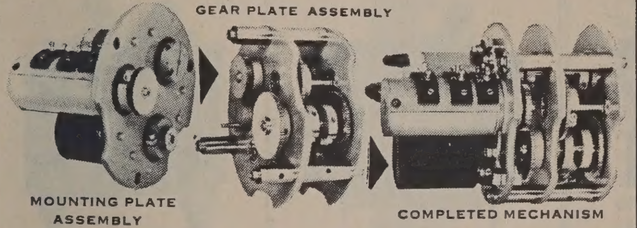
SERVO MECHANISMS & COMPONENTS

PREDESIGNED MECHANISMS

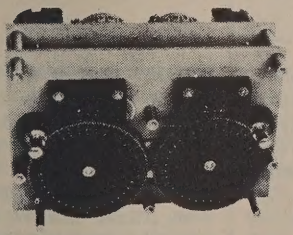
A complete line of off-the-shelf components for assembling an unlimited variety of geared mechanisms. Gear ratios to 78,125:1, zero-backlash spring-loaded gears and torque-limiting slip clutches are featured. Assembled units meet design and materials requirements of MIL-E-5400 and MIL-E-16400.

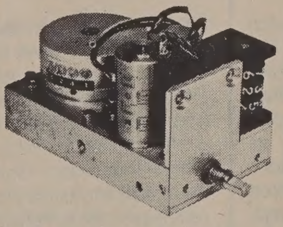


For complete data and catalog of stocked components, request Bulletin 102.

CUSTOM DESIGNS

PMC specializes in design and manufacture servo mechanisms and mechanical modules to user requirements for airborne, ground support, communications, fire control and other critical applications. The units shown below are typical of the mechanisms designed and manufactured for military and industrial equipments.

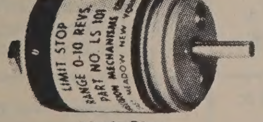




Short lead time delivery on both prototypes and production quantities.

ADJUSTABLE LIMIT SWITCHES & STOPS

0-10, -20, -40 revolutions without snap action switch, 0-25 revolutions with snap action switches actuated just before mechanical stops. All models infinitely adjustable with single external screw. SPDT snap action switch rated 7A, 250V.



Limit Stop
Series LS 100
5/8 and 7/8″ dia.

Limit Stop And Switch
Series LS 300
1 5/16″ dia.

For complete data, request Bulletins 103 and 104

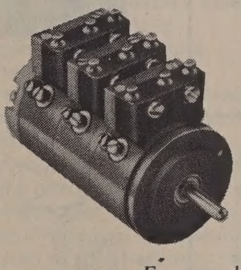
CAM SWITCHES

Adjustable-In-Motion

PMC's patented cam switch design incorporates in a single component all the functions of a conventional plate cam, cam follower and snap-action switch, eliminating the need for separately-mounted cam mechanisms and switches and their associated hardware. Externally-adjustable dwell angles can be set to any position with respect to the shaft. All models available as single- or multi-switch types, with ganged switches independently adjustable.

Model CS 402 Miniature Cam Switches

Miniature units designed and manufactured to military and aerospace specifications.

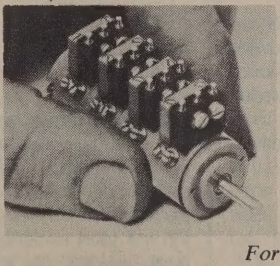


Diameter: 1-1/16″, equivalent to to BuOrd Size 11
Length: 0.8″, one switch, plus 0.5″ per switch
Dwell Angle: 3° to 357°
Switch: SPDT
Rating: 5A, 250VAC, 30VDC
Multi-Switch Models: up to 10 switches
Shaft: 0.125″ dia.

For complete data, request Bulletin 106

Model CS 601 Subminiature Cam Switches

Subminiature units for airborne, space vehicle and other applications where size and weight are critical.

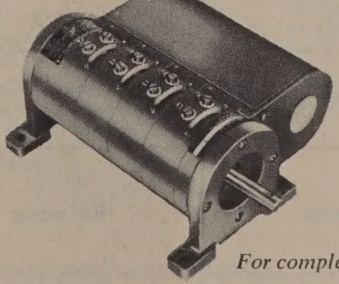


Diameter: 0.75″, equivalent to BuOrd Size 8
Length: 0.730″ one switch, plus 0.437″ per switch
Dwell Angle: 3° to 357°
Switch: SPDT
Rating: 7A, 250VAC, 30VDC
Shaft: 0.125″ dia.
Multi-Switch Models: up to 8 switches

For complete data, request Bulletin 109

Model CS 501 High-Power Cam Switches

Industrial types for control, cycling and sequencing of machine operations. End- or side-mounting, with or without switch covers. Dials permit visual adjustment of switching points and dwell angles.



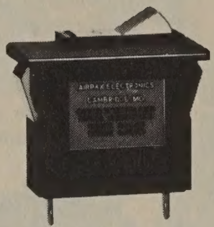
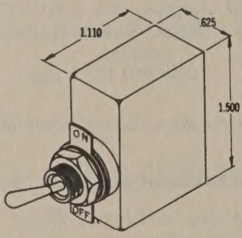
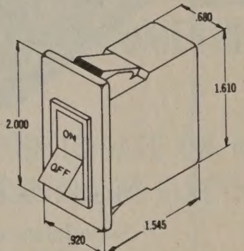
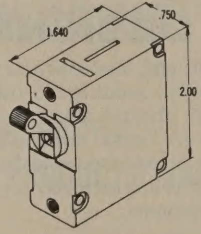
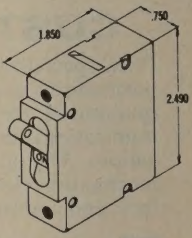
Dwell Angle: 5° to 355°
Diameter: 3.5″
Length: 3″ one switch, plus 1.5″ per switch
Shaft: 0.5″ dia.
Switches: SPDT, DPDT. Special types to requirements.
Ratings: to 25A and 600 V, inrush current to 75A.

For complete data, request Bulletin 108

PRECISION MECHANISMS CORPORATION
44 BROOKLYN AVENUE, WESTBURY, L.I., NEW YORK 11590 • (516) ED 3-5955

AIRPAX™ Electromagnetic Circuit Protectors and Circuit Breakers

■ Airpax magnetic circuit protectors and circuit breakers have been used for many years to solve the protection problems inherent with fuses and thermal breakers. Magnetic protectors are the acknowledged standard in military equipment, computer systems, ground fault personnel protection systems, and other industrial equipment. Airpax magnetic protectors and breakers eliminate the replacement problem inherent with fuses. The minimum trip current is not affected by temperature extremes, as is the case with fuses and thermal breakers. Precision protection required for electronic equipment is provided.

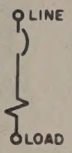
	AP/UP	203	APG/UPG	APL/UPL
MODEL DESIGNATION			AIRPAX ELECTRONICS CAMBRIDGE, MD.	AIRPAX ELECTRONICS CAMBRIDGE MD.
DIMENSIONS				
GENERAL DESCRIPTIONS AND APPLICATIONS	Types AP and UP are sealed electromagnetic circuit protectors qualified to the requirements of specification MIL-C-39019. AP and UP protectors will withstand up to 100G shock applied repeatedly in any plane, as well as 10G vibration from 10 to 2000 Hz under full load, which makes their use practical in mobile equipment. All will operate at rated value between —40°C and +100°C. For more information, request Bulletin 2001.	Combines over-current protection with ON-OFF switch and pilot light functions, for use in high quality industrial, medical, and military equipment where reliable protection and attractive appearance are demanded. Optional colors, plus a single rocker actuator for multipole assemblies, provide ease of operation and panel uniformity. An optional illuminated handle can be used to indicate circuit condition. Snap-in front panel mounting provides economy and simplifies installation. Optional flush mounting also available. For more information, request Bulletin 2009.	APG/UPG protectors are suitable for use in any situation where low cost precision operation is required. Multipole assemblies have a single toggle handle — a unique feature which simplifies mounting. Also available with rocker arm and thumbwheel actuators for improved panel appearance, as well as a panel seal version for marine or military environments. For more information, request Bulletin 2003.	APL/UPL circuit protectors are ruggedly constructed to provide dependable protection under the most severe conditions of use in industrial, military (QPL to MIL-C-55629), marine, or any application where precision protection is required. The versatility of the APL line makes it ideal for special purpose applications. For more information, request Bulletin 2002.
Number of Poles	1, 2, 3	1, 2, 3	1, 2, 3, 4	1, 2, 3, 4, 5, 6, 7, 8, 9
Current and Voltage Ratings	0.05-20 amperes, 240V ac, 50V dc	0.05-10 amperes, 250V ac, 50V dc 10.1-20 amperes, 120V ac, 32V dc	0.05-30 amperes, 277V ac, 65V dc 31-50 amperes, 120V ac, 50V dc	0.05-20 amperes, 277V ac 0.05-50 amperes, 250V ac, 65V dc 51-100 amperes, 120V ac, 32V dc
Interrupting Capacity	1000 amperes	1000 amperes	1000 amperes at 277V ac, 65V dc 5000 amperes: (30 A max. rating at 120V ac) (20 A max. rating at 250V ac) (10 A max. rating at 277V ac)	1000 amperes, 277V ac, 65V dc 2000 amperes, 32V dc 5000 amperes, 120V ac (50 A max. rating) 5000 amperes, 277V ac (20 A max. rating)
UL/CSA	Yes (UP, single pole, series only)	Yes	Yes (UPG)	Yes (UPL)

AIRPAX ELECTRONICS • CAMBRIDGE DIVISION • CAMBRIDGE, MARYLAND 21613

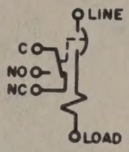
Phone: (301) 228-4600 Telex: 8-7715 TWX: 710-865-9655

AIRPAX™ Electromagnetic Circuit Protectors and Circuit Breakers

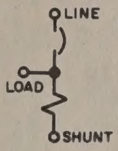
All Airpax Circuit Protectors and Circuit Breakers are available in many mechanical and electrical configurations to provide maximum versatility for the designer. The following internal circuits are available and can be combined in multipole units.



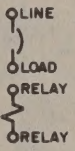
SERIES TRIP
A SPST two-terminal device with the sensing coil and contacts in series with the load being protected.



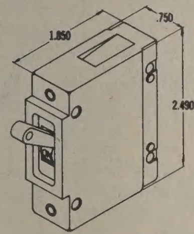
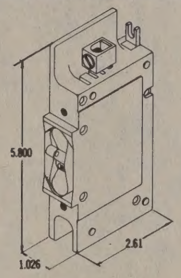
SERIES TRIP PLUS AUXILIARY SWITCH
A SPDT auxiliary switch is added to the series trip unit to provide auxiliary switching functions.



SHUNT TRIP
A connection is brought our from the internal coil-contact junction to a third terminal, permitting a shunt across the trip coil.

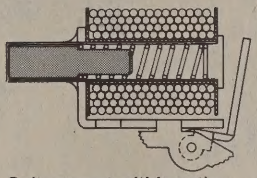


RELAY TRIP
Coil and contact leads are brought out to separate pairs of terminals. This configuration permits the overload sensing coil to be placed in a circuit which is electrically isolated from the trip contacts.

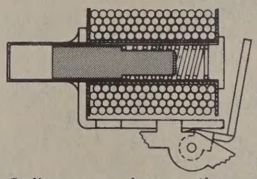
205	209
	
The 205 provides improved electrical performance plus a dust-proof enclosure. All openings in the case (including arc blowout vent and handle) have been sealed with resilient rubber and mylar. Case sections are of tongue and groove construction to provide an overlapping closure. Ideal for application in extremely harsh environments. For more information, request Bulletin 2002.	209 molded case circuit breakers present to electrical contractors, O.E.M.'s, and panel and equipment builders a more compact, competitive unit. Front or back connected terminal styles. Readily mounted in switch boards, panel enclosures, panel boards, or junction boxes. Family consists of the 209, a labeled circuit breaker; 219 manual motor controller; and 229 appliance controller. For more information, request Bulletin 2012
1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6
0.05-20 amperes, 480V ac 0.50-50 amperes, 250V ac, 65V dc 51-100 amperes, 120V ac, 32V dc	0.10-100 amperes, 125V dc 0.10-75 amperes, 600V ac 0.10-100 amperes, 120, 240, 277, 480V ac
1000 amperes, 250V ac, 65V dc 2000 amperes, 32V dc 5000 amperes, 120V ac (50 A max. rating) 5000 amperes, 480V ac (20 A max. rating)	5000 amperes
Yes	Yes

Hydraulic-Magnetic Time Delay Used in Airpax Circuit Protectors and Circuit Breakers

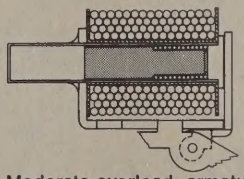
Unlike fuses and thermal circuit breakers, magnetic protectors employ a solenoid with an iron slug moving in oil, to provide an inverse time delay. The oil viscosity changes with temperature, causing the trip time of a magnetic protector to decrease as temperature increases and increase as temperature decreases, but the trip current remains unchanged. This makes possible accurate protection throughout the ambient temperature range without derating the protector.



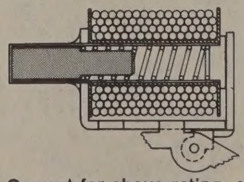
Coil current within rating.



Coil current above rating, moderate overload.



Moderate overload, armature operates after delay.



Current far above rating, armature trips without delay.

GENERAL CHARACTERISTICS

Trip Free
Airpax circuit protectors and circuit breakers will trip open on overload, even when forcibly held on. This prevents the operator from damaging the equipment by restraining the handle in the ON position.

Trip Indication
The operating handle moves forcibly and positively to the OFF position on overload.

Shock
Protectors will withstand shocks of 100G without tripping, while carrying full rated current, when tested per MIL-STD-202C, Method 213, Test Condition 1.

Vibration
Protectors will withstand 10G without tripping, while carrying full rated current, when tested per MIL-STD-202C, Method 201A.

Ambient Operation
—40°C to +85°C.

Insulation Resistance
100 megohms minimum at 500V dc.

Dielectric Strength
1500 ac at 60Hz.

Endurance
When the protector is operated as a switch carrying full rated current, at a maximum rate of 6 operations per minute, the operating life will exceed 10,000 operations.

AIRPAX ELECTRONICS • CAMBRIDGE DIVISION • CAMBRIDGE, MARYLAND 21613
Phone: (301) 228-4600 Telex: 8-7715 TWX: 710-865-9655

ALCOSWITCH®

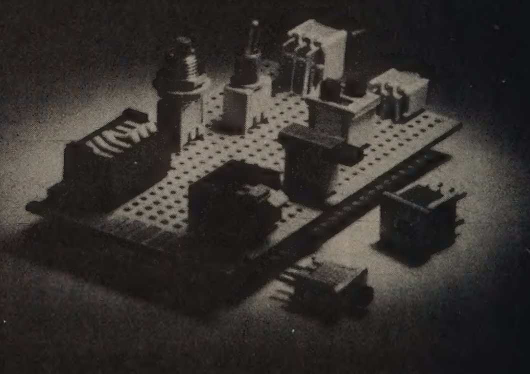
WORLD'S SMALLEST SWITCHES FOR INDUSTRIAL APPLICATIONS

A truly subminiature switch family designed specifically for printed circuit application. Not merely a diminution of existing miniatures, but a complete new series designed from the bottom up for today's subminiaturization standards. These switches contain the most-asked-for features as outlined below.

- UNIFORM 0.1" SPACING
  Between all terminals and anchor pins.
- GOLD PLATED CONTACTS
  Most needed for logic circuitry.
- CASE MATERIAL
  Flame retardant Diallyl Phthalate.
- HIGH TORQUE BUSHING
  Withstands mechanical abuse.
- ANTI PUSH-IN TOGGLE
  Prevents possible damage to inner mechanism.
- CLOSER SPACING ON PANELS
  Allows 3 single pole switches per linear inch.
- LOWER DENSITY
  Allows clearance on PC boards spaced on 1/2" centers.
- SLIDE SWITCH DESIGN
  Utilizes toggle action design.
- COMPLEMENTARY PUSHBUTTONS
  Available in many styles and configurations.
- DIP SWITCHES TOO!
  This completes the line of switches for PC use.

We're late comers in DIPS, but, we've got one of the largest variety including, rockers, slides, pianos and SPDT models. All with high quality design features, excellent tactile feel and in stock for immediate delivery.

Please call (617) 685-4371 or Telex 710 342-0552 and ask for Customer Service for selection assistance; prices, samples and a copy of our 76-page catalog.



TYPES SHOWN ARE TT SERIES

ALCO® ELECTRONIC PRODUCTS, INC. NO. ANDOVER, MASS. 01845
A Subsidiary of AUGAT, INC.

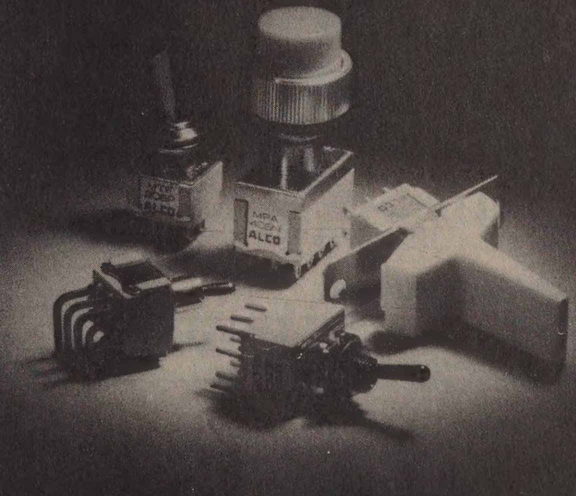
ALCOSWITCH®

MINIATURE SWITCHES WITH THE MOST WANTED FEATURES

When you compare price you must compare these outstanding features! Remember these are included "AT NO EXTRA COST".

- MOLDED-IN TERMINALS
  Eliminates costly epoxy seals.
- FINE SILVER CONTACTS
  Provide a high 6 Ampere rating.
- GOLD FLASH ON TERMINALS
  Prevents oxidation to ease solderability and extend shelf life.
- CASE MATERIAL
  Flame retardant Diallyl Phthalate.
- HIGH TORQUE BUSHING
  Withstands mechanical abuse.
- LEVER STOP DEVICE
  Prevents push-in of toggle and avoids possible damage.
- NEW FRAME DESIGN
  Allows use on 250VAC as well as 125VAC.
- UL LISTED
  Reference E-46765 on most models.
- ISOLATION BARRIERS
  Inside as well as outside.
- HIGHEST QUALITY
  Designed for maximum reliability.
- NO HIDDEN COSTS
  Investigate, you'll buy ALCOSWITCH.

For additional information, quantity pricing or a Free Sample, please call our Customer Service at (617) 685-4371 or Telex 710 342-0552. Also, don't forget to ask for our latest 76-page catalog which contains complete engineering data on our full line of switches.

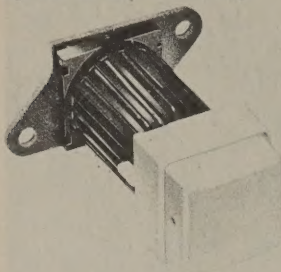


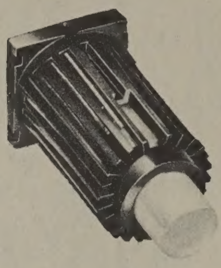
TYPES SHOWN ARE GREEN SERIES

ALCO® ELECTRONIC PRODUCTS, INC. NO. ANDOVER, MASS. 01845
A Subsidiary of AUGAT, INC.

Pushbutton Switches/K500 Series

Up to 6PDT — 1 Amp





For chassis or PC board mounting only. No front panel screws. Six PDT silver alloy self-cleaning slide-action contacts. Occupies less than one square inch of panel space. Only 1½" depth behind panel. Long-life special nylon parts used throughout. Pushbutton switches can be furnished with round ⅜" diameter or ¾" square button in white (W), black (BK), red (R), yellow (Y), green (G), or blue (B). Square buttons may be engraved or hot stamped. Illuminated pushbutton switches are available using lamps which are accessible from front. Special unbased lamps in 6, 12, 24 v 1 watt are available all over the world. UL Component Recognition File E62296

SPECIFICATIONS

Contact Rating: 1 amp at 30 vdc or 0.2 amp at 115 vac (0.5 amp at 26 vdc, vac — UL Rating)

Contact Arrangement: Two, four, and six form C contacts

Life Expectancy: 10^6 mechanical; 5 x 10^4 at rated load

Ambient Temperature Range: −20°C to 60°C

Dielectric Strength: Under room conditions, 500v rms

Insulation Resistance: Under room conditions, 10^9 ohms.

Terminals: Solder lugs or PC pins

HOW TO ORDER

Your part number consists of the switch part number, color of button, contact arrangement and PC if printed circuit terminals are desired. Add letters "PC' 'at end of part number.

For example: to order a pushbutton switch with a push lock, push release function, a non-illuminated square black button, four form C contacts, and printed circuit terminals, the following part number would be used: **K560 BK-4C-PC.**

Note: Solder temperature: Max. 270°C (500°F) Solder time: Max. 5 sec.

PART NUMBERS FOR PUSHBUTTON SWITCHES

Function	Non-Illuminated		Illuminated	
	Round	Square	Round	Square
Momentary	K 500	K 520	K 600	K 620
Push Lock, Push Release	K 540	K 560	K 640	K 660
Push Lock, Reset Solenoid*	K 502	K 522	K 602	K 622

* Standard solenoid is for 24 vac or vdc (200 ohms); other coils can be supplied to special order.

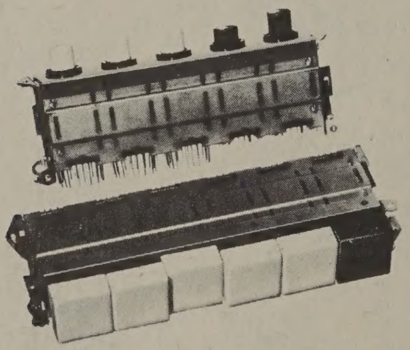
PART NUMBERS

For Incandescent Lamps and Accessories

P/N	Description
2305	6 - 7V, 1W Unbased Lamp
2321	12 - 15V, 1W Unbased Lamp
2341	24 - 30V, 1W Unbased Lamp
LTa110Z1	Lamp Inserter
Z1693	Button Remover

Multiple Switches/T596 Series

Up to 6PDT Per Station — 1 Amp



SERIES T596 MULTIPLE SWITCHES

For front panel, chassis, or PC board mounting using 4-40 screws. Up to 6 PDT silver-nickel self-cleaning slide-action contacts. Occupies less than one square inch of panel space. Only 1½" depth behind panel. Long-life special nylon parts used throughout. Pushbutton switch can be furnished with round ⅜" diameter or square ⅞" x 13⁄16" with 0.827" center-to-center spacing, in white, black, red, yellow, green, or blue buttons. Square buttons may be engraved or hot stamped. Illuminated pushbutton switches are available using lamps, which are accessible from front. Special unbased lamps in 6, 12, 24 v 1 watt are available all over the world.

SPECIFICATIONS

Contact Rating: 1 Amp at 30 VDC or 0.2 Amp at 115 VAC.

Contact Arrangement: Two, four and six form C contacts.

Life expectancy: 10^5 mechanical; 5 x 10^4 at rated load.

Ambient Temperature Range: −20°C to 60°C.

Dielectric Strength: Under room conditions, 500 v RMS.

Insulation Resistance: Under room conditions, 10^9 ohms.

Terminals: Solder lugs or PC terminals.

SWITCH CHARACTERISTICS

Switch Function	Frame Part Number
Non-lock (momentary) Push lock, push release	T596.10

STATION PART NUMBERS

Function	Non-illuminated		Illuminated	
	Round	Square	Round	Square
Non-lock (momentary)	500.1	520.1	600.1	620.1
Push lock, push release	540.4	560.4	640.4	660.4

FOR EXAMPLE, TO ORDER:

A multiple-station pushbutton switch with: Ten interlock, non-illumnated stations with white round buttons, four form C contacts, and printed circuit terminals, the following part number would be developed: (See example at right)

Note: Solder temp.: Max. 270°C (500°F) Solder time: Max. 5 sec.

T 596.20-10 / 500.2 W / 4C / PC

Frame #
Number of stations
Station part #
Color of buttons
Contacts on each station
PC pins

AMERICAN ZETTLER, INC.

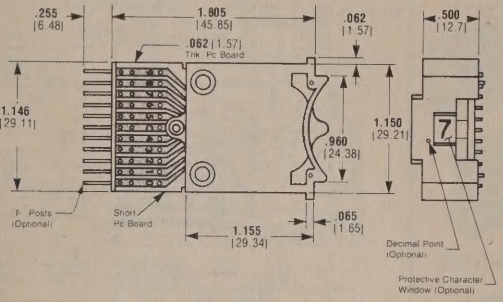
DEPT. EM, 16881 HALE AVE., IRVINE, CA 92714
PHONE (714) 540-4190, TELEX 67-8472

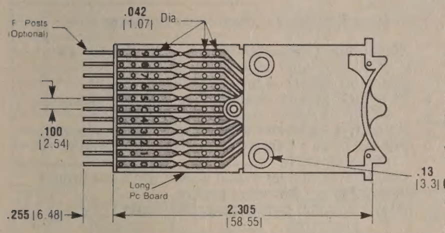
THUMBWHEEL SWITCHES

INTRODUCTION

AMP thumbwheel switches provide a simple, highly reliable means of manually programming various types of electrical/electronic equipment. These miniature switches are designed for front and rear panel mounting and can be used singly or "stacked" for either individual or matrix output applications. They are ideally suited for use in machine tool and process control systems as well as test equipment, aircraft, various instruments and input data terminals. For more details, ask for AMP Catalog No.73-143.

.500 [12.7] STANDARD SPECIFICATIONS


.255
[6.48]
1.805
[45.85]
.062
[1.57]
.500
[12.7]
.062 [1.57]
Thk. Pc Board
1.146
[29.11]
1.150
[29.21]
.960
[24.38]
7
F Posts
(Optional)
Short
Pc Board
1.155
[29.34]
.065
[1.65]
Decimal Point
(Optional)
Protective Character
Window (Optional)


F Posts
(Optional)
.042
[1.07] Dia.
.100
[2.54]
.13
[3.3]
Long
Pc Board
.255 [6.48]
2.305
[58.55]

ELECTRICAL

Outputs: Decimal, BCD and BCO. Other codes also available.
Contact Resistance (pad-to-pad): .1 ohm (max.).
Current Rating: 3 amperes (continuous); .125 ampere (switching).
Insulation Resistance (74°F [23.3°C], sea level): 1 x 10^9 ohms (min.).
Dielectric Withstanding Voltage: 500 VDC (min.).
Capacitance (between any two conductors): 5 pf (max.).

MECHANICAL

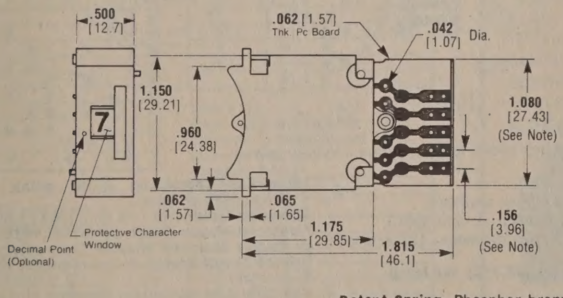
Wheel/Dial Positions: 8 and 10, standard.

Wheel/Dial Characters: White, gothic style, .18" [4.57 mm] high (max.).
Operating Force: .4 to 1.25 lb. [1.78 to 5.56 N].
Structural Plastic: Black, polycarbonate (glossy finish) or polyester (matte finish).
Protective Character Window: Clear polycarbonate.
Printed Circuit Boards: Flame retardant, glass epoxy laminate.
Contacts: Gold-over-nickel plated phosphor bronze.
Detent Spring: Phosphor bronze.
Life: 1,000,000 detent operations (min.).

ENVIRONMENTAL (MIL-STD-202)

Temperature: —40°F to + 190°F [—40°C to + 87.7°C].
Shock: 25 G in all planes.
Vibration: 10-2000 Hz (Method 204B, Condition B).

.500 [12.7] SEALED & ENCLOSED SPECIFICATIONS


.500
[12.7]
.062 [1.57]
Thk. Pc Board
.042
[1.07] Dia.
1.150
[29.21]
.960
[24.38]
7
1.080
[27.43]
(See Note)
.062
[1.57]
.065
[1.65]
1.175
[29.85]
1.815
[46.1]
.156
[3.96]
(See Note)
Protective Character
Window
Decimal Point
(Optional)

ELECTRICAL

Outputs: BCD. Other codes also available.
Contact Resistance (pad-to-pad): .1 ohm (max.).
Current Rating: 3 amperes (continuous); .125 ampere (switching).
Insulation Resistance (74°F [23.3°C], sea level): 1 x 10^9 ohms (min.).
Dielectric Withstanding Voltage: 500 VDC (min.).
Capacitance (between any two conductors): 5 pf (max.).

MECHANICAL

Wheel/Dial Positions: 10, standard. Other variations available.
Wheel/Dial Characters: White, gothic style, .18" [4.57 mm] high (max.).
Operating Force: .4 to 1.25 lb. [1.78 to 5.56 N].
Structural Plastic: Black, polyester (matte finish).
Protective Character Window: Clear polycarbonate.
Printed Circuit Boards: Flame retardant glass epoxy laminate.
Contacts: Gold-over-nickel plated phosphor bronze.
Detent Spring: Phosphor bronze.
Life: 500,000 detent operations (MIL-STD-202, Method 106).

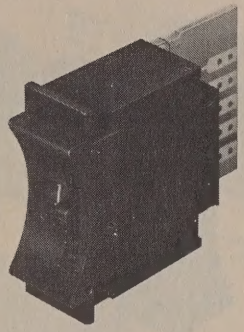
ENVIRONMENTAL (MIL-STD-202)

Temperature: —55°C to +85°C (Method 107, Condition A).
Shock: 10 microsecond contact opening (max.) (Method 213, 100 G sawtooth pulse).
Vibration: 10 microsecond contact opening (max.) (Method 204, 10 to 500 Hz, .06 double amplitude).
Altitude: 70,000 ft. [21 336 m] (Method 105, Condition C).

(Sealed Switch Only)

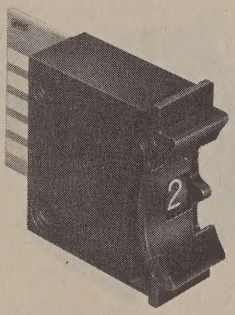
Seal: MIL-S-22710, Paragraph 4.8.14.1.
Moisture Resistance: 25 megohms (min.) (Method 106).
Sand and Dust: Method 110, Condition B.
Explosion: Method 109.
Salt Spray: Method 101, Condition B.

AMP



.500 [12.7] STANDARD

AMP .500 (12.7) standard thumbwheel switches are available as 8 or 10 position switches with outputs in decimal, BCD or BCO. They can be supplied with short or long boards and for mother/daughter board, pc connector, solderless wire or soldered wire connection. Standard housings with a glossy or fine matte finish incorporate a mounting flange to facilitate front or rear panel mounting.

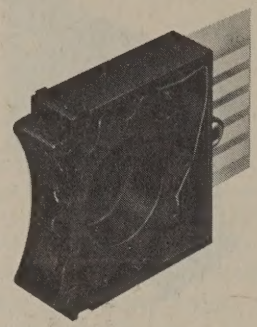


.500 [12.7] SEALED AND ENCLOSED

AMP .500 (12.7) sealed and enclosed thumbwheel switches provide varying degrees of environmental protection, as required. The enclosed version employs a housing design which serves as a barrier against such contaminants as dirt and dust. The sealed version, using the same housing, also has an epoxy seal which provides protection against fumes, vapors and moisture. Both versions are currently supplied as a 10 position switch with a BCD output, but can be made available with a variety of outputs, special features and options.

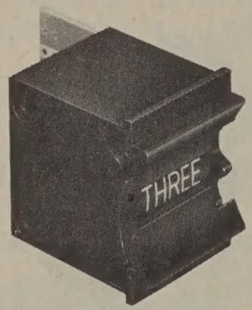
AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP



.350 [8.89]

AMP .350 [8.89] thumbwheel switches are furnished with most of the same capabilities as the .500 [12.7] standard switch, but are intended for use where horizontal mounting space is limited or where a wider switch is unnecessary. Available outputs and options also include the same broad range as the wider switch.



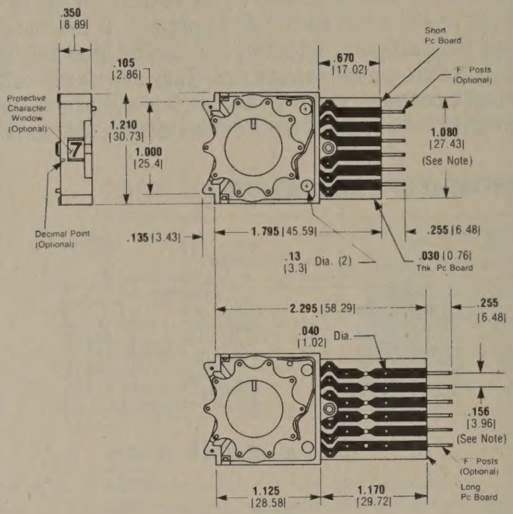
MESSAGE WHEEL

AMP message wheel thumbwheel switches are specifically designed for the use of words, abbreviations or symbols to identify switch positions. Their 1" [25.4 mm] wide housings make them ideal for handling virtually any special readout requirement. The switch is presently furnished as a 10 position module with a BCD output, but can be readily adapted to accommodate any of the other decimal, BCD and BCO outputs as well as all available options.

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

THUMBWHEEL SWITCHES

.350 [8.89] SPECIFICATIONS


.350
[8.89]
.105
[2.86]
Protective Character Window (Optional)
1.210
[30.73]
1.000
[25.4]
7
Decimal Point (Optional)
.135 [3.43]
.670
[17.02]
Short Pc Board
"F" Posts (Optional)
1.080
[27.43]
(See Note)
1.795 [45.59]
.255 [6.48]
.13
[3.3]
Dia. (2)
.030 [0.76]
Thk Pc Board
2.295 [58.29]
.255
[6.48]
.040
[1.02]
Dia.
.156
[3.96]
(See Note)
"F" Posts (Optional)
Long Pc Board
1.125
[28.58]
1.170
[29.72]

Note: 10 position BCD switch with separate common to complement shown for illustration purposes only.

ELECTRICAL

Outputs: Decimal and BCD. Other codes also available.

Contact Resistance (pad-to-pad): .1 ohm (max.)

Current Rating: 3 amperes (continuous); .125 ampere (switching).

Insulation Resistance (74°F [23.3°C], sea level): 1 x 10^9 ohms (min.)

Dielectric Withstanding Voltage: 500 VCD (min.)

Capacitance (between any two conductors): 5 pf (max.)

MECHANICAL

Wheel/Dial Positions: 10, standard. Other variations available.

Wheel/Dial Characters: White, gothic style, .18" [4.57 mm] high (max.)

Operating Force: .4 to 1.25 [1.78 to 5.56 N]

Structural Plastic: Black, polycarbonate (glossy finish) or NORYL† (matte finish)

Protective Character Window: Clear polycarbonate

Printed Circuit Boards: Flame retardant, glass epoxy laminate

Contacts: Gold-over-nickel plated phosphor bronze

Detent Spring: Phosphor bronze

Life: 1,000,000 detent operations (min.)

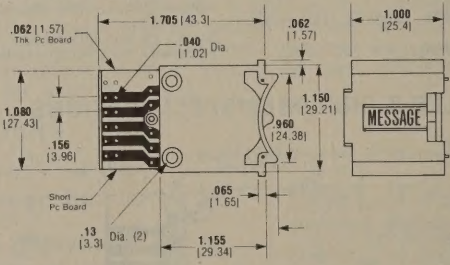
ENVIRONMENTAL (MIL-STD-202)

Temperature: —40°F to +190°F [—40°C to +87.7°C]

Shock: 25 G in all planes

Vibration: 10-2000 Hz (Method 204B, Condition B)

MESSAGE SPECIFICATIONS


.062 [1.57]
Thk Pc Board
1.705 [43.3]
.040
[1.02]
Dia
.062
[1.57]
1.000
[25.4]
1.080
[27.43]
.156
[3.96]
1.150
[29.21]
.960
[24.38]
MESSAGE
Short Pc Board
.065
[1.65]
.13
[3.3]
Dia. (2)
1.155
[29.34]

Note: 10 position BCD switch shown for illustration purposes only

ELECTRICAL

Outputs: BCD. Other codes also available.

Contact Resistance (pad-to-pad): .1 ohm (max.)

Current Rating: 3 amperes (continuous); .125 ampere (switching).

Insulation Resistance (74°F [23.3°C], sea level): 1 x 10^9 ohms (min.)

Dielectric Withstanding Voltage: 500 VDC (min.)

Capacitance (between any two conductors): 5 pf (max.)

MECHANICAL

Wheel/Dial Positions: 10, standard. Other variations available.

Wheel/Dial Characters: White, gothic style, .19" [4.83 mm] high (max.)

Operating Force: 4 to 1.25 lb. [1.78 to 5.56 N]

Structural Plastic: Black, polyester (matte finish)

Protective Character Window: Clear polycarbonate

Printed Circuit Boards: Flame retardant glass epoxy laminate

Contacts: Gold-over-nickel phosphor bronze

Detent Spring: Phosphor bronze

Life: 1,000,000 detent operations

ENVIRONMENTAL (MIL-STD-202)

Temperature: —40°F to +190°F [—40°C to +87.8°C]

Shock: 25 G in all planes

Vibration: 10-2000 Hz (Method 204B, Condition B)

PART NUMBERS

435415-1—Output code is 10 position BCD (Truth Table 3). Switch has a special pc board and will not mate with AMP pc connectors. Dial messages for this particular switch are:

Dial Position	0	1	2	3	4	5	6	7	8	9
Dial Message	NORM +MTR	NORM —MTR	NORM +FT	NORM —FT	AUTO +MTR	AUTO —MTR	AUTO +FT	AUTO —FT	LAMP TEST	

435415-2—Output code is 10 position BCD (Truth Table 3). Switch has a special pc board and will not mate with AMP pc connectors. Special feature also includes four 1N4148 diodes mounted on switch pc board. Dial messages for this particular switch are:

Dial Position	0	1	2	3	4	5	6	7	8	9
Dial Message	NORM +MTR	NORM —MTR	NORM +FT	NORM —FT	AUTO +MTR	AUTO —MTR	AUTO +FT	AUTO —FT	LAMP TEST	

THUMBWHEEL SWITCHES

AMP

TRUTH TABLES

Table 1
10 Pos. Decimal

Dial Position	Common to:									
	0	1	2	3	4	5	6	7	8	9
0	●									
1		●								
2			●							
3				●						
4					●					
5						●				
6							●			
7								●		
8									●	
9										●

Table 2
8 Pos. Decimal
8 Pos. Decimal

Dial Position	Common to:							
	0	1	2	3	4	5	6	7
0	●							
1		●						
2			●					
3				●				
4					●			
5						●		
6							●	
7								●

Table 3
10 Pos. BCD

Dial Position	Common to:			
	1	2	4	8
0				
1	●			
2		●		
3	●	●		
4			●	
5	●		●	
6		●	●	
7	●	●	●	
8				●
9	●			●

Table 4
10 Pos. BCD Complement

Dial Position	Common to:			
	1	2	4	8
0	●	●	●	●
1		●	●	●
2	●		●	●
3			●	●
4	●	●		●
5		●		●
6	●			●
7				●
8	●	●	●	
9		●	●	

Table 5
10 Pos. BCD w/Complement

Dial Position	Common to:							
	1	2	4	8	1	2	4	8
0					●	●	●	●
1	●					●	●	●
2		●			●		●	●
3	●	●					●	●
4			●		●	●		●
5	●		●			●		●
6		●	●		●			●
7	●	●	●					●
8				●	●	●	●	
9	●			●		●	●	

Table 6
10 Pos. BCD w/Separate
Common to Complement
Common X to ●
Common Y to ○

Dial Position	Common to:			
	1	2	4	8
0	○	○	○	○
1	●	○	○	○
2	○	●	○	○
3	●	●	○	○
4	○	○	●	○
5	●	○	●	○
6	○	●	●	○
7	●	●	●	○
8	○	○	○	●
9	●	○	○	●

Table 7
10 Pos. BCD 9's Complement

Dial Position	Common to:			
	1	2	4	8
0	●			●
1				●
2	●	●	●	
3		●	●	
4	●		●	
5			●	
6	●	●		
7		●		
8	●			
9				

Table 8
10 Pos. BCD 9's Complement w/Complement

Dial Position	Common to:							
	1	2	4	8	1	2	4	8
0	●			●		●	●	
1				●	●	●	●	
2	●	●	●					●
3		●	●		●			●
4	●		●			●		●
5			●		●	●		●
6	●	●					●	●
7		●			●		●	●
8	●					●	●	●
9					●	●	●	●

Table 9
8 Pos. BCO

Dial Position	Common to:		
	1	2	4
0			
1	●		
2		●	
3	●	●	
4			●
5	●		●
6		●	●
7	●	●	●

Table 10
8 Pos. BCO Complement

Dial Position	Common to:		
	1	2	4
0	●	●	●
1		●	●
2	●		●
3			●
4	●	●	
5		●	
6	●		
7			

Table 11
8 Pos. BCO w/Complement

Dial Position	Common to:					
	1	2	4	1	2	4
0				●	●	●
1	●				●	●
2		●		●		●
3	●	●				●
4			●	●	●	
5	●		●		●	
6		●	●	●		
7	●	●	●			

Table 12
8 Pos. BCO w/Separate
Common to Complement
Common X to ●
Common Y to ○

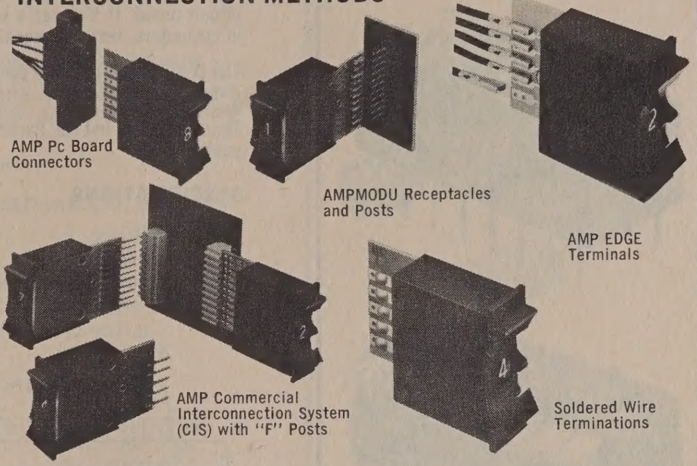
Dial Position	Common to:		
	1	2	4
0	○	○	○
1	●	○	○
2	○	●	○
3	●	●	○
4	○	○	●
5	●	○	●
6	○	●	●
7	●	●	●

Table 13
10 Pos. + and —,
Repeating (DPDT)
Common X to ●
Common Y to ○

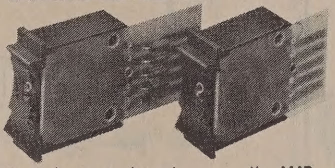
Dial Position	Common to:			
	+	—	+	—
+	○		●	
—		○		●
+	○		●	
—		○		●
+	○		●	
—		○		●
+	○		●	
—		○		●
+	○		●	
—		○		●

OPTIONS

INTERCONNECTION METHODS


AMP Pc Board Connectors
AMPMODU Receptacles and Posts
AMP EDGE Terminals
AMP Commercial Interconnection System (CIS) with "F" Posts
Soldered Wire Terminations

BOARD LENGTHS

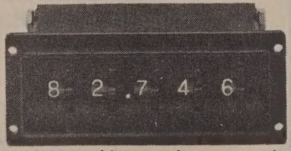


Input/output boards on all AMP switches may be supplied in two lengths. A long board is used where components such as diodes and resistors are required in the switching function and are to be mounted directly onto the board. The short board is used where no such components are needed. All interconnection methods may be used with either board length.

PROTECTIVE CHARACTER WINDOWS

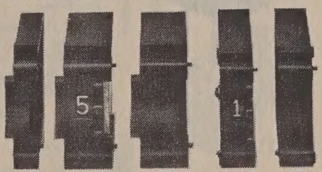
Transparent plastic windows are available on .500 [12.7] and .350 [8.89] switches. They provide protection for the wheel characters against dirt, dust and other contaminants. They are ideally suited for use in industrial environments.

SPECIAL MARKING



Special marking such as punctuation, abbreviations and symbols can be supplied on switch modules and spacers. These markings are in addition to the special markings which may be obtained on the switch wheels.

SPACERS



Spacers are available for custom stacking or assembling switch moddules. They are supplied with glossy or fine matte finishes. Material construction of the spacers is black polycarbonate (glossy finish) or black thermoplastic (matte finish).

Figure 1. Spacers for .500 [12.7] Standard & Message Wheel Switches.

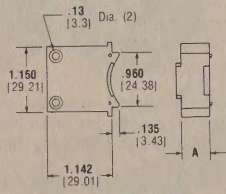
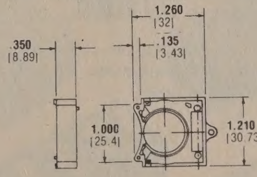


Figure 2. Spacer for .350 [8.89] Switches.



ASSEMBLY HARDWARE
When switches are purchased as individual modules, assembly hardware must be ordered separately.

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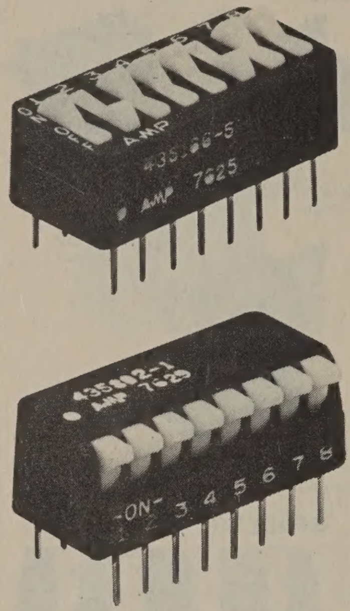
INCORPORATED
HARRISBURG, PENNSYLVANIA 17105
Phone: 717-564-0100 TWX: 510-657-4110

AMP

7000 SERIES


0 OFF
1 2 3 4 5 6 7 8
AMP
435166-5
AMP 7625
435802-1
AMP 7-29
ON 1 2 3 4 5 6 7 8

FEATURES

- High Density—Low profile, compact design requires a minimum of pc board area.
- Available in standard or right angle versions.
- Simple Operation — Rocker actuators instantly change program.
- Easy Mounting—Switches can be flow-soldered directly to pc board or simply inserted into DIP headers or IC packaging receptacles.
- Economical—Board mounted switches eliminate the need for interconnection wiring to perform switching functions.
- High Reliability—Fully enclosed design protects contact surfaces from environmental hazards. Optional transparent cover is also available.
- Versatile Application — Switches furnished in various sizes, ranging from 1 to 12 positions.

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INCORPORATED
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PHONE: 717-564-0100 TWX: 510-657-4110

DUAL-IN-LINE PACKAGE SWITCHES

The AMP Dual In-Line Package Switch provides a highly reliable, low cost means of manually programming various types of electrical/electronic equipment. This unique device is essentially a multiplicity of rocker actuated, single-pole, single-throw switches packaged in a housing with input/output leads on .100" x .300" centers and is specifically designed to be mounted on a printed circuit board. It features a very low profile, and is ideally suited for programming logic functions in computers, test equipment, telephone equipment, process control equipment, etc.

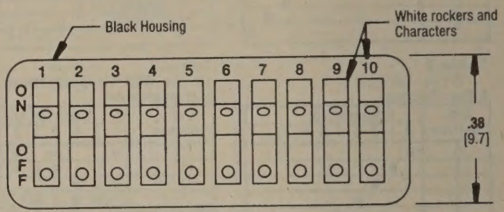
The Dual In-Line Package Switch requires no hardware for mounting and can be either flow-soldered directly to a pc board or simply inserted into AMP's DIP headers or IC packaging receptacles.

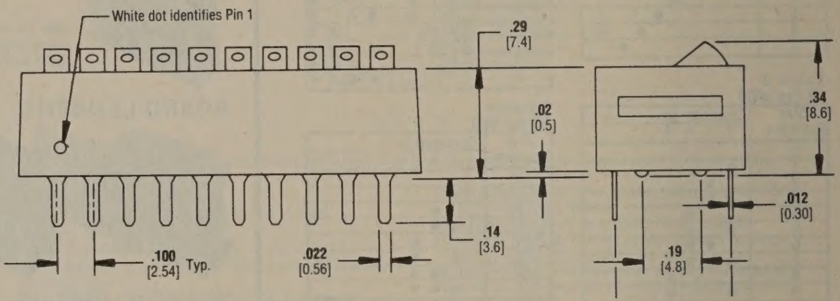
The AMP Dual In-Line Package Switch can be supplied in a wide range of sizes, from 1 to 12 positions.

SPECIFICATIONS

DIMENSIONAL

All dimensions in inches.


Black Housing
White rockers and Characters
1
2
3
4
5
6
7
8
9
10
ON
OFF
.38
[9.7]


White dot identifies Pin 1
.29
[7.4]
.02
[0.5]
.34
[8.6]
.012
[0.30]
.14
[3.6]
.19
[4.8]
.100
[2.54] Typ.
.022
[0.56]

ELECTRICAL

Circuit Current/Voltage Ratings: Nonswitching .... 1.5A @ 50 VDC
Switching .... 100 ma @ 5 VDC
25 ma @ 24 VDC

Contact Resistance (50 MV open-circuit, 10 ma) .... 100 Milliohms (Max.)

Insulation Resistance (@ 100 VDC) Between adjacent open or closed switches:
Initial .... 1×10^{11} Ohms (Min.)
After environmental exposure .... 1×10^{9} Ohms (Min.)

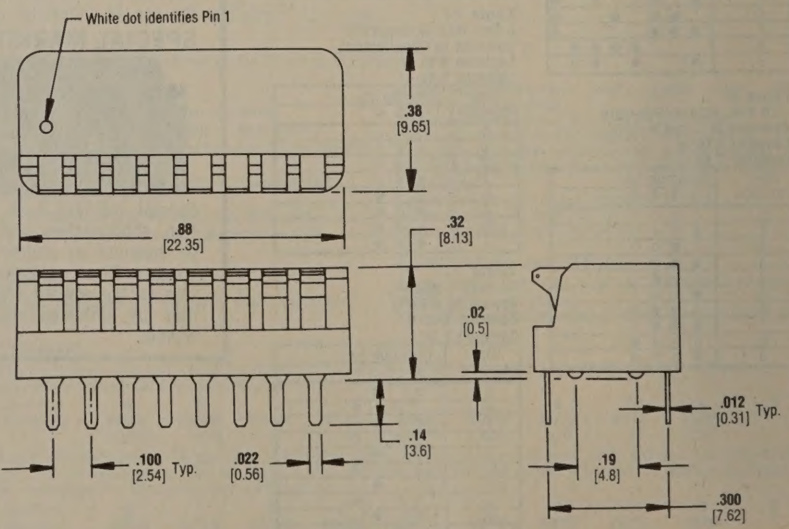
Dielectric Breakdown Voltage .... 500 VDC (Min.)

Circuit Capacitance (between adjacent switches) .... 5 Picofarads (Max.)

Shock: Discontinuity shall not exceed 1.0 microseconds when shocked 3 times in each of 6 directions for a combined total of 18 shocks. Shock wave parameters are 20g level, 11 millisecond duration, half sine pulse shape.

Vibration: Discontinuity shall not exceed 1.0 microseconds when tested in accordance with MIL-STD-202 D Method 204, Condition C.

MATERIAL Housing .... Glass-filled polyester
Actuators .... Polyester
Contacts .... Beryllium copper, gold-over-nickel plated


White dot identifies Pin 1
.38
[9.65]
.88
[22.35]
.32
[8.13]
.02
[0.5]
.012
[0.31] Typ.
.14
[3.6]
.100
[2.54] Typ.
.022
[0.56]
.19
[4.8]
.300
[7.62]

DUAL-IN-LINE PACKAGE SWITCHES

AMP 7030 SERIES RECESSED CAM DIP SWITCHES

FEATURES

Low Profile above P.C. Board.

Design prevents accidental change of rocker position.

Easy to apply tape processing seal available for top of switch.

Epoxy seal on bottom combined with tape seal on top inhibit contamination of contacts during processing.

94V-0 Rated Material.

Marking on rockers provides excellent legibility for program setting and identification.

MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is black with white markings.

Rockers are 94V-0 Rated Unfilled Polyester — color is white with optional red markings.

Contacts are Beryllium Copper with gold over nickel plating.

Sealing Material is epoxy.

ELECTRICAL & MECHANICAL RATINGS

Contact Resistance	100 milliohms max.
Ins. Resistance	1×10^{11} ohms
Dielectric Strength	500 VDC
Cycle Life	7000 Cycles/Pole min.
Capacitance	5 picofarads
Operating Temp	0°F to 190°F
Current/Voltage Rating	24 volts @ 25 ma max. switching

AMP 7100 AND 7130 SERIES ECONOMY DIP SWITCHES

FEATURES

Economical substitute where cycle life is not critical.

94V-0 Rated Material.

Low Profile (on 7130 Series).

Marking on rockers provides excellent legibility for program setting (on 7130 Series).

Design prevents accidental change of rocker position (on 7130 Series).

MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is blue with white markings.

Rockers are 94V-0 Rated Unfilled Polyester— color is white with optional red markings.

Contacts are copper alloy with gold plate on contact surfaces.

ELECTRICAL & MECHANICAL RATINGS

Contact Resistance	100 milliohms max.
Ins. Resistance	1×10^{11} ohms
Dielectric Strength	500 VDC
Cycle Life	2000 cycles/pole
Capacitance	5 picofarads
Operating Temp	0°F thru 190°F
Current/Voltage Rating	24 volt @ 25 ma max. (switching)

AMP 7200 AND 7040 SERIES LED DIP SWITCHES AND MOMENTARY CAM DIP SWITCHES

FEATURES

Momentary or detented rockers available.

Switch leads and LED leads independently terminated for circuit connection versatility.

Permits rapid circuit test or fault indication.

Permits rapid program verification.

Permits Dual-In-Line Packaging of LED's.

94V-0 Rated Materials (Except Diodes).

MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is black with white markings.

Rockers are Unfilled Polyester—color is white.

Contacts are Beryllium Copper with gold over nickel plating.

LEDS are epoxy encapsulated GaAsp or GaP Diodes—color is red.

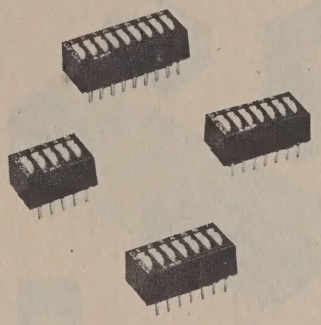
ELECTRICAL & MECHANICAL RATINGS

Contact Resistance	100 milliohms max.
Ins. Resistance	1×10^{11} ohms
Dielectric Strength	500 VDC
Cycle Life	7000 Cycles/Pole min.
Capacitance	5 picofarads
Operating Temp	0°F to 190°F

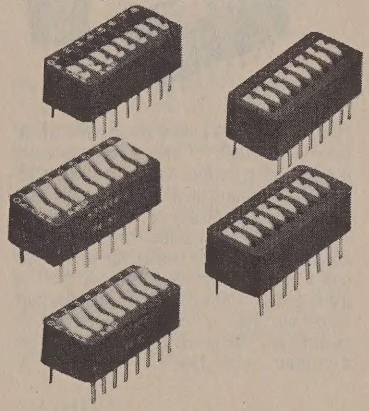
Current/Voltage Rating ....
  Contacts
    24 volts @ 25 ma
  LED's
    Operating Voltage—2.0 V max. @ 20 ma
    Reverse Voltage—5.0 V max. @ 100 microamps
    Power Dissipation—230 mw max. @ 25°C
    Lumination—0.4 millicandella min. @ 20 ma

AMP

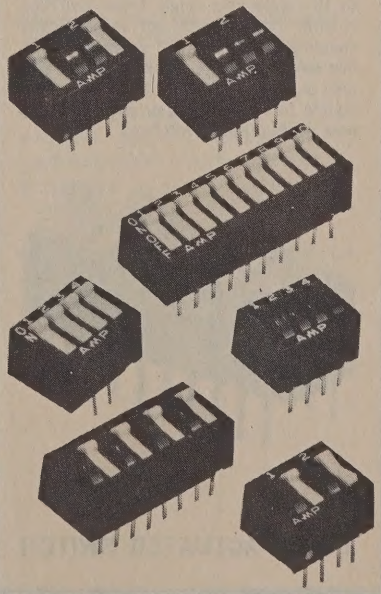
7030 SERIES



7100 & 7130 SERIES



7200 & 7040 SERIES



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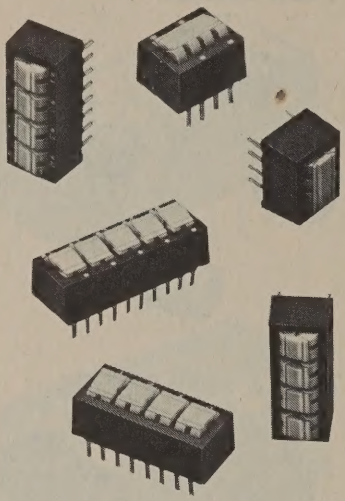
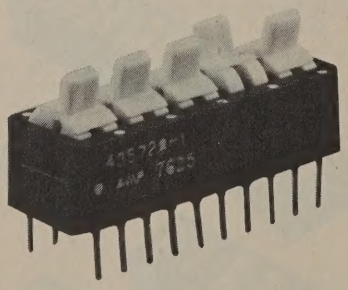
AMP

7010 & 7020 SERIES



The AMP Dual-in-Line Package Multipole switch provides a means of manually programming various types of electrical/electronic equipment. The multipole switch is essentially a multiplicity of single pole switches mechanically coupled to provide switching of various poles simultaneously. The switch is packaged in a housing with input/output leads on .100" x .300" centers and is specifically designed to be mounted on a printed circuit board.

The AMP Multipole Switch can be supplied in a wide range of sizes—from 4 to 10 single pole single throw switches—with the capability of mechanically coupling a maximum of 6 poles within one switch package. These switches can also be furnished with 2 to 5 single pole double throw switches or 1 or 2 double pole double throw switches.


435728-1
AMP 7625

LEVER ACTUATED SWITCH

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

MULTIPOLE SWITCHES (DUAL-IN-LINE)

ELECTRICAL SPECIFICATIONS

SPDT or DPDT Switching—Make before break—Circuit Current/Voltage Ratings

Non-switching
1.5A @ 50 VDC
Switching
100 ma @ 5 VDC
25 ma @ 24 VDC

Contact Resistance (50 MV open-circuit, 2 MA) 100 Milliohms (Max.)

Insulation Resistance (@ 100 VDC)
between adjacent closed switches—
1 x 10^{11} Ohm (Initial)
1 x 10^{9} after environmental tests
between adjacent open switches—
1 x 10^{11} Ohm (Initial)
1 x 10^{9} after environmental tests

Dielectric Breakdown Voltage—500 VDC (Min.)

Circuit Capacitance (between adjacent switches)—5 pfd

MECHANICAL SPECIFICATIONS

Operating Temperature — 0°F thru 190°F

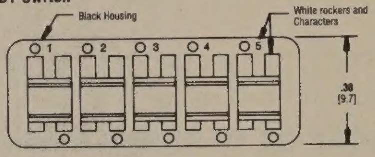
Shock: Discontinuity shall not exceed 1.0 microseconds when shocked 3 times in each of 6 directions for a combined total of 18 shocks. Shock wave parameters are 20g level, 11 millisecond duration, half sine pulse shape.

Note: All dimensions in inches unless indicated otherwise.

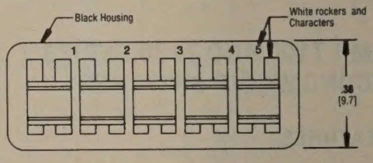
Specifications subject to change. Consult AMP Incorporated for latest design specifications.

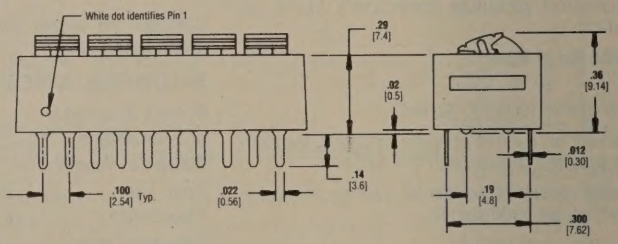
Specifications

SPDT Switch

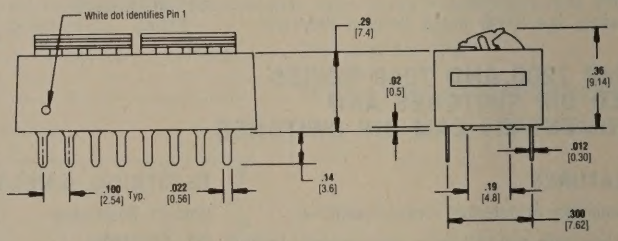

Black Housing
White rockers and Characters
1
2
3
4
5
.38
[9.7]

DPST Switch

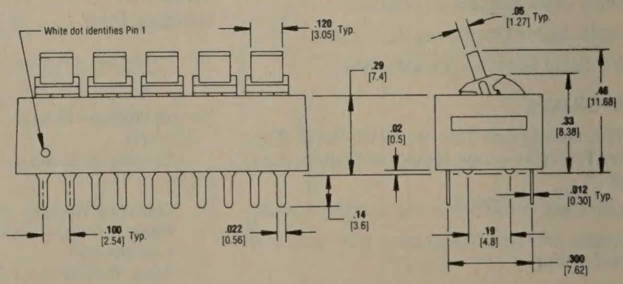

Black Housing
White rockers and Characters
1
2
3
4
5
.38
[9.7]


White dot identifies Pin 1
.29
[7.4]
.02
[0.5]
.36
[9.14]
.012
[0.30]
.14
[3.6]
.100
[2.54] Typ.
.022
[0.56]
.19
[4.8]
.300
[7.62]

DPDT Switch

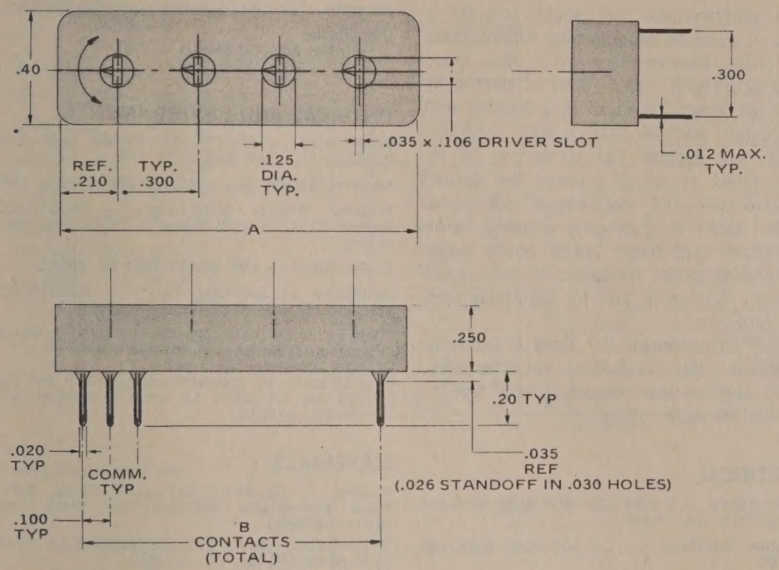

White dot identifies Pin 1
.29
[7.4]
.02
[0.5]
.36
[9.14]
.012
[0.30]
.14
[3.6]
.100
[2.54] Typ.
.022
[0.56]
.19
[4.8]
.300
[7.62]

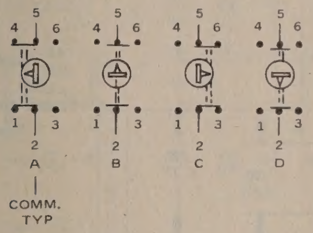
Lever Actuated Dimensions


White dot identifies Pin 1
.120
[3.05] Typ.
.05
[1.27] Typ.
.29
[7.4]
.46
[11.68]
.33
[8.38]
.02
[0.5]
.012
[0.30] Typ.
.14
[3.6]
.100
[2.54] Typ.
.022
[0.56]
.19
[4.8]
.300
[7.62]

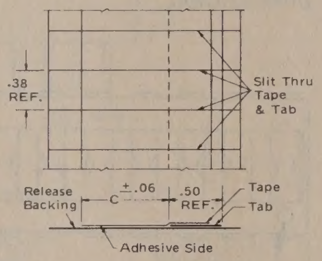
MINIATURE Double Pole, Double Throw Switch

AMP


.40
.300
.035 x .106 DRIVER SLOT
.012 MAX. TYP.
REF. .210
TYP. .300
.125 DIA. TYP.
A
.250
.20 TYP
.035 REF
(.026 STANDOFF IN .030 HOLES)
.020 TYP
COMM. TYP
.100 TYP
B CONTACTS (TOTAL)


5
4
6
1
3
2
A
B
C
D
COMM. TYP

Sealing Tape


.38 REF.
Slit Thru Tape & Tab
Release Backing
±.06
C
.50 REF.
Tape
Tab
Adhesive Side

SPECIFICATIONS

Electrical

Circuit Current/Voltage Rating:
Non-switching — 1.0A max. @ 50 VDC
Switching — 100 ma @ 5 VDC 25 ma @ 24 VDC
Contact Resistance — 50 Milliohms (Max.) @ 50 Millivolts open circuit voltage at 10 Milliamps current

Insulation Resistance:
between adjacent closed switches — 1 x 10^9 ohms (Min.) at 100 VDC
between adjacent open switches — 1 x 10^9 ohms (Min.) at 100 VDC

Dielectric Breakdown Voltage — 500 VDC (Min.)

Mechanical

Operating Temperature — 0°F thru 190°F

Life Cycle — 2,000 switch operations (Min.)

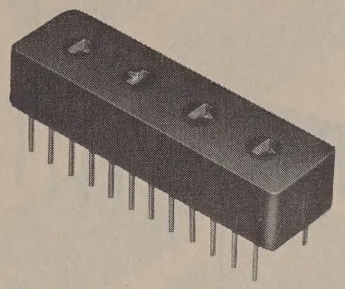
Materials

Housing and Actuator — U.L. recognized, 94V-0 rated polyester.
Contacts — Gold-plated copper-nickel alloy.

Dimensional

All dimensions are in inches unless otherwise noted.

7400 SERIES



The AMP miniature double pole, double throw switch in one to 5 position configurations is a high density, low profile, p.c. board mountable switch suitable for a wide range of logic level switching operation. A small screwdriver is used to position the actuator which is bidirectional and continuously rotatable. Each position has built-in detented action for positive positioning. All switches mounted directly to your board on a .100 Grid pattern can be either flow soldered or inserted into AMP DIP receptacles.

FEATURES

- High density, low profile (only .250″ high)
- Housings made of U.L. recognized, 94V-0 rated polyester material
- Simple operation — screwdriver actuated
- Positive detented action
- Positive control — alternate "off" position rotates in either direction
- Economical — mounts directly to p.c. board eliminating need for costly interconnect wiring
- Choice of sizes from 1 to 5 positions (Four position presently available. Other sizes will be proposed upon request.)

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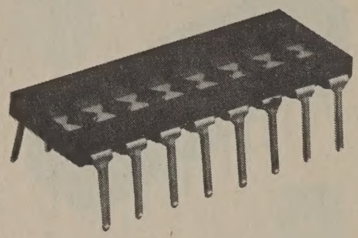
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP

PROGRAMMABLE DUAL-IN-LINE (DIP) SHUNT

7600 SERIES



FEATURES

- Very low profile — .077″ [1.96 mm] above board
- Low cost tamper-proof programming
- Housings made of UL recognized, 94V-0 rated, glass-filled thermoplastic polyester
- Large current capacity — 5 amperes (one conductor)
- Excellent strap visibility for determining state of operation
- Cut straps can be reconnected: by solder bridging, then re-opened; by use of solder wick
- Suitable for DIP handling techniques
- No extra space required for end-to-end mounting
- No loose pieces
- Ideal for volume requirements of similar programs
- Can be supplied pre-programmed
- Variety of marking and color coding possibilities

Dimensioning:
All dimensions in inches and millimeters. Values in brackets are metric equivalents.

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP's programmable DIP shunt provides a means of manually programming various types of electrical/electronic equipment. This unique device is basically a multiplicity of electrically conductive straps packaged in a housing with input/output leads on .100″ x .300″ [2.54 mm x 7.62 mm] centers. The straps can be retained intact or cut to produce the desired "closed-circuit" and "open-circuit" conditions. The DIP shunt is specifically designed to be mounted on a pc board and is ideally suited for achieving circuit crossovers on single-sided pc boards and can be used for addressing computer terminals.

The AMP programmable DIP shunt is currently available in 2 thru 12-positions, but other sizes can be supplied upon request. A hand tool is available for strap cutting.

ELECTRICAL

Current Rating — 5 A for 20° Rise Above Ambient (one conductor per shunt)

Insulation Resistance — 1 x 10^{11} Ohms (min.) @ 100 VDC

Dielectric Withstanding Voltage — 1000 VDC (min.)

Capacitance:
(Between Adjacent Straps) — 2 pf.
(Across Cut Strap) — 5 pf.

PHYSICAL AND ENVIRONMENTAL

Temperature — MIL-STD-202, Method 102A, Test Condition D [—65°C thru +125°C]

Moisture Resistance — MIL-STD-202, Method 106D

Terminal Strength (Bend Test) — MIL-STD-202, Method 211A, Test Condition B (5 bending operations)

Solderability* — AMP Specification No. 209-11

Resistance to Soldering Heat* — MIL-STD-202, Method 210A, Test Condition E, Procedure 2

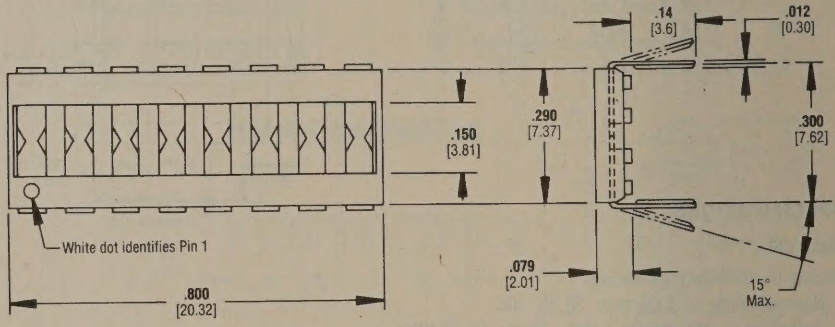
* Cut straps can be reconnected by solder bridging. Solder bridging recommendations are:
—Use low temperature solder.
—Use solder tip approximately 1/32″ [0.79 mm] dia.
—Do not let solder tip come in contact with plastic material.

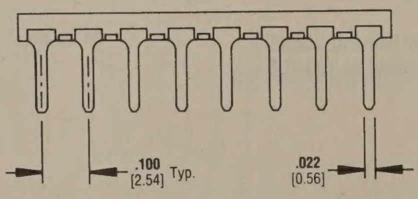
MATERIALS

Housing — UL Recognized 94V-0 Rated, Glass-Filled Thermoplastic Polyester; Color, Black (other colors available)

Metal Parts — Brass with Electroplated Tin Finish (gold plated I/O legs are optional)

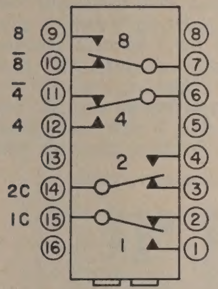
DIMENSIONAL





ROTARY PRINTED CIRCUIT BOARD (PCB) Switches

Pin Configuration Schematic (Position 0)


8
$\overline{8}$
$\overline{4}$
4
2C
1C
8
8C
4C
4
2
$\overline{2}$
$\overline{1}$
1
2
1
⑨
⑩
⑪
⑫
⑬
⑭
⑮
⑯
⑧
⑦
⑥
⑤
④
③
②
①

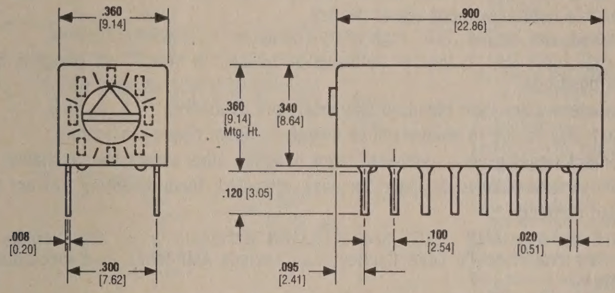
Binary Weights 8-4-2-1

Truth Table
(BCD and BCD Complement)

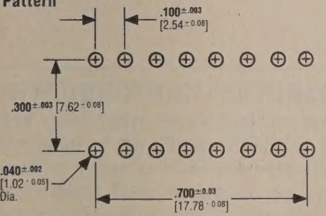
Pole Pos.	8	4	2	1	$\overline{8}$	$\overline{4}$	$\overline{2}$	$\overline{1}$
0					●	●	●	●
1				●	●	●	●	
2			●		●	●		●
3			●	●	●	●		
4		●			●		●	●
5		●		●	●		●	
6		●	●		●			●
7		●	●	●	●			
8	●					●	●	●
9	●			●		●	●	
10 or A	●		●			●		●
11 or B	●		●	●		●		
12 or C	●	●					●	●
13 or D	●	●		●			●	
14 or E	●	●	●					●
15 or F	●	●	●	●				

● = CONNECTION

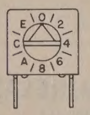
Typical Body Dimensions


.360
[9.14]
.900
[22.86]
.360
[9.14]
Mtg. Ht.
.340
[8.64]
.120 [3.05]
.008
[0.20]
.300
[7.62]
.095
[2.41]
.100
[2.54]
.020
[0.51]

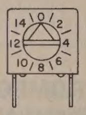
Hole Pattern


.100±.003
[2.54±0.08]
.300±.003 [7.62±0.08]
.040±.002
[1.02±0.05]
Dia.
.700±0.03
[17.78±0.08]

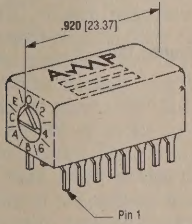
Stamping Details



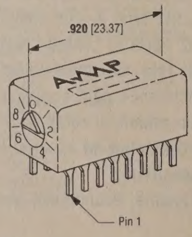
Style I
Part Number: 53137-1


14
0
2
12
4
10
8
6

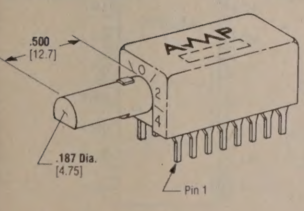
Style II
Part Number: 53137-2


.920 [23.37]
AMP
Pin 1

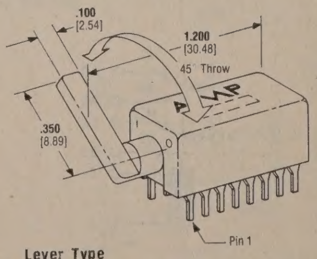
Screwdriver Slot
Hexadecimal Type
16 Position


.920 [23.37]
AMP
Pin 1

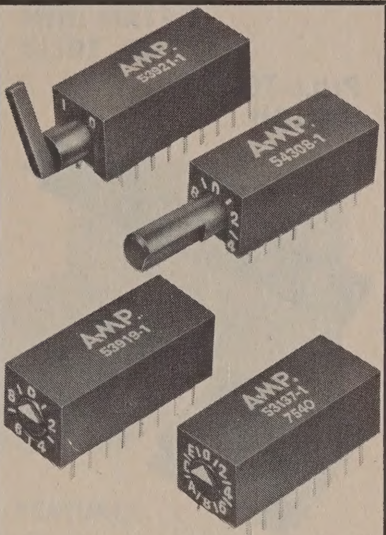
Screwdriver Slot
BCD Type
10 Position
Part Number: 53919-1


.500
[12.7]
.187 Dia.
[4.75]
AMP
Pin 1

Extended Shaft
BCD Type
10 Position
Part Number: 54308-1


.100
[2.54]
1.200
[30.48]
45° Throw
.350
[8.89]
AMP
Pin 1

Lever Type
2 Position (Position 1 is same as pole position "F" on truth table)
Part Number: 53921-1


AMP 53921-1
AMP 54308-1
AMP 53919-1
AMP 53137-1 7540

The AMP Printed Circuit Board Rotary Switches are 16 pin DIP packages with 4 P.D.T. switches which are operated by encoded cams. A shaft with screwdriver slot, lever, or extension turns the cam in either direction to the desired "positive detent" setting. The setting may be outwardly indicated by a pointer. The switches are especially designed for printed circuit board mounting and are completely compatible with the latest packaging techniques. Input/output pins are spaced on .100" x .300" centers, allowing them to be mounted in a board by the normal methods used for 16-lead IC's.

FEATURES

- 16 Pin DIP
- 8421 Encoding with Complement
- 4 Pole Double Throw
- Positive Detent
- PC Mounted with Edge Actuation
- Optional Actuation Methods

ELECTRICAL SPECIFICATIONS

Voltage Rating — 120 volts RMS (max.)
Current Rating — 1.0 Ampere (max.)
Contact Resistance — 100 Milliohms (max.)
Dielectric Strength — 300 VAC 60 Hz
Dc Insulation Resistance — 1,000 Megohms

MECHANICAL SPECIFICATIONS

Contact Material — Phosophor Bronze, Gold-over-Nickel Plated
Detent Release Torque — 1 Oz.-In. (Min.)
Life Expectancy (min.)
2,000 Revolutions

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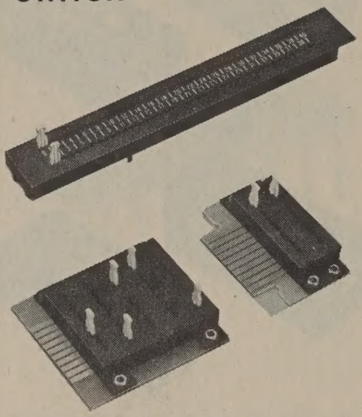
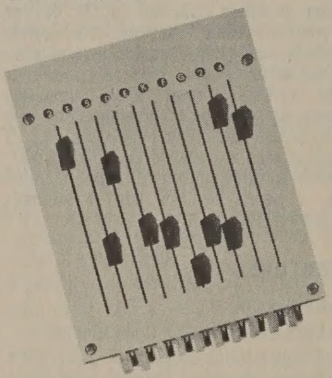
AMP

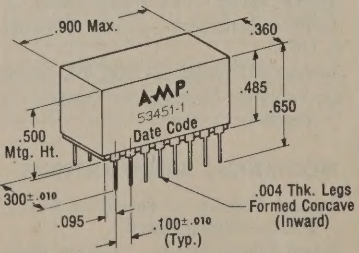
PULL-TO-SET SWITCH



MATRIX SLIDE SWITCHES



RELAY



All dimensions in inches.

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PULL TO SET SWITCHES/MATRIX SLIDE SWITCHES ELECTROMECHANICAL RELAYS

PULL-TO-SET SWITCH

FEATURES

- Economical low cost switching.
- Modular design for maximum flexibility.
- Choice of board mount assemblies or individual switches to mount on your board.
- Sturdy construction.
- Long life — 25,000 cross-point switching.
- High pressure, positive contact.
- Single pole, ten throw functions.
- Available in 1 x 10, 5 x 10, and 2 x 40 position modules.

MATRIX SLIDE SWITCHES

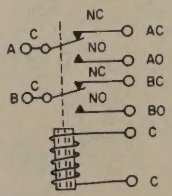
FEATURES

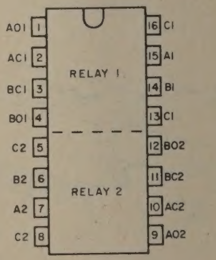
- Contact lifting principle employing detent channel and ball assures longer life by eliminating abrasion and preventing metal smear between pc board conductors.
- Standard switch sizes include 5 x 10, 10 x 10, 5 x 16 and 10 x 16 slide/position configurations.
- Flexible modular design permits various combinations of non-standard switch configurations.
- Standard sizes available with or without visual display.
  Standard visual readouts are legible .125″ high white characters on black background.
- Standard readout characters are "0 thru 9" followed by letters "A thru F" on switches having more than 10 slide positions.
- Visual readout characters other than standard characters are available.
- Small physical switch size is due to unique roll-up design of visual display indicators.
- Interchangeable contact finger grips — standard color is black; other colors also available.
- Brushed stainless steel face plate is designed for easy, attractive flush mounting to front panel.
- Gold or nickel plated contacts.
- Slide output tabs mate with AMP "110" Series FASTON Receptacles; pc board connections accept DUO-TYNE Flag One-Piece Pc Edge Connector or various AMP-UNYT Pc Connectors with crimp snap-in contacts.
- High speed machine-applied terminations assure top quality, low cost connections.

ELECTROMECHANICAL RELAY
TWO DPDT (2 FORM C)
PART NO. 53451-1

FEATURES

- Two independent relays per unit.
- 16-pin. DIP-type device compatible with present packaging techniques for IC's.
- DPDT (2 Form C) switch configuration (per relay).
- 4.5 volt relay designed to be IC controlled.
- Low resistance gold contacts.
- Electromechanical relay with true circuit isolation.
- Correct installation assured by symmetrical package design.
- High sensitivity.
- Fast, reliable, economical switching.

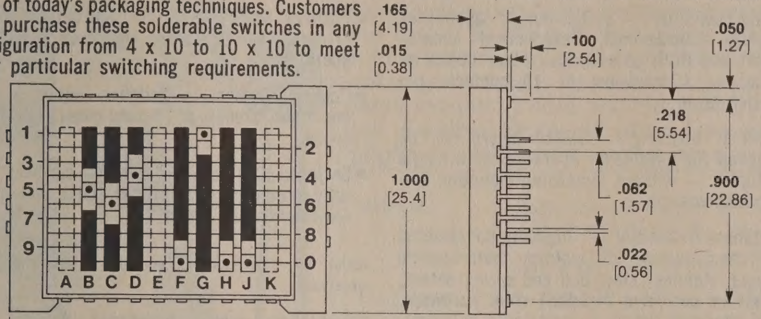


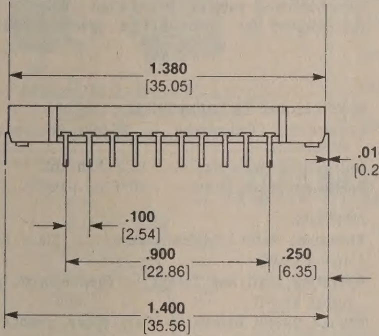


MINI-MATRIX SLIDE SWITCH / 3500 SERIES ROTARY SWITCH

INTRODUCTION

AMP Mini-Matrix Slide switches provide a highly reliable, low cost means of manually programming various types of electrical/electronic equipment. These unique devices are basically a multiplicity of manually operated slides which select cross-points in a matrix. They feature an extremely compact design and a very low profile, making the switches highly compatible with the miniaturization standards of today's packaging techniques. Customers may purchase these solderable switches in any configuration from 4 x 10 to 10 x 10 to meet their particular switching requirements.





ELECTRICAL SPECIFICATIONS

Contact Voltage/Current Rating:
Switching — 12 VDC at 100 MA
Nonswitching — 50 VAC at 100 MA

Contact Resistance (Dry Circuit):
Less than 1 Ohm

Insulation Resistance:
1 x 10^{10} Ohms (min.) at 100 VDC

Dielectric Withstanding Voltage:
200 VDC (min.)

Electrical Life End-Point*:
2000 Cycles (min.)

MATERIAL SPECIFICATIONS

Structural Plastic: UL recognized, 94V-0 rated, glass-filled thermoplastic polyester

Slide Springs: Stainless steel

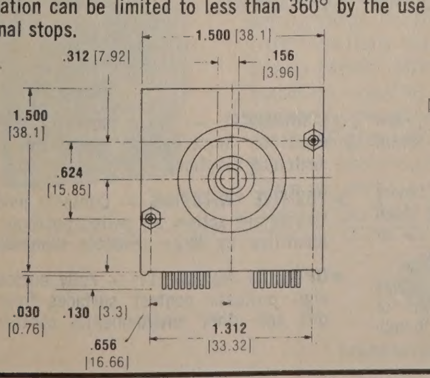
Column and Row Axes Buses: Copper alloy with contact areas electroplated gold

Contact Surfaces: Electroplated gold

* Electrical life end-point is defined as a contact resistance greater than 1 ohm.

INTRODUCTION/FEATURES

AMP 3500 Series Rotary Switches are designed to meet the needs of the Citizens Band (CB) Industry and can be used in numerous other communicative receive/transmit applications. These reliable, low cost programming switches are available with output codes that include BCD, variations of BCD, direct 7-segment displays, plus various receive/transmit outputs. Other output codes and any number of detent positions from 18 to 50 can be furnished in the same switch package height and width dimensions. Also, as many as seven .130″ (3.3 mm) thick layers can be stacked to provide up to 63 output functions per detent position. Each switch features a bidirectional rotating pc board with fixed, insert molded cantilever brush contacts. Insert molding of the contacts ensures accurate positioning as well as closely controlled contact forces. The detent is accomplished by spring loaded stainless steel balls in a molded detent housing. This design assures a positive snap and eliminates hang-up between switching positions. Actuator rotation can be limited to less than 360° by the use of internal stops.



ELECTRICAL SPECIFICATIONS

Circuit Current Rating (at 24 VDC):
Switching — 125 MA (max.)
Nonswitching — 2.5 amperes (max.)

Contact Resistance (at 6 VDC, 40 MA): 1 ohm

Insulation Resistance (at 100 VDC):
1 x 10^8 ohms (min.)

Dielectric Withstanding Voltage:
250 VDC (min.)

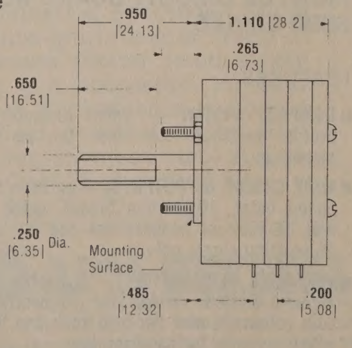
Capacitance: 5 picofarads (max.)

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

Contact Life Expectancy:
25,000 bidirectional rotation at rated load

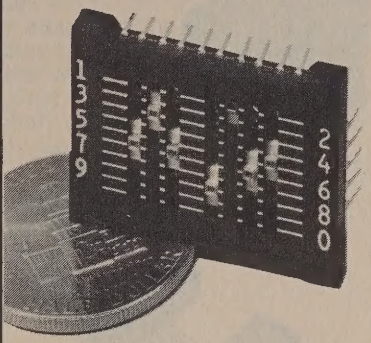
Initial Operating Force:
0.5 to 2 in-lb (2.2 to 8.9 N)

Temperature:
Operating — −20°F to +190°F (−28.8°C to +87.7°C)
Nonoperating — −100°F to +275°F (−73.3°C to +135°C)



AMP

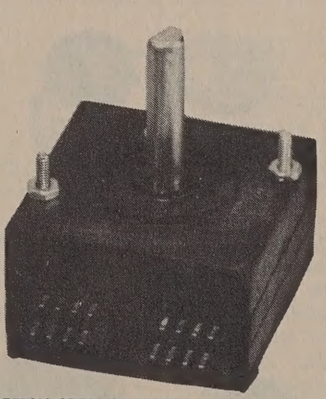
MINI-MATRIX SLIDE SWITCH



FEATURES

- 10 x 10 switch occupies only 1″ x 1.38″ (25.4 mm x 35.05 mm) of area on a pc board
- Very low profile — extends only .165″ (4.19 mm) above pc board
- Can be soldered to a pc board with other components
- Plastic parts made of UL recognized, 94V-0 rated thermoplastic polyester
- Customer selects the exact configuration — from 4 x 10 to 10 x 10 — to meet his particular switching requirements

3500 SERIES ROTARY SWITCH



MATERIAL SPECIFICATIONS

Housing, Front & Rear Covers:
94V-0 rated black thermoplastic

Operating Shaft: Zinc alloy

Connecting Hardware:
Brass or corrosion resistant steel

Printed Circuit Boards:
Plastic sheet, copper clad, grade FR-4 with electroless nickel plated circuits

Contacts:
Copper alloy, bright tin-over-nickel plated

Detent Wheel: Black polycarbonate

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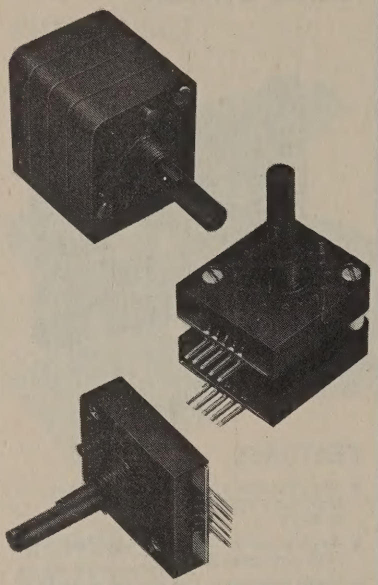
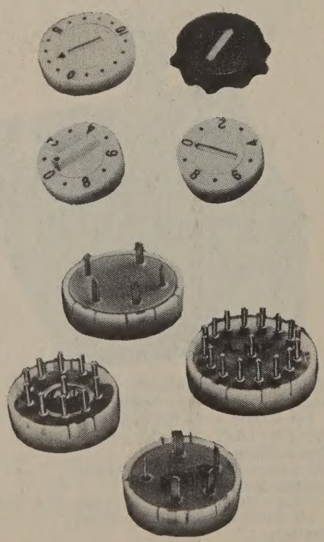
MULTI-LAYER ROTARY SWITCHES
PRINTED CIRCUIT BOARD ROTARY SWITCHES

3000 SERIES



The AMP Multi-Layer Rotary Switch is specifically designed for logic level circuitry but is capable of controlling electrical circuits that operate at current ratings of 2 amperes, 115 volts ac (nonswitching) and up to 125 milliamperes, 115 volts ac (switching).

6000 SERIES



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MULTI-LAYER ROTARY SWITCH
3000 SERIES

FEATURES

- Code Flexibility — Switch output capabilities include hexadecimal, hexadecimal complement and BCD, plus various other codes requiring a maximum of 13 contacts per switch layer.
- Modular Stacking — Switch layers can be stacked for multi-layer operation by a single actuator — without increasing mounting surface dimensions.
- Optimum Reliability — Ruggedly constructed switches consist of molded thermoplastic layers, stainless steel ball and spring detent, brass or corrosion resistant steel hardware, and phosphor bronze contacts with gold-over-nickel plating.
- Positive Switching — Positive detent action of detent wheel assures error-free operation. operation.
- Compact Design — Switches require a minimum of front- or behind-panel mounting space.
- Enclosed Contacts — Contact surfaces are fully protected against dirt, dust and other environmental hazards.

Note: All dimensions in inches unless indicated otherwise.

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

SPECIFICATIONS

ELECTRICAL

Circuit Current Rating:
Nonswitching — 2A @ 115 VAC
Switching (Resistive Load) — 125 MA @ 115 VAC (Max.)

Initial Contact Resistance (Measured from input terminal, thru contact to output terminal) — 100 Milliohms (Max.)

Insulation Resistance (@ 250 VDC) — 1 x 10^8 Ohms (Min.)

Dielectric Breakdown Voltage — 300 VDC (Min.)

DIMENSIONAL

PHYSICAL AND ENVIRONMENTAL

Contact Life Expectancy — 25,000 Rotations @ Rated Load

Initial Operating Force — 1 to 2 Inch/Lbs.

Operating Temperature — —40°F to +190°F

MATERIAL

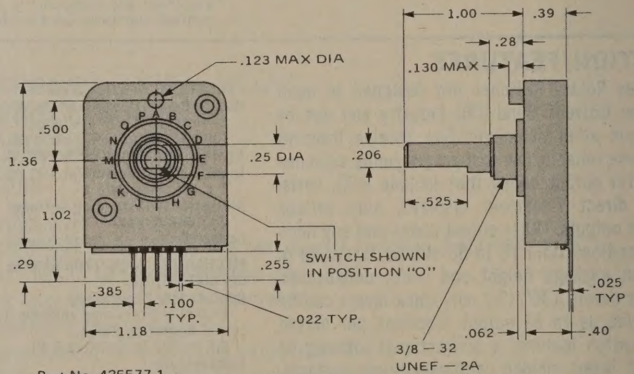
Structural Parts (Switch Layers) — Glass filled nylon 94-V2

Operating Shaft and Detent — Thermoplastic polyester 94-V-0

Printed Circuit Boards — Glass epoxy, copper clad

Contacts — Phosphor bronze, gold-over-nickel plated

Hardware — Brass or corrosion resistant steel



Part No. 435577-1

NOTES:
1. Knobs for operating switches are to be supplied by the customer.
2. Stops for limiting switch rotation to less than 360° can be provided upon request.

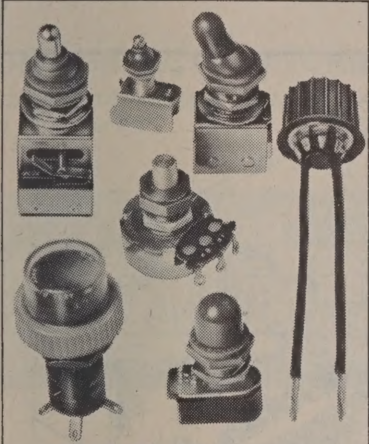
PRINTED CIRCUIT BOARD ROTARY SWITCHES
6000 SERIES

FEATURES

- **COMPACT DESIGN** — Small diameter, low profile switches are ideal for pc board mounting.
- **WIDE CHOICE OF OUTPUTS**—8-position binary coded octal, 10-position binary coded decimal, 16-position hexadecimal and 8-, 10- or 16-position single pole.
- **VERSATILE APPLICATION** — Available styles include slotted version for screwdriver or coin actuation, plus bar-type knob and thumbwheel versions for hand rotation.
- **ECONOMICAL** — Board mounting eliminates need for input/output wiring to perform switching functions.
- **POSITIVE SWITCHING** — Contacts have positive detent action; all switch positions easily identified by large readable numerals.
- **OPTIMUM RELIABILITY** — Fully enclosed design protects contact surfaces from dust, dirt and other environmental contaminants.

SWITCH ENVIRONMENTAL SEALING

Toggle, pushbutton and rotary switch seals



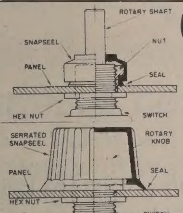
Meets MIL-B-5423 specs; EMI/RFI-shielded versions available.

MIL AND INDUSTRIAL VERSION: HEXSEALS®

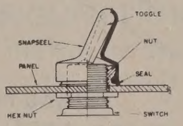
Provide positive high-pressure environmental sealing for all standard switches and rotary shafts with one-piece silicone boots incorporating a molded-in hex nut for water-tight, dust-tight protection. Replacing regular mounting hardware, vibration-resistant Hexseals fit snugly around the switch neck to seal both the panel mounting hole and the switch—even against a 30 foot head of water or gas. Flexible Hexseals allow free motion of shaft or lever. A variety of boot height, diameter and thread sizes are available. Ask for Bulletin HEX-72

Material:	Boot: Silicone rubber unless otherwise specified. Silicone rubber conforms to ZZ-R-765-Class III, Gr. 50. Other elastomers available on special order. Nut: Brass, nickel plated
Temp. Range:	—160°F TO +500°F (—106°C TO +260°C)
Pressure Range:	Exceeds 15 psi internal and external
Shelf Life:	Excess of 25 years
Resistant to:	Salt spray, weather, sunlight, ozone, and most acids,
Stock Colors:	grey, transparent (Clear); Other colors available on special order.

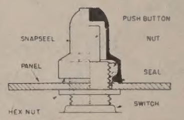
COMMERCIAL VERSION: SNAPSEALS T.M.



Rotary Shaft Seals
Shaft diameter: 1/4″ nom.; bushing diameter: 3/8″. For Ratchet Knob Type: knob height: 1/2″ approx.; knob diameter: 5/8″ approx.



Toggle Switch Boots
Bat handle height from panel: 7/8″; bat handle diameter: up to 1/4″; bushing diameter: 1/2″ max.

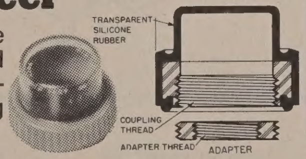


Pushbutton Boots
Pushbutton height from panel: up to 9/16″; pushbutton diameter: up to 1/4″; bushing diameter: 3/8″ or 15/32″.

Low-cost, easy-to-install Snapseels slip easily over standard pushbutton, toggle or rotary switches to provide double insulation while sealing against moisture, dirt and dust, solvents, most acids and external pressures of 10 psi. Many sizes. SPECIFICATIONS: Material: black neoprene (other materials and colors available); Operating temperatures: —65°F to +300°F; Shelf Life: 2 years; Mounting nut: nickel-plated brass.
Ask for Bulletin SNP-72

INDICATOR LIGHT SEALS: RubRglas®-Seel

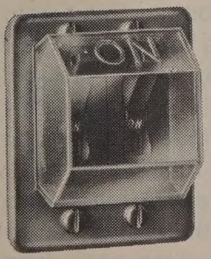
Transparent and flexible pressure switch boots of glass-clear silicone rubber allow complete visibility of the completely enclosed and sealed lamp filament and "press-to-test" markings. Molded to a corrosion-resistant aluminum nut with an integral gasket rib for firm seating against any panel surface. Wide range of thread sizes available.
Ask for Bulletin HEX-72A



Coupling Thread
13/16-32NS-2B
11/16-32NS-2B
7/8-32NS-2B
11/16-32NS-2B
.850-24NS-2B

CIRCUIT BREAKER BOOTS

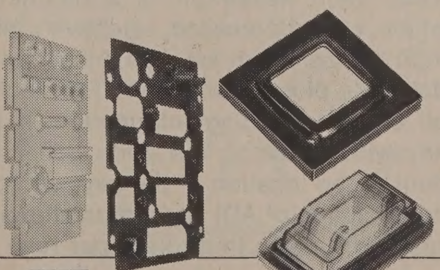
Protective RubRglas®-Seals



Shield exposed panel openings and circuit breakers with single, double or triple pole switch handles against weather, salt water, acids and dirt without redesigning equipment or hindering operation. Tough but flexible wide-angle boots made of glass-clear silicone rubber keep switch handles visible and accessible for easy manual operation. Boot assemblies consist of RubRglas shield, cadmium-plated steel frame, self-sealing stainless steel screws (Seelskrews®). Over 25-year shelf life.
Ask for Bulletin No. CB-72

EXOTIC ELASTOMERS

Extreme precision tolerances in all types of miniature elastomer molding. Cut waste to a minimum by getting the best performance out of vitons, silicones and other hard working materials.



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DIVISION OF APM CORPORATION
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THE CLEAN FIGHTERS

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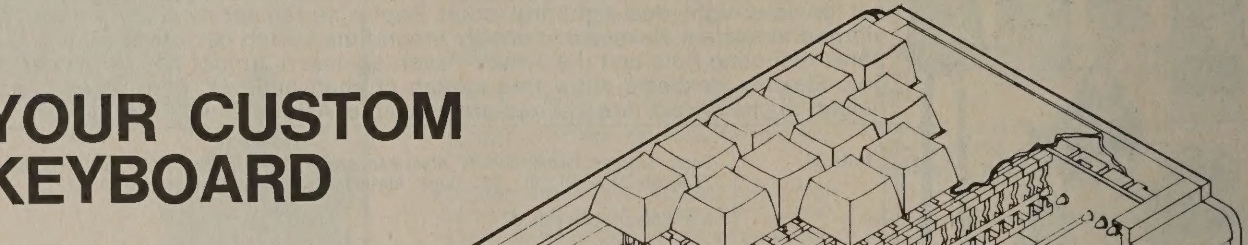
ADI APPLIED DYNAMICS INTERNATIONAL

3800 STONE SCHOOL ROAD/ANN ARBOR, MICHIGAN 48104/PHONE 313–971–7840

KEYBOARD PRODUCTS

YOUR CUSTOM KEYBOARD



If you need a custom keyboard, you need ADI. ADI keyboards eliminate the need for engineering design costs. Universal parts and modular construction are used to give you low cost and fast delivery on specialized keyboards. Photo-optic coding eliminates contact switching, giving you years of trouble-free service.

In the ADI keyboard, beams of light are directed through a key matrix to photodetectors, whose amplified outputs provide TTL compatible encoded data. Each keyswitch is a notched steel mask which, when depressed, selectively interrupts these light beams. Each key has access to fourteen (14) data bits plus a strobe bit. This technique places all of the encoding information in the individual keyswitch, making the code generation independent of the location of the keyswitch. The modular construction of ADI keyboards allows up to ten key rows with up to thirty keys per row.

The secret of the ADI Custom Keyboard is the standardized interface from the key matrix. Almost any key array, and modifications to this array, can be provided without changing the 17 pin interface connection from the key matrix. This interface presents the encoded data plus strobe from any depressed key anywhere in the matrix. Sufficient bits are available to encode more than 1000 keys while eliminating the possibility of any erroneous codes resulting from simultaneous depression of two or more keys. The standard keyswitch code structure provides for a final multi-mode code of up to eight data bits with additional bits available.

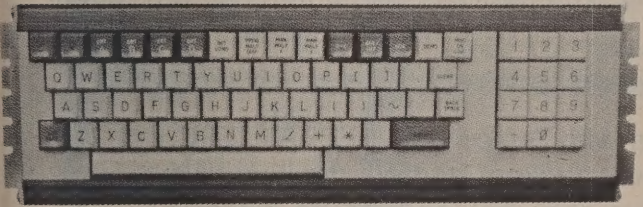
FEATURES

MODULAR CONSTRUCTION —

Universal components may be assembled to match almost any requirement.

NON-CONTACT SWITCHING —

Problems of contact bounce, wear and resistance are eliminated.



STANDARD PANEL CUTOUT —

A variety of key arrays may be adapted to a simple rectangular cutout by adding the low cost trim panels.

CONVERTIBLE CONFIGURATION —

In addition to changes in the key array, keyboards may be simply changed from chassis mount to desktop units.

BUILT-IN ERROR PROTECTION —

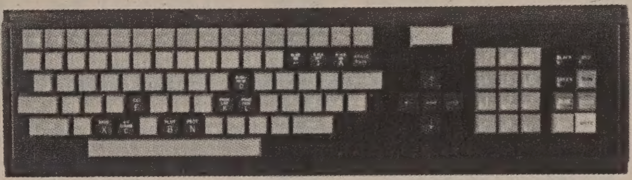
Each keyswitch contains the coding for lockout and rollover protection.

LOW COST —

Mass production of universal parts and elimination of non-recurring design charges provides a superior keyboard at minimum cost.

UNIVERSAL LOGIC —

The logic, either hardwired or programmed, automatically adapts to changes in the key array.



ULTRA-RELIABLE —

Steel keyswitches with life in excess of 100 million operations, solid state switching, and conservative design mean years of trouble-free operation.

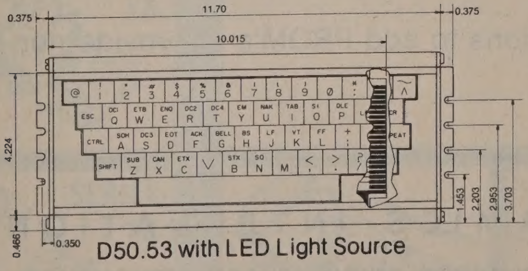
μ-PROCESSOR COMPATIBLE —

The Basic Keyboard, which provides TTL compatible encoded data without logic, is ideally suited to micro-processor based systems. The Universal Logic Card is eliminated, and the encoded keyboard output presents a minimum burden on processor overhead and memory requirements. The simple algorithms for rollover/lockout error protection and code conversion adapt automatically to different key arrays.

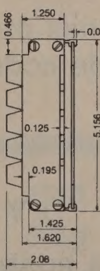
SPECIFICATIONS

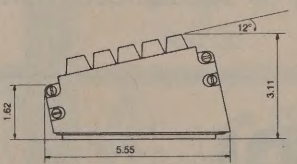
Power Required	+5 vdc, ±5% 250 ma (Basic) 550 ma (Std)
Keytops	Sloped (Std) Stepped (Opt)

Key Spacing	¾ inch centers
Key Pressure	2.0 ±0.5 oz.
Key Travel	0.195 inch
Switch Point	0.150 inch nominal
Dimensions	See Drawings



D50.53 with LED Light Source





Notes: 1. Length determined by key array
2. Increase width by 0.75 inch for each additional row.

INSTANT PROTOTYPES —

Rapid delivery of special keyboard prototypes is arranged to fit each customer's needs.

The modular construction of ADI Custom Keyboards allows almost any key array to be assembled without requiring any non-recurring charges other than tooling of special two-shot molded legends. ADI Custom Keyboards are available in two versions: the Model D40 Series without logic, and the Model D52 Series with logic. A number of options are also available, including additional encoded keys. Please contact ADI for complete information.

D40 SERIES KEYBOARDS include:

Encoded keys for ASCII code generation with Space Bar, REPEAT, ESC, LF, CR, CTRL, and SHIFT (2) keys, rollover/lockout coding, positive true TTL compatible 13 bit parallel output, two-shot molded keytops, chassis mount end plates, and LED light source.

D52 SERIES KEYBOARDS include:

D40 Keyboard as described above, plus the Keyboard Logic Card which provides 4-mode ASCII operation, 7 or 8 bit negative true parallel output, electronic latching, gated outputs, pulsed and latched strobe signals, keyboard inhibit control line, alpha shift reverse control line, repeat circuitry, and provision for options as listed.

KEYBOARD OPTIONS

- Shift Lock
- Numeric Cluster, 12 key
- Selective Shift Inhibit
- Stepped Keys
- Desktop Enclosure
- Trim Panels
- Engraved Legends

LOGIC OPTIONS

- Parity Generation
- Upper Case Only
- Automatic Repeat
- Repeat Rate Limiter
- Neg True Open Collector
- Pos True
- Serial, TTL
- Serial, EIA

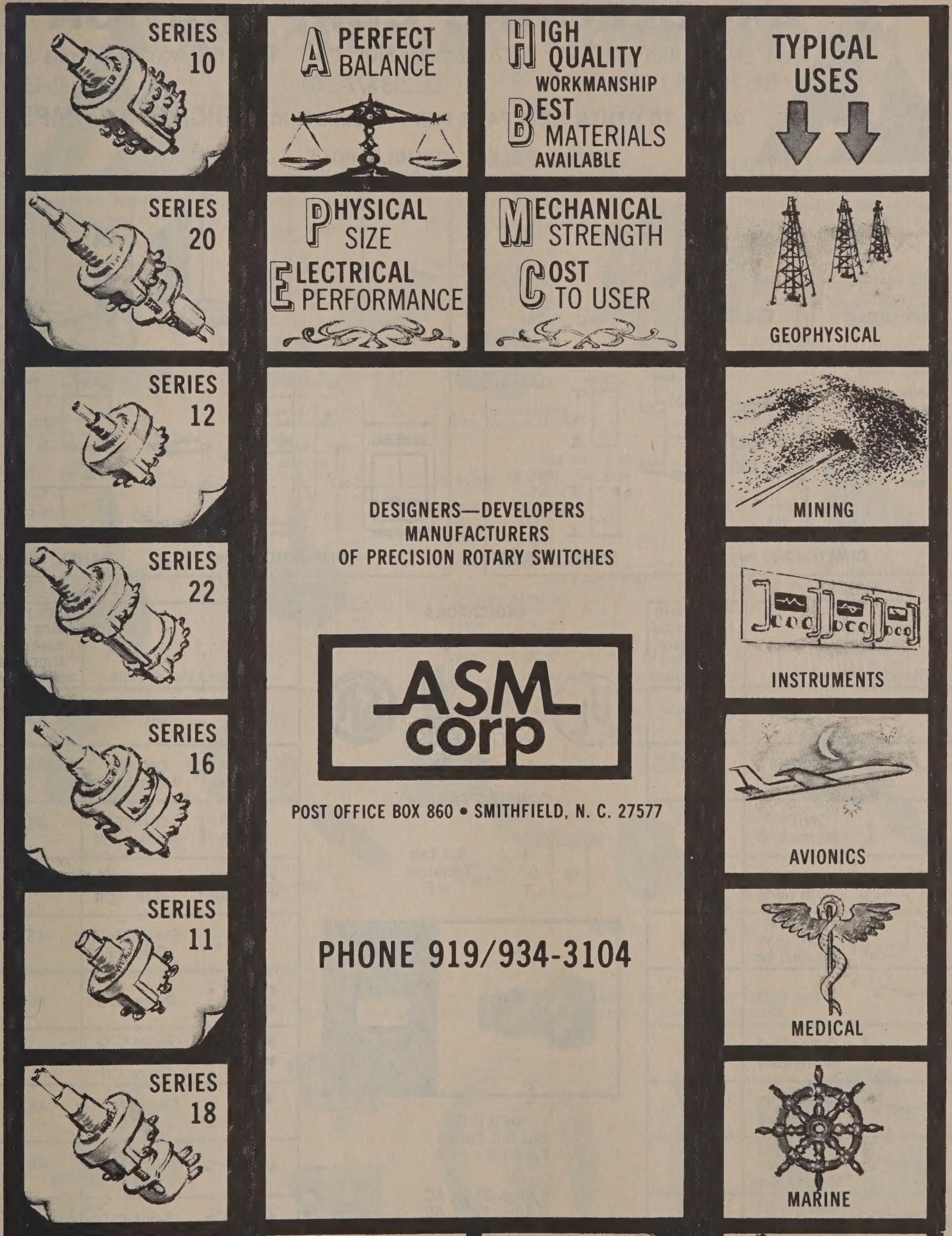
The keyboard Logic Card also has provisions to add PROM's to provide non-logical bit pairing or specialized multi-mode codes.

ADI

APPLIED DYNAMICS INTERNATIONAL

3800 STONE SCHOOL ROAD/ANN ARBOR, MICHIGAN 48104/PHONE 313—971—7840

an internatio-muller group company



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ELECTRICAL PERFORMANCE

MECHANICAL STRENGTH

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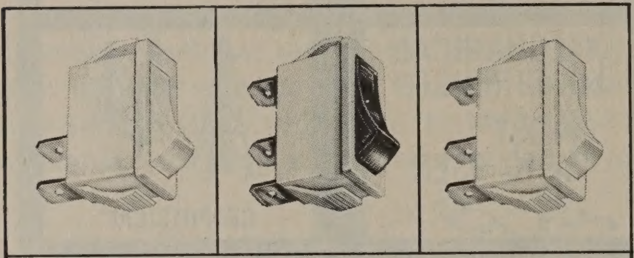
SERIES 10
SERIES 20
SERIES 12
SERIES 22
SERIES 16
SERIES 11
SERIES 18
SERIES 14
REMOTELY CONTROLLED
TYPICAL USES
GEOPHYSICAL
MINING
INSTRUMENTS
AVIONICS
MEDICAL
MARINE
85°C
125°C
200°C
TEMP. RANGE

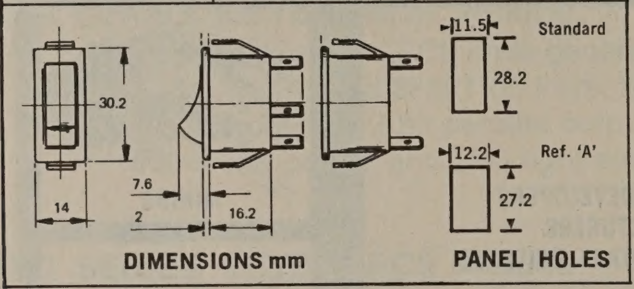
ARCOLECTRIC CORPORATION

Dept. EM, P.O. Box 348 • 11120 Chandler Blvd. • North Hollywood, California 91603
TEL: 213-985-3130 TEL: 213-877-6969 TELEX: 65-1349

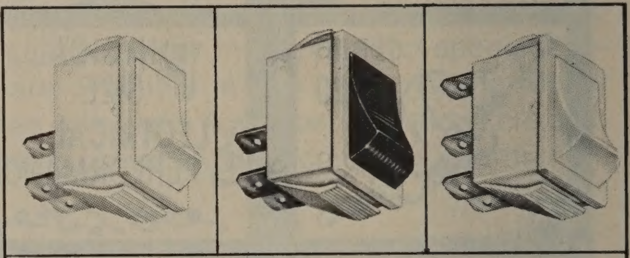
REFER TO OTHER EEM PAGE FOR ARCOLECTRIC INDICATOR LAMPS

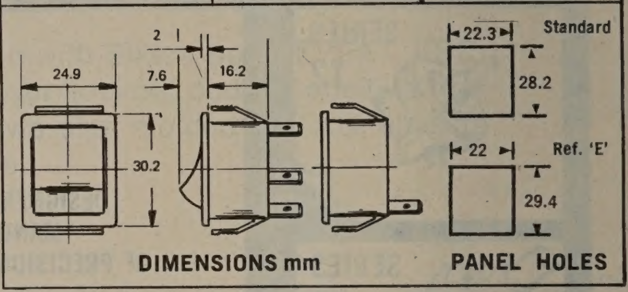
SINGLE POLE




30.2
7.6
14
2
16.2
11.5
Standard
28.2
12.2
Ref. 'A'
27.2
DIMENSIONS mm
PANEL HOLES

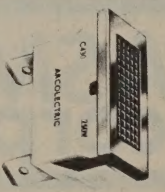
DOUBLE POLE



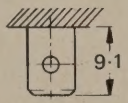

2
24.9
7.6
16.2
30.2
22.3
Standard
28.2
22
Ref. 'E'
29.4
DIMENSIONS mm
PANEL HOLES

Standard Panel Hole	with plain fixing clips normally supplied as standard
ON/OFF	400
ON/OFF Momen. on	401
ON/OFF Momen. off	402
ON/OFF with light	403
ON/OFF with light Momen. on	404
2-Pos C/O	410
2-Pos C/O Momentary	411
3-Pos C/O centre off	420
3-Pos C/O centre off Mom. 1-side	421
3-Pos C/O centre off Mom. 2-sides	422

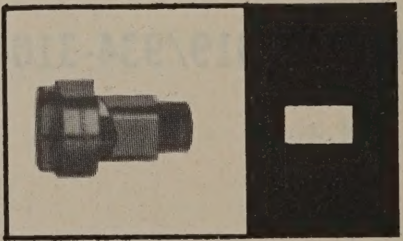
INDICATORS


ARCOLECTRIC

CONSULT FACTORY



6.3 Tab Terminal =C



No. 1139 Cut Out Punch For 11.5 x 28.2

5 Amp. 250v. AC
8 Amp. 125v. AC
10 Amp. 250v. AC
(Non-Inductive)

Standard Panel Hole	with plain fixing clips normally supplied as standard
ON/OFF	450
ON/OFF Momen. on	451
ON/OFF Momen. off	452
ON/OFF with light	453
Single Pole ON/OFF	457
2-pos C/O	460
2-pos C/O Momentary On or Off	461
Single Pole 2-pos C/O	462
Single Pole 2-pos C/O	467
3-pos C/O centre off	470

Other Circuits Available

Standard Colors: Black, White

Snap-in Fixing

Panel Thickness Between:
.75 mm (.03″) and 3.3 mm (.13″)

Standard voltage for lighted versions 12V and 125V.
Standard Lens colors for lighted 12V, Red, Amber, Green.
Standard Lens colors for lighted 125V, Red, Amber, Clear.
Other voltages and colors made to order.

ARCOLECTRIC CORPORATION

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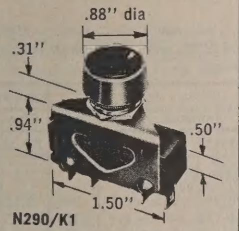
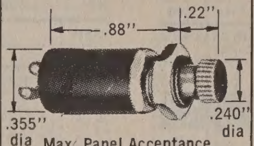
2-CIRCUIT MOMENTARY
15A, 125/250V AC
NO/NC
Red/Black/Green/White



N290/K1

T906 SPST MOMENTARY N. OPEN
T908 SPST MOMENTARY N. CLOSED
1A, 125/250V AC,
Solder Terminals
Buttons
Red/Black/Green/White

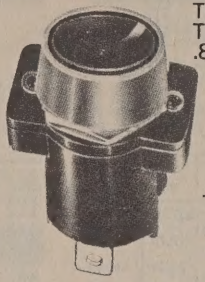


Max. Panel Acceptance Using Two Nuts .11"

T936/DI/C SPST Momentary N. Open
T938/DI/C SPST Momentary N. Closed
1A, 125/250V AC
.250 Tab Terminals
Overall Length N. Open approx. 2.0"
Overall Length N. Closed approx. 1.75"

Max. Panel Acceptance Using Two Nuts .16"

These switches are same as T936/DI/C but with large .88" dia. button. 1 Amp.



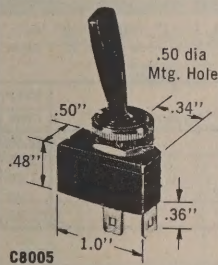
T936/CK
Norm Open

T938/CK
Norm Closed

Terminals .250" Tab

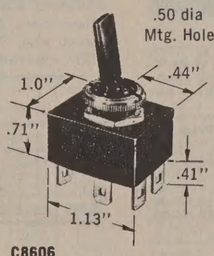
Red/Blk/Grn/White

800 SINGLE POLE
10A, 125/250V AC
.250" Tab Terminals



C8005

800 DOUBLE POLE
10A, 125/250V AC
.250" Tab Terminals



C8606

800 SINGLE POLE UL and CSA

No. 5 Lever 1.06"	No. 6 Lever .70"		
C8005	C8006	SPST	On-Off
C8105	C8106	SPDT	On-On
C8205	C8206	SPDT-C-Off	On-Off-On

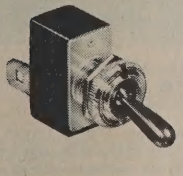
800 DOUBLE POLE

No. 5 Lever 1.06"	No. 6 Lever .70"		
C8505	C8506	DPST	On-Off
C8605	C8606	DPDT	On-On
C8705	C8706	DPDT-C-Off	On-Off-On

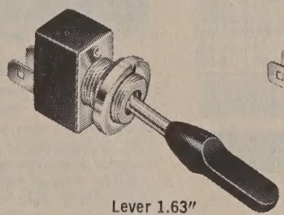
Other Circuits Available

⅝" Nylon lever
BC1600 P/C

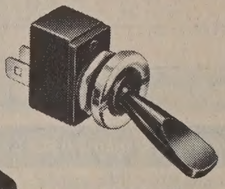
REQUEST OUR COMPLETE CATALOG.



Lever .56"
BC.601/C

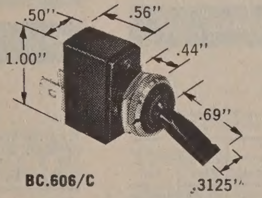


Lever 1.63"
BC.602/C

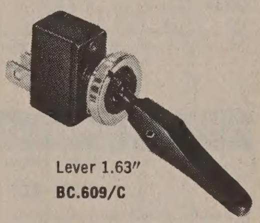


Lever 1.06"
BC.605/C

BLACK NYLON LEVER
3A, 125/250V AC; 10A, 25VDC
BC606/C Rear .250" Tab Term.
G606 Top Screw Term.
T606 Top Solder Term.



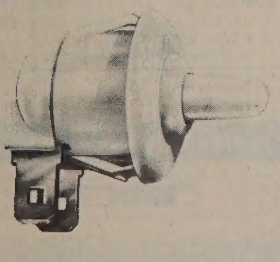
BC.606/C

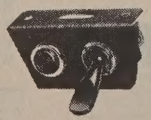


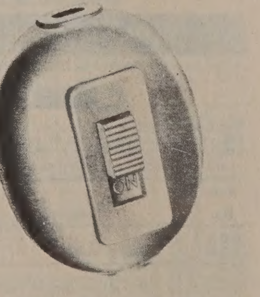
Lever 1.63"
BC.609/C

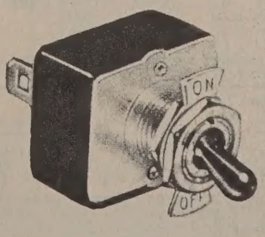
Switches BC601/C through BC609/C are ON-OFF S.P.

Arcolectric manufactures a complete range of switches and indicator lights for all industrial and OEM uses. Our full line catalog sent on request.









Details of international approvals for switches and indicators on request.

BSI DVE S D UL SA APPROVED TO AUSTRALIAN STANDARD SABS

For further details on these and other items, request our catalog. All items described here are subject to changes in design without notice.

bussmann manufacturing div.

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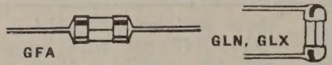
fuses and holders

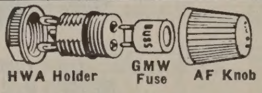
TRON® SUBMINIATURE PIG-TAIL FUSES



Glass-tube construction with 1-1/2" leads of #24 tinned copper for 1/100-5 amp ratings, #18 tinned copper for 7-15 amp ratings. Hermetically sealed. Color coded to indicate amp ratings. For circuits with fault current of 50 amps or less (1/100-5 amps for 125 V or less, 7-15 amps for 32 V or less). GLN, GLX body size, .140" x .3"; GFA body size, .145" x .3".

Buss No.	Amperes	Net Price For Ten	Net Price For 100
GLN	1/100	$21.30	$177.00
GLN	1/32, 1/20, 1/16, 1/10, 1/8, 3/10, 4/10, 7, 8, 15	17.70	148.00
GLX	15/100, 2/10, 1/4, 1/2, 6/10, 3/4, 1, 1-1/2, 2, 3, 4, 5	23.30	194.00
GFA	1/100, 1/32, 1/20, 1/16, 1/10, 1/8, 15/100, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10	7.70	77.00
GFA	3/4, 1, 1-1/2, 2, 3, 4, 5, 7, 8, 15	6.90	69.00

SUBMINIATURE PRONG TYPE UNIT



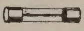
Rated 125 V or less, fault current not over 300 amps; open at 200% within 10 sec or less. Use AF knob for waterproof. Size, .270" dia., .250" lg. (body).

Buss No.	Amperes	Net Price For Ten	Net Price For 100
GMW	1/200, 1/100, 1/64, 1/32, 1/16	$12.30	$107.00
GMW	1/10, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10, 3/4, 1, 1-1/2, 2, 3, 4, 5	9.70	97.00
HWA*	Holder, fits all GMW	12.40	103.00
HWA†	Holder, fits all GMW	11.00	110.00
AF	Knob only, fits HWA	1.60	16.00

*With AF knob. †Without AF knob.

13/64 x 45/64 inch FUSES

(5mm x 20mm)

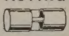


Protection of miniaturized circuits — commonly used in foreign equipment. Carry 100%, open at 200% in 10 sec.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
GMA	1/8	125	$2.65	$53.00
GMA	1/4, 1/2, 7/10	125	2.05	41.00
	1, 1-2/10, 1-1/2, 2, 3, 4,		1.75	35.00
GMA	5, 6, 10	125	1.75	35.00

1/4 x 5/8 inch FUSES

FAST ACTING FUSE

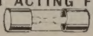


Glass tube, 1/4" x 5/8". Carry 110%, open at 135% in 1 hour.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
AGA	1, 1-1/2, 2, 2-1/2	32	$0.70	$14.00
AGA	3	32	.70	14.00
AGA	5, 6, 7-1/2, 10, 15, 20	32	.50	10.00
AGA	25, 30	32	.50	10.00

1/4 x 7/8 inch FUSES

FAST ACTING FUSE

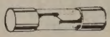


Glass tube, carry 110%, open at 135% in 1 hour.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
AGW	1, 2-1/2, 3, 4	32	$0.70	$14.00
AGW	5, 6, 7-1/2, 15, 20, 30	32	.50	10.00

1/4 x 1 inch FUSES

FAST ACTING FUSES



Glass tube, 1/4" x 1". Carry 100%, open at 200% in 5 seconds. 1/500 to 1/32 amp sizes have bridge construction; all others straight-through element. U/L Approved.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
AGX	1/500	250	$10.05	$167.00
AGX	1/200	250	4.45	89.00
AGX	1/100	250	3.75	75.00
AGX	1/32	250	3.25	65.00
AGX	1/16	250	2.05	41.00
AGX	1/10, 1/8, 3/16, 2/10	250	1.70	34.00
AGX	1/4, 3/8, 4/10, 1/2, 3/4	250	.95	19.00
AGX	1, 1-1/2, 2, 3, 4	125*	.70	14.00
AGX	5, 8, 10, 15, 20	32†	.50	10.00
AGX	25, 30	32	.50	10.00

*1 A, 250. †5 A, 125.

1/4 x 1-1/4 inch FUSES

FAST ACTING FUSES

Glass tube, 1/4" x 1-1/4". Carry 110%, open at 135% in 1 hour or less. 1/500 to 2 amp sizes will open at 200% in 5 seconds or less. 1/500 to 1/32 amp have bridge construction; all others straight-through element. U/L Approved.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
AGC	1/500	250	$10.05	$167.00
AGC	1/200	250	4.45	89.00
AGC	1/100	250	3.75	75.00
AGC	1/32	250	3.25	65.00
AGC	1/16, 1/8, 15/100, 175/1000, 3/16, 1/10, 2/10	250	1.70	34.00
AGC	1/4, 3/10, 3/8, 45/100, 1/2, 6/10, 3/4	250	.95	19.00
AGC	1, 1-1/4, 1-1/2, 1-6/10, 2	250	.70	14.00
AGC	2-1/2, 3	250	.70	14.00
AGC	4	32‡	.70	14.00
MTH	4, 5, 6	250	.85	17.00
AGC	5, 6, 7-1/2, 8, 10, 15	32‡	.50	10.00
AGC	20	32‡	.50	10.00
AGC	25, 30	32‡	.50	10.00

‡Not U/L listed.

1/4 x 1-1/4 inch FUSES

CERAMIC TUBE FUSES

High interrupting capacity for use on circuit delivering as high as 25,000 amps at 125 V, or 10,000 amps at 250 V. 1/4" x 1-1/4". Carry 110%, open at 135% in 1 hour. Up to 15 amp size U/L Approved.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
ABC	1/4	250	$1.40	$28.00
ABC	1, 2, 3	250	1.40	28.00
ABC	5, 6, 8, 10	250	1.20	24.00
ABC	12, 15, 20	250	1.20	24.00
ABC	25, 30	125	1.75	35.00

1/4 x 1-1/4 inch FUSES

VISUAL INDICATING FUSES

For use with HLD fuseholder. Bright red dot on indicating pin extends from end of fuse when fuse is open even after power is off. Rated 125 V or less, carries 110%, opens at 135% in 1 hour or less. Only 1/4" x 1-1/4".

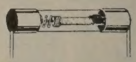
Buss No.	Amperes	Net Price For Five	Net Price For 100
GBA	3/4	$4.55	$91.00
GBA	1, 1-1/2, 2, 3, 4, 5	3.35	67.00

Fiber tube with silver plated indicating pin which extends when fuse is blown. May be used to actuate a signal when used in HKA fuseholder or Signal Fuse Block. Dual tube construction in sizes larger than 5 amps (cannot be used in HKA fuseholder). Voltage, 125 volts, except 8 amp and over which are 32 volts. Size, 1/4" x 1-1/4".

Buss No.	Amperes	Net Price For Five	Net Price For 100
GLD	3/4	$4.05	$81.00
GLD	1, 1-1/2, 2, 3, 4, 5	3.15	63.00
GLD	6, 8, 10, 12, 15, 20	4.45	89.00

1/4 x 1-1/4 inch FUSES

FUSETRON PIG-TAIL FUSES



Body 1/4" x 1-1/4", #20 tinned leads, 1-1/4". 1/100 to 2-8/10 same as MDL type; 3 to 7 amps same as MDX type. U/L Approved.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
MDV	1/100, 1/32	250	$3.35	$67.00
MDV	1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 3/4, 8/10, 1	250	2.55	51.00
MDV	1-1/4, 1-1/2, 1-6/10, 2	125	2.45	49.00
MDV	2-1/2, 2-8/10, 3, 3-2/10, 4, 5, 6-1/4, 7	125	2.05	41.00

FAST ACTING FUSE

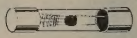
PIG-TAIL FUSES

Glass tube 1/4" x 1-1/4" with 1-1/4" leads of #20 tinned wire. Carry 110%, open 135% in 1 hour. 250 V. U/L Approved.

Buss No.	Amperes	Net Price For Five	Net Price For 100
GJV	1/16	$2.55	$51.00
GJV	1/8	2.55	51.00
GJV	1/4, 3/10, 3/8, 1/2, 3/4	1.70	34.00
GJV	1, 1-1/2, 2, 3	1.30	26.00
GJV	4, 5, 6	1.40	28.00

1/4 x 1-1/4 inch FUSES

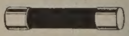
FUSETRON GLASS TUBE FUSES



Dual-element slow-blowing type, 1/4" x 1-1/4". Fuse link operates only on very high overloads or short-circuits; thermal cutout functions on low overloads (cannot operate quickly on any load, thus providing long time-lag). Carry 110%, open at 135% in 1 hour. MDL 1/100 to 2-8/10 amp and MDX 3 to 7 amp sizes. U/L Approved. MDL type has longer time-lag than MDX type.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
MDL	1/100, 1/32	250	$2.75	$55.00
MDL	1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 7/10, 3/4, 8/10, 1		2.05	41.00
MDX	1-1/4, 1-1/2, 1-6/10, 2	250	2.15	43.00
MDL	1-2/10, 1-1/4, 1-1/2, 1-6/10, 2	125	1.95	39.00
MDL	2-1/2, 2-8/10	125	1.70	34.00
MDX	3, 3-2/10, 4, 5	125	1.70	34.00
MDX	6-1/4, 7	125	1.90	38.00
MDL	3, 3-2/10, 4, 5, 6-1/4, 8, 10, 15, 20, 25, 30	32	1.70	34.00

1/4 x 1-1/4 inch FUSES



Fusetron dual-element fuse, slow-blowing type, ceramic tube. Carry 110%, open at 135% in 1 hour.

Buss No.	Amperes	Volts	Net Price For Five	Net Price For 100
MDA	1/100, 1/32	250	$3.55	$71.00
MDA	1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 3/4, 8/10, 1, 1-1/4, 1-1/2, 1-6/10, 2	250	2.85	57.00
MDA	2-1/2, 2-8/10, 3, 3-2/10, 4, 5, 6-1/4, 7, 8, 10, 15, 20	250	2.05	41.00
MDA	25, 30	125	2.05	41.00

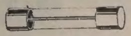
bussmann manufacturing div.

Dept. EM, University at Jefferson • St. Louis, Mo. 63107 • Tel: (314) 421-1740

fuses and holders

9/32 x 1-1/4 inch FUSES

AGS GLASS TUBE FUSES



Test specification; carry, 110%, open at 135% within 1 hour except 35 and 40 amp units which open at 300% in 2 to 4 seconds when tested in standard 30-amp test circuit. **Note:** These units in sizes larger than 30 amps are not recommended for use in fuse clips or fuseholders as clips will not carry the high currents.

Buss No.	Amperes	Volts	Net Price For Five	100
AGS	1/16	250	$3.15	$63.00
AGS	1/8	250	2.25	45.00
AGS	1/4, 1/2	250	1.20	24.00
AGS	1, 2, 2-1/2, 3	250	1.20	24.00
AGS	5, 10, 15, 20 ,25, 30	32	.90	18.00
AGS	35, 40, 50	32	1.10	22.00

9/32 x 1-1/4 inch FUSES

CERAMIC TUBE FUSES

Carrry 110%, at 135% in 1 hour. 35 and 40 amp. open at 300% in 2 to 4 seconds when tested in a standard 30 amp. test circuit.

Buss No.	Amperes	Volts	Net Price For Five	100
ABS	1, 2, 3	250	$2.15	$43.00
ABS	5, 8, 10, 15, 20	250	2.05	41.00
ABS	25, 30	125	2.05	41.00
ABS	35, 40	32	2.15	43.00

9/32 x 1-1/4 inch FUSES

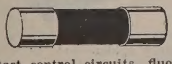
FUSETRON DUAL-ELEMENT FUSES

Glass tube, slow-blowing. Avoid needless blows from starting currents or surges, yet provides protection against short-circuits or continuous overloads. Carry 110%, open at 135% in 1 hour. Approximate blowing time: at 200% load, 25 seconds; at 300% load, 8 seconds; at 500% load, 3 seconds.

Buss No.	Amperes	Volts	Net Price For Five	100
MDM	1/10, 15/100, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10, 3/4, 8/10, 1	250	$2.75	$55.00
MDM	1-1/4, 1-6/10, 2	125	2.75	55.00
MDM	2-1/2, 2-8/10, 3	125	2.15	43.00
MDM	3-2/10, 4, 5, 6-1/4, 8, 10, 10, 15, 20, 25, 30, 35, 40	32	2.15	43.00

13/32 x 1-3/8 inch FUSES

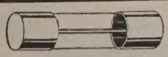
"QUICK-BLOWING" 600 V FUSES



Designed to protect control circuits, fluorescent lighting circuits or similar uses where quick-blowing characteristics are desired. Use HPC-L fuseholder or 3845 fuse block. U/L Approved. Fiber tube 13/32″ x 1-3/8″.

Buss No.	Amperes	Net Price For Ten	100
BBS	4/10, 3/4, 8/10	$4.20	$42.00
BBS	1, 2, 3, 4, 5	4.10	41.00

13/32 x 1-1/2 inch FUSES



Glass tube, carry 110%, open at 135% in 1 hour. 3 amp. and smaller sizes U/L listed.

Buss No.	Amperes	Volts	Net Price For Ten	100
AGU	1, 2, 3, 4	250	$2.60	$26.00
AGU	5, 10, 15, 20, 25, 30	32	2.60	26.00

13/32 x 1-1/2 inch FUSES

MIDGET TYPE FUSES

Up to 15 amp size U/L Approved.

Buss No.	Amperes	Volts	Net Price For Ten	100
BAF	1, 3, 5, 6, 10	250	$2.40	$24.00
BAF	15, 20, 25, 30	125	2.40	24.00

13/32 x 1-1/2 inch FUSES

INDICATING, LAMINATED TUBE FUSES

Red button on indicating pin extends from end of fuse when fuse is blown. Units are built in accordance with Navy Specifications. These units may be used in Buss HPC-C fuseholders. Voltage, (1-15 amps), 250, others, 125 V.

Buss No.	Amperes	Net Price For Ten	100
MIN	1, 2, 3, 5, 10, 15, 20, 25, 30	$6.90	$69.00

SIGNAL OR VISUAL INDICATING FUSES

MIC fuses have silver-plated indicating pin. Pin may be used as visual indicator or may be used to actuate a signal. **MIJ** fuses are similar to MIC types except they have been specially designed for complex circuitry as in computers. Voltage, 250 except 20 amps and over which are 32 V.

Buss No.	Amperes	Net Price For Ten	100
MIC	1, 2, 3, 5, 10, 15, 20, 25, 30	$7.70	$77.00
MIJ	1, 2, 3, 5, 10, 15, 20, 25, 30	9.10	91.00

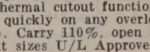
13/32 x 1-1/2 inch FUSES

HIGH INTERRUPTING CAPACITY FUSES

Type KTK — For use on circuits as high as 100,000 amps and sand filler surrounding a silver fuse at 600 volts or less, AC only. Glass fiber melamine tubes element. **Amperes:** 1/10, 1/8, 2/10, 1/4, 3/10, 1/2, 3/4, 1. 1-1/2. 2. 3. 4. 5. 6. 8. 10. 12. 15. 20, 25, 30. Lot of 10, Net $17.50. Lot of 100, Net $145.00.

13/32 x 1-1/2 inch FUSES

FUSETRON FIBER TUBE FUSES



Dual-element slow-blowing type, 13/32″ x 1-1/2″ overall. Fuse link operates only on very high overloads or short circuits; thermal cutout functions on low overloads (cannot operate quickly on any overload, thus providing longer time lag). Carry 110%, open at 135% in 1 hour. 125 and 250 volt sizes U/L Approved.

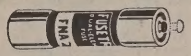
Buss No.	Amperes	Volts	Net Price For Ten	100
FNM	1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4, 1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3-2/10, 3-1/2, 4, 4-1/2, 5, 5-6/10, 6-1/4, 7, 8, 9, 10	250	$6.50	$65.00
FNM	12, 15	125	6.50	65.00
FNM	20, 25, 30	32	6.50	65.00

Same as series FNM above, except glass tube instead of fibre tube.

Buss No.	Amperes	Volts	Net Price For Ten	100
MDR	1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10	250	$6.50	$65.00
MDR	1, 1/2, 1-6/10	125	6.50	65.00
MDR	2-1/2, 3, 3-2/10, 4, 5, 6-1/4, 8, 10, 15, 20	32	5.30	53.00
MDR	25, 30, 35, 40	32	5.70	57.00

13/32 x 1-1/2 inch FUSES

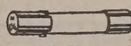
INDICATING FUSETRON FUSES



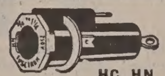
Similar to FNM types. Indicating pin extends from fuse when fuse blows. Use in signal fuse block or HPC-C fuseholder (larger than 10 amps units cannot be used in HPC-C). U/L Approved in 0-15 amp sizes.

Buss No.	Amperes	Net Price For Ten	100
FNA	1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4,1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3, 3-2/10, 2-1/2, 4, 4-1/2, 5, 5-6/10, 6, 6-1/4, 7, 8, 10	$12.10	$100.00
FNA	12, 15, 20, 25, 30	13.60	113.00

TYPE C AND N FUSES, HOLDERS



C, N



HC, HN

Matched glass fuses and fuseholders for specific size ranges. **Type N** fuses are dual-element time-delay or slow-blowing type. 0 to 1-1/4 amp sizes, 1/4″ x 1-1/4″; 1-3/10 to 7 amp sizes, 1/4″ x 1-7/16″. **Type C** fuses are single-element quick-blowing type. 0 to 3-1/2 amp sizes, 1/4″ x 1-1/16″; 3-6/10 to 10 amp sizes, 1/4″ x 1-1/4″. Holders rated at 250 volts.

TYPE N FUSES

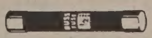
Amperes	Holder No. HN-	Volts	Net Price For Five	100
1/100, 1/32	0 to 3/10	250	$2.75	$55.00
1/16, 1/10, 15/100, 2/10, 1/4, 3/10	0 to 3/10	250	2.05	41.00
4/10	3/10 to 1/2	250	2.05	41.00
1/2	3/10 to 1/2	250	2.05	41.00
6/10	1/2 to 3/4	250	2.05	41.00
7/10, 3/4	1/2 to 3/4	250	2.05	41.00
8/10, 1	3/4 to 1-1/4	250	2.05	41.00
1-1/4	3/4 to 1-1/4	250	1.95	39.00
1-6/10	1-3/10 to	125	1.95	39.00
1-3/4	1-3/4	125	1.95	39.00
2	1-3/4 to 2-1/2	125	1.95	39.00
2-1/2	1-3/4 to 2-1/2	125	1.95	39.00
2-8/10	2-1/2 to 3-1/2	125	1.95	39.00
3-2/10	2-1/2 to 3-1/2	125	1.95	39.00
3-1/2	2-1/2 to 3-1/2	125	1.95	39.00
4	3-1/2 to 5	125	1.95	39.00
5	3-1/2 to 5	125	1.95	39.00
6-1/4	5 to 7	125	1.95	39.00
7	5 to 7	125	1.95	39.00

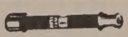
TYPE C FUSES

Amperes	Holder No. HC-	Volts	Net Price For Five	100
1/32	0 to 3/10	250	$3.15	$63.00
1/16	0 to 3/10	250	2.05	41.00
1/8, 3/16	0 to 3/10	250	1.70	34.00
1/4	0 to 3/10	250	1.30	26.00
3/10	0 to 3/10	250	1.30	26.00
3/8	3/10 to 1/2	250	1.30	26.00
1/2	3/10 to 1/2	250	1.30	26.00
3/4	1/2 to 3/4	250	1.30	26.00
1	3/4 to 1-1/4	250	.80	16.00
1-1/4	3/4 to 1-1/4	250	.80	16.00
1-1/2	1-1/4 to 1-3/4	250	.80	16.00
1-3/4	1-1/4 to 1-3/4	250	.80	16.00
2	1-3/4 to 2-1/2	250	.80	16.00
2-1/2	1-3/4 to 2-1/2	250	.80	16.00
3	2-1/2 to 3-1/2	250	.80	16.00
3-1/2	2-1/2 to 3-1/2	250	.85	17.00
4	3-6/10 to 5	250	.85	17.00
5	3-6/10 to 5	250	.85	17.00
6	5 to 7	250	.85	17.00
7	5 to 7	250	.85	17.00
8	7 to 10	250	.85	17.00
10	7 to 10	250	.85	17.00

Type HC and Type HN Fuseholders— All sizes (specify). Net for 10 $3.20. Net for 100 $32.00.

HIGH VOLTAGE FUSES





Designed for protection of circuits up to 20 kW on DC and 30 kVA on AC.

Buss No.	Amperes	Volts	Net Price For Ten	100
HVA	3/8, 1/2, 3/4, 1, 1-1/2, 2	1000	$5.00	$50.00
HVB	1/2, 3/4, 1, 1-1/2, 2	2500	7.00	70.00
HVJ	1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1-1/2, 2	5000	13.00	107.00
HVL	1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1-1/2, 2	10K	24.70	205.00

bussmann manufacturing div.

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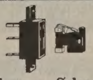
fuses and holders

SFE STANDARD FUSES

Different amperages are different lengths, making it impossible to over-fuse. Glass tube, 1/4" dia. Carry 110%, open at 135% in 1 hour. Made to SAE specifications and U/L Approved. 32 volts or less.

Buss No.	Amperes	Length In.	Net Price For	
			Five	100
SFE	4	5/8	$0.46	$9.20
SFE	6	3/4	.46	9.20
SFE	7-1/2, 9	7/8	.46	9.20
SFE	14	1-1/16	.46	9.20
SFE	20	1-1/4	.46	9.20
SFE	30	1-7/16	.60	12.00

SIGNAL-INDICATING ALARM ACTIVATING TYPE UNIT



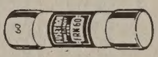
HLT
Holder
GMT
Fuse

Takes only 1/4" x 1-15/32" space. Color indicator. Rated 300 V or less; 100% for 10 min.; open at 150% within 5 min.

Buss No.	Amperes and Color of Indicator	Net Price For	
		Ten	100
GMT	18/100*, 1/4†, 1/2‡, 35/100§, 3/4#, 1•, 1-1/3∧, 2⊓, 3◄, 5∞, 7-1/2♠, 10**	$7.30	$73.00
HLT	Holder, fits all GMT	7.70	77.00

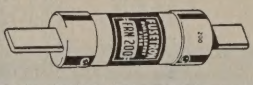
Color of Indicator: *Yellow; †violet; ‡red; §black; #brown; •gray; ∧white; ⊓orange; ◄blue; ∞green; ♠black-white; **red-white.

FUSETRON DUAL-ELEMENT FUSES



Long time-lag prevents useless shut-downs caused by ordinary fuses opening on starting currents or other harmless overloads, yet protects against short-circuits. On normal installations will guard motors against burn-out from overloads or single phasing. U/L Listed for motor running and circuit protection up to 250 volts.

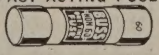
Buss No.	Amperes	Net Price For	
		Ten	100
FRN	1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4, 1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3-2/10, 3-1/2, 4, 4-1/2, 5, 5-6/10, 6-1/4, 7, 8, 9	$8.50	$85.00
	10, 12, 15, 17-1/2, 20, 25, 30	8.20	82.00
FRN	35, 40, 45, 50, 60	15.20	126.00



FRN	70, 80, 90, 100	$34.60	$287.00

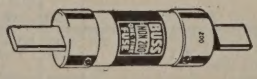
BUSS ONE-TIME FUSES

FAST ACTING FUSE



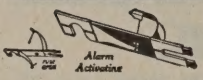
Get same care in engineering and manufacture as other BUSS products. Each can be depended upon to operate as intended under all service conditions. Carry U/L label. For voltage up to 250.

Buss No.	Amperes	Net Price For	
		Ten	100
NON	1, 3, 6, 10, 15, 20, 25, 30	$2.40	$24.00
NON	35, 40, 45, 50, 60	4.40	44.00



NON	70, 80, 90, 100	$18.70	$155.00

GRASSHOPPER FUSES



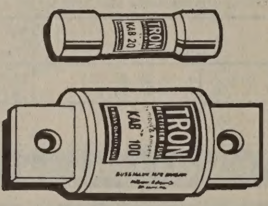
Alarm activating and signal indicating. Length: 1-43/64", except 35D (1-5/8"), 35E (1-63/64").

Buss No.	Amperes	Blowing Time		Net Price For	
		Amp	Sec.	Ten	100
35A*	1-1/3#	2	90	$5.30	$53.00
35B*	1-1/3**	2	90	5.30	53.00
35B*	2**	3	180	5.30	53.00
35C*	2#	3	180	5.30	53.00
35D*	1-1/3**	2	90	9.70	97.00
35E	3**	4	300	5.30	53.00
35F*	1/2#	3/4	9	5.30	53.00
35G*	3**	4-1/2	300	5.30	53.00
35H*	5**	6-1/2	300	5.30	53.00
35J†	1/2#	3/4	90	7.30	73.00
35K†	1-1/3#	2	180	9.70	97.00
35L†	2#	3	180	9.70	97.00
35M†	3**	4-1/2	300	9.10	91.00
35N†	5**	6-1/2	300	9.10	91.00
35P†	3/4#	1-1/8	90	6.90	69.00
35R*	18/100#	.270	90	6.90	69.00
35S†	1/4#	.375	90	7.30	73.00
35T*	65/100#	1.1	180	7.30	73.00

Volts: *90 or less. †160 or less. Mounting Screw: #No. 10. **No. 6.

TRON RECTIFIER FUSES

For Protection of Semiconductor Rectifiers and Similar Applications



Especially designed for protection of semiconductor rectifiers, thyristors and other solid state devices. High interrupting capacity and very fast clearing to restrict let-through current and energy to very low values. Give safe short-circuit protection for systems with fault current to 200 kA at 600 volts or less. Carry 100%, open at 1000 secs between 150% and 180% of rating; open within 1 sec at 250% of rating.

GBB SERIES

Size, 1-1/4" length x 1/4" diameter.

Buss No.	Amperes	Max. Volts	Net Each
GBB	1, 1-1/4, 2, 3, 4, 5, 6, 7, 8, 9, 10	130	$1.16
GBB	12, 15, 20, 25, 30	65	1.16

KAA SERIES

Size, 1-1/2" length x 13/32" diameter. Also available up to 1000 amps; prices on request.

KAA	1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30	130	$1.67

KAW SERIES

Size, 1-1/2" length x 13/32" diameter.

KAW	1, 2, 3, 4, 5, 7, 8, 10, 12, 15, 20, 25, 30	130	$1.71

KAB SERIES

Size, 9/16" diameter x 2" length, values to 30 amps; 1-7/32" diameter x 3-1/8" length, 70 amps to 200 amps. Also available up to 800 amps; prices on request.

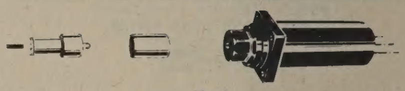
KAB	1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 17-1/2, 20, 25, 30	250	$1.90
KAB	70, 80, 90, 100, 150, 200	250	8.53

KAC SERIES

Size, 2-7/8" length x 9/16" diameter. Also available up to 800 amps; prices on request.

KAC	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 17-1/2, 20, 25, 30	600	$2.80

SERIES 70 FUSE



Type
HWG*

SIGNAL-INDICATING • ALARM-ACTIVATING

For use in telephone and similar applications. Color code indicating pin extends from end when fuse opens. Glass tube construction. Rated 300V.

Buss No.	Amperes	Net Price For	
		Ten	100
70E	18/100	$11.80	$118.00
70X	2/10	11.80	118.00
70F	1/4	9.50	95.00
70K	1/4	11.80	118.00
70G	1/2	9.50	95.00
70H	3/4	9.50	95.00
70J	3-1/3	9.50	95.00
GKB	1	11.80	118.00
70A	1-1/3	9.50	95.00
70B	2	9.50	95.00
70C	3	9.50	95.00
70D	5	9.50	95.00
71A	6	9.50	95.00
70M	8	10.20	102.00
GKB	10	10.20	102.00

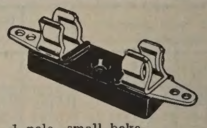
*HWG holder fits all Series 70 fuses. Rated 15A, 300V. Net Each $1.92

BLOCKS FOR TRON RECTIFIER FUSES

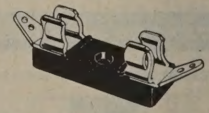
Buss No.	No. Poles	For Fuse* Symbol Amp.	Base Size In.	Net Each
4515	1	KAA or KAW 1 to 30	3/4 x 2-9/16	$0.97
4525	2		1-5/16 x 2-9/16	1.89
4535	3		2-1/16 x 2-9/16	2.78
4386	1	KAB 1 to 30	3/4 x 3-1/4	1.44
4287	2		2 x 3-1/2	2.78
3959	3		3 x 3-1/2	4.35
3556	1	KAB 70 to 100	1-1/2 x 3-1/8	3.15
3521	3		5-23/32 x 3-1/8	9.45
3595	1	KAC 1 to 30	1-1/4 x 3-1/2	2.33
3528	2		2-1/2 x 3-1/2	4.59
2795	3		3-1/2 x 3-1/2	6.56

*GBB series — use any BUSS block for 1/4" x 1-1/4" fuse.

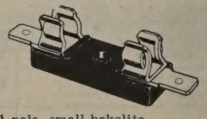
BLOCKS FOR 1/4 x 1 inch FUSES



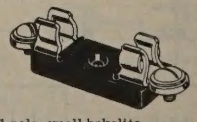
No. 4520 — 1 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each $0.35



No. 3992 — 1 pole, small bakelite base, one piece solder terminals and spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each $0.42



No. 2698 — 1 pole, small bakelite base, ¼ in. quick-connect terminals, spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each $0.44



No. 4399 — 1 pole, small bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each $0.53

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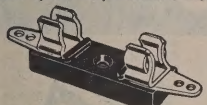
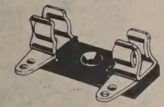
fuses and holders

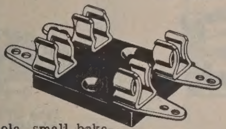
BLOCKS FOR 1/4 x 1-1/4 inch FUSES (cont'd)



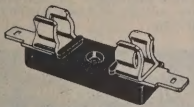
No. 4405 — 1 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.35



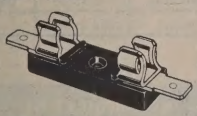
No. 4406 — 1 pole, small bakelite base, side solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .. $0.35



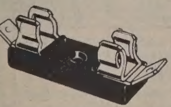
No. 4408 — 2 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, 1.000 x 1.625 inches. Net Each $0.61



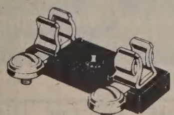
No. 2799 — 1 pole, small bakelite base, 3/16 in. quick-connect terminals. Beryllium copper albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.646



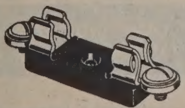
No. 2841 — 1 pole, small bakelite base, 1/4 in. quick-connect terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.425



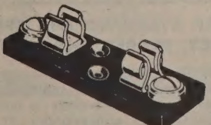
No. 2839 — 1 pole, small bakelite base, 1/4 in. quick-connect terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.425



No. 2958 — 1 pole, small bakelite base, screw side terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.536

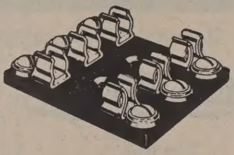


No. 4407 — 1 pole, small bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.652 inches. Net Each $0.53

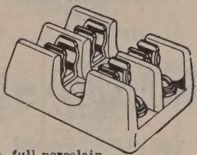


No. 4512 — 1 pole, full bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .750 x 2.1875 inches. Net Each $0.65

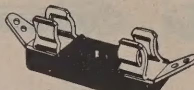
BLOCKS FOR 1/4 x 1-1/4 inch FUSES (cont'd)



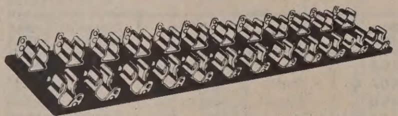
No. 4532 — 3 pole, full bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, 1.6875 x 2.1875 inches. Net Each $1.93



No. 4161 — 2 pole, full porcelain base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base dimensions, 1.3125 x 2.2500 inches. Net Each $1.50



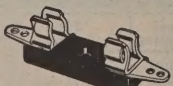
No. 3998 — 1 pole, small bakelite base, one piece solder terminals and suring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each $0.34



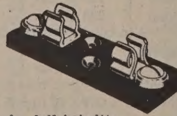
Molded black phenolic base; Albaloy plated spring clips for strong grip, high corrosion resistance. * x 1-5/8", 3823 Series.

Buss No.	No. Poles	Base Size* In.	Net Each
3823-1	1	1/2	$0.34
3823-2	2	1-1/8	.55
3823-3	3	1-3/4	.91
3823-4	4	2-3/8	1.10
3823-5	5	3	1.36
3823-6	6	3-5/8	1.61
3823-7	7	4-1/4	1.81
3823-8	8	4-7/8	2.07
3823-9	9	5-1/2	2.34
3823-10	10	6-1/8	2.58
3823-11	11	6-3/4	2.85
3823-12	12	7-3/8	3.13

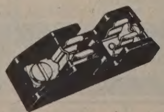
BLOCKS FOR 13/32 x 1-1/2 inch FUSES



No. 4421 — 1 pole, small bakelite base, solder terminals. Beryllium copper silver plated clips. Base dimensions, .6250 x 2.3125 inches. Net Each $0.75

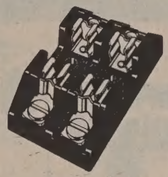


No. 4515 — 1 pole, full bakelite base, screw terminals. Beryllium copper silver plated clips. Base dimensions, .7500 x 2.5625 inches. Net Each $0.97

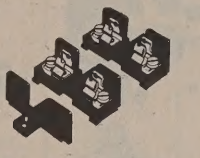


No. 2807 — 1 pole, molded phenolic base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .859 x 3.000 inches. Net Each $0.98

BLOCKS FOR 13/32 x 1-1/2 inch FUSES (cont'd)



No. 2808 — 2 pole, molded phenolic base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base Dimensions, 1.625 x 3.000 inches. Net Each .. $1.61



Add-On Fuse Block — Each pole locks into each other. New poles can be added at any time, each has end barrier. Net Each $0.22

No. 3742 Specify End Barrier Only. Net Each $1.50

No. 3743 Specify One-Pole Only — Base dimensions, .787 x2.562 inches. Marking strip in 50 inch lengths. Net Each $0.69

TRON FUSE CLIPS FOR P.C. BOARDS

For ¼" diameter fuses — offer economical way to mount fuses on printed circuit boards. Clips with two tabs, especially bowed that snap in P.C. board to hold clip firmly while being wane soldered, eliminates riveting. Clips available with end stops and single tabs.

BUSS No.	No. Tabs	Clip Material	Clip Finish	Net Each
1A1310-05	1	Beryllium Copper	Tin	$0.18
1A0581-01	1	Spring Bronze	Albaloy	.18
1A0581-05	1	Beryllium Copper	Tin	.18
1A1119-05	2	Beryllium Copper	Silver	.13
1A1119-10	2	Spring Bronze	Albaloy	.076
1A1120-05	2	Beryllium Copper	Silver	.13
1A1120-10	2	Spring Bronze	Albaloy	.12

BUSS FUSE CLIPS

Buss No.	Description	For Dia Fuse In.	Net Each
3434	Insulated Twin Clip	1/4	$0.28
5681-15	Clip	1/4	.053
5678-14	Clip and Terminal	1/4	.066
4431	Clip Assembly	1/4	.16
4432	Clip Assembly	1/4	.19
5682-01	Clip	1/4	0.98
5682-41	Clip	1/4	0.49
5682-44	Clip	1/4	0.49
4567	Clip Assembly	1/4	.16
4583	Clip Assembly	1/4	.18
5682-02	Clip	1/4	.098
5672-11	Clip	9/32	.081
5674-41	Clip	9/32	.081
4560	Clip Assembly	9/32	.26
4585	Clip Assembly	9/32	.35
5674-01	Clip	9/32	.16
5956-16	Clip	13/32	.081
5960-61	Clip	13/32	.099
5960-07	Clip	13/32	.26
5960-63	Clip	13/32	.099
4561	Clip Assembly	13/32	.26
4586	Clip Assembly	13/32	.43
5960-09	Clip	13/32	.26

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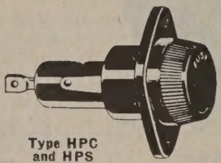
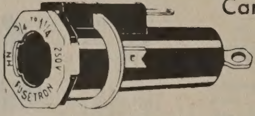
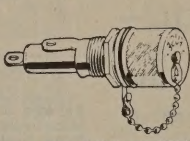
BUSS FUSEHOLDERS

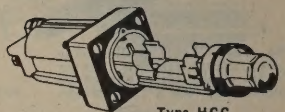
Carton Quantity 10 on all Fuseholders

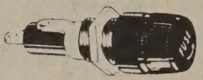

Type HPC and HPS


Type HC and HN

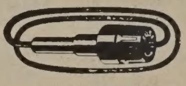
Type HKL

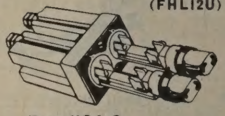

Type HMR and HMS

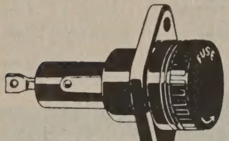

Type HGC (FHL12U)

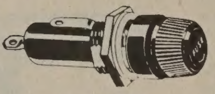

Series HJ and HK

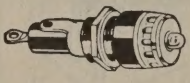
Type HKA


Series HR

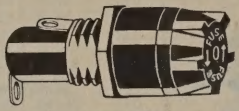

Type HGA-C (FHL10U)

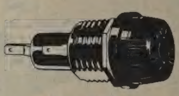

HPC-D

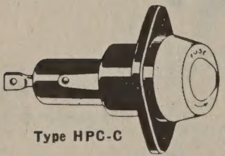

Series HCM


Type HLD

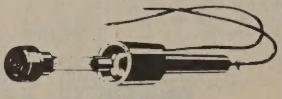
No. 5487


Type HTA


Type HPG and HPL-B


Type HPC-C

Series HH and HI


Type HLQ and HLR

*VOLTAGE: On lamp indicating holders shows operating range for lamp indication. On non-indicating holders shows maximum voltage of fuses commercially available that will fit holders.

NON-INDICATING FOR 1/4 x 1 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HDI	In-line	250 or less	15A	$0.28
HHI	In-line	250 or less	15A	.41
HJM	Panel	125 or less	30A	.65
HJM-CC	Panel	125 or less	30A	.65
HJM-H	Panel	125 or less	30A	.71
9969	Spring nut for panel mounting in-line holder			.053

LAMP-INDICATING FOR 1/4 x 1 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HJL	Panel	100 to 250	20A	$2.96

SHIELDED NON-INDICATING FOR 1/4 x 1 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HMS	Panel	250 or less	30A	$7.71

SHIELDED NON-INDICATING FOR 1/4 x 1-1/4 INCH FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HMR	Panel	250 or less	30A	$7.71

SIGNAL ACTIVATING-LAMP INDICATING FOR 1/4 x 1-1/4 inch INDICATING FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HKA	Panel	125 or less	5A	$6.41

LAMP INDICATING FOR 1/4 x 1-1/4 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HGA	Panel	100 to 250	30A	$8.33
HGA-C	Panel	100 to 250	30A	9.19
HGB	Panel	100 to 250	30A	7.03
HGB-C	Panel	100 to 250	30A	7.73
HKL	Panel	100 to 250	20A	2.87
HKL-X	Panel	100 to 250	20A	2.87
HKR	Panel	24 to 32	20A	4.63
HKT	Panel	10 to 14	20A	4.63
HKU	Panel	4 to 6	20A	4.63
HKX	Panel	24 to 32	20A	4.63

VISUAL INDICATING FOR 1/4 x 1-1/4 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HLD	Panel	125 or less	30A	$0.77
5487	Knob assembly for HLD holder			.39

NON-INDICATING FOR 1/4 x 1-1/4 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HCM	Panel	250 or less	18A	$1.02
HCM-H	Panel	250 or less	18A	1.08
HDJ	In-line	250 or less	15A	.28
HHJ	In-line	250 or less	15A	.41
HKP	Panel	250 or less	30A	.65
HKP-CC	Panel	250 or less	30A	.65
HKP-H	Panel	250 or less	30A	.75
HKP-HH	HKP 1-4 in quick-connect term			.77
HLF	Panel	250 or less	30A	.65
HMB	Panel	250 or less	30A	.65
HMJ	HDJ holder w/SFE 20 fuse & wire leads			.58
HRJ	HHJ holder w/SFE 20 fuse & wire leads			.67
HTA	Panel	250 or less	15A	.65
HTA-DD	HTA w/3/16 in. quick-connect term.			.75
HTA-HH	HTA w/1/4 in. quick-connect term.			.75
9969	Spring nut for panel mounting in-line holders			.053

NON-INDICATING FOR 9/32 x 1-1/4 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HCM	Panel	250 or less	18A	$1.02
HCM-H	Panel	250 or less	18A	1.08

NON-INDICATING FOR 13/32 x 1-3/8 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HPC-L	Panel	600 or less	5A	$1.10

NON-INDICATING FOR 13/32 x 1-1/2 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HPC	Panel	250 or less	30A	$1.10
HPC-D	Panel	250 or less	30A	2.23
HPG	Panel	600 or less	30A	1.16
HPL-B	Panel	600 or less	30A	3.15
HPS	Panel	600 or less	30A	1.10

VISUAL INDICATING FOR 13/32 x 1-1/2 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HPC-C	Panel	250 or less	30A	$1.36

LAMP INDICATING FOR 13/32 x 1-1/2 inch FUSES

Buss No.	Type Mounting	*Fuse Voltage	Current Capacity	Net Each
HGC	Panel	200 to 500	30A	$8.83

OTHER STANDARD AND SPECIAL FUSES, BLOCKS AND HOLDERS

If the fuses, fuse blocks and holders shown do not fit your requirements ask for information on other types. Fuses and fuse mountings to meet JAN and Military specifications also available. If you have a special problem in protection, send description or sketch giving number of circuits, type of fuse, terminals, etc., desired. We welcome such inquiries.

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military fuses and holders

BUSS FUSES LISTED UNDER MIL-F-15160D

Suffix **S** on Military type designation (e.g., F01A250V1/500A-S) indicates silver plating; if silver plating is not required, omit (e.g., F01A250V1/500A).

Military Type Designation	Nearest Buss Equiv.	Price Each
F01A250V1/500A S	AGX1/500	$1.67
F01A250V1/200A-S	AGX1/200	.74*
F01A250V1/100A-S	AGX1/100	.62*
F01A250V1/32A-S	AGX1/32	.54*
F01A250V1/16A-S	AGX1/16	.34*
F01A250V1/8A-S	AGX1/8	.28*
F01A250V1/4A-S	AGX1/4	.16*
F01A250V3/8A-S	AGX3/8	.16*
F01A250V1/2A-S	AGX1/2	.16*
F01A125V3/4A-S	AGX3/4	.16*
F01A125V1A-S	AGX1	.12*
F01A125V1-1/2A-S	AGX1-1/2	.12*
F01A125V2A-S	AGX2	.12*
F02A250V1/100A-S	AGC1/100	.63*
F02A250V1/32A-S	AGC1/32	.54*
F02A250V1/16A-S	AGC1/16	.28*
F02A250V	AGC1/8	.28*
F02A250V1/4A-S	AGC1/4	.16*
F02A250V3/8A-S	AGC3/8	.16*
F02A250V1/2A-S	AGC1/2	.16*
F02A250V3/4A-S	AGC3/4	.16*
F02A250V1A-S	AGC1	.12*
F02A250V1-1/2A-S	AGC1-1/2	.12*
F02A250V2A-S	AGC2	.12*
F02A250V3A-S	AGC3	.12*
F02A250V4A-S	MTH4	.14*
F02A250V5A-S	MTH5	.14*
F02A250V6A-S	MTH6	.14*
F02A125V10A-S	GLH10	.20*
F02A32V15A-S	AGC15	.08*
F02A32V20A-S	AGC20	.08*
F02B250V1/100A-S	MDL1/100	.46*
F02B250V1/32A-S	MDL1/32	.46*
F02B250V1/16A-S	MDL1/16	.34*
F02B250V1/8A-S	MDL1/8	.34*
F02B250V1/4A-S	MDL1/4	.34*
F02B250V3/8A-S	MDL3/8	.34*
F02B250V1/2A-S	MDL1/2	.34*
F02B250V3/4A-S	MDL3/4	.34*
F02B250V1A-S	MDL1	.34*
F02B250V1-1/2A-S	MDX1-1/2	.36*
F02B250V2A-S	MDX2	.36*
F02B125V3A-S	MDX3	.28*
F02B125V5A-S	MDX5	.28*
F02B32V8A-S	MDL8	.28*
F02B32V10A-S	MDL10	.28*
F02B32V15A-S	MDL15	.28*
F02B32V20A-S	MDL20	.28*
F03A250V1A-S	ABC1	.23*
F03A250V3A-S	ABC3	.23*
F03A250V5A-S	ABC5	.20*
F03A250V8A-S	ABC8	.20*
F03A250V10A-S	ABC10	.20*
F03A250V12A-S	ABC12	.20*
F03A250V15A-S	ABC15	.20*
F03A125V20A-S	ABC20	.20*
F03A125V30A-S	ABC30	.30*
F03B250V1/100A-S	MDA1/100	.59*
F03B250V1/32A-S	MDA1/32	.59*
F03B250V1/16A-S	MDA1/16	.48*
F03B250V1/8A-S	MDA1/8	.48*
F03B250V15/100A-S	MDA15/100	.48*
F03B250V3/16A-S	MDA3/16	.48*
F03B250V1/4A-S	MDA1/4	$0.48*
F03B250V3/8A-S	MDA3/8	.48*
F03B250V1/2A-S	MDA1/2	.48*
F03B250V3/4A-S	MDA3/4	.48*
F03B250V1A-S	MDA1	.48*
F03B125V3A-S	MDA3	.34*
F03B125V5A-S	MDA5	.34*
F03B125V8A-S	MDA8	.34*
F03B125V10A-S	MDA10	.34*
F03B125V12A-S	MDA12	.34*
F03B125V15A-S	MDA15	.34*
F03B125V20A-S	MDA20	.34*
F03B125V30A-S	MDA30	.34*
F05A32V10A-S	AGS10	.15*
F05A32V15A-S	AGS15	.15*
F05A32V20A-S	AGS20	.15*
F05A32V25A-S	AGS25	.15*
F05A32V30A-S	AGS30	.15*
F05B32V10A-S	MDM10	.36*
F05B32V15A-S	MDM15	.36*
F05B32V20A-S	MDM20	.36*
F05B32V25A-S	MDM25	.36*
F05B32V30A-S	MDM30	.36*
F06A250V1A-S	ABS1	.36*
F06A250V2A-S	ABS2	.36*
F06A250V3A-S	ABS3	.36*
F06A250V5A-S	ABS5	.35*
F06A250V10A-S	ABS10	.35*
F06A250V15A-S	ABS15	.35*
F07A250V1A-S	AGU1	.21*
F07A250V2A-S	AGU2	.21*
F07A250V3A-S	AGU3	.21*
F07A32V5A-S	AGU5	.21*
F07A32V10A-S	AGU10	.21*
F07A32V15A-S	AGU15	.21*
F07A32V20A-S	AGU20	.21*
F07A32V30A-S	AGU30	.21*
F07B125V1A-S	MDR1	.54*
F07B125V2A-S	MDR2	.54*
F07B125V3A-S	MDR3	.44*
F07B32V5A-S	MDR5	.44*
F07B32V10A-S	MDR10	.44*
F07B32V15A-S	MDR15	.44*
F07B32V20A-S	MDR20	.44*
F07B32V30A-S	MDR30	.48*
F09A250V1A-S	BAN1	.23
F09A250V2A-S	BAN2	.23
F09A250V3A-S	BAN3	.23
F09A250V3-1/2A-S	BAN3-1/2	.23
F09A250V5A-S	BAN5	.23
F09A250V6A-S	BAN6	.23
F09A250V6-1/4A-S	BAN6-1/4	.23
F09A250V7A-S	BAN7	.23
F09A250V8A-S	BAN8	.23
F09A250V10A-S	BAN10	.23
F09A250V10A-S	BAN15	.23
F09A250V20A-S	BAN20	.23
F09A250V25A-S	BAN25	.23
F09A250V30A-S	BAN30	.23
F09B250V1/10A-S	FNM1/10	.54
F09B250V15/100A-S	FNM15/100	.54
F09B250V2/10A-S	FNM2/10	.54
F09B250V3/10A-S	FNM3/10	.54
F09B250V4/10A-S	FNM4/10	$0.54
F09B250V1/2A-S	FNM1/2	.54
F09B250V6/10A-S	FNM6/10	.54
F09B250V8/10A-S	FNM8/10	.54
F09B250V1A-S	FNM1	.54
F09B250V1-1/4A-S	FNM1-1/4	.54
F09B250V1-6/10A-S	FNM1-6/10	.54
F09B250V2A-S	FNM2	.54
F09B250V2-1/2A-S	FNM2-1/2	.54
F09B250V3-2/10A-S	FNM3-2/10	.54
F09B250V4A-S	FNM4	.54
F09B250V5A-S	FNM5	.54
F09B250V6-1/4A-S	FNM6-1/4	.54
F09B250V8A-S	FNM8	.54
F09B250V10A-S	FNM10	.54
F09B125V15A-S	FNM15	.54
F09B32V20A-S	FNM20	.54
F09B32V25A-S	FNM25	.54
F09B32V30A-S	FNM30	.54
F15A250V1A-S	NFA1	.24
F15A250V3A-S	NFA3	.24
F15A250V6A-S	NFA6	.24
F15A250V10A-S	NFA10	.24
F15A250V15A-S	NFA15	.24
F15A250V20A-S	NFA20	.24
F15A250V25A-S	NFA25	.24
F15A250V30A-S	NFA30	.24
F15B250V1A-S	FRN1	.71
F15B250V1-1/10A-S	FRN1-6/10	.71
F15B250V2A-S	FRN2	.71
F15B250V2-1/2A-S	FRN2-1/2	.71
F15B250V1-6/10A-S	FRN3-2/10	.71
F15B250V4A-S	FRN4	.71
F15B250V5A-S	FRN5	.71
F15B250V6-1/4A-S	FRN6-1/4	.71
F15B250V8A-S	FRN8	.71
F15B250V10A-S	FRN10	.68
F15B250V12A-S	FRN12	.68
F15B250V15A-S	FRN15	.68
F15B250V20A-S	FRN20	.68
F15B250V25A-S	FRN25	.68
F15B250V30A-S	FRN30	.68
F60C500V1/8A-S	KLM1/8	1.44
F60C500V1/4A-S	KLM1/4	1.44
F60C500V3/8A-S	KLM3/8	1.44
F60C500V1/2A-S	KLM1/2	1.44
F60C500V3/4A-S	KLM3/4	1.44
F60C500V1A-S	KLM1	1.44
F60C500V3A-S	KLM3	1.44
F60C500V6A-S	KLM6	1.44
F60C500V8A-S	KLM8	1.44
F60C500V10A-S	KLM10	1.44
F60C500V15A-S	KLM15	1.44
F60C500V20A-S	KLM20	1.44
F60C500V25A-S	KLM25	1.44
F60C500V30A-S	KLM30	1.44

*Add $9.00 Stamping Charge and a minimum $10.00 per thousand Silver Plating Charge per item.

INSTRUMENT TYPE FUSES LISTED UNDER MIL-F-23419A, DATED 19 DEC. 1966

Part No.	Type Designation	Nearest Buss Equivalent	Price Each
M23419/1-001	FM01 1/200A	GMU 1/200A	$1.18
M23419/1-002	FM01 1/100A	GMU 1/100A	1.18
M23419/1-003	FM01 1/64A	GBU 1/64A	1.18
M23419/1-004	FM01 1/32A	GMU 1/32A	1.18
M23419/1-005	FM01 1/16A	GMU 1/16A	1.18
M23419/1-006	FM01 1/10A	GMU 1/10A	.89
M23419/1-007	FM01 1/8A	GMU 1/8A	.89
M23419/1-008	FM01 2/10A	GMU 2/10A	.89
M23419/1-009	FM01 1/4A	GMU 1/4A	.89
M23419/1-010	FM01 3/10A	GMU 3/10A	.89
M23419/1-011	FM01 4/10A	GMU 4/10A	.89
M23419/1-012	FM01 1/2A	GMU 1/2A	.89
M23419/1-013	FM01 6/10A	GMU 6/10A	.89
M23419/1-014	FM01 3/4A	GMU 3/4A	.89
M23419/1-015	FM01 1A	GMU 1A	.89
M23419/1-016	FM01 1-1/2A	GMU 1-1/2A	.89
M23419/1-017	FM01 2A	GMU 2A	.89
M23419/1-018	FM01 3A	GMU 3A	.89
M23419/1-019	FM01 4A	GMU 4A	.89
M23419/1-020	FM01 5A	GMU 5A	.89
M23419/1-021	FM03 1/100	—	.91
M23419/1-022	FM03 1/32	—	.84
M23419/1-023	FM03 1/16	—	.53
M23419/1-024	FM03 1/8	—	.53
M23419/1-024	FM03 1/4	—	.45
M23419/1-025	FM03 3/8	—	.45
M23419/1-026	FM03 1/2	—	.45
M23419/1-027	FM03 3/4	—	.45
M23419/1-028	FM03 1	—	.33
M23419/1-029	FM03 1-1/2	—	.33
M23419/1-030	FM03 2	—	.33
M23419/1-031	FM03 3	—	.33
M23419/1-032	FM03 4	—	.33
M23419/1-033	FM03 5	—	.33
M23419/1-034	FM03 6	—	.33
M23419/1-035	FM03 8	—	.33
M23419/1-036	FM03 10	—	.33
M23419/1-037	FM03 12	—	.33
M23419/1-038	FM03 15	—	.33
M23419/1-039	FM03 20	—	.33
M23419/1-040	FM03 25	—	.35

FM03 listed under **MIL-F-23419B**, 1/100 to 25 amps.

OTHER BUSS MIL FUSES AND BLOCKS

Fuses to MIL-F-15160D also available in styles:

F10A, F11A, F14A, F14B, F15B, F16A, F16B, F19A, F19B, F20A, F20B, F21A, F21B, F22A, F22B, F27A, F28A, F29A, F30A, F36A, F36B, F37A, F37B, F38A, F39A, F39B, F40A, F40B, F50A, F61C, F62C, F63C, F64C, F65C, F66C, F77A.

Fuse Blocks to MIL-F-21346, Aircraft Limiters to MIL-F-5372C and Aircraft Blocks to MIL-F-5372C are also available.

FUSE CLIPS LISTED MIL-F-21346 DATED 24 APRIL 1958

FC21AN	5682-11	$0.081
FC21BN	5674-10	.14
FC21CN	5960-23	.21
FC22AN	5678-05	.14
FC22CN	5623-11	.32

BUSS FUSEHOLDERS LISTED UNDER MIL-F-19207B, DATED 31 AUG. 1966

Extractor post, blown fuse indicating and non-indicating types.

Buss and Military Type Designation	Electrical Rating	Price Each, Lots of 1-99	100-499	500-999
FHL10U	30A, 90-250V	$5.95	$5.19†	—
FHL11U	30A, 90-250V	4.80	3.99†	—
FHL12U	30A, 90-500V	5.44	4.73†	—
FHL17G1	20A, 90-250V	3.47	2.90	$2.31
FHL18G1-1	20A, 12-22V	5.42	4.52	3.61
FHL18G1-2	20A, 23-33V	5.42	4.52	3.61
FHL18G1-3	20A, 34-45V	5.42	4.52	3.61
FHL18G1-4	20A, 46-60V	5.42	4.52	3.61
FHL18G1-5	20A, 61-80V	5.42	4.52	3.61
FHL18G1-6	20A, 81-90V	5.42	4.52	3.61
FHL18G1-7	20A, 2.5-4V	5.42	4.52	3.61
FHL18G1-8	20A, 5-7V	5.42	4.52	3.61
FHL18G1-9	20A, 8-12V	5.42	4.52	3.61
FHN19G	15A, 250V	1.68	1.40	1.11
FHN20G		1.89	1.58	1.26
FHL22W	20A, 250V	2.46	2.05	1.64
FHN23W	30A, 250V	2.88	2.39	1.91
FHN26G1	30A, 250V	1.32	1.10	.88
FHL29G-1	30A, 12-22V	7.83	6.79†	—
FHL29G-2	30A, 23-33V	7.83	6.79†	—
FHL29G-3	30A, 34-45V	7.83	6.79†	—
FHL29G-4	30A, 46-60V	7.83	6.79†	—
FHL29G-5	30A, 61-80V	7.83	6.79†	—
FHL29G-6	30A, 81-90V	7.83	6.79†	—
FHL30G-1	30A, 12-22V	8.05	6.72†	—
FHL30G-2	30A, 23-33V	8.05	6.72†	—
FHL30G-3	30A, 34-45V	8.05	6.72†	—
FHL30G-4	30A, 46-60V	8.05	6.72†	—
FHL30G-5	30A, 61-80V	8.05	6.72†	—
FHL30G-6	30A, 81-90V	8.05	6.72†	—
FHN31G1	5A, 250V	1.49	1.24	.99
FHN42W	5A, 125V	1.55	1.29	1.03

†Lots 100 Up.

custom switches at OFF-THE-SHELF PRICES

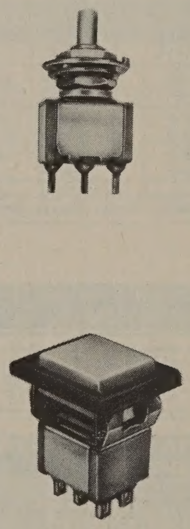
CALL (617) 926-0800

Let C & K Components build exactly the right switch for your OEM applications. No tooling charges and no engineering lead time when you select from our wide range of pre-engineered options. Actuators. Circuit configurations. Terminal styles. Mounting methods. Plus many others. Don't compromise your design to use a "standard" switch. C & K's custom switches, at off-the-shelf prices, are readily available. We will generally build a sample at no cost to you.

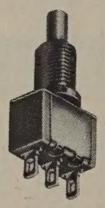
Check the pictorial presentation of our popular Toggle/Rocker/PC Mount lines at right. Everything shown represents pre-engineered options. Almost any combination is possible. And there are others not shown. There are over 250,000 toggle combinations alone.

Examine, too, the other C & K switch lines below. Some of them, like the subminiature slide switch, are new from C & K.

SNAP-ACTING PUSHBUTTONS

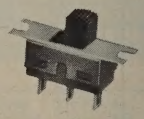


6 AMP ALTERNATE OR MOMENTARY ACTION PUSHBUTTON



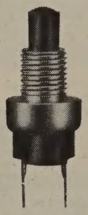
NEW

SLIDE SWITCH



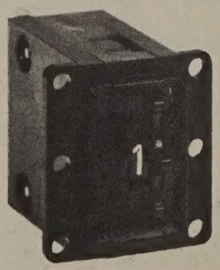
NEW

SUBMINIATURE PUSHBUTTON

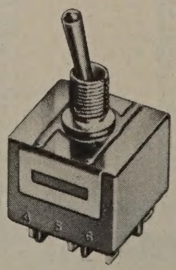


MICROMINIATURE PUSHBUTTON

THUMBWHEEL (Multiple Sections Available)

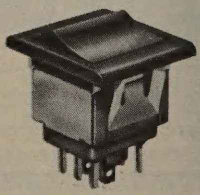


MINIATURE POWER TOGGLE



NEW

ILLUMINATED ROCKER (Shown with Bezel)



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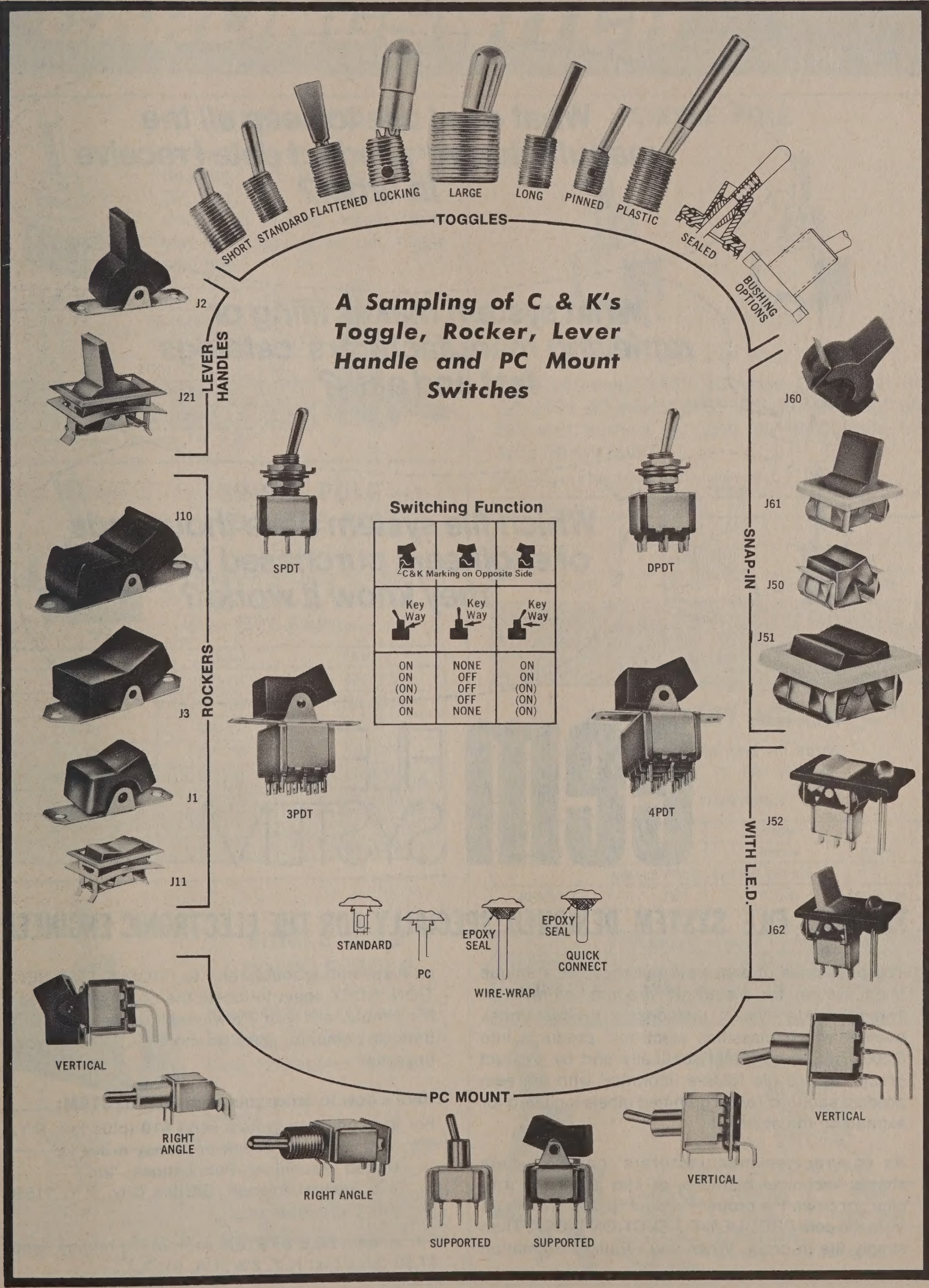
TOGGLES
SHORT
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BUSHING OPTIONS
LEVER HANDLES
J2
J21
ROCKERS
J10
J3
J1
J11
SNAP-IN
J60
J61
J50
J51
WITH L.E.D.
J52
J62
SPDT
DPDT
3PDT
4PDT
STANDARD
PC
EPOXY SEAL
WIRE-WRAP
EPOXY SEAL
QUICK CONNECT
PC MOUNT
VERTICAL
RIGHT ANGLE
RIGHT ANGLE
SUPPORTED
SUPPORTED
VERTICAL
VERTICAL

A Sampling of C & K's Toggle, Rocker, Lever Handle and PC Mount Switches

Switching Function

C&K Marking on Opposite Side		
Key Way	Key Way	Key Way
ON ON (ON) ON ON	NONE OFF OFF OFF NONE	ON ON (ON) (ON) (ON)

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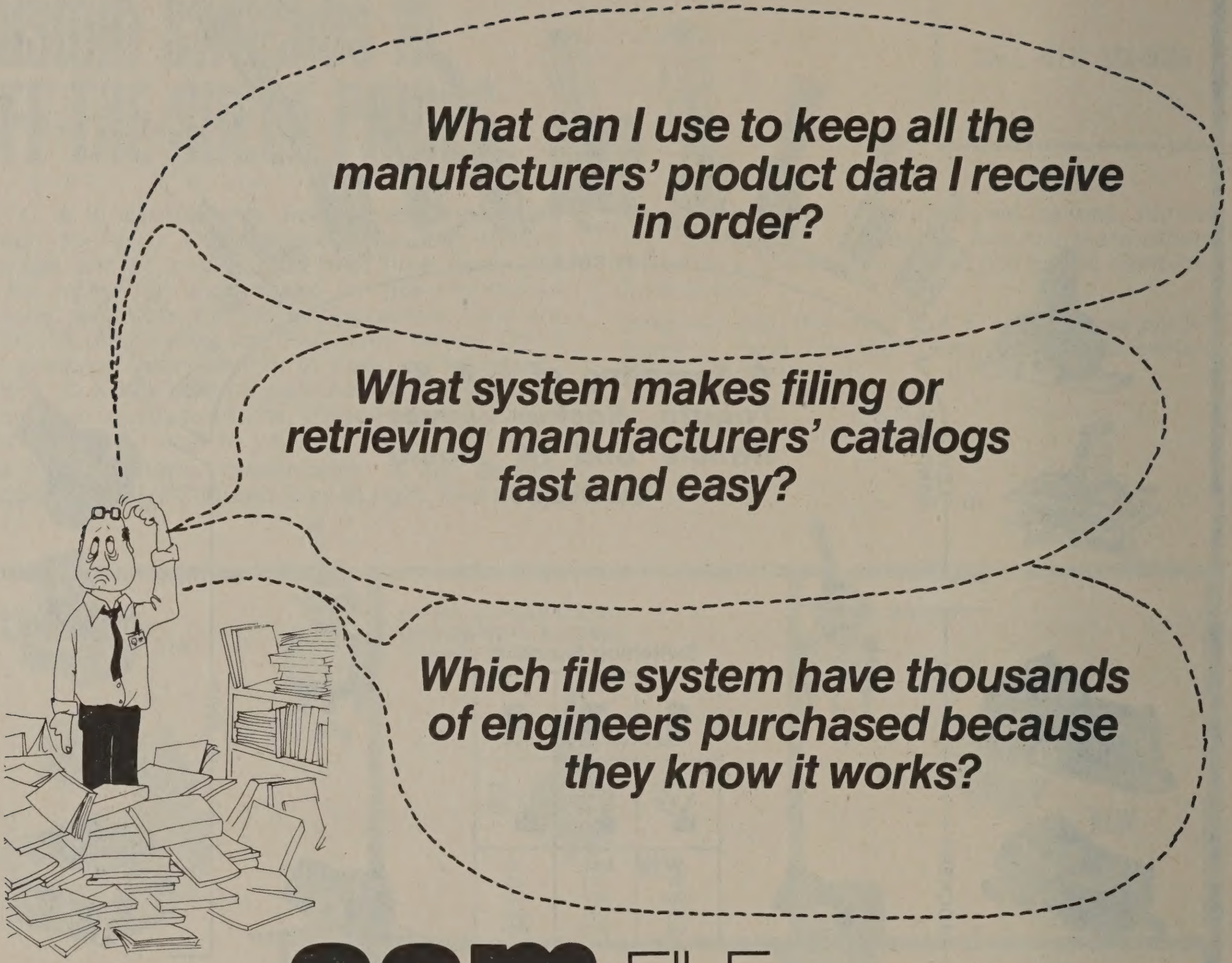
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CARLINGSWITCH

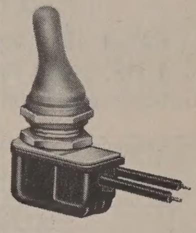
THE BIGGEST SINGLE NAME IN SWITCHES

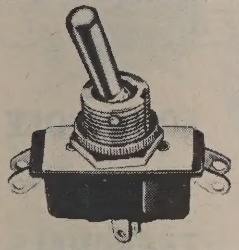
SINGLE POLE

Screw Terminals 15/32". Threaded Bushing, 15/32". Dia. Ball Toggle 3/8" long. Bat Toggle 11/16" long. U.L. Appd. Rubber toggle boots may be supplied on all toggle switches.

Catalog No.	Rating	Toggle
110-S-73	6A.-125V.	Bat
110-S-23	6A.-125V.	Ball
160-S-73	10A.-125V.	Bat
WIRE LEADS		
111-16-73	6A.-125V.	Bat

6" Leads Stripped 1/2" 105C. TFF. Wire.



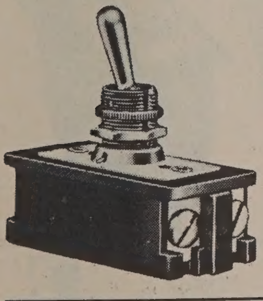


SINGLE POLE — DOUBLE POLE

SOLDER LUGS 15/32"

Threaded Bushing 15/32" Dia. Bat Toggle 11/16" long. U.L. Appd. All Have 250V. Ratings.

Catalog No.	Action	Rating
110-73	SP - ST	6A.-125V.
112-73	SP - DT	3A.-125V.
216-73	DP - ST	3A.-125V.
316-73	DP - DT	3A.-125V.
2BB62-73	SP - DT	6A.-125V.
2BK62-73	DP - ST	6A.-125V.
2BL62-73	DP - DT	6A.-125V.
160-73	SP - ST	10A.-125V.



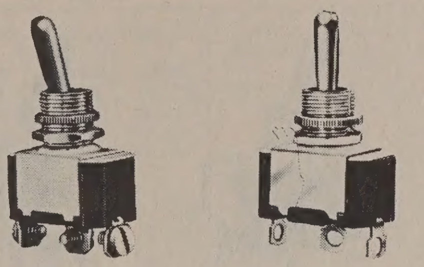
SINGLE POLE DOUBLE POLE

Heavy Duty AC-DC Type. 15/32" Bushing. 11/16" Bat Toggle. All Have Horsepower Ratings.

Catalog No.	RATINGS 125V.	250V.	Action
DA284*	16A.	8A.	DP - ST
DK284*	16A.	8A.	DP - ST
EA204†	20A.	10A.	SP - ST
EK204†	20A.	10A.	DP - ST

* 1 HP 125-250V. rating.
† 1½ HP 125-250V. rating.

SINGLE POLE



SCREW TERMINALS OR SOLDER LUGS.

Rated 15 Amps.* 125V. 10 Amps. 250VAC. ¾ HP. 125-250V. AC. except SPST is 1 HP. Rated 15/32" Dia. Threaded Bushing 15/32" long. 11/16" Bat Toggle. U.L. Appd. Heavy Duty.

* Applicable to low voltage DC requirements.

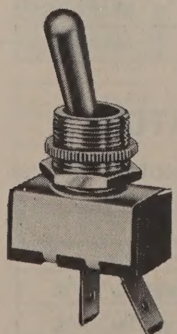
Catalog No.	Terminals	Action
2FA54-73	Screw	SP - ST
2FB54-73	Screw	SP - DT
2FC54-73	Screw	SP - DT, Center Off
2FA53-73	Lugs	SP - ST
2FB53-73	Lugs	SP - DT
2FC53-73	Lugs	SP - DT, Center Off

MOMENTARY ACTION

SAME Specifications as above Except SPST. ¾ HP. Rated.

SCREW TERMINALS

Catalog No.	ACTION Up	Center	Down
SINGLE POLE SINGLE THROW			
6FA54-73	Off	None	Mom. On
6FA58-73	On	None	Mom. Off
SINGLE POLE DOUBLE THROW			
6FB54-73	On	None	Mom. On
6FC54-73	Mom. On	Off	Mom. On
6FC58-73	On	Off	Mom. On



SINGLE POLE

20 AMP.

20 Amp. 125 VAC
10 Amp. 250 VAC
1½ HP 125-250 VAC

Catalog No.	Terminals	Toggle
CA204	Screw	Nickel-Bat

Also available SP - DT (ON-ON).
Optional Terminals: Solder Lug, .250 Spade, Wire Leads.

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CARLINGSWITCH

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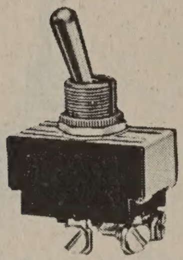
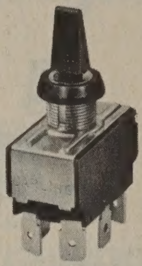
DOUBLE POLE





SCREW TERMINALS OR SOLDER LUGS

Rated 15 Amps.* 125V 10 Amps. 250V. AC. ¾ HP. 125-250V. AC. Threaded Bushing 15/32″ Dia. Threaded Bushing 15/32″ long. 11/16″ Bat Toggle. U.L. Appd. Heavy Duty. New one piece decorator series nylon toggle available on single and double pole "G" Series switches.

* Applicable to low voltage DC requirements.

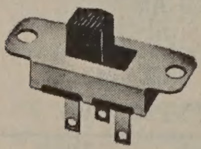
Catalog No.	Terminals	Action
2GK54-73	Screw	DP - ST
2GL54-73	Screw	DP - DT
2GM54-73	Screw	DP - DT, Center Off
2GK50-73	Lugs	DP - ST
2GL50-73	Lugs	DP - DT
2GM50-73	Lugs	DP - DT, Center Off

MOMENTARY ACTION

Same Specifications As Above.

SCREW TERMINALS

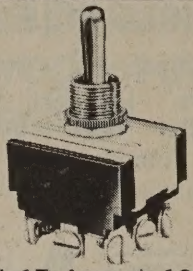
Catalog No.	ACTION Up	Center	Down
DOUBLE POLE SINGLE THROW			
6GK5E-73	Off	None	Mom. On
6GK5S-73	On	None	Mom. Off
DOUBLE POLE DOUBLE THROW			
6GL5E-73	On	None	Mom. On
6GM5S-73	Mom. On	Off	Mom. On
6GM5E-73	On	Off	Mom. On



SLIDE SWITCHES

1⅛″ Mounting Centers Single Poles Rated 4A 125V. AC.

Catalog No.	Action	Terminals
S60A-BL	SP - ST	Solder Lugs 13/64″ long
S60B-BL	SP - DT	Solder Lugs 13/64″ long



THREE POLE SCREW TERMINALS

Rated 17 Amps.* 125V. AC. 12 Amps. 250V. AC. 1 HP. 1-2-3 Phase 120-600V. AC. 15/32″ Dia. Bushing 15/32″ long. 11/16″ Bat Toggle.

* Applicable to low voltage DC requirements.

Catalog No.	Action
HK274-73	3P - ST
HL274-73	3P - DT
HM274-73	3P - DT, Center Off

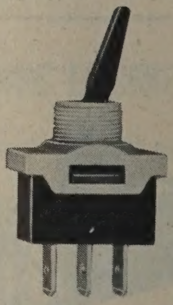
FOUR POLE SCREW TERMINALS

The Four Pole Switch has the same physical appearance as the Three Pole Switch pictured above. Only dimensional difference is in the width when the Fourth pole is added.

Rating 15A. 125V. 10A. 250V. AC. 15/32″ Dia. Bushing. 15/32″ long. 11/16″ Bat Toggle. Heavy Duty.

Catalog No.	Action
1K254-73	4P - ST
1L254-73	4P - DT
1M254-73	4P - DT, Center Off

TOTALLY INSULATED TOGGLE SERIES



Double-insulated nylon toggle series features patented wiping action contact assembly. Specify solder lugs, .250″ tabs or wire leads.

Catalog No.	Circuit	Rating
DA 101-PB-B	SP-ST .250 Tabs	10A 125V. AC 5A 250V. AC
DA 105-PB-B	SP-ST Wire Leads	1½ H.P. 125-250V. AC

Also available with SP-DT (ON-ON, ON-OFF-ON) and ratings of 20A 125V. AC, 10A 250V. AC, 1½ H.P. 125-250V. AC.

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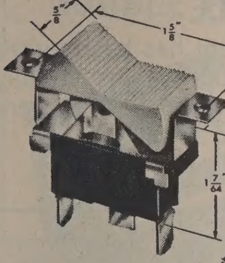
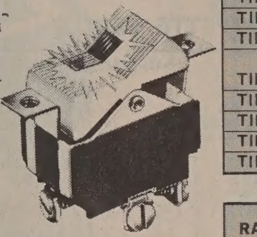
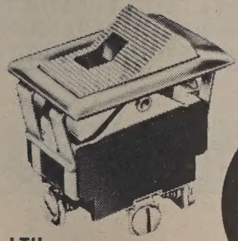
SWITCHES - TIPPETTE* LIGHTED - TIPPETTE



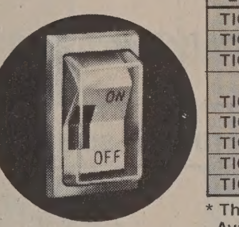
TIL Series



LTIL Series



LTIL Series with snap-in bracket



Silicone seal available

TIL Series

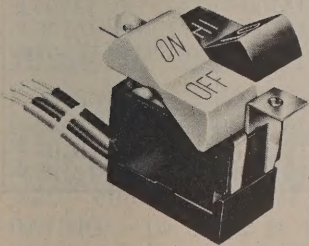
* Tippette is a Carling Trademark

RATING 15A.-125V. AC† 10A.-250V. AC ¾ HP 125-250V. AC						OPERATION AND CIRCUIT CHARACTERISTICS		
SOLDER LUGS	.250 SPADE TERM.	.205 SPADE TERM.	.187 SPADE TERM.	SCREW TERM.	WIRE LEADS	Pos. #1	Pos. #2 (Center)	Pos. #3
						SINGLE POLE SINGLE THROW		
TILA50	TILA51	TILA52	TILA53	TILA54	TILA55	On	None	Off
TILA5A	TILA5B	TILA5C	TILA5D	TILA5E	TILA5F	Off	None	Mom. On
TILA5L	TILA5M	TILA5Q	TILA5R	TILA5S	TILA5T	On	None	Mom. Off
						SINGLE POLE DOUBLE THROW		
TILB50	TILB51	TILB52	TILB53	TILB54	TILB55	On	None	On
TILB5A	TILB5B	TILB5C	TILB5D	TILB5E	TILB5F	On	None	Mom. On
TILC50	TILC51	TILC52	TILC53	TILC54	TILC55	On	Off	On
TILC5A	TILC5B	TILC5C	TILC5D	TILC5E	TILC5F	On	Off	Mom. On
TILC5L	TILC5M	TILC5Q	TILC5R	TILC5S	TILC5T	Mom. On	Off	Mom. On

TIG Series (With ONE Tippette Lever)

RATING 15A.-125V. AC† 10A.-250V. AC ¾ HP 125-250V. AC						OPERATION AND CIRCUIT CHARACTERISTICS		
SOLDER LUGS	.250 SPADE TERM.	.205 SPADE TERM.	.187 SPADE TERM.	SCREW TERM.	WIRE LEADS	Pos. #1	Pos. #2 (Center)	Pos. #3
						DOUBLE POLE SINGLE THROW		
TIGK50	TIGK51	TIGK52	TIGK53	TIGK54	TIGK55	On	None	Off
TIGK5A	TIGK5B	TIGK5C	TIGK5D	TIGK5E	TIGK5F	Off	None	Mom. On
TIGK5L	TIGK5M	TIGK5Q	TIGK5R	TIGK5S	TIGK5T	On	None	Mom. Off
						DOUBLE POLE DOUBLE THROW		
TIGL50	TIGL51	TIGL52	TIGL53	TIGL54	TIGL55	On	None	On
TIGL5A	TIGL5B	TIGL5C	TIGL5D	TIGL5E	TIGL5F	On	None	Mom. On
TIGM50	TIGM51	TIGM52	TIGM53	TIGM54	TIGM55	On	Off	On
TIGM5A	TIGM5B	TIGM5C	TIGM5D	TIGM5E	TIGM5F	On	Off	Mom. On
TIGM5L	TIGM5M	TIGM5Q	TIGM5R	TIGM5S	TIGM5T	Mom. On	Off	Mom. On

* These switches are applicable to low voltage DC requirements.
Available in 3 and 4 Pole Series. For Lighted Tippette add Prefix "L" to above numbers.



TIG Series with double actuators

Standard Colors are WHITE, -WH and BLACK, -BL. Other colors available upon request.

Imprinting on Actuators may be had upon request.

Brackets — In addition to the illustrations shown, we offer a variety of brackets — offset, flat, angled, open ear, snap-in, etc. Specials can be made upon request. Snap-in style is designed for panel thickness of approximately .040" to .100". For mounting information and dimensions consult distributor. This model bracket is available on single, double and three pole Tippettes — Single and double pole lighted Tippettes. Narrow or wide bezels.

LIGHTED TIPPETTE FEATURES

Actuators, Brackets & Accessories — Available in the same styles as listed in the Tippette Series. Lenses are Red, Amber, Clear and White. Special variations and colors available.

Lamp Characteristics

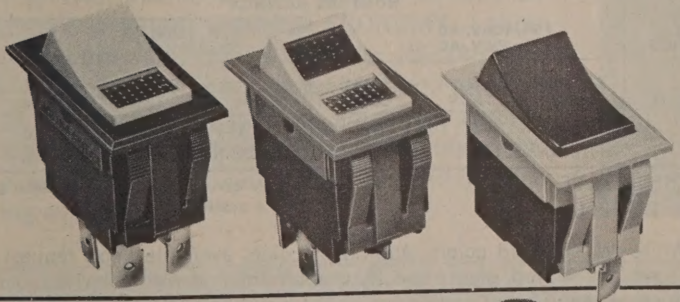
Neon (Standard)

120*-240 Volts	.002 Amps.

Incandescent

6 Volts	.20 Amps.
12 Volts	.08 Amps.
24-28 Volts	.04 Amps.

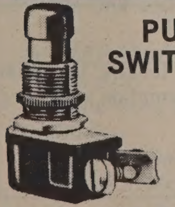
*Available with "High Brightness" in 120.

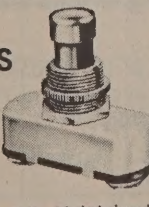


CURVED ROCKER TIPPETTES

Insulated all-nylon bracket/bezel and rocker may be molded in any color combination of available Zytel 101 colors. Switch snap-mounts into conventional opening in panel from .030" to .250" thick. Available with ratings and circuit characteristics for single and double pole Tippettes and lighted Tippettes listed above. U/L and C.S.A. listings. Rocker may be ordered smooth (no light), or with one or two large-lens indicator lights as illustrated. Legend imprinting may be specified.

PUSH SWITCHES





Type: PP - Push, On - Push, Off. Maintained. NO Normally Open. Momentary NC Normally Closed. Momentary. All Have 15/32" Dia. Bushing. Push buttons with color coded caps available.
* Screw Terminals. Others Have Solder Lugs.
† Ratings up to 2 HP available.

PA300 Series

MAINTAINED OR MOMENTARY CONTACTS

Catalog No.	Rating	Type
110-SP*	6A.-125V.	P.P.
PA354†	15A.-125V.	P.P.
110-PM-OFF	6A.-125V.	N.O.
172*	10A.-250V.	N.O.
170	10A.-250V.	N.C.
16-3P-OFF	3A.-125V.	N.O.
16-3P-ON	3A.-125V.	N.C.

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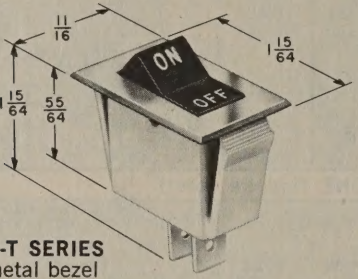
CARLINGSWITCH

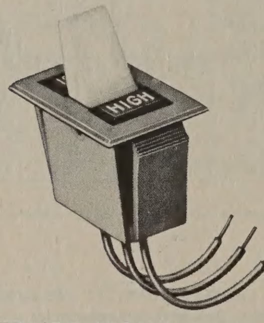
THE BIGGEST SINGLE NAME IN SWITCHES

MINI TIPPETTE SERIES — SINGLE AND DOUBLE POLE

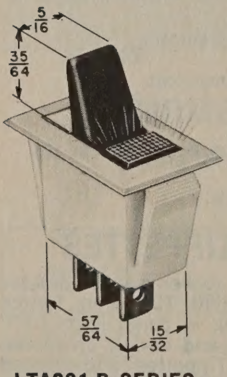
Insulated all nylon bracket/bezel and rocker may be molded in any available DuPont Zytel color. Snap-in mounting. Lighted and unlighted versions. Imprinting available on bezel, lens or rocker. New, patented wiping action contact arrangement has been tested to withstand in excess of 100,000 cycles at fully rated inductive load. Excellent for low voltage, very low current applications. UL and CSA listed.



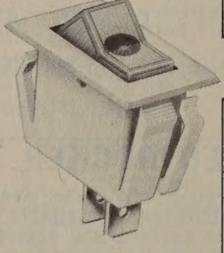
TA201-T SERIES
with metal bezel



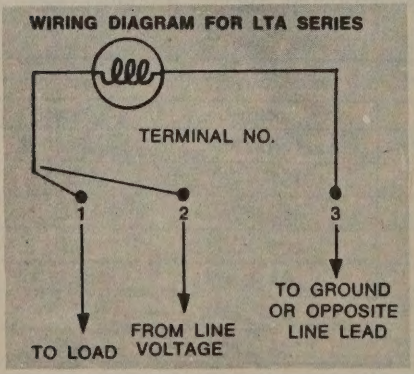
TB105-P SERIES
Featuring wire leads and imprinting



LTA201-P SERIES



LTA210-R SERIES


WIRING DIAGRAM FOR LTA SERIES
TERMINAL NO.
1
2
3
TO LOAD
FROM LINE VOLTAGE
TO GROUND OR OPPOSITE LINE LEAD

MINI TIPPETTE SERIES

OPERATION AND CIRCUIT CHARACTERISTICS	NOMINAL RATINGS** 15A.-125V. AC 10A.-250V. AC ¾ HP 125-250V. AC			10A.-125V. AC 5A.-250V. AC ½ HP 125-250V. AC		
SINGLE POLE-SINGLE THROW	SOLDER LUGS	.250 TABS	WIRE LEADS	SOLDER LUGS	.250 TABS	WIRE LEADS
On-None-Off Off-None-Mom. On On-None-Mom. Off	TA200-T	TA201-T	TA205-T	TA100-T TA10A-T TA10L-T	TA101-T TA10B-T TA10M-T	TA105-T TA10F-T TA10T-T
SINGLE POLE-DOUBLE THROW On-None-On On-None-Mom. On On-Off-On	TB200-T	TB201-T	TB205-T	TB100-T TB10A-T TC100-T	TB101-T TB10B-T TC101-T	TB105-T TB10F-T TC105-T

PADDLE TOGGLE SERIES

OPERATION AND CIRCUIT CHARACTERISTICS	NOMINAL RATINGS** 15A.-125V. AC 10A.-250V. AC ¾ HP 125-250V. AC			10A.-125V. AC 5A.-250V. AC ½ HP 125-250V. AC		
SINGLE POLE-SINGLE THROW	SOLDER LUGS	.250 TABS	WIRE LEADS	SOLDER LUGS	.250 TABS	WIRE LEADS
On-None-Off Off-None-Mom. On On-None-Mom. Off	TA200-P	TA201-P	TA205-P	TA100-P TA10A-P TA10L-P	TA101-P TA10B-P TA10M-P	TA105-P TA10F-P TA10T-P
SINGLE POLE-DOUBLE THROW On-None-On On-None-Mom. On On-Off-On	TB200-P	TB201-P	TB205-P	TB100-P TB10A-P TC100-P	TB101-P TB10B-P TC101-P	TB105-P TB10F-P TC105-P

LIGHTED SERIES

OPERATION AND CIRCUIT CHARACTERISTICS	NOMINAL RATINGS* 15A.-125V. AC 10A.-250V. AC			10A.-125V. AC 5A.-250V. AC		
SINGLE POLE-SINGLE THROW	SOLDER LUGS	.250 TABS	WIRE LEADS	SOLDER LUGS	.250 TABS	WIRE LEADS
On-None-Off	LTA210-P LTA210-R	LTA211-P LTA211-R	LTA215-P LTA215-R	LTA110-P LTA110-R	LTA111-P LTA111-R	LTA115-P LTA115-R

Mounting Hole: .550 x 1.125
Panel Thickness: .202-.250

* Also Available with Horsepower Rating
** L Rating available.

*Black - B and White - W, standard colors. Additional colors available upon request. If additional features are desired, please specify this information with basic number when ordering, such as metal bezel, imprinting or lamp voltages, 120 VAC std. 250 VAC, 6 VDC, 12 VDC and 28 VDC available.

When ordering metal bezel, stainless steel is standard. Consult factory for other finishes. Specify if for low energy, dry circuit applications. For information regarding double pole Mini Tippettes, please consult factory.

HOW TO ORDER (EXAMPLE):

LTA201-P	**B**	**W**	**R**
Basic No.	Actuator Color*	Base Color*	Lens Color

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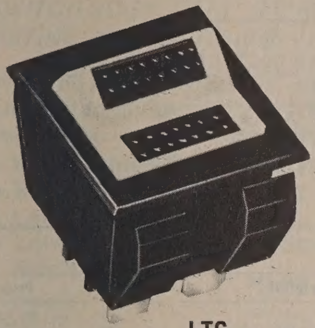
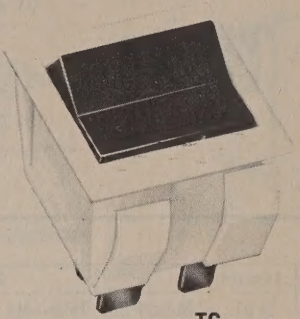
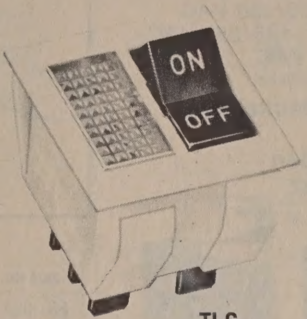
DOUBLE POLE MINI TIPPETTE SERIES


LTG Series


TG Series

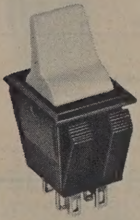


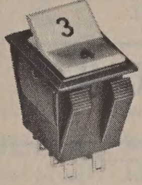
TLG Series

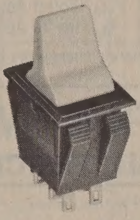
Recommended mounting hole: 1.00″ x 1.125″ Panel thickness: .030″ to .250″

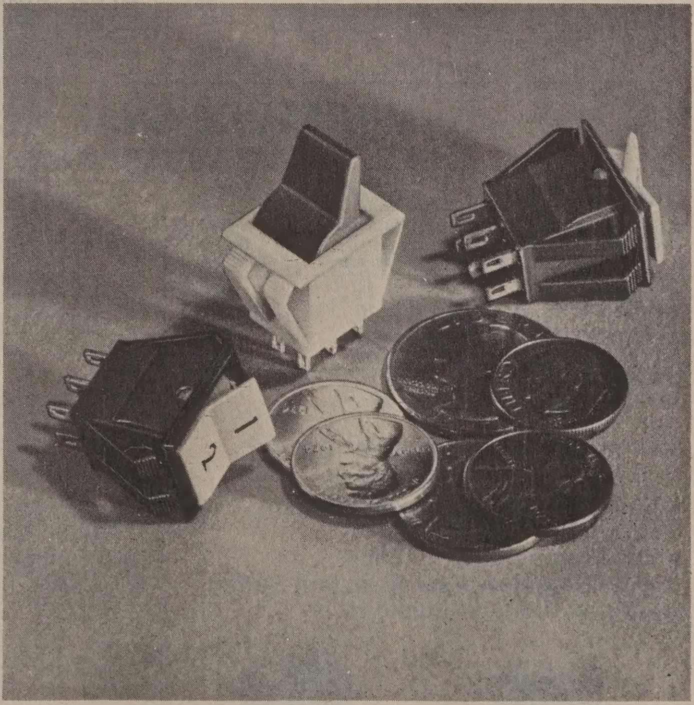
Double pole Mini Tippettes may be ordered in a variety of circuits and styles; lighted and unlighted. Consult your Carlingswitch distributor.

CARLING'S NEW SUBMINIATURE TIPPETTES









10 AMPS 125 VAC

FOR SMALL CHANGE!

SIZE — just .750″ (behind panel) with .750″ x .590″ bezel. Snaps into conventional .515″ x .625″ cutout in panel up to .156″ thick. RATING — 10 amps at 125 VAC, 5 amps at 250 VAC, inductive, UL listed. All SP and DP circuit variations available. ECONOMY — about ½ the price of competitive units. RELIABILITY — patented wiping action contact arrangement. Suited for low voltage, low amperage applications. Fully insulated Zytel 101 body and actuator, in any of Zytel colors. Legend imprinting available.

OPERATION AND CIRCUIT CHARACTERISTICS	NOMINAL RATINGS	CATALOG NUMBERS		OPERATION AND CIRCUIT CHARACTERISTICS	NOMINAL RATINGS	CATALOG NUMBERS	
Single Pole, Double Throw		Solder Lugs	Printed Circuit Terminals	Double Pole, Double Throw		Solder Lugs	Printed Circuit Terminals
On-None-On	10A, 125VAC 5A, 250VAC	SGB0410	SGB0411	On-None-On	10A, 125VAC 5A, 250VAC	SGD0410	SGD0411
On-None-Mom. On		SCG041A	SGB041B	On-None-Mom. On		SGD041A	SGD041B
On-Off-On		SGBC410	SGBC411	On-Off-On		SGDC410	SGDC411
Mom. On-Off-On		SGBC41A	SGBC41B	Mom. On-Off-On		SGDC41A	SGDC41B
Mom. On-Off-Mom. On		SGBC41L	SGBC41M	Mom. On-Off-Mom. On		SGDC41L	SGDC41M

Example	SGB0410	TB	W
For tippette actuator add -T paddle actuator add -P	Basic No.	Actuator & Color	Base Color

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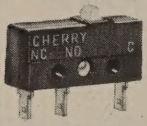
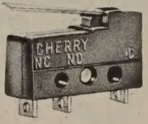
SUBMINIATURE SNAP ACTION SWITCHES

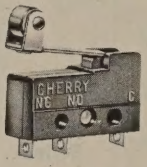
SERIES E61—LIGHT FORCE
SERIES E62—STANDARD FORCE

SWITCH BODY: 25/32″ x 23/64″ x 1/4″
RATINGS: E61—5 Amps., 125/250 VAC
E62—10.1 Amps., 125/250 VAC
—1/4 H.P., 125 VAC
Und. Lab. Inc. listed, and CSA approved.

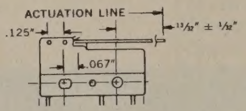
- **Long Life Coil Spring Mechanism**
- **Large Overtravel**
- **Rock Wipe Contact Action**
- **Integral Hinged Actuator**
- **Small Compact Size**

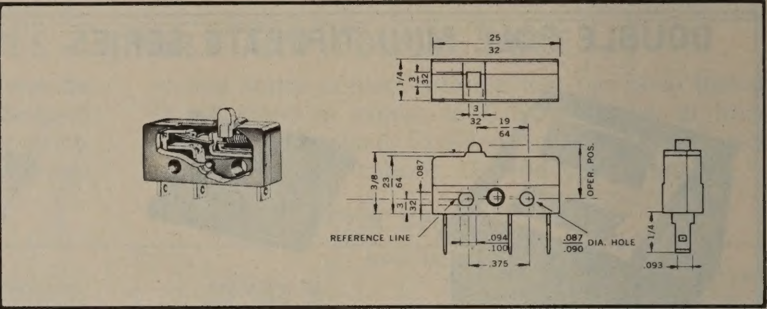

E61-00A/ E62-00A


E61-00H/ E62-00H


E61-00K/ E62-00K

ACTUATORS—Actuator lengths are dimensioned from centerline of switch mounting hole as shown.





Part No.	Circuitry	Description	Price
E61-00A	SPDT	Button Q.C. Terminals	$1.59
E61-10A	SPDT	Button, Solder Terminals	1.59
E61-00H	SPDT	9/32″ Actr, Standard Lever Ratio, Q.C. Terminals	1.85
E61-10H	SPDT	9/32″ Actr, Standard Lever Ratio, Solder Terminals	1.85
E61-50H	SPDT	13/32″ Actr, High Lever Ratio, Q.C. Terminals	1.85
E61-60H	SPDT	13/32″ Actr, High Lever Ratio, Solder Terminals	1.85
E61-00K	SPDT	13/64″ Roller Actr, Standard Lever Ratio, Q.C. Terminals	2.11
E61-10K	SPDT	13/64″ Roller Actr, Standard Lever Ratio, Solder Terminals	2.11
E61-50K	SPDT	21/64″ Roller Actr, High Lever Ratio, Q.C. Terminals	2.11
E61-60K	SPDT	21/64″ Roller Actr, High Lever Ratio, Solder Terminals	2.11

To specify 10.1 Amps merely change the E61 to E62.

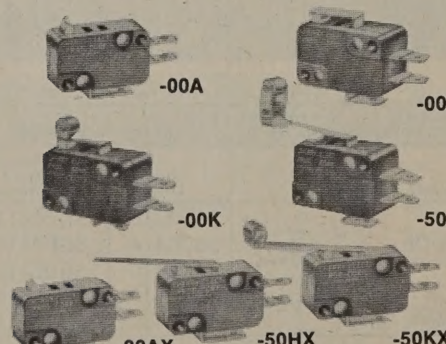
MINIATURE SNAP ACTION SWITCHES
STANDARD AND LIGHT FORCE

SERIES E22
3 Amp., 125 VAC
SERIES E23
5 Amp., 1/4 H.P., 125/250 VAC
SERIES E33
10 Amp., 1/2 H.P., 125/250 VAC
SERIES E34
15 Amp., 1/2 H.P., 125/250 VAC

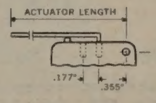
OPERATING FORCES		
SERIES	Standard Force Gms. max.	Light Force Gms. max.
E22	75	15
E23	170	45
E33	285	75
E34	400	100

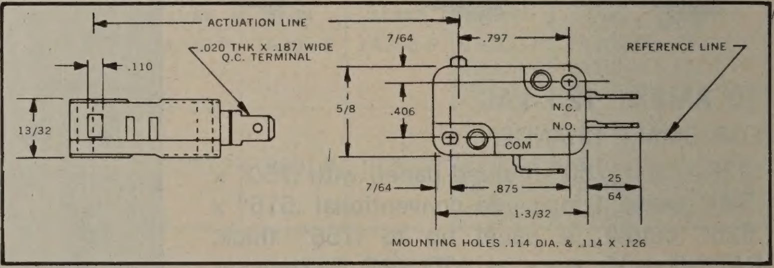
SWITCH BODY: 1-3/32″ x 5/8″ x 13/32″
Und. Lab. Inc. listed, and CSA approved.

- **Long Life Coil Spring Mechanism**
- **Large Overtravel**
- **Rock Wipe Contact Action**
- **Wide Rounded Wear Resistant Button**
- **Integral Hinged Actuators**



ACTUATORS—Actuator lengths are dimensioned from centerline of switch mounting hole as shown.





Part No.	Circuitry	Terminal	Description	Price E22	Price E23	Price E33	Price E34
STANDARD FORCE							
E23-00A	SPDT	QC	Button	$1.13	$1.04	$1.08	$1.08
E23-10A	SPDT	Screw	Button	1.77	1.67	1.68	1.68
E23-20A	SPDT	Solder	Button	1.13	1.04	1.08	1.08
E23-00H	SPDT	QC	27/32″ Actr, Std. Ratio	1.32	1.22	1.23	1.23
E23-50H	SPDT	QC	1 13/32″ Actr, Std. Ratio	1.32	1.22	1.23	1.23
E23-70H	SPDT	Solder	1 13/32″ Actr, Std. Ratio	1.32	1.22	1.23	1.23
E23-50HL	SPDT	QC	1 9/16″ Actr, High Ratio	1.32	1.22	1.23	1.23
E23-00K	SPDT	QC	13/16″ Roller Actr, Std. Ratio	1.56	1.47	1.48	1.48
E23-20K	SPDT	Solder	13/16″ Roller Actr, Std. Ratio	1.56	1.47	1.48	1.48
E23-50K	SPDT	QC	1 11/32″ Roller Actr, Std. Ratio	1.56	1.47	1.48	1.48
E23-70K	SPDT	Solder	1 11/32″ Roller Actr, Std. Ratio	1.56	1.47	1.48	1.48
E23-50KL	SPDT	QC	1 1/2″ Roller Actr, High Ratio	1.56	1.47	1.48	1.48
E23-00P	SPDT	QC	13/16″ One-way Roller Actr, Std. Ratio	1.99	1.89	1.91	1.91
E23-50P	SPDT	QC	1 11/32″ One-way Roller Actr, Std. Ratio	1.99	1.89	1.91	1.91

Note: to specify E33, 10 Amp series, E34, 15 Amp series or E22, 3 Amp series, merely change the E23 series prefix to the desired series (i.e., E22, E33, E34).

LIGHT FORCE

Part No.	Circuitry	Terminal	Description	Price E22	Price E23	Price E33	Price E34
E33-00AX	SPDT	QC	Button	1.39	1.13	1.14	1.14
E33-50HX	SPDT	QC	1 13/32″ Actr, Std. Ratio	1.58	1.32	1.33	1.33
E33-55HX	SPDT	QC	2 3/4″ Actr, Std. Ratio	1.65	1.39	1.40	1.40
E33-75HX	SPDT	QC	1 9/16″ Actr, Std. Ratio	1.58	1.32	1.33	1.33
E33-85HX	SPDT	QC	2 9/32″ Actr, High Ratio	1.65	1.36	1.40	1.40
E33-50KX	SPDT	QC	1 11/32″ Roller Actr, Std. Ratio	1.85	1.58	1.60	1.60
E33-75KX	SPDT	QC	1 1/2″ Roller Actr, High Ratio	1.85	1.58	1.60	1.60

Note: To specify E22, 3 Amp series, E23, 5 Amp series or E34, 15 Amp series, merely change the E33 series prefix to the desired series (i.e., E22, E23, E34).

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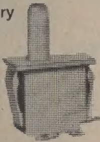
PANEL MOUNT PUSHBUTTON SNAP ACTION SWITCHES
MOMENTARY—PUSH-PULL (RESET)—"CHEAT" INTERLOCK—"PUSH-PUSH"

SERIES E69—SINGLE POLE

SWITCH BODY: 1-1/4" x 1" x 11/16"
RATING: 10 amp., 125/250 VAC
1/3 H.P. 125/250 VAC
TERMINALS: This switch series has quick connect terminals .187" x .020".
Und. Lab. Inc. listed, and CSA approved

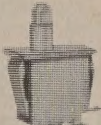
- **Rock-Wipe Contact Action**
- **Snap-in Panel Mounting**
- **Large Overtravel**
- **Long-Life Coil Spring Snap-Action Mechanism**

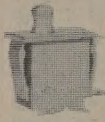
E69-00A
Basic
Momentary
Action



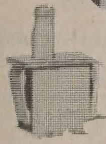
E69-40A
Short
Button
Momentary

E69-50A
For Auxiliary
Push Button

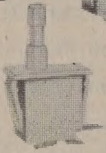




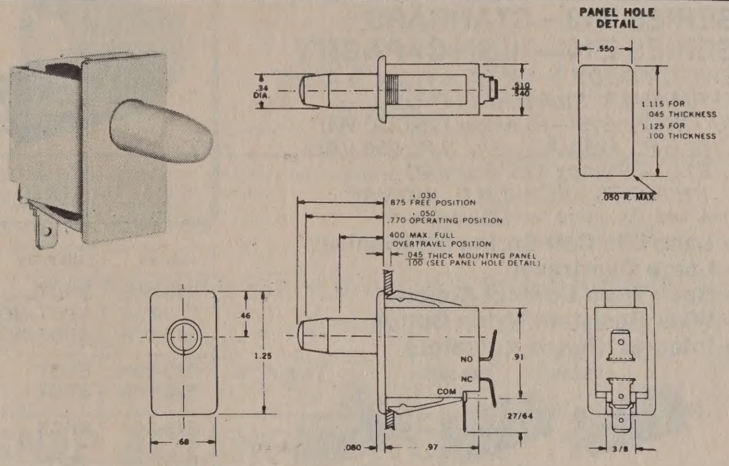
E69-20A
Push-Pull
(Reset)



E69-30A
Momentary
"Cheat"
Interlock



E69-60A
Push-Push
(Alt. Action)


PANEL HOLE DETAIL
.550
1.115 FOR .045 THICKNESS
1.125 FOR .100 THICKNESS
.050 R. MAX.
.34 DIA.
.510
.540
+.030 .875 FREE POSITION
+.050 .770 OPERATING POSITION
.400 MAX. FULL OVERTRAVEL POSITION
.045 / .100 THICK MOUNTING PANEL (SEE PANEL HOLE DETAIL)
.46
1.25
.68
NO
NC
COM
.91
27/64
.080
.97
3/8

Part No.	Price
E69-00A	$1.39
E69-40A	1.48
E69-50A	1.39
E69-20A	1.36
E69-30A	1.84
E69-60A	3.23

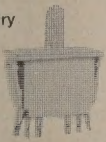
Single Pole
PANEL HOLE DETAIL
LENGTH—1.115 for .045 Thickness
1.125 for .100 Thickness
WIDTH—.550
CORNERS—.050 R. Max.

SERIES E79—DOUBLE POLE

SWITCH BODY 1½" x 1" x 11/16"
RATING: 10 amp., 125/250 VAC
⅓ H.P. 125/250 VAC
TERMINALS: This switch series has quick connect terminals .187" x .020".
Und. Lab. Inc. listed, and CSA approved

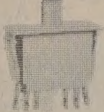
- **Rock-Wipe Contact Action**
- **Snap-in Panel Mounting**
- **Large Overtravel**
- **Long-Life Coil Spring Snap-Action Mechanism**

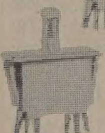
E79-00A
Basic
Momentary
Action



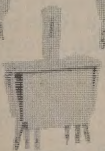
E79-40A
Short
Button
Momentary

E79-50A
For Auxiliary
Pushbutton

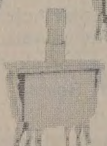




E79-20A
Push-Pull
(Reset)



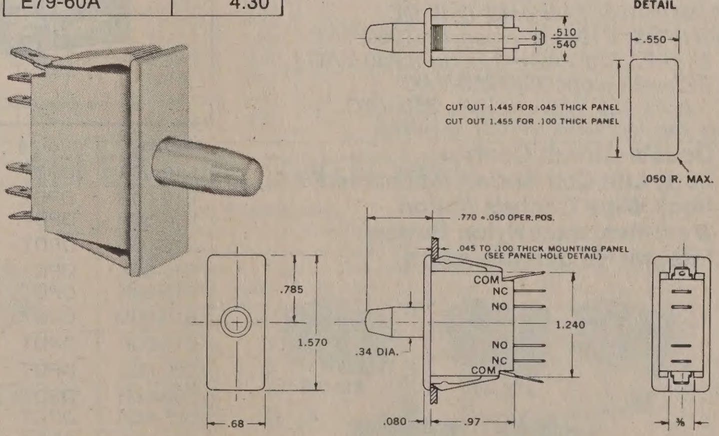
E79-30A
Momentary
"Cheat"
Interlock



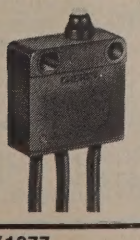
E79-60A
Push-Push
(Alt. Action)

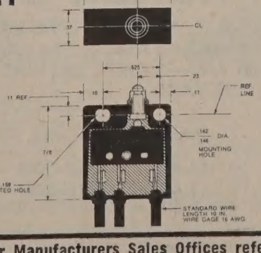
Part No.	Price
E79-00A	$2.38
E79-40A	2.46
E79-50A	2.38
E79-20A	2.33
E79-30A	3.44
E79-60A	4.30

Double Pole
PANEL HOLE DETAIL
LENGTH—1.445 for .045 Thickness
1.455 for .100 Thickness
WIDTH—.550
CORNERS—.050 R. Max.


PANEL HOLE DETAIL
.510
.540
.550
CUT OUT 1.445 FOR .045 THICK PANEL
CUT OUT 1.455 FOR .100 THICK PANEL
.050 R. MAX.
.770 ±.050 OPER. POS.
.045 TO .100 THICK MOUNTING PANEL (SEE PANEL HOLE DETAIL)
COM
NC
NO
1.240
NO
NC
COM
.785
1.570
.34 DIA.
.68
.080
.97
⅜

SERIES E72—SEALED SWITCH NEW FROM CHERRY—A SWITCH WITHIN A SWITCH




.92
.37
CL
.625
.23
.11 REF
.16
.11
REF. LINE
.142 / .146 DIA. MOUNTING HOLE
7/8
.144 X .158 SLOTTED HOLE
STANDARD WIRE LENGTH 10 IN. WIRE GAGE 16 AWG

We built an umbrella around a switch . . . by putting our subminiature snap-action switch inside a sturdy housing and injection molding epoxy plastic that encapsulates the switch and leads to seal out dirt and moisture. The result? A switch you can splash, spray, freeze, subject to all kinds of weather. This switch comes with insulated, 10 inch, 16 gauge leads attached. Electrical rating E72 series—10.1 amp., ¼ H.P. 125/250 VAC.

Part No.	Circuitry	Description	Price
E72-40A	SPDT	Button	$3.15
E72-40H	SPDT	Actr	3.37
E73-40A	SPDT	Button	3.91
E73-40H	SPDT	Actr	4.13

Note: For low energy switching applications, the E73 series of this switch is available with gold "crosspoint" contacts. The E73-40A is rated at 0.1 amp., 125 VAC.

CHERRY

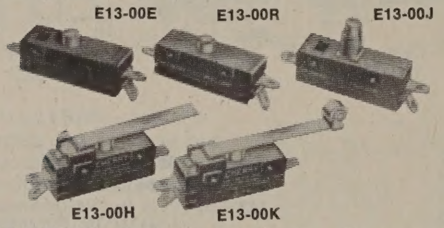
CHERRY ELECTRICAL PRODUCTS CORP.
DEPT. EM / 3600 SUNSET AVENUE / WAUKEGAN, ILLINOIS 60085
(312) 689-7700 /TWX (910) 235-1572 / CABLE: CHERRY, WAUKEGAN

GENERAL PURPOSE SNAP ACTION SWITCHES

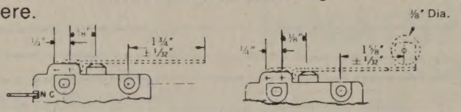
SINGLE POLE
SERIES E13—STANDARD
SERIES E14—HIGH CAPACITY

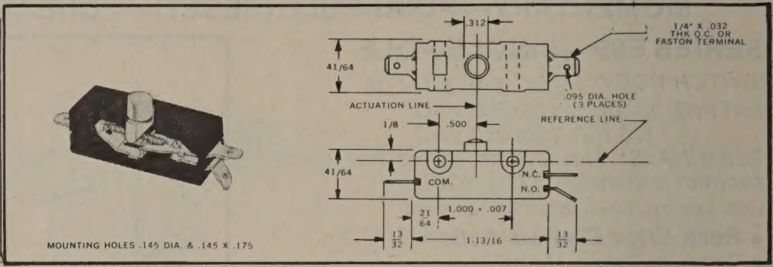
SWITCH BODY: 1-13/16″ x 41/64″ x 41/64″
TERMINALS: Standard 1/4″ QC
RATINGS: E13—15 amps 125/250 VAC
¾ H.P., 125 VAC—1½ H.P., 250 VAC
E14—25 amps 125/250 VAC
1 H.P., 125 VAC—2 H.P., 250 VAC
Und. Lab. Inc. listed, and CSA approved.

- **Long Life Coil Spring Mechanism**
- **Large Overtravel**
- **Rock Wipe Contact Action**
- **Wear Resistant Nylon Button**
- **Integral Hinged Actuators**


E13-00E
E13-00R
E13-00J
E13-00H
E13-00K

ACTUATORS—Actuator lengths are dimensioned from centerline of switch mounting hole as shown here.


⅜″ Dia.
¼″
1¾″ ± 1/32″
1⅝″ ± 1/32″
N C

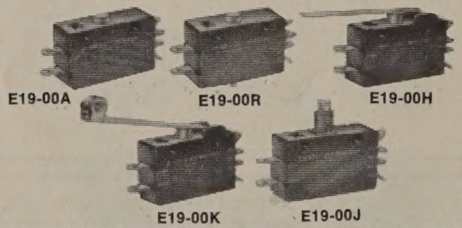

.312
1/4″ X .032 THK Q.C. OR FASTON TERMINAL
41/64
.095 DIA. HOLE (3 PLACES)
ACTUATION LINE
REFERENCE LINE
1/8
.500
41/64
COM.
N.C.
N.O.
21/64
1.000 ± .007
13/32
1-13/16
13/32
MOUNTING HOLES .145 DIA. & .145 X .175

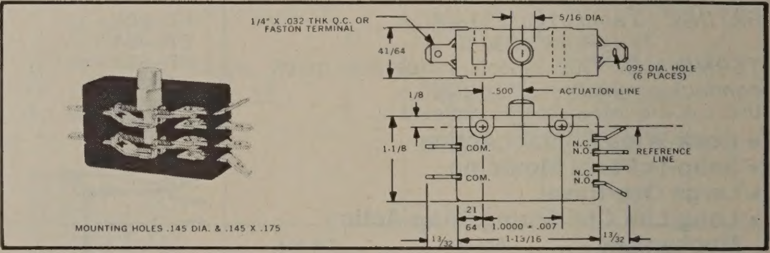
Part No.	Circuitry	Description	Price
E13-00E E13-01E E13-02E	SPDT SPDT-NO SPDT-NC	Button Button Button	$1.06 1.03 1.03
E13-00H E13-50H	SPDT SPDT	1½″ Actr. Std. Ratio 1¾″ Actr. High Ratio	1.53 1.53
E13-00J	SPDT	Button, Ferrule Mounting	1.20
E13-00K E13-50K	SPDT SPDT	1⅜″ Roller Actr. Standard Ratio 1⅝″ Roller Actr. High Ratio	1.92 1.92
E13-00M	SPDT	Button, Ferrule Mounting Hi Overtravel	1.48
E13-00R	SPDT	Button, Reset	2.35
E14-00A	SPDT	Button	1.48
E14-00H E14-50H	SPDT SPDT	27/32″ Actr. Standard Ratio 1 3/32″ Actr. High Ratio	1.93 1.93
E14-00K E14-50K	SPDT SPDT	11/16″ Roller Actr. Standard Ratio 15/16″ Roller Actr. High Ratio	2.33 2.33

DOUBLE POLE
SERIES E19—STANDARD
SERIES E20—HIGH CAPACITY

SWITCH BODY: 1-13/16″ x 1-1/8″ x 41/64″
TERMINALS: Standard 1/4″ QC
RATINGS: E19—15 amps 125/250 VAC
¾ H.P., 125 VAC—1½ H.P., 250 VAC
E20—20 amps 125/250 VAC
1 H.P., 125 VAC—2 H.P., 250 VAC
Und. Lab. Inc. listed, and CSA approved.

- **Double Circuit Control**
- **Long Life Coil Spring Mechanism**
- **Rock Wipe Contact Action**
- **Wear Resistant Nylon Button**
- **Integral Hinged Actuators**

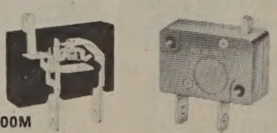

E19-00A
E19-00R
E19-00H
E19-00K
E19-00J


1/4″ X .032 THK Q.C. OR FASTON TERMINAL
5/16 DIA.
41/64
.095 DIA. HOLE (6 PLACES)
1/8
.500
ACTUATION LINE
1-1/8
COM.
COM.
N.C.
N.O.
N.C.
N.O.
REFERENCE LINE
21/64
1.0000 ± .007
13/32
1-13/16
13/32
MOUNTING HOLES .145 DIA. & .145 X .175

Part No.	Circuitry	Description	Price
E19-00A	DPDT	Button	$2.31
E19-00H E19-50H	DPDT DPDT	1½″ Actr. Standard Ratio 1¾″ Actr. High Ratio	2.57 2.57
E19-00J	DPDT	Button, Ferrule Mounting	2.44
E19-00K E19-50K	DPDT DPDT	1⅜″ Roller Actr. Standard Ratio 1⅝″ Roller Actr. High Ratio	2.74 2.74
E19-00M	DPDT	Button, Ferrule Mounting Hi Overtravel	2.70
E19-00R	DPDT	Button, Reset	3.39
E20-00A	DPDT	Button	3.42
E20-00H E20-50H	DPDT DPDT	27/32″ Actr. Standard Ratio 1 3/32″ Actr. High Ratio	3.68 3.68
E20-00J	DPDT	Button, Ferrule Mounting	3.55
E20-00K E20-50K	DPDT DPDT	11/16″ Roller Actr. Standard Ratio 15/16 Roller Actr. High Ratio	3.85 3.85

ENCLOSED-SINGLE THROW SNAP ACTION SWITCHES

SERIES E10
SERIES E15
SERIES E16
SERIES E18



A single pole, single throw switch with light force and large overtravel. Solderable QC ¼″ terminals. Switch body: 1⅛″ x 47/64″ x 7/16″.

E10-00M—NC, 10 AMPS., ⅓ H.P., 125 VAC—5 AMPS., 250 VAC
E15-00M—NC, 6 AMPS., 125 VAC—3 AMPS., 250 VAC
E16-00M—NO, 2 AMPS., 125 VAC—1 AMP., 250 VAC
E18-00M—NO, 3¼ AMPS., 125 VAC

Part No.	Circuitry	Price	Part No.	Circuitry	Price
E10-00M	SPST-NC	$1.40	E16-00M	SPST NO	$1.40
E15-00M	SPST NC	1.40	E18-00M	SPST NO	1.40

CHERRY ELECTRICAL PRODUCTS CORP.
DEPT. EM / 3600 SUNSET AVENUE / WAUKEGAN, ILLINOIS 60085
(312) 689-7700 /TWX (910) 235-1572 / CABLE: CHERRY, WAUKEGAN

LOW TORQUE SNAP ACTION SWITCHES

SERIES E51

SWITCH BODY: 1-7/32″ x 17/32″ x 11/16″
RATING: E51—5 amps., 125/250 VAC
Und. Lab. Inc. listed, and CSA approved

- **Long Life Coil Spring Mechanism**
- **Low Torque Rotary Actuation**
- **Clockwise or Counter Clockwise**
- **Rock Wipe Contact Action**
- **Combination Quick Connect & Solder Terminals**
- **Double Rivet Sturdy Case Construction**

E51-00B

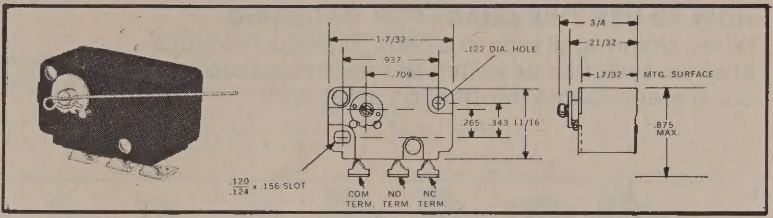
E51-00E

E51-50B

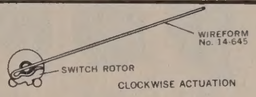
E51 50E

E51-60B

E51-60E



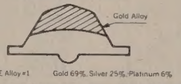
ACTUATORS—Wireform actuators are supplied unassembled for each E51 switch. Wireforms may be readily assembled to switch rotor as illustrated below.



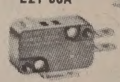
	E51-00B	E51-00R	E51-00E	E51-00T	E51-50B	E51-50R	E51 50E	E51-50T	E51-60B	E51-60R	E51-60E	E51-60T
DIRECTION OF ACTUATOR	Clockwise		Counter Clockwise		Clockwise		Counter Clockwise		Clockwise		Counter Clockwise	
TERMINALS	Standard Parallel .205″	.187″	Standard Parallel .205″	.187″	Vertical Twist .205″	.187″	Vertical Twist .205″	.187″	Vertical Straight .205″	.187″	Vertical Straight .205″	.187″
PRICE	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27	$3.27

LOW ENERGY SNAP ACTION SWITCHES
WITH GOLD "CROSSPOINT" CONTACTS

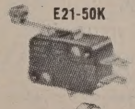
Cherry Gold "Crosspoint" Contact switches are available in a wide variety of switch types and mountings as shown at left. These provide extremely low insertion resistance and long life . . . measured in millions of operations. The contact material is W/E Alloy #1 . . . 69% Gold, 25% Silver, 6% Platinum.

CROSS SECTION OF CONTACT


Electrical Rating:
0.1 Amp.,
125 VAC

E21-00A


E21-50H

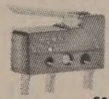
E21-50K


E68-00A

E78-00A

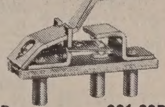
G13-00E

E63-00A


E63-00H

E63-00K

E53-00B

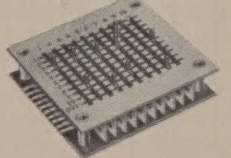

S31-20P

Part No.	Circuitry	Terminal	Description	Price
E21-00A	SPDT	QC	Button	$2.03
E21-20A	SPDT	Solder	Button	2.03
E21-00AX	SPDT	QC	Button, Light Force	2.38
E21-50H	SPDT	QC	$1\frac{13}{32}$″Actuator Standard Ratio	2.22
E21-70H	SPDT	Solder	$1\frac{13}{32}$″Actuator Standard Ratio	2.22
E21-50HX	SPDT	QC	$1\frac{13}{32}$″ Actr. Std. Ratio Light Force	2.57
E21-85HX	SPDT	QC	2.932″ Actr. High Ratio, Light Force	2.63
E21-00K	SPDT	QC	$\frac{13}{16}$″ Roller Actr. Std. Ratio	2.47
E21-50K	SPDT	QC	$1\frac{11}{32}$″ Roller Actr. Std. Ratio	2.47
E21-70K	SPDT	Solder	$1\frac{11}{32}$″ Roller Actr. Std. Ratio	2.47
E21-50KX	SPDT	QC	$1\frac{11}{32}$″ Roller Actr. Std. Ratio, Light Force	2.83
E53-00B	SPDT	QC	Clockwise Actuation	4.24
E53-00E	SPDT	QC	Counter Clockwise Actuation	4.24
E53-00R	SPDT	QC	Clockwise Actuation	4.24
E53-00T	SPDT	QC	Counter Clockwise Actuation	4.24

Part No.	Circuitry	Terminal	Description	Price
E63-00A	SPDT	QC	Button	$2.64
E63-10A	SPDT	Solder	Button	2.64
E63-00H	SPDT	QC	$\frac{9}{32}$″ Actuator Standard Ratio	2.78
E63-10H	SPDT	Solder	$\frac{9}{32}$″ Actuator Standard Ratio	2.78
E63-50H	SPDT	QC	$\frac{13}{32}$″ Actuator High Ratio	2.78
E63-60H	SPDT	Solder	$\frac{13}{32}$″ Actuator High Ratio	2.78
E63-00K	SPDT	QC	$\frac{13}{64}$″ Roller Actr. Std. Ratio	3.02
E63-10K	SPDT	Solder	$\frac{13}{64}$″ Roller Actr. Std. Ratio	3.02
E63-50K	SPDT	QC	$\frac{21}{64}$″ Roller Actr. High Ratio	3.02
E63-60K	SPDT	Solder	$\frac{21}{64}$″ Roller Actr. High Ratio	3.02
E68-00A	SPDT	QC	Basic Momentary Action	2.38
E68-30A	SPDT	QC	Momentary/"Cheat" Interlock	2.79
E78-00A	SPDT	QC	Basic Momentary Action	4.11
G13-00E	SPDT	QC	Button	2.09
S31-20P	SPDT	PC	Open—For PC Board Mounting	2.12

MATRIX TYPE SELECTOR SWITCHES

Manual programming and switching for complex control equipment. Each of two standard types is expandable up to five modules, providing 500 to 1,000 crosspoints. Custom design available up to 2,784 crosspoints.



Electrical Capacity:

1. Make and break 48 volts DC at 0.50 Amp. 125 Volts AC at 0.15 Amp.
2. Current carrying only (no make and break) 2 Amp. AC or DC.

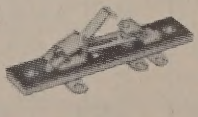
Insertion Resistances:
50 milliohms plus 6 milliohms per inch of printed circuit.
Note: Overall width of basic 10 x 10 and 20 x 10 Selector Switch is 3½ inches. For each 10 sliders added to the basic unit add 3 inches to overall width. A 20 slider unit measures 6½ inches wide; a 30 slider unit measures 9½ inches wide; a 40 slider unit measures 12½ inches wide and a 50 slider unit measures 15½ inches wide.

Switch No.	Circuitry	Price	Switch No.	Circuitry	Price
C10-01A	20 x 10	$ 53.98	C10-20A	10 x 10	$ 38.56
C10-02A	20 x 20	61.66	C10-42A	10 x 20	50.12
C10-03A	20 x 30	92.52	C10-43A	10 x 30	66.31
C10-04A	20 x 40	100.25	C10-44A	10 x 40	84.82
C10-05A	20 x 50	115.65	C10-45A	10 x 50	103.31
			C10-56A	48 x 58	314.58

OPEN TYPE SNAP ACTION SWITCHES

BASIC OPEN
SERIES S23—LIGHT FORCE

SWITCH PANEL: 2⅛″ x $\frac{7}{16}$″ x $\frac{3}{32}$″
RATINGS: 5 amps. 125 VAC



SERIES S25—STANDARD

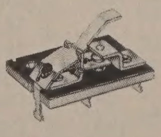
SWITCH PANEL: 2⅛″ x $\frac{7}{16}$″ x $\frac{3}{32}$″
RATINGS: 10 amps., 125 VAC—5 amps. 250 VAC—⅙ HP 125/250 VAC

Part No.	Circuitry	Description	List Price
S23-00T	SPDT	Flat solder	$1.60

Note: To specify 10 amp. S25 series merely change the S23 prefix to S25.

MINIATURE OPEN
SERIES S30

SWITCH PANEL: $1\frac{1}{16}$″ x ¾″ x $\frac{3}{32}$″
RATINGS: 10 Amps., 125 VAC—5 Amps. 250 VAC—1/6 HP 125/250 VAC



Part No.	Circuitry	Description	List Price
S30-00W	SPDT	Int. solder	$1.60

CHERRY®

CHERRY ELECTRICAL PRODUCTS CORP.
DEPT. EM / 3600 SUNSET AVENUE / WAUKEGAN, ILLINOIS 60085
(312) 689-7700 /TWX (910) 235-1572 / CABLE: CHERRY, WAUKEGAN

THUMBWHEEL/LEVERWHEEL

HOW TO USE THIS CHART FOR ORDERING

When ordering standard Cherry Thumbwheel/Leverwheel switches or switch assemblies, please call out the applicable information as at right:

T35J-01 A 3

Series
*Optional Pin Terminations
Code Suffix
Finish**
Number of Switches in Assembly

*J = J-pin terminations
F = F-pin terminations

**A = Gloss finish M = Matte finish

SUFFIX NO.	DESCRIPTION	POSI-TIONS	READ-OUT	T-10 .500W Back Mount Min.	L-10 .500W Back Mount Min.	T-11 .500W Front Mount Min.	L-11 .500W Front Mount Min.
-01	Decimal	10	0-9	$ 5.00	$ 5.50	$ 4.90	$ 5.50
-02	Binary Coded Decimal (BCD)	10	0-9	5.00	5.50	4.90	5.50
-03	16 Position Binary	16	0-15	9.00		9.10	
-04	BCD Plus Complement, 1 Common	10	0-9	8.50	8.40	8.30	8.40
-05	BCD Plus Complement, 2 Commons	10	0-9		10.30		10.30
-06	BCD Plus Odd Parity	10	0-9				
-07	Binary Coded Octal (BCO)	8	0-7	7.50	5.90	7.50	5.90
-08	16 Position Binary Plus Complement, 1 Common	16	0-15	10.00		9.20	
-09	16 Position Binary Plus Complement, 2 Commons	16	0-15	10.00		10.00	
-10	BCD Plus Even Parity	10	0-9		7.70		7.70
-11	Double Pole Decimal	10	0-9	7.85	9.90	7.85	9.90
-12	BCD Complement Only	10	0-9				
-13	16 Position Binary	16	0-9, A-F	9.10		9.10	
-15	BCD With Separate C To Not True Bits	10	0-9	10.00		10.00	
-17	Decimal	8	0-7	6.50	5.80	6.50	5.80
-20	Decimal	12	0-11			5.50	
-45	BCD Make Before Break	10	0-9				
-46	BCD Make Before Break With Diode Provisions	10	0-9				
-47	BCO With Separate C To Not True Bits	8	0-7				
-49	Excess 3 Grey Code Negative	10	0-9				
-50	Excess 3 Grey Code Positive	10	0-9		7.50		
-51	Decimal With Diode Provisions	10	0-9				
-52	BCD With Diode Provisions	10	0-9	6.50		6.50	
-53	16 Position Binary With Diode Provisions	16	0-15	10.50		10.50	
-54	BCD & Complement, 1 Common With Diode Provisions	10	0-9	9.50		9.50	
-57	BCO With Diode Provisions	8	0-7	7.50		6.20	
-60	BCD	12	0-11	9.40		9.50	
-62	9's Complement of BCD	10	0-9				
-63	16 Position Binary With Diode Provisions	16	0-9, A-F	10.50		10.50	
-65	Kelvin-Varley Voltage Divider	10	0-9				
-67	1-2-2-2-2 Resistive Decade	10	0-9				
-68	2 Out Of 5 Code	10	0-9				
-69	Decimal Make Before Break	10	0-9				
-70	Aiken Code 1-2-4-2'	10	0-9				
-71	Aiken Code Modern 1-2-4-2'	10	0-9				
-72	Complement of 9's Complement With Diode Provisions	10	0-9				
-77	BCO Complement Only	8	0-7				
-78	Decimal With Common In Middle	10	0-9				
-84	Double Pole Repeating	2	−, +				
-85	Double Pole Repeating	2	0-1				
-86	Double Pole Repeating	2	0-5				
-88	16 Position Binary & Complement, 1 Common	16	0-9, A-F	9.75		9.20	
-89	16 Position Binary & Complement, 2 Commons	16	0-9, A-F	11.25		11.25	
-90	7 Bar Indicator	10	A-G				
-92	Double Pole Repeating	2	0-1				
-93	Double Pole Repeating	2	0-5				
-94	Single Pole Repeating	2	−, +	4.90	5.40	4.90	5.40
-95	Single Pole Repeating	2	0-1	4.90	5.40	4.90	5.40
-96	Single Pole Repeating	2	0-5	4.90	5.40	4.90	5.40
-97	Double Pole Repeating	2	+, −				
-98	Decimal Make Before Break	16	0-15				

CHERRY

CHERRY ELECTRICAL PRODUCTS CORP.
DEPT. EM / 3600 SUNSET AVENUE / WAUKEGAN, ILLINOIS 60085
(312) 689-7700 /TWX (910) 235-1572 / CABLE: CHERRY, WAUKEGAN

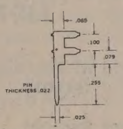
COMPLETE PRODUCT LISTING

The example at left calls out a **T-35 Series** back-mount Thumbwheel, with **J-pin terminations, 10 position decimal** code, **black gloss finish,** in a **three switch assembly.**

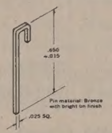
AVAILABLE PC BOARD TERMINATIONS

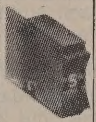
All PC boards have a .040″ diameter hole to accommodate a wire for each output. Pin terminations for mother-board insertion or for wire-wrap capabilities can be applied upon request. Two types of pin terminations are available:

P SERIES



J SERIES



 T-20 .500W Back Mount Submin.	 **L-20** .500W Back Mount Submin.	 **T-24** .500W Dust-proof Submin.	 **T-35** .350W Narrow Back Mount	 **T-38** .350W Dstprf. Narrow Bk. Mt.	 **T-50** .315W Back Mount Submin.	 **T-54** .315W Circuit Bd. Mt. Submin.	 **T-63** .315W Back Mount	 **T-64** .315W Circuit Board Mount	 **T-65** .315W Front Mount	 **T-71** .315W Integral Bezel Ft. Mt.	 **T-72** .787W Ft. Mt. Wide Window	 **T-75** .394W Front Mount	**SUFFIX NO.**
$ 4.30	$ 5.40	$ 7.50	$ 3.00	$ 4.00	$ 3.80	$ 2.50	$ 3.00	$ 2.00	$ 3.00	$ 3.00	$ 5.00	$ 3.00	-01
4.30	5.40	7.00	3.00	4.00	3.80	2.50	3.00	2.00	3.00	3.00	5.00	3.00	-02
7.00					5.50	2.50	5.50	2.50	5.50		7.50	5.50	-03
6.00	6.50	11.10	4.10	5.10	4.70	3.00	4.00	2.00	4.00	4.00	6.00	4.00	-04
													-05
6.75	6.60						5.00	2.00	5.00	5.00	7.00	5.00	-06
4.50	5.40	7.00	3.50	4.50	4.30	3.00	3.50	2.00	3.50	3.50	5.50	3.50	-07
8.10								2.50					-08
9.00								2.50					-09
5.60	6.60						5.00	2.00	5.00	5.00	7.00	5.00	-10
5.75	9.90						4.50	2.50	4.50	4.50	6.50	4.50	-11
5.00	5.90	7.00	4.00	4.50	4.90	2.00	4.00	2.00	4.00	4.00	6.00	4.00	-12
7.00					5.50	2.50	5.50	2.50	5.50		7.50	5.50	-13
6.85	9.20												-15
4.30	5.40	10.50	3.50	4.50	4.30	2.00	3.25	2.00	3.25	3.25	5.25	3.25	-17
4.30	5.40						3.00	2.00	3.00		5.00	3.00	-20
4.30							3.00	2.00	3.00	3.00	5.00	3.00	-45
							4.00	2.00	4.00	4.00	6.00	4.00	-46
5.85	9.20												-47
							5.00	2.50	5.00	5.00	7.00	5.00	-49
							5.00	2.50	5.00	5.00	7.00	5.00	-50
							4.00	2.00	4.00	4.00	6.00	4.00	-51
5.40	6.50				4.50	2.00	4.00	2.00	4.00	4.00	6.00	4.00	-52
7.00								2.50					-53
7.00	7.60												-54
5.40	6.50				5.00	2.00	4.50	2.00	4.50	4.50	6.50	4.50	-57
4.30	5.40				4.30	2.00	6.00	2.00	6.00		8.00	6.00	-60
4.75	5.40												-62
7.25							5.00	2.50	5.00	5.00	7.00	5.00	-63
6.50	10.30												-65
6.50	9.70												-67
6.50	7.60						5.00	2.50	5.00	5.00	7.00	5.00	-68
4.75	5.40						3.00	2.00	3.00	3.00	5.00	3.00	-69
							5.00	2.50	5.00	5.00	7.00	5.00	-70
							5.00	2.50	5.00	5.00	7.00	5.00	-71
6.50	7.60												-72
4.90	5.90	7.00	4.50	5.00			4.00	2.00	4.00	4.00	6.00	4.00	-77
4.30	5.40												-78
4.30	5.80												-84
4.30	5.80												-85
4.30	5.80												-86
8.10													-88
9.30													-89
							5.50	2.50	5.50	5.50	7.50	5.50	-90
							4.50	2.50	4.50	4.50	6.50	4.50	-92
							4.50	2.50	4.50	4.50	6.50	450	-93
4.30	5.40	6.00	3.00	4.00	4.30	2.50	3.50	2.00	3.50	3.50	5.50	3.50	-94
4.30	5.40	6.00	3.00	4.00	4.30	2.50	3.50	2.00	3.50	3.50	5.50	3.50	-95
4.30	5.40	6.00	3.00	4.00	4.30	2.50	3.50	2.00	3.50	3.50	5.50	3.50	-96
							4.50	2.50	4.50	4.50	6.50	4.50	-97
8.10													-98

CHERRY

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DEPT. EM / 3600 SUNSET AVENUE / WAUKEGAN, ILLINOIS 60085
(312) 689-7700 /TWX (910) 235-1572 / CABLE: CHERRY, WAUKEGAN

THUMBWHEEL SWITCHES

LIST PRICE ADDED FOR OPTIONS AND SPECIAL FEATURES

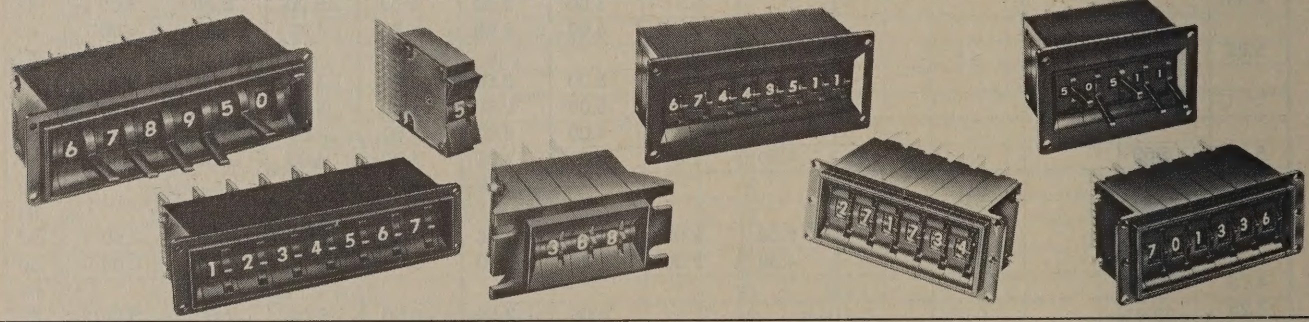
1. Stop pins (to limit wheel rotation), when installed at factory	$0.50/switch
2. Matte Finish (per switch)	0.30/switch
3. Spacers (all sizes: blank, gloss or matte)	0.50 each
4. Imprinting on switch or spacer (see 10)	0.50 each
5. Component installation (excluding component cost)	0.20 comp.
6. Pin terminals on Circuit Board	Consult Factory
7. End caps	0.70/set
8. Assembly hardware (charged only when shipped unassembled):	
T20, L20, T24, T35, T38, T50, T51, T63, T65, T72, T75	0.30/set
T10, T11, L10, L11	0.50/set
9. Assembly of switches (price includes hardware but not endcaps):	
First switch in each assembly	$ 0.50/switch
Each additional switch	0.30/switch
Maximum	3.00 asembly
10. Special wheel imprinting, Setup Charge	25.00 per order
11. Nonstandard hot stamp type face,) one time tooling charge	5.00/character 15.00/minimum
12. Function switch double width	Consult Factory
Add $2.50 to list price of standard code listing in available series	2.50/switch
13. Special color wheel imprinting	0.25/switch
Setup	25.00
14. Colored switches or wheels	Consult Factory
15. Nonstandard Circuit Board codes or configurations	Consult Factory

COMPUTATION OF ASSEMBLY PRICE

(Items may be purchased individually)

1. Add the list price for each switch plus the options.
2. Add the spacer and end cap list price.
3. Add the assembly charge (see item 9 at right).
4. Compute the total number of individual switches to be purchased and refer to the discount schedule for the correct multiplier.
5. Multiply the assembly list price (from 1, 2 and 3 above) by the multiplier (4) to arrive at the discounted assembly price.

SOME TYPICAL ASSEMBLIES COMPLETE WITH END CAPS

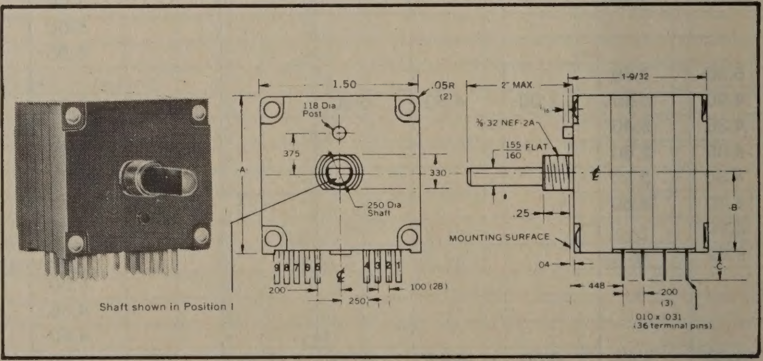


ROTOCODE®

THE NEW ROTARY SWITCH WITH CODED ELECTRICAL OUTPUT

A rotary shaft drives one or more PC board discs whose concentric traces rotate past stationary contact wipers of precious metal. Pin terminals on .100″ centers solder directly to your PC board.

The PC discs may be used on one or both sides. Each side provides a 7-bit code plus common and replaces the function of a multi-deck rotary switch.



SWITCH CHARACTERISTICS:

Operating Torque: 5 to 25 inch ounces
Contact Resistance: Initial 0.10 ohms max.
Insulation Resistance: 1000 megohms
Dielectric Strength: 500 VAC min.
Current Carrying Capacity: 1 amp.
Current Switching: 125 milliamps, 28 VDC
Life: Min. 1,000,000 detent operations. Consult Factory for 125 VAC
Temperature: −65°C to +85°C (altitude not exceeding 70,000 ft.)

MATERIALS:

Case, End Bearing, Shaft, Contact Modules: Thermoplastic
Terminals: Pre-plated for Solderability
Contact (Wipers): Precious Metal
Printed Circuit Discs: G10 Glass-Filled Epoxy PC Board with Precious Metal Circuitry

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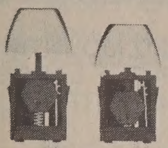
KEYBOARD SWITCHES

LOW PROFILE KEYBOARD SWITCHES WITH GOLD "CROSSPOINT" CONTACTS



MECHANICAL

Operating Force ...... 2½ oz. ± ½ oz. Std. (Also available with 6 oz. Operating Force
Pretravel .... .085 ± .030 Std. (Alternate action version pretravel .030 ± .055)
Total Travel .... .160 ± .020 Std.

ELECTRICAL

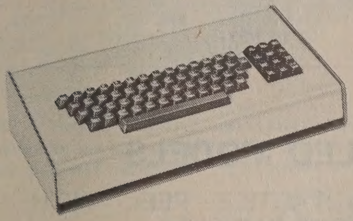
Contact Rating (Form A contacts)
DC Resistive ....3W max.
AC Resistive ....3VA max.
Current ....0.125 amp. max. switching
0.5 amp. max. carry
Voltage ....28V max.
Initial Contact Resistance ....200 milliohms max.
(typically 25 milliohms)

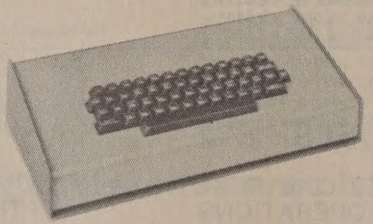
This proven design concept (crossed knife edge contact configuration) provides high force per unit of contact area, and virtually eliminates contact closure interference by contaminates. Contacts are normally held apart for greater shock resistance. No microphonics or bounce during turn-off or at rest. Three types with straight or angled stems for sloped or stepped keyboards.

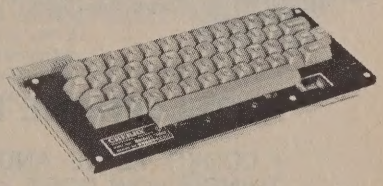
Part No.	Contacts	Operating Force (oz.)	Stem Angle	Stem Design	Price
M51-0101	A	6	Str.	Plain	$1.40
M51-0106	A	3	Str.	Plain	1.40
M61-0100	A	2½	Str.	Plain	1.40
M61-0110	A	2½	10	Plain	1.40
M61-0120	A	2½	Str.	T	1.40
M61-0800	A (Alt.)	2½	Str.	Plain	2.23
M62-0100	A+A	2½	Str.	Plain	1.97
M62-0900	A+B	3½	Str.	Plain	2.17
M41-0100▲▲	A	(Lighted)	Str.	Plain	2.37

▲▲Does not include lamp. Uses standard industry size T-1 Bi-Pin bulb.

KEYBOARDS







STANDARD KEYBOARDS SPECIFICATIONS CHART

Cherry Part No.	Key Legend Format Similar to	No. of Keys	Sloped or Stepped	Housing	Code	No. of Modes	Strobe Goes	Logic	Price
B70-4753	ASR-33	53	SL	NO	SPECIAL	4	HIGH	POS	$105.00
B70-54AA	ASR-33	53	SL	YES	SPECIAL	4	HIGH	POS	160.00
B70-60AA	ASR-33	53	ST	NO	SPECIAL	4	HIGH	POS	105.00
B70-61AA	ASR-33	53	ST	YES	SPECIAL	4	HIGH	POS	160.00
B80-3766	ASCII TRI-MODE	66	SL	NO	ASCII	3	LOW	NEG	110.00
B80-31AA	ASCII TRI-MODE	66	SL	YES	ASCII	3	LOW	NEG	165.00
B80-48AA	ASCII TRI-MODE	66	ST	NO	ASCII	3	LOW	NEG	110.00
B80-49AA	ASCII TRI-MODE	66	ST	YES	ASCII	3	LOW	NEG	165.00
B80-65AA	ASCII TRI-MODE	67	SL	NO	ASCII	3	LOW	NEG	115.00
B65-1712	3 x 4	12	SL	NO	NONE	—	—	—	31.00
B65-1716	3 x 4	16	SL	NO	NONE	—	—	—	37.00

B99-74AB Telephone Format Keycap Kit
This kit adheres closely to telephone format with the following exceptions: Operator is not above the O and caps at lower left and right are blank. There are an additional 4 blank 1 x 1 caps, 2 blank 1 x 2 caps and 2 blank 1 x 1½ caps. These are two-shot molded Keycaps styled in Helvetica. The color is black body with white legend. $6.04

B99-75AB
Same as B99-74AB except color is white body with black legend. $6.04

B99-76AB Hexidecimal Keycap Kit
Kit consists of 1 thru 0 and A thru F plus 4 blank 1 x 1 caps, 2 blank 1 x 2 caps and 2 blank 1 x 1½ caps. These are two-shot molded Keycaps styled in Trade Gothic Bold. Color is black body with white legend. $7.06

B99-77AB
Same as B99-76AB except color is white with black legend $7.06

B99-65AB
This kit consists of Alphabet and Punctuation (1 x 1), 4 blanks (1 x 1½), 2 shift caps and 1 lock cap both 1 x 1½. 2 shift keys with hardware. 4 shift springs (all different). 1 x 8 spacebar with hardware. These are two-shot molded Keycaps styled in Helvetica. Color is white body with black legend. $22.62

B99-66AB
Same as above except color is black body with white legend. $22.62

B99-05AC
Relegendable 1 x 1 Keycap. Kit consists of 1-pc. 038-7226 white base and 1-pc. 028-7236 transparent cover. $.45

B99-06AC
Relegendable 1 x 2 Keycap. Kit consists of 1-pc. 028-7211 transparent cover.

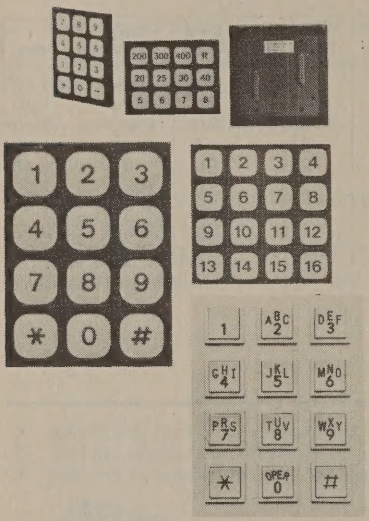
Individual caps A thru Z and 0 thru 9 available in both black body, white legend and white body, black legend. These are two-shot molded Keycaps styled in Helvetica. $.60

CHOMERICS KEYBOARDS

77 DRAGON COURT, WOBURN, MA
TEL: (617) 935-4850 • TWX: 710-393-0173

QUICKEY™ FLAT OR TACTILE MODELS

• MORE THAN 10M OPERATIONS • LOW PROFILE • SIMPLE CONCEALED MOUNTING • VERY LOW COST • DUST AND MOISTURE RESISTANT • PIN TERMINAL OUTPUT • LARGE ARRAYS POSSIBLE FROM STD UNITS • 8 MODELS WITH BELL COMPATIBLE TONE OUTPUT



STANDARD EF MODELS—.005″ Key Travel		STANDARD ER MODELS—.035″ Key Travel				
MODEL # ½″ CENTERS	**MODEL # ¾″ CENTERS**	**MODEL # ½″ CENTERS**	**MODEL # ¾″ CENTERS**	**FORMAT**	**ENCODING**	**NO. OF KEYS**
EF21280	EF20467	ER21622	ER21605	TOUCH TONE	SINGLE POLE	12
EF21289	EF20071	ER21623	ER21606	TOUCH TONE	MATRIX	12
	EF20070		ER21607	CALCULATOR	SINGLE POLE	12
	EF21314		ER21782	BLANK	SINGLE POLE	12
EF21261	EF20597	ER21625	ER21609	CALCULATOR	SINGLE POLE	16
	EF20092		ER21610	TOUCH TONE	SINGLE POLE	16
EF22090	EF20458	ER22092	ER21611	TOUCH TONE	MATRIX	16
EF22641	EF22495	ER22476	ER22496	HEXADECIMAL	SINGLE POLE	16
	EF22278		ER21783	BLANK	SINGLE POLE	16

STANDARD CF MODELS—.005″ Key Travel		STANDARD CR MODELS—.035″ Key Travel				
CF22882	CF22884	CR22886	CR22888	TOUCH TONE	MK5086N	12
CF22883	CF22885	CR22887	CR22889	TOUCH TONE	MK5086N	16
DIMENSIONS ½″ CENTERS 12 KEY—2.080″ x 1.580″ 16 KEY—2.080″ x 2.080″				**¾″ CENTERS** 12 KEY—3.000″ x 2.250″ 16 KEY—3.000″ x 3.000″		

TELEPHONE MODELS

• LOOKS, FEELS AND ACTS LIKE REAL THING • LOW COST <10M OPERATIONS

MODEL NO.	ENCODING	NO. PINS
ET22736	SINGLE POLE	13
ET22770	Touch Tone 2 Commons	9
ET22771	Touch Tone 1 Common	8
ET22772	Touch Tone No Common	7
CT22890	MK5086N	5
Dimensions—3.000″ x 2.250″ all models		

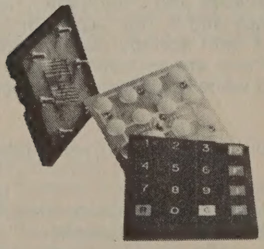
SEALED MODELS

• COMBINES TACTILE FEEL WITH WEATHER PROOF PACKAGE

MODEL NO.	FORMAT	ENCODING	NO. OF KEYS
EC21606	Touch Tone	Touch Tone	12
EC21611	Touch Tone	Touch Tone	16
EC21609	Calculator	Single Pole	16
EC22496	Scale	Single Pole	16
EC21605	Touch Tone	Single Pole	12

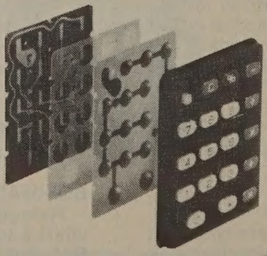
MANY SPECIAL KEYBOARDS AVAILABLE!

MILITARY VERSIONS



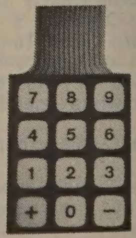
Combines Chomerics Bubble Key with MIL PC Board and Rubber Boot Type Keytops Meets MIL STDS 202, 810 and P-11268. Ask for EM Data.

DISCRETE KEY MODELS



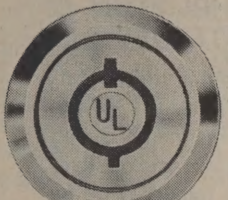
Combine Single or 2-Shot Key Tops with Chomerics Bubble Technology. Lowest Cost Discrete Key Assemblies. Ask for EK Data.

KEYBOARD COMPONENTS



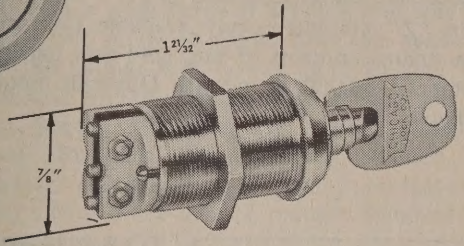
KCS Provides Lowest Possible Cost for Springs, Switches, Coding and Terminal Strip in a One Piece Assembly for your Housing and Keytops.

Maximum Security Switch Locks for every application!



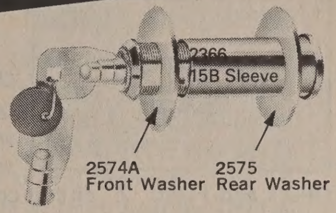
ACE Switch Locks

4900 Series **Ace Locks**
Underwriter's Listed **20 tumblers**

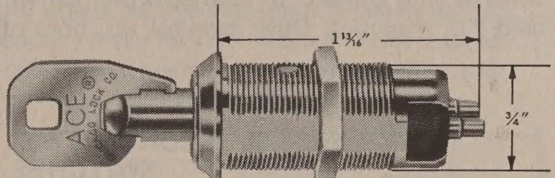


No. 4902 — SPDT switch lock. Hardened steel cylinder mounted in a brass barrel 7/8" diameter; solder terminals, polished chrome finish. Furnished with micro-switch No. 11SM1.

No. 4901—(not shown) Same specs as 4902, except with adjustable sleeve and washers. Adjustable 1-7/8" to 3-3/4" thickness.

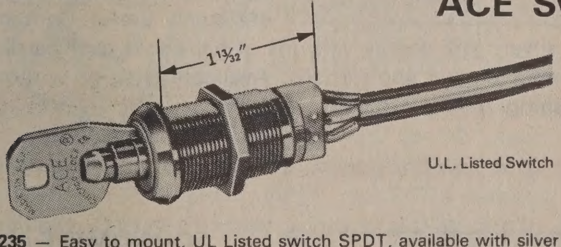


No. 3039—SPST switch with adjustable sleeve and washers; dependable wiping contacts. Solder terminals. Lock all brass construction, polished chrome finish. Key removable "off," "on" or "off-on." Also available in die cast outer barrel.



No. 4073—Maintaining contact switch. Key removable "off," "on" or "off-on". Also available as 4073-70 with momentary contact switch. All brass construction. Also offered with die cast outer barrel. No. 2274-80 same as 4073 except with double bitted lock.

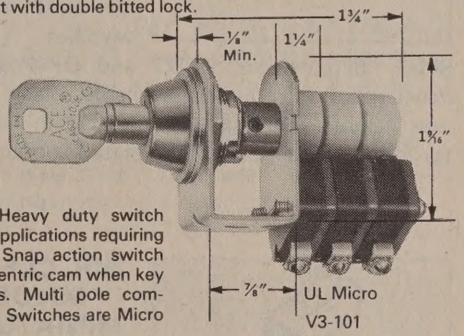
ACE Switch Locks



U.L. Listed Switch

No. 4235 — Easy to mount, UL Listed switch SPDT, available with silver plated contacts and 10" wire leads. Offered without 10" leads at reduced cost. Furnished with micro-switch 1SX1-H58.

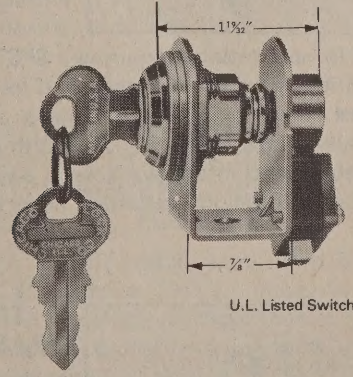
U.L. Listed Switch



No. EXA-112-3—Heavy duty switch lock designed for applications requiring UL Listed switch. Snap action switch actuated by an eccentric cam when key turned 90 degrees. Multi pole combinations available. Switches are Micro No. V3-101.

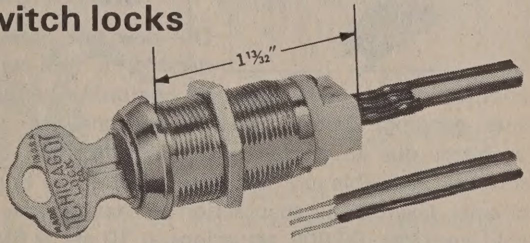
UL Micro
V3-101

Chicago double bitted switch locks



No. EXD-98
Same as EXA-112, except with double bitted cylinder. Designed for high current applications. Multiple pole combinations available. Furnished with micro-switch V3-101.

U.L. Listed Switch



No. 3535 — UL Listed switch, SPDT. Furnished with silver plated contacts and 10" wire leads. Same as 4235 except has double bitted cylinder. Available without 10" leads at reduced cost. Furnished with micro-switch 1SX1-H58.

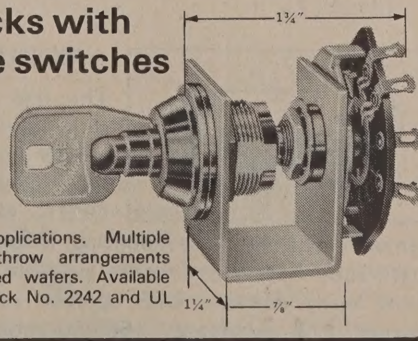
Current Ratings	**Lock Numbers**
*125-250VAC, 5 AMP; 30 VDC, 3 AMP	4901, 4902
*125-250VAC, 7 AMP; 28 VDC, 7 AMP	3535, 4235
110-120VAC, 10 AMP; 10 VDC, 10 AMP	2174, 2174-70, 3039, 4073, 4073-70
125 VDC, ½ AMP	EXD-98, EXA-112†
125-250 VAC, 10 AMP	EXD-98-25
125-250 VAC — Over 10 AMP	EXD-112-25

†When ordering, specify if for appliances requiring T.V. approved switches. Only available on EXD-98 or EXA-112 series.

CURRENT RATINGS for 4188, 2242 and 4903	**Voltage**	**AC amps Resistive**	**DC amps Resistive**
	6V	5.5	5.5
	12V	3.5	3.5
	24V	1.75	1.55
	48V	.8	.65
	115V	.23	.21

***Silver plated contacts.**
Also suited for low energy circuits.

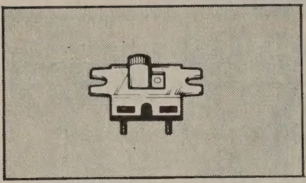
Switch locks with wafer type switches



No. 4188 — Key operated with bracket mounting and Ace cylinder. Switch designed for low voltage applications. Multiple poles and various throw arrangements available with stacked wafers. Available with double bitted lock No. 2242 and UL lock 4903.

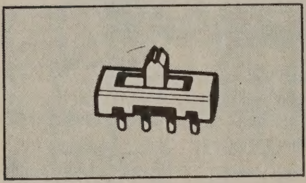
CHICAGO LOCK CO.

4311 West Belmont Ave., Chicago, Illinois 60641
Phone 312 282 7177



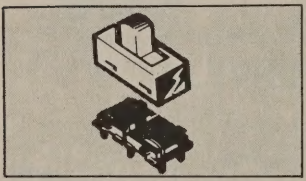
MINI MIKE SLIDE SWITCHES

Our standard line of high quality miniature slide and snap action switches. Available in SPST, SPDT, DPDT and Form Z" circuit configurations. Low energy switches with contacts of hard gold over barrier. Standard P.C. mounting. Other terminal variations offered.



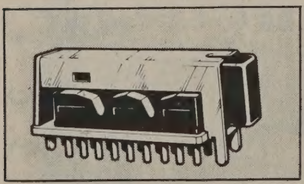
ECONOMITE SLIDE SWITCHES

Save on cost without sacrificing quality. Our line of low cost miniature slide switches, available in SPDT SP3Position, DPDT and DP4Position circuits. Panel and P.C. mounting available. Black button in various heights. Nominal rating — 300 milliamps 125VAC for 10,000 actuations. Silver plated contacts.



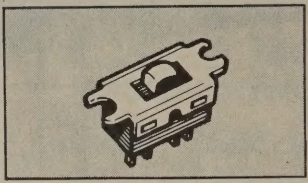
MR. CLEAN WAVE SOLDERABLE MINIATURE SLIDE SWITCHES

Our new line of wave solderable, anti-contamination, miniature slide switches. Features a unique (patents pending) 2-piece assembly designed to alleviate problems due to contamination by flux and cleaning solvents. Available in SPST, SPDT, DPDT and Form "Z" circuits. Over center snap action mechanism, low energy gold contacts, 50.000 actuations at 10 ma @ 6VDC resistive End of Life Criteria: 100 milliohms. Now available with stand off bases.



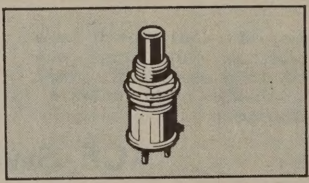
MODULE SERIES

This line of subminiature slide switches offers a greater number of switching capabilities. SPDT, DPDT, 4PDT and 6PDT circuitry options. P.C. mounting. Momentary and alternate action actuation modes available. Silver contacts. Low energy versions with contacts of hard gold over barrier. Life expectancy 150,000 actuations for SPDT and DPDT versions. 4PDT and 6PDT life expectancy of 10 000 actuations; 250,000 actuations for low energy models.



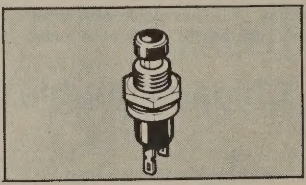
TAPIT KEYBOARD PUSHBUTTON SWITCHES

A 4 terminal momentary printed circuit switch. SPST — normally closed, Form "Z" alternate circuits available. Contacts of silver. Low energy contacts of hard gold over barrier. Life expectancy: 10,000 actuations. Optional mounting tabs available.



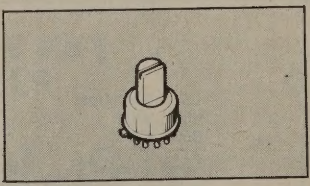
TO-5 PUSHBUTTON SPASAVER SWITCH

Where space is a consideration, this SPST normally open, momentary switch is extremely useful. Contacts of silver, low energy versions of hard gold over barrier. Printed circuit applications. Available with or without bushing.



ECONOMITE MINIATURE PUSHBUTTON SWITCHES

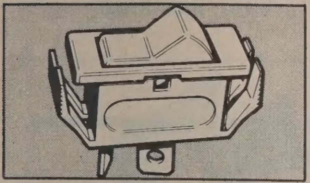
Attractive miniature pushbutton switches, ideal for use in applications requiring a SPST momentary action circuit. Where space, weight and low cost are of importance these switches offer many advantages. Contacts of silver. Low energy versions with gold contacts. These reliable switches are available in a variety of pushbutton colors and include necessary panel mounting hardware.



TO-5 ROTARY SPASAVER SWITCH

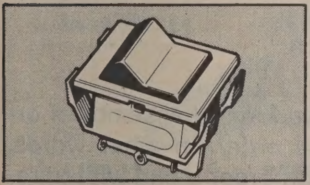
This wave solderable subminiature rotary switch gets up to 8 positions into a TO-5 can. The compact size offers a distinct advantage, in view of the increasing cost of P.C. board real estate and the premium on front or rear panel space. P.C., panel and board socket mounting with optional bushing. Actuator moves through 360 degrees in detented steps of 45 degrees. Available with stops as required from 2 to 8 positions. Low energy contacts of hard gold over barrier. Also available in DPDT circuitry. Life expectancy: 10,000 actuations.

CHICAGO SWITCH, INC. / 1714 N. DAMEN AVE. / CHICAGO, ILL. 60647 / (312) 489-5500



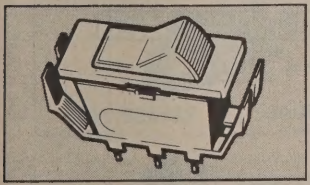
26 SERIES SINGLE POLE ROCKER AND PADDLE SWITCHES

Variety enhances the desirability of these switches. Modern styling with a wide range of actuator and case color choices. Solder, screw or slip-on terminals available. U.L. and CSA listings, with ratings up to 10 amps. SPST. SPDT circuits available. Matching panel lights and lighted versions. Special colors, hot stamping and metal bezels optional. Standard silver-cadmium contacts. Heavy duty versions available. Two switches in one case or a switch plus a lens in one case on request. Standard snap-in panel mounting.



27 SERIES DOUBLE POLE ROCKER AND PADDLE SWITCHES

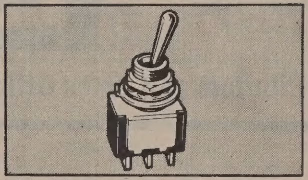
U.L. and CSA listings with ratings up to 10 amps. Compact switches with attractive styling and easy snap-in installation. SPST, SPDT, DPST, and DPDT versions are available. Choice of solder, screw or slip-on terminals. Switches come in a variety of case and actuator colors. Special colors, hot stamping and metal bezels are available on request. Standard silver-cadmium contacts. Lighted versions and matching panel lights are also offered.



38 SERIES DOUBLE POLE ROCKER — SINGLE POLE SIZE

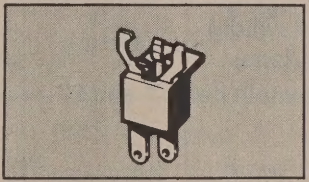
This switch, U.L. listed 6 amps at 125VAC inductive is a DPDT rocker switch in a package no larger than our single pole package. Features modern styling with a snap-in installation. Available in versions of SPST, SPDT, DPST, and DPDT. Solder or slip-on terminals. Heavy duty, low energy and dry circuit versions offered. Black, white, grey color combinations. Matching panel lights and lighted single pole versions available. Special colors, hot stamping and metal bezels optional. Low cost, high quality.

CALL OR SEND FOR OUR INFORMATIVE 24 PAGE CATALOG WHICH INCLUDES PHOTOS, LINE DRAWINGS, SPECIFICATIONS AND ORDERING INFORMATION ON OUR COMPLETE LINE OF SWITCHES AND INDICATORS.



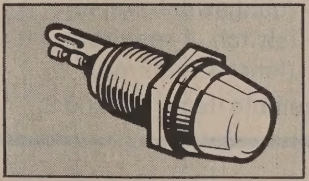
MINIATURE TOGGLE SWITCHES

Small switches, big in quality and long life. U.L. listed at 5 amps inductive 120VAC. SPDT and DPDT circuits available with solder or P.C. terminals. Life expectancy: 100,000 actuations at rated load for ON-ON versions. All others, 40,000 actuations. Panel or printed circuit mounting make for easy installation where speed, size and cost are at a premium. Includes mounting hardware. Other versions available on request.



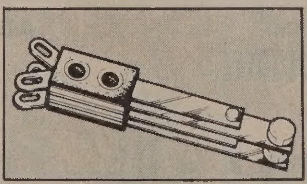
KLIPSOCKET

For all T-1 ¾ Midget Flange Based Incandescent and Neon Lamps. Bulb engages with nickel - silver contact/terminals which are molded in the glass filled nylon base. Terminals are designed for soldering or slip-on connectors.



PANEL INDICATOR LIGHTS

Three series of panel indicators to satisfy your lighting requirements. Long life and high brilliance Neon and incandescent versions available. Relampable indicators to fit T-1 ¾ midget flange based lamps. Wide range of color, terminal and lens choices offered. Nylon body mounts, snap-in, snap-out lenses. U.L. listed versions. Watertight models. Chrome bezel option.



LEAF SWITCHES

Low cost, long life leaf switching, custom designed to fit your application without costly tooling or special designing. Because of our engineering, production, design facilities, and tooling versatility, you can get the exact switch to meet your requirements. Wide variety of actuators, contacts, lifters and blades.

CHICAGO SWITCH, INC. / 1714 N. DAMEN AVE. / CHICAGO, ILL. 60647 / (312) 489-5500

CLARE-PENDAR

CLARE-PENDAR
a GENERAL INSTRUMENT CO.
3101 W. Pratt Ave., Chicago, Ill. 60645
(312) 262-7700

Distributors and Sales Offices Located in Major Cities

HOW TO ORDER

Individual parts are ordered by their respective part numbers from the appropriate pages in this catalog. These part numbers include descriptive information, such as contact arrangement or lens size and color. Whenever parts are to be assembled prior to shipment, the following format is to be used:

Switch and Lens Assemblies

Item 1:	S18011	(switch)
Item 2:	C1480AWW	(lens)

Note on purchase order "Assemble items 1 and 2"

Adapter Assemblies

Item 1:	A131	(adapter)
Item 2:	S18011	(switch)
Item 3:	C1480AWW	(lens)

Note on purchase order "Assemble items 1, 2 and 3."

Gangswitch Assemblies

Item 1:	G16704AH6J1	(gangswitch frame)
Item 2:	S18011	(switch, 4 required)
Item 3:	C1410AWW	(lens, 4 required)

Note on purchase order "Assemble items 1, 2 and 3."

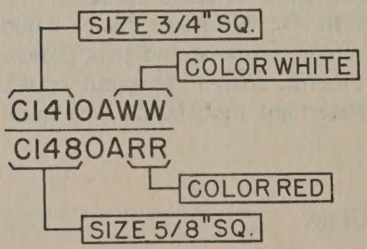
The sequence used in the examples given above should be followed in all cases (switch/lens, adapter/switch/lens or gangswitch frame/switches/lenses).

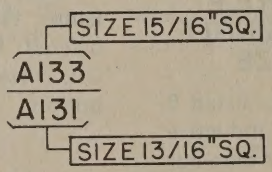
If a purchase order were to include the three assemblies listed above, it would have eight line items. The purchase order would then require three footnotes:

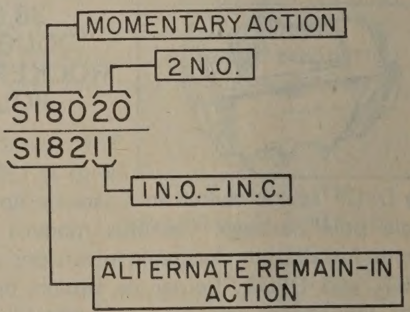
"Assemble items 1 and 2."
"Assemble items 3, 4 and 5."
"Assemble items 6, 7 and 8."

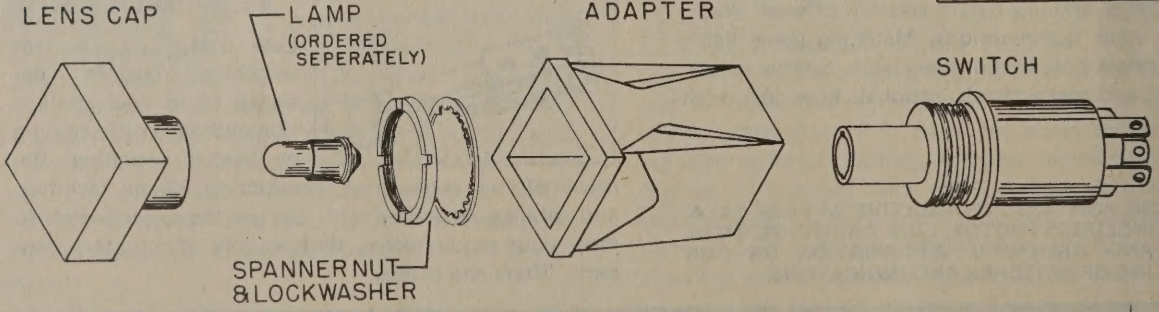
This pattern must be followed for all assemblies ordered on a given purchase order. In other words, assemblies can appear on an order along with unrelated piece parts, but the items used in the assembly must appear in the sequence as illustrated. The footnote guarantees that the units will be shipped as an assembly.

If a lamp is required, it would be ordered as the final item to be included in the assembly. Most Distributors chose to order lamps separately.

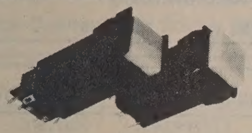
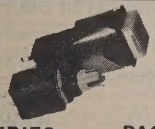
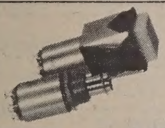
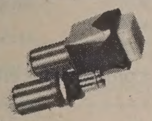
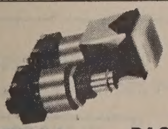
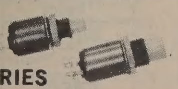

SIZE 3/4" SQ.
COLOR WHITE
C1410AWW
C1480ARR
COLOR RED
SIZE 5/8" SQ.

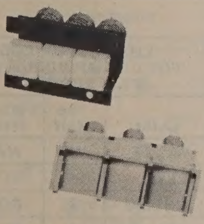

SIZE 15/16" SQ.
A133
A131
SIZE 13/16" SQ.


MOMENTARY ACTION
2 N.O.
S18020
S18211
1 N.O. – 1 N.C.
ALTERNATE REMAIN-IN ACTION


LENS CAP
LAMP (ORDERED SEPERATELY)
ADAPTER
SWITCH
SPANNER NUT & LOCKWASHER

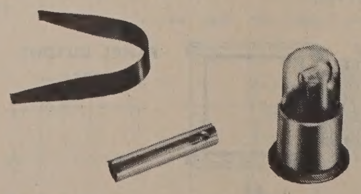
CLARE-PENDAR SWITCHLIGHTS

PRODUCT	SWITCH ACTION	CIRCUITS	CONTACT RATING 28 VDC/125 VAC RESISTIVE LOAD	BALL PARK PRICE	DESCRIPTION
 (MONOFORM) **S410 SERIES** **PAGE 4006**	INDICATOR			$ 4.00	COMMERCIAL SWITCHLIGHT FRONT PANEL SNAP-IN SINGLE OR DUAL LIGHT AND SPLIT SCREENS.
	MOMENTARY OR ALTERNATE	2 N.O. —OR— 1 N.O. & 1 N.C.	2 AMPERES		
	MOMENTARY OR ALTERNATE (REMAIN-IN)	2 FORM C	10 AMPERES		
 **S190 SERIES** **PAGE 4007**	INDICATOR			$ 3.00	COMMERCIAL SWITCHLIGHT FRONT PANEL SNAP-IN OR REAR MOUNTABLE. CHOICE OF LENS SHAPES AND SIZES.
	MOMENTARY OR ALTERNATE	2 FORM C	2 AMPERES		
S490 SERIES **PAGE 4012**	INDICATOR			$ 5.00	LOW PROFILE ECONOMICAL SWITCHLIGHT.
	MOMENTARY	2 N.O. —OR— 1 N.O. & 1 N.C.	1 AMPERE		
S180 SERIES **PAGE 4008**	MOMENTARY OR ALTERNATE (REMAIN-IN)	2 N.O. —OR— 1 N.O. & 1 N.C.	2 AMPERES	$ 7.00	MOST COMMONLY USED POPULAR SWITCHLIGHT.
 **S220 SERIES** **PAGE 4009**	MOMENTARY OR ALTERNATE (REMAIN-IN)	6 N.O. —OR— 3 N.O. & 3 N.C.	2 AMPERES	$11.00	MULTI-CIRCUIT. (6 INDEPENDENT CIRCUITS) SWITCHLIGHT.
 **S570 SERIES** **PAGE 4011**	MOMENTARY OR ALTERNATE (REMAIN-IN)	2 FORM C —OR— 4 FORM C	2 AMPERES	$12.00	SNAP ACTION CONTACTS 2 OR 4 FORM C SWITCHLIGHT.
 **S610 SERIES** **PAGE 4010**	MOMENTARY OR ALTERNATE (REMAIN-IN)	2 N.O. & 2 N.C.	10 AMPERES	$12.00	HEAVY DUTY 10 AMP SWITCHLIGHT WITH SNAP ACTION CONTACTS.
 **S510 SERIES** **S520 SERIES** **PAGE 4010**	MOMENTARY	1 N.O.	1 AMPERE	$ 8.00	SUBMINIATURE SWITCHLIGHT.



FRONT AND
REAR PANEL
MOUNTING
FRAMES

GANGSWITCHES **PAGE 4013**

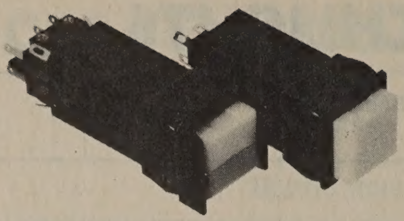


LAMPS AND TOOLS **PAGE 4012**

LENS CAPS **PAGE 4014**

CLARE-PENDAR

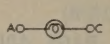
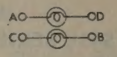
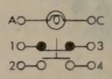
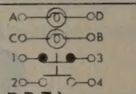
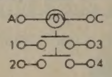
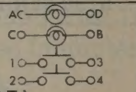
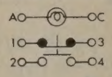
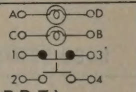
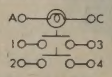
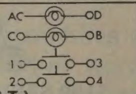
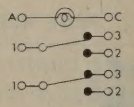
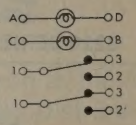
CLARE-PENDAR
a GENERAL INSTRUMENT CO.
3101 Pratt Avenue
Chicago, Illinois 60645 • (312) 262-7700



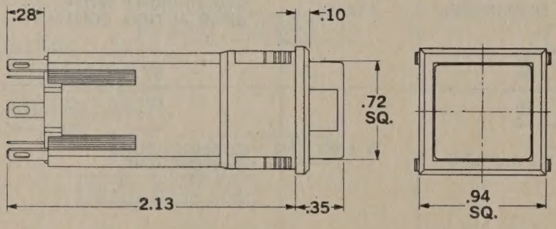
MONOFORM S410 SERIES

Indicator
Momentary
Alternate
(Remain-In)

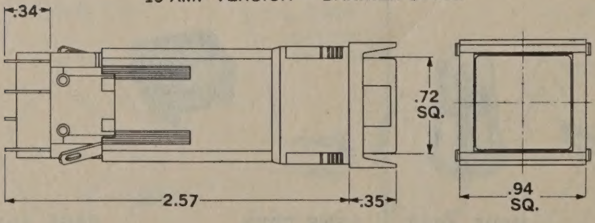
- Front Panel Snap-in Mounting
- UL Recognized Wiping Contact in 10 Amp Switches
- UL Recognized 2 Amp Switches
- Single or Dual Light

LENS SIZE	CONTACT RATING	SWITCH ACTION	LAMPS REQ.	HOUSING STYLE	PART NUMBER SWITCH / LENS	CIRCUITS SINGLE LIGHT	CIRCUITS DUAL LIGHT
¾" SQ.	—	INDICATOR	1	FLAT	S410 00 / C1960A**	 INDICATOR ONLY	
			1	BARRIER	S410 00 H4 / C1960A**		
			2	FLAT	S420 00 / C2961A****		
			2	BARRIER	S420 00 H4 / C2961A****		
	2 AMP UL FILE NO. E49131	MOMENTARY	1	FLAT	S410 11 / C1960A**	 1 N.O., 1 N.C. (S.P.D.T.)	
			1	BARRIER	S410 11 H4 / C1960A**		
			2	FLAT	S420 11 / C2961A****		
			2	BARRIER	S420 11 H4 / C2961A****		
			1	FLAT	S410 20 / C1960A**	 2 N.O. (D.P.S.T.)	
			1	BARRIER	S410 20 H4 / C1960A**		
			2	FLAT	S420 20 / C2961A****		
			2	BARRIER	S420 20 H4 / C2961A****		
		ALTERNATE	1	FLAT	S411 11 / C1960A**	 1 N.O., 1 N.C. (S.P.D.T.)	
			1	BARRIER	S411 11 H4 / C1960A**		
			2	FLAT	S421 11 / C2961A****		
			2	BARRIER	S421 11 H4 / C2961A****		
			1	FLAT	S411 20 / C1960A**	 2 N.O. (D.P.S.T.)	
			1	BARRIER	S411 20 H4 / C1960A**		
			2	FLAT	S421 20 / C2961A****		
			2	BARRIER	S421 20 H4 / C2961A****		
	10 AMP UL FILE NO. E49131	MOMENTARY	1	FLAT	S410 2C / C1960A**	 2 FORM C. (D.P.D.T.)	
			1	BARRIER	S410 2C H4 / C1960A**		
			2	FLAT	S420 2C / C2961A****		
			2	BARRIER	S420 2C H4 / C2961A****		
		ALTERNATE	1	FLAT	S411 2C / C1960A**		
			1	BARRIER	S411 2C H4 / C1960A**		
			2	FLAT	S421 2C / C2961A****		
			2	BARRIER	S421 2C H4 / C2961A****		
		ALTERNATE (REMAIN-IN)	1	FLAT	S412 2C / C1960A**		
			1	BARRIER	S412 2C H4 / C1960A**		
			2	FLAT	S422 2C / C2961A****		
			2	BARRIER	S422 2C H4 / C2961A****		

2 AMP VERSION — FLAT HOUSING STYLE



10 AMP VERSION — BARRIER STYLE



S410 SPECIFICATIONS:

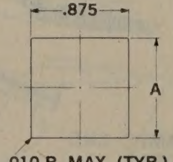
Contact Ratings (30 VDC or 125 VAC)
2 amp (100,000 cycles)
10 amp (50,000 cycles)
Total Travel .187 inches
Operating Force 24 oz. nominal
Lamp: Lens accommodates one or two T-1¾ midget flange base lamps (not supplied).

Note: Colors can be mixed on 2 lamp display lens — an ordering example for a lens with white on the top half and red on the bottom half is P/N C2961A WW RR.

****LENS COLORS FOR SINGLE LAMP DISPLAY**

Color	Code
WHITE	WW
RED	RR
GREEN	GG
YELLOW	YY

PANEL CUTOUT



.010 R. MAX. (TYP.)

Panel Thickness	Dim. A
.045-.078	.875
.093	.890
.125	.905
.187	.920

For row mounting, add .940 for each additional unit.

******LENS COLOR CODE FOR 2 LAMP DISPLAY SPLIT SCREEN**

Color	Top Half	Bottom Half
WHITE	WW	WW
RED	RR	RR
GREEN	GG	GG
YELLOW	YY	YY

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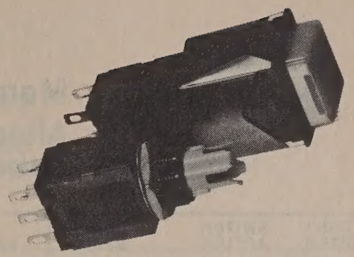
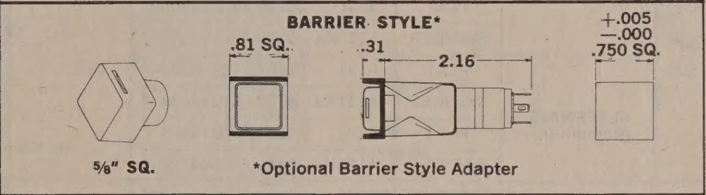
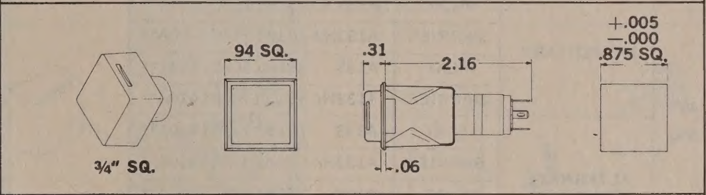
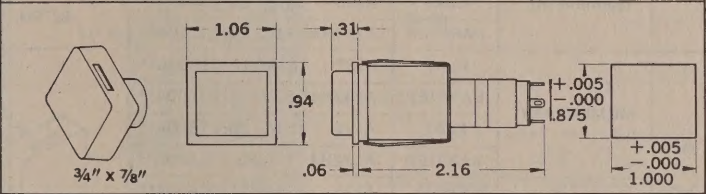
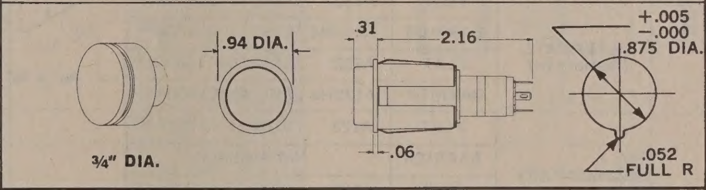
S190 SERIES

- **Front Panel Snap-in or Rear Panel Mounting**
- **4 Lens Shapes and Sizes**
- **Low Cost — Wiping Contacts**
- **Quick Connect and Solder Wire Terminals**

Indicator
Momentary
Alternate

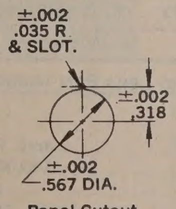


LENS SIZE	SWITCH ACTION	ADAPTER STYLE	PART NUMBER ADAPTOR/SWITCH/LENS		SWITCH AND ADAPTER LENS CAP / PANEL CUTOUT
5/8" SQ.	INDICATOR	FLAT	A131	/S190 00/C1480A**J8	 BARRIER STYLE* .81 SQ. .31 2.16 +.005 —.000 .750 SQ. 5/8" SQ. *Optional Barrier Style Adapter
		BARRIER	A131H4	/S190 00/C1480A**J8	
	MOMENTARY	FLAT	A131	/S190 2C/C1480A**J8	
		BARRIER	A131H4	/S190 2C/C1480A**J8	
	ALTERNATE	FLAT	A131	/S191 2C/C1480A**J8	
		BARRIER	A131H4	/S191 2C/C1480A**J8	
3/4" SQ.	INDICATOR	FLAT	A133	/S190 00/C1410A**J8	 .94 SQ. .31 2.16 .06 +.005 —.000 .875 SQ. 3/4" SQ.
		BARRIER	A133H4	/S190 00/C1410A**J8	
	MOMENTARY	FLAT	A133	/S190 2C/C1410A**J8	
		BARRIER	A133H4	/S190 2C/C1410A**J8	
	ALTERNATE	FLAT	A133	/S191 2C/C1410A**J8	
		BARRIER	A133H4	/S191 2C/C1410A**J8	
3/4" x 7/8"	INDICATOR	FLAT	A132	/S190 00/C1600A**J8	 1.06 .31 .94 .06 2.16 +.005 —.000 .875 +.005 —.000 1.000 3/4" x 7/8"
		BARRIER	A132H4	/S190 00/C1600A**J8	
	MOMENTARY	FLAT	A132	/S190 2C/C1600A**J8	
		BARRIER	A132H4	/S190 2C/C1600A**J8	
	ALTERNATE	FLAT	A132	/S191 2C/C1600A**J8	
		BARRIER	A132H4	/S191 2C/C1600A**J8	
3/4" DIA.	INDICATOR	FLAT	A123	/S190 00/C1310A**J8	 .94 DIA. .31 2.16 .06 +.005 —.000 .875 DIA. .052 FULL R 3/4" DIA.
		BARRIER		Not Available	
	MOMENTARY	FLAT	A123	/S190 2C/C1310A**J8	
		BARRIER		Not Available	
	ALTERNATE	FLAT	A123	/S191 2C/C1310A**J8	
		BARRIER		Not Available	

For Rear Mounting: Specify Switch and Lens Part Number Only.

S190 SPECIFICATIONS

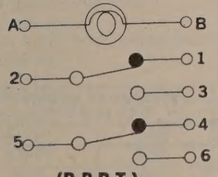
Contact Ratings (30 VDC or 125 VAC) .... 2 amps. Resistive
Plunger Travel .... 0.187 inch
Operating Force .... 24 oz. nominal
Terminals—Accept two #22 awg. wires for soldering or 0.110-inch quick connect receptacles.*
*Quick connect receptacles P/N.
Non-insulation support—AMP. 42570-1
Insulation support—AMP. 42657-1
Lamp Lens accommodates one T 1¾ midget flange base lamp (Not supplied)


±.002
.035 R
& SLOT.
±.002
.318
±.002
.567 DIA.

Panel Cutout

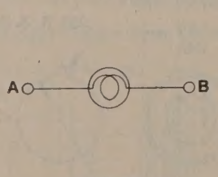
**Specify Lens Color LENS COLORS	
Color	Code
White	WW
Red	RR
Green	GG
Yellow	YY

Schematic

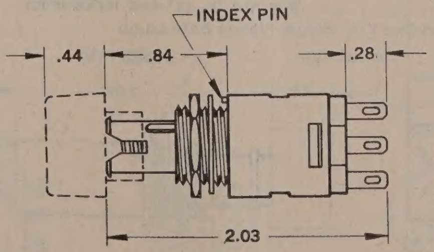


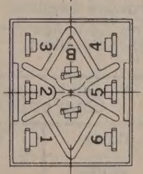
(D.P.D.T.)
2 Form C
S1902C Switch
S1912C Switch

Schematic



S190 00
Indicator


INDEX PIN
.44
.84
.28
2.03



Termination Detail

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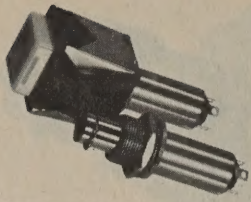
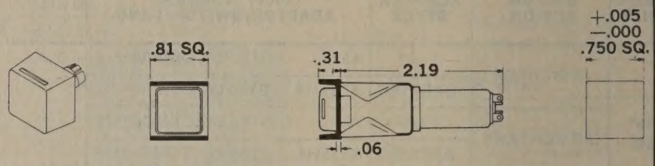
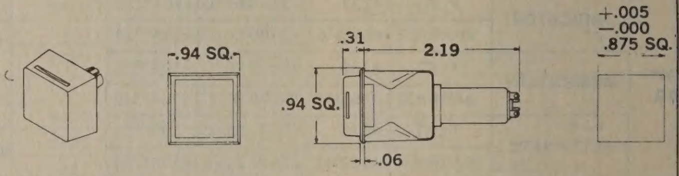
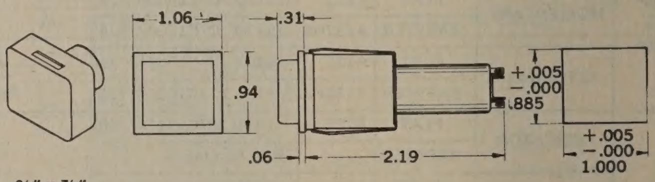
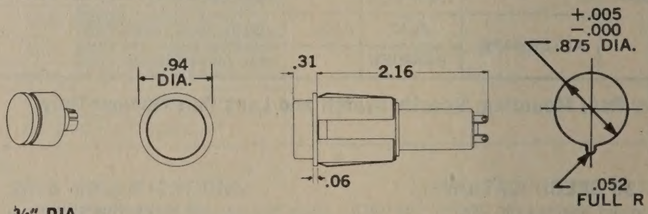


S180 SERIES

Momentary
Alternate
(Remain-In)

- Front Panel Snap-in or Rear Panel Mounting
- 4 Lens Shapes and Sizes
- High Reliability Wiping Contacts

LENS SIZE	SWITCH ACTION	ADAPTER STYLE	PART NUMBER ADAPTER/SWITCH/LENS	LENS CAP	SWITCH AND ADAPTER	PANEL CUTOUT
5/8" SQ.	MOMENTARY	FLAT	A131 /S180 11/C1480A**	 5/8" SQ.	BARRIER STYLE* *Optional Barrier Style Adapter	
		BARRIER	A131H4 /S180 11/C1480A**			
		FLAT	A131 /S180 20/C1480A**			
		BARRIER	A131H4 /S180 20/C1480A**			
	ALTERNATE (Remain-In)	FLAT	A131 /S182 11/C1480A**			
		BARRIER	A131H4 /S182 11/C1480A**			
		FLAT	A131 /S182 20/C1480A**			
		BARRIER	A131H4 /S182 20/C1480A**			
3/4" SQ.	MOMENTARY	FLAT	A133 /S180 11/C1410A**	 .94 SQ. .31 2.19 .94 SQ. .06 +.005 −.000 .875 SQ. 3/4" SQ.		
		BARRIER	A133H4 /S180 11/C1410A**			
		FLAT	A133 /S180 20/C1410A**			
		BARRIER	A133H4 /S180 20/C1410A**			
	ALTERNATE (Remain-In)	FLAT	A133 /S182 11/C1410A**			
		BARRIER	A133H4 /S182 11/C1410A**			
		FLAT	A133 /S182 20/C1410A**			
		BARRIER	A133H4 /S182 20/C1410A**			
7/8" x 3/4"	MOMENTARY	FLAT	A132 /S180 11/C1600A**	 1.06 .31 .94 +.005 −.000 .885 .06 2.19 +.005 −.000 1.000 3/4" x 7/8"		
		BARRIER	A132H4 /S180 11/C1600A**			
		FLAT	A132 /S180 20/C1600A**			
		BARRIER	A132H4 /S180 20/C1600A**			
	ALTERNATE (Remain-In)	FLAT	A132 /S182 11/C1600A**			
		BARRIER	A132H4 /S182 11/C1600A**			
		FLAT	A132 /S182 20/C1600A**			
		BARRIER	A132H4 /S182 20/C1600A**			
3/4" DIA.	MOMENTARY	FLAT	A123 /S180 11/C1310A**	 .94 DIA. .31 2.16 .06 +.005 −.000 .875 DIA. .052 FULL R 3/4" DIA		
		BARRIER	Not Available			
		FLAT	A123 /S180 20/C1310A**			
		BARRIER	Not Available			
	ALTERNATE (Remain-In)	FLAT	A123 /S182 11/C1310A**			
		BARRIER	Not Available			
		FLAT	A123 /S182 20/C1310A**			
		BARRIER	Not Available			

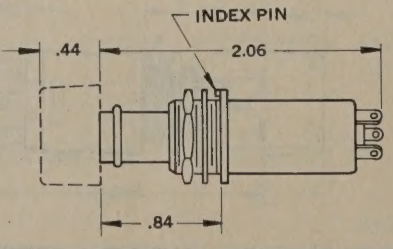
For Rear Mounting: Specify Switch and Lens Part Number Only.

S180 SPECIFICATIONS

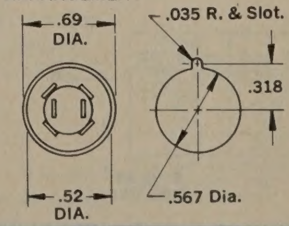
Contact Rating (at 28 VDC or 125 VAC) .... 2 amp. Resistive
Life (at rated load) .... 100,000 cycles
Plunger Travel .... 0.187 in.
Operating Force .... 24 ± 8 oz.
Hardware Supplied .... Hex nut (5/16-32) and lockwasher
Lamp: Lens Accommodates One T 3/4 Midget Flange Base Lamp
(Not Supplied)

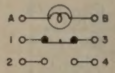
Momentary	S180 11	S180 20
Alternate (Remain-in)	S182 11	S182 20
Circuit	1 NO, 1 NC	2 NO
Schematic		

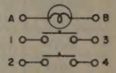
**Specify Lens Color LENS COLORS	
Color	Code
White	WW
Red	RR
Green	GG
Yellow	YY



TERMINAL ARRANGEMENT







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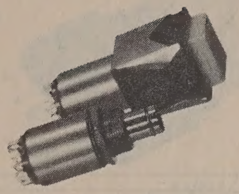
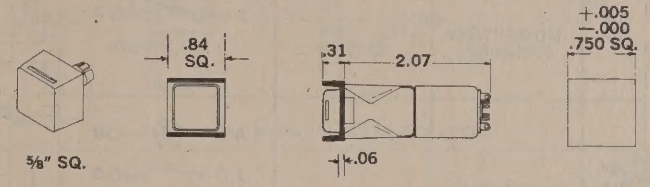
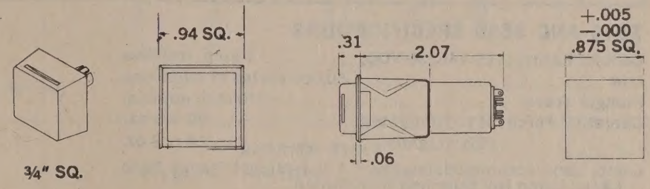
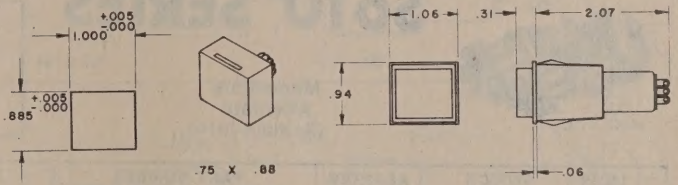
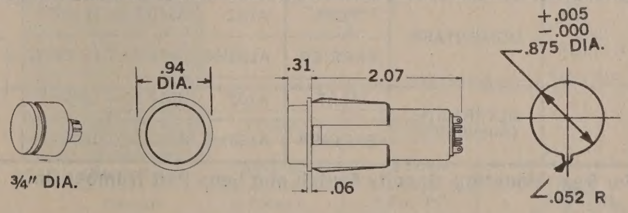
S220 SERIES

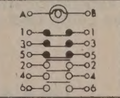
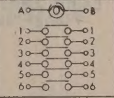
- **Front Panel Snap-in or Rear Panel Mounting**
- **4 Lens Shapes and Sizes**
- **Multi-Circuit Capability (6 Independent Circuits)**
- **High Reliabilty Wiping Contacts**

Momentary
Alternate
(Remain-In)



LENS SIZE	SWITCH ACTION	ADAPTER STYLE	PART NUMBER ADAPTER/SWITCH/LENS	LENS CAP	SWITCH AND ADAPTER	PANEL CUTOUT
5/8" SQ.	MOMENTARY	FLAT	A131 /S220 33/C1480A**		BARRIER STYLE*  * OPTIONAL BARRIER STYLE ADAPTER	
		BARRIER	A131H4 /S220 33/C1480A**			
		FLAT	A131 /S220 60/C1480A**			
		BARRIER	A131H4 /S220 60/C1480A**			
	ALTERNATE (Remain-In)	FLAT	A131 /S222 33/C1480A**			
		BARRIER	A131H4 /S222 33/C1480A**			
		FLAT	A131 /S222 60/C1480A**			
		BARRIER	A131H4 /S222 60/C1480A**			
3/4" SQ.	MOMENTARY	FLAT	A133 /S220 33/C1410A**			
		BARRIER	A133H4 /S220 33/C1410A**			
		FLAT	A133 /S220 60/C1410A**			
		BARRIER	A133H4 /S220 60/C1410A**			
	ALTERNATE (Remain-In)	FLAT	A133 /S222 33/C1410A**			
		BARRIER	A133H4 /S222 33/C1410A**			
		FLAT	A133 /S222 60/C1410A**			
		BARRIER	A133H4 /S222 60/C1410A**			
3/4" x 7/8"	MOMENTARY	FLAT	A132 /S220 33/C1600A**		BARRIER STYLE 	
		BARRIER	A132H4 /S220 33/C1600A**			
		FLAT	A132 /S220 60/C1600A**			
		BARRIER	A132H4 /S220 60/C1600A**			
	ALTERNATE (Remain-In)	FLAT	A132 /S222 33/C1600A**			
		BARRIER	A132H4 /S222 33/C1600A**			
		FLAT	A132 /S222 60/C1600A**			
		BARRIER	A132H4 /S222 60/C1600A**			
3/4" DIA.	MOMENTARY	FLAT	A123 /S220 33/C1310A**			
		BARRIER	Not Available			
		FLAT	A123 /S220 60/C1310A**			
		BARRIER	Not Available			
	ALTERNATE (Remain-In)	FLAT	A123 /S222 33/C1310A**			
		BARRIER	Not Available			
		FLAT	A123 /S222 60/C1310A**			
		BARRIER	Not Available			

For Rear Mounting: Specify Switch and Lens Part Number Only.

Momentary	S220 33	S220 60
Alternate (Remain-In)	S222 33	S222 60
Circuit	3 NO, 3 NC (3PDT)	6 NO (6PST)
Schematic		

S220 SPECIFICATIONS

Electrical

Contact Rating (at 28 VDC or 125VAC) .... 2 amp. resistive
LIFE (at rated load) .... 100,000 cycles

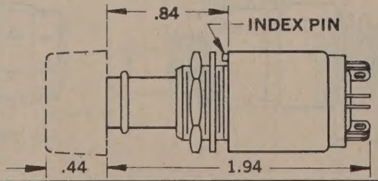
Mechanical

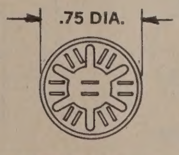
Plunger Travel .... 0.187 in.
Operating Force .... 24 ± 8 oz.
Hardware Supplied .... Hex nut (9/16-32) and lockwasher

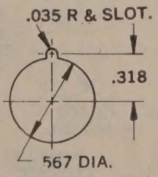
Environmental

Lamp: Lens Accommodates One T-1¾ Midget Flange Base Lamp (Not Supplied).

**Specify Lens Color LENS COLORS	
Color	**Code**
White	WW
Red	RR
Green	GG
Yellow	YY







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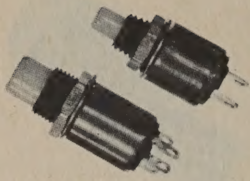
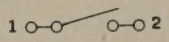
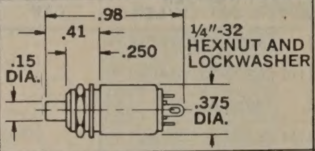
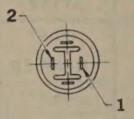
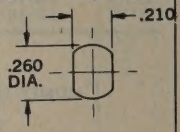
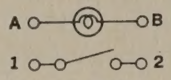
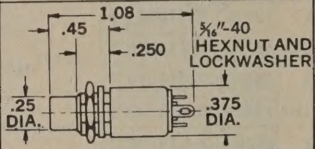
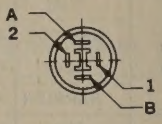
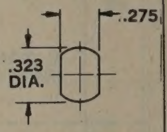


S510 SERIES

SUBMINIATURE

Momentary
Lighted
Unlighted

- Subminiature Snap Action Switch
- Rear Panel Mounting
- Easy Lamp Replacement on S520

LENS SIZE	SWITCH ACTION	PART NUMBER	SCHEMATIC	DIMENSIONAL DRAWING	TERMINAL ARRANGEMENT	RECOMMENDED PANEL CUTOUT
16" DIA.	MOMENTARY (Unlighted)	S510 10*	 I N.O. (SPST)	 .98 .41 .250 ¼"-32 HEXNUT AND LOCKWASHER .15 DIA. .375 DIA.		
25" DIA.	MOMENTARY (Lighted)	S520 10*	 I N.O. (SPST)	 1.08 .45 .250 5⁄16"-40 HEXNUT AND LOCKWASHER .25 DIA. .375 DIA.		

S510 AND S520 SPECIFICATIONS

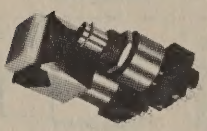
Contact Rating (115 VAC/30 VDC)	1 amp. resistive
Life	50,000 cycles at rated load
Plunger Travel	.070 inch nominal
Operating Force S510 (Unlighted)	20 ± 8 oz.
S520 (Lighted)	24 ± 8 oz.

Lamp: Lens Accommodates One T 1 Sub-Midget Flange Base Lamp. Lamp Not Supplied With Switch.

***Specify Lens Color**
LENS COLORS

Color	Code	Color	Code
White	W	Yellow	Y
Red	R	Black [1]	Z
Green	G		

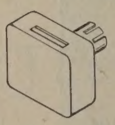
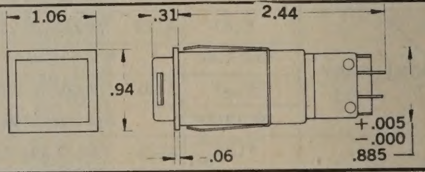
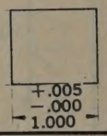
[1] For Unlighted Switch Only



S610 SERIES

Momentary
Alternate
(Remain-In)

- Snap-Action Power Switch
- Front Panel Snap-In or Rear Panel Mounting
- 10 Amp Capability

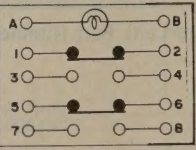
LENS SIZE	SWITCH ACTION	ADAPTER STYLE	PART NUMBER ADAPTER/SWITCH/LENS	LENS CAP	SWITCH AND ADAPTER	PANEL CUTOUT
¾" x ⅞"	MOMENTARY	FLAT	A132 /S610 22/C1600A**		 1.06 .31 2.44 .94 +.005 −.000 .885 .06	 +.005 −.000 1.000
		BARRIER	A132H4 /S610 22/C1600A**			
	ALTERNATE (Remain-In)	FLAT	A132 /S612 22/C1600A**			
		BARRIER	A132H4 /S612 22/C1600A**			

For Rear Mounting: Specify Switch and Lens Part Number Only.

S610 SPECIFICATIONS

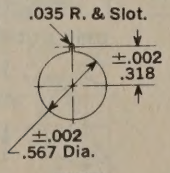
Contact Rating (at 28 VDC or 125 VAC)	10 amp. resistive
Life (at rated load)	50,000 cycles
Plunger Travel	0.187 ± 0.02 in.
Operating Force	32 oz. ± 12 oz.
Hardware Supplied	Hex nut (5⁄16-32 and Lockwasher

Lamp: Lens Accommodates One T 1¾ Midget Flange Base Lamp (Not Supplied)

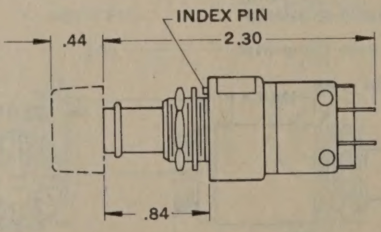
Momentary	S610 22	 A B 1 2 3 4 5 6 7 8
Alternate (Remain-In)	S612 22	
Circuit	2 N.O. - 2 N.C.	

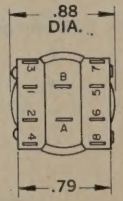
****Specify Lens Color**
LENS COLORS

Color	Code
White	WW
Red	RR
Green	GG
Yellow	YY


.035 R. & Slot.
±.002
.318
±.002
.567 Dia.

PANEL CUTOUT


INDEX PIN
.44
2.30
.84


.88 DIA.
.79
1
2
3
4
5
6
7
8
A
B

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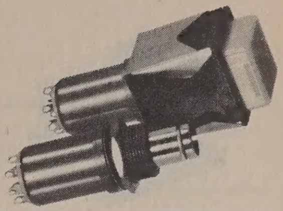
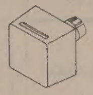
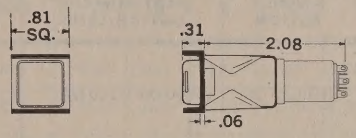
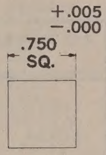
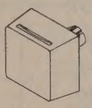
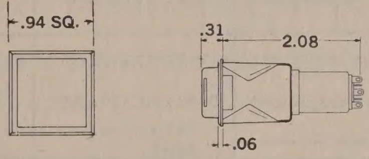
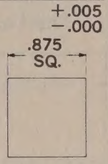
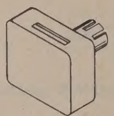
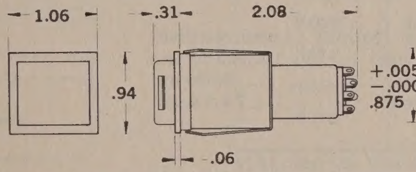
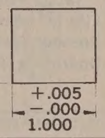
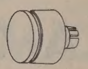
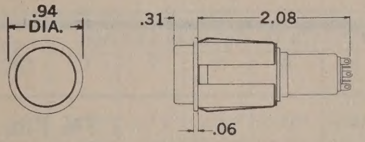
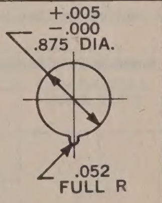
- **Compact Snap Action Switch**
- **Front Panel Snap-in or Rear Panel Mounting**
- **4 Lens Shapes and Sizes**
- **Multi-Circuit Form C**

S570 SERIES

Momentary
Alternate
(Remain-In)



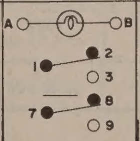
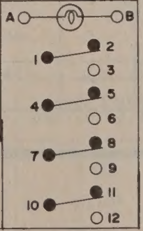
LENS SIZE	SWITCH ACTION	ADAPTER STYLE	PART NUMBER ADAPTER/SWITCH/LENS	LENS CAP	SWITCH AND ADAPTER	PANEL CUTOUT
5/8″ SQ.	MOMENTARY	FLAT	A131 /S570 22/C1480A**	 5/8″ SQ.	BARRIER STYLE*  * OPTIONAL BARRIER STYLE ADAPTER	
		BARRIER	A131H4 /S570 22/C1480A**			
		FLAT	A131 /S570 44/C1480A**			
		BARRIER	A131H4 /S570 44/C1480A**			
	ALTERNATE (Remain-In)	FLAT	A131 /S572 22/C1480A**			
		BARRIER	A131H4 /S572 22/C1480A**			
		FLAT	A131 /S572 44/C1480A**			
		BARRIER	A131H4 /S572 44/C1480A**			
3/4″ SQ.	MOMENTARY	FLAT	A133 /S570 22/C1410A**	 3/4″ SQ.		
		BARRIER	A133H4 /S570 22/C1410A**			
		FLAT	A133 /S570 44/C1410A**			
		BARRIER	A133H4 /S570 44/C1410A**			
	ALTERNATE (Remain-In)	FLAT	A133 /S572 22/C1410A**			
		BARRIER	A133H4 /S572 22/C1410A**			
		FLAT	A133 /S572 44/C1410A**			
		BARRIER	A133H4 /S572 44/C1410A**			
3/4″ x 7/8″	MOMENTARY	FLAT	A132 /S570 22/C1600A**	 3/4″ x 7/8″	BARRIER STYLE 	
		BARRIER	A132H4 /S570 22/C1600A**			
		FLAT	A132 /S570 44/C1600A**			
		BARRIER	A132H4 /S570 44/C1600A**			
	ALTERNATE (Remain-In)	FLAT	A132 /S572 22/C1600A**			
		BARRIER	A132H4 /S572 22/C1600A**			
		FLAT	A132 /S572 44/C1600A**			
		BARRIER	A132H4 /S572 44/C1600A**			
3/4″ DIA.	MOMENTARY	FLAT	A123 /S570 22/C1310A**	 3/4″ DIA.		
		BARRIER	Not Available			
		FLAT	A123 /S570 44/C1310A**			
		BARRIER	Not Available			
	ALTERNATE (Remain-In)	FLAT	A123 /S572 22/C1310A**			
		BARRIER	Not Available			
		FLAT	A123 /S572 44/C1310A**			
		BARRIER	Not Available			

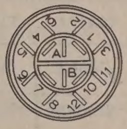
For Rear Mounting: Specify Switch and Lens Part Number Only.

S570 SPECIFICATIONS

Contact Rating (at 28 VDC & 125 VAC) ....2 amp. resistive
Life (at rated load) ....50,000 cycles
Plunger Travel 0.125
Operating Force ....S570 22 32 ±16 oz.
S572 22 32 ±16 oz.
S570 44 40 ±16 oz.
S572 44 40 ±16 oz.
Hardware Supplied ....Hex nut (⅜₁₆-32) and Lockwasher

Lamp: Lens Accommodates One T 1¾ Midget Flange Base Lamp. (Not Supplied).

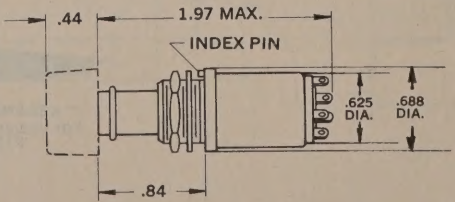
Momentary	S570 22	S570 44
Alternate (Remain-In)	S572 22	S572 44
Circuit	2 Form C.	4 Form C.
Schematic		 A B 1 2 3 4 5 6 7 8 9 10 11 12

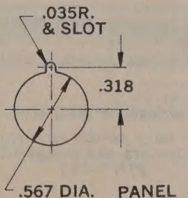


TERMINAL ARRANGEMENT
S57044
S57244

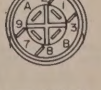
**Specify Lens Color LENS COLORS	
Color	**Code**
White	WW
Red	RR
Green	GG
Yellow	YY

Rear Panel Mounting Dimensions





PANEL CUTOUT



TERMINAL ARRANGEMENT
S57022
S57222

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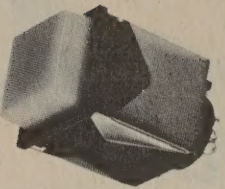
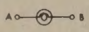
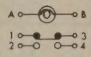
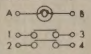
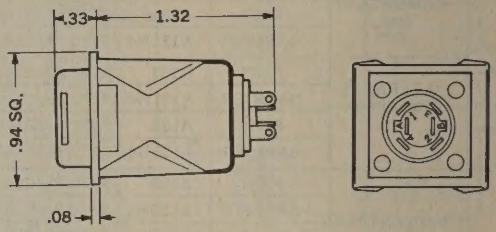


S490 SERIES

Indicator
Momentary

- Premium Switchlight
- Compact Wiping Action Switch
- Front Panel Snap-in Mounting
- Economical

LENS SIZE	SWITCH ACTION	PART NUMBER SWITCH/LENS	CIRCUIT
¾" SQ.	INDICATOR	S490 00/C110 OA**	
	MOMENTARY	S490 11/C110 OA**	 1 NO, 1 NC (SPDT)
	MOMENTARY	S490 20/C110 OA**	 2 NO (DPST)

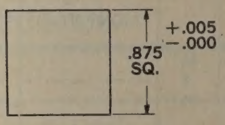


S490 specifications

Contact Rating
(at 28 VDC or 125 VAC) ..1 amp. resistive
Life (at rated load) ....100,000 cycles
Plunger Travel ....0.090 in.
Operating Force ....24 ± 8 oz.

**Specify Lens Color

LENS COLORS	
Color	**Code**
White	WW
Red	RR
Green	GG
Yellow	YY



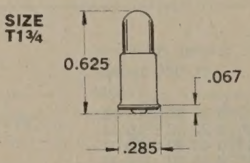
PANEL CUTOUT

LAMPS

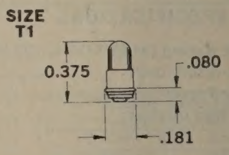
T 1¾ Fits All Switchlights Except S-520

Part No.	Size	DC Volts	Current MA	M.S.C.P.	Life Hours
CM327	T1¾	28	40	.34 at 28 vdc	1000
CM328	T1¾	6	200	.34 at 5.0 vdc	1000
CM682	T1	5	60	.032 at 5.0 vdc	200.000
CM6839	T1	28	24	.13 at 28 vdc	16,000

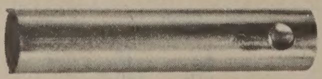
Midget Flanged Base



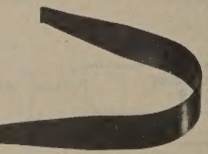
Sub-Midget Flanged Base



TOOLS



SPANNER WRENCH
For easy switch removal
from Adapters and Gangswitches
P/N T-225



RELAMPING TOOL
For easier lens removal
P/N T-200

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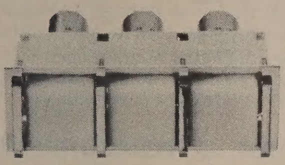
GANGSWITCHES

GANGSWITCH ASSEMBLY ORDERING EXAMPLE

G118 04 A J1/S222 33 F4/C1210ARR
(4 Station Frame/Switchlight/Lens Cap)
(F4 mod. spanner nut used for gangswitch mounting)

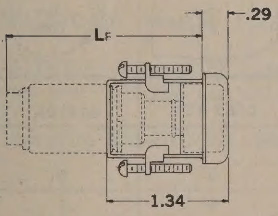
FRONT PANEL MOUNTING FRAMES

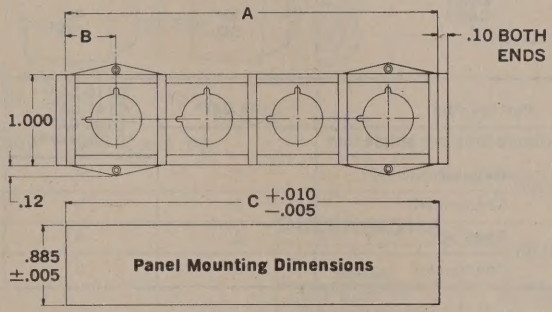


G1670 — A H6J1
G1680 — A H6J1

SWITCH CENTERS	GANGSWITCH FRAME PART NUMBER	FIXED DIM. B	VARIABLE DIMEN-SIONS	CENTER DIMENSION OF STATIONS 1	2	3	4	5	COMPAT-IBLE LENS CAPS
7/8″	G1670_AH6J1	.488″	A	.976″	1.851″	2.726″	3.601″	4.476″	3/4″ SQ. C120 & C141
			C	.991″	1.866″	2.741″	3.616″	4.491″	
1″	G1680_AH6J1	.550″	A	1.100″	2.100″	3.100″	4.100″	5.100″	3/4″x7/8″ C121 & C160
			C	1.115″	2.115″	3.115″	4.115″	5.115″	

SPECIFY NUMBER OF STATIONS REQUIRED (1 THROUGH 5 STATIONS)

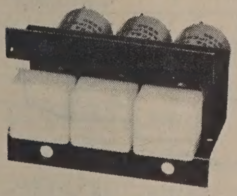




COMPATIBLE SWITCH TYPE	LF
S180	2.27″
S190*	2.24″
S220	2.15″
S570	2.16″
S610	2.51″

* S190 must use lens with "J8" mod.

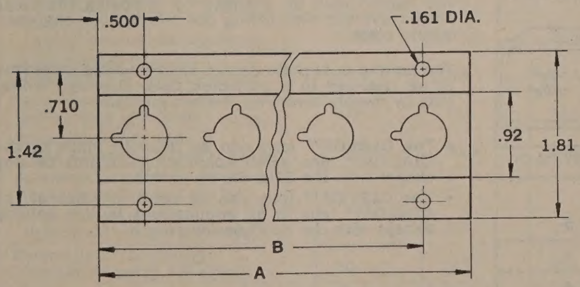
REAR PANEL MOUNTING FRAMES

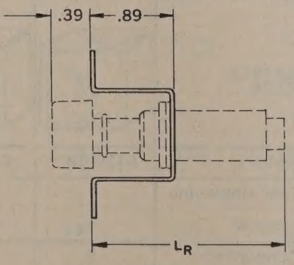


G1160 — A J1
G1180 — A J1

SWITCH CENTERS	GANGSWITCH FRAME PART NUMBER	VARIABLE DIMENSIONS	CENTER DIMENSION OF STATIONS 1	2	3	4	5	COMPATIBLE LENS CAPS
3/4″	G1160_A J1	A	1.00″	1.75″	2.50″	3.25″	4.00″	C120 C141 C148
		B	—	1.25″	2.00″	2.75″	3.50″	
1″	G1180_A J1	A	1.00″	2.00″	3.00″	4.00″	5.00″	C120, C121 C131 C141 C148 C160
		B	—	1.50″	2.50″	3.50″	4.50″	

SPECIFY NUMBER OF STATIONS REQUIRED (1 THROUGH 5 STATIONS)





COMPATIBLE SWITCH TYPE	LR
S180	2.11″
S190*	2.08″
S220	1.99″
S570	2.00″
S610**	2.35″

* S190 must use lens with "J8" mod.
** Available on G118 frame only.

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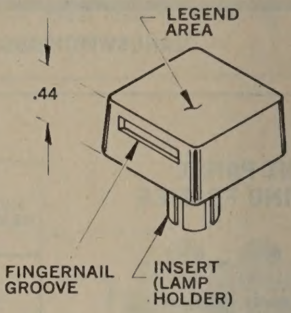
LENS CAPS AND ENGRAVED LEGENDS

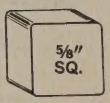
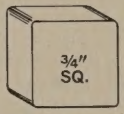
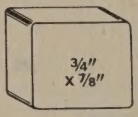
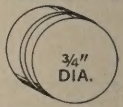
STANDARD LENS CAPS

PUSH TO TEST

- 4 Standard Sizes — 4 Colors Available
- All with easy front-panel-removal and no-tool lamp replacement
- Quick Distributor Delivery on Engraved Legends



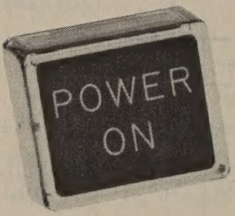
ENGRAVING INFORMATION

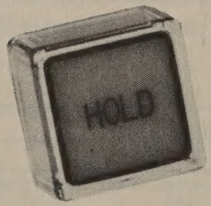
LENS CAPS	 5/8" SQ.	 3/4" SQ.	 3/4" x 7/8"	 3/4" DIA.
Part Number	C148 OA**	C110 OA** C141 OA** C196 OA** C296 1A**	C160 OA**	C131OA**
Max. Characters per single line				
.125 High Regular	5	5	6	5
.125 High Condensed	6	8	9	7
.160 High Regular	4	4	5	4
.160 High Condensed	5	6	7	5

**Specify Lens Color

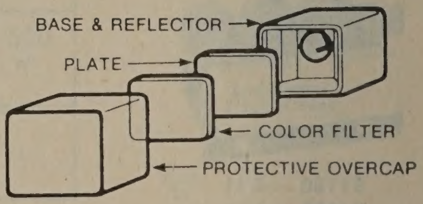
LENS COLORS	
Color	Code
White	WW
Red	RR
Green	GG
Yellow	YY

Clear Overcap Style (Changeable Legend)

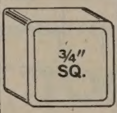
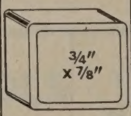




- 2 Standard Sizes — 4 Colors Available
- Changeable Legend for Greater Flexibility
- Quick Distributor Delivery on Engraved Legends



ENGRAVING INFORMATION

CHANGEABLE LENS CAPS	 3/4" SQ.	 3/4" x 7/8"
Part Number	C120 OA**	C121 OA**
Characters per single line		
.125 High Regular	4	5
.125 High Condensed	5	7
.160 High Regular	3	4
.160 High Condensed	5	6

**Specify Lens Color

LENS COLORS	
Color	Code
White	WW
Red	RR
Green	GG
Yellow	YY

The legend may be changed by removing the clear plastic overcap and lifting out the film or engraved legend plate.

The unique dual plate design allows a solid code lens to be changed to a projected color (through white) lens by merely reversing the two plates.

- The C120 OA** lens can be used in place of the C141 OA** lens in all applications in this catalog except with the S190 Series switch.
- The C121 OA** lens can be used in place of the C160 OA** lens in all applications in this catalog except with the S190 Series switch.

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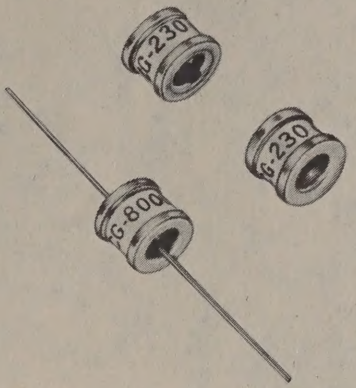
CLARE CIRCUIT PROTECTION

CG SERIES SURGE ARRESTORS

GENERAL INFORMATION

The CG series of Comm Gaps are miniature voltage surge arrestors designed to protect sensitive electronic equipment and personnel from damage and injury due to excessive voltages or currents. They consist of two electrodes hermetically sealed in a gas filled, rugged, metal-ceramic cylinder. In operation, the Comm Gap is a voltage dependent switch which at its breakdown voltage, changes its impedance from a near infinite resistance to a virtual short circuit. These devices are capable of fast operation and can handle extremely high levels of current for short durations. Comm Gaps are used in either one of two operating modes:

1) Passive Mode (Surge protectors)
2) Active Mode (Energy transfer switches used in trigger circuits and relaxation oscillators)



ENVIRONMENTAL RATINGS

Operating Temperature: −55°C to +125°C

Temperature Cycling (MIL-STD-202, Method 102A, Cond. C): −65°C to +125°C

Humidity (MIL-STD-202, Method 103B, Cond. B): 95% Rel. Humidity

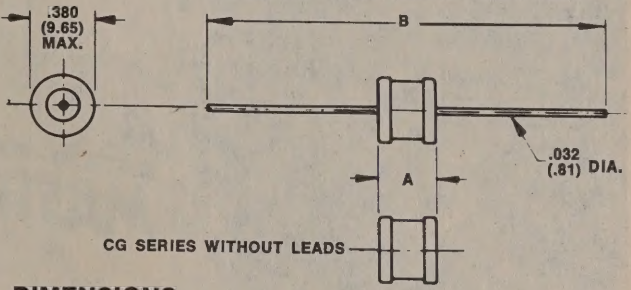
Vibration (MIL-STD-202, Method 204B, Cond. C): 10-55Hz, .06DA

Shock (MIL-STD-202, Method 213A, Cond. C): 100g's

Thermal Shock (MIL-STD-202, Method 107, Cond. B): −65°C to +125°C

Barometric Pressure MIL-STD-202, Method 105C, Cond B): 50,000 ft.

CG SERIES WITH LEADS
(LEADS ARE TINNED, COPPER CLAD STEEL)



DIMENSIONS

Series	Size	
	A	B
CG75 thru 470	.265 ±.012(6.73 ±.30)	2.05(52.1) Nominal
CG800 thru 1000	.289 ±.012(7.34 ±.30)	2.08(52.8) Nominal

RATINGS AND CHARACTERISTICS

Product Type	CG75 CG75L	CG90 CG90L	CG110 CG110L	CG145 CG145L	CG230 CG230L	CG350 CG350L	CG470 CG470L	CG800 CG800L	CG1000 CG1000L
Breakdown Voltage DC (dv/dt = 100V/s)	75 ±20%	90 ±20%	110 ±20%	145 ±20%	230 ±15%	350 ±15%	470 ±15%	800 ±15%	1000 ±15%
Breakdown Surge 1 (max. volts @ tr = 10V/us)	300V	350V	400V	450V	700V	—	—	—	—
Breakdown Surge 2 (max. volts @ tr = 100V/us)	500V	550V	600V	650V	1000V	—	—	—	—
Breakdown Surge 3 (max. volts @ tr = 500V/us)	700V	750V	800V	850V	1300V	—	—	—	—
Breakdown Surge 4 (max. volts @ tr = 5kV/us)	1000V	1000V	1000V	1000V	1500V	2000V	2500V	4000V	4000V
Insulation Resistance (min. megohms) Note 1	10k	10k	10k	10k	10k	10k	10k	10k	10k
Interelectrode Capacitance (max. picofarads) Note 2	1.5pF	1.4pF	1.4pF	1.4pF	1.2pF	1.0pF	1.0pF	1.0pF	1.0pF
Holdover Voltage DC (typical volts, series R = 200 ohms)	55V	60V	60V	60V	70V	70V	75V	75V	75V
Arc Voltage (typical volts @ min. of 5 amps)	10V	10V	10V	10V	10V	10V	10V	10V	10V
Transition Time (typical time in microseconds)	0.1us	0.1us	0.1us	0.1us	0.1us	0.1us	0.1us	0.1us	0.1us
Surge Current Capacity 1 (max. amps @ 10/50us surge)	5kA	5kA	5kA	5kA	5kA	5kA	5kA	5kA	5kA
Surge Current Capacity 2 (max. amps @ 10/250us surge)	1kA	1kA	1kA	1kA	1kA	1kA	1kA	1kA	1kA
Surge Current Capacity 3 (max. amps @ 10/1000us surge)	500A	500A	500A	500A	500A	500A	500A	500A	500A
Follow-on Current AC, 60Hz (peak ½ cycle amps @ 120V)	—	—	—	—	—	10A	12A	14A	15A
Surge Life (10/250us) (typical surges @ 1000 amps)	200	250	200	250	250	250	100	100	100
Surge Life 2 (10/1000us) (typical surges @ 500 amps)	50	50	50	50	50	50	50	50	50
CG Series without leads	$2.20	$2.20	$2.20	$2.20	$1.95	$1.95	$1.95	$2.25	$2.25
CGL Series with leads	$2.35	$2.35	$2.35	$2.35	$2.10	$2.10	$2.10	$2.40	$2.40

Note 1. Insulation resistance measured at 100Vdc except at 50Vdc for units rated 145V and below.
Note 2. Capacitance measurements for unleaded devices.

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'78
THE MASTER CATALOG
THE ELECTRONIC DISTRIBUTORS
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MASTER CATALOG
FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

YESTERDAY'S RADIO MASTER IS TODAY'S

ELECTRONIC DISTRIBUTORS MASTER CATALOG

Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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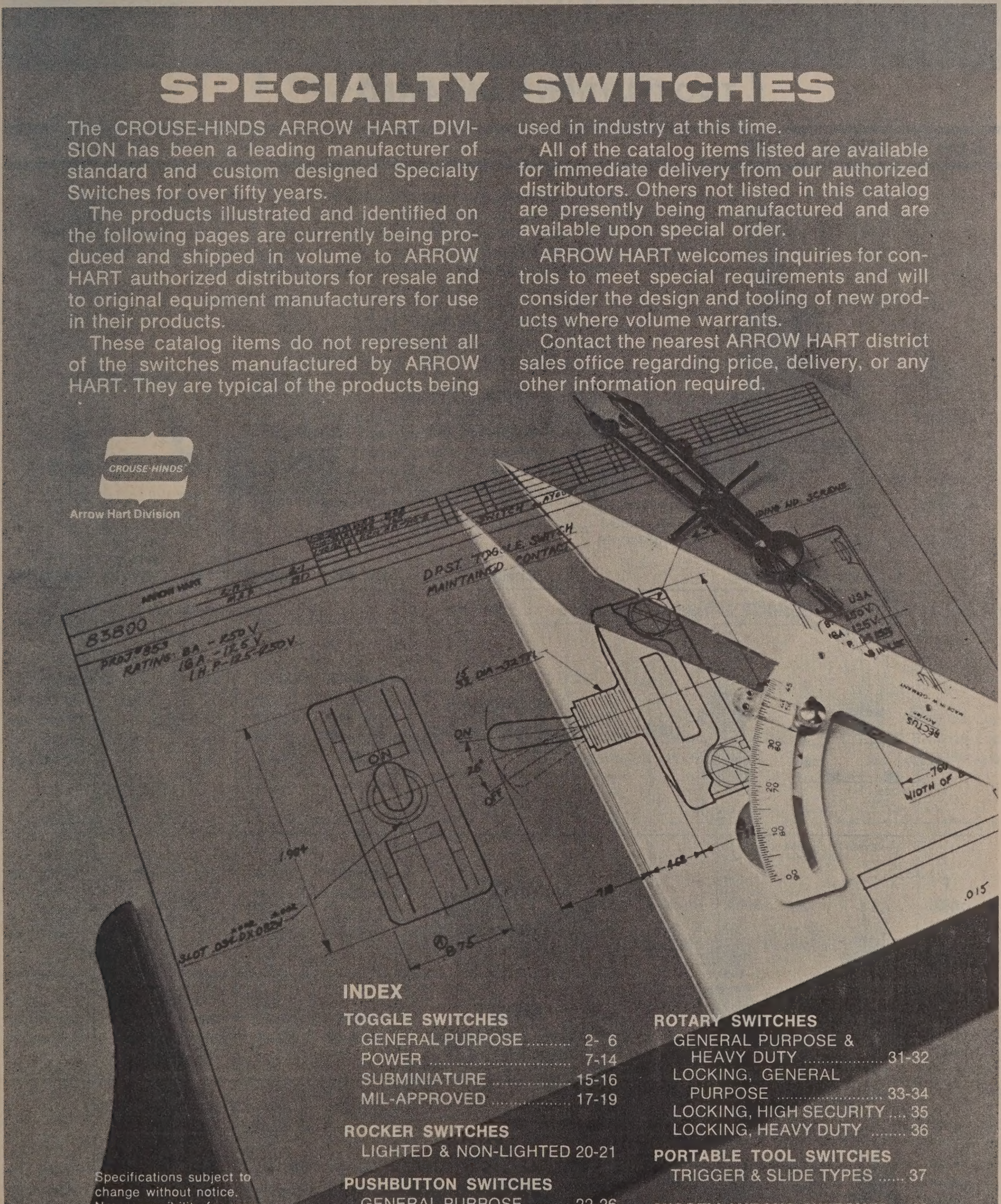

SPECIALTY SWITCHES

The CROUSE-HINDS ARROW HART DIVISION has been a leading manufacturer of standard and custom designed Specialty Switches for over fifty years.

The products illustrated and identified on the following pages are currently being produced and shipped in volume to ARROW HART authorized distributors for resale and to original equipment manufacturers for use in their products.

These catalog items do not represent all of the switches manufactured by ARROW HART. They are typical of the products being used in industry at this time.

All of the catalog items listed are available for immediate delivery from our authorized distributors. Others not listed in this catalog are presently being manufactured and are available upon special order.

ARROW HART welcomes inquiries for controls to meet special requirements and will consider the design and tooling of new products where volume warrants.

Contact the nearest ARROW HART district sales office regarding price, delivery, or any other information required.

CROUSE-HINDS
Arrow Hart Division

Specifications subject to change without notice. No responsibility for errors or omissions in this catalog is assumed by the Crouse-Hinds Company or its Arrow Hart Division.

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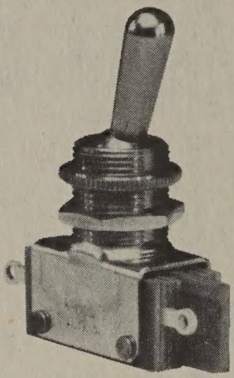
CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES
GENERAL PURPOSE
TWO-POSITION MAINTAINED

CANOPY SERIES, 3 AMP



CAT. NO. 21350EH

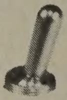
Designed for use in small appliances and instrumentation panels of all types, this group offers a full selection of circuits in a small size base. Switching mechanism consists of a roller which operates on a track of laminated phenolic, a time-proven design which assures exceedingly long life and high reliability.

- *Roller action contacts with quick make-break*
- *Laminated base construction*
- *Bright nickel finished exposed parts*
- *UL Listed, File E1148, Guide WOYR*

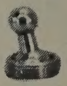
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

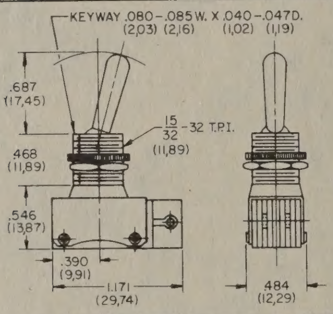
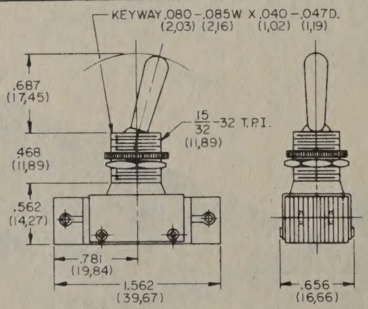
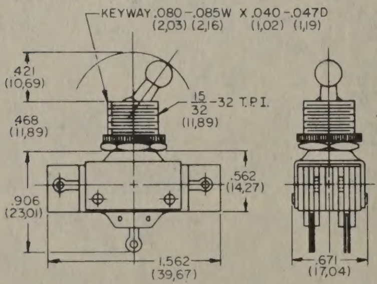
LEVER STYLES



BAT



BALL

Body Dimensions	Circuit	Cat. No.	Action•	Lever	Slotted Sleeve Length, in.	Termination
 20994LH	**SPST** **3 Amp, 250 V AC/DC**	20994CS 20994LH 21615BD 21615BE 80054S	Off-On Off-On Off-On Off-On Off-(On)	Ball Bat Ball Bat Bat	15/32 15/32 1 1 15/32	Solder Lug Solder Lug Solder Lug Solder Lug Solder Lug
 20902CX	**SPDT** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	21350BF 21350EH 21661BE 21827GA	On-On On-On On-On On-(On)	Ball Bat Bat Bat	15/32 15/32 1 15/32	Solder Lug Solder Lug Solder Lug Solder Lug
	DPST **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	20902N 20902CX	Off-On Off-On	Ball Bat	15/32 15/32	Solder Lug Solder Lug
 20905BX	**DPDT** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	20905BX 20905FR 20905KA 21858X	On-On On-On On-On On-(On)	Ball Bat Bat Bat	15/32 15/32 1 15/32	Solder Lug Solder Lug Solder Lug Solder Lug

KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19)
.687 (17,45)
15/32-32 T.P.I. (11,89)
.468 (11,89)
.546 (13,87)
.390 (9,91)
1.171 (29,74)
.484 (12,29)
KEYWAY .080-.085W X .040-.047D. (2,03) (2,16) (1,02) (1,19)
.687 (17,45)
15/32-32 T.P.I. (11,89)
.468 (11,89)
.562 (14,27)
.781 (19,84)
1.562 (39,67)
.656 (16,66)
KEYWAY .080-.085W X .040-.047D (2,03) (2,16) (1,02) (1,19)
.421 (10,69)
15/32-32 T.P.I. (11,89)
.468 (11,89)
.562 (14,27)
.906 (23,01)
1.562 (39,67)
.671 (17,04)

•*( ) indicates momentary action.*

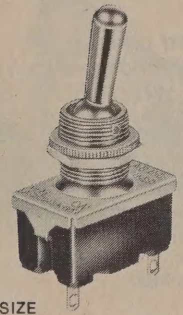
AVAILABLE OPTIONS: Modifications available on sleeve; terminals and lever arrangements — please consult factory

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES
GENERAL PURPOSE
TWO-POSITION MAINTAINED

050 SERIES, LOW LEVEL


CAT. NO. 83050, SHOWN ACTUAL SIZE

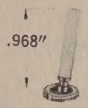
Total dependability in a space-saving package, Arrow Hart Midget switches are designed to meet the exacting low energy demands of computer, data processing and military and aircraft instrument panel applications. Wiping blade contact mechanism with positive quick make-break action provides exceptionally long electrical and mechanical life.

- *Wiping blade contact mechanism with positive quick make-break*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Circuits SPST through DPDT*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES

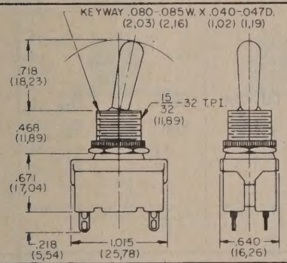
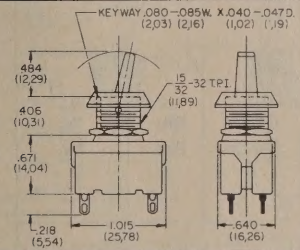
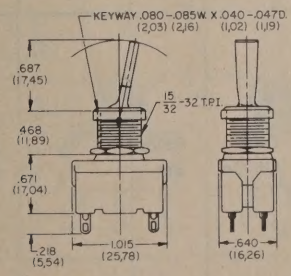


BATON

MOLDED PADDLE

MOLDED TAPER

METAL PADDLE

Body Dimensions		Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .718 (18,23) 15/32-32 T.P.I. (11,89) .468 (11,89) .671 (17,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83050	**SPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83050	Off-On	Bat	15/32	Solder Lug
			83050CG	Off-On	Metal Paddle	15/32	Solder Lug
			83050CL(*)	Off-On	Baton	15/32	Solder Lug
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .484 (12,29) 15/32-32 T.P.I. (11,89) .406 (10,31) .671 (14,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83052SG	**SPDT** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83052SG	On-On	Molded Taper	13/32	Solder Lug
			83052	On-On	Bat	15/32	Solder Lug
			83052CG	On-On	Metal Paddle	15/32	Solder Lug
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .687 (17,45) 15/32-32 T.P.I. .468 (11,89) .671 (17,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83054CG	**DPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83053SG	On-On	Molded Taper	13/32	Solder Lug
			83053	On-On	Bat	15/32	Solder Lug
			83053CG	On-On	Metal Paddle	15/32	Solder Lug
			83053CL(*)	On-On	Baton	15/32	Solder Lug
		DPDT **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83054SG	On-On	Molded Taper	13/32	Solder Lug
			83054	On-On	Bat	15/32	Solder Lug
			83054C	On-On	Molded Paddle	15/32	Solder Lug
			83054CG	On-On	Metal Paddle	15/32	Solder Lug
			83054CL(*)	On-On	Baton	15/32	Solder Lug
			83054S†	On-On	Bat	15/32	Solder Lug

† Silicone rubber seal in sleeve.

** Insert dash number for baton lever color: BLACK (-1), WHITE (-2), RED (-3). Other colors available on special order — see page 40.*

AVAILABLE OPTIONS: Modifications available include: special lever finishes and colors; quick-connect terminals; momentary action; special plating — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

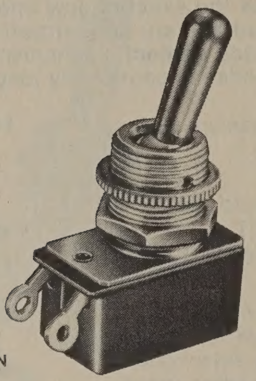
CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES

GENERAL PURPOSE

TWO-POSITION MAINTAINED

86 SERIES, 6 AMP



CAT. NO. 86994N

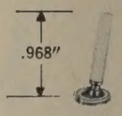
These Arrow Hart toggle switches feature wiping action contacts in a fully enclosed bakelite base. Their small size and proven reliability make them ideal for use in small home appliances, radio and electronic applications.

- *Wiping (slider) contact mechanism*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Slotted sleeve ($^{15}/_{32}$″ dia., 32 threads per inch)*
- *UL Listed, File E1148, Guide WOYR*

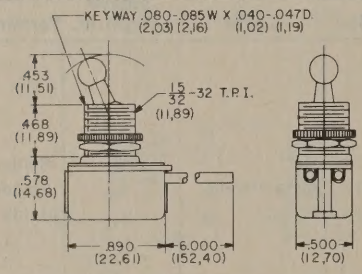
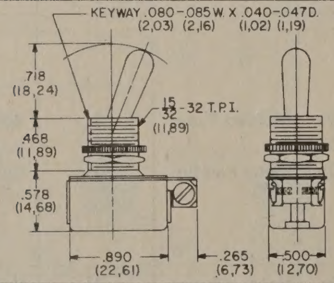
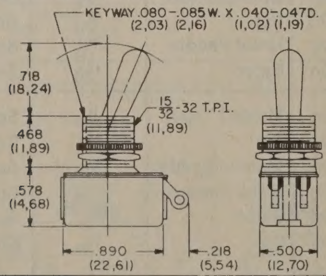
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES



BATON

Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085W X .040-.047D. (2,03) (2,16) (1,02) (1,19) .453 (11,51) 15/32-32 T.P.I. (11,89) .468 (11,89) .578 (14,68) .890 (22,61) 6.000 (152,40) .500 (12,70) 86599CA	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	86599CA 86599QE	Off-On Off-On	Ball Bat	$^{15}/_{32}$ $^{15}/_{32}$	Wire Lead Wire Lead
 KEYWAY .080-.085W X .040-.047D. (2,03) (2,16) (1,02) (1,19) .718 (18,24) 15/32-32 T.P.I. (11,89) .468 (11,89) .578 (14,68) .890 (22,61) .265 (6,73) .500 (12,70) 86964E	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	86964E 86994N	Off-On Off-On	Bat Bat	$^{15}/_{32}$ $^{15}/_{32}$	Screw Solder Lug
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .718 (18,24) 15/32-32 T.P.I. (11,89) .468 (11,89) .578 (14,68) .890 (22,61) .218 (5,54) .500 (12,70) 80994BD	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	86994CL(*) 80994BD†	Off-On Off-On	Baton Bat	$^{15}/_{32}$ $^{15}/_{32}$	Solder Lug Solder Lug

* *Insert dash number for baton lever color: BLACK (-1), WHITE (-2), RED (-3). Other colors available on special order — see page 40.*

† *3 Amp, 250 V AC/DC only.*

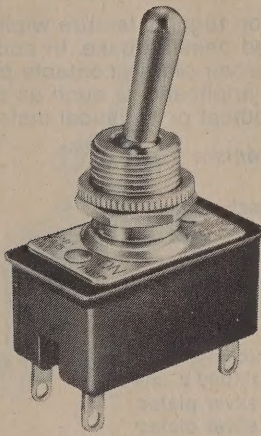
AVAILABLE OPTIONS: Modifications available include: custom levers; indicating dials (ON-OFF, HI-LO); special sleeve lengths; momentary contact — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES
GENERAL PURPOSE
TWO-POSITION MAINTAINED / MOMENTARY

CLASSIC 015 SERIES, LOW LEVEL TO 6 AMP


CAT. NO. 81024GB,
SHOWN ACTUAL SIZE

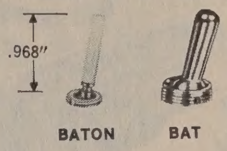
These deluxe toggle switches offer either end-connected or back-connected terminals in a fully enclosed bakelite base. Wiping blade action and heavy silver plated contacts assure long electrical and mechanical life and provide top performance for low energy applications.

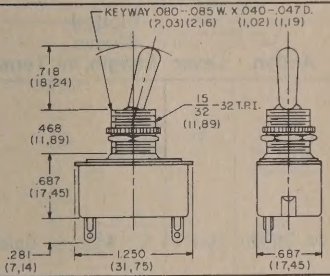
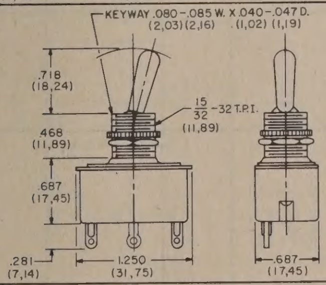
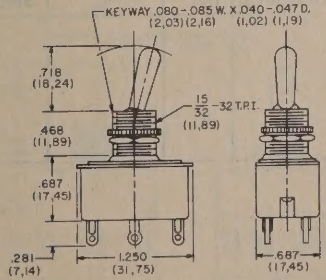
- *Wiping blade contact mechanism with positive quick make-break*
- *Molded phenolic base*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES


.968"
BATON
BAT

Body Dimensions	Circuit	Cat. No.	Action●	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080–.085 W. X .040–.047 D. (2,03)(2,16) (1,02)(1,19) .718 (18,24) 15/32–32 T.P.I. (11,89) 468 (11,89) .687 (17,45) .281 (7,14) 1.250 (31,75) .687 (17,45) 81015AW	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81015CL(*) 81015AW 81045FB	Off-On Off-On Off-(On)	Baton Bat Bat	15/32 15/32 15/32	Solder Lug Solder Lug Solder Lug
 KEYWAY .080–.085 W. X .040–.047 D. (2,03)(2,16) (1,02)(1,19) .718 (18,24) 15/32–32 T.P.I. (11,89) 468 (11,89) .687 (17,45) .281 (7,14) 1.250 (31,75) .687 (17,45) 81021AV	**SPDT** **6 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	81021AV 81051G	On-On On-(On)	Bat Bat	15/32 15/32	Solder Lug Solder Lug
 KEYWAY .080–.085 W. X .040–.047 D. (2,03)(2,16) (1,02)(1,19) .718 (18,24) 15/32–32 T.P.I. (11,89) 468 (11,89) .687 (17,45) .281 (7,14) 1.250 (31,75) .687 (17,45) 81027CE	**DPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81024GB 81024KB† 81054H	Off-On Off-On Off-(On)	Bat Bat Bat	15/32 15/32 15/32	Solder Lug Solder Lug† Solder Lug
	DPDT **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81027CB† 81027CE 81027CL(*) 81057N	On-On On-On On-On On-(On)	Bat Bat Baton Bat	15/32 15/32 15/32 15/32	Solder Lug† Solder Lug Solder Lug Solder Lug

† Cat. Nos. 81024KB and 81027CB have end-connected solder lugs (not shown in Body Dimensions drawing).
** Insert dash number for baton lever color: BLACK (-1), WHITE (-2), RED (-3). Other colors available on special order — see page 40.*
● ( ) indicates momentary action.

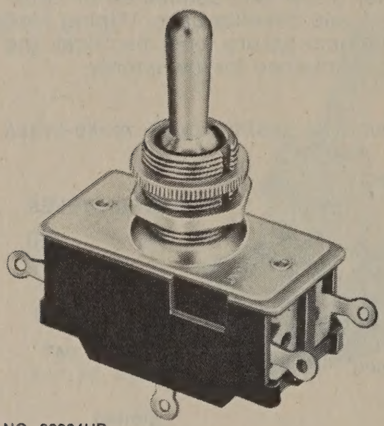
AVAILABLE OPTIONS: Modifications include: ball lever, metal paddle lever, or other custom levers; special sleeve lengths; gold plating of current-carrying parts; screw terminals or wire leads; silicone rubber seal between lever and bushing — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES
GENERAL PURPOSE
THREE-POSITION MAINTAINED

024 SERIES, 6 AMP



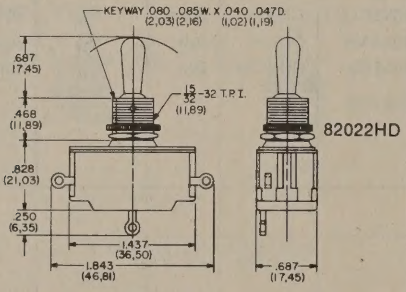
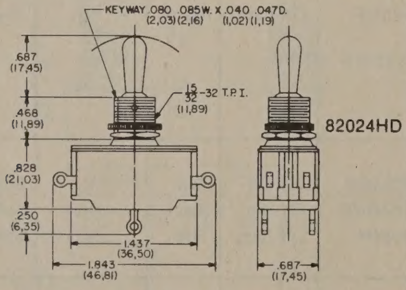
CAT. NO. 82024HD,

These Arrow Hart three-position toggles feature wiping blade construction in a fully enclosed bakelite base. In addition to the positive wiping action, heavy silver-plated contacts make these switches ideal for low energy applications, such as radio equipment, computers and medical or technical instrumentation.

- *Wiping blade contact mechanism*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Heavy silver-plated contacts*
- *3 positions, center OFF*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts	Bright nickel
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080 .085W. X .040 .047D. (2,03)(2,16) (1,02)(1,19) .687 (17,45) 15/32-32 T.P.I. (11,89) .468 (11,89) .828 (21,03) .250 (6,35) 1.437 (36,50) 1.843 (46,81) .687 (17,45) 82022HD	**SPDT** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	82022HD	On-Off-On	Bat	$\frac{15}{32}$	Solder Lug
 KEYWAY .080 .085W. X .040 .047D. (2,03)(2,16) (1,02)(1,19) .687 (17,45) 15/32-32 T.P.I. (11,89) .468 (11,89) .828 (21,03) .250 (6,35) 1.437 (36,50) 1.843 (46,81) .687 (17,45) 82024HD	**DPDT** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	82024HD	On-Off-On	Bat	$\frac{15}{32}$	Solder Lug

AVAILABLE OPTIONS: Modifications available include: screw terminals — please consult factory.

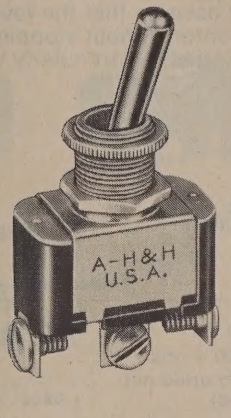
CROUSE-HINDS®
Arrow Hart Division

POWER TOGGLE SWITCHES

AC ONLY, HORSEPOWER RATED

THREE-POSITION MAINTAINED / MOMENTARY

608 SERIES, 10 AMP/20 AMP



CAT. NO. 82602,
SHOWN ACTUAL SIZE

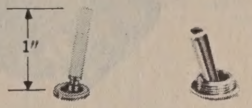
Arrow Hart AC Utility Series switches are designed to provide high interrupting capacity in a small size phenolic base. A butt-type contact mechanism with fine silver buttons and ball joint lever construction assure long life and high reliability for a wide range of general utility applications.

- *Heavy duty silver contacts (butt-type)*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Screw, solder lug, and quick-connect terminals*
- *Horsepower rating*
- *Circuits SPST through DPDT*
- *UL Listed, File E1148, Guide WOYR*

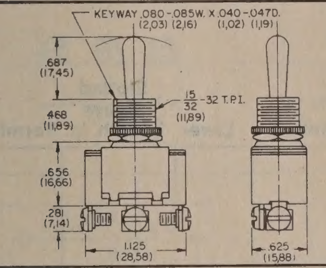
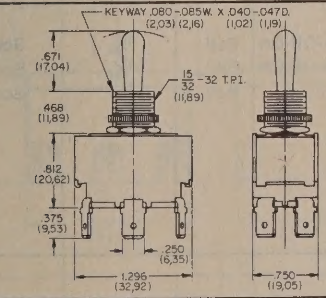
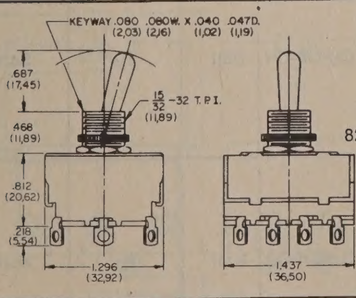
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES



BATON BAT

Body Dimensions	Circuit	Cat. No.	Action ●	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .687 (17,45) 15/32 -32 T.P.I. (11,89) .468 (11,89) .656 (16,66) .281 (7,14) 1.125 (28,58) .625 (15,88) 82602	**SPST** 15 Amp, ¾ HP, 125 V AC 10 Amp, ¾ HP, 250 V AC	82600 *	Off-On	Bat	15/32	Screw
		82720	Off-(On)	Bat	15/32	Screw
		82601 *	Off-On	Bat	15/32	Solder Lug
		82601P *	Off-On	Bat	15/32	Quick-Connect
		82779SA†	Off-On	Bat	15/32	Screw
	SPDT 15 Amp, ¾ HP, 125 V AC 10 Amp, ¾ HP, 250 V AC	82604 *	On-On	Bat	15/32	Screw
		82605 *	On-On	Bat	15/32	Solder Lug
		82605P *	On-On	Bat	15/32	Quick-Connect
		82602 *	On-Off-On	Bat	15/32	Screw
		82603P*	On-Off-On	Bat	15/32	Quick-Connect
		82603 *	On-Off-On	Bat	15/32	Solder Lug
		82728	On-(On)	Bat	15/32	Screw
		82726 *	(On)-Off-(On)	Bat	15/32	Screw
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .671 (17,04) 15/32 -32 T.P.I. (11,89) .468 (11,89) .812 (20,62) .375 (9,53) .250 (6,35) 1.296 (32,92) .750 (19,05) 82609P	**DPST** 15 Amp, ¾ HP, 125 V AC 10 Amp, ¾ HP, 250 V AC	82606 *	Off-On	Bat	15/32	Screw
		82607 *	Off-On	Bat	15/32	Solder Lug
		82607P *	Off-On	Bat	15/32	Quick-Connect
	DPDT 15 Amp, ¾ HP, 125 V AC 10 Amp, ¾ HP, 250 V AC	82610 *	On-On	Bat	15/32	Screw
		82611 *	On-On	Bat	15/32	Solder Lug
		82611P *	On-On	Bat	15/32	Quick-Connect
		82608 *	On-Off-On	Bat	15/32	Screw
		82609 *	On-Off-On	Bat	15/32	Solder Lug
		82609P *	On-Off-On	Bat	15/32	Quick-Connect
		82738	On-(On)	Bat	15/32	Screw
		82734	(On)-Off-On	Bat	15/32	Screw
		82736 *	(On)-Off-(On)	Bat	15/32	Screw
 KEYWAY .080 .080W. X .040 .047D. (2,03) (2,16) (1,02) (1,19) .687 (17,45) 15/32 -32 T.P.I. (11,89) .468 (11,89) .812 (20,62) .218 (5,54) 1.296 (32,92) 1.437 (36,50) 82636	**3PST** 15 Amp, 1 HP, 125 V AC 10 Amp, 250 V AC	82612	On-Off	Bat	15/32	Screw
		82613P	On-Off	Bat	15/32	Quick-Connect
	3PDT 15 Amp, 1 HP, 125 V AC 10 Amp, 250 V AC	82616	On-On	Bat	15/32	Screw
		82617	On-On	Bat	15/32	Solder Lug
		82617P	On-On	Bat	15/32	Quick-Connect
		82614	On-Off-On	Bat	15/32	Screw
		82615	On-Off-On	Bat	15/32	Solder Lug
		82626	On-(On)	Bat	15/32	Screw
		82624	On-Off-(On)	Bat	15/32	Screw
	4PDT 15 Amp, ¾ HP, 125 V AC 10 Amp, ¾ HP, 250 V AC	82635	On-On	Bat	15/32	Screw
		82636	On-On	Bat	15/32	Solder Lug
		82633	On-Off-On	Bat	15/32	Screw
		82634	On-Off-On	Bat	15/32	Solder Lug

* *Available with optional colored baton lever. To order, add suffix CL plus dash number to indicate color: Black (-1), White (-2), Red (-3). Other colors available on special order — see page 40.*

† *Cat. No. 82779SA is rated 20 Amp, 1 HP, 125 V AC and 10 Amp, 1 HP, 250 V AC.*

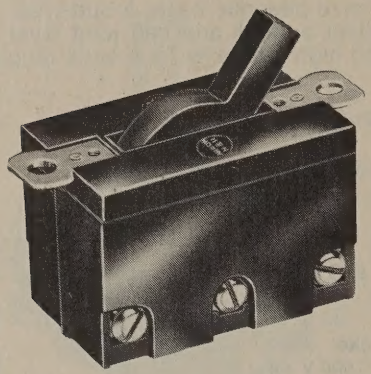
● *( ) indicates momentary action.*

AVAILABLE OPTIONS: Modifications available include: custom levers; special finishes; silicone rubber seal between lever and bushing; momentary contact — please consult factory.

CROUSE-HINDS®
Arrow Hart Division

POWER TOGGLE SWITCHES
HEAVY DUTY
THREE-POSITION MAINTAINED

638 SERIES, POSITIVE CENTER OFF, 2 HP/30 AMP



CAT. NO. 80988

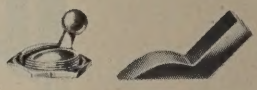
These three-position heavy duty toggle switches offer a unique positive center OFF feature, which assures that the lever cannot be moved from one side through the center without stopping. Because of this design, the Arrow Hart 638 Series is particularly well-suited for motor reversing applications.

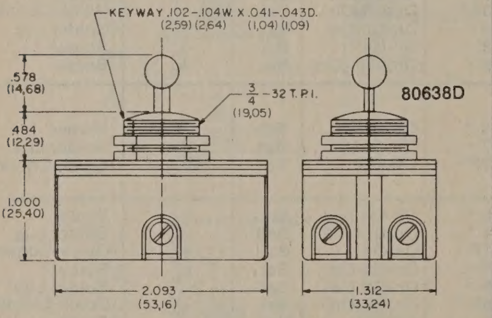
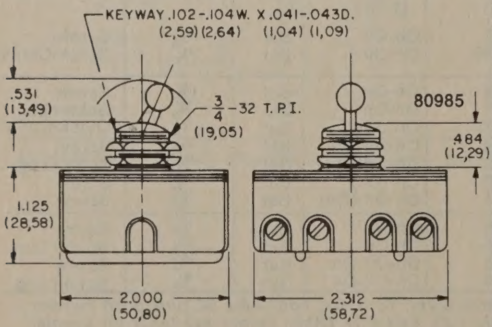
- *3 positions, positive center OFF*
- *Sliding wedge contacts*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Horsepower rating*

COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel
Dielectric breakdown ...	Exceeds 1000 V rms
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES


BALL
SQUARE

Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .102-.104W. X .041-.043D. (2,59) (2,64) (1,04) (1,09) .578 (14,68) .484 (12,29) 1.000 (25,40) 3/4-32 T.P.I. (19,05) 80638D 2.093 (53,16) 1.312 (33,24)	**DPDT** **14 Amp, ¾ HP, 125 V AC/DC** **7 Amp, ¾ HP, 250 V AC/DC**	86038*	On-Off-On	Ball	11/32	Screw
		80638D	On-Off-On	Ball	15/32	Screw
		80976■	On-On	Ball	15/32	Screw
 KEYWAY .102-.104W. X .041-.043D. (2,59) (2,64) (1,04) (1,09) .531 (13,49) 3/4-32 T.P.I. (19,05) 80985 .484 (12,29) 1.125 (28,58) 2.000 (50,80) 2.312 (58,72)	**3PDT** **10 Amp, ½ HP, 125 V AC/DC** **5 Amp, ½ HP, 230 V AC/DC**	80983	On-Off-On	Ball	15/32	Screw
	4PDT **10 Amp, ½ HP, 125 V AC/DC** **5 Amp, ½ HP, 230 V AC/DC**	80985	On-Off-On	Ball	15/32	Screw

* *Dustproof sleeve.*
■ *No positive center OFF*

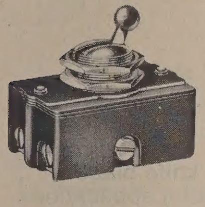
AVAILABLE OPTIONS: Modifications available include: flush mounting; elimination of center OFF feature — please consult factory.

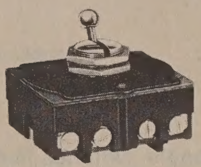
CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

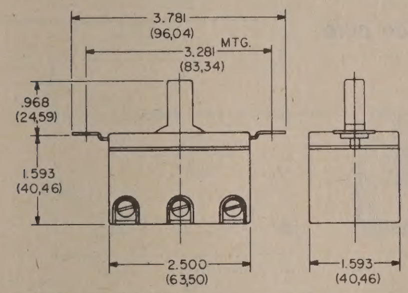
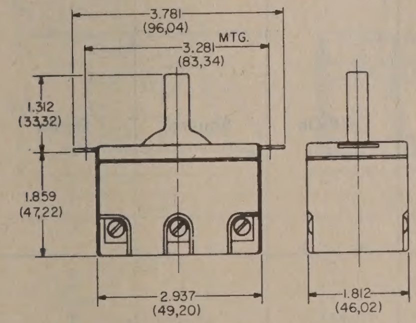
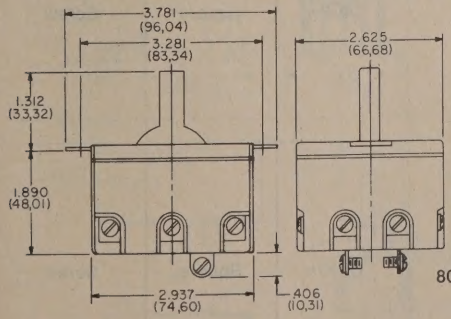
CROUSE-HINDS
Arrow Hart Division

POWER TOGGLE SWITCHES
HEAVY DUTY
THREE-POSITION MAINTAINED

638 SERIES, POSITIVE CENTER OFF, 2 HP/30 AMP


CAT. NO. 80638D


CAT. NO. 80985

Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 3.781 (96,04) MTG. 3.281 (83,34) .968 (24,59) 1.593 (40,46) 2.500 (63,50) 1.593 (40,46) 80634	**DPDT** 20 Amp, 125 V AC/DC 10 Amp, 250 V AC/DC†	80634 80975■	On-Off-On On-On	Square Square	Not sleeve mounted	Screw Screw
 3.781 (96,04) MTG. 3.281 (83,34) 1.312 (33,32) 1.859 (47,22) 2.937 (49,20) 1.812 (46,02) 80988	**DPDT** 30 Amp, 125 V AC/DC 20 Amp, 250 V AC/DC	80988	On-Off-On	Square	Not sleeve mounted	Screw
 3.781 (96,04) 3.281 (83,34) 2.625 (66,68) 1.312 (33,32) 1.890 (48,01) 2.937 (74,60) .406 (10,31) 80899	**3PDT** 30 Amp, 125 V AC/DC 20 Amp, 250 V AC/DC	80898	On-Off-On	Square	Not sleeve mounted	Screw
	4PDT 30 Amp, 125 V AC/DC 20 Amp, 250 V AC/DC	80899	On-Off-On	Square	Not sleeve mounted	Screw

† 1½ HP, 250 V DC; 2 HP, 230 V AC.

■ No positive center OFF

AVAILABLE OPTIONS: Modifications available include: flush mounting; elimination of center OFF feature — please consult factory.

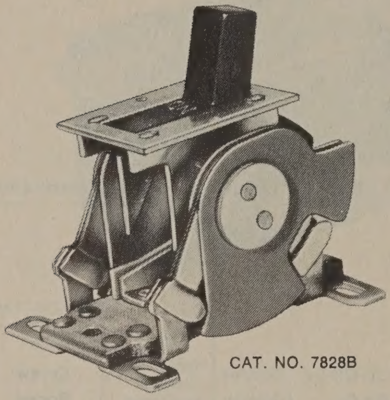
CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS
Arrow Hart Division

POWER TOGGLE SWITCHES

TWO-POSITION MAINTAINED

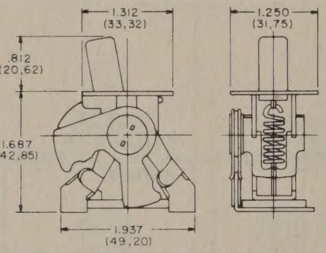
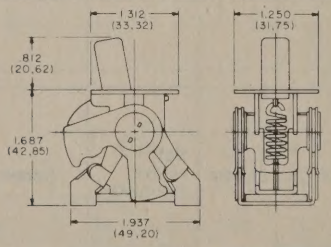
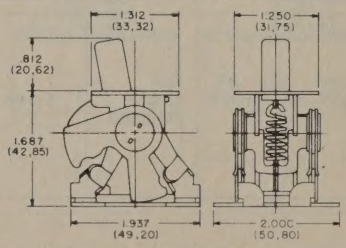
30 & 60 AMP AC/DC EXTRA HEAVY DUTY SERIES



CAT. NO. 7828B

Arrow Hart extra heavy duty toggle switches feature knife blade contacts, and have been designed primarily for industrial applications up to 600 volts AC/DC.

- *Knife blade contacts for high reliability*
- *Molded phenolic lever*
- *Single pole, double pole and three pole*
- *Quick make-break action*

Body Dimensions	Circuit	Cat. No.	Action	Lever	Termination
 1.312 (33,32) 1.250 (31,75) .812 (20,62) 1.687 (42,85) 1.937 (49,20) 8684U	**SPST** **30 Amp, 250 V AC/DC** **2 HP, 120 V-240 V AC**	8684U	Off-On	Square	Screw
 1.312 (33,32) 1.250 (31,75) .812 (20,62) 1.687 (42,85) 1.937 (49,20) 8685U	**SP** **QUAD BREAK** **30 Amp, 250 V AC/DC** **2 HP, 120 V-240 V AC**	8685U	Off-On	Square	Screw
 1.312 (33,32) 1.250 (31,75) .812 (20,62) 1.687 (42,85) 1.937 (49,20) 2.000 (50,80) 8686U	**DPST** **30 Amp, 250 V AC/DC** **2 HP, 125 V-250 V AC**	8686U	Off-On	Square	Screw

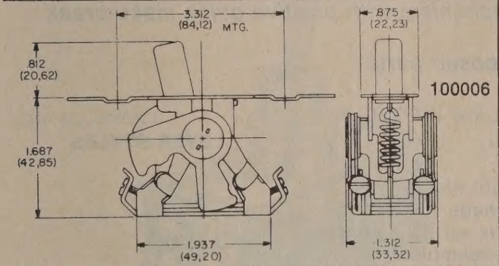
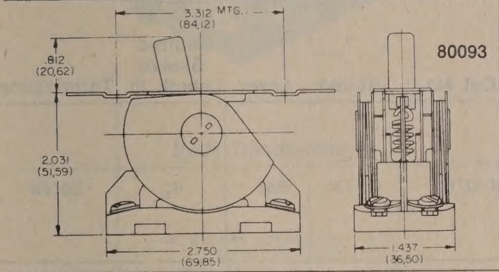
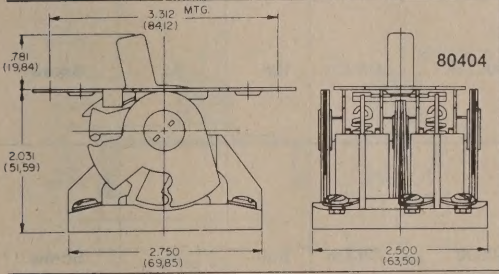
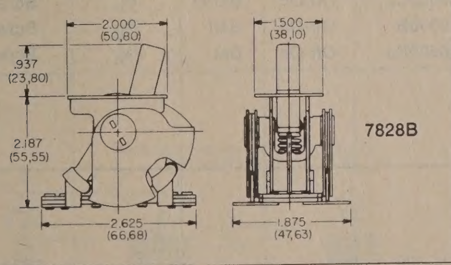
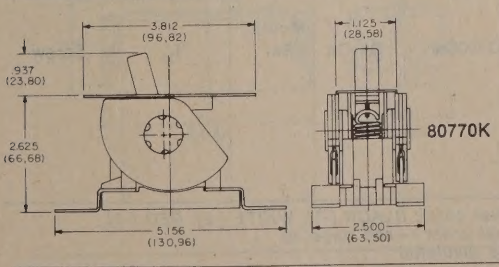
CROUSE-HINDS

Arrow Hart Division

POWER TOGGLE SWITCHES

TWO-POSITION MAINTAINED

30 & 60 AMP AC/DC EXTRA HEAVY DUTY SERIES

Body Dimensions	Circuit	Cat. No.	Action	Lever	Termination
 3.312 (84,12) MTG. .875 (22,23) .812 (20,62) 100006 1.687 (42,85) 1.937 (49,20) 1.312 (33,32)	**DPST** 30 Amp, 250 V AC/DC 2 HP, 120 V-240 V AC	100006	Off-On	Square	Screw
 3.312 MTG. (84,12) .812 (20,62) 80093 2.031 (51,59) 2.750 (69,85) 1.437 (36,50)	**DPST** 30 Amp, 250 V AC/DC 20 Amp, 600 V AC/DC 2 HP, 115 V-600 V AC	80093	Off-On	Square	Screw
 3.312 MTG. (84,12) .781 (19,84) 80404 2.031 (51,59) 2.750 (69,85) 2.500 (63,50)	**3PST** 30 Amp, 250 V AC/DC 20 Amp, 600 V AC/DC 2 HP, 120 V-600 V AC	80404	Off-On	Square	Screw
 2.000 (50,80) 1.500 (38,10) .937 (23,80) 7828B 2.187 (55,55) 2.625 (66,68) 1.875 (47,63)	**DPST** 60 Amp, 250 V AC/DC 25 Amp, 600 V AC/DC 2 HP, 125 V-250 V AC	7828B	Off-On	Square	Screw
 3.812 (96,82) 1.125 (28,58) .937 (23,80) 80770K 2.625 (66,68) 5.156 (130,96) 2.500 (63,50)	**DPST** 60 Amp, 250 V DC-575 V AC 5 HP, 230 V-575 V AC	80770K	Off-On	Square	Screw

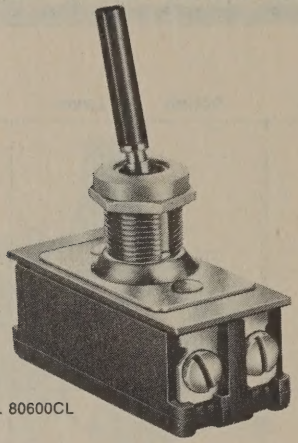
AVAILABLE OPTIONS: Modifications available include: special levers for mechanical operation — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS
Arrow Hart Division

POWER TOGGLE SWITCHES
MEDIUM DUTY
TWO-POSITION MAINTAINED

600 SERIES, 1 HP/16 AMP



CAT. NO. 80600CL

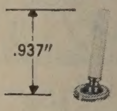
The Arrow Hart 600 Series has been designed especially for small motor applications. These switches feature wiping contact action with positive quick make-break, and are suitable for AC or DC use.

- *Wiping blade contact mechanism with positive quick make-break*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Horsepower rating*
- *UL Listed, File E1148, Guide WOYR*

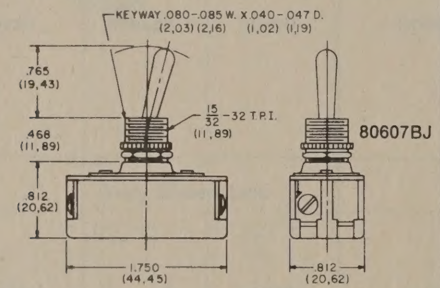
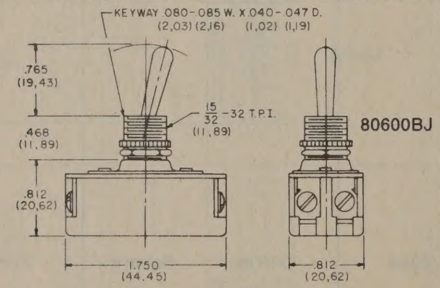
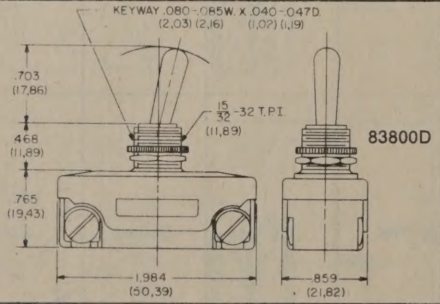
COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel
Dielectric breakdown ...	Exceeds 1000 V rms
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES



BATON

Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .765 (19,43) 15/32-32 T.P.I. (11,89) .468 (11,89) .812 (20,62) 1.750 (44,45) .812 (20,62) 80607BJ	**SPST** **12 Amp, 125 V AC/DC** **6 Amp, 250 V AC/DC**	80607BJ	Off-On	Bat	15/32	Screw
	SPDT **12 Amp, 125 V AC/DC** **6 Amp, 250 V AC/DC**	80618K	Off-On	Bat	15/32	Screw
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .765 (19,43) 15/32-32 T.P.I. (11,89) .468 (11,89) .812 (20,62) 1.750 (44,45) .812 (20,62) 80600BJ	**DPST** **16 Amp, 1 HP, 125 V AC/DC** **8 Amp, 1 HP, 250 V AC/DC**	80600 80600CL(*) 80600B 80600BJ	Off-On Off-On Off-On Off-On	Ball Baton Ball Bat	5/16 15/32 15/32 15/32	Screw Screw Screw Screw
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .703 (17,86) 15/32-32 T.P.I. (11,89) .468 (11,89) .765 (19,43) 1.984 (50,39) .859 (21,82) 83800D	**DPST** **16 Amp, 1 HP, 125 V AC/DC** **8 Amp, 1 HP, 250 V AC/DC**	83800D■	Off-On	Molded Bat	15/32	Screw

* *Insert dash number for baton lever color: BLACK (-1), WHITE (-2), RED (-3). Other colors available on special order — see page 40.*

■ *All molded construction, double insulated.*

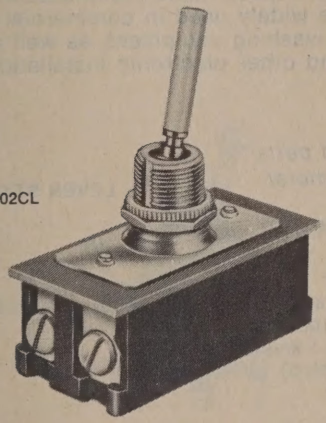
AVAILABLE OPTIONS: Modifications available include: special sleeve lengths; custom levers; wire lead terminals — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

POWER TOGGLE SWITCHES
HEAVY DUTY
TWO-POSITION MAINTAINED

602 SERIES, 1½ HP/20 AMP


CAT. NO. 80602CL

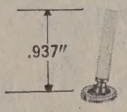
These heavy duty toggle switches have been designed primarily for motor applications requiring interrupting capability up to 1½ horsepower. They feature wiping action, positive quick make-break, and are suitable for AC or DC use.

- *Wiping blade contact mechanism with positive quick make-break*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Horsepower rating*
- *UL Listed, File E1148, Guide WOYR*

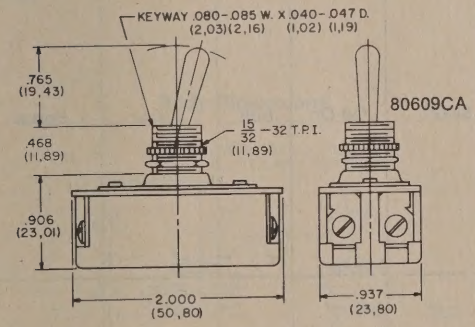
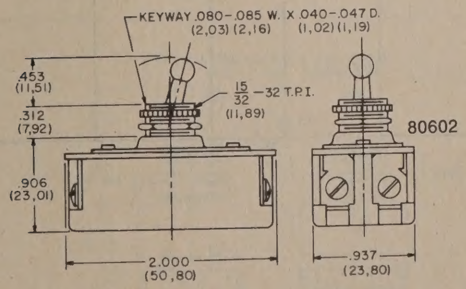
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES



BATON

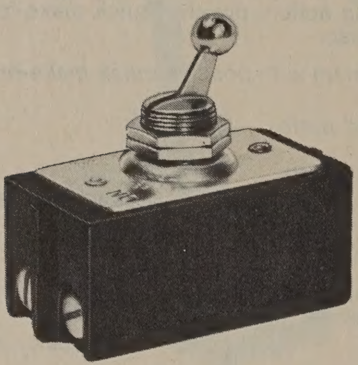
Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085 W. X .040-.047 D. (2,03)(2,16) (1,02) (1,19) .765 (19,43) .468 (11,89) 15/32 -32 T.P.I. (11,89) .906 (23,01) 2.000 (50,80) .937 (23,80) 80609CA	**SPST** **15 Amp, ¾ HP, 125 V AC/DC** **10 Amp, ¾ HP, 250 V AC/DC**	80601BD	Off-On	Bat	15/32	Screw
	SPDT **15 Amp, ¾ HP, 125 V AC/DC** **10 Amp, ¾ HP, 250 V AC/DC**	80609CA	On-On	Bat	15/32	Screw
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .453 (11,51) .312 (7,92) 15/32 -32 T.P.I. (11,89) .906 (23,01) 2.000 (50,80) .937 (23,80) 80602	**DPST** **20 Amp, 1½ HP, 125 V AC/DC** **10 Amp, 1½ HP, 250 V AC/DC**	80602CL(*)	Off-On	Baton	15/32	Screw
		80602CA	Off-On	Bat	15/32	Screw
		80602	Off-On	Ball	5/16	Screw
		80602C	Off-On	Ball	15/32	Screw

** Insert dash number for baton lever color: BLACK (-1), WHITE (-2), RED (-3). Other colors available on special order — see page 40.*

CROUSE-HINDS
Arrow Hart Division

POWER TOGGLE SWITCHES
HEAVY DUTY
TWO-POSITION MAINTAINED

421 SERIES, 2 HP/20 AMP



CAT. NO. 80421.

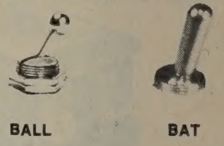
These heavy duty switches feature quick make-break action in a molded phenolic base. They are widely used in commercial and industrial power tools and floor washing equipment, as well as in power circuits for computers and other electronic installations.

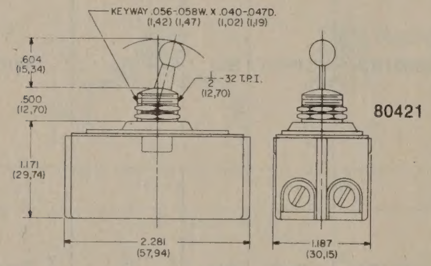
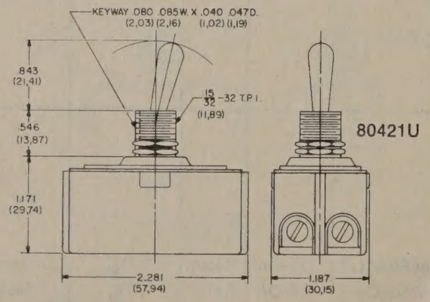
- *Positive quick make-break*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Slotted sleeve, ½″ or 15/32″ diameter*
- *Horsepower rating*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel
Dielectric breakdown . . .	Exceeds 1000 V rms
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

LEVER STYLES



Body Dimensions	Circuit	Cat. No.	Action	Lever	Slotted Sleeve Length, In.	Termination
 KEYWAY .056-.058W. X .040-.047D. (1,42) (1,47) (1,02) (1,19) .604 (15,34) 1/2-32 T.P.I. (12,70) .500 (12,70) 1.171 (29,74) 2.281 (57,94) 1.187 (30,15) 80421	**DPST** **1½ HP, 125 V AC/DC** **20 Amp, 2 HP, 250 V AC/DC**	80421	Off-On	Ball	11/32▲	Screw
 KEYWAY .080 .085W. X .040 .047D. (2,03) (2,16) (1,02) (1,19) .843 (21,41) 15/32-32 T.P.I. (11,89) .546 (13,87) 1.171 (29,74) 2.281 (57,94) 1.187 (30,15) 80421U	**DPST** **1½ HP, 125 V AC/DC** **20 Amp, 2 HP, 250 V AC/DC**	80421U	Off-On	Bat	15/32	Screw

▲ *½″ dia. sleeve.*

CROUSE-HINDS®
Arrow Hart Division

SUBMINIATURE TOGGLE SWITCHES

TWO & THREE-POSITION MAINTAINED/MOMENTARY

INSTRUMENT GRADE

CAT. NO. TS3.

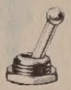
These Arrow Hart subminiature toggle switches are ideal for use in electronic test equipment, communications, switchboards, computers, aerospace instrumentation — wherever high switching reliability must be installed in a minimum amount of space. Gold plated contacts assure long shelf life and optimum low energy performance.

- *Maintained and momentary switching action*
- *Rhodium-plated contact carriers for long mechanical life*
- *Butt-type gold plated silver contacts for low energy reliability*
- *Circuits SPST thru DPDT*
- *Gold anodized aluminum exposed parts*
- *Combination solder lug/quick-connect terminals*
- *Slotted sleeve (¼″ dia., ¼″ length)*

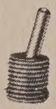
COMMON SPECIFICATIONS

Exposed metal parts . . .	Gold anodized aluminum
Dielectric breakdown . . .	Exceeds 1000 V rms
Stationary contact material	Gold plated silver buttons
Moving contact material .	Rhodium-plated silver
Terminals	Gold flash
Base material	Molded diallyl phthalate
Contact mechanism	TS type: knee action TC, TE, TG, TM types: rocker action
Standard hardware	2 gold anodized hex nuts, 1 lockwasher, 2 locating rings (unassembled)

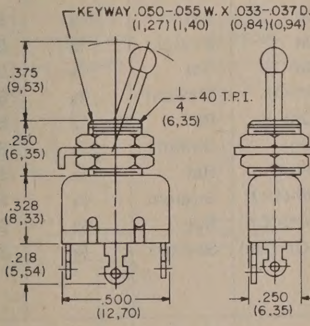
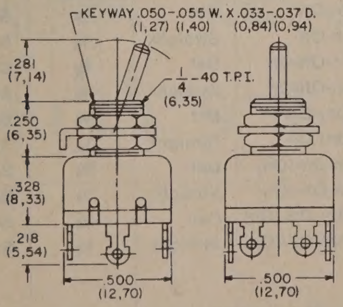
LEVER STYLES



BALL



STRAIGHT

Body Dimensions	Circuit	Cat. No.	Action●	Lever	Slotted Sleeve Length, In.	Termination
 TS3	**SPST** **5 Amp, 125 V AC** **5 Amp, 29 V DC**	TS1	Off-On	Ball	¼	Solder Lug
	SPDT **5 Amp, 125 V AC** **5 Amp, 29 V DC**	TSH3	On-On	Straight	¼	Solder Lug
		TS3	On-On	Ball	¼	Solder Lug
		TCH3	On-Off-On	Straight	¼	Solder Lug
		TC3	On-Off-On	Ball	¼	Solder Lug
		TEH3	(On)-Off-On	Straight	¼	Solder Lug
		TE3	(On)-Off-On	Ball	¼	Solder Lug
		TGH3	(On)-Off-(On)	Straight	¼	Solder Lug
		TG3	(On)-Off-(On)	Ball	¼	Solder Lug
		TMH3	(On)-On	Straight	¼	Solder Lug
		TM3	(On)-On	Ball	¼	Solder Lug
 TSH6	**DPST** **5 Amp, 125 V AC** **5 Amp, 29 V DC**	TSH2	Off-On	Straight	¼	Solder Lug
		TS2	Off-On	Ball	¼	Solder Lug
	DPDT **5 Amp, 125 V AC** **5 Amp, 29 V DC**	TSH6	On-On	Straight	¼	Solder Lug
		TS6	On-On	Ball	¼	Solder Lug
		TCH6	On-Off-On	Straight	¼	Solder Lug
		TC6	On-Off-On	Ball	¼	Solder Lug
		TEH6	(On)-Off-On	Straight	¼	Solder Lug
		TE6	(On)-Off-On	Ball	¼	Solder Lug
		TGH6	(On)-Off-(On)	Straight	¼	Solder Lug
		TG6	(On)-Off-(On)	Ball	¼	Solder Lug
		TMH6	(On)-On	Straight	¼	Solder Lug
		TM6	(On)-On	Ball	¼	Solder Lug

●( ) *Indicates momentary action.*

AVAILABLE OPTIONS: Mcdifications available include: colored lever adapters; special sleeve lengths; optional levers; special hardware; printed circuit and right angle terminals — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

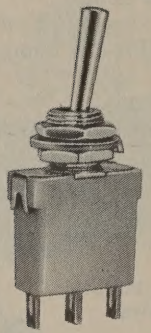
CROUSE-HINDS®
Arrow Hart Division

SUBMINIATURE TOGGLE SWITCHES

TWO & THREE-POSITION MAINTAINED/MOMENTARY

UTILITY GRADE

These general purpose subminiature utility switches are suited for applications where low cost dependability is important. Because these switches meet the standards prescribed by the International Electrotechnical Commission (IEC) they are ideal for use in products destined for sale in Canada and Europe.



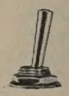
CAT. NO. CTS3,

- *Positive and momentary switching action*
- *Meet Continental European standards prescribed by IEC*
- *Molded phenolic base*
- *Combination solder lug/quick-connect terminals*
- *Slotted sleeve (¼″ dia.) **

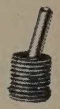
COMMON SPECIFICATIONS

Exposed metal parts ...	Chrome-plated steel frame and lockwasher, chrome-plated brass bushing, nuts and lever
Dielectric breakdown ...	2000 V rms
Contact material	Silver
Terminals	Silver
Base	Molded phenolic
Contact mechanism	Rocker
Standard hardware	2 hex nuts, 1 locating ring (unassembled)

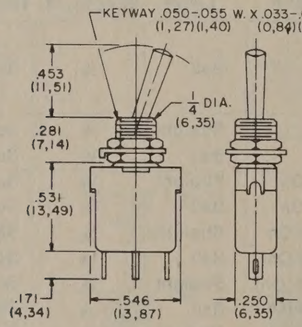
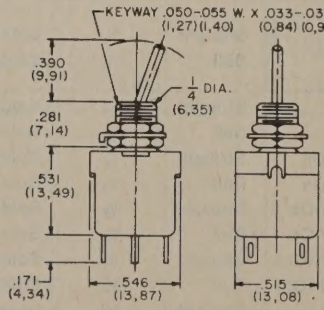
LEVER STYLES



BAT



STRAIGHT

Body Dimensions		Circuit	Cat. No.	Action●	Lever	Slotted Sleeve Length, In.	Termination
 KEYWAY .050-.055 W. X .033-.037 D. (1,27)(1,40) (0,84)(0,94) .453 (11,51) 1/4 DIA. (6,35) .281 (7,14) .531 (13,49) .171 (4,34) .546 (13,87) .250 (6,35)	CTS3	**SPDT** **5 Amp, 125 V AC** **3 Amp, 250 V AC**	CTS3	On-On	Bat	⅜	Solder Lug
			CTS3P	On-On	Straight	⅜	Solder Lug
			CTC3	On-Off-On	Bat	⅜	Solder Lug
			CTC3P	On-Off-On	Straight	⅜	Solder Lug
			CTM3	On-(On)	Bat	¼	Solder Lug
			CTM3P	On-(On)	Straight	¼	Solder Lug
			CTE3	On-Off-(On)	Bat	¼	Solder Lug
			CTE3P	On-Off-(On)	Straight	¼	Solder Lug
			CTG3	(On)-Off-(On)	Bat	¼	Solder Lug
			CTG3P	(On)-Off-(On)	Straight	¼	Solder Lug
 KEYWAY .050-.055 W. X .033-.037 D. (1,27)(1,40) (0,84)(0,94) .390 (9,91) 1/4 DIA. (6,35) .281 (7,14) .531 (13,49) .171 (4,34) .546 (13,87) .515 (13,08)	CTC6P	**DPDT** **5 Amp, 125 V AC** **3 Amp, 250 V AC**	CTS6	On-On	Bat	⅜	Solder Lug
			CTS6P	On-On	Straight	⅜	Solder Lug
			CTC6	On-Off-On	Bat	⅜	Solder Lug
			CTC6P	On-Off-On	Straight	⅜	Solder Lug
			CTM6	(On)-On	Bat	¼	Solder Lug
			CTM6P	(On)-On	Straight	¼	Solder Lug
			CTE6	On-Off-(On)	Bat	¼	Solder Lug
			CTE6P	On-Off-(On)	Straight	¼	Solder Lug
			CTG6	(On)-Off-(On)	Bat	¼	Solder Lug
			CTG6P	(On)-Off-(On)	Straight	¼	Solder Lug

● ( ) Indicates momentary action.

** Thread size to be standardized to ¼″ x 40 UNS — please consult factory for complete information.*

AVAILABLE OPTIONS: Modifications available include: colored lever adapters — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES

MILITARY APPROVED

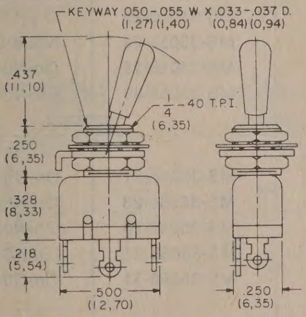
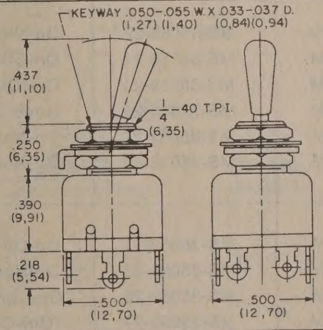
MS-75028 & MS-75029 SUBMINIATURE SERIES

CAT. NO. TM6M,
SHOWN ACTUAL SIZE

These subminiature toggle switches are manufactured in full accordance with MIL-S-3950, drawings MS-75028* and MS-75029*. Switches are supplied with two hex nuts, two locating rings and one locking ring.

** The design and construction of this type material is subject to revision of Military Standards. We suggest that the factory be contacted for latest data.*

- *Maintained and momentary action*
- *Rhodium plated contact carriers for extra long mechanical life*
- *Butt-type gold plated silver contacts for low energy reliability*
- *Circuits SPST thru DPDT*
- *Clear anodized aluminum finish*
- *Aluminum exposed parts*
- *Combination solder lug/quick-connect terminals*
- *Slotted sleeve (¼″ dia., ¼″ length)*

Body Dimensions		Circuit	Cat. No.	MS Part No.	Action●
 KEYWAY .050-055 W X .033-.037 D. (1,27) (1,40) (0,84) (0,94) .437 (11,10) 1/4-40 T.P.I. (6,35) .250 (6,35) .328 (8,33) .218 (5,54) .500 (12,70) .250 (6,35)	TS3M	**SPST**	TS1M	MS-75028-22	On-None-Off
		SPDT	TC3M	MS-75028-21	On-Off-On
			TE3M	MS-75028-31	(On)-Off-On
			TG3M	MS-75028-27	(On)-Off-(On)
			TM3M	MS-75028-26	(On)-None-On
			TS3M	MS-75028-23	On-None-On
 KEYWAY .050-.055 W. X .033-.037 D. (1,27) (1,40) (0,84)(0,94) .437 (11,10) 1/4-40 T.P.I. (6,35) .250 (6,35) .390 (9,91) .218 (5,54) .500 (12,70) .500 (12,70)	TM6M	**DPST**	TS2M	MS-72059-22	On-None-Off
		DPDT	TC6M	MS-75029-21	On-Off-On
			TE6M	MS-75029-31	(On)-Off-On
			TG6M	MS-75029-27	(On)-Off-(On)
			TM6M	MS-75029-26	(On)-None-On
			TS6M	MS-75029-23	On-None-On

●*( ) Indicates momentary action.*

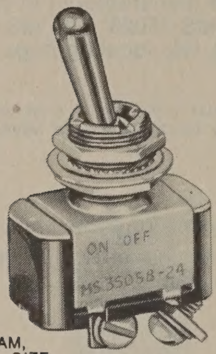
CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

TOGGLE SWITCHES

MILITARY APPROVED

MS-35058 & MS-35059 SERIES

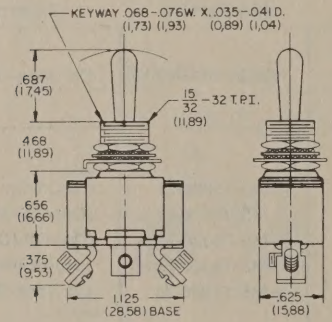
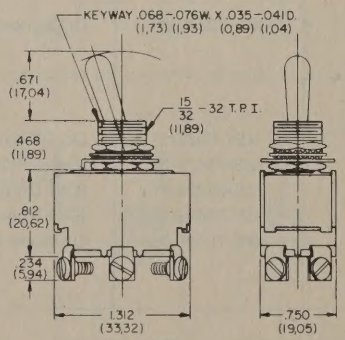

ON OFF
MS 35058-24

CAT. NO. 35058AM,
SHOWN ACTUAL SIZE

This Arrow Hart toggle switch series is manufactured in full accordance with MIL-S-3950, drawings MS-35058* and MS-35059*. Switches are supplied with two hex nuts, one locating ring and one shakeproof lockwasher; screw terminals.

** The design and construction of this type material is subject to revision of Military Standards. We suggest that the factory be contacted for latest data.*

- *Butt type contacts*
- *Molded phenolic base*
- *Exposed parts of non-ferrous material, satin chrome finished*
- *Slotted sleeve ($\frac{15}{32}$″ dia., 32 T.P.I.)*
- *Action designations stamped on side*
- *Momentary and maintained contact*

Body Dimensions	Circuit	Cat. No.	MS Part No.	Action●
 KEYWAY .068-.076W. X. .035-.041D. (1,73) (1,93) (0,89) (1,04) .687 (17,45) 15/32 -32 T.P.I. (11,89) .468 (11,89) .656 (16,66) .375 (9,53) 1.125 (28,58) BASE .625 (15,88) 35058EM	**SPST**	35058WM	MS-35058-22	On-None-Off
		35058AM	MS-35058-24	On-Off-None
		35058CM	MS-35058-25	On-(Off)-None
		35058BM	MS-35058-28	None-Off-(On)
		35058XM	MS-35058-29	On-None-(Off)
		35058YM	MS-35058-30	Off-None-(On)
	SPDT	35058EM	MS-35058-21	On-Off-On
		35058DM	MS-35058-23	On-None-On
		35058FM	MS-35058-26	On-None-(On)
		35058GM	MS-35058-27	(On)-Off-(On)
		35058HM	MS-35058-31	On-Off-(On)
 KEYWAY .068-.076W. X .035-.041D. (1,73) (1,93) (0,89) (1,04) .671 (17,04) 15/32 -32 T.P.I. (11,89) .468 (11,89) .812 (20,62) .234 (5,94) 1.312 (33,32) .750 (19,05) 35059DM	**DPST**	35059WM	MS-35059-22	On-None-Off
		35059AM	MS-35058-24	On-Off-None
		35059CM	MS-35059-25	On-(Off)-None
		35059BM	MS-35059-28	None-Off-(On)
		35059XM	MS-35059-29	On-None-(Off)
		35059YM	MS-35059-30	Off-None-(On)
	DPDT	35059EM	MS-35059-21	On-Off-On
		35059DM	MS-35059-23	On-None-On
		35059FM	MS-35059-26	On-None-(On)
		35059GM	MS-35059-27	(On)-Off-(On)
		35059HM	MS-35059-31	On-Off-(On)

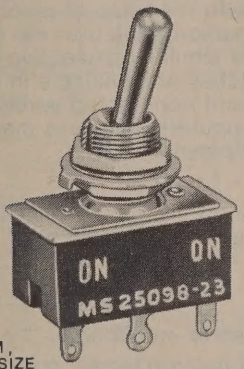
●*( ) Indicates momentary action.*

CROUSE-HINDS
Arrow Hart Division

TOGGLE SWITCHES

MILITARY APPROVED

MS-25098 & MS-25100 SERIES

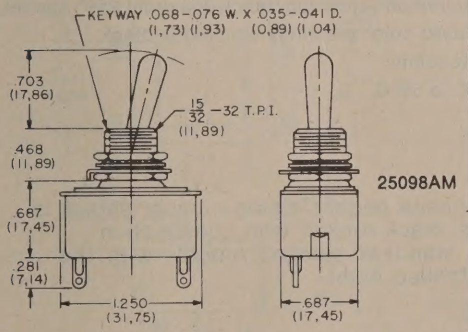
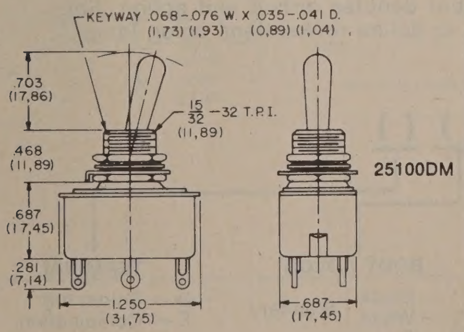

ON
ON
MS 25098-23

CAT. NO. 25098DM,
SHOWN ACTUAL SIZE

These Arrow Hart toggle switches are manufactured in full accordance with MIL-S-3950, drawings MS-25098* and MS-25100*. Switches are supplied with two hex nuts, one locating ring and one shakeproof lockwasher; solder lug terminals.

** The design and construction of this type material is subject to revision of Military Standards. We suggest that the factory be contacted for latest data.*

- *Wiping action contacts*
- *Molded phenolic base*
- *Exposed parts of non-ferrous material, satin chrome finished*
- *Slotted sleeve ($\frac{15}{32}$" dia., 32 T.P.I.)*
- *Action designations stamped on side*
- *Momentary and maintained contact*

Body Dimensions	Circuit	Cat. No.	MS Part No.	Action•
	**SPST**	25098AM 25098BM 25098CM	MS-25098-22 MS-25098-29 MS-25098-30	On-None-Off On-None-(Off) Off-None-(On)
	SPDT	25098DM	MS-25098-23	On-None-On
	**DPST**	25100AM 25100BM 25100CM	MS-25100-22 MS-25100-29 MS-25100-30	On-None-Off On-None-(Off) Off-None-(On)
	DPDT	25100DM	MS-25100-23	On-None-On

KEYWAY .068-.076 W. X .035-.041 D.
(1,73) (1,93) (0,89) (1,04)
.703 (17,86)
$\frac{15}{32}$ -32 T.P.I. (11,89)
.468 (11,89)
.687 (17,45)
.281 (7,14)
1.250 (31,75)
.687 (17,45)
25098AM
KEYWAY .068-.076 W. X .035-.041 D.
(1,73) (1,93) (0,89) (1,04)
.703 (17,86)
$\frac{15}{32}$ -32 T.P.I. (11,89)
.468 (11,89)
.687 (17,45)
.281 (7,14)
1.250 (31,75)
.687 (17,45)
25100DM

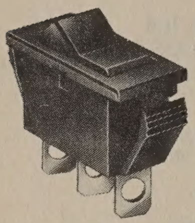
• ( ) *Indicates momentary action.*

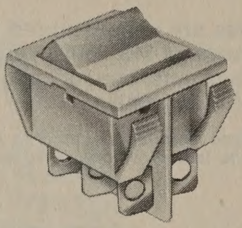
CROUSE-HINDS®
Arrow Hart Division

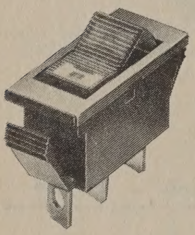
MINIATURE SNAP-IN ROCKER SWITCHES

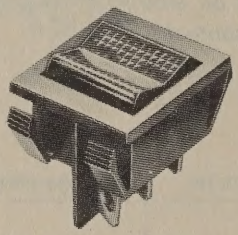
LIGHTED & NON-LIGHTED

1600/2600 SERIES, 16 AMP


SINGLE POLE
2-POSITION
(non-lighted)


DOUBLE POLE
2-POSITION
(non-lighted)


SINGLE POLE
2-POSITION
(lighted)


DOUBLE POLE
2-POSITION
(lighted)

1600/2600 Series Miniature Rocker Switches offer designers a choice of colors and terminations with the ease of labor saving snap-in mounting. The 16 Amp rating affords the user the opportunity to utilize them in applications where similar competitive switches cannot be used. These low cost switches are available in single and double pole models in both lighted and non-lighted versions. They are widely used on instruments, computers, business machines, appliances and communication equipment.

- *16 Amp, 250 V AC*
- *Matching indicator lights available*
- *Slow make-break action*
- *Low cost*
- *Compact design with popular snap-in mounting*
- *UL, CSA, VDE, Semko, El Finland listed (Demko, Nemko, and U.T.E. pending)*

COMMON SPECIFICATIONS

Operation	Rocker lever action, two or three position maintained or momentary, with or without illumination
Mounting	Snap-In feature (see cutout dimension)
Termination	Combination solder lug/quick connect (.250″ spade)
Lever and Base	Standard color presently stocked is black
Insulation Resistance . . .	50 megohms
Operating Temp. Range .	−40° to 55°C

HOW TO ORDER NON-LIGHTED SWITCHES

Choose the circuit and action required from the selection chart on opposite page. Catalog number shown is complete ordering number. These non-lighted switches have black base, black rocker, with combination quick connect/solder lug terminal. All non-lighted switches listed are standard stocked models with the exception of those numbers marked with an asterisk, which are non-stocked items.

HOW TO ORDER LIGHTED SWITCHES

Refer to selection chart on opposite page. First 4 digits of catalog number denotes circuit and action. For complete ordering number, 4 additional letters/numbers are required to define rocker/lens color, lamp voltage, body color, and terminal style — as illustrated below:

X X X X — ( ) ( ) ( ) ( )

BASIC NO.	TRANSLUCENT ROCKER/LENS COLOR	LAMP VOLTAGE	BODY COLOR	TERMINAL
Note: Use 1609 for indicator light	A — Amber G — Green R — Red W — White	0 — No lamp 1 — 110 V, neon 2 — 240 V, neon 4 — 6 V, filament 5 — 12 V, filament 6 — 24 V, filament	1 — Black } Standard 2 — White } Standard 3 — Red } Special 4 — Green } Special 5 — Gray } Special	B — Solder lug E — Combination quick connect/solder lug

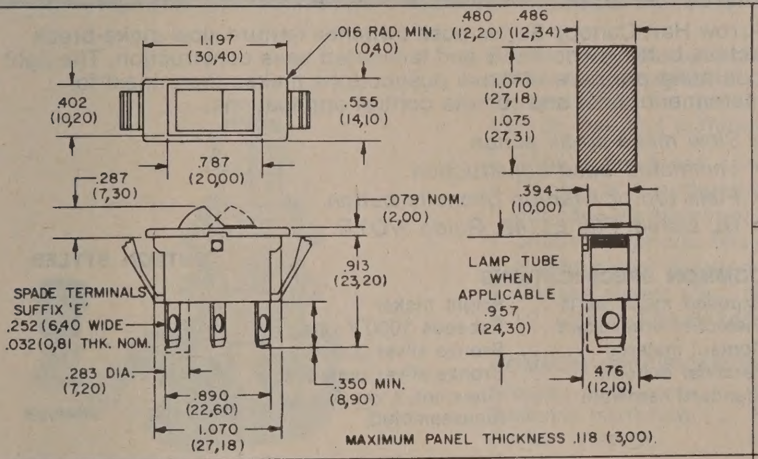
EXAMPLE: 1624-R41E = SPDT, On-Off-On action, red rocker/lens, 6-volt lamp, black body, combination terminal

CROUSE-HINDS®
Arrow Hart Division

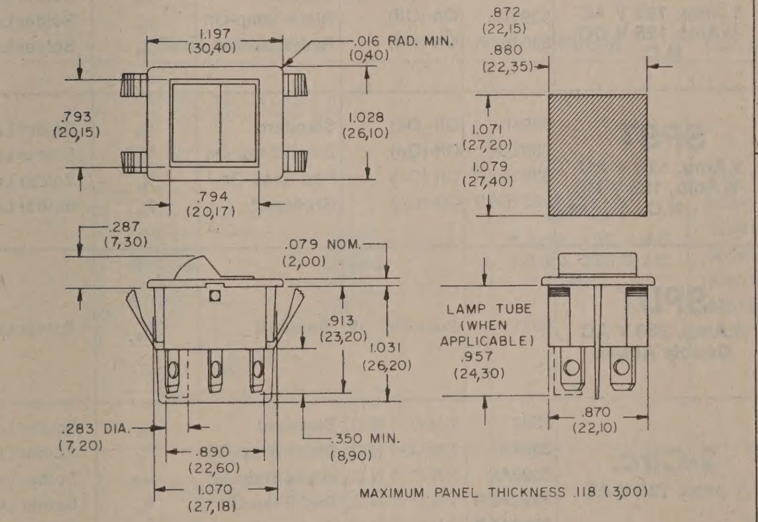
MINIATURE SNAP-IN ROCKER SWITCHES

LIGHTED & NON-LIGHTED

Dimensions



1.197
(30,40)
.016 RAD. MIN.
(0,40)
.480 .486
(12,20) (12,34)
.402
(10,20)
.555
(14,10)
1.070
(27,18)
1.075
(27,31)
.787
(20,00)
.287
(7,30)
.079 NOM.
(2,00)
.394
(10,00)
.913
(23,20)
LAMP TUBE
WHEN
APPLICABLE
.957
(24,30)
SPADE TERMINALS
SUFFIX 'E'
.252 (6,40 WIDE
.032 (0,81 THK. NOM.
.283 DIA.
(7,20)
.890
(22,60)
1.070
(27,18)
.350 MIN.
(8,90)
.476
(12,10)
MAXIMUM PANEL THICKNESS .118 (3,00)



1.197
(30,40)
.016 RAD. MIN.
(0,40)
.872
(22,15)
.880
(22,35)
.793
(20,15)
1.028
(26,10)
1.071
(27,20)
1.079
(27,40)
.794
(20,17)
.287
(7,30)
.079 NOM.
(2,00)
.913
(23,20)
1.031
(26,20)
LAMP TUBE
(WHEN
APPLICABLE)
.957
(24,30)
.870
(22,10)
.283 DIA.
(7,20)
.890
(22,60)
.350 MIN.
(8,90)
1.070
(27,18)
MAXIMUM PANEL THICKNESS .118 (3,00)

Circuit	Cat. No.	Action●	Lighted
SPST	1600-11E	Off-On	No
	1600-( ) ( ) ( ) ( )		Yes
	1601-11E	Off-(On)	No
	1601-( ) ( ) ( ) ( )		Yes
	1605-11E*	On-(Off)	No
SPDT	1602-11E	On-On	No
	1603-11E	On-(On)	No
	1604-11E	On-Off-On	No
	1606-11E*	(On)-Off-(On)	No
	1607-11E*	On-Off-(On)	No
SPST	1625-( ) ( ) ( ) ( )	On-(Off)	Yes
SPDT	1622-( ) ( ) ( ) ( )	On-On	Yes
	1623-( ) ( ) ( ) ( )	On-(On)	Yes
	1624-( ) ( ) ( ) ( )	On-Off-On	Yes
	1626-( ) ( ) ( ) ( )	(On)-Off-(On)	Yes
	1627-( ) ( ) ( ) ( )	On-Off-(On)	Yes
DPST	2600-11E	Off-On	No
	2600-( ) ( ) ( ) ( )		Yes
	2601-11E	Off-(On)	No
	2601-( ) ( ) ( ) ( )		Yes
	2605-11E*	On-(Off)	No
	2605-( ) ( ) ( ) ( )		Yes
DPDT	2602-11E	On-On	No
	2603-11E	On-(On)	No
	2604-11E	On-Off-On	No
	2606-11E*	(On)-Off-(On)	No
	2607-11E*	On-Off-(On)	No

● ( ) indicates momentary action
** Non-stocked items*

NOTES:

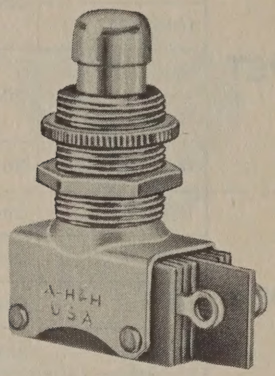
1. *Switches are rated at 16 A, 250 V AC, except models 1606, 1607, 2606 and 2607, which are rated at 6 A, 250 V AC. Approvals pending (UL, CSA, etc.)*
2. *All lamps are assembled integral with the base, except for a switch or indicator with Green translucent rocker/lens. These are fitted with 110 V or 240 V fluorescent lamp. These particular lamps are inserted into a tube at the rear of the base. Other switches with the tube in the base can be supplied on special order to enable lamps to be fitted on site.*
3. *Other optional circuits, colors, functions, terminals available on special order — please consult factory.*

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

PUSHBUTTON SWITCHES
GENERAL PURPOSE
MOMENTARY/DOUBLE ACTION

CANOPY SERIES, 1 AMP AC ONLY



CAT. NO. 3391

Arrow Hart Canopy Series push switches feature slow make-break action, butt-type contacts and laminated base construction. The light operating pressure of these pushbuttons makes them ideal for instrument panel and remote control applications.

- *Slow make-break action*
- *Laminated base construction*
- *Plain top or snap-on phenolic button*
- *UL Listed, File E1148, Guide WOYR*

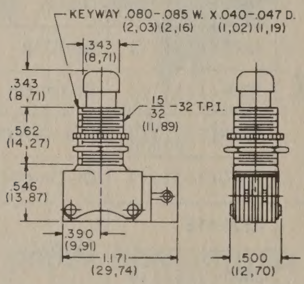
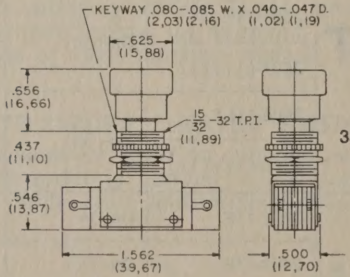
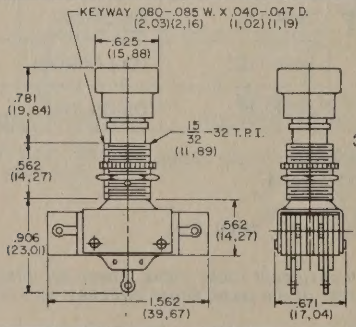
COMMON SPECIFICATIONS

Exposed metal parts	Bright nickel
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

BUTTON STYLES

STANDARD

SNAP-ON

Body Dimensions	Circuit	Cat. No.	Action●	Button	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .343 (8,71) .343 (8,71) 15/32 -32 T.P.I. (11,89) .562 (14,27) .546 (13,87) .390 (9,91) 1.171 (29,74) .500 (12,70) 3391	**SPST** **1 Amp, 125 V AC** **¾ Amp, 125 V DC** **N.C.**	3391	On-(Off)	Standard	9/16	Solder Lug
		3391GJ	On-(Off)	Black Snap-On	9/16	Solder Lug
		3391GJR	On-(Off)	Red Snap-On	9/16	Solder Lug
	SPST **1 Amp, 125 V AC** **¾ Amp, 125 V DC** **N.O.**	3391E	Off-(On)	Standard	9/16	Solder Lug
		3391GL	Off-(On)	Black Snap-On	9/16	Solder Lug
		3391GLR	Off-(On)	Red Snap-On	9/16	Solder Lug
		3391GLB	Off-(On)	Grooved*	9/16	Solder Lug
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .625 (15,88) .656 (16,66) 15/32 -32 T.P.I. (11,89) .437 (11,10) .546 (13,87) 1.562 (39,67) .500 (12,70) 3392A	**SPDT** **3 Amp, 250 V AC** **Double Action**	80711	Push-On/Off	Standard	9/16	Solder Lug
	2-Circ. **1 Amp, 125 V AC**	3392	1 N.O.-1 N.C.	Standard	9/16	Solder Lug
		3392A	1 N.O.-1 N.C.	Black Snap-On	7/16	Solder Lug
		3392AE	1 N.O.-1 N.C.	Black Snap-On	9/16	Solder Lug
		3392AER	1 N.O.-1 N.C.	Red Snap-On	9/16	Solder Lug
		3392AEB	1 N.O.-1 N.C.	Grooved*	9/16	Solder Lug
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .625 (15,88) .781 (19,84) 15/32 -32 T.P.I. (11,89) .562 (14,27) .906 (23,01) .562 (14,27) 1.562 (39,67) .671 (17,04) 3599GF	**DPDT** **3 Amp, 125 V AC/DC** **1 Amp, 125 V AC/DC**	3599GF	On-(On)	Black Snap-On	9/16	Solder Lug
		80714	Push-On/Off	Standard	9/16	Solder Lug

** A snap-on button should be ordered for grooved models.*
● ( ) indicates momentary action.

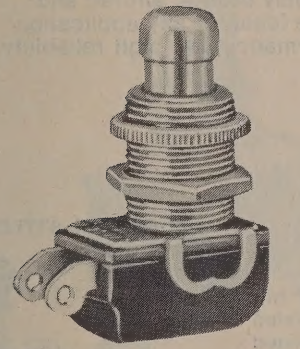
AVAILABLE OPTIONS: Modifications available include: screw terminals and wire leads; overthrow buttons; special button styles and colors — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS
Arrow Hart Division

PUSHBUTTON SWITCHES
GENERAL PURPOSE
MOMENTARY ACTION

511 SERIES, 3 AMP, AC ONLY



CAT. NO. 80511

These versatile butt action type push switches offer light operating pressure, high reliability and long life. A variety of styles are available to meet a wide range of applications, such as burglar alarms, keyboards, test and communications equipment, industrial hardware, etc.

- *Slow make-break contact action*
- *Choice of 3 button styles — standard aluminum, concave aluminum or snap-on molded phenolic*
- *Molded phenolic base*
- *Bright nickel finished exposed parts*
- *Slotted sleeve ($\frac{15}{32}$" dia., 32 T.P.I.)*
- *UL Listed, File E1148, Guide WOYR*

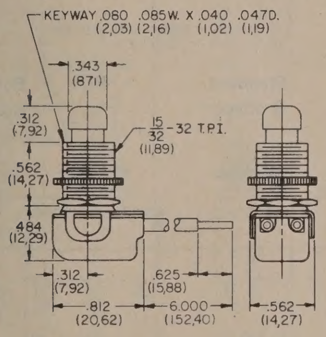
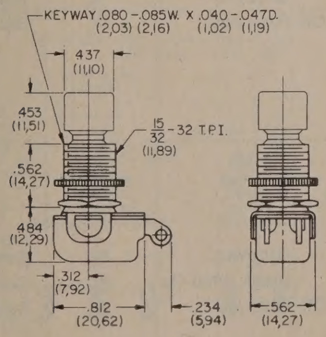
COMMON SPECIFICATIONS

Exposed metal parts ...	Aluminum
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminals	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

BUTTON STYLES

SNAP-ON

CONCAVE

Body Dimensions	Circuit	Cat. No.	Action●	Button	Slotted Sleeve Length, in.	Termination
 KEYWAY .080 .085W. X .040 .047D. (2,03) (2,16) (1,02) (1,19) .343 (8,71) .312 (7,92) $\frac{15}{32}$-32 T.P.I. (11,89) .562 (14,27) .484 (12,29) .312 (7,92) .625 (15,88) .812 (20,62) 6.000 (152,40) .562 (14,27) 80512	**SPST** **3 Amp, 125 V AC** **1 Amp, 250 V AC** **N.C.**	80511	On-(Off)	Standard	$\frac{9}{16}$	Solder Lug
		80541	On-(Off)	Black Snap-On	$\frac{9}{16}$	Solder Lug
		80541R	On-(Off)	Red Snap-On	$\frac{9}{16}$	Solder Lug
		80541L	On-(Off)	Grooved*	$\frac{9}{16}$	Solder Lug
		80511C	On-(Off)	Concave	$\frac{9}{16}$	Solder Lug
		80512	On-(Off)	Standard	$\frac{9}{16}$	Wire Lead
 KEYWAY .080-.085W. X .040-.047D. (2,03) (2,16) (1,02) (1,19) .437 (11,10) .453 (11,51) $\frac{15}{32}$-32 T.P.I. (11,89) .562 (14,27) .484 (12,29) .312 (7,92) .812 (20,62) .234 (5,94) .562 (14,27) 80511CE	**SPST** **3 Amp, 125 V AC** **1 Amp, 250 V AC** **N.O.**	80511E	Off-(On)	Standard	$\frac{9}{16}$	Solder Lug
		80541E	Off-(On)	Black Snap-On	$\frac{9}{16}$	Solder Lug
		80541ER	Off-(On)	Red Snap-On	$\frac{9}{16}$	Solder Lug
		80541EL	Off-(On)	Grooved*	$\frac{9}{16}$	Solder Lug
		80511CE	Off-(On)	Concave	$\frac{9}{16}$	Solder Lug

** A snap-on button should be ordered for grooved models.*

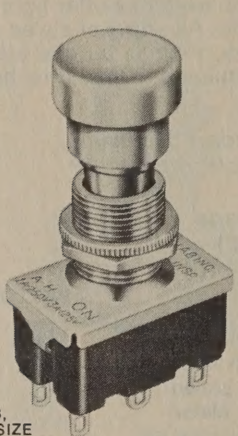
● ( ) indicates momentary action.

AVAILABLE OPTIONS: Modifications available include: special button colors; screw terminals; quick-connect terminals; overthrow button — please consult factory.

CROUSE-HINDS
Arrow Hart Division

PUSHBUTTON SWITCHES
GENERAL PURPOSE
MOMENTARY/DOUBLE ACTION

094 SERIES, 3 AMP AC/DC



CAT. NO. 83094CB,
SHOWN ACTUAL SIZE

These Arrow Hart pushbuttons feature combination solder lug/quick connect terminals, silver plated current carrying parts and a single wiping blade contact mechanism. Widely used in aircraft and electronic instrument panels, they are ideal for any application requiring small size, maximum performance and high reliability.

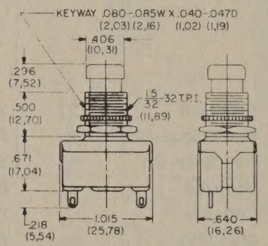
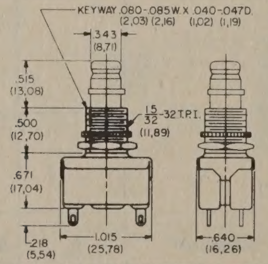
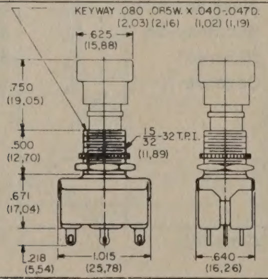
- *Single wiping blade contact action*
- *Molded phenolic base*
- *Silver plated current carrying parts*
- *Plain top or snap-on phenolic button*

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

BUTTON STYLES

STANDARD
SNAP-ON

Body Dimensions		Circuit	Cat. No.	Action●	Button	Slotted Sleeve Length, In.	Termination
 KEYWAY .080-.085W X .040-.047D (2,03) (2,16) (1,02) (1,19) .406 (10,31) .296 (7,52) 15/32-32 T.P.I. (11,89) .500 (12,70) .671 (17,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83090	**SPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83090 83090C	Off-(On) Off-(On)	Standard Grooved*	15/32 15/32	Solder Lug Solder Lug
 KEYWAY .080-.085W X .040-.047D (2,03) (2,16) (1,02) (1,19) .343 (8,71) .515 (13,08) 15/32-32 T.P.I. (11,89) .500 (12,70) .671 (17,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83093C	**DPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83093C 83098C	Off-(On) Push-On/Off	Grooved* Grooved*	15/32 9/16	Solder Lug Solder Lug
 KEYWAY .080-.085W X .040-.047D (2,03) (2,16) (1,02) (1,19) .625 (15,88) .750 (19,05) 15/32-32 T.P.I. (11,89) .500 (12,70) .671 (17,04) .218 (5,54) 1.015 (25,78) .640 (16,26)	83094CB	**DPDT** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	83094C 83094CB 83099C	On-(On) On-(On) Push-On/Off	Grooved* Black Snap-On Grooved*	15/32 15/32 9/16	Solder Lug Solder Lug Solder Lug

** A snap-on button should be ordered for grooved models.*
●( ) Indicates momentary action.

AVAILABLE OPTIONS: Modifications available include: special button colors — please consult factory.

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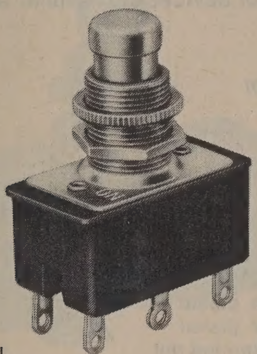
CROUSE-HINDS®
Arrow Hart Division

PUSHBUTTON SWITCHES
GENERAL PURPOSE
MOMENTARY ACTION

INTERMEDIATE SERIES, LOW LEVEL TO 6 AMP



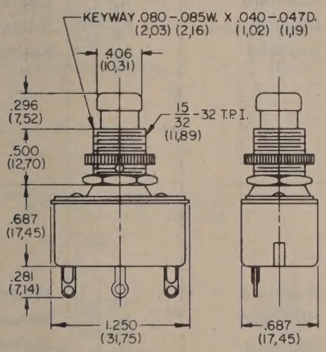
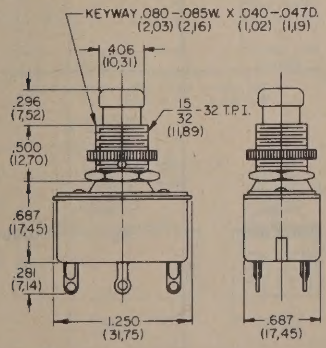
CAT. NO. 81087J, SHOWN ACTUAL SIZE

These momentary action push switches feature wiping action and a positive quick make-break mechanism for applications where foolproof movement is required. Intermediate Series switches are widely used in standard duty or low energy applications, such as remote control circuits, aircraft and ground support instrumentation, etc.

- *Wiping blade contact mechanism with positive quick-make break*
- *Molded phenolic*
- *Solder lug terminals*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

Body Dimensions	Circuit	Cat. No.	Action●	Button	Slotted Sleeve Length, in.	Termination
 KEYWAY .080 –.085W. X .040 –.047D. (2,03) (2,16) (1,02) (1,19) .406 (10,31) .296 (7,52) 15/32 -32 T.P.I. (11,89) .500 (12,70) .687 (17,45) .281 (7,14) 1.250 (31,75) .687 (17,45) 81081G	**SPDT** **6 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	81081G	On-(On)	Standard	15/32	Solder Lug
 KEYWAY .080 –.085W. X .040 –.047D. (2,03) (2,16) (1,02) (1,19) .406 (10,31) .296 (7,52) 15/32 -32 T.P.I. (11,89) .500 (12,70) .687 (17,45) .281 (7,14) 1.250 (31,75) .687 (17,45) 81087J	**DPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81084G	Off-(On)	Standard	15/32	Solder Lug
	DPDT **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81087J	On-(On)	Standard	15/32	Solder Lug

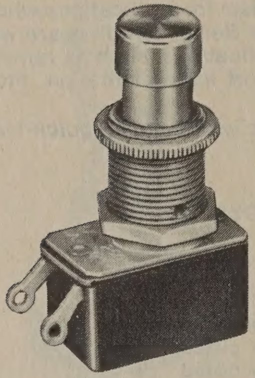
● ( ) indicates momentary action.

AVAILABLE OPTIONS: Modifications available include: screw terminals; wire leads; end-connect solder lugs; snap-on buttons; overthrow buttons — please consult factory.

CROUSE-HINDS
Arrow Hart Division

PUSHBUTTON SWITCHES
GENERAL PURPOSE
ALTERNATE ACTION

DOUBLE ACTION SERIES, 6 AMP AC/DC



CAT. NO. 82403

These Arrow Hart switches feature a push-to-make, push-to-break contact mechanism, and are widely used on vacuum cleaners, maintenance equipment, foot control devices and similar applications.

- *Push-to-make/push-to-break*
- *Wiping blade contact mechanism*
- *Molded phenolic base*
- *Choice of button styles*
- *UL Listed, File E1148, Guide WOYR*

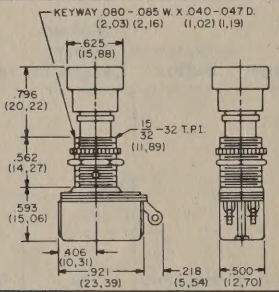
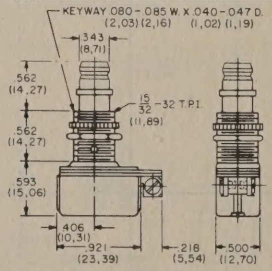
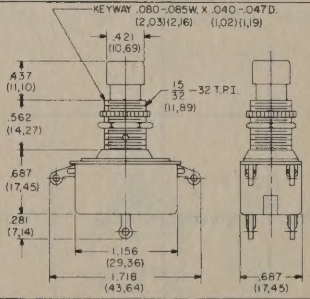
COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel finish
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

BUTTON STYLES

STANDARD

SNAP-ON

Body Dimensions	Circuit	Cat. No.	Action	Button	Slotted Sleeve Length, In.	Termination
 KEYWAY .080 - .085 W. X .040 - .047 D. (2,03) (2,16) (1,02) (1,19) .625 (15,88) .796 (20,22) $\frac{15}{32}$ -32 T.P.I. (11,89) .562 (14,27) .593 (15,06) .406 (10,31) .921 (23,39) .218 (5,54) .500 (12,70) 82403C	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	82403 82403C 82403CL	Off-On Off-On Off-On	Standard Black Snap-On Grooved*	$\frac{9}{16}$ $\frac{9}{16}$ $\frac{9}{16}$	Solder Lug Solder Lug Solder Lug
 KEYWAY .080 - .085 W. X .040 - .047 D. (2,03) (2,16) (1,02) (1,19) .343 (8,71) .562 (14,27) $\frac{15}{32}$ -32 T.P.I. (11,89) .562 (14,27) .593 (15,06) .406 (10,31) .921 (23,39) .218 (5,54) .500 (12,70) 82405CL	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	82404 82405 82405CL	Off-On Off-On Off-On	Standard Standard Grooved*	$\frac{9}{16}$ $\frac{9}{16}$ $\frac{9}{16}$	Wire† Screw Screw
 KEYWAY .080-.085W. X .040-.047D. (2,03)(2,16) (1,02)(1,19) .421 (10,69) .437 (11,10) $\frac{15}{32}$ -32 T.P.I. (11,89) .562 (14,27) .687 (17,45) .281 (7,14) 1.156 (29,36) 1.718 (43,64) .687 (17,45) 81117	**DPDT** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81117	On-On	Standard	$\frac{9}{16}$	Solder Lug

** A snap-on button should be ordered for grooved models.*
† Cat. No. 82404 has wire termination (not screw as shown on drawing).

AVAILABLE OPTIONS: Modifications available include: special button colors; extra-light operating pressures — please consult factory.

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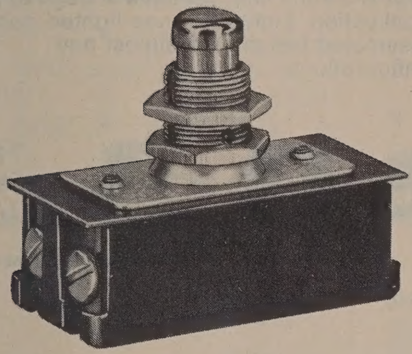
CROUSE-HINDS®
Arrow Hart Division

POWER PUSHBUTTON SWITCHES

MOMENTARY/ALTERNATE ACTION

HEAVY DUTY SERIES, 12, 16 & 20 AMP AC/DC



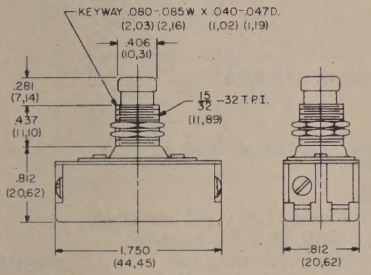
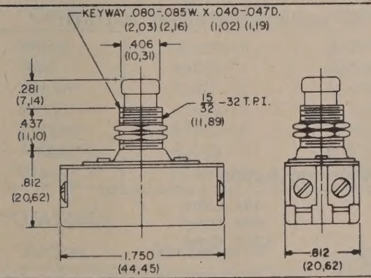
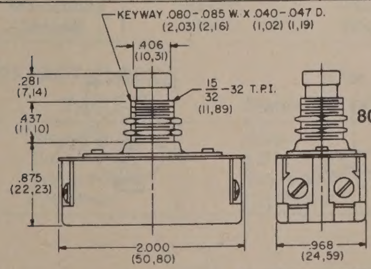
CAT. NO. 80938,
SHOWN ACTUAL SIZE

These heavy duty momentary and alternate action push switches are designed especially for long life and rugged applications, such as industrial vacuum cleaners, heavy appliances, automotive equipment, welding machines, maintenance gear, etc.

- *Wiping blade contact mechanism*
- *Molded phenolic base*
- *Screw terminals*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts ...	Bright nickel
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)

Body Dimensions	Circuit	Cat. No.	Action•	Button	Slotted Sleeve Length, in.	Termination
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .406 (10,31) .281 (7,14) $\frac{15}{32}$ -32 T.P.I. (11,89) .437 (11,10) .812 (20,62) 1.750 (44,45) .812 (20,62) 80631	**SPST** **16 Amp, 1 HP, 125 V AC/DC** **8 Amp, 1 HP, 250 V AC/DC**	80631	Off-(On)	Standard	$\frac{15}{32}$	Screw
	SPDT **12 Amp, 125 V AC/DC** **6 Amp, 250 V AC/DC**	80979	On-(On)	Standard	$\frac{15}{32}$	Screw
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .406 (10,31) .281 (7,14) $\frac{15}{32}$ -32 T.P.I. (11,89) .437 (11,10) .812 (20,62) 1.750 (44,45) .812 (20,62) 80630	**DPST** **16 Amp, 125 V AC/DC** **8 Amp, 250 V AC/DC**	80630 80863 81951*	Off-(On) Off-On Off-On	Standard Standard Standard	$\frac{15}{32}$ $\frac{9}{16}$ $\frac{9}{16}$	Screw Screw Screw
 KEYWAY .080-.085 W. X .040-.047 D. (2,03) (2,16) (1,02) (1,19) .406 (10,31) .281 (7,14) $\frac{15}{32}$ -32 T.P.I. (11,89) .437 (11,10) .875 (22,23) 2.000 (50,80) .968 (24,59) 80938	**DPST** **20 Amp, 1½ HP, 125 V AC/DC** **10 Amp, 1½ HP, 250 V AC/DC**	80938	Off-(On)	Standard	$\frac{15}{32}$	Screw

• ( ) Indicates momentary action.

** 20 Amp, 1½ HP, 125 V AC/DC*
10 Amp, 1½ HP, 250 V AC/DC

AVAILABLE OPTIONS: Modifications available include: snap-on buttons, overthrow buttons — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

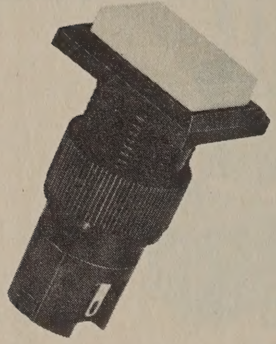
CROUSE-HINDS
Arrow Hart Division

LIGHTED PUSH SWITCHES

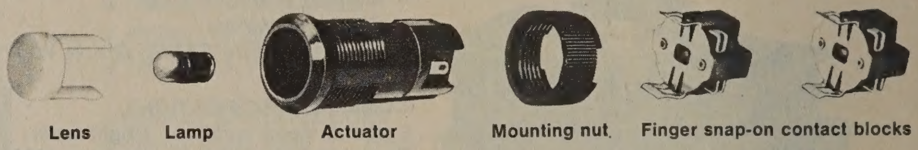
MOMENTARY & ALTERNATE ACTION

ADAPT-A-SWITCH

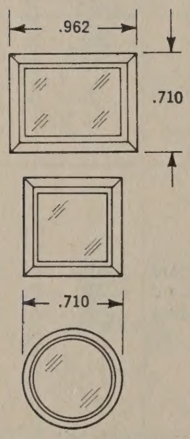
Thousands of switching variations can be created using the 31 standard components of Arrow Hart's unique Adapt-A-Switch line, versatile enough to meet practically any low energy switching application. Lighted or non-lighted push switches, or indicators only, may be assembled instantly in almost any combination of shapes, colors and configurations.



SHOWN ACTUAL SIZE



- *Unique construction design concept enables user to build lighted and non-lighted switches and indicators to exact requirements.*
- *Space-saving design makes unusually high density mounting possible.*
- *One piece terminal-to-contact construction ensures minimum heat rise.*
- *Silver contacts for low energy reliability.*

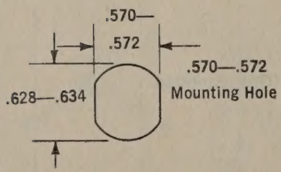


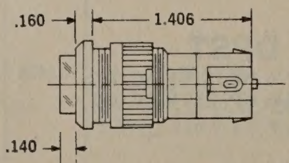
COMMON SPECIFICATIONS

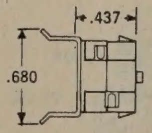
Actuator terminals	Tin plated solder type, accepts #18 wire
Actuator weight	8 grams
Plunger travel	.094 inches
Contact block terminals	Solid fine silver solder type, accepts #18 wire
Contact block weight	4 grams
Contacts	Positive snap, wiping action
Contact ratings	Standard duty (fine silver): 5 amp, 125 V AC resistive; 2 amp, 250 V AC resistive; 5 amp, 28 V DC resistive. Low energy (gold plated): minimum rating for dry circuit application is 10 micro amp 50 mV. Gold plated contacts are for applications under 100 mW.
Dielectric strength	Exceeds 1000 V rms
Mechanical and Electrical Life, @ full ratings	100,000 cycles min.

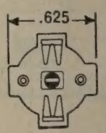
MAX. OPERATING FORCE:

Poles	Momentary		Alternate Action	
1	12 Oz.	341. Gms.	16 Oz.	454. Gms.
2	24 Oz.	682. Gms.	32 Oz.	909. Gms.
3	36 Oz.	1022. Gms.	48 Oz.	1363. Gms.
4	48 Oz.	1363. Gms.	Do not use	









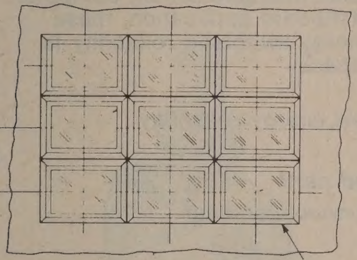
CROUSE-HINDS®
Arrow Hart Division

LIGHTED PUSH SWITCHES

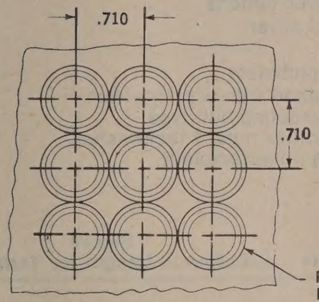
MOMENTARY & ALTERNATE ACTION

ADAPT-A-SWITCH

HIGH DENSITY MOUNTING



RECTANGULAR
LENS SPACING

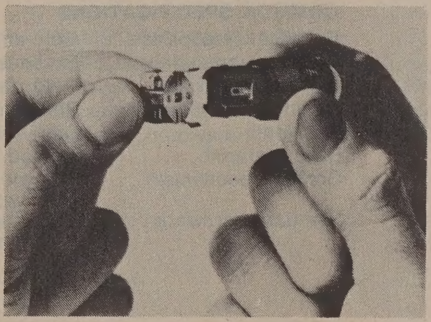


ROUND AND SQUARE
LENS SPACING

ORDERING INFORMATION

1. Determine lens shape and color. Specify catalog number.
   Example: For square red lens, order Cat. No. 83500-81.
2. Determine shape and action of actuator required. Specify catalog number.
   Example: For square momentary actuator, order Cat. No. 83502.
3. Determine number of poles required — either standard duty or low energy. Specify catalog number.
   Example: For standard duty, single pole contact block, order Cat. No. 83500-30.
4. Determine accessories required. Specify catalog number.
   Example: For special mounting wrench, order Cat. No. 83500-45.

SNAP-ON CONTACT BLOCK



LENSES

Color	Rectangular	Square	Round
White	83500-70	83500-80	83500-90
Red	83500-71	83500-81	83500-91
Green	83500-72	83500-82	83500-92
Blue	83500-73	83500-83	83500-93
Yellow	83500-74	83500-84	83500-94
Amber	83500-75	83500-85	83500-95
Black	83500-76	83500-86	83500-96

ACTUATORS

Action	Rectangular	Square	Round
Momentary	83501	83502	83503
Alternate	83504	83505	83506

CONTACT BLOCKS

Type	Standard	Low Level
Single Pole	83500-30	83600-30
Double Pole	83500-230	Consult Factory
Triple Pole	83500-330	Consult Factory
Four Pole	83500-430	Consult Factory

LIGHTED INDICATORS

Cat. No.	Indicator Body	Description
83507	Rectangular	Identical in appearance to the switches described above. To order an indicator, specify catalog number for indicator body and select catalog number of lens from table.
83508	Square	
83509	Round	

NOTE: An actuator can be converted to an indicator by use of a snap-on clip — catalog number 83500-51.

ACCESSORIES

Description	Cat. No.
Bright chrome round snap-on bezel	83500-46
Special mounting wrench	83500-45

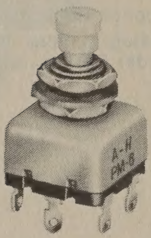
NOTE: Lamps not supplied — use standard T1¾ incandescent groove base. (6 V. #337; 14 V. #336; 28 V. #334.)

CROUSE-HINDS®
Arrow Hart Division

SUBMINIATURE PUSHBUTTON SWITCHES

MOMENTARY ACTION

INSTRUMENT GRADE SERIES



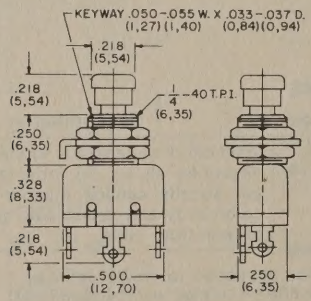
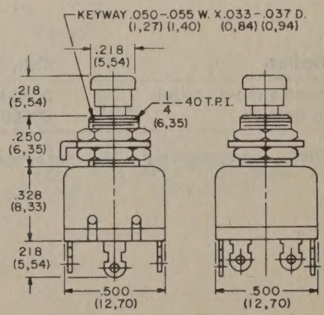
CAT. NO. PM6,
SHOWN ACTUAL SIZE

These Arrow Hart subminiature pushbuttons incorporate maximum performance, dependability and durability on an ultra-lightweight subminiature base. Ideal for electronic instrumentation, computer equipment and communication switchboard application, these switches are used wherever low energy switching reliability is required in a minimum amount of space.

- *Gold plated silver contacts for low energy reliability*
- *Leaf blade wiping action*
- *Gold anodized aluminum exposed parts*
- *Combination solder lug/quick-connect terminal*
- *Slotted sleeve*

COMMON SPECIFICATIONS

Exposed metal parts	Gold anodized aluminum
Dielectric breakdown ...	Exceeds 1000 V rms
Contact material	Gold plated silver buttons
Moving contact material .	Rhodium plated silver
Terminals	Gold flash
Base material	Molded diallyl phthalate
Contact mechanism	PM type: leaf blade with wiping action PMQ type: snap-acting butt type
Standard hardware	2 gold anodized hex nuts, 1 lockwasher, 2 locating rings (unassembled)

Body Dimensions		Circuit	Cat. No.	Action•	Button	Sleeve Length, in.	Termination
	PM3	**SPDT** **1 Amp, 115 V AC** **2 Amp, 29 V DC**	PM3	On-(On)	White Nylon	¼	Solder Lug
		SPDT **7 Amp, 125 V AC** **5 Amp, 29 V DC**	PMQ3*	On-(On)	White Nylon	¼	Solder Lug
	PM6	**DPDT** **1 Amp, 115 V AC** **2 Amp, 29 V DC**	PM6	On-(On)	White Nylon	¼	Solder Lug
		3PST **1 Amp, 115 V AC** **2 Amp, 250 V AC** **29 V DC**	PM7 PM8	Off-(On) On-(Off)	White Nylon White Nylon	¼ ¼	Solder Lug Solder Lug

* *Snap-acting butt-type contacts.*
• *( ) indicates momentary action.*

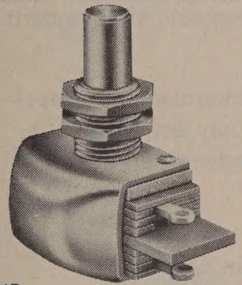
AVAILABLE OPTIONS: Modifications available include: printed circuit and right angle terminals; colored caps; special dress nuts — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

ROTARY SWITCHES
GENERAL PURPOSE
TWO-POSITION MAINTAINED

CANOPY SERIES, 3 AMP AC/DC

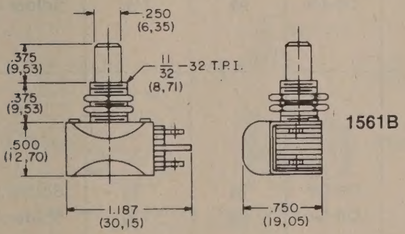
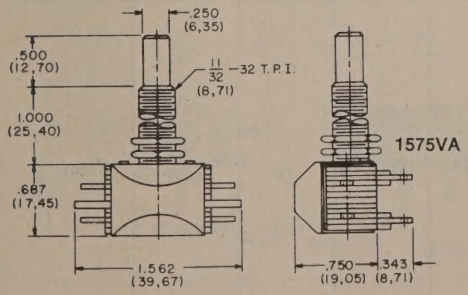

CAT. NO. 1561B,
SHOWN ACTUAL SIZE

These Arrow Hart roto-power switches offer a complete selection of circuits in a compact base. A time-proven roller-type switching mechanism assures high-reliability, and their small size makes them ideal for use in appliances and instrument panels of all kinds.

- *Roller action contacts*
- *Laminated base construction*
- *Non-slotted sleeve (¹¹⁄₃₂″ dia., 32 T.P.I.)*
- *Shaft diameter ¼″*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Silver plated
Standard hardware	2 hex nuts (unassembled)

Body Dimensions	Circuit	Cat. No.	Action	Non-Slotted Sleeve Lgth., In.	Shaft Lgth., In.	Termination
 .250 (6,35) .375 (9,53) 11/32 -32 T.P.I. (8,71) .375 (9,53) .500 (12,70) 1.187 (30,15) .750 (19,05) 1561B	**SPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1561B 1561BS	Off-On Off-On	⅜ ⅜	⅜ 1⅛	Solder Lug Solder Lug
 .250 (6,35) .500 (12,70) 11/32 -32 T.P.I. (8,71) 1.000 (25,40) .687 (17,45) 1.562 (39,67) .750 (19,05) .343 (8,71) 1575VA	**DPDT** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1575VA	On-On	1	½	Solder Lug

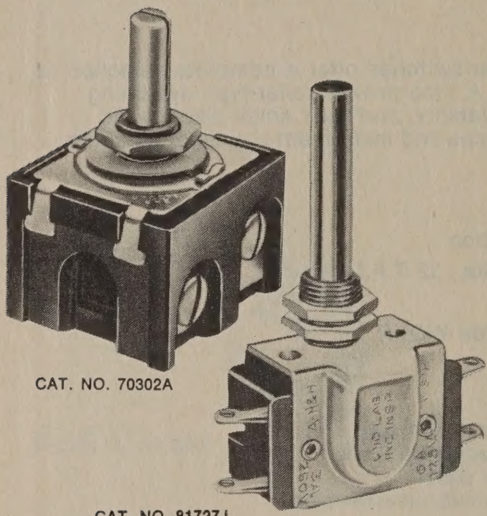
AVAILABLE OPTIONS: Modifications available include: special shaft lengths; special sleeve lengths; screwdriver slot actuators — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

ROTARY SWITCHES
INTERMEDIATE & HEAVY DUTY
TWO-POSITION MAINTAINED

INTERMEDIATE & HEAVY DUTY SERIES, 6 & 20 AMP


CAT. NO. 70302A

CAT. NO. 81727J

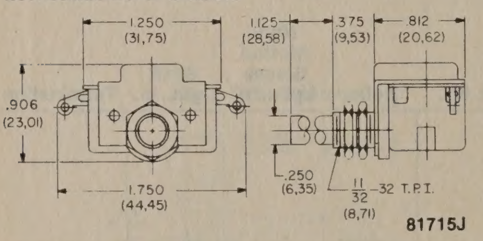
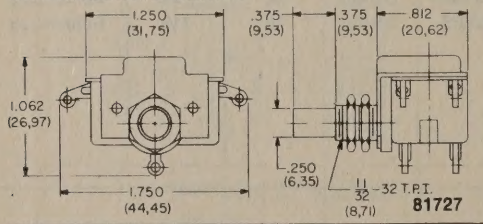
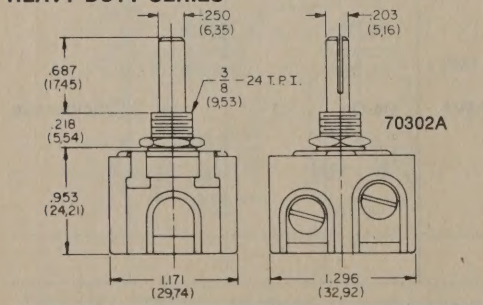
Arrow Hart Intermediate Series roto-power switches offer wiping blade action and excellent reliability for a variety of applications including medical and technical instrumentation.

The Heavy Duty Series offers high current switching capability for AC applications. Heavy silver button contacts are standard.

- *Molded phenolic base*
- *Wiping blade contact mechanism (Intermediate Series)*
- *Non-slotted ⅜″ dia. sleeve (Heavy Duty Series)*
- *Non-slotted 11⁄32″ dia. sleeve (Intermediate Series)*
- *UL Listed, File E1148, Guide WOYR*

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Silver plated bronze
Standard hardware	2 hex nuts (unassembled)

Body Dimensions	Circuit	Cat. No.	Action	Non-Slotted Sleeve Lgth., In.	Shaft Lgth., In.	Termination
INTERMEDIATE SERIES  1.250 (31,75) 1.125 (28,58) .375 (9,53) .812 (20,62) .906 (23,01) .250 (6,35) 11/32 -32 T.P.I. (8,71) 1.750 (44,45) 81715J	**SPST** **6 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	81715 81715J	Off-On Off-On	⅜ ⅜	⅜ 1⅛	Solder Lug Solder Lug
	SPDT **6 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	81721J	On-On	⅜	1⅛	Solder Lug
INTERMEDIATE SERIES  1.250 (31,75) .375 (9,53) .375 (9,53) .812 (20,62) 1.062 (26,97) .250 (6,35) 11/32 -32 T.P.I. (8,71) 1.750 (44,45) 81727	**DPDT** **6 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	81727 81727J	On-On On-On	⅜ ⅜	⅜ 1⅛	Solder Lug Solder Lug
HEAVY DUTY SERIES  .250 (6,35) .203 (5,16) .687 (17,45) 3/8 -24 T.P.I. (9,53) .218 (5,54) 70302A .953 (24,21) 1.171 (29,74) 1.296 (32,92)	**DPST** **20 Amp, 1 HP, 5L, 120 V AC** **20 Amp, 2 HP, 240 V AC**	70302A	Off-On	7⁄32	11⁄16	Screw

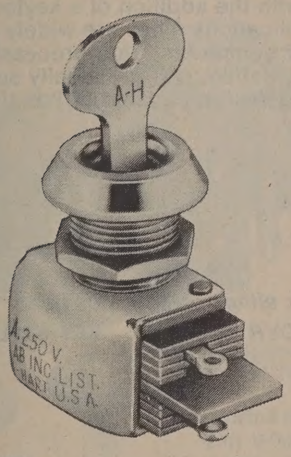
AVAILABLE OPTIONS: Modifications available include: special shaft lengths; special sleeve lengths; custom machined shafts — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

ROTARY LOCK SWITCHES
GENERAL PURPOSE
TWO-POSITION MAINTAINED

CANOPY SERIES, 3 AMP AC/DC


A-H
A 250 V.
AB INC. LIST.
HART U.S.A.

CAT. NO. 1561L

These lock-type roto-power switches offer all the features of the non-locking Canopy Series, with the addition of a key-lock mechanism for circuit security applications. They are used to prevent unauthorized activation of electrical equipment, and as an extra safety measure in home workshops, etc.

- *Roller action contact*
- *Laminated base construction*
- *Slotted sleeve (15/32″ dia., 32 T.P.I.)*
- *Bright nickel plated dress nut*
- *Available with key removable in either or both positions*
- *UL Listed, File E1148, Guide WOYR*

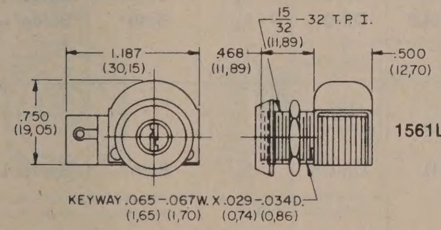
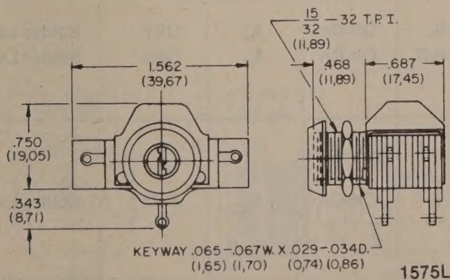
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Silver plated
Standard hardware	1 hex nut, 1 dress nut (unassembled)

KEY STYLES

1561-488

1561-1488

Body Dimensions	Circuit	Cat. No.	Action	Slotted Sleeve Lgth., In.	Key Removal Positions	Termination
 15/32 −32 T.P. I. (11,89) 1.187 (30,15) .468 (11,89) .500 (12,70) .750 (19,05) KEYWAY .065−.067W. X .029−.034D. (1,65) (1,70) (0,74) (0,86) 1561L	**SPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1561L	Off-On	9/16	Off†	Solder Lug
		1561LE	Off-On	9/16	Both*	Solder Lug
	SPDT **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1565L	On-On	9/16	Both*	Solder Lug
 15/32 —32 T.P. I. (11,89) 1.562 (39,67) .468 (11,89) .687 (17,45) .750 (19,05) .343 (8,71) KEYWAY .065−.067W. X .029−.034D. (1,65) (1,70) (0,74) (0,86) 1575L	**DPST** **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1572L	Off-On	9/16	Off†	Solder Lug
	DPDT **3 Amp, 125 V AC/DC** **1 Amp, 250 V AC/DC**	1575L	On-On	9/16	Both*	Solder Lug

† *Use key style 1561-488 or 1561-1488*
* *Use key style 1561-487 or 1561-1487*

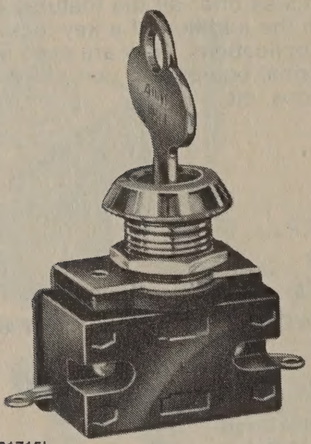
AVAILABLE OPTIONS: Modifications available include: wire leads; models with key removable in "ON" position only — please consult factory.

CROUSE-HINDS®
Arrow Hart Division

ROTARY LOCK SWITCHES

TWO-POSITION MAINTAINED

INTERMEDIATE SERIES, 6 AMP AC/DC

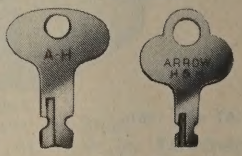


CAT. NO. 81715L, SHOWN ACTUAL SIZE

These Arrow Hart rotary lock switches offer all the benefits of the non-locking Intermediate Series, with the addition of a keylock mechanism for circuit security applications. They are widely used to prevent unauthorized activation of computers, data processing equipment and electronic instrumentation, and are ideally suited for any application requiring a locking switch capable of handling power and/or low energy loads.

- *Wiping blade contact mechanism*
- *Molded phenolic base*
- *Slotted sleeve (¹⁵⁄₃₂″ dia., 32 T.P.I.)*
- *Bright nickel plated dress nut*
- *Available with key removable in either or both positions*
- *UL Listed, File E1148, Guide WOYR*

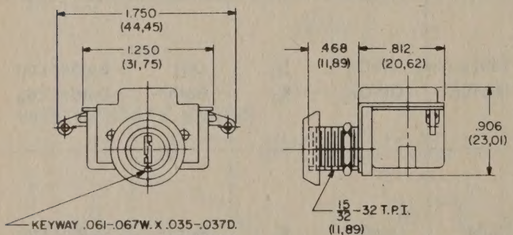
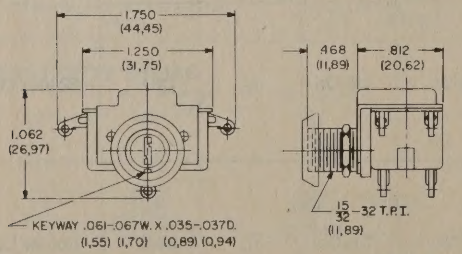
KEY STYLES



1561-488 1561-1488

COMMON SPECIFICATIONS

Exposed metal parts	Bright nickel finish
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Silver plated bronze
Standard hardware	1 hex nut, 1 dress nut (unassembled)

Body Dimensions	Circuit	Cat. No.	Action	Slotted Sleeve Lgth., In.	Key Removal Positions	Termination
 81715L	**SPST** 6 Amp, 125 V AC/DC 3 Amp, 125 V AC/DC	81715L 81715LE	Off-On Off-On	⁵⁄₁₆ ⁵⁄₁₆	Off† Both*	Solder Lug Solder Lug
	SPDT 6 Amp, 125 V AC/DC	81721L	On-On	⁵⁄₁₆	Both*	Solder Lug
 81727L	**DPST** 6 Amp, 125 V AC/DC 3 Amp, 125 V AC/DC	81724L 81724LC	Off-On Off-On	⁵⁄₁₆ ⁵⁄₁₆	Off† Both*	Solder Lug Solder Lug
	DPDT 6 Amp, 125 V AC/DC	81727L	On-On	⁵⁄₁₆	Both*	Solder Lug

1.750
(44,45)
1.250
(31,75)
.468
(11,89)
.812
(20,62)
.906
(23,01)
15/32-32 T.P.I.
(11,89)
KEYWAY .061-.067W. X .035-.037D.
(1,55) (1,70) (0,89) (0,94)

1.750
(44,45)
1.250
(31,75)
1.062
(26,97)
.468
(11,89)
.812
(20,62)
15/32-32 T.P.I.
(11,89)
KEYWAY .061-.067W. X .035-.037D.
(1,55) (1,70) (0,89) (0,94)

† *Use key style 1561-488 or 1561-1488*
* *Use key style 1561-487 or 1561-1487*

AVAILABLE OPTIONS: Modifications available include: screw terminals or wire leads; available with key removable in "ON" position only — please consult factory.

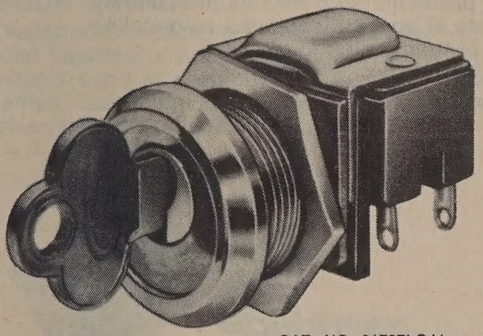
CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS®
Arrow Hart Division

ROTARY LOCK SWITCHES

TWO-POSITION MAINTAINED

HIGH SECURITY SERIES, 6 AMP AC/DC



CAT. NO. 81727LQ41, SHOWN ACTUAL SIZE

These Arrow Hart rotary lock switches have been designed to provide maximum circuit security. They incorporate a high-quality lock assembly, and are capable of handling either power or low energy loads. High Security Series switches are used to prevent unauthorized activation of computers, data processing equipment, duplicating machines, alarm systems, etc.

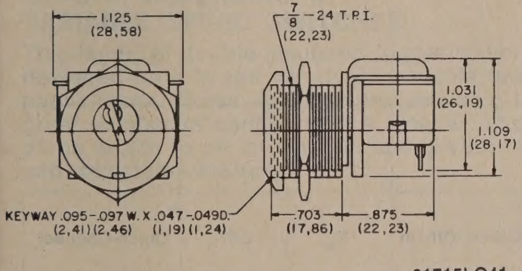
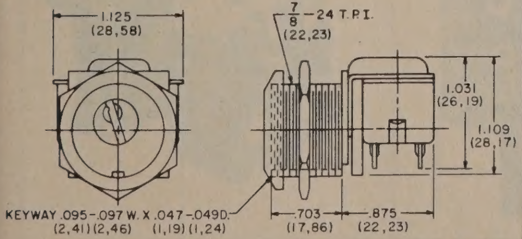
- *High quality Corbin lock*
- *Wiping blade contact mechanism*
- *Molded phenolic base*
- *Slotted sleeve (7/8″ dia.)*
- *Bright nickel plated dress nut*
- *Two keys provided with every switch*

KEY STYLES

81715-41
81715-61

COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Silver plated bronze
Standard hardware	1 hex nut, 1 dress nut (unassembled)

Body Dimensions	Circuit	Cat. No.	Action	Slotted Sleeve Lgth., In.	Key Removal Positions	Termination
 1.125 (28,58) 7/8 -24 T.P.I. (22,23) 1.031 (26,19) 1.109 (28,17) KEYWAY .095-.097 W. X .047-.049D. (2,41) (2,46) (1,19) (1,24) .703 (17,86) .875 (22,23) 81715LQ41	**SPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81715LQ61	Off-On	45/64	Off†	Solder Lug
		81715LQ41	Off-On	45/64	Both*	Solder Lug
	SPDT **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81721LQ61	On-On	45/64	CC-On†	Solder Lug
		81721LQ41	On-On	45/64	Both*	Solder Lug
 1.125 (28,58) 7/8 -24 T.P.I. (22,23) 1.031 (26,19) 1.109 (28,17) KEYWAY .095-.097 W. X .047-.049D. (2,41) (2,46) (1,19) (1,24) .703 (17,86) .875 (22,23) 81727LQ61	**DPST** **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81724LQ61	Off-On	45/64	Off†	Solder Lug
		81724LQ41	Off-On	45/64	Both*	Solder Lug
	DPDT **6 Amp, 125 V AC/DC** **3 Amp, 250 V AC/DC**	81727LQ61	On-On	45/64	CC-On†	Solder Lug
		81727LQ41	On-On	45/64	Both*	Solder Lug

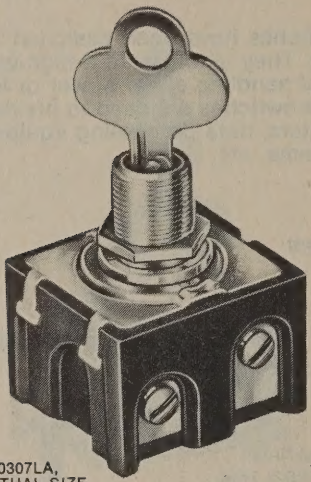
† *Use key style 81715-61.*
* *Use key style 81715-41.*

CROUSE-HINDS®
Arrow Hart Division

ROTARY LOCK SWITCHES

MULTI-POSITION MAINTAINED

HEAVY DUTY SERIES, 20 AMP AC



CAT. NO. 70307LA, SHOWN ACTUAL SIZE

These heavy duty rotary lock switches combine high-reliability switching, heavy duty circuit protection and maximum economy. They are used in a wide variety of applications such as gasoline pumps, heating and cooling systems, etc.

- *Slow make/slow break contacts*
- *Molded phenolic base*
- *2 thru 4 positions*
- *Cast or stamped key*
- *Horsepower rating*

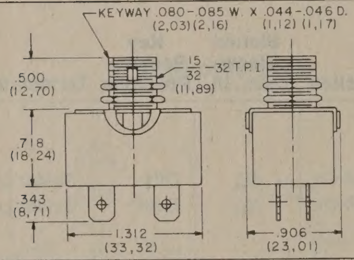
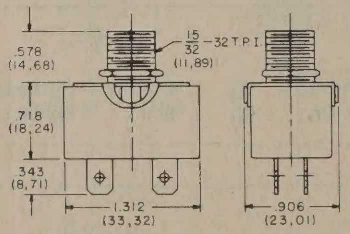
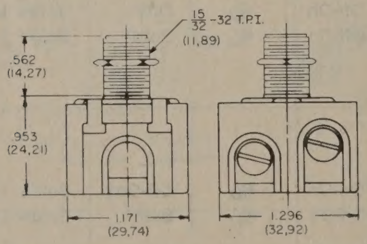
COMMON SPECIFICATIONS

Exposed metal parts . . .	Bright nickel finish
Dielectric breakdown . . .	Exceeds 1000 V rms
Contact material	Heavy silver plate
Standard hardware	2 hex nuts

KEY STYLES

82787-10

1561-1488

Body Dimensions	Circuit	Cat. No.	Action	Slotted Sleeve Lgth., In.	Key Removal Position	Termination
 KEYWAY .080-.085 W. X .044-.046 D. (2,03) (2,16) (1,12) (1,17) 15/32 -32 T.P.I. (11,89) .500 (12,70) .718 (18,24) .343 (8,71) 1.312 (33,32) .906 (23,01) 82787B	**DPST** **20 Amp,** **120-240 V AC** **1½ HP, 120 V AC** **2 HP, 240 V AC**	82787B	Off-On-Off-On	½	Off†	Quick-Connect
 .578 (14,68) 15/32 -32 T.P.I. (11,89) .718 (18,24) .343 (8,71) 1.312 (33,32) .906 (23,01) 82787LA	**DPST** **20 Amp,** **120-240 V AC** **1½ HP, 120 V AC** **2 HP, 240 V AC**	82787LA	Off-On-Off-On	37/64	Off*	Quick-Connect
 15/32 -32 T.P.I. (11,89) .562 (14,27) .953 (24,21) 1.171 (29,74) 1.296 (32,92) 70307LA	**DPST** **20 Amp,** **120-240 V AC** **1½ HP, 120 V AC** **2 HP, 240 V AC**	70307LA	Off-On	9/16	Off*	Screw

† *Use key style 82787-10.*
* *Use key style 1561-1488.*

AVAILABLE OPTIONS: Modifications available include: different circuits — please consult factory.

CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

CROUSE-HINDS

Arrow Hart Division

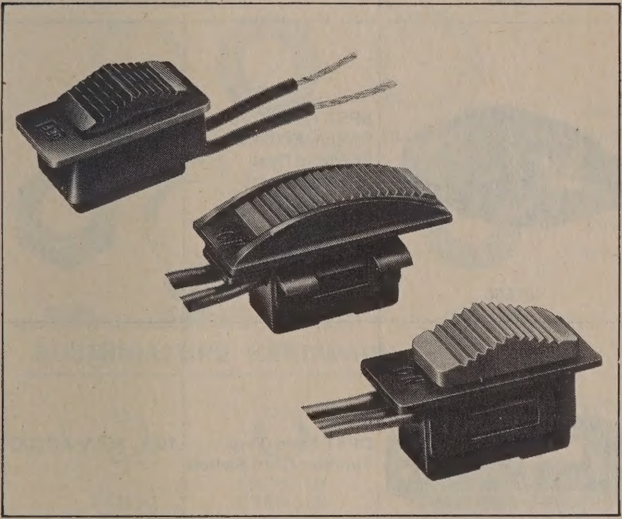
PORTABLE TOOL SWITCHES

TRIGGER & SLIDE TYPES

The Crouse-Hinds Arrow Hart Division is a leading manufacturer of controls for the Portable Tool Industry. The trigger and slide switches illustrated below are only a few of the many types presently being manufactured and shipped to OEM customers for use in their products. Some authorized Arrow Hart distributors carry many variations of these switches for replacement applications. Please consult the factory or your nearest Arrow Hart representative for complete information.

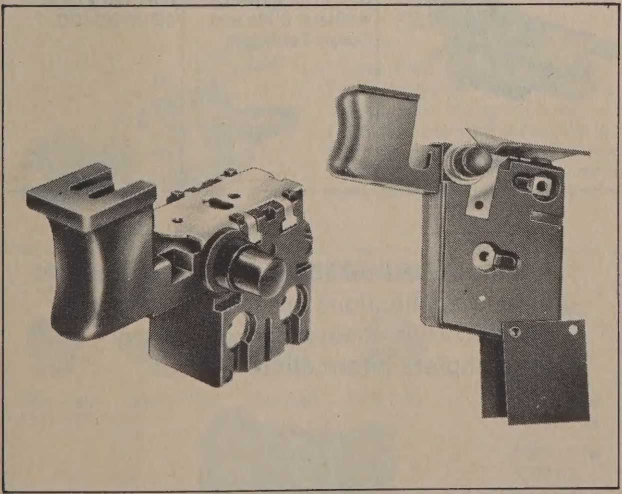
SLIDE SWITCHES

Designed expressly for fractional horsepower motors; also capable of handling tungsten lamp loads. Widely used in projection equipment, photo flood lamps, instrument panels, portable tools, vacuum cleaners and similar applications.



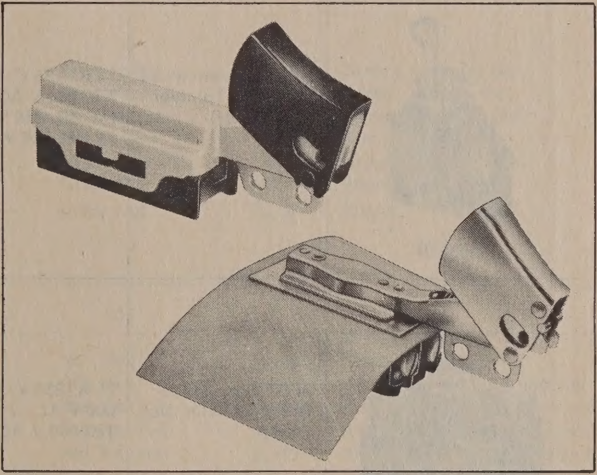
ON-OFF, REVERSING & VARIABLE SPEED SWITCHES

This family of double insulated trigger switches is designed for a broad variety of portable tool applications. These switches are available in a great number of configurations, from a simple off-on action to off-on variable speed with reversing and adjustable feature.



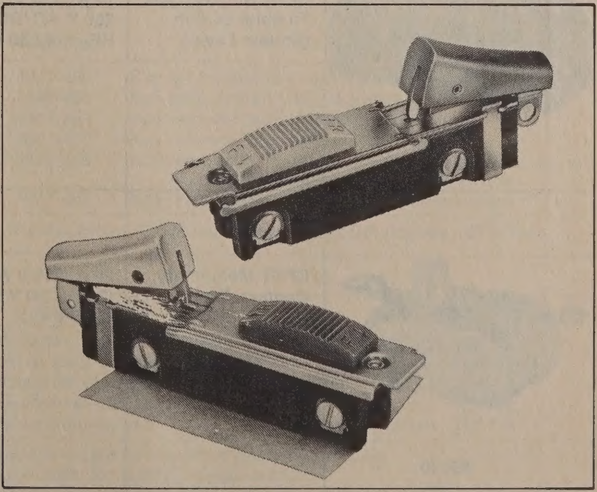
EXTENDED TRIGGER SWITCHES, STANDARD & HEAVY DUTY

An extensive variety of extended trigger switches for nearly any portable tool application. Current ratings range from 10 amps to 20 amps at 125 V AC. Certain types feature all-molded construction for double insulation applications. Others offer rugged metal frame and trigger construction for heavy duty use.



TANDEM INTERLOCKING SWITCHES, SLIDE & LEVER

Arrow Hart interlocking switches are widely used in heavy-duty portable tools for industrial and commercial applications. They combine a pressure lever switch and special circuitry, to allow reversing of series wound motors, or 2-speed control.



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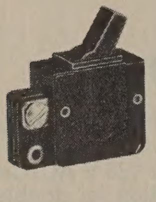
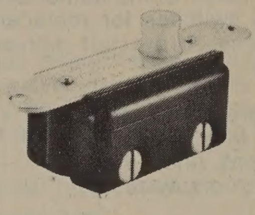
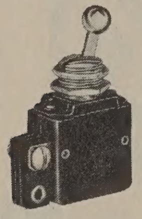
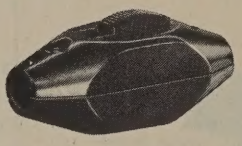
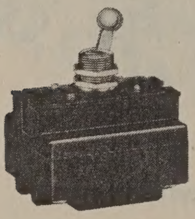
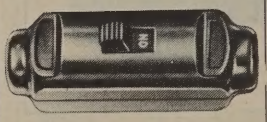
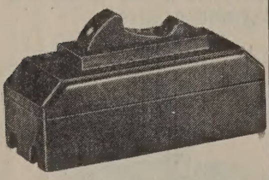
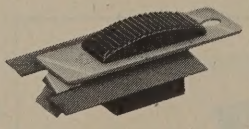
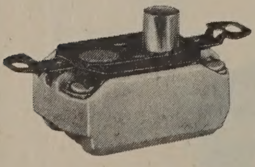
CROUSE-HINDS®
Arrow Hart Division

MISCELLANEOUS SWITCHES

TUMBLER, PUSH, FEED-THRU, SLIDE, TOGGLE

	Description	Rating		Description	Rating
 80323	SPST fully enclosed Miniature Tumbler (Square Lever)	10 A, 125 V; 7 A, 250 V AC/DC (¾ HP, 230 V AC; ½ HP, 250 V DC)	 82321	DPST Momentary Contact Push Switch (N.O.) Suitable for Side or Back Wiring	20 A, 120-240 V AC (2 HP, 240 V AC)
 80323B	SPST fully enclosed Miniature Tumbler (Ball Lever)	10 A, 125 V; 5 A, 250 V AC/DC (¾ HP, 230 V AC; ½ HP, 250 V DC)	 81550	SPST Feed-Thru Switch, Enclosed in Phenolic Base (Sliding Lever)	10 A, 125 V; 5 A, 250 V AC/DC
 80949	3PST Slow-Make-Break Tumbler (Ball Lever)	25 A, 250 V; 6 A, 600 V AC (2 HP, 120-600 V AC)	 100002X	DPST Feed-Thru Tumbler Cord Switch	10 A, 250 V AC/DC
 80176	DPST Rocker-Type Tumbler Switch (Square Lever)	15 A, 125 V; 10A, 250 V AC/DC (½ HP, 115-230 V AC)	 81569	SPST Slide Switch w/Black Slide and Screw Terminals	6 A, 125 V; 3 A, 250 V AC/DC
 80050	DPST Momentary Contact Push Switch (N.O.) w/ Metal Button and Porcelain Base	20 A, 250 V AC/DC (2 HP, 230 V AC-1250 V DC)	Additional miscellaneous switches for unique applications are available upon special order. Please consult factory for complete information.		

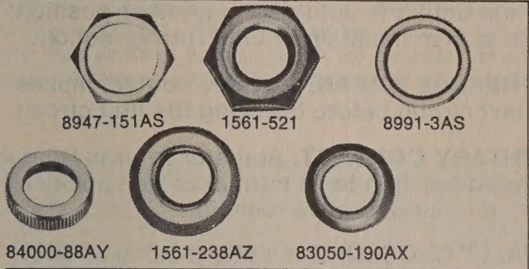
CROUSE-HINDS COMPANY, ARROW HART DIVISION / SPECIALTY SWITCH PRODUCTS / DEPT. EM, HARTFORD, CT 06101 / (203) 249-8471

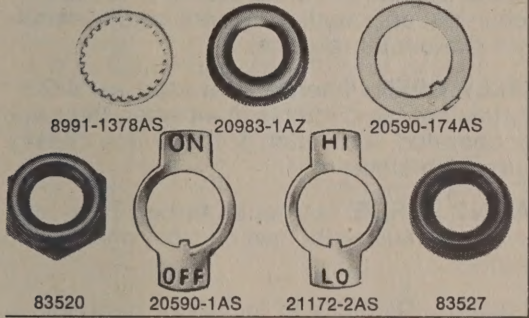
CROUSE-HINDS®
Arrow Hart Division

HARDWARE & ACCESSORIES

MOUNTING HARDWARE & BRACKETS

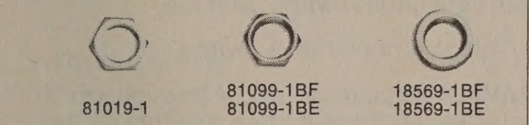
STANDARD HARDWARE

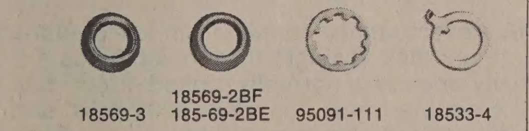




Cat. No.	Description	Size	Material	Finish
8947-151AS	Std. Hex	15/32-32	Brass	Tin Dip
1561-521	Thick Hex	15/32-32	Brass	Nickel
8991-3AS	Std. Knurled	15/32-32	Brass	Tin Dip
1561-238AZ	Top Nut	15/32-32	Brass	Nickel
83050-190AX	Dress Nut	15/32-32	Brass	Satin Chrome
84000-88AY	Dress Nut	15/32-32	Brass	Chrome
8991-1378AS	Lockwasher	15/32	Bronze	Tin Dip
20983-1AZ	Dress Nut	15/32-32	Brass	Nickel
20590-174AS	Locating Ring	15/32	Brass	Tin Dip
20590-1AS	On-Off Dial	15/32	Brass	Tin Dip
21172-2AS	Hi-Lo Dial	15/32	Brass	Tin Dip
83520	Dress Nut	15/32-32	Plastic	Black
83527	Dress Nut	15/32-32	Plastic	Black

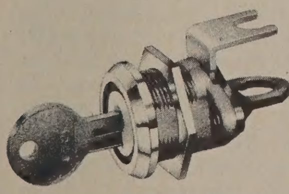
SUBMINIATURE HARDWARE





Cat. No.	Description	Size	Material	Finish
81019-1	Std. Hex	1/4-40	Brass	Nickel
81099-1BF	Std. Hex	1/4-40	Aluminum	Gold Anodized
81099-1BE	Std. Hex	1/4-40	Aluminum	Clear Anodized
18569-1BF	Std. Knurled	1/4-40	Aluminum	Gold Anodized
18569-1BE	Std. Knurled	1/4-40	Aluminum	Clear Anodized
18569-3	Dress Nut	1/4-40	Stainless	Steel
18569-2BF	Dress Nut	1/4-40	Aluminum	Gold Anodized
18569-2BE	Dress Nut	1/4-40	Aluminum	Clear Anodized
18533-4	Long Tab Locking Ring	1/4	Steel	Zinc
95091-111	Internal Tooth Lockwasher	1/4	Steel	Zinc

LOCKING BRACKETS FOR TOGGLE SWITCHES

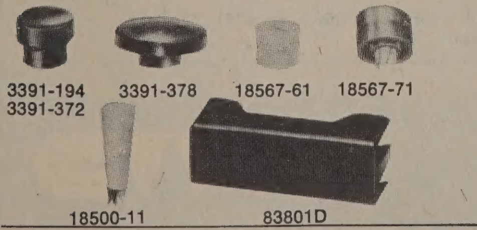

CAT. NO. 8947-400

These lock brackets provide a flexible way to convert toggle switches to rotary locking switches. All styles are high security locks. Hardware provided is 1 dress nut, 1 hex nut, 2 keys, unassembled. Individual models are keyed alike.

Cat. No.	Description
8947-400*	Key removable in counterclock position
8947-401*	Key removable in center position
8947-404*	Key removable in clockwise position
8947-405*	Key removable in either extreme position
8947-406*	Key removable in counterclock position when using AC only momentary single throw switch
8947-407*	Key removable in any one of three positions

**Replacement key is stock item. Order Catalog No. 82787-55*

MISCELLANEOUS ACCESSORIES



Cat. No.	Description	Size
3391-194	Black molded snap-on pushbutton cap	Standard - 1/2" dia.
3391-372	Red molded snap-on pushbutton cap	Standard - 1/2" dia.
3391-378	Red transparent pushbutton cap	Standard - 1" dia.
18567-61■	White nylon snap-on cap	Subminiature - 7/32" dia.
18567-71■	White nylon snap-on cap	Subminiature - 3/8" dia.
18500-11■	Subminiature toggle switch white bat lever adapter.	
83801D	Molded insulator for 83800D toggle switch.	

■ Available in a wide assortment of colors. Please consult factory for complete information.

CROUSE-HINDS®

Arrow Hart Division

SPECIALTY SWITCHES

GLOSSARY

ACTUATOR. Switch part to which an external force is applied to operate the switch.

ALTERNATE ACTION. (push-push). Actuator moves to a position upon application of an actuating force and remains there after the removal of the force. Application of a second actuating force is required to return the actuator to its original position.

BREAK-BEFORE-MAKE. (non-shorting). Movable contact breaks one circuit before making the next circuit.

BREAKDOWN VOLTAGE. (dielectric strength). The highest voltage the insulator can withstand without breaking down.

CONTACT BOUNCE. The time during switching in which electrical instability caused by the rebound of the contacts is observed (millisecond range).

CONTACT RATING. The capacity to carry an electrical load.

CONTACT RESISTANCE. The resistance of a pair of contacts, measured at the terminals. Typical initial values are in the range of a few milliohms. These values usually increase during life.

INSULATION RESISTANCE. (leakage resistance). The resistance between two normally insulated parts measured at specified high D.C. potential (megohm range).

LIFE EXPECTANCY. (useful life). Depends upon the end of life criteria for a specific application.

MAINTAINED CONTACT. Actuator remains in given position until it is actuated to another position, which is also maintained until further action.

MAKE-BEFORE-BREAK. Movable contact makes the next circuit before breaking the first circuit.

MOMENTARY CONTACT. Actuator returns from its operated position to its normal or free position when actuating force is removed.

NORMALLY CLOSED. Often abbreviated as N.C., indicates that the circuit is closed when the switch is not operated. Activation of the switch causes the circuit to open.

NORMALLY OPEN. Often abbreviated as N.O., indicates that the circuit is open when the switch is not operated. Activation of the switch causes the circuit to close.

OPERATING FORCE. (actuation force). The force required to transfer the switch from one position to another.

OVERTRAVEL. Distance in inches or degrees between the electrical operating position and the extreme position to which the actuator may be moved without switch damage.

POLE. Output terminal of a switch.

PRETRAVEL. Distance or angle through which the actuator moves from its free position to its electrical operating position.

THROW. Movement of a contact from one stationary point to another. A single-throw switch has a normally open or a normally closed circuit per pole. A double-throw has a normally open and a normally closed circuit per pole.

TO ORDER SPECIAL COLORS FOR BATON LEVERS

Special-color dash numbers: GREEN (-4) GRAY (-5) YELLOW (-6) BEIGE (-7)

These are normally available within two weeks of receipt of order. Additional special colors are available on large volume orders — please consult factory.

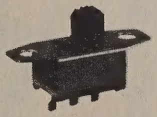
SWITCHES

CW Industries manufactures a broad variety of switches which are classified by the size of the moving contact. A single moving contact, combined with two stationary contacts, is the simplest type of switch, whereby one circuit is made or broken. Adding more moving contacts and mating stationary contacts to the switch structure produces multi-pole switches. CW makes switches having up to four poles with four switching functions which can be performed simultaneously. Adding more stationary contacts to the switch, without adding moving contacts, provides extra switch positions and allows the performance of sequential switching functions. CW also manufactures switches having up to four positions, so that with this switch four switching functions on any one pole can be performed sequentially.

Classifying CW switches by size of moving contact makes almost all fall into one of four categories: Swidget Jr., Swidget, Standard and Special Switches.

SWIDGET JR (MICRO-MINIATURE)

The smallest of all CW switches, the Swidget Jr. is designed to meet industry's demand for tiny, yet reliable, components at a moderate price. The GS-115 SPDT version occupies only 0.09 square inches of printed circuit board space. The switch body occupies only 0.02 cubic inches in volume. The double pole GS-113 occupies only 0.12 square inches of printed circuit board space and its body occupies only 0.03 cubic inches. Generally, these switches are designed to switch up to 0.5 amp AC-DC at 125 volts.



GS-111

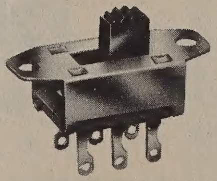
GS-115

SWIDGET (MINIATURE)

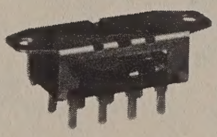
The double pole double throw version of this switch series occupies a cross-sectional printed circuit board area of 0.25 square inches and was the smallest CW slide switch until additional customer miniaturization demands brought about the Swidget Jr. above. This Swidget series is more moderately priced than the Swidget Jr. series and is used in applications up to 8.5 amp AC, 0.5 amp DC at 125 volts.

All "Swidgets" were originally actuated from the top. For more versatility, CW engineers designed the "Sydewynder"® version of this switch which is actuated from the side. The slide switch with the actuating button emerging from the side of the switch housing has been patented by CW (patent numbers 3,270,149 and 3,461,252). CW now offers both types of Swidgets, the conventional top actuated and the side actuated "Sydewynder".

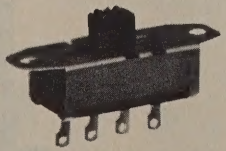
Some CW Swidgets are also available with bifurcated contacts. For most applications, the basic CW "slide and shoe" single moving contact will give reliable and long-life performance. But for some low voltage, low current circuits, the CW bifurcated moving contact may be best suited.



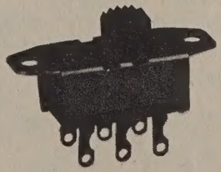
SWIDGET
MINIATURE



SWIDGET
MINIATURE
"SYDEWYNDER"



BIFURCATED
MINIATURE
GBB-127-S
BREAK BEFORE MAKE



BIFURCATED
MINIATURE
GMB-126
MAKE BEFORE BREAK

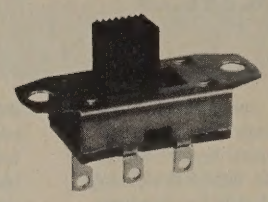
CW INDUSTRIES

550 DAVISVILLE ROAD, WARMINSTER PENNSYLVANIA 18974
PHONE 215–355-7080 • TWX 510–667-1875 • Cable–CWIND
Quality products through creative engineering

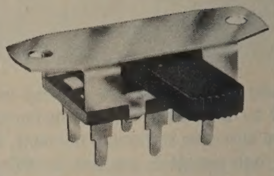
STANDARD

This switch series was the first of its type and was originally developed in the early part of the century. Improvements have been made throughout the years. These are the most moderately priced of all CW switches and will switch up to 13 amp AC, 0.5 amp DC at 125 volts.

As in the case of the miniature "Swidgets", these switches are available with the actuating button emerging from the side of the housing, and can be sub-classified into top actuated and side actuated "Sydewynder" switches.



Slide Switch - Standard
GF-324

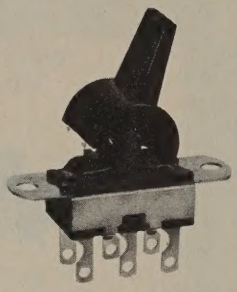


Standard
"Sydewynder" Switch
GG-350 PC

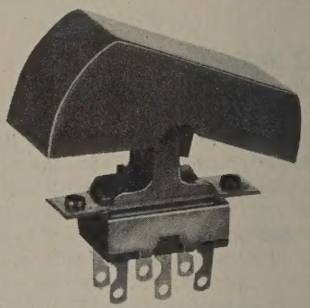
SUPERSTRUCTURES

ROCKER SWITCHES

For styling or functional purposes, many applications make actuating a switch by means of a "rocker" action rather than a "slide" action more desirable. CW has mounted to the basic slide switch assembly a support bracket and mating actuating knob that converts many basic slide switch types into "rocker" switches. Several brackets provide mounting center, mounting depth and height options. Choice of size, style, color, and finish of actuating knobs is also available.



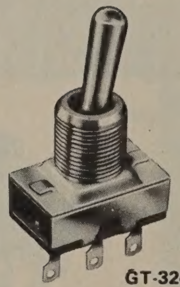
GR20-326



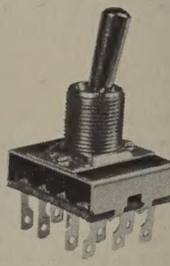
GR21-326

TOGGLE SWITCHES

A bushing and toggle arrangement can be added to many CW switch types, offering a series of toggle switches that permit the simplicity and reliability of CW switches at a price far less than a toggle switch of similar circuitry.



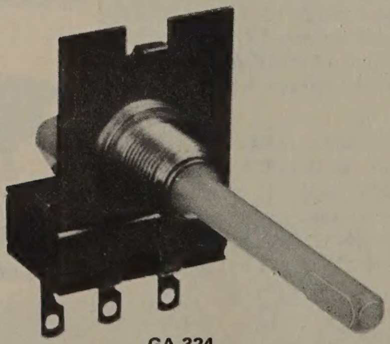
GT-324



GT-342

ROTARY SWITCHES

CW flexibility permits you to change many of its slide switches into rotary actuated switches with the addition of a simple superstructure.



GA-324

CW INDUSTRIES

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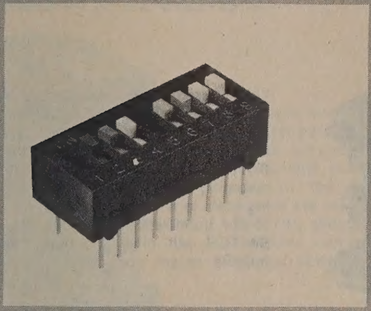
Quality products through creative engineering

SPECIAL SWITCHES

Integral in CW's competence is its ability to meet the continuing demand of the electrical and electronics industry for new switches for new products. In most instances, this can be accomplished with effective savings in cost and time.

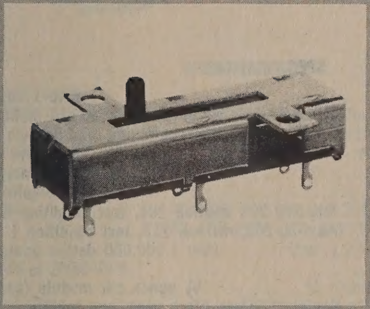
A highly developed expertise enables CW to modify a standard CW switch to answer a special construction requirement. This can be done, for example, by designing a new button, by creating a new housing or by adapting basic switch movements to individual mechanical or electrical requirements.

Whatever the switch need may be, expert CW engineers are always available for consultation . . . to help solve unique problems and, if need be, to work with customer engineers in the development of an entirely new switch for an entirely new application.



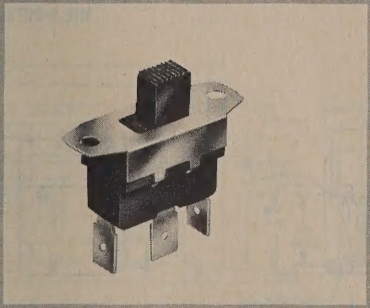
DIP SWITCH

The new CW Dip Switch is ideal for high density, printed circuit board applications requiring multi station/manual selection "on-off" switching. The spring loaded contact provides continuous wiping action. Actuating buttons are color coded for easy identification.



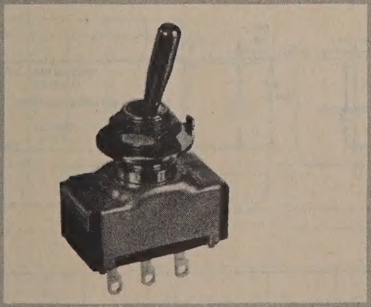
ANTENNA SWITCH

To meet the needs of TV game manufacturers and FCC requirements on isolation, CW modified its standard terminal spacing to develop the GF-226 "Antenna Switch". The increased spacing between contacts and metallic shielding on three sides allows many customers to use this switch in units which are FCC approved as Type I TV devices.



SUPER SWITCH

Designed to meet the current surge and flammability standards for "TV" rated switches imposed by Underwriters Laboratories, this switch movement is different from other CW slide switch movements. It is rated "TV-3", 15.0 amp AC at 125 volts and 3.0 amp AC at 250 volts by U.L. and Canadian Standards Association.



TOGGLE SWITCH - MINIATURE

The latest addition to the CW Family of Miniaturized Switches is ideal for applications in the instrument, appliance, industrial control and communications industries. The switch mechanism is virtually tease-proof, providing a true 2-position "on-off" action.

CW INDUSTRIES

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Quality products through creative engineering

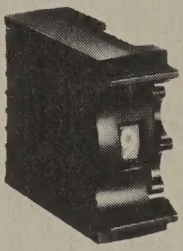
DIGITRAN® DIGITAL SWITCHES and DATA ENTRY DEVICES

SERIES 200 & 700

MINISWITCH®

8, 10, 12 DIAL POSITIONS

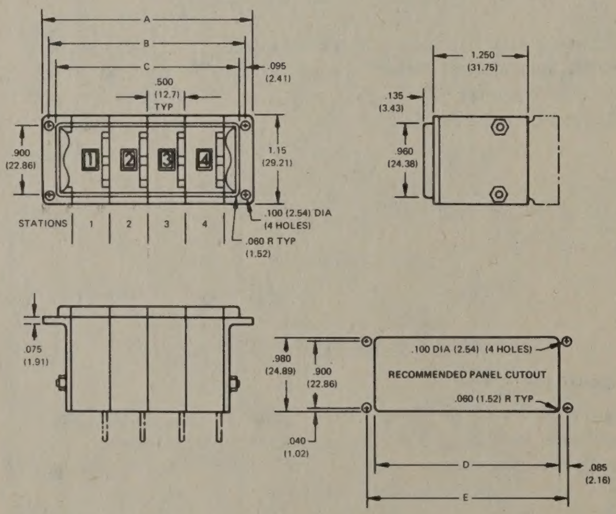
QPL approved to
MIL-S-22710/15 & /20



The Series 200 has potted wire lead terminations, and the Series 700 has a P/C board extending from the rear of the switch. Both can be completely sealed. The 700 Series can be furnished unsealed but with the dust proof feature for commercial or non-critical applications. Note that both are physically identical, and therefore may be mixed in one complete assembly with end mounting brackets.

SPECIFICATIONS

Operating Force	7 to 12 ounces
Rated Electrical Loads	115 volts A.C. or 28 volts D.C. at 125 milliamps. Non-switching load 3 amps max.
Initial Contact Resistance	(Series 200) 0.2 ohms max. (Series 700) 0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	750 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 100G
Life	Over 1,000,000 detent operations
Operating Temperature	—65°C to +85°C
Weight	2/5 ounce per module (approx.)
Standard Color	Non-glare, matte black case and end brackets. Satin black wheel and dial with white characters.
Dial Character Height	0.170 (8 or 10 position)
Moisture Resistance	Per MIL-STD-202, method 106
Thermal Shock	Per MIL-STD-202, method 107, test condition A
Salt Spray	Per MIL-STD-202, method 101, test condition B
Series 200 and 700 are QPL approved to	MIL-S-22710C/15
Series 700 dual lamped units are QPL approved to	MIL-S-22710C/20

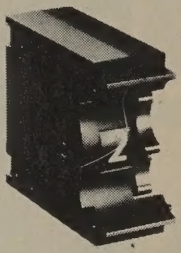

A
B
C
.500
(12.7)
TYP
.095
(2.41)
.900
(22.86)
1.15
(29.21)
STATIONS
1
2
3
4
.100 (2.54) DIA
(4 HOLES)
.060 R TYP
(1.52)
1.250
(31.75)
.135
(3.43)
.960
(24.38)
.075
(1.91)
.980
(24.89)
.900
(22.86)
.040
(1.02)
.100 DIA (2.54) (4 HOLES)
RECOMMENDED PANEL CUTOUT
.060 (1.52) R TYP
D
E
.085
(2.16)

Number of .5"(12.7) Stations	A	B	C	D	E
1	1.26(32.0)	1.09(27.7)	.90(22.9)	.92(23.4)	1.09(27.7)
2	1.76(44.7)	1.59(40.4)	1.40(35.6)	1.42(36.1)	1.59(40.4)
3	2.26(57.4)	2.09(53.1)	1.90(48.3)	1.92(48.8)	2.09(53.1)
4	2.76(70.1)	2.59(65.8)	2.40(61.0)	2.42(61.5)	2.59(65.8)
5	3.26(82.8)	3.09(78.5)	2.90(73.7)	2.92(74.2)	3.09(78.5)
6	3.76(95.5)	3.59(91.2)	3.40(86.4)	3.42(86.9)	3.59(91.2)
7	4.26(108.2)	4.09(103.9)	3.90(99.1)	3.92(99.6)	4.09(103.9)
8	4.76(120.9)	4.59(116.6)	4.40(111.8)	4.42(112.3)	4.59(116.6)
9	5.26(133.6)	5.09(129.3)	4.90(124.5)	4.92(125.0)	5.09(129.3)
10	5.76(146.3)	5.59(142.0)	5.40(137.2)	5.42(137.7)	5.59(142.0)

SERIES 8000

MINISWITCH®

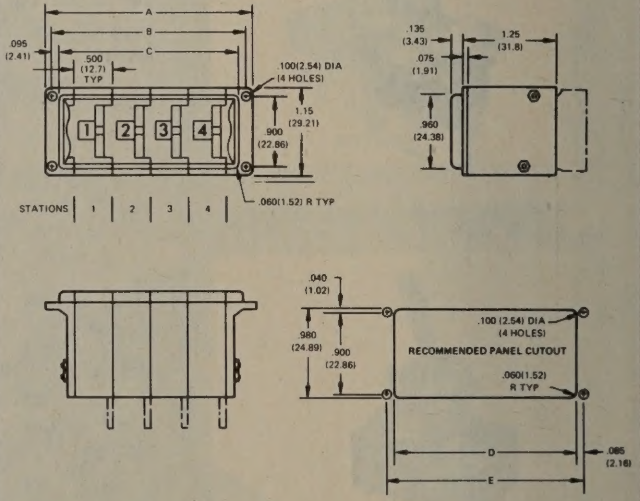
8, 10, 16 DIAL POSITIONS



This switch is a miniaturized version of the Series 300 DIGISWITCH. It is mounted from the rear of the panel with four mounting screws and, like the DIGISWITCH, can be grouped with end mounting brackets into as many switching units in a row as desired. Like most of our thumbwheel switches, the MINISWITCH will give you over 1,000,000 reliable detent operations.

SPECIFICATIONS

Operating Force	6 to 11 ounces
Rated Electrical Loads	115 volts A.C. or 28 volts D.C. at 125 milliamps. Non-switching load 3 amps max.
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	750 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 100G
Life	Over 1,000,000 detent operations
Operating Temperature	—65°C to +85°C
Weight	⅓ ounce per module (approx.)
Standard Color	Non-glare matte black case, end brackets, wheel and dial with white dial characters
Dial Character Height	0.200 (8 or 10 position)
Designed to meet	MIL-S-22710/19


A
B
C
.095
(2.41)
.500
(12.7)
TYP
.100(2.54) DIA
(4 HOLES)
1.15
(29.21)
.900
(22.86)
STATIONS
1
2
3
4
.060(1.52) R TYP
.135
(3.43)
1.25
(31.8)
.075
(1.91)
.960
(24.38)
.040
(1.02)
.980
(24.89)
.900
(22.86)
.100 (2.54) DIA
(4 HOLES)
RECOMMENDED PANEL CUTOUT
.060(1.52)
R TYP
D
E
.085
(2.16)

Number of .5"(12.7) Stations	A	B	C	D	E
1	1.26(32.0)	1.09(27.7)	.90(22.9)	.92(23.4)	1.09(27.7)
2	1.76(44.7)	1.59(40.4)	1.40(35.6)	1.42(36.1)	1.59(40.4)
3	2.26(57.4)	2.09(53.1)	1.90(48.3)	1.92(48.8)	2.09(53.1)
4	2.76(70.1)	2.59(65.8)	2.40(61.0)	2.42(61.5)	2.59(65.8)
5	3.26(82.8)	3.09(78.5)	2.90(73.7)	2.92(74.2)	3.09(78.5)
6	3.76(95.5)	3.59(91.2)	3.40(86.4)	3.42(86.9)	3.59(91.2)
7	4.26(108.2)	4.09(103.9)	3.90(99.1)	3.92(99.6)	4.09(103.9)
8	4.76(120.9)	4.59(116.6)	4.40(111.8)	4.42(112.3)	4.59(116.6)
9	5.26(133.6)	5.09(129.3)	4.90(124.5)	4.92(125.0)	5.09(129.3)
10	5.76(146.3)	5.59(142.0)	5.40(137.2)	5.42(137.7)	5.59(142.0)

DIGITAL SWITCHES and DATA ENTRY DEVICES

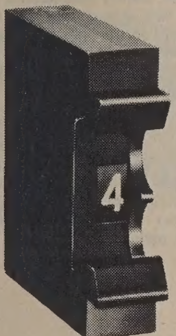
DIGITRAN®

SERIES 300

DIGISWITCH®

8, 10, 12, 16 DIAL POSITIONS

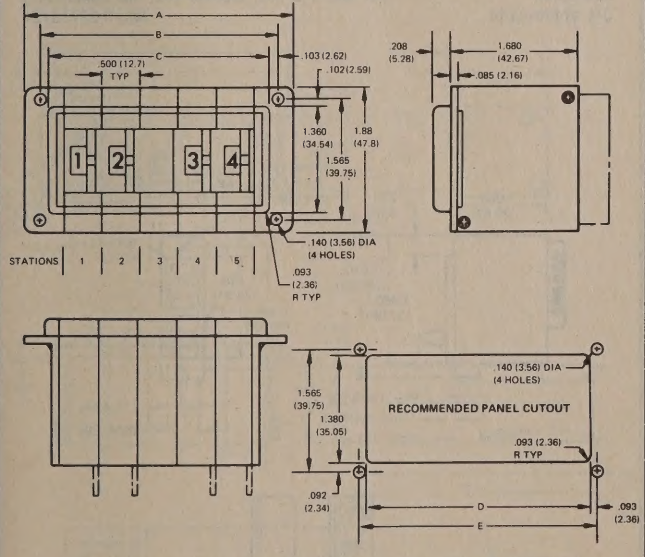
QPL approved to MIL-S-22710/11



This one module shown is our standard, general purpose unit. When grouped together with end brackets, the assembly is installed through a cut-out from the rear of the panel. Simple mounting screws are required. Note that the DIGISWITCH, which is the largest of all our switches, can be supplied with up to 16 dial positions.

SPECIFICATIONS

Operating Force	7 to 10 ounces
Rated Electrical Loads	28 volts A.C. or 28 volts D.C. at 125 milliamps. Non-switching load 3 amps max.
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	1000 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 100G
Life	Over 1,000,000 detent operations
Operating Temperature	—65°C to +85°C
Weight	¾ ounce per module (approx.)
Standard Color	Glossy black case, end brackets, wheel and dial with white dial characters
Dial Character Height	0.235 (8-10 or 12 position)
QPL approved to	MIL-S-22710/11


A
B
C
.500 (12.7) TYP
.103 (2.62)
.102 (2.59)
1.360 (34.54)
1.88 (47.8)
1.565 (39.75)
208 (5.28)
1.680 (42.67)
.085 (2.16)
1
2
3
4
STATIONS
1
2
3
4
5
.140 (3.56) DIA (4 HOLES)
.093 (2.36) R TYP
1.565 (39.75)
1.380 (35.05)
.140 (3.56) DIA (4 HOLES)
RECOMMENDED PANEL CUTOUT
.093 (2.36) R TYP
.092 (2.34)
D
E
.093 (2.36)

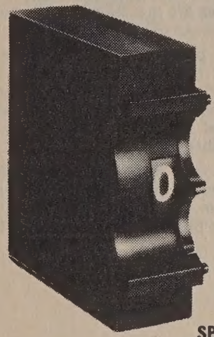
Number of .5"(12.7) Stations	A	B	C	D	E
1	1.41(35.8)	1.08(27.3)	.87(22.1)	.89(22.6)	1.08(27.3)
2	1.91(48.5)	1.58(40.0)	1.37(34.8)	1.39(35.3)	1.58(40.0)
3	2.41(61.2)	2.08(52.7)	1.87(47.5)	1.89(48.0)	2.08(52.7)
4	2.91(73.9)	2.58(65.4)	2.37(60.2)	2.39(60.7)	2.58(65.4)
5	3.41(86.6)	3.08(78.1)	2.87(72.9)	2.89(73.4)	3.08(78.1)
6	3.91(99.3)	3.58(90.8)	3.37(85.6)	3.39(86.1)	3.58(90.8)
7	4.41(112.0)	4.08(103.5)	3.87(98.3)	3.89(98.8)	4.08(103.5)
8	4.91(124.7)	4.58(116.2)	4.37(111.0)	4.39(111.5)	4.58(116.2)
9	5.41(137.4)	5.08(128.9)	4.87(123.7)	4.89(124.2)	5.08(128.9)
10	5.91(150.1)	5.58(141.6)	5.37(136.4)	5.39(136.9)	5.58(141.6)

SERIES 9000 & 19000

DIGISWITCH®

8, 10, 12, 16 DIAL POSITIONS

SERIES 9000, QPL approved to MIL-S-22710/12



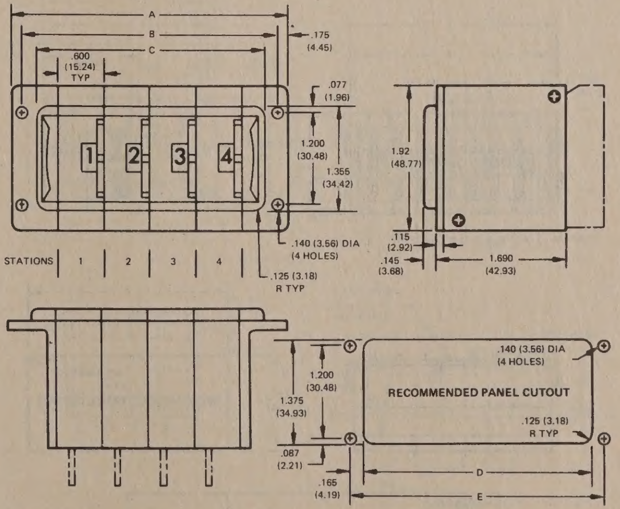
All switching characteristics are the same as the Series 300 above, only these two modified standards are sealed as follows:

The Series 9000 is completely sealed. Excellent for use on machines or equipment that are exposed to heavy concentrations of liquids such as oils or water. Further, on, you will see that our MINI-SWITCH also comes in a sealed version. Consider this, however, if your application requires the operator to wear heavy protective gloves, this larger (.6" wide) switch might be more practical. The Series 9000 is QPL approved to MIL-S-22710.

Series 19000 is unsealed, but is considered "dust proof".

SPECIFICATIONS

Operating Force	7 to 10 ounces
Rated Electrical Loads	28 volts A.C. or 28 volts D.C. at 125 milliamps. Non-switching load 3 amps max.
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	1000 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 100G
Life	Over 1,000,000 detent operations
Operating Temperature	—65°C to +85°C
Weight	1 ounce (approx.)
Standard Color	Non-glare, matte black case and end brackets. Satin black wheel and dial with white characters.
Dial Character Height	0.235 (8-10 or 12 position)
Moisture Resistance	Per MIL-STD-202, method 106
Thermal Shock	Per MIL-STD-202, method 107, test condition A
Salt Spray	Per MIL-STD-202, method 101, test condition B
Series 19000 is designed to meet	MIL-S-22710
Series 9000 is QPL approved to	MIL-S-22710C/12


A
B
C
.175 (4.45)
.600 (15.24) TYP
.077 (1.96)
1.200 (30.48)
1.355 (34.42)
1.92 (48.77)
1
2
3
4
STATIONS
1
2
3
4
.140 (3.56) DIA (4 HOLES)
.125 (3.18) R TYP
.115 (2.92)
.145 (3.68)
1.690 (42.93)
1.200 (30.48)
1.375 (34.93)
.140 (3.56) DIA (4 HOLES)
RECOMMENDED PANEL CUTOUT
.125 (3.18) R TYP
.087 (2.21)
.165 (4.19)
D
E

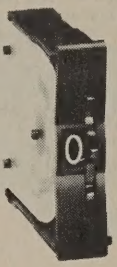
NUMBER OF .6"(15.2) STATIONS	A	B	C	D	E
1	1.80(45.7)	1.54(39.0)	1.19(30.1)	1.21(30.6)	1.54(39.0)
2	2.40(61.0)	2.14(54.2)	1.79(45.3)	1.81(45.8)	2.14(54.2)
3	3.00(76.2)	2.74(69.5)	2.39(60.6)	2.41(61.1)	2.74(69.5)
4	3.60(91.4)	3.34(84.7)	2.99(75.8)	3.01(76.3)	3.34(84.7)
5	4.20(106.7)	3.94(100.0)	3.59(91.1)	3.61(91.6)	3.94(100.0)
6	4.80(121.9)	4.54(115.2)	4.19(106.3)	4.21(106.8)	4.54(115.2)
7	5.40(137.2)	5.14(130.4)	4.79(121.5)	4.81(122.1)	5.14(130.4)
8	6.00(152.4)	5.74(145.7)	5.39(136.8)	5.41(137.3)	5.74(145.7)
9	6.60(167.6)	6.34(160.9)	5.99(152.0)	6.01(152.5)	6.34(160.9)
10	7.20(182.9)	6.94(176.2)	6.59(167.3)	6.61(167.8)	6.94(176.2)

DIGITRAN® DIGITAL SWITCHES and DATA ENTRY DEVICES

SERIES 23000

"SNAP-IN" SLIMSWITCH

10 DIAL POSITIONS



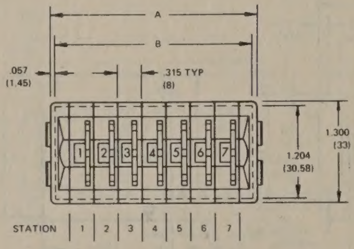
Our newest addition to the MINISWITCH line. Series 23000 is the economy leader of the digital switch industry. They cost less to buy, less to assemble, less to install. They conserve panel space, too. Using our unique assembly strap, switch assemblies are quickly and easily put together without using tools.

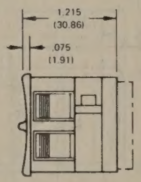
SNAP-IN panel mounting eliminates the need for installation hardware and tools and allows you to relax panel cut out tolerances. The molded-on bezels cover irregular panel cut outs, chipped paint and surface abrasions.

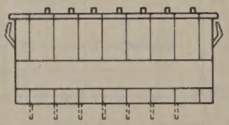
Switch module width is only .315" (8mm) so you can put more switches into a given space with better readability. That's why we call the Series 23000-the SLIMSWITCH.

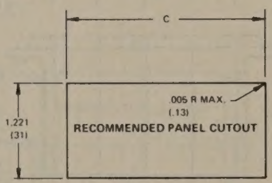
SPECIFICATIONS

Operating Force	4 to 8 ounces
Rated Electrical Loads	28 volts A.C. or 28 volts D.C. at 50 milliamps resistive, at 25°C (77°F). Non-switching current limit: 2 amps
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	500 volts RMS
Vibration	5 G's 70-2000 cps; .06 in. double amplitude, 10-70 cps
Shock	100 G's, 6 millisecond duration, sawtooth.
Life	Over 1,000,000 detent operations at 25°C (77°F)
Operating Temperature	−20°C to 65°C
Standard Color	Case, wheel and end brackets, black or Grey semi-matte as molded. Dial markings, white on black or black on Grey hot-stamped per detail specifications.
Dial Character Height	0.170"









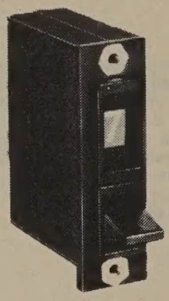
NUMBER OF MODULES	A	B	C
1	.745 (19)	.649 (16.5)	.669 (17)
2	1.060 (27)	.964 (24.5)	.984 (25)
3	1.375 (35)	1.279 (32.5)	1.299 (33)
4	1.690 (43)	1.594 (40.5)	1.614 (41)
5	2.005 (51)	1.909 (48.5)	1.929 (49)
6	2.320 (59)	2.224 (56.5)	2.244 (57)
7	2.635 (67)	2.539 (64.5)	2.559 (65)
8	2.950 (75)	2.854 (72.5)	2.874 (73)
9	3.265 (83)	3.169 (80.5)	3.189 (81)
10	3.580 (91)	3.484 (88.5)	3.504 (89)
N	N x .315 + .430 N x (8) + (11)	N x .315 + .334 N x (8) + (8.5)	N x .315 + .354 N x (8) + (9)

SERIES 24000

DIGILEVER®

10 DIAL POSITIONS

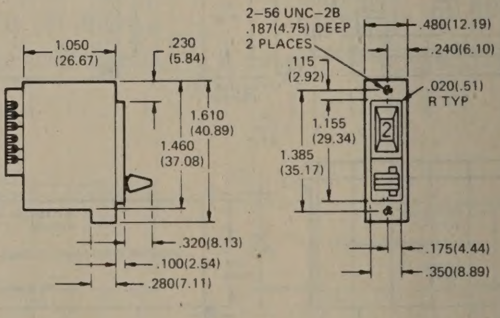
QPL approved to MIL-S-22710/24

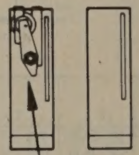


Brand new for 1972. This little toggle or paddle handle switch mounts in a panel cut-out with two screws. You can mount a row of them in one large cut-out, or mount them in a series of individual cut-outs. By actuating the toggle in either direction, the digits click in view, in sequence. And, you will like the short arc between each position. It's faster than ordinary toggle and thumbwheel switches. The front face is completely sealed so that with a mounting gasket, your equipment will be properly protected against contamination from the front of the panel.

SPECIFICATIONS

Operating Force	15 to 30 ounces
Rated Electrical Loads	28 volts D.C. at 125 milliamps. Non-switching load 3 amps max.
Initial Contact Resistance	< 100 milliohms between common terminal and output terminal
Insulation Resistance	1000 megohms
Dielectric Strength	750 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 100G
Life	Over 1,000,000 detent operations
Operating Temperature	−65°C to +75°C
Weight	3/5 ounce per module (approx.)
Standard Color	Non-glare black. Dial: Satin black. Dial Markings: White.
Dial Character Height	0.200"
Moisture Resistance	Per MIL-STD-202, method 103
Thermal Shock	Per MIL-STD-202, method 107, test condition A
Salt Spray	Per MIL-STD-202, method 101, test condition B
QPL approved to	MIL-S-22710/24





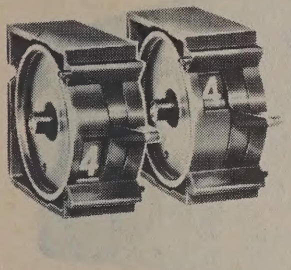
VIEW WITH LAMP ATTACHMENT

DIGITRAN®

SERIES 28000

MINILEVER®

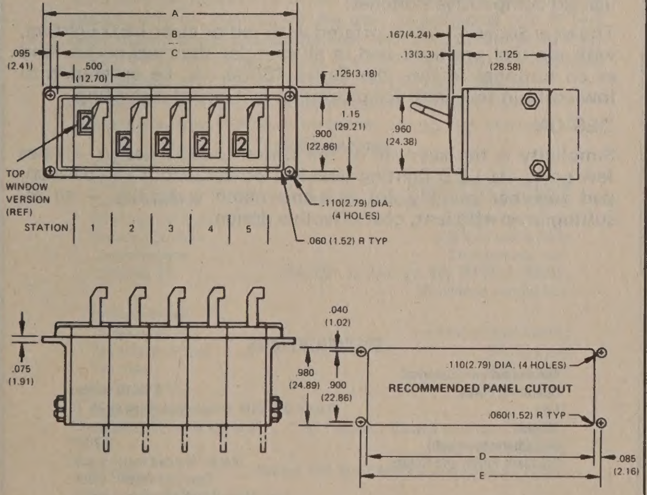
10, 12 DIAL POSITIONS



The MINILEVER is a comparatively new innovation to thumbwheel switches. Each module is actuated by a geared type lever. By moving the lever in either direction, you can instantly position the digits from zero (0) to ten (10), or zero (0) to twelve (12). For instance, they have been used on credit checking machines. The operator can set up the customers' credit card number rapidly, then push a button and check the customers' credit. He can then instantly reset all digits back to zero with one sweep of the hand. We also have a special version where the reset of all digits back to zero is done with one separate lever. A great switch for peripheral computer equipment.

SPECIFICATIONS

Operating Force	4 to 8 ounces
Rated Electrical Loads	28V (D.C.), 50 m.a. per common terminal. Non-switching current limit: one amp. All specs applicable after life at rated load.
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	500 volts RMS
Vibration	MIL-STD-202 method 204, test condition B 15G
Shock	MIL-STD-202, method 213, test condition 1 50G
Life	Over 1,000,000 detent operations
Operating Temperature	—40°C to +71°C
Weight	½ ounce per module (approx.)
Standard Color	Case, end brackets, detent lever: Non-glare black. Dial: Satin black. Dial Markings: White.
Dial Character Height	0.200 (10 or 12 position)

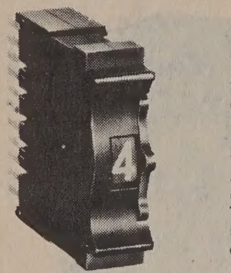

A
B
C
.095
(2.41)
.500
(12.70)
.125(3.18)
1.15
(29.21)
.900
(22.86)
2
TOP
WINDOW
VERSION
(REF)
STATION
1
2
3
4
5
.110(2.79) DIA.
(4 HOLES)
.060 (1.52) R TYP
.167(4.24)
.13(3.3)
1.125
(28.58)
.960
(24.38)
.075
(1.91)
.040
(1.02)
.980
(24.89)
.900
(22.86)
.110(2.79) DIA. (4 HOLES)
RECOMMENDED PANEL CUTOUT
.060(1.52) R TYP
D
E
.085
(2.16)

Number of .5" (12.7) Stations	A ±.03(7.62)	B	C	D	E
1	1.26(32.0)	1.09(27.7)	.90(22.9)	.92(23.4)	1.09(27.7)
2	1.76(44.7)	1.59(40.4)	1.40(35.6)	1.42(36.1)	1.59(40.4)
3	2.26(57.4)	2.09(53.1)	1.90(48.3)	1.92(48.8)	2.09(53.1)
4	2.76(70.1)	2.59(65.8)	2.40(61.0)	2.42(61.5)	2.59(65.8)
5	3.26(82.8)	3.09(78.5)	2.90(73.7)	2.92(74.2)	3.09(78.5)
6	3.76(95.5)	3.59(91.2)	3.40(86.4)	3.42(86.9)	3.59(91.2)
7	4.26(108.2)	4.09(103.9)	3.90(99.1)	3.92(99.6)	4.09(103.9)
8	4.76(120.9)	4.59(116.6)	4.40(111.8)	4.42(112.3)	4.59(116.6)
9	5.26(133.6)	5.09(129.3)	4.90(124.5)	4.92(125.0)	5.09(129.3)
10	5.76(146.3)	5.59(142.0)	5.40(137.2)	5.42(137.7)	5.59(142.0)
11	6.26(159.0)	6.09(154.7)	5.90(149.9)	5.92(150.4)	6.09(154.7)

SERIES 29000

ECONOMY MINISWITCH®

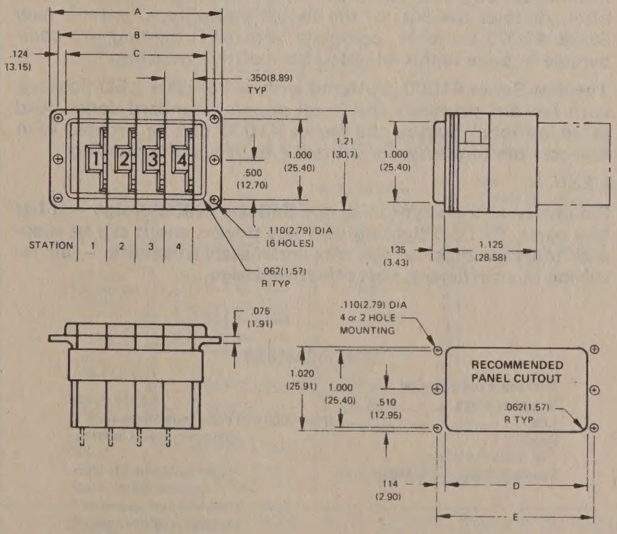
10, 12 DIAL POSITIONS



Here is our new little money saver. Although slightly derated electrically from our Series 8000 MINISWITCH, certain mechanical and material changes have reduced the selling price considerably without reducing quality. If you have an application where the ultimate in low cost is mandatory, this is the switch. This switch is also sealed against normal exposure to dust and other dry contaminants.

SPECIFICATIONS

Operating Force	4 to 8 ounces
Rated Electrical Loads	28 Vac or 28 Vdc at 50 m.a. at 25°C (77°F). Non-switching load 2 amp max.
Initial Contact Resistance	0.1 ohms max.
Insulation Resistance	1000 megohms
Dielectric Strength	500 volts RMS
Vibration	15 G's 70-2000 cps; .06 in. double amplitude, 10-70 cps
Shock	100 G's, 6 millisecond duration, sawtooth.
Life	Over 1,000,000 detent operations at 25°C (77°F)
Operating Temperature	0°C to +65°C
Weight	¼ ounce per module (approx.)
Standard Color	Beige case and end brackets with black dial characters. Black case with white dial characters on special order.
Dial Character Height	0.200"


A
B
C
.124
(3.15)
.350(8.89)
TYP
1
2
3
4
.500
(12.70)
1.000
(25.40)
1.21
(30.7)
1.000
(25.40)
STATION
1
2
3
4
.110(2.79) DIA
(6 HOLES)
.062(1.57)
R TYP
.135
(3.43)
1.125
(28.58)
.075
(1.91)
.110(2.79) DIA
4 or 2 HOLE
MOUNTING
1.020
(25.91)
1.000
(25.40)
.510
(12.95)
RECOMMENDED
PANEL CUTOUT
.062(1.57)
R TYP
114
(2.90)
D
E

NUMBER OF .35"(8.9) STATIONS	A	B	C	D	E
1	1.10(27.9)	.91(23.1)	.66(16.8)	.68(17.3)	.91(23.1)
2	1.45(36.8)	1.26(32.0)	1.01(25.7)	1.03(26.2)	1.26(32.0)
3	1.80(45.7)	1.61(40.9)	1.36(34.6)	1.38(35.1)	1.61(40.9)
4	2.15(54.6)	1.96(49.8)	1.71(43.5)	1.73(44.0)	1.96(49.8)
5	2.50(63.5)	2.31(58.7)	2.06(52.4)	2.08(52.9)	2.31(58.7)
6	2.85(72.4)	2.66(67.6)	2.41(61.3)	2.43(61.8)	2.66(67.6)
7	3.20(81.3)	3.01(76.5)	2.76(70.2)	2.78(70.7)	3.01(76.5)
8	3.55(90.2)	3.36(85.3)	3.11(79.0)	3.13(79.6)	3.36(85.3)
9	3.90(99.1)	3.71(94.2)	3.46(87.9)	3.48(88.4)	3.71(94.2)
10	4.25(108.0)	4.06(103.1)	3.81(96.8)	3.83(97.3)	4.06(103.1)

DIGITRAN® DIGITAL SWITCHES and DATA ENTRY DEVICES

SERIES 41000

LED-LIGHTED MINISWITCH®

10 DIAL POSITIONS

THE DIGITRAN COMPANY is proud to announce the first in a series of LED-lighted digital switches: the Series 41000 MINISWITCH.

In addition to eliminating most of the cost and all of the inconvenience of incandescent-lighted switches, the new Series 41000 is designed for ease of assembly and eye-appeal, with all snap-together construction and a unitized front panel appearance. Switch modules may be either front- or rear-mounted, and no visual separation between modules is evident because of a front-panel snap-on bezel.

Interchangeable with conventional 8 mm (.315") wide digital switches, the LED-lighted Series 41000 eliminates bulb replacement and installs in minutes without straps or hardware. Unlike incandescent-lighted switches, where the lighting subsystem often doubles the cost of the switch assembly, Digitran's new Series 41000 switches, complete with LED lighting, are comparable in price with un-lighted competitive switches.

The new Series 41000 is offered with red or clear LED lighting, with ten dial positions and in all popular standard codes. And as an optional feature the Series 41000 can be ordered with low-cost pin terminals for printed circuit board mounting.

DESIGN

Simplicity is the keynote of the Series 41000's design — it has few parts, its LED lighting uses less power, and it can be snapped together quickly for mix-and-match versatility — all resulting in an efficient, cost effective design.

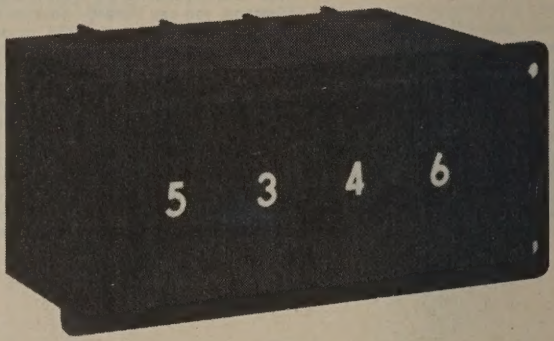
SPECIFICATIONS

Mechanical and Electrical	
Operating Force	4 to 10 ounces
Life	Over 1,000,000 detent operations at 25°C.
Weight	¼ ounce per module (approx.)
Dial Character Height	0.170"
Standard Finish and Colors	Bezel: Molded matte black; Case and Wheel: Black; Dial: Matte black background with translucent white characters
Rated Electrical Loads	125 milliamps at 28 VAC or 28 VDC. Non-switching load 2 amps.
Contact Resistance	0.100 ohms max. initial, 0.200 ohms max. after life test.
Insulation Resistance	1000 megohms min.
Dielectric Withstanding	500 VRMS
Lighting (optional)	
Internal LED Standard Colors	Clear and Red
Environmental	
Operating Temperature	−20°C to +65°C (−40°F to +149°F)
Storage Temperature	−40°C to +85°C (−40°F to +185°F)
Moisture Resistance	1 megohms min. insulation resistance after 10-day soak at 90%-95% relative humidity.

SERIES 43000

LED-LIGHTED MINISWITCH®

10 DIAL POSITIONS



THE DIGITRAN COMPANY is proud to announce the second in a series of LED-lighted digital switches: the Series 43000 MINISWITCH.

In addition to eliminating most of the cost and all of the inconvenience of incandescent-lighted switches, the new Series 43000 is designed for ease of assembly and eye-appeal, with all snap-together construction which requires no tools and very little time for switch assembly.

Interchangeable with conventional .500" (12.7 mm) wide digital switches, the LED-lighted Series 43000 eliminates bulb replacement and installs in minutes. Unlike incandescent-lighted switches, where the lighting subsystem often doubles the cost of the switch assembly, Digitran's new Series 43000 switches, complete with LED lighting, are comparable in price with un-lighted competitive switches.

The new Series 43000 is offered with red or clear LED lighting, with ten dial positions and in all popular standard codes. And as an optional feature the Series 43000 can be ordered with low-cost pin terminals for printed circuit board mounting.

DESIGN

Simplicity is the keynote of the Series 43000's design — it has few parts, its LED lighting uses less power, and it can be snapped together quickly for mix-and-match versatility — all resulting in an efficient, cost effective design.

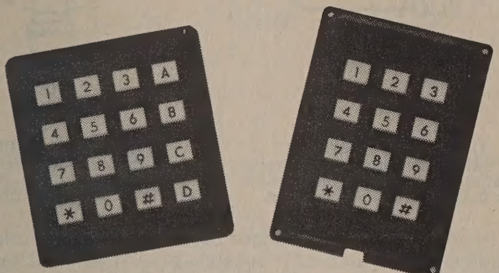
SPECIFICATIONS

Mechanical and Electrical	
Operating Force	4 to 10 ounces
Life	Over 1,000,000 detent operations at 25°C.
Weight	¼ ounce per module (approx.)
Dial Character Height	0.200"
Standard Finish and Colors	Bezel: Molded matte black; Case and Wheel: Black; Dial: Matte black background with translucent white characters
Rated Electrical Loads	125 milliamps at 28 VAC or 28 VDC. Non-switching load 2 amps.
Contact Resistance	0.100 ohms max. initial, 0.200 ohms max. after life test.
Insulation Resistance	1000 megohms min.
Dielectric Withstanding	500 VRMS
Lighting (optional)	
Internal LED Standard Colors	Clear and Red
Environmental	
Operating Temperature	−20°C to +65°C (−40°F to +149°F)
Storage Temperature	−40°C to +85°C (−40°F to +185°F)
Moisture Resistance	1 megohms min. insulation resistance after 10-day soak at 90%-95% relative humidity.

DIGITAL SWITCHES and DATA ENTRY DEVICES DIGITRAN®

SERIES KL
MINIKEY

LOW PROFILE KEYBOARDS
12 OR 16 KEY MATRIX



LOW PROFILE...
MINIKEYS are less than 5/16" high from the top of the key to the rear suface, yet key stroke is almost 1/16".

TACTILE FEEL...
Key operation is positive, natural and quiet. . .the ideal "tactile feel" for keyboards of this type.

RELIABILITY...
MINIKEYS are made to last over 1,000,000 operations per key, (MTBF) when switching a 50 milliamp resistive load at 28VDC. Precious metal contacts ensure contact closure and reliable performance in "dry circuits" and "logic circuits".

VERSATILITY...
MINIKEYS may be used just about anywhere Key operated data entry is required.

● Front or real of panel mounting versions available. ● Frame and key colors may be specified by the user, at extra cost. ● Special key legends may be specified by the user, at additional cost. ● Two basic frame designs provide the user with a maximum of 12 Keys in a 3 x 4 Key matrix or 16 Keys in a 4 x 4 Key matrix. ● Electrical terminations with Pin terminations are standard. Special terminations provided at additional cost. ● Touch Tone* versions available. ● A moisture barrier protects the contacts.

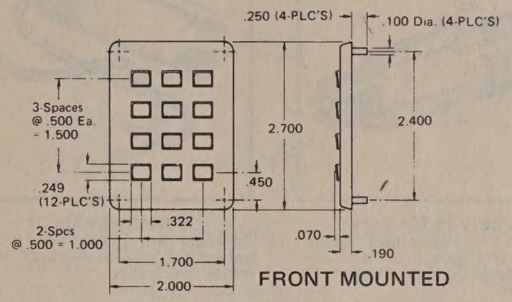
SPECIFICATIONS

Electrical Data	
Contact rating	50 ma @ 28VDC resistive
Contact resistance	500 milliohms max @ .2 ma @ 17VDC
Insulation resistance	250 megohms min.
Dielectric Strength	250 VAC min @ 60Hz
Contact bounce	3 milliseconds, max.
Operating life	1,000,000 operations per Key, MTBF, @ 28VDC, 50 milliamp resistive load
Mechanical Data	
Terminations	Per detailed specifications
Key actuation force	90 ±30 grams
Key travel	.050" nominal
Key overtravel	30% of Key travel, nominal
Materials & Finishes	
Keytops	2-shot molded ABS with white keys and black legends are standard.
Housing	Molded ABS, black with textured finish is standard.
Environmental Data	
Operating temperature	+32°F, (0°C) to +131°F, (+55°F)
Storage temperature	–40°F, (-40°C) to +160°F, (+71°C)
Relative humidity	0 to 95% (Non-condensing)

*Touch Tone is a registered Trademark of A T & T.

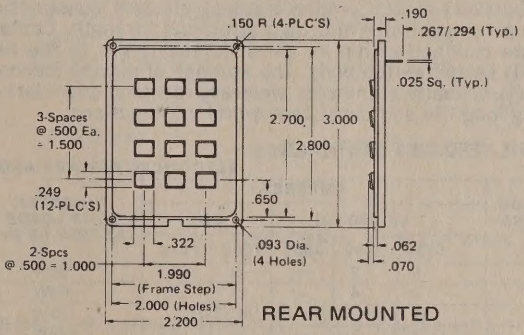
LINE DRAWINGS

12 KEY MATRIX



.250 (4-PLC'S)
.100 Dia. (4-PLC'S)
3-Spaces @ .500 Ea. = 1.500
2.700
2.400
.450
.249 (12-PLC'S)
.322
2-Spcs @ .500 = 1.000
.070
.190
1.700
2.000

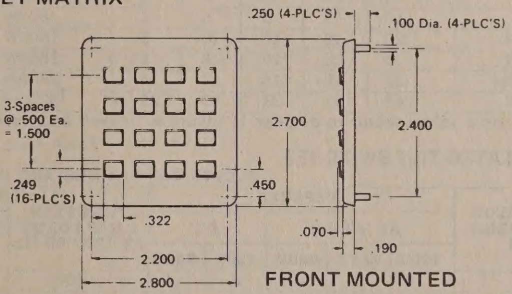
FRONT MOUNTED



.150 R (4-PLC'S)
.190
.267/.294 (Typ.)
.025 Sq. (Typ.)
3-Spaces @ .500 Ea. = 1.500
2.700
3.000
2.800
.650
.249 (12-PLC'S)
.322
.093 Dia. (4 Holes)
.062
.070
2-Spcs @ .500 = 1.000
1.990 (Frame Step)
2.000 (Holes)
2.200

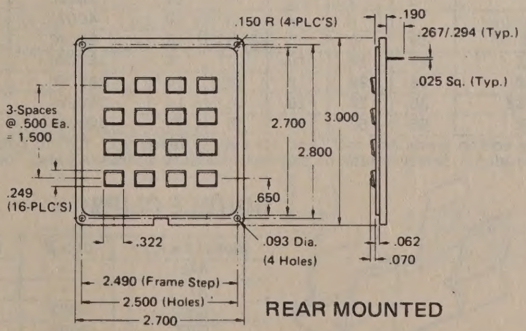
REAR MOUNTED

16 KEY MATRIX



.250 (4-PLC'S)
.100 Dia. (4-PLC'S)
3-Spaces @ .500 Ea. = 1.500
2.700
2.400
.450
.249 (16-PLC'S)
.322
.070
.190
2.200
2.800

FRONT MOUNTED



.150 R (4-PLC'S)
.190
.267/.294 (Typ.)
.025 Sq. (Typ.)
3-Spaces @ .500 Ea. = 1.500
2.700
3.000
2.800
.650
.249 (16-PLC'S)
.322
.093 Dia. (4 Holes)
.062
.070
2.490 (Frame Step)
2.500 (Holes)
2.700

REAR MOUNTED

CONSULT THE FACTORY, OUR LOCAL SALES OFFICE OR DISTRIBUTOR FOR SPECIFIC PRICING AND OUR LIBERAL QUANTITY DISCOUNTS.

SEND FOR OUR COMPLETE CATALOG TODAY!

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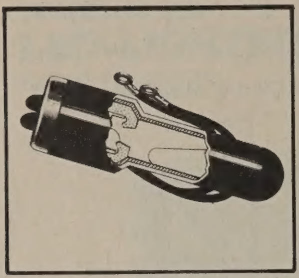
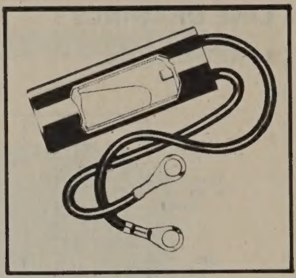
durakool®

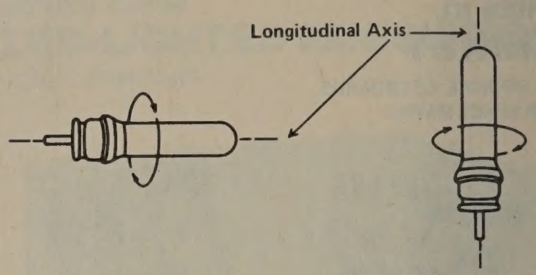
TILT & TIP OVER SWITCHES



Mercury-to-Mercury
Contacts are made and broken through two pools of mercury; clean snap-action, no chatter, little erosion.



Mercury-to-Metal
Contacts are made and broken between a pool of mercury and a metal electrode.



Tilt Switch Mounting
Tilt switches mount horizontally. Rotation around the longitudinal axis does not affect operation.

Tip Switch Mounting
Tip switches mount vertically. Rotation around the longitudinal axis does not affect operation.

All Durakool switch products are of all-steel construction providing compact size and high structural strength. Contact areas are confined within an arc suppressing gas in the hermetically sealed switch body. The absence of moving mechanical parts virtually eliminates wear and contact degradation, assuring long life and consistent switching functions.

In addition to the standard tilt and tip over switches listed, Durakool manufactures thousands of custom switches for specific OEM applications. Special angle, make and break requirements and leaded types are available on special factory order.

UNINSULATED TILT SWITCHES

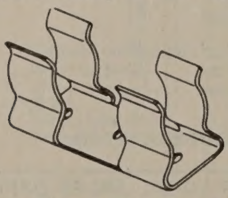
CATALOG DESIGNATION	ELECTRICAL RATINGS AND OPERATING ANGLES: AMPERES AC (60 Hz) 120V	240V	480V	DC 120V	240V	TUNGSTEN LAMP LOADS AT 120V 60 Hz	MOTOR RATINGS HP AC (60 Hz) 120-480V	DC 120-240V	*MINIMUM RECOMMENDED OPERATING ANGLE	PHYSICAL DIMENSIONS: LENGTH	LARGEST DIAMETER
A¼	.5	.2	—	.5	.25	30W	—	—	16°	13/64	5/32
A½	1	.4	—	.5	.4	60W	—	—	20°	⅜	.235
AIS	(1 Ampere 6V—24 VAC/DC)					75W	—	—	20°	39/64	13/32
AIN	1	.7	—	.5	.4	100W	—	—	16°	1 1/64	13/32
G5N	5	4	—	3	2	400W	¼	⅛	16°	1 33/64	27/64
G8N	10	8	5	5	4	800W	⅓	⅙	14°	1 55/64	½
G10N	20	16	10	10	8	1600W	¾	⅓	13°	2 9/64	39/64
G20N	35	28	18	18	14	2800W	1½	¾	9°	2 53/64	9/64
G20SN	35	28	18	18	14	2800W	1½	¾	12°	2 5/16	49/64
G35N	65	52	33	33	26	5200W	3	1½	9°	3 7/16	63/64

*Includes a safety factor in degrees to insure a "make" and "break" of the mercury contacts.

INSULATED TILT SWITCHES

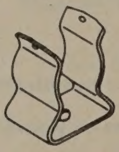
*CATALOG DESIGNATION	ELECTRICAL RATINGS AND OPERATING ANGLES: AMPERES AC (60 Hz) 120V	240V	480V	DC 120V	240V	TUNGSTEN LAMP LOADS AT 120V 60 Hz	MOTOR RATINGS HP AC (60 Hz) 120-480V	DC 120-240V	**MINIMUM RECOMMENDED OPERATING ANGLE	PHSICAL DIMENSIONS: LENGTH	LARGEST DIAMETER	TERMINAL DATA: SCREW SIZE	HOLE SIZE
A½	1	.4	—	.5	.4	60W			16°	11/16	31/32		
A1	1	.7	—	.5	.4	100W	—	—	16°	1 21/64	½	#8	.170
G5	5	4	—	3	2	400W	—	—	16°	1 63/64	27/32	#8	.170
G8Z	10	8	5	5	4	800W	¼	⅛	14°	2 1/32	¾	#10	.203
G10Z	20	16	10	10	8	1600W	⅓	⅙	13°	2⅜	27/32	#10	.203
G20Z	35	28	18	18	14	2800W	¾	⅓	9°	3 7/32	1 1/32	#10	.203
G20SZ	35	28	18	18	14	2800W	1½	¾	12°	2 21/32	1 1/32	#10	.203
G35Z	65	52	33	33	26	5200W	3	1½	9°	3¾	1¼	¼	.265

*For cotton leads add "-1" and for rubber leads add "-2" to catalog number, e.g., G5Z-2.
**Includes a safety factor in degrees to insure a "make" and "break" of the mercury contacts.



DOUBLE CLIPS

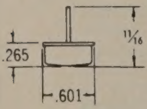
Model Switch	Clip #	Model Switch	Clip #
A½	—	G10Z	2009
A1	—	G20Z	2009
G5Z	2023	G20SZ	2009
G8Z	2008	G35Z	2010



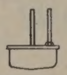
SINGLE CLIP
P-122 For Models
A1, G5Z, G8Z, G10Z

DURAKOOL SCHEDULE E SWITCHES TO8 SERIES TIP OVER SWITCH

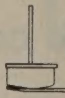
Durakool TO8 Series mercury Tip Over Switches are of the normally closed contact configuration and are omnidirectional.



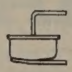
TYPE A



TYPE B



TYPE C



TYPE D

TYPE	PART #	ANGLE	CONTACT RATING VOLTS/AC	AMPS
A	TO8-1001	17-27°	120	1.7
D	TO8-1002	15-35°	120	1.7
C	TO8-1003	15-35°	120	1.7
A	TO8-1004	10-30°	120	1.7
B	TO8-1005	10-30°	120	1.7
A	TO8-1006	15-35°	120	1.7

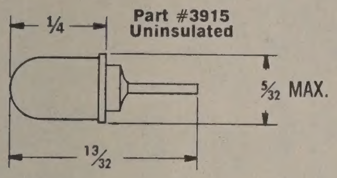
Any of the above types can be provided in angle specifications shown. Special vibration dampening types are also available. Consult the factory with your specific requirements for availability.

durakool inc., 1010 N. MAIN ST. • ELKHART, IND. 46514 • 219/264-1116 • TELEX—25-8482

durakool®

DURAKOOL SCHEDULE E SWITCHES

A¼ Micro-Mini Tilt Switch
Part No. 3915—Uninsulated



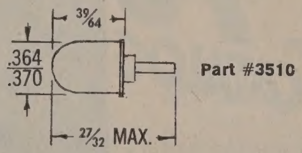
Part #3915
Uninsulated
¼
5/32 MAX.
13/32

ACTUAL SIZE

VOLTAGE	LOAD TYE	WATTAGE	CURRENT
120 VAC	TUNGSTEN	30W	¼A
120 VAC	INDUCTIVE RESISTIVE	60W	½A
240 VAC	INDUCTIVE RESISTIVE	50W	.2A
12 VDC	TUNGSTEN RESISTIVE	6W	½A
240 VDC	RESISTIVE	60W	¼A

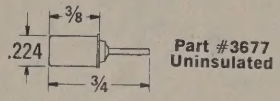
Typical Included Angle 8°

AIS / Extended Electrode
Uninsulated Switches
Part No. 3510
1 Amp. 6V—24 VAC/DC
Typical Included Angle 8°

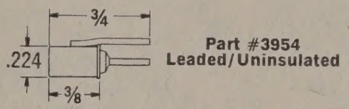


39/64
.364
.370
Part #3510
27/32 MAX.

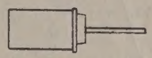
A½ Mini Tilt Switch



3/8
.224
3/4
Part #3677
Uninsulated



3/4
.224
3/8
Part #3954
Leaded/Uninsulated

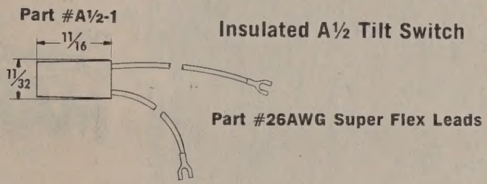

ACTUAL SIZE

VOLTAGE	LOAD TYPE	WATTAGE	CURRENT
120 VAC	TUNGSTEN	60W	½A
120 VAC	INDUCTIVE RESISTIVE	120W	1A
240 VAC	INDUCTIVE RESISTIVE	100W	.4A
12 DC	TUNGSTEN RESISTIVE	12W	1A
240 VDC	RESISTIVE	120W	½A

Typical Included Angle 10°

Minimum Recommended Angle 20°

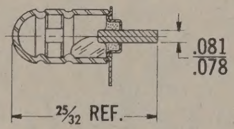
Insulated A½ Tilt Switch



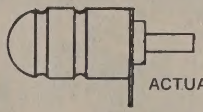
Part #A½-1
11/16
11/32
Part #26AWG Super Flex Leads

ANTI-VIBRATION TILT SWITCH / UNINSULATED
Part No. 3018

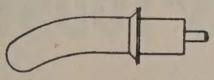
CONTACT RATINGS:
1 Amp @ 120 VAC
0.7 Amp @ 240 VAC
0.5 Amp @ 120 VDC
0.4 Amp @ 240 VDC
0.8 Amp @ 120 VAC (Tungsten)



.081
.078
25/32 REF.


ACTUAL SIZE

WIDE ANGLE G5 SWITCH
Part No. 3843



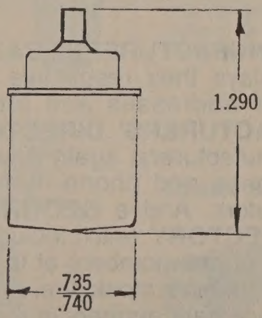
ELECTRICAL RATINGS AND OPERATING ANGLES

AMPERES					TUNGSTEN LAMP LOADS AT 120V 60 Hz	MOTOR RATINGS HP		OPERATING ANGLE TYPICAL
AC (60 Hz)			DC			AC (60 Hz) 120-480V	DC 120-240V	
120V	240V	480V	120V	240V				
5	4	—	3	2	400W	¼	⅓	35°

PROXIMITY SWITCH
Part No. 3943

General Purpose N.O. Contacts	
Volts AC	Amps
120	20
240	15
480	10
120 VAC	½ HP

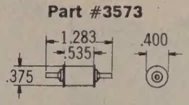
Magnet not supplied by Durakool



1.290
.735
.740

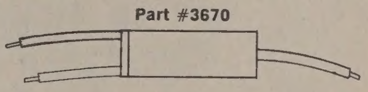
DOUBLE ENDED DPST A1 TILT SWITCHES

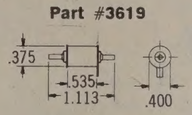
Uninsulated DPST



Part #3573
1.283
.535
.400
.375

Insulated DPST



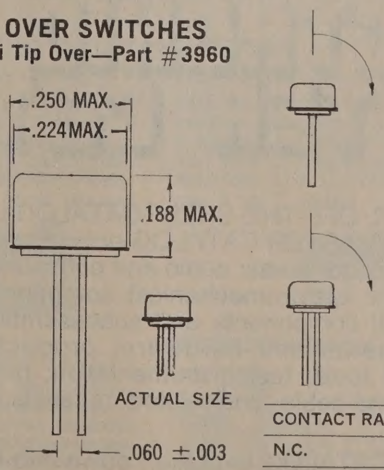


Part #3619
.375
.535
1.113
.400

ELECTRICAL RATINGS AND OPERATING ANGLES

					TUNGSTEN LAMP LOADS AT 120V 60 Hz	MOTOR RATINGS HP		*MINIMUM RECOM. OPTG. ANGLE
AC (60 Hz)			DC			AC (60 Hz)	DC 120-240V	
120V	240V	480V	120V	240V				
1	.7	—	.5	.4	100W	—	—	16°

TIP OVER SWITCHES
Mini Tip Over—Part #3960



.250 MAX.
.224MAX.
.188 MAX.
ACTUAL SIZE
.060 ±.003

X DIRECTION OF TIP FROM VERTICAL
62° ± 20° BREAK
44° ± 15° MAKE

Y DIRECTION OF TIP FROM VERTICAL
17° ± 4° BREAK
5° ± 4° MAKE

CONTACT RATING	⅛A 201V AC
N.C.	¼A 50 VDC

'78
THE MASTER CATALOG
THE ELECTRONIC DISTRIBUTORS MASTER CATALOG
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FORMERLY: OFF-THE-SHELF CATALOG
THE ONLY NATIONAL CATALOG OF ELECTRONIC PARTS, INSTRUMENTS AND EQUIPMENT DESIGNED EXCLUSIVELY FOR DISTRIBUTORS AND THEIR CUSTOMERS.

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Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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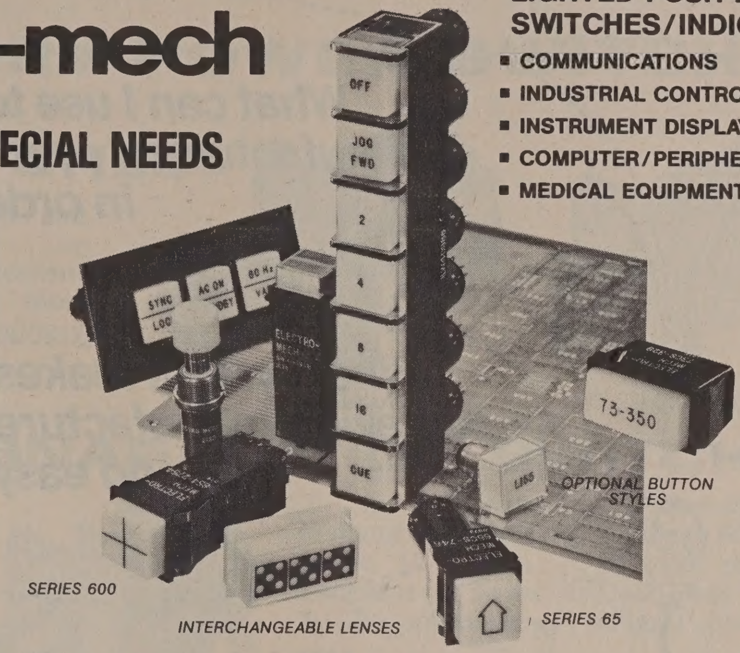
electro-mech

STANDARD DESIGNS FOR SPECIAL NEEDS

LIGHTED PUSH-BUTTON SWITCHES/INDICATORS

- COMMUNICATIONS
- INDUSTRIAL CONTROLS
- INSTRUMENT DISPLAYS
- COMPUTER/PERIPHERALS
- MEDICAL EQUIPMENT


OFF
JOG FWD
2
4
8
16
CUE
SYNC
LOC
AC ON
80 Hz
VA
73-350
OPTIONAL BUTTON STYLES
SERIES 600
INTERCHANGEABLE LENSES
SERIES 65

GENERAL SWITCH SPECIFICATIONS:

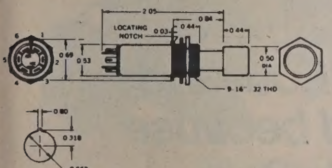
Technical specifications apply to all Electro-Mech Switch models unless otherwise specified:

- **Ratings:** 30 Volts DC or 15 Volts AC; 2 amps resistive; 1 amp inductive
- **Weight:** 0.8 oz. (approx.)
- **Operating Pressure:** 2 lbs. +1 lb.
- **Plunger Travel:** 3/16" (approx.)
- **Actuations:** 100,000
- Accommodates all **"switchlines"** standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp. 3 actuation modes standard also in 2, 3, 4 and 6-pole configuration.

SWITCHLINE *and* SLIMLINE SWITCHES

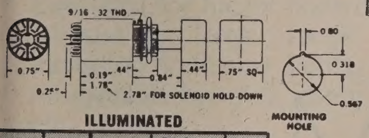
1PST-2PDT *SERIES 2150*

A new 2100 Series Slimline version of our standard Illuminated Pushbutton Switch featuring silver slide bar action. Add BR after part number for mounting on 5/8" centers. Utilizes AN3140-T 1-3/4 or ALC-100 bulb. All other specifications same as standard.


2.05
0.84
LOCATING NOTCH
0.03
0.44
0.44
0.69
0.53
0.50 DIA
9/16"-32 THD
0.80
0.318
0.567
MOUNTING HOLE

	1PST		2PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1PDT	2PDT
Momentary	2128	2129	2130	2131	2132	2149	2150
Push-on/ Push-off	2228	2229	2230	2231	2232	2249	2250

2PDT-6PDT *SERIES 2650*


9/16 - 32 THD
0.75"
0.25"
0.19"
1.78"
.44"
0.84"
.44"
.75" SQ
2.78" FOR SOLENOID HOLD DOWN
0.80
0.318
0.567
MOUNTING HOLE

ILLUMINATED

	Mom.	Push-on Push-off	Push-on Remain in Push-off	Snap Feel Mom.
2PDT	2650	2750	2850	2550
3PDT	2651	2751	2851	2551
4PDT	2652	2752	2852	2552
5PDT	2653	2753	2853	2553
6PDT	2654	2754	2854	2554

SOLENOID HOLD-DOWN

SERIES 3054

Switchline Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6PDT. Same specifications as standard model.

SWITCHLINE
3054

MINIATURE FRONT PANEL MOUNT MOMENTARY SWITCHES

SERIES 5000

An exceptionally short momentary switch available in circuit configurations up to 2PDT. Clear anodized case. All specifications same as standard model except plunger travel which is 3/32".

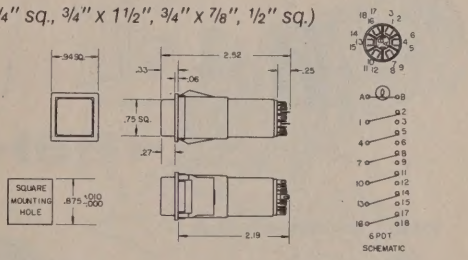
	1PST		2PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1PDT	2PDT
Momentary	5128	5129	5130	5131	5132	5149	5150

DESIGNER GROUP SWITCHES

(3/4" sq., 3/4" x 1 1/2", 3/4" x 7/8", 1/2" sq.)

Series 65, 73, 600, 800, 61

These Electro-Mech Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.


.94 SQ
.33
.06
2.52
.25
.75 SQ.
.27
SQUARE MOUNTING HOLE
.875 +.010 -.000
2.19
6 PDT SCHEMATIC

All Designer Group units feature:

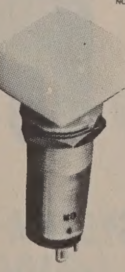
- **1PST TO 6PDT**
- **MOMENTARY; ALTERNATE ACTION; PUSH-ON REMAIN-IN; PUSH-ON, PUSH-OFF *and* MOMENTARY SNAP-FEEL**

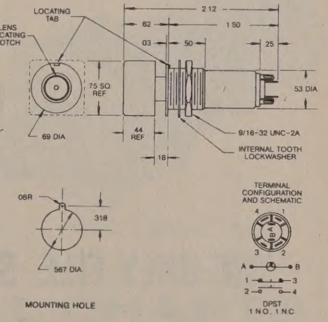
SHORT HOUSING

SERIES 6100 (3/4" sq.)

High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard Electro-Mech model sizes.

- **INDUSTRY'S SHORTEST ALTERNATE-ACTION DESIGN**
- **REQUIRES ONLY 1 1/2" BEHIND PANEL**

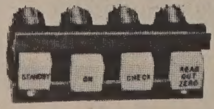



LOCATING TAB
LENS LOCATING NOTCH
2.12
.62
1.50
.03
.50
.25
.75 SQ REF
.53 DIA
.69 DIA
.44 REF
.18
9/16-32 UNC-2A
INTERNAL TOOTH LOCKWASHER
TERMINAL CONFIGURATION AND SCHEMATIC
.08R
.318
.567 DIA
MOUNTING HOLE
DPST 1 N.O. 1 N.C.

SUB-PANEL/INTERLOCKING SWITCH ASSEMBLIES

SERIES 400

Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations.


STANDBY
ON
CHECK
READ OUT ZERO

SERIES 500

Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, 7/8" or 1" centers.

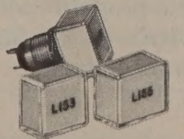
10 AMP *Series 4000* DPST-2 N.O.

for U.L. Applications

Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

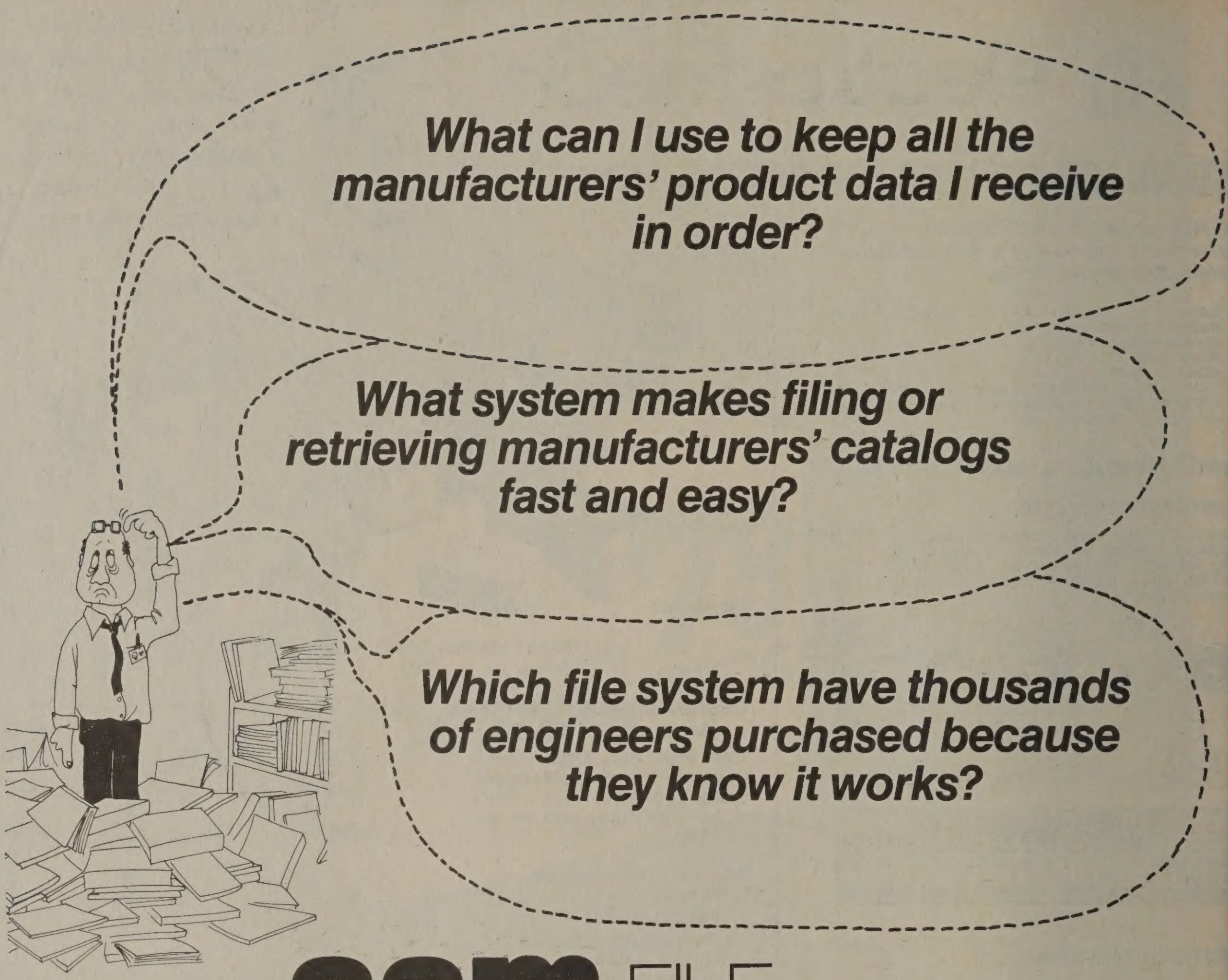
INTERCHANGEABLE LENSES/*FILTERS*

Series 150



Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.

ELECTRO-MECH COMPONENTS. INC. • 1826 NORTH FLORADALE AVE. • SO. EL MONTE. CALIF. 91733 • (213) 442-7180


What can I use to keep all the manufacturers' product data I receive in order?
What system makes filing or retrieving manufacturers' catalogs fast and easy?
Which file system have thousands of engineers purchased because they know it works?

eem FILE SYSTEM

THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

Here's how to order your eem FILE SYSTEM:

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
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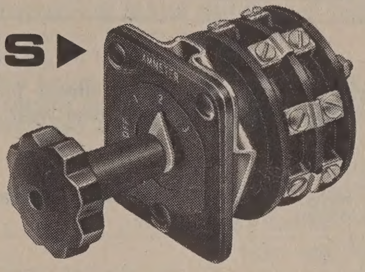
For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. • 645 Stewart Ave., Garden City, N.Y. 11530

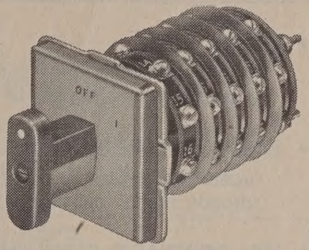
ROTARY POWER SWITCHES

DETENT SWITCHES ▸

10 to 30 amp . . . Standard and Miniaturized versions . . . up to 600V . . . up to 75 poles . . . 2 to 16 positions. Excellent for selection and control circuits. Most have UL & CSA approvals . . . military equivalents.



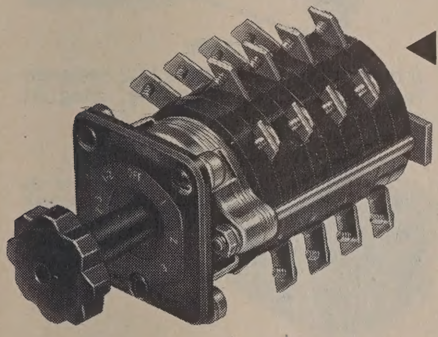
Standard



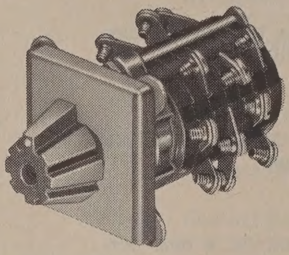
Miniaturized

◂SNAP-ACTION SWITCHES

20 to 200 amp . . . Standard and Miniaturized versions . . . up to 600V . . . up to 12 poles . . . 2 to 4 positions. Excellent for switching D. C. Most have UL & CSA approvals . . . military equivalents.



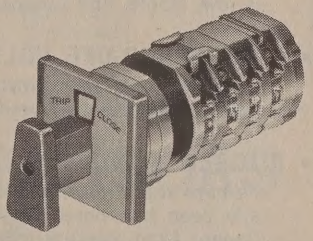
Standard



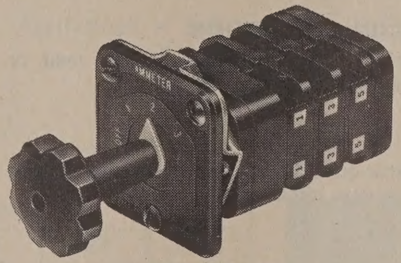
Miniaturized

CAM-ACTUATED SWITCHES ▸

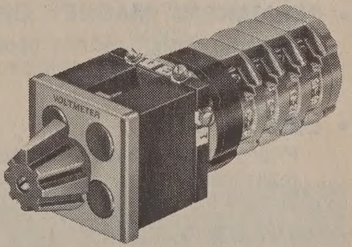
12 to 60 amp is Standard and Miniaturized versions . . . up to 600V . . . up to 24 poles . . . 2 to 12 positions. Excellent for motor control applications. Unusually large range of options including indicator lights, spring-return, removeable handles, many handle styles, etc.



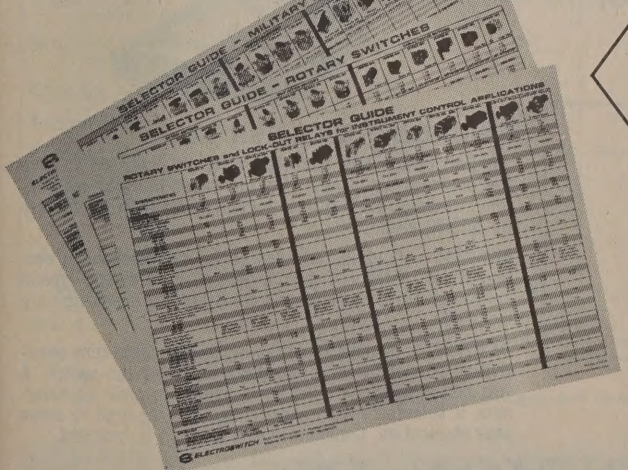
With Mechanical Target



Standard Size



With Lighted Plate


SELECTOR GUIDE - MILITARY SWITCHES
SELECTOR GUIDE - ROTARY SWITCHES
SELECTOR GUIDE
ROTARY SWITCHES and LOCK-OUT RELAYS for INSTRUMENT CONTROL APPLICATIONS
ELECTROSWITCH

FREE WALL CHARTS

Handy 11" x 17" charts show wide range of switch types and specifications. Three versions available: (1) Industrial Switches (2) Instrument & Control Switches and Utility devices (3) Military Switches. You may also request our Bulletin C-1, a "catalog of available catalogs".

OTHER PRODUCTS AVAILABLE . . . include: **Lock-out Relays** and **Control/Switch Relays.** Many options and special features are available on all our product lines.

ELECTROSWITCH

ELECTRO SWITCH CORP. • Weymouth, Massachusetts 02188 • Telephone: 617/335/5200 • TWX: 710/388/0377

MERCURY FILM SWITCHES

- OPERATE IN ALL POSITIONS
- TWO BILLION CYCLE RELIABILITY
- NO CONTACT BOUNCE
- STABLE CONTACT RESISTANCE

- **LONG LIFE**
  Self healing mercury contacts are coupled with an almost foolproof energizing mechanism to eliminate contact and frictional wear.

- **HIGH RELIABILITY**
  Operation joins two mercury films. There are no contact interfaces to impede signal passage. Over 2 Billion Cycle MCBF.

- **NO CONTACT BOUNCE**
  Mercury contacts are joined without bounce or noise in a perfect electrical closure.

- **OPERATION IN ANY POSITION**
  A patented design uses strong surface tension forces to hold mercury films securely to wetted surfaces regardless of position.

- **LOW AND STABLE CONTACT RESISTANCE**
  Mercury contacts are renewed with every operation. Contact resistance is low, stable, and independent of load being switched.

- **HIGH STAND-OFF VOLTAGE**
  Large contacts gaps provide 1250 VAC breakdown ratings. A near perfect hermetic seal assures that it will last the life of the switch.

- **RUGGED CONSTRUCTION**
  Perhaps the strongest switching capsule ever made. A sample has literally been hammered into a wooden plank without structural damage. Danger from mercury leakage is eliminated.

- **PERMANENT MAGNET OR COIL ACTUATION**
  Versatile design permits updating all applications where dry reed, or mercury wetted reed, switches have been used in the past.

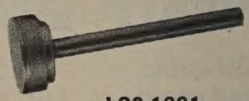
- **LOW IN COST**
  Priced to serve almost any application LC2 now allows the use of high reliability switching in cost conscious circuits.

- **CONTACT FACTORY**
  For information and test data on our complete line of mercury film switches and relays.

SPECIFICATIONS

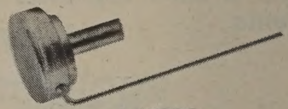
Contact Form	Form 'A' SPST-NO(1)
Life	Indefinite
Reliability (MCBF)	$> 2 \times 10^9$ (2)
Rated Contact Load (DC)	5V, 2 amps 24V, 1 amp 200V, 0.1 amps
Contact Resistance	0.15 ohms
Contact Resistance Stability	±0.015 ohms
Contact Breakdown	1250 VRMS
Contact Bounce	None

NOTES: (1) Contact factory for Form B; Form C; and latching models.
(2) Based upon tests conducted on over 100 units tested to over 3.4×10^{10} operations.
(3) Contact factory for higher voltage models.



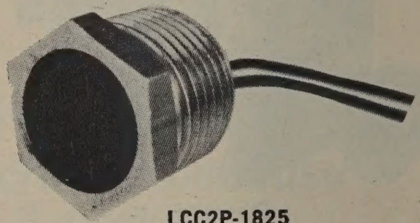
LC2-1091

The basic mercury film switch. It may be operated by a permanent magnet or a coil.



LC2SPC

A miniature version of the LC2 designed for direct PCB mounting. Magnet actuated.

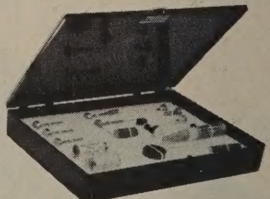


LCC2P-1825

A rugged encapsulated LC2 housed in a brass fitting that matches a ⅜-18NPT threaded conduit. Magnet actuated.

LC2P-1823

An encapsulated LC2 package with mounting screw slots. Magnet Actuated.



ENGINEERING DESIGN KITS

The two design kits detailed below are intended to give the engineer an insight into the capabilities of mercury film switching. Each kit may be purchased from the factory for $49.00 each.

DK1-2328 — Contains samples of various mechanical configurations of the LC2 switch. Mounting hardware, typical permanent drive magnets and complete documentation are included.

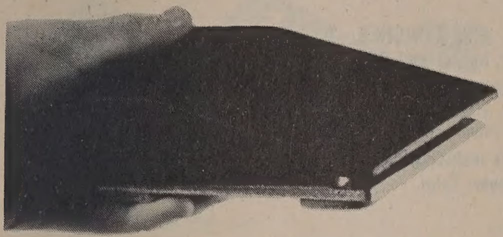
DK2-2329 — Demonstrates the range of ampere turn sensitivities normal to the production output of the switch. A test coil is provided. This kit is helpful in order to determine if selected switch sensitivities are required to serve your application. Complete documentation is included.

FIFTH DIMENSION INC.

5-D
707 ALEXANDER ROAD • PRINCETON, NEW JERSEY 08540
TELEPHONE: (609) 452-1200 • TWX: 510-685-2387

SOLID STATE COMPATIBLE FOOT SWITCH

- No Contact Bounce
- Billion Cycle Reliability
- Hermetically Sealed Self Healing Contacts
- Resistance Stable to 0.015 OHMS
- No Signal Distortion
- Will Switch NANO-AMPS or 2.0 AMPERES with Equal Reliability
- Features use of LC2 Mercury Film Switching Capsule Described eem Page 4072 (1977)



FP 1830

No contact bounce, self healing contacts. Sealed contact chamber excludes contamination while protecting volatile atmospheres from electrical arcs. Contact resistance that varies less than 0.015 ohms over life even when switching nano-amps. The FP 1830 is highly compatible with solid state signals.

APPLICATIONS IN MEDICAL ELECTRONICS;
SOPHISTICATED INSTRUMENTATION;
COMPUTER CONTROL

FP 1830 SPECIFICATIONS

Contact Form	SPST - NO
Contact Life	Indefinite
Mechanical Life	5 x 10^6 Operations
Reliability (Mean Cycles between Failure)	1 x 10^9 Operations
Rated Contact Load	2.0 Amperes at 5V DC 1.0 Amperes at 24V DC 0.1 Amperes at 200V DC
Contact Resistance	0.25 Ohms
Contact Resistance Stability	±0.015 Ohms
Contact Breakdown	600V DC 1250V AC
Contact Bounce	None

OMNIDIRECTIONAL POSITION SENSORS MONITORS VERTICALLY

- Ultra Miniature
- Hermetically Sealed
- Rugged Steel Case
- 360° Sensitivity
- Low Cost
- Convenient Mounting Packages
- Normally Open or Closed Contacts

Applications:

- Fall Down Switches
- Automotive
- Medical Electronics
- Appliances
- TV Games
- Digital Watches
- Ordnance Fuses
- Industrial Control
- Interlocks
- Marine Products

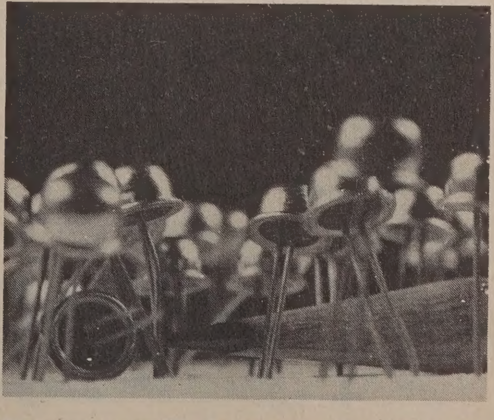
TILT SWITCH SPECIFICATIONS

SWITCH NUMBER	TS6	TS3	TS7	TS7B
Contact Form (Switch Vertical)	Closed	Closed	Open	Closed
Nominal Operate Angle (from Horizontal)	65°	70°	75°	45°
Operate Angle Tolerance	±15°	±20°	±10°	±10°
Typical Angular Hysterisis	20°	30°	10°	15°
Contact Material	Gold	Mercury	Mercury	Mercury
Contact Resistance (Typical) (Ohms)	5 stable 10K transitional 10^8 open	2	1.0	1.0
Contact Load Limit				
Amperes at 12V DC	0.02	0.5	1.0	1.0
Amperes at 115V AC	—	0.25	0.5	0.5

Note: #1. The TS3 and TS6 are intended for non-critical attitude determination. They should not be used in applications where tight angular tolerances or close repeatability are required.

#2. PATENTS APPLIED FOR.

#3. Contact Factory for other Nominal Operate Angles and other Angle tolerances.



Illustrated is the TS3 Switch. It was designed for the digital watch industry. It is one of the smallest tilt switches in industry.

FIFTH DIMENSION INC.

(5-D) 707 ALEXANDER ROAD • PRINCETON, NEW JERSEY 08540
TELEPHONE: (609) 452-1200 • TWX: 510-685-2387

Grayhill®

TOP ACCESS ROCKER DIP SWITCHES

SPECIFICATIONS

Mechanical Life: 50,000 Operations per Rocker.

Make and Break Current Rating: 35,000 Operations at 50 MA, 30 VDC; 25,000 Operations at 125 MA, 30 VDC.

Contact Resistance: 100 Milliohms Maximum after life (30 Milliohms initially), measured at 2MA DC and 50 MV (open circuit).

Insulation Resistance (at 100 VDC): Between Adjacent Open or Closed Contacts: 50,000 Megohms after life, (100,000 Megohms initially).

Dielectric Strength: Between Adjacent Open or Closed Contacts: 500 VAC after life (750 VAC initially).

Current Carry Rating: 5 Amps with a maximum contact temperature rise of 20° C.

MATERIALS AND FINISHES

Switch Cover, Rocker and Base: Polyester.

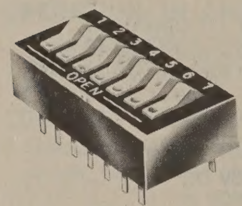
Base Seal: Epoxy.

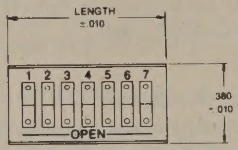
Shorting Bar: Brass, Gold plated .00001″ minimum over Nickel plated .00005″ minimum.

Base Contacts including Terminals: Brass, Gold plated .00001″ minimum.

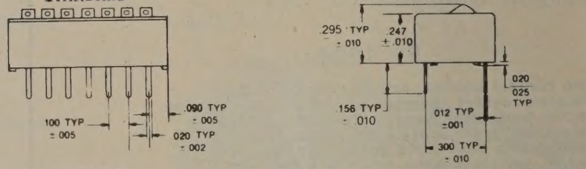
Protective Cover: Zytel.

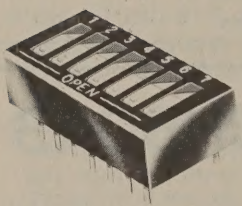
SPST ROCKER DIP SWITCHES 2 THRU 10 STATIONS

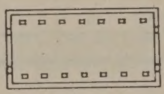

1
2
3
4
5
6
7
OPEN


LENGTH ±.010
1 2 3 4 5 6 7
OPEN
.380 ±.010

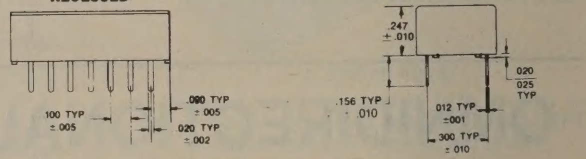
STANDARD


.090 TYP ±.005
100 TYP ±.005
.020 TYP ±.002
.295 TYP ±.010
.247 ±.010
.156 TYP ±.010
.012 TYP ±.001
.300 TYP ±.010
.020 .025 TYP


1
2
3
4
5
6
7
OPEN

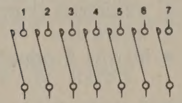


RECESSED


.090 TYP ±.005
100 TYP ±.005
.020 TYP ±.002
.247 ±.010
.156 TYP ±.010
.012 TYP ±.001
.300 TYP ±.010
.020 .025 TYP

TYPICAL CIRCUIT DIAGRAM

(SHOWN IN OPEN POSITION FOR A SWITCH WITH SEVEN ROCKERS)

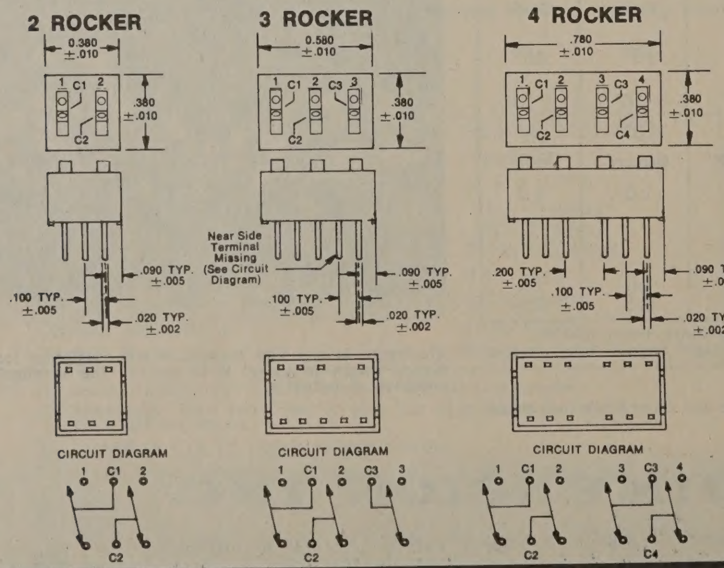


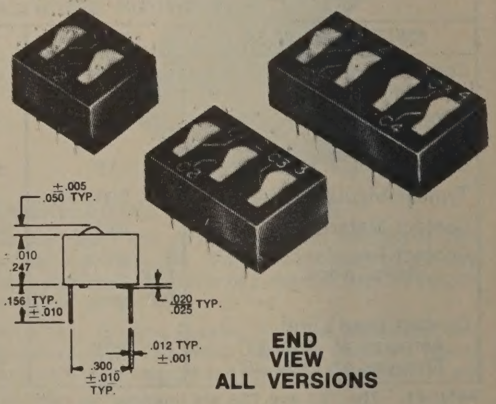
ORDERING INFORMATION

SPST ROCKER DIP SWITCHES

No. of Rockers	Length	Standard Part Number	Recessed Part Number	Unit Price	Uses Cover	No. of Rockers	Length	Standard Part Number	Recessed Part Number	Unit Price	Uses Cover
2	0.280	76B02	76RB02	$3.05	76P02	7	0.780	76B07	76RB07	$3.35	76P07
3	0.380	76B03	76RB03	3.10	76P03	8	0.880	76B08	76RB08	3.45	76P08
4	0.480	76B04	76RB04	3.15	76P04	9	0.980	76B09	76RB09	3.55	76P09
5	0.580	76B05	76RB05	3.20	76P05	10	1.080	76B10	76RB10	3.60	76P10
6	0.680	76B06	76RB06	3.30	76P06	SEE DISCOUNT SCHEDULE ON FOLLOWING PAGE					

THE DIP-C™ SINGLE POLE / DOUBLE THROW CIRCUITRY


2 ROCKER
3 ROCKER
4 ROCKER
0.380 ±.010
0.580 ±.010
.780 ±.010
.380 ±.010
1 C1 2
C2
1 C1 2 C3 3
1 C1 2 3 C3 4
C4
Near Side Terminal Missing (See Circuit Diagram)
.090 TYP. ±.005
.100 TYP. ±.005
.020 TYP. ±.002
.200 TYP. ±.005
CIRCUIT DIAGRAM
CIRCUIT DIAGRAM
CIRCUIT DIAGRAM


±.005 .050 TYP.
±.010 .247
.156 TYP. ±.010
.020 .025 TYP.
.012 TYP. ±.001
.300 ±.010 TYP.
END VIEW ALL VERSIONS

ORDERING INFORMATION:

SPDT ROCKERS DIP SWITCHES

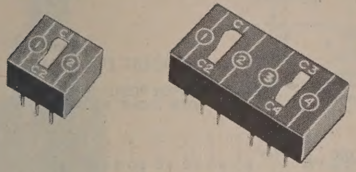
No. of Rockers	Part Number	Unit Price	Uses Cover
2	76C02	$3.40	76P03
3	76C03	3.65	76P05
4	76C04	3.90	76P07

SEE DISCOUNT SCHEDULE ON FOLLOWING PAGE

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

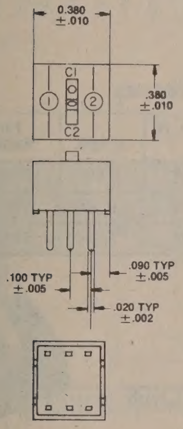
TOP ACCESS ROCKER DIP SWITCHES

Grayhill

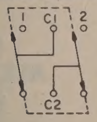

C1
1
2
C2
C1
C2
2
3
C3
C4
4

THE DOUBLE-DIP™ DOUBLE POLE / DOUBLE THROW CIRCUITRY

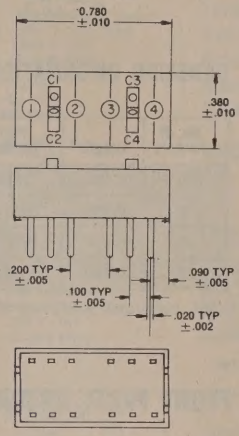
1 ROCKER


0.380 ±.010
C1
1
2
C2
.380 ±.010
.100 TYP ±.005
.090 TYP ±.005
.020 TYP ±.002

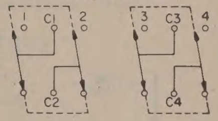
CIRCUIT DIAGRAM



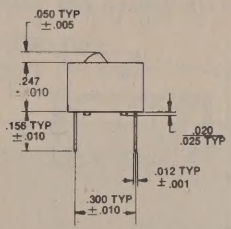
2 ROCKER


0.780 ±.010
C1
C3
1
2
3
4
C2
C4
.380 ±.010
.200 TYP ±.005
.100 TYP ±.005
.090 TYP ±.005
.020 TYP ±.002

CIRCUIT DIAGRAM


1
C1
2
3
C3
4
C2
C4

END VIEW ALL VERSIONS


.050 TYP ±.005
.247 ±.010
.156 TYP ±.010
.020 .025 TYP
.012 TYP ±.001
.300 TYP ±.010

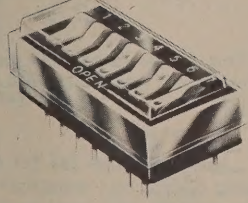
ORDERING INFORMATION:

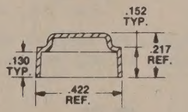
DPDT ROCKER DIP SWITCHES

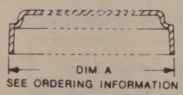
No. of Rockers	Part Number	Unit Price	Uses Cover
1	76D01	$3.50	76P03
2	76D02	4.00	76P07

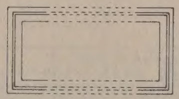
SEE DISCOUNT SCHEDULE BELOW

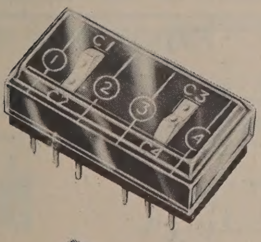
PROTECTIVE COVERS FOR THE TOP ACCESS SWITCHES




.152 TYP.
.130 TYP.
.217 REF.
.422 REF.


DIM. A
SEE ORDERING INFORMATION

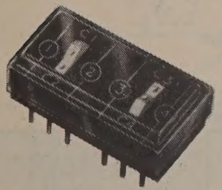



C1
1
2
C2
3
C3
C4
4

ORDERING INFORMATION:

PROTECTIVE COVER

Dim. A	Part Number	Unit Price	Dim. A	Part Number	Unit Price
0.322	76P02	15¢	0.822	76P07	15¢
0.422	76P03	15¢	0.922	76P08	15¢
0.522	76P04	15¢	1.022	76P09	15¢
0.622	76P05	15¢	1.122	76P10	15¢
0.722	76P06	15¢			



DISCOUNT SCHEDULE

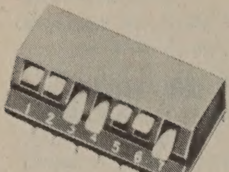
1- 9 UNIT PRICE 10-24 LESS 8% 25-49 LESS 16% 50-99 LESS 21%	100-499 LESS 30% 500-999 LESS 35% (PART NOS. 76C, 76D AND 76P) 500-999 LESS 40% (PART NOS. 76B AND 76RB) 1000 UP CONTACT GRAYHILL

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

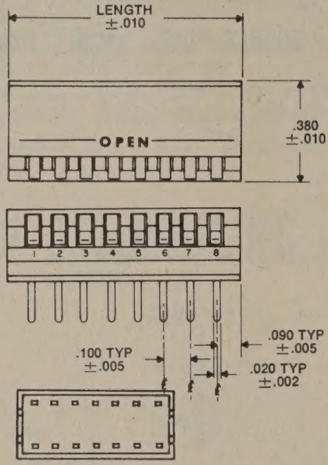
Available Locally Through Your Grayhill Distributor

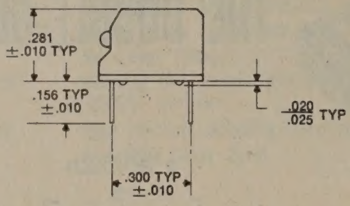
Grayhill®

SIDE ACTUATED AND FRONT PANEL MOUNT



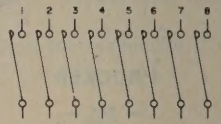
THE PIANO-DIP™ SPST — SIDE ACTUATED 4 THRU 10 STATIONS


LENGTH
±.010
.380
±.010
OPEN
1 2 3 4 5 6 7 8
.100 TYP
±.005
.090 TYP
±.005
.020 TYP
±.002


.281
±.010 TYP
.156 TYP
±.010
.020
.025 TYP
.300 TYP
±.010

TYPICAL CIRCUIT DIAGRAM

(SHOWN IN OPEN POSITION FOR A SWITCH WITH EIGHT ROCKERS)

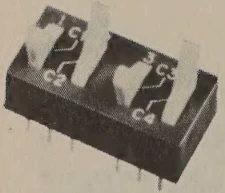


ORDERING INFORMATION:

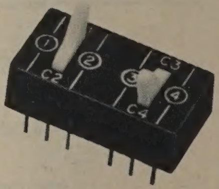
SPST PIANO DIP SWITCHES

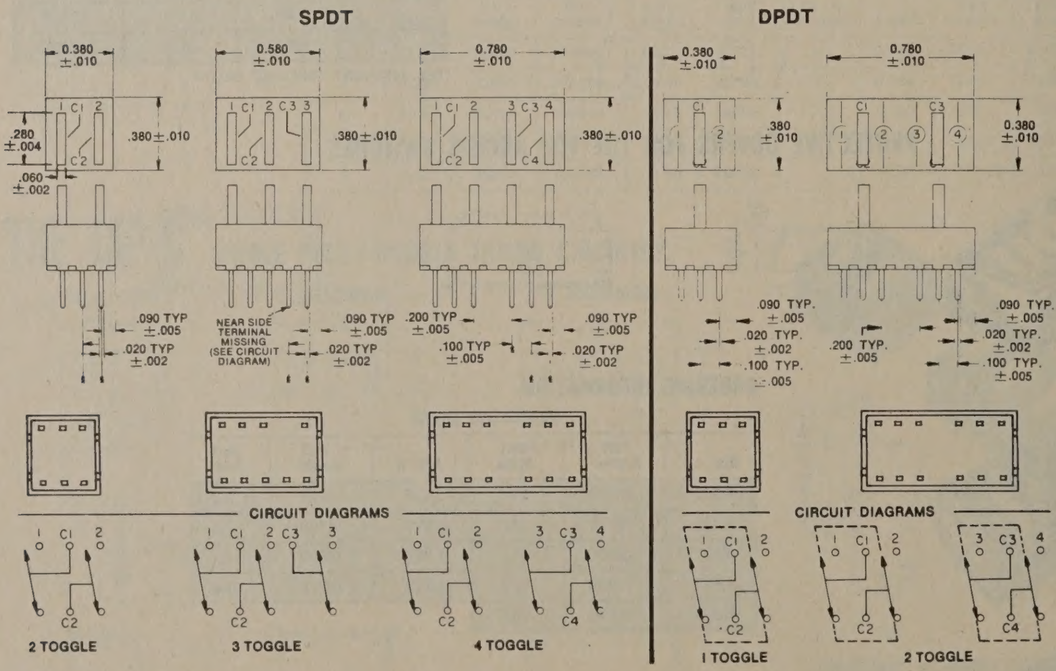
No. of Rockers	Length	Part Number	Unit Price	No. of	Length	Part Number	Unit Price
4	0.480	76PB04	4.65	8	0.880	76PB08	5.05
5	0.580	76PB05	4.75	9	0.980	76PB09	5.15
6	0.680	76PB06	4.85	10	1.080	76PB10	5.25
7	0.780	76PB07	4.95				

SEE DISCOUNT SCHEDULE BELOW

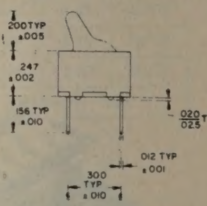


THE TOGGLE-DIP™ FRONT PANEL PROGRAMMING SWITCHES




SPDT
DPDT
0.380
±.010
0.580
±.010
0.780
±.010
.280
±.004
.380±.010
.060
±.002
1 C1 2
C2
2 C3 3
3 C3 4
C4
.090 TYP
±.005
.020 TYP
±.002
NEAR SIDE TERMINAL MISSING (SEE CIRCUIT DIAGRAM)
.200 TYP
±.005
.100 TYP
±.005
CIRCUIT DIAGRAMS
2 TOGGLE
3 TOGGLE
4 TOGGLE
1 TOGGLE
2 TOGGLE

END VIEW ALL VERSIONS


.200 TYP
±.005
.247
±.002
.156 TYP
±.010
.020
.025 TYP
.012 TYP
±.001
.300 TYP
±.010

ORDERING INFORMATION:

SPDT TOGGLE-DIP SWITCHES			DPDT TOGGLE-DIP SWITCHES		
No. of Rockers	Part Number	Unit Price	No. of Rockers	Part Number	Unit Price
2	76TC02	$3.40	1	76TD01	$3.50
3	76TC03	3.65	2	76TD02	4.00
4	76TC04	3.90			

DISCOUNT SCHEDULE	
1- 9 UNIT PRICE	100-499 LESS 30%
10-24 LESS 8%	500-999 LESS 35%
25-49 LESS 16%	1000 UP CONTACT GRAYHILL
50-99 LESS 21%	

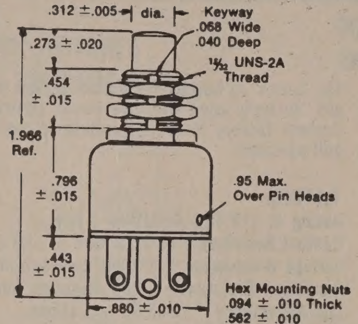
PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

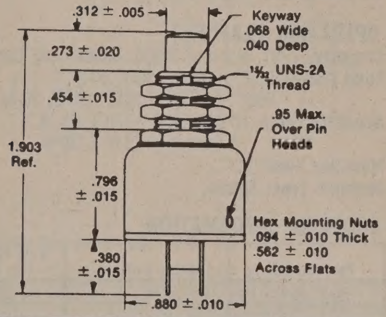
Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

SNAP ACTION AND WIPING CONTACT PUSHBUTTON SWITCHES — MOMENTARY CONTACT

Grayhill®

10 AMP SNAP ACTION


.312 ±.005 dia.
Keyway .068 Wide .040 Deep
.273 ± .020
15/32 UNS-2A Thread
.454 ± .015
1.966 Ref.
.796 ± .015
.95 Max. Over Pin Heads
.443 ± .015
Hex Mounting Nuts .094 ± .010 Thick .562 ± .010 Across Flats
.880 ± .010


.312 ± .005
Keyway .068 Wide .040 Deep
.273 ± .020
15/32 UNS-2A Thread
.454 ±.015
.95 Max. Over Pin Heads
1.903 Ref.
.796 ± .015
Hex Mounting Nuts .094 ± .010 Thick .562 ± .010 Across Flats
.380 ± .015
.880 ± .010

RATING:

Rating at 115 VAC Resistive: 10 Amps.
Contact Resistance: Less than 25 milliohms on new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulation Resistance: 1,000 megohms minimum.
Life Expectancy: 25,000 operations.

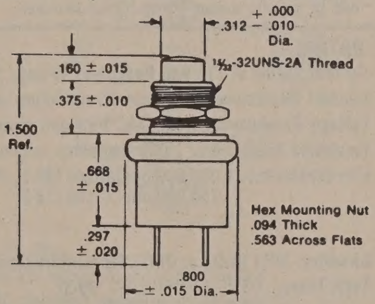
OPERATING FEATURES:

Circuitry: SPST and SPDT, momentary contact. Audible "Click" is produced by the snap action mechanism featuring extremely fast make and break, minimum contact "bounce."
Total Button Travel: .065" approximately.
Overtravel: .008" approximately.
Actuating Force: 36 ounces approximately.
Mounting Hole: 31/64"
Terminal Type: Solder. Also available with FASTON Terminals.

ORDERING INFORMATION:

Part Number	Button Color	Terminal Type	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
2201 (N.O.)	Red	Solder	$4.00 Ea.	$2.80 Ea.
7-7 (N.O.)	Black	Solder	4.00 Ea.	2.80 Ea.
2202 (N.C.)	Black	Solder	4.00 Ea.	2.80 Ea.
7-8 (N.C.)	Red	Solder	4.00 Ea.	2.80 Ea.
7-26R (SPDT)	Red	Solder	5.30 Ea.	3.71 Ea.
7-26B (SPDT)	Black	Solder	5.30 Ea.	3.71 Ea.

1 AMP WIPING CONTACT — UL LISTED AT 3 AMPS


.312 + .000 − .010 Dia.
.160 ± .015
15/32-32UNS-2A Thread
.375 ± .010
1.500 Ref.
.668 ± .015
Hex Mounting Nut .094 Thick .563 Across Flats
.297 ± .020
.800 ± .015 Dia.

The Series 4000 wiping contact push button switches are available in standard and positive feel contact action versions. Contact factory for positive feel versions.

RATING:

Rating at 115 VAC Resistive: 1 Amp.
Contact Resistance: Less than 25 milliohms on new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulation Resistance: 1,000 megohms minimum.
Life Expectancy: 100,000 operations.
UL Rating at 3 Amp: 6,000 operations.

OPERATING FEATURES:

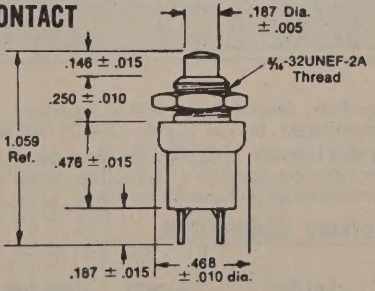
Circuitry: SPST (N.O.) or (N.C.) momentary contact.
Total Button Travel: .140" ±.032 (4001, 10-9).
.110" +.020 −.010 (4002, 10-10).
Overtravel: .020" minimum (4001 10-9).
Pretravel: .010" minimum (4002 10-10).
Actuating Force: 22 ounces ±8 (4001, 4002, 10-9, 10-10).
Mounting Hole: 31/64".
Terminal Type: Solder.

ORDERING INFORMATION:

Part Number	Button Color	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
4001* (N.O.)	Red	$1.50 Ea.	$1.05 Ea.
10-9* (N.O.)	Black	1.50 Ea.	1.05 Ea.
4002* (N.C.)	Black	1.50 Ea.	1.05 Ea.
10-10* (N.C.)	Red	1.50 Ea.	1.05 Ea.

* Add UL to part number for UL listed switches.

¼ AMP WIPING CONTACT


.187 Dia. ± .005
.146 ± .015
1/4-32UNEF-2A Thread
.250 ± .010
1.059 Ref.
.476 ± .015
.187 ± .015
.468 ± .010 dia.

RATING:

Rating at 115 VAC Resistive: ¼ Amp.
Contact Resistance: Less than 25 milliohms on new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulated Resistance: 1,000 megohms minimum.
Life Expectancy: 100,000 operations.

OPERATING FEATURES:

Circuitry: SPST (N.O.) momentary contact switch.
Total Button Travel: .095" ±.010.
Overtravel: .005 minimum.
Actuating Force: 16 ounces ±4.
Mounting Hole: 21/64".
Terminal Type: Solder.

ORDERING INFORMATION:

Part Number	Button Color	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
23-1 (N.O.)	Red Button	$1.70 Ea.	$1.19 Ea.
23-4 (N.O.)	Black Button	1.70 Ea.	1.19 Ea.

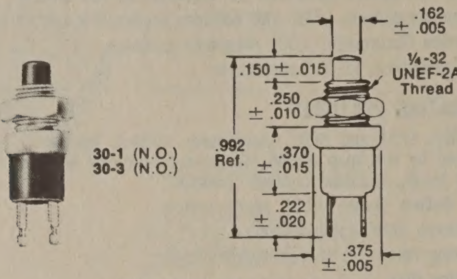
Available Locally Through Your Grayhill Distributor

Grayhill®

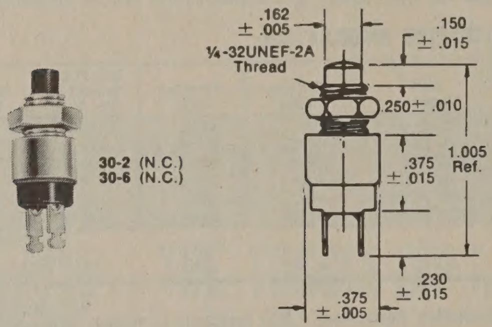
MINIATURE BUTT CONTACT PUSHBUTTON SWITCHES — MOMENTARY CONTACT

1 AMP BUTT CONTACT — UL LISTED AT 5 AMPS — SERIES 30

1 MILLION OPERATIONS — WIDE RANGE OF CIRCUITRY AND OPTIONS


30-1 (N.O.)
30-3 (N.O.)
.162 ± .005
¼-32 UNEF-2A Thread
.150 ± .015
.250 ± .010
.992 Ref.
.370 ± .015
.222 ± .020
.375 ± .005

HEX MOUNTING NUT, .109 Thick, .375 Across Flats


30-2 (N.C.)
30-6 (N.C.)
.162 ± .005
¼-32UNEF-2A Thread
.150 ± .015
.250 ± .010
.375 ± .015
1.005 Ref.
.230 ± .015
.375 ± .005

The Series 30 butt contact push button switches are available in standard, normally open with overtravel, positive feel and push-pull versions. Contact factory for part numbers of overtravel, positive feel and push-pull versions.

RATING:

Rating at 115 VAC Resistive: 1 Amp.
Contact Resistance: 25 milliohms or less on a new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulation Resistance: 1,000 megohms minimum.
Life Expectancy: 1,000,000 operations.
UL Rating at 5 Amps: 6,000

OPERATING FEATURES:

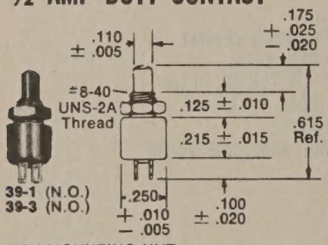
Circuitry: SPST (N.O.) or (N.C.), Momentary Contact.
Total Travel: .062″ ±.010″ (30-1, 30-3).
.065″ +.010″ −.015″ (30-2, 30-6).
Actuating Force: 10 ounces ±4 (30-1, 30-3).
8 ounces ±4 (30-2, 30-6).
Mounting Hole: 17/64″.
Terminal Type: Solder.

ORDERING INFORMATION:

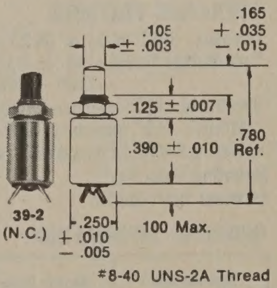
Part Number	Button Color	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
30-1* (N.O.)	Red	$1.15 Ea.	$0.81 Ea.
30-2* (N.C.)	Black	1.15 Ea.	0.81 Ea.
30-3* (N.O.)	Black	1.15 Ea.	0.81 Ea.
30-6* (N.C.)	Red	1.15 Ea.	0.81 Ea.

* Add UL to part number for UL listed switches.

½ AMP BUTT CONTACT


.110 ± .005
.175 + .025 − .020
#8-40 UNS-2A Thread
.125 ± .010
.215 ± .015
.615 Ref.
39-1 (N.O.)
39-3 (N.O.)
.250 + .010 − .005
.100 ± .020

HEX MOUNTING NUT
.063 Thick .219 Across Flats


.105 ± .003
.165 + .035 − .015
.125 ± .007
.390 ± .010
.780 Ref.
39-2 (N.C.)
.250 + .010 − .005
.100 Max.
#8-40 UNS-2A Thread

GOLD PLATED CONTACT SYSTEM
MOLDED-IN TERMINALS (N.O. VERSIONS) PREVENTS FLUX CONTAMINATION

The Series 39 butt contact pushbutton switches are available in standard, normally open with overtravel. Contact factory for part numbers of overtravel versions.

RATING:

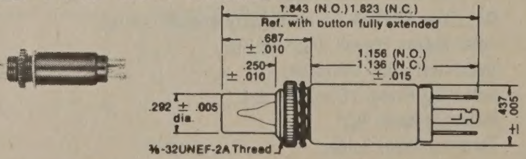
Current Rating at 115 VAC Resistive: ½ Amp. (39-1, 39-3) ¼ Amp. (39-2).
Contact Resistance: Less than 25 milliohms on a new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulation Resistance: 1,000 megohms minimum.
Life Expectancy: 1,000,000 operations (39-1, 39-3).
250,000 operations (39-2).

Circuitry: SPST (N.O.) or (N.C.), Momentary Contact.
Total Travel: .035″ ±.015″ (39-1, 39-3).
.042″ ±.010″ (39-2).
Actuating Force: 4 ounces +4, −2 (39-1, 39-3).
4 ounces ±2 (39-2).
Mounting Hole: 11/64″.
Terminal Type: Solder.

ORDERING INFORMATION:

Part Number	Button Color	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
39-1 (N.O.)	Red	$1.55 Ea.	$1.09 Ea.
39-3 (N.O.)	Black	1.55 Ea.	1.09 Ea.
39-2 (N.C.)	Black	2.10 Ea.	1.47 Ea.

ILLUMINATED 1 AMP BUTT CONTACT


1.843 (N.O.) 1.823 (N.C.)
Ref. with button fully extended
.687 ± .010
.250 ± .010
1.156 (N.O.)
1.136 (N.C.)
± .015
.292 ± .005 dia.
.437 ± .005
⅜-32UNEF-2A Thread

RATING:

Rating at 115 VAC Resistive: 1 Amp.
Contact Resistance: 25 milliohms or less on a new switch.
Voltage Breakdown: 1,000 VAC between mutually insulated parts.
Insulated Resistance: 1,000 megohms minimum.
Life Expectancy: 500,000 operations.

OPERATING FEATURES:

Circuitry: SPST (NO) or (NC) momentary contact.
Independent Lamp and Switch Circuits.

Lamp: Neon, General Electric A9A or equivalent.
Incandescent, General Electric 1764 (20 VDC Max.) or equivalent.
Extended Lamplife: Lamp does not move during actuation of the switch. Incandescent operation at the voltage stated above provides lamp life commensurate with the switch life.

ORDERING INFORMATION:

Part No.	Circuitry	Lamp Type	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
40-1 (Specify Color*)	SPST-NO	Neon	$3.30 Ea.	$2.31 Ea.
40-2 (Specify Color*)	SPST-NC	Neon	3.60 Ea.	2.52 Ea.
40-100 (Specify Color†)	SPST-NO	Incandescent	3.65 Ea.	2.56 Ea.
40-102 (Specify Color†)	SPST-NC	Incandescent	3.90 Ea.	2.73 Ea.

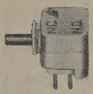
* Clear, Transparent Amber, Transparent Red, and Frosted White.
† Clear, Transparent Amber, Transparent Red, Frosted White, Frosted Red, Frosted Green, and Frosted Yellow.

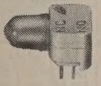
Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

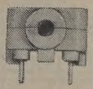
MULTI-CIRCUIT-BUTT AND WIPING CONTACT PUSHBUTTON SWITCHES

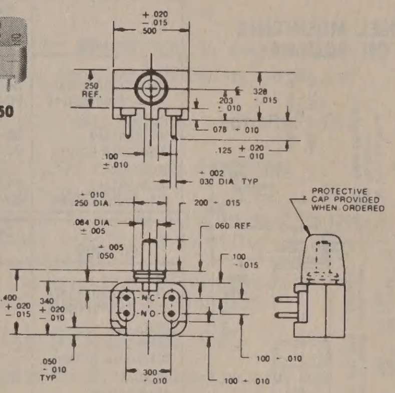
Grayhill®

PC BOARD PUSHBUTTON SWITCHES
FREE OF SOLDER FLUX CONTAMINATION

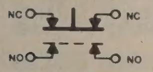

39-251


39-250




+ .020
− .015
.500
.250
REF.
.328
± .015
.203
± .010
.078 ± .010
.125 + .020
− .010
.100
± .010
+ .002
.030 DIA TYP
+ .010
.250 DIA
.200 ± .015
.084 DIA
± .005
.060 REF
+ .005
.050
.100
± .015
.400
+ .020
− .015
.340
+ .020
− .010
N C
N O
.050
± .010
TYP
.300
± .010
.100 ± .010
.100 ± .010
PROTECTIVE
CAP PROVIDED
WHEN ORDERED

CIRCUIT DIAGRAM



Single Pole, Double Throw (2 Circuit)

MOMENTARY CONTACT

RATING:

Rating at 28 VDC or 115 VAC, Resistive Load: 250 MA.

CONTACT RESISTANCE: 25 milliohms or less on a new switch.

VOLTAGE BREAKDOWN: 1,000 VAC between mutually insulated parts.

INSULATION RESISTANCE: 1,000 megohms minimum.

Life Expectancy: 500,000 operations.

Contact Bounce: 5 milliseconds or less for the life of the switch.

MATERIALS AND FINISHES:

Switch Base and Cover: Polyester, red in color.

Button: Nylon.

Terminals: Brass, Gold plated.

Shorting Bar: Phosphor Bronze, Gold plated.

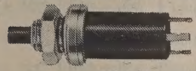
Spring: Tinned Music Wire.

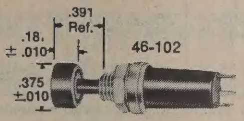
Protective Cap: Vinyl, red in color.

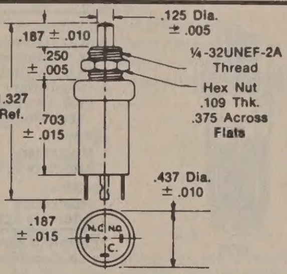
ORDERING INFORMATION:

Part No.	Switch Button Color	Unit Price	50-99 Pcs.	100-499 Pcs.
SWITCH WITH PROTECTIVE CAP ASSEMBLED				
39-250 RED	Red	$1.60	$1.36	$1.12
39-250 BLK	Black	1.60	1.36	1.12
SWITCH WITHOUT PROTECTIVE CAP				
39-251 RED	Red	$1.40	$1.19	$0.98
39-251 BLK	Black	1.40	1.19	0.98
PROTECTIVE CAP ONLY				
SHH1065	—	$0.10	$0.09	$0.07

½ AMP WIPING CONTACT


46-101


.391
Ref.
.18.
± .010
.375
±.010
46-102


.125 Dia.
± .005
.187 ± .010
.250
± .005
¼-32UNEF-2A
Thread
Hex Nut
.109 Thk.
.375 Across
Flats
1.327
Ref.
.703
± .015
.437 Dia.
± .010
.187
± .015
N.C
N.O
C.

RATING:

Rating at 115 VAC Resistive: ¼ Amp.

Contact Resistance: Less than 25 milliohms on a new switch.

Voltage Breakdown: 1,000 VAC between mutually insulated parts.

Insulation Resistance: 1,000 megohms minimum.

Life Expectancy: 250,000 operations.

OPERATING FEATURES:

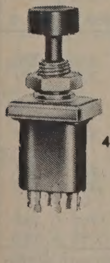
Circuitry: SPDT (break before make), momentary contact.

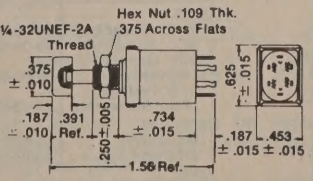
Button Travel: Total Travel .180″ minimum.
Break before Make: Rest Position to N.C. Break .020″ min.
Rest Position to N.O. Make .140″ max.

Actuating Force: Momentary Contact 17 ounces ±5.

Mounting Hole: $^{17}/_{64}$″.

Terminal Type: Solder.


46-200


Hex Nut .109 Thk.
.375 Across Flats
¼-32UNEF-2A
Thread
.375
± .010
.187
± .010
.391
Ref.
.250 ± .005
.734
± .015
.625
± .015
.187
± .015
.453
± .015
1.56 Ref.

Series 46-150 is SPDT momentary, bushing and panel sealed with ratings and operating features the same as Series 46-102 except life expectancy is 100,000 operations. Series 46-270 is DPDT momentary, bushing and panel sealed with rating and operating features the same as Series 46-200 except life expectancy is 100,000 operations.

ORDERING INFORMATION:

Part Number	Button Color	Unit Price Subject to Qty. Disc.	Net Price For 100 Pieces
MOMENTARY BREAK BEFORE MAKE*			
46-101R	Red Button	$1.75 Ea.	$1.23 Ea.
46-101B	Black Button	1.75 Ea.	1.23 Ea.
46-102R	Red Button Cap	1.85 Ea.	1.30 Ea.
46-102B	Black Button Cap	1.85 Ea.	1.30 Ea.
46-150R	Red Button Cap	4.10 Ea.	2.87 Ea.
46-150B	Black Button Cap	4.10 Ea.	2.87 Ea.
46-200R	Red Button Cap	3.70 Ea.	2.59 Ea.
46-200B	Black Button Cap	3.70 Ea.	2.59 Ea.
46-270R	Red Button Cap	5.15 Ea.	3.61 Ea.
46-270B	Black Button Cap	5.15 Ea.	3.61 Ea.

*Available in Momentary Make Before Break versions. Contact factory.

DISCOUNTS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Available Locally Through Your Grayhill Distributor

Grayhill®

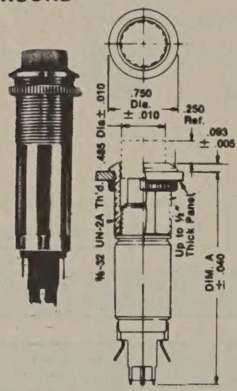
THE DECORATOR LINE OF PUSHBUTTON SWITCHES

A COORDINATED LINE OF LIGHTED AND UNLIGHTED PUSHBUTTON SWITCHES WIDE CHOICE OF CIRCUITRY AND MOUNTING, WIPING AND BUTT CONTACTS

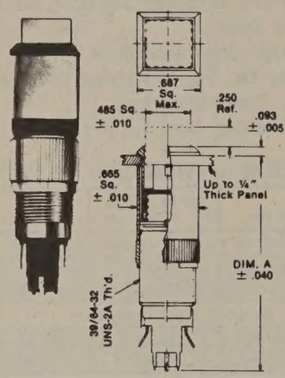
LIGHTED DECORATOR LINE — ¼ AMP RATINGS

FRONT PANEL BEZEL MOUNTING

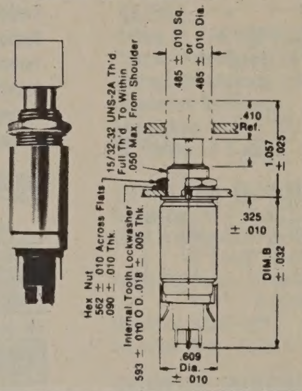
ROUND


.750 Dia. ± .010
.250 Ref.
.093 ± .005
.485 Dia.± .010
⅜-32 UN-2A Th'd.
Up to ¼" Thick Panel
DIM. A ± .040

SQUARE


.687 Sq. Max.
485 Sq. ± .010
.250 Ref.
.093 ± .005
.665 Sq. ± .010
Up to ¼" Thick Panel
DIM. A ± .040
39/64-32 UNS-2A Th'd.

SUB-PANEL MOUNTING ROUND OR SQUARE


485 ± .010 Sq. or 485 ± .010 Dia.
15/32-32 UNS-2A Th'd Full Th'd To Within .050 Max From Shoulder
.410 Ref.
1.057 ± .025
Hex Nut 562 ± .010 Across Flats .090 ± .010 Thk.
Internal Tooth Lockwasher 593 ± .010 O D .018 ± .005 Thk.
.325 ± .010
DIM. B ± .032
.609 Dia. ± .010

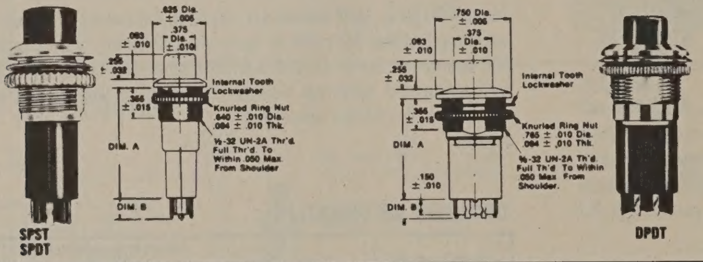
Circuitry	Switch Part No.* Frt. Panel Round	Switch Part No.* Frt. Panel Square	Dim. A
SPST —			
(N.O.) Momentary	80-02-01	80-01-01	1.883
(N.C.) Momentary	80-02-02	80-01-02	1.883
SPDT —			
Momentary	80-02-05	80-01-05	1.883
Alternate Action	80-02-07	80-01-07	2.240
DPDT —			
Momentary	80-02-08	80-01-08	1.883
Alternate Action	80-02-09	80-01-09	2.240

Circuitry	Switch Part No.* Sub Panel	Dim. A	Dim. B
SPST —			
(N.O.) Momentary	80-03-01	1.883	1.159
(N.C.) Momentary	80-03-02	1.883	1.159
SPDT —			
Momentary	80-03-05	1.883	1.159
Alternate Action	80-03-07	2.240	1.516
DPDT —			
Momentary	80-03-08	1.883	1.159
Alternate Action	80-03-09	2.240	1.516

*Complete part number requires button cap part number also. See following page.

UNLIGHTED DECORATOR LINE — ¼ AND 1 AMP RATINGS

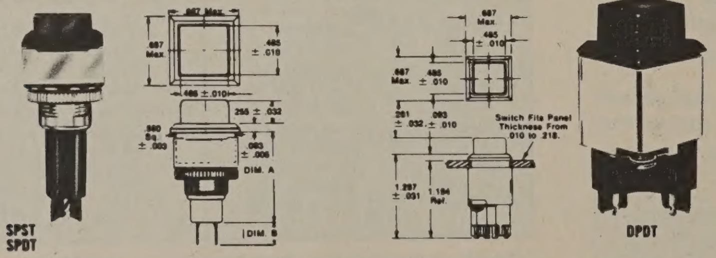
FRONT PANEL BEZEL MOUNTING — ROUND BUTTONS


.625 Dia. ± .005
.375 Dia. ± .010
.093 ± .010
.255 ± .032
.365 ± .015
Internal Tooth Lockwasher
Knurled Ring Nut .640 ± .010 Dia. .094 ± .010 Thk.
½-32 UN-2A Thr'd. Full Thr'd. To Within .050 Max. From Shoulder
DIM. A
DIM. B
SPST
SPDT
.750 Dia. ± .005
.375 Dia. ± .010
.093 ± .010
.255 ± .032
.365 ± .015
Internal Tooth Lockwasher
Knurled Ring Nut .765 ± .010 Dia. .094 ± .010 Thk.
⅝-32 UN-2A Th'd. Full Th'd To Within .050 Max From Shoulder.
.150 ± .010
DIM. A
DIM. B
DPDT

	Switch Part No.*	Dim. A	Dim. B
SPST —			
(N.O.) Momentary	30-05-01	.710 ±.015	.220 ±.025
(N.C.) Momentary	30-05-02	.690 ±.015	.220 ±.025
(N.O. Overtravel) Momentary	30-05-03	.780 ±.015	.220 ±.025
(N.O. Positive Feel) Momentary	30-05-04	.910 ±.020	.220 ±.025
SPDT —			
Momentary	46-05-05	.992 ±.015	.187 ±.015
Alternate Action	46-05-07	1.278 ±.015	.187 ±.015
DPDT —			
Momentary	46-05-08	1.001 ±.015	.187 ±.015
Alternate Action	46-05-09	1.130 ±.015	.187 ±.015

*Complete part number requires button cap part number also. See following page.

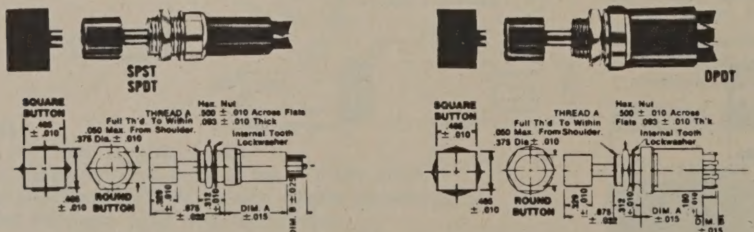
FRONT PANEL BEZEL MOUNTING — SQUARE BUTTONS


.687 Max.
.687 Max.
.485 ± .010
.485 ± .010
.255 ± .032
.880 Sq. ± .003
.093 ± .005
DIM. A
DIM. B
SPST
SPDT
.687 Max.
.485 ± .010
.687 Max.
.485 ± .010
.281 ± .032
.093 ± .010
Switch Fits Panel Thickness From .010 to .218.
1.297 ± .031
1.194 Ref.
DPDT

	Switch Part No.*	Dim. A	Dim. B
SPST —			
(N.O.) Momentary	30-01-01	.880 ±.020	.220 ±.025
(N.C.) Momentary	30-01-02	.830 ±.020	.220 ±.025
(N.O. Overtravel) Momentary	30-01-03	.920 ±.020	.220 ±.025
(N.O. Positive Feel) Momentary	30-01-04	1.037 ±.020	.220 ±.025
SPDT —			
Momentary	46-01-05	1.174 ±.015	.187 ±.015
Alternate Action	46-01-07	1.264 ±.015	.187 ±.015
DPDT —			
Momentary	46-01-08	As Shown	
Alternate Action	46-01-09		

*Complete part number requires button cap part number also. See following page.

SUB-PANEL MOUNT — ROUND OR SQUARE BUTTONS


SPST
SPDT
SQUARE BUTTON
.485 ± .010
THREAD A Full Th'd To Within .050 Max. From Shoulder.
.375 Dia. ± .010
Hex. Nut .500 ± .010 Across Flats .093 ± .010 Thick
Internal Tooth Lockwasher
.485 ± .010
ROUND BUTTON
.875 ± .032
DIM. A ± .015
DIM. B ± .025
DPDT
SQUARE BUTTON
.485 ± .010
THREAD A Full Th'd To Within .050 Max. From Shoulder.
.375 Dia ± .010
Hex. Nut .500 ± .010 Across Flats .093 ± .010 Th'k
Internal Tooth Lockwasher
.485 ± .010
ROUND BUTTON
.875 ± .032
DIM. A ± .015
DIM. B ± .015

	Switch Part No.*	Thread A	Dim. A	Dim. B
SPST —				
(N.O.) Momentary	30-03-01	⅜-32	.359	.220
(N.C.) Momentary	30-03-02	⅜-32	.308	.220
(N.O. Overtravel) Momentary	30-03-03	⅜-32	.387	.220
(N.O. Positive Feel) Momentary	30-03-04	15/32-32	.377	.220
SPDT —				
Momentary	46-03-05	⅜-32	.703	.187
Alternate Action	46-03-07	⅜-32	.750	.187
DPDT —				
Momentary	46-03-08	⅜-32	.701	.187
Alternate Action	46-03-09	⅜-32	.750	.187

*Complete part number requires button cap part number also. See following page.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

THE DECORATOR LINE OF PUSHBUTTON SWITCHES

Grayhill®

LIGHTED DECORATOR LINE PUSHBUTTON SWITCHES ARE DESIGNATED AS THE GRAYHILL SERIES 80 SPST, SPDT, DPDT CIRCUITRY

CONTACTS: Wiping type.

CURRENT RATING AT 115 VAC RESISTIVE: ¼ amp.

CONTACT RESISTANCE: Less than 25 milliohms on a new switch.

VOLTAGE BREAKDOWN: 1,000 VAC between mutually insulated parts.

INSULATION RESISTANCE: 1,000 megohms minimum.

LIFE EXPECTANCY: 250,000 operations.

LAMPS: All button caps accept standard T-1¾ midget flange base lamps. Lamps are not supplied with button caps or assemblies of caps and switches.
It is recommended that the lamp used in these switches be rated at 0.34 CP to provide sufficient illumination.

PART NUMBERS FOR SWITCH WITH BUTTON CAP:

Identifies the GRAYHILL Lighted Decorator Line

Style —
- 01 = ½″ Square Bezel Front Panel Mount
- 02 = ½″ Round Bezel Front Panel Mount
- 03 = Sub-Panel Mount

Circuitry and Characteristics —
- 01 = SPST — N.O. Momentary
- 02 = SPST — N.C. Momentary
- 05 = SPDT (Break before Make) Momentary
- 07 = SPDT (Break before Make) Alternate Action
- 08 = DPDT (Break before Make) Momentary
- 09 = DPDT (Break before Make) Alternate Action

80 - 01 - 05 - 500 A 63 63

Type —
- 500 = ½″ Square Cap (must be used when Switch Style is 01)
- 501 = ½″ Round Cap (must be used when Switch Style is 02)

Keying —
A = Non-Keyed B = Keyed

Top Color —

Bottom Color —

Color Code
- 61 = White
- 62 = Amber
- 63 = Red
- 64 = Green
- 66 = Yellow

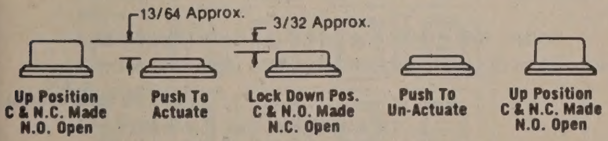
Note: Solid color buttons are ordered by the same number in both color positions.

PRICES:

Switch Part No.*	Unit Price w/Cap	Net Price 100 Pieces	Switch Part No.*	Unit Price w/Cap	Net Price 100 Pieces	Switch Part No.*	Unit Price w/Cap	Net Price 100 Pieces
80-01-01	$6.00	$4.20	80-02-01	$6.00	$4.20	80-03-01	$5.10	3.57
80-01-02	6.00	4.20	80-02-02	6.00	4.20	80-03-02	5.10	3.57
80-01-05	6.00	4.20	80-02-05	6.00	4.20	80-03-05	5.10	3.57
80-01-07	7.35	5.15	80-02-07	7.35	5.15	80-03-07	6.10	4.27
80-01-08	6.55	4.59	80-02-08	6.55	4.59	80-03-08	5.95	3.96
80-01-09	7.90	5.53	80-02-09	7.90	5.53	80-03-09	6.65	4.66

*Part Number shown is for basic switch. Price includes switch and cap. Complete Part Number must contain button cap information.

ALTERNATE ACTION OPERATING SEQUENCE FOR ALL APPLICABLE TYPES


13/64 Approx.
3/32 Approx.
Up Position C & N.C. Made N.O. Open
Push To Actuate
Lock Down Pos. C & N.O. Made N.C. Open
Push To Un-Actuate
Up Position C & N.C. Made N.O. Open

LEGENDS: All ½″ square button caps can be legended to order. Applicable to the Series 80 lighted switches and the Series 30 and 46 unlighted switches.
All ½″ round button caps can be legended to order. Applicable to the Series 80 lighted switches. Note: The ⅜″ round button caps used on the Series 30 and 46 unlighted switches are concave to provide for finger fit and cannot be legended.
Contact factory for legend styles and limitations.

UNLIGHTED DECORATOR LINE PUSHBUTTON SWITCHES ARE DESIGNATED AS THE GRAYHILL SERIES 30 OR 46. SERIES 30, SPST CIRCUITRY

CONTACTS: Butt type.

RATING AT 115 VAC RESISTIVE: 1 amp.

CONTACT RESISTANCE: 25 milliohms or less on a new switch.

VOLTAGE BREAKDOWN: 1,000 VAC between mutually insulated parts.

INSULATION RESISTANCE: 1,000 megohms minimum.

LIFE EXPECTANCY:

Circuitry	Operations
SPST (N.O.)	1,000,000
SPST (N.C.)	
SPST (N.O., with Overtravel)	500,000
SPST (N.O., Positive Feel)	200,000

SERIES 46 — SPDT OR DPDT CIRCUITRY

CONTACTS: Wiping type.

CURRENT RATING AT 115 VAC RESISTIVE: ¼ Amp.

CONTACT RESISTANCE: Less than 25 milliohms on a new switch.

VOLTAGE BREAKDOWN: 1,000 VAC between mutually insulated parts.

INSULATION RESISTANCE: 1,000 megohms minimum.

LIFE EXPECTANCY: 250,000 operations.

SWITCH SELECTION:

Series 30 — 1 Amp Rating (Circuitry 01, 02, 03 & 04)
Series 46 — ¼ Amp Rating (Circuitry 05, 07, 08, & 09)

Style —
- 01 = ½″ Square Button, Front Panel Bezel Mounting
- 05 = ⅜″ Round Button, Front Panel Bezel Mounting
- 03 = Sub-Panel Mount

Circuitry — **SERIES 30**
- 01 = SPST — N.O. Momentary
- 02 = SPST — N.C. Momentary
- 03 = SPST — N.O., Overtravel, Momentary
- 04 = SPST — N.O., Positive Feel, Momentary

Circuitry — **SERIES 46**
- 05 = SPDT (Break before Make) Momentary
- 07 = SPDT (Break before Make) Alternate Action
- 08 = DPDT (Break before Make) Momentary
- 09 = DPDT (Break before Make) Alternate Action

30 - 01 - 01 - 500 - 01 01

BUTTON CAP SELECTION:

Top Color —

Color Code
- 01 = White
- 03 = Red
- 04 = Green
- 05 = Blue
- 06 = Yellow
- 07 = Black

Bottom Color —
Note: Solid color buttons are ordered by the same number in both color positions.

- 500 = ½″ Square Cap (Must Be Used With -01 Switch Style)
- 502 = ⅜″ Round Cap (Must Be Used With -05 Switch Style)

PRICES:

Switch Part No.*	Unit Price Subject to Qty. Disc.	Net Price 100 Pieces	Switch Part No.*	Unit Price Subject to Qty. Disc.	Net Price 100 Pieces
30-01-01	$2.70	$1.89	46-01-05	$2.80	$1.96
30-01-02	2.95	2.07	46-01-07	4.40	3.08
30-01-03	2.80	1.96	46-01-08	3.90	2.73
30-01-04	3.55	2.49	46-01-09	5.40	3.78
30-03-01	1.70	1.19	46-03-05	2.40	1.68
30-03-02	2.00	1.40	46-03-07	4.00	2.80
30-03-03	2.00	1.40	46-03-08	3.60	2.52
30-03-04	2.90	2.03	46-03-09	4.75	3.33
30-05-01	2.70	1.89	46-05-05	2.80	1.96
30-05-02	2.95	2.07	46-05-07	4.40	3.08
30-05-03	2.80	1.96	46-05-08	3.90	2.73
30-05-04	3.55	2.49	46-05-09	5.40	3.78

*Part Number shown is for basic switch. Price includes switch and cap. Complete Part Number must contain button cap information.

Available Locally Through Your Grayhill Distributor

Grayhill®

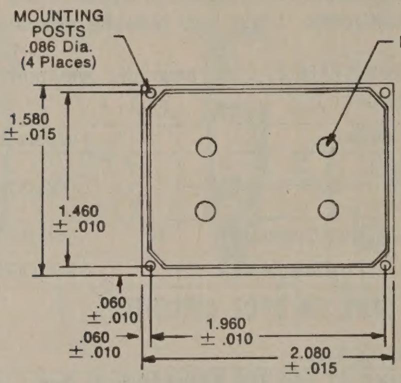
3 x 4 KEYBOARD PADS

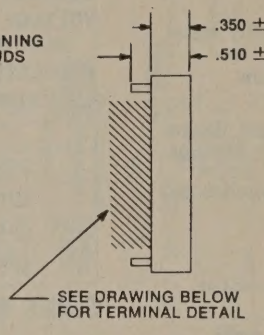
EXCELLENT TACTILE FEEL/RECESSED BUTTONS

ADAPTABLE TO "TOP-SIDE" OR SUB-PANEL MOUNTING

REPLACES EXISTING KEYBOARDS

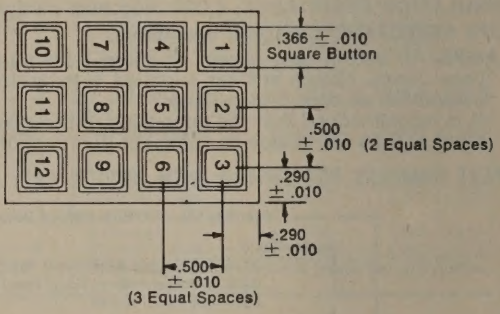
SERIES 83 ½" BUTTON CENTERS, POST MOUNTING


MOUNTING POSTS .086 Dia. (4 Places)
RETAINING STUDS
1.580 ± .015
1.460 ± .010
.060 ± .010
.060 ± .010
1.960 ± .010
2.080 ± .015


.350 ± .010
.510 ± .010
SEE DRAWING BELOW FOR TERMINAL DETAIL

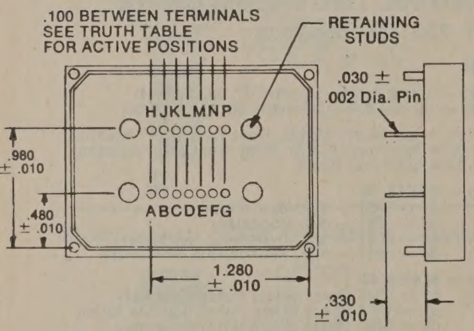
Patent No. 3,967,084

BUTTONS NUMBERED FOR IDENTIFICATION PURPOSES ONLY. SEE LEGEND OPTIONS


10
7
4
1
11
8
5
2
12
9
6
3
.366 ± .010 Square Button
.500 ± .010 (2 Equal Spaces)
.290 ± .010
.290 ± .010
.500 ± .010 (3 Equal Spaces)

TERMINAL LOCATIONS

ONLY THE TERMINALS INDICATED IN THE TRUTH TABLES ARE SUPPLIED WITH SWITCH
TERMINALS ARE LETTERED FOR IDENTIFICATION PURPOSES ONLY AND NOT LETTERED ON PRODUCT


.100 BETWEEN TERMINALS SEE TRUTH TABLE FOR ACTIVE POSITIONS
RETAINING STUDS
HJKLMNP
ABCDEFG
.980 ± .010
.480 ± .010
1.280 ± .010
.030 ± .002 Dia. Pin
.330 ± .010

CODES AND TRUTH TABLES

TERMINAL LOCATIONS

BUTTON LOCATION	M	H	E	A	B	F	G	L
1	●			●				●
2		●		●				●
3			●	●				●
4	●				●			●
5		●			●			●
6			●		●			●
7	●					●		●
8		●				●		●
9			●			●		●
10	●						●	●
11		●					●	●
12			●				●	●

2 OUT OF 7 CODE

TERMINAL LOCATIONS

BUTTON LOCATION	B	C	D	E	M	L	K
1	●						●
2	●		●				
3	●			●			
4		●					●
5		●	●				
6		●		●			
7						●	●
8			●			●	
9				●		●	
10					●		●
11			●		●		
12				●	●		

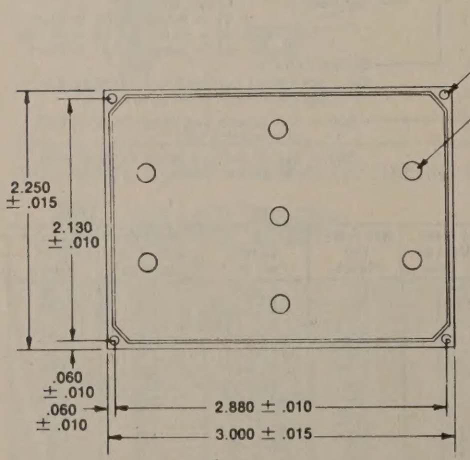
MATRIX

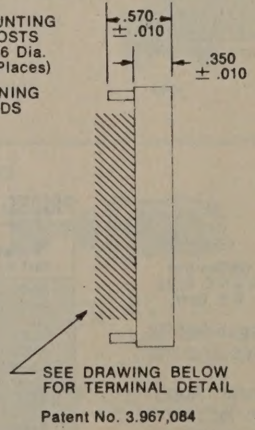
TERMINAL LOCATIONS

BUTTON LOCATION	K	H	A	J	C	B	N	E	F	M	P	G	D
1	●												●
2		●											●
3			●										●
4				●									●
5					●								●
6						●							●
7							●						●
8								●					●
9									●				●
10										●			●
11											●		●
12												●	●

SINGLE POLE/COMMON BUSS

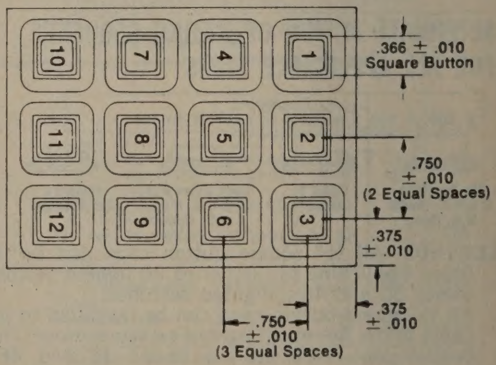
SERIES 84 ¾" BUTTON CENTERS, POST MOUNTING


MOUNTING POSTS .086 Dia. (4 Places)
RETAINING STUDS
2.250 ± .015
2.130 ± .010
.060 ± .010
.060 ± .010
2.880 ± .010
3.000 ± .015


.570 ± .010
.350 ± .010
SEE DRAWING BELOW FOR TERMINAL DETAIL

Patent No. 3.967,084

BUTTONS NUMBERED FOR IDENTIFICATION PURPOSES ONLY. SEE LEGEND OPTIONS


10
7
4
1
11
8
5
2
12
9
6
3
.366 ± .010 Square Button
.750 ± .010 (2 Equal Spaces)
.375 ± .010
.375 ± .010
.750 ± .010 (3 Equal Spaces)

On Series 84 contact GRAYHILL for terminal locations of ¾" button center for all circuitry codes.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

3 x 4 KEYBOARD PADS

Grayhill®

EXCELLENT TACTILE FEEL/RECESSED BUTTONS

1
2
3
4
5
6
7
8
9
*
0
#

SERIES 83 ½ INCH BUTTON CENTERS

RUGGED BUTTON CONSTRUCTION

TESTED FOR MILLIONS OF OPERATIONS

PROVIDES TACTILE AND AUDIO FEEDBACK

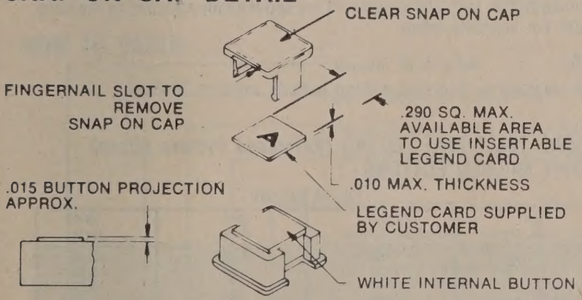
1
2
3
4
5
6
7
8
9
*
0
#

SERIES 84 ¾ INCH BUTTON CENTERS

LEGEND OPTIONS

- **SELF LEGEND**
- **NUMERIC TELEPHONE LEGEND**
- **STANDARD TELEPHONE LEGEND**

SNAP-ON CAP DETAIL


CLEAR SNAP ON CAP
FINGERNAIL SLOT TO REMOVE SNAP ON CAP
.290 SQ. MAX. AVAILABLE AREA TO USE INSERTABLE LEGEND CARD
A
.015 BUTTON PROJECTION APPROX.
.010 MAX. THICKNESS
LEGEND CARD SUPPLIED BY CUSTOMER
WHITE INTERNAL BUTTON

LEGEND OPTIONS

—101

—102

1	2	3
4	5	6
7	8	9
*	0	#

—103

1	ABC 2	DEF 3
GHI 4	JKL 5	MNO 6
PRS 7	TUV 8	WXY 9
*	OPER 0	#

SELF LEGEND SNAP-ON CAPS

TWO SHOT MOLDED BUTTONS BLACK LEGEND ON WHITE

STANDARD LEGEND OPTIONS. ANY LEGEND CAN BE HOT STAMPED OR TWO SHOT MOLDED. CONTACT GRAYHILL.

SPECIFICATIONS AND ORDERING INFORMATION

RATING:

Rating At 24 VDC: 10 milliamps, resistive.
Contact Resistance: Compatible with MOS, TTL and DTL.
Voltage Breakdown: 250 VAC between mutually insulated parts.
Life Expectancy: 3,000,000 operations per button.
Contact Bounce: 4 milliseconds at make, 10 milliseconds at break typical.

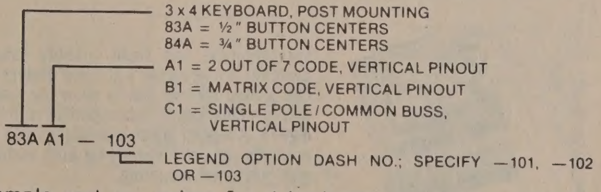
MATERIALS AND FINISHES:

Housing: ABS Plastic (Black).
Button: ABS Plastic (White with Molded-in Black Legend).
Terminals: Brass, Tin Plated.

OPERATING FEATURES:

Button Travel: 0.015″ nominal, total travel.
Pretravel: 0.012″ nominal.
Operating Force: 220 ± 40 grams initially.

ORDERING INFORMATION:



83A A1 — 103

3 x 4 KEYBOARD, POST MOUNTING
83A = ½″ BUTTON CENTERS
84A = ¾″ BUTTON CENTERS
A1 = 2 OUT OF 7 CODE, VERTICAL PINOUT
B1 = MATRIX CODE, VERTICAL PINOUT
C1 = SINGLE POLE/COMMON BUSS, VERTICAL PINOUT
LEGEND OPTION DASH NO.; SPECIFY —101, —102 OR —103

Sample part no. orders 3 x 4 keyboard, ½″ button centers, post mounting, 2 out of 7 code output, standard telephone legend in two-shot molded buttons, black lettering on white.

PRICE:

No. 11 Beginning	1-49	50-99	100-499	500 UP
83A	$10.00	$8.59	$7.07	CONTACT GRAYHILL
84A	11.00	9.35	7.70	

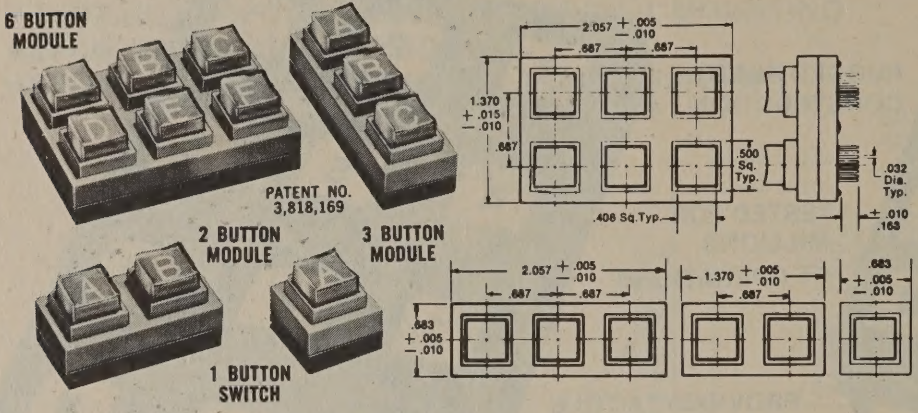
OPTIONS: —Button Colors
—Black Buttons with White Legends
—Different Legends
CONTACT GRAYHILL

Available Locally Through Your Grayhill Distributor

Grayhill®

PUSHBUTTON SWITCH MODULES PC MOUNTABLE—SERIES 82

SELF-GENERATED LOGIC, 1 TO 4 POLES PER BUTTON, WIDE CHOICE OF CIRCUITRY STACK IN ANY ARRAY, CHOICE OF COLORS, CHOICE OF LEGENDS



RATING:

Rating at 5 VDC: 100 milliamps. **Life Expectancy:** 1,500,000 operations.
Contact Resistance: 25 milliohms or less on a new switch.
Voltage Breakdown: 250 VAC between mutually insulated parts.
Insulation Resistance: 1,000 megohms minimum.

OPERATING FEATURES:

Button Travel: 0.130" total travel. **Overtravel:** 0.080".
Operating Force: 4-7 ounces (dependent on number of poles).

MOUNTING:

Modules are designed to plug into any printed circuit board from $\frac{1}{16}$" to $\frac{1}{8}$" thick. Modules can be stacked horizontally or vertically for any combination of button array and still maintain $\frac{11}{16}$" button centers.

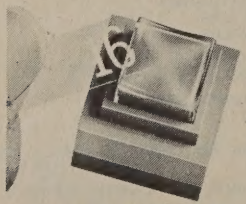
7-WIRE CODE CAPABILITY UNDER EACH BUTTON

The GRAYHILL Series 82 Pushbutton Modules represent the most versatile switches now available to generate coded outputs for control systems of all kind: The capabilities are practically endless since any code up to 7-wire can be accomplished right in the switches. CONTACT FACTORY.

LEGENDS:

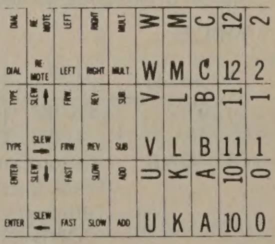
Hot stamped, two-shot molded, or field-legendable with easy slip-ins. Standard telephone legend configuration and many other typical legends readily available.

SERIES 82 PUSH BUTTON MODULES WITH INSERTABLE LEGENDS



For prototype and small quantity usage. Switches are available with clear protective cap slotted on one side to allow the insertion of a clear plastic tab imprinted with the legend. A legend sheet is available with all normally required legends for both vertical and horizontal mounting.

Legend sheet is sold separately, GRAYHILL Part No. 82-AC-2017. Contains white legends 0-19, A-Z, and all other normally used symbols and word groups. Simply cut out and insert in slotted button.



DIAL	RE-MOTE	LEFT	RIGHT	MULT	W	M	C	12	2
TYPE	SLEW →	FRW	REV	SUB	V	L	B	11	1
ENTER	SLEW ←	FAST	SLOW	ADD	U	K	A	10	0

ORDERING INFORMATION:

For hot stamped or two shot molded button.
To order a Series 82 pushbutton module, there are five areas in which information is required:

1. Type of Module: 1-, 2-, 3-, or 6-button.
2. Type of Mounting: Either horizontal or vertical.
3. Circuitry required for each button (A=SPST; B=2PST; C=3PST, etc.)
4. Color for each internal button (GRAY is standard; other available colors are WHITE, RED, GREEN, and BLACK. Colors can be intermixed. For example, Buttons A thru E are GRAY and F is WHITE.)
5. Legending required on buttons (Button A legend #1, Button B legend #2, etc.)

Upon receipt of your order, a part number will be assigned to facilitate future identification of this part. These numbers are sequentially assigned as the need arises and are non-descriptive.

PRICES:

With hot stamped or Two shot molded buttons, contact GRAYHILL.

STANDARD TELEPHONE LEGEND (Reference Picture Above) TWO SHOT MOLDED BUTTONS

TOP SIX BUTTONS

Part No.	Circuitry Each Button	Unit Price	50-99 Pieces
82-601-85	SPST	$6.00	$5.10
82-601-86	2PST	6.60	5.61
82-601-87	3PST	7.20	6.12
82-601-88	4PST	7.80	6.63

BOTTOM SIX BUTTONS

Part No.	Circuitry Each Button	Unit Price	50-99 Pieces
82-601-89	SPST	$6.00	$5.10
82-601-90	2PST	6.60	5.61
82-601-91	3PST	7.20	6.12
82-601-92	4PST	7.80	6.63

Also available in 2 out of 7 code output — Contact GRAYHILL.

For prototypes 4PST circuitry can be ordered and pins can be clipped to provide desired circuitry. Coded circuitry cannot be achieved in this manner. These modules are gray in color and are quickly available through your local GRAYHILL distributor.

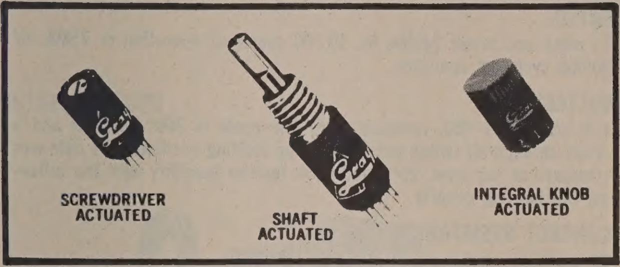
INSERTABLE LEGEND MODULES

Part No.	No. of Buttons	Circuitry	Unit Price	50-99 Pieces
82-101-71	1	SPST	$1.55	$1.32
82-101-74	1	4PST	1.85	1.57
82-201-41	2	SPST	2.60	2.21
82-201-44	2	4PST	3.20	2.72
82-301-61	3	SPST	3.65	3.10
82-301-64	3	4SPT	4.55	3.87
82-601-81	6	SPST	6.80	5.78
82-601-84	6	4PST	8.60	7.31
		ACCESSORY		
82AC2017	Legend Sheet for Above Modules		$1.00	$0.85

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

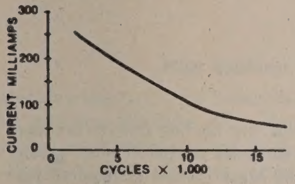
0.3" DIAMETER ROTARY SWITCHES 10 POSITIONS, 1 OR 2 POLES—SERIES 75

Grayhill®


SCREWDRIVER ACTUATED
SHAFT ACTUATED
INTEGRAL KNOB ACTUATED

RATING:

Life Expectancy:



CIRCUIT DIAGRAM

(Switch is viewed from shaft end and shown in position 1.)

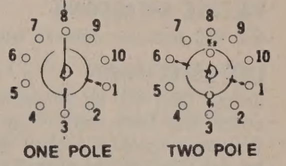

8
7
9
6
10
5
1
4
2
3
ONE POLE
TWO POLE

Chart shown for non-shorting contacts (break before make). Voltage: 115 VAC or 30 VDC, resistive load.

One cycle is 360° rotation and a return through all switch positions to the starting position. The data for the above curve was measured at sea level, 25°C. and 68% relative humidity with the following life limiting criteria.

Contact Resistance: 50 milliohms maximum. (15 milliohms initially).

Insulation Resistance: 10,000 megohms minimum between mutually insulated parts. (50,000 megohms initially.)

Voltage Breakdown: 500 VAC minimum between mutually insulated parts.

HOW TO ORDER:

75 AP 36 - 01 - 1 - 10 - N - C

General Description
No. of Decks (One Deck Only)
No. of Poles Per Deck (1 or 2 Poles)
No. of Positions (2 thru 10 - 1 Pole; 2 thru 2 - 2 Pole)
Type of Contacts (N = Non-Shorting Only)
Stop Arrangement, Single Pole/Deck Maximum Positions (C = Continuous; F = Stop Between 10 and 1)
Angle of Throw
Style
Series

PRICES:

Style	Unit Price	
	1 Pole/Deck	2 Pole/Deck
AF or CF	$7.40	$9.75
AP or CP	7.10	8.95
BF	8.75	11.10
BP	8.45	10.30

ALL PRICES SUBJECT TO QUANTITY DISCOUNT.

For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

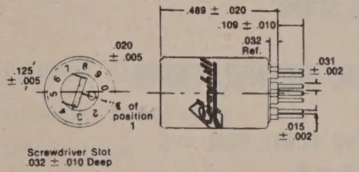
DESIGNED AS THE WORLD'S SMALLEST ROTARY SWITCH

RATED TO MAKE AND BREAK LOGIC LOADS FOR A MINIMUM OF 15,000 CYCLES OF OPERATION

NON-SHORTING WIPING CONTACTS

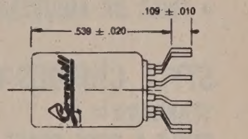
SCREWDRIVER ACTUATED

Style AP


.489 ± .020
.109 ± .010
.020 ± .005
.032 Ref.
.031 ± .002
.125 ± .005
℄ of position 1
.015 ± .002
Screwdriver Slot .032 ± .010 Deep

Style AF

All Dimensions Not Shown and Front View Same as Style AP

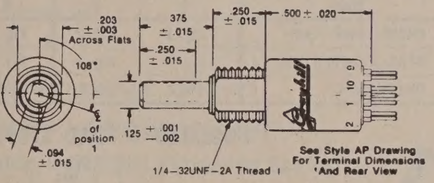

.109 ± .010
.539 ± .020

REAR VIEWS SHOWN BELOW

SHAFT OPERATED

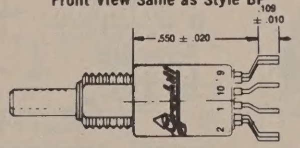
Style BP

See Style AP for Terminal Dimensions


.203 ± .003 Across Flats
375 ± .015
.250 ± .015
.500 ± .020
.250 ± .015
108°
℄ of position 1
.125 + .001 − .002
.094 ± .015
1/4−32UNF−2A Thread
See Style AP Drawing For Terminal Dimensions And Rear View

Style BF

All Dimensions Not Shown and Front View Same as Style BP

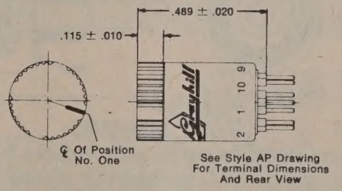

.109 ± .010
.550 ± .020

REAR VIEWS SHOWN BELOW

INTEGRAL KNOB ACTUATED

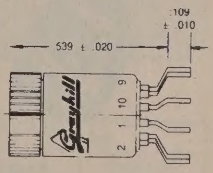
Style CP

See Style AP for Terminal Dimensions

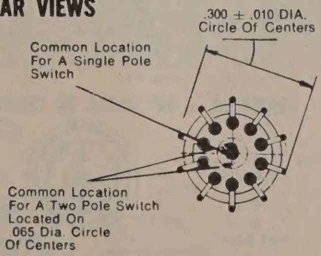

.489 ± .020
.115 ± .010
℄ Of Position No. One
See Style AP Drawing For Terminal Dimensions And Rear View

Style CF

All Dimensions Not Show and Front View Same as Style CP


.109 ± .010
539 ± .020

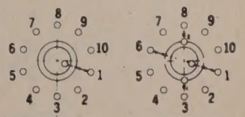
REAR VIEWS


.300 ± .010 DIA. Circle Of Centers
Common Location For A Single Pole Switch
Common Location For A Two Pole Switch Located On .065 Dia. Circle Of Centers

SERIES 75 PATENT NO. 3,803,370

CIRCUIT DIAGRAM

(Switch is viewed from shaft end and shown in position 1.)


8
7
9
6
10
5
1
4
2
3
ONE POLE
TWO POLE

Available Locally Through Your Grayhill Distributor

Grayhill®

1/2" DIAMETER, SINGLE DECK ROTARY SWITCHES—SERIES 50, 51

OUTSTANDING CIRCUIT VERSATILITY AND A WIDE RANGE OF OPTIONS

AVAILABLE IN STANDARD OR MILITARY STYLES
ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES
22½°, 30,°, 36°, 45°, 60° OR 90° ANGLES OF THROW

OTHER OPTIONS INCLUDE:

- 1 THRU 4 POLES
- SEALED OR UNSEALED
- SOLDER LUG OR PC TERMINALS
- FIXED OR ADJUSTABLE STOPS

STYLE CHOICES AND DESIGNATIONS

STANDARD = A
STYLE A WITH SHAFT AND PANEL SEAL = S
STYLE A, PC MOUNTABLE = P
STYLE A WITH SHAFT AND PANEL SEAL, PC MOUNTABLE = SP

Style	A	S	P	SP
FRONT (Shaft End)	Fig. 1	Fig. 2	Fig. 1	Fig. 2
REAR (Terminal End)	Fig. 3	Fig. 3	Fig. 4	Fig. 4
Dimension C	.617	.617	.667	.667

RATED:
To make and break 200MA for 10,000 cycles of operation or 75MA for 20,000 cycles of operation.

VOLTAGE:
115 VAC or 30 VDC, resistive load. One cycle is 360° rotation and a return through all switch positions to the starting position. This data was measured at sea level, 25°C and 68% relative humidity with the following life limiting criteria.

CONTACT RESISTANCE:
20 milliohms maximum (8 millioms initially).

INSULATION RESISTANCE:
10,000 megohms minimum between mutually insulated parts (50,000 megohms initially).

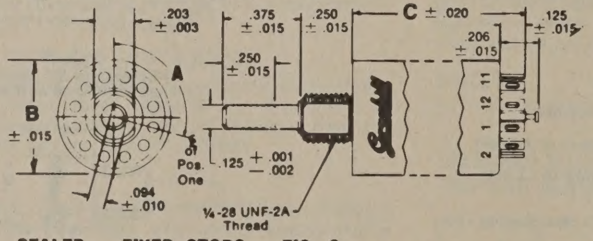
VOLTAGE BREAKDOWN:
600 VAC minimum between mutually insulated parts.

LIFE EXPECTANCY:
Contact GRAYHILL for information if the life limiting criteria are more critical than those listed, if the required cycles of operation are greater than those listed, if a larger make and break current is required than the one listed for the desired number of cycles, or if elevated temperatures or reduced pressures are part of the operating environment.

Series	51	50
Angle of Throw	30°	36°
Angle A	105°	108°
Dimension B	.562	.500

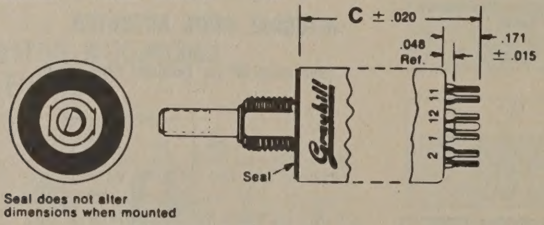
UNSEALED — FIXED STOPS FIG. 1

Grayhill
7
9


.203 ± .003
.375 ± .015
.250 ± .015
C ± .020
.125 ± .015
.206 ± .015
.250 ± .015
A
B ± .015
Pos. One
.125 + .001 − .002
.094 ± .010
¼-28 UNF-2A Thread
11
12
1
2
Grayhill

SEALED — FIXED STOPS — FIG. 2

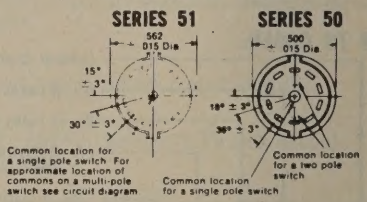
Grayhill
11 10 9


C ± .020
.048 Ref.
.171 ± .015
Seal
Grayhill
11
12
1
2

Seal does not alter dimensions when mounted

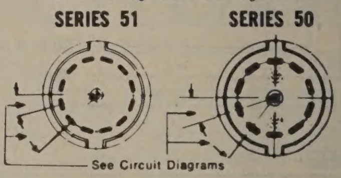
SOLDER LUG TERMINALS FIG. 3

Shown for 30 and 36 Angles of Throw
See Circuit Diagrams for other Angles of Throw


SERIES 51
SERIES 50
.562 ± .015 Dia
.500 ± .015 Dia
15° ± 3°
30° ± 3°
18° ± 3°
36° ± 3°
Common location for a single pole switch For approximate location of commons on a multi-pole switch see circuit diagram
Common location for a single pole switch
Common location for a two pole switch

TERMINALS FOR PC MOUNTING FIG. 4

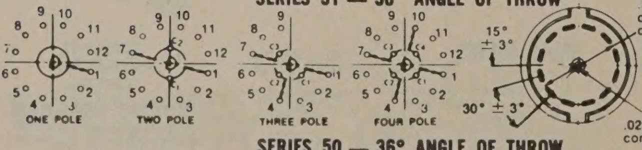
Shown for 30 and 36 Angles of Throw
See Circuit Diagrams for other Angles of Throw


SERIES 51
SERIES 50
See Circuit Diagrams

CIRCUIT DIAGRAMS

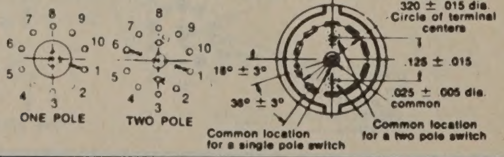
Switches are viewed from shaft end and shown in position 1

SERIES 51 — 30° ANGLE OF THROW

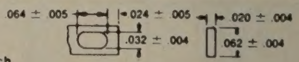

ONE POLE
TWO POLE
THREE POLE
FOUR POLE
1 2 3 4 5 6 7 8 9 10 11 12
15° ± 3°
30° ± 3°
.382 ± .015 dia circle of term. centers
.025 ± .005 dia common

Common location for a single pole switch. Two pole commons are located as shown in circuit diagram on a .156 ± .015 dia. Circle of centers, four pole commons are located as shown in circuit diagram on a .175 ± .015 dia circle of centers.

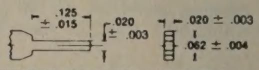
SERIES 50 — 36° ANGLE OF THROW


ONE POLE
TWO POLE
1 2 3 4 5 6 7 8 9 10
.320 ± .015 dia. Circle of terminal centers
.125 ± .015
.025 ± .005 dia. common
18° ± 3°
36° ± 3°
Common location for a single pole switch
Common location for a two pole switch

SOLDER LUG TERMINAL DETAIL


.064 ± .005
.024 ± .005
.020 ± .004
.032 ± .004
.062 ± .004

PC TERMINAL DETAIL


.125 ± .015
.020 ± .003
.020 ± .003
.062 ± .004

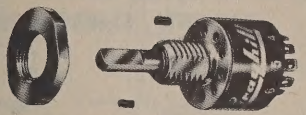
NOTE Series 50P and 51P may be printed circuit mounted on a .025 grid. Contact GRAYHILL for P.C board drilling information.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

1/2" DIAMETER, SINGLE DECK ROTARY SWITCHES — SERIES 50, 51

Grayhill®

ADJUSTABLE STOPS



Adjustable stop versions of the Series 50 and 51 Rotary Switches are readily available from local distributor stock. The adjustable stop versions are form, fit and function equivalents to their fixed stop counterparts. Adjustable stop Series 50 and 51 Rotary Switches can be provided in all angles of throw and with or without shaft and panel seal. Contact your local distributor or GRAYHILL for cross reference information between fixed and adjustable stop switches.

45°, 60° OR 90° ANGLES OF THROW

The Series 50 Rotary Switch is also available with 45° (8 position), 60° (6 position) or 90° (4 position) angles of throw. These angles of throw are available with 1 or 2 poles per deck, solder lug or PC mount terminals, with or without shaft and panel seal, fixed or adjustable stops and in standard or military types.

22½° ANGLE OF THROW

The Series 51 is now available in a 22½ angle of throw, 16 position switch. It is rated to make and break 100 MA for 10,000. The contact resistance is 50 milliohms (10 milliohms initially). Voltage breakdown is 400 VAC minimum between mutually insulated parts. It comes in solder lug and PC terminals and with 1 or 2 poles. Contact GRAYHILL for complete electrical, dimensional, part number and price information.

HOW TO ORDER:

GENERAL DESCRIPTION

No. of Decks (One Deck Only)

No. of Poles Per Deck (See Circuit Diagrams for Series 50 or 51)

No. of Positions (30° Angle of Throw-1 Pole, 2 thru 12; 2 Pole, 2 thru 6; 3 Pole or 4 Pole, 2 or 3)

Type of Contacts (N = Non-Shorting; S = Shorting)

50A36 — 01 — 2 — 04S — F

Add -F for Stop between First and Last Position of a 1 Pole/Deck Switch with Max. Positions. No Notation required for Continuous Rotation.

Angle of Throw (30° for Series 51; 36° for Series 50)

Style (See Line Drawings)

Series (50 or 51)

MILITARY STYLE ROTARY SWITCHES

The Series 50 and 51 Rotary Switches are also available with military type switch materials. Many types of the Series 50 are fully qualified to MIL-S-3786/20. Many types of the Series 51 are fully qualified to MIL-S-3786/35. These documents as well as the QPL (Qualified Products List) should be consulted for complete specification and ordering information. Contact GRAYHILL for additional assistance in specifying military styles Series 50 and 51 Rotary Switches.

ADDITIONAL STANDARD FEATURES OR OPTIONS

— Screwdriver Slotted Shafts

— Coded Versions

— Spring Return (Momentary Positions)

— Push-To-Turn or Pull-To-Turn†

— Keylock (Key Operated)†

— RFI Grounding†

— Electrostatic or Electromagnetic Shielding†

— Intermix of Shorting and Non-Shorting Contacts†

Complete description in GRAYHILL Engineering Catalog

† Indicates not available through distributors

PRICES:

UNIT PRICE
STYLES A AND P

	Non-Shorting		Shorting	
No. of Poles	Series 50	Series 51	Series 50	Series 51
1	$8.00	$8.65	$8.30	$8.95
2	11.15	11.80	11.85	12.45
3	—	13.70	—	14.80
4	—	15.80	—	17.20

STYLES S AND SP

	Non-Shorting		Shorting	
No. of Poles	Series 50	Series 51	Series 50	Series 51
1	$8.40	$9.00	$8.75	$9.35
2	11.50	12.20	12.25	12.90
3	—	14.15	—	15.20
4	—	16.20	—	17.60

Available Locally Through Your Grayhill Distributor

Grayhill®

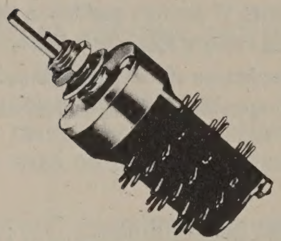
1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

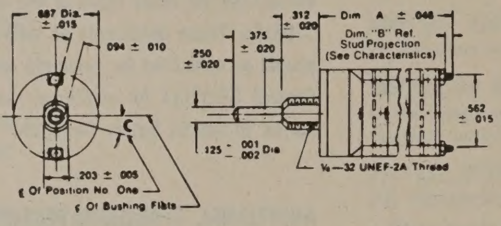
VALUE ENGINEERED TO COMPETE IN PRICE AND OUT PERFORM OPEN-WAFERS ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES

VERSATILITY — CHOICE OF

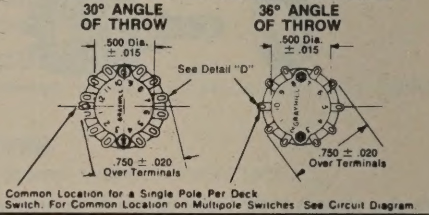
- 30° OR 36° ANGLE OF THROW
- 1 TO 6 POLES, PER DECK
- 1 THRU 12 DECKS
- .125" OR .250" DIA. SHAFT
- PC MOUNTABLE TERMINALS
- SINGLE OR CONCENTRIC SHAFTS

STANDARD .125" DIA. SHAFT — STYLE A



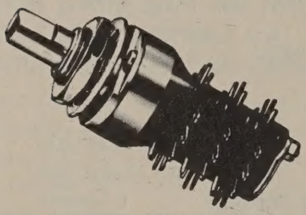

.687 Dia.
± .015
.094 ± .010
C
.203 ± .005
℄ Of Position No. One
℄ Of Bushing Flats
.312 ± .020
.375 ± .020
.250 ± .020
Dim. A ± .046
Dim. "B" Ref. Stud Projection (See Characteristics)
.562 ± .015
.125 + .001 − .002 Dia.
⅜—32 UNEF-2A Thread

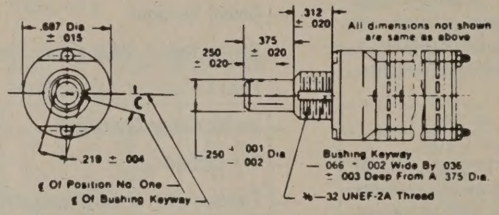
REAR VIEW / STANDARD SWITCHES


30° ANGLE OF THROW
36° ANGLE OF THROW
.500 Dia. ± .015
.500 Dia. ± .015
See Detail "D"
.750 ± .020 Over Terminals
.750 ± .020 Over Terminals
GRAYHILL

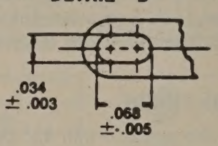
Common Location for a Single Pole Per Deck Switch. For Common Location on Multipole Switches See Circuit Diagram.

STANDARD .250" DIA. SHAFT — STYLE B



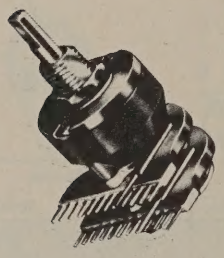

.687 Dia ± .015
C
.219 ± .004
℄ Of Position No. One
℄ Of Bushing Keyway
.312 ± .020
.375 ± .020
.250 ± .020
All dimensions not shown are same as above
.250 + .001 − .002 Dia.
Bushing Keyway — .066 + .002 Wide By .036 + .003 Deep From A .375 Dia.
⅜—32 UNEF-2A Thread

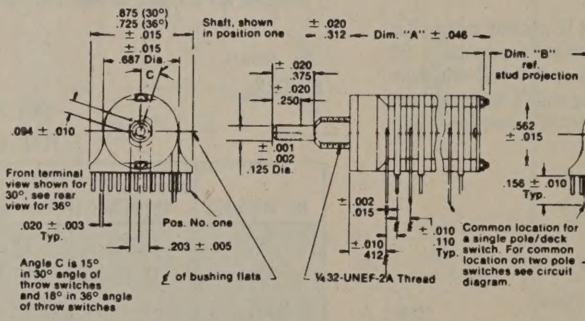
DETAIL "D"


.034 ± .003
.068 ±.005

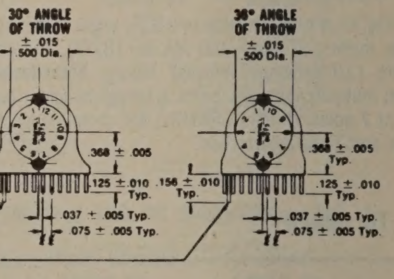
Style	Angle of Throw	Angle C
A	30°	15°
A	36°	36°
B	30°	15°
B	36°	36°

PC MOUNT .125" DIA. SHAFT — STYLE AF



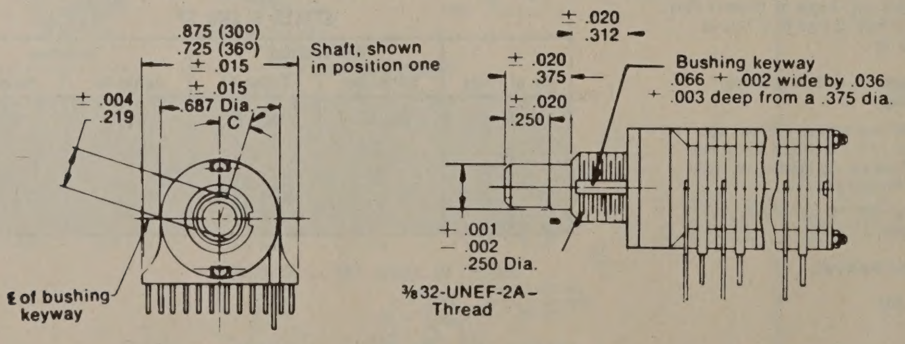

.875 (30°)
.725 (36°)
± .015
± .015
.687 Dia.
C
Shaft, shown in position one
.094 ± .010
Front terminal view shown for 30°, see rear view for 36°
.020 ± .003 Typ.
Pos. No. one
.203 ± .005
Angle C is 15° in 30° angle of throw switches and 18° in 36° angle of throw switches
℄ of bushing flats
± .020 .312
Dim. "A" ± .046
± .020 .375
± .020 .250
+ .001 − .002 .125 Dia.
± .002 .015
± .010 .412
± .010 .110 Typ.
⅜32-UNEF-2A Thread
Dim. "B" ref. stud projection
.562 ± .015

REAR VIEWS / PC MOUNT SWITCHES


30° ANGLE OF THROW
36° ANGLE OF THROW
± .015 .500 Dia.
± .015 .500 Dia.
.368 ± .005
.156 ± .010 Typ.
.125 ± .010 Typ.
.037 ± .005 Typ.
.075 ± .005 Typ.
.368 ± .005 Typ.
.156 ± .010 Typ.
.125 ± .010 Typ.
.037 ± .005 Typ.
.075 ± .005 Typ.

Common location for a single pole/deck switch. For common location on two pole switches see circuit diagram.

PC MOUNT .250" DIA. SHAFT — STYLE BF


.875 (30°)
.725 (36°)
± .015
± .015
.687 Dia.
C
Shaft, shown in position one
± .004 .219
℄ of bushing keyway
± .020 .312
± .020 .375
± .020 .250
Bushing keyway .066 + .002 wide by .036 + .003 deep from a .375 dia.
+ .001 − .002 .250 Dia.
⅜32-UNEF-2A-Thread

No. of Decks	Dim. "A"	Dim. "B"	Approx. Weight Grams
1	.761	.031	14
2	.979	.031	16
3	1.197	.031	18
4	1.415	.031	20
5	1.633	.031	22
6	2.131	.281	24
7	2.349	.281	26
8	2.567	.281	28
9	2.785	.281	30
10	3.003	.281	32
11	3.221	.281	34
12	3.439	.281	36

(All Dim. And Views Not Shown, Same As Above)

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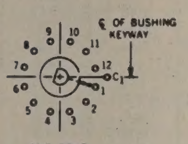
1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

Grayhill®

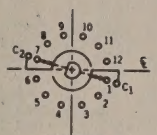
CIRCUIT DIAGRAMS

STANDARD

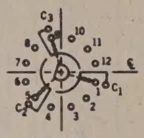
30° ANGLE OF THROW



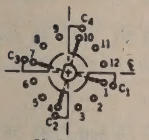
ONE POLE



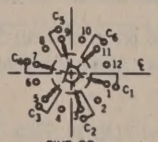
TWO POLE



THREE POLE

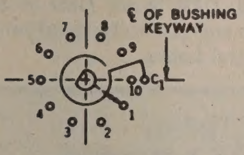


FOUR POLE

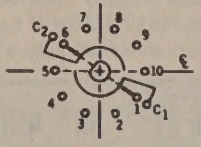


FIVE OR SIX POLE

36° ANGLE OF THROW



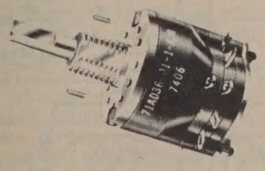
ONE POLE



TWO POLE

ADJUSTABLE STOPS

AVAILABLE FROM LOCAL DISTRIBUTOR STOCK STYLES AD, BD, ADF AND BDF



Number of positions per pole can be changed by removing and relocating stop pins in holes in the switch front plate. Available in the single shaft versions with either .125" or .250" diameter; 30° or 36° angle of throw; and solder lug terminals or PC mount.

SHAFT AND PANEL SEAL

STYLES AS, BS, ASF AND BSF

Shaft is sealed by "O" ring inside bushing. Panel is sealed by "O" ring at base of bushing. Seals do not alter dimensions as shown in the drawings when switch is mounted. Panel seal is silicone rubber. Shaft seal is an "O" ring per MIL-P-5516B.

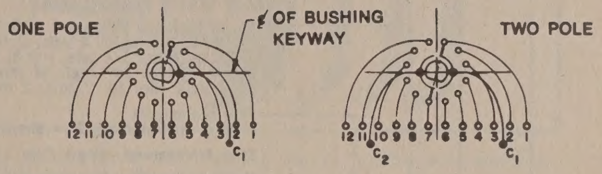
CONCENTRIC SHAFT SWITCHES

STYLE C

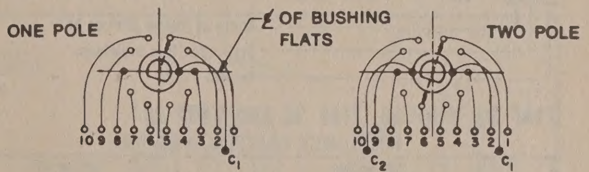
Concentric shaft version of Series 71. Available with solder lug or PC mount termination with 30° or 36° angles of throw. Poles per deck limitations are the same as the single shaft versions. Limited to three decks per each section and to a maximum of six poles per section. Contact GRAYHILL for complete ordering and pricing information.

PC MOUNT

30° ANGLE OF THROW



36° ANGLE OF THROW



RECOMMENDED PC BOARD HOLE PATTERN: Contact GRAYHILL for complete PC Board layout of a two deck switch, 30° or 36° angle of throw, one and two pole per deck.

RATED:
To make and break 400 MA for 10,000 cycles of operation or 200 MA for 25,000 cycles of operation.

VOLTAGE:
115 VAC or 30 VDC, resistive load.

RATED:
To make and break 300 MA for 10,000 cycles of operation or 100 MA for 25,000 cycles of operation.

VOLTAGE:
30 VDC, Inductive load (250 millihenries).

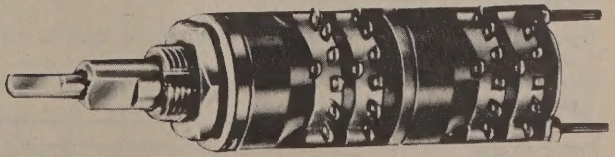
One cycle is 360° rotation and a return through all switch positions to the starting position. This data was metered at sea level, 25°C and 68% relative humidity with the following life limiting criteria.

CONTACT RESISTANCE:
50 milliohms maximum (10 milliohms initially).

INSULATION RESISTANCE:
10,000 megohms minimum between mutually insulated parts (50,000 megohms initially).

VOLTAGE BREAKDOWN:
500 VAC minimum between mutually insulated parts.

LIFE EXPECTANCY:
Contact GRAYHILL for information if the life limiting criteria are more critical than those listed, if the required cycles of operation are greater than those listed, if a larger make and break current is required than the one listed for the desired number of cycles, or if elevated temperatures or reduced pressures are part of the operating environment.



HOW TO ORDER AND PRICES:
See next page.

Available Locally Through Your Grayhill Distributor

Grayhill®

1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

HOW TO ORDER:

71A30 — 02 — 1 — 12N — C

- General Description
- No. of Decks (12 decks max.; also see poles per deck limitation below.)
- No. of Poles Per Deck (See circuit diagrams for style and angle of throw limitations. Also limited to a maximum of 16 total poles per switch.)
- No. of Positions (30° angle of throw — 1 pole, 2 thru 12; 2 pole, 2 thru 6; 3 pole, 2 thru 4; 4 pole, 2 or 3; 5 or 6 pole, 2 only. 36° angle of throw — 1 pole 2 thru 10; 2 pole, 2 thru 5.)
- Type of Contacts (N = Non-shorting; S = Shorting.)
- Stop Arrangement, Single Pole 1 Deck.
- Maximum Positions (C = Continuous; F = Stop between first and last position.)
- Angle of Throw (30° or 36°)
- Style (See line drawings)
- Series

71AF 30, 71BF 30, 71AF 36 AND 71BF 36

POLES/DECK AND POSITIONS/POLE

Number of Decks	30° or 36° Angle of Throw		Number of Decks	30° or 36° Angle of Throw	
	1 (2-12)	2 (2-6)		1 (2-12)	2 (2-6)
1	$7.15	$7.50	7	$27.85	$30.30
2	10.60	11.30	8	31.30	34.10
3	14.05	15.10	9	34.75	N.A.
4	17.50	18.90	10	38.20	N.A.
5	20.95	22.70	11	41.65	N.A.
6	24.40	26.50	12	45.10	N.A.

71A 30, 71B 30, 71A 36 AND 71B 36

POLES/DECK AND POSITIONS/POLE

Number of Decks	30° and 36° Angle of Throw		30° Angle of Throw			
	1 (2-12)	2 (2-6)	3 (2-4)	4 (2-3)	5 (2)	6 (2)
1	$6.25	$6.60	$6.95	$7.30	$7.65	$8.00
2	8.75	9.45	10.15	10.85	11.55	12.25
3	11.25	12.30	13.35	14.40	15.45	N.A.
4	13.75	15.15	16.55	17.95	N.A.	N.A.
5	16.25	18.00	19.75	N.A.	N.A.	N.A.
6	18.75	20.85	N.A.	N.A.	N.A.	N.A.
7	21.25	23.70	N.A.	N.A.	N.A.	N.A.
8	23.75	26.55	N.A.	N.A.	N.A.	N.A.
9	26.25	N.A.	N.A.	N.A.	N.A.	N.A.
10	28.75	N.A.	N.A.	N.A.	N.A.	N.A.
11	31.25	N.A.	N.A.	N.A.	N.A.	N.A.
12	33.75	N.A.	N.A.	N.A.	N.A.	N.A.

NOTE: Number of Positions does not affect price.

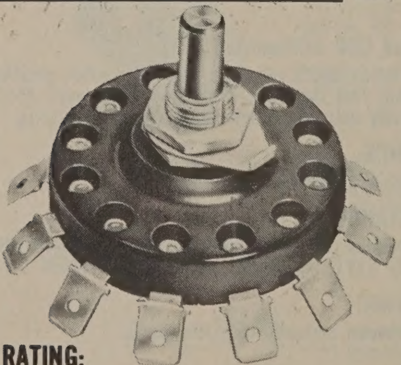
For adjustable stop prices of 71AD 30, 71BD 30, 71AD 36 and 71BD 36 add 50¢ to the price above of a similar style switch without the adjustable stop feature.

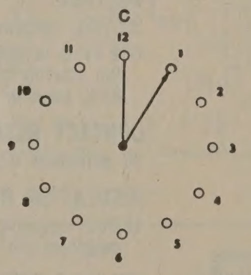
For sealed prices of 71AS 30, 71BS 30, 71AS 36 and 71BS 36 add $1.00 to the price above of a similar style switch without the seal feature. For adjustable stop prices of 71ADF 30, 71BDF 30, 71ADF 36 and 71BDF 36 add 50¢ to the price above of a similar style printed circuit terminal switch (terminals all out one side) without the adjustable stop feature.

For sealed prices of 71ASF 30, 71BSF 30, 71ASF 36 and 71BSF 36 add $1.00 to the price above of a similar style printed circuit terminal switch (terminals all out one side) without the seal feature.

Grayhill®

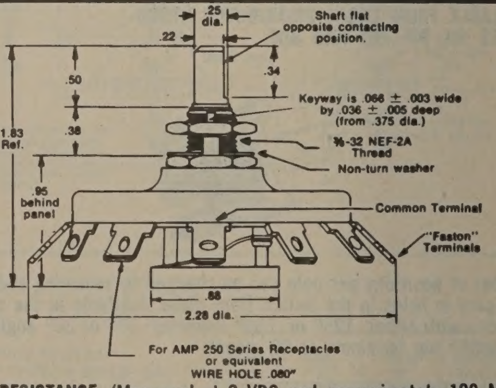
15 AMP, UL LISTED ROTARY SWITCHES — 30° ANGLE OF THROW 1 POLE, 2 TO 11 POSITIONS 'FASTON' TERMINALS





CIRCUIT DIAGRAM

Drawings and Spec. For Ref. Only


.25 dia.
.22
Shaft flat opposite contacting position.
.50
.34
Keyway is .066 ± .003 wide by .036 ± .005 deep (from .375 dia.)
1.83 Ref.
.38
⅜-32 NEF-2A Thread
Non-turn washer
.95 behind panel
Common Terminal
"Faston" Terminals
.88
2.28 dia.
For AMP 250 Series Receptacles or equivalent
WIRE HOLE .080"

RATING:

Series 19 switches are UL listed at:

15 amps, 120 VAC, non-inductive load. 1 amp, 120 VDC, non-inductive load.

This rating is based on the following criteria:

Overload — 50 operations at 125% rated AC load and 150% rated DC load.

Endurance — 6000 operations at rated load with 900 VAC dielectric strength before and after test.

Temperature Rise — Not to exceed 30°C when carrying rated AC load after endurance test.

Contacts will carry 20 amps at 115 volts AC with 30°C maximum temperature rise.

CONTACT RESISTANCE: (Measured at 2 VDC and approximately 100 MA) for new switch approximately 10 milliohms.

INSULATION RESISTANCE: Approximately 100,000 megohms. Between mutually insulated parts.

VOLTAGE BREAKDOWN: Approximately 2500 VAC. Between mutually insulated parts.

HOW TO ORDER:

Part Number 19101-* UL.

*(Indicate number of positions — 2, 3, 4, etc.)

No. of Positions	2	3	4	5	6	7	8	9	10	11
PRICES	$6.80	$7.05	$7.30	$7.55	$7.80	$8.05	$8.30	$8.55	$8.80	$9.05

ALL PRICES SUBJECT TO QUANTITY DISCOUNT.

For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

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NOW UL LISTED 1 INCH, 1 AMP, ROTARY SWITCHES

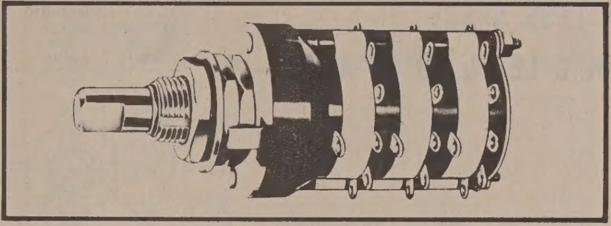
Grayhill®

OUR MOST POPULAR ROTARY SWITCH FAMILY AVAILABLE IN STANDARD AND MILITARY STYLES SINGLE OR CONCENTRIC SHAFTS AND A WIDE RANGE OF VARIATIONS AND OPTIONS

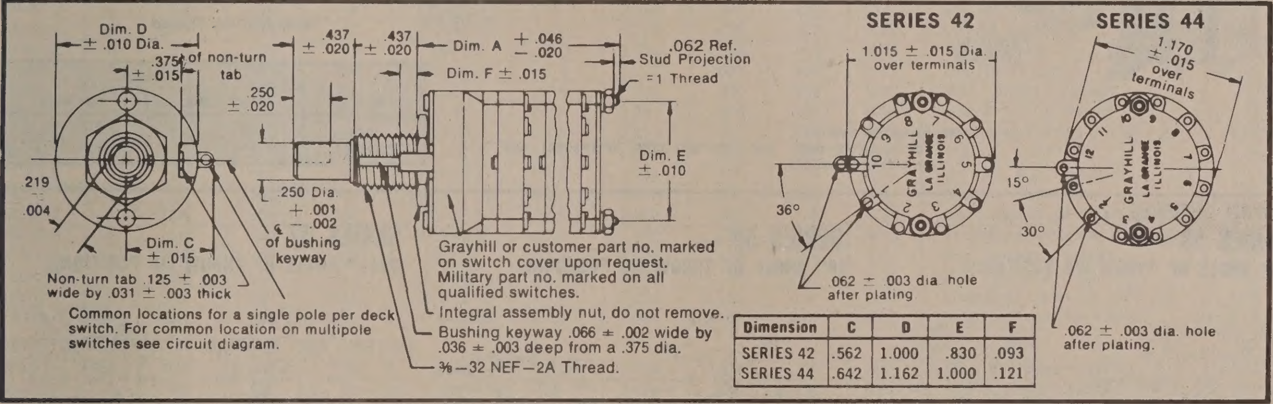
INCLUDING

- 30°, 36°, 45°, OR 90° ANGLES OF THROW
- 1 THRU 6 POLES/DECK
- 1 THRU 12 DECKS
- NON-SHORTING OR SHORTING CONTACTS
- ADJUSTABLE STOPS
- SHAFT AND PANEL SEALS
- PC MOUNTING
- ADD-A-POTS
- ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES

SINGLE SHAFT STYLES A AND D



Military styles (style M [85°C], style H and HS [125°C]), are qualified to MIL-S-3786/4-1. Patent No. 3,297,836.


Dim. D
± .010 Dia.
.375 ℄ of non-turn tab
± .015
.437
± .020
.437
± .020
Dim. A + .046 − .020
.062 Ref. Stud Projection
=1 Thread
Dim. F ± .015
.250
± .020
.219
.004
Dim. E
± .010
.250 Dia.
+ .001
− .002
℄ of bushing keyway
Dim. C
± .015
Non-turn tab .125 ± .003 wide by .031 ± .003 thick
Common locations for a single pole per deck switch. For common location on multipole switches see circuit diagram.
Grayhill or customer part no. marked on switch cover upon request. Military part no. marked on all qualified switches.
Integral assembly nut, do not remove.
Bushing keyway .066 ± .002 wide by .036 ± .003 deep from a .375 dia.
⅜—32 NEF—2A Thread.
SERIES 42
1.015 ± .015 Dia. over terminals
36°
GRAYHILL
LA GRANGE
ILLINOIS
.062 ± .003 dia. hole after plating
SERIES 44
1.170 ± .015 over terminals
15°
30°
.062 ± .003 dia. hole after plating.

Dimension	C	D	E	F
SERIES 42	.562	1.000	.830	.093
SERIES 44	.642	1.162	1.000	.121

RATING:

Rated: To make and break the following loads with 30° or 36° angle of throw: 1 amp., 115VAC resistive; 1 amp., 6 to 28 VDC resistive; 0.25 amp., 115 VAC inductive; 0.02 amp., 115 VDC inductive; 0.10 amp., 6 to 28 VDC inductive; 0.10 amp., 115 VDC resistive. To carry 10 amps continuously.

Contact Resistance: .010 ohms initial. After 25,000 cycles of operation .020 ohms maximum.

Insulation Resistance: 50,000 megohms minimum (initially).

Voltage Breakdown: 1,000 VAC initially (500 VAC or better after most environmental tests).

Life Expectancy: 100,000 mechanical cycles of operation.

Stop Strength: 15 pound-inches minimum.

Rotational Torque: 20-96 ounce-inches, depending on the number of poles per deck and the number of decks.

Contacts: Shorting or non-shorting wiping contacts with over 150 grams contact force.

Shaft Flat Orientation: Flat opposite contacting position of pole number one. (See circuit diagram.)

ORDERING INFORMATION

How to determine part number — Sample part number for a standard style, fixed stop, 2 deck, 1 pole per deck 12 positions per pole, 30° angle of throw rotary switch with non-shorting contacts.

General Description
Number of Decks (1 thru 3)
Number of Poles per Deck (1 or 2)
Number of Positions per Pole
(AJ = Adjustable Stops)
Type of Contacts —
N = Non-Shorting, S = Shorting

44 A 30 - 02 - 1 · 12 N - F

Add -F for Stop between First and Last Position of a 1 Pole/Deck Switch with Max. Positions. No Notation required for Continuous Rotation.
Angle of Throw (See Series)
Style —
A = Standard, Solder Lug Terminals
D = Style A with Adjustable Stops
Series 42 (36°) or Series 44 (30°)

For other angles of throw; 3 to 6 poles per deck; 4 thru 12 decks; military, sealed, UL listed, or PC mountable styles, contact factory.

PRICES:

ONE POLE PER DECK

SERIES 42A 36 AND 44A 30 (FIXED STOPS) / SERIES 44A 30

No. of Decks	Dim. A	Number of Positions 2	3	4	5	6	7	8	9	10	11	12
1	1.025	$10.70	$10.85	$11.00	$11.15	$11.30	$11.45	$11.60	$11.75	$11.90	$12.05	$12.20
2	1.375	12.10	12.40	12.70	13.00	13.30	13.60	13.90	14.20	14.50	14.80	15.10
3	1.717	13.50	13.95	14.40	14.85	15.30	15.75	16.20	16.65	17.10	17.55	18.00

TWO POLES PER DECK

SERIES 42A 36 AND 44A 30 (FIXED STOPS) / SERIES 44A 30

No. of Decks	Number of Positions 2	3	4	5	6
1	$11.80	$12.10	$12.40	$12.70	$13.00
2	14.40	15.00	15.60	16.20	16.80
3	17.00	17.90	18.80	19.70	20.60

SERIES 42D36 (ADJ. STOPS)

No. of Decks	Dim. A	No. of Positions 2-10 1 Pole	2-5 2 Pole
1	1.025	$11.90	$12.70
2	1.375	14.50	16.20
3	1.717	17.10	19.70

SERIES 44D30 (ADJ. STOPS)

No. of Decks	Dim. A	No. of Positions 2-12 1 Pole	2-6 2 Pole
1	1.025	$12.20	$13.00
2	1.375	15.10	16.80
3	1.717	18.00	20.60

QUANTITY DISCOUNTS APPLY. For example 100 pieces of one part number carry a 50% discount from list prices shown.
DISCOUNTS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

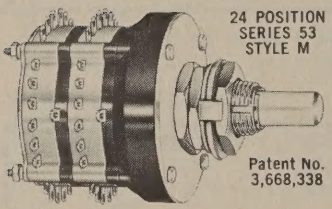
Available Locally Through Your Grayhill Distributor

Grayhill®

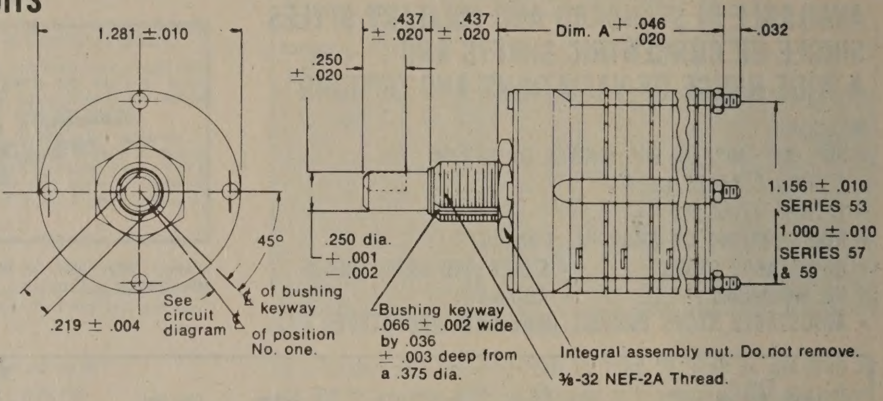
16, 20 AND 24 POSITION ROTARY SWITCHES — SERIES 53, 57, 59

MAKE AND BREAK MORE CIRCUITS IN LESS SPACE

LOGIC LEVEL TO ½ AMP


24 POSITION
SERIES 53
STYLE M

Patent No. 3,668,338

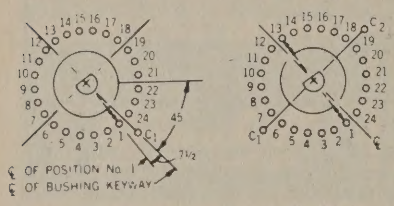

1.281 ±.010
.437 ± .020
.437 ± .020
Dim. A +.046 −.020
.032
.250 ± .020
45°
.250 dia. +.001 −.002
.219 ± .004
See circuit diagram
℄ of bushing keyway
℄ of position No. one.
Bushing keyway .066 ± .002 wide by .036 ± .003 deep from a .375 dia.
Integral assembly nut. Do not remove.
⅜-32 NEF-2A Thread.
1.156 ± .010 SERIES 53
1.000 ± .010 SERIES 57 & 59

Mounting Hardware:
Two mounting nuts, one internal tooth lockwasher and one non-turn washer.

Series	Diameter Front Plate	 Terminals
53	1.281 ±.010	1.350 ±.015
57 or 59	1.125 ±.010	1.190 ±.015

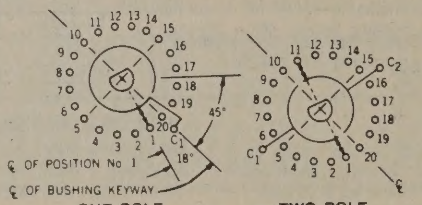
CIRCUIT DIAGRAMS

SERIES 53 —
15° ANGLE OF THROW (24 POSITIONS)


℄ OF POSITION No. 1
℄ OF BUSHING KEYWAY
45
7½
C1
C2

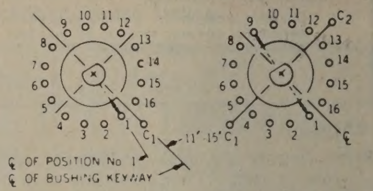
ONE POLE TWO POLE

SERIES 59 —
18° ANGLE OF THROW (20 POSITIONS)


℄ OF POSITION No. 1
℄ OF BUSHING KEYWAY
45°
18°
C1
C2

ONE POLE TWO POLE

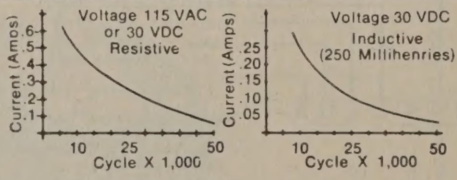
SERIES 57 —
22½° ANGLE OF THROW (16 POSITIONS)


℄ OF POSITION No. 1
℄ OF BUSHING KEYWAY
11°
15°
C1
C2

ONE POLE TWO POLE

RATINGS:

Life Expectancy:



Switch rating for break before make contacts.

Curve data based on test data conducted at sea level, 25°C, and 68% relative humidity.

Cycle equals 360° rotation and return.

Cycling rate is 10 cycles per minute.

Life limiting or failure criteria for these curves are:

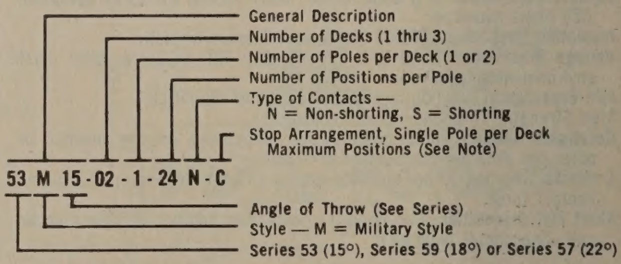
Contact Resistance: 50 milliohms maximum (15 milliohms initially).

Insulation Resistance: 10,000 megohms minimum between mutually insulated parts. (50,000 megohms initially.)

Voltage Breakdown: 500 VAC minimum between mutually insulated parts. These switches will carry 4 amperes with a maximum contact temperature rise of 20°C.

ORDERING INFORMATION AND PRICES:

How to determine part number: Suffix "C" or "F" is required for a complete part number when ordering single pole/deck switches with maximum number of positions. Samle part number for a 2 deck, 1 pole/deck, 24 position, Style M, 15° angle of throw, non-shorting contact switch without stops:



53 M 15-02-1-24 N-C

General Description
Number of Decks (1 thru 3)
Number of Poles per Deck (1 or 2)
Number of Positions per Pole
Type of Contacts — N = Non-shorting, S = Shorting
Stop Arrangement, Single Pole per Deck Maximum Positions (See Note)
Angle of Throw (See Series)
Style — M = Military Style
Series 53 (15°), Series 59 (18°) or Series 57 (22°)

For 3 to 12 poles per deck; 4 thru 12 decks; military qualified, sealed styles, contact factory

SERIES 53, 57, AND 59 PRICES

No. of Decks	Dim. A	Poles/Deck and Positions/Pole 1 Pole 2-24 2-20 2-16	 SERIES 53 SERIES 59 SERIES 57	 2 Pole 2-12 2-10 2-8
1	.916	$18.90		$20.90
2	1.249	26.30		28.30
3	1.582	33.70		36.70

ALL PRICES SUBJECT TO QUANTITY DISCOUNT. For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

DISCOUNTS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

HAMLIN INC

REED SWITCHES / INDUSTRIAL SENSORS • LIQUID CRYSTAL DISPLAYS

DEPT. EM, 628 LAKE STREET • LAKE MILLS, WISCONSIN 53551
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

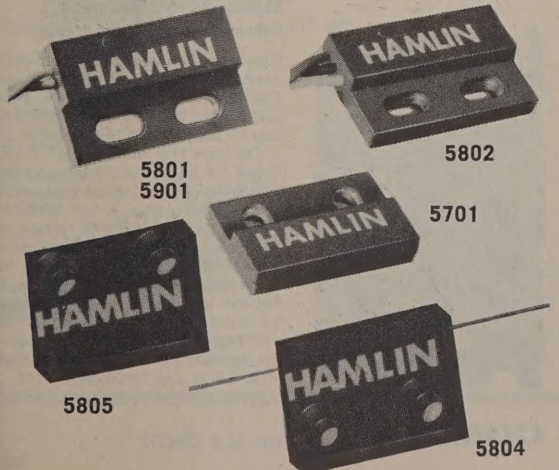
MAGNETIC REED SWITCHES

Micro-miniature • Tiny • Sub-miniature • Compact • Mercury-wetted • High voltage • High current

Switch Model No.	Form	Max. DC Contact Rating	Max. Amps	Max. DC Volts	Stock Ampere Turn Pull-In Range	Normal Stocking Tolerance A.T.	Overall Length Nominal Inches	Glass Length Max. Inches	Glass Diameter Max. Inches	Magnet	Special Features	List Price 500's
HAMLIN DRY REED FORM C MAGNETIC REED SWITCHES												
MDRR-DT	C	3W	.240	28	20-50	±7.5	2.076	.562	.105	H-33	3W Low Profile Form C	$2.30
MRH-DT	C	3W	.250	28	20-60	±7.5	2.124	.610	.130	H-33	Instrument Grade Form C	2.40
MRG-DT	C	3W	.250	28	20-60	±7.5	2.125	.610	.130	H-33	Mod. Current & Voltage	2.06
MLC-DT	C	3W	.110	28	27.5, 32.5, & 37.5	±10	2.125	.610	.130	H-33	Economy Form C - Sub-Miniature	1.45
DLC-DT	C	10W	.500	200	50-115	±15	3.375	1.562	.218	H-32	Economy Form C - Standard	1.10
DRR-DTH	C	10W	.500	250	50-115	±7.5	3.375	1.562	.218	H-34	High Breakdown Form C	1.35
DRT-DTH	C	20W	1.500	500	60-115	±7.5	3.375	1.562	.218	H-34	Inductive Loads	2.94
HAMLIN DRY REED FORM A MAGNETIC REED SWITCHES												
MITI-1	A	.1W	.010	10	30 ±15	±15	.740	.260	.055	H-31	Micro-Miniature	1.95
MMRR-2	A	.3W	.010	28	17.5-52.5	±7.5	2.000	.375	.090	H-31	"Grain of Wheat" Size	1.35
MRMF-2	A	.3W	.010	28	27.5-52.5	±10	2.230	.830	.130	H-33	Low Thermal EMF 5MV/OC	3.15
MSRF-2	A	.3W	.010	28	27.5-52.5	±10	2.230	.830	.102	H-33	Low R.F. Losses	1.05
MINI-2S	A	3W	.110	28	7.5-32.5	±7.5	1.235	.500	.070	H-31	The Mini-Reed	.87
MDRR-4	A	10W	.500	100	12.5-52.5	±7.5	1.235	.600	.105	H-33	Low Profile Form A	.64
MSRR-2	A	10W	.500	200	17.5-52.5	±7.5	2.250	.800	.090	H-33	Mod. Current & Voltage	.72
MRR-2	A	10W	.500	200	17.5-52.5	±7.5	2.230	.800	.130	H-33	Mod. Current & Voltage	.72
MRR-5	A	10W	.500	500	27.5-62.5	±7.5	2.230	.800	.130	H-33	Breakdown Voltage to 1000 VDC	1.65
MDSR-4	A	10W	.500	100	12.5-52.5	±7.5	1.590	.600	.090	H-33	.090 Dia. Low Profile	.64
MARR-2	A	10W	.500	100	17.5-52.5	±7.5	2.230	.800	.105	H-33	.105 Dia. High Reliability	.68
MLC-2	A	10W	.500	100	30.35 +40	±10	2.230	.800	.105	H-33	Economy Form A	.55
MSRH-2	A	10W	.500	200	17.5-52.5	±7.5	2.230	.800	.105	H-33	Instrument Grade - Prem. Per.	.87
MARR-5	A	10W	.500	500	17.5-52.5	±7.5	1.775	.750	.105	H-33	Breakdown Voltage to 1000 VDC	1.65
SRR-2	A	15W	1.000	400	35-115	±7.5	3.375	1.425	.195	H-32	Mod. Current & Voltage	1.10
DRR-1	A	15W	1.000	400	42.5-132.5	±7.5	3.250	2.100	.207	H-34	Mod. Current & Voltage	.84
DRR-5	A	25W	1.000	1000	52.5-132.5	±7.5	3.250	2.100	.207	H-34	Breakdown Voltage to 1500 VDC	1.58
DRT-5	A	50W	3.000	1000	57.5-132.5	±7.5	3.250	2.100	.207	H-34	Inductive Load Type Contact	2.88
HAMLIN MERCURY-WETTED MAGNETIC REED SWITCHES												
MDC-1	A	50W	2.000	100	40-80	±10	2.250	.610	.130	H-33	Tiny Size, Mercury Wetted	2.25
MDC-DT	C	14W	.500	28	70	±15	1.600	.600	.132	H-32	Form C, Mercury Wetted	5.62
MTHG-2	A	3W	.100	28	40	±15	1.590	.560	.090	H-33	All Position Mercury Wetted	3.00
HAMLIN "SPECIAL" MAGNETIC REED SWITCHES												
MSLS-2	A	10W	.100	100	—	—	1.784	.800	.105	—	Latching Reed Switch	1.95
MAAC-2	A	1W	.100	110 VAC	17.5-52.5	±7.5	1.775	.800	.105	H-33	Lamp/High Inrush Loads	.60
HAMLIN HIGH VOLTAGE MAGNETIC REED SWITCHES												
DRVT-5	A	50W	.004	3500	.90-150	±10	3.250	1.950	.218	H-34	Breakdown Voltage to 5,000 VDC	2.75
DRVT-10	A	50W	3.000	7500	100-150	±10	3.250	1.950	.218	H-34	Breakdown Voltage to 10,000 VDC	3.50
DRVT-15	A	50W	.004	3500	250 Max.	—	3.195	1.950	.207	H-34	Breakdown Voltage to 15,000 VDC	7.00
HAMLIN HIGH CURRENT MAGNETIC REED SWITCHES												
SRT-2	A	110VA	1.000	28VDC 110 VAC	57.5-132.5	±7.5	3.375	1.610	.195	H-32	High Power Inductive Loads	1.99
DRR-129	A	100W	3.000	250	42.5-132.5	±7.5	3.250	1.950	.207	H-34	Ideal High Current Loads	1.56

MAGNETICALLY ACTUATED REED PROXIMITY SENSORS

High Reliability and Long Life • Hermetically Sealed



ORDERING/PRICING INFORMATION

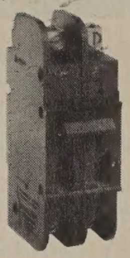
Mfr.'s Type	Form	Contact Rating Watts	AC & DC OPERATION Switching Voltage	Current Amps	Breakdown Voltage	List Price
5801	A	10	200 VDC 240 VAC	.500	400 VDC	$3.75
5802	C	3	100 VDC 120 VAC	.250	200 VDC	7.75
5804	A	10	100 VDC 120 VAC	.500	250 VDC	1.45

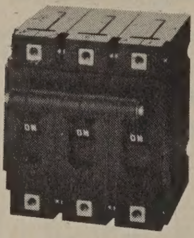
Mfr's. Type	Form	Current Rating	1½ AMP AC ONLY Voltage Rating	Blocking Voltage		
5901	A	1½ Amps	120-240 VAC 50-60 Hz	400V Peak		7.75

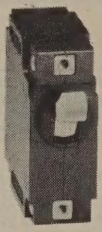
Mfr's. Type	Use With	MAGNETIC ACTUATORS Operating Distance	Differential	Release Distance		
5701	5801 5901	To 5/8"	1/8"-1/4"	9/16"-13/16"		2.00
5805	5802 5804	To 29/32"	1/32"-7/16"	39/64"-1"		1.20

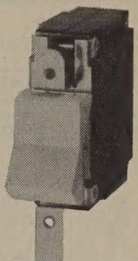
HEiNEMANN

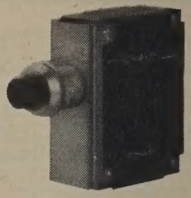
HYDRAULIC-MAGNETIC CIRCUIT PROTECTORS


E-FRAME


SERIES AM1


SERIES JA


SERIES JC


SERIES JD

With the widest range of styles and electrical ratings in the industry, Heinemann circuit breakers offer almost unlimited options: integral or fractional must-hold ratings from 0.010 to 100A, and in steps to 225A; single- and multipole models; breakers for 50/60Hz, 400Hz, or dc service; breakers qualified under Mil Specs; and breakers in any series which include special internal circuits such as high-inrush capability, relay-trip, auxiliary switches, dual rating, DuCon® construction for both current and voltage sensing, and other optional circuits for sophisticated control functions.

Hydraulic-magnetic actuation (a Heinemann invention) assures that must-hold and must-trip points are unaffected by ambient temperature fluctuations. Very precise control within a narrow current band is thus possible. In addition, a wide selection of time-delay characteristics permits close match of breaker to equipment requirements, allowing high temporary overloads to prevent nuisance tripping or tripping instantaneously according to the particular design need.

Consult the Heinemann Protector Selector (Bulletin 304) or contact your nearby Heinemann representative for complete technical assistance. Individual product-line bulletins listed below.

E-FRAME: Smaller than other E-Frame breakers, competitively priced. Approx. 5¾h x 2w x 2⅝d (2-pole). Available in 1 to 6 poles.

SERIES AM1: 1 to 4 poles. UL-component-recognized. Special circuits available. Approx. 2.5h x 2.5d, .75w per pole.

SERIES JA: Compact OEM breaker. Only 2.5 oz/pole. 1 to 4 poles. Approx. 2h x 1.875d, .75w per pole.

JA VARIANTS. Snap-In JB (1 to 4 poles) installs in rectangular panel cutout without screws. JC (1 to 4 poles—single-pole shown) has white or gray rocker handle. JD has round button for push-push operation. JE has moisture-sealed bat-type toggle for marine applications.

CONDENSED GUIDE TO HEINEMANN CIRCUIT BREAKERS

Type	Series	Bulletin	Poles	Maximum* Voltages	Interrupting Cap. (amp)	Current (amp)
PANEL MOUNTING	E-Frame	CF-3104	1,2,3,4,5,6	240 AC 480 AC 240 AC (400~) 125 DC	5,000 5,000 5,000 5,000	0.01 to 100 0.01 to 100 0.15 to 100 0.05 to 50
	EH-Frame	GH-3442	3	480 AC	10,000	0.5 to 100
	CJ	3111	2	120/240AC	10,000	125 to 200
			3	240 AC	10,000	100 to 225
GENERAL PURPOSE	1163	3412	1,2,3	250 AC 125 DC	5,000 5,000	0.01 to 100 0.016 to 100
AUXILIARY	0111	3201	1	250 AC	1,500	0.01 to 50
AM SERIES	AM1	AM-3306	1,2,3,4	250 AC 250 AC (400~) 65 DC	1,000 1,000 1,000	0.02 to 60 0.02 to 60 0.02 to 60
	AM1000	3305	1,2,3	250 AC 250 AC (400~) 125 DC	1,500 1,500 2,000	0.01 to 70 0.15 to 65 0.015 to 100
MINIATURE	JA, JB, JC, JD, JE	J-3333	1,2,3,4	250 AC 250 AC (400~) 65 DC	1,000 1,000 1,000	0.020 to 30 0.100 to 30 0.020 to 20

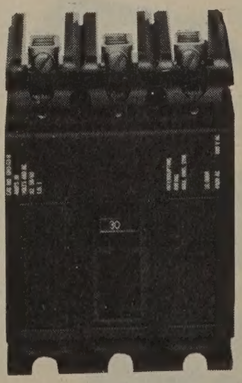
*AC voltages are 60 Hz unless marked with (400~).

LOW-COST RESETTABLE PUSHBUTTON PROTECTOR, DIRECT REPLACEMENT FOR FUSE AND CYLINDRICAL FUSEHOLDER

The brand-new Heinemann Re-Cirk-It® circuit protector is resettable with just a light finger touch on the pushbutton, and fits a ⅝" circular panel hole to directly replace a glass fuse and fuseholder. Presently available in a choice of current ratings from 3 through 20A at 120V ac or 32V dc, and 3 through 10A at 240V ac. Time delay prevents nuisance tripping.

Protector trips only on overcurrent conditions, cannot be turned off manually. Also cannot be held on against a fault. ¼" quick-on terminals are standard. UL-recognized as component—appliance control.

Priced as low as a fuse and fuseholder in OEM quantities. Ready for immediate delivery. Alternate button styles available on special order. Bulletin 4000.



ANNOUNCING THE HEINEMANN SERIES GH3—a new low-cost fully-magnetic EH-Frame breaker

Now you can afford a completely magnetic three-pole three-phase branch-circuit protector at a price lower than you are accustomed to pay for an ordinary thermal unit.

The new Heinemann GH3 is UL-listed for short-circuit interrupting capacity of 10,000 amp at 480V 60Hz three-phase at 45% to 50%power factor. Wide range of standard off-the-shelf continuous current ratings from 15 to 100 amp. Already proven in such heavy-duty applications as computer main frames, air conditioning, machine tools.

6" high, 4.125" wide, 3.375" deep—fits standard EH-Frame panel cutout. Wgt. 3.3 lb. Ask for Bulletin 3442.

HEINEMANN ELECTRIC COMPANY Trenton, N.J. 08602

6867

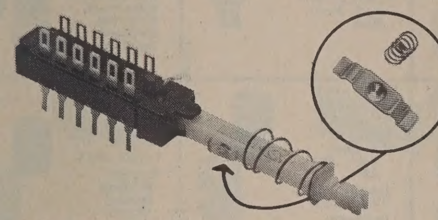
SCHADOW™

MODULAR PUSH BUTTON SWITCHES

"Creative Switchmakers" for Home Entertainment Products and Test Equipment

If it's a better switch you need . . . better switch to Schadow!

better switch...here's why...

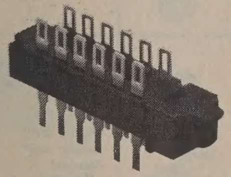


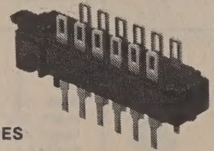
INDIVIDUAL COIL SPRING LOADED MOVING CONTACTS

- The coil spring-loaded contoured moving contacts have been designed to provide balanced contact pressure for optimum surface to surface interface with the fixed contacts . . . assuring reliable performance in low voltage (dry circuit) applications
- Long term low contact resistance
- Constant coil spring tension at the contact points provides positive self-cleaning action

HAND WIRING AND FLO-SOLDERING CONNECTIONS ARE STANDARD

- Solder lugs on top for hand wiring
- PC spikes at bottom for flo-soldering





MODULE ADVANTAGES

- Enclosed housing protects inner contact area from dust and foreign intrusions
- Fixed terminals are "staked" in position, providing an extra seal to help prevent wicking of solder or flux
- Molded PC Board Standoffs, front and back, on bottom side, assure parallel mounting

SUPERIOR MODULAR CONSTRUCTION

- Ease of maintenance . . . switch plunger with sliding contacts is removable from the front without disturbing electrical connections

TECHNICAL DATA

Contact Resistance ....4-6 mOhms
after 25,000 cycles ....6-20 mOhms
Lifetime Expectation Interlocked (50,000)
Momentary, Push Push (100,000) cycles
Material of Construction
Fixed contact. Brass/Silver Plated ....0002"
Moving contact ....Bimetal Brass/Silver .0004"
Plunger Material....Polycarbonate V-0 rated or Delrin
Contacts ....Non-shorting
Housing Material.........Polycarbonate V-0 rated or Glass Reinforced Nylon

Terminal Board Material ....High Grade Paper Phenolic or V-0 rated material......Series F
Key pressure with 2PDT ....28 oz.
Key pressure with 4PDT ....32 oz.
Key pressure with 6PDT ....35 oz.
Key pressure with 8PDT ....42 oz.
Key pressure with 10PDT ....46 oz.
Key pressure with Power Switch ....42 oz.

NOTE: Lighter key pressures available, contact factory for details.

NOTE: For switching applications requiring flame retardant materials, contact factory.

CHASSIS DIMENSIONS FOR SERIES F & SERIES G SWITCHES

NOTE: Maximum stations to be grouped in one interlocking action. 10mm-10 / 12.5mm-23 / 15mm-23 / 17.5mm-23 / 20mm-19

C Dim. 10mm (.394)

No. of Stations	A MTG.	B O-ALL
2	1.181	1.417
3	1.575	1.811
4	1.969	2.205
5	2.362	2.598
6	2.756	2.992
7	3.150	3.386
8	3.543	3.780
9	3.937	4.173
10	4.331	4.567
11	4.724	4.961
12	5.118	5.354
13	5.512	5.748
14	5.906	6.142
15	6.299	6.535
16	6.693	6.929
17	7.087	7.323
18	7.480	7.717
19	7.874	8.110
20	8.268	8.504
21	8.661	8.898
22	9.005	9.291
23	9.449	9.685
24	9.843	10.079
25	10.236	10.472
26	10.630	10.866
27	11.024	11.260
28	11.417	11.654
29	11.811	12.047
30	12.205	12.441
31	12.598	12.835
32	12.992	13.228
33	13.386	13.622
34	13.780	14.016
35	14.173	14.409
36	14.567	14.803
37	14.961	15.197
38	15.354	15.591
39	15.748	15.984
40	16.142	16.378
41	16.535	16.772
42	16.929	17.165
43	17.323	17.559

C Dim. 12.5mm (.492)

No. of Stations	A MTG.	B O-ALL
2	1.201	1.437
3	1.693	1.929
4	2.185	2.421
5	2.677	2.913
6	3.169	3.406
7	3.661	3.898
8	4.154	4.390
9	4.646	4.882
10	5.138	5.374
11	5.630	5.866
12	6.122	6.358
13	6.614	6.850
14	7.106	7.343
15	7.598	7.835
16	8.091	8.327
17	8.583	8.819
18	9.075	9.311
19	9.567	9.803
20	10.059	10.295
21	10.551	10.787
22	11.043	11.280
23	11.535	11.772
24	12.028	12.264
25	12.520	12.756
26	13.012	13.248
27	13.504	13.740
28	13.996	14.232
29	14.488	14.724
30	14.980	15.217
31	15.472	15.709
32	15.965	16.201
33	16.457	16.693
34	16.949	17.185

C Dim. 15mm (.590)

No. of Stations	A MTG.	B O-ALL
2	1.378	1.614
3	1.969	2.205
4	2.560	2.795
5	3.150	3.386
6	3.740	3.976
7	4.331	4.567
8	4.921	5.157
9	5.512	5.748
10	6.102	6.339
11	6.693	6.929
12	7.283	7.520
13	7.874	8.110
14	8.465	8.701
15	9.055	9.291
16	9.646	9.882
17	10.236	10.472
18	10.827	11.063
19	11.417	11.654
20	12.008	12.244
21	12.598	12.835
22	13.189	13.425
23	13.780	14.016
24	14.370	14.606
25	14.961	15.197
26	15.551	15.787
27	16.142	16.378
28	16.732	16.968
29	17.323	17.559

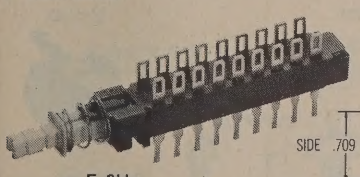
C Dim. 17.5mm (.689)

No. of Stations	A MTG.	B O-ALL
2	1.476	1.713
3	2.165	2.402
4	2.854	3.091
5	3.543	3.780
6	4.232	4.468
7	4.921	5.157
8	5.610	5.846
9	6.299	6.535
10	6.988	7.224
11	7.677	7.913
12	8.366	8.602
13	9.055	9.291
14	9.744	9.980
15	10.433	10.669
16	11.122	11.358
17	11.811	12.047
18	12.500	12.736
19	13.189	13.425
20	13.878	14.114
21	14.567	14.803
22	15.256	15.492
23	15.945	16.181
24	16.634	16.870
25	17.323	17.559

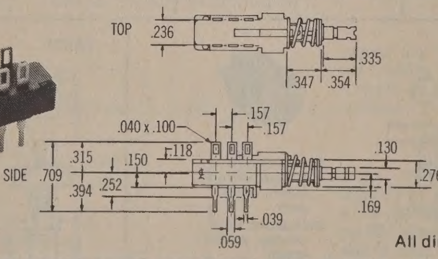
C Dim. 20mm (.787)

No. of Stations	A MTG.	B O-ALL
2	1.575	1.811
3	2.362	2.598
4	3.150	3.386
5	3.937	4.173
6	4.724	4.961
7	5.512	5.748
8	6.299	6.535
9	7.807	7.323
10	7.874	8.110
11	8.661	8.898
12	9.449	9.685
13	10.236	10.472
14	11.024	11.260
15	11.811	12.047
16	12.598	12.835
17	13.386	13.622
18	14.173	14.409
19	14.961	15.197
20	15.748	15.984
21	16.535	16.772
22	17.323	17.559

F SERIES

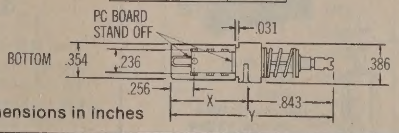


F-6U
6P DT



MODULE DIMENSIONS

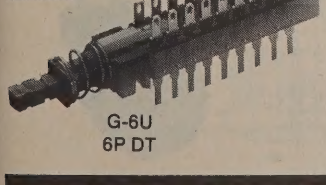
	X	Y
2PDT	.827	1.670
4PDT	1.300	2.143
6PDT	1.772	2.615
8PDT	2.244	3.087
10PDT	2.716	3.559
16PDT		



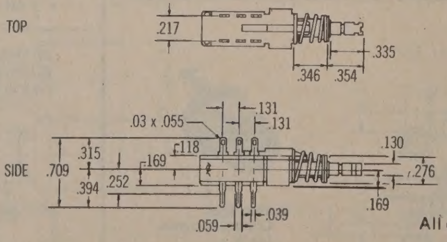
All dimensions in inches

G SERIES

More compact to accommodate depth limitations

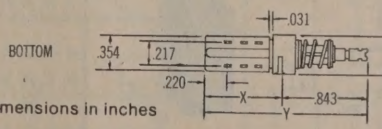


G-6U
6P DT



MODULE DIMENSIONS

	X	Y
2PDT	.705	1.548
4PDT	1.098	1.941
6PDT	1.492	2.335
8PDT	1.895	2.705

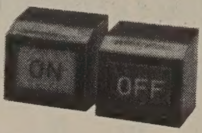


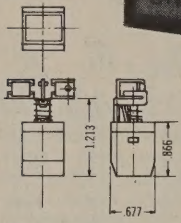
All dimensions in inches

MECHANICAL REFLECTING INDICATOR BUTTONS FOR F & G SERIES

- Uses no energy. Needs no lamp, lamp/holder, power supply, switch contact or wiring.
- Works on the principle of reflecting ambient light through a clear plastic lens.
- Generates no heat and eliminates costly lamp replacement.

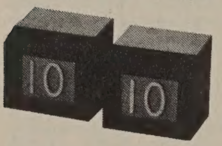
FA 110 DUAL LEGEND INDICATOR BUTTON





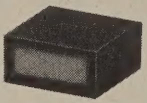
Legend and color change when button is depressed. (Legend is on indicator surface.)

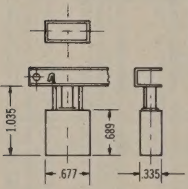
Button Shell Colors: Black, white, grey
Indicators: Black, green, orange, white, grey, yellow



Legend remains the same, but indicator color changes when the button is depressed. (Legend is on rear side of clear lens cap.)

FA 100





Button Shell Colors: Chrome, black, white, grey
Indicators: Blue, orange, yellow, green, amber, white

right on the button . . .

standard buttons for Series F and G Switches

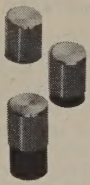
Rectangular buttons also can be snapped on vertically to provide more selection of larger buttons on smaller chassis spacing. Standard colors shown ... other colors to match or contrast with your equipment available on special order.

FG
Diameter: .346"
Length: .413"
Standard Minimum Spacing: 10mm
Colors: Black, White, Grey, Red, Green, Chrome

F-200
Diameter: .394"
Length: .433"
Standard Minimum Spacing: 12.5mm
Colors: Chrome/Black, Black/Black

FZ
Diameter: .394"
Length: .642"
Standard Minimum Spacing: 12.5mm
Colors: Black/Black, White/Black, White/Red, Red/Black, Red/Grey

F1.12 - H-3
F1.15 - H-3
F1.21 - H-3
Diameters: .433", .433", .433"
Lengths: .472", .591", .827"
Cap Depth: .472"
Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap



F1.12 - H-4
F1.15 - H-4
F1.21 - H-4
Diameters: .394", .394", .394"
Lengths: .472", .591", .827"
Cap Depth: .079"
Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap

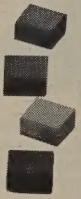
F1.12 - H-5
F1.15 - H-5
F1.21 - H-5
Diameters: .480", .480", .480"
Lengths: .571", .689", .925"
Cap Depth: .571"
Standard Minimum Spacing: 12.5mm
Colors: Black/Chrome

FGK
Diameter: .473"
Length: .492"
Standard Minimum Spacing: 12.5mm
Colors: Red, White, Black

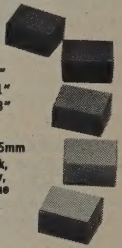
FSC
Width: .386"
Height: .217"
Length: .441"
Standard Minimum Spacing: 10mm
Colors: White, Black, Grey

FSD
Width: .484"
Height: .276"
Length: .413"
Standard Minimum Spacing: 12.5mm
Colors: Black, White

FU12
Width: .470"
Height: .216"
Length: .440"
Standard Minimum Spacing: 12.5mm
Colors: Black, White, Grey, Red

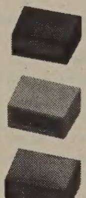


FSB
Width: .579"
Height: .291"
Length: .433"
Standard Minimum Spacing: 15mm
Colors: Black, White, Grey, Red, Chrome

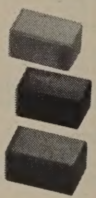


FE
Width: .681"
Height: .236"
Length: .472"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey,

FSA
Width: .677"
Height: .315"
Length: .512"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey
Inserts: Silver or Gold

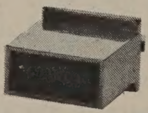


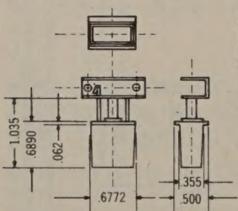
FA
Width: .772"
Height: .394"
Length: .453"
Standard Minimum Spacing: 20mm
Colors: Black, White, Grey,



04-7060-00
Width: .487"
Height: .487"
Length: .590"
Cap Depth: .480"
Standard Minimum Spacing: 12.5mm
Colors: Spun-Finish Chrome

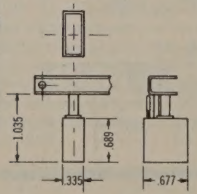
FA 106





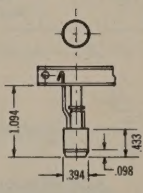
Button Shell Colors: Chrome, black
Indicators: Blue, orange, yellow, green, amber, white

FA 101



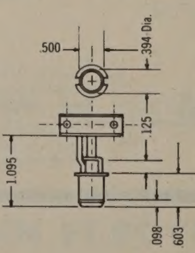
Button Shell Colors: Chrome, black, white, grey
Indicators: Orange, yellow, green

FA 201



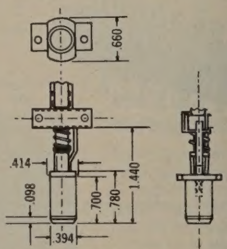
Button Shell Colors: Chrome, black, white, grey
Indicators: Blue, orange, yellow, green

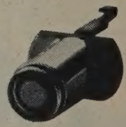
FA 206



Button Shell Colors: Chrome, black
Indicators: Blue, orange, yellow, green

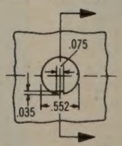
FA 207

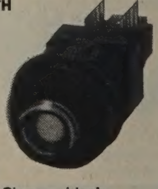




Button Shell Colors: Chrome, black
Indicators: Blue, orange, yellow, green

ZF THREADED BUSHING MOUNT WITH FA 200 BUTTON





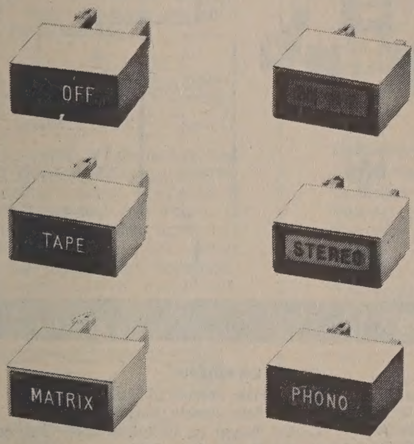
Button Shell Colors: Chrome, black, white, grey
Indicators: Blue, orange, yellow, green
Choice of black or chrome front mounting nut.

IEE/SCHADOW inc

A SUBSIDIARY OF ITT

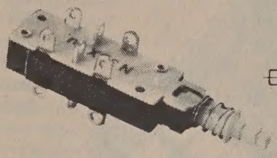
NEED GRAPHICS?

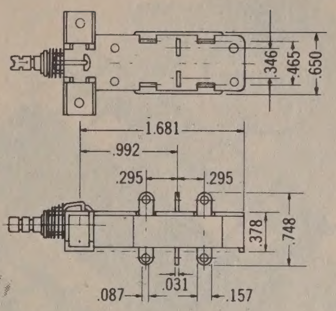
Several examples are shown below. Your specific requirements quoted on request. (Graphics pictured on FA 100 push buttons)


OFF
TAPE
STEREO
MATRIX
PHONO

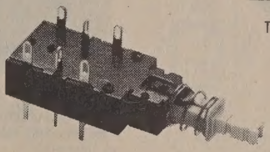
N30 TV-5 rated power switches

(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved.

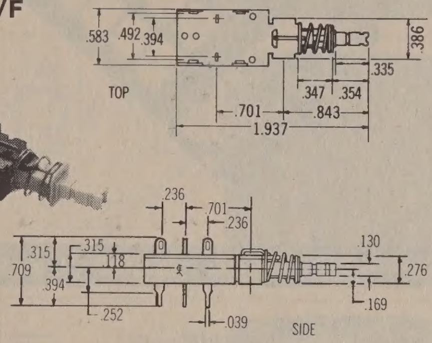



.346
.465
.650
1.681
.992
.295
.295
.378
.748
.087
.031
.157

Series NE 15/F line switches



(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved, 6 AMP 250 VAC.


.583
.492
.394
.386
.335
TOP
.347
.354
.701
.843
1.937
.236
.701
.236
.315
.315
.118
.709
.394
.252
.039
.130
.276
.169
SIDE

CA-110 SERIES

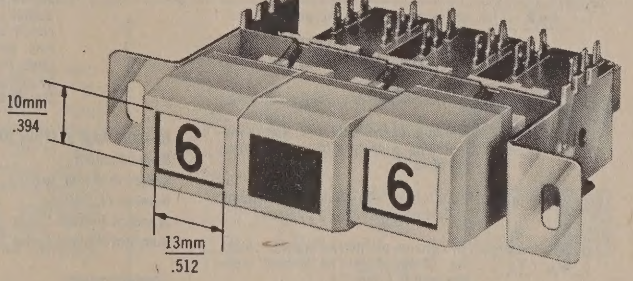
Schadow, the creative switchmaker, has developed a "lampless" push button switch, with bright color indicators — with or without graphics — to mechanically indicate changing functions.

This innovative push-button switch, Series CA 110, is for use in high quality commercial applications. The sophistication of the series in terms of electrical construction (bifurcated contacts — coil spring loaded) and mechanical actions available, will satisfy the most demanding switching requirements.

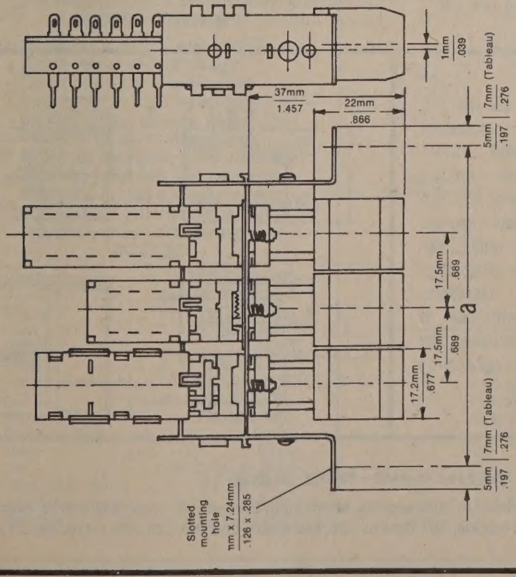
Tableau or stacked switches are available in Series CA 110, 15 switches wide x 10 high per chassis.

Because a lamp and socket assembly is omitted, economies in manufacture permit a lower pricing schedule, and the elimination of another drain on electrical power sources.

If it's a better switch you need . . . better switch to Schadow.


10mm
.394
6
6
13mm
.512

CA 110


1mm
.039
7mm (Tableau)
.276
37mm
1.457
22mm
.866
5mm
.197
17.5mm
.689
a
17.5mm
.689
17.2mm
.677
7mm (Tableau)
.276
5mm
.197
Slotted mounting hole
mm x 7.24mm
.126 x .285

Legend and color change when button is depressed. (Legend is on indicator surface.)

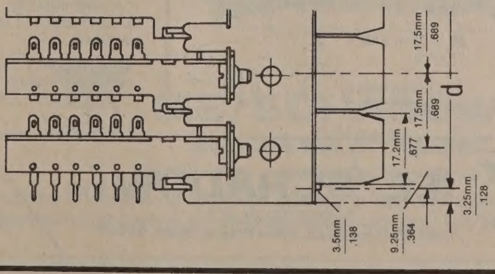
or

Legend remains the same, but indicator color changes when the button is depressed. (Legend is on rear side of clear lens cap.)

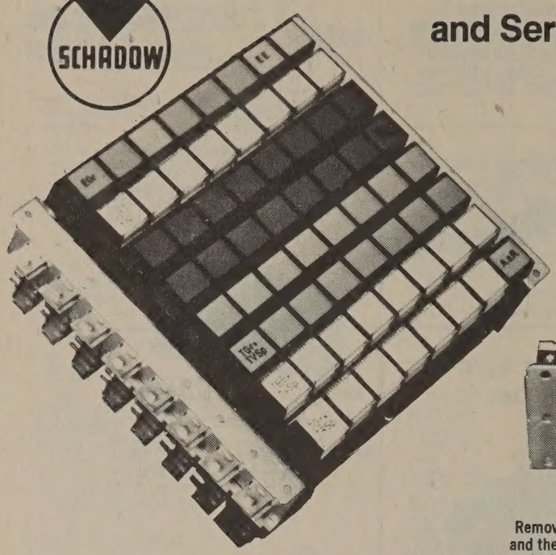
STANDARD COLORS		
BUTTON SHELL	INDICATOR OFF	INDICATOR ON
White Gray Black	White Gray Black Yellow Green Orange Metallic	White Gray Black Yellow Green Orange Metallic

For custom legend applications contact factory.

CA 110 TABLEAU

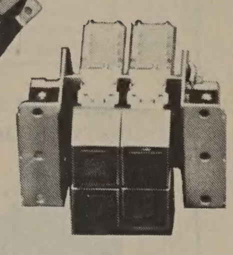

17.5mm
.689
d
17.5mm
.689
17.2mm
.677
3.25mm
.128
3.5mm
.138
9.25mm
.364

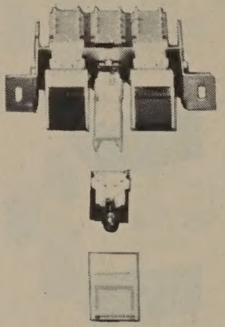
High quality Series CL illuminated and Series C non-illuminated push button switches



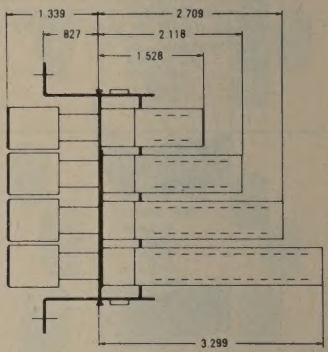
This push-button switch is for use in high quality commercial applications. The sophistication of the Series "CL" & "C" in terms of electrical construction (bifurcated contacts — coil spring loaded) and mechanical actions available will satisfy the most demanding switching requirements.

Tableau or stacked switches available either "CL" or "C" Series, 15 switches wide x 10 high per chassis. With the designation Series "CL" this switch is available with slip-on lamp holder. Use Type 5522 lamp. Button spacing is 17.5mm (.689").





Remove plunger, including button and the sliding bifurcated contacts, by loosening the locking bar.



SPECIFICATIONS: SERIES CL and C PUSH BUTTON SWITCHES

MECHANICAL DATA

Key travel = .315" Contact travel = .197"
Life 300,000 cycles depending upon load.
Key pressure — 2 & 4PDT = 35 oz.; 6 & 8PDT = 49 oz.

MECHANICAL ACTIONS AVAILABLE

Gr = Interlocking.
Gr₁, Gr₂ = Two independent interlocking groups.
o.A. = Momentary.
A.o.R. = Momentary release button for interlocking.
EE = Push-push.
Z = Central release for individual latching.
Sp = Blocking action only one key down. Switching is delayed to increase margin of safety.
Gr + Sp = Interlocking with blocking. Maximum 15 button (stations) in one row.
Gr₁, + Sp Gr₂, + Sp = Two groups of interlocking with blocking. (Group 1 can be blocked independent of Group 2.)
o.A. + VSp = Momentary action with blocking.
EE + VSp = Push to engage, push again to release — with blocking. The depressed button must first be released before another button can be depressed.
Gr + VSp + A.o.R. = Interlocking with blocking and locking of button with one central momentary release button. The depressed button must first be released by central release button or solenoid remote release, before another one button can be depressed.
Gr + RSp + A.o.R. = Locked — Interlocking with blocking. A central release button must first be depressed before any of one interlocked buttons can be depressed; this button remains latched after release button is allowed to return. The main circuit can be interrupted, if necessary, through the release button contacts. In this way, a 4 amp. circuit can be switched, without current, through standard C-Module switch contacts.

CHASSIS AND STATION DATA

Model Number 17.5
Center to center spacing .... 0.689"
Number of stations 1-15
Standard Buttons-Series "C" (Non-illuminated) CSX
Standard Buttons-Series "CL" (Illuminated) . CRS, CRR

CONTACT TYPES

Standard: Non-shorting — Solder Terminals Top, PC Terminals Bottom.
Shorting: ks Short PC top, Standard PC bottom: SI
Short PC terminals both sides: SC
Special cut off terminals either side .036" long.

INSULATION MATERIAL

Contact Plate: Phenolic 20.62.8 Kl.IV
Module: Polycarbonate (Makrolon)
Contact Plunger 2u, 4u: Polycarbonate (Makrolon)
Contact Plunger 6u, 8u: Polyamid
Outer Plunger: Azetalharz

ELECTRICAL DATA

Voltage Max.: 1000 volts.
Current Max.: 2 amps cos$_\phi$ = 1.
Load Max.: 100 watts ac.
Load Max.: 25 watts dc.
Test Voltages: Contact to ground 300 volts ac.
Terminal to terminal: 2000 volts ac.
Auxiliary terminals to outer-terminals: 100 volts ac.
Lamp holder contacts to ground: 1500 volts ac.
Insulation Resistance: 10^{12} Ω after 96 hours storage in 95-100% humidity.
Contact Resistance: 5 milli Ω.
Contact Resistance: After 25,000 switching cycles — about 15 milli Ω (depends on load).
Dielectric loss, tgδ 4×10^3 (300 kHz).

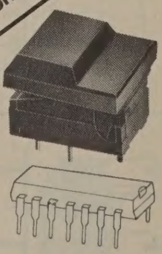
POWER SWITCH NC17 (UL, CSA and VDE Approved)

Max Voltage — 250 ac.
Max. Current — 6A (Cosϕ = 0.75)
Max. Current — 3A (Inductive load)
Max. Voltage — 250 dc.
Max. Current — 4A dc.
Test voltage between terminals & chassis: 3000V ac.
Test voltage between terminals & contacts: 2000V ac.
Contact Resistance: 50 milli Ω (With rated load).

---

digitast™

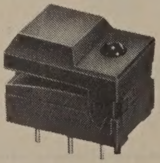
modular electronic switch input component



digitast

SR 12.3mm wide x 17.1mm

ST 17.3mm wide x 17.1mm (pictured)

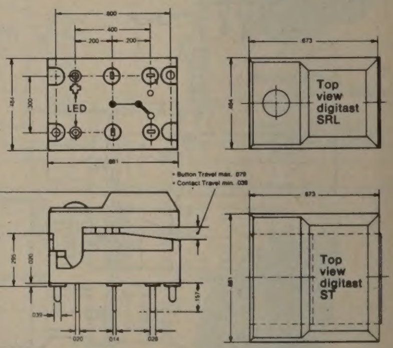


digitast

SRL (LED factory or customer installed) 12.3mm wide x 17.1mm (pictured)

STL (LED factory or customer installed) 17.3mm wide x 17.1mm

Digitast for use with DIP packages, consistent tactile feel, SPDT momentary spring loaded contact, less than 1 ms contact bounce, 24v 10ma rating. Mechanical life greater than 1 million operations. Available with built in LED. PCB mounting. Hot stamped graphics available.



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Manufacturing facilities in Minneapolis, Minnesota, Einbeck, W. Germany and W. Berlin
In Canada: Audio Electronics, 167 Denison St., Markham, Ontario L3R 1B5 • 416/495-0720

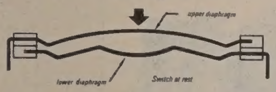
low cost
3 point contact
totally sealed
highest integrity

disc switch

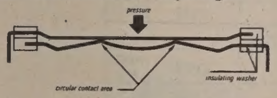
modular electronic components

TOTAL SEALING

The Disc switch is totally sealed through insert moulding and ultra-sonic welding.

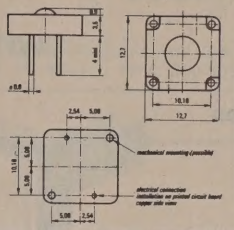

upper diaphragm
lower diaphragm
Switch at rest

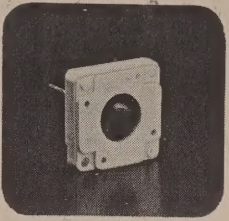
The Disc switch is built around two contact diaphragms separated by an insulating material. The profile of each of these two diaphragms is such that, under the action of applied pressure on the upper dome, it is momentarily collapsed, making instant positive, 3 point contact with the lower diaphragm.


pressure
circular contact area
insulating washer

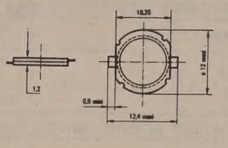
- High Reliability...10 X 10^6
- Self Cleaning
- Broad Range of Switching Power...from a few milliwatts to 30 watts.
- Low Bounce (less than 100 microseconds)

MD Disc module: Extra-flat momentary contact module. Shorter stroke configuration installable directly on printed circuit board. Enables you to design your own keyboard adapted to your own specific needs.

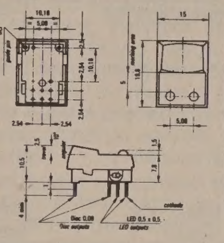

mechanical mounting (possible)
electrical connection installation on printed circuit board copper side view
10,16
12,7
2,54
5,08

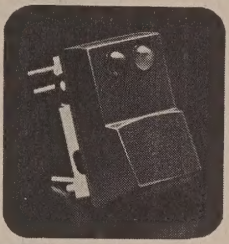


ED Disc element: Basic contact element; actuation of the basic contact element requires a resiliant (i.e., neoprene) cover on plunger with a minimum diameter of 3 MM/.118". Travel of the dome must be positively limited to 0.4 MM/.016". We can deliver this mounted on your printed circuit board to your specific requirements.

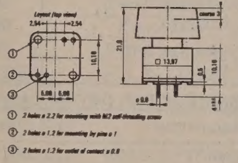


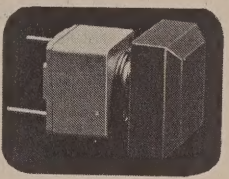
DMB Modular Rocker Disc Switch: Momentary contact for use on printed circuit board. Customer design and installation from bread board through production. Can be mounted in line on 15.24 MM/.600" centers or in a matrix (.600" x .800"). Available with one or two L.E.D.'s (red, green or yellow). Engraving or hotstamped graphics available.


10,16
5,08
15
2,54
cathode
Disc 0,08
Disc outputs
LED 0,5 x 0,5
LED outputs



TFD Alpha-numeric data entry keyboard style switch: Size, stroke and touch approximate industry standard for data entry switches. Low profile.


Layout (top view)
2,54
10,16
5,08
21,8
13,97
① 2 holes ø 2.2 for mounting with M2 self-threading screw
② 2 holes ø 1.2 for mounting by pins ø 1
③ 2 holes ø 1.2 for outlet of contact ø 0.8



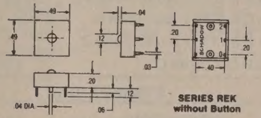
unique
versatile

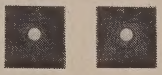
Series "R"™

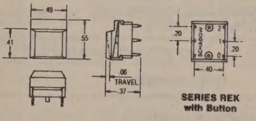
electronic switch input components

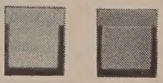
Series R is the economical answer for an electronic switch input component to use with standard dual-in-line packages (DIP's), ideally designed for incorporation into a broad variety of electronic devices including advanced microprocessor controlled equipment. Series R is compatible with TTL, CMOS Logic. Redundant contacts insure required reliability.

SERIES REK


49
20
12
04 DIA
06
03
SERIES REK without Button




49
41
55
06 TRAVEL
37
20
40
SERIES REK with Button

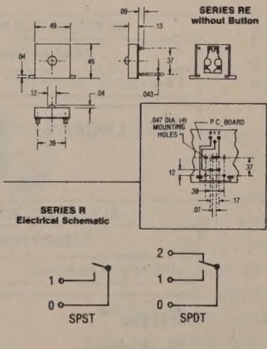


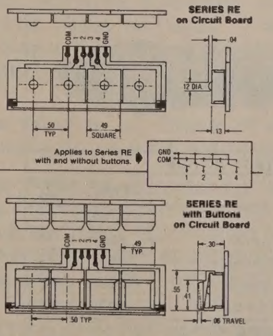
SPECIFICATIONS:

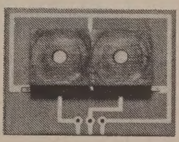
- Available in SPST and SPDT
- Extremely compact design
- Crisp, consistent tactile feel
- Installable on customer-designed printed circuit boards (edge connections or pin connections)
- Graphics available upon request
- Actuating method can be custom designed or use a choice of standard button colors: black, white, red, blue, green and orange.

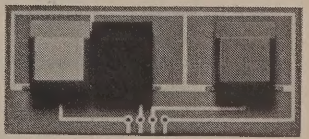
Wattage Capacity	.200mW (Series RE) 250mW (Series REK)
Voltage	20 V. (Series RE) 25 V. (Series REK)
Current	10mA
Contacts	Silver or Gold
Contact Resistance	≤100m (Series REK) ≤300m –1 (Series RE)
Contact Bounce	.1 Millisec. Max.
Operating Force	100 Grams
Travel	.03 in.
Life	10^6 Cycles @ 10mA
Temperature Range	–20°C to +70°C
Total Button Travel	0.8 mm
Pre-travel	0.4mm

SERIES RE


SERIES RE without Button
49
13
37
04
12
39
.047 DIA. (4) MOUNTING HOLES
P.C. BOARD
17
07
SERIES R Electrical Schematic
SPST
SPDT
0
1
2


SERIES RE on Circuit Board
COM
GND
12 DIA.
50 TYP
49 SQUARE
Applies to Series RE with and without buttons.
SERIES RE with Buttons on Circuit Board
30
55
41
50 TYP
06 TRAVEL





Due to continuing research and product technology, specifications are subject to change without notice.

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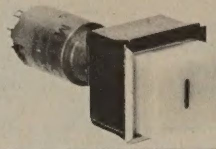
ILLUMINATED PRODUCTS INC.
A Subsidiary of Oak Industries Inc.

2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504

SWITCH SELECTION GUIDE

Friction Cap Presslites



MATCHING INDICATOR BASES

DESCRIPTION	TYPE	PAGE NO.
General Purpose	332,* 532* 534	4
Press-to-Test	533,* 535	4

MOMENTARY ACTION SWITCH BASES

DESCRIPTION	TYPE	PAGE NO.
½ Amp reed, single pole form A	830, 860	4
Low level S.P.D.T. 2 circuit form Z	545	5
	546	5
	567	5
	568	6
3 Amp S.P.D.T. 2 circuit form Z	542*	5
	543*	5
	562	5
	563	6
5 Amp S.P.D.T. form C	318, 518*	6
5 Amp D.P.D.T. form C	321, 521*	6
10.5 amp S.P.S.T.—N.O. form X	585*	7
10.5 Amp S.P.D.T. 2 circuit form Z	581*	7
10.5 Amp D.P.S.T.—N.O. form X	586*	7
10.5 Amp D.P.D.T. 2 circuit form Z	582*	8
15 Amp S.P.D.T. form C	319, 519*	8

ALTERNATE ACTION SWITCH BASES

DESCRIPTION	TYPE	PAGE NO.
5 Amp S.P.D.T. form C	316, 516*	6
5 Amp D.P.D.T. form C	320, 520*	6
10.5 Amp S.P.S.T.—N.O. form X	575*	7
10.5 Amp S.P.D.T. 2 circuit form Z	571*	7
10.5 Amp D.P.S.T.—N.O. form X	576*	7
10.5 Amp D.P.D.T. 2 circuit form Z	572*	8
15 Amp S.P.D.T. form C	317, 517*	8

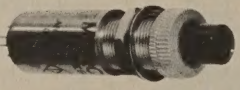
PUSHBUTTONS

DESCRIPTION	TYPE	PAGE NO.
Round, square, and rectangular. Various styles and colors	—	9-10

MOUNTING HARDWARE

DESCRIPTION	TYPE	PAGE NO.
Surface or recess mounting.	—	11-14

Low Profile Presslites



MOMENTARY ACTION

DESCRIPTION	TYPE	PAGE NO.
5 Amp S.P.D.T. form C	418,* 618*	15
10.5 Amp S.P.S.T.—N.O. form X	685*	16
10.5 Amp S.P.D.T. 2 circuit form Z	681*	16
10.5 Amp D.P.S.T.—N.O. form X	686*	16
10.5 Amp D.P.D.T. 2 circuit form Z	682*	16

ALTERNATE ACTION

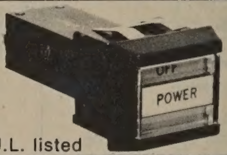
DESCRIPTION	TYPE	PAGE NO.
5 Amp S.P.D.T. form C	416,* 616*	15
10.5 Amp S.P.S.T.—N.O. form X	675*	16
10.5 Amp S.P.D.T. 2 circuit form Z	671*	16
10.5 Amp D.P.S.T.—N.O. form X	676*	16
10.5 Amp D.P.D.T. 2 circuit form Z	672*	16

Snap-in Presslites

MOMENTARY ACTION SWITCH

DESCRIPTION	TYPE	PAGE NO.
½ Amp S.P.S.T.—N.O. form X	590	17-18
	591	17-18
Matching indicators	592	17-18
	593	17-18

Rainbow(TM) Presslites



Contact module is U.L. listed

MOMENTARY ACTION

DESCRIPTION	TYPE	PAGE NO.
10.5 Amp S.P.S.T.—N.O. form X	1113	19-20
10.5 Amp S.P.D.T. 2 circuit form Z	1111	19-20
10.5 Amp D.P.S.T.—N.O. form X	1114	19-20
10.5 Amp D.P.D.T. 2 circuit form Z	1112	19-20

ALTERNATE ACTION

DESCRIPTION	TYPE	PAGE NO.
10.5 Amp S.P.S.T.—N.O. form X	1123	19-20
10.5 Amp S.P.D.T. 2 circuit form Z	1121	19-20
10.5 Amp D.P.S.T.—N.O. form X	1124	19-20
10.5 Amp D.P.D.T. 2 circuit form Z	1122	19-20

Watertight and E.M.I. Suppressed Presslites

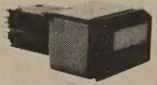
MOMENTARY ACTION

DESCRIPTION	TYPE	PAGE NO.
Watertight, 3 Amp S.P.D.T. 2 circuit	643	21

MOMENTARY OR ALTERNATE ACTION

DESCRIPTION	TYPE	PAGE NO.
Splashproof or oiltight	—	22
Splashproof and E.M.I. suppressed	—	22

Marcoflex



ALTERNATE & MOMENTARY ACTION

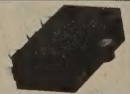
DESCRIPTION	PAGE NO.
1 Amp S.P.D.T. (Form C)	25-26

Split Legend

ALTERNATE & MOMENTARY ACTION

DESCRIPTION	PAGE NO.
10.5 Amp Form X and Z	23-24

Snipe(TM) Switches

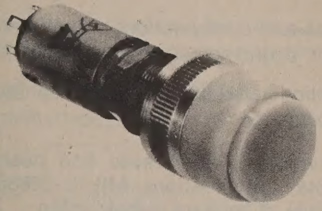


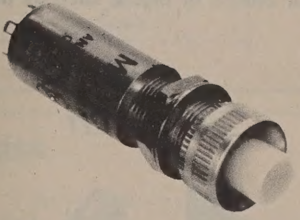
MOMENTARY ACTION

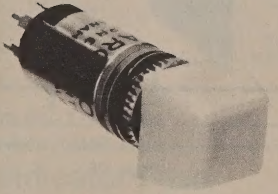
DESCRIPTION	TYPE	PAGE NO.
10.5 Amp single pole form X	669 ϕ	27
10.5 Amp single pole, 2 circuit form Z	670 ϕ	27

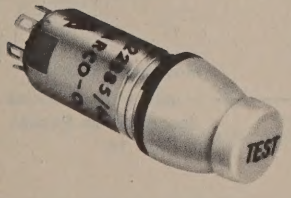
☐ Suitable for use with Light Emitting Diode (L.E.D.)
* UL Recognized
ϕ UL Listed and C.S.A. certified

Presslite Switches









Illuminated Products' versatile and expanding line of modular Presslite switch and matching indicator assemblies is the end product of years of continuing design improvement to meet the increasing demands of the control/display markets. The incorporation of modern materials, combined with rigid quality control procedures and continuous testing of production samples, assures high reliability and extremely long life.

A wide range of electrical ratings and contact configurations are available in both alternate (push-on-push-off) and momentary operation. Where the switch is operated within its rating, the following life expectancies apply:

Rating	Type	Expected Life at Rated Load
½ Amp	590, 591	1 to 3 million cycles
½ Amp	830, 860 (dry reed)	2 to 10 million cycles
3 Amps	542, 543, 545, 546, 562, 563, 565, 567, 568, 643	1 to 2 million cycles
5 Amps	316, 318, 320, 321, 416, 418, 516, 518, 520, 521, 616, 618	500,000 to 1 million cycles
10.5 Amps	571, 572, 575, 576, 581, 582, 585, 586, 671, 672, 675, 676, 681, 682, 685, 686, 700 series, 800 series, and all Rainbow™ switches	100,000 cycles @ 10.5 Amps to 1 million cycles @ 5 Amps
15 Amps	317, 319, 517, 519	50,000 to 100,000 cycles

Unless otherwise specified in the following pages, Presslite materials are as follows:

Contacts: Coin silver

Solder Terminals: Coin silver or plated brass

Terminal Insulation: Molded thermoset plastic

Housing: Anodized aluminum, except 10.5 amps Presslite bases on Pages 7, and 8, 16 and 19 which have thermoplastic and nickel plated brass mounting bushing housing.

Marcoflex switches on Pages 25 and 26 have one piece thermoplastic housing and terminal insulation.

Where the Presslite or Matching Indicator is to be used with a neon lamp, the A1H high brightness type is recommended. Best illumination is achieved with lunar or other light color pushbuttons. Green or blue should be avoided. A 27K ohm dropping resistor is recommended for the A1H neon lamp. On most types, this resistor can be provided as an integral part of the switch or indicator base.

Presslites, Friction Cap

Ordering Information

The Friction Cap Presslite series provides the broadest possible flexibility in terms of electrical characteristics, appearance and mounting procedure, allowing the user to "engineer" a switch assembly to meet his specific requirements.

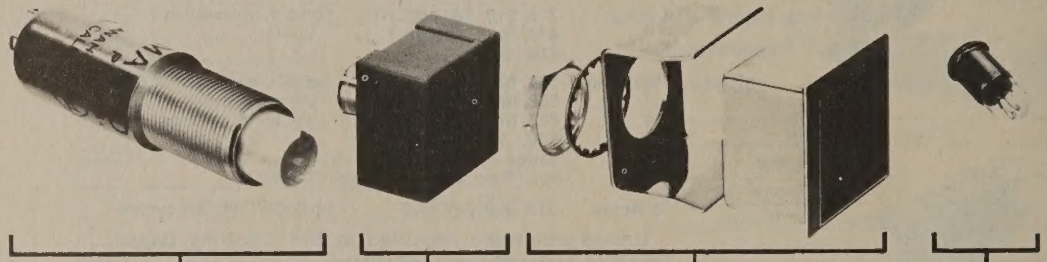
Many pushbutton sizes and configurations are offered, with sufficient space for engraved legends or symbols.

A wide range of mounting hardware is available to meet virtually every panel appearance or mounting requirement.

Many Presslite illuminated switch bases and pushbuttons meet applicable specifications MIL-S-22885. Consult factory for details of military construction.

A complete part number for a Friction Cap Presslite assembly consists of four blocks of digits, such as the following:

516 — 40112 — 51 — 327



Switch or Indicator Base Type — select from those described on Pages 4 thru 8.

Pushbutton — select assembly as described on Pages 9 and 10.

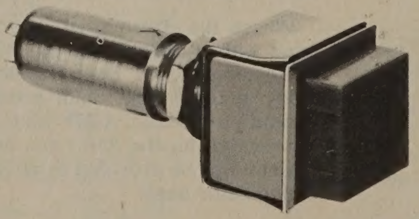
Mounting Hardware — select assembly as described on Pages 11 thru 14.

Lamps — T-1 ¾ midget flange base. Select from Group A, Page 28.

PUSHBUTTON CODE

4 0 1 12

Size — 4
Keying — 0
Style — 1
Color — 12



Complete Assembly Part Number 516-40112-51-327

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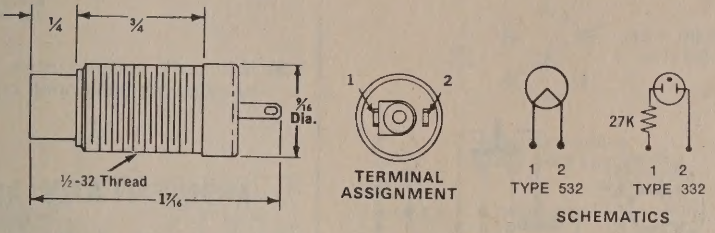
OAK

Presslites, Friction Cap

indicator base


¼
¾
⁹⁄₁₆ Dia.
½-32 Thread
1⁷⁄₁₆
1
2
TERMINAL ASSIGNMENT
1 2
TYPE 532
27K
1 2
TYPE 332
SCHEMATICS

TYPE 532

U.L. RECOGNIZED

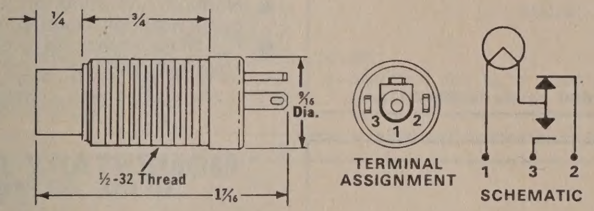
- Provides same pushbutton projection as Presslite switch bases in all styles of mounting hardware.

TYPE 332

U.L. RECOGNIZED
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 1 provides for A1H neon lamp operation.

press-to-test indicator base

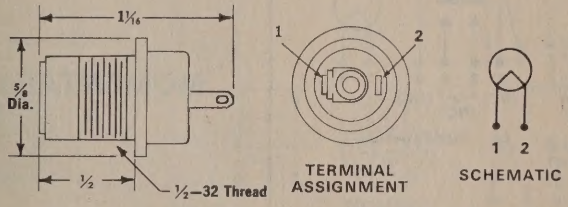

¼
¾
⁹⁄₁₆ Dia.
½-32 Thread
1⁷⁄₁₆
3
2
1
TERMINAL ASSIGNMENT
1 3 2
SCHEMATIC

TYPE 533

U.L. RECOGNIZED

- Provides same pushbutton projection as Presslite switch bases in all styles of mounting hardware.
- Nominal operating force: 16 oz.
- Nominal pushbutton travel: ¹⁄₃₂ in.

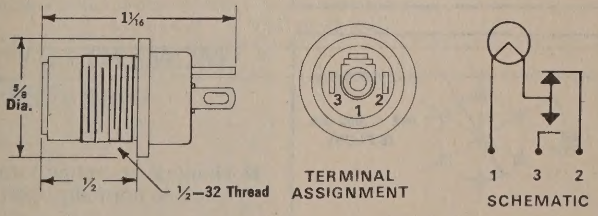
indicator base


1¹⁄₁₆
⅝ Dia.
½
½—32 Thread
1
2
TERMINAL ASSIGNMENT
1 2
SCHEMATIC

TYPE 534

- Intended for use with Friction Cap mounting hardware styles 7 and 8 only.
- Provides same pushbutton projection as Presslite switch bases.

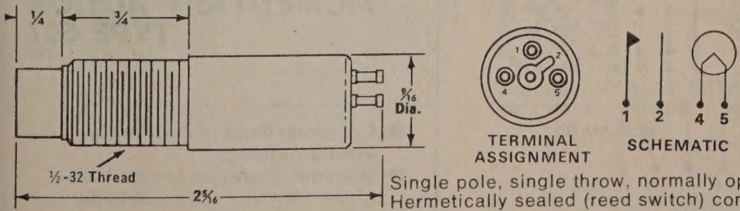
press-to-test indicator base


1¹⁄₁₆
⅝ Dia.
½
½—32 Thread
3
2
1
TERMINAL ASSIGNMENT
1 3 2
SCHEMATIC

TYPE 535

- Intended for use with Friction Cap mounting hardware styles 7 and 8 only.
- Provides same pushbutton projection as presslite switch bases.
- Nominal operating force: 16 oz.
- Nominal pushbutton travel: ¹⁄₃₂ in.

½ amp switch base


¼
¾
⁹⁄₁₆ Dia.
½-32 Thread
2⁵⁄₁₆
1
2
4
5
TERMINAL ASSIGNMENT
1 2 4 5
SCHEMATIC

Single pole, single throw, normally open (Form A)
Hermetically sealed (reed switch) contacts
Contact rating: ½ amp max., 200 volts max.
10 watts resistive max.
Nominal pushbutton travel: ³⁄₁₆ in.

MOMENTARY ACTION TYPE 830

- Nominal operating force: 5 oz.

MOMENTARY ACTION TYPE 860

- Nominal operating force: 10 oz.

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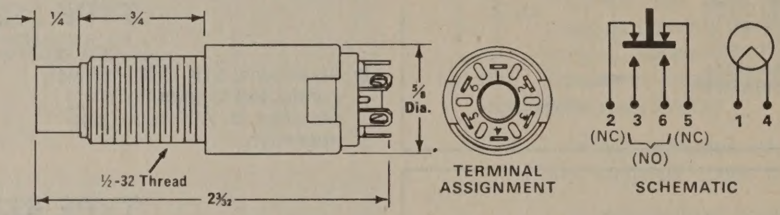
Presslites, Friction Cap

3 amp switch base


¼
¾
⅝ Dia.
½-32 Thread
2 3/32
TERMINAL ASSIGNMENT
2 3 6 5 1 4
(NC)
(NC)
(NO)
SCHEMATIC

Single pole, 2 circuit, double break (Form Z).
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.

MOMENTARY ACTION TYPE 542

U.L. RECOGNIZED

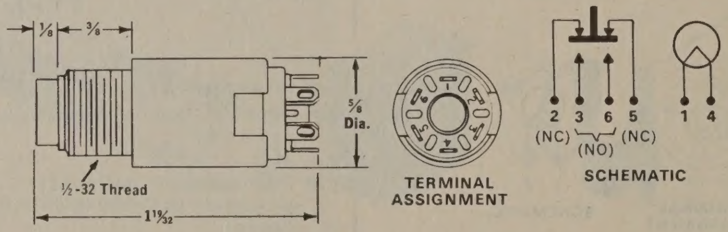
- Nominal operating force: 14 oz. to close normally open contacts.

MOMENTARY ACTION TYPE 545

LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.
- For 14 oz. operating force specify type 547.

3 amp switch base


⅛
⅜
⅝ Dia.
½-32 Thread
1 19/32
TERMINAL ASSIGNMENT
2 3 6 5 1 4
(NC)
(NC)
(NO)
SCHEMATIC

Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
Mounting hardware: intended for use with style 1 (knurled nut) or styles 7 and 8 (snap-in mounting adaptors).

MOMENTARY ACTION TYPE 543

U.L. RECOGNIZED

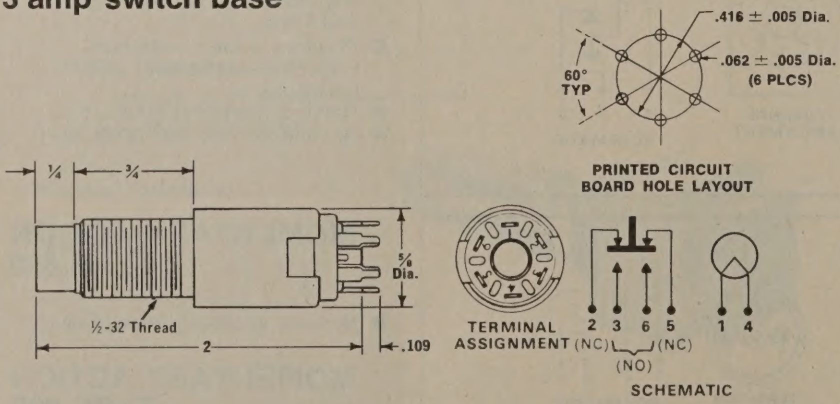
- Nominal operating force: 14 oz. to close normally open contacts.

MOMENTARY ACTION TYPE 546

LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

3 amp switch base


.416 ± .005 Dia.
.062 ± .005 Dia. (6 PLCS)
60° TYP
PRINTED CIRCUIT BOARD HOLE LAYOUT
¼
¾
⅝ Dia.
½-32 Thread
2
.109
TERMINAL ASSIGNMENT
2 3 6 5 1 4
(NC)
(NC)
(NO)
SCHEMATIC

Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
Terminals: Designed for soldering to P.C. Board.

MOMENTARY ACTION TYPE 562

- Nominal operating force: 14 oz. to close normally open contacts.

MOMENTARY ACTION TYPE 567

LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

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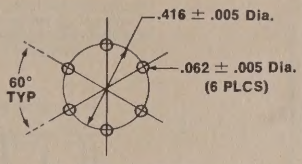
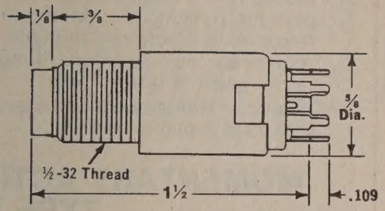
OAK

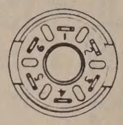
Presslites, Friction Cap

3 amp switch base

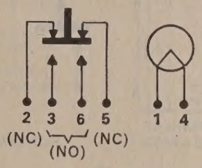


PRINTED CIRCUIT BOARD HOLE LAYOUT





TERMINAL ASSIGNMENT



SCHEMATIC

Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including $\frac{1}{32}$ in. pretravel and $\frac{1}{32}$ in. overtravel.
Mounting hardware: intended for use with style 1 (knurled nut) or styles 7 and 8 (snap-in mounting adaptors).

MOMENTARY ACTION TYPE 563

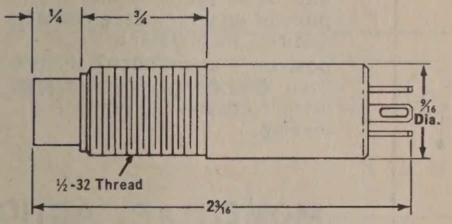
- Nominal operating force: 14 oz. to close normally open contacts.

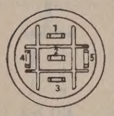
MOMENTARY ACTION, TYPE 568

LOW LEVEL

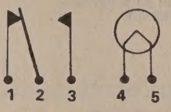
- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

5 amp switch base

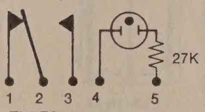




TERMINAL ASSIGNMENT



TYPES 516 & 518



TYPES 316 & 318

SCHEMATICS

Single pole, double throw (Form C) snap action contacts.
Contact rating: 5 amps resistive at 115 VAC or 28 VDC

ALTERNATE ACTION TYPE 516

U.L. RECOGNIZED

- Nominal operating force: 24 oz.
- Nominal pushbutton travel: $\frac{7}{32}$ in.

TYPE 316

INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 5, provides for A1H neon lamp operation.

MOMENTARY ACTION TYPE 518

U.L. RECOGNIZED

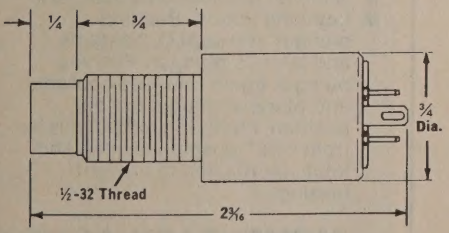
- Nominal operating force: 32 oz.
- Nominal pushbutton travel: $\frac{3}{32}$ in.

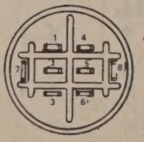
TYPE 318

INTERNAL RESISTOR

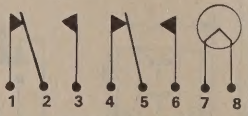
- An internal 27K OHM resistor, connected to terminal No. 5, provides for A1H neon lamp operation.

5 amp switch base

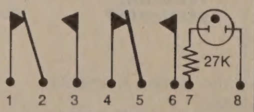




TERMINAL ASSIGNMENT



TYPES 520 & 521



TYPES 320 & 321

SCHEMATICS

Double pole, double throw (Form C) snap action contacts.
Contact rating: 5 amps resistive at 115 VAC or 28 VDC.

ALTERNATE ACTION TYPE 520

U.L. RECOGNIZED

- Nominal operating force: 32 oz.
- Nominal pushbutton travel: $\frac{7}{32}$ in.

TYPE 320

INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 7, provides for A1H neon lamp operation.

MOMENTARY ACTION TYPE 521

U.L. RECOGNIZED

- Nominal operating force: 40 oz.
- Nominal pushbutton travel: $\frac{3}{32}$ in.

TYPE 321

INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 7, provides for A1H neon lamp operation.

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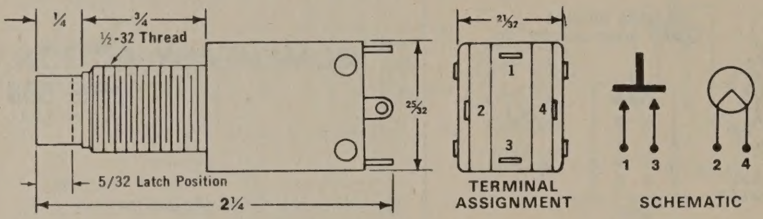
OAK

Presslites, Friction Cap

10.5 amp switch base


¼
¾
½-32 Thread
25/32
5/32 Latch Position
2¼
21/32
1
2
4
3
1 3
2 4

TERMINAL ASSIGNMENT

SCHEMATIC

Single pole, single throw, double make (Form X) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

ALTERNATE LATCHING ACTION TYPE 575

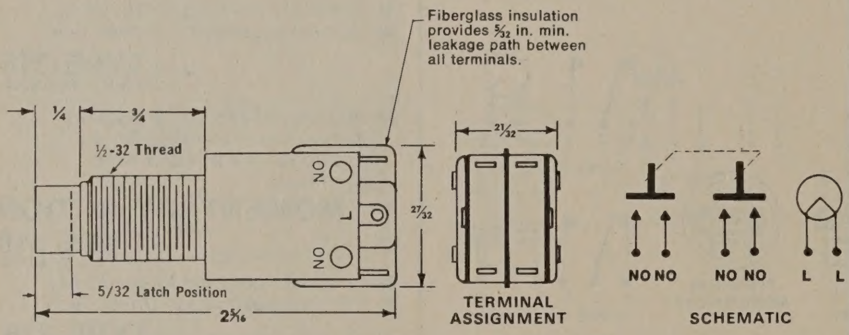
- Nominal operating force: 12 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger, pushing plunger again releases contacts and plunger returns to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

MOMENTARY ACTION TYPE 585

- Nominal operating force: 10 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

10.5 amp switch base


Fiberglass insulation provides 5/32 in. min. leakage path between all terminals.
¼
¾
½-32 Thread
NO
L
NO
27/32
5/32 Latch Position
2 5/16
21/32
NO NO
NO NO
L L

TERMINAL ASSIGNMENT

SCHEMATIC

Double pole, single throw, double make (Form X) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

ALTERNATE LATCHING ACTION TYPE 576

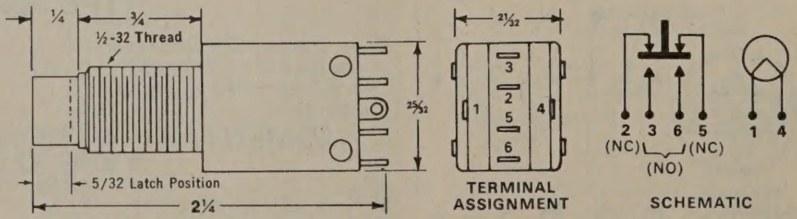
- Nominal operating force: 20 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and returns plunger to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

MOMENTARY ACTION TYPE 586

- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

10.5 amp switch base


¼
¾
½-32 Thread
25/32
5/32 Latch Position
2¼
21/32
3
2
1
5
4
6
2 3 6 5
1 4
(NC)
(NC)
(NO)

TERMINAL ASSIGNMENT

SCHEMATIC

Single pole, 2 circuit, double break (Form Z) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

ALTERNATE LATCHING ACTION TYPE 571

- Nominal operating force: 12 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and plunger returns to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

MOMENTARY ACTION TYPE 581

- Nominal operating force: 10 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

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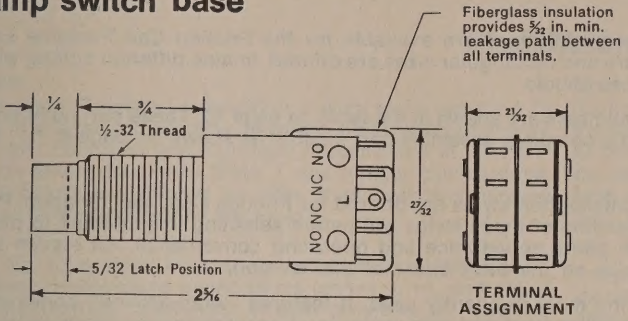
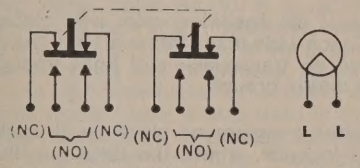
Presslites, Friction Cap

10.5 amp switch base


Fiberglass insulation provides 5/32 in. min. leakage path between all terminals.
1/4
3/4
1/2-32 Thread
NO NC NC NO
L L
27/32
5/32 Latch Position
2 5/16
21/32
TERMINAL ASSIGNMENT


(NC)
(NC)
(NO)
(NC)
(NC)
(NO)
L
L

SCHEMATIC

Double pole, 2 circuit, double break (Form Z) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
1/4 H.P., 125/250 VAC

ALTERNATE LATCHING ACTION TYPE 572

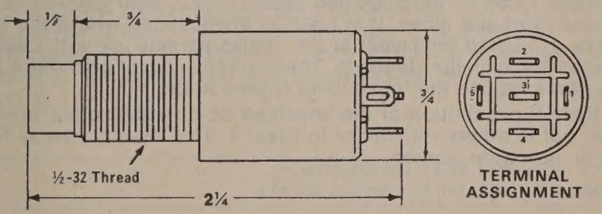
- Nominal operating force: 20 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and returns plunger to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

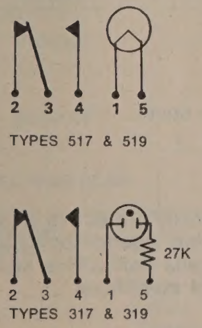
MOMENTARY ACTION TYPE 582

- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

15 amp switch base


1/8
3/4
3/4
1/2-32 Thread
2 1/4
2
3
1
5
4
TERMINAL ASSIGNMENT


2 3 4 1 5
27K
2 3 4 1 5

TYPES 517 & 519

TYPES 317 & 319

SCHEMATICS

Single pole, double throw (Form C) snap action contacts.
Contact rating: 15 amps resistive at 115 VAC or 28 VDC.

ALTERNATE ACTION TYPE 517

- Nominal operating force: 32 oz.
- Nominal pushbutton travel: 7/32 in.

TYPE 317

INTERNAL RESISTOR

- An internal 27K OHM resistor connected to terminal No. 5 provides for A1H neon lamp operation.

MOMENTARY ACTION TYPE 519

- Nominal operating force: 40 oz.
- Nominal pushbutton travel: 5/32 in.

TYPE 319

INTERNAL RESISTOR

- An internal 27K OHM resistor connected to terminal No. 5 provides for A1H neon lamp operation.

Presslites, Friction Cap

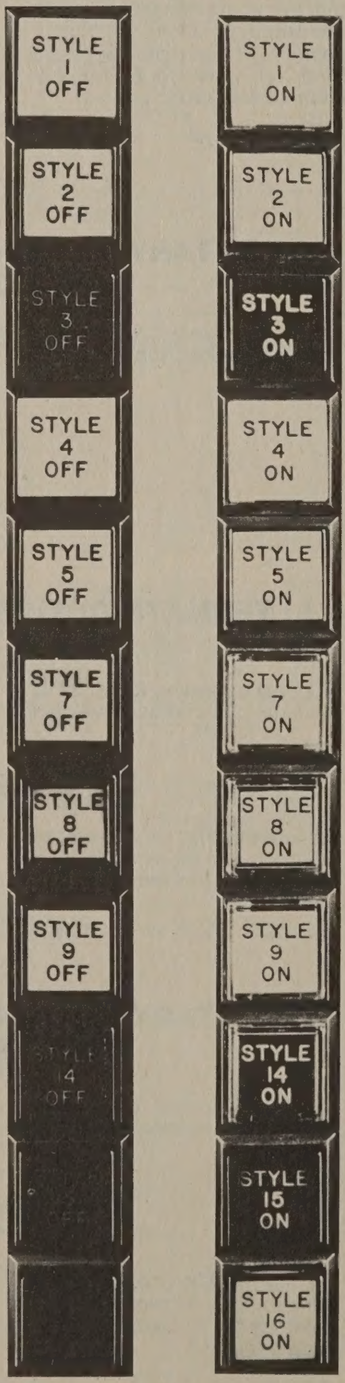
Pushbuttons

A wide variety of pushbuttons are available for the Friction Cap Presslite switch line. Round, square and rectangular sizes are offered, in nine different colors, with or without legends or symbols.

Pushbutton part numbers are shown in the table on page 13. These part numbers are used to construct a complete assembly part number as shown on page 6.

STYLES

Eleven different pushbutton styles are offered for Friction Cap and Snap-in Presslites. An understanding of these styles will permit selecting pushbuttons to provide the best possible panel appearance and operating convenience. All eleven styles are shown in color on the back cover of this catalog.



Style 1 . . . . . is the most frequently used. It features "wrap-around" construction, providing front and side surfaces of one continuous piece of translucent plastic in the color specified. It also provides the largest possible legend area in each size.

Style 2 . . . . . provides a flat lens of the specified color with black opaque sides. It is used where a $\frac{1}{32}$ inch wide black frame around the illuminated area is desired, or where no transmission of light through the sides is allowed, such as in matrix groups.

Style 3 . . . . . is a Style 1 pushbutton oversprayed black on all surfaces. It is used only with engraved legends, where the message illuminates in the specified color while the background remains black. This style provides maximum legibility in the "on" condition. Where severe usage is anticipated, a protective cover (Style 14 or 15) is recommended to prevent damage to the black surface.

Style 4 . . . . . has a lunar Style 1 wrap-around lens with an internal filter of the specified color. The color is visible only when the lamp is "on". In a low ambient light environment, Style 4 is virtually identical to Style 1 in appearance. The greater the ambient light, the less saturated the appearance of the color when the lamp is on.

Style 5 . . . . . is similar in performance to Style 4, but features black opaque sides with the $\frac{1}{32}$ inch wide frame around the illuminated area, as described under Style 2.

Style 7 . . . . . is a Style 1 cap of the specified color, with a clear protective cover over the front and sides. It is used in applications where the legend must be protected from wear or dirt. It also permits use with customer-provided film or vellum legends. The protective cover provides a $\frac{1}{16}$ inch wide frame around the translucent legend area.

Style 8 . . . . . is a Style 2 pushbutton of the specified color with a clear protective cover, but is otherwise similar to Style 7. The legend area is framed by a $\frac{3}{32}$ inch wide border.

Style 9 . . . . . is a Style 4 pushbutton with a clear protective cover. The legend area is framed by a $\frac{1}{16}$ inch wide border.

Style 14 . . . . is a Style 3 pushbutton with a clear protective cover.

Style 15 . . . . is a Style 3 pushbutton with a grey, neutral density protective cover of about 25% light transmission, for use in hidden legend applications. The legend is nearly invisible when the lamp is "off". This style is particularly effective under high ambient light conditions.

Style 16 . . . . is a Style 4 pushbutton with the neutral density cover described in Style 15. In the "off" condition, the background is dark grey, and the legend is barely visible under normal ambient light levels. When "on", the background illuminates in the selected color, and is framed by a $\frac{1}{16}$ inch wide black border.

ILLUMINATED PRODUCTS INC.
A Subsidiary of Oak Industries Inc.
2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
Tel: (714) 540-9471 TWX: 910-595-1504
OAK

Presslites, Friction Cap

Pushbuttons

COLORS

The standard Presslite pushbutton colors were selected to provide the best compromise between pleasing appearance in the "off" condition and high light transmission in the "on" condition when used with Style 1 and similar pushbuttons. Several colors are offered in more than one transmission grade, or otherwise require discussion:

White
(Color No. 5) is snow white in the off condition. When used with black oversprayed pushbuttons (styles 3, 14, and 15), a pale blue internal color filter is also provided to eliminate possible confusion with yellow when the lamp is on.

Lunar
(Color No. 17) provides transmission characteristics midway between clear and white (color No. 5). It is recommended where high ambient light level might otherwise make it difficult to determine when the lamp behind a white lens is "on", or in applications involving low brightness lamps such as neons. Because of its high transmission, the outline of the filament is slightly noticeable. Lunar is also used in Styles 4, 5, 9, and 16 Presslite pushbuttons to provide maximum color transmission from the internal color filter. When supplied as color No. 5 (White, when lamp is on), a pale blue internal color filter is also provided in Styles 4, 5, 9, and 16, to eliminate possible confusion with yellow when the lamp is on.

Red
(Colors No. 6 and 36) is provided in two transmission grades to meet both general purpose and warning applications. Color No. 6 is a pure "lipstick red" color in the "off" condition, providing excellent diffusion when "on". Color No. 36 is recommended for warning applications and for use with neon lamps. This color is much darker in the "off" condition than Color No. 6, and provides greater light transmission. In high ambient light areas, Color No. 36 provides a greater on-off contrast ratio than does No. 6.

Green
(Colors No. 7 and 37) is also provided in two transmission grades. Color No. 7 is a rather dark, "grass green" in the "off" condition and is a very saturated, pure green when "on". No. 37 is a greyish-green in the "off" condition and transmits more light when "on" than does No. 7. Both grades completely hide the lamp filament. Green is not satisfactory for use with neon lamps.

Blue
(Color No. 11) is selected in a transmission grade that allows the lamp filament to be slightly noticeable. This is necessary to provide sufficient brightness for general use, since incandescent lamps have very little blue in their output. Like green, blue cannot be used with neon lamps.

Other Standard Colors offered are yellow (No. 12) and orange (No. 16).

Frequently, styling considerations for a commercial product dictate the use of non-standard colors to achieve a particular effect. Illuminated Products' engineers will be glad to assist you in developing special colors for such applications.

LEGENDS

In addition to identifying the function of Presslite pushbuttons and indicator lens caps by the suitable selection of colors, their versatility and convenience may be greatly extended by an engraved or hot-stamped legend.

Hot stamping is not as durable as engraving. While it is entirely satisfactory for indicator lens caps and infrequently used pushbuttons, it is not recommended in applications where the pushbutton may be operated many times a day. In this case engraving is essential.

The most common type used for hot-stamped and engraved legends is ⅛ inch high News Gothic, which permits an average of about 8 letters per horizontal inch. For best appearance, at least 1/16 inch of space should be allowed at both the beginning and end of each line. The same amount of space should be allowed between lines. For example, a ¾ inch square pushbutton will accept 3 lines of type, each line having up to 5 letters, while a ½ inch square pushbutton can accommodate only 2 lines of 3 letters each. Where more letters per line are required, Condensed News Gothic may be used or the letter size reduced.

Most Illuminated Products' distributors provide custom engraving of Presslites and indicators, and the factory maintains a well equipped engraving and hot stamping department. When ordering custom engraving, full details should be provided on a drawing or sketch. Unless otherwise specified by the customer, black letters will be used on white, orange, and yellow backgrounds, and white will be used on red, green, and blue backgrounds.

PUSHBUTTON PART NUMBERS FOR FRICTION CAP PRESSLITES
(Where a number is not shown, the pushbutton is not available in that style)

PUSHBUTTON SHAPE	PUSHBUTTON SIZE	PUSHBUTTON STYLE (See Page 9)										
		1	2	3	4	5	7	8	9	14	15	16
ROUND	½ IN.	1016	1026	1036	—	—	—	—	—	—	—	—
	⅝ IN.	6016	6026	6036	6046	6056	6076	6086	—	60146	60156	—
	¾ IN.	5016	5026	5036	5046	5056	—	—	—	—	—	—
SQUARE	½ IN.	2016	2026	2036	2046	2056	—	—	—	—	—	—
	⅝ IN.	3016	3026	3036	3046	3056	—	—	—	—	—	—
	¾ IN.	4016	4026	4036	4046	4056	4076	4086	4096	40146	40156	40166
	¾ IN. KEYBOARD	15016	—	—	15046	—	—	—	—	—	—	—
RECTANGULAR	½ x ¾ IN.	8016	—	8036	8046	—	—	—	—	—	—	—
	½ x ⅞ IN.	7016	7026	7036	7046	7056	—	—	—	—	—	—
	¾ x 1 IN.	12016	12026†	12036	12046	12056†	—	12086	12096†	—	—	—

Pushbutton Colors: Last digit, 6, of above part number designates translucent red color.

For other colors, substitute one of the following:

White*: 5 Dark Red*: 36 Orange: 16 Blue: 11
Yellow: 12 Light Green*: 37 Green: 7 Lunar*: 17

*Colors 5, 17, 36, and 37 not available in Styles 4, 5, 9, and 16 (internal color filters).

Above part numbers are for unkeyed (rotatable) caps.
For keyed (non-rotatable) caps, substitute "1" for the first "0" of the part number. Example: 1016 is unkeyed. 1116 is keyed.

Square or rectangular mounting hardware provides inherent cap keying. Therefore, assemblies which use square or rectangular recess adaptors or recess barrier mounts are provided with unkeyed caps.

Pushbutton Materials: All of the above pushbuttons are high impact-resistant plastic per L-P-349a (Tenite) except those marked "†" are per L-P-393 (polycarbonate).

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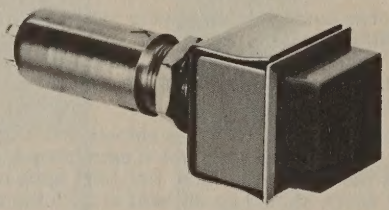
Presslites, Friction Cap

Friction Cap Presslite Mounting Hardware



The versatility of Illuminated Products' Presslites is extended by the broad selection of mounting hardware styles and finishes. These include knurled nut and safety collar for surface or sub panel mounting, and 6 different recess mounting configurations including the low cost snap-in type.

The third block of digits in the complete Presslite part number identifies mounting hardware, as follows:

516 — 40112 — 51 — 327

Finish
1 Bright
2 Black

Style
1 Knurled Nut
4 Safety Collar
5 Recess Adaptor
6 Recess Barrier Mount
7 Flush Snap-In Mount
8 Barrier Snap-In Mount
50X Recess Adaptors on Mounting Strip
60X Recess Barrier Mounts on Mounting Strip

The above part number describes an assembly which includes a bright recess adaptor.

The projection of the Presslite base behind the front of the mounting panel depends on the base type, and the style of mounting hardware, as shown below. To determine projection behind the back of the panel, the panel thickness must be subtracted from this dimension.

BASE PROJECTION BEHIND FRONT OF MOUNTING PANEL

OVERALL BASE LENGTH (See pages 4-8)	MOUNTING HARDWARE STYLE (See pages 12-14)							
	1 KNURLED NUT	4 SAFETY COLLAR	5 RECESS ADAPTOR	6 RECESS BARRIER MOUNT	7 FLUSH SNAP-IN MOUNT	8 BARRIER SNAP-IN MOUNT	50X RECESS MOUNTING STRIP	60X BARRIER MOUNTING STRIP
1 1/16	—	—	—	—	1 5/16	1 5/16	—	—
1 7/16	1 1/16	15/16	1 7/16	1 7/16	1 11/16	1 11/16	1 7/16	1 7/16
1 19/32	1 11/32	—	—	—	1 13/16	1 13/16	—	—
2 3/32	1 3/4	1 5/8	2 3/16	2 3/16	2 5/16	2 5/16	2 1/4	2 1/4
2 3/16	1 13/16	1 11/16	2 5/16	2 5/16	2 7/16	2 7/16	2 5/16	2 5/16
2 1/4	1 7/8	1 3/4	2 3/8	2 3/8	2 1/2	2 1/2	2 3/8	2 3/8
2 5/16	1 15/16	1 13/16	2 7/16	2 7/16	2 9/16	2 9/16	2 7/16	2 7/16

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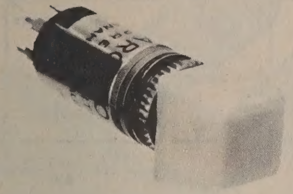
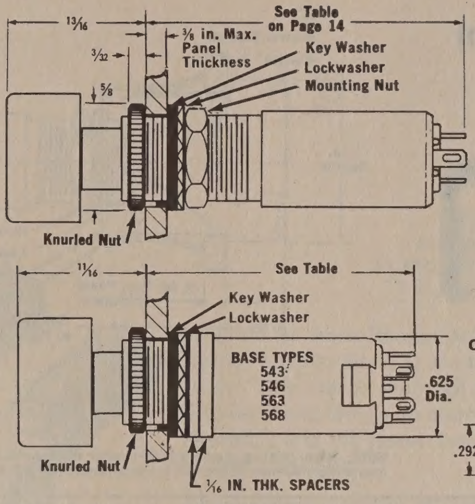
Presslites, Friction Cap

STYLE 1
knurled nut



Materials and Finishes:
Knurled nut: anodized aluminum.
Key washer: brass, nickel plated.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.


13/16
See Table on Page 14
3/8 in. Max. Panel Thickness
3/32
5/8
Key Washer
Lockwasher
Mounting Nut
Knurled Nut
11/16
See Table
Key Washer
Lockwasher
BASE TYPES
543
546
563
568
.625 Dia.
Knurled Nut
1/16 IN. THK. SPACERS

Recommended mounting tool for tightening knurled nut:
Marco Oak #51630

AVAILABLE PUSHBUTTON SIZES

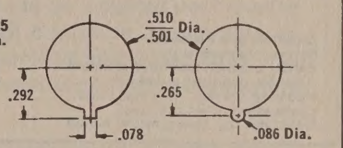
○ 1/2 in. round
5/8 in. round
3/4 in. round

□ 1/2 in. square
5/8 in. square
3/4 in. square

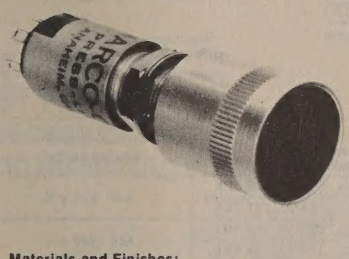
▭ 1/2 in. x 3/4 in. rect.
1/2 in. x 7/8 in. rect.
3/4 in. x 1 in. rect.

FINISH
Bright (No. 1) or Black (No. 2)

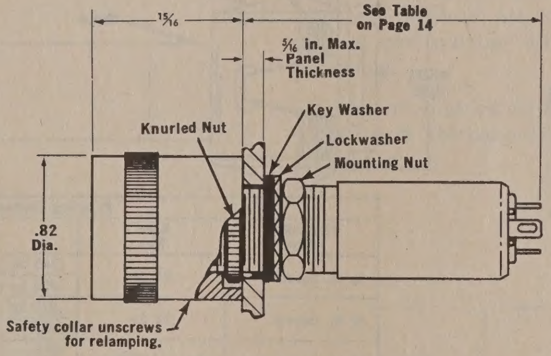
PANEL CUTOUTS (Key washer and slot may be omitted in some installations)


.510
.501
Dia.
.292
.078
.265
.086 Dia.

STYLE 4
safety collar



Materials and Finishes:
Safety collar: anodized aluminum.
Knurled nut: anodized aluminum.
Key washer: brass, nickel plated.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.


15/16
See Table on Page 14
5/16 in. Max. Panel Thickness
Key Washer
Knurled Nut
Lockwasher
Mounting Nut
.82 Dia.
Safety collar unscrews for relamping.

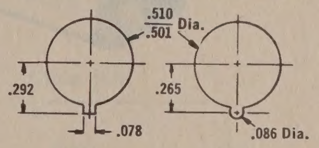
Recommended mounting tool for tightening knurled nut:
Marco Oak #51630.

AVAILABLE PUSHBUTTON SIZES

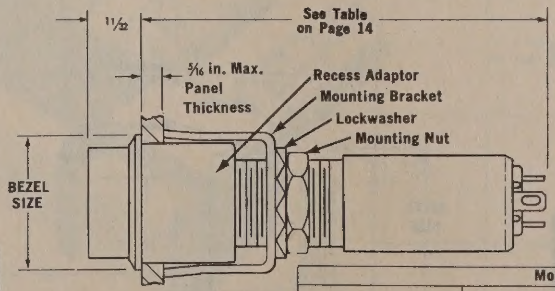
○ 3/4 in. round

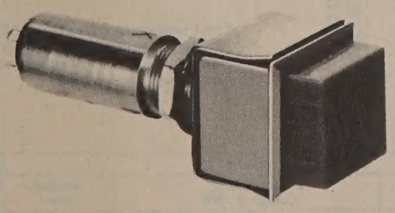
FINISH
Bright (No. 1) only

PANEL CUTOUT (Key washer and slot may be omitted in some installations)


.510
.501
Dia.
.292
.078
.265
.086 Dia.

STYLE 5
recess adaptor


11/32
See Table on Page 14
5/16 in. Max. Panel Thickness
Recess Adaptor
Mounting Bracket
Lockwasher
Mounting Nut
BEZEL SIZE



Materials and Finishes:
Recess adaptor: aluminum, anodized or bright nickel plated.
Mounting bracket: stainless steel.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

AVAILABLE PUSHBUTTON SIZES

○ 1/2 in. round
5/8 in. round
3/4 in. round

□ 1/2 in. square
5/8 in. square
3/4 in. square

▭ 1/2 in. x 7/8 in. rect.

FINISH
Bright (No. 1) or Black (No. 2)

Mounting Dimensions

Pushbutton Size	Bezel Size	Panel Cutout Dimensions	
		Single Unit $+.015$ $-.000$	Stacked Units
1/2 in. Round	.65 Dia.	.562 Dia.	——
5/8 in. Round	.80 Dia.	.718 Dia.	——
3/4 in. Round	.93 Dia.	.843 Dia.	——
1/2 in. Square	.67 Sq.	.571 Sq.	Add .671 x N *
5/8 in. Square	.81 Sq.	.718 Sq.	Add .817 x N *
3/4 in. Square	.94 Sq.	.843 Sq.	Add .942 x N *
1/2 in. 7/8 in. Rect.	.67 x 1.05 Rect.	.571 x .961 Rect.	Add 1.060 x N *

*N = No. of additional units. Example: Cutout length for three 1/2 in. sq. recess adaptors is .671 x 2 + .571 = 1.913 $^{+.015}_{-.000}$

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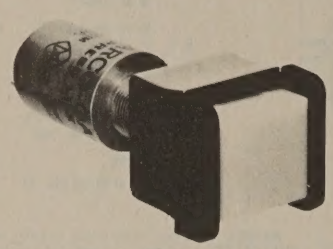
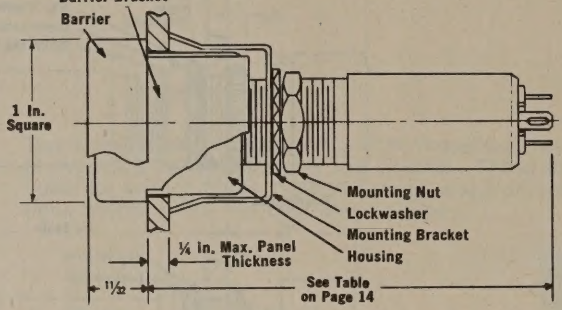
Presslites, Friction Cap

STYLE 6
recess barrier mount

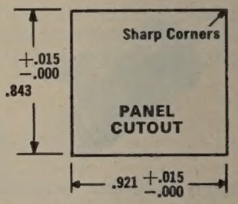



Barrier Bracket
Barrier
1 In. Square
Mounting Nut
Lockwasher
Mounting Bracket
Housing
¼ in. Max. Panel Thickness
11/32
See Table on Page 14

AVAILABLE PUSHBUTTON SIZES

☐ ¾ in. square

FINISH
Black (No. 2) only

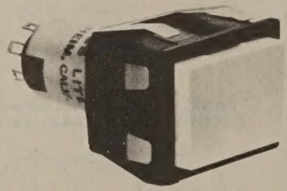

Sharp Corners
PANEL CUTOUT
.843 +.015 −.000
.921 +.015 −.000

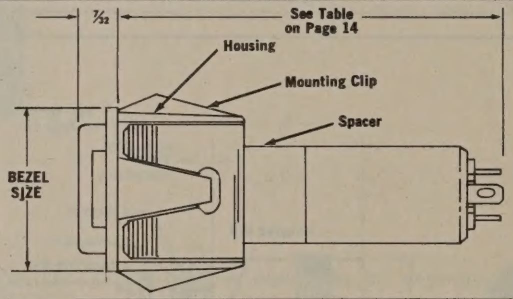
For each additional assembly add .906.

Materials and Finishes:
Barrier: thermoplastic.
Barrier bracket: anodized aluminum.
Housing: anodized aluminum.
Mounting bracket: stainless steel.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

NOTE: When ordering please specify number of assemblies to be mounted in a single slot, to assure proper quantity of intermediate barriers. (Style 60X is recommended where 3 or more switches are to be mounted together.)

STYLE 7
flush snap-in mount




7/32
See Table on Page 14
Housing
Mounting Clip
Spacer
BEZEL SIZE

AVAILABLE PUSHBUTTON SIZES

☐ ⅝ in. square**
¾ in. square

☐ ¾ in. x 1 in. rectangular

FINISH
Black (No.2) only

**Not recommended for use with 10.5 amp Presslite bases shown on pages 10 and 11, since they will not pass through panel cutout.

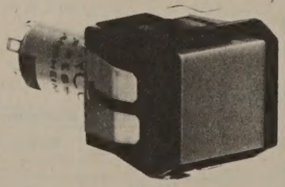
Mounting Dimensions

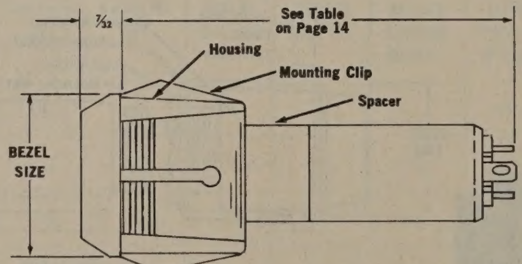
Pushbutton Size	Bezel Size	Single Unit Cutout ±.005	Stacked Units*
⅝ in. Square **	.81 Sq.	.745 for panels .050 to .120 THK.	Add .815 x N
		.755 for panels .120 to .187 THK.	
¾ in. Square	.94 Sq.	.870 for panels .050 to .120 THK.	Add .940 x N
		.880 for panels .120 to .187 THK.	
¾ in. x 1 in. Rect.	.94 x 1.18 Rect.	.870 x 1.110	Add .942 x N Vertical
			Add 1.182 x N Horizontal

*N = No. of additional units. Example: Cutout length for three ⅝ in sq. mounts is .815 x 2 + .745 = 2.375 ±.005.

Materials and Finishes:
Housing: thermoplastic.
Mounting clip: stainless steel.
Spacer: aluminum.

STYLE 8
barrier snap-in mount




7/32
See Table on Page 14
Housing
Mounting Clip
Spacer
BEZEL SIZE

AVAILABLE PUSHBUTTON SIZES

☐ ⅝ in. square**
¾ in. square

FINISH
Black (No. 2) only

**Not recommended for use with 10.5 amp Presslite bases shown on pages 10 and 11, since they will not pass through panel cutout.

Mounting Dimensions

Pushbutton Size	Bezel Size	Single Unit Cutout ±.005	Stacked Units*
⅝ in Square**	.81 Sq.	.745 for panels .050 to .120 THK.	Add .815 x N
		.755 for panels .120 to .187 THK.	
¾ in. Square	.94 Sq.	.870 for panels .050 to .120 THK.	Add .940 x N
		.880 for panels .120 to .187 THK.	

*N = No. of additional units. Example: Cutout length for three ⅝ in sq. mounts is .815 x 2 + .745 = 2.375 ±.005.

Materials and Finishes:
Housing: thermoplastic.
Mounting clip: stainless steel.
Spacer: aluminum.

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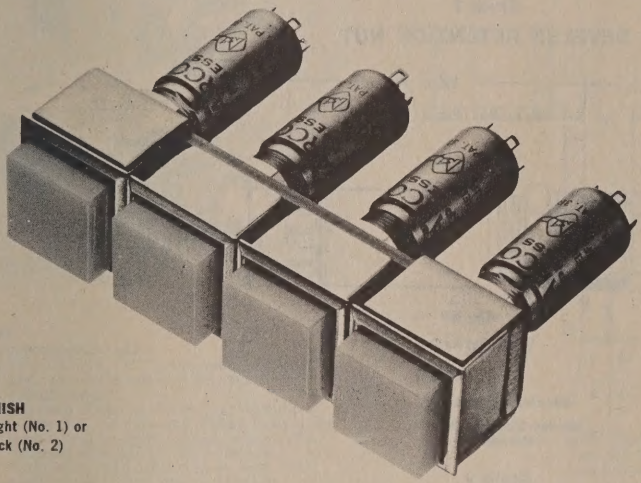
Presslites, Friction Cap

STYLE 50X recess adaptors on mounting strip



FINISH
Bright (No. 1) or
Black (No. 2)

Available
Pushbutton Sizes
☐ ¾ In. Square

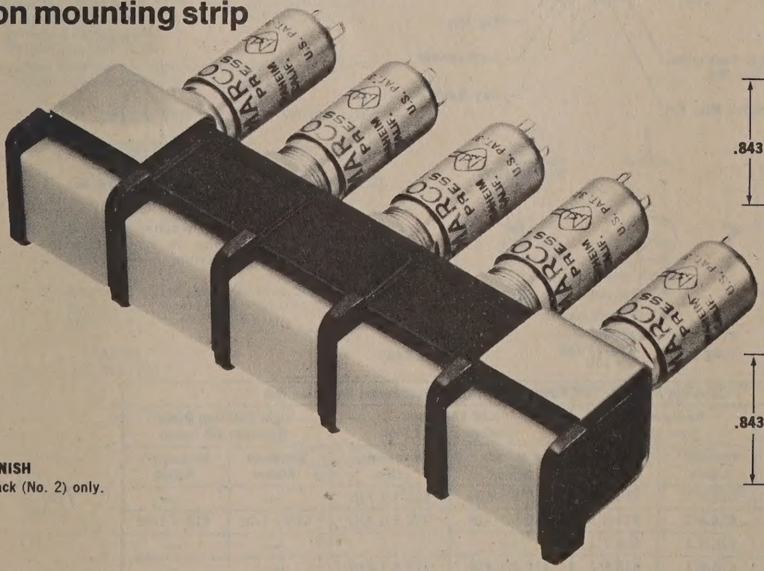
Where 3 or more Recess Adaptors (Style 5) or Recess Barrier Mounts (Style 6) are to be mounted next to each other, it is recommended complete assemblies be ordered mounted on an aluminum strip to facilitate final assembly into the panel. Installation requires tightening of only 2 hex nuts.

When ordering 50X or 60X assemblies, X is the number of stations. Thus, part no. 516-4015-5081 describes an 8 station recess adaptor assembly with bright finish.

Where more than one type of base or pushbutton color is to be installed on the mounting strip, or special legends are required, provide complete information and a special part number will be assigned to identify the assembly.

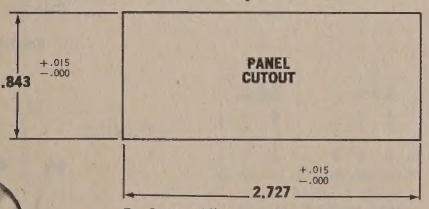
The mounting strips do not alter space requirements of Style 5 or 6. The panel cutouts for 3 or more stations are as follows:

STYLE 60X recess barrier mounts on mounting strip



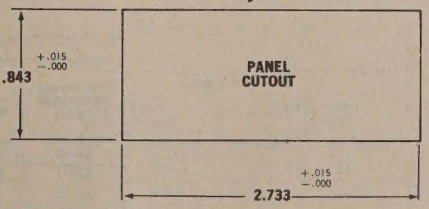
FINISH
Black (No. 2) only.

Style 50X



For 3 assemblies on strip.
For each additional assembly add .942.

Style 60X



For 3 assemblies on strip.
For each additional assembly add .906.

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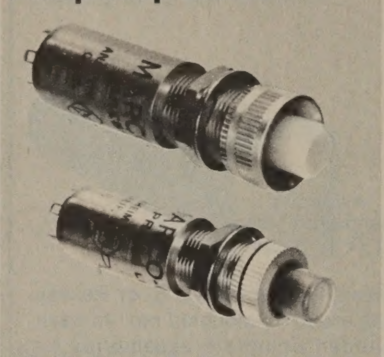
OAK

Presslites, Low Profile

5 amp snap action



Suitable for use with Light Emitting Diode (L.E.D.)

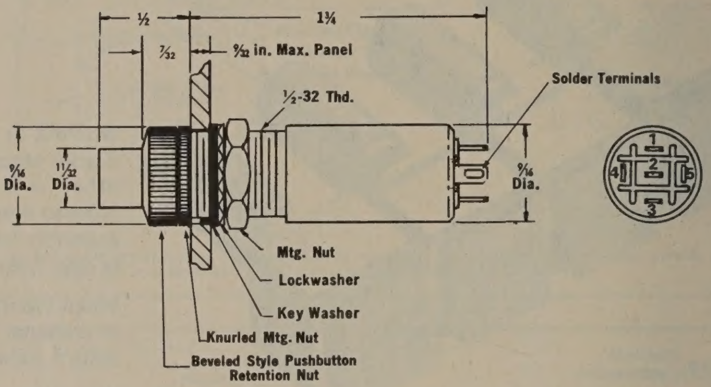
Notes:

1. **Switch Characteristics:**
   - Contact rating: 5 amps resistive at 115 VAC or 28 VDC.
   - Nominal pushbutton travel:
     Type 416,676 7/32 in.
     Type 418,618 1/8 in.
   - Nominal operating force:
     Type 416,616 1½ lbs.
     Type 416,618 2 lbs.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349.
   - Pushbutton retention and knurled Mtg. nut: aluminum, bright anodized.
   - Keywasher and Mtg. nut; brass, nickel plated.
   - Housing: aluminum, anodized.
   - Terminals and contacts; coin silver.
   - Terminal board; molded thermoset plastic.
3. **Lamp:** T-1¾ incandescent, T-2 neon, or D2 L.E.D. with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton retention nut. Switches will not operate with lamp removed.
4. **Weight:** Approx. .5 oz.
5. **Styles:** Where maximum indication of pushbutton illumination is of primary importance, the reflector style retention nut is recommended.

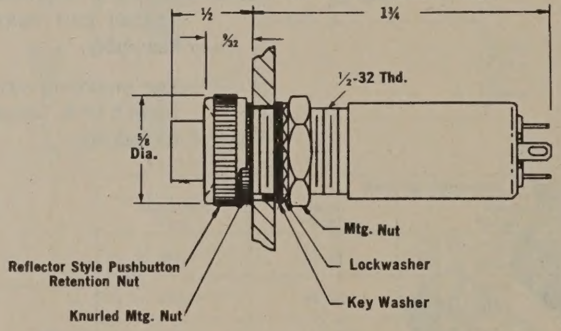
ALTERNATE ACTION TYPE 416, TYPE 616
MOMENTARY ACTION TYPE 418, TYPE 618

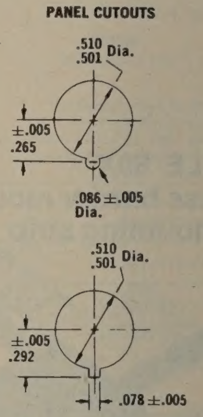
U.L. RECOGNIZED

Style 1
BEVELED RETENTION NUT

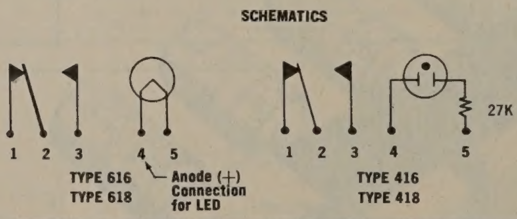

½
1¾
7/32
3/32 in. Max. Panel
½-32 Thd.
Solder Terminals
9/16 Dia.
11/32 Dia.
9/16 Dia.
Mtg. Nut
Lockwasher
Key Washer
Knurled Mtg. Nut
Beveled Style Pushbutton Retention Nut
1
2
3
4
5

Style 2
REFLECTOR RETENTION NUT


½
1¾
7/32
½-32 Thd.
5/8 Dia.
Mtg. Nut
Lockwasher
Key Washer
Reflector Style Pushbutton Retention Nut
Knurled Mtg. Nut


PANEL CUTOUTS
.510 .501 Dia.
±.005 .265
.086 ±.005 Dia.
.510 .501 Dia.
±.005 .292
.078 ±.005

Key washer and slot may be omitted for mounting in round hole.


SCHEMATICS
1 2 3 4 5
TYPE 616
TYPE 618
Anode (+) Connection for LED
27K
1 2 3 4 5
TYPE 416
TYPE 418

Complete Assembly Part Numbers For Style 1 Pushbutton Retention Nut						
Translucent Pushbutton Colors	Incandescent (Less Lamp)		115 VAC Neon (Includes A1H Lamp)		Light Emitting Diode (Includes D2 Lamp)	
	Alternate Action	Momentary Action	Alternate Action	Momentary Action	Alternate Action	Momentary Action
White	616-5-1	618-5-1	416-5-1-A1H	418-5-1-A1H	—	—
Red	616-6-1	618-6-1	416-6-1-A1H	418-6-1-A1H	616-6-1-D2	618-6-1-D2
Green	616-7-1	618-7-1	—	—	—	—
Amber	616-8-1	618-8-1	416-8-1-A1H	418-8-1-A1H	—	—
Blue	616-11-1	618-11-1	—	—	—	—
Yellow	616-12-1	618-12-1	—	—	—	—
Orange	616-16-1	618-16-1	—	—	—	—
Lunar	616-17-1	618-17-1	416-17-1-A1H	418-17-1-A1H	—	—

( ) Designates color selection.

To order switch with reflector style pushbutton retention nut (style 2), change hardware designation number from 1 to 2. Example: 616-5-2.

To order switch with incandescent lamp installed, add lamp number as 3 digit suffix to part number. Example: 616-5-1-327.

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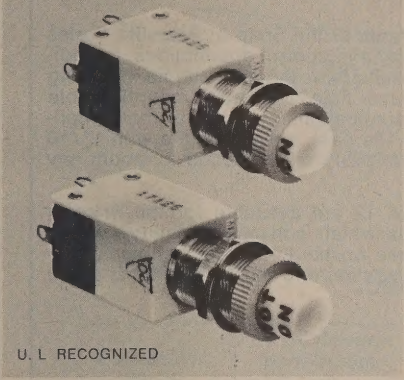
Tel: (714) 540-9471 TWX: 910-595-1504

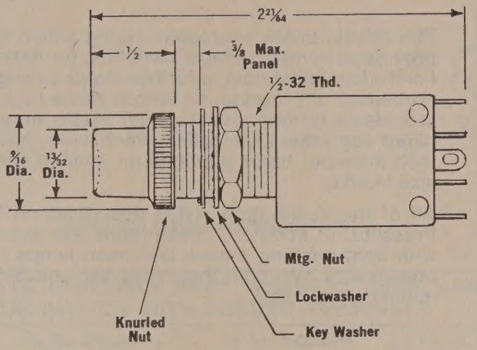
OAK

Presslites, Low Profile

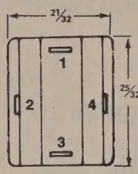
10.5 amp snap action



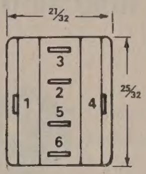
U. L RECOGNIZED

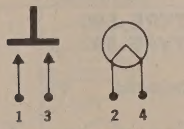


Type 675
Type 685



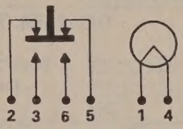
Type 671
Type 681





SCHEMATICS

Single Throw, Normally Open
Type 675 Alternate Action
Type 685 Momentary Action
Contact Module
U.L. Listed

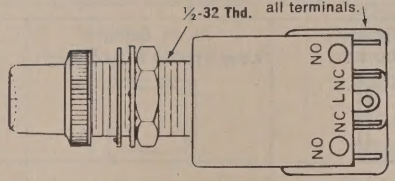


Double Throw, 2 Circuit
Type 671 Alternate Action
Type 681 Momentary Action
Contact Module
U.L. Listed

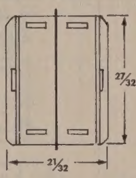
Notes:

1. **Switch Characteristics:**
   - Contact rating; 10.5 amps resistive, 125/250 VAC. 10.5 amps resistive, 28 VDC, ¼ H.P. 125/250 VAC.
   - Alternate action switches: pushing button closes N.O. contacts and latches pushbutton. Pushing button again releases contacts and returns pushbutton to "out" position. Pushbutton latch point is ⁵⁄₃₂ in. from "out" position. Switch and latch interlocked to prevent teasing.
   - Nominal pushbutton travel:
     Alternate action switches: ⁷⁄₃₂ in.
     Momentary action switches: ⁵⁄₃₂ in.
   - Nominal operating force:
     Single pole switches: 12 oz.
     Double pole switches: 20 oz.
2. **Materials and Finishes:**
   - Pushbuttons; high impact resistant plastic per L-P-349a.
   - Knurled nut; aluminum, bright anodized.
   - Keywasher and mtg. nut; brass, nickel plated.
   - Lockwasher; stainless steel.
   - Housing; molded thermoplastic.
   - Contacts: coin silver.
3. **Lamp:** T-1¾ incandescent with midget flange base or AIH neon. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.
4. **Weight:** Approx. .6 oz.
5. **Solder Terminals:** Terminals accept AMP FASTON No. 60729-1 receptacles or equiv.

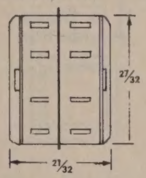
Fiberglass insulation provides ⁵⁄₃₂ in. min. leakage path between all terminals.

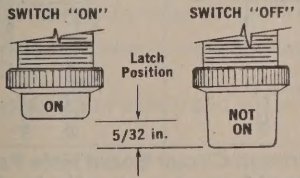


Type 676
Type 686

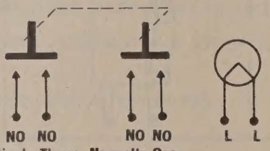


Type 672
Type 682



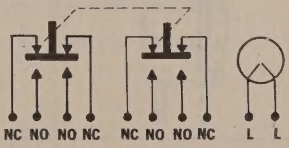


Alternate action switches may be ordered with pushbuttons marked as shown to give positive indication of switch position.



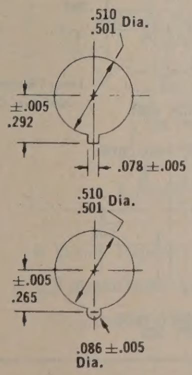
SCHEMATICS

Single Throw, Normally Open
Type 676 Alternate Action
Type 686 Momentary Action
Contact Modules
U.L. Listed



Double Throw, 2 Circuit
Type 672 Alternate Action
Type 682 Momentary Action
Contact Modules
U.L. Listed

PANEL CUTOUTS



Complete Assembly Part Numbers (Less Lamp)
For Switches With Unmarked Pushbutton

Translucent Pushbutton Colors	Single Pole				Double Pole			
	Single Throw, Normally Open		Double Throw, 2 Circuit		Single Throw, Normally Open		Double Throw, 2 Circuit	
	Alternate	Momentary	Alternate	Momentary	Alternate	Momentary	Alternate	Momentary
White	675-5	685-5	671-5	681-5	676-5	686-5	672-5	682-5
Red	675-6	685-6	671-6	681-6	676-6	686-6	672-6	682-6
Green	675-7	685-7	671-7	681-7	676-7	686-7	672-7	682-7
Amber	675-8	685-8	671-8	681-8	676-8	686-8	672-8	682-8
Blue	675-11	685-11	671-11	681-11	676-11	686-11	672-11	682-11
Yellow	675-12	685-12	671-12	681-12	676-12	686-12	672-12	682-12
Orange	675-16	685-16	671-16	681-16	676-16	686-16	672-16	682-16
Lunar	675-17	685-17	671-17	681-17	676-17	686-17	672-17	682-17

To order switch with "Not On" marking on pushbutton, add 5 to part number suffix. Examples: 675-55, 671-56.
To order switch with lamp installed, add lamp number as 3 digit suffix to part number. Example: 675-55-**327**.

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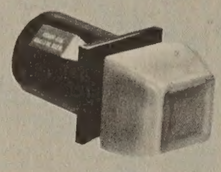
OAK

Presslites, Snap-in

½ amp momentary action switch and matching indicator

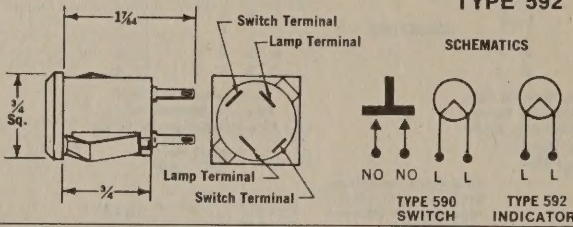


Suitable for use with Light Emitting Diode (L.E.D.)

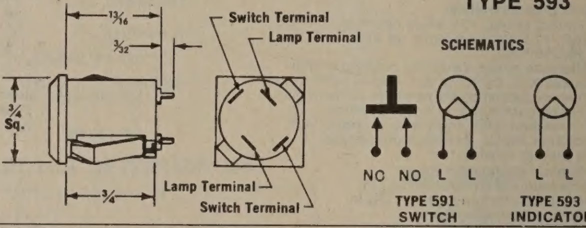
The double break bifurcated wiping action contacts of the Snap-In Presslite Series provide extremely reliable switching for data entry and control applications. In addition to low initial cost, a further major saving results from the very simple mounting procedure of pressing the switch into a round panel hole. The round mounting hole provides a further advantage for matrix mount applications. Instead of the complicated egg crate assemblies which were used in the past, a simple plate with 11/16 inch diameter holes punched on ¾ inch centers is all that is needed to mount any size matrix.

All of the pushbutton styles described on Page 12 are available for the Snap-In Presslite. In addition, pushbuttons are available which enhance legibility for use with light emitting diodes and neon lamps. These pushbuttons may be used interchangeably with both the Types 590 and 591 Presslite, and the Types 592 and 593 matching indicator.

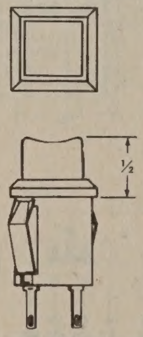
SOLDER TERMINALS TYPE 590 TYPE 592


1⁷⁄₆₄
Switch Terminal
Lamp Terminal
SCHEMATICS
¾ Sq.
Lamp Terminal
Switch Terminal
¾
NO NO L L
L L
TYPE 590 SWITCH
TYPE 592 INDICATOR

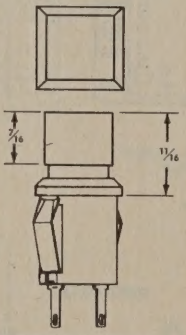
PRINTED CIRCUIT TERMINALS TYPE 591 TYPE 593


¹³⁄₁₆
³⁄₃₂
Switch Terminal
Lamp Terminal
SCHEMATICS
¾ Sq.
Lamp Terminal
Switch Terminal
¾
NO NO L L
L L
TYPE 591 SWITCH
TYPE 593 INDICATOR

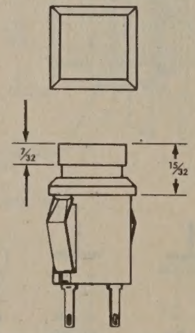
½ In. Square Pushbutton



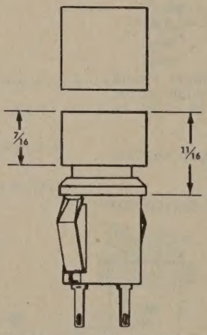
⅝ In. Square Pushbutton



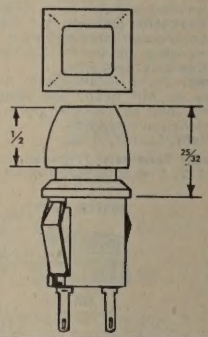
⅝ In. Square Low Profile Pushbutton



¾ In. Square Pushbutton



¾ In. Square Keyboard Pushbutton

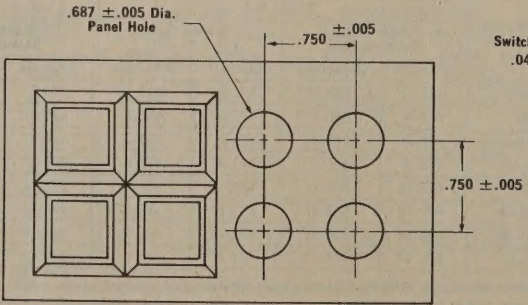


Notes:

1. **Switch Characteristics**
   - Contact rating: ½ amp resistive at 30 VDC. 1/10 amp resistive at 115 VAC.
   - Nominal pushbutton travel: .1 in.
   - Nominal operating force: 4 oz.
2. **Materials and Finishes:**
   - Pushbuttons: high impact plastic per L-P-349a.
   - Housing: black thermoplastic.
   - Mounting clip: stainless steel.
   - Lamp terminals: beryllium copper, tin plated.
   - Switch terminals and contacts: brass, gold plated.
3. **Lamp:** T-1¾ incandescent, T-2 neon, or L.E.D. with midget flange base. See lamp selection guide. Lamp remains stationary when pushbutton is depressed.
4. **Mounting:** Assemblies press fit into .687 ±.005 dia. holes from front of panel .Mounting clips accommodate panels from ¹⁄₁₆ in. to ³⁄₁₆ in.
5. **Weight:** Approx. .25 oz.
6. **Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 -1 or equiv.

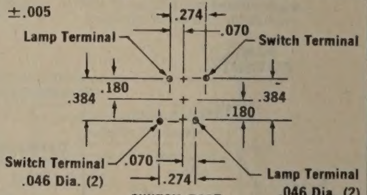
MATRIX MOUNTING

Switch and Indicator Bases may be mounted to form any size Matrix by spacing panel holes as shown.

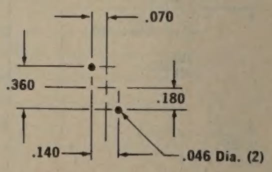

.687 ±.005 Dia.
Panel Hole
.750 ±.005
.750 ±.005

Printed Circuit Board Hole Patterns (Viewed from component side of boards.)

Tolerances ±.005


.274
.070
Lamp Terminal
Switch Terminal
.384
.180
.384
.180
Switch Terminal
.046 Dia. (2)
.070
.274
Lamp Terminal
.046 Dia. (2)

SWITCH BASE
TYPE 591


.070
.360
.180
.140
.046 Dia. (2)

INDICATOR BASE
TYPE 593

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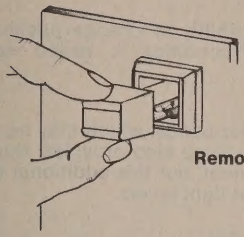
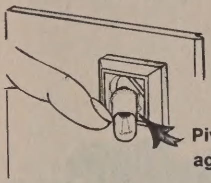
Presslites, Snap-in

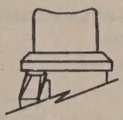
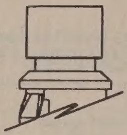
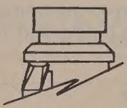
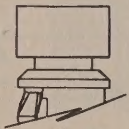
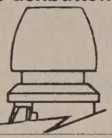
RELAMPING PROCEDURE





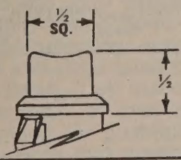
To replace lamp, reverse procedure.

COMPLETE ASSEMBLY PART NUMBERS (LESS LAMPS) FOR SWITCH WITH SOLDER TERMINALS

Pushbutton Style Designation See Pages 9 and 10	½ In. Square Pushbutton 	⅝ In. Square Pushbutton 	⅝ In. Square Low Profile Pushbutton 	¾ In. Square Pushbutton 	¾ In. Square Keyboard Pushbutton 
1	590-5216	590-5316	590-5416	590-5516	590-5616
2	—	590-5326	590-5426	590-5526	—
3	—	590-5336	590-5436	590-5536	—
4	590-5246	590-5346	—	590-5546	590-5646
5	—	590-5356	—	590-5556	—
7	—	—	—	590-5576	—
8	—	—	—	590-5586	—
9	—	—	—	590-5596	—
14	—	—	—	590-55146	—
15	—	—	—	590-55156	—
16	—	—	—	590-55166	—

- **Pushbutton Colors:** Last digit, 6, of above part numbers designates translucent red color. For other colors change to one of following: white 5; green 7; blue 11; yellow 12; orange 16; lunar 17; dark red 36; light green 37. Do not specify colors 17, 36, and 37 as filter colors for styles 4, 5, 9, and 16.
- **Base Types:** To order complete assembly with other base types change 590 to desired type, (i.e., 591, 592, 593)
- **Lamps:** To order complete assembly with lamp installed, add lamp no. as 3 digit suffix to part no. Example: 590-5216-**327**.
- **Styles:** See Pages 9 and 10 for description of pushbutton styles.

COMPLETE ASSEMBLY PART NUMBERS WITH NEON OR LIGHT EMITTING DIODE LAMP FOR SWITCH WITH SOLDER TERMINALS

½ In. Square High Brightness Pushbutton	Transparent Pushbutton Colors	115 VAC Neon (Includes A1H Lamp)	Light Emitting Diode* (Includes D2 Lamp)
	Clear	590- 5P73-A1H	—
	Red	590- 6P73-A1H	590-6P71-D2
	Amber	590- 8P73-A1H	—
	Lunar	590-17P73-A1H	—

- **Base Types:** To order complete assembly with other base types change 590 to desired type, (i.e., 591, 592, 593)
- **Translucent Colors:** Not recommended.

* Pushbutton has an internal microgroove lens for optimum light dispersion.

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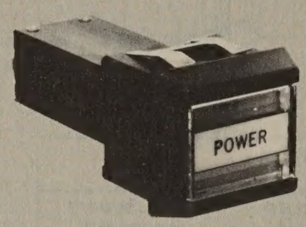
OAK

Presslites, Rainbow

10.5 amp snap action



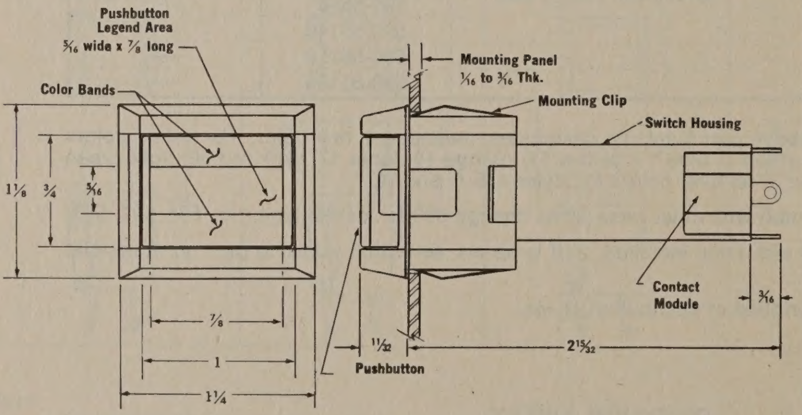
Contact Module U.L. Listed

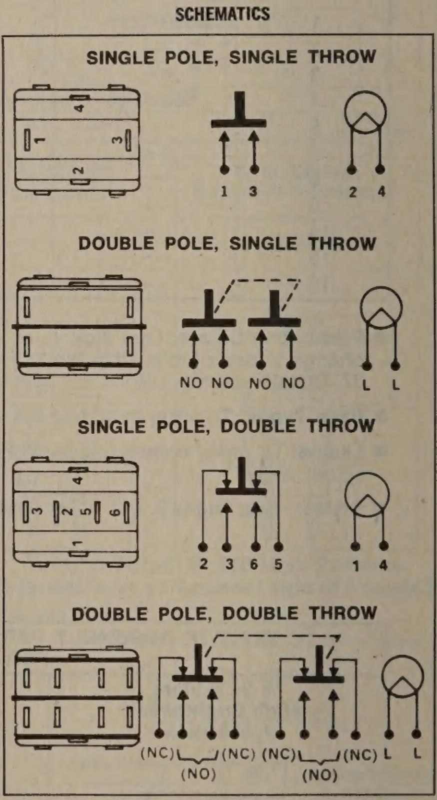
The Rainbow Switch is totally unique in its ability to change pushbutton color when it is depressed from the "off" to the "on" condition. A varied selection of colors is available to the designer.

A white legend area is provided between the color bands, which may be illuminated by a lamp contained inside the pushbutton. This lamp also provides illumination of the color bands for operation in a dark environment, but this additional illumination is unnecessary for viewing under normal ambient light levels.

Alternate action switches provide a latching action, so the pushbutton remains down while the switch is "on", and returns to the out position when the switch is turned "off" by again depressing the pushbutton. This latching action retains the color and legend changes between operations. Momentary action Rainbow Switches are also offered as companion items. Their color and legends remain changed only while the pushbutton is depressed, after which they return to the out position.

In addition to the combinations listed below, many other variations are possible, and should be discussed with IPI Application Engineers.


Pushbutton Legend Area
5/16 wide x 7/8 long
Color Bands
1 1/8
3/4
5/16
7/8
1
1 1/4
Mounting Panel 1/16 to 3/16 Thk.
Mounting Clip
Switch Housing
Contact Module
3/16
11/32
2 15/32
Pushbutton


SCHEMATICS
SINGLE POLE, SINGLE THROW
1 3
2 4
DOUBLE POLE, SINGLE THROW
NO NO NO NO
L L
SINGLE POLE, DOUBLE THROW
2 3 6 5
1 4
DOUBLE POLE, DOUBLE THROW
(NC) (NC) (NC) (NC) L L
(NO) (NO)

Notes:

1. **Switch Characteristics:**
   - Contact rating: 10.5 amps at 125/250 volts AC or 28 volts DC resistive, 1/4 HP 125/250 volts AC. Contact module U.L. listed.
   - Alternate action switches: depressing pushbutton from "out" to "in" position changes color bands from one selected color to any other selected color, and button remains latched down. The next actuation restores color bands and switch to the "out" position. Switch and latch interlocked to prevent teasing.
2. **Materials and Finishes:**
   - Switch housing: Molded thermoplastic, optional black or light gray color.
   - Mounting clips: stainless steel.
   - Lamp terminals: brass, gold flashed and tin plated.
   - Switch terminals: brass, silver plated.
   - Cap assembly: molded thermoplastic.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Pushbutton engages switch plunger with tight friction fit permitting relamp from front of panel without use of tools.
4. **Mounting:** assembly snaps in from front of panel without the use of tools.
5. Terminals accept AMP FASTON receptacle #60729-1 or equal.

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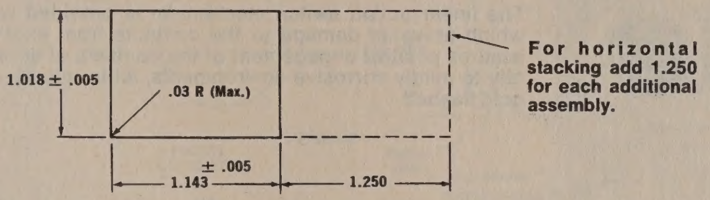
Presslites, Rainbow

PANEL CUTOUT

BASE SIZE 1
(¾ IN. x 1 IN. PUSHBUTTON)



For horizontal stacking add 1.250 for each additional assembly.

Complete Assembly Part Numbers (Less Lamp) For Rainbow™ Switch With Gray Housing and ¾ in. x 1 in. Pushbutton

"In" Position Color Band Colors	Single Pole				Double Pole			
	Single Throw Normally Open		Double Throw 2 Circuit		Single Throw Normally Open		Double Throw 2 Circuit	
	Alternate	Momentary	Alternate	Momentary	Alternate	Momentary	Alternate	Momentary
Black	1123-5-0-120105	1113-5-0-120105	1121-5-0-120105	1111-5-0-120105	1124-5-0-120105	1114-5-0-120105	1122-5-0-120105	1112-5-0-120105
White	1123-5-5-120105	1113-5-5-120105	1121-5-5-120105	1111-5-5-120105	1124-5-5-120105	1114-5-5-120105	1122-5-5-120105	1112-5-5-120105
Red	1123-5-6-120105	1113-5-6-120105	1121-5-6-120105	1111-5-6-120105	1124-5-6-120105	1114-5-6-120105	1122-5-6-120105	1112-5-6-120105
Green	1123-5-7-120105	1113-5-7-120105	1121-5-7-120105	1111-5-7-120105	1124-5-7-120105	1114-5-7-120105	1122-5-7-120105	1112-5-7-120105
Blue	1123-5-11-120105	1113-5-11-120105	1121-5-11-120105	1111-5-11-120105	1124-5-11-120105	1114-5-11-120105	1122-5-11-120105	1112-5-11-120105
Yellow	1123-5-12-120105	1113-5-12-120105	1121-5-12-120105	1111-5-12-120105	1124-5-12-120105	1114-5-12-120105	1122-5-12-120105	1112-5-12-120105
Orange	1123-5-16-120105	1113-5-16-120105	1121-5-16-120105	1111-5-16-120105	1124-5-16-120105	1114-5-16-120105	1122-5-16-120105	1112-5-16-120105

- **Housing Colors:** To order switch with black housing color, change second digit of base assembly part number from 1 to 0. Examples: 1023-5-0-120105.

- **Color Bands:** Above part numbers are for switches with white "out" color bands. To order switch with other colors, change first dash no. of part number from 5 to one of the following:

Black	0	Red	6	Blue	11	Orange	16
White	5	Green	7	Yellow	12		

Examples: For red "out" color band: 1123-6-0-120105.

- **Lamps:** To order complete assembly with lamp installed, add lamp no. as 3 digit suffix to part number. Examples: 1123-5-0-120105-327.

LEGENDS

Pushbuttons and color bands may be marked with any letter/number combination space permitting. Specify marking desired after selecting assembly part number designating switch type and color band colors from above tables. Unless otherwise specified all marking will be black, 7/64 in. high. Maximum number of characters per line is nine. Indicate desired marking for pushbutton and each upper and lower color band. Note that pushbutton legend marking does not change when pushbutton is depressed and marking for upper and lower color bands may be different if desired. A sketch similar to the illustrated example should be included with order.

EXAMPLE:
ASSEMBLY PART NO. 1121-5-16-120105
With Special Marking

"Out" Position	OFF	Upper color band (white)
	POWER	Pushbutton legend (white)
	OFF	Lower color band (white)
"In" Position	ON	Upper color band (orange)
	POWER	Pushbutton legend (white)
	ON	Lower color band (orange)

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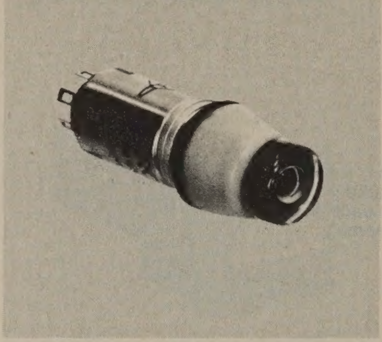
OAK

Presslites, Watertight, Splashproof, and E.M.I. Suppressed

watertight, 3 amp momentary action



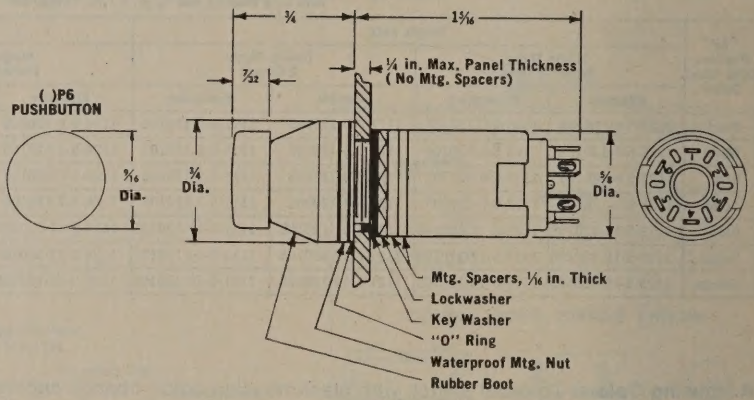
This switch features a grey silicone rubber boot and rubber washer which provide a true watertight seal from the front of the mounting panel. The pushbutton screws into the switch base and may be removed from the front of the panel for relamping.

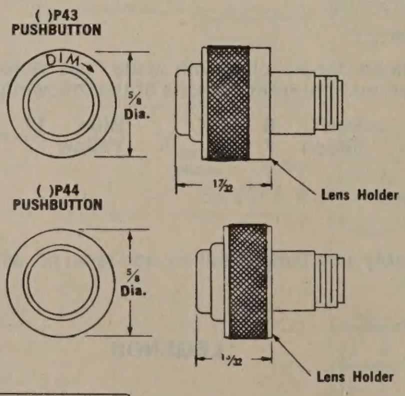
When switching a 3 amp resistive load, life expectancy exceeds 1 million cycles.

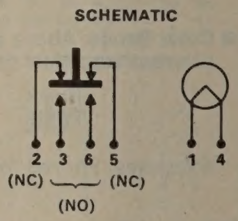
The linear action switch mechanism is provided with a special overtravel device which prevents damage to the contacts from excessive pushbutton pressure and assures positive engagement of the contacts at an optimum force. To assure immunity to mildly corrosive environments, all terminals, contacts and springs are heavy gold flashed.

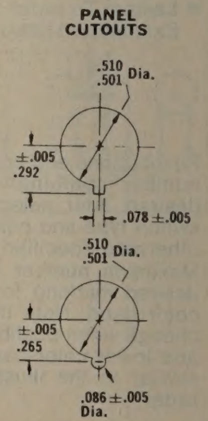
Notes:

1. **Switch Characteristics:**
   - Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
   - Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
   - Nominal operating force: 48 oz.
2. **Materials and Finishes:**
   - Pushbuttons: high impact resistant plastic per L-P-349a.
   - Lens holders: aluminum, black anodized.
   - Rubber boot and "O"-ring: silicone rubber.
   - Mtg. tube and spacers: aluminum, anodized per MIL-A-8625.
   - Keywasher: brass, nickel plated.
   - Lockwasher: stainless steel.
   - Terminal board: molded thermoset plastic.
   - Terminals and contacts: coin silver, gold plated.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide.
4. **Mounting:** Recommended mounting tool for tightening mounting nut: Marco-Oak #51630 (Xcelite Inc. #ST62-196 or equivalent).


( )P6
PUSHBUTTON
9/16 Dia.
¾
1 5/16
7/32
¾ Dia.
¼ in. Max. Panel Thickness (No Mtg. Spacers)
⅝ Dia.
Mtg. Spacers, 1/16 in. Thick
Lockwasher
Key Washer
"O" Ring
Waterproof Mtg. Nut
Rubber Boot


( )P43
PUSHBUTTON
DIM
⅝ Dia.
17/32
Lens Holder
( )P44
PUSHBUTTON
⅝ Dia.
17/32
Lens Holder


SCHEMATIC
2
3
6
5
1
4
(NC)
(NO)
(NC)


PANEL
CUTOUTS
.510
.501 Dia.
±.005
.292
.078 ±.005
.510
.501 Dia.
±.005
.265
.086 ±.005
Dia.

(Key washer and slot may be omitted in some installations)

Complete Assembly Part Numbers (Less Lamp)			
Transparent Pushbutton Colors	( )P6 Pushbutton	( )P43 Dimmer Pushbutton	( )P44 Non-Dim Pushbutton
Clear*	643-35-7	643-15-7	643-25-7
Red	643-36-7	643-16-7	643-26-7
Green	643-37-7	643-17-7	643-27-7
Amber	643-38-7	643-18-7	643-28-7
Blue	643-311-7	643-111-7	643-211-7
Yellow	643-312-7	643-112-7	643-212-7
Orange	643-316-7	643-116-7	643-216-7
Lunar	643-317-7	643-117-7	643-217-7

Translucent colors: Add "TL" to first Dash No. of Part Number. Example: TL

*White if translucent color specified.

( ) Designates color selection.

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 643-36-7-327.

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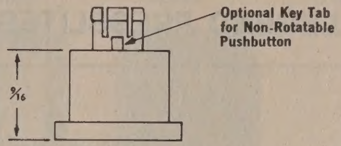
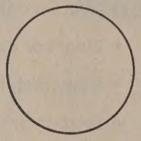
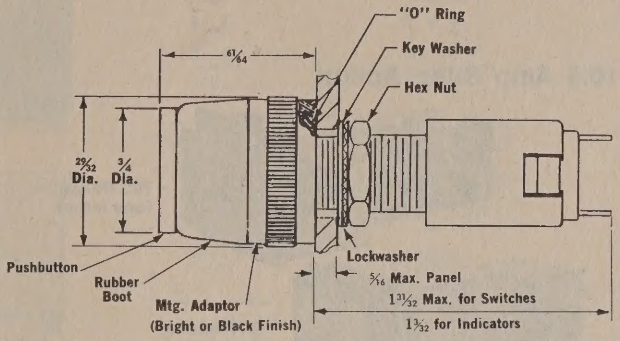
Presslites, Watertight, Splashproof, and E.M.I. Suppressed

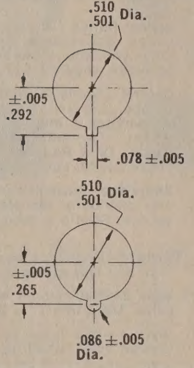
splashproof, oiltight presslites


Optional Key Tab for Non-Rotatable Pushbutton
9/16




"O" Ring
Key Washer
Hex Nut
61/64
29/32 Dia.
3/4 Dia.
Lockwasher
Pushbutton
Rubber Boot
Mtg. Adaptor (Bright or Black Finish)
5/16 Max. Panel
1 31/32 Max. for Switches
1 3/32 for Indicators

PANEL CUTOUTS


.510 .501 Dia.
±.005 .292
.078 ±.005
.510 .501 Dia.
±.005 .265
.086 ±.005 Dia.

Notes:

1. **Switch or Indicator Bases:**
   - All Presslite base types shown on pages 7, 8, 9, 10, and 11 except types 534, 535, 543, 546, 563, and 568 may be used with this mounting accessory.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349a.
   - Rubber boot: gray silicone rubber supplied with bright anodized adaptor. Black neoprene rubber supplied with black anodized adaptor. (Neoprene seals recommended for oiltight applications.)
   - Mounting adaptor: aluminum, bright or black anodized.
   - Hex nut: brass, nickel plated.
   - Lockwasher: stainless steel.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.

**Complete Assembly Part Numbers (Less Lamp)
With Rotatable Pushbutton and Type 542 Switch**

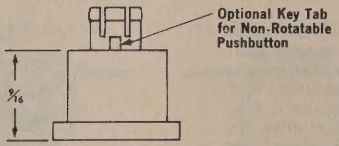
Translucent Pushbutton Colors	Mounting Adaptor Finish	
	Bright Anodized	Black Anodized
White	542-9015-91	542-9015-92
Red	542-9016-91	542-9016-92
Green	542-9017-91	542-9017-92
Blue	542-90111-91	542-90111-92
Yellow	542-90112-91	542-90112-92
Orange	542-90116-91	542-90116-92
Lunar	542-90117-91	542-90117-92

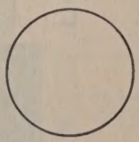
To order complete assembly with other base type, change Base No. 542 to desired type. Example: 521-9015-91

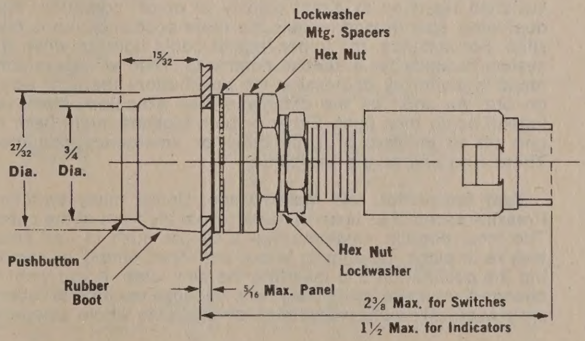
To order non-rotatable pushbutton change second digit of Pushbutton No. from 0 to 1. Example: 542-9115-91

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 542-9015-91-327

splashproof, E.M.I. suppressed, presslites


Optional Key Tab for Non-Rotatable Pushbutton
9/16

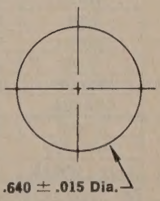



Lockwasher
Mtg. Spacers
Hex Nut
15/32
27/32 Dia.
3/4 Dia.
Pushbutton
Rubber Boot
Hex Nut
Lockwasher
5/16 Max. Panel
2 3/8 Max. for Switches
1 1/2 Max. for Indicators

Notes:

1. **Switch or Indicator Bases:**
   - All Presslite base types shown on pages 7, 8, 9, 10, and 11 except types 534, 535, 543, 546, 563, and 568 may be used with this mounting accessory.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349a.
   - Rubber boot: gray silicone rubber.
   - Hex nuts and spacers: brass, nickel plated.
   - Lockwashers: stainless steel.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.

PANEL CUTOUT



**Complete Assembly Part Numbers (Less Lamp)
With Type 542 Switch**

Translucent Pushbutton Colors	Rotatable Pushbutton	Non-Rotatable Pushbutton
White	542-53660-10-5	542-53660-11-5
Red	542-53660-10-6	542-53660-11-6
Green	542-53660-10-7	542-53660-11-7
Blue	542-53660-10-11	542-53660-11-11
Yellow	542-53660-10-12	542-53660-11-12
Orange	542-53660-10-16	542-53660-11-16
Lunar	542-53660-10-17	542-53660-11-17

To order complete assembly with other base type, change Base No. 542 to desired type. Example: 521-53660-10-5

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 542-53660-10-5-327

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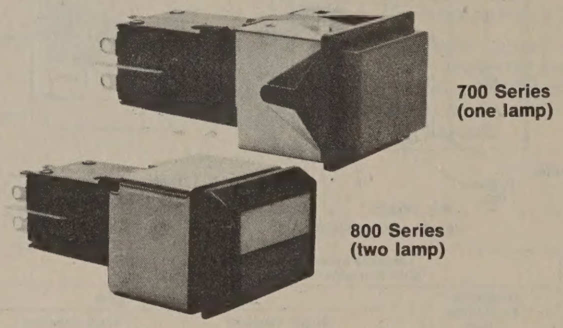
OAK

PUSHBUTTON SINGLE & SPLIT LEGEND PRESSLITES

10.5 Amp Snap Action



Either Presslite series—the *700* (single lamp) or *800* (two lamps)—are available with a wide range of legends, colors, styles, actions and mountings to fit your needs.

Five pushbutton styles are available in any of nine standard colors. They come in either single or split legend designs, with or without barriers, in either black or light gray.

Unmatched flexibility. Not only in color and style, but in mountings and actions. You can choose from two mounting styles: A snap-in for fast mounting and a hard-mount for severe conditions.

You can specify momentary or alternate action. Alternate action switches come with a latching pushbutton which remains depressed while the switch is "on."

Our new patented mechanism interlocks the switching and latching actions so it's impossible to "tease" the switch. Either it's on or it's off. Period. Competitive designs require full depression to latch; incomplete depression only provides a temporary closure until finger pressure is removed.

Display options. Applications are limited only by the designer's ingenuity and job requirements. In the simplest application, single lamp models are energized directly by the voltage being switched resulting in direct display of on-off condition. With dual lamp, split legend models, far more sophistication is possible. For instance, the upper legend could light up when the system is ready for a special command. Then when the command is given (by depressing the pushbutton) the light would go out. As soon as the command was executed, the lower legend could then light. Either or both legends might flash on and off to indicate a malfunction or emergency condition. There's no end to the flexibility.

Easy installation and maintenance. Unlike many switches, Presslite assemblies snap in quickly from the front of the panel. The most popular versions take a simple push in and snap, they're in place. Relamping is accomplished simply by removing the pushbutton and inserting the new lamp. If you want to change the legend that's easy, too, because each color legend plate is quickly replaced without removing the whole assembly.

Single lamp pushbutton part numbers

Lens or Filter Color	Pushbutton Style				
	1	2	4	5	8
WHITE	12015	12025	—	—	12085
RED	12016	12056	12046	12056	12086
GREEN	12017	12027	12047	12057	12087
BLUE	120111	120211	120411	120511	120811
YELLOW	120112	120212	120412	120512	120812
ORANGE	120116	120216	120416	120516	120816
LUNAR	120117	120217	—	—	120817
DARK RED	120136	120236	—	—	120836
LIGHT GREEN	120137	120237	—	—	120837

Single lamp pushbuttons are made from butyrate plastic, per L-P-349.
Two lamp pushbuttons are made from polycarbonate plastic, per L-P-393.

- Five Pushbutton Styles
- Nine Standard Colors
- Single or Split Legends
- Momentary or Alternate Actions
- Snap-in or Hard mounting
- U.L. Recognized

PUSHBUTTONS

Styles: Series 700 and 800 Presslites' five standard styles meet most application requirements. Specials, such as hidden legends, are also available. When you require two different styles on a split legend pushbutton, a drawing or sketch should be provided.

Colors: Standard—white, lunar, red, dark red, green, light green, blue, orange, and yellow. Standard colors were selected to provide a pleasing appearance in the "off" position and high light transmission when the lamp is "on." Two different reds and greens are offered for most effective illumination. Dark Red and Light Green provide optimum legibility under high ambient light. Lunar is similar to white, but provides higher light transmission.

Engraving: Presslites are engraved at the factory, or your Illuminated Products distributor can provide custom engraving. Where you anticipate severe service, Style 8 is recommended to protect the engraved legend.

Style 1—One-piece design with wrap-around construction provides colored front and side surfaces.

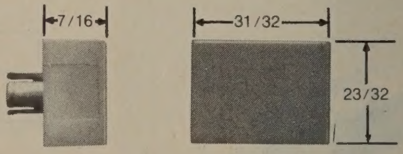
Style 2—Flat colored lens has a 1/32" black opaque frame and black opaque sides. Used where no light transmission through the sides is allowed.

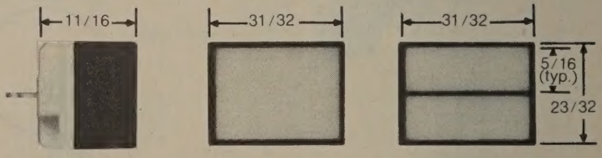
Style 4—This lunar color Style 1 pushbutton has an internal filter of the desired color, which is visible only when the lamp is illuminated.

Style 5—Same as Style 4, but has black opaque sides.

Style 8—Same as Style 2, except colored lens is covered with a clear window. Recommended for applications where the legend must be protected from abrasion.

Single lamp





Two lamp

Two lamp pushbutton part numbers

Lens or Filter Color	Single Lens			Split Lens		
	Style 2	Style 5	Style 8	Style 2	Style 5	Style 8
WHITE	3225	—	3285	3325	3355	3385
RED	3226	3256	3286	3326	3356	3386
GREEN	3227	3257	3287	3327	3357	3387
BLUE	32211	32511	32811	33211	33511	33811
YELLOW	32212	32512	32812	33212	33512	33812
ORANGE	32216	32516	32816	33216	33516	33816
LUNAR	32217	—	32817	33217	—	33817
DARK RED	32236	—	32836	33236	—	33836
LIGHT GREEN	32237	—	32837	33237	—	33837

Part numbers listed for split legend pushbuttons designate the same color lens or filter on both top and bottom. For different colors at the bottom portion, add one of the following numbers: white 5, red 6, green 7, blue 11, yellow 12, orange 16, lunar 17, dark red 36, light green 37. Example: 332512 for white lens on the top, yellow lens on the bottom.

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OAK

PUSHBUTTON SINGLE & SPLIT LEGEND PRESSLITES

BASE ASSEMBLIES

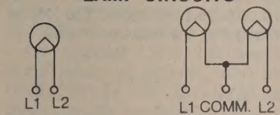
Contact rating: 10.5 amps resistive, ¼ hp, 125/250 vac. 10.5 amps resistive, 28 vdc. Contact modules U.L. listed, CSA certified.

Latching action: Alternate action switches have latching pushbutton feature. Pushbutton latch point is 5/32" from "out" position.

Materials and finishes: Black or light gray thermoplastic housing. Contacts are silver alloy. Switch terminals are silverplated brass. Lamp terminals are tin-plated brass.

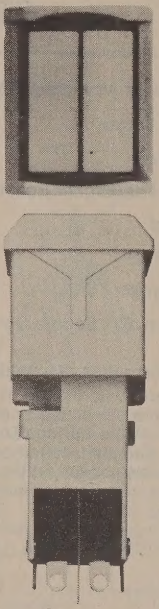
Nominal operating force: Single pole, alternate; 16 ozs., double pole, alternate; 24 ozs. Single pole, momentary; 10 ozs. double pole, momentary; 16 ozs.

LAMP CIRCUITS

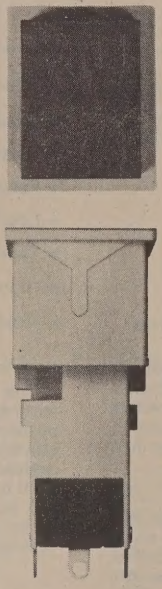


Single lamp **Two lamp**

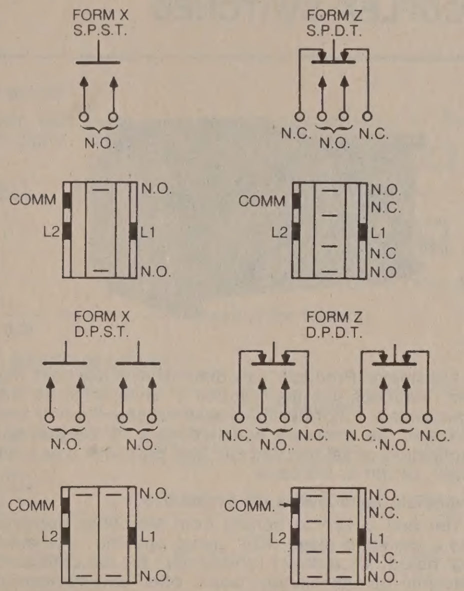
BARRIER



BEZEL



CONTACT AND TERMINAL ARRANGEMENTS



Base assembly part numbers

Base Type			Single Lamp—700 Series				Two Lamp—800 Series			
			Black Housing		Gray Housing		Black Housing		Gray Housing	
			Bezel	Barrier	Bezel	Barrier	Bezel	Barrier	Bezel	Barrier
Matching Indicator			700	750	710	770	800	850	810	870
ALTERNATE ACTION SWITCHES	FORM X	S.P.S.T.	701	751	711	771	801	851	811	871
		D.P.S.T.	702	752	712	772	802	852	812	872
	FORM Z	S.P.D.T.	703	753	713	773	803	853	813	873
		D.P.D.T.	704	754	714	774	804	854	814	874
MOMENTARY ACTION SWITCHES	FORM X	S.P.S.T.	705	755	715	775	805	855	815	875
		D.P.S.T.	706	756	716	776	806	856	816	876
	FORM Z	S.P.D.T.	707	757	717	777	807	857	817	877
		D.P.D.T.	708	758	718	778	808	858	818	878

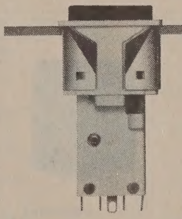
MOUNTING HARDWARE

For most applications, snap-in clips provide more than adequate retention and minimal mounting time. In severe applications involving shock, vibration or substantial wiring harness loads, the sleeve mounting method provides extremely rigid clamping. The sleeve is easily tightened by means of two screws behind the pushbutton.

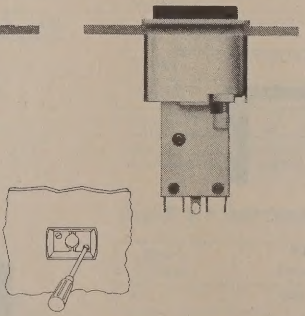
MOUNTING HARDWARE PART NUMBERS	
Snap-in 01	Sleeve 02

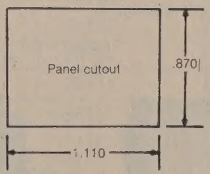
Snap-in clip and mounting sleeve material is stainless steel.
Panel thickness:
Snap-in—⅙" to 3/16"
Sleeve —1/32" to ¼"

SNAP-IN CLIPS



SLEEVE MOUNTING





For vertical stacking, add .942 for each additional assembly.

For horizontal stacking, add 1.182 for each additional assembly.

Tolerances:
±.005 for snap-in
$^{+.015}_{-.005}$ for sleeve mounting

Lamp part numbers

	Lamp No.	Rated Voltage	Amps	Approx. M.S.C.P.	Average Life (Hrs.)	MS Part No.
SIZE T-1¾ MIDGET FLANGE BASE 	345	6.0	.04	.04	10,000	—
	328	6.0 (5.0)*	.20 (.18)*	.60 (.34)*	1,000 (10,000)*	MS25237-328
	381	6.3	.20	.40	2,000	—
	344	10.0	.014	.006	50,000	—
	330	14.0	.08	.50	1,500	MS25237-330
	327	28.0	.04	.34	4,000	MS25237-327
	387	28.0	.04	.30	7,000	MS25237-387

* Figures in parentheses are for derated operation at 5 volts.
Service conditions such as dc operation, voltage surges, temperature, shock, and vibration may contribute to shorter average life.

HOW TO ORDER A complete part number for an assembly consists of four block of digits, like these . . .

711-12016-01-327

Switch or indicator base assembly (select above)
Pushbutton (select from Page 23)
Mounting hardware (select above)
Lamp (select above)

ILLUMINATED PRODUCTS INC.
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2620 South Susan Street, P.O. Box 11930, Santa Ana, CA 92711
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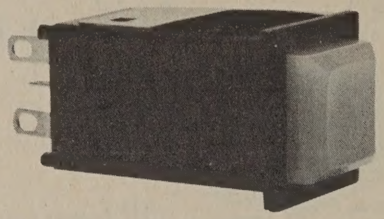
MARCOFLEX SWITCHES



650 Series

- Alternate or Momentary Action
- Double Throw
- Small Size
- Fewer Parts/Higher Reliability
- Low Cost
- Tactile Feel
- High Contact Force
- Mounts in .625 Square Opening or P.C. Board

Illuminated Products' new dimension in low-cost, high-quality small switches has the features of units twice its size. It also represents a major design breakthrough—the first small switch to break the alternate action/double throw barrier. And for application versatility, you can also purchase it as a momentary action switch or indicator.

Immediate applications for Series 650

The first switch to benefit from Marcoflex construction fits into a standard sized .625″ panel opening...or mounts on a P.C. board. It's a direct replacement for the compact switches presently on the market, which offer only momentary action and single throw. You're sure to find many uses for Series 650.

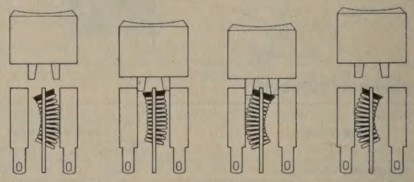
For example, high contact force combines with wiping action and bifurcated contacts to make these units particularly well suited for low level use. They're also ideal for peripheral equipment, eliminating the complex circuits otherwise required to compensate for lack of alternate or double throw mechanical action.

Versatility and low cost broaden the spectrum of applications to include lab test equipment, process control apparatus, broadcast studio controls, vending machines, hotel and airline reservation systems, and much more.

This Form C switch (single pole, double throw) has uniquely simple construction. It's the first to use Illuminated Products' patented Marcoflex design. Lower parts count and easy manufacturing combine to produce a cost-effective switch with inherent reliability.

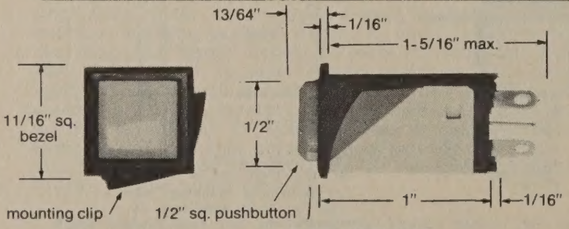
How the Marcoflex mechanism works

The Marcoflex design is based on a compressed spring, mounted in a slot in the common terminal with a slider inserted in the top of the spring. The spring's geometry is such that it stays in a buckled condition. Because of the bi-stable configuration of this assembly, the spring can be buckled to the left or right of the common terminal, turning the switch on or off.

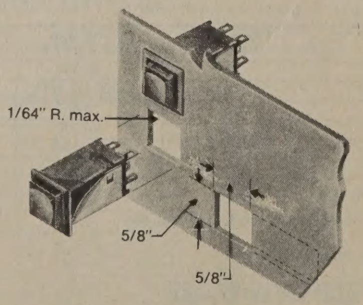


Alternate action begins with switch OFF. As push-button begins descent, right-hand actuator contacts slider disc. Bi-stable spring is forced to the left creating wiping action; switch turns ON. Pushbutton returns to top position. To turn switch OFF, the action repeats in reverse.

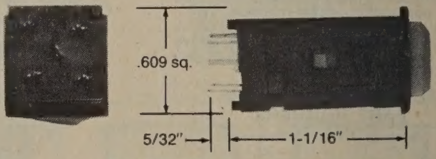
Momentary action switches have reduced contact gap on one side so that the spring does not reach a stable position at the opposite side, and returns to previous position when push-button is released.



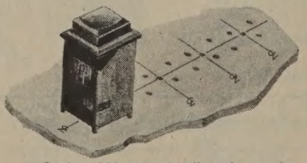
SOLDER TERMINALS



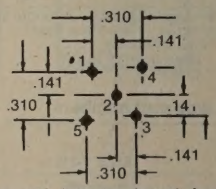
Series 650 mounts in panels from 3/64″ to 3/16″ thick. For horizontal or vertical stacking, add .690″ for each additional unit.



P.C. TERMINALS



Series 650 mounts directly on the P.C. board. Note the location of the P.C. board holes in relation to the fingernail groove and "IPI" logo.



PC board layout, viewed from component side All holes .046 in. diameter. Omit No. 1, 2 & 3 holes for indicators.

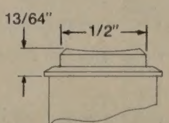


Fig. 1

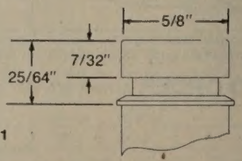


Fig. 2

Pushbuttons are available in ½ inch and ⅝ inch square sizes. The ½ inch size (Fig. 1) features a concave top and solid color construction. The ⅝ inch version (Fig. 2) has a flat top. It is available in solid colors or with black opaque sides.

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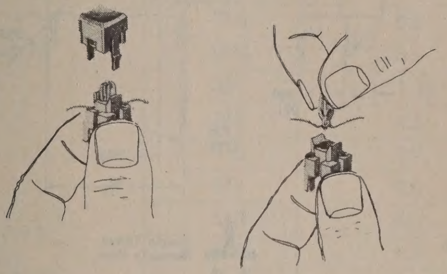
PUSHBUTTON SWITCHES

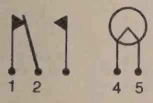
Economical lamps, easily replaced



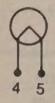
Series 650 accepts any low-cost, unbased T-1¾ incandescent or AIC neon lamp. Assembled units come with your choice of eight lamps, with voltages from 5-125 volts and rated life of as high as 7,000 hours. Lamps with other characteristics are also available on special order.

No special tools are required to relamp. Just spread the lamp leads as shown, then insert into cavity. Press the pushbutton firmly over the lamp retainer, until parts lock together, then cut the leads off flush.

Schematics



Switch Base

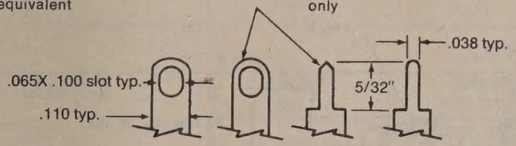


Indicator Base

Terminals

Solder terminals accept AMP Faston receptacle #60415-1 or equivalent

Tip configuration for N.O. (#3) terminal of momentary switches only



Solder Terminals P.C. Terminals

Technical data

Switch characteristics:
- Single pole, double throw (Form C)
- Alternate/momentary action with independent lamp circuit.
- Also available as matching indicator light

Materials and finishes:
- Molded thermoplastic pushbutton
- Molded black thermoplastic base
- Lamp terminals are .012" thick copper alloy
- Stainless steel mounting clip

Contact Rating:
- 1 amp resistive at 30 VDC
- ¼ amp resistive at 125 VAC

Pushbutton travel:
- .08" total

Operating force:
- 12 oz. nominal

Recommended chassis punch:
- Greenlee #731 (⅝" square)

Soldering and cleaning:
To assure clean contacts, solvents or flux should not be allowed to enter the back of the housing. Vapor degreasing should also be avoided.

How to order

A complete part number for an assembly consists of three blocks of digits, like these...

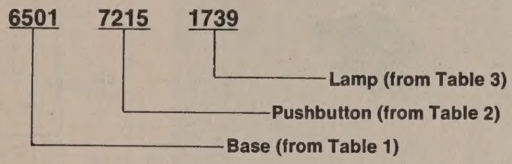


TABLE 1. BASE SELECTOR

Mounting Method	Part Number*		
	Alternate Action Switch	Momentary Action Switch	Indicator Light
Square Panel Cutout (Solder Terminals, 1 clip)	6511	6521	6501
Horizontal or Vertical Panel Stack (Solder Terminals, 2 clips)	6512	6522	6502
Printed Circuit Board Mount (PCB Terminals, no clips)	6610	6620	6600

*Note: Last digit of base assembly number designates quantity of mounting clips which are recommended for the indicated mounting method (0, 1 or 2). A different quantity may be specified by changing this digit accordingly.

TABLE 2. PUSHBUTTON SELECTOR*

Pushbutton Color	Part Number		
(Translucent)	½" sq. concave top, solid color	⅝" sq. flat top solid color	⅝" sq. flat top with black opaque sides
Dark Red**	72136	74136	74236
Orange	72116	74116	74216
Yellow	72112	74112	74212
Light Green	72137	74137	74237
Blue	72111	74111	74211
White**	7215	7415	7425
Lunar**	72117	74117	74217

*May be custom-marked to your requirements
**Suitable for illumination with AIC neon lamp

TABLE 3. LAMP SELECTOR*

Rated Voltage	Amps	Approx. M.S.C.P.	Avg. Life (hours)	Part Number
5	.066	.11	7,000	1739
6	.200	.60	1,000	1784
6.3	.075	.23	1,000	1739
10	.04	.08	5,000	2107
14	.08	.50	1,500	1705
28	.04	.34	4,000	1764
28	.04	.30	7,000	2187
105-125	.0012	—	5,000	AIC**

*Consult factory for availability of lamps with other ratings
**Requires external 27K Ohm series resistor

In addition to the complete assemblies shown above, the base, pushbutton, and lamp may be ordered separately by the individual part numbers shown in the tables.

For prices, application assistance, or additional information, contact your nearest sales representative, distributor, or:

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SNIPE Switch and Actuators

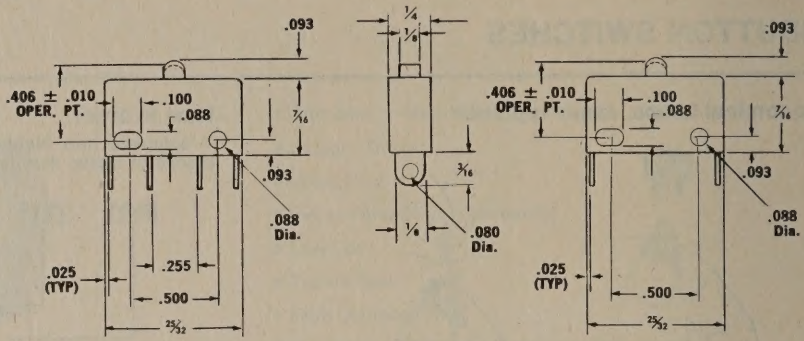
10.5 amp, momentary action SNIPE switch

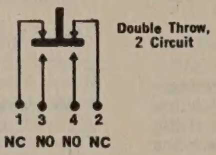
U.L. listed
C.S.A. certified

Notes:

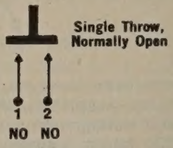
1. **Contact Rating:** 10.5 amps resistive, 125/250 VAC, 10.5 amps resistive, 28 VDC. ¼ h.p., 125/250 VAC.
2. **Switch Characteristics:**
   - Pretravel; .050 in. max.
   - Overtravel; .012 in. min.
   - Operating force; 8 oz. max.
   - Release force; 2 oz. nominal
   - Movement diff.; .020 ± .005 in.
3. **Materials and Finishes:**
   - Plunger: molded thermoplastic & copper alloy
   - Housing: molded plastic
   - Terminals; brass, silver plated
   - Contacts: silver. Gold plating optional.
4. **Solder Terminals:** Terminals accept AMP FASTON No. 60729-1 receptacles.
5. U.S. Patent No. 3624332
6. **Operating characteristics with actuators*:**
   - Pretravel: .110 max.
   - Overtravel: .03 min.
   - Release force: .5 oz. min.
   - Operating force: 2-4 oz.
   - Movement differential: .044 ± .012

* Measured at the top of lever or roller.


.093
.406 ± .010
OPER. PT.
.100
.088
7⁄16
.093
.088
Dia.
.025
(TYP)
.255
.500
25⁄32
¼
⅛
3⁄16
⅛
.080
Dia.
.406 ± .010
OPER. PT.
.100
.088
7⁄16
.093
.093
.088
Dia.
.025
(TYP)
.500
25⁄32


Double Throw,
2 Circuit
1 3 4 2
NC NO NO NC

TYPE 670-00
TYPE 670-01


Single Throw,
Normally Open
1 2
NO NO

TYPE 669-00
TYPE 669-01

Part Numbers — Switches

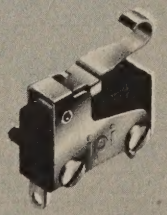
Contacts	Double Throw 2 Circuit	Single Throw Normally Open
Coin Silver	670-00 *	669-00 *
Coin Silver, Gold Plated	670-01 *	669-01 *

* U.L. listed and C.S.A. certified

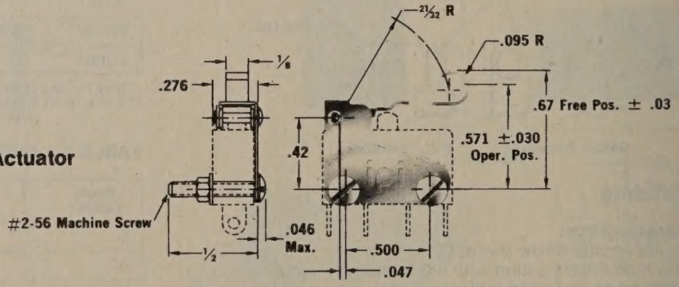
Part Numbers — Actuators

Lever Type	67042-1
Roller Type	67042-2

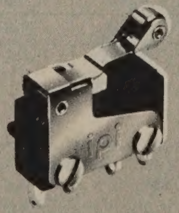
lever actuator



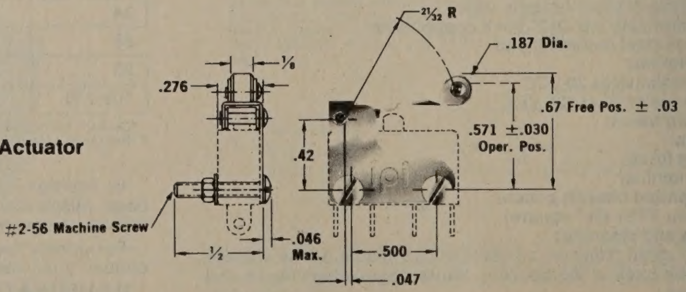
Lever Actuator


21⁄32 R
.095 R
⅛
.276
.67 Free Pos. ± .03
.571 ±.030
Oper. Pos.
.42
#2-56 Machine Screw
.046
Max.
½
.500
.047

roller actuator



Roller Actuator


21⁄32 R
.187 Dia.
⅛
.276
.67 Free Pos. ± .03
.571 ±.030
Oper. Pos.
.42
#2-56 Machine Screw
.046
Max.
½
.500
.047

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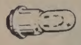
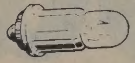
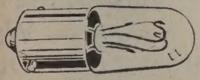
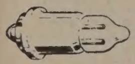
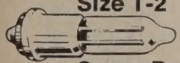
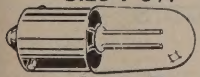
LAMP SELECTION GUIDE FOR SWITCHES

INCANDESCENT TYPE

	LAMP NO.	RATED VOLTAGE	AMPERAGE	APPROX. CANDLEPOWER	AVERAGE LIFE (Hrs.)	NOTES
Size T-1 Sub-midget Flange Base  **Group M**	682	5.0	.060	.03	100,000	MS24515-682
	685	5.0	.060	.05	100,000	MS24515-685
	718	5.0	.115	.15	40,000	MS24515-718
	6839	28.0	.024	.13	16,000	MS3338-6839
Size T-1¾ Midget Flange Base  **Group A**	331	1.35	.06	.01	500	
	268	2.5	.35	.21	10,000	
	338	2.7	.06	.04	6,000	MS25237-338
	345	6.0	.04	.03	10,000	
	328	6.0	.20	.34 @ 5 V	1,000	MS25237-328
	380	6.3	.04	.02	50,000	
	350	6.3	.15	.45	3,000	
	349	6.3	.20	.55	3,000	
	381	6.3	.20	.40	50,000	
	344	10.0	.014	.004	10,000	
	367X	10.0	.04	.08	5,000	
	330	14.0	.08	.50	750	MS25237-330
	370	18.0	.04	.15	1,000	
	327	28.0	.04	.34	1,000	MS25237-327
	387	28.0	.04	.30	25,000	MS18209-387
Size T-3¼ Miniature Bayonet Base Single Contact  **Group B**	316	6.0	.70	3.4	500	MS25231-316
	44	6.3	.25	.9	3,000	
	47	6.3	.15	.52	3,000	
	1816	13.0	.33	3.0	1,000	
	1815	14.0	.20	1.4	3,000	
	313	28.0	.17	3.0	500	MS25231-313
	1819	28.0	.04	.34	1,000	MS25231-1819
	1829	28.0	.075	1.0	1,000	MS25231-1829
	1835	55.0	.05	1.1	10,000	

NEON GLOW TYPE

	LAMP NO.	RATED VOLTAGE	STARTING VOLTAGE	RECOMMENDED SERIES RESISTOR	NOTES
Size T-2  **Group C**	**A1G**	105-125 AC OR DC	65 VAC 95 VDC	68KΩ	
	A1H (High Brightness)	105-120 VAC 150 VDC	95 VAC	27KΩ	
Size T-2  **Group D**	**C7A**	105-125 AC OR DC	65 VAC 90 VDC	68KΩ	MS25252-C7A
	C9A (High Brightness)	105-125 AC OR DC	105 VAC	27KΩ	MS25252-C9A
Size T-3¼  **Group E**	**NE51**	105-125 AC OR DC	65 VAC 90 VDC	100KΩ	
	NE51H (High Brightness)	105-125 AC OR DC	105 VAC	27KΩ	

Notes:

1. Candlepower values indicated are approximate initial mean spherical candlepower at rated voltage.
2. Service conditions such as voltage surges, temperature, shock, and vibration may contribute to a shorter average life.

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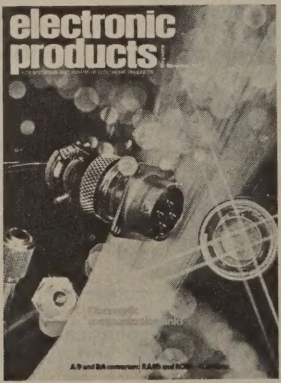

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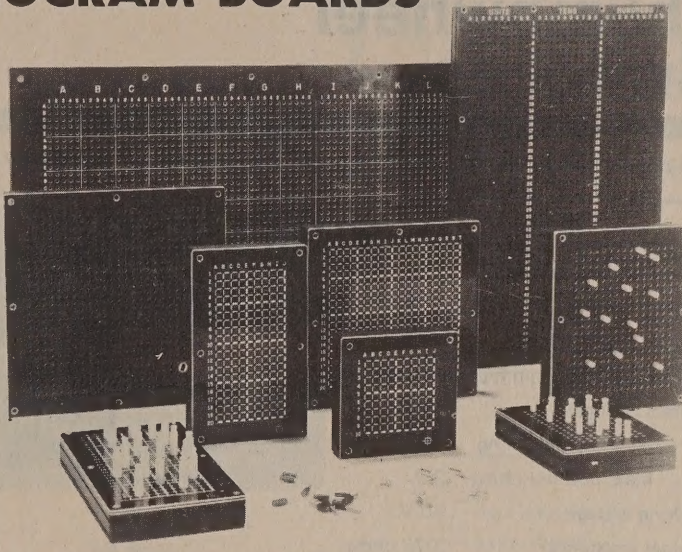
MATRIX PROGRAM BOARDS

GENERAL:

As the result of over ten years experience, INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have lead them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • A two deck (X-Y) contact matrix is comprised of a set of contact busses (inputs) running at 90° to a second set of busses (outputs) • These two contact levels are isolated except at those crosspoints where programming pins are inserted • Terminals (solder/solderless) are provided on the rear surface for each contact buss • INFO-LITE offers two crosspoint grids: the 2000 Series with .250" grid and the 1000 Series with .130" grid • Panels with 5 x 5 to 100 x 100 crosspoints and up to10 contact decks can be supplied to economically meet your requirements, whether for prototype or production quantities.



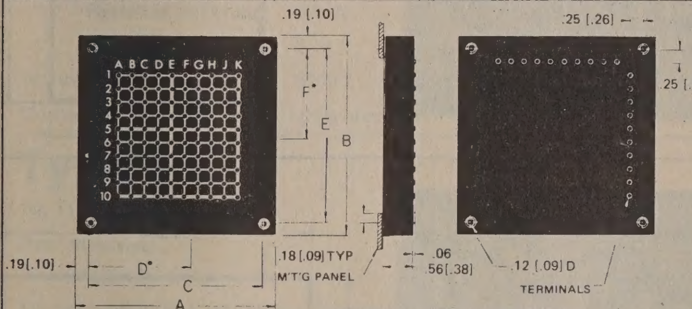
FEATURES

- Reliable closed entry contacts
- Rugged programming pins that will not bend
- Rapid & convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES



*ADDITIONAL MOUTING HOLE POSITION

Matrix Size	Dash #	2000 Series — 250" GRID						1000 Series — .130" Grid					
		A	B	C	D	E	F	A	B	C	D	E	F
10 x 10	-1	3.63	3.63	3.25	—	3.25	—	2.02	2.02	1.82	—	1.82	—
10 x 20	-3	3.63	6.12	3.25	—	5.75	2.75	2.02	3.32	1.82	—	3.12	—
10 x 25	-4	3.63	7.38	3.25	—	7.00	3.50	2.02	3.97	1.82	—	3.77	1.82
10 x 50	-5	3.63	13.62	3.25	—	13.25	4.50 8.75	2.02	7.22	1.82	—	7.02	3.51
20 x 20	-8	6.12	6.12	5.75	2.75	5.75	2.75	3.32	3.32	3.12	—	3.12	—
25 x 25	-9	7.38	7.38	7.00	3.50	7.00	3.50	3.97	3.97	3.77	1.82	3.77	1.82

To obtain A or B sizes of special matrix, use: For 1000 Series - L = .13 x (6 + N); For 2000 Series - L = .25 x (5 + N); N - Number of crosspoints.

STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vert.; 2nd Deck Horiz.
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps std; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XXX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

SPECIFYING PART NUMBERS

X000-X-XX

.130" GRID 1
.250" GRID 2
MATRIX SIZE (SEE TABLE)
S SILVER CONTACT FINISH
G GOLD CONTACT FINISH
A SCREENED FRONT PANEL
B BLANK FRONT PANEL

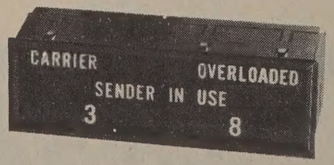
EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts & blank front panel would have Pt. No. 2000-8-BS.

U.S. Patent No. 3,631,374

OTHER INFO-LITE PRODUCTS

NUMERIC READOUTS

LIGHTED INDICATORS

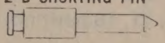


STANDARD PROGRAMMING PINS

1000 SERIES 2-D SHORTING PIN

No. 1010X

2000 SERIES 2-D SHORTING PIN

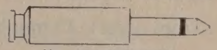


No. 2010X

1000 SERIES 2-D DIODE PIN

No. 1020X-CSXXXX

2000 SERIES 2-D DIODE PIN



No. 2020X-CSXXXX

SEE OUR LIGHTED DISPLAY AND READOUT PRODUCTS IN SECTION 2450.

"LINKS BETWEEN MAN AND MACHINE"
INFO-LITE CORPORATION
46-10 104th STREET • CORONA, N. Y. 11368

For more information or engineering assistance, contact your local representative or call us direct at
(212) 476-1287

Thumbwheel Switches

INTERSWITCH

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Type A

10, 11, 12, 16 positions

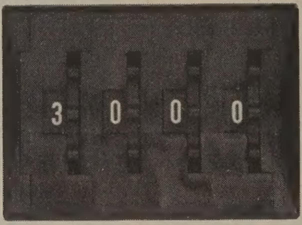
Rear mounted

Black or grey housing

11 mm wide x 53 mm high x 54 mm deep

Contact ratings:

Resistive switching	.25 A
Max. non-switching	2 A
Working voltage	50 V
Contact resistance	.070 ohms



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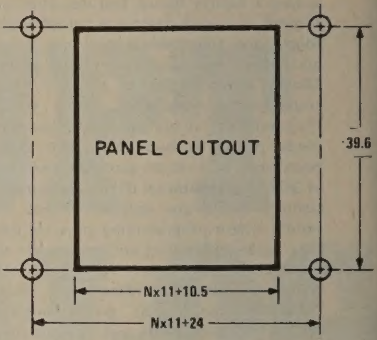


Type B

10, 11, 12, 16 positions

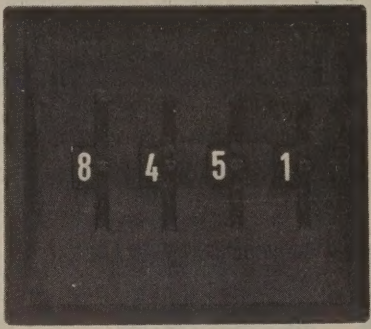
Front mounted

Black or tan housing

12.5 mm wide x 58 mm high x 57 mm deep

Contact ratings:

Resistive switching	.25 A
Max. non-switching	2 A
Working voltage	50 V
Contact resistance	.070 ohms



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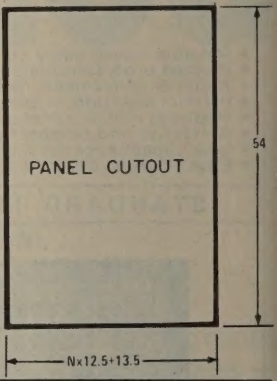


Type G (world's largest)

10 positions only

Front mounted

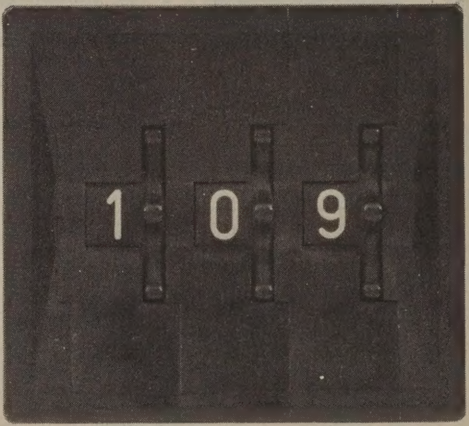
Black or tan housing

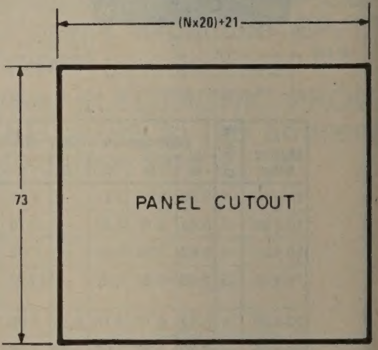
20 mm wide x 76 mm high x 79 mm deep

Contact ratings:

Resistive switching	.5 A
Max. non-switching	4 A
Working voltage	250 V
Contact Resistance	.060 ohms

3/4 Scale





Type H (std.) and Type S (sealed)

10, 11, 16 positions

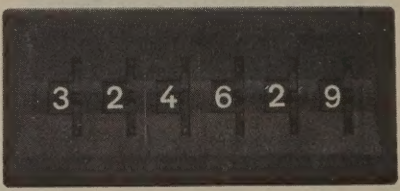
Front mounted

Black or tan housing

10 mm wide x 33 mm high x 38 mm deep

Contact ratings:

Resistive switching	.1 A
Max. non-switching	1 A
Working voltage	50 V
Contact resistance	.070 ohms



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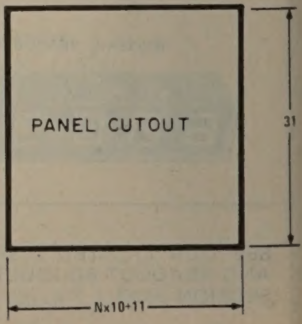

Thumbwheel Switches

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Types L and N

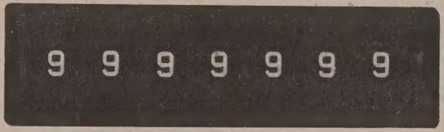
10 positions only Rear mounted

Black or tan housing

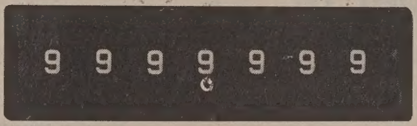
Type L - 8 mm wide x 24 mm high x 35 mm deep

Type N - 7 mm wide x 24 mm high x 35 mm deep

Contact ratings:	
Resistive switching	.075 A
Max. non-switching	1 A
Working voltage	50 V
Contact resistance	.070 ohms

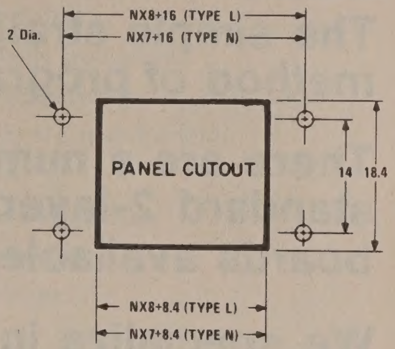


TYPE L



TYPE N

3/4 Scale


NX8+16 (TYPE L)
NX7+16 (TYPE N)
2 Dia.
PANEL CUTOUT
14
18.4
NX8+8.4 (TYPE L)
NX7+8.4 (TYPE N)

Type M

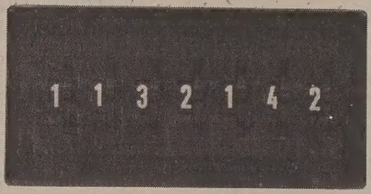
10, 11 positions

Front mounted

Black or tan housing

8 mm wide x 33 mm high x 38 mm deep

Contact ratings:	
Resistive switching	0.1 A
Max. non-switching	1 A
Working voltage	50 V
Contact resistance	.070 ohms



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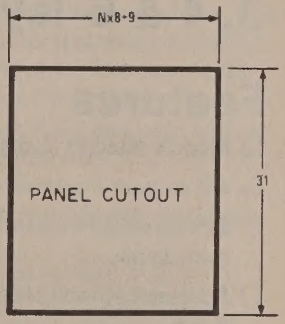

Nx8+9
PANEL CUTOUT
31

Type P

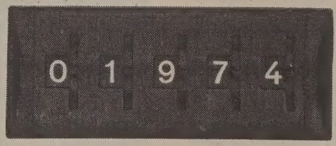
10, 11, 16 positions

Rear mounted

Black or tan housing

10 mm wide x 30.5 mm high x 41 mm deep

Contact ratings:	
Resistive switching	0.1 A
Max. non-switching	1 A
Working voltage	50 V
Contact resistance	.070 ohms



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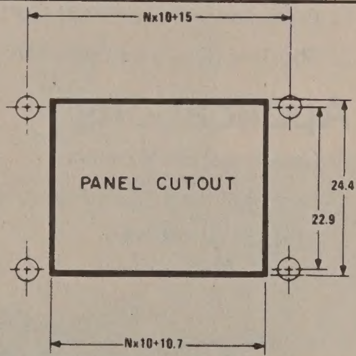

Nx10+15
PANEL CUTOUT
24.4
22.9
Nx10+10.7

Type R

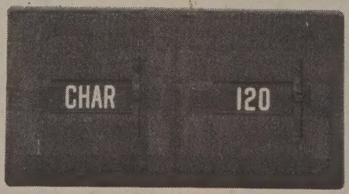
10 positions only

Front mounted

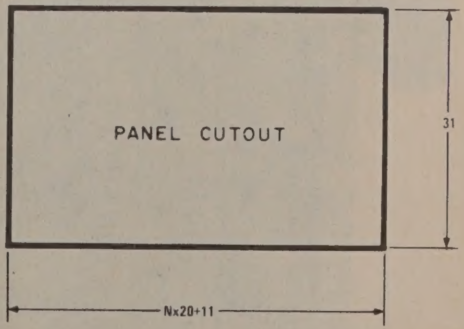
Black or tan housing

20 mm wide x 33 mm high x 40 mm deep

Contact ratings:	
Resistive switching	0.1 A
Max. non-switching	1 A
Working voltage	50 V
Contact resistance	.070 ohms



3/4 Scale


PANEL CUTOUT
31
Nx20+11

Options Available

A	Stops - to limit number of positions.
D	Hot stamped decimal point on switch housing or spacer.
L	Long board - for mounting components.
M	Custom marking - on thumbwheel, spacer or housing.
1,2,3,4,5	Colored wheel - 1-green, 2-yellow, 3-red, 4-blue, 5-white (standard wheel is black).
P	Printed circuit pins.

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

Matrix Boards

INTERSWITCH

ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA. 94010 • (415) 347-8217 • TWX 910-374-2353 • TELEX 34-9373

The simple straight-forward method of programming.

There are a number of standard 2-layer matrix boards available, but,

We specialize in custom 2, 3, 4 & 6 layer matrix boards.

Features

☐ Models rated at 2, 6 and 16 amps.
☐ All contact materials gold plated.
☐ Silk-screened inscriptions protected by a clear melamine layer.
☐ Spacing between rows and between columns .1", 3 and 6 mm.
☐ Protected and supported bus bar pairs.
☐ Shorting pins, diode pins and cable pins available.

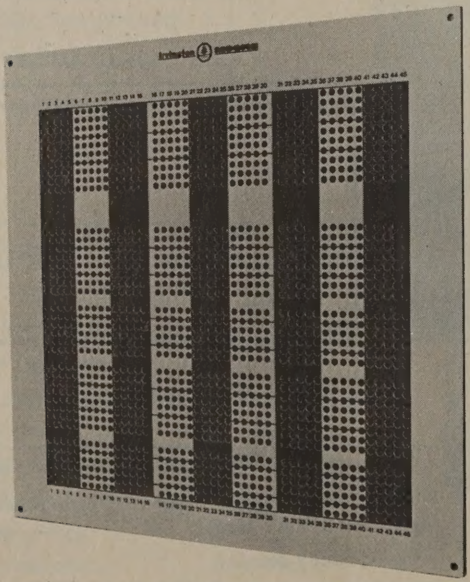
Applications

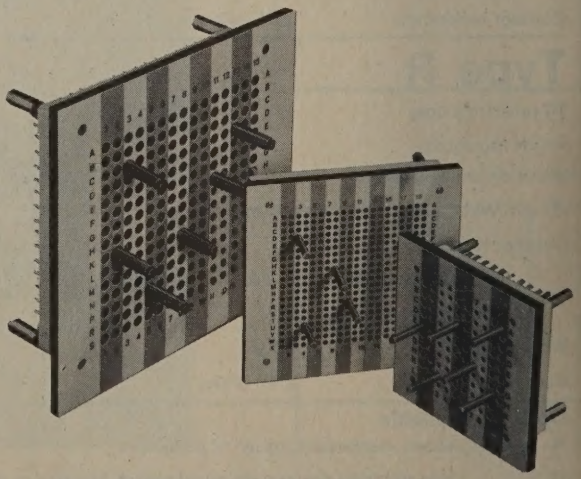
☐ Circuit test programmers.
☐ Reprogrammable diode matrix memories.
☐ Traffic controllers.
☐ Program variables for N-C machine tools.
☐ Memories for computers.
☐ Program variables for process controls.
☐ Power distribution systems.
☐ Lighting systems.
☐ Sound systems.

A matrix board is a manual programming device for electronic equipment. It is designed for situations where flexibility, economy and programming ease must be maximized. The inscribed face provides visual definition of each instruction, simplifying programming. Once programmed, circuits can be left indefinitely or changed as needed. Typical applications include the governing of batch processing, supervising of automatic machines and coordinating test equipment.

A matrix board is mechanically and electrically reliable, and comes in a variety of standard sizes. Custom boards can also be built to customer specifications in varying sizes and hole patterns.

The matrix is built around perpendicular rows of conductors, or bus bars contained in two or more layers. Those running vertically are called columns, those running horizontally are called rows. Where these conductors cross - the X, Y junction - a hole through the face of the matrix board allows a shorting pin to be inserted. A pin placed at that point connects one row to one column and closes the circuit between the two bus bars. Thus the basic function of the matrix board is that of a switch. Its advantage is the combination of switching actions that can be accomplished, and the ability to change, or reprogram the board quickly.





Data Modules

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A Unique Way of Programming

Features

☐ 4 switches per module.
☐ Compact size.
☐ Large visual display.
☐ Quick program change.
☐ Equal to a 1 x 4 matrix.
☐ Available with diodes.
☐ Available with right angle mounting.
☐ Available with changeover contacts.

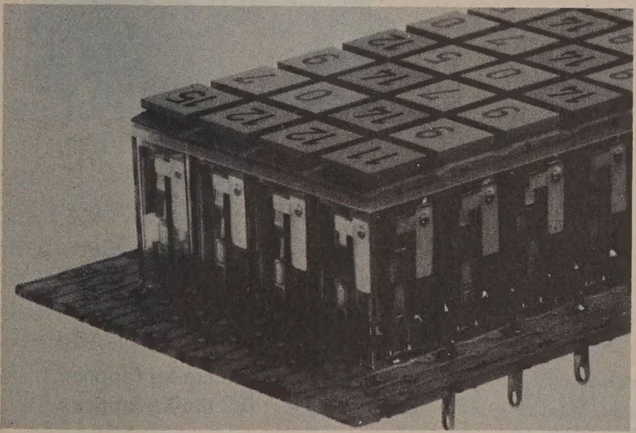
Applications

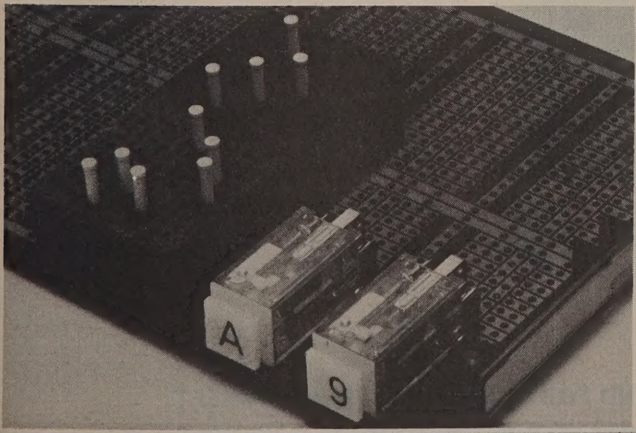
☐ Program variables for process controls for:
- Plastic molding equipment.
- Chemical formulating.
- Soap and cosmetic production.
- Paper products processing.

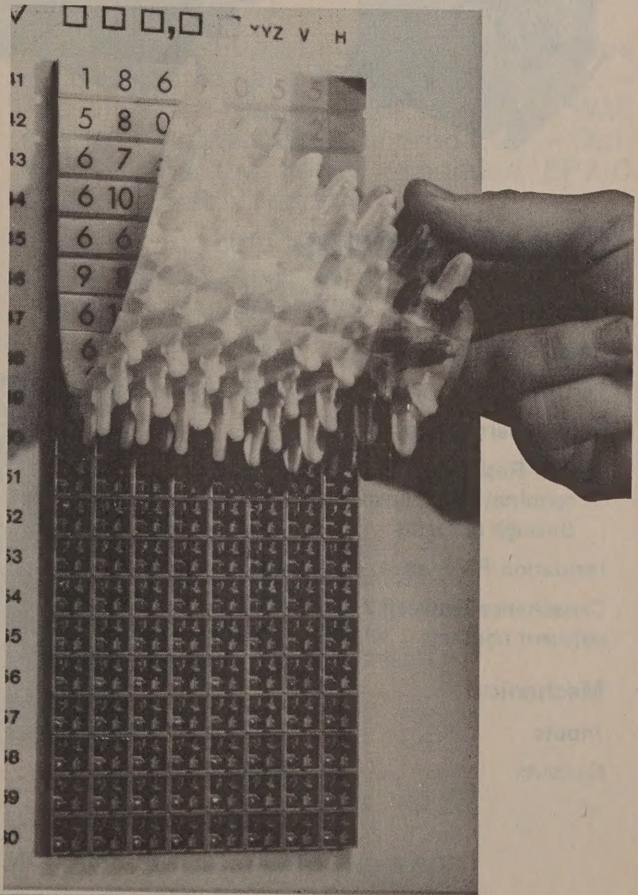
☐ Program variables for N-C machine tools.
☐ Program variables for:
- Computers and peripherals.
- Automatic typewriters.
- Automatic sprinklers.

The Series 300 and 400 Data Modules are 5-terminal miniature coding devices with 1-2-4-8 binary outputs. The output code selection is obtained by inserting one of the 16 different plastic programming keys. The keys selectively close from none to all four of the contacts housed within the Data Module. These units are available with or without diodes in series with the outputs.

The Series 200 Data Modules have four changeover contacts (9 terminals) thereby providing both the binary and complementary outputs.







GRS Rotary Switch

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The INTERSWITCH GRS Rotary Switch was designed for PCB mounting. Two models are available for mounting to vertical PCB's and two models for mounting to horizontal PCB's.

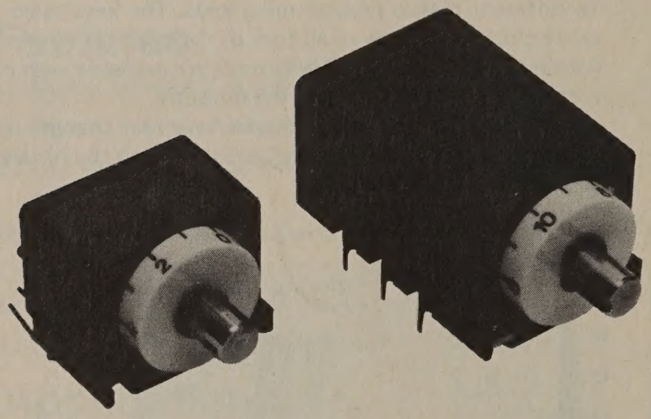
These switches are available with either decimal outputs or binary coded outputs and with the following detent angles:

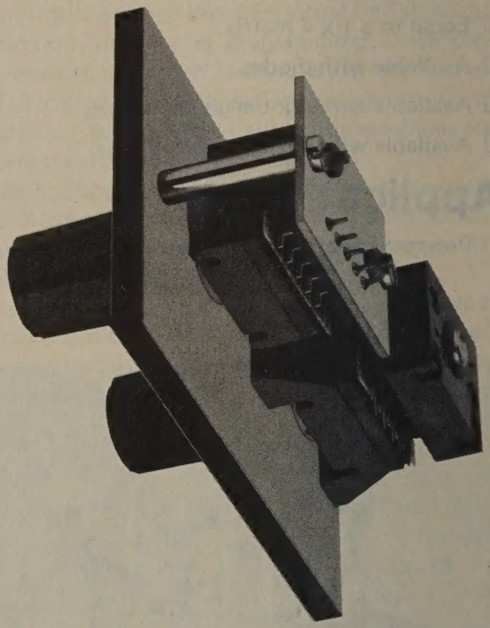
15° (24 position)
22.5° (16 position)
30° (12 position)
36° (10 position)

Stops may be ordered to limit the number of positions to something less if desired.

Switches may be ordered with shorting or non-shorting contacts. In addition, special output codes can be designed to fit your particular needs.

The GRS 1 and GRS 3 Rotary Switches may be ordered with up to four sections. Alternate mounting methods of the GRS 2 and GRS 4 give you greater freedom for your designs. In addition, some special shaft options are also available.





Specifications

Electrical

Rated Voltage	50 V
Test Voltage	500 V
Rated Thermal Current	1 A
Overall Resistance terminal-to-terminal through contacts	< 90 milliohms
Insulation Resistance	10^4 megohms
Capacitance between 2 adjacent contacts	0.87 pF (approx.)

Mechanical

Inputs	1 or 2 per plane
Outputs	Max. 12 per plane

Mechanical Cont'd.

Actuating torque	
30° or 36° detent angle	0.6 cm-kg (approx.)
15° or 22.5° detent angle	0.9 cm-kg (approx.)
Lifetime	100,000 detent operations

Environmental

Temperature Range	-25° C to +70° C

Materials

Au on PCB	2 microns
Au on Sliding Contacts	20 microns
Insulating Material	Polycarbonate, red

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WE INTERRUPT THIS CATALOG

TO TELL YOU SOMETHING IMPORTANT!

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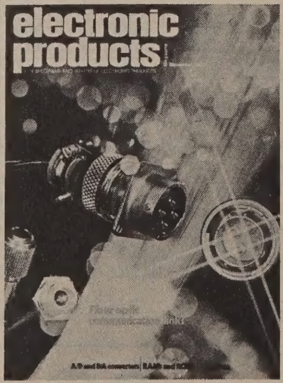

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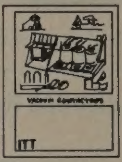
vacuum contactors

Vacuum Contactors are used to control large amounts of DC, power frequency and RF currents with ratings up to 50 kv and currents up to 900 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. This 12 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC & DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.

This 12-page catalog provides complete specifications on 3-pole vacuum contactors, high voltage AC and DC contactors, high voltage overcurrent relays and high voltage RF contactors actuated by solenoid, air or motor drives. Engineering notes are included that relate ratings to a variety of specific applications.

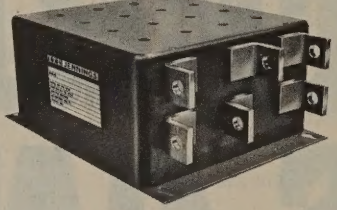


RP103-101

RP900-901

RP233X

RP20B



RP151

RP157

Model Number	Test Voltage (Pk KV)	Operate Voltage (Pk KV)	Continuous Current (Amps)	Max. Interrupt AC Current (Amps RMS)	Max. Interrupt DC Power (KW)	Capacitor Discharge Decaying to 0 in 200 μs	Contact Arrangement	Actuator Voltage (Volts)	Time to Close (Ms)	Break Time (Ms)	Weight (Lbs.)
RP101F4903D21B20 RP101F4904D21B20	50	30	200 DC	N/A	500 (10 A Max.)	N/A	N/O N/C	115 60 Hz	60	50	8¾
RP101F4304D26B20	50	30	200 DC	N/A	500 (10 A Max.)	N/A	N/O N/C	100 DC	55	42	8¾
RP103F4903D21B20 RP103F4904D21B20	50	30	200 RMS	2000	N/A	50 K Amps	N/O N/C	115 60 Hz	60	50	8¾
RP103F4304D26B20	50	30	200 RMS	2000	N/A	50 K Amps	N/O	100 DC	55	42	8¾
RP901K4903D21B30 RP901K4904D21B30	70	50	400 DC	N/A	500 (10 A Max.)	N/A	N/O N/C	115 60 Hz	60	50	15
RP901K4601D26B30 RP901K4602D26B30	70	50	400 DC	N/A	500 (10 A Max.)	N/A	N/O N/C	100 DC	34 60	11 25	15
RP900K4903D21B30 RP900K4904D21B30	70	50	400 RMS	4000 at 13 KV RMS	N/A	100 K Amps	N/O N/C	115 60 Hz	60	50	15
RP900K4601D26B30 RP900K4602D26B30	70	50	400 RMS	4000 at 13 KV RMS	N/A	100 K Amps	N/O N/C	100 DC	34 60	11 25	15

Unit	Pk. Operate Voltage 32 MHz	Contact Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Arrangement	Open Time	Close Time	Pull-in Current RMS	Hold Current RMS	Hold Power Watts	Actuating Voltage or Air Pressure	Approx. Weight	Life	Auxiliary Contacts Ratings Volt RMS Current RMS
RP233X4513006M00 (Solenoid Operated)	25	35	.0005	2	25	N/O	17 Ms.	7.5 Ms.	.7	.09	10	100 VDC	3 lbs.	1x10^{5}	Form C 230/7
RT224070A31NB (Solenoid Operated)	5	25	.0005	2.5	n/a	Latching	<300 Ms.	<300 Ms.	.3	n/a	n/a	230 VAC	12 lbs.	2.5x10^{5}	Form C 230/15
RP233D1585 (Air Operated)	25	35	.0005	2	25	N/O	<200 Ms.	n/a	n/a	n/a	n/a	40 ±5 psig	12 oz.	1x10^{5}	n/a
RF20B1586 (Air Operated)	20	135	.0004	10	2.5	N/O	<200 Ms.	n/a	n/a	n/a	n/a	35 ±5 psig	2 lbs. 12 oz.	1x10^{6}	n/a

Model Number	Operate Voltage V (RMS)	Continuous Current 60 Hz	Interrupt Current Amps RMS	Mechanical Life (Min.)	Actuator Voltage	Approx. Pull-in Current Amps RMS	Approx. Hold Current Amps RMS	Interrupt Time	Auxiliary Contacts	Weight
RP151B4541X44R20	600	200	2000	1x10^{6}	26.5 VDC	2.8	.4	Less than 1 Cycle	2 SPDT 230 VAC/10 A	16 lbs.
RP157B4549X41TX0 (60 Hz) RP157B4549X4KTX0 (50 Hz)	1500	300	3000	1x10^{6}	115 VAC	14.2	1.3	Less than 2 Cycles	4 SPDT 230 VAC/5 A	25 lbs.

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DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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vacuum interrupters

ITT Jennings offers a line of Vacuum Interrupters for use in power generation and distribution systems. Their high dependability compared with other types of interrupters has been proven in over 20 years of in-field service. In fact, the first commercial vacuum interrupter supplied by ITT Jennings, installed as a line-and-load dropping switch on a 138 kv transmission line, is still going strong. Vacuum Interrupters are simple in principle. They require that only two contacts be separated in a vacuum environment. ITT Jennings builds them with heavy metal alloy construction combined with ceramic envelopes. This inherently high dielectric device provides numerous advantages such as:

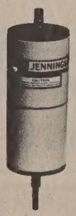
- Short actuator stroke, which simplifies operation
- High interrupting and operating speed.
- Rapid dielectric recovery, which minimizes restrikes.
- Very high 60 cps and Impulse Withstand Voltages.
- Extremely small and lightweight for their capacity.
- Quiet operation.
- Long, maintenance-free life.
- Using no oil, they are non-flammable, non-toxic, and non-explosive.

ITT Jennings Vacuum Interrupters are found in applications such as line and load dropping switches on 230 kv lines, and for switching large capacitor banks (usually at 15.5 kv, but they have been used in systems up to 345 kv). They are also used to interrupt transformer magnetizing currents up to 230 kv, for fault interruption up to 115 kv, and to control arc furnaces and other mining equipment at supply voltages up to 24.5 kv.

Twelve-page catalog provides engineering information on the selection and use of vacuum interrupters in various general purpose, utility and industrial applications. Contains complete specifications on vacuum interrupters and special vacuum interrupter switches for RF applications.

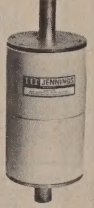
RP157

RP951B



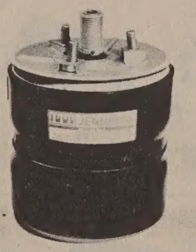
RP103C1

RP909

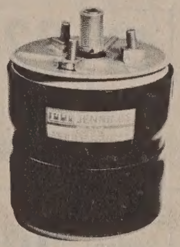


RP904D

RP602B



RP720



RP723/
RP728

ELECTRICAL								MECHANICAL				RELIABILITY	
Model Number	*Line-to-Line Voltage, Rated Max. KV (RMS)	Low Frequency Withstand Voltage KV (RMS)	Basic Impulse Level KV (Crest)	Continuous Current A (RMS)	Interrupting Ability, Max. @ Rated Voltage AC (RMS)	Momentary Current A (RMS)	Contact Stroke INCH	Contact Opening & Closing Velocity FT/SEC.	Contact Opening Force Max. Lbs.	Approx. Weight Lbs.	Moving Contact Weight Lbs.	Mechanical Life Operations @ Rated Current	Typical Operations Life/ Operations @ Max. Interrupting Current
RP157B	5	11	45	300	2000	20,000	3/16	2	10	2.5	0.8	500,000	50
RP951B	5	21	60	600	4000	30,000	¼	2	32	7	1½	500,000	100
RP103C1	15.5	36	95	200	2000	20,000	5/32	1	8	2¼	¼	250,000	100
RP602B	15.5	36	95	600	2000	20,000	¼	2¾	20	1.8	0.8	20,000 (in oil)	50
RP603B	38	80	150	600	2000	20,000	⅜	3	20	2.5	1.0	10,000	50
RP903C	15.5	50	110	600	4000	30,000	¼	2	32	8	1¼	500,000	50
RP904D	5	21	60	600	8000	30,000	¼	2	32	8	1¼	250,000	50
RP908	15.5	50	110	600	8000	20,000	¼	3/2.5	15	6	1.0	20,000	12
RP909	15.5	50	110	600	12,000	20,000	⅜	4/3	20	7	1.8	10,000	12
RP720	15.5	50	110	1200	20,000	32,000	⅝	6/3	45	13	2.4	10,000	4
RP723	15.5	50	110	2000	23,000	60,000	¾	7/2¾	45	24	3.70	10,000	4
RP728	15.5	50	110	2000	33,600	60,000	¾	7/3¼	45	24	3.70	10,000	4

* Higher voltages available on some models

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DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

JANCO CORPORATION

Series "A" MINIATURE ROTARY SELECTOR SWITCHES

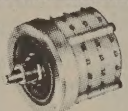
Series A-15 15°

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

6-1900 Series	1 pole/deck
6-1912 Series	2 pole/deck
6-1980 Series	3 pole/deck
6-1914 Series	4 pole/deck
6-1913 Series	6 pole/deck

Max. Positions: 24
Body Diameter: 2″

Series A-20 20°

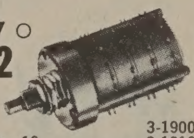


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 18
Body Diameter: 2″

Available only in single pole per deck construction.

Series A-22 22½°

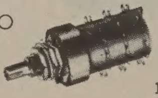


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

3-1900 Series	1 pole/deck
3-1912 Series	2 pole/deck
3-1914 Series	4 pole/deck

Max. Positions: 16
Body Diameter: 1.5″

Series A-30 30°



ELECTRICAL RATING:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.

1905 Series	1 pole/deck
1-1909 Series	2 pole/deck
4-1900 Series	3 pole/deck
67-1940 Series	4 pole/deck
67-1900 Series	6 pole/deck

Max. Positions: 12
Body Diameter: 1.036″

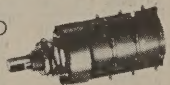
Series A-36 36°

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 10
Body Diameter: 1.036″

1900 Series	1 pole/deck
1960 Series	2 pole/deck

Series A-45 45°



ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Max. Positions: 8
Body Diameter: 1.036″

1906 Series	1 pole/deck
1-1910 Series	2 pole/deck

Series A-60 60°

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 6
Body Diameter: 1.036″

Available only in single pole per deck construction.

Series A-90 90°

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Max. Positions: 4
Body Diameter: 1.036″

Available only in single pole per deck construction.

Series "B" MICRO-MINIATURE ROTARY SELECTOR SWITCHES

- TOTALLY ENCLOSED
- EXPLOSION PROOF
- UNITIZED CONSTRUCTION

All switches offer maximum protection against radio frequency interference.

Body Diameter: .623″

Electrical Rating Continuous:
8 amps at 28 v dc

Switching Rate:
0 to 0.25 amp resistive
0 to 28 v dc
0 to 0.25 amp resistive
0 to 115 v ac
0 to 0.12 amp inductive
0 to 28 v dc

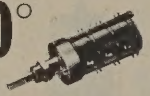
Torque: 5 to 9″ ounces

Contact Resistance:
.005 ohms average

Insulation Resistance:
100,000 megohms minimum at 100 volts
10,000 megohms minimum at 500 volts

Designed and Built to meet the environmental and functional requirements of MIL-S-3786

Series B-30 30°



Max. Positions: 12

2500 Series	1 pole/deck
2530 Series	2 pole/deck
2531 Series	3 pole/deck

"M" SERIES

2500M Series	1 pole/deck
2530M Series	2 pole/deck
2531M Series	3 pole/deck

Series B-36 36°

Max. Positions: 10

1-2500 Series	1 pole/deck
1-2530 Series	2 pole/deck

"M" SERIES

1-2500M Series	1 pole/deck
1-2530M Series	2 pole/deck

Series B-45 45°

Max. Positions: 8

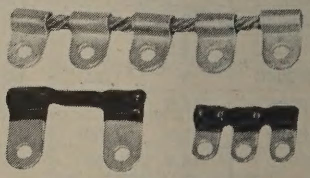
2-2500 Series	1 pole/deck
2-2530 Series	2 pole/deck

"M" SERIES

2-2500M Series	1 pole/deck
2-2530M Series	2 pole/deck

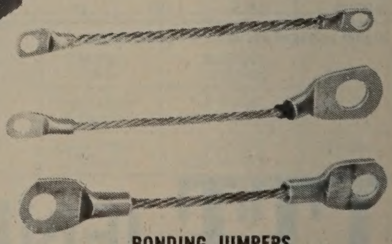
ELECTRICAL HARDWARE PRODUCTS FOR AIRCRAFT

EXTERNAL AMMETER SHUNTS MIL-S-61-B



FLEXIBLE BUS ASSEMBLIES

BUS BARS

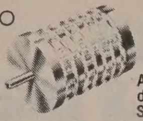


BONDING JUMPERS

JANCO CORPORATION
Box 3038 • Burbank, CA. 91504 • 3111 Winona Avenue • (213) 849-2107 • (213) 845-7473 • TWX 910-498-2701

Series "C" ROTARY SELECTOR SWITCHES

Series C-22 22½°

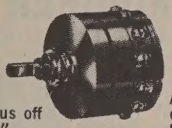


Max. Positions: 16
Body Diameter: 3″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.

Available only in single pole per deck construction.
Screw terminals only.

Series C-30 30°



Max. Positions: 11 plus off
Body Diameter: 2.180″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available in 1 and 3 poles per deck construction.
Screw terminals only.

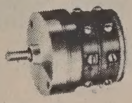
Series C-36 36°

Max. Positions: 9 plus off
Body Diameter: 2.375″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available only in single pole per deck construction.
Screw terminals only.

Series C-45 45°

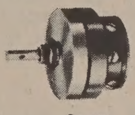


Max. Positions: 7 plus off
Body Diameter: 1.93″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available in 1 and 2 poles per deck construction.
Screw terminals only.

Series C-90 90°



Max. Positions: 4
Body Diameter: 2.12″

Screw terminals only.

ELECTRICAL RATING:
1 pole construction
15 amps Res. 115 v ac
15 amps Res. 28 v dc
10 amps Ind. 28 v dc
2 pole construction
7.5 amps Res. 115 v ac
7.5 amps Res. 28 v dc
5 amps Ind. 28 v dc

GENERAL SPECIFICATIONS

All switches offer maximum protection against radio frequency interference.

ELECTRICAL RATING:
Carry 10 amps continuous.
Make and Break — see individual switch data.

VOLTAGE DROP:
0.1 volt or less at rated amperage.
Initial Contact Resistance: .003 ohm.

LIFE:
10,000 double cycles make and break rated amperage.

TORQUE:
1 to 3 inch lbs.

SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECS.:
MIL-S-6807 (rotary switches enclosed)
MIL-S-3786 (rotary switches)
MIL-E-5272 (environmental testing)

ON MOST OF THE SWITCHES LISTED, THE FOLLOWING FEATURES ARE AVAILABLE:

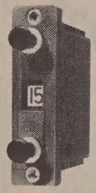
- O-ring Shaft and Panel Seal
- Combination of Decks
- Bridging contacts
- Momentary positions
- Isolated positions
- Adjustable stops
- Solenoid driven
- Keylock
- Gang switches
- Concentric shaft switches

JANCO CORPORATION

Series "D" PUSHBUTTON ROTARY SWITCHES

FEATURES: • Totally enclosed, explosion proof. • Printed-circuit construction. • Black or white numbers on black or white background indicate switch positions (black numbers on white background for lighted switches). • All standard codes available. Available in 8, 10, 12 or 16 positions. • Plastic covered buttons, available in black, red, green, yellow, white or blue.

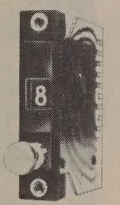
BI-DIRECTIONAL



Index	Series	No. of Positions
45°	D45B	8
36°	D36B	10
30°	D30B	12
22½°	D22B	16

SERIES 2800 QPL to MIL-S-22710/18

UNI-DIRECTIONAL



Index	Series	No. of Positions
45°	D45U	8
36°	D36U	10
30°	D30U	12
22½°	D22U	16

SERIES 2900M QPL to MIL-S-22710/23

PERFORMANCE DATA:

ELECTRICAL RATING CONTINUOUS:
3 amps

MAKE AND BREAK
.125 amp res. at 28 v dc and 115 v ac
.05 amp ind. at 28 v dc

PUSH FORCE:
55 oz. max.

CONTACT RESISTANCE:
Initial .100 ohms
After life .160 ohms

LIFE:
50,000 cycles
Cycle consists of 720° rotation

INSULATION RESISTANCE:
5,000 megohms

ALTITUDE:
70,000 ft.

TEMPERATURE RANGE:
−65°C to +85°C

PLUNGER TRAVEL:
.180 approx.

DIELECTRIC STRENGTH:
750 volts RMS

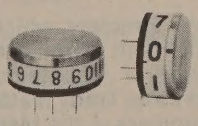
WEIGHT:
½ oz. approx.

Designed to meet the requirements of MIL-S-22710

TYPICAL UNIQUE APPLICATIONS OF JANCO ROTARY SWITCHES

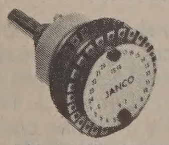
JANCO
JANCO
JMP 36

MINIATURE PIN-TYPE ROTARY SWITCHES
For printed circuit boards and front panel mounting. Various numbers of positions and poles.



MINI CODE SWITCHES
Intended to be used with card racks on ½″ centers, the unit measures ⅜″ high. Can be lighted.

SINCE 1947 . . . JANCO has solved thousands of switching problems! For a quick solution to your specific problem — call JANCO direct.



FOR "DRY" CIRCUIT SWITCHING
To interface with low level and "dry" logic circuits. Available in a variety of detent angles and output codes.

MASTER COMMUNICATIONS SELECTOR SWITCH
Provides standard coded outputs and offers unique switching functions. Only .675″ in diameter.

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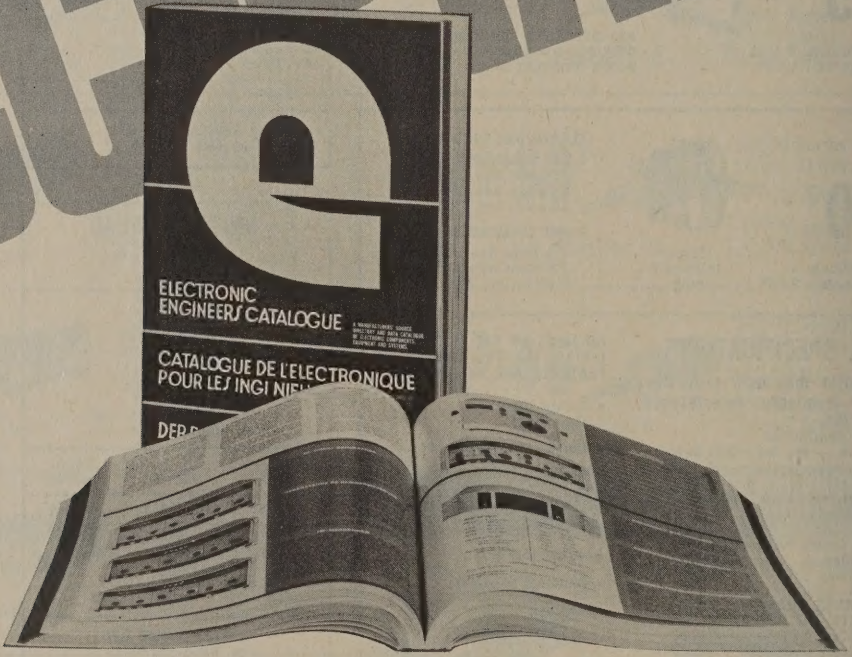
ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



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It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

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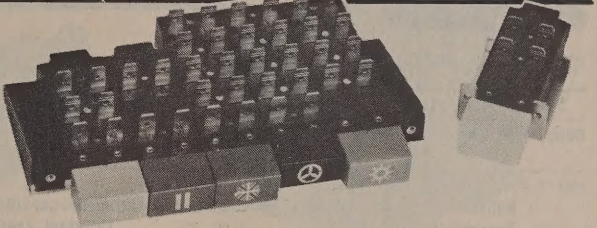
LEDEX PUSH BUTTON CONTROLS



SERIES 1500 / 16A-250 Vac Power Switch

The Series 1500 single and ganged switch assemblies give you many benefits not found in other switches.

Up to five circuits per switch station, in combinations of N.O. or N.C. contacts, enables you to perform more complex switching in less space. Switch single phase, two phase/three wire, or three phase power with one module.

Combine the wide variety of circuits with the interrelated switching logic, such as interlock, reciprocal or master release, or any combination of these for the exact solution to your switching requirements.

STANDARD FEATURES AND OPTIONS

CAPACITY... single push button to fifteen button assemblies.
CONTACTS... double breaking, silver plated brass.
MAX. CIRCUITRY PER... std. length — 1 NO+3 NC or 2 NO+2 NC or 3 NO+1 NC.
SWITCH MODULE... extended — 1 NO+4 NC or 2 NO+3 NC or 3 NO +2 NC or 4 NO+1 NC.
CURRENT CAPACITY ... 16A/250 VAC resistive.
LIFE, ELECTRICAL @ 10A/250 VAC... 5 x 10^4 with resistive load.
TERMINAL COLOR CODE... red dot — normally closed, no marking — normally open.
TERMINALS... spade lug .248″ x .032″; mate with Amp "Faston" #42844-1 or equivalent.
MOUNTING... two holes for #6 screws or #4-48 tapped plates.
CAPS (NON-REMOVABLE)... size — .49″ x .96″. (Color (opaque) — black, white, red, yellow, green, blue, dark grey, light grey.
LEGENDS... hot stamping or engraving.

All of this, plus the Series 1500 **saves you money**... when buying them — when installing them — when using them! Priced as low as $.85 per station at the 1000 quantity makes them one of the most economical power switches available. When installing them, simply attach spade terminals to the color coded contacts — eliminate soldering and relay hook-up. You get the biggest savings when you use them. Series 1500's are high-quality switches built to take it. The rugged construction and non-removable caps make these switches ideal for use in vending machines, major appliances, and other equipment subject to heavy use.

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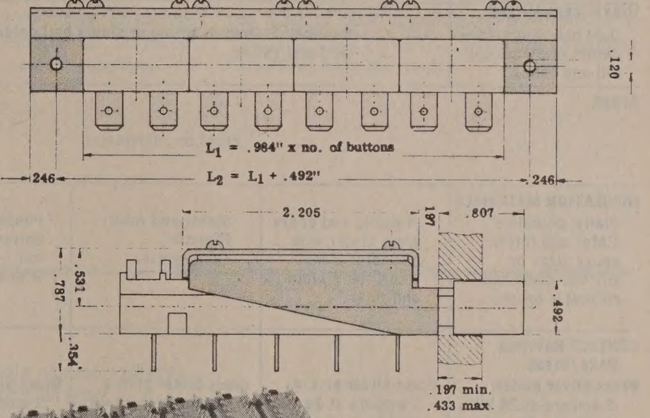
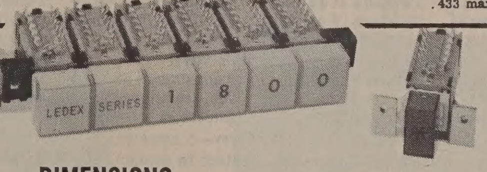
DIMENSIONS



SERIES 1800/Illuminated Push Button Controls



Tailor the Series 1800 illuminated push button controls to meet your specific switching requirements. You can integrate up to twenty high and low level switch modules on a mounting rail. The modules can be programmed to provide the interrelated release actions and interlock you desire.

The low level modules, with self-cleaning contacts, should be used to switch loads less than 20 watts. They are available with either 2P2T or 4P2T wiping contacts. For controlling circuits up to 6A/250 VAC, use the modules with bridging contacts. They are available with 2 NC, 2 NO, or 1 NC+1 NO contacts.

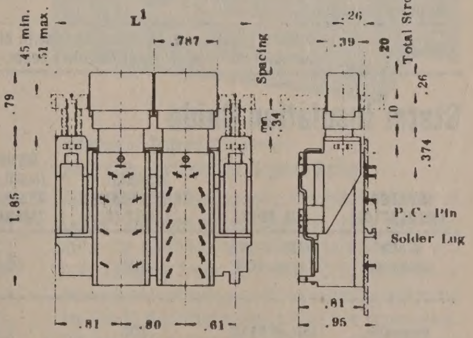
Options include single or dual bulb illumination. Legends can be hot stamped or engraved on opaque and transparent caps. Mylar film legends can be inserted behind the outer button lens on transparent caps.

For ease of installation, assemblies are available with P.C. or solder lug terminals. The solder lug terminals also accept Amp "Faston" #110 connectors or equivalent.

STANDARD FEATURES AND OPTIONS

CAPACITY... one to twenty switch modules on a frame.
SWITCHING ACTION... momentary. Push/push, reciprocal, master, reciprocal plus master release, interlock.
CONTACTS:
WIPING... 2P2T or 4P2T contacts @ 1A/60V. 20W maximum; 10 mA/5V minimum.
LIFE... 1,000,000 actuations @ minimum or 50,000 @ maximum load.
BRIDGING... 1 NO+1 NC, 2 NO or 2 NC contacts @ 6A/250 VAC maximum; 10 mA/20V minimum.
LIFE... 250,000 actuations @ minimum or 50,000 @ maximum load.
MATERIAL... silver plated brass.
TERMINALS... solder lug accepts Amp "Faston" #110 or printed circuit board pins.
LEGENDS... hot stamp, engrave or film insert (see legend chart for standard type).

DIMENSIONS



L^1 = .80″ x No. buttons +.82″

ILLUMINATION... single or dual sockets for T4.6 mm lamps at all stations. Rectangle cap style 7⁄16 x ¾ available in single socket only.
CAPS:
⅜ x ¾ inch.
Opaque... black, white, red, green, yellow, blue, light gray.
Transparent with light diffusing grid or plain... clear, red, green, yellow, blue.
7⁄16 x ¾ and ¾ x ¾ inch.
Opaque... black, light gray.
Transparent for inner cap legend... clear, red, green, yellow, blue.
MOUNTING... front panel mounting with #4-48 screws.

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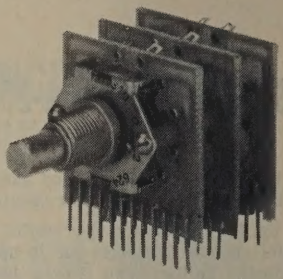
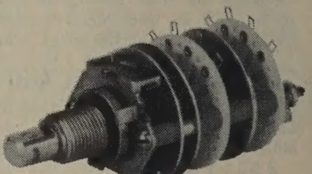
LEDEX
LEDEX INC.
DEPT. EM, 126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

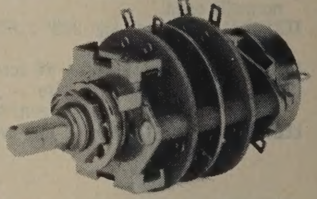
ROTARY MANUAL SWITCHES

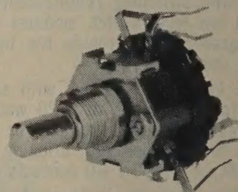
STANDARD SPECIFICATIONS

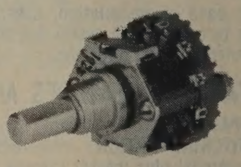
	206, 208, 210, 212	304, 306, 312	404, 406, 412	504, 506, 512	524
CONSTRUCTION	Throughbolts				
SHAFT— Military	¼″ steel, cadmium plated, chromated per QQ-P-416, class 2, type 11 (50 hour salt spray).				
Commercial	¼″ steel, cadmium plated.				
MOUNTING	Steel bushing, ⅜-32 thread, optional ¼ or ⅜ inch, standard length.				
SPACERS	Glass filled nylon, grade G 1/30.				
LOCATING LUG	Standard fixed at .375″ radius; or can be deleted.	Standard fixed at 17/32″ radius; or can be deleted.	Variable at 15° increments except 75°, 90°, 105°, 255°, 270°, 285°.	Standard fixed at 17/32″ radius; or can be deleted.	Variable at any angle ±2° at 17/32″ radius, or can be deleted.
METAL PARTS	All metal parts cold rolled steel with cadmium plating for commercial applications. Chromate dip for 50 to 100 hour salt spray per MIL-S-3786 for military applications. Special materials such as passivated stainless steel or nickel plated brass parts are also available.				
INDEX MECHANISM	Dual ball Starmate detent or single ball hill and valley.	Dual ball Starmate, spring or single ball detent (Hill and Valley).			Single or dual ball detent.
STOPS	Fixed or adjustable.				Fixed at positions specified.
INSULATION MATERIALS	Diallyl phthalate stator and rotor; epoxy glass or silicone glass with polyester rotors.	Phenolic and epoxy glass stator with polyester glass rotor; Kel-F stator and rotor.	Stator and rotor: Phenolic, Epoxy glass.	Phenolic stator with polyester glass rotor; Kel-F with Kel-F.	Phenolic and epoxy glass stator with polyester glass rotor.
CONTACT RATINGS Make/Break	**Brass-Silver plated** .5 ampere at 28 VDC, resistive; .25 ampere at 110 VAC, resistive. **Solid Silver** 1 ampere at 28 VDC, resistive; .5 ampere at 110 VAC, resistive.	**Brass-Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac. **Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Brass-Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac. **Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Brass-Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac. **Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.	**Brass-Silver plated** 1 ampere at 28 vdc, resistive; .5 ampere at 110 vac. **Solid Silver** 2 amperes at 28 vdc, resistive; 1 ampere at 110 vac.
	Carry—5 amperes.	Carry—5 amperes.	Carry—5 amperes.	Carry—10 amperes.	Carry—5 amperes.
	Dielectric—750 volts, contact to contact.	Dielectric—1,000 volts, contact to contact; 500 volts when contacts are insulated back to back.			
	Contact resistance, in accordance with MIL-S-3786, will not exceed .010 ohms initially nor .020 ohms after rotational life tests.				









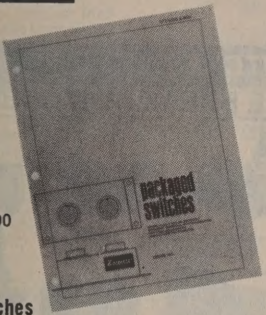


Stator Insulation Guide

STATOR INSULATION	MIL SPEC.	USABLE TEMPERATURE LIMIT (C)	MINIMUM INSULATION RESISTANCE (MEGOHMS)	
diallyl phthalate	MIL-M-14F type SDG	125	10,000	Most recent material, combines best combinations of desirable dielectric, low moisture, and structural characteristics at prices competitive to phenolic.
Phenolic	MIL-P-3115, type PBE-P	100	1,000	Most economical, most commonly used. Though non-nutrient to fungi, varnish impregnation per MIL-V-173 is available. Meets most military and commercial application requirements.
Epoxy-Glass	MIL-P-18177, type GEE	125	10,000	Economical, excellent structural and dielectric strength. Lower moisture absorption rate than phenolic.
Silicone Glass	MIL-P-997C, type GSG	125	10,000	Good RF characteristics. Lower structural strength than epoxy glass, and slightly higher in cost.
Kel-F	Fedspec L-P-385B	125	20,000	Excellent structural and dielectric strength, low moisture absorption.

LEDEX INC.
126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

STEPPING SWITCHES/CIRCUIT SELECTORS

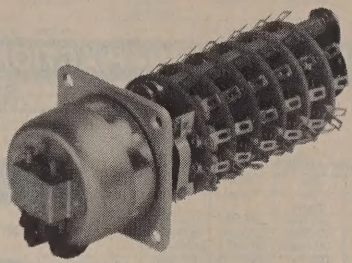


Catalog B-3200

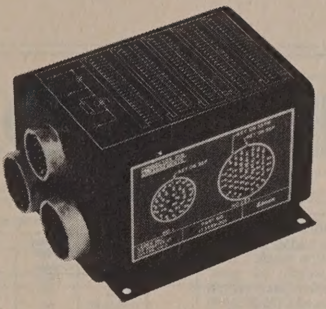
Packaged Switches
Catalog B-3200 provides design guidelines for specifying and using hermetically sealed switches where high reliability requirements or harsh environmental conditions are factors that the designer must consider in the application.

Several stock models, including compact 5 pole 2 throw, 49 pole 2 throw, and 39 pole 3 throw switches, are available for immediate delivery. Circuit diagrams and various switch control methods are given for each of the ten stock models shown.

Custom engineered programmers, variable intervalometers, controllers and management systems are provided as examples of how packaged switches can be tailored to meet a wide range of exacting requirements.



Ledex Stepping Switches
Used for relays, transfer switching, remote control of predetermined circuit patterns, remote sequencing of complex switching arrangements, or in programming checkout and sequential operations. They are known best for their ability to perform multiple switching functions reliably, in limited space, and under severe operating and environmental conditions. Available in open construction, prewired modules or as packaged control solutions.

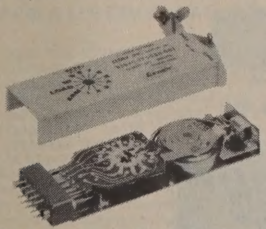


Ledex Hermetically Sealed Switches
Engineered to withstand severe shock and vibration, such as encountered in aircraft, missile and military applications, and to provide added switching reliability in adverse environments. Used extensively in aerospace and underwater guidance controls, as mode selectors, in rocket firing devices, and in a variety of military control functions that demand a high degree of reliability. There are 13 models available from the shelf.

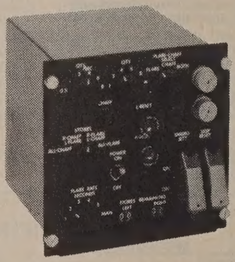
LEDEX PACKAGED CONTROL SOLUTIONS

Here are examples of Ledex Stepping Switches designed into compact, reliable control packages that combine the best characteristics of solid state and electromechanical technologies.

Whether your problem involves armament controls or commercial control functions, there's a good chance Ledex has already solved a similar problem. Our Packaged Switches Catalog, B-3200, shows several more detailed examples and also includes specifications for 13 hermetically sealed switches available from the shelf.



Miniaturized Armament Control Intervalometer
Flat, compact, 12-position stepping switch measures only ½" x 1¼" x 4¼", fires 19 rockets, sequentially in pairs. It includes a Ledex pulser to control time intervals over mil-spec. temperature and voltage ranges.



Dual Channel Flare/Chaff Dispenser Programmer
An all electronic dispenser, except for mechanical counters, allows programming of rate and quantity for flare or chaff dispensing by independent or simultaneous channel operation. Output pulses of up to 10 amperes per channel drive the electromechanical distributor switches located elsewhere in the aircraft. This state of the art experience can also be put to use in commercial applications as well as military. Let us interface your requirements with a "black box" solution.

SEC
MS X 100
MS X 10
INTERVALOMETER

Universal Stores Dispenser Intervals Variable on Digital Basis
All solid state and among the most flexible of Ledex intervalometer designs, this one permits the pilot to vary release intervals to any rate ranging from 30 ms to 9.99 seconds in increments of 10 ms. It includes a stepping switch to distribute sequential fire commands. Timing tolerance is ±10% over a voltage range of 22 to 32 volts and temperature to −55°C to +85°C. The package includes built-in suppression to protect solid state circuitry when switching inductive loads.

For engineering assistance and technical literature, write or phone:

LEDEX INC.
126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 244-9530

itw LICON

PRECISION SNAP-ACTION SWITCHES

BASIC SWITCHES

Type 10. Highly sensitive "serpentine blade" snap action switch. UL rated for precision basic switch appli. 15amps (75-80%PF) 125, 250, 480 VAC. 0.5A, 125 VDC. #6 Screw Term and cup washer.

TYPE 08. Similar to Type 10 series except U.L. rated for industrial control switch applications at 22.5 amps - 125, 250, 480 VAC; 5 amp - 125 VDC; 1/3 H.P. - 125 VAC; and 1/2 H.P. - 250 VAC. To order Type 08 switches, simply change the "10" prefix to "08".

MINIATURE SWITCH

Type 11. High capacity two circuit Double break mechanism with wiping action. UL/CSA listed. SPDT DB. Form Z. ¾ Hp. 250 VAC. 10 amp 125/250 VAC 75%-80%P.F.

HEAVY DUTY SWITCH

Type 14. Industrial limit switch. Uses double break mechanism for high electrical rating. UL listed. 20 amps @ 125/250 480 VAC. 75%-80%PF. SPDT-DB. Form Z.

SUBMINIATURE SWITCH

Type 16. Double break. 2 circuit. UL/CSA listed. 10 amps @ 125/250 VAC.

SUB SUBMINIATURE

Type 18. Double break. Rated: 7 amps @ 125/250 VAC; 3 amps inductive @ 28 VDC. UL listed. Diallylphthalate case.

DOUBLE POLE SWITCH

Type 22. DPDT high current interruption. Rated: 10 amps @ 125/250 VAC, 75-80%PF. UL listed. 10 amps @ RES 28 VDC. Double bearing guide. Wiping action. Beryllium copper switch blades.

DOUBLE POLE SUBMIN.

Type 26. Two Butterfly Double break mechanisms. Both poles operate simultaneously due to special linkage. Uses type 76 actuators. UL rated 8 amps 125/250 VAC, 75-80% PF. UL listed. DPDT-DB Form ZZ). 10 amps. res., 5 ind. @ 28 VDC.

TYPE 10 PRECISION SNAP-ACTION 15 AMP

Type	Splash Proof Seal	Oper. Force (Oz.)	RLS Force (Oz.)	Pre-Tra-Travel	Over Travel	Mov Diff.
10-132	No	10±3	4 Min.	.015 Max	.005 Min.	.0004-.002
10-332	No	10±3	4 Min.	.015 Max.	.219 Min.	.0004-.002
10-332001	Yes	11±4	4 Min.	.015 Max.	.219 Min.	.0004-.002
10-432	No	6 Max.	½ Min.	.156 Max.	.060 Min.	.050 Max.
10-532	No	6 Max.	½ Min.	.187 Max.	.060 Min.	.050 Max.
10-632	No	3.5 Mx.	½ Min.	.406 Max.	.156 Min.	.005-.045
10-732	No	3.5 Mx.	½ Min.	.312 Max.	.156 Min.	.045 Max.
10-832	No	10±3	4 Min.	.015 Max.	.060 Min.	.0004-.002
10-932	No	10±3	4 Min.	.015 Max.	.140 Min.	.0004-.002

TYPE 11 MINIATURE 10 AMP

Type	Terminals	Description
11-104	End Solder	Basic Switch
11-204	#4 Screw	Basic Switch
11-304	Side Solder	Basic Switch
11-504	Quick Disconnect, 250	Basic Switch
11-114	End Solder	Reset Action
11-314	Side Solder	Reset Action

MECHANICAL CHARACTERISTICS

Pretravel	.050 max.
Overtravel	.015 min.
Operating Force	8±3 oz.
Release Force	4 oz. min.
Movement Differential	.020±.005

TYPE 14 HEAVY DUTY 20 AMP

Type	Mntg.	Oper. Force	Release Force	Pre-Travel	Over Travel	Mov. Diff.
14-324	Stan.	12±3	4 Min.	.074 Max.	.218 Min.	.020±.005
14-12403	Vert.	12±3	4 Min.	.074 Max.	.218 Min.	.020 + .005
14-124	Stan.	12±3	4 Min.	.074 Max.	.030 Min.	.020 + .005
14-12404	Vert.	12±3	4 Min.	.074 Max.	.030 Min.	.020 + .005
14-12804	Vert.	12±3	4 Min.	.074 Max.	.030 Min.	.020 + .005
14-724	Stan.	5±2	2 Min.	.56 Min.	.060 Max.	.046±.0121
14-72403	Vert.	5±2	2 Min.	.156 Min.	.060 Max.	.046 + .012

TYPE 16 SUBMINIATURE 10 AMP

16-104	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-304	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-404	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-40421	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-403	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-504	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005
16-503	Stan.	3-8±2	2 Min.	.050 Max.	.012 Min.	.020±.005

TYPE 16 INTEGRAL LEVER 5 AMP

Series 16-47 INTEGRAL LEVER SWITCH is specially designed to reduce customer cost. It features the Butterfly® double break snap action mechanism with an integral actuator assembly, which resists contact welding, minimizes mechanical bounce and increases electrical life. Additional features are 2 circuit control with 1 switch, and a higher current rating than comparable sized single break switches.

The 16-47 is U.L. approved at 5 AMP @ 125/250 V.A.C., ¼H.P. @ 125 V.A.C. A variety of integral levers are available to suit your individual switching requirements, in momentary and maintained action.

MECHANICAL CHARACTERISTICS TYPE 16-470004

Contact Arrangement	SNPO-DB	Operating Force	10 G. max.
Pretravel	.153 ref.	Release Force	10 G. max.
Overtravel	.062 ref.	Movement Differential	.100 ref.

MECHANICAL CHARACTERISTICS Type 16-470101

Contact Arrangement	SPDT-DB	Operating Force	1.5 oz. max.
Pretravel	.225 max.	Release Force	5 G. min.
Overtravel	.060 min.	Movement Differential	.100±.015

TYPE 18 SUB-SUBMINIATURE 7 AMP

Type	Terminal	Circuit
18-40421	Solder-Lug	DPDT-DB (Form Z)
18-430080	P.C. Terminals	SPDT-DB (Form Z)

MECHANICAL CHARACTERISTICS

Operating Force	5^{+3}_{-2} oz.
Release Force	1½ oz. min.
Pretravel	.030 max.
Overtravel	.006 min.
Movement Differential	.015±.005

TYPE 22 MINIATURE 10 AMP

22-104	End Solder	DPDT-DB (Form ZZ)
22-304	Side Solder	DPDT-DB (Form ZZ)
22-202	#4 Screw	DPST-DB (N.O.)(Form XX)
22-504	½" Quick Disconnect	DPDT-DB (Form ZZ)

CHARACTERISTICS

Pretravel	.060 max.
Overtravel	.015 min.
Operating Force	17±5 oz.
Release Force	4 oz. min.
Movement Differential	.030±.007
Terminals	Solder (side or end) #4 screw ¼" quick disconnect

TYPE 26 SUBMINIATURE 2 POLE 8 AMP

Circuitry	Simultaneity	Contact Material	Terminal	Part No.
DPDT-DB (Form ZZ)	Simultaneous	Silver	End Solder	26-804
DPDT-DB (Form ZZ)	Simultaneous	Gold Plated	End Solder	26-804001
DPDT-DB (Form ZZ)	Non-Simultaneous	Silver	End Solder	26-804010
DPDT-DB (Form ZZ)	Non-Simultaneous	Gold Plated	End Solder	26-804011
DPDT-DB (Form ZZ)	Simultaneous	Silver	Side Solder	26-904
DPDT-DB (Form ZZ)	Simultaneous	Gold Plated	Side Solder	26-904001
DPDT-DB (Form ZZ)	Non-Simultaneous	Silver	Side Solder	26-904010
DPDT-DB (Form ZZ)	Non-Simultaneous	Gold Plated	Side Solder	26-904011

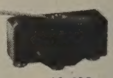
MECHANICAL CHARACTERISTICS

Pretravel	.050 max.	Release Force	5 oz. min.
Overtravel	.012 min.	Movement Differential	.020±.005
Operating Force	12±4 oz.		

SINGLE BREAK SWITCHES

10-132

10-332
10-332001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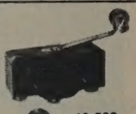
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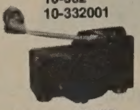
10-632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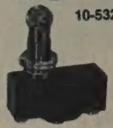
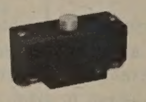
10-832


10-932

DOUBLE BREAK SWITCHES

11-104

14-3204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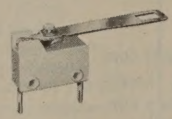
14-724

16-104

16-304

16-404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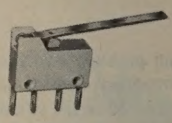
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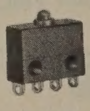
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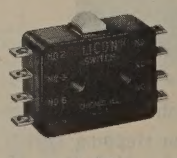
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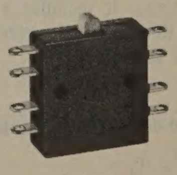

26-804

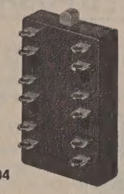
3 POLE SUBMIN.
Type 36. Compact triple pole double break switch. Three butterfly double break mechanisms. Rated at 7.5 amps 125/250 VAC. simultaneous handling for up to 6 circuits in a single switch. Uses 76 series actuators. UL listed. 3 PDT-DB (ZZZ).

TYPE 36 SUBMINIATURE 3 POLE 7.5 AMP

Circuitry	Simultaneity	Contact Material	Terminal	Part No.
3PDT-DB (ZZZ)	Simultaneous	Silver	End Solder	36-604
3PDT-DB (ZZZ)	Simultaneous	Gold Plated	End Solder	36-604001
3PDT-DB (ZZZ)	Non-Simultaneous	Silver	End Solder	36-604010
3PDT-DB (ZZZ)	Non-Simultaneous	Gold Plated	End Solder	36-604011
3PDT-DB (ZZZ)	Simultaneous	Silver	Side Solder	36-704
3PDT-DB (ZZZ)	Simultaneous	Gold Plated	Side Solder	36-704001
3PDT-DB (ZZZ)	Non-Simultaneous	Silver	Side Solder	36-704010
3PDT-DB (ZZZ)	Non-Simultaneous	Gold Plated	Side Solder	36-704011

MECHANICAL CHARACTERISTICS

Pretravel . . . . .050 max.
Overtravel . . . . .012 min.
Operating Force . . . . 16 ± 4 oz.
Release Force . . . . 4 oz. min.
Movement Differential . . . .020 ± .010



36-704

ACTUATORS

TYPE 11 ACTUATORS

Type	Kind	Oper. Force	RLS Force	Pre-travel	Over-travel	Mov. Dif.
71-1040	Roller	3.5 Max	2 Min	.093Max	.062Min	.030 + .015
71-2010	O.T.	8 + 3	4 Min	.050Max	.215Min	.020 + .005

TYPE 16 ACTUATORS

Type	Kind	Oper. Force	RLS Force	Pre-travel	Over-travel	Mov. Dif.
76-1200	Roller	2.5Max	1 Min.	.125Max	.025Min	.047 + .011
76-2110	Lever	2.5Max	1 Min.	.125Max	.025Min	.047 + .013
76-1220	Roller	5 + 3	2min.	.050Max	.012Min	.020 + .005
76-2260	O.T.	5/32Min	. . . . . .	. . . .	. . . .	. . . .

TYPE 18 ACTUATORS

Type	Kind	Oper. Force	RLS Force	Pre-travel	Over-travel	Mov. Dif.
78-3000	Lever	. . . .	. . . . . .	. . . .	. . . . . .	. . . .
78-3100	Roller	6 + 2	2 Min.	.125Max	.030 Min	.035 + .015

TYPE 22 ACTUATORS

72-1160	Roller	. . . .	. . . .	. . . .	. . . .	. . . .
72-1150	Lever	10 Max	1.5 Max	.150Max	.035Min	.070 + .015
72-2080	O.T.	17 + 5	4 Min	.060Max	.215Min	.030 + .007

TYPE 26/36 ACTUATORS

76-1200	Roller	12 Max	1.5 Min	.125Max	.025Min	.055 + .022
76-1210	Lever	9 Max	2 Min	.155Max	.025Min	.065 Max
76-1220	Short	12 + 4	5 Min	.050Max	.012Min	.020 + .005
76-2260	O.T.	16 + 4	4 Min	.050Max	.150Min	.020 + .005

DOOR INTERLOCK SWITCHES

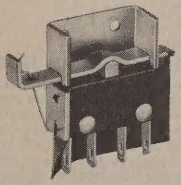
TYPE 76 DOOR INTERLOCK SWITCHES

The Licon Type 76 Door Interlock Switches are low cost mechanisms for the protection of personnel involved in testing and servicing hazardous electronic equipment.

For rugged dependability and quality assurance, the Licon 76-6 Series characterizes the need for a compact subminiature safety device, at reasonable cost.

Under power conditions this design employs the highly reliable Type 16 double break switch for automatic interruption of power when service door or cabinet drawer is entered, and features a manual set (pull to maintain) for the continuation of power when servicing or testing circuits is required.

Following service when door is closed, the actuating rod returns to normal or reset position allowing power to continue.



76-6005

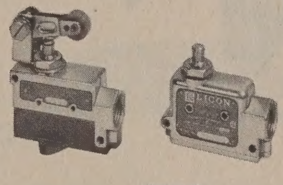
76-6005
Single Pole Interlock Switch
76-6009
Double Pole Interlock Switch
76-6012
Triple Pole Interlock Switch

INDUSTRIAL LIMIT SWITCHES

SERIES 30 DIECAST ENCLOSED

Accurate repeatability, long life and precise electrical control for heavy duty limit, safety and interlock operations. Durable switch protection, multiple mounting and actuating flexibility. Internal basic switch accessible for wiring or replacement by removing bottom plate. Available in a variety of infinitely adjustable actuators. Aluminum housing. Permits adequate wiring room. Has ½-14 internal tab conduit hub. Rated 15 amps, 125, 250 and 480 VAC; ½ amp 115 VDC. Size: 3 x 1 x 2½".

Type No.	Description	Housing	Mount
30-100	Overtravel plunger	Diecast	Side
30-200	Sealed OT plunger	Diecast	Side
30-300	Roller lever	Diecast	Side
30-400	Sealed roller	Diecast	Side
30-420	Sealed roller	Diecast	Side
30-500	Roller plunger	Diecast	Side
30-600	Palm button	Diecast	Side
30-700	Sealed roller	Diecast	Side
30-200010	Sealed OT plunger	Diecast	Side
30-220010	Sealed OT plunger	Diecast	Base
30-340	Roller lever	Split	Side
30-350	Roller lever	Split	Base
30-40001	Roller lever	Split	Side
30-42001	Roller lever	Split	Side
30-540	Roller plunger	Split	Side



Series 30

SEALED LIMIT SWITCHES

TYPE 62 & 63 HERMETIC AND ENVIRONMENT FREE SWITCHES

Licon's Type 63 sealed limit switches are designed to resist various environmental containments such as moisture, dust, and oil. Designed for rugged duty, Type 63 meets specifications of MIL-S-8805, enclosure design #3 or #4. Type 63 features a one piece housing with "O" ring seals at the plunger and either epoxy potting or hermetic header and epoxy potting at terminal base. Series 63 operates effectively in ambient temperature ranges of 65° to 185°F, an ice scraper ring and wiper at the plunger insure low temperature performance. For higher temperature requirement consult factory.

Type 63 switches are available in a variety of double break switch mechanisms and terminals, including plug connectors, wire leads either stripped and tinned or with plug connectors. Wire leads are potted at base to insure insulation and strain relief.

Type 63 is bushing mounted. Two corrosion resistant wire lock hex nuts one keyway washer and one internal tooth lock washer are furnished to provide a non-turn mounting. Roller plunger models with adjustable roller orientation have a positive locking nut in addition to the standard hardware.

The Licon type 62 series is a true hermetically sealed environment-free snap-action switch with a maximum leak rate of 1 x 10^{-8}C.C./sec. This switch enclosure is designed to meet the sealing requirements as defined per MIL-S-8805, Hermetic, design style 5.

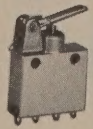
Roller Plunger

Pin Plunger

SERIES 65 SUBMINIATURE ENVIRONMENT FREE

Dependable, environment-free snap action switching with ratings up to 10 amps, 28 VDC. SPDT 2-circuit configuration. Solder terminals. Quick disconnect, screw and potted leads available on special order. Size: .850" x .875" x .320"..5" mounting centers. UL listed.

Type	Description
65-101	Rigid lever
65-301	Roller lever
65-401	OT Plunger



Series 65

LICON FOR ADDITIONAL ORDERING INFORMATION, REFER TO LICON SWITCH SELECTION GUIDE.
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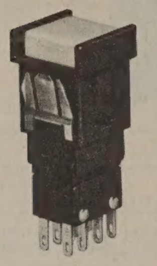
LIGHTED PUSHBUTTON SWITCHES



TYPE 01-665
SQUARE SNAP IN BEZEL ONE LIGHT

Licon's Series 01-665 is a compact, single lamp switch with snap in panel mounting and a choice of bezel, single barrier or double barrier housing. Series 01-665 can be mounted individually or in various strip arrays. The basic switching mechanism is Licon's "Butterfly"® double break snap action switch, available in momentary and alternate action, indicator only. Series 01-665 is UL and CSA listed at 10 amps at 125/250 VAC. Contacts are available in silver or gold plating, for low level switching. Standard terminals are .110 Quick Connect. Series 01-665 accepts standard T1¾ flange base lamps, replaceable from the front panel without tools. Panel cutout .875 sq.

HOUSING DESCRIPTION

Series 01-665 is available in bezel only, double barrier, vertical mount, double barrier horizontal mount, and single barrier. To specify desired housing substitute the following numbers for the X in part numbers shown above.

HOUSING STYLE

1. Vertical row mount with vertical barriers
2. Horizontal row mount with vertical barriers
4. Horizontal row mount with single vertical barrier
6. Horizontal row mount bezel only

ORDERING GUIDE 01-665 MOMENTARY ACTION

Switch Description	Contacts	
	Silver	Gold
1 Pole Form C	01-66551X	—
1 Pole Form Z	01-66553X	01-66552X
2 Pole Form C	01-66561X	—
2 Pole Form Z	01-66563X	01-66562X
Indicator Only	01-66500X	—

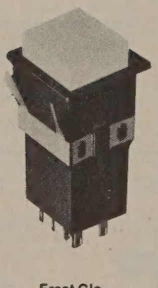
ORDERING GUIDE 01-665 MAINTAINED ACTION

Switch Description	Contacts	
	Silver	Gold
1 Pole Form C	01-66511X	—
1 Pole Form Z	01-66513X	01-66512X
2 Pole Form C	01-66521X	—
2 Pole Form Z	01-66523X	01-66522X

LENS CAP ORDERING GUIDE

Color	Solid Color Lens	Projected Color Lens
White	01-921411	01-921421
Red	01-921412	01-921422
Green	01-921413	01-921423
Blue	01-921414	01-921424
Yellow	01-921415	01-921425
Amber	01-921416	01-921426
Orange	01-921417	01-921427

Insertable Legend



Frost Glo

TYPE 01-669
RECTANGULAR SNAP IN BEZEL ONE LIGHT

This versatile switch offers Licon's exclusive "Frost Glo" illumination, solid or projected color lens caps, insertable legend, one piece construction, and front panel mounting and relamping. Mounts in common .855 x 1.095 panel coutout.

The heart of series 01-669 is Licon's double break Butterfly® switching mechanism. Available as single or double pole, with momentary or maintained action. Series 01-669 is rated at up to 10 amps (Form Z) or 5 amps (Form C) at 125/250 VAC. Contact material is solid fine silver; gold is also available for "low level" switching. Standard terminals mate with .110 Faston receptacles. Unit accepts one T-1¾ Flange Base Lamp which can be ordered separately.

SWITCH DESCRIPTION

Circuitry	Action	Silver	Gold
SPDT Form C	Momentary Alternate	01-669511 01-669111	01-669551 01-669151
DPDT Form C	Momentary Alternate	01-669611 01-669211	01-669651 01-669251
SPDT Form Z	Momentary Alternate	01-669531 01-669131	01-669571 01-669171
DPDT Form Z	Momentary Alternate	01-669631 01-669231	01-669671 01-669271

Series 01-669 is also available as an indicator only — Part No. 01-669001.

01-669 LENS CAP ORDERING GUIDE

LENS DISPLAY	Display Method	
	Solid Color	Projected Color
Insertable Legend "Frost Glo"	01-96921X 01-96931X	01-96922X N.A.
HIDDEN DISPLAY (Smoked Overcap)	01-96941X	01-96942X

X = COLOR: White 1, Red 2, Green 3, Blue 4, Yellow 5, Amber 6, Orange 7
(Note—Amber and Orange not available as "Frost Glo".)

TYPE 01-7
THERMOPLASTIC ONE LIGHT PUSHBUTTON SWITCHES

Display flexibility at an optimum in a one light switch. Series 01-748 & 01768 can be obtained with a number of large round, square or rectangular Lens Caps. A variety of color choices are available as well as legend engraving or hot stamping.

SWITCH ORDERING GUIDE SERIES 01-748 & 768

Description	15/32 — 32 Bushing Screw Base Lamp		5/8 — 32 Bushing Flange Base Lamp	
	Maint.	Mom.	Maint.	Mom.
1 Pole Form Z	01-748130	01-748530	01-768130	01-768530
2 Pole Form Z	01-748230	01-748630	01-768230	01-768630
Indicator		01-748000	—	01-768000

LIGHT EMITTING DIODE 01-7

For the ultimate in long life illumination, Light Emitting Diode 01-7 switches and indicators are available. The L.E.D is permanently installed in the switch actuator unit which in turn accepts a low profile cylindrical plunger. In addition to increased life, (as compared to incandescent lamps) L.E.D.'s provides low heat outputs, low power drain and solid state reliability.

01-7 with red low profile plunger, Intregal L.E.D. & .110 Terminals

Description	Contacts	Parts No.
Momentary Action Form Z	Silver	01-700152
Momentary Action Form ZZ	Silver	01-700153
Alternate Action Form Z	Silver	01-700154
Alternate Action Form ZZ	Silver	01-700155
Indicatory Only	—	01-700156

LENS ORDERING GUIDE

Description	Series 01-748	Series o1-768
5/8 Sq.	01-9113XX	01-9213XX
5/8 Rd.	01-9313XX	01-9413XX
3/4 Sq.	01-9114XX	01-9214XX
3/4 Rd	01-9314XX	01-9414XX
7/8 x 1-1/8	—	01-9519XX
1-1/8 Rd.	—	01-9418XX

LENS COLOR

FOR SPECIFIED LENS COLOR, substitute the appropriate Numbers In Place Of "XX" in part number shown above.

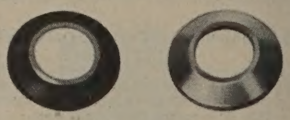
SOLID COLOR LENS

(11) White	(13) Green	(15) Yellow	(17) Orange
(12) Red	(14) Blue	(16) Amber	

BEZEL DRESS NUT

Bezel dress nuts are available in either flat black or silver finish. Front of panel appearance can be easily improved by this simple economical option, for 15/32 threaded bushings.

Flat Black P/N 80-701319 Silver P/N 80-701320



LICON *FOR ADDITIONAL ORDERING INFORMATION, REFER TO LICON SWITCH SELECTION GUIDE.*

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06 SERIES
RECTANGULAR ONE OR TWO LIGHT

SWITCH ORDERING GUIDE

Contact Form	Contact Material	Switch Action	No. of Poles	06 with .110 QC Terms	06 with PC Terms
Form C	Silver	Momentary	One	06-710001	06-710026
		Momentary	Two	06-710002	06-710027
		Alternate	One	06-710003	06-710028
		Alternate	Two	06-710004	06-710029
Form Z	Silver	Momentary	One	06-710005	06-710030
		Momentary	Two	06-710006	06-710031
		Alternate	One	06-710007	06-710032
		Alternate	Two	06-710008	06-710033
Form X	Silver	Momentary	One	06-710009	06-710034
		Momentary	Two	06-710010	06-710035
		Alternate	One	06-710011	06-710036
		Alternate	Two	06-710012	06-710037
Form C	Gold	Momentary	One	06-710013	06-710038
		Momentary	Two	06-710014	06-710039
		Alternate	One	06-710015	06-710040
		Alternate	Two	06-710016	06-710041
Form Z	Gold	Momentary	One	06-710017	06-710042
		Momentary	Two	06-710018	06-710043
		Alternate	One	06-710019	06-710044
		Alternate	Two	06-710020	06-710045
Form X	Gold	Momentary	One	06-710021	06-710046
		Momentary	Two	06-710022	06-710047
		Alternate	One	06-710023	06-710048
		Alternate	Two	06-710024	06-710049
Indicator Only	—	—	—	06-710025	06-710050

Switch rating for gold plated contacts .100 A, 10 VDC Res. Max.

Licon's series 06 Lighted Pushbutton Switches offer exclusive Butterfly® switching action with the verstility of one or two lamp illumination with an excess of 200 display options. Available in either one or two poles with silver or gold contacts, series 06 is rated at 100,000 cycles life at full rated load.

Series 06 offers direct front of panel installation in a .700 x .920 panel cut-out in panels .062 to .140 thickness. The matte black snap-in bezel mount assures rigid retention and permanent alignment. 10 A at 125/250 Electrical Rating. U.L. Listed & C.S.A. Approved. All terminal spacing is .125 minimum (3mm).

All lenses accept T1-3/4 flange base lamps. (1 0r 2) (Order separately)

SERIES 06 LENS ORDERING GUIDE

No. of Lamps & Display	Lens Illumination Solid Color	Projected Color	Projected Color Insertable Legend	Hidden Display
One light full	06-611XZ	06-612 XZ	06-614XZ	06-616XZ
Two light Vertical split	—	06-622XZ	06-624XZ	06-626XZ
Two light Horiz. split	—	06-632XZ	06-634XZ	06-636XZ
Two light Full screen	06-641XZ	06-642XZ	06-644XZ	06-646XZ

NOTE: X = Left or Upper section; Z = Right or Lower section.

Substitute the following No. in each X or Z to specify color.
1 = White, 2 = red, 3 = Green, 4 = Blue, 5 = Yellow, 6 = Amber.

05 SERIES
MINIATURE SQUARE SNAP IN BEZEL ONE LIGHT

05 Series

The Series 05 Lighted & Non-Lighted units offer maximum design flexibility in a compact package. All units mount in a .625 ±.005 square cutout. Panel thickness 1/32 to 3/32. Lenses order separately. Units accept (1) t1-3/4 Wedge Base Lamp. (Not supplied).

SERIES 05 LIGHTED & NON-LIGHTED

Description	.110 QC Term. Part No. Lighted	.110 QC Term. Part No. Non-Lighted	P.C. Term. Part No. Lighted	P.C. Term. Part No. Non-Lighted
SPST N.O.	05-115	05-215	05-165	05-265
DPST N.O.	05-125	05-225	05-175	05-275
Indicator Only	05-105	—	05-155	—

STANDARD LENS ORDERING GUIDE

WHITE	80-050007	YELLOW	80-050011
RED	80-050008	AMBER	80-050012
GREEN	80-050009	ORANGE	80-050013
BLUE	80-050010	CLEAR	80-050014

For the ultimate in indication combined with high reliability switching, the Series 05 with L.E.D. display provides the proper interface. Lenses order separately. Units supplied with Integral LED.

SERIES 05 WITH L.E.D. DISPLAY
P.C. BOARD TERM.

Description	P.C. Term. Part No.
SPST N.O.	05-4650X
DPST N.O.	05-4750X
INDICATOR	05-4550X

SUBSTITUTE "X" WITH: 1 for Red LED, 2 for Green LED, or 3 for Yellow LED.
Note: All LED units utilize high efficiency LED's. Max forward current 50 MA.

LED LENS ORDERING GUIDE

WHITE	86-050011	YELLOW	86-050015
RED	86-050012	AMBER	86-050016
GREEN	86-050013	BLACK	86-050017
BLUE	86-050014		

NON-LIGHTED PUSHBUTTON SWITCHES

76-7 SERIES
15/32-32 BUSHING SIZE

Series 76-7, 15/32 BUSHING SIZE
A "Computer Quality" switch available in either single or double pole momentary or maintained action and rated at 10 Amps 125/250 VAC in Silver or Gold contacts. Combination .110 Quick connect & solder terminals are standard. U.L. and C.S.A. listed. An optional dress bezel nut adds to the appearance of the switch.

Circuit	Action	Pushbutton Colors			
SPDT Form Z	Maint.	White 76-7042 76-7142*	Black 76-7043 76-7143*	Red 76-7044 76-7144*	Green 76-7045 76-7145*
DPDT Form Z	Maint.	76-7046 76-7146	76-7047 76-7147*	76-7048 76-7148	76-7049 76-7149
SPDT Form Z	Mom.	76-7050 76-7150*	76-7051 76-7151*	76-7052 76-7152*	76-7053 76-7153*
DPDT Form Z	Mom.	76-7054 76-7154*	76-7055 76-7155*	76-7056 76-7156*	76-7057 76-7157*

*Indicates Gold Contacts

76-2 SERIES
¼-40 BUSHING

Series 76-2, ¼-40 Bushing
A momentary action single or double pole switch rated at 10 amps 125/250 VAC — UL & C.S.A. Listed with Solder terminals. Ideally suited for applications where space is restricted. A locking tab located on switch actuator assures positive panel alignment.

Circuit	No. of Poles	Button Color	Part No.
SPDT Form Z	1	White	76-2220/404
SPDT Form Z	1	Black	76-2221/404
SPDT Form Z	1	Red	76-2222/404
SPDT Form Z	1	Green	76-2223/404
SPDT Form Z	2	White	76-2190/404
SPDT Form Z	2	Black	76-2191/404
SPDT Form Z	2	Red	76-2192/404
SPDT Form Z	2	Green	76-2193/404

itw LICON *FOR ADDITIONAL ORDERING INFORMATION, REFER TO LICON SWITCH SELECTION GUIDE.*

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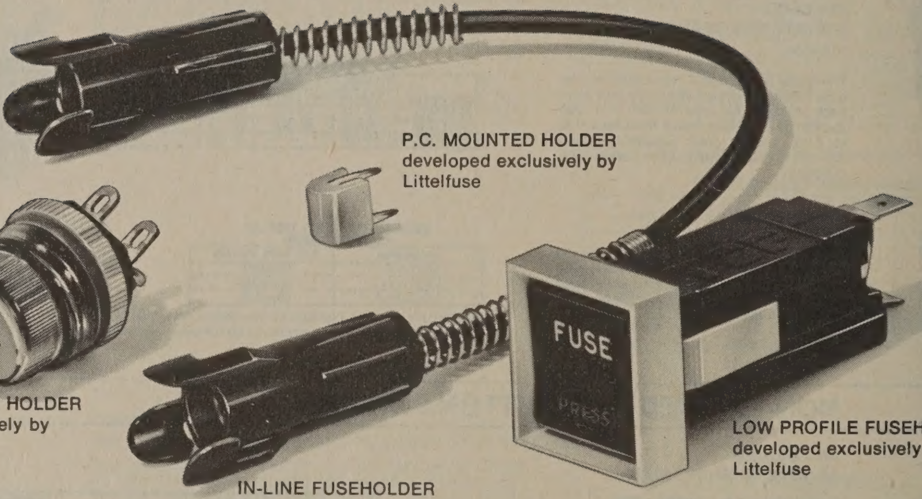
At Littelfuse we don't just meet your Circuit Protection needs —we anticipate them.


P.C. MOUNTED HOLDER
developed exclusively by
Littelfuse

TWIN MICROFUSE HOLDER
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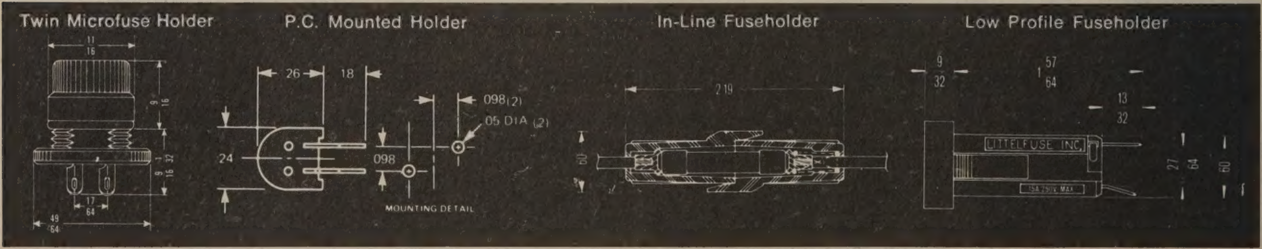
IN-LINE FUSEHOLDER
developed exclusively by
Littelfuse

LOW PROFILE FUSEHOLDER
developed exclusively by
Littelfuse
FUSE
FUSE
PRESS

But that should come as no surprise. Since 1927, Littelfuse has provided the electronic industry with a complete line of fuses, fuseholders, circuit breakers, switches, and relays. Whatever a customer's need, we have a quality product to satisfy it.

But Littelfuse has to do more than keep up with the industry—we have to stay ahead of it. Our research and development engineers are constantly designing and testing to create tomorrow's products—more advanced, more streamlined, more versatile. Low-Profile Snap Mount fuseholders, P.C. Board fuseholders, Twin Microfuse holders, "Twist-Lock" In-Line fuseholders—these are just a few of the products developed exclusively by Littelfuse.

For detailed information on the complete line of Littelfuse products, write for Catalog #17. Or contact our representative or authorized Littelfuse distributor in your area. He will be glad to help you determine your immediate needs—and to help you plan for tomorrow's.


Twin Microfuse Holder
P.C. Mounted Holder
In-Line Fuseholder
Low Profile Fuseholder
11/16
9/16
1 9/32
9/16
17/64
49/64
26
18
24
098
098 (2)
05 DIA (2)
MOUNTING DETAIL
2.19
60
9/32
1 57/64
13/32
27/64
60
LITTELFUSE INC.
15A 250V MAX

Littelfuse– *first in design and innovation*

P.C. Mounted Holder — 281007
A low-profile, plug-in fuseholder accommodating Littelfuse picofuses and microfuses. Edge-mounted, the holder permits easy and rapid fuse removal and replacement. Rated at 5 amps to 125 volts.

Twin Microfuse Holder — 280021
A versatile twin or single circuit holder for space-tight applications. Accepts two microfuses or a combination of micro and picofuse. Rated at 5 amps to 125 volts.

In-Line Fuseholder — 155100
A low-cost holder with "twist lock" allowing easy fuse extraction and replacement. Accepts all ¼" x 1¼" fuses and SFE fuses to 20 amps. Available in black, transparent or six other standard colors.

Low Profile Fuseholder
Square cap fuseholder snaps into chassis, eliminating need for mounting hardware. The cap snaps open for quick and easy fuse insertion and removal. Aesthetically styled to complement modern instrument panels, the holder is available in several color combinations.

HOW TO ORDER LOW PROFILE FUSEHOLDERS
Six digit number is a coded description of fuseholder

348	6	4	5
A	B	C	D

A Series Number **348** for 3AG Standard fuses, **347** for Pin Indicating.

B Terminal Style: **6**, 3/16" w. quick-connect and solder type; **8**, ¼" w. quick-connect and solder type.

C Bezel Color: Specify **1**, red; **2**, green; **3**, yellow; **4**, blue; **5**, white; **7**, black; **9**, gray.

D Cap Color: Specify **1**, red; **2**, green; **3**, yellow; **4**, blue; **5**, white; **7**, black; **9**, gray.

NOTE: To order a cap assembly **only** for 3AG standard fuses, use 348 series number and insert a **0** in the terminal style and bezel color locations (348 001). To order a cap assembly for 3AG Pin Indicating fuses, use **347** series number and insert a **0** in the terminal style and bezel color locations (347 001). To order a body assembly **only**, use 348 (for 3AG fuses) and insert a **0** in the cap color location (348 850). The body assembly only for 3AG Pin Indicating fuses is identical to 348 series.

Littelfuse offers more than 6,000 kinds of fuses, fuseholders, circuit breakers, switches, and relays, including the following:

¼" dia. x 1¼" long 3AG fuses for electronic circuit protection applications.

311 Series
Glass tube. Medium-acting for automobiles, radios, amplifiers, etc. 4-30 amps.

312 Series
Glass tube. Fast-acting for general fuse protection. 1/100-10 amps.

313 Series
Glass tube. Slo-Blo. Designed to withstand momentary high-current surges but to open quickly on sustained overloads. 1/100-30 amps.

314 Series
Ceramic tube. High interrupting capacity up to 10,000 amps at 250 volts. 1/8-30 amps.

All fuses shown above can be supplied with pigtail leads for "Soldered In" applications. Similar electrical performance also available in 9/32" x 1-1/4" and 13/32" x 1-1/2" Fuses.

342 (000) Series
3AG Miniature, Space-saving Panel Fuseholder. Rated at 20 amperes to 250 volts.

341 (000) Series
3AG Panel Fuseholder with screw driver slot knob. Rated at 15 amperes to 250 volts.

342006
3AG Watertight Panel Fuseholder. Rated at 20 amperes to 250 volts.

344 (000) Series
3AG Indicating Fuseholder for visual display of blown fuse. Two lens styles available. Rated at 20 amperes to 250 volts.

340255
3AG Shielded Fuseholder. Eliminates radio frequency interference. Rated at 30 amperes to 250 volts.

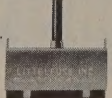
Subminiature Picofuse
9/32" long x 3/32" dia. Axial leads—275 (000) Series. Radial leads—276 (000) Series. 1/16-15 amps to 125 volts.

Subminiature Microfuse
Plug-in or pigtail types with transparent or metal caps. 10,000 amp short circuit capacity. 1/500-5 amps to 125 volts.

Subminiature Fuseholder
For picofuse and microfuse. Available in standard, indicating, or R.F. shielded types.

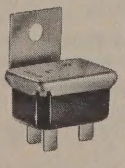
Fuse Clips
Available with solder lugs, with and without fuse stops and for printed circuit board mounting.

Fuse Blocks
Open fuse mountings with solder, screw or quick connect terminals. 1-12 poles.



Circuit Breakers
Manual reset breakers. Rated currents 4/10-4.1 amps to 250 volts.

Switches
Momentary action SPST switches. Rated at 5 amps-125 volts or 2.5 amps-250 volts.



Relays
Low voltage power relays for automotive, marine and recreational vehicle applications.

Littelfuse Inc. *Subsidiary of Tracor, Inc.*

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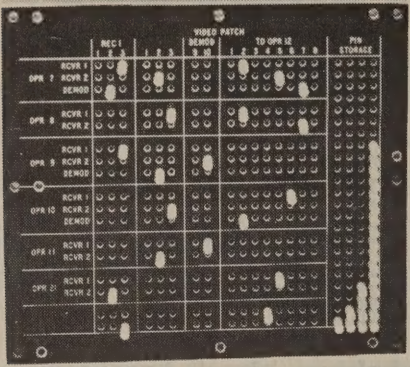
LVC INDUSTRIES INC.

CO-ORD SWITCH · BLOC-LITE DIVISIONS

135-25 37th AVE. • FLUSHING, NEW YORK 11354 • (212) 939-9777

MATRIX BOARDS
SLIDE SWITCHES
LIGHT INDICATORS

MATRIX PROGRAM BOARDS



CO-ORD Matrix Program Boards are composed of 2 to 10 decks of contacts that are bussed on .250 centers. The contact rows of one deck are usually oriented perpendicular to the rows of adjacent deck(s) so as to obtain switching crosspoints. Electrical connections of the bussed contact rows are effected by inserting shorting pins at the desired crosspoints; "CO-AX", phone plug type pins are available for networks which require component insertion (Diodes, resistors, etc.). Single board matrices of up to 11,000 crosspoints are available in standard or special arrangements. Bussed and isolated contacts can be had alone or in combination. Panels may be screened, engraved, or fitted with pre-punched templates for rapid program changing.

U. S. Patent No. 3,349,361

APPLICATIONS

- Computer memories
- Cordless patch panels
- Function generators (Analog/Digital)
- Power distributors
- Thermocouple signal selectors
- Circuit/Component test programmers
- Lighting systems (Special effects)
- Variable sequence selectors
- Variable diode matrices
- Code generators
- Traffic control panels
- Decade switches
- Vending machine control
- Numeric controlled machinery
- Data channeling and logging
- Communications distributors

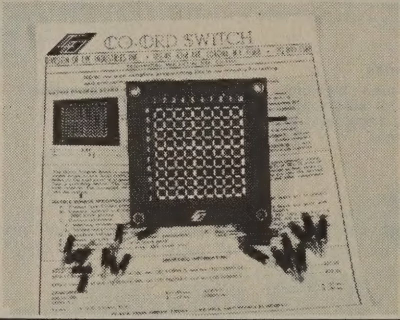
FEATURES

- Closed entry contacts
- High mechanical environment capacity
- Low interlead capacitance
- Attractive and uncluttered
- Compact package
- Standard sizes available
- Permits insertion of components into network without soldering
- Wide variety of switching combinations

SPECIFICATIONS

- Contact Resistance
  - a Total Pin Resistance: .004 OHM MAX.
  - b Volume Resistivity of Strip: .003 OHM/IN
- Breakdown Voltage: 1000 VRMS MIN.
- Current Capacity: 5 AMPS Continuous (up to 100 amps on special application)
- Materials:
  - a Plastic Parts: Black Phenolic XXX
  - b Flexible Contacts: Heat Treated Beryllium Copper
  - c Terminals: Brass
  - d Finishes: Gold, Silver or Nickel

PROGRAM BOARD KITS



KIT BPS-1 consists of a 10 x 10 matrix board similar to #63014-1, below. 10 shorting pins and 10 "CO-AX" diode pins with 1N270's installed **$30.00**

KIT BPS-2 is the same as BPS-1 but without diodes **$25.25**

10 x 10 matrix board	**$20.00 ea.**
Shorting pin	.17 ea.
Diode pin w/1N270	.99 ea.
Diode pin w/o diode	.51 ea.

AVAILABLE FROM STOCK

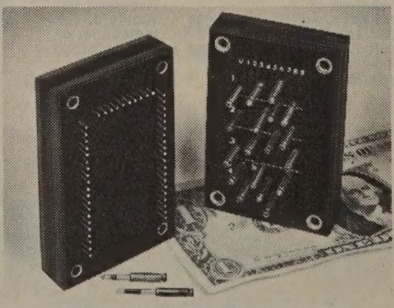
STANDARD MATRIX BOARDS — SERIES 63014

DASH	-1	-2	-3	-4	-5	-6	-7	-8	-9
MATRIX	10 x 10	10 x 15	10 x 20	10 x 25	15 x 20	15 x 25	20 x 20	10 x 50	25 x 25

AVAILABLE FROM STOCK. ADD DASH NO. (1 Thru 9) MATRIX SIZE.

MINIATURE PROGRAM BOARD

.100 and .125 inch Center Line



TENTH INCH MATRIX AT $.08 PER POINT

These Matrix Program Boards are designed to meet the increased technological requirements for miniaturization in electronic systems and equipment. They have all the same features of the larger matrices and can be supplied in from 2 to 4 decks of bussed contacts. Single matrix boards of up to 2500 crosspoints can be furnished in one solid unit, with rugged Shorting and CO-AX (diode) pins available for programming functions. A standard 2 deck matrix measures .315 inches thick from the front to rear panel; program pins are .280 inches long by .063 inches in diameter. Termination of the bussed contacts are to .040 diameter pin terminals, which allow the matrix to be plugged into mating female receptacles or connected to directly by wave, dip, or hard soldering. Contact resistance is only .005 ohms per crosspoint; breakdown voltage 600 VRMS; current capacity 3 amps continuous.

WRITE FOR YOUR NEW PRODUCT CATALOGUE

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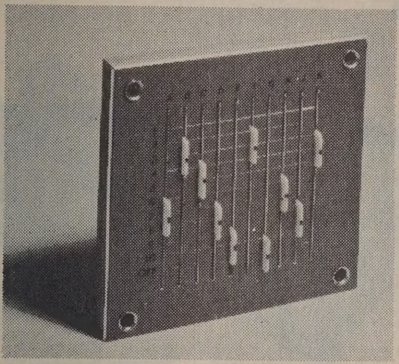
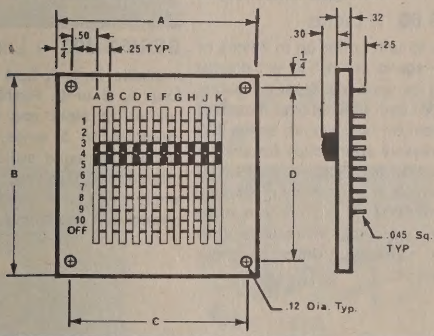
MATRIX BOARDS
SLIDE SWITCHES
LIGHT INDICATORS

MATRIX SLIDE SWITCHES





CO-ORD Matrix Slide Switches are designed to provide reliable, low cost matrix switching for applications requiring manual data entry operations. These simplified, versatile switches are available in various ranges of standard sizes, with capacities including up to 25 outputs per switching line. Each output is controlled by a separate contact slider which in turn can provide as many as 25 positions (variations). Special designed Matrix Slide Switches can be supplied with as many as 5000 switching positions.

Switching quality and reliability is achieved through such advanced designed features as; positive detent positioning resulting from the unique individual GSD (Guide-Slide-Detent) Housing, panoramic viewing of the switching functions facilitating rapid circuit selection and minimizing data entry error, rugged solid block closed construction containing each contact and slider in a basic unitized assembly, electrical and mechanical integrity assured through the use of only the highest quality materials.

Write for Bulletin 1474

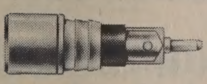
MATRIX SLIDE SWITCH — Series No. 85000-

DASH NUMBER	MATRIX SIZE	NUMBER OF SLIDERS	NUMBER OF POSITIONS	DIMENSIONS			
				A	B	C	D
1	10 X 10	10	10	3.75	3.75	3.25	3.25
2	10 X 20	10	20	3.75	5.75	3.25	5.25
3	20 X 10	20	10	6.25	3.75	5.75	3.25
4	20 X 20	20	20	6.25	5.75	5.75	5.25
5	25 X 25	25	25	7.50	6.75	7.00	6.25

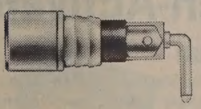
NO. 85000-1 (10 x 10) 1 - 9 PIECES $28.00 EA.

MINI-BRITE "simplicity" in subminiature indicator lights

MINI-BRITE
75001
Panel Mount



MINI-BRITE
75002
Panel/Printed
Circuit Mount



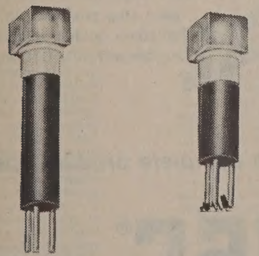
MINI-BRITE
75003
Printed Corcuit
Mount

MINI-BRITE subminiature indicators have been engineered and are manufactured with the idea of achieving the ultimate in simplicity, standardization, reliability and cost reduction . . . this has been accomplished by the design of a unique housing and contact arrangement centered on the use of standard, wire terminal lamps . . . which provides light intensity comparable to units five times their size.
Conforms to MS90308. U. S. Patent #3,559,153

Write for Bulletin 1470

- **FRONT RELAMPABLE**
  just remove the snap on cap
- **STANDARD LAMPS**
  any T-1 lamp, wire lead type
- **EASY INSTALLATION**
  press housing into hole
- **WIRING OPTIONS**
  combination solder/female terminal
- **MOUNTING OPTIONS**
  panel mounted, panel/printed circuit
- **HIGH DENSITY PACKAGING**
  mount on .250 centers.

STANDARD OR SPECIAL CONFIGURATIONS



MINI-TRANS subminiature Transistorized indicator lights

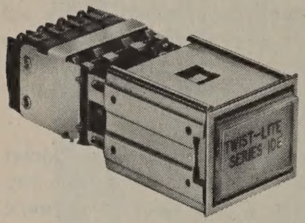
The MINI-TRANS series incorporates a silicon planar transistor, either NPN or PNP, which will turn on the indicator and provide an extremely bright indication from signal levels as low as 0.30 mA. In addition to standard circuits, specially designed physical and electrical configurations can be furnished to customer specifications. Units can be supplied with a built-in resistor of any standard value. This unique transistorized design capability is ideally suited when extremely low level signals are used for front panel indications, assuring long life and maximum brightness. A wide range of standard incandescent lamps are available to meet your requirements. Except for the increased length of the housing, these indicators are compatible and have all the features of the MINI-BRITE series.

Write for Bulletin No. 1470T

BLOC-LITE Lighting Devices • ANNUNCIATORS • LIGHT MATRICES • SPECIAL INDICATORS • DISPLAY PANELS • EDGE-LIGHTED PANELS

RUGGED, DEPENDABLE Control Panel Components for Demanding Applications...

Lighted Pushbutton Switches



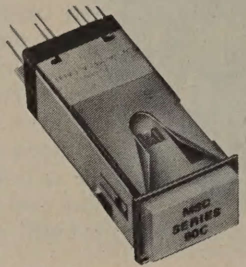
SERIES 10 & 12 4 Lamp

A modular approach to lighted pushbutton switches offering front of panel relamping and relegending without tools. Series 10 features positive hard-mount sleeve; Series 12 features spring-clip mount. Individual lamp color control; full or split displays in colors; up to 4 lines of engraved legend on ¾" x 1" display face. Snap on switch modules in momentary or alternate action; 2PDT or 4PDT. Withstands environmental extremes. Many optional accessories. Units to meet MIL-S-22885.

VERT
MANUV
FAIL
800 SQUARE TELLITE

SERIES 800, 820 & 830 4 Lamp

Rack-Mounted/plug in lighted pushbutton switches. Series 800 offers ¾" square display face; Series 820 offers ¾" x 1" display face; both models offer solid-state switching, as well as snap-action. The Series 830 is a shortened version of the Series 800 requiring approximately 1.36" less behind panel space. All units feature front of panel relamping or relegending without tools. Full or split displays in colors. Each unit available as either switch-lite or indicator-lite only assemblies with up to 4 lines of engraved legend. Withstands environmental extremes. Many optional accessories. Units to meet MIL-S-22885/80.



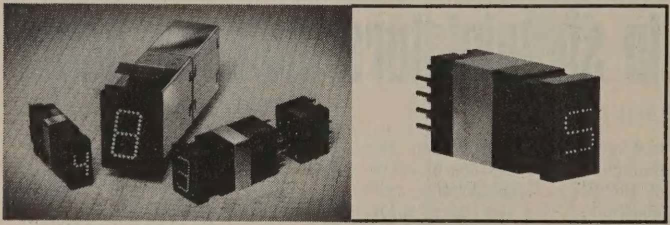
SERIES 90 2 Lamp

All Series 90 units offer up to 3-lines of engraved legend on ½" x ¾" display face. Full or split displays in colors. Series 90E and 90K utilize mounting tabs for positive hard mount; Series 90C utilizes pressure spring-clips for snap-in mounting. 90E and 90K offer 2PDT or 4PDT alternate or momentary switching; 90C offers SPDT or 2PDT alternate or momentary switching. Withstands environmental extremes. Units to meet MIL-S-22885/58.

SERIES 600 1 Lamp

Available in 1, 2, 3, 4 and 6 pole, form A, B or C. Pushbuttons in 6 colors; 12 sizes and shapes. For loads up to 2 amps, multi-point, sliding bifurcated switch contacts offered; for loads up to 5 or 10 amps, long-life snap-action contacts offered in 2-pole form C.

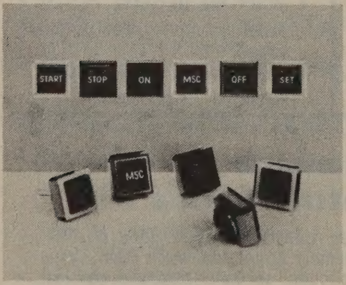
Readout Displays



SERIES 900 Fiber Optic Readouts • Model 925 High-Brightness

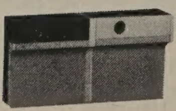
Fiber optic tubes transmit light direct to display face in easy-to-read dot-pattern segments. Incandescent lamps or light emitting diodes (LED) used as light source. These units deliver greater light intensity than can be achieved with conventional tube type, projection or bar segment readouts, due to the maximum efficiency achieved in light transfer from the source to display screen through fiber optic tubes. Model 925 offers display brightness of 2000 foot lamberts. High readability is achieved in direct sunlight with a 15:1 contrast ratio. Available in both 7 or 16 segment displays for both numeric and alpha-numeric presentation. Decoder/driver circuitry available in some models. Character heights from .27" to .85".

Solid State Touch Activators



SERIES 400
Sealed Units

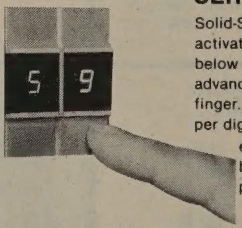
Completely sealed solid-state touch-activators for solid-state switch circuits. Provide protection against environmental extremes. Touch to activate; no pushing, pulling, or flipping of switches. No mechanical contacts; no contact bounce. Up to 3 lines of engraved legend, with or without LED status lights. Bezels available in variety of colors.



SERIES 440 Low-Cost Units

Touch to activate. Design style compatible with Series 481 Thumbwheel. Color coded legend plates, with or without LED status lights. Brushed aluminum touch-plate. Use with CMOS, TTL, DTL or HTL. Snap-in mounting.

Solid State Thumbwheel Switches - Touch-Activated



SERIES 481

Solid-State Thumbwheel Switch with touch activation. Simply touch the "touch-plate" below the numeric display, and the switch will advance, step-by-step, until you remove your finger. Stepping advance rate is 0.3 seconds per digit. Bright numeric LED display indicates each step position. No rotating of cumbersome ratchet wheels. Circuitry compatible with TTL, DTL and HTL.

Solid-State Voice Readout Systems Also Available

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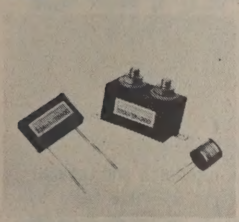
CIRCUIT PROTECTORS

MCG

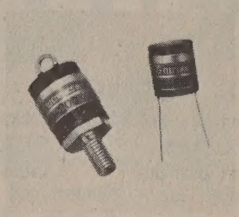
AC POWER LINE PROTECTION

TSA



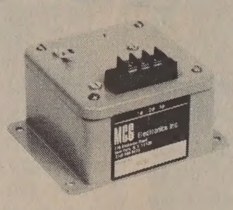
The TSA units will prevent transient damage by rapidly switching from an open circuit to a clamping state whenever a transient voltage exceeds the clamping threshold. These units operate on overvoltages of either polarity and recover automatically when the transient disappears. The TSA-1.7's & TSA-3 units are especially suited for connection across the AC line. Voltage clamping from 4.7V to 400V peak.

LA-LD



On sensing an overvoltage situation, (of either polarity), the AC Crowbar unit will turn on rapidly to heavily shunt the AC line being protected. The resulting overcurrent will operate the line circuit breaker or fuse. LA & LB units are often used as AC overvoltage monitors to energize circuit breaker trip coils. Suitable for 120 & 240VAC single phase service at 2.5A to 80A RMS.

SERIES P



The Series P operates rapidly to prevent damage to equipment operating on the AC power lines, by switching rapidly to a clamping state whenever a transient exceed the clamping threshold. The units operate on overvoltages of either polarity, on 1ϕ and 3ϕ lines and recover automatically when the transient expires. Severe transient conditions cause the protector to switch to a crowbar mode and cause an external fuse or circuit breaker to operate. Available for 120, 240, 380 & 440VAC lines, 1ϕ & 3ϕ service.

MCG SERIES

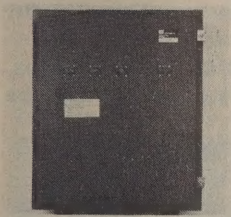
MCG series of AC line Protectors is designed to rapidly clamp (in nanoseconds) substantial transients of either polarity to safe levels. Energy handling capabilities range from 160 joules to 480 joules and is available for use on 120, 240, 277, 380 & 480VAC RMS lines in 1ϕ & 3ϕ service. LED's indicate line status & integrity of internal fusing.

MIL STD

This MIL STD-1399 AC line Protector is designed to operate on a 120VAC, 10A line and limit a 2500 transient spike (1200V at 40us) to less than 400Volts max. This unit is inserted between the equipment being protected & the AC power line, will operate at nanosecond speeds, and limit transients of either polarity.

DC POWER LINE PROTECTION

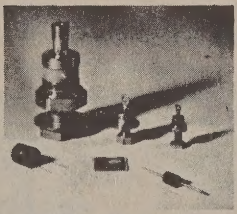
PTSA



The PTSA units are AC power line transient suppressors that are designed to absorb high energy transients (120-450 joules) that can appear on 120V, 240V, 380V & 480VAC lines in single and three phase service.

The PTSA operates rapidly to prevent transient damage by switching from an "open" circuit to a clamping state whenever a transient voltage exceeds the clamping threshold, and clamps transients very hard once the threshold level is exceeded.

TSD



The TSD series is a group of easy-to-use transient suppressors that are well suited to protect a wide variety of electronic equipments from failure due to high voltage transients.

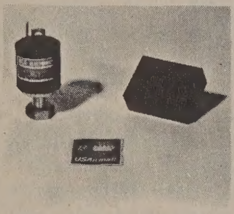
These units will rapidly clamp, by zener action, an incoming voltage transient to a selected voltage level by diverting the transient energy through itself for the duration of the overvoltage. Recovery is automatic when the transient expires.

Clamping voltages from 4.7V to 800V are available with energy levels from .1 to 30 joules.

LVC-1

The LVC-1's are overvoltage protectors that sense when a DC overvoltage is occuring and switch rapidly from an "open" to a virtual "short" circuit within microseconds. Any potentially destructive energy from transients, maladjustments, series regulator faults etc. is now provided with a very low resistance path around sensitive components, such as IC's, transistors etc. TRIP voltages from 5.2V -600V @ 3A to 470A current levels are available.

LVC-10



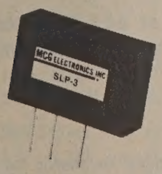
Provides Clamping and Crowbar Protection in a single package. The initial transient is zener clamped for a fixed interval (adjustable) and then the LVC-10 switches to a "brute force" crowbar (short circuit) mode, if the transient persists. Avoids NUISANCE tripping in electrically "noisy" areas. The LVC-10's are available with clamping voltages ranging from 4.7 to 100V at currents from 3A to 235A.

CCB-10

Series CCB Clamping Crowbars determine automatically on an energy basis whether a clamping or a crowbar type of protection is required. For low energy transients, the CCB merely clamps the transient to safe levels. For large energy transients, the CCB will switch to a crowbar (shorting) mode to provide brute force protection. Clamping voltages from 5.3V to 200V at current levels of 3A to 235A are available.

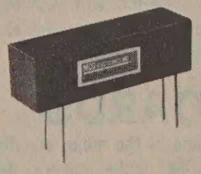
SIGNAL/DATA/TELEPHONE LINE PROTECTOR

SLP-2, 3



THE SLP −2 & −3 protectors were expressly designed to protect signal/data/telephone lines from transient overvoltages (ANSI C37.90A) caused by lightning, heavy machinery, elevator motors generators, etc. The SLP interfaces between the signal line and the sensitive circuit to provide a sophisticated blend of high speed (nanoseconds) voltage limiting and brute force protection. The SLP's recover automatically to standby when the need for protection has passed. Protection levels range from ±6 to ±200V.

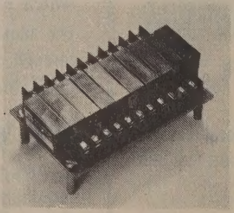
SLP-4



The SLP-4 protectors are dual versions of the SLP-3 protectors and are designed to protect both the input and return circuit lines of a single circuit from the effects of transient overvoltages. (ANSI C37.90A) Protection levels range from ±6V to ±200V.

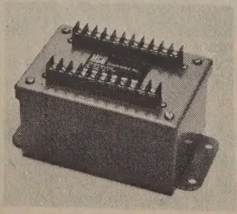
The new SLP-4 interfaces between the signal lines and the sensitive circuit to provide low cost, high speed protection.

MULTIPLE SLP



Up to 10 SLP-2's or SLP-3's modules can be mounted on a heavy duty printed circuit board. Fitted with input and output terminal strips to facilitate ease of installing or retrofitting. The assembly can be mounted flush with a chassis or supported ¼'' or more above the chassis. With a full compliment of SLP's, the board & components will fit in a 5¼ × 3'' × 1½'' (L×W×H) area.

ENCLOSED SLP



SLP-2 and SLP-3 units are incorporated in a heavy duty steel enclosure to provide an easy method of installation in the field. Up to 20 SLP units can be accomodated with input and output terminal strip connections provided at the top of the box. Installation is easy. Bolt down the box & then insert signal inputs & outputs under the appropriate terminal strip screw & tighten.

PROTECTS ELECTRIC/ELECTRONIC EQUIPMENT AGAINST

- **SHORT DURATION TRANSIENTS**
- **HIGH ENERGY LINE SURGES**
- ***LIGHTNING DAMAGE***

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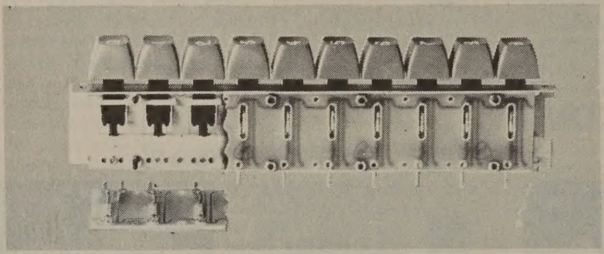
Maxi-SWITCH
KEYSTRIPS AND KEYBOARDS

The Maxi-Switch Company is a leading producer of pushbutton switch components and switch assemblies for the computer, photo-copy, business machine, automation and peripheral equipment industries.

The Maxi-Switch Keystrip construction technique facilitates the design and production of custom keyboards. Individual pushbutton stations may be purchased singly, in Keystrips, numeric blocks, or as completed Keyboards, with or without encoding circuitry. The wide range of features, options and accessories complement Keyboard adaptability.

1600 & 1800 KEYSTRIPS



1600 KEYSTRIP

Maxi-Switch Keystrips present a unique approach to switch construction. These modular units offer long mechanical life and high quality in readily available, off-the-shelf assemblies. Combinations of different contact types, contact forms and plunger actions may be used within a single Keystrip. Up to 20 or more stations may be accommodated per Keystrip with standard spacing of ⅝″ or ¾″ between stations. Other spacings are optionally available.

Standard Series 1600 and Series 1800 switches are equipped with glass reed contacts, and differ only in frame height and available options (1600—1.5″ high, 1800—1.1″ high). Contact options (1600 only) include cross-bar palladium leaf contacts and 15 ampere snap-action power contacts. Reset and lockout solenoids may also be used with Series 1600 Keystrips.

Individual reeds may be tied to a common bus on one side, or brought out to separate terminals, depending on the requirements of the application. The common bus feature saves component and mother-board space, and requires fewer solder connections.

SPECIFICATIONS

BUTTONS:

A variety of lighted and unlighted buttons available in several colors. Ask for Maxi-Switch Bulletin MS 2500 for information on buttons and Keystrip/Keyboard illumination.

TERMINALS:

Printed circuit, pierced solder lug, plug-in male/female contacts, wire-wrap, .110 quick connect.

CONTACTS:

Glass Reed, Form A or B, 28 VDC @ 250 Ma.

Cross-Bar Palladium leaf contacts, Form A, B or C (1600 only). 3 Ampere @ 28 VDC, 3 Ampere @ 115 VAC.

Snap Action Power Contacts (1600 only). 10 Ampere @ 250 VAC, ½ Ampere @ 125 VDC; or 15 Ampere @ 250 VAC, ½ Ampere @ 125 VDC.

PLUNGER ACTIONS:

Momentary Contact (standard)
Interlatch and Lockout
Alternate Action (push-push)
Lockout Only
Key Motion Sensing
Cross-Bank Interlatch and Lockout

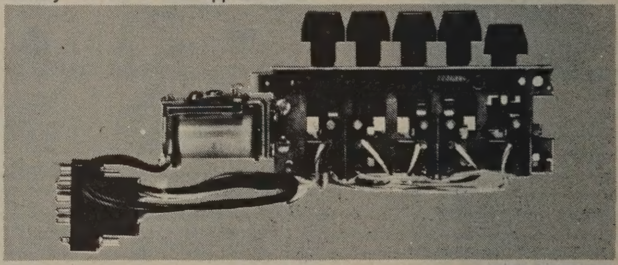
1200 & 1400 KEYSTRIPS

Series 1200 and 1400 Keystrips feature two-piece steel frames as the basic structure, with pushbutton components mounted between two frame halves.

Series 1200 and 1400 Keystrips may be lighted with one or two lamps per switch station (Form A lamp contact not available on 1400 switches with more than 3 bits). Midget groove T-1¾ bulbs are used. Lamp sockets may be furnished with solder lugs, AMP 78 Series taper tabs, 3″ pigtail lead wires, or with common bussing.

Series 1200 Keystrips provide circuit switching of up to 20 positions per keystrip. Many action options are available, and variations of standard design may be quickly accomplished using basic shelf stock for fast prototype and production service.

The range of available contact forms (A, AA, B, C or F), plunger actions, terminals and buttons allow the designer to specify switches which are exactly suited to the application.



1200 KEYSTRIP

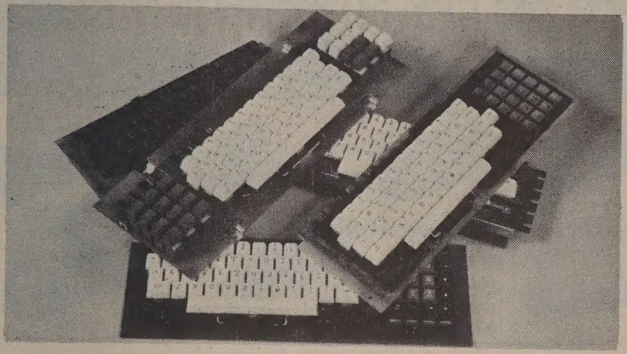
Maxi-Switch offers the newest concept in binary coded decimal switching. Series 1400 switches represent a significant advancement in the development of simplified mechanical encoding techniques, eliminating the maze of contacts, diodes, and interconnections normally associated with switch encoding.

The Maxi Binary Switch will provide 3, 4, 5 or 6-bit binary output through snap-action contacts rated at 3 amperes, 300 watts, Form "A" (SPST/NO) or Form "C" (SPDT).

KEYBOARDS

Maxi-Switch is one of the major suppliers of encoded keyboards for data terminals and other alpha/numeric data entry applications. Users may choose from a wide range of standard off-the-shelf versions such as ASR-33, ASR-37, APL 3270 and ANSI Standard. Smaller styles such as the popular 16-key encoded hex pad or 12-key, wired-only pad are also available at attractive prices.

Chances are Maxi-Switch can supply your keyboard need with a standard product, and that means a savings of both time and money. For specific information, ask your local Maxi-Switch representative for a standard keyboard catalog, or contact the factory directly. Maxi-Switch invests as much in good customer service as in innovative keyboard design. We try hard to do business on your schedule. If that sounds like a refreshing change, give Maxi-Switch a try.



The Maxi **standard** keyboard line includes several series, with many variations available within each.

Keyboard encoding may be standard USASCII or EBCDIC, or special codes as required. Standard data levels are provided. Keytops are available in a variety of sizes, styles, colors and languages. Custom legends supplied on request.

- **2900 Series:** Modular reed switch keyboards. Reeds are replaceable from the back of the circuit board should it ever be necessary. Modules in 1 through 6 stations. Proven to 100,000,000 operations.
- **3200 Series:** Low-cost mechanical switches, dual bifurcated contacts, gold-plated, built-in wiping action.
- **3400 Series:** Modular mechanical switches, single or double contact closure per key position, optional illumination in the keystem.
- **4000 Series:** Low cost/high reliability solid-state keyboards with capacitive coupled switches. Latest breakthrough in keyboard technology. Long life, environmental resistance, and large capacitance change during switching to produce reliable switching.

Maxi provides a **custom** keyboard design service. Using keyboard design kits available from local representatives (see index, back of this catalog for addresses) or direct from the factory, users may specify all keyboard parameters, including types and location of key switches, operating force, type of logic, code, button styles, colors and legends.

SPECIFICATIONS

- **2900 Series** (sold only as part of a keyboard assembly)
  Ht. — 1.54″, including keytop
  Total Travel — .175″, ±.010″
  Operating Life — 100 million (typical load)
- **3200 Series**
  Ht. — 1.59″, including keytop
  Total Travel — .180″, ±.010″
  Operating Life — 20 million (typical load)
- **3400 Series**
  Ht. — 1.59″, including keytop
  Total Travel — .187″, ±.010″
  Operating Life — 20 million (typical load)
- **4000 Series** (sold as complete keyboard only)
  Ht. — 1.45″, including keytop
  Total Travel — .165″, ±.010″

PRODUCT DEVELOPMENT

Maxi engineers are devoted to an on-going program of innovation in keyboard design. For example, Maxi is currently the only major keyboard manufacturer to offer mechanical, reed and solid-state keyboards. New products are continuously introduced to help the company stay abreast of rapidly expanding needs in the information processing industry. Watch for regular product announcements resulting from this developmental commitment.

ENGINEERING/QC

Maxi-Switch engineers have extensive experience in the design and development of custom keyboards for special applications. Their logic and keyswitch designs are subject to rugged life tests, and finished keyboards must pass rigid quality control procedures at several stages of production. Final keyboard checkout insures that each unit performs under load and is thoroughly tested to meet customer specifications.

MANUFACTURING

All Maxi-Switch keyboard and keystrip products are manufactured in a new and modern facility in suburban Minneapolis. In-house capabilities include keyboard design and layout, automatic soldering, keyswitch molding, metal stamping and automated assembly. Skilled technicians man the production assembly lines, using only the best in components and materials.

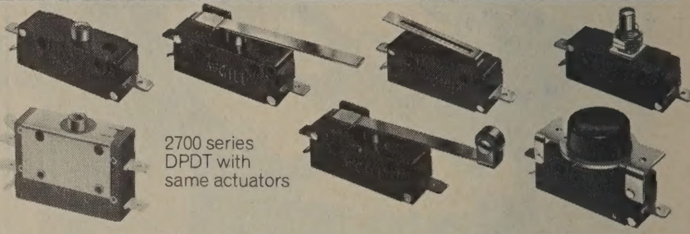
THE Maxi-SWITCH CO.

DEPT. EM, 9697 EAST RIVER RD. • MINNEAPOLIS, MN 55433
(612) 755-7660

think quality specify McGill switches

snap-action

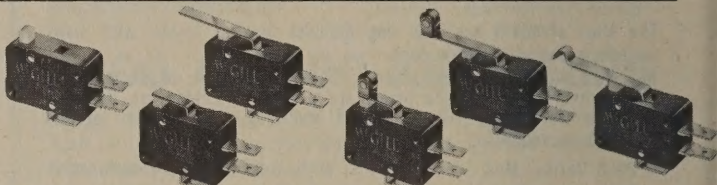
High reliability through design simplicity. Fewer parts to wear—minimum spring flexing increases life. No coil springs. Less than .005″ differential travel. SPDT, SPST. **2600 Series**—20 A, 125-250 V AC; 1 HP 125 V AC; 2 HP 250 V AC; 50/60 Hz. **2650 Series**—25 A 125-250 V AC; 1½ HP 125 V AC; 2 HP 250 V AC. Operating force: 20 oz. max. **1600 Series**—Light operating force—10 oz. max. 15 A 125-250 V AC; ¾ HP 125 V AC; 1½ HP 250 V AC. Also available as **2700 Series** in DPDT models with same actuators and rated: 20 A, 125-250 V AC, 2 HP 250 V AC, 50/60 Hz. U.L. Listed. C.S.A. Approved.



2700 series
DPDT with
same actuators

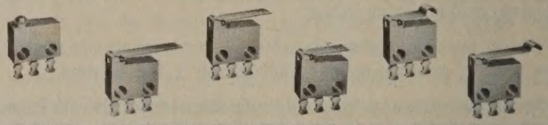
miniature snap-action

1$\frac{3}{32}$″ x ⅝″ x $\frac{13}{32}$″ case. Oversize silver contacts. Excellent wiping action and low contact bounce. SPDT, SPST. **4600 Series**—6—14 oz. max. operating force. 15A, ½ HP 125-250 V AC; ½ A 125 V DC, ¼ A 250 V DC; 4 A "L" 125 V AC. **4700 Series**—Light operating force—8 oz. and 75 gram max. 10 A, ⅓ HP, 125-250 V AC; 4 A "L" 125 V AC. U.L. Listed. C.S.A. Approved. **4613 Series** meets requirements for TV fire protection.



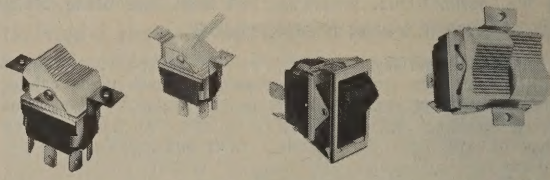
sub-miniature snap-action

4900 Series—smallest precision snap-action switches available. Case dimensions less than .250″ x .300″ x .100″. Choice of contacts, terminals and actuators. SPDT. 2 A 125-250 V AC; 2 A (Res.) 30 V DC; 1 A (Ind.) 30 V DC. Meet MIL-S-8805 specifications. Temp. range —100° F to +185° F. Up to 250° F continuous duty temp. ratings available.



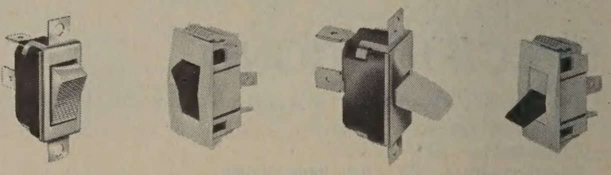
rocker and paddle

Your choice of actuator color, style. Proven reliable detent mechanism. Snap-in mounting optional. Variety of SP and DP, 3-pole, 4-pole and 2-circuit models. **0801 SP and 0811 DP Series** — 20 A 277 V AC; 1½ HP 125-250 V AC. **1801 SP and 1811 DP Series**—6 A 125 V AC; 3 A 250 V AC; ¼ HP 125-250 V AC. **0840 3-pole and 4-pole series** — 17 A 277 V AC; 6 A 600 V AC; 1 HP 125 V AC; 2 HP 250-480-600 V AC; 1, 2 or 3 phase. U.L. Listed. C.S.A. Approved.



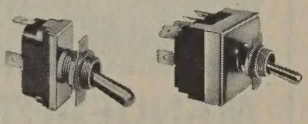
miniature rocker and paddle

High rating reliability. Choice of standard or specially styled actuators terminals, circuitry to meet your needs. Optional snap-in mounting. **0805 Series**—12 A 125 V AC; 6 A 250 V AC; ½ HP 125-250 V AC and 15 A 125-277 V AC, ¾ HP 125-250 V AC. **1805 Series** 8 A 128 V AC; 4 A 250 V AC; ⅓ HP 125-250 V AC. Also available with 6 A "L" 125-250 V AC rating. **0806 Series**—features neon indicator light. Same ratings as 12 A 0805 series switches. U.L. Listed. C.S.A. Approved.



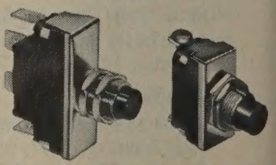
toggle

Reliable proven positive detent mechanisms. Wide variety of circuitry in 6 A to 20 A ratings. SP, DP, 3-pole and 4-pole models. Choice of spade, screw or solder terminals. U.L. Listed.



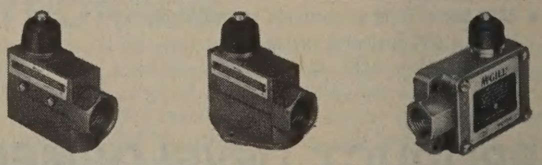
push button

Momentary and maintained contact push-button switches up to 30 A. Variety of mechanisms, including snap-action, SPST, SPDT, 2-circuit. U.L. Listed.



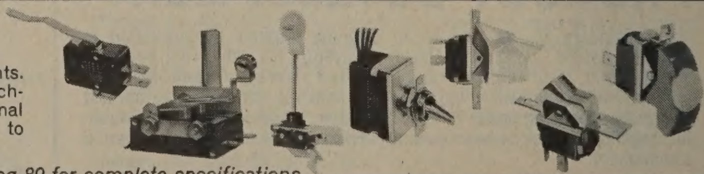
precision metal-cased

Applicable for limit, safety and automatic control uses. In die-cast housings with variety of direct action and adjustable level actuators. **1502 Series** 20 A, 125-250, 480 V AC, ½ A 125 V DC, ¼ A 250 V DC. **1503 Series** same rating with added 10 A, 125 V AC Lamp Load and 1 HP 125 V AC, 2 HP 250 V AC. U.L. Listed.



specially-engineered

Modifications of basic switches to meet application requirements. Special actuator designs and colors, mounting hardware and attachments to provide more design latitude, style-appeal and functional reliability. Complete application engineering abilities and facilities to develop the best answer to your special switch problems.



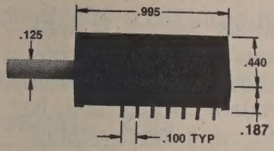
Request Catalog 89 for complete specifications.

McGILL MANUFACTURING CO., INC., ELECTRICAL DIVISION, VALPARAISO, INDIANA 46383. Phone: (219) 464-4911

COMPONENT PRODUCTS GROUP

DAVEN ROTARY SWITCHES

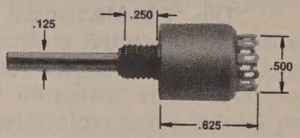
Dipswitch



SPECIFICATIONS

Switching Capacity 1/8 amp.
Up to 3 Non-shorting closures per position.
Up to 5 Shorting closures per position.
Six Positions Max. 60°
Contact Resistance .050 ohms max.
Dielectric 500 VAC
Insulation 10,000 Megohms
External Stop option
(Up to 30 ounce inches)

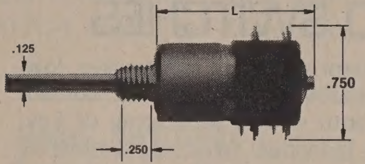
G/K Series



SPECIFICATIONS

Switching Capacity 1 amp.
1 pole, 12 position to
4 pole, 3 position
Shorting or Non-shorting
Indexing—30°, 36°, 45°, 60°
QPL per MIL-S-3786/20E
Explosion Levels "E" + "F"
Dielectric 1000 VRMS
Insulation 50,000 Megohms
Contact Resistance—.020 ohms max.
P/C and Solder Terminals
Mounting Hardware Supplied

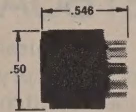
S Series



SPECIFICATIONS

Switching Capacity ½ amp.
Up to six decks from 1 pole 20 positions to 8 pole 2 positions
Indexing—18°, 22½°, 30°, 36°, 45°, 60°..
BCD 1 thru 6
BCO 1 thru 3
Dielectric 500 VRMS
Insulation 50,000 Megohms
Stop Strength 80 ounce inches
"L" from .812 to 3.0 inches

P Series



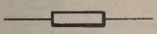
SPECIFICATIONS

Switching Capacity ½ amp.
1 pole, 10 position
2 pole, 5 position
Indexing 36°
Shorting & non-shorting
Screw driver operated
Printed Circuit Terminals
Dielectric 1000 VRMS
Insulation 50,000 Megohms
Stop strength 24 inch ounces.
Contact Resistance .030 ohms max.

COMPLETE CATALOG RS-77

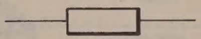
DAVEN PRECISION WIREWOUND RESISTORS

Miniature Axial



.100—.187 diameter
.235—.500 Long
Resistance to 1 Megohm Max.
T.C. to ±3 PPM/°C
Standard ±10 PPM/°C
Tolerances .02—0.1%
Wattage .03—.125W
Operating Temp.
-55 to +145°C

Standard Axial



.250—.500 diameter
.343—2.00 Long
Resistance to 24 Megohms Max.
T.C. to ±2 PPM/°C
Standard ±10 PPM/°C
Tolerances .005—0.1%
Wattage—.125—2.0W
Operating Temp.
-55 to ±145°C

Printed Circuit

.281—.500 diameter
.312—.500 high
Resistance to
2.6 Megohms Max.
T.C. to ±2 PPM/°C
Standard ±10 PPM/°C
Tolerances .01—0.1%
Wattage .250—.500W
Lead spacing .200—.300

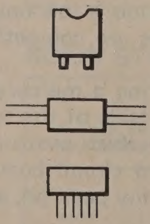
Lug Type

.437—.937 diameter
.500—2.0 Long
Center Tap lugs and radial leads
Lugs accommodate #6 screws.
Resistance to 19 megohms.
T.C. to ±3 PPM/°C
Standard ±20 PPM/°C
Tolerances .01—0.1%

FUSE RESISTORS

TWO for the price of ONE...
Precision resistor and fuse...
.140—.200 diameter
.400—.500 long
.01 ohms to 2.5k resistance.
Tolerances ±.02—±5%
Fusing time 5μs—3 minutes
Tradeoffs on the above required.

NETWORKS



CUSTOM for your convenience
Resistors matched to .005%
T.C.'s matched to .5 PPM
Matched reactive components.
CR, RC, C, L, R combinations
Cold Junction Reference
Environmental and Hermetic Seals.
Ladders; R-2R BCD, mix radix
Bipolar, Binary bipolar, shift binary, summing

COMPLETE CATALOG WW-75

McGRAW-EDISON COMPANY
Edison Electronics Division
Grenier Field Municipal Airport, Manchester, N.H. 03103 • (603) 669-0940 • TWX 710-220-1747

Mechanical Enterprises, Inc.

8000 Forbes Place • Springfield, Va. 22151
(703) 321-8282 • TWX 710-832-0942

KEYBOARD SWITCHES

Mechanical Enterprises offers inexpensive, low-bounce mercury contact and mechanical contact keyboard switches, both with a wide array of keytops. In addition to individual switches, completely assembled small keyboards for OEM in standardized configurations are available to save on engineering and layout charges.

The T-5 Mechanical Contact Switch is well suited to protected environments where open contacts can be used and where low cost is a prime requisite. The Mercutron Keyboard Switch, M-5, is an ideal low-cost replacement for solid-state switches and perfect for environments unsuitable for most other types of switches.

COMMON FEATURES OF M-5 AND T-5 SWITCHES

Plunger styles available are: the blade and cruciform stems for doubleshot keytops producing a flat or sloped keyboard; the slanted stem for a doubleshot keytop producing a stepped keyboard; the pushbutton style for use with a legend plate; and two plungers designed specifically to accept lenses for lighted switches.

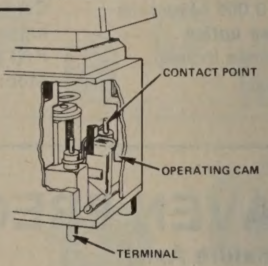
The lighted version of switches accept bi-pin style T-1 incandescent lamps. These switches are easily relamped from the front panel. Each lens contains a plastic film light diffuser which may be lettered by printing or transfer type lettering.

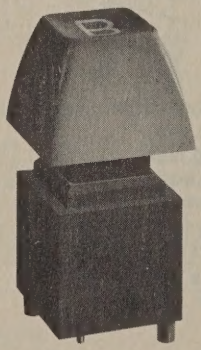
All switches are also available with alternate switching action: push on/push off.

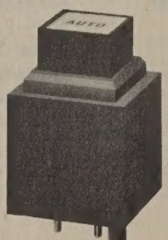
SERIES T-5 . . . with gold-plated mechanical contacts

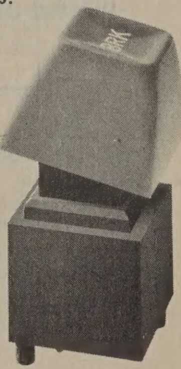
These Keyboard Switches have low-bounce mechanical contacts with a rated life of 20 x 10^6 operations.

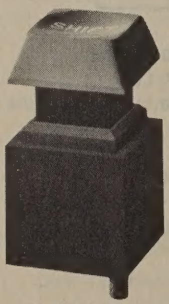
Switching action is accomplished by movement of one gold-plated bar against another at right angles (classic cross bar switching) at a velocity determined only by spring forces. This design provides a much more constant and lower contact bounce than is found in conventional mechanical contact switches.

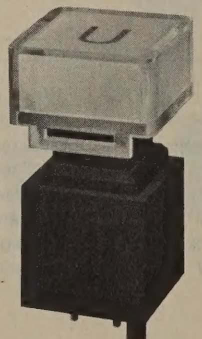


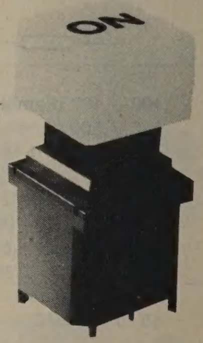

T & M-5C


T & M-5H


T & M-5S


T & M-5B

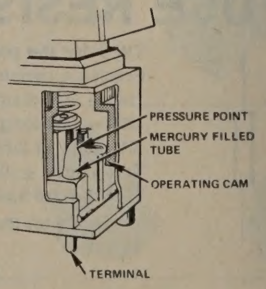

T & M-5L


T & M-5K

SERIES M-5 . . . with flexible tube mercury contacts

Mercutron Keyboard Switches provide a low-bounce switching closure with sealed contacts. Unit prices are competitive with reed switches.

Switching is accomplished by breaking a mercury core inside a flexible tube by slight pressure on the outside of the tube. The mercury switching element terminates in pins which protrude through the switch body for soldering into the printed circuit board. The M-5 is unaffected by attitude: it will operate in any position, as well as under acceleration forces.



KEYBOARD ASSEMBLIES 10, 12 and 16 Positions

A variety of small keyboards made from T-5 and M-5 Keyswitches are available as standard units. Both encoded and non-encoded versions on 3/4 and 5/8 inch centers with a selection of keytop styles provide for numerous keyed inputs. Keyboards are made for behind-panel mounting with attractive keytop arrays projecting through single or multiple openings. Contact us for details on standard configurations.

MICRO SWITCH

TABLE OF CONTENTS

The products described in the following pages are representative of the thousands of position sensing and manual control products manufactured and distributed worldwide by MICRO SWITCH. For comprehensive catalogs write MICRO SWITCH, Freeport, Illinois 61032, Dept. 720E. Or, call (815) 235-6600. For application assistance, contact a nearby MICRO SWITCH Branch Office. See listing in this Directory. For off-the-shelf products, see your local MICRO SWITCH Authorized Distributor.

MANUALLY OPERATED SWITCHES

PUSHBUTTONS

AML p. 4160

Wide choice of visual display with power, electronic or solid state switching. Single level termination with all common types. Choice of snap in front mount or strip and matrix mount.

Series 4 p. 4165

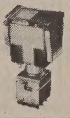
Snap in front mount with easy wiring for low installed cost. Single section. Electrical ratings from 10 amps to gold contacts to solid state switching.

Series 3 p. 4168

Matrix, individual or strip mount. 1 or 2 section. 5 amp rating. Various button styles and visual display.

Series 2 p. 4171

Individual or strip, snap in mount. 1 to 4 section buttons for many display possibilities. Widest choice of switch modules, plus coil operation.



SN/SD p. 4175

Hall effect, solid state switching. Wide selection of buttons and legends. Snap in or P.C. board mount in standard or low profile modules.

Unlighted Pushbuttons p. 4176

Bushing mounted. Wide choice of circuitry or ratings.

TOGGLE SWITCHES

Series 8 p. 4177

Complete miniature manual line. 6 amp rating. 1 to 4 poles. Variety of actuators, contacts and termination. Use where low cost and small size are critical requirements.

Type TS p. 4179

Standard size toggles, 1 or 2 pole. Various actions, circuitry and termination. Use where a lower cost standard size toggle is required.

Type TL-TP p. 4180

Sealed toggle and rocker toggle series. Standard size. 1, 2 and 4 poles. Various actuators, termination, and circuitry. Has both mil. listings and UL listings.

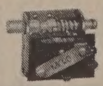
Type AT p. 4182

Toggle switch assemblies using basic switches. Wide variety of ratings, contacts, actuators, terminals, and sealing. Mil. listings available.

SPECIAL PURPOSE

Type AC p. 4184

Door interlock switches for use in hazardous electronic equipment. Variety of precision snap-acting switches.



POSITION SENSING SWITCHES

BASIC SWITCHES

Type SX p. 4185

Smallest snap-action switches from MICRO SWITCH. Rated to 7 amperes. Choice of actuators and terminal styles. Use where the smallest and least weight, snap acting switch is essential.

Type SM p. 4186

Slightly larger than SX switches. Rated to 11 amperes. Choice of contacts, actuators and terminal styles. Use for communications/office equipment and other smaller application needs.

Type V3 p. 4187
Type XL p. 4188

Standard or low operating forces. Rated to 15 amperes. Use for appliance-vending machine and similar applications. XL Solid state Hall effect integrated circuit in a V3 package.

Type Z & A p. 4189

Standard size switches. Ratings to 25 amps. High precision — long life. Wide choice of actuators and terminals. Use for general purpose applications.

Type SE/XE p. 4192

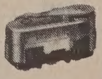
Sealed, environment-proof switches. Rated to 7 amperes. Choice of auxiliary actuators and terminal styles. Use where a sealed SM or a sealed SX is needed. Mil. listings.

Type HM p. 4193

Hermetically-sealed switches. Rated 5 amperes, 28 VDC and 125 VAC, 400 hertz. High temperature version to 500°F (260°C). The ultimate in sealing, plus small size. Mil. listings.

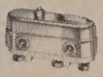
Type HS p. 4194

Hermetically sealed switch. Rated to 25 amperes, 28 VDC. High temperature version to 300°F (149°C). Choice of integral levers and terminals. Standard size switch with the best seal. Mil. listings.



Type HT p. 4194

High temperature switch (up to +1000°F 538°C). Side and panel mount. Rated 3 amperes 125 VAC. Use for oven/furnace applications.



Mercury Switch p. 4195

Low cost hermetically-sealed switches. Easy installation and low force operation. Tilt (position-sensitive) switches are actuated by the normal movements of machine parts.

SOLID STATE NO TOUCH SENSORS

103SR/400SR p. 4196

Magnetically operated Hall effect sensors. May be directly interfaced with most electronic circuits.

XK p. 4196

Eddy current, ferromagnetic operated sensor. Rugged plastic package and direct interface with logic devices.

AV p. 4197

Vane operated Hall effect sensor. 0 to 100 KHz, speed of operation.

FW p. 4197

Choice of ferromagnetic or all metals sensing proximity switches. Protected from RFI effects. Environment sealed. Direct interface with logic devices.

MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

AML ADVANCED MANUAL LINE

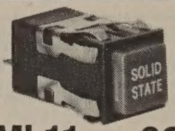
MICRO SWITCH AML (Advanced Manual Line) presents a new dimension in lighted pushbutton and indicator control. Designed by industrial designers for industrial designers, AML was developed with appearance and human factors in mind. The coordinated button height, bezel size, and the compatibility of the square and rectangular shapes combine to "harmonize" your panel.

Displays range from split-screen and hidden-color to a unique three-segment lens cap indicator — all with transmitted, projected, or dead front illumination. And a choice of lamps, including a T-1¾ wedge base lamp, neon and LED's.

Solid state pushbuttons operate at 5 V or 6-16 V with a built-in regulator, sink (TTL or CMOS) and source; electronic control from logic level switching to 3 amperes, 125 VAC; and power control up to 10 amperes at 250 VAC.

AML devices have the same shallow behind-panel depth and single level termination. They can either be snapped in place from the front, or subpanel mounted using individual strip or matrix mounting hardware.

AML is designed to comply with IEC, CEE24, UL and CSA standards.



SOLID STATE PUSHBUTTON SWITCHES . . . AML10 SERIES

These switches utilize the proven MICRO SWITCH Hall effect integrated circuit to control transistor and logic level circuitry.

AML11 . . . SOLID STATE SWITCH . . . INCANDESCENT ILLUMINATION

ELECTRICAL SPECIFICATIONS

RECOGNIZED BY UL–CERTIFIED BY CSA

Electrical Characteristics						Absolute Maximum Rating			
				Switching Time Max.					
Integrated Circuit Function	Supply Current (Max.)	Output Voltage (Operated)	Output Leakage Current Max. (released)	Rise 10% to 90%	Fall 90% to 10%	Supply Voltage (Vs)	Voltage Externally Applied to Output	Loads to Output	Storage Temperature
5 VDC Sinking[1]	3.5 mA (Released) 6.5 mA (Operated no load)	+.4 volt (Sinking (8 mA)	2.0 μA	1.0 μsec (Sinking 8 mA)	1.0 μsec	−.5 to +7.0 VDC (0°C to +65°C)	−.5 volt min. +15 volts max. (Off condition)	20 mA (Sinking)	−40°C to +65°C
5 VDC Sourcing[1]	3.5 mA (Released) 4.5 mA (Operated no load)	(Vs −1.8) VDC min. (20 mA load)	2.0 μA	1.0 μsec (Sourcing 20 mA)	1.5 μsec	−.5 to +7.0 VDC (0°C to +65°C)	+7.0 VDC max. −0.5 VDC min. (Off condition)	40 mA	−40°C to +65°C
6-16 VDC Sinking[2]	6.5 mA @ 6 VDC 10.0 mA @ 16 VDC (plus load current)[3]	+.4 volt (Sinking 20 mA max.)	20 μA	1.5 μsec (Sinking 20 mA)	0.5 μsec	−1.2 to +20 VDC	+20 VDC max. in Off condition only −0.5 VDC min. in Off or On condition	40 mA	−40°C to +65°C

[1] Over temperature range of 0°C to +55°C and supply voltage of 4.5 to 5.5 VDC.
[2] Over temperature range of 0°C to +55°C and supply voltage of 6 to 16 VDC.
[3] At 24°C.

ORDERING GUIDE—SOLID STATE (INCANDESCENT ILLUMINATION)

AML11 C B A 2 AA

HOUSING TYPE
- B PB Square Non-Ill.
- C PB-Square 1 Lamp Cir.
- E PB-Rect. Non-Ill.
- F PB-Rect. 1 Lamp Cir.
- G PB-Rect. 2 Lamp Cir.

BEZEL COLOR
- B Black

LAMP TYPE
- A No Lamp Installed (See AML91)

TERMINAL TYPE
- 2 .100 x .020 (Solder or Quick connect)
- 3 .025 x .025 (Printed Circuit, Wire-Wrap or Push-On)

CIRCUITRY CODES

5 Volt Sinking
- AA Mom. Action
- AE Alt. Action

5 Volt Sourcing
- AB Mom. Action
- AF Alt. Action

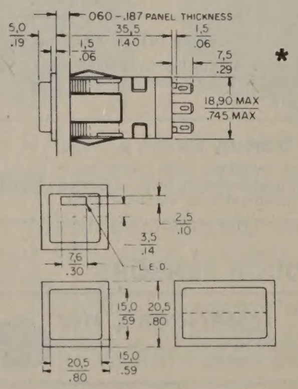
6-16 Volt Sinking
- BA Mom. Action
- BE Alt. Action

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

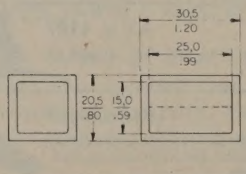
Key: 0,0 — mm / 0.00 — inches

AML . . . OVERALL DIMENSIONS

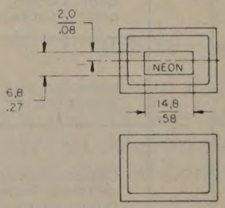
AML 10 SERIES



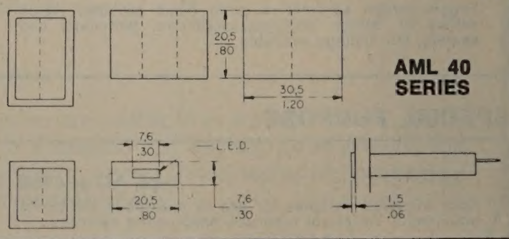
AML 20 SERIES



AML 30 SERIES



AML 40 SERIES



* Behind panel dimensions are alike for all AML Series switches.

AML12 . . . SOLID STATE SWITCH . . . LED ILLUMINATION

ORDERING GUIDE — SOLID STATE (LED ILLUMINATION)

RECOGNIZED BY UL **AML12 C B C 8 BA**

HOUSING TYPE
C
PB — Square
1 LED

BEZEL
B
Black

LED COLOR/VOLTAGE

B	*V. Red
C	5.0 V. Red
D	10.0 V. Red
E	15.0 V. Red
H	*V. Yellow
J	5.0 V. Yellow
K	10.0 V. Yellow
L	15.0 V. Yellow
R	* V. Green
S	5.0 V. Green
T	10.0 V. Green
W	15.0 V. Green

* See application information

TERMINAL TYPE/DIODE PROTECTION

2
.110 x .020
(Solder or Quick Connect)

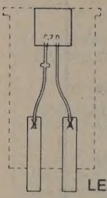
3
.025 x .025
(Printed Circuit, Wire-Wrap or Push-On)

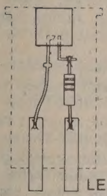
8
.110 x .020
(With Diode Protection for LED)

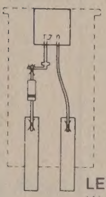
9
.025 x .025
(With Diode Protection for LED)

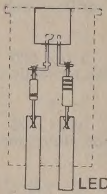
CIRCUITRY CODES

	5 volt current sinking
AA	Mom. Action
AE	Alt. Action
	5 volt current sourcing
AB	Mom. Action
AF	Alt. Action
	6-16 volt current sinking
BA	Mom. Action
BE	Alt. Action


LED

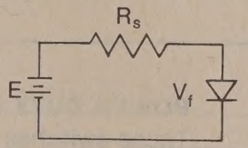

LED W/RES


LED W/DIODE


LED + RES & DIODE

APPLICATION INFORMATION

AML12, 22 and 42 pushbuttons and indicators constructed for voltage levels of 5, 10, and 15 VDC are provided with internal resistors to control LED current to a nominal 20 mA. For those devices without internal current limiting resistors, suitable external control of the LED current must be provided. It is recommended that a minimum of 5 VDC open circuit voltage with an appropriate series resistance be used to drive LED devices. This minimizes the effect of temperature (current variation) on forward voltage of the LED. Refer to equations at right.



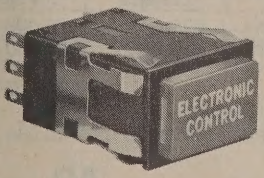
$$R_s = \frac{E - V_f}{I_f}$$

WHERE: R_s = Series Resistance
E = Supply Voltage
V_f = Forward Voltage of LED
I_f = Circuit Current

If a diode is added in series for reverse polarity protection then:

$$R_s = \frac{E - V_f - V_{PD}}{I_f}$$

WHERE: V_{PD} = Forward Voltage of Protection Diode



ELECTRONIC DUTY PUSHBUTTON SWITCHES . . . AML20 SERIES

These switches provide versatile switching capabilities from logic level switching to 3 amperes, 125 VAC.

AML21 . . . ELECTRONIC CONTROL SWITCH . . . INCANDESCENT ILLUMINATION

ORDERING GUIDE — ELECTRONIC CONTROL (INCANDESCENT ILLUMINATION)

LISTED BY UL
CERTIFIED BY CSA

AML21 C B A 2 AA

HOUSING TYPE

B
PB Square
Non-Ill.

C
PB Square
1 Lamp Cir.

E
PB-Rect.
Non-Ill.

F
PB-Rect.
1 Lamp Cir.

G
PB-Rect.
2 Lamp Cir.

BEZEL COLOR
B
Black

LAMP TYPE
A
No Lamp Installed
(See AML91)

TERMINAL TYPE

2
.100 x .020
(Solder or Quick Connect)

3
.025 x .025
(Printed Circuit, Wire-Wrap or Push-On)

CIRCUITRY CODES

	Silver Contacts
AA	Mom. Action 1-Pole Double-Throw
AB	Alt. Action 1-Pole Double-Throw
AC	Mom. Action 2-Pole Double-Throw
AD	Alt. Action 2-Pole Double-Throw
	Gold Contacts
BA	Mom. Action 1-Pole Double-Throw
BB	Alt. Action 1-Pole Double-Throw
BC	Mom. Action 2-Pole Double-Throw
BD	Alt. Action 2-Pole Double-Throw

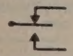
ELECTRICAL SPECIFICATIONS

Contacts	Voltage	Current	Load Type	Life (90% Survival)
Silver	250 VAC	2 Amperes	75% P.F.*	25,000 operations
	125 VAC	3 Amperes	75% P.F.*	25,000 operations
	24 VDC	2 Amperes	Resistive	25,000 operations
Gold	24 VDC	100 mA	Resistive	100,000 operations
	5 VDC	10 mA	Resistive	100,000 operations
	.5 VDC	1 mA	Resistive	100,000 operations

* Power Factor

Switch resistance is less than 1% of load resistance on greater than 5 volt, below .5 volts resistance is impractical to predict.

Contact arrangement
1 or 2 poles
Form C



AML22 . . . ELECTRONIC CONTROL SWITCH . . . LED ILLUMINATION

ORDERING GUIDE — ELECTRONIC CONTROL (LED ILLUMINATION)

LISTED BY UL

AML22 C B C 8 AA

HOUSING TYPE
C PB-Sq. 1-LED

BEZEL COLOR
B Black

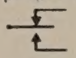
LED COLOR/ VOLTAGE	
B	*V. Red
C	5.0 V. Red
D	10.0 V. Red
E	15.0 V. Red
H	*V. Yellow
J	5.0 V. Yellow
K	10.0 V. Yellow
L	15.0 V. Yellow
R	*V. Green
S	5.0 V. Green
T	10.0 V. Green
W	15.0 V. Green

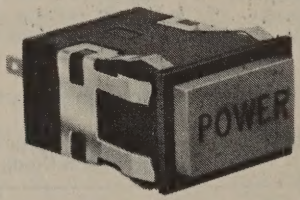
* See LED application (AML12)

TERMINAL TYPE/ DIODE PROTECTION
2 .110 x .020 (Solder or Quick Connect)
3 .025 x .025 (Printed Circuit, Wire-Wrap or Push-on)
8 .110 x .020 with diode protection for LED
9 .025 x .025 with diode protection for LED

CIRCUITRY CODES	
	Silver Contacts
AA	Mom. Action 1-Pole Double-Throw
AB	Alt. Action 1-Pole Double-Throw
AC	Mom. Action 2-Pole Double-Throw
AD	Alt. Action 2-Pole Double-Throw
	Gold Contacts
BA	Mom. Action 1-Pole Double-Throw
BB	Alt. Action 1-Pole Double-Throw
BC	Mom. Action 2-Pole Double-Throw
BD	Alt. Action 2-Pole Double-Throw

Contact arrangement
1 or 2 poles: Form C





POWER DUTY PUSHBUTTON SWITCHES . . . AML30 SERIES

These switches are designed for power (line disconnect) applications up to 10 amperes at 250 VAC.

ELECTRICAL SPECIFICATIONS

Voltage	Current	Loadtype	Life (90% Survival)
125 VAC	10 amperes	60% P.F.*	25,000 operations
250 VAC	10 amperes	60% P.F.*	25,000 operations

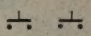
* Power Factor.

AML31/32 . . . POWER SWITCH . . . INCANDESCENT/NEON ILLUMINATION

ORDERING GUIDE — POWER SWITCH AML31 (INCANDESCENT)

LISTED BY UL
CERTIFIED BY CSA

Contact arrangement
2 poles
Form X



AML31 F B A 4 AD

HOUSING TYPE
E PB-Rect. Non-Ill.
F PB-Rect. 1 Lamp Cir.

BEZEL COLOR
B Black

LAMP TYPE
A No Lamp Installed (See AML91)

TERMINAL TYPE
4 .187 x .020 (Solder or Quick Connect) N/C

CIRCUITRY CODES
AD Alt. Action 2-Pole, Single-Throw Normally-Open (X)
AC Mom. Action 2-Pole, Single-Throw Normally-Open Form X

ORDERING GUIDE — POWER SWITCH AML32 (NEON) LISTED BY UL

AML32 F B C 7 AD

HOUSING TYPE
F PB-Rect. 1-Lamp Circuits

BEZEL COLOR
B Black

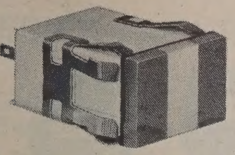
LAMP VOLTAGE/ COLOR	
B	125 V. Red
C	250 V. Red
D	125 V. Yellow
E	250 V. Yellow
K	125 V. Clear
L	250 V. Clear

TERMINAL TYPE/ INTEGRAL LAMP CIRCUIT
4 .187 x .020 (Solder or Quick Connect)
7 .187 x .020 with integral lamp circuit

CIRCUITRY
AD Alt. Action 2-Pole, Single-Throw Normally-Open (X)
AC Mom. Action 2-Pole, Single-Throw Normally Open, Form X

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm
0.00 — inches



INDICATORS . . . AML40 SERIES

These indicators provide illuminated displays for control panel applications.

AML41/42 . . . INDICATORS . . . INCANDESCENT/LED ILLUMINATION

LISTED BY UL

ORDERING GUIDE — INDICATORS AML41 (INCANDESCENT)

AML41* C B A 2

HOUSING TYPE	
C	Square 1-Lamp Cir.
D	Square 2-Lamp Cir.
F	Rectangular 1-Lamp Cir.
G	Rectangular 2-Lamp Cir.
J	Rectangular (Lens Type) 1-Lamp Cir.
K	Rectangular (Lens Type) 2-Lamp Cir.
L	Rectangular (Lens Type) 3-Lamp Cir.

BEZEL COLOR	
B	Black

LAMP TYPE	
A	No Lamp Installed (See AML91)

TERMINAL TYPE	
2	.110 x .020 (Solder or Quick Connect)
3	.025 x .025 (Printed Circuit, Wire-Wrap or Push-On)

* ALSO CERTIFIED BY CSA

ORDERING GUIDE — INDICATORS AML42 (LED)

AML42 S B C 8

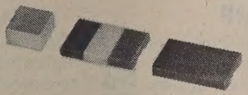
HOUSING TYPE	
S	Rectangular 1-LED

BEZEL COLOR	
B	Black

LED COLOR/ VOLTAGE	
B	*V. Red
C	5.0 V. Red
D	10.0 V. Red
E	15.0 V. Red
H	*V. Yellow
J	5.0 V. Yellow
K	10.0 V. Yellow
L	15.0 V. Yellow
R	*V. Green
S	5.0 V. Green
T	10.0 V. Green
W	15.0 V. Green

* Refer to LED application information, AML12.

TERMINAL TYPE/ DIODE PROTECTION	
2	.110 x .020 (Solder or Quick Connect)
3	.025 x .025 (Printed Circuit Wire-Wrap or Push-On)
8	.110 x .020 With diode protection for LED
9	.025 x .025 With diode protection for LED



BUTTONS . . . AML50 SERIES

Pushbutton, lens style, LED and neon buttons provide a wide selection of lighted displays plus maximum legending space.

AML51 . . . BUTTONS FOR INCANDESCENT PUSHBUTTONS AND INDICATORS

ORDERING GUIDE — BUTTONS FOR INCANDESCENT PUSHBUTTONS AND INDICATORS

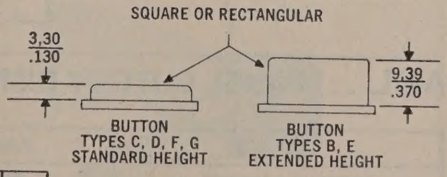
AML51 L 10 R W B

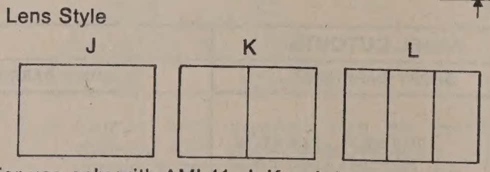
BUTTON TYPE	
B	Square Full Screen (Use with display/ legend type #10 and #20 only)
C	Square Full Screen
D	*Square 2-Split Horizontal
E	Rectangular Full Screen (Use with display/legend type #10 and #20 only)
F	Rectangular Full Screen
G	Rectangular 2-Split Horizontal
J	*Rect. Lens Full Screen
K	*Rect. Lens 2-Split Vertical
L	*Rect. Lens 3-Split Vertical
* M	Square Mushroom, Full Screen (Use with display legend type #10 and #20 only)

* Use with AML41 Devices only.

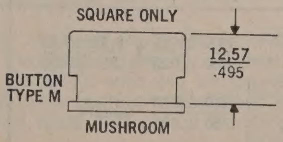
DISPLAY/LEGEND TYPE	
10	Transmitted color, no legend
11	Transmitted color, insert, with clear cap
20	Transmitted color, with legend
21	Transmitted color, insert, clear cap, with legend
30	Dead front, no legend
40	Dead front, with legend
50	Projected color no legend
60	Projected color with legend

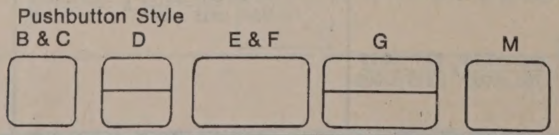
FULL/ COLOR	2-SPLIT/ COLOR	3-SPLIT/ COLOR
R Red	R Red	R Red
Y Yellow	Y Yellow	Y Yellow
G Green	G Green	G Green
B Blue	B Blue	B Blue
W White	W White	W White


SQUARE OR RECTANGULAR
3,30
.130
9,39
.370
BUTTON TYPES C, D, F, G STANDARD HEIGHT
BUTTON TYPES B, E EXTENDED HEIGHT



(For use only with AML41, J, K or L lens type devices)

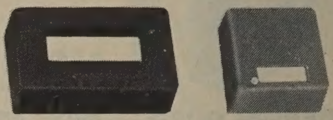




DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

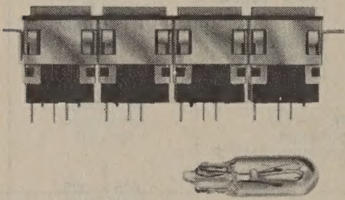
AML52 . . . BUTTONS FOR LED/NEON PUSHBUTTONS



ORDERING GUIDE — BUTTONS FOR LED/NEON PUSHBUTTONS

AML52 N 10 R

BUTTON TYPE	DISPLAY/LEGEND TYPE	COLOR
C Square Full Screen (For LED Pushbutton)	10 Transmitted color, no legend	R Red Y Yellow G Green
N Rect. Full Screen (For Neon Pushbutton)	20 Transmitted color, with legend	B Blue W White K Black

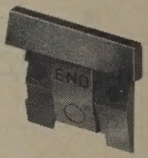


MOUNTING BRACKETS, BARRIERS AND LAMPS

AML61 Mounting brackets provide simple assemblies to surface or subpanel-mount AML devices.

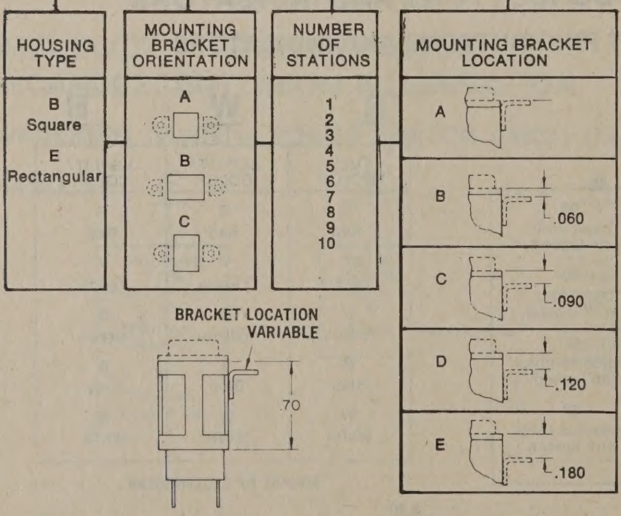
AML71 Barriers can be used to segregate switches or indicators for either individual or slot-mounting.

AML91 Incandescent Lamps used with AML11, 21, 31 and 41 devices.



ORDERING GUIDE — STRIP MOUNTING ASSEMBLY

AML 61 B A 5 A



HOUSING TYPE	MOUNTING BRACKET ORIENTATION	NUMBER OF STATIONS	MOUNTING BRACKET LOCATION
B Square	A	1	A
E Rectangular	B	2	B .060
	C	3	C .090
		4	D .120
		5	E .180
		6	
		7	
		8	
		9	
		10	

ORDERING GUIDE — LAMP

AML91 L A 86

DEVICE	TYPE	LAMP NO.
L Lamp	A Wedge base T-1¾	86 6.3 volts
		73 14.0 volts
		85 28.0 volts

ORDERING GUIDE — BARRIERS

AML71 S C B

LENGTH	TYPE	COLOR
S Short, for use with square devices and short side of rectangular device.	C Center	B Black
L Long, for use with long side of rectangular device.	E End	

AML . . . PANEL CUTOUT DIMENSIONS For Single Switches/Indicators

PANEL CUTOUTS		
WITHOUT BARRIERS	**SHORT BARRIERS**	**LONG BARRIER**
19,0 ±0,15 / .750 ±.005 x 6,35 ±0,15 / .250 ±.005	19,0 ±0,15 / .750 ±.005 x 23,6 ±0,15 / .930 ±.005	23,6 ±0,15 / .915 ±.005 x 29,2 ±0,15 / 1.141 ±.005
19,0 ±0,15 / .750 ±.005 SQUARE	19,0 ±0,15 / .750 ±.005 x 33,7 ±0.15 / 1.325 ±.005	
19,0 ±0,15 / .750 ±.005 x 29,0 ±0,15 / 1.14 ±.005		

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

SERIES 4 LIGHTED PUSHBUTTON SWITCHES/INDICATORS

- Choice of Solid State or Precision Snap-Action Switching
- Low Installed Cost
- Front of Panel Mounting and Relamping — Without Tools
- Distinctive Lighted Display Colors
- Attractive Housings with Barriers or Full Bezels

Series 4 provides an attractive panel display and switching versatility at a low installed cost to help you stretch your panel budget. Units can be furnished assembled, with lamp, ready to snap-in the panel. There is a choice of solder/quick-connect terminals or printed circuit board terminals.

See Catalog 200 for additional information and listings.

BUTTONS

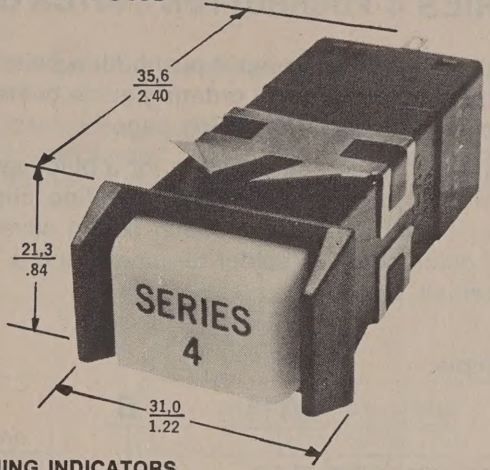
Vivid color buttons provide attractive, clearly visible lighted display with: (1) transmitted color — display color can be distinguished whether the lamp is ON or OFF; (2) projected color — button is white with the lamp OFF and colored when illuminated; and (3) hidden legend/hidden color — button appears black with the lamp off, and legend and color appear when illuminated.

LAMPS

The Series 4 lamp remains stationary during button operation, minimizing filament breakage due to a moving lamp. There is a choice of T-3¼ wedge-base lamps (6, 12 and 28 V) or T-2 telephone slide-base lamps (120 V).

HOUSINGS

Housings for switches and indicators are identical in appearance, but the indicator housings have no provision for switching. They may be snap-in mounted on panels up to .20″ (10,2mm) thick. Housings are available in full bezel or barrier styles, momentary or alternate action switching, and contain the lamp socket and termination means.

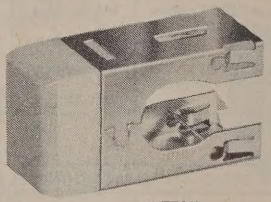


MATCHING INDICATORS

The indicators are identical externally to the Series 4 lighted switches for a harmonious panel appearance. See Catalog 200 for ordering.

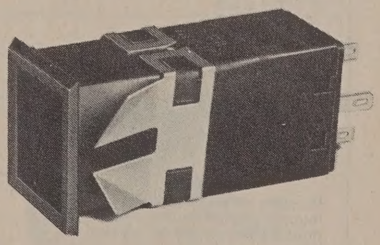
LOCKED BUTTON OPTION

Series 4 can be furnished with a locked button option for use in areas accessible to the public, where tampering and vandalism are problems. The housing has a special mounting clip with built-in button retainer. This mounting clip must be removed from behind panel to allow button removal. Button movement during switch operation is unaffected by the locked button feature. (These units cannot be relamped from front of panel.)



BUTTON

LAMP

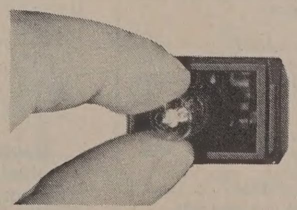


HOUSING

CONVENIENT PANEL FRONT MOUNTING AND RELAMPING

1. Snap-in mounting. Switch or indicator is easily inserted into the cutout. Mounting clips grip the panel. No tools are needed.

2. Lamps and legends can be changed from panel front. When button is removed, lamp is extracted from its socket and retained in button.



3. Ease of lamp replacement. After the inoperative lamp is automatically removed with the button, the new lamp is inserted without the use of tools.

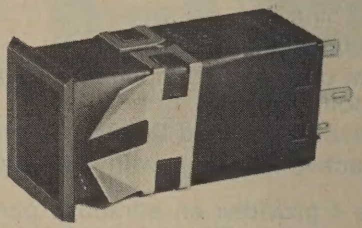
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

SERIES 4 PUSHBUTTON SWITCH ORDERING GUIDE

Catalog listings for Series 4 pushbutton switch housings may be derived from the ordering guide below. To order buttons, refer to the following page.

4A11BAA11 is a catalog listing for a black switch housing with a bezel on all sides, mounting clips on long sides, 1-pole momentary action 5-amp silver contacts, .110″ quick-connect/solder terminals, and a T-3¼ lamp socket. UL listed.



Example:

4A11 **B** **AA** **11**

SWITCH HOUSING STYLE	
4A11	Bezel on all sides, mounting clips on long sides
4A12	Bezel on all sides, mounting clips on short sides
4A13	Bezel on all sides, mounting clips on long sides, housing provisions for locked button
4A21	Barriers on short sides, mounting clips on long sides
4A22	Barriers and mounting clips on short sides
4A23	Barrier on one short side, mounting clips on long sides
4A24	Barrier on one short side, mounting clips on short sides
4A25	Barriers on short sides, mounting clips on long sides, housing provisions for locked button
4A26	Barrier on one short side, mounting clips on long sides, housing provisions for locked button
4A31	Barriers and mounting clips on long sides
4A32	Barriers on long sides, mounting clips on short sides
4A33	Barrier on one long side, mounting clips on long sides
4A34	Barrier on one long side, mounting clips on short sides
4A35	Barriers and mounting clips on long sides, housing provisions for locked button
4A36	Barrier on one long side, mounting clips on long sides, housing provisions for locked button

HOUSING COLOR	
B	Black

SNAP-ACTION SWITCHING ELEMENT

Electrical Data and UL code	Action	Terminals	
		.110 QC	PC
1-Pole (SPDT) 5 a. silver contacts L-4	Momentary	AA	AD
	Alt. Action	BA	BD
2-Pole (DPDT), 5 a. silver contacts L-4	Momentary	EA	ED
	Alt. Action	FA	FD
1-Pole (SPDT), gold contacts L-22	Momentary	CA	CD
	Alt. Action	DA	DD
2-Pole (DPDT) gold contacts L-22	Momentary	GA	GD
	Alt. Action	HA	HD
2-Pole combination gold (SPDT) 1a, and 5 a. silver (SPDT) contacts	Momentary	JA	JD
	Alt. Action	KA	KD
1-Pole (SPDT) 10 a. silver contacts L-99	Momentary	LA	
	Alt. Action	MA	
2-Pole (DPDT) 10 a. silver contacts L-99	Momentary	NA	
	Alt. Action	PA	
1-Pole (SPDT) gold alloy contacts	Momentary	QA	
	Alt. Action	RA	
2-Pole (DPDT) gold alloy contacts	Momentary	TA	
	Alt. Action	VA	

SOLID STATE SWITCHING ELEMENT

Electrical Data	Action		
Current Sinking, Regulated 6-16 Volts	Momentary only	SA	SC
Current Sourcing, Regulated 6-16 Volts	Momentary only	SB	SD
Current Sinking, 5 Volts	Momentary only	SS	

ILLUMINATION	
11	No lamp, has lamp socket for T-3¼ wedge base lamps
41*	No lamp, has lamp socket for T-2 telephone slide-base No. 5 lamps
91	Unlighted, no lamp socket

* If the locked button option is specified in the Housing Style code, the unit will have a UL Listing of 120 volts max., lamp.

Mounting clips on the long sides of the housing are specified when individually mounted or when the long sides of strip mounted housings parallel the long sides of the panel cutout slot. The most secure mounting is achieved when the mounting clips are on the long sides.

Mounting clips on the short sides of the housing are specified when short sides of strip mounted housings parallel the long sides of the panel cutout slot.

SERIES 4 BUTTON ORDERING GUIDE

Buttons may be furnished with or without the metal shell, assembled or unassembled. When type B, C, D, E, or F buttons are ordered unassembled, the insert is also unassembled.

Catalog listings for Series 4 buttons are derived from the ordering guide, as shown in the example, below.

4B1AGN is a catalog listing for a green (transmitted color) unlegended button. (If the button shell is also desired, substitute 4B2 for 4B1 in the listing.)

Example:

4B1 A G N

BUTTON WITHOUT METAL SHELL

4B1
Button only
(without metal shell)

BUTTON WITH METAL SHELL

4B2
Both button and
metal shell provided

BUTTON WITH METAL SHELL, WITH PROVISION FOR LOCKED BUTTON

4B3
Both button and
metal shell provided

BUTTON TYPE

A
Transmitted color, 5 sides lighted. 1-piece translucent button.

B
Projected color, 5 sides lighted. Translucent white button & color insert.

C
Hidden color/hidden legend, 5 sides lighted. Transparent black button & translucent color insert.

D
Hidden color/hidden legend, only face lighted. Transparent black button & translucent color insert.

E
Transmitted color, 5 sides lighted. Transparent colorless button & translucent color insert.

F
Transmitted color, only face lighted. Transparent colorless button & color insert.

G
Same as type "A" except .250″ higher.

DISPLAY COLOR

B
Std. Blue

G
Std. Green

R
Std. Red

S
Transparent Black (Unlighted applications only)

Y
Std. Yellow

W
Std. White (Do not use with Type B button)

A
Std. Amber (For use with Type A or G button only)

LEGEND (Legend Order Sheet must accompany all orders for legended buttons)

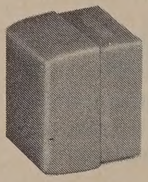
U
No legend, button unassembled. (For customer who does his own legending.) Use with any button except 4B1A —

N
No legend, button assembled. (For applications not requiring legends.) Use with any button.

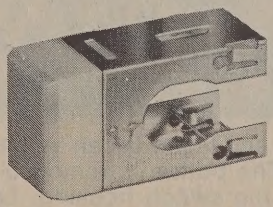
L
Legend on button only, button assembled. (For customer who prefers to have MICRO SWITCH provide legending.) Use with any button.

K
Legend on insert only, button assembled. (For C, D, E and F button types.)

J
Legends on both button and insert, button assembled. Use with S & D button types.



Button



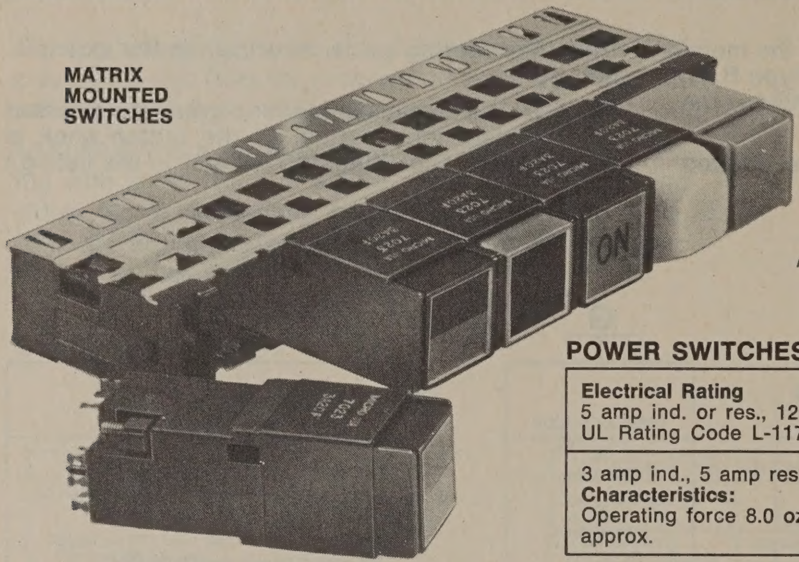
Button and
Metal Shell

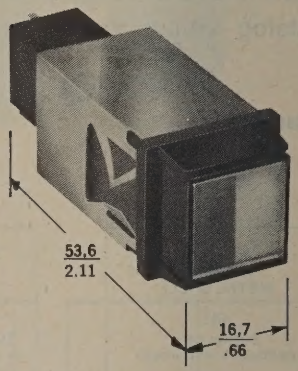
LAMP DATA

Listing Code	Industry Lamp No.	Design Volts					
			Socket Volts	6.3	6.0	5.5	5.0
4Z213	159	6.3	Amps	.15	.14	.135	.12
			MSCP	.34	.27	.24	.17
			Rated Life— Hours Avg.	9,000	16,500	28,000	28,000
4Z212	259	6.3	Socket Volts	6.3	6.0	5.5	5.0
			Amps	.25	.24	.225	.21
			MSCP	.65	.52	.39	.29
			Rated Life— Hours Avg.	9,000	16,000	44,500	50,000
4Z242	NONE	120	Amps— .025 Rated Life 5,000 Hrs.				

Listing Code	Industry Lamp No.	Design Volts					
			Socket Volts	14	12	11	10
4Z221	161	14	Amps	.19	.17	.16	.15
			MSCP	1.0	.60	.4	.3
			Rated Life— Hours Avg.	4,000	25,000	26,500	28,000
4Z231	656 or 152	28	Socket Volts	28	27	26	24
			Amps	.06	.057	.054	.05
			MSCP	.65	.52	.49	.39
			Rated Life— Hours Avg.	5,000	7,500	10,000	10,000
4Z222	557	14	Amps— .420 MSCP 2.5—Rated Life 500 Hrs.				

SERIES 3 LIGHTED PUSHBUTTON SWITCHES





POWER SWITCHES

Electrical Rating
5 amp ind. or res., 125 VAC
UL Rating Code L-117

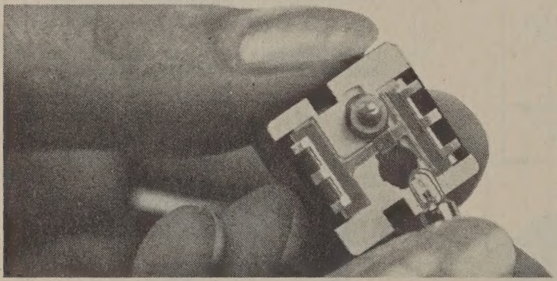
3 amp ind., 5 amp res., 28 VDC
Characteristics:
Operating force 8.0 oz. (2,22 N.) approx.

Series 3 has multiple options in the same size package. By standardizing on Series 3 as building blocks for your control panels, you can specify either matrix, individual, or strip mounting, momentary and two-level alternate-action, power or reed switches (with audible "click click" feedback), and matching lighted indicators.

Matrix mounted switches are provided with termination suitable for direct wiring, printed circuit board mounting or plug-in termination to customer pre-wired connector blocks. They can be replaced from the panel front by simply using a screw driver to disengage the switch mounting lugs from the mounting rails.

Individual mount switches have spring clips on two sides for front of panel snap-in mounting.

BUTTONS



Lamps and legends can be changed from the panel front. The button is removed by pulling it forward out of the switch housing. Lamps are retained in the button for ease of replacement.

Relegendable buttons have a transparent colorless insert which fits over a colored diffuser plate and snaps into the button's shell. Legending may be applied to the diffuser plate. The diffuser plate can be easily removed and replaced if a change of legend information is desired. To ensure proper orientation during assembly, the button is keyed to the switch housing. Lighted display is provided by one or two 5, 12, 14 or 28 volt T-1 lamps.

LEGENDING

MICRO SWITCH will furnish hot stamp legending in standard modified Gothic. Contact our local branch office for Series 3 legend order sheets that provide data on type size and possible number of characters per line.

INDICATORS

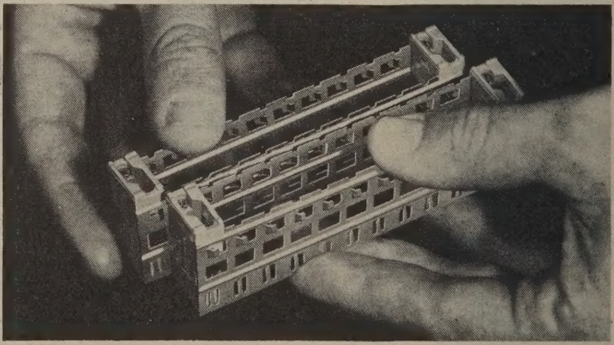
Lighted indicators are identical in size and appearance to the switches, but without provision for switching. See Catalog 200 for ordering.

MOUNTING

Mounting options for Series 3 switches and indicators are:

1. Individual mount units have integral clips on two sides of the housing for front of panel snap-in mounting. They can be mounted in separate cutouts or strip mounted in a single cutout.

2. Units that require Type 3M mounting hardware are mounted in a single cutout. Two or more rows can be attached together to form a matrix or a single row can be strip mounted.



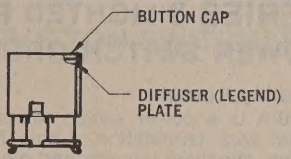
TERMINATION-SWITCHES AND INDICATORS

Direct wiring to switch, plug-in to connector blocks, or printed circuit board termination. Available on either switch or connector.

NOTE: Caution should be exercised when soldering to direct wire terminations to prevent overheating and flux contamination of the switch contacts.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm
0.00 — inches

SERIES 3 LIGHTED PUSHBUTTON SWITCHES BUTTON ORDERING GUIDES



THREE-PIECE RELEGENDABLE BUTTONS

(Cap, Diffuser/Legend Plate, and Lampholder), Flat Style Single-Section or Two Section Display

Note: If lamps are not desired, omit the Lamp Code number from the catalog listing.

3D11WW1L-1 is a relegendable flat button, has a single section display, black button shell, white display color, transparent colorless cap, legend, and one 5-volt lamp. For use with switches only.

Example:

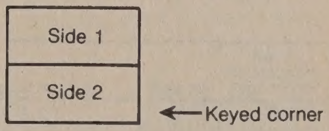
CONSTRUCTION	SHELL COLOR	DISPLAY COLOR*	CAP COLOR	LEGEND	LAMPS
3D1	1	WW	1	L	1
3D1 Single-section display 3D2 Two-section display	1 Black 2 Gray	W white R red G green B blue Y yellow D orange K black	1 transparent colorless 2 Transparent black, hidden color 3 Projected color, translucent white	Switch Buttons: L with legend N w/o legend Indicator Buttons:** M with legend P w/o legend	1 one 5 volt 2 two 5 volt 3 one 28 volt 4 two 28 volt 5 one 12 volt 6 two 12 volt 7 one 14 volt 8 two 14 volt (Omit character if no lamp desired.)

*For single-section buttons, enter a double letter at this position in the Catalog Listing. Example: Red — RR

**Note: Only "indicator style" buttons should be used in indicators, as indicated by the M or P Legend Code letters.

When ordering two-section buttons, add the letter for Side 1 first. Example: If you desire Side 1 to be Red and Side 2 Blue, enter RB.

View from top of two-section button



ONE-PIECE NON-RELEGENDABLE BUTTONS

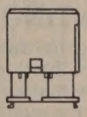
Flat Style or Truncated Style Single-Section Display

Note: If lamps are not desired, omit the lamp Code number from the catalog listing.

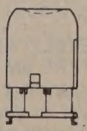
3D4RM2 is a non-relegendable truncated button, has single section display, red button color, legend, and two 5-volt lamps. For use with indicators only.

CONSTRUCTION	DISPLAY COLOR	LEGEND	LAMPS
3D4	R	M	2
3D3 Flat style, single-section 3D4 Truncated style, single-section	W white R red G green B blue Y yellow	Switch Buttons: L with legend N w/o legend Indicator Buttons:** M with legend P w/o legend	1 one 5 volt 2 two 5 volt 3 one 28 volt 4 two 28 volt 5 one 12 volt 6 two 12 volt 7 one 14 volt 8 two 14 volt (Omit character if no lamp desired.)

Flat Style



Truncated Style



All 3D4 type buttons will be engraved legending. Hidden color and hidden legending available on request. Contact your nearest MICRO SWITCH Branch Office.

** Note: Only "indicator style" buttons should be used in indicators as indicated by the M or P Legend Code.

SERIES 3 LIGHTED PUSHBUTTON SWITCHES
POWER SWITCH ORDERING GUIDE

Ordering Example
3A10-A is a power switch for matrix or strip mounting, has direct wire termination, 1-pole Form Z circuitry, momentary action, two lamp circuits, and black housing.

THRU-PLUNGER SWITCHES
Switches with Electrical Codes 16, 17, 66, and 67, have thru-plungers which attach to mechanical interlock devices to provide bailing and lockout functions.

Example: 3A 10 A

POWER SWITCH MOUNTING TYPE

3A
For matrix or strip mounting. Requires use of 3M type mounting hardware.

3G
For individual or strip mounting. No additional mounting hardware required.

ELECTRICAL CODE			DESCRIPTION			
Thru Plunger for Inter-lock‡	Direct Wire	P.C. Term.	Poles	Switch Circuitry	Action	Lamp Ckt(s)
16	10	70	1	Form Z	Mom	2
	11		1	Form X	Mom	2
	12		1	Form Y	Mom	2
17	13	71	1	Form Z	Mom	1
	14		1	Form X	Mom	1
	15		1	Form Y	Mom	1
66	20	72	2	Form Z	Mom	2
	21		2	Form X	Mom	2
	22		2	Form Y	Mom	2
	23		2	1 (Z), 1 (Y)	Mom	2
	24		2	1 (X), 1 (Z)	Mom	2
67	25	73	2	Form Z	Mom	1
	26		2	Form X	Mom	1
	27		2	Form Y	Mom	1
	28		2	1 (Z), 1 (Y)	Mom	1
	29		2	1 (X), 1 (Z)	Mom	1
	30	74	1	Form Z	Alt	2
	31		1	Form X	Alt	2
	32		1	Form Y	Alt	2
	33	75	1	Form Z	Alt	1
	34		1	Form X	Alt	1
	35		1	Form Y	Alt	1
	40	76	2	Form Z	Alt	2
	41		2	Form X	Alt	2
	42		2	Form Y	Alt	2
	43		2	1 (Z), 1 (Y)	Alt	2
	44		2	1 (X), 1 (Z)	Alt	2
	45	77	2	Form Z	Alt	1
	46		2	Form X	Alt	1
	47		2	Form Y	Alt	1
	48		2	1 (Z), 1 (Y)	Alt	1
	49		2	1 (X), 1 (Z)	Alt	1
	50		1	Form Z	Mom	None
	51		1	Form X	Mom	None
	52		1	Form Y	Mom	None
	53		2	Form Z	Mom	None
	54		2	Form X	Mom	None
	55		2	Form Y	Mom	None
	56		2	1 (Z), 1 (Y)	Mom	None
	57		2	1 (X), 1 (Z)	Mom	None
	58		1	Form Z	Alt	None
	59		1	Form X	Alt	None
	60		1	Form Y	Alt	None
	61		2	Form Z	Alt	None
	62		2	Form X	Alt	None
	63		2	Form Y	Alt	None
	64		2	1 (Z), 1 (Y)	Alt	None
	65		2	1 (X), 1 (Z)	Alt	None

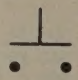
‡ Use 3A only

Color Code	DESCRIPTION	
	Housing (bezel*)	Barrier
A	Black	None
F	Black	Black

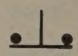
* Bezel provided with 3G and 3F only.

Circuitry:

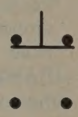
X=SPST—N.O. Double Make



Y=SPST—N.C. Double Break



Z=SPDT— Double-make Double-Break Break-before-Make



ADD—1 to listing if connector block is required (3A modules only).

(Connector blocks have direct wire terminations only.)

Reed switch units are also available. See Catalog 200.

MOUNTING HARDWARE

Mounting hardware for 3A units is provided by a box girder structure. Interlocking tabs enable them to be assembled into a multi-row matrix. To specify the row length in the catalog listing, add the number of switches and/or indicators, then convert the total to the proper suffix number, i.e. "09" for a 5-unit row. proper suffix number, i.e. "09" for a 5-unit row.

Each 3M Type listing consists of two mounting bars and two mounting blocks in packet form.

COMPLETELY ASSEMBLED STRIPS OR MATRICES USING TYPE 3M MOUNTING HARDWARE

MICRO SWITCH will provide completely assembled strips or matrices at an additional charge per station of first level devices (switches) with no set-up charge. Contact your MICRO SWITCH Branch Office for pricing of assembled strips or matrices.

Example: 3M1 — 09

MOUNTING HARDWARE BASE LISTING

3M1 Standard Type for use with connector blocks for plug-in wiring

3M2 Narrow width type, allows direct wiring

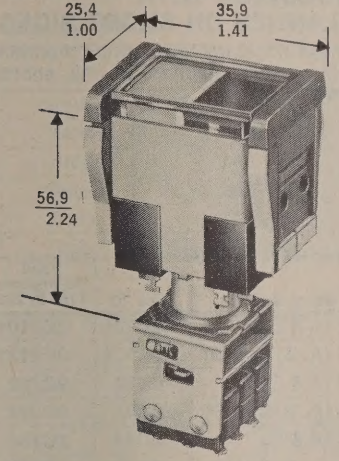
ROW LENGTH

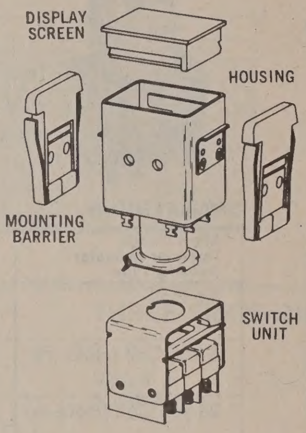
01	1-Unit	17	9-Unit
02	1½-Unit	18	9½-Unit
03	2-Unit	19	10-Unit
04	2½-Unit	20	10½-Unit
05	3-Unit	21	11-Unit
06	3½-Unit	22	11½-Unit
07	4-Unit	23	12-Unit
08	4½-Unit	24	12½-Unit
09	5-Unit	25	13-Unit
10	5½-Unit	26	13½-Unit
11	6-Unit	27	14-Unit
12	6½-Unit	28	14½-Unit
13	7-Unit	29	15-Unit
14	7½-Unit	30	15½-Unit
15	8-Unit	31	16-Unit
16	8½-Unit		

SERIES 2 RECTANGULAR DISPLAY MODULAR LIGHTED PUSHBUTTON SWITCHES BARRIER MOUNT MODULES

Operator-Indicator Housing Modules

SHORT BARRIER MOUNT





Catalog Listings

Short Barrier Operator-Indicator Housing Type	No. of Sockets	Type 2C	Hand Relampable Type 2F200
No Coil	2 (A & C)	2C1†	2C201†
	4 (A, B, C, & D)	2C3†	2C203†
6 vdc Hold-in Coil	2 (A & C)	2C13	2C213
	4 (A, B, C, & D)	2C15	2C215
28 vdc Hold-in Coil	2 (A & C)	2C25	2C225
	4 (A, B, C, & D)	2C27	2C227
48 vdc Hold-in Coil	2 (A & C)	2C37	2C237
	4 (A, B, C, & D)	2C39	2C239

INDICATOR HOUSING MODULES

Indicators match their respective operator-indicator counterparts in panel appearance, but have no provision for attaching switch units. They utilize the same barriers for panel mounting.

MOUNTING BARRIERS

Molded color barriers are available in two panel thickness ranges (.19″ panels require the .06″ to .19″ type). For strip-mounted units, specify one more barrier than the number of units in the group.

HOLD-IN COIL ELECTRICAL DATA

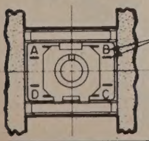
(also available in Flange mount)

Hold-in coil equipped operator-indicator housings enable electromagnetic maintained and released contact. When energized, the coil holds the device in the operated condition, after the screen has been manually depressed.

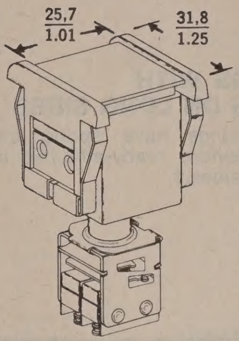
Approximate coil power ratings are 1.3 watts, 6 vdc coil and 1.7 watts, 28 or 48 vdc coil.

ELECTRICAL BAIL

The circuit at right shows a means of operating any number of hold-in coil units, one-by-one, in situations that require only one switch to be operated at a time. A cancel switch can be installed at either or both points "A" and "B" to perform clearing of all switches.



LAMP TERMINAL DESIGNATION, 2 TERMINALS FOR EACH LAMP, PLATED FOR SOLDERING



LONG BARRIER MOUNT

These housings are assembled to panels with mounting barriers attached to the longer sides.*

Catalog Listings

Long Barrier Operator-Indicator Housing Type	No. of Sockets	Type 2C	Hand Relampable Type 2C200
No Coil	2 (A & C)	2C7†	2C207†
	4 (A, B, C, & D)	2C9†	2C209†
6 vdc Hold-in Coil	2 (A & C)	2C19	2C219
	4 (A, B, C, & D)	2C21	2C221
28 vdc Hold-in Coil	2 (A & C)	2C31	2C231
	4 (A, B, C, & D)	2C33	2C233
48 vdc Hold-in Coil	2 (A & C)	2C43	2C243
	4 (A, B, C, & D)	2C45	2C245

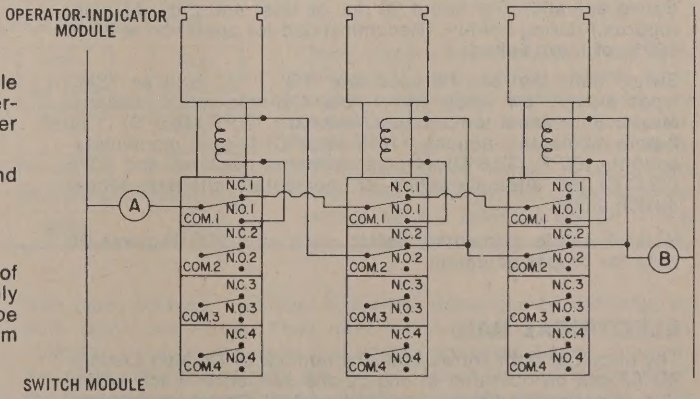
See Catalog 200 for additional information and listings.

Catalog Listings

Barrier Mount Indicator Housing Type	No. of Sockets	Type 2F	Hand Relampable Type 2F200
Long	2 (A & C)	2F7	2F207
	4 (A, B, C, & D)	2F9	2F209
Short	2 (A & C)	2F1	2F201
	4 (A, B, C, & D)	2F3	2F203

Catalog Listings

Mounting Barriers	For Panel Thickness	Gray	Black	White	Red
Attach to Long Sides	.06″ to .19″	2B2	2B4	2B14	2B15
	.19″ to .31″	2B6	2B8	2B16	2B17
Attach to Short Sides	.06″ to .19″	2B1	2B3	2B10	2B11
	.19″ to .31″	2B5	2B7	2B12	2B13



DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

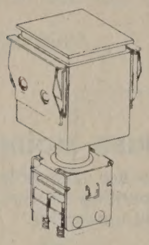
Key: 0,0 — mm / 0.00 — inches

* Switch modules shown on page 16.
† UL Component Recognized.

MICRO SWITCH A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

SERIES 2 FLANGE MOUNT MODULES

Operator-Indicator Housing Modules



HOUSINGS WITH FLANGES ON LONG SIDES

These housings have spring clip mounting devices ready-attached on the longer sides.‡

Catalog Listings

Long Flange Operator-Indicator Housing Type	No. of Sockets	Type 2C	Hand Relampable Type 2C200
No Coil	2 (A & C)	2C4†	2C204†
	4 (A, B, C, & D)	2C6†	2C206†
6 vdc Coil (Hold-in)	2 (A & C)	2C16	2C216
	4 (A, B, C, & D)	2C18	2C218
28 vdc Coil (Hold-in)	2 (A & C)	2C28	2C228
	4 (A, B, C, & D)	2C30	2C230
48 vdc Coil (Hold-in)	2 (A & C)	2C40	2C240
	4 (A, B, C, & D)	2C42	2C242
28 vdc Coil* (Pull-in)	4 (A, B, C, & D)	2C68	2C268

* Also available with flanges on all four sides — 2C77 (Type 2C) and 2C277 (Type 2C200)

INDICATOR HOUSINGS

Catalog Listings

Flange Mount Indicator Housing Type	No. of Sockets	Type 2F	Hand Relampable Type 2F200
Long Flange	2 (A & C)	2F4	2F204
	4 (A, B, C, & D)	2F6	2F206
Short Flange	2 (A & C)	2F10	2F210
	4 (A, B, C, & D)	2F12	2F212

PULL-IN COIL ELECTRICAL DATA

(available in Flange mount only)

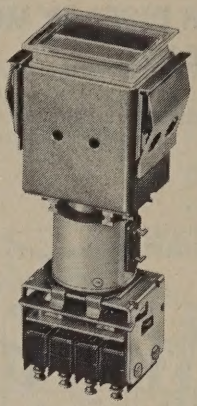
Pull-in coil equipped operator-indicators enable electromagnetic actuated, maintained and released contacts. Energizing the coil pulls in the operating plunger, causing circuit transfer in the switching unit. A 28 vdc, 2.2 amps. (approx.) is required during actuation (for about 20 ms. or less) and only .11 amp. (approx.) during hold-in. (Recommended for operation at 85 to 100% of rated voltage.)

Switch units that can be used are "TB", "PL" and all "SM" types except low force and 4-pole alternate-action designs. Maximum ambient temperature limits are 120°F (48.9°C) (1 or 2 pole momentary-action), 110°F (48.9°C) (3-pole momentary-action), 100°F (37.8°C) (4-pole momentary-action) and 90°F (32.2°C) (all alternate-action or momentary/alternate-action) switch units.

Note: A 4-pole momentary switch such as a 2D9 requires 28 volts for proper actuation.

ELECTRICAL BAIL

The circuit at right shows how any number of Catalog Listings 2D162 can be operated in one-by-one sequence. Each actuation releases previously actuated switch. Power is required only during the reset pulse. (Reset can also be accomplished by depressing previously actuated screen.)



HOUSINGS WITH FLANGES ON SHORT SIDES

These housings have spring mounting clips ready-attached to the shorter sides.‡

Catalog Listings

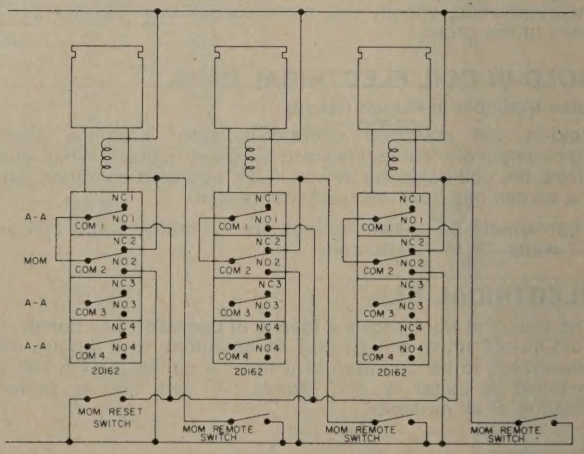
Short Flange Operator-Indicator Housing Type	No. of Sockets	Type 2C	Hand Relampable Type 2C200
No Coil	2 (A & C)	2C10†	2C210†
	4 (A, B, C, & D)	2C12†	2C212†
6 vdc Coil (Hold-in)	2 (A & C)	2C22	2C222
	4 (A, B, C, & D)	2C24	2C224
28 vdc Coil (Hold-in)	2 (A & C)	2C34	2C234
	4 (A, B, C, & D)	2C36	2C236
48 vdc Coil (Hold-in)	2 (A & C)	2C46	2C246
	4 (A, B, C, & D)	2C48	2C248

SPACING BARRIERS

Spacing barriers, not necessary for mounting, can be used to color code groupings and prevent accidental actuation of two screens with one push.

Catalog Listings

Spacing Barriers	Gray	Black	White	Red
For Long Flange Housing	2B9	2B18	2B19	
For Short Flange Housing	2B23	2B24	2B25	2B26



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‡ Switch modules shown on page 16.
† UL component recognized.

SERIES 2 DISPLAY SCREENS

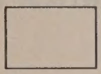
ONE-PIECE DISPLAY SCREENS

One-piece single-section display screens are available in two styles — standard (translucent) and truncated pyramid (translucent or transparent).

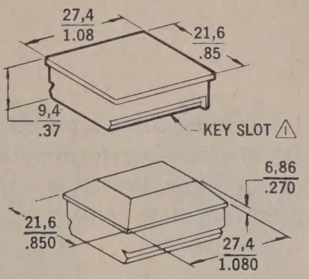
Catalog Listings

Color	Standard	Truncated Pyramid†	
		Transparent	Translucent
Red	2A1	2A97	2A92
Yellow	2A2	2A98	2A93
Green	2A3	2A99	2A94
Blue	2A4	2A100	2A95
White	2A5	2A96*	2A91
Amber	Not Available	2A113	2A112

* Colorless transparent
† May not be stock items.



Single Section

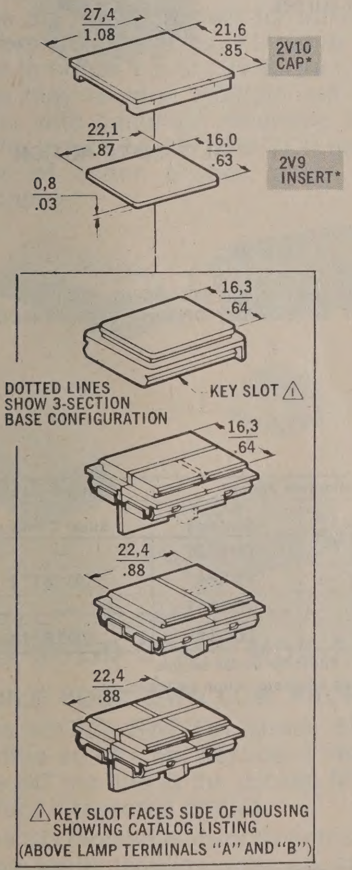

27,4
1.08
21,6
.85
9,4
.37
KEY SLOT ⚠
6,86
.270
21,6
.850
27,4
1.080

KEY SLOT FACES SIDE OF HOUSING SHOWING CATALOG LISTING (ABOVE LAMP TERMINALS "A" AND "B")

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

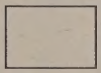
Key: 0,0 — mm / 0.00 — inches

THREE-PIECE DISPLAY SCREENS


27,4
1.08
21,6
.85
2V10
CAP*
22,1
.87
16,0
.63
2V9
INSERT*
0,8
.03
16,3
.64
DOTTED LINES
SHOW 3-SECTION
BASE CONFIGURATION
KEY SLOT ⚠
16,3
.64
22,4
.88
22,4
.88
⚠ KEY SLOT FACES SIDE OF HOUSING
SHOWING CATALOG LISTING
(ABOVE LAMP TERMINALS "A" AND "B")

* Order for replacement only.

Single Section

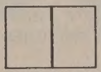


These screens have transparent colored or colorless caps, transparent colorless legend inserts and translucent colored bases.

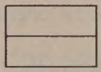
Catalog Listings

Color	Colored Caps	Colorless Caps
Red	2A66	2A81
Yellow	2A67	2A82
Green	2A68	2A85
Blue	2A69	2A86
White	—	2A70
Amber	—	2A114

Two Section



LATERAL SPLIT



LONGITUDINAL SPLIT

Silicone rubber light baffles prevent spillage from one section to another. Bases are translucent colored with transparent colorless caps and inserts.

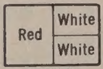
Catalog Listings

Colors	Lateral Split	Longitudinal Split
Yellow-Yellow	2A44	2A59
Green-Blue	2A45	2A60
Green-White	2A46	2A61
Green-Green	2A47	2A62
Blue-White	2A48	2A63
Blue-Blue	2A49	2A64
White-White	2A50	2A65

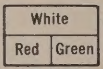
Catalog Listings

Colors	Lateral Split	Longitudinal Split
Red-Red	2A36	2A51
Red-Yellow	2A37	2A52
Red-Green	2A38	2A53
Red Blue	2A39	2A54
Red-White	2A40	2A55
Yellow-Green	2A41	2A56
Yellow-Blue	2A42	2A57
Yellow-White	2A43	2A58

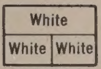
THREE AND FOUR SECTION


Red
White
White

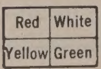
2A218


White
Red
Green

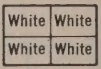
2A170


White
White
White

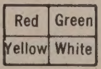
2A171


Red
White
Yellow
Green

2A172


White
White
White
White

2A173


Red
Green
Yellow
White

2A174

These screens are available in any combination of red, yellow, green, blue, amber and white. Half-segments are illuminated by two lamps and quarter-segments by one lamp each. Items shown are stock items. If you desire other color arrangements, contact your nearest MICRO SWITCH Branch Office.

SCREENS WITH COLORED RIM CAPS

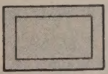


FIG. 1

FIG. 2

Catalog Listings

Color of Rim Cap		
Red	Green	Blue
2A106	2A108	2A107

With these screens, a change in control status can be indicated by both color and shape. They have colored transparent rim caps, colorless transparent inserts and white translucent bases. Filters of the same color as the caps are put on two of the four lamps. When the filtered lamps are lighted, a solid color appears (Fig. 1), while the unfiltered lamps, when lighted, result in a white display with a colored frame (Fig. 2).

Since the insert is exposed, legending should be done on the base or reverse side of the insert.

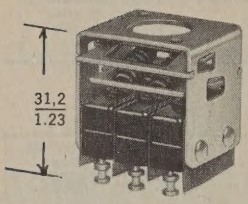
MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

SERIES 2 SWITCH MODULES

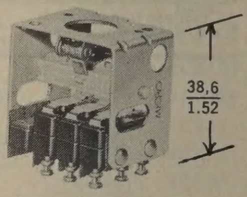
Interchangeable type 2D switch modules attach to spring clips on the bottom of operator-indicator housings. Dependable performance at power or low energy loads is assured by MICRO SWITCH time-proven snap-action basic switches. Options include momentary action (push-on release-off), alternate-action (push-on push-off); 1, 2, or 4-pole double-throw and twin-break circuitry; and solder, screw or quick-connect terminals.

"SM" SUBMINIATURE (MULTI-SPDT) SWITCH MODULES



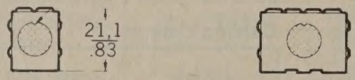
MOMENTARY ACTION

"SM" switch modules are available with momentary-action in a choice of two styles, one having a pronounced touch-feedback, while the other has a low force for rapid operation; alternate-action; and a combination momentary/alternate-action. Extra length turret type terminals are solder plated.



ALTERNATE ACTION

KEYING TAB FOR ORIENTATION OF SWITCH UNITS WITH OPERATOR-INDICATOR UNITS



NOTE — 'T2' TERMINALS ARE PLATED FOR SOLDERING
— SWITCHES DO NOT NECESSARILY OPERATE SIMULTANEOUSLY

Catalog Listings

No. of SPDT Circuits	Momentary-Action			
	Touch-Feedback Type		Low Force Type	
	Gold Contacts	Silver Contacts	Gold Contacts	Silver Contacts
1	2D113†	2D100†	2D320	—
2	2D1†	2D2†	2D140†	2D139†
3	2D4†	2D5†	—	—
4	2D8†	2D9†	2D152†	2D151†

Catalog Listings

No. of SPDT Circuits	Alternate Action		Mom./Alt.-Action
	Gold Contacts	Silver Contacts	Silver Contacts
1	2D174	2D118†	—
2	2D25†	2D26†	2D161*†
3	2D28†	2D101†	—
4	2D32†	2D33†	2D162‡†

* Has one momentary and one alternate-action switch.
‡ Has one momentary and three alternate-action switches.
† UL Component Recognized.

ELECTRICAL RATING

Silver Contacts	Gold Contacts
30 VDC-5 amps res. sea level or 50,000 ft., 3 amps ind. sea level, 2.5 amps ind., 50,000 ft., max. inrush, 24 amps.	30 VDC-0.5 amp ind., 1 amp res. sea level and 50,000 ft., 2 amps max. inrush.
UL and CSA rating for basic switch: 125 or 250 VAC—5 amps UL Code L-4	UL and CSA rating for basic switch: 125 VAC—1 amp UL Code L-22

Other switch modules using V3, Z, A, DT, TB, MT, and HS basic switches are available for various circuitry and electrical ratings. See Catalog 200.

SN SOLID STATE PUSHBUTTON SWITCHES

SWITCHING CONCEPT

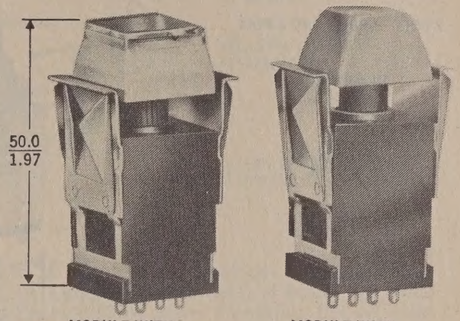
The Hall effect solid state concept is one of the most reliable switching elements ever designed. An integrated circuit, actuated by magnets, produces an analog control voltage. This voltage is converted into a digital output with a trigger circuit. Two isolated outputs are available from each switch module which may be used individually or wired in parallel. Level and pulsed outputs are available.

The 11SN Series switches are made for direct panel mounting with snap-in hardware and the 101SN Series, 201SN Series and 301SN Series mount direct to printed circuit boards without additional mounting or support hardware. Lighted modules are available in both the 11SN Series and the 201SN Series.

SN BUTTONS

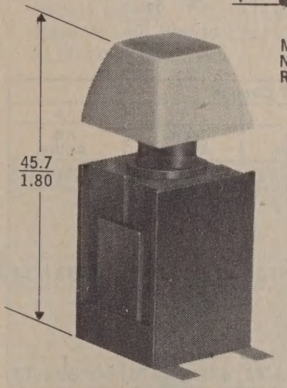
The SN Series is ideal for building custom arrays. There are thousands of legends tooled and we have the in-house capability to tool any special legend you may require. Multiple-unit buttons and space bars with complete mounting hardware are available. In fact, MICRO SWITCH has the largest selection of button shapes, sizes, and colors in the industry.

11SN PANEL MOUNTED MODULES

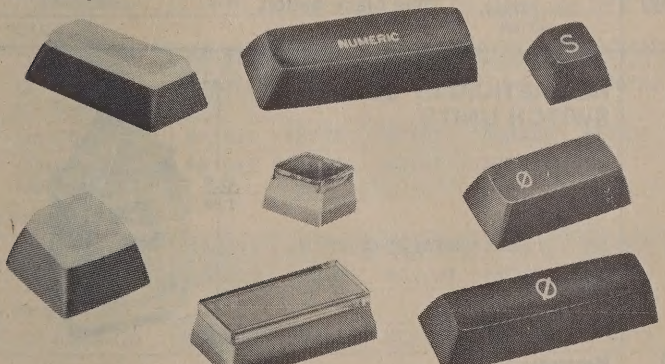


MODULE WITH NON-LIGHTED RELEGENDABLE BUTTON

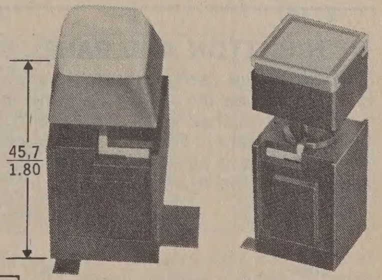
MODULE WITH NON-LIGHTED TRUNCATED BUTTON



101SN MODULES non-lighted and 301SN TWO-LEVEL MODULES


NUMERIC
S
0
0

201SN LIGHTED MODULES



MODULE WITH TRUNCATED LIGHTED BUTTON

MODULE WITH RELEGENDABLE LIGHTED BUTTON

Additional information for SN and SD is included in Catalog 200.

SD SOLID STATE MODULES

BUILD YOUR OWN LOW PROFILE KEYBOARD

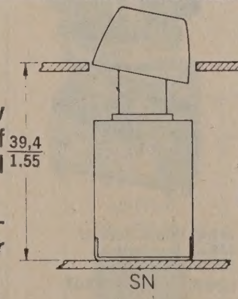
The MICRO SWITCH Series SD module is a low profile solid state keyboard module. The heart of the SD module is the proven MICRO SWITCH Hall Effect integrated circuit.

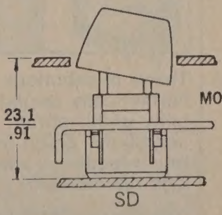
The SD module is directly compatible with all common logic families with no special buffering or electronic circuitry needed.

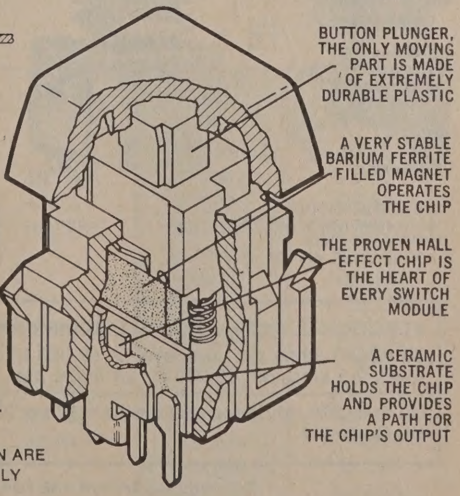
Buttons are available in a wide variety of sizes, shapes, and colors.

SD modules are available with:

- Level or pulsed outputs
- Sourcing or sinking outputs
- Momentary or alternate action
- Scanning interface
- LED Lighting
- Stepped or sloped buttons






BUTTON PLUNGER, THE ONLY MOVING PART IS MADE OF EXTREMELY DURABLE PLASTIC
A VERY STABLE BARIUM FERRITE FILLED MAGNET OPERATES THE CHIP
THE PROVEN HALL EFFECT CHIP IS THE HEART OF EVERY SWITCH MODULE
A CERAMIC SUBSTRATE HOLDS THE CHIP AND PROVIDES A PATH FOR THE CHIP'S OUTPUT

MODERN LOW-PROFILE DESIGN.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

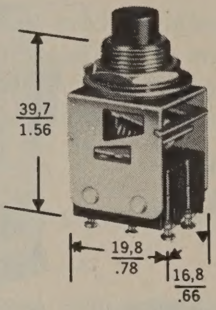
PB PUSHBUTTON SWITCHES

TOUCH-FEEDBACK TYPE

2-POLE, 3-POLE, AND 4-POLE

MOMENTARY-ACTION

ALTERNATE-ACTION



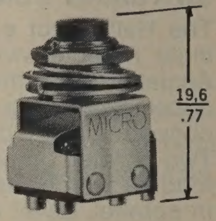
Catalog Listings

Button Color	No. of SPDT Circuits				
	2	2	3	4	4
	Mom. Action	Alt. Action	Mom. Action	Mom. Action	Alt. Action
Black	2PB11-T2	82PB19-T2	3PB11-T2	4PB11-T2	84PB19-T2
	2PB732-T2 (M8805/ 23-001)	—	—	4PB714-T2 (M8805/ 23-003)	—
Red	2PB12-T2	82PB21-T2	3PB12-T2	4PB12-T2	84PB21-T2
	2PB717-T2 (M8805/ 23-002)	—	—	4PB717-T2 (M8805/ 23-004)	—
Green	2PB273-T2	82PB22-T2	3PB273-T2	4PB273-T2	84PB22-T2

SHORT TRAVEL SWITCH

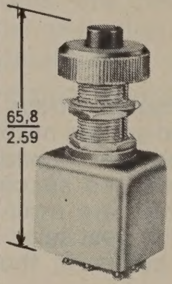
2-POLE AND 3-POLE

MOMENTARY-ACTION



Catalog Listings

Button Color	No. of SPDT Circuits	
	2	3
Black	2PB7	3PB7
Red	2PB8	3PB8



MOMENTARY-ACTION

SEALED AT BUSHING, BUTTON, PANEL AND SWITCH UNITS

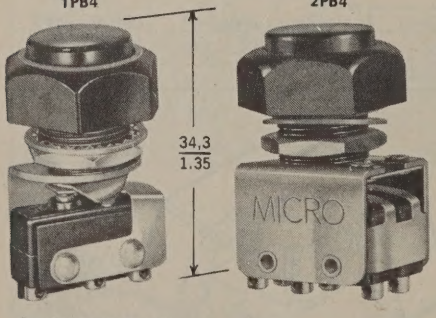
Catalog Listing **2PB901-T2** meets the submergence requirements of MIL-STD-108D (up to 10 p.s.i. water pressure for one hour). It is sealed facenut-to-panel, button-to-facenut, and bushing-to-facenut (prevents entry of water from back of panel, up and over bushing wall). The two SPDT switch units are potted in a corrosion-resistant metal enclosure.

The knurled facenut is chrome finished to provide an attractive panel appearance with the black button.

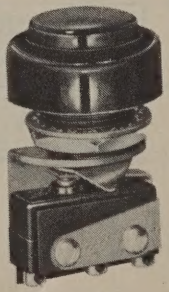
WITH BUTTON AND PANEL SEALS

This two-piece design assembly enables the pushbutton to be separated from the switch unit and mounted in the panel. The switch unit is then easily wired and snapped into place from behind the panel. There is an elastomer seal bonded between the plunger and button collar and an "O" ring seals the button assembly to the panel front.

1PB4 2PB4



MOMENTARY-ACTION
BOTH HAVE BLACK BUTTONS
OPERATING FORCE
1,36 Kg/3 LBS. APPROX.



1PB42 (Black Button)
1PB43 (Red Button)
OPERATING FORCE
1,36 Kg/3 LBS. APPROX.

ELECTRICAL RATING FOR ALL SERIES PB EXCEPT 700PB
30 VDC-5 amps res. sea level or 50,000 ft., 3 amps ind. sea level, 2.5 amp ind. 50,000 ft., 24 amps max. inrush.

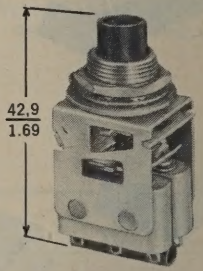
UL and CSA rating for basic switch: 125 or 250 VAC—5 amps
UL Code L-4

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

HERMETICALLY SEALED SWITCH UNITS

2-POLE MOMENTARY-ACTION



Hermetic Seal

Sealing consists of metal-to-metal fusion around the cover, actuator, base and mounting holes of each switching unit. The terminals are joined to the housing by glass-to-metal seals. The vapor-proof container permits use in damp locations without danger of condensation on the contacts, as well as providing protection from external contaminants. All external parts are corrosion resistant and meet MIL-S-6743 specifications. This design also meets explosion-proof requirements of MIL-E-5272.

Electrical Rating: 3 amps, ind., 5 amps res., 28 VDC and 115 VAC 400 cps.

Catalog Listings

Button Color	No. of SPDT Circuits		
	2	3	4
Black	702PB1	703PB1	704PB1
Red	702PB2	703PB2	—
Green	702PB3	703PB3	—

These pushbuttons are equipped with MICRO SWITCH "HM" hermetically sealed switch units which provide electrical stability under abrupt changes in atmosphere and environmental conditions. Good feel of the switching action is provided by a touch-feedback which is transmitted through the button when it is operated.

See Catalog 200 for additional information and listings.

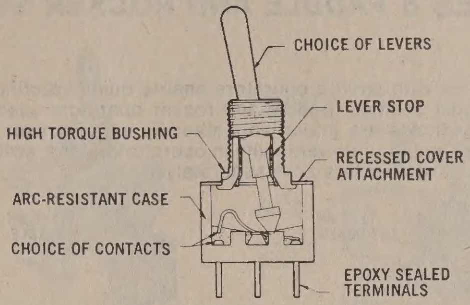
SERIES 8 MINIATURE MANUAL SWITCHES

The MICRO SWITCH Series 8 line of miniature manual switches is ideally suited for commercial applications which have limited space requirements and demand high quality and performance standards.

All switches have silver contacts and solder terminals unless otherwise noted. Many additional circuitry combinations, actuators, terminals variations and contact materials are available. See Catalog 200.

Complete dimension drawings and specifications are shown in Catalog 200.

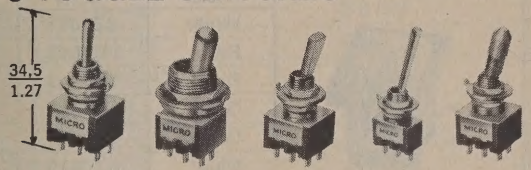
QUALITY CONSTRUCTION



Electrical Data

Fine Silver Contacts: 6 amps, res.; 2 amps, ind., 125 VAC (60Hz) and 28 VDC. UL Listed (most models): 6 amps, 125 VAC. Gold/Nickel Plated Brass or Fine Silver Contacts: 0.5 VA max. at 20 volts max.

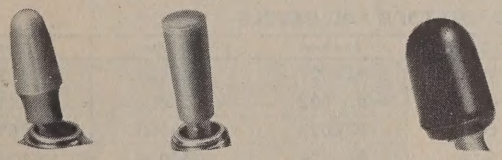
SERIES 8 TOGGLE SWITCHES



Order Guide

Circuitry Description	Small Lever	Large Lever	Flatted Lever	Long Lever	Lever Lock
1 POLE					
On-None-On	8A1011	8B1011	8C1011	8D1011	8E1011
On-None-On PC Terminal	8A1012A	—	8C1012A	—	8E1012A
On-Off-On	8A1021	8B1021	8C1021	8D1021	8E1021
(On)-None-(On) Momentary	8A1041	8B1041	8C1041	8D1041	—
2 POLE					
On-None-On	8A2011	8B2011	8C2011	8D2011	8E2011
On-Off-On	8A2021	8B2021	8C2021	8D2021	8E2021
4 POLE					
On-None-On	8A4011	8B4011	8C4011	8D4011	8E4011

COLORED LEVER SLEEVES



For 8A

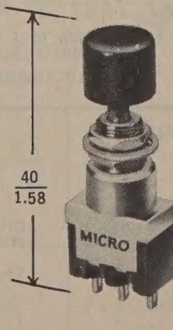
For 8B

Round Tip	Cone Tip	Color	Round Tip
8Z0111	8Z0151	White	8Z0131
8Z0112	8Z0152	Red	8Z0132
8Z0113	8Z0153	Black	8Z0133
8Z0114	8Z0154	Gray	8Z0134
8Z0115	8Z0155	Green	8Z0135
8Z0116	8Z0156	Blue	8Z0136
8Z0117	8Z0157	Amber	8Z0137
8Z0118	8Z0158	Yellow	8Z0138

NOTE: Grayed in listings are nomally stock items. Other listings are available but may have low volume charges in small quantities.

SERIES 8 PUSHBUTTON SWITCHES

Type 8N switches meet requirements for a miniaturized ¼″ diameter bushing mounted pushbutton. Concave surface buttons are available in two sizes and eight colors. Buttons are ordered separately.



8N Order Guide

Circuitry Description	1 Pole	2 Pole	3 Pole	4 Pole
Alternate-Action	8N1011	8N2011	8N3011	8N4011
Momentary-Action	8N1021	8N2021	8N3021	8N4021

Buttons

	Dimensions	Catalog Listing	Color
LARGE BUTTON	.59″ DIA. BY .39″ HEIGHT	8Z0061	WHITE
		8Z0062	RED
		8Z0063	BLACK
		8Z0064	GRAY
		8Z0065	GREEN
		8Z0066	BLUE
		8Z0067	AMBER
		8Z0068	YELLOW
SMALL BUTTON	.39″ DIA. BY .30″ HEIGHT	8Z0081	WHITE
		8Z0082	RED
		8Z0083	BLACK
		8Z0084	GRAY
		8Z0085	GREEN
		8Z0086	BLUE
		8Z0087	AMBER
		8Z0088	YELLOW

MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

SERIES 8 PADDLE AND ROCKER SWITCHES

8H TYPE

8H switches with paddle operators enable quick identification of the toggle position. Paddle and rocker operators used with type 8H switches are interchangeable. To simplify user parts inventories and provide versatility in operator options, switches, paddle, and rockers are sold separately.

TYPE 8H
ROCKER

TYPE 8H
PADDLE

8H ORDER GUIDE

Circuitry Description	1 Pole	2 Pole
On-None-On	8H1011	8H2021
(On)-None-(On)	8H1041	8H2041
On-None-(On)	8H1061	8H2061

(On) Momentary

BEZEL ACCESSORY

An optional colored bezel accessory is available for use with individual mount units (see photo) to enhance panel appearance and identify control functions. The bezel is assembled by snapping it into the flanges on two sides of the switch. They can be removed and replaced if color changes are necessary.

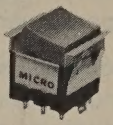
8H OPERATORS AND BEZELS

Color	Rocker	Paddle	Bezel
White	8Z0021	8Z0001	8Z0191
Red	8Z0022	8Z0002	8Z0192
Black	8Z0023	8Z0003	8Z0193
Gray	8Z0024	8Z0004	8Z0194
Green	8Z0025	8Z0005	8Z0195
Blue	8Z0026	8Z0006	8Z0196
Amber	8Z0027	8Z0007	8Z0197
Yellow	8Z0028	8Z0008	8Z0198

8K TYPE

8K switches feature one-lamp illumination and relamping from the front of panel. Type 8K lighted switches are used with rocker operators only. Lamps are not furnished with 8K switches. Order below.

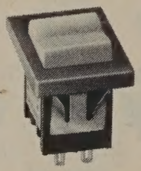
TYPE 8K
ROCKER
(Lighted)



8K ORDER GUIDE

Circuitry Description	Only 2 Pole
On-None-On	8K2011
On-None-(On)	8K2061

See Catalog 200 for additional variations.



8K ROCKERS AND BEZELS

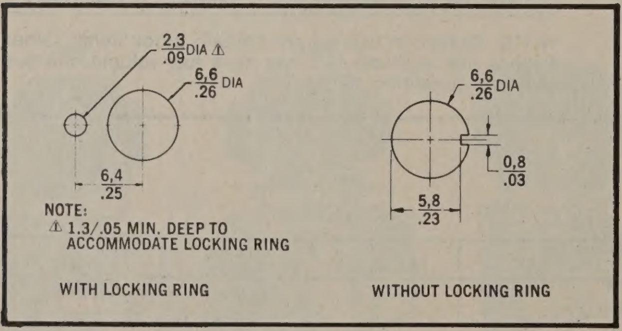
Color	Rocker	Bezel
White	8Z0041	8Z0211
Red	8Z0042	8Z0212
Black	8Z0043	8Z0213
Gray	—	8Z0214
Green	8Z0045	8Z0215
Blue	8Z0046	8Z0216
Amber	8Z0047	8Z0217
Yellow	8Z0048	8Z0218

8K LAMPS

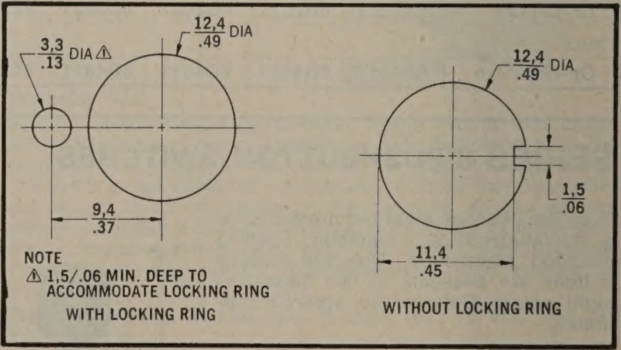
Catalog Listing	Rated Voltage	Nominal Current (Amps)
8Z0101	6.3	.20
8Z0102	14.0	.08
8Z0103	28.0	.04

PANEL CUTOUT

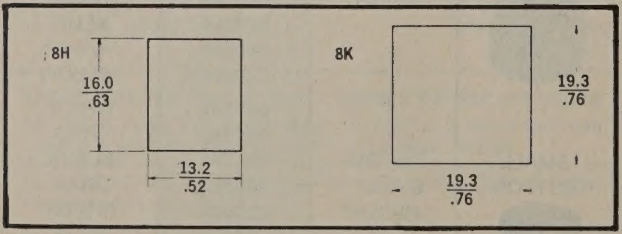
Types 8A, 8C, 8D, 8N:


2,3 / .09 DIA ⚠
6,6 / .26 DIA
6,4 / .25
NOTE:
⚠ 1.3/.05 MIN. DEEP TO ACCOMMODATE LOCKING RING
WITH LOCKING RING
6,6 / .26 DIA
0,8 / .03
5,8 / .23
WITHOUT LOCKING RING

Type 8B:


12,4 / .49 DIA
3,3 / .13 DIA ⚠
9,4 / .37
NOTE
⚠ 1,5/.06 MIN. DEEP TO ACCOMMODATE LOCKING RING
WITH LOCKING RING
12,4 / .49 DIA
1,5 / .06
11,4 / .45
WITHOUT LOCKING RING

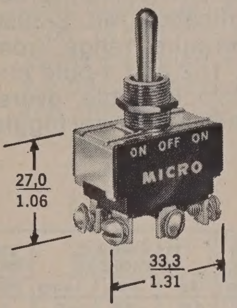
Types 8H and 8K:

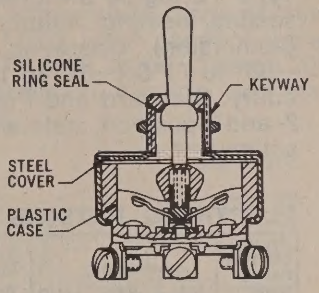

8H
16.0 / .63
13.2 / .52
8K
19.3 / .76
19.3 / .76

DIMENSIONS SHOWN ARE
FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches

11TS AND 12TS TOGGLE SWITCHES

Series 11TS and 12TS toggle switches are ruggedly constructed for contact protection from dust and moisture. Available with either solder, screw or .250″ width quick connect terminals, this series offers a choice of single-pole, double-throw or double-pole double-throw circuitries. The series is UL and CSA listed.





DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

2-POSITION

Circuitry	Circuit(s) Made With Toggle At:		Electrical Rating and UL Code	Catalog Listing		Quick Connect Terminals
	Keyway Position	Opposite Keyway		Screw Terminals	Solder Terminals	
ONE POLE	OFF	2-3 ON	L-80, 15 amps	11TS15-2	11TS115-2	11TS95-2
	2-1 ON	2-3 ON	L-80, 15 amps	11TS15-3	11TS115-3	11TS95-3
	2-1 ON*	OFF	L-31, 10 amps	11TS15-6	11TS115-6	11TS95-6
	2-1 ON*	2-3 ON	L-31, 10 amps	11TS15-8	11TS115-8	11TS95-8
TWO POLE	OFF	2-3 & 5-6 ON	L-80, 15 amps	12TS15-2	12TS115-2	12TS95-2
	2-1 & 5-4 ON	2-3 & 5-6 ON	L-80, 15 amps	12TS15-3	12TS115-3	12TS95-3
	2-1 & 5-4 ON*	OFF	L-37, 15 amps	12TS15-6	—	12TS95-6
	2-1 & 5-4 ON*	2-3 & 5-6 ON	L-37, 15 amps	12TS15-8	12TS115-8	—

3-POSITION

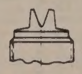
Circuitry	Circuit(s) Made With Toggle At:			Electrical Rating and UL Code	Catalog Listing		Quick Connect Terminals
	Keyway Position	Center Position	Opposite Keyway		Screw Terminals	Solder Terminals	
ONE POLE	2-1 ON	OFF	2-3 ON	L-80, 15 amps	11TS15-1	11TS115-1	11TS95-1
	2-1 ON*	OFF	2-3 ON	L-31, 10 amps	11TS15-5	—	11TS95-5
	2-1 ON*	OFF	2-3 ON*	L-31, 10 amps	11TS15-7	11TS115-7	11TS95-7
TWO POLE	2-1 & 5-4 ON	OFF	2-3 & 5-6 ON	L-80, 15 amps	12TS15-1	12TS115-1	12TS95-1
	2-1 & 5-4 ON*	OFF	2-3 & 5-6 ON	L-37, 15 amps	12TS15-5	12TS115-5	—
	2-1 & 5-4 ON*	OFF	2-3 & 5-6 ON*	L-37, 15 amps	12TS15-7	12TS115-7	12TS95-7
	2-1 & 5-4 ON	2-1 & 5-6 ON	2-3 & 5-6 ON	L-80, 15 amps	—	12TS115-10†	12TS95-10†

* Marked toggle positions are momentary. All other positions are maintained.
† Circuitry diagrams are shown under Series TP.

LOCKING CONFIGURATIONS FOR TL, 13AT AND 23AT SERIES ONLY

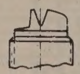
When ordering pull-to-unlock toggle listings, add the suffix letter shown in this chart to the standard toggle listing and the MS-number. For example, to order a 1TL1-1 pull-to-unlock toggle switch with the lever locked in the center position, add the letter "E"; i.e., 1TL1-1E, MS-24658-21E.

"A"



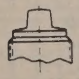
LOCKED IN THREE POSITIONS

"B"



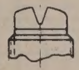
LOCKED IN CENTER AND EXTREME POSITION (KEYWAY SIDE)

"D"



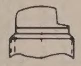
LOCKED OUT OF CENTER POSITION

"E"



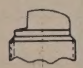
LOCKED IN CENTER POSITION

"F"



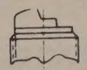
LOCKED IN EXTREME POSITION (OPPOSITE KEYWAY)

"G"



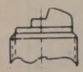
LOCKED IN EXTREME POSITION (KEYWAY SIDE)

"H"



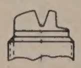
LOCKED OUT OF CENTER AND EXTREME POSITION (KEYWAY SIDE)

"J"



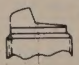
LOCKED OUT OF CENTER AND EXTREME POSITION (OPPOSITE KEYWAY)

"K"



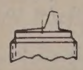
LOCKED IN CENTER AND EXTREME POSITION (OPPOSITE KEYWAY)

"L"



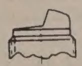
LOCKED OUT OF EXTREME POSITION (KEYWAY SIDE)

"M"



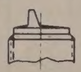
LOCKED OUT OF AND INTO EXTREME POSITION (OPPOSITE KEYWAY)

"N"



LOCKED OUT OF EXTREME POSITION (OPPOSITE KEYWAY)

"P"



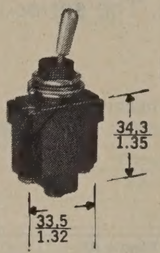
LOCKED OUT OF AND INTO EXTREME POSITION (KEYWAY SIDE)

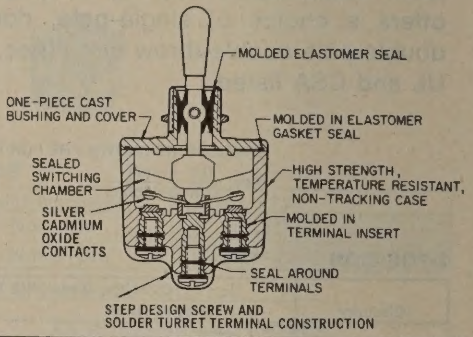
MICRO SWITCH A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

TL TOGGLE SWITCHES

Type TL toggle switches have environment-proof sealing meeting military specification MIL-S-3950 (Immersion). Operating temperature range from −65° to 71°C (−85° to 160°F). 1, 2 and 4-pole circuitry. Standard and Pull-to-Unlock toggle levers. 2- and 3-position, maintained and momentary toggle action.

For additional information, circuitry and terminal options refer to Catalog 200. For UL Listed versions see Catalog 100 or convert the listings below. Substitute a 5 in place of the 1 before the dash. Example: 1TL1-2 becomes 1TL5-2.




MOLDED ELASTOMER SEAL
ONE-PIECE CAST BUSHING AND COVER
MOLDED IN ELASTOMER GASKET SEAL
SEALED SWITCHING CHAMBER
HIGH STRENGTH, TEMPERATURE RESISTANT, NON-TRACKING CASE
SILVER CADMIUM OXIDE CONTACTS
MOLDED IN TERMINAL INSERT
SEAL AROUND TERMINALS
STEP DESIGN SCREW AND SOLDER TURRET TERMINAL CONSTRUCTION

ELECTRICAL RATINGS

MICRO SWITCH Rating Code*	28 Volts D.C.			115 VDC	250 VDC	115 Volts A.C. 60 & 400 CPS			230 VAC
	Ind.	Res.	Lamp	Res.	Res.	Ind.	Res.	Lamp	Res.
1	15	20	5	0.75	0.5	10	15	3	6
2	10	15	4	0.75	0.5	7	15	2	6
3	15	20	7	0.75	0.5	15	15	4	6
4	10	18	5	0.75	0.5	8	11	2	6
5	12	20	5	0.75	0.5	15	15	4	6
6	10	18	4	0.75	0.5	8	11	2	6

ORDER GUIDE — 2-POSITION SWITCHES

Circuitry	Circuit(s) Made With Toggle At:		Standard Toggle			Pull-to-Unlock Toggle	
	Keyway Position	Opposite Keyway	Electrical Rating Code	Catalog Listing	Military Number	Add Suffix To Standard Toggle Listing‡	Military Number†
ONE POLE	OFF	2-3	1	**1TL1-2**	MS24523-22	D, G	MS24658-22
	OFF*	2-3	2	**1TL1-4**	MS24523-29		
	1-2*	OFF	2	**1TL1-6**	MS24523-30	F	MS24658-30
	1-2	2-3	1	**1TL1-3**	MS24523-23	D, G	MS24658-23
	1-2*	2-3	2	**1TL1-8**	MS24523-26	F	MS24658-26
TWO POLE	OFF	2-3, 5-6	3	**2TL1-2**	MS24524-22	D, G	MS24659-22
	OFF*	2-3, 5-6	4	**2TL1-4**	MS24524-29		
	1-2, 4-5*	OFF	4	**2TL1-6**	MS24524-30	F	MS24659-30
	1-2, 4-5	2-3, 5-6	3	**2TL1-3**	MS24524-23	D, F, G	MS24659-23
	1-2, 4-5*	2-3, 5-6	4	**2TL1-8**	MS24524-26		
FOUR POLE	OFF	2-3, 5-6, 8-9, 11-12	5	**4TL1-2**	MS24525-22		
	1-2, 4-5, 7-8, 10-11*	OFF	6	**4TL1-6**	MS24525-30		
	1-2, 4-5, 7-8, 10-11	2-3, 5-6, 8-9, 11-12	5	**4TL1-3**	MS24525-23	D, F	MS24660-23
	1-2, 4-5, 7-8, 10-11*	2-3, 5-6, 8-9, 11-12	6	**4TL1-8**	MS24525-26		

ORDER GUIDE — 3-POSITION SWITCHES

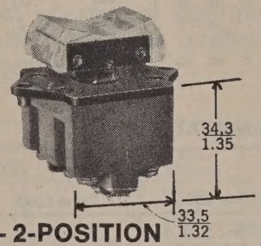
Circuitry	Circuit(s) Made With Toggle At:			Standard Toggle			Pull-to-Unlock Toggle	
	Keyway Position	Center Position	Opposite Keyway	Electrical Rating Code	Catalog Listing	Military Number	Add Suffix To Standard Toggle Listing‡	Military Number†
ONE POLE	1-2	OFF	2-3	1	**1TL1-1**	MS24523-21	A, E, P	MS24658-21
	1-2*	OFF	2-3	2	**1TL1-5**	MS24523-31	E	MS24658-31
	1-2*	OFF	2-3*	2	**1TL1-7**	MS24523-27	E	MS24658-27
	None**	OFF	2-3	1	**1TL1-21**	MS24523-24	E, K	MS24658-24
	None**	1-2	2-3	1	**1TL1-31**	MS24523-33		
	None**	1-2	2-3*	2	**1TL1-51**	MS24523-32		
	1-2*	OFF	None**	2	**1TL1-61**	MS24523-28		
TWO POLE	1-2, 4-5	OFF	2-3, 5-6	3	**2TL1-1**	MS24524-21	A, E, L	MS24659-21
	1-2, 4-5*	OFF	2-3, 5-6	4	**2TL1-5**	MS24524-31	M, N	MS24659-31
	1-2, 4-5*	OFF	2-3, 5-6*	4	**2TL1-7**	MS24524-27	E	MS24659-27
	None**	OFF	2-3, 5-6	3	**2TL1-21**	MS24524-24	E, F, K, M	MS24659-24
	None**	OFF*	2-3, 5-6	4	**2TL1-41**	MS24524-25	F	MS24659-25
	None**	1-2, 4-5	2-3, 5-6	3	**2TL1-31**	MS24524-33	E, F, K, M	MS24659-33
	None**	1-2, 4-5	2-3, 5-6*	4	**2TL1-51**	MS24524-32	E	MS24659-32
	1-2, 4-5*	OFF	None**	4	**2TL1-61**	MS24524-28	E	MS24659-28
	1-2, 4-5	1-2, 5-6	2-3, 5-6	3	**2TL1-10△**	MS27407-4	A, E, P	MS27408-4
	1-2, 4-5*	1-2, 5-6	2-3, 5-6	4	**2TL1-50△**	MS27407-5	K, M	MS27408-5
	1-2, 4-5*	1-2, 5-6	2-3, 5-6*	4	**2TL1-70△**	MS-27407-6		
FOUR POLE	1-2, 4-5, 7-8, 10-11	OFF	2-3, 5-6, 8-9, 11-12	5	**4TL1-1**	MS24525-21	A, E	MS24660-21
	1-2, 4-5, 7-8, 10-11*	OFF	2-3, 5-6, 8-9, 11-12	6	**4TL1-5**	MS24525-31		
	1-2, 4-5, 7-8, 10-11*	OFF	2-3, 5-6, 8-9, 11-12*	6	**4TL1-7**	MS24525-27		
	None**	OFF	2-3, 5-6, 8-9, 11-12	5	**4TL1-21**	MS24525-24		
	None**	1-2, 4-5, 7-8, 10-11	2-3, 5-6, 8-9, 11-12	5	**4TL1-31**	MS24525-33		
	1-2, 4-5, 7-8, 10-11	2-3, 4-5	2-3, 5-6, 8-9, 11-12	5	**4TL1-10△**	—	A	
	1-2, 4-5, 7-8, 10-11*	2-3, 4-5, 7-8, 11-12	2-3, 5-6, 8-9, 11-12	6	**4TL1-50△**	MS27409-2		
	1-2, 4-5, 7-8, 10-11*	2-3, 4-5	2-3, 5-6, 8-9, 11-12*	6	**4TL1-70△**	—		
	1-2, 4-5, 7-8, 10-11	2-3, 4-5, 7-8, 11-12	2-3, 5-6, 8-9, 11-12	5	**4TL1-12△**	MS27406-1	A	MS27409-1
	1-2, 4-5, 7-8, 10-11*	2-3, 4-5, 7-8, 11-12	2-3, 5-6, 8-9, 11-12*	6	**4TL1-72△**	MS27406-3		

△ Circuitry diagrams are shown under Series TP.
* These positions only are momentary. All others are maintained.
** Toggle lever is blocked from these positions. Toggle becomes two position, with center being one extreme position.
† Also add appropriate suffix letter to the Military Approval number.
‡ See Pull-to-Unlock configurations on the preceding page.

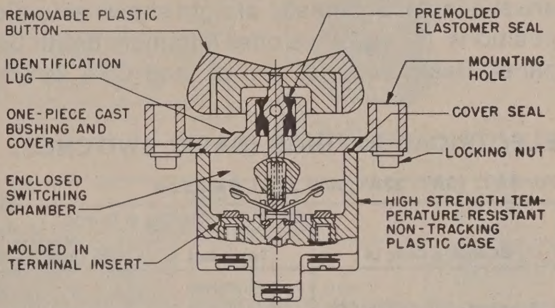
TP ROCKER BUTTON SWITCHES

"TP" rocker button actuated switches combine the advantages of toggle switch circuitry and current carrying capacity with versatile pushbutton manual control and styling. Their internal operating mechanism and case design are identical to the "TL" lever actuated toggle switches. They also offer similar versatility with two button styles, two- and three-position, maintained and momentary operation and 1-, 2- and 4-pole circuitry. "TP" rocker button switches have a temperature range of from —65° to 160°F (—54° to 71°C). Flush panel or above panel mounting. Series TP is UL listed. Catalog 200 supplies additional information, circuitry and button options, and listings.

ABOVE PANEL TYPE


34,3
1.35
33,5
1.32

CONSTRUCTION BELOW PANEL TYPE


REMOVABLE PLASTIC BUTTON
PREMOLDED ELASTOMER SEAL
IDENTIFICATION LUG
MOUNTING HOLE
ONE-PIECE CAST BUSHING AND COVER
COVER SEAL
LOCKING NUT
ENCLOSED SWITCHING CHAMBER
HIGH STRENGTH TEMPERATURE RESISTANT NON-TRACKING PLASTIC CASE
MOLDED IN TERMINAL INSERT

ORDER GUIDE — 2-POSITION

Circuitry	Circuit(s) Made With Button At: Ident. Lug Position	Circuit(s) Made With Button At: Opposite Ident. Lug	Electrical Rating and UL Code No.	Catalog Listing: Flush Panel: Translucent Button	Catalog Listing: Flush Panel: Transparent Button	Catalog Listing: Above Panel: Translucent Button	Catalog Listing: Above Panel: Transparent Button
ONE POLE	OFF	2-3	L80, 15 amps	1TP1-2	1TP12-2	—	—
	1-2*	OFF	L31, 10 amps	1TP1-6	—	—	—
	1-2	2-3	L80, 15 amps	1TP1-3	1TP12-3	1TP16-3	1TP4-3
TWO POLE	OFF	2-3, 5-6	L32, 15 amps	2TP1-2	2TP12-2	—	—
	1-2, 4-5	2-3, 5-6	L32, 15 amps	2TP1-3	2TP12-3	2TP16-3	2TP4-3
FOUR POLE	OFF	2-3, 5-6, 8-9, 11-12	L32, 15 amps	4TP1-2	—	—	—
	1-2, 4-5, 7-8, 10-11	2-3, 5-6, 8-9, 11-12	L32, 15 amps	4TP1-3	—	—	—

ORDER GUIDE — 3-POSITION

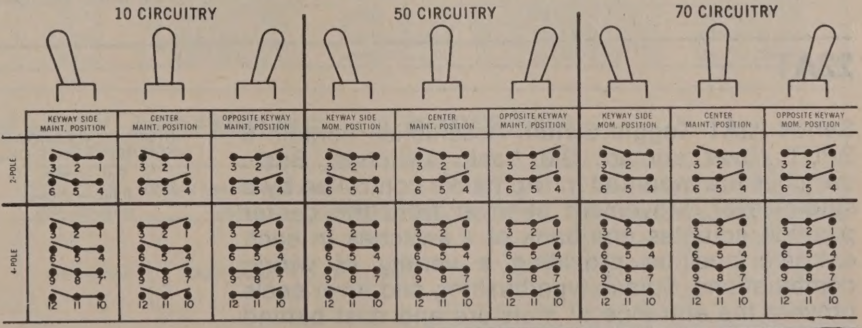
Circuitry	Circuit(s) Made With Button At: Ident. Lug Position	Circuit(s) Made With Button At: Center Position	Circuit(s) Made With Button At: Opposite Ident. Lug	Electrical Rating and UL Code No.	Catalog Listing: Flush Panel: Translucent Button	Catalog Listing: Flush Panel: Transparent Button	Catalog Listing: Above Panel: Translucent Button	Catalog Listing: Above Panel: Transparent Button
ONE POLE	1-2	OFF	2-3	L80, 15 amps	1TP1-1	—	—	1TP4-1
	1-2*	OFF	2-3	L31, 10 amps	1TP1-5	—	—	—
	1-2*	OFF	2-3*	L31, 10 amps	1TP1-7	1TP12-7	1TP16-7	1TP4-7
	None**	OFF	2-3	L80, 15 amps	1TP1-21	—	—	—
TWO POLE	1-2, 4-5	OFF	2-3, 5-6	L32, 15 amps	2TP1-1	2TP12-1	—	2TP4-1
	1-2, 4-5*	OFF	2-3, 5-6	L31, 10 amps	2TP1-5	—	—	—
	1-2, 4-5*	OFF	2-3, 5-6*	L31, 10 amps	2TP1-7	2TP12-7	2TP16-7	2TP4-7
	None**	OFF	2-3, 5-6	L32, 15 amps	2TP1-21	—	—	—
	1-2, 4-5	1-2, 5-6	2-3, 5-6	L32, 15 amps	2TP1-10	—	—	—
	1-2, 4-5*	1-2, 5-6	2-3, 5-6*	4‡	2TP1-70	2TP12-70	—	—
FOUR POLE	1-2, 4-5, 7-8, 10-11	OFF	2-3, 5-6, 8-9, 11-12	L32, 15 amps	4TP1-1	—	—	—
	1-2, 4-5, 7-8, 10-11*	OFF	2-3, 5-6, 8-9, 11-12*	L31, 10 amps	4TP1-7	4TP12-7	—	—

* These positions only are momentary. All others are maintained.
‡ Refer to TL Electrical Rating Chart.

** Toggle lever is blocked from these positions. Toggle becomes two position with center being one extreme position.

SPECIAL CIRCUITRIES

Catalog Listings with —10, —50, and —70 suffix numbers shown in the TL, TP, and TS Ordering Charts have special "on-on-on" circuits, as illustrated. TL's with —12 suffix are same as —50, except keyway position is maintained; while —72 is same as —50, except that opposite keyway position is momentary.


10 CIRCUITRY
50 CIRCUITRY
70 CIRCUITRY
KEYWAY SIDE MAINT. POSITION
CENTER MAINT. POSITION
OPPOSITE KEYWAY MAINT. POSITION
KEYWAY SIDE MOM. POSITION
CENTER MAINT. POSITION
OPPOSITE KEYWAY MAINT. POSITION
KEYWAY SIDE MOM. POSITION
CENTER MAINT. POSITION
OPPOSITE KEYWAY MOM. POSITION
2-POLE
4-POLE
3 2 1
6 5 4
9 8 7
12 11 10

Catalog listings for button only.	Color	Listing
	Translucent	12PA3
	Transparent	12PA4
	White†	12PA5-W
	Yellow†	12PA5-Y
	Black†	12PA5-BK
	Red†	12PA5-R

† Will accept engraved legends.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: $\frac{0{,}0 \text{ — mm}}{0.00 \text{ — inches}}$

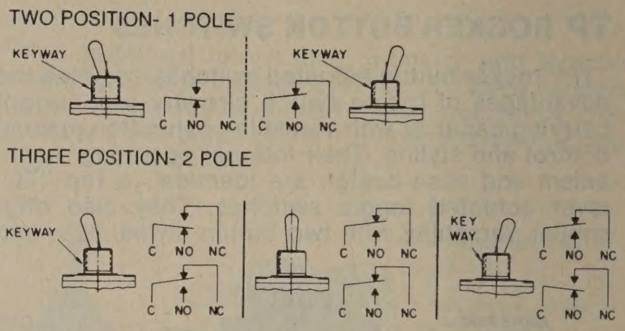
For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

AT TOGGLE SWITCH ASSEMBLIES

AT Toggle Switch Assemblies couple a toggle switch operator with one or more precision SM, SX, or V3 type basic switches. Momentary and maintained two position and three position devices are available. Schematic at right shows actuation by positions. AT switches offer minimum depth behind panel. Basic switches are UL and CSA listed.



ELECTRICAL RATINGS (BASIC SWITCHES)

For 6AT, 13AT, 23AT, and 22AT Switches

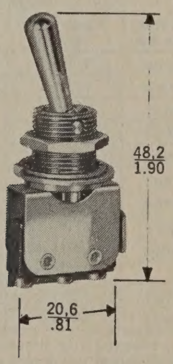
UL Rating Code L4	Rating at 30 VDC		
	Type Load	Amperes at Sea Level	50,000 feet
5 amps, 125-250 VAC	Inductive	3	2.5
	Resistive	5	5
	Max. Inrush	24	24

For High Capacity AT Switches

UL Rating Code L86	Rating at 30 VDC		
	Type Load	Ampere Capacity at Sea Level	50,000 feet
15 Amps, 125-250 VAC ⅓ HP, 125-250 VAC ½ Amp, 125 VDC ¼ Amp, 250 VDC 5 Amps, 125 VAC (L)	Inductive	10	6
	Resistive	10	10
	Motor	6	6

6AT 2-POSITION

Series 6AT Toggle Switch Assemblies control 1, 2, or 3-pole, double-throw precision SM basic switches. Silver contacts in a choice of pierced solder terminals, "T" turret terminals, or "T2" double-turret terminals. Bushing sizes are offered in ¼" or ¹⁵⁄₃₂" as charted below. Gold contact versions for low energy circuits are listed in Catalog 200.



Mounting Style	Number of Poles	Type Contacts	Catalog Listings		
			Solder Terminals	"T" Terminals	"T2" Terminals
¼" Bushing with Key Tab	1	Silver	6AT2	6AT2-T 6AT68-T*	6AT2-T2 6AT68-T2*
	2	Silver	6AT3	6AT3-T	6AT3-T2
	3	Silver	6AT501	6AT501-T	6AT501-T2
¼" Bushing without Key Tab	1	Silver	6AT1	6AT1-T 6AT75-T* 6AT201-T†	6AT1-T2 6AT201-T2†
	2	Silver	6AT4	6AT4-T 6AT231-T†	6AT4-T2 6AT231-T2†
¹⁵⁄₃₂" Bushing with Key Washer	1	Silver	6AT6	6AT6-T	6AT6-T2
	2	Silver	6AT7	6AT7-T	6AT7-T2
	3	Silver	6AT10	6AT10-T	6AT10-T2

* Extra Long Toggle Lever — 1.70mm/.67"

† Momentary position opposite keyway. Key washer in place of key tab.

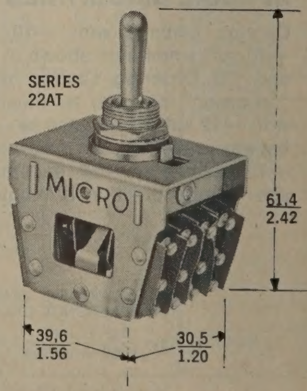
22AT

Series 22AT Toggle Switch Assemblies contain 8 SPDT silver contact SM basic switches. Basic switches are mounted in two banks controlled by a single lever. Movement of lever from the center position actuates one bank of 4 switches in each extreme position providing a variety of wiring combinations. Splash type bushing and lever seals prevent the entrance of moisture and dust behind the panel, or into the contact area.

Toggle Lever Position			Catalog Listing with "T" Terminals
Key Tab Position	Center Position	Position Opposite Key Tab	
Momentary	Maintained	Momentary	22AT1-T
Maintained	Maintained	Maintained	22AT2-T
Maintained	Maintained	Momentary	22AT3-T

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

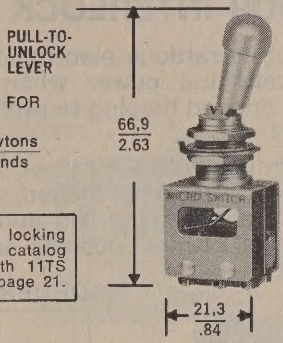
Key: $\frac{0,0 \text{ — mm}}{0.00 \text{ — inches}}$



AT TOGGLE SWITCH ASSEMBLIES (Cont.)

13AT AND 23AT

Series 13AT and 23AT contain two, three, or four SPDT subminiature type SM basic switches. Silver contacts. Standard toggle, tab, or pull-to-unlock levers. Gold contact versions are listed in Catalog 200.



DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or pounds

* A chart showing the 13 locking configurations and their catalog listing is shown beneath 11TS and 12TS listings. See page 21.

PULL-TO-UNLOCK LEVER OPTIONS

As a guard against accidental operation, pull-to-unlock toggle levers must be pulled .090 inch (approx.) to change positions.

TWO POSITION

Toggle Lever Position		No. of Poles	Type Contacts	Standard Lever Catalog Listings			Pull-to-Unlock with Solder Terminals Specify Locking Letter*		Tab Lever with "T2" Terminals
Keyway	Opposite Keyway			Solder Terminals	"T" Terminals	"T2" Terminals			
Maint.	Maint.	2	Silver	23AT1	23AT1-T	23AT1-T2	23AT1-	Specify D, F or G from locking chart and add code letter to catalog listing at left	23AT402-T2
		3	Silver	23AT2	23AT2-T	23AT2-T2	23AT2-		23AT408-T2
		4	Silver	23AT3	23AT3-T	23AT3-T2	23AT3-		—
Mom.	Maint.	2	Silver	23AT4	23AT4-T	23AT4-T2	—		23AT403-T2
		3	Silver	23AT5	—	23AT5-T2	—		—
		4	Silver	23AT6	—	23AT6-T2	—		—

THREE POSITION

Toggle Lever Position			No. of Poles	Type Contacts	Standard Lever Catalog Listings			Pull-to-Unlock with Solder Terminals Specify Locking Letter*		Tab Lever with "T2" Terminals
Keyway	Center	Opposite Keyway			Solder Terminals	"T" Terminals	"T2" Terminals			
Maint.	Maint.	Maint.	2	Silver	13AT2	13AT2-T	13AT2-T2	13AT2-	Specify any locking chart letter and add to catalog listing at left	13AT402-T2
			3	Silver	13AT5	13AT5-T	—	13AT5-		—
			4	Silver	13AT9	13AT9-T	13AT9-T2	13AT9-		13AT409-T2
Mom.	Maint.	Mom.	2	Silver	13AT1	13AT1-T	13AT1-T2	13AT1-	Specify E, L or N from locking chart and add code letter to catalog listing at left	13AT401-T2
			3	Silver	13AT4	—	—	—		13AT413-T2
			4	Silver	13AT8	—	13AT8-T2	13AT8-		13AT408-T2
Maint.	Maint.	Mom.	2	Silver	13AT3	13AT3-T	13AT3-T2	13AT3-	Specify E, G, B, L, P or N from locking chart and add code letter to catalog listing at left	13AT403-T2
			4	Silver	13AT10	—	—	13AT10-		13AT410-T2

M8805/26 TOGGLE SWITCHES

TWO POSITION

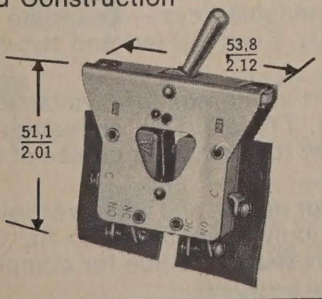
Toggle Lever Position		No. of Poles	Type Contacts	Standard Lever With "T2" Terminals		Tab Lever With "T2" Terminals	
Keyway	Opposite Keyway			Catalog Listing	Military Approval No.	Catalog Listing	Military Approval No.
Maint.	Maint.	2	Silver	23AT73-T2	M8805/26-001	23AT473-T2	M8805/26-003
		4	Silver	23AT74-T2	M8805/26-002	23AT474-T2	M8805/26-004

THREE POSITION

Toggle Lever Position			No. of Poles	Type Contacts	Standard Lever With "T2" Terminals		Tab Lever With "T2" Terminals	
Keyway	Center	Opposite Keyway			Catalog Listing	Military Approval No.	Catalog Listing	Military Approval No.
Mom.	Maint.	Mom.	2	Silver	13AT271-T2	M8805/26-005	13AT471-T2	M8805/26-006
			3	Silver	13AT274-T2	M8805/26-011	13AT474-T2	M8805/26-012
Maint.	Maint.	Maint.	2	Silver	13AT272-T2	M8805/26-007	13AT472-T2	M8805/26-008
			3	Silver	13AT275-T2	M8805/26-013	13AT475-T2	M8805/26-014
Maint.	Maint.	Mom.	2	Silver	13AT273-T2	M8805/26-009	13AT473-T2	M8805/26-010

TOGGLE SWITCH HIGH CAPACITY ASSEMBLIES — 3 POSITIONS

- 2-4-6-8-10 Switch Control
- V3 Basic Switches
- 3-Hole Mounting
- Rugged Construction



Toggle Lever Positions			Number of Basic Switches	Lever Length		Catalog Listing
One Extreme	Center	Other Extreme		mm	In.	
Maintained	Maintained	Maintained	2	22,4	.88	11AT30
			4	22,4	.88	15AT1
			6	22,4	.88	7AT4
			8	22,4	.88	8AT4
			10	31,8	1.25	10AT4
Momentary	Maintained	Momentary	2	22,4	.88	11AT20
			4	22,4	.88	15AT2
			6	31,8	1.25	7AT51
			8	31,8	1.25	8AT1
			10	31,8	1.25	10AT1
Momentary	Maintained	Maintained	2	22,4	.88	11AT50
			4	22,4	.88	15AT3
			6	22,4	.88	7AT6
			8	22,4	.88	8AT6

For electrical ratings, refer to preceding page.

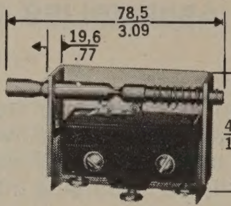
MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

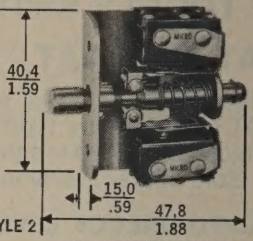
AC DOOR INTERLOCK SWITCHES

For use on hazardous electronic equipment. They automatically cut power when service door or drawer is opened helping to protect personnel and equipment.

To test circuits with the power "on" the actuating rod can be manually set (pulled) to a maintained-on position. The actuating rod automatically returns to the normal or reset position as door closes.

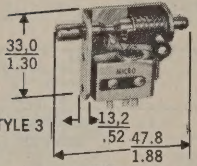


STYLE 1

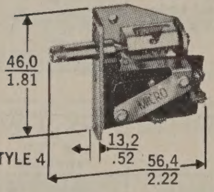


STYLE 2

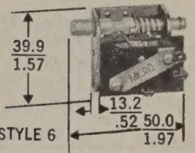
CHARACTERISTICS:
F.P. — Free Position
O.P. — Operating Position
D.P. — Depressed Position



STYLE 3



STYLE 4



STYLE 6

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

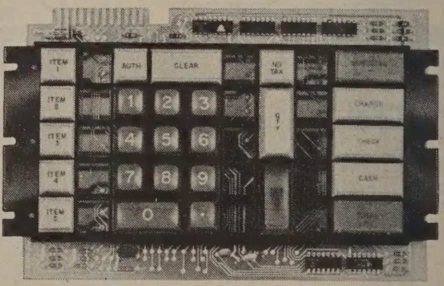
ORDER GUIDE — DOOR INTERLOCK SWITCHES

Actuators	Description	Style No.	Electrical Data	Catalog Listing	Basic Switch Type	F.P. Max. mm (in.)	O.P. Min. mm (in.)	D.P. Max. mm (in.)
Steel	High Capacity	1	15 amp	**1AC2**	BZ	11,1 .438	6,35 .250	3,18 .125
	Up to 4 separate SPDT circuits	2	5 amp	**8AC1**	SM(4)	9,53 .375	5,16 .203	3,18 .125
	Three 1 foot leads Sealed basic switches	3	5 amp	**9AC4**	SE	9,53 .375	5,16 .203	3,18 .125
	Two 3 foot leads SPST—N.O. Sealed basic switches	3	5 amp	**9AC12-3**	SE	9,53 .375	5,16 .203	3,18 .125
	Can be reset without momentary circuit break	4	15 amp	**13AC1**	V3	15,9 .625	12,3 .485	6,68 .263
*High strength thermo-plastic		6	15 amp	**22AC1**	V3	9,53 .375	5,16 .203	3,18 .125
	Tapped hole in end of actuator rod	6	15 amp	**22AC2**	V3	9,53 .375	5,16 .203	3,18 .125
	Tapped hole in end of steel actuator rod	6	15 amp	**2AC59 (MS16101-1)**	V3	9,53 .375	5,16 .203	3,18 .125
	Up to four separate SPDT circuits	2	5 amp	**8AC9 (MS16106-3)**	SM(4)	9,53 .375	5,16 .203	3,18 .125

* Not for use in temperatures over +185°F (85°C).
For higher temperatures order steel actuator Catalog Listing. For other variations see Catalog 200.

Key: 0,0 — mm
0.00 — inches

KEYBOARDS



MICRO SWITCH now offers a line of truly effective, Sealed Solid State Keyboards for applications in industrial, aerospace, marine, military and other severe environments. These ruggedly constructed, sealed keyboards are especially designed to provide protection against accidental spills of coffee or sodas, splash-over or drip through of oil and moisture, and accumulation of sand, dust, chips or other contaminants which can damage or cause failure of non-sealed units. In addition, this custom designed sealing capability protects the expensive electronics usually located behind or underneath the keyboard. Sealed keyboards meet the requirements of NEMA 2, 3, 3R, 12 and 13, and military specifications (MIL-STD-202) for sealing, vibration and shock.

KEYBOARDS TO FIT EVERY NEED

At MICRO SWITCH, we have the world's most complete line of solid state keyboards . . . which means unmatched design flexibility for you. Our application engineers will custom tailor a keyboard to your exact specifications, whether from our time-proven SW series or our new low-profile SD series.

Choose from keys offering over 10,000 legends, 30 colors, and 60 shapes, including standards, sculptured or re-legendable keys — or create new keys to fit your needs. Even lighted and two-level keys are available.

MICRO SWITCH keyboards are available with features like MOS, TTL and DTL encoding, and with two-key or N-key rollover. Your choice of alpha and numeric arrays.

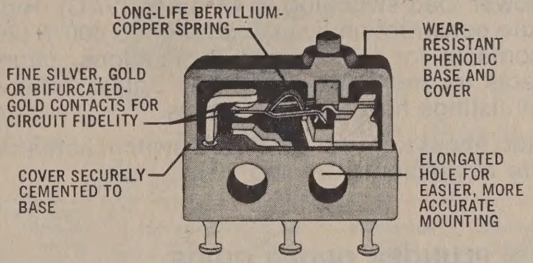
So whatever your needs, and whatever your budget, we'd like to supply a keyboard to fit. Contact a MICRO SWITCH Branch Office for complete information.

TYPE SX SUBMINIATURE BASIC SWITCHES

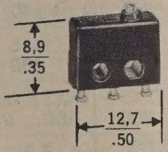
The SX series basic switches are the smallest snap-action switches from MICRO SWITCH. These switches are ideal where savings in space and weight are important. Unless otherwise noted, all listings have silver contacts. Variations include high temperature designs for up to 400°F (204°C), gold contacts for low energy applications, and bifurcated gold contacts for maximum reliability.

The SX switches are available with several types of terminations. The T and T2 terminals provide easy lead wire attachment.

Additional terminal types and switch/actuator variations are available in Catalog 200.


LONG-LIFE BERYLLIUM-COPPER SPRING
WEAR-RESISTANT PHENOLIC BASE AND COVER
FINE SILVER, GOLD OR BIFURCATED-GOLD CONTACTS FOR CIRCUIT FIDELITY
COVER SECURELY CEMENTED TO BASE
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING

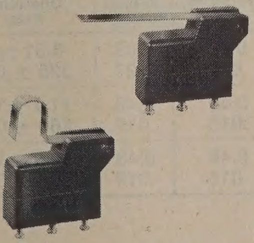
STRAIGHT PLUNGER ORDER GUIDE



Recommended For	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point*
Most applications	5 amps L-4	**11SX21-T**	1,39 5	0,1 .004	0,051 .002	8,13 .320
Lower Force	7 amps L-7	**2SX1-T**	0,83 3	0,1 .004	0,13 .005	8,13 .320
Applications requiring gold contacts	1 amp L-22	**3SX1-T**	1,39 5	0,1 .004	0,13 .005	8,13 .320
MIL-S-8805 application requirements +180°F (82°C) maximum use	7 amps	**21SX39-T (MS24547-1)**	1,39 5	0,1 .004	0,13 .005	8,13 .320
Operating in temperature to: +400°F (204°C)**	7 amps	**4SX1-T**	1,39 5	0,1 .004	0,13 .005	8,13 .320
Best reliability with higher current rating (Bifurcated gold contacts)**	1 amp L-22	**12SX1-T**	1,39 5	0,1 .004	0,076 .003	8,13 .320

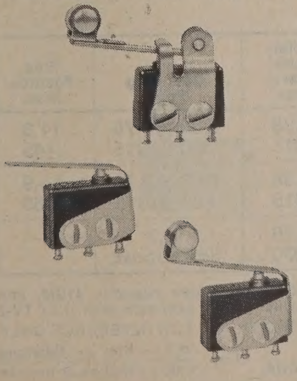
* ±0,38mm ±.015 in.

INTEGRAL LEVER ORDER GUIDE



Description	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point
.505 inch (12,8mm) long straight lever	5 amps L-4	**311SX2-T**	0,31 1.1	0,64 .025	0,89 .035	8,26 ±1,91 .325 ±.075
.042 inch (1,1mm) long simulated roller lever	5 amps L-4	**311SX4-T**	0,59 2.1	0,25 .010	0,38 .015	14,15 ±0,91 .557 ±.036

AUXILIARY ACTUATOR ORDER GUIDE (order switches separately)



Description	Actuator Length mm inches	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point‡	Free Position
Roller lever	16,5 .65	**JX-25**	0,42 1.5	0,51 .020	0,76 .030	14,9 ±1,14 .585 ±.045	16,8 max. .660
Straight leaf	9,4 .37	**JX-40**	1,95 7	0,38 .015	0,64 .025	7,5 .295	12,3 ref. .485
Roller leaf	6,1 .24	**JX-45**	1,95 7	0,38 .015	0,64 .025	12,2 .480	16,5 ref. .650

NOTE: All characteristics are taken with actuator assembled on Catalog Listing 1SX1-T as shown. Actuators should be used at temperatures below +300°F (149°C).

Except where stated‡ ±0,76mm ±.030 in.

** For best results especially in the application of the bifurcated contact 12SX series and high temperature 4SX1-T, contact a MICRO SWITCH Branch Office.

Key: 0,0 — mm or Newtons
0.00 — inches or ounces.

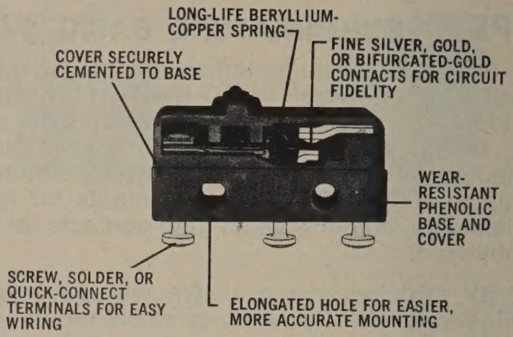
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .087 INCH DIAMETER (2,21mm) ON .19 INCH (4,8mm) CENTERS.

MICRO SWITCH A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

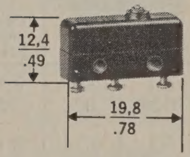
TYPE SM SUBMINIATURE BASIC SWITCHES

The SM series switches are slightly larger than the SX switches. They feature precision operation, long life, and power load switching to 11 amps (VAC). High temperature construction available for up to 400°F (204°C). Gold contacts for low energy applications, bifurcated contacts for maximum reliability. Unless otherwise noted, all listings have silver contacts.

Additional terminal types and switch/actuator variations are available in Catalog 200.


LONG-LIFE BERYLLIUM-COPPER SPRING
COVER SECURELY CEMENTED TO BASE
FINE SILVER, GOLD, OR BIFURCATED-GOLD CONTACTS FOR CIRCUIT FIDELITY
WEAR-RESISTANT PHENOLIC BASE AND COVER
SCREW, SOLDER, OR QUICK-CONNECT TERMINALS FOR EASY WIRING
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING

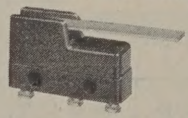
PIN PLUNGER ORDER GUIDE

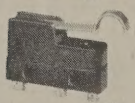


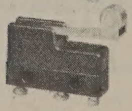
Recommended For	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel Max.	Operating Point*
Most applications	5 amps L-4	**11SM1-T**	0,83-1,39 3-5	0,13 .005	0,1 .004	8,38 .330
Operating in temperatures to +400°F (204°C)†	—	**11SM244-T**	0,83-1,39 3-5	0,13 .005	0,1 .004	8,38 .330
Up to 11 ampere ¼ hp (AC) load handling†	11 amps L-141	**41SM1-T**	0,83-1,39 3-5	0,13 .005	0,1 .004	8,38 .330
Best reliability Bifurcated gold contacts†	1 amp L-22	**12SM4-T**	0,83-1,39 3-5	0,076 .003	0,1 .004	8,38 .330
Sealed plunger construction	5 amps L-4	**411SM1**	0,83-1,39 3-7.5	0,13 .005	0,1 .004	8,38 .330
Center plunger position	5 amps L-4	**51SM1-T**	0,56-1,39 2-5	0,25 .010	0,15 .006	10,3 ±0,51 .406 ±.020
MIL-S-8805 application requirements solder terminals	5 amps	**21SM284 (MS25085-1)**	0,83-1,39 3-5	0,13 .005	0,1 .004	8,38 .330

Except where stated* ±0,38mm
±.015 in.

INTEGRAL LEVER ORDER GUIDE

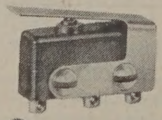


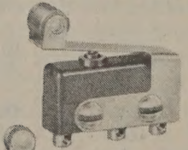




Description	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Characteristics Overtravel Min.	Differential Travel Max.	Operating Point
.565 inch (14,35mm) long straight lever	5 amps L-4	**311SM2-T**	0,31 1.1	0,66 .026	0,69 .027	8,51 ±2 .335 ±.080
.251 inch (6,38mm) long simulated roller lever	5 amps L-4	**311SM4-T**	0,39 1.4	0,46 .018	0,48 .019	11,7 ±1,5 .460 ±.060
.251 inch (6,38mm) long roller lever	5 amps L-4	**311SM6-T**	0,39 1.4	0,46 .018	0,48 .019	14,2 ±1.5 .560 ±.060

AUXILIARY ACTUATOR ORDER GUIDE (order switches separately)





Description	Actuator Length mm Inches	Typical Catalog Listing	Operating Force Max.	Overtravel Max.	Differential Travel Max.	Operating Point	Free Position Max.
Straight leaf	16,8 .66	**JS-2**	2,78 10	0,38 .015	0,38 .015	8,89 ±0,76 .350 ±.015	11,3 .445
Roller leaf (bronze roller)	15 .59	**JS-5**	2,78 10	0,38 .015	0,38 .015	14,2 ±0,76 .560 ±.015	16,9 .665
Roller lever (steel roller)	25,4 1.00	**JS-246**	0,28 1	0,76 .030	0,76 .030	14,3 .562 approx.	—

† Note: For best results, especially in the application of the high temperature 11SM244, 10 ampere capacity 41SM, and the bifurcated contact 12SM, contact a MICRO SWITCH Branch Office. SM basic switches are available with (UL) TV-2 rated versions.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

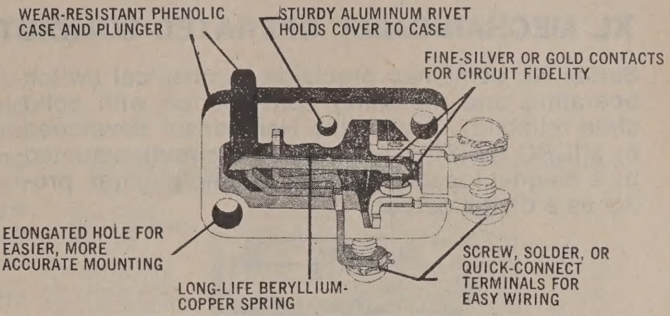
NOTE: Actuators should be used below +300°F.
All characteristics are taken with actuator assembled to Catalog Listing 11SM1-T as shown.

Key: $\frac{\text{0,0 — mm}}{\text{0.00 — inches}}$ or $\frac{\text{Newtons}}{\text{ounces}}$

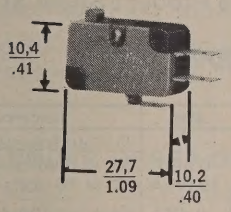
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .087 INCH (2,21mm) MAX. DIA. ON .38 INCH (9,5mm) CENTERS.

TYPE V3 MINIATURE BASIC SWITCHES

V3 switches combine small size with high electrical capacity up to 15 amps, ½ hp. Operating force goes as low as 7 grams maximum with actuator. Long mechanical life of 10,000,000 cycles with 95% survival. Standard temperature tolerances up to 180°F (82°C). Catalog 200 offers additional terminations, integral actuators, and switch variations, plus auxiliary actuators.


WEAR-RESISTANT PHENOLIC CASE AND PLUNGER
STURDY ALUMINUM RIVET HOLDS COVER TO CASE
FINE-SILVER OR GOLD CONTACTS FOR CIRCUIT FIDELITY
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING
SCREW, SOLDER, OR QUICK-CONNECT TERMINALS FOR EASY WIRING
LONG-LIFE BERYLLIUM-COPPER SPRING

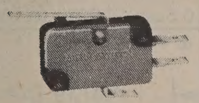
PLUNGER ORDER GUIDE

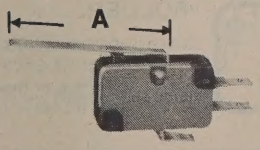


Recommended For	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel	Operating Point*
Most applications	11 amps L-156	**V3-101-D8**	2,22 8 max.	1,02 .040	0,15-0,41 .006-.016	14,7 .578
Added overtravel	10 amps L-112	**V3-1101-D8**	0,72 max. 2.6	1,27 .050	0,051-0,25 .002-.010	14,7 .578
Lower force Added overtravel	10 amps L-131	**V3-2101-D8**	0,5 max. 1.8	1,27 .050	0,051-0,25 .002-.010	14,7 .578
Lower force	5 amps L-162	**V3-2401-D8**	0,25 .9	1,27 .050	0,051-0,25 .002-.010	14,7 .578
Lowest force	3 amps L-163	**V3-2451-D8**	0,15 .53	1,27 .050	0,051-0,25 .002-.010	14,7 .578
Up to 15 amps load handling	15 amps L-83	**V3-3001-D8**	1,34 max. 4.8	1,27 .050	0,051-0,25 .002-.010	14,7 .578

* ±0,38mm
±.015 in.

STRAIGHT LEVER ORDER GUIDE





Recommended For	Length of Lever "A" mm Inches	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point
Most applications	35,6 1.40	11 amps L-156	**V3L-104-D8**	1,11 4	2,29 .090	1,27 .050	15,2 ±1,5 .600 ±.060
Added overtravel	59,4 2.34	11 amps L-156	**V3L-131-D8**	0,59 2.1	3,81 .150	2,29 .090	14,7 ±2 .580 ±.080
	35,6 1.40	10 amps L-112	**V3L-1108-D8**	0,33 1.2	2,29 .090	0,76 .030	15,2 ±1,5 .600 ±.060
	59,4 2.34	10 amps L-112	**V3L-1122-D8**	0,20 .71	4,06 .160	1,4 .055	15,2 ±1,8 .600 ±.070
Lower force Added overtravel	35,6 1.40	10 amps L-131	**V3L-2102-D8**	0,31 1.1	2,29 .090	0,76 .030	15,2 ±1,5 .600 ±.060
	59,4 2.34	10 amps L-131	**V3L-2106-D8**	0,16 .57	4,06 .160	1,4 .055	15,2 ±1,8 .600 ±.070
Lowest force	35,6 1.40	5 amps L-162	**V3L-2424-D8**	0,12 .42	2,29 .090	0,76 .030	15,2 ±1,5 .600 ±.060
	59,4 2.34	5 amps L-162	**V3L-2425-D8**	0,07 .25	4,06 .160	1.4 .055	15,2 ±2 .600 ±.080
Up to 15 amps load handling. Best for performance under shock and vibration	35,6 1.40	15 amps L-83	**V3L-3005-D8**	0,72 2.6	2,29 .090	0,81 .032	15,2 ±1,5 .600 ±.060
	59,4 2.34	15 amps L-83	**V3L-3013-D8**	0,39 1.4	4,06 .160	1,52 .060	15,2 ±1,9 .600 ±.075

ROLLER LEVER ORDER GUIDE

Recommended For	Length of Lever "A" mm Inches	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point
Most applications	20,6 .81	11 amps L-156	**V3L-139-D8**	2,22 8	1,02 .040	0,41 .016	20,6 ±0,76 .810 ±.030
Added overtravel	20,6 .81	10 amps L-112	**V3L-1117-D8**	0,72 2.6	1,14 .045	0,33 .013	20,6 ±0,76 .810 ±.030
Lower force Added overtravel	20,6 .81	10 amps L-131	**V3L-2103-D8**	0,50 1.8	1,14 .045	0,33 .013	20,6 ±0,76 .810 ±.030
Up to 15 amps load handling. Best for performance under shock and vibration	20,6 .81	15 amps L-83	**V3L-3003-D8**	1,34 4.8	1,02 .040	0,33 .013	20,6 ±0,76 .810 ±.030

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .11 INCH (2,8mm) DIA. ON .88 INCH (22,4mm) CENTERS.

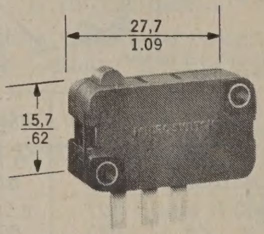
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

MICRO SWITCH A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

XL MECHANICALLY OPERATED SOLID STATE SWITCHES

Series XL combines precision mechanical switch operating and mounting convenience with solid state reliability. It uses the Hall sensor developed by MICRO SWITCH. An integrated circuit, actuated by a magnet located in the operating plunger, produces a digital output.



Mounting dimensions and mechanical characteristics are similar to the popular V3 type snap-action switch. Over 500 actuators are available, including pin plunger, straight levers, simulated roller levers, and roller levers.

XL switches can be used directly with electronic circuits, such as discrete transistors, integrated logic or SCR's. The digital logic level output eliminates the need for conditioning circuitry to obtain a square wave output.

Terminals are combination solder/quick-connect. A terminal housing can be provided for use with AMP .110″ push-on terminals.

For more information, see Product Sheet XL.

ELECTRICAL CHARACTERISTICS, 5 VDC CIRCUIT

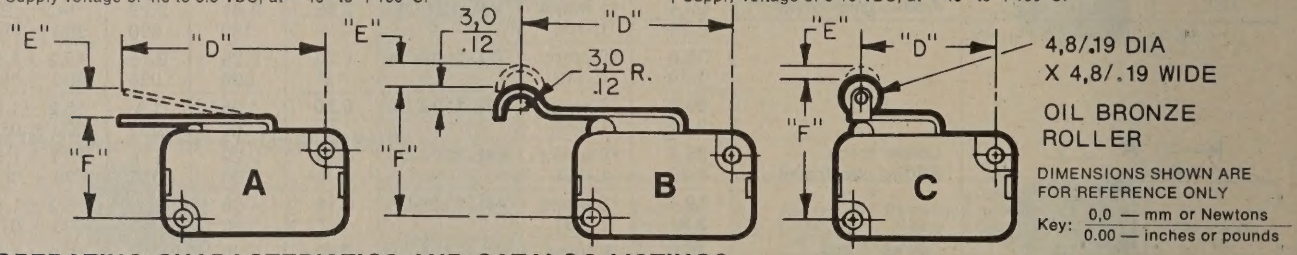
	Typ.	Max.	Remarks
Supply Current* At 24° ±2°C, supply voltage of 5 ±0.5% VDC	2.5mA	4.0mA	Output transistor OFF
Output Voltage* (output transistor ON)	0.15V	0.4V	Sinking 8mA max.
Output Leakage Current (output transistor OFF)	—	20μA	Leakage into switch output
Output Switching Time* Rise Fall	0.2μsec. 0.1μsec.	1.0μsec. 0.5μsec.	10% to 90% 90% to 10%

* Supply voltage of 4.5 to 5.5 VDC, at −40° to +100°C.

ELECTRICAL CHARACTERISTICS, 6-16 VDC CIRCUIT

	Typ.	Max.	Remarks
Supply Current At 24° ±2°C	3mA 5mA	6.5mA 10.0mA	Output transistor OFF V_s = 6 volts V_s = 16 volts
Output Voltage† (output transistor ON)	0.15V	0.4V	Sinking 20mA
Output Leakage† Current (output transistor OFF)	—	20μA	Leakage into switch output
Output Switching Time† Rise Fall	0.2μsec. 0.1μsec.	1.5μsec. 0.5μsec.	10% to 90% 90% to 10%

† Supply voltage of 6-16 VDC, at −40° to +100°C.



OPERATING CHARACTERISTICS AND CATALOG LISTINGS

Dimension "D"	Lever Style**	"E" Pretravel (Max.)	"F" Operating Point‡	Overtravel (Min.)	Differential Travel (Max.)	Operating Force Ounces	Operating Force Newtons	5 VDC Type Sinking	6-16 VDC Type Sinking
— —	None	1,65mm .065 in.	14,22mm .560 in.	0,76mm .030 in.	0,18mm .007 in.	.35 ±.10	0,10 ±0,03	**37XL11-01**	**47XL11-01**
						1.25 ±.25	0,35 ±0,07	**37XL11-02**	**47XL11-02**
						3.00 ±.60	0,83 ±0,17	**37XL11-03**	**47XL11-03**
21,84mm .860 in.	A	1,78mm .070 in.	14,73mm .580 in.	0,64mm .025 in.	0,25mm .010 in.	△.40 ±.15	0,11 ±0,04	**37XL11XA-11**	**47XL11XA-11**
						1.50 ±.30	0,42 ±0,08	**37XL11XA-12**	**47XL11XA-12**
						3.00 ±.70	0,83 ±0,19	**37XL11XA-13**	**47XL11XA-13**
35,56mm 1.400 in.	A	4,44mm .175 in.	14,22mm .560 in.	1,27mm .050 in.	0,38mm .015 in.	△.20 max.	0,06 max.	**37XL11XA-21**	**47XL11XA-21**
						.75 max.	0,21 max.	**37XL11XA-22**	**47XL11XA-22**
						1.50 max.	0,42 max.	**37XL11XA-23**	**47XL11XA-23**
59,44mm 2.340 in.	A	6,60mm .260 in.	13,34mm .525 in.	2,54mm .100 in.	0,76mm .030 in.	△.15 max.	0,04 max.	**37XL11XA-31**	**47XL11XA-31**
						△.50 max.	0,14 max.	**37XL11XA-32**	**47XL11XA-32**
						1.00 max.	0,28 max.	**37XL11XA-33**	**47XL11XA-33**
32,64mm 1.285 in.	B	4,44mm .175 in.	17,40mm .685 in.	1,27mm .050 in.	0,38mm .015 in.	△.20 max.	0,06 max.	**37XL11XB-11**	**47XL11XB-11**
						.75 max.	0,21 max.	**37XL11XB-12**	**47XL11XB-12**
						1.50 max.	0,42 max.	**37XL11XB-13**	**47XL11XB-13**
20,57mm .810 in.	C	1,90mm .075 in.	20,19mm .795 in.	0,64mm .025 in.	0,25mm .010 in.	△.50 max.	0,14 max.	**37XL11XC-01**	**47XL11XC-01**
						1.75 max.	0,49 max.	**37XL11XC-02**	**47XL11XC-02**
						4.00 max.	1,11 max.	**37XL11XC-03**	**47XL11XC-03**

△ Lever may not be self returning.

‡ Typical values. Contact Branch Office for information on tolerance.

** Other lever styles are available. Contact Branch Office.

NOTE:
The output transistors of the listings shown are "normally open", i.e., they are not conducting with plunger in free position. To order devices which are "normally closed" (conducting with plunger in free position), substitute 12 for 11 immediately after the XL in the catalog listing. Example: 37XL12XA-11.

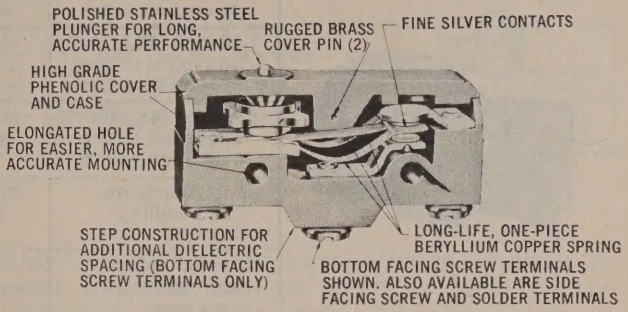
TYPES Z AND A STANDARD BASIC SWITCHES

The type Z switch design meets most applications needs. Modifications of the standard silver contact design and material, spring configuration, and plunger locations give the type A switches greater electrical load handling capacity. Other changes in materials and switch design provide operating characteristics, temperature tolerances, and sealing to cover a wide range of special requirements. See Catalog 100.

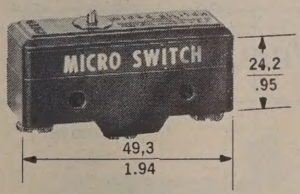
Terminal variations include solder, quick-connect, and side facing screws.

Features include operating force down to 1 oz (28,4 gms.) Differential travel down to .0002 to .0003 inch (0,005 to 0,008mm). Power load switching capacity to 25 amps and motor handling capacity of 2HP at 250 VAC.

Catalog 100 provides additional listings for all variations and accessories shown in this section.


POLISHED STAINLESS STEEL PLUNGER FOR LONG, ACCURATE PERFORMANCE
RUGGED BRASS COVER PIN (2)
FINE SILVER CONTACTS
HIGH GRADE PHENOLIC COVER AND CASE
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING
STEP CONSTRUCTION FOR ADDITIONAL DIELECTRIC SPACING (BOTTOM FACING SCREW TERMINALS ONLY)
LONG-LIFE, ONE-PIECE BERYLLIUM COPPER SPRING
BOTTOM FACING SCREW TERMINALS SHOWN. ALSO AVAILABLE ARE SIDE FACING SCREW AND SOLDER TERMINALS

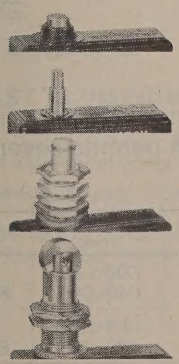
PIN PLUNGER ORDER GUIDE


MICRO SWITCH
24,2
.95
49,3
1.94

Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel	Operating Point*
Most applications	15 amps L-96	**BZ-2R-A2**	2,5-3,61 9-13	0,13 .005	0,01-0,05 .0004-.0020	15,88 .625
Up to 22 ampere load handling	22 amps L-161	**BM-1R-A2**	1,95-2,78 7-10	0,13 .005	0,013-0,025 .0005-.0010	15,88 .625
Up to 20 ampere load handling	20 amps L-23	**BA-2R-A2**	3,89-6,12 14-22	0,25 .010	0,05-0,19 .0020-.0075	16,26 .640
Up to 25 ampere load handling	25 amps Motor Control	**BE-2R-A4**	3,89-6,12 14-22	0,25 .010	0,05-0,19 .0020-.0075	16,26 .640

* ±0,38mm
±.015 in.

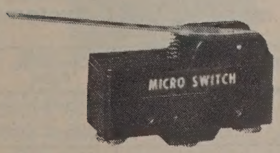
OVERTRAVEL PLUNGER ORDER GUIDE



Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel	Operating Point
Added overtravel. For manual operation and slow 20° (max.) cam rise	15 amps L-96	**BZ-2RD-A2**	2,5-3,61 9-13	1,52 .060	0,01-0,05 .0004-.0020	21,21* .835
Added overtravel. For in-line operation and with JR auxiliary actuators	15 amps L-96	**BZ-2RS-A2**	2,5-3,61 9-13	1,52 .060	0,01-0,063 .0004-.0025	28,20* 1.110
Added overtravel. For manual in-line operation and for slow 30° (max.) rise cam	15 amps L-96	**BZ-2RQ1-A2**	2,5-3,61 9-13	5,56 .219	0,01-0,05 .0004-.0020	21,82* .859
Added overtravel. Roller plunger for rapid cam 30° (max.) rise and slide operation	15 amps L-96	**BZ-2RQ18-A2**	2,5-3,61 9-13	3,56 .140	0,01-0,05 .0004-.0020	33,32 ±1,14 1.312 ±.045

* ±0,51mm
±.020 in.

STRAIGHT LEVER ORDER GUIDE


MICRO SWITCH

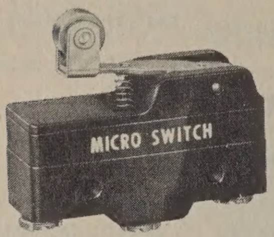
Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel	Operating Point
2.5 inch lever requirements	15 amps L-96	**BZ-2RW80-A2**	0,7 2.5	5,56 .219	0,18-1,27 .007-.050	19,1 ±0,76 .750 ±.030
6-inch lever requirements	15 amps L-96	**BZ-2RW863-A2**	0,28 1	14,68 .578	0,46-3,68 .018-.145	19,1 ±1,52 .750 ±.060

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139″ (3,53mm) DIAMETER ON 1 INCH (25,4mm) CENTERS.
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

TYPES Z AND A, DT AND MT

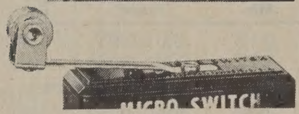
ROLLER LEVER ORDER GUIDE



Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel	Operating Point*
1.05 inch (26,7mm) long (steel roller) lever applications	15 amps L-96	**BZ-2RW822-A2**	1,67 6	2,39 .094	0,08-0,51 .003-.020	30,17 1.188
1.90 inch (48,3mm) long (steel roller) lever applications	15 amps L-96	**BZ-2RW82-A2**	0,97 3.5	3,96 .156	0,10-1,0 .004-.040	30,17 ±0,76 1.188 ±.030
Up to 20 ampere load handling long lever	20 amps L-23	**BA-2RV2-A2**	0,97 3.5	1,52 .060	2,16 .085	30,17 ±0,76 1.188 ±.030
Up to 20 ampere load handling short lever	20 amps L-23	**BA-2RV22-A2**	1,67 6	0,76 .030	1,14 .045	29,77 1.172

Except where stated* ±0,38mm
±.015 in.

FLEXIBLE LEAF ORDER GUIDE

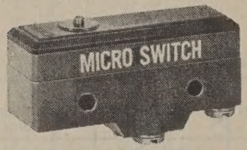


Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Over-travel Max.	Differ-ential Travel Max.	Operating Point*
Force and stability of the flexible leaf actuator	15 amps L-96	**BZ-2RL-A2**	1,39 5	1.52 .060	1,27 .050	17,48 .688
Applications requiring the force and stability of the flexible leaf with roller	15 amps L-96	**BZ-2RL2-A2**	1,39 5	1,52 .060	1,27 .050	28,6 1.125

* ±0,76mm
±.030 in.

BASIC SWITCH VARIATIONS

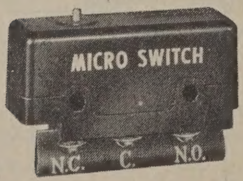
PIN PLUNGER — SPECIAL CIRCUITRY ORDER GUIDE



Recommended for	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel	Operating Point*
Double-Break, Low DC applications	15 amps L-73	**BZ-3AT**	4,45-7,23 16-26	0,13 .005	0,051-0,13 .002-.005	15,9 .625

* ±0,38mm
±.015 in.

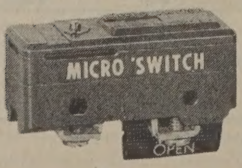
DT DOUBLE-POLE DOUBLE-THROW ORDER GUIDE



Type DT double-pole double-throw switches offer two independent single-pole double-throw circuits in one basic switch housing. Design permits several wiring combinations.

Description	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel	Operating Point
Pin plunger	10 amps L-59	**DT-2R-A7 (MS25008-1)**	3,34-5,56 12-20	0,13 .005	1,02-1,52 .040-.060	15,6 .615 ±.015
Straight lever	10 amps L-59	**DT-2RV-A7**	0,97-1,67 3.5-6	1,57 .062	12,4-19,2 .490-.755	21.8 .859 ±.030

MT MAGNETIC BLOW-OUT ORDER GUIDE



Type MT magnetic blow-out switches offer single-pole double-throw circuitry in a basic switch. Designed for switching high capacity (125 and 250 VDC) systems.

Description	Electrical Data and UL Code	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel	Operating Point
Pin plunger SPDT	10 amps L-168*	**MT-4R-A28**	3,34-5,0 12-18	0,13 .005	0,1-0,18 .004-.007	15,9 ±0,38 .625 ±.015

* UL rating established with switch non-polarized

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

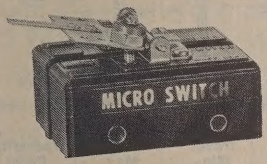
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139" (3,52mm) DIAMETER ON 1 INCH (25,4mm) CENTERS.

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

BASIC SWITCH VARIATIONS/ACCESSORIES

6AS STRAIGHT LEVER ORDER GUIDE

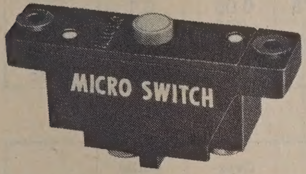
6AS switches are two basic switches ganged together and actuated by a single actuator. See Catalogs 100 or 200 for many additional variations.



Description	Electrical Data and UL Code	Typical Catalog Listing	Lever Length mm Inches	Operating Force Max.	Over-travel Min.	Differ-ential Travel Max.	Operating Point
Centered lever. Adjustment over both switches. 15 amps.	15 amps L-96	**6AS32**	58,72 2.312	2,22 8	0,51 .020	2,77 .109	18,29 .720 adj.

3MN DOUBLE-BREAK ORDER GUIDE

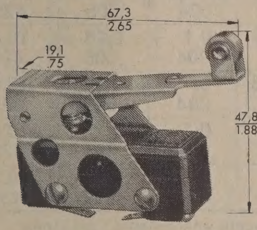
Type 3MN switches are for use with limit or control mechanisms on machine tools, presses, or other industrial equipment. The terminals of two-circuit double-break switches must be wired to equal voltage sources and the same polarity. The loads should be on the same sides of the lines.

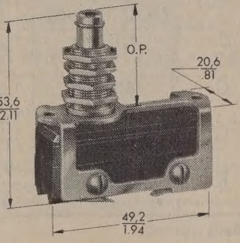


Description	Electrical Data and UL Code	Typical Catalog Listing	Operating Force	Overtravel Min.	Differential Travel	Operating Point Max.*
For most applications	15 amps Motor Control	**3MN1**	3,34-5,56 12-20	2,03 .080	0,38-0,63 .015-.025	2,16 .085

* ±0,38mm
±.015 in.

TYPE Z AUXILIARY ACTUATORS (order switches separately)





Description	For Type Z Switches	Over-travel Min.	Operating Point*	Free Position Max.
Adjustable roller lever. Tang on top of actuator can be bent to adjust O.P. and F.P.	**AD5721R** **(8805/59)** **AN3169-1**	11,1 .437 approx.	31,75-41,15 1.25-1.62	39,6-43,7 1.56-1.72
Straight plunger. Panel mount. Adjustable O.P.	**MC2711** **(8805/58)** **AN3168-2**	4,78 .188	27,79 1.094	29,4 1.156

Except where stated* ±1,14mm
±.045 in.

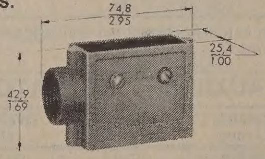
See Catalogs 100 or 200 for other variations.

ACCESSORIES

DIE CAST ALUMINUM ENCLOSURE

- Protect Switch From Physical Abuse
- Protect Personnel From Contact With Exposed Terminals
- ½-14NPSM Internal Thread Conduit Hub

3PA1 SIDE MOUNT—Can be mounted from either side through .140″ (3,55mm) dia. holes on 1″ (25,4mm) centers.



3PA1

8MA1

Key: 0,0 — mm or grams
0.00 — inches or ounces

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139″ (3,53mm) DIAMETER.

ADJUSTABLE MOUNTING BRACKET

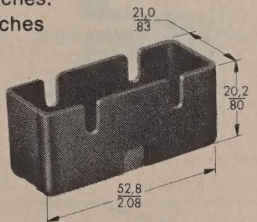
The operation point of the basic switch can be regulated up to .080″ (2mm) by loosening the locking screw, inserting a screwdriver in the adjusting slot, and twisting.

Listing 8MA1 — Has adjustment slot on the left.

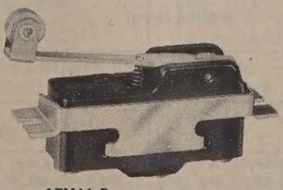
PLASTIC TERMINAL ENCLOSURES

- Protect Personnel From Contact With Exposed Terminals

5PA1—For solder terminal switches.
5PA2—For screw terminal switches



5PA2



17MA1-B

17MA1-B CONVERSION MOUNTING BRACKET

- Converts Basic Switches From Side To Top Mount

MICRO SWITCH

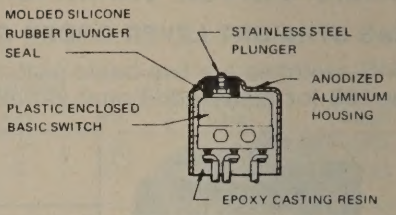
A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

TYPE SE AND XE ENVIRONMENT-PROOF SWITCHES

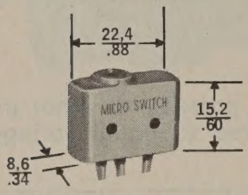
Type SE and XE switches are the smallest environment-proof switches offered by MICRO SWITCH. Both types enclose basic switches within a corrosion resistant aluminum housing. Type SE switches enclose a type SM basic switch and XE switches enclose the smaller SX basic switch.

Type SE and XE offer power load switching capability to 7 amps and temperature tolerance to 230°F (110°C) with high temperature versions to 300°F (149°C). Catalog 200 gives additional information and listings for SE and XE switches, actuators, and terminations.

TYPICAL CONSTRUCTION DETAIL

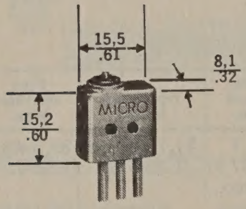

MOLDED SILICONE RUBBER PLUNGER SEAL
STAINLESS STEEL PLUNGER
ANODIZED ALUMINUM HOUSING
PLASTIC ENCLOSED BASIC SWITCH
EPOXY CASTING RESIN

ORDER GUIDE — TYPE SE ENVIRONMENT-PROOF SWITCHES



Recommended for	Electrical Data	Typical Catalog Listing	Operating Force	Over-travel Min.	Differ-ential Travel Max.	Operating Point
Most applications	A	**1SE1†**	1,39-4,73 5-17	0,08 .003	0,1 .004	10,8 .425
For customer leading	A	**1SE1-T**	1,39-4,73 5-17	0,08 .003	0,1 .004	10,8 .425
UL and CSA listing and UL and CSA listed lead wire	B L4	**4SE1†**	1,39-4,73 5-17	0,08 .003	0,1 .004	10,8 .425
Oil resistant Fluosilicone seal	A	**5SE1†**	1,39-4,73 5-17	0,08 .003	0,1 .004	10,8 .425
Oil resistant. Leadwire tolerates +392°F (200°C)	A	**6SE1†**	1,39-4,73 5-17	0,08 .003	0,1 .004	10,8 .425

ORDER GUIDE — TYPE XE ENVIRONMENT-PROOF SWITCHES



Recommended for	Electrical Data	Typical Catalog Listing	Operating Force	Over-travel Min.	Differ-ential Travel Max.	Operating Point*
Most applications MIL-S-8805 requirements	C	**1XE1†** **(MS27994-1)**	1,39-4,73 5-17	0,1 .004	0,13 .005	10,8 .425
For customer leading	C	**1XE1-T** **(MS27994-3)**	1,39-4,73 5-17	0,1 .004	0,13 .005	10,8 .425
UL listing and UL and CSA listed leadwire	D L7	**4XE1†**	1,39-4,73 5-17	0,1 .004	0,13 .005	10,8 .425
Oil resistant Fluosilicone seal	C	**5XE1†**	1,39-4,73 5-17	0,1 .004	0,13 .005	10,8 .425
Oil resistant. Leadwire tolerates +392°F (200°C)	C	**6XE1†**	1,39-4,73 5-17	0,1 .004	0,13 .005	10,8 .425
For customer leading Use to +300°F (149°C)	E	**14XE1-T**	2,5 9 max.	0,1 .004	0,13 .005	10,9 .430

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

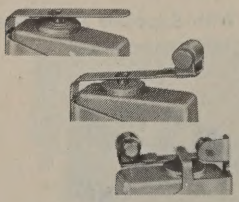
Key: 0,0 — mm or Newtons
0.00 — inches or ounces

† These listings have one foot leads. For longer leads contact your nearest MICRO SWITCH Branch Office.

Except where stated* ±0,51mm ±.020 in.

Switches held depressed for extended periods of time at temperature extremes may experience retarded plunger return upon deactuation. Where such a condition exists in the applications, contact a MICRO SWITCH Branch Office for special designs that are available.

SWITCHES ARE NOT INCLUDED WITH THE ACTUATORS



ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE SE SWITCHES

Description	Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point‡	Free Position*
Straight leaf	**JE-1‡**	3,34 12	0,38 .015	0,64 .025	11,2 .440	15 .590
Roller leaf	**JE-5**	3,34 12	0,38 .015	0,64 .025	16,3 .640	20,1 .790
Roller lever	**JE-21**	1,67 6	0,25 .010	0,41 .016	16,3 .640	18,8 .740

All characteristics taken with actuator assembled on 1SE1 switch as shown.
‡ Mounting hardware furnished.

* ±0,76mm ±.030 in.

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF 2,21/.087 DIA.

ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE XE SWITCHES

Description	Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Point	Free Position
Straight leaf	**JM-1**	5,84 21	0,23 .009	0,3 .012	10,8 ±0,76 .425 ±.030	14 ±0,76 .550 ±.030
Roller lever	**JM-5**	5,84 21	0,23 .009	0,3 .012	15,9 ±0,89 .625 ±.035	19,1 ±0,89 .750 ±.035

All characteristics taken with actuator assembled on 1XE1 switch as shown.

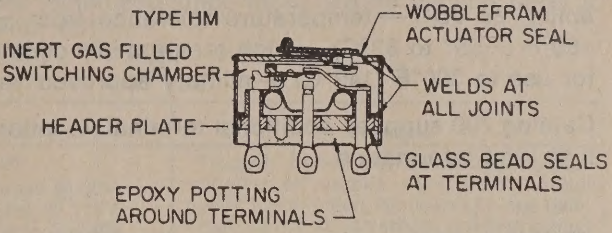
ELECTRICAL DATA

A	5 amps res., 3 amps ind. (sea level), 5 amps res., 2.5 amps ind. (50,000 feet), 28 VDC, 5 amps res., 5 amps ind., 125 or 250 VAC, 60 Hz.	C	7 amps res., 4 amps ind. (sea level), 7 amps res., 2.5 amps ind. (50,000 feet), 28 VDC, 7 amps res., 4 amps ind. sea level), 115 VAC, 400 Hz.
B	UL and CSA Rating — 5 amps, 250 VAC, 60 Hz. L4	D	UL Rating, 7 amps, 250 VAC, 60 Hz. L7
		E	7 amps res., 4 amps ind. (sea level), 7 amps res., 2.5 amps ind. (50,000 feet), 28 VDC.

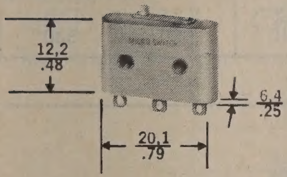
TYPE HM MINIATURE HERMETICALLY SEALED SWITCHES

Type HM miniature basic switches are the smallest hermetically sealed switches offered by MICRO SWITCH. Features include single-pole double-throw circuitry — power load switching capability to 5 amps, 28 VDC and 125 VAC, 400 Hertz — temperature tolerance from −85° to 250°F (−65° to 121°C) — high temperature version for use from −85° to 500°F (−65° to 260°C) — military approved versions.

Silver, gold, or bifurcated gold contacts are available. Additional information and listings are offered in Catalog 200.


TYPE HM
WOBBLEFRAM ACTUATOR SEAL
INERT GAS FILLED SWITCHING CHAMBER
WELDS AT ALL JOINTS
HEADER PLATE
GLASS BEAD SEALS AT TERMINALS
EPOXY POTTING AROUND TERMINALS

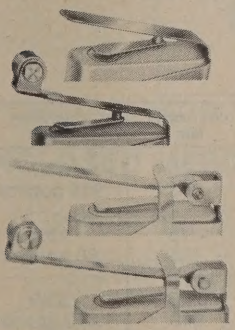
ORDER GUIDE — TYPE HM HERMETICALLY SEALED SWITCHES



Recommended for	Electrical Data	Typical Catalog Listing	Operating Force Max.	Over-travel Min.	Differential Travel Max.	Operating Point*
Most applications	F	**1HM1**	1,95 7	0,08 .003	0,15 .006	8,38 .330
Applications requiring gold contacts	H	**3HM1**	1,95 7	0,08 .003	0,15 .006	8,38 .330
Operating in temperature to 300°F (149°C)	G	**5HM1**	1,95 7	0,08 .003	0,15 .006	8,38 .330
1 foot long leads MIL-W-16878 Type E wire. Use to +500°F (260°C)	G	**6HM1-1**	1,95 7	0,08 .003	0,15 .006	8,38 .330
MIL-S-8805 application requirements	I	**1HM19 (MS27216-1)**	1,95 7	0,08 .003	0,15 .006	8,38 .330
Bifurcated gold contacts	J	**9HM1**	1,95 7	0,08 .003	0,15 .006	8,38 .330
Exceeds MIL-S-8805 requirements for shock and vibration	K	**11HM1**	1,95 7	0,08 .003	0,15 .006	8,38 .330

* ±0,38mm
±0.15 in.

ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE HM SWITCHES



Description	Temperature (Max.)	Typical Catalog Listing	Operating Force Max.	Over-travel Min.	Differential Travel Max.	Operating Point	Free Position
Leaf	500°F (260°C)	**JS-152**	2,50 9	0,76 .030	0,76 .030	8,64 .340 approx.	12,2 .480 approx.
Roller leaf	500°F (260°C)	**JS-151**	2,50 9	0,76 .030	0,76 .030	14 .550 approx.	17,5 .690 approx.
Straight lever	500°F (260°C)	**JS-307**	0,42 1.5	0,64 .025	1,42 .056	10,3 .406 approx.	—
Roller lever	500°F (260°C)	**JS-308**	0,42 1.5	0,64 .025	1,42 .056	14,3 .562 approx.	—

NOTE: Type HM switches are not generally recommended for 115 VAC, 60 Hz. If you have a 60 Hz application in the milliamp range, contact your nearest MICRO SWITCH Branch Office for assistance.

For applications that require the switch to function electrically during exposure to sub-freezing temperatures contact a MICRO SWITCH Branch Office for special design variations that are available.

ELECTRICAL DATA			
F	5 amps res., 3 amps ind., 23 VDC or 115 VAC, 400 Hz	I	4 amps res., 2 amps ind., 0.5 amps lamp load, 115 VAC, 400 Hz 4 amps res., 2 amps ind., 1 amp lamp load 28 VDC
G	4 amps res., 2 amps ind., 28 VDC 2.5 amps res. or ind., 115 VAC, 400 Hz	J	½ amp res., ¼ amp ind., (sea level or 70,000 ft.) 28 VDC
H	1 amp res., 0.25 amp ind., 28 VDC	K	3 amps res., 1 amp ind. (sea level or 70,000 ft.) 28 VDC lamp res. or ind. (sea level) 115 VAC, 400 Hz

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF 1,9/.08 DIA. ON .37 INCH (9,4mm) CENTERS.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

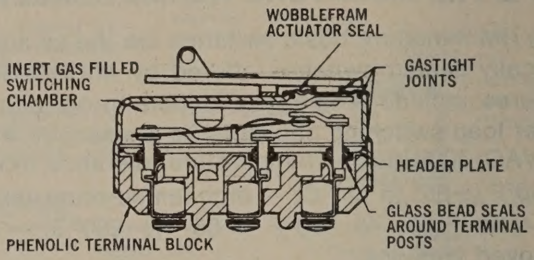
MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

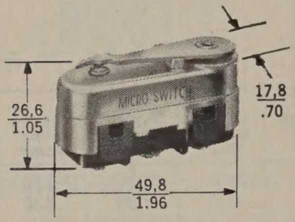
TYPE HS HERMETICALLY SEALED

Features include power load switching capability to 25 amps, 28 VDC — temperature tolerance from −67° to 180°F (−55° to 82°C) — high temperature construction for use to 300°F (149°C) — military approved versions.

Catalog 200 supplies additional terminal variations, listings, and information.



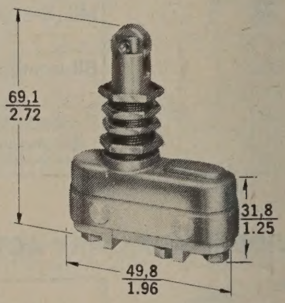
ORDER GUIDE — TYPE HS HERMETICALLY SEALED SWITCHES



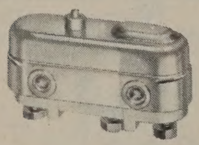
Recommended for	Electrical Data	Typical Catalog Listing	Operating Force Max.	Overtravel Min.	Differential Travel Max.	Operating Position
Most applications MIL-S-8805 (M8805/47)	L	**1HS1** **(MS25011-1)**	2,78-6,12 10-22	0,25 .010	0,51 .020	13,5 .530
Lead wire termination	M	**4HS4-118**	2,78-6,12 10-22	0,25 .010	0,51 .020	15,6 .615 ±.020
Roller lever	L	**1HS3**	2,78-6,12 10-22	0,25 .010	0,51 .020	18,3 .720
Operating in temperature to +250°F (121°C)	N	**101HS1**	2,78-6,12 10-22	0,25 .010	0,51 .020	13,5 .530

TYPE HT HIGH TEMPERATURE

Type HT switches will withstand temperatures up to +1000°F. These switches contain the switching element mounted on a ceramic base within a stainless steel enclosure. Side and panel mount are available. Catalog 200 provides additional information on HT switches.



ORDER GUIDE — TYPE HT HIGH TEMPERATURE SWITCHES



Description	Electrical Data	Catalog Listing	Operating Force	Overtravel Min.	Operating Point
Straight plunger panel mount	P	**1HT1**	2,78-5,56 10-20	4,78 .188	23,7 .935 approx.
Roller plunger panel mount	P	**3HT1**	8,34 30 max.	4,78 .188	16,8 .66 approx.
Pin plunger side mount	P	**2HT1**	2,78-5,56 10-20	0,25 .010	35,9 1.413 approx.

ELECTRICAL DATA

L	25 amps res., 10 amps ind., 5 amps motor, 3 amps lamp load, 28 VDC 1 amp res., 1 amp ind., 125 VAC, 60 Hz UL-CSA Rating: 1 amp, 125 VAC, 60 Hz
M	15 amps res., 10 amps ind., 28 VDC, 1 amp res., 1 amp ind., 125 VAC, 60 Hz
N	20 amps res., 10 amps ind., 28 VDC, 1 amp res., 1 amp ind., 125 VAC, 60 Hz UL-CSA Rating: 1 amp, 125 VAC, 60 Hz
P	10 amps res., 5 amps ind., 4 amps motor load, 2.4 amps lamp load, 28 VDC
UL	switches L110 3 amps, 1/10 HP, 125 VAC 3 amps, 1/6 HP, 250 VAC

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF .139″ (3,53mm) DIA. ON 1 INCH (25,4mm) CENTERS.

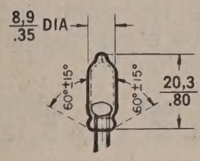
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

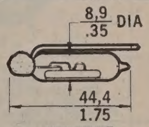
MERCURY SWITCHES

MICRO SWITCH mercury switches are glass tubes into which stationary electrodes and a pool of mercury are hermetically sealed. Tilting the tubes moves the mercury pool, which makes or breaks contact between the electrodes. There is a wide range of sizes, electrical capacities, and operating characteristics. Maintenance costs are minimized since there are no moving parts to wear out.

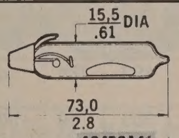
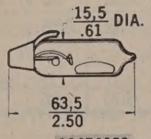
- SINGLE POLE
  SINGLE THROW
  LIGHT DUTY

Catalog Listing	Differential Angle	Electrical Data	Comments
 **AS408VO**	60° ±15° Break from vertical (one plane only)	Resistive: AC: 2 amps @ 30V 1 amp @ 115V .5 amp @ 230V DC: 1.2 amps @ 30V .6 amp @ 115V .3 amp @ 230V Inductive: Inrush current should not exceed above values. 50,000 operations at full load	"Tipover" Series. Use as safety switch on portable or mobile equipment. Circuit opens if equipment accidentally tips over. When switch is in vertical position circuit will break within 60° ±15° from vertical in one plane only as shown. Platinum wetted electrodes provide low and stable contact resistance from low energy loads to maximum rated loads. (Mercury to wetted electrode contacts.) No lead wires attached. Mtg. clip 1MR14-A

- SINGLE POLE
  SINGLE THROW
  MEDIUM DUTY

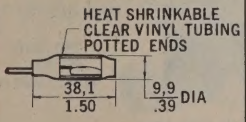
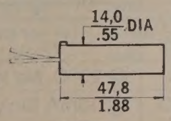
Catalog Listing	Differential Angle	Electrical Data	Comments
 **AS412A1** *	.3° to 1.2°	Resistive: 1 amp @ 115 VAC 0.6 amp @ 115 VDC Inductive: @ 30 VAC 1.5 amps steady state 3.5 amps inrush	Low Cost Precision Switch. (Mercury to dry electrode contacts.) Mtg. clip 1MR14-A

- SINGLE POLE
  SINGLE THROW
  HEAVY DUTY

Catalog Listing	Differential Angle	Electrical Data	Comments
 **AS452A41** *	1° to 3°	Resistive: AC: 30 amps @ 30V 20 amps @ 115V 10 amps @ 230V DC: 30 amps @ 30V 12 amps @ 115V 6 amps @ 230V	All switches in these families have the same tube diameter and electrode configuration. Length of tube and mercury fill determine the differential angle. NOTE: AS454A is a high capacity switch at minimum cost. (Mercury to wetted electrode contacts.)
 **AS454A89** *	2° to 5°	Motor Loads: AC: .5 hp @ 115V .5 hp @ 230V DC: .25 hp @ 115V .25 hp @ 230V AC lamp load: 1000 watts	Mtg. clips 1MR2-B or 1MR7-B

* This catalog listing has 1 inch (178mm) PVC leadwires. Other types and lengths are available. See the Mercury Switch Instruction Manual AS-1.

ENCLOSED MERCURY SWITCHES

Catalog Listing	Differential Angle	Electrical Data	Comments
 HEAT SHRINKABLE CLEAR VINYL TUBING POTTED ENDS 38,1/1.50 9,9/.39 DIA **AS408D65**	12° max.	Resistive: AC: 1.5 amps @ 30V .5 amp @ 115V DC: 2 amps @ 30V .7 amp @ 115V Inductive: Inrush current should not exceed above values.	Heat shrinkable clear vinyl tubing over switch. Ends are potted. (Mercury to dry electrode contacts.) Listing has 7.75 inch (197mm) PVC leads. Mtg. clip 1MR14-A
 **7MP1-2**	12° max.	Resistive AC: 8 amps @ 30V 4.5 amps @ 115V 2.25 amps @ 230V DC: 8 amps @ 30V 3 amps @ 115V 1.5 amps @ 230V Motor Loads: AC: 1/20 hp @ 115V & 230V DC: 1/40 hp @ 115V & 230V AC Lamp Load: 225 watts	Polypropylene can. The basic switch is AS417B. (Mercury to dry electrode contacts.) Listing has 6 inch (152mm) PVC leads. Mtg. clip 2MR4-B

FOR FURTHER INFORMATION

Request a copy of the Mercury Switch Instruction Manual AS-1 for application data and details on other variations available. Mounting clips described in Catalog 200.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

SERIES SR MAGNETICALLY OPERATED SOLID STATE PROXIMITY SENSORS

Series SR solid state Hall effect sensors are versatile, reliable devices operated by the magnetic field of a magnet or electromagnet. They can be used directly with electronic circuits, such as discrete transistors, integrated logic, or SCR's. The digital level output eliminates the need for conditioning circuitry to obtain a square wave output.

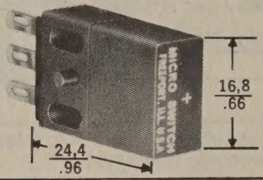
400SR SENSORS

The rugged 400SR plastic package has elongated mounting holes which simplify mounting and adjustment. Solder quick-connect (3-pin) terminals accept standard .110 x .020 push-on connectors. A locating boss aids in sensor orientation and gang mounting. The boss corresponds to an indentation on the other side of the housing to facilitate positioning. A silver cross mark on the sensor face identifies the sensitive area for accuracy in magnet location.

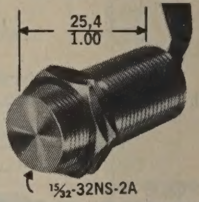
103SR SENSORS

Solid state circuitry for the 103SR is sealed in a threaded aluminum bushing providing environmental protection, plus ease of mounting and adjustment. Six-inch 20-gage stranded leadwires are color coded (other types and lengths are available). The output can be either digital current sourcing, sinking, or analog (linear).

These sensors meet the applicable portions of NEMA Type 3, 3R, 3S, 4, 4X, 6, 12 and 13 classifications.



For more information, see Product Sheets SR and 400SR. Data is included on magnetic field sensor, interfacing, magnets and Calibrated Hall Element.



Catalog Listing	Supply Voltage	Output Type Operating Temperature °C	Output Current	Output Voltage	Supply Current	Switching Time µsec Rise	Switching Time µsec Fall	Leakage Current µ amps	Magnetic Characteristics Op Gauss Max.	Op Gauss Typ.	Rel. Gauss Min.	Rel. Gauss Typ.	Diff. Gauss Min.	Diff. Gauss Typ.
103SR5A-1*	4.5-9.0	Digital (sinking) −40 to +100	8mA	.4V max.	4mA max.	0.5	0.5	5 max.	575	352	82	213	82	140
103SR11A-1*	4.5-7.0	Digital (sourcing) −40 to +100	20mA	3.4V min.	4mA max.	0.5	1.5	5 max.	575	352	82	213	82	140
103SR13A-1†	6-16	Digital (sinking)	20mA	.4V max.	3-5mA	1.5	0.5	10 max.	492	328	40	246	33	82
103SR17A-1†		−40 to +105							205	49	−205	−49	33	98
413SR10†		−40 to +150						20 max.	600	400	50	300	40	100
417SR10†		−40 to +150							250	60	250	60	40	120
103SR12A-1†	6-16	Digital (sourcing) −40 to +105	10mA	(Vs-2)V min.	3-5mA	0.5	2.0	10 max.	492	328	40	246	33	82
412SR10†		−40 to +150	20mA					20 max.	600	400	50	300	40	100

* Operating characteristics apply at 24° ±2°C and 5 VDC ±.5% supply.
† Operating characteristics apply over the full temperature range and 6-16 VDC supply.

SERIES XK FERROUS METALS SENSITIVE PROXIMITY SENSORS

Series XK Proximity Sensors are ferromagnetic metals sensitive and will detect stationary or moving targets. They are actuated without physical contact or attraction between the sensor target. Ordinary ferrous metal of any thickness or thin non-ferrous metal foil targets will operate the device.

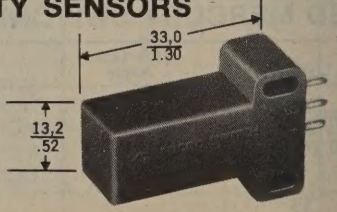
Completely self-contained, XK sensors utilize the Eddy current principle.

These sensors meet the applicable portions of NEMA Type 3, 3R, 3S, and 13 classifications. They are capable of being gang mounted for use in cam sequencing applications.

ORDERING INFORMATION

Catalog Listing	Termination
101XK11-1	One foot of 22 Gage stranded, irradiated PVC insulation
101XK11-Q	Accepts AMP "110" faston or other .110 x .020" push-on terminals

For more information, see Product Sheet XK.



LEADWIRE TERMINATION AVAILABLE

OPERATING CHARACTERISTICS

	Min.	Max.	Remarks
Supply Voltage (V_s)	6 VDC	16 VDC	
Load Voltage (V_L)		25 VDC	
Supply Current		18mA	@ 25°C, No load
Output Voltage Operated (Target Present)		0.4 VDC	@ 10mA Sinking
Output Leakage Current Released (No Target Present)		5µA	
Output Switching Time (Sinking 20mA) Rise Time		1.0µsec.	10% to 90%
Fall Time		1.0µsec.	90% to 10%

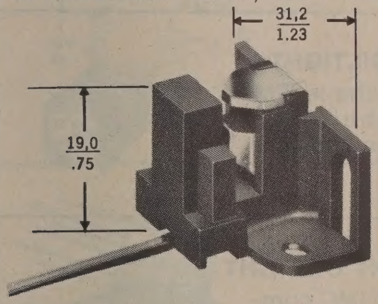
AV SERIES VANE OPERATED SOLID STATE POSITION SENSORS

Series AV incorporates a Hall effect sensor and magnet in a rugged easy-to-apply package. It is operated by passing a ferrous vane through the gap between the magnet and Hall sensor. The vane shunts the magnetic flux from the Hall sensor, causing a digital output to be produced.

Unlike magnetic pick-ups, there is no minimum speed of operation. The AV may be operated at any speed from 0 to 100 kHz. As long as the vane is in the gap, the output remains in the operated condition. The On and Off time can be programmed by the dimension of the vane, enabling the sensor to be used in many application situations.

The AV may be used as a limit switch by operating with one large vane; as a tachometer sensor by using a toothed wheel; or as a machinery synchronizing element by using a cam or sector. Leadwires or 3 pin solder/quick-connect termination is available. The housing material and leadwires are UL recognized.

For more information, see Product Sheet AV.



ELECTRICAL CHARACTERISTICS

	Min.	Typ.	Max.	Remarks
Supply Current	—	3mA	—	Plus load current V_s = 6 volts
	—	5mA	13mA	V_s = 16 volts
Output Voltage (no vane in gap)				
Sinking	—	—	0.4V	Sinking 20mA max.
Sourcing	$(V_s$-2)V	$(V_s$-1.5)V	—	Sourcing 20mA max.
Output Leakage Current (vane in gap)				
Sinking	—	—	10μA	Leakage into switch output
Sourcing	—	—	10μA	Leakage from switch output
Output Switching Time				With 20mA load
Sinking Rise	—	0.2μsec.	1.5μsec.	10% to 90%
Fall	—	0.1μsec.	0.5μsec	90% to 10%
Sourcing Rise	—	0.1μsec.	0.5μsec.	10% to 90%
Fall	—	0.5μsec.	2.0μsec.	90% to 10%

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_s)	Continuous: −1.2 VDC and +20 VDC
Voltage externally applied to output	Sinking: +20 VDC max. (vane in gap only) −0.5 VDC (vane in or out of gap)
	Sourcing: +6.5 VDC max. (vane in gap) (V_s +4) VDC (no vane in gap)
Load on Output	40mA continuous
Temperature	−40° to +150°C (−40° to +302°F)

ORDERING GUIDE

Catalog Listing	Type of Output Circuit	Termination
1AV2A	Sinking	Leadwires
1AV3A	Sinking	Solder/quick-connect
1AV2B	Sourcing	Leadwires
1AV3B	Sourcing	Solder/quick-connect

SERIES FW MINIATURE SELF CONTAINED PROXIMITY CONTROLS

100FW SERIES

Series 100FW proximity switches utilize the eddy current principle. They are actuated by metal objects without physical contact.

Shielded Sensor. Switches with a shielded sensor have the housing extended flush to the sensing face, thus shielding the sensor from the effect of metallic material that might be located near the sides of the switch.

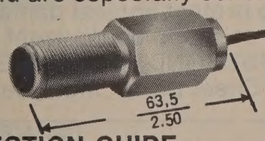
Unshielded Sensor. Switches with an unshielded sensor have a longer operating point than the shielded design. 100FW series switches detect all metals and are especially sensitive to ferrous types.

200FW SERIES

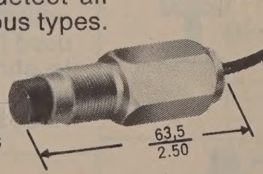
Series 200FW proximity switches are operated by the magnetic field of a permanent magnet or electromagnet. The switching element is a Hall sensor with a digital output.

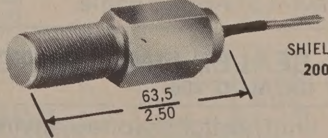
Sensor Design. The sensor is completely shielded with an all-metal face which provides physical and environmental protection to the switch. Since the 200FW is not affected by surrounding non-ferrous metals, the sensor can be used in applications that require detection of movement through a non-ferrous wall.

SHIELDED SENSOR
112FW SERIES



UNSHIELDED SENSOR
122FW SERIES





SHIELDED SENSOR
200FW SERIES

FW SELECTION GUIDE

Input Voltage	Input Current	Type	Output Current	Output Voltage	Sensing Range Shielded	Sensing Range Unshielded	Catalog Listing	Termination	Circuitry	Temperature Range
18 to 32 VDC	20mA max.	Sinking	120mA max. Res. or Ind.	1.0 VDC max. Actuated	2,41mm* .095 in.		**112FW12-R1**	Conn.	SPNO	−65°F −54°C to +257°F +125°C
							112FW12-4	Wire		
			50mA max. Lamp	32 VDC max. Deactuated		5,84mm* .230 in.	**122FW12-R1**	Conn.		
							122FW12-4	Wire		
			50mA max. Lamp	0.4 VDC max. Actuated 32 VDC max. Deactuated	350 gauss max. required to operate 30 gauss min. required to release.		**212FW10-R**	Conn.	SPNO	−65°F −54°C to +212°F +100°C
							212FW10-4	Wire		

* With standard actuator 15,875 dia. x 1,585 thick (.625 dia. x .062 thick) SAE 1020 steel (Head-on mode).

MICRO SWITCH

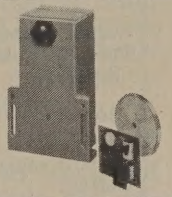
A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

OTHER PRODUCTS

NO-TOUCH POSITION SENSING SWITCHES

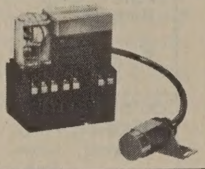
REQUEST CATALOG 100.

PHOTOELECTRIC CONTROLS



Photoelectric controls detect opaque or translucent materials at short or long range. The many types provide you with the broadest selection available.

PROXIMITY CONTROLS



Proximity controls respond to the nearness of metal. MICRO SWITCH offers the most complete line in the industry.

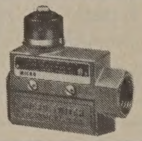
ELECTRO MECHANICAL POSITION SENSING SWITCHES

REQUEST CATALOG 100.

OILTIGHT LIMIT SWITCHES

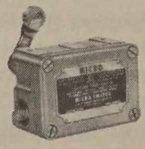
Various limit switches provide years of application proven reliability even in the most demanding environmental conditions.

ENCLOSED SWITCHES



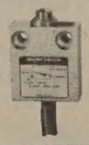
Enclosed switches provide a wide selection of sizes, sealing, actuation, circuitries and electrical ratings.

EXPLOSION-PROOF SWITCHES



Some explosion-proof switches are fully interchangeable with non-explosion proof types. Others are both explosion-proof and sealed for use in outdoor hazardous applications.

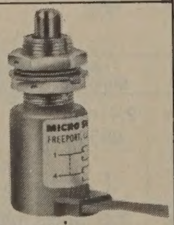
MINIATURE OILTIGHT LIMIT SWITCHES



The "914CE" are miniature enclosed switches. They are environmentally sealed and have a pre-wired cable.

SMALL SEALED LIMIT SWITCHES

REQUEST CATALOG 200.

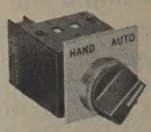


"EN" limit switches offer environment-proof versatility. Many combinations of actuators, circuitries, terminals and electrical ratings are offered for military aerospace and commercial aircraft applications.
The "HE" is a hermetically sealed version of the EN switch. Applications will be similar except the HE meets maximum sealing requirements.
"HR" switches combine hermetic sealing with high temperature capabilities.

MANUALLY OPERATED CONTROLS

REQUEST CATALOG 100.

PW MINIATURE OILTIGHT

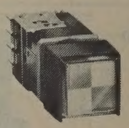


Square format PW Miniature oiltight manual controls save panel space yet provide much of the same operating choices as heavy duty oiltight devices.

PT HEAVY DUTY OILTIGHT

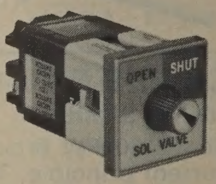
Heavy duty oiltight controls use tandem mounted contact blocks for multiple circuitry choices. Large square legend plates communicate even under the worst conditions.

PM COMPACT OILTIGHT



Modern square shape PM compact pushbuttons/indicators are the smallest oiltight controls.

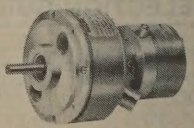
CMC MULTILIGHT OILTIGHT



MICRO SWITCH CMC combines switching, indicator and legend into a single unit with up to 16 heavy duty or 32 electronic duty circuits in an almost unlimited sequence of actuation.

ES CURRENT SENSOR

The ES package contains a solid state Hall sensor operated by a very low resistance coil. A digital output is provided as long as the current exceeds the specified level. They are used in circuits to protect against damage due to short circuits or other overcurrent conditions. 100 MICROSECOND RESPONSE TIME. Request Product Sheet ES for more details.



DC CONTROL MOTORS

If you'd like to give your products a faster start, ask us about our complete line of low inertia motors with fast acceleration and deceleration. Sizes from 1 to 6 inches diameter, with integral tachometer options. Request product sheets for more details.

MINELCO

A TALLEY INDUSTRIES COMPANY

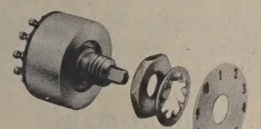
Dept. EM, 135 South Main St., Thomaston, CT. 06787.
Phone: 203-283-8261 TWX: 710-475-1091

SWITCHES

also see

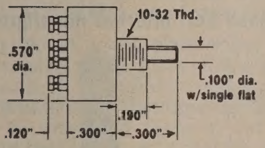
- MINELCO INDICATORS
- MINELCO LED INDICATORS
- MINELCO ELAPSED TIME INDICATORS

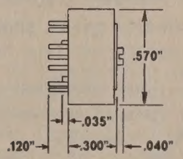
Minelco Miniature Rotary Selector Switches



Model SW67S

Model SW62S


.570"
dia.
10-32 Thd.
.100" dia.
w/single flat
.190"
.120"
.300"
.300"


.570"
.035"
.120"
.300"
.040"

Model SW62S (PC board mounting)
Model SW67S (Panel mounting)

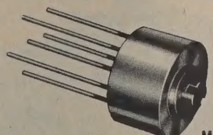
Low-cost, low profile reliable rotary switches, with up to 10 factory-set stops, featuring patented "poker chip" detent action for fast, positive positioning. Detent index is 36 degrees. Both models measure .570" dia. and .300" high. They have molded-in terminals and a slotted shaft for screwdriver adjustment.

Model SW62S has molded-in spacers for PC board standoff.

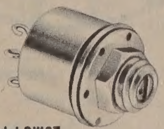
Model SW67S is O-Ring sealed, both shaft-to-bushing and bushing-to-panel.

See Bulletin S-67 for detailed specifications.

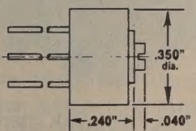
Patent No. 3,596,013

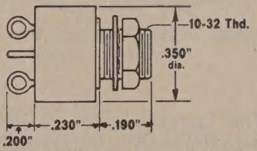


Model SW32



Model SW37


.350"
dia.
.240"
.040"


10-32 Thd.
.350"
dia.
.230"
.190"
.200"

Model SW32 (PC board mounting)
Model SW37 (Panel mounting)

Lowest profile switches available. These O-Ring sealed rotary selector switches provide control of several circuits in an absolute minimum of space. Detent action is at 60 degree intervals. Both switches measure .350" in diameter. They are ideally suited for miniaturized electronic and communications equipment and testing circuitry.

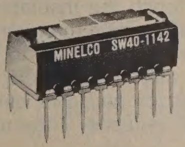
Model SW32 has ½ inch tinned terminal leads.

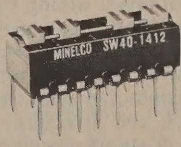
Model SW37 has solder-lug terminals.

See Bulletin S-66A for detailed specifications.

Patent No. 3,260,805

Miniature DIP Slide Switches


MINELCO SW40-1142


MINELCO SW40-1412

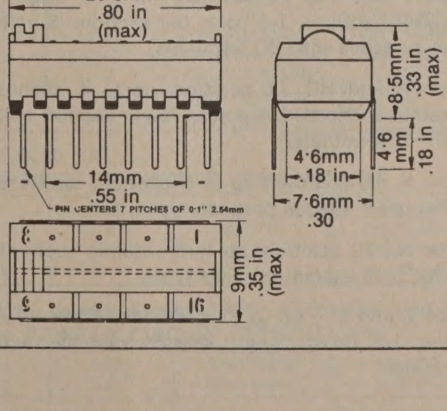
Model SW-40

Minelco Miniature DIP Slide Switches are available in the widest variety of switching combinations in the industry. They feature true "make-before-break" action and have spring loaded, double ball bearing detent action for smooth and positive location of each switching position.

Each switch can perform many functions. They are designed for a wide variety of applications. Clear plastic cover optional.

See Bulletin SW-69
for detailed specifications

Dimensions


20·5mm
.80 in
(max)
14mm
.55 in
PIN CENTERS 7 PITCHES OF 0·1" 2.54mm
8·5mm
.33 in
(max)
4·6
mm
.18 in
4·6mm
.18 in
7·6mm
.30
9mm
.35 in
(max)
8
1
9
16

OAK Industries Inc.

SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014

TELEPHONE: 815 • 459 • 5000 ■ TWX: 910 • 634 • 3353 ■ TELEX: 72 • 2447

ROTARY SWITCHES

There's an Oak Product For Almost Every Switching Need.

The Switch Division of Oak Industries Inc. offers the industry's broadest range of switching devices. Switch types include:

Rotary	**Rocker**
Lever	**Toggle**
Pushbutton	**Keylock**
Keyboard	

A complete line of solenoids; rotary, linear, tubular, stepping switch and the Magton high precision rotary solenoids are also available from OAK. See **eem** Page 3614 Solenoid Product Section 4500 for additional information.

There are dozens of catalogs that describe the products in detail. Only a limited amount of data is given in these pages. Contact your OAK distributor or field sales office, listed in the directory section of **eem**, for catalogs and product information.

A major service to switch users is Oak's complete in-house fabricating, and assembly capability. Oak can handle all metalworking, wiring and PC board attachment requirements, to deliver a finished switch subassembly ready to incorporate into your equipment.

For IMMEDIATE DELIVERY, most popular types of Oak Switches are available from stock through a nationwide network of electronic distributors.

ROTARY SWITCHES

STANDARD TYPES

The most extensive line of stock rotary switches in the industry, from ½" diameter to 2$\frac{5}{16}$" diameter are available. A wide range of the most popular types, are stocked for immediate delivery by OAK distributors nationwide.

OFF-THE-SHELF SWITCHES

Typical of the variety of switch configurations is the distributor product listing for the Type AM "Acorn" 1" diameter switch shown on the next page. In addition, a similar choice of switches is available on the types listed below:

- ½" Subminiature enclosed, 11 position, up to 4 sections, 1-3 poles per section. Single section switches with PC terminals.
- 1$\frac{5}{16}$" Type F and FC, 11 position, up to 2 phenolic or ceramic sections, 1-4 poles per section. (Single section switches with PC terminals).
- 1⅞" Type H and HC, 11 position, up to 4 phenolic or ceramic sections. 1-4 poles. Single section switches with PC terminals.
- 1$\frac{17}{32}$" Type K, 12 position, up to 6 phenolic sections, 1-6 poles, plus special purpose types.
- 1$\frac{17}{32}$" Type JC, 12 position, up to 5 ceramic sections, 1-6 poles, plus special purpose types.
- 2$\frac{5}{16}$" Type L and MF, up to 23 positions, 4 phenolic sections, 1-2 poles. Single section switches with PC terminals.

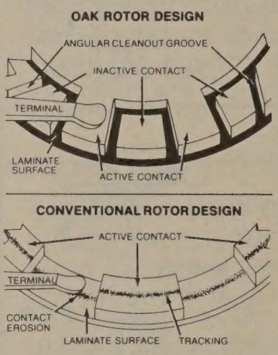
MODULINE™ ROTARY SWITCHES

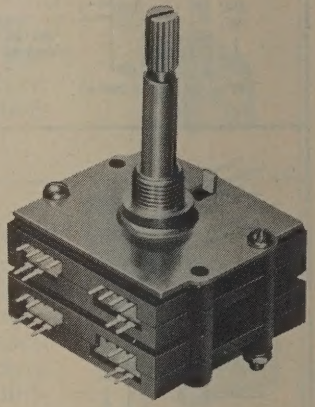
In addition to the complete assembled, off-the-shelf switches, the MODULINE program offers you an almost unlimited choice of switch modifications, with fast delivery from the distributor's factory-approved assembly facility. You can select the detent angle, switching configuration, shaft length, shaft end, shaft angle and bushing style, in up to 5-section switches.

MODULINE switches are generally shipped by the distributor in 3 days or less, depending on quantity. Request Form SP-467 for more information.

NEW "COMMUNICATOR" PROGRAMMABLE UP TO 60 POSITION ROTARY SWITCH

Eliminates opens, shorts, backlash and internal misalignment





The Communicator Series rotary switches from Oak mark a breakthrough in rotary switch design. Functional design innovations offer unparalleled long-term contact registry and switch integrity. For the first time ever, a switch capable of up to sixty positions can be offered with guaranteed switch position accuracy for the life of the switch.

The exclusive rotor design assures high dependability because the stationary wiping contacts never touch the insulator surface. Instead, they move from electrically active to electrically inactive metal surfaces. Tracking is eliminated due to Oak's exclusive clean-out grooves and rotor circuit design. In addition, contact erosion or the formation of particles between contact and insulator is drastically reduced. Intermittent opens or shorts are eliminated.

Index notches in the edge of the PC board rotor function as a cam for the detent mechanism. Since the rotor and cam are of one piece construction, misalignment between detent and contact as well as backlash from loose rotors is virtually impossible!

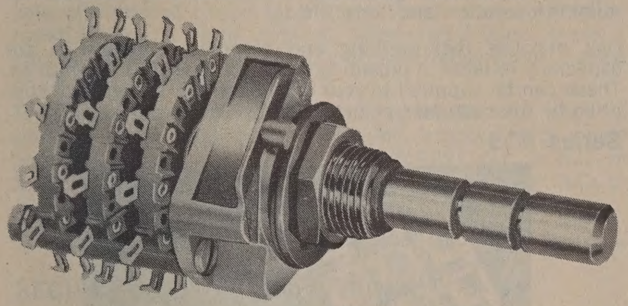
Fully programmable design with up to 60 detent positions are available. Oak will design a metalization layout for the double-sided PC board to match your truth table and provide the desired outputs. A single section can accommodate two seven-segment readouts or two eight-bit binary codes with separate commons. The number of switch positions is programmed by changing the number of index notches cut into the board edge. Request Form F-890 for more information.

OAK Industries Inc.
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: 815 • 459 • 5000 ■ TWX: 910 • 634 • 3353 ■ TELEX: 72 • 2447

ROTARY SWITCHES

Typical of Distributor Availabilities is this Listing from the Oak Distributor Catalog

TYPE AM "ACORN" 1″ ROTARY SWITCH



Rugged miniature switches with diallyl phthalate stators insulation and acetal copolymer rotors.

Designed to meet demanding electrical and mechanical requirements. Only 1″ in diameter, ideal for spacesaving applications in transistorized circuits, miniature electronic equipment and instrumentation. Materials and finishes suitable to withstand 50-hour salt spray test. Contacts are silver plated brass with gold plating. Offer longest shelf life and easy solderability; double-wiping and self-cleaning. For unusually severe circuit requirements, use switches with silver alloy contacts, listed below.

SPECIFICATIONS

SIZE: 1″ dia. nominal, with 1 to 3 sections. Max. Depth, 1³⁄₃₂″.

MOUNTING: Single hole, with ⅜-32 bushing, ⅜″ long. Locating lug on ⅜″ radius.

SHAFT: .250 $^{+.000}_{-.003}$; 1½″ long; grooved for break-off at ¾″, 1⅛″.

INDEXING: Unidex™ 30°.

STOP STRENGTH: One fixed stop, 15 in./lbs.; one adjustable stop, 10 in./lbs.

STATOR INSULATION: Diallyl Phthalate per MIL-M-14.

ROTOR INSULATION: Celcon (Acetal Copolymer).

FINISH: Suitable to withstand 50-hour salt spray per MIL-S-3786.

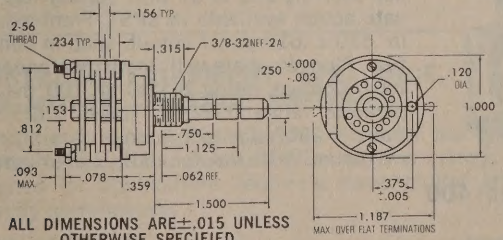
CONTACTS STANDARD: Silver plated brass, with additional gold plating of 15 millionths.

CONTACT RESISTANCE: 0.003 to .015 ohms.

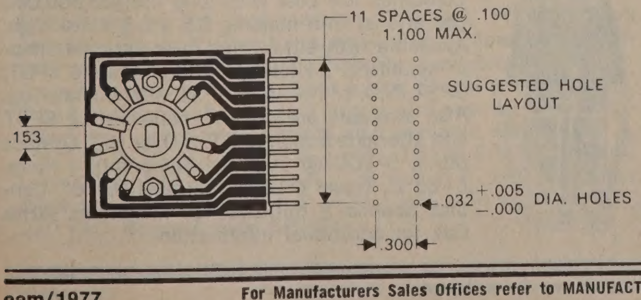
ELECTRICAL RATING: Break .5 amp at 28 volts DC, 0.25 amp at 110 volts, AC, resistive. Carry 5 amps.

HARDWARE: Includes ⅜-32 mounting nut and lockwasher.

PACKAGING: Oakote protective packaging protects switches from tarnish and corrosion.



ALL DIMENSIONS ARE±.015 UNLESS OTHERWISE SPECIFIED.



COMPLETE SWITCHES

WITH STANDARD CONTACTS — 50 HOUR SALT SPRAY

Total Poles	Active Positions	Poles Section	No. of Sections	Catalog Number	
				Shorting	Non-Shorting
1	2-12	1	1	399279-AM	399280-AM
2	2-6	2	1	399281-AM	399282-AM
2	2-12	1	2	399283-AM	399284-AM
3	2-5	3	1	399260-AM	399261-AM
3	2-12	1	3	399285-AM	399286-AM
4	2	4	1	399289-AM	399290-AM
4	2-6	2	2	399287-AM	399288-AM
5	2-3	5	1	399262-AM	399263-AM
6	2-5	3	2	399264-AM	399265-AM
6	2-6	2	3	399291-AM	399292-AM
8	2	4	2	399293-AM	399294-AM
9	2-5	3	3	399266-AM	399267-AM
10	2-3	5	2	399268-AM	399269-AM
15	2-3	5	3	399270-AM	399271-AM

WITH SILVER ALLOY CONTACT

1	2-12	1	1	399272-AM	399273-AM

WITH PC TERMINATIONS*

1	2-12	1	1	399048-AM	399049-AM
2	2-6	2	1	399050-AM	399051-AM
3	2-5	3	1	399052-AM	399053-AM
6	2	6	1	399054-AM	399055-AM

* Standard printed circuit board hole patterns are available from your local distributor. Request Drawing Number 302300-101.

SWITCH COMPONENTS

Shaft and Index Assemblies for design and development of special subminiature switch types. Use with separate switch sections to construct subminiature switches for special applications. Include mounting nut and lockwasher, stop washer, strut screws and spacers, washers, nuts. Indexing, 2 to 12 positions.

Shaft depth 1″ — Catalog No. 399257-A
Shaft depth 4½″ — Catalog No. 399258-A

SEPARATE SECTIONS — ONLY

Total Poles	Active Positions	Section Type	Catalog Number	
			Shorting	Non-Shorting
1	2-12	Std.	399114-AM	399174-AM
2	2-6	Std.	399115-AM	399175-AM
3	2-5	Std.	399106-AM	399107-AM
4	2	Std.	399116-AM	399176-AM
5	2-3	Std.	399108-AM	399109-AM
1	2-11	Notched Blade	399117-AM	—
1	2-10	Consecutive Shorting	399118-AM	—
1	—	Capacitor Decode	—	399177-AM
1	—	Resistor Decode	—	399178-AM
1	—	Binary Coded 0-11	—	399259-AM

SECTIONS ONLY — WITH PRINTED CIRCUIT TERMINATIONS

1	2-12	Std. P.C.	399136-AM	399137-AM
2	2-6	Std. P.C.	399138-AM	399139-AM
3	2-5	Std. P.C.	399156-AM	399157-AM
6	2	Std. P.C.	399158-AM	399159-AM

SILVER, GLASS EPOXY, 'PCB' SECTIONS ONLY — WITH PRINTED CIRCUIT TERMINATIONS

1	2-12	Glass Epoxy	4-1432-755	4-1442-140
2	2-6	Glass Epoxy	4-2552-115	4-2552-415

OAK Industries Inc.

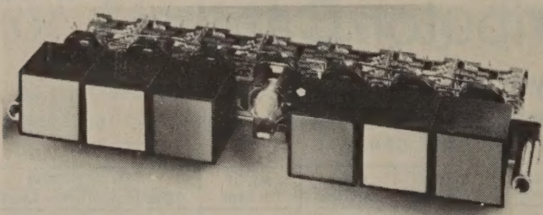
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014

TELEPHONE: 815•459•5000 ■ TWX: 910•634•3353 ■ TELEX: 72•2447

PUSHBUTTON AND KEYBOARD SWITCHES

Illuminated Pushbutton Switches

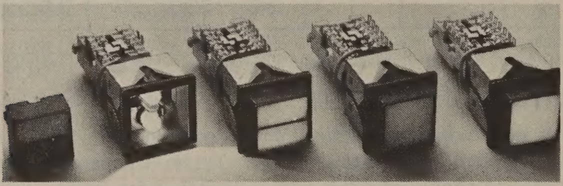
Series 300



The Series 300 pushbutton switches are constructed for reliable performance and long life (500,000 minimum) in demanding applications. Single, dual and four-lamp displays, with momentary, interlock, alternate action or indicator available on the same switch bank. Switching up to 4PDT. Modular design, with up to 12 stations on a single bank, in any switching mix. Front relampable, with replaceable legend plates and button assemblies. Lamps are stationary, eliminating movement when button is actuated. Lamp terminals are independent of switch and can be factory wired.

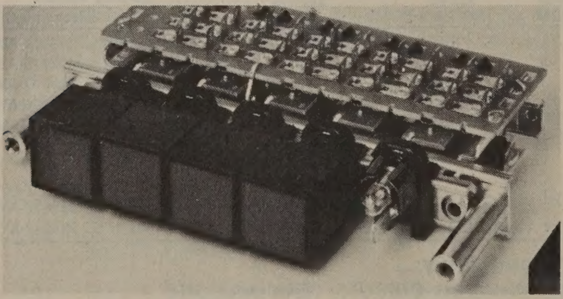
Options include solder clip, printed circuit clip or printed circuit lug, terminals; choice of lunar white, white, red, green, amber, yellow, orange or blue legend plates. Rated at 0.5 A @ 28 VDC, 0.25 A @ 110 VAC for silver plated brass contacts, at 1.0 A @ 28 VDC, 0.5 A @ 110 VAC for solid silver contacts. For more information request Form F-853.

Series 300SL



Single pushbutton switches with snap-in construction for fast mounting. Same reliable switch design as Model 300, with some options and ratings. Single or split display with dual-lamp construction. Button housing has finger grip for easy removal to permit lamp replacement from front of panel. For more information request Form F-853.

Series 1300



Series 1300 switches are low cost, single-lamp, single display, front relampable units that can be supplied with up to 21 buttons on a bank. Buttons are on ¾" centers. Low power modules, rated 1 A @ 28 VDC have up to 10-pole switching capability. Power type, rated 6 A @ 125 VAC available as DPDT or 4PDT. Button operations include normal latching, momentary, accumulative latching, notched latching, push-push, group latching and mechanical or electrical blockout.

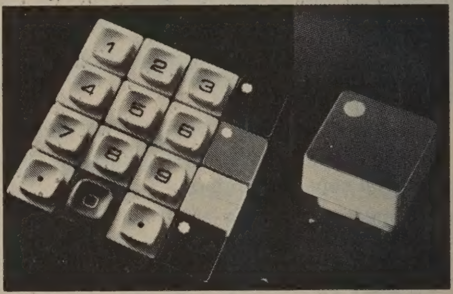
Keyboard Switches

Four series of Oak keyboard switches offer a wide range of design options for any application from data entry terminals to business machines.

All series can be supplied in a wide range of key colors and legends. All feature gold-alloy, crossbar-wiping contacts for reliable operation and long life.

Oak in-house metalworking and assembly capabilities are especially reliable in providing complete keyboard assemblies. These can be supplied to your specifications, using parts supplied by the customer, or produced by Oak.

Series 415



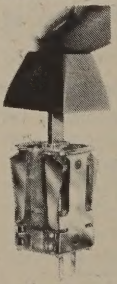
The low-profile Series 415 has a height of 0.415" above the printed circuit board and is available with either ⅝" or ¾" square buttons, or rectangular for two station operation.

SPST, normally open, tested to 10 million operations. Temperature range −20°C to +75°C. Travel 0.100", pretravel 0.70". Contact bounce 3 milliseconds maximum. Write Oak for additional information.

Series 415LED

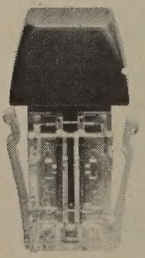
The basic Series 415 switch, with flat top and light emitting diode to provide positive visual confirmation of data entry and operation status. Eliminates errors in operation of data terminals, communications, security and educational equipment. 0.610" square buttons allow the Model 415LED to be combined with Model 415 on the same keyboard array. (Request Bulletin F-729 for additional information).

Series 475



The compact, high reliability Series 475 switches have been tested for more than 20 million operations. Available switching actions include SPST and DPST, N.O. or N.C., SPDT non-shorting and SPST with dummy lug. Alternate action available in SPST. Front-mounting in .510 x .610 panel cutout, snap-in construction. Plungers mate with industry standard key tops. Contact rating 5 VDC @ 100 ma. Temperature range 0-85°C. Travel 0.125". Pretravel 0.090". Contact bounce 3 milliseconds maximum. Write Oak for additional information.

Series 400



Combines low cost with long life (20,000,000 operations) in a housing 0.5 x 0.5 x 1.0 high. Available with either plug-in or optional snap-in mounting. Switching options include SPST, DPST, N.O. or N.C. and SPST with dummy lug. Also available are positive non-shorting SPDT and alternate action SPST, N.O. or N.C. Contact rating 5 VDC @ 100 ma. Temperature range 0-85°C. Travel 0.125". Pretravel 0.070". Contact bounce 3 milliseconds maximum. Write Oak for additional information.

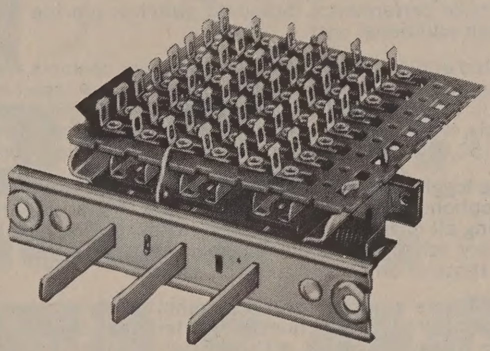
OAK Industries Inc.
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: 815 • 459 • 5000 ■ TWX: 910 • 634 • 3353 ■ TELEX: 72 • 2447

PUSHBUTTON, KEYLOCK AND POWER ROTARY SWITCHES

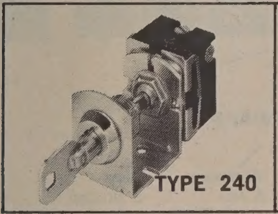
MULTIPLE PUSHBUTTON SWITCHES

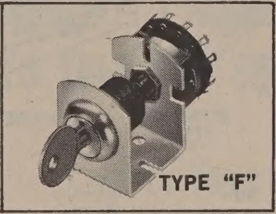
Full flexibility, permitting a wide range of circuit design possibilities, is incorporated in Oak's multiple pushbutton switches. Available with solder tab terminals, quick connecting terminals, and printed circuit tabs. Current and voltage ratings on resistive load at room ambient: silver-plated brass, break 1 amp at 28 VDC, 0.5 amp at 110 VAC; silver alloy, break 2 amps at 28 VDC, 1 amp at 110 VAC.

Type 130 (shown) provides from 1 to 21 buttons with ¾″ spacing, or 1 to 25 buttons with ⅝″ spacing. With single phenolic insulator, switching is up to 6 SPST, N.O. or N.C., or 5 SPDT; with stators on two sides, 12 SPST, N.O. or N.C., or 10 SPDT. Request Form SP-684 for more information.



SECURITY KEYLOCK SWITCHES


TYPE 240

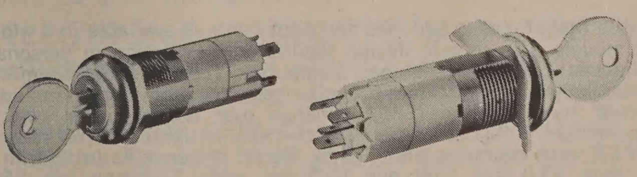

TYPE "F"

For applications requiring maximum security. Oak provides keylock switches for power requirement of 1 to 38 amps and from 2 to 8 switching positions. These tamper-proof keylocks are available in cylindrical and flat key styles with a wide range of standard key pull locations.

The economical Type 240 keyswitch series for industrial equipment and appliances handle power input ratings of 7½ to 38 amps, including motor ratings of ¼ to 1 H.P., 120 V, or 2 H.P. at 240 V. Single or double pole switching is available with indexing from 2 to 8 positions with key pull locations in increments of 45 degrees. Request Form SP-735 for additional information.

Low power rotary switching with keylock security utilizes the Oak "F" type switch, which features a patented Unidex™ detent with a choice of 36, 45, 60, and 90 degrees throw with key pull locations in increments of 45 degrees. Current and voltage ratings with resistive load at room ambient: silver-plated brass break 1 amp at 28 VDC; 0.5 amp at 110 VAC; silver alloy break 2 amps at 28 VDC; 1 amp at 110 VAC. Multiple section switches available. Request Form F-706 for further information.

ANTI-STATIC KEYLOCK SWITCHES



Combines security with equipment circuit protection against static discharges that can reach 20,000 volts under appropriate atmospheric conditions. Essential in data terminals, and any other low current devices. Long life, up to 10,000 operations, UL and CSA listed with wide range of key and switching options.

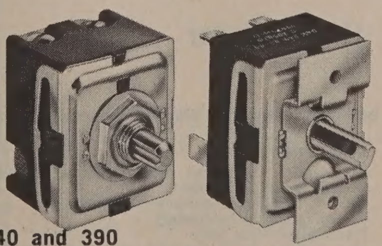
Operating voltages from dry circuit to 4 amps @ 120 VAC: ¾″ diameter x 2$\frac{1}{16}$″ deep for high density packaging. Switching enclosed: SPST, SPDT, SP3T, SP4T, DPST. Electrical ratings: 1.0 amp @ 28 VDC, 4.0 amps at 120 VAC, Contact resistance: 10 milliohms. Request Form F-781 for additional information.

ELECTRICAL EQUIPMENT, APPLIANCE, AND MOTOR CONTROL SWITCHES

Oak offers three series of rotary switches for the control of diverse electrical equipment, appliances, and motors. All are designed for applications requiring compactness and high capacity performance.

Series 910

Engineered on the long-accepted "Diamond H" slow-break principle, Series 910 switches provide high capacity, dependable switching, and years of reliability. Available with 2, 4, or 6 spade terminals for simplified wiring. Single or double pole, 2 to 8 positions (off-on, 3 to 7 heats) with special circuit variations and motor rated circuits also available. Ratings: 15 A, 120-240 V; 20 A, 120-240 V; 1 H.P., 120 V; 2 H.P., 240 VAC only; 30 A, 120-240 V; 1 H.P., 120 V; 2 H.P., 240 VAC only; 20 A max. on any one circuit. ½ to 1 H.P., 120 V; 1 to 2 H.P., 240 VAC. Request Form SP-587.



Series 240 and 390

Series 240 with screw terminals and Series 390 with spade terminals are electrically and mechanically interchangeable. Available with single or double pole, indexing from 2 to 8 positions in steps of 45, 51.42, 60, 72, 90 or 180 degrees, operating full rotary or with stops as required. U.L. listed. Standard AC ratings range from 7½ to 38 amps, including motor ratings of ¼ to 1 H.P., 120 V; 2 H.P., 240 V. Request Form SP-738 for additional information.

OAK Industries Inc.
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: 815•459•5000 ■ TWX: 910•634•3353 ■ TELEX: 72•2447

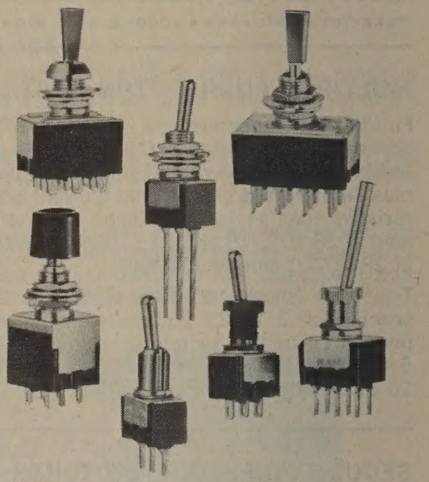
TOGGLE SWITCHES

This new series of Oak miniature toggle switches offer many important **standard** features that make them the preferred switch for all commercial applications. In spite of their small size, their rugged construction assures no compromise with quality or performance. Standard switches provide the following characteristics without additional cost.

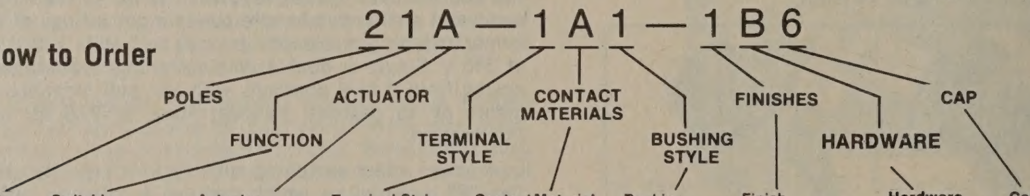
■ Rated at 6 Amp @ 125 VAC ■ Solid silver contacts are standard ■ U.L. and C.S.A. listing available ■ High impact, molded case ■ Insert-molded or epoxy-sealed, terminals eliminate solder flux contamination ■ High-torque-resistant bushing assembly, with mounting hardware ■ Anti-rotational actuators ■ Long operating life (over 50,000 cycles) ■ Vibration resistant construction.

These toggle switches are available in an almost unlimited range of combinations and options. Theoretically, over 200,000 variations are possible. Most types, including all of the most popular switches, can be supplied from stock, or on short delivery schedules. Compare the number of styles and options described here with those of other toggle switch sources.

■ Six toggle actuators plus a pushbutton style ■ Available in 1, 2, 3 or 4 poles ■ Nine switching functions ■ Six terminal styles, including three PC types ■ Three contact materials ■ Three bushing styles, plus o-ring seals ■ Three handle and hardware finishes ■ Three mounting nut types ■ Nine color caps. Request Form F-811 for more information.



How to Order



Poles
1. Single
2. Double
3. Three
4. Four

Switching Function
- 1. On-None-On (Alternate)
- 2. On-Off-On
- 3. (On)-Off-(On)
- 4. On-None-(On) (Momentary)
- 5. On-Off-(On)
- *6. On-On-On
- *7. (On)-On-(On)
- *8. On-On-(On)
- 9. None-On-(On)
- 0. (On)-Off-On

*2 and 4 poles only
( )—indicates momentary action

Actuator
- A. Standard Miniature
- B. Long
- C. Flat Plastic†
- D. Bulldog
- E. Flat Metal
- F. Short
- G. Push-Button† (available in Alternate (1) or Momentary (4) functions in 1 and 2 poles only)

†A cap color must be selected

Terminal Style
1. Solder (standard)
2. Printed Circuit
3. P.C. Right (L) Horizontal
4. P.C. Right (L) Vertical
5. Wire Wrap™
6. Center Pole Removed in 3-Pole Type

™ Gardner-Denver

Contact Material
- A. Coin Silver (standard)
- B. .000050 Gold over .000200 Nickel-Plated Brass
- C. .000050 Gold over Silver

Bushing Style
1. Slotted (standard)
2. Flatted
3. Threadless
4. "O" Ring**

** Adds 3mm (.118) to lever length

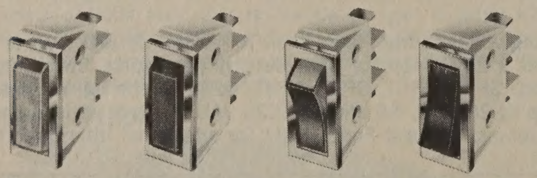
Finish
1. Standard Chrome
2. Black Bushing and Nut
3. Black Bushing, Nut and Handle

Hardware
- A. Hex (standard)
- B. Knurled Round
- C. Dress Nut
- D. None Required
- E. Knurled "O" Style Nut

Caps
- 0. No Cap
- 1. Black
- 2. White
- 3. Red
- 4. Blue
- 5. Yellow
- 6. Green
- 7. Gray
- 8. Orange
- 9. Pink
- X. Black Waterproof (only available on Actuator (A)

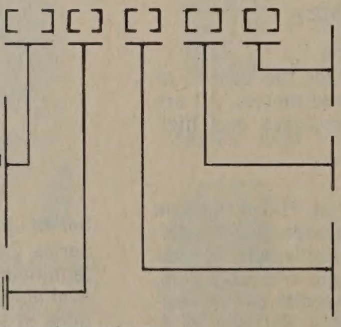
Note: When actuator (C) and (G) are selected, a cap must be chosen.

SNAP-IN ROCKER SWITCHES, PILOT LIGHTS



This versatile line of rocker switches and pilot lights is available in a wide variety of models. The snap-in design facilitates installation in personal care appliances, business machines, computers, test and measurement instruments, home and restaurant appliances. Available types include lighted on-off rocker switch (SPST), change over on/on rocker switch (SPDT), momentary unlighted rocker switch (NO), unlighted on/off rocker switch (SPST), and matching pilot lights. Metric dimensions (with trim): 33.4 mm. long, 33.0 mm. high, and 15.0 mm. wide. Terminals are .250 Quick-connects. Your Oak distributor can supply any of the switches that can be described by the part numbering system shown. Request Form F-924.

How to Order



Series indicates body color switch and or indicator function.

White Body	Black Body	Description
14	24	On/off/on, 3 position, center off, unlighted
15	25	On/off, spst, unlighted
16	26	On/on, spdt, change-over, unlighted
17	27	On/off, spst, illuminated
18	28	Neon pilot light only
19	29	Momentary; spst, normally open unlighted

Trim
T = Chrome Bezel added if requested

Voltage must be specified on illuminated versions only due to the internal series resistor required for the neon lamp.
—1 = 16 Amp, 120 Volts ac. (Lighted only)
—2 = 8 Amp, 240 Volts ac. (Lighted only)

Actuator or lens shape.
F = Flat shape of actuator or lens
C = Curved shape of actuator or lens

Actuator or lens color.
W = White actuator
B = Black actuator (unlighted only)
A = Amber color lens
R = Red color lens
C = Clear color lens

Part numbers and code letters must be specified in the sequence shown above.

Examples:

1. 25T-W-F	Black body, on/off, spst, unlighted, trim added, white actuator, flat shape.
2. 15-B-C	White body, black actuator, curved shape.
3. 17T-R-F-1	White body, trim added, red illuminated lens, flat shape, 16 amp, 120 volts ac.
4. 19-B-C	White body, black actuator, curved shape.

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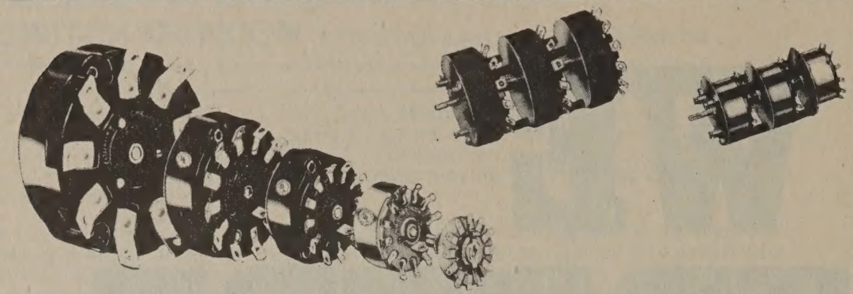
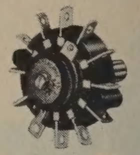
OHMITE® power tap switches, high current, non-shorting type



INTRODUCING

MODEL 711

Smallest Switch for Its Rating
7 Amps, 125 Volts



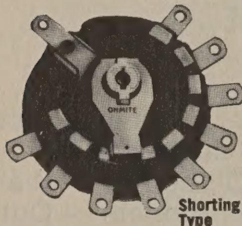
All Ohmite switches feature the slow-break, quick-make action deemed so desirable for switching of AC current.

All models except 711 feature all ceramic, arc-proof bodies and solid silver alloy, fixed and movable contacts. The large, thick, silver-alloy fixed contact disks are permanently welded to copper studs. These, in turn, are riveted and soldered to sturdy terminal lugs, assuring a permanent mechanical and electrical joint. The rotor (moving) contact, also of solid silver-alloy, is riveted and soldered to the contact arm. Face of the rotor contact is slightly rounded assuring a perfect seating of the contacts with a slight rubbing, self-cleaning motion on every operation. Models 111, 212, 312 and 412 are UL listed.

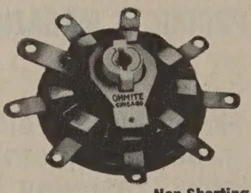
The new Model 711 tap switch was designed to achieve high current capability with small size. It is actually smaller than many low current instrument switches. It interrupts 7 amperes at 125 VAC and can carry 15 amperes AC or DC. The Model 711 features a melamine phenolic body with solid silver-alloy fixed and movable contacts.

Model	Alternate Current Rating		Diameter	Shaft Diameter	Max. Panel Thickness	Weight	No. of Taps
	Amps.	Volts					
711	7	125	1⅛″	¼″	⅛″	.047 lb.	3-11
111	15	125	1¾″	¼″	¼″	.16 lb.	3-11
212	20	150	2¼″	¼″	¼″	.4 lb.	3-12
312	30	300	3⁵⁄₁₆″	¼″	¼″	.75 lb.	3-12
412	50	300	4³⁄₁₆″	¼″	¼″	1.4 lb.	3-12
608	100	300	6″	⅜″	1″	5 lb.	3-8

ALL CERAMIC OPEN TYPE TAP SWITCHES



Shorting Type



Non-Shorting Type

Designed to transfer currents of several amperes in circuits requiring high voltage insulation. Ceramic body construction. Monel metal taps; silver-graphite brush.

Switches up to 8 taps are approximately 3¼″ diameter including lugs; 9 to 12 tap switches are approximately 4¼″ diameter. Switches can be ordered assembled 2 to 3 in tandem. Single hole mounting by means of ⅜″ diameter bushing and hexagon nut accommodates panels up to ¼″ thick (maximum).

Maximum current capacity is 7 amperes but only 3 amperes at 120 V.A.C. should be interrupted. Current ratings are less for all direct current circuits above 20 volts, for inductive circuits and high voltages.

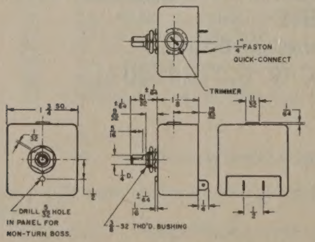
OHMITE® OHMITROL solid state power and motor speed controls

FEATURES:

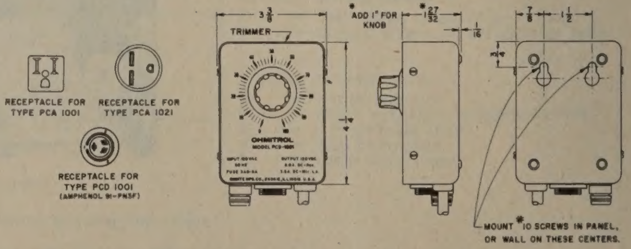
- Conserves space & power
- Smallest 1 & 2 KW control
- AC & DC output types
- Built-in on-off switch
- Adjustable control range
- Choice of component & portable styles
- Long life

Catalog No.		Input Volts	Freq.	Output Range (Nominal)	Load Capacity Rating (Maximum)
Component Style	Portable Style				
PCA-1000-08	PCA-1001-08	120 VAC	60 Hz	0-120 VAC	1 KW, 8.3 Amps AC
PCA-1000-15	—				15 Amps AC
PCA-1100-08	PCA-1101-08		50 Hz		1 KW, 8.3 Amps AC
PCA-1020-08	PCA-1021-08	240 VAC	60 Hz	0-240 VAC	2 KW, 8.3 Amps AC
PCA-1120-08	PCA-1121-08		50 Hz		
PCD-1000-06	PCD-1001-06	120 VAC	60 Hz	0-120 VDC and Full 120 VDC	6.0 Amp DC Resistive 3.5 Amp DC Motor Load
PCD-1100-06	PCD-1101-06		50 Hz		
PCD-1020-06	PCD-1021-06	240 VAC	60 Hz	0-240 VDC and Full 240 VDC	
PCD-1120-06	PCD-1121-06		50 Hz		

Model PCA-Component Style



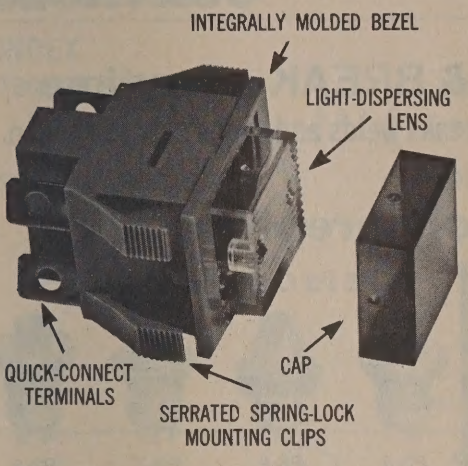
Models PCA and PCD-Portable

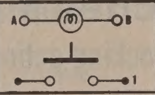
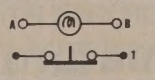
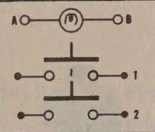
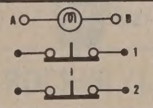
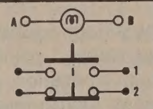
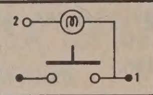
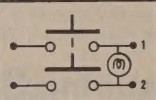

RECEPTACLE FOR TYPE PCA 1001
RECEPTACLE FOR TYPE PCA 1021
RECEPTACLE FOR TYPE PCD 1001 (AMPHENOL 91-PN3F)
3⅜
TRIMMER
OHMITROL
*ADD 1″ FOR KNOB
*1 27/32
1/16
⅞
1½
MOUNT #10 SCREWS IN PANEL, OR WALL ON THESE CENTERS.

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

OSLO PUSHBUTTON SWITCHES



Circuit Number	Circuit Diagram	Switching	TYPE DL LIGHTED CATALOG NUMBER Momentary Action	TYPE DL LIGHTED CATALOG NUMBER Alternating Action	TYPE DP NON-LIGHTED CATALOG NUMBER Momentary Action	TYPE DP NON-LIGHTED CATALOG NUMBER Alternating Action
1		single-pole single-throw normally open	DLM1	DLA1	DPM1	DPA1
2		single-pole single-throw normally closed	DLM2	DLA2	DPM2	DPA2
3		double-pole single-throw normally open	DLM3	DLA3	DPM3	DPA3
4		double-pole single-throw normally closed	DLM4	DLA4	DPM4	DPA4
5		double-pole cir. #1 normally open cir. #2 normally closed	DLM5	DLA5	DPM5	DPA5
6		single-pole single-throw normally open	DLM6	DLA6	Above types do not include lamp-circuit.	
7		double-pole single-throw normally open	DLM7	DLA7		

ELECTRICAL FEATURES

Load rating: 10 amperes 125/250 volts ac.
Contacts: fine silver, double-break, break-before-make
Circuits: single-pole and double-pole
Dielectric strength: 2000 volts ac rms.
Life: 25,000 operations at maximum rating

MECHANICAL FEATURES

One-piece molded-nylon body has integral, serrated, spring-lock clips.
Bezel molded integral with body.
Metal bezel available.
Molded-in light-dispersing lens.
Interchangeable lens-caps in wide choice of colors.
Positive mechanical indication of switch-contact position.
250,000 mechanical operations.

TERMINALS

Style A—1/4-inch quick-connect
Style B—3/16-inch quick-connect
Style C—Solder-lug, for #12 wire

STANDARD LAMPS

Integral with switch;
Internally connected per diagrams above.
6, 12, and 28 volt incandescent lamps standard.
125 and 250 volt neon lamps standard.

SPECIAL ORDER LAMPS

125 volt incandescent lamp available.
125 and 250 volt Blue or Green neon lamps available. Consult factory for price and delivery information.

COLOR DESIGNATIONS

Body and integral bezel
White—C7, Grey—C8, Black—C9,

Transparent lens-cap
Red—1, Clear—2, Amber—3,
Green—4, Blue—5

Opaque pushbutton-cap
White—7, Grey—8, Black—9,
Blue—10, Green—11, Red—12

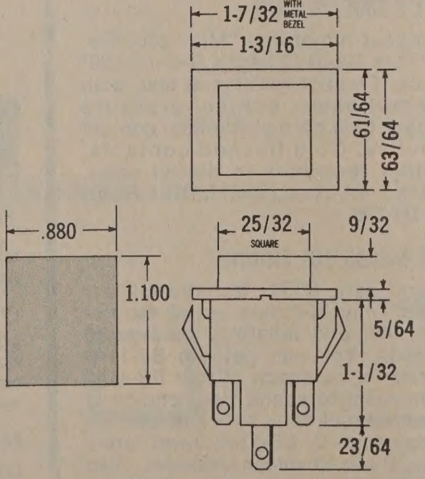
TYPE DG – Lighted Indicators

Type DG Lighted Indicators are identical in size and mounting with Type DL and DP switches and can be grouped easily with them without need for special mounting provision. A choice of different lens-cap heights is available.

TYPE DGS the low-profile indicator extends the same distance from the panel as the Type DL or DP switch in its ON position (1/16 inch).

TYPE DGT the high-profile indicator extends the same distance from the panel as the Type DL or DP switch in its OFF position (9/32 inch).

OUTLINE DIMENSIONS
(inches)



METAL BEZELS (optional)

Gold-color—F1, Chrome—F2

MARKINGS

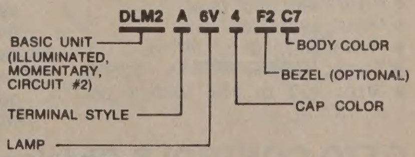
Letters, numbers, and symbols can be applied to lens-caps.

MOUNTING

Snap-in mounting in rectangular hole; fits any panel-thickness 1/32 to 3/16 inch.

ORDERING EXAMPLE

Develop catalog-number of unit by adding to the basic Type Number, shown above, the applicable code-letters or numbers in the sequence shown below.



OSLO CONTROLS INCORPORATED

417 Washington Ave., North Haven, Conn. 06473 Tel. (203) 239-3515

OTTO CONTROLS **OTTO CONTROLS**

OTTO snap-action switches MAKE & BREAK everytime

because the OTTO design features inherent rocking-action that breaks welds and wipes contacts clean.

PUSHBUTTONS* miniature & moistureproof

TYPE P1 (MIL-S-8805/3)

P1-1

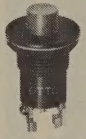
P1-2

P1-3

P1-5

P1-6

P1-7


P1-8

FEATURES

- 250,000 mech. cycles.
- High contact pressure: 120 gr.
- Low contact resist: <10 milliohms.
- Repeatable trip point within .001".
- Rolling sleeve principle seals button.
- Sealed case and terminals.

Pushbutton is sealed by silicone rubber boot operating on a "rolling sleeve" principle to give long life and smooth operation. Case & terminals sealed against environment and solder flux. Load ratings: 10 A. res., 5 A. ind., 3A. lamp. Contact forms: N.O., N.C., 2-circuit. Red or black button.

TYPE P3 Commercial Grade

P3-3

P3-6

P3-7

P3-8

Momentary or push-pull double-break action. Same specs as P1 military series. Choice of solder or screw terminals. Designed for use in panel boards, computers, business machines, instruments. Can be used as limit switch.

twostep™ for applications requiring 3 modes of operation

FEATURES

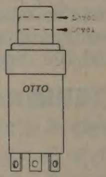
- Unique 2-position design.
- Sequential contact action.
- 12 contact arrangements.
- Make- before-break contact option.
- Moistureproof construction.
- 100,000 mechanical cycles.

P2-1

P2-3

P2-6

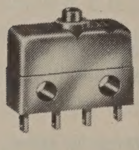
Ideal for "off-high-low", "off-slow-fast", "Stop-fine-course" applications. Each level operates an independent set of SPDT circuits rated to 5 A. Twelve contact arrangements are offered to satisfy just about any circuit requirement. Also available as DPDT single detent.

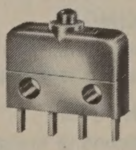


BASICS* unique patented design assures extraordinary long life less than 10 milliohms contact resistance

SUB-SUBMINIATURE

TYPE B3 for low level circuits


MIL-S-8805/76


MIL-S-8805/101

CHARACTERISTICS

- Contact Resistance: .010Ω max.
- 10 million mech. cycles.
- 100,000 cycles at full load.
- Operating Force: 5^{+3}_{-2} oz.
- Release Force: 1.5 oz. min.
- Pretravel: .035" max.
- Overtravel: .006" min.
- Move. Diff.: .015±.005 in.
- Temp. Range: −65° to +125°C.
- Size: .200" or .156" wide x .350" h. x .510" lg.

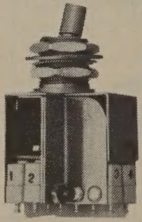
MIL-S-8805/76 THIN B3-4140

For your run-of-the- "MIL" projects, OTTO's B3-4140 series is only .200" thick. Contact resistance less than 10 milliohms, contact pressure higher than normal, minimal contact bounce. Gold flashed contacts, solder terminals in diallyl case. Rated 4A Res. SPDT; 8A. Res., SPDT-DB.

MIL-S-8805/101 THINNER B3-1140

Brand new, OTTO inspired military spec. Only .156" thin, yet all the rating, life, and reliability of the /76 version. You can get five B3-1140 series in the space of four B3-4140 with room to spare. Your choice of double-break form X, Y, Z and single break form C. B3-1140 turret terminals, B3-2140 solder terminals. Also commercial versions.

TOGGLE/PUSHBUTTON ACTUATORS



T1-0001. Four position, 6-pole toggle featuring MIL-S-8805/4 basic switches. Positions #1 & #3 are 2PDT maintained action each, position #4 is 2PDT momentary, position #2 is center "off". Rated 7A. res. each pole. **T1-0004.** Same except 3-position, 4-pole toggle. Position #1 is 2PDT momentary, position #2 is center "off", position #3 is 2PDT maintained action. **T1-0005.** Same as T1-0001 except all four positions are maintained action.

T2-0001. Combo toggle & pushbutton. It's a 2-position toggle and a pushbutton switch all in one. 30° toggle throw, .135" total pushbutton travel with 4.5 lbs. operating force. Rated 10A res. & ind.

T4-0001. Four-way toggle with 4-pole N.O. double-break momentary action. Rated 5A. res. Dims.: 1.156 dia. X 1.160 behind panel.

OTTO CONTROLS Division, OTTO engineering, Inc.
36 Main St., Carpentersville, Illinois 60110 Phone: 312/428-7171

*U.S. Pat. No. 3,612,793.

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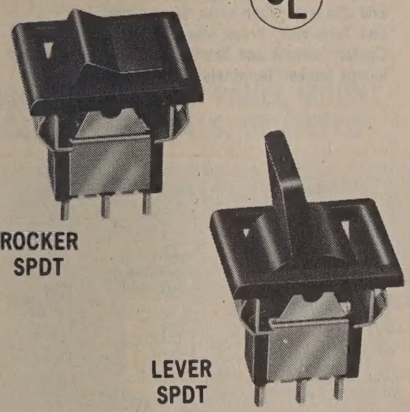
See these other Raytheon Products in EEM

Knobs—Section 2400
Hardware—Section 2800
Test Jacks—Section 2100
Opto-electronics—Section 3700


ROCKER
SPDT
LEVER
SPDT

SNAP-IN ROCKER/LEVER SERIES R, SERIES LE

The Series R and Series LE rocker and lever switches are high quality with actuators styled to complement modern panel design. Both series snap-in front panel mounting. Bezel and actuator colors can be color coordinated. A black bezel and black actuator is supplied, unless otherwise specified. Spring steel springs hold the switches firmly in place. Rated at 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes with resistive load at 250 VAC: both SPDT and DPDT versions are available. Solder-lug terminal.

SPECIFICATIONS

Contact Rating: 5 Amperes with resistive load at 120 VAC or 28 VAC; 2 Amperes with resistive load at 250 VAC.
Electrical Life: 100,000 make and break cycles at full load on all models.
Contact Resistance: 10 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both coin silver and gold plated contacts.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.

MATERIALS

Case: Black phenolic resin.
Rockers and Lever Handles: Nylon.
Mounting Bracket: Stainless steel.
End Contact: Coin silver, silver plated.
End Terminal: Brass, silver plated.
Center Contact and Terminal: Brass or zinc, silver plated.
Snap-in Springs: Spring steel, nickel plated.
Bezel: Nylon.

ROCKER SNAP-IN SOLDER TERMINALS UL LISTED

Cat. No.	Type	Desc.
R1A1* R2A1*	SPDT DPDT	On-None-On On-None-On

LEVER SNAP-IN SOLDER TERMINALS UL LISTED

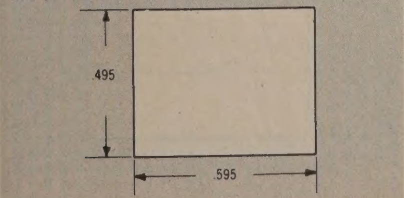
Cat. No.	Type	Desc.
LE1A1* LE2A1*	SPDT DPDT	On-None-On On-None-On

*Unless specified bezel and actuator supplied in black. See table

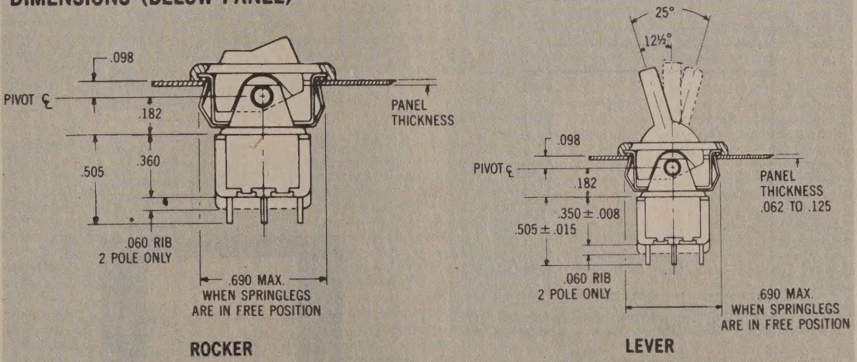
TABLE 1

COLOR OPTIONS BEZEL AND ACTUATOR
W = White
BL = Black
R = Red

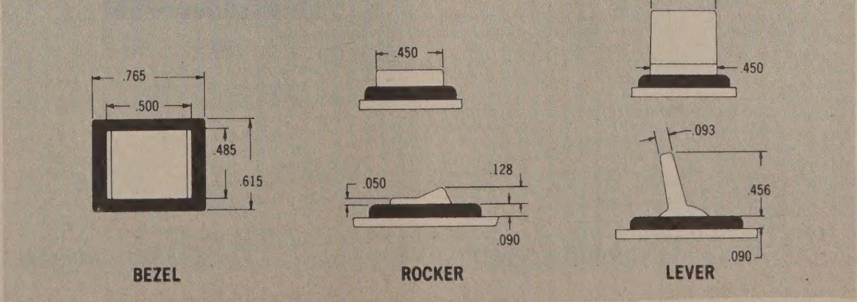
MOUNTING CUTOUT



DIMENSIONS (BELOW PANEL)

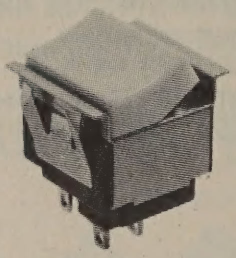

.098
PIVOT ℄
.182
PANEL THICKNESS
.505
.360
.060 RIB
2 POLE ONLY
.690 MAX.
WHEN SPRINGLEGS
ARE IN FREE POSITION
ROCKER
25°
12½°
.098
PIVOT ℄
.182
PANEL THICKNESS
.062 TO .125
.350 ± .008
.505 ± .015
.060 RIB
2 POLE ONLY
.690 MAX.
WHEN SPRINGLEGS
ARE IN FREE POSITION
LEVER

DIMENSIONS (ABOVE PANEL)


.765
.500
.485
.615
BEZEL
.450
.050
.128
.090
ROCKER
.432
.450
.093
.456
.090
LEVER

RAYTHEON

ROCKER AND LEVER SWITCHES



LIGHTED ROCKER DPDT

LIGHTED ROCKER SNAP-IN MOUNT—SERIES LR

This high quality lighted rocker switch snaps into front of panel. The bezel/lens combination suits them for attractive modern panel styling. A choice of bezel and lens colors is available (Table 1). A black bezel with a white lens is provided, unless otherwise specified. SPDT and DPDT models available. Solder-lug terminals. Bulb is not supplied. (Use bulb sizes T 1½ and T 1¾). Separate lamp circuit for added flexibility. Rated at 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes at 250 VAC. Actuator/lens is removable from front for easy bulb replacement.

SPECIFICATIONS

Contact Rating: 5 Amperes with resistive load at 120 VAC or 28 VDC. 2 Amperes with resistive load at 250 VAC.
Electrical Life: 100,000 make and break cycles at full load.
Contact Resistance: 5 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both coin silver and gold plated contacts.
Insulation Resistance: 20,000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.

MATERIALS

Case: Melamine.
Housing: Stainless steel.
Bezel: Nylon.
Lens: Lexan (R).
Snap-in Springs: Spring steel, nickel plated.
End Contacts: Coin silver, silver plated.
End Terminals: Brass, silver plated.
Center Contact and Terminals: Brass, silver plated.
Lamps Socket Terminals: Brass, electro-tin plated.

ROCKER SNAP-IN, LIGHTED, SOLDER TERMINALS UL LISTED

Cat. No.	Type	Desc.
LR1A1	SPDT	On-None-On
LR1C1	SPDT	On-Off-On
LR1B1	SPDT	On-None-(On)
LR2A1	DPDT	On-None-On
LR2C1	DPDT	On-Off-On
LR2B1	DPDT	On-None-(On)

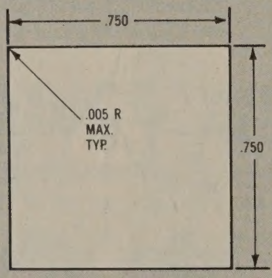
L1 = Lens B2 = Bezel provided with switch. See table 1 for color choice.

TABLE 1

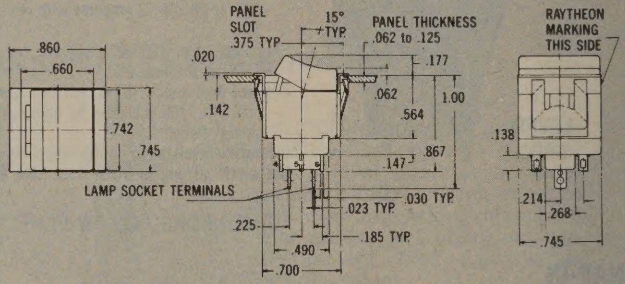
COLOR OPTIONS BEZEL AND LENS

W = White
R = Red
Or = Orange
Y = Yellow
GR = Green
BL = Black (bezel only)

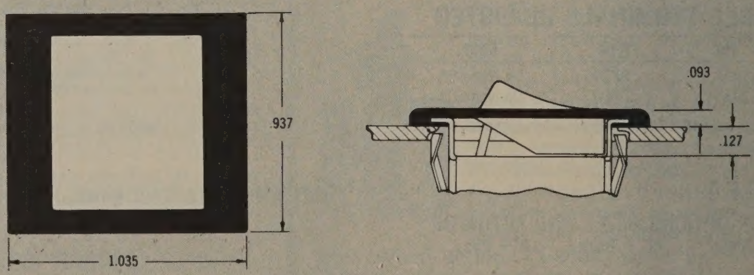
MOUNTING CUTOUT


.750
.005 R
MAX.
TYP.
.750

SPDT & DPDT
Same Dimensions

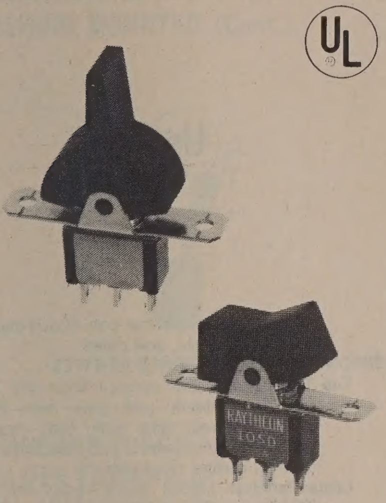

.860
.660
.742
.745
PANEL
SLOT
.375 TYP.
15°
TYP.
PANEL THICKNESS
.062 to .125
.020
.177
.142
.062
1.00
.564
.867
.147
LAMP SOCKET TERMINALS
.030 TYP.
.023 TYP.
.225
.185 TYP.
.490
.700
RAYTHEON
MARKING
THIS SIDE
.138
.214
.268
.745

BEZEL


.937
1.035
.093
.127

RAYTHEON

ROCKER AND LEVER SWITCHES


RAYTHEON
105D

REAR-PANEL MOUNTED ROCKER AND LEVER

Ruggedly constructed, these compact switches can handle 5 Amperes at 120 VAC. Both rocker and lever models are available. Designed to mount behind a front panel, standoff hardware is provided. Terminals are solder-lug. SPDT, DPDT, 3PDT, and 4PDT sizes are available in both styles. Actuator color is black, unless otherwise specified. See Table 1 for color choices.

SPECIFICATIONS

Contact Rating: 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes with resistive load at 250 VAC.

Electrical Life: 100,000 make and break cycles at full load on all models. All momentary models—40,000 cycles.

Contact Resistance: 10 millohms maximum initial at 2 to 4 VDC.

Insulation Resistance: 1000 megohms minimum

Dielectric Strength: 1000 Volts RMS at sea level.

MATERIALS

Case: Black phenolic resin.

Rockers and Lever Handles: Nylon.

Housing: Stainless steel.

Mounting Bracket: Stainless steel.

End Contact: Coin silver, silver plated.

End Terminal: Brass, silver plated.

Center Contact and Terminal: Brass or zinc, silver plated.

Hardware Supplied: Two screws, two lockwashers, two nuts, and two standoffs for 1/8 inch panels.

ROCKER—BEHIND PANEL MOUNT, SOLDER TERMINALS, UL LISTED

Cat. No.	Type	Desc.
105DJ1	SPDT	On-None-On
105EJ1	SPDT	On-Off-On
105FJ1	SPDT	None-On-(On)
205NJ1	DPDT	On-None-On
205PJ1	DPDT	On-Off-On
205RJ1	DPDT	None-On-(On)
305DJ1	3PDT	On-None-On
405NJ1	4PDT	On-None-On

LEVER—BEHIND PANEL MOUNT, SOLDER TERMINALS, UL LISTED

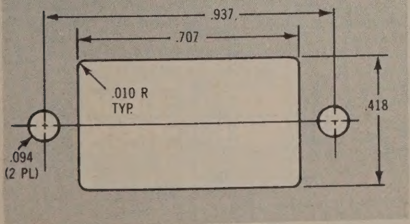
Cat. No.	Type	Desc.
105DJ2	SPDT	On-None-On
105EJ2	SPDT	On-Off-On
105FJ2	SPDT	None-On-(On)
205NJ2	DPDT	On-None-On
205PJ2	DPDT	ON-Off-On
205RJ2	DPDT	None-On-(On)
305DJ2	3PDT	On-None-On
405NJ2	4PDT	On-None-On

TABLE 1

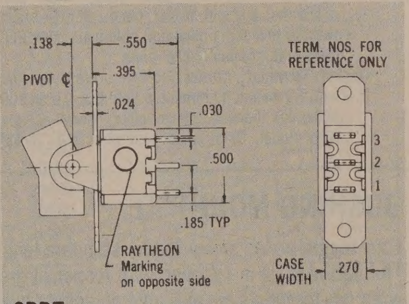
COLOR OPTIONS ROCKER/LEVER

W = White	R = Red	BL = Black

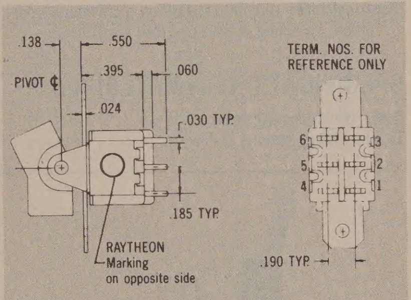
PANEL CUTOUT


.937
.707
.010 R
TYP.
.418
.094
(2 PL)

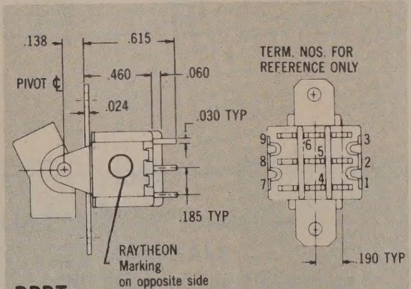
DIMENSIONS APPLY TO BOTH ROCKER AND LEVER STYLES


.138
.550
PIVOT ¢
.395
.024
.030
.500
.185 TYP
TERM. NOS. FOR REFERENCE ONLY
3
2
1
RAYTHEON Marking on opposite side
CASE WIDTH
.270

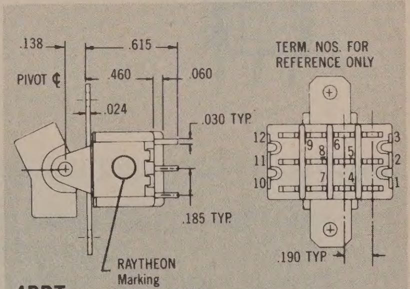
SPDT


.138
.550
PIVOT ¢
.395
.060
.024
.030 TYP.
.185 TYP
TERM. NOS. FOR REFERENCE ONLY
6
5
4
3
2
1
RAYTHEON Marking on opposite side
.190 TYP.

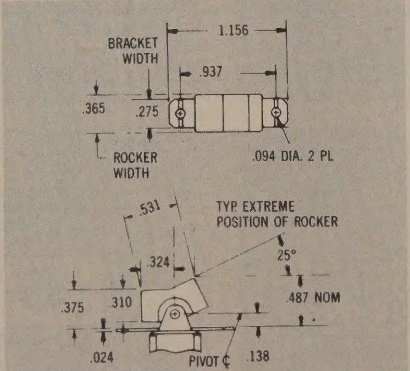
3PDT


.138
.615
PIVOT ¢
.460
.060
.024
.030 TYP
.185 TYP
TERM. NOS. FOR REFERENCE ONLY
9
8
7
6
5
4
3
2
1
RAYTHEON Marking on opposite side
.190 TYP

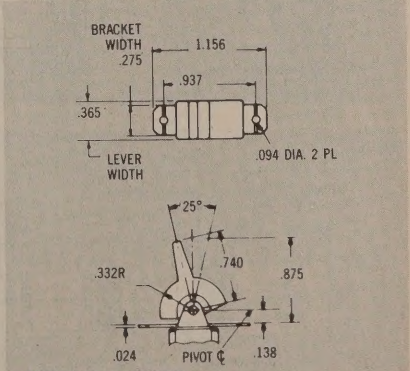
DPDT


.138
.615
PIVOT ¢
.460
.060
.024
.030 TYP.
.185 TYP.
TERM. NOS. FOR REFERENCE ONLY
12
11
10
9
8
7
6
5
4
3
2
1
RAYTHEON Marking on opposite side
.190 TYP.

4PDT


BRACKET WIDTH
1.156
.937
.365
.275
ROCKER WIDTH
.094 DIA. 2 PL
.531
TYP. EXTREME POSITION OF ROCKER
.324
25°
.375
.310
.487 NOM
.024
PIVOT ¢
.138

ROCKER ACTUATOR


BRACKET WIDTH
.275
1.156
.937
.365
LEVER WIDTH
.094 DIA. 2 PL
25°
.740
.332R
.875
.024
PIVOT ¢
.138

LEVER ACTUATOR

RAYTHEON TOGGLE SWITCHES

MINIATURE TOGGLE SWITCHES

Quality ultra-small toggle switches combining high current capacity and long life in a miniature package. The small case size makes them ideally suited for miniaturized equipment where front, and rear of panel space is limited. There are two mounting styles: bushing mounted, and right angle PC mounted. All standard terminals have coin silver contacts and terminals. PC, right angle PC, and wire-wrap terminals have gold contacts and terminals.
Most models UL listed. File E53864.

SPECIFICATIONS—ELECTRICAL

Current Rating: Coin silver contacts 5 Amperes resistive load at 120 VAC or 28 VDC, or 2 Amperes at 250 VAC. Brass contacts with gold over nickel plate 0.4 Volt-Amperes at 20 Volts maximum (AC or DC).

Contact Resistance: 10 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both silver and gold-plated contacts.

Insulating Resistance: Over 1000 megohms between terminals and case ground at 500 VDC.

Dielectric Strength: 1000 VAC between terminals and case ground for a duration of 1 minute.

Electrical Life: 100,000 (40,000 on momentary types) on-off, switching actions at rated current.

SPECIFICATIONS—MATERIAL

Case: Black phenolic resin.

Toggle: Brass, chrome plated.

Bushing: Brass, nickel plated.

Housing: Stainless steel.

SPECIFICATIONS—CONTACTS

STANDARD TERMINALS AND CONTACTS:

End Terminals: Contact surface—coin silver; Body—coin silver or brass, silver plated.

Center Terminal: Contact surface—brass or zinc, silver plated; Body—brass or zinc silver plated.

PC TERMINALS:

End Terminals: Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.

Center Terminal: Contact surface—brass or zinc with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—single pole model. Brass with gold plate over nickel plate. Two, three and four pole models-brass, silver plated, or zinc, gold plated.

WIRE-WRAP AND RIGHT ANGLE PC TYPES:

End Terminals: Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.

Center Terminal: Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.

HARDWARE SUPPLIED

Flatted toggle: one N-3 dress nut, one N-2 hex nut, one standard locking ring;

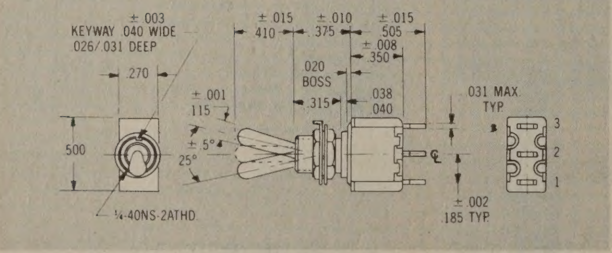
Right angle toggle: none (has non-threaded bushing);

All other toggles: two N-2 hex nuts, one standard locking ring.

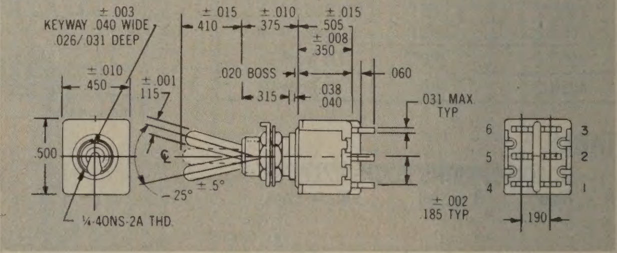
BUSHING MOUNTED

Four toggle styles are available: standard length bat, long bat, long plastic bat, and flatted toggle. The flatted style is supplied with a special dress mounting nut (N-3). Solder lug, PC pin, or wire-wrap (R) terminals are available on some styles. Not all combinations of switch size, toggle style, and terminals are available. See chart on page 5.

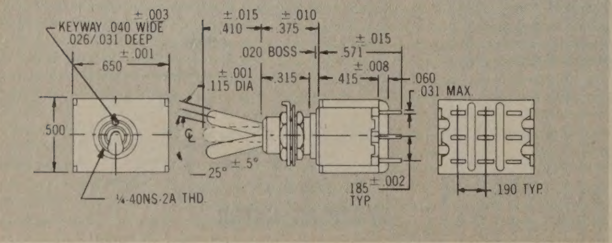
SPDT


± .003
KEYWAY .040 WIDE
.026/.031 DEEP
.270
± .001
.115
.500
± 5°
25°
¼-40NS-2ATHD
± .015
.410
± .010
.375
± .015
.505
± .008
.350
.020 BOSS
.315
.038
.040
.031 MAX TYP
± .002
.185 TYP
3
2
1

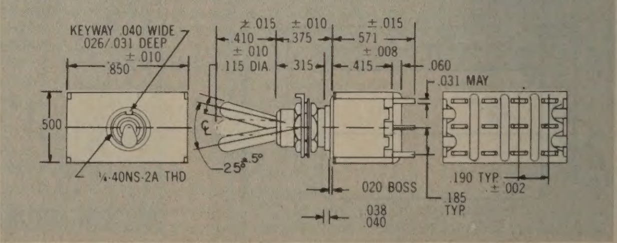
DPDT


± .003
KEYWAY .040 WIDE
.026/.031 DEEP
± .010
.450
± .001
.115
.500
25°
± 5°
¼-40NS-2A THD.
± .015
.410
± .010
.375
± .015
.505
± .008
.350
.020 BOSS
.315
.038
.040
.060
.031 MAX TYP
± .002
.185 TYP
.190
6
5
4
3
2
1

3PDT

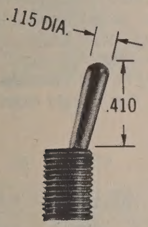

± .003
KEYWAY .040 WIDE
.026/.031 DEEP
± .001
.650
± .001
.115 DIA
.500
25°
± 5°
¼-40NS-2A THD.
± .015
.410
± .010
.375
.020 BOSS
± .015
.571
.315
± .008
.415
.060
.031 MAX
.185 ± .002 TYP
.190 TYP

4PDT

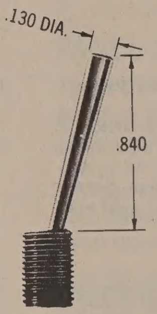

KEYWAY .040 WIDE
.026/.031 DEEP
± .010
.850
.500
¼-40NS-2A THD
25°
± 5°
± .015
.410
± .010
.375
± .015
.571
± .010
.115 DIA
.315
± .008
.415
.060
.031 MAY
.190 TYP
± .002
.185 TYP
.020 BOSS
.038
.040

RAYTHEON TOGGLE SWITCHES

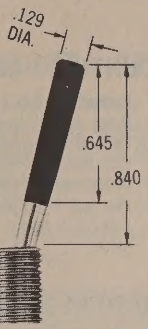
BUSHING MOUNTED (Cont.)



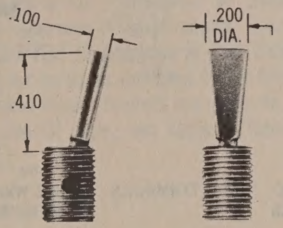
STANDARD TOGGLE



LONG TOGGLE



LONG PLASTIC TOGGLE
Black Only



FLATTED TOGGLE
With Anti-Rotation Pinning

STANDARD TOGGLE—SOLDER TERMINALS

1/4—40NS 2Athd bushing, UL listed.

Cat. No.	Type	Desc.
105B	SPDT	On-None-(On)
105D	SPDT	On-None-On
105E	SPDT	On-Off-On
105F	SPDT	None-On-(On)
105G	SPDT	(On)-Off-(On)
105H	SPDT	On-Off-(On)
205B	DPDT	On-None-(On)
205N	DPDT	On-None-On
205P	DPDT	On-Off-On
205PA	DPDT	On-On-On
205R	DPDT	None-On-(On)
205S	DPDT	(On)-Off-(On)
205SA	DPDT	(On)-On-(On)
205T	DPDT	On-Off-(On)
205TA	DPDT	On-On-(On)
305B	3PDT	On-None-(On)
305D	3PDT	On-None-(On)
305E	3PDT	On-Off-On
305H	3PDT	On-Off-(On)
405N	4PDT	On-None-On
405P	4PDT	On-Off-On
405Pa	4PDT	On-On-On

STANDARD TOGGLE—PC TERMINALS

1/4-40NS 2Athd bushing, gold contacts and terminals.

Cat. No.	Type	Desc.
105D2	SPDT	On-None-On
105E2	SPDT	On-Off-On
105F2	SPDT	None-On-(On)
105G2	SPDT	(On-Off-(On)
105H2	SPDT	On-Off-(On)
205N2	DPDT	On-None-On
205P2	DPDT	On-Off-On
205PA2	DPDT	On-On-On
205R2	DPDT	None-On-(On)
205S2	DPDT	(On)-Off-(On)
205T2	DPDT	On-Off-(On)
305D2	3PDT	On-None-On
305E2	3PDT	On-Off-On
405N2	4PDT	On-None-On
405P2	4PDT	On-Off-On
405PA2	4PDT	On-On-On

STANDARD TOGGLE—WIRE WRAP TERMINALS

1/4-40NS 2Athd bushing, gold terminals and contacts

Cat. No.	Type	Desc.
105D6	SPDT	On-None-On
105E6	SPDT	On-Off-On
205N6	DPDT	On-None-On
305D6	3PDT	On-None-On
405N6	4PDT	On-None-On

LONG TOGGLE—PC TERMINALS

1/4-40NS 2Athd bushing—gold terminals & contacts

Cat. No.	Type	Desc.
105D2L	SPDT	On-None-On
105E2L	SPDT	On-Off-On
205N2L	DPDT	On-None-On
205P2L	DPDT	On-Off-On
305D2L	3PDT	On-None-On
405N2L	4PDT	On-None-On

Color caps available: Order C-9 cap in black, red, white, yellow, green, blue gray. Cap is 0.375 inch long vinyl.

LONG PLASTIC TOGGLE—SOLDER TERMINALS

1/4-40NS 2Athd bushing, UL listed

Cat. No.	Type	Desc.
105DL3	SPDT	On-None-On
105EL3	SPDT	On-Off-On
105FL3	SPDT	None-On-(On)
205NL3	DPDT	On-None-On
205PL3	DPDT	On-Off-On
205TL3	DPDT	On-Off-(On)
305DL3	3PDT	On-None-On
405NL3	4PDT	On-None-On

FLATTED TOGGLE—SOLDER TERMINALS

1/4-40NS, 2Athd bushing, UL listed

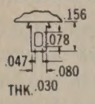
Cat. No.	Type	Desc.
105D49	SPDT	On-None-On
105E49	SPDT	On-Off-On
105G49	SPDT	(On)-Off-(On)
205N49	DPDT	On-None-On
205P49	DPDT	On-Off-On
205R49	DPDT	None-On-(On)
205SA49	DPDT	(On)-On-(On)

RAYTHEON

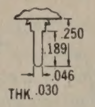
TOGGLE SWITCHES

BUSHING MOUNTED (Cont)

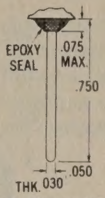
TERMINALS


.156
.078
.047
.080
THK. .030

STANDARD TERMINALS

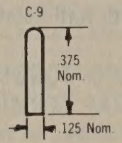

.250
.189
.046
THK. .030

PC TERMINALS


EPOXY SEAL
.075 MAX.
.750
.050
THK. .030

WIRE WRAP (R) TERMINALS

C9 TOGGLE CAP


C-9
.375 Nom.
.125 Nom.

MOUNTING HARDWARE

N-1 Knurled nut 0.363 inch diameter, 0.062 thickness. Brass, bright nickel finish.

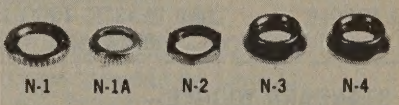
N-1A Decorative knurled nut 0.312 inch diameter, 0.08 inch thickness. Fine straight knurl, blind internal thread. Brass, bright nickel finish.

N-2 Hex nut ¼-40 thousands 0.312 inch diameter, 0.062 inch thickness. Cold rold steel bright nickel finish.

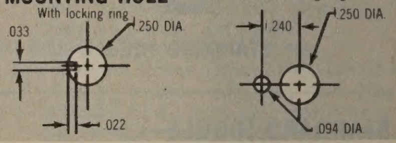
N-3 Dress nut, blind thread 0.350 inch diameter (flats), 0.375 inch diameter and 0.120 inch thickness. Brass, bright nickel finish.

N-4 Dress nut, through thread 0.350 inch diameter (flats), 0.375 inch diameter and 0.120 inch thickness. Brass, bright nickel finish.

MOUNTING HARDWARE


N-1
N-1A
N-2
N-3
N-4

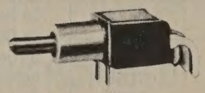
MOUNTING HOLE


With locking ring
.250 DIA.
.033
.022
Without locking ring
.240
.250 DIA.
.094 DIA.

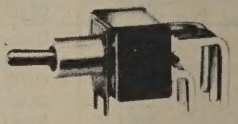
RIGHT ANGLE PC MOUNTED

These switches are provided with a short toggle and a nonthreaded bushing; they mount directly on a PC board. Toggle moves in a direction parallel to the surface of the board.

SPDT A RIGHT ANGLE MOUNTING



DPDT A RIGHT ANGLE MOUNTING

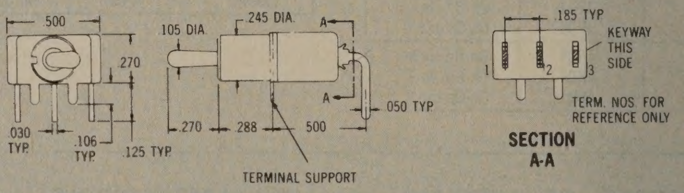


SHORT TOGGLE RIGHT ANGLE PC TERMINALS

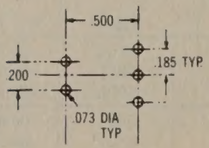
Unthreaded bushing, gold terminals and contacts

Cat. No.	Type	Desc.
105DPC	SPDT	On-None-On
105E3	SPDT	On-Off-On
105F3	SPDT	None-On-(On)
205NPC	DPDT	On-None-On
205P3	DPDT	On-Off-On

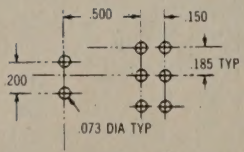
SPDT


.500
.270
.030 TYP.
.106 TYP.
.125 TYP.
.105 DIA.
.245 DIA.
A
A
.270
.288
.500
.050 TYP.
TERMINAL SUPPORT
.185 TYP.
KEYWAY THIS SIDE
1
2
3
TERM. NOS. FOR REFERENCE ONLY
SECTION A-A

PC HOLE PATTERN

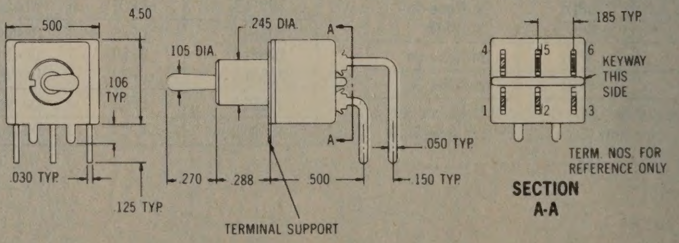

.500
.185 TYP.
.200
.073 DIA TYP

SPDT


.500
.150
.185 TYP
.200
.073 DIA TYP

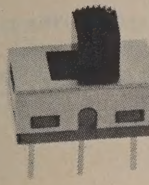
DPDT

DPDT

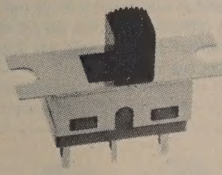

.500
4.50
.106 TYP
.030 TYP
.125 TYP.
.105 DIA.
.245 DIA.
A
A
.270
.288
.500
.050 TYP.
.150 TYP
TERMINAL SUPPORT
.185 TYP
4
5
6
KEYWAY THIS SIDE
1
2
3
TERM. NOS. FOR REFERENCE ONLY
SECTION A-A

RAYTHEON

SLIDE SWITCHES, SNAP ACTION



PC MOUNT



PANEL MOUNT

TABLE 1

COLOR OPTIONS*

W = White
R = Red
Y = Yellow
B = Blue
OR = Orange
GR = Green
BL = Black

*Available on special order, minimum 500 pieces

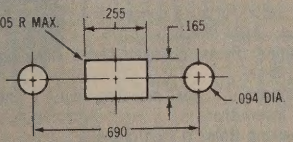
PANEL MOUNT—SOLDER TERMINAL

Cat. No.	Type	Desc.
S1A1M1	SPDT	On-None-On

PC MOUNT—PC TERMINALS

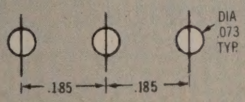
Cat. No.	Type	Desc.
S1A2M2	SPDT	On-None-On
	PC-Mount—gold terminals and contacts	
S1A7M2	SPDT	On-None-On
	PC Mount—silver terminals and contacts	

MOUNTING PANEL VERSION



RECOMMENDED SCREW THREAD: #2
HARDWARE NOT SUPPLIED

PC MOUNT VERSION



PANEL AND PC MOUNT—SERIES S1

These subminiature slide switches have the same toggle-action mechanism as used in the Raytheon toggle switches. A spring-loaded teflon actuator operates the mechanism. The standard version can handle 6 Amperes resistive at 120 VAC or 20 VDC (3 Amperes at 250 VAC). A low energy version Model S1A2M2 has gold plated contacts for levels as low as 0.4 Volt-Amperes at 20 Volts maximum (AC or DC). Panel mounting or PC board mount models are available. A black slide handle is provided, unless otherwise specified on special order; see Table 1. Terminals on panel mount style are solder-lug.

SPECIFICATIONS

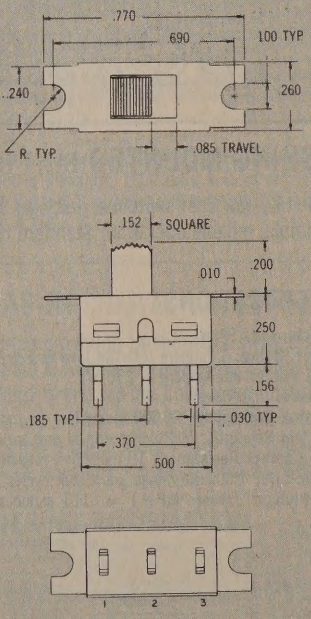
Contact Rating—Standard Version: 6 Amperes with resistive load at 120 VAC or 28 VDC; 3 Amperes at 250 VAC.
Contact Rating—Low Energy Version: 0.4 Volt-Amperes at 20 Volts maximum; AC or DC.
Contact Resistance: 10 milliohms maximum initially.
Electrical Life: 40,000 actuations at full load.
Mechanical Life: 250,000 actuations (low energy).
Insulation Resistance: 100,000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.
Actuation Force: 150 to 350 grams initially.

MATERIALS

Case: Melamine.
Housing: Stainless steel.
Slide Handle: Nylon.
End Contact—Standard Version: Coin silver, silver plated.
End Contact—Low Energy Version: Brass with 50 millionths minimum gold plate over 200 millionths nominal nickel plate.
End Terminal: Brass, silver plated.
Center Contact and Terminal—Standard Version: Brass, silver plated.
Center Contact and Terminal—Low Energy Version: Brass with 50 millionths minimum gold plate over 200 millionths nominal nickel plate.

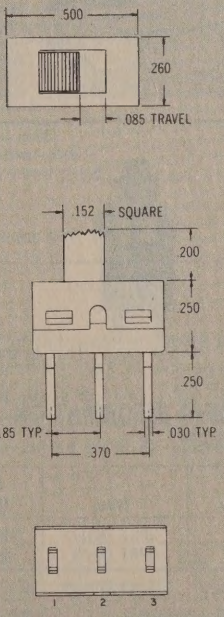
PANEL MOUNT

S1A1M1



PC MOUNT

S1A2M2
S1A7M2



RAYTHEON

PUSH BUTTON SWITCHES

DPDT Version Shown
SPDT Available

ORDERING INFORMATION

Model No.	Type	Description	Caps* Style
P1F1	SPDT	Momentary	C7, C8
P2F1	DPDT	Momentary	C7, C8

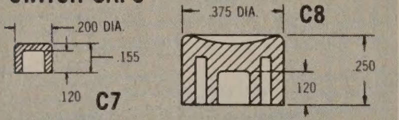
*There is a choice of colors in either style. See Table 1. Specify color required and cap style.

TABLE 1

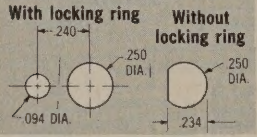
Color Caps for Small cap C-7, Large cap C-8

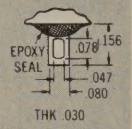
BL = Black	OR = Orange	G = Gray
B = Brown	Y = Yellow	W = White
R = Red	GN = Green	

SWITCH CAPS


.200 DIA.
.155
.120
C7
.375 DIA.
C8
.250
.120

MOUNTING HOLES


With locking ring
.240
.250 DIA.
.094 DIA.
Without locking ring
.250 DIA.
.234


EPOXY SEAL
.078
.156
.047
.080
THK .030

BUSHING MOUNTED SNAP-ACTION—SERIES P

These momentary snap-action switches are especially recommended for low energy circuits because of their gold-on-brass contacts. The solder-lug terminals are epoxy sealed. Two sizes of snap-on nylon caps are available in a choice of colors. The switches can be wired for either normally open or normally closed operation. SPDT and DPDT.

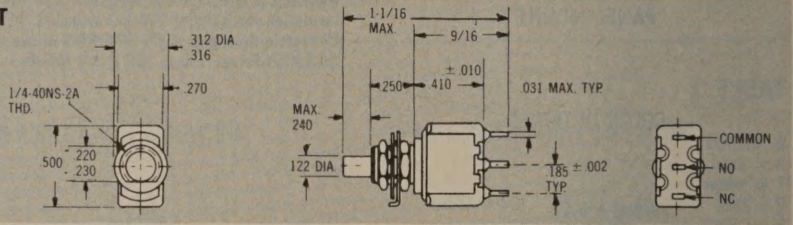
SPECIFICATIONS

Common Contact: Brass with gold plate over nickel.
Center and End Contact: Precious metal inlay on brass, gold plated.
Contact Rating: 1 Ampere resistive load at 120 VAC or 28 VDC.
Terminals: Gold over brass terminals, epoxy sealed.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.
Electric Life: 60,000 cycles minimum at full load.
Mechanical Life: 100,000 make and break cycles, minimum.
Maximum Allowable Force on Plunger: 10 pounds.

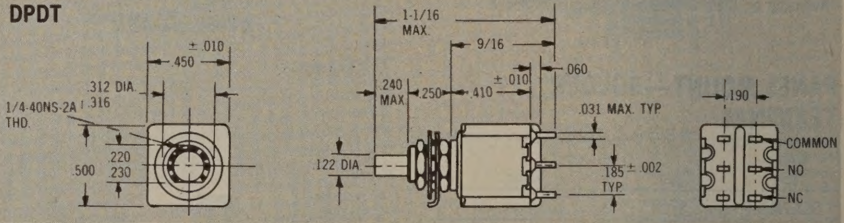
MATERIALS

Case: General purpose phenolic.
Housing: Stainless steel.
Bushing: Cadmium with clear chromate over brass. High torque to withstand 12 inches per pound.
Hardware: Two hex mounting nuts, one internal tooth lockwasher, one locking ring.

SPDT


.312 DIA.
.316
1/4-40NS-2A THD.
.270
.500
.220
.230
1-1/16 MAX.
9/16
± .010
.250
.410
.031 MAX. TYP.
MAX. .240
.122 DIA.
.185 ± .002 TYP.
COMMON
NO
NC

DPDT


± .010
.450
.312 DIA.
.316
1/4-40NS-2A THD.
.500
.220
.230
1-1/16 MAX.
9/16
± .010
.060
.240 MAX.
.250
.410
.031 MAX. TYP.
.190
.122 DIA.
.185 ± .002 TYP.
COMMON
NO
NC

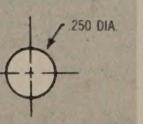
SERIES MP

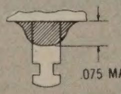
ORDERING INFORMATION UL LISTED

Model No.	Type	Description (Momentary)
MP1F1*	SPST (N.O.)	Momentary-N.O.
MP1E1**	SPST (N.C.)	Momentary-N.C.

*Red Plunger **Black Plunger

MOUNTING HOLE





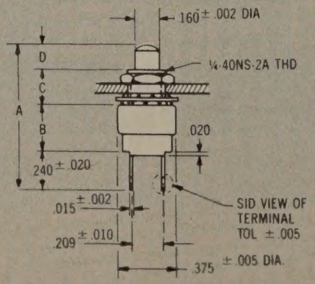
Sealing feature on Solder Lug

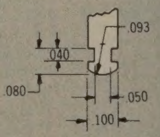
BUSHING MOUNTED BUTT CONTACT—SERIES MP

These tiny, low cost switches, just over 1 inch long, can carry 1 Ampere at 28 VDC. Butt contacts for simple, reliable operation. Standard terminal is solder-lug. Black phenolic plunger. SPST only.

SPECIFICATIONS

Contacts: Coin Silver.
Contact Rating: 1 Ampere resistive load at 120 VAC or 28 VDC or 0.5 Ampere at 250 VAC.
Terminals: Coin Silver.
Insulation Resistance: 20,000 megohms minimum.
Dielectric Strength: 1000 volts rms at sea level.
Initial Contact Resistance: 10 millohms, maximum.
Electric Life: 1,000,000 make and break cycles.
Total Plunger Travel: MP1F1 = .110 includes .020 minimum over travel. MP1E1 = .055 includes .020 minimum pre travel.
Actuation Force: 8 ounces ± 4.
Case: Diallyl Phthalate (DAP).
Bushing: Brass, cadmium plated with clear chromate finish.
Hardware: 1 Hex mounting nut; 1 internal tooth lockwasher.
Mounting Hole: ¼ inch diameter.


.160 ± .002 DIA
¼-40NS-2A THD
D
C
A
B
.020
.240 ± .020
.015 ± .002
.209 ± .010
SID VIEW OF TERMINAL TOL ± .005
.375 ± .005 DIA.


.093
.040
.080
.050
.100

	A (REF)	B ± 0.015	C ± 0.010	D ± 0.015
MP1F1	1.047	0.407	0.227	0.173
MP1E1	1.047	0.407	0.250	0.150

RAYTHEON PUSH BUTTON SWITCHES

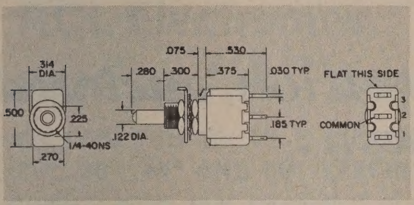
BUSHING MOUNTED 6 AMP, SERIES 6P

These snap action bushing mounted switches have a 6 Amp rating at 120 Vac. Standard solder lug terminals. Two versions available: momentary, and alternate action.

ORDERING INFORMATION

Model No.	Contacts	Description	Caps*
6P1K1	SPDT	Alternate Action	C7, C8
6P1F1	SPDT	Momentary	C7, C8

*There is a choice of colors available in either style. See Table I page 8. Specify color and style.



SPECIFICATIONS

Contact Rating: 6 amps with resistive load @ 120 VAC or 28 VDC; 3 amps with resistive load @ 250 VAC.
Contact Resistance: 20 milliohms max. initial @ 2-4 VDC, 100 milliamps for both coin silver & gold plated contacts.
Insulation Resistance: 1,000 megohms min.
Dielectric Strength: 1,000 volts RMS @ sea level
Electrical Life: 100,000 operations at full load
Operating Force: 2.5 pounds

MATERIALS

Case: Melamine
Bushing: Brass, nickel plated
Housing: Stainless steel
Plunger: Nylon
End Contact: Coin silver, silver plated
End Terminal: Brass, silver plated
Center Contact & Terminal: Brass, silver plated
Hardware: Nut—Brass, nickel plated
Locking Ring—Brass, bright nickel plated
Lockwasher—C.R.S., bright nickel plated

SNAP-IN ALTERNATE ACTION 6 AMPERE—SERIES 6P

This miniature snap-in pushbutton has a pushbutton cap less than ½ inch square. Yet the switch can carry a big load—6 Amperes at 120 VAC. An attractive front panel bezel can be color coordinated with the cap, both being available in a choice of colors. The alternate action, push on-off feature, is an added plus in a switch of such a small size. SPDT configuration only. Standard solder-lug terminals. Switch is held firmly in place in panel by spring steel clips. Front panel mounted.

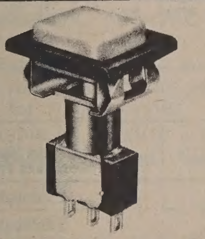
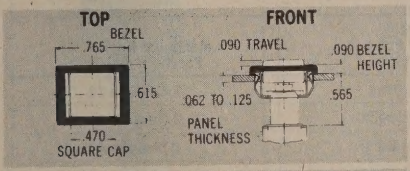
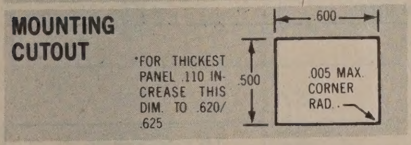


TABLE 1

COLORS FOR BEZEL (B1) AND CAP (C6)

W = White
BL = Black
R = Red
OR = Orange
Y = Yellow
GR = Green
G = Gray (bezel only)





ORDERING INFORMATION

Model No.	Contacts	Description** Alternate Action	Bezel Order No.	Bezel Color*	Cap Order No.	Cap Color*
6P1K1J81	SPDT	push on/off	B1	Black	C6	White

*Other colors available. See Table 1. Specify color required.
**Sequence depends on wiring.

SPECIFICATIONS

End Contact: Coin silver, silver plated.
End Terminal: Brass, silver plated.
Center Contact and Terminal: Brass, silver plated.
Contact Rating: 6 Amperes with resistive load at 120 VAC or 28 VDC; 3 Amperes with resistive load at 250 VAC.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.
Initial Contact Resistance: 20 milliohms maximum at 2 to 4 VDC.
Electrical Life: 100,000 operations at full load.
Operating Force: 2.0 pounds.

MATERIALS

Case: Phenolic resin.
Housing: Stainless steel.
Spring: Steel, nickel plated.
Bezel: Nylon.
Cap: Nylon.
Bracket: Stainless steel.

SNAP-IN SNAP-ACTION SERIES P-J81

These snap-action pushbutton switches mount from the front of the panel, snapping into place and held by nickel plated spring steel clips. The pushbutton cap is less than ½ inch square. Both cap and bezel can be color coordinated by selecting from the available colors; see Table 1. A white cap with a black bezel is supplied, unless otherwise specified. Terminals are solder-lug and are epoxy sealed. Both bezel and cap are nylon. The switches can be wired for either normally open or normally closed operation. SPDT and DPDT.

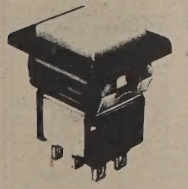
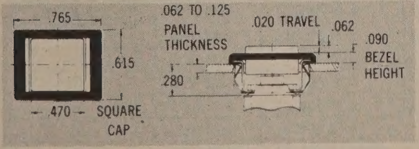


TABLE 1

*COLOR OPTIONS
BEZEL (B1)
AND CAP (C6)

W = White
BL = Black
R = Red
OR = Orange
Y = Yellow
GR = Green
GY = Gray

(1 & 2 Pole only)



ORDERING INFORMATION

Model No.	Contacts	Description	Bezel Order No.	Bezel Color*	Cap Order No.	Cap Color*
P1F1J81	SPDT	Momentary	B1	Black	C6	White
P2F1J81	DPDT	Momentary	B1	Black	C6	White

SPECIFICATIONS

Common Contact: Brass with gold plate over nickel.
Center and End Contact: Precious metal inlay on brass, gold plated.
Contact Rating: 1 Ampere resistive load at 120 VAC or 28 VDC.
Terminals: Gold over brass terminals, epoxy sealed.
Insulation Resistance: 1000 megohms minimum.
Dielectric Strength: 1000 Volts RMS at sea level.
Electric Life: 60,000 cycles minimum at full load.
Mechanical Life: 100,000 make and break cycles, minimum.
Maximum Allowable Force On Plunger: 10 pounds.

MATERIALS

Case: General purpose phenolic.
Housing: Stainless steel.
Bezel: Nylon.
Cap: Nylon.

AMF

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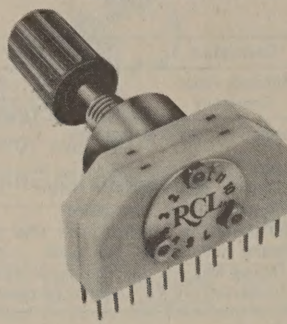
RCL Electronics

"X" switches

series "X30" 12 position, enclosed molded pc switches...



ONLY RCL OFFERS THESE EXCLUSIVE FEATURES:

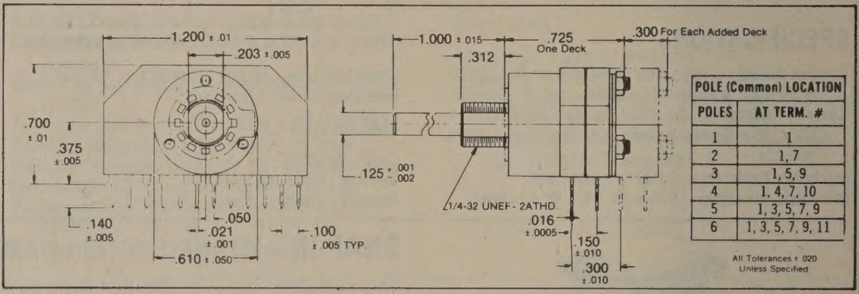
- An exceptionally sturdy miniature switch with adjustable stops, as standard, designed for insertion into printed circuit boards. Engineered to withstand unusual stress and strains.
- Provides the ultimate in reliability as soldering is completely eliminated.
- Behind panel stickout is .687″ (17.46mm) for 1 deck and .300″ (7.62mm) for each additional deck.
- Eliminates all point to point wiring-labor costs.
- Sells at lower cost than old-fashioned open deck wafer switches.
- Up to 12 active positions per deck — shorting or non-shorting, with 30° spacing.
- On any one deck of a multi-pole switch a variety of combinations of shorting (MBB) and non-shorting (BBM) actions may be obtained. For example, a six pole switch may be ordered with 4 poles — shorting action, and 2 poles, non-shorting action.

GENERAL FEATURES:

- Adjustable stops offer maximum versatility at no extra charge. (Fixed stops optional at no extra charge.)
- Up to 12 positions per pole (30° Spacing) and as many as 6 poles per deck are available.
- Shorting and non-shorting poles may be grouped on one deck in any combination. Shorting and non-shorting positions on any one pole are also available.
- Switching elements are completely enclosed.
- Contact and lug assembly is integrally molded and completely enclosed. This eliminates the possibility of movement of contacts and terminals, and prevents flux flowing onto the contact surface during soldering or cleaning operations.
- Industry standard spacing on terminals.
- Shaft and panel seals available.

ELECTRICAL FEATURES:

- **Initial contact resistance** — .015 max.
- **Current breaking capacities:**
  250 MA — 115 VAC resistive
  250 MA — 28 VDC resistive
  125 MA — 28 VDC inductive
- **Dielectric strength (voltage breakdown)** —
  a. Between any two adjacent positions — 1000 V-RMS (60 cycles)
  b. Between any active position to ground — 1000 V-RMS (60 cycles)
- **BCD Coding Available**
- **Current Carrying Capacity** — 5.3 amps
- **Insulation Resistance** (measured at 25°C, 50%RH) — 10° megohms
- **Capacitance** — Between adjacent active contacts — .2 pF max. Between contact and common terminal — .2 pF max.



POLE (Common) LOCATION	
POLES	AT TERM. #
1	1
2	1, 7
3	1, 5, 9
4	1, 4, 7, 10
5	1, 3, 5, 7, 9
6	1, 3, 5, 7, 9, 11

30° SHORTING

Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-X30M-12-J	1 Pole Per Deck	2 through 12
12-X30M-6-J	2 Poles Per Deck	2 through 6
13-X30M-4-J	3 Poles Per Deck	2 through 4
14-X30M-3-J	4 Poles Per Deck*	2 or 3

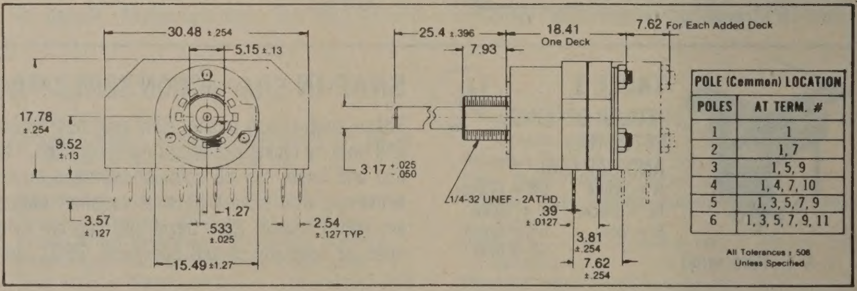
* 5 and 6 poles available (maximum 2 positions per pole)

30° NON-SHORTING

Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-X30B-12-J	1 Pole Per Deck	2 through 12
12-X30B-6-J	2 Poles Per Deck	2 through 6
13-X30B-4-J	3 Poles Per Deck	2 through 4
14-X30B-3-J	4 Poles Per Deck*	2 or 3

* 5 and 6 poles available (maximum 2 positions per pole)

METRIC DIMENSIONS



POLE (Common) LOCATION	
POLES	AT TERM. #
1	1
2	1, 7
3	1, 5, 9
4	1, 4, 7, 10
5	1, 3, 5, 7, 9
6	1, 3, 5, 7, 9, 11

UP TO 12 DECKS ARE AVAILABLE

MECHANICAL FEATURES:

- Life expectancy — in excess of 25,000 mechanical operations. (NOTE: The actual life is determined by a number of variable factors. These include: electrical loading, environment, rate of rotation, maximum contact resistance, minimum insulation resistance, and the minimum voltage breakdown which is required at the end of the life.)
- Detent — stainless steel roller-type snaps positively from position to position. The detent housing is made of special high strength plastic, providing positive action and minimal wear. Commercial series, "Zamac" (Zinc) detent housing.
- Stop strength — Designed to withstand 10 pound-inches of torque.
- "Molded-in" terminals result in exceptionally high contact stability, completely eliminating movement.
- Terminal locations clearly marked on rear cover plate.
- Materials and Finishes:
  Rotor — Lexan
  Rotor Blade — Beryllium copper (heavy silver plated) Gold plating available — consult factory
  Detent Housing — High Grade Die Cast
  Shaft — Stainless steel

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series "V" switch

AVAILABLE IN 12, 10, 8 OR 6 POSITIONS! (30°, 36°, 45° AND 60° SPACING) WITH TRUE ½" DIAMETER AND .355" LENGTH!

A totally integrated series of switches where all common angles of rotation are available in a single subminiature size (½" True Diameter x .355 length).

Overall length including terminals (total depth-behind-panel) has been significantly reduce to less than ½" (.355)!

SPECIFICATIONS:

Contact Resistance: 10 milliohms maximum initial.

Insulation Resistance: 50,000 megohms initial; 10,000 megohms minimum between mutually insulated parts.

Voltage Breakdown: 600 VAC minimum between mutually insulated parts.

Electrical Rating: Will make and break 50 milliamperes: 115 VAC for 25,000 cycles or 200 milliamperes: 115 VAC for 10,000 cycles.

Poles: Available in 1 and/or 2 poles.

Spacing Between Positions: Available with 30°, 36°, 45°, 60° Spacing.

Deck and Terminal Arrangement: Available only in one deck with terminals projecting from rear of switch.

Shaft Length, Flat and Orientation: Available in accordance with individual requirements.

Materials and Finishes: In accordance with applicable MIL specs.

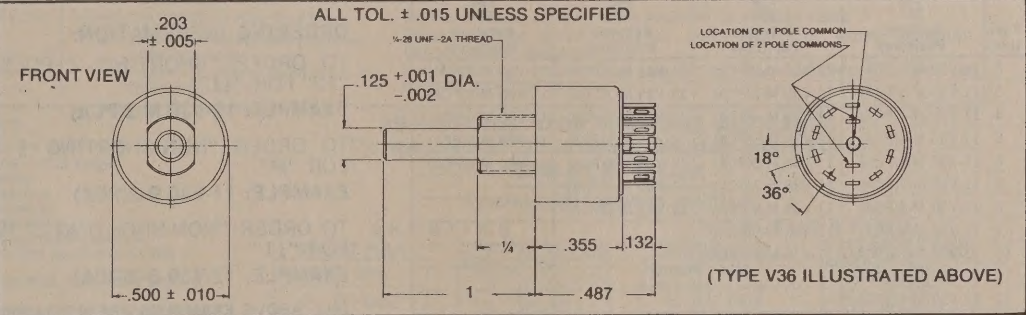
Contacts: Common Terminals, Wipers: Metal alloys with characteristics consistent with performance requirements.

Environmental Requirements: Meets or exceeds MIL-S-3786.

Explosion Proof: Per paragraph 4.8.12 of MIL-S-3786.

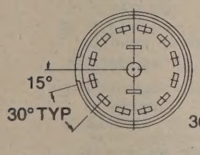
MEETS ALL REQUIREMENTS OF MIL-S-3786/20 & 35

RCL SERIES V30, V36, V45, V60

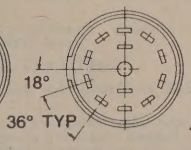


(TYPE V36 ILLUSTRATED ABOVE)

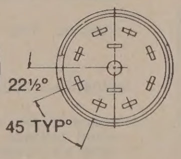
V30



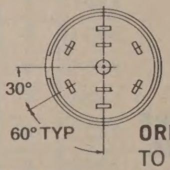
V36



V45



V60



SHORTING - 1 POLE

Positions	V30 30° Between Positions	V36 36° Between Positions	V45 45° Between Positions	V60 60° Between Positions
2	11-V30 M-2	11-V36 M-2	11-V45 M-2	11-V60 M-2
3	11-V30 M-3	11-V36 M-3	11-V45 M-3	11-V60 M-3
4	11-V30 M-4	11-V36 M-4	11-V45 M-4	11-V60 M-4
5	11-V30 M-5	11-V36 M-5	11-V45 M-5	11-V60 M-5
6	11-V30 M-6	11-V36 M-6	11-V45 M-6	11-V60 M-6*
7	11-V30 M-7	11-V36 M-7	11-V45 M-7	
8	11-V30 M-8	11-V36 M-8	11-V45 M-8*	
9	11-V30 M-9	11-V36 M-9		
10	11-V30 M-10	11-V36 M-10*		
11	11-V30 M-11			
12	11-V30 M-12*			

* All switches furnished with fixed stops. For Continuous Rotation add suffix "CR."
* Adjustable stop versions available. To order add suffix "J".

ORDERING INFORMATION:

TO ORDER "SHORTING - 2 POLES"
SUBSTITUTE PREFIX "12" FOR "11"
EXAMPLE: 12-V30M-2

TO ORDER "NON-SHORTING - 1 POLE"
SUBSTITUTE "B" FOR "M"
EXAMPLE: 11-V30 B-2

TO ORDER "NON-SHORTING - 2 POLES"
SUBSTITUTE PREFIX "12" FOR "11"
EXAMPLE: 12-V30 B-2

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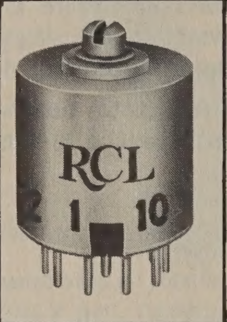
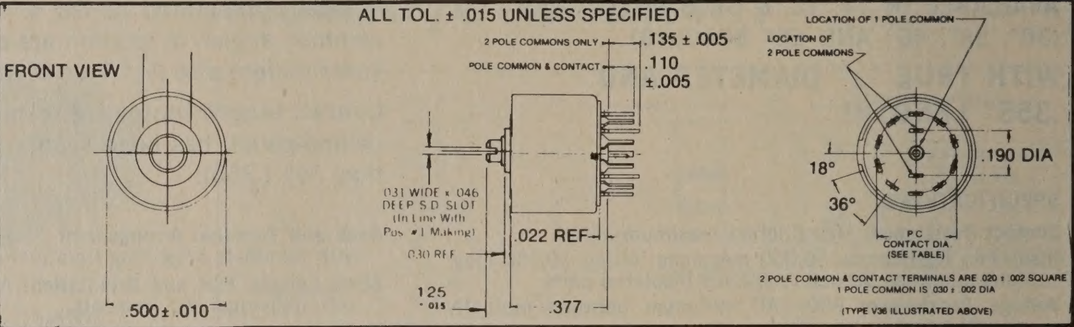
RCL Electronics

series "V" switches--printed circuit




ALL TOL. ± .015 UNLESS SPECIFIED
FRONT VIEW
.500± .010
2 POLE COMMONS ONLY
.135 ± .005
POLE COMMON & CONTACT
.110 ±.005
.031 WIDE x .046 DEEP S.D. SLOT (In Line With Pos #1 Making)
.030 REF
.022 REF
.125 ± .015
.377
LOCATION OF 1 POLE COMMON
LOCATION OF 2 POLE COMMONS
.190 DIA
18°
36°
PC CONTACT DIA (SEE TABLE)
2 POLE COMMON & CONTACT TERMINALS ARE .020 ± .002 SQUARE
1 POLE COMMON IS .030 ± .002 DIA
(TYPE V36 ILLUSTRATED ABOVE)

BEHIND PANEL DISTANCE FROM MOUNTING SURFACE TO PC BOARD IS .380″ SHORTER THAN SIMILAR COMPETITIVE SWITCHES

* All switches furnished with fixed stops. For Continuous Rotation add suffix "CR".
Note: Also available with standard ¼″ long bushing & 1″ long shaft.
To order, use Suffix PC.

- Shaft and panel seals not available on PCA versions.

SHORTING - 1 POLE

Positions	V30 30° Between Positions	V36 36° Between Positions	V45 45° Between Positions	V60 60° Between Positions
2	11-V30 M-2(PCA)	11-V36 M-2(PCA)	11-V45 M-2(PCA)	11-V60 M-2(PCA)
3	11-V30 M-3(PCA)	11-V36 M-3(PCA)	11-V45 M-3(PCA)	11-V60 M-3(PCA)
4	11-V30 M-4(PCA)	11-V36 M-4(PCA)	11-V45 M-4(PCA)	11-V60 M-4(PCA)
5	11-V30 M-5(PCA)	11-V36 M-5(PCA)	11-V45 M-5(PCA)	11-V60 M-5(PCA)
6	11-V30 M-6(PCA)	11-V36 M-6(PCA)	11-V45 M-6(PCA)	11-V60 M-6(PCA)*
7	11-V30 M-7(PCA)	11-V36 M-7(PCA)	11-V45 M-7(PCA)	
8	11-V30 M-8(PCA)	11-V36 M-8(PCA)	11-V45 M-8(PCA)*	
9	11-V30 M-9(PCA)	11-V36 M-9(PCA)		
10	11-V30 M-10(PCA)	11-V36 M-10(PCA)*		
11	11-V30 M-11(PCA)			
12	11-V30 M-12(PCA)*			

TYPE	PC CONTACT PITCH DIA.		POSITIONS
V30 PCA	.366	9.29mm	12
V36 PCA	.340	8.63mm	10
V45 PCA	.340	8.63mm	8
V60 PCA	.340	8.63mm	6

ORDERING INFORMATION:

TO ORDER "SHORTING-2 POLES", SUBSTITUTE PREFIX "12" FOR "11"
EXAMPLE: 12-V30 M-2(PCA)

TO ORDER "NON-SHORTING-1 POLE", SUBSTITUTE "B" FOR "M"
EXAMPLE: 11-V30 B-2(PCA)

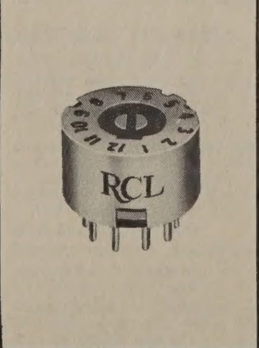
TO ORDER "NON-SHORTING-2 POLES", SUBSTITUTE "12" FOR "11"
EXAMPLE: 12-V30 B-2(PCA)

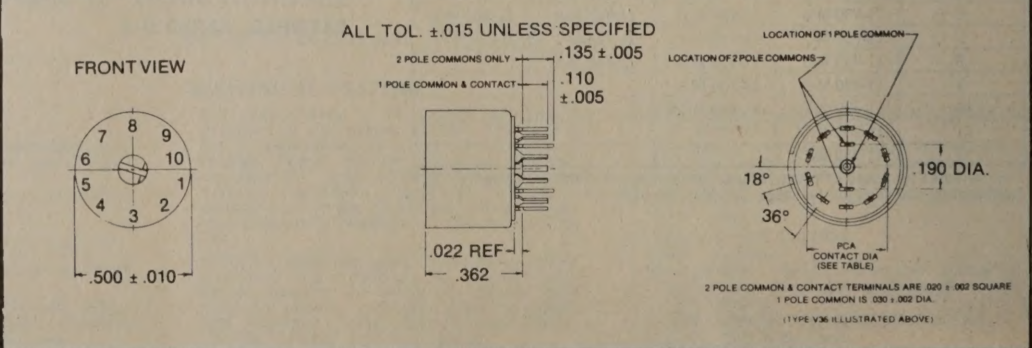
(ALL ABOVE EXAMPLES ARE 2 POSITION 30° SWITCHES)

subminiature printed circuit

DEVELOPED TO MOUNT ON PC CARDS WHERE BOARD-TO-BOARD SPACING IS AT A PREMIUM OVERALL DEPTH ABOVE CARD IS .362″

TO ORDER SUBMINIATURE PRINTED CIRCUIT "V" SERIES, SUBSTITUTE "PCB" FOR "PCA" ON CHART ABOVE.
EXAMPLE: 11-V30 M-2(PCB)




ALL TOL. ±.015 UNLESS SPECIFIED
FRONT VIEW
8
7
9
6
10
5
1
4
2
3
.500 ± .010
2 POLE COMMONS ONLY
.135 ±.005
1 POLE COMMON & CONTACT
.110 ±.005
.022 REF
.362
LOCATION OF 1 POLE COMMON
LOCATION OF 2 POLE COMMONS
.190 DIA.
18°
36°
PCA CONTACT DIA (SEE TABLE)
2 POLE COMMON & CONTACT TERMINALS ARE .020 ± .002 SQUARE
1 POLE COMMON IS .030 ± .002 DIA.
(TYPE V36 ILLUSTRATED ABOVE)

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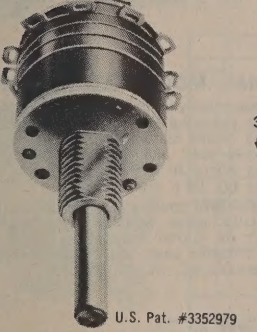
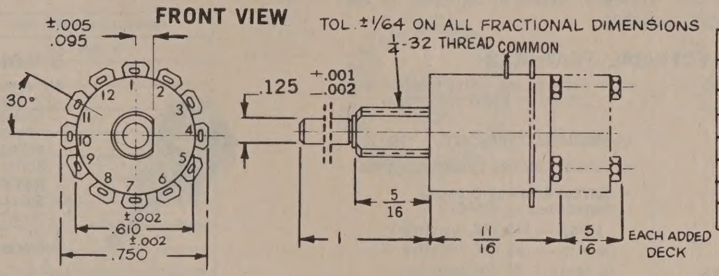
series "c" miniature rotary switches

- Up to 12 active positions per deck shorting **or** non-shorting, with 30° spacing.
- Shorting **AND** non-shorting poles may be grouped on one deck in any combination.
- As many as 6 poles per deck.
- All individual deck parts are self-contained, and are permanently molded into place.
- Available with adjustable stops.
- **MILITARY QUALIFIED TO MIL-S-3786/41 AND LISTED ON QPL**



U.S. Pat. #3352979



POLE (Common) LOCATION	
POLES	AT TERM. #
1	1
2	1, 7
3	1, 5, 9
4	1, 4, 7, 10
5	1, 3, 5, 7, 9
6	1, 3, 5, 7, 9, 11

SERIES "CC" (COMMERCIAL VERSION OF SERIES "C")

All specifications and features remain essentially the same as in the Series "C" switch. Electrical specifications are:

1. - Initial contact resistance—.015Ω max.
2. Current breaking capacities
   1/8 amp—115 V.A.C. resistive
   1/8 amp— 28 V.D.C. resistive
   1/8 amp— 28 V.D.C. inductive
3. Dielectric strength (voltage breakdown)—
   a. between any two adjacent positions—500V (60 cycles)
   b. between any active position to ground 1000V (60 cycles)

Materials and tooling are modified to reduce cost.
Priced at the same level as open frame or wafer switches.
Off-the-shelf delivery.
For ordering information see below, but indicate CC. (For example: 11-CCM-2).

ELECTRICAL FEATURES

1. Initial contact resistance — .010Ω max.
2. Current carrying capacity — 5.5 amps.
3. Current breaking capacities
   ¼ amp — 115 V.A.C. resistive
   ¼ amp — 28 V.D.C. resistive
   ⅛ amp — 28 V.D.C. inductive.
4. Dielectric strength (voltage breakdown) —
   a. between any two adjacent positions — 800 v RMs (60 cycles).
   b. between any active position to ground 1500 V (60 cycles).
5. Insulation resistance (measured at 25°C, 50% RH at sea level) — 10^5 megohms.
6. Thermal EMF — 1 microvolt/°C maximum.
7. Capacitance — between adjacent active contacts .5 PFD Max.
8. Capacitance — between contact and common terminal .9 PFD Max.

MECHANICAL FEATURES

1. Life expectancy — in excess of 50,000 mechanical operations.
2. Detent — stainless steel roller-type detent snaps from position to position. Detent housing made of special high-strength plastic, providing positive action and minimal wear.
3. Stop strength — Designed to withstand 10 pounds-inches of torque.
4. "Molded in" terminals give exceptional terminal strength, completely eliminating movement.
5. Terminal locations clearly marked on rear cover plate.
6. On any one deck of a multi-pole switch, a variety of combinations of shorting (MBB) and non-shorting (BBM) actions may be obtained.
7. Materials and finishes:
   Rotor — Lexan
   Rotor blade — Beryllium copper (silver plated)
   Contacts & solder terminals — solid silver alloy
   Housing — Diallyl Phthalate
   Stator — Diallyl Phthalate
   Shaft — stainless steel
8. One piece contact terminal construction has holes large enough to accept two #22 AWG wires.
9. Shaft and panel seal at additional cost may be specified by using prefix "S" before switch type numbers. Bushing and shaft stick-out from mounting surface is reduced by 1/16". Overall length of switch from mounting surface is increased by 1/16".
10. Explosion proof per paragraph 4, p. 12 of MIL-S-3786.

ENGINEERING NOTE
Series "A" available with above specifications but with "wrap-around" turret-type solder lugs. "Across-terminal" dimension is .820 (±.002).

ADJUSTABLE STOP VERSIONS AVAILABLE
(To specify add "J" to below ordering information)

SINGLE DECK

Spacing: 30° between positions

SHORTING

SINGLE POLE

Positions	Type
2	11-CM-2
3	11-CM-3
4	11-CM-4
5	11-CM-5
6	11-CM-6
7	11-CM-7
8	11-CM-8
9	11-CM-9
10	11-CM-10
11	11-CM-11
12	11-CM-12 (with stops)
12	11-CM-12-CR (continuous rotation)

2 POLES PER DECK

Positions	Type
2	12-CM-2
3	12-CM-3
4	12-CM-4
5	12-CM-5
6	12-CM-6

3 POLES

Positions	Type
2	13-CM-2
3	13-CM-3
4	13-CM-4

4 POLES

Positions	Type
2	14-CM-2
3	14-CM-3

5 POLES

Positions	Type
2	15-CM-2

6 POLES

Positions	Type
2	16-CM-2

NON-SHORTING

SINGLE POLE

Positions	Type
2	11-CB-2
3	11-CB-3
4	11-CB-4
5	11-CB-5
6	11-CB-6
7	11-CB-7
8	11-CB-8
9	11-CB-9
10	11-CB-10
11	11-CB-11
12	11-CB-12 (with stops)
12	11-CB-12-CR (continuous rotation)

2 POLES PER DECK

Positions	Type
2	12-CB-2
3	12-CB-3
4	12-CB-4
5	12-CB-5
6	12-CB-6

3 POLES PER DECK

Positions	Type
2	13-CB-2
3	13-CB-3
4	13-CB-4

4 POLES PER DECK

Positions	Type
2	14-CB-2
3	14-CB-3

5 POLES PER DECK

Positions	Type
2	15-CB-2

6 POLES PER DECK

Positions	Type
2	16-CB-2

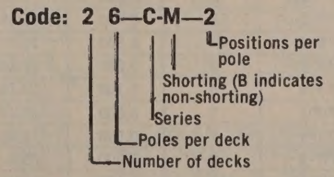
MULTI-DECK SWITCHES UP TO 12 DECKS AVAILABLE

For multi-deck version of these switches, indicate number of decks as follows. Merely change first number of coding as shown:

Number of decks	
One deck	1 1-CB-4
Two decks	2 1-CB-4
Three decks	3 1-CB-4

"M" = Shorting action (MBB)
"B" = Non-shorting action (BBM)
Supplied unless otherwise specified.

Code: 2 6—C-M—2



e.g. this is 2 decks, 6 poles per deck, Series "C" shorting action, 2 positions per pole.

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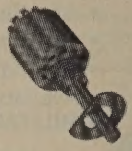
RCL Electronics

miniature rotary switches

(LOW COST COMMERCIAL VERSIONS)



Completely automated facilities and mass production tooling, now makes RCL highly competitive in commercial applications with "obsolete" wafer-type and open frame switches.

Material and tooling are modified to reduce cost, but comparable performance is maintained with our "standard" series of switches, to correspond with "instrument type" switches.

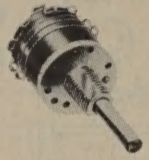
MODIFICATIONS OF ELECTRICAL FEATURES

COMMERCIAL TYPE "CC," "DC," "HC," "FC," "RC"

- Initial Contact Resistance: .015Ω max.
- Current Breaking Capacities:
  1/8 amp — 115 VAC resistive
  1/8 amp — 28 VDC resistive
  1/8 amp — 28 VDC inductive
- Dielectric Strength (Voltage Breakdown):
  a. Between any two adjacent positions — 500V (60 cycles)
  b. Between any active position to ground — 1000V (60 cycles)

COMMERCIAL TYPES "EC," "TC"

- Current Carrying Capacity: 6 amps
- Current Breaking Capacity (Rated Load at 125°C)
  1 amp — 115 VAC resistive
  3/4 amp — 28 VDC resistive
  1/4 amp — 28 VDC inductive



SPECIAL MODIFICATIONS AVAILABLE

All commercial version RCL switches are available with the following features at additional cost:

- Spring return feature (Series CC and DC only)
- "Push-to-turn" and "pull-to-turn" spring loaded action where an isolated position is required (Series CC, DC)
- Non-standard shaft and bushing lengths
- Specially coded outputs, including decimal to binary for digital applications
- 1/4" diameter shaft and 3/8"-32 threaded bushing (Series CC, DC, HC, AC only)

RCL STANDARD SERIES	RCL SERIES	BODY DIAM.	MAX. POS. PER DECK	MAX. POLES PER DECK	MAX. NO. OF DECKS
C	CC	.610	12	6	12
D	DD	.610	10	2	12
H	HC	.610	6	3	12
T	TC	1.380	12	6	20
E	EC	1.380	24	12	20
F FPC	FC FCPC	.524	10	3	1
R RPC	RC RCPC	.586	12	4	1
FJ	FCJ	.524	10	3	1
RJ	RCJ	.586	12	4	1
	K	1.260	12	2	8

RCL "PIP"/DIP SWITCH

"PROGRAMMABLE IN-LINE PACKAGE" SWITCH

LOW PROFILE VERSION

STANDARD VERSION

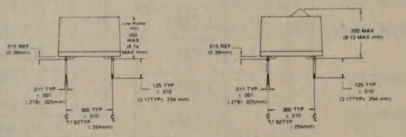
- 2-10 position decimal miniature input device
- Replaces slide switches, toggle switches, thumbwheels, etc.
- Positive detent action
- Low and uniform contact resistance
- Snap-on transparent plastic shield available
- True wiping action
- Delivery from stock
- Withstands ultrasonic cleaning
- Long life expectancy (3000 operations per rocker minimum)
- Rocker marking available for positive position identification
- Competitively priced

ORDERING INFORMATION

RCL PART NUMBER	NO. OF ROCKERS	LENGTH INCHES	LENGTH MM
PIP-2	2	0.300	7.62
PIP-3	3	0.400	10.16
PIP-4	4	0.500	12.7
PIP-5	5	0.600	15.24
PIP-6	6	0.700	17.78
PIP-7	7	0.800	20.32
PIP-8	8	0.900	22.86
PIP-9	9	1.000	25.4
PIP-10	10	1.100	27.94

- To order Protective Covers, specify RCL PIP Part Number and Covers.
- To order Low Profile Switch use Suffix "LP"

DIMENSIONS



LOW PROFILE RECESSED ROCKER VERSION

- Low Profile above PC Board .265
- Provides total security once the switches are set
- Recessed Rocker prevents accidental actuation of positions
- Can be easily sealed prior to board immersion
- Red marker available for positive position identification

The "PIP" switch may be inserted into a standard header or IC packaging receptacle without the use of any additional attachments. Flow soldering may be substituted to achieve direct mounting. Interconnecting wiring is completely eliminated.

GENERAL FEATURES

EASE OF OPERATION: Programs easily modified by manually changing position of rocker arms.

ECONOMICAL: Board mounted switches permit updating circuits without costly wiring changes.

DEPENDABILITY: Complete insulation of contact surfaces from unwanted surrounding risks.

SIZE AVAILABILITY: From 2 through 10 positions.

INTEGRATED TERMINALS: Terminals are molded into the basic switch structure, offering the ultimate in contact protection.

SMALL SIZE: Overall height will not exceed .320". Utilizes least possible P.C. board space.

WIPING BALL CONTACT: Spring loaded contacts prevent possible "opens" during normal operation, including shock and vibration. Important in logic applications.

PLASTIC DUST COVER: Available as an optional feature. Permits switch to remain in position during cleaning or soldering operations with minimum resultant contamination. Aids in prevention of accidental actuation of switch during regular day to day operations.

ELECTRICAL SPECIFICATIONS

SPST Switching: Make before break

Current Voltage Ratings:

Non-Switching	Switching
50 VDC @ 100 mA	5 VDC @ 100 mA (Typ.) 24 VDC @ 25 mA (Max.)

Contact Resistance:
100 Milliohms (Max.) after life, measured at
100 Milliamps and 5 VDC (Typ.)

Insulation Resistance (at 100 VDC):
Between adjacent open or closed switches —
1 x 10^{11} ohm (initial)
1 x 10^{9} after environmental tests

Dielectric Breakdown Voltage: Between adjacent open or closed switches — 500 VDC (Min.)

Circuit Capacitance (between adjacent switches): 5 pfd

MECHANICAL SPECIFICATIONS

Operating Temperature: −40°F thru +195°F

Shock: Per MIL-STD-202, Method 205. No discontinuity exceeding 10 microseconds.

Vibration: Discontinuity shall not exceed 10 microseconds when tested in accordance with MIL-STD-202D, Method 204, Condition C

Life Expectancy: 3000 operations per rocker (Min.)

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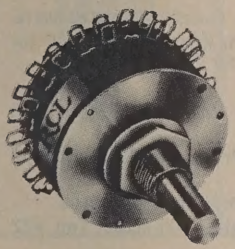
miniature rotary switches

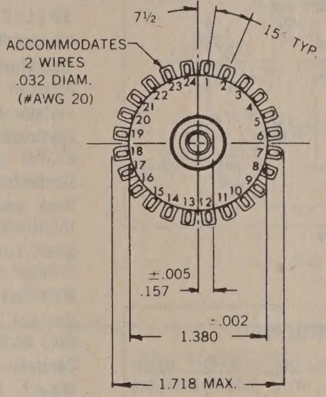
AVAILABLE WITH CONCENTRIC SHAFT

SERIES "E" 1⅜" BODY DIAMETER

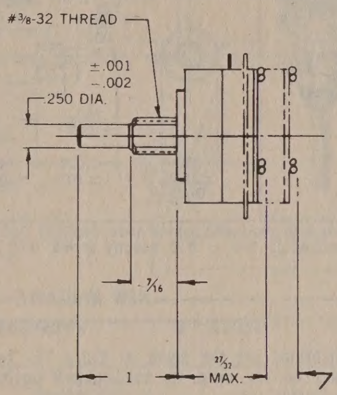
- Up to 24 active positions per deck, **shorting or non-shorting**, and up to 12 poles per deck
- Meets all applicable requirements of Mil S-3786
- Available with concentric shaft
- Available with adjustable stops



Poles	Pole (Common) Location At Term. #
1	1
2	1, 13
3	1, 9, 17
4	1, 7, 13, 19
5	1, 5, 9, 13, 17
6	1, 5, 9, 13, 17, 21
7	1, 3, 5, 7, 9, 11, 13
8	1, 3, 5, 7, 9, 11, 13, 15
9	1, 3, 5, 7, 9, 11, 13, 15, 17
10	1, 3, 5, 7, 9, 11, 13, 15, 17, 19
11	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21
12	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23



FRONT VIEW



5/16 EACH ADDED DECK

SERIES "EC" (LOW COST COMMERCIAL VERSION OF SERIES "E")

All specifications and features remain essentially the same as in the Series "E" switch. Materials and tooling are modified to reduce cost. Electrical specifications are derated by approximately 40%.

Priced at the same level as open frame or wafer switches. For ordering information see below but indicate EC. (For example: 11-ECM-2)

ELECTRICAL FEATURES

SERIES E

- Contact Resistance: .010 ohms max. initial
- Current Carrying Capacity: 10 amps
- Current Breaking Capacity:
  2 amp — 115 VAC Resistive
  1 amp — 28 VDC Resistive
  .5 amp — 28 VDC Inductive

SERIES EC

- Current Carrying Capacity: 6 amps
- Current Breaking Capacity:
  1 amp — 115 VAC Resistive
  ¾ amp — 28 VDC Resistive
  ¼ amp — 28 VDC Inductive

MECHANICAL FEATURES

- Life Expectancy: In excess of 50,000 mechanical operations
- Rotational Torque: 20 to 80 ounce-inches depending on number of poles per deck and number of decks.
- Stop Strength: 15 pound-inches.
- Solder terminals will accept two .032 diam. (AWG #20) wires.
- "Molded-in" terminals result in exceptionally high contact stability, completely eliminating movement.
- Shaft and Panel Seals at additional cost may be specified by using Prefix "S" before Switch Type Numbers. This reduces bushing and shaft stick-out from mounting surface by 1/16". Overall lengths of switch from mounting surface is increased by 1/16".
- Explosion Proof per paragraph 4.8.12 of MIL-S-3786.
- Weight: 1 Deck Switch 1.75 oz. For each additional deck add .500 oz.

ALSO AVAILABLE IN 12 POSITION VERSION AS SERIES "T" AND IN 12 POSITION COMMERCIAL VERSION AS SERIES "TC"

ALTHOUGH ONLY 1 DECK IS SHOWN FOR ILLUSTRATIVE PURPOSES, UP TO 20 DECKS ARE AVAILABLE.

SINGLE DECK SPACING 15° BETWEEN POSITIONS

SINGLE POLE

Positions	Shorting Type	Non-Shorting Type
2	11-EM-2	11-EB-2
3	11-EM-3	11-EB-3
4	11-EM-4	11-EB-4
5	11-EM-5	11-EB-5
6	11-EM-6	11-EB-6
7	11-EM-7	11-EB-7
8	11-EM-8	11-EB-8
9	11-EM-9	11-EB-9
10	11-EM-10	11-EB-10
11	11-EM-11	11-EB-11
12	11-EM-12	11-EB-12
13	11-EM-13	11-EB-13
14	11-EM-14	11-EB-14

Positions	Shorting Type	Non-Shorting Type
15	11-EM-15	11-EB-15
16	11-EM-16	11-EB-16
17	11-EM-17	11-EB-17
18	11-EM-18	11-EB-18
19	11-EM-19	11-EB-19
20	11-EM-20	11-EB-20
21	11-EM-21	11-EB-21
22	11-EM-22	11-EB-22
23	11-EM-23	11-EB-23
24	11-EM-24	11-EB-24
*24	11-EM-24CR Continuous Rotation	11-EB-24CR Continuous Rotation

2 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	12-EM-2	12-EB-2
3	12-EM-3	12-EB-3
4	12-EM-4	12-EB-4
5	12-EM-5	12-EB-5
6	12-EM-6	12-EB-6
7	12-EM-7	12-EB-7
8	12-EM-8	12-EB-8
9	12-EM-9	12-EB-9
10	12-EM-10	12-EB-10
11	12-EM-11	12-EB-11
12	12-EM-12	12-EB-12

3 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	13-EM-2	13-EB-2
3	13-EM-3	13-EB-3
4	13-EM-4	13-EB-4
5	13-EM-5	13-EB-5
6	13-EM-6	13-EB-6
7	13-EM-7	13-EB-7
8	13-EM-8	13-EB-8

4 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	14-EM-2	14-EB-2
3	14-EM-3	14-EB-3
4	14-EM-4	14-EB-4
5	14-EM-5	14-EB-5
6	14-EM-6	14-EB-6

5 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	15-EM-2	15-EB-2
3	15-EM-3	15-EB-3
4	15-EM-4	15-EB-4

6 POLES PER DECK

Positions	Shorting Type	Non-Shorting Type
2	16-EM-2	16-EB-2
3	16-EM-3	16-EB-3
4	16-EM-4	16-EB-4

AMF

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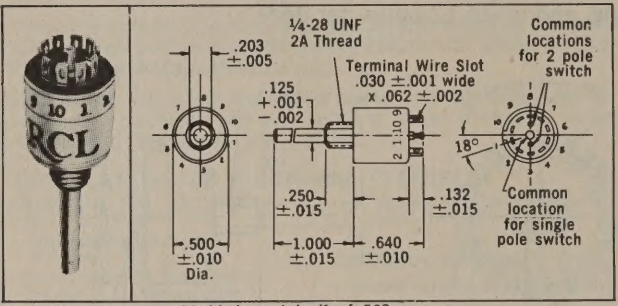
RCL Electronics
miniature rotary switches

OFF-THE-SHELF DELIVERY

MILITARY QUALIFIED TO MIL-S-3786/20 AND LISTED ON QPL

RCL SERIES "F" 10-POSITION SWITCHES


¼-28 UNF
2A Thread
.203 ±.005
.125 +.001 −.002
Terminal Wire Slot .030 ±.001 wide x .062 ±.002
Common locations for 2 pole switch
18°
.250 ±.015
.132 ±.015
Common location for single pole switch
.500 ±.010 Dia.
1.000 ±.015
.640 ±.010
RCL
10 1

Available with shortened behind panel depth of .563 max.
(Instead of .640 ± .010, specify Series "FF".)

NOW AVAILABLE

SERIES "G" 6-POSITION SWITCHES

Specifications are the same as RCL's "F" series, but with 60° throw and non-shorting only. Up to 1 pole-6 position, or 2 pole-3 position.

Available with standard solder lugs or printed circuit terminals.

½" DIAMETER

This subminiature rotary switch has been designed to offer the features of larger switches in a fraction of the space formerly required.

SPECIFICATIONS FOR BOTH "F" AND "R" SERIES

Contact Resistance: 10 milliohms maximum initial.

Insulation Resistance: 50,000 megohms initial; 10,000 megohms min. between mutually insulated parts.

Voltage Breakdown: 600 VAC min. between mutually insulated parts.

Electrical Rating: Will make and break 50 milliamperes: 115 VAC for 25,000 cycles or 200 milliamperes 115 VAC for 10,000 cycles.

Contacts: Shorting or non-shorting contacts.

Deck and Terminal Arrangement: Available only in one deck with terminals projecting from rear of switch.

Shaft Length, Flat and Orientation: Available in accordance with individual requirements.

Materials and Finishes: In accordance with applicable MIL specs.

Contact Terminals: Solid silver alloy gold plated. Will accept Two #22 AWG wires.

Common: Terminal brass gold plated.

Wipers: Solid silver alloy.

Environmental requirements: Meets or exceeds MIL-S-3786. Explosion proof per paragraph 4.8.12 of MIL-S-3786.

SERIES "F" SINGLE DECK — 36° BETWEEN POSITIONS

SHORTING

SINGLE POLE

Positions	Type
2	11-FM-2
3	11-FM-3
4	11-FM-4
5	11-FM-5
6	11-FM-6
7	11-FM-7
8	11-FM-8
9	11-FM-9
10	11-FM-10
*10	11-FM-10-CR

2 POLES

Positions	Type
2	12-FM-2
3	12-FM-3
4	12-FM-4
5	12-FM-5

3 POLES

Positions	Type
2	13-FM-2
3	13-FM-3

(*continuous rotation)

NON-SHORTING

SINGLE POLE

Positions	Type
2	11-FB-2
3	11-FB-3
4	11-FB-4
5	11-FB-5
6	11-FB-6
7	11-FB-7
8	11-FB-8
9	11-FB-9
10	11-FB-10
*10	11-FB-10-CR

2 POLES

Positions	Type
2	12-FB-2
3	12-FB-3
4	12-FB-4
5	12-FB-5

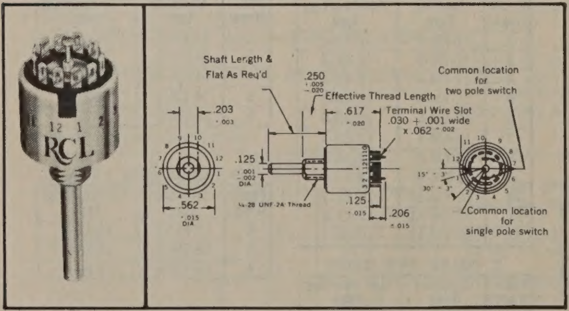
3 POLES

Positions	Type
2	13-FB-2
3	13-FB-3

(*continuous rotation)

ORDERING INFORMATION:
△ Shortened bushing and shaft stick-out available with screwdriver slot for P.C. applications. Specify PCA
△ Shaft and panel seals may be specified by using Prefix "S".
△ Standard terminal with shortened bushing and shaft stick-out available. Contact factory.

SERIES "R" 12-POSITION SWITCHES
MILITARY QUALIFIED TO MIL-S-3786/35 AND LISTED ON QPL


Shaft Length & Flat As Req'd
.250 +.005 −.020
Effective Thread Length
Common location for two pole switch
.203 ±.003
.617 ±.020
Terminal Wire Slot .030 + .001 wide x .062 ±.002
.125 +.001 −.002 DIA
¼-28 UNF-2A Thread
15° ± 3°
30° ± 3°
.562 ±.015 DIA
.125 ±.015
.206 ±.015
Common location for single pole switch
RCL
12 1

SPECIAL ENGINEERING NOTE
BOTH SERIES ("F" and "R")
AVAILABLE WITH PRINTED CIRCUIT TERMINALS! (To order specify suffix "PC")

9/16" DIAMETER

SHORTING

SINGLE POLE

Positions	Type
2	11-RM-2
3	11-RM-3
4	11-RM-4
5	11-RM-5
6	11-RM-6
7	11-RM-7
8	11-RM-8
9	11-RM-9
10	11-RM-10
11	11-RM-11
12	11-RM-12
*12	11-RM-12-CR

(*continuous rotation)

2 POLES

Positions	Type
2	12-RM-2
3	12-RM-3
4	12-RM-4
5	12-RM-5
6	12-RM-6

3 POLES

Positions	Type
2	13-RM-2
3	13-RM-3
4	13-RM-4

4 POLES

Positions	Type
2	14-RM-2
3	14-RM-3

6 POLES

Positions	Type
2	16-RM-2

NON-SHORTING

SINGLE POLE

Positions	Type
2	11-RB-2
3	11-RB-3
4	11-RB-4
5	11-RB-5
6	11-RB-6
7	11-RB-7
8	11-RB-8
9	11-RB-9
10	11-RB-10
11	11-RB-11
12	11-RB-12
*12	11-RB-12-CR

(*continuous rotation)

† 6 POLE SERIES AVAILABLE WITH STANDARD TERMINALS ONLY

2 POLES

Positions	Type
2	12-RB-2
3	12-RB-3
4	12-RB-4
5	12-RB-5
6	12-RB-6

3 POLES

Positions	Type
2	13-RB-2
3	13-RB-3
4	13-RB-4

4 POLES

Positions	Type
2	14-RB-2
3	14-RB-3

6 POLES†

Positions	Type
2	16-RB-2

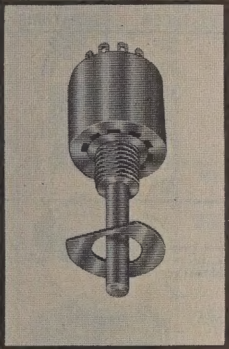
AMF

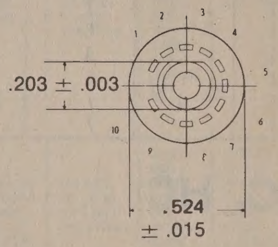
RCL Electronics

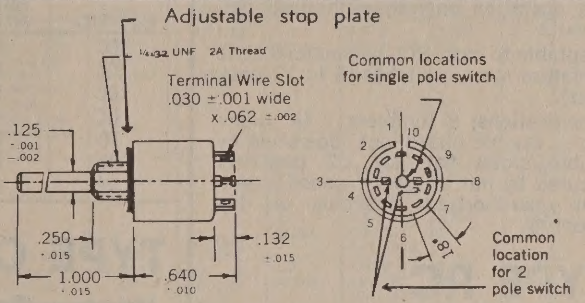
GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

commercial sub-miniature rotary switches

RCL SERIES "FCJ" COMPLETELY ENCLOSED SWITCHES WITH ADJUSTABLE STOPS




1
2
3
4
5
6
7
8
9
10
.203 ± .003
.524
± .015


Adjustable stop plate
¼-32 UNF 2A Thread
Terminal Wire Slot
.030 ±.001 wide
x .062 ±.002
.125
+.001
−.002
.250
±.015
1.000
±.015
.640
±.010
.132
±.015
Common locations
for single pole switch
1
2
3
4
5
6
7
8
9
10
18°
Common
location
for 2
pole switch

A subminiature rotary switch with adjustable stops... permits the user to vary the number of positions!

FEATURES

- **From 2 to 10 positions available merely by moving external plate!**
- **Shorting or non-shorting action available.**
- **As many as 3 poles possible on one deck!**
- **Instant switching to any desired number of positions.**
- **Available with P.C. terminals. To order use Suffix P.C.**
- **Permits stocking of a minimum number of switch types.**
- **Ideal for breadboard setups and prototype work — where rapid circuit modification may be desired.**

This switch is furnished with one internal fixed stop and one external adjustable stop plate. This permits adjustment of the number of positions.

Adjustments are made merely by rotating the external adjustable plate until its integral stop tab passes through the proper hole in the switch front plate.

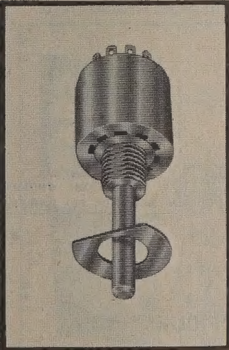
36° SHORTING

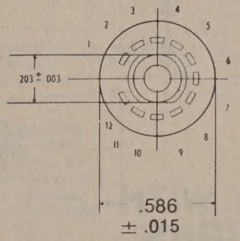
Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-FCM-10-J	1 pole per deck	2 through 10
12-FCM-5-J	2 poles per deck	2 through 5
13-FCM-3-J	3 poles per deck	2 or 3

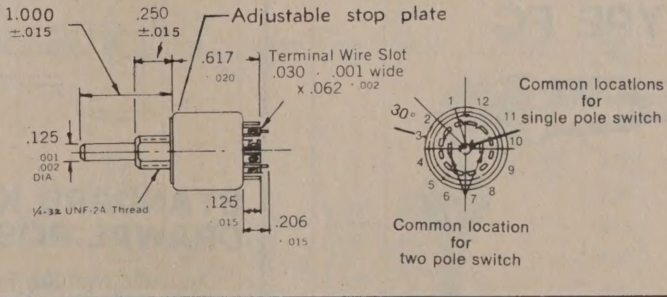
36° NON-SHORTING

Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-FCB-10-J	1 pole per deck	2 through 10
12-FCB-5-J	2 poles per deck	2 through 5
13-FCB-3-J	3 poles per deck	2 or 3

RCL SERIES "RCJ" COMPLETELY ENCLOSED SWITCHES WITH ADJUSTABLE STOPS




1
2
3
4
5
6
7
8
9
10
11
12
.203 ± .003
.586
± .015


1.000
±.015
.250
±.015
Adjustable stop plate
.617
±.020
Terminal Wire Slot
.030 ± .001 wide
x .062 ±.002
.125
+.001
−.002
DIA
¼-32 UNF-2A Thread
.125
±.015
.206
±.015
Common locations
for
single pole switch
30°
1
2
3
4
5
6
7
8
9
10
11
12
Common location
for
two pole switch

A subminiature rotary switch with adjustable stops... permits the user to vary the number of positions!

FEATURES

- **From 2 to 12 positions available merely by moving external plate!**
- **Shorting or non-shorting action available.**
- **As many as 4 poles possible on one deck!**
- **Instant switching to any desired number of positions.**
- **Available with P.C. terminals. To order use Suffix P.C.**
- **Permits stocking of a minimum number of switch types.**
- **Ideal for breadboard setups and prototype work — where rapid circuit modification may be desired.**

This switch is furnished with one internal fixed stop and one external adjustable stop plate. This permits adjustment of the number of positions.

Adjustments are made merely by rotating the external adjustable plate until its integral stop tab passes through the proper hole in the switch front plate.

30° SHORTING

Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-RCM-12-J	1 pole per deck	2 through 12
12-RCM-6-J	2 poles per deck	2 through 6
13-RCM-4-J	3 poles per deck	2 through 4
14-RCM-3-J	4 poles per deck	2 or 3

30° NON-SHORTING

Type No.	Single Deck Number of Poles Per Deck	Maximum Number of Positions Per Pole
11-RCB-12-J	1 pole per deck	2 through 12
12-RCB-6-J	2 poles per deck	2 through 6
13-RCB-4-J	3 poles per deck	2 through 4
14-RCB-3-J	4 poles per deck	2 or 3

INDUSTRY'S BEST DELIVERY

AMF
GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

RCL Electronics

keylock switches

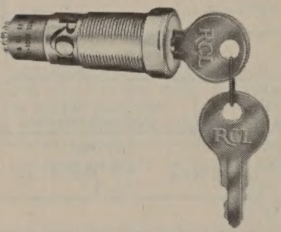
SERIES CC, DC, HC, FC, RC

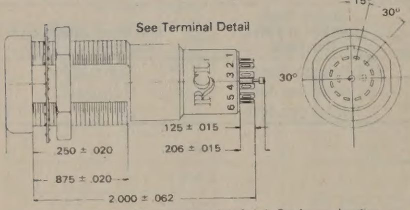
Provides maximum security by permitting operation only by authorized personnel.

Adaptable to most RCL commercial style miniature rotary switches (6 to 12 positions).

Specifications: 8 tumblers . . . 7/8" diameter . . . Double bitted lock. Operation by double sided flat key . . . 2 provided. Secured by nut at rear of panel to prevent unauthorized loosening or dismounting.

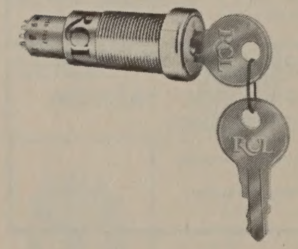
TYPE RC

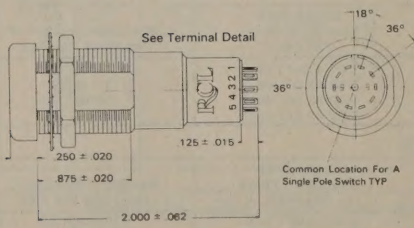



Rear View
15°
30°
See Terminal Detail
30°
6 5 4 3 2 1
125 ± 015
206 ± 015
250 ± 020
875 ± .020
2.000 ± .062

Common Location For a Single Pole Switch. For Approx. Location of Commons on a Multi-Pole Switch See Circuit Diagrams Type "R"

TYPE FC



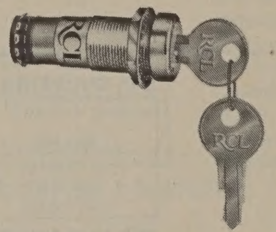

18°
36°
See Terminal Detail
36°
5 4 3 2 1
125 ± .015
.250 ± .020
.875 ± .020
2.000 ± .062

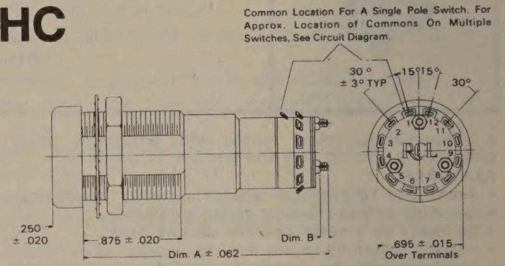
Common Location For A Single Pole Switch TYP

TERMINAL NUMBERS

RCL SERIES	TOTAL # OF POSITIONS AVAILABLE	A	KEY INSERTION AND WITHDRAWAL POSITIONS B	C	D	ANGLE OF THROW	CONFIGURATIONS
CC	12	1	4	7	10	30°	2
CC	12	1		7		30°	1
DC	10	1		6		36°	3
HC	6	1		4		60°	4
FC	10	1		6		36°	3
RC	12	1	4	7	10	30°	2
RC	12	1		7		30°	1

TYPE CC, DC, HC



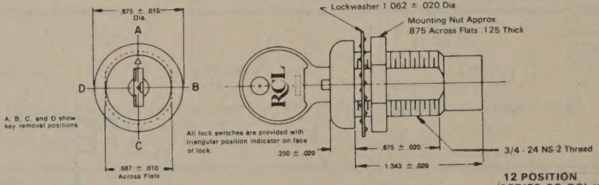

30°
± 3° TYP
15° 15°
30°
1 2 3 4 5 6 7 8 9 10 11 12
RCL
.250 ± .020
.875 ± .020
Dim. B
Dim. A ± .062
.695 ± .015
Over Terminals

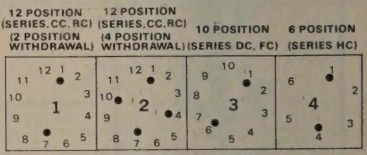
Common Location For A Single Pole Switch. For Approx. Location of Commons On Multiple Switches, See Circuit Diagram.

NO. OF DECKS	DIM A	DIM B
1	2.070	.062
2	2.365	.062
3	2.660	.062
4	2.995	.062
5	3.250	.062
6	3.795	.312

NO. OF DECKS	DIM A	DIM B
7	4.090	.312
8	4.385	.312
9	4.680	.312
10	4.975	.312
11	5.270	.312
12	5.565	.312

LOCK ASSEMBLY


.875 ± .015 Dia
A
B
C
D
A, B, C, and D show key removal positions
.687 ± .010 Across Flats
RCL
All lock switches are provided with triangular position indicator on face of lock.
Lockwasher 1.062 ± .020 Dia
Mounting Nut Approx .875 Across Flats .125 Thick
.250 ± .020
.875 ± .020
1.343 ± .020
3/4 - 24 NS-2 Thread


12 POSITION (SERIES, CC, RC) (2 POSITION WITHDRAWAL)
12 POSITION (SERIES, CC, RC) (4 POSITION WITHDRAWAL)
10 POSITION (SERIES DC, FC)
6 POSITION (SERIES HC)
1
2
3
4

CONFIGURATIONS

STANDARD KEY WITHDRAWAL POSITIONS

Available With Key Removal Only at Position Indicated.

Engineering Note: All Configurations Available For Key Withdrawal In Every Position. Contact Factory. Special 2, 3 or 4 key lock Switches available to provide limited access on different levels of authority. Consult factory.

ORDERING INFORMATION

To order Keylock Modification, use prefix -001

EXAMPLE:

To order CC Type Switch (Commercial Version) 2001-11-CCM-2
(2 position, single pole, single deck with keylock)
(4001 would indicate 4 position Key Withdrawal — available only in 12 position switch)

Refer to RCL miniature Rotary Switch Catalog for complete ordering information on all series of switches.

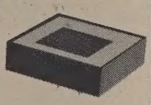
WILD ROVER®

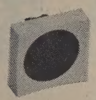
Touch Switches
Keyboards

PRODUCTS OF:
REFAC electronics corporation
DEPT. EM, P.O. BOX 809, WINSTED, CT 06098 (203) 379-2731

TOUCH SWITCH FEATURES

- Extremely fast turn-on and turn-off.
- Very low transient noise.
- Exceptionally rugged construction for long life and ease of handling during assembly.
- Economical design. Simple to mount.
- Clean, contemporary graphics to accent highly functional packaging.
- Unique ability to handle inductive loads as well as dry circuits or low level applications with ease.
- Optional legendizing.

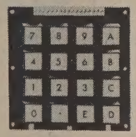




Part No.	Description	Rating	Contact Form	Contact Resistance	Operating Force	Life	Temperature Range	Terminal Type	Nom. Weight	Dimensions	Touch Plate Dimension	List Price
TC-1C	Touch switch capsule	115 VAC, 1.6 amp; 24 VDC, 1 amp resistive	Single pole, single throw, normally open, momentary	30 milliohms nominal	50 ±30 grams	High Loads: More than 1,000,000 cycles Low Level Loads: More than 10,000,000 cycles	(−54°C - +93°C) −65°F - +200°F	¼″ long, 0.041″ dia. printed circuit pins	1.4 grams	0.615″ dia. x 0.160″ thick	0.465″ dia.	$ .60
MM-1	Micro-movement touch switch	24 VAC or DC at 100 ma. resistive	Single pole, single throw, normally open, momentary	0.0075 ohms nominal; 0.100 ohms after 1,000,000 cycles	15 grams minimum, 58 grams nominal 100 grams maximum, 0,010″ travel	1,000,000 cycles at rated load	(−20°C - +65°C) −4°F - +149°F	7⁄32″ long, 0.040″ dia. printed circuit pins	1.5 grams	0.590″ sq. x 0.172″ nom. thick	0.315″ sq.	.40
MM-2									1.4 grams	0.590″ sq. x 0.172″ nom. thick	0.315″ dia.	.40
MM-3									1.3 grams	0.630″ dia. x 0.172″ nom. thick	0.315″ dia.	.40
MM-4									1.1 grams	0.492″ sq. x 0.172″ nom. thick	0.315″ dia.	.40
MM-5									1.1 grams	0.492″ sq. x 0.172″ nom. thick	0.315″ sq.	.40
TC-1M7	Mini-lithic touch switch	115 VAC RMS, 1.6 amp, resistive; 24 VDC, 1 amp resistive	Form A (SPST) momentary, normally open	0.030 ohms nominal; 0.100 ohms max. throughout life	50-120 grams	1,000,000 cycles at rated load	(−45°C - +75°C) −50°F - +167°F	13⁄64″ long, 0.041″ dia. printed circuit pins	4.1 grams	0.750″ sq. x 0.250″ nom. thick	0.500″ dia. (approx.)	1.25
TC-1M8									3.4 grams	0.750″ sq. x 0.250″ nom. thick	0.500″ dia. (approx.)	1.25
TC-1M9									5.3 grams	0.875″ sq. x 0.255″ nom. thick	0.500″ sq.	1.25
TC-1/SE1	Sealed touch switch	115 VAC, 1.6 amp; 24 VDC, 1 amp	Form A (SPST) momentary, normally open	30 milliohms nominal 100 milliohms maximum	75-150 grams	High Loads: More than 1,000,000 cycles Low Level Loads: More than 10,000,000 cycles	(−54°C - +75°C) −65°F - +167°F	Screw type (recessed 4-40 screw) standard; other types available	0.3 oz. nominal	1.00″ square	0.800″ dia.	2.80
TC-1/SE2									0.3 oz. nominal	1.00″ square	0.800″ dia.	2.80
TC-1/SE3									0.3 oz. nominal	1.00″ diameter	0.800″ dia.	2.80
TC-1/SE4									0.3 oz. nominal	0.950″ diameter	0.820″ dia.	2.60

KEYBOARD FEATURES

- PCK-1 or -2 individual keyboard switches for short-run or custom-design keyboard construction.
- PCK-12 and -16 keyboards with touch tone, business machine and special legends available.
- Standard 5, 8, and 12-key MKM, MK Series military and commercial touch keyboards.
- All long life, positive feel, low bounce, and inexpensive.



1
2
3
4
5
6
7
8
9
CLR
0
ENTR

SUB
ALL
5
6
3
4
1
2

STEP
UP
STEP
DOWN
AUTO

Part No.	Description	Rating	Contact Resistance	Contact Configuration	Bounce	Life	Temperature Range	PC Contacts	Terminals	Shorting Contact	Overall Dimensions	List Price
PCK-1*	Individual key for 1⁄32″ board	24 VDC resistive up to 200 ma.	50 milliohms max. after life test	SPST N.O. (Form A)	Less than 2 milliseconds leading or trailing edge	10 million cycles at 5 VDC, 5 ma; 2 million cycles at 24 VAC, 200 ma	−65°F to +167°F (−54°C to +75°C)	N/A	N/A	Beryllium copper 0.000010″ gold over nickel	0.500″ square x 0.300″ nom. thick	$ .25
PCK-2*	Individual key for 1⁄16″ board							0.00005″ gold over nickel on 1 oz. copper pads	0.025″ square x 0.500″ long Wire Wrap® pins, tin plated			.25
PCK-12-TC*	3 x 4 keyboard touch tone legend										3.000″ high x 2.380″ wide	7.60
PCK-12-MC*	3 x 4 keyboard machine legend											7.60
PCK-12-MT*	3 x 4 keyboard machine legend,											8.95
PCK-12-TT*	3 x 4 keyboard touch tone legend											8.95
PCK-16-TC*	4 x 4 keyboard touch tone legend										3.000″ high x 3.000″ wide	9.45
PCK-16-MC*	4 x 4 keyboard machine legend											9.45
PCK-16-MT*	4 x 4 keyboard machine legend,											10.15
PCK-16-TT*	4 x 4 keyboard touch tone legend											10.15
MK-5†	5 key commercial	5 VDC, 10 ma inductive or 24 VDC, 200 ma resistive after life test	2 ohms maximum after life test	SPST N.O. momentary contact	Less than 5 milliseconds	1 million cycles	−67°F to +185°F (−55°C to +85°C)	0.00005″ gold over nickel on 1 oz. copper pads	Tin plated brass, 0.025″ square x 0.500″ long	Silver grid	2.375″ high x 1.750″ wide	17.50
MK-8†	8 key commercial										3.250″ high x 1.750″ wide	18.50
MK-12†	12 key commercial										3.000″ high x 2.375″ wide	21.50
MKM-5†	5 key military								Gold plated brass, 0.025″ square x 0.500″ long		2.375″ high x 1.750″ wide	19.50
MKM-8†	8 key miltary										3.250″ high x 1.750″ wide	20.50
MKM-12†	12 key military										3.000″ high x 2.375″ wide	23.50

* Operating Force 20-60 grams. Key Travel 0.055″ ±0.015″. Cap and Base Material Celcon®, black. Touch Plate Area 0.500″ square.
† Operating Force 100-400 grams. Key Trvel 0.005″ nom. Touch Plate Area 0.500″ square x 1⁄32″ recess.

Shallco

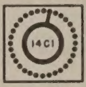
14, 18, 22 SERIES ROTARY SWITCHES

AVAILABLE CIRCUITS

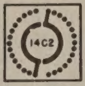
SERIES 14

VIEWS SHOWN ARE EXTREME CCW POSITION AS VIEWED FROM SHAFT END

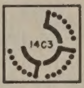
11¼° INDEXING SHORTING



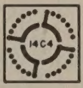
1 POLE
2 to 31 Pos. with Stops
32 Pos. Continuous Rot



2 POLE
2 to 15 Positions

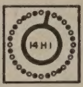


3 POLE
2 to 7 Positions

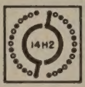


4 POLE
2 to 7 Positions

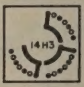
22½° INDEXING NON-SHORTING



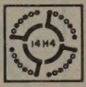
1 POLE
2 to 15 Pos. with Stops
16 Pos. Continuous Rot



2 POLE
2 to 8 Positions

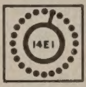


3 POLE
2 to 4 Positions

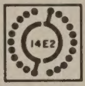


4 POLE
2 to 4 Positions

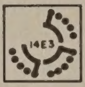
15° INDEXING SHORTING



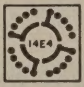
1 POLE
2 to 23 Pos. with Stops
24 Pos. Continuous Rot



2 POLE
2 to 11 Positions

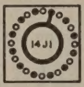


3 POLE
2 to 5 Positions

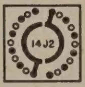


4 POLE
2 to 5 Positions

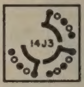
30° INDEXING NON-SHORTING



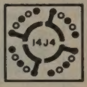
1 POLE
2 to 11 Pos. with Stops
12 Pos. Continuous Rot.



2 POLE
2 to 6 Positions



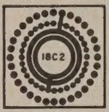
3 POLE
2 to 3 Positions



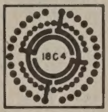
4 POLE
2 to 3 Positions

SERIES 18

11¼° INDEXING SHORTING

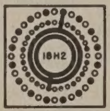


2 POLE
2 to 31 Pos. with Stops
32 Pos. Continuous Rot

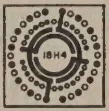


4 POLE
2 to 15 Positions

22½° INDEXING NON-SHORTING

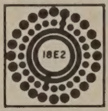


2 POLE
2 to 15 Pos. with Stops
16 Pos. Continuous Rot

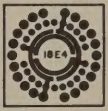


4 POLE
2 to 8 Positions

15° INDEXING SHORTING

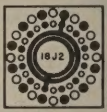


2 POLE
2 to 23 Pos. with Stops
24 Pos. Continuous Rot

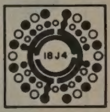


4 POLE
2 to 11 Positions

30° INDEXING NON-SHORTING



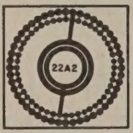
2 POLE
2 to 11 Pos. with Stops
12 Pos. Continuous Rot



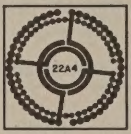
4 POLE
2 to 6 Positions

SERIES 22

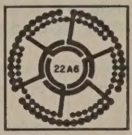
7½° INDEXING SHORTING



2 POLE
2 to 46 Pos. with Stops
48 Pos. Continuous Rot

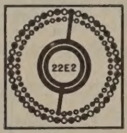


4 POLE
2 to 23 Positions

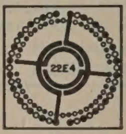


6 POLE
2 to 15 Positions

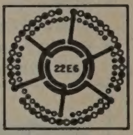
15° INDEXING NON-SHORTING



2 POLE
2 to 23 Pos. with Stops
24 Pos. Continuous Rot



4 POLE
2 to 12 Positions



6 POLE
2 to 8 Positions

SPECIFICATIONS

ELECTRICAL

Current Ratings: Carry — 10 amps, continuous
Make and Break, 2 amps up to 120 VAC or up to 30 VDC at 10,000 and 20,000 cycles respectively.
Higher loads may be switched with shorter life.

Contact Resistance: .003 ohms max., initial
.010 ohms max., end of life

Insulation Resistance: > 10^{14} ohms

Voltage Breakdown: Between Poles — 2,000 V. RMS
Between Contacts — 1500 V. RMS
Between Decks — 6,000 V. RMS
Circuit to Frame — 3,000 V. RMS

MECHANICAL

Terminal Strength: Withstands 5 lbs. pull.
Detent: Star wheel type
Stop Strength: Withstands 50 in-lbs.
Mounting: 2 hole type, see outline drawings.
Construction: Open frame type

MATERIAL

Current Carrying Parts: Solid Silver-Alloy
Terminals: Turret type capable of attaching two 20 AWG wires. Terminals are integral with contacts.
Decks: Glass Epoxy per Mil-P-18177
Detent and Shaft Assembly: Stainless Steel

ENVIRONMENTAL

Temperature Range: Commercial, —40°C. to +85° C. Military, —65°C. to +125°C.
Other: Designed to meet the general requirements of Mil-S-3786.

SHALLCO, INC.
P.O. BOX 1089 • HIGHWAY 301 SOUTH • SMITHFIELD, NORTH CAROLINA 27577 • (919) 934-3135

Shallco

14, 18, 22 SERIES ROTARY SWITCHES

DEVELOPING THE TYPE NUMBER

The system below will assist you in specifying the correct part number of the switch required for your application. Submit any special shaft modifications or other desired modifications as separate data. Our Engineering Department can assist you with major variations.

SERIES AND SIZE

	SPECIFY
1¾" SQUARE	14
2¼" SQUARE	18
2¾" SQUARE	22

POLES/DECK

SPECIFY
1
THRU
8

SWITCHING ACTION

SPECIFY	
M	SHORTING (MBB)
B	NON-SHORTING (BBM)

NUMBER OF DECKS

SPECIFY
1
THRU
10
1 THRU 10 IS STANDARD. ADDITIONAL DECKS ON REQUEST

18 E 2 — M 14 — 2 — T

DETENT ANGLE

	SPECIFY
7½°	A
11¼°	C
15°	E
22½°	H
30°	J

POSITIONS/POLE

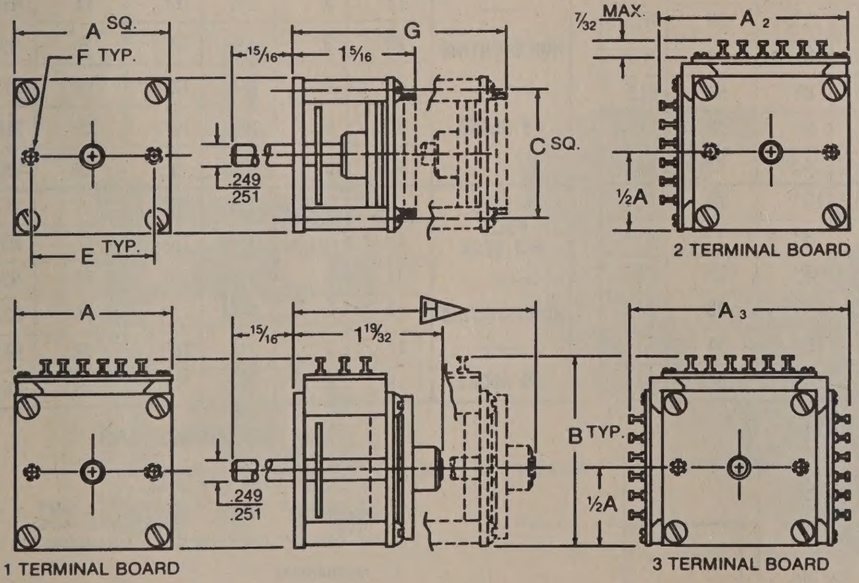
REFER TO DECK LAYOUTS NEXT PAGE
2
THRU
48
SPECIFY

TERMINAL BOARD OPTION

THE LETTER "T" AFTER THE NUMBER INDICATES TERMINAL BOARDS. SEE OUTLINE DRAWINGS FOR INCREASED SIZE.
T
SPECIFY

Example: 18E2-M14-2-T is a series 18, 2¼" square, 15° indexing, 2 poles per deck, shorting (make before break), 14 position, 2 deck switch with terminal boards.

OUTLINE DRAWINGS



Back-Panel Depth				
No. of Decks	G		H	
	Series 14	Series 18 & 22	Series 14	Series 18 & 22
2	2¼	2⁹⁄₃₂	2½	2⁹⁄₁₆
3	3³⁄₁₆	3¼	3⁷⁄₁₆	3¹⁷⁄₃₂
4	4⅛	4⁷⁄₃₂	4⅜	4½
5	5¹⁄₁₆	5³⁄₁₆	5⁵⁄₁₆	5¹⁵⁄₃₂
6	6	6⁵⁄₃₂	6¼	6⁷⁄₁₆
7	6¹⁵⁄₁₆	7⅛	7³⁄₁₆	7¹³⁄₃₂
8	7⅞	8³⁄₃₂	8⅛	8⅜
9	8¹³⁄₁₆	9¹⁄₁₆	9¹⁄₁₆	9¹¹⁄₃₂
10	9¾	10¹⁄₃₂	10	10⁵⁄₁₆

NOTES:

H The H Dimension for a two and three terminal board switch is the same, for the corresponding number of decks, as the H dimension for the single terminal board switch.

Tolerances:
Decimals ± .010
Fractions ± 1/32

Terminals Per Deck (Max.)			
Series	No. Terminal Boards		
	1	2	3
14	18	36	54
18	24	48	72
22	30	60	90

Standard Dimensions							
Series	A	A_2	A_3	B	C	E	F
14	1¾	2³⁄₁₆	2⅝	2³⁄₁₆	1.438	1.375	6-32
18	2¼	2⅝	3	2⅝	1.875	1.500	8-32
22	2¾	3¹⁄₁₆	3⅜	3¹⁄₁₆	2.250	1.500	8-32

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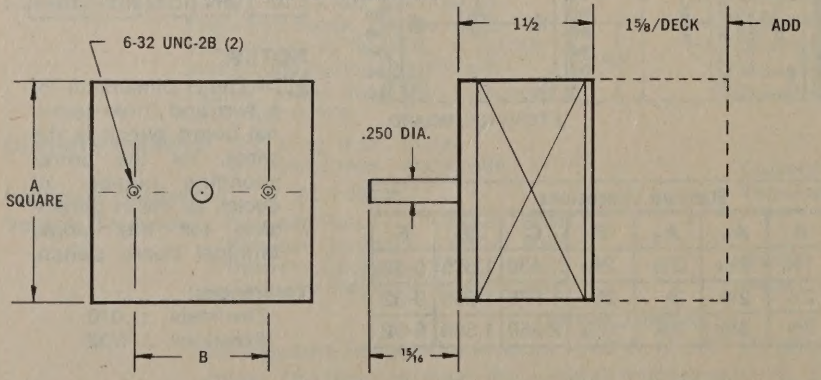
CUSTOM INSTRUMENT SWITCHES

THE CES SERIES ROTARY SWITCHES ARE AVAILABLE IN MANY STYLES. ALL SWITCHES ARE PRECISION MADE FROM STANDARD TOOLS IN PREMIUM MATERIALS AT REASONABLE PRICES IN ALL QUANTITIES.

	Maximum Positions	Dim. A	Dim. B	Contact Spacing	Maximum Positions w/Stops	Deck Type
SINGLE POLE PER DECK — SHORTING — 1-8 DECKS	20	1¾	1¼	18°	20	A9
	22	1¾	1¼	16.36°	22	A21
	26	2⅛	1½	13.84°	25	B29
	30	2⅛	1½	12°	29	B21
	36	2⅛	1½	10°	35	B1
	40	3	1½	9°	39	N3
	45	3	1½	8°	44	N9
	50	3⅝	2½	7.2°	49	D19
	60	3⅝	2½	6°	58	D5
	72	5	2½	5°	70	E1
	80	5	2½	4.5°	77	F7
	100	7	2½	3.6°	98	H3
	120	7	2½	3°	116	H1
	144	8	2½	2.5°	139	K1
TWO POLES PER DECK — SHORTING — 1-8 DECKS	9	1¾	1¼	18°	9	A11
	10	1¾	1¼	16.36°	10	A27
	14	2⅛	1½	12°	14	B35
	17	2⅛	1½	10°	17	B5
	40	3	1½	9°	39	N13
	45	3	1½	8°	44	N17
	60	4	2½	6°	58	E15
	72	5	2½	5°	70	F11
	80	6	2½	4.5°	77	G5
3 TO 4 POLES PER DECK — SHORTING — 1-8 DECKS	16	2½	1½	10°	16	C5
	19	3	1½	9°	19	N23
	21	3	1½	8°	21	N29
	28	4	2½	6°	28	E7
	34	5	2½	5°	34	F3
	36	6	2½	4.5°	36	G7

	Maximum Positions	Dim. A	Dim. B	Contact Spacing	Maximum Positions w/Stops	Deck Type
SINGLE POLE PER DECK — NON-SHORTING — 1-8 DECKS	11	1¾	1¼	32.72°	11	A10
	13	2⅛	1¼	27.69°	13	B10
	15	2⅛	1¼	24°	15	B12
	16	2⅛	1¼	22.5°	16	B16
	18	2½	1¼	20°	18	C2
	20	2½	1¼	18°	20	C12
	24	3	1¼	15°	24	N10
	25	3⅝	1¼	14.4°	24	D14
	30	3⅝	2½	12°	29	D6
	36	5	2½	10°	35	F2
	40	5	2½	9°	39	F8
	50	6	2½	7°	50	G2
	60	7	2½	6°	58	H2
	72	8	2½	5°	70	K2
TWO POLES PER DECK — NON-SHORTING — 1-8 DECKS	7	2⅛	1¼	24°	7	B22
	9	2⅛	1¼	20°	9	B6
	18	2½	1¼	20°	18	C28
	11	3	1¼	16°	11	N16
	20	3	1¼	18°	20	N30
	30	4	2½	12°	29	E12
	36	5	2½	10°	35	F10
	40	6	2½	9°	38	G8
3 TO 4 POLES PER DECK — NON-SHORTING — 1-6 DECKS	9	2½	1¼	20°	9	C6
	10	3	1¼	18°	10	N36
	11	3	1¼	16°	11	N38
	14	4	2½	12°	14	E20
	17	5	2½	10°	17	F4
	19	6	2½	9°	19	G6

OUTLINE DIMENSIONS



SPECIFICATIONS

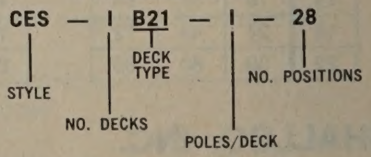
ELECTRICAL

1. SILVER ALLOY SWITCHING
2. CURRENT CAPACITY: SWITCH — 2 AMPS CARRY — 10 AMPS
3. CONTACT RESISTANCE: 3-5 MILLIOHMS

MECHANICAL

1. ALUMINUM MTG. PLATE
2. GLASS EPOXY DECKS
3. BALL TYPE DETENT
4. LIFE: >20,000 CYCLES

ORDERING CODE



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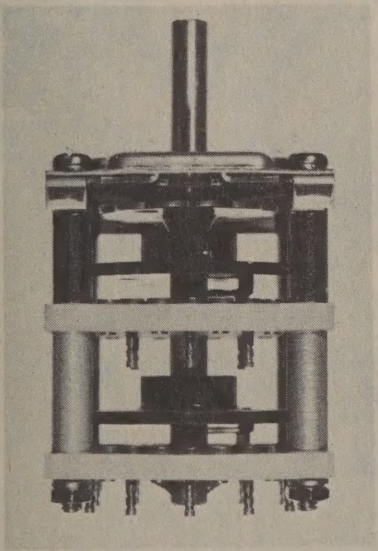
Shallco — **DAVEN**

We now offer the complete line of DAVEN open-frame rotary switches and DAVEN audio attentuators, long known for their high quality and superior features. All part numbers, type numbers and spec numbers remain the same.



DAVEN
IN
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SEND FOR ILLUSTRATED LITERATURE DESCRIBING THE PRODUCT AREA OF YOUR INTEREST. CALL OR WRITE . . .

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Shigoto Switches— perfect as nature.

Nature seldom makes mistakes. Likewise Shigoto. You get fewer out-of-tolerance switches from us. And, because we control manufacture from design to delivery, you get them when you want them. Any way, shape or form you want them. Shigoto *has* to save OEM's production dollars. Naturally! We make a living helping you make money.

Some of the standard items in the Shigoto switch lineup:

- slide type
- toggle
- rocker type
- snap action
- lever type
- illuminated
- keyboard
- rotaries
- thumb wheel
- P.C. board type
- knife type
- limit type
- ganged
- reed type
- key lock
- foot pedal

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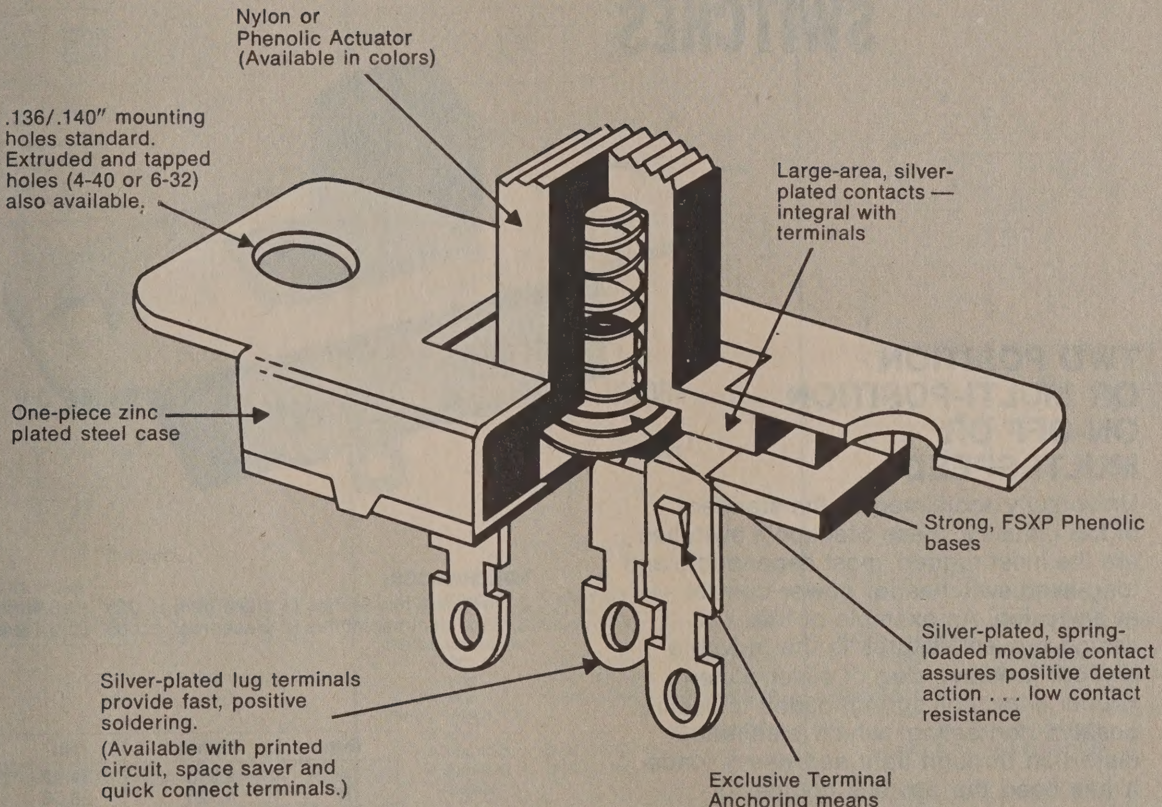
... THE INSIDE STORY


Nylon or Phenolic Actuator (Available in colors)
.136/.140″ mounting holes standard. Extruded and tapped holes (4-40 or 6-32) also available.
Large-area, silver-plated contacts — integral with terminals
One-piece zinc plated steel case
Strong, FSXP Phenolic bases
Silver-plated, spring-loaded movable contact assures positive detent action . . . low contact resistance
Silver-plated lug terminals provide fast, positive soldering.
(Available with printed circuit, space saver and quick connect terminals.)
Exclusive Terminal Anchoring means

For over 35 years, Stackpole switches have been noted for quality. This reputation stems from the basic design and is continued through the use of carefully selected raw materials fabricated on the most modern high volume production machinery in existence.

Our rigid silver plated sliding contact as featured on Series 10 and 20 switches is coil spring loaded. The contact does not flex. This is definitely advantageous in high current applications.

The terminals in all switches are locked to the base either by swaging or with a lance, to prevent push-through during assembly. These are but a few of the hidden features which make Stackpole the number one choice in applications requiring low cost switches.

STACKPOLE®

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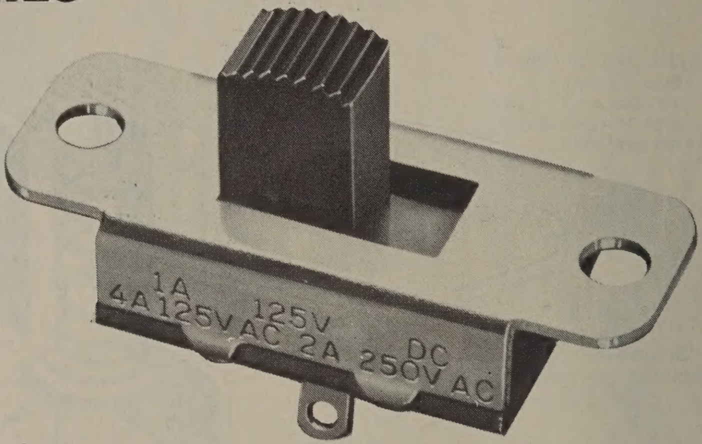
BASIC SINGLE-POLE SWITCHES



TWO POSITION OR MULTI-POSITION ON-OFF OR MULTI-SPEED

Universally acclaimed as the standard of the industry, these Stackpole switches are the most rugged, most dependable and long-lived switches for power control — at any price. An example of the design-proven features is the movable contact (a heavy slug of silver-plated copper alloy, coil spring-loaded to assure positive contacting) which eliminates distortion through light and heavy loads. It has been the obvious choice for thousands of applications and proven through the hundreds of millions of Stackpole switches in customer use today.

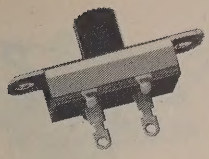
TOLERANCES

2 place decimal inches (1 place mm) ±.025″ (±0.4mm)
3 place decimal inches (2 place mm) ±.005″ (±0.13mm)

Dim.	Inches	mm
A	1.375	34.92
B	1.125	28.58
C	.469	11.91
D	.293	7.44
E	.53	13.5
F	.454	11.53
G	.243	6.17
H	.224	5.69
J	.191	4.85
K	.278	7.06
L	.88	22.4
M	.138 D	3.51 D
N	.34	8.6
P	.025	0.64
Q	.28	7.1
R	.31	7.9
S	.37	9.4
T	.26	6.6
U	.070 D	1.78 D
V	.110	2.79
W	.172	4.37
X	.080 D	2.03 D
Y	.080	2.03
Z	.160	4.06

STANDARD MATERIALS

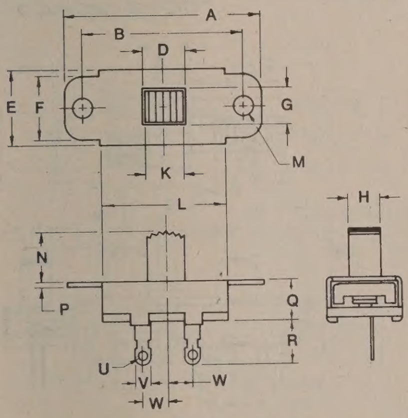
CASE: Cold Rolled Steel, Zinc Plated
BASE: Fibre surfaced XP Phenolic Laminate
ACTUATOR: Phenolic or Nylon, Black
TERMINALS: Copper Alloy, Silver Plated
SLIDING CONTACT: Copper Alloy, Silver Plated
SPRING FOR CONTACT: Music Wire



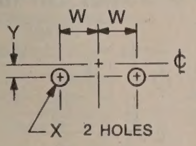
SERIES P-20 PUSH SWITCH

(Momentary Action — Normally Open)

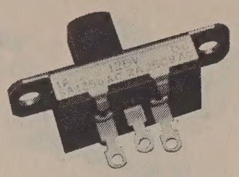
Depress the actuator for instant "ON". Applications range from ringing a bell to activating an alarm or completing a circuit. Single circuit is closed, as long as the knob is depressed.



P.C BOARD LAYOUT



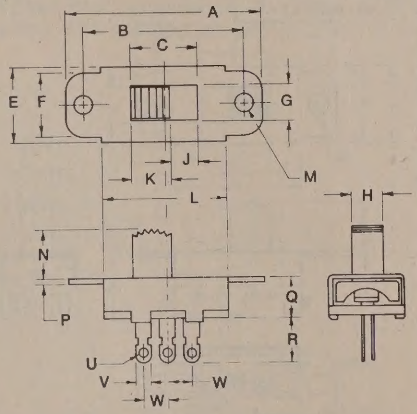
125 VAC UL & CSA RATING	PART NO.
3 amp.	P-2011SR03-O



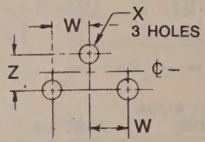
SERIES S-20 STANDARD SWITCH

(Most Economical)

Basic and most economical "ON-OFF" type switch. Available to 7 amps in maintained action; to 6 amps in spring-return action. Both single-throw and double-throw versions can be supplied.

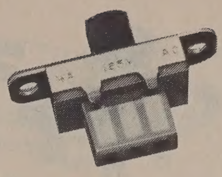


P.C BOARD LAYOUT



125 VAC UL & CSA RATING	PART NO. Single-Throw	Double-Throw
Maintained Action		
4 amp.	S-2011SD04-O	S-2012SD04-O
6 amp.	S-2011SD06-O	S-2012SD06-O
*7 amp.	S-2011SD07-O	S-2012SD07-O
Spring Return		
6 amp	—	S-2012SR06-O
6 amp N.O.	S-2011SR06-O	—
6 amp N.C.	S-2011SR06-R	—

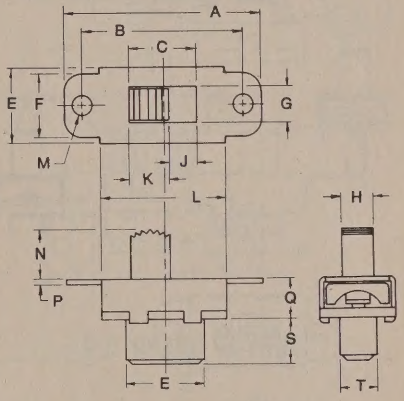
* UL only



SERIES S-25 "PUSH-IN-LEAD" SWITCH

(No Soldering Required)

Optimum in labor savings design . . . stranded (pre-tinned) or single strand 18 or 20 gauge wire leads can be inserted directly into the switch base without special connectors, machines or fixtures. Soldering and other hand operations are eliminated. Available to 6 amps in maintained and spring-return action.



125 VAC UL & CSA RATING	PART NO. Single-Throw	Double-Throw
Maintained Action		
4 amp.	S-2511CD04-O	S-2512CD04-O
6 amp.	S-2511CD06-O	S-2512CD06-O
Spring Return		
6 amp	—	S-25125R06-O
6 amp N.O.	S-2511SR06-O	—
6 amp N.C.	S-2511SR06-R	—

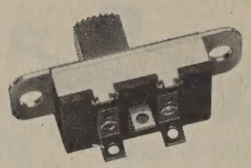
OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

ACTUATOR HEIGHTS	Yes	Yes	Yes
ACTUATOR COLORS	Yes	Yes	Yes
SPECIAL BASE MATERIALS	Yes	Yes	
SPECIAL TERMINALS	Yes	Yes	
TERMINAL SHIELDS		Yes	
ROCKER VERSIONS		Yes	Yes
SPECIAL MOUNTING HOLES	Yes	Yes	Yes
TWIST-TAB MOUNTING	Yes	Yes	Yes
REMOVE MOUNTING EARS	Yes	Yes	Yes
WELDED LEADS	Yes	Yes	
SPECIALLY PLATED CASES	Yes	Yes	Yes
HEAVY DETENTS			
SOLDER GUARDS	Yes	Yes	

SEE PAGES 4240 & 4241 FOR DETAILS OF OPTIONS

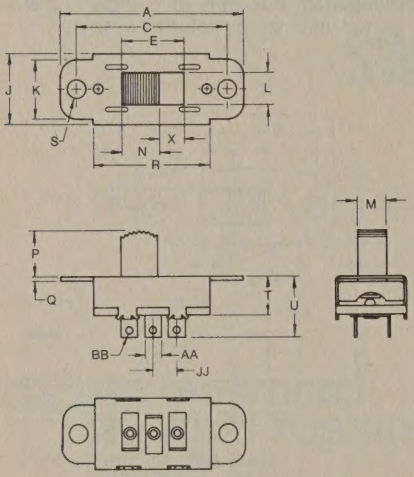
SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

STACKPOLE
COMPONENTS COMPANY

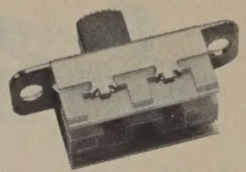


SERIES S-22
HIGH-POWER SWITCH
(Unique Rivet Contacts)

Heavy-duty design features special rivet contacts and extra-sturdy terminals. Rugged construction single-throw or double-throw available to 10 amps.

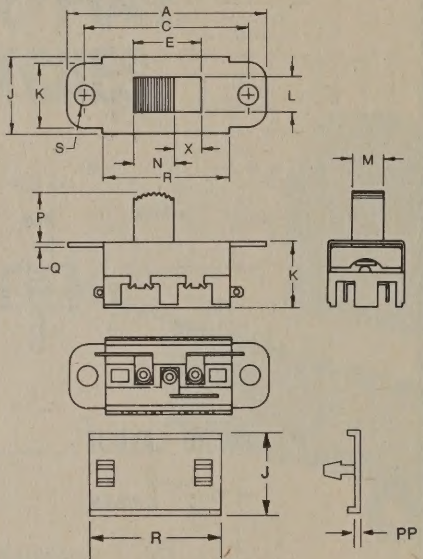


125 VAC UL & CSA RATING	PART NO.	
	Single-Throw	Double-Throw
10 amp.	S-2211CD10-0	S-2212CD10-0



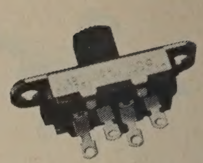
SERIES S-21
QUICK-CONNECT SWITCH
(Accepts Push-On Connectors)

A high-power switch with specially designed nylon base providing foolproof insulation and use of 110 (Faston®) type connectors. Maintained action to 10 amps; spring-return to 8 amps in single-throw or double-throw.



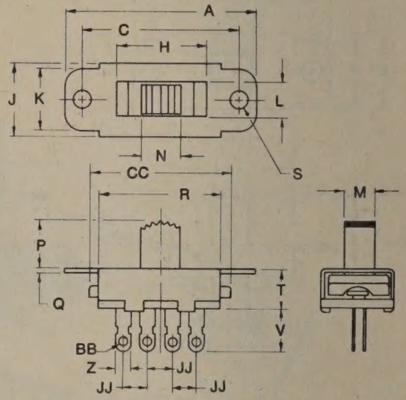
125 VAC UL & CSA RATING	PART NO.	
	Single-Throw	Double-Throw
Maintained Action		
*6 amp.	S-2111SD06-O	S-2112SD06-O
10 amp.	S-2111CD10-O	S-2112CD10-O
Spring Return		
3 amp.	—	S-2112SR03-O
*8 amp.	—	S-2112SR08-O
3 amp N.O.	S-2111SR03-O	—
*8 amp. N.O.	S-2111SR08-O	—
3 amp. N.C.	S-2111SR03-R	—
*8 amp. N.C.	S-2111SR08-R	—

Note: Terminal shield shown above is optional.
* UL only

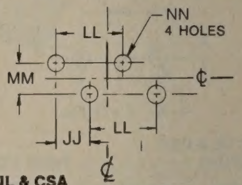


SERIES S-20
STANDARD SWITCH
(Most Economical Three-Position)

Three-position switch with optional uses such as "CENTER-OFF" or "OFF-LOW-HIGH". Available to 6 amps in maintained detent, spring-return from one end to center, or spring-return from position 3 to position 1.



P.C BOARD LAYOUT



125 VAC UL & CSA RATING	PART NO.	
Maintained Action	(Standard)	(With Ball Detent)
6 amp.	S-2013SD06-O	S-2013BD06-O
Spring-Return To Center From One End		
6 amp.		S-2013RC06-U
Spring-Return From Position 3 to Position 1		
6 amp.		S-2013SR06-U

OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

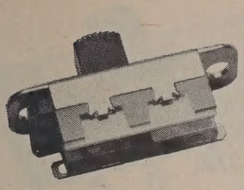
ACTUATOR HEIGHTS	Yes	Yes	Yes
ACTUATOR COLORS	Yes	Yes	Yes
SPECIAL BASE MATERIALS	Yes		Yes
SPECIAL TERMINALS	Yes	Yes	Yes
TERMINAL SHIELDS	Yes	Yes	Yes
ROCKER VERSIONS	Yes	Yes	Yes
SPECIAL MOUNTING HOLES	Yes	Yes	Yes
TWIST-TAB MOUNTING	Yes	Yes	Yes
REMOVE MOUNTING EARS	Yes	Yes	Yes
WELDED LEADS	Yes		Yes
SPECIALLY PLATED CASES	Yes	Yes	Yes
HEAVY DETENTS			
SOLDER GUARDS	Yes		Yes

Dim.	Inches	mm
A	1.375	34.92
B	1.656	42.06
C	1.125	28.58
D	1.406	35.71
E	.469	11.91
F	.594	15.09
G	.771	19.58
H	.646	16.41
J	.53	13.5
K	.45	11.4
L	.243	6.17
M	.224	5.69
N	.278	7.06
P	.34	8.6
Q	.025	0.64
R	.88	22.4
S	.138 D	3.51 D
T	.28	7.1
U	.47	11.9

SEE PAGES 4240 & 4241 FOR DETAILS OF OPTIONS

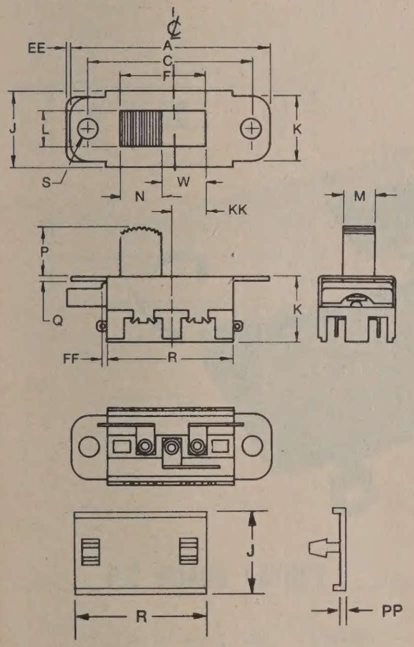
SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

TOLERANCES - PG. 4234



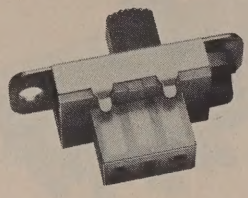
SERIES S-21
QUICK-CONNECT SWITCH
(Accepts Push-On Connectors)

Three-position, high-power switch with specially designed nylon base for foolproof insulation and use of 110 (Faston®) type connectors. Available to 6 amps. End position is "OFF".



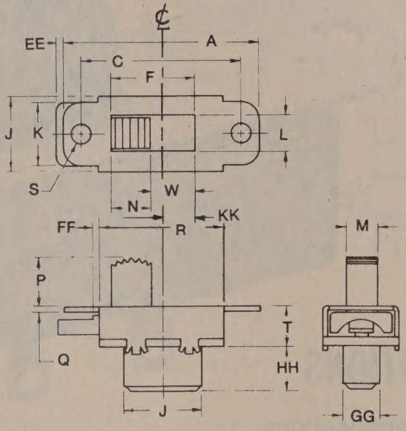
125 VAC UL & CSA RATING	PART NO.
*6 amp.	S-2113SD06-X

Note: Terminal shield shown above is optional.
* UL only

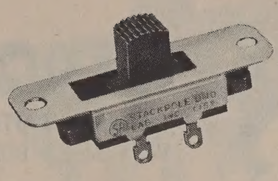


SERIES S-25
THREE-POSITION, PUSH-IN-LEAD
(No Soldering Required)

Optimum in labor saving design . . . Special nylon base provides for insertion of 18 or 20 gauge stranded (pre-tinned) or solid leads. The design allows "OFF-LOW-HIGH" application. Available to 5 amps. End position is "OFF".

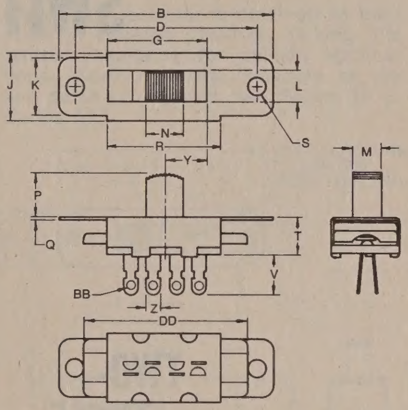


125 VAC UL & CSA RATING	PART NO.
5 amp.	S-2513SD05-X

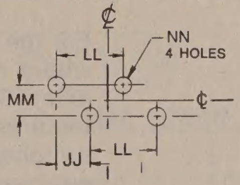


SERIES S-20
STANDARD, FOUR-POSITION SWITCH

A four-position switch specifically designed for three-speed appliance applications "OFF-LO-MED-HIGH". Available to 6 amps. End position is "OFF".



P.C BOARD LAYOUT



125 VAC UL & CSA RATING	PART NO.
6 amp.	S-2014SD06-X

OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

Yes	Yes		ACTUATOR HEIGHTS
Yes	Yes		ACTUATOR COLORS
		Yes	SPECIAL BASE MATERIALS
Yes		Yes	SPECIAL TERMINALS
Yes		Yes	TERMINAL SHIELDS
			ROCKER VERSIONS
Yes	Yes		SPECIAL MOUNTING HOLES
			TWIST-TAB MOUNTING
Yes	Yes		REMOVE MOUNTING EARS
		Yes	WELDED LEADS
Yes	Yes	Yes	SPECIALLY PLATED CASES
			HEAVY DETENTS
		Yes	SOLDER GUARDS

Dim.	Inches	mm
V	.31	7.9
W	.316	8.03
X	.191	4.85
Y	.323	8.20
Z	.110	2.79
AA	.125	3.18
BB	.070 D	1.78 D
CC	1.022	25.96
DD	1.264	32.11
EE	.05	1.3
FF	.04	1.0
GG	.27	6.9
HH	.37	9.4
JJ	.172	4.37
KK	.235	5.97
LL	.344	8.74
MM	.160	4.06
NN	.080 D	2.03 D
PP	.031	0.79

TOLERANCES - PG. 4234

SEE PAGES 4240 & 4241 FOR DETAILS OF OPTIONS

SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

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COMPONENTS COMPANY

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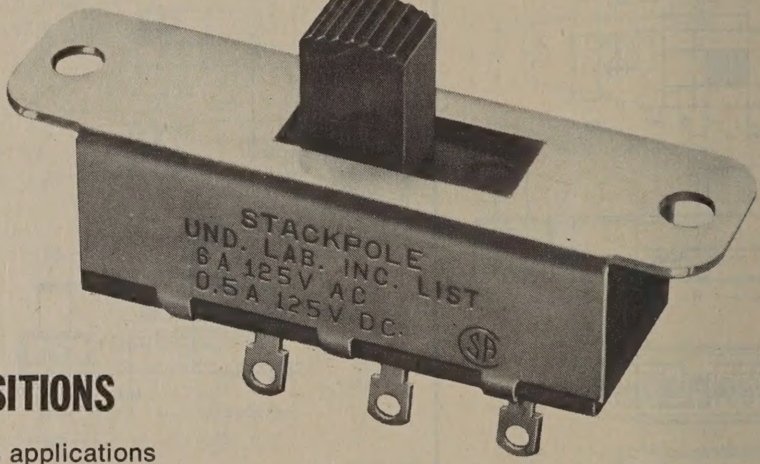
COMPONENTS COMPANY
Dept. EM, P.O. BOX M, FARMVILLE, VA 23901 • Phone (804) 392-4111 • TWX 710-874-3710

MULTI-POLE, LARGE-CASE SWITCHES



TWO-
THREE-
FOUR-POSITIONS

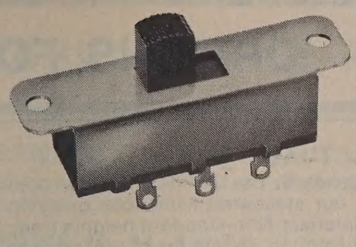
For the numerous applications where multi-poles and the allied Stackpole rugged features are required, these switches offer the designer/engineer the same superior quality and design excellence as the basic single-pole switches; the highly acclaimed coil spring-loaded slug contact, the lance-anchored, wrap-around terminal and the numerous Stackpole options and accessories.

STANDARD MATERIALS

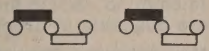
CASE: Cold Rolled Steel, Zinc Plated
BASE: Fibre surfaced XP Phenolic Laminate
ACTUATOR: Phenolic, Black
TERMINALS: Copper Alloy, Silver Plated
SLIDING CONTACT: Copper Alloy, Silver Plated
SPRING FOR CONTACT: Music Wire

Dim.	Inches	mm
A	1.890	48.00
B	1.625	41.28
C	.278	7.06
D	.53	13.5
E	.471	11.96
F	.243	6.17
G	.224	5.69
H	.138 D	3.51 D
J	1.39	35.3
K	.34	8.6
L	.031	0.79
M	.49	12.4
N	.31	7.9
P	.110	2.79
Q	.070 D	1.78 D
R	.187	4.75
S	.465	11.81
T	.344	8.74
U	.622	15.80
V	.64	16.3
W	.397	10.08
X	.172	4.37
Y	.160	4.06
Z	.080 D	2.03 D

TOLERANCES - PG. 4234



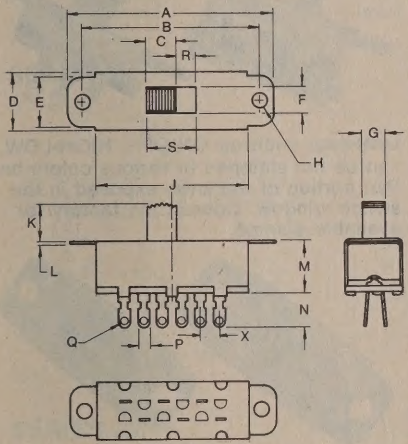
SERIES S-10



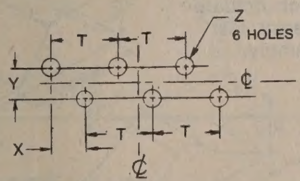
DOUBLE-POLE, DOUBLE-THROW

("ON-OFF" Control for Two Circuits)

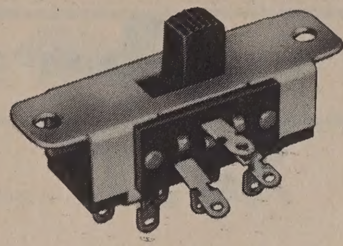
Basic contact design in a double-pole switch. Select from proven Stackpole performance in maintained or spring-return action. Available to 6 amps.



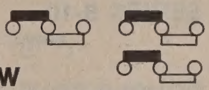
P.C BOARD LAYOUT



125 VAC UL & CSA RATING	PART NO.
Maintained Action 6 amp.	S-1022SD06-O
Spring-Return 6 amp.	S-1022SR06-O



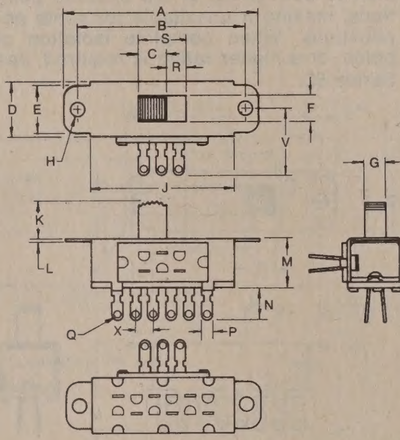
SERIES S-11



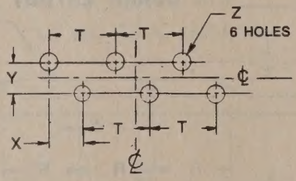
TRIPLE-POLE, DOUBLE-THROW

(CONTROL FOR THREE CIRCUITS)

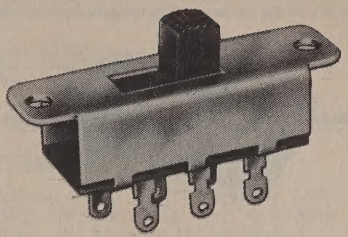
Rugged circuit control allows three isolated double-throw switching functions in one package. Either maintained or spring-return versions. Available to 6 amps.



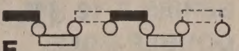
P.C BOARD LAYOUT



125 VAC UL & CSA RATING	PART NO.
Maintained Action 6 amp.	S-1132SD06-O
Spring-Return 6 amp.	S-1132SR06-O



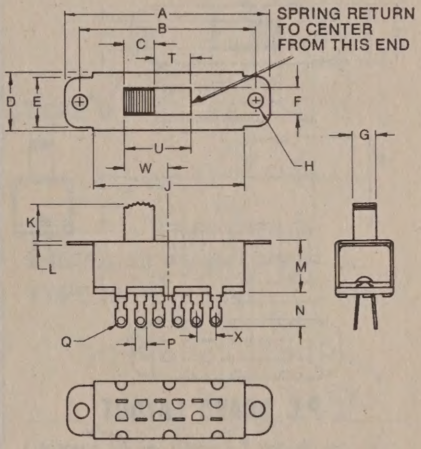
SERIES S-10



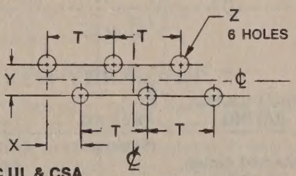
DOUBLE-POLE, THREE-POSITION

Available in maintained action standard detent, special skid-proof ball detent; and in spring-return from one end position to the center position. Available to 6 amps.

(**Note:** One terminal is common to both poles in extreme positions making this switch unsuitable for certain applications. When complete isolation of the two poles is required, see Series 12 or Series 51.)



P.C BOARD LAYOUT

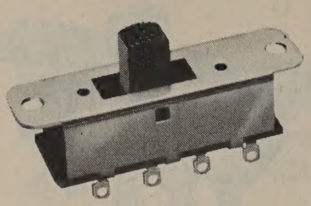


125 VAC UL & CSA RATING	PART NO. (Standard)	(With Ball Detent)
Maintained Action 6 amp.	S-1023SD06-O	S-1023BD06-O
Spring-Return To Center From One End 6 amp.		S-1023RC06-O

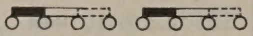
OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

ACTUATOR HEIGHTS	Yes	Yes	Yes
ACTUATOR COLORS	Yes	Yes	Yes
SPECIAL BASE MATERIALS	Yes	Yes	Yes
SPECIAL TERMINALS	Yes	Yes	Yes
TERMINAL SHIELDS	Yes	Yes	Yes
ROCKER VERSIONS	Yes	Yes	Yes
SPECIAL MOUNTING HOLES	Yes	Yes	Yes
TWIST-TAB MOUNTING			
REMOVE MOUNTING EARS	Yes	Yes	Yes
WELDED LEADS	Yes	Yes	Yes
SPECIALLY PLATED CASES	Yes	Yes	Yes
HEAVY DETENTS			
SOLDER GUARDS	Yes	Yes	Yes

SEE PAGES 4240 & 4241 FOR DETAILS OF OPTIONS SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

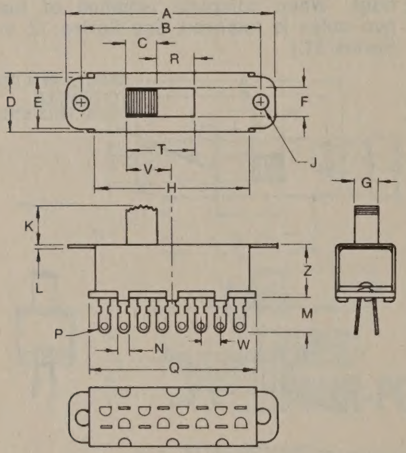


SERIES S-12

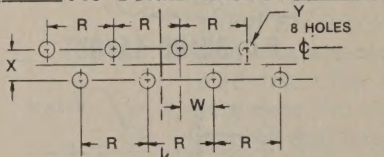


DOUBLE-POLE, THREE-POSITION WITH ISOLATED SWITCHING

Two poles with completely isolated three-position switching functions. Available in maintained action, standard detent or skid-proof ball detent; also, with spring-return from both ends to the center. Available to 8 amp maintained action and to 3 amp spring return.

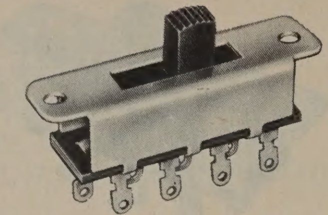

A
B
C
R
D
E
F
T
V
J
H
G
K
L
Z
M
P
N
W
Q

P.C BOARD LAYOUT

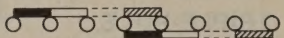

R
R
R
Y
8 HOLES
X
W
R
R
R

125 VAC UL & CSA RATING	PART NO. (Standard)	(With Ball Detent)
Maintained Action *8 amp.		S-1223BA08-O
Spring-Return To Center 3 amp.	S-1223SB03-O	S-1223RB03-O

* UL only



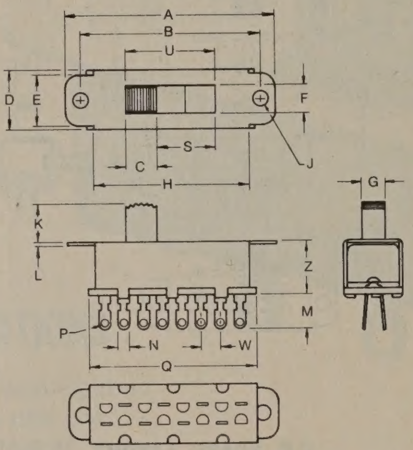
SERIES S-10



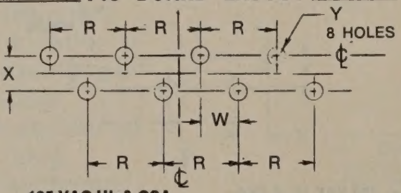
DOUBLE-POLE, FOUR-POSITION

Primarily used for variable speed switching of appliances, such as vacuum cleaners. Available in maintained action to 6 amps.

(**Note:** This switch has two terminals common to both poles at the extreme positions, making it unsuitable for some applications. When complete isolation of poles, or a higher rating is required, see Series 52.


A
B
U
D
E
F
S
C
J
H
G
K
L
Z
M
P
N
W
Q

P.C BOARD LAYOUT


R
R
R
Y
8 HOLES
X
W
R
R
R

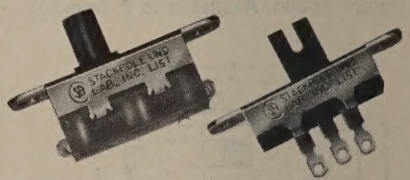
125 VAC UL & CSA RATING	PART NO.
6 amp.	S-1024SD06-O

OPTIONS FOR

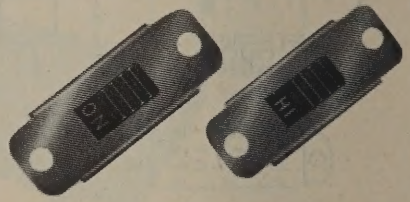
ACTUATORS

Standard: The .34″ (8.6mm) high actuator is our standard in phenolic or nylon materials. Non-standard heights from .22″ (5.6mm) to .75″ (19.0mm) in various colors are available in production quantities.

Non-Standard Shapes: Stackpole is often called upon to complement a special design by altering the actuator of a switch. Round, screwdriver slots or any shape required to accommodate your design can be made available.

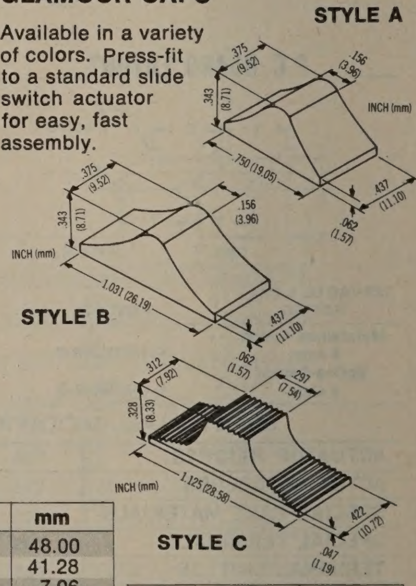

STACKPOLE LAB. INC. LIST
STACKPOLE LAB. INC. LIST

Lettering, such as ON-OFF, HIGH-LOW, can be hot stamped in various colors on that portion of the knob exposed in the switch window. Consult the factory for available stamps.



GLAMOUR CAPS

Available in a variety of colors. Press-fit to a standard slide switch actuator for easy, fast assembly.


STYLE A
.375 (9.52)
.156 (3.96)
.343 (8.71)
INCH (mm)
.750 (19.05)
.437 (11.10)
.062 (1.57)
.375 (9.52)
.343 (8.71)
.156 (3.96)
INCH (mm)
1.031 (26.19)
STYLE B
.437 (11.10)
.062 (1.57)
.312 (7.92)
.297 (7.54)
.328 (8.33)
INCH (mm)
1.125 (28.58)
.422 (10.72)
STYLE C
.047 (1.19)

OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

ACTUATOR HEIGHTS	Yes	Yes
ACTUATOR COLORS	Yes	Yes
SPECIAL BASE MATERIALS	Yes	Yes
SPECIAL TERMINALS	Yes	Yes
TERMINAL SHIELDS		
ROCKER VERSIONS	Yes	
SPECIAL MOUNTING HOLES	Yes	Yes
TWIST-TAB MOUNTING		
REMOVE MOUNTING EARS	Yes	Yes
WELDED LEADS	Yes	Yes
SPECIALLY PLATED CASES	Yes	Yes
HEAVY DETENTS	Yes	Yes
SOLDER GUARDS	Yes	Yes

Dim.	Inches	mm
A	1.890	48.00
B	1.625	41.28
C	.278	7.06
D	.53	13.5
E	.471	11.96
F	.243	6.17
G	.224	5.69
H	1.39	35.3
J	.138 D	3.51 D
K	.34	8.6
L	.031	0.79
M	.31	7.9
N	.110	2.79
P	.070 D	1.78 D

Dim.	Inches	mm
Q	1.52	38.6
R	.344	8.74
S	.529	13.44
T	.622	15.80
U	.807	20.50
V	.397	10.08
W	.172	4.37
X	.160	4.06
Y	.080 D	2.03 D
Z	.49	12.4

SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

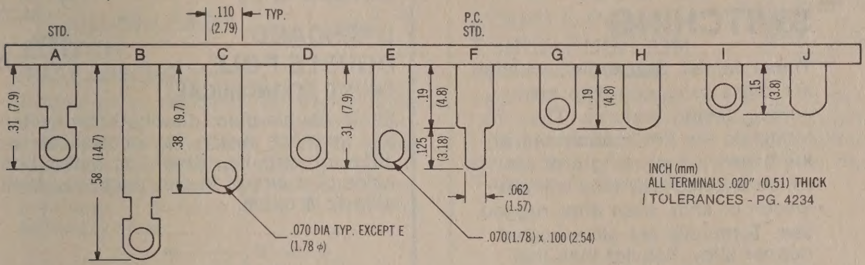
TOLERANCES - PG. 4234

BASIC SINGLE-POLE AND LARGE CASE SWITCHES

TERMINALS

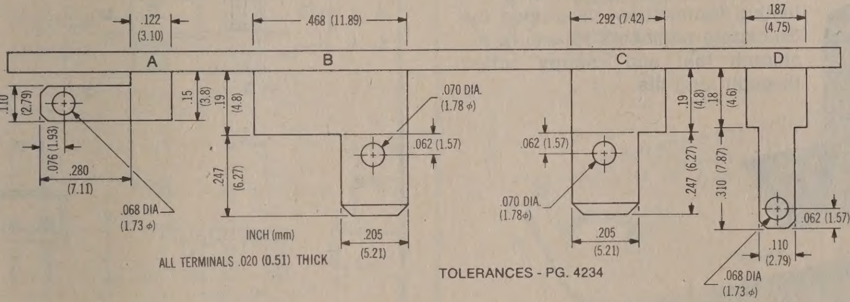
Silver plating is standard; however, special plating is available in production quantities. Consult the factory.

SERIES 10, 11, 12, 20


.110 (2.79) TYP.
STD.
P.C. STD.
A
B
C
D
E
F
G
H
I
J
.31 (7.9)
.58 (14.7)
.38 (9.7)
.31 (7.9)
.19 (4.8)
.125 (3.18)
.19 (4.8)
.15 (3.8)
.062 (1.57)
.070 DIA TYP. EXCEPT E (1.78 ⌀)
.070(1.78) x .100 (2.54)

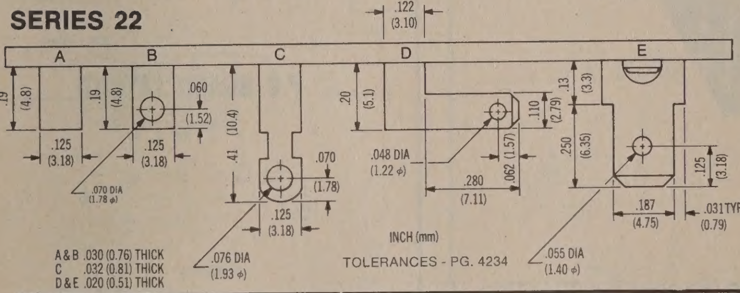
INCH (mm)
ALL TERMINALS .020" (0.51) THICK
TOLERANCES - PG. 4234

SERIES 21


.122 (3.10)
.468 (11.89)
.292 (7.42)
.187 (4.75)
A
B
C
D
.110 (2.79)
.076 (1.93)
.280 (7.11)
.068 DIA (1.73 ⌀)
.15 (3.8)
.19 (4.8)
.247 (6.27)
.070 DIA. (1.78 ⌀)
.062 (1.57)
.062 (1.57)
.070 DIA. (1.78⌀)
.205 (5.21)
.205 (5.21)
.19 (4.8)
.18 (4.6)
.247 (6.27)
.310 (7.87)
.062 (1.57)
.110 (2.79)
.068 DIA (1.73 ⌀)

INCH (mm)
ALL TERMINALS .020 (0.51) THICK
TOLERANCES - PG. 4234

SERIES 22


.122 (3.10)
A
B
C
D
E
.19 (4.8)
.19 (4.8)
.060 (1.52)
.125 (3.18)
.125 (3.18)
.070 DIA (1.78 ⌀)
.41 (10.4)
.070 (1.78)
.125 (3.18)
.076 DIA (1.93 ⌀)
.20 (5.1)
.048 DIA (1.22 ⌀)
.280 (7.11)
.062 (1.57)
.110 (2.79)
.13 (3.3)
.250 (6.35)
.125 (3.18)
.187 (4.75)
.031 TYP. (0.79)
.055 DIA (1.40 ⌀)

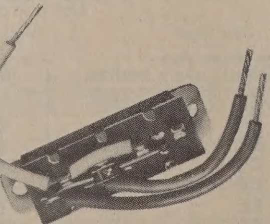
A & B .030 (0.76) THICK
C .032 (0.81) THICK
D & E .020 (0.51) THICK

INCH (mm)

TOLERANCES - PG. 4234

WELDED LEADS

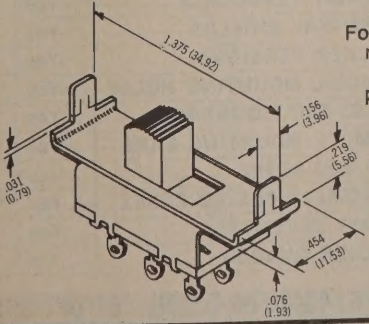
Switches can be supplied pre-wired (18 or 20 gauge leads) or with preassembled components (diodes, resistors) to assist in production handling. Consult factory for details.

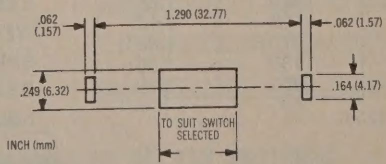


MOUNTING

All switches are supplied with .138" (3.51mm) diameter mounting holes. Optional mounting holes available include extruded #4 or #6; or extruded and tapped 4-40 or 6-32.

For PC mounting, the extended mounting ears can be removed from the switch. Twist-tab mounting is available on the complete line of single-pole, two position & Series 20 three position slide switches.


1.375 (34.92)
.156 (3.96)
.219 (5.56)
.031 (0.79)
.454 (11.53)
.076 (1.93)

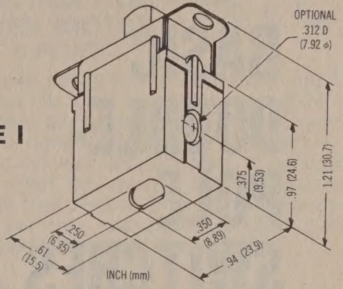

.062 (.157)
1.290 (32.77)
.062 (1.57)
.249 (6.32)
.164 (4.17)
TO SUIT SWITCH SELECTED
INCH (mm)

TERMINAL SHIELDS

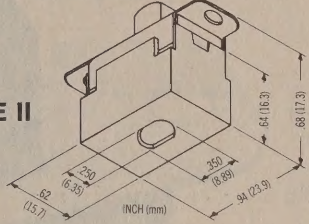
Snap-on nylon type shields to meet UL-94V-2 requirements are available on Series 20, 22 and 10 switches.

SERIES 20 and 22

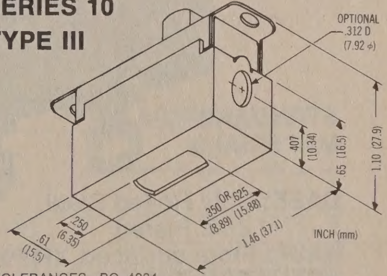
TYPE I


OPTIONAL .312 D (7.92 ⌀)
.375 (9.53)
.97 (24.6)
1.21 (30.7)
.250 (6.35)
.61 (15.5)
.350 (8.89)
.94 (23.9)
INCH (mm)

TYPE II


.64 (16.3)
.68 (17.3)
.250 (6.35)
.62 (15.7)
.350 (8.89)
.94 (23.9)
INCH (mm)

SERIES 10 TYPE III


OPTIONAL .312 D (7.92 ⌀)
.407 (10.34)
.65 (16.5)
1.10 (27.9)
.250 (6.35)
.61 (15.5)
.350 OR .625 (8.89) (15.88)
1.46 (37.1)
INCH (mm)

TOLERANCES - PG. 4234

ROCKER VERSIONS

Most Stackpole slide switches are available as rocker switches. For mounting and rocker selection see pages 4252 and 4253 of this catalog.

Special base materials, case plating, actuator materials and precious metal contacts are available on most rocker switches.

Stackpole is often called upon to design switches to meet customer's special specifications. Please contact factory for your needs.

SPECIAL DETENT

The "feel" or operating force can be altered on Stackpole switches to meet customer requirements. If standard switches do not provide desired results, please contact factory for alternatives.

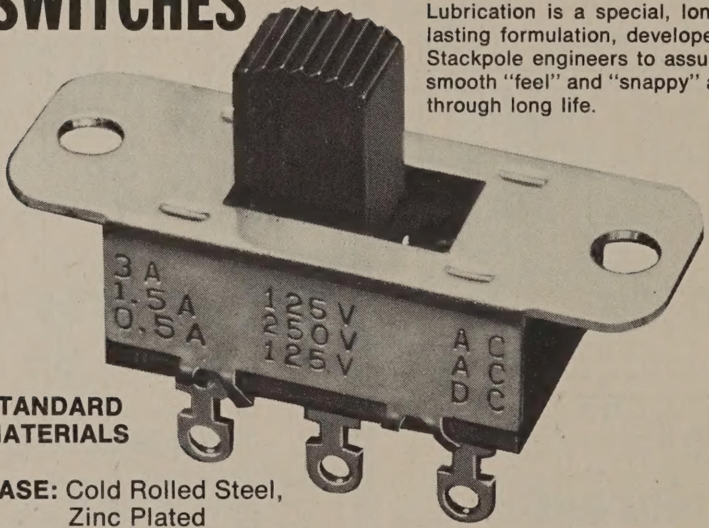
STACKPOLE
COMPONENTS COMPANY
Dept. EM, Box M, Farmville, VA 23901
Phone (801) 392-4111 • TWX 710-874-3710

STACKPOLE
COMPONENTS COMPANY
Dept. EM, Box M, Farmville, VA 23901
Phone (801) 392-4111 • TWX 710-874-3710

BASIC DOUBLE-POLE SWITCHES

SIMPLE TWO-CIRCUIT SWITCHING

These famed Stackpole switches are mass produced with many unique design features. The terminals are firmly anchored in the base by a swaging process which assures that they will not loosen or shift, even after rugged use. Terminals are silver-plated copper alloy, heavier than that found in any similar product. Lubrication is a special, long-lasting formulation, developed by Stackpole engineers to assure a smooth "feel" and "snappy" action through long life.



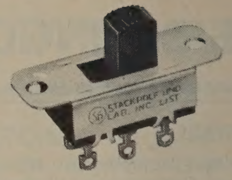
STANDARD MATERIALS

CASE: Cold Rolled Steel, Zinc Plated
BASE: Fibre surfaced XP Phenolic Laminate
ACTUATOR: Phenolic or Nylon, Black
TERMINALS: Copper Alloy, Silver Plated
SLIDING CONTACT: Silver Clad Phos. Bronze (Except S-5224XD11-U)

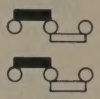
Dim.	Inches	mm
A	1.375	34.92
B	1.968	49.99
C	1.656	42.06
D	1.125	28.58
E	1.718	43.64
F	1.406	35.71
G	.469	11.91
H	1.112	28.24
J	.750	19.05
K	.52	13.2
L	.454	11.53
M	.243	6.17
N	.224	5.69
P	.138 D	3.51 D
Q	.278	7.06
R	.191	4.85
S	.88	22.4
T	.34	8.6
U	.025	0.64
V	.35	8.9
W	.070 D	1.78 D
X	.117	2.97
Y	.29	7.4

Dim.	Inches	mm
Z	.282	7.16
AA	.246	6.25
BB	.37	9.4
CC	1.23	31.2
DD	.472	11.99
EE	.250	6.35
FF	.45	11.4
GG	.82	20.8
HH	.266	6.76
JJ	.217	5.51
KK	.61	15.5
LL	.32	8.1
MM	.240	6.10
NN	.805	20.45
PP	.307	7.80
QQ	1.50	38.1
RR	.022	0.56
SS	.56	14.2
TT	.460	11.68
UU	.123	3.12
VV	.073 D	1.85 D
WW	.133	3.38
XX	.030	0.76

TOLERANCES - PG. 4234



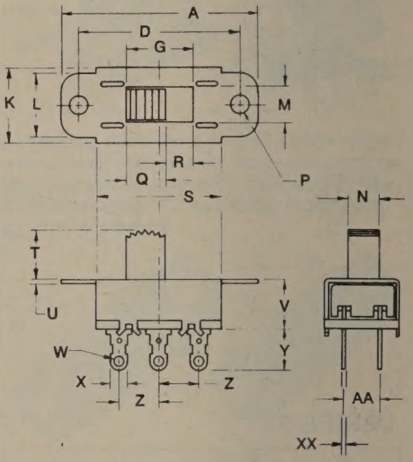
SERIES S-50



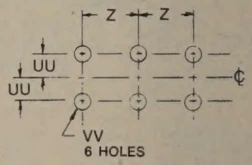
STANDARD DOUBLE-POLE

(MOST ECONOMICAL)

Basic double-pole, double-throw switch. Six terminal switch for control of two different circuits. Break or make both sides of a circuit in one package. Available to 4 amps.



P.C BOARD LAYOUT



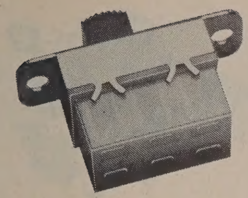
125 VAC UL & CSA

RATING	PART NO.
3 amp.	S-5022CD03-O
4 amp.	S-5022CD04-O

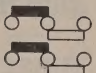
OPTIONAL MODIFICATIONS —

ACTUATOR HEIGHTS	Yes
ACTUATOR COLORS	Yes
SPECIAL BASE MATERIALS	Yes
SPECIAL TERMINALS	Yes
TERMINAL SHIELDS	Yes
ROCKER VERSIONS	Yes
SPECIAL MOUNTING HOLES	Yes
TWIST-TAB MOUNTING	Yes
REMOVE MOUNTING EARS	Yes
WELDED LEADS	Yes
SPECIALLY PLATED CASES	Yes
HEAVY DETENTS	Yes
SOLDER GUARDS	Yes

SEE PG. 4246 FOR DETAILS OF OPTIONS

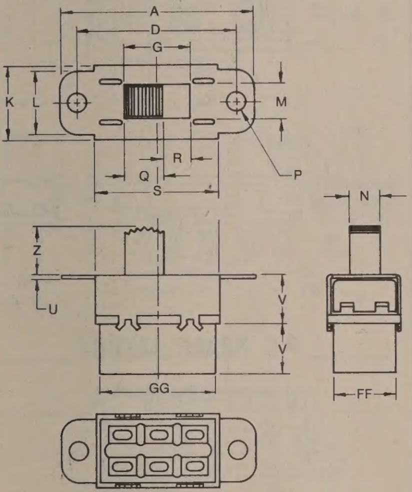


SERIES S-55 "PUSH-IN-LEAD" SWITCH



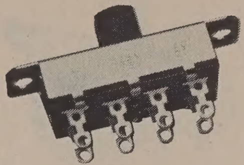
(FAST ASSEMBLY)

Double-pole, double-throw performance for control of two circuits—stranded (pretinned) or single strand, 18 or 20 gauge leads can be inserted directly into the switch base without special connectors, machines or fixtures. Save by reducing assembly time.

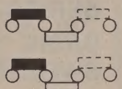


125 VAC UL & CSA

RATING	PART NO.
Not Rated	S-5522CD00-O

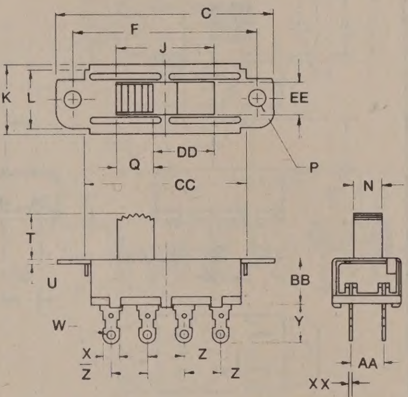


SERIES S-51 DOUBLE-POLE, THREE-POSITION

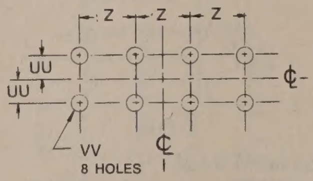


(ISOLATED POLES)

Ideal for appliances requiring "LOW-OFF-HIGH" or "HIGH-LOW-OFF". Switch action is maintained by utilizing either standard (for 1 amp.) or ball detent (for 3 amps.). Available to 3 amps.

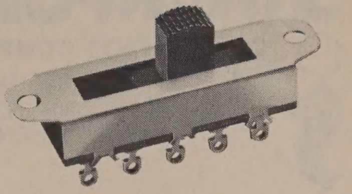


P.C BOARD LAYOUT

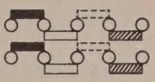


125 VAC UL & CSA

RATING	PART NO.
1 amp.	S-5123SD01-O
3 amp. (Ball Detent)	S-5123BD03-O

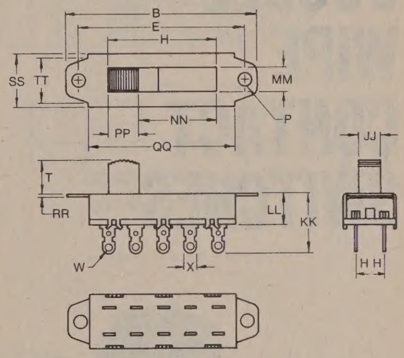


SERIES S-52 FOUR-POSITION, POWER SWITCH

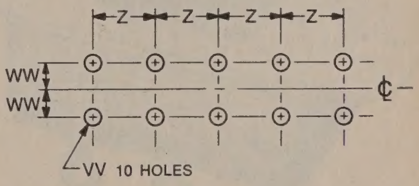


(TWO CIRCUITS)

Specially designed 11 amp rated appliance switch. Built with extra-rugged .040" (1.02mm) thick terminals, a unique, ramp detent construction and coil spring-loaded, silver-plated copper alloy contacts. Feel the quality and depend on trouble-free performance. (Special economy version available unrated part S-5224BD00-U. Send for drawing.)



P.C BOARD LAYOUT



125 VAC UL & CSA

RATING	PART NO.
Not Rated 11 amp.	S-5224BD00-U S-5224XD11-U

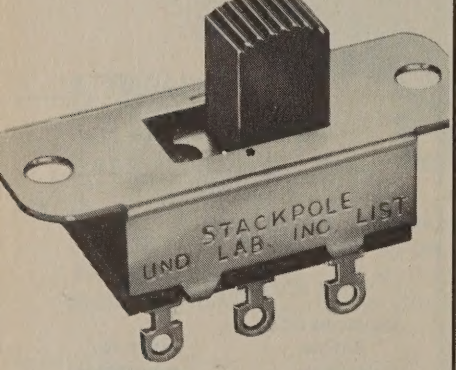
—OPTIONS AND ACCESSORIES AVAILABLE

	Yes	Yes	ACTUATOR HEIGHTS
	Yes	Yes	ACTUATOR COLORS
	Yes	Yes	SPECIAL BASE MATERIALS
	Yes	Yes	SPECIAL TERMINALS
			TERMINAL SHIELDS
Yes			ROCKER VERSIONS
Yes	Yes	Yes	SPECIAL MOUNTING HOLES
Yes	Yes		TWIST-TAB MOUNTING
Yes	Yes		REMOVE MOUNTING EARS
	Yes	Yes	WELDED LEADS
Yes	Yes	Yes	SPECIALLY PLATED CASES
Yes	Yes		HEAVY DETENTS
	Yes		SOLDER GUARDS

SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

STACKPOLE
COMPONENTS COMPANY
Dept. EM, P.O. Box M, Farmville,
VA 23901 (804) 392-4111
TWX 710-874-3710

BASIC DOUBLE-WIPE CONTACT SWITCHES

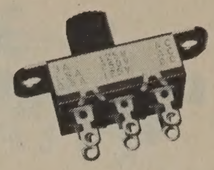


PREFERRED IN MODERN INSTRUMENT APPLICATIONS

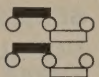
Stackpole engineering sets the standard for switch precision in double-wipe contact switches for dry circuit applications (low voltage and current). Specifications, such as low contact resistance over long life with provision for either shorting or non-shorting contacts, are provided in a design which utilizes redundant contacting by virtue of double-wipe contacts.

STANDARD MATERIALS

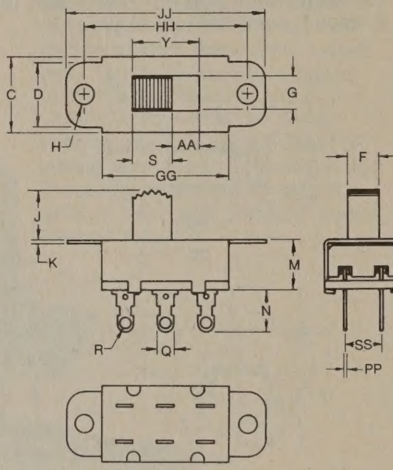
CASE: Cold Rolled Steel, Zinc Plated
BASE: Fibre Surfaced XP Phenolic Laminate
ACTUATOR: Phenolic or Nylon, Black
TERMINALS: Copper alloy, Silver Plated
SLIDING CONTACT: Silver Clad Phos. Bronze



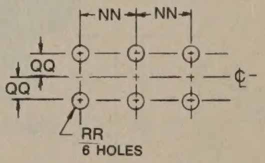
SERIES S-70
BASIC "ON-OFF" SWITCH



Available in double-pole and single-pole (one row of terminals removed to provide single-pole operation). Ideal instrument "ON-OFF" switch. Available to 1 amp.

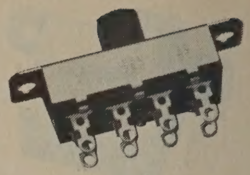


P.C BOARD LAYOUT

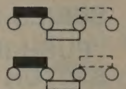


125 VAC UL & CSA RATING	PART NO.
Single-Pole (not rated)	
Non-Shorting	S-7012XD00-O
Shorting	S-7012XD00-S
Double-Pole	
*1 amp. Non-shorting	S-7022XD01-O
*1 amp. Shorting	S-7022XD01-S

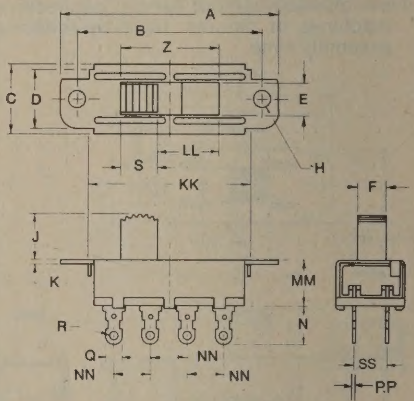
* UL only



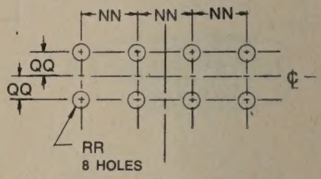
SERIES S-71
THREE-POSITION



Available in double-pole and single-pole (one row of terminals removed to provide single-pole operation). For "LOW-HIGH-OFF" or "LOW-MED-HIGH" applications.



P.C BOARD LAYOUT



NO RATING	PART NO.
Single-Pole	
Non-Shorting	S-7113BD00-O
Shorting	S-7113BD00-S
Double-Pole	
Non-shorting	S-7123BD00-O
Shorting	S-7123BD00-S

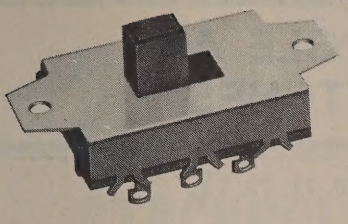
OPTIONAL MODIFICATIONS —

ACTUATOR HEIGHTS	Yes	Yes
ACTUATOR COLORS	Yes	Yes
SPECIAL BASE MATERIALS	Yes	Yes
SPECIAL TERMINALS	Yes	Yes
TERMINAL SHIELDS	Yes	
ROCKER VERSIONS	Yes	
SPECIAL MOUNTING HOLES	Yes	Yes
TWIST-TAB MOUNTING	Yes	Yes
REMOVE MOUNTING EARS	Yes	Yes
WELDED LEADS	Yes	Yes
SPECIALLY PLATED CASES	Yes	Yes
HEAVY DETENTS	Yes	
SOLDER GUARDS	Yes	Yes

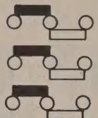
SEE PG. 4246 FOR DETAILS OF OPTIONS

Dim.	Inches	mm
A	1.656	42.06
B	1.406	35.71
C	.52	13.2
D	.454	11.53
E	.250	6.35
F	.224	5.69
G	.243	6.17
H	.138 D	3.51 D
J	.34	8.6
K	.025	0.64
L	.31	7.9
M	.35	8.9
N	.29	7.4
P	.27	6.9
Q	.117	2.97
R	.070 D	1.78 D
S	.278	7.06
T	.194	4.93
U	.275	6.99
V	1.16	29.5

TOLERANCES - PG. 4234

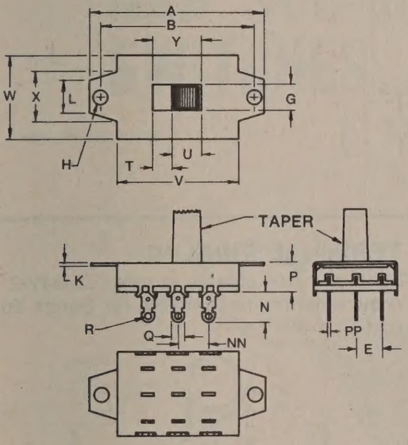


SERIES S-72

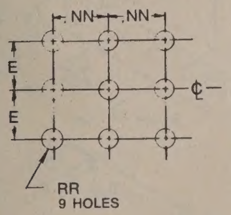


TWO-POSITION, TRIPLE-POLE

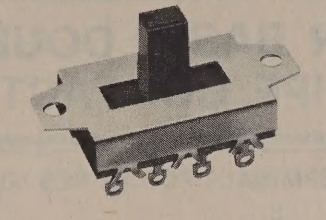
Basic "ON-OFF" switch handles up to three circuits. Also available with the center row of terminals omitted to provide a spring-return, double-pole switch.



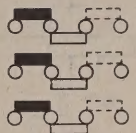
P.C BOARD LAYOUT



NO RATING	PART NO.
Three-Pole	
Non-shorting	S-7232BD00-O
Shorting	S-7232BD00-S
Double-Pole, Spring-Return	
Non-shorting	S-7222SR00-O
Shorting	S-7222SR00-S

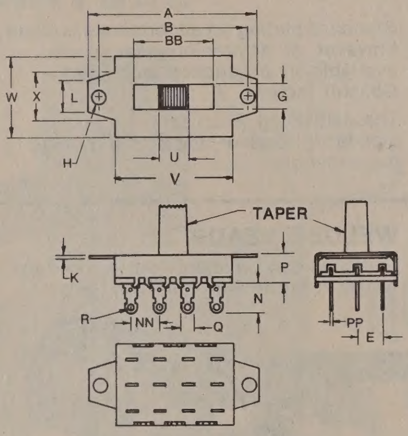


SERIES S-72

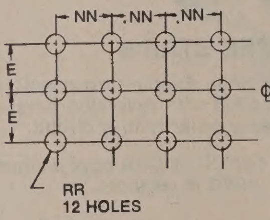


THREE-POSITION, TRIPLE-POLE SWITCH

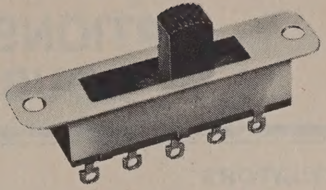
Switch up to three circuits to three separate modes in a single package.



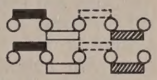
P.C BOARD LAYOUT



NO RATING	PART NO.
Non-Shorting	S-7233BD00-U
Shorting	S-7233BD00-SU

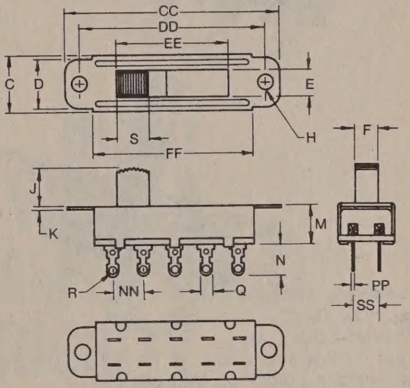


SERIES S-73

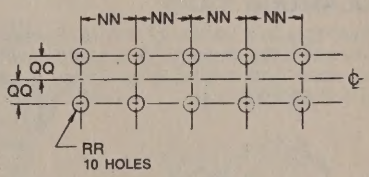


FOUR-POSITION

Available in double-pole and single-pole (one row of terminals removed to provide single-pole operation). For circuitry such as "LOW-MED-HIGH-OFF".



P.C BOARD LAYOUT



NO RATING	PART NO.
Single-Pole	
Non-shorting	S-7314BD00-U
Shorting	S-7314BD00-SU
Double-Pole	
Non-shorting	S-7324BD00-U
Shorting	S-7324BD00-SU

Dim.	Inches	mm
W	.80	20.3
X	.47	11.9
Y	.469	11.91
Z	.750	19.05
AA	.191	4.85
BB	.781	19.84
CC	1.938	49.23
DD	1.688	42.88
EE	1.031	26.19
FF	1.44	36.6
GG	.88	22.4
HH	1.125	28.58
JJ	1.375	34.92
KK	1.23	31.2
LL	.472	11.99
MM	.37	9.4
NN	.282	7.16
PP	.020	0.51
QQ	.123	3.12
RR	.073 D	1.85 D
SS	.246	6.25

TOLERANCES - PG. 4234

—OPTIONS AND ACCESSORIES AVAILABLE

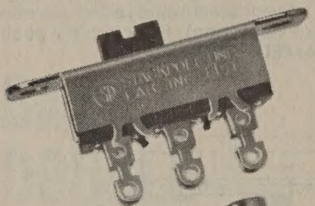
Yes	Yes	Yes	ACTUATOR HEIGHTS
Yes	Yes	Yes	ACTUATOR COLORS
Yes	Yes	Yes	SPECIAL BASE MATERIALS
Yes	Yes	Yes	SPECIAL TERMINALS
			TERMINAL SHIELDS
			ROCKER VERSIONS
Yes	Yes	Yes	SPECIAL MOUNTING HOLES
			TWIST-TAB MOUNTING
Yes	Yes	Yes	REMOVE MOUNTING EARS
Yes	Yes	Yes	WELDED LEADS
Yes	Yes	Yes	SPECIALLY PLATED CASES
			HEAVY DETENTS
			SOLDER GUARDS

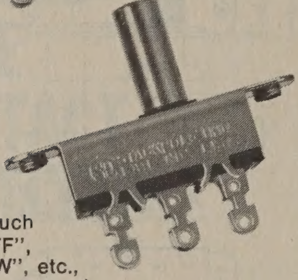
SEE PAGES 4252 & 4253 FOR DETAILS OF ROCKER SWITCHES

OPTIONS FOR BASIC DOUBLE-POLE AND DOUBLE-WIPE CONTACT SWITCHES

ACTUATORS

Standard: The actuators shown in these sections are standard length and shape. All switches except series S-72 available .12″ (3.0mm) to .75″ (19.0mm) high. For specific materials and non-standard shapes or lengths, please contact factory.

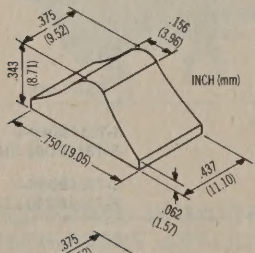




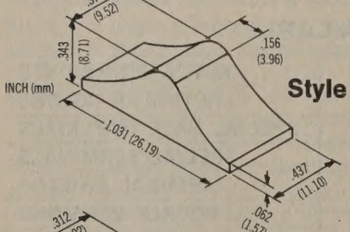
Lettering such as "ON-OFF", "HIGH-LOW", etc., can be hot stamped in various colors on that portion of the knob exposed in the switch window. Consult factory for available stamps.

GLAMOUR CAPS

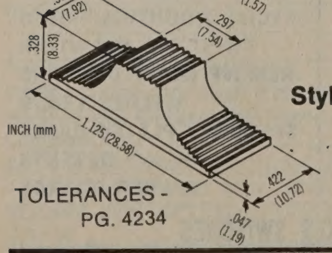
Available in a variety of colors. Press-fit (for easy, fast assembly) to a slide switch actuator. Not available on Series S-72 and S-5224XD11-U.


.375 (9.52)
.156 (3.96)
.343 (8.71)
INCH (mm)
.750 (19.05)
.437 (11.10)
.062 (1.57)

Style "A"


.375 (9.52)
.156 (3.96)
.343 (8.71)
INCH (mm)
1.031 (26.19)
.437 (11.10)
.062 (1.57)

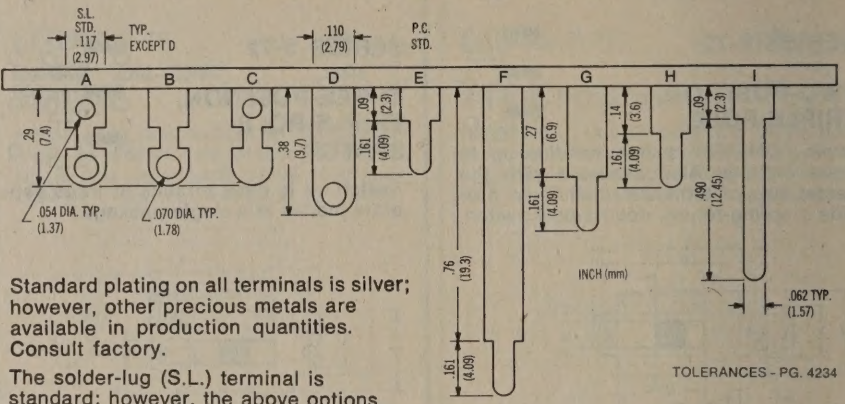
Style "B"


.312 (7.92)
.297 (7.54)
.328 (8.33)
INCH (mm)
1.125 (28.58)
.422 (10.72)
.047 (1.19)

Style "C"

TOLERANCES - PG. 4234

TERMINALS FOR SERIES 50, 51, 52, 70, 71, 72, 73


S.L. STD.
.117 (2.97)
TYP. EXCEPT D
.110 (2.79)
P.C. STD.
A
B
C
D
E
F
G
H
I
.29 (7.4)
.054 DIA. TYP. (1.37)
.070 DIA. TYP. (1.78)
.38 (9.7)
.09 (2.3)
.161 (4.09)
.76 (19.3)
.161 (4.09)
.27 (6.9)
.161 (4.09)
.14 (3.6)
.161 (4.09)
.09 (2.3)
.490 (12.45)
INCH (mm)
.062 TYP. (1.57)

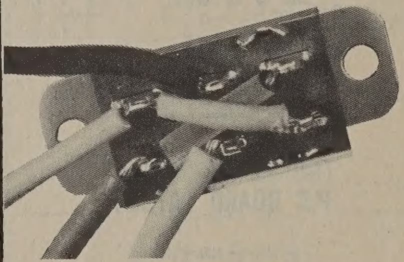
Standard plating on all terminals is silver; however, other precious metals are available in production quantities. Consult factory.

The solder-lug (S.L.) terminal is standard; however, the above options are available.

TOLERANCES - PG. 4234

WELDED LEADS

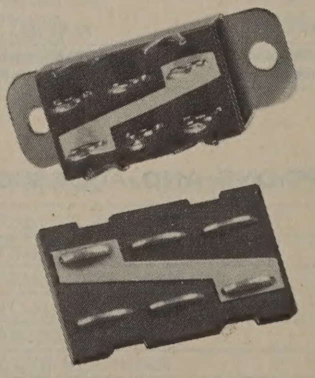
Switches can be supplied pre-wired to assist in production handling —



JUMPER STRIPS

Double-pole, double-throw switches can be supplied with reversing jumper strips to reverse polarity in a circuit.

(**Note:** For UL or CSA applications a solder guard is required.)

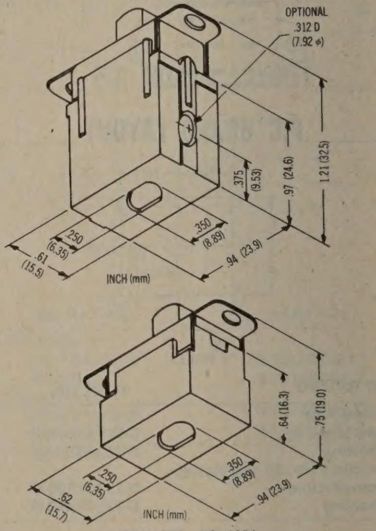


MOUNTING

.138 (3.51mm) diameter mounting holes are standard on all switches. Number 4 and number 6 extruded or number 4-40 and number 6-32 extruded and tapped mounting holes are available in production quantities on most switches. Twist-tab mounting is available on Series 50, 51, 55, 70 and 71 switches. See page 4241 for details.

TERMINAL SHIELDS

Snap-on nylon shields to meet UL-94V-2 requirements are available for Series 50 and 70 switches.


OPTIONAL .312 D (7.92 ⌀)
.375 (9.53)
.97 (24.6)
1.21 (32.5)
.250 (6.35)
.350 (8.89)
.61 (15.5)
.94 (23.9)
INCH (mm)
.64 (16.3)
.75 (19.0)
.250 (6.35)
.350 (8.89)
.62 (15.7)
.94 (23.9)
INCH (mm)

TOLERANCES - PG. 4234

ROCKER VERSIONS

Series 50, 55 and 70 switches are available as rocker types. See pages 4252 and 4253 for illustrations.

Special base materials, case plating, actuator materials and precious metal contacts are available on most rocker switches.

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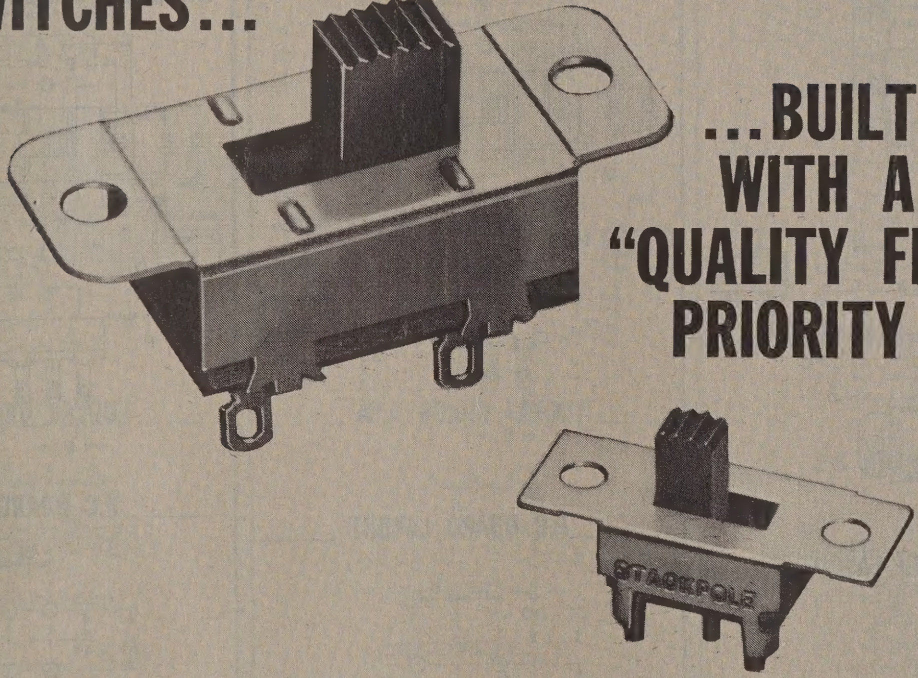
VA 23901 (804) 392-4111
TWX 710-874-3710

FAMED STACKPOLE QUALITY BUILT INTO MINIATURE AND SUB-MINIATURE SWITCHES...



...BUILT WITH A "QUALITY FIRST" PRIORITY

Scaled to match the miniaturization of modern electronic equipment with flawless construction to meet the precise standards of today's electronic products. Stackpole miniature switches incorporate dependable quality and long life to satisfy the most stringent requirements.

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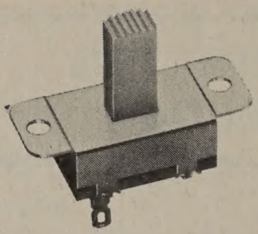
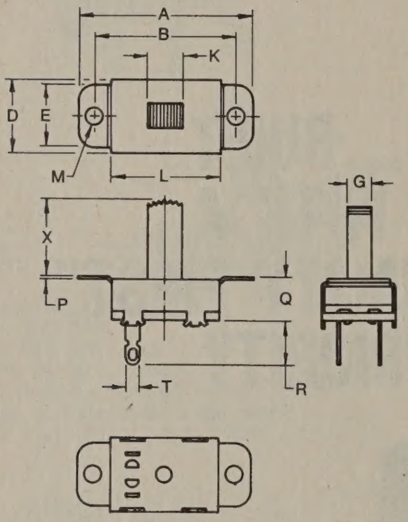


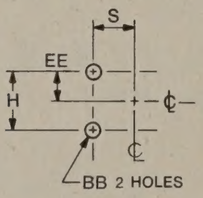
SERIES P-90 MOMENTARY ACTION

NORMALLY OPEN, PUSH SWITCH

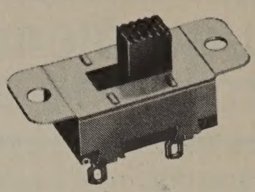
Depress the actuator for instant "ON". Applications range from ringing a bell to activating a circuit for remote control. Single circuit is closed, as long as the knob is depressed.



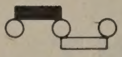
P.C BOARD LAYOUT



PART NO.
P-9011SR00-0

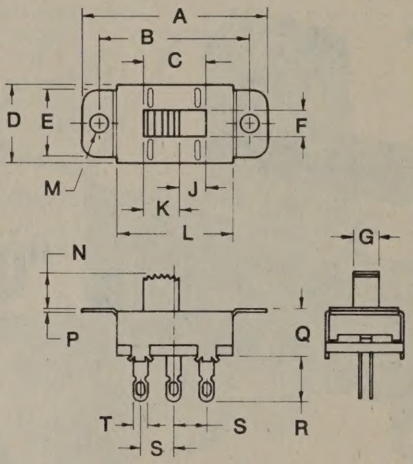


SERIES S-90 STANDARD MINIATURE SWITCH

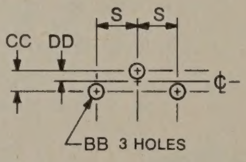


SINGLE-POLE, TWO-POSITION

Basic "ON-OFF" performance and high-quality, long-life construction in maintained detent. Available in 1 and 3 amp versions. Contact factory for optional heavy detent.

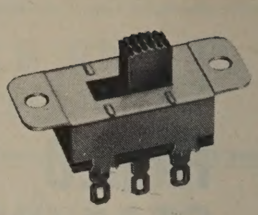


P.C BOARD LAYOUT

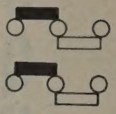


125 VAC UL & CSA

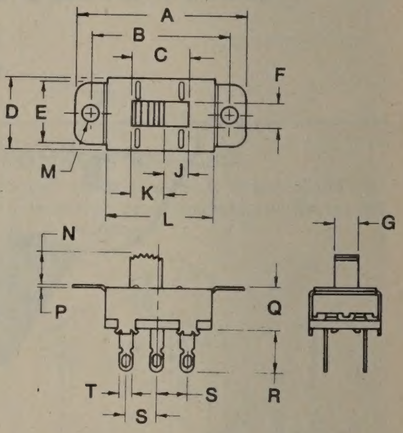
RATING	PART NO.	
Maintained Action	Single-Throw	Double-Throw
1 amp.	S-9011CD01-O	S-9012CD01-O
3 amp.	S-9011CD03-O	S-9012CD03-O



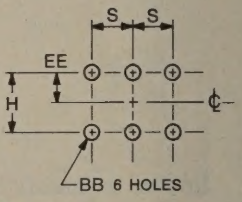
SERIES S-90 STANDARD TWO-POLE, TWO-POSITION MINIATURE SWITCH



Basic miniature size double-pole, double-throw switch. For control of two circuits. Make or break both sides of a circuit with one device. One row of terminals is omitted for single pole spring return. Available to 3 amps.



P.C BOARD LAYOUT



125 VAC UL & CSA

RATING	PART NO.	
1 amp.	S-9022CD01-O	
3 amp.	S-9022CD03-O	
Spring-Return	Single-Throw	Double-Throw
3 amp.	S-9011SR03-C	S-9012SR03-C

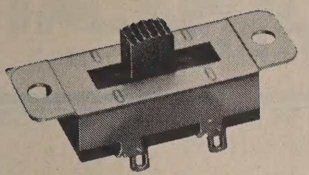
(For single-throw normally closed specify S-9011SR03-CR)

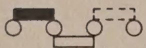
OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

ACTUATOR HEIGHTS	Yes	Yes	Yes
ACTUATOR COLORS	Yes	Yes	Yes
SPECIAL BASE MATERIALS	Yes	Yes	Yes
SPECIAL TERMINALS	Yes	Yes	Yes
SPECIAL MOUNTING HOLES	Yes	Yes	Yes
REMOVE MOUNTING EARS	Yes	Yes	Yes
WELDED LEADS	Yes	Yes	Yes
SPECIALLY PLATED CASES	Yes	Yes	Yes
HEAVY DETENTS		Yes	Yes
SOLDER GUARDS		Yes	Yes

Dim.	Inches	mm
A	1.000	25.40
B	.812	20.62
C	.342	8.69
D	.43	10.9
E	.371	9.42
F	.143	3.63
G	.125	3.18
H	.272	6.91
J	.142	3.61
K	.200	5.08
L	.63	16.0
M	.100 D	2.54 D
N	.19	4.8
P	.018	0.46
Q	.26	6.6

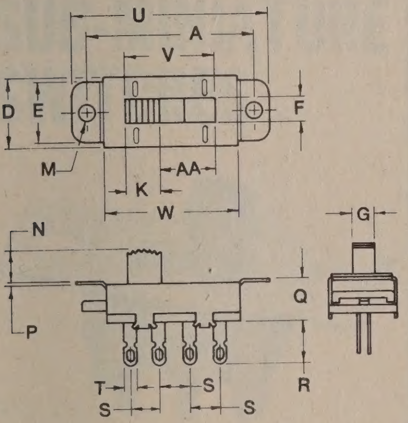
TOLERANCES - PG. 4234



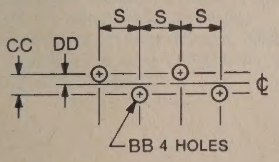


SERIES S-91
SINGLE-POLE, THREE-POSITION MINIATURE

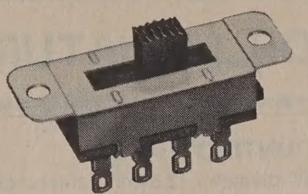
Ideal for applications such as "OFF-LOW-HIGH", "LOW-MED-HIGH". Maintained detent. Available to 3 amps.

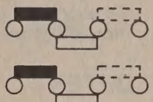


P.C BOARD LAYOUT



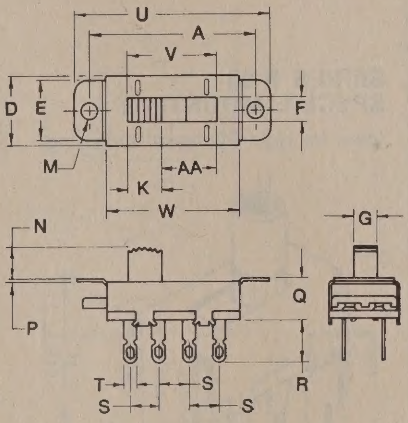
125 VAC UL & CSA RATING	PART NO.
Maintained Action	
1 amp.	S-9113CD01-O
3 amp.	S-9113CD03-O



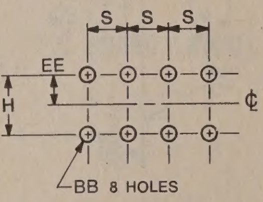


SERIES S-91
DOUBLE-POLE, THREE-POSITION MINIATURE

Switch isolated circuits to three modes with a single device. Available to 3 amps. One row of terminals is omitted for single pole spring return.

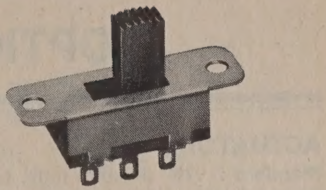


P.C BOARD LAYOUT



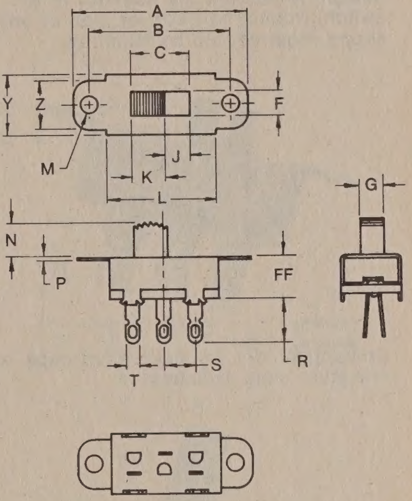
125 VAC UL & CSA RATING	PART NO.
1 amp.	S-9123CD01-O
3 amp.	S-9123CD03-O
†Spring-Return, both ends to center	S-9113SB00-C
†Spring-Return, one end to center	S-9113SC00-CE

† Not Rated

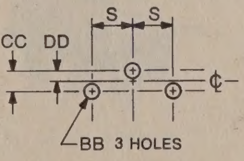


SERIES S-98
THE SKINNY MINI

Basic "ON-OFF" switch to meet the requirement for minimum switch space in cases where width is a prime consideration. For optional case style see page 4250.



P.C BOARD LAYOUT



NO RATING	PART NO.
Single-Throw	S-9811CD00-O
Double Throw	S-9812CD00-O

Dim.	Inches	mm
R	.24	6.1
S	.181	4.60
T	.080	2.03
U	1.190	30.23
V	.548	13.92
W	.80	20.3
X	.44	11.2
Y	.35	8.9
Z	.290	7.37
AA	.348	8.84
BB	.065 D	1.65 D
CC	.095	2.41
DD	.047	1.19
EE	.136	3.45
FF	.25	6.4

TOLERANCES - PG. 4234

OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

Yes	Yes	Yes	ACTUATOR HEIGHTS
Yes	Yes	Yes	ACTUATOR COLORS
Yes	Yes	Yes	SPECIAL BASE MATERIALS
Yes	Yes	Yes	SPECIAL TERMINALS
Yes	Yes		SPECIAL MOUNTING HOLES
Yes	Yes	Yes	REMOVE MOUNTING EARS
Yes	Yes	Yes	WELDED LEADS
Yes	Yes	Yes	SPECIALLY PLATED CASES
Yes	Yes		HEAVY DETENTS
Yes	Yes		SOLDER GUARDS

STACKPOLE
COMPONENTS COMPANY

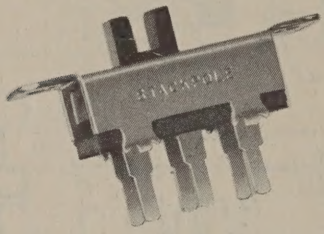
SEE PAGES 4250 FOR DETAILS OF OPTIONS

OPTIONS FOR MINIATURE SWITCHES

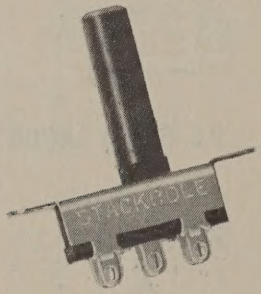
ACTUATORS

Standard is .19″ (4.8mm) high, black nylon actuator. Non-standard lengths and colors are available in production quantities. Please consult factory. (Actuators can be supplied with white or red dot to indicate "ON-OFF".)

Non-Standard Shapes: Stackpole is often called upon to complement a special design by altering the actuator of a switch. Round, screwdriver slot, or any shape required can be supplied.



Contact factory for decorative caps on miniature slide switches.



MOUNTING

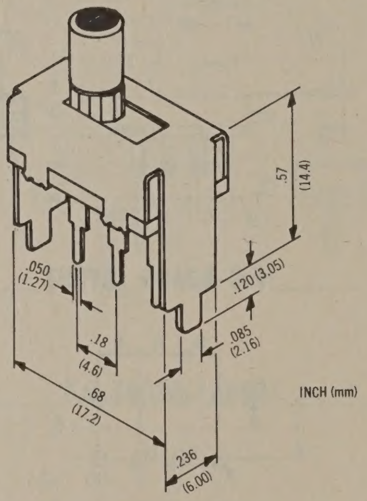
.100″ diameter (2.54mm) clearance mounting holes are standard. Also available in production quantities are #4 extruded or 4-40 extruded and tapped mounting holes.

DETENT

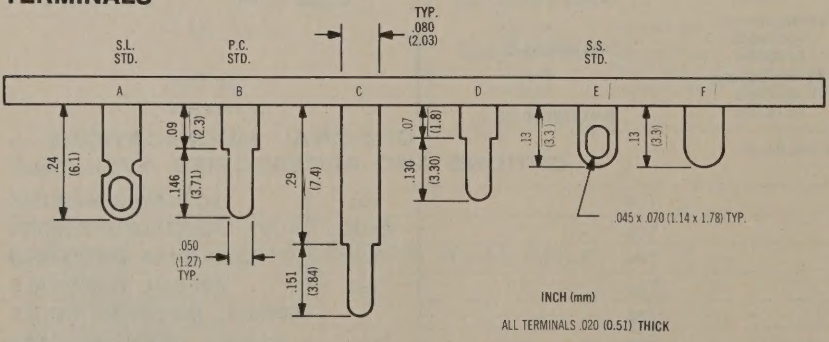
Heavy detent is available on most miniature switches—specify as required.

SERIES S-98 SPECIAL MOUNTING

Ideal for rigid PC board mounting.


.57
(14.4)
.120 (3.05)
.050
(1.27)
.18
(4.6)
.085
(2.16)
.68
(17.2)
.236
(6.00)
INCH (mm)

TERMINALS


TYP.
.080
(2.03)
S.L.
STD.
P.C.
STD.
S.S.
STD.
A
B
C
D
E
F
.24
(6.1)
.09
(2.3)
.146
(3.71)
.29
(7.4)
.07
(1.8)
.130
(3.30)
.13
(3.3)
.13
(3.3)
.045 x .070 (1.14 x 1.78) TYP.
.050
(1.27)
TYP.
.151
(3.84)
INCH (mm)
ALL TERMINALS .020 (0.51) THICK

TOLERANCES - PG. 4234

All terminals are silver plated, unless otherwise specified. Standard solder-lug terminal is supplied, unless printed circuit or other type is specified.

Optional terminals for Series 90, 91, and 98 are above.

SOLDER GUARDS

All miniature switches requiring CSA certification must be supplied with solder guards attached.

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VA 23901 (804) 392-4111
TWX 710-874-3710

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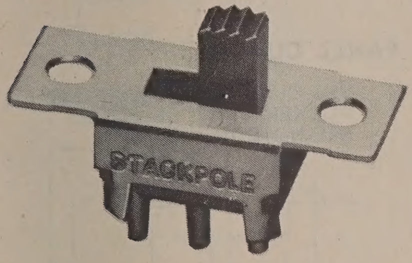
SUB-MINIATURE SWITCHES



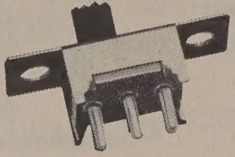
Ultra-shallow, ultra-compact . . . rugged little switches ideally suited for use in test equipment, instrumentation and the new world of hand-held devices (mini-calculators, microphones, shavers) wherever both size and weight are a factor in product design.

STANDARD MATERIAL

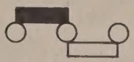
CASE: Cold Rolled Steel, Nickel Plated
BASE: Glass Filled Epoxy
ACTUATOR: Nylon, Black
TERMINALS: Copper Alloy, Silver Plated
SLIDING CONTACT: Silver Clad, Phos. Bronze

Dim.	Inches	mm
A	.762	19.35
B	.562	14.27
C	.245	6.22
D	.32	8.1
E	.265	6.73
F	.098	2.49
G	.090	2.29
H	.132	3.35
J	.120	3.05
K	.125	3.18
L	.38	9.7
M	.100 D	2.54 D
N	.19	4.8
P	.016	0.41
Q	.23	5.8
R	.10	2.5
S	.040 D	1.02 D
T	.060 D	1.52 D

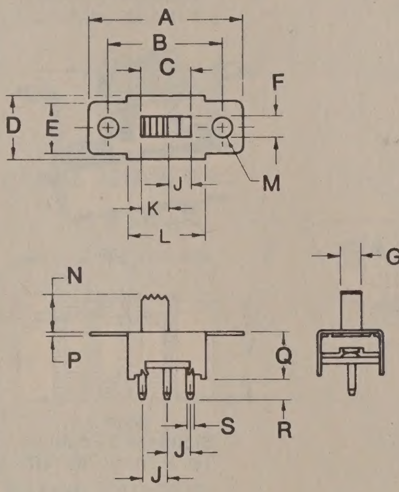
TOLERANCES - PG. 4234



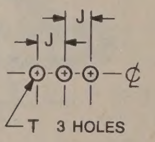
SERIES S-60 SINGLE-POLE, DOUBLE-THROW



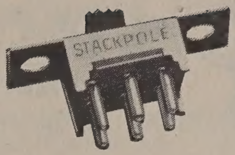
Basic "ON-OFF" switch provides reliability in sub-miniaturization. Break-before-make (non-shorting) configuration guards your circuitry.



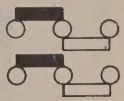
P.C BOARD LAYOUT



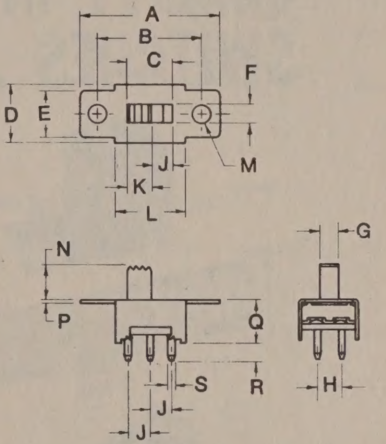
NO RATING	PART NO.
Single-Throw	S-6011CD00-O
Double-Throw	S-6012CD00-O



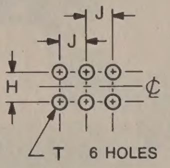
SERIES S-60 DOUBLE-POLE, DOUBLE-THROW



Controls two circuits while maintaining tiny case size.



P.C BOARD LAYOUT



NO RATING	PART NO.
Single-Throw	S-6021CD00-O
Double-Throw	S-6022CD00-O

OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

Yes	ACTUATOR HEIGHTS	Yes
Yes	ACTUATOR COLORS	Yes
	SPECIAL BASE MATERIALS	
	SPECIAL TERMINALS	
	TERMINAL SHIELDS	
	ROCKER VERSIONS	
Yes	SPECIAL MOUNTING HOLES	Yes
	TWIST-TAB MOUNTING	
Yes	REMOVE MOUNTING EARS	Yes
	WELDED LEADS	
	SPECIALLY PLATED CASES	
	HEAVY DETENTS	
	SOLDER GUARDS	

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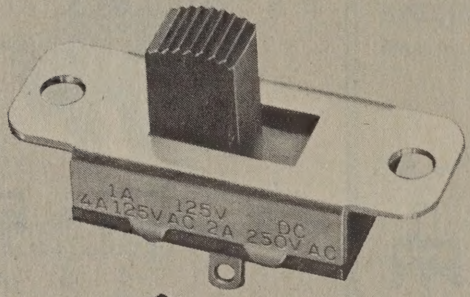
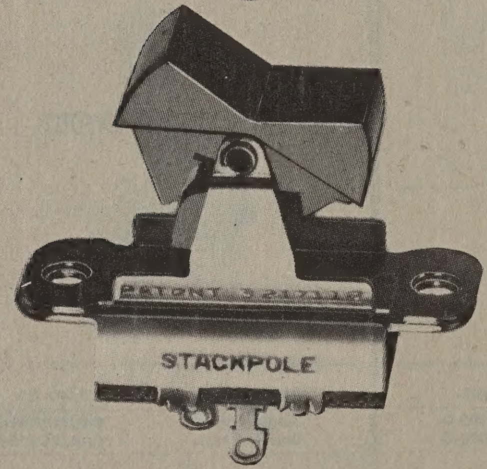
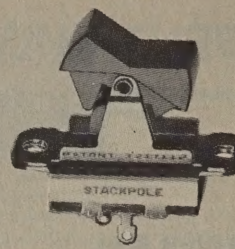
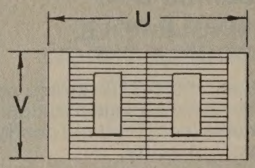
FAMED STACKPOLE QUALITY IN SWITCHES...


1A 125V DC
4A 125VAC 2A 250VAC

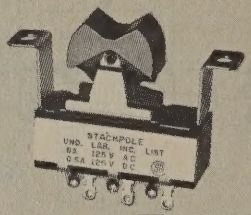

PATENT 3,217,118
STACKPOLE

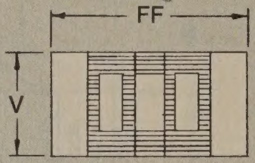
...PLUS THE LATEST AND MOST INNOVATIVE ROCKER VARIATIONS



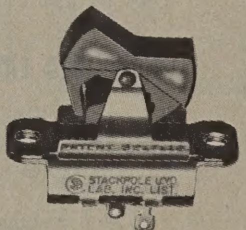


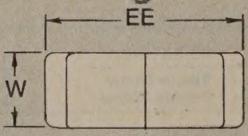
Style A
Standard 2 Position
Total Throw 34°-30′


STACKPOLE
UND. LAB. INC. LIST
6A 125V AC
0.5A 125V DC

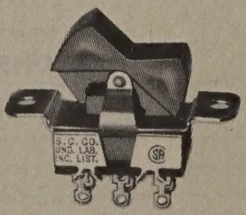


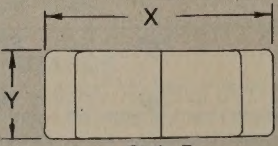
Style B
Standard 3 Position
Total Throw 66°-40′





Style C
Slim Line 2 Position
Total Throw 34°-30′


S.C. CO.
UND. LAB.
INC. LIST.

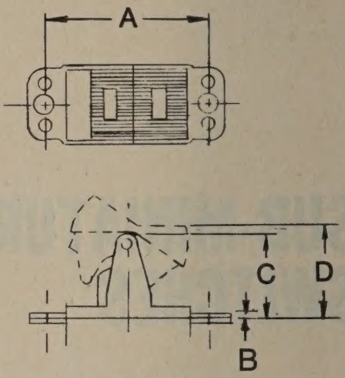


Style D
Low Profile 2 Position
Total Throw 45°

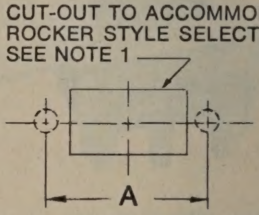
STANDARD ROCKER MOUNTING

For 2- and 3-Position Switches, Series 20, 21, 22, 25, 50, 55, 70. Use Rocker Styles A or C for two-Position Switches. Rocker Style B for three-Position Switch, except Series 21 and 25.

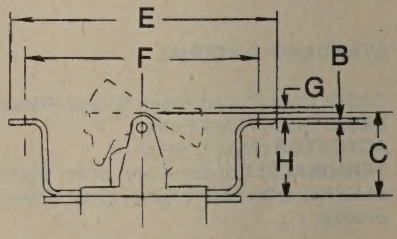
SUB-PANEL MOUNTING



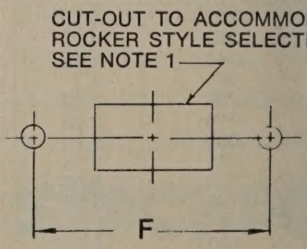
PANEL CUTOUT


CUT-OUT TO ACCOMMODATE
ROCKER STYLE SELECTED
SEE NOTE 1
A

PANEL MOUNTING



PANEL CUTOUT

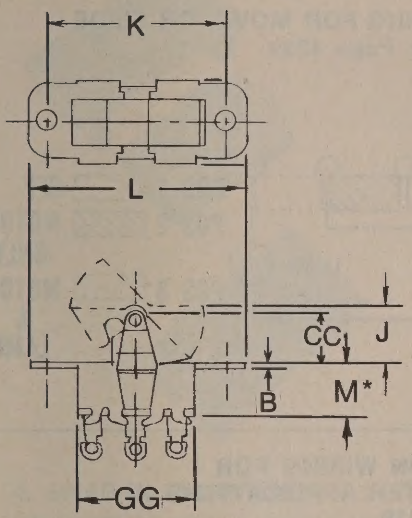

CUT-OUT TO ACCOMMODATE
ROCKER STYLE SELECTED
SEE NOTE 1
F

Note: 1 Allow .015″ min. (0.38mm) clearance all around.
2 Style A and B also available smooth.

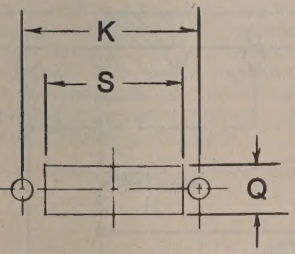
LOW PROFILE ROCKER MOUNTING

For2 Position Switches. Series 25, 50, 70, Use Rocker Style D.

SUB-PANEL MOUNTING

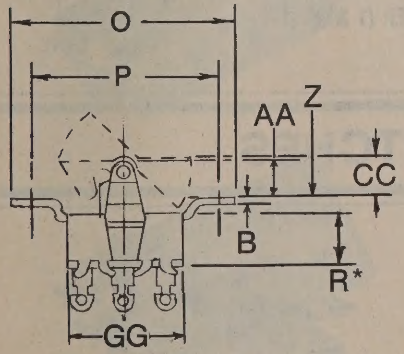


PANEL CUTOUT

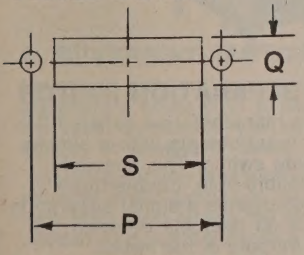


RECOMMENDED PANEL PIERCING

OFFSET MOUNTING



PANEL CUTOUT



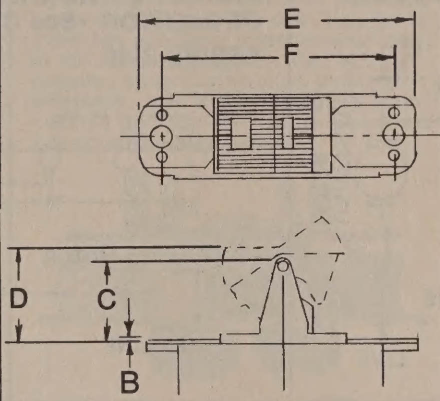
RECOMMENDED PANEL PIERCING

* Use dimension M for Series 25.
* Use dimension R for Series 50 and 70.

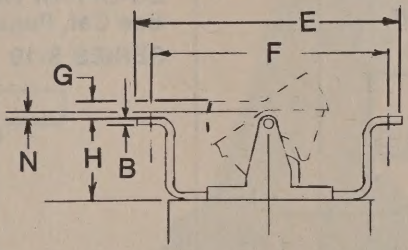
LARGE CASE ROCKER MOUNTING TWO POSITION SWITCHES

Series 10 and 11 Switches use Rocker Styles A or C.

SUB-PANEL MOUNTING

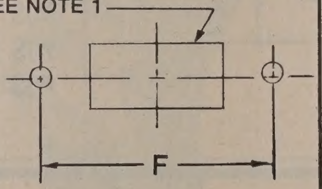


PANEL MOUNTING



PANEL CUTOUT

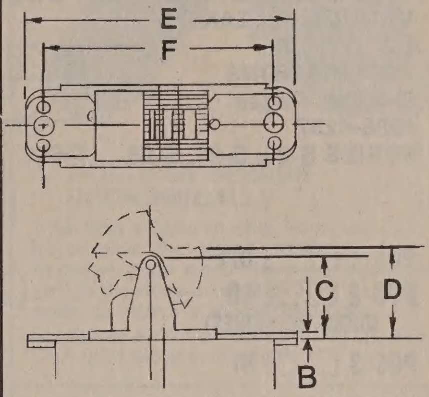
CUT-OUT TO ACCOMMODATE
ROCKER STYLE SELECTED
SEE NOTE 1



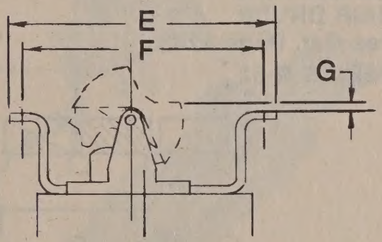
LARGE CASE ROCKER MOUNTING THREE POSITION SWITCHES

Series 10, 11 and 12 Switches Use Rocker Style B.

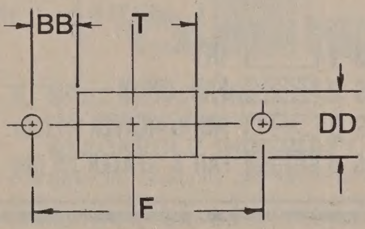
SUB-PANEL MOUNTING



PANEL MOUNTING



PANEL CUTOUT



RECOMMENDED PANEL PIERCING

Dim.	Inches	mm
A	1.125	28.58
B	.025	0.64
C	.59	15.0
D	.65	16.5
E	1.890	48.01
F	1.625	41.28
G	.09	2.3
H	.56	14.2
J	.45	11.4
K	1.250	31.75
L	1.500	38.10
M	.29	7.4
N	.03	0.8
O	1.56	39.6
P	1.312	33.32
Q	.373	9.47
R	.35	8.9
S	.950	24.13
T	.780	19.81
U	.788	20.02
V	.414	10.52
W	.290	7.37
X	.920	23.37
Y	.343	8.71
Z	.085	2.16
AA	.28	7.1
BB	.336	8.53
CC	.37	9.4
DD	.444	11.28
EE	.800	20.32
FF	.750	19.05
GG	.88	22.4

TOLERANCES - PG. 4234

NOTE: 3 WHEN STRUCTURING STACKPOLE PART NUMBERS INCLUDE THE PREFIX R FOR ALL ROCKER TYPES AND THE SUFFIX I FOR LOW PROFILE ROCKER TYPES.

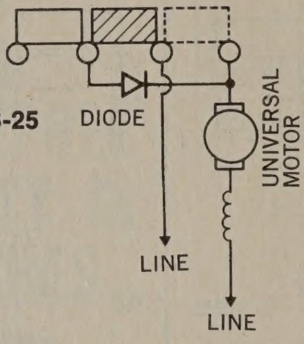
4 FOR SWITCH DIMENSIONS NOT SHOWN IN THESE FAMILY DRAWINGS, REFER TO THE CORRESPONDING SLIDE SWITCH DRAWINGS ELSEWHERE IN THIS CATALOG.

SUGGESTED WIRING FOR STACKPOLE SWITCHES

STACKPOLE
COMPONENTS COMPANY

TWO SPEED WIRING FOR POWER TOOL, VACUUM CLEANER, OR OTHER APPLICATIONS

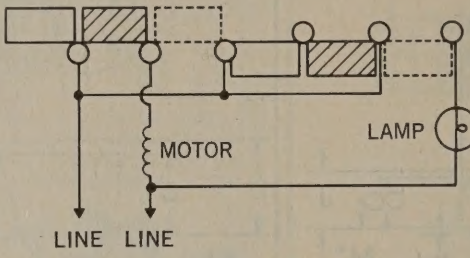
See Cat. Pages 4236-4237
SERIES S-20, S-21, S-25



POS 1 ☐ OFF
POS 2 ▨ LO
(DIODE IN SERIES)
POS 3 ⬚ HI

THREE POSITION WIRING FOR MOVIE OR SLIDE PROJECTOR

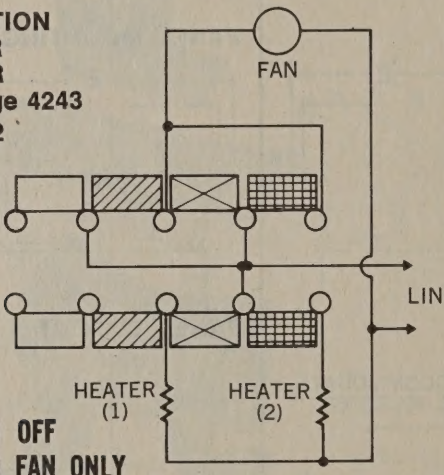
See Cat. Page 4239
SERIES S-10



POS 1 ☐ OFF
POS 2 ▨ MOTOR ONLY
POS 3 ⬚ MOTOR & LAMP

FOUR POSITION WIRING FOR HAIR DRYER

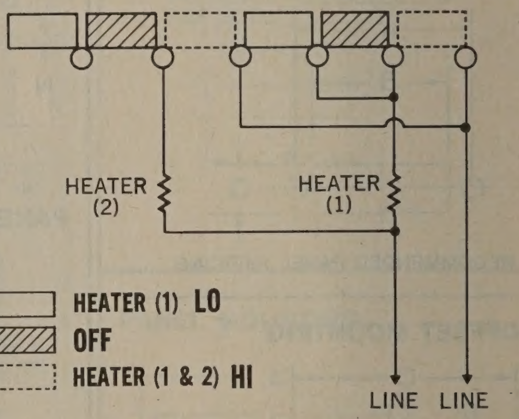
See Cat. Page 4243
SERIES S-52



POS 1 ☐ OFF
POS 2 ▨ FAN ONLY
POS 3 ☒ FAN & HEATER (1) (LO)
POS 4 ▦ FAN & HEATER (2) (HI)

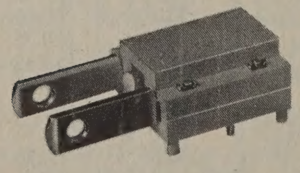
THREE POSITION WIRING FOR LO-OFF-HI HEATER APPLICATIONS

See Cat. Page 4239
SERIES S-10



POS 1 ☐ HEATER (1) LO
POS 2 ▨ OFF
POS 3 ⬚ HEATER (1 & 2) HI

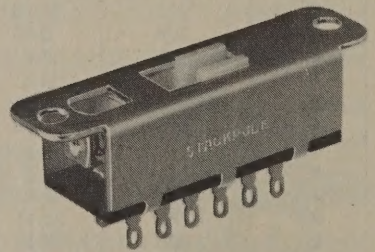
STACKPOLE CUSTOM SWITCHES



1. AC BLADE SWITCH

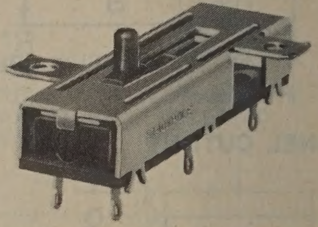
This switch was designed for use in a rechargeable battery pack.

When the switch is plugged into an AC receptacle, the switch permits the battery to charge. When plugged into the power tool, a probe in the tool shifts the switch, providing battery power to be made available to the tool.



2. FOUR-CIRCUIT MICROPHONE SWITCH

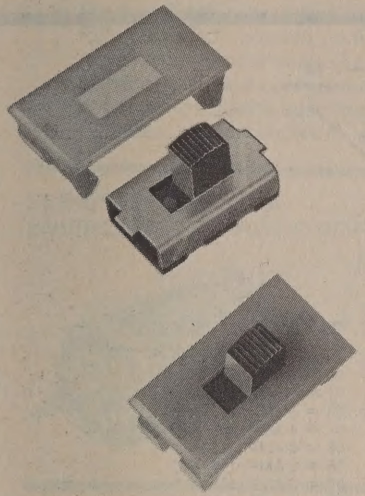
Compact and rugged, this four-pole, two-position switch with spring-return is used as a function switch offering multiple circuit capability necessary for CB mike applications.



3. HIGH SEPARATION SWITCH

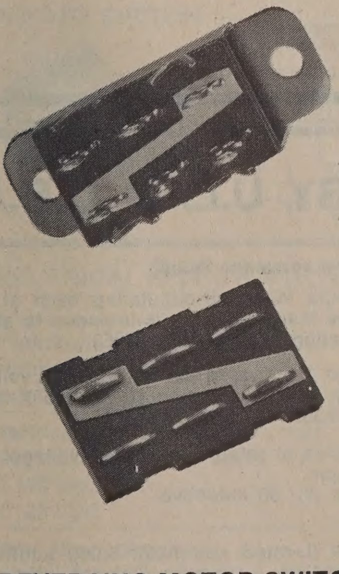
Video game manufacturers satisfy FCC separation requirements with a simple, low-cost slide switch. This specially designed double-pole, double-throw switch accomplishes a signal separation in excess of 60 decibels between the inputs and outputs of the switch (separation is measured at approximately 70. MHz). The switch is supplied with or without a grounding tab.

STACKPOLE CUSTOM SWITCHES



4. SNAP-IN MOUNTING

Simple attachment of a special nylon plate to a slide switch provides an effective, economical means of mounting the switch to a housing. The "adaptor" can be supplied with Stackpole two position Series 20, 22 or 25 switches. The "adaptor" with switch assembled is merely snapped into the opening of a housing, eliminating screws, rivets and other mounting hardware.



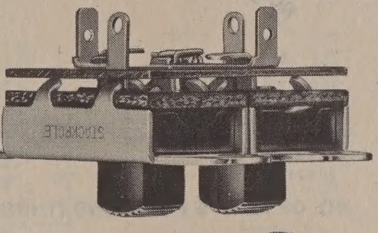
5. REVERSING MOTOR SWITCH

Reversing circuitry is accomplished by attaching a brass strip to each side of the base, mechanically attached by the staking of terminal to base.

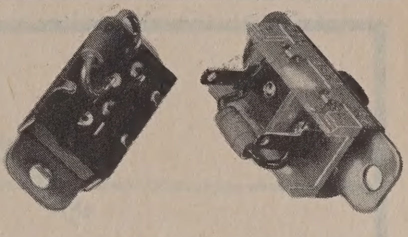
This construction eliminates the need for external cross-jumpering by soldering wire leads and allows for the space needed, if quick connectors are used.

6. DOUBLING THE SWITCHES CAN HALVE THE COST

By ganging two slide switches, Stackpole saves this customer the time required to make two additional solder connections in the unit. Ganging can also solve complex switching function problems efficiently. This single operating knob controls the "ON-OFF" of two separate functions in a floor polisher.

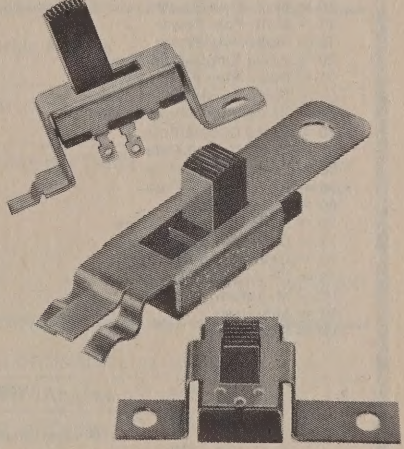


WET PICKUP
SCRUB
POLISH
SHAMPOO
OFF



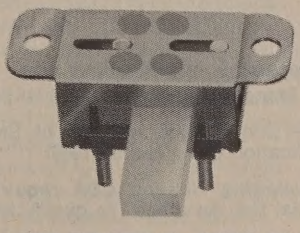
7. MULTIPLE SPEEDS ECONOMICALLY

Attaching diodes to slide switches to accomplish two-speed operation becomes even more attractive when the switch provides a terminal with enough room to attach a quick connector. Stackpole switches are listed by UL and CSA with diodes attached.



8. SPECIAL MOUNTING — NO PROBLEM WITH STACKPOLE INGENUITY

Remarkable flexibility can be built into every Stackpole slide switch by simply modifying the case. Difficult for you? Easy for us. Consult Stackpole for help on those unusual design problems.



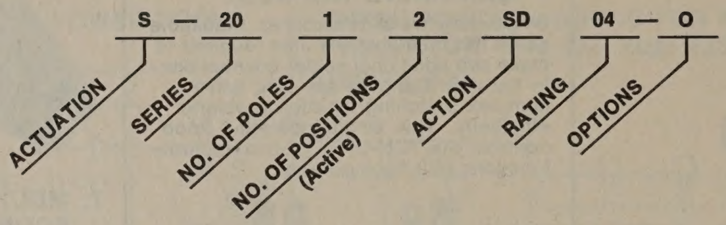
9. LOW-PROFILE, SIDE-SLIDE MINIS

Available in single- and double-pole, two-position, this side-actuated switch is ideal where space is at a premium. Available with standard printed-circuit and standard solder-lug terminals, this low-profile mini-switch offers high reliability at low cost.

All information as contained on our product sheets is provided in good faith and is based on Stackpole's experience and testing programs. These recommendations are non-binding and do not absolve customers from their responsibility for checking the suitability of our products for their particular applications. Equally, such recommendations are not to be regarded as authorizing use of our products in contravention of any patent rights, and no liability is accepted by Stackpole for patent infringement.

THE STACKPOLE SWITCH NUMBERING SYSTEM

All Stackpole Switches are assigned a number to help you identify the item you desire. This number will also help speed your product through UL and CSA listing when applicable.



ACTUATION
S = Slide
R = Rocker
P = Push

SERIES
01 = Special
10 = Multi-Pole Power
11 = Multi-Pole Power
12 = Multi-Pole Power
20 = Basic Single-Pole Power
21 = Basic Single-Pole Power
22 = Basic Single-Pole Power
25 = Basic Single-Pole Power
50 = Basic Double-Pole
51 = Basic Double-Pole
52 = Basic Double-Pole
55 = Basic Double-Pole
60 = Sub-Miniature
70 = Double-Wipe Contacts
71 = Double-Wipe Contacts
72 = Double-Wipe Contacts
73 = Double-Wipe Contacts
90 = Miniature
91 = Miniature
98 = Skinny Mini

NO. OF POLES
1 = Single
2 = Double
3 = Triple
Etc.

NO. OF ACTIVE POSITIONS (THROWS)
1 = Single
2 = Double
3 = Three Position
Etc.

ACTION
AA = Alternate Action
BD = Ball Detent
BA = Ball Detent All Positions
BT = Bow-Tie Detent
CD = Case Detent
SD = Contact Detent
HD = Heavy Detent
RB = SB with Ball Detent
RC = SC with Ball Detent
SA = Smooth Action
SR = Spring Return, Normally Open (NO) if Single Throw
SB = Spring Return Both Ends to Center
SC = Spring Return One End to Center
XD = Special Detent

RATING,(1) UL & CSA
UNLESS OTHERWISE NOTED
00 = Non-Rated
01 = 1 AMP, 125 VAC
03 = 3 AMP, 125 VAC
04 = 4 AMP, 125 VAC
05 = 5 AMP, 125 VAC
06 = 6 AMP, 125 VAC
07 = 7 AMP, 125 VAC
08 = 8 AMP, 125 VAC
10 = 10 AMP, 125 VAC
11 = 11 AMP, 125 VAC
1T = TV-1, 120 VAC
3X = 3 AMP, 120 VAC "L"
6 AMP, 125 VAC
4L = 4 AMP, 120 VAC "L"

OPTIONS
O = No Options
C = Off-Center Terminals
D = Diode Attached
E = Extra Terminal
H = Horizontal Actuator
I = Low Profile Bracket
R = Normally Closed (NC) if Single Throw and Spring Return
S = Shorting Contacts
U = Unshielded Actuator Window
X = Special Circuit (OFF-ON-ON etc.)

NOTE: Other numbers may be added to this list by Stackpole Engineering and will be reflected in the part number assigned to your specific part.

(1) Most Stackpole switches also have 125 VDC & 250 VAC UL & CSA ratings, consult factory.

STACKPOLE SWITCHES ARE LISTED BY U.L. & C.S.A.

UL AND CSA REQUIREMENTS

OUR FILE NUMBERS ARE: UL E10809
CSA LR3969

The applicable specifications are:

UL — Standards for Safety, SPECIAL-USE SWITCHES, UL-1054

CSA — Construction and Test of, SNAP SWITCHES, Specification C22.2 No. 55-1957.

The following UL and CSA requirements must be met by "Special Use Switches" to qualify for UL and CSA listings.

I. General Requirements

1. Minimum air gaps (across a surface or through air) between live and dead metal parts or between live parts of opposite polarity — 3/64″ minimum for ratings of 250 V or less.
2. CSA requirements are the same as for UL except that the air gap between live and dead metal parts at the wiring terminals must be 3/32″ minimum for all applications except radio devices and 1/8″ minimum for radio devices.

II. Test Conditions (in the sequence listed)

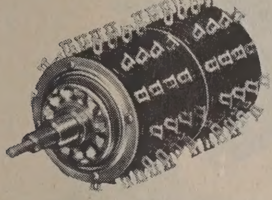
1. Mold Stress: 300 hours in an air-circulating oven at the maximum temperature that the switch is intended to attain in the end-use application (typically 50-105°C).
2. Overload: 50 cycles at 1.5 X rated current at rated voltage for ampere ratings up to and including 10 A (1.25 X rated current for ratings greater than 10 amperes).
3. Endurance: 6,000 cycles at rated current and voltage at a cycling rate of 6-10 cpm.
   a. AC — power factor .75/.80 inductive
   b. DC — resistive
4. Continued Endurance (L-rated switches): 6,000 additional cycles at rated current on a tungsten-filament lamp load at 120 VAC.
5. Temperature Rise: Temperature rise is taken as close to the body of the switch as possible with thermocouples soldered directly to the switch terminals. The current used is the maximum ampere rating of the switch. Maximum permitted temperature rise is 30°C.
6. Dielectric Test: 1000 V RMS, 60 Hertz for 1 minute between
   a. live and dead metal parts
   b. live metal parts of opposite polarity
   No failures at any step are permitted.

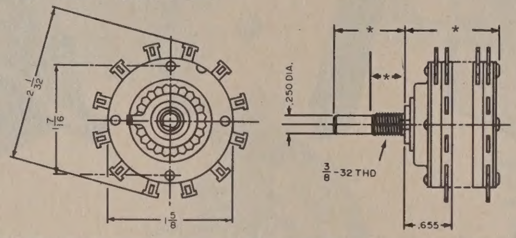
STACKPOLE®

ROTARY SWITCHES

Stackpole rotary switches combine the high reliability of fully enclosed, modular construction with economy and a wide range of off-the-shelf options. Three separate series provide sizes and configurations to meet any application need. For complete specifications of standard rotary switches, request Bulletin 73-108.

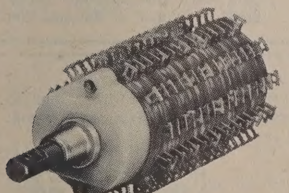
SERIES 600—1⅝" DIA. ENVIRONMENT-PROOF ROTARY SWITCH

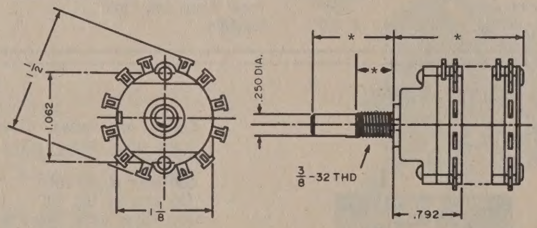




Index Angles	15°, 30°, 60°, 90°
No. of Decks	15°—3 max. 30°, 60° & 90°—15 max.
Poles per Deck	15°—12 max. 30°— 6 max. 60°— 4 max. 90°— 3 max.

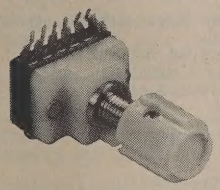
SERIES 100—1⅛" DIA. ENVIRONMENT-PROOF ROTARY SWITCH

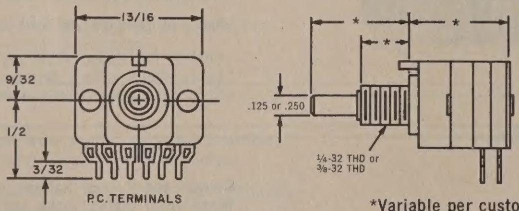




Index Angles	22½°, 30°, 36°, 45°, 60°, 90°
No. of Decks	20 max. for any Index Angle
Poles per Deck	30°, up to 6, max. 36°, up to 5, max. 60°, 4 max. 90°, 3 max. *22½° & 45°—Consult Stackpole

SERIES 80—SUBMINIATURE ENVIRONMENT-PROOF ROTARY SWITCH





PC or Solder Lug Terminals

Index Angles	30°, 60°, 90°
No. of Decks	30°, 10 max. 60°, 10 max. 90°, 10 max.
Poles per Deck	30°, up to 6, max. 60°, up to 4, max. 90°, up to 3, max.

*Variable per customer requirements.

ELECTRICAL SPECIFICATIONS

	Series 80	Series 100	Series 600
Breakdown Voltage (Sea Level)			
Terminal to terminal	600 VAC	1000 VAC	1000 VAC
Terminal to ground	1000 VAC	2000 VAC	2000 VAC
Electrical Rating (Resistive Load)			
Silver-plated brass contacts			
At 125 VAC	.050 Amp	.3 Amp	.5 Amp
At 28 VDC	.1 Amp	.5 Amp	1 Amp
Silver-alloy contacts			
At 125 VAC	.075 Amp	.5 Amp	1 Amp
At 28 VDC	.125 Amp	1 Amp	2 Amp
Current-carrying capacity (Max temp rise, 30° C)	6 Amp	15 Amp	25 Amp
Contact Resistance (Silver-Plated Brass)			
Average initial, less than	.005 Ohm	.005 Ohm	.005 Ohm
Maximum initial	.010 Ohm	.010 Ohm	.010 Ohm

ADVANTAGES

All series feature totally enclosed designs, seal out dirt, moisture and corrosion, seal in lubrication. Rugged, torsionally rigid assemblies withstand rough usage. Series 100 conforms to MIL-S-3786 for shock, vibration and explosion-proofing.

Series 80 has 13/16" x 9/16" body with in-line pins, ideal for either PC board insertion or hand solder applications.

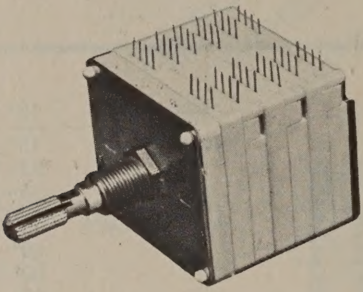
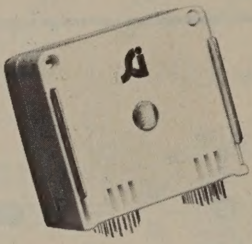
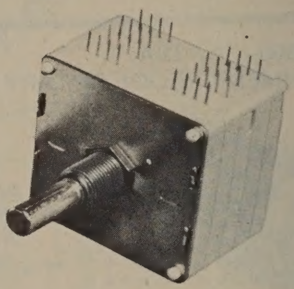
DELIVERY

Fastest in the industry. Within two weeks for standard configurations, within three weeks on specials (samples in 2-3 days). Request Bulletin 73-108 for information and method of specifying custom-design switches.

STACKPOLE COMPONENTS CO. • P. O. BOX 14466 • RALEIGH, N. C. 27610 • PHONE: 919-828-6201

P/REL™ STANDARD GRIGSBY'S NEW PROGRAMMABLE ROTARY ENCODED LOGIC SWITCH

- Fully programmable up to 60 detent positions

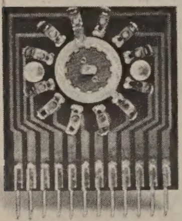
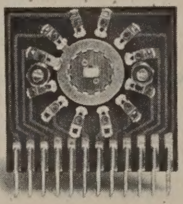
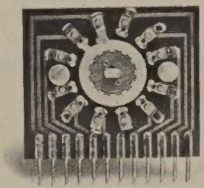




ELECTRICAL RATINGS

Current Carrying Capacity	.25 amp @ 115 VAC
Resistive Load	.125 amp @ 115 AC
Contact Resistance	initial 0.10 ohm maximum
Insulation Resistance	100 megohms
Dielectric Strength	500 VAC minimum
Contact Life	25K cycles of 720° (50K cycles of 360°)

Operating Force	14 to 24 inch oz. standard
Temperature Ranges	-55°C to +85°C
Insulation	Molded Valox 310
Programmable Disc	Plated Copper clad laminate
Contacts	Plated spring tempered material
Front Plate and Shaft	Cold rolled steel cadmium plated
Bushing	Brass, aluminum or die cast zinc

NEW SM-PCB ROTARY SWITCHES

- Three profile heights .625", .742", .875"

Current and Voltage Ratings: Resistive Load.
Brass silver plated, make and break:

.550 amp at 28 VDC	.170 amp at 115 VAC RMS
135 amp at 100 VDC	.8 amp at 24 VAC RMS

Coin silver alloy, make and break:

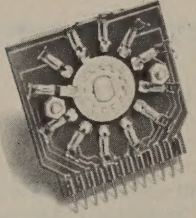
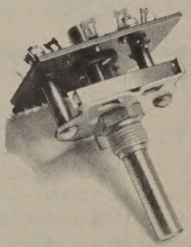
1.10 amp at 28 VDC	.335 amp at 115 VAC RMS
.27 amp at 100 VDC	1.6 amp at 24 VAC RMS

Current Carrying Capacity:
Brass silver plated - 2 amp Coin silver alloy - 2 amp

Dielectric Stength: 750 VAC between critical parts and ground.

Contact Resistance: (Path resistance not included).
Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

SK-PCB

- Available in standard .875" profile height

Current and Voltage Ratings: Resistive Load.
Brass silver plated, make and break:

1.5 amp at 28 VDC	.230 amp at 115 VAC RMS
.22 amp at 100 VDC	1.75 amp at 24 VAC RMS

Coin silver alloy, make and break:

.34 amp at 100 VDC	.450 amp at 115 VAC RMS

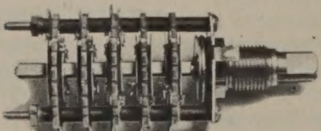
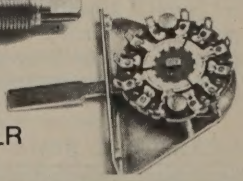
Current Carrying Capacity:
Brass silver plated - 2 amp, Coin silver alloy - 2 amp

Dielectric Strength: 750 VAC between critical parts and ground

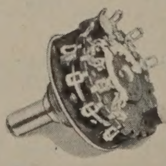
Contact Resistance: (Path resistance not included)
Silver plated parts - average initial 3 milliohms.
Coin silver alloy parts - average initial milliohms.

SUBMINIATURE TYPE ROTARY SWITCHES

- Available 1-6 Poles
- 12 position 30° Throw

SMLR



Current and Voltage Ratings: Resistive Load.
Brass, silver plated, make and break:

.550 amp at 28 VDC	.170 amp at 115 VAC RMS
.135 amp at 100 VDC	.8 amp at 24 VAC RMS

Coin silver alloy, make and break:

1.100 amp at 28 VDC	.335 amp at 115 VAC RMS
.27 amp at 100 VDC	1.6 amp at 24 VAC RMS

Current Carrying Capacity:
Brass silver plated - 7 amp. Coin silver alloy - 9 amp

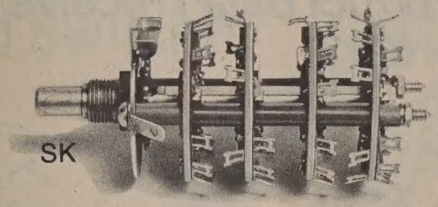
Dielectric Strength: 750 VAC between critical parts and ground.

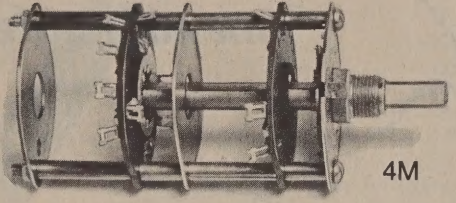
Contact Resistance: Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

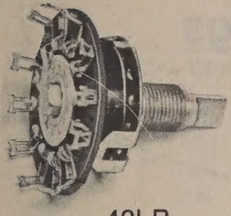
Standard Grigsby

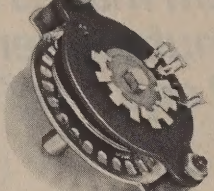
Rotary Switches

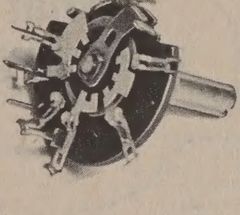
SK, 4M, 42LR, 7M, 5M ROTARY SWITCHES

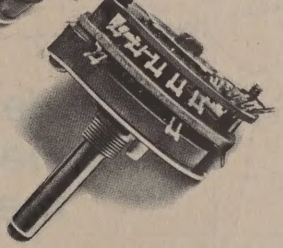

SK


4M


42LR


7M


5M



Current and Voltage Ratings: Resistive Load.
Brass, silver plated, make and break:

1.5 amp at 28 VDC	.230 amp at 115 VAC RMS
.22 amp at 100 VDC	1.75 amp at 24 VAC RMS

Coin silver alloy, make and break:

2.6 amp at 38 VDC	.450 amp at 115 VAC RMS
.34 amp at 100 VDC	3.4 amp at 24 VAC RMS

Current Carrying Capacity:
Brass silver plated - 9 amp. Coin silver alloy - 12 amp

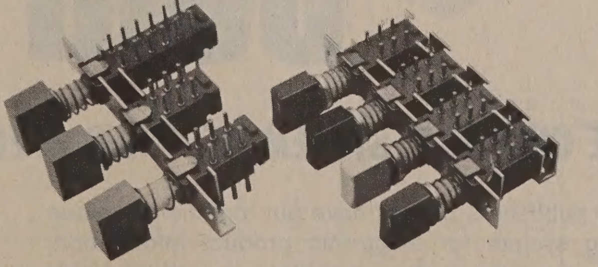
Dielectric Strength: 1,000 VAC between critical parts and ground.

Contact Resistance: Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

New Dual Flex Detent™
added to 7M line

- 1 9/16″ Detent
- Dual ball starwheel design for long life
- Positive indexing

PB 400 PUSHBUTTON SWITCHES



Contact Resistance: (Contact + Path): Average initial less than 5 milliohms. Average after 25,000 cycles (no load) is less than 10 milliohms.

Insulation Resistance: Between adjacent terminals, also between terminals and chassis - greater than 7,500 megohms.

Current/Voltage Ratings: Resistive Load a.c. 40 watt/d.c. 15 watt.

100 ma @ 150 VDC	175 ma @ 250 VAC
350 ma @ 125 VAC	1.3 amp @ 28 VAC

Current Carrying Capacity: 2 amp maximum

Voltage Breakdown: Between all terminals connected together and mounting chassis, also between adjacent terminals—1500 VAC minimum.

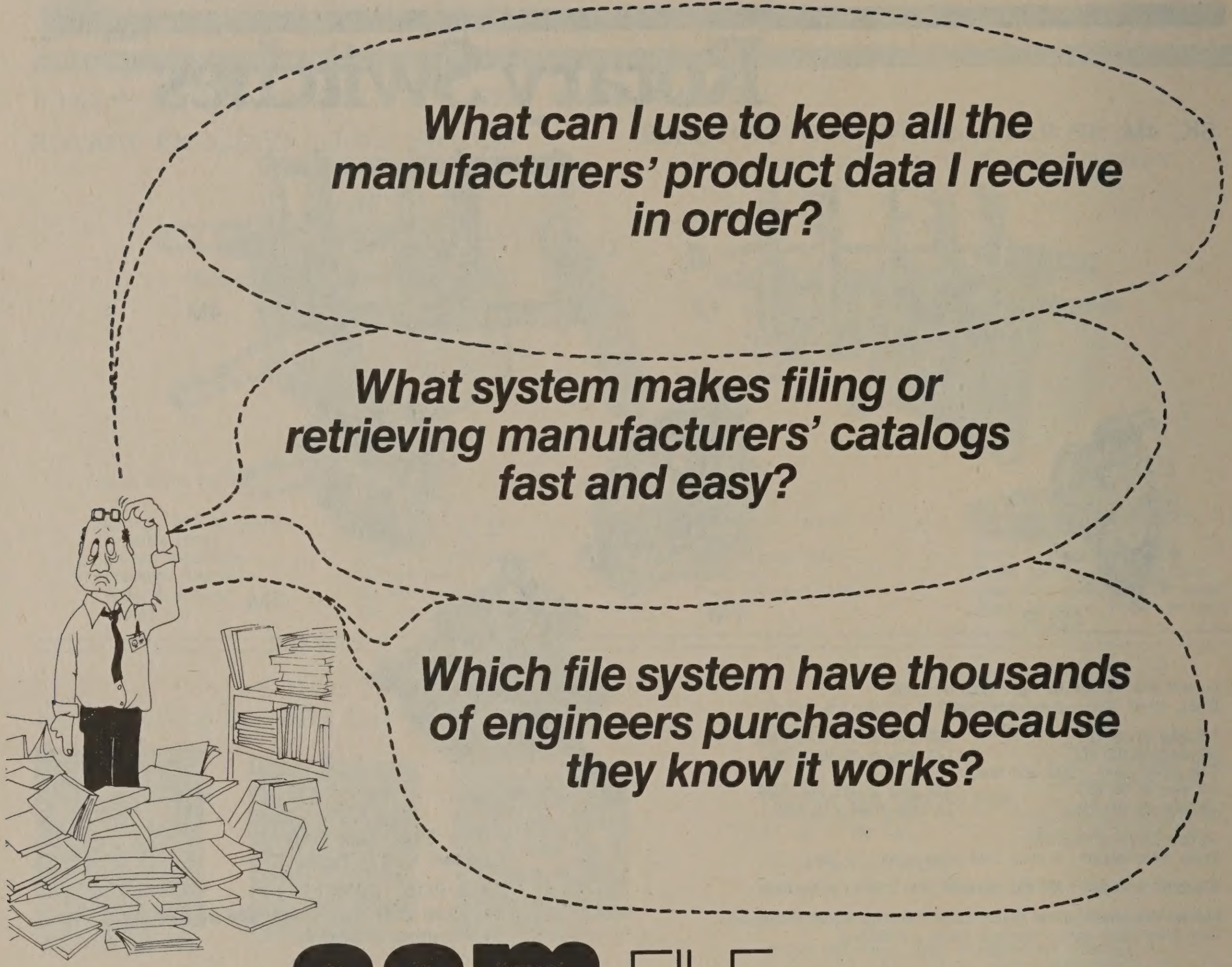
Switching Functions: 2, 4, 6 and 8 pole, double-throw, non-shorting.

A/C Switch Availability: A two pole double throw A/C switch, rated at 4A/250V can be included in the switching functions on any available switch chassis.

Standard Grigsby's Engineering Staff will answer any inquiries regarding your switch problems or switch design. Because our switches are custom built, it is necessary for us to know how you wish to combine your options and what circuitry is required. Your own drawings may be submitted or you may use our convenient layout sheets that are available without charge by contacting our Sales Office.

standard grigsby, inc.

Dept. EM, 920 Rathbone Ave., Aurora, IL 60507 (312) 844-4300
TWX 910-232-3138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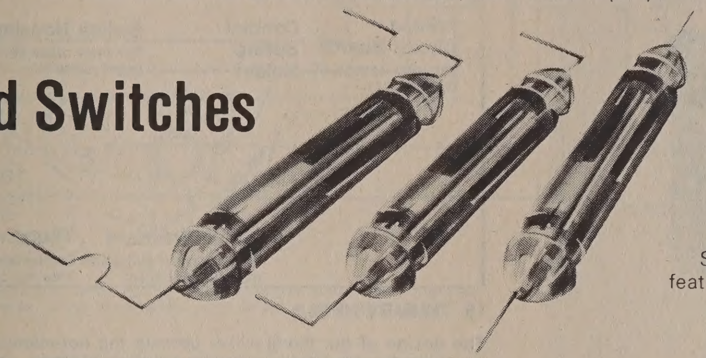
Standex Electronics

4538 CAMBERWELL ROAD • CINCINNATI, OHIO 45209 • (513) 871-3777

Reed Switches



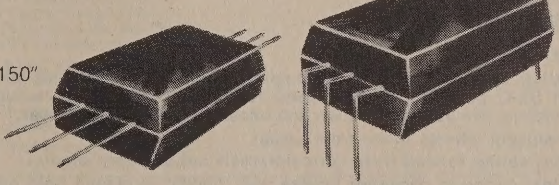
GS125 — Standard
GS100 — Miniature
GS560 — Dip Size
GS 125G — Ideal for use in high impedance circuits • compatible with FET's and CMOS. devices.
VS100 — True miniature vacuum switch. Ideally suited for telephone switch gear.
Standex manufactures its own reed switches and features the strongest glass to metal seals available.

	PHYSICAL CHARACTERISTICS				ELECTRICAL CHARACTERISTICS								
SWITCH TYPE	GLASS DIA. IN (MM)	GLASS LENGTH IN (MM)	LEAD DIA.	OVERALL LENGTH	CONTACT ARRANG.	POWER CAP.	CURRENT SWITCH.	VOLTAGE SWITCHING	OPERATE A.T.	OPERATE TIME MAX.	CONTACT RESIS. MAX.	BREAK VOLTS MIN.	INSULATION RESIS. MIN.
GS125	.125 (3)	.780 (19.8)	.022 (.56)	2.125 (54)	SPNO FORM A	10VA	1 amp	150V D.C. (250V A.C.)	17.5-62.5	1 MS Includ. Bounce	.150 ohm	350V D.C. Min.	10^{12} ohm
GS100	.095 (2.4)	.780 (19.8)	.022 (.56)	2.125 (54)	SPNO	10VA	1 amp	150V D.C. (250V A.C.)	17.5-62.5	1 MS	.150 ohm	350V D.C. Min.	10^{12} ohm
GS560	.090 (2.28)	.560 (14.2)	.0195 (.49)	2.125 (54)	SPNO	10VA	.5 amp	100V D.C.	12.5-42.5	1 MS	.150 ohm	250V D.C.	10^{10} ohm
GS125G	.125 (3)	.780 (19.8)	.022 (.56)	2.125 (54)	SPNO	10VA	1 amp	150V D.C. (250V A.C.)	17.5-62.5	1 MS	.150 ohm	350V D.C. Min.	10^{14} ohm
VS100	.095 (2.4)	.830 (21)	.022 (.56)	2.125 (54)	SPNO	10VA 1VA	1 amp @ 10V D.C.* 1 MA @ 1000V D.C.		20-80	1 MS	.150 ohm	1500 V D.C.	10^{12} ohm

NOTES:
1. Release A.T.'s - 45% to 75% of operate A.T.
2. Switches stocked in 25, 35, 45, 55 A.T. with +7.5 A.T. tolerance.
3. Contact material is a proprietary alloy standalloy.

* Consult factory

Reed Relays Series MG

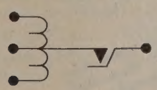


FEATURES: • Low level and 1 amp • Molded epoxy • Available .100" - .150" • Available with diode, electrostatic and magnetic shielding

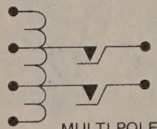
SPECIFICATIONS:

Contact Rating — 1 amp 250V A.C.
Contact Life Resistive (only) — 1000 x 10^6
Operate Time — 1.0 MS
Release Time — .4 MS
Contact Resistance — .150 Ω Max.
Cont. Break Down Voltage — 350V D.C.
Cont. Insulation Resistance 10^{10} Ω Min.
Cont. Capacitance — .2 pf

SCHEMATIC



SINGLE POLE



MULTI POLE

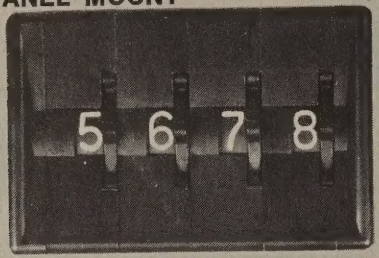
DIMENSIONS:

Pin spacing on 1.00 centers x .100 or .150
Relay Length .900
Relay Height .320
Width as shown in table.

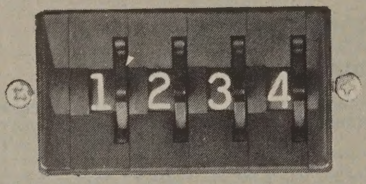
RELAY TYPE	PIN SPACE	POLES	RATED COIL VOLTS	MUST OPERATE	MUST RELEASE	COIL OHMS	RELAY WIDTH
MG100 — **1—5**	.100	**1**	**5** 6	**4.0** 4	**.5** .5	**500** 125	.32
MG150 — **1—5**	.150		12 24	9.6 19	1.0 2.0	500 2000	.42
MG100 — **2—6**	.100	**2**	5 **6**	4.0 **4.0**	.5 **.5**	250 **110**	.42
MG150 — **2—6**	.150		12 24	9.6 19	1.0 2.0	440 1760	.57
MG100 — **3—12**	.100	**3**	6	4.0	.5	85	.57
MG150 — **3—12**	.150		**12** 24	**9.6** 19	**1.0** 2.0	**340** 1360	.72
MG100 — **4—24**	.100	**4**	6	4.0	.5	62	.62
MG150 — **4—24**	.150		12 **24**	9.6 **19**	1.0 **2.0**	250 **1000**	.87
MG100 — **5—12**	.100	**5**	6 **12** 24	4.0 **9.6** 19	.5 **1.0** 2.0	45 **180** 720	.72
MG100 — **6—6**	.100	**6**	**6** 12 24	**4** 9.6 19	**.5** 1.0 2.0	**34** 136 544	.87

Thumbwheel Switches

FRONT PANEL MOUNT



REAR PANEL MOUNT



ECONOMICAL TO SPECIFY, EASY TO INSTALL, EFFICIENT IN USE

SAE's family of Thumbwheel Switches consists of three rear-mounted widths and two front-mounted widths. Up to four characters can be hot-stamped on the .500″ wide wheel.

Contact springs and holders are unique in that one design fits all switches. Contacts can be arranged in any of the four quadrant positions, or even four contacts can be mounted, if required, for 4-pole switching. This versatility makes it possible to duplicate every existing output code and also allows the design of complex switching codes not available from any other manufacturer.

There are six fingers to provide greater circuit design flexibility in adapting to codes.

Printed circuit boards offer the flexibility of different terminations to suit your particular application. Almost any type of connection can be made.

SPECIFICATIONS

Materials:

Housing, opaque wheels, contact spring holder and end plates made from SE-O polyester thermoplastic for dimension stability, solvent resistance, low surface friction and excellent resistance to wear.

Translucent wheels made from Lexan.

Detent spring formed from corrosion-resistant stainless steel.

Contact spring is phosphor bronze with .00005″ minimum gold over .00005″ minimum nickel.

PCB is .031″ fiberglass, flame retarded epoxy resin per MIL-P-13949D with .00003″ minimum gold per MIL-G-45204, Type II, Class 1 over .0002″ minimum nickel per QQ-N-290, Class 2.

Hardware is corrosion resistant steel.

Mechanical:

Life: Over 1,000,000 detent operations.

Operating Force: 7 to 12 ounces.

Operating Temperatures: −20°C to +70°C.

Weight: Approximately ⅓ ounce.

Environmental:

Vibration: 15G's 10-2000 cycles per MIL-STD-202, Method 204.

Shock: 200G's for 6 ms.

Electrical:

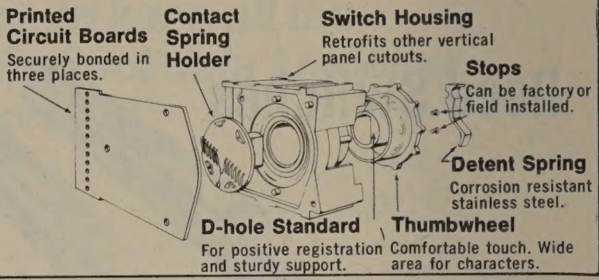
Rating: 0.100 amp at 115 VAC or 28 VDC (resistive). Current carrying capacity (non switching) is 1 amp per common output line.

Contact Resistance: 0.1 ohm maximum.

Insulation Resistance: 1000 megohms.

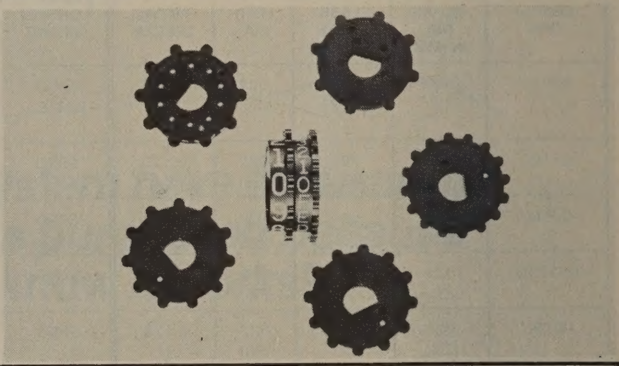
Dielectric Strength: 100 V RMS.

CONSTRUCTION


Printed Circuit Boards
Securely bonded in three places.
Contact Spring Holder
Switch Housing
Retrofits other vertical panel cutouts.
Stops
Can be factory or field installed.
Detent Spring
Corrosion resistant stainless steel.
D-hole Standard
For positive registration and sturdy support.
Thumbwheel
Comfortable touch. Wide area for characters.

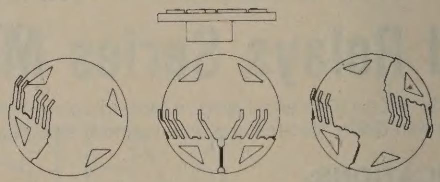
15 THUMBWHEELS

The design of the thumbwheel permits the hot-stamping process to be utilized to its fullest extent in creating a clean, permanent character that's unbeatable for legibility. The wheels are available in three drum widths and have 8, 10, 11, 12 or 16 positions.



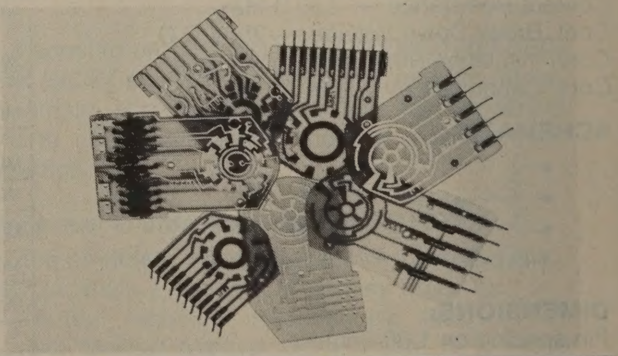
ONE-DESIGN CONTACT SPRING AND HOLDER

Fits all Thumbwheel Switches.



VARIETY OF PRINTED CIRCUIT BOARDS

SAE PCBs provide for hard-wiring or printed circuit board pins, accepts diodes, resistors, resistor networks and complete circuits.



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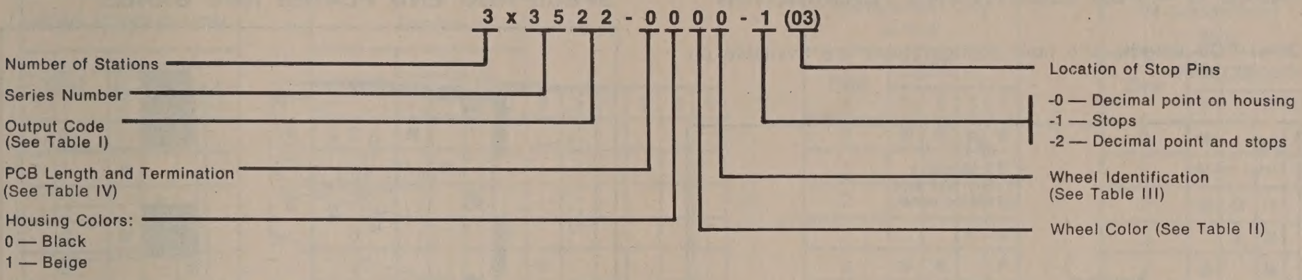
Thumbwheel Switches

ORDERING INFORMATION



3 x 3 5 2 2 - 0 0 0 0 - 1 (03)

Number of Stations

Series Number

Output Code
(See Table I)

PCB Length and Termination
(See Table IV)

Housing Colors:
0 — Black
1 — Beige

Location of Stop Pins

-0 — Decimal point on housing
-1 — Stops
-2 — Decimal point and stops

Wheel Identification
(See Table III)

Wheel Color (See Table II)

Note:
Whenever stop pins are called out on multiple station assemblies, clarification has to be made in the description as to which station gets stops.

TABLE I — MOUNTING SIZES AND CODES

Table I lists SAE's standard part numbers, but represents only a fraction of the overall switch codes that can readily be provided — either to retrofit an existing competitive device, or to satisfy a new or unique application.

Part No.'s					Description	Truth Table (See page 4)
5000 Series	4000 Series	3500 Series	3100 Series	2700 Series		
.500" Width	.394" Width	.350" Width	.315" Width	.290" Width		
Rear Mtg.	Front Mtg.	Rear Mtg.	Front Mtg.	Rear Mtg.		
5022	4022	3522	3122	2722	BCD 1, 2, 4, 8 — Standard Single Pole	1
5050	4050	3550	3150	2750	Decimal, Single Pole Standard Break Before Make	2
5052	4052	3552	3152	2752	Decimal, Single Pole Make Before Break	2
5060	4060	3560	3160	2760	Decimal, Double Pole (12 Output Lines)	*
5070	4070	3570	3170	2770	Complement Only BCD $\overline{1}$, $\overline{2}$, $\overline{4}$, $\overline{8}$	3
5078	4078	3578	3178	2778	9's complement of BCD	4
5082	4082	3582	3182	2782	Complement only of 9's complement	5
5090	4090	3590	3190	2790	BCD 1, 2, 4, 8 with separate common to not true bits	6
5095	4095	3595	3195	2795	BCD 1, 2, 4, 8 plus complement, one common	7
5100	4100	3600	3200	2800	SPDT Repeating x5 marked +, −, + etc.	8
5130	4130	3630	3230	2830	DPDT Repeating x5 marked +, −, + etc.	9
5132	4132	3632	3232	2832	DPDT Repeating x5 marked 0, 1, 0 etc.	9
5134	4134	3634	3234	2834	DPDT Repeating x5 marked 0, 5, 0 etc.	9
5150	4150	3650	3250	2850	Aiken 1, 2, 4, 2′	*
5152	4152	3652	3252	2852	2 out of 5 Code / 1, 2, 4, 7 + EBP	*
5162	4162	3662	3262	2862	Resistor Decade, 1, 2, 2, 2, 2	*
5163	4163	3663	3263	2863	Resistor Decade 1, 2, 3, 6	*
5165	4165	3665	3265	2865	Kelvin Varley Voltage Divider	*
5168	4168	3668	3268	2868	Wolff-Poggendorf Voltage Divider	*
**	†	3706	†	†	16 position hexadecimal 1, 2, 4, 8	10
**	†	3707	†	†	Same except wheel marked 0-15	10
**	†	3720	†	†	Hexadecimal with separate common to not true bits	11
***	†	3752	†	†	12 position binary 1, 2, 4, 8	*
5308	4308	3808	3408	3008	8 position BCO 1, 2, 4	*
5340	4340	3840	3440	3040	BCO complement only $\overline{1}$, $\overline{2}$, $\overline{4}$	*
5361	4361	3861	3461	3061	11 position decimal Single Pole	*
5362	4362	3862	3462	3062	Same except Make Before Break	*

*Consult factory representative for separate listing †NOT AVAILABLE
**½" wide switch is accomplished by ordering a 3706 or 3720 plus a .150" wide spacer, No. 1454
***½" wide switch is accomplished by ordering a 3752 plus a .150" wide spacer, No. 1453

COLORS, MARKINGS, OPTIONS

Black housings are generally preferred for use with equipment with light colored panels. For dark-colored panels, or where many assemblies are involved, matte beige looks more attractive. Decimal points and custom markings are white on black housings and are black on beige housings.

For long assemblies in which many consecutive switches are involved, consider using a different colored wheel for the first station of each related group of switches. Or use colors to separate groups into functional blocks, i.e., Red for danger; Yellow for caution; Green for proceed; Blue for control, etc.

TABLE II — WHEEL COLORS

OPAQUE		TRANSLUCENT
0 — Black	**5 — Green**	**3 — White (customer supplies external lighting)**
1 — Beige	**6 — Blue**	**8 — White (SAE provides internal lighting)**
2 — Red	**7 — Special**	
4 — Yellow	**9 — White**	

TABLE III — WHEEL IDENTIFICATION

("0" in part number)

10 position	0-9	8 position	0-7
10 position	+ − + etc.	11 position	0-10
10 position	0, 1, 0 etc.	12 position	0-11
10 position	0, 5, 0 etc.	16 position	0-9, A-F
		16 position	0-15

"0" specifies standard numerals. The "1" designation covers special or custom markings. Whenever "1" is specified for custom markings, SAE must be advised what characters are to be provided in each position of the wheel in relation to the output code.

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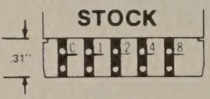
Thumbwheel Switches

ORDERING INFORMATION

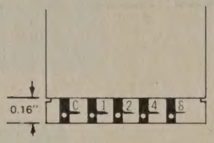
TABLE IV— PCB LENGTH AND TERMINATION

Other PCB lengths and hole configurations are available on special order.

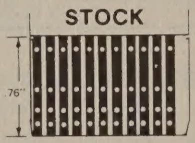
#0
Direct solder.



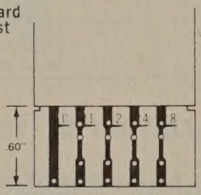
#1
Solder only.
Shortest depth behind panel.



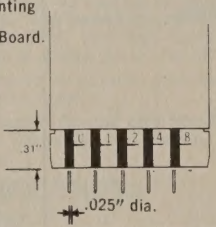
#2
Component Mounting Board.
For direct soldering.



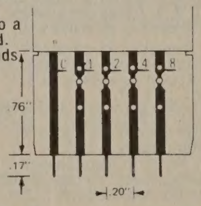
#3
Component Mounting Board for shallowest depth behind panel.
Solder only.



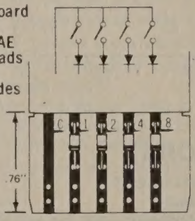
#4*
With pins for mounting into a Mother Board.



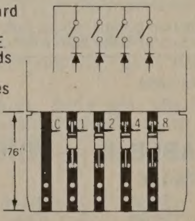
#5
Component Mounting Board with pins for mounting into a Mother Board. Customer loads and solders own diodes.



#6
Component Mounting Board with diodes installed. SAE supplies, loads and solders 1N4148 diodes with anode toward common.

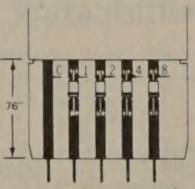


#7
Component Mounting Board with diodes installed. SAE supplies, loads and solders 1N4148 diodes with cathode toward common.



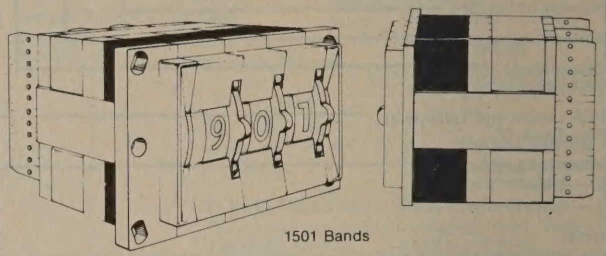
#8
Same as #6 except includes pins for mounting into a Mother Board.

#9
Similar to 7 and 8 cathode toward common and PC pins.



***Note:** SAE can provide dimensional drawings indicating the recommended Mother Board hole locations in relation to the panel cutout.

SPECIFYING END PLATES AND BANDS



END PLATE NUMBERS

Wheel Positions	Switch Series	5000	4000	3500	3100	2700
8, 10, 11, 12	Matte Black	1350	1340	1335	1331	1335
8, 10, 11, 12	Matte Beige	1351	1341	1336	1332	1336
16	Matte Black	—	—	1367	—	—

SPACER NUMBERS

Wheel Position	Color	.500" Wide	.394" Wide	.350" Wide	.315" Wide	.175" Wide
8, 10, 11 and 12	Black	1450 1410* —	1440 — —	1430 1400* 1436†	1420 — —	1400 — —
8, 10, 11 and 12	Beige	1451 1411*	1441 —	1431 1401*	1421 —	1401 —
16	Black	— —	— —	1434 1454‡	— —	— —

* ½ as wide as the switch, i.e., .250" and .175"
† Similar to #1430 except face height measures .960" in lieu of .980"
‡ .150" wide

Blind Slave Switch Modules are available to satisfy 2-pole decimal requirements or custom multi-pole switching applications. The 5000 Series slave switch is made from Spacer No. 1410 (.250" wide). All of the other switch sizes are slaved by using a spacer, the same width as the switch housing.

BAND HARDWARE NUMBERS

Number of Switches	Band Hardware Suffix Numbers (to Part No. 1501)				
1	67	75	52	58	46
2	117	114	87	90	74
3	167	154	122	121	104
4	217	193	157	153	133
5	267	232	192	184	162
6	317	272	226	215	190
7	367	311	261	247	219
8	416	350	296	278	248
9	466	389	331	310	277
10	516	429	366	341	306

Note: There are many other band lengths required because custom assemblies occasionally require spacers that are one-half the width of the switch module. Any length bands are readily available. The longer assemblies may require 4 bands for stability purposes.

STOP PIN NUMBERS

	1510	1510	1510	1511	1511

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Thumbwheel Switches

ORDERING INFORMATION
TRUTH TABLES

REf. #1

Binary Coded Decimal

Dial	Common Connected to:			
	1	2	4	8
0				
1	●			
2		●		
3	●	●		
4			●	
5	●		●	
6		●	●	
7	●	●	●	
8				●
9	●			●

Ref. #2

Decimal

Dial	Common Connected to:									
	0	1	2	3	4	5	6	7	8	9
0	●									
1		●								
2			●							
3				●						
4					●					
5						●				
6							●			
7								●		
8									●	
9										●

Ref. #3

Complement Only to BCD

Dial	Common Connected to:			
	$\overline{1}$	$\overline{2}$	$\overline{4}$	$\overline{8}$
0	●	●	●	●
1		●	●	●
2	●		●	●
3			●	●
4	●	●		●
5		●		●
6	●			●
7				●
8	●	●	●	
9		●	●	

Ref. #4

9's Complement of BCD

Dial	Common Connected to:			
	1	2	4	8
0	●			●
1				●
2	●	●	●	
3		●	●	
4	●		●	
5			●	
6	●	●		
7		●		
8	●			
9				

Ref. #5

Complement Only to 9's Complement

Dial	Common Connected to:			
	1	2	4	8
0		●	●	
1	●	●	●	
2				●
3	●			●
4		●		●
5	●	●		●
6			●	●
7	●		●	●
8		●	●	●
9	●	●	●	●

Ref. #6

BCD Plus Complement Two Commons. True-Not True

Dial	Common Connected to:			
	1	2	4	8
0	○	○	○	○
1	●	○	○	○
2	○	●	○	○
3	●	●	○	○
4	○	○	●	○
5	●	○	●	○
6	○	●	●	○
7	●	●	●	○
8	○	○	○	●
9	●	○	○	●

Ref. #7*

BCD Plus Complement One Common

Dial	Common Connected to:							
	1	2	4	8	$\overline{1}$	$\overline{2}$	$\overline{4}$	$\overline{8}$
0					●	●	●	●
1	●					●	●	●
2		●			●		●	●
3	●	●					●	●
4			●		●	●		●
5	●		●			●		●
6		●	●		●			●
7	●	●	●					●
8				●	●	●	●	
9	●			●		●	●	

*Also available with one common connected to the BCD and a second common connected to the complement.

Ref. #8

SPDT Repeating x5

Dial			Common Connected to:			
			+	-		
+	0	0	●			
−	1	5		●		
+	0	0	●			
−	1	5		●		
+	0	0	●			
−	1	5		●		
+	0	0	●			
−	1	5		●		
+	0	0	●			
−	1	5		●		

Ref. #9

DPDT Repeating x5

Dial			Common Connected to:			
			A		B	
+	0	0	●		●	
−	1	5		●		●
+	0	0	●		●	
−	1	5		●		●
+	0	0	●		●	
−	1	5		●		●
+	0	0	●		●	
−	1	5		●		●
+	0	0	●		●	
−	1	5		●		●

Ref. #10

Hexadecimal

Dial		Common Connected to:			
		1	2	4	8
0	0				
1	1	●			
2	2		●		
3	3	●	●		
4	4			●	
5	5	●		●	
6	6		●	●	
7	7	●	●	●	
8	8				●
9	9	●			●
A	10		●		●
B	11	●	●		●
C	12			●	●
D	13	●		●	●
E	14		●	●	●
F	15	●	●	●	●

Ref. #11

Hexadecimal Plus Complement - 2 Commons True-Not True

Dial	Common Connected to:			
	1	2	4	8
0	○	○	○	○
1	●	○	○	○
2	○	●	○	○
3	●	●	○	○
4	○	○	●	○
5	●	○	●	○
6	○	●	●	○
7	●	●	●	○
8	○	○	○	●
9	●	○	○	●
A	○	●	○	●
B	●	●	○	●
C	○	○	●	●
D	●	○	●	●
E	○	●	●	●
F	●	●	●	●

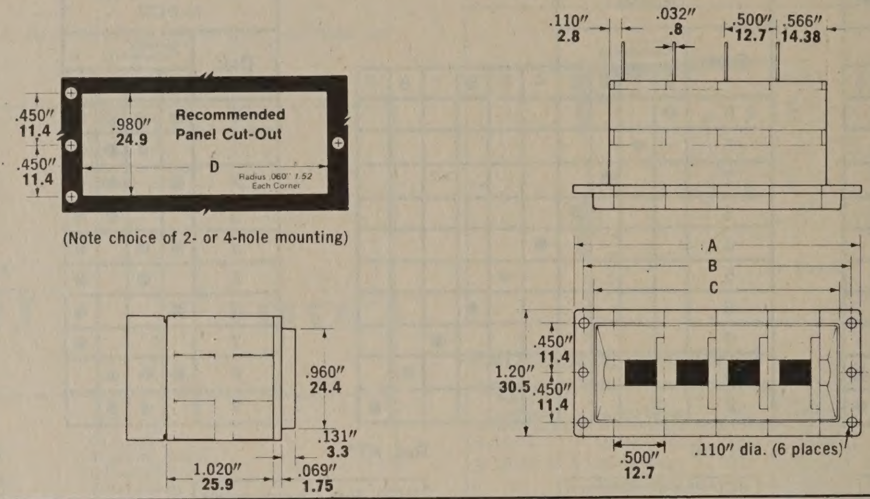
STANFORD APPLIED ENGINEERING, INC.
340 MARTIN AVENUE
SANTA CLARA, CALIFORNIA 95050
(408) 243-9200 / TWX 910-338-0132

Stanford
Applied
Engineering

Thumbwheel Switches

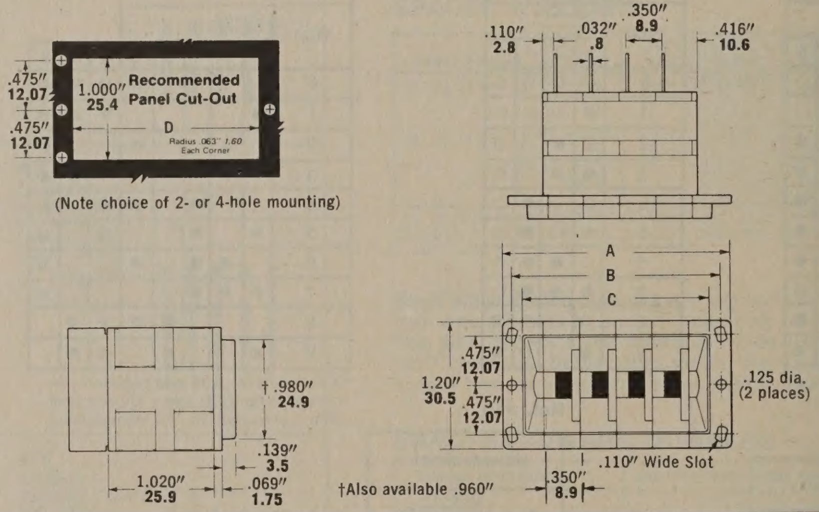
DIMENSIONS
SERIES 5000
SERIES 3500

SERIES 5000


.450″
11.4
.450″
11.4
.980″
24.9
Recommended
Panel Cut-Out
D
Radius .060″ 1.52
Each Corner
.960″
24.4
.131″
3.3
1.020″
25.9
.069″
1.75
.110″
2.8
.032″
.8
.500″
12.7
.566″
14.38
A
B
C
.450″
11.4
1.20″
30.5
.450″
11.4
.500″
12.7
.110″ dia. (6 places)

(Note choice of 2- or 4-hole mounting)

SERIES 3500


.475″
12.07
.475″
12.07
1.000″
25.4
Recommended
Panel Cut-Out
D
Radius .063″ 1.60
Each Corner
† .980″
24.9
.139″
3.5
1.020″
25.9
.069″
1.75
.110″
2.8
.032″
.8
.350″
8.9
.416″
10.6
A
B
C
.475″
12.07
1.20″
30.5
.475″
12.07
.125 dia.
(2 places)
.110″ Wide Slot
.350″
8.9

(Note choice of 2- or 4-hole mounting)

†Also available .960″

5000 SERIES DIMENSIONS

Number of Switches	A Nx.50″ +.76″ Nx12.7mm +19.3mm	B Nx.50″ +.59″ Nx12.7mm +15mm	C Nx.50″ +.40″ Nx12.7mm +10.2mm	D Nx.50″ +.416″ Nx12.7mm +10.6mm
1	1.260 32.0	1.090 27.7	.900 22.9	.916 23.3
2	1.760 44.7	1.590 40.4	1.400 35.6	1.416 36.0
3	2.260 57.4	2.090 53.1	1.900 48.3	1.916 48.7
4	2.760 70.1	2.590 65.8	2.400 70.0	2.416 61.4

3500 SERIES DIMENSIONS

Number of Switches	A Nx.350″ +.750″ Nx8.9mm +19.0mm	B Nx.350″ +.575″ Nx8.9mm +14.6mm	C Nx.350″ +.306″ Nx8.9mm +7.8mm	D Nx.350″ +.322″ Nx8.9mm +8.2mm
1	1.100 27.9	.925 23.5	.656 16.7	.672 17.1
2	1.450 36.8	1.275 32.4	1.006 25.6	1.022 26.0
3	1.800 45.7	1.625 41.3	1.356 34.5	1.372 34.9
4	2.150 54.6	1.975 50.2	1.706 43.4	1.722 43.8

Notes:

1. Tolerances for 0-10 switches is ±.010.
2. Character in the window.
   8, 10, 11 and 12 position — .220″
   16 position — .150″

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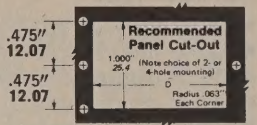
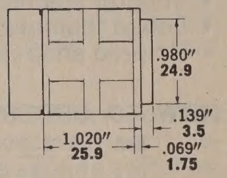
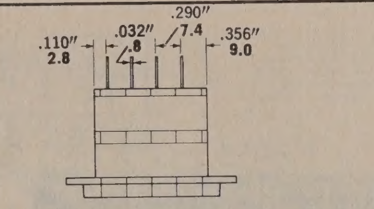
Thumbwheel Switches

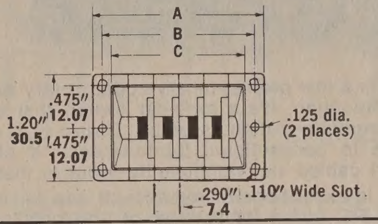
DIMENSIONS
SERIES 2700
SERIES 4000/3100

SERIES 2700

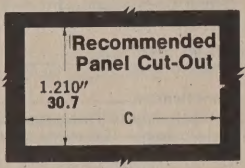

.475″
12.07
.475″
12.07
Recommended
Panel Cut-Out
1.000″
25.4
(Note choice of 2- or
4-hole mounting)
D
Radius .063″
Each Corner

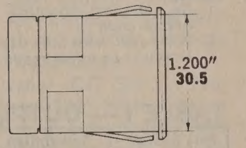

.980″
24.9
.139″
3.5
1.020″
25.9
.069″
1.75

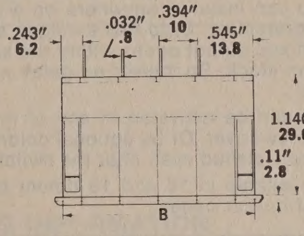

.290″
7.4
.110″
2.8
.032″
.8
.356″
9.0

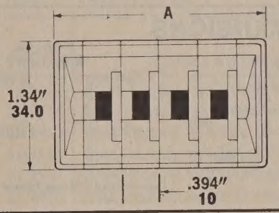

A
B
C
.475″
12.07
1.20″
30.5
.475″
12.07
.125 dia.
(2 places)
.290″
7.4
.110″ Wide Slot

SERIES 4000

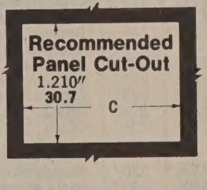

Recommended
Panel Cut-Out
1.210″
30.7
C

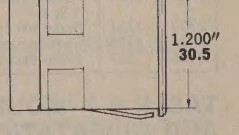


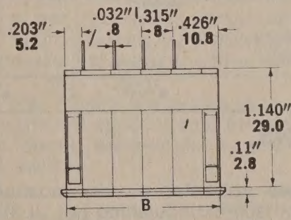

.243″
6.2
.032″
.8
.394″
10
.545″
13.8
1.140″
29.0
.11″
2.8
B

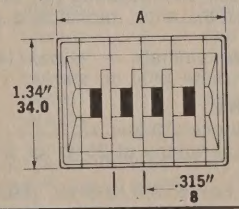

A
1.34″
34.0
.394″
10

SERIES 3100


Recommended
Panel Cut-Out
1.210″
30.7
C




.203″
5.2
.032″
.8
.315″
8
.426″
10.8
1.140″
29.0
.11″
2.8
B


A
1.34″
34.0
.315″
8

2700 SERIES DIMENSIONS

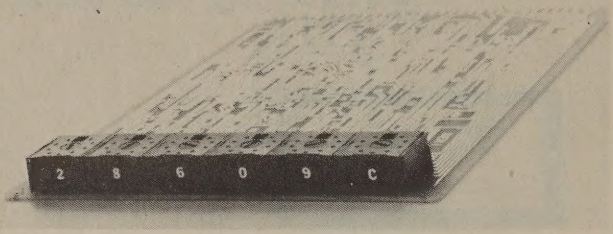
Number of Switches	A Nx.290″ +.75″ Nx7.4mm +19.0mm	B Nx.290″ +.575″ Nx7.4mm +14.6mm	C Nx.290″ +.306″ Nx7.4mm +7.8mm	D Nx.290″ +.322″ Nx7.4mm +8.2mm
1	1.040 26.4	.865 22.0	.596 15.2	.612 15.6
2	1.330 33.8	1.155 29.4	.886 22.6	.902 22.9
3	1.620 41.2	1.445 36.8	1.176 30.0	1.192 30.3
4	1.910 48.5	1.735 44.2	1.466 37.4	1.482 37.6

4000 SERIES DIMENSIONS / 3100 SERIES DIMEN.

	4000 SERIES DIMENSIONS			3100 SERIES DIMEN.		
Number of Switches	A Nx.394″ +.520″ Nx10mm +13.2mm	B Nx.394″ +.394″ Nx10mm +10mm	C Nx.394″ +.403″ Nx10mm +10.2mm	A Nx.315″ +.440″ Nx8mm +11.2mm	B Nx.315″ +.315″ Nx8mm +8mm	C Nx.315″ +.324″ Nx8mm +8.2mm
1	.914 23.2	.787 20.0	.797 20.2	.755 19.2	.630 16.0	.639 16.2
2	1.308 33.2	1.181 30.0	1.191 30.2	1.070 27.2	.945 24.0	.954 24.2
3	1.702 43.2	1.575 40.0	1.585 40.2	1.385 35.2	1.260 32.0	1.269 32.2
4	2.096 53.2	1.969 50.0	1.979 50.2	1.700 43.2	1.575 40.0	1.584 40.2

Strip-Pak™ Switches

MODULAR ROTARY PCB SWITCH



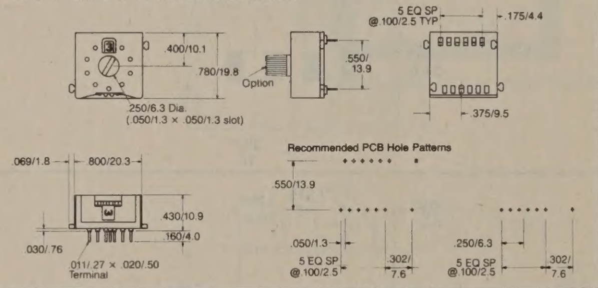
Strip-Pak is a low profile, binary-coded rotary switch designed for PCB mounting. It's a modular switch that snaps together to form a multiple-station assembly. Strip-Pak is an economical alternative to conventional thumbwheels. It eliminates hard wiring and cables and significantly reduces installation costs.

Strip-Pak is exceptionally versatile. It can be installed at the edge of a PC board for vertical or horizontal mounting on a front panel. Or you can install it anywhere on a board for behind-the-panel programming. Strip-Pak's unique snap-together design allows for mixed output codes within the same group of switches. Right from stock. So there's no delay when ordering custom assemblies.

Strip-Pak switches can be activated in any of three ways. By thumb pressure. Screwdriver. Or by optional color-coded snap-in knobs that can be installed even after the switch is mounted.

Strip-Pak is also available in 10 and 16 detent positions with a wide spectrum of output codes.

OUTLINE DIMENSIONS



SPECIFICATIONS

Materials:

Housing: Glass-filled polyester — low moisture absorption, solvent resistant and self-extinguishing per UL 94V-0.

Contact/Terminal: Copper alloy, nickel and gold plated (30μ in. min.).

PC Board: Epoxy glass laminate — ½ oz. (14 grams) copper, nickel plate and gold plate (30μ in. min.).

Physical Characteristics:

No. of Switching Positions: 10 and 16.

Life: 500,000 detent operations at 25°C for a resistive load of 0.010 amp at 28 VDC.

Tangential Operating Force: 3.5 to 9 oz. (99.2 to 255 grams).

Temperature Range: −20°C to +75°C operating
−40°C to +100°C storage

Standard Color: Black (color coded knob optional).

Weight: 0.15 oz. (4.25 grams)/station.

Electrical Characteristics:

Max. Recommended Non-switching Load: 3 amp at 115 VDC or 28 VDC.

Max. Recommended Switching Load: 0.125 amp at 115 VAC or 28 VDC.

Min. Recommended Switching Load: 0.000010 amp at 0.020 VDC.

Dielectric Withstanding Voltage: 500 V RMS.

Insulation Resistance: 1000 megohms, min. (dry).

Switch Circuit Resistance: 0.100 ohm, max., initial. 0.200 ohm, max., after life test.

SERIES 2200

- Modular design.
- Long life (500,000 detent operations).
- Wide range of available codes.
- Wave solderable.
- Positive detent.
- Low profile (0.430/11mm high).
- Integral mechanical stabilizer pin.
- Lobed thumbwheel.
- Colored snap-in extender knobs (optional).

HOW TO ORDER

3 x 2 2 2 2 - 0 0 0 0 - 1 (03)

No. of Stations
Series Number
Output Code (See Table I)
Mounting Attitude (See Table II)
Identification
0 — Standard — Drum Marking
1 — Custom — Drum Marking
2 — Standard — Decal
3 — Custom — Decal
4 — Standard — Both Drum Marking and Decal

Knob Length
0 — No knob
1 — .30/7.6
2 — .50/12.7
3 — .75/19.0

Knob Color
0 — Black
1 — Beige
2 — Red
4 — Yellow
5 — Green
6 — Blue
9 — White

Location of Stop Pins
-0 — Decimal point on housing
-1 — Stops
-2 — Decimal point and stops

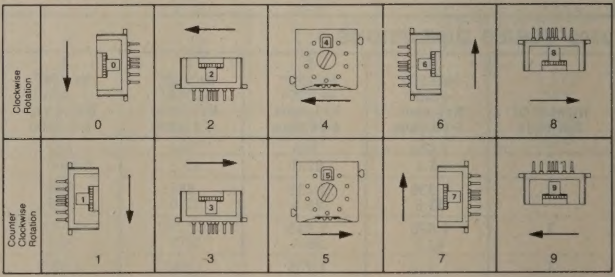
Notes:

1. Be sure the mounting attitude is consistent with rotation specified by output code.
2. Whenever stop pins are called out on multiple station assemblies, clarification has to be made in the description as to which station gets stops.

TABLE I — OUTPUT CODES

Part Number CW	Part Number CCW	Description	
		10 Position Wheels	**Consult Factory for Truth Tables**
2222	2223	BCD 1, 2, 4, 8, Standard Single Pole	
2230	2230	DPDT Repeating X5 marked +, −, +	
2231	2231	DPDT Repeating X5 marked 0, 1, 0	
2232	2232	DPDT Repeating X5 marked 0, 5, 0	
2250	—	Decimal, Single pole, break-before-make	
—	2251	Decimal, Single pole, break-before-make	
2270	2271	Complement only BCD $\overline{1}$, $\overline{2}$, $\overline{4}$, $\overline{8}$	
2278	2279	9's complement of BCD	
2282	2283	Complement of 9's complement	
2290	2291	BCD 1, 2, 4, 8, with separate common to not-true bits	
2295	2296	BCD 1, 2, 4, 8, plus complement, one common	
		16 Position Wheels	
2306	2307	Hexadecimal 1, 2, 4, 8, Marked 0-9, A-F	
2308	2309	Same except wheel marked 0-15	
2320	2321	Complement to Hexadecimal $\overline{1}$, $\overline{2}$, $\overline{4}$, $\overline{8}$, marked 0-9, A-F	
2322	2323	Same except wheel marked 0-15	
2328	2329	Hexadecimal with separate commons to not-true bits marked 0-9, A-F	
2330	2331	Same except 0-15	
2334	2335	Hexadecimal + complement with one common marked 0-9, A-F	
2336	2337	Same except 0-15	

TABLE II — MOUNTING ATTITUDE AND ORIENTATION



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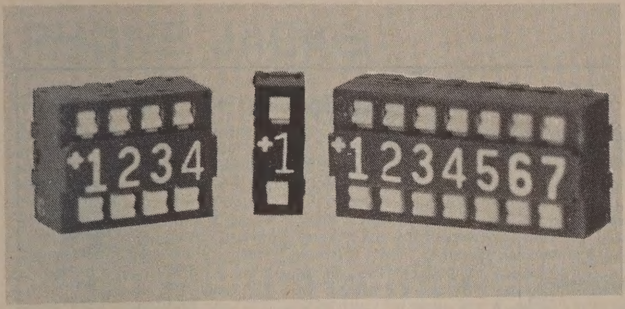
340 MARTIN AVENUE
SANTA CLARA, CALIFORNIA 95050
(408) 243-9200 / TWX 910-338-0132

Stanford Applied Engineering

BIT™ Switch

DIP SWITCH
SERIES 1000



A miniature, behind-the-panel, PCB Mounted BCD or Hexadecimal to 10-position decimal input device. Performs the same functions as slide switches, thumbwheels, toggle switches, etc.

Applications include switching circuits or BCD coding in computer peripherals, communications equipment, instrumentation/test equipment, traffic signal controllers, matrix mounting, etc. SAE's miniature Series 1000 BIT Switch offers the design and packaging engineer many unique advantages over similar type devices available today.

First, the switch's new, improved mechanical design assures greater component reliability. A wider, sturdier lever wheel provides for constant and positive wiping action, whether under shock or vibration, for more dependable electrical performance. The lever wheel design also features a large recess across the top of each end, to make programming even simpler. And, the greater housing surface area allows for larger characters and numerals — a very legible .120″ high, which can be hot-stamped for either horizontal or vertical mounting.

To utilize minimum space behind the panel, BIT Switch features a reduced profile that measures only .280″ high. Switch housings and lever wheels are molded in a solvent-resistant type thermoplastic. Additionally, any custom marking can be provided; and for those applications where required, accommodations for a dust cover have been provided on the switch housing. The table shown at right lists the various Series 1000 switches available.

SPECIFICATIONS

Material:

Housing: Blue, Type 6/6 30% glass-filled nylon.

Base: Blue, Type 6/6 30% glass-filled nylon.

Lever Wheels: White, polyester thermoplastic.

Contact Slugs: Phosphor bronze with 0.00003″ hard gold over 0.00005″ nickel.

Contact Terminals: Beryllium copper with 0.00003″ hard gold over 0.00005″ gold.

Mechanical: 2000 switching operations for each SPST station.

Electrical:

Current Rating Non-Switching: 50 VDC at 100 mA.

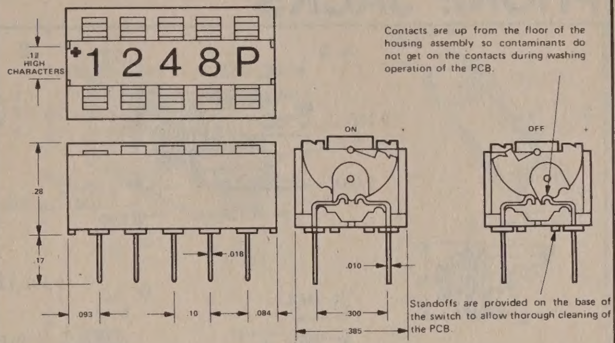
Current Rating Switching: 5 VDC at 100 mA or 24 VDC at 25 mA.

Contact Resistance: 100 milliohms, maximum.

Insulation Resistance: 100,000 megohms.

Dielectric Breakdown Voltage: 500 VDC, minimum.

Circuit Capacitance: 5 pF, maximum.



Contacts are up from the floor of the housing assembly so contaminants do not get on the contacts during washing operation of the PCB.

Standoffs are provided on the base of the switch to allow thorough cleaning of the PCB.

Note: Available for custom marking are the numerals 0 through 10 for either horizontal or vertical mounting, and the letters A, B, C, D, E, F and P for horizontal only.

ORDERING INFORMATION

Part No.	Length ±.005″	No. of Stations	Colors Available	Identification (Horizontal Mounting)
1001-093	.180	1x SPST	Black Housing w/White Lever Wheel	1
1002-692	.280	2x SPST	Blue Housing w/White Lever Wheel	1-2
1003-692	.380	3x SPST	Blue Housing w/White Lever Wheel	1-3
1004-692	.480	4x SPST	Blue Housing w/White Lever Wheel	1-4
1005-692	.580	5x SPST	Blue Housing w/White Lever Wheel	1-5
1006-692	.680	6x SPST	Blue Housing w/White Lever Wheel	1-6
1007-692	.780	7x SPST	Blue Housing w/White Lever Wheel	1-7
1008-692	.880	8x SPST	Blue Housing w/White Lever Wheel	1-8
1009-692	.980	9x SPT	Blue Housing w/White Lever Wheel	1-9
1010-692	1.080	10x SPST	Blue Housing w/White Lever Wheel	0-9

Covers for BIT SWITCHES are available to act as a dust cover for hostile environment applications; prevent unintentional programming; use during wave-solder to prevent flux from contaminating the switch.

Part No. Cover	Position	Part No. Cover	Position
6802	1002-692	6807	1007-692
6803	1003-692	6808	1008-692
6804	1004-692	6809	1009-692
6805	1005-692	6810	1010-692
6806	1006-692		

Cover increases package dimension as follows:

Height: .280″ to .320″ (adds .040″).

Width: .385″ to .435″ (adds .050″).

Length (for 1008): .880″ to .975″ (adds .095″).

™Stanford Applied Engineering, Inc.

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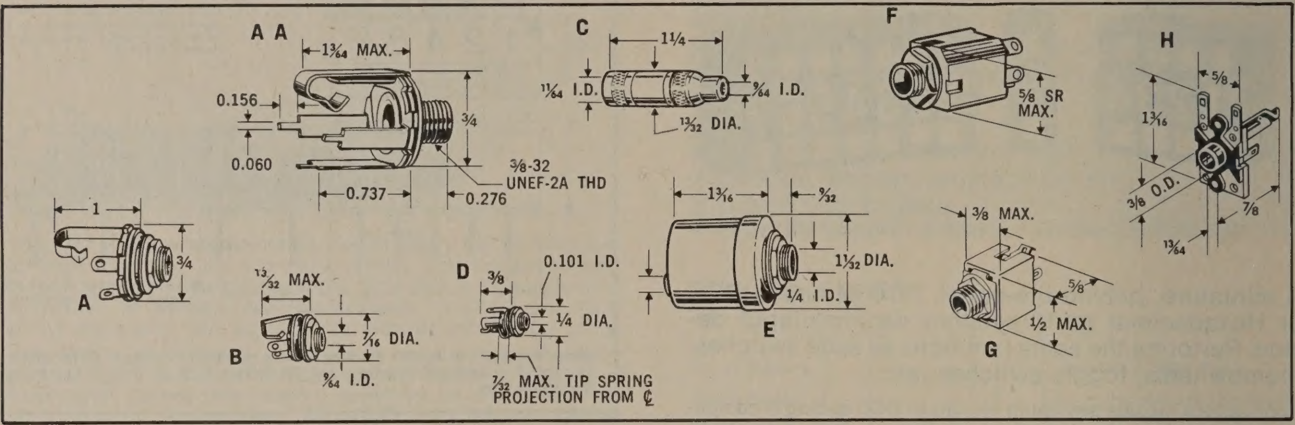
340 MARTIN AVENUE
SANTA CLARA, CALIFORNIA 95050
(408) 243-9200 / TWX 910-338-0132

Stanford Applied Engineering

SWITCHCRAFT® INC.

5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

PHONE JACKS



A. LITTEL-JAX® PHONE JACKS

Quality phone jacks that mate with standard ¼" phone plugs. Notched insulating washers, mechanically interlock springs and solder lugs. "V" bend in tip spring firmly "holds" mating plug. Minimum space requirements. Economical. Mounts in single ⅜" hole, panel up to 3/32" thick, except L-11 and L-12A in panels up to ¼" thick.

Nos. C-11 and C-12A mate with No. 440 (PJ-055B) Plug; C-12B, S-12B and S-13B mate with No. 480 (JAN-PJ-068) or No. 484 (W.E. No. 309) Plug. Nos. C-11 and C-12B have locating pins (non-turn devices). No. S-11 similar to No. 11 except .210" I.D. sleeve. C-11, C-12B and C-12A per MIL-J-641. All others mate with standard ¼" dia. plugs.

AA.

New Littel-Jax PC-12A for printed circuit mounting. Std. ¼" dia. jack with all the construction features of standard Littel-Jax. Same circuit as in No. 12A.

No. 14B stereo Littel-Jax, switches-out speakers when connecting stereo headphones. Dual, N.O. switch contacts, open both stereo circuits independently when a 3-conductor plug is inserted.

TWO CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	Mil-Type	U.S.A. List Price
11	I	250	—	$0.75
C-11	I	440	JJ-034	1.10
L-11	I	250	—	.85
S-11	I	S-250	—	.80
12A	III	250	—	.80
C-12A	III	440	JJ-089	1.25
L-12A	III	250	—	.95
S-12A	III	480	—	.90
PC-12A	III	250	—	.90
13	V	250	—	1.50
13A	VI	250	—	1.35
13E	IX	250	—	1.50

THREE CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	Mil-Type	U.S.A. List Price
12B	IV	267	—	.90
C-12B	IV	480	JJ-033	1.25
L-12B	IV	267	—	1.20
S-12B	IV	480	—	1.20
13B	VII	267	—	1.30
S-13B	VII	480	—	1.70
14B	XII	267	—	1.75

® Registered trademark of Switchcraft, Inc.

B. TINI-JAX® MINIATURE PHONE JACKS

Miniature 2-Conductor Phone Jacks, approximately ⅓ the size of the Littel-Jax; otherwise similar in construction. Mount in ¼" dia. hole; panel up to ⅛" thick. No. 43A has a unique spring design that requires a pear shaped tip, such as Switchcraft Tini-Plug® No. 750.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
41	I	750	2	$0.70
42A	III	750	2	.75
43A	VI	750	2	1.15

C. "TINI-EXTENSION JAX"

An extension or cable jack to mate with Tini-Plug, Two-conductor. Metal housing for ruggedness and electrical shielding. Solder lug terminals.

Switchcraft Part No. 125 .... U.S.A. List Price **$2.20**

D. MICRO-JAX® SUB MINIATURE PHONE JACK

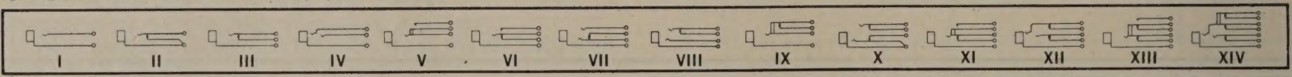
Precision manufactured jack for miniaturized applications. Two-conductor, single closed circuit. See Schematic Circuit III. Silver plating on special tempered nickel silver sprngs. Internally keyed nylon insulation interlocks springs and solder lugs to eliminate shorts. Fits .190" dia. hole in panels to 3/32" thick. Only 1/25th the size of standard phone jacks. Mates with Micro-Plug®, Series 850, 880.

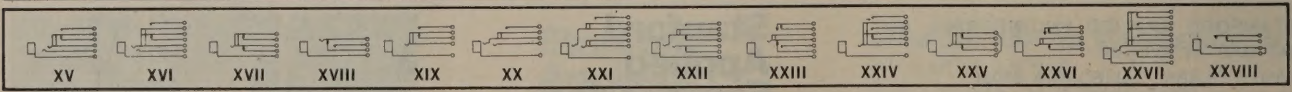
Switchcraft Part No. TR-2A .... U.S.A. List Price **$0.90**

E. "SHIELDED JAX"

A unique modification of the Littel-Jax. The shield is assembled into and made part of the jack. Ideal for high impedance circuits.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
CN-11	I	250	2	$1.55
CN-12A	III	250	2	1.60
CN-12B	IV	267	3	1.85





THE ABOVE ARE STRICTLY ELECTRICAL SCHEMATICS AND DO NOT NECESSARILY INDICATE RELATIVE SOLDER LUG POSITIONS.

PHONE JACKS

F. HI-D JAX® PHONE JACKS

New smaller, more compact phone jacks, mate with std. ¼″ phone plugs. Molded box body protects integral silver-plated, nickel silver springs. Low contact resistance and electrical leakage with little capacity between the springs. Mount on ⅝″ centers in single ⅜″ hole in panels up to 5/32″ thick, depth behind panel 1 13/32″. All part Nos. with "L" prefix mount in panels up to ¼″ thick; part Nos. with "N" prefix feature a threaded nylon bushing to provide complete insulation of jack sleeve from mtg. panel. Part Nos. with "NL" prefix feature a ⅜″ long threaded nylon bushing (same as "N" series) and mount in panels up to ¼″ thick. All part Nos. with "M" prefix are designed and adjusted to mate with telephone and MIL-std. plugs. Tip and ring (3-cond.) springs are gold plated, and shunt and isolate switching circuits (where used) have welded cross bar palladium contacts for stable, low resistance inter-connections in sensitive and critical circuits. Prefix "MN" is same as "M" above except bushing is molded nylon. Stereo HI-D Jax Nos. 114B and L-114B switches out speakers when connecting stereo headphones. Dual N.C. switch contacts opens both stereo circuits independently when a 3-cond. plug is inserted. New HI-D Jax with P.C. terms. mount to single- and double-sided, and multilayer boards up to 3/32″ thick. Standoff shoulders on terms. provide stable mtg. Perfectly compatible with wave, dip or hand soldering. Lock nut and washer supplied for additional mtg. to chassis/panel.

TWO CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	U.S.A. List Price
111	I	250	$0.70
111PC	I	250	.70
L-111	I	250	.90
N-111	I	250	.90
NL-111	I	250	.95
112A	III	250	.75
112APC	III	250	.80
L-112A	III	250	.95
N-112A	III	250	.95
NL-112A	III	250	1.00
113	V	250	1.30
113D	VI	250	1.30
113DPC	VI	250	1.40
113E	IX	250	1.30

THREE CONDUCTOR TYPES

Part No.	Schematic No.	Typical Mating Plug	U.S.A. List Price
112B	IV	267	.80
112BPC	IV	267	.85
L-112B	IV	267	1.00
M-112B	IV	482	1.25
MN-112B	IV	482	1.45
N-112B	IV	267	1.00
113B	VII	267	1.05
113BPC	VII	267	1.15
N-113B	VII	267	1.15
NL-113B	VII	267	1.20
113F	XXVIII	267	1.05
113FPC	XXVIII	267	1.40
114B	XII	267	1.15
L-114B	XII	267	1.30
M-114B	XII	482	1.65
MN-114B	XII	482	1.80
N-114B	XII	267	1.30
NL-114B	XII	267	1.35

G. "TINI-D JAX" MINIATURE PHONE JACK

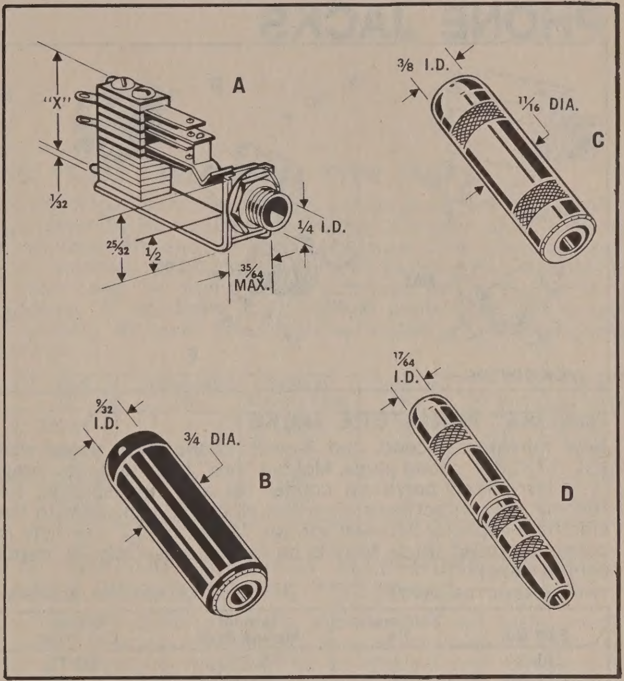
New, small completely enclosed, molded phone jack. Mate with Switchcraft Tini-Plug, No. 750 etc. Phenolic housing protects the bifurcated beryllium copper springs from being bent during mounting. No. 142A has threaded bushing for conventional mtg. Tip spring terminals that "snap-in" P.C. boards. Mount on ⅜″ centers, in ¼″ dia. hole in panels up to ⅛″ thick. Depth behind panel 7/16″.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
142A	III	750	2	$0.80

H. "R-JAX" ECONOMY PHONE JACKS

Radically new jack design. Simple mounting needs only two (2) 3/32″ dia. rivets to fasten securely to mounting panel. Accept standard ¼″ dia. phone plugs.

Part No.	Schematic No.	Typical Mating Plug	Conductors	U.S.A. List Price
2A	II	250	2	$0.70
2B	IV	267	3	.75
4B	XII	267	3	1.10



A. "LF-JAX" LONG FRAME JACKS

Quality long frame phone jacks with a ground lug that is an integral part of the frame. Welded fine silver cross bar contacts are rated at 8 amps, 125 VAC. Frame also available with a non-turn device, prefix Part No. with letter "R". Standard types mount in single ⅜″ dia. hole in panels up to 5/16″ thick. Depth behind panel, only 2 25/32″.

Part No.	Schematic No.	Typical Mating Plug	Cond.	"X" Dim.	U.S.A. List Price
31	I	250	2	17/32″	$1.30
32	II	250	2	⅝″	1.75
32A	III	250	2	⅝″	1.75
32B	IV	267	3	13/16″	1.75
33A	VI	250	2	⅝″	1.90
33B	VII	267	3	27/32″	1.90
34B	XII	267	3	⅞″	2.10
35	XIII	250	2	1 3/16″	2.55
36	XIV	267	3	1⅛″	2.85

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"EXTENSION JAX" CABLE EXTENSION JACKS

Standard ¼″, 2- and 3-conductor extension phone jacks with solder lugs or screw tpe terminals. Size 11/16″ O.D., 2 5/32 long; 121 and 131 ½″ O.D., 2½″ long. Black handles are durable plastic. Shielded handles are brass, bright nickel plated.

Part No.	Fig.	Cond.	Typical Mating Plug	Term.	Handle	U.S.A. List Price
80	B	2	250	Screw	Black	$2.00
88	B	2	250	Solder	Black	1.80
120	C	2	270	Screw	Shielded	2.65
121	D	2	270	Solder	Shielded	2.75
126	C	2	R-280	Solder	Shielded	2.90
128	C	2	270	Solder	Shielded	2.40
S-128	C	2	S-250	Solder	Shielded	2.60
131	D	3	290	Solder	Shielded	3.50
830	B	3	267	Screw	Black	2.65
S-830	B	3	480	Screw	Black	3.50
838	B	3	267	Solder	Black	2.40
1230	C	3	290	Screw	Shielded	3.40
S-1230	C	3	480	Screw	Shielded	4.20
1238	C	3	290	Solder	Shielded	3.15

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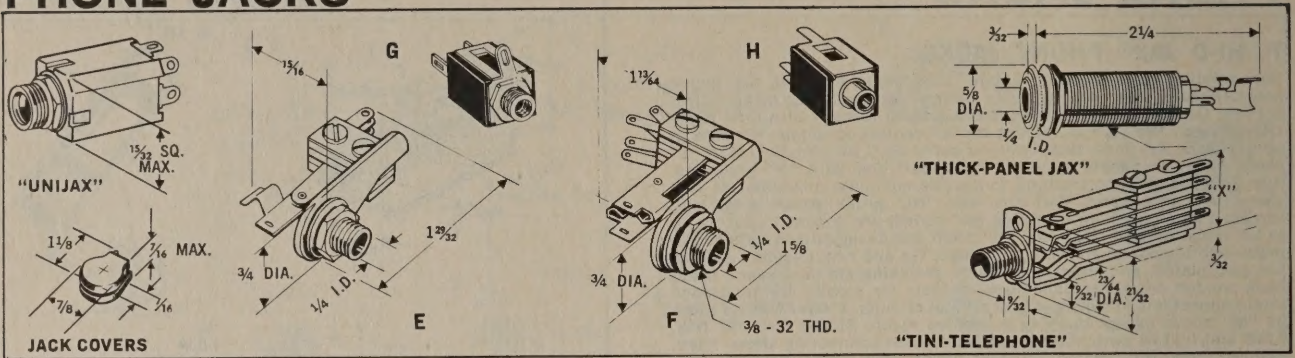
PHONE JACKS



"UNIJAX" MINIATURE JACKS

New, miniature 2-cond. and 3-cond. phone jacks, mate with std. .173″ dia. phone plugs. Molded "box" body protects integral silver-plated beryllium copper tip and ring springs. Extremely low contact resistance and electrical leakage with low electrical capacity between springs. Mounts in 9/32″ dia. hole in panels up to 1/8″ thick. Mounts on 15/32″ centers. Only 7/8″ depth behind panel.

TWO CONDUCTOR TYPES **U.S. PAT. NO. 3,383,481**

Part No.	Schematic No.	Typical Mating Plug	U.S.A. List Price
UJ-1	I	TT-251	$0.75
UJ-2A	III	TT-251	.80

THREE CONDUCTOR TYPES

UJ-2B	IV	TT-253	$0.90
UJ-4B	XII	TT-253	1.25

JACK COVERS

Handy, rugged, springload phone jack covers. Covers jack opening when phone plug is removed. Protects against dust and moisture. Series 500 — Use with standard 3/8-32 threaded bushing type phone jacks. Series 600 — Use with certain type tipjacks with 1/4″ mounting height of tip jack head 1/8″ to 3/16″. Also used on covers for Tini-Jax jacks. Contact Switchcraft for Series 600 Jack Covers.

Part No.	Color	U.S.A. List Price	Part No.	Color	U.S.A. List Price
510	Olive Drab	$1.35	515	Black	$2.00
512	Bright Nickel	1.35	520	Navy Gray	2.00

"MICRO-D JAX" SUBMINIATURE ENCLOSED PHONE JACK

"Super-Small", 2-cond., shunted, fully enclosed jack is only 5/16″ x 11/32″ x 11/16″. One-piece molded body locks all internal parts in place. Mates with Switchcraft Micro-Plug phone plugs.

G.

No. MDSL-2A has solder lugs and #10-48 threaded bushing with mtg. washer and lock nut (supplied). Mounts thru 13/64″ dia. hole in panels up to 1/16″ thk., singly or in rows on .350″ (min.) centers.

H.

No. MDPC-2A has P.C. terms. with standoff shoulders. Mounts singly or in rows or arrays on .315″ (min.) centers or .350″ (min.) centers. Adjacent sleeves touch each other when mtd. on .315″ centers.

Part No.	Schematic No.	Typical Mating Plug	Conductor	U.S.A. List Price
MDPC-2A MDSL-2A	III	850	2	$.80 .80

E. "SF-JAX" SHORT FRAME JACKS

Series 20 — High quality commercial jacks, solder lugs parallel to mounting surface. Mount in 3/8″ dia. holes, panels up to 3/16″ thick.

F.

Series 50 — Similar to Series 20, except solder lug location necessitates more depth but requires less panel space. Mount in panels up to 1/4″ thick. Switching contacts, where applicable, are welded fine silver cross bar, rated at 8 amps, 125 VAC.

Part No. C-55B is MIL-type with military insulation and finishes, otherwise similar to commercial Series 50. Mounts in panels up to 1/4″ thick.

SERIES 20

Part No.	Schematic No.	Typical Mating Plug	Mil-Type	U.S.A. List Price
22A	III	250	—	$1.60
23	V	250	—	1.90
23B	VII	267	—	1.90
24B	XII	267	—	2.10
25	XIII	250	—	2.55

SERIES 50 AND C-50

51	I	250	—	$1.30
52B	IV	267	—	1.60
C-52B	IV	482	JJ-103	2.55
53B	VII	267	—	1.90
54A	XI	250	—	2.10
54B	XII	267	—	2.10
55	XIII	250	—	2.55
C-55B	XV	482	JJ-095	3.50
56	XIV	267	—	2.65

"TINI-TELEPHONE" MINIATURE JACKS

Series TT-600, high-quality, miniature phone jacks in 2-cond. and 3-cond. types. Mate with std. .173″ dia. phone plugs. Gusseted steel frame for extra rigidity and stability. Special nickel-silver springs provide long life. Welded crossbar palladium contacts. Solder-lug terminals std., wire-wrap term. available on special order. Mounts in 1/4″ hole, on 7/16″ centers, in panels up to 9/32″ thick. Only 2 3/16″ depth behind panel.

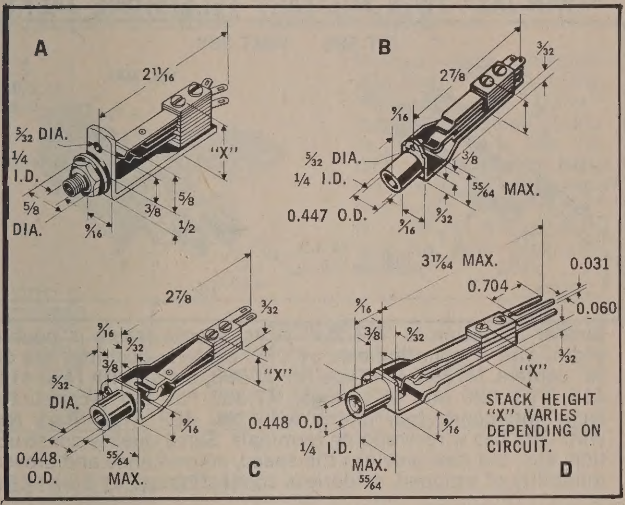
Part No.	Schematic No.	Typical Mating Plug	Conductors	"X" Dim.	U.S.A. List Price
TT-631	I	TT-251	2	27/64″	$1.40
TT-632A	II	TT-251	2	13/32″	1.80
TT-632B	IV	TT-253	3	15/32″	1.70
TT-634B	XII	TT-253	3	1/2″	2.05

"THICK-PANEL JAX" THICK PANEL JACKS

Phone jacks with long bushing. Mount in single 15/32″ dia. hole in panels up to 1 1/4″ thick. Solder lug terminals. Ideal for use with microphones; extra shielding virtually eliminates audio hum. No. 151, 2-conductor mates with 240, 245, 250, 255, 270 and 280 Plugs. No. 152B, 3-conductor mates with 260, 267, 269 and 297 Plugs.

Part No.	Description	U.S.A. List Price
151	2-cond. Brass Nickel Plated	$2.55
152B	3-cond. Brass Nickel Plated	2.75

PHONE JACKS



A. "M-JAX" MILITARY TELEPHONE JACKS

Very heavy long frame jacks often referred to as the Navy Jack. Ideal for industrial and Military equipment. Long heavy duty springs with fine silver contacts. Mounts on single ⅜" hole, in panels up to ¼" thick.

Part No.	Schematic No.	Adjusted for Plug	Mil-Type No.	"X" Dim.	U.S.A. List Price
M-443B	VII	482	JJ-106	⅞"	$3.30
M-444B	XII	482	JJ-082	15/16"	3.50
M-445	XIII	440	JJ-104	1¼"	4.25
M-446A	XVI	482	JJ-081	1¼"	5.95

B. "MT-JAX" MILITARY TELEPHONE JACKS

Long frame, telephone switchboard jacks designed for high quality communication and military equipment. Springs are of a special nickel silver alloy with welded cross bar palladium contacts. "MT-Jax" jacks are available in two frame designs, i.e., "A" & "C". Part numbers in chart cover "A" frame design as shown in Fig. C. For frame design "C" as shown in Fig. B, add prefix letter "C" to part numbers.

Part No.	Schematic No.	Adjusted for Plug	Mil-Type No.	"X" Dim.	U.S.A. List Price
MT-331	I	440*	JJ-086	7/16"	$1.85
MT-332A	III	440	JJ-024	½"	2.20
MT-332B	IV	482†	JJ-022	9/16"	2.20
MT-332C	XVIII	440	JJ-016	9/16"	2.55
MT-333	V	440	JJ-084	15/32"	2.45
MT-333B	VII	482	—	9/16"	2.55
MT-334A	XI	440	—	9/16"	2.60
MT-334B	XII	482	JJ-042	9/16"	2.60
MT-334C	XVII	440	JJ-072	⅝"	2.60
MT-334E	XXV	440	JJ-085	9/16"	2.60
MT-334F	XIX	440	JJ-035	9/16"	2.60
MT-335A	XXVI	440	JJ-017	9/16"	2.95
MT-336A	XIV	482	JJ-075	11/16"	3.75
MT-336B	XXI	482	JJ-077	13/16"	3.75
MT-336C	XXII	482	JJ-073	11/16"	3.75
CMT-336E	XXIII	440	JJ-019	¾"	3.75
MT-342B§	IV	480‡	—	9/16"	2.55
MT-344B§	XII	480	—	⅝"	2.95

* MIL Type PJ-055.
† MIL Type PJ-051B.
‡ MIL Type PJ-068.
§ Bushing .2085".

C. "T-JAX" TELEPHONE TYPE JACKS

Long frame, switchboard type, phone jacks. For high quality communication equipment. Springs of nickel silver alloy for maximum life and corrosion resistance. Fine silver contacts are standard. Available in two frame designs. Part numbers in chart cover "A" frame design as shown in Fig. C. For frame design "C" as shown in Fig. B, add prefix letter "C" to part numbers. All jacks listed mate with standard ¼" dia. phone plugs.

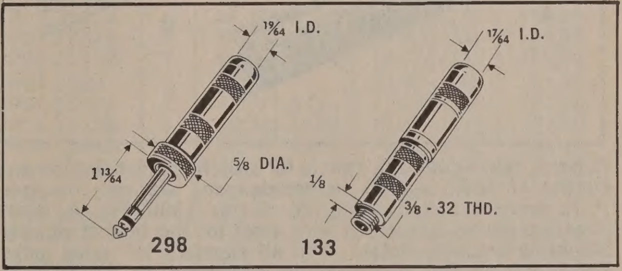
Part No.	Schematic No.	Typical Mating Plug	Conductors	"X" Dim.	U.S.A. List Price
T-331	I	440	2	7/16"	$1.60
T-332A	III	440	2	½"	1.80
T-332B	IV	482	3	9/16"	1.80
T-334B	XII	482	3	13/16"	2.25

D. "WMT-JAX" MILITARY TELEPHONE JACKS WITH WIRE-WRAPPING TERMINALS

Long-frame telephone jacks, same as "MT-Jax" jacks, except with wire-wrapping terminals designed to meet all electrical and mechanical requirements for efficient and reliable wire-wrapping terminals. Wire-wrapping terminals have special shoulder which provides a "stop" for the wire-wrapping tool. Construction materials, contacts and mounting styles identical to those of "MT-Jax" jacks.

Part No.	Schematic No.	Adjusted for Plug	Conductors	"X" Dim.	U.S.A. List Price
WMT-332A	III	440	2	½"	$2.40
WMT-332B	IV	482†	3	9/16"	2.40
WMT-334B	XII	482	3	37/64"	2.90
WMT-336A	XIV	482	3	¾"	4.00

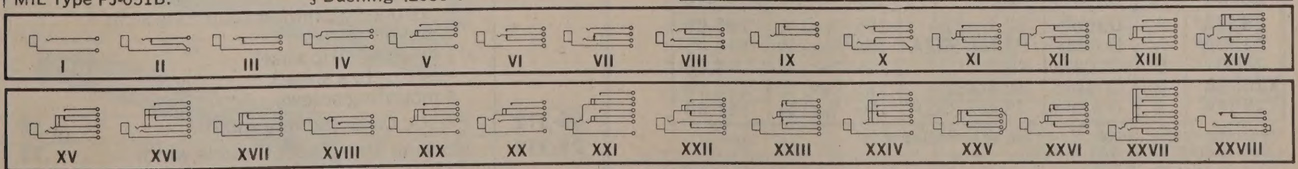
† MIL Type PJ-051B.



"LOCK-PLUG" PLUGS AND "LOCK-EXTENSION JAX" CABLE EXTENSION JACKS

Standard size ¼", 3-cond. phone plug and mating cable extension jacks, with built-in locking device. Ideal for all P.A., audio applications. Plug has coupling ring that can be threaded to bushing of Littel-Jax jack or mating end of a "Lock-Extension Jax" jack. "Lock-Plug" handle: 1 51/64" lg.; ½" dia. "Lock-Extension Jax" jack; ½" O.D., 2½" lg. Solder lug terminals. Available in 2-cond. types on special order.

Part No.	Description	U.S.A. List Price
298	3-cond. "Lock-Plug" plug	$3.05
133	3-cond. "Lock-Extension Jax" jack	3.80



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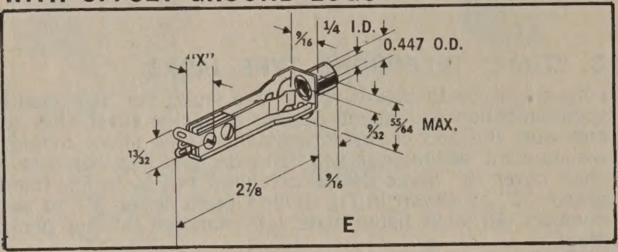
PHONE JACKS

E. "MT-JAX" MILITARY TELEPHONE JACKS WITH OFFSET GROUND LUGS



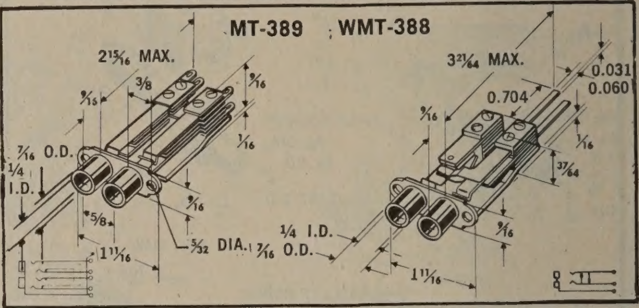
E

"MT-Jax" jacks with offset ground lugs are similar to "MT-Jax" jacks except ground lugs are offset. Reduces cost and simplifies ground lug terminal wiring. With ground lugs offset in the away position with respect to jack side frame member, a single ground buss wire runs through entire row of lugs. For two rows on 5⁄8″ vertical centers with lugs facing each other, ground buss wire connects all lugs in both rows.

Part No.	Schematic No.	Adjusted for Plug	Mil-Type No.	"X" Dim.	U.S.A. List Price
XMT-332A	III	440	JJ-024	1⁄2″	$2.30
XMT-332B	IV	482†	JJ-022	9⁄16″	2.30
XMT-334B	XII	482	JJ-042	9⁄16″	2.70

† MIL Type PJ-051B.

"TWIN-JAX" TWIN MILITARY TELEPHONE JACKS

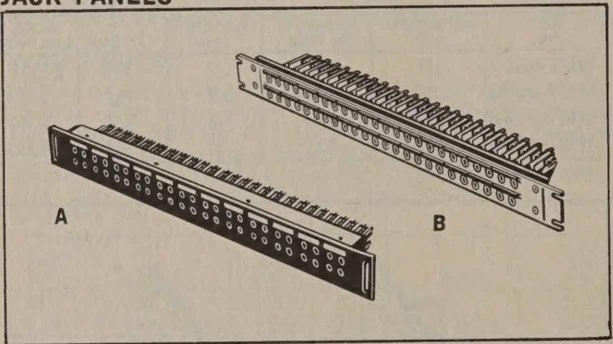


Similar in design to "MT-Jax" jacks, except frame is double width, with 2 mounting ears on 13⁄8″ centers; bushings are on 5⁄8″ centers. MT388, Mil-Type No. JJ-088, mates with Nos. 411, 412, 413, 420 and 423 plugs. MT-389 has two 3-conductor jacks interconnected, mates with No. 482 Plug. Part No. WMT-389 has wire-wrapping terminals. Same quality construction, etc.; but now provides the speed, convenience and proven reliability of wrapped, solderless connections.

Switchcraft Part No. MT-388 .... U.S.A. List Price **$6.60**
Switchcraft Part No. MT-389 .... U.S.A. List Price **7.65**
Switchcraft Part No. WMT-389 .... U.S.A. List Price **7.65**

JACK PANELS

JACK PANELS

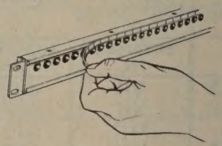


Rugged, heavy-duty jack panels for switching, distribution and control of audio signals in broadcasting stations, theatres, P. A. systems installations, etc. Series 1200, Fig. A, black phenolic panels reinforced with steel for the utmost rigidity. Mounting brackets slotted to fit all standard 19″ relay racks. Panel includes plastic covered designation strips. Series 2800, Fig. B, clear anodized aluminum panel. Extremely rugged, yet lightweight. Includes new narrow designation strip for each row. Add Prefix "X" to part numbers to indicate offset ground lugs on jacks. Aluminum panels available only with offset lugs.

Part No.	Fig.	Rows	Number of Jacks	Size, In. W x D x H	U.S.A. List Price
1200	A	Single	24 *	19x11⁄4x13⁄4	$17.65
1232A	A	Single	24 T-332A	19x11⁄4x13⁄4	53.55
1332A	A	Single	24 MT-332A	19x11⁄4x13⁄4	59.85
1400	A	Single	26 *	19x 5⁄8x13⁄4	17.65
2400	A	Double	48 *	19x11⁄4x21⁄8	18.25
2432A	A	Double	48 T-332A	19x11⁄4x21⁄8	93.45
2532A	A	Double	48 MT-332A	19x11⁄4x21⁄8	110.25
2600	A	Double	52*	19x 5⁄8x13⁄4	23.10
2632A*	A	Double	52 T-332A	19x 5⁄8x13⁄4	105.00
2732A*	A	Double	52 MT-332A	19x 5⁄8x13⁄4	114.45
2800	B	Double	48 *	19x 5⁄8x13⁄4	48.60
X2832A	B	Double	48 T-332A	19x 5⁄8x13⁄4	133.10
X2932A	B	Double	48 MT-332A	19x 5⁄8x13⁄4	151.80

* Recommended plugs for these assemblies are: Switchcraft Nos. 420 & 425.

U.S. Patent No. 3,597,867. Canadian Patent No. 927, 597. (April 1, 1971)



JACK PANELS WITH "KWIK-CHANGE" DESIGNATION STRIP

Switchcraft jack panels now feature the exclusive "Kwik-change" designation strip in Series 1400-300 and Series 2600-300. Identical to Series 1400 and Series 2600 as described above, except for new designation strip. "Kwik-change" strip consists of a clear plastic snap-on cover and a re-usable plastic marking strip. Marking strip has matte-finish for in-the-field identification with ink, pencil, etc. Part nos. listed below are jack panels less jacks. Can be supplied with jacks on special order. "Kwik-change" designation strips are available in KITS for retro-fitting old style panels.

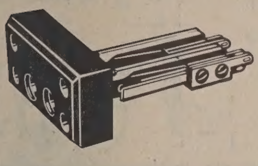
Part No.	Rows	Number of Jacks	Size, In. W x D x H	U.S.A. List Price
1400-301	Single	26	19x11⁄4x13⁄4	$22.60
2600-301	Double	52	19x 5⁄8x13⁄4	23.10

"KWIK-CHANGE" DESIGNATION STRIP KITS

Part No.	Designation	U.S.A. List Price
DS-301	Designation Strip Kit (single width) consists of: 1 extruded aluminum mounting strip 1 plastic cover 1 marking strip sheet (5 strips to a sheet) 4 mounting screws. For use on Series 1400 & 2600 jack panels and similar types.	$4.05
DS-302	Plastic Cover (single width).	1.05
DS-303	Marking Strip Sheet (single width 5 strips to a sheet). For 19″ panels, Series 1400, 2600, JP07, JP09, JP11.	.60
DS-311	Designation Strip Kit (double width) consists of: 1 extruded aluminum mounting strip 1 plastic cover 1 marking strip sheet (3 strips to a sheet) 4 mounting screws.	4.35
DS-312	Plastic Cover (double width).	1.15
DS-313	Marking Strip Sheet (Double width — 3 strips to a sheet).	.70

JACK PANELS & ACCESSORIES

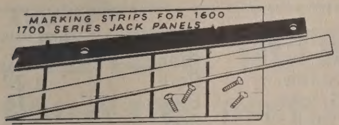
"DUAL-JAX BLOCKS" JACK BLOCKS



Molded black phenolic jack blocks for mounting "MT-Jax" and "T-Jax" long frame phone jacks, on ⅝" centers. Can be rack panel mounted individually or in multiples. Blocks are 2¾" W. x 1¼" H. x ⅝" D. Mount with four No. 8-32 flat head screws.

Part No.	Description	U.S.A. List Price
2300	Jack Block, less jacks	**$1.90**
2331	Two MT-331 jacks	**5.35**
2332A	Two MT-332A jacks	**5.90**
2332B	Two MT-332B jacks	**5.90**

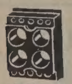
DESIGNATION STRIPS

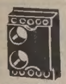


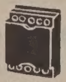
"Kwik-Change" reusable designation strips, and covers standard with Modular Jack Panels. Series JP01-2000 thru JP11-2000.

Part No.	Description	U.S.A. List Price
DS-307	Designation Strip Kit, complete. Includes sheet of 5 marking strips and 2 plastic covers. For 19" panels.	**$1.50**
DS-308	Same as DS-307, except for 23" panels.	**1.65**
DS-306	Designation Marking Strips. Sheet of 5 strips for 19" or 23" panels.	**.60**

MODULE INSERTS SERIES JP9900


JP9942

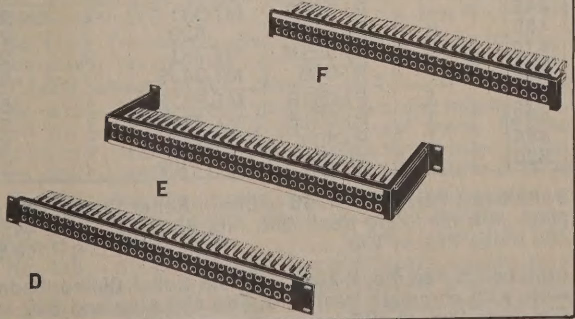

JP9922


JP9902

Rugged molded plastic inserts, used in the Modular Jack Panels, JP01-2000 thru JP11-2000.

Part No.	Description	U.S.A. List Price
JP9942	Black; 4 jack openings (less jacks). Includes 2, #4-40 mounting screws.	**$1.15**
JP9922	Black; 2 jack openings (less jacks). Includes 2, #4-40 mounting screws.	**1.15**
JP9902	Black; with holes. Includes 2, #4-40 mounting screws.	**1.05**

MODULAR JACK PANELS, SERIES "JP"



Unique modular jack panel concept. Insert assemblies (up to 4 jacks) are installed from rear and fastened from front. Mounting and wiring are quick and easy. Individual jacks or assemblies are removed with minimum disturbance to adjacent jacks and wiring. Accepts all Switchcraft and other standard telephone jack panel components (incl. WECo types), jacks, lamp jacks, switches, and coaxial jacks.

Three mounting styles: rack, extension, or flush mount: two panel widths: 19" and 23". All panels are 1¾" high; two "kwik-change" designation strips are supplied.

Series "JP" panels are lightweight, black anodized aluminum; inserts are precision molded black plastic (mounting screws supplied).

Series JP01-2000 through JP06-2000: Double row panels; insert openings on ⅝" centers in quads: ¾" between openings in adjacent quads — no accidental cross-connect.

Series JP01-2000, JP03-2000, and JP05-2000 (19" wide) mount 48, "MT-Jax" telephone jacks or 24 "Twin-Jax" phone jacks.

Series JP02-2000, JP04-2000, and JP06-2000 (23" wide) mount 56 components.

Series JP07-2000 through JP11-2000: Double row with openings on ⅝" centers. Series JP07-2000, JP09-2000, and JP11-2000 (19" wide) mount 52 "MT-Jax" telephone jacks or 26 "Twin-Jax" phone jacks.

Series JP08-2000 (23" wide) mounts 64 "MT-Jax" jacks or 32 "Twin-Jax" phone jacks.

Series JP07-2000 is equivalent to WECo #230A. Series JP08-2000 is equivalent to WECo #231A.

Part No.	Fig.	Number of Jacks	Size, In W x D* x H	U.S.A. List Price
JP01-2000	D	48‡	19x ¾x1¾	**$22.00**
JP01-2C32A	D	48, MT-332A	19x3⅝x1¾	**109.00**
JP01-2S32B	D	48, MT-332B	19x3⅝x1¾	**109.00**
JP01-2S34B	D	48, MT-334B	19x3⅝x1¾	**127.00**
JP02-2000	D	56‡	23x ¾x1¾	**26.00**
JP02-2S32A	D	56, MT-332A	23x3⅝x1¾	**127.00**
JP02-2S32B	D	56, MT-332B	23x3⅝x1¾	**127.00**
JP02-2S34B	D	56, MT-334B	23x3⅝x1¾	**147.00**
JP03-2000	E	48‡	19x5½x1¾	**27.00**
JP03-2S32A	E	48, MT-332A	19x5½x1¾	**114.00**
JP03-2S32B	E	48, MT-332B	19x5½x1¾	**114.00**
JP03-2S34B	E	48, MT-334B	19x5½x1¾	**132.00**
JP04-2000	E	56‡	23x5½x1¾	**31.00**
JP04-2S32A	E	56, MT-332A	23x5½x1¾	**131.00**
JP04-2S32B	E	56, MT-332B	23x5½x1¾	**131.00**
JP04-2S34B	E	56, MT-334B	23x5½x1¾	**152.00**
JP05-2000†	F	48‡	19x 25/32x1¾	**24.00**
JP05-2S32A†	F	48, MT-332A	19x3⅝x1¾	**110.00**
JP05-2S32B†	F	48, MT-332B	19x3⅝x1¾	**110.00**
JP05-2S34B†	F	48, MT-334B	19x3⅝x1¾	**129.00**
JP06-2000†	F	56‡	23x 25/32x1¾	**27.00**
JP06-2S32A†	F	56, MT-332A	23x3⅝x1¾	**128.00**
JP06-2S32B†	F	56, MT-332B	23x3⅝x1¾	**128.00**
JP06-2S34B†	F	56, MT-334B	23x3⅝x1¾	**149.00**
JP07-2000	D	52‡	19x ¾x1¾	**24.00**
JP07-2S32A	D	52, MT-332A	19x3⅝x1¾	**114.00**
JP07-2S32B	D	52, MT-332B	19x3⅝x1¾	**114.00**
JP07-2S34B	D	52, MT-334B	19x3⅝x1¾	**132.00**
JP08-2000	D	64‡	23x3⅝x1¾	**28.00**
JP08-2S32A	D	64, MT-332A	23x3⅝x1¾	**138.00**
JP08-2S32B	D	64, MT-332B	23x3⅝x1¾	**138.00**
JP08-2S34B	D	64, MT-334B	23x3⅝x1¾	**157.00**
JP09-2000	E	52‡	19x5½x1¾	**34.00**
JP09-2S32A	E	52, MT-332A	19x5½x1¾	**129.00**
JP09-2S32B	E	52, MT-332B	19x5½x1¾	**129.00**
JP09-2S34B	E	52, MT-334B	19x5½x1¾	**149.00**
JP11-2000	F	52‡	19x 25/32x1¾	**27.00**
JP11-2S32A	F	52, MT-332A	19x3⅝x1¾	**123.00**
JP11-2S32B	F	52, MT-332B	19x3⅝x1¾	**123.00**
JP11-2S34B	F	52, MT-334B	19x3⅝x1¾	**142.00**

* Panel depth, not including jacks. ‡ Less jacks. † Panels can be mounted flush or with standoff legs. Recommended for 7" standoff mounting with Switchcraft Bracket Kit Part No. K-107. (See Page 4279 for details.)

SWITCHCRAFT® INC.

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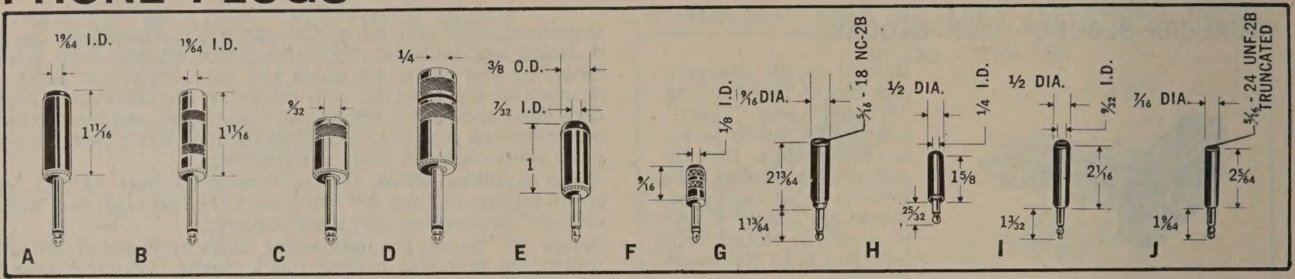
PHONE PLUGS



LITTEL-PLUG® PHONE PLUGS

Small size phone plugs fit standard ¼″ phone jacks except *Nos. S-250, S-260 and S-280 which have a .206″ dia. sleeve. †Nos. C-240, C-245 and C-270 feature an integral cable clamp with screw terminals. §No. R-280 has short sleeve or Revere Recorders. ‡No. 288 has a wide insulator between tip and sleeve for use in a 3-conductor jack to perform a 2-conductor function without shorting. Plugs with solder terminals have built in cable clamp. Shielded metal handles are nickel plated brass; others are molded of durable plastic; ⅝″ long x ½″ dia.

TWO-CONDUCTOR TYPE

Part No.	Fig.	Typical Mating Littel-Jax Jacks	Handle	Terminals	U.S.A. List Price
240	A	11	Black	Screw	$1.30
C-240†	A	11	Black	Screw	1.50
245	A	11	Red	Screw	1.30
C-245†	A	11	Red	Screw	1.50
250	A	11	Black	Solder	1.25
255	A	11	Red	Solder	1.25
270	B	11	Shielded	Screw	1.85
C-270†	B	11	Shielded	Screw	2.10
280	B	11	Shielded	Solder	1.80
288‡	B	11	Shielded	Solder	1.85
S-250*	A	S-11	Black	Solder	1.30
S-280*	B	S-11	Shielded	Solder	1.80

THREE-CONDUCTOR TYPE

260	A	12B	Black	Screw	$2.10
S-260*	A	S-12B	Black	Screw	2.85
267	A	12B	Black	Solder	1.85
269	A	12B	Red	Solder	1.85
290	B	12B	Shielded	Screw	2.40
297	B	12B	Shielded	Solder	2.30

STANDARD ¼″ PHONE PLUGS

Available with phenolic or shielded, nickel plated over brass handle.

TWO-CONDUCTOR TYPE — SCREW TERMINALS

Typical mating jack, Littel-Jax No. 11 No. 169 features circuit closing device. No. 170 has a two-piece handle with built-in clamp for ¼″ cable.

Part No.	Fig.	Handle	Length & Dia.	U.S.A. List Price
40	A	Black	2 1/16x¾	$1.30
45	A	Red	2 1/16x¾	1.30
70	B	Shielded	2 1/16x11/16	2.15
160	C	Shielded	1x11/16	1.75
169	C	Shielded	1x¾	3.50
170	D	Shielded	2 1/16x11/16	2.75

THREE-CONDUCTOR TYPE—SOLDER TERMINALS

Typical mating jack, No. 12B. No. 190A has two-piece handle with built-in cable clamp for ¼″ cable.

60	A	Black	2 1/16x11/16	$1.80
90	C	Shielded	1x11/16	2.25
190	B	Shielded	2 1/16x11/16	2.60
190A	D	Shielded	2 1/16x11/16	3.25

"LUG-PLUG" PHONE PLUGS

Low cost, two-conductor phone plugs. Fit all ¼″ phone jacks. All have solder lug terminals. Handle: Shielded metal or phenolic.

Part No.	Fig.	Typical Mating Littel-Jax Jacks	Handle	Length & Dia.	U.S.A. List Price
350	A	11	Black	1⅝x½	$1.10
355	A	11	Red	1⅝x½	1.10
380	—	11	Shielded	1x½	1.35

TINI-PLUG MINIATURE PHONE PLUGS

Miniature, 2-cond. phone plugs for use with Tini-Jax. Only ⅓ the size of standard phone plugs. Handles 1⅝″ overall length, are plastic or brass, nickel plated.

Part No.	Fig.	Terminal	Handle	U.S.A. List Price
740	E	Screw	Black	$1.20
745	E	Screw	Red	1.20
750	E	Solder	Black	1.15
755	E	Solder	Red	1.15
770	E	Screw	Shielded	1.70
780	E	Solder	Shielded	1.60

MICRO-PLUG SUBMINIATURE PHONE PLUGS

Subminiature 2-conductor phone plugs, only 1 1/64″ long; ¼″ O.D., .097″ dia. sleeve. Mate with No. TR-2A. Have screw on handles in black, red or natural anodized aluminum; accommodates cables up to 7/64″ dia. All plugs have integral cable clamps.

Part No.	Fig.	Description	U.S.A. List Price
850	F	Black Handle	$1.10
855	F	Red Handle	1.10
880	F	Natural Handle	1.10

MILITARY TYPE LITTEL-PLUG PHONE PLUGS AND "EXTENSION-JAX" PHONE JACKS

Designed to meet exact industrial and military requirements. Plugs are made in accordance with MIL-P-642(A) specifications. One-piece tip rod and one-piece sleeve and plug body provide internal interlock to prevent parts shifting position. No. 820 "Extension-Jax" jack meets MIL-J-641A specifications and mates with Littel-Plug plug No. 430. No. 470 has shielded handle; all others plastic: †Red. ‡Black. All plugs have screw terminals.

Part No.	Fig.	Mil-Type No.	Typical Mating Jack	Cond.	U.S.A. List Price
420‡	G	PJ-047B	MT-388	2	$2.85
425†	G	PJ-047R	MT-388	2	2.85
430‡	H	PJ-054B	820	2	2.45
435†	H	PJ-054R	820	2	2.45
440‡	—	PJ-055B	MT-331	2	2.30
445†	—	PJ-055R	MT-331	2	2.30
450‡	H	PJ-540B	820	2	2.30
470	—	PJ-055M	MT-331	2	2.90
480‡	I	PJ-068	MT-342B	3	5.00
482†	J	PJ-051R	MT-332B	3	5.55
483‡	J	PJ-051B	MT-332B	3	5.55
484†	J	PJ-309	M-444	3	5.00
820‡	—	JJ-026	430 Plug	2	3.00

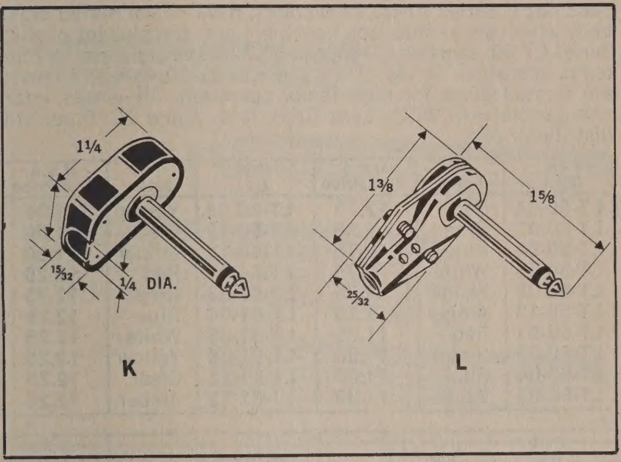
Switchcraft Part No. P-2380 — Strain Relief Clamp. Cadmium plate with chromate treatment. Fits 430, 435, 440, 445 and 450 plugs. Pkg. of 100 .... U.S.A. List Price $8.00

Switchcraft Part No. P-2381 — Strain Relief Clamp. Cadmium plate with chromate treatment. Fits 480 plug and 820 extension jack. Pkg. of 100 .... U.S.A. List Price $8.00

® Registered trademark of Switchcraft, Inc.

PHONE PLUGS

"FLAT-PLUG" PHONE PLUGS



¼″ phone plugs featuring flat, space-saving handles. Ideal for applications where conventional plugs would protrude too far. Nos. 220, 225 have adapter clips which make them convenient to clamp standard phone tips to terminals. Shielded flat plugs. Nos. 228 and 238 have nickel plated steel handles; all others have red or black plastic handles. No. S-230 has a .206″ dia. sleeve.

TWO-CONDUCTOR TYPE

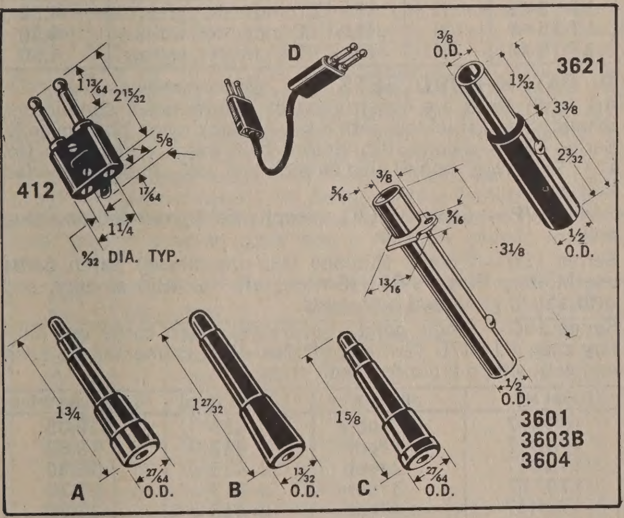
Part No.	Fig.	Typical Mating Jack	Handle	Terminals	U.S.A. List Price
220	K	11	Black	Screw	$1.85
225	K	11	Red	Screw	1.85
227	K	11	Black	Solder	1.45
228	L	11	Shielded	Solder	1.70
229	K	11	Red	Solder	1.45

THREE-CONDUCTOR TYPE

Part No.	Fig.	Typical Mating Jack	Handle	Terminals	U.S.A. List Price
230	K	12B	Black	Screw	$2.25
S-230	K	S-12B	Black	Screw	2.85
235	K	12B	Red	Screw	2.25
237	K	12B	Black	Solder	2.20
238	L	12B	Shielded	Solder	2.35
239	K	12B	Red	Solder	2.20

JACKS & PLUGS

MILITARY TYPE "TWIN-PLUG" PHONE PLUGS



Meet exact industrial and military requirements. No. 411, both design and materials, is manufactured in accordance with MIL-P-642(A) specs. Nos. 412 and 413, use identical materials. "Twin-Plug" plug sleeves spaced ⅝″ center to center with self-aligning feature.

Part No. 411—Two electrically independent 2-conductor plugs in black plastic handle. Has provision for Cord Clamp No. S-2674. Military Type PJ-327 (Old Navy No. 491242). Interchangeable with W.E. 327 .... U.S.A. List Price **$7.05**

Part No. 412—Two electrically independent 2-conductor plugs in black plastic handle. Has external cord clamp. Old Military Type PJ-289. Similar to W.E. 289B ...... U.S.A. List Price **$6.55**

Part No. 413—Three circuit plug with two electrically independent tip circuits in heavy duty die cast frame. Molded black phenolic handle notched to indicate polarity. Interchangeable with MIL-Type PJ-421 and W.E. 241..U.S.A. List Price **$7.20**

Part No. 414—Six circuit plug. Two electrically independent 3-conductor ¼″ dia. fingers. Black polarized handle. Interchangeable with W.E. 338A .... U.S.A. List Price **$12.30**

Part No. 415—Six circuit plug. Two electrically independent 3-conductor fingers. One ¼″ dia. finger, one .206″ dia. for automatic polarization. Black handle .... U.S.A. List Price **$13.70**

Part No. S-2674—Strain relief clamp, natural brass. Used with Nos. 411, 414, 415 "Twin-Plug" plugs. Pkg. of 100. U.S.A. List Price **$14.00**

"CV-JAX" COAXIAL VIDEO JACKS AND "CV-PLUG" COAXIAL VIDEO PLUGS

High quality coaxial-video jacks and plugs designed for use in patching high frequency signals, microwave, telemetry and data transmitting applications. Jacks are made for 50 and 70 ohm circuits and use standard RG cables. No. 3601 accepts RG-59/U. No. 3603B has crimp termination feature and accepts RG-59A/U (73 ohm video) or RG-59B/U (75 ohm) cable; crimp sleeve supplied. No. 3604 has same features as No. 3603B except rear bushing (ferrule) accepts larger RG-62/U or RG-62B/U (93 ohm) cables (solder terminating). Mates with plugs, Part No. 3621 and 3622. Heat sink protects insulation when soldering cable shield. Mount in single 7/16″ hole: Depth behind panel is 2 29/64″. No. 3621, terminating plug with 75 ohm ±1% ½ watt resistor. No. 3622, feed through plug.

JACKS		PLUGS	
Part No.	U.S.A. List Price	Part No.	U.S.A. List Price
3601	$13.95	3621	$6.65
3603B	13.30	3622	6.00
3604	13.30		

"DUMMY-PLUG" DUMMY PLUGS

Low cost, 2- and 3-conductor molded plastic dummy plugs for use in switchboards, jack panels. Inserts in jack as does a phone plug to switch circuits, but can not couple incoming signals. Can also be used to plug up unused phone jacks to prevent accidental insertion of a phone plug. Series 491, 3-conductor, .207″ dia. finger. Series 492, 3-conductor, .250″ dia. finger. Series 493, 2-conductor, .250″ dia.

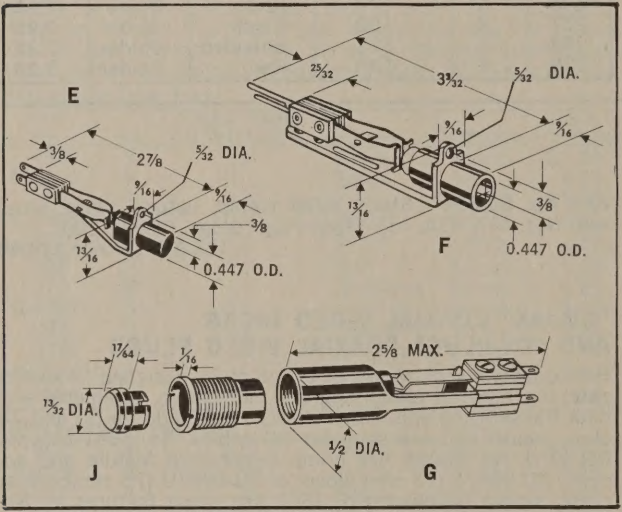
Part No.	Fig.	Handle	Typical Mating Jack	U.S.A. List Price
491-01	A	Red	MT-342B	$0.65
491-02	A	Black	MT-342B	.65
491-05	A	White	MT-342B	.65
492-01	B	Red	MT-332B	.65
492-02	B	Black	MT-332B	.65
492-05	B	White	MT-332B	.65
493-01	C	Red	MT-331	.65
493-02	C	Black	MT-331	.65
493-05	C	White	MT-331	.65

JACKS & PLUGS

REPLACEMENT PATCH CORDS

Patch cords are made of bronze tinsel conductors, insulated and shielded, with a heavy black nylon braid overall. Cords designed for use with Switchcraft plugs 413, 420 and 482 or equivalents. When used with No. 420, clip off unnecessary lead. Series 89Q — 2-cond. shielded cord; shield term. at both ends. Series 89P — 2-cond. shielded cord; shield term. at one end only.

Part No.		Length	U.S.A. List Price
Both Ends Shielded	One End Shielded		
89QA89	89PA89	6 inch	$3.30
89QB89	89PB89	1 foot	4.05
89QD89	89PD89	2 feet	4.40
89QF89	89PF89	3 feet	4.90
89QH89	89PH89	4 feet	5.15
89QK89	89PK89	6 feet	6.55
89QN89	89PN89	10 feet	9.45



"LAMP-JAX" LAMP JACKS

E.

Switchboard type long frame lamp jacks. No. LT-47, black nylon housing insulates lamp from frame. Interchangeable with WECo No. 47B. Accepts standard lamp and lamp caps. WECo Nos. 2, 72 or TEL-LED solid-state lamps. No. LT-48, ballast lamp jacks for circuits with high temperature and wattage. Steel frame and bushing. Teflon sleeve. Accepts standard telephone lamps or ballast lamp No. 60XA. Both jacks mount in standard Switchcraft jack panels.

F.

No. WLT-47, similar to LT-47, except wire-wrapping terminals. Eliminates soldering. Terminals are .704" long x 0.060" wide x .025" thick for actuator springs. Uses standard T-2 slide base lamps; mounts in Series 1200, 1400, 2400, 2600, 2800 and "JP" panels.

G.

No. LT-49 lamp jack has long leaf springs and nickel plated brass frame. Mounts in panels/chasses, 1/32" to 1/4" thick in 7/16" O.D. holes on 9/16" min. centers. No mtg. hardware required. Straight solder terminals. Uses T-2 lamp or TEL-LED solid-state lamp.

TEL-LED INDICATOR SOLID-STATE LAMPS

Bright red LED indications (180° viewing angle) from solid-state lamp for new equipment and retrofits. Plug-in replacement for T-2 slide base incand. lamps has solid-state reliability, low power, low heat and immunity to shock/vibration. 48 VDC operation @ 8.5 ma. Fits Switchcraft "Lamp-Jax" jacks and other std. telephone type lamp jacks. Color bezels are ideal for color coding groups of indicators.

J.

Lens Caps. Series LT-50, in 6 colors, have nickel plated brass body which snaps into jack housing. Lens: translucent plastic. Series LT-60, same as LT-50, except 7 lenses are glass for high temp. operation. Series LT-61, same as LT-50, except 7 lenses are frosted glass for high temp. operation. All lenses interchangeable with WECo Lens Caps, Nos. 2 and 72. 5 per std. distributor pkg.

Part No.	Color	U.S.A. List Price	Part No.	Color	U.S.A. List Price
LT-50-01	Red	$2.75	LT-60-08	Yellow	$11.00
LT-50-03	Green	2.75	LT-60-12	Clear	11.00
LT-50-04	Blue	2.75	LT-60-13	Amber	11.00
LT-50-05	White	2.75	LT-61-01	Red	12.25
LT-50-08	Yellow	2.75	LT-61-03	Green	12.25
LT-50-13	Amber	2.75	LT-61-04	Blue	12.25
LT-60-01	Red	11.00	LT-61-05	White	12.25
LT-60-03	Green	11.00	LT-61-08	Yellow	12.25
LT-60-04	Blue	11.00	LT-61-12	Clear	12.25
LT-60-05	White	11.00	LT-61-13	Amber	12.25

Part No.	Fig.	Description	U.S.A. List Price
LT-47	E	"Lamp-Jax" lamp jack	$1.90
LT-48	E	"Lamp-Jax" lamp jack	2.90
WLT-47	F	"Lamp-Jax" lamp jack	2.05
LT-49	G	"Lamp-Jax" lamp jack	2.90
LT-71-48	H	TEL-LED Indicator, red	4.50
LT-72-48	H	TEL-LED Indicator, black	4.50
LT-73-48	H	TEL-LED Indicator, green	4.50
LT-75-48	H	TEL-LED Indicator, white	4.50
LT-78-48	H	TEL-LED Indicator, yellow	4.50

D. PATCH CORD SETS

See illustration on Page 4277.

All patch cords are constructed of bronze tinsel conductors, insulated and shielded, with a heavy black nylon braid overall. Series 17Q — 2-cond. (tip/sleeve) twin patch cords have No. 413 "Twin-Plug" phone plug at each end with shields grounded both ends.

Series 17P — Same as 17Q, except shield grounded one plug only.

Series 18Q — 2-cond. shielded (tip/ring/sleeve) patch cords use Military Plug PJ-051 (Switchcraft No. 482) at each end with shield grounded both ends.

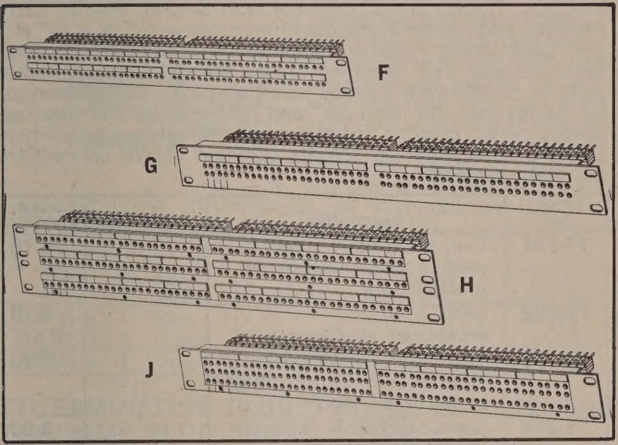
Series 19Q — Single cond. (tip/sleeve) patch cords use Military plug PJ-047B (Switchcraft No. 420) connected to each end with shield grounded both ends.

Part No.	Length	Plugs Used	U.S.A. List Price
17QA17	6 inch	413	$16.05
17QB17	1 foot	413	16.50
17QD17	2 feet	413	16.80
17QF17	3 feet	413	17.20
17QH17	4 feet	413	17.85
17QK17	6 feet	413	19.00
17QN17	10 feet	413	20.10
17PA17	6 inch	413	16.05
17PB17	1 foot	413	16.50
17PD17	2 feet	413	16.80
17PF17	3 feet	413	17.25
17PH17	4 feet	413	17.85
17PK17	6 feet	413	19.00
17PN17	10 feet	413	20.10
18QA18	6 inch	482	16.80
18QB18	1 foot	482	17.55
18QD18	2 feet	482	18.25
18QF18	3 feet	482	19.00
18QH18	4 feet	482	19.75
18QK18	6 feet	482	21.20
18QN18	10 feet	482	23.45
19QA19	6 inch	420	8.75
19QB19	1 foot	420	9.20
19QD19	2 feet	420	9.90
19QF19	3 feet	420	10.60
19QH19	4 feet	420	11.35
19QK19	6 feet	420	13.30
19QN19	10 feet	420	15.35

SWITCHCRAFT® INC.
5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

"TINI-TELEPHONE" PATCHING SYSTEM COMPONENTS

SERIES TT "TINI-TELEPHONE" JACK PANELS



Series "TT" Jack Panels provide up to 104 jacks (1¾" x 19" area) or 156 jack (2⅝" x 19" area) in standard panels. Constructed of black anodized, extruded aluminum with an extra wide flange for greater rigidity. Series 1600 double row panel for 96 TT-Jax jacks comprises an aluminum panel and 4 molded plastic inserts which accommodates 24 jacks each. Series A1600 — similar to Series 1600; accepts 104 TT-Jax or "WTT-Jax" jacks (3 rows, 52 jacks ea.; jack mtg. centers 5/16" each row). Provides greater connecting density on standard 1¾" x 19" panel. Series B1600 and C1600 — 3 row panels with 2⅝" x 19" front panel area. Series B1600 mounts 144 TT-Jax or "WTT-Jax" jacks, and Series C1600 holds 156 jacks. Series 1700, a double row panel for 48 "TT-Twin-Jax" jacks; consists of aluminum panel with 2 molded plastic inserts which accept 24 twin jacks ea. Series B1700 same as Series 1700 except mounts 48 "Tri-Jax" jacks, Part Nos. TT-95 or WTT-95 (24 per insert). All Series feature exclusive Switchcraft "kwik-change" designation strips. Strips consist of a clear plastic snap-on cover and a reusable plastic marking strip.

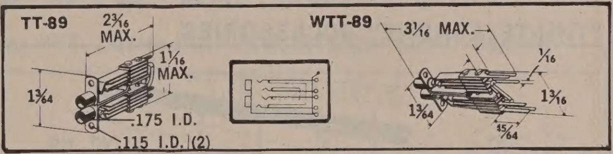
Part No.	Fig.	Rows	Number of Jacks	U.S.A. List Price
1600	F	Two	96* single jacks	$34.75
1632A	F	Two	96, TT-32A	167.85
1634B	F	Two	96, TT-34B	213.15
A1600	F	Two	104* single jacks	40.55
B1600	H	Three	144* single jacks	52.10
C1600	H	Three	156* single jacks	57.75
1700	G	Two	48* twin jacks	40.55
1789	G	Two	48, TT-89	301.35
B1700	J	Three	48* "Tri-Jax" triple jacks	46.30
B1795	J	Three	48, TT-95 "Tri-Jax" jacks	346.50
WB1795	J	Three	48, WTT-95 "Tri-Jax" jacks	370.65
TT-505			Panel Insert, less jacks — 24 holes — For Nos. 1600 and B1600	4.60
TT-506			Panel Insert, blank for Nos. 1600, A1600, B1600 and C1600	2.30
TT-507			Panel Insert, less jacks — 48 holes — For No. 1700	6.40
TT-509			Panel Insert, less jacks — 26 holes — For Series A1600 and C1600	5.50
TT-511			Panel Insert, less jacks — 72 holes — For No. B1700	12.10

* Supplied less jacks.

® Registered trademark of Switchcraft, Inc.

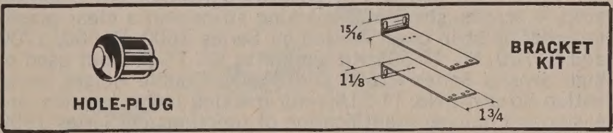
"TINI-TELEPHONE" "TWIN-JAX" TWIN JACKS

"TT Twin-Jax" and "WTT Twin-Jax" twin jacks are similar in design to TT-Jax and "WTT-Jax" single jacks described above, except the 2 frames are welded back-to-back with mtg. holes on 13/16" centers and bushings on 5/16" centers. Twin jacks are designed to be mounted on Series 1700 jack panels. Part No. TT-89 has solder lug terminals; Part No. WTT-89, wire-wrapping terminals. Both mate with TT-Patch Cords. Series TT-120, TT-160, TT-740, and TT-860.



Switchcraft Part No. TT-89 .... U.S.A. List Price **$5.75**
Switchcraft Part No. WTT-89 .... U.S.A. List Price **5.90**

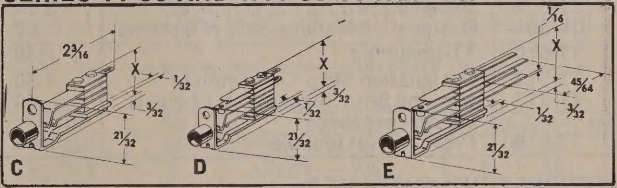
JACK PANEL ACCESSORIES



Hole Plug, P-1801, molded nylon, fits all Switchcraft jack panels, Series 1200, 1400, 2400, 2600, 2800. Designed to plug unused holes in jack panels. Bracket Kit, K-107, consists of 2 long L-shaped steel, stand-off brackets and eight No. 6-32 self-tapping screws. To hold jack panels, Series 1400, 2600, 7" in front of mounting rack.

Part No.	Description	U.S.A. List Price
P-1801	Hole Plug	$0.35
K-107	Bracket Kit	5.45

SERIES TT-30 AND WTT-30 TT-JAX® PHONE JACKS



New, "tini-telephone" jacks, miniatures of the std. long frame telephone-type jacks. Rugged steel frame, with gusset for extra rigidity. Special nickel silver springs with welded crossbar palladium contacts. Series TT-30 require only 2 13/16" depth behind panel, mounted on 5/16" centers, in a ¼" dia. hole in panels up to ⅜" thick. Designed to be mounted on Series 1600, A1600, B1600 and C1600 "TT" Jack Panels. Series TT-30 jacks also available with wire-wrap terminals. Fig. E. Series WTT-30. Same quality construction. Depth behind panel 2 11/16". Both TT-30 and WTT-30 jacks can be mounted in combination or interchangeably with "TT-Switch" switches and "TT Lamp-Jax" lamp jacks on Series 1600, A1600, B1600, and C1600 panels.

SERIES TT-30

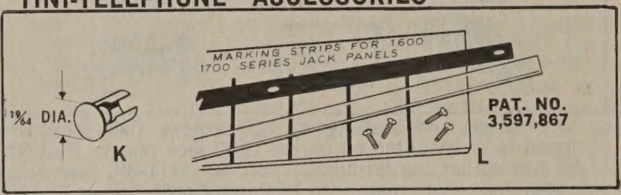
Part No.	Fig.	Schematic No.	Typical Mating Plug	Conductors	"X" Dim.	U.S.A. List Price
TT-31	D	I	TT-251	2	27/64"	$1.35
TT-32A	D	III	TT-251	2	13/32"	1.70
TT-32B	C	IV	TT-253	3	15/32"	1.55
TT-33B	C	VIII	TT-253	3	31/64"	2.00
TT-34B	C	XII	TT-253	3	½"	2.00
TT-34C	D	XVII	TT-251	2	35/64"	2.00
TT-35	D	XIII	TT-251	2	39/64"	2.40
TT-36	D	XX	TT-253	3	39/64"	2.40
TT-36C	C	XXII	TT-253	3	⅝"	2.75

SERIES WTT-30

Part No.	Fig.	Schematic No.	Typical Mating Plug	Conductors	"X" Dim.	U.S.A. List Price
WTT-31	E	I	TT-251	2	7/16"	1.45
WTT-32A	E	III	TT-251	2	7/16"	1.85
WTT-32B	E	IV	TT-253	3	9/16"	1.80
WTT-33	E	V	TT-251	2	⅝"	2.10
WTT-34B	E	XII	TT-253	3	37/64"	2.10
WTT-36C	E	XXII	TT-253	3	47/64"	2.95

"TINI-TELEPHONE" PATCHING SYSTEM COMPONENTS

"TINI-TELEPHONE" ACCESSORIES

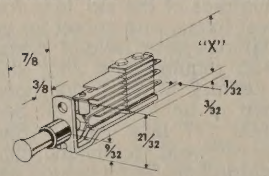


K.
TT-Hole Plug — used to close off unused holes in TT-Jack Panels. Black plastic with brass sleeve.

L.
"Kwik-Change" Designation Strip Kits for TT-Jack Panels. No. TT-501 Kit consists of an extruded aluminum mounting strip, 4 screws, sheet of 5 marking strips and a clear plastic designation strip cover — used on Series 1600, B1600, 1700, and B1700. No. TT-504 Kit similar to Kit TT-501 but used on high density Series A1600 and C1600. Double Height Designation Strip Kit No. TT-516 — for marking larger legends, and easier and quicker identification of functions on Series 1600, B1600, 1700, and B1700 "tini-telephone" Jack Panels. Includes extruded aluminum black anodized mounting strips, 4 mounting screws, matte finish white plastic marking strip and clear plastic cover. With Series 1600, B1600, and B1700 panels. "Kwik-Change" designation strips project approx. 5/32″ above top edge of panel.

Part No.	Description	U.S.A. List Price
TT-501	Designation Strip Kit, complete	$3.65
TT-502	Designation Marking Strip of 5 sheets	.65
TT-503	Clear plastic designation strip cover (Also used on Kit No. TT-504)	1.20
TT-504	Designation Strip Kit, complete	3.65
DS-303	Designation Marking Strip of 5 sheets	.60
TT-510	TT-Hole Plug	.40
TT-516	Designation Strip Kit, complete	4.30
TT-517	Marking Strip Sheet (double height) 3 strips per sheet	.90
TT-518	Plastic Cover (double height)	1.55

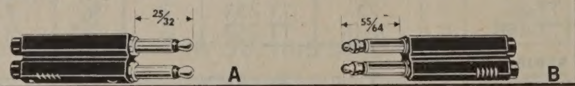
"TT-SWITCH" SWITCHES



Series TT-300 "tini-telephone" switch. Small, compact. Designed to be mounted in combination or interchangeable with TT-Jax, "TT Lamp-Jax" jacks on Series 1600 jack panels. Available in momentary (NON-LOCKING) or Push-to-Lock/Pull-to-Release actions. White plastic knob. Special nickel silver springs with welded crossbar palladium contacts rated at 2 amps, 200 watts, non-inductive load. Mounts with No. 3-48 screw (not furnished) in 1/4″ dia. hole in panels to 3/8″ thick. Depth behind panel 2 3/16″.

Part No.		Action	Schematic No.	"X" Dim.	U.S.A. List Price
Non-Locking	Push-Lock/ Pull-Release				
TT-301	TT-301L	S.P.S.T.n.o.	1-A	15/32″	$3.80
TT-306	TT-306L	D.P.D.T.	2-C	11/16″	5.50
TT-307	TT-307L	3P.S.T.n.o.	3-A	47/64″	5.55

TT-TWIN PLUG MINIATURE TELEPHONE TWIN PLUGS

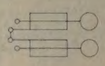
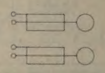


Series TT-260 miniaturized twin phone plugs are the only plugs available which fit jacks on 5/16″ centers, both horizontally and vertically in dense arrays.

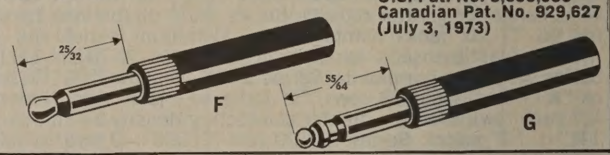
A.
Part Nos. TT-261 and TT-262 are twin 2-cond.

® Registered trademark of Switchcraft, Inc.

B.
Part Nos. TT-263 and TT-264 are twin 3-cond. Handle easily installed and removed. Handle dimensions — 5/16″ W. x 5/8″ H. x 1 3/4″ Long (max.). Polarizing notches on handles locate finger positions, and .173″ diameter fingers are self-aligning. Access ports on handle permit probe insertion for tip circuit monitoring. Mates with "TT Twin-Jax" and TT-Jax jacks with bushings spaced on 5/16″ centers. Tip and ring terminals are screw-type, shield bridging feature permits common sleeve connections with cable shield.

Part No.	Description	Schematic	U.S.A. List Price
TT-261	Two, electrically independent, 2-cond. plugs in one black handle		$6.70
TT-262	Same as TT-261 except red handle		6.70
TT-263	Six-circuit, two, electrically independent, 3-cond. plugs in one black handle		8.90
TT-264	Same as TT-263, except red handle		8.90

TT-PLUG®

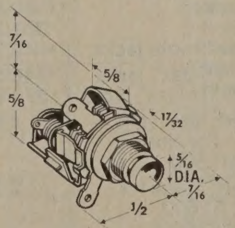


U.S. Pat. No. 3,656,089
Canadian Pat. No. 929,627
(July 3, 1973)

Series TT-250 miniaturized 2- and 3-cond. phone plugs, .173″ dia. finger fits all "tini-telephone" jacks — Series TT-30, WTT-30, TT-600 and Part Nos. TT-89, WTT-89, TT-95, and WTT-95. Also mates with "Unijax" jacks, Series TT-250 plus are used on Series TT-720 and TT-740 patch cords. Handles twist-on and twist-off. Each handle includes a special boss which mates with a groove in the plug body. A 30° clockwise twist locks the handle on the plug body. The knurled area of the handle should be squeezed lightly to unlock. To remove — slide handle forward. Plastic handle: 1 1/2″ long x 5/16″ dia.

Part No.	Fig.	Conductors	Handle	U.S.A. List Price
TT-251	F	2	Black	$2.80
TT-252	F	2	Red	2.80
TT-253	G	3	Black	4.05
TT-254	G	3	Red	4.05

ILLUMINATED "LITTEL-LITE" SWITCHES

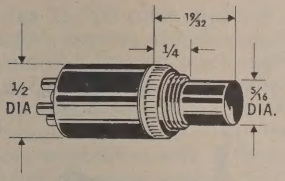


Series 210 "Littel-Lite" Switches are unusually small, momentary contact, illuminated pushbutton types. Requires minimum panel space; ideal for limited space applications and press-to-test circuits. One-piece, clear plastic button and shaft is illuminated by a single miniature lamp, 6V or 28V. Lamps are not furnished. See lamp listings. Includes kit of 4 color chips (red, amber, green, and yellow), can be inserted in switch at any time. Nickel silver spring contacts are recommended for low level circuits where contact resistance is not important. Also available, fine silver contacts (Part No. suffix "S") rated at 3 amps, 300 watts, max. A.C. non-inductive load. Lighting circuit is independent of switching circuit. Mounts in single 3/8″ hole in panels up to 1/4″ thick; depth behind panel 1 3/16″.

Part No.	Action	Schematic Circuit	U.S.A. List Price
211	S.P.S.T.n.o	1-A	$3.10
213	S.P.D.T.	1-C	3.85
211S	S.P.S.T.n.o	1-A	3.90
213S	S.P.D.T.	1-C	4.60

“TINI-TELEPHONE” PATCHING SYSTEM COMPONENTS

SERIES DA SWITCH

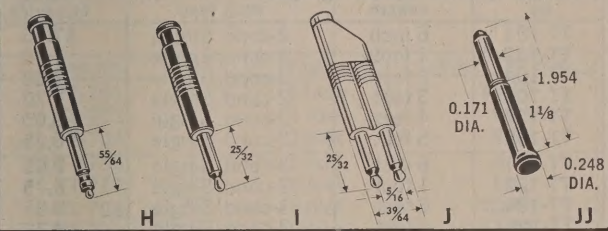


Series DA. Completely enclosed, momentary action pushbutton switch. Anodized aluminum body protects switch contacts from dirt, dust and from being bent. A-B contact arrangement provides a 1-A, 1-B or 1-C circuit when externally wired. Integral hard gold plated contacts rated at 500 mA, 50 watts max., AC, non-inductive load. Terminals accept AMP Series 53 taper pins. Mount in ⅜″ hole on 17/32″ centers. Depth behind panel 15/16″.

Part No.	Button Color	Part No.	Button Color	U.S.A. List Price
DA-01-3	Red			**$3.70**
DA-02-3	Black	**DA-05-3**	White	**3.70**
DA-03-3	Green	**DA-08-3**	Yellow	**3.70**

TT-TERMINATING PLUG, TT-LOOPING PLUG, AND TT-DUMMY PLUG PHONE PLUGS

Canadian Pat. No. 929,627 (July 3, 1973)



H.
TT-Phone Plug Terminating Plugs for terminating circuits with a specific load. A precision ½ watt, ±1% resistor is molded into the handle. Resistance value marked on handle.

I.
TT-Phone Plug Dummy Plugs plug into TT-Jax jacks to actuate shunt and isolated switching circuits.

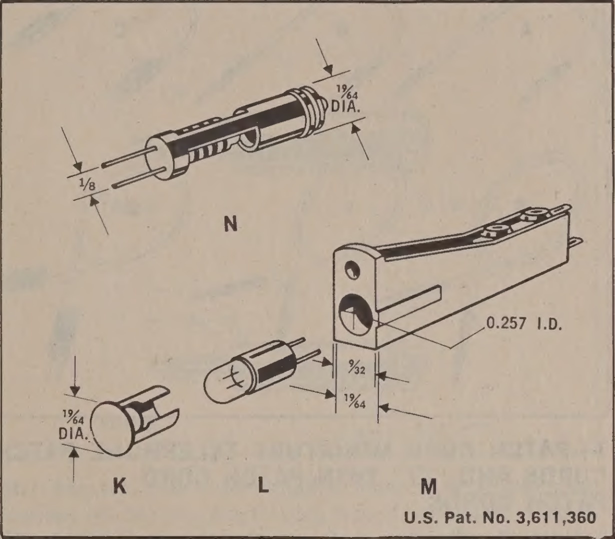
J.
TT-Phone Plug Looping Plugs for looping or patching adjacent jack circuits. Fingers of twin looping plugs are wired internally. Terminating and Dummy plugs; .173″ dia. finger; 1½″ L. x 19/64″ dia. handle. Looping twin plugs; (2) .173″ dia. fingers; 19/64″ W. x 1¾″ L. handle.

J.
Dummy TT-Twin Plugs — Designed to be inserted into twin phone jacks to actuate shunt and isolated switching circuits. .173″ O.D. fingers; tips, rings (3-cond.) and sleeves completely isolated. Molded ivory handle.

JJ.
Dummy TT-Plug plug actuates shunt isolated switching circuits for simulated jack operation. 2- and 3-cond. types; resists taking permanent set and ensures consistent operation of jack springs, shunt and switching circuits. Flared handle for easy insertion and withdrawal.

Part No.	Description	U.S.A. List Price
TT-201	2-cond. terminating plug — 135 ohms	**$4.10**
TT-203	3-cond. terminating plug — 135 ohms	**4.75**
TT-204	3-cond. terminating plug — 600 ohms	**4.75**
TT-205	2-cond. dummy plug	**2.00**
TT-206	3-cond. dummy plug	**2.45**
TT-207	2-cond. looping plug	**6.05**
TT-208	3-cond. looping plug	**7.60**
TT-209	Twin, 2-cond. dummy plug	**3.00**
TT-210	Twin, 3-cond. dummy plug	**4.50**
TT-515-1	Molded red plastic, used on 2- and 3-cond. TT-Jax Jacks	**.45**
TT-515-2	Same as No. TT-515-1, except red	**.45**
TT-515-5	Same as No. TT-515-1, except white	**.45**

M. “TT LAMP-JAX” MINIATURE LAMP JACKS



U.S. Pat. No. 3,611,360

Small, space-saving “tini-telephone” lamp-jack. Designed to mount on Series 1600, A1600, B1600, and C1600 TT-Jack Panels. Lamp-jack, one-piece molded housing, has integral heat sink fins. Accepts industry standard T-1¾ bi-pin lamps.

K.
TT-Jewel Assembly consists of a colored jewel and a brass sleeve which accepts the bi-pin lamp. Jewel serves as a relamping tool for the lamp jack. Lamp jack mounts with one #3-48, 5/16″ long screw (not furnished). Depth behind panel — 2 3/16″.

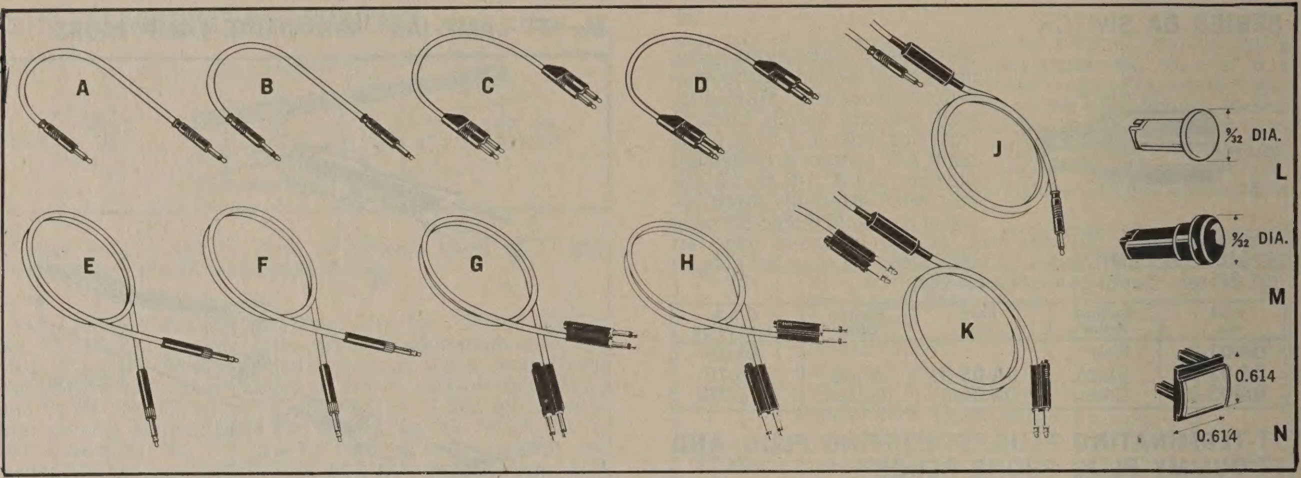
Part No.	Fig.	Description	U.S.A. List Price
TT-420	M	Lamp Jack	**$1.60**
TT-401	K	Jewel — Red	**.45**
TT-403	K	Jewel — Green	**.45**
TT-404	K	Jewel — Blue	**.45**
TT-405	K	Jewel — White	**.45**
TT-408	K	Jewel — Yellow	**.45**
TT-413	K	Jewel — Amber	**.45**
P-2315	L	6 V Bi-Pin Lamp	**2.00**
P-2316	L	28 V Bi-Pin Lamp	**2.25**

N. TT-LED CARTRIDGES SOLID STATE LAMPS

Electroluminescent diode with 180° viewing angle, limiting resistor, molded housing and colored bezels. Emitted color: red. Long life and low power demand in Series 1600, A1600, B1600, and C1600 TT-Jack Panels. Standard voltages: 6, 24/28, and 48 VDC. Will not operate on AC. Used with “TT Lamp-Jax” lamp jacks; replaces bi-pin lamp and TT Jewel Assembly.

Part No.	Voltage	Bezel Color	U.S.A. List Price
TT-451-06	6	Red	**$4.05**
TT-451-24	24	Red	**4.05**
TT-451-48	48	Red	**4.05**
TT-452-06	6	Black	**4.05**
TT-452-24	24	Black	**4.05**
TT-452-48	48	Black	**4.05**
TT-453-06	6	Green	**4.05**
TT-453-24	24	Green	**4.05**
TT-453-48	48	Green	**4.05**
TT-455-06	6	White	**4.05**
TT-455-24	24	White	**4.05**
TT-455-48	48	White	**4.05**
TT-458-06	6	Yellow	**4.05**
TT-458-24	24	Yellow	**4.05**
TT-458-48	48	Yellow	**4.05**

TT-PATCH CORD CORDS



TT-PATCH CORD MINIATURE TELEPHONE PATCH CORDS AND "TT" TWIN PATCH CORD PATCH CORDS

"tini-telephone" patch cords are available in 2 styles—(1) 2- and 3-cond. single and twin plugs, molded on braided shield, grey plastic jacketed cables; (2) 2- and 3-cond. attachable single and twin plugs with braided shield, nylon woven, black cord. TT-Patch Cord cords mate with "Unijax" jacks; TT-Jax jacks, Series TT-30, WTT-30, TT-600; Nos. TT-89 & WTT-89 "TT Twin-Jax" jacks; & Nos. TT-95 & WTT-95 "Tri-Jax" jacks. TT-Patch Cord cords with twin plugs mate with "TT Twin-Jax" jacks and single TT-Jax jacks spaced on 5/16" centers.

Series TT-100 — A Single cond. Shielded cable with a 2-cond. phone plug molded at each end.

Series TT-120 — B 2-cond. Shielded cable with a 3-cond. phone plug molded at each end.

Series TT-140 — C 2-cond. Shielded cable with a 3-cond. twin-plug molded at each end. Sleeve circuits are common. Tip circuits wired tip to tip.

Series TT-160 — D 4-cond. Shielded cable with 5-cond. twin-plug molded at each end. Sleeve circuits common. Tip circuits wire tip to tip, ring circuits wired ring to ring.

Series TT-720 — E 2-cond. Shielded cord with a TT-251 phone plug attached to each end. Shield is grounded to sleeve of each plug and the tinsel cond. is wired tip to tip. The other conductor is clipped off.

Series TT-740 — F 2-cond. Shielded cord with a TT-253 phone plug attached to each end. Shield is grounded to sleeve of each plug, the two cond. are wired tip to tip and ring to ring.

Series TT-840 — G 2-cond. Shielded cord with a TT-261 twin-plug phone plug attached to each end. Plug sleeves at both ends connected in common through shield. Tips wired to corresponding plug tips on opposite end.

Series TT-860 — H 4-cond. Shielded (5-circuit) cord with a TT-263 twin phone plug attached to each end. Plug sleeves at both ends connected in common through shield. Tips and rings wired to corresponding plug fingers at both ends.

Part No.	Length	Plug Type	U.S.A. List Price
TT-101	6 inch	2-cond. Single	$7.10
TT-102	1 foot	2-cond. Single	7.20
TT-104	2 feet	2-cond. Single	7.50
TT-106	3 feet	2-cond. Single	7.70
TT-107	4 feet	2-cond. Single	8.05
TT-108	5 feet	2-cond. Single	8.25
TT-121	6 inch	3-cond. Single	8.65
TT-122	1 foot	3-cond. Single	8.75
TT-124	2 feet	3-cond. Single	9.05
TT-126	3 feet	3-cond. Single	9.30
TT-127	4 feet	3-cond. Single	9.55
TT-128	5 feet	3-cond. Single	9.75
TT-141	6 inch	3-cond. twin	9.05
TT-142	1 foot	3-cond. twin	9.15
TT-144	2 feet	3-cond. twin	9.35
TT-146	3 feet	3-cond. twin	9.65
TT-147	4 feet	3-cond. twin	9.90
TT-148	5 feet	3-cond. twin	10.10
TT-161	6 inch	5-cond. twin	12.05
TT-162	1 foot	5-cond. twin	12.50
TT-164	2 feet	5-cond. twin	13.25
TT-166	3 feet	5-cond. twin	13.95
TT-167	4 feet	5-cond. twin	14.40
TT-168	5 feet	5-cond. twin	14.70
TT-721	6 inch	TT-251	11.60
TT-722	1 foot	TT-251	12.60
TT-724	2 feet	TT-251	13.45
TT-726	3 feet	TT-251	14.60
TT-727	4 feet	TT-251	15.85
TT-728	5 feet	TT-251	17.00
TT-729	6 feet	TT-251	17.85
TT-741	6 inch	TT-253	14.15
TT-742	1 foot	TT-253	15.35
TT-744	2 feet	TT-253	16.20
TT-746	3 feet	TT-253	17.25
TT-747	4 feet	TT-253	18.65
TT-748	5 feet	TT-253	19.70
TT-749	6 feet	TT-253	20.70
TT-841	6 inch	TT-261	20.30
TT-842	1 foot	TT-261	20.95
TT-844	2 feet	TT-261	21.65
TT-846	3 feet	TT-261	22.90
TT-847	4 feet	TT-261	24.15
TT-848	5 feet	TT-261	25.40
TT-849	6 feet	TT-261	26.65
TT-861	6 inch	TT-263	29.85
TT-862	1 foot	TT-263	31.15
TT-864	2 feet	TT-263	32.75
TT-866	3 feet	TT-263	34.95
TT-867	4 feet	TT-263	37.50
TT-868	5 feet	TT-263	39.35
TT-869	6 feet	TT-263	41.30

TT-PATCH CORD CORDS

TT-REPLACEMENT CORDS

Series TT-700 cords made of high quality bronze tinsel conductors, covered with thermoplastic insulation, then a braided shield and braided black nylon jacket. Cord ends reinforced to accept the internal threaded end of a TT-Phone Plug plug. Used as a replacement cord on Series TT-720 & TT-740 patch cords. Also used on TT-Twin Plug plugs. Series TT-260 in dual cable assemblies with 2- and 3-cond. (or combinations) plug fingers requiring independent tip, ring, and sleeve circuits. Used also for single cable assemblies where supplementary cross-over wiring is needed for common tip ring, and/or sleeve circuits.

Series TT-800 cords are same as Series TT-700 except cord ends are not reinforced. For fabricating cable assemblies with Part Nos. TT-261 and TT-262 "TT" Twin-Plug plugs or as replacement cord on Series TT-840 TT-Patch Cord cords.

Series TT-820 cords have identical construction as Series TT-800 cords except they are 4-cond. shielded. Used to fabricate cable assemblies with Nos. TT-263 and TT-264 TT-Twin Plug plugs or as replacement cords for Series TT-860 TT-Patch Cord cords.

Part No.	Length	U.S.A. List Price
TT-701	6 inch	**$5.10**
TT-702	1 foot	**6.05**
TT-704	2 feet	**6.95**
TT-706	3 feet	**8.10**
TT-707	4 feet	**9.40**
TT-708	5 feet	**10.40**
TT-709	6 feet	**11.45**
TT-801	7 inch	**5.45**
TT-802	13 inch	**6.00**
TT-804	25 inch	**6.60**
TT-806	37 inch	**7.85**
TT-807	49 inch	**9.15**
TT-808	61 inch	**10.40**
TT-809	73 inch	**11.70**
TT-821	7 inch	**9.55**
TT-822	13 inch	**10.80**
TT-824	25 inch	**12.40**
TT-826	37 inch	**14.60**
TT-827	49 inch	**17.15**
TT-828	61 inch	**19.05**
TT-829	73 inch	**20.95**

"TINI-TELEPHONE" ATTENUATOR PATCH CORDS

For back-to-back patching of telephone transmission equipment; matches +7 dB receive and −16 dB transmit levels.

J.

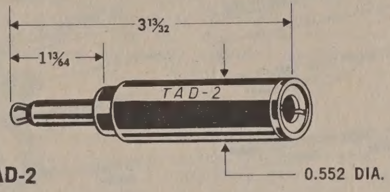
Single cords are 2-cond. shielded: 23 dB resistive pad connected between tips and rings.

K.

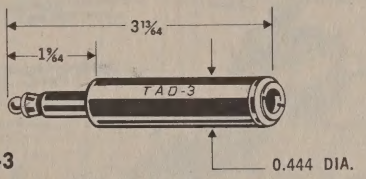
Twin cords are 4-cond. shielded; 23 dB pads are cross-over wired between tips and rings of twin plug fingers on opposite ends. Twin plug handles have polarizing notches.

Part No.	Length	Plug Type	U.S.A. List Price
TT-941	6 feet	3-cond., No. TT-253	**$31.75**
TT-942	10 feet	3-cond., No. TT-253	**38.10**
TT-943	15 feet	3-cond., No. TT-253	**47.65**
TT-951	6 feet	Twin 3-cond., No. TT-263	**57.15**
TT-952	10 feet	Twin 3-cond., No. TT-263	**63.50**
TT-953	15 feet	Twin 3-cond., No. TT-263	**73.10**

"TINI-TELEPHONE" PATCH ADAPTERS



TAD-2



TAD-3

Patch Adapters have fingers which conform to MIL-P-642 specifications (PJ-047, 2-cond; PJ-051, 3-cond.) and built-in standard miniaturized telephone-type jack in handle. Eliminates cross patching problems in telephone and other audio systems. Eliminates "combination" patch cords (standard plug on one end and miniaturized plug on the other). Part No. TAD-2 converts standard 2-cond. jack (¼" I.D.) sleeve to standard miniaturized jack (.173" I.D. sleeve). Part No. TAD-3 converts standard 3-cond. jack (¼" I.D. sleeve) to standard miniaturized jack (.173" I.D. sleeve).

Switchcraft Part No. TAD-2 .... U.S.A. List Price **$4.75**

Switchcraft Part No. TAD-3 .... U.S.A. List Price **7.00**

"TINI-TELEPHONE" SIGNAL PLUGS

Seals jack bushing openings; eliminates accidental plug insertion into critical circuits. Legend capability.

L.

Series TT-512 Critical Circuit Signal Plugs fit flush against jack bushing.

M.

Series TT-513 Priority Circuit Signal Plugs: same as Series TT-512, except extended flange behind button.

N.

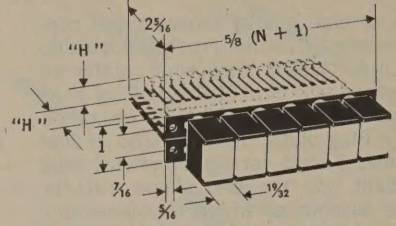
Series TT-514 Designation Signal Plugs cover 4 jacks in .312" sq. openings. Series TT-512 and TT-513 used on all TT-Jack Panel jack panels: Series TT-514 used on Series 1700 and B1700.

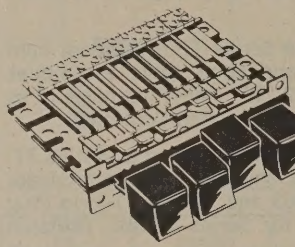
Part No.	Fig.	Part No.	Fig.	Color	U.S.A. List Price
TT-512-1	L	**TT-513-1**	M	Red	**$0.40**
TT-512-2	L	**TT-513-2**	M	Black	**.40**
TT-512-3	L	**TT-513-3**	M	Green	**.40**
TT-512-4	L	**TT-513-4**	M	Blue	**.40**
TT-512-5	L	**TT-513-5**	M	White	**.40**
TT-512-8	L	**TT-513-8**	M	Yellow	**.40**
		TT-514-2	N	Black	**.70**

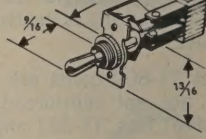
SWITCHES

Switchcraft switches give you unlimited latitude in the selection of switching functions and actuation for customizing your equipment designs. Whether you choose pushbutton or lever actuated switches, Switchcraft Authorized Industrial Distributors can aid you in the selection and specification of the proper switch to fill your particular requirements. All Multi-Switch® switches are factory-assembled to your specifications or select one from the standard listing shown in this catalog. Factory assembly, plus rigorous inspection and testing, is your assurance of optimum performance and dependability.

Only Switchcraft offers 2 complete lines of multiple station pushbutton, and lever switches . . . 2 proven solutions to man-machine interface problems.







PUSHBUTTON ACTION

Whatever your requirements for switching, you will find Switchcraft Multi-Switch® switches enable you to design a cybernetically correct, error-reducing panel. Both illuminated and non-illuminated types are available with non-lock, all-lock, interlock, push-to-lock, push-to-release functions. Illuminated types offer single or multiple lighting effects. Series 7000 and 21000 frames are available from 1 to 37 stations in a row, Littel Multi-Switch® switches Series 35000, 36000, 37000 and 38000, are compact switching units offering 1 to 18 stations in a row. Series 65000, 66000, 67000, 70000 and 71000 are low cost switches, in all functions, up to 18 stations in a row.

LEVER ACTION

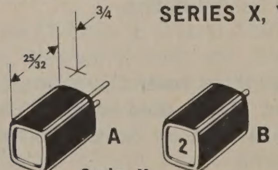
Switchcraft offers the largest selection of illuminated and non-illuminated lever-type switches in the industry. They come in a wide choice of sizes, 2 or 3 position, locking and non-locking types. They range in size and style from miniaturized "Feather Lever", featuring changeable push-on color knobs to "Lever-Lite", a 3-color illuminated type lever switch; to the industry standard "Telever", a telephone type switch featuring field changeable functions.

® Registered trademark of Switchcraft, Inc.

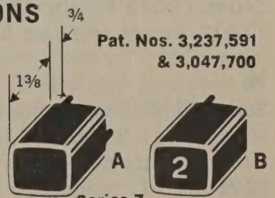
"GLO-BUTTON" PUSHBUTTONS

SERIES X, Y, Z

Pat. Nos. 3,237,591 & 3,047,700



Series X



Series Z

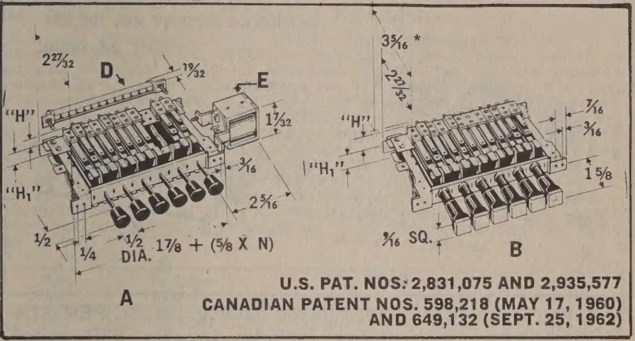
Series No.	Size	Screen Color	Illuminator Color	U.S.A. List Price
X21248	1/2" square	Black	Orange-Red	$1.55
X51248	1/2" square	White	Orange-Red	1.55
Y21248	3/4" H. x 5/8" W.	Black	Orange-Red	1.90
Y28248	3/4" H. x 5/8" W.	Black	Chartreuse	1.90
Y51248	3/4" H. x 5/8" W.	White	Orange-Red	1.90
Z21248	5/8" H. x 3/4" W.	Black	Orange-Red	1.90
Z28248	5/8" H. x 3/4" W.	Black	Chartreuse	1.90
Z51248	5/8" H. x 3/4" W.	White	Orange-Red	1.90

Economy of non-illuminated buttons with the vivid color-legend display of illuminated buttons. "Glo-Button" pushbuttons look and function like an illuminated button, but require no lamp or power. Mount on all pushbutton switches with standard .050" x .187" plungers, as Switchcraft Series 7000, 8000, 35000, 70000 and 71000 Multi-Switch® switches, and other switches having maintained plunger action with a maximum of 1/16" fallback. "Glo-Button" pushbuttons have a translucent front screen on which a legend is marked in an opaque color. The opaque color provides a background for the legend while the legend itself remains clear (Figs. A). An internal fluorescent illuminator is carried on a pusher which has two legs extending from the rear. When the button is depressed, the rear legs of the pusher bring the fluorescent illuminator flush with the screen which then lights up due to reflected ambient light, and projects a clearly visible legend, see Fig. B. All "Glo-Button" pushbuttons have black button housings and are available with standard legends: "A" thru "Z", "0" thru "50", and "ON", "OFF". Eight basic types of button are offered. To order, specify part number and add suffix letter or numeral to part number which describes desired legend. Example: To order 1/2" sq. "Glo-Button" pushbutton with black screen, orange-red illuminator and numeral "7", part number would read X21248-7.

SWITCHCRAFT® INC.

5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

MULTI-SWITCH SWITCHES



U.S. PAT. NOS: 2,831,075 AND 2,935,577
CANADIAN PATENT NOS. 598,218 (MAY 17, 1960)
AND 649,132 (SEPT. 25, 1962)

Basic design simplicity provides a unique multiple station pushbutton switch that's rugged, compact, versatile and completely flexible in switching functions. Order the Multi-Switch you now require from stock, and later change circuits and/or functions in the field by simply positioning adjustments of stop plate, latch bar spring. Standard Multi-Switch switches are available with these functions. Interlock, restores to normal any previously actuated station when another station is actuated.

Lock-out feature when combined with interlock prevents the operation of more than one pushbutton at a time. (Standard on all assembled interlock switches.) Non-Lock, momentary action of each station. All-Lock, accumulative locking of all stations with restoration of all stations to normal when release station is depressed. Push-Lock/Push-Release — pushbutton locks when depressed and is released when again depressed.

A. SERIES 7000 NON-ILLUMINATED SWITCHES

Heavy gauge steel switch frames mount on panels up to 3/8″ thick, with 3 5/16″ depth behind panel. Rugged, welded end-mounting brackets have four 8-32 tapped holes for ease of panel mounting. Attractive, round brown push-on-buttons supplied for each station, plus extra red button for use when switch requires a release station. Center-to-center distance between buttons is 5/8″. Steel plunger .050″ x .187″ accepts standard push-on-buttons and "Glo-Button" pushbuttons. Standard plunger is 1 1/8″ long, but can be supplied up to 5 3/4″ long on special order. Switch frames with buttons on 3/4″ centers are available in Series 8000 which has all the same features as Series 7000. Switches feature switch stacks with welded-crossbar palladium contacts rated at 2 amps, 200 watts, max., AC, non-inductive load. Series 7000 Multi-Switch switches are available with from 1 to 37 stations. Series 8000 from 1 to 31 stations. When ordering Series 8000 add 10% to prices. All switches are completely assembled and tested at the factory. All assemblies listed in the Part No. table have 2-C or 4-C switch stacks at each station. Additional switching and other options are available on special order. Only the most commonly used switch assemblies are listed below.

PART NUMBERS/2-C PER STATION (DIM. H - 25/32″ H₁ - 25/32″)

Interlock with Lock-Out*	U.S.A. List Price	Non-Lock†	All-Lock†	Push-Lock/ Push-Release†	No. of Stations	U.S.A. List Price
7200K-606	$20.45	7202-606	7203-606	7207-606	2	$16.40
7400K-606	30.60	7402-606	7403-606	7407-606	4	26.20
7600K-606	41.35	7602-606	7603-606	7607-606	6	36.65
7800K-606	52.15	7802-606	7803-606	7807-606	8	46.95
71000K-606	63.15	71002-606	71003-606	71007-606	10	57.55
71200K-606	74.25	71202-606	71203-606	71207-606	12	67.85

PART NUMBERS/4-C PER STATION (DIM. H - 25/32″ H₁ - 25/32″)

Interlock with Lock-Out*	U.S.A. List Price	Non-Lock†	All-Lock†	Push-Lock/ Push-Release†	No. of Stations	U.S.A. List Price
7200K-612	$25.50	7202-612	7203-612	7207-612	2	$21.45
7400K-612	44.00	7402-612	7403-612	7407-612	4	36.30
7600K-612	56.45	7602-612	7603-612	7607-612	6	51.80
7800K-612	72.40	7802-612	7803-612	7807-612	8	67.45
71000K-612	88.65	71002-612	71003-612	71007-612	10	82.95
71200K-612	104.95	71202-612	71203-612	71207-612	12	98.55

* Changeable functions in the field. † Not changeable in the field.

B. SERIES 21000 ILLUMINATED SWITCHES

Similar in switching functions and characteristics to non-illuminated Multi-Switch switch but, with these outstanding features: modern square button design with bright uniform front and side illumination provided by lamp diffusers; knurled retaining collar for quick easy front-of-panel lamp replacement. Two lamp voltages: 6V and 28V. Buttons with white jewels and white diffusers are furnished for switching and release stations. Standard switches listed below provide "L" type lighting (pushbuttons light in "IN" position). To have pushbutton light in "OUT" position, prefix Part No. with M (e.g. M2110). To have them light in both the "IN" and "OUT" positions, prefix with N. All switches include switch stacks at each station incorporating welded-crossbar palladium contacts rated at 2 amps, 200 watts, AC, non-inductive load. Center-to-center distance between buttons is 5/8″ on Series 21000, available with up to 37 stations in a row. Series 22000, buttons on 3/4″ centers, available up to 31 stations only. Add 10% to price of Series 21000 when ordering Series 22000. Series 21000 and 22000 switches are completely assembled and inspected at the factory. All assemblies listed in the Part No. table have 2-C or 4-C switch stacks at each station and provide "L" type lighting. Additional switching and/or other types of lighting available on special order. Only the most commonly used switch assemblies are listed. Refer to lamp listing for lamp data.

PART NUMBERS/2-C PER STATION (DIM. H - 13/16″ H₁ - 25/32″)

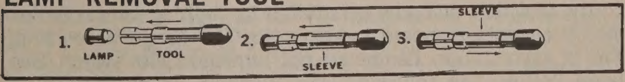
Interlock with Lock-Out*	U.S.A. List Price	Non-Lock†	All-Lock†	Push-Lock/ Push-Release†	No. of Stations	U.S.A. List Price
21200K-506	$28.40	21202-506	21203-506	21207-506	2	$24.40
21400K-506	47.20	21402-506	21403-506	21407-506	4	42.80
21600K-506	65.90	21602-506	21603-506	21607-506	6	61.25
21800K-506	84.90	21802-506	21803-506	21807-506	8	79.75
211000K-506	104.50	211002-506	211003-506	211007-506	10	99.00
211200K-506	133.10	211202-506	211203-506	211207-506	12	117.70

PART NUMBERS/4-C PER STATION (DIM. H - 13/16″ H₁ - 25/32″)

Interlock with Lock-Out*	U.S.A. List Price	Non-Lock†	All-Lock†	Push-Lock/ Push-Release†	No. of Stations	U.S.A. List Price
21200K-512	$33.55	21202-512	21203-512	21207-512	2	$29.60
21400K-512	57.40	21402-512	21403-512	21407-512	4	53.00
21600K-512	80.85	21602-512	21603-512	21607-512	6	74.35
21800K-512	105.05	21802-512	21803-512	21807-512	8	100.10
211000K-512	129.80	211002-512	211003-512	211007-512	10	124.30
211200K-512	155.10	211202-512	211203-512	211207-512	12	147.40

* Changeable functions in the field. † Not changeable in the field.

LAMP REMOVAL TOOL



Subminiature T-1¾ lamps are easily removed with Switchcraft No. P-2460 Lamp Removal Tool. (1) Simply slip tool over lamp; (2) slide sleeve forward; and (3) pull or slide lamp free. Orange plastic cap on tool serves as finger grip. Also useful on lamps for "Uniswitch" switches, Series LUS; littel Multi-Switch 37000, and DW Multi-Switch switches, Series 67000. Front access to lamp is required.

Switchcraft Part No. P-2460 .... U.S.A. List Price **$1.50**

E. SOLENOID RELEASE — "J" SERIES

A simple solenoid assembly which can be easily assembled on the end of a standard switch. Part No. J-1, is for use on interlocked switches. Part No. J-3, for use on all-lock switches with up to 12 stations. Both are for use in 115 volt, 60 cycle, AC circuits. Specify type of solenoid with your order for a standard Multi-Switch switch.

Switchcraft Part No. J-1 .... U.S.A. List Price **$12.60**
Switchcraft Part No. J-3 .... U.S.A. List Price **13.20**

D. LOCK-OUT BAR "K" SERIES

Prevents operation of more than one switching station at a time. Mounts on back of standard Multi-Switch Series 7000, 8000, 21000 and 22000 frames with two screws (furnished). Available from 2 to 37 stations for a single frame. Lock-Out Bars listed are for 5/8″ center plunger only; for 3/4″ centers, order special.

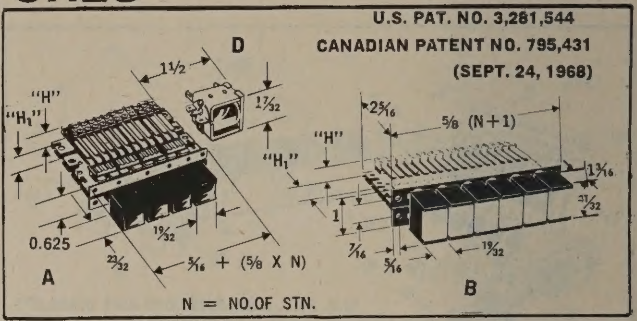
Part No.	No. of Stations	U.S.A. List Price	Part No.	No. of Stations	U.S.A. List Price
K-02	2	$3.95	K-08	8	$5.00
K-04	4	4.65	K-10	10	5.70
			K-12	12	6.40

SWITCHCRAFT® INC.

5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

LITTEL MULTI-SWITCH SWITCHES

Compact, versatile high-quality, multiple station pushbutton switches. Four standard functions available: Interlock — actuating a pushbutton automatically restores to normal the pushbutton previously actuated. Lock-Out — prevents operation of more than one pushbutton at a time. This feature is included on all interlock frames. Non-Lock — each pushbutton has momentary action. All-Lock — all pushbuttons, except release, lock when depressed. All pushbuttons restored to normal by actuating release pushbutton. Push-Lock/Push-Release — pushbutton locks when depressed and is released when again depressed. Buttons on ⅝″ centers. Switches available from 1 to 18 stations.


U.S. PAT. NO. 3,281,544

CANADIAN PATENT NO. 795,431

(SEPT. 24, 1968)

A. SERIES 35000 NON-ILLUMINATED SWITCHES

Switches mount on panels up to ⅛″ thick. Provides 6PDT switching in .6 sq. in. Narrow rectangular silhouette permits stacking in parallel rows on ¾″ centers. Only 2 5/16″ depth behind panel. End brackets have four 6-32 tapped mounting holes. A square black pushbutton is furnished for each station and an extra red pushbutton is supplied for use when switch has momentary release station (All-Lock function). Plungers made from .050″ x .187″ steel will accept std. push-on pushbuttons as well as Switchcraft pushbuttons. Series 590, A-590, C-590, D-590, E-590, 600 and "Glo-Button" pushbuttons Series X, Y, and Z. Refer to listings in the catalog. On 2-C PER STATION switches, each station includes two No. 83P switch stacks. On 4-C PER STATION switches, each station includes four No. 83P switch stacks. The following part numbers cover completely assembled and factory tested switches. Should you require optional accessories as different pushbuttons, solenoid release, etc., make your selection from these product listings and add them to the switch part number of your choice shown below. Only the most commonly used switches are listed here.

PART NUMBERS/2-C PER STATION (DIM. H - 15/32″ H_1 - 15/32″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
35021K-206	35022-206	35023-206	35027-206	2	$15.40
35041K-206	35042-206	35043-206	35047-206	4	24.75
35061K-206	35062-206	35063-206	35067-206	6	34.65
35081K-206	35082-206	35083-206	35087-206	8	44.55
35101K-206	35102-206	35103-206	35107-206	10	54.45
35121K-206	35122-206	35123-206	35127-206	12	64.55

PART NUMBERS/4-C PER STATION (DIM. H - 15/32″ H_1 - 15/32″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
35021K-212	35022-212	35023-212	35027-212	2	$20.45
35041K-212	35042-212	35043-212	35047-212	4	34.85
35061K-212	35062-212	35063-212	35067-212	6	49.90
35081K-212	35082-212	35083-212	35087-212	8	65.00
35101K-212	35102-212	35103-212	35107-212	10	80.10
35121K-212	35122-212	35123-212	35127-212	12	95.05

B. SERIES 37000 SINGLE LAMP ILLUMINATED SWITCHES

Identical in switching functions and characteristics as non-illuminated Series 35000, but features large rectangular shaped pushbuttons which serve as a color or legend coded panel indicator light which actuates up to 6PDT switching. Switches mount in parallel rows from 1″ centers and up. Depth behind panel 2 5/16″. Pushbuttons with large transparent clear display screen and white legend insert, can be hot stamped or engraved, are furnished for switching and release stations. On 2-C PER STATION switches, each station includes two No. 83P switch stacks, one No. H-83P lighting stack and one No. H (convenience) lighting spring. On 4-C PER STATION switches, each station includes four No. 83 switch stacks, one No. H-83P lighting stack and one No. H (convenience) spring. Lighting arrangements such as "L" — pushbuttons light in "IN" position; "M" — pushbuttons light in "OUT" position; and "N" — pushbuttons light in both "IN" and "OUT" positions, can be effected by wiring direct to the No. H-83; and No. H lighting stacks. A single 6V or 28V lamp can be used at each station, not furnished with switch. Refer to Lamp listing. The following part numbers cover completely assembled and factory tested switches. Should you require additional solenoid, etc., make your selection from the various listings and add to the switch part number you have chosen from listing below. Only the most commonly used switches are listed here.

PART NUMBERS/2-C PER STATION (DIM. H - ½″ H_1 - 15/32″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
37021K-1206	37022-1206	37023-1206	37027-1206	2	$24.40
37041K-1206	37042-1206	37043-1206	37047-1206	4	43.35
37061K-1206	37062-1206	37063-1206	37067-1206	6	62.65
37081K-1206	37082-1206	37083-1206	37087-1206	8	81.75
37101K-1206	37102-1206	37103-1206	37107-1206	10	100.75
37121K-1206	37122-1206	37123-1206	37127-1206	12	119.90

PART NUMBERS/4-C PER STATION (DIM. H - ½″ H_1 - 15/32″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
37021K-1212	37022-1212	37023-1212	37027-1212	2	$29.50
37041K-1212	37042-1212	37043-1212	37047-1212	4	53.45
37061K-1212	37062-1212	37063-1212	37067-1212	6	77.55
37081K-1212	37082-1212	37083-1212	37087-1212	8	102.10
37101K-1212	37102-1212	37103-1212	37107-1212	10	126.50
37121K-1212	37122-1212	37123-1212	37127-1212	12	150.70

B. SERIES 38000 TWIN LAMP ILLUMINATED SWITCHES

Same compact assembly and versatility as Series 37000, except features twin lamp illumination at each station for redundant or two color, split-face (alternate) lighting. On 2-C PER STATION switches, each station includes three No. H-83P lighting switch stacks and one No. H lighting spring. This arrangement provides up to 3PDT circuitry. One pole is needed for lighting lamps. On 4-C PER STATION switches, each station includes three No. H-83P lighting switch stacks, two No. 83P switch stacks and one No. H lighting spring. This combination offers 5PDT circuitry; of which, one pole is required for lighting lamps. Series 38000 accepts standard industry No. 718 flange base lamp. Two at each station. Lamps are not furnished with switch. See lamp listing. The following part numbers cover completely assembled and factory tested switches. Should you require optional accessories such as solenoid release, etc., make your selection from product listings and add them to the switch part number of your choice shown below.

PART NUMBERS/2-C PER STATION (DIM. H - ½″ H_1 - ½″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
38021K-1206	38022-1206	38023-1206	38027-1206	2	$30.70
38041K-1206	38042-1206	38043-1206	38047-1206	4	55.90
38061K-1206	38062-1206	38063-1206	38067-1206	6	81.05
38081K-1206	38082-1206	38083-1206	38087-1206	8	106.90
38101K-1206	38102-1206	38103-1206	38107-1206	10	132.00
38121K-1206	38122-1206	38123-1206	38127-1206	12	157.30

PART NUMBERS/4-C PER STATION (DIM. H - ½″ H_1 - ½″)

Interlock with Lock-Out	Non-Lock	All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
38021K-1212	38022-1212	38023-1212	38027-1212	2	$35.75
38041K-1212	38042-1212	38043-1212	38047-1212	4	66.00
38061K-1212	38062-1212	38063-1212	38067-1212	6	96.45
38081K-1212	38082-1212	38083-1212	38087-1212	8	128.70
38101K-1212	38102-1212	38103-1212	38107-1212	10	157.30
38121K-1212	38122-1212	38123-1212	38127-1212	12	188.10

ACCESSORIES FOR MULTI-SWITCH SWITCHES

D. SERIES NJ SOLENOID RELEASE

A simple solenoid assembly which can be added to the end of a standard Series 35000, 37000, or 38000, littel Multi-Switch switch to provide electrical release of activated stations. No. NJ-1 designed to release up to 18 interlock stations. No. NJ-3 releases up to 12 all-lock stations. Both are used in 115 VAC, 60 Hz circuits. No. NJ-2 performs the "lock-up" functions, i.e., energizing solenoid immediately immobilizes all switch stations. Actuated stations cannot be released and unactuated; stations cannot be operated until solenoid is de-energized. No. NJ-4 (releases up to 18 interlock stations) and No. NJ-7 (releases up to 12 all-lock stations) are rated at 24 VDC. No. NJ-5 (releases up to 18 interlock stations) and No. NJ-8 (releases up to 12 all-lock stations) are rated at 28 VDC. No. NJ-6 (releases up to 18 interlock stations) and No. NJ-9 (releases up to 12 all-lock stations) are rated at 48 VDC.

Part No.	Function Used-On	Voltage	Max. Duty Cycle	U.S.A. List Price
NJ-1	Interlock	115 VAC	25%	$12.10
NJ-2	Lock-Up	115 VAC	100%	12.10
NJ-3	All-Lock	115 VAC	10%	12.10
NJ-4	Interlock	24 VDC	25%	12.10
NJ-5	Interlock	28 VDC	25%	12.10
NJ-6	Interlock	48 VDC	25%	12.10
NJ-7	All-Lock	24 VDC	10%	12.10
NJ-8	All-Lock	28 VDC	10%	12.10
NJ-9	All-Lock	48 VDC	10%	12.10

LAMPS FOR ILLUMINATED SWITCHES

Lamps are not normally supplied with illuminated Switchcraft switches. See table below for recommendations of lamp to be used.

Part No.	Description	Recommended Switch	List Price U.S.A.
P-1217	6 V, 200 ma., Ind. No. 1786, Screw base	1	$1.55
P-1218	28 V, 40 ma., Hudson No. 369, Screw Base	2	2.60
P-1518	110-125 VAC, 2 ma., Ind. No. NE-2J, Flange Base Neon	3, 8	4.60
P-1519*	110-125 VAC, 1 ma., Ind. No. NE-2D, Flange Base Neon	3	7.75
P-1593-1	28 V, 40 ma., Ind. No. 327, T-1¾ Flange Base	3, 4, 6, 8	1.70
P-1593-2	6 V, 200 ma., Ind. No. 328, T-1¾ Flange Base	3, 4, 6, 8	1.40
P-1593-4	14 V, 80 ma., Ind. No. 330, T-1¾ Flange Base	3, 4, 6, 8	1.70
P-1593-5	6.3 V, 75 ma., Ind. No. 377, T-1¾ Flange Base, Long Life	3, 4, 6, 8	1.70
P-1593-6	28 V, 40 ma., Ind. No. 387, T-1¾ Flange Base, Long Life	3, 4, 6, 8	1.45
P-1593-7	6 V, 200 ma., Ind. No. 381, T-1¾ Flange Base, Long Life	3, 4, 6, 8	1.75
P-1890	6 V, 126 ma., (or 5 V, 115 ma.) Ind. No. 718, T-1 Submin. Flange Base	5, 8	4.00
P-2193	105-125 VAC, 0.8 ma., Ind. No. A1H Neon	3	3.85
P-2290	6 V, 75 ma., Ind. No. 7377, T-1¾ Bi-Pin	7	1.85

1. Lamp supplied with Series 25000 and 27000 "Lever-Lite". Also for use with "NF-Lite" and "Littel-Lite" switches.
2. Series 25000 and 27000 "Lever-Lite", "NF-Lite", and "Littel-Lite" switches.
3. Series 15000, 21000, and 22000.
4. Series 37000 "Push-Lite", "CordMASTER", & "Lever-Lite" Series 84000 switches and "PL" Indicators.
5. Series 38000.
6. Series 67000.
7. "Uniswitch" switches.
8. Series OA, OB Orcon switches; Series OJ, OK Orcon indicators. (P-1518 not available with Series OJ indicator.)

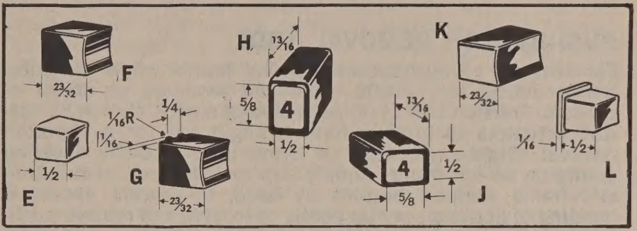
IMPORTANT NOTE: Use Part No. T-14 Lamp Socket to convert Series 25000 and 27000 "Lever-Lite" switches to accept this lamp. Use Part No. T-1 Lamp Adapter to convert sockets on Series 15000, 21000, 22000, 67000. "Push-Lite" switches and "PL" Indicators to accept Part No. P-1890 lamp.

IMPORTANT NOTE: Use Part No. T-2 Lamp Adapter to convert sockets on Series OA, OB Orcon switches and Series OJ, OK Orcon indicators. to accept Part No. P-1890.

* **Caution:** When any switch series utilizes neon type lamps, the lamp shell must be properly grounded to eliminate shock hazard when pushbutton is removed. Bent lamp terminal is common to lamp shell. Permanent ground should be established either by proper line, polarization or use of an isolation transformer.

PUSHBUTTONS FOR MULTI-SWITCH SWITCHES

Non-illuminated pushbuttons for Switchcraft Series 7000, 8000, 35000, 70000 and 71000 Multi-Switch switches, and all other pushbutton switches with a standard .50″ x .187″ plunger. Also fit on Series 5000 "Push-Push" switch.



E.

Series 590, small pushbutton with concave face.

F.

Series A-590, square with lateral concave face.

G.

Series A-590-T2 and A-590-T4, same as Series A-590 except base of pushbutton has tabs to prevent removal of button from front of panel.

H. and J.

Series C-590, and D-590, rectangular pushbuttons with recessed face. Pushbuttons have black housing with white face. Legend on face is black. Available legends are "A" thru "Z", "0" thru "60", and "ON", "OFF". Series C-590 mounts on multiple station pushbutton switches with plungers on ⅝″ centers; Series D-590 — plungers on ¾″ centers. To order: specify Series number and add suffix letter or numeral to part number which describes desired legend. Example: To order C-590 with letter "A" part number would read C-590-A.

K.

Series E-590, dual pushbutton simultaneously actuates two pushbutton stations (⅝″ plunger centers) or individual switches mounted on 1¼″ centers or more. Concave face.

L.

Series 600, similar to Series 590, except has 19/32″ square shoulder. Refer to listings for data on "Glo-Button" pushbuttons, Series X, Y, and Z.

NOTE: Pushbuttons ordered for use with Series 70000 and 71000 switches are not normally assembled to the switches at the factory. For a nominal extra charge, pushbuttons will be installed on switches prior to delivery from factory.

Part No.	Fig.	Color	Size W (″)	Size H (″)	U.S.A. List Price
591	E	Red	½	½	$0.35
592	E	Black	½	½	.35
593	E	Green	½	½	.35
594	E	Blue	½	½	.35
595	E	White	½	½	.35
596	E	Brown	½	½	.35
598	E	Yellow	½	½	.35
A-591	F	Red	19/32	19/32	.65
A-592	F	Black	19/32	19/32	.65
A-593	F	Green	19/32	19/32	.65
A-594	F	Blue	19/32	19/32	.65
A-595	F	White	19/32	19/32	.65
A-596	F	Brown	19/32	19/32	.65
A-598	F	Yellow	19/32	19/32	.65
A-591-T2	G	Red	19/32	19/32 (1)	.70
A-591-T4	G	Red	19/32	19/32 (2)	.70
A-592-T2	G	Black	19/32	19/32 (1)	.70
A-592-T4	G	Black	19/32	19/32 (2)	.70
A-593-T2	G	Green	19/32	19/32 (1)	.70
A-593-T4	G	Green	19/32	19/32 (2)	.70
A-594-T2	G	Blue	19/32	19/32 (1)	.70
A-594-T4	G	Blue	19/32	19/32 (2)	.70
A-595-T2	G	White	19/32	19/32 (1)	.70
A-595-T4	G	White	19/32	19/32 (2)	.70
A-596-T2	G	Brown	19/32	19/32 (1)	.70
A-596-T4	G	Brown	19/32	19/32 (2)	.70
A-598-T2	G	Yellow	19/32	19/32 (1)	.70
A-598-T4	G	Yellow	19/32	19/32 (2)	.70
C-590	H	Black Housing	¾	19/32	1.25
D-590	J	White Face	¾	⅝	1.25
E-591	K	Red	1 15/64	19/32	.80
E-592	K	Black	1 15/64	19/32	.80
E-593	K	Green	1 15/64	19/32	.80
E-594	K	Blue	1 15/64	19/32	.80
E-595	K	White	1 15/64	19/32	.80
E-596	K	Brown	1 15/64	19/32	.80
E-598	K	Yellow	1 15/64	19/32	.80
601	L	Red	½	½ (3)	.40
602	L	Black	½	½ (3)	.40
603	L	Green	½	½ (3)	.40
604	L	Blue	½	½ (3)	.40
605	L	White	½	½ (3)	.40
606	L	Brown	½	½ (3)	.40
608	L	Yellow	½	½ (3)	.40

1. Additional 1/16″ height due to tabs. 2. Additional ⅛″ height due to tabs. 3. 19/32″ sq. shoulder.

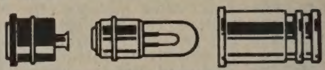
ACCESSORIES FOR MULTI-SWITCH SWITCHES

PUSHBUTTON REMOVAL TOOL

For removal of pushbuttons on DW Multi-Switch switches. Series 70000 and 71000, when not mounted on panel or chassis. Arms on tool fit on each side of switch station "cross-rib" actuators to give uniform lifting force for pushbutton removal. Right-angle tips on arms offer positive levering points on switch frame. Simply slip tool between pushbutton and frame; support buttons by hand, to prevent excessive bending of actuator; pry up gently to loosen, and remove pushbuttons. Rugged .050" thick steel construction is shaped for easy use and virtually infinite life.

Switchcraft Part No. A-1125 .... U.S.A. List Price **$6.25**

LAMP ADAPTER

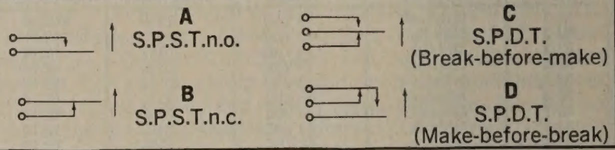


Lamp Adapter, Part No. T-1, converts T-1 lamp base to a T-1¾ lamp base. For Series 21000, 22000, 37000, and 67000. Adapter permits use of T-1 (P-1890) midget flange base in sockets designed for T-1¾ lamps.

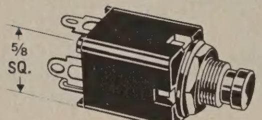
Switchcraft Part No. T-1 .... U.S.A. List Price **$0.90**

BASIC SCHEMATIC CIRCUITS

Switch circuitry can be described as combinations of basic schematic circuits as shown. N.O. means normally open; N.C. means normally closed.



HI-D SWITCH® SWITCHES



Series H-100, H-200—compact momentary action switches. Molded box body protects contact springs. Low electrical leakage, low capacity. Integral fine-silver plated contacts for use in circuits where contact resistance is not critical. One piece plastic button and shaft in red — Series H-100, and black — Series H-200. Mounts on ⅝" centers in either of two planes; in a single ⅜" hole in panels up to 5/32" thick. Depth behind panel 1 3/32". Mtg. hex nut & flat washer supplied. NEW Series H-100PC & H-200PC — Same as Series H-100 & H-200 except terminals are printed circuit type for mtg. on single- or double-sided or multilayer boards. Standoff shoulders on terminals provide stable mtg.

Part Numbers		Action	Schematic Circuit	U.S.A. List Price
Red Button	Black Button			
H-101	H-201	S.P.S.T.n.o.	1-A	$1.50
H-102	H-202	S.P.S.T.n.c.	1-B	1.50
H-103	H-203	S.P.D.T.	1-C	1.75
H-101PC	H-201PC	S.P.S.T.n.o.	1-A	1.50
H-102PC	H-202PC	S.P.S.T.n.c.	1-B	1.50
H-103PC	H-203PC	S.P.D.T.	1-C	1.75

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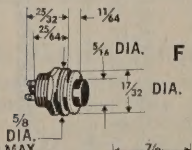
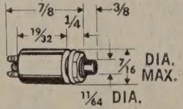
"BUTTON-SWITCH" SWITCHES



F

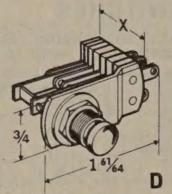
G



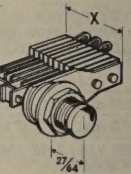
Series 903, 923. Unusually small, momentary action pushbutton switches. Enclosed in metal housing; black or red plastic button. Series 903. Fig. F. back panel mounting; 15/32" hole, mounts in panels up to 19/64" thick. Series 923. Fig. G. front panel mounting; ¼" hole, mounts in panels up to 5/32" thick. Both rated at 250 mils, AC, non-inductive load, 30 watts max.

Part Numbers		Action	Schematic Circuit	U.S.A. List Price
Red Button	Black Button			
903	913	S.P.D.T. "Break-Make"	1-C	$2.00
903D	913D	S.P.D.T. "Make-Break"	1-D	2.00
923	933	S.P.D.T. "Break-Make"	1-C	2.10
923D	933D	S.P.D.T. "Make-Break"	1-D	2.10

NON-LOCKING FLAT FRAME SWITCHES



D



E

D.

"FF" Switch switches. Series 1000. Flat frame construction offers multiple pole switching with minimum depth behind panel. "Welded silver cross bar contacts rated at 8 A, 125 VAC. 1-pc. black button and shaft. ⅜" diameter threaded shank; mounts in panels up to ¼" thick.

E.

"NF" Switch switches, Series 4000, same as "FF" Switch switches except smaller springs. Ideal for mounting in ultra-compact equipment. Only ½" W.; 1⅝" L.; mounts in ⅜" hole in panels up to 5/32" thick.

Part No. Series 1000	"X" Dim.	Part No. Series 4000	"X" Dim.	Action	Schematic Circuit	U.S.A. List Price
1001	⅝"	4001	9/16"	S.P.S.T.n.o.	1-A	$2.00
1003	⅝"	4003	¾"	S.P.D.T.	1-C	2.15
1004	13/16"	4004	¾"	D.P.S.T.n.o.	2-A	2.30
1006	⅞"	4006	1"	D.P.D.T.	2-C	2.75
1009	1⅛"	4009	1 3/16"	3P.D.T.	3-C	3.95

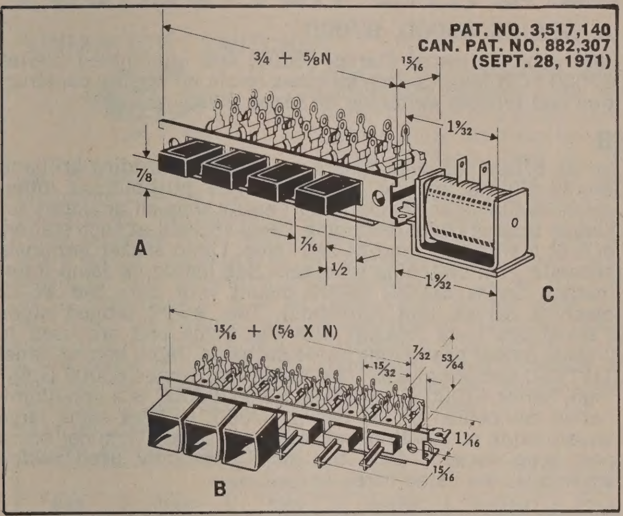
C. SOLENOID RELEASE — DW SERIES

See illustration on next page.

Simple pull-type, solenoid assemblies are available that can be added on the end of a Series 65000, 66000, 67000, 70000, 71000 DW Multi-Switch switch. Solenoid assembly, mounting hardware, screws and instruction sheet furnished. Specify separately.

Part No.	Description	U.S.A. List Price
DW-1	Used with interlock function in switches having 1 to 12 stations. Operates from 115V AC, 60 Hz source. Coil resistance is 361Ω. Duty cycle is 20%.	$7.85
DW-3	Used with all-lock function in switches having 1 to 12 stations. Operates from 115V AC, 60 Hz source. Coil resistance is 130Ω. Duty cycle is 10%.	7.85
DW-4	Same as DW-1 except operates from 24V DC. Coil resistance 14.2Ω.	10.40
DW-7	Same as DW-3 except operates from 24V DC. Coil resistance 8.96Ω.	10.40

DW MULTI-SWITCH SWITCHES



New, economy multiple station pushbutton switch. The DW (double-wipe) Multi-Switch switch is available up to 18 stations in a single row; or on special order, ganged assemblies with interaction between rows. Max. switching per station is 4-C (D.P.D.T.). Each station utilizes specially designed switching modules with U-shaped, high reliable bifurcated contactors rated at 3 amps. A.C.; 0.5 amp. D.C., 125 V. non-inductive load. DW Multi-Switch switches are available in 5 series: 65000, 66000, 67000, 70000, and 71000. All provide four standard functions: Interlock — actuating and pushbutton automatically restores to normal the pushbutton previously actuated. Lock-Out — prevents operation of more than one pushbutton at a time. This feature is included on all interlock switches. Non-Lock — each pushbutton has momentary action. All-Lock — all pushbuttons, except releases, lock when depressed. All pushbuttons restored to normal by actuating (momentary) release pushbutton. Push-Lock/Push-Release — pushbuttons lock when depressed and release when again depressed. All Series—pushbuttons on ⅝″ centers. DW Multi-Switch swtiches are available in single row assemblies with irterlock and all-lock functions from one to twelve stations; with non-lock and push-lock/push-release functions up to eighteen stations.

A. SERIES 65000

Series 65000 switches are completely assembled and tested at the factory. All standard assemblies have 2-C and/or 4-C switch modules with solder-lug terminals. Integral black pushbutton-actuators at each station. Eliminates possible pushbutton loss. Assemblies, from 1 to 18 stations mount with only two No. 6 screws (not furnished). Depth behind panel — 2-C assemblies — 1$\frac{1}{16}$″; 4-C assemblies — 1$\frac{15}{16}$″. Overall switch height is $\frac{27}{32}$″. The following part numbers cover a completed switch assembly. Only the most commonly used switch assemblies are listed here.

PART NUMBERS/2-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
65021K-206	65022-206	2	$3.40
65041K-206	65042-206	4	5.50
65061K-206	65062-206	6	7.90
65081K-206	65082-206	8	10.30
65101K-206	65102-206	10	12.75
65121K-206	65122-206	12	15.20

All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
65023-206	65027-206	2	$3.60
65043-206	65047-206	4	5.60
65063-206	65067-206	6	8.00
65083-206	65087-206	8	10.35
65103-206	65107-206	10	13.25
65123-206	65127-206	12	15.45

PART NUMBERS/4-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
65021K-212	65022-212	2	$4.60
65041K-212	65042-212	4	7.45
65061K-212	65062-212	6	11.25
65081K-212	65082-212	8	14.65
65101K-212	65102-212	10	17.85
65121K-212	65122-212	12	21.50

All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
65023-212	65027-212	2	$4.70
65043-212	65047-212	4	7.85
65063-212	65067-212	6	11.35
65083-212	65087-212	8	14.90
65103-212	65107-212	10	18.10
65123-212	65127-212	12	21.15

B. SERIES 70000, 71000

New versatile DW Multi-Switch switches. Series 70000, 71000 retain all features of Series 65000, but feature "Cross-Rib" actuators which accept 11 different Switchcraft pushbuttons, plus many other types and styles. Series 70000 switches have a $\frac{15}{16}$″ long "Cross-Rib" actuator to accept Series 590, A-590, A-590-T2, A-590-T4, C-590, D-590, E-590, 600 & "Glo-Button" pushbuttons Series X, Y, Z. Series 71000 have ¾″ long "Cross-Rib" actuator to accept same pushbuttons as Series 70000 except Series A-590, E-590. Pushbuttons must be ordered separately as they are not supplied with switches. See listings for pushbutton data. Only the most commonly used switch assemblies are listed here:

PART NUMBERS 2-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
70021K-206	70022-206	2	$3.40
70041K-206	70042-206	4	5.50
70061K-206	70062-206	6	7.90
70081K-206	70082-206	8	10.30
70101K-206	70102-206	10	12.75
70121K-206	70122-206	12	15.20

All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
70023-206	70027-206	2	$3.60
7C043-206	70047-206	4	5.60
70063-206	70067-206	6	8.00
70083-206	70087-206	8	10.35
70103-206	70107-206	10	12.85
70123-206	70127-206	12	15.45

PART NUMBERS 4-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
70021K-212	70022-212	2	$4.60
70041K-212	70042-212	4	7.45
70061K-212	70062-212	6	11.25
70081K-212	70082-212	8	14.65
70101K-212	70102-212	10	17.85
70121K-212	70122-212	12	21.50

All-Lock	Push-Lock/ Push-Release	No. of Stations	U.S.A. List Price
70023-212	70027-212	2	$4.70
70043-212	70047-212	4	7.85
70063-212	70067-212	6	11.35
70083-212	70087-212	8	14.90
70103-212	70107-212	10	18.10
70123-212	70127-212	12	21.15

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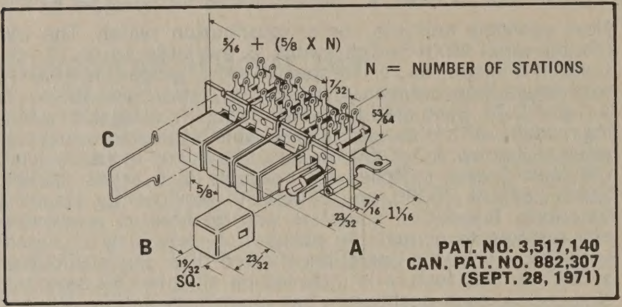
PUSHBUTTON SWITCHES



PAT. NO. 3,517,140
CAN. PAT. NO. 882,307
(SEPT. 28, 1971)

C. METAL BARRIERS FOR SERIES 67000

Sturdy wire barriers fit between pushbuttons and prevent accidental simultaneous actuation of adjacent pushbuttons. Can be installed on Series 67000 only.

Switchcraft Part No. P-2359 .... U.S.A. List Price **$5.00** per pkg. of 25

DW MULTI-SWITCH SWITCHES

SERIES 66000/2-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
66021K-506	66022-506	2	$4.55
66041K-506	66042-506	4	6.75
66061K-506	66062-506	6	9.80
66081K-506	66082-506	8	12.80
66101K-506	66102-506	10	15.60
66121K-506	66122-506	12	18.20
All-Lock	**Push-Lock/ Push-Release**	**No. of Stations**	**U.S.A. List Price**
66023-506	66027-506	2	$4.65
66043-506	66047-506	4	7.10
66063-506	66067-506	6	9.90
66083-506	66087-506	8	12.85
66103-506	66107-506	10	17.35
66123-506	66127-506	12	19.60

SERIES 67000/2-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
67021K-506	67022-506	2	$5.30
67041K-506	67042-506	4	8.80
67061K-506	67062-506	6	12.55
67081K-506	67082-506	8	16.70
67101K-506	67102-506	10	20.20
67121K-506	67122-506	12	24.15
All-Lock	**Push-Lock/ Push-Release**	**No. of Stations**	**U.S.A. List Price**
67023-506	67027-506	2	$5.45
67043-506	67047-506	4	8.90
67063-506	67067-506	6	12.65
67083-506	67087-506	8	16.95
67103-506	67107-506	10	20.50
67123-506	67127-506	12	24.40

A. SERIES 66000, 67000

New non-illuminated (Series 66000) and illuminated (Series 67000) DW Multi-Switch switches retain all quality construction and reliable switching of Series 65000.

B.

Series 67000 has large square pushbutton, providing brilliant, evenly-diffused lighting. Standard white pushbuttons (other colors available on special order) easily snap-off actuators for simple front-of-panel relamping. Lamp sockets, at each station, accept a single 6V, and/or 28V lamp. Lamp socket terminals separate from switching terminals. See listing for lamp information. Series 66000, 67000 mount with only two #6-32 machine screws (not furnished). Two #6-32 tapped studs ("stand offs") are integral with the frame and are used to provide proper positioning of the switches. Depth behind panel 1½″ (2-C switching); 2⅜″ (4-C switching). Series 66000 is 27⁄32″ high; Series 67000 is 1 1⁄16″ high. Series 66000 is a non-illumination companion to the Series 67000. Utilizes same large square white pushbutton, but less lamp socket terminal board and lamp sockets. Only the most commonly used switch assemblies are listed here:

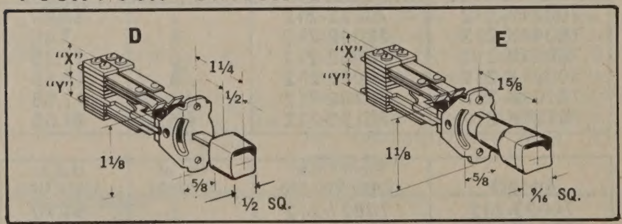
SERIES 66000/4-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
66021K-512	66022-512	2	$5.45
66041K-512	66042-512	4	9.05
66061K-512	66062-512	6	13.10
66081K-512	66082-512	8	17.10
66101K-512	66102-512	10	21.20
66121K-512	66122-512	12	24.30
All-Lock	**Push-Lock/ Push-Release**	**No. of Stations**	**U.S.A. List Price**
66023-512	66027-512	2	$5.55
66043-512	66047-512	4	9.20
66063-512	66067-512	6	13.20
66983-512	66087-512	8	17.35
66103-512	66107-512	10	21.30
66123-512	66127-512	12	24.60

SERIES 67000/4-C PER STATION

Interlock with Lock-Out	Non-Lock	No. of Stations	U.S.A. List Price
67021K-512	67022-512	2	$6.65
67041K-512	67042-512	4	11.50
67061K-512	67062-512	6	16.55
67081K-512	67082-512	8	22.05
67101K-512	67102-512	10	26.95
67121K-512	67122-512	12	32.20
All-Lock	**Push-Lock/ Push-Release**	**No. of Stations**	**U.S.A. List Price**
67023-512	67027-512	2	$6.75
67043-512	67047-512	4	11.60
67063-512	67067-512	6	16.70
67083-512	67087-512	8	22.35
67103-512	67107-512	10	27.20
67123-512	67127-512	12	31.80

"PUSH-PUSH" SWITCHES



Push-to-lock, push-to-release or momentary action pushbutton switches. Welded cross-bar palladium contacts rated at 2 amps, 200 watts, max., non-inductive load. Mount with two 3-48 screws (not supplied) on ⅝″ centers. Depth behind panel, 2⅞″. Series 5000, Fig. D, non-illuminated, supplied with square brown button. Series 15000, Fig. E, illuminated; available in three lighting arrangements. "L" button lights in "IN" position; "M" button lights in "OUT" position; "N" button lights in "IN" and "OUT" positions. Series 15000 part numbers listed below provide "L" type lighting. For "M" type prefix part no. with "M"; for "N" type prefix part no. with "N". Series 15000 supplied less lamp. 6V or 28V lamps can be used. See listing for lamp data.*

*Add suffix "L" to part number to indicate locking type.

NON-ILLUMINATED SERIES 5000

Part Number Non-Locking*	Action	Schematic Circuit	"X" Dim.	"Y" Dim.	U.S.A. List Price
5006	D.P.D.T.	2-C	—	½″	$10.00
5012	4P.D.T.	4-C	9⁄16″	½″	13.35

ILLUMINATED SERIES 15000

15006	D.P.D.T.	2-C	11⁄32″	½″	$13.40

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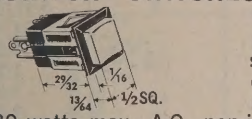
PUSHBUTTON SWITCHES

"UNISWITCH" SWITCHES



New, low cost momentary action pushbutton switches. Only 11/16″ sq. and mount in a single panel cutout, .615″ sq. from front of panel. Contacts rated at 250 ma., 30 watts max.; A.C., non-inductive load. Series US non-illuminated. Series LUS illuminated. Use one 6V, ½ watt, T-1¾ bi-pin lamp. (Not supplied with switch.) See lamp listings. Lamp replaced from front of panel. Both switches incorporate a special "Adjusto-Clip" which allows simple, "snap- lock" mounting. The "Uniswitch" switches mount in panels 13/16″ min. to 17/64″ max. thick in .615″ sq. holes. Depth behind panel only 15/16″ max. "Uni-switch" switches available in 1-A circuit (SPST n.o.). Solder lug terminals for switching also accept #5-40 screw connections. NEW P.C. terminals mount in single- or double-sided boards or multilayers. NEW solder/quick-connect terminals accept AMP Series 110 receptacles.

PART NUMBERS

SOLDER/SCREW TERMINALS

Pushbutton Colors					U.S.A. List Price
Red	Green	Blue	White	Yellow	
LUS-01-1	LUS-03-1	LUS-04-1	LUS-05-1	LUS-08-1	$2.20
US-01-1	US-03-1	US-04-1	US-05-1	US-08-1	1.70

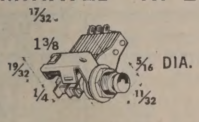
PRINTED CIRCUIT TERMINALS

LUS-01-1PC	LUS-03-1PC	LUS-04-1PC	LUS-05-1PC	LUS-08-1PC	$2.20
US-01-1PC	US-03-1PC	US-04-1PC	US-05-1PC	US-08-1PC	1.70

SOLDER/QUICK-CONNECT

LUS-01-1ST	LUS-03-1ST	LUS-04-1ST	LUS-05-1ST	LUS-08-1ST	$2.20
US-01-1ST	US-03-1ST	US-04-1ST	US-05-1ST	US-08-1ST	1.70

ILLUMINATED "NF-LITE" SWITCHES



Series 4100 and 4200 "NF-Lite" illuminated switches indicate switching and circuit functions at a glance. Flat frame construction provides multiple pole momentary action switching. Lighting circuit is independent of switching circuit. Ideal for control panel or press-to-test applications. Contacts are welded silver cross bar rated at 8 amps, 125 VAC.

Series 4100, uses single miniature lamp; 6V or 28V. Light from lamp is filtered through color chip to clear plastic pushbutton. Various colored chips can be inserted at any time. Series 4200, same as Series 4100, except utilizes two lamps for greater illumination or color coding of two circuit conditons. Both series require 11/16″ min., 15/16″ max., depth behind panel depending on size of stack; mounts in ⅜″ hole in panels up to ¼″ thick. Series 4100 furnished with one kit of 4 color chips (red, amber, green, and yellow). Series 4200 furnished with two kits. Lamps must be purchased separately. See lamp listing.

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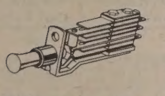
SERIES 4100

Part No.	Action	Schematic Circuit	U.S.A. List Price
4106	D.P.D.T.	2-C	$4.40

SERIES 4200

4206	D.P.D.T.	2-C	$625

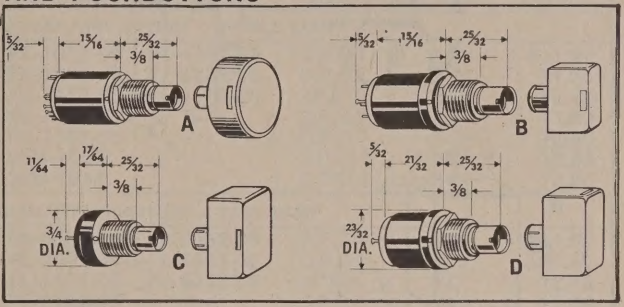
"TT-SWITCH" MINIATURE SWITCHES



Series TT-300 "tini-telephone" switch. Small, compact. Ideal for control panels and chassis where space is at a premium and reliable switching is needed. Available in momentary (non-locking) or Push-to-Lock/Pull-to-Release actions. White plastic knob. Special nickel springs with welded crossbar palladium contacts rated at 2 amps, 200 watts, non-inductive load. Mounts with No. 3-28 screw (not furnished) in ¼″ dia. hole in panels to ⅜″ thick. Depth behind panel 23/16″.

Part No.				
Non-Locking	Push-Lock/ Pull-Release	Action	Schematic No.	U.S.A. List Price
TT-301	TT-301L	S.P.S.T.n.o.	1-A	$3.80
TT-306	TT-306L	D.P.D.T.	2-C	5.50
TT-307	TT-307L	3P.S.T.n.o.	3-A	5.55

ORCON® SWITCHES, INDICATORS AND PUSHBUTTONS



A. ORCON PUSHBUTTON SWITCHES

Series OA Orcon Switches: Featuring 2PDT through 6PDT circuitry. Contacts are coin silver, cobalt-gold plated with self-aligning SNAP-SLIDE lifting and wiping action. Rated at 2 amps, 60 watts max., DC, non-inductive load; 3 amps, 90 watts max., DC, non-inductive load; 2 amps, 250 watts max., AC, non-inductive load; or 3 amps, 375 watts max., AC, non-inductive load. Threaded shoulders ½″-32 or 9/16″-32 for direct or subpanel mounting. Non-turn key prevents switch from turning in mounting hole. Hex nut and washers supplied. Overall diameter is ¾″; mounting centers as close as ¾″. Numbered solder terminals are silver laminated brass, cobalt-gold plated; pin or turret terminals for hard wiring. Accommodates T-1¾ incandescent lamp. T-1 incandescent bulb with T-2 adapter. See listing for lamp data. Uses Series OP-10, OP-30 and OP-50 Pushbuttons. Lamps not supplied with switches.

B.

Series OB Orcon Switches: Similar to Series OA Orcon Pushbutton Switch, except circuitry is SPDT and DPDT in a 23/32″ diameter case.

SERIES OA

Momentary Positive Action	Alternate Action	Push-Lock/ Push-Release	Circuitry	Schematic*	U.S.A. List Price
OA-2106	OA-6106	OA-7106	2PDT	2	$11.00
OA-2112	OA-6112	OA-7112	4PDT	4	13.25
OA-2118	OA-6118	OA-7118	6PDT	6	15.45
Momentary Silent			Circuitry	Schematic*	U.S.A. List Price
OA-9106			2PDT	2	$10.50
OA-9112			4PDT	4	12.70
OA-9118			6PDT	6	14.90

SERIES OB

Momentary Positive Action	Alternate Action	Push-Lock/ Push-Release	Circuitry	Schematic*	U.S.A. List Price
OB-2103	OB-6103	OB-7103	SPDT	1	$9.90
OB-2106	OB-6106	OB-7106	DPDT	2B	11.00
Momentary Silent			Circuitry	Schematic*	U.S.A. List Price
OB-9103			SPDT	1	$9.40
OB-9106			DPDT	2B	10.50

*See next page for schematics.

ORCON INDICATORS

Orcon Indicators: Lighted indicators make panel displays more attractive while adding easy visual recognition through a variety of pushbuttons (screens) and colors. Electrical ratings are 30 volts, DC or 125 volts AC. Each indicator is matched in size, shape and button configurations with Series OA and OB Orcon pushbutton switches. Uses Series OP-10, OP-30 and OP-50 Orcon pushbuttons. Lamps and adapters not supplied with indicators. See listing for lamp data.

C. Series OJ: Similar to Series OA Orcon pushbutton switch.
Switchcraft Part No. OJ-0100 .... U.S.A. List Price **$6.60**

D. Series OK: Similar to Series OB Orcon pushbutton switch.
Switchcraft Part No. OK-0100 .... U.S.A. List Price **$7.20**

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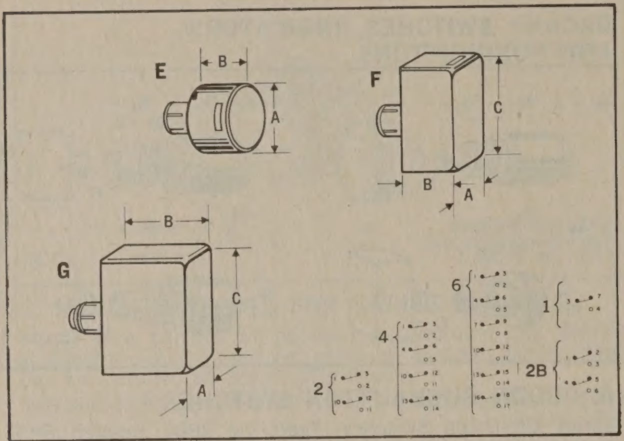
PUSHBUTTON SWITCHES



E. ORCON PUSHBUTTONS

Series OP-10 Pushbuttons: Handsome, functional, round pushbuttons have glossy exterior finish and are molded of stable plastic in colors. Used with Series OA and OB Orcon switches and Series OJ and OK Orcon indicators. Uses 1 lamp.

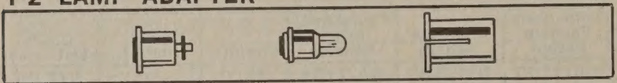
F.

Series OP-30 Pushbuttons: Same as Series OP-10 except pushbuttons are square. Part No. OP-37 uses 2 lamps (redundant lighting).

G.

Series OP-50 Pushbuttons: Same as Series OP-10 except pushbuttons are rectangular. Part Nos. OP-59, OP-60 and OP-61 use 2 lamps (redundant lighting).

T-2 LAMP ADAPTER



Lamp Adapter No. T-2, converts T-1 lamp base to a T-1¾ base. For Series OA and OB Orcon pushbutton switches and Series OJ and OK Orcon indicators.

Switchcraft Part No. T-2 .... U.S.A. List Price **$1.00**

Series OP-10 Round	Size		U.S.A. List Price
	A	B	
OP-11	½	—	$1.50
OP-12	⅝″	—	1.50
OP-13	¾″	½″	1.50
OP-15	1″	—	1.50
OP-16	1⅛″	—	1.50

Suffix Letter	Color	Suffix Letter	Color
R	Red	W	White
X	Black	Y	Yellow
G	Green	E	Orange
B	Blue	C	Clear

SPECIFYING NOTE: To order pushbuttons, color must be specified. To specify pushbuttons, add dash (-) and suffix letter to indicate color. For example: No. OP-11-C is the complete part number for a ½″ diameter, clear, Series OP-10 Pushbutton.

Series OP-30 Square	Size		U.S.A. List Price
	A	B	
OP-31	½″	½″	$1.50
OP-32	⅝″	½″	1.50
OP-33	¾″	½″	1.50
OP-34	⅞″	½″	1.50
OP-35	1″	½″	1.50
OP-36	1⅛″	½″	1.50
OP-37*	¾″	1″	1.50

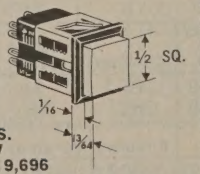
SPECIFYING NOTE: Pushbutton color must be specified by dash (-) and suffix letter — Refer to "SPECIFYING NOTE" above for Series OP-10. Typical part number for ⅞″ square, orange Series OP-30 Pushbutton is OP-34-E.

Series OP-50 Rectangular	Size			U.S.A. List Price
	A	B	C	
OP-51	½″	½″	¾″	$1.50
OP-52	¾″	½″	⅞″	1.50
OP-53	¾″	½″	1″	1.50
OP-54	¾″	½″	1½″	1.50
OP-55	½″	½″	1½″	1.50
OP-56	$^9/_{16}$″	½″	⅞″	1.50
OP-57	⅝″	½″	¾″	1.50

SPECIFYING NOTE: Pushbutton color must be specified by dash (-) and suffix letter — Refer to "SPECIFYING NOTE" above for Series OP-10. Typical part number for ⅝″ x ¾″, blue Series OP-50 Pushbutton is OP-57-B.

* Pushbutton has redundant lighting, i.e., sockets for 2 lamps.

"BOX SWITCH", SERIES BXR



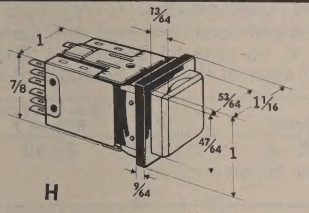
U.S. PAT. NOS. 3,446,467 AND 3,419,696

Miniature non-illuminated momentary pushbutton switch offers broad switching capabilities in minimum panel space. $^{11}/_{16}$″ square switch mounts in panels up to $^3/_{32}$″ thick and occupies only $1^7/_{32}$″ maximum behind panel space. ($1^7/_{32}$″ less panel thickness.) Molded plastic body protects against dust and dirt; prevents bending/disfiguring of contacts caused by excessive handling. Attractive bezel frames pushbutton and acts as built-in escutcheon plate. Unique "Adjusto-Clip" mounting provides snap-in, front of panel mounting in panels from $^3/_{64}$″ to $^3/_{32}$″ thick in .615″ square holes. Red, black, green, or white pushbuttons with $^7/_{64}$″ button stroke. Integral slide contacts of special spring tempered phosphor bronze, silver-plated, rated at 250 ma., 30 watts max., AC, non-inductive load. Choose solder lug/quick connect (AMP FASTON Series 110) or P.C. terminals.

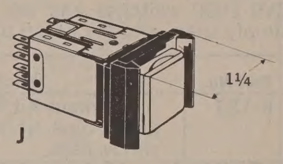
Part Numbers				Action	Schematic Circuit	U.S.A. List Price
Red Button	Black Button	Green Button	White Button			
SOLDER LUG/QUICK CONNECT TERMINALS						
BXR-01-1	BXR-02-1	BXR-03-1	BXR-05-1	S.P.S.T.n.o.	1-A	$4.00
BXR-01-3	BXR-02-3	BXR-03-3	BXR-05-3	S.P.D.T.	1-C	4.20
BXR-01-6	BXR-02-6	BXR-03-6	BXR-05-6	D.P.D.T.	2-C	4.55
	BXR-02-10	BXR-03-10		D.P.S.T.n.o.+D.P.D.T.	2-A+2-C	5.25
P.C. TERMINALS						
BXR-01-1PC	BXR-02-1PC	BXR-03-1PC	BXR-05-1PC	S.P.S.T.n.o.	1-A	$4.00
BXR-01-3PC	BXR-02-3PC	BXR-03-3PC	BXR-05-3PC	S.P.D.T.	1-C	4.20
BXR-01-6PC	BXR-02-6PC	BXR-03-6PC	BXR-05-6PC	D.P.D.T.	2-C	4.55
BXR-01-10PC	BXR-02-10PC	BXR-03-10PC	BXR-05-10PC	D.P.S.T.n.o.+D.P.D.T.	2-A+2-C	5.25

PUSHBUTTON SWITCHES

SERIES PL "PUSH-LITE" SWITCHES



H



J

U.L. LISTED
U.S. PAT. NO. 3,681,552
CANADIAN PATENT NOS. 949,109 (JUNE 11, 1974)
AND 940,179 (JANUARY 5, 1974)

"Push-Lite" switch is the first completely enclosed, lighted pushbutton switch which features long-life, highly-reliable leaf-spring switching. Available in momentary or push-lock/push-release functions; single or twin lamps; with or without barriers; full or split-face display; 1-C to 4-C switching; black or grey switch housing. Standard pushbutton color is white, other colors available on special order. Molded crossbar palladium contacts rated at 2 amps, 200 watts, max., AC, non-inductive load are std. U.L. listed switching up to 8 A available. Mount with clamp-type bracket, no screws, washers or nuts needed.

H.

Flange mounting requires 1" x .875" panel cutout.

J.

Barrier mounting requires 1 3/16" x .875" panel cutout. Can be mounted in vertical or horizontal rows and in matrixes. Depth behind panel only 1 3/4". "Push-Lite" switch accepts standard T-1 3/4 flange base lamps (not furnished with switch) in either 6V or 28V. See listing. Specify one lamp for single lamp style or two lamps of twin-lamp type when redundant or split-face lighting is required. Barriers and colored filter snap-inserts optional.

NEW Series 26U-1000 U.L. listed switches have large welded silver crossbar contacts rated at 8 A, 125 VAC. These high current switches are excellent choice for mandatory U.L. switching.

PUSHBUTTONS/INDICATOR SCREENS

Series PL-500 Pushbuttons/Indicator Screens are available separately for use with "Push-Lite" switches or "PL" Indicators for in-the-field substitution and/or replacement.

Part No.	Color	U.S.A. List Price Per Pkg. of 10	Part No.	Color	U.S.A. List Price Per Pkg. of 10
PL-501	Red	$3.00	PL-508	Yellow	$3.00
PL-503	Green	3.00	PL-512	Clear	3.00
PL-504	Blue	3.00	PL-513	Amber	3.00
PL-505	White	3.00			

COLOR FILTER SNAP-INSERTS

Translucent filters for special color-coding in "Push-Lite" switch and "PL" Indicators. Use with white or clear pushbuttons. Series PL-300 filters are used for full color display; Series PL-400 for split-face display.

SERIES PL-300 FULL DISPLAY COLOR FILTERS

Part No.	Color	U.S.A. List Price Per Pkg. of 25	Part No.	Color	U.S.A. List Price Per Pkg. of 25
PL-301	Red	$3.75	PL-305	White	$3.75
PL-303	Green	3.75	PL-308	Yellow	3.75
PL-304	Blue	3.75			

SERIES PL-400 SPLIT-FACE DISPLAY COLOR FILTERS

Part No.	Color	U.S.A. List Price Per Pkg. of 50	Part No.	Color	U.S.A. List Price Per Pkg. of 50
PL-401	Red	$5.00	PL-405	White	$5.00
PL-403	Green	5.00	PL-408	Yellow	5.00
PL-404	Blue	5.00			

Part Numbers				
Black Housing White Pushbutton	Grey Housing White Pushbutton	Action	Schematic	U.S.A. List Price
MOMENTARY ACTION — SINGLE LAMP				
PL-1032-05	PL-4032-05	S.P.D.T.	1-C	$11.25
PL-1062-05	PL-4062-05	D.P.D.T.	2-C	11.50
PL-1122-05	PL-4122-05	4P.D.T.	4-C	12.45
PL-1232-05	—	S.P.S.T.	1-C†	11.50
PL-1262-05	—	D.P.D.T.	2-C†	12.55
26U-1003	—	S.P.D.T.	1-C†	12.60
26U-1004	—	D.P.D.T.	2-C†	12.85
MOMENTARY ACTION — TWIN LAMP				
PL-2032-05	PL-5032-05	S.P.D.T.	1-C	$11.50
PL-2062-05	PL-5062-05	D.P.D.T.	2-C	11.85
PL-2122-05	PL-5122-05	4P.D.T.	4-C	12.70
PL-2232-05	—	S.P.S.T.	1-C†	12.00
PL-2262-05	—	D.P.D.T.	2-C†	12.90
26U-1005	—	S.P.D.T.	1-C†	12.85
26U-1006	—	D.P.D.T.	2-C†	13.75
PUSH-LOCK/PUSH-RELEASE — SINGLE LAMP				
PL-1037-05	PL-4037-05	S.P.D.T.	1-C	$11.85
PL-1067-05	PL-4067-05	D.P.D.T.	2-C	12.10
PL-1127-05	PL-4127-05	4P.D.T.	4-C	13.05
PL-1237-05	—	S.P.S.T.	1-C†	12.40
PL-1267-05	—	D.P.D.T.	2-C†	13.15
26U-1007	—	S.P.D.T.	1-C†	13.25
26U-1008	—	D.P.D.T.	2-C†	14.00
PUSH-LOCK/PUSH-RELEASE — TWIN LAMP				
PL-2037-05	PL-5037-05	S.P.D.T.	1-C	$13.05
PL-2067-05	PL-5067-05	D.P.D.T.	2-C	13.35
PL-2127-05	PL-5127-05	4P.D.T.	4-C	14.30
PL-2237-05	—	S.P.S.T.	1-C†	13.60
PL-2267-05	—	D.P.D.T.	2-C†	14.40
26U-1009	—	S.P.D.T.	1-C†	14.45
26U-1010	—	D.P.D.T.	2-C†	15.20

† Switch rating is 8 A, 125 VAC, U.L. listed.

OPTIONAL MOUNTING BARRIERS

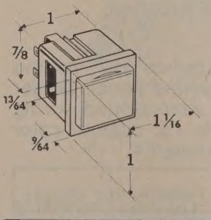
Barriers, molded of plastic, can be used to separate "Push-Lite" switches, "PL" Indicators, or combinations of "Push-Lite" switches and "PL" Indicators and prevent accidental operation of adjacent switches. Series PL-100 is an end barrier. One is required when switches are adjacently mounted; two are required when switches are individually mounted. Series PL-200 is a center barrier. Two are required between switches when adjacently mounted.

J.

"Push-Lite" switch (above) is shown with two, Part No. PL-102 end barriers installed.

Part No.	Description	U.S.A. List Price Per Pkg. of 10
PL-102	End barrier — black	$1.50
PL-111	End barrier — grey	1.50
PL-202	Center barrier — black	1.50
PL-211	Center barrier — grey	1.50

SERIES PL-9000 "PL" INDICATORS



Designed as perfect match for front panel appearance of "Push-Lite" switches — but functions only as a lighted indicator. Create unlimited combination of rows and/or matrix arrays with or without "Push-Lite" switches. Mounts same as "Push-Lite" switches; behind panel depth 1 25/64" max. Uses same lamp, color filter, snap inserts, light divider & optional mounting barriers as "Push-Lite" switches.

Part No.	Description	U.S.A. List Price
PL-9105	Black housing; uses 1 or 2 lamps. White screen.	$2.95
PL-9205	Same as No. PL-9105 except grey housing.	2.95

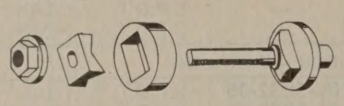
PUSHBUTTON SWITCHES

LIGHT DIVIDER

Light divider for use in standard "Push-Lite" switch pushbuttons and "PL" Indicator screens to separate lighting from twin-lamps. Order a light divider for each switch or indicator specified where split-face lighting is desired.

Switchcraft Part No. PL-551 .... U.S.A. List Price **$2.50** per package of 25

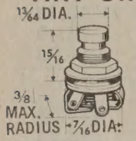
CHASSIS PUNCH



Part No. A-1201 Chassis Punch fabricates rectangular holes in panels or chassis for mounting individual "Push-Lite" switches or "PL" Indicators (without mounting barriers). Requires minimum torque to cleanly punch ⅞" x 1" hole in cold rolled steel (16 ga., .0625" max.) or aluminum (12 ga., .080" max.).

Switchcraft Part No. A-1201 .... U.S.A. List Price **$90.00**

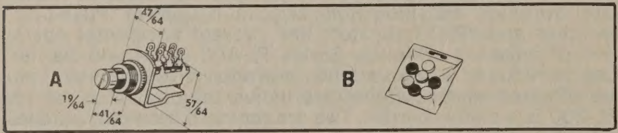
"TINY SWITCH" PUSHBUTTON SWITCHES



Series 950, red button, and Series 960, black button subminiature pushbutton switches for limited space applications. Integral contacts suitable for low level circuits where contact resistance is not important. Mounts in ¼" hole in panels up to 3/32" thick; depth behind panel ⅜".

Part Number		Action	Schematic Circuit	U.S.A. List Price
Red Button	Black Button			
951	961	S.P.S.T.n.o.	1-A	$1.35
952	962	S.P.S.T.n.c.	1-B	1.35
953	963	S.P.D.T.	1-C	1.70

DVR SWITCH SWITCHES SERIES DVR-2000



Recognition of individual switch positions occurs quickly even from a distance, with this single station non-illuminated pushbutton switch. With plunger in the "out" position, a black recognition color band contrasts with the recognition cap color. With plunger set to the "in" position, only the colored recognition cap is visible. Special copper alloy, silver plated, U-shaped contactors assure uniform tension. Contactors are rated at 0.5 amp, DC, 3 amps, AC, 125 volts, non-inductive load. Also available with 1-C circuitry rated at 11 amps., 125/250 VAC, ¼ hp. Threaded bushing mounts in a single-hole .468" (15/32") diameter in panels up to ¼" thick. Mounting centers are ¾" minimum. If non-turn mounting is required, bushing has machined slot to mate with keyed panel hole. Nickel plated copper alloy mounting nut is supplied.

A.

Series DVR-2000: 1-C or 2-C circuitry; requires 1 5/32" behind panel; 3-C or 4-C circuitry requires 2 1/32" behind panel. Solder lug terminals has 5/64" diameter hole and wrap-around wiring notches. Order Recognition Color Cap Kits for custom color coding according to your individual requirements.

Part No. Momentary (Non-Lock)	U.S.A. List Price	Part No. Push-Lock/ Push-Release	U.S.A. List Price	Switching
DVR-2203	$1.85	DVR-2703	$2.15	1-C
DVR-2206	2.15	DVR-2706	2.40	2-C
DVR-2209	2.40	DVR-2709	2.70	3-C
DVR-2212	2.70	DVR-2712	3.10	4-C
DVR-22P3	6.70	DVR-27P3	7.00	1-C‡

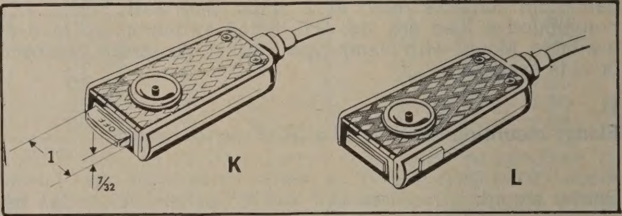
‡ Switch rating is 11 amp, 125/250 VAC, ¼ hp.

B. RECOGNITION COLOR CAP KITS

Recognition Color Caps in black and colors are used with Series DVR-2000 switches and are to be ordered separately. Caps simply snap onto the keyed plunger of the DVR Switch switch.

Part No.	Contents	U.S.A. List Price Pkg. of 7
K-123	Assortment Kit, 1 ea.: red, black, green, blue, white, brown and yellow caps	$0.90
		U.S.A. List Price Pkg. of 25
RC-201	25 ea., red caps	$2.50
RC-202	25 ea., black caps	2.50
RC-203	25 ea., green caps	2.50
RC-204	25 ea., blue caps	2.50
RC-205	25 ea., white caps	2.50
RC-206	25 ea., brown caps	2.50
RC-208	25 ea., yellow caps	2.50

"CORDMASTER" SWITCH PENDANT SWITCHES



Extremely versatile pendant (cord) switch with top or edge operated pushbutton operation, illuminated and non-illuminated. Attractively patterned stainless steel sheath fits over white shock resistant thermoplastic switch housing to provide greater strength. Series 4200, Fig. K, has top operated pushbutton action. Three standard functions available: Non-Lock — momentary action; Locking — button locks when depressed, releases when side button is depressed; Push-to-Lock, Push-to-Release — button locks when depressed and is released when depressed again. Series 42000E, Fig. L, has edge operation; supplied with "L" type illumination (top jewel lights when button is depressed). Illumination supplied by Ind. No. 377, 6V miniature, T-1¾ flange base lamp (not supplied with switch). See listing for lamp data. Part No. listed has locking function with front button release. Both Series have spring tempered nickel contact springs with cross-bar welded palladium contacts rated at 2 amps, 200 watts, max., AC, non-inductive load. This switch is not recommended for 120 VAC line switching. Switches accept cables up to .270" dia. Overall dimensions: 1¾" W. x 3 11/16" L. x ⅝" H.

Part No.	Function	Action	Schematic	U.S.A. List Price
42206	Non-Lock	D.P.D.T.	2-C	$11.45
42306	Locking	D.P.D.T.	2-C	12.10
42706	Push to Lock, Push-to-Release	D.P.D.T.	2-C	12.70

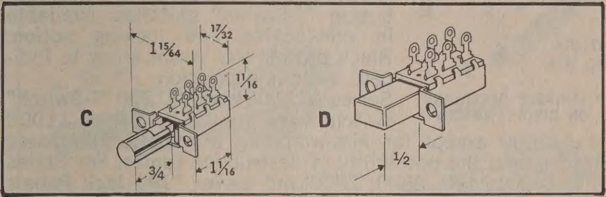
SERIES DUS PUSHBUTTON SWITCHES WITH SOLID STATE ILLUMINATION

Series DUS. Compact, S.P.S.T.(n.o.) switch has red LED in pushbutton for bright, 180° indication. Built-in resistor permits operationg on 6 VDC at only 13.5 ma. Terminals are solder/screw type. Dimensions, contact ratings and "Adjusto-Clip" mtg. are same as "Uniswitch" switches on Page 4291.

Part No.	Pushbutton	Schematic	U.S.A. List Price
DUS-011-06	Red	1-A (S.P.S.T.n.o.)	$5.50
DUS-021-06	Black		5.50
DUS-031-06	Green		5.50
DUS-041-06	Blue		5.50
DUS-051-06	White		5.50
DUS-081-06	Yellow		5.50

PUSHBUTTON SWITCHES

PUSHSWITCH PUSHBUTTON SWITCHES



C.

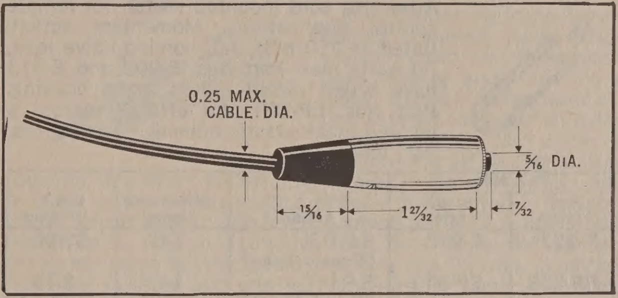
Economical Series PS Pushswitch, non-illuminated pushbutton switches are the evolutional outcome of design innovation and traditional Switchcraft quality and applications knowledge. Used for all types of commercial and industrial applications, such as, computers, radio receivers, transmitters, appliances, production line controls, public address, etc., at a drastically reduced cost. Series PS-5000: switching is either 1-C or 2-C. Housing is steel, cadmium plated, with iridescent iridite finish; contacts are brass, silver plated; U-shaped sliders are copper alloy, silver plated, and assure continuous "double-wiping" action for cleaning of contacts and uniform, reliable contact life. Lubricated contacts insure continuous wiping action. Solder lug terminals have .078″ diameter hole and wrap-around notches for wiring on each terminal. Mounted on 3/4″ minimum centers in panels up to 3/16″ thick. Mounting ears are one-piece construction with housing. Mounting holes are .156″ diameter. Handsome 5/16″ diameter molded nylon pushbuttons are integral with actuators. Rated at 0.5 amp, DC, 3 amps, AC, 125 volts, non-inductive load. Submitted to U.L. for listing.

D.

Series PS-6000 Pushswitch switches are similar to Series PS-5000, except for large 7/16″ x 7/32″ rectangular pushbuttons.

Part No.	Action	Push-button Color	Circuitry	U.S.A. List Price
PS-5203-01	Momentary	Red	1-C	$0.75
PS-5203-02		Black		.75
PS-5203-04		Blue		.75
PS-5203-05		White		.75
PS-5206-01		Red	2-C	.90
PS-5206-02		Black		.90
PS-5206-04		Blue		.90
PS-5206-05		White		.90
PS-5703-01	Push-Lock/ Push-Release	Red	1-C	1.05
PS-5703-02		Black		1.05
PS-5703-04		Blue		1.05
PS-5703-05		White		1.05
PS-5706-01		Red	2-C	1.15
PS-5706-02		Black		1.15
PS-5706-04		Blue		1.15
PS-5706-05		White		1.15
PS-6203-01	Momentary	Red	1-C	.75
PS-6203-02		Black		.75
PS-6203-04		Blue		.75
PS-6203-05		White		.75
PS-6206-01		Red	2-C	.90
PS-6206-02		Black		.90
PS-6206-04		Blue		.90
PS-6206-05		White		.90
PS-6703-01	Push-Lock/ Push-Release	Red	1-C	1.05
PS-6703-02		Black		1.05
PS-6703-04		Blue		1.05
PS-6703-05		White		1.05
PS-6706-01		Red	2-C	1.15
PS-6706-02		Black		1.15
PS-6706-04		Blue		1.15
PS-6706-05		White		1.15

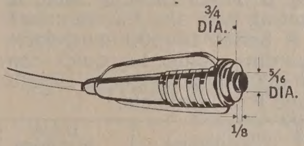
"CORD-SWITCH" CORD SWITCHES, SERIES ED



Rugged, attractive cord switch has brilliant satin nickel finish with red or black pushbutton. Contacts rated at 250 ma., 30 watts (maximum), AC, non-inductive load. Black neoprene cable relief bushing accepts cables up to 0.25″ diameter. Housing diameter 3/4″ length 3″.

Part No.				
Red Button	Black Button	Action	Schematic	U.S.A. List Price
ED-903	ED-913	S.P.D.T. "Break-Make"	1-C	$4.00

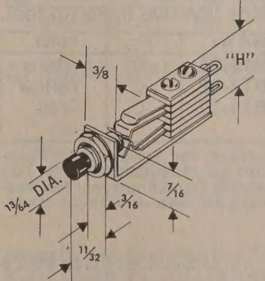
"CORDETTE" SWITCH PENDANT SWITCHES



Small lightweight pendant, momentary action (cord) switches provide remote switching of industrial and commercial instrumentation and control devices. Attractive one-piece grey molded body protects switching controls from dirt and dust. Switch has 1-A (S.P.S.T.) circuit. Integral brass, hard gold contacts rated at 500 ma., 50 watts max., A.C. non-inductive load. Not recommended for use in high voltage circuits. Part No. 921 has phono jack termination molded to body. Mates with Switchcraft molded cable assemblies with phono plug terminations such as 3501, 3501MC, etc. or industry standard phono plugs. Part No. 921K same as 921 except 6′ or 2-cond. unshielded cable molded to switch body. Stripped and tinned cable termination. Overall dimensions 1 3/16″ wide by 2 15/16″ long (not including cable).

Switchcraft Part No. 921	U.S.A. List Price **$6.00**
Switchcraft Part No. 921K	U.S.A. List Price **7.05**

MINIATURE "TF" SWITCH SWITCHES



"Tiny Frame" switches. Small, sturdily constructed, provides simple, direct acting pushbutton switching for use where space is at a premium. Available in Series 970L push-to-lock, pull-to-release; or Series 970, momentary action. Nickel silver springs, integral contacts, recommended for low level circuits where contact resistance is unimportant. Requires only 1 19/32″ depth behind panel; mount in single 1/4″ hole in panels up to 3/32″ thick.

SERIES 970 — NON-LOCKING

Part No.	Action	Schematic Circuit	"H" Dim.	U.S.A. List Price
976	D.P.D.T.	2-C	19/32″	$2.45

SERIES 970L — LOCKING

976L	D.P.D.T.	2-C	19/32″	$2.80

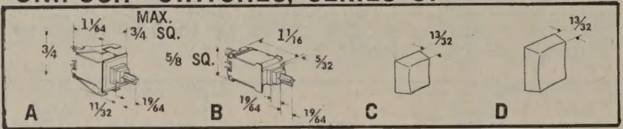
PUSHBUTTON SWITCHES

"CORD-SWITCH" CORD SWITCHES

Attractive cord mounted switch for remote control applications. Momentary action. Rated at 250 mils, AC, non-inductive load, 30 watts max. Part Nos. E-903 and E-913 have bright nickel plated brass housing. Part Nos. EP-903 and EP-913 feature a molded black plastic housing. Housing dia. 11/16", length 2 3/16".

Part Nos.				
Red Button	Black Button	Action	Schematic Circuit	U.S.A. List Price
E-903	E-913	S.P.D.T. "Break-Make"	1-C	$3.00
EP-903	EP-913	S.P.D.T. "Break-Make"	1-C	2.75

"UNIPUSH" SWITCHES, SERIES UP



Low-cost, single-station, pushbutton switches with gold alloy contacts to provide up to 10 million operations (1-10 ma., 4-14 VDC, resistive). Fig. A Series UP-100: momentary action, front-of-panel mounting, solder lug/quick connect terminals. Fig. A Series UP-200: same as Series UP-100 except P.C. Terminals; 1-A and 2-A switching only. Fig. B Series UP-400: same as Series UP-100 except rear mounting type and P.C. terminals (for sub-panel mounting). Fig. A Series UP-500: push-lock/push-release function, front mounting, solder lug/quick connect terminals. Fig. B Series UP-800: same as Series UP-500 except rear of panel mounting and P.C. Terminals.

Part No.	Fig.	Circuitry	U.S.A. List Price
UP-101M	A	1-A	$1.40
UP-104M	A	2-A	1.60
UP-113M	A	1-A+1-B	1.60
UP-201M	A	1-A	1.40
UP-204M	A	2-A	1.60
UP-401M	B	1-A	1.40
UP-404M	B	2-A	1.60
UP-413M	B	1-A+1-B	1.60
UP-501L	A	1-A	1.70
UP-504L	A	2-A	1.90
UP-513L	A	1-A+1-B	1.90
UP-801L	B	1-A	1.70
UP-804L	B	2-A	1.90
UP-813L	B	1-A+1-B	1.90

PUSHBUTTONS, SERIES PB11 AND PB12 (1)

Attractive, rugged, square pushbuttons designed for "Unipush" switches. Fig. C Series PB11 (11/16 sq.); Fig. D Series PB12 (31/32" sq.). Concave pushbutton faces provide positive fingertip feel.

Part No.	Fig.	Color	Part No.	Fig.	Color
PB11-01	C	Red	PB11-05	C	White
PB11-02	C	Black	PB11-08	C	Yellow
PB11-03	C	Green	PB11-11	C	Grey
PB11-04	C	Blue			

(1) Part nos. are for Series PB11 Pushbuttons; for Series PB12 Pushbuttons, substitute "12" for "11" in part no. (example: No. PB12-01 is 31/32" square, red pushbutton). Truncated pushbuttons for keyboard applications, Series PB2, are available with or without standard double-shot legends.

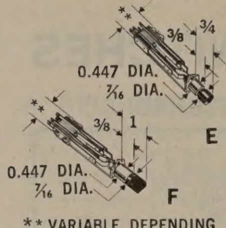
Switchcraft Pushbuttons,
Series PB11, Fig. C .... U.S.A. List Price **$0.25**

Switchcraft Pushbuttons,
Series PB12, Fig. D .... U.S.A. List Price **$0.30**

® Registered trademark of Switchcraft, Inc.

"T-SWITCH" SWITCHES

Rugged, long frame switches for quality communications equipment. Welded crossbar palladium contacts rated at 2 amps, 200 watts max., AC, non-inductive load. Require minimum of panel space, only 9/16" x 13/16"; 2 7/8" depth behind panel. Series 11000, Fig. E, pushbutton T-Switch. Available in momentary action and push-to-lock pull-to-release action. Series 11200, Fig. F, 2-pos. turn button "T-Switch" switches. Available in non-locking and locking action. Black button with white arrow to indicate switching position.

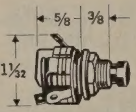


** VARIABLE DEPENDING ON CIRCUIT HEIGHT

Series W11000 and W11200 "T-Switch" switches are similar to Series 11000 and 112000 except for wire-wrapping terminals. Eliminates soldering and the possibility of destructive fumes. For Series 1200, 1400, 2400, 2600, 2800 and Series "JP" Jack Panels and other industry standard telephone jack panels, call directors, comm. panels, P.A. and other communication equipment.

Part No. Non-Locking *	Action	Schematic Circuit	U.S.A. List Price
E. PUSHBUTTON — SERIES 11000			
11003	S.P.D.T.	1-C	$7.10
W11003			7.25
W11006	D.P.D.T.	2-C	9.25
11012	4P.D.T.	4-C	12.00
W11012			12.95
F. TURN BUTTON — SERIES 11200			
11203	S.P.D.T.	1-C	$7.45
W11203			7.25
11206	D.P.D.T.	2-C	9.20
W11206			9.25
11212	4P.D.T.	4-C	12.55
W11212			12.95

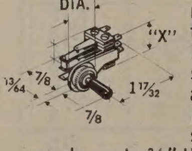
LITTEL-SWITCH® SWITCHES



Series 100, 200, tiny momentary contact pushbutton switches. Rugged, dependable action. All contacts insulated from panel bushing with interlocking phenolic washers. Series 100 and 200, springs are of nickel silver, recommended only for low level circuits where contact resistance is unimportant. Series 100S and 200S have fine silver contacts rated at 3 amps or 300 watts max., AC, non-inductive load. One-piece plastic button and shaft in red or black. Mounts in 3/8" hole in panels up to 1/4".

Part Nos.				
Red Button	Black Button	Action	Schematic Circuit	U.S.A. List Price
101	201	S.P.S.T.n.o.	1-A	$1.30
102	202	S.P.S.T.n.c.	1-B	1.30
102S	202S	S.P.S.T.n.c.	1-B	1.90
103	203	S.P.D.T.	1-C	1.60

"LEV-R" SWITCH SWITCHES, SERIES 12000



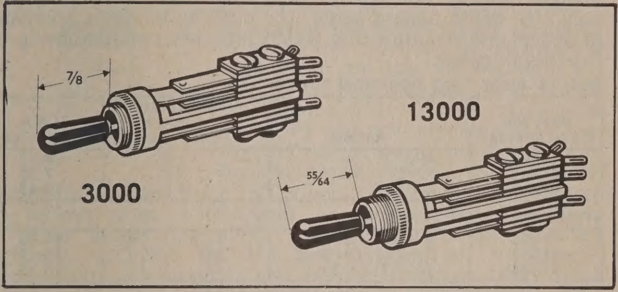
Small right-angle action switches requiring minimum of depth behind panel. Available in two and three position, locking and non-locking types. Long leaf-type springs insure long switch life. Fine silver contacts rated at 3 amps, 300 watts max., AC, non-inductive load. Requires only 7/8" depth behind panel; single 1/2" dia. mounting hole; mounts in panels up to 3/32" thick. Supplied with nickel plated locknut and removable black plastic knob.

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	"X" Dim.	U.S.A. List Price
TWO POSITION TYPES				
12003	S.P.D.T.	1-C	3/4"	$3.50
12006	D.P.D.T.	2-C	1"	4.40
THREE POSITION TYPES				
12034	S.P.S.T.n.o. Ea. Sec.	1-A 1-A	13/16"	$4.20
12037	S.P.D.T. Ea. Sec.	1-C† 1-C†	7/8"	4.80
THREE POSITION TYPES LOCKING ONE SIDE — NON-LOCKING OTHER SIDE				
12033T	S.P.D.T.n.o.	1-C†	23/32"	$3.95
12037T	S.P.D.T. Ea. Sec.	1-C† 1-C†	7/8"	4.85

* Add suffix letter "L" to Part No. to indicate locking type.
† n.o. center position off.

LEVER SWITCHES

"LEV-R" SWITCH SWITCHES, SERIES 3000, 13000



Small lever action switches in two and three position types, locking and non-locking action. Requires half the space usually needed for a lever switch; frame bushing and shaft nickel plated brass. Supplied with locknut and screw-on black knob. Fine silver contacts rated at 3 amps, 300 watts, max., AC, non-inductive load. Non-locking types have spring return. Series 3000 mounts in panels up to 3/32" thick; Series 13000 mounts in panels up to 1/4" thick. Both Series are 5/8" wide; requires 2¼" behind panel; mounts in single ½" dia. hole.

SERIES 3000 TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
3001	S.P.S.T.n.o.	1-A	$3.30
3003	S.P.D.T.	1-C	4.00
3004	D.P.S.T.n.o.	2-A	4.30
3006	D.P.D.T.	2-C	4.75
3009	3P.D.T.	3-C	6.15

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
3033	S.P.D.T.n.o.	1-C†	$4.30
3034	S.P.S.T.n.o. Ea. Sec.	1-A 1-A	4.45
3036	S.P.D.T. Ea. Sec.	1-C 1-C	5.05
3037	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	5.15
30312	D.P.D.T. Ea. Sec.	2-C 2-C	6.75
30313	D.P.D.T.n.o. Ea. Sec.	2-C† 2-C†	6.75

SERIES 13000 TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
13001	S.P.S.T.n.o.	1-A	$3.60
13003	S.P.D.T.	1-C	4.15
13004	D.P.S.T.n.o.	2-A	4.55
13006	D.P.D.T.	2-C	5.05
13009	3P.D.T.	3-C	6.60

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
13033	S.P.D.T.n.o.	1-C†	$4.60
13034	S.P.S.T.n.o. Ea. Sec.	1-A 1-A	4.70
13036	S.P.D.T. Ea. Sec.	1-C 1-C	5.50
13037	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	5.50
130312	D.P.D.T. Ea. Sec.	2-C 2-C	7.10
130313	D.P.D.T.n.o. Ea. Sec.	2-C† 2-C†	7.10

INTER-COM SWITCHES‡ SERIES 3000

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
3033T	S.P.D.T.n.o.	1-C†	$4.30
3037T	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	5.15

SERIES 13000

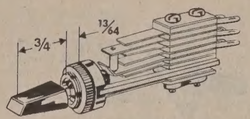
Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
13033T	S.P.D.T.n.o.	1-C†	$4.60
13037T	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	5.50

† n.o. center position off.

‡ Inter-communications."Talk-Listen" switches, lever locks on one side of neutral and operates non-locking on the other side.

* Add suffix letter "L" to Part No. to indicate locking type.

"LEV-R" SWITCH SWITCHES, SERIES 28000



"Lev-R" Switch switches, Series 28000. Compact, lever action switch in two and three position, locking and non-locking types. Smooth, easier lever action assured with special nylon roller. Supplied with locknut, non-turn ring (slips over slotted bushing to prevent switch from turning in mounting hole), and a black knob which is molded directly to the lever. Eliminates loose or lost knobs. Fine silver contacts rated at 3 amps, 300 watts, max., AC, non-inductive load. Mounts on 5/8" centers in panels up to 3/32" thick. Requires only one 15/32" dia. mounting hole for bushing and one 1/8" dia. hole for non-turn device; depth behind panel, 2¼".

TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
28201	S.P.S.T.n.o.	1-A	$4.20
28203	S.P.D.T.	1-C	5.10
28206	D.P.D.T.	2-C	6.30

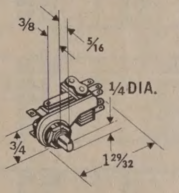
THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
28304	S.P.S.T.n.o. Ea. Sec.	1-A 1-A	$5.50
28306	S.P.D.T. Ea. Sec.	1-C 1-C	6.05
28307	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	6.15
28312	D.P.D.T. Ea. Sec.	2-C 2-C	7.45

* Add suffix letter "L" to Part No. to indicate locking type.

† Center position open (OFF).

"RS" SWITCH ROTARY SWITCHES



Rugged rotary switches, available in various multiple circuits, two and three position types, locking or non-locking action. Ideal for communication, musical and test equipment applications. Fibre cam actuates long, leaf-type springs resulting in easy action; good wiping action of contacts. Fine silver contacts rated at 3 amps, 300 watts max., AC, non-inductive load. Requires only 7/8" depth behind panel, mounts in single 3/8" hole in panels up to ¼" thick.

TWO POSITION TYPES

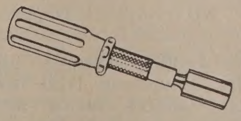
Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
2003	S.P.D.T.	1-C	$3.00
2006	D.P.D.T.	2-C	4.00

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
2036	S.P.D.T. Ea. Sec.	1-C 1-C	$4.00

* Add suffix letter "L" to Part No. to indicate locking type.

SPECIAL WRENCHES



Special Switchcraft wrenches designed to assemble knurled locknuts normally furnished with lever and button switches and jacks. A-1070 wrench fits 15/32-32 locknuts; A-1071 for use with ¼"-32 knurled locknuts.

Switchcraft Part No. A-1070 .... U.S.A. List Price **$25.00**
Switchcraft Part No. A-1071 .... U.S.A. List Price **25.00**

Part No. A-1132. As above except for hex and knurled locknuts as follows: No. P-1000-1 ½" hex locknut: Hi-D Switch, "RS-Switch", Littel-Switch, "NF-Switch", "FF-Switch" pushbutton switches; Hi-D Jax, Littel-Jax, "SF-Jax" and "LF-Jax". No. P-1150-1 3/8" hex locknut ("TF-Switch" switch). No. P-1970 ½" knurled locknut ("DA-Switch" switch).

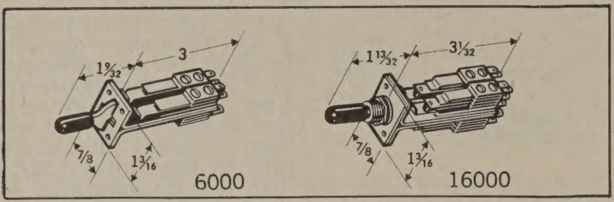
Part No. A-1132 .... U.S.A. List Price **$15.75**

SWITCHCRAFT® INC.

5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

LEVER SWITCHES

"TELEVER" SWITCH SWITCHES



Series 6000 and 16000. Rugged telephone type lever switches featuring "T-Beam" frame construction which results in a relatively light construction with sturdiness of a structural "T-Beam". Available in two and three positions, locking and non-locking types. Nylon rollers on the lever actuate the special nickel silver springs, providing smooth action; assures long dependable spring life. Welded crossbar palladium contacts are standard, rated at 2 amps, 200 watts max., AC, non-inductive load. Series 6000 mounts with four No. 3-48 machine screws. Mounting centers 17/32" x 13/16", mounts in panels up to ¼" thick. Series 16000 features single hole mounting; 15/32-32 threaded bushing. Mounts in ½" dia. hole in panels up to ¼" thick. Part No. 545, "Stop Plate" provides positive "stops" for two position action. Part No. 540, "Stop Plate" provides non-locking or momentary action. The "Stop Plates" can be changed in the field. Both Series switches supplied with black insulated knob. All have tinned solder lug terminals.

SERIES 6000 TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
6006	D.P.D.T.	2-C		$7.70
60012	4P.D.T.	4-C		10.30

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
6036	S.P.D.T. Ea. Sec.	1-C	1-C	$7.70
60312	D.P.D.T. Ea. Sec.	2-C	2-C	10.80
60324	4P.D.T. Ea. Sec.	4-C	4-C	15.70

SERIES 16000 TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
16006	D.P.D.T.	2-C		$8.05
16008	4P.S.T.n.o.	4-A		9.05
16009	3P.D.T.	3-C		9.65
160012	4P.D.T.	4-C		10.95
160024	8P.D.T.	8-C		16.05

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
16036	S.P.D.T. Ea. Sec.	1-C	1-C	$8.05
16038	D.P.S.T.n.o. Ea Sec.	2-A	2-A	9.05
160312	D.P.D.T. Ea. Sec.	2-C	2-C	10.95
160312D	D.P.D.T. Ea. Sec.	2-D	2-D	12.05
160316	4P.S.T.n.o. Ea. Sec.	4-A	4-A	14.15
160324	4P.D.T. Ea. Sec.	4-C	4-C	16.05

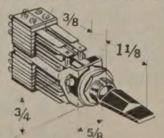
* Add suffix letter "L" to Part No. to indicate locking type. Series 16000 non-locking type can be converted to locking type by removing "Stop Plate".

Part No. 530 Escutcheon Plate. For Series 6000 "Telever" Switch switches with 4 mounting screws U.S.A. List Price **$1.25**

Part No. 540 Stop Plate. For Series 16000 "Telever" Switch switches. Converts from locking to non-locking action. Includes two mounting screws .... U.S.A. List Price **$0.45**

Part No. 545 Stop Plate. For Series 16000 "Telever" Switch switches. Converts from 3-position to 2-position. Includes two mounting screws .... U.S.A. List Price **$0.45**

"LT SWITCH" SWITCHES



U.S. PAT. NO. 3,433,906
CANADIAN PAT. NO. 850,234, AUG. 25, 1970

Series 41000. Smallest high-quality, telephone type lever switch available. Two or three position types with positive locking and/or non-locking action. Special damping block guards against transient leaf bounce. "Can't-Cheat" detent guide prevents accidental actuator by-pass of switching positions. Switch has rigid "U"-shaped, twin girder frame. Its parallel steel members terminate in an interlocked box where spring combinations are mounted. The special long life, nickel-silver springs can be individually fastened to any one of the frame's four switch stacks mounting positions. Welded cross bar palladium contacts rated at 2 amps, 200 watts max., AC, non-inductive load are standard. Series 41000 mounts on 23/32" centers in a 15/32" dia. hole in panels up to ¼" thick. Requires only 2⅛" depth behind panel. The bushing includes a keyway to accept the non-turn ring which prevents switch turning or twisting in panel.

SERIES 41000 TWO POSITION TYPES

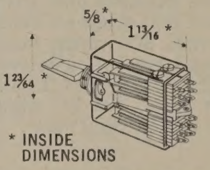
Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
41203	4P.D.T.	1-C		$6.15
41206	S.P.D.T.	2-C		7.70
41212	D.P.D.T.	4-C		10.45

THREE POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1	Pos. 2	U.S.A. List Price
41306	S.P.D.T. Ea. Sec.	1-C	1-C	$7.70
41312	D.P.D.T. Ea. Sec.	2-C	2-C	10.45
41324	4P.D.T. Ea. Sec.	4-C	4-C	15.35

* Add suffix letter "L" to Part No. to indicate locking type.

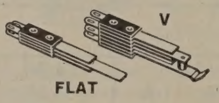
MOLDED DUST COVERS



Molded Dust Covers give full environmental protection and acts as electrical insulating shield for "LT Switch" switches. Protects against moisture, dust, dirt, contamination; guards against tampering and accidental damage of springs/contacts. Hi-temp. molded Lexan polycarbonate plastic; reinforced corners and walls.

Part No.	Description	U.S.A. List Price
P-2360	Used on non-locking and locking version of "LT Switch" switches. Part Nos. 41203, 41206, 41306, 41308, 41312.	$0.55
P-2362	Used on Part Nos. 41208 and 41324 non-locking and locking "LT Switch" switches.	.60

STACK SWITCHES

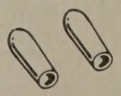


General purpose stack switch assemblies made from a pile-up of various actuator springs, contact springs and lifters. These stack switch assemblies can be used on manually operated devices where switching is operated by cams, levers, pushbuttons and other mechanical devices. General purpose stack switches are available with a "Flat" or "V" actuator spring. Fine silver or palladium cross bar welded contacts are standard, rated at 2 amps, 200 watts max., AC, non-inductive load. Supplied with pressure plate and two No. 5-40 screws; mounts on ⅜" centers. Height of stack depends on switching circuit; 1-B circuit 21/64" H., min.; 2-C circuit 45/64" H., max. Only the most commonly used "Flat" actuator stack switches are listed below. Contact Switchcraft for price and delivery information on "V" actuator spring stack switches.

FLAT ACTUATOR SPRING

Part No.	Contact Material	Action	Schematic Circuit	U.S.A. List Price
AA01AA	Silver	S.P.S.T.n.o.	1-A	$1.30
AA01AB	Palladium	S.P.S.T.n.o.	1-A	1.45
AA03AA	Silver	S.P.D.T.	1-C	1.65
AA06AA	Silver	D.P.D.T.	2-C	2.35
AA06AB	Palladium	D.P.D.T.	2-C	2.75

PUSH-ON COLOR KNOBS



Kit of molded plastic knobs. Available in 10 colors. For "Feather-Lever" Switch switches. Series 29000. Knobs can be changed quickly—simply pull off present knob and push-on new one. For permanence, use plastic cement.

Part No.	Color	Part No.	Color	U.S.A. List Price Per Pkg. of 10
K-108	One of each color	K-114	Brown	$1.15
K-109	Red	K-115	Orange	1.15
K-110	Black	K-116	Yellow	1.15
K-111	Green	K-117	Ivory	1.15
K-112	Blue	K-118	Gray	1.15
K-113	White	—	—	1.15

Kit No. K-103. Assorted ⅜" mtg. center contact springs and associated parts .... U.S.A. List Price **$41.80**

Kit No. K-119. "Tini-Stack" Assorted 3/16" mtg. center contact springs and associated parts .... U.S.A. List Price **$41.80**

LEVER SWITCHES

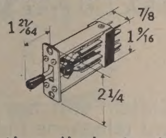
STACK SWITCH KITS

Experimental kits of component parts for assembling switch stacks. Designed to speed the assembly of engineering samples in the lab, aid maintenance men in the field and save time in general replacement. Ideal for mechanical engineers and coin machine servicing; used in relays, electronic organs, etc. Each kit consists of 136 springs in different thicknesses, over 152 phenolic spacers and insulators in various sizes, hard-rubber insulating tubing, two sets of stack assembling pins, two roller assemblies, assorted contacts, etc. Kit No. K-119, consisting of "Tini-Stack" components are miniature variations of standard switch stack springs, spacers, etc. All in compartmented plastic box.

Kit No. K-101. Assorted ¼″ and ⅜″ mtg. center contact springs and associated parts .... U.S.A. List Price **$41.80**

Kit No. K-102. Assorted ¼″ mtg. center contact springs and associated parts .... U.S.A. List Price **$41.80**

"LO-CAP" SWITCH SWITCHES



Series 10000. Low-capacity lever actuated switches, previously referred to as Federal Anti-Capacity switches. Specially designed flat actuator springs are wide spaced on a large molded insulating block. This construction eliminates the build-up of induced alternating current between springs. Rugged "U" shaped aluminum frame. Roller actuation for easy lever operation. Available in 2 and 3 position models, locking and non-locking types. Actuator springs have fine silver contacts rated at 1 amp, 100 watts, max., AC non-inductive load. Supplied with polished chrome escutcheon plate. Mounts with two No. 6-32 flat head screws (not supplied). Mounting centers 1 15/16″. Depth behind panel 3 7/16″.

TWO POSITION TYPES

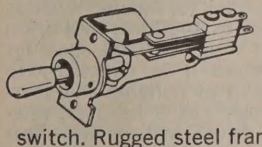
Part No. Non-Locking*	Old Federal No.‡	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
10206	—	D.P.D.T.	2-C	$12.75

THREE POSITION TYPES

10325	12494	4P.D.T.n.o. Ea. Sec.	4-C† 4-C†	$31.75

† n.o. center position off.
* Add suffix letter "L" to Part No. to indicate locking type.
‡ Old Federal Part No. refer to locking type switches only.

"FEATHER-LEVER" SWITCH MINIATURE SWITCHES



Miniature lever switches, light-weight, compact, mount on 7/16″ centers. Available in 2 and 3 position, locking and non-locking types. Actuator designed with nylon roller for smoother, easy lever operation over entire life of switch. Rugged steel frame withstands rough usage shock and vibration. Nickel silver springs with fine silver contacts, rated at 2 amperes, 200 watts, max., AC non-inductive load. Supplied with black plastic push-on knob. Other push-on knobs, available in 10 colors. See listing below. Series 29000, with bushing, mounts in 5/16″ O.D. panel hole. Supplied with locknut. Require only 1 9/32″ depth behind panel, mount in panels up to ⅛″ thick.

TWO POSITION TYPES

Part No. Non-Locking	Part No. Locking	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
29203	29203L	S.P.D.T.	1-C	$3.70
29206	29206L	D.P.D.T.	2-C	4.40

THREE POSITION TYPES

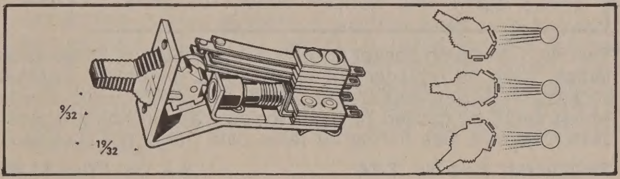
29303	29303L	S.P.D.T.n.o.	1-C†	$4.05
29306	29306L	S.P.D.T. Ea. Sec.	1-C 1-C	4.75
29307	29307L	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	4.85
29312	29312L	D.P.D.T. Ea. Sec.	2-C 2-C	6.15

INTER-COMM SWITCHES‡

Part No. Non-Locking	Part No. Locking	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
29303T		S.P.D.T.n.o.	1-C†	$4.05
29307T		S.P.D.T.n.o. Ea. Sec.	1-C 1-C	4.85

† n.o. center position off.
‡ Inter-communications."Talk-Listen" switches, lever locks on one side of neutral and operates non-locking on the other side.
* Add suffix letter "L" to Part No. to indicate locking type.

3-COLOR ILLUMINATED LEVER SWITCHES "LEVER-LITE" SWITCH SWITCHES SERIES 25000



"Lever-Lite" Switch switches, Series 25000. Illumination indicates positions at a glance. Individual color chips can be inserted in each switch position. Available in 2 or 3 position, locking and non-locking types. Reduces panel space; minimizes costly wiring. Supplied with 6V (No. P-1217) miniature screw base lamp and six color chips: Red, Green, Amber, Yellow, Blue and White. Other lamps available; see listing for lamp data. Nickel-silver springs, silver contacts rated 3 amps, 300 watts max., AC, non-inductive load. Requires only 2¼″ depth behind panel, can be mounted on ⅝″ centers in panels up to 3/32″ thick. Size: 2¼″ L. x 39/64″ W. x 1 7/32″ H.

TWO POSITION TYPES

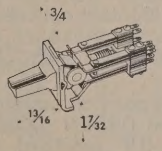
Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
25201	S.P.S.T.n.o.	1-A	$7.05
25203	S.P.D.T.	1-C	7.45
25206	D.P.D.T.	2-C	8.80

THREE POSITION TYPES

25304	S.P.S.T.n.o. Ea. Sec.	1-A 1-A	$8.00
25306	S.P.D.T. Ea. Sec.	1-C 1-C	8.80
25312	D.P.D.T. Ea. Sec.	2-C 2-C	16.60

* Add suffix letter "L" to Part No. to indicate locking type.

"LEVER-LITE" SWITCH SWITCHES SERIES 27000



"Lever-Lite" Switch switches, Series 27000 illuminated lever switch, 3-color lighting identical to Series 25000, but utilizes a larger, contoured lever and larger, factory installed color filters. Available in 2 or 3 position, locking and non-locking types. Mounts on ¾″ centers, in panels up to 3/32″ thick. Depth behind panel 2 3/16″. Nickel silver springs with fine silver contacts rated at 3 amps, 300 watts, max., AC, non-inductive load. On standard 2 position type AMBER lights in the "NEUTRAL" position; GREEN lights in the "DOWN" position. On 3 position types, RED lights in the "UP" position, AMBER in "NEUTRAL" position and GREEN in the "DOWN" position. Supplied with a 6V lamp (No. P-1217). Other lamps available; see listing for lamp data.

TWO POSITION TYPES

Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
27206	D.P.D.T.	2-C	$11.00
27212	4P.D.T.	4-C	13.45

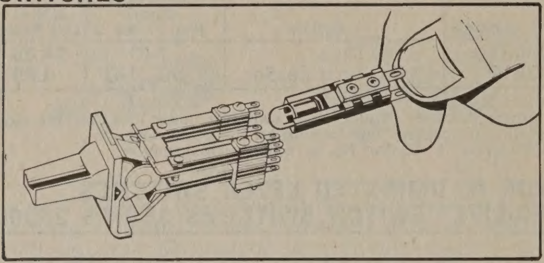
THREE POSITION TYPES

27306	S.P.D.T. Ea. Sec.	1-C 1-C	$11.00
27307	S.P.D.T.n.o. Ea. Sec.	1-C† 1-C†	11.20
27312	D.P.D.T. Ea. Sec.	2-C 2-C	13.45

† n.o. center position off.
* Add suffix letter "L" to Part No. to indicate locking type.

LEVER SWITCHES

LAMP SOCKET FOR "LEVER-LITE" SWITCH SWITCHES



Part No. T-14 Lamp Socket accepts T-1¾ miniature flange base lamps. Used as replacement or specified instead of original sockets on Series 25000 and 27000. Shield prevents shorts which might be caused by lamp socket frame rubbing against switch springs. See listing for lamp data (lamp not supplied).

Switchcraft Part No. T-14 .... U.S.A. List Price **$1.45**

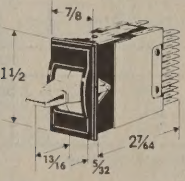
ESCUTCHEON PLATES FOR "LEVER-LITE" SWITCH SWITCHES

For easy and convenient mounting of Series 25000 and 27000 Switches. Satin black finish. Eliminates punching rectangular hole in mounting panel. Part No. 531 for Series 25000, complete with two No. 3-48 black machine screws. Part No. 532 for Series 27000, complete with two No. 2-56 machine screws.

Switchcraft Part No. 531 .... U.S.A. List Price **$0.35**

Switchcraft Part No. 532 .... U.S.A. List Price **0.45**

"LEVER-LITE" III SWITCH SWITCHES SERIES 84000



U.S. PATENT NOS. 3,727,020 AND 3,821,533. CANADIAN PAT. NOS. 972,791 (AUG. 12, 1975) AND 990,330 (JUNE 1, 1976)

"Lever-Lite" III Switch switches Series 84000 is the third generation of illuminated lever switches which embody the most modern electrical, mechanical, and human factors design concepts. Available in 2- and 3-position types with locking, non-locking, and talk-listen functions and a variety of circuits form from D.P.D.T. to 8P.D.T. Contact springs are silver plated phosphor bronze. Contacts are welded cross bar silver rated at 8 amps, 125 VAC. All switches are U.L. listed.

Lever illumination is multi-color, i.e., 2-position switches have AMBER color (NEUTRAL position) and GREEN (DOWN position); 3-position switches have RED (UP position), AMBER (NEUTRAL), and GREEN (DOWN position). Switch uses one, standard T-1¾ flange base lamp (not supplied). See listing for lamp recommendations.

Series 84000 switches are mounted, relamped (without tools), terminated, and removed from front of panel. Color filters changeable from front. Terminals are solder lug type, which also accepts AMP 110 FASTON.

Mounting hole is ¾" x 1⅜". Behind panel dimensions are 1⅜" H. x ¾" W. x 1¹³⁄₁₆" D. maximum.

TWO POSITION TYPES

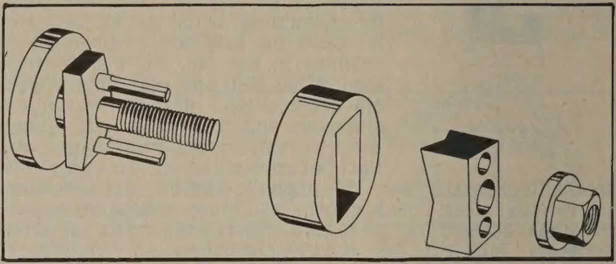
Part No. Non-Locking*	Action	Schematic Circuit Pos. 1 Pos. 2	U.S.A. List Price
84206	D.P.D.T.	2-C	$10.80
84212	4P.D.T.	4-C	13.35

THREE POSITION TYPES

84306	S.P.D.T. Ea. Sec.	1-C	1-C	$10.80
84312	D.P.D.T. Ea. Sec.	2-C	2-C	13.35
84324	4P.D.T. Ea. Sec.	4-C	4-C	18.40

* Add suffix letter "L" to Part No. to indicate locking type.

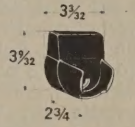
CHASSIS PUNCH



Quick, economical, and accurate individual mounting hole fabrication for Series 84000 switches. Only simple hand tools and minimum torque is needed to punch holes in panel or chassis — 16 ga. (.0625") maximum for cold rolled steel or 12 ga. (.080") maximum for aluminum. Just mark the opening, drill pilot holes and punch out precision ¾" x 1⅜" opening.

Switchcraft Part No. A-1202 .... U.S.A. List Price **$37.50**

"CRADLE-SWITCH" SWITCHES

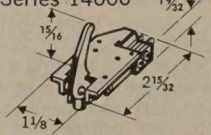


High quality "Cradle-Switch" switches holds W.E. and other standard telephone industry handsets. Housing is sturdy, yet flexible enough to withstand shocks and vibrations. Housing includes specially designed Hook Switch with a 4-C (4P.D.T.) contact arrangement. Switch has long nickel silver springs with welded silver cross bar contacts rated at 8 amps, 125 VAC. Ideal for use in critical low level audio circuits, i.e., in communication and instrumentation applications.

Part No.	Description	U.S.A. List Price
14412G	Handset Cradle Switch. Black housing. 4-C (4P.D.T.) circuit	$13.30
14512G	As above, except beige.	13.30
14612G	As above, except white.	13.30

"HOOK SWITCH" SWITCHES

Series 14000



Quality constructed leaf-type switches actuated by a hook (or hanger) such as designed in Series 14000; or by a nylon actuator as in Series 14100G. Ideal for equipment where it is necessary to actuate a circuit by hanging an accessory on a "hook", as a headset, telephone handset or microphone. Series 14000 utilizes fine silver contacts rated at 3 amps, 300 watts max., AC, non-inductive load. Series 14100G features welded cross-bar gold alloy contacts rated at 1 amp, 100 watts max., AC, non-inductive load.

Part No.	Action	Schematic Circuit	U.S.A. List Price
14006	D.P.D.T.	2-C	$5.30
14106G	D.P.D.T.	2-C	5.75

AMBIENT LIGHT SHIELD

(See Series 27000 on Page 4299.)

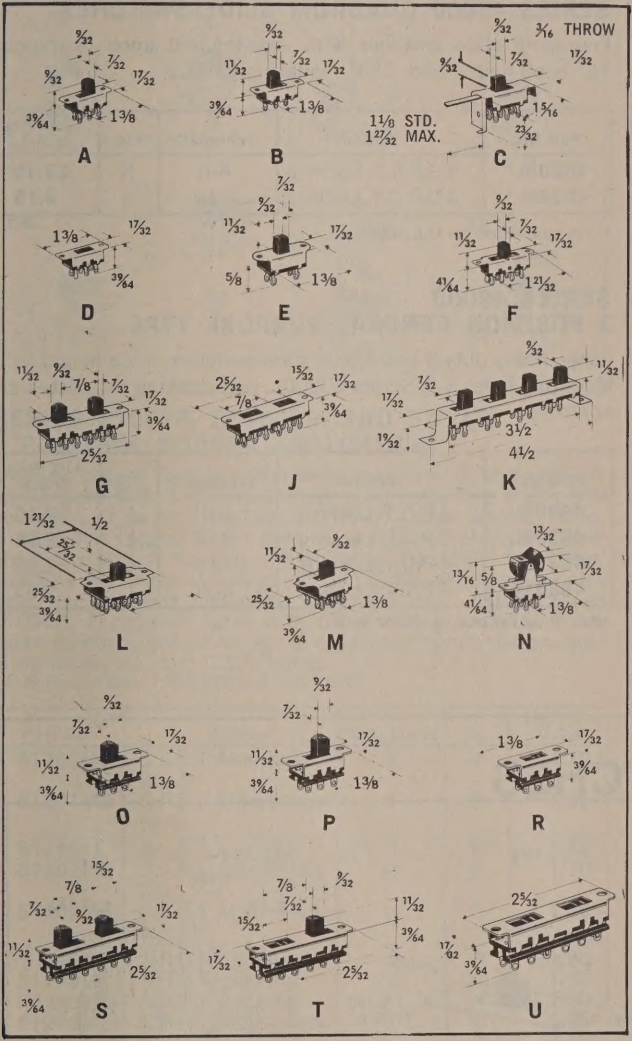
For use where Series 27000 switches are mounted on minimum centers. Shield gives positive separation of lighting between switches. Shield is placed between panel and switch, held in place by mounting screws. Two shields can be used per switch if desired.

Switchcraft Part No. P-1864 .... U.S.A. List Price **$0.25**

SWITCHCRAFT® INC.

5555 NORTH ELSTON AVENUE / CHICAGO, ILLINOIS 60630 / TEL: (312) 792-2700 / TWX: 910-221-5199

"DOUBLE-WIPE" SLIDE SWITCHES



Series 46000R, 47000R, 48000, 49000, 50000, 51000R, 52000, and 53000 low-cost, precision "double-wipe" slide switches. Switches use special U-shaped, bifurcated sliders to assure continuous wiping action. Contacts rated at 0.5 amp, DC, 3 amps, AC, 125 volts, non-inductive load. Standard solder lug terminals have a 5/64" dia. center hole and wrap-around notch for wiring ease. Most switches furnished with black 11/32" knob and .140" (9/64") dia mounting holes. Nos. 46206LFR, 46256LFR and 47227LFR flush screwdriver actuated knob. All slide and rocker switches are U.L. approved unless otherwise noted. See next page for slide switch contact arrangement.

New Phase III Slide Switches, Series 46000E, 47000E and 51000E high performance switches, feature glass filled nylon terminal boards, allowing excellent mechanical stability, high leakage resistance, the ability to withstand high temperatures, flame retardance, and self extinguishing characteristics. Standard knob color is black. Terminal holes in solder lug are .070" x .085" and accept wires as large as #14 AWG. Series 46000E, 47000E, and 51000E are U.L. and C.S.A. listed.

Series B51000R, B52000, 54000R, 55000 and B55000: All advanced materials and features of other slide switches. Series B51000R, B52000, B54000R and B55000 have offset mounting brackets for recessed mounting. No separate standoff mounting hardware needed. Holes in mounting brackets are 9/64" dia. Series 54000R, B54000R, and B55000 have new black knob with smooth streamline appearance. Electrical ratings are same as Series 46000, above. Submitted for U.L. listing.

IMPORTANT U.L. LISTING NOTE — Switches, Series 46000, 47000, 49000, 50000, 51000, 52000, 54000 and 55000 have additional U.L. listing of 1.5A, 250 VAC.

SERIES 46000R AND 46000E*
2 AND 3 POSITION GENERAL PURPOSE TYPE

Series 46000R rated at 3 amps, AC, 0.5 amp, DC, 125 volts, non-inductive load. No. 46206MP, 2 position momentary switch with 1 1/8" plunger and extruded and tapped 6-32 mounting holes. Nos. 46206LFR and 46256LFR feature a flush screwdriver slotted knob. No. 46204MBR pushbutton switch with 11/32" knob. All Series 46000R U.L. listed except No. 46204MBR. Series 46000E. 2 position types with locking or momentary functions. U.L. and C.S.A. listed. Rated at 0.5 amp, DC, 3 amps, AC, 125 volts, non-inductive load. Unless otherwise indicated, switches have non-shorting contacts and black nylon knob with serrated crown. Nos. 46203LSE and 46206LSE have shorting contacts; Nos. 46206LFE and 46256LFE have flush actuators.

Part No.	Action	Schematic	Fig.	List Price U.S.A.
46201ME	S.P.S.T. Momentary (n.o.)	I	O	$1.15
46201MR	S.P.S.T. Momentary	I	B	1.05
46202LE	S.P.S.T. Locking	II	O	.85
46202LR	S.P.S.T. Locking	II	A	.75
46202ME	S.P.S.T. Momentary (n.c.)	II	O	1.15
46203LE	S.P.D.T. Locking	III	O	.90
46203LR	S.P.D.T. Locking	III	A	.80
46203LSE	S.P.D.T. Locking	III	P	.95
46203LSR	S.P.D.T. Locking	III	A	.85
46203ME	S.P.D.T. Momentary	III	O	1.20
46203MR	S.P.D.T. Momentary	III	B	1.10
46204LE	D.P.S.T. Locking	2-II	O	.95
46204LR	D.P.S.T. Locking	2-II	A	.85
46204MBR	D.P.S.T. Momentary	IV	E	1.10
46204ME	D.P.S.T. Momentary (n.o.)	2-I	O	1.25
46204MR	D.P.S.T. Momentary	2-I	B	1.15
46206LE	D.P.D.T. Locking	2-III	O	1.05
46206LFE	D.P.D.T. Locking	2-III	R	1.20
46206LFR	D.P.D.T. Locking	2-III	D	1.10
46206LR	D.P.D.T. Locking	2-III	A	.90
46206LSE	D.P.D.T. Locking	2-III	P	1.10
46206LSR	D.P.D.T. Locking	2-III	A	.95
46206ME	D.P.D.T. Momentary	2-III	S	1.40
46206MP	D.P.D.T. Momentary	2-III	C	1.20
46206MR	D.P.D.T. Momentary	2-III	B	1.25
46256LFE	D.P.D.T. Locking	2-III	R	1.25
46256LFR	D.P.D.T. Locking	V	D	1.15

* U.S. Patent Nos. 3,502,825 (exc. 46204MBR) and 3,485,966.

Three position types with positive center detent action. All have shutter type dust cover to prevent dirt and dust from contaminating switch contacts. Series 46300LDR type — locking in all positions. Series 46300MDR type — momentary action on either side of center. Center position OFF. Series 46300TDR type — momentary one side of center (locking) position, locking other side.

Part No.	Circuitry	Action Positions #1	Center Locking	#2	Schematic	Fig.	List Price U.S.A. List Price
46311LDR	S.P.T.T.	L		L	VI	F	$1.10
46311MDR	S.P.T.T.	M		M	VI	F	1.20
46313LDR	D.P.T.T.	L		L	2-VI	F	1.15
46313MDR	D.P.T.T.	M		M	2-VI	F	1.25
46313TDR	D.P.T.T.	L		M	2-VI	F	1.20

"DOUBLE-WIPE" SLIDE SWITCHES

SERIES 47000R AND 47000E† TANDEM SLIDE SWITCHES

Compact, two-gang slide switches. Series 47000LR and 47000LE; two independent knobs; No. 47206LCR, single knob construction with coupling link between knobs. One knob 11/32" high, other flush screwdriver operated. No. 47227LFR, two knobs flush with switch housing, one knob screwdriver actuated. Knobs are coupled. Shorting bar each section. Rated at 0.5 amp, DC, 3 amps, AC, 125 volts, non-inductive load. Series 47000R are U.L. listed. Series 47000E: 2 position types with locking function and non-shorting contacts. Tandem switches have two switches in one housing, operating independently except for 47206LCE and 47227LFE which have internal mechanical coupling for simultaneous operation. Black nylon serrated knob except for flush actuator types. U.L. and C.S.A. listed.

Part No.	Action	Schematic	Fig.‡	List Price U.S.A.
47202LE	S.P.S.T.-S.P.S.T. Locking	II II	S	$1.45
47202LR	S.P.S.T.-S.P.S.T. Locking	II II	G	1.25
47206LE	D.P.D.T.-D.P.D.T. Locking	2-III 2-III	S	1.70
47206LR	D.P.D.T.-D.P.D.T. Locking	2-III 2-III	G	1.55
47206LCE	D.P.D.T.-D.P.D.T.	2-III 2-III	T	2.20
47227LFE	D.P.D.T.-D.P.D.T.	V V	U	2.45
47227LFR	D.P.D.T.-D.P.D.T. Locking	V V	J	2.30

† U.S. Patent No. 3,485,966.

SERIES 48000 QUADRUM SLIDE SWITCHES

Four-gang slide switches with independent knob operation. 11/32" knob height and .153" mounting holes.

Part No.	Action	Schematic	Fig.‡	List Price U.S.A.
48208L*	4 S.P.S.T. Locking	4-II	K	$3.45
48224L*	4 D.P.D.T. Locking	8-III	K	4.15

* Not submitted for U.L. approval.

SERIES 49000 3 POSITION GENERAL PURPOSE TYPE

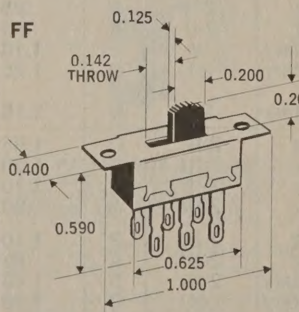
Large, heavy duty 3 and 4 pole slide switches. Knob height ½". Mounting holes 9/64". Series 49000L, non-shorting U.L. listed as approved.

Part No.	Action	Schematic	Fig.‡	List Price U.S.A.
49309L	3 P.D.T. Locking	3-III	L	$2.45
49329L	3 P.T.T. Locking	3-VI	L	2.55
49312L	4 P.D.T. Locking	4-III	L	2.55
49331L	4 P.T.T. Locking	4-VI	L	2.65

‡See illustrations on Page 4301.

"DOUBLE-WIPE" SLIDE SWITCHES

FF



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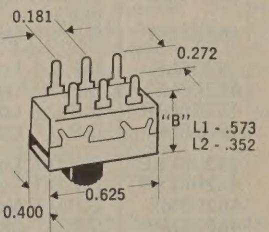

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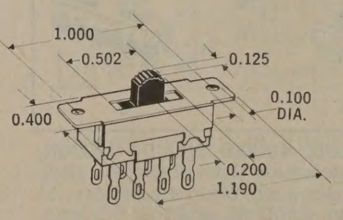

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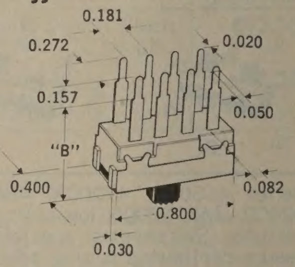


"TINI-SLIDE" MINIATURE SWITCHES, SERIES 56000

Precision, miniature locking slide switches have unique wiping/lifting/sliding action of silver contacts & 2-C switching rated at 0.5A, 125 VAC or DC, non-ind. Plastic parts self-ext. per U.L. & ASTM specs. Molded term. board prevents solder, flux & other contaminants from entering switch around terms. Solder lug types mount with mach. screws or rivets (not incl.). PC term. types have standoff shoulders for mtg. to boards. Behind panel distance: No. 56206L1 — .590"; No. 56206L2 — .441". Max. above board distance: No. C56206L1 — .573"; No. C56206L2 — .352".

U.S. Patent No. 3,947,391

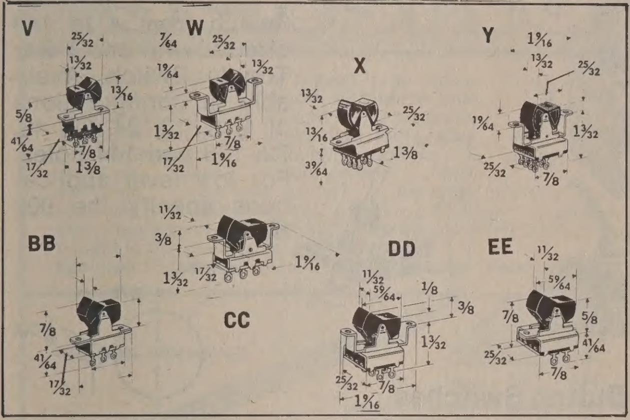
Part No.	Action	Schematic	Terms.	Fig.	U.S.A. List Price
56206L1	D.P.D.T. Locking	2-III	Solder	FF	$1.30
56206L2			Solder	FF	1.30
C56206L1			PC	GG	1.30
C56206L2			PC	GG	1.30

"TINI-SLIDE" MINIATURE SLIDE SWITCHES SERIES 56300

New, 3-pos. slide switches have same materials and contact ratings at 2-pos. Series 56000 switches. Min. life is 6000 cycles (10,000 cycles for dry circuit load). Nos. 56313L1 & 56313L2 have solder lugs; Nos. C56313L1 & C56313L2 have P.C. terms. "B" dim. (see illustration JJ) is .585" — C56313L1; .364" — C56313L2. Behind panel dim.: 56313L1 — .602"; 56313L2 — .453"; C56313L1 — .742"; C56313L2 — .521". Black knobs are .187" high.

Part No.	Action	Schematic	Terms.	Fig.	U.S.A. List Price
56313L1	D.P.D.T. Locking	2, VI	Solder	HH	$1.85
56313L2			Solder	HH	1.85
C56313L1			PC	JJ	1.85
C56313L2			PC	JJ	1.85

"DOUBLE-WIPE" SLIDE SWITCHES



SERIES 51000R, B51000R, AND 51000E
2 POSITION ROCKER SWITCHES*

Compact rocker switches offer same quality and dependability as standard slide switches. Rocker pivot mounting allows free actuation of switch mechanism. Black rocker knobs. Series 51000R has rugged rocker bracket, precision welded to standard flush switch housing. New Series B51000R has offset brackets for flush or sub-panel mounting, which eliminates need for separate mounting hardware. U.L. listed. Series 51000E: 2 position types with non-shorting contacts. Black nylon rocker knobs have legend areas and serrations on operating faces. U.L. and C.S.A. listed.

* U.S. Patent Nos. 3,502,825 and 3,485,966.

Part No.	Action	Schematic	Fig.‡	List Price U.S.A.
51201ME	S.P.S.T. Momentary (n.o.)	I	V	$1.70
51201MR	S.P.S.T. Momentary (n.o.)	I	N	1.55
51202LE	S.P.S.T. Locking	II	V	1.55
51202ME	S.P.S.T. Momentary (n.c.)	II	V	1.70
51202MR	S.P.S.T. Momentary (n.c.)	II	N	1.55
B51203LR	S.P.D.T. Locking	III	W	1.80
51203LE	S.P.D.T. Locking	III	V	1.65
51203LR	S.P.D.T. Locking	III	N	1.50
51203ME	S.P.D.T. Momentary	III	V	1.85
51204LE	D.P.S.T. Locking	2-I	V	1.65
51204ME	D.P.S.T. Momentary (n.o.)	2-I	V	1.85
51204MR	D.P.S.T. Momentary	2-I	N	1.65
B51206LR	D.P.D.T. Locking	2-III	W	1.85
B51206MR	D.P.D.T. Momentary	2-III	W	2.10
51206LE	D.P.D.T. Locking	2-III	V	1.70
51206ME	D.P.D.T. Momentary	2-III		1.90
51206MR	D.P.D.T. Momentary	2-III	N	1.70

‡Fig. N is on Page 4301.

SERIES 52000 AND B52000
2 POSITION ROCKER SWITCHES

Larger than Series 51000, offering 3 and 4 poles of switching, Series 52000L, non-shorting; Series 52000LS with shorting contacts. U.L. listed. New Series B52000 have new offset mounting bracket for flush or sub-panel mounting — no extra mounting hardware needed. U.L. listed.

Part No.	Action	Schematic	Fig.	List Price U.S.A.
52207L	3P.S.T. Locking	3-I	X	$1.70
52208L	4P.S.T. Locking	4-I	X	1.80
B52208L	4P.S.T. Locking	4-I	Y	2.20
B52209L	3P.D.T. Locking	2-III	Y	2.30
52209L	3P.D.T. Locking	3-III	X	1.85
B52212L	4P.D.T. Locking	4-III	Y	2.40
52212L	4P.D.T. Locking	4-III	X	1.95

SERIES 50000
2 POSITION GENERAL PURPOSE TYPE

Series 50000L and M, non-shorting contacts; U.L. listed.

Part No.	Action	Schematic	Fig.‡	List Price U.S.A.
50207L	3P.S.T. Locking	3-II	M	$1.50
50207M	3P.S.T. Momentary	3-II	M	1.65
50208L	4P.S.T. Locking	4-II	M	1.55
50209L	3P.D.T. Locking	3-III	M	1.60
50209M	3P.D.T Momentary	3-III	M	1.80
50212L	4P.D.T. Locking	4-III	M	1.65

‡Fig. M is on Page 4301.

SERIES 54000R AND B54000R
2 POSITION ROCKER SWITCHES

New, precision 1- or 2-pole switching. Series 54000R has new, slim black rocker knob which provides clean, linear appearance. Submitted to U.L. for listing. Series B54000R has new slim knob plus offset mounting bracket feature. U.L. listed.

Part No.	Action	Schematic	Fig.	List Price U.S.A.
54203LR B54203LR	S.P.D.T. Locking	III	BB CC	$1.50 1.80
54203MR B54203MR	S.P.D.T. Momentary	III	BB CC	1.65 1.95
54206LR B54206LR	D.P.D.T. Locking		BB CC	1.55 1.85
54206MR B54206MR	D.P.D.T. Momentary	2-III	BB CC	1.70 2.00

SERIES 55000 AND B55000
2 POSITION, 3- AND 4-POLE ROCKER SWITCHES

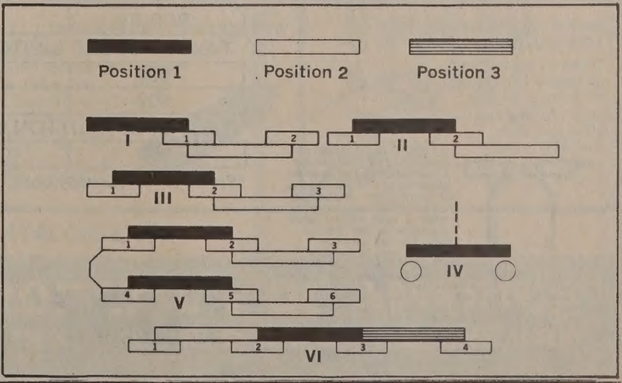
New, 3 or 4 poles of precision switching with a selection of non-shorting or shorting contacts. Series 55000 features new, slim, black rocker knob. U.L. listed. Series B55000 switches have both new slim, black rocker knob and offset mounting bracket feature for flush or sub-panel mounting.

Part No.	Action	Schematic	Fig.	List Price U.S.A.
B55208L 55208L	4P.S.T. Locking	4-I	DD EE	$2.10 1.85
B55209L 55209L	3P.D.T. Locking	3-III	DD EE	2.10 1.85
B55212L 55212L	4P.D.T. Locking	4-III	DD EE	2.25 1.95

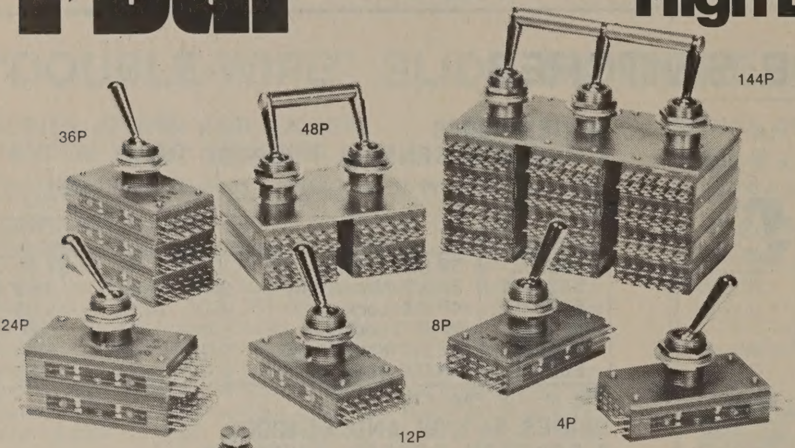
"DW" SLIDE SWITCH CONTACT ARRANGEMENT

Standard "break" before "make" (non-shorting). "Make" before "break" (shorting) switches are available in some models, refer to Series 46000 and 52000.

BASIC SCHEMATIC CHART

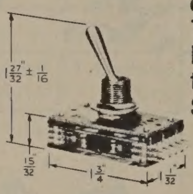


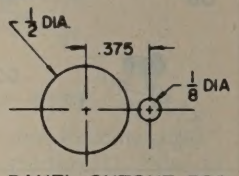
T-bar® SWITCHES for Multipole High Density Switching



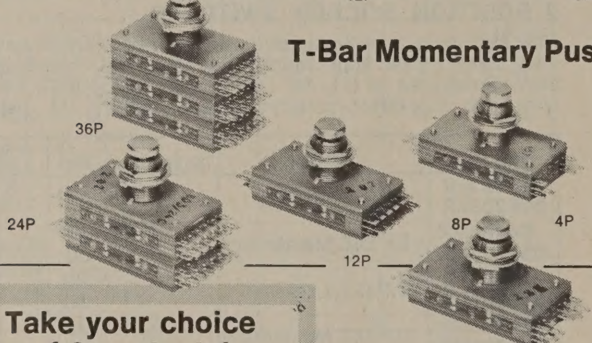
T-Bar Toggle Switches

Switch from 4 to 144 circuits with one T-Bar Toggle Switch. Available in configurations of 4, 8, 12, 24, 36, 48, 72, 108 and 144 poles. For low level applications specify the 902 Series.



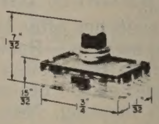


PANEL CUTOUT FOR TOGGLE AND PUSH-BUTTON SWITCHES



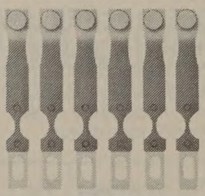
T-Bar Momentary Push-Button Switches

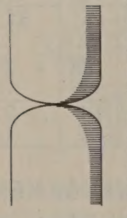
Switch from 4 to 36 circuits with one T-Bar Momentary Push-Button Switch. Available in configurations of 4, 8, 12, 24 and 36 poles.



Take your choice of 2 contacts!

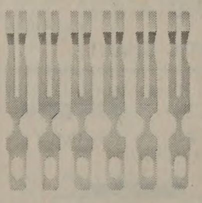
800 SERIES
for reliable General Purpose Switching

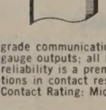




The 800 Series contact is a highly reliable gold-plated button contact. With its high contact pressure and positive wiping action, it is used in control type applications and in general purpose switching, such as relays, valves, lamps, etc. Contact Rating: up to 5 AMPS max.

900 SERIES
for reliable Low Level Switching



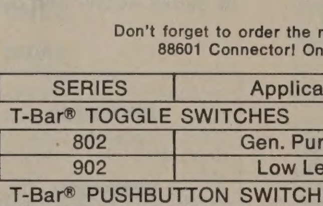


The 900 Series DATA-RITE™ contact has the reliability of a bifurcated contact with the added feature of two degrees of wiping action. The unique EDGE-TO-DOME contact guarantees a clean surface, which is critical for low level signals. The 900 Series is typically used in computer I/O signals; voice and data-grade communications; thermocouple and strain gauge outputs; all low level switching, whenever reliability is a premium, or whenever slight variations in contact resistance cannot be tolerated. Contact Rating: Microvolts up to 1 AMP max.

SWITCH SPECIFICATIONS

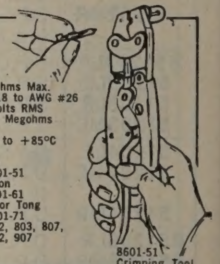
Contacts: Series 800—general purpose gold plated
Series 900—low-level bifurcated gold plated
Contact Rating: Series 800—5 amps max. resistive to 150 watts
Series 900—1 amp maximum resistive to 50 watts
Life Expectancy: at 20 CPM Series 800—50,000 cycles
Series 900—50,000 cycles
Contact Resistance: 20 milliohms typical
Ambient Temperatures: —55° to plus 85°C
Terminals: Mate with T-Bar Connectors
Dielectric Strength: 1000 VRMS @ 60 cycles/sec. (higher available)
Insulation: 5000 megohms min. (higher available)

T-BAR CONNECTORS



The T-Bar Series 88601 Connector has been specifically designed for use with T-Bar switches and relays. The connector contacts are crimp type which are snapped into a plastic insulator block. After installation, connectors are held in place against shock and vibration by use of a retaining clip.

Current Carrying Capacity	5 Amps
Contact Resistance	5 Milliohms Max.
Wire Accommodated	AWG #18 to AWG #26
Dielectric Strength	1000 Volts RMS
Insulation Resistance	100,000 Megohms Min.
Ambient Temperature	—55°C to +85°C
Weight	0.3 Oz.
Recommended Tools	Crimper P/N 8601-51 Extraction P/N 8601-61 Connector Tong P/N 8601-71
Use 88601 With	801, 802, 803, 807, 901, 902, 907



8601-51 Crimping Tool

HOW TO ORDER

1. Specify Series **2.** Specify Number of Poles and Contact Form

Don't forget to order the mating T-Bar Series 88601 Connector! One for each 6 poles.

902 — **12 C**

SERIES	Application	No. of Poles	Contact Forms*
T-Bar® TOGGLE SWITCHES			
802	Gen. Purpose	4 to 144	"A" or "C"
902	Low Level		
T-Bar® PUSHBUTTON SWITCHES			
803	Gen. Purpose	4 to 36	"A" or "C"

*Form "A" — normally open contacts. Form "C" — double throw, break-before-make.

Manufactured under 1 or more of the following patents: 3206990, 3226508, 3689856.
®"T-Bar"—Reg. T.M.

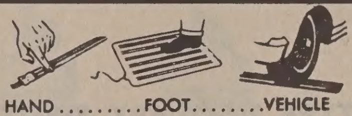
T-bar INCORPORATED
SWITCHING COMPONENTS DIV.
141 Danbury Road, Wilton, Conn. 06897 • (203) 762-8351

Bob Paul -4944

TAPESWITCH®

PRESS-AT-ANY-POINT RIBBON AND MAT

SENSING SWITCHES



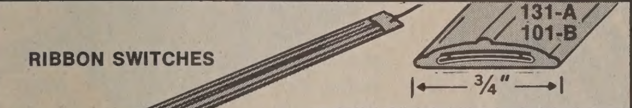
Tapeswitch products are proven in all industries. Patented construction withstands tons of force yet can close on light finger pressure. TAPESWITCHES are unexcelled for—*safety . . . automation . . . antiburglar systems . . . counting . . . timing . . . door control . . . light switching . . . machine control . . . material handling . . . seat switching . . . computer and console switching* . . . plus many other applications. TAPESWITCH RIBBON SWITCHES can be bought in the size and length needed.

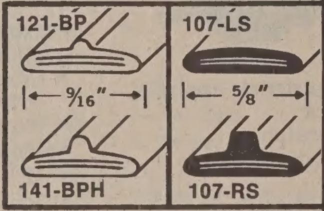
Features: Inherently sealed. Self bottoming. **Press-at-any-point operation** eliminates linkages. All styles except flex-action switches can be coiled without shorting. Millions of impacts at one point.

Rating: All Tapeswitches are rated at more than 1 ampere, 117 VAC. However, for floor switching low voltage is recommended.

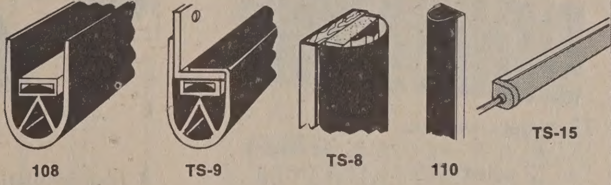
TAPESWITCHES are designed in accord with the best principles of switch and cable design, with jacketing and insulation meeting the requirements of MIL-C-9154 and MIL-I-631C respectively. Unique Fail-Safe circuitry is feasible with all Tapeswitches. See our Literature.

RIBBON SWITCHES



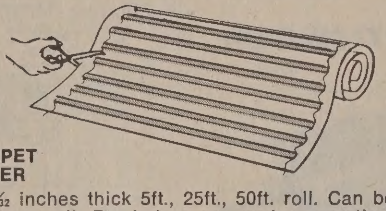


Factory sealed units with 18 inch connecting leads at one end. Sensitivity: 8, 12, or 40 ounces finger pressure. Standard lengths: 1, 2, 5, 8, 10, 12, 15, 18, 20 ft. Double leads on order. See text at top.



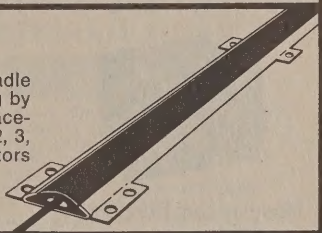
TAPESWITCH CONTROFLEX® SAFETY EDGES

Serve as cushioned sensing switches for the leading edges of doors, gate arms, machinery, presses, elevators, to stop or reverse the acting force. Numerous styles available. Double leads optional for Tapeswitch true "Fail-Safe" Circuit. Write or call for detailed literature.



PE-30 UNDER CARPET SWITCHING RUNNER

30 inches wide x 3/32 inches thick 5ft., 25ft., 50ft. roll. Can be cut to any length from roll. Can be used for indoor use under carpeting. Excellent under plywood or tile. Parallel Tapeswitches between clear sheeting. Tinned wires for easy connections.

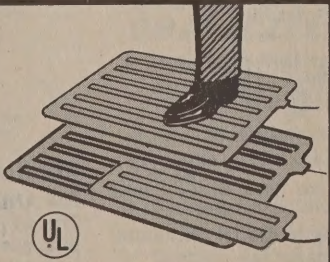


RBMA ROAD SWITCH

Successful, rugged roadway treadle for counting, timing, controlling by vehicles. 7/16" thick. Sealed, replaceable switch element. Lengths: 2, 3, 5, 8, 10 ft. Cast iron end protectors available.

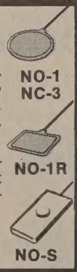
TAPESWITCH RELAY R-1

FOR AC CONTROL WITH ANY TAPESWITCH. This plug-in unit has AC outlet sockets giving Normally **ON** or Normally **OFF** 117 Volts AC at 5 Amperes. Built-in low voltage transformer. Simultaneous action.



CVP SWITCHING MATS

CVP style mats are durable flexible area switches for use exposed or under rubber mat or carpeting. UL listed for use in alarms. 3/32" thick. Available 6" x 23", 17" x 23", 23" x 35".

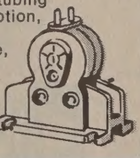


POINT AND WAFER SWITCHES

NO-1 and NO-1R—Rugged compact wafer switch. Normally Open. For under valuable objects or general purpose detection. 2 lb. nom. sensitivity.

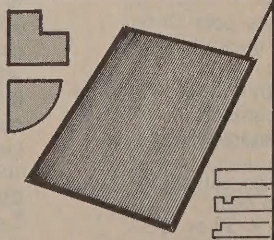
NC-3—Normally closed detector switch. Opens when weight is lifted off. 2 lb. nom. sensitivity.

NO-S—1 ounce sensitivity wiping action. Super sensitive.



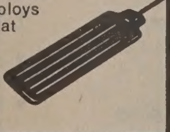
SENSITIVE AIRWAVE SWITCH MODEL AW

High quality diaphragm switch, adjustable sensitivity. Operates from tubing squeeze, air motion, light vacuum, breath pressure, etc. Silver contacts. Many adjustment features.



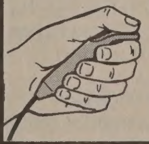
CKP & CRP HEAVY DUTY INDUSTRIAL SWITCH CARPET.

Both styles 1/2 inch thick with ramped edging. Sealed. Available any size or shape. Weatherproof. Standard sizes: 24" x 36", 30" x 30", 30" x 48", 36" x 48", 36" x 72". Optional features available.



111 CONTROFLEX® FOOTSWITCH

Rugged, low-profile sealed vinyl footswitch. Rated at 100 watts. Employs Controflex® in flat pad. Non tiring. Stand or jump on it. 2" x 5" x 3/8" 6 ft. lead wire. SPST N.O.



177 CONTROFLEX® HAND FLEX SWITCH

Innovation in hand controls. Rugged, sealed, compact. Hold in Palm and flex with thumb. 177 NO is **Normally Open.** 177 NC-3 is SPDT.

CALL OR WRITE FOR OUR COMPLETE CATALOG C-5A

TAPESWITCH CORPORATION OF AMERICA

100 SCHMITT BLVD., FARMINGDALE, N.Y. 11735 • (516) 694-6312 • (212) 895-8713 • Telex: 144611

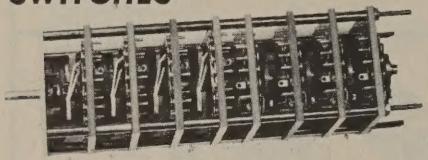
Tech Labs
SINCE 1935

SWITCHES AND ATTENUATORS

TECH LABORATORIES, INC.
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
PALISADES PARK, N.J. 07650
TEL: (201) 944-2221

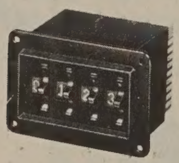
SWITCHES

SQUARE ROTARY SWITCHES



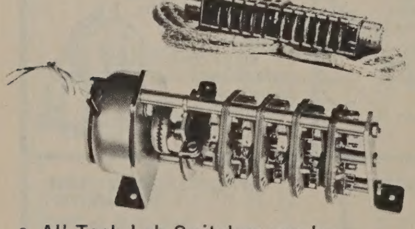
- 13 models available
- 1⁵⁄₁₆″ sq. to 8″ sq. x 15 decks (max.)
- 1 to 12 poles
- Up to 150 positions/pole
- Fixed stops or continuous rotation
- 3 amps at 120 VAC to 15 amps at 120 VAC
- Precious metal contacts

THUMBWHEEL SWITCHES



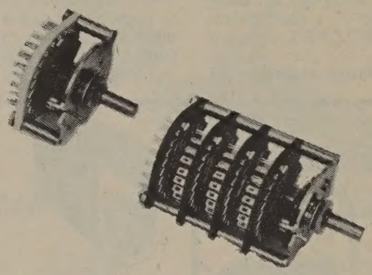
- Modular construction
- Compact
- Wide range of logic codes
- Positive detent
- Simple installation
- Two models available — Panelmite and Thumbmite

REMOTELY CONTROLLED ROTARY SWITCHES



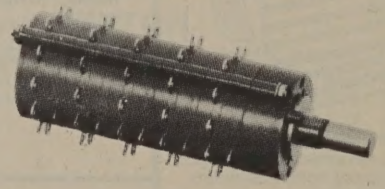
- All Tech Lab Switches can be supplied as stepping switches or continuous motor driven
- Solenoid drives
- Motor and Geneva drives
- Enercon AC incremental motor drive
- Available with interrupters or homing decks
- Completely pre-wired ready to install
- Hermetic sealing available
- May be remotely controlled by: Master-slave arrangement; Computer or other; External pulse
- Either AC or DC operation

TYPE 2 ROTARY SWITCH

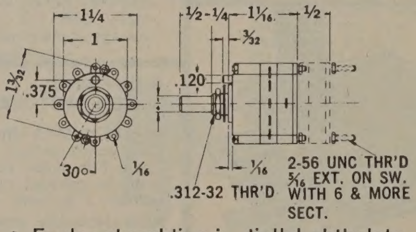


- Four insulation materials available
- 1 to 4 poles/deck
- Up to 24 positions/pole
- 2¼″ x 1¾″ x 24 decks (max.)
- Adjustable stops
- 5 amps, 120 VAC max.
- Precious metal contacts

TYPE 3 ROTARY SWITCH



DIMENSIONS

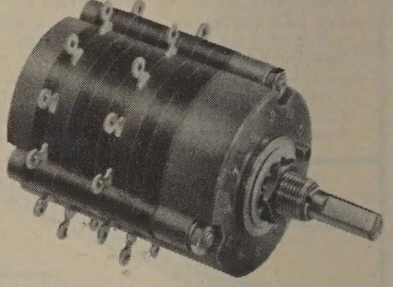


- Enclosed molding in diallyl phthalate
- Molded in terminals
- 1 or 2 poles/deck
- Up to 12 positions/pole
- 1¼″ OD up to 8 decks (max.)
- Adjustable stops
- 12 amps, 28 VDC
- Precious metal contacts
- Mixed decks of shorting and non-shorting
- Mixed shorting and non-shorting contacts on each deck
- Choice of either ⅜-32 or ⁵⁄₁₆-32 mounting bushing

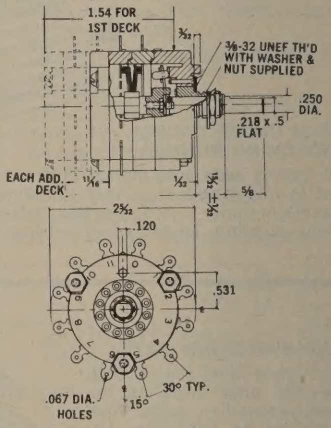
SPECIALS

Tech Labs can customize your Switch and Attenuator requirements, completely pre-wire your switches ready for installation. We can also undertake prototype design and manufacturing. Contact our factory for quotations.

ROTARY INSTRUMENT SWITCH SERIES 2000



- Extremely low contact resistance — <1 milliohm
- Extremely high insulation resistance — more than one million megohms
- Totally enclosed — dust tight
- Long life — > one million
- 12 position/1-6 pole/deck max.
- Solid silver contacts
- External adjustable stops
- Shorting (MBB)



SPECIAL DESIGN VARIATIONS

SIX AND ELEVEN POSITION DETENTS

The six position detent is 60° throw, skipping every other contact. The eleven position detent is 30° throw with the eleventh position omitted so that the detent goes 60° from position ten to position zero.

OFFSET WIPERS

30° and 180° offset wipers are available for use in special circuits.

CAPACITANCE

Less than 1 micromicrofarad between contacts or to ground.

CURRENT CAPACITY

5 amps maximum continuous duty.

THERMAL EMF

Extremely low. Silver contacts & brushes.

VOLTAGE BREAKDOWN

Withstands 1500V RMS between contacts and to ground.

LOSSES

Low electrical losses at frequencies up to several megacycles.

Tech Labs
SINCE 1935

TECH LABORATORIES, INC.
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
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TEC LAB 5 AMP 50 VDC TOGGLE SWITCHES

EQUIVALENT TO TORBAL 5 AMP

Tec Lab switches are available in many **combinations** of bushings, terminals, handles, housings and electrical styles.

The most widely used **combinations**, or **types**, are listed in the table below. These are coded with the outline drawings on this page so you can determine construction details and dimensions of the various parts of the switch.

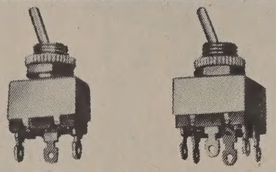
The SP-1, for example, has short bushing, solder terminals, long stem handle, single-pole housing and double-throw electrical style.

Model Designation	Bushing A	Terminal B	Handle C	Housing D	Elec. E
SP-1	1	1	1	1	1
SP-3	2	1	1	1	1
SP-4	1	1	1	1	2
SP-5	1	2	1	1	1
SP-6	1	1	4	1	1
SP-7	1	1	2	1	1
SP-10	2	1	3	1	1
SP-11	1	1	3	1	1
SP-14	2	1	4	1	1
DP-1	1	1	1	2	1
DP-3	2	1	1	2	1
DP-6	1	1	4	2	1
DP-7	1	1	2	2	1
DP-10	2	1	3	2	1
DP-11	1	1	3	2	1

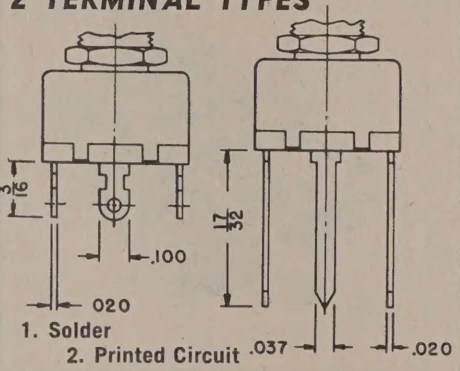
Generally, switch types not listed in this table can be made available. To specify the type desired in your inquiry, list the numerical style desired for each switch feature. Example, to specify switch having the following styles:

	Block Letter	Style No.
Bushing, long	A	2
Terminal, printed circuit	B	2
Handle, ball end, long	C	4
Housing, single-pole	D	1
Electrical, double-throw	E	1

Specify A2 — B2 — C4 — D1 — E1



2 TERMINAL TYPES



APPLICABLE MIL SPEC

MIL-S-3950 MS-75028 MS-75029

MATERIAL SPEC

- **Base**
  Rogers RX-600
  Phenolic Glass Fiber
- **Housing and Mounting Bushing**
  One-piece casting of Duronze III — corrosion proof
  Conforms to QQ-M-151 & AN-QQ-S-91
- **Contacts**
  Fine silver-gold plated

OPERATING CHARACTERISTICS

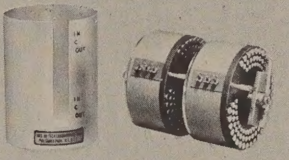
- **Insulation Resistance**
  Greater than 100,000 megohms at 100 VDC and 70°F
- **Dielectric Strength**
  At sea level 1,000V rms at 60 cps for 1 min.
- **Contact Resistance**
  Initial — less than .010 ohms
- **Contact Rating**

DC Load	AC Load
Inductive	Inductive
28V	**125V**
5 amp	5 amp

- **Temperature Range**
  −55°C to 85°C
- **Vibration Endurance**
  10 to 2,000 cps per MIL-R-25018
- **Shock Endurance**
  75G
- **Contact Chatter**
  10 microseconds or less MIL-R-5757
- **Corrosion Resistance**
  of complete assembly 50 hrs per QQ-M-151
- **Mechanical Endurance**
  100,000 cycles switching 10 amp. 50 VDC resistive load

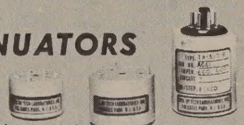
ATTENUATORS

ROTARY/VARIABLE



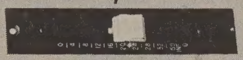
- Five basic models — 1⅞″ to 3″ dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

FIXED ATTENUATORS



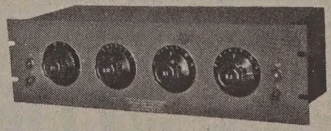
- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available

VERTICAL/VARIABLE



- Two basic models — 1″ and 1½″ wide
- Many circuit configurations available
- Wide range of impedance
- Available with detents, tapers and cueing
- Black anodized escutcheon plate
- Precious metal contacts
- Up to 30 steps

PRECISION ATTENUATORS



TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*

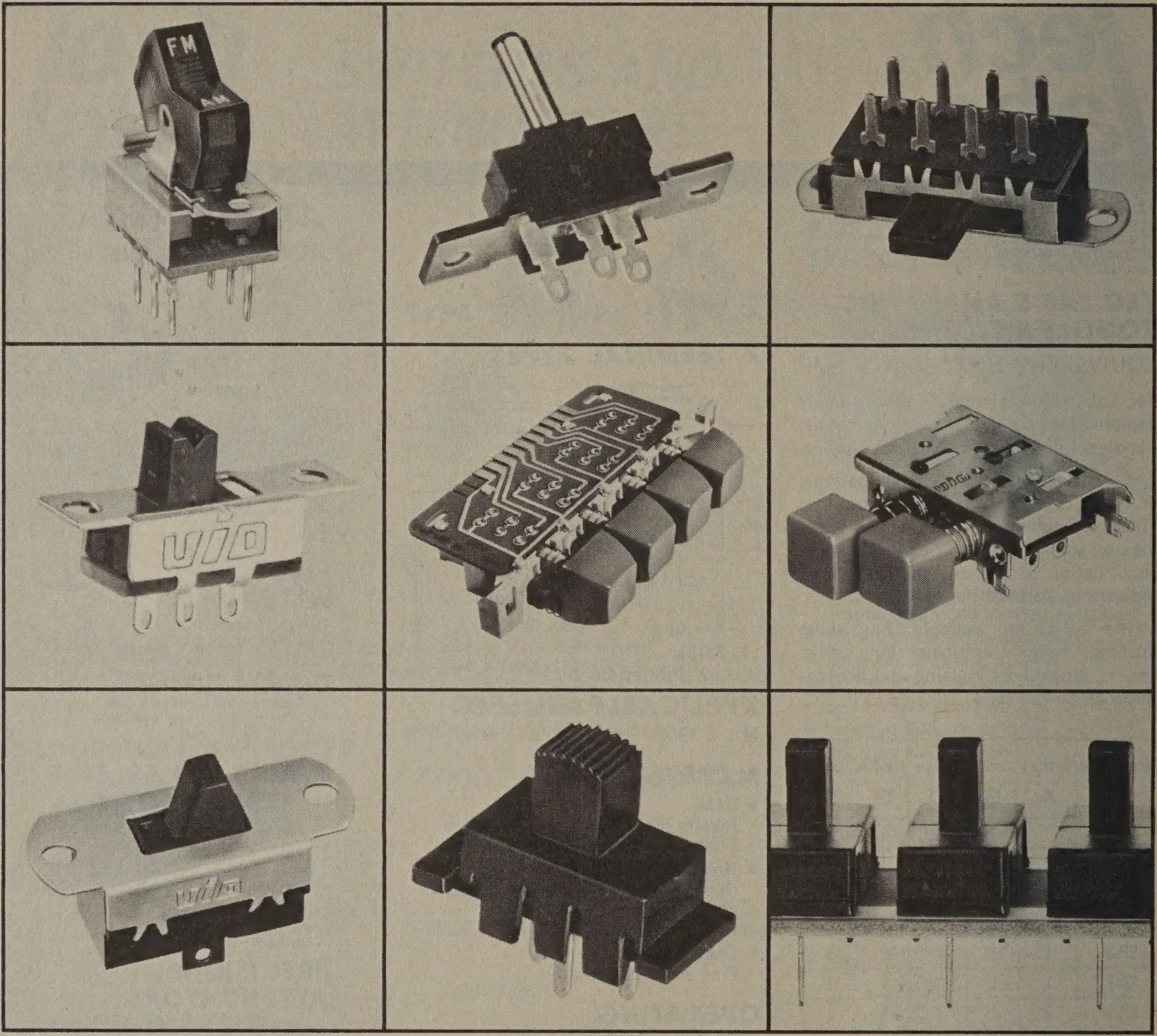
- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz
  Lower values of loss, essentially flat to 10 MHz

Type No.	Circuit	db Range	db/ Step	Dimensions
11-T	"T"	111	0.1	5¼″x19″x5″
11-H	Bal. "H"	111	0.1	5¼″x19″x10″

* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE

- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified — Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%



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Lighted Pushbutton Switches

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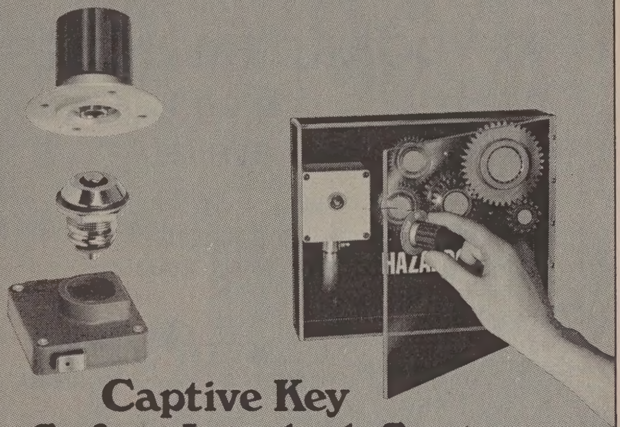
In a field full of appearance quality/performance switching variables, Unimax switches are the ones that *show* you care about quality, performance and price.

- *Single Lamp*—Round, square or rectangular, lighted and unlighted, momentary or alternate switching. 1-4 poles.
- *Dual Lamp*—Rectagular and square, double pole, momentary or alternate action. 5A @ 250VAC or 28 VDC. Keylock versions.
- *Four Lamp*—Multi-switch configurations. Approved to MIL-S-22885/9-12. Also meets high-shock requirements of MIL-S-910C.
- *Oil-Tight*—Pilot, lighted, unlighted, emergency, key-operated rotary types. 500V @ 10A ratings.

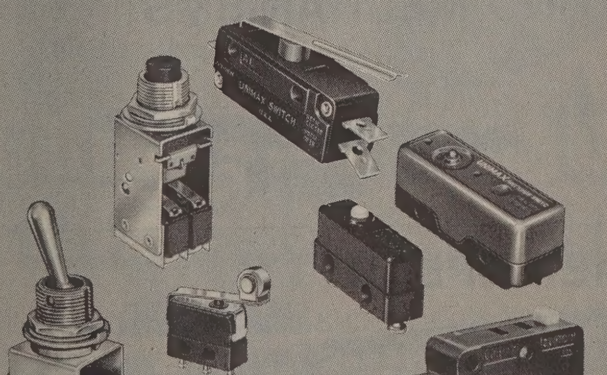


Captive Key Safety Interlock Systems

Current and expanding OSHA regulations attempt to limit mans disregard for his own and others safety. The Unimax "GW" line of "Captive Key" Interlocks and Safety Switches enables designers and users of hazardous machines to comply with the most stringent guard interlocking requirements. The "GW" system combines, in an integral unit, fail-safe electrical switching with a tamper-proof mechanical locking mechanism which positively prevents the release of a guard until the machine is securely isolated. Ask for Catalog 70.

The industry's widest selection of precision, general purpose, miniature and sub-miniature snap-action switches, as well as toggle and push-button switch assemblies. Ratings from low-level to 25A. All actuator styles available. Ask for catalog 60.

Snap-Action Switches



A full range of snap-acting switches enclosed in rugged die cast metal housings for protection against mechanical damage and, depending on the method of sealing, against destructive environmental conditions, Series KS (compact) is available with either through bolt or flange mounting. Series KL (heavy duty) is horsepower rated. Series KWL (splash proof) and KXL (explosion proof) are suitable for use in severe environments. All types are available with a variety of actuators. Ask for Catalog 30.

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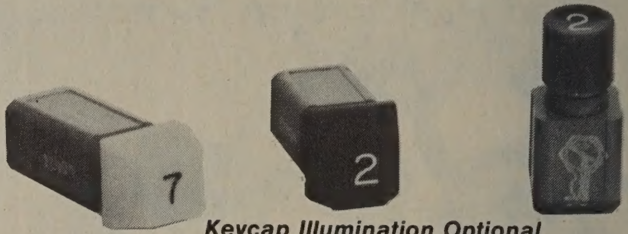

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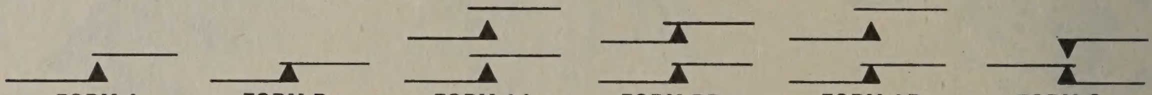

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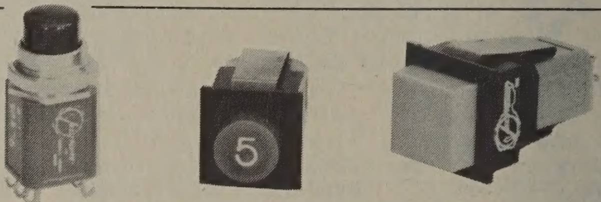

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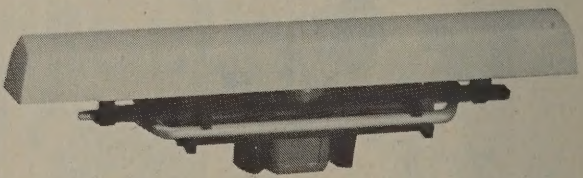

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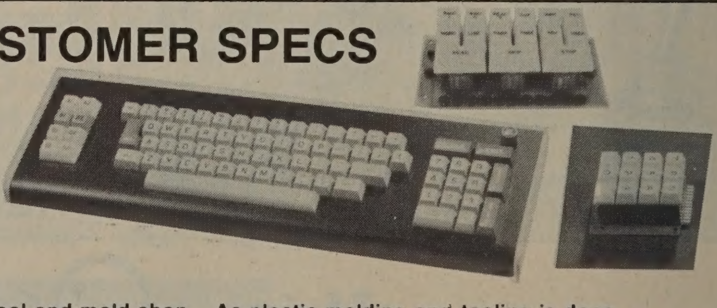

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CARBORUNDUM THERMISTORS

APPLICATION DATA

Carborundum thermistors are temperature dependent resistors, offered in a wide variety of resistance-temperature characteristics. They are available with a wide range of negative temperature coefficients at 25°C ranging from −0.3%/°C to −5.4%/°C. These parts are made from ceramic materials, bonded in a high-temperature firing process into rod, disc, and chip configurations. They are available in a large range of sizes, thermal characteristics, resistance values, and temperature coefficients to suit the needs of many types of electrical and electronic circuits.

Carborundum offers long experience in the design of special resistance devices. This, together with expertise in the field of ceramic technology, assures a stable and uniform product to meet your thermistor requirements. All materials used in the manufacture of Carborundum thermistors are of the highest quality. Strict quality control is maintained over all stages of manufacture, and a minimum of two calibrations at the specified reference temperature is standard.

DEFINITIONS

Zero Power Resistance . . . is the resistance of a thermistor at the calibrating temperature, measured in such a manner that the measuring current does not appreciably heat the thermistor. Resistance, as used here, means zero power resistance unless otherwise stated.

Beta (β) . . . is the number that satisfies the equation:

$$R_1/R_2 = {}_{\epsilon}\beta\ (1/T_1\text{-}1/T_2)$$

Carborundum determines beta from measurements at 25°C and 73.2°C. Beta is proportional to the slope of the resistance-temperature characteristic, and it is also known as the material constant. It is not truly a constant, but it gives a good approximation of resistance over a substantial working range. In the equation, ϵ is 2.718 . . ., the base of natural logarithms, and β, T_1, and T_2 are in Kelvin (K).

Alpha (α) . . . or temperature coefficient of resistance (TCR) is proportional both to beta and to the square root of the temperature at which it is specified. Very nearly,

$$\alpha = -100\ \beta/T^2$$

In this equation, temperature is in Kelvin (K), and α is in percent per degree C (%/°C). It is evident that alpha becomes much higher as temperatures decrease.

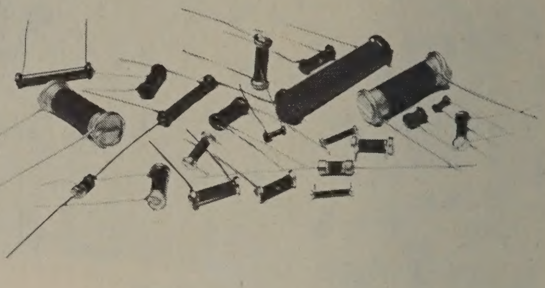
Dissipation Constant (δ) . . . is the ratio of power dissipated by the thermistor divided by the temperature rise above ambient due to self-heating. Here, it is 20 times the power required, in watts, to bring the thermistor to 75°C in an ambient of 25°C, and it is expressed in milliwatts.

Time Constant (τ) . . . is the time required for a thermistor which has attained equilibrium after being self-heated to 75°C to cool to 43.4°C in an ambient of 25°C. It is expressed in seconds.

Both δ and τ are necessarily approximate quantities, and they represent complicated concepts. They cannot be fully defined or used unless the conditions under which they are measured are fully defined.

In particular, note that the dissipation of a thermistor is the sum of dissipation due to conduction, convection, and radiation, which are related to temperature by linear, square-law, and fourth-power equations respectively. Only over narrow temperature ranges can dissipation constant be considered constant.

Also note that time constant is defined by a zero-power cooling curve. If the thermistor is attached to a heat sink the effective time constant is changed substantially. The time required for a thermistor to reach equilibrium due to heating from a current passing through it may be dramatically different from the time constant as defined above.



THERMISTOR SPECIFICATION

Thermistors are most often specified by a zero power resistance, suitably toleranced, at some specified temperature (most often 25°C or 37.8°C), and by a temperature coefficient, also suitably toleranced. This is all that is required as an electrical specification. Additional specifications may result in double dimensioning and be unduly restrictive (and therefore costly) or ambiguous.

The zero power resistance of a thermistor should be read in a temperature controlled, agitated oil bath. Not only does the oil bath provide a more controllable constant temperature, but it also speeds the settling of the reading.

TEMPERATURE COEFFICIENTS

Of a variety of ways in which temperature coefficients may be expressed, beta is chosen as being the most nearly universal. If β is known, then it is possible to calculate the approximate resistance of the thermistor at any given temperature.

Alpha changes with temperature. Due to the problems associated with the accurate measurement of an incremental difference in temperature, direct measurement of α is both impractical and imprecise.

The ratio of resistances between two temperatures may be specified. In order to obtain the approximate resistance at any other temperature, beta must be calculated or a resistance-temperature characteristic curve used.

Resistance may be specified at each of two (or more) temperatures. Where this is done, one resistance usually carries a tight tolerance, the other resistance(s) a much looser tolerance. Two tight tolerances on resistance at two different temperatures may result in an unrealistically tight tolerance on temperature coefficient.

OTHER CONSIDERATIONS

In creating a specification for a thermistor, the following should be taken into account:

- . . . size of the thermistor body and size overall.
- . . . coating material, if any.
- . . . marking, if any.
- . . . lead detail, including material, length, diameter, and trim.

Note that δ and τ are fully defined by the physical parameters of a thermistor. If they are shown on a drawing, they should be shown as nominal or marked for reference only.

When possible, specify a thermistor by part number. Second best, show a part number with exceptions (for example, 0325F5-434 except ±5% tolerance on resistance). When neither of these is practical, it is best to fully define the thermistor by a detail drawing.

CARBORUNDUM

The Carborundum Company, Graphite Products Division, Post Office Box 339,
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CARBORUNDUM THERMISTORS

RODS AND CHIPS

ROD THERMISTORS

Rod thermistors are manufactured by extruding and firing a suitable ceramic mixture. For a given type of thermistor, low-, medium-, or high-sensitivity, a number of mixtures are available: in general, a mixture yielding a higher resistivity product also yields a higher beta or temperature sensitivity.

Standard rod thermistors are shown in the table below. They have a resistance tolerance of ±10% at 25°C, and they are neither coated nor marked. Special rod thermistors may be ordered with intermediate resistance values, other resistance tolerances, other calibration temperatures, coating, marking, special lead preparation, etc. Parts without wire leads are also available.

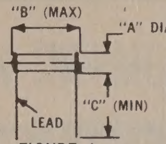


FIGURE 1

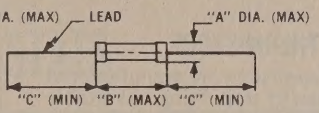


FIGURE 2

Style	Figure	Dimensions (inches) A	B	C	AWG	Dissipation Constant (mw/°C)	Time Constant (seconds)
0325F5- 0325H5-	1	0.12	0.30	1.00	24	6.0	10
0540F4-	2	0.20	0.50	1.25	20	9.5	22
0550H4-	2	0.20	0.63	1.25	20	11.0	25
0550F5- 0550H5-	1	0.22	0.63	1.38	20	11.0	25
1099F5-	1	0.38	1.13	1.38	20	24.0	90

		MEDIUM TEMPERATURE COEFFICIENT Type "F" Rods Beta ±10%			HIGH TEMPERATURE COEFFICIENT Type "H" Rods Beta ±5%	
Resistance Ohms ±10% @ 25°C	Dash Number	Style 0325F5	Styles 0540F4- 0550F5-	Style 1099F5-	Style 0325H5-	Styles 0550H4- 0550H5-
2.2	-402	——	——	1300	——	——
3.3	-403	——	——	1350	——	——
4.7*	-404	——	1300	1400	——	——
6.8	-406	——	1350	1450	——	——
10.0*	-410	1300	1400	1500	——	——
15.0	-411	1350	1450	1550	——	——
22.0*	-412	1400	1500	1600	——	——
33.0	-413	1450	1550	1600	——	——
47.0*	-414	1500	1600	1650	——	——
68.0	-416	1550	1600	1650	——	——
100*	-420	1600	1650	1700	——	——
150	-421	1600	1650	1700	——	——
220*	-422	1650	1700	1750	——	——
330	-423	1650	1700	1750	——	——
470*	-424	1700	1750	1800	——	——
680	-426	1700	1750	1800	——	——
1,000*	-430	1750	1800	1850	——	3000
1,500	-431	1750	1800	1850	——	3100
2,200*	-432	1800	1850	1900	3000	3150
3,300	-433	1800	1850	1900	3100	3200
4,700*	-434	1850	1900	1950	3150	3300
6,800	-436	1850	1900	1950	3200	3400
10,000*	-440	1900	1950	2000	3300	3500
15,000	-441	1900	1950	2000	3400	3600
22,000*	-442	1950	2000	2050	3500	3700
33,000	-443	1950	2000	2050	3600	3800
47,000*	-444	2000	2050	2100	3700	3900
68,000	-446	2000	2050	2100	3800	4000
100,000*	-450	2050	2100	2150	3900	4100
150,000	-451	2050	2100	2150	4000	4150
220,000*	-452	2100	2150	2200	4100	4200
330,000	-453	2100	2150	2200	4150	4250
470,000*	-454	2150	2200	2200	4200	4300
680,000	-456	2150	2200	——	4250	4350
1,000,000*	-460	2200	2200	——	4300	4400
1,500,000	-461	2200	——	——	4350	——
2,200,000	-462	2200	——	——	4400	——

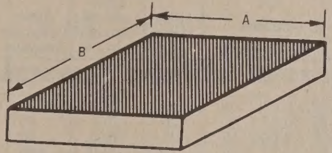
Order by the style number followed by the dash number. For example, part number 0540F4-404 is a thermistor of style 0540F4-, of 4.7 ±10% ohms resistance, and with a beta of 1300 ±10% K.

STOCK ITEMS, carried by Carborundum distributors, are styles 0540F4- and 0550H4- of those resistance values marked with an asterisk (*).

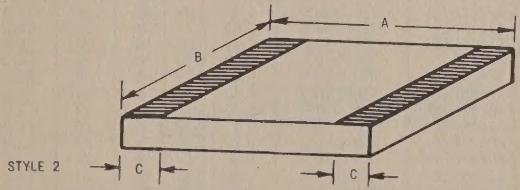
CHIP THERMISTORS

Chip thermistors, manufactured by a proprietary process, are available to meet today's needs for miniaturization. Standard parts, shown in the table below, are furnished without leads, and are suitable for use in hybrid microcircuits. Parts with wire leads are also available.

The basic material system is substantially the same as that for disc thermistors, and the data for temperature characteristics of disc thermistors apply. Chip thermistors have a nominal thickness of 0.015 inch. Metallization is Dupont 8032 silver.



STYLE 1



Carborundum Part Number	Resistance at 25°C in Ohms	Nominal Dimensions A	B	C	Style	Dissipation Constant mw/°C	Time Constant Seconds
A1515C-1	300 ±10%	0.15	0.15		1	4.5	8.5
A1010C-1	680 ±10%	0.10	0.10		1	3.0	6.0
A0505C-1	2,800 ±10%	0.05	0.05		2	1.5	4.0
A1005D-1	53,000 ±10%	0.10	0.05	0.015	2	2.5	5.0
A2010D-1	53,000 ±10%	0.20	0.10	0.030	2	6.0	18.0
B1515C-1	26 ±10%	0.15	0.15		1	4.5	8.5
B1010C-1	60 ±10%	0.10	0.10		1	3.0	6.0
B0505C-1	240 ±10%	0.05	0.05		1	1.5	4.0
B1005D-1	3,000 ±10%	0.10	0.05	0.015	2	2.5	5.0
B2010D-1	3,000 ±10%	0.20	0.10	0.030	2	6.0	18.0
C1515C-1	55 ±10%	0.15	0.15		1	4.5	8.5
C1010C-1	130 ±10%	0.10	0.10		1	3.0	6.0
C0505C-1	520 ±10%	0.05	0.05		1	1.5	4.0
C1005D-1	9,200 ±10%	0.10	0.05	0.015	2	2.5	5.0
C2010D-1	9,200 ±10%	0.20	0.10	0.030	2	6.0	18.0
D1515C-1	500 ±10%	0.15	0.15		1	4.5	8.5
D1010C-1	1,100 ±10%	0.10	0.10		1	3.0	6.0
D0505C-1	4,400 ±10%	0.05	0.05		1	1.5	4.0
D1005D-1	88,000 ±10%	0.10	0.05	0.015	2	2.5	5.0
D2010D-1	88,000 ±10%	0.20	0.10	0.030	2	6.0	18.0

The Carborundum Company, Graphite Products Division, Post Office Box 339,
Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

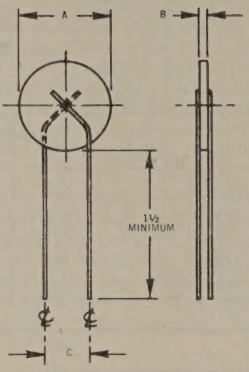
CARBORUNDUM

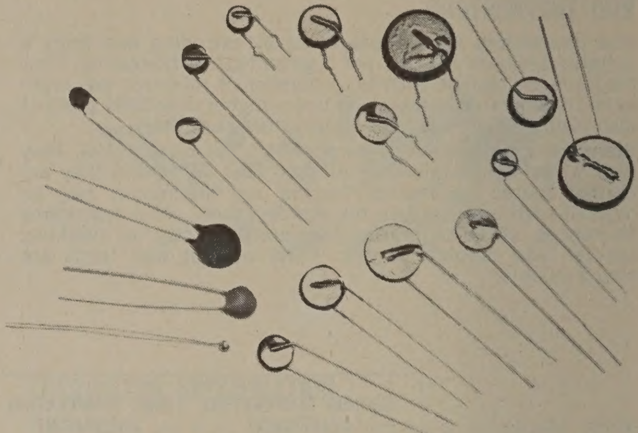
CARBORUNDUM THERMISTORS
HIGH SENSITIVITY NTC DISCS

DISC THERMISTORS

Disc thermistors are manufactured by pressing and firing a suitable ceramic mixture. Carborundum offers six standard mixtures of various resistivity and beta.

Standard disc thermistors are shown in the table on this page. They have a resistance tolerance of ±10% at 25°C, and they are neither coated nor marked. Special disc thermistors may be ordered with intermediate resistance values, other resistance tolerances, other calibration temperatures, coating, marking, special lead preparation, etc. Parts without wire leads are also available.





Notes:

1. Dielectric coating and marking are extra-cost options.
2. Kinked leads for printed circuit use available upon request.

TYPICAL PARTS

TYPE "A" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
*A3306J-16	50 ±20%	0.82	0.06	⅜	18	29.0	100
A2606J-16	75 ±20%	0.65	0.06	⅜	20	20.0	80
A2004J-16	100 ±10%	0.50	0.04	¼	20	15.0	60
A3311J-16	100 ±20%	0.82	0.11	⅜	18	29.0	150
*A2207J-16	120 ±20%	0.55	0.07	¼	20	17.0	75
*A3312J-16	120 ±20%	0.82	0.12	⅜	18	29.0	150
A1604J-16	150 ±10%	0.40	0.04	¼	20	9.0	38
*A1203J-16	200 ±10%	0.30	0.03	¼	24	8.0	30
A2612J-16	200 ±20%	0.65	0.12	⅜	20	22.0	100
*A1204J-16	300 ±10%	0.30	0.04	¼	24	8.0	30
*A0803J-16	500 ±10%	0.20	0.03	⅛	24	7.0	20
A1612J-16	500 ±10%	0.40	0.12	¼	20	11.0	60
*A0805J-16	750 ±10%	0.20	0.05	⅛	24	7.0	23
*A0807J-16	1,000 ±10%	0.20	0.07	⅛	24	7.2	26
A1212J-16	1,000 ±10%	0.30	0.12	¼	24	9.0	40
A0809J-16	1,500 ±10%	0.20	0.09	⅛	24	7.5	30
A0810J-16	2,000 ±10%	0.20	0.10	⅛	24	7.5	30

TYPE "B" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
*B3306J-16	2.0 ±20%	0.82	0.06	⅜	18	29.0	100
B2605J-16	3.0 ±20%	0.65	0.05	⅜	20	20.0	80
*B1804J-16	3.8 ±20%	0.45	0.04	⅜	22	12.0	48
*B2004J-16	5.0 ±10%	0.50	0.04	¼	20	15.0	60
B3312J-16	5.0 ±20%	0.82	0.12	⅜	18	29.0	150
*B1604J-16	7.5 ±10%	0.40	0.04	¼	20	9.0	38
*B1203J-16	10.0 ±10%	0.30	0.03	¼	24	8.0	30
B2612J-16	10.0 ±20%	0.65	0.12	⅜	20	22.0	100
*B1205J-16	15.0 ±10%	0.30	0.05	¼	24	8.5	35
*B1206J-16	20.0 ±10%	0.30	0.06	¼	24	8.5	35
B2012J-16	20.0 ±10%	0.50	0.12	¼	20	16.0	80
*B0804J-16	30.0 ±10%	0.20	0.04	⅛	24	7.0	20
B0807J-16	50.0 ±10%	0.20	0.07	⅛	24	7.2	26
B1212J-16	50.0 ±10%	0.30	0.12	¼	24	9.0	40
B0809J-16	75.0 ±10%	0.20	0.09	⅛	24	7.5	30
B0810J-16	100.0 ±10%	0.20	0.10	⅛	24	7.5	30

TYPE "L" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
L1205J-16	3,000 ±10%	0.30	0.05	¼	24	8.5	35
*L1209J-16	5,000 ±10%	0.30	0.09	¼	24	9.0	40
*L0805J-16	7,500 ±10%	0.20	0.05	⅛	24	7.0	23
*L0807J-16	10,000 ±10%	0.20	0.07	⅛	24	7.2	26
*L0810J-16	15,000 ±10%	0.20	0.10	⅛	24	7.5	30

Specifications	Type A	Type B	Type C	Types D & L	Type M
R @ 25°C / R @ 125°C	28.5	14.2	18.7	35.3	62.0
β (K) ±5% (25.0°C - 73.2°C)	3980	3070	3415	4200	4900
Temp. Coef. (α) %/°C @ 25°C	−4.4	−3.4	−3.8	−4.7	−5.4

TYPE "C" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
*C2604J-16	10.0 ±10%	0.65	0.04	⅜	20	20.0	80
C2004J-16	15.0 ±10%	0.50	0.04	¼	20	15.0	60
C1603J-16	20.0 ±10%	0.40	0.03	¼	20	9.0	38
C3312J-16	20.0 ±20%	0.82	0.12	⅜	18	29.0	150
C1605J-16	30.0 ±10%	0.40	0.05	¼	20	9.0	38
*C1205J-16	50.0 ±10%	0.30	0.05	¼	24	8.5	35
C2012J-16	50.0 ±10%	0.50	0.12	¼	20	16.0	80
*C0803J-16	75.0 ±10%	0.20	0.03	⅛	24	7.0	20
*C0804J-16	100.0 ±10%	0.20	0.04	⅛	24	7.0	20
C1612J-16	100.0 ±10%	0.40	0.12	¼	20	11.0	60
*C0807J-16	150.0 ±10%	0.20	0.07	⅛	24	7.2	26
C0808J-16	200.0 ±10%	0.20	0.08	⅛	24	7.2	26
C1212J-16	200.0 ±10%	0.30	0.12	¼	24	9.0	40
C0810J-16	300.0 ±10%	0.20	0.10	⅛	24	7.5	30

TYPE "D" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
D2604J-16	100 ±20%	0.65	0.04	⅜	20	20.0	80
D2003J-16	150 ±10%	0.50	0.03	¼	20	15.0	60
D1804J-16	200 ±10%	0.45	0.04	¼	20	12.0	48
D3312J-16	200 ±20%	0.82	0.12	⅜	18	29.0	150
D1604J-16	300 ±10%	0.40	0.04	¼	20	9.0	38
*D1204J-16	500 ±10%	0.30	0.04	¼	24	8.0	30
D2612J-16	500 ±20%	0.65	0.12	⅜	20	22.0	100
D1206J-16	750 ±10%	0.30	0.06	¼	24	8.5	35
*D1207J-16	1,000 ±10%	0.30	0.07	¼	24	8.5	35
D1612J-16	1,000 ±10%	0.40	0.12	¼	20	11.0	60
*D0806J-16	1,500 ±10%	0.20	0.06	⅛	24	7.0	23
*D0807J-16	2,000 ±10%	0.20	0.07	⅛	24	7.2	26
D1212J-16	2,000 ±10%	0.30	0.12	¼	24	9.0	40
*D0810J-16	3,000 ±10%	0.20	0.10	⅛	24	7.5	30

TYPE "M" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

Carborundum Part Number	Resistance at 25°C in Ohms	Dimensions			Lead Wires AWG	Dissipation Constant mw/°C	Time Constant Seconds
		A	B	C			
M1203J-16	7,500 ±10%	0.30	0.03	¼	24	8.0	30
M1204J-16	10,000 ±10%	0.30	0.04	¼	24	8.5	35
M2012J-16	10,000 ±10%	0.50	0.12	¼	20	16.0	80
M1207J-16	15,000 ±10%	0.30	0.07	¼	24	8.5	35
*M0803J-16	20,000 ±10%	0.20	0.03	⅛	24	7.0	20
M1209J-16	20,000 ±10%	0.30	0.09	¼	24	9.0	40
*M0805J-16	30,000 ±10%	0.20	0.05	⅛	24	7.0	23
*M0809J-16	50,000 ±10%	0.20	0.09	⅛	24	7.5	30
*M0810J-16	75,000 ±10%	0.20	0.10	⅛	24	7.5	30

* Disc thermistors carried by Carborundum distributors are indicated by asterisk.

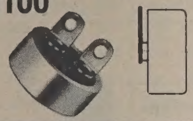
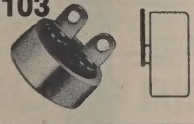
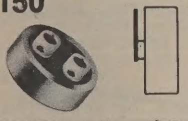
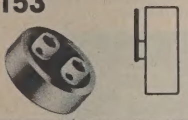
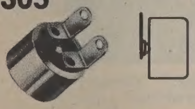
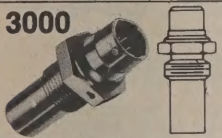
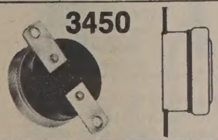
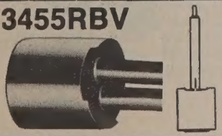
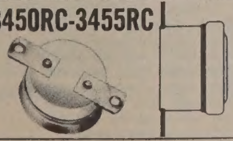
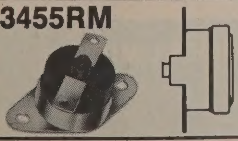
CARBORUNDUM

The Carborundum Company, Graphite Products Division, Post Office Box 339,
Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

Elmwood Sensors
Precision Controls
1653 Elmwood Avenue, Cranston, R. I. 02907
Phone (401) 781-6500 • TWX 710-381-6413

Elmwood thermostats are precision-engineered for quick, reliable response in high limit or control applications. Many meet military specifications, as well as U.L., C.S.A. and European requirements. Exposures are from —65°F to +550°F, ratings to 15 Amps, with narrow or wide differentials as required. A variety of brackets and terminals are available, as well as custom packaging. Write or phone for complete catalog.

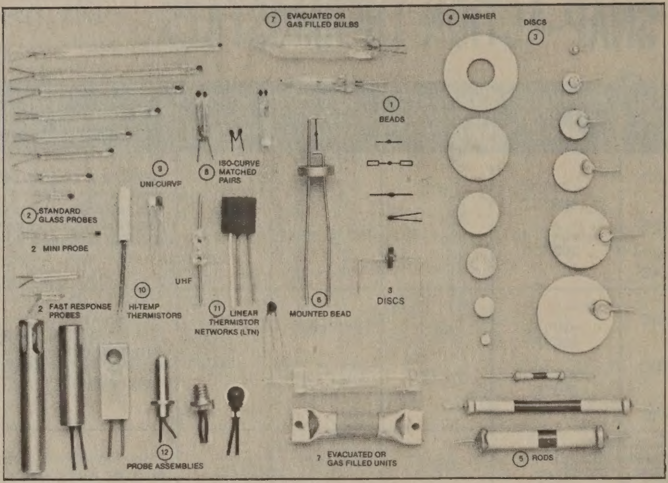
SUB-MINIATURE SNAP-ACTION THERMOSTATS

DESCRIPTION	ELECTRICAL RESISTIVE RATINGS	TEMPERATURE SET POINT RANGE	NARROWEST TOLERANCE ALLOWABLE	NARROWEST DIFFERENTIAL AVAILABLE	APPROV. AGENCY LISTINGS	TYPICAL APPLICATIONS
3100  Hermetically sealed, all welded construction long life, narrow or wide tolerances and differentials.	6 Amp. 125 VAC 7 Amp 30 VDC 3 Amp 250 VAC	—30° to 500°F —34.44° to 260°C	±3°F ±1.7°C	6°F max. 3.3°C max.	U.L.	High-temp control for glue guns, copy machines, computers, aircraft, electronic controls with commercial or military specifications.
3103  Similar to 3100 with additional mfg. and testing procedures to requirement of MIL-S-24236.	6 Amp 125 VAC 7 Amp 30 VDC 3 Amp 250 VAC	—30° to 500°F —34.44° to 260°C	±3°F ±1.7°C	6°F max. 3.3°C max.	U.L.	Similar to 3100, for more stringent military requirements, such as Apollo and Skylab heat controls.
3150  Hermetically sealed, all welded const. Similar to 3100 except low silhouette .301″ max. design	4 Amp 120 VAC 30 VDC 2 Amp 250 VAC	—30° to 350°F —34.44° to 177°C	±3°F ±1.7°C	6°F max. 3.3°C max.	U.L.	Copy machines, computers, aircraft, electronic controls with commercial or military specifications where space is critical.
3153  Similar to 3150 with additional mfg. and testing to requirements of MIL-S-24236	4 Amp 120 VAC 30 VDC 2 Amp 250 VAC	—30° to 350°F —34.44° to 177°C	±3°F ±1.7°C	6°F max. 3.3°C max.	U.L.	Similar to 3150, for more stringent military requirements, such as Apollo and Skylab heat controls.
3305  Subminiature .430″ dia., hermetically sealed, tolerances to ±3°F and narrow differentials.	3 Amp 120 VAC 30 VDC	100° to 250°F 37.8° to 121°C	±3°F ±1.7°C	6°F max. 3.3°C max.	None	Crystal ovens, gyros, electronics overheat protection where subminiature thermostat is required.
3000  Custom package housings for any Elmwood thermostats. Housings all-welded stainless steel.	Any model	—30° to 500°F —34.44° to 260°C	±4°F ±2.2°C	8°F max. 4.4°C max.	See other models	Aircraft bleed air duct sensing, hydraulic oil temp control, liquid bath control, heater control.
3001-3004 Non-hermetic, utilizing 3100 design with phenolic and metal housing.	7 Amp 120 VAC 30 VDC 3 Amp 250 VAC	0° to 335°F —17.8° to 168.3°C	±4°F ±2.2°C	8°F max. 4.4°C max.	U.L. C.S.A.	**3001-** Computers, copy machines, radar equipment, where low height .281″ is required. **3004-** Where 4mm spacing is required for Europe.
3450  Non-hermetic, with 15 Amp 120 VAC rating. U.L. and C.S.A. listings for 100,000 cycles.	15 Amp 120 VAC 12 VDC 10 Amp 277 VAC	32° to 335°F 0° to 170°C	±5°F ±3°C	20°F 11°C min, below set point.	U.L. C.S.A.	Power supplies, communication, medical equipment, computers where high amp loads are present. Where 4mm spacing is required for Europe specify 3455R.
3455RBV  Epoxy overmold constr. of 3455R. For elec. insulation of terminal or moist conditions.	15 Amp 120 VAC 12 VDC 10 Amp 277 VAC	0° to 221°F —20° to 105°C	±5°F ±3°C	20°F 11°C min. below set point.	U.L. C.S.A. Inter-nat'l	Similar to 3455R with epoxy overmold for protection of terminals and sealing of unit.
3450RC-3455RC  High temperature, with 15 Amp 120 VAC rating. Rivet insert sleeve construction for International listings.	15 Amp 120 VAC 12 VDC 10 Amp 277 VAC	32° to 500°F 0° to 260°C	±5°F ±3°C	20°F 11°C min. below set point.	U.L. C.S.A. Inter-nat'l	Similar to above, where high temperatures are present. 3450RC — 3 mm spacing 3455RC — 4 mm spacing
3455RM  Non-hermetic manual reset. Will not recycle automatically at room temperature.	15 Amp 120 VAC 10 Amp 240 VAC	125° to 300°F 52° to 150°C	±8°F ±5°C	Man. reset Auto. reset below 40°F 4.44°C	U.L. Inter-nat'l	High limit protection where manual reset is required. 3455RM meets 4mm spacing required for Europe.

THERMISTORS

Fenwal® Electronics

WORLDWIDE THERMISTOR
LEADERSHIP
THROUGH QUALITY



● THERMISTOR CONFIGURATIONS ●

1. Glass Coated Beads — used where small size, fast response, high precision, stability, and temperatures to 300°C are required.

2. Glass Probes — medium-small in size. Many of the advantages of beads but rugged, more easily mounted, useful in liquid media.

3. Discs — used where medium power dissipation is a requirement and space not a problem. Useful to 150°C.

4. Washers — used where high power dissipation is a prime requirement.

5. Rods — these units have power dissipation intermediate between discs and washers and are also used where their physical shape is an asset.

6. Mounted Beads — provide ease in using glass beads in such applications as gas chromatography, flow and vacuum measurement, etc.

7. Vacuum and Gas Filled Assemblies — high power sensitivity for specialized circuit applications.

● INTERCHANGEABLE THERMISTORS ●

8. Iso-Curve® Interchangeable Thermistors — these units available in bead or glass probe configurations, follow standard curves over wide temperature range, and are completely interchangeable. Units match standard curves as close as ± 1/4 % of resistance or as required.

9. Uni-Curve® Interchangeable Thermistors — completely interchangeable units having an accuracy of +0.2°C over a temperature range of 0°C to 70°C and available on special order to other tolerances and ranges.

● HI-TEMP THERMISTORS ●

10. Hi-Temp Thermistors — designed specifically for HI-TEMP measurement and control in applications having operating ranges from 500°C to 1000°C.

● LINEAR THERMISTOR NETWORKS (LTN) ●

11. Linear Thermistor Networks (LTN™) — precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.

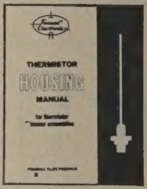
● THERMISTOR PROBES ●

12. Probe Assemblies — standard catalog types or built to specific military or commercial requirements. We are experienced in design of probe assemblies for all fields of application including industrial control and indication, aerospace — specializing in telemetry applications, and oceanographic — featuring fast response, very high pressure, and interchangeability using our Iso-Curve and Uni-Curve Thermistors.

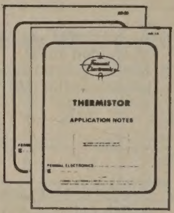
Here's Help in Applying F. E. Thermistors . . .

THERMISTOR MANUAL

THERMISTOR MANUAL (EMC-6). Most complete up-to-date listing of thermistors available. Theory, engineering data, complete specifications.



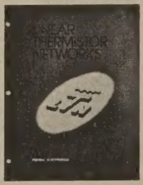
THERMISTOR HOUSING MANUAL (L-5A). Detailed information on how Fenwal Electronics can build thermistor sensor assemblies to fit your requirements.



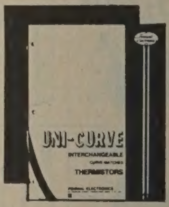
THERMISTOR APPLICATIONS NOTES (AN-1A, AN-2A). "Methods for designing linear temperature read out circuits (AN-1A)" and "Using thermistors to compensate for transistor temperature sensitivity (AN-2A)"

HI-TEMP THERMISTORS

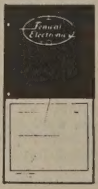
HI-TEMP THERMISTOR BULLETIN (L-8A) features thermistors designed specifically for high temperature measurement and control applications having operating ranges from 500°C to 1000°C.



LINEAR THERMISTOR NETWORKS (LTN™) precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.



INTERCHANGEABLE THERMISTORS: ISO-CURVE manual (L-2B) and UNI-CURVE manual (L-6A) provide indepth data pertaining to precision and low-cost RT, curve-matched interchangeable thermistors.



CAPSULE THERMISTOR COURSES (L-3A). A complete 24-page primer on thermistors, their characteristics and uses, including curves, circuit diagrams and applications data.

EXPERIMENTER'S THERMISTOR KITS

Model G-200 Standard Kit. Contains 12 different thermistors (2 glass probes, 3 beads, 2 discs, 3 rods, 2 washers). Each thermistor is packed with specification sheets showing characteristics. **PRICE: 19.95**

Model G-700 Low-Cost Kit. Includes four glass beads and probes, manual, and computer for a variety of applications. **PRICE: 4.95**

Model G-701 Economy Kit. Includes 10 glass beads and probes, manual and computer for a wider range of applications than G-700 kit above. **PRICE: 9.95**

Model G-500 Uni-Curve Kit. Contains 6 standard Rt curve matched interchangeable thermistors (3K, 5K, 10K, 30K, 50K, 100K. Includes complete data sheets with full specifications and DC. TC listings. **PRICE 19.95**

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63 FOUNTAIN STREET, FRAMINGHAM, MASS. 01701 U.S.A.
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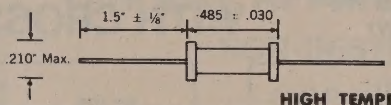
Keystone
CARBON COMPANY

ROD TYPE THERMISTORS



Tolerance on resistance is ± 10% at 25°C.
Maximum operating temperature is 125°C.

LOW/MEDIUM TEMPERATURE COEFFICIENT

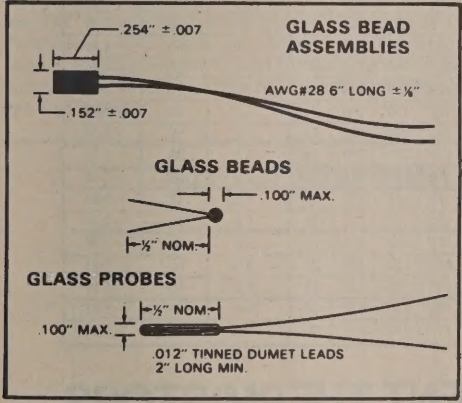
TYPE	RESISTANCE AT °C 0	25	37.8	50	75	104.4	125	BETA ±10% (37.8-104.4°C)	R @ 25°C / R @ 125°C	Neg. Temp. Coef. @ 25°C
15-20-35-S1	30.6	20	16.4	13.8	9.90	7.01	5.65	1500	3.5	1.59
15-50-42-S1	80.6	50	40.1	32.9	22.6	15.3	11.9	1700	4.2	1.78
15-100-42-S1	161	100	80.2	65.8	45.3	30.6	23.8	1700	4.2	1.78
15-200-42-S1	322	200	160	132	90.6	61.2	47.7	1700	4.2	1.78
15-500-50-S1	847	500	391	314	206	133	100	1900	5.0	1.98
15-1K-50-S1	1690	1K	782	628	413	266	201	1900	5.0	1.98
15-2K-52-S1	3430	2K	1560	1240	808	515	387	1950	5.2	2.03
15-5K-54-S1	8680	5K	3860	3060	1980	1240	924	2000	5.4	2.07
15-10K-54-S1	17.4K	10K	7730	6130	3950	2480	1850	2000	5.4	2.07
15-20K-59-S1	35.6K	20K	15.3K	12K	7560	4640	3400	2100	5.9	2.17
15-50K-62-S1	90K	50K	37.9K	29.5K	18.5K	11.2K	8120	2150	6.2	2.22

HIGH TEMPERATURE COEFFICIENT

TYPE	RESISTANCE AT °C 0	25	37.8	50	75	104.4	125	BETA ±10% (37.8-104.4°C)	R @ 25°C / R @ 125°C	Neg. Temp. Coef. @ 25°C
15-5K-181-S1	13.7K	5K	3150	2100	979	450	276	3425	18.1	3.74
15-10K-192-S1	28.2K	10K	6240	4100	1890	855	520	3500	19.2	3.83
15-20K-292-S1	67.2K	20K	11.6K	7140	2920	1190	685	4000	29.2	4.46
15-50K-292-S1	168K	50K	28.9K	17.8K	7320	2980	1710	4000	29.2	4.46
15-100K-404-S1	372K	100K	55K	32.4K	12.2K	4540	2080	4400	40.4	4.86
15-200K-424-S1	753K	200K	109K	63.9K	23.9K	8740	4720	4450	42.4	4.91
15-500K-482-S1	1.95meg	500K	268K	154K	55.6K	19.7K	10.4K	4600	48.2	5.03
15-1meg-583-S1	4.06meg	1meg	523K	294K	100K	33.7K	17.1K	4830	58.3	5.22

GLASS BEADS • GLASS PROBES • GLASS BEAD ASSEMBLIES

Glass bead thermistors are exceptionally stable because the glass seal protects the thermistor from hostile environments.



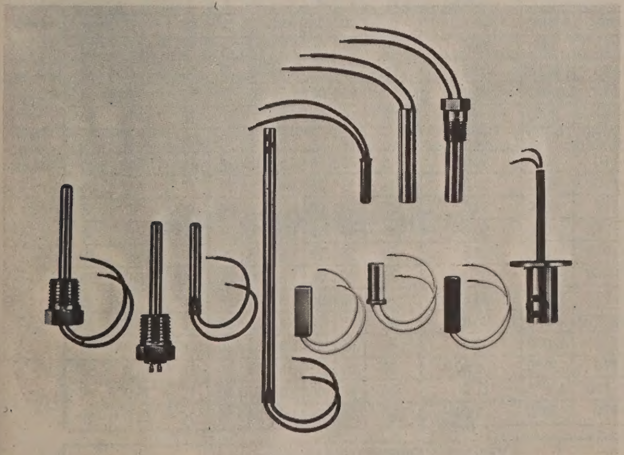
RESISTANCE/TEMPERATURE CHARACTERISTICS

TYPE	−21.5°C	0°C	25°C	37.8°C	50°C	104.4°C	150°C	232°C	TEMP. COEFF. AT 25°C
RL0504-8783-95-G___*	154.5K	48.48K	15K	8783	5484	924.5	290.3	59.55	−4.36%
RL0504-16.92K-112-G___	370.3K	105.3K	30K	16.92K	10.18K	1511	426.9	83.08	−4.67%
RL0504-27.76K-120-G___	643.1K	182.2K	50K	27.76K	16.50K	2313	642.0	109.7	−4.80%
RL0504-55.53K-120-G___	1.286 meg	364.5K	100K	55.53K	32.99K	4628	1284	219.5	−4.80%
RL0504-111.3K-125-G___	2.699 meg	743.5K	200K	111.3K	65.78K	8904	2415	407.4	−4.85%
RL0504-272.6K-142-G___	7.391 meg	1.976 meg	500K	272.6K	158.6K	19.20K	4706	682.0	−5.04%
RL0504-530.5K-148-G___	15.04 meg	3.939 meg	1 meg	530.5K	301.7K	35.84K	8780	1252	−5.14%

*Not presently available in Glass Probes.
Tolerance on resistance values ± 20% @25°C. Closer tolerances available.
Beads have a maximum operating temperature of 260°C.

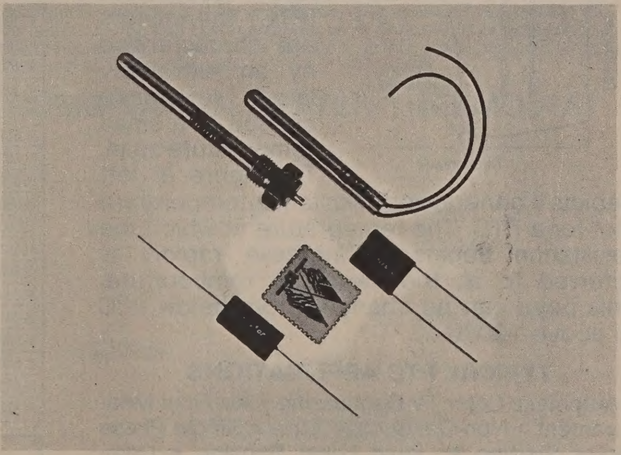
- **-G1** for Glass Beads with platinum leads
- **-G15** for Glass Probes
- **-G20** for Glass Bead Assemblies

THERMISTOR PROBES



The probes illustrated above include stainless steel, aluminum, and chrome-plated materials in a variety of configurations. In addition, a variety of other designs are available. These probes are used in conjunction with solid state circuitry for liquid level measurement, and for use as sensors to measure the temperature of liquids or surface temperatures. Write for probe catalog TP-739.

LINISTOR® ASSEMBLIES



Keystone developed Linistor assemblies to give an accurate resistance response over a temperature span of 0° to 100° C. Because Linistor assemblies have flattened out the thermistor resistance curve to a constant and predictable straight-line plot, they are valuable in a wide range of applications. Four standard encasements are available. Tolerance on resistance of Linistor is ± 2% at 25°C. Write for Linistor Bulletin L-601.

Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
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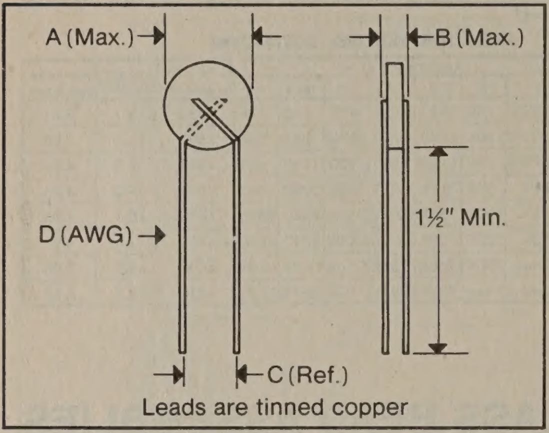
DISC TYPE THERMISTORS WITH CROSSED LEADS



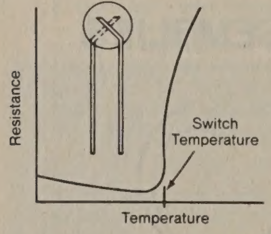
Leads are tinned copper

Maximum operating temperature—125°C

Keystone also offers a line of Disc-Type Thermistors ranging in sizes from .100 inch to 1.00 inch in diameter. Thirty-four different slopes are available (temperature coefficients from −3.75% per °C at 25°C to −5.22% per °C at 25°C). Resistance values range from 11.16 ohms to 518,400 ohms at 25°C. Write for short form catalog T-504 or complete catalog BW2.

KCC TYPE	R @ 25°C	Tol. ±%	A Max.	B Max.	C Ref.	D AWG	Dissipation Constant (MW °/C)	Time Constant (Sec)	Temp. Coef. at 25°C % per °C
RL1004-65.6-59-D1	100	20	.110"	.120"	.100	26	2.5	9	−3.38
RL1003-312-73-D1	500	10	.110"	.110"	.100	26	2.5	9	−3.83
RL1007-624-73-D1	1000	10	.110"	.160"	.100	26	2.8	10	−3.83
RL1003-1746-97-D1	3000	10	.110"	.110"	.100	26	2.5	9	−4.39
RL1004-2910-97-D1	5000	10	.110"	.120"	.100	26	2.5	9	−4.39
RL1009-5820-97-D1	10,000	10	.110"	.180"	.100	26	3.0	10	−4.39
RL1007-13770-120-D1	25,000	10	.110"	.160"	.100	26	2.8	10	−4.84
RL1003-26670-140D1	50,000	10	.110"	.110"	.100	26	2.5	9	−5.08
RL1006-53330-140-D1	100,000	10	.110"	.145"	.100	26	2.8	10	−5.08
RL1004-104550-155-D1	200,000	10	.110"	.120"	.100	26	2.5	9	−5.22
RL2004-16.4-59-D1	25	20	.220"	.125"	.156	24	6.5	20	−3.38
RL2007-32.8-59-D1	50	20	.220"	.165"	.156	24	6.5	30	−3.38
RL2003-62.4-73-D1	100	10	.220"	.115"	.156	24	6.5	20	−3.83
RL2005-124.8-73-D1	200	10	.220"	.140"	.156	24	6.5	20	−3.83
RL2008-187.1-73-D1	300	10	.220"	.175"	.156	24	6.5	30	−3.83
RL2013-312-73-D1	500	10	.220"	.230"	.156	24	7.2	50	−3.83
RL2004-582-97-D1	1000	10	.220"	.125"	.156	24	6.5	20	−4.39
RL2006-657-69-D1	1000	20	.220"	.150"	.156	24	6.5	20	−3.58
RL2007-1164-97-D1	2000	10	.220"	.165"	.156	24	6.5	30	−4.39
RL2009-1446-97-D1	2500	10	.220"	.185"	.156	24	6.5	30	−4.39
RL2010-1746-97-D1	3000	10	.220"	.195"	.156	24	7.0	35	−4.39
RL2006-2753-120-D1	5000	10	.220"	.150"	.156	24	6.5	20	−4.84
RL2012-5506-120-D1	10,000	10	.220"	.220"	.156	24	7.2	50	−4.84
RL2006-13330-140-D1	25,000	10	.220"	.150"	.156	24	6.5	20	−5.08
RL2012-26660-140-D1	50,000	10	.220"	.220"	.156	24	7.2	50	−5.08
RL2008-52270-155-D1	100,000	10	.220"	.175"	.250	24	6.5	30	−5.22
RL3004-6.56-59-D1	10	20	.320"	.125"	.156	24	7.0	35	−3.38
RL3504-31.2-73-D1	50	10	.370"	.125"	.250	24	7.5	45	−3.83
RL4004-174.6-97-D1	300	10	.420"	.125"	.250	24	8.0	50	−4.39
RL4504-3.28-59-D1	5	20	.475"	.130"	.328	22	10.0	60	−3.38
RL4504-15.6-73-D1	25	10	.475"	.130"	.328	22	10.0	60	−3.83
RL4504-116.4-97-D1	200	10	.475"	.130"	.328	22	10.0	60	−4.39
RL7605-6.24-73-D1	10	20	.795"	.150"	.328	20	16.0	70	−3.83
RL7605-58.2-97-D1	100	10	.795"	.150"	.328	20	16.0	70	−4.39

PTC—POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the switching temperature. This point can be changed from below 0°C to above 120°C.

TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing

For detailed application notes, write for Bulletin PTC-9-75.

Type No.	Switch Point	Res. in Ohms @ 25°C ±30%	Oper. Voltage 2	Ref. Dimensions (in.)					Lead Mat'l. 1	D.C. MW/°C	T.C. (Sec.)
				A	B	C	D	E			
RL3006-50-30-25-PTO	30°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-40-25-PTO	40°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-50-25-PTO	50°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-60-25-PTO	60°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL5506-5-65-50-PTO	65°C	5.00	50	.55	.06	1.5	.33	20	TC	14.0	50
RL5510-25-65-120-PTO	65°C	25.0	120	.55	.10	.5	.33	22	TAS	15.0	90
RL3006-50-70-25-PTO	70°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-80-25-PTO	80°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-90-25-PTO	90°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3006-50-110-25-PTO	110°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL5510-32-110-50-PTO	110°C	32.0	50	.55	.10	1.5	.33	20	TC	20.0	80
RL3006-20-120-25-PTO	120°C	20.0	25	.30	.06	1.5	.25	22	TC	8.0	30
RL3006-50-120-25-PTO	120°C	50.0	25	.30	.06	1.5	.25	24	TC	7.0	35
RL3312-200-120-50-PTO	120°C	200.0	50	.33	.12	1.5	.25	20	TC	12.0	40
RL5505-2.5-120-20-PTO	120°C	2.50	20	.55	.05	1.5	.33	20	TC	14.0	50
RL5505-5-120-20-PTO	120°C	5.00	20	.55	.05	1.5	.33	20	TC	14.0	50
RL6306-11-120-20-PTO	120°C	11.0	20	.63	.06	1.5	.33	20	TC	15.0	70
RL8206-4-120-30-PTO	120°C	4.00	30	.82	.06	1.5	.33	18	TC	20.0	80

TYPICAL CONFIGURATIONS

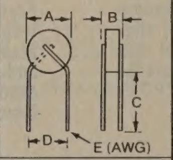


Fig.1 (STRAIGHT LEAD)

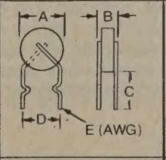


Fig. 2 (INSIDE KINK)

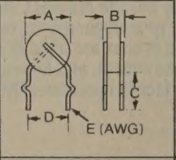


Fig. 3 (OUTSIDE KINK)

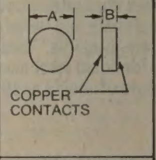


Fig. 4 (NO LEADS)

NOTE: 1. Lead Material: TC = Tinned Copper. TAS = Tinned Annealed Steel.
2. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req.—contact factory).
3. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

Keystone CARBON COMPANY

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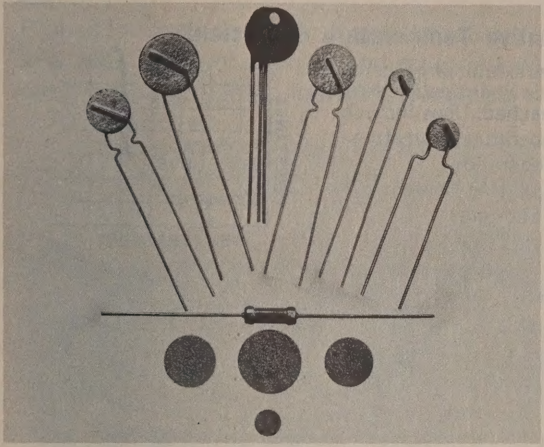
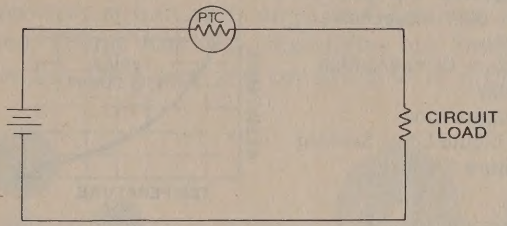
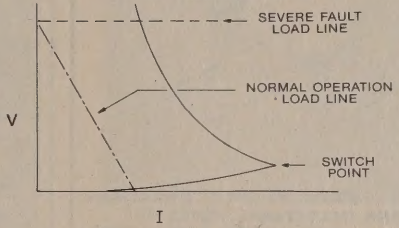
POPULAR PTC CIRCUIT APPLICATIONS

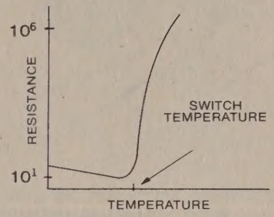


A large resistance change in a small temperature span best describes PTC thermistors. The temperature at which the resistance begins to increase rapidly is known as the "switching temperature." Because of this transformation, PTC's are an ideal component for circuits where the built-in switching temperature can be used to advantage. A few of the many applications are shown on this page.

NON-DESTRUCTIVE FUSE

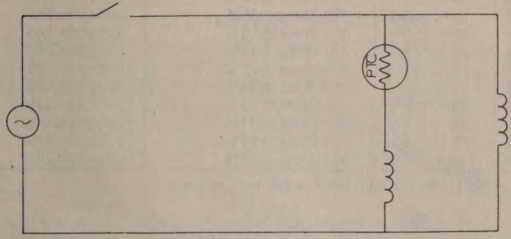






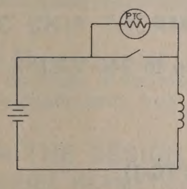
In normal operation the PTC dissipates minimal power keeping its body temperature well below the switch temperature. If a fault of sufficient magnitude occurs, additional power drives the temperature of the PTC up to the switch temperature. At this point additional power becomes available to the PTC, and the only stable operating point is at a much higher resistance than the switch temperature resistance as shown in the illustration above.

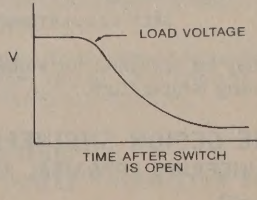
MOTOR STARTING



In the above circuit the PTC thermistor replaces the troublesome starting switch in a single-phase motor. When the circuit is energized the PTC has a low resistance and permits most of the line voltage to be applied to the starter winding. As the motor starts, the PTC heats up until the switch temperature is reached at a rate determined by the thermal inertia of the PTC and current flowing through the starting winding. At this point, the thermistor rapidly changes from a low resistance device to a high resistance unit, and the steady state power applied to the PTC is very low causing the current through the starting winding to be negligible.

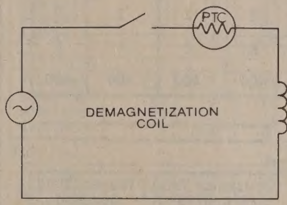
ARC SUPPRESSION

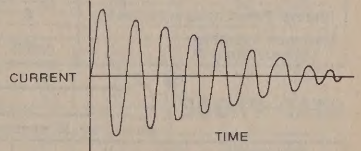




In the above illustrations the PTC switches from a low resistance to a high resistance when the switch is opened. The low resistance of the PTC provides effective arc suppression, and the subsequent PTC switching action transfers essentially all of the power supply voltage from the inductive load to the PTC element.

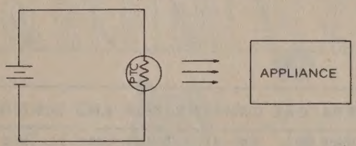
AUTOMATIC DEGAUSSING

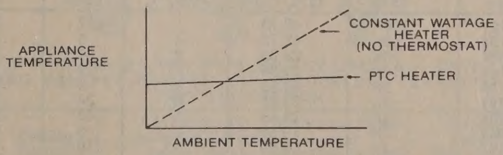




When the switch on the above circuit is closed, a high percentage of the line voltage is impressed across the demagnetization coil. Within a short period of time, the PTC self-heats, switching from a low resistance level to a high resistance, and thereby decreasing the demagnetization coil current to near zero. The length of time for this switching action to occur is a function of the power applied to the PTC and its thermal inertia.

COMBINATION HEATER-THERMOSTAT





PTC thermistors provide an economical method of temperature control by combining the function of the heater and thermostat in one ceramic pellet. This thermostatic action is accomplished by the steep PTC characteristic. As the ambient temperature rises, the resistance of the PTC is increased, thus reducing the input power to the circuit maintaining a relatively constant temperature.

Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
814-781-1591 • Telex No. 91-4517

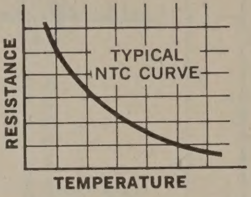
MIDWEST COMPONENTS INC.

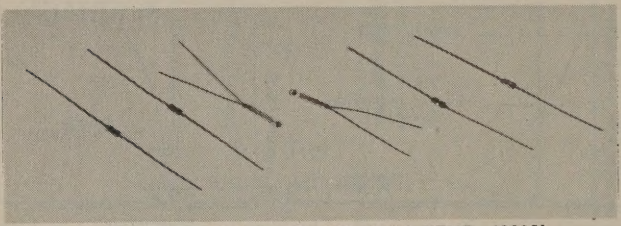
NTC and PTC THERMISTORS

NTC (Negative Temperature Coefficient)

Thermistors offer inexpensive solutions to:

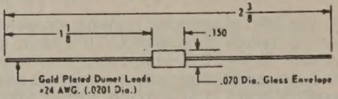
- Temperature Compensation
- Time Delay
- Surge Suppression
- Gas and Liquid Level Sensing
- Temperature Sensing





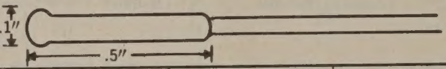
HIGH TEMPERATURE SENSING (MAX. TEMP. 400°C)

H-SERIES THERMISTORS

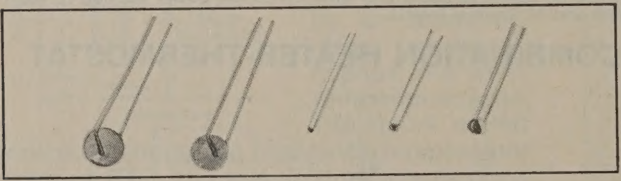


Catalog Number	1H-104	1H503	1H-203	2H-103	2H502
Zero Power Resistance @ 25°C Ohms ±10%	100,000	50,000	20,000	10,000	5,000
Resistance Ratio $\frac{R25°C}{R125°C}$	29.85	29.85	29.85	19.80	19.80
Dissipation Constant ( ) $\frac{\text{milliwatts}}{°C}$	2	2	2	2	2
Thermal Time Constant (τ) (sec.)	8	8	8	8	8
Maximum Operating Temperature (°C)	400	400	400	400	400

BEAD PROBE



Zero Power Resistance at 25°C Ohms ±20%	Catalog Number	Resistance Ratio R25°C/R125°C ±5%	Thermal Time Constant (τ) Seconds
10,000	81G-10350	29.85	25
50,000	81G-50350	35.0	25
500,000	81G-50450	46.5	25
1,000,000	81G-10550	51.5	25



TEMPERATURE COMPENSATION AND SENSING

Type	Ohms @ 25°C	Res. Ratio 25°C/125°C	Diss. Const. MW/°C	Time Const.	Dia. In.
4D101	100K	48.78	4	12	.1
4D103	50K	48.78	4	8	.1
1D051	20K	29.85	2	4.5	.05
1D101	10K	29.85	4	12	.1
1D103	5K	29.85	4	8	.1
1D201	3K	29.85	8	34	.2
1D501	1K	29.85	19	140	.5
2D054	1K	19.80	2	3	.05
2D102	1K	19.80	4	10	.1
2D104	500	19.80	4	6	.1
2D202	300	19.80	8	24	.2
3D504	5	12.95	15.5	70	.5
4D051	200K	48.78	2	4.5	.05

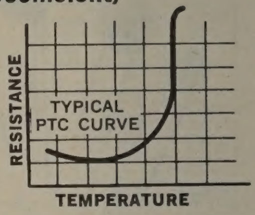
NTC THERMISTORS FOR SURGE SUPPRESSION

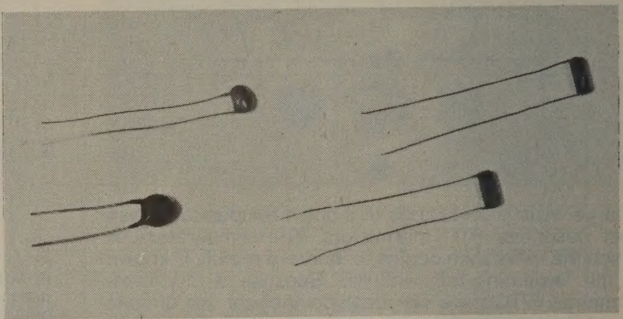
Stud assembly allows heat sinking for max. power dissipation. Available in resistances as low as 1 ohm at 25°C.

PTC (Positive Temperature Coefficient)

Thermistors exhibit large increases in resistance when specified switch temp. is reached. Uses include:

- Overtemperature protectors
- Surge Generation
- Self Regulating Heaters
- Current Limiters

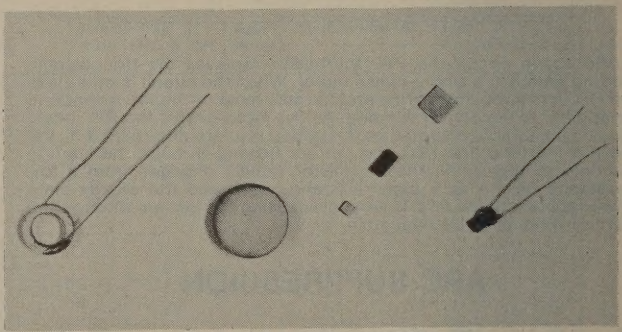




CURRENT LIMITERS* AND TEMPERATURE SENSORS

Part No.	Break Point	Resistances		Nominal Sizes
155D10112	55°C ±5°C	100 Ohms ±40%	@ 25°C	.25" x .250" Thk.
227D11212	127°C ±5°C	1100 Ohms ±40%	"	.1" x .160" Thk.
175D40113	75°C ±5°C	400 Ohms ±40%	"	.2" Dia.x.080" Thk.
200D10112	100°C± 5°C	100 Ohms ±40%	"	.3" x .170" Thk.
170D10114	70°C ±5°C	100 Ohms ±40%	"	.18" x .1" Thk.
155Q20111	55°C ±5°C	200 Ohms ±15%	"	.295x.09x.145
165Q20111	65°C ±5°C	200 Ohms ±15%	"	.295x.09x.145
165Q80111	65°C ±5°C	750 Ohms ±33%	"	.295x.09x.145
175Q20111	75°C ±5°C	200 Ohms ±25%	"	.295x.09x.145
175Q80111	75°C ±5°C	750 Ohms ±33%	"	.295x.09x.145
185Q20111	85°C ±5°C	200 Ohms ±25%	"	.295x.09x.145
185Q80111	85°C ±5°C	750 Ohms ±33%	"	.295x.09x.145
195Q80111	95°C ±5°C	750 Ohms ±33%	"	.295x.09x.145
220Q32211	120°C ±5°C	3200 Ohms ±25%	"	.295x.09x.145

* Current Limiters are available with 1000 volt ratings

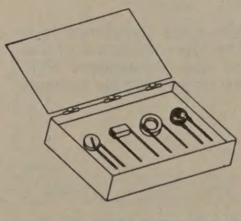


SELF REGULATING HEATERS

Heaters may be specified for voltages up to 240 V.R.M.S. in any operating temperature.

FOR THE DESIGN ENGINEER...

PTC ENGINEERING APPRAISAL KIT (KPTC-1)



Kit includes four PTC devices ranging from breakpoints of 0°C to 125°C in typical lead configurations most widely specified by the design engineer. Technical data for each device is also included. $10.00 ea.

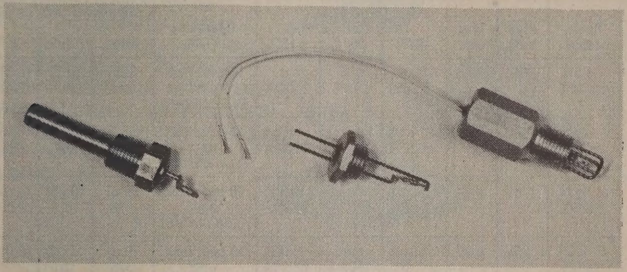
MIDWEST COMPONENTS, INC.
P.O. BOX 787 MUSKEGON, MICHIGAN • TELEPHONE : (616) 777-2602 — TWX: 510-394-4130

MIDWEST COMPONENTS INC.

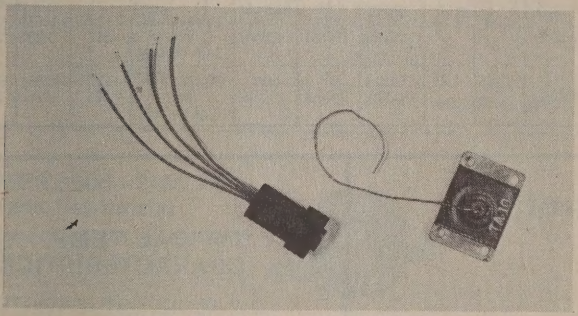
PROBES and VARISTORS

PTC

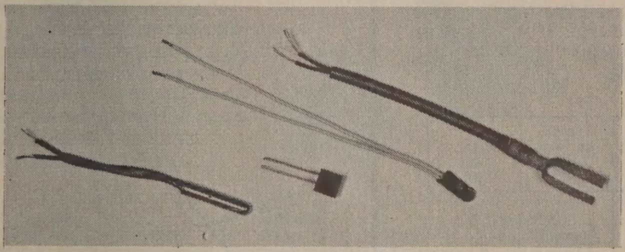
Probes for every specialized application are available in a wide range of designs and materials with operating temperatures up to 400°C. Available with NTC or PTC Devices.



LIQUID AND GAS MEASUREMENTS

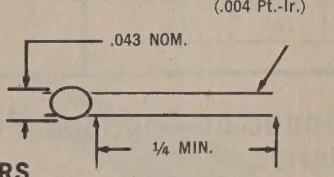


SURFACE TEMPERATURE SENSORS



SPECIALIZED APPLICATIONS

FOR SMALL SIZE, FAST RESPONSE: .043″ DIA. BEADS



Glass coated bead Thermistors feature HIGH-TEMPERATURE STABILITY. Leads are fired-in platinum-iridium.

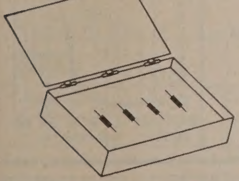
NTC CHIP THERMISTORS

Chip Thermistors are available with or without leads or protective coatings in resistance from 100 to 100K ohms in temperature coefficients from −3.9%/°C to −4.9%/°C.

FOR THE DESIGN ENGINEER . . .

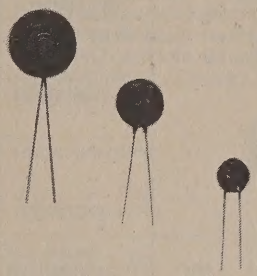
H-SERIES HERMETICALLY SEALED THERMISTOR KIT

(KNTC-1)

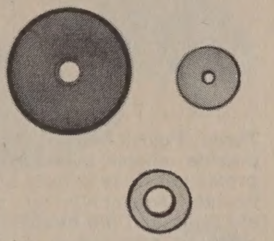


Kit includes four NTC devices ranging from 10,000 to 100,000 Ohms at 25°C good for use up to 400°C. Technical data for each device is also included. $10.00 ea.

Midwests' Varistors offer inexpensive answers to problems of transient, surge, and lightning suppression. Energy handling capabilities are limitless depending upon size and construction of devices.



SMALL TYPE DISCS DESIGNED FOR PROTECTION OF CONTACTORS, RELAYS, AND SOLID STATE COMPONENTS



3″ AND 6″ DIAMETER DISCS FOR MEDIUM POWER APPLICATIONS ALLOW FOR CUSTOM ASSEMBLIES FOR POWER SUPPLY COMPONENTS

Catalog Number	Maximum Values						Specifications	
	Continuous Operating Voltage (Volts)		Continuous Power Rating (Watts)	Discharge Capacity (Watt-Seconds)	Peak Discharge -Voltage for Given DC Dicharge Current		DC Test Voltage & Current	
	(DC)	(AC)			(Amps)	(Volts)	(Volts ±20)%	(Amps)
.5″ DIA.								
70D-5010	150	135	.25	30	.10	400	175	.001
68D-5010	60	54	.25	30	.10	200	75	.0025
67D-5010	30	27	.25	30	.25	100	35	.005
65D-5010	15	13.5	.25	20	.25	60	15	.010
.75″ DIA.								
71D-7000	150	135	.75	50	.125	400	175	.005
68D-7000	60	54	.75	50	.25	185	70	.0125
66D-7000	30	27	.75	50	.25	185	70	.0125
63D-7000	15	13.5	.75	50	.50	100	35	.025
1.0″ DIA.								
71D10000	300	270	1.5	275	.25	1000	350	.005
68D10000	150	135	1.5	275	.50	575	175	.010
66D10000	60	54	1.5	275	1.0	305	70	.025
63D10000	30	27	1.5	275	1.5	175	35	.050
3″ DIA.								
71W30100	1500	1350	3.5	9250	10	7500	1800	0.0025
69W30100	300	270	3.0	5100	1.5	1350	520	0.050
68W30100	150	135	3.0	5100	2.5	800	230	0.050
67W30100	60	54	3.0	1700	5.0	250	85	0.100
66W30100	30	27	3.0	1700	5.0	150	36	0.100
63W30100	15	13.5	3.0	1350	10	100	25	0.500
62W30100	7	6.3	3.0	1100	10	40	9	0.500
6″ DIA.								
69W60100	275	250	10	22,500	10	1200	550	0.500
68W60200	200	180	10	22,500	12.5	990	400	0.500
68W60100	150	135	10	22,500	15	780	300	0.500

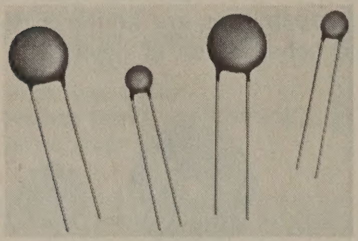
3″ AND 6″ ASSEMBLIES FOR HIGH ENERGY USES. ALL UNITS HAVE STANDARD BRACKET MOUNTS AND SOLDERLESS TERMINALS FOR FAST CONNECTION

Type	Catalog Number	Continuous DC Operating Voltage Rating (Volts)	Continuous Power Loss in Operation (Watts)	Discharge Capacity (Watt-Seconds)
BRACKET	9RV3A12	150	3	5,100
	9RV3A14	300	3	5,100
	9RV3A15	600	6	10,200
	9RV6A4	150	40	90,000
	9RV6A5	300	20	45,000
	9RV6A6	275	10	22,500
	9RV6A7	275	20	45,000
	9RV6A8	275	30	67,500
	9RV6A9	275	40	90,000
	9RV6A10	550	20	45,000
BOX	9RV6A65	550	120	270,000
	9RV6A55	550	240	540,000

MIDWEST COMPONENTS, INC.
P.O. BOX 787 MUSKEGON, MICHIGAN • TELEPHONE : (616) 777-2602 — TWX: 510-394-4130

muRata
CORPORATION
OF AMERICA

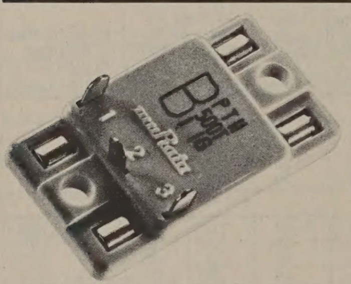
Positive Temperature Coefficient Resistors
POSISTORS®



These Posistors are designed to provide reliable over-current circuit protection. They consist of a barium titanate semiconductor resistance elements that are heat/current sensitive as indicated in the curve below. Once the threshold current is reached, self-heating causes the device to increase resistance rapidly thus protecting the circuit with which it is in series.

For Circuit Protection...PTH60 Series

Part Number	Temp. Char.	Resistance	Max. Volt.	Max. Curr.	Protective Threshold Current 25°C	60°C	−10°C	Operating Time	Dimension inch (mm) D Max.	dφ	T
PTH60AR750M2C101	AR	75Ω ±20%	160V	0.3A	100mA ±20%	min. 70mA	max. 150mA	10 sec. max. over 0.3A current	(8.2) .323	(0.5) .02	(6.5) .256
PTH62AR270M2C221	AR	27Ω ±20%	160V	0.8A	220mA ±20%	min. 150mA	max. 320mA	15 sec. max. over 0.8A current	(15.7) .618	(0.65) .026	(6.5) .256
PTH61AR470M2B151	AR	47Ω ±20%	125V	0.5A	150mA ±20%	min. 100mA	max. 210mA	10 sec. max. over 0.5A current	(9.6) .378	(0.65) .026	(6.0) .236
PTH61AR220M2B231	AR	22Ω ±20%	125V	0.8A	230mA ±20%	min. 150mA	max. 320mA	10 sec. max. over 0.8A current	(9.6) .378	(0.65) .026	(6.0) .236
PTH623AR150M2B291	AR	,15Ω ±20%	125V	1.0A	290mA ±20%	min. 190mA	max. 400mA	15 sec. max. over 1.0A current	(13.0) .512	(0.65) 0.26	(6.0) .236
PTH62AR100M2B371	AR	10Ω ±20%	125V	1.2A	370mA ±20%	min. 240mA	max. 250mA	20 sec. max. over 1.2A current	(15.1) .595	(0.65) .026	(6.0) .236

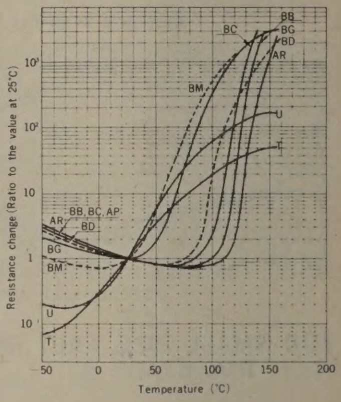


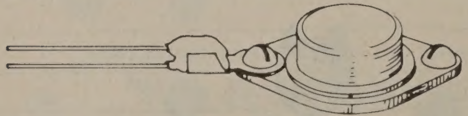
For Heating-Control... PTH457 Series

This 457 Series of Posistors is specifically designed for both self-heating and heater-control applications in consumer and industrial products. They eliminate nichrome wire heaters and bimetalic thermostats and are inherently self-compensating.

Part Number	Temp. Char.	Nom. Resist. Value (Ohms)	Resist. Range (Ohms)	Oper. Volt (V)	Current at Oper. Voltage (MA)	Approx. Surface Temp. (°C)	Max. Volt (V)
PTH457BD500T140	BD	50	50-330	120	16±20%	90	140
PTH457BC500T140	BC	50	50-330	120	17±20%	100	140
PTH457BB500T140	BB	50	50-330	120	18±20%	110	140
PTH457AR500T140	AR	50	50-330	120	20±20%	120	140
PTH457BD020T31.5	BD	2	2-12	12	140±20%	90	31.5
PTH457AR020T31.5	AR	2	2-12	12	180±20%	120	31.5

TYPICAL TEMP. CHARACTERISTICS





For Semiconductor Overload Protection... PTH487A Series

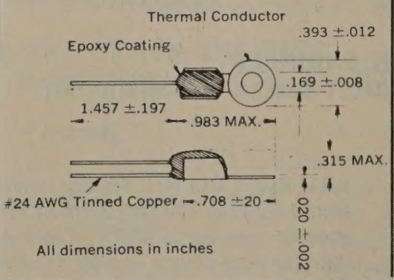
The PTH487A is designed to sense the case temperature of high power semiconductors and appropriately reduce the power dissipation of these devices when dangerous power and/or current limits are approached. The PTH487A is normally used in the base biasing circuit of the protected semiconductor as shown in the diagram below. The collector dissipation is limited when constant overloads are present in the manner indicated in the Ic vs temperature curve.

SPECIFICATIONS

Part No.	Temp. Char.	Resistance (1.5 VDC)		
PTH487A	BE	77°F 500Ω Max.	176°F 2KΩ Max.	194°F 3KΩ Min.

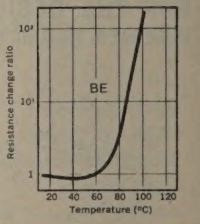
Voltage	Current	Withstand Voltage
12.5 VDC Max.	0.1A Max.	15 VDC Min.

DIMENSIONS



All dimensions in inches

TYPICAL RESISTANCE vs TEMPERATURE CHARACTERISTICS



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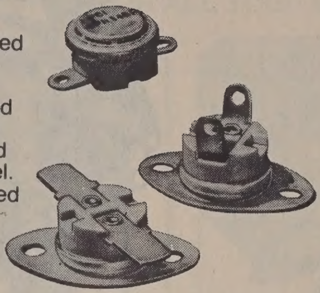
MARIETTA, GEORGIA 30067
PHONE: (404) 422-9777

TELEX: 54-2329
TWX: 810-763-4723

pci SNAP-ACTION THERMOSTATS

SERIES 5002—Miniature High Temp Thermostat

Miniature, rugged switch suited for high temperature applications; plattens, steam equipment, electrically heated press heads, etc. Available in ceramic base only with closed caps of brass or stainless steel. Cap construction can be sealed with resin for additional protection.

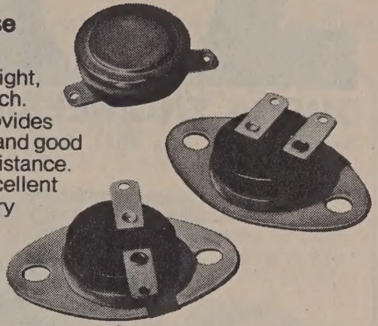


Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5002	SPST Single Break	3 1.5	120V ac 240V ac	−20°F to +575°F

Ask for Reference Sheet 5002

SERIES 5003—Close Control Thermostat

Extremely thin, lightweight, water type thermal switch. Overall depth .250." Provides fast, positive response and good shock and vibration resistance. NC or NO contacts. Excellent repeat reliability. Factory calibrated.

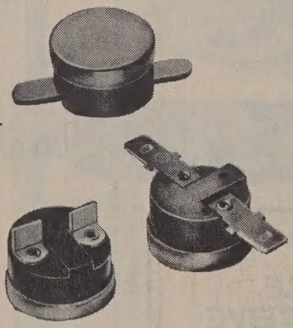


Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5003	SPST Single Break	5	120V ac	−20°F to +350°F

Ask for Reference Sheet 5003

SERIES 5004—240V AC Surface Thermostat

Designed with 4 mm clearance and for operation at 240V ac. Applications include industrial, electronic and electrical equipment such as business machines, radar, computer peripherals, heater blanket controls and heat sink protection. Excellent shock and vibration resistance. Rapid thermal response due to low mass. Factory calibrated. U/L recognized.

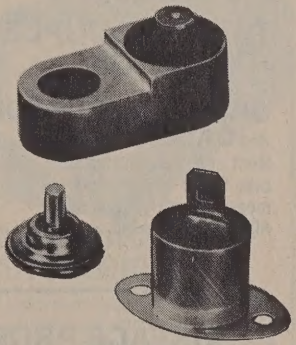


Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5004	SPST Single Break	7	240V ac	−20°F to +350°F

Ask for Reference Sheet 5004

SERIES 5011—Hermetically Sealed Surface Thermostat

Low cost, designed to meet exacting requirements of shock and vibration applications. For use where temperature control, warning or protection is required. Fast response. Factory calibrated and 100% inspected. Available with a variety of adapter packages (plug, bolt or isolated base mounting) to suit specific applications.

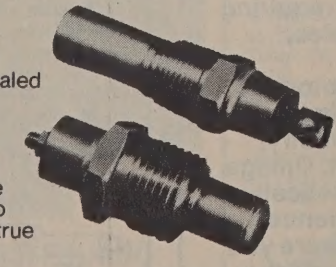


Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5011	SPST Single Break	3	120V ac 32V dc	−20°F to +575°F

Ask for Reference Sheet 5011

SERIES 5020—Immersion Thermostst

A snap-acting hemetically sealed temperature control designed for use where a sealed unit and high vibration resistance are required. Applications include water-cooled engines and engine generator sets. Temperature sensing element confined to very tip, assuring rapid and true response to liquid or air temperature.

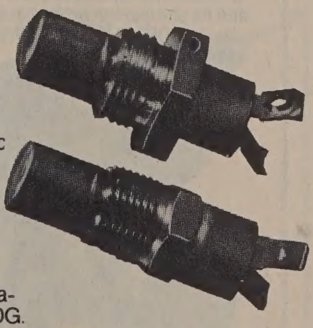


Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5020	SPST Single Break	3	32V dc	−20°F to +525°F

Ask for Reference Sheet 5020

SERIES 5100—Immersion Thermostat

Especially designed for use where a sealed unit and high vibration resistance are required. Applications include water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated as in commerical dryers and sterilizing equipment. Designed for rapid response to liquid or air temperature. Approved for vibration per MIL-E-5272 proc. XII 10G.



Series Part No.	Type	Contacts Amps	Volts	Operating Temp. Range
5100	SPST Single Break	3 1.5	120V ac 240V ac	−20°F to +575°F

Ask for Reference Sheet 5100

pci **Protective Controls Inc.**
A subsidiary of North American Philips Controls Corp., Frederick, Md. 21701—(301) 663-5141

®OMEGA

OMEGA ENGINEERING, INC.
Dept. EM, P.O. Box 4047, Stamford, CT 06907

OMEGA 1977
TEMPERATURE
MEASUREMENT
HANDBOOK

WRITE OR PHONE . . .

NEW! FREE!

THERMOCOUPLE HANDBOOK

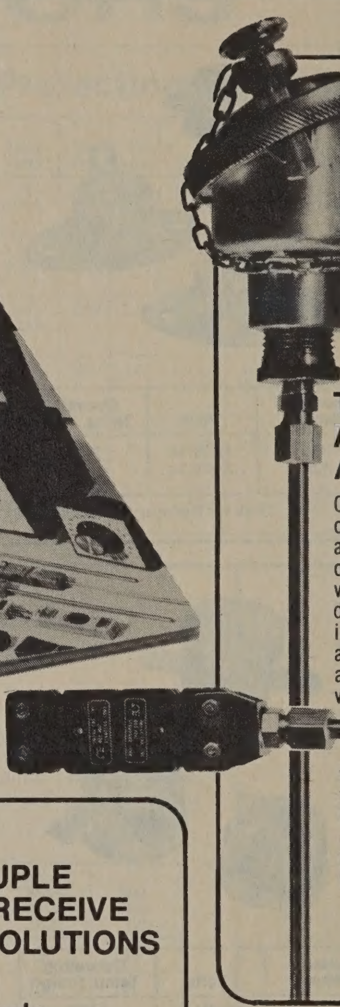
OMEGA'S HANDBOOK and CATALOG . . .
Most complete listing of over 8,000 temperature measurement products. All prices included.

SURFACE PROBES AND PYROMETERS

OMEGA offers a number of unique, patented thermocouple probes designed for measuring the precise temperature of moving and stationary surfaces. Also available are companion readout meters, portable pyrometers and companion probes for heavy duty service. New miniature thermometer and its companion probes are in stock also ALL OFF-THE-SHELF. **Prices start at $15.00 per probe.**

YOUR THERMOCOUPLE PROBLEMS RECEIVE REALISTIC SOLUTIONS AT OMEGA

Most thermocouple problems can be solved using Omega's "off-the-shelf" thermocouple products. But, if you have that SPECIAL problem requiring exotic thermocouples, multipoint/profile thermocouples, motorized switches, or anything unusual in thermometry, just send us a print. Omega will quote you realistically. Our years of experience and technology assure you QUICK DELIVERY and the right temperature sensor for the job. AND, WE KEEP OUR PROMISES.

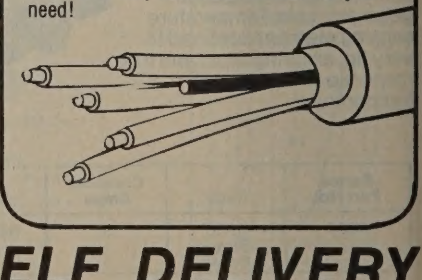


THERMOCOUPLES AND ASSEMBLIES

OMEGA produces a broad range of thermocouples, probes and assemblies, including a full line of sub-miniature probes, bare wire-type thermocouples with a diameter as fine as 0.0005 inches, quick-disconnect type assemblies, replacement probes and thermocouple assemblies with a variety of heads and terminations. All are available for IMMEDIATE DELIVERY. Refer to FREE catalog for complete listing and prices. **Prices start at $2.50 per thermocouple.**

THERMOCOUPLE WIRE

OMEGA's broad range of thermocouple wire encompasses just about every conceivable type available, including bare wire, teflon coated wire, metal-sheathed wire, all types of asbestos, glass, plastic covered and enameled wire in sizes from 0.0005" diameter on up. Even tungsten-rhenium, platinum and base metal alloys, plus various extension wire types . . . all ON HAND for IMMEDIATE DELIVERY. Buy as little or as much as you need!



FOR IMMEDIATE OFF-THE-SHELF DELIVERY CALL OMEGA . . . (203) 359-1660 or TELEX 996404

Ask about "Speed Service": orders shipped within 24 hours when requested. Minimum Order: $10.00.

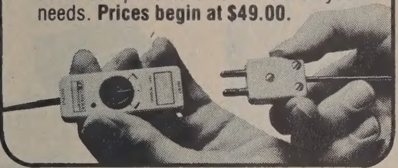
THERMOCOUPLES

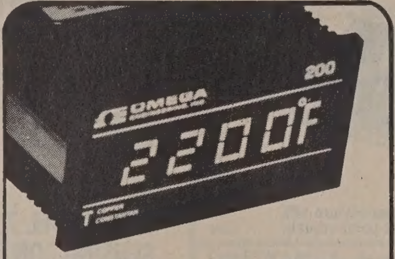
ONE COMPLETE SOURCE FOR ALL YOUR OFF-THE-SHELF THERMOCOUPLE REQUIREMENTS.

NEW! ELECTRONIC ICE POINT

The OMEGA-MCJ is an incredible Thermocouple Ice Point Reference built into a color-coded thermocouple connector! Available in 9 calibrations, converts from a "female" to a "male" connector in seconds. **Priced at $49.00.**

OMEGA also offers many other types of thermocouple references and cold junctions compensators to fill all of your needs. **Prices begin at $49.00.**

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OMEGA
2200F
T COPPER CONSTANTAN

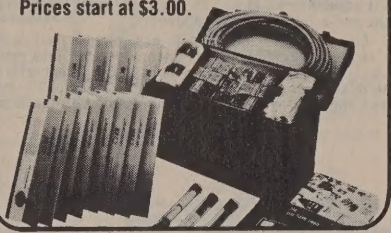
METERS, AMPLIFIERS AND READOUTS

OMEGA's expanded line of readout meters, digital readouts for thermocouples, thermistors and RTD's, plus thermocouple amplifiers are available now for IMMEDIATE DELIVERY. **Meter prices start at $36.00.**

THERMOCOUPLE ASSEMBLY KITS

CEMENTS AND LACQUERS

OMEGA offers an expanded variety of kits to cement fine gage thermocouples in place and to build a variety of thermocouple probes and assemblies in only minutes, available OFF-THE-SHELF. **Prices start at $3.00.**



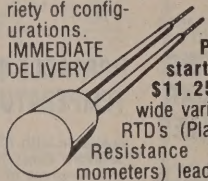
TEMPERATURE SENSITIVE PAINTS, LACQUERS, CRAYONS, SPRAYS AND PELLETS

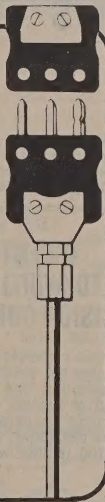
If you require any markers to be used as high quality surface temperature indicators, OMEGA has a vast variety of convenient forms, including paints, lacquers, crayons, sprays and pellets OFF-THE-SHELF. **Prices start at $1.00.**

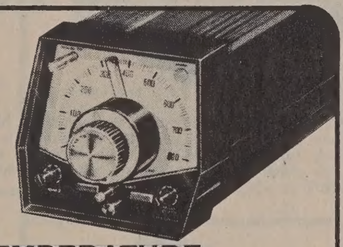
TEMPILAQ
2500°F
1371°C
by TEMPIL° CORP.

THERMISTORS AND RTD's

OMEGA's expanded line of curve matched thermistors and probes is available in a variety of configurations. IMMEDIATE DELIVERY **Prices start at $11.25.** A wide variety of RTD's (Platinum Resistance Thermometers) lead configurations and sizes with a choice of compressions heads and quick disconnects is available for IMMEDIATE DELIVERY. **Prices begin at $49.00 for single units.**

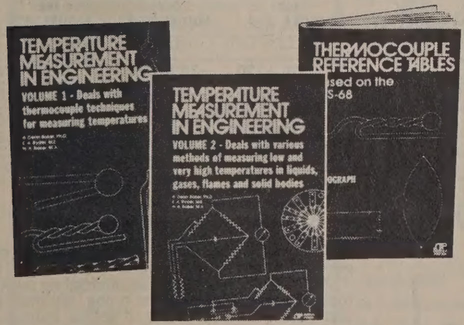






TEMPERATURE CONTROLLERS

OMEGA's solid state plug-in electronic indicating temperature controllers feature full plug-in construction; plug-in relays; full-time, full-scale indication; thermocouple break protection; heating and cooling lights and easy screw terminal wiring. 3 lbs. Available for IMMEDIATE DELIVERY. **Price: $160.00.**


TEMPERATURE MEASUREMENT IN ENGINEERING
VOLUME 1 - Deals with thermocouple techniques for measuring temperatures
TEMPERATURE MEASUREMENT IN ENGINEERING
VOLUME 2 - Deals with various methods of measuring low and very high temperatures in liquids, gases, flames and solid bodies
THERMOCOUPLE REFERENCE TABLES
based on the IPTS-68

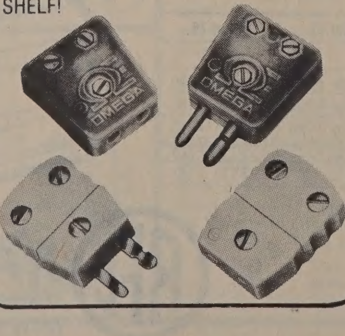
Some of the MOST USEFUL AND NEEDED BOOKS ON TEMPERATURE MEASUREMENT!

Temperature Measurement in Engineering, volumes 1 & 2, by H. Dean Baker, E.A. Ryder & N.H. Baker, are classics in the field of temperature measurement and should be on the shelf of every serious temperature measurement researcher or engineer. Vol. 1 $4.95, Vol. 2 $9.95.

Thermocouple Reference Tables based on the IPTS-68 completely revised and unabridged reference tables were developed the National Bureau of Standards; in a handy pocket editions. $2.95.

THERMOCOUPLE CONNECTORS

Omega has the MOST complete selection of Thermocouple CONNECTORS offered today! We can fill your every connector need . . . from Ultra-High Temperature Ceramic Connectors, to our new extra small Sub-Miniature Connectors. And a full selection of every needed thermocouple accessory is also available . . . connectors and accessories are available for immediate delivery . . . OFF-THE-SHELF!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"OMNI-AMP" THERMOCOUPLE AMPLIFIERS

THERMOCOUPLE AMPLIFIER
OMEGA

Just plug a thermocouple into Omega's unique new miniature, portable amplifier. A choice of ranges will enable you to boost any millivolt signal from unity to 100 times. Low cost and inexpensive operation from two small mercury batteries eliminates need for thermocouple and meter impedance matching. Drives any readout device with 1000 ohms or greater input impedance. Lab models too! NOW . . . OFF-THE-SHELF! Nothing like it is available from any other source. **Prices start at only $95.00.**

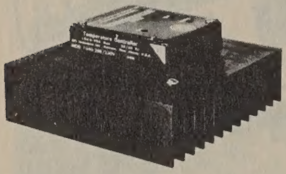
THERMOCONTROL DIVISION Since 1922

Temperature Measurement and Control Equipment

MINIATURE COMPONENT-TYPE PROPORTIONAL CONTROLLERS

RFL Models 70, 72 and 75 are compact, nonindicating units capable of precision control of electrically energized heating applications. 70 & 72 units feature proportional bandwidth and coarse and fine temperature set point adjustments. Model 75 low cost model has a single set point adjustment and a fixed, narrow bandwidth.

Current to heating load is controlled by all solid-state components for reliable long life performance. Operates into resistive loads ranging from 1 to 15 amperes using a negative temperature coefficient sensor (Thermistor) as the sensing element. Model 70's mode of operation is phase angle firing. Models 72 and 75 are zero voltage firing.



9200 WATTS

RFL MODEL 7040 is a completely solid-state, high load capability, proportional controller. The controller, while small in size, will control resistive loads from 100 to 9,200 watts. Thermistor sensors operating between 8000 ohms and 100 ohms are used providing an operating range of −70°C to +325°C.

DIRECT-SETTING, RTD (WIRE) SENSING, PRECISION CONTROLLER

RFL Model 71 is a completely solid-state, null balance, visual set point, proportional temperature controller. The controller is capable of precisely controlling resistive heaters with one RTD type sensor throughout a visual set point temperature range of 0°C to +500°C (+32°F to +932°F). The controller, while small in size, will control resistive loads from 100 to 3000 watts.

Direct-setting control dial 42065 (Optional)

Model	Overall Range (°C)	Accuracy to	Current Load	Sensor Resistance	Sensors
70	−70 to +325	±0.05°C	1-15 Amps	8000 to 100 ohms	Series 27687
71	0 to +500	±0.05°C	1-15 Amps	RTD Type (100 Ohm) Sensor	24928
72	−90 to +325	±0.1°C	1-15 Amps	30,000 to 300 ohms	Series 27687
75	—65 to +325	±0.2°C	1-15 Amps	6000 to 100 ohms	Series 27687
7040	−70 to +325	±0.05°C	1-40 Amps	8000 to 100 ohms	Series 27687

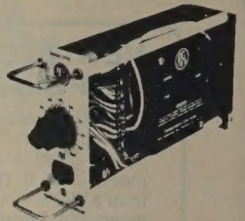
RFL SENSORS

SENSOR	RANGE (C°)			
	Model 71	Models 70 & 7040	Model 72	Model 75
24928	0 to +500			
27687-3		−5 to +120	−30 to +80	−0 to +120
27687-5		+30 to +160	+10 to +130	+40 to +160
27687-7		+80 to +250	+40 to +200	+85 to +250
27687-13		+220 to +325	+165 to +325	+230 to +325
27687-15		−70 to +10	−90 to −10	−65 to +10

Models 70, 72, 75, and 7040 probes 3/16" diameter by 1¼" long.
Model 71 probe 3/16" diameter by 4" long.

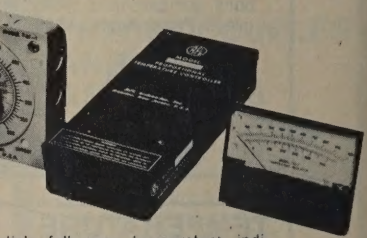
NOTE: 34739 Stainless Steel Well must be used for liquid immersion of all probes except 24928 and 42301
42060 0-100 Setting Dial (for Models 70, 75, and 7040)
42070 0-100 Setting Dial (for Model 72)

PLUG-IN SYSTEM MODULES FOR MULTIPOINT OPERATION



By combining RFL 70 Series Controllers with RFL's new TB-1 Plug-in Modules and TB-3 Chassis, a complete 8-point "do it yourself" control system is possible.

NEW MODEL 76 THERMOCOUPLE/RTD SENSING CONTROLLER

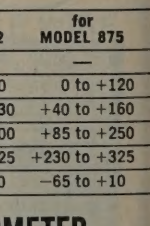


Wide range, all solid-state construction and high accuracy are just a few of the features of the new Model 76. Options include direct setting dials, full range temperature indicator, output level indicator and assorted sensor configurations. Specs· Accuracy to ±0.1°C, loads from 1 to 15 amps—115 or 230 volts, zero voltage firing proportioning mode, size 7¾" x 3⅜" x 1⅝" high.

STANDARD MODELS

76T-1	−100 to +200°C	76J-1	0—300°C	76K-1	0—1000°C
76P-1	0 to 500°C	76J-2	0—500°C		

PORTABLE 800 SERIES TEMPERATURE CONTROLLERS

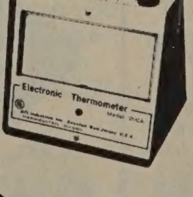


Available with RFL Models 70, 71, 72, and 75 Temperature Controllers. An ideal unit to evaluate the effectiveness of closer temperature control of your existing equipment. These convenient units consist of the solid-state controller, a control box containing an ON/OFF switch, power level indicator, load-output socket (115 or 230V), sensor jack, set point knob and scale, line fuse and an 8-foot line cord. Select probes from table below.

SENSORS AND RANGES (C°)

SENSOR	for MODEL 871	for MODEL 870	for MODEL 872	for MODEL 875
42301	0 to +500	—	—	—
42300-3	—	−5 to +120	−30 to +80	0 to +120
42300-5	—	+30 to +160	+10 to +130	+40 to +160
42300-7	—	+80 to +250	+40 to +200	+85 to +250
42300-13	—	+220 to +325	+165 to +325	+230 to +325
42300-15	—	−70 to +10	−90 to −10	−65 to +10

DIRECT READING ELECTRONIC THERMOMETER



MODEL 290A Electronic indicating thermometer provides measurement span of —60°C (—76°F) to +130°C (+266°F) in 3 ranges selected by push-buttons using single thermistor probe. Multiple scale taut-band meter has °C and °F scales. Built-in calibration check and adjustment assure long-term accuracy. Storage well for probe in back of unit. Probes available for gas, liquid, and surface contact.

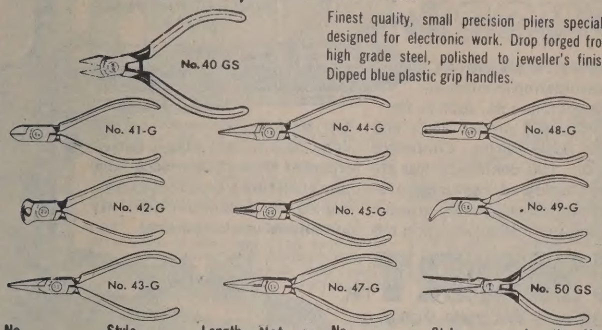
SPECIFICATIONS

Accuracy: ±1.5°C (±2.5°F) with ambient temperatures at 25°C ±10°C
Range: —60°C to +130°C in three overlapping scales: —60°C to +10°C, 0°C to +70°C, and +60°C to +130°C.
Indication: 4½" taut-band meter.
Power Source: 9 volt "transistor" battery.
Size: 5¾" wide x 5½" high x 4½" deep.
Detailed descriptive literature available.

RFL Industries, Inc.
Thermocontrol Division • Boonton, New Jersey 07005 • U.S.A
(201) 334-3100 / TWX: 710-987-8352 / CABLE: RADAIRCO, N. J.

TOOLS BY **CHANNELLOCK**® MEADVILLE, PA. 16335

Little Champ PRECISION PLIERS



Finest quality, small precision pliers specially designed for electronic work. Drop forged from high grade steel, polished to jeweller's finish. Dipped blue plastic grip handles.

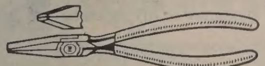
No.	Style	Length	Net
40GS	Flush Cutting, Sharp Nose Diagonal, Coiled Spring	4¼″	$8.20
41G	Diagonal Cutter	4¼″	6.48
41GS	Diagonal Cutter, Coiled Spring	4¼″	7.02
42G	End Cutting Nipper	4″	6.48
43G	Needle Nose, No Side Cutter, Plain Nose	4¾″	5.94
43GS	Needle Nose, No Cutter, Plain Nose, Coiled Spring	4¾″	6.48

No.	Style	Length	Net
44G	Plain Nose	4¾″	$5.62
45G	Round Nose	4½″	5.94
47G	Needle Nose, Side-Cutter, Nose Serrations	4¾″	6.70
47GS	Needle Nose, Side Cutter, Nose Serrations, Coiled Spring	4¾″	7.24
48G	Transverse End Cutter	4¾″	6.48
49G	Curved Needle Nose	4½″	6.26
50GS	Extra Long Needle Nose, Coiled Spring	5¾″	7.34

Specially Designed ELECTRONICS PLIERS

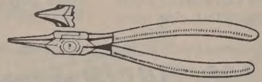
Four matched, long-reach pliers with precision matched jaws, hand honed cutting edges. Drop forged of special analysis steel, properly heat treated. Polished finish. Smooth, dipped plastic, blue grips.

No.	Size	Net
718G	8″	$6.48
728G	7½″	7.56
738G	8″	6.48
748G	8″	6.48



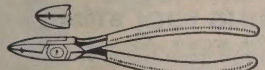
NO. 718G FLAT NOSE PLIERS

Precision-matched jaws give firm grip in hard-to-reach places.



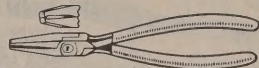
NO. 738G ROUND NOSE PLIERS

You can pick up a hair with these precision machined points.



NO. 728G DIAGONAL CUTTER

Patented wire-stripping notch, that **really works!**



NO. 748G END CUTTER

Fine enough to cut a human hair, sturdy enough to cut 12 gauge copper wire.

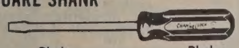
SCREWDRIVERS

Blades forged from tough chrome vanadium steel. Tips ground lengthwise for greater end strength and snug fit in screw slot. Opaque blue plastic (UL) handles are shockproof, breakproof and shaped for non-slip grip.

ROUND SHANK

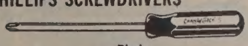
No.	Blade Size, In.	List	No.	Blade Size, In.	Net
181RD	⅛x 1	$1.20	31610RD	3/16x 10	$2.38
3164RD	3/16x 4	1.80	144RD	¼x 4	2.26
3166RD	3/16x 6	1.90	146RD	¼x 6	2.38
3168RD	3/16x 8	2.22	5166RD	5/16x 6	2.64

SQUARE SHANK



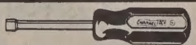
No.	Blade Size, In.	List	No.	Blade Size, In.	Net
141SQ	¼x 1	$1.50	5166SQ	5/16x 6	$2.82
3164SQ	3/16x 4	1.90	5168SQ	5/16x 8	3.12
144SQ	¼x 4	2.28	388SQ	⅜x 8	3.98
146SQ	¼x 6	2.52	3812SQ	⅜x 12	5.48
148SQ	¼x 8	2.68			

PHILLIPS SCREWDRIVERS



No.	Blade Size, In.	Net
102-SP	¼x 1 5/16	$2.18
101-P	3/16x 3	2.04
102-P	¼x 4	2.38
103-P	5/16x 6	3.16
104-P	⅜x 8	3.86

NUTDRIVERS



Hex	Lgth.	Net	Hex	Lgth.	Net
3/16	3	$2.22	11/32	3	$2.22
7/32	3	2.22	⅜	3	2.22
¼	3	2.22	7/16	3⅛	2.68
9/32	3	2.22	½	3⅛	2.68
5/16	3	2.22			

SCREWDRIVER KIT

Pocket-size, handy bench sets, color coded. Special E-Z Grip handle included.

SCREWDRIVER KIT SD-5

Includes:

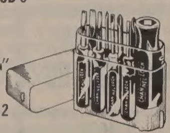
5 Screwdrivers:

3/32″, ⅛″, 5/32″, 3/16″, ¼″

3 Phillips Head:

No. 0, No. 1 and No. 2

Net: $9.32



NUTDRIVER KIT

Pocket-size, handy bench sets, color coded. Special E-Z Grip handle included.

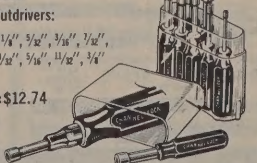
NUTDRIVER KIT ND-1

Includes:

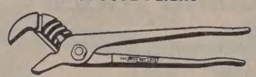
10 Nutdrivers:

3/32″, ⅛″, 5/32″, 3/16″, 7/32″, ¼″, 9/32″, 5/16″, 11/32″, ⅜″

Net:$12.74



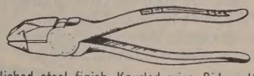
TONGUE AND GROOVE PLIERS



The **original, genuine** tongue and groove plier. Patented, non-slip undercut channels. Patented reinforcing rib for extra strength. Dipped plastic grips optional at slight extra cost.

No.	Size	Adjust	Capacity	Net
420	9½″	5	1½″	$5.84
424	4½″	4	½″	5.18
426	6½″	5	⅞″	4.54
430	10″	7	2″	6.04
440	12″	7	2¼″	6.48
460G	16″	8	4¼″	9.72

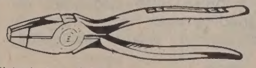
LINEMEN'S PLIER—Bevel Nose



Polished steel finish. Knurled grips. Side cutter. Dipped plastic grips optional at slight extra cost.

No.	Size	Net
3046	6″	$7.02
3047	7″	7.34
3048	8½″	8.64

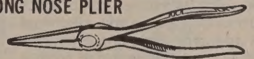
LINEMEN'S PLIER—Rounded Nose



Polished steel finish. Knurled grips. Side cutter. Dipped plastic grips optional at slight extra cost.

No.	Size	Net
346	6″	$7.02
347	7″	7.34
348	8½″	8.64

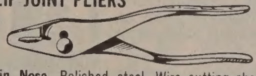
LONG NOSE PLIER



Point 3/32″ round. Polish steel finish. Knurled grips. Dipped plastic grips optional at slight extra cost.

No.	Size	Side Cutter	Net
317	7½″	With	$7.02
3017	7½″	Without	5.84
326	6″	With	6.38
3026	6″	Without	5.30

SLIP JOINT PLIERS



Thin Nose. Polished steel. Wire cutting shear.

No.	Size	Net
516	6″	$4.64

With Side Cutter. Polished steel. Precision tool with fine cutting edge.

No.	Size	Net
537	7″	$7.56

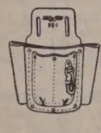
Heavy Duty With Cutter. Finest quality. Polished steel.

No.	Size	Net
546	6″	$4.64
548	8″	5.40
5410	10″	5.72

TOOL HOLSTERS

Highest quality top grain leather. Stress points reinforced with rivets. Convenient knife or wrench snap.

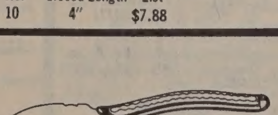
No.	Size	No. Pkts.	Net
1	9¼″x 8½″	5	$10.42
2	9¼″x 10½″	5	11.60



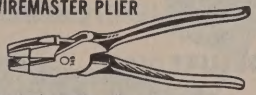
SUPERIOR PLASTIC GRIPS

For maximum hand comfort, durable molded plastic grips. Blue color for good visibility, reduce plier loss. Easy to install. Order by desired grip size.

Plier Size	Grip Size	Net
6″	Small	$1.10
7″	Medium	1.18
8″, 9½″, 10″	Large	1.30



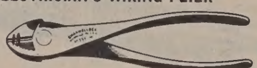
WIREMASTER PLIER



Finest wire-cutting plier ever made. Joint rivet closer to cutting provides 40% more cutting power than standard design pliers. Special enclosed-joint construction holds cutter edges in perfect alignment for life of plier. Dipped plastic grips optional at slight extra cost.

No.	Size	Net
349	9″	$10.70

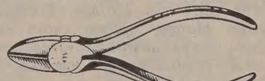
ELECTRICIAN'S WIRING PLIER



Triple-use wiring plier: Cuts, strips insulation, loops wire. Patented wire stripping notches strip insulation from 14 and 12 gauge copper wire quickly, cleanly. Dipped plastic grips optional at slight extra cost.

No.	Size	Net
337-W	7″	$7.34

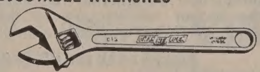
DIAGONAL CUTTER—Box Joint



Precision honed cutting edges. Polished steel finish. Knurled grips. Dipped plastic grips optional at slight extra cost.

No.	Size	Net
435	5″	$5.94
436	6″	6.48
437	7″	7.24

ADJUSTABLE WRENCHES

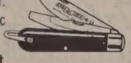


Drop forged of special analysis steel. Chrome plated. Dipped plastic grips optional at slight extra cost.

No.	Size	Cap.	Net	No.	Size	Cap.	Net
804	4″	½″	$5.72	810	10″	1⅛″	$8.42
806	6″	¾″	5.84	812	12″	1 5/16″	12.20
808	8″	15/16″	6.58	815	15″	1 11/16″	18.36

ELECTRICIAN'S KNIFE

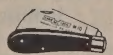
2½″ precision-honed blade.
3″ self-locking screwdriver.
Unbreakable phenolic plastic handle.



No.	Closed Length	Net
11	3¾″	$6.90

SKINNING KNIFE

3″ precision-honed blade.
Self-locking. Unbreakable phenolic plastic handle.



No.	Closed Length	List
10	4″	$7.88

FOR HOME AND INDUSTRY EDSYN® PRODUCTS

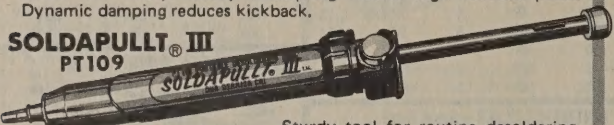
SOLDERING + DESOLDERING + RESOLDERING

HOW TO *Choose* A SOLDERING INSTRUMENT

SOLDAPULLT® DESOLDERING TOOLS

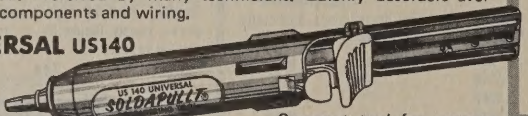
DELUXE DS017

Extremely rugged for volume desoldering. Heavy duty plastic barrel and trigger housing for long, dependable operation. Simple twist-lock separation for fast cleaning. Oversize plunger fully enclosed for safety. Heavy mainspring creates high vacuum pulse. Dynamic damping reduces kickback.



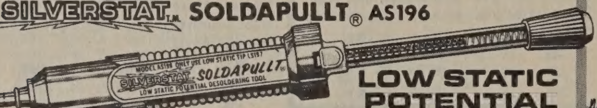
SOLDAPULLT® III PT109

Sturdy tool for routine desoldering. Slim profile without sacrifice in performance has Deluxe Model features; fully enclosed plunger shaft; dynamic damping for very low recoil. Preferred by many technicians. Quickly desolders average size components and wiring.



UNIVERSAL US140

Compact tool for convenient tool box storage. Precision molded plastic barrel and low mass plunger creates rapid vacuum impulse with negligible recoil. Three position plunger adjusts loading span to fit large or small hands. Ample vacuum for most circuit board desoldering requirements.



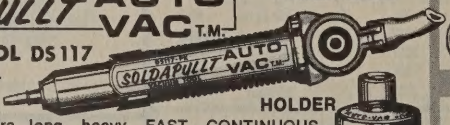
SILVERSTAT™ SOLDAPULLT® AS196

LOW STATIC POTENTIAL

Designed for low static work stations to protect components from effects of static electricity. Low static electrical characteristics providing ground path via operator, reducing discharge to susceptible components. Special material protects operator from a direct electrical short or shock.

SOLDAPULLT AUTO VAC T.M.

VACUUM TOOL DS 117



POWER HEAD

HOLDER

Completely-AUTOMATIC Vacuum Desoldering Tool.

Designed for extra long, heavy, FAST, CONTINUOUS production desoldering requirements. A simple push on the trigger will vacuum up solder-terminal point after point, WITHOUT manual reloading.

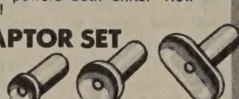
POWER HEAD and HOLDER are offered as a set DS117

HOLDER Simply insert Desoldering Tool in Holder pushing trigger. Presto! Tool is SELF-CLEANED! Vacuum Pump VP171 powers both units. New-clean-fast-safe-efficient = time + money saver!

SP198 PICKUP ADAPTOR SET

OCTAVAC T.M.

Simplifies pickup of small components

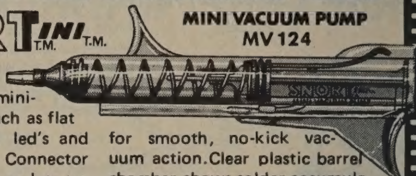


FOR USE ONLY WITH DS117 SOLDAPULLT AUTO VAC T.M.

SPECIAL PURPOSE DESOLDERING TOOLS

SNORT *INI* T.M. T.M.

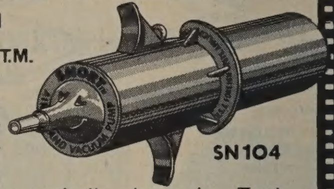
MINI VACUUM PUMP MV124



Designed expressly for desoldering microminiature components, such as flat pac IC's, pin diodes led's and 28-30 AWG wiring. Connector pins on .100 centers or less are easily desoldered. Features are resilient teflon tip, spring arrestor plunger, with de-acceleration tab for smooth, no-kick vacuum action. Clear plastic barrel chamber shows solder accumulation at all times. Easy tool to manipulate for maximum dexterity in minimal working areas.

SNORT T.M.

AIR and VACUUM PUMP

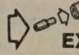


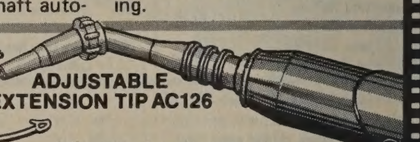
SN104

Ideal tool for occasional TV or Hi-Fi repairs and hobby projects. Operates similarly to bellows or squeeze bulb. Two-piece plastic construction with built in spring. Integral cleaning shaft automatically cleans tips. Tool snaps apart for routine cleaning.

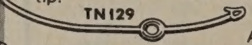
MICRO ADAPTER **MA176**

Tip inserts into regular tip.





ADJUSTABLE EXTENSION TIP AC126



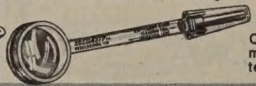
TN129

Tip cleaner needle. Special design for fast tying of wire bundles or components with lacing cord.

Adjustable extension tip extends the reach of SOLDAPULLT® and SOLDAVAC® Tools. 360° swivel tip allows angular adjustment without loss of vacuum. Quickly snaps on or off regular tips.

SOLDASIP® RESOLDERING WICK SW091

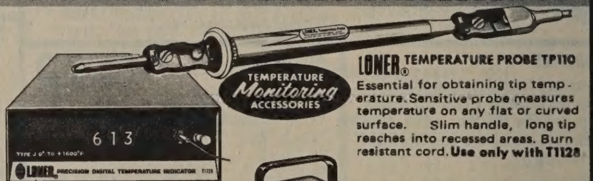
Place SOLDASIP® Wick on solder connection, pressing soldering iron tip against the wick. Solder will flow away from connection and into strands of the wick, making connection ready for removal or resoldering.



BURNISHING TOOL BT028

Combination of fine abrasive, high quality magnifying lens plus hi power lens in protective cap.

TEMPERATURE PROBES and ACCESSORIES



613
TYPE J 0° TO +1600°F
LONER PRECISION DIGITAL TEMPERATURE INDICATOR TI128
TEMPERATURE Monitoring ACCESSORIES

LONER® TEMPERATURE PROBE TP110

Essential for obtaining tip temperature. Sensitive probe measures temperature on any flat or curved surface. Slim handle, long tip reaches into recessed areas. Burn resistant cord. **Use only with TI128**

LONER® DIGITAL TEMPERATURE INDICATOR TI128

Precision instrument temp. range 0°F to 1600°F Integrated circuit A/D processing ± 0.5°F accuracy. 1/2" high characters. Type J lead. 115 or 220 VAC — 50 Watts.

LONER® ANALOG (DIAL) METER LTM95

Dial meter, accurate °C and °F scale covers soldering tip temp. range 400°F to 900°F. Type J. Thermocouple lead, calibration seals included.

Triple M Mate ™ PERFECT SOLDERING TIPS

Designed Exclusively for the LONER® and ERSA Soldering Tools

Work Rated as GOOD, BETTER or BEST for:

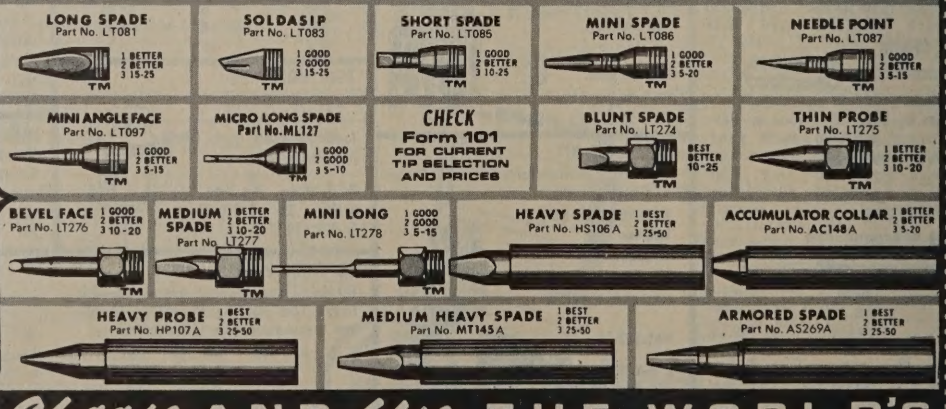
1. HEAT TRANSFER
2. DURABILITY
3. THERMAL LOAD IN WATTS

IMPORTANT: WHEN ORDERING TIPS, ALWAYS SPECIFY MODEL NUMBER OF YOUR LONER® OR ERSA® TOOLS

EXAMPLES: LONER MODEL 950-950A-950B; ERSA Tip16

TA153 Converts 32 THREAD to 20 — MODEL 950

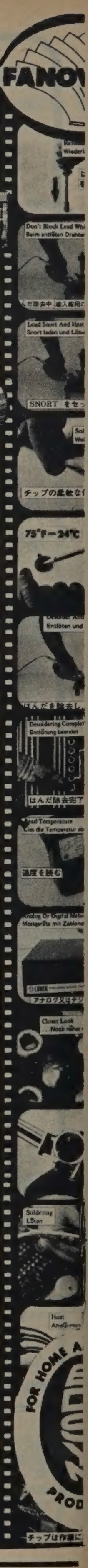
TA185 Converts 20 THREAD to 32 — MODEL 950A



Tip	Part No.	1	2	3
LONG SPADE	LT081	BETTER	BETTER	15-25
SOLDASIP	LT083	GOOD	GOOD	15-25
SHORT SPADE	LT085	GOOD	BETTER	10-25
MINI SPADE	LT086	GOOD	BETTER	5-20
NEEDLE POINT	LT087	GOOD	BETTER	5-15
MINI ANGLE FACE	LT097	GOOD	BETTER	5-15
MICRO LONG SPADE	ML127	GOOD	GOOD	5-10
BLUNT SPADE	LT274	BEST	BETTER	10-25
THIN PROBE	LT275	BETTER	BETTER	10-20
BEVEL FACE	LT276	GOOD	BETTER	10-20
MEDIUM SPADE	LT277	BETTER	BETTER	10-20
MINI LONG	LT278	GOOD	GOOD	5-15
HEAVY SPADE	HS106A	BEST	BETTER	25-50
ACCUMULATOR COLLAR	AC148A	BETTER	BETTER	5-20
HEAVY PROBE	HP107A	BEST	BETTER	25-50
MEDIUM HEAVY SPADE	MT145A	BEST	BETTER	25-50
ARMORED SPADE	AS269A	BEST	BETTER	25-50

CHECK Form 101 FOR CURRENT TIP SELECTION AND PRICES

HOW TO *Choose* AND *Use* THE WORLD'S



= SOLDER *Ability!*

EDSYN pioneer in SolderABILITY presents FANOVISION - graphic motion in a training manual designed to stimulate the mind to SAVE TIME on the line. Available at $7.95

FANOVISION
T.M.

AT PARTICIPATING DISTRIBUTORS ONLY

144 PAGE TRAINING MANUAL
OVER 1,000 ILLUSTRATIONS
IT'S FAN TO LEARN!

T.M.
LONER® SOLDERING INSTRUMENT
in a class by itself... for you alone!

Model No. 950 CL080

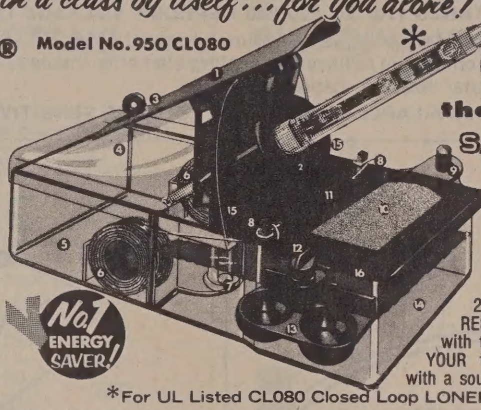
LONER® STORY

FEATURES: a soldering instrument with nothing to hide, we left everything in plain view so that you can best see how a soldering instrument differs from a soldering iron. One instrument performs most soldering cycles from heavy to micro termination — The **LONER® SOLDERING INSTRUMENT.**

FAST ACCURATE SOLDERING CYCLES: After a fast 45 second warm-up, each soldering cycle is automatically thermally balanced to match each termination load (range: 590°F to 750°F) with the precise preset soldering temperature.

ENERGY SAVER: High power is consumed ONLY during soldering operation and NOT during energy saving idling cycle.

BASIC DESIGN: Allows use of a wide variety of tip styles to simplify a maximum of techniques required in working on today's electronic hardware.



UL LISTED TIP TO PLUG

B-170 *Base 1*

the first FULLY engineered SAFELOCK idle-rest® SOLDERING STATION

① SAFELOCK TOOL RELEASE	⑨ PUMP & FILL CAP
② TOOL SUPPORT	⑩ SPONGE
③ SAFELOCK RELEASE	⑪ SPONGE COVER PLATE
④ THERMAL COVER	⑫ PUMP SELECTOR VALVE
⑤ STORAGE CHAMBER	⑬ CLEANING BASINS
⑥ SOLDER SPOOL SSS94	⑭ RESERVOIR
⑦ MOUNT PORT	⑮ COVER RELEASE PEGS
⑧ PULL PEGS	⑯ PUMP HOUSING ASSEMBLY

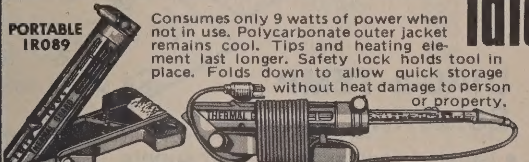
EDSYN® projects the Soldering Technician into the 21st Century, with the NEW Deluxe Base 1 IDLE-REST® Professional Soldering Tool Holder. Blast off with the first fully engineered Soldering Station to reach YOUR technical sphere — make the quickest recovery with a sound turn around — Base 1 IDLE-REST® Tool Holder.

*For UL Listed CL080 Closed Loop LONER® and ERI40 ERSA Tip 16 only

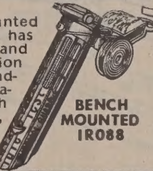
idle·rest®

PORTABLE IR089

Consumes only 9 watts of power when not in use. Polycarbonate outer jacket remains cool. Tips and heating element last longer. Safety lock holds tool in place. Folds down to allow quick storage without heat damage to person or property.

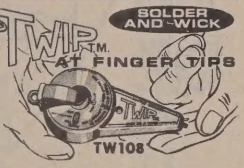


Bench mounted IDLE-REST™ has same thermal and Polycarbonate construction as portable model. Threaded bushing allows permanent installation on bench top. Two spools of solder, accessory apron and sponge included.



BENCH MOUNTED IR088

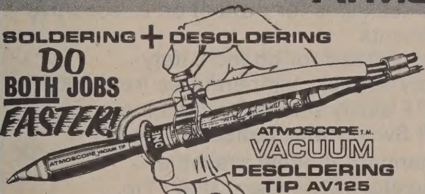
SOLDER AND WICK
TWIP™ AT FINGER TIPS



TW108

ATMOSCOPE T.M. ACCESSORIES

SOLDERING + DESOLDERING
DO BOTH JOBS FASTER!



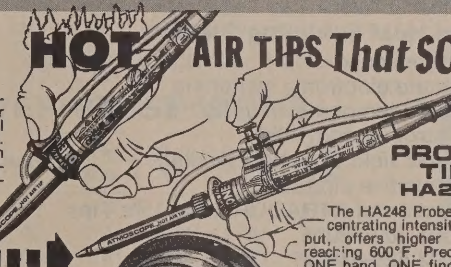
ATMOSCOPE T.M. VACUUM DESOLDERING TIP AV125

Converts LONER to a dual soldering and desoldering tool. Large mass head provides high-heat reserve for continuous production line work. Unbreakable desoldering chamber allows fast & safe handling. Simple ONE hand, ONE finger operation. NO FOOT PEDAL NEEDED.

JET TIP HA120

Converts LONER Soldering Instrument to hot air generator up to 400°F. Solder as usual without removing attachments. Ideal for shrinking tubing in tight areas, forming small plastic parts, heat testing components, etc. Operates on low pressure air.

HOT AIR TIPS That SOLDER



solder as usual with EITHER TIP

PROBE TIP HA248

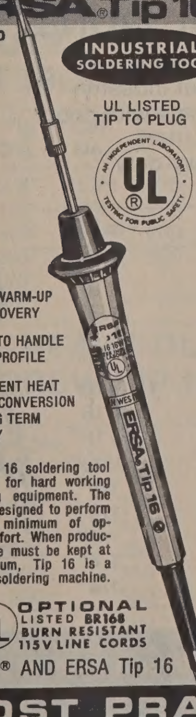
The HA248 Probe Tip, by concentrating intensity of heat output, offers higher temperatures reaching 600°F. Precision trigger, ONE hand, ONE finger operation, NO FOOT PEDAL NEEDED! Operates on low pressure air. Solder as usual.

ERSA® Tip 16

ERI40

INDUSTRIAL SOLDERING TOOL

UL LISTED TIP TO PLUG



- FAST WARM-UP AND RECOVERY
- EASY TO HANDLE PENCIL PROFILE
- EFFICIENT HEAT ENERGY CONVERSION FOR LONG TERM ECONOMY

The Tip 16 soldering tool is built for hard working soldering equipment. The tool is designed to perform with a minimum of operator effort. When production time must be kept at a minimum, Tip 16 is a rugged soldering machine.

OPTIONAL LISTED BR168 BURN RESISTANT 115V LINE CORDS

LONER® AND ERSA Tip 16

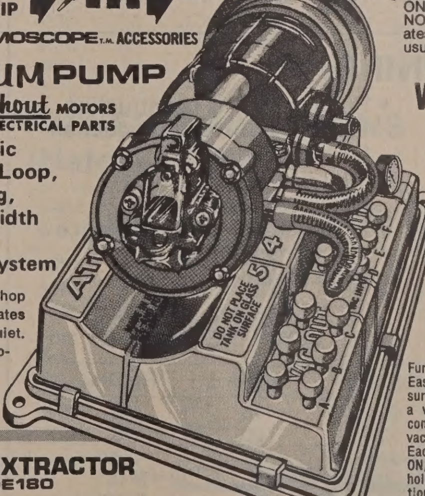
IDEAL SOURCE OF VACUUM FOR ATMOSCOPE T.M. ACCESSORIES

ATMOSCOPE™ VP171 VACUUM PUMP

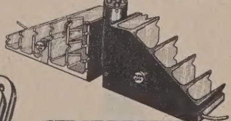
HIGH VACUUM *without* **MOTORS or ELECTRICAL PARTS**

100% Pneumatic
Automatic Closed Loop,
Self-Regulating,
Variable Pulse Width
Modulation
Vacuum Control System

Vacuum to 22" mercury from shop air supply of 90 to 120 PSI. Operates on demand, compact, whisper quiet. Twelve manifold outlets allow operation of several vacuum tools from one pump.


4
5
DO NOT PLACE TANK ON GLASS SURFACE

VICE less VICE



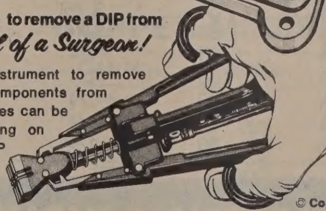
ATMOSCOPE™ HF172 VACUUM HOLDING Fixtures

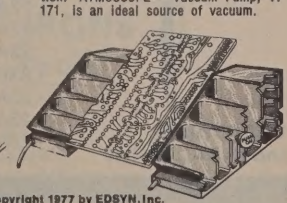
Furnished as a twin set, each identical. Easily moved on bench top or other FLAT surface, they can be positioned to hold a variety of sizes of circuit boards or components. Quickly connects to any vacuum source of 12 to 20" mercury. Each has a holding power up to 30 lbs. ON/OFF Switch permits VICELESS (nonholding) or VICE (holding), for fast action. ATMOSCOPE™ Vacuum Pump, VP 171, is an ideal source of vacuum.

KLATCH™ DIP EXTRACTOR DE180

QUADRAMATIC Action allows YOU to remove a DIP from SIDES or ENDS ***with the skill of a Surgeon!***

Use with the LONER® Soldering Instrument to remove 14-16 point DIP (Dual Inline Pin) components from circuit boards. Several types and shapes can be easily removed in seconds, depending on type of tip being used. The DE180 DIP Extractor can also be used separately as DUAL AXIS hand tongs.





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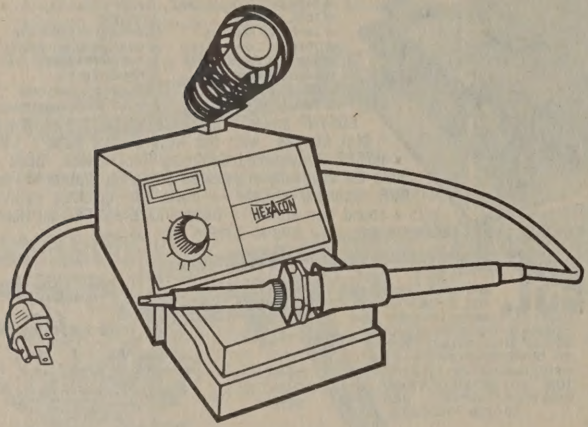
MOST PRACTICAL SOLDER HANDLING TOOLS

HEXACON SOLDERING IRONS

VOLTAGE RANGE: 6 to 240 • OPERATE IDENTICALLY ON A.C. OR D.C., ANY CYCLE
STANDARD VOLTAGES 110/120, 220/240 • SPECIFY VOLTAGE ON ORDER

Equipped with extra flexible, high temperature approved cords. Three wire cords standard with all irons. Nickel chromium replaceable heating elements, insulated with finest mica, protected by rugged outer housing. Replaceable tips.

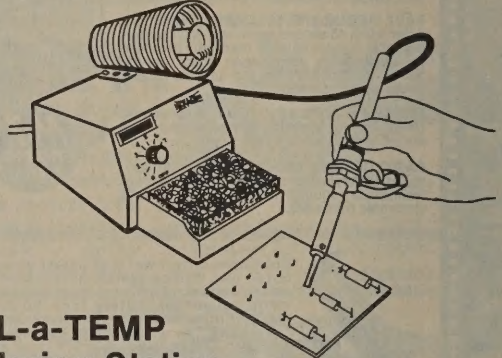
POSI-GROUND® AVAILABLE TO PROTECT VOLTAGE SENSITIVE COMPONENTS



THERM-O-TRAC

Controlled Heat Soldering Stations

- Temperature sensor "up front" where it belongs
- All solid state electronic switching
- Dial selected temperature to 850° F
- Close control—within 10° F
- No magnetic field or voltage leakage—safe for sensitive circuitry
- Wide selection of XTRADUR Long Life Tips
- Model 1001 500-720° F
- Model 1002 525-850° F



DIAL-a-TEMP Soldering Station

- Isolated, low voltage power supply
- Posi-Ground® construction eliminates all voltage leakages for protection of sensitive components
- Internally fused for added safety
- Infinitely variable temperatures from 350° F to 950° F easily selected by dialing
- On-Off Switch with Indicator Light
- Two standard models available:
  Catalog No. 1520—Uses 3/16" Tip
  Catalog No. 1524—Uses 1/4" Tip
- No special tip requirements—uses standard Xtradur and Durotherm Long-Life plug tips

HEXACON MINIRONS

- Rugged quality construction that will withstand production line conditions
- Slim-line case promotes maximum visibility
- Lightweight—perfect balance
- Full wattage range 15 to 60 watts

SLIM LINE CASE—
SLIM LINE HANDLE

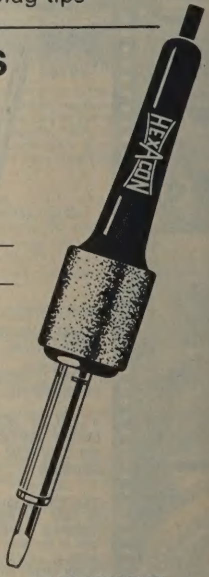
Cat. No.	Watts	Tip Dia.
21A	15	1/8"
21A	20	1/8"
21A	25	1/8"
22A	25	3/16"
22A	30	3/16"
22A	35	3/16"
23A	25	1/4"
23A	30	1/4"
23A	40	1/4"
23A	50	1/4"
23A	60	1/4"

DURORTHERM and XTRADUR tips

SUPER PENCIL IRONS

- Standard for dependability in production throughout industry.
- Strong fiberglass handle with cool cork finger grip
- Precision wound heavy-duty industrial element

Cat. No.	Watts	Tip Dia.
25S	20	1/8"
25S	25	1/8"
25S	30	1/8"
25S	35	1/8"
25S	40	1/8"
26S	30	3/16"
26S	35	3/16"
26S	40	3/16"
26S	50	3/16"
24S	25	1/4"
24S	30	1/4"
24S	40	1/4"
24S	50	1/4"
24S	60	1/4"



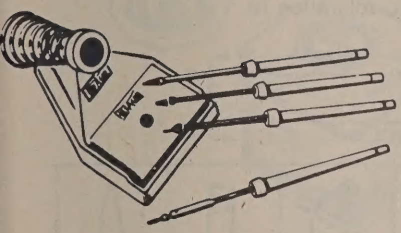
DUROTHERM and XTRADUR tips

HEXACON ELECTRIC COMPANY

159 WEST CLAY AVE., ROSELLE PARK, N. J. 07204
PHONE (201) 245-6200 • TELEX 138812

HEXACON SOLDERING IRONS HEXACON

MICRO-MINI IRON AND STAND

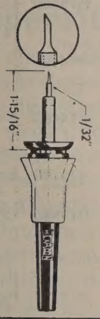


Iron Specifications

No.	Temp.
M 65 M 65K	650
M 70 M 70K	700
M 75 M 75K	750
M 85 M 85K	850
M 065	650
M 070	700
M 075	750
M 085	850

Tip Kit "K" includes
Holder, Iron plus 7 Tips

HEXACON HORNET IRONS



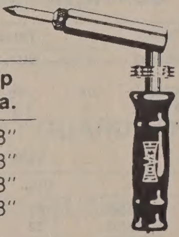
H 10 K Kit (12 watts)
H 11 K Kit (17 watts)
H 14 K Kit (20 watts)

- Lightweight
- Cool Handle

Kits include iron, 2 tips and sponge.

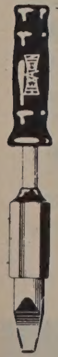
DUROTHERM and XTRADUR tips

HEAVY DUTY HATCHET IRONS

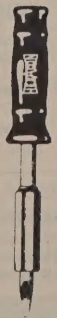


Cat. No.	Watts	Tip Dia.	Cat. No.	Watts	Tip Dia.
70H	100	3/8"	153H	175	3/8"
74H	125	1/4"	155H	200	3/8"
100H	110	3/8"	200H	200	5/8"
116H	175	3/8"	300H	300	7/8"
150H	150	3/8"			

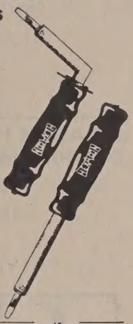
HEAVY-DUTY SCREW TIP IRONS



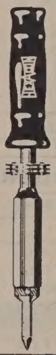
Cat. No.	Watt	Tip Dia.
85	90	1/2
120	120	5/8
170	175	1
225	250	1-1/8
350	350	1-3/8
500	500	1-5/8
700	700	1-3/4
800	800	1-3/4



PINPOINT IRONS DUROTHERM and XTRADUR tips

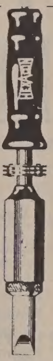


P25	25	1/8"	25H	25	1/8"
P25	35	1/8"	25H	35	1/8"
P25	50	1/8"	25H	50	1/8"
P26	30	3/16"	26H	30	3/16"
P26	40	3/16"	26H	35	3/16"
P26	50	3/16"	26H	50	3/16"
P24	40	1/4"	24H	40	1/4"
P24	50	1/4"	24H	50	1/4"
P24	60	1/4"	24H	60	1/4"



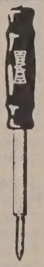
HEAVY DUTY PLUG-TIP IRONS

Cat. No.	Watt	Tip Dia.	Cat. No.	Watt	Tip Dia.
P70	100	3/8	P151	175	1/2
P100	110	3/8	P152	200	1/2
P115	150	3/8	P200	200	5/8
P116	175	3/8	P250	250	5/8
P150	150	3/8	P300	300	7/8
P153	175	3/8	P550	550	1-1/8
P155	200	3/8			

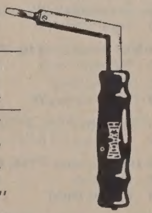


POWERHOUSE IRONS

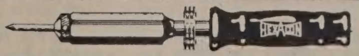
Cat. No.	Watts	Tip Dia.	Cat. No.	Watts	Tip Dia.
30S	80	1/4"	P34	80	1/4"
P30	40	1/4"	P34	90	1/4"
P30	60	1/4"	P35	80	5/16"
P30	75	1/4"	P35	90	5/16"
P30	80	1/4"	P35	100	5/16"
P34	70	1/4"			



POWERHOUSE IRONS (Hatchet Type)



Cat. No.	Watt	Tip Dia.	Cat. No.	Watt	Tip Dia.
30H	40	1/4"	34H	70	1/4"
30H	50	1/4"	34H	80	1/4"
30H	60	1/4"	34H	90	1/4"
60H	70	1/4"	35H	80	5/16"
30H	75	1/4"	35H	90	5/16"
30H	75	1/4	35H	90	5/16"
30H	80	1/4"	35H	100	5/16"



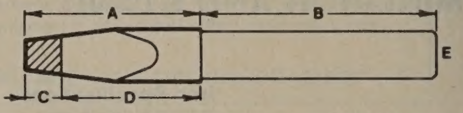
"COPPER MISER" IRONS

Cat. No.	Watts	Tip Dia.
P114	100	1/4"
P154	150	1/4"
P238	200	3/8"
P212	200	1/2"
P338	300	3/8"

HEXACON SOLDERING IRON TIPS HEXACON

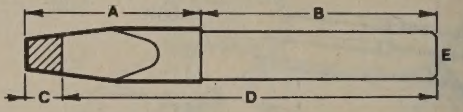
DUROTHERM Iron plated with patented stainless steel bonded to copper shank. Precision ground to tolerance of .001. Lectrotin on working surface and immunized over entire surface.

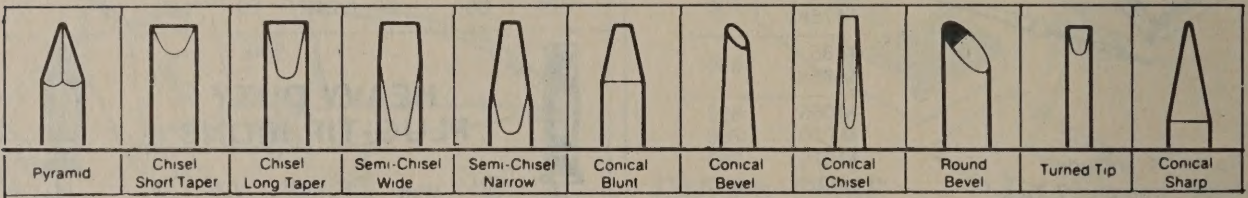
A. Heavy Iron Coating
B. Scale resistant Stainless Steel
C. Pretinned Lectrotin
D. Immunized Nickel and Chrome
E. Iron, Nickel and Chrome coated



XTRADUR Heavy Iron plated over OFHC Copper alloy with shank precision ground to tolerance of .001. Pretinned with Lectrotin process and immunized with Nickel and Chrome.

A. Heavy Iron Coating
B. Iron, Nickel and Chrome
C. Pretinned Lectrotin
D. Immunized Nickel and Chrome
E. Iron, Nickel and Chrome coated





CATALOG NUMBERS ARE FOR DUROTHERM TIPS. FOR XTRADUR, SEE NOTES

Tip No.	Style of Point	Tip No.	Style of Point	Tip No.	Style of Point
1/8" x 2-1/4" Fit Iron Nos. 25S, P25, 25H, 21A					
HT248D	Pyramid	**HT222D**	Conical, blunt	**HT693D**	R.B., TT 1/16"
HT249D	Chisel, short	**HT331D**	Conical, sharp	**HT104D**	R.B., TT 1/32"
HT376D	Chisel, long	**HT638D**	Round, bevel	**HT216D**	R.B., groove
HT560D	Semi-chisel	**HT361D**	Chisel, TT 1/16"	**HT244D**	Conical, bevel
3/16" x 2-1/4" Fit Iron Nos. 26S, P26, 26H, 22A					
HT251D	Pyramid	**HT190D**	Semi-chisel, W	**HT290D**	Chisel, TT 1/8"
HT294D	Chisel, short	**HT214D**	Conical, blunt	**HT548D**	S-chisel, N, TT 1/8"
HT195D	Chisel, long	**HT281D**	Conical, sharp	**HT479D**	Conical TT 1/8"
HT207D	Semi-chisel, N	**HT288D**	Pyramid, TT 1/8"	**HT220D**	R.B., TT 1/16"
1/4" x 2-1/4" Fit Iron Nos. 24S, P24, 24H, 23A					
HT325D	Pyramid	**HT102D**	Round, bevel	**HT513D**	Conical, TT 1/8"
HT553D	Chisel, short	**HT586D**	Conical, S-chisel	**HT463D**	Chisel, L, TT 3/16"
HT313D	Semi-chisel, W	**HT691D**	Chisel, TT 1/16"	**HT841D**	S-chisel, N. TT 1/8"
HT397D	Semi-chisel, M	**HT699D**	S-chisel, Lg. TT 1/8"	**HT692D**	Chisel, L, TT 1/8"
HT417D	Semi-chisel, N	**HT451D**	Chisel, L, TT 1/8"	**HT552D**	S-chisel, 3/8" Shank
HT418D	Conical, blunt	**HT324D**	Chisel, S, TT 1/8"		
1/4" x 2-3/4" Fit Iron Nos. P30, 30H, P34, 34H					
HT252D	Pyramid	**HT263D**	Pyramid, TT 1/8"	**HT452D**	Conical, TT 1/8"
HT253D	Chisel, short	**HT264D**	Chisel, SH, TT 1/8"	**HT580D**	Conical, TT 3/16"
HT202D	S-chisel, Wide	**HT356D**	Chisel, M, TT 1/8"	**HT473D**	Chisel, TT 3/16"
HT426D	S-chisel, N	**HT685D**	Chisel, Lg, TT 1/8"	**HT130D**	Round, bevel
HT131D	Conical, sharp				
1/4" x 3" Extra long for P30, 30H, P34, 34H. Also for competitive makes					
HT468D	Chisel, long	**HT708D**	S-chisel, N, Lg	**HT487D**	Chisel, Lg, TT 1/8"
HT299D	Semi-chisel, W	**HT453D**	Conical, bevel	**HT519D**	Chisel, Lg, TT 1/8"
HT328D	Semi-chisel, N	**HT234D**	Chisel, Lg, TT 5/32"	**HT362D**	Conical groove
1/4" x 3-3/4" Extra long for P30, 30H, P34, 34H. Also for competitive makes.					
HT563D	Pyramid, long	**HT691D**	Semi-chisel, N	**HT603D**	Chisel, Lg, TT 1/8"
HT188D	Chisel, long	**HT626D**	Pyramid, TT, 1/8"	**HT391D**	Semi-chisel, N
HT382D	Semi-chisel, W	**HT698D**	S-chisel, TT 1/8"	**HT277D**	Chisel, Lg, TT 3/16"
1/4" x 4" Fit Irons P114, P154, P214.					
HT495D	Chis., Lg, TT 3/16"	**HT494D**	Semi-chisel, N	**HT496D**	Chisel, long
1/4" x 4-1/4" Fit Irons P114, P154					
HT258D	Pyramid	**HT230D**	Semi-chisel, W	**HT460D**	Conical, bevel
HT259D	Chisel, short				
3/8" x 4-1/4" Fit Iron Nos. P100, P150, P238, P338, 100H, 150H					
HT255D	Pyramid	**HT266D**	Chisel, Sh, TT 1/4"	**HT177D**	S-chisel, W, TT 1/4"
HT493D	Chisel, short	**HT335D**	Chisel, Lg, TT 1/4"	**HT577D**	S-chisel, N, TT 1/4"
HT151D	Chisel, long	**HT108D**	Conical, sharp	**HT145D**	Chisel, Sh, TT 3/16"
HT183D	Semi-chisel, N	**HT114D**	Conical, blunt, Sm	**HT475D**	S-chisel, N. TT 3/16"
HT593D	Semi-chisel, W	**HT240D**	Conical, blunt M	**HT481D**	Chisel, N. Sh, TT 1/8"
HT265D	Pyramid, TT 1/4"				
3/8" x 4" Fit Iron Nos. P100, P150, P238, 100H, 150H; Extra long for P70, 70H.					
HT566D	Pyramid	**HT365D**	Semi-chisel, thin	**HT4300**	Round, bevel
HT198D	Chisel, short	**HT370D**	S-chisel, Lg, N	**HT319D**	S-chisel, N, TT 1/4"
HT918D	S-chisel, Sh, M	**HT140D**	Semi-chisel, W		

Tip No.	Style of Point	Tip No.	Style of Point	Tip No.	Style of Point
3/8" x 3-3/4" Fit Iron Nos. P70, 70H; Also fit other makes					
HT254D	Pyramid	**HT339D**	S-chisel, N, TT 1/4"	**HT291D**	S-chisel, W, TT 1/4"
HT488D	Chisel, short	**HT129D**	Semi-chisel, W	**HT510D**	Conical, sharp
1/2" x 4" Fit Iron Nos. P151, 151H, P152, P212					
HT323D	Chisel, short blunt	**HT2030**	Conical, blunt		
HT1630	Semi-chisel, N	**HT1940**	Semi-chisel, thin		
HT444D	S-chisel, long taper				
1/2" x 4-1/4" Fit Iron Nos. P151, P212, 151H					
HT257D	Pyramid	**HT293D**	Chisel, short	**HT446D**	S-chisel, Lg, Taper
HT123D	S-chisel N, TT 3/8"				
5/8" x 4" Fit Iron Nos. P125, P200, 200H, P250					
HT256D	Pyramid	**HT891D**	Chisel, long	**HT178D**	Semi-chisel, W
5/8" x 4-1/4" Fit Iron Nos. P200, P250, 200H					
HT260D	Pyramid	**HT371D**	Semi-chisel, N	**HT499D**	Chisel, long
7/8" x 4-3/4" Fit Iron Nos. P300, 300H					
HT261D	Chisel, short	**HT179D**	Semi-chisel, W		
1-1/8" x 5-1/4" Fits No. 500					
HT262X	Chisel	**HT229X**	Semi-chisel	**HT233X**	Pyramid

Special types available upon request.

SCREW TIPS All Conventional Semi-chisel Types

Tip No.	Dia.	Thread	Iron No.	Tip No.	Dia.	Thread	Iron No.
HT268X	1/2"	5/16-18	60 and 85	**HT272X**	1-1/8"	5/8-11	225
				HT273X	1-3/8"	5/8-11	350
HT269X	5/8"	5/16-18	120	**HT274X**	1-5/8"	5/8-11	500
HT271X	1"	1/2-13	170	**HT275X**	1-3/4"	5/8-11	700

HORNET TIPS

TIPS FOR IRONS Nos. H10 and H11

No.	Dia.	No.	Dia.	No.	Dia.
HT866D	1/32"	**HT896D**	1/16"	**HT871X**	1/8"
HT867D	1/32"	**HT864X**	1/8"	**HT873X**	1/8"
HT868D	1/16"	**HT870X**	1/8"		

TIPS FOR IRON No. H14

No.	Dia.	No.	Dia.	No.	Dia.
HT654X	1/8"	**HT656X**	3/16"	**HT658X**	1/8"
HT655X	1/8"	**HT657X**	3/16"	**HT659X**	1/8"

CATALOG NOS. shown are for DUROTHERM. For XTRADUR substitute "X" for "D"; cost approximately 10% less than DUROTHERM.

SAMPLE TIPS for your evaluation. Ask for new Tip Sketch Catalog with detailed sketches of 250 Standard Coated Tips.

WL TIPS FOR WTCP UNITS

WL1	Semi-chisel 1/16"	**WL5**	Chisel 1/4"	**WL9**	Bevel 3/32"	**WL13**	Semi-chisel 1/32"
WL2	Semi-chisel 3/32"	**WL6**	Semi-chisel 5/64"	**WL10**	Bevel 1/8"	**WL14**	Conical 1/32"
WL3	Semi-chisel 1/8"	**WL7**	Semi-chisel 3/64"	**WL11**	Bevel 3/16"	**WL15**	Semi-chisel 1/8"
WL4	Chisel 1/4"	**WL8**	Bevel 1/16"	**WL12**	Bevel 1/32"	**WL16**	Conical 1/64"

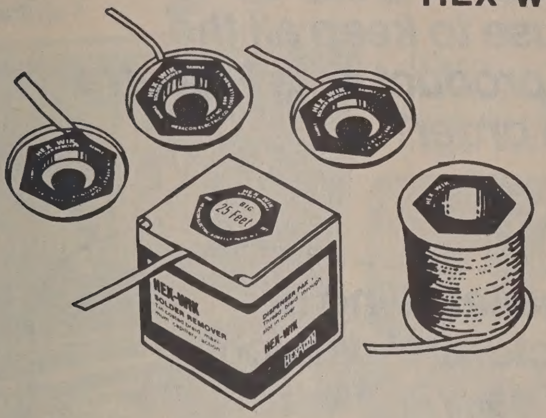
CONICAL CHISEL

CONICAL BEVEL

Specify temperature desired. Other sizes available.
Send for complete list.

HEXACON SOLDERING ACCESSORIES HEXACON

HEX-WIK the superior solder removal braid



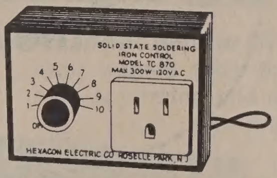
Meets all Military and
Government specifications

- The easiest and most economical method of desoldering printed wiring boards without measling, delamination or lifted pads.
- Simplifies removal and replacement of components.
- Can be used for solder removal on plated thru and multi-layer printed wiring board assemblies.
- Braid processed for long shelf life insures greater capillary action.
- Available in 6 sizes 1/32", 3/64" and 1/16" for micro work, 5/64", 1/8" and 5/32" for larger work.
- For convenience ... 6, 10 or 15 ft. on 2" spools.
- For economy ... 25, 50 or 100 ft. in handy Dispenser Paks. Larger spools available on request.

Hexacon manufactures a complete line of soldering accessories: solder suckers, heat sinks, braid cleaners, erasure cleaners, tweezers, tip cleaning sponges, desoldering tips, desoldering wells, mini pots, etc.

Temperature Control Units

- Controlled AC input provided from 0-95% of line voltage
- Capacity 300 watts on 115 volts
- Solid state circuitry includes built-in fuse protection
- Idling temperature may be readily controlled
- Thermal working zones may be varied by adjusting input control
- Use same iron for different capacity jobs
- Calibrate control settings to maintain proper working ranges as required by government specifications
- Rugged design provides long maintenance, free operational life


SOLID STATE SOLDERING IRON CONTROL MODEL TC 870 MAX 300W 120V AC
1
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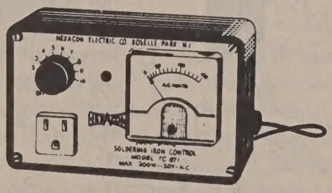
HEXACON ELECTRIC CO ROSELLE PARK N.J

Model 870
3 wire grounded design.
Size 1⅝" x 4".
Weight 10 oz.


HEXACON ELECTRIC CO ROSELLE PARK N.J
AC VOLTS
SOLDERING IRON CONTROL MODEL TC 871 MAX 300W-120V-AC

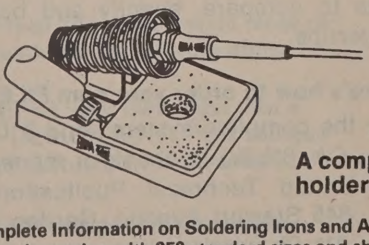
Model 871
3 wire design. Comes with voltmeter for visual indication of voltage input to iron. Size 2" x 6¼".
Weight 18 oz.

HEAT GUARD SOLDERING IRON HOLDERS

- Protect iron and tip
- Conserve energy — nonheat sinking
- Cool, safe holder assembly
- Full operator protection

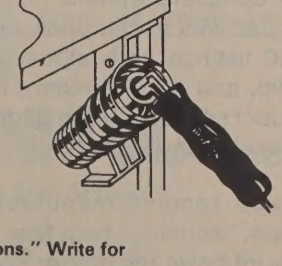
MODEL 890
Ceramic Base with Reservoir and Sponge

- For instrument irons
- Water injection keeps sponge wet
- Non-skid base — can be used in clean room without marring bench
- Base easily cleaned



MODEL 893
Bench Mounted

- For under-bench mounting
- Angle adjustable for operator convenience and safety
- Sturdy construction — easily cleaned



A complete line of iron holders are available.

For complete Information on Soldering Irons and Accessories, write for Catalog "Soldering Irons." Write for complete tip catalog with 250 standard sizes and shapes. Custom tips designed to specifications.

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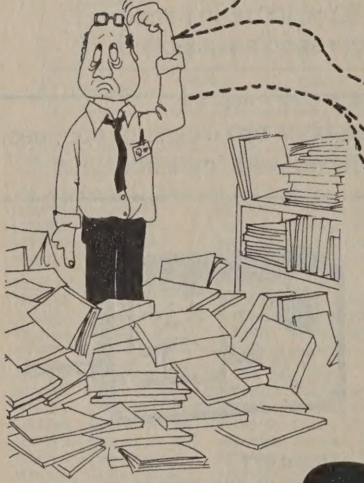

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Genesis I

Basic Technician's Kit No. 7609M
18¼" x 13" x 5¾"

It's no mystery why our 7609's have been selling like crazy. We've tracked down the best tools around and placed them under maximum security in a rugged ABS case that stands up to anything. This kit covers just about every need in the service, installation and maintenance of electronic equipment from pinball machines to computers. It includes the most requested items such as punches and alignment tools, hammers, flashlights, inspection mirrors, scribes, spring hooks, soldering iron, VOM's, parts boxes and much, much more!

Techni-Tool

FREE –
Color Tool Kit Brochure contains our comprehensive tool kit line with **Design-a-Kit** for customizing.

Engineer's Tool Kit No. 7615
18" x 12½" x 7¼"

Your prints will be all over this one! It has 138 of the most wanted tools for servicing and installing devices such as terminal and office equipment and military and industrial hardware. Packaged in a unique 3-pallet configuration, the tools are securely housed in a reinforced black leather-grain vinyl hardwood case. Pallets are flow-charted for efficiency. The lid has room for books, papers, etc. Solid brass hardware and comfort grip handle. Many requested options have been included as standard in this, our most complete kit.

PROOF POSITIVE:

1. Our standard line of tool kits cover a wide range of in-plant and field situations. There's something for almost everyone!
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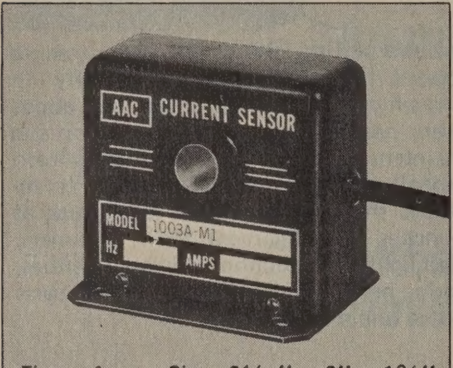

Figure 1 Size: 2¹⁄₁₆″ x 2″ x 1¾″

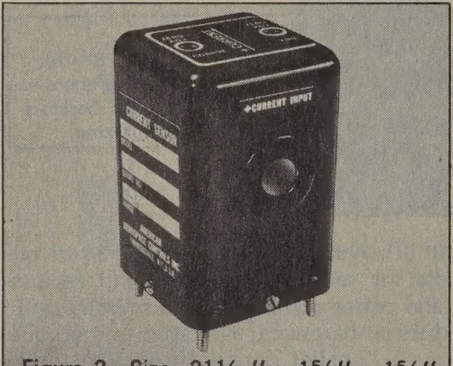

Figure 2 Size: 2¹¹⁄₁₆″ x 1⅝″ x 1⅝″

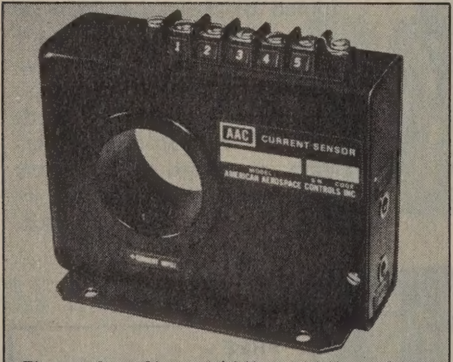

Figure 3 Size: 3½″ x 4¼″ x 2³⁄₁₆″

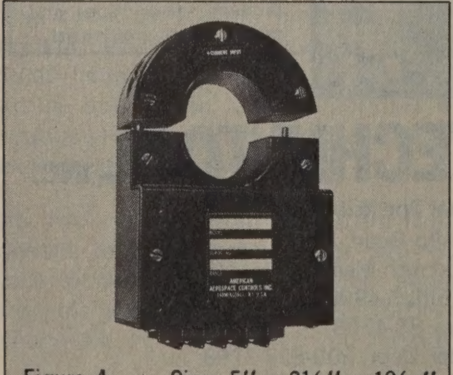

Figure 4 Size: 5″ x 3¼″ x 1⁹⁄₁₆″

(A.C.) CURRENT SENSORS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
1003AM1	2 to 100 A AC	6	+5 VDC	2% F.S.	150 ms	1
1002	5 to 100 A AC	5	+5 VDC	1% F.S.	50 ms	5
1004	5 to 100 A AC	5	+5 VDC	2% F.S.	150 ms	5
1003AM2	100 to 250 A AC	4	+5 VDC	2% F.S.	150 ms	—
1001	150 to 5000 A AC	9	+5 VDC	2% F.S.	150 ms	4
1003AM3	350 to 1500 A AC	8	+5 VDC	2% F.S.	150 ms	—

(D.C.) CURRENT SENSORS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
904B	0.1 to 5 mA	6	+5 VDC	1% F.S.	50 ms	—
903B	5 to 5000 mA	10	+5 VDC	1% F.S.	50 ms	5
903C	5 to 5000 mA	10	+5 VDC	2% F.S.	50 ms	5
903D	20 to 5000 mA	8	+5 VDC	4% F.S.	50 ms	5
936	50 to 500 mA	2	+5 VDC	2% F.S.	100 ms	—
937	10 to 30 A	3	+5 VDC	2% F.S.	1 ms	—
913A	10 to 100 A	4	+5 VDC	1% F.S.	1 ms	2
913B	10 to 100 A	4	+5 VDC	1% F.S.	1 ms	5
913C	10 to 100 A	4	+5 VDC	2% F.S.	1 ms	5
923B	10 to 100 A	4	+5 VDC	1% F.S.	1 ms	5
923C	10 to 100 A	4	+5 VDC	2% F.S.	1 ms	5
923D	10 to 100 A	4	+5 VDC	4% F.S.	1 ms	5
902	50 to 500 A	5	+5 VDC	1% F.S.	5 ms	—
934	100 to 1000 A	7	+5 VDC	2% F.S.	1 ms	—

BIDIRECTIONAL CURRENT SENSORS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
905B	±50 to ±5000 mA	7	±5 V	1% F.S.	50 ms	5
905C	±50 to ±5000 mA	7	±5 V	2% F.S.	50 ms	5
925B	±10 to ±100 A	4	±5 V	1% F.S.	1 ms	5
925C	±10 to ±100 A	4	±5 V	2% F.S.	1 ms	5
925D	±10 to ±100 A	4	±5 V	4% F.S.	1 ms	5
907A	±25 to ±250 A	6	±5 V	2% F.S.	40 μs	—
908	±25 to ±200 A	5	±250 mV	2.5% F.S.	5 μs	—
910	±25 to ±250 A	6	±250 mV	2% F.S.	5 μs	—
927C	±50 to ±1000 A	9	±5 V	2% F.S.	100 μs	—
942A	±100 to ±1000 A	8	±5 V	1% F.S.	100 μs	3
942B	±100 to ±1000 A	8	±10 V	1% F.S.	100 μs	3
927B	±150 to ±1000 A	7	±5 V	1% F.S.	100 μs	—
909	±150 to ±2500 A	8	±250 mV	2% F.S.	200 μs	4
909M4	±150 to ±2500 A	8	±5 V	2.5% F.S.	200 μs	4

CURRENT, VOLTAGE AND POWER INSTRUMENTATION

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MOVEABLE JAW CURRENT SENSORS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
932	±10 to ±500 A	10	±5 V	1% F.S.	100 µs	6
930	±30 to ±500 A	4	±1 V	2% F.S.	100 µs	6
929	50 to 500 A	6	+5 V	1% F.S.	200 µs	6
938	±100 to ±1000 A	1	±5 V	1 to 5% F.S.	200 µs	—

CURRENT LEVEL DETECTORS

SERIES	INPUT RANGES	# OF MODELS	OUTPUT	REPEATABILITY	RESPONSE	FIG.
850	2 to 250 A AC	9	Relay	2% F.S.	500 ms	—
901B	20 to 5000 mA DC	9	+5 V & SW.	1% F.S.	50 ms	—
800	200 mA DC	1	Switch	N/A	1 ms	—

VOLTAGE SENSORS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
101	90 to 300 VAC	2	+1.35 VDC	2% Vmax.	17 ms	7
101M3	90 to 150 VAC	1	+5 VDC	2% F.S.	17 ms	7
102M3	90 to 175 VAC	1	+5 VDC	2% F.S.	3 ms	7
105	340 to 540 VAC	4	+5 VDC	2% F.S.	17 ms	7
108	130 to 500 VAC	4	+5 VDC	2% F.S.	200 ms	—
109	120 to 270 VAC	6	+1 ma DC	.5% Vmax.	300 ms	—
110	120 to 270 VAC	6	+1 ma DC	.5% Vmax.	300 ms	—

WATT TRANSDUCERS

SERIES	INPUT RANGES	# OF MODELS	FULL SCALE OUTPUT	ACCURACY	RESPONSE	FIG.
407	0.3 to 60 KW DC	12	+250 mV DC	2% F.S.	5 µs	—
401	2.7 to 450 KW DC	126	+250 mV DC	2.5% F.S.	200 µs	4
404	1 to 200 KVA AC	24	+5 VDC	2% F.S.	50 ms	—
411	1 to 100 KW AC	16	+100 mV DC	2% F.S.	400 ms	8
412	1 to 80 KW AC	16	+100 mV DC	2% F.S.	400 ms	8
413	1 to 100 KW AC	16	+5 VDC	2% F.S.	400 ms	8
414	1 to 80 KW AC	16	+5 VDC	2% F.S.	400 ms	8
415A	1 to 100 KW AC	16	+5 VDC	2% F.S.	400 ms	8
411M1	4 to 200 KW AC	8	+100 mV DC	2% F.S.	400 ms	8
413M1	4 to 200 KW AC	8	+5 VDC	2% F.S.	400 ms	8
416A	4 to 200 KW AC	8	+5 VDC	2% F.S.	400 ms	8

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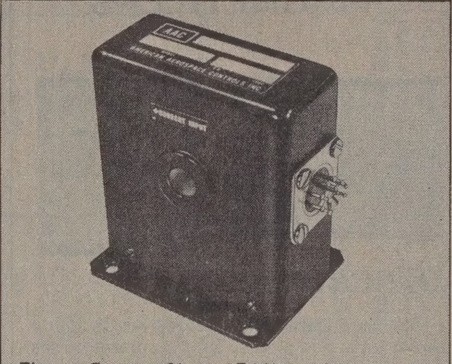


Figure 5 Size: 2 7/8″ x 2 9/16″ x 2″

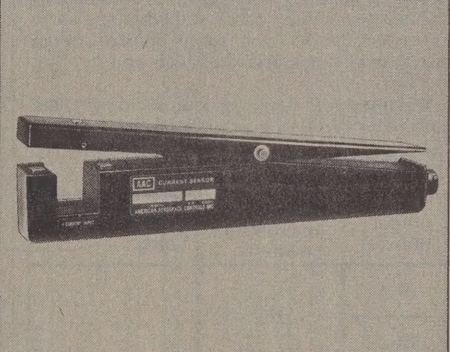


Figure 6 Size: 1 7/8″ x 9″ x 1 1/8″

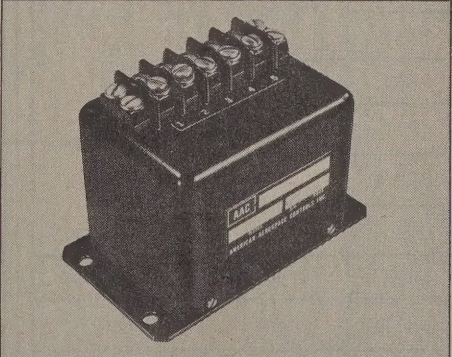


Figure 7 Size: 3 1/16″ x 3 3/4″ x 2 3/16″

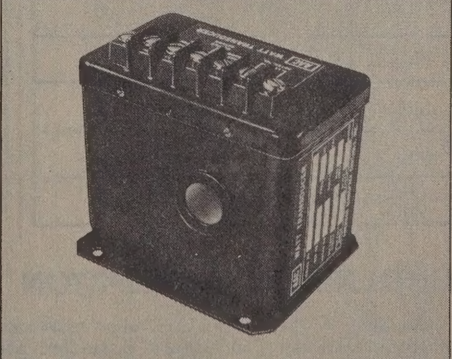
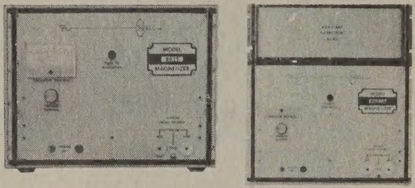


Figure 8 Size: 4″ x 4 1/8″ x 3 3/8″

FW BELL INC.

A Subsidiary of
The Arnold Engineering Company

MAGNETIZERS



DESCRIPTION

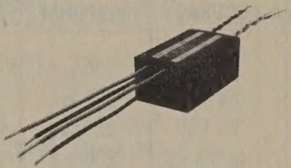
Bell magnetizers are capacitive discharge power units designed to supply current pulses to a magnetizing fixture coil. The energy level of the pulse is variable and accurately repeatable. Magnetizers are available for all materials including samarium-cobalt and other rare earth magnets. The Bell magnetizers operate at high and low voltages and with high and low impedance fixtures.

A full range of standard fixtures and complete engineering fixture service is available.

SPECIFICATIONS

model number	energy maximum, watt-sec	storage voltage, Volts
860	600	35 to 350
861		
860 A	1200	
861 A		
870	1800	
871		
870 A	3000	
871 A		
MC 1	40	650
MC2B	493	880
MC-2000	2280	820
MC4A	945	3000
MC4B	3780	3000
MC4C	11340	3000
MSC2	104	700
MSC 2000	2000	850

REAL POWER TRANSDUCERS



DESCRIPTION

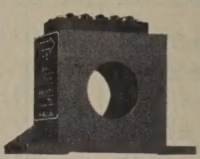
PX 2000 and PX 4000 series transducers are compact, accurate, and dependable solid-state modules for the measurement and control of single-phase and three-phase power in various frequency ranges. The module output is a power proportional dc voltage.

The light-weight transducers are epoxied in small nylon cases with through mounting holes and wire leads. This configuration facilitates assembly with associated devices. Simplicity, versatility, high performance, and low cost make these modules ideal for many applications.

SPECIFICATIONS

	PX 2000 series	PX 4000 series
Rated power levels	50-2000 W	1000-2000 W
Rated current levels	0.5-20A	5 A
Rated voltage	120 V 220 V	220 V
Frequencies, nominal	60-180-360 Hz	1-3 kHz
Frequency range	25 to 1200 Hz	0.5 to 10 kHz
Rated dc output across 50 ohm	± 55 mV	≥ 27 mV
Ripple, peak to peak	< 200%	< 200%
Response time to 99%	<50μs	<5μs
Rated accuracy	0.5%	0.5%
Linearity vs. power	± 0.2%	± 0.2%

DC AND AC CURRENT SENSORS



FEATURES

- Fast responding
- Non-contact operation
- Output voltage isolated from input
- Very low insertion impedance
- Minimal distortion from adjacent conductors
- Amplified and non-amplified models available

DESCRIPTION

FW Bell current sensors are designed to meet the challenging requirements of many different current measurement applications. The sensors are compact non-contact Hall effect devices.

The Bell current sensors function by sensing the magnetic field surrounding a current carrying conductor.

SPECIFICATIONS

model	rated current	rated output	accuracy
ID-5001M	350 A ac/dc	0.5 to 1.1 mV/A	± 2% RO
ID-5011M	350 A ac/dc	0.5 mV/A	± 2% RO
ID-5021M	350 A ac/dc	0.5 mV/A	± 2% RO
ID-5031M	350 A ac/dc	0.5 mV/A	± 2% RO
IA-5023P	250 A dc	10 V dc	± 0.5% RO
IA-5022P	500 A dc	10 V dc	± 0.5% RO
IA-5021P	1000 A dc	10 V dc	± 0.5% RO
IA-5020P	2000 A dc	10 V dc	± 0.5% RO
IF-5002M	500 A ac/dc	0.15 to 0.30 mV/A	± 0.5% RO
IF-5001M	1000 A ac/dc	0.15 to 0.30 mV/A	± 0.5% RO
IF-5000M	2000 A ac/dc	0.15 to 0.30 mV/A	± 0.5% RO

ORDERING INFORMATION

Contact F. W. Bell, Inc. for application assistance. Product assistance and technical literature are available. If standard models are not available, F. W. Bell, Inc. can design for your special electrical and physical requirements.

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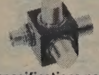
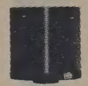
Columbus, Ohio 43229   TWX: 810-337-2851

PIEZOELECTRIC ACCELEROMETERS

A complete product line of local or remote sensing accelerometers with a built-in pre-amplifier. Total freedom from expensive and inaccurate charge amplifiers. Drive 60, or more, feet of cable without signal degradation. Cable noise, which introduces distortion in charge-coupled accelerometers, does not affect these accelerometers.

	Miniature, Low Mass, High Frequency 		Miniature Triaxial, Low Mass, High Frequency  All specifications per axis		High Sensitivity, Low Noise Floor 	High Sensitivity, OEM 	General Purpose, Low Cost 	Very High Stability 	Seismic 
	Model 501	Model 506	Model 505	Model 505-ISO	Model 507	Model 524-ISO	Model 508	Model 525-ISO	Model 510
Sensitivity (at 70°F and 100 Hz). Sensitivity calibration supplied with each unit.	10 mV/g ±10%		10 mV/g ±10%		100 mV/g ±5%	100 mV/g ±5%	10 mV/g ±5%	25 mV/g ±5%	8 V/g ±20%
Sensitivity change vs. temperature (max.) −65°F 70°F (Reference Temp.) 150°F 200°F 250°F	+10% 0% −5% −10% −15%		+10% 0% −5% −10% −15%		+10% 0% −5% −10% −15%	+10% 0% −5% −10% −15%	+10% 0% −5% −10% −15%	+5% 0% −3% −4% −5%	50°F to 100°F, ±5% 32°F to 150°F, ±10%
Transverse sensitivity (max.)	5%		5%		5%	5%	5%	5%	3%
Noise floor (max.)	20μV		20μV		20μV	30μV	20μV	20μV	Equivalent to 0.0005 g rms (0.1 to 100 Hz)
Equivalent g's rms (max.) at 1 Hz to 25 kHz	0.0020 g rms		0.0020 g rms		0.0002 g rms	0.0003 g rms	0.0020 g rms	0.0008 g rms	
Amplitude linearity	±1% to ±212 g peak		±1% to ±212 g peak		±1% to ±21 g peak	±1% to ±25 g peak ±3% to ±50 g peak	±1% to ±212 g peak	±1% to ±84 g peak	±1% to ±0.3 g peak
Operating temperature range **Peak operating g's** **Shock survivability (peak g's)**	−65°F to 250°F ±212 ±10,000		−65°F to 250°F ±212 ±10,000		−65°F to 250°F ±21 ±5,000	−65°F to 250°F ±25 ±5,000	−65°F to 250°F ±212 ±10,000	−65°F to 250°F ±84 ±5,000	32°F to 150°F ±0.25 ±10 (fragile)
Frequency response Basic unit: −65°F to 200°F, ±5% points, min.-max. −65°F to 250°F, ±5% points, min.-max. −65°F to 250°F, ±3dB points, min.-max.	4 to 20,000 Hz 7 to 20,000 Hz 2 to 40,000 Hz	4 to 15,000 Hz 7 to 15,000 Hz 2 to 33,000 Hz	4 to 12,000 Hz 7 to 12,000 Hz 2 to 25,000 Hz	4 to 10,000 Hz 7 to 10,000 Hz 2 to 16,000 Hz	3 to 7,000 Hz 6 to 7,000 Hz 2 to 12,000 Hz	3 to 5,000 Hz 6 to 5,000 Hz 2 to 12,000 Hz	3 to 15,000 Hz 6 to 15,000 Hz 2 to 30,000 Hz	3 to 12,000 Hz 5 to 12,000 Hz 2 to 20,000 Hz	For 32°F to 150°F 0.1 to 150 Hz ±5% 0.03 to 250 Hz ±3dB
Mounted resonant frequency (typical)	65 kHz	55 kHz	45 kHz	38 kHz	26 kHz	30 kHz	45 kHz	35 kHz	600 Hz
Unit with isolation stud, mounted; ±5% points Resonant frequency (typical)	N/A		N/A		6 to 4,000 Hz 20 kHz	6 to 3,000 Hz 20 kHz	3 to 8,000 Hz 32 kHz	3 to 7,000 Hz 30 kHz	N/A
Unit with magnetic mount, mounted; ±5% points Resonant frequency (typical)	4 to 10,000 Hz 35 kHz	4 to 8,000 Hz 30 kHz	N/A		6 to 4,000 Hz 22 kHz	6 to 2,500 Hz 20 kHz	3 to 7,000 Hz 28 kHz	3 to 6,000 Hz 25 kHz	N/A
Dynamic output impedance (at 70°F and 100 Hz), max.	1,500 Ω		1,500 Ω		1,500 Ω	600 Ω	1,500 Ω	1,500 Ω	1,500 Ω
Grounding (Isolated units available grounded)	Case grounded	Case isolated	Case grounded	Case isolated	Case grounded	Case isolated	Case grounded	Case isolated	Case grounded
Power requirements, mA at a reference of 12 to 30 VDC Nominal quiescent bias voltage (at 70%F)	0.5 +5/−15% 3 VDC		0.5 +5/−15% 3 VDC		0.5 +5/−15% 3 VDC	4.0 ±10% 5 VDC	0.5 +5/−15% 3 VDC	0.5 +5/−15% 3 VDC	0.5 +5/−15% 3 VDC
Isolation stud (Optional) P/N Mounting	Use Model 506	N/A	Use Model 505-ISO	N/A	070106 ¼-28 UNC x 0.150″	070106 ¼-28 UNC x 0.150″	070108 10-32 UNC x 0.150″	070106 ¼-28 UNC x 0.150″	N/A
Magnetic mount (Optional) P/N Grounding	070112 Grounded		070109 Isolated		070110 Isolated	070110 Isolated	070109 Isolated	070110 Isolated	N/A
Cable	2 ft. coaxial, integral		Optional		Optional	Optional	Optional	Optional	Optional
Connector	Microdot S-50, on cable, male		4 Pin Microtech DR-4S-4		Microdot S-50, female	2 Pin, S-2051-10SL-4P	Microdot S-50, female	Bayonet, SS7002-8-2P, Hermetic Seal Corp. (or equiv.)	Microdot S-50, female
Case	Titanium		Block, aluminum		Titanium	303SS, hermetic seal	Base: 303SS; Cap: anodized alum. (blue)	Titanium, hermetic seal	Anodized alum., black
Weight	1.8 grams	2 grams	10 grams	11 grams	35 grams	100 grams	12 grams	40 grams	485 grams
Size	0.31″ Dia. x 0.42″ H		0.84″ H x 0.84″ W x 0.84″ L		0.75″ Hex. x 1.27″ H	1.00″ Hex. x 2.00″ H	0.50″ Hex. x 0.77″ H	0.75″ Hex. x 1.75″ H	2.00″ Dia. x 2.17″ H
Mounting	Integral stud 6-32 UNC-2A x 0.135″		10-32 Tapped hole in base, 0.20″ dp.		¼-28 Tapped hole in base, 0.19″ dp.	¼-28 Tapped hole in base, 0.19″ dp.	10-32 Tapped hole in base, 0.12″ dp.	¼-28 Tapped hole in base, 0.19″ dp.	¼-28 Tapped hole in base, 0.30″ dp.
Options	Flat base, or 5-40 x 0.135″ stud		SEE ACCESSORIES BELOW FOR: Power Supplies, Cables, Isolation Studs, and Magnetic Base Mounts.						
Compatible Power Supplies	P-16, P-18, P-20		P-16, P-18, P-20, one per axis required		P-16, P-18, P-20	P-18/4	P-16, P-18, P-20	P-16, P-18, P-20	P-16, P-18
Unit Price (1 to 4) — Quantity Discounts Available	$300	$325	$975		$250	$250	$175	$275	$700

ACCESSORIES	Description		Quantity	Unit Price
Power Supplies	Model P-16	0.5 mA, constant current; 1.5 V rms maximum output. With internal battery	1-4	$ 70.00
	Model P-18	OEM, 0.5 mA, constant current; 1.5 V rms maximum output. 12 to30 VDC input supplied by customer.	1-4	$ 55.00
	Model P-18/4	OEM, 4.0 mA, constant current; 3.5 V rms maximum output. 12 to 30 VDC input supplied by customer.	1-4	$ 65.00
	Model P-20	0.5 mA, constant current; 1.5 V rms or 5 V rms maximum output (x 1 or x 10 gain). Gain adjustable for sensitivity normalization. With internal battery.	1-4	$225.00
Interface Extension Cables	P/N 070603	The standard is low noise, high temperature (250°F) coax cable terminated with Microdot connectors, 3 foot section. For special length cables add $3.00/ft.	1-24	$ 35.00
	P/N 070623	For use with Model 505 and 505-ISO. Three feet of four conductor cable ending in three one-foot coax cables to mate with three power supplies.	1-99	$ 75.00
Cable Adaptor	P/N 070806	Required when Model 501 or 506 is used with an Extension Cable.	1-99	$ 8.00
Accelerometer Isolation Studs	P/N 070106	For use with Accelerometer Models 507, 524-ISO, and 525-ISO	1-99	$ 8.00
	P/N 070108	For use with Accelerometer Model 508	1-99	$ 8.00
Magnetic Base Mounts	P/N 070109	For use with Accelerometer Models 505, 505-ISO and 508	1-99	$ 50.00
	P/N 070110	For use with Accelerometer Models 507, 524-ISO and 525-ISO	1-99	$ 50.00
	P/N 070112	For use with Accelerometer Models 501 and 506	1-99	$ 50.00

- Available on **GSA.**
- Minimum Order: $50.
- Prices: F.O.B. Cambridge, MA.
- Custom designed units available.
- Typical Delivery: 2-4 Weeks

BBN Instruments Company
A Division of Bolt Beranek and Newman, Inc.
50 Moulton Street, Cambridge, Ma. 02138 U.S.A.
Phone: (617) 491-0091/Telex: 92-1470/Cable BBNCO

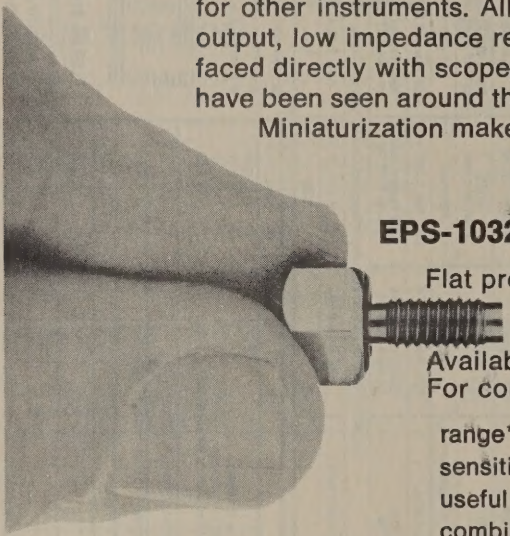
We're making it big

Entran offers four proofs means more measurement

Small gives you advantages you don't get with big.

Like less measuring surface to bear loads, hence better impact resistance. Small means superior handling ease, especially in hard-to-get-at places—meaning more applications flexibility. Small means less mass to distort your test scale. And more room for other instruments. All this at no sacrifice in data. All Entran devices give you high output, low impedance readings, both static and dynamic, so they can usually be interfaced directly with scopes, recorders and milliammeters. No wonder Entran's miniatures have been seen around the big names.

Miniaturization makes sense. And dollars.



EPS-1032. You can screw it in just about anywhere.

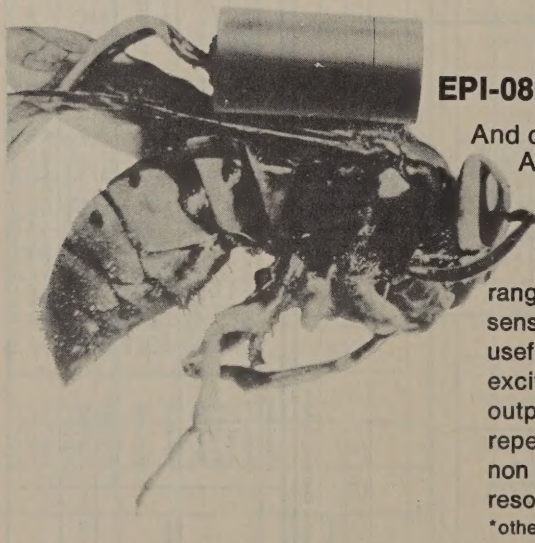
Flat pressure readings, static & dynamic, in 5 to 5,000 psi ranges to as high as 90 KHz. Infinite resolution. Insensitive to acceleration, vibration or shock. Stainless steel, with built in "o" ring seal. Available in our standard UNF thread or optional M5 metric version. For corrosive or water usage, order "welded" version at $50.00 extra.

range*	5 psi	50 psi	100 psi	250 psi	1000 psi
sensitivity mV/psi nom.	3	2	1.2	0.5	0.12
useful frequency nom.	9 KHz	15 KHz	15 KHz	20 KHz	40 KHz
combined non-lin & hyst:	± 1% below 100 psi, ± ½% 100 psi or above				

excitation: 6V
output imp.: 250 Ω nom.
repeatability: 0.25%

$\$340^{00}$

thread length: 7/16"
*other ranges available



EPI-080. Would you believe an 0.080" diameter?

And only 0.25" in length. Gives static & dynamic pressure readings. Atomically bonded diffused diaphragm with leads attached to non-active area make device virtually insensitive to acceleration, vibration and shock. (P. S. We're not kidding. The scale of the photo is real.)

range*	25 psi	50 psi	100 psi	250 psi	500 psi
sensitivity mV/psi nom.	3	1.8	1.0	0.4	0.2
useful frequency nom.	25 KHz	30 KHz	40 KHz	60 KHz	80 KHz

excitation: 5V
output imp: 750 Ω nom.
repeatability: 0.5%
non lin. & hyst: ± 1%
resolution: infinite
*other ranges available

$\$360^{00}$

Must not be used in water or corrosive medium.

Entran Pressure Transducers

Entran Devices, Inc. 145 Paterson Ave., Little Falls, N.J. 07424

by making it small.

that miniaturization for your money.

EGC-500DS. At last, a really rugged accelerometer.

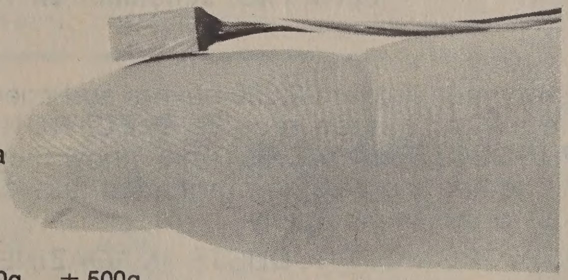
Static & dynamic measurements of acceleration, vibration and shock in ranges from 5 to 1,000 g. Fully damped to eliminate resonance and fitted with mechanical stops to impede overload response—guaranteed overrange of 1000%. And only a half inch cube to boot.

range*	± 5g	± 10g	± 50g	± 100g	± 500g
sensitivity mV/g nom.	25	20	4	2	0.5
useful freq.	150 Hz	200 Hz	600 Hz	1000 Hz	1500 Hz

$325.00

excitation: 15V
damping: 0.7 cr. nom.
linearity: ± 1%
output impedance: 450 Ω nom.
input impedance: 1000 nom.
*other ranges available

size: 0.5″ x 0.5″ x 0.6″ high
mounting: 10-32UNF
tapped hole



EGA-125-D (damped). Think small. And get big results.

Less than 0.006 cu. inches in volume. Weighs only half a gram. Yet gives you static & dynamic readings of acceleration, vibration and shock. And comes with .7 critical damping to eliminate resonance.

range*	± 5g	± 10g	± 50g	± 100g	± 500g
sensitivity mV/g nom.	15 mV/g	12 mV/g	4 mV/g	2.5 mV/g	.5 mV/g
useful frequency nom.	150 Hz	200 Hz	500 Hz	600 Hz	1200 Hz

$270.00

*other ranges available

excitation: 15V
linearity: ± 1%

Wt: 0.5 grams without leads
5 other mounting styles available at no extra charge

Tell us your range and we'll do the rest.

Every Entran device comes complete and ready to use. All you need do is supply the excitation voltages on two leads and read the output in millivolts on the other two leads. All units give you direct linear output in millivolts/psi or millivolts/g. All read both static and dynamic pressure or acceleration. There is no need for charge or voltage amplifiers. All units are supplied with calibration traceable to the National Bureau of Standards.

and Entran Accelerometers

Telephone 201/785-4060
Telex 130-361

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TO TELL YOU SOMETHING IMPORTANT!

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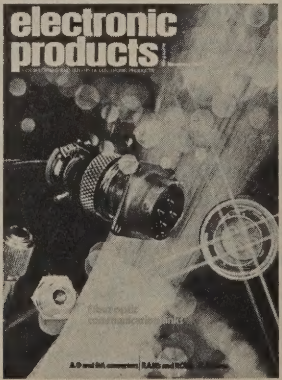

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LINDEN LABORATORIES, INC

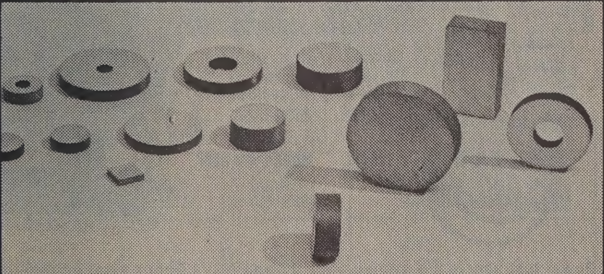
box 920, state college, pennsylvania 16801 / 814 355-5491
A RESOURCE MANAGEMENT CORPORATION SUBSIDIARY

Underwater Transducers

Linden's compact, light-weight, and rugged underwater transducers offer maximum physical strength and electrical performance in both fresh and salt water applications. "Off-the-shelf" models are available with a variety of mountings, housings, cable types and lengths, and cable/connector combinations as well as custom designs manufactured to your specifications. A variety of operating frequencies are available in the range of 40 KHz to 400 KHz, assuring the highest performance and reliability.

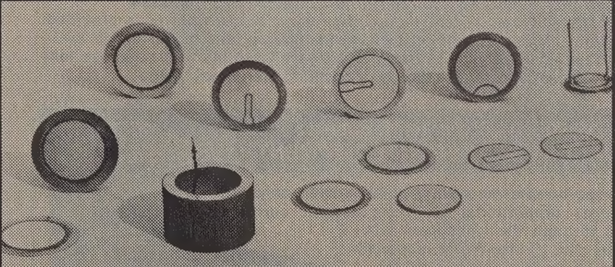
Air Acoustic Transducers

Linden's air acoustic transducers, operating at a standard frequency range of 25 KHz and 40 KHz, offer the design engineer a highly sensitive transmitting/receiving device at the lowest possible cost. Other frequencies are available on a custom basis in ranges 20 KHz to 75 KHz. A choice in housing and leads is available in standard models. Custom-made to your specifications or "off-the-shelf", Linden's versatile air acoustic transducer line offer high quality and reliable performance in a diversity of applications.



Piezoceramics

Linden's high quality piezoceramics are available in Barium Titanate, Lead Metaniobate, and Lead Zironate Titanate ceramics. There are a variety of standard shapes (disc, plate, and ring), sizes, and thicknesses to offer versatility in particular and unique applications. For special properties critical to your application, density, frequency and coupling coefficient can be specified in custom designs.



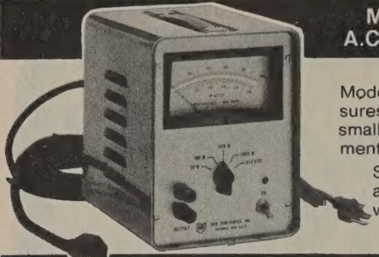
Benders

Linden's benders function as transmitters and receivers in sound system applications offering low frequency with small material mass promoting higher sensitivity. With a wide range of capabilities for recreating pleasant or irritating sounds and a variety of mountings, Linden's ultra-reliable benders, in both standard models or designed to customer specifications, are effectively operated by circuits driven with as little as 1.5 volts DC.

Founded in 1952, Linden Laboratories, Inc. is a major source of supply of piezoceramics, underwater transducers, air acoustic transducers, and benders. With complete in-house manufacturing facilities covering an area of over 23,000 square feet, expert engineering and technological know-how, and stringent quality control procedures, Linden can assure their customers of the highest performance and reliability and timely delivery to meet their requirements.

OSI EQUIPMENT FOR CURRENT AND POWER MEASUREMENT

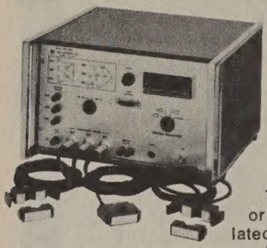
MULTIRANGE A.C. WATTMETER



Model WM1000 wattmeter measures real power consumed by small motors, electronic test equipment and other electrical loads.

Selectable full scale ranges are 50, 100, 500 and 1000 watts with an accuracy of ±3%.

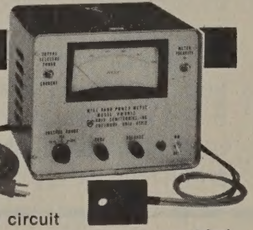
DIGITAL WATTMETER



The Model WM365A Digital Wattmeter measures power in single-phase or three-phase systems where the input power frequency may vary from d.c. to 400 Hertz. The d.c. to 5 kilohertz response insures accurate measurements when harmonics are present due to solid state switching, non-symmetrical waveforms or d.c. components.

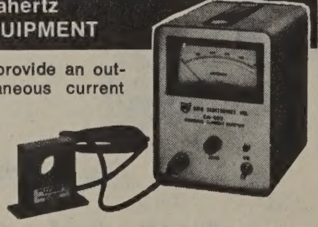
The digital panel meter displays total power or phase power. BCD and analog signals related to power are provided for computer and recorder interface. The BCD and analog outputs are electrically isolated from the power system.

WIDEBAND POWER MONITORS



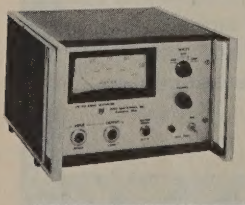
PM-6010 Series Power Monitors are designed to provide power or current measurements where d.c., sinusoidal, non-sinusoidal or pulse power is delivered to a load. Currents up to 1000 Amperes can be handled with negligible circuit interaction due to the use of circuit isolated transducers. Meter display of peak or average power is provided. 0 to 1 volt output proportional to instantaneous power or current is available for oscilloscope monitoring of detailed waveforms with risetimes less than 1 microsecond in the d.c. to Megahertz frequency range.

WIDEBAND d.c. to Megahertz CURRENT MEASURING EQUIPMENT



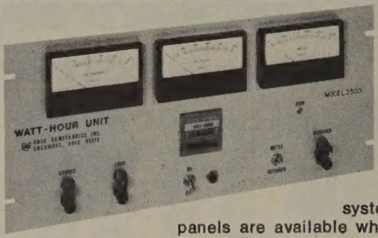
CM Series current measuring units provide an output signal proportional to instantaneous current flowing through the transducer window. The d.c. to Megahertz response and ability to faithfully reproduce 1 micro-second transients provide an ideal way to monitor critical circuits without electrical connection and with minimum interaction caused by measurement. The panel meter provides a display of direct current while the +1 to −1 volt output can be used for monitoring or control purposes with current flow in either direction.

AUDIO WATTMETER



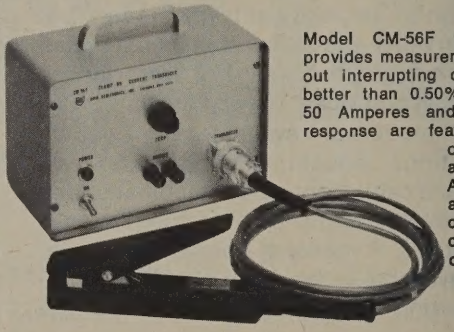
The Model PM1215 Audio Wattmeter measures DC to 30 kHz power delivered to resistive or reactive loads. Full scale ranges of 400, 800, and 1600 watts are provided corresponding to voltage inputs of 25, 50, and 100V RMS. A front panel meter displays average power. A 0 to 1V output is provided for oscilloscope observation of the instantaneous power wave shape.

WATT-HOUR AND AMP-HOUR METERS



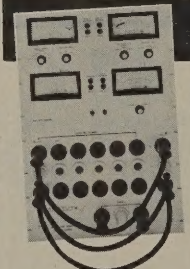
Registration of total energy consumption of motors, processes and equipment in a.c. or d.c. circuits is available on resettable counters. Other units provide a registration of charge flow, or Ampere-Hours, into or out of battery systems. Multiple measurement panels are available which provide display and electrical outputs related to instantaneous current, voltage and power in addition to energy registration.

CLAMP-ON CURRENT TRANSDUCER



Model CM-56F Current Transducer provides measurement of current without interrupting circuit. Accuracy of better than 0.50%, measurements to 50 Amperes and d.c. to Kilohertz response are featured. An electrical output providing an analog 0.1 Volt/Ampere signal is available for use in control systems, computer interfacing or recording.

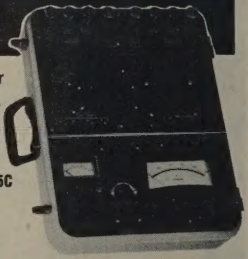
POWER TEST PANELS



Current
Voltage
Power
VARS

Power Factor
Frequency
Watt-hour
Amp-hour

MODEL PTP-100



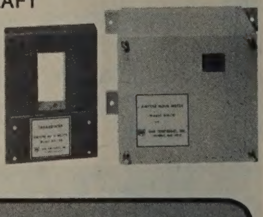
MODEL WM-2C5C

Power test panels are available for DC and AC (2, 3, or 4 wire) system loads. Voltage ranges from 50 to 500 volts and current ranges from 10 to 10,000 Amperes may be specified. Isolated electrical outputs are provided to drive recorders or remote indicators. Packaging methods include 19″ rack panel, standard instrument housings and NEMA type enclosures. Available options: Digital meters, BCD outputs, true RMS outputs, set-point switched outputs and data storage for computer interfacing.

MILITARY EQUIPMENT

SHIPBOARD • AVIONICS • SPACECRAFT
NUCLEAR POWER PLANTS

MODEL AH-10



OSI has an established reputation for building rugged, highly reliable measurement systems to meet government and military specifications. Systems include current, power, amp-hour, watt-hour, etc.

OHIO SEMITRONICS, INC.

1205 CHESAPEAKE AVENUE • COLUMBUS, OHIO 43212 • PHONE: 614-486-9581

PIONEER IN SOLID STATE TECHNOLOGY FOR ENERGY CONVERSION AND POWER MONITORING

OSI A.C. and D.C. WATT-HOUR and D.C. AMP-HOUR METERS

DESCRIPTION

The O.S.I. Watt-hour and Amp-hour Meters provide a convenient and highly accurate way to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy input.

These solid-state units utilize low loss transducers and are especially suited for watt-hour or amp-hour totalization, power or current monitoring and observation of waveforms in applications where SCR chopped, or other non-sinusoidal waveforms are involved.

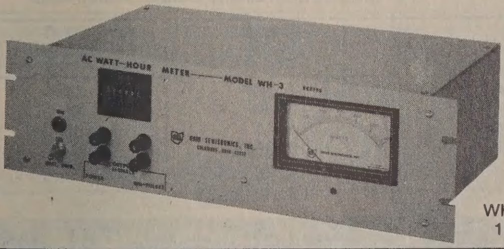
In addition to the display of totalized watt-hours or amp-hours since last reset, these units provide a panel meter indication of average watts or amps.

Many models available for electric vehicle, solar electric system, and commercial building power applications.

FEATURES

4½" Meter, 6 digit counter.
0 to 8 volt output proportional to watts or amps.
±0.5% f.s. accuracy.
Convenient Rack Mount—5¼" high.
Complete—Ready for customer installation.
For complete specifications, contact O.S.I.

A.C. WATT-HOUR METERS



Request Bulletin WH74-1 listing 102 models.

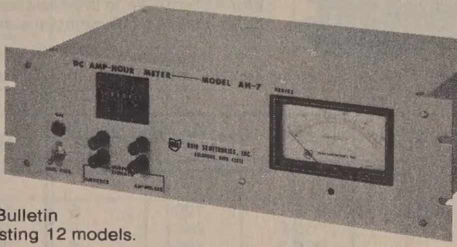
SINGLE PHASE 60 Hz MODELS

MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH3-1	120	5	600	.1
WH3-2	240	5	1.2K	1
WH3-31	120	100	12K	10

OPTIONS:

BCD Output	Electronic Counters
Split Transducers	Instrument Enclosure

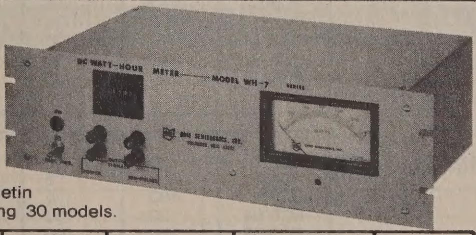
D.C. AMPERE-HOUR METERS



Request Bulletin AH76-1 listing 12 models.

MODEL	INPUT CURRENT AMPERES	METER FULL SCALE CURRENT	AH PER COUNT
AH7-5	5	5	.001
AH7-100	100	100	.01
AH7-1K	1K	1K	.1

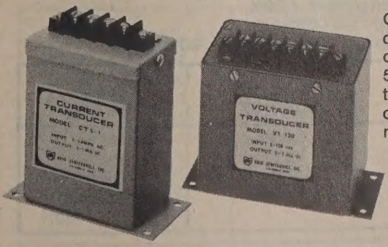
D.C. WATT-HOUR METERS



Request Bulletin WH76-1 listing 30 models.

MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH7-1	120	5	600	.1
WH7-2	240	5	1.2K	1
WH7-3	480	5	2.5K	1
WH7-46	120	2000	250K	100

VOLTAGE AND CURRENT TRANSDUCERS



OSI Voltage and Current Transducers provide an isolated d.c. output proportional to 50 to 500 Hz inputs. Models with filtered outputs to meet many control and metering requirements are available.

Request Bulletin CT76-2.

MODEL	FULL SCALE INPUT	FULL SCALE OUTPUT D.C.	ACCURACY
VT120	150V	0 to 1ma	±0.5%
VT240	300V	0 to 1ma	±0.5%
CT5-1	5A	0 to 1ma	±0.5%
CT10-1	10A	0 to 1ma	±0.5%

The following models have d.c. outputs proportional to true RMS inputs, sine or distorted waveshape.

MODEL	FULL SCALE INPUT	FULL SCALE OUTPUT D.C.	ACCURACY
VT1R	120V	0 to 1ma	±0.5%
VT2R	240V	0 to 1ma	±0.5%
CT1R	5A	0 to 1ma	±0.5%

OSI OHIO SEMITRONICS, INC.

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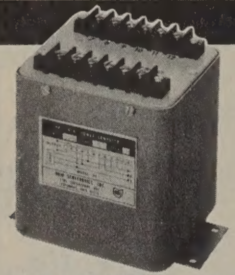
PIONEER IN SOLID STATE TECHNOLOGY FOR ENERGY CONVERSION AND POWER MONITORING

OSI TRANSDUCERS, WATT, CURRENT, VOLTAGE,

WATT TRANSDUCERS



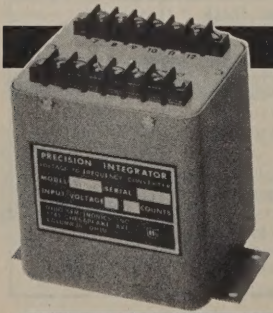
OSI Watt Transducers provide an isolated d.c. output proportional to the true power (EI x Cos θ) consumed in single or three phase circuits. Their fast response makes them very useful on non-sinusoidal as well as sinusoidal waveforms. Outputs of millivolts, milliamperes or volts are available, offering flexibility to the designer in interfacing to control or metering systems.

Over 100 standard units with current ranges of 1 through 1000 Amperes available. Contact O.S. I. for detailed specifications. Bulletin PC76-1.

APPLICATION	MODEL	FULL SCALE INPUTS		OUTPUT CALIBRATION
		VOLTS	AMPS	
SINGLE PHASE	PC5-1	120	5	500W
	PC5-2	240	5	1KW
	PC5-3	480	5	2KW
	PC5-58	120	100	10KW
	PC5-59	240	100	20KW
	PC5-60	480	100	40KW
	PC5-94	120	1000	100KW
	PC5-95	240	1000	200KW
	PC5-96	480	1000	400KW
3 PHASE 3 WIRE	PC5-4	120	5	1KW
	PC5-5	240	5	2KW
	PC5-6	480	5	4KW
	PC5-14	240	10	4KW
	PC5-62	240	100	40KW
	PC5-98	240	1000	400KW
3 PHASE 4 WIRE	PC5-7	120	5	1.5KW
	PC5-8	240	5	3KW
	PC5-9	480	5	6KW
	PC5-64	120	100	30KW
	PC5-65	240	100	60KW
	PC5-66	480	100	120KW

ACCURACY: PC5-1 thru PC5-14 ±0.5% f.s.
PC5-58 thru PC5-98 ±0.75%f.s.
POWER FACTOR RANGE: 0 lead to 0 lag
FREQUENCY RANGE: 50 to 70Hz
OUTPUT: Single Phase: 0 to 50mv
3 Phase, 3 wire: 0 to 100mv
3 Phase, 4 wire: 0 to 150mv
NOTE: Output options of 0 to 1ma and 0 to ±10 volts are available.

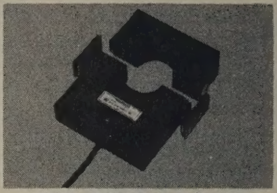
PRECISION INTEGRATOR



The VFC series of Precision Integrators works from analog signals of 50, 100 and 150 millivolts supplied from watt transducers, current transducers or shunts. The output is a pulse with a rate proportional to the input. Pulse rates of 1,500 to 10,000 per hour are available in 21 standard models. The output pulse is derived from relay contacts with 1 ampere capacity, so it is ideal for operating electromechanical counters and data acquisition systems.

CURRENT TRANSDUCERS—d.c. to KILOHERTZ

MODEL CT200LT



MODEL CT1KLTS (Split Version)

These current transducers provide flat d.c. to Kilohertz response which allows accurate waveform monitoring and measurements of d.c., sinusoidal or distorted waveform currents with high accuracy. Since no physical or electrical connection is necessary to the circuit being monitored, they are especially useful where high voltages are present by providing an output which is electrically isolated from the current source.

Standard models are available in full scale currents of 50 to 8000 Amperes, extended temperature ranges and split versions. Signal conditioners for 10 volt outputs, true rms measurements, and interfacing to other equipment are available. (See "Signal Conditioners" below).

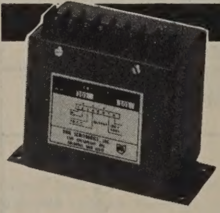
Transducers with response from d.c. to megahertz are available. Ask for Bulletin HE7-4 covering the CT-W Series.

SPECIFICATIONS COMMON TO ALL CT-LT SERIES TRANSDUCERS

Linearity: ±0.5% Full Scale
Temperature Effect (−40°C to +65): ±1% Reading
Response: d.c. to 5KHz
Rise Time For Step Input: 100 Microseconds
Isolation from Line to Output: >5000 volts

MODEL	ENCLOSED CURRENT rms	OUTPUT FULL SCALE mv
CT100LT	100A	50
CT200LT	200A	50
CT400LT	400A	50
CT1KLT	1000A	50
	Request Bulletin CT4-1 listing 30 models.	

SIGNAL CONDITIONER



These signal conditioners provide excitation current for the CT-L current transducers and other Hall Effect devices requiring a low drift, constant current. They also provide amplification for the outputs of current transducers and other Hall Effect devices. Output of CTA113 and CTA114 is proportional to the true rms of the input.

SPECIFICATIONS COMMON TO ALL CTA SIGNAL CONDITIONERS

Amplifier Section (Output)
Drift: 2mv
Response: d.c. to 5KHz
Linearity: 0.1%
Control Current
Adjustment: ±30%
Drift: <0.005%/°C
Operating Power: 115vac, 60Hz.

MODEL	INPUT	CONTROL CURRENT OUTPUT	OUTPUT FROM AMPLIFIER
CTA101	±50mv	100ma	±10V
CTA201	±50mv	200ma	±10V
CTA113	50mv (AC)	100ma	+10Vdc
CTA114	50mv (AC)	100ma	+1ma (0 to 7K ohm load)

OHIO SEMITRONICS, INC.

1205 CHESAPEAKE AVENUE • COLUMBUS, OHIO 43212 • PHONE: 614-486-9561
PIONEER IN SOLID STATE TECHNOLOGY FOR ENERGY CONVERSION AND POWER MONITORING

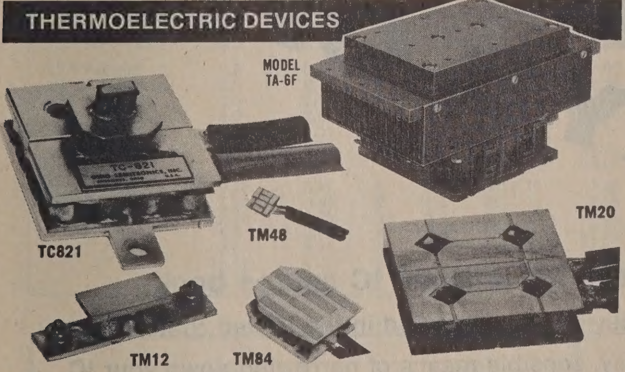
OSI SEMICONDUCTOR MATERIALS, DEVICES HALL EFFECT - INFRARED - THERMOELECTRIC

HALLTRON, MAGNETIC FIELD SENSORS

OSI offers a wide variety of standard Hall Effect probes for magnetic sensing or measuring applications. The high linearity, low noise, excellent stability and ruggedness permit optimum use in your most critical applications. Reliability has been proved by years of continuous operation in industrial and military systems. Large quantity production enables OSI to offer high quality units at attractive prices.

MODEL NO.	DESCRIPTION	HALL OUTPUT, V_H, MILLIVOLTS ±25% (B=10Kg, I_c=NOMINAL)	NOMINAL CONTROL CURRENT, I_c, mA	OHMIC RESIDUAL V_{RO}, MILLIVOLTS		INPUT RESISTANCE R_{IN}, OHMS (NOMINAL)	OUTPUT RESISTANCE R_{OUT}, OHMS (NOMINAL)	DIMENSIONS L/W/T, INCHES	TEMPERATURE COEFFICIENT OF V_HIN%/°C (AVG.)
				(B=0 I_c=10mA.)	(B=0 I_c=100mA.)				
HP316	Miniature Axial	100	100	—	0.5	2	1	.125 dia. .250	−0.2
HP318	Standard Axial	250	100	—	0.5	5	4	.250 dia. .5	−0.2
HP325	Miniature Transverse	200	25	0.5	—	15	10	.187 .075 .015	−0.25
HR36	High Linearity	350	350	—	0.15	1.5	1.5	.500 .375 .025	−0.1
HR66	Low Cost	500	200	—	0.5	5	4	.250 .200 .028	−0.15
HR72	High Sensitivity	700	100	0.2	—	9	6	.250 .200 .028	−0.25
HR170	Low Temperature	10	100	—	0.03	1.2	.6	.250 .200 .025	−.005

THERMOELECTRIC DEVICES



O.S.I. offers a variety of thermoelectric cooling units ranging from the TC Series, used in spot cooling applications where up to 115 degree Centigrade temperature depression is needed, to the TA Series which can remove up to 85 watts from chemical bath, electronic package, or enclosure. The controllable, reversible heat pumping properties of thermoelectric devices make them ideally suited for temperature control. The MTM85 and TM84 are suited to IR detector cooling. Two and three stage coolers are also available for lower temperature IR detector cooling.

MODEL	ΔT DEG. C.	HEAT PUMP WATTS AT ΔT=0	MAX. INPUT CURRENT AMPERES
TM-20	65	20	30
TC-44	90	6	30
TM-12	65	2.4	30
TA-6F	55	85	30
TC-1851	115	3	25
TC-821	115	1.3	25
TM-318	60	20	8
MTM-85	60	1.7	5
TM-84	65	1	4.4
MTM-124	60	3.5	4

ENERGY CONVERSION — IR — DEVICE MATERIALS

Semiconductor compounds and alloys of the following types, covering a wide range of controlled electronic properties for applications such as INFRA-RED DETECTORS, MAGNETIC SENSORS, THERMOELECTRIC COOLING/POWER GENERATION, OPTICAL AND INFRA-RED COATINGS/FILTERS, AND CRYOGENIC SENSORS, are available from stock. High quality electronically characterized materials suitable for PHOTOCONDUCTIVE and PHOTOVOLTAIC sensors are available.

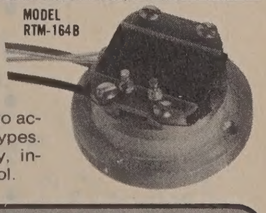
Material	Carrier Concentration/cm^3
InAs	10^{15} - 10^{19}
InSb	10^{14} - 10^{19}
Bi-Te alloys	10^{18} - 10^{19}
PbTe and PbTe alloys	As Desired

These materials are available in ingot, rod, slice and polished wafer form. Oriented single crystals of InSb having dislocation densities well below 100/cm^2 are available for infra-red sensor construction. High figure of merit p and n type Bi-Te alloys are in stock for thermoelectric applications. InAs with Hall coefficients at R.T. in the range from 10 to 1000 cm^3/coulomb is immediately available for many device applications.

Any feasible high purity alloy or compound consisting of Pb, Bi, Tl, Tn, As, Sn, Sb, Se or Te with selective doping can be manufactured and supplied on request.

High purity zone refined ingots of most of the above elements used in our electronically characterized compounds can be delivered on request.

THERMOELECTRIC COOLED IR DETECTOR ASSEMBLIES



Complete IR detector assemblies include mounting base, thermoelectric cooler, cold plates, thermistor, IR detector, window and/or filter. Assemblies may be bare (as shown), sealed or vacuum encapsulated. Customer engineering service is provided to accommodate specified IR detector and filter types. Applications include surveillance, security, instrumentation and industrial process control.

OSI

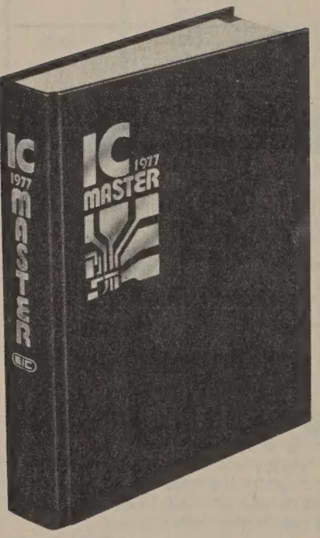
OHIO SEMITRONICS, INC.

1205 CHESAPEAKE AVENUE • COLUMBUS, OHIO 43212 • PHONE: 614-486-9561

PIONEER IN SOLID STATE TECHNOLOGY FOR ENERGY CONVERSION AND POWER MONITORING

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

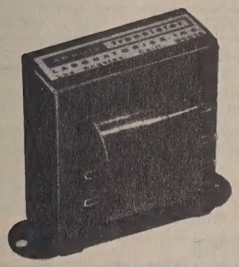
The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

THE FORMAT OUTLINED:

- **FIVE MASTER SELECTION GUIDES** — 84 companies' IC's organized by type, function, key parameters
- **OVER 1,000 PAGES OF TECHNICAL INFORMATION** — Provided directly by manufacturers covering 17,000 IC's
- **ALTERNATE SOURCE DIRECTORY** — The only industry-wide, pin-for-pin version available
- **MILITARY PARTS INDEX AND CROSS REFERENCE CHART** — Identifies all IC's with JAN qualification
- **MILITARY DEVICE TESTING TABLE** — List companies that screen to Mil. Std. 883
- **MILITARY PARTS INDEX** — The first functional guide to JAN qualified parts
- **PART NUMBER INDEX** — Parts from 84 manufacturers, in numerical sequence
- **APPLICATION NOTE DIRECTORY** — Digest of currently active application note material
- **PRODUCT INDEX** — Provides alphanumeric listing of 84 manufacturers' lines
- **PART NUMBER GUIDE** — Instantly decodes each company's part numbering system
- **MANUFACTURERS AND DISTRIBUTORS DIRECTORY**

United Technical Publications, 645 Stewart Ave., Garden City, NY 11530

abbott 60 ∿ industrial power transformers



specifications

INPUT PRIMARY: 115 VAC (50 to 65 Hz), 1 phase

REGULATION: 15% max. from no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input

INSULATION TEST: 1500 VAC

OPERATING TEMP.: 80°C maximum ambient

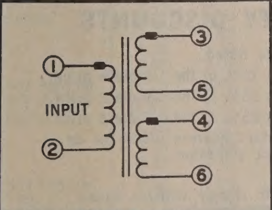
APPROXIMATE EFFICIENCY: Ranges from 80% to 90%

CONSTRUCTION: Commercial grade using Grain Oriented Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating. Vacuum impregnated with a high quality insulating varnish having a class "H" rating

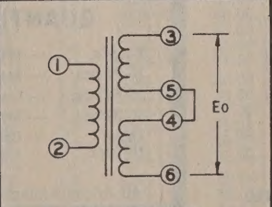
For 230 VAC input (at no additional cost) add suffix "A" to standard model number. Example: 6B5-10A. Other outputs and/or inputs available on request.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	Price 1-9 pcs.
5 V Parallel 10 V.C.T. Series	2.0	1.0	1	1.2	6B5-10	$7.40
	3.0	1.5	2	1.5	6B5-15	8.25
	6.0	3.0	3	2.2	6B5-30	9.40
	12.0	6.0	4	3.0	6B5-60	11.10
	18.0	9.0	5	4.3	6B5-90	14.50
	26.0	13.0	6	5.5	6B5-130	16.00
	32.0	16.0	7	7.0	6B5-160	19.00
6.3 V Parallel 12.6 V.C.T. Series	1.60	0.80	1	1.2	6B6-10	7.40
	2.40	1.20	2	1.5	6B6-15	8.25
	4.80	2.40	3	2.2	6B6-30	9.40
	9.40	4.70	4	3.0	6B6-60	11.10
	14.4	7.20	5	4.3	6B6-90	14.50
	20.6	10.3	6	5.5	6B6-130	16.00
	25.4	12.7	7	7.0	6B6-160	19.00
8 V Parallel 16 V.C.T. Series	1.20	0.60	1	1.2	6B8-10	7.40
	1.80	0.90	2	1.5	6B8-15	8.25
	3.60	1.80	3	2.2	6B8-30	9.40
	7.60	3.80	4	3.0	6B8-60	11.10
	11.2	5.60	5	4.3	6B8-90	14.50
	16.2	8.10	6	5.5	6B8-130	16.00
	20.0	10.0	7	7.0	6B8-160	19.00
10 V Parallel 20 V.C.T. Series	1.0	0.5	1	1.2	6B10-10	7.40
	1.5	0.75	2	1.5	6B10-15	8.25
	3.0	1.5	3	2.2	6B10-30	9.40
	6.0	3.0	4	3.0	6B10-60	11.10
	9.0	4.5	5	4.3	6B10-90	14.50
	13.0	6.5	6	5.5	6B10-130	16.00
	16.0	8.0	7	7.0	6B10-160	19.00
12 V Parallel 24 V.C.T. Series	0.82	0.41	1	1.2	6B12-10	7.40
	1.24	0.62	2	1.5	6B12-15	8.25
	2.50	1.25	3	2.2	6B12-30	9.40
	5.0	2.50	4	3.0	6B12-60	11.10
	7.5	3.75	5	4.3	6B12-90	14.50
	10.82	5.41	6	5.5	6B12-130	16.00
	13.32	6.66	7	7.0	6B12-160	19.00

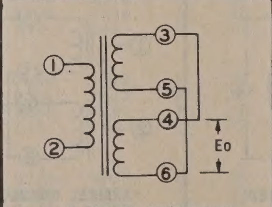
Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	Price 1-9 pcs.
17 V Parallel 34 V.C.T. Series	0.58	0.29	1	1.2	6B17-10	$7.40
	0.88	0.44	2	1.5	6B17-15	8.25
	1.76	0.88	3	2.2	6B17-30	9.40
	3.52	1.76	4	3.0	6B17-60	11.10
	5.28	2.64	5	4.3	6B17-90	14.50
	7.64	3.82	6	5.5	6B17-130	16.00
	9.40	4.70	7	7.0	6B17-160	19.00
20 V Parallel 40 V.C.T. Series	0.5	0.25	1	1.2	6B20-10	7.40
	0.74	0.37	2	1.5	6B20-15	8.25
	1.5	0.75	3	2.2	6B20-30	9.40
	3.0	1.5	4	3.0	6B20-60	11.10
	4.5	2.25	5	4.3	6B20-90	14.50
	6.5	3.25	6	5.5	6B20-130	16.00
	8.0	4.0	7	7.0	6B20-160	19.00
28 V Parallel 56 V.C.T. Series	0.36	0.18	1	1.2	6B28-10	7.40
	0.52	0.26	2	1.5	6B28-15	8.25
	1.06	0.53	3	2.2	6B28-30	9.40
	2.14	1.07	4	3.0	6B28-60	11.10
	3.20	1.60	5	4.3	6B28-90	14.50
	4.64	2.32	6	5.5	6B28-130	16.00
	5.70	2.85	7	7.0	6B28-160	19.00
44 V Parallel 88 V.C.T. Series	0.22	0.11	1	1.2	6B44-10	7.40
	0.34	0.17	2	1.5	6B44-15	8.25
	0.68	0.34	3	2.2	6B44-30	9.40
	1.36	0.68	4	3.0	6B44-60	11.10
	2.04	1.02	5	4.3	6B44-90	14.50
	2.94	1.47	6	5.5	6B44-130	16.00
	3.62	1.81	7	7.0	6B44-160	19.00
60 V Parallel 120 V.C.T. Series	0.16	0.08	1	1.2	6B60-10	7.40
	0.250	0.125	2	1.5	6B60-15	8.25
	0.50	0.25	3	2.2	6B60-30	9.40
	1.0	0.50	4	3.0	6B60-60	11.10
	1.5	0.75	5	4.3	6B60-90	14.50
	2.16	1.08	6	5.5	6B60-130	16.00
	2.66	1.33	7	7.0	6B60-160	19.00



BASIC CIRCUIT



SERIES CONNECTED



PARALLEL CONNECTED

QUANTITY DISCOUNTS

1-9 pcs.	— price listed.
10-24 pcs.	— less 10% of the 1-9 piece price.
25-49 pcs.	— less 19% of the 1-9 piece price.
50-99 pcs.	— less 25% of the 1-9 piece price.
Above 100 pcs.	— Contact nearest office for an exact quotation.

All Prices subject to change without notice.

Size	A	B	C	D	E	F	HOLE*	
1	1.95	1.62	2.31	2.37	—	2.87	.18	FIG. 1
2	2.26	1.87	2.68	2.81	—	3.12	.18	FIG. 1
3	2.57	2.12	3.06	3.12	—	3.56	.18	FIG. 1
4	2.81	2.37	3.37	2.25	2.12	2.70	.2 x .3	FIG. 2
5	3.12	2.62	3.75	2.50	2.25	2.86	.2 x .3	FIG. 2
6	3.44	2.87	4.12	2.75	2.37	2.98	.2 x .3	FIG. 3
7	3.75	3.12	4.50	3.00	2.50	3.11	.2 x .3	FIG. 3

DIMENSIONAL TOLERANCE = ±.06
TERMINATION: SOLDER LUGS

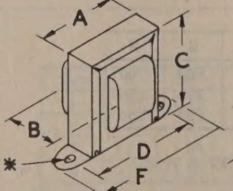


FIG. 1

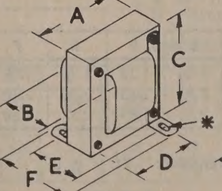


FIG. 2

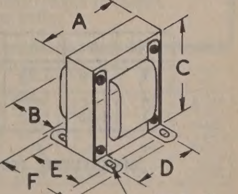


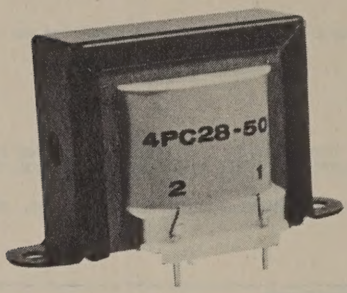
FIG. 3

abbott transistor
TRANSFORMER DIVISION

GENERAL OFFICES
Dept. EM 639 S. Glenwood Place
Burbank, CA 91506
(213) 841-3630
Telex 69-6282

EASTERN OFFICES
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

abbott 60∿/400∿ P.C. transformers



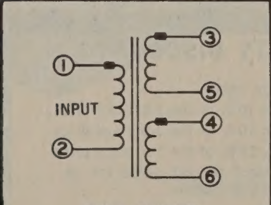
SPECIFICATIONS	6PC SERIES	4PC SERIES
INPUT PRIMARY:	115 vac, 50-400 Hz, 1 Phase	115 vac, 380-420 Hz, 1 Phase
REGULATION:	20% or less from no load to full load	10% or less from no load to full load
SECONDARY VOLTAGE TOLERANCE:	Within 5% of listed output voltage when measured at full load and 115 vac input	
INSULATION TEST:	1000 vac	
OPERATING TEMPERATURE:	85°C maximum ambient	
CONSTRUCTION:	Printed circuit pin plug-in	
TYPICAL EFFICIENCY RANGE:	72%-76%	90%-93%
OPTIONS AVAILABLE:	Other output voltages and 230 vac input are available. Please consult our nearest office for complete information.	

features

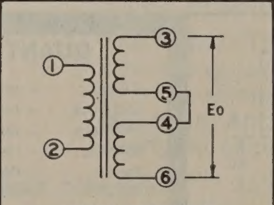
- For Printed Circuits
- Close Regulation
- 85°C Operation
- Small Size
- Stock Delivery

The miniature power transformers listed on this page are specifically designed for mounting on printed circuit boards. Two lines are available: the 6PC Series for 60 Hz application, and the 4PC Series for 400 Hz. Small size, reliability and sensible prices are major features of these OEM transformers. Take a good look at these Models. If you don't find what you want, call us for a special quotation.

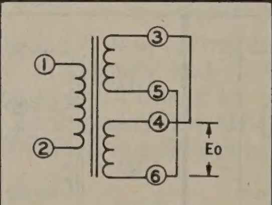
			60∿				400∿			
Output Volts (F.L.)	Size	Weight Lbs. Typ.	Output Cur. (Amps) Parallel Connection	Series Connection	Model No.	Price 1-9 Pcs.	Output Cur. (Amps) Parallel Connection	Series Connection	Model No.	Price 1-9 pcs.
5V Parallel	1	0.20	0.300	0.150	6PC5-1	$5.10	2.0	1.0	4PC5-10	$6.80
10VCT Series	2	0.33	0.800	0.400	6PC5-4	5.25	5.0	2.5	4PC5-25	8.40
	3	0.56	1.500	0.750	6PC5-7	5.75	8.0	4.0	4PC5-40	9.60
6.3V Parallel	1	0.20	0.238	0.119	6PC6-1	5.10	1.58	0.79	4PC6-10	6.80
12.6VCT Series	2	0.33	0.636	0.318	6PC6-4	5.25	4.00	2.0	4PC6-25	8.40
	3	0.56	1.190	0.595	6PC6-7	5.75	8.0	4.0	4PC6-50	9.60
8V Parallel	1	0.20	0.186	0.093	6PC8-1	5.10	1.25	0.625	4PC8-10	6.80
16VCT Series	2	0.33	0.500	0.250	6PC8-4	5.25	3.12	1.56	4PC8-25	8.40
	3	0.56	0.936	0.468	6PC8-7	5.75	6.2	3.1	4PC8-50	9.60
10V Parallel	1	0.20	0.150	0.075	6PC10-1	5.10	1.0	0.5	4PC10-10	6.80
20VCT Series	2	0.33	0.400	0.200	6PC10-4	5.25	2.5	1.25	4PC10-25	8.40
	3	0.56	0.750	0.375	6PC10-7	5.75	5.0	2.5	4PC10-50	9.60
12V Parallel	1	0.20	0.124	0.062	6PC12-1	5.10	0.832	0.416	4PC12-10	6.80
24VCT Series	2	0.33	0.334	0.167	6PC12-4	5.25	2.5	1.25	4PC12-25	8.40
	3	0.56	0.62	0.312	6PC12-7	5.75	4.2	2.1	4PC12-50	9.60
17V Parallel	1	0.20	0.088	0.044	6PC17-1	5.10	0.588	0.294	4PC17-10	6.80
34VCT Series	2	0.33	0.236	0.118	6PC17-4	5.25	1.47	0.735	4PC17-25	8.40
	3	0.56	0.440	0.220	6PC17-7	5.75	2.94	1.47	4PC17-50	9.60
20V Parallel	1	0.20	0.074	0.037	6PC20-1	5.10	0.500	0.250	4PC20-10	6.80
40VCT Series	2	0.33	0.200	0.100	6PC20-4	5.25	1.25	0.625	4PC20-25	8.40
	3	0.56	0.374	0.187	6PC20-7	5.75	2.50	1.25	4PC20-50	9.60
28V Parallel	1	0.20	0.052	0.026	6PC28-1	5.10	0.356	0.178	4PC28-10	6.80
56VCT Series	2	0.33	0.144	0.072	6PC28-4	5.25	0.892	0.446	4PC28-25	8.40
	3	0.56	0.266	0.133	6PC28-7	5.75	1.78	0.89	4PC28-50	9.60
44V Parallel	1	0.20	0.034	0.017	6PC44-1	5.10	0.226	0.113	4PC44-10	6.80
88VCT Series	2	0.33	0.092	0.046	6PC44-4	5.25	0.568	0.284	4PC44-25	8.40
	3	0.56	0.170	0.085	6PC44-7	5.75	1.12	0.56	4PC44-50	9.60
60V Parallel	1	0.20	0.024	0.012	6PC60-1	5.10	0.166	0.083	4PC60-10	6.80
120VCT Series	2	0.33	0.068	0.034	6PC60-4	5.25	0.416	0.208	4PC60-25	8.40
	3	0.56	0.124	0.062	6PC60-7	5.75	0.82	0.41	4PC60-50	9.60



BASIC CIRCUIT



SERIES CONNECTED



PARALLEL CONNECTED

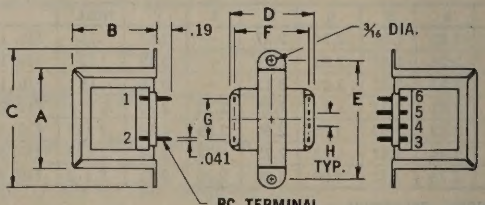
QUANTITY DISCOUNTS

1-9 pcs.	— price listed.
10-24 pcs.	— less 10% of the 1-9 piece price.
25-49 pcs.	— less 19% of the 1-9 piece price.
50-99 pcs.	— less 25% of the 1-9 piece price.
Above 100 pcs.	— Contact nearest office for an exact quotation.

All Prices subject to change without notice.

SIZE	A	B	C	D	E	F	G	H
1	1.46	1.22	2.06	1.13	1.75	1.00	.600	.200
2	1.72	1.40	2.35	1.23	2.00	1.10	.750	.250
3	1.96	1.65	2.81	1.43	2.37	1.30	.750	.250

DIMENSIONAL TOLERANCE: .XX = ±.02 .XXX = ±.007



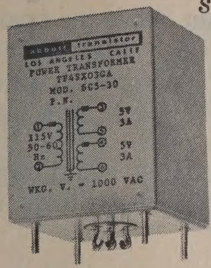
PC TERMINAL

abbott transistor
TRANSFORMER DIVISION

GENERAL OFFICES
Dept. EM 639 S. Glenwood Place
Burbank, CA 91506
(213) 841-3630
Telex 69-6282

EASTERN OFFICES
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

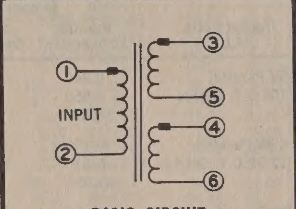
abbott 60 ∿/400 ∿ MIL-T-27D power transformers



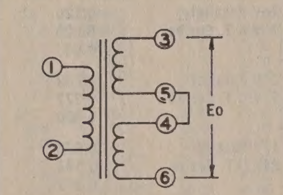
specifications

Specifications	6C Series	4A Series
INPUT PRIMARY:	115 VAC, 50 to 65 Hz, 1 Phase	115V , 400 Hz ±20 Hz, 1 Phase
REGULATION:	10% no load to full load	10% no load to full load
SECONDARY VOLTAGE TOLERANCE:	Within 3% when measured at full load and 115 VAC input	Within 5% when measured at full load and 115 VAC input
INSULATION TEST:	1500 VAC	1500 VAC
OPERATING TEMP.:	90°C maximum ambient	105°C maximum ambient
CONSTRUCTION:	To MIL-T-27D, grade 4, class "S" life "X", (10,000 hrs.)	To MIL-T-27D, grade 5, class "S", life "X", (10,000 hrs.)
EFFICIENCY:	From 80% to 90%	From 90% to 93%
ENVIRONMENT:	Encapsulated to meet MIL-STD-810B for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.	
OPTIONS AVAILABLE:	Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.	

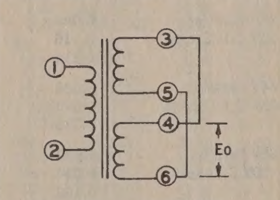
	60 ∿						400 ∿					
Output Volts (F.L.)	**Output Current (Amps) Parallel Connection**	**Series Connection**	**Size**	**Weight Lbs. Typ.**	**Model Number**	**Price 1-4 Pcs.**	**Output Current (Amps) Parallel Connection**	**Series Connection**	**Size**	**Weight Lbs. Typ.**	**Model Number**	**Price 1-4 Pcs.**
5V Parallel 10V.C.T. Series	1.00	0.50	EB	1.2	6C5-5	$30.00	1.40	0.70	1	.26	4A5-7	$18.00
	3.00	1.50	FA	2.2	6C5-15	35.00	2.00	1.00	2	.30	4A5-10	18.75
	6.00	3.00	GA	3.3	6C5-30	40.00	5.00	2.50	3	.47	4A5-25	21.00
	12.00	6.00	HA	4.7	6C5-60	45.00	8.00	4.00	4	.77	4A5-40	25.00
	20.00	10.00	JA	7.4	6C5-100	55.00						
6.3V Parallel 12.6V.C.T. Series	0.80	0.40	EB	1.2	6C6-5	30.00	1.11	0.55	1	.26	4A6-7	18.00
	2.38	1.19	FA	2.2	6C6-15	35.00	1.58	0.79	2	.30	4A6-10	18.75
	4.76	2.38	GA	3.3	6C6-30	40.00	4.00	2.00	3	.47	4A6-25	21.00
	9.52	4.76	HA	4.7	6C6-60	45.00	8.00	4.00	4	.77	4A6-50	25.00
	20.00	10.00	JA	7.4	6C6-126	55.00						
8V Parallel 16V.C.T. Series	0.62	0.31	EB	1.2	6C8-5	$30.00	0.874	0.437	1	.26	4A8-7	18.00
	1.86	0.93	FA	2.2	6C8-15	35.00	1.25	0.625	2	.30	4A8-10	18.75
	3.72	1.86	GA	3.3	6C8-30	40.00	3.12	1.56	3	.47	4A8-25	21.00
	7.44	3.72	HA	4.7	6C8-60	45.00	6.24	3.12	4	.77	4A8-50	25.00
	17.50	8.75	JA	7.4	6C8-140	55.00						
	20.00	10.00	KA	9.8	6C8-160	65.00						
10V Parallel 20V.C.T. Series	0.50	0.25	EB	1.2	6C10-5	30.00	0.70	0.35	1	.26	4A10-7	18.00
	1.50	0.75	FA	2.2	6C10-15	35.00	1.00	0.50	2	.30	4A10-10	18.75
	3.00	1.50	GA	3.3	6C10-30	40.00	2.50	1.25	3	.47	4A10-25	21.00
	6.00	3.00	HA	4.7	6C10-60	45.00	5.00	2.50	4	.77	4A10-50	25.00
	14.00	7.00	JA	7.4	6C10-140	55.00						
	17.00	8.50	KA	9.8	6C10-170	65.00						
12V Parallel 24V.C.T. Series	0.40	0.20	EB	1.2	6C12-5	30.00	0.58	0.29	1	.26	4A12-7	18.00
	1.20	0.60	FA	2.2	6C12-15	35.00	0.84	0.42	2	.30	4A12-10	18.75
	2.40	1.20	GA	3.3	6C12-30	40.00	2.08	1.04	3	.47	4A12-25	21.00
	4.80	2.40	HA	4.7	6C12-60	45.00	4.16	2.08	4	.77	4A12-50	25.00
	11.60	5.80	JA	7.4	6C12-140	55.00						
	14.16	7.08	KA	9.8	6C12-170	65.00						
17V Parallel 34V.C.T. Series	0.30	0.15	EB	1.2	6C17-5	30.00	0.411	0.205	1	.26	4A17-7	18.00
	0.88	0.44	FA	2.2	6C17-15	35.00	0.588	0.294	2	.30	4A17-10	18.75
	1.76	0.88	GA	3.3	6C17-30	40.00	1.47	0.735	3	.47	4A17-25	21.00
	3.52	1.76	HA	4.7	6C17-60	45.00	2.94	1.47	4	.77	4A17-50	25.00
	8.20	4.10	JA	7.4	6C17-140	55.00						
	10.00	5.00	KA	9.8	6C17-170	65.00						
20V Parallel 40V.C.T. Series	0.24	0.12	EB	1.2	6C20-5	30.00	0.350	0.175	1	.26	4A20-7	18.00
	0.72	0.36	FA	2.2	6C20-15	35.00	0.50	0.250	2	.30	4A20-10	18.75
	1.44	0.72	GA	3.3	6C20-30	40.00	1.25	0.625	3	.47	4A20-25	21.00
	2.88	1.44	HA	4.7	6C20-60	45.00	2.50	1.25	4	.77	4A20-50	25.00
	7.00	3.50	JA	7.4	6C20-140	55.00						
	8.50	4.25	KA	9.8	6C20-170	65.00						
28V Parallel 56V.C.T. Series	0.18	0.09	EB	1.2	6C28-5	30.00	0.250	0.125	1	.26	4A28-7	18.00
	0.54	0.27	FA	2.2	6C28-15	35.00	0.356	0.178	2	.30	4A28-10	18.75
	1.08	0.54	GA	3.3	6C28-30	40.00	0.892	0.446	3	.47	4A28-25	21.00
	2.16	1.08	HA	4.7	6C28-60	45.00	1.78	0.89	4	.77	4A28-50	25.00
	5.00	2.50	JA	7.4	6C28-140	55.00						
	6.06	3.03	KA	9.8	6C28-170	65.00						
44V Parallel 88V.C.T. Series	0.10	0.05	EB	1.2	6C44-5	30.00	0.158	0.079	1	.26	4A44-7	18.00
	0.30	0.15	FA	2.2	6C44-15	35.00	0.226	0.113	2	.30	4A44-10	18.75
	0.60	0.30	GA	3.3	6C44-30	40.00	0.568	0.284	3	.47	4A44-25	21.00
	1.20	0.60	HA	4.7	6C44-60	45.00	1.12	0.56	4	.77	4A44-50	25.00
	3.16	1.58	JA	7.4	6C44-140	55.00						
	3.86	1.93	KA	9.8	6C44-170	65.00						
60V Parallel 120V.C.T. Series	0.08	0.04	EB	1.2	6C60-5	30.00	0.116	0.058	1	.26	4A60-7	18.00
	0.24	0.12	FA	2.2	6C60-15	35.00	0.166	0.083	2	.30	4A60-10	18.75
	0.48	0.24	GA	3.3	6C60-30	40.00	0.416	0.208	3	.47	4A60-25	21.00
	0.96	0.48	HA	4.7	6C60-60	45.00	0.82	0.41	4	.77	4A60-50	25.00
	2.32	1.16	JA	7.4	6C60-140	55.00						
	2.82	1.41	KA	9.8	6C60-170	65.00						



BASIC CIRCUIT



SERIES CONNECTED



PARALLEL CONNECTED

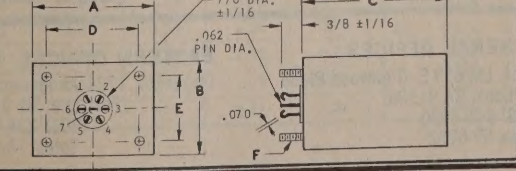
QUANTITY DISCOUNTS

1-4 pcs.	- price listed
5-9 pcs.	- less 4% of the 1-4 piece price.
10-24 pcs.	- less 8% of the 1-4 piece price.
25-49 pcs.	- less 13% of the 1-4 piece price.
50-99 pcs.	- less 19% of the 1-4 piece price.
Above 100 pcs.	- Contact nearest office for an exact quotation.

All Prices subject to change without notice.

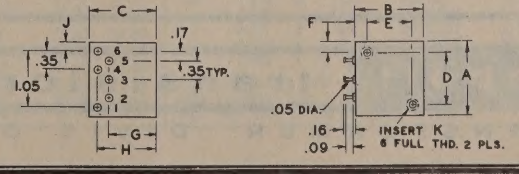
Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x ⅜
FA	2.312	2.062	3.125	1.688	1.438	6-32 x ⅜
GA	2.750	2.375	3.812	2.125	1.750	6-32 x ⅜
HA	3.062	2.625	4.250	2.297	1.859	8-32 x ⅜
JA	3.562	3.062	4.875	2.625	2.125	8-32 x ⅜
KA	3.938	3.375	5.250	3.000	2.438	10-32 x ½

DIMENSIONAL TOLERANCE PER MIL-T-27D.

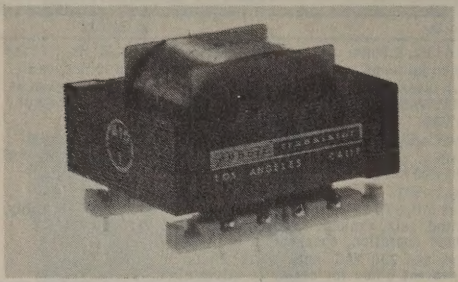


Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32

DIMENSIONAL TOLERANCE = ±.02, EXCEPT F, G, H, J = ±.04



abbott low profile transformers



These miniature power transformers are specifically designed for use in PC board card racks where height above the board is critical. These low profile transformers have a height of only 1.03 inches for 1.2 watts output, 1.17 inches for 3.25 watts output, and 1.31 inches for 6.0 watts output.

If the exact unit you require is not listed as a standard item, please contact our nearest office and we will be happy to quote on your exact requirements.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Series Connection	Size	Weight Lbs. Typ.	Model No.	Price 1-9 Pcs.
5V Parallel	0.240	0.120	1	0.18	6LP5-1	$5.75
10V.C.T. Series	0.650	0.325	2	0.31	6LP5-3	5.90
	1.2000	0.600	3	0.52	6LP5-6	6.80
6.3V Parallel	0.190	0.095	1	0.18	6LP6-1	5.75
12.6V.C.T. Series	0.516	0.258	2	0.31	6LP6-3	5.90
	0.954	0.477	3	0.52	6LP6-6	6.80
8V Parallel	0.150	0.075	1	0.18	6LP8-1	5.75
16V.C.T. Series	0.406	0.203	2	0.31	6LP8-3	5.90
	0.750	0.375	3	0.52	6LP8-6	6.80
10V Parallel	0.120	0.060	1	0.18	6LP10-1	5.75
20V.C.T. Series	0.326	0.163	2	0.31	6LP10-3	5.90
	0.600	0.300	3	0.52	6LP10-6	6.80
12V Parallel	0.100	0.050	1	0.18	6LP12-1	5.75
24V.C.T. Series	0.272	0.136	2	0.31	6LP12-3	5.90
	0.500	0.250	3	0.52	6LP12-6	6.80
17V Parallel	0.070	0.035	1	0.18	6LP17-1	5.75
34V.C.T. Series	0.192	0.096	2	0.31	6LP17-3	5.90
	0.352	0.176	3	0.52	6LP17-6	6.80
20V Parallel	0.060	0.030	1	0.18	6LP20-1	5.75
40V.C.T. Series	0.160	0.080	2	0.31	6LP20-3	5.90
	0.300	0.150	3	0.52	6LP20-6	6.80
28V Parallel	0.044	0.022	1	0.18	6LP28-1	5.75
56V.C.T. Series	0.116	0.058	2	0.31	6LP28-3	5.90
	0.214	0.107	3	0.52	6LP28-6	6.80
44V Parallel	0.028	0.014	1	0.18	6LP44-1	5.75
88V.C.T. Series	0.074	0.037	2	0.31	6LP44-3	5.90
	0.136	0.068	3	0.52	6LP44-6	6.80
60V Parallel	0.020	0.010	1	0.18	6LP60-1	5.75
120V.C.T. Series	0.054	0.027	2	0.31	6LP60-3	5.90
	0.100	0.050	3	0.52	6LP60-6	6.80

features

- Low Profile PC Mounting
- 85°C Operation
- Hi-Reliability

specifications

INPUT PRIMARY: 115 VAC (50 to 400 Hz) 1 phase.

REGULATION: 20% or less from no load to full load.

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

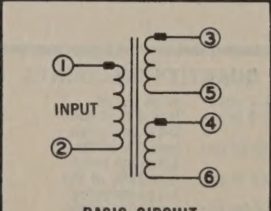
INSULATION TEST: 1000 VAC.

OPERATING TEMPERATURE: 85°C maximum ambient.

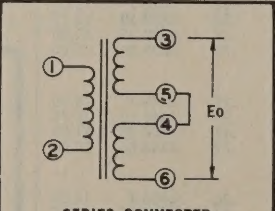
CONSTRUCTION: Printed circuit pin plug in.

APPROXIMATE EFFICIENCY: Ranges from 72% to 76%.

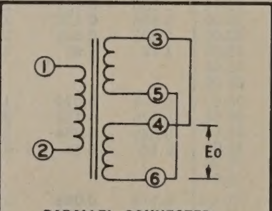
For 230 VAC input (at no additional cost) add suffix "A" to standard model number. Example: 6LP5-1A.



BASIC CIRCUIT



SERIES CONNECTED



PARALLEL CONNECTED

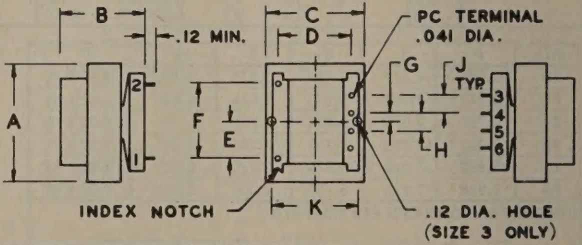
QUANTITY DISCOUNTS

1-9 pcs.	— price listed.
10-24 pcs.	— less 10% of the 1-9 piece price.
25-49 pcs.	— less 19% of the 1-9 piece price.
50-99 pcs.	— less 25% of the 1-9 piece price.
Above 100 pcs.	— Contact nearest office for an exact quotation.

All Prices subject to change without notice.

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.03	1.12	.85	.250	.550	.100	.200	.200	1.000
2	1.62	1.17	1.31	.95	.375	.750	.125	.250	.250	1.160
3	1.87	1.31	1.56	1.10	.650	1.400	.150	.300	.300	1.250

DIMENSIONAL TOLERANCE .XX = ±.02 .XXX = ±.007



abbott transistor
TRANSFORMER DIVISION

GENERAL OFFICES
Dept. EM 639 S. Glenwood Place
Burbank, CA 91506
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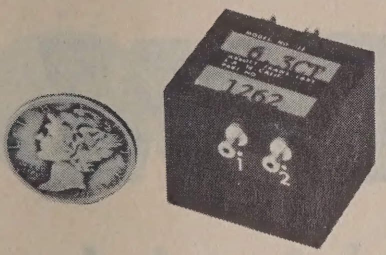
abbott 400 ∿ transformers



features

- Hermetically sealed
- 105°C operation
- To meet MIL-T-27D
- Designed exclusively for 400 Hz
- For aerospace application
- Molded diallyl phthalate

DELIVERY IS FROM STOCK

specifications

Input Primary
115V, 400 Hz ±20 Hz, 1 phase

Regulation
10% no load to full load

Secondary Voltage Tolerance
Within 5% when measured at full load and 115 VAC input

Insulation Test
2500 VDC or 150% of secondary voltage (whichever is higher)

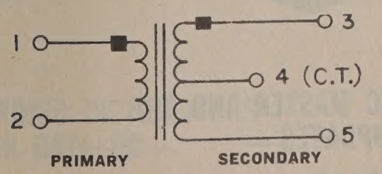
Construction
To MIL-T-27D, grade: 5, class: "S", life: "X" (10,000 hrs.) case: smaller

Environment
Encapsulated to meet MIL-STD-810B, including vibration to Proc. XII, temperature to 105°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum)

Output Secondary
See voltage and current of specific models listed

Standard models with outputs from 350 to 5,000 VAC are also available from stock. Contact our nearest office for your free copy of our complete brochure.

TYPICAL CIRCUIT DIAGRAM



"■" refers to in-phase points

Case Size	Width (in.)	Depth (in.)	Height (in.)	Weight (lbs.)
A	0.87	0.74	0.78	0.06
B	1.25	1.19	0.88	0.12
C	1.43	1.24	1.27	0.26
D	1.47	1.28	1.40	0.29
E	2.31	1.52	1.75	0.75
F	2.75	2.71	2.31	1.84

Output Volt	Output Current (Amps)	Size	Sec. DCR (ohms)	Model Number	Price 1 Pc.	Price 2-4 Pcs.
5.0	0.400	A	0.60	2E5CT	$28.80	$24.00
	1.200	B	0.144	6E5CT	26.40	22.00
	3.000	C	0.046	15E5CT	27.60	23.00
	4.800	D	0.040	24E5CT	31.20	26.00
	16.000	E	0.009	80E5CT	36.00	30.00
	35.000	F	0.012	175E5CT	66.00	55.00
6.3	0.317	A	1.06	2E6.3CT	28.80	24.00
	0.950	B	0.24	6E6.3CT	26.40	22.00
	2.380	C	0.088	15E6.3CT	27.60	23.00
	3.800	D	0.107	24E6.3CT	31.20	26.00
	12.800	E	0.016	80E6.3CT	36.00	30.00
	27.800	F	0.019	175E6.3CT	66.00	55.00
8.0	0.250	A	1.63	2E8CT	28.80	24.00
	0.750	B	0.396	6E8CT	26.40	22.00
	1.880	C	0.135	15E8CT	27.60	23.00
	3.000	D	0.140	24E8CT	31.20	26.00
	10.000	E	0.017	80E8CT	36.00	30.00
	22.000	F	0.010	175E8CT	66.00	55.00
10	0.200	A	2.50	2E10CT	28.80	24.00
	0.600	B	0.587	6E10CT	26.40	22.00
	1.500	C	0.27	15E10CT	27.60	23.00
	2.400	D	0.180	24E10CT	31.20	26.00
	8.000	E	7.2	80E10CT	36.00	30.00
	17.500	F	0.020	175E10CT	66.00	55.00
12.6	0.158	A	4.10	2E12.6CT	28.80	24.00
	0.475	B	0.99	6E12.6CT	26.40	22.00
	1.180	C	0.32	15E12.6CT	27.60	23.00
	1.900	D	0.225	24E12.6CT	31.20	26.00
	6.350	E	0.030	80E12.6CT	36.00	30.00
	13.900	F	0.021	175E12.6CT	66.00	55.00
14	0.142	A	5.59	2E14CT	28.80	24.00
	0.428	B	1.11	6E14CT	26.40	22.00
	1.070	C	0.35	15E14CT	27.60	23.00
	1.720	D	0.32	24E14CT	31.20	26.00
	5.600	E	0.04	80E14CT	36.00	30.00
	12.500	F	0.022	175E14CT	66.00	55.00
16	0.125	A	6.63	2E16CT	28.80	24.00
	0.375	B	1.58	6E16CT	26.40	22.00
	0.940	C	0.54	15E16CT	27.60	23.00
	1.500	D	0.35	24E16CT	31.20	26.00
	5.000	E	0.05	80E16CT	36.00	30.00
	10.900	F	0.025	175E16CT	66.00	55.00
18	0.111	A	9.00	2E18CT	28.80	24.00
	0.333	B	2.21	6E18CT	26.40	22.00
	0.832	C	0.74	15E18CT	27.60	23.00
	1.330	D	0.40	24E18CT	31.20	26.00
	4.450	E	0.08	80E18CT	36.00	30.00
	9.700	F	0.027	175E18CT	66.00	55.00
20	0.100	A	10.9	2E20CT	28.80	24.00
	0.300	B	2.78	6E20CT	26.40	22.00
	0.750	C	1.4	15E20CT	27.60	23.00
	1.200	D	0.48	24E20CT	31.20	26.00
	4.000	E	0.09	80E20CT	36.00	30.00
	8.750	F	0.020	175E20CT	66.00	55.00
22	0.091	A	14.6	2E22CT	28.80	24.00
	0.273	B	2.80	6E22CT	26.40	22.00
	0.680	C	0.92	15E22CT	27.60	23.00
	1.090	D	0.63	24E22CT	31.20	26.00
	3.630	E	0.12	80E22CT	36.00	30.00
	7.900	F	0.020	175E22CT	66.00	55.00
25	0.080	A	20.4	2E25CT	28.80	24.00
	0.240	B	3.60	6E25CT	26.40	22.00
	0.600	C	1.3	15E25CT	27.60	23.00
	0.900	D	0.68	24E25CT	31.20	26.00
	3.200	E	0.13	80E25CT	36.00	30.00
	7.000	F	0.042	175E25CT	66.00	55.00
28	0.071	A	30.0	2E28CT	28.80	24.00
	0.214	B	4.20	6E28CT	26.40	22.00
	0.535	C	1.83	15E28CT	27.60	23.00
	0.855	D	0.98	24E28CT	31.20	26.00
	2.850	E	0.14	80E28CT	36.00	30.00
	6.250	F	0.043	175E28CT	66.00	55.00
31	0.064	A	25.6	2E31CT	28.80	24.00
	0.192	B	5.71	6E31CT	26.40	22.00
	0.485	C	1.62	15E31CT	27.60	23.00
	0.772	D	1.27	24E31CT	31.20	26.00
	2.470	E	0.18	80E31CT	36.00	30.00
	5.650	F	0.061	175E31CT	66.00	55.00
35	0.057	A	29.5	2E35CT	28.80	24.00
	0.171	B	6.89	6E35CT	26.40	22.00
	0.428	C	2.28	15E35CT	27.60	23.00
	0.685	D	1.70	24E35CT	36.00	30.00
	2.280	E	0.28	80E35CT	33.60	28.00
	5.000	F	0.098	175E35CT	66.00	55.00
39	0.051	A	38.6	2E39CT	28.80	24.00
	0.154	B	9.39	6E39CT	26.40	22.00
	0.384	C	2.54	15E39CT	27.60	23.00
	0.615	D	2.20	24E39CT	31.20	26.00
	2.050	E	0.32	80E39CT	36.00	30.00
	4.480	F	0.110	175E39CT	66.00	55.00
43	0.046	A	44.3	2E43CT	28.80	24.00
	0.139	B	10.25	6E43CT	26.40	22.00
	0.348	C	2.85	15E43CT	27.60	23.00
	0.556	D	2.42	24E43CT	31.20	26.00
	1.860	E	0.35	80E43CT	36.00	30.00
	4.060	F	0.114	175E43CT	66.00	55.00
48	0.041	A	57.	2E48CT	$28.80	$24.00
	0.125	B	15.30	6E48CT	26.40	22.00
	0.312	C	4.05	15E48CT	27.60	23.00
	0.500	D	3.27	24E48CT	31.20	26.00
	1.660	E	0.40	80E48CT	36.00	30.00
	3.650	F	0.160	175E48CT	66.00	55.00
55	0.036	A	89.	2E55CT	28.80	24.00
	0.109	B	17.30	6E55CT	26.40	22.00
	0.262	C	7.2	15E55CT	27.60	23.00
	0.435	D	3.83	24E55CT	31.20	26.00
	1.450	E	0.67	80E55CT	36.00	30.00
	3.170	F	0.196	175E55CT	66.00	55.00
63	0.031	A	100.	2E63CT	28.80	24.00
	0.095	B	24.9	6E63CT	26.40	22.00
	0.238	C	6.51	15E63CT	27.60	23.00
	0.380	D	5.35	24E63CT	31.20	26.00
	1.270	E	0.71	80E63CT	36.00	30.00
	2.770	F	0.20	175E63CT	66.00	55.00
70	0.028	A	139	2E70CT	28.80	24.00
	0.085	B	27.1	6E70CT	26.40	22.00
	0.214	C	9.4	15E70CT	27.60	23.00
	0.342	D	8.10	24E70CT	31.20	26.00
	1.140	E	0.80	80E70CT	36.00	30.00
	2.500	F	0.25	175E70CT	66.00	55.00
80	0.025	A	163.	2E80CT	28.80	24.00
	0.075	B	39.0	6E80CT	26.40	22.00
	0.198	C	13.4	15E80CT	27.60	23.00
	0.300	D	9.0	24E80CT	31.20	26.00
	1.000	E	0.92	80E80CT	36.00	30.00
	2.180	F	0.34	175E80CT	66.00	55.00
90	0.022	A	218.	2E90CT	28.80	24.00
	0.067	B	41.0	6E90CT	26.40	22.00
	0.166	C	15.9	15E90CT	27.60	23.00
	0.267	D	12.5	24E90CT	31.20	26.00
	0.890	E	1.08	80E90CT	36.00	30.00
	1.940	F	0.38	175E90CT	66.00	55.00
100	0.020	A	283.	2E100CT	28.80	24.00
	0.060	B	59.5	6E100CT	26.40	22.00
	0.150	C	16.8	15E100CT	27.60	23.00
	0.240	D	14.4	24E100CT	31.20	26.00
	0.800	E	1.64	80E100CT	36.00	30.00
	1.750	F	0.52	175E100CT	66.00	55.00
110	0.018	A	392.	2E110CT	28.80	24.00
	0.054	B	62.3	6E110CT	26.40	22.00
	0.136	C	22.1	15E110CT	27.60	23.00
	0.218	D	19.5	24E110CT	31.20	26.00
	0.728	E	2.03	80E110CT	36.00	30.00
	1.590	F	0.72	175E110CT	66.00	55.00
123	0.016	A	495.	2E123CT	28.80	24.00
	0.048	B	96.0	6E123CT	26.40	22.00
	0.122	C	30.7	15E123CT	27.60	23.00
	0.195	D	21.9	24E123CT	31.20	26.00
	0.650	E	2.35	80E123CT	36.00	30.00
	1.420	F	0.81	175E123CT	66.00	55.00
138	0.014	A	550.	2E138CT	28.80	24.00
	0.043	B	133.0	6E138CT	26.40	22.00
	0.108	C	36.0	15E138CT	27.60	23.00
	0.174	D	30.3	24E138CT	31.20	26.00
	0.580	E	3.17	80E138CT	36.00	30.00
	1.260	F	1.14	175E138CT	66.00	55.00
157	0.038	B	153.0	6E157CT	26.40	22.00
	0.095	C	53.	15E157CT	27.60	23.00
	0.152	D	36.1	24E157CT	31.20	26.00
	0.508	E	3.60	80E157CT	36.00	30.00
	1.100	F	1.31	175E157CT	66.00	55.00
175	0.034	B	168.0	6E175CT	26.40	22.00
	0.085	C	56.	15E175CT	27.60	23.00
	0.136	D	49.5	24E175CT	31.20	26.00
	0.455	E	5.50	80E175CT	36.00	30.00
	1.000	F	1.87	175E175CT	66.00	55.00
200	0.030	B	248.0	6E200CT	26.40	22.00
	0.071	C	65.	15E200CT	27.60	23.00
	0.120	D	57.	24E200CT	31.20	26.00
	0.400	E	5.60	80E200CT	36.00	30.00
	0.875	F	2.65	175E200CT	66.00	55.00
220	0.027	B	278.	6E220CT	26.40	22.00
	0.068	C	91.5	15E220CT	27.60	23.00
	0.109	D	79.	24E220CT	31.20	26.00
	0.364	E	8.1	80E220CT	36.00	30.00
	0.790	F	2.92	175E220CT	66.00	55.00
250	0.024	B	407.	6E250CT	26.40	22.00
	0.060	C	141.	15E250CT	27.60	23.00
	0.096	D	114.	24E250CT	31.20	26.00
	0.320	E	11.2	80E250CT	36.00	30.00
	0.700	F	3.95	175E250CT	66.00	55.00
275	0.021	B	417.	6E275CT	26.40	22.00
	0.054	C	146.	15E275CT	27.60	23.00
	0.087	D	120.	24E275CT	31.20	26.00
	0.290	E	13.6	80E275CT	36.00	30.00
	0.635	F	4.65	175E275CT	66.00	55.00
310	0.019	B	592.	6E310CT	26.40	22.00
	0.048	C	160.	15E310CT	27.60	23.00
	0.077	D	180.	24E310CT	31.20	26.00
	0.266	E	14.1	80E310CT	36.00	30.00
	0.565	F	6.80	175E310CT	66.00	55.00

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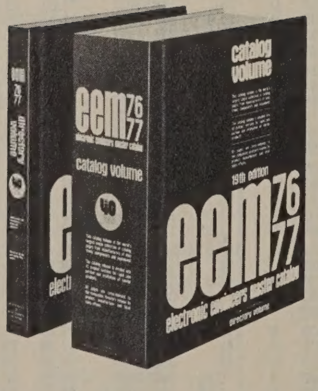
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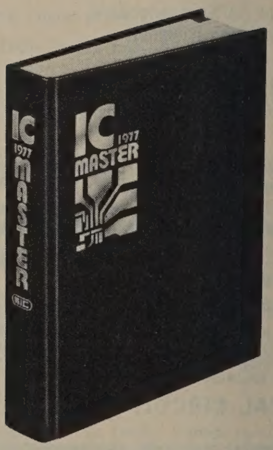
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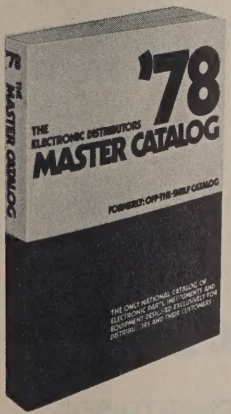
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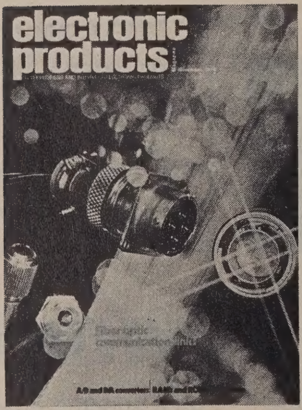
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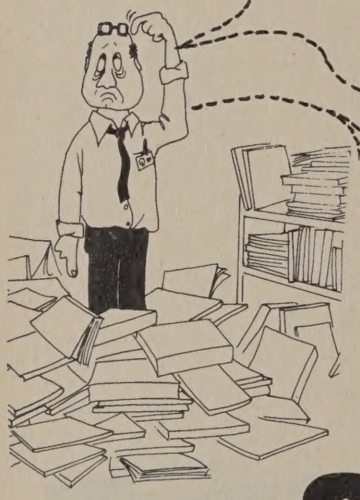

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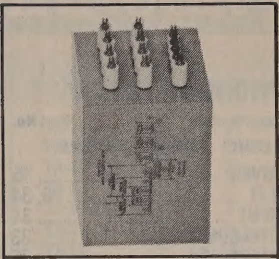

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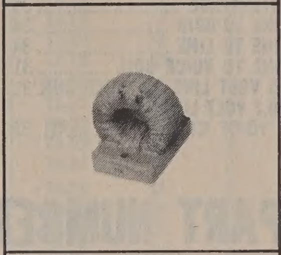

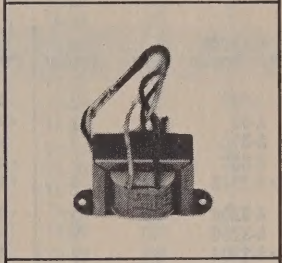

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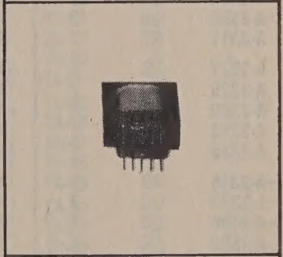

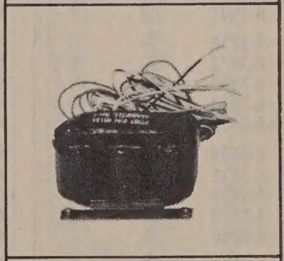

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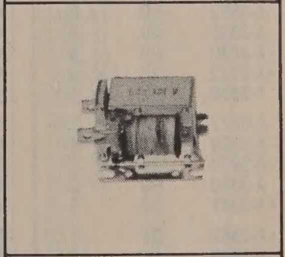

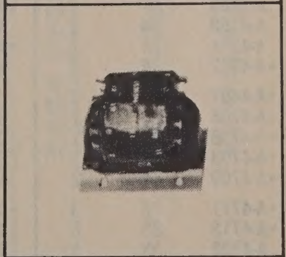

COIL COMPANY OF AMERICA, INC.

Over 35 Years of Electronic Experience

Dept. EM, 221 Washington St., Northvale, N.J. 07647 • (201) 768-3434

ESSEX STANCOR

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NOTE *Stancor cataloged transformers are designed for Class "A" operation; 105°C. maximum final temperature — 65°C. rise (max.) in a 40°C. ambient unless otherwise rated. They are non energy limiting, unless otherwise noted, and are designed to meet U/L specifications in terms of temperature rise, insulation and construction.*

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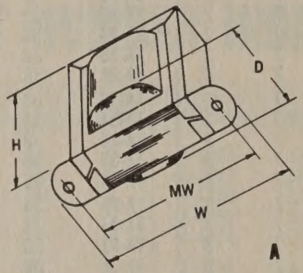
√ New item. • Available until stock is depleted.

ESSEX STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 HZ.§

To continue to provide you with the most complete selection of low voltage transformers in the industry, Stancor has added 40 new items to its line. These new transformers, noted with a check mark (√), are listed here along with all the rectifier, control and filament transformers in the Stancor line. Other general information and ordering instructions are provided on inside front cover of this catalog.



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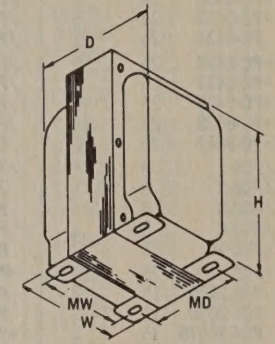

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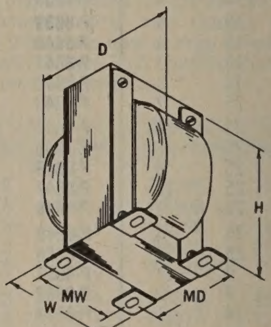

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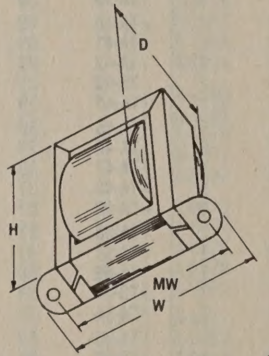

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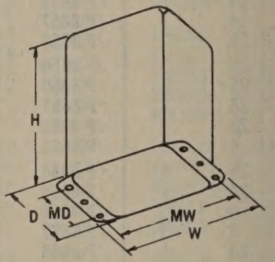


SC

Section	STANCOR PART NO.	Style	Secondary ▲		Primary Volts	Insulation Test RMS Volts*	Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
1	P-8628	A	2.5C.T.	0.3	117	1500	Leads	Leads	1¼	2⅛	1⁵⁄₁₆	1¾	—	0.3
	P-8629	A	2.5	1.0	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	0.4
	P-4026	A	2.5	1.5	117	2500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	0.7
	• P-4082	SC	2.5C.T.	2.5	117/107	2500	Leads	Leads	2¹¹⁄₁₆	2¹¹⁄₁₆	2¼	2⅜	1½	1.5
	• P-6133†	S	2.5C.T.	5.0	117	7500	Leads	Leads	2¾	3⅛	2¼	2¹³⁄₁₆	—	1.5
	• P-3024†	C	2.5C.T.	10.0	117/107	2500	Leads	Leads	3⅛	2½	2¾	2	1¾	2.5
	• P-6454	S	2.5C.T.	10.0	117/107	7500	Leads	Leads	3⅛	3⅝	2½	3⅛	—	2.5
	• P-3060	NV	2.5C.T.	10.0	117	10000	Lugs	Lugs	3⁷⁄₁₆	2¹³⁄₁₆	2⅜	2¼	1⅞	2.5
2	• P-6467	A	5.0C.T.	3.0	117	2500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	• P-6455	S	5.0C.T.	6.0	117/107	2000	Leads	Leads	2¾	3⅛	2⅛	2¹³⁄₁₆	—	2.0
	• P-3062†	NV	5.0C.T.	6.0	117	2500	Lugs	Lugs	3⅛	2½	2¼	2	2	2.3
	• P-5000†	C	5.0C.T.	6.0	117/107	2500	Leads	Leads	3⅛	2½	3	2	2	3.1
	P-6135	NV	5.0C.T.	10.0	117	2500	Leads	Leads	3⅛	2½	2¾	2	2⅜	3.0
	P-6433†	NV	5.0C.T.	15.0	117	2500	Leads	Leads Lugs	3⅛	2½	2¾	2	2¼	3.0
	F-516	SC	5.0C.T.	20.0	115/230	2500	Terms	Terms	4¹¹⁄₁₆	4⁷⁄₁₆	3¹¹⁄₁₆	3⅞	2¾	6.5
	P-6492	C	5.0C.T.	30.0	117	2500	Leads	Leads	4¹¹⁄₁₆	3¾	4	3	2¹³⁄₁₆	7.5
	P-6468†	C	5.0C.T.	30.0	117/107	2500	Lugs	Lugs	4¼	3⁷⁄₁₆	3⅞	2¾	2¹¹⁄₁₆	6.3
3	P-8385	A	6.3C.T.	0.3	117	1500	Leads	Leads	1¼	2⅛	1⅜	1¾	—	0.3
	P-6465	A	6.3C.T.	0.6	117	1500	Leads	Leads	1⅜	2⅜	1½	2	—	0.4
	P-8705	A	6.3C.T.	0.6	230	1500	Leads	Leads	1⅜	2⅜	1½	2	—	0.4
	P-8389	A	6.3	1.0	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	0.6
	P-6134	A	6.3C.T.	1.2	117	3000	Leads	Leads	1⅝	2⅞	1⅞	2⅜	—	0.8
	P-8190	A	6.3	1.2	117	5000	Leads	Leads	2	3¼	1⅞	2¹³⁄₁₆	—	1.0
	P-8191	A	6.3	1.2	6.3	5000	Leads	Leads	2	3¼	2	2¹³⁄₁₆	—	1.0
	P-5014†	NV	6.3C.T.	3.0	117	2500	Lugs	Lugs	3⅛	2½	2½	2	1¾	2.0

§ May be operated from a 400 Hz. source with no change in output ratings.
* Insulation Test Voltage: Twice allowable RMS working voltage plus 1000 volts.
† Has electrostatic shield.
▲ R.M.S. values.
• Available until stock is depleted.

ESSEX STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 Hz.§ (Cont'd)

Section	STANCOR PART NO.	Style	Secondary ▲		Primary Volts	Insulation Test RMS Volts*	Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
4	P-6466	A	6.3C.T.	3.0	117	2500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-6462	S	6.3	3.0	117/107	7000	Leads	Leads	3⅛	3⅝	2⅜	3⅛	—	2.0
	P-4019†	C	6.3C.T.	4.0	117/107	2500	Leads	Leads	3⅛	2½	2¾	2	1¾	2.7
	√P-8648	A	6.3C.T.	4.0	117	1500	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.6
	√P-8649	A	6.3C.T.	5.0	117	1500	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.8
	P-3064†	NV	6.3C.T.	6.0	117	2500	Lugs	Lugs	3⅛	2½	2⅜	2	2	2.4
	P-4089	C	6.3C.T.	6.0	117/107	2500	Leads	Leads	3½	2¹³⁄₁₆	3¼	2¼	2	3.5
	P-6456	A	6.3C.T.	6.0	117/107	2000	Leads	Leads	2⅜	3¾	2⅜	3⅛	—	2.0
	√P-8651	A	6.3C.T.	8.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.4
	P-6464	C	6.3C.T.	10.0	117	2000	Leads	Leads	3½	2¹³⁄₁₆	3¼	2¼	2	3.5
	P-6308†	NV	6.3C.T.	10.0	117/107	2500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4
	P-8189	C	6.3C.T.	20.0	117	2500	Leads	Leads	3⅞	3⅛	4¼	2½	3	6.9
	P-6309	NV	6.3C.T.	20.0	117/107	2500	Leads	Leads	4⁹⁄₁₆	3¾	3⅜	3	2⅜	6.7
5	P-5015†	NV	7.5C.T.	4.0	117	2500	Lugs	Lugs	3⅛	2½	2¼	2	2⅛	2.7
	P-6138†	NV	7.5C.T.	8.0	117	2500	Leads	Leads	3¹³⁄₁₆	3⅛	2¾	2½	2⅜	4.7
	P-6457	C	7.5C.T.	21.0	117/107	2000	Leads	Leads	4⅝	3¾	4	3	2¾	8.0
6	√P-8652	A	10.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	0.9
	√P-8653	A	10.0C.T.	2.0	117	1500	Leads	Leads	2	3¼	2	2¹³⁄₁₆	—	1.3
	P-8380	A	10.0C.T.	3.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	1.6
	√P-8654	A	10.0C.T.	4.0	117	1500	Leads	Leads	2⅝	4	2⅛	3⁹⁄₁₆	—	2.3
	P-5016†	NV	10.0C.T.	4.0	117	2500	Lugs	Lugs	3⁷⁄₁₆	2¹³⁄₁₆	2½	2¼	2	3.3
	P-6458	NV	10.0C.T.	5.0	117/107	2000	Leads	Leads	3¹⁄₁₆	2½	2½	2⅛	1¹³⁄₁₆	3.0
	P-4096†	C	10.0C.T.	5.0	117/107	2500	Leads	Leads	3⅞	3⅛	3¼	2½	1¹⁵⁄₁₆	4.0
	√P-8655	NV	10.0C.T.	6.0	117	1500	Leads	Leads	3⅛	2½	2¾	2	2⁵⁄₁₆	3.1
	√P-8656	NV	10.0C.T.	8.0	117	1500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	3	2¼	2½	4.1
	P-6139†	NV	10.0C.T.	8.0	117	2500	Leads	Leads	3¹³⁄₁₆	3⅛	3	2½	2⅜	4.9
	P-4097†	C	10.0C.T.	8.0	117/107	2500	Leads	Leads	3⅞	3⅛	3¾	2½	2½	5.2
	P-6461	C	10.0C.T.	10.0	117	2000	Leads	Leads	3⅞	3¼	3⁹⁄₁₆	2½	2¹¹⁄₁₆	5.0
7	P-3020†	C	11.0C.T.	10.0	117/107	2500	Leads	Leads	4¹¹⁄₁₆	3¾	3⅝	3	2⁷⁄₁₆	7.7
8	P-8390	A	12.0	.150	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8391	A	12.0	.350	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8392	A	12.0	.700	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8393	A	12.0	1.200	117	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.85
	√P-8657	A	12.0	2.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.3
	√P-8658	A	12.0	4.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.3
	√P-8659	NV	12.0	6.0	117	1500	Leads	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4
	√P-8660	NV	12.0	8.0	117	1500	Leads	Leads	3¹³⁄₁₆	3⅛	2¾	2½	2⅛	4.3
9	P-8384	A	12.6C.T.	1.0	117	1500	Leads	Leads	2	3¼	1¾	2¹³⁄₁₆	—	0.9
	P-8130	A	12.6C.T.	2.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8715	A	12.6C.T.	2.0	230	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8358	A	12.6C.T.	3.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	1.6
	P-8641	A	12.6C.T.	4.0	117	1500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
	P-8642	C	12.6C.T.	6.0	117	1500	Leads	Leads	3½	2¹³⁄₁₆	3⅜	2¼	2³⁄₁₆	3.8
	P-8643	C	12.6C.T.	8.0	117	1500	Leads	Leads	3⅞	3⅛	3⅝	2½	2⅜	5.0
	P-8644	C	12.6C.T.	10.0	117	1500	Leads	Leads	4¼	3⁷⁄₁₆	3⅞	2¾	2¾	6.3
	P-8716	A	12.6C.T.	4.0	230	2500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
10	P-8604	A	20.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
11	P-8394	A	24.0C.T.	.085	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8720	A	24.0C.T.	.085	230	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8395	A	24.0C.T.	.200	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8721	A	24.0C.T.	.200	230	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8396	A	24.0C.T.	.400	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8722	A	24.0C.T.	.400	230	1500	Leads	Leads	1⅝	2⅞	1½	2⅜	—	.60
	P-8397	A	24.0C.T.	.700	117	1500	Leads	Leads	2	3¼	1¾	2¹³⁄₁₆	—	.85
	P-8723	A	24.0C.T.	.700	230	1500	Leads	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.85
	√P-8661	A	24.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2¹⁄₁₆	2¹³⁄₁₆	—	1.4
	√P-8662	A	24.0C.T.	2.0	117	1500	Leads	Leads	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
	√P-8663	NV	24.0C.T.	4.0	117	1500	Leads	Leads	3¹³⁄₁₆	3⅛	2¹³⁄₁₆	2½	2⅛	4.0
	√P-8664	NV	24.0C.T.	6.0	117	1500	Leads	Leads	4³⁄₁₆	3⁷⁄₁₆	3	2¾	2¼	5.7
	√P-8665	NV	24.0C.T.	8.0	117	1500	Leads	Leads	4³⁄₁₆	3⁷⁄₁₆	3⅜	2¾	2¾	7.3
	√P-8666	NV	24.0C.T.	12.0	117	1500	Leads	Leads	4⁹⁄₁₆	3¾	4⅝	3	3¼	11.2
12	P-6469	A	25.2	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8707	A	25.2	1.0	230	1500	Leads	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8180	A	25.2C.T.	1.0	117	1500	Leads	Leads	2	3¼	2¼	2¹³⁄₁₆	—	1.4
	P-8357	A	25.2C.T.	2.0	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.2
	P-8388	A	25.2C.T.	2.8	117	1500	Leads	Leads	2⅝	4	2¼	3⁹⁄₁₆	—	2.2

* Insulation Test Voltage: Twice allowable RMS working voltage plus 1000 volts. † Has electrostatic shield. √ New item. ▲ R.M.S. values.

§ May be operated from a 400 Hz. source with no change in output ratings.

ESSEX STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH SINGLE SECONDARY: ALL PRIMARIES 50/60 Hz.§ (Cont'd)

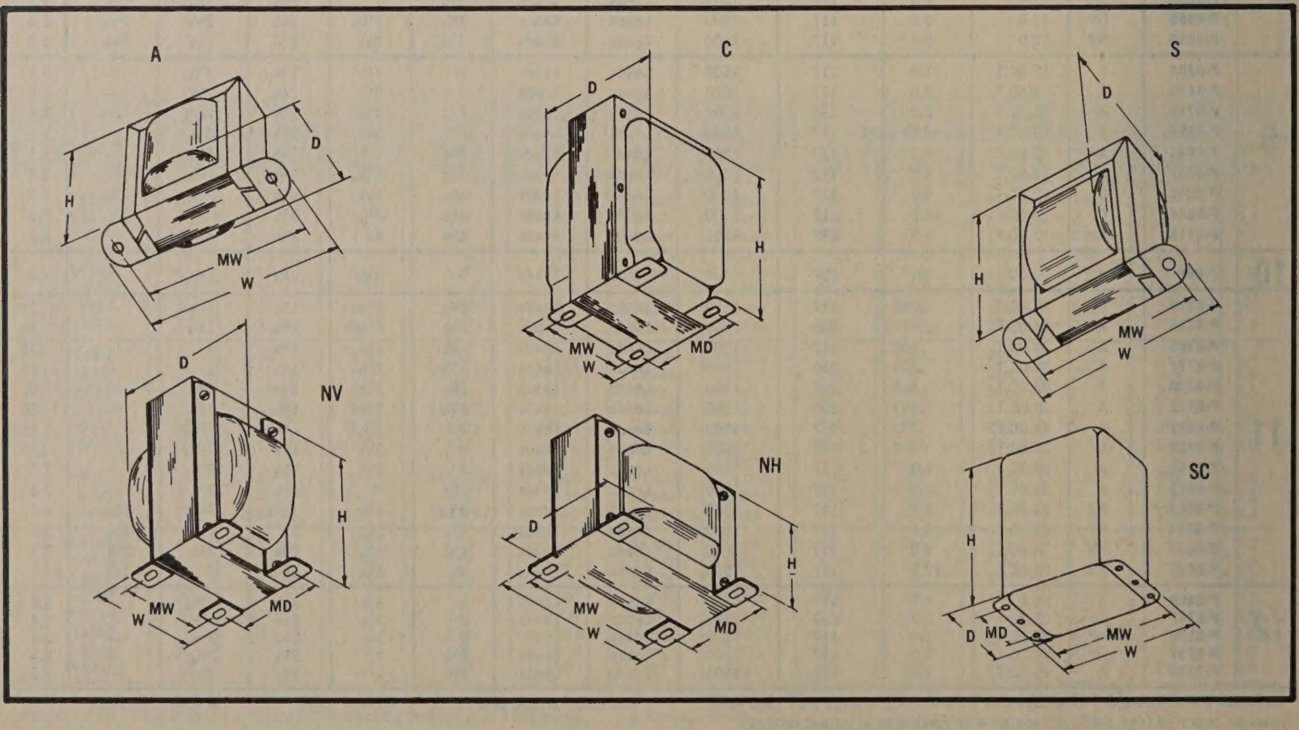
Section	STANCOR PART NO.	Style	Secondary ▲		Primary Volts	Insulation Test RMS Volts*	Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
1	P-8645	C	25.2C.T.	5.0	117	1500	Leads	Leads	4¼	3 7/16	3⅞	2¾	2 11/16	6.0
	P-8646	C	25.2C.T.	7.5	117	1500	Leads	Leads	4¼	3½	4¼	2¾	3⅛	7.3
	P-8647	C	25.2C.T.	10.0	117	1500	Leads	Leads	4 11/16	3¾	5	3	3⅞	12.3
2	P-8606	A	26.0C.T. Nominal	.040	117‡	2500	Leads	Leads	1¼	2⅛	1⅜	1¾	—	.25
			‡ Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.											
	P-8607	A	26.0C.T. Nominal	.25	117‡	2500	Leads	Leads	1⅝	2⅞	1¾	2⅜	—	.70
			‡ Primary tapped to provide secondary voltages of 24.5C.T. or 27.5C.T. or 29C.T.											
	P-8608	A	26.5C.T.	0.6	117	2500	Leads	Leads	2	3¼	2⅛	2 13/16	—	1.3
	P-8609	A	26.8C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2 13/16	—	1.3
3	P-8600	A	28.0C.T.	.085	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8601	A	28.0C.T.	.175	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8602	A	28.0C.T.	.300	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8603	A	28.0C.T.	.800	117	1500	Leads	Leads	2	3¼	2⅛	2 13/16	—	1.0
	√P-8667	A	28.0C.T.	1.0	117	1500	Leads	Leads	2	3¼	2⅛	2 13/16	—	1.4
	√P-8668	NV	28.0C.T.	2.0	117	1500	Leads	Leads	3⅛	2½	2½	2	2 3/16	2.9
	√P-8669	NV	28.0C.T.	4.0	117	1500	Leads	Leads	3 13/16	3⅛	3¼	2½	2½	5.3
	√P-8670	NV	28.0C.T.	6.0	117	1500	Leads	Leads	4 3/16	3 7/16	3½	2¾	2⅝	7.0
4	P-8610	A	36.0C.T.	.065	117	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8728	A	36.0C.T.	.065	230	1500	Leads	Leads	1¼	2⅛	1¼	1¾	—	.25
	P-8611	A	36.0C.T.	.135	117	1500	Leads	Leads	1⅜	2⅜	1⅜	2	—	.35
	P-8612	A	36.0C.T.	.300	117	1500	Leads	Leads	1⅝	2⅞	1⅝	2⅜	—	.60
	P-8613	A	36.0C.T.	.550	117	1500	Leads	Leads	2	3¼	1⅞	2 13/16	—	1.0
	√P-8671	A	36.0C.T.	1.0	117	1500	Leads	Leads	2⅜	3¾	2¼	3⅛	—	2.0
	√P-8672	NV	36.0C.T.	2.0	117	1500	Leads	Leads	3 7/16	2 13/16	2¾	2¼	2⅛	3.5
	√P-8673	NV	36.0C.T.	4.0	117	1500	Leads	Leads	4 3/16	3 1/16	2⅞	2¾	2⅜	6.0
	√P-8674	NV	36.0C.T.	6.0	117	1500	Leads	Leads	4 9/16	3¾	3½	3	2⅝	8.3
5	P-8605	A	48.0C.T. Nominal	1.0	117‡	2500	Leads	Leads	2⅝	4	2⅜	3 9/16	—	2.3
			‡ Primary tapped to provide secondary voltages of 45C.T. or 51C.T. or 54C.T.											

* Insulation Test Voltage: Twice allowable RMS working voltage plus 1000 volts.

§ May be operated from a 400 Hz. source with no change in output ratings.

√ New item.

▲ R.M.S. values.



ESSEX STANCOR

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS

WITH MULTIPLE SECONDARIES: ALL PRIMARIES 50/60 HZ.§

Section	STANCOR Part No.	Style	Secondary▲		Insulation Test RMS Volts•	Primary Volts	Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
1	•P-6144†	C	2.5C.T. 5.0C.T. 6.3C.T.	3.5 3.0 3.0	2500	117	Leads	Leads	3½	2 13/16	3¼	2¼	2	3.7
	•P-6463	NV	6.0C.T. or 6.5C.T. or 7.0C.T.	13.0	2000	117	Lugs	Lugs	3 7/16	2 13/16	2⅞	2¼	2 11/16	4.5
2	P-6428†	C	6.3 6.3 6.3 6.3C.T.	1.75 1.75 1.75 1.75	2500	117	Leads	Leads	3⅛	2½	3⅛	2	2	3.0
	P-6430†	C	6.3C.T. 6.3C.T.	3.0 3.0	2500	117	Leads	Leads	3⅛	2½	2⅞	2	1⅞	2.8
	P-6429†	C	6.3 6.3 6.3 6.3C.T.	3.5 3.5 3.5 3.5	2500	117	Leads	Leads	3⅞	3⅛	3½	2½	2 3/16	4.8
	P-6431†	C	6.3C.T. 6.3C.T.	6.0 6.0	2500	117	Leads	Leads	3⅞	3⅛	3½	2½	2 3/16	4.8
	P-6434	C	12.6 12.6C.T.	2.5 2.5	1500	117	Leads	Leads	3½	2 13/16	3¼	2¼	2	3.5

WITH DUAL C.T. SECONDARIES:‡ALL PRIMARIES 50/60 Hz.§ EXCEPT 🌡 FOR 60 Hz.§

Section	STANCOR Part No.	Style	Volts	Amps.	Insulation Test RMS Volts•	Primary Volts	Pri.	Sec.	H	W	D	MW	MD	Wt. Lbs.
3	√P-8680	S	12.0C.T. 12.0C.T.	0.1 0.1	1500 1500	115	Lugs	Lugs	2	2⅜	1⅝	2	—	0.65
	√P-8681	S	12.0C.T. 12.0C.T.	0.25 0.25	1500 1500	115	Lugs	Lugs	2⅜	2⅞	1¾	2⅜	—	0.95
	√P-8682	S	12.0C.T. 12.0C.T.	0.5 0.5	1500 1500	115	Lugs	Lugs	2⅜	2⅞	1⅞	2⅜	—	1.1
	√P-8683	S	12.0C.T. 12.0C.T.	1.0 1.0	1500 1500	115	Lugs	Lugs	2¾	3⅛	2⅛	2 13/16	—	1.7
	√P-8676	NH	12.0C.T. 12.0C.T.	1.0 1.0	1500 1500	115	Lugs	Lugs	2½	3	2 9/16	2½	2	2.3
	√P-8677	NH	12.0C.T. 12.0C.T.	2.0 2.0	1500 1500	115	Lugs	Lugs	2½	3	3	2½	2⅜	2.9
	√P-8678	NH	12.0C.T. 12.0C.T.	4.0 4.0	1500 1500	115	Lugs	Lugs	3⅛	3¾	2 15/16	3⅛	2¼	4.5
	√P-8679	NH	12.0C.T. 12.0C.T.	6.0 6.0	1500 1500	115	Lugs	Lugs	3½	4⅛	3 1/16	3 7/16	2⅜	5.8
4	√P-8684	NH	18.0C.T. 18.0C.T.	1.0 1.0	1500 1500	115🌡	Lugs	Lugs	2½	3	2½	2½	2	2.3
	√P-8685	NH	18.0C.T. 18.0C.T.	2.0 2.0	1500 1500	115🌡	Lugs	Lugs	3¼	3 13/16	3⅛	3⅛	2¼	4.5
	√P-8686	NH	18.0C.T. 18.0C.T.	4.0 4.0	1500 1500	115🌡	Lugs	Lugs	3 9/16	4⅛	3⅛	3 7/16	2¼	5.8
	√P-8687	NH	18.0C.T. 18.0C.T.	8.0 8.0	1500 1500	115🌡	Lugs	Leads	3⅞	4½	4⅛	3¾	2¾	8.9
	√P-8688	NH	18.0C.T. 18.0C.T.	12.0 12.0	1500 1500	115🌡¢	Lugs	Lugs	4 7/16	5¼	4¼	4⅜	2¾	12.8
5	√P-8675	NH	34.0C.T. 34.0C.T.	4.0 4.0	1500 1500	115	Lugs	Lugs	3¾	4½	4¼	3¾	3⅜	11.3

MULTITAPPED FOR TUBE CHECKERS: PRIMARIES 50/60 Hz.§

Section	STANCOR Part No.	Style	Secondary Rating (RMS)	Insulation Test RMS Volts•	Primary Volts	Pri.	Sec.	H	W	D	MW	MD	Wt. Lbs.
6	P-1834-3	A	117/107/85 @.20A 70 @.3CA 50 @.50A 35 @.60A 30/25/20/12@.80A 7.5/7/6.3/5 @3.0A 4/3.3/2.5/2 1.5/1.4/1.1	1500 1500 1500 1500 1500 1500	105/ 115/ 125	Leads	Leads/ Lugs	2⅝	4	2⅞	3 9/16	—	2.4

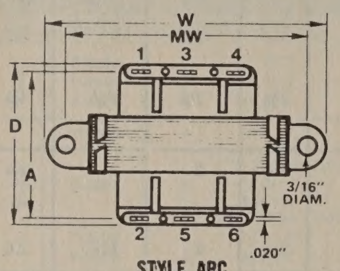
† Has Electrostatic shield. ‡ Windings may be connected in series or parallel if properly phased. • Available until stock is depleted. **ALL SECONDARY VOLTAGES ±3%.**

* Insulation Test Voltage: Twice allowable RMS Working Voltage plus 1000 Volts. § May be operated from a 400 Hz. source with no change in output ratings.

¢ Tapped at 100/105/110/115 Volts. ▲ R.M.S values. 🌡 For 60 Hz.

ESSEX STANCOR

FOR SMALL D.C. POWER SUPPLIES PLUG-IN PRINTED CIRCUIT TYPE POWER TRANSFORMERS



STYLE APC
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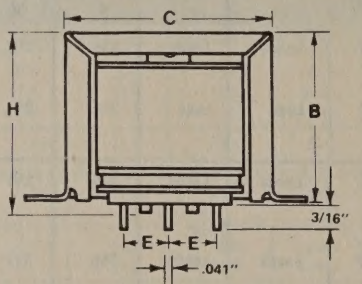
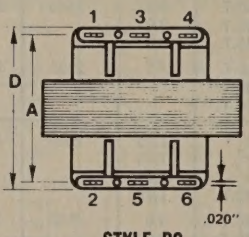
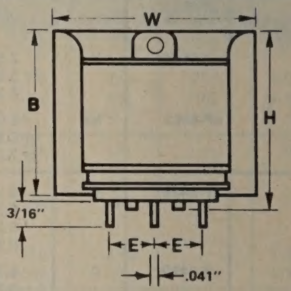


STYLE APC (SIDE VIEW)



STYLE PC
(BOTTOM VIEW)

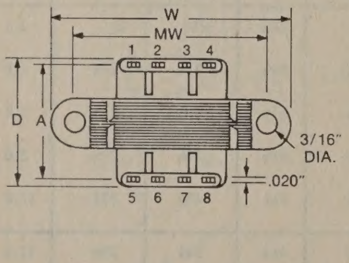


STYLE PC (SIDE VIEW)

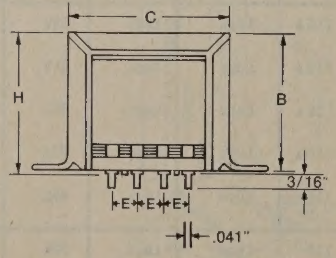
WITH SINGLE PRIMARY FOR 115 VOLTS, 50-60 HERTZ INPUT

Section	STANCOR Part No.	Style	VA Cap.*	Output From Two Secondary Windings▲			Case Dimension			Mounting Dimensions			Wt. Lbs.
				Individually	Parallel	Series	H	W	D	MW	A	E	
1	PPC-1	PC	1.5	4.0V. @ .188A.	4.0V. @ .376A.	8.0V. @ .188A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-2	PC	1.5	7.5V. @ .100A.	7.5V. @ .200A.	15V. @ .100A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-3	PC	1.5	15V. @ .050A.	15V. @ .100A.	30V. @ .050A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-4	PC	1.5	27V. @ .028A.	27V. @ .056A.	54V. @ .028A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-5	PC	1.5	38V. @ .020A.	38V. @ .040A.	76V. @ .020A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-6	PC	1.5	58V. @ .013A.	58V. @ .026A.	116V. @ .013A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
	PPC-7	PC	1.5	20V. @ .038A.	20V. @ .076A.	40V. @ .038A.	1⅛	1 13/32	1 5/32	—	1	0.31	.22
2	PPC-11	APC	4.5	4.0V. @ .562A.	4.0V. @ 1.13A.	8.0V. @ .562A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-12	APC	4.5	7.5V. @ .300A.	7.5V. @ .600A.	15V. @ .300A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-13	APC	4.5	15V. @ .150A.	15V. @ .300A.	30V. @ .150A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-14	APC	4.5	27V. @ .084A.	27V. @ .168A.	54V. @ .084A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-15	APC	4.5	38V. @ .060A.	38V. @ .120A.	76V. @ .060A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-16	APC	4.5	58V. @ .033A.	58V. @ .066A.	116V. @ .033A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
	PPC-17	APC	4.5	20V. @ .112A.	20V. @ .224A.	40V. @ .112A.	1 13/32	2⅜	1¼	2	1.1	0.4	.47
3	PPC-21	APC	7.5	4.0V. @ .940A.	4.0V. @ 1.88A.	8.0V. @ .940A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-22	APC	7.5	7.5V. @ .500A.	7.5V. @ 1.00A.	15V. @ .500A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-23	APC	7.5	15V. @ .250A.	15V. @ .500A.	30V. @ .250A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-24	APC	7.5	27V. @ .140A.	27V. @ .280A.	54V. @ .140A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-25	APC	7.5	38V. @ .100A.	38V. @ .200A.	76V. @ .100A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-26	APC	7.5	58V. @ .065A.	58V. @ .130A.	116V. @ .065A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66
	PPC-27	APC	7.5	20V. @ .188A.	20V. @ .376A.	40V. @ .188A.	1⅝	2 13/16	1 15/32	2⅜	1.3	0.4	.66

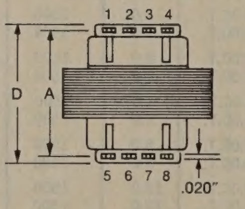
* All Primaries for 115V., 50-60 Hz. ▲ R.M.S. Values.



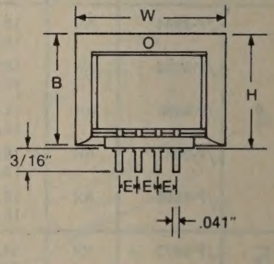
STYLE APC
(BOTTOM VIEW)



STYLE APC
(SIDE VIEW)



STYLE PC
(BOTTOM VIEW)



STYLE PC
(SIDE VIEW)

WITH DUAL PRIMARY FOR 115-230 VOLTS, 50-60 HERTZ INPUT

Section	STANCOR Part No.	Style	VA Cap.*	Output From Two Secondary Windings▲			Case Dimension			Mounting Dimensions			Wt. Lbs.
				Individually	Parallel	Series	H	W	D	MW	A	E	
4	PPC-8	PC	1.5	15V. @ 50MA.	15V. @ 100MA.	30V.C.T. @ 50MA.	1 3/16	1⅜	1⅛	—	1	0.20	.22
5	PPC-18	APC	4.5	6.3V. @ 350MA.	6.3V. @ 700MA.	12.6V.C.T. @ 350MA.	1 7/16	2⅜	1¼	2	1.13	0.28	.47
	PPC-19	APC	4.5	8V. @ 280MA.	8V. @ 560MA.	16V.C.T. @ 280MA.	1 7/16	2⅜	1¼	2	1.13	0.28	.47
	PPC-20	APC	4.5	12V. @ 180MA.	12V. @ 360MA.	24V.C.T. @ 180MA.	1 7/16	2⅜	1¼	2	1.13	0.28	.47
	PPC-28	APC	4.5	10V. @ 225MA.	10V. @ 450MA.	20V.C.T. @ 225MA.	1 7/16	2⅜	1¼	2	1.13	0.28	.47
	PPC-29	APC	4.5	115V. @ 20MA.	115V. @ 40MA.	230V.C.T. @ 20MA.	1 7/16	2⅜	1¼	2	1.13	0.28	.47

* All primaries for 115-230 V., 50-60 Hz. ▲ R.M.S. values.

ESSEX STANCOR

POWER SUPPLY TRANSFORMERS

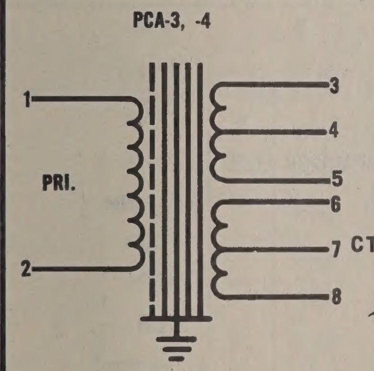
(FOR PERIPHERAL COMPUTER ACCESSORIES — "PCA SERIES")

Designed for use in power supplies delivering regulated positive and negative D.C. voltage for Op-Amps and separate 5 to 6 Volt regulated D.C. voltage for Logic circuits. All transformer ratings are for continuous duty with a 105°C. maximum operating temperature limit. All primaries for 120 volts, 50-60 Hertz. All have electrostatic shield grounded to core internally.

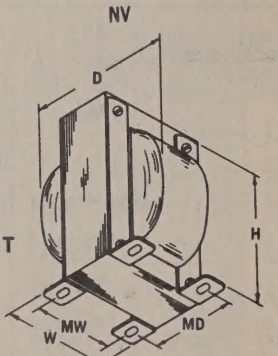
Sec-tion	STANCOR Part No.	Style	Sec. #1 A.C.▲		Sec. #2 A.C.▲		Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amps.	Volts	Amps.	Pri.	Sec.	H	W	D	MW	MD	
1	PCA-1	S	35C.T.	0.21	—	—	Lugs	Lugs	2⅜	2⅞	1⅝	2⅜	—	1.0
	PCA-2	S	33C.T.	0.35	—	—	Lugs	Lugs	2¹¹⁄₁₆	3⅛	1⅞	2¹³⁄₁₆	—	1.4
	PCA-3	NV	33C.T.	0.21	18C.T.	1.25	Lugs	Lugs	3⅛	2½	2⅝	2	2⅜	3.0
	PCA-4	NV	34C.T.	0.35	19C.T.	2.50	Lugs	Lugs	3³⁄₁₆	2¹³⁄₁₆	2⅞	2¼	2⅜	3.9

▲ R.M.S. values.

PCA-3, -4



NV



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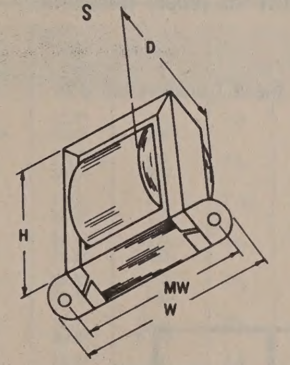
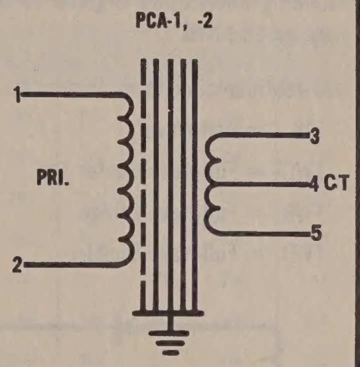


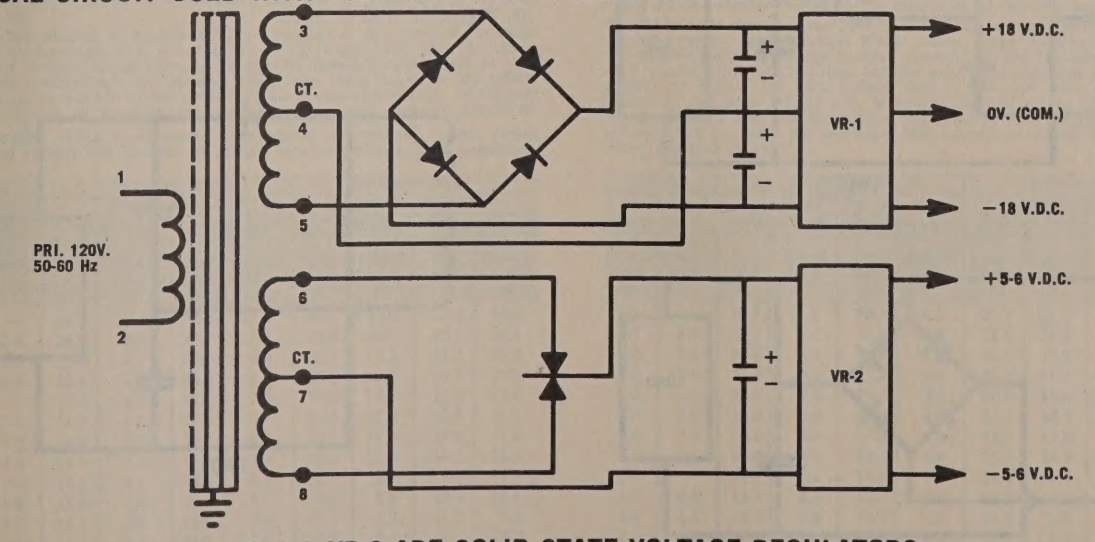
PCA-1, -2



D.C. OUTPUT RATINGS

STANCOR Part No.	Secondary No. 1 FWB Rectifier	Input Filter Cap.	Secondary No. 2 FWCT Rectifier	Input Filter Cap.
PCA-1	Pos. 21V. D.C. at 150MA. D.C. Neg. 21V. D.C. at 150MA. D.C.	500MF 500MF	—— ——	—— ——
PCA-2	Pos. 21V. D.C. at 250MA. D.C. Neg. 21V. D.C. at 250MA. D.C.	500MF 500MF	—— ——	—— ——
PCA-3	Pos. 21V. D.C. at 150MA. D.C. Neg. 21V. D.C. at 150MA. D.C.	500MF 500MF	8.5V. D.C. at 2.0 Amps. D.C. ——	1000MF ——
PCA-4	Pos. 21V. D.C. at 250MA. D.C. Neg. 21V. D.C. at 250MA. D.C.	500MF 500MF	8.0V. D.C. at 4.0 Amps. D.C. ——	3000MF ——

TYPICAL CIRCUIT USED WITH PCA-3 AND PCA-4 POWER TRANSFORMERS



VR-1 & VR-2 ARE SOLID STATE VOLTAGE REGULATORS

ESSEX STANCOR

D.C. POWER SUPPLY TRANSFORMERS

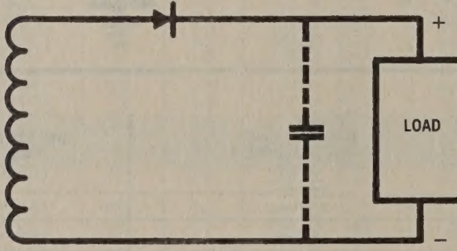
HOW TO DETERMINE SECONDARY AC (RMS) CURRENT RATINGS

The tabular data for the various Rectifier, Control and Filament types of transformers listed in this catalog shows A.C. (R.M.S) secondary current, unless otherwise indicated, as in the "RT" and "TP" series listings.

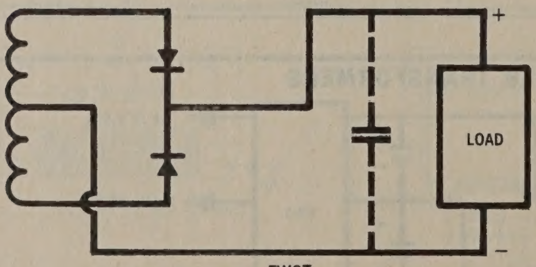
When used in various rectifier circuits, with the possibility of different types of loads, the RMS secondary current will be different for each specific condition. To assist the user, the following information is given so that the proper transformer may be selected.

The rectifier circuits as related to these transformers are:

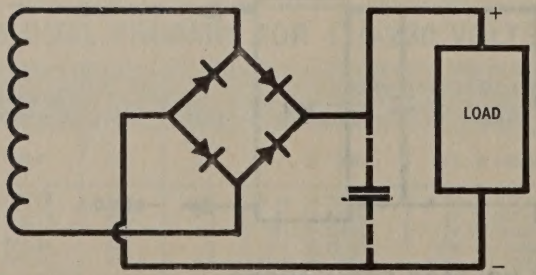
HW = Half-Wave
FWCT = Full-Wave Center Tap
FWB = Full-Wave Bridge
FWD = Full-Wave Doubler



HW



FWCT



FWB

The formula for the relation between secondary RMS current (I_{AC}) which the transformer has to deliver and the D.C. output current taken from the rectifier (I_{DC}) is:

$$I_{AC} = K_{FF} \times I_{DC}$$

where K_{FF} is the form factor. The factor for each circuit and type of load is as follows:

REACTOR LOAD

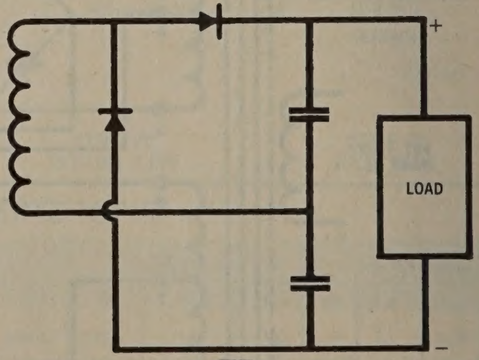
Rectifier Circuit	Form Factor
HW	1.25
FWCT	0.7
FWB	1.0

CAPACITOR LOAD

Rectifier Circuit	Form Factor
HW	2.3
FWCT	1.2
FWB	1.8
FWD	4.0 (approx.)

Only transformers with a CT connection are usable in the FWCT circuit and the FWD circuit will have only a capacity load. The size and type of capacitors used in the FWD circuit will affect the form factor. The factor shown is an approximate maximum for the full-wave symmetrical voltage doubler circuit using two similar electrolytic capacitors.

The transformer selected for a specific D.C. output voltage and current rating, with known type of load after the rectifier, should deliver sufficient RMS voltage to make up for the voltage drop in each rectifier junction plus any drop in a filter or regulator that is used.

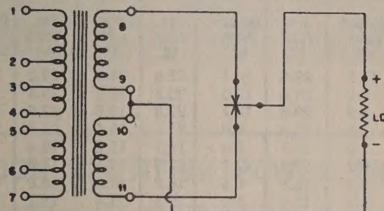


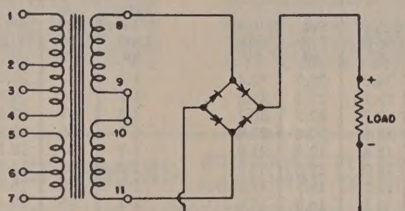
FWD

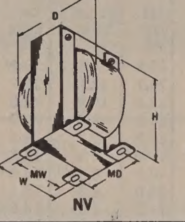
ESSEX STANCOR

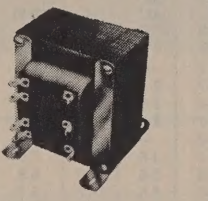
RECTIFIER TRANSFORMERS

UNIVERSAL RECTIFIER TRANSFORMERS: PRIMARIES 117 VOLTS 50/60 Hz.—SOLDER LUG TERMINATION









Section	STANCOR Part No.	Style	Rectifier Circuit	Range of Applied AC Volts Under Load (Approx.)	Output Resistive or Inductive Load Max. DC Volts	Output Resistive or Inductive Load Max. DC Amps.	Output Capacitive Load* Max. DC Volts	Output Capacitive Load* Max. DC Amps.	Case Dimension H	Case Dimension W	Case Dimension D	Mtg. Dimension MW	Mtg. Dimension MD	Wt. Lbs.
1	RT-201	NV	C.T. Bridge	11.7 to 29.4 11.1 to 28.5	11.2 23.0	2.0 1.25	13.8[1] 30.0[2]	2.0 1.25	3⅛	2½	2⅜	2	2⅛	2.5
	RT-202	NV	C.T. Bridge	12.0 to 29.8 12.0 to 29.8	11.1 24.3	4.0 2.0	14.7[3] 33.0[1]	4.0 2.0	3 7/16	2 13/16	2¾	2¼	2⅜	3.8
	RT-204	NV	C.T. Bridge	11.7 to 29.2 11.6 to 29.2	12.0 24.0	8.0 4.0	14.5[4] 32.4[3]	8.0 4.0	3 13/16	3⅛	3½	2½	2⅞	6.1
	RT-206	NV	C.T. Bridge	12.0 to 29.7 12.0 to 29.7	11.5 24.0	12.0 6.0	14.4[5] 32.0[6]	12.0 6.0	4 3/16	3 7/16	4	2¾	3¼	9.1
	RT-208	NV	C.T. Bridge	12.1 to 29.2 12.1 to 29.2	11.4 23.7	15.0 8.0	14.8[7] 32.5[4]	15.0 8.0	4 9/16	3¾	5	2 15/16	3¾	12.6
	RT-2012	NV	C.T. Bridge	12.2 to 29.0 12.2 to 29.0	11.4 23.5	22.5 12.0	14.3[8] 33.0[5]	22.5 12.0	5 5/16	4⅜	5⅞	3½	4¼	20.5
	RT-400	NV	C.T. Bridge	23.5 to 60.0 23.5 to 60.0	25.0 53.0	1.0 0.5	34.0[9] 74.0[10]	1.0 0.5	3⅛	2½	3⅜	2	2¼	2.7
	RT-401	NV	C.T. Bridge	24.0 to 59.0 24.0 to 59.0	25.0 52.5	2.0 1.0	34.0[11] 73.5[9]	2.0 1.0	3 7/16	2 13/16	3 11/16	2¼	2½	4.1
	RT-402	NV	C.T. Bridge	23.0 to 58.0 23.0 to 58.0	25.0 51.5	4.0 2.0	33.5[6] 72.5[9]	4.0 2.0	3 13/16	3⅛	4½	2½	3 1/16	6.9
	RT-408	NV	C.T. Bridge	25.0 to 53.5 25.0 to 53.5	— 44.0	— 8.0	— 63.0[4]	— 8.0	5 5/16	4⅜	6¾	3½	5¼	26.5
	RT-4012	NV	C.T. Bridge	25.0 to 53.0 25.0 to 53.0	— 43.5	— 12.0	— 60.0[5]	— 12.0	7⅛	5⅝	6½	4⅝	5½	34.0

* MFD Filter Capacitor: 1-1000, 2-500, 3-2000, 4-4000, 5-6000, 6-3000, 7-7500, 8-12000, 9-1500, 10-600, 11-2500

RECTIFIER CIRCUIT POWER TRANSFORMERS

Each transformer has the winding arrangement and terminal numbering shown in the schematic diagrams above. The primary winding is connected to terminals 1, 2, 3 & 4. A separate winding is connected to terminals 5, 6 & 7 that may be used in series with the primary to raise or lower the secondary voltage output. A variety of combinations is possible using the taps on both windings, plus the "Aiding" or "Bucking" action of the extra winding.

Designed for 117 V. 50/60 cycle operation; may also be satisfactorily operated at 400 cycles.

The secondary winding of each transformer consists of two identical windings connected to terminals 8 & 9 and to 10 & 11 respectively. Use the tables showing the various output voltages for specific terminal connections as your guide. Many combinations are possible other than those listed in the tables. All ratings shown are for normal convection air cooled applications. Select only rectifiers capable of handling the output voltages and currents described.

When operating these transformers continuously at maximum rated output voltage and current and because of certain other conditions, it is sometimes necessary to derate the rectified output current (DC) as much as 20%, in order to stay within the recommended operating temperature limit of 105 degrees Centigrade. The type of rectifier circuit and load (capacitive, inductive or resistive) determines the relative amount of current (RMS) in the transformer secondary winding. The relationship of AC to DC (secondary RMS current to rectified DC output) for typical circuits and loads is given in the Technical Data on Page 9 of this catalog. Operating duty cycle, type of cooling (natural convection in free air or otherwise) and the power line input voltage and frequency also have an effect on the transformer temperature. These things should all be properly related to the results in any specific application.

The "RT-Series" of transformers may also be used in other rectifier circuits than the Full-wave C.T. and Full-wave Bridge shown above. In circuits such as the Half-wave or Full-wave Voltage Doubler (symmetrical) and Full-wave Bridge, where a C.T. connection is not required, both secondary windings may be connected in parallel, to double the RMS current that is available from each secondary separately. The RMS voltage will, of course, be half of the amount available as that obtained with the secondaries connected in series. Please refer to the adjacent data to obtain the secondary RMS current as related to each rectifier circuit and type of load.

RT-201		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 2.0 A. DC				Output 1.25 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.4	11.2	28.8	13.8	28.5	23.0	27.9	30.0
1-7	2-6	26.0	9.8	25.7	11.7	25.4	20.0	25.1	26.4
1-6	2-5	23.0	8.4	22.7	9.9	22.3	17.3	21.8	22.2
1-7	2-5	20.9	7.4	20.8	8.6	20.2	15.4	19.8	19.7
1-3	—	19.4	6.7	19.1	7.6	18.6	13.9	18.2	17.6
1-7	3-6	17.8	6.1	17.6	6.7	17.2	12.8	16.8	15.7
1-6	3-5	16.3	5.3	16.1	6.0	15.7	11.2	15.2	13.8
1-7	3-5	14.9	4.7	14.8	5.3	14.3	10.3	14.1	12.4
1-4	—	14.2	4.4	14.2	5.0	13.7	9.7	13.5	11.6
1-7	4-6	13.4	4.0	13.3	4.4	12.7	8.8	12.5	10.4
1-6	4-5	12.4	3.6	12.4	3.9	11.7	7.9	11.7	9.5
1-7	4-5	11.7	3.3	11.7	3.5	11.1	7.4	11.1	8.7

* 1000 MFD. † 500 MFD.

RT-202		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 4.0 A. DC				Output 2.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.7	11.1	29.3	14.7	29.7	24.3	24.3	33.0
1-7	2-6	26.2	9.8	26.0	12.6	26.2	21.5	26.0	29.0
1-6	2-5	24.4	8.8	24.0	11.3	24.3	19.5	23.9	26.0
1-7	2-5	21.9	7.8	21.7	9.9	21.8	17.6	21.5	23.1
1-3	—	20.9	7.4	20.7	9.3	20.9	16.6	20.6	21.7
1-7	3-6	19.2	6.6	18.9	8.2	19.1	15.1	18.9	19.6
1-6	3-5	18.0	6.1	17.8	7.5	18.0	14.2	17.8	18.2
1-7	3-5	16.6	5.5	16.4	6.6	16.6	12.8	16.4	16.3
1-4	—	14.4	4.4	14.2	5.3	14.4	19.8	14.2	13.7
1-7	4-6	13.5	4.1	13.4	4.9	13.5	10.1	13.4	12.6
1-6	4-5	12.9	3.9	12.7	4.4	12.9	9.5	12.7	11.7
1-7	4-5	12.2	3.7	12.0	4.0	12.2	8.9	12.0	10.8

* 2000 MFD. † 1000 MFD.

ESSEX STANCOR

RECTIFIER TRANSFORMERS

RT-204		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 8.0 A. DC				Output 4.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.2	12.0	28.8	14.5	29.2	24.0	29.0	32.4
1-7	2-6	25.7	10.5	25.7	12.6	25.7	21.1	25.4	29.2
1-6	2-5	22.8	9.2	22.8	10.9	22.8	18.7	22.7	25.7
1-7	2-5	20.6	8.3	20.6	9.6	20.7	16.6	20.6	22.8
1-3	—	19.3	7.7	19.3	8.7	19.4	15.4	19.0	21.0
1-7	3-6	17.6	7.0	17.6	7.8	17.8	14.0	17.6	19.0
1-6	3-5	16.2	6.3	16.2	6.9	16.3	12.7	16.1	17.2
1-7	3-5	15.0	5.8	15.0	6.3	15.1	11.6	14.9	15.6
1-4	—	14.2	5.4	14.2	5.8	14.4	11.0	14.2	14.8
1-7	4-6	13.3	5.0	13.3	5.3	13.4	10.2	13.3	13.5
1-6	4-5	12.5	4.6	12.5	4.9	12.6	9.4	12.5	12.4
1-7	4-5	11.7	4.3	11.7	4.5	11.8	8.8	11.6	11.4

* 4000 MFD. † 2000 MFD.

RT-206		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 12.0 A. DC				Output 6.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.8	11.5	29.6	14.4	29.6	24.0	29.2	32.0
1-7	2-6	26.0	9.9	25.8	12.0	25.8	20.6	25.4	27.3
1-6	2-5	23.8	8.8	23.6	10.7	23.8	18.6	23.6	24.6
1-7	2-5	21.2	7.6	21.0	9.0	21.2	16.4	21.0	21.4
1-3	—	19.7	7.0	19.7	8.4	19.7	15.2	19.4	19.2
1-7	3-6	17.9	6.2	17.8	7.2	17.9	13.5	17.8	17.3
1-6	3-5	16.7	5.7	16.6	6.6	16.8	12.5	16.6	15.8
1-7	3-5	15.4	5.1	15.4	5.9	15.4	11.4	15.2	14.0
1-4	—	14.6	4.7	14.5	5.2	14.6	10.6	14.5	13.4
1-7	4-6	13.5	4.2	13.4	4.7	13.5	9.8	13.4	12.0
1-6	4-5	12.9	3.9	12.8	4.3	12.9	9.2	12.8	11.0
1-7	4-5	12.0	3.4	12.0	3.9	12.0	8.4	12.0	10.0

* 6000 MFD. † 3000 MFD.

RT-208		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 15.0 A. DC				Output 8.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.2	11.4	29.2	14.8	29.2	23.7	29.0	32.5
1-7	2-6	25.4	9.9	25.4	12.5	25.3	21.0	25.2	27.0
1-6	2-5	24.1	9.3	24.0	11.6	24.0	19.4	23.9	25.5
1-7	2-5	21.5	8.2	21.5	10.0	21.3	17.0	21.3	22.0
1-3	—	19.3	7.1	19.3	8.7	19.1	14.9	19.1	21.2
1-7	3-6	17.6	6.4	17.5	7.7	17.4	13.4	17.4	17.0
1-6	3-5	16.8	6.0	16.8	7.2	16.8	12.9	16.7	16.1
1-7	3-5	15.6	5.5	15.5	6.5	15.4	11.7	15.4	14.5
1-4	—	14.4	5.0	14.4	5.7	14.2	10.7	14.2	13.1
1-7	4-6	13.4	4.5	13.4	5.1	13.3	9.8	13.3	11.9
1-6	4-5	13.0	4.3	12.9	4.8	12.9	9.5	12.8	11.4
1-7	4-5	12.2	3.9	12.1	4.4	12.1	8.7	12.1	10.4

* 7500 MFD. † 4000 MFD.

RT-2012		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 22.5 A. DC				Output 12.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.1	11.4	28.8	14.3	29.0	23.5	28.7	33.0
1-7	2-6	25.2	9.7	25.1	12.0	25.3	20.4	25.1	28.0
1-6	2-5	23.6	8.9	23.6	10.9	23.5	18.8	23.5	25.7
1-7	2-5	21.1	7.7	21.0	9.4	21.0	16.3	20.9	22.3
1-3	—	19.3	7.2	19.3	8.3	19.2	14.8	19.2	20.2
1-7	3-6	17.7	6.3	17.7	7.2	17.5	13.4	17.5	17.7
1-6	3-5	16.9	6.0	16.9	6.7	16.8	12.5	16.8	16.7
1-7	3-5	15.6	5.4	15.7	5.9	15.5	11.5	15.5	15.1
1-4	—	14.6	4.9	14.6	5.4	14.5	10.7	14.5	13.7
1-7	4-6	13.5	4.4	13.5	4.7	13.5	9.7	13.4	12.6
1-6	4-5	13.0	4.3	13.0	4.5	13.0	9.3	13.0	11.9
1-7	4-5	12.2	3.9	12.1	4.0	12.2	8.6	12.0	10.8

* 11,250 MFD. † 6000 MFD.

RT-400		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 1.0 A. DC				Output 0.5 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	60.0	25.0	60.0	34.0	60.0	53.0	60.0	74.0
1-7	2-6	53.5	22.0	53.5	30.0	53.0	47.0	53.0	65.0
1-6	2-5	47.0	19.0	47.0	25.0	47.0	41.5	47.0	57.0
1-7	2-5	42.5	17.0	42.5	22.5	42.5	37.5	42.5	51.5
1-3	—	39.0	16.0	39.0	20.0	39.0	34.5	39.5	47.0
1-7	3-6	36.0	14.0	36.0	18.5	36.0	32.0	36.0	43.0
1-6	3-5	32.5	13.0	32.5	16.5	32.5	29.0	32.5	38.5
1-7	3-5	30.5	12.0	30.5	15.0	30.5	26.5	30.5	36.0
1-4	—	29.0	11.0	29.0	14.5	29.0	25.0	29.0	34.0
1-7	4-6	27.5	10.0	27.5	13.0	27.0	23.5	27.0	32.0
1-6	4-5	25.5	9.5	25.5	12.0	25.0	22.0	25.0	29.0
1-7	4-5	23.5	9.0	23.5	11.0	23.5	20.5	23.5	27.0

* 1500 MFD. † 600 MFD.

RT-401		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 2.0 A. DC				Output 1.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	59.0	25.0	59.0	34.0	59.5	52.5	59.5	73.5
1-7	2-6	53.0	22.0	52.5	30.0	53.0	46.5	52.5	65.0
1-6	2-5	48.5	20.0	48.0	27.0	48.5	43.0	48.0	59.5
1-7	2-5	43.5	18.0	43.5	24.0	44.0	39.0	44.0	53.5
1-3	—	42.0	17.0	42.0	22.5	42.0	37.0	42.0	51.0
1-7	3-6	38.0	15.0	38.0	20.5	38.5	33.5	38.5	46.5
1-6	3-5	36.0	14.5	36.0	19.0	36.0	31.5	36.0	43.5
1-7	3-5	33.0	13.0	33.0	17.0	33.5	29.0	33.5	40.0
1-4	—	29.0	11.0	29.0	14.5	29.0	25.0	29.0	34.5
1-7	4-6	27.0	10.5	27.0	13.0	27.0	23.0	27.0	32.0
1-6	4-5	25.5	10.0	25.5	12.5	26.0	22.0	26.0	30.5
1-7	4-5	24.0	9.0	24.0	11.5	24.5	20.5	24.5	28.5

* 2500 MFD. † 1500 MFD.

RT-402		Full-Wave C.T.				Full-Wave Bridge			
STANCOR Power Supply		Output 4.0 A. DC				Output 2.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	58.0	25.0	58.0	33.5	58.0	51.5	58.0	72.5
1-7	2-6	51.0	21.5	51.0	29.0	51.0	45.0	51.0	63.5
1-6	2-5	45.5	19.0	45.5	25.0	45.5	40.0	45.5	56.0
1-7	2-5	41.0	17.0	41.0	22.0	41.0	36.0	41.0	50.0
1-3	—	38.0	15.5	38.0	20.5	38.5	33.5	38.5	46.5
1-7	3-6	35.0	14.0	35.0	18.5	35.0	30.5	35.0	42.5
1-6	3-5	32.0	13.0	32.0	16.5	32.0	28.0	32.0	39.0
1-7	3-5	29.5	12.0	29.5	15.0	30.0	26.0	30.0	36.0
1-4	—	28.0	11.0	28.0	14.0	28.5	24.5	28.5	33.5
1-7	4-6	26.0	10.0	26.0	13.0	26.5	22.5	26.5	31.5
1-6	4-5	24.5	9.5	24.5	12.0	25.0	21.0	25.0	29.0
1-7	4-5	23.0	9.0	23.0	11.0	23.5	20.0	23.5	27.0

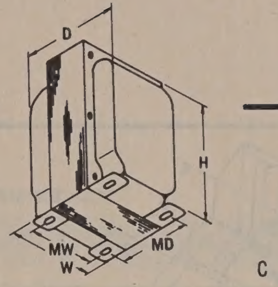
* 3000 MFD. † 1500 MFD.

RT-408/RT-4012		RT-408 Full-Wave Bridge				RT-4012 Full-Wave Bridge			
STANCOR Power Supply		Output 8.0 A. DC				Output 12.0 A. DC			
		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 vac Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	53.5	44.0	53.0	63.0	53.0	43.5	53.0	60.0
1-7	2-6	50.0	40.5	50.0	59.0	49.5	40.0	49.0	55.0
1-6	2-5	45.3	37.0	45.0	52.0	43.5	34.0	43.0	48.0
1-7	2-5	42.5	34.5	42.0	48.0	41.5	32.0	41.0	45.4
1-3	—	37.5	30.5	37.5	40.0	37.5	29.0	37.0	40.0
1-7	3-6	35.5	27.5	35.5	39.0	35.5	27.0	35.0	37.5
1-6	3-5	32.5	25.0	33.0	35.5	32.8	24.0	32.7	34.0
1-7	3-5	31.5	24.0	31.5	31.5	31.0	23.0	30.8	31.0
1-4	—	29.0	21.5	29.0	29.5	29.0	21.2	29.0	29.0
1-7	4-6	27.5	20.5	27.5	28.0	27.8	20.0	28.0	28.0
1-6	4-5	26.0	19.5	26.0	26.0	26.0	19.0	26.0	25.0
1-7	4-5	25.0	18.0	25.0	25.0	25.0	18.0	25.0	24.0

* 4000 MFD. † 6000 MFD.

ESSEX STANCOR

RECTIFIER & TRANSISTOR POWER TRANSFORMERS

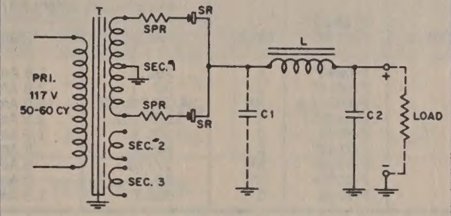


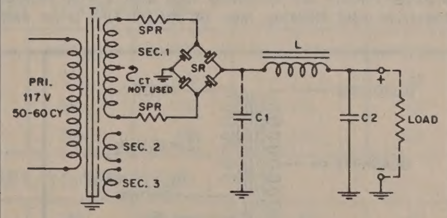
SILICON RECTIFIER POWER TRANSFORMERS: PRIMARIES 117 VOLTS 50/60 Hz.§ LEAD WIRE TERMINATION

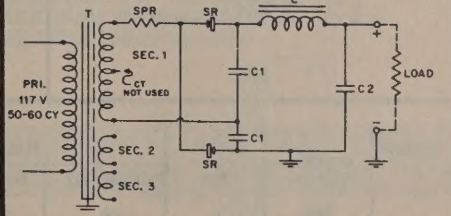
Section	STANCOR Part No.	Style	Secondary #1 Volts	Secondary #1 DCMA‡	Secondary #2 Volts	Secondary #2 Amps.	Secondary #3 Volts	Secondary #3 Amps.	Case Dimension H	Case Dimension W	Case Dimension D	Mtg. Dimension MW	Mtg. Dimension MD	Wt. Lbs.
1	• RP-400	C	400 C.T.	400	6.3	3.0	6.3	3.0	4¼	3 7/16	4¼	2¾	3 1/16	7.1
	• RP-600	C	300 C.T.	600	6.3	2.5	6.3	2.5	4¼	3 7/16	4¼	2¾	3 1/16	7.1
	RP-800	C	200 C.T.	800	6.3	2.0	6.3	2.0	4¼	3 7/16	4⅛	2¾	2 15/16	6.9
	• RP-1600	C	100 C.T.	1600	6.3	1.5	6.3	1.5	4¼	3 7/16	3⅞	2¾	2 11/16	6.0
	• RP-2000	C	80 C.T.	2000	6.3	1.5	6.3	1.5	4¼	3 7/16	4	2¾	2 13/16	6.5
	• RP-2500	C	60 C.T.	2500	6.3	1.5	6.3	1.5	4¼	3 7/16	3⅞	2¾	2 11/16	6.0

‡ Refer to operating. Conditions as shown below.

Section	STANCOR No.	SR†	L STANCOR No.	C1 (in MFD)	C2 (in MFD)	SPR*	DC Output Volts	DC Output MA.	Rectifier Load
2	RP-400	Four #F-4	C-2709	10	10	Yes	192	400	Capacitive
	RP-400	Four #F-4	C-2690	—	200	No	173	540	Inductive
	RP-600	Four #F-6	C-2690	80	80	Yes	190	600	Capacitive
	RP-600	Four #F-6	C-2690	—	125	No	126	1090	Inductive
	RP-800	Two #40-L	C-2690	40	150	Yes	105	800	Capacitive
	RP-800	Two #40-L	C-2690	—	350	No	86	1340	Inductive
	RP-1600	Two #40-L	C-2690	200	200	Yes	53	1600	Capacitive
	RP-1600	Two #40-L	C-2690	—	300	No	41	2600	Inductive
	RP-2000	Two #40-L	C-2690	500	500	Yes	47	2000	Capacitive
	RP-2000	Two #40-L	C-2686	—	1000	No	33	2950	Inductive
	RP-2500	Two #40-LF	C-2691	500	500	Yes	31	2500	Capacitive
	RP-2500	Two #40-LF	C-2686	—	1000	No	23	3950	Inductive
3	RP-400	Four #F-4	C-1710	8	10	Yes	502	150	Capacitive
	RP-400	Four #F-4	C-1722	—	20	No	330	302	Inductive
	RP-600	Four #F-6	C-2334	8	20	Yes	322	305	Capacitive
	RP-600	Four #F-6	C-2690	—	125	No	285	425	Inductive
	RP-800	Four #F-6	C-2709	30	40	Yes	247	377	Capacitive
	RP-800	Four #F-6	C-2708	—	250	No	172	625	Inductive
	RP-1600	Four #F-4	C-2690	40	80	Yes	100	880	Capacitive
	RP-1600	Four #F-4	C-2690	—	300	No	88	1160	Inductive
	RP-2000	Four #F-4	C-2690	100	100	Yes	93	810	Capacitive
	RP-2000	Four #40-L	C-2690	—	250	No	71	1450	Inductive
	RP-2500	Four #40-L	C-2690	200	200	Yes	70	1060	Capacitive
	RP-2500	Four #40-L	C-2690	—	500	No	50	1950	Inductive
4	RP-400	Four #F-6	C-1420	8	0.5	Yes	1040	75	Capacitive
	RP-600	Four #F-6	—	60	—	Yes	802	142	Capacitive
	RP-800	Two #F-6	—	80	—	Yes	536	188	Capacitive
	RP-1600	Two #F-6	C-2326	80	16	Yes	240	325	Capacitive
	RP-2000	Two #F-6	—	150	—	Yes	212	390	Capacitive
	RP-2500	Two #40-L	—	500	—	Yes	150	553	Capacitive







NOTE: Filtering shown permits maximum output ripple voltage of 3% or less. § May be operated from a 400 Hz. source with no change in output ratings.

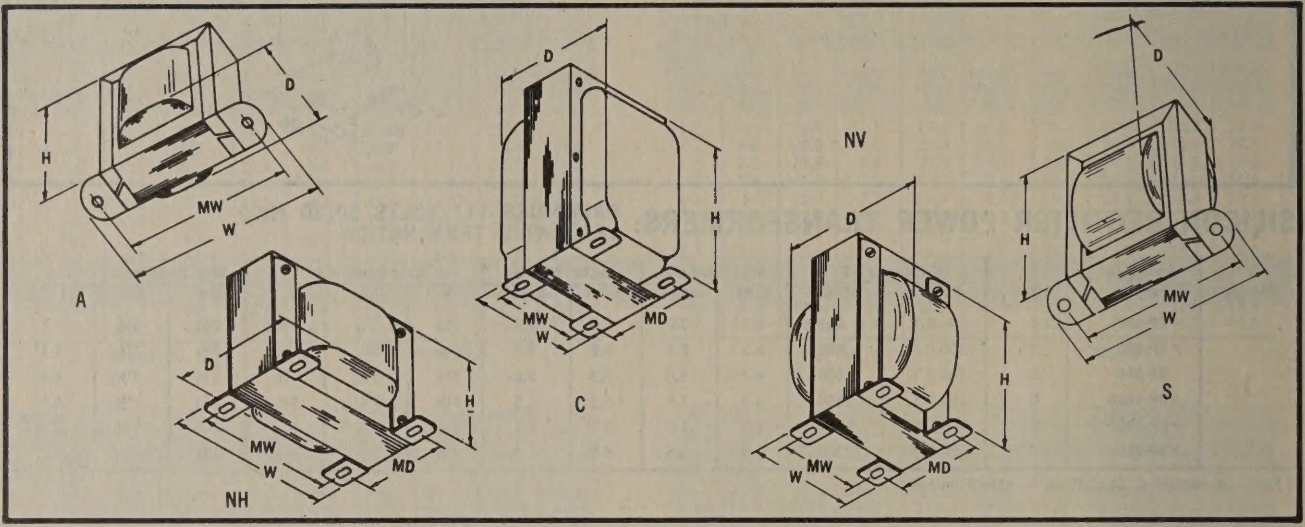
† Quantity Shown is Total Number used in a given circuit. Rectifiers should be equivalent to Sarkes Tarzian numbers shown.

* Surge protection resistors are recommended when capacitor input filters are used. Allow 3.3 ohms per 70 volts R.M.S. applied voltage. Transformers secondary winding DC resistance may be used as part or all of the amount required.

• Available until stock is depleted.

ESSEX STANCOR

RECTIFIER AND TRANSISTOR POWER TRANSFORMERS



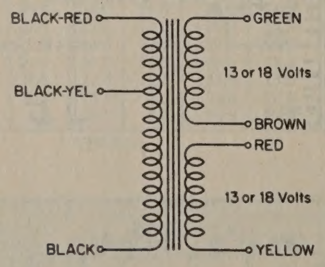
FOR TRANSISTOR POWER SUPPLIES: PRIMARIES 117 VOLTS 60 Hz.§—LEAD WIRE TERMINATION, EXCEPT †

Section	STANCOR Part No.	Style	Secondary #1		Secondary #2		Case Dimension			Mounting Dimension		Wt. Lbs.
			Volts	Amperes	Volts	Amperes	H	W	D	MW	MD	
1	P-8604*	A	20C.T.	1.0 Amps. RMS	—	—	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
	P-8614*	C	30	3.0 Amps. RMS	—	—	3½	2¹³⁄₁₆	3⅝	2¼	2⁷⁄₁₆	4.2
	√P-8621‡▲	NH	24/26/28/30	15.0 Amps. RMS	—	—	3¹³⁄₁₆	4½	5½	3¹¹⁄₁₆	4⅜	17.0
	√P-8623‡†	S	18/20/22	2.0 Amps. RMS	—	—	3⅛	3⅝	2¼	3⅛	—	2.5
	P-8197	C	50C.T.	1.0 Amps. RMS	—	—	3⅛	2½	2¹¹⁄₁₆	2	1¾	2.3
	P-8198	C	54C.T.	.5 Amps. RMS	6.3	.5 Amps. RMS	2⅝	2³⁄₁₆	2⁹⁄₁₆	1¾	1⅝	1.7
	P-8193•	NV	17/18	6 Amps. RMS	—	—	3¹³⁄₁₆	3⅛	3⅛	2½	2⅝	6.0
	P-8194•	NV	36	3 Amps. RMS	36	3 Amps. RMS	4⁹⁄₁₆	3¾	3¾	3	3	10.0
	P-8196	C	80C.T.	1.5 Amps. RMS	—	—	3½	2¹³⁄₁₆	3⅝	2¼	2⅜	4.5

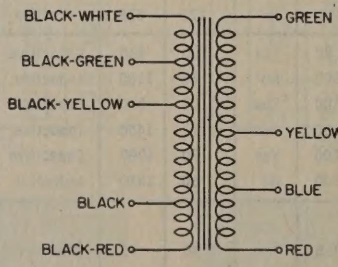
• Write for Bulletin #587 for Rectifier Circuits showing DC Voltages and allowable DC current.
§ May be operated from a 400 Hz. source with no change in output ratings.
* May be operated from 117 volts 50/60 Hz. at full rated load.
√ New item.
‡ Secondary is one tapped winding.
▲ Secondary leads have lugs attached.
† Has solder lug terminations.

RECTIFIER TRANSFORMERS: PRIMARIES 117 VOLTS 60 Hz.§—LEAD WIRE TERMINATION

Multiple Primary and Secondary Taps offer a wide selection of output Voltages. All DC current ratings are based on capacitor input Filtering. Max. DC Ma For TP-1 is for each Secondary.



TP-1



6.5
7.5
8
9
9.5
10
13.5 C.T.
14.5 C.T.
16 C.T.
18 C.T.
19 C.T.
20
21 C.T.
22
24
26.5 C.T.
27
28
29 C.T.
31.5
32 C.T.
35.5 C.T.
37 C.T.
42 C.T.

Typical Secondary AC Voltages

TP-2 TP-3 TP-4 TP-5 TP-6

Section	STANCOR Part No.	Style	Max. DCMA			Case Dimension			Mounting Dimension		Wt. Lbs.
			Full-Wave C.T.	Bridge	Half-Wave	H	W	D	MW	MD	
2	TP-1	C	1500	900	450	3⅛	2½	3	2	2	2.7
	TP-2	A	150	100	50	1⅝	2⅞	1⅞	2⅜	—	0.7
	TP-3	A	400	300	150	2⅜	3¾	2⅛	3⅛	—	1.5
	TP-4	C	1500	1000	500	3⅛	2½	3⅛	2	2⅛	3.2
	TP-5	A	1100	750	375	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
	√TP-6	A	50	35	25	1⅜	2⅜	1⁷⁄₁₆	2	—	0.45

§ May be operated from a 400 Hz. source with no change in output ratings. √ New item.

ESSEX STANCOR

RECTIFIER & TRANSISTOR POWER TRANSFORMERS

MINIATURIZED CONTROL TRANSFORMERS

PRIMARIES 117 VOLTS 50/60 Hz.§ SECONDARIES 12 VOLTS—LEAD WIRE TERMINATION

Section	STANCOR Part No.	Style	Secondary Amperes			Case Dimension			Mtg. Dimension	Wt. Lbs.
			RMS	Bridge†	Half-Wave†	H	W	D	MW	
1	P-8390	A	.150	.100 DC	.050 DC	1¼	2⅛	1¼	1¾	.25
	P-8391	A	.350	.200 DC	.110 DC	1⅜	2⅜	1⅜	2	.35
	P-8392	A	.700	.450 DC	.225 DC	1⅝	2⅞	1½	2⅜	.60
	P-8393	A	1.200	.750 DC	.375 DC	2	3¼	1⅝	2¹³⁄₁₆	.85

§May be operated from a 400 Hz. source with no change in output ratings.

MINIATURIZED CONTROL TRANSFORMERS

PRIMARIES 117 VOLTS 50/60 Hz. § SECONDARIES 24 VOLTS C.T.—LEAD WIRE TERMINATION

Section	STANCOR Part No.	Style	Secondary Amperes			Case Dimension			Mtg. Dimension	Wt. Lbs.
			RMS	Full-Wave†	Bridge†	H	W	D	MW	
2	P-8394	A	.085	.135 DC	.065 DC	1¼	2⅛	1¼	1¾	.25
	P-8395	A	.200	.275 DC	.135 DC	1⅜	2⅜	1⅜	2	.35
	P-8396	A	.400	.550 DC	.270 DC	1⅝	2⅞	1½	2⅜	.60
	P-8397	A	.700	.925 DC	.450 DC	2	3¼	1⅝	2¹³⁄₁₆	.85

PRIMARIES 230 VOLTS 50/60 Hz. § SECONDARIES 24 VOLTS C.T.—LEAD WIRE TERMINATION

3	P-8720	A	.085	.135 DC	.065 DC	1¼	2⅛	1¼	1¾	.25
	P-8721	A	.200	.275 DC	.135 DC	1⅜	2⅜	1⅜	2	.35
	P-8722	A	.400	.550 DC	.270 DC	1⅝	2⅞	1½	2⅜	.60
	P-8723	A	.700	.925 DC	.450 DC	2	3¼	1⅝	2¹³⁄₁₆	.85

PRIMARIES 117 VOLTS 50/60 Hz.§ SECONDARIES 28 VOLTS C.T.—LEAD WIRE TERMINATION

4	P-8600	A	.085	.110 DC	.065 DC	1¼	2⅛	1¼	1¾	.25
	P-8601	A	.175	.225 DC	.125 DC	1⅜	2⅜	1⅜	2	.35
	P-8602	A	.300	.350 DC	.200 DC	1⅝	2⅞	1½	2⅜	.60
	P-8603	A	.800	1.000 DC	.500 DC	2	3¼	2	2¹³⁄₁₆	1.0

PRIMARIES 117 VOLTS 50/60 Hz.§ SECONDARIES 36 VOLTS C.T.—LEAD WIRE TERMINATION

5	P-8610	A	.065	.075 DC	.045 DC	1¼	2⅛	1¼	1¾	.25
	P-8611	A	.135	.175 DC	.100 DC	1⅜	2⅜	1⅜	2	.35
	P-8612	A	.300	.350 DC	.200 DC	1⅝	2⅞	1½	2⅜	.60
	P-8613	A	.550	.650 DC	.350 DC	2	3¼	1⅝	2¹³⁄₁₆	1.0

PRIMARIES 230 VOLTS 50/60 Hz. § SECONDARIES 36 VOLTS C.T.—LEAD WIRE TERMINATION

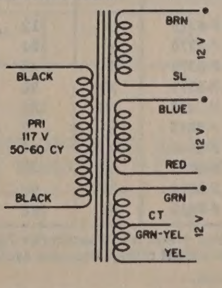
6	P-8728	A	.065	.075 DC	.045 DC	1¼	2⅛	1¼	1¾	.25

§May be operated from a 400 Hz. source with no change in output ratings.

VERSATILE LOW CURRENT CONTROL TRANSFORMERS: PRIMARIES 117 VOLTS 50/60 Hz.§ LEAD WIRE TERMINATION MULTIPLE SECONDARIES

Three isolated 12 Volt Secondaries (one with a center tap) provide many combinations of output voltages and current by series or parallel combinations.

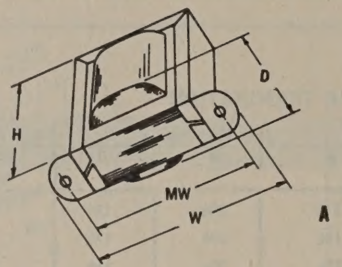
Section	STANCOR Part No.	Style	Amperes▲ Each Sec.	Case Dimension			Mtg. Dim.	Wt. Lbs.
				H	W	D	MW	
7	P-8361	S	.10	1¾	2	1½	1¾	.36
	P-8362	S	.15	2	2⅜	1¾	2	.60
	P-8363	S	.25	2⅜	2⅞	1¾	2⅜	.85
	P-8364	S	.50	2⅜	2⅞	2⅛	2⅜	1.25



• New Part Number † All values of output DC are based on a capacitive load.
§May be operated from a 400 Hz. source with no change in output ratings.
▲ R.M.S. values.

ESSEX STANCOR

CONTROL TRANSFORMERS



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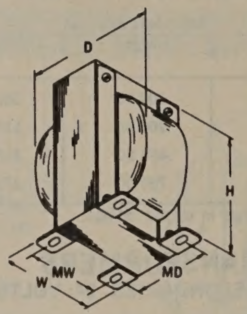

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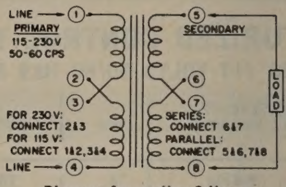
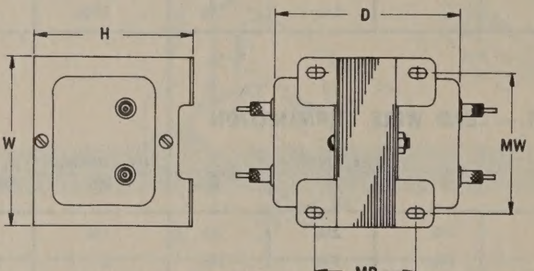
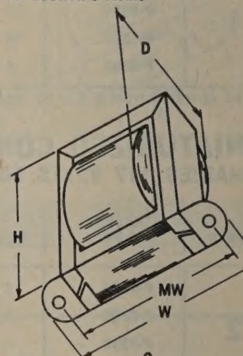


Diagram for section 3 items



STYLE NCF & PCF



S

NORMAL REACTANCE TYPE: PRIMARIES 115 VOLTS 50/60 Hz.—LEAD WIRE TERMINATION§

Section	STANCOR Part No.	Secondary ▲			Case Dimension			Mounting Dimension		Approx. Wt. Lbs.
		Volts	Amps.	V-A Cap.	H	W	D	MW	MD	
1	•NCF-24150	24	6.25	150	4	4¼	4⅛	3¾	3	8½
	•NCF-32150	32	4.7	150	4	4½	4⅛	3¾	3	8½

POWER CIRCUIT TRANSFORMERS: PRIMARIES 50/60 Hz.—LEAD WIRE TERMINATION§

Section	STANCOR Part No.	Primary Volts	Secondary ▲			Case Dimensions			Mounting Dimensions		Weight Lbs.
			Volts	Amps.	V-A Cap.	H	W	D	MW	MD	
2	PCF-2025	230	115	.25	25	2 13/16	3	3	2⅜	1½	2
	PCF-2050	230	115	.45	50	2 13/16	3	3½	2⅜	2	2¾
	PCF-24075	230/460	115	.65	75	3 3/16	3½	3⅝	3	2¼	4¼
	PCF-24250	230/460	115	2.2	250	4 9/16	5¼	4 9/16	4¼	3	12

PRIMARIES 115/230 VOLTS 50/60 Hz.§—SOLDER LUG TERMINATION—WITH DUAL SECONDARY WINDINGS#

Typical Applications: Automatic Assembly equipment. Relays, Solenoids, Small Motors, Speed Changers, Recording Devices, Pumps, Electronic Tubes, Heating Elements, Elevators, Door Openers, Automatic Musical Instruments, Low Voltage Lighting Signal Lamps, Spark Plug Testers, Control Valves for Fluids and Gases, Fans and Blowers, Mechanical and Electrical Signs and similar applications.

Section	STANCOR Part No.	Style	V-A Cap.	Output From Two Secondary Windings* ▲			Case Dimension			Mounting Dimension		Wt. Lbs.
				Individually	Parallel	Series	H	W	D	MW	MD	
3	P-6375	S	12	6V. @ 1A.	6V. @ 2A.	12V. @ 1A.	2⅜	2⅞	1⅝	2⅜	—	1.0
	P-6376	S	24	6V. @ 2A.	6V. @ 4A.	12V. @ 2A.	2¾	3⅛	1⅞	2 13/16	—	1.5
	P-6377	S	48	12V. @ 2A.	12V. @ 4A.	24V. @ 2A.	3⅛	3⅝	2¼	3⅛	—	2.5
	P-6378	NV	96	12V. @ 4A.	12V. @ 8A.	24V. @ 4A.	3 7/16	2 13/16	2⅞	2¼	2¼	4.2
	P-6379	NV	192	12V. @ 8A.	12V. @ 16A.	24V. @ 8A.	4 3/16	3 7/16	3⅜	2¾	3	8.0
	P-8615	S	12	24V. @ 0.25A.	24V. @ 0.5A.	48V. @ 0.25A.	2⅜	2⅞	1⅝	2⅜	—	1.0
	P-8616	S	24	24V. @ 0.5A.	24V. @ 1A.	48V. @ 0.5A	2¾	3⅛	1⅞	2 13/16	—	1.5
	P-8617	S	48	24V. @ 1A.	24V. @ 2A.	48V. @ 1A.	3⅛	3⅝	2¼	3⅛	—	2.5
	P-8618	NV	96	24V. @ 2A.	24V. @ 4A.	48V. @ 2A.	3 7/16	2 13/16	2 15/16	2¼	2¼	4.2
	P-8619	NV	192	24V. @ 4A.	24V. @ 8A.	48V. @ 4A.	4 3/16	3 7/16	3⅜	2¾	3	8.0

* By connecting primaries in series (for 230 Volts) but using only 115 Volts input, a series of half voltage output ratings becomes available at the full rated current from each secondary.

▲ R.M.S. values.

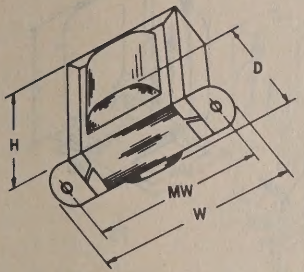
# (Refer to Schematic Diagram above.)

• Available until stock is depleted.

§ May be operated from a 400 Hz. source with no change in output ratings.

ESSEX STANCOR

AUTO TRANSFORMERS



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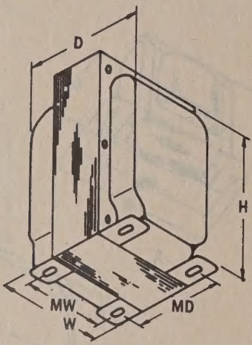

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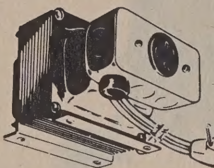

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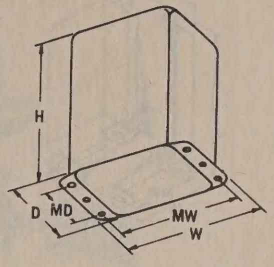

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STEP-DOWN AUTO-TRANSFORMERS: PRIMARIES 230 VOLTS 50/60 Hz., LINE CORD & PLUG§ SECONDARIES 115 VOLTS, STANDARD FEMALE RECEPTACLE, EXCEPT †

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Style	Case Dimension			Mounting Dimension		Wt. Lbs.
							H	W	D	MW	MD	
1	P-6287	230	115	40	1500	C	3½	2⅝	2½	2	1½	2.2
	√P-8620†	230	115	50	1500	A	2⁵⁄₁₆	3¹¹⁄₁₆	1⅞	3⅛	—	1.5
	P-8630	230	115	85	1500	C	3½	2⅝	2¾	2	1¾	2.5
	P-8631	230	115	125	1500	C	3½	2⅝	3	2	2	3.0
2	√P-8632	230	115	200	1500	C	3⅞	3⅛	3¾	2½	2	4.2
	√P-8633	230	115	300	1500	C	3⅞	3⅛	4⅛	2½	2⁵⁄₁₆	5.2
	√P-8634	230	115	400	1500	C	3⅞	3⅛	4¾	2½	3	7.0
	√P-8635	230	115	500	1500	C	4⁹⁄₁₆	3¾	4¾	3	3⁵⁄₁₆	10.3
	√P-8636	230	115	1000	1500	C	4⁹⁄₁₆	3¼	6⅜	3	4⅞	17.0
3	•SD-50	230	115	50	1500	SC	3½	3½	2⅞	3⅛	2	2.8
	•SD-100	230	115	100	1500	SC	4⁵⁄₁₆	4⁷⁄₁₆	3¹¹⁄₁₆	3⅞	2¾	4.3
	•SD-150	230	115	150	1500	SC	5⁵⁄₁₆	5¼	4⁹⁄₁₆	4¾	2½	7.0
	•SD-250	230	115	250	1500	SC	5⁵⁄₁₆	5¼	4⁹⁄₁₆	4¾	2½	8.8
	•SD-500	230	115	500	1500	SC	6¹⁄₁₆	5⅞	5⁵⁄₁₆	5⅜	3½	14.5
	•SD-1000	230	115	1000	1500	SC	7¹⁄₁₆	6½	6⅛	6	4¼	22.5

STEP-UP AUTO-TRANSFORMERS: PRIMARIES 115 VOLTS 50/60 Hz., LINE CORD & PLUG§ SECONDARIES 230 VOLTS, STANDARD FEMALE RECEPTACLES

4	√P-8637	115	230	85	1500	C	3½	2⅝	2¾	2	1¾	2.5
	√P-8638	115	230	125	1500	C	3½	2⅝	3	2	2	3.0
	√P-8639	115	230	300	1500	C	3⅞	3⅛	3⅞	2½	2⅜	5.2
	√P-8640	115	230	500	1500	C	4⁹⁄₁₆	3¾	4¾	3	3⁵⁄₁₆	10.3

LINE ADJUSTING AUTO-TRANSFORMERS: PRIMARIES 50/60 Hz., LINE CORD & SELECTOR SWITCH§ SECONDARIES FEMALE RECEPTACLE WITH VOLTMETER

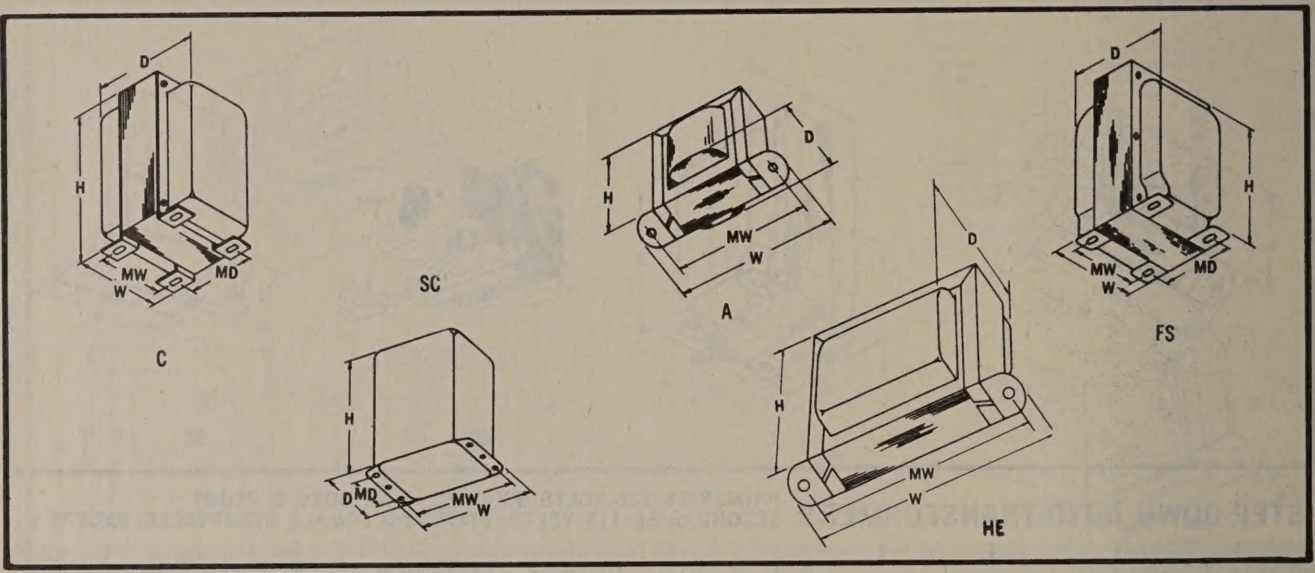
5	•PV-6442	65/75/90/100/ 115/130/145	115	350	500	C	5½	3¼	6½	3	5¹⁄₁₆	10.5

STEP-UP—STEP-DOWN AUTO-TRANSFORMERS: (Three Wire Line Cord and Receptacle) 208/230 VOLTS OR 230/208 VOLTS 60 Hz. BY MEANS OF CONNECTION CHANGE INSIDE OUTLET BOX

6	PSU-3000	208	230	3000	1750	PSU	4	4½	6	3¾	2⁹⁄₁₆	10.0

§ May be operated from a 400 Hz. source with no change in output ratings. † Has Leadwires. √ New item. • Available until stock is depleted.

ISOLATION/AUTO TRANSFORMERS



LINE ADJUSTING ISOLATION TRANSFORMERS: PRIMARIES 50/60 Hz.,§ LINE CORD & SELECTOR SWITCH SECONDARY STANDARD FEMALE RECEPTACLE

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Style	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Wt. Lbs.
1	•IS-50	105/115/125	125/115/105	50	1500	SC	4 11/16	4 7/16	3 11/16	3 7/8	2 3/4	5.0
	•IS-100	105/115/125	125/115/105	100	1500	SC	5 5/16	5 1/4	4 5/16	4 3/4	2 1/2	8.5

STRAIGHT ISOLATION: ELECTROSTATIC SHIELDS GRNDED. TO CORE: PRIMARIES 50/60 Hz. LINE CORD§ SECONDARY FEMALE RECEPTACLE, EXCEPT P-8622, P-6411, P-6411A, P-6412 & P-6413 LEAD TERMINATION

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Style	H	W	D	MW	MD	Wt. Lbs.
2	P-6413	115	115	0.6	1500	A	1 1/4	2 1/8	1 1/4	1 3/4	—	0.25
	P-6411	115	115	15	1500	A	2	3 1/4	1 7/8	2 13/16	—	1.0
	P-6411A	115	115	15	1500	HE	2	3 1/4	1 7/8	2 13/16	—	1.1
	P-6412	115	115	35	1500	A	2 3/8	3 3/4	2	3 1/8	—	1.7
	P-6410	115	115	50	1500	C	3 1/2	2 13/16	3 1/8	2 1/4	1 7/8	3.7
	P-6160	105/115/125#	115	100	1500	C	4 11/16	3 3/4	3 3/4	3	2 5/16	7.0
	P-8622	115†	115/230¶	150	1500	C	3 7/8	3 1/8	4	2 1/2	2 3/4	6.2
	P-6161	105/115/125#	115	250	1500	C	4 11/16	3 3/4	5 1/2	3	4 5/16	14.2
	P-6298	105/115/125#	115	500	1500	FS	7 5/8	5 5/8	7 1/4	4 5/8	4 1/4	28.0

STEP-DOWN ISOLATION: ELECTROSTATIC SHIELDS GRNDED. TO CORE: PRIMARIES 50/60 Hz., LINE CORD§ SECONDARY FEMALE RECEPTACLE, EXCEPT ‡

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Style	H	W	D	MW	MD	Wt. Lbs.
3	P-6406‡	115/230†*	115	50	1500	A	2 3/8	3 3/4	2 5/16	3 1/8	—	1.8
	P-6383	210/230/250#	115	100	1500	C	4 11/16	3 3/4	3 3/4	3	2 5/16	7.3
	P-6385	210/230/250#	115	250	1500	C	4 11/16	3 3/4	5 1/2	3	4 5/16	14.2
	P-6387	210/230/250#	115	500	1500	FS	7 3/4	5 5/8	7 1/8	4 5/8	4 1/4	29.5
	P-6389	210/230/250▲	115	1000	1500	FS	7 5/8	5 5/8	7 3/4	4 5/8	5	34.0
	P-6390	210/230/250▲	115	1500	1500	FS	7 5/8	5 5/8	9 1/4	4 5/8	6 1/2	50.0

ISOLATION TESTING TRANSFORMERS: ELECTROSTATIC SHIELDS GRNDED. TO CORE: PRIMARIES 50/60 Hz., LINE CORD SECONDARY THREE FEMALE RECEPTACLES§

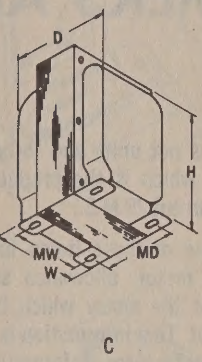
Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Style	H	W	D	MW	MD	Wt. Lbs.
4	P-6415	117	105/115/125	350	1500	C	5 1/2	4 5/8	5 13/16	3 1/2	4 1/16	17.0

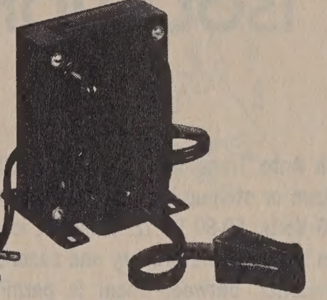
§ May be operated from a 400 Hz. source with no change in output ratings. ▲ Has primary terminals. # Has switch. ‡ Has Leadwires
* Primary is two separate 115 volt windings. † Has Electrostatic Shield on separate leadwire (not grounded). ¶ Secondary is two separate 115 volt windings.
•Available until stock is depleted.

Add Dept. EM to address to tell them you saw it in eem

ESSEX STANCOR

ISOLATION/AUTO TRANSFORMERS





GISD, GSD SERIES

Available in 9 sizes to handle continuous duty power requirements from 75 VA. to 1.5 KVA., 230 volts 50/60 Hz. to 115 volts, single phase.
All units built in type "C" mounting style semi-shielded construction. Case and core are connected internally to third wire in line cord and output receptacle, to comply with modern safety standards.

STEP-DOWN AUTO-TRANSFORMERS: (Three Conductor Line Cord and Receptacle)

230/115 VOLTS, 50/60 Hz.§ CASE AND CORE INTERNALLY CONNECTED TO THIRD CONDUCTOR OF NEMA STANDARD CORD AND RECEPTACLE FOR SAFETY

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Stye	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Wt. Lbs.
1	GSD-75	230	115	75	1500	C	3⅞	3³⁄₁₆	2¾	2½	1½	3.0
	GSD-100	230	115	100	1500	C	3⅞	3³⁄₁₆	3	2½	1¾	3.7
	GSD-150	230	115	150	1500	C	3⅞	3³⁄₁₆	3¼	2½	2	4.4
	• GSD-200	230	115	200	1500	C	3⅞	3³⁄₁₆	3⁵⁄₁₆	2½	2	4.4
	GSD-250	230	115	250	1500	C	3⅞	3³⁄₁₆	3⅝	2½	2⅜	5.8
	GSD-300	230	115	300	1500	C	3⅞	3³⁄₁₆	3⅝	2½	2⅜	5.8
	GSD-350	230	115	350	1500	C	3⅞	3³⁄₁₆	4⁵⁄₁₆	2½	3	7.3
	• GSD-400	230	115	400	1500	C	3⅞	3³⁄₁₆	4⁵⁄₁₆	2½	3⅝	7.3
	GSD-500	230	115	500	1500	C	4⅝	3¹³⁄₁₆	4⁷⁄₁₆	3	3⅜	10.6
	GSD-750	230	115	750	1500	C	4⅝	3¹³⁄₁₆	5³⁄₁₆	3	4⅛	14.4
	GSD-1000	230	115	1000	1500	C	4⅝	3¹³⁄₁₆	6	3	5	17.0
	GSD-1500	230	115	1500	1500	C	5½	4⅝	6	3½	4⅜	20.0

• Available until stock is depleted.

STRAIGHT ISOLATION: (Three Conductor Line Cord and Receptacle)

115/115 VOLTS, 50/60 Hz.§ CASE AND CORE AND ELECTROSTATIC SHIELD INTERNALLY CONNECTED TO THIRD CONDUCTOR OF NEMA STANDARD CORD AND RECEPTACLE FOR SAFETY

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Stye	H	W	D	MW	MD	Wt. Lbs.
2	GIS-100	115	115	100	1500	C	3½	2¹³⁄₁₆	3⁹⁄₁₆	2¼	2⁷⁄₁₆	4.5
	GIS-150	115	115	150	1500	C	3⅞	3³⁄₁₆	4³⁄₁₆	2½	2¹⁵⁄₁₆	7.0
	GIS-250	115	115	250	1500	C	4¹¹⁄₁₆	3¼	4⅜	3	3³⁄₁₆	9.3
	GIS-500	115	115	500	1500	C	4¹¹⁄₁₆	3¾	6	3	4¹³⁄₁₆	16.5
	GIS-1000	115	115	1000	1500	C	5½	4⁹⁄₁₆	8⅛	3½	6½	31.5

STEP-DOWN ISOLATION: (Three Conductor Line Cord and Receptacle)

230/115 VOLTS, 50/60 Hz.§ CASE AND CORE AND ELECTROSTATIC SHIELD INTERNALLY CONNECTED TO THIRD CONDUCTOR OF NEMA STANDARD CORD AND RECEPTACLE FOR SAFETY

Section	STANCOR Part No.	Input Voltage	Output Voltage	V-A Cap.	RMS Test Voltage	Stye	H	W	D	MW	MD	Wt. Lbs.
3	GISD-100	230	115	100	1500	C	3½	2¹³⁄₁₆	3⁹⁄₁₆	2¼	2⁷⁄₁₆	4.5
	GISD-150	230	115	150	1500	C	3⅞	3⅛	4³⁄₁₆	2½	2¹⁵⁄₁₆	7.0
	GISD-250	230	115	250	1500	C	4¹¹⁄₁₆	3¼	4¼	3	3³⁄₁₆	9.0
	GISD-500	230	115	500	1500	C	4¹¹⁄₁₆	3¾	6	3	4¹³⁄₁₆	16.0
	GISD-1000	230	115	1000	1500	C	5½	4⁹⁄₁₆	8⅛	3½	6½	31.0

§ May be operated from a 400 Hz. source with no change in output ratings.

WHY & WHERE AUTO TRANSFORMERS & ISOLATION TRANSFORMERS ARE USED

AUTO TRANSFORMERS

Stancor stock Auto Transformers are normally connected for either step-down or step-up applications involving line voltages of 115 or 230 Volts, 50-60 Hertz. Where it is not necessary to have isolation between the primary and secondary circuits, and a direct connection between them is permissible, the Auto Transformer offers the advantages of smaller size and less weight plus lower cost.

This type of unit is generally used in applications involving American appliances used abroad where our standard 115 Volt equipment must operate from a 230 Volt source. It is also used for foreign appliances designed for 230 Volt operation, which are to be used on our 115 Volt circuits. Our catalog items are designed for continuous rated output on either 50 or 60 Hertz. It is important to bear in mind that the Auto Transformer or Isolation type changes only the voltage levels and does not change the frequency from 50 to 60 Hertz or vice versa. In appliances using synchronous motors, such as clocks or phonograph record changers and players, the speed will be different when using them on a frequency which differs from the frequency they were originally designed for. In these cases the manufacturer of the appliance should be consulted to obtain the proper motor.

The V-A rating is equivalent to a Wattage rating where a resistive load and/or unity power factor exists. When inductive loads such as motors are used (as in a motor driven appliance) the power factor is not unity and to be accurate the output is expressed in V-A, which is the product of the output voltage and the output current (R.M.S.)

When selecting one of these items for use with an appliance which includes a motor, allowance should be made for the starting current of the motor which is somewhat higher than the running current. This information is generally available from the appliance manufacturer. Information pertaining to the AC Wattage or current required by an appliance is generally marked on the item by the manufacturer and should be observed. It is much better to buy a transformer with a larger V.A. rating than you will actually need because of larger motor starting currents and variations in the line voltage and/or frequency in some locations, which could cause overheating.

When using Auto Transformers of the two-conductor termination type it is necessary that the power line polarity be observed since one side of the 115 Volt circuit is normally at ground potential. Use of polarized plugs and receptacles is an aid in observing proper polarity. The case of the transformer is not connected to any part of the electrical winding for two conductor terminations but it is a good safety precaution to ground the case, if possible. Where there are three-conductor termination plugs and receptacles the third or grounding conductor is connected to the case internally and therefore the case is automatically connected to the conduit or ground system of the electrical power line wiring.

ISOLATION TRANSFORMERS

Isolation Transformers are used where a direct connection between primary and secondary circuits is not desired and the circuits must be isolated. This results in a larger, heavier and more costly item for a given power rating. However, in addition to the isolating advantages an electrostatic shield is generally added to minimize capacitive coupling between primary and secondary circuits. This helps to minimize the transfer of unwanted power line transients and interference from other sources connected to the power line by capacitive coupling to the secondary circuit. The standard insulation test voltage rating between windings and between each winding and the core is 1,500 Volts R.M.S. This is normally sufficient for 115 and 230 Volt operation.

The V-A rating should be selected for each specific application, with allowance for any abnormal load or environmental conditions. All catalog items have an operating temperature limit of 105 Degrees C. (Designed for a 65 Degrees C. maximum temperature rise above a maximum ambient temperature of 40 Degrees C., with unrestricted free air ventilation.) V-A output ratings are for continuous operation from the specified input voltage and frequency.

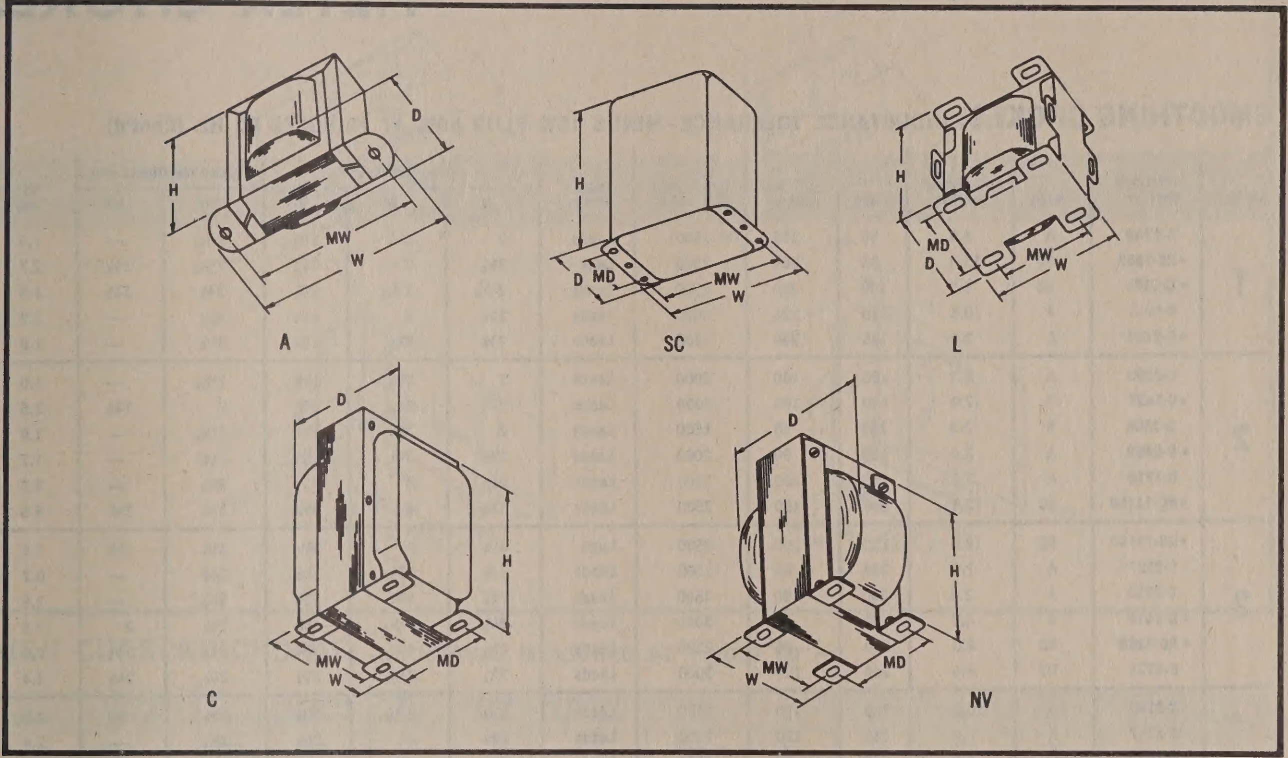
GENERAL INFORMATION

All of these items have Class "A" insulation and are rated to have a maximum operating temperature limit of 105 Degrees C. These units may be used with rectifiers but the form factor as explained elsewhere in this catalog should be observed for various combinations of rectifier circuits and types of load following the rectifier.

These items are made with our standard N.E.M.A. plugs and receptacles, primarily for use in this country. However, when used overseas where different types of plugs are necessary an adaptor can be used or our plug can be removed and a foreign plug attached to the end of the line cord.

ESSEX STANCOR

FILTER CHOKES



SMOOTHING CHOKES: INDUCTANCE TOLERANCE - MINUS 15% PLUS 50% AT 10 VOLTS 60 Hz.

Section	STANCOR Part No.	Style	Inductance Henries	DCMA	DC Res. Ohms	Insul. Test RMS Volts*	Termination	Case Dimension H	Case Dimension W	Case Dimension D	Mtg. Dimension MW	Mtg. Dimension MD	Wt. Lbs.
1	C-2345	A	350	5	5600	2500	Leads	2	3¼	1¾	2¹³⁄₁₆	—	1.0
	C-2344	A	1.5	10	85	2500	Leads	1¼	2⅛	1⅛	1¾	—	0.4
	C-2707	A	2.0	15	70	1500	Leads	1¼	2⅛	1⅛	1¾	—	0.4
	C-1515	A	20.0	15	900	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
	C-2346	A	35	15	1800	1500	Leads	1⅜	2⅜	1⅜	2	—	0.5
	C-2318	A	12.0	30	400	2000	Leads	1⅜	2⅜	1⅜	2	—	0.5
	•RS-1540	SC	15.0	40	475	2500	Lugs	2¹¹⁄₁₆	2¹¹⁄₁₆	2¼	2⅜	1½	1.5
	C-1080	A	3.5	50	200	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
2	C-1706	A	4.5	50	300	1500	Leads	1⅜	2⅜	1¼	2	—	0.5
	C-1325	A	5.0	50	250	1500	Leads	1⅝	2⅞	1¼	2⅜	—	0.7
	•C-1227	A	7.0	50	350	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
	C-1707	A	7.0	50	550	1500	Leads	1⅜	2⅜	1¼	2	—	0.5
	C-1333	A	8.0	50	450	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
	C-1279	A	8.5	50	400	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
	C-1215	A	9.0	50	500	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
3	C-1003	A	16.0	50	580	1500	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	1.0
	•RS-1555	SC	15.0	55	380	2500	Lugs	2¹¹⁄₁₆	2¹¹⁄₁₆	2¼	2⅜	1½	2.0
	•C-1708	A	13.0	65	500	1500	Leads	2	3¼	1¾	2¹³⁄₁₆	—	1.0
	C-1355	L	8.0	75	290	1500	Lugs	2	2	2⅜	1³⁄₁₆	1½	1.0
	C-1002	A	15.0	75	400	1500	Leads	2⅜	3¾	2	3⅛	—	1.7

* Insulation Test Voltage: Twice Allowable RMS Working Voltage plus 1000 Volts.

• Available until stock is depleted.

ESSEX STANCOR

FILTER CHOKES

SMOOTHING CHOKES: INDUCTANCE TOLERANCE - MINUS 15% PLUS 50% AT 10 VOLTS 60 Hz. (Cont'd)

Section	STANCOR Part No.	Style	Inductance Henries	DCMA	D.C. Res. Ohms	Insul. Test RMS Volts*	Termi- nation	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD	Wt Lbs.
1	C-1709	A	8.0	85	250	1500	Leads	2	3¼	1⅞	2 13/16	—	1.4
	•RS-1585	SC	15.0	85	285	2500	Lugs	3 5/16	3	2½	2 11/16	1¾	2.7
	• C-2305	SC	5.0	100	300	1500	Leads	2 11/16	2 11/16	2¼	2⅜	1½	1.5
	C-1001	A	10.5	110	225	3000	Leads	2⅝	4	2⅛	3 9/16	—	2.3
	•C-2704	A	9.0	125	250	1500	Leads	2⅜	3¾	1⅞	3⅛	—	1.8
2	C-2303	A	2.5	130	100	2000	Leads	2	3¼	1⅝	2 13/16	—	1.0
	•C-1421	C	7.0	140	165	3000	Leads	3⅛	2½	2¾	2	1¾	2.5
	C-2304	A	2.3	150	60	1500	Leads	2	3¼	1¾	2 13/16	—	1.0
	• C-2309	A	3.0	150	90	2000	Leads	2⅜	3¾	1⅞	3⅛	—	1.7
	C-1710	A	7.0	150	200	1500	Leads	2⅝	4	2	3 9/16	—	2.2
	•RC-12150	SC	12.0	150	150	2500	Leads	3⅞	4	3¼	3½	2¼	5.5
3	•RS-12150	SC	12.0	150	150	2500	Lugs	4¼	4	3¼	3½	2¼	5.5
	C-2327	A	1.5	200	85	1500	Leads	1⅝	2⅞	1½	2⅜	—	0.7
	C-2325	A	2.0	200	60	1500	Leads	2⅜	3¾	1⅞	3⅛	—	1.8
	• C-1411	C	4.5	200	80	3000	Leads	3½	2 13/16	4¼	2¼	2	3.5
	• RC-8200	SC	8.0	200	85	2500	Leads	4 5/16	4 7/16	3 13/16	3⅞	2¾	7.0
	C-1721	NV	8.5	200	120	3000	Leads	3 7/16	2 13/16	2⅝	2¼	2½	4.4
4	•C-2705	C	10.0	200	150	2500	Leads	3½	2 13/16	3 9/16	2¼	2 5/16	4.5
	C-2717	A	4.0	250	100	2500	Leads	2⅝	4	2⅛	3 9/16	—	2.4
	C-1412	C	4.0	250	60	3000	Leads	3½	2 13/16	3⅝	2¼	2⅜	4.3
	C-2343	A	0.75	300	32	1500	Leads	1⅝	2⅞	1⅜	2⅜	—	0.7
	C-2320	A	1.0	300	43	1500	Leads	2⅜	3¾	2	3⅛	—	1.7
	C-2334	A	2.8	300	60	1500	Leads	2⅝	4	2⅛	3 9/16	—	2.5
5	C-1722	NV	8.0	300	80	3000	Leads	4 9/16	3¾	3	3	2½	7.3
	•C-2308	C	8.0	300	80	3000	Leads	4 11/16	3¾	4	3	2 13/16	7.8
	C-2347	A	1.0	350	40	1500	Leads	2	3¼	1¾	2 13/16	—	1.0
	C-2328	A	0.8	375	25	1500	Leads	2⅜	3¾	1⅞	3⅛	—	1.5
	C-2709	A	2.0	400	40	2500	Leads	2⅝	4	2⅛	3 9/16	—	2.3
	C-2708	A	0.32	600	10	1500	Leads	2	3¼	1¾	2 13/16	—	1.3

SWINGING CHOKES: INDUCTANCE MEASURED AT 50 VOLTS 60 Hz.

Section	STANCOR Part No.	Style	Inductance Henries	DCMA	D.C. Res. Ohms	Insul. Test RMS Volts*	Termi- nation	H	W	D	MW	MD	Wt Lbs.
6	•C-1718	C	13.5 3.5	15 150	130	2000	Leads	3⅛	2½	2⅝	2	1⅝	2.3

* Insulation Test Voltage: Twice Allowable RMS Working Voltage plus 1000 Volts.

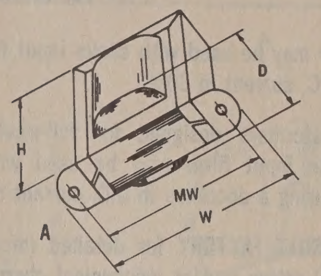
• Available until stock is depleted.

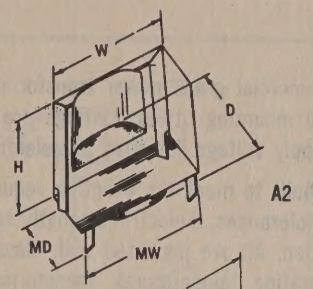
The Stancor line of "Smoothing" and "Swinging" types of Filter Chokes has been designed for use with the various Power and Plate Transformers listed in this catalog. The range of electrical ratings available covers requirements for practically all of the Filter Chokes used in Home Radio and Television Receivers, Audio Amplifiers and low power Radio Transmitters. In addition, a myriad of other electronic apparatus applications for these items exists.

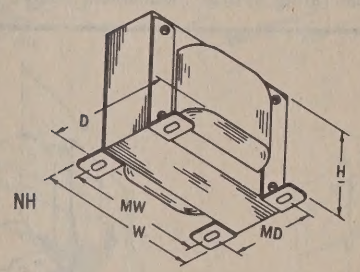
Inductance values shown are measured at the full amount of D.C. listed and at the specified values of RMS Voltage and Frequency. All of these items are made with Class "A" insulating materials and will withstand operation up to a limit of 105°C., continuously.

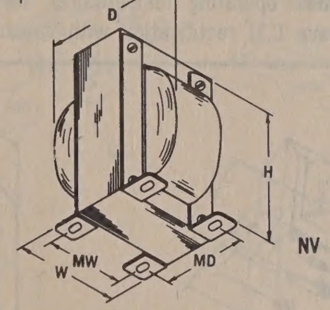
ESSEX STANCOR

FILTER CHOKES









HIGH CURRENT CHOKES: INDUCTANCE MEASURED AT 1 VOLT 60 Hz.

Section	STANCOR Part No.	Style	Inductance Millihenries	DC Amps	DC Res. Ohms	Insul. Test* RMS Volts	Termination	Case Dimension			Mtg. Dimension		Wt. Lbs.
								H	W	D	MW	MD	
1	TC-1	A2	3.0	1.0	.25	1000	Leads	1 3/16	1 1/2	1 1/8	1 3/16	7/16	0.3
	TC-2	A2	11.0	1.0	.75	1000	Leads	1 3/16	1 1/2	1 1/8	1 3/16	7/16	0.3
	C-2690	NV	300 or 75	1.0 2.0	3.0 .75	1500	Leads	3 7/16	2 13/16	3	2 1/4	2 5/8	5.0
	C-2685	NH	35	2.0	.75	1500	Leads	2 3/16	2 5/8	2 1/8[1]	2 3/16	2	1.9
	C-2691	NV	80 or 20	2.5 5.0	.60 .15	1500	Leads	3 13/16	3 1/8	3 1/2	2 1/2	3	7.0
	C-2686	NH	25	4.0	.425	1500	Leads	2 7/8	3 3/8	2 5/8	2 13/16	2 1/8	3.4
	C-2687	NH	10	8.0	.15	1500	Leads	3 3/16	3 3/4	3[2]	3 1/8	2 1/2	5.3
	C-2688	NH	10	12.5	.11	1500	Leads	3 1/2	4 1/8	2 7/8	3 7/16	2 3/8	5.9
	C-2689	NH	5	22.5	.03	1500	Leads	3 13/16	4 1/2	4 3/8	3 3/4	3 1/2	11.9
	C-2692	NV	24 6	20 40	.12 .029	1500	Self Leads	5 1/4	4 7/16	5 1/4	3 1/2	4 1/4	21.2

[1] Mounting foot depth — 2 11/16" O.A. [2] Mounting foot depth — 3 3/16" O.A.

MINIATURIZED HIGH CURRENT CHOKES: INDUCTANCE MEASURED AT 1 VOLT 60 Hz.

Section	STANCOR Part No.	Style	Inductance Millihenries	DC Amps	DC Res. Ohms	Insul. Test* RMS Volts	Termination	Case Dimension			Mtg. Dimension		Wt. Lbs.
								H	W	D	MW	MD	
2	• C-2721	A	2000	.065	180	1500	Leads	1 1/4	2 1/8	1 1/8	1 3/4	—	0.25
	C-2722	A	400	.135	31	1500	Leads	1 1/4	2 1/8	1 1/8	1 3/4	—	0.25
	• C-2723	A	700	.135	40	1500	Leads	1 7/16	2 3/8	1 1/4	2	—	0.35
	C-2724	A	250	.275	16	1500	Leads	1 7/16	2 3/8	1 1/4	2	—	0.35
	• C-2725	A	400	.275	22	1500	Leads	1 5/8	2 7/8	1 7/16	2 3/8	—	0.65
	• C-2726	A	125	.550	6.0	1500	Leads	1 5/8	2 7/8	1 7/16	2 3/8	—	0.65
	• C-2727	A	250	.500	10	1500	Leads	2	3 1/4	1 11/16	2 13/16	—	1.00
	C-2728	A	75	1.000	2.5	1500	Leads	2	3 1/4	1 11/16	2 13/16	—	1.00

* Insulation Test Voltage: Twice Allowable RMS Working Voltage plus 1000 Volts.

• Available until stock is depleted.

The above listed "HIGH CURRENT CHOKES" are normally used in low voltage, high current D.C. power supply filter applications, where low voltage drop across the filter and good voltage regulation is required, without any type of voltage regulator.

The "MINIATURIZED HIGH CURRENT CHOKES" are primarily for use with the "Miniaturized Control/Rectifier Transformers" listed elsewhere in this catalog. When used in small D.C. power supplies with these transformers, a combination of small physical size and adequate voltage regulation for many applications is possible, without a solid state voltage regulator.

These chokes are made with Class "A" insulating materials and may be operated up to a maximum limit of 105°C., continuously.

ESSEX STANCOR

POWER TRANSFORMERS

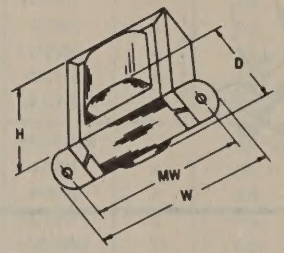
PLATE AND FILAMENT TYPE

Stancor's broad line of commercial grade power transformers offers a choice of standard mounting styles. Listings are in ascending order of plate-supply voltage for ease of selection.

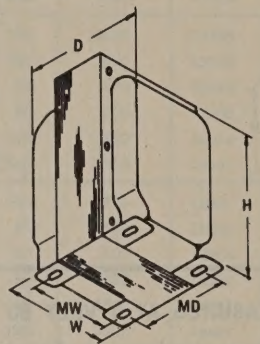
All units are designed and built to meet the exacting requirements for EIA for electrical tolerances, dielectric strength, temperature rise and construction. All are insulated with class A materials (105°C max. operating temperature). Transformers designed for full-wave C.T. rectification with capacitor input filter may be used with choke input filter allowing an increase in D.C. current of 30%.

Transformers designed for full-wave C.T. rectification with choke input filter may be used with capacitor input filter requiring a decrease in D.C. current of 25%.

CONSULT FACTORY for detailed information concerning electrical rating and/or mechanical characteristics.



A



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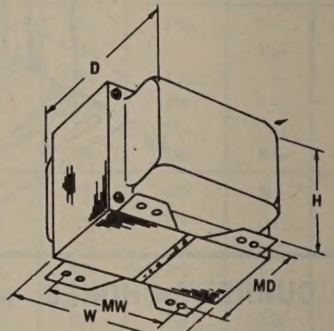

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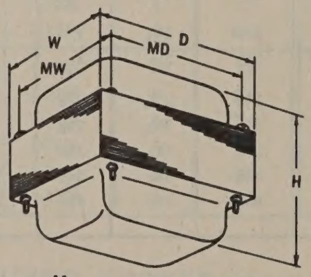

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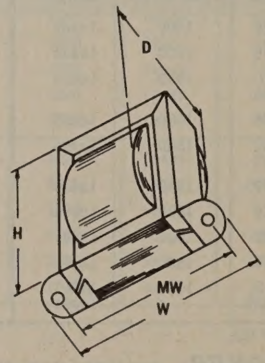

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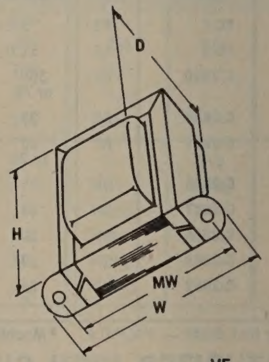


VE

FOR CAPACITOR INPUT SYSTEMS: PRIMARIES 117 VOLTS 60 Hz.§

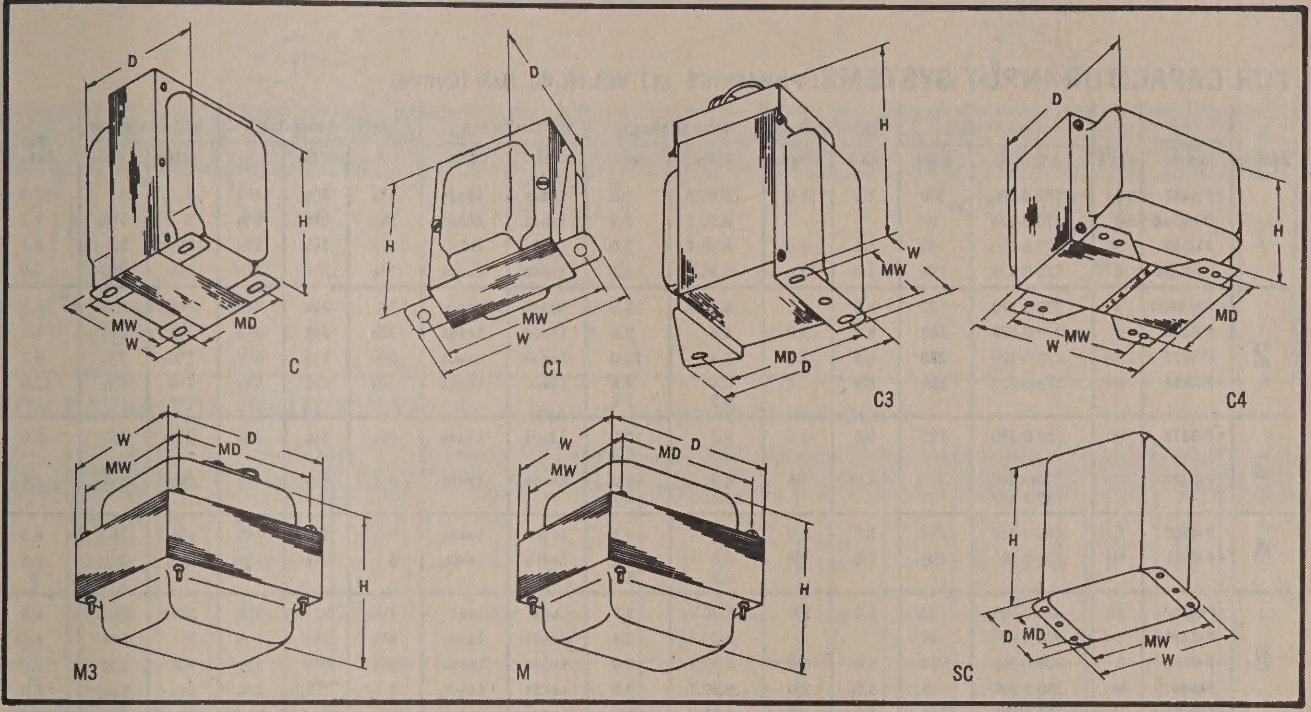
Section	STANCOR Part No.	Style	Plate Winding		Rectifier Fila.		Other Windings		Termination		Case Dimension			Mtg. Dimension		Wt. Lbs.
			A.C. Volts	DCMA	Volts	Amps.	Volts	Amps.	Pri.	Sec.	H	W	D	MW	MD	
1	•P-8379	M†	115‡	290			2.7 6.3	.45 8.0	Leads	Leads	4	2¹³⁄₁₆	3⁷⁄₁₆	2⁷⁄₁₆	3	5.7
	•P-8158	M†	117‡	200			6.3 6.3 6.3	4.25 4.0 2.0	Leads	Leads	3⅝	3⁷⁄₁₆	4³⁄₁₆	2¾	3⁷⁄₁₆	6.2
	• P-8386	C4†	117‡	300			6.3	10.0	Leads	Leads	3⅛	3¾	4	2⅛	2½	6.9
	PS-8415	S	125¶	15			6.3	.6	Leads	Leads	1¹⁵⁄₁₆	2⅜	1¹¹⁄₁₆	2	—	0.7
	P-8624	S	125¶	15			12.6	0.3	Leads	Leads	1¹⁵⁄₁₆	2⅜	1¹¹⁄₁₆	2	—	0.7
2	PS-8416	S	125-0-125	25			6.3	1.0	Leads	Leads	2⁵⁄₁₆	2¹³⁄₁₆	1¾	2⅜	—	1.0
	P-8625	S	125-0-125	25			12.6	0.6	Leads	Leads	2⁵⁄₁₆	2¹³⁄₁₆	1¾	2⅜	—	1.0
	PA-8421	A	125¶	50			6.3	2.0	Leads	Leads	2¼	3¹¹⁄₁₆	2⅛	3⅛	—	1.5
	P-8626	A	125¶	50			12.6	1.0	Leads	Leads	2¼	3¹¹⁄₁₆	2⅛	3⅛	—	1.5
	P-8181	VE	150¶	25			6.3C.T.	.5	Leads	Leads	1¹⁵⁄₁₆	2⅜	1¹³⁄₁₆	2	—	0.8
	P-8627	VE	150¶	25			12.6C.T.	0.3	Leads	Leads	1¹⁵⁄₁₆	2⅜	1¹³⁄₁₆	2	—	0.8
3	• P-9000C	C†	155‡	450			6.3 6.3	2.0 13.5	Leads	Leads	4³⁄₁₆	3½	4⅞	3¹⁄₁₆	3¹³⁄₁₆	12.0

‡ For use in Voltage Doubler Circuits. ¶ For use in Half-Wave Circuits. • Available until stock is depleted. † With Copper shorting band to reduce external Magnetic Field.
§ May be operated from a 400 Hz. source with no change in output ratings. **ALL SECONDARY A.C. VOLTAGES ±3%. ALL PCC AND PSC NUMBERS MAY BE OPERATED AT 50 Hz.**

ESSEX STANCOR

POWER TRANSFORMERS

PLATE AND FILAMENT TYPE



FOR CAPACITOR INPUT SYSTEMS: PRIMARIES 117 VOLTS 60 Hz.§ (Cont'd)

Section	STANCOR Part No.	Style	Plate Winding		Rectifier Fila.		Other Windings		Termination		Case Dimension			Mtg. Dimension		Wt. Lbs.
			A.C. Volts	DCMA	Volts	Amps.	Volts	Amps.	Pri.	Sec.	H	W	D	MW	MD	
1	P-8359	C	190-160-0-160-190	70			6.3C.T. 6.3	3.0 .6	Leads	Leads	3⅛	2½	2⅝	2	1⅞	2.8
	P-8383	C	200-0-200	110			6.3 6.3C.T.	2.0 4.0	Leads	Leads	3⅛	2½	3¼	2	2¼	3.0
	PC-8417	C	220-0-220	50			6.3 25.2	.6 .5	Leads	Leads	3⅛	2½	2⅝	2	1 9/16	2.2
2	•PSC-40	SC	225-0-225	40	5.0	2.0	6.3C.T.	2.0	Lugs	Lugs	3¾	3½	2⅞	3⅛	2	3.2
	•P-8155	M	225-0-225	90	5.0	2.0	6.3	5.15	Leads	Leads	3¾	2 13/16	3⅜	2¼	2 13/16	4.5
	PC-8418	C	230-0-230	50			6.3	2.5	Leads	Leads	3⅛	2½	2⅝	2	1 9/16	2.2
	PM-8418	M	230-0-230	50			6.3	2.5	Leads	Leads	2⅝	2½	3	2	2½	2.2
	PC-8401	C	235-0-235	40	5.0	2.0	6.3C.T.	2.0	Leads	Leads	3⅛	2½	2⅝	2	1 9/16	2.2
3	PM-8401	M	235-0-235	40	5.0	2.0	6.3C.T.	2.0	Leads	Leads	2⅝	2½	3	2	2½	2.2
	•PC-8402	C	240-0-240	55	5.0	2.0	6.3C.T.	2.0	Leads	Leads	3⅛	2½	2¾	2	1¾	2.4
	PM-8402	M	240-0-240	55	5.0	2.0	6.3C.T.	2.0	Leads	Leads	2¾	2½	3	2	2½	2.4
	PC-8419	C	240-0-240	70			6.3	3.0	Leads	Leads	3⅛	2½	2⅞	2	1 13/16	2.6
4	PM-8419	M	240-0-240	70			6.3	3.0	Leads	Leads	2⅞	2½	3	2	2½	2.6
	•PC-8431	C	245-0-245	40			6.3C.T.	2.0	Leads	Leads	2⅝	2 3/16	2 5/16	1¾	1 7/16	1.6
	P-8173	C1	250-0-250	10			6.3 6.3	.6 1.2	Leads	Leads	2¼	2⅞	2¼	2⅜	—	1.0
	P-8174	C1	250-0-250	20			6.3 6.3	.6 1.2	Leads	Leads	2⅝	3 5/16	2¼	2 13/16	—	1.5
5	•PC-8432	C	250-0-250	55			6.3C.T.	2.0	Leads	Leads	2⅝	2 3/16	2 9/16	1¾	1 11/16	1.9
	PC-8403	C	250-0-250	70	5.0	2.0	6.3C.T.	2.5	Leads	Leads	3⅛	2½	3½	2	2 1/16	3.2
	•PM-8403	M	250-0-250	70	5.0	2.0	6.3C.T.	2.5	Leads	Leads	3⅛	2½	3	2	2½	3.2
	•PC-8433	C	255-0-255	70			6.3C.T.	2.5	Leads	Leads	3⅛	2½	2⅝	2	1 11/16	2.3
6	PC-8404	C	260-0-260	90	5.0	2.0	6.3C.T.	3.0	Leads	Leads	3½	2 13/16	3½	2¼	2¼	4.0
	•PM-8404	M	260-0-260	90	5.0	2.0	6.3C.T.	3.0	Leads	Leads	3½	2 13/16	3⅜	2¼	2 13/16	4.0
	PC-8420	C	260-0-260	90			6.3	4.0	Leads	Leads	3½	2 13/16	3¼	2¼	2	3.5
	PM-8420	M	260-0-260	90			6.3	4.0	Leads	Leads	3½	2 13/16	3⅜	2¼	2 13/16	3.5

• Available until stock is depleted

§ May be operated from a 400 Hz. source with no change in output ratings. **ALL SECONDARY A.C. VOLTAGES ±3%. ALL PCC AND PSC NUMBERS MAY BE OPERATED AT 50 Hz.**

ESSEX STANCOR

POWER TRANSFORMERS

PLATE AND FILAMENT TYPE

FOR CAPACITOR INPUT SYSTEMS: PRIMARIES 117 VOLTS 60 Hz.§ (Cont'd)

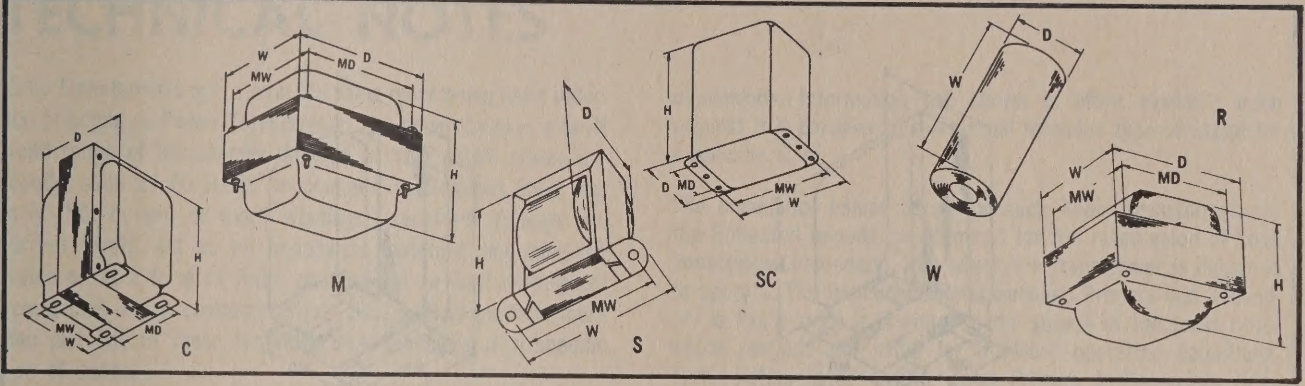
Section	STANCOR Part No.	Style	Plate Winding		Rectifier Fila.		Other Windings		Termination		Case Dimension			Mtg. Dimension		Wt. Lbs.
			A.C. Volts	DCMA	Volts	Amps.	Volts	Amps.	Pri.	Sec.	H	W	D	MW	MD	
1	•P-8353	C3	265-0-265	300	5.0	6.0	12.6C.T.	6.0	Leads	Leads‡	5⅞	3¾	4¾	3	4	12.5
	PC-8434	C	270-0-270	90			6.3C.T.	2.5	Leads	Leads	3⅛	2½	2⅝	2	1¹¹⁄₁₆	2.3
	PSC-55	SC	270-0-270	55	5.0	2.0	6.3C.T.	2.0	Lugs	Lugs	3¾	3½	2⅞	3⅛	2	3.5
	PC-8405	C	270-0-270	120	5.0	3.0	6.3C.T.	3.5	Leads	Leads	3⅞	3⅛	3½	2½	2⁹⁄₁₆	4.9
2	•PM-8405	M	270-0-270	120	5.0	3.0	6.3C.T.	3.5	Leads	Leads	3⁷⁄₁₆	3⅛	3¾	2½	3⅛	4.9
	P-8356	C†	270-0-270	260	5.0	3.0	6.3	8.8	Leads	Leads	3⅞	3⅛	3⅜	2½	2¼	6.5
	P-8377	M†	270-0-270	280	5.0	3.0	6.3	10.0	Leads	Leads	3⅝	3⅛	3¹⁵⁄₁₆	2¹¹⁄₁₆	3⁵⁄₁₆	6.7
	•P-8334	M†	275-0-275	305	5.0	5.0	6.8 6.3	8.5 1.2	Leads	Leads	5⅛	3¾	4⁹⁄₁₆	3¼	4¹⁄₁₆	13.0
3	•P-8373	M	280-0-280	280	5.0	3.0	6.3 24.0	10.0 2.6	Leads	Leads	4¼	3⅛	3¾	2¹¹⁄₁₆	3⁵⁄₁₆	8.0
	P-8378	C†	280-0-280 250-0-250	300	5.0/3.0	4.5	6.3 24.0	10.0 1.2	Leads	Leads	3⅞	3⅛	4⅝	2½	3¼	7.9
4	P-8355	C4†	285-0-285	250	5.0	3.0	6.3	9.5	Leads	Leads	3³⁄₁₆	3¾	3½	2½	2³⁄₁₆	6.5
	•P-8381	M†	290-0-290	290	5.0	3.0	6.3 6.3	5.0 5.0	Leads	Leads	5	3⅛	3¹³⁄₁₆	2¹¹⁄₁₆	3⁵⁄₁₆	6.9
5	•PSC-60	SC	300-0-300	60	5.0	2.0	6.3C.T.	3.0	Lugs	Lugs	4¼	4	3¼	3½	2¼	4.5
	P-6358	C	300-0-300	65			6.3C.T.	2.7	Leads	Leads	3⅛	2½	2½	2	1¾	3.0
	P-8175	C	300-0-300	70	5.0	3.0	6.3C.T.	3.0	Leads	Leads	3½	2⅞	3½	2¼	2⅜	4.0
	•PM-8423	M	300-0-300	90	5.0	2.0	6.3C.T.	3.5	Leads	Leads	3	2¹³⁄₁₆	3⅜	2¼	2¹³⁄₁₆	4.0
	•P-8177	C	300-0-300	120	5.0	3.0	6.3C.T.	3.0	Leads	Leads	3⅞	3³⁄₁₆	3⅝	2¾	2⁹⁄₁₆	5.8
6	•P-8164	M†	300-0-300	225	5.0	3.0	6.3	9.0	Leads	Leads	4⅛	3⁷⁄₁₆	4³⁄₁₆	2¾	3⁷⁄₁₆	7.5
	•P-8335	M†	300-0-300	325	5.0	6.0	6.3 6.3	8.8 1.5	Leads	Leads	5⅛	3¾	4⁹⁄₁₆	3¼	4¹⁄₁₆	13.0
	•P-8338	M†	315-0-315	310	5.0	6.0	6.7 6.4	10.0 1.6	Leads	Leads	5⅛	3⅞	4¼	3	3¾	12.5
7	•P-8371	M3†	320-0-320 200-0-200	200 80	5.0C.T.	3.0	6.3 6.3 6.3	4.0 4.0 3.0	Leads	Leads‡	5⅜	3¾	4⅝	3	3¾	11.3
	PC-8406	C	325-0-325	40	5.0	2.0	6.3C.T.	2.0	Leads	Leads	3⅛	2½	2¾	2	1¹¹⁄₁₆	2.4
	PM-8406	M	325-0-325	40	5.0	2.0	6.3C.T.	2.0	Leads	Leads	2¾	2½	3	2	2½	2.4
	PC-8407	C	325-0-325	55	5.0	2.0	6.3C.T.	2.0	Leads	Leads	3⅛	2½	3⅛	2	2¹⁄₁₆	3.2
8	•PM-8407	M	325-0-325	55	5.0	2.0	6.3C.T.	2.0	Leads	Leads	3⅛	2½	3	2	2½	3.2
	•PC-8437	C	325-0-325	55			6.3C.T.	2.0	Leads	Leads	2⅝	2³⁄₁₆	2⁹⁄₁₆	1¾	1⅝	1.9
	PC-8422	C	325-0-325	150	5.0	3.0	6.3C.T.	5.0	Leads	Leads	3⅞	3⅛	3⅞	2½	2⁹⁄₁₆	5.8
9	PM-8422	M	325-0-325	150	5.0	3.0	6.3C.T.	5.0	Leads	Leads	3⅝	3⅛	3¾	2½	3½	5.8
	P-8339	C	325-0-325	255	5.0	3.0	12.6C.T.	5.25	Leads	Leads	4⁹⁄₁₆	3¾	4⅜	3	3³⁄₁₆	8.5
	•PC-8436	C	330-0-330	40			6.3C.T.	2.0	Leads	Leads	2⅝	2³⁄₁₆	2⁹⁄₁₆	1¾	1⅝	1.9
	•PCC-70	SC	335-0-335	70	5.0	2.0	6.3C.T.	3.0	Leads	Leads	3⅞	4	3¼	3½	2¼	4.5
10	•PC-8408	C	340-0-340	70	5.0	2.0	6.3C.T.	2.5	Leads	Leads	3½	2¹³⁄₁₆	3⅜	2¼	2⅛	3.8
	PM-8408	M	340-0-340	70	5.0	2.0	6.3C.T.	2.5	Leads	Leads	3½	2¹³⁄₁₆	3⅜	2¼	2¹³⁄₁₆	3.8
	•PC-8438	C	345-0-345	70			6.3C.T.	2.5	Leads	Leads	3⅛	2½	2¾	2	1¾	2.5
	•PCC-105	SC	345-0-345	105	5.0	2.0	6.3C.T.	3.5	Leads	Leads	4⁵⁄₁₆	4⁷⁄₁₆	3¹¹⁄₁₆	3⅞	2¾	6.5
	•P-6011	M	350-0-350	70	5.0C.T.	3.0	6.3C.T.	2.5	Leads	Leads	3⅜	2½	3	2	2½	3.5
11	•PC-8439	C	350-0-350	90			6.3C.T.	3.0	Leads	Leads	3⅛	2½	3⅛	2	2³⁄₁₆	3.1
	PC-8409	C	350-0-350	90	5.0	2.0	6.3C.T.	3.0	Leads	Leads	3½	2¹³⁄₁₆	3⅝	2¼	2⅜	4.5
	PM-8409	M	350-0-350	90	5.0	2.0	6.3C.T.	3.0	Leads	Leads	3½	2¹³⁄₁₆	3⅜	2¼	2¹³⁄₁₆	4.5
	•P-8176	C	350-0-350	110	5.0	2.0	6.3C.T. 6.3C.T.	3.0 3.0	Leads	Leads	3¹³⁄₁₆	3¼	3⅛	2½	2⅞	5.5
12	PC-8410	C	360-0-360	120	5.0	3.0	6.3C.T.	3.5	Leads	Leads	3⅞	3⅛	3¾	2½	2⁷⁄₁₆	5.5
	•PM-8410	M	360-0-360	120	5.0	3.0	6.3C.T.	3.5	Leads	Leads	3½	3⅛	3¾	2½	3⅛	5.5
	•P-8351	M	360-0-360	240	5.0	6.0	6.5	9.3	Leads	Leads	4¹⁵⁄₁₆	3¾	4⁹⁄₁₆	3¼	4¹⁄₁₆	10.5

† With Copper shorting band to reduce external Magnetic Field. ‡ Plate winding and rectifier filament winding Connected to Tube Socket. • Available until stock is depleted. § May be operated from a 400 Hz. source with no change in output ratings. **ALL SECONDARY A.C. VOLTAGES ±3%. ALL PCC AND PSC NUMBERS MAY BE OPERATED AT 50 Hz.**

ESSEX STANCOR

POWER TRANSFORMERS

PLATE AND FILAMENT TYPE



FOR CAPACITOR INPUT SYSTEMS: PRIMARIES 117 VOLTS 60 Hz.§ (Cont'd)

Section	STANCOR Part No.	Style	Plate Winding		Rectifier Fila.		Other Windings		Termination		Case Dimension			Mtg. Dimension		Wt. Lbs.
			A.C. Volts	DCMA	Volts	Amps.	Volts	Amps.	Pri.	Sec.	H	W	D	MW	MD	
1	PC-8411	C	375-0-375	150	5.0	3.0	6.3C.T.	4.5	Leads	Leads	4¼	3 7/16	4	2¾	2 13/16	5.8
	•PM-8411	M	375-0-375	150	5.0	3.0	6.3C.T.	4.5	Leads	Leads	3⅞	3 7/16	4⅛	2¾	3 7/16	5.8
	•P-8169	M†	380-0-380	220	5.0	3.0	6.3 6.3 6.3	1.2 5.0 7.0	Leads	Leads	4¾	3¾	4 9/16	3	3¾	10.5
	•P-8170	C†	380-0-380	220	5.0	3.0	6.3 6.3 6.3	1.2 6.0 7.0	Leads	Leads	4¾	3¾	4¾	3	3 9/16	10.5
2	•PC-8442	C	400-0-400	200			6.3C.T.	5.0	Leads	Leads	3⅞	3⅛	3⅞	2½	2⅝	5.7
3	PC-8412	C	400-0-400	200	5.0	3.0	6.3C.T.	5.0	Leads	Leads	4 11/16	3¾	4	3	2 13/16	8.2
	•PM-8412	M	400-0-400	200	5.0	3.0	6.3C.T.	5.0	Leads	Leads	3⅞	3¾	4½	3	3¾	8.2
	PC-8413	C	400-0-400	250	5.0	4.0	6.3C.T.	5.0	Leads	Leads	4 11/16	3¾	4½	3	3 5/16	10.0
	•P-6143	C	440-0-440	130	5.0	3.0	6.3C.T.	3.5	Leads	Leads	4¼	3 7/16	4 1/16	2¾	2 13/16	7.0
	PC-8414	C	600-0-600	200	5.0	3.0	6.3 6.3	3.0 3.0	Leads	Leads	4 11/16	3¾	4¼	3	3 1/16	8.3

† With Copper shorting band to reduce external Magnetic Field. • Available until stock is depleted.
§ May be operated from a 400 Hz. source with no change in output ratings. **ALL SECONDARY A.C. VOLTAGES ±3%.**

FOR CATHODE RAY TUBES: PRIMARIES 117 VOLTS 50/60 Hz., EXCEPT ↓ FOR 60 Hz. ONLY

Section	STANCOR Part No.	Style	A.C. Volts	DCMA	Rect. Volts	Rect. Amps.	Other Volts	Other Amps.	Pri.	Sec.	H	W	D	MW	MD	Wt. Lbs.
4	P-8150	SC	1550¶	1.5	2.5	1.75			Leads	Leads	3 1/16	3	2½	2 11/16	1¾	1.8
	P-8179	M	1600¶	3.0			6.3/5/2.5 6.3/5/2.5	1.0 3.0	Lugs	Lugs	3½	2½	3	2	2½	3.5
	•P-8178↓	C	1800¶	2.0	2.5	1.8	2.5 6.3	2.2 0.6	Leads	Leads	3⅞	3⅛	3¾	2½	2½	5.0
	P-8151↓	C	2400¶	5.0	2.5	2.0	2.5	2.0	Leads	Leads	4¼	3 7/16	3⅞	2¾	2 11/16	6.4

FOR SOLAR CF-160 CONDENSER TESTER: PRIMARIES 117 VOLTS 60 Hz.§

Section	STANCOR Part No.	Style	A.C. Volts	DCMA	Rect. Volts	Rect. Amps.	Other Volts	Other Amps.	Pri.	Sec.	H	W	D	MW	MD	Wt. Lbs.
5	•P-6459	R	550¶ 55	30 60			6.3 6.3	0.9 0.6	Leads	Leads	2¼	2 3/16	2⅝	1¾	2 3/16	1.4

FOR 100 WS ELECTRONIC PHOTOFLASH: PRIMARIES 105/115/125 VOLTS 60 Hz.§

Section	STANCOR Part No.	Style	A.C. Volts	DCMA	Rect. Volts	Rect. Amps.	Other Volts	Other Amps.	Pri.	Sec.	H	W	D	MW	MD	Wt. Lbs.
6	P-6425	S	380¶ Charges 1050 mfd. to 450 volts D.C.	20					Leads	Leads	2 5/16	2⅞	2	2⅜	—	1.4
	P-6426	W	Trigger Coil for use with **P-6425**. Ratio 1 to 35 Write for Bulletin #470R for Circuit Details						Leads	Leads	—	¾	9/16	—	—	0.2

¶ For use in Half-Wave Circuits. § May be operated from a 400 Hz. source with no change in output ratings. **ALL SECONDARY A.C. VOLTAGES ±3%.**

SAFETY TYPE STEP-DOWN ISOLATION TRANSFORMER

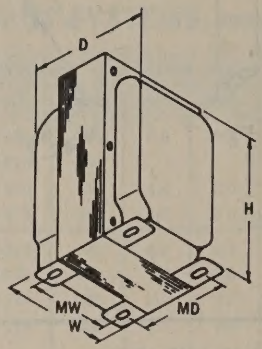
DESIGNED FOR INSPECTION LAMP SERVICE WITH G.E. #75A21 BULB TO COMPLY WITH OSHA REQUIREMENTS

Section	STANCOR Part No.	Style	Secondary		Insulation Test RMS Volts	Primary Volts	Termination		Case Dimension			Mtg. Dimension		Wt. Lbs.
			Volts	Amps.			Pri.	Sec.	H	W	D	MW	MD	
7	P-8650	C	12.0	6.5	1500	117▲	Cord/Plug	Receptacle	3½	2 13/16	3⅜	2¼	2¼	4.0

▲ Case and Core are connected internally to third wire in line cord and output receptacle. For 117V., 50-60 Hz. operation. Electrostatic shield connected to core and case internally. • Available until stock is depleted.

ESSEX STANCOR

PLATE TRANSFORMERS



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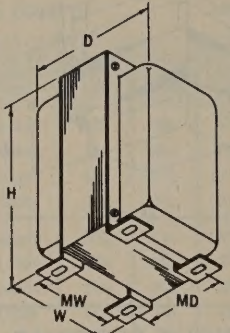


FS

FOR REACTOR INPUT SYSTEMS: ALL PRIMARIES 50/60 HZ.§

Section	STANCOR Part No.	Style	Plate Winding A.C. Volts	D.C. Volts	DCMA #		Primary Volts	Case Dimension			Mounting Dimension		Wt. Lbs.
					CCS	ICAS		H	W	D	MW	MD	
1	•P-8040*	C	500-40-0-500	400 40	300	375	115	4 11/16	3¾	4⅝	3	3 7/16	9.8
	•P-8042*	C	770-510-40-0-510-770	600 400 40	300	375	115	4 11/16	3¾	6½	3	5 5/16	18.0
	•P-8034*	FS	2900-2385-0-2385-2900	2500 2000	300	375	115/230	9 1/16	7¼	8⅛	6	5⅝	62.8
	•P-8035*	FS	2950-2375-0-2375-2950	2500 2000	500	575	115/230	9 1/16	7¼	9⅝	6	7 1/16	80.0

CCS RATING FOR REACTOR INPUT-ICAS RATING FOR CAPACITOR INPUT: ALL PRIMARIES 50/60 Hz.§

2	PC-8301‡	C	415-0-415	300 425	200	 160	117	3⅞	3⅛	3½	2½	2 3/16	4.8
	PC-8302‡	C	515-0-515	385 500	235	 200	117	4¼	3 7/16	4⅛	2¾	2 15/16	6.8
	PC-8303‡	C	665-0-665	500 750	250	 200	117	4 11/16	3¾	4⅜	3	3 3/16	9.6
	PC-8304‡	C	750-0-750	600 850	265	 200	117	4 11/16	3¾	4⅞	3	3 11/16	11.5
	PC-8305‡	C	920-0-920	750 1000	250	 200	117	4 11/16	3¾	5	3	3 13/16	11.9

All "C" style have Leads; "SC" style have Lugs; "FS" have Terminals.
§ May be operated from a 400 Hz. source with no change in output ratings.
• Available until stock is depleted.

‡ Secondary C.T. must be grounded.
* Secondary C.T. does not have to be grounded.
# Maximum output current rating will be reduced according to form factor for rectifier circuit and type of load used.

ALL SECONDARY A.C. VOLTAGES ±3%.

ESSEX STANCOR

AUDIO TRANSFORMERS TECHNICAL NOTES

Audio Transformers operate on the same electro-magnetic induction principle as Power Transformers but generally over a fairly broad range of frequencies; instead of at a single power frequency, such as 60 Hertz. In common applications they may carry D.C. in one or more windings, transform Voltage and Current levels, act as an Impedance matching and coupling device or as a form of filter; passing only a limited range of frequencies (voice communication). Usually they perform more than just one of these functions simultaneously in a specific type of usage.

In some applications the frequency response, amount of magnetic shielding, maximum operating level, percentage of waveform distortion and insertion loss of the transformer are important.

The most commonly required electrical information pertaining to Audio Transformers is listed in this catalog wherever it applies, along with the physical mounting style, weight and dimensions. Information not shown is often available upon request if it pertains to the normal intended type of usage for a specific item.

The Impedance values listed for each Audio Transformer are the Reflected Impedance (Primary) for the rated value of Load Impedance (Secondary), into which the transformer is designed to operate. The Impedance Ratio between Primary and Secondary is fixed; since it is equal to the square of the turns ratio, which remains the same for different operating conditions. Turns Ratios listed are for Total Primary to Secondary, with the exception of the Driver Transformers for use with tubes. These are listed for Primary to ½ Secondary operation and are typically used in Class "B" Amplifier applications.

Accuracy of turns ratios is maintained within plus or minus 3 percent. Center taps are accurate within plus or minus 1 percent. Values of Primary D.C. listed are maximum and, in the case of push-pull operation with a center-tapped winding, are the maximum amount for each half of the winding, unless otherwise indicated.

HANDY METHOD FOR APPROXIMATING THE PRIMARY TO SECONDARY RATIO REQUIRED OF A DRIVER TRANSFORMER IN CLASS B OR AB$_2$ SERVICE

$$\text{Transformer ratio, primary: } \tfrac{1}{2} \text{ secondary} = \frac{\sqrt{PZ_L}}{0.35E_s}.$$

Where: P = Driving power in watts required for tubes to be driven.

Z_L = Plate load impedance of driver tube(s) selected.

E_s = Peak grid-to-grid signal voltage required for tubes to be driven.

Factor values for this formula are data commonly found in tube manuals. Select driver tubes capable under typical operation of delivering 1.5 times the grid driving power requirements of the stage to be driven. Pentode or tetrode drivers should be operated with inverse feedback.

TURNS/IMPEDANCE RATIOS

Turns Ratio "NR" may be expressed as the ratio of turns between the Primary and Secondary windings. It is also the Voltage Ratio between them and may be expressed as:

$$NR = \frac{N\,\text{sec.}}{N\,\text{pri.}} = \frac{E\ \text{sec.}}{E\ \text{pri.}}.$$

Since the Impedance Ratio is equal to the square of the Turns Ratio:

$$(NR)^2 = ZR \text{ or } NR = \sqrt{\frac{Z\,\text{sec.}}{Z\,\text{pri.}}}.$$

Where: N sec. = Number of Secondary Turns.
N pri. = Number of Primary Turns.
E sec. = Secondary Voltage.
E pri. = Primary Voltage.
NR = Turns Ratio between windings.
Z = Impedance in Ohms.
ZR = Impedance Ratio between windings.

INSERTION LOSS

Insertion loss is expressed in Decibels (db) as a measure of efficiency, thusly:

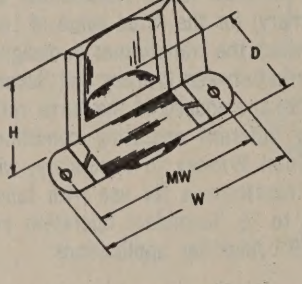
$$\text{Insertion loss in db} = 10 \log \frac{P\,\text{input}}{P\,\text{output}}.$$

Where P = power (in Watts).

If it is measured at mid-band Frequency it is a simple expression of the transformer efficiency. At other frequencies it includes the Frequency Response characteristics of the transformer for specific conditions.

ESSEX STANCOR

AUDIO TRANSFORMERS



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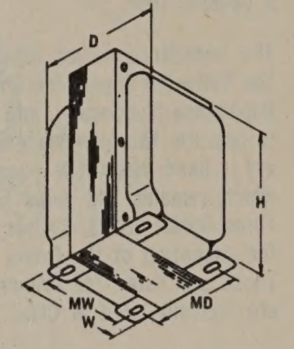

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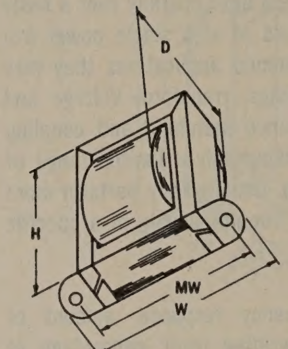

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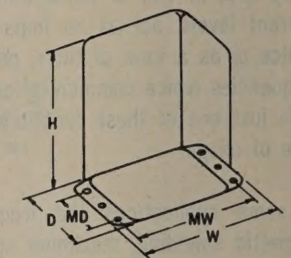


SC

OUTPUT: SINGLE PLATE TO VOICE COIL AND/OR LINE

Section	STANCOR Part No.	Style	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response In Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	• A-8070	A	1000	4.0	90	4	Leads	Leads	20	0.27	16:1	200-15000	1000	1⅜	2⅜	1½	2	—	0.4
	A-3332	A	2000	3.2	50	3	Leads	Leads	140	0.63	24.3:1	100-20000	1000	1¼	2⅛	1¼	1¾	—	0.4
	A-3876	A	2000	4.0	60	5	Leads	Leads	47	0.27	22.3:1	50-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
	• A-3336	A	2500 b	3.5	50	5	Leads	Leads	200	0.56	28.1:1	200-20000	1500	1⅜	2⅜	1⅝	2	—	0.4
2	A-3328	A	4000	3.5	10	3	Leads	Leads	350	0.53	33.8:1	80-20000	1000	1¼	2⅛	1⅛	1¾	—	0.4
	A-3877	A	5000	4.0	40	5	Leads	Leads	125	0.30	35.2:1	200-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
	A-3309	A	5000	3-4	35	3	Leads	Leads	340	0.50	37.3:1	200-15000	1500	1¼	2⅛	1⅜	1¾	—	0.4
3	A-8092	A	5000	3-4	50	8	Leads	Leads	300	0.43	37.5:1	200-20000	1500	1⅝	2⅞	1½	2⅜	—	0.5
	• A-3337	S	5000	6-8	40	10	Leads	Leads	350	0.66	26:1	200-20000	1000	2⅜	2⅞	1¾	2⅜	—	1.0
	A-3878	A	7000	4.0	30	5	Leads	Leads	350	0.43	42.1:1	200-20000	1000	1⅜	2⅜	1¼	2	—	0.4
4	• A-2313	A	7000	8.0	40	10	Leads	Leads	500	0.64	30:1	100-20000	1000	2	3¼	2	2 13/16	—	1.0
	A-3329	A	8000	3.5	10	3	Leads	Leads	500	0.51	49.1:1	200-15000	1000	1¼	2⅛	1⅛	1¾	—	0.4
	A-3879	A	10000	4.0	30	5	Leads	Leads	275	0.28	49.7:1	200-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
5	• A-3881	A	15000	4.0	10	5	Leads	Leads	640	0.33	59.3:1	200-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
	A-3250	A	20000/ 10000/5000	500/332/200/ 125/50	15	5	Lugs	Lugs	1500	55	6.25:1	50-20000	1500	2	3¼	1⅞	2 13/16	—	1.0
	A-3327	A	25000	4.0	5	5	Leads	Leads	1200	0.6	80.4:1	200-15000	1000	1⅜	2⅜	1⅜	2	—	0.4

OUTPUT: PUSH-PULL PLATES TO VOICE COIL AND/OR LINE

6	• A-3872	SC	5000C.T.	15/8/4	75	18	Leads	Leads	200	1.1	18.2:1	70-15000	1500	2 11/16	2¾	2¼	2⅜	1½	1.7
	A-3800	C	5000C.T.	500/250/15/8/4	80	30	Leads	Leads	280	21	3.12:1	20-20000	1500	3½	2 13/16	3¼	2¼	2	3.7
7	A-3801	C	6600C.T.	500/250/15/8/4	150	35	Leads	Leads	125	10	3.64:1	30-20000	2000	3⅞	3⅛	3½	2½	2 5/16	4.8
	• A-3304	C	10000/7000 C.T.	500/15/8/4	60	25	Leads	Leads	280	20	4.5:1	100-20000	2000	3⅛	2½	2¾	2	1¾	2.7
	A-3311	C	10000C.T.	500/15/8/4	70	25	Leads	Leads	450	22	4.47:1	60-20000	1500	3½	2 13/16	3¼	2¼	2	3.5

b Has 3% and 6% primary Taps. • Available until stock is depleted.

ESSEX STANCOR

AUDIO TRANSFORMERS

OUTPUT: PUSH-PULL PLATES TO VOICE COIL AND/OR LINE (Cont'd)

Section	STANCOR Part No.	Style	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	A-3831	A	10000C.T.	8/4/2	40	5	Leads	Leads	300	0.67	35.7:1	100-15000	1000	1⅝	2⅞	1¾	2⅜	—	0.7
	A-8093	A	10000C.T.	3-4	40	10	Leads	Leads	500	0.46	53.7:1	100-15000	1500	1⅝	2⅞	1½	2⅜	—	0.7
	A-3335	S	10000C.T.	6-8/3.2-4	.40	10	Leads	Leads	550	0.5	36.2:1	100-15000	2000	2⅜	2⅞	2	2⅜	—	1.0
	•PCO-150	SC	10000C.T.c	600/150/16/8/4	200*	15	Leads	Leads	475	30	3.94:1	50-10000	2500	4¼	4	3¼	3½	2¼	5.0
2	•PCO-150A	SC	12000C.T.	600/150/16/8/4	200*	15	Leads	Leads	550	35	4.32:1	50-10000	2000	4¼	4	3¼	3½	2¼	5.0
	•A-3496	A	14000C.T.	4.0	25	5	Leads	Leads	600	0.33	59.3:1	100-15000	1000	1⅜	2⅜	1⅜	2	—	0.4
	A-3250	A	20000C.T.	500/333/200/125/50	15	5	Lugs	Lugs	1450	55	6.25:1	40-15000	1500	2	3¼	1⅞	2¹³⁄₁₆	—	1.0

UNIVERSAL OUTPUT: "POLY-PEDANCE"—SINGLE OR PUSH-PULL PLATES TO VOICE COIL

3	A-3856	A	S. or P.P. Plates 4000 to 14000	.05 to 122	35	4	Leads	Lugs	300	1.2	18.3:1	——	1500	1⅜	2⅜	1½	2	—	0.4
	•A-3822	A	S. Plate 7000 to 10000	.7 to 4	35	4	Leads	Lugs	275	0.4	50:1	——	1000	1⅜	2⅜	1⅜	2	—	0.4
	A-3823	A	S. or P.P. Plates 4000 to 14000	.05 to 122	40	8	Leads	Lugs	525	2.2	18.2:1	——	1500	1⅝	2⅞	1⅝	2⅜	—	0.7
4	•A-3850	S	S. or P.P. Plates 4000 to 14000	.05 to 122	40	8	Leads	Lugs	500	1.7	18.2:1	——	1000	2	2⅜	1⅝	2	—	0.7
	•A-3825	A	S. Plate 1500 to 4500	.3 to 4	75	8	Leads	Lugs	140	0.9	25:1	——	1500	2	3¼	1¾	2¹³⁄₁₆	—	.09
	•A-3824	A	S. or P.P. Plates 6000 to 10000	.6 to 4	75	8	Leads	Lugs	175	0.5	44:1	——	1500	2	3¼	2	2¹³⁄₁₆	—	1.4
5	A-3849	A	S. Plate 1500 to 10000	.02 to 21	55	10	Lugs	Lugs	260	1.4	18.2:1	——	1000	1⅝	2⅞	1½	2⅜	—	0.7
	A-3880	A	P.P. Plates 4000 to 14000	.02 to 122	40	15	Lugs	Lugs	350	1.0	18.2:1	——	1500	2⅜	3¾	2⅛	3⅛	—	1.7
	A-3852	S	P.P. Plates 4000 to 14000	.05 to 122	40	18	Leads	Lugs	475	1.0	22.4:1	——	1500	2⅜	2⅞	2	2⅜	—	1.3
	•A-3870	A	P.P. Plates 4000 to 14000	.05 to 122	50	18	Lugs	Lugs	600	2.0	18.2:1	——	1500	2	3¼	2	2¹³⁄₁₆	—	1.3
	A-3830	S	P.P. Plates 3000 to 10000	.04 to 122	60	20	Leads	Lugs	170	0.7	18.2:1	——	1500	2¾	3⅛	2⅛	2¹³⁄₁₆	—	1.8

OUTPUT: HIGH FIDELITY

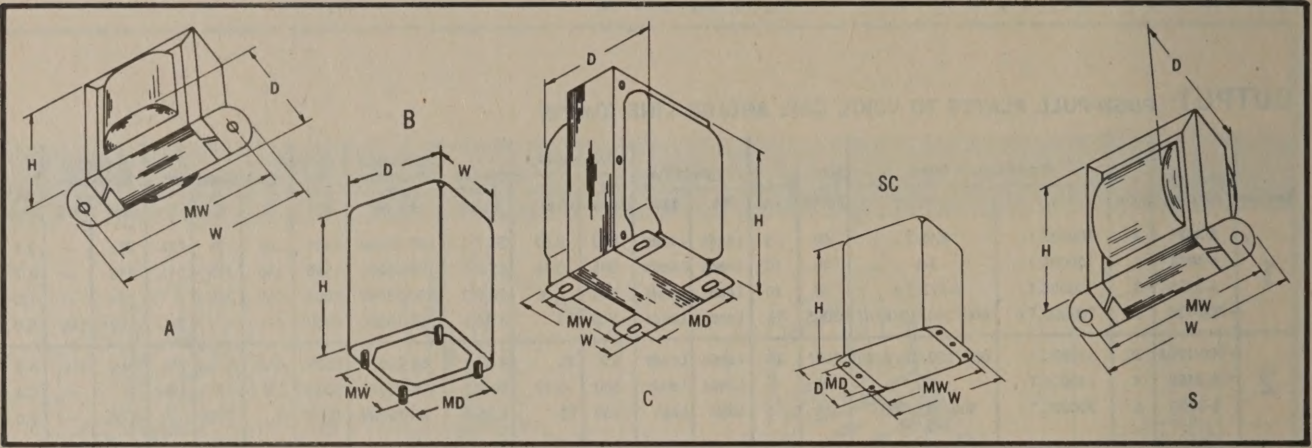
Section	STANCOR Part No.	Style	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±1 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
6	A-8053	C	5000C.T.	16/8	150	50	Leads	Leads	155	0.75	5.5:1	20-20000	2000	4¼	3⁷⁄₁₆	4¼	2¾	3³⁄₁₆	6.5
	A-8056	C	6600C.T.	16/8	125	50	Leads	Leads	235	0.75	20:1	20-20000	2000	4¼	3⁷⁄₁₆	4¼	2¾	3³⁄₁₆	6.5
	•A-8072	C	7600C.T. a	16/8/4	100	25	Leads	Leads	292	1.0	22:1	20-20000	2000	4¼	3⁷⁄₁₆	4¼	2¾	3³⁄₁₆	6.5

Section	STANCOR Part No.	Style	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±1.5 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
7	•BO-2	B	20000C.T.	600/150	10	1.0	Lugs	Lugs	600	16	5.5:1	30-20000	1500	3½	2⅞	2¹¹⁄₁₆	2	1⅞	3.0

* Total for both halves. a. Has Screen Grid taps on primary. • Available until stock is depleted. c. Has cathode feedback Winding.

ESSEX STANCOR

AUDIO TRANSFORMERS



LINE TO VOICE COIL

Section	STANCOR Part No.	Style	Impedance in Ohms		Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	A-8104	S	3000/2000/1500/ 1000/500	4/8/16	10	Lugs	Lugs	175	1.5	12.8:1	50-15000	1500	2⅜	2⅞	1¾	2⅜	—	1.5
	•A-3882	C	500/333/250	4/8/15	25	Lugs	Lugs	33	0.9	5.85:1	50-15000	1000	3⅛	2½	2⅞	2	1¹¹⁄₁₆	2.4
	A-3883	S	500	4/6/8/15	25	Lugs	Lugs	24	1.0	5.75:1	50-15000	1500	2⅜	2⅞	1¾	2⅜	—	1.1
2	A-8101	A	500	3.2/6-8	5	Lugs	Leads	40	0.5	8.8:1	60-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
	A-7947	A	2000/1500/1000/500	3.2/6-8	8	Lugs	Lugs	150	0.8	17.2:1	60-15000	1500	1⅝	2⅞	1⅝	2⅜	—	0.7
	A-7949	S	2000/1500/1000/500	3.2/6-8	12	Lugs	Lugs	120	0.8	17.7:1	50-15000	1500	2⅜	2⅞	1¾	2⅜	—	1.1
	A-3837	S	500	.06 to 48	15	Lugs	Lugs	50	0.4	7.9:1	60-15000	1500	2⅜	2⅞	2	2⅜	—	1.4

• Available until stock is depleted.

25 VOLT LINE TO VOICE COIL

Section	STANCOR Part No.	Style	Impedance in Ohms		Power Steps in Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
3	A-8096	S	78/156/312/625/ 1250	4/8/16	8/4/2/1/0.5	Lugs	Lugs	72	1.0	8.8:1	30-20000	1000	2	2⅜	1⅝	2	—	0.65
	A-8097	S	39/78/156/312/ 625/1250	4/8/16	16/8/4/2/ 1/0.5	Lugs	Lugs	60	1.1	8.68:1	30-20000	1000	2¾	3⅛	2¼	2¹³⁄₁₆	—	1.6
	A-8095	A	125/250/500/ 1000/2000	4/8	5/2.5/1.25/ .62/.31	Lugs	Lugs	100	0.6	15.6:1	30-20000	1000	1⅜	2⅜	1½	2	—	0.4
	A-8099	A	312/625/1250	4/8	2/1/0.5	Lugs	Lugs	85	0.6	12.2:1	50-15000	1000	1¼	2⅛	1⅜	1¾	—	0.3
4	A-8087	A	312/625/1250	8	2/1/0.5	Leads	Leads	85	0.7	12.2:1	40-15000	1000	1⅜	2⅜	1⅜	2	—	0.4
	•A-8088	A	156/312/625/ 1250/2500/5000	8	4/2/1/.5/ .25/.12	Leads	Leads	130	0.5	24.3:1	40-20000	1000	1⅝	2⅞	1⅝	2⅜	—	0.7
	A-8086	A	1250#	8	0.5	Leads	Leads	55	0.6	11.2:1	40-20000	1000	1⅜	2⅜	1⁵⁄₁₆	2	—	0.4
	A-8055	A	625/1250	8	1/0.5	Leads	Leads*	114	.69	11.9:1	50-15000	1000	1¼	2⅛	1⁵⁄₁₆	1¾	—	.25
	A-8071	A	625/1250	8	1/0.5	Leads	Leads	114	.69	11.9:1	50-15000	1000	1¼	2⅛	1⁵⁄₁₆	1¾	—	.25
	A-8089	A	156/312/625/1250	8	4/2/1/0.5	Leads	Leads	54	.42	12.5:1	40-20000	1000	1⅝	2⅞	1⁷⁄₁₆	2⅜	—	0.6

#Includes C.T. connection for balanced line operation.

*Self Leads — 2 inches long, skinned and tinned 1 inch.

70.7 VOLT LINE TO VOICE COIL

5	A-8102	S	625/1250/2500/ 5000/10000	4/8/16	8/4/2/1/0.5	Lugs	Lugs	670	1.0	24.9:1	50-20000	1000	2	2⅜	1⅝	2	—	0.7
	A-8103	S	312/625/1250/ 2500/5000/10000	4/8/16	16/8/4/2/ 1/0.5	Lugs	Lugs	585	1.1	24.5:1	40-15000	1000	2¾	3⅛	2¼	2¹³⁄₁₆	—	1.5
	A-8105	A	1000/2000/4000/ 8000/16000	4/8	5/2.5/1.25/ .62/.31	Lugs	Lugs	950	0.6	44.2:1	50-20000	1000	1⅜	2⅜	1½	2	—	0.4
	A-8105A	A	1000/2000/4000 8000/16000	4/8	5/2.5/1.25/ .62/.31	Leads	Leads	950	0.6	44.2:1	50-20000	1000	1⅜	2⅜	1½	2	—	0.4
6	A-8109	A	2500/5000/10000	4/8	2/1/0.5	Lugs	Lugs	800	0.6	34.9:1	50-15000	1000	1¼	2⅛	1⅜	1¾	—	0.3
	A-8080	A	1000/1250/1667/ 2500/5000	8/16	5/4/3/2/1	Lugs	Lugs	275	1.5	17.2:1	50-20000	1000	1⅜	2⅜	1½	2	—	0.4
	A-8082	S	333/357/384/ 417/455	8/16	15/14/13/ 12/11	Lugs	Lugs	30	1.1	5.1:1	50-20000	1000	2⅜	2⅞	1¾	2⅜	—	1.2

• Available until stock is depleted.

ESSEX STANCOR

AUDIO TRANSFORMERS

70.7 VOLT LINE TO VOICE COIL (Cont'd)

Section	STANCOR Part No.	Style	Impedance in Ohms		Power Steps in Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	A-8081	S	500/555/625/715/833	8/16	10/9/8/7/6	Lugs	Lugs	70	1.3	6.86:1	50-20000	1000	2	2⅜	1⅝	2	—	0.7
	A-8083	A	2500/5000/10000	8	2/1/0.5	Leads	Leads	635	0.7	34.7:1	50-20000	1000	1⅜	2⅜	1⅜	2	—	0.4
	•A-4781	A	1000/1250/1667/2500/5000	8	5/4/3/2/1	Lugs	Lugs	260	1.0	24.4:1	50-20000	1000	1⅜	2⅜	1½	2	—	0.4
2	A-8084	A	1250/2500/5000/10000/20000/40000	8	4/2/1/.5/.25/.12	Leads	Leads	1150	0.4	67.6:1	50-20000	1000	1⅝	2⅞	1⅝	2⅜	—	0.7
	A-8085	A	156/312/625/1250	8	4/2/1/0.5	Leads	Leads	500	.48	34.8:1	50-20000	1000	1⅝	2⅞	1⅜	2⅜	—	0.6
	*A-4785	S	625/1250/2500/5000/10000	8	8/4/2/1/0.5	Lugs	Lugs	600	0.7	33.7:1	50-20000	1000	2	2⅜	1⅝	2	—	0.7
	•A-4799	A	500/1000/2000	8	10/5/2.5	Lugs	Lugs	130	0.9	14.7:1	50-20000	1000	1⅝	2¾	1⅝	2⅜	—	0.5
3	A-8076	S	250/500/1000/2000	4/8/16	20/10/5/2.5	Lugs	Lugs	65	0.7	11.2:1	50-20000	1000	2⅜	2⅞	1⅞	2⅜	—	1.0
	A-8077	S	208/416/833/1666/3333	4/8/16	24/12/6/3/1.5	Lugs	Lugs	63	0.7	14:1	40-20000	1000	2¾	3⅛	2	2¹³⁄₁₆	—	1.5
	A-8078	S	167/250/500/1000	4/8/16	30/20/10/5	Lugs	Lugs	35	0.8	8:1	40-20000	1500	2⅜	2⅞	1¾	2⅜	—	1.0
	A-8079	S	100/125/200/333	4/8/16	50/40/25/15	Lugs	Lugs	22	1.2	4.46:1	40-20000	1000	2⅜	2⅞	2	2⅜	—	1.4

*Self Leads — 2 inches long, skinned and tinned 1 inch.

140 VOLT LINE TO VOICE COIL

Section	STANCOR Part No.	Style	Pri.	Sec.	Power Steps in Watts	Pri.	Sec.	Pri. Ohms	Sec. Ohms	Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	H	W	D	MW	MD	Wt. Lbs.
4	*A-8108	A	4000/8000/16000/32000	4/8	5/2.5/1.25/.62	Lugs	Lugs	2000	0.7	64.2:1	40-15000	1000	1⅜	2⅜	1½	2	—	0.4
	•A-8106	S	2500/5000/10000/20000	4/8/16	8/4/2/1	Lugs	Lugs	1250	1.0	35.3:1	40-15000	1000	2	2⅜	1⅝	2	—	0.7

• Available until stock is depleted.

TECHNICAL DATA FOR CONSTANT VOLTAGE TYPES

The Constant Voltage Line Sound Distribution Systems have become the most widely accepted systems in use today. They offer the Sound Engineer an easy means of establishing the volume level of each speaker in a system without the use of potentiometers or similar devices. The proven simplicity and versatility of these systems minimize the problem of speaker impedance mismatching thereby insuring high quality sound reproduction and minimum power losses. The use of higher power driving the constant voltage lines also helps to lower power losses over longer distances.

Most of the newer P. A. amplifiers have a designated 25 volt, 70.7 volt or 140 volt outlet on the output transformer, but almost any older amplifier has an impedance tap which may be used for the desired voltage output.

To insure a steady maintenance of the desired line voltage, it is recommended that the amplifier should be capable of producing 1½ times the total power of the various speakers connected. Hence, if the sum of the speakers equals 25 watts, the driving amplifier should be capable of producing 37½ watts. The power and impedance figures shown here with the formulas are based on the total power actually supplied to the speakers and not on the maximum capability of the amplifier.

The following table lists various amplifier power ouputs with the corresponding impedance tap on the output transformer which will supply these three basic line voltages:

Watts Power Output	Impedance For 140 Volt Line	Impedance For 70.7 Volt Line	Impedance For 25 Volt Line
5	4,000	1,000	125
10	2,000	500	62.5
15	3,333	333	41.7
20	1,000	250	31.2
25	800	200	25
30	666	166	21
40	500	125	15.6
50	400	100	12.5
60	333	83	10.5
80	250	62.5	7.8
100	200	50	6.3

For power ratings not shown in this table, use the following formula:

$Z = E^2/W$
Z = Ohms
E = Volts
W = Watts Output

Impedance Tap for: 140 volt line = 20,000/W
70.7 volt line = 5,000/W
25 volt line = 625/W

To establish the volume level of the various speakers in the system, it is necessary to know the power output of the amplifier and the power desired at each speaker. To choose the correct line transformers, match the power to be delivered to each speaker with the power tap on the line transformer. Then connect the primaries of the line transformers in parallel to the proper voltage tap on the output transformer of the amplifier. When the sum of the power ratings shown on each line transformer is equal to the power rating of the amplifier, and the speakers are connected to the appropriate secondary taps, the system is correctly matched.

To determine the proper tap on the primary of the line transformer for a given wattage input to the speaker, use the formula:

$Z = E^2/W$

EXAMPLE: In a 70.7 volt system assume that the speaker requires 5 watts. What is the impedance of the tap required to produce this wattage?

$Z = E^2/W = 70.7 \times 70.7/5 = 5{,}000/5 = 1{,}000$ ohms

To determine the wattage input to the speaker when the tap is already connected, use the formula:

$W = E^2/Z$

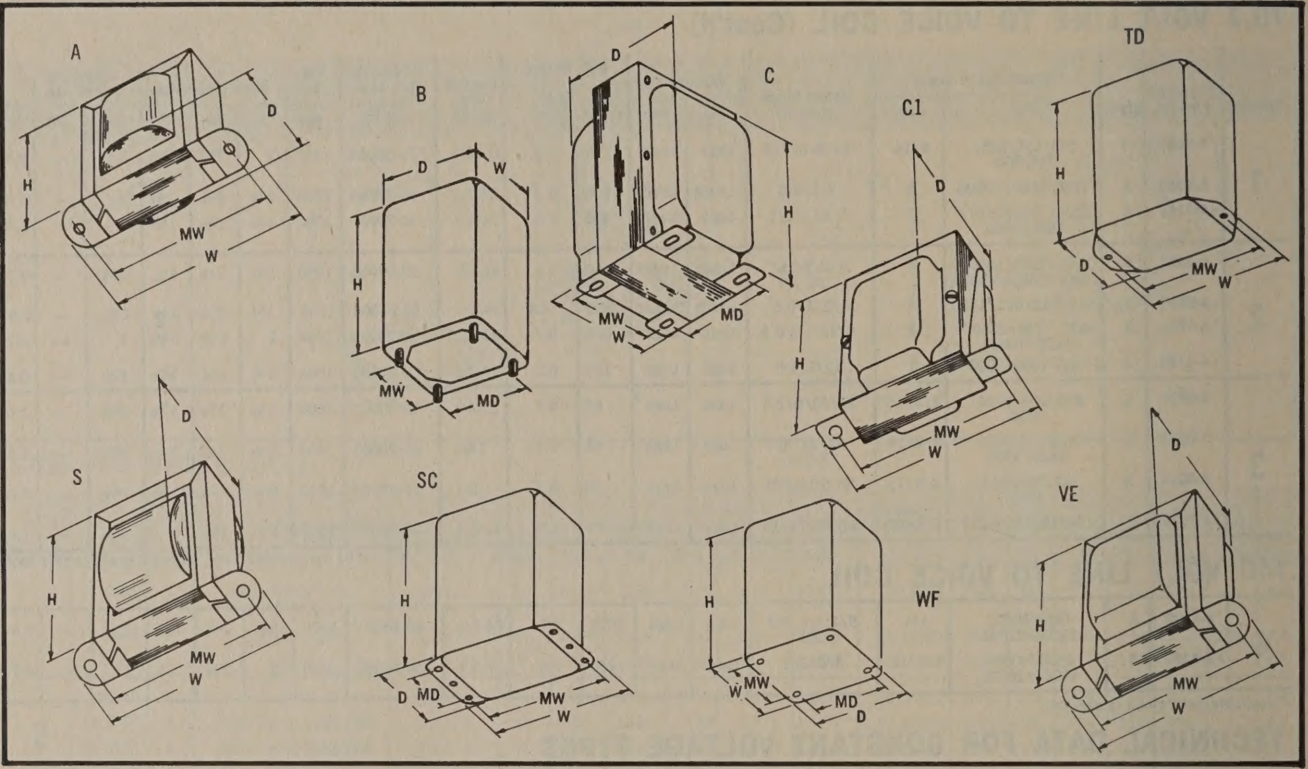
EXAMPLE: In a 70.7 volt system, assume a speaker connected to the 500 Ohm tap of the primary of the line transformer. What wattage is produced by the use of this tap?

$W = E^2/Z = 70.7 \times 70.7/500 = 5{,}000/500 = 10$ Watts

REMEMBER: Each speaker must have its own line-matching transformer and all of the line-matching transformers are connected in parallel to the proper voltage tap on the output transformer of the amplifier.

ESSEX STANCOR

AUDIO TRANSFORMERS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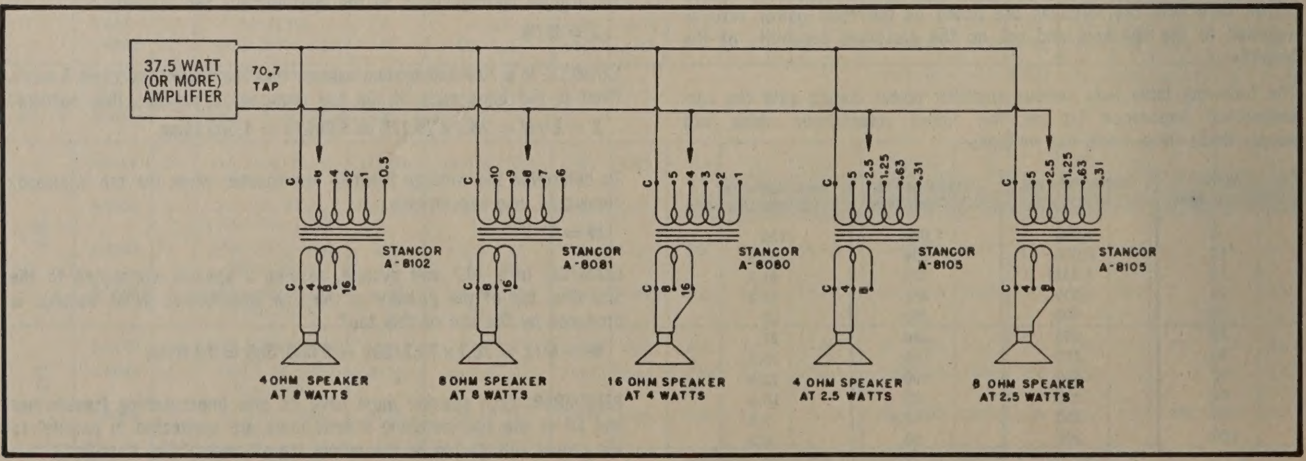
FOR INTERCOMS AND TRANSCEIVERS

Section	STANCOR Part No.	Style	Application	Impedance in Ohms		Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs
				Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	A-4744	VE	Intercom Input	4	25000	—	Leads	Leads	0.6	750	1:79.5	200-7000	1500	1⅜	2⅜	1½	2	—	0.5
	A-8090	A	Line to Voice Coil	45 or 50	6-8/3-4	3	Lugs	Lugs	4.0	0.5	2.52:1	100-20000	1000	1⅜	2⅜	1¼	2	—	0.5
	•A-8091	A	Line to Voice Coil	45 or 50	6-8/3-4	8	Lugs	Lugs	4.2	0.5	2.52:1	100-20000	1000	1⅝	2⅞	1½	2⅜	—	0.7
	A-4749	TD	Telephone Patch Circuit	10000	500	—	Leads	Leads	1325	20	7.8:1	200-4000	1000	2	2¼	1 9/16	1 15/16	—	1.0

•Available until stock is depleted.

A TYPICAL 70.7 VOLT LINE DISTRIBUTION SYSTEM SHOWING THE PROPER STANCOR UNIT


37.5 WATT (OR MORE) AMPLIFIER
70.7 TAP
C
8
4
2
1
0.5
STANCOR A-8102
C
4
8
16
4 OHM SPEAKER AT 8 WATTS
C
10
9
8
7
6
STANCOR A-8081
C
8
16
8 OHM SPEAKER AT 8 WATTS
C
5
4
3
2
1
STANCOR A-8080
C
8
16
16 OHM SPEAKER AT 4 WATTS
C
5
2.5
1.25
.63
.31
STANCOR A-8105
C
4
8
4 OHM SPEAKER AT 2.5 WATTS
C
5
2.5
1.25
.63
.31
STANCOR A-8105
C
4
8
8 OHM SPEAKER AT 2.5 WATTS

ESSEX STANCOR

AUDIO TRANSFORMERS

MICROPHONE, PICKUP OR LINE TO GRID

Section	STANCOR Part No.	Style	Application	Impedance in Ohms		Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
				Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	•A-4705	A	S.B. Mic. to S. Grid	200/70	80000	—	Leads	Leads	12	1050	1:20	200-5000	1500	1⅜	2⅜	1⅜	2	—	0.5
	•A-4706	A	S.B. Mic. to S. Grid	100	60000	—	Leads	Leads	26	1850	1:24.6	200-5000	1500	1⅜	2⅜	1½	2	—	0.5
	•A-4708	S	D.B. Mic. to S. Grid	200C.T.	57000	—	Lugs	Lugs	46	2500	1:17	200-7000	1500	2	2⅜	1½	2	—	0.7
	•A-4747	VE	S.B. Mic. or Line to S. Grid	70	1.300,000	—	Leads	Leads	2.7	3300	1:137	200-5000	1500	1½	1$^{13}/_{16}$	1¼	1½	—	0.5
	A-4351	SC	Mic. or Line to S. Grid	500/333/ 200/125/ 50	89000	—	Leads	Leads	22	3100	1:13.3	60-10000	1500	2$^{11}/_{16}$	2$^{11}/_{16}$	2¼	2⅜	1½	1.4
2	•A-4352	A	Mic. or Line to P.P Grids	500/333/ 200/125/ 50	89000 C.T.	—	Lugs	Lugs	25	3500	1:13.3	60-10000	1000	2	3¼	1⅞	2$^{13}/_{16}$	—	1.0
	•A-4709	SC	Dyn. Mic. or Pickup to S. Grid	30/15/ 8/4	106,000	—	Leads	Leads	2.2	3600	1:60	30-15000	1500	2$^{11}/_{16}$	2$^{11}/_{16}$	2¼	2⅜	1½	1.7
	•A-4778	C1	Line to S. Grid	600/500 C.T.	240,000	—	Leads	Leads	35	5500	1:20	200-7000	1500	2¼	2⅞	1$^{13}/_{16}$	2⅜	—	1.0
	A-4779	A	Line to S. or P.P. Grids	600/500 C.T.	60000 C.T.	—	Leads	Leads	37	1600	1:10	100-10000	1500	1⅜	2⅜	1⅜	2	—	0.5

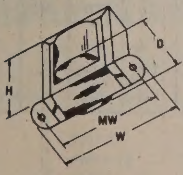
LINE TO LINE

Section	STANCOR Part No.	Style	Impedance in Ohms		Frequency Response in Hz. ±3 DB	Audio Watts	Termination		Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	H	W	D	MW	MD	
3	A-4350	A	50/125/200/333/500	50/125/200/333/500	200-15000	10	Lugs	Lugs	2	3¼	1⅞	2$^{13}/_{16}$	—	1.0
	•A-4407	C	50/125/200/333/500	50/125/200/333/500	100-15000	20	Lugs	Lugs	3⅛	2½	2¾	2	1¾	2.4

HI-FI: WF SERIES — SHIELDED

Section	STANCOR Part No.	Style	Application	Impedance in Ohms		Audio Level	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
				Pri.	Sec.		Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
4	WF-20	WF	Mic., Pickup or Line to Grid	500-600/ 333/250/ 200/125- 150/50	50000 C.T.	+7db	Lugs	Lugs	88.0	3150	1:10	30-20000	500	2	1½	1½	1$^{5}/_{32}$	1$^{5}/_{32}$	0.6
	WF-30	WF	Mixer, Mic., Pickup, or Line to Line	500-600/ 333/250/ 200/125- 150/50	500-600/ 333/250/ 200/125- 150/50	+7db	Lugs	Lugs	80.0	84.2	1:1	30-20000	500	2	1½	1½	1$^{5}/_{32}$	1$^{5}/_{32}$	0.6

• Available until stock is depleted.



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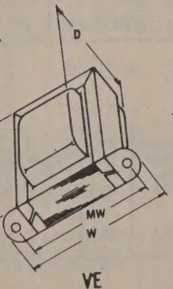

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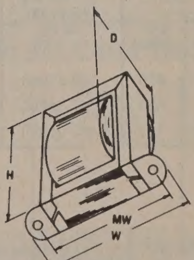

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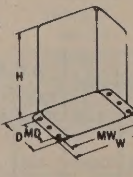

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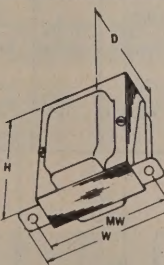

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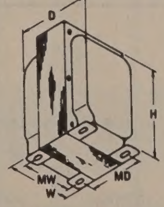

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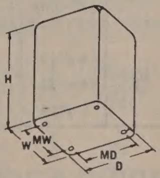
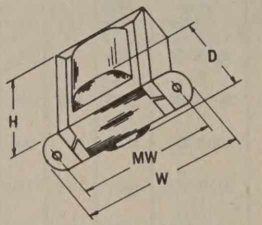


WF

ESSEX STANCOR

AUDIO TRANSFORMERS



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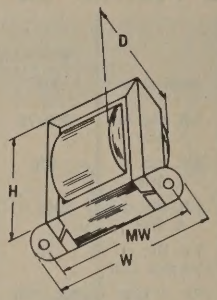


S

INTERSTAGE: SINGLE PLATE (7,000 TO 20,000 OHM) TO SINGLE GRID

Section	STANCOR Part No.	Style	Ratio	Max. Pri. DCMA	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
					Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
1	A-53	A	1:3	10	Leads	Leads	400	1500	1:3	100-10000	1000	1⅜	2⅜	1⅜	2	—	0.5

INTERSTAGE: SINGLE PLATE (7,000 TO 15,000 OHM) TO PUSH-PULL GRIDS

2	A-52C	A	1:2	10	Leads	Leads	570	1450	1:2	100-10000	1000	1⅜	2⅜	1½	2	—	0.4
	A-53C	A	1:3	10	Leads	Leads	400	1500	1:3	100-10000	1000	1⅜	2⅜	1½	2	—	0.5
	A-63C	A	1:3	10	Leads	Leads	565	2050	1:3	100-10000	1000	1⅝	2⅞	1⅝	2⅜	—	0.7

INTERSTAGE: PUSH-PULL PLATES (7,000 TO 15,000 OHM) TO PUSH-PULL GRIDS

3	•A-4711	A	1:1	10	Leads	Leads	1300	1600	1:1	60-10000	1000	1⅝	2⅞	1⅝	2⅜	—	0.7

INTERSTAGE: MULTI-PURPOSE (7,000 TO 15,000 OHM PLATES)

4	•A-4774	S	1:3 Proper Connections will provide Ratios of 1:1, 1:3, or 1:6. May be used for Single or Push-Pull Plates to Single or Push-Pull Grids.	10	Leads	Leads	1250	4000	1:3	70-10000	1000	2⅜	2⅞	1¾	2⅜	—	1.2

DRIVER: SINGLE PLATE TO PUSH-PULL GRIDS*

Section	STANCOR Part No.	Style	Pri. Impedance in Ohms	Max. Pri. DCMA	Pri.: ½ Sec. Ratio	Audio Watts	Termination		D.C. Resist.		Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
							Pri.	Sec.	Pri. Ohms	Sec. Ohms			H	W	D	MW	MD	
5	•A-4713	A	10000	30	2:1	5	Leads	Leads	550	875	100-20000	1500	1⅝	2⅞	1⅝	2⅜	—	0.7
	•A-4752	A	10000	40	2/1.5/1:1	10	Leads	Leads	420	650	60-10000	1500	2	3¼	1¾	2¹³⁄₁₆	—	1.2
	A-4723	A	10000	30	3:1	5	Leads	Leads	435	435	200-15000	1500	1⅝	2⅞	1⅝	2⅜	—	0.7

MODULATION

Section	STANCOR Part No.	Style	Impedance in Ohms		Max. Sec. DCMA	Audio Watts	Termination		D.C. Resist.		Overall Turns Ratio	Frequency Response in Hz. ±3 DB	RMS Test Voltage	Case Dimension			Mounting Dimension		Wt. Lbs.
			Pri.	Sec.			Pri.	Sec.	Pri. Ohms	Sec. Ohms				H	W	D	MW	MD	
6	•A-3812	A	10000C.T.	4000	50	5	Leads	Leads	435	165	1.58:1	200-5000	1500	1⅝	2⅞	1⅝	2⅜	—	0.7

* Refer to information pertaining to turns ratios shown on page 5. • Available until stock is depleted.

ESSEX STANCOR

MINIATURE TRANSISTOR TRANSFORMERS

FOR PC BOARD APPLICATIONS

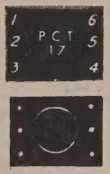
COLOR CODING by application to assure immediate and positive transformer identification.

RECTANGULAR SHAPE allows the utmost utilization of space and stacking in limited area.

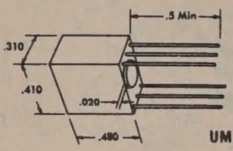
PROTECTIVE STAND-OFF prevents solder flow-back and maximum lead exit protection.

SPACED LEADS of fatigue resistant gold plated nickel-iron alloy are .020″ in diameter, 5/16″ long and have multiples of 0.1″ grid spacing for printed circuit application.

Magnetic Shielding Available* Net Wt. 1/10 oz. each



PCT



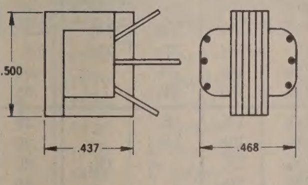
UME

POLYCHROMATRANS: WITH MULTIPLES OF 0.1″ GRID SPACING FOR PRINTED CIRCUITS

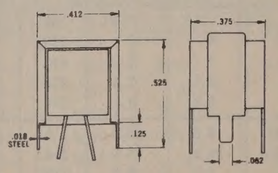
Section	STANCOR Part No.	Power Level in M.W.	Application	Color Application Guide	Matching Impedance		Max. MA. D.C. Unbal. in Pri.	D.C. Resistance		Overall Turns Ratio	RMS Test Volts
					Pri.	Sec.		Pri.	Sec.		
1	PCT-14	15	Input	Brown	200,000C.T.	1000C.T.	0	6300	130	14.1:1	500
	•PCT-15	35	Input	Brown	50000C.T.	1000C.T.	0	4600	90	7.1:1	500
	PCT-17	15	Input	Brown	200,000	1000	0	6300	130	14.1:1	500
	PCT-23	55	Interstage	Red	25000C.T.	1000C.T.	.5	2000	140	5:1	500
	•PCT-25	75	Interstage	Red	10000C.T.	1500C.T.	1	1250	360	2.57:1	500
2	•PCT-31	75	Driver	Orange	10000C.T.	2000C.T.	1	1000	400	2.24:1	500
	•PCT-39	75	Driver	Orange	10000C.T.	500C.T.	1	1000	85	4.47:1	500
	•PCT-54	75	Output	Yellow	600C.T.	12	4.5	92	4	7.06:1	500
	PCT-60	75	Output	Yellow	500C.T.	600	3	80	118	1.1:1	500
	•PCT-62	75	Output	Yellow	1500C.T.	600	3	200	110	1.58:1	500
3	•PCT-71	75	Output	Yellow	600C.T.	3.2	4.5	95	.07	13.6:1	500
	PCT-76	75	Output Isolation	Green	10000C.T.	10000C.T.	1	1100	1400	1:1	500
	PCT-77	75	Output Isolation	Green	600C.T.	600C.T.	3	85	110	1:1	500
	PCT-116	—	Choke	Blue	6HYS.	—	2	1800	—	—	500
	PCT-117	—	Choke	Blue	1.25HYS.	—	2	200	—	—	500

*SPCT-10 Magnetic Alloy Shield — fits all PCT Transformers.

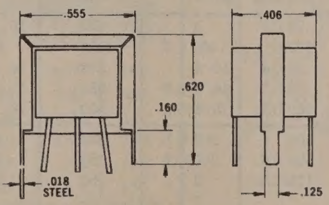
TRANSISTOR TRANSFORMERS PICO-MINIATURE TYPES



PMT-76 TO 81



PMTF-55 TO 75



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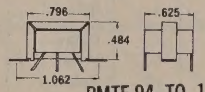
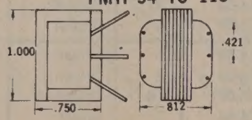
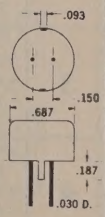


PMTF-94 TO 113



PMTF-128 TO 146



PTH

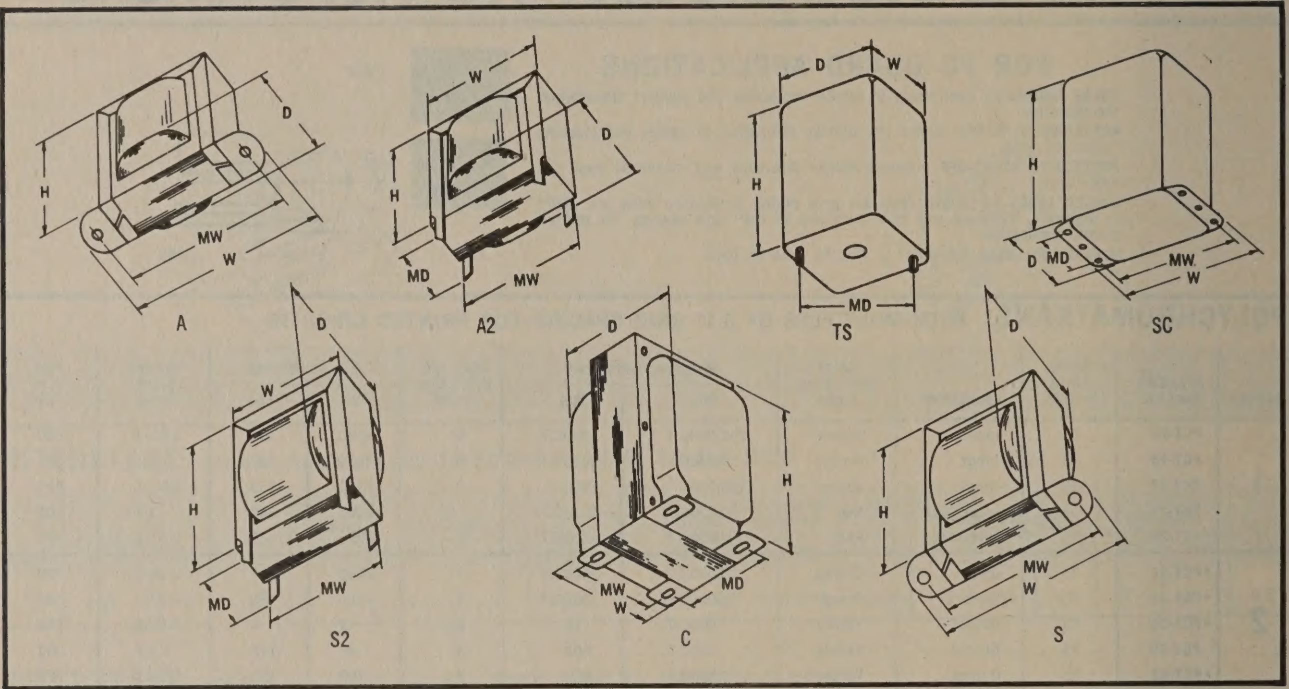
FOR AUDIO APPLICATIONS: ALL UNITS TERMINATE WITH LEADS — FOR PC BOARD APPLICATIONS

Section	STANCOR Type No.	Application	Turns Ratio Pri. to Sec.	Impedance in Ohms		D.C. Resistance in Ohms		Power Level (MW)
				Pri.	Sec.	Pri.	Sec.	
4	PMT-74	Interstage	1:1	600C.T.	600C.T.	48	60	300
	PMTF-73	Driver	4:1	10000C.T.	600C.T.	900	50	200
	PMTF-74	Interstage	1:1	600C.T.	600C.T.	48	60	300
	•PMTF-75	Isolation	1:1	15000C.T.	15000C.T.	925	1200	200
	PMTF-81	Input	1:1.4	600C.T.	1200C.T.	55	109	30
	•PMTF-98	Output	40:1	100,000	60	4800	3.5	100
	PMTF-110	Output	2.72:1	400	50	30	9	75
	PMTF-145	Input	1:11	600	75000C.T.	48	1300	200
	PTH-31	Inductor — 1.0 Henry (Zero D.C.)				520	—	—

•Available until stock is depleted.

ESSEX STANCOR

TRANSISTOR TRANSFORMERS



FOR AUDIO APPLICATIONS: ALL UNITS TERMINATE WITH LEADS

Section	STANCOR Part No.	Style	Application	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	DC Res. in Ohms		Case Dimensions			Mtg. Dimensions		Wt. Lbs.
				Pri.	Sec.			Pri.	Sec.	H	W	D	MW	MD	
1	TA-1	A	Input	600 C.T.	10	20	.05	42	0.8	13/16	1 5/8	1	1 3/8	—	.07
	TA-2	A	Interstage	100 C.T.	10 C.T.	100	.25	4.3	0.8	1 1/4	2 1/8	1 1/2	1 3/4	—	.25
	TA-3	A	Interstage	100	1000 C.T.	100	.25	5.8	45	1 3/8	2 3/8	1 1/2	2	—	.35
	TA-4	A	Interstage	500 C.T.	5000 C.T.	12	.03	37	250	1 3/8	2 3/8	1 5/8	2	—	.35
	TA-5	A	Driver	1000	200 C.T.	10	.05	400	115	11/16	1 5/16	5/8	1 1/16	—	.05
	TA-6	A	Driver	2000	200 C.T.	5	.05	720	115	11/16	1 5/16	5/8	1 1/16	—	.05
2	TA-7	A	Driver	100	100 C.T.	100	.5	12	12	1 5/8	2 7/8	1 5/8	2 3/8	—	.60
	•TA-8	A	Output	9800	15	2	.05	640	2	11/16	1 5/16	5/8	1 1/16	—	.05
	TA-9	A	Output	1000	16/8/4	10	.2	180	3.5	13/16	1 5/8	7/8	1 3/8	—	.07
	TA-10	A	Output	2000 C.T.	16/8/4	—	.2	250	4	13/16	1 5/8	7/8	1 3/8	—	.08
	TA-11	A	Output	48 C.T.	16/8	275	5	5	1.5	2	3 1/4	1 7/8	2 13/16	—	1.0
3	TA-12	A	Output	20 C.T.	8	500	10	.55	.35	1 3/8	2 3/8	1 5/8	2	—	.45
	•TA-13	SC	Driver	200 C.T.	400 C.T.	10	.6	4	7	2 15/16	2 11/16	2 1/4	2 3/8	1 1/2	1.5
	•TA-14	SC	Output	24 C.T.	16/4	200	10	2	1.2	4 5/16	4 7/16	3 11/16	3 7/8	2 3/4	6.6
	TA-56	S†	Output	48 C.T.	16/8/3.2	550	10	3.6	1.4	2 3/8	2 7/8	1 3/4	2 3/8	—	.90
	TA-57	S	Output	100 C.T.	16/8/3.2	500	10	6.6	1.5	2 3/8	2 7/8	1 7/8	2 3/8	—	.95
4	TA-58	A	Driver	100	200 C.T.	200	.5	6.5	15.5	1 1/4	2 1/8	1 3/8	1 3/4	—	.20
	TA-59	A	Driver	500 C.T.	200 C.T.	50	.5	36.5	15.5	1 1/4	2 1/8	1 3/8	1 3/4	—	.20
	•TA-60	TS	Output	125 C.T.	8	50	1.5	7.5	0.9	1 11/16	1 5/16	1 5/16	—	1 9/32	.30
	•TA-61	S	Driver	*	*	—	—	1.8	1.8	2	2 3/8	1 1/2	2	—	.60
	•TA-62	A	Output	25	4	400	4	1.5	0.4	1 5/8	2 7/8	1 5/8	2 3/8	—	.60

FOR TRANSISTORIZED AUTO RADIOS

5	•TA-48	S2	Interstage	1000	40	10	2	136	2.8	1 3/4	1 7/16	1 1/4	1 1/16	9/16	.35
	•TA-49	S	Output	30 C.T.	4	50	10	2.2	0.3	2 3/8	2 7/8	1 1/2	2 3/8	—	.80
	•TA-50	A2	Output	9	4	920	10	.15	1.0	2	2 5/16	1 5/8	1 7/8	13/16	1.0
	•TA-51	S2	Interstage	1000	10	10	2	170	1.0	1 3/4	1 7/16	1 1/4	1 1/16	9/16	.35

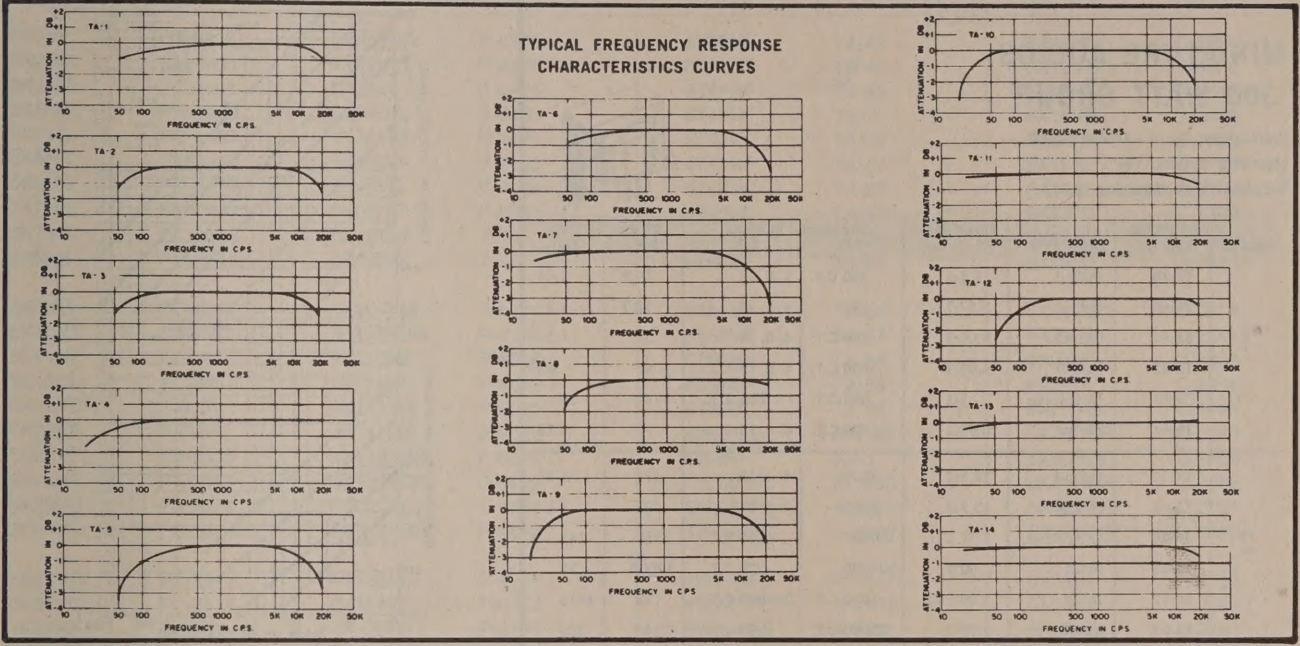
FOR TRANSISTOR MOBILE MODULATOR (WRITE FOR BULLETIN 545 FOR CIRCUIT)

Section	STANCOR Part No.	Style	Application	Impedance in Ohms		Max. Pri. DCMA	Audio Watts	Case Dimensions			Mtg. Dimensions		Wt. Lbs.
				Pri.	Sec.			H	W	D	MW	MD	
6	•TA-15	A	Input	50 to 100	10	50	.005	15/16	1 5/8	1	1 3/8	—	0.15
	TA-16	A	Driver	20	36 C.T.	400	1.0	1 1/4	2 1/8	1 1/8	1 3/4	—	0.20
	•TA-17	C	Modulation	8 C.T.	7500/5000 @ 120 Ma	—	35.0	3 1/8	2 1/2	3	2	2	3.0

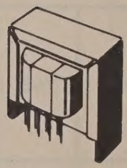
*Trifilar Wound-Ratio 1:1:1. †Has Lugs on Secondary. •Available until stock is depleted.

ESSEX STANCOR

TRANSISTOR TRANSFORMERS


TYPICAL FREQUENCY RESPONSE CHARACTERISTICS CURVES

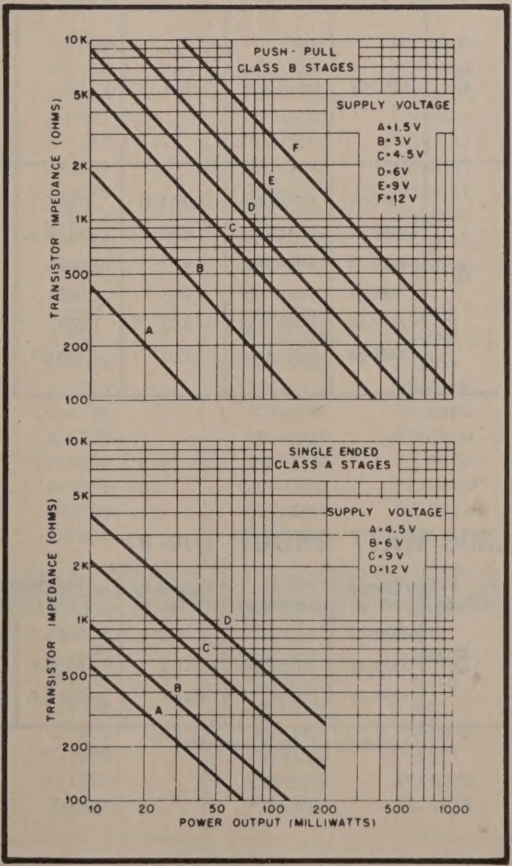
MINIATURE AUDIOS
.150 WATT GROUP



Dimensions: 21/32″H x 13/16″W x 5/8″D.
Mounting tabs: 3/16″ wide, 25/32″ centers.
Weight: .65 oz. Mounting Type A1.

Section	STANCOR Part No.	Application	Turns Ratio Pri. to Sec.	Impedance in Ohms		D.C. Res. in Ohms		Power Level (MW)
				Pri.	Sec.	Pri.	Sec.	
1	TA-18	Input	1:45.4	30C.T.	50000	14.7	4060	150
	TA-19	Interstage	3.08:1	100C.T.	10C.T.	19	1.27	150
	•TA-20	Output	5.22:1	350C.T.	4/12	38	1.45	150
	TA-21	Output	5.53:1	500C.T.	4/8/16	75.3	3.55	150
	TA-22	Interstage	3.16:1	500C.T.	50	59.7	7.9	150
	TA-23	Output	5.65:1	600C.T.	4/8/16	73.2	3.2	150
2	TA-24	Interstage	10.0:1	500C.T.	50000	76.8	5135	150
	•TA-25	Output	6.75:1	825C.T.	4/8/16	74	2.7	150
	•TA-26	Output	9.80:1	1250	4/12	132.5	1.4	150
	TA-27	Interstage	1:4.08	1200	20000C.T.	142	1860	150
	TA-28	Interstage	1.65:1	1500	500C.T.	104	46.5	150
	TA-29	Output	11.8:1	2500	4/16	370	2.3	150
3	TA-30	Interstage	1:1.22	5000C.T.	7500C.T.	650	790	150
	TA-31	Interstage	1:1.41	5000C.T.	10000C.T.	635	825	150
	•TA-53	Interstage	1:3	5000C.T.	45000	310	1400	150
	TA-32	Interstage	1:4	5000C.T.	80000C.T.	500	5200	150
	TA-33	Output	24.6:1	10000C.T.	4/8/16	1174	2.6	150
	TA-34	Interstage	6.97:1	10000	200C.T.	1200	25.0	150
4	TA-35	Interstage	2.24:1	10000	2000C.T.	1200	257	150
	TA-36	Interstage	1.83:1	10000	3000C.T.	1200	385	150
	•TA-54	Interstage	5:1	20000	800C.T.	1350	95	150
	•TA-37	Output	5.55:1	400C.T.	11	71.5	1.5	150
	TA-38	Interstage	1.72:1	500C.T.	150C.T.	62	21.2	150

•Available until stock is depleted.

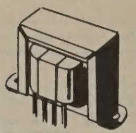


ESSEX STANCOR

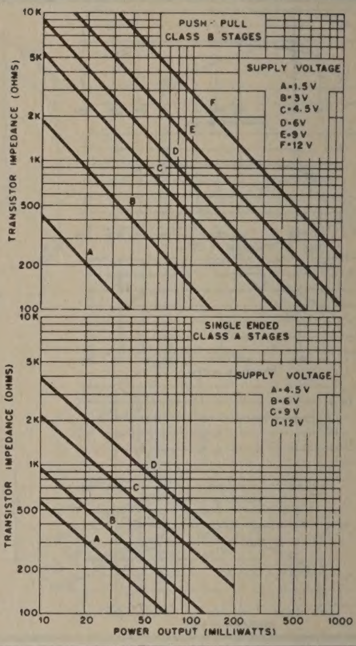
TRANSISTOR TRANSFORMERS

MINIATURE AUDIOS .300 WATT GROUP

Dimensions: 13/16"H x 1 5/8"W x 3/4"D.
Mounting Centers: 1 3/8".
Weight: 1.2 oz. Mounting Type A.



Section	STANCOR Part No.	Application	Turns Ratio Pri. to Sec.	Impedance in Ohms Pri.	Impedance in Ohms Sec.	DC Res. in Ohms Pri.	DC Res. in Ohms Sec.
1	TA-39	Output	2.5:1	100 C.T.	4, 8, 16	10.9	1.45
	• TA-40	Output	3.27:1	160	4, 8, 16	18.7	1.4
	TA-41	Output	5.00:1	400 C.T.	4, 8, 16	34	1.5
	TA-42	Output	5.60:1	500 C.T.	4, 8, 16	47	.85
	TA-52	Interstage	1:1	500 C.T.	500 C.T.	40	55
	TA-43	Output	6.63:1	700 C.T.	4, 8, 16	77	1.15
2	• TA-44	Output	12.5:1	2500	4, 8, 16	172	1.15
	TA-45	Output	13.7:1	3000	4, 8, 16	192	1.2
	TA-46	Interstage	8.17:1	100000	1500 C.T.	3250	143
	TA-55	Input	50:1	500000	200 C.T.	12000	18
	TA-47	Input	1.00:14.1	1000 C.T.	200000 C.T.	123	1815
	TA-63	Driver	3.17:1	20000 C.T.	2000 C.T.	2140	325



MINIATURE AUDIOS FOR PRINTED CIRCUITS .150 WATT GROUP (FIG. A)

3	TAPC-28	Interstage	1.65:1	1500	500 C.T.	104	46.5
4	TAPC-31	Interstage	1.00:1.41	5000 C.T.	10000 C.T.	635	825
	• TAPC-32	Interstage	1.00:4	5000 C.T.	80000 C.T.	500	5200
	TAPC-34	Interstage	6.97:1	10000	200 C.T.	1200	25
	TAPC-35	Interstage	2.24:1	10000	2000 C.T.	1200	257
	• TAPC-36	Integstage	1.83:1	10000	3000 C.T.	1200	385
	TAPC-38	Interstage	1.72:1	500 C.T.	150 C.T.	62	21.2

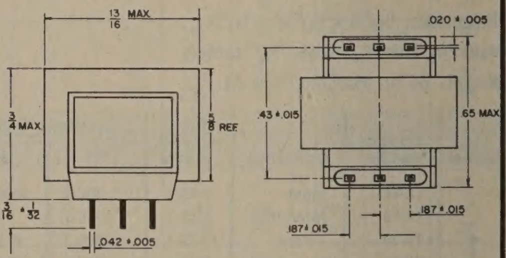


Fig. A

.300 WATT GROUP (FIG. B)

Section	STANCOR Part No.	Application	Turns Ratio Pri. to Sec.	Impedance in Ohms Pri.	Impedance in Ohms Sec.	DC Res. in Ohms Pri.	DC Res. in Ohms Sec.
5	•TAPC-47	Input	1:14.1	1000 C.T.	200000 C.T.	123	1815
	TAPC-52	Interstage	1:1	500 C.T.	500 C.T.	40	55
	TAPC-63	Driver	3.17:1	20000 C.T.	2000 C.T.	2140	325

•Available until stock is depleted.

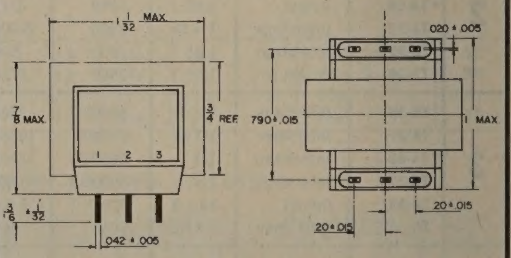


Fig. B

ESSEX STANCOR

CROSS REFERENCE INDEX
STANCOR/ALLIED

ALLIED	STANCOR	ALLIED	STANCOR	ALLIED	STANCOR	ALLIED	STANCOR
6K1VF	PS-8416	6K80VBR	P-6378	6T38HF	TA-42	6X11HF	C-2326
6K2HB	PM-8401	6K81VCP	P-6415	6T40HF	TA-44	6X12VG	†C-1420
6K3VG	PC-8406	6K82VF	P-6425	6T41HF	TA-45	6X13HF	C-1515
6K5HB	PM-8409	6K83HF	P-8190	6T42HF	TA-1	6X14HF	†C-1708
6K5VG	PC-8409	6K84VBR	P-3060	6T44PC	TA-18	6X15HF	C-1709
6K6HB	PM-8410	6K85VG	P-6492	6T45HF	TA-47	6X16HF	C-1710
6K6VG	PC-8410	6K90VG	P-4089	6T46PC	TA-28	6X17HF	C-2304
6K7HB	PM-8411	6K96HF	P-8357	6T48HF	TA-52	6X18HF	C-2309
6K7VG	PC-8411	6K101HF	TP-2	6T49HF	TA-55	6X19HF	C-2325
6K8HB	PM-8412	6K102HF	TP-3	6T50VF	TA-61	6X20HF	C-2345
6K8VG	PC-8411	6K104VG	TP-4	6T51VF	TA-56	6X21VG	†C-1421
6K10HF	P-6466	6K106VBR	P-8193	6T52VF	TA-57	6X22HF	C-2344
6K11HF	P-3062	6K110HF	P-8358	6T53HF	TA-58	6X24HF	C-2303
6K13VG	PC-8417	6K112HF	P-6412	6T54HF	TA-59	6X25HF	C-2346
6K26VBR	P-3064	6K115VG	P-3020	6T55PC	TA-54	6X27VG	C-1411
6K26VF	P-6456	6K117HF	P-4026	6W2HFL	A-8105	6X29HBR	C-2685
6K27VF	PS-8415	6K119VBR	P-6379	6W8HF	A-53	6X30HBR	C-2686
6K28HF	PA-8421	6K120VBR	P-6433	6W14HFL	A-3856	6X31HBR	C-2688
6K29HB	PM-8404	6K121VF	P-6454	6W15HFL	A-3823	6X32VBR	C-2691
6K29VG	PC-8404	6K122VBR	P-6458	6W16VFL	A-3852	6X33VBR	C-2690
6K30VG	PC-8413	6K123VG	P-6461	6W27HFL	A-7947	6X34HF	C-2708
6K31VG	PC-8414	6K124VF	P-6462	6W28VFL	A-8102	6X35HF	C-2343
6K32HF	P-6465	6K128HF	P-8191	6W29HFL	A-8101	6X37VG	†C-2705
6K34VBR	P-6308	6K129VG	P-8196	6W30VHL	A-3883	6X39VG	C-1412
6K35HF	P-6134	6K130VG	PC-8305	6W33HF	A-3332	6X40HF	C-2318
6K35VG	P-3024	6K132VG	PC-8422	6W34HF	A-3876	6X41HBR	C-2687
6K36HF	P-8130	6K133VG	TP-1	6W35HF	A-3877	6X42HBR	C-2689
6K37HF	P-6469	6K140HF	P-6406	6W36HFL	†A-3822	6X43HF	†C-2704
6K38VCP	P-6410	6K206	PC-8401	6W36HFL	A-3878	6X44HF	C-2707
6K39HF	P-6467	6T1HF	TA-5	6W36HFL	A-3879	705-0001	PS-8416
6K45HB	PM-8422	6T2HF	TA-6	6W44HFL	A-7949	705-0002	PM-8401
6K47VF	P-6133	6T3HF	TA-7	6W45VFL	A-8104	705-0005	PC-8406
6K49HB	PM-8418	6T5HF	TA-16	6W46VFL	A-8103	705-0008	PM-8409
6K49VG	PC-8418	6T6HF	TA-2	6W47HF	A-3327	705-0010	PM-8410
6K50HB	PM-8402	6T7HF	TA-3	6W48VF	A-3337	705-0011	PC-8410
6K50VG	PC-8402	6T8HF	TA-4	6W49VG	A-3801	705-0012	PM-8411
6K51HB	PM-8419	6T9PC	TA-19	6W51HF	A-3878	705-0013	PC-8411
6K51VG	PC-8419	6T10PC	TA-22	6W52HF	A-3879	705-0014	PM-8412
6K53HB	PM-8403	6T11PC	TA-24	6W55HF	A-4744	705-0015	PC-8411
6K53VG	PC-8403	6T13PC	TA-30	6W60HFL	A-3824	705-0017	P-6466
6K54HB	PM-8408	6T14PC	TA-31	6W61HF	A-52C	705-0018	P-3062
6K54VG	PC-8408	6T15PC	TA-32	6W62HF	A-63C	705-0032	P-6456
6K55VG	PC-8420	6T16PC	TA-34	6W65VG	A-8053	705-0033	P-3064
6K56VG	PC-8405	6T17PC	TA-35	6W66VG	A-8056	705-0034	PS-8415
6K57VG	P-4019	6T18PC	TA-36	6W68HF	A-4713	705-0035	PA-8421
6K63VBR	RT-201	6T19PC	TA-38	6W69HF	A-4723	705-0036	PM-8404
6K64VBR	RT-202	6T20HF	TA-46	6W70VG	†A-3304	705-0037	PC-8404
6K65VBR	RT-204	6T22HF	TA-9	6W71VG	A-3311	705-0039	PC-8413
6K66VBR	RT-206	6T23HF	TA-10	6W72VG	A-3800	705-0041	PC-8414
6K67VBR	RT-208	6T24HF	TA-11	6W73HF	A-3831	705-0042	P-6465
6K70VBR	P-6135	6T25HF	TA-12	6W75HF	†A-4752	705-0044	P-6308
6K71VBR	P-5014	6T27PC	TA-20	6X1HF	C-1003	705-0045	P-6134
6K72VBR	P-6309	6T28PC	TA-21	6X2HF	C-1002	705-0046	P-8130
6K73VBR	P-5015	6T29PC	TA-23	6X3HF	C-1279	705-0047	P-6469
6K74VBR	P-6138	6T30PC	TA-25	6X4HF	C-1001	705-0048	P-6410
6K75VBR	P-5016	6T31PC	TA-26	6X5HF	C-1706	705-0049	P-6467
6K76VBR	P-6139	6T33PC	TA-33	6X6HF	C-1707	705-0060	PM-8422
6K77VFL	P-6375	6T35HF	TA-39	6X7HF	C-1080	705-0064	P-6133
6K78VFL	P-6376	6T36HF	TA-40	6X8VBR	C-1721	705-0066	PM-8418
6K79VFL	P-6377	6T37HF	TA-41	6X9HF	C-2327	705-0067	PC-8418

† Available until stock is depleted.

CROSS REFERENCE INDEX
STANCOR/ALLIED (cont.)

ESSEX STANCOR

ALLIED	STANCOR	ALLIED	STANCOR	ALLIED	STANCOR	ALLIED	STANCOR
705-0068	PM-8402	705-0514	TA-31	705-0859	A-8053	928-0017	A-3877
705-0069	PC-8402	705-0515	TA-32	705-0860	A-8056	928-0018	A-3879
705-0070	PM-8419	705-0517	TA-35	705-0862	A-4713	928-0020	A-8097
705-0071	PC-8419	705-0518	TA-36	705-0863	A-4723	928-0028	A-7947
705-0074	PM-8403	705-0519	TA-38	705-0864	†A-3304	928-0031	A-8080
705-0075	PC-8403	705-0520	TA-46	705-0867	A-3831	928-0033	A-8101
705-0077	PC-8408	705-0521	TA-9	705-1101	C-1003	928-0034	A-8102
705-0079	PC-8420	705-0522	TA-10	705-1103	C-1279	928-0035	A-8103
705-0081	PC-8405	705-0523	TA-11	705-1104	C-1001	928-0036	A-8104
705-0082	P-4019	705-0524	TA-12	705-1105	C-1706	928-0037	A-8105
705-0087	RT-201	705-0526	TA-20	705-1106	C-1707	928-0046	C-1001
705-0088	RT-202	705-0527	TA-21	705-1107	C-1080	928-0047	C-1002
705-0089	RT-204	705-0528	TA-23	705-1109	C-2327	928-0048	C-1003
705-0090	RT-206	705-0529	TA-25	705-1111	C-2326	928-0052	C-1412
705-0091	RT-208	705-0530	TA-26	705-1113	C-1515	928-0053	C-1515
705-0094	P-6135	705-0532	TA-33	705-1115	C-1709	928-0054	C-1706
705-0095	P-5014	705-0534	TA-39	705-1117	C-2304	928-0055	C-1707
705-0096	P-6309	705-0535	TA-40	705-1118	C-2309	928-0057	C-1709
705-0097	P-5015	705-0536	TA-41	705-1119	C-2325	928-0058	C-1710
705-0098	P-6138	705-0537	TA-42	705-1120	C-2345	928-0060	C-1722
705-0099	P-5016	705-0539	TA-44	705-1121	†C-1421	928-0062	C-2304
705-0100	P-6139	705-0540	TA-45	705-1122	C-2344	928-0063	C-2305
705-0101	P-6375	705-0541	TA-1	705-1124	C-2303	928-0064	C-2318
705-0102	P-6376	705-0542	TA-18	705-1125	C-2346	928-0066	C-2326
705-0103	P-6377	705-0543	TA-47	705-1129	C-2685	928-0067	C-2327
705-0104	P-6378	705-0544	TA-28	705-1130	C-2686	928-0068	C-2328
705-0105	P-6415	705-0545	TA-52	705-1131	C-2688	928-0070	C-2685
705-0106	P-6425	705-0546	TA-55	705-1132	C-2691	928-0071	C-2686
705-0107	P-8190	705-0548	TA-56	705-1133	C-2690	928-0072	C-2687
705-0108	P-3060	705-0549	TA-57	705-1134	C-2708	928-0073	C-2688
705-0109	P-6492	705-0550	TA-58	705-1135	C-2343	928-0074	C-2689
705-0115	P-4089	705-0551	TA-59	705-1138	†C-2705	928-0075	C-2690
705-0123	P-8357	705-0552	TA-54	705-1142	C-2687	928-0076	C-2691
705-0127	TP-2	705-0801	A-8105	705-1143	C-2689	928-0079	C-2707
705-0128	TP-3	705-0805	A-53	705-1144	†C-2704	928-0080	C-2708
705-0130	TP-4	705-0811	A-3856	705-1145	C-2707	928-0091	C-2343
705-0132	P-8193	705-0812	A-3823	705-3712	P-4026	928-0092	C-2344
705-0136	P-8358	705-0813	A-3852	705R0001	PS-8416	928-0100	C-2721
705-0138	P-6412	705-0821	A-7947	705R0017	P-6466	928-0101	C-2722
705-0141	P-3020	705-0822	A-8102	705R0042	P-6465	928-0102	C-2723
705-0144	P-6379	705-0823	A-8101	705R0045	P-6134	928-0103	C-2724
705-0145	P-6433	705-0824	A-3883	705R0046	P-8130	928-0104	C-2725
705-0146	P-6454	705-0827	A-3332	705R0047	P-6469	928-0105	C-2726
705-0147	P-6458	705-0828	A-3876	705R0048	P-6410	928-0106	C-2727
705-0148	P-6461	705-0829	A-3877	705R0087	RT-201	928-0107	C-2728
705-0149	P-6462	705-0830	†A-3822	705R0088	RT-202	928-0327	A-3327
705-0153	P-8191	705-0830	A-3878	705R0089	RT-204	928-0329	A-3329
705-0154	P-8196	705-0830	A-3879	705R0101	P-6375	928-0383	A-3883
705-0155	PC-8305	705-0838	A-7949	705R0102	P-6376	928-0688	A-8088
705-0157	PC-8422	705-0839	A-8104	705R0103	P-6377	928-0695	A-8095
705-0158	TP-1	705-0840	A-8103	705R0104	P-6378	928-0708	†A-8108
705-0165	P-6406	705-0841	A-3327	705R0107	P-8190	928-2003	P-3020
705-0503	TA-7	705-0842	A-3337	705R0123	P-8357	928-2006	P-3060
705-0505	TA-16	705-0843	A-3801	705R0127	TP-2	928-2010	P-3064
705-0506	TA-2	705-0845	A-3878	705R0128	TP-3	928-2012	P-4026
705-0507	TA-3	705-0846	A-3879	705R0136	P-8358	928-2021	P-5015
705-0508	TA-4	705-0849	A-4744	705R0144	P-6379	928-2022	P-5016
705-0510	TA-22	705-0854	A-3824	928-0004	A-3328	928-2065	P-6133
705-0511	TA-24	705-0855	A-52C	928-0005	A-3332	928-2066	P-6134
705-0513	TA-30	705-0856	A-63C	928-0007	A-52C	928-2067	P-6135

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† Available until stock is depleted.

CROSS REFERENCE INDEX

STANCOR/ALLIED (cont.)

ALLIED	STANCOR
928-2070	P-6139
928-2075	P-6160
928-2076	P-6161
928-2080	P-6308
928-2081	P-6309
928-2090	P-6358
928-3000	P-6375
928-3001	P-6376
928-3002	P-6377
928-3003	P-6378
928-3004	P-6379
928-3010	P-6410
928-3011	P-6411
928-3012	P-6415
928-3013	P-6425
928-3014	P-6413
928-3018	P-6433
928-3019	P-6454
928-3020	P-6455
928-3021	P-6456
928-3022	P-6458
928-3024	P-6461
928-3027	P-6465
928-3028	P-6466
928-3029	P-6467
928-3031	P-6469
928-3041	P-6492
928-3060	P-8130
928-3061	P-8150
928-3062	P-8151
928-3077	P-8178
928-3078	P-8180
928-3079	P-8179
928-3080	P-8190
928-4016	P-8357
928-4017	P-8358
928-4020	P-8361
928-4021	P-8362
928-4022	P-8363
928-4023	P-8364
928-4031	P-8381
928-4034	P-8384
928-4035	P-8385
928-4038	P-8388
928-4046	P-8390
928-4047	P-8391
928-4048	P-8392
928-4049	P-8393
928-4050	P-8394
928-4051	P-8395
928-4052	P-8396
928-4053	P-8397
928-4600	P-8600
928-4601	P-8601
928-4602	P-8602
928-4603	P-8603
928-4610	P-8610
928-4611	P-8611
928-4612	P-8612
928-4613	P-8613
928-4615	P-8181
928-5000	PA-8421
928-5050	PC-8301
928-5055	PC-8304
928-5056	PC-8305
928-5062	PC-8403
928-5066	PC-8407
928-5068	PC-8409
928-5069	PC-8410
928-5075	PC-8417
928-5076	PC-8418
928-5077	PC-8419
928-5079	PC-8422
928-5091	P-8615
928-5092	P-8616
928-5093	P-8617
928-5094	P-8618
928-5095	P-8619
928-5096	P-8624
928-5097	P-8625
928-5098	P-8626
928-5099	P-8627
928-5676	PCT-76
928-5677	PCT-77
928-7215	PS-8415
928-7216	PS-8416
928-7600	†RC-12150
928-7620	RS-1555
928-8001	RT-201
928-8002	RT-202
928-8003	RT-204
928-8004	RT-206
928-8005	RT-208
928-8007	RT-400
928-8008	RT-401
928-8009	RT-402
928-8012	RT-2012
928-8105	TA-5
928-8106	TA-6
928-8107	TA-7
928-8111	TA-11
928-8112	TA-12
928-8121	TA-21
928-8128	TA-28
928-8130	TA-30
928-8131	TA-31
928-8135	TA-35
928-8138	TA-38
928-8139	TA-39
928-8141	TA-41
928-8143	TA-43
928-8147	TA-47
928-8152	TA-52
928-8155	TA-55
928-8155	TC-2
928-8159	TA-59
928-8201	TP-1
928-8202	TP-2
928-8203	TP-3
928-8204	TP-4
928-8720	P-8720
928R3000	P-6375
928R3002	P-6377
928R3003	P-6378
928R3031	P-6469
928R3060	P-8130
928R8003	RT-204
928X2079	P-6298

STANCOR/HARCO

HARCO	STANCOR
M8-008	P-8684
M8-009	P-8685
M8-010	P-8686
M8-011	P-8688
M8-016	P-8687

† Available until stock is depleted.

CROSS REFERENCE INDEX
STANCOR/MERIT

ESSEX STANCOR

MERIT	STANCOR
A-25	A-8088
A-70	A-8084
A-2700	TA-8
A-2701	TA-25
A-2702	TA-21
A-2705	TA-20
A-2747	TA-11
A-2751	TA-7
A-2759	TA-38
A-2761	TA-42
A-2763	TA-9
A-2767	TA-10
A-2779	TA-33
A-2781	TA-35
A-2789	TA-54
A-2800	A-8080
A-2801	A-8081
A-2802	A-8082
A-2805	A-8095
A-2806	A-8096
A-2810	A-7947
A-2818	A-8084
A-2900	A-3856
A-2901	A-3823
A-2902	A-3849
A-2904	A-3852
A-2905	A-3830
A-2906	A-7947
A-2907	A-7949
A-2909	A-8091
A-2910	PMTF-119
A-2919	A-4352
A-2921	†A-4752
A-2924	A-4352
A-2925	A-3250
A-2927	A-3329
A-2928	A-3876
A-2929	A-4706
A-2930	A-3877
A-2931	A-3878
A-2932	A-3879
A-2934	A-3881
A-2936	A-8093
A-2938	A-8093
A-3005	A-8101
A-3012	A-8093
A-3013	A-8105
A-3014	A-8102
A-3015	A-8103
A-3019	A-8092
A-3025	A-3332
A-3026	A-3309
A-3031	A-3336
A-3102	†A-8072
A-3130	A-3801
A-3131	A-3800
A-3132	A-3311
A-4107	A-3336
A-4148	A-8083
A-4149	A-8087
C-2973	C-2334
C-2974	C-2325
C-2975	C-1706
C-2976	C-1707
C-2977	C-1325
C-2981	C-1279
C-2985	C-1515
C-2987	C-1003
C-2990	C-1002
C-2991	C-2334
C-2993	C-1001
C-2994	C-2327
C-2995	C-1709
C-2996	C-2326
C-3180	†C-2705
C-3181	C-1721
C-3192	†C-1420
C-3196	C-1411
C-4084	C-2347
C-4095	TC-2
C-4124	TC-1
C-4133	C-2708
P-2872	P-8377
P-2881	P-8355
P-2882	P-8355
P-2885	P-8356
P-2888	P-8389
P-2939	P-6133
P-2940	P-6454
P-2941	P-6455
P-2943	P-6458
P-2944	P-6134
P-2945	P-6466
P-2946	P-6466
P-2947	P-6456
P-2948	P-6308
P-2949	PM-8402
P-2950	PM-8406
P-2953	PM-8422
P-2954	PM-8411
P-2955	PM-8412
P-2957	PM-8408
P-2958	PM-8403
P-2959	P-8130
P-2960	P-5015
P-2961	P-6430
P-2962	P-6469
P-2964	P-6465
P-3040	P-6467
P-3045	PA-8421
P-3046	P-8181
P-3047	PM-8418
P-3048	PM-8420
P-3051	PM-8404
P-3074	P-8190
P-3077	P-8164
P-3095	PC-8414
P-3096	P-6412
P-3097	P-8191
P-3116	P-6383
P-3117	P-6385
P-3138	†PV-6442
P-3141	P-6308
P-3143	P-6138
P-3145	P-4096
P-3146	P-6461
P-3147	PC-8418
P-3148	PC-8420
P-3149	PC-8401
P-3150	PC-8406
P-3153	PC-8422
P-3155	PC-8412
P-3160	PC-8408
P-3172	P-6298
P-3175	PC-8302
P-3177	P-6415
P-3197	P-6160
P-3198	P-6160
P-3199	P-6161
P-4126	P-8388
P-4141C	P-9000C
P-4142	TP-6
P-4145	TP-5
P-4151C	P-9003C

† Available until stock is depleted.

CROSS REFERENCE INDEX

STANCOR/MICROTRAN

MICROTRAN	STANCOR	MICROTRAN	STANCOR	MICROTRAN	STANCOR	MICROTRAN	STANCOR
M-1551	GSD-750	MM2-FB	PMT-41	QGL-50	PT-14	SMT13-FB	PMTF-83
M-1553	P-8632	MM4-FB	PMTF-97	QGL-100	PT-18	VM3-FPB	PMTF-82
M-1554	GSD-1500	MM5-FB	PMTF-99	QGL-250	PT-23	VM6-FPB	PMTF-79
M-1555	GSD-250	MM6-FB	PMTF-98	QGL-500	PT-27	VM12-FPB	PMTF-86
M-1556	P-8631	MMT-13	PMTF-83	QGL-1000	PT-31	VM13-FPB	PMTF-89
M-1558	P-8635	MT6-FB	TA-46	QGL-1500	PT-33		
M-1559	P-8633	MT26-FB	PMTF-74	QGM-1	PT-38		
M-8200	C-2725	PM3-M	PCT-14	QGM-2	PT-42		
M-8201	C-2708	PM7-M	PCT-15	QGM-5	PT-47		
M-8203	C-2691	PM11-M	PCT-23	QGM-10	PT-51		
M-8204	C-2686	PM17-M	PCT-76	QGM-15	PT-53		
M-8242	P-6465	PM19-M	PCT-31	QGM-25	PT-56		
M-8243	P-6466	PM29-M	PCT-39	QGM-50	PT-60		
M-8244	P-6434	PM33-M	PCT-62	QGM-100	PT-64		
M-8245	P-8603	PM39-M	PCT-116	QIL-150	PT-20		
M-8247	P-6378	PM90-M	SPCT-10	QIL-2500	PT-36		
M-8256	P-8196	QGL-5	PT-1	SM1-FB	PMTF-94		
M-8286	P-6456	QGL-10	PT-5	SM2-FB	PMT-41		
M-8287	P-8358	QGL-15	PT-7	SM4-FB	PMTF-97		
MM1-FB	PMTF-94	QGL-30	PT-11	SM6-FB	PMTF-98		

STANCOR/SIGNAL

SIGNAL	STANCOR	SIGNAL	STANCOR	SIGNAL	STANCOR	SIGNAL	STANCOR
24-0.1	P-8680						
24-0.25	P-8681						
24-0.5	P-8682						
24-1	P-8676						
24-1A	P-8683						
24-2	P-8677						
24-4	P-8678						
24-6	P-8679						
68-4	P-8675						

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† Available until stock is depleted.

CROSS REFERENCE INDEX

STANCOR/THORDARSON-MEISSNER

T-M	STANCOR
20A00	A-4779
20A01	†A-4778
20A04	A-4744
20A07	A-4350
20A16	A-52C
20A18	A-53C
20A19	A-4774
20A23	A-63C
20A30	†A-4747
20A31	A-4352
20A32	†A-4705
20A33	A-4706
20A45	A-53
20A46	A-63C
20A93	A-63C
20A96	A-4774
20A101	A-4711
25A16	WF-20
25A22	WF-30
25A58	WF-20
25A60	WF-30
20C00	C-2685
20C01	C-2686
20C02	C-2687
20C03	C-2688
20C09	†C-2704
20C16	C-2717
20C25	C-2690
20C26	C-2691
20C43	C-1515
20C47	C-1706
20C48	C-1709
20C50	C-2345
20C51	C-2346
20C52	C-2318
20C58	C-2328
20C64	C-2309
20C65	C-1355
20C66	C-1215
20C67	C-2305
20C68	C-1710
20C70	C-1722
20C71	†C-1420
20C75	†C-1718
20C81	C-1279
20C82	C-1080
20C84	C-1707
20C85	†C-1708
20C86	C-1002
20C88	C-2305
20C90	C-1001
20C91	†C-1421
20C94	C-1411
20C95	C-1721
20C96	C-1721
20C100	C-2689
20C102	C-2707
20C166	C-1355
25C33	†RC-12150
25C34	RC-8200
25C49	†RS-1540
25C51	RS-1555
25C53	†RS-1585
25C57	†RS-12150
26C40	C-2344
26C41	C-2327
26C42	C-1325
26C43	C-2325
26C44	C-2326
26C44	C-2328
26C44	C-2343
26C45	†C-2705
26C77	C-2343
26C78	C-2347
26C79	C-2328
26C79	C-2343
26C80	C-2328
26C80	C-2343
26C80	C-2347
26C81	C-2708
26C85	C-1001
26C86	C-1002
26C87	C-1003
26C88	C-2303
26C89	C-2304
26C90	C-1412
26C91	C-2334
26C92	C-2328
26C93	C-2326
26C94	C-2325
20D23	A-4713
20D85	A-4723
20D89	A-4723
21F00	P-6133
21F01	P-3024
21F02	P-3060
21F02P	P-6454
21F03	P-6467
21F04	P-6135
21F07A	P-6468
21F08	P-6134
21F09	P-6134
21F09	P-8389
21F10	P-6466
21F11	P-3064
21F12	P-6308
21F13	P-6135
21F14	†P-6144
21F15	P-5015
21F16	P-6138
21F18	P-6458
21F21	P-6465
21F24	P-6429
21F25	P-6309
21F27	P-8608
21F28	P-6139
21F28	P-8656
21F29	P-4097
21F30	P-1834-3
21F31	P-6133
21F32	P-3024
21F33	P-6468
21F34	P-4026
21F35	P-4082
21F37	P-3062
21F40	P-6466
21F41	P-4019
21F42	P-4089
21F43	P-6308
21F45	P-5015
21F46	P-6138
21F47	P-4096
21F51	P-6469
21F58	P-3060
21F59	P-3064
21F61	P-5016
21F62	P-6138
21F72	P-6456
21F74	P-6464
21F77	P-8189
21F81	P-8358
21F82	P-8609
21F83	P-8357
21F84	P-8661
21F87	P-6430
21F88	P-6428
21F90	P-6434
21F94	P-6467
21F96	P-8651
21F100	P-8606
21F101	P-8607
21F103	P-6454
21F105	P-6455
21F107	P-5014
21F108	P-6462
21F109	†P-6463
21F111	P-6457
21F112	P-6461
21F113	P-3020
21F114	P-8388
21F115	†P-6144
21F119	P-6431
21F132	P-8389
21F162	P-6465
25F63	F-516
25F94	P-4082
26F60	P-8190
26F65	P-8191
26F66	P-6433
26F67	P-8130
26F68	P-6469
21M50	†A-3812
21M59	†A-3812
MIT201	PMTS-4
MIT202	PMTS-53
MIT203	PMTS-56
MIT204	PMTS-22
MIT205	PMTS-23
MIT206	PMTS-24
MIT207	PMTS-15
MIT-208	PMTS-19
MIT-209	PMTS-25
MIT210	PMTS-26
MIT211	PMTS-27
MIT212	PMTS-31
MIT213	PMTS-32
MIT214	PMTS-33
MIT215	PMTS-34
MIT216	PMTS-35
MIT217	PMTS-36
MIT218	PMTS-37
MIT219	PMTS-30
MIT220	PMTS-29
MIT221	PMTS-28
MIT222	PMTS-18
MIT223	PMTS-38
MIT224	PMTS-17
MIT225	PMTS-12
MIT226	PMTS-21
MIT227	PMTS-20
MIT236	PMTS-7
MIT237	PMTS-8
MIT238	PMTS-12
MIT239	PMTS-38
MIT240	PMTS-9
MIT241	PMTS-74
MIT246	PMTS-17
MIT247	PMTS-7
MIT248	PMTS-12
MIT251	PMTS-25
MIT252	PMTS-18
MIT253	PMTS-38
MIT254	PMTS-4
MIT255	PMTS-53
MIT256	PMTS-56
MIT257	PMTS-23
MIT258	PMTS-19
MIT259	PMTS-26
MIT260	PMTS-27
MIT261	PMTS-30
MIT262	PMTS-29
MIT263	PMTS-28
MIT264	PMTS-12
MIT265	PMTS-21
MIT266	PMTS-20
MIT268	PMTS-7
MIT269	PMTS-8
MIT270	PMTS-12
MIT271	PMTS-74
MIT281	PMTS-30
MIT283	PMTS-74
MIT285	PMTS-29
MIT286	PMTS-16
MIT287	PMTS-71
MIT289	PMTS-25
MIT290	PMTS-70
MIT291	PMTS-27
MIT293	PMTS-75
MIT294	PMTS-38
21P51	P-8040

† Available until stock is depleted.

ESSEX STANCOR

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T-M	STANCOR
21P53	P-8042
21P73	PC-8301
21P76	PC-8302
21P80	PC-8303
21P84	PC-8304
21P86	PC-8305
21P89	PC-8302
26P122	P-8355
22R00	PM-8401
22R02	P-8175
22R04	PM-8423
22R05	P-8177
22R05U	P-8177
22R06	PM-8422
22R15	P-8176
22R16	PC-8409
22R30	PC-8403
22R32	P-8176
22R33	PC-8411
22R36	PC-8414
22R39	PS-8416
22R40	P-8178
22R42	P-8150
22R90	P-6358
22R94	P-8359
22R115	P-6426
24R00	PM-8401
24R00U	PC-8401
24R01	PM-8406
24R01U	PC-8406
24R02	PM-8408
24R02U	PC-8408
24R03	PC-8413
24R04	PM-8409
24R04U	PC-8409
24R06	PM-8411
24R06U	PC-8411
24R07	PM-8412
24R07U	PC-8412
24R08	PM-8407
24R08U	PC-8407
24R09	PM-8403
24R09U	PC-8403
24R10	PC-8417
24R11	PM-8418
24R11U	PC-8418
24R12	PM-8419
24R12U	PC-8419
24R13	PM-8404
24R13U	PC-8404
24R16	PC-8418
24R19	PM-8402
24R19U	PC-8402
24R20	PM-8405
24R20U	PC-8405
24R21U	P-8175
24R22	PM-8410
24R22U	PC-8410
24R25	†P-6143
24R26	PM-8412
24R26U	PC-8412
24R27	PC-8414
24R30	P-8151
24R40	PM-8409
24R40U	PC-8409
24R69	†PC-8432
24R77	P-8179
24R87	PC-8422
24R89	P-8173
24R90	P-8174
24R92	P-8151
24R96	P-6358
24R100	RP-400
24R101	RP-600
24R102	†RP-800
24R103	RP-1600
24R104	RP-2000
24R105	RP-2500
24R107	P-6425
25R04	†PCC-70
25R06	PCC-105
25R13	†PCR-85
25R20	†PCR-300
25R23	PSC-40
25R24	PSC-55
26R31	PM-8420
26R31U	PC-8420
26R37	PS-8415
26R38	PA-8421
26R45	P-8339
26R47	P-8377
26R51	P-8355
26R53	P-8356
26R60	P-8181
26R63	†P-8155
26R71	P-8164
26R86	†P-8170
26R95	†P-8169
26R106	P-8379
26R116	P-8377
26R123	P-8378
26R150	P-9000C
26R152	P-9003C
22S20	A-3332
22S22	A-3332
22S24	A-3309
22S25	A-3309
22S31	A-3328
22S31	A-3850
22S32	A-3328
22S45	A-3876
22S46	A-3336
22S46	A-3876
22S50	†A-3822
22S51	A-4749
22S61	A-3309
22S61	A-3332
22S63	A-8053
22S64	†A-3304
22S65	†A-8072
22S67	A-8056
22S70	A-3800
22S71	A-3800
22S81	A-8091
22S84	A-7947
22S85	A-7947
22S86	A-3856
22S87	A-3850
22S88	A-3870
22S90	A-3250
22S103	A-8101
22S109	A-8104
24S02	A-8077
24S04	A-3856
24S05	A-3856
24S06	A-3337
24S06	A-3823
24S07	A-3849
24S08	A-3850
24S12	A-3852
24S14	A-3870
24S18	A-3801
24S19	A-3335
24S21	A-8096
24S22	A-8097
24S24	A-8095
24S27	A-3250
24S30	A-3309
24S40	A-3879
24S42	A-3830
24S45	A-3883
24S46	A-7947
24S47	A-7949
24S48	A-3309
24S48	A-3850
24S49	A-3329
24S50	A-3332
24S50	A-3849
24S50	A-3876
24S51	A-3877
24S51A	A-3877
24S52	A-3879
24S53	A-3332
24S54	A-3881
24S55	A-3830
24S57	A-3801
24S58	†A-3304
24S60	A-3856
24S61	A-3823
24S63	A-3825
24S64	A-3849
24S64	A-3856
24S64	A-8092
24S67	A-7949
24S71	A-8102
24S72	A-8103
24S74	A-8105
24S75	A-8101
24S81	A-3329
24S83	A-3879
24S85	A-3332
24S87	A-3876
24S89	A-3336
24S89	A-3825
24S93	A-8093
24S96	A-2313
24S98	A-3879
24S99	A-3327
24S105	A-8076
24S109	A-8099
24S123	A-8082
24S124	A-8081
24S125	A-8080
24S126	A-8099
24S149	A-3336
24S153	A-8109
26S33	A-3878
26S46	A-3852
26S48	A-3309
26S48	A-3878
26S49	A-8092
26S50	A-3849
26S58	A-3332
26S59	A-3335
26S64	A-3849
TR-1	TA-52
TR-2	TA-30
TR-3	TA-31
TR-4	TA-28
TR-5	TA-38
TR-6	TA-36
TR-7	TA-35
TR-10	TA-53
TR-11	TA-22
TR-12	TA-19
TR-13	TA-32
TR-14	TA-27
TR-17	TA-54
TR-19	TA-37
TR-22	TA-41
TR-23	TA-34
TR-23	TA-46
TR-24	TA-46
TR-26	TA-24
TR-28	TA-47
TR-32	TA-33
TR-34	TA-18
TR-36	TA-55
TR-60	TA-56
TR-61	TA-56
TR-63	TA-57
TR-64	TA-7
TR-65	TA-58
TR-66	TA-59
TR-67	TA-60
TR-101	TA-20
TR-102	TA-21
TR-103	TA-23
TR-104	TA-25
TR-105	TA-26

† Available until stock is depleted.

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STANCOR/THORDARSON-MEISSNER (cont.)

T-M	STANCOR	T-M	STANCOR	T-M	STANCOR	T-M	STANCOR
TR-106	TA-27	TR-300	TA-12	23V51	P-6376	23V101	P-8193
TR-107	TA-29	TR-301	TA-13	23V52	P-6377	23V102	P-8194
TR-108	TA-32	TR-307	TA-17	23V53	P-6378	23V112	P-8621
TR-109	TA-33	TR-467	PMT-4	23V54	P-6379	23V115	TP-6
TR-111	TA-39	TR-469	PMT-15	23V58	P-6161	23V116	TP-2
TR-112	TA-40	TR-470	PMT-4	23V59	P-8622	23V117	TP-3
TR-113	TA-41	TR-533	TC-1	23V60	RT-201	23V118	TP-5
TR-114	TA-42	23V12	†PV-6442	23V61	RT-202	23V119	TP-4
TR-115	TA-43	23V17	P-6412	23V62	RT-204	23V121	TP-1
TR-116	TA-9	23V18	P-6160	23V63	RT-206	23V122	P-8196
TR-117	TA-44	23V19	P-6415	23V64	RT-208	23V126	P-6161
TR-118	TA-45	23V20	P-8633	23V65	RT-408	23V128	P-6383
TR-119	TA-47	23V21	P-8631	23V66	RT-2012	23V129	P-6385
TR-154	TC-2	23V22	P-8632	23V67	RT-4012	23V130	P-6387
TR-163	TA-50	23V24	P-8635	23V70	P-8630	23V141	P-8390
TR-179	TA-48	23V25	P-6160	23V71	P-8631	23V154	P-8395
TR-186	TA-51	23V28	P-6298	23V72	P-8633	23V155	P-8396
TR-259	TA-4	23V45	P-6410	23V79	P-8620	23V158	P-8397
TR-295	TA-1	23V46	PSU-3000	23V80	P-6406	23V189	P-6411
TR-296	TA-2	23V50	P-6375	23V81	P-8630	23V236	P-8361
						23V237	P-8362
						23V238	P-8363
						23V239	P-8364

† Available until stock is depleted.

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STANCOR/TRIAD

TRIAD	STANCOR	TRIAD	STANCOR	TRIAD	STANCOR	TRIAD	STANCOR
A-1X	A-4706	F-22A	P-8189	F-151XP	PPC-21	R-7A	PC-8407
A-4X	A-4352	F-23U	P-6139	F-152XP	PPC-22	R-7B	PM-8407
A-6X	†A-4709	F-24U	P-5015	F-153XP	PPC-23	R-8A	PC-8403
A-31X	A-53C	F-25X	P-8130	F-154XP	PPC-24	R-8B	PM-8403
A-55J	PMT-133	F-26X	P-8358	F-155XP	PPC-25	R-9A	P-8175
A-57J	WF-30	F-32A	P-6430	F-156XP	PPC-26	R-10A	PC-8404
C-2X	C-2707	F-33U	P-4096	F-157XP	PPC-27	R-10B	PM-8404
C-3X	C-1215	F-34A	P-6428	F-161XP	PPC-19	R-11A	PC-8409
C-4X	C-1706	F-36A	P-6429	F-180X	P-8652	R-14A	PC-8410
C-5X	C-1003	F-40X	P-8609	F-181U	P-8641	R-14B	PM-8410
C-6X	†C-1227	F-41X	P-8357	F-182U	P-8642	R-16A	PC-8411
C-7X	C-1709	F-42A	P-6434	F-183U	P-8643	R-16B	PM-8411
C-8X	C-1709	F-43X	P-4019	F-184X	P-8667	R-21A	PC-8412
C-10X	†C-2704	F-43X	P-6465	F-185U	P-8668	R-21B	PM-8412
C-11X	†C-1421	F-44X	P-8130	F-187U	P-8669	R-22A	P-8359
C-12A	C-1710	F-45X	P-8180	F-188X	P-8611	R-24A	PC-8413
C-12X	C-1710	F-45X	P-8661	F-189X	P-8613	R-29A	PS-8416
C-13X	C-2309	F-46X	P-6469	F-190U	P-8672	R-30X	PA-8421
C-14A	C-1721	F-48U	P-8193	F-191U	P-8673	R-38A	†P-8170
C-14X	C-1721	F-49U	P-8194	F-192X	P-8662	R-39BC	†P-8338
C-15A	C-1412	F-50X	P-8191	F-193U	P-8663	R-43C	P-8179
C-15X	C-2717	F-52X	P-8190	F-202U	RT-201	R-49BS	P-8396
C-16A	†C-2705	F-55X	P-8357	F-203U	RT-202	R-54X	PS-8415
C-17X	C-2328	F-56X	P-8388	F-204U	RT-204	R-67BC	P-8164
C-21X	C-2327	F-57X	P-8180	F-205U	RT-206	R-69BC	P-8377
C-23X	C-2326	F-71U	P-3060	F-211Z	P-8615	R-72A	PC-8412
C-24X	C-2327	F-72Z	P-6133	F-212Z	P-8616	R-75BA	P-8356
C-24X	C-2343	F-79U	P-8621	F-213Z	P-8617	R-104A	PC-8419
C-27X	C-2343	F-90X	TP-2	F-214U	P-8618	R-105A	P-6358
C-28X	C-2328	F-91X	TP-3	F-215U	P-8619	R-106A	PC-8402
C-28X	C-2343	F-92A	TP-4	F-333P	PPC-8	R-106B	PM-8402
C-28X	C-2347	F-93X	TP-5	F-348XP	PPC-18	R-107A	PC-8407
C-34X	C-2328	F-94X	TP-6	F-349XP	PPC-19	R-107B	PM-8407
C-34X	C-2343	F-105Z	P-6375	F-350XP	PPC-20	R-108A	PC-8403
C-36X	C-2343	F-106Z	P-6376	F-358XP	PPC-28	R-108B	PM-8403
C-40X	C-2708	F-107Z	P-6377	F-363XP	PPC-29	R-109A	P-8175
C-47U	C-2690	F-108U	P-6378	F-3181U	P-6377	R-109B	PM-8423
C-48U	C-2691	F-109U	P-6379	N-1X	P-8620	R-112A	P-8356
C-50X	C-2709	F-113X	P-8390	N-3M	P-8630	R-113A	PC-8406
C-56U	C-2685	F-114X	P-8392	N-4M	P-8632	R-113B	PM-8406
C-57U	C-2686	F-115X	P-8394	N-5M	P-8633	R-114A	PC-8410
C-58U	C-2687	F-116X	P-8395	N-7M	P-8636	R-114B	PM-8410
C-59U	C-2688	F-117X	P-8396	N-35M	†PV-6442	R-115A	PC-8408
C-60U	C-2689	F-118X	P-8397	N-48X	P-6411	R-115B	PM-8408
C-80U	C-2692	F-131P	PPC-1	N-51X	P-6412	R-121A	PC-8412
F-3X	P-6454	F-132P	PPC-2	N-53M	P-6160	R-121B	PM-8412
F-5U	P-3060	F-133P	PPC-3	N-55M	P-6161	R-122A	P-8355
F-7X	P-6467	F-134P	PPC-4	N-57M	P-6298	R-124BC	P-8379
F-8X	P-3062	F-135P	PPC-5	N-68X	P-6406	R-139A	P-8356
F-11U	P-6492	F-136P	PPC-6	N-73A	P-8622	R-300A	P-9000C
F-13X	P-6465	F-137P	PPC-7	P-5A	P-8040	R-302A	P-9003C
F-14X	P-6134	F-141XP	PPC-11	P-11A	PC-8304	S-1X	A-3876
F-14X	P-8389	F-142XP	PPC-12	PL-10	P-6426	S-2X	A-3332
F-14Z	P-6465	F-143XP	PPC-13	R-2C	PS-8415	S-2X	A-3849
F-15U	P-6433	F-144XP	PPC-14	R-3A	†PC-8432	S-2X	A-3876
F-16X	P-6466	F-145XP	PPC-15	R-4A	PC-8401	S-3X	A-3877
F-18A	P-4089	F-146XP	PPC-16	R-4B	PM-8401	S-5X	A-8092
F-18A	P-3064	F-147XP	PPC-17	R-5A	P-6358	S-5Z	A-8092
F-18X	P-6456	F-148XP	PPC-20	R-6A	PC-8402	S-6X	A-3309
F-21A	P-6464	F-149XP	PPC-18	R-6B	PM-8402	S-11X	A-3879

† Available until stock is depleted.

CROSS REFERENCE INDEX
STANCOR/TRIAD (cont.)

TRIAD	STANCOR
S-12X	A-3332
S-12X	A-3336
S-12Z	A-3879
S-13X	A-3327
S-14Z	A-3328
S-15X	A-8093
S-16X	A-3332
S-17X	A-3879
S-18X	A-3849
S-19Z	A-8093
S-20X	A-3332
S-20Z	A-3332
S-22A	A-3800
S-23X	A-8090
S-25Z	A-8104
S-30X	A-3336
S-30X	A-3825
S-30X	A-3849
S-30X	A-3876
S-35A	A-8053
S-38X	A-3881
S-38Z	A-3879
S-39X	A-3496
S-39X	†A-3822
S-41X	A-3309
S-41X	A-3850
S-41Z	A-3850
S-42A	A-8053
S-43Z	A-8078
S-44Z	A-8079
S-46A	A-8077
S-47Z	A-8102
S-48X	A-3309
S-51X	A-3856
S-52X	A-3856
S-53X	A-3337
S-53X	A-3823
S-54X	A-3849
S-54X	A-8092
S-55X	A-3870
S-55Z	A-3852
S-57Z	A-3830
S-57Z	A-3870
S-60A	A-3801
S-62X	A-3309
S-62X	A-3332
S-63X	A-3856
S-65X	A-8101
S-67X	A-3849
S-70Z	A-8105
S-72Z	A-8076
S-78Z	A-7947
S-83Z	A-3883
S-84X	A-4350
S-85X	A-8080
S-86X	A-8103
S-131X	A-8087
S-132X	A-8095
S-133Z	A-8096
S-146A	†A-8072
S-148A	A-3311
S-2502	A-8087
S-7002	A-8083
SP-4	PCT-14
SP-5	PCT-15
SP-7	PCT-17
SP-13	PCT-23
SP-15	PCT-25
SP-21	PCT-31
SP-29	PCT-39
SP-50	PCT-60
SP-52	PCT-62
SP-66	PCT-76
SP-67	PCT-77
SP-106	PCT-116
SP-107	PCT-117
SP-310	SPCT-10
TY-18X	TA-59
TY-44X	TA-9
TY-45X	TA-42
TY-46X	TA-3
TY-47X	TA-10
TY-48X	TA-39
TY-51X	TA-6
TY-52X	TA-63
TY-53X	TA-13
TY-56X	TA-35
TY-61X	TA-7
TY-62X	TA-33
TY-63X	TA-11
TY-150X	TA-52
TY-151XT	TA-31
TY-152X	TA-12

† Available until stock is depleted.

ESSEX STANCOR

CROSS REFERENCE INDEX
STANCOR/UTC

UTC	STANCOR
A-10	WF-20
A-20	WF-30
CG-40	†C-2705
CG-100	†RS-12150
DIT-1	PMTS-4
DIT-2	PMTS-53
DIT-3	PMTS-56
DIT-5	PMTS-23
DIT-8	PMTS-19
DIT-9	PMTS-25
DIT-10	PMTS-26
DIT-11	PMTS-27
DIT-19	PMTS-30
DIT-20	PMTS-29
DIT-21	PMTS-28
DIT-22	PMTS-18
DIT-23	PMTS-38
DIT-25	PMTS-12
DIT-26	PMTS-21
DIT-27	PMTS-20
DIT-36	PMTS-7
DIT-37	PMTS-8
DIT-38	PMTS-12
DIT-41	PMTS-74
DIT-230	PMTS-30
DIT-240	PMTS-74
DIT-250	PMTS-29
DIT-255	PMTS-16
DIT-260	PMTS-71
DIT-270	PMTS-25
DIT-273	PMTS-70
DIT-276	PMTS-27
DIT-283	PMTS-75
DIT-288	PMTS-38
DOT-1	PMTS-4
DOT-2	PMTS-53
DOT-3	PMTS-56
DOT-4	PMTS-22
DOT-5	PMTS-23
DOT-6	PMTS-24
DOT-7	PMTS-15
DOT-8	PMTS-19
DOT-9	PMTS-25
DOT-10	PMTS-26
DOT-11	PMTS-27
DOT-12	PMTS-31
DOT-13	PMTS-32
DOT-14	PMTS-33
DOT-15	PMTS-34
DOT-16	PMTS-35
DOT-17	PMTS-36
DOT-18	PMTS-37
DOT-19	PMTS-30
DOT-20	PMTS-29
DOT-21	PMTS-28
DOT-22	PMTS-18
DOT-23	PMTS-38
DOT-24	PMTS-17
DOT-25	PMTS-12
DOT-26	PMTS-21
DOT-27	PMTS-20
DOT-36	PMTS-7
DOT-37	PMTS-8
DOT-38	PMTS-12
DOT-39	PMTS-38
DOT-40	PMTS-9
DOT-41	PMTS-74
DOT-46	PMTS-17
DOT-47	PMTS-7
DOT-48	PMTS-12
DOT-255	PMTS-16
DOT-275	PMTS-12
DOT-277	PMTS-12
DOT-278	PMTS-27
DOT-283	PMTS-75
DOT-288	PMTS-38
FT-2	P-6134
FT-4	P-6466
FT-5	P-6454
FT-6	P-6467
FT-7	P-5015
FT-8	P-6308
FT-10	P-6377
FT-13	P-8606
FT-14	P-8607
FT-15	P-8605
R-14	C-1333
R-15	C-2318
R-16	†RS-1540
R-18	C-1709
R-41	P-8630
R-42	P-8632
R-44	P-8633
R-45	P-8635
R-72	P-6410
R-73	P-6160
R-74	P-6161
R-79	†PV-6442
R-97	P-6385
R-101	PC-8405
R-110	P-8175
R-113	PC-8412
S-1	A-53
S-26	RS-1555
S-53	P-3024
S-55	P-6466
S-57	P-3060
S-70	P-6431
SO-3P	TA-34
SO-7P	TA-54
SO-8P	TA-35
SO-9P	TA-21
UC-3X	C-1215
UC-8X	C-1709
UC-15A	C-1412
UC-27X	C-2343
UC-40X	C-2708
UC-1706	C-1706
UC-2685	C-2685
UF-13X	P-6465
UF-25X	P-8130
UF-26X	P-8358
UF-45X	P-8180
UF-90X	TP-2
UF-91X	TP-3
UF-92A	TP-4
UF-93X	TP-5
UF-94X	TP-6
UN-51X	P-6412
UN-68X	P-6406
UP-6134/F14	P-6134
UP-6308	P-6308
UP-6375	P-6375
UP-6377	P-6377
UP-6411/N48	P-6411
UP-6458	P-6458
UP-6465	P-6465
UP-6466/F16	P-6466
UP-6467	P-6467
UP-6468	P-6468
UP-6469	P-6469
UP-8130/F44	P-8130
UP-8180	P-8180
UP-8190	P-8190
UP-8357/F41	P-8357
UP-8358	P-8358
UP-8361	P-8361
UP-8363	P-8363
UP-8364	P-8364
UP-8384	P-8384
UP-8385	P-8385
UP-8388	P-8388
UP-8389	P-8389
UP-8390	P-8390
UP-8391	P-8391
UP-8392	P-8392
UP-8393	P-8393
UP-8394	P-8394
UP-8395	P-8395
UP-8396	P-8396
UP-8397	P-8397
UP-8600	P-8600
UP-8601	P-8601
UP-8609/F40	P-8609
UP-8611	P-8611
UP-8613	P-8613
URT-201	RT-201
URT-202	RT-202
URT-204	RT-204
URT-206	RT-206
UTA-2	TA-2
UTA-7	TA-7
UTA-38	TA-38
UTA-39	TA-39
UTA-52	TA-52
UTA-59	TA-59

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† Available until stock is depleted.

POWER TRANSFORMERS-P.C. PLUS FAST SERVICE!

INC.

SECONDARY RMS RATING

PRIMARY 50/500 Hz

Series V.C.T. @ MA	Parallel @ 2x Current V @ MA	Size	Single 115V 6 Pin	Dual 115/230V 8 Pin	Single 277V 6 Pin	Single 332V 6 Pin	Single 460V 6 Pin
10 @ 120	5 @ 240	37	PC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1	GPC-10-120B1
10 @ 440	5 @ 880	50	PC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2	GPC-10-440B2
10 @ 1000	5 @ 2000	62	PC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3	GPC-10-1000B3
10 @ 2400	5 @ 4800	24	PC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4	GPC-10-2400B4
12.6 @ 100	6.3 @ 200	37	PC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5	GPC-12-100B5
12.6 @ 350	6.3 @ 700	50	PC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6	GPC-12-350B6
12.6 @ 800	6.3 @ 1600	62	PC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7	GPC-12-800B7
12.6 @ 2000	6.3 @ 4000	24	PC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8	GPC-12-2000B8
16 @ 75	8 @ 150	37	PC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9	GPC-16-75B9
16 @ 260	8 @ 520	50	PC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10	GPC-16-260B10
16 @ 640	8 @ 1280	62	PC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11	GPC-16-640B11
16 @ 1500	8 @ 3000	24	PC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12	GPC-16-1500B12
20 @ 60	10 @ 120	37	PC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13	GPC-20-60B13
20 @ 220	10 @ 440	50	PC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14	GPC-20-220B14
20 @ 500	10 @ 1000	62	PC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15	GPC-20-500B15
20 @ 1200	10 @ 2400	24	PC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16	GPC-20-1200B16
24 @ 50	12 @ 100	37	PC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17	GPC-24-50B17
24 @ 180	12 @ 360	50	PC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18	GPC-24-180B18
24 @ 450	12 @ 900	62	PC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19	GPC-24-450B19
24 @ 1000	12 @ 2000	24	PC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20	GPC-24-1000B20
34 @ 35	17 @ 70	37	PC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21	GPC-34-35B21
34 @ 125	17 @ 250	50	PC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22	GPC-34-125B22
34 @ 300	17 @ 600	62	PC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23	GPC-34-300B23
34 @ 700	17 @ 1400	24	PC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24	GPC-34-700B24
40 @ 30	20 @ 60	37	PC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25	GPC-40-30B25
40 @ 110	20 @ 220	50	PC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26	GPC-40-110B26
40 @ 250	20 @ 500	62	PC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27	GPC-40-250B27
40 @ 600	20 @ 1200	24	PC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28	GPC-40-600B28
56 @ 20	28 @ 40	37	PC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29	GPC-56-20B29
56 @ 80	28 @ 160	50	PC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30	GPC-56-80B30
56 @ 180	28 @ 360	62	PC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31	GPC-56-180B31
56 @ 420	28 @ 840	24	PC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32	GPC-56-420B32
88 @ 15	44 @ 30	37	PC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33	GPC-88-15B33
88 @ 50	44 @ 100	50	PC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34	GPC-88-50B34
88 @ 120	44 @ 240	62	PC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35	GPC-88-120B35
88 @ 270	44 @ 540	24	PC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36	GPC-88-270B36
120 @ 10	60 @ 20	37	PC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37	GPC-120-10B37
120 @ 35	60 @ 70	50	PC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38	GPC-120-35B38
120 @ 85	60 @ 170	62	PC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39	GPC-120-85B39
120 @ 200	60 @ 400	24	PC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40	GPC-120-200B40
180 @ 6	90 @ 12	37	PC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41	GPC-180-6B41
180 @ 24	90 @ 48	50	PC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42	GPC-180-24B42
180 @ 55	90 @ 110	62	PC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43	GPC-180-55B43
180 @ 130	90 @ 260	24	PC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44	GPC-180-130B44
230 @ 5	115 @ 10	37	PC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45	GPC-230-5B45
230 @ 20	115 @ 40	50	PC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46	GPC-230-20B46
230 @ 40	115 @ 80	62	PC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47	GPC-230-40B47
230 @ 100	115 @ 200	24	PC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48	GPC-230-100B48

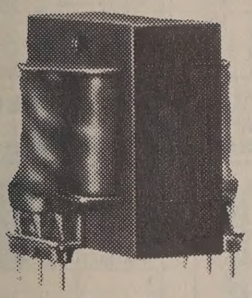
RATINGS BASED ON 20% REGULATION.

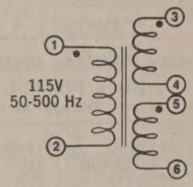
METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

POWER TRANSFORMERS-P.C. *PLUS* FAST SERVICE!

Single 115V Primary
Type PC-6 Pins




1
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115V
50-500 Hz
4
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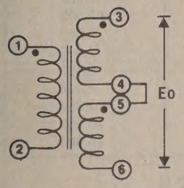
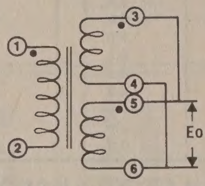
2
6

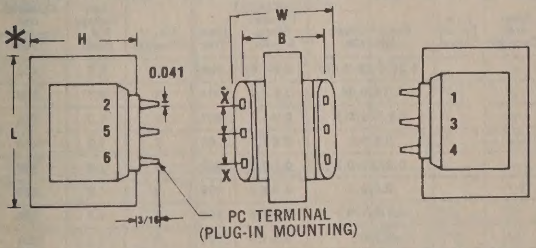
BASIC SCHEMATIC
Transformer can be connected in series or parallel.



SERIES CONNECTED



PARALLEL CONNECTED


*
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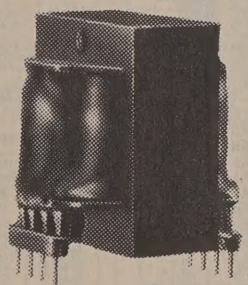
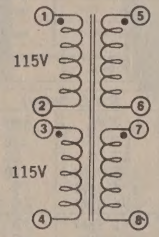
3/16
PC TERMINAL
(PLUG-IN MOUNTING)

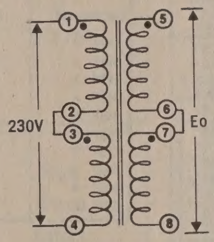
BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE

Dual 115/230V Primary
Type DPC-8 Pins




1
5
115V
2
6
3
7
115V
4
8

BASIC SCHEMATIC
Transformer can be connected in series or parallel.


1
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230V
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3
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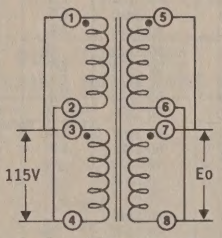
7
Eo
4
8

SERIES CONNECTED


1
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115V
Eo
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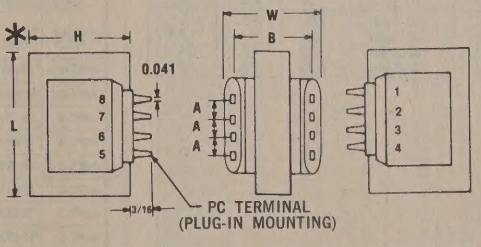
PARALLEL CONNECTED


*
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0.041
8
7
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L
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A
1
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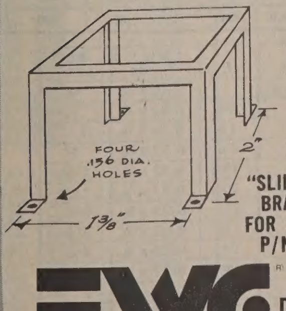
3
4
3/16
PC TERMINAL
(PLUG-IN MOUNTING)

BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE

*Size	VA	L	W	H	6 PIN X	8 PIN A	B	Wt. Oz.
37	1.2	1⅜	1⅛	1³⁄₁₆	0.312	.200	1.000	3
50	4.4	1⅝	1¼	1⅜	0.400	.250	1.100	5
62	10	1⅞	1⁷⁄₁₆	1⅝	0.400	.250	1.300	9
24	24	1⅝	2¼	1⅜	0.400	.250	2.100	12


FOUR
.156 DIA.
HOLES
2"
1⅜"

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24

EWC for fast service. Efficient and speedy response to customer needs is what EWC is all about. In addition to our standard line, we welcome inquiries about problems calling for custom designs. Cutting through red tape with person-to-person discussions has established EWC as an ideal supplier of quality products for quality-conscious companies.

EWC INC.
Dept. EM / 725 Federal Ave. / Kenilworth, NJ 07033 / (201) 245-3200 / TWX 710-996-5993

FREED TRANSFORMER CO., INC.

MIL-T-27 COMPONENTS

TRANSISTOR SUPPLY TRANSFORMERS
TST SERIES

Manufactured and Guaranteed to Specifications MIL-T-27

TST-6 — Frequency 57 Hz to 63 Hz — Primary 115 volts units with * primary 115 and/or 230 volts

TST-4 — Frequency 380 Hz to 1000 Hz — Primary 115 volts

TST units can be supplied in commercial type construction (channel or shell type with leads).

**When ordering specify (6) for 57 to 63 Hz and (4) for 380 to 1000 Hz

D.C. to RMS Conversion Chart

Resistive or Inductive Loads		Capacitive Loads	
Full Wave Center Tapped	Full Wave Bridge	Full Wave Center Tapped	Full Wave Bridge
E_{RMS} = 2.22 Edc	E_{RMS} = 1.11 Edc	E_{RMS} = 1.6 Edc	E_{RMS} = .8 Edc
I_{RMS} = .75 Idc	I_{RMS} = 1.05 Idc	I_{RMS} = 1.1 Idc	I_{RMS} = 1.55 Idc
Edc – should include voltage drop across reactor and voltage drop across one diode for F.W.C.T. and voltage drop across two diodes for F.W. Bridge.			

	R.M.S. Output		Case	
Part No.	Volt	Amp	—4	—6
TST(**)-1	6.3 CT	.30	AH	AH
TST(**)-2	6.3 CT	.60	AH	AJ
TST(**)-3	12.6 Split	.80	AJ	EB
TST(**)-4	12.6 Split	1.5	AJ	FA
TST(**)-5	12.6 Split	2.0	AJ	GB*
TST(**)-6	25.2 Split	1.5	EB	GA*
TST(**)-7	25.2 Split	4.0	GB	JA*
TST(**)-8	30 Split	.50	AJ	FA
TST(**)-9	30 Split	1.0	AJ	GB*
TST(**)-10	30 Split	1.5	EB	GA*
TST(**)-11	30 Split	2.0	FA	HA*
TST(**)-12	40 Split	.50	AJ	FA
TST(**)-13	40 Split	1.0	EB	GA*
TST(**)-14	40 Split	1.5	FA	HA*
TST(**)-15	40 Split	2.0	FA	JB*
TST(**)-16	50 Split	.50	AJ	GB*
TST(**)-17	50 Split	1.0	FA	GA*
TST(**)-18	50 Split	1.5	FA	JB*
TST(**)-19	50 Split	2.0	GB	JA*
TST(**)-20	60 Split	.50	AJ	GB*
TST(**)-21	60 Split	1.0	FA	HA*
TST(**)-22	60 Split	1.5	FA	JA*
TST(**)-23	70 Split	.50	EB	GA*
TST(**)-24	70 Split	1.0	FA	JB*
TST(**)-25	70 Split	1.5	GB	JA*
TST(**)-26	80 Split	.25	AJ	FA
TST(**)-27	80 Split	.50	EB	GA*
TST(**)-28	80 Split	1.0	FA	JB*
TST(**)-29	90 Split	.25	AJ	GB*
TST(**)-30	90 Split	.50	EB	GA*
TST(**)-31	90 Split	1.0	FA	JA*
TST(**)-32	100 Split	.25	AJ	GB*
TST(**)-33	100 Split	.50	FA	GA*
TST(**)-34	100 Split	1.20	GA	KB*

STANDARD MILITARY AUDIO TRANSFORMERS
Frequency Response 300-10,000 Hz ±2 DB

Catalog No.	Application	Type Designation	Impedance Level in Ohms Primary	Impedance Level in Ohms Secondary	Ratio	Max. Power Level DBM	Pri. D.C. Per Side in Ma	Max. D.C. unbal-ance	Case
MGA 1	Transformer; interstage, single or P.P. plates to single or P.P. grid	TF4RX15AJ	10,000 C.T.	90,000 split and C.T.	1:3 overall	+15	10	10	AJ
MGA 2	Transformer; matching 600 ohm line to voice coil.	TF4RX16AJ	600 split	4, 8, 16	6.12:1 overall	+33	0	0	AJ
MGA 3	Transformer; input, 600 ohm line to single or P.P. grids.	TF4RX10AJ	600 split	135,000 C.T.	1:15	+15	0	0	AJ
MGA 4	Transformer; matching, 600 ohm line to 600 ohm line.	TF4RX16AJ	600 split	600 split	1:1	+15	0	0	AJ
MGA 5	Transformer; output, single plate 7,600 ohm, 4,800 ohm to 600 ohm line.	TF4RX13AJ	7,600 tap @ 4,800	600 split	3.56:1	+33	40	40	AJ
MGA 6	Transformer; output, single plate 7,600 ohm, 4,800 ohm to voice coil.	TF4RX13AJ	7,600 tap @ 4,800	4, 8, 16	21.8:1	+33	40	40	AJ
MGA 7	Transformer; output, single or P.P. plates to 600 ohm line.	TF4RX13AJ	15,000 C.T.	600 split	5:1	+33	10	10	AJ
MGA 8	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	24,000 C.T.	600 split	6.32:1	+30	10	1	AJ
MGA 9	Transformer; output, P.P. plates to 600 ohm line.	TF4RX13AJ	60,000 C.T.	600 split	10:1	+27	10	1	AJ

STANDARD MILITARY POWER AND FILAMENT TRANSFORMERS
Primary 105/115/125V 60~

SINGLE PHASE 400 Hz, AND THREE PHASE 60 AND 400 Kz TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

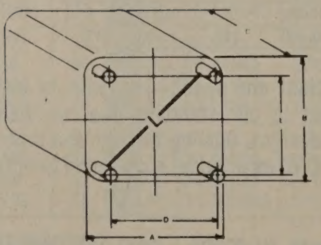
Catalog No.	MIL-T-27 Type Designation	Hi Volt	D.C. Volts	D.C. Amps	Fil. No. 1	Fil. No. 2	Case
MGP 1	TF4RX03HA001	200/100/0/100/200	185	.070	5 6. 3V @ 2A	6. 3V @ 3A	HA
MGP 2	TF4RX03JB002	650 C.T.	260	.070	5/6. 3V @ 2A	6. 3V @ 4A	JB
MGP 3	TF4RX03KB006	650 C.T.	245	.150	6. 3V @ 5A	5V @ 3A	KB
MGP 4	TF4RX03LB003	800 C.T.	318	.175	5V @ 3A	6. 3V @ 8A	LB
MGP 5	TF4RX03MB004	900 C.T.	345	.250	5V @ 3A	6. 3V @ 8A	MB
MGP 6	TF4RX02KB001	700 C.T.	255	.250			KB
MGP 7	TF4RX02LB002	1100 C.T.	419	.250			LB
MGP 8	TF4RX02NB003	1600 C.T.	640	.250			NB

Catalog No.	MIL-T-27 Type Designation	Secondary Volts	Secondary Current Amps	Secondary Test Volts RMS	Case
MGF 1	TF4RX01EB002	2.5	3.0	2,500	EB
MGF 2	TF4RX01GB003	2.5	10.0	2,500	GB
MGF 3	TF4RX01FB004	5.0	3.0	2,500	FB
MGF 4	TF4RX01HB005	5.0	10.0	2,500	HB
MGF 5	TF4RX01FB006	6.3	2.0	2,500	FB
MGF 6	TF4RX01GB007	6.3	5.0	2,500	GB
MGF 7	TF4RX01JB008	6.3	10.0	2,500	JB
MGF 8	TF4RX01KB009	6.3	20.0	2,500	KB
MGF 9	TF4RX01JB012	2.5	10.0	10,000	JB
MGF 10	TF4RX01KB013	5.0	10.0	10,000	KB

PULSE TRANSFORMERS

Catalog No.	MIL Type	Blocking Osc.	Inter-stage Coupling	Low Power Output	Pulse Voltage Kilovolts	Pulse Duration Micro-seconds	Duty Rate	No. of Windings	Test Voltage KV., RMS	Character-istic Impedance Ohms	Case No.
MPT-1	TF4RX35YY	✓	✓		0.25/0.25/0.25	0.2-1.0	.004	3	0.7	250	DM-20
MPT-2	TFR4X35YY	✓	✓		0.25/0.25	0.2-1.0	.004	2	0.7	250	DM-20
MPT-3	TF4RX35YY	✓	✓		0.5/0.5/0.5	0.2-1.5	.002	3	1,0	250	DM-18
MPT-4	TF4RX35YY	✓	✓		0.5/0.5	0.2-1.5	.002	2	1.0	250	DM-18
MPT-5	TF4RX35YY	✓	✓		0.5/0.5/0.5	0.5-2.0	.002	3	1.0	500	DM-20
MPT-6	TF4RX35YY	✓	✓		0.5/0.5	0.5-2.0	.002	2	1.0	500	DM-20
MPT-7	TF4RX35YY	✓	✓	✓	0.7/0.7/0.7	0.5-1.5	.002	3	1.5	200	DM-18
MPT-8	TF4RX35YY	✓	✓	✓	0.7/0.7	0.5-1.5	.002	2	1.5	200	DM-18
MPT-9	TF4RX35YY	✓	✓	✓	1.0/1.0/1.0	0.7-3.5	.002	3	2.0	200	DM-18
MPT-10	TF4RX35YY	✓	✓	✓	1.0/1.0	0.7-3.5	.002	2	2.0	200	DM-18
MPT-11	TF4RX35YY	✓	✓	✓	1.0/1.0/1.0	1.0-5.0	.002	3	2.0	500	DM-01
MPT-12	TF4RX35YY	✓	✓	✓	0.15/0.15/0.3/0.3	0.2-1.0	.004	4	0.7	700	DM-8

MIL CASES, NOMINAL DIMENSIONS, INCHES



Mil Case	A	B	C	D	L	E	Mtg. Studs	Wt. Lbs.
AH	1 5/16	1 5/16	1 3/4		1 1/4		6-32 x 3/8	3/8
AJ	1 5/8	1 5/8	2 3/8	1 3/16		1 3/16	6-32 x 3/8	2/3
EA	1 15/16	1 13/16	2 3/4	1 3/8		1 1/4	6-32 x 3/8	1
EB	1 15/16	1 13/16	2 7/16	1 1/8		1 1/4	6-32 x 3/8	7/8
FA	2 5/16	2 1/16	3 1/8	1 11/16		1 7/16	6-32 x 3/8	1 3/4
FB	2 5/16	2 1/16	2 1/2	1 11/16		1 7/16	6-32 x 3/8	1 1/2
GA	2 3/4	2 3/8	3 13/16	2 1/8		1 3/4	6-23 x 3/8	3 1/2
GB	2 3/4	2 3/8	2 13/16	2 1/8		1 3/4	6-32 x 3/8	2 1/2
HA	3 1/16	2 5/8	4 1/4	2 19/64		1 55/64	8-32 x 3/8	4 1/2
HB	3 1/16	2 5/8	3 3/16	2 19/64		1 55/64	8-32 x 3/8	3 1/2
JA	3 9/16	3 1/16	4 7/8	2 5/8		2 1/8	8-32 x 3/8	6
JB	3 9/16	3 1/16	3 7/8	2 5/8		2 1/8	8-32 x 3/8	5
KA	3 15/16	3 3/8	5 1/4	3		2 7/16	10-32 x 1/2	8 1/2
KB	3 15/16	3 3/8	4 5/16	3		2 7/16	10-32 x 1/2	7

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

Add Dept. EM to address to tell them you saw it in eem

FREED TRANSFORMER CO., INC.

HERMETICALLY SEALED MINIATURE AND SUB-MINIATURE FILTERS TO MIL-F-18327

Freed Standard Filters are **Hermetically Sealed Miniature and Sub-Miniature** high performance components designed for both production and laboratory applications in the Communications and Electronic industry. In order to achieve attenuation requirements not obtainable with one single filter, one can combine several standard filters of different transmission characteristics. Wide Band Pass characteristics are obtainable by combining low and high Pass Units. The astatic construction of inductive components together with special shielding reduces the hum pick-up of the standard filters.

Low Pass Filters: The attenuation characteristics of Low Pass Filters are 6db or less at cut-off frequency • **ILP-ILM Interstage Low Pass Filter.** Characteristic impedance 10,000 ohms, in and out • **LLP-LLM Line Low Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **High Pass Filters:** The attenuation characteristics of High Pass Filters are 6db or less at cut-off frequency • **IHP-IHM Interstage High Pass Filter.** Characteristic Impedance 10,000 ohms, in and out. • **LHP-LHM Line High Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **Band Pass Filters:** The attenuation characteristics of Band Pass Filters are 2db or less at plus or minus 3% of center frequency • **IBP-IBM Interstage Band Pass Filter.** Normal input impedance — 10,000 ohms. Output impedance .5 megohms. Effective voltage step-up 2:1. (Output voltage to source voltage.) • **LBP-LBM Line Band Pass Filter.** Nominal input impedance 500 to 600 ohms. Output impedance .5 megohms. Effective voltage step-up 5:1. (Output voltage to source voltage.)

Special filters in all six types are available upon request.

MINIATURE

Catalog No.	Cut-off Frequency Hz
ILP- 100	100
ILP- 200	200
ILP- 300	300
ILP- 500	500
ILP- 750	750
ILP- 1,000	1,000
ILP- 1,500	1,500
ILP- 2,000	2,000
ILP- 2,500	2,500
ILP- 3,000	3,000
ILP- 5,000	5,000
ILP- 7,000	7,000
ILP- 10,000	10,000
ILP- 15,000	15,000
ILP- 20,000	20,000
ILP- 23,000	23,000
ILP- 25,000	25,000
ILP- 32,000	32,000
ILP-130,000	130,000
ILP-150,000	150,000
LLP- 500	500
LLP- 1,000	1,000
LLP- 1,500	1,500
LLP- 1,600	1,600
LLP- 2,000	2,000
LLP- 2,500	2,500
LLP- 3,000	3,000
LLP-16,000	16,000
LLP-20,000	20,000
LLP-70,000	70,000
LLP-80,000	80,000

Low Pass Filters

attenuation ≥35 Db at 1.5 x Fc ≥ 40 Db at 2 x Fc

Catalog No.	Cut-off Frequency Hz
IHP- 200	200
IHP- 250	250
IHP- 300	300
IHP- 400	400
IHP- 500	500
IHP- 1,000	1,000
IHP- 2,000	2,000
IHP- 3,000	3,000
IHP-10,000	10,000
IHP-15,000	15,000
LHP- 200	200
LHP- 300	300
LHP- 400	400
LHP- 500	500
LHP- 800	800
LHP- 1,000	1,000
LHP- 2,000	2,000
LHP- 6,000	6,000
LHP-10,000	10,000

High Pass Filters

attenuation ≥35 Db at .67 x Fc ≥40 Db at .5 Fc

Catalog No.	Cut-off Frequency Hz
IBP- 100	100
IBP- 200	200
IBP- 250	250
IBP- 400	400
IBP- 500	500
IBP- 700	700
IBP- 800	800
IBP- 900	900
IBP- 1,000	1,000
IBP- 1,500	1,500
IBP- 2,000	2,000
IBP- 3,000	3,000
IBP- 5,000	5,000
IBP- 7,200	7,200
IBP-10,000	10,000
IBP-12,000	12,000
IBP-15,000	15,000
IBP-30,000	30,000
IBP-57,600	57,600
LBP- 100	100
LBP- 300	300
LBP- 400	400
LBP- 600	600
LBP- 800	800
LBP- 1,000	1,000
LBP- 1,500	1,500
LBP- 2,000	2,000
LBP- 3,000	3,000
LBP- 7,200	7,200
LBP-10,000	10,000
LBP-14,400	14,400
LBP-20,000	20,000
LBP-28,800	28,800

Band Pass Filters

attenuation ≥40 Db at 0.5 x Fc and 2 x Fc

SUB-MINIATURE

Catalog No.	Cut-off Freq. Hz	Case No.
ILM- 300	300	DF-01
ILM- 500	500	DF-01
ILM- 750	750	DF-01
ILM- 1,000	1,000	DF-01
ILM- 1,500	1,500	DF-01
ILM- 2,000	2,000	DF-01
ILM- 2,500	2,500	DF-01
ILM- 3,000	3,000	DF-01
ILM- 5,000	5,000	DF-01
ILM- 7,000	7,000	DF-01
ILM- 10,000	10,000	DF-01
ILM- 15,000	15,000	DF-01
ILM- 20,000	20,000	DF-01
ILM- 23,000	23,000	DF-01
ILM- 25,000	25,000	DF-01
ILM- 32,000	32,000	DF-01
ILM-130,000	130,000	DF-01
ILM-150,000	150,000	DF-01
LLM- 500	500	DF-03
LLM- 1,000	1,000	DF-03
LLM- 1,500	1,500	DF-02
LLM- 1,600	1,600	DF-02
LLM- 2,000	2,000	DF-02
LLM- 2,500	2,500	DF-02
LLM- 3,000	3,000	DF-02
LLM-16,000	16,000	DF-02
LLM-20,000	20,000	DF-02
LLM-70,000	70,000	DF-02
LLM-80,000	80,000	DF-02

Low Pass Filters

attenuation ≥30 Db at 1.5 x Fc ≥40 Db at 2 x Fc

Catalog No.	Cut-off Freq. Hz	Case No.
IHM- 300	300	DF-01
IHM- 400	400	DF-01
IHM- 500	500	DF-01
IHM- 1,000	1,000	DF-01
IHM- 2,000	2,000	DF-01
IHM- 3,000	3,000	DF-01
IHM-10,000	10,000	DF-01
IHM-15,000	15,000	DF-01
LHM- 300	300	DF-03
LHM- 400	400	DF-03
LHM- 500	500	DF-03
LHM- 800	800	DF-03
LHM- 1,000	1,000	DF-02
LHM- 2,000	2,000	DF-02
LHM- 6,000	6,000	DF-02
LHM-10,000	10,000	DF-02

High Pass Filters

attenuation ≥30 Db at .67 x Fc ≥40 Db at .5 Fc

Catalog No.	Cut-off Freq. Hz	Case No.
IBM- 400	400	DF-02
IBM- 500	500	DF-02
IBM- 700	700	DF-02
IBM- 800	800	DF-02
IBM- 900	900	DF-02
IBM- 1,000	1,000	DF-02
IBM- 1,500	1,500	DF-02
IBM- 2,000	2,000	DF-01
IBM- 3,000	3,000	DF-01
IBM- 5,000	5,000	DF-01
IBM- 7,200	7,200	DF-01
IBM-10,000	10,000	DF-01
IBM-12,000	12,000	DF-01
IBM-15,000	15,000	DF-01
IBM-30,000	30,000	DF-01
IBM-57,600	57,600	DF-01
LBM- 300	300	DF-02
LBM- 400	400	DF-02
LBM- 600	600	DF-02
LBM- 800	800	DF-02
LBM- 1,000	1,000	DF-01
LBM- 1,500	1,500	DF-01
LBM- 2,000	2,000	DF-01
LBM- 3,000	3,000	DF-01
LBM- 7,200	7,200	DF-01
LBM-10,000	10,000	DF-01
LBM-14,400	14,400	DF-01
LBM-20,000	20,000	DF-01
LBM-28,800	28,800	DF-01

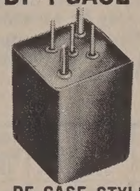
Band Pass Filters

attenuation ≥35 Db at 0.5 x Fc and 2 x Fc

ALL MINIATURE FILTERS ARE SUPPLIED IN DF-1 CASE

DF-1 CASE

Height: 2½"
Width: 1 11/16"
Depth: 1 3/16"
Mtg. Cen.: 1¼"x¾"
Studs: 4 6-32x⅜"
Knockout: ⅞" dia.



DF CASE STYLE DF-01

Height: 1⅜"
Width: ¾"
Depth.: ¾"
Mtg. Cen.: 9/16" Diag.
Studs: 2 ÷ 4-40

DF-02

Height: 1⅜"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾" Diag.
Studs: 2 ÷ 4-40

DF-03

Height: 1¾"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾"
Studs: 2 ÷ 4-40

SUBMINIATURE TELEMETERING BAND PASS FILTERS

Type No.	Center Frequency Fo - in Hz	Band Width <3DB	Stop Band Attenuation
MTN-.4	.4	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-.56	.56	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-.73	.73	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-.96	.96	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-1.3	1.3	±7½%	≥38 DB @ 1.75 & .58 Fo
MTN-1.7	1.7	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-2.3	2.3	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-3.0	3.0	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTH-3.9	3.9	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-5.4	5.4	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-7.35	7.35	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTH-10.5	10.5	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-14.5	14.5	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-30	30	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-40	40	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-52.5	52.5	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-70	70	±7½%	≥ 38 DB @ 1.75 & .58 Fo
MTN-22	22	±15%	≥ 40 DB @ 2.5 & .4 Fo
MTW-30	30	±15%	≥ 40 DB @ 2.5 & .4 Fo
MTW-40	40	±15%	≥ 40 DB @ 2.5 & .4 Fo
MTW-52.5	52.5	±15%	≥ 40 DB @ 2.5 & .4 Fo
MTW-70	70	±15%	≥ 40 DB @ 2.5 & .4 Fo

CASE SIZES

DF-01	DF-02
¾ x ¾ x 1⅜	1 x 1 x 1⅜
MTN-2.3 Thru MTW-70	MTN-4 Thru MTN 1.7

NULL "T" FILTERS
SERIES 1950

Standard models are available for 30, 60 and 120 cycles in a wide range of impedances. Each network will give a minimum of 50 db attenuation at the null frequency.

The null frequency is adjusted to a tolerance of ±2%.

All Null T Filters are hermetically sealed.

Prices on request.

Catalog No.	Frequency
NTF- 30	30 Hz
NTF- 60	60 Hz
NTF-120	120 Hz

FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

FREED TRANSFORMER CO., INC.

TOROIDAL INDUCTORS

Using the latest developments in the field of magnetic materials and new impregnation and molding techniques the Freed Transformer Co. makes available to the industry the most extensive line of toroidal inductors.

Freed toroids are available in three types of constructions. Open units coated with a special high temperature extremely low loss compound, hermetically sealed in metal cases or molded in special **Freed Epoxy Resin.** Both hermetically sealed and molded units meet the latest military specification MIL-T-27A(graded 1 or 4 and 2 or 5 respectively.)Freed toroidal inductors are supplied with either molypermalloy or carbonyl iron powder cores

1. Temperature Stabilization:

The molypermalloy and carbonyl iron powder cores have a temperature coefficient of inductance. Depending on the degree of temperature stabilization the cores have different temperature coefficients. The degree of stabilization is denoted by a two-letter code.

SF	Non-stabilized cores, ±2½% inductance variations from —55°C to +85°C.
SN	Non-stabilized cores, +2% inductance variations from —55°C to +85°C.
SE	Temperature stabilized cores, +0.1% to —0.4% inductance variations from —1.5°C to +54°C.
SB	Temperature stabilized cores, ±0.1% inductance variations from +13°C to +35°C.
SD	Temperature stabilized cores, ±0.1% inductance variations from —1.5°C to +54°C.
SW	Temperature stabilized cores, ±0.25% inductance variations from —54°C to +85°C.
SM	Temperature stabilized cores, ±.25% —65°C to +125°C.
SP	Temperature stable carbonyl iron cores, ±0.3% inductance variations from —55°C to +85°C.

The temperature (stabilization) coefficient of an inductor will depend upon the nominal inductance value, operating frequency and A.C. voltage across the coil. Under some unfavorable working conditions the temperature coefficient of inductance corresponding to a given stability characteristic may be exceeded.

Toroids with special requirements such as tapped toroids, toroidal transformers, molded and cased units with dimensions other than standard sizes and high temperature toroids can be supplied on request. Our engineering and laboratory facilities are available for consultation, research and development.

TOROIDAL INDUCTORS

Type	Ω/H	Max. Norm. Idc	Max. Norm. Iac	Max. Norm. Vac	Uncased	Mold	Case	Frequency
TI- 1	70	55	73.5	0.46	OS-8	MR-6	DT-3, DT-5	1–15 KHz
TI- 1A	68	75	90.5	0.57	OS-9	MR-7	DT-4	1–15 KHz
TI- 2	160	90	135	0.85	OS-6	MR-5	DT-3, DT-5	10–50 KHz
TI- 3	600	100	67	0.42	OS-6	MR-5	DT-3, DT-5	50–200 KHz
TI- 3A	310	150	240	1.5	OS-10	MR-8	DT-4	50–200 KHz
TI- 4	110	55	67	0.42	OS-5	MR-4	DT-2, DM-11	1–15 KHz
TI- 5	260	28	35	0.22	OS-3	MR-3	DT-1, DM-2	1–15 KHz
TI- 6	230	75	125	0.80	OS-10	MR-8	DT-4	10–50 KHz
TI- 7	480	40	53	0.33	OS-3	MR-3	DT-1, DM-2	10–50 KHz
TI- 8	1,500	50	80	0.5	OS-3	MR-3	DT-1, DM-2	30–75 KHz
TI- 9	150	200	240	1.5	OS-10	MR-3	DT-4	30–75 KHz
TI-10	430	125	270	1.7	OS-7	MR-5	DT-3, DT-5	30–75 KHz
TI-11	30	120	190	1.2	OS-11	MR-10	DT-4	1–15 KHz
TI-12	45	100	160	1	OS-9	MR-8	DT-4	1–15 KHz
TI-13	55	140	175	1.1	OS-9	MR-8	DT-4	10–50 KHz
TI-14	580	150	—	—	OS-5	MR-4	DT-2, DM-11	10–100 KHz
TI-15	900	100	—	—	OS-3	MR-3	DT-1, DM-2	10–100 KHz
TI-16	600	16	21	0.13	OS-1	MR-1, MS-1	DST-1	1–15 KHz
TI-17	1,200	20	29	0.18	OS-1	MR-1, MS-1	DST-1	10–50 KHz
TI-18	2,600	30	40	0.25	OS-1	MR-1, MS-1	DST-1	30–75 KHz

Type	Ω/H	Max. Norm. Idc	Max. Norm. Iac	Max. Norm. Vac	Uncased	Mold	Case	Frequency
TI-19	4,500	25	29	0.18	OS-1	MR-1, MS-1	DST-1	50–200 KHz
TI-20	2,750	100	*	*	OS-4	MR-3A	DT-2	20KHz–2MHz
TI-21	1,200	350	*	*	OS-1	MR-1, MS-1	DT-1	100KH –10MHz
TI-22	5,600	210	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-23	7,000	250	*	*	OS-2	MR-2	DT-1	50KHz–5MHz
TI-24	330	15	18	0.11	OS-1	MR-1, MS-1	DST-1	200Hz–12KHz
TI-25	200	20	24	0.15	OS-12	MR-2	DT-1	200Hz–12KHz
TI-26	150	25	32	0.20	OS-3	MR-3	DT-1, DM-3	200Hz–12KHz
TI-27	76.5	50	62	0.39	OS-5	MR-4	DT-2, DM-11	200Hz–12KHz
TI-28	48.5	50	64	0.40	OS-8	MR-6	DT-3, DT-5	200Hz–12KHz
TI-29	33.5	70	88	0.55	OS-9	MR-7	DT-4	200Hz–12KHz
TI-30	28	100	135	0.84	OS-9	MR-8	DT-4	200Hz–12KHz
TI-31	19.5	100	136	0.85	OS-11	MR-10	DT-4	200Hz–12KHz
TI-32	48.5	6	14.5	0.09	OS-3	MR-3	DT-1, DM-2	100Hz–10KHz
TI-33	2,150	8	13	0.08	OS-13	MR-11	DT-6	1–15 KHz
TI-34	1,700	8	9.5	0.06	OS-14	MR-11	DT-6	1–15 KHz
TI-35	4,100	10	18	0.11	OS-13	MR-11	DT-6	10–50 KHz
TI-36	3,950	10	11	0.07	OS-14	MR-11	DT-6	10–50 KHz
TI-37	23.5	10	32	0.20	OS-5	MR-14	DT-2, DM-11	100Hz–10KHz
TI-38	100	4	9.5	0.06	OS-1	MR-1, MS-1	DST-1	100Hz–10KHz

*TI-20 through TI-23 have a very low voltage coefficient and inductance will change very little with voltage. Because of high frequency application, the maximum voltage is limited rather by breakdown than by saturation.

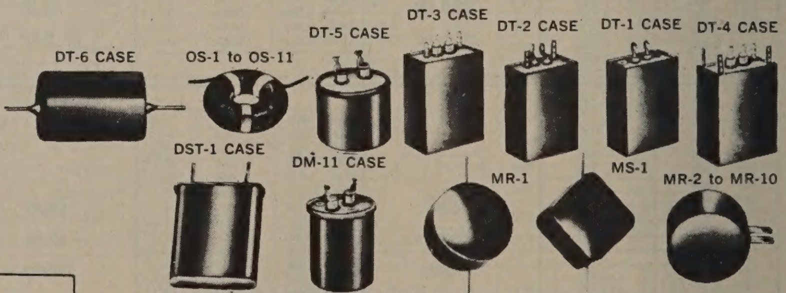
$$\text{Normalized } V_{AC} = \frac{V}{F}\,\frac{1}{\sqrt{L_H}}$$

$$\text{Normalized } I_{AC} = I_{AC}\sqrt{L_H}$$

$$\text{Normalized } I_{DC} = I_{DC}\sqrt{L_H}$$

where F —operating frequency in Hz
L_H —inductance in henries
Iac—A.C. current in MA
Idc—D.C. current in MA
V —A.C. voltage across the core

CASED, UNCASED AND MOLDED UNITS



UNCASED		
Type	**O.D.**	**Hi.**
OS-1	5/8"	5/16"
OS-2	7/8"	3/8"
OS-3	1"	3/8"
OS-4	1"	9/16"
OS-5	1 5/16"	5/8"
OS-6	1 5/8"	7/8"
OS-7	1 11/16"	5/8"
OS-8	1 7/8"	11/16"
OS-9	2 1/4"	1 1/8"
OS-10	2 3/8"	1 1/4"
OS-11	2 5/8"	1 1/8"
OS-12	13/16"	3/8"
OS-13	3/8"	1/4"
OS-14	7/16"	7/32"

MOLDED			
Type	**O.D.**	**Hi.**	**Clearance Hole Mounting**
MR-1	7/8"	13/32"	Pig Tails
MR-2	1 1/16"	1/2"	No. 4
MR-3	1 3/16"	1/2"	No. 6
MR-3A	1 3/16"	11/16"	No. 6
MR-4	1 1/2"	3/4"	No. 8
MR-5	1 7/8"	1"	No. 8
MR-6	2 1/8"	7/8"	No. 8
MR-7	2 3/8"	1 5/16"	No. 10
MR-8	2 1/2"	1 3/8"	No. 10
MR-9	2 5/8"	1 7/16"	No. 10
MR-10	2 7/8"	1 3/8"	No. 10
MR-11	7/16"	1/4"	Pig Tails
MS-1	25/32"x25/32"	13/32"	Pig Tails

CASED							
Type	**Hi.**	**Dia.**	**Length**	**Width**	**Mtg.**	**Mtg. Cen.**	**Cutout**
DT-1	1 7/32"		1 1/16"	1/2"	2 4-40 inserts	3/4"	5/16" x 1/2".
DT-2	1 3/4"		1 7/16"	13/16"	2 6-32 studs	7/8" x 9/32"	3/8" x 11/16"
DT-3	2"		1 25/32"	7/8"	2 6-32 studs	1 1/4" x 3/8"	3/8" x 3/4"
DT-4	3 1/8"		2 3/4"	1 5/16"	4 8-32 studs	2 1/16" x 11/16"	3/4" x 3/8"
DT-5	1 3/16"	1 13/16"			2 6-32 inserts	1 1/8"	3/8" x 1"
DT-6	5/8"	1/2"			Pig Tails		
DM-2	1"	1 1/8"			2 4-40 inserts	5/8"	3/8" x 7/8"
DM-11	1 1/2"	1 3/8"			2 6-32 inserts	7/8"	3/8" x 7/8"
DST-1	25/32"		3/4"	11/32"	1/4" long pins	To fit 1/2" crystal socket	

FREED TRANSFORMER COMPANY. INC.

FREED TRANSFORMER CO., INC.

COMMERCIAL GRADE COMPONENTS

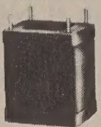
These components are designed to meet the demand for low-cost replacement parts for commercial electronic equipment.

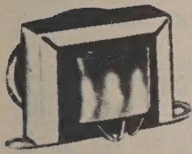
The best commercially available materials have been utilized in the design of these units, to insure reliability and excellent performance characteristics. Vacuum impregnation with a non-hygroscopic varnish to prevent penetration of humidity are employed to give these units long life and trouble-free performance.

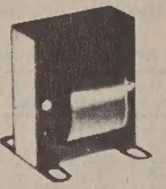
230-115 V, 50-60 C.P.S. Stepdown Transformers rated from 25 V A up to 5,000 V A Rating and line booster transformers are included in this series.

All units, with only a few exceptions, are uncased or of shell-type construction.

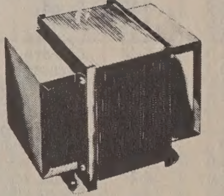
Isolation transformers and Stepdown transformers are equipped with line cord and receptacle.

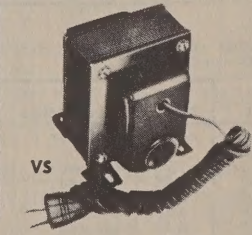

DC


CH


FV

Case No.	Height	Width	Depth	Mtg. Centers	Mtg. Studs
DC2B	3½	2⅝	2¼	2x1¾	(4)8-32
DC4A	3¾	3⅛	3	2½x2½	(4)8-32
DC5C	4⅞	4⅛	3½	3⅛x2⅝	(4)10-32
DC6A	4⅞	5	4⅛	3¾x3	(4)10-32
CH60	2	3¼	1¾	2 13/16	(2) 3/16
CH62	2	3¼	2⅛	2 13/16	(2) 3/16
CH70	2 5/16	3 11/16	2¼	3⅛	(2) 3/16
CH80	2⅝	4	2⅝	3 9/16	(2) 3/16
FV10	3 1/16	2½	2 9/16	2x2	(4) 13/64x21/64
FV12	3 1/16	2½	2 11/16	2x2⅛	(4) 13/64x21/64
FV22	3 7/16	2 13/16	2⅞	2¼x2¼	(4) 3/16x⅜
FV30	4 1/32	3⅛	3	2½x2¼	(4) 13/64x21/64
HB718	6¼	6½	8½	4¾x4½	(4) 9/32x21/32
HB728	6¼	6½	9¾	4¾x5¾	(4) 9/32x21/32
VS401	3 9/16	2 15/16	3¼	2¼x1 15/16	(4) 3/16x⅜
VS501	3 29/32	3¼	3⅜	2½x2 1/16	(4) 3/16x⅜
VS503	3 29/32	3¼	3⅝	2½x2 5/16	(4) 3/16x⅜
VS601	4 21/32	3⅞	3⅝	3x2 7/16	(4) 3/16x⅜
VS603	4 21/32	3⅞	3⅞	3x2 11/16	(4) 3/16x⅜
VS604	4 21/32	3⅞	4	3x2⅞	(4) 3/16x⅜
VS611	4 21/32	3⅞	4⅞	3x3 11/16	(4) 3/16x⅜
VS612	4 21/32	3⅞	5	3x3 13/16	(4) 3/16x⅜
VS706	5 7/16	4 9/16	5½	3½x3¾	(4) 3/16x⅜
VS714	5 7/16	4 9/16	6½	3½x4¾	(4) 3/16x⅜
VS718	5 7/16	4 9/16	7	3½x5¼	(4) 9/32x21/32
VS728	5 7/16	4 9/16	8¼	3½x6½	(4) 3/16x⅜


HB


VS

FILAMENT TRANSFORMERS

All primaries are for 115V, 50/60 c.p.s.

Catalog No.	Secondary Voltage	Secondary Current Amps	Secondary Test Voltage RMS	Case Size
TF 1	2.5 (C.T.)	7.5	1500	CH60
TF 2	2.5 (C.T.)	10	1500	CH70
TF 3	2.5 (C.T.)	5	7500	DC2B
TF 4	2.5 (C.T.)	10	7500	DC4A
TF 5	5.0 (C.T.)	4	1500	CH60
TF 6	5.0 (C.T.)	6	1500	CH70
TF 7	5.0 (C.T.)	10	1500	CH80
TF 8	5.0 (C.T.)	10	1500	FV10
TF 9	5.0 (C.T.)	20	2500	FV30
TF 10	5.0 (C.T.)	20	10,000	DC6A
TF 11	6.3 (C.T.)	1.35	1500	CH50
TF 12	6.3 (C.T.)	3	1500	CH60
TF 13	6.3 (C.T.)	5	1500	CH70
TF 14	6.3 (C.T.)	7	1500	FV12
TF 15	6.3 (C.T.)	10	1500	FV22
TF 16	10 (C.T.)	5	2500	CH80
TF 17	10 (C.T.)	5	2500	FV10
TF 18	10 (C.T.) or 11 (C.T.) (tapped primary)	12 or 11	7500	DC-5C
TF 19	12.6 (C.T.)	2	1500	CH62

TF 3, 4, 10 & 18 supplied with terminals. All others with leads.

AUTO TRANSFORMERS

To be used as step-down transformer. Equipped with standard receptacle and line cord.

Catalog No.	Transformation	VA Rating	Weight (lbs.)	Case Size
SDT 1*	230/115 V. 50/60 c.p.s.	25	1	CH-60
SDT 2*	230/115 V. 50/60 c.p.s.	50	1¼	CH-62
SDT 3	230/115 V. 50/60 c.p.s.	50	2½	VS-300
SDT 4	230/115 V. 50/60 c.p.s.	100	3	VS-401
SDT 5	230/115 V. 50/60 c.p.s.	200	5	VS-501
SDT 6	230/115 V. 50/60 c.p.s.	300	6½	VS-601
SDT 7	230/115 V. 50/60 c.p.s.	400	8	VS-604
SDT 8	230/115 V. 50/60 c.p.s.	500	11	VS-611
SDT 9	230/115 V. 50/60 c.p.s.	750	15	VS-706
SDT 10	230/115 V. 50/60 c.p.s.	1000	23	VS-718
SDT 11	230/115 V. 50/60 c.p.s.	1500	29½	VS-728
SDT 12*	230/115 V. 50/60 c.p.s.	2000	37	HB-718

*Supplied with leads without line cord and receptacle.

ISOLATION TRANSFORMERS

Electrostatic shield between primary and secondary. Equipped with standard receptacle and line cord.

Catalog Number	Primary Voltage 50/60 c.p.s.	Secondary Voltage	VA Rating	Case Size
IT 1	115	115	50	VS-401
IT 2	115	115	100	VS-503
IT 3	115	115	300	VS-700
IT 4	115	115	500	VS-714
IT 5*	220/440	110/220	250	VS-612
IT 6*	220/440	110/220	500	VS-714

*Supplied with leads without line cords and receptacle.

MCV – CONSTANT VOLTAGE TRANSFORMERS – MCV

(FERRO-RESONANT TRANSFORMERS)

The MCV line of constant voltage transformers provides accurate regulation against line and/or load variations, without the use of tubes or moving parts.

Input Voltage Range 95 to 130

Rated output within ± 2% of nominal value. Regulation automatically maintained within ± 1%. Regulation from 25% to full load ± 2%.

- MILITARY SPECIFICATIONS
- NO TUBES
- COMMERCIAL
- NO MOVING PARTS
- ACCURATE REGULATIONS
- FAST RESPONSE
- FULLY AUTOMATIC
- SUPPLIED WITH CONDENSERS

Reg. Output in R.M.S. Volts	Output in V.A. P.F-1	CATALOG NUMBERS			
		60 Cycles		400 Cycles	
		Comm.	Military*	Comm.*	Military*
115	5	MCV65LC	MCV65LM	MCV45LC	MCV45LM
115	25	MCV625LC	MCV625LM	MCV425LC	MCV425LM
115	75	MCV675LC	MCV675LM	MCV475LC	MCV475LM
115	125	MCV6125LC	MCV6125LM	MCV4125LC	MCV4125LM
115	175	MCV6175LC	MCV6175LM	MCV4175LC	MCV4175LM
115	250	MCV6250LC	MCV6250LM	MCV4250LC	MCV4250LM
115	375	MCV6375LC	MCV6375LM	MCV4375LC	MCV4375LM
115	500	MCV6500LC	MCV6500LM	MCV4500LC	MCV4500LM
115	750	MCV6750LC	MCV6750LM	MCV4750LC	MCV4750LM
115	1000	MCV61000LC	MCV61000LM	MCV41000LC	MCV41000LM
26	5	MCV654FC	MCV654FM	MCV454FC	MCV454FM
26	25	MCV6254FC	MCV6254FM	MCV4254FC	MCV4254FM
26	75	MCV6754FC	MCV6754FM	MCV4754FC	MCV4754FM
26	125	MCV61254FC	MCV61254FM	MCV41254FC	MCV41254FM
6.4	5	MCV65FC	MCV65FM	MCV45FC	MCV45FM
6.4	25	MCV625FC	MCV625FM	MCV425FC	MCV425FM
6.4	75	MCV675FC	MCV675FM	MCV475FC	MCV475FM
6.4	125	MCV6125FC	MCV6125FM	MCV4125FC	MCV4125FM

*Condensers are not provided with units. Where condensers are provided they are external to units.

AVAILABLE UPON REQUEST
MAGNETIC AMPLIFIERS AND SATURABLE TRANSFORMERS

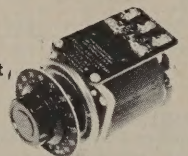
FREED TRANSFORMER COMPANY. INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

Variac® Adjustable Autotransformers

VARIAC® MANUALLY OPERATED AUTOTRANSFORMERS

The GenRad Variac autotransformer is a continuously variable unit used to control AC voltage. Features the Duratrak® contact surface, a uniform silver-alloy coating to prevent injurious high-temperature oxidation and resultant brush-track deterioration — track will show no significant wear after 1,000,000 cycles of brush operation. Variac autotransformers are highly efficient, have high thermal capacity, can withstand very high short-term overloads, and do not affect waveform or power factor. Other features: Good regulation; smooth control; long life; linear output voltage; low maintenance; easy installation. All necessary mounting hardware is included with each unit. Portable types, indicated by T in Model No., have an overload protection reset switch, line switch, convenience outlet, and a 6-ft. two- or three-wire line cord. Manually operated and motor-driven Variacs are available in a wide variety of voltage and current ratings, with or without cases. All except portable units can be equipped with ball bearings at slightly higher prices; ball bearings, indicated by BB in Model No. of manually operated units, are included with 4- and 6-gang types. **Angle of Rotation:** 320°. **Line Frequency:** 50 and/or 60 Hz unless otherwise specified. **Input Voltages:** 120, 208, 240 or 280 volts. **Output Voltages:** 0-120/140, 0-208, 0-240/280, 0-480 or 0-560 volts, continuously adjustable. **Current Ratings:** 2 to 300 amps.

W30 Basic Uncased Unit



W2 Basic Uncased Unit

W5M Single Unit Cased

W8 Single Unit Uncased

U2 Uncased

ACCESSORIES FOR VARIACS

REPLACEMENT BRUSHES

Model No.	For Variac Model
VB-1	M2, U2, V2, W2, W5H
VB-2	M5, V5, W5, W5L
VB-3	W8, W8L
VBT-6†	W50
VBT-7†	W50H
VBT-8†	M20, W20
VBT-10	M10, W10
VBT-11	W10H
VBT-12†	W20H
VBT-13†	W30
VBT-14†	W30H

† Brush set.

SINGLE-PHASE MODELS

MANY MODELS, AS NOTED, LISTED UNDER UL RE-EXAMINATION SERVICE AND CSA

120-VOLT INPUT UNITS

Line voltage connection output, 0-120 volts; overvoltage connection output, 0-140 volts.

Model No.	Output Amps		kVA	Description	Size, Inches			Shpg. Lbs.
	Rated	Max.			W.	D.↓	H.	
U2	2.25‡	3.0‡	0.36	Uncased	3	2 7/8	3 1/4	5
W2M	2.0	2.6	0.31	Cased†	4 1/8	4 3/8	5 9/16	9
W2	2.4	3.1	0.37	Uncased†	3 1/4	3 15/16	3 1/4	6
W5M	5.0	6.5	0.78	Cased†§	4 7/8	4 3/8	6 9/16	13
W5	6.0	7.8	0.94	Uncased†§	4 1/2	3 15/16	4 1/2	12
W5LM	7.1	9.2	1.1	Cased¶	4 7/8	4 3/8	6 9/16	13
W5L	8.5	11.0	1.32	Uncased¶	4 1/2	3 15/16	4 1/2	12
W8	8.5	11.0	1.32	Uncased	4 1/2	4 7/16	4 1/2	15
W8L	10.0	13.0	1.56	Uncased¶	4 1/2	4 7/16	4 1/2	15
W10	10.0	13.0	1.56	Uncased†§	5 3/4	4 11/16	5 3/4	18
W10M	10.0	13.0	1.56	Cased†§	6 3/4	5 1/4	9 15/32	21
W20	20.0	26.0	3.12	Uncased†§	7 1/2	4 5/8	7 1/2	27
W20M	20.0	26.0	3.12	Cased†	8 5/8	5 3/8	11 15/16	27
W30M	28.0	32.0	3.84	Cased	11	5 3/4	14 3/4	46
W30	30.0	36.0	4.32	Uncased	10	4 3/32	10 3/4	36
W50M	40.0	45.0	5.40	Cased†§	13 7/16	7 1/4	16 27/32	74
W50	50.0	50.0	6.00	Uncased†§	12 1/2	6 7/32	12 1/2	65
W30G2M	56.0	64.0	7.7	2-Gang W30M▲	11 3/8	11 1/2	14 15/16	83
W30G2	60.0	72.0	8.6	2-Gang W30▲	10	11 5/16	10 3/4	77
W50G2M	80.0	90.0	10.8	2-Gang W50M▲	13 13/16	16 1/8	17 1/16	160
W30G3M	84.0	96.0	11.5	3-Gang W30M▲	11 3/8	16 1/8	14 15/16	115
W50G2	100.0	100.0	12.0	2-Gang W50▲	12 1/2	15 15/16	12 1/2	147
W30G3	90.0	108.0	13.0	3-Gang W30▲	10	15 15/16	10 3/4	108
W50G3M	120.0	135.0	16.2	3-Gang W50M▲	13 13/16	22 1/2	17 1/16	221
W50G3	150.0	150.0	18.0	3-Gang W50▲	12 1/2	22 5/16	12 1/2	206
W50G4BBM	160.0	180.0	21.6	4-Gang W50BBM▲	13 13/16	28 7/8	17 1/16	313
W50G4BB	200.0	200.0	24.0	4-Gang W50BB▲	12 1/2	28 11/16	12 1/2	288
W50G6BBM	240.0	270.0	32.4	6-Gang W50BBM▲	13 13/16	41 5/8	17 1/16	430
W50G6BB	300.0	300.0	36.0	6-Gang W50BB▲	12 1/2	41 7/16	12 1/2	400

240-VOLT INPUT UNITS

Line voltage connection output, 0-240 volts; overvoltage connection output, 0-280 volts. All types except portable units can also use a 120-volt input.

Model No.	Output Amps		kVA	Description	Size, Inches			Shpg. Lbs.
	Rated	Max.			W.	D.↓	H.	
W5H	2.0	2.6	0.62	Uncased†	4 1/2	3 15/16	4 1/2	10
W5HM	2.0	2.6	0.62	Cased†	4 7/8	4 3/8	6 9/16	13
W10H	4.0	5.2	1.25	Uncased†	5 3/4	4 11/16	5 3/4	18
W10HM	4.0	5.2	1.25	Uncased†	6 3/4	5 1/4	9 15/32	21
W20H	8.0	10.4	2.50	Uncased†§	7 1/2	4 5/8	7 1/2	27
W20HM	8.0	10.4	2.50	Cased†	8 5/8	5 3/8	11 15/16	31
W30H	12.0	15.6	3.74	Uncased	10	4 3/32	10 3/4	36
W30HM	12.0	15.6	3.74	Cased	11	5 3/4	14 3/4	46
W50HM	20.0	31.0	7.45	Cased†§	13 7/16	7 1/4	16 27/32	76
W50H	25.0	32.5	7.80	Uncased†§	12 1/2	6 7/32	12 1/2	67
W30HG2	24.0	31.2	7.50	2-Gang W30H▲	10	11 5/16	10 3/4	75
W30HG2M	24.0	31.2	7.50	2-Gang W30HM▲	11 3/8	11 1/2	14 15/16	81
W30G2M	28.0	32.0	7.70	2-Gang W30M•■	11 3/8	11 1/2	14 15/16	83
W30G2	30.0	36.0	8.60	2-Gang W30•■	10	11 5/16	10 3/4	77
W50HG2M	40.0	62.0	14.90	2-Gang W50HM▲	13 13/16	16 1/8	17 1/16	165
W50HG2	50.0	65.0	15.60	2-Gang W50H▲	12 1/2	15 15/16	12 1/2	153
W50HG3M	60.0	93.0	22.30	3-Gang W50HM▲	13 13/16	22 1/2	17 1/16	230
W50HG3	75.0	97.5	23.4	3-Gang W50H▲	12 1/2	22 5/16	12 1/2	214
W50HG4BBM	80.0	124.0	29.8	4-Gg. W50HBBM▲	13 13/16	28 7/8	17 1/16	328
W50HG4BB	100.0	130.0	31.2	4-Gang W50HBB▲	12 1/2	28 11/16	12 1/2	300
W50HG6BBM	120.0	186.0	44.6	6-Gg. W50HBBM▲	13 13/16	41 5/8	17 1/16	458
W50HG6BB	150.0	195.0	46.8	6-Gang W50HBB▲	12 1/2	41 7/16	12 1/2	428

*kVA ratings — normal input line voltage times maximum current: maximum current can be drawn at maximum voltage for line voltage connection only. †CSA Approved. ††Listed ratings are for metal panel mountings, ratings in air, 2.0 and 2.5 amps respectively. §Listed under Re-examination Service of UL. ¶For 60 Hz only; no overvoltage connection supplied. • Series-connected windings; do not use with grounded load. ▲ Parallel-connected windings; one or more W50-P1 chokes required (see below). ■Also can be used at 120-volt input with 2x the output ratings shown. ↓Depth behind panel except cased types (excluding knobs).

MODEL W50-P1 CHOKE FOR PARALLEL COMBINATIONS

When windings of identical Variacs are paralleled to obtain higher load ratings, it is recommended to use one or more chokes to limit excess circulating current in the event that brushes accidentally get out of line. Use 1 choke for 2 Variacs in parallel; 3 chokes for 3 Variacs; 4 chokes for 5 Variacs; 6 chokes for 6 Variacs. Parallel operation of units smaller than Model W30 is not recommended since the next larger unit is more economical. For W50 Series Variacs, the choke can be mounted directly on the terminal plates.

GenRad

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ATLANTA (404) 394-5380 • LOS ANGELES (714) 540-9830
SAN FRANCISCO • (408) 985-0662 • DALLAS (214) 234-3357
TORONTO (416) 252-3395 • ZURICH (01) 55 24 20

Variac® Adjustable Autotransformers

VARIAC® MANUALLY OPERATED AUTOTRANSFORMERS

W-TYPE MANUAL THREE-PHASE GANGED MODELS

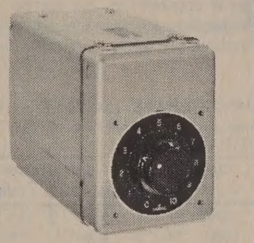
240-VOLT INPUT GANGED UNITS
All units listed require an input of 240 volts except W5LG3M. W5LG3, and W8LG3, which require 208 volts. All have an output range of 0-240 volts except types with H in Model No., 0-280 volts, and types with L in Model No., 0-208 volts. Ball bearings are included with 4- and 6-gang types; available for other types at extra cost.

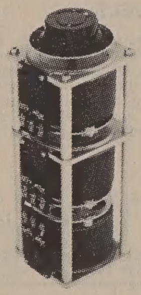
Model No.	Output Amps		kVA*	Description	Size, Inches			Shpg. Lbs.
	Rated	Max.			W.	D.♦	H.	
W5LG3M	7.1	9.2	3.31	3-Gang W5LM†‡	5⅛	13 3/32	6¾	32
W5LG3	8.5	11.0	3.96	3-Gang W5L†‡	4½	12 15/16	4½	30
W8LG3	10.0	13.0	4.68	3-Gang W8L†‡	4½	14¾	4½	36½
W5HG2	2.0	2.6	1.08	2-Gang W5H§	4½	8 13/16	4½	21
W5HG2M	2.0	2.6	1.08	2-Gang W5HM§	5⅛	8 31/32	6¾	23
W2G3M	2.0	2.6	1.08	3-Gang W2M†¶	4⅜	12 15/16	5¾	21
W2G3	2.4	3.1	1.29	3-Gang W2†¶	3¼	12 3/16	3¼	19
W10HG2	4.0	5.2	2.16	2-Gang W10H§	5¾	10 7/16	5¾	33
W10HG2M	4.0	5.2	2.16	2-Gang W10HM§	7⅛	10⅝	9 11/16	37
W5G3M	5.0	6.5	2.70	3-Gang W5M†¶	5⅛	13 3/32	6¾	32
W5G3	6.0	7.8	3.24	3-Gang W5†¶	4½	12 15/16	4½	30
W8G3	8.5	11.0	4.57	3-Gang W8†¶	4½	14¾	4½	36
W20HG2	8.0	10.4	4.32	2-Gang W20H§#	7½	10 5/16	7½	55
W20HG2M	8.0	10.4	4.32	2-Gang W20HM§#	9	10½	12 1/16	59
W10G3	10.0	13.0	5.40	3-Gang W10†¶	5¾	15⅛	5¾	48
W10G3M	10.0	13.0	5.40	3-Gang W10M†¶	7⅛	15 5/16	9 11/16	54
W30HG2	12.0	15.6	6.48	2-Gang W30H§#	10	11 5/16	10¾	75
W30HG2M	12.0	15.6	6.48	2-Gang W30HM§#	11⅜	11½	14 15/16	81
W20G3	20.0	26.0	10.80	3-Gang W20†¶#	7½	14⅞	7½	78
W20G3M	20.0	26.0	10.80	3-Gang W20M†¶#	9	15 1/16	12 1/16	84
W50HG2M	20.0	31.0	12.90	2-Gang W50HM§#	13 13/16	16⅛	17 1/16	165
W30G3M	28.0	32.0	13.30	3-Gang W30M†¶#	11⅜	16⅛	14 15/16	115
W50HG2	25.0	32.5	13.50	2-Gang W50H§#	12½	15 15/16	12½	153
W30G3	30.0	36.0	15.00	3-Gang W30†¶#	10	15 15/16	10¾	108
W50G3M	40.0	45.0	18.70	3-Gang W50M†¶#	13 13/16	22½	17 1/16	221
W50G3	50.0	50.0	20.80	3-Gang W50†¶#	12½	22 5/16	12½	206
W50HG4BBM	40.0	62.0	25.80	4-Gg. W50HBBM§#	13 13/16	28⅞	17 1/16	328
W50HG4BB	50.0	65.0	27.00	4-Gg. W50HBB§#	12½	28 11/16	12½	300
W50G6BBM	80.0	90.0	37.40	6-Gg. W50BBM†¶#▲	13 13/16	41⅝	17 1/16	430
W50G6BB	100.0	100.0	41.60	6-Gg. W50BB†¶#▲	12½	41 7/16	12½	400

480-VOLT INPUT GANGED UNITS
All Variacs listed are for "Y" connection. Overvoltage circuits are not recommended. Ball bearings are included with 6-gang types; available for remaining types at extra cost. Output voltage range, 0-480 volts.

Model No.	Output Amps		kVA*	Description	Sizes, Inches			Shpg. Lbs.
	Rated	Max.			W.	D.♦	H.	
W5HG3	2.0	2.6	2.16	3-Gang W5H	4½	12 15/16	4½	29
W5HG3M	2.0	2.6	2.16	3-Gang W5HM	5⅛	13 3/32	6¾	31
W10HG3	4.0	5.2	4.32	3-Gang W10H	5¾	15⅛	5¾	46
W10HG3M	4.0	5.2	4.32	3-Gang W10HM	7⅛	15 5/16	9 11/16	52
W20HG3	8.0	10.4	8.65	3-Gang W20H	7½	14⅞	7½	73
W20HG3M	8.0	10.4	8.65	3-Gang W20HM	9	15 1/16	12 1/16	81
W30HG3	12.0	15.6	13.00	3-Gang W30H	10	15 15/16	10¾	107
W30HG3M	12.0	15.6	13.00	3-Gang W30HM	11⅜	16⅛	14 15/16	113
W50HG3M	20.0	31.0	25.80	3-Gang W50HM	13 13/16	22½	17 1/16	230
W50HG3	25.0	32.5	27.00	3-Gang W50H	12½	22 5/16	12½	214
W50HG6BBM	40.0	62.0	51.50	6-Gang W50HBBM▲	13 13/16	41⅝	17 1/16	458
W50HG6BB	50.0	65.0	54.00	6-Gang W50HBB▲	12½	41 7/16	12½	428

* kVA ratings — normal input line voltage times maximum current; maximum current can be drawn at maximum voltage for line voltage connection only. † "Y"-circuit connected. ‡ For 60 Hz only; no overvoltage connection. § Open-delta circuit connected. ¶ Overvoltage connection not recommended. ▲ See previous page for W50-P1 Choke for parallel combinations. ♦ Depth behind panel except cased types (excluding knobs). # Also for single-phase 120-volts input.


W10G3M
3-Gang
Cased


W5G3
3-Gang
Jncased

W30G6BB
6-Gang
Uncased

SINGLE-PHASE PORTABLE VARIACS

Portable, metered, cased Variacs with 2-wire or 3-wire cord and receptacle, and convenient carrying handle. Meter accuracy is 3% of full scale except 5% for ammetered Model W20HMT3A. Power switch disconnects both sides of line. Meters are switchable under load. Types MT and MT3 have overvoltage connections and corresponding dial scales; line-voltage connections and dial scales on special order.

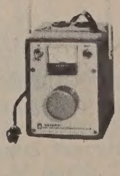
120-VOLT INPUT
All units have max, output voltage range of 0-140 volts except W5LMT3 which has 0-120 volts. Models W5MT and W10MT come in 2-wire version; all others in 3-wire version.

Model No.	Rated Output, Amps	Meter Range (full-scale)			Size, Inches			Shpg. Weight Lbs.
		Amps	Watts	V	W.	D.	H.	
W5MT*†	5.0				4⅞	4⅜	6 9/16	15
W5MT3*†	5.0				4⅞	4⅜	6 9/16	15
W5MT3VM	5.0			150	4⅞	4⅜	6 9/16	19
W5MT3A	5.0	1/5		150	6¾	5¼	9½	19
W5MT3W	5.0		150/750	150	6¾	5¼	9½	19
W5MT3AW	5.0	1/5	150/750	150	11 15/16	5⅜	8⅝	21
W5LMT3§	7.1				4⅞	4⅜	6 9/16	18
W8MT3	10.0				5⅜	6⅛	7	16
W8MT3VM	10.0			150	5⅜	6⅛	7	16
W10MT†	10.0				6¾	5¼	9½	24
W10MT3†	10.0				6¾	5¼	9½	24
W10MT3A	10.0	2/10		150	8⅝	5⅜	11 15/16	30
W10MT3W	10.0		300/1500	150	8⅝	5⅜	11 15/16	30
W20MT3A	18.0	20		150	8⅝	5⅜	11 15/16	34
W20MT3†	18.0				8⅝	5⅜	11 15/16	23

240-VOLT INPUT
All units have max. output voltage range of 0-280 volts. Models W5HMT and W10HMT come in 2-wire cord and receptacle; all others in 3-wire cord and receptacle.

Model No.	Rated Output, Amps	Amps	Watts	V	W.	D.	H.	Shpg. Weight Lbs.
W5HMT†	2.0				4⅞	4⅜	6 9/16	15
W10HMT	4.0				6¾	5¼	9½	24
W10HMT3†	4.0				6¾	5¼	9½	24
W20HMT3†	8.0				8⅝	5⅜	11 15/16	35
W20HMT3A	8.0	10		300	8⅝	5⅜	11 15/16	31

* Listed under UL Re-examination Service. † CSA Approved. § 60 Hz only.


W8MT3VM

W8MT3

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Variac® Adjustable Autotransformers

VARIAC® MANUAL AND MOTOR-DRIVEN AUTOTRANSFORMERS

M-TYPE MANUAL MODELS FOR 350-1200 Hz OPERATION

For use at line frequencies between 350 and 1200 Hz. Equivalent to their Type-W counterparts, but smaller and lighter, and provide better regulation at 400 Hz than 60 Hz models. Conform to most military specifications for shock, vibration, salt spray, tropicalization, altitude, humidity and temperature.

SINGLE-PHASE 120-VOLT INPUT UNITS

Line voltage connection output, 0-120 volts; overvoltage connection output, 0-140 volts.

Model No.	Output Amps		kVA*	Description	Shpg. Wt. Lbs.
	Rated	Max.			
M2	2.4	3.1	0.37	Uncased	4
M5	6.0	7.8	0.94	Uncased	6
M10	10.0	13.0	1.56	Uncased	11
M20	20.0	26.0	3.12	Uncased	18

* kVA ratings — normal input line voltage times maximum current; maximum current can be drawn at maximum voltage for line voltage connection only.

SINGLE-PHASE 240-VOLT INPUT UNITS

Line voltage connection output, 0-240 volts; overvoltage connection output, 0-280 volts.

Model No.	Output Amps		kVA*	Description	Shpg. Wt. Lbs.
	Rated	Max.			
M2G2	2.4	3.1	0.74	2-Gang M2	6
M5G2	6.0	7.8	1.88	2-Gang M5	12
M10G2	10.0	13.0	3.12	2-Gang M10	18
M20G2	20.0	26.0	6.24	2-Gang M20	34

THREE-PHASE 240-VOLT INPUT UNITS

Line voltage connection output, 0-240 volts; overvoltage connection not recommended.

Model No.	Output Amps		kVA*	Description	Shpg. Wt. Lbs.
	Rated	Max.			
M2G3	2.4	3.1	1.29	3-Gang M2	9
M5G3	6.0	7.8	3.24	3-Gang M5	14
M10G3	10.0	13.0	5.40	3-Gang M10	27
M20G3	20.0	26.0	10.80	3-Gang M20	48

MOTOR DRIVEN MODELS

All W- and M-type Variac autotransformers, both single and ganged, can be supplied with motor drives. Motors are fully enclosed, two-phase gear-reduction servo types having very low moments of inertia; the motor mounting plate is attached to the base end of the autotransformer by means of four heavy corner posts. Gear coupling is used to facilitate precise alignment, eliminate phase shift problems, and permit a number of drive speeds by simple change of gears. Three basic internal-geared motor speeds are available which, with a selection of standard coupling gears, makes possible the assembly of units having nominal full-traverse (320°) speeds of 2, 4, 8, 16, 32, 64 or 128 seconds at 60 Hz (approximately 20% slower at 50 Hz). The 2- and 4-second units are intended for high-speed servo applications; slower speed models are primarily for remote positioning. Cases are available for most models as indicated. **All motor-driven Variacs are furnished complete with ball bearings, a 120-volt phase-shift capacitor, and an adjustable microswitch for setting traverse limits.**

HOW TO ORDER

```
W 5 H G 3      D 8 C K      M
A ——┘          B ——┘        C┘
```

A **Basic Unit Prefix:** Select from table below the desired basic Variac unit, as described elsewhere in these pages.

B **Motor Indicator Suffix:** Add appropriate suffix for each Variac as indicated by an X in columns below. Suffix indicates seconds for 320° traverse.

C **Case Suffix:** Add final suffix M if case available and desired. Case fully encloses both motor and Variac.

Variac Prefix No.			Motor Indicator: D ( ) CK					
	2	4	8	16	32	32	64	128
M2	X	X	X	X	....	X	X	....
M2G2	X	X	X	X	....	X	X	....
M2G3	....	X	X	X	....	X	X	....
M5	X	X	X	X	....	X	X	....
M5G2	X	X	X	X	....	X	X	....
M5G3	....	X	X	X	....	X	X	....
M10	X	X	X	X	X	....	X	X
M10G2	....	X	X	X	X	....	X	X
M10G3	....	....	X	X	X	....	X	X
M20	....	X	X	X	X	....	X	X
M20G2	....	....	X	X	X	....	X	X
M20G3	....	....	X	X	X	....	X	X
W2	X	X	X	X	....	X	X	....
W2G2	X	X	X	X	....	X	X	....
W2G3	....	X	X	X	....	X	X	....
W5	X	X	X	X	....	X	X	....
W5G2	X	X	X	X	....	X	X	....
W5G3	....	X	X	X	....	X	X	....
W5H	X	X	X	X	....	X	X	....
W5HG2	X	X	X	X	....	X	X	....
W5HG3	....	X	X	X	....	X	X	....
W5L	X	X	X	X	....	X	X	....
W5LG2	X	X	X	X	....	X	X	....
W5LG3	....	X	X	X	....	X	X	....
W8	X	X	X	X	....	X	X	....
W8G2	X	X	X	X	....	X	X	....
W8G3	....	X	X	X	....	X	X	....
W8L	X	X	X	X	....	X	X	....
W8LG2	X	X	X	X	....	X	X	....

Variac Prefix No.			Motor Indicator: D ( ) CK					
	2	4	8	16	32	32	64	128
W8LG3	....	X	X	X	....	X	X	....
W10	X	X	X	X	X	....	X	X
W10G2	....	X	X	X	X	....	X	X
W10G3	....	....	X	X	X	....	X	X
W10H	X	X	X	X	X	....	X	X
W10HG2	....	X	X	X	X	....	X	X
W10HG3	....	....	X	X	X	....	X	X
W20	....	X	X	X	X	....	X	X
W20G2	....	....	X	X	X	....	X	X
W20G3	....	....	X	X	X	....	X	X
W20H	....	X	X	X	X	....	X	X
W20HG2	....	....	X	X	X	....	X	X
W20HG3	....	....	X	X	X	....	X	X
W30	....	X	X	X	X	....	X	X
W30G2	....	....	....	X	X	....	X	X
W30G3	....	....	....	....	X	....	X	X
W30H	....	X	X	X	X	....	X	X
W30HG2	....	....	....	X	X	....	X	X
W30HG3	....	....	....	....	X	....	X	X
W50	....	....	....	X	X	....	X	X
W50G2	....	....	....	....	X	....	X	X
W50G3	....	....	....	....	X	....	X	X
W50G4	....	....	....	....	....	....	....	X
W50G6	....	....	....	....	....	....	....	X
W50H	....	....	....	X	X	....	X	X
W50HG2	....	....	....	....	X	....	X	X
W50HG3	....	....	....	....	X	....	X	X
W50HG4	....	....	....	....	....	....	....	X
W50HG6	....	....	....	....	....	....	....	X

Distributors for Variac® autotransformers:

Abern Safety Equipment, 37 Warehouse Point Rd., Wallingford, CT 06492; (203) 265-5621
Delta Technical Products, 5934 W. Gunnison St., Chicago, IL 70360; (312) 286-1141
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Industrial Temperature Control, 23419 Ford Rd., Dearborn, MI 48128; (313) 278-2210
Lafayette Industrial Electronics, 1400 Worcester St., Natick, MA 01760; (617) 969-6100
James W. Clary Co., 1713 2nd Ave. S., Birmingham, AL 35233; (205) 322-2486, 800-292-3467 in AL, 800-633-4215 outside AL
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hisonic inc.

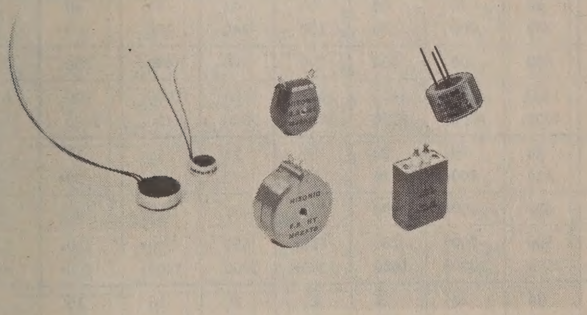
249 N. TROOST • OLATHE, KANSAS 66061
PHONE: 913-782-0012
TELEX: 4-2562

INDUCTORS

Hisonic has long been a leader in the custom development and manufacture of high Q precision inductors. Originally confined to MPP and PI toroidal types, capabilities have been expanded to include ferrite pot core and laminated alloy core types and cover virtually every known construction that applications may require.

Although Hisonic stocks several series (primarily toroidal) most are custom made to specific requirements which results in less compromise in your applications and usually lower cost.

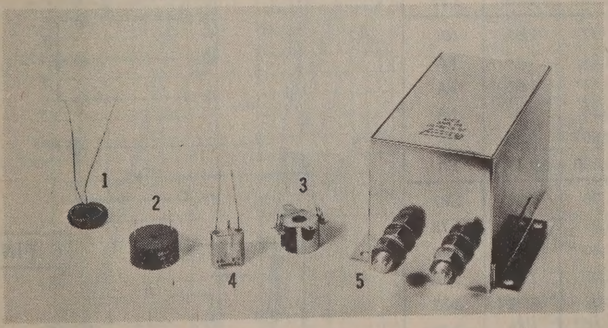
STANDARD
UNCASED MOLDED METAL CASED



*Toroidal Series	Ind. Range	Max Q	Freq Range	DC R Ohms/MH	Uncased Size
J2	5.6MH to 3.3HY	90	Up to 30KHZ	.50	.620D x .30H
J3	2.7 to 470MH	110	20 to 150KHZ	1.1	.620D x .30H
J4	.56 to 33MH	110	100 to 400KHZ	5.1	.620D x .30H
J5	.10 to 10MH	150	250KHZ to 1.5MHZ	8.9	.620D x .30H
R2	6.8MH to 6.8HY	135	Up to 20KHZ	.18	.960D x .40H
R3	3.3 to 470MH	180	10 to 60KHZ	.39	.960D x .40H
R4	1.2 to 68MH	170	40 to 160KHZ	.90	.960D x .40H
S2	6.8MH to 15HY	160	Up to 15KHZ	.10	1.250D x .62H
S3	3.3 to 560MH	225	10 to 60KHZ	.21	1.250D x .62H
T2	22MH to 39HY	210	Up to 15KHZ	.045	1.850D x .85H
V2	68MH to 68HY	245	Up to 8KHZ	.028	2.400D x .92H
W2	100MH to 100HY	260	Up to 6KHZ	.021	2.700D x 1.05H

*Write for Series Bulletins on electrical and case style details

EXAMPLE *CUSTOM INDUCTORS



P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250μH@1.5ADC	Tor.	.970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50 uH @100ADC	Lam	2.65x5x3H

*Advise requirements for recommended solution and quotation

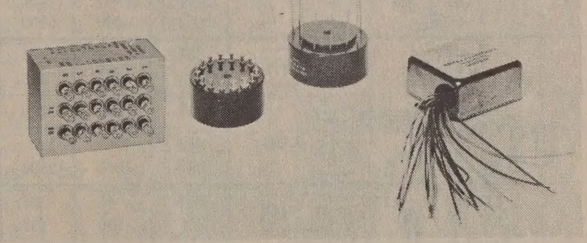
TRANSFORMERS

Hisonic has recognized capabilities in the design and manufacture of transformers, particularly for technically sophisticated custom applications. Thousands of Hisonic converter transformers are "flying" over the world, powering aircraft com/nav equipment. Special signal and matching transformers for both voice and wide video ranges are in use in communication systems.

Constructions include toroidal, pot core and laminated core to commercial and MIL specifications.

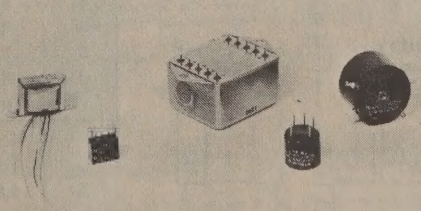
There are few "stock" items, but hundreds of designs and our engineering staff are ready to solve your transformer problems quickly.

EXAMPLE DC CONV/AC POWER



P/N	Input	OP Freq	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x.6x.48H
24-0193-10	14/28V DC	6KHZ	18	4.7,11.5CT,22.5CT,550	1.8 ODx.94H
24-0135-10	14/28V DC	4KHZ	25	9,20CT,1170	1.8x2.0x.88H
24-0107-10	14/28V DC	2KHZ	27	90/45CT,180/25,180/25	2.1 ODx.88H
24-0202-11	14/28V DC	4KHZ	35	9.5CT,22.5CT,100,100	1.8x2.0x.88H
24-0114-10	14/28V DC	400HZ	75	26 , 60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT,22.5CT,100,100	2.0x2.0x1.0H
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4,1.4,10 (RMS)	1.9 ODx.86H
24-0169-10	26V AC	400HZ	17	21/13CT (RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20,27,27,42 (RMS)	3.2x3.8x4.1H

EXAMPLE SIGNAL/PULSE/MATCH



P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150,25	100KHZ−2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ−2MHZ	4mw	1.1 ODx.75H
24-0205-10	Voice Range Hybrid	600:600+600	300−3000HZ	100mw	1.0x1.0x1.0H
24-0240-10	Wide Band Hybrid	600:600+600	50HZ−50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50:100+100	700KHZ−4MHZ	10mw	.75 ODx.85H
24-0153-10	Pulse Match	10K:40K	tp1.2ms,tr60μs	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5:600w/tap	tp.4μs,tr.2μs	6KW	1.5 ODx.8H

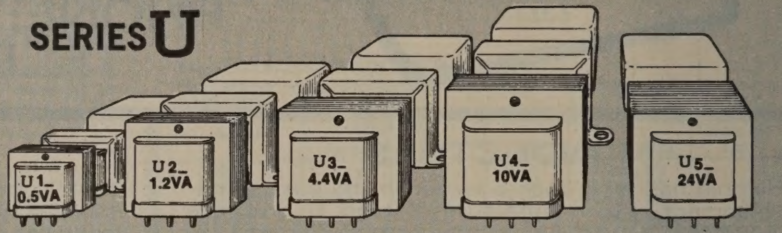
hisonic inc.

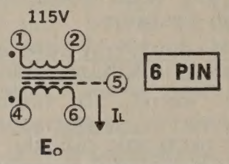
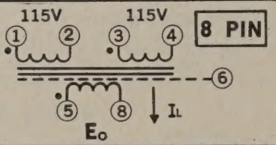
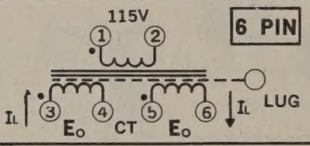
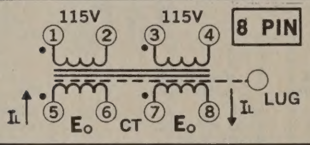
OTHER PRODUCTS: High, Low & Band Pass and Suppression Filters • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

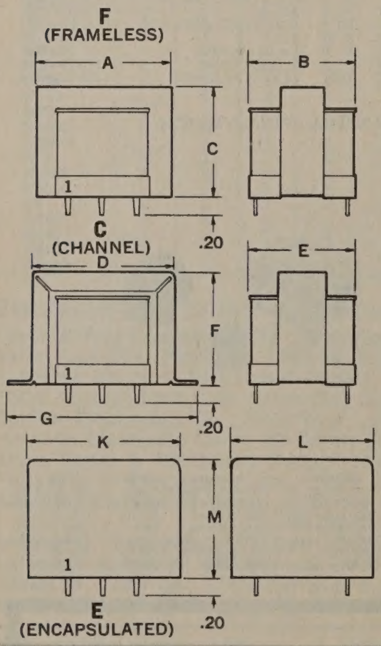
PLUG-IN P.C. BOARD POWER

- OVER 2,500 STD. MODELS
- 115V - 115/230V INPUT
- SINGLE - DUAL - CT OUTPUT
- 25 STD. OUTPUT VOLTAGES
- POWER RATINGS TO 24 VA
- ELECTROSTATIC SHIELD OPTION

SERIES U


U1_
0.5VA
U2_
1.2VA
U3_
4.4VA
U4_
10VA
U5_
24VA

WINDING CONFIGURATION	OUTPUT VOLTAGE Eo (RMS)	4.0	4.5	5.0	5.5	6.3	7.5	8.0	9.0	10	12	15
	Dash	-004	-04.5	-005	-05.5	-06.3	-07.5	-008	-009	-010	-012	-015
	Model	OUTPUT CURRENT I_L (MA) PER SECONDARY										
 115V 1 2 5 4 6 IL Eo 6 PIN	U11-	120	110	100	95	80	65	60	55	50	45	35
	U21-	300	270	240	220	200	170	150	140	120	100	80
	U31-	1100	980	880	800	700•	600•	520	480	440	360	300•
	U41-	2400	2200	2000	1800	1600•	1400•	1300	1100	1000	900	670•
	U51-	6000	5300	4800	4400	4000•	3200•	3000	2600	2400	2000	1600•
 115V 115V 1 2 3 4 6 5 8 IL Eo 8 PIN	U12-	105	95	90	80	70	55	50	48	44	40	30
	U22-	300	270	240	220	200	170	150	140	120	100	80
	U32-	1100	980	880	800	700	600	520	480	440	360	300
	U42-	2400	2200	2000	1800	1600	1400	1300	1100	1000	900	670
	U52-	6000	5300	4800	4400	4000	3200	3000	2600	2400	2000	1600
 115V 1 2 6 PIN LUG IL 3 4 5 6 IL Eo CT Eo	U13-	45	41	38	36	30	24	22	21	19	17	13
	U23-	150	135	120•	110	100•	85	75•	70	60•	50•	40
	U33-	550	490	440•	400	350•	300	260•	240	220•	180•	150
	U43-	1200	1100	1000•	900	800•	700	650•	550	500•	450•	335
	U53-	3000	2600	2400•	2200	2000•	1600	1500•	1300	1200•	1000•	800
 115V 115V 1 2 3 4 8 PIN LUG IL 5 6 7 8 IL Eo CT Eo	U14-	42	38	35	34	28	22	21	20	18	16	12
	U24-	150	135	120•	110	100•	85	75•	70	60•	50•	40
	U34-	550	490	440•	400	350•	300	260•	240	220•	180•	150
	U44-	1200	1100	1000•	900	800•	700	650•	550	500•	450•	335
	U54-	3000	2600	2400•	2200	2000•	1600	1500•	1300	1200•	1000•	800

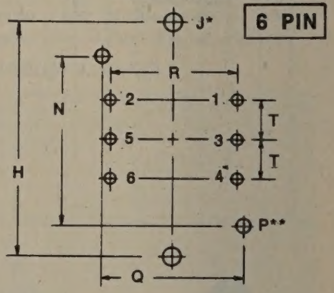

F
(FRAMELESS)
A
B
C
1
C
(CHANNEL)
D
.20
E
F
1
G
.20
K
L
M
1
E
(ENCAPSULATED)
.20

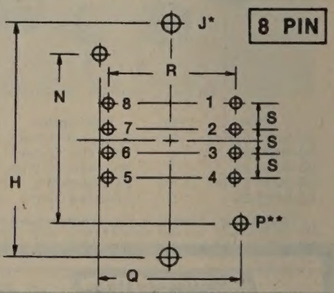
MECHANICAL DIMENSIONS (INCHES)

	U1_	U2_	U3_	U4_	U5_
A	1.00	1.38	1.63	1.88	1.63
B	0.95	1.13	1.24	1.44	2.23
C	0.83	1.15	1.38	1.59	1.38
D	NA	1.46	1.72	1.96	NA
E	NA	1.13	1.24	1.44	NA
F	NA	1.22	1.40	1.65	NA
G	NA	2.07	2.38	2.82	NA
H	NA	1.75	2.00	2.38	NA
J*	NA	0.19D	0.19D	0.19D	NA
K	1.15	1.67	1.76	2.02	1.87
L	1.37	1.42	1.64	1.76	2.73
M	0.87	1.25	1.40	1.65	1.40
N	0.92	1.36	1.45	1.71	1.51
P**	4-40	6-32	6-32	6-32	8-32
Q	1.13	1.12	1.34	1.46	2.34
R	0.78	1.00	1.10	1.30	2.10
S	0.15	0.20	0.25	0.25	0.25
T	0.20	0.31	0.40	0.40	0.40

*FASTENER HOLES PROVIDED ON C STYLE
**TAPPED INSERTS PROVIDED ON E STYLE
RECOMMENDED P.C. PIN HOLE DIA. = .052

P.C. BOARD LAYOUT
(CIRCUIT SIDE)


J*
6 PIN
R
N
2
1
5
3
6
4
T
T
H
P**
Q


J*
8 PIN
R
N
8
1
7
2
6
3
5
4
S
S
S
H
P**
Q

Inductive Components, Inc.

DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

TRANSFORMERS FROM STOCK

TRANSFORMER SELECTION AND PART NUMBER SYSTEM

1. DETERMINE DESIRED WINDING CONFIGURATION. 2. SELECT APPROPRIATE LOAD CURRENT RATING I_L (WITHIN WINDING CONFIGURATION) UNDER DESIRED OUTPUT VOLTAGE E_O COLUMN HEADING. 3. READ MODEL (VERTICAL SHADED COLUMN) AND DASH NO. (HORIZONTAL SHADED COLUMN). ADD APPROPRIATE SUFFIXES TO SPECIFY MOUNTING AND SHIELDING.

DEFINES V.A., SIZE AND WINDING — MODEL

DEFINES E_O AT RATED LOAD I_L — DASH NO.

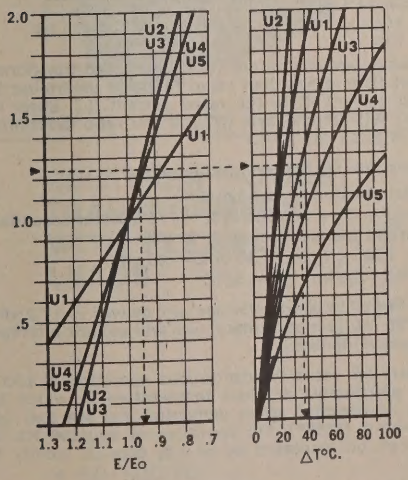
U31-005-C-S

ELECTROSTATIC SHIELDING:
N — NO SHIELD
S — SHIELD

MOUNTING STYLE:
F — FRAMELESS
C — CHANNEL FRAME
E — ENCAPSULATED

	17	20	24	28	32	38	44	54	60	75	90	100	115	230		AVAILABILITY OF OPTIONS			
Dash	-017	-020	-024	-028	-032	-038	-044	-054	-060	-075	-090	-100	-115	-230	DASH				
Model	OUTPUT CURRENT I_L (MA) PER SECONDARY														MODEL	-F	-C	-E	-S
U11-	30	25	20	18	15	12	11	10	8	7	5	3	2	NA	U11-	✓	NA	✓	✓
U21-	70	60	50	40	38	35	30	25	20	15	12	11	10•	5•	U21-	✓	✓	✓	✓
U31-	250	220	180	160	140	120	100	80	70	60	48	45	40•	20•	U31-	✓	✓	✓	✓
U41-	600	500	420	360	310	260	240	190	170	130	110	100	90•	45•	U41-	✓	✓	✓	✓
U51-	1400	1200	1000	840	750	640	540	440	400	320	260	240	200•	100•	U51-	✓	NA	✓	✓
U12-	25	22	18	16	13	11	10	9	7	6	4	2	2	NA	U12-	✓	NA	✓	✓
U22-	70	60	50	40	38	35	30	25	20	15	12	11	10	5	U22-	✓	✓	✓	✓
U32-	250	220	180	160	140	120	100	80	70	60	48	45	40	20	U32-	✓	✓	✓	✓
U42-	600	500	420	360	310	260	240	190	170	130	110	100	90	45	U42-	✓	✓	✓	✓
U52-	1400	1200	1000	840	750	640	540	440	400	320	260	240	200	100	U52-	✓	NA	✓	✓
U13-	11	10	8	7	6	5	4	4	NA	NA	NA	NA	NA	NA	U13-	✓	NA	✓	✓
U23-	35•	30•	25	20•	19	18	15•	13	10•	8	6	6	5	2	U23-	✓	✓	✓	✓
U33-	125•	110•	90	80•	70	60	50•	40	35•	30	24	22	20	10	U33-	✓	✓	✓	✓
U43-	300•	250•	210	180•	155	130	120•	95	85•	65	55	50	45	20	U43-	✓	✓	✓	✓
U53-	700•	600•	500	420•	370	320	270•	220	200•	160	130	120	100	50	U53-	✓	NA	✓	✓
U14-	10	9	7	7	6	5	4	3	NA	NA	NA	NA	NA	NA	U14-	✓	NA	✓	✓
U24-	35•	30•	25	20•	19	18	15•	13	10•	8	6	6	5	2	U24-	✓	✓	✓	✓
U34-	125•	110•	90	80•	70	60	50•	40	35•	30	24	22	20	10•	U34-	✓	✓	✓	✓
U44-	300•	250•	210	180•	155	130	120•	95	85•	65	55	50	45	20•	U44-	✓	✓	✓	✓
U54-	700•	600•	500	420•	370	320	270•	220	200•	160	130	120	100	50•	U54-	✓	NA	✓	✓

- DELIVERY: MODELS MARKED • ARE IN STOCK FOR IMMEDIATE DELIVERY (STYLE **F-N**). OTHER MODELS AND STYLES — STOCK TO ONE WEEK.
- NO MINIMUM ORDER FOR STOCK • UNITS.
- CONSULT CURRENT PRICE LIST, REP OR FACTORY FOR NET PRICES AND QUANTITY DISCOUNTS.
- SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.



REGULATION AND TEMPERATURE RISE

To determine the actual voltage output (E) of any transformer (listed in the chart above) when the required load current (I) is other than rated (I_L), refer to the graphs shown. Use of these curves enables the designer to predict, with useful accuracy, the actual voltage output and expected temperature rise of the transformer under consideration as a function of load current. All data shown represents operation at nominal voltage input, (115 or 230V) 60 Hz sine wave, with free convection cooling in still air at 25°C. ambient.

To use the curves, first determine the ratio of the required load current (I) to the rated load current (I_L). Enter the graphs at the extreme left vertical axis (I/I_L) at the appropriate ratio and read ratio of E/E_O and ΔT°C.

The following example is illustrated in dotted lines on the graphs:
Transformer model selected — U32-012-X-X
From above chart — $E_O = 12$ volts at $I_L = 360$ MA.
Required load current — $I = 450$ MA.
$I/I_L = 450/360 = 1.25 \therefore E/E_O = .95$ or $E = .95 \times E_O$
$E_O = .95 \times 12 \approx 11.4$ volts and $\Delta T \approx 37$°C.

To summarize, A **U32-012-X-X** transformer will deliver approximately 11.4 volts at a load current of 450 MA and will exhibit a temperature rise of approximately 37°C above ambient at that load.

Series U transformers are rated for continuous operation at 105°C. Therefore, the maximum permissible ambient temperature in which the U-32-012-X-X transformer can be operated when delivering 450 MA load current is 105° - 37° = 68°C (154°F).

All Series U transformers **(except style -E)** are varnish impregnated and finished with a special black polyurethane overcoat for added moisture resistance. All models are tested for primary to secondary and winding to core dielectric strength of **1500** VRMS.

For operation at 400 Hz, the rated load current (I_L) shown in the chart above can be increased **by as much as 1.8 times. Contact factory for specific data.**

SPECIAL WINDING CONFIGURATIONS AND VOLTAGE/CURRENT RATINGS AVAILABLE TO MEET YOUR REQUIREMENTS. CONTACT OUR NEAREST REPRESENTATIVE OR FACTORY FOR DETAILED APPLICATIONS INFORMATION.

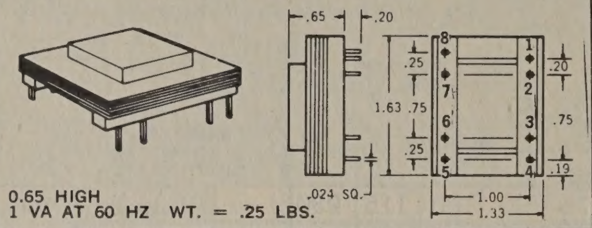
Inductive Components, Inc.

DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

SERIES F FLATFORMER™

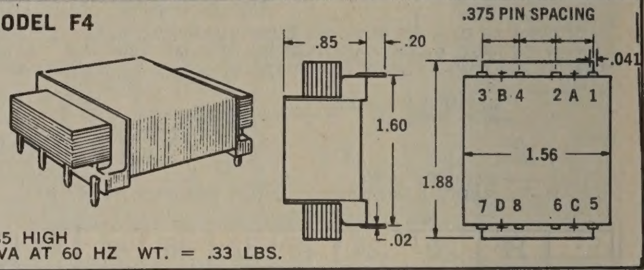
LOW PROFILE·PLUG-IN P.C. BOARD MOUNT·50/60/500 Hz·POWER TRANSFORMERS

MODEL F2



0.65 HIGH
1 VA AT 60 HZ WT. = .25 LBS.

MODEL F4



0.85 HIGH
7 VA AT 60 HZ WT. = .33 LBS.

TRANSFORMER SELECTION AND PART NUMBER SYSTEM

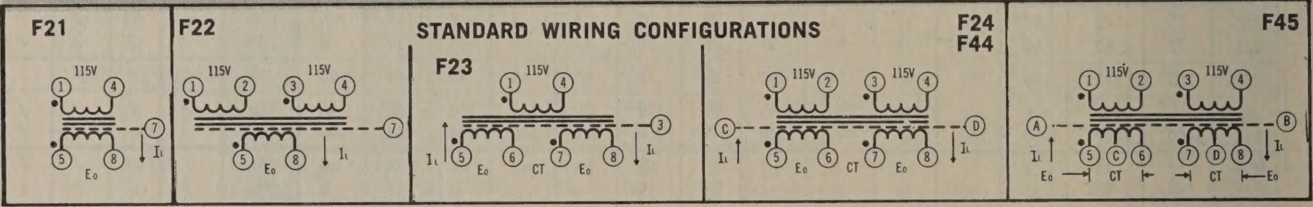
1. DETERMINE DESIRED WINDING CONFIGURATION. 2. SELECT APPROPRIATE LOAD CURRENT RATING I_L (WITHIN WINDING CONFIGURATION IN DESIRED OUTPUT VOLTAGE E_O LINE HEADING. 3. READ MODEL (HORIZONTAL SHADED COLUMN) AND DASH NO. (VERTICAL SHADED COLUMN). ADD APPROPRIATE SUFFIXES to SPECIFY MOUNTING AND SHIELDING.

DEFINES V.A., SIZE AND WINDING — MODEL
DEFINES E_O AT RATED LOAD I_L — DASH NO.

F44-008-F-S

ELECTROSTATIC SHIELDING — N — NO SHIELD; S — SHIELD
MOUNTING STYLE — F — FRAMELESS

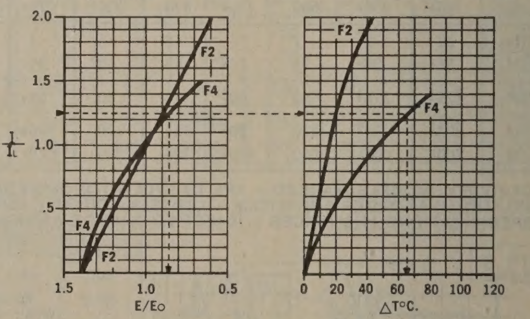
STANDARD WIRING CONFIGURATIONS



SPECIAL WINDING CONFIGURATIONS AND VOLTAGE/CURRENT RATINGS AVAILABLE TO MEET YOUR REQUIREMENTS. CONTACT OUR NEAREST REPRESENTATIVE OR FACTORY FOR DETAILED APPLICATIONS INFORMATION.

E_O(RMS) ⇩	DASH ⇩	STANDARD MODELS					
		F21	F22	F23	F24	F44	F45
		OUTPUT CURRENT I_L (MA) PER SECONDARY					
2.0	−002	500	500	250	225	1600	1600
4.0	−004	250	250	125	110	800	800
4.5	−0.45	220	220	110	100	750	750
5.0	−005	200	200	100	90•	700•	700
5.5	−0.05	180	180	90	80	630	630
6.3	−06.3	150	150	75	68•	550•	550
7.5	−07.5	130	130	65	58	490	490
8.0	−008	120	120	60	54•	400•	400
9.0	−009	110	110	55	50	375	375
10	−010	100	100	50	45•	350•	350
12	−012	80	80	40	36•	290•	290
15	−015	65	65	32	28	230	230
17	−017	58	58	29	26•	200•	200
20	−020	50	50	25	22•	175•	175
24	−024	40	40	20	18	140	140
28	−028	35	35	17	15•	120•	120
32	−032	30	30	15	13	105	105
44	−044	20	20	10	9	75•	75
60	−060	15	15	7	6•	55•	55
115	−115	8	8	4	3	30•	30
Shield Available		YES	YES	YES	NO	YES	YES

REGULATION AND TEMPERATURE RISE



To determine the actual voltage output (E) of any listed transformer when the load current (I) is other than rated (I_L), first determine the ratio of required load current (I) to the rated current (I_L). Enter the graphs at the extreme left vertical axis (I/I_L) at the ratio determined above and read ratio of E/E_O and ΔT°C.

The dotted lines illustrate the following example:

Transformer model selected — F44-020-X-X
From chart (to left) — $E_O = 20$ volts at $I_L = 175$ MA (per secondary)
Required load current (per secondary) — 220 MA
$I/I_L = 220/175 = 1.26 \therefore E/E_O = .86$ or $E = .86 \times E_O$
$E = .86 \times 20 \approx 17.2$ volts and $\Delta T \approx 65°C$.

To summarize, an F44-020-X-X transformer will deliver ≈ 17.2 volts at a load current of 220 MA (per secondary) and will exhibit a temperature rise of ≈ 65°C above ambient.

Series F transformers are rated for continuous operation at 130°C. Thus, the maximum permissible ambient temperature in which the F44-020-X-X unit can be operated when delivering 220 MA (per secondary) is 130°-65°=65°C (149°F). For operation at 400/500 Hz the load current shown can be increased by ≈ 1.5; consult factory for specific data.

■ CONSTRUCTION: ALL MODELS VACUUM VARNISHED AND FURNISHED WITH SPECIAL BLACK POLYURETHANE OVERCOAT. ■ RATINGS: E_O AND I_L GIVEN FOR 115V 50/60 HZ SINE WAVE INPUT. ■ HI-POT: 1500V RMS WINDING TO WINDING & WINDING TO CORE. ■ DELIVERY: MODELS MARKED • FOLLOWING I_L RATING ARE AVAILABLE FROM STOCK (STYLE F-N). OTHER MODELS — STOCK TO ONE WEEK. ■ CONSULT CURRENT PRICE LIST, REP OR FACTORY FOR NET PRICES & QUANTITY DISCOUNTS. ■ NO MINIMUM ORDER FOR STOCK • UNITS. ■ SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Inductive Components, Inc.

DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

J M Transformer Company

DEPT. EM
262 MOTT STREET
NEW YORK, N.Y. 10012
(212) 966-4195

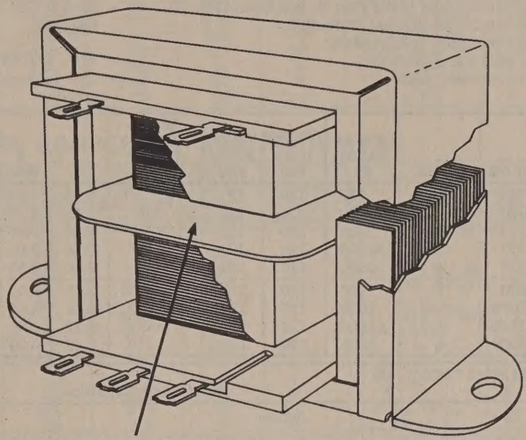
TRANSFORMERS

From less than 1 VA to 1000 VA
Available with secondary voltages up to 500 V
Available with secondary current ratings to 20 Amps

PROTOTYPES AVAILABLE WITHIN ONE WEEK — OFTEN SAME DAY SERVICE

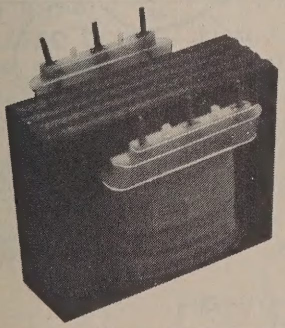
No set-up charges on any special order

CHECK OUR LOW PRICES!



SPLIT BOBBIN POWER TRANSFORMERS

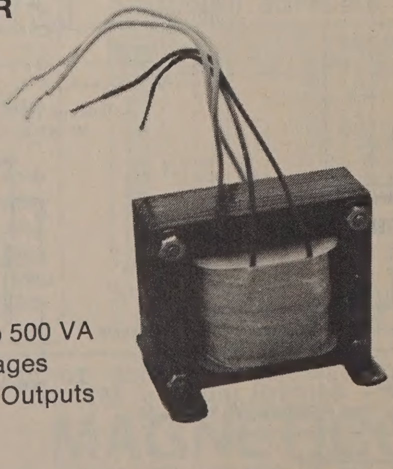
- 50/60 Hz
- Power Ratings to 200 VA
- 115 V and 230 V Primaries
- Terminals and Flexible Leads Available
- Non-Concentric Winding — Lower Capacitance — Better Insulation — 2500 V Hipot, No need for Electro-static Shield
- Also Useful for UL Medical Applications



MINIATURE PLUG-IN POWER TRANSFORMERS PC APPLICATION

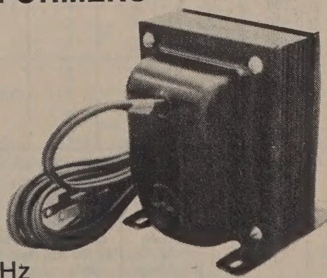
- 50/500 Hz
- Power Ratings up to 24 VA
- Single and Dual Primaries
- Single and Dual Secondaries

RECTIFIER POWER TRANSFORMERS WITH FLEXIBLE LEADS



- 50/500 Hz
- Power Ratings up to 500 VA
- Wide Range of Voltages
- Single and Multiple Outputs

STEP DOWN AUTO TRANSFORMERS



- 50/60 Hz
- 230/115 V
- 100 VA-1000 VA
- Also available with open frame construction

K.G.S. electronics, inc.

kgs electronics

Dept. EM, 2029 North Lincoln Avenue • Pasadena, California 91103 • Telephone (213) 798-0786

ISOLATION TRANSFORMERS (UL LISTED FOR USE IN MEDICAL AND DENTAL EQUIPMENT)

FEATURES:

★ **CASED UNITS:**

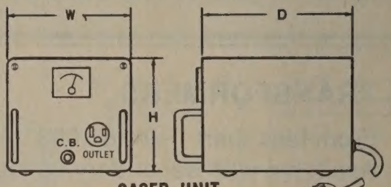
- ▲UL-544 Listed Model IT-1500
- Low Leakage Current.
- Built-In Hospital Grade Plug (1) and Receptacle (2).
- Built-In Circuit Breaker Protection.
- Built-In Output Voltage Meter.
- Portable and High Power.
- Built-In Power Cord.

★ **UNCASED UNITS:**

- ■UL-544 Recognized Model 1275T
- Open Frame Constructed Per MIL-T-27D (Grade 6).
- Low Temperature Rise (Class R).
- Used In The Cased Units.
- Shielded.

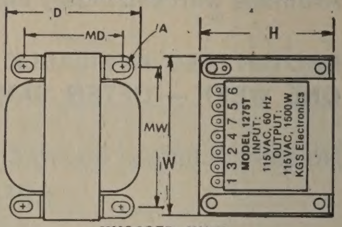
★ **APPLICATION:**

- Low Leakage Current 120 VAC, 60 Hz Line Isolation.


W
D
H
C.B.
OUTLET

CASED UNIT

Part No.	Finish	Power Rating VA	Voltage (60 Hz) Input VAC	Voltage (60 Hz) Output VAC	Recommended Fuse or C.B.	Dimensions in Inches W	D Max.	H	MD	MW	A	Wt. App. Lbs.
1740T	Uncased	250	120	120	2.5 A	5.25	4.63	4.38	2.88	4.38	.28 x .41	11
1273T		500	120	120	5 A	5.25	5.38	4.38	3.63	4.38	.28 x .41	17
1274T		1000	120	120	10 A	6.38	6.25	5.31	4.50	5.31	.28 x .50	31
1275T		■1500	120	120	15 A	7.06	7.00	6.06	5.00	5.81	.31 x .69	42
1282T		2000	120	120	20 A	7.06	7.50	6.06	6.00	5.81	.31 x .69	52
IT-500	Cased	500	120	120	B/in C.B.	6.00	7.00	5.00	NA	NA	NA	20
IT-1000		1000	120	120	B/in C.B.	6.88	8.00	6.00	NA	NA	NA	35
IT-1500		▲1500	120	120	B/in C.B.	8.12	9.00	6.75	NA	NA	NA	50
IT-2000		2000	120	120	B/in C.B.	8.12	9.00	6.75	NA	NA	NA	60


D
MD
A
H
MW
W
1 3 2 4 7 5 6
MODEL 1275T
INPUT: 115VAC, 60 Hz
OUTPUT: 115VAC, 1500 W
KGS Electronics

UNCASED UNIT

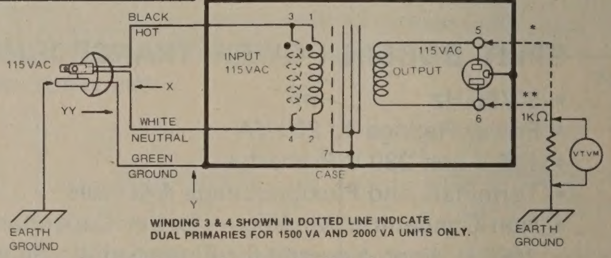
Leakage Current (μA) *	**	Input Fault Condition
5.0	5.0	Normal
5.0	5.0	Neutral at X shorted to ground
3.0	3.0	Neutral at X open
5.0	3.0	Ground at Y open
3.0	7.0	115 VAC input polarity reversed
Below 10.0		Ground open at Y. Case to ground leakage

* Output Leakage Current from Terminal 5 to Ground as measured by VTVM.

** Output Leakage Current from Terminal 6 to Ground as measured by VTVM.

NOTE: 1. These leakage currents are typical values for uncased units and were measured at room temperature and environment.

2. Case to ground leakage when ground opens at YY depends on type and length of line cord used.


BLACK
HOT
115VAC
X
YY
WHITE
NEUTRAL
GREEN
GROUND
Y
INPUT
115VAC
3
1
4
2
7
CASE
115VAC
OUTPUT
5
6
*
**
1KΩ
VTVM
EARTH GROUND
EARTH GROUND

WINDING 3 & 4 SHOWN IN DOTTED LINE INDICATE DUAL PRIMARIES FOR 1500 VA AND 2000 VA UNITS ONLY.

(1) IT-2000 is 20 AMP plug, all others 15 AMP plug.

(2) Single receptacle for the Models IT-500 and IT-1000 dual receptacle for the Models IT-1500 and IT-2000.

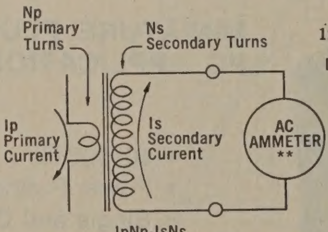
★ **HOW TO ORDER:** Order by Part Number.

CURRENT TRANSFORMERS

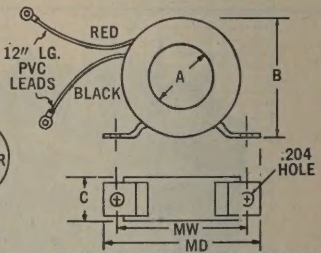
CT SERIES

CT Series Size	* Primary Current Amps	Secondary Meter Current Amps	Secondary V RMS @ 60 Hz Max.	Secondary Burden @ 60 Hz VA Max. **	Dimensions in Inches A	B	C	MD	MW	Wt. (lb.)
10	20	0.05	1.0	.05	.55	2.00	1.00	2.65	2.12	.3
	30	0.1	1.5	.15						
	50	0.1	2.5	.25						
	100	0.1	5.0	.50						
11	20	1	.5	.5	.90	2.62	1.12	3.31	2.68	.7
	30	1	2.5	1						
	50	1	4	2						
	100	1 or 5	9	2						
51	40	5	.5	2.5	1.00	3.25	1.50	3.75	3.12	1.2
	50	5	1	5						
	60	5	1.5	5						
	100	5	2.5	5						
52	150	5	3	5	1.40	3.50	1.55	4.25	3.62	1.6
	200	5	5	5						
	300	5	7	5						
	400	5	9	5						
53	500	5	3	5	2.00	4.00	1.30	4.75	4.12	1.4
	600	5	4	5						
	800	5	5	5						
	1000	5	6	5						

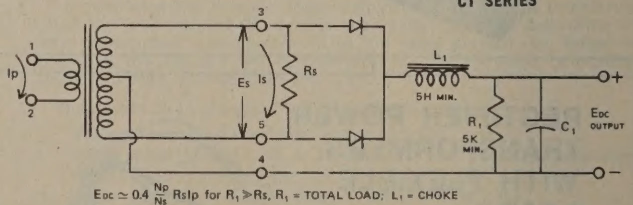
**Max. Burden for 2% Accuracy: .48 ohms for 1A Ammeter, .02 ohms for 5A Ammeter.


Np
Primary
Turns
Ns
Secondary Turns
Ip
Primary
Current
Is
Secondary
Current
AC
AMMETER
**

IpNp-IsNs
AC AMMETER and RANGE EXTENSION
CT SERIES SCHEMATIC


RED
12" LG.
PVC
LEADS
BLACK
A
B
.204
HOLE
C
MW
MD

FINISH: COTTON TAPE WRAPPED AND EPOXY DIPPED
CT SERIES


3
1
Ip
2
Es
Is
Rs
5
4
L₁
5H MIN.
+
R₁
5K MIN.
C₁
Edc OUTPUT
−

$E_{DC} \simeq 0.4 \frac{N_P}{N_S} R_S I_P$ for $R_1 \gg R_S$, R_1 = TOTAL LOAD; L_1 = CHOKE

AC AMPS/DC VOLTS CONVERTER
CMC SERIES SCHEMATIC

CMC SERIES

CMC Series Size	Primary Current Amps *	Secondary Burden @ 60 Hz RS (ohms)	Secondary Es RMS @ 60 Hz Max.	Secondary Tracking Deviation ±% Es
37	0-1	1K	20	3
	0-5	1K	20	3
	0-10	1K	20	3
	0-20	1K	20	3
	0-30	1K	20	3

CLP Series

Semi-permanent, CLAMP-ON type current transformers. Contact factory.

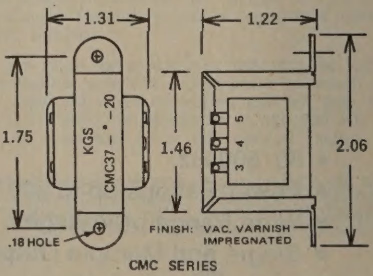
HOW TO ORDER

CT11 - 20 - *

- * — Secondary meter current
- 20 — Primary current to be measured
- CT11 — Series type and size

CMC37 - * - 20

- 20 — Secondary RMS voltage Es
- * — Primary current
- CMC37 — Series


1.31
1.22
1.75
1.46
2.06
KGS
CMC37 - * - 20
5
4
3
.18 HOLE

FINISH: VAC. VARNISH IMPREGNATED

CMC SERIES

MAGNETICO SCOTT-T-TRANSFORMERS MAGNETICO

FEATURES:

Precision
Repeatability
Stability
No System Trimming Required

SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

Part No.	Input Voltage Line to Line	Output Voltage RMS Sine & Cosine	Frequency Hz	Input Z K Ohm	Typical Load K Ohm	Accuracy Arc Seconds	Size Inches	Weight Oz.
50890	11.8	6	400	20	100	4 min.	1 x ½ x 7/16	.5
10472	11.8	6	400	10	10	5 min.*	¾ x 1½ x ⅜	.6
11870	90	6 CT	60	500	100	60	1.1 x 2.1 x 1.1	4
12092	90	6 CT	400	5000	100	60	1.1 x 2.1 x 1.1	4
12094	90	6 CT	60 & 400	500	100	60	1.1 x 2.1 x 1.1	4
50460	90	6	400	60	10	60	⅞ x 1⅝ x 11/16	2
50642	11.8	6	400	30	10	60	⅞ x 1⅝ x 11/16	2
50726	90	6 CT	400	500	100	60	13/16 x 1½ x ⅝	1.5
50728	90	3 CT	400	500	100	60	13/16 x 1½ x ⅝	1.5
50738	11.8	6 CT	400	10	100	60	13/16 x 1½ x ⅝	1.5
50740	11.8	3 CT	400	10	100	60	13/16 x 1½ x ⅝	1.5
9652	11.8	5	400	100	10	30	1⅜ x 2¾ x ⅞	5
9514	90	4.25	400	1000	10	30	1⅜ x 2¾ x ⅞	5
9561	11.8	1.75	400	10	10	2 min.	1 x 2 x .65	3

*10472A, 3 min.

RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

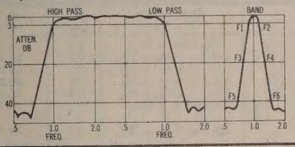
Part No.	Input Voltage 2 Phase, 4 Wire	Output Voltage 3 Phase, 3 Wire (L-L)	Frequency Hz	Load Typical Min. Ohms (L-L)	Input Z Typical Ohms Open CKT	Accuracy Arc Minutes	Size Inches	VA Rating
10084	11.8	11.8	400	150	2K	2	1 x 2 x .65H	1
10086	6.0	11.8	400	150	1K	2	1 x 2 x .65H	1
10088	9.0	11.8	400	300	2K	1.5	1⅜ x 2¾ x .65H	0.5
10090	9.0	90	400	2500	2K	1.5	1⅜ x 2¾ x ⅞H	3.2
11999	7.0	11.8	400	50	500	2	2 x 4 x 1H	2.8
50749	7.2	90	60	8000	700	1	1½ x 3⅜ x 1¼H	1
12186	7.0	90	60	4000	250	1	2 x 4 x 1½H	2
52020	9	11.8	400	14	100	3.5	1½ x 2½ x 1¼	10
52021	9	90	400	800	100	3.5	2 x 4 x 1¼	10
52022	9	11.8	60	19	100	3.5	3 x 6 x 2	10
52023	9	90	60	800	100	3.5	4 x 8 x 2	10
52378	14	90	400	325	50	10	3 x 3½ x 4 13/16	25
52379	14	90	60	325	30	10	4¼ x 5 x 6¾	25

LOW COST QUICK RESPONSE PROTOTYPE TRANSFORMER SERVICE

Primary 115 V 60 or 400 Hz, you specify single secondary E & I. Typical 2-3 day delivery for open types up to 100 watts 60 Hz, 500 watts 400 Hz. Standard Inductors available. Also Standard Miniature 400 Hz Transformers, 2 to 9 VA, 1" diameter. Free spec. sheets.

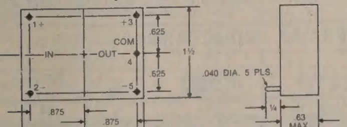
LC FILTERS — LOW PASS / HIGH PASS / BAND PASS / BAND STOP

Filters: All types of filters, 200 Hz to 30 MHz, including high performance elliptic function filters.
For prompt quote provide: Type, Insertion Loss, Desired Attenuation Characteristic, Source Z and Load Z, Quantity and delivery requirements.



POWER SUPPLY REGULATED DC-DC

Input Voltage: 554, 28 V ±15%; 553, 12 V ±15%; 552, 5 V ±10%
Output Voltage: +15 V ±4%, −15 V ±4%
Output Voltage Balance: 1%
Line Regulation:
15 mV max. 0-25°C; 25 mV max. 0-70°C
Load Regulation:
15 mV max. 0-25°C; 25 mV max. 0-70°C
Output Current: 100 mA max. each output 0-25°C; Derate 1 mA/°C to 70°C
Input-Output Isolation: 100 Meg ohm min. 0-50 VDC
Dielectric Strength: 100 VRMS
Full Load Efficiency: 50%



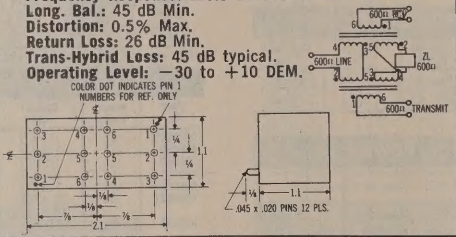
HI-CURRENT SWITCHING REGULATOR SUPPLIES

Input: 115 V or 230 V Single Phase, 208 V 3 Phase
Size: 12" x 14" x 5½" Hi
Model 500, Output 5 VDC, 50 Amp
Model 501, Output 5 VDC, 100 Amp
Model 502, Output 5 VDC, 150 Amp
Model 503, Output 5 VDC, 200 Amp
Efficiency to 70%. Ripple 30 MV, Regulation .2/.2%. Above 40°C Derate to 80% Output at 70°C.

AUDIO HYBRID PART No. 50819

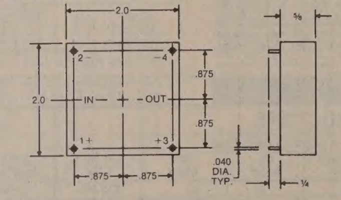
Frequency Response: ±0.5 dB 300 to 3500 Hz
Long. Bal.: 45 dB Min.
Distortion: 0.5% Max.
Return Loss: 26 dB Min.
Trans-Hybrid Loss: 45 dB typical.
Operating Level: −30 to +10 DEM.

COLOR DOT INDICATES PIN 1
NUMBERS FOR REF. ONLY



POWER SUPPLY

Input Voltage: 564 28 VDC ±15%; 563 12 VDC ±15%; 562 5 VDC ±10%
Output Voltage: 5 VDC ±5%
Output Current: 0-500 mA 0-70°C
Line Regulation: 1%
Load Regulation: 1%
Input-Output Isolation: 100 Meg Ohm Min. @ 50 VDC
Dielectric Strength: 100 VRMS
Full Load Efficiency: 50%



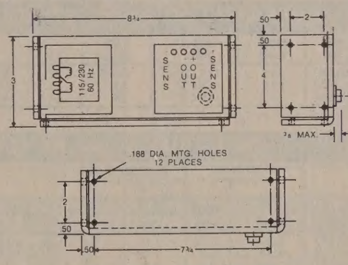
STANDARD SUPPLIES

Model No.	Input	Output	% Regulation Line/Load
452	*	5 VDC, 1 A	.2/.2
453	*	15 VDC, .3 A	.2/.2
454	*	5 VDC, 9 A	.1/.2
455	*	15 VDC, 3 A	.5/.2
472	*	+15, −15 VDC, .05/.05A	.2/.2
552	5 VDC	+15, −15 VDC, .05/.05A	.2/.2
553	12 VDC	+15, −15 VDC, .05/.05A	.2/.2
554	28 VDC	+15, −15 VDC, .05/.05A	.2/.2
562	5 VDC	5 VDC .5 A	1/1
563	12 VDC	5 VDC .5 A	1/1
564	28 VDC	5 VDC .5 A	1/1

*115 V, 60/400 Hz

ALL SUPPLIES
1. Rated to 60°C, 80% Output at 70°C
2. Derate 1 MA/°C to 70°C for 552, 553, 554
3. Ripple 30 MV, except 10 MV 452 and 454

LINE OPERATED POWER SUPPLY 50 WATT DC OUTPUT

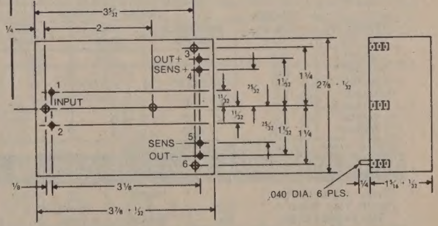


Input: 105 to 125 VAC, 60 to 400 Hz

	PS 454	PS 455
Output:	5 V ±1% 0-10 ADC	15 V ±1% 0-3.3 ADC
Load Reg.:	1.0%	0.5%
Line Reg.:	0.2%	0.2%
Ripple:	0.1%	0.2%

Stability: ±0.3% After Warmup
Temperature Coefficient: .02% Per °C
Overload Protection: Current Foldback Limiting

LINE OPERATED POWER SUPPLY 5 WATT DC OUTPUT



	PS 452	PS 453
Output:	5 VDC ±1% 0-1 Amp	15 ±1% 0.33 ADC

Input: 105-125 VAC, 60 to 400 Hz
Temperature Range: −0°C to +70°C
Load Reg.: 0.2%
Line Reg.: ±0.2%
Ripple: 0.1% Max.
Stability: ±0.1% After Warmup
Temperature Coefficient: 0.02%/°C
Overload Protection: Current Limit Fold Back

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400 Hz TOROIDAL PC POWER TRANSFORMERS (Fig. W)

Ideal for applications requiring minimum size and weight. Feature epoxy molded case and printed circuit pins which can be bent for chassis mounting. Toroidal cores provide greater efficiency and low phase shift. All have 115V primary windings and center .170" clearance hole for #8 screw. MIL Type TF5SX01ZZ.

Part No.	Secondary V	Secondary mA	VA	Size, Inches O.D. x Ht.	Wt., Oz.	Net Ea., 1-9★
M8106	28 CT	320	9	1 5/32 x 1⅛	2	$19.65
M8107	28 CT	710	20	1½ x 1¼	4	22.80
M8108	56 CT	160	9	1 5/32 x 1⅛	2	19.80
M8109	56 CT	356	20	1½ x 1¼	4	22.80
M8111	115 CT	170	20	1½ x 1¼	4	22.80

INDUSTRIAL AND HERMETICALLY SEALED POWER TRANSFORMERS AND CHOKES

For low voltage, high current applications such as filament supplies, silicon rectifiers, etc. Primary 105/115/125 VAC. DC output for resistive or inductive load based on 1V drop per rectifier. Isolation Transformers have electrostatic shielding and CT for use in either FW bridge or FW CT.

HERMETIC 50/60 Hz POWER (Fig. P)

Part No.	Secondary		Rectifier Circuit		Size, Inches W x D x H	MIL Case	Net 1-9★
	VAC	RMS Amps	VDC‡	VDC†			
M8042	6.3 CT	.6	1.9	3.8	1⅝ x 1⅝ x 2⅜	AJ	$20.85
M8043	6.3 CT	2	1.9	3.8	2 1/16 x 2 5/16 x 2½	FB	29.10
M8087	12.6 CT	3	4.7	9.4	2⅜ x 2¾ x 3 13/16	GA	33.00
M8044	12.6	2	10.5§	21§	3 1/16 x 3 9/16 x 3⅞	JB	38.70
	12.6 CT	2					
M8088	26 CT	2.5	10.8	21.6	2⅝ x 3 1/16 x 4¼	HA	34.20
M8152	28 CT	.15	11.7	23.4	1⅝ x 1⅝ x 2⅜	AJ	21.90
M8045	28 CT	.6	11.7	23.4	2 1/16 x 2 5/16 x 3⅛	FA	31.50
M8023	35 CT	3	14.5	29	3⅜ x 3 15/16 x 5¼	KA	46.05
M8089	40 CT	.1	17	34	1⅝ x 1⅝ x 2⅜	AJ	22.80
M8046	49 CT	2.5	21	42	3 11/16 x 4 5/16 x 5 9/16	LA	46.05
M8024	70 CT	1	30	60	3 1/16 x 3 9/16 x 4⅞	JA	38.70
M8056	80 CT	.6	35	70	2⅝ x 3 1/16 x 4¼	HA	39.60

‡Full-wave CT. †Full-wave bridge. §Series.

HERMETIC 50/60 Hz ISOLATION/POWER (Fig. P)

Part No.	Input Volts	Output Volts	RMS Amps	VA	Size, Inches W x D x H	MIL Case	Net Each 1-9★
M8094	115	115 CT	.0085	1	1 5/16 x 1 5/16 x 1¾	AH	$16.35
M8151	115	115 CT	.13	15	2 1/16 x 2 5/16 x 3⅛	FA	32.10*
M8096†	115	115 CT	.35	40	2⅜ x 2¾ x 3 13/16	GA	37.80

†Primary 105/115/125V.

INDUSTRIAL 50/60 Hz CONTROL/POWER

Part No.	Secondary		Rectifier Circuit		Size, Inches L x W x H	Mounting Centers	Fig.	Net Each 1-9★
	VAC	RMS Amp	CT Full Wave DC Volts †	F. W. Bridge DC Volts ‡				
M8243	6.3 CT	2.0	1.9	3.8	3¼ x 1⅝ x 1 15/16	2 13/16	X	$12.00*
M8286	6.3 CT	6.0	1.9	3.8	3 11/16 x 2⅛ x 2¼	3⅛	X	13.05
M8287	12.6 CT	3.0	4.7	9.4	3 11/16 x 2⅛ x 2¼	3⅛	X	13.05
M8244	12.6 CT	2.0	10.5§	21§	3⅜ x 2⅞ x 3 3/32	2 13/16 x 2½	Y	15.00*
	12.6	2.0						
M8222	18.5 CT	3.0	7.4	14.8	3⅜ x 2½ x 3 3/32	2 13/16 x 2⅛	Y	14.85
M8288	26 CT	2.5	10.8	21.6	3 x 2¾ x 2¾	2½ x 2⅜	Y	14.85
M8245	28 CT	.6	11.7	23.4	3¼ x 2⅛ x 1 15/16	2 13/16	X	11.25
M8255	30 CT	2.5	12.5	25	3¾ x 2¾ x 3 15/32	3⅛ x 2¼	Y	20.10
M8223	35 CT	3.0	14.5	29	4⅛ x 3 x 3¾	3 7/16 x 2⅜	Y	21.60
M8289	40 CT	.1	17	34	2⅜ x 1⅜ x 1½	2	X	10.20
M8290	40 CT	.3	17	34	2 13/16 x 1⅝ x 1⅝	2⅜	X	9.45
M8291	40 CT	.75	17	34	3 11/16 x 2⅛ x 2¼	3⅛	X	13.05
M8246	49 CT	2.5	21	42	4½ x 3¼ x 4 1/32	3¾ x 2½	Y	28.50
M8224	70 CT	1.0	30	60	3¾ x 2¾ x 3 15/32	3⅛ x 2¼	Y	18.75
M8256	80 CT	.6	35	70	3 x 2⅝ x 2¾	2½ x 2⅜	Y	18.15

†CT Full-wave ‡Bridge §Series

#Sec. connected in series, 24V @ 4A; parallel connected 12V @ 8A. All units color coded leads.

HERMETIC 400 Hz POWER (Fig. P)

Part No.	Secondary		Rectifier Circuit		Size, Inches W x D x H	MIL Case	Net 1-9★
	VAC	RMS Amps	VDC #	VDC†			
M8063‡•	2.85	.045	1.5§	3	1 5/16 dia. x 1 1/16	YY	$12.45
	2.85	.045					
M8064‡	6.3 CT	.6	1.9	3.8	1 5/16 x 1 5/16 x 1¾	AH	16.65
M8075‡•	6.3 CT	.3	1.9	3.8	1 5/16 dia. x 1 1/16	YY	11.40
M8076‡	12.6 CT	.3	4.7	9.4	1 5/16 x 1 5/16 x 1¾	AH	16.65
M8039	12.6	.8	10.5§	21§	1⅝ x 1⅝ x 2⅜	AJ	25.20
	12.6 CT	.8					
M8077	12.6	2	10.5§	21§	2 1/16 x 2 5/16 x 3⅛	FA	35.40*
	12.6 CT	2					
M8038	12.6	.3	16§	32§	1⅝ x 1⅝ x 2⅜	AJ	24.75
	12.6	.3					
	12.6	.3					
M8018	18.5 CT	1	7.4	14.8	1 13/16 x 1 15/16 x 2¾	EA	27.60
M8019	18.5 CT	3	7.4	14.8	2 1/16 x 2 5/16 x 3⅛	FA	32.10
M8065	26 CT	1.5	10.8	21.6	1 13/16 x 1 15/16 x 2¾	EA	31.80
M8066	26 CT	3	10.7	21.5	2 1/16 x 2 5/16 x 3⅛	FA	40.20
M8079	26 CT	4	10.8	21.6	2⅝ x 3 1/16 x 4¼	HA	34.20
M8020	35 CT	3	14.5	29	2⅜ x 2¾ x 3 13/16	GA	39.60
M8068	40 CT	.2	17	34	1⅝ x 1⅝ x 2⅜	AJ	20.25
M8041‡	50 CT	.25	21.5	43	1 5/16 x 1 5/16 x 1¾	AH	15.75
M8080	50 CT	.2	21.5	43	1⅝ x 1⅝ x 2⅜	AJ	20.10
M8070‡	65 CT	.170	28.4	56.8	1 5/16 x 1 5/16 x 1¾	AH	17.55
M8021	70 CT	1	30	60	2 1/16 x 2 5/16 x 3⅛	FA	44.70

#Full-wave CT. †Full-wave bridge. ‡Primary 115V only. §Series. •Fig. K.

HERMETIC 400 Hz ISOLATION/POWER (Fig. P)

Part No.	Input Volts	Output Volts	RMS Amps	VA	Size, Inches W x D x H	MIL Case	Net 1-9★
M8058†	115	115 CT	.017	2	1 5/16 Dia. x 1 7/16	YY	$14.55
M8059	115	115 CT	.35	40	1 13/16 x 1 15/16 x 2 7/16	EB	24.00
M8060	115	115 CT	1.3	150	2⅜ x 2¾ x 3 13/16	GA	42.00
M8061†	115	115 CT	2.6	300	3 1/16 x 3 9/16 x 4⅞	JA	69.60
M8062†	115	115 CT	4.4	500	3⅜ x 3 15/16 x 5¼	KA	75.00
M8082†	26	12.6 CT	.15	1.9	1 5/16 Dia. x 1 7/16	YY	18.30
		12.6	.15	1.9			
M8083	115	115 CT	.03	10 total	1⅝ x 1⅝ x 2⅜	AJ	26.40
		12.6 CT	.25				
		12.6	.25				
M8084	115	115 CT	.12	14	1⅝ x 1⅝ x 2⅜	AJ	19.50
M8085	115	115 CT	.7	80	2 1/16 x 2 5/16 x 3⅛	FA	40.20

‡Primary 105/115/125V. †Fig. K.

INDUSTRIAL 50/60 ISOLATION/POWER

Part No.	Input Volts	Output Volts	Current RMS Amps	VA	Size, Inches L x W x H	Mounting Centers	Fig.	Net Each 1-9★
M8294	115	115 CT	.0085	1	2⅛ x 1⅛ x 1 3/16	1¾	X	$7.50
M8295	115	115 CT	.030	3.5	2 13/16 x 1⅛ x 1⅝	2⅜	X	14.55
		12.6 CT	.25	3.15				
		12.6	.25	3.15				
M8251	115	115 CT	.13	15	3¼ x 1⅝ x 1 15/16	2 13/16	X	14.25
M8296†	115	115 CT	.35	40	4 x 2¼ x 2 9/16	3 9/16	X	15.60
M8278†	115	115 CT	.9	100	3¾ x 3¼ x 3 15/32	3⅛ x 2¾	Y	24.75

† Primary 105/115/125V. All units color coded leads.

FILTER INDUCTORS

For transistor and low voltage applications. May be connected in series or parallel. 1500V test. MIL Type TF4RX04 (Fig. P) listed on left. Open frame model numbers listed on right.

HERMETICALLY SEALED INDUCTORS

HERMETIC Part No.	Mil Case Fig. P xx	Series Connected			Parallel Connected			Net Each 1-9★
		Inductance Henrys	DC Amps	DCR Ohms	Inductance Henrys	DC Amps	DCR Ohms	
M8098	AH	3.5	.050	200	.875	.10	50	$12.90
M8099	AJ	1.0	.15	65	.25	.30	16	15.90
M8101	FB	.32	.6	16	.08	1.2	4	23.55*
M8102	JA	.2	1.0	4	.05	2.0	1	29.40*
M8103	JA	.07	2.5	.84	.0175	5.0	.21	39.60*
M8104	JA	.022	4.0	.4	.0055	8.0	.1	35.40*
M8105	KA	.022	5.0	.2	.005	10.0	.05	43.50*

*Special order only, add $25.00 lot set-up charge.

OPEN FRAME INDUCTORS

OPEN Part No.	Size, Inches L x W x H	Mounting Centers	Fig.	Net Each 1-9★
M8198	2⅛ x 1⅛ x 1 3/16	1¾	X	$6.15
M8199	2⅜ x 1¼ x 1½	2	X	7.05
M8201	3¼ x 1⅝ x 1 15/16	2 13/16	X	8.70
M8202	3⅜ x 2⅜ x 3 3/32	2 13/16 x 2⅛	Y	14.40
M8203	3¾ x 2⅞ x 3 15/32	3⅛ x 2½	Y	19.20*
M8204	3⅜ x 2¾ x 3 3/32	2 13/16 x 2½	Y	15.90
M8205	4½ x 3⅞ x 4 1/32	3¾ x 2½	Y	23.40

DC TO DC CONVERTER TRANSFORMERS—SWITCHING TYPE▲

Permits conversion of low-voltage DC to higher voltages for operating mobile equipment or for DC isolation. Supplied with schematic and component values.

Select the Unit That Meets Your Power & Size Requirements	Part No.	Total VA Output♦	DC Input Volts	DC Output** Volts	DC Output** Bridge mA	DC Output** CT Full Wave Volts	DC Output** CT Full Wave mA	Switching Freq. Hz (approx.)	Size, Inches D x W x H	Size, Inches Mtg. MD	Size, Inches Cent. MW	Type of Construction	Fig.	Approx. Weight Oz.	Net Each 1-9★
High Voltage Low Power Miniature Design	M8149	25mW	3	1,000*	25μA	—	—	400	1 1/64 x 61/64 x 27/32	—	—	Plug-in	U	1.2	$9.30
	M8050	25mW	1	1,000*	25μA	—	—	400	1 11/16 x 13/16 x 27/32	1⅜	—	Open Frame with Leads	L	1.25	7.65
	M8051	25mW	3	1,000*	25μA	—	—	400	1 x 1 x 1⅜	1⅛	—	MIL — AG	Q	2.4	14.85
	M8073	25mW	4	425-500*	50μA	—	—	50-3K†	⅜ x ⅜ x ⅜	—	—	Open Frame	C	.1	6.60
	M8074	50mW	3	535*	90μA	—	—	400	1 11/16 x 13/16 x 27/32	1⅜	—	Open Frame	L	1.25	7.35
	M8072	190mW	2.7	480*	400μA	—	—	800	1 11/16 x 13/16 x 27/32	1⅜	—	Open Frame	L	1.25	10.05
	M8120	190mW	28	480*	400μA	—	—	3.5K	1 11/16 x 13/16 x 27/32	1⅜	—	Open Frame	L	1.25	10.65
For Displays Nixie-Panaplex	M8121	3	5	190	15	—	—	20K	9/16D x 11/32H — ‡			Open Frame	V	.3	7.80
5 VA High Voltage Low Profile Encapsulated	M8115	5	13.8	±250 or 500■	10	250	20	6K	1¼D x ¾H — .140 Cl. Hole			Toroidal	V	1.1	26.10
	M8117	5	28	±250 or 500■	10	250	20	6K	1¼D x ¾H — .140 Cl. Hole			Toroidal	V	1.1	27.15
	M8122	5	5	±15 or 30	175	15	350	20K	⅞D x 17/32H — .140 Cl. Hole			Toroidal	W	1.1	21.30
High Frequency Encapsulated	M8132	30	13.8	±15 or 30■	1,000	15	2,000	20K	1¼D x ¾H — .140 Cl. Hole			Toroidal	V	1.1	24.90
	M8133	30	28	±15 or 30■	1,000	15	2,000	20K	1¼D x ¾H — .140 Cl. Hole			Toroidal	V	1.1	24.90
Medium Power Low Profile Encapsulated	M8113	50	13.8	±14 or 28■	1,750	14	3,500	2.5K	2⅛D x 1¼H — .170 Cl. Hole			Toroidal	V	6	45.00
	M8114	50	28	±14 or 28■	1,750	14	3,500	2.5K	2⅛D x 1¼H — .170 Cl. Hole			Toroidal	V	6	38.70
	M8116	50	13.8	±35 or 70■	700	35	1,400	2.5K	2⅛D x 1¼H — .170 Cl. Hole			Toroidal	V	6	45.00
	M8118	50	28	±35 or 70■	700	35	1,400	2.5K	2⅛D x 1¼H — .170 Cl. Hole			Toroidal	V	6	38.70

♦Full-wave and CT loads may be simultaneously drawn, but for continuous duty, total V.A. output should not be exceeded.
■For positive and negative voltage supply as utilized in op-amp and similar circuitry.

**Based on approximately 1 volt drop per rectifier.
†Frequency depends on load and bias conditions.
▲M8050, M8051, M8073, M8074 are blocking oscillator types.

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

MICROTRAN COMPANY, INC.

PRINTED CIRCUIT 50/60 Hz POWER TELEPHONE COUPLING TRANSFORMERS

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PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

PERMITS PACKAGING FLEXIBILITY UNOBTAINABLE WITH PREPACKAGED POWER SUPPLIES • LOW PROFILE MINIATURIZED CONSTRUCTION • PRECISION SPACED MOLDED-IN TERMINALS • DUAL SECONDARIES MAY BE PARALLEL OR SERIES CONNECTED.

Lugs on PC2000 Series Provide for 115/230V Primary Voltage Options Without Changes in PC Board. PC3000 Series has 8 PC Pins. 50/60 Hz.

TRANSFORMERS FOR POWER SUPPLIES, INSTRUMENTS, AND CONTROL EQUIPMENT

115V. Primary		115/230V. Primary				Secondary			
						Parallel Connected		Series Connected	
Part No.	Price 1-9★	Part No.	Price 1-9★	Part No.	Price 1-9★	AC Volts	RMS Amps	AC Volts	RMS Amps
PC6506	$6.75	PC2506	$7.95	PC3506	$7.95	6.3	.250	(Single Secondary)	
PC6512	7.05	PC2512	8.25	PC3512	8.25	12.6	.120	25.2 C.T.	.060
PC6524	7.05	PC2524	8.40	PC3524	8.40	40.0	.040	80.0 C.T.	.020
PC6528	7.20	PC2528	8.55	PC3528	8.55	58.0	.026	116.0 C.T.	.013
PC6608	7.35	PC2608	9.00	PC3608	8.55	6.3	.700	12.6 C.T.	.350
PC6616	7.35	PC2616	9.15	PC3616	8.70	28.0	.156	56.0 C.T.	.078
PC6624	7.35	PC2624	9.15	PC3624	8.70	40.0	.110	80.0 C.T.	.055
PC6628	7.35	PC2628	9.15	PC3628	8.70	58.0	.066	116.0 C.T.	.033
PC6632	7.35	PC2632	9.30	PC3632	8.85	115.0V @ .020A and 12.6V @ .150A			
PC6708	7.05	PC2708	9.00	PC3708	8.40	6.3	1.200	12.6 C.T.	.600
PC6712	7.05	PC2712	9.00	PC3712	8.40	12.6	.600	25.2 C.T.	.300
PC6715	7.05	PC2715	9.00	PC3715	8.40	20.0	.370	40.0 C.T.	.185
PC6716	7.05	PC2716	9.15	PC3716	8.40	28.0	.270	56.0 C.T.	.135
PC6724	7.05	PC2724	9.15	PC3724	8.55	40.0	.180	80.0 C.T.	.090
PC6728	7.05	PC2728	9.15	PC3728	8.55	58.0	.130	116.0 C.T.	.065
PC6732	7.05	PC2732	9.30	PC3732	8.55	115.0V @ .025A and 12.6V @ .250A			

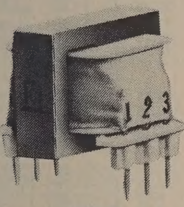


FIG. U

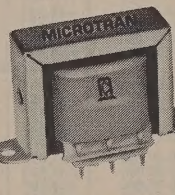
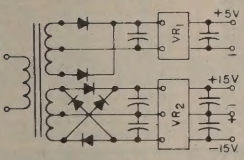


FIG. 2



Typical Application

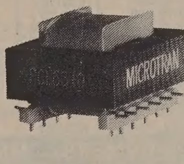


FIG. F

Series	Approx. Watts	Fig.	Size, Inches W	Size, Inches D	Size, Inches H	Wt. Oz.
PC6200/PCT6200	1	U	$1\frac{1}{64}$	1⅜	$\frac{27}{32}$	2.3
PC2500/PC3500/PC6500	1½	U	$1\frac{25}{64}$	$1\frac{5}{32}$	$1\frac{11}{64}$	3.2
PC2600/PC3600/PC6600†	4½	2	$1\frac{45}{64}$	1¼	$1\frac{25}{64}$	6.5
PCL6600	4½	F	$1\frac{51}{64}$	$1\frac{13}{32}$	$1\frac{3}{16}$	6.6
PC2700/PC3700/PC6700‡	7½	2	$1\frac{61}{64}$	$1\frac{15}{32}$	$1\frac{41}{64}$	9.5
PC6900/PCT6900§	24	U	$1\frac{41}{64}$	2¼	$1\frac{11}{32}$	12.0

†Channel mtg. 2″ M.C. ‡2⅜″ M.C. PC and PCT Series have same dimensions.
§PC6900-FB mtg. bracket avail. on special order; four $\frac{5}{32}$″ holes on 1⅜″ x 2″ ctrs.

For Construction of Low Cost, Miniaturized, Regulated and Unregulated DC Power Supplies for Latest Solid-State Logic and Op Amp Circuitry. All Primaries 115V 50/60 Hz Except PCL6600 Series 115/230V.

TRANSFORMERS FOR +5V DC UNREGULATED AND REGULATED POWER SUPPLIES

	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected					
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T. F.W. DC Volts	Current mA DC	Fig. No	Net Price 1-9★
PC6205	4.50	0.18	9.0 C.T.	0.09	+5.0	75	U	$9.15
PC6505	4.50	0.36	9.0 C.T.	0.18	+5.0	150	U	7.05
PC6605	4.50	1.10	9.0 C.T.	0.55	+5.0	450	2	7.65
PCL6605	4.50	1.10	9.0 C.T.	0.55	+5.0	450	F	9.75
PC6705	4.50	2.00	9.0 C.T.	1.00	+5.0	825	2	7.20
PC6905	4.50	5.00	9.0 C.T.	2.50	+5.0	2000	U	9.60
PC6210	7.75	0.12	15.5 C.T.	0.06	+8.5†	50	U	9.30
PC6510	7.75	0.22	15.5 C.T.	0.11	+8.5†	90	U	7.05
PC6610	7.75	0.64	15.5 C.T.	0.32	+8.5†	265	2	7.65
PCL6610	7.75	0.64	15.5 C.T.	0.32	+8.5†	265	F	9.75
PC6710	7.75	1.20	15.5 C.T.	0.60	+8.5†	500	2	7.20
PC6910	7.75	3.10	15.5 C.T.	1.55	+8.5†	1300	U	9.60

†+8.5 DC output volts for input to +5V IC Voltage Regulator.

TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected					
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T. F.W. DC Volts	Current mA DC	Fig. No	Net Price 1-9★
PC6211	12.0	0.07	24.0 C.T.	0.035	±15	22	U	$9.30
PC6511	12.0	0.13	24.0 C.T.	0.065	±15	40	U	7.05
PC6611	12.0	0.40	24.0 C.T.	0.200	±15	120	2	7.65
PCL6611	12.0	0.40	24.0 C.T.	0.200	±15	120	F	9.75
PC6711	12.0	0.76	24.0 C.T.	0.380	±15	220	2	7.20
PC6911	12.0	1.90	24.0 C.T.	0.950	±15	550	U	9.60
PC6214	16.0	0.05	32.0 C.T.	0.025	±20†	15	U	9.30
PC6514	16.0	0.10	32.0 C.T.	0.050	±20†	30	U	7.05
PC6614	16.0	0.30	32.0 C.T.	0.150	±20†	90	2	7.65
PCL6614	16.0	0.30	32.0 C.T.	0.150	±20†	90	F	9.75
PC6714	16.0	0.56	32.0 C.T.	0.280	±20†	165	2	7.20
PC6914	16.0	1.40	32.0 C.T.	0.700	±20†	410	U	9.60

†±20 DC output volts for input to ±15V output IC Voltage Regulator.

TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

	Secondary #1		Secondary #2		DC Output #1		DC Output #2			
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T.F.W. DC Volts	Cur. mA DC	C.T.F.W. DC Volts	Cur. mA DC	Fig. No.	Net Price 1-9★
PCT6230	9.0 C.T.	0.048	24 C.T.	0.020	+5.0	40	±15	12	U	$10.05
PCT6530	9.0 C.T.	0.072	24 C.T.	0.032	+5.0	60	±15	20	U	7.50
PCT6630	9.0 C.T.	0.240	24 C.T.	0.080	+5.0	200	±15	50	2	8.10
PCL6630	9.0 C.T.	0.240	24 C.T.	0.080	+5.0	200	±15	50	F	10.05
PCT6730	9.0 C.T.	0.480	24 C.T.	0.160	+5.0	400	±15	100	2	7.95
PCT6930	9.0 C.T.	1.200	24 C.T.	0.440	+5.0	1000	±15	275	U	10.05
PCT6531	15.5 C.T.	0.048	32 C.T.	0.020	+8.5†	40	±20†	12	U	7.50
PCT6631	15.5 C.T.	0.140	32 C.T.	0.058	+8.5†	115	±20†	35	2	8.10
PCL6631	15.5 C.T.	0.140	32 C.T.	0.058	+8.5†	115	±20†	35	F	10.05
PCT6731	15.5 C.T.	0.300	32 C.T.	0.100	+8.5†	250	±20†	60	2	7.95
PCT6931	15.5 C.T.	0.690	32 C.T.	0.298	+8.5†	575	±20†	175	U	10.05

†+8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulators.

TRANSFORMERS SUPPLIED WITH ENGINEERING BULLETIN PROVIDING SCHEMATICS AND SUGGESTED COMPONENTS. Latest 3-terminal IC regulators permit manufacture of power supplies, using only 5 components, with typical regulation of 0.1% load and line, and 1 mV ripple.

TELEPHONE COUPLING TRANSFORMERS

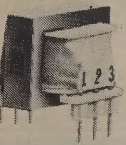


FIG. U

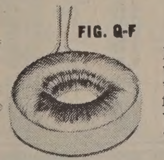


FIG. Q-F

DESIGNED TO MEET FCC PART 68

For interconnect of voice/data modem terminals to telephone lines. Permits optimum use of voice-grade telephone lines for broadband computer modems over a wide dynamic signal range with minimum distortion. PC construction.

- **Frequency Response:** 300-3500 Hz ±0.5 dB.
- **Level:** −45 dBm to +7 dBm.
- **Return Loss:** 26 dB min.
- **Impedance Matching:** ±10% over entire frequency range.
- **Distortion:** 0.5% max.
- **Long Balance:** Per FCC 68.310.

DIMENSIONS

Series	Width	Depth	Height	Weight
T1000	¾″	$\frac{19}{32}$″	$\frac{7}{16}$″	.4 oz.
T2000	$\frac{49}{64}$″	$1\frac{1}{16}$″	$\frac{23}{32}$″	.5 oz.
T3000	$1\frac{1}{64}$″	$\frac{61}{64}$″	$\frac{27}{32}$″	1.2 oz.
T4000	$1\frac{15}{32}$″	$1\frac{5}{32}$″	1¼″	3.5 oz.
T6000†	$1\frac{61}{64}$″	$1\frac{15}{32}$″	$1\frac{41}{64}$″	9.5 oz.

†Channel frame mounting 2⅜″ M.C. T5220 dimensions same as PCL6600.

Part No.	Application	Primary Impedance	Secondary Impedance	Fig. No.	Price 1-9★
T1104	Coupling	600	600	U	$5.70
T2104	Coupling	600	600	U	4.65
T2106	Coupling	600 C.T.	600 C.T.	U	4.95
T2108	Coupling	600	900	U	4.65
T2110	Coupling§	900	900	U	4.95
T4113	Coupling☐	900/600 @ 60/75 mA D.C.	600 Split	U	7.65
T6112	Coupling§	600	900/600 @ 100/120 mA D.C.	2	15.75
T2220	Hybrid‡	600(4W)	600/600	U	6.15
T3220	Hybrid‡	600(4W)	600/600	U	6.60
T4220	Hybrid‡§	600(4W)	600/600 @ 60 mA D.C.(2W)	U	11.40
T5220	Hybrid‡§	600(4W)	600/600@ 100 mA D.C.(2W)	F	21.00
T2316	Bridging	4000	600	U	4.80
T4415	Holding Coil	2.0 hy @ 60 mA, 1.3 hy @ 100 mA D.C., 180Ω		U	5.10
T7410	Holding Coil	1.0 hy @ 0 mA, 0.8 hy @ 25 mA D.C., 225Ω		Q-F	7.95
T8410	Holding Coil	1.0 hy @ 0 mA, 0.8 hy @ 40 mA D.C., 113Ω		Q-F	8.40

‡2 required for Hybrid operation, trans-hybrid loss 45 db typical.
§Electrostatic Shield. ☐ Level −15 to +7 dBm.

REQUEST ENGINEERING APPLICATION BULLETIN F232.

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

MICROTRAN COMPANY, INC.

MINIATURIZED AUDIO TRANSFORMERS

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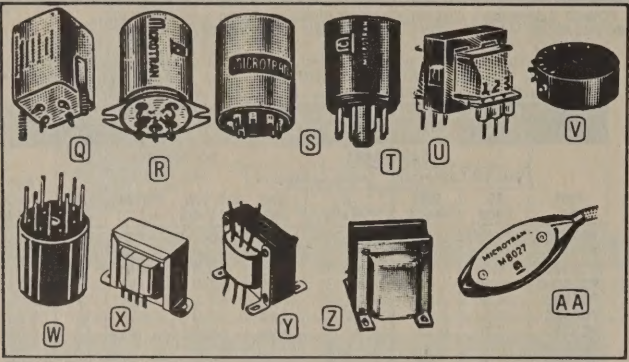

MINIATURE TRANSISTOR AND AUDIO TRANSFORMERS — M AND MT SERIES

M-M (Fig. O): Molded, for P.C. use. Cast epoxy resin provides highest resistance to temperature extremes. MIL Types TF5RX—ZZ. Max. Size, 1$\frac{5}{32}$" x ⅞" x ⅞". Wt., 1¾ oz. **M-AG (Fig. Q):** Enclosed in modified MIL-T-27 AG case with compression sealed ceramic terminals. MIL Type TF4RX—YY. Max. Size, 1" x 1" x 1⅜". Wt., 2⅜ oz. **M-H (Fig. R):** Hermetically sealed with high compression glass terminals, gray enamel finish. Available on special order with .120" holes. MIL Type TF4RX—YY. Size, $\frac{15}{16}$" dia. x 1$\frac{7}{16}$" max. Wt., 1¼ oz. **M-A (Fig. S):** Aluminum case with 2-56 screws. MIL Type TF3RX—YY. Size, .875" dia. x 1$\frac{3}{16}$". Wt., 1.25 oz. **M-FB (Fig. L):** Open frame with channel. Available with plug-in tab channel or without channel on special order. MIL Type TF6RX—ZZ. Size, 1$\frac{3}{64}$" x 1$\frac{3}{16}$" x $\frac{27}{32}$" max., plus tabs. Wt., 1.13 oz. **M-P (Fig. T):** Octal plug-in type in sealed plastic housing. MIL Type TF6RX—ZZ. Size, 1$\frac{3}{32}$" dia. x 1$\frac{15}{32}$". Wt., 2 oz. **M90 Shield (Fig. E):** 25 db magnetic shield for Type M-A. Two clearance holes on $\frac{11}{16}$" centers. **M-PC (Fig. U):** Open frame PC with terminals molded into bobbin to maintain accurate dimensions for PC board. MIL Type TF6RX—ZZ. Size, ⅞" x 1$\frac{1}{32}$" x 1"; terminals $\frac{3}{16}$" below bobbin. Wt., 1.2 oz. See PC4400 Series for dimensions.

MINIATURE AUDIO TRANSFORMERS — M AND MT SERIES

Part No.†	Primary Impedance	Secondary Impedance	Primary DC mA Unbalance	Operating Level DBM	Freq. Response ±2 db	Net Each, Lots of 1-9★ -A	-AG	-FB -PC	-H	-M	-P
•M12-	50/250 CT	50/250/600 CT	0	8	20-20,000	$12.15	$15.15	$6.75	$13.35	$13.35	$11.40*
•M1-	50/250/600 CT	50,000	0	5	20-20,000	13.05	15.60	7.80	14.10	14.10	12.00
M1-S	Same as M1 above — with dual nickel alloy shield — (see Fig. H)					15.60 (M1-S Pricing)					
•M2-	50/250/600 CT	50,000 CT	0	5	20-20,000	13.65	16.65*	8.25	14.85*	14.85*	12.90*
M14-	200	½ Megohm	0	9	80- 3,000	11.25*	12.75*	6.60*	11.70	11.85*	10.80*
M4-	15,000	60,000	0	6	20-15,000	11.25	12.75	6.60	11.70	11.85*	10.95*
M6-	15,000	95,000 CT	0	5	20-15,000	12.15	13.65*	7.20	12.45	12.75*	11.25*
•M11-	50,000	50/250/600 CT	0	5	20-20,000	13.20	15.75*	7.95	14.25*	14.25*	12.45*
M13-	Reactor	300 Hy. 0 DC	50 Hy. @ 3 mA		6,000Ω DCR	8.40*	10.65*	5.40*	9.90*	10.05	9.60*
M90	Magnetic Shield Mu-Metal slip on can for M-A Series. 25 db shielding.					1.95 (M90 Pricing)					
MT14-	400	10	50	25	200-20,000	9.00*	10.50*	4.35*	9.45	9.60	9.00*
MT1-	600	600	10	23	200-15,000	10.05	11.55	5.40*	10.50	10.65*	9.60
††MT35-	600	600 CT & 600 CT	0	5	40-20,000	12.35	15.30*	7.20*	13.50*	13.95	11.55
MT26-	600 CT	600 CT	20	23	200-15,000	10.65	13.05	5.70	11.40	11.70	10.20
MT9-	600 CT	1,200 CT	4	23	200-15,000	10.80*	13.20	5.85	11.55	11.85	10.20
MT33-	600/150 Split	600/150 Split	20	23	200-20,000	12.45*	15.45*	7.05	13.65	13.65	11.70
•MT22-	600/150 Split	1,200 CT	4	23	200-15,000	11.70*	14.25*	6.45	12.75*	12.75*	10.95*
MT12-	2,000	3.4	10	32	200-15,000	8.70*	10.50*	4.35	9.45*	9.60*	9.00*
MT24-	2,500	600 CT	10	32	200-15,000	9.60*	11.10*	4.65*	9.75	10.20	9.30*
•MT13-	4,000 CT	3.4	3	32	200-15,000	9.75*	11.25*	4.80	10.05	10.35*	9.45*
MT11-	4,000 CT	600 CT	3	32	200-15,000	10.20	12.60*	5.25	11.25*	11.25	10.20*
MT21-	4,000 CT	600/150 Split	3	32	200-15,000	11.70	14.25*	6.45*	12.75	12.75	10.65*
MT25-	7,500 CT	600 CT	8	32	200-15,000	10.50	12.90	5.55	11.25*	11.55	10.20*
•MT34-	10,000/2,500 Split	2,000/500 Split	4	20	200-20,000	12.30*	15.45*	7.05	13.65	13.65*	11.70*
•MT10-	25,000	600	3	22	200-15,000	9.75*	11.25*	5.10	10.20*	10.35*	9.60*
•MT7-	25,000	1,200 CT	3	22	200-15,000	10.65*	12.15	5.70	10.95	11.25*	10.20*
•MT18-	25,000 CT	1,200 CT	6	22	200-15,000	11.10*	13.50	6.15	11.85*	12.15	10.65*
MT3-	50,000	600	3	20	300-15,000	10.35*	11.85*	5.70*	10.80*	10.95*	9.90*
MT8-	50,000 CT	1,200 CT	3	20	300-15,000	11.10*	13.50*	6.15*	11.85*	12.15*	10.65*

•Not available in PC construction. ††For telephone line coupling or hybrid telephone line.

†ORDER BY COMPLETE MICROTRAN NUMBER (M1-A).

MICRO-MINIATURE AUDIO AND TRANSISTOR TRANSFORMERS — MM AND MMT SERIES

MM-M (Fig. J): Molded, for plug-in printed circuit applications. Cast epoxy resin for high resistance to extremes of ambient temperature. MIL Type TF5RX—ZZ. Size, ⅞" x $\frac{25}{32}$" x $\frac{17}{32}$" with $\frac{5}{32}$" pins, .020" dia. Wt., ½ oz. **MM-H (Fig. K):** Hermetically sealed with high compression glass term. Gray enamel finish. MIL Type TF4RX—YY. Size, $\frac{15}{16}$" dia. x $\frac{11}{16}$". Wt., ¾ oz. **MM-FB (Fig. L):** Open frame with channel. Available with plug-in tab channel or without channel on special order. MIL Type TF6RX—ZZ. Size, $\frac{13}{16}$" x $\frac{19}{32}$" x $\frac{15}{32}$", plus tabs.

†ORDER BY COMPLETE MICROTRAN NUMBER (MM1-M).

Part No.†	Primary Impedance	Secondary Impedance	Primary DC mA Unbalance	Operating Level DBM	Frequency Response ±2 db	Net Each, Lots of 1-9★ -FB	-H	-M
MM2-	10,000	90,000	0	4	150-10,000	$6.75*	$11.70	$10.20*
MM7-	30,000	1,200	0.5	20	200-10,000	5.70	10.65*	9.15*
MM6-	100,000	60	0.5	20	250-10,000	6.00	10.80*	9.15
MM5-	Reactor 50 Hy. @ 1 Mil DC			4,700 ohms DC Res.		5.55*	9.75	8.70*
MMT1-	600	600	8	22	200-15,000	4.65	9.60	8.55
MMT26-	600 CT	600 CT	16	22	200-15,000	5.40	11.40	9.30
MMT33-	600 CT	600/150 Split	16	22	200-15,000	6.30	12.45	10.50
MMT9-	600 CT	1,200 CT	16	22	200-15,000	5.40	11.40	9.30
MMT32-	600 CT	1,200/300 Split	16	22	200-15,000	6.30	12.30*	10.50*
MMT12-	2,000	3.4	5	28	200-15,000	4.80	9.75*	8.55*
MMT31-	2,000 CT	500 CT	10	28	200-15,000	5.55	11.25*	9.75
MMT19-	2,500	2,500 CT	2	23	200-15,000	5.55	10.95*	9.30
MMT11-	4,000 CT	600 CT	5	28	200-15,000	5.55	11.40	9.45
MMT21-	4,000 CT	600/150 Split	5	28	200-15,000	6.45	12.30*	10.65
MMT25-	7,500 CT	600 CT	4	22	200-15,000	5.85	11.55*	9.90*
MMT17-	10,000 CT	200 CT	6	20	200-15,000	6.45	12.15*	10.35*
MMT28-	10,000 CT	1,500 CT	2	20	200-15,000	5.85	11.55*	9.90
MMT29-	10,000 CT	10,000 CT	2	20	200-15,000	6.00	11.85	10.05
MMT10-	25,000	600	1	20	200-15,000	5.85	10.65*	9.00
MMT27-	25,000 CT	600 CT	2	20	200-15,000	6.15	11.85*	10.20*
MMT7-	25,000	1,200 CT	1	20	200-15,000	6.00	11.10	9.60
MMT18-	25,000 CT	1,200 CT	2	20	200-15,000	6.15	11.85*	10.20
MMT5-	50,000	6	1	20	200-15,000	6.00	10.95*	9.60*
MMT3-	50,000	600	0.7	20	200-15,000	6.00	10.95*	9.60
MMT4-	50,000 CT	600 CT	1.4	20	200-15,000	6.75	12.45*	10.80

SUBMINIATURE AUDIO AND TRANSISTOR TRANSFORMERS — SM AND SMT SERIES

SM-AF (Fig. N): MIL-T-27B-AF modified case; compression sealed ceramic terminals; gray enamel finish. MIL Type TF4RX—YY. Size, ¾" x ¾" x 1⅛" max. with two 4-40NC-2 spade mtg. bolts. Wt., 1⅛ oz. **SM-H (Fig. K):** Hermetically sealed; high compression glass terminals; Gray enamel finish. MIL Type TF4RX—YY. Size, $\frac{15}{16}$" dia. x $\frac{15}{16}$" h. Wt., 1 oz. **SM-FB (Fig. L):** Open frame with channel. With plug-in tab mounted channel or without channel on special order. MIL Type TF6RX—ZZ. Size, $\frac{15}{16}$" x $\frac{19}{32}$" x ¾", plus tabs. Wt., 0.750 oz. **SM-M (Fig. O):** Molded, for plug-in PC applications. MIL Type TF5RX—ZZ. Size, 1$\frac{5}{32}$" x ⅞" x ¾" max. Wt., 1½ oz.

Part No.†	Primary Impedance	Secondary Impedance	Primary DC mA Unbalance	Operating Level DBM	Frequency Response ±2 db	Net Each, Lots of 1-9★ -AF	-FB	-H	-M
SM2-	10,000	90,000	0	8	100-10,000	$15.15*	$7.65	$13.65*	$13.65*
SM5-	Reactor 50 Hy. @ 1 Mil DC			3,000 ohms DC Res.		12.45*	6.00	11.55*	11.55*
SMT1-	600	600	9	23	200-15,000	13.50	6.00	12.00*	12.00*
•SMT26-	600 CT	600 CT	18	23	200-15,000	—	6.60	13.35*	13.20
•SMT9-	600 CT	1,200 CT	18	23	200-15,000	—	7.20	13.95*	13.80*
SMT19-	2,500	2,500 CT	5	26	200-15,000	15.00*	7.20	13.65*	13.50
•SMT17-	10,000 CT	200 CT	6	20	200-15,000	—	7.50	14.25*	14.10
SMT7-	25,000	1,200 CT	1.5	20	200-15,000	15.00*	7.20	13.65*	13.50

*Special order only, add $25.00 lot set-up charge.

†ORDER BY COMPLETE MICROTRAN NUMBER (SMT1-FB).

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

MICROTRAN COMPANY, INC.

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MICROPHONE/TRANSDUCER INPUT TRANSFORMERS

FOR PROFESSIONAL SOUND STUDIOS
BROADCAST MIXING CONSOLES
CONTROL & INSTRUMENT AMPLIFIERS

MICROTRAN
S101-SP

Fig. -SP PRINTED CIRCUIT MOUNTED
Double Mu-metal Shielded. ¾″ D x 1⅙″ H. 7-.040 pins ⅛″ H.

MICROTRAN
S101-S

Fig. -S SINGLE THREADED STUD MOUNTING
Double Mu-metal shielding. 3″ color coded leads. ⅝″ D x 1³⁄₁₆″ H. ⁵⁄₁₆″ D stud.

Wide bandwidth — Broad frequency response — Hi efficiency. Extremely low distortion. Power level range up to +0 dBm. Negligible hum pick-up due to nested Mu-metal shields and unique gapless core construction. Ease of mounting and orientation for minimum hum pick-up. Polarizing voltage connection for condenser microphones. Subminiature size permits close spacing to adjacent circuitry. Low microphonics.

Part No.†	Nominal Turns Ratio Pri:Sec	Nominal Impedance Ratio		Typical Open Circuit Pri. Impedance @ 50 Hz	Frequency Response	Replaces Threaded Stud Mounting Beyer P/N‡	Net Each Lots of 1-9★	
		Primary	Secondary				-S	-SP
S101-†	1:20	12.5	5,000	100	30-15,000Hz ±1db	TR-BV35704	$12.75	$16.35
S105-†	1:15	200	45,000	2,000	30-15,000Hz ±1db	351.015.006	15.75	18.90
S107-†	1:15	200/50 Split	45,000	2,000	30-15,000Hz ±1db	351.215.006	18.45	20.70
S108-†	1:10	200	20,000	2,000	30-15,000Hz ±1db	351.010.005	14.85	18.00
S111-†	1:7.1	200	10,000	2,000	30-15,000Hz ±1db	351.007.004	14.40	17.40
S116-†	1:5	200	5,000	2,000	30-15,000Hz ±1db	351.005.003	13.95	16.95
S118-†	1:5	200/50 Split	5,000	2,000	30-15,000Hz ±1db	351.205.003	15.75	18.75
S126-†	1:1	600 CT	600	3,750	30-20,000Hz ±.5db	TR-145/BV35508	12.75	16.35
S130-†	1:1	10,000	10,000	100,000	30-15,000Hz ±1db	TR-145/BV35590	13.80	18.00
S100-FB		Right angle mounting bracket for S100-S Series.					.81	—

‡ -SP Type is replacement for STR/BV37 & 370 PC pins.

† ORDER BY COMPLETE PART NUMBER (S101-SP).

PICO MINIATURE TRANSFORMERS — PM SERIES

PM-M (Fig. A): Epoxy molded finish; gold plated leads, 0.020″ x ¾″. Frequency Response, ±2 db, 300 Hz to 100 kHz (PM3 and PM5, to 45 kHz). Power level given for 15% max. distortion, except PM35, 20% and PM37, 25%. Size, .410″ x .465″ x .310″ max. Wt., 0.1 oz. MIL Type TF5RZ—ZZ. **PM-F (Fig. B).** Open frame, resin impregnated, 4″ #30 plastic leads. Size, .250″ x .375″ x .406″ max. Wt., .05 oz. MIL Type TF6RX—ZZ.

† ORDER BY COMPLETE MICROTRAN NO. (PM3-M).

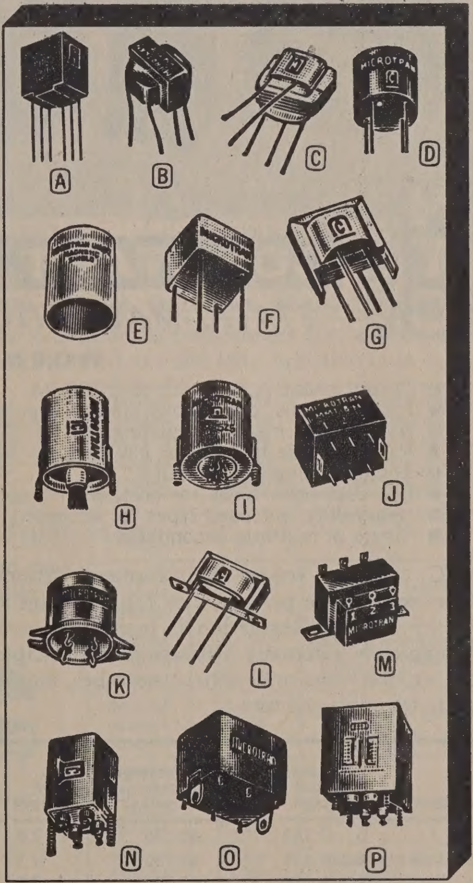
Part No.†	Primary Impedance	Secondary Impedance	Unbal. Pri. DC mA	Pri. DCR	Sec. DCR	Power Level MW	Lots of 1-9★ Net Each	
							-M	-F
PM37-	120 CT	3.2	10	16	0.75	50	$10.80	$6.90
PM38-	300 CT	600	7	41	98	50	10.95	7.20
PM35-	500	50	3	60	8	50	10.80	6.45
PM36-	500	500/125 Split	3	72	85	50	11.70	7.20
PM34-	600 CT	600 CT	3	75	105	50	11.55	7.50
PM33-	1,500 CT	600	3	170	95	50	11.40	7.35
PM31-	2,500	2,500 CT	1	250	325	50	11.70	7.05
PM29-	10,000 CT	500 CT	1	1,050	80	50	13.65	—
PM27-	10,000	1,200	0.5	1,050	280	50	11.55	7.35
PM23-	10,000 CT	1,200 CT	1	1,050	280	50	13.65	—
PM25-	10,000	1200/300 Split	0.5	1,050	280	50	13.80	—
PM19-	10,000 CT	2,000 CT	1	1,000	300	50	13.50	—
PM21-	10,000	2000/500 Split	0.5	1,000	300	50	13.80	—
PM17-	10,000 CT	10,000 CT	1	1,000	1,300	50	13.65	—
PM15-	25,000	1,000	0.25	1,700	110	40	12.90	7.35
PM11-	25,000 CT	1,000 CT	0.5	1,700	110	40	13.50	—
PM13-	25,000	1000/250 Split	0.25	1,700	110	40	13.65	—
PM7-	50,000 CT	1,000 CT	0	3,300	75	10	14.25	—
PM9-	50,000	1000/250 Split	0	3,300	75	10	14.70	—
PM5-	200,000	1,000	0	5,300	110	10	13.65	—
PM3-	200,000 CT	1,000 CT	0	5,300	110	10	14.55	—
PM40-	Audio Choke	3.5 Hy.	2	700	—	—	9.00	5.70*
PM39-	Audio Choke	6 Hy.	2	1,800	—	—	9.75*	6.30*
PM90	Magnetic Shield Mu-Metal slip-on can for PM-M Series. 20 db shielding.						1.50	—

ULTRA-MINIATURE TRANSISTOR TRANSFORMERS — UM SERIES

Frequency Response, ±2 db, 300-10 kHz. Leads supplied, 4″ #27 color-coded. Power levels given for 7½% max. distortion. **UM-F (Fig. C):** Size, ⅜″ x ⅜″ x ¹¹⁄₃₂″. Wt., 0.08 oz. MIL Type TF6RX—ZZ (Insert MIL No. from table). **UM-M (Fig. D):** Size, ½″ dia. x ½″, with 1″ leads. Wt., 0.14 oz. MIL Type TF5RX—ZZ.

†ORDER BY COMPLETE MICROTRAN NO. (UM25-M).

Part No.†	Primary Impedance	Secondary Impedance	Unbal. Pri. DC mA	Pri. DCR	Sec. DCR	Level @ 300 Hz	Level @ 1 kHz	Net Each Lots of 1-9★	
								-F	-M
UM25-	400	50	3	35	5	15mw	500mw	$4.50	$9.15
UM29-	600 CT	600 CT	7	45	60	5mw	400mw	5.25	8.70
UM24-	1,000	50	3	65	10	5mw	500mw	4.50	9.15*
UM33-	1,000 CT	600	6	80	65	5mw	500mw	6.00	9.15
UM32-	1,500 CT	600	5	135	65	5mw	500mw	6.00	9.15
UM39-	2,500 CT	600 CT	2	250	50	5mw	500mw	5.85	9.75
UM34-	10,000 CT	600 CT	2	850	40	5mw	500mw	6.00	10.35
UM31-	10,000 CT	1,200 CT	2	850	120	5mw	500mw	6.00	10.35
UM37-	10,000	2,000 CT	1	850	200	5mw	500mw	5.25	9.75
UM35-	15,000 CT	15,000 CT	1	930	1,210	5mw	300mw	6.30	10.95
UM36-	20,000 CT	800 CT	.5	1,100	80	5mw	500mw	5.55	10.95
UM23-	20,000	1,200 CT	.5	1,100	110	5mw	300mw	5.25	10.50
UM21-	100,000	1,000	0	1,900	135	5mw	70mw	6.00	9.45
UM28-	Choke	10 Hy. (0 DC) 8 Hy. (0.5mA)					650	3.75	7.05*
UM90	Magnetic Shield Mu-Metal slip-on can for UM-M Series. 20 db shielding.							2.40	—



VERI-MINIATURE TRANSISTOR TRANSFORMERS — VM SERIES

Frequency Response, ±2 db, 200-10 kHz. Lead supplied, 4″ #27 color-coded. Power levels given for 7½% max. distortion. **VM-M (Fig. F):** For plug-in printed circuit applications. Cast epoxy resin provides high resistance. Size, ⁹⁄₁₆″ x ⁹⁄₁₆″ x ½″. Wt., 0.25 oz. MIL Type TF5RX—ZZ (Insert MIL No. from table). **VM-FPB (Fig. G):** Plug-in tab mounted channel. Size, ¹⁷⁄₃₂″ x ¹⁵⁄₃₂″ x ⁷⁄₁₆″. Wt., 0.2 oz. MIL Type TF6RX—ZZ.

† ORDER BY COMPLETE MICROTRAN NO. (VM8-M).

Part No.†	Primary Impedance	Secondary Impedance	Unbal. Pri. DC mA	Pri. DCR	Sec. DCR	Power Level MW	Net Each Lots of 1-9★	
							-FPB	-M
VM1-	50	600	5.5	7	90	15	$4.80	$8.25
VM7-	500	3.4	3.5	50	.5	15	4.80	8.55
VM16-	500 CT	250 CT	7.5	50	25	15	5.10	8.85*
VM14-	600 CT	600 CT	7.0	50	65	15	5.25	9.60
VM8-	1,250	3.4	2.0	135	.5	15	4.95	8.85
VM10-	2,500	2,500 CT	1.5	225	215	3	5.70	9.45
VM17-	10,000 CT	5,000 CT	0	400	300	5	6.15*	9.90
VM12-	20,000	1,000	.16	625	85	5	5.40*	8.85
VM13-	20,000	1,000 CT	.16	625	85	5	5.55*	9.60
VM3-	25,000	600	.15	720	45	2.5	5.40	9.00
VM5-	50,000	600	.1	830	55	5	5.40	9.45
VM15-	50,000 CT	50,000 CT	0	2,000	2,600	5	6.90	9.75
VM6-	100,000	1,200 CT	.07	2,000	150	5	6.15*	8.85
VM2-	200,000	600	.05	3,000	110	2.5	6.00	8.85
VM4-	200,000	1,200	.035	3,100	165	5	6.15	9.90
VM90	Magnetic Shield Mu-Metal slip-on can for VM-M Series. 20 db shielding.						1.95	—

*Special order only, add $25.00 lot set-up charge.

DECI-MINIATURE PC AUDIO TRANSFORMERS AND CHOKES

Primary and secondary windings may be interchanged to obtain varied matching requirements such as input, interstage, output and isolation. Designed for printed circuits. Frequency Response, ±2 db, 200-15,000 Hz. Size, ¹³⁄₁₆″W x ¹⁹⁄₃₂″D x ¾″H. Open frame — plug-in design. Fig. U. See PC4300 Series for dimensions.

Part No.	Primary Impedance	Secondary Impedance	Pri. DC Unbalance mA	Operating Level DBM	Net Each 1-9★
DCM2-PC	15,000 CT	15,000 CT	3	19	$5.55
DCM3-PC	15,000 CT	600 CT	3	19	5.25
DCM4-PC	10,000 CT	5,000 CT	4	20	5.40
DCM6-PC	10,000 CT	1,500 CT	4	20	5.25
DCM7-PC	5,000 CT	80,000 CT	6	15	5.70
DCM8-PC	4,000 CT	1,200 CT	6	20	4.95
DCM9-PC	4,000 CT	600 CT	6	20	4.95
DCM10-PC	4,000	600/150 Split	3	20	5.25
DCM11-PC	2,500 CT	2,500 CT	8	20	4.95
DCM12-PC	2,500	2500/625 Split	4	20	5.25
DCM13-PC	2,500 CT	625 CT	8	20	4.80
DCM14-PC	2,500 CT	200 CT	8	20	4.65
DCM18-PC	600 CT	50,000 CT	16	20	5.70
DCM19-PC	600	8000/2000 Split	8	20	5.25
DCM20-PC	600 CT	200 CT	16	20	4.35
DCM21-PC	600 CT	600 CT	16	20	4.35
DCM22-PC	250 CT	600 CT	25	20	4.35
DCM51-PC	Choke 10Hy @ 0mA DC 5Hy @ 3mA DC			300Ω DCR	4.05
DCM52-PC	Choke 5Hy @ 0mA DC 2Hy @ 5mA DC			155Ω DCR	3.60
DCM53-PC	Choke 2.5Hy @ 0mA DC 1Hy @ 7mA DC			75Ω DCR	3.45

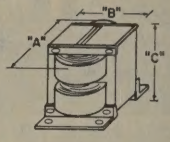
IMMEDIATE DELIVERY FROM STOCKING DISTRIBUTORS

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

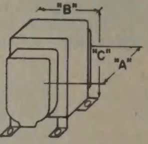
Cord/Receptacle Adapter Kits →

NEW MINIATURE TYPE MCV-1

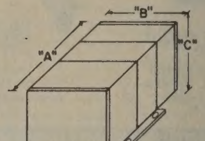
118 or 5 V output ±1% at 0.6 VA with 95-130 V, 60 cycle input. Only 2⁷⁄₁₆″ by 1²⁵⁄₆₄″ dia. including built-in capacitor. (Also made in any voltage and current combination to max. of 0.6 VA @ 60 cy., 5 VA @ 400 cy.)



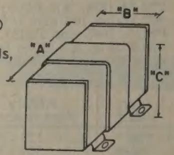
STYLE O—OPEN TYPE
external capacitor



STYLE E—ENCLOSED
w. end bells & wire
leads, external capacitor



CV120-C thru
CV1000-C



STYLE C—ENCLOSED
w. end housing &
internal screw terminals,
internal capacitor

CV7.5-C thru
CV60-C

NTC

CONSTANT VOLTAGE TRANSFORMERS

STATIC-MAGNETIC VOLTAGE REGULATING TRANSFORMERS

NORMAL HARMONIC TYPES

- Output capacity from 0.5 to 3,000 VA
- Instantaneous, continuous voltage regulation
- No tubes or manual adjustments
- Ratings made to order at low cost
- Compact, single-unit design
- Low-cost open types for component applications
- Heavy-duty, enclosed types for accessory uses
- Single or multiple secondaries

NTC constant voltage transformers maintain output voltages within one percent with input voltage fluctuations up to 15 percent. Regulation is instantaneous, continuous and completely automatic. Operating on principles of ferroresonance, the transformers have no tubes, moving parts or separate saturable reactors.

Most important, the design of NTC constant voltage transformers enables their outputs to be made exactly to your specifications — and at decidedly low cost even in small quantities. With only a few basic lamination configurations and windings, virtually any output voltage/current combination can be obtained. *Since the transformers are designed to your specific requirements they often eliminate costly circuitry and expensive components.*

POWER SUPPLIES, too . . . Neshaminy's engineering skills are at your service for the design and quantity production of complete, regulated power supplies in any capacity and rating. Let us discuss your next requirement.

Model	Regulated Output Voltage	Input Voltage Range (60 cycles)	VA Output	Nominal Mounting Centers	Approx. Overall Dimensions, Inches A B C	Approx. Net Wt., lbs.	Style
MCV-1	5 or 118	95-130	0.6	1³⁄₁₆ x 1³⁄₁₆	1²⁵⁄₆₄ dia. x 2⁷⁄₁₆	6 oz	—
CV7.5—E	6.3 or 118	95-130	7.5	2⅜ x 1⅛	2½ x 4 x 2¾	3	E
CV7.5—C	6.3 or 118	95-130	7.5	3 x 1⅝	4⅝ x 3⅞ x 2¾	4	C
CV15—E	6.3 or 118	95-130	15	2⅜ x 1½	2⅞ x 4 x 2¾	4	E
CV15—C	6.3 or 118	95-130	15	3 x 2	5 x 3⅞ x 2¾	5	C
CV30—E	6.3 or 118	95-130	30	2⅜ x 2¼	3⅝ x 4 x 2¾	6	E
CV30—C	6.3 or 118	95-130	30	3 x 2¾	5¾ x 3⅞ x 2¾	7	C
CV60—E	6.3 or 118	95-130	60	2⅜ x 3⅛	4½ x 4 x 2¾	8	E
CV60—C	6.3 or 118	95-130	60	3 x 3⅝	6⅝ x 3⅞ x 2¾	9	C
CV120—O	6.3 or 118	95-130	120	2⁵⁄₁₆ x 5³⁄₁₆	4 x 5⅞ x 5¾	12	O
CV120—C	6.3 or 118	95-130	120	4⅝ x 6⅛	9⅜ x 7⁷⁄₁₆ x 6	14	C
CV150—O	6.3 or 118	95-130	150	2⁵⁄₁₆ x 5³⁄₁₆	4 x 5⅞ x 5¾	14	O
CV150—C	6.3 or 118	95-130	150	4⅝ x 6⅛	9⅜ x 7⁷⁄₁₆ x 6	16	C
CV250—O	118	95-130 or 190-260	250	2¹¹⁄₁₆ x 5³⁄₁₆	4⅜ x 5⅞ x 5¾	24	O
CV250—C	118	95-130 or 190-260	250	4⅝ x 6⅛	9¾ x 7⁷⁄₁₆ x 6	27	C
CV500—O	118	95-130 or 190-260	500	3¹⁵⁄₁₆ x 5³⁄₁₆	5⅝ x 5⅞ x 5¾	35	O
CV500—C	118	95-130 or 190-260	500	4⅝ x 6⅛	11 x 7⁷⁄₁₆ x 6	38	C
CV1000—O	118	95-130 or 190-260	1000	5³⁄₁₆ x 6¹¹⁄₁₆	8⅜ x 5⅞ x 5¾	52	O
CV1000—C	118	95-130 or 190-260	1000	4¾ x 6⅛	14⅞ x 7⁷⁄₁₆ x 6	56	C

TYPICAL STANDARD MODELS

1% output regulation. Closer regulation to order. Output contains approx 14% total rms harmonic content. SPECIAL MODELS can be made quickly to exact requirements in any step-up or step-down ratio of voltage to current within the desired VA rating and with single or multiple secondaries, with or without centertaps. CV models also available for 50 cycles, and MCV models for 50 or 400 cycles.

NOTES

1. Cord/Receptacle kits, similar to that shown in illustration are available on all "C" style transformers of 118 VAC output rating.
2. Specify required input voltage range on CV transformers from 250 to 1000 VA.
3. To specify output voltage required (6.3 or 118 VAC) add voltage to model number (Example — 15 VA cased transformer with 118 VAC output would be model #CV15-118).
4. "C" style units have built-in capacitors. Styles "E" and "O" have external capacitors.

Send us your requirements for a prompt quotation.

NESHAMINY TRANSFORMER COMPANY

Furlong, Pa. 18925
(215) 794-7411

NTC is a division of the Neshaminy Electronic Corporation

Prices and specifications subject to change without notice

WIDEBAND TRANSFORMERS

North Hills

UNBALANCED TO BALANCED TRANSFORMERS

Balanced secondaries center-tapped and dc-isolated from primaries. Mid-band insertion loss less than 0.5 dB. Bandwidth defined at low frequency end by 3 dB drop from mid-band response, at high end by max. VSWR of 1.25.

LOW POWER SERIES (1W)

Series	Radio Frequency		Medium Frequency		Video	
Cases	BA, BB, HB		BA, BB		LA, LB	
Unb./Bal. (Ω)	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz
50:50	0001	.1-125	0010	.01-80	0009	.001-25
50:75	0101	.1-125	0111	.01-80	0104	.001-25
50:90	0200	.1-125	0202	.01-60	0203	.001-20
50:100	0300	.1-100	0301	.01-60	0311	.001-20
50:124	0307	.1-100	0302	.01-60	0306	.001-20
50:135	0310	.1-100	0312	.01-60	0303	.001-18
50:150	0400	.1-100	0401	.01-60	0415	.001-15
50:200	0500	.1-100	0520	.01-60	0511	.001-15
50:300	0501	.1-100	0521	.01-50	0517	.001-12
50:450	0600	.1-65	0602	.01-40	0603	.001-10
50:600	0700	.1-65	0703	.01-32	0706	.001-8
50:800	0800	.1-60	0801	.01-25	0802	.001-7
50:1200	0900	.1-30	0902	.01-15	0904	.001-6
75:50	1000	.1-100	1001	.01-60	1002	.001-25
75:75	1100	.1-100	1112	.01-60	1102	.001-25
75:90	1200	.1-100	1201	.01-60	1202	.001-20
75:100	1300	.1-100	1310	.01-60	1314	.001-20
75:124	1302	.1-100	1311	.01-60	1301	.001-20
75:135	1317	.1-100	1315	.01-60	1312	.001-20
75:150	1400	.1-100	1405	.01-60	1404	.001-16
75:200	1500	.1-100	1513	.01-60	1516	.001-15
75:300	1501	.1-100	1514	.01-60	1502	.001-15
75:450	1600	.1-60	1601	.01-40	1602	.001-12
75:600	1700	.1-60	1707	.01-32	1704	.001-10
75:800	1800	.1-30	1801	.01-20	1802	.001-10
75:1200	1900	.1-30	1905	.01-15	1902	.001-9
75:1850	1906	.1-15	1901	.01-8	1903	.001-6

EXTENDED VIDEO SERIES Response down to 20 Hz

Type No.	Unb./Bal.	Bandwidth	Case Styles
0014	50:50	20 Hz-6 MHz	PB
0113	50:75	20 Hz-6 MHz	PB
0315	50:100	20 Hz-6 MHz	PB
0316	50:124	20 Hz-6 MHz	PB
0522	50:200	20 Hz-4 MHz	PB
1003	75:50	20 Hz-6 MHz	PB
1111	75:75	20 Hz-6 MHz	LA, LB
1307	75:110	20 Hz-6 MHz	LA, LB
1309	75:124	20 Hz-9 MHz	PB
1408	75:150	20 Hz-6 MHz	PB
1520	75:300	20 Hz-4 MHz	PB

HIGH POWER SERIES

Power Level	10 W	25 W	100 W	1 kW
Cases	HB	BA, BB	BA, BB	KA
MHz Range	.1-30	.1-30	.5-30	2-32
Unb./Bal. (Ω)	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011	0012	0013
50:75	0108	0109	0105	0107
50:100	0309	0308	0304	0314
50:150	0406	0402	0404	0407
50:200	0519	0512	0516	0515
50:300	0514	0518	0506	0513
50:450	0604	0605	0606	0601
50:600	0705	0701	0704	0702
75:75	1105	1110	1118	1108
75:100	1306	1304	1305	1316
75:150	1406	1401	1403	1407
75:200	1517	1519	1512	1518
75:300	1515	1510	1505	1511
75:450	1603	1604	1605	1606
75:600	1709	1703	1708	1705

MANY VARIATIONS AND CUSTOM DESIGNS TO 1 GHz ALSO AVAILABLE

ISOLATION TRANSFORMERS UNBALANCED TO UNBALANCED

Ground Isolation in 50 and 75Ω Coaxial Systems

CC, PA

CD

- Flat frequency, linear phase response.
- Insulated BNC connectors.
- 140 dB isolation at power frequencies.

Type No.	Impedance Unb/Unb(Ω)	Bandwidth
0005-CC	50:50	1 kHz - 25 MHz
1103-CC	75:75	1 kHz - 25 MHz
0112-CC	50:75	1 kHz - 25 MHz
0017-CC	50:50	10 Hz - 5 MHz
1117-CC	75:75	10 Hz - 5 MHz
1116-PA	75:75	20 Hz - 20 MHz

10 KV Isolation for Public Utility Data Transmission

6 kHz to 2.5 MHz bandwidths.

1115-CD: 75Ω coax to 75Ω coax.
1313-CD: 75Ω coax to 124Ω balanced line.

HUMBUCKING CHOKES

75:75 ohms, Insulated BNC connectors

Type	Bandwidth	Rejection at 60 Hz
1119-PA	DC to 15 MHz	50 dB min.
1120-CC	DC to 20 MHz	40 dB min.

ULTRA-WIDE COAXIAL MATCHING TRANSFORMERS

Unbalanced to unbalanced transformers. BNC input and output connectors. Low VSWR. 0.1-300 MHz. Available in JA case only.

0003-JA	50:50	Phase Reversing
1106-JA	75:75	Phase Reversing
0102-JA	50:75	Impedance Adapters
0201-JA	50:90	Impedance Adapters
1203-JA	75:90	Impedance Adapters

SUBMINIATURE SERIES

NA molded case. 0.1-300 MHz bandwidth.

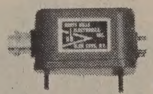
.6 x .6 x .4″

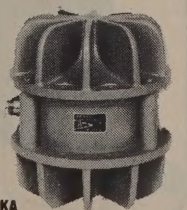
0003-NA 1106-NA 2200-NA	50: 50 75: 75 90: 90	Unbalanced to Unbalanced Phase Reversing DC Coupled
0007-NA 1107-NA 2201-NA	50: 50 75: 75 90: 90	Unbalanced to Unbalanced Phase Reversing DC Isolated
0002-NA 0508-NA 1506-NA	50: 12.5 50:200 75:300	Unbalanced to Unbalanced Non-Inverting DC Coupled
0004-NA 0509-NA 1101-NA 1507-NA	50: 50 50:200 75: 75 75:300	Unbalanced to Balanced DC Coupled
0510-NA 1508-NA	50:200 75:300	Balanced to Balanced DC Coupled

CASE STYLES

HB

BA, LA


BB, LB, PB


KA

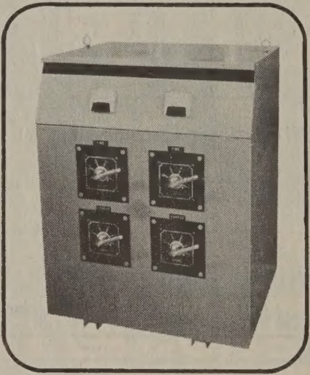
OVERALL DIMENSIONS (Inches)

Case	L	W	H
BA	2.3	1.3	1.2
BB	2.6	1.3	1.2
CC	3.5	1.7	1.6
HB	0.9	0.9	0.7
KA	5.4	4.6	5.5
LA	2.9	1.7	1.3
LB	3.2	1.7	1.3
PA	3.0	4.0	2.0
PB	3.0	3.6	2.0

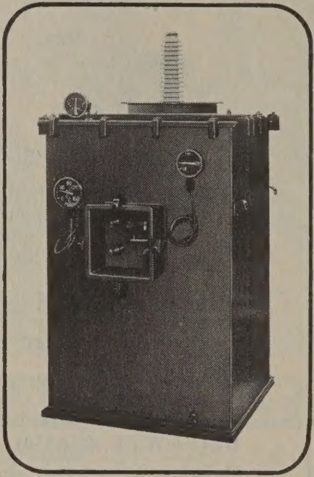
North Hills Electronics, INC.

GLEN COVE, N.Y. 11542 • 516-671-5700

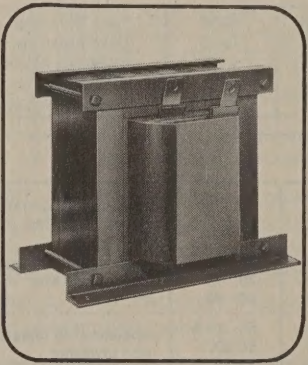
NWL ...the source for industrial and electronic transformers



Heating transformers for resistance and induction furnaces

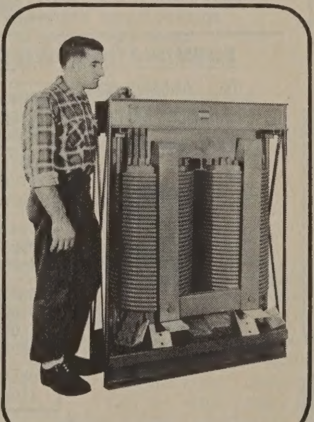


Oil filled high voltage transformers

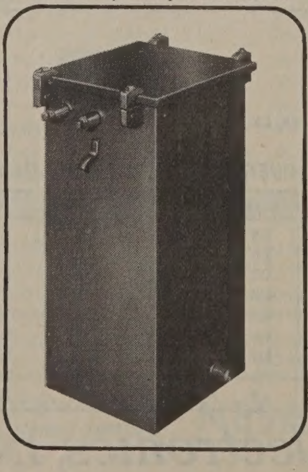


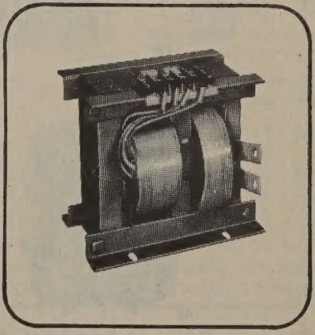
Current limiting reactors

High power and high current water cooled transformers



Oil filled specialty transformers





High impedance transformers

Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.

NWL ...the source for:

TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output

PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors

---

NWL ... transformers from the ordinary to the extraordinary

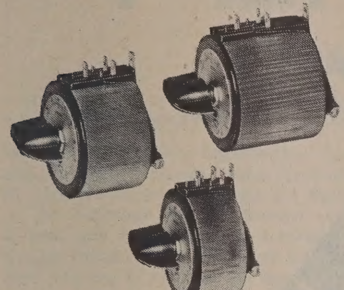
NWL TRANSFORMERS

Rising Sun Road, Bordentown, N.J.
609-298-7300

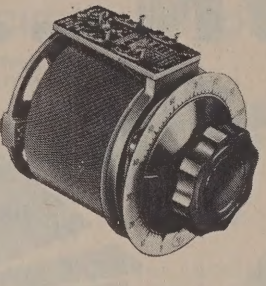
Call us for quote or specs

NWL also designs and manufactures custom built AC/DC power supplies, laboratory and industrial types. See our ad under DC POWER SOURCES.

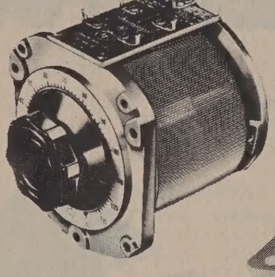
OHMITE® variable transformers



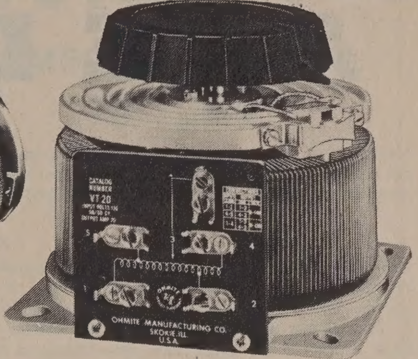
VT1, VT02, VT3 SERIES, SINGLE UNCASED
The VT1, rated 1 ampere, is the smallest commercial variable transformer available.



VT5 SERIES, SINGLE, UNCASED



VT10 SERIES, SINGLE, UNCASED



VT25 SERIES, UNCASED

Unique for the design innovations they incorporate, Ohmite "OHMITRAN" v.t.® variable transformers include exclusive field-proven features. They offer long, low maintenance operation with excellent regulation at any voltage setting within the rated load plus an output free of waveform distortion. (Ratings shown at right are for use in free air.) Enclosed units, units with meters, 2 & 3 in tandem and 3 phase models are available in most models in the basic series.

FEATURES

- Positive current transfer — specially designed brushes are connected through high conductivity contact arms to large slip ring which contacts a wide area of the collector ring.
- Adjustable shaft extends from either side.
- Mounts interchangeable with virtually all other comparable types.
- Direct reading, two scale dial — calibrated for overvoltage connection on front, line voltage connection on reverse side.
- Overvoltage options available.
- UL and CSA listings available in certain models.
- Easily replaceable brushes
- Clockwise or counter-clockwise operation on Series VT5, VT10 and VT25

ENCLOSURES

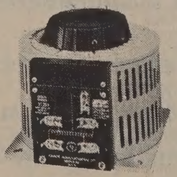
Type	Available for:	Features
B	VT25	EXPOSES TRANSFORMER'S TERMINAL RANGE & MOUNTING BASE
E	All	FOR PERMANENT MOUNTING ON PANEL, ETC.
F	All	STANDARD PORTABLE LINE CORD, OUTLET SOCKET, FUSE
G	VT8 VT25	DELUXE PORTABLE CIRCUIT BREAKER, OVERVOLTAGE — NO OVER-VOLTAGE SELECTOR, HANDLE DOUBLES AS EASEL
Metered	VT8 VT25	VOLTMETER VOLTMETER + AMMETER VOLTMETER + WATTMETER

Series Catalog No.	Wt. Lbs.	Dimensions	
		Base	Depth
VT1	1.5	2⅞″ Diam.	1¹³⁄₁₆″
VT02	2.25	2⅞″ Diam.	2⁵⁄₁₆″
VT3	3	2⅞″ Diam.	2¹³⁄₁₆″
VT5	5.25	3³⁄₁₆″ Diam.	3⅝″
VT10	10.25	4⅞″ x 5¹¹⁄₁₆″	4½″
VT25	22	7½″ x 7½″	4½″

BASIC SERIES

Cat. No.	Input Volts	Freq. Hz.	Description	Output	
				Volts	Amps
VT1	120	50 60	Basic Uncased Model	0-120 0-132	1.3
VT1F	120	60	Portable Enclosure	0-132	1.0
VT1N	120	60	Basic Uncased Model	0-120	1.5
VT1NF	120	60	Portable Enclosure	0-120	1.2
VT02	120	50 60	Basic Uncased Model	0-120 0-132	2.0
VT02F	120	60	Portable Enclosure	0-132	1.75
VT02N	120	60	Basic Uncased Model	0-120	2.5
VT02NF	120	60	Portable Enclosure	0-120	2.0
VT2LN	40	60	Hi-Amps, Low Volts	0-40	5.0
VT3	120	50 60	Basic Uncased Model	0-120 0-132	3.0
VT3N	120	60	Basic Uncased Model	0-120	3.3
*VT5	120	50 60	Basic Uncased Model	0-120 0-140	4.75
VT5F	120	60	Portable Enclosure	0-140	4.75
VT4LN	40	50	Hi-Amps, Low Volts	0-40	12.0
*VT10	120	50 60	Basic Uncased Model	0-120 0-140	10.0
VT10F	120	60	Portable Enclosure	0-140	10.0
VT10G	120	50 60	Deluxe Portable Enclosure	0-120 0-140	8.0
VT10H	240	50 60	Basic Uncased Model	0-240 0-280	4.0
VT8LN	40	50	Hi-Amps, Low Volts	0-40	22.0
*VT25	120	50 60	Basic Uncased 20A Model	0-120 0-140	25.0
VT25B	120	50 60	"B" Type Enclosure	0-120 0-140	25.0
VT25H	240	50 60	Basic Uncased Model	0-240 0-280	11.0
VT25HB	240	50 60	"B" Type Enclosure	0-240 0-280	11.0
VT25G	120	50 60	Deluxe Portable Enclosure	0-120 0-140	20.0
VT25F	120	50 60	Portable Enclosure	0-120 0-140	25.0

*Models VT5, VT10 and VT25 have replaced the industry standard VT4, VT8 and VT20 Models.



VT25B

VT02E

VT10G

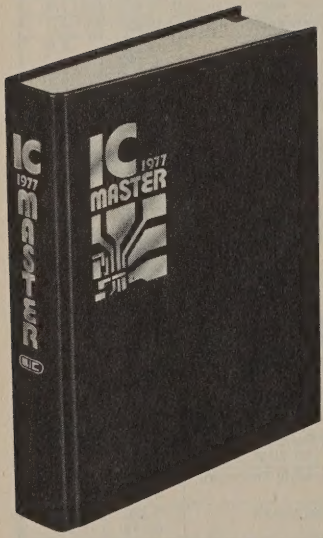
VT5F

VT10GCV
(with voltmeter)

OHMITE MFG. CO., a North AMERICAN PHILIPS company /

WHEN THE CHIPS ARE DOWN...

THE NEW 1977 IC MASTER PAYS OFF!



The new IC MASTER is the ultimate IC source book.

It lists virtually every IC device manufactured in the United States.

The IC MASTER is the easy, sensible means of narrowing down your IC choices quickly, accurately and systematically. All information is cross-referenced and indexed for rapid problem solving and device selection. And, additionally, the MASTER is updated three times yearly by accumulative supplements.

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PERKIN-ELMER

PRECISION TOROIDAL TRANSFORMERS

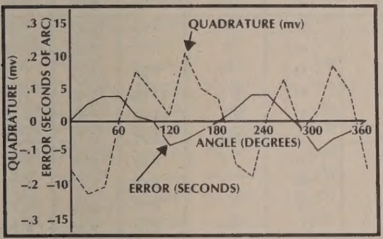
- **INPUT SCOTT T**
- **REFERENCE ISOLATION**
- **OUTPUT SCOTT T**
- **DIGITALLY TAPPED**
- **COMBINATION**
- **PRECISION RATIO**
- **RESOLVER ISOLATION**
- **CUSTOM DESIGNS**

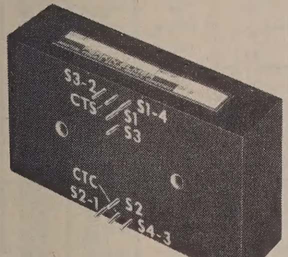
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

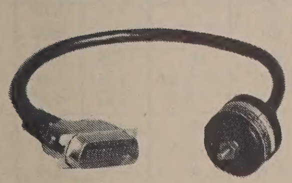
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

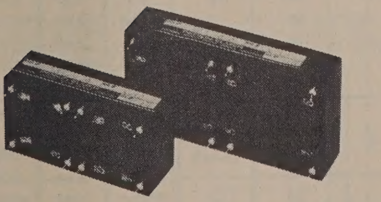
SCOTT T TRANSFORMERS

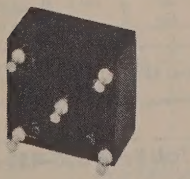
The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin θ and cos θ) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.











INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

Input V rms L-L	Output V rms	Load K Ω	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	2.5	25	45	1.0	40	8	2x1x.625	PC 2x6-32	403-2187
	5.0	20	30	1.0	50	75	2x1x.6	PC 2x4-40	403-2064
	7.2 CT	10 to CT	60	1.0	20	10 to CT	2x1x.6	PC 2x4-40	403-2065
	10.2	10	60	2.0	50	50	2x1x.6	PC 2-4-40	403-2066
12	7.5	10	15	1.0	50	75	2x1x.6	PC 2x4-40	403-2055
90	1.1	10	15	0.03	300	1	2x1x1.1	PC 2x4-40	403-2078
	4.25	10	30	1.0	1000	11	2.5x1.25x.65	PC 2x4-40	403-2034
	4.25 CT	10	30	1.0	1000	11	2.78x1.41x.8	PC 2x4-40	403-2033
	17.8 CT	2.3 to CT	30	.7	100	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2019
	26.0 CT	10 to CT	30	1.4	100	15 to CT	2.78x1.41x.8	PC 2x4-40	403-2051
90 (60 Hz)	14 CT	100 to CT	360	12.0	45	15 to CT	4x2.25x1.15	2x6-32	403-2058
96	14.4 CT	10 to CT	15	.25	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2067
			45	.75	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2068
			180	5.0	30	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2069
	20 CT	10 to CT	15	.25	200	10 to CT	2.78x1.41x.8	PC 2x4-40	403-2007

COMBINATION INPUT SCOTT T TRANSFORMERS

11.8 2 channel	5.0	20	30	1.0	50	45	2x1x.8	PC 2x4-40	403-2042
11.8 3 channel	3.2	300	45	.5	50	20	2.94x1.06x.8	PC 2x4-40	403-2048

COMBINATION SCOTT T / RESOLVER ISOLATION

Scott T 11.8	6.0	20	30	1.0	35	20	2x1x.6	PC 2x4-40	403-2070
OR									
Resolver 26	6.0	20	30	1.0	300	20			

OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

Output V rms	Input V rms L-L	Load Ω L-L	Trans. Accuracy Arc. Min.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	4.7	150	1	15	.25	7	2.78x1.41x.8	PC 2x4-40	403-2027
	6	150	2	8	.5	8	2.78x1.41x.61	PC 2x4-40	403-2071
	5 F.B. 2.5	100	3	8	.35	8	2.78x1.41x.61	PC 2x4-40	403-2075
	11.8 F.B. 6 CT	25	6	12	.8	2	2.78x1.41x.61	PC 2x4-40	403-2056
90	7	6000	1.5	50	3.0	600	2x1x1.1	PC 2x4-40	403-2077
	F.B. 2.8	6000	1.5	80	3.0	500	2.3x1.3x1	PC 4x4-40	403-2176

F.B. = Feedback winding.

RESOLVER ISOLATION TRANSFORMERS

Output V rms L-L	Input V rms L-L	Load K Ω L-L	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
7	7 (5 KHz)	10	.5	2	50	25	2x1x.6	PC 2x4-40	403-2072
9 CT	11.8	25 to CT	.3	1	80	50 to CT	1.63x.81x.5	PC	403-2063
11.1	6	.4	2	36	6	14	2.5x1.25x.65	PC 2x4-40	403-2003
26	6	6	3	36	.2	10	2.78x1.41x.61	PC 2x4-40	403-2073

PRECISION REFERENCE ISOLATION TRANSFORMERS

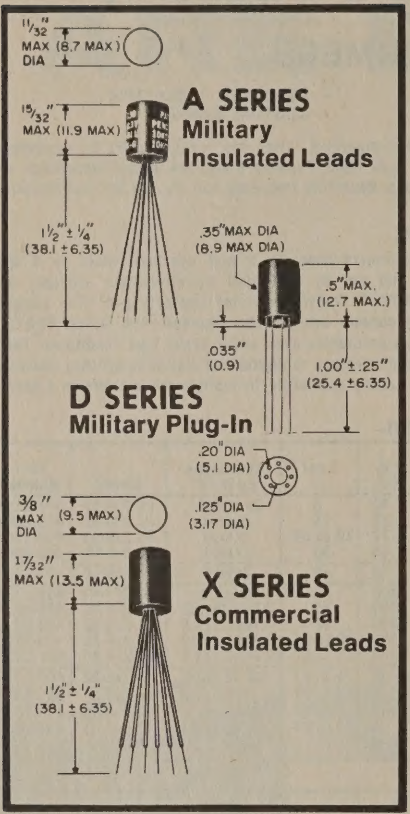
Output V rms	Input V rms	Load K Ω	Trans. Accuracy %	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
3	115	90	.05	2.5	40	.7	1.5x1.5x.75	PC 1x6-32	403-2061
	26			5	4.5				
	115	10	.1	1.3	180	2.75	.814x.814x.5	PC	403-2166
5	26	.4	.1	1	100	5.5	1x1x.58	PC	403-2026
		20	2	6	100	30	.813x.813x.5	PC	403-2189
6	26	10	.01	2.5	70	15	1x1x.58	PC	403-2040
			.02	2.5	70	15	1x1x.58	PC	403-2041
6 CT	26	45 to CT	.1	1.5	100	4 to CT	1.25x1.25x.5	PC	403-2015
20	20	5	.2	2	50	140	1x1x.5	PC	403-2062
30	7.5	50	.2	200	.5	225	.88x.88x.88	2x2-56	403-2047

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

For information on price, delivery and other standard or custom designed transformers call or write
THE PERKIN-ELMER CORPORATION • ELECTRONIC PRODUCTS DEPT. • Main Avenue, Norwalk, Connecticut 06856 • Telephone (203) 762-6574 or 762-4786
Contact us about our **VERNISTAT® a.c. Potentiometers, Adjustable Function Generators and Digital Converters.**

PICO's ultra-miniature transformers



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . .
  All **MILITARY** Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case
  Transformers are Type TF5R21ZZ.
  Inductors are TF5R20ZZ.
- FREQUENCY RESPONSE:. . . . .
  ±3 db, 300 Hz - 100 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . . . . .
  5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH: . . . .
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE:. . . .
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . .
  1/10 Ounce
- OPERATING TEMPERATURE: . .
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
  Commercial Units have maximum operating temperature of +85°C
- TERMINALS: . . . .
  Solid .016 Diameter Conductor.
  Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK:. . . . . . .
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Send for new 68 page Pico Catalog

(All PICO Products are patented)

SEC. 5600 • TRANSFORMERS

PICO PART NUMBER			PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS	POWER MILLIWATTS at 1 KHz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS	PICO PRICES 1-9 *		
A-Series Insulated Leads	D-Series PLUG-IN	X-Series Comm							A-Series	D-Series	X-Series
A1020	D4020	X10200	40	40	600	15	4	4.8	$ 7.66	$ 8.04	$ 6.23
A1025	D4025	X10250	80 ct	32 split	600	12	9.8	6	9.63	10.11	7.82
A1030	D4030	X10300	120 ct	3.2	600	10	10	0.46	7.30	7.67	5.94
A1035	D4035	X10350	120 ct	60 ct	600	10	12	6	9.63	10.11	7.82
A1040	D4040	X10400	120 ct	120 ct	600	10	12	16	9.63	10.11	7.82
A1045	D4045	X10450	150 ct	12	600	10	11	1.5	7.30	7.67	5.94
A1050	D4050	X10500	150 ct	50	600	10	15	5	8.11	8.52	6.59
A1055	D4055	X10550	150 ct	100	600	10	15	10	8.11	8.52	6.59
A1060	D4060	X10600	150 ct	150 ct	600	10	15	17	9.63	10.11	7.82
A1065	D4065	X10650	150	600 ct	600	10	15	60	8.11	8.52	6.59
A1070	D4070	X10700	300 ct	12	600	7	20	1.6	7.30	7.67	5.94
A1075	D4075	X10750	300 ct	50	600	7	30	5	8.11	8.52	6.59
A1080	D4080	X10800	300 ct	150	600	7	30	15	8.11	8.52	6.59
A1085	D4085	X10850	300 ct	300 ct	600	7	30	36	9.63	10.11	7.82
A1090	D4090	X10900	300 ct	600	600	7	19	89	7.66	8.04	6.23
A1092	D4092	X10920	300 ct	600 ct	600	7	30	60	9.63	10.11	7.82
A1095	D4095	X10950	320 ct	3.2	600	7	20	0.46	7.30	7.67	5.94
A1100	D4100	X11000	400	10	600	8	40	1	7.66	8.04	6.23
A1105	D4105	X11050	400 ct	40 split	600	8	46	8	9.63	10.11	7.82
A1110	D4110	X11100	400	100	600	8	40	10	7.66	8.04	6.23
A1115	D4115	X11150	400 ct	120 split	600	8	46	26	9.63	10.11	7.82
A1120	D4120	X11200	400 ct	200	600	8	40	20	8.11	8.52	6.59
A1125	D4125	X11250	400 ct	400 split	600	8	46	74	9.63	10.11	7.82
A1130	D4130	X11300	400 ct	1000 ct	600	8	40	100	11.06	11.61	9.00
A1135	D4135	X11350	400 ct	2000 ct	600	8	40	200	11.06	11.61	9.00
A1140	D4140	X11400	400 ct	4000 ct	600	8	45	550	9.97	10.47	8.11
A1145	D4145	X11450	500 ct	50 ct	600	3	50	5	8.57	9.00	6.96
A1150	D4150	X11500	500	50	600	3	60	8	6.90	7.25	5.61
A1155	D4155	X11550	*500	500	600	3	50	60	8.57	9.00	6.96
A1160	D4160	X11600	500 ct	500 ct	600	3	50	60	8.57	9.00	6.96
A1165	D4165	X11650	500 ct	600	600	5.5	31	90	7.66	8.04	6.23
A1170	D4170	X11700	500 ct	600 ct	600	5.5	50	68	8.57	9.00	6.96
A1175	D4175	X11750	600	3.2	600	3	60	0.58	6.90	7.25	5.61
A1180	D4180	X11800	600 ct	12	600	5	43	1.5	7.66	8.04	6.23
A1185	D4185	X11850	600 ct	50	600	5	60	5	7.66	8.04	6.23
A1190	D4190	X11900	640 ct	3.2	600	5	43	0.46	7.66	8.04	6.23
A1195	D4195	X11950	700	100	600	4	70	10	7.66	8.04	6.23
A1200	D4200	X12000	800 ct	3.2	600	4	51	0.46	7.66	8.04	6.23
A1205	D4205	X12050	800 ct	12	600	4	50	1.5	7.66	8.04	6.23
A1210	D4210	X12100	800 ct	800	600	4	80	80	8.57	9.00	6.96
A1215	D4215	X12150	900 ct	600	600	4	52	89	7.66	8.04	6.23
A1220	D4220	X12200	1000 ct	12	600	3.5	70	1.5	7.66	8.04	6.23
A1225	D4225	X12250	1000 ct	50 ct	600	3.5	100	5	8.57	9.00	6.96
A1230	D4230	X12300	1000	50	600	3	110	8	6.90	7.25	5.61
A1235	D4235	X12350	1000 ct	50	600	3	110	8	8.57	9.00	6.96
A1240	D4240	X12400	1000 ct	1000 ct	600	3	100	100	8.57	9.00	6.96
A1245	D4245	X12450	1000 ct	4000 split	600	3	100	400	11.06	11.61	9.00
A1250	D4250	X12500	1060 ct	3.2	600	3.5	70	0.38	7.66	8.04	6.23
A1255	D4255	X12550	1200	3.2	600	2	100	0.5	6.90	7.25	5.61
A1260	D4260	X12600	1200	1200	600	2	120	120	6.90	7.25	5.61
A1265	D4265	X12650	1500 ct	12	600	3	105	1.5	7.66	8.04	6.23
A1270	D4270	X12700	*1500 ct	600 ct	600	3	150	60	11.06	11.61	9.00
A1275	D4275	X12750	1500 ct	600	600	3	85	89	7.66	8.04	6.23
A1280	D4280	X12800	1500 ct	600 ct	600	3	150	60	8.57	9.00	6.96
A1285	D4285	X12850	*1500	1500	600	3	150	150	8.57	9.00	6.96
A1290	D4290	X12900	1600 ct	3.2	600	3	109	0.46	7.66	8.04	6.23
A1295	D4295	X12950	2000 ct	2000 split	600	3	195	125	9.97	10.47	8.11
A1300	D4300	X13000	1000 ct	16,000 split	125	3.5	120	940	9.97	10.47	8.11
A1305	D4305	X13050	2000 ct	8000 split	125	3	195	450	9.97	10.47	8.11
A1310	D4310	X13100	3000	3000	125	2	300	300	8.04	8.44	6.53
A1315	D4315	X13150	*4000 ct	8000 ct	125	2	320	590	9.97	10.47	8.11
A1320	D4320	X13200	7500 ct	12	125	1	500	1.6	8.04	8.44	6.53
A1325	D4325	X13250	7500 ct	50	125	1	750	5	8.57	9.00	6.96
A1330	D4330	X13300	7500	100	125	1	750	10	8.57	9.00	6.96
A1335	D4335	X13350	7500	600	125	1	750	60	9.42	9.89	7.66
A1340	D4340	X13400	7500	2500	125	1	750	250	9.42	9.89	7.66
A1345	D4345	X13450	*7500 ct	7500 ct	125	1	750	750	11.06	11.61	9.00
A1350	D4350	X13500	8000 ct	3.2	125	1	500	0.38	8.04	8.44	6.53

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery—
stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

P.O. Box 1206. Mt. Vernon. New York 10551 • phone 914-699-5514

PICO PART NUMBER			PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS	POWER MILLIWATTS at 1 KHz	PRIMARY UNBAL-ANCED DC CURRENT	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS	PICO PRICES 1-9 *		
A-Series Insulated Leads	D-Series Plug-In	X-Series Comm							A-Series	D-Series	X-Series
A1355	D4355	X13550	8000	1000	125	1	800	100	9.42	9.89	7.66
A1360	D4360	X13600	*8000 ct	1200 ct	125	1	640	115	9.97	10.47	8.11
A1365	D4365	X13650	*9000 ct	9000 ct	125	1	850	1080	10.38	10.90	8.45
A1370	D4370	X13700	10,000	3.2	125	1	790	0.6	7.66	8.04	6.23
A1375	D4375	X13750	10,000	100	125	1	1000	10	8.45	8.87	6.88
A1380	D4380	X13800	10,000	500 ct	125	1	780	50	8.45	8.87	6.88
A1385	D4385	X13850	10,000 ct	500 ct	125	1	1000	50	10.24	10.75	8.33
A1390	D4390	X13900	10,000	1000	125	1	1000	100	8.45	8.87	6.88
A1395	D4395	X13950	10,000	1200 ct	125	1	780	110	8.45	8.87	6.88
A1400	D4400	X14000	10,000 ct	1200 ct	125	1	1000	120	10.24	10.75	8.33
A1405	D4405	X14050	10,000 ct	1500 ct	125	1	780	125	9.22	9.68	7.50
A1410	D4410	X14100	10,000	2000 ct	125	1	1000	200	9.42	9.68	7.66
A1415	D4415	X14150	10,000 ct	2000 split	125	1	550	225	9.97	10.47	8.11
A1420	D4420	X14200	10,000 ct	2000 ct	125	1	1000	200	10.24	10.75	8.33
A1425	D4425	X14250	10,000	2000 ct	125	1	780	190	8.45	8.87	6.88
A1430	D4430	X14300	10,000	5000	125	1	1000	500	9.87	10.36	8.02
A1435	D4435	X14350	10,000	7500	125	1	1000	750	9.87	10.36	8.02
A1440	D4440	X14400	10,000 ct	10,000 ct	125	1	975	1175	9.63	10.11	7.82
A1445	D4445	X14450	*10,000	10,000	125	1	1000	1000	10.74	11.28	8.73
A1450	D4450	X14500	15,000	10,000	60	0.5	1500	1000	10.74	11.28	8.73
A1455	D4455	X14550	20,000	500	60	0.5	1600	60	9.63	10.11	7.82
A1460	D4460	X14600	20,000	800	60	0.5	825	110	7.66	8.04	6.23
A1465	D4465	X14650	20,000 ct	800 ct	60	0.5	830	110	8.81	9.25	7.16
A1470	D4470	X14700	20,000	1000	60	0.5	1600	130	9.63	10.11	7.82
A1475	D4475	X14750	20,000 ct	1000 split	60	0.5	800	110	9.97	10.47	8.11
A1480	D4480	X14800	20,000	5000	60	0.5	1600	550	9.63	10.11	7.82
A1485	D4485	X14850	20,000	10,000	60	0.5	1600	1100	9.63	10.11	7.82
A1490	D4490	X14900	20,000	20,000	60	0.5	1600	1850	9.63	10.11	7.82
A1495	D4495	X14950	30,000	5000	60	0.25	1700	500	10.74	11.28	8.73
A1500	D4500	X15000	30,000	10,000	60	0.25	1700	1000	10.74	11.28	8.73
A1505	D4505	X15050	30,000	30,000	60	0.25	1700	2000	10.74	11.28	8.73
A1510	D4510	X15100	40,000 ct	400 split	60	0.25	1700	60	10.74	11.28	8.73
A1515	D4515	X15150	40,000	1000	60	0.25	1700	115	10.74	11.28	8.73
A1520	D4520	X15200	40,000	2000	60	0.25	1700	225	10.74	11.28	8.73
A1525	D4525	X15250	40,000 ct	4000 ct	60	0.25	1700	450	11.13	11.69	9.05
A1530	D4530	X15300	40,000	10,000	60	0.25	1700	1200	10.74	11.28	8.73
A1535	D4535	X15350	40,000	20,000	60	0.25	1700	2300	10.74	11.28	8.73
A1540	D4540	X15400	40,000	40,000	60	0.25	1700	2000	10.74	11.28	8.73
A1545	D4545	X15450	d 100,000	100	30	0	7900	17	12.31	12.93	10.01
A1550	D4550	X15500	*d100,000 ct	500 ct	30	0	7900	85	12.31	12.93	10.01
A1555	D4555	X15550	d 100,000	10,000	30	0	7900	1700	11.85	12.44	9.64
A1560	D4560	X15600	d 200,000	1000	30	0	8500	100	11.85	12.44	9.64
A1565	D4565	X15650	d 200,000 ct	1000 ct	30	0	8500	100	12.59	13.22	10.24
A1570	D4570	X15700	d 200,000	10,000	30	0	8500	1000	14.03	14.73	11.41
A1575	D4575	X15750	d 200,000 ct	20,000	30	0	8500	2900	14.03	14.73	11.41
A1580	D4580	X15800	d 250,000	1000	30	0	10,000	125	14.03	14.73	11.41
A-SHIELD	D-SHIELD		Magnetic shield—mu metal case .37" d X .56" h (single)						1.20	1.20	
AYY-SHIELD	DYY-SHIELD		Magnetic shield—mu metal case .395" d X .64" h (double)						1.20	1:20	

* INCLUDES ELECTROSTATIC SHIELD d RESPONSE AT 100 KHz NOT WITHIN 3db

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

PICO's ultra-miniature transformers

A SERIES
Military Insulated Leads

D SERIES Military Plug-In

X SERIES
Commercial Insulated Leads

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

POWER TRANSFORMERS (FREQ. 380-1000 Hz)

PICO PART NUMBER			PRIMARY VOLTAGE (VOLTS)	SECONDARY VOLTAGE (VOLTS)	SECONDARY CURRENT MILLIAMPS	PICO PRICES 1-9 *		
A Series	D Series	X Series				A	D	X
A1705	D4605	X17050	28	6.3 6.3	30 30	9.97	10.47	8.11
A1710	D4610	X17100	28	6.3	60	8.45	8.87	6.88
A1715	D4615	X17150	* 28	28	10	9.97	10.47	8.11
A1720	D4620	X17200	*115	115	2	11.06	11.61	9.00
A1725	D4625	X17250	115	57.5	4	11.06	11.61	9.00
A1730	D4630	X17300	115	6.3	40	11.06	11.61	9.00

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(All PICO Products are patented)

INDUCTORS

TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR. ALL INDUCTORS WITH SPLIT WINDINGS HAVE MEASUREMENTS LISTED FOR BOTH SERIES CONNECTIONS AND PARALLEL CONNECTIONS.

SINGLE WINDINGS

PICO PART NUMBER			INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PICO PRICES 1-9 *		
A-Series	D-Series	X-Series				A	D·	X·
A1820	D4700	X18200	.075 .018	10 20	10.5	6.14	6.45	4.99
A1830	D4705	X18300	0.3 0.15	4 20	25	6.14	6.45	4.99
A1840	D4710	X18400	1.25 0.5	2 11	100	6.20	6.51	5.04
A1850	D4715	X18500	3.5 1.0	2 5	560	6.14	6.45	4.99
A1860	D4720	X18600	6.0 1.5	2 5	2100	7.30	7.67	5.94
A1870	D4725	X18700	20.0 8.0	1 3	5100	9.22	9.68	7.51

SPLIT WINDINGS

PICO PART NUMBER			INDUCTANCE HENRIES	DC CURRENT ma *	DC RESISTANCE OHMS	PICO PRICES 1-9 *		
A Series	D Series	X Series				A	D	X
A1880	D4730	X18800	SERIES { .075 .06 PARALLEL { .018 .015	10 30 20 60	10.5 2.6	7.30	7.67	5.94
A1890	D4735	X18900	SERIES { 0.3 0.15 PARALLEL { .075 .04	4 20 8 40	25 6.2	8.11	8.52	6.59
A1900	D4740	X19000	SERIES { 3.5 1.0 PARALLEL { 0.9 0.25	2 5 4 10	560 140	8.11	8.52	6.59
A1910	D4745	X19100	SERIES { 6.0 1.5 PARALLEL { 1.5 0.38	2 5 4 10	2100 525	8.11	8.52	6.59
A1920	D4750	X19200	SERIES { 20 8 PARALLEL { 5 2	1 3 2 6	5100 1275	9.97	1047	8.11

Delivery—
stock to one week

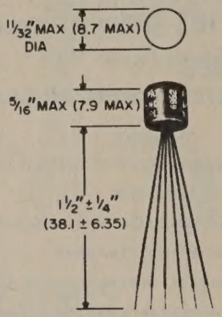
For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

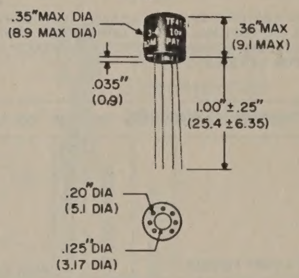
P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

PICO's ultra-miniature transformers

B SERIES
Insulated Leads



C SERIES
Plug-In



Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
  All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case
  Transformers are Type TF5R21ZZ.
  Inductors are TF5R20ZZ.
- FREQUENCY RESPONSE: . .
  ±3 db, 400 Hz - 100 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . .
  5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH:. .
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE .
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . .
  1/15 Ounce
- OPERATING TEMPERATURE:
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
- TERMINALS: . . . .
  Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK: . . . . . .
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

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(All PICO Products are patented)

SEC. 5600 • TRANSFORMERS

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS	POWER MILLIWATTS at 1 KHz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS	PICO PRICES 1-9 *	
B-Series Insulated Leads	C-Series (Plug-In)							B-Series	C-Series
B2020	C3020	40	40	600	15	4	5	$ 7.66	$ 8.04
B2025	C3025	80 ct	32 split	600	12	11.5	4	9.63	10.11
B2030	C3030	120 ct	3.2	600	10	10	0.38	7.30	7.67
B2035	C3035	120 ct	60 ct	600	10	10	6	9.63	10.11
B2040	C3040	120 ct	120 ct	600	10	11	12	9.63	10.11
B2045	C3045	150 ct	12	600	10	11	1.5	7.30	7.67
B2050	C3050	150 ct	50	600	10	15	5	8.11	8.52
B2055	C3055	150 ct	100	600	10	15	10	8.11	8.52
B2060	C3060	150 ct	150 ct	600	10	14	16	9.63	10.11
B2065	C3065	150	600 ct	600	10	15	60	8.11	8.52
B2070	C3070	300 ct	12	600	7	20	1.6	7.30	7.67
B2075	C3075	300 ct	50	600	7	30	5	8.11	8.52
B2080	C3080	300 ct	150	600	7	30	15	8.11	8.52
B2085	C3085	300 ct	300 ct	600	7	29	31	9.63	10.11
B2090	C3090	300 ct	600	600	7	20	89	7.66	8.04
B2091	C3091	300 ct	600 ct	600	7	20	89	9.63	10.11
B2095	C3095	320 ct	3.2	600	7	20	0.38	7.30	7.67
B2100	C3100	400	10	600	8	40	1	7.66	8.04
B2105	C3105	400 ct	40 split	600	8	50	6.5	9.63	10.11
B2110	C3110	400	100	600	8	40	10	7.66	8.04
B2115	C3115	400 ct	120 split	600	8	45	25	9.63	10.11
B2120	C3120	400 ct	200	600	8	40	20	8.11	8.52
B2125	C3125	400 ct	400 split	600	8	50	89	9.63	10.11
B2130	C3130	400 ct	1000 ct	600	8	40	100	11.06	11.61
B2135	C3135	400 ct	2000 ct	600	8	40	200	11.06	11.61
B2140	C3140	400 ct	4000 ct	600	8	45	365	9.97	10.47
B2145	C3145	500 ct	50 ct	600	3	65	8.5	8.45	8.87
B2150	C3150	500	50	600	3	65	8.5	6.90	7.25
B2155	C3155	*500	500	600	3	45	55	8.45	8.87
B2160	C3160	500 ct	500 ct	600	5.5	49	52	8.45	8.87
B2165	C3165	500 ct	600	600	5.5	32	89	7.66	8.04
B2170	C3170	500 ct	600 ct	600	5.5	32	89	8.45	8.87
B2175	C3175	600	3.2	600	3	60	0.5	6.90	7.25
B2180	C3180	600 ct	12	600	5	43	1.5	7.66	8.04
B2185	C3185	600 ct	50	600	5	60	5	7.66	8.04
B2190	C3190	640 ct	3.2	600	5	43	0.38	7.66	8.04
B2195	C3195	700	100	600	5	70	10	7.66	8.04
B2200	C3200	800 ct	3.2	600	4	50	0.38	7.66	8.04
B2205	C3205	800 ct	12	600	4	50	1.5	7.66	8.04
B2210	C3210	800 ct	800	600	4	78	82	8.45	8.87
B2215	C3215	900 ct	600	600	4	53	90	7.66	8.04
B2220	C3220	1000 ct	12	600	3.5	70	1.5	7.66	8.04
B2225	C3225	1000 ct	50 ct	600	3	110	8.5	8.45	8.87
B2230	C3230	1000	50	600	3	110	8.5	6.90	7.25
B2235	C3235	1000 ct	50	600	3	110	8	8.45	8.87
B2240	C3240	1000 ct	1000 ct	600	3	98	105	8.45	8.87
B2245	C3245	1000	4000 split	600	3	100	425	11.06	11.61
B2250	C3250	1060 ct	3.2	600	3.5	70	0.38	7.66	8.04
B2255	C3255	1200	3.2	600	2	110	0.45	6.90	7.25
B2260	C3260	1200	1200	600	3	110	125	6.90	7.25
B2265	C3265	1500 ct	12	600	3	105	1.5	7.66	8.04
B2270	C3270	1500 ct	600 ct	600	3	87	90	6.90	7.25
B2275	C3275	1500 ct	600	600	3	87	90	7.66	8.04
B2285	C3285	*1500	1500	600	3	140	155	8.45	8.87
B2290	C3290	1600 ct	3.2	600	3	109	0.38	7.66	8.04
B2295	C3295	2000 ct	2000 split	600	3	180	110	9.97	10.47
B2300	C3300	1000 ct	16,000 split	125	3.5	120	1600	9.97	10.47
B2305	C3305	2000 ct	8000 split	125	3	180	440	9.97	10.47
B2310	C3310	3000	3000	125	3	280	340	8.11	8.52
B2315	C3315	*4000 ct	8000 ct	125	2	300	530	9.97	10.47
B2320	C3320	7500 ct	12	125	1	500	1.6	8.45	8.87
B2325	C3325	7500 ct	50	125	1	750	5	8.45	8.87
B2330	C3330	7500	100	125	1	750	10	8.45	8.87
B2335	C3335	7500	600	125	1	750	60	9.42	9.89
B2340	C3340	7500	2500	125	1	750	250	9.42	9.89
B2345	C3345	*7500	7500	125	1	725	875	9.97	10.47
B2350	C3350	8000 ct	3.2	125	1	500	0.38	8.45	8.87
B2355	C3355	8000	1000	125	1	800	100	9.42	9.89

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

* INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery:
Stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS	POWER MILLIWATTS at 1 KHz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS	PICO PRICES 1-9 *	
B-Series Insulated Leads	C-Series (Plug-In)							B-Series	C-Series
B2360	C3360	*8000 ct	1200 ct	125	1	800	120	9.97	10.47
B2365	C3365	*9000 ct	9000 ct	125	1	850	950	9.97	10.47
B2370	C3370	10,000	3.2	125	1	790	0.6	7.66	8.04
B2375	C3375	10,000	100	125	1	1000	10	8.45	8.87
B2380	C3380	10,000	500 ct	125	1	850	50	8.45	8.87
B2385	C3385	10,000 ct	500 ct	125	1	870	50	9.97	10.47
B2390	C3390	10,000	1000	125	1	1000	100	8.45	8.87
B2395	C3395	10,000	1200 ct	125	1	850	130	8.45	8.87
B2400	C3400	10,000 ct	1200 ct	125	1	870	130	9.97	10.47
B2405	C3405	10,000 ct	1500 ct	125	1	850	115	9.22	9.68
B2410	C3410	10,000	2000 ct	125	1	1000	200	9.42	9.89
B2415	C3415	10,000 ct	2000 split	125	1	620	220	9.97	10.47
B2420	C3420	10,000 ct	2000 ct	125	1	870	180	9.97	10.47
B2425	C3425	10,000	2000 ct	125	1	850	180	8.45	8.87
B2430	C3430	10,000	5000	125	1	1000	500	9.97	10.47
B2435	C3435	10,000	7500	125	1	1000	750	9.97	10.47
B2440	C3440	10,000 ct	10,000 ct	125	1	970	1200	9.63	10.11
B2445	C3445	*10,000	10,000	125	1	1000	1300	9.63	10.11
B2450	C3450	15,000	10,000	60	0.75	1500	1000	9.63	10.11
B2455	C3455	20,000	500	60	0.5	2000	50	9.63	10.11
B2460	C3460	20,000	800	60	0.5	800	140	7.66	8.04
B2465	C3465	20,000 ct	800 ct	60	0.5	800	140	8.81	9.25
B2470	C3470	20,000	1000	60	0.5	2000	100	9.63	10.11
B2475	C3475	20,000 ct	1000 split	60	0.5	800	110	11.06	11.61
B2480	C3480	20,000	5000	60	0.5	2000	500	9.63	10.11
B2485	C3485	20,000	10,000	60	0.5	2000	1000	9.63	10.11
B2490	C3490	20,000	20,000	60	0.5	2000	2300	9.63	10.11
B2495	C3495	30,000	5000	60	0.25	2800	500	9.97	10.47
B2500	C3500	30,000	10,000	60	0.25	2800	1000	9.97	10.47
B2505	C3505	30,000	30,000	60	0.25	2800	3500	9.97	10.47
B2510	C3510	40,000 ct	400 split	60	0	2800	38	11.06	11.61
B2515	C3515	40,000	1000	60	0	2800	90	11.06	11.61
B2520	C3520	40,000	2000	60	0	2800	200	11.06	11.61
B2525	C3525	40,000 ct	4000 ct	60	0	2800	370	11.06	11.61
B2530	C3530	40,000	10,000	60	0	2800	930	11.06	11.61
B2535	C3535	40,000	20,000	60	0	2800	2000	11.06	11.61
B2540	C3540	40,000	40,000	60	0	2800	3500	11.06	11.61
B-Shield	C-Shield	MU-METAL SHIELD .37" d X .40" h (9.40 mm d X 10.16 mm h)						1.20	1.20

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

PICO's ultra-miniature transformers

B SERIES
Insulated Leads

C SERIES
Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

(All PICO Products are patented)

Send for new 68 page Pico Catalog

INDUCTORS

TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR. ALL INDUCTORS WITH SPLIT WINDINGS HAVE MEASUREMENTS LISTED FOR BOTH SERIES CONNECTIONS AND PARALLEL CONNECTIONS.

SINGLE WINDINGS

PICO PART NUMBER		INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PICO PRICES 1-9 *	
B-Series Insulated Leads	C-Series (Plug-In)				B-Series	C-Series
B2570	C3570	0.1 .08	4 10	25	6.14	6.45
B2575	C3575	0.9 0.5	2 6	105	6.14	6.45
B2580	C3580	2.5 0.9	2 4	630	6.14	6.45
B2585	C3585	4.5 1.2	2 4	2300	7.30	7.67

SPLIT WINDINGS

PICO PART NUMBER		INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PICO PRICES 1-9 *	
B-Series Insulated Leads	C-Series (Plug-In)				B-Series	C-Series
B2590	C3590	SERIES {0.1 .08 PARALLEL {.025 .02	4 10 8 20	25 6.5	7.66	8.04
B2595	C3595	SERIES {0.9 0.5 PARALLEL {0.23 0.13	2 6 4 12	105 26	7.66	8.04
B2600	C3600	SERIES {2.5 0.9 PARALLEL {0.6 0.23	2 4 4 8	630 160	7.66	8.04
B2605	C3605	SERIES {4.5 1.2 PARALLEL {1.1 0.3	2 4 4 8	2300 575	8.11	8.52

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery:
Stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

PICO's ultra-miniature AUDIO: transformers

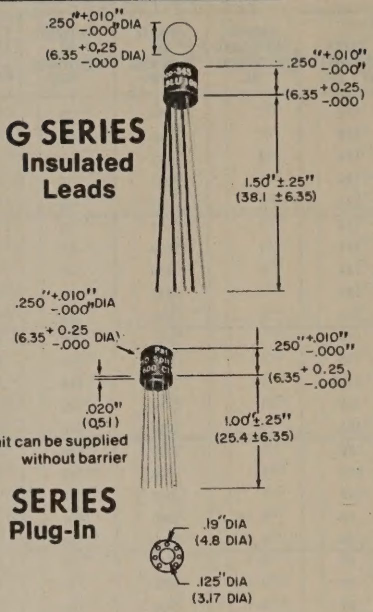
1/4"x1/4"

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

G SERIES Insulated Leads

F SERIES Plug-In


.250"+.010" -.000" DIA
(6.35 +0.25 -.000 DIA)
.250"+.010" -.000"
(6.35 +0.25 -.000)
1.50"±.25"
(38.1 ±6.35)
.250"+.010" -.000" DIA
(6.35 +0.25 -.000 DIA)
.250"+.010" -.000"
(6.35 +0.25 -.000)
.020"
(0.51)
Unit can be supplied without barrier
1.00"±.25"
(25.4 ±6.35)
.19" DIA
(4.8 DIA)
.125" DIA
(3.17 DIA)

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27:
  All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case
  Transformers are Type TF5R21ZZ.
  Inductors are TF5R20ZZ.
- FREQUENCY RESPONSE:
  ±3 db, 400 Hz - 250 KHz At 1.0 milliwatt
- MAXIMUM DISTORTION:
  5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH:
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE:
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT:
  1.1 GRAMS
- OPERATING TEMPERATURE:
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
- TERMINALS:
  Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D.
- THERMAL SHOCK:
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

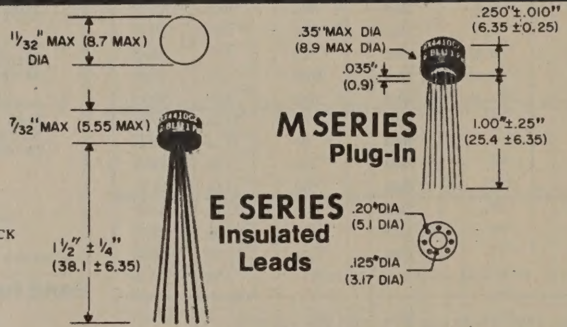
PICO's ultra-miniature PULSE transformers

FEATURES

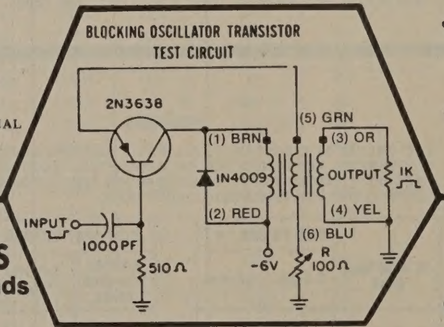
- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

M SERIES Plug-In

E SERIES Insulated Leads


11/32" MAX (8.7 MAX) DIA
7/32" MAX (5.55 MAX)
1 1/2" ± 1/4"
(38.1 ±6.35)
.35" MAX DIA
(8.9 MAX DIA)
.035"
(0.9)
.250"±.010"
(6.35 ±0.25)
1.00"±.25"
(25.4 ±6.35)
.20" DIA
(5.1 DIA)
.125" DIA
(3.17 DIA)

Dimensions are in inches (MM)


BLOCKING OSCILLATOR TRANSISTOR TEST CIRCUIT
2N3638
(1) BRN
IN4009
(2) RED
(5) GRN
(6) BLU
(3) OR
OUTPUT
(4) YEL
IK
INPUT
1000PF
510Ω
-6V
R
100Ω

SPECIFICATIONS

- MIL-T-21038:
  All Units are Designed to MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH:
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE:
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT:
  1/20 Ounce
- OPERATING TEMPERATURE:
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
- TERMINALS:
  Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK:
  25 Cycles, Method 107C, MIL-STD-202D, Test Condiction A-1

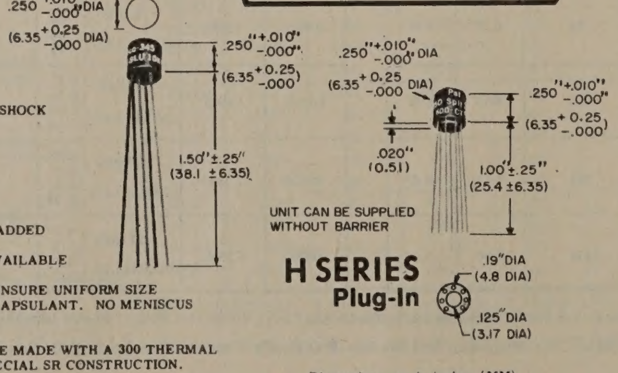
PICO's ultra-miniature PULSE transformers

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

J SERIES Insulated Leads

H SERIES Plug-In


.250"+.010" -.000" DIA
(6.35 +0.25 -.000 DIA)
.250"+.010" -.000"
(6.35 +0.25 -.000)
1.50"±.25"
(38.1 ±6.35)
.250"+.010" -.000" DIA
(6.35 +0.25 -.000 DIA)
.250"+.010" -.000"
(6.35 +0.25 -.000)
.020"
(0.51)
1.00"±.25"
(25.4 ±6.35)
UNIT CAN BE SUPPLIED WITHOUT BARRIER
.19" DIA
(4.8 DIA)
.125" DIA
(3.17 DIA)

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038:
  All Units Are Designed to MIL-T-21038 and Are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH:
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE:
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT:
  1.1 GRAMS
- OPERATING TEMPERATURE:
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
- TERMINALS:
  Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D.
- THERMAL SHOCK:
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery: Stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

SEC. 5600 • TRANSFORMERS

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS	POWER MILLIWATTS at 1 KHz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS	PICO PRICES 1-9 *	
F-Series Plug-In	G-Series Insulated Leads							F-Series	G-Series
F5705	G6005	50	50	100	5.0	7.5	9.0	$ 9.90	$ 9.43
F5710	G6010	100	100	100	5.0	15	18	9.90	9.43
F5715	G6015	120 ct	3.2	100	4.5	15	0.75	9.90	9.43
F5720	G6020	150 ct	12 split	100	4.0	20	2.4	10.75	10.24
F5725	G6025	300 ct	600 split	100	3.0	40	90	10.75	10.24
F5730	G6030	400 ct	400 split	100	2.5	54	58	11.53	10.98
F5735	G6035	500 ct	50 split	100	2.0	62	10	11.53	10.98
F5740	G6040	500	600	100	2.0	62	90	10.75	10.24
F5745	G6045	600 ct	600 split	100	2.0	70	90	11.53	10.98
F5750	G6050	900 ct	600	100	1.5	130	90	11.83	11.27
F5755	G6055	1K ct	1K split	100	1.5	110	140	11.83	11.27
F5760	G6060	1.5K ct	600 split	100	1.2	175	69	11.83	11.27
F5765	G6065	2K ct	8K split	80	1.0	200	1000	12.68	12.08
F5770	G6070	10K ct	500 split	80	0.5	1000	60	12.98	12.36
F5775	G6075	10K	500	80	0.5	1000	60	12.68	12.08
F5780	G6080	10K ct	1.2K split	80	0.5	1100	160	12.98	12.36
F5785	G6085	10K	1.2K	80	0.5	1100	130	12.68	12.08
F5790	G6090	10K ct	2K split	80	0.5	1100	250	12.98	12.36
F5795	G6095	10K ct	10K ct	80	0.5	1100	1100	11.83	11.27
F5800	G6100	10K	10K	80	0.5	1100	1100	11.53	10.98
F5805	G6105	10K ct	10K split	80	0.5	1100	1100	12.98	12.36
F5810	G6110	25K ct	1K split	50	0.3	2100	130	13.77	13.11
F5815	G6115	25K	1K	50	0.3	2100	130	12.98	12.36
F5820	G6120	30K ct	1.2K	50	0.3	2300	180	13.77	13.11

INDUCTORS

PICO PART NUMBER		INDUCTANCE HENRIES	DC CURRENT ma *	DC RESISTANCE OHMS	PRICES 1-9 *	
F-Series Plug-In	G-Series Insulated Leads				F-Series	G-Series
F5825	G6125	SERIES 10.0 2.75 PARALLEL 2.5 .65	0 2 0 4	2250 560	10.75	10.24
F5830	G6130	SERIES 5.5 1.5 PARALLEL 1.3 .40	0 2 0 4	1000 250	10.75	10.24
F5835	G6135	SERIES .85 .25 PARALLEL .21 .06	1 6 2 12	240 60	10.75	10.24
F5840	G6140	SERIES .6 .15 PARALLEL .15 .04	0 5 0 10	144 36	10.75	10.24

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Send for new 68 page Pico Catalog

(All PICO Products are patented)

MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D.C. RESISTANCE			PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μ SEC.	RISE TIME μ SEC.	% OVER SHOOT	DROOP %	% BACK SWING	1-2 BRN RED	3-4 OR YEL	5-6 GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	6.68	7.40
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	6.68	7.40
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	6.68	7.40
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	6.68	7.40
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	6.68	7.40
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	6.68	7.40
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	6.68	7.40
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	6.68	7.40
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	6.68	7.40
MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1																			
E5200	M5345	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	6.68	7.40
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3 MHz	1	0.02	5	5	5	3.0	2.2	0.9	6.68	7.40
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	6.68	7.40

**Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage =1V*

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1-9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width μSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in/out,	P Width μSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H5400	J5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	0	35	9.60	8.88
H5405	J5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	9.60	8.88
H5410	J5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	9.60	8.88
H5415	J5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	9.60	8.88
H5420	J5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	9.60	8.88
H5425	J5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	9.60	8.88
H5430	J5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	9.60	8.88
H5435	J5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	9.60	8.88
H5440	J5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	9.60	8.88
H5445	J5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	9.60	8.88
H5450	J5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	9.60	8.88
H5455	J5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	9.60	8.88
H5460	J5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	9.60	8.88

**Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage =1V*

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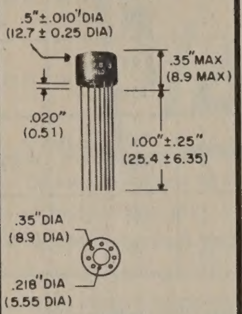
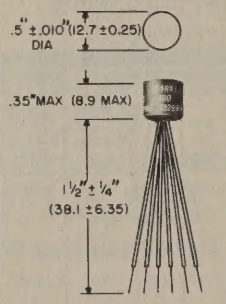
PICO's ultra-miniature transformers

L SERIES
Plug-In



P SERIES
Insulated Leads



Dimensions are in inches (MM)

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*	
P-Series Insulated Leads	L-Series Plug-in		SER	PAR	1KHz and HIGHER	400 Hz	300 Hz			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.3	.16	30.0	2	1.2	.3	1.58:1	3.16:1	9.97	9.63
L-8205	P-9205	20 ct	20 ct	5	.6	.3	.16	30.0	2	2.8	.7	1:1	2:1	9.97	9.63
L-8210	P-9210	32 ct	32 ct	8	.6	.3	.16	23.0	3.3	4.5	1.13	1:1	2:1	9.97	9.63
L-8215	P-9215	40 ct	40 ct	10	.6	.3	.16	21.0	3.7	5	1.25	1:1	2:1	9.97	9.63
L-8218	P-9218	48 ct	16 ct	4	.6	.3	.16	19.0	3.75	3	.75	1.73:1	3.46:1	9.97	9.63
L-8220	P-9220	50 ct	50 ct	12.5	.6	.2	.16	19.0	5	7	1.75	1:1	2:1	9.97	9.63
L-8225	P-9225	80 ct	32 ct	8	.6	.3	.16	15.0	7.5	4.3	1.13	1.58:1	3.16:1	9.97	9.63
L-8228	P-9228	100 ct	40 ct	10	.6	.3	.16	13.0	10.8	5	1.25	1.58:1	3.16:1	9.97	9.63
L-8230	P-9230	100 ct	100 ct	25	.6	.3	.16	13.0	10.8	12	3	1:1	2:1	9.97	9.63
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.3	.16	12.0	9.3	2.2	.55	3.06:1	6.12:1	9.97	9.63
L-8240	P-9240	120 ct	60 ct	15	.6	.3	.16	12.0	9	7.2	1.8	1.41:1	2.83:1	9.97	9.63
L-8245	P-9245	120 ct	120 ct	30	.6	.3	.16	12.0	11.6	13	3.3	1:1	2:1	9.97	9.63
L-8250	P-9250	150 ct	12 ct	3	.6	.3	.16	11.0	11.2	2.2	.55	3.54:1	7.08:1	9.97	9.63
L-8255	P-9255	150 ct	50 ct	12.5	.6	.3	.16	11.0	13	6.8	1.7	1.73:1	3.46:1	9.97	9.63
L-8260	P-9260	150 ct	100 ct	25	.6	.3	.16	11.0	13	11.8	3	1.22:1	2.45:1	9.97	9.63
L-8265	P-9265	150 ct	150 ct	37.5	.6	.3	.16	11.0	13	18.3	4.6	1:1	2:1	9.97	9.63
L-8270	P-9270	150 ct	600 ct	150	.6	.3	.16	11.0	13	75	19	1:2	1:1	9.97	9.63
L-8275	P-9275	200 ct	200 ct	50	.6	.3	.16	10.0	19	21.3	5.4	1:1	2:1	9.97	9.63
L-8280	P-9280	300 ct	12 ct	3	.6	.3	.16	8.0	24	1.7	.43	5:1	10:1	9.97	9.63
L-8285	P-9285	300 ct	50 ct	12.5	.6	.3	.16	8.0	30	6.8	1.7	2.45:1	4.9:1	9.97	9.63
L-8290	P-9290	300 ct	150 ct	37.5	.6	.3	.16	8.0	30	18	4.6	1.41:1	2.83:1	9.97	9.63
L-8295	P-9295	300 ct	300 ct	75	.6	.3	.16	8.0	30	34	8.5	1:1	2:1	9.97	9.63
L-8300	P-9300	300 ct	600 ct	150	.6	.3	.16	8.0	30	60	15	1:1.41	1.41:1	9.97	9.63
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.3	.16	7.5	31	1.7	.43	5:1	10:1	9.97	9.63
L-8310	P-9310	400 ct	40 ct	10	.6	.3	.16	7.0	41	4.5	1.13	3.16:1	6.32:1	9.97	9.63
L-8315	P-9315	400 ct	120 ct	30	.6	.3	.16	7.0	41	12	3	1.83:1	3.65:1	9.97	9.63
L-8320	P-9320	400 ct	200 ct	50	.6	.3	.16	7.0	41	21.3	5.4	1.41:1	2.83:1	9.97	9.63
L-8325	P-9325	400 ct	400 ct	100	.6	.3	.16	7.0	41	37.5	9.4	1:1	2:1	9.97	9.63
L-8330	P-9330	400 ct	1000 ct	250	.6	.3	.16	7.0	41	96	24	1:1.58	1.26:1	9.97	9.63
L-8335	P-9335	400 ct	2000 ct	500	.6	.3	.16	7.0	41	212	53	1:2.24	1:1.12	9.97	9.63
L-8340	P-9340	400 ct	4000 ct	1000	.6	.3	.16	7.0	41	375	94	1:3.16	1:1.58	9.97	9.63
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.3	.16	6.0	48	1.7	.43	6.25:1	12.5:1	9.97	9.63
L-8344	P-9344	500 ct	16 ct	4	.6	.3	.16	6.0	48	1.9	.5	5.6:1	11.2:1	9.97	9.63
L-8345	P-9345	500 ct	50 ct	12.5	.6	.3	.16	6.0	39	6.8	1.7	3.16:1	6.32:1	9.97	9.63
L-8347	P-9347	500 ct	150 ct	37.5	.6	.3	.16	6.0	48	18	4.6	1.83:1	3.65:1	9.97	9.63
L-8350	P-9350	500 ct	500 ct	125	.6	.3	.16	6.0	48	54	-	1:1	2:1	9.97	9.63
L-8355	P-9355	*500 ct	500 ct	-	.6	.3	.16	6.0	48	68	-	1:1	-	10.38	9.97
L-8360	P-9360	500 ct	600 ct	150	.6	.3	.16	6.0	48	59	15	1:1.1	1.83:1	9.97	9.63
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.3	.16	5.5	53	1.7	.43	6.85:1	13.7:1	9.97	9.63
L-8367	P-9367	600 ct	30 ct	7.5	.6	.3	.16	5.5	53	4.2	1.1	4.47:1	8.94:1	9.97	9.63
L-8370	P-9370	600 ct	48 ct	12	.6	.3	.16	5.5	53	6.8	1.7	3.54:1	7.07:1	9.97	9.63
L-8375	P-9375	600 ct	200 ct	50	.6	.3	.16	5.5	53	21.3	5.3	1.73:1	3.46:1	9.97	9.63
L-8380	P-9380	600 ct	600 ct	150	.6	.3	.16	5.5	57	79	20	1:1	2:1	9.97	9.63
L-8385	P-9385	*600 ct	600 ct	-	.6	.3	.16	5.5	53	75	-	1:1	-	10.38	9.97
L-8387	P-9387	600 ct	1200 ct	300	.6	.3	.16	5.5	53	105	26	1:1.41	1.41:1	9.97	9.63
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.3	.16	5.5	66	1.7	.43	7.07:1	14.14:1	9.97	9.63
L-8395	P-9395	700 ct	100 ct	25	.6	.3	.16	5.0	69	12	3	2.65:1	5.29:1	9.97	9.63
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.3	.16	5.0	75	1.7	.43	7.9:1	15.8:1	9.97	9.63
L-8405	P-9405	800 ct	48 ct	12	.6	.3	.16	5.0	75	6.8	1.7	4.08:1	8.16:1	9.97	9.63
L-8410	P-9410	800 ct	800 ct	200	.6	.3	.16	5.0	75	105	26	1:1	2:1	9.97	9.63
L-8415	P-9415	900 ct	600 ct	150	.6	.3	.16	4.5	79	75	19	1.22:1	2.45:1	9.97	9.63
L-8420	P-9420	1000 ct	12 ct	3	.6	.3	.16	4.5	103	1.6	.4	9.13:1	18.3:1	9.97	9.63
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.3	.16	4.5	103	6.4	1.6	4.47:1	8.94:1	9.97	9.63
L-8430	P-9430	1000 ct	1000 ct	250	.6	.3	.16	4.5	103	115	29	1:1	2:1	9.97	9.63
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.3	.16	4.0	108	1.7	.43	9.1:1	18.2:1	9.97	9.63
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.3	.16	4.0	113	1.7	.43	9.68:1	19.4:1	9.97	9.63
L-8445	P-9445	1200 ct	500 ct	125	.6	.3	.16	4.0	113	54	13.5	1.55:1	3.1:1	9.97	9.63
L-8450	P-9450	1200 ct	1200 ct	300	.6	.3	.16	4.0	113	126	31.6	1:1	2:1	9.97	9.63
L-8455	P-9455	*1200 ct	1200 ct	-	.6	.3	.16	4.0	111	125	-	1:1	-	10.38	9.97
L-8460	P-9460	1500 ct	12 ct	3	.6	.3	.16	3.5	126	1.6	.4	11.2:1	22.4:1	9.97	9.63
L-8465	P-9465	1500 ct	500 ct	125	.6	.3	.16	3.5	126	68	17	1.73:1	3.46:1	9.97	9.63
L-8470	P-9470	*1500 ct	600 ct	-	.6	.3	.16	3.5	126	94	-	1.58:1	-	10.38	9.97
L-8475	P-9475	*1500 ct	1500 ct	-	.6	.3	.16	3.5	126	176	-	1:1	-	10.38	9.97
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.3	.16	3.5	130	1.7	.43	11.2:1	22.4:1	9.97	9.63
L-8483	P-9483	2000 ct	8 ct	2	.6	.3	.16	3.0	210	1.2	.3	15.8:1	31.6:1	9.97	9.63
L-8485	P-9485	2000 ct	2000 ct	500	.6	.3	.16	3.0	198	218	55	1:1	2:1	9.97	9.63
L-8490	P-9490	*2000 ct	2000 ct	-	.6	.3	.16	3.0	198	218	-	1:1	-	9.97	9.63
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.3	.16	3.0	198	850	213	1:2	1:1	9.97	9.63
L-8497	P-9497	2500 ct	2500 ct	625	.6	.3	.16	2.5	220	305	76	1:1	2:1	9.97	9.63
L-8500	P-9500	3000 ct	3000 ct	750	.6	.3	.16	2.5	243	335	84	1:1	2:1	9.97	9.63

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*INCLUDES ELECTROSTATIC SHIELD

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SPECIFICATIONS

- **MIL-T-27** . . . .
All Units are Designed to MIL-T-27 and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . .
±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- **MAXIMUM DISTORTION:** . . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- **DIELECTRIC STRENGTH:** . . . .
All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . .
Greater than 10.000 Megohms at 300 V DC
- **WEIGHT:** . . . .
5 Grams
- **OPERATING TEMPERATURE:** . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . .
Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- **THERMAL SHOCK:** . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

(All PICO Products are patented)

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PICO PART NUMBER P-Series Insulated Leads	PICO PART NUMBER L-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and HIGHER	POWER WATTS 400 Hz	POWER WATTS 300 Hz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9* L-Series	PICO PRICES 1-9* P-Series
L-8505	P-9505	*3000 ct	3000 ct	-	.6	.3	.16	2.5	304	335	-	1:1	-	10.38	9.97
L-8510	P-9510	3600 ct	3600 ct	900	.6	.3	.16	2.5	330	366	92	1:1	2:1	9.97	9.63
L-8512	P-9512	4000 ct	16 ct	4	.6	.3	.16	2.0	350	3	.75	15.8:1	31.6:1	9.97	9.63
L-8514	P-9514	4000 ct	600 ct	150	.6	.3	.16	2.0	350	76	19	2.58:1	5.16:1	9.97	9.63
L-8515	P-9515	4000 ct	1000 ct	250	.6	.3	.16	2.0	350	115	29	2:1	4:1	9.97	9.63
L-8520	P-9520	*4000 ct	8000 ct	-	.6	.3	.16	2.0	350	1062	-	1:1.41	-	10.38	9.97
L-8525	P-9525	5000 ct	500 ct	125	.6	.3	.16	2.0	350	67	17	3.16:1	6.32:1	9.97	9.63
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.3	.16	2.0	390	538	135	1:1	2:1	9.97	9.63
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.3	.16	1.5	600	7	1.75	12.2:1	24.5:1	11.06	10.74
L-8540	P-9540	7500 ct	100 ct	25	.6	.3	.16	1.5	600	12	3	8.66:1	17.3:1	11.06	10.74
L-8545	P-9545	7500 ct	600 ct	150	.6	.3	.16	1.5	600	78	19.5	3.54:1	7.07:1	11.06	10.74
L-8550	P-9550	7500 ct	2500 ct	625	.6	.3	.16	1.5	600	305	77	1.73:1	3.46:1	11.06	10.74
L-8555	P-9555	*7500 ct	7500 ct	-	.6	.3	.16	1.5	750	828	-	1:1	-	11.85	11.06
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.3	.16	1.5	750	1.7	.43	25:1	50:1	11.06	10.74
L-8565	P-9565	8000 ct	1000 ct	250	.6	.3	.16	1.5	750	115	29	2.83:1	5.66:1	11.06	10.74
L-8570	P-9570	*8000 ct	1200 ct	-	.6	.3	.16	1.5	750	158	-	2.58:1	-	11.85	11.06
L-8575	P-9575	*9000 ct	9000 ct	-	.6	.3	.16	1.4	796	1100	-	1:1	-	11.85	11.06
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.3	.16	1.4	1048	1.7	.43	28:1	56:1	11.06	10.74
L-8585	P-9585	10,000 ct	16 ct	4	.6	.3	.16	1.4	1048	3	.75	25:1	50:1	11.06	10.74
L-8590	P-9590	10,000 ct	100 ct	25	.6	.3	.16	1.4	839	12	3	10:1	20:1	11.06	10.74
L-8595	P-9595	10,000 ct	200 ct	50	.6	.3	.16	1.4	839	27	6.7	7.07:1	14.14:1	11.06	10.74
L-8600	P-9600	10,000 ct	500 ct	125	.6	.3	.16	1.4	850	67	17	4.47:1	8.94:1	11.06	10.74
L-8605	P-9605	10,000 ct	600 ct	150	.6	.3	.16	1.4	850	74	18.5	4.08:1	8.16:1	11.06	10.74
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.3	.16	1.4	850	115	29	3.16:1	6.32:1	11.06	10.74
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.3	.16	1.4	850	158	39.5	2.89:1	5.77:1	11.06	10.74
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.3	.16	1.4	850	177	44	2.58:1	5.16:1	11.06	10.74
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.3	.16	1.4	850	255	64	2.24:1	4.47:1	11.06	10.74
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.3	.16	1.4	850	630	158	1.41:1	2.83:1	11.06	10.74
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.3	.16	1.4	850	772	193	1.15:1	2.3:1	11.06	10.74
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.3	.16	1.4	866	1215	304	1:1	2:1	11.06	10.74
L-8645	P-9645	*10,000 ct	10,000 ct	-	.6	.3	.16	1.4	1060	1215	-	1:1	-	11.85	11.06
L-8650	P-9650	15,000 ct	400 ct	100	.6	.3	.16	1.0	1305	47	12	6.12:1	12.24:1	11.06	10.74
L-8652	P-9652	15,000 ct	500 ct	125	.6	.3	.16	1.0	1305	53	13	5.48:1	10.95:1	11.06	10.74
L-8655	P-9655	15,000 ct	600 ct	150	.6	.3	.16	1.0	1305	72.5	18	5:1	10:1	11.06	10.74
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.3	.16	1.0	1305	1215	304	1.22:1	2.45:1	11.06	10.74
L-8665	P-9665	*15,000 ct	15,000 ct	-	.6	.3	.16	1.0	1305	1800	-	1:1	-	11.85	11.06
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.3	.16	1.0	1305	1800	450	1:1	2:1	11.06	10.74
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.3	.16	1.0	1343	115	29	4:1	8:1	11.06	10.74
L-8680	P-9680	20,000 ct	500 ct	125	.5	.3	.16	1.0	1560	68	17	6.33:1	12.65:1	11.85	11.06
L-8685	P-9685	20,000 ct	600 ct	150	.5	.3	.16	1.0	1560	75	19	5.77:1	11.55:1	11.85	11.06
L-8690	P-9690	20,000 ct	800 ct	200	.5	.3	.16	1.0	1560	108	27	5:1	10:1	11.85	11.06
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.3	.16	1.0	1560	121	30.5	4.47:1	8.94:1	11.85	11.06
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.3	.16	1.0	1560	672	168	2:1	4:1	11.85	11.06
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.3	.16	1.0	1560	1520	380	1.41:1	2.83:1	11.85	11.06
L-8710	P-9710	*20,000 ct	20,000 ct	-	.5	.3	.16	1.0	1560	2727	682	1:1	-	12.31	11.85
L-8715	P-9715	25,000 ct	500 ct	125	.4	.3	.16	0.8	2170	68	17	7.07:1	14.14:1	11.85	11.06
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.3	.16	0.8	2170	120	30	5:1	10:1	11.85	11.06
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.3	.16	0.8	2400	7	1.75	24.5:1	49:1	12.31	11.85
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.3	.16	0.8	2400	156	39	5:1	10:1	12.31	11.85
L-8732	P-9732	30,000 ct	500 ct	125	.33	.3	.16	0.8	2400	68	17	7.75:1	15.5:1	12.31	11.85
L-8734	P-9734	30,000 ct	200 ct	50	.33	.3	.16	0.8	2400	29	7.2	12.25:1	24.5:1	12.31	11.85
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.3	.16	0.8	2400	673	169	2.45:1	4.9:1	12.31	11.85
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.3	.16	0.8	2400	1520	380	1.73:1	3.46:1	12.31	11.85
L-8745	P-9745	*30,000 ct	30,000 ct	-	.33	.3	.16	0.8	3000	3310	-	1:1	-	13.22	12.44
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.16	0.7	3400	57	14.3	10:1	20:1	13.22	12.44
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.16	0.7	3400	268	67	4.47:1	8.94:1	13.22	12.44
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.16	0.7	3400	476	119	3.16:1	6.32:1	13.22	12.44
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.16	0.7	3400	2700	675	1.41:1	2.83:1	13.22	12.44
L-8770	P-9770	*40,000 ct	40,000 ct	-	.25	.25	.16	0.7	3400	4750	-	1:1	-	14.73	14.10
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.16	0.6	4850	27	6.7	15.8:1	31.6:1	14.73	14.10
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.16	0.6	4850	68	17	10:1	20:1	14.73	14.10
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.16	0.6	4850	75	18.5	9.13:1	18.26:1	14.73	14.10
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2.1	4:1	15.90	15.50
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	15.90	15.50
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	15.90	15.50
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	16.70	16.10
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	16.70	16.10
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	16.70	16.10
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	16.70	16.10
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	16.70	16.10
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	16.70	16.10
PICO-L-SHIELD MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)														1.20	
PICO-P-SHIELD MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)															1.20

*INCLUDES ELECTROSTATIC SHIELD

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PICO's ultra-miniature transformers

L SERIES
Plug-In

P SERIES
Insulated Leads

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.
- ALL POSSIBLE LEAD SPACINGS AVAILABLE - CONTACT FACTORY FOR PIN LAYOUT SAME AS DUAL IN-LINE INTEGRATED CIRCUITS ("DIP" PACKAGE).

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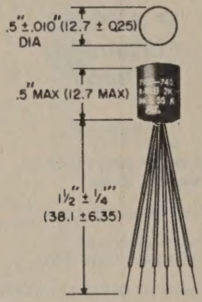
Insulated Leads



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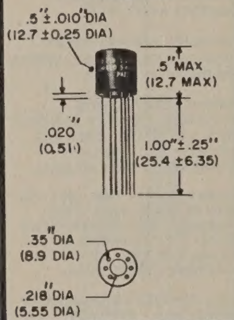

Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27** . . . .
All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . .
±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≧ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz
- **DIELECTRIC STRENGTH:** . . . .
All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . .
Greater Than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . .
7.5 Grams
- **OPERATING TEMPERATURE:** . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . .
Solid .016 Diameter Conductor Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- **THERMAL SHOCK:** . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

(All PICO Products are patented)

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PICO PART NUMBER K-Series Insulated Leads	PICO PART NUMBER N-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and HIGHER	POWER WATTS 400 Hz	POWER WATTS 150 Hz	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9* K-Series	PICO PRICES 1-9* N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.075	22.0	1.75	1.0	.3	1.58:1	3.16:1	9.63	9.97
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.075	22.0	1.75	2.5	.63	1:1	2:1	9.63	9.97
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.075	18.0	2.7	3.7	.93	1:1	2:1	9.63	9.97
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.075	16.0	3	5.2	1.3	1:1	2:1	9.63	9.97
K-7218	N-6218	48 ct	16 ct	4	1.0	.75	.075	13.0	4.5	2.4	.6	1.73:1	3.46:1	9.63	9.97
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.075	13.0	4.5	6.2	1.6	1:1	2:1	9.63	9.97
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.075	11.0	6.6	3.7	.93	1.58:1	3.16:1	9.63	9.97
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.075	10.0	9.7	5.6	1.4	1.58:1	3.16:1	9.63	9.97
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.075	10.0	9.7	11	2.8	1:1	2:1	9.63	9.97
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.075	9.0	10.8	1.6	.4	3.06:1	6.12:1	9.63	9.97
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.075	9.0	10.8	8.5	2.2	1.41:1	2.83:1	9.63	9.97
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.075	9.0	10.8	15	3.8	1:1	2:1	9.63	9.97
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.075	8.0	13.5	1.75	.44	3.54:1	7.08:1	9.63	9.97
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.075	8.0	12	5.8	1.5	1.73:1	3.46:1	9.63	9.97
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.075	8.0	12	13	3.3	1.22:1	2.44:1	9.63	9.97
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.075	8.0	12	20	5	1:1	2:1	9.63	9.97
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.075	8.0	12	82	20.5	1:2	1:1	9.63	9.97
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.075	7.0	17	24	6.0	1:1	2:1	9.63	9.97
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.075	5.0	30	1.75	.44	5:1	10:1	9.63	9.97
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.075	5.0	27	6.2	1.6	2.45:1	4.9:1	9.63	9.97
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.075	5.0	26	21	5.3	1.41:1	2.83:1	9.63	9.97
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.075	5.0	27	38	9.5	1:1	2:1	9.63	9.97
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.075	5.0	27	66	17	1:1.41	1.41:1	9.63	9.97
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.075	5.0	30	1.75	.44	5:1	10:1	9.63	9.97
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.075	5.0	39	4.3	1.1	3.16:1	6.32:1	9.63	9.97
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.075	5.0	30	14	3.5	1:83:1	3.65:1	9.63	9.97
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.075	5.0	39	24	6	1.41:1	2.83:1	9.63	9.97
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.075	5.0	39	42	10.5	1:1	2:1	9.63	9.97
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.075	5.0	39	109	28	1:1.58	1.26:1	9.63	9.97
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.075	5.0	39	198	49	1:2.24	1:1.12	9.63	9.97
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.075	5.0	39	436	109	1:3.16	1:1.58	9.63	9.97
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.075	4.5	43	1.6	.4	6.25:1	12.5:1	9.63	9.97
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.075	4.5	43	2.3	.56	5.6:1	11.2:1	9.63	9.97
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.075	4.5	43	5.8	1.5	3.16:1	6.32:1	9.63	9.97
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.075	4.5	43	19.8	5	1.83:1	3.65:1	9.63	9.97
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.075	4.5	43	60	15	1:1	2:1	9.63	9.97
K-7355	N-6355	*500 ct	500 ct	-	1.0	.75	.075	4.5	43	60	-	1:1	-	9.97	10.38
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.075	4.5	43	66	17	1:1.1	1.83:1	9.63	9.97
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.075	4.0	68	1.75	.44	6.85:1	13.7:1	9.63	9.97
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.075	4.0	60	3.7	.93	4.47:1	8.94:1	9.63	9.97
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.075	4.0	60	5.9	1.5	3.54:1	7.07:1	9.63	9.97
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.075	4.0	60	25	6.3	1.73:1	3.46:1	9.63	9.97
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.075	4.0	60	66	17	1:1	2:1	9.63	9.97
K-7385**	N-6385**	*600 ct	600 ct	-	1.0	.75	.075	4.0	60	68	-	1:1	-	9.97	10.38
K-7386**	N-6386**	*600 ct	900 ct	-	1.0	.75	.075	4.0	60	104	-	1:1.22	-	9.97	10.38
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.075	4.0	60	116	29	1:1.41	1.41:1	9.63	9.97
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.075	4.0	69	1.75	.44	7.07:1	14.14:1	9.63	9.97
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.075	4.0	62	10.6	2.7	2.65:1	5.29:1	9.63	9.97
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.075	3.5	78	1.75	.44	7.91:1	15.8:1	9.63	9.97
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.075	3.5	74	6	1.5	4.08:1	8.16:1	9.63	9.97
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.075	3.5	74	102	26	1:1	2:1	9.63	9.97
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.075	3.0	90	66	17	1.23:1	2.45:1	9.63	9.97
K-7417**	N-6417**	*900 ct	900 ct	-	1.0	.75	.075	3.0	90	102	-	1:1	-	9.97	10.38
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.075	3.0	115	1.75	.44	9.13:1	18.26:1	9.63	9.97
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.075	3.0	100	5.8	1.5	4.47:1	8.94:1	9.63	9.97
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.075	3.0	75	103	26	1:1	2:1	9.63	9.97
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.075	3.0	115	1.75	.44	9.1:1	18.2:1	9.63	9.97
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.075	3.0	122	1.75	.44	9.68:1	19.4:1	9.63	9.97
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.075	3.0	113	63	16	1.55:1	3.1:1	9.63	9.97
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.075	3.0	113	155	39	1:1	2:1	9.63	9.97
K-7455	N-6455	*1200 ct	1200 ct	-	1.0	.75	.075	3.0	109	150	-	1:1	-	9.97	10.38
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.075	2.5	140	1.75	.44	11.18:1	22.36:1	9.63	9.97
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.075	2.5	150	60	15	1.73:1	3.46:1	9.63	9.97
K-7470	N-6470	*1500 ct	600 ct	-	1.0	.75	.075	2.5	150	66	-	1.58:1	-	9.97	10.38
K-7475	N-6475	*1500 ct	1500 ct	-	1.0	.75	.075	2.5	150	168	-	1:1	-	9.97	10.38
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.075	2.5	140	1.75	.44	11.18:1	22.36:1	9.63	9.97
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.075	2.0	250	1.0	.25	15.8:1	31.6:1	9.63	9.97
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.075	2.0	185	255	64	1:1	2:1	9.63	9.97
K-7490	N-6490	*2000 ct	2000 ct	-	1.0	.75	.075	2.0	175	240	-	1:1	-	9.97	10.38
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.075	2.0	185	1015	254	1:2	1:1	9.63	9.97
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.075	2.0	245	268	68	1:1	2:1	9.63	9.97
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.075	1.8	267	295	74	1:1	2:1	9.63	9.97
K-7505	N-6505	*3000 ct	3000 ct	-	1.0	.75	.075	1.8	267	368	-	1:1	-	9.97	10.38
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.075	1.5	300	413	103	1:1	2:1	9.63	9.97
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.075	1.5	395	2.5	.65	15.8:1	31.6:1	9.63	9.97
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.075	1.5	395	66	17	2.58:1	5.16:1	9.63	9.97

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*	
K-Series Insulated Leads	N-Series Plug-in		SER	PAR	1KHz and HIGHER	400 Hz	150 Hz			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.075	1.5	395	108	27	2:1	4:1	9.63	9.97
K-7520	N-6520	*4000 ct	8000 ct	-	1.0	.75	.075	1.5	390	955	-	1:1.41	-	9.97	10.38
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.075	1.3	450	62	16	3.16:1	6.32:1	9.63	9.97
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.075	1.3	450	620	155	1:1	2:1	9.63	9.97
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.075	1.0	670	6	1.5	12.25:1	24.5:1	10.74	11.06
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.075	1.0	670	11	2.8	8.66:1	17.32:1	10.74	11.06
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.075	1.0	670	66	16.5	3.54:1	7.07:1	10.74	11.06
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.075	1.0	670	268	67	1.73:1	3.46:1	10.74	11.06
K-7555	N-6555	*7500 ct	7500 ct	-	1.0	.75	.075	1.0	670	925	-	1:1	-	11.06	11.85
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.075	1.0	765	1.75	.44	25:1	50:1	10.74	11.06
K-7565	N-6565	8000 ct	1000 ct	250	1.0	.75	.075	1.0	695	106	26.5	2.83:1	5.66:1	10.74	11.06
K-7570	N-6570	*8000 ct	1200 ct	-	1.0	.75	.075	1.0	715	153	-	2.58:1	-	11.06	11.85
K-7575	N-6575	*9000 ct	9000 ct	-	1.0	.75	.075	1.0	925	1020	-	1:1	-	11.06	11.85
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.075	1.0	768	1.6	.4	28:1	56:1	10.74	11.06
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.075	1.0	756	1.7	.43	25:1	50:1	10.74	11.06
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.075	1.0	780	10	2.5	10:1	20:1	10.74	11.06
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.075	1.0	780	24	6	7.07:1	14.14:1	10.74	11.06
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.075	1.0	780	60	15	4.47:1	8.94:1	10.74	11.06
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.075	1.0	780	83	21	4.08:1	8.16:1	10.74	11.06
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.075	1.0	780	106	27	3.16:1	6.32:1	10.74	11.06
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.075	1.0	780	145	36	2.89:1	5.77:1	10.74	11.06
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.075	1.0	780	160	40	2.58:1	5.16:1	10.74	11.06
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.075	1.0	780	300	75	2.24:1	4.47:1	10.74	11.06
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.075	1.0	780	610	153	1.41:1	2.83:1	10.74	11.06
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.075	1.0	780	932	233	1.16:1	2.31:1	10.74	11.06
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.075	1.0	780	1075	269	1:1	2:1	10.74	11.06
K-7645	N-6645	*10,000 ct	10,000 ct	-	1.0	.75	.075	1.0	715	985	-	1:1	-	11.06	11.85
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.075	0.8	1165	52	13	6.12:1	12.25:1	10.74	11.06
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.075	0.8	1165	60	15	5.48:1	10.95:1	10.74	11.06
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.075	0.8	1165	80	20	5:1	10:1	10.74	11.06
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.075	0.8	1165	1050	263	1.22:1	2.45:1	10.74	11.06
K-7665	N-6665	*15,000 ct	15,000 ct	-	.66	.66	.075	0.8	1165	1600	-	1:1	-	11.06	11.85
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.075	0.8	1165	1600	400	1:1	2:1	10.74	11.06
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.075	0.8	1560	108	27	4:1	8:1	10.74	11.06
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.075	0.7	1750	60	15	6.32:1	12.65:1	11.06	11.85
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.075	0.7	1750	82	20.5	5.77:1	11.55:1	11.06	11.85
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.075	0.7	1750	98	24.5	5:1	10:1	11.06	11.85
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.075	0.7	1750	135	34	4.47:1	8.94:1	11.06	11.85
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.075	0.7	1750	610	153	2:1	4:1	11.06	11.85
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.075	0.7	1750	1075	269	1.41:1	2.83:1	11.06	11.85
K-7710	N-6710	*20,000 ct	20,000 ct	-	.5	.5	.075	0.7	1715	2370	-	1:1	-	11.85	12.31
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.075	0.6	2470	60	15	7.07:1	14.14:1	11.06	11.85
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.075	0.6	2470	106	27	5:1	10:1	11.06	11.85
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.075	0.5	2730	6.2	1.6	24.5:1	49:1	11.85	12.31
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.075	0.5	2815	156	39	5:1	10:1	11.85	12.31
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.075	0.5	2730	61	15.3	7.7:1	15.5:1	11.85	12.31
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.075	0.5	2730	24	6	12.2:1	24.5:1	11.85	12.31
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.075	0.5	2730	620	155	2.45:1	4.9:1	11.85	12.31
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.075	0.5	2730	1090	272	1.73:1	3.46:1	11.85	12.31
K-7745	N-6745	*30,000 ct	30,000 ct	-	.33	.33	.075	0.5	2730	3740	-	1:1	-	12.44	13.22
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.075	0.5	3150	53	13	10:1	20:1	12.44	13.22
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.075	0.5	3150	300	75	4.47:1	8.94:1	12.44	13.22
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.075	0.5	3150	548	137	3.16:1	6.32:1	12.44	13.22
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.075	0.5	3150	3075	769	1.41:1	2.83:1	12.44	13.22
K-7770	N-6770	*40,000 ct	40,000 ct	-	.25	.25	.075	0.5	3940	4350	-	1:1	-	14.10	14.73
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.075	0.4	4275	24	6	15.8:1	31.6:1	14.10	14.73
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.075	0.4	4275	60	15	10:1	20:1	14.10	14.73
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.075	0.4	4275	82	21	9.13:1	18.26:1	14.10	14.73
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.075	0.4	4500	6270	1568	1:1	2:1	14.10	14.73
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.075	0.4	5960	1650	412	2:1	4:1	15.50	15.90
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.075	0.4	5960	6	1.5	35.4:1	70.7:1	15.50	15.90
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.075	0.3	7200	1690	423	2.3:1	4.6:1	15.50	15.90
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.075	0.3	7200	9920	2480	1:1	2:1	15.50	15.90
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.075	0.3	7500	1350	338	3:1	6:1	16.10	16.70
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.075	0.3	9550	1635	410	2.5:1	5:1	16.10	16.70
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.075	0.3	10,000	8.5	2.2	40.8:1	81.6:1	16.10	16.70
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.075	0.3	10,000	14	3.5	31.6:1	63.2:1	16.10	16.70
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.075	0.3	10,000	62	15.5	14.1:1	28.3:1	16.10	16.70
K-7813	N-6813	100,000 ct	1000 ct	250	.1	.1	.075	0.3	10,000	140	35	10:1	20:1	16.10	16.70
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.075	0.3	10,000	248	62	7.07:1	14.14:1	16.10	16.70
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.075	0.3	10,000	1075	270	3.16:1	6.32:1	16.10	16.70
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	16.95	17.45
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	16.95	17.45
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	16.95	17.45
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	16.95	17.45
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	16.95	17.45
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	17.45	17.90
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	17.45	17.90
PICO- K-SHIELD MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)														1.20	
PICO-N-SHIELD MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)															1.20

PICO's ultra-miniature transformers

K SERIES
Insulated Leads

N SERIES
Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

(All PICO Products are patented)

Send for new 68 page Pico Catalog

Delivery: Stock to one week

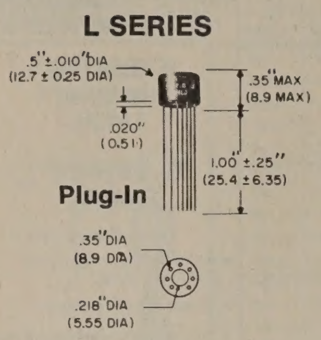
PICO Electronics, Inc.

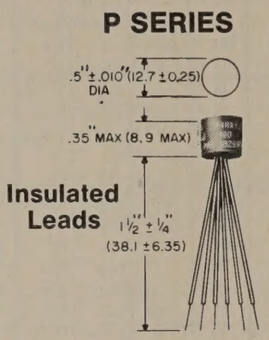
P.O. Box 1206
Mt. Vernon
New York 10551

phone
914-699-5514

For immediate engineering assistance or to place an order—

Call Toll Free 800-431-1064





Dimensions are in inches (MM)

PICO's
ultra-miniature transformers

L SERIES
Plug-In

P SERIES
Insulated Leads

POWER TRANSFORMERS — INDUCTORS

INDUCTORS

PART NUMBER L-Series	PART NUMBER P-Series	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PICO PRICES 1-9* L-Series	PICO PRICES 1-9* P-Series
L-8850	P-9850	SERIES .069 .015 PARALLEL .015 .0037	10 100 20 200	8.5 2	8.11	7.66
L-8855	P-9855	SERIES .17 .04 PARALLEL .04 .01	6 60 12 120	21.4 5.2	8.11	7.66
L-8860	P-9860	SERIES 1.3 .32 PARALLEL .32 .08	2 22 4 44	162 40	8.11	7.66
L-8865	P-9865	SERIES 7.4 1.8 PARALLEL 1.85 .45	0.9 9.0 1.8 18	880 214	8.11	7.66
L-8870	P-9870	SERIES 32 8 PARALLEL 8 2	0.5 4 1 8	3710 904	9.97	9.63
L-8875	P-9875	SERIES 100 25 PARALLEL 25 6.25	0.25 2.5 0.5 5.0	12940 3160	9.97	9.63

Ordering Instructions: No minimum. Net 30 days
F.O.B. Mt. Vernon, New York. P.O. Box 1206

POWER TRANSFORMERS
(FREQ. 380 - 4000 Hz)

MILITARY DESIGNATION TF5S03ZZ

REGULATION APPROXIMATELY 24%. NO LOAD VOLTAGE SET AT APPROXIMATELY +12% OF NOMINAL AND FULL LOAD VOLTAGE AT -12%. POWER LEVEL OF ALL TRANSFORMERS IS .375 WATTS. TEMPERATURE RISE IS APPROXIMATELY 45°C.

PRIMARY VOLTAGE 115 v

PART NUMBER L-Series	PART NUMBER P-Series	SECONDARY VOLTAGE SER	SECONDARY VOLTAGE PAR	SECONDARY CURRENT MILLIAMPS SER	SECONDARY CURRENT MILLIAMPS PAR	PICO PRICES 1-9* L-Series	PICO PRICES 1-9* P-Series
L-8900	P-9900	*115 ct	57.5	3.2	6.4	13.22	12.44
L-8905	P-9905	88 ct	44	4.2	8.4	13.22	12.44
L-8910	P-9910	80 ct	40	4.6	9.2	13.22	12.44
L-8915	P-9915	68 ct	34	5.5	11	13.22	12.44
L-8920	P-9920	56 ct	28	6.6	13.2	13.22	12.44
L-8925	P-9925	36 ct	18	10.4	20.8	13.22	12.44
L-8930	P-9930	24 ct	12	15.5	31	13.22	12.44
L-8935	P-9935	16 ct	8	23	46	13.22	12.44
L-8940	P-9940	12.8 ct	6.4	29	58	13.22	12.44
L-8945	P-9945	10 ct	5	37.5	75	13.22	12.44

PRIMARY VOLTAGE 28v

PART NUMBER L-Series	PART NUMBER P-Series	SECONDARY VOLTAGE SER	SECONDARY VOLTAGE PAR	SECONDARY CURRENT MILLIAMPS SER	SECONDARY CURRENT MILLIAMPS PAR	PICO PRICES 1-9* L-Series	PICO PRICES 1-9* P-Series
L-8950	P-9950	115 ct	57.5	3.2	6.4	13.22	12.44
L-8955	P-9955	88 ct	44	4.2	8.4	13.22	12.44
L-8960	P-9960	80 ct	40	4.6	9.2	13.22	12.44
L-8965	P-9965	68 ct	34	5.5	11	13.22	12.44
L-8970	P-9970	*56 ct	28	6.6	13.2	13.22	12.44
L-8975	P-9975	36 ct	18	10.4	20.8	13.22	12.44
L-8980	P-9980	24 ct	12	15.5	31	13.22	12.44
L-8985	P-9985	16 ct	8	23	46	13.22	12.44
L-8990	P-9990	12.8 ct	6.4	29	58	13.22	12.44
L-8995	P-9995	10 ct	5	37.5	75	13.22	12.44

* INCLUDES ELECTROSTATIC SHIELD

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

FEATURES

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SPECIFICATIONS

- MIL-T-27 (MILITARY DESIGNATION): . . . . . All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case. Power Transformers TF5S03ZZ, Inductors TF5R20ZZ
- DIELECTRIC STRENGTH: . . . . . . All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . . . . Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . 5 Grams
- OPERATING TEMPERATURE: . . . . -55°c to 105°c For Class R, 130°c For Class S.
- TERMINALS: . . . . Solid .016 Diameter Conductor Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK: . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery—
stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-431-1064***

PICO Electronics, Inc.

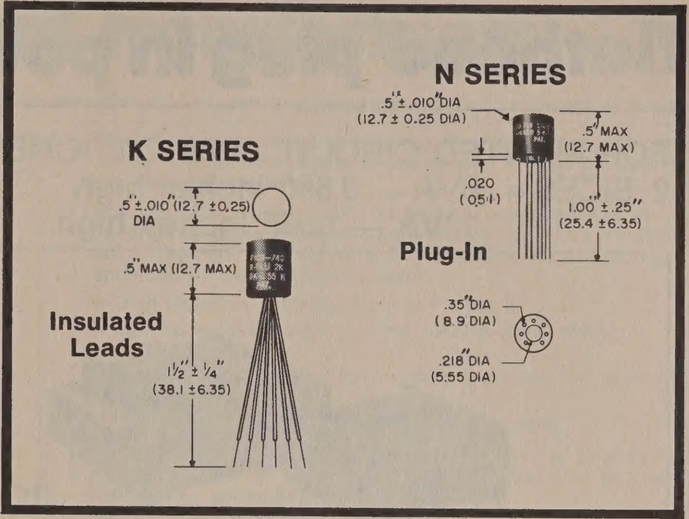
P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

PICO's ultra-miniature transformers

K SERIES
Insulated Leads

N SERIES
Plug-In

POWER TRANSFORMERS—INDUCTORS



Dimensions are in inches (MM)

POWER TRANSFORMERS (FREQ. 380 - 4000 Hz)

MILITARY DESIGNATION TF5S03ZZ

REGULATION APPROXIMATELY 24%. NO LOAD VOLTAGE SET AT APPROXIMATELY +12% OF NOMINAL AND FULL LOAD VOLTAGE AT -12%. POWER LEVEL OF ALL TRANSFORMERS IS .75 WATTS. TEMPERATURE RISE IS APPROXIMATELY 45°C.

PRIMARY VOLTAGE 115v

PART NUMBER K-Series	PART NUMBER N-Series	SECONDARY VOLTAGE SER	SECONDARY VOLTAGE PAR	SECONDARY CURRENT MILLIAMPS SER	SECONDARY CURRENT MILLIAMPS PAR	PICO PRICES 1-9 * K-Series	PICO PRICES 1-9 * N-Series
K-7900	N-6900	*115 ct	57.5	6.5	13	12.44	13.22
K-7905	N-6905	88 ct	44	8.5	17	12.44	13.22
K-7910	N-6910	80 ct	40	9.4	18.8	12.44	13.22
K-7915	N-6915	68 ct	34	11	22	12.44	13.22
K-7920	N-6920	56 ct	28	13.4	26.8	12.44	13.22
K-7925	N-6925	36 ct	18	20.8	41.6	12.44	13.22
K-7930	N-6930	24 ct	12	31	62	12.44	13.22
K-7935	N-6935	16 ct	8	47	94	12.44	13.22
K-7940	N-6940	12.8 ct	6.4	58.6	117	12.44	13.22
K-7945	N-6945	10 ct	5	75	150	12.44	13.22

PRIMARY VOLTAGE 28v

PART NUMBER K-Series	PART NUMBER N-Series	SECONDARY VOLTAGE SER	SECONDARY VOLTAGE PAR	SECONDARY CURRENT MILLIAMPS SER	SECONDARY CURRENT MILLIAMPS PAR	PICO PRICES 1-9 * K-Series	PICO PRICES 1-9 * N-Series
K-7950	N-6950	115 ct	57.5	6.5	13	12.44	13.22
K-7955	N-6955	88 ct	44	8.5	17	12.44	13.22
K-7960	N-6960	80 ct	40	9.4	18.8	12.44	13.22
K-7965	N-6965	68 ct	34	11	22	12.44	13.22
K-7970	N-6970	*56 ct	28	13.4	26.8	12.44	13.22
K-7975	N-6975	36 ct	18	20.8	41.6	12.44	13.22
K-7980	N-6980	24 ct	12	31	62	12.44	13.22
K-7985	N-6985	16 ct	8	47	94	12.44	13.22
K-7990	N-6990	12.8 ct	6.4	58.6	117	12.44	13.22
K-7995	N-6995	10 ct	5	75	150	12.44	13.22

* INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days
F.O.B. Mt. Vernon, New York. P.O. Box 1206

INDUCTORS

PART NUMBER K-Series	PART NUMBER N-Series	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PICO PRICES 1-9 * K-Series	PICO PRICES 1-9 * N-Series
K-7850	N-6850	SERIES { .065 .015 PARALLEL { .015 .0037	10 100 20 200	4.3 1	7.66	8.11
K-7855	N-6855	SERIES { .17 .04 PARALLEL { .04 .01	6 60 12 120	10.7 2.6	7.66	8.11
K-7860	N-6860	SERIES { 1.3 .32 PARALLEL { .32 .08	2 22 4 44	81 20	7.66	8.11
K-7865	N-6865	SERIES { 7.4 1.8 PARALLEL { 1.85 .45	0.9 9.0 1.8 18	440 107	7.66	8.11
K-7870	N-6870	SERIES { 32 8 PARALLEL { 8 2	0.5 4 1 8	1855 452	7.66	8.11
K-7875	N-6875	SERIES { 100 25 PARALLEL { 25 6.25	9.25 2.5 0.5 5.0	6470 1580	9.63	9.97

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

SPECIFICATIONS

• MIL-T-27 (MILITARY DESIGNATION):	All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case. Power Transformers TF5S03ZZ, Inductors TF5R20ZZ
• DIELECTRIC STRENGTH:	All Units Tested at 200 V RMS
• INSULATION RESISTANCE:	Greater than 10,000 Megohms at 300 V DC
• WEIGHT:	7.5 Grams
• OPERATING TEMPERATURE: . . .	-55°c to 105°c For Class R, 130°c For Class S.
• TERMINALS:	Solid .016 Diameter Conductor Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
• THERMAL SHOCK:	25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.
- ALL POSSIBLE LEAD SPACINGS AVAILABLE - CONTACT FACTORY FOR PIN LAYOUT SAME AS DUAL IN-LINE INTEGRATED CIRCUITS ("DIP" PACKAGE).

Delivery—
stock to one week

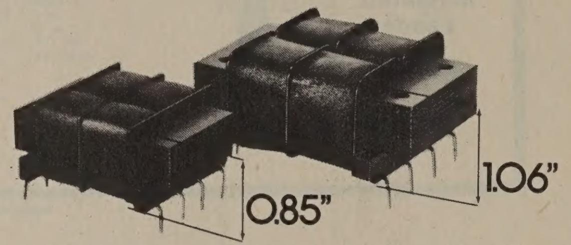
*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

flathead® plug in power transformers

FOR PRINTED CIRCUIT APPLICATIONS
2 SIZES — 6VA — 0.850 inches high
12VA — 1.065 inches high



LOW PROFILE: Allows 1 inch card spacing for 6va units or 1¼ inch card spacing for 12va units.

DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

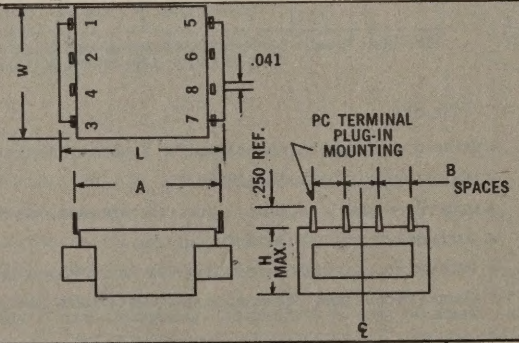
1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

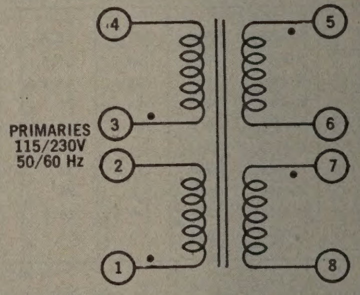
The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.

Part No.	Size	SECONDARY*	
		Series	Parallel
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

* Regulation of Size 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.



Size	L	W	H	A	B	Oz.
6	1⅞	1 9/16	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11



*INDICATES LIKE POLARITY

"Always in Stock" — "THE PRONTO CHALLENGE: — We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

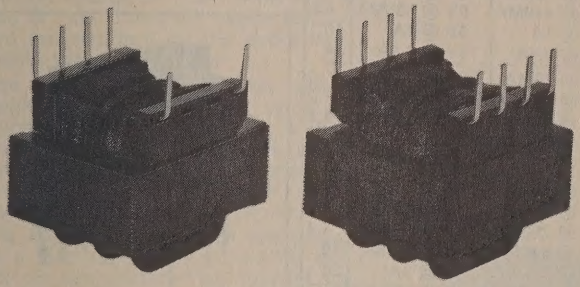
"See page 4459 for prices"

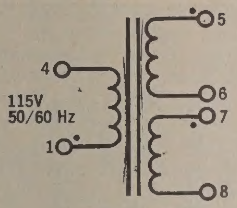
signal TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

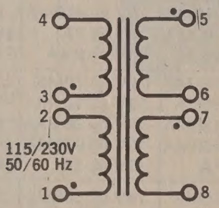
split/tran® p.c. board transformers

SPLIT BOBBIN—HIGHLY ISOLATED

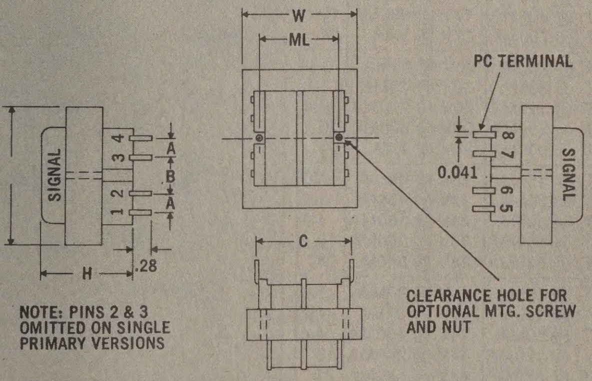




6 PIN
TYPE ST



8 PIN
TYPE DST



NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS

CLEARANCE HOLE FOR OPTIONAL MTG. SCREW AND NUT

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
3	2.4	1⅜	1⅛	1³⁄₁₆	¹⁵⁄₁₆	.250	.250	1.200	None	0.25
4	6	1⅝	1⁵⁄₁₆	1⁵⁄₁₆	1¹⁄₁₆	.250	.350	1.280	4-40 x 1⅜ Nylon	0.44
5	12	1⅞	1⁹⁄₁₆	1⁷⁄₁₆	1¼	.300	.400	1.410	4-40 x 1⅜ Nylon	0.70
6	20	2¼	1⅞	1⁷⁄₁₆	1½	.300	.400	1.600	4-40 x 1⅜ Nylon	0.80

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — 2500V hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST-4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28V @ 0.7A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

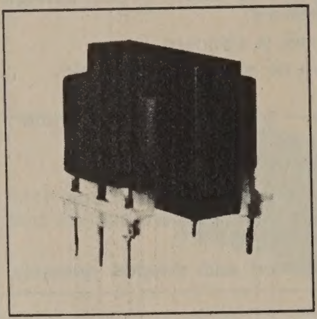
"Always in Stock"—"THE PRONTO CHALLENGE:—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

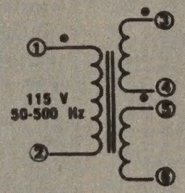
"See page 4459 for prices"

signal
TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

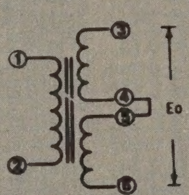
miniature plug in power transformers

SINGLE 115V PRIMARY TYPE PC 6 PINS

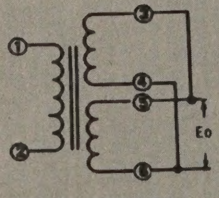




BASIC SCHEMATIC



SERIES CONNECTED

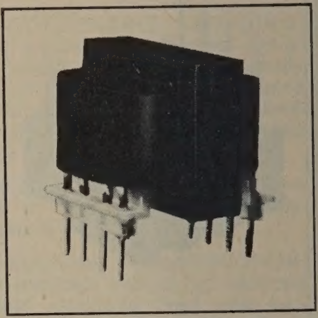


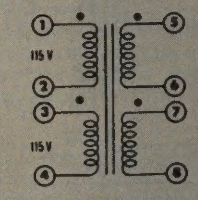
PARALLEL CONNECTED

PRIMARY 50/500 Hz		SECONDARY RMS RATING*		Size (VA)
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	
PC 10-90	DPC 10-90	10V C.T. @ 90MA	5V @ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T. @ 120MA	5V @ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T. @ 440MA	5V @ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T. @ 1A	5V @ 2A	10
PC 10-2400	DPC 10-2400	10V C.T. @ 2.4A	5V @ 4.8A	24
PC 12-70	DPC 12-70	12.6V C.T. @ 70MA	6.3V @ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T. @ 100MA	6.3V @ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T. @ 350MA	6.3V @ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T. @ 800MA	6.3V @ 1.6A	10
PC 12-2000	DPC 12-2000	12.6V C.T. @ 2A	6.3V @ 4A	24
PC 16-55	DPC 16-55	16V C.T. @ 55MA	8V @ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T. @ 75MA	8V @ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T. @ 260MA	8V @ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T. @ 640MA	8V @ 1.28A	10
PC 16-1500	DPC 16-1500	16V C.T. @ 1.5A	8V @ 3A	24
PC 20-45	DPC 20-45	20V C.T. @ 45MA	10V @ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T. @ 60MA	10V @ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T. @ 220MA	10V @ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T. @ 500MA	10V @ 1A	10
PC 20-1200	DPC 20-1200	20V C.T. @ 1.2A	10V @ 2.4A	24
PC 24-35	DPC 24-35	24V C.T. @ 35MA	12V @ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T. @ 50MA	12V @ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T. @ 180MA	12V @ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T. @ 450MA	12V @ 900MA	10
PC 24-1000	DPC 24-1000	24V C.T. @ 1A	12V @ 2A	24
PC 28-30	DPC 28-30	28V C.T. @ 30MA	14V @ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T. @ 40MA	14V @ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T. @ 160MA	14V @ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T. @ 360MA	14V @ 720MA	10
PC 28-800	DPC 28-800	28V C.T. @ 800MA	14V @ 1.6A	24
PC 34-25	DPC 34-25	34V C.T. @ 25MA	17V @ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T. @ 35MA	17V @ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T. @ 125MA	17V @ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T. @ 300MA	17V @ 600MA	10
PC 34-700	DPC 34-700	34V C.T. @ 700MA	17V @ 1.4A	24
PC 40-20	DPC 40-20	40V C.T. @ 20MA	20V @ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T. @ 30MA	20V @ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T. @ 110MA	20V @ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T. @ 250MA	20V @ 500MA	10
PC 40-600	DPC 40-600	40V C.T. @ 600MA	20V @ 1.2A	24
PC 56-15	DPC 56-15	56V C.T. @ 15MA	28V @ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T. @ 20MA	28V @ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T. @ 80MA	28V @ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T. @ 180MA	28V @ 360MA	10
PC 56-420	DPC 56-420	56V C.T. @ 420MA	28V @ 840MA	24
PC 88-10	DPC 88-10	88V C.T. @ 10MA	44V @ 20MA	1.0
PC 88-15	DPC 88-15	88V C.T. @ 15MA	44V @ 30MA	1.2
PC 88-50	DPC 88-50	88V C.T. @ 50MA	44V @ 100MA	4.4
PC 88-120	DPC 88-120	88V C.T. @ 120MA	44V @ 240MA	10
PC 88-270	DPC 88-270	88V C.T. @ 270MA	44V @ 540MA	24
PC 120-8	DPC 120-8	120V C.T. @ 8MA	60V @ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T. @ 10MA	60V @ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T. @ 35MA	60V @ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T. @ 85MA	60V @ 170MA	10
PC 120-200	DPC 120-200	120V C.T. @ 200MA	60V @ 400MA	24
PC 180-6	DPC 180-6	180V C.T. @ 6MA	90V @ 12MA	1.2
PC 180-24	DPC 180-24	180V C.T. @ 24MA	90V @ 48MA	4.4
PC 180-55	DPC 180-55	180V C.T. @ 55MA	90V @ 110MA	10
PC 180-130	DPC 180-130	180V C.T. @ 130MA	90V @ 260MA	24
PC 230-5	DPC 230-5	230V C.T. @ 5MA	115V @ 10MA	1.2
PC 230-20	DPC 230-20	230V C.T. @ 20MA	115V @ 40MA	4.4
PC 230-40	DPC 230-40	230V C.T. @ 40MA	115V @ 80MA	10
PC 230-100	DPC 230-100	230V C.T. @ 100MA	115V @ 200MA	24

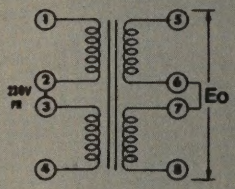
* See Table on opposite page for method of determining RMS Secondary Current.

DUAL 115/230V PRIMARY TYPE DPC 8 PINS

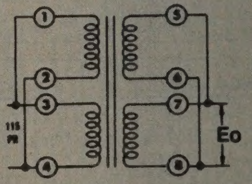




BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED

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"See page 4459 for prices"

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for printed circuits applications

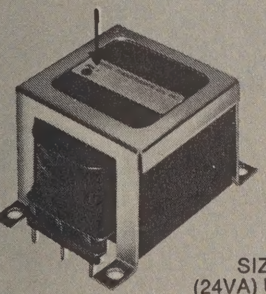
Signal has the most complete and diversified selection of miniature plug-in power transformers. **All items are stocked in depth for immediate off-the-shelf delivery.**

Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC - 8 Pin) are standard for the entire line. 1000V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



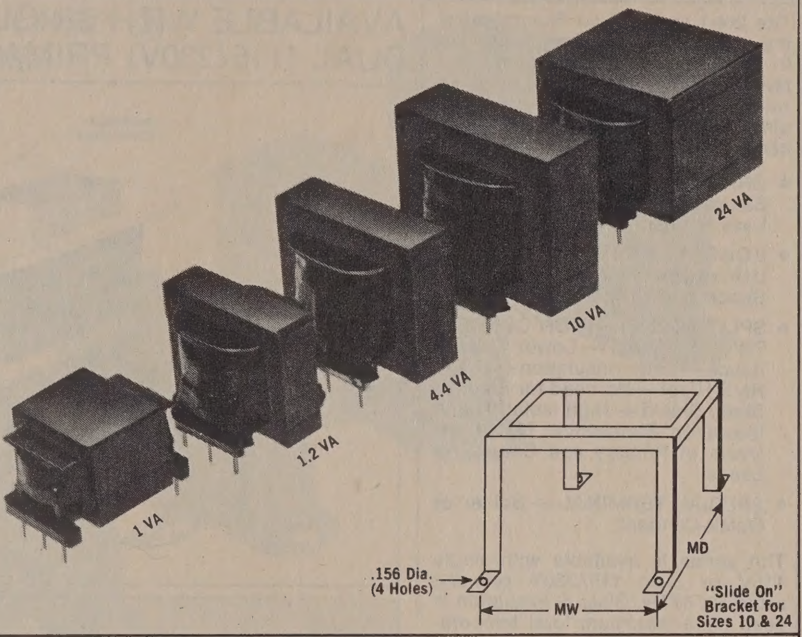
SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

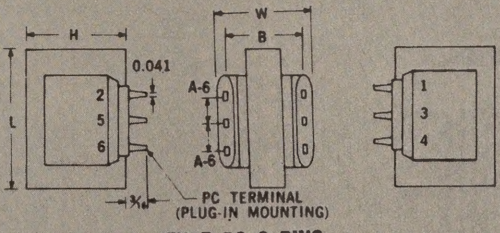
For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.



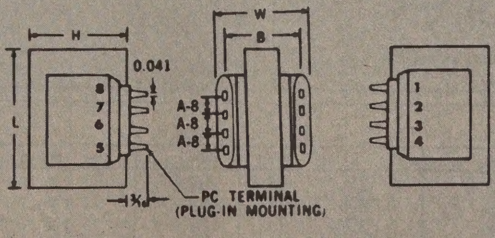
DIMENSIONS

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (oz.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1⅜	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1⅜	1⅛	1³⁄₁₆	0.312	0.200	1.000	3	—	—	—
4.4	1⅝	1¼	1⅜	0.400	0.250	1.100	5	—	—	—
10	1⅞	1⁷⁄₁₆	1⅝	0.400	0.250	1.300	9	10-BR	1⁴¹⁄₆₄	1⅛
24	1⅝	2¼	1⅜	0.400	0.250	2.100	12	24-BR	1⅜	2

* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add 1⁄32" to the height of the transformer.



TYPE PC 6 PINS



TYPE DPC 8 PINS

"Always in Stock"—"THE PRONTO CHALLENGE:—We ship your prototypes (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

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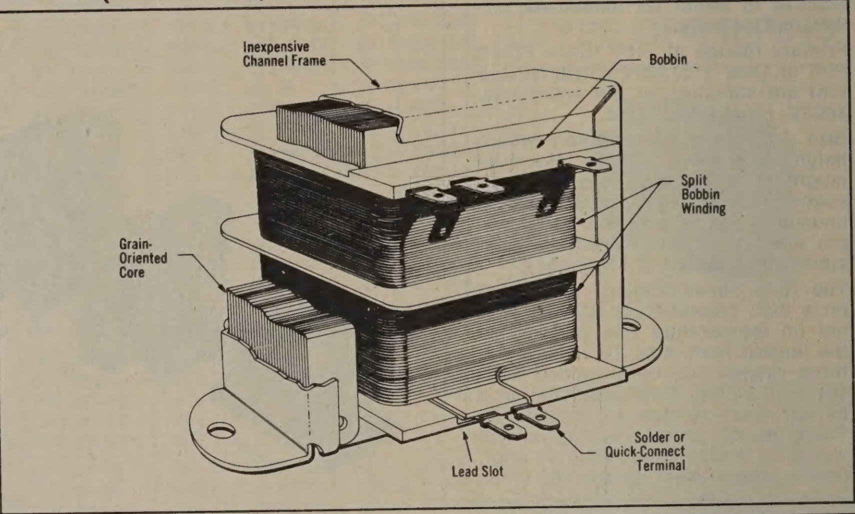
cut size and weight with "2-4-1"

The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

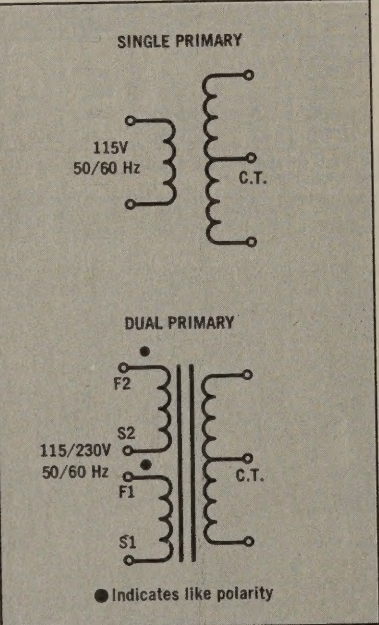
- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 125°C continuous.

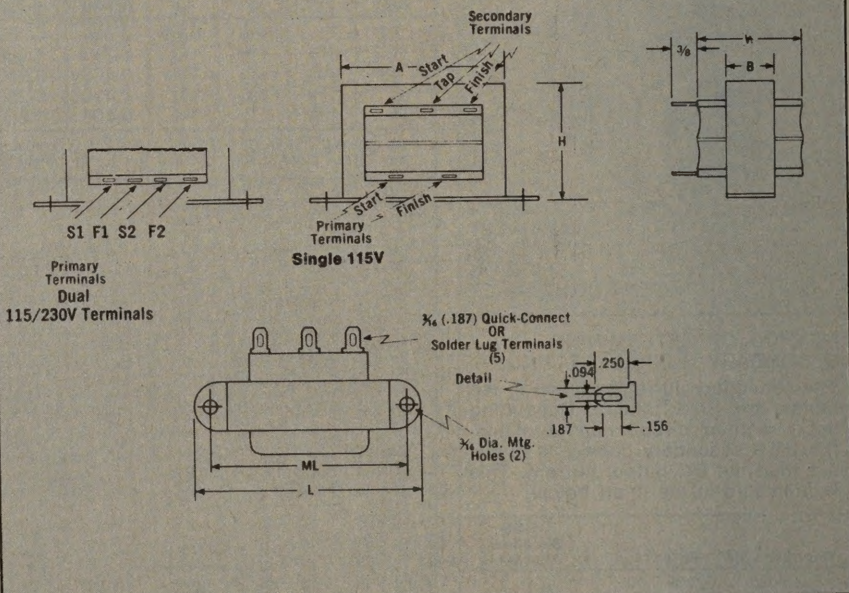
AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES



Inexpensive Channel Frame
Bobbin
Split Bobbin Winding
Grain-Oriented Core
Solder or Quick-Connect Terminal
Lead Slot



SINGLE PRIMARY
115V
50/60 Hz
C.T.
DUAL PRIMARY
F2
S2
115/230V
50/60 Hz
F1
S1
C.T.
● Indicates like polarity



Secondary Terminals
A
Start
Tap
Finish
H
3/8
W
B
S1 F1 S2 F2
Primary Terminals
Dual 115/230V Terminals
Start
Finish
Primary Terminals
Single 115V
3/16 (.187) Quick-Connect OR Solder Lug Terminals (5)
Detail
.094
.250
.187
.156
3/16 Dia. Mtg. Holes (2)
ML
L

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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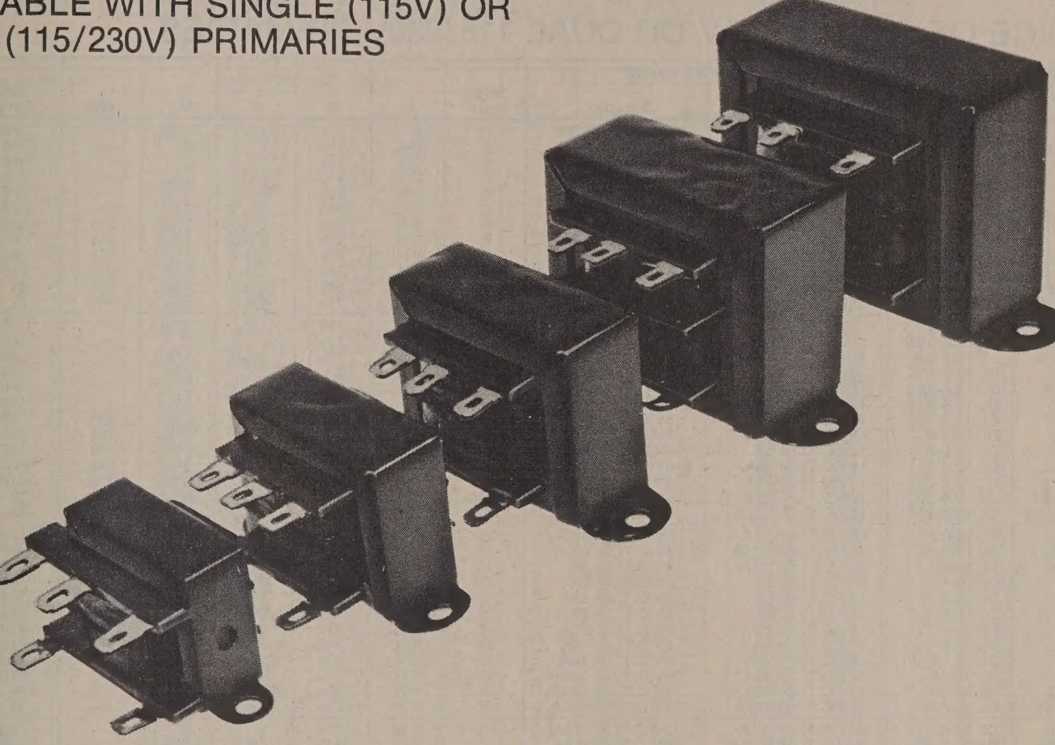
series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES



METHOD OF DETERMINING
SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quite on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	3	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number		Secondary RMS Ratng	Part Number		Secondary RMS Rating
Single 115V	Dual 115/23V		Single 115V	Dual 115/230V	
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0.2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

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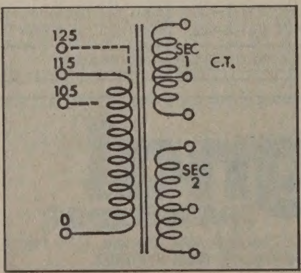
rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

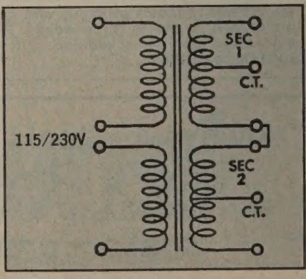
Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
10-0.1	DL 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	2	1½	1¾	1 23/32	—	#8	0.3
10-0.25	DL 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	2⅜	1½	2	2	—	#8	0.5
10-0.5	DL 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	2⅜	1¾	2	2	—	#8	0.8
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3⅜	3⅛	2 13/16	2 13/16	2½	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5¼	5½	4⅜	4⅜	3⅝	¼	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
12.8-0.1	DL 12.8-0.1	12V C.T. @ 0.1A	6V C.T. @ 0.2A	C	2	1½	1¾	1 23/32	—	#8	0.3
12.8-0.25	DL 12.8-0.25	12V C.T. @ 0.25A	6V C.T. @ 0.5A	C	2⅜	1½	2	2	—	#8	0.5
12.8-0.5	DL 12.8-0.5	12V C.T. @ 0.5A	6V C.T. @ 1A	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8
12.8-1	DL 12.8-1	12V C.T. @ 1A	6V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
12.8-2A	DL 12.8-2A	12V C.T. @ 2A	6V C.T. @ 4A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
12.8-2	DL 12.8-2	12V C.T. @ 2A	6V C.T. @ 4A	B	3	2½	2½	2½	2	#8	2.3
12.8-4	DL 12.8-4	12V C.T. @ 4A	6V C.T. @ 8A	B	3	2⅞	2½	2½	2⅜	#8	2.8
12.8-6	DL 12.8-6	12V C.T. @ 6A	6V C.T. @ 12A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
12.8-8	DL 12.8-8	12V C.T. @ 8A	6V C.T. @ 16A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
12.8-12	DL 12.8-12	12V C.T. @ 12A	6V C.T. @ 24A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	6.0
12.8-25	DL 12.8-25	12V C.T. @ 25A	6V C.T. @ 50A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.5
12.8-50‡	DL 12.8-50	12V C.T. @ 50A	6V C.T. @ 100A	B	5¼	6	4⅜	4⅜	4⅛	¼	20.7
12.8-100‡	DL 12.8-100	12V C.T. @ 100A	6V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
16-0.1	DL 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	2	1⅝	1¾	1 23/32	—	#8	0.4
16-0.25	DL 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	2⅜	1¾	2	2	—	#8	0.7
16-0.5	DL 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3¾	3⅛	3⅛	3⅛	2¼	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3¾	3½	3⅛	3⅛	2⅝	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4⅛	3⅞	3⅝	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4½	5⅜	4	3¾	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7½	7½	6⅜	6¾	4⅝	¼	50.0
24-0.1	DL 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	2⅜	1½	2	2	—	#8	0.5
24-0.25	DL 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0
24-0.5	DL 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
24-1A	DL 24-1A	24V C.T. @ 1A	12V C.T. @ 2A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2½	2½	2½	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2⅞	2½	2½	2⅜	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4⅛	3⅞	3⅝	3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5¼	4¾	4⅜	4⅜	3⅜	¼	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5¼	5⅝	4⅜	4⅜	4⅛	¼	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6⅜	6¼	5 5/16	5 5/16	4⅜	¼	31.3
——	24-100 △	24V C.T. @ 100A	12V'C.T. @ 200A	B	7½	7	6⅜	6¾	4⅛	¼	43.0
36-0.1	DL 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	2⅜	1⅝	2	2	—	#8	0.5
36-0.25	DL 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8
36-0.5	DL 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	3⅛	2	2¾	2 13/16	—	#8	1.3
36-1A	DL 36-1A	36V C.T. @ 1A	18V C.T. @ 2A	C	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.3
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2¾	2½	2½	2¼	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4½	4½	4⅛	3¾	3⅜	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6⅜	6	5 5/16	5 5/16	4⅜	¼	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	40.0
——	36-100△	36V C.T. @ 100A	18V C.T. @ 200A	B	7½	9	6¼	6¾	5 7/16	¼	63.5
56-0.1	DL 56-0.1	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	2⅜	1¾	2	2	—	#8	0.8
56-0.25	DL 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
56-0.5	DL 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4⅛	3¾	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5¼	5	4⅜	4⅜	3⅝	¼	17.0
56-12†	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6⅜	5¼	5 5/16	5 5/16	3⅜	¼	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6⅜	7⅛	5 5/16	5 5/16	5⅛	¼	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7½	7½	6¼	6¾	4⅞	¼	56.3
——	56-100△	56V C.T. @ 100A	28V C.T. @ 200A	B	7½	11¼	6¼	6¾	8¼	¼	95.0

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.



All transformers are designed conservatively for a max of 45°C rise above ambient and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.



rectifier power transformers

IDEAL FOR USE IN SINGLE OR DUAL DC POWER SUPPLIES

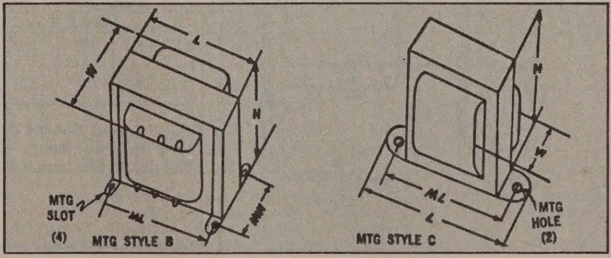
Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
68-0.1	DL 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8
68-0.25	DL 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
68-0.5A	DL-68-0.5A	68V C.T. @ 0.5A	34V C.T. @ 1A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
68-0.5	DL 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	B	3	2¾	2½	2½	2¼	#8	2.7
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4½	4½	3¾	3¾	3⅜	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	39.7
——	68-50△	68V C.T. @ 50A	34V C.T. @ 100A	B	7½	9	6¼	6¾	5 7/16	¼	58.5
80-0.1	DL 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	2⅞	1⅝	2 5/16	2⅜	—	#8	0.8
80-0.25	DL 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	3⅛	2	2¾	2 13/16	—	#8	1.3
80-0.5A	DL 85-0.5A	80V C.T. @ 0.5A	40V C.T. @ 1A	C	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.2
80-0.5	DL 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	B	3	2¾	2½	2½	2¼	#8	2.8
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5¼	4¼	4⅜	4⅜	2⅞	¼	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5¼	5½	4¾	4⅜	3⅞	¼	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6⅜	5¼	5 5/16	5 5/16	3¼	¼	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6⅜	6	5 5/16	5 5/16	4⅛	¼	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7½	6½	6¼	6¾	3⅞	¼	40.3
——	80-50△	80V C.T. @ 50A	40V C.T. @ 100A	B	7½	9	6¼	6¾	6½	¼	78.0
88-0.1	DL 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	2⅞	1¾	2 5/16	2⅜	—	#8	1.0
88-0.25	DL 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
88-0.5	DL 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	B	3 9/16	2⅜	3 1/16	3⅛	—	#8	2.2
88-1	DL 88-1	88V C.T. @ 1A	44V C.T. @ 2A	B	3¾	3	3⅛	3⅛	2¼	#8	4.5
88-2	DL 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
88-4	DL 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	5¼	4½	4⅜	4⅜	3⅛	¼	13.4
88-6‡	DL 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	5¼	5½	4¾	4⅜	3⅞	¼	19.0
88-8‡	DL 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8
88-12‡	DL 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	6⅜	6½	5 5/16	5 5/16	4⅝	¼	35.0
——	88-25△	88V C.T. @ 25A	44V C.T. @ 50A	B	7½	8	6¼	6¾	5⅝	¼	62.0
——	88-50△	88V C.T. @ 50A	44V C.T. @ 100A	B	7½	11	6¼	6¾	8⅝	¼	100.0
120-0.5	DL 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.2
120-1	DL 120-1	120V C.T. @ 1A	60V C.T. @ 2A	B	3¾	3⅜	3⅛	3⅛	2¾	#8	5.8
120-2	DL 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	4½	3¾	3¾	3¾	2¾	#10	8.5
120-4	DL 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	5¼	5½	4⅜	4⅜	3⅞	¼	17.0
120-6‡	DL 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	6⅜	6	5 5/16	5 5/16	3⅞	¼	27.0
120-8‡	DL 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	6⅜	6½	5 5/16	5 5/16	4⅝	¼	34.0
120-12‡	DL 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	6⅜	7¼	5 5/16	5 5/16	5⅜	¼	42.0
120-20‡	DL 120-20	120V C.T. @ 20A	60V C.T. @ 40A	B	7½	8	6¼	6¾	5⅜	¼	57.0
160-0.5	DL 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
160-1	DL 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	4⅛	3⅝	3 7/16	3 7/16	2⅝	#10	6.5
160-2	DL 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	4½	4⅜	3¾	3¾	3⅜	#10	11.0
160-4‡	DL 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	6⅜	5¼	5 5/16	5 5/16	3¼	¼	21.0
160-8‡	DL 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	6⅜	6¾	5 5/16	5 5/16	4⅞	¼	36.0
——	160-12△	160V C.T. @ 12A	80V C.T. @ 24A	B	7½	6½	6¼	6¾	3⅞	¼	39.8
180-0.5	DL 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	B	3¾	3⅜	3⅛	3⅛	2¾	#8	5.8
180-1	DL 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	4⅛	3⅞	3⅝	3 7/16	3	#10	8.2
180-2	DL 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	5¼	5	4⅜	4⅜	3⅝	¼	15.8
180-4	DL 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	27.0
180-6‡	DL 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	37.0
180-8‡	DL 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	6⅜	7¾	5 5/16	5 5/16	5⅝	¼	42.0
180-12‡	DL 180-12	180V C.T. @ 12A	90V C.T. @ 24A	B	7½	8¼	6¼	6¾	5⅝	¼	62.0
230-0.5	DL 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	B	3¾	3⅝	3⅛	3⅛	3	#8	6.5
230-1	DL 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	4½	3¾	3¾	3¾	3	#10	9.4
230-2	DL 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	5¼	4¾	4⅜	4⅜	3⅜	¼	14.5
230-4‡	DL 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	6⅜	6	5 5/16	5 5/16	4⅛	¼	28.4
230-6‡	DL 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	38.0
300-0.5	DL 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	4½	3½	3¾	3¾	2½	#10	7.0
300-1	DL 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	5¼	4⅛	4⅜	4⅜	3	¼	12.8
300-2	DL 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	5¼	5¾	4⅜	4⅜	4½	¼	21.0
300-4‡	DL 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	6⅜	5¾	5 5/16	5 5/16	3⅞	¼	27.5

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.



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"See page 4459 for prices"

signal TRANSFORMER

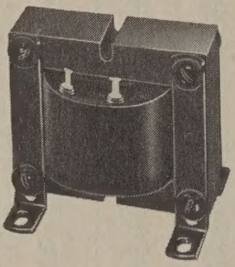
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

filter chokes

0.5 TO 1000 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

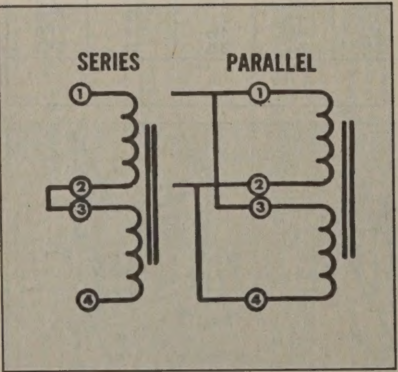


FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-0.5	400	0.5	4.0	C	3⅛	2⅛	2¾	2¹³⁄₁₆	—	#8	1.5
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2¹³⁄₁₆	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3⁷⁄₁₆	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4⁷⁄₁₆	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4⁷⁄₁₆	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4⁷⁄₁₆	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4⁷⁄₁₆	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5⁵⁄₁₆	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5⁵⁄₁₆	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5⁵⁄₁₆	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7	6½	6¾	4⅛	¼	48.0
CH-250	0.3	250	0.00115	B	7½	8	6½	6¾	5⅛	¼	56.0
CH-500	0.055	500	0.00027	B	7½	6½	6½	6¾	4⅛	¼	50.0
CH-1000	0.015	1,000	0.000065	B	7½	6½	6½	6¾	4⅜	¼	70.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS



Part No.	Series Connected			Parallel Connected			Mtg. Style	Dimensions					Mtg. Screw	Appr. Lbs.
	Ind. (MHY)	Curr. (Amps)	Res. Ω	Ind. (MHY)	Curr. (Amps)	Res. Ω		L	W	H	ML	MW		
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2⁵⁄₁₆	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2¹³⁄₁₆	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3¹⁄₁₆	2¹³⁄₁₆	2¹³⁄₁₆	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3⁹⁄₁₆	2¹³⁄₁₆	2¹³⁄₁₆	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for applications requiring lower inductance values at high currents, such as low voltage, DC supplies or SCR filters.

"Always in Stock"—"THE PRONTO CHALLENGE:—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 4459 for prices"

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TRANSFORMER

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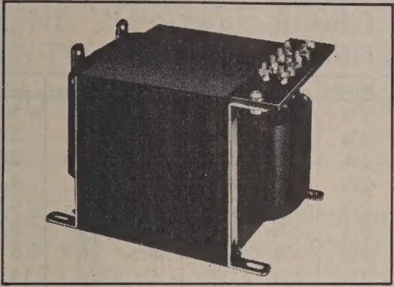
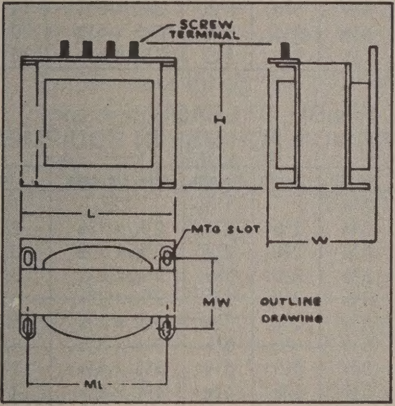
very high current transformers/chokes

6 TO 24 VOLTS
250 TO 1400 AMPERES





TRANSFORMERS

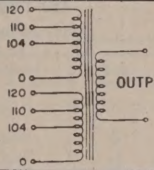
Part No.	Secondary Volts	Secondary Amps. Nominal (45°C rise)	Secondary Amps. Max. (100°C rise)	Dimensions L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
6-250	6	250	350	7½	5	7¼	6¾	3 9/16	¼	32
9-250	9	250	350	7½	5¾	7¼	6¾	4 5/16	¼	40
12-250	12	250	350	7½	6¼	7¼	6¾	4 13/16	¼	48
24-250	24	250	350	7½	9	7¼	6¾	7 9/16	¼	80
6-500	6	500	700	7½	6	7¼	6¾	4 9/16	¼	40
9-500	9	500	700	7½	8½	7¼	6¾	6 1/16	¼	60
12-500	12	500	700	7½	9	7¼	6¾	7 9/16	¼	80
24-500	24	500	700	9	13	8	7½	8½	¼	140
3-1000	3	1000	1400	7½	6	7¼	6¾	4 9/16	¼	40
6-1000	6	1000	1400	7½	9	7¼	6¾	7 9/16	¼	80
12-1000	12	1000	1400	9	13	8	7½	8½	¼	140

CHOKES

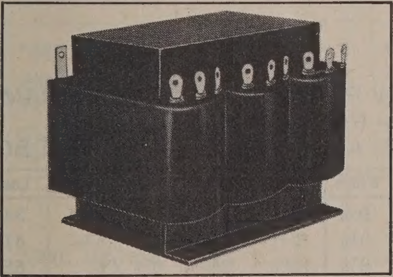
Part No.	Inductance (Milli-hy)	Current (Amperes)	Resis. (Ohms)	Dimensions L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-250	.3	250	.00115	7½	8	6¼	6¾	5⅛	¼	56
CH-500	.055	500	.00027	7½	6½	6¼	6¾	4⅛	¼	50
CH-1000	.015	1000	.000065	7½	7½	6¼	6¾	5⅛	¼	70

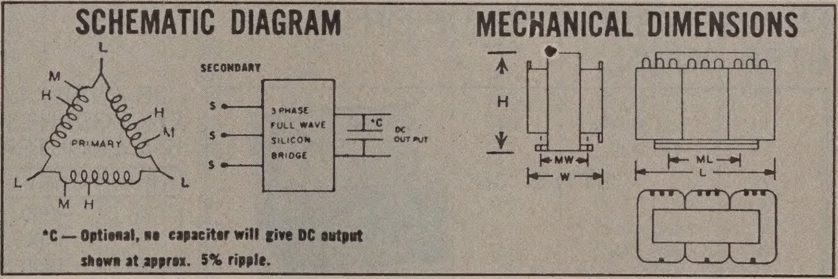
As shown on the schematic diagram dual primaries are provided. This permits parallel connection for 104, 110, or 120 volts or series connection for 208, 214, 220, 230, and 240 volts. Frequency range is 50 to 500 cps.

It is important to note that primary taps may be used to adjust the secondary voltages. Line voltages up to 125V (parallel) or 250V (series) may be used on the lowest primary tap. Nickel plated screw terminals are provided on a heavy phenolic board for easy primary connections.



3 phase high current rectifier transformers





*C — Optional, no capacitor will give DC output shown at approx. 5% ripple.

DC OUTPUT VOLTAGE

Part No.	Pri Tap "L" Supply Voltage 208	Pri Tap "L" Supply Voltage 220	Pri Tap "M" Supply Voltage 208	Pri Tap "M" Supply Voltage 220	Pri. Tap "H" Supply Voltage 208	Pri. Tap "H" Supply Voltage 220	DC Rated Amps	Approximate Dimensions L	W	H	ML	MW	Approx. Lbs.
3PH 24-50	24	25	26	27.5	28	30	50	7¾	6	5½	4.8	4⅞	35
3PH 24-100	24	25	26	27.5	28	30	100	11½	5	8¼	7.2	4	62
3PH 24-200	24	25	26	27.5	28	30	200	11½	8⅝	8¼	7.2	6¼	90
3PH 48-30	42	44	47	50	52	55	30	7¾	6	5½	4.8	4⅞	35
3PH 48-60	42	44	47	50	52	55	60	11½	5	8¼	7.2	4	62
3PH 48-120	42	44	47	50	52	55	120	11½	8⅝	8¼	7.2	6¼	90

At higher power loads (above 2-3 KVA) it becomes inefficient to use single phase 115 or 230 volt standard lines. With this in mind, our engineering staff has developed a line of 3 phase transformers for use off 208 or 220V 3 phase power lines. These offer the significantly higher conversion efficiency and lighter power line drain of 3 phase systems. Since the principal applicaiton of these items is in high power dc power supplies, output ratings are given in dc voltage and current assuming the use of a 3 phase full wave rectifier.

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TRANSFORMER

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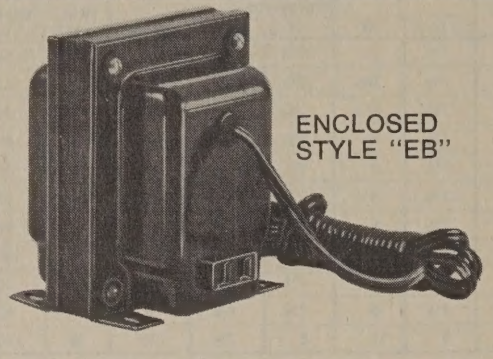
step down auto transformers

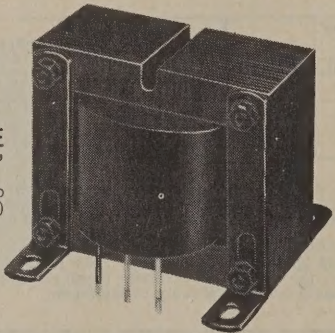
50/60 Hz 100-2000 VA — 230/115V



ENCLOSED
STYLE "EB"

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1¹¹⁄₁₆	1.5
120	112	2⅞	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2⁷⁄₁₆	5.5
500	150	3¼	4⅞	3⅞	2½ x 3⁷⁄₁₆	8
750	175	3¼	5⅞	3⅞	2½ x 4⁷⁄₁₆	11
1000	1100	4½	5⅛	5½	3½ x 3½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26



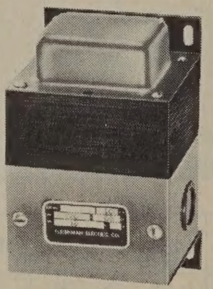
OPEN FRAME
STYLE "OF"
(May be used step-up or step-down)

BLACK ENAMEL FINISH. 8″ LEADS INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1¹⁵⁄₁₆	2¹³⁄₁₆	1.3
120	112-OF	3⅜	2½	2⅞	2¹³⁄₁₆ x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2¹³⁄₁₆ x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2¹³⁄₁₆ x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2¹³⁄₁₆ x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

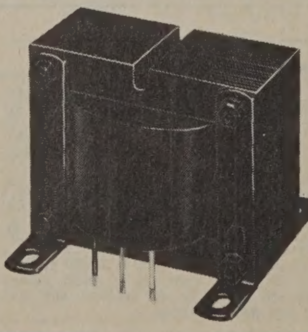
HEAVY DUTY — 3 TO 6 KVA
230/115V OR 115/230V. MAY BE USED STEP-UP OR STEP-DOWN

STYLE "JB"



"JB." VERY LOW REGULATION. BLACK ENAMEL ENCLOSURES — PANEL MOUNTED KNOCKOUTS ON ALL SIDES OF JUNCTION BOX.

KVA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
3	1300	9⅛	9	6⅝	8⅛ x 4¼	34
4	1400	9⅛	9½	6⅝	8⅛ x 4¾	41
5	1500	9⅛	10⅝	6⅝	8⅛ x 6	55
6	1600	9⅛	11¼	6⅝	8⅛ x 6½	60



STYLE "OF"

"OF." BLACK ENAMEL FINISH. OPEN FRAME. 8″ LEADS. INEXPENSIVE VERSION FOR USE IN EQUIPMENT.

KVA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
3	1300-OF	7⅛	5½	6⅛	5¹³⁄₁₆ x 3¾	30
4	1400-OF	7⅛	6	6⅛	5¹³⁄₁₆ x 4¼	36
5	1500-OF	7⅛	7	6⅛	5¹³⁄₁₆ x 5½	51
6	1600-OF	7⅛	8½	6⅛	5¹³⁄₁₆ x 6	54

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voltage regulators

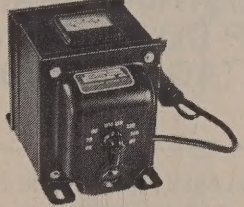
MANUALLY CONTROLLED
LINE VOLTAGE ADJUSTMENT
65 TO 145V OR 145 TO 245V.
OUTPUTS 115V OR 230V.

Easy Line Voltage Adjustment: Switch provided for 65 to 145V or 145 to 245V inputs, 50/60 cycle.

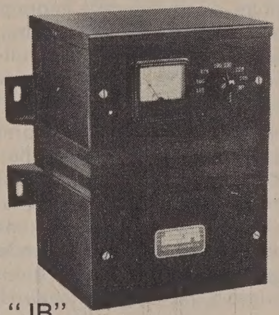
Built-in Meter: Output continuously monitored with Red Line at 115V or 230V output, as required.

Simple Installation: Up to 2KVA (Style EB): Receptacle and Line Cord with Plug.

Over 2KVA (Style JB): Enclosed Junction Box, Panel Mounted with Leads. Knockouts provided on all sides.



STYPE "EB"



STYLE "JB"

	VA	Cat. No.	Style	Width	Depth	Height	Mtg. Centers	Lbs.
"300" SERIES INPUT RANGE: 65-75-90-100-115-130-145V. OUTPUT: 115V. — 50/60 CYCLE	150	315	EB	3⅞	7	4⅞	3 x 5	5.5
	350	335	EB	3⅞	7⅝	4⅞	3½ x 5⅝	8
	500	350	EB	3⅞	7⅝	4⅞	3½ x 5⅞	9
	750	375	EB	3⅞	9⅛	4⅞	3½ x 7⅛	14.2
	1000	3100	EB	4½	9	5⅝	3½ x 7 9/16	15.5
	1500	3150	EB	4½	10½	5⅝	3½ x 8	23.5
	2000	3200	JB	9⅛	10⅛	7½	8⅛ x 4	32
	3000	3300	JB	9⅛	10⅝	7½	8⅛ x 4½	37
	5000	3500	JB	9⅛	12½	7½	8⅛ x 6½	60
"400" SERIES INPUT RANGE: 65-75-90-100-115-130-145V. OUTPUT: 230V. — 50/60 CYCLE	150	415	EB	3⅞	7¼	4⅞	3 x 5¼	5
	350	435	EB	3⅞	8¼	4⅞	3½ x 6¼	10
	500	450	EB	3⅞	8⅞	4⅞	3½ x 6⅞	13
	750	475	EB	3⅞	9⅝	4⅞	3½ x 7 9/16	17
	1000	4100	EB	4½	10	5	3½ x 7½	22
"500" SERIES INPUT RANGE: 145-160-175-190-210-225-245V. OUTPUT: 115V. — 50/60 CYCLE	150	515	EB	3⅞	7	4⅞	3 x 5	5.5
	350	535	EB	3⅞	7⅝	4⅞	3½ x 5⅝	8
	500	550	EB	3⅞	7⅞	4⅞	3½ x 5⅞	9
	750	575	EB	3⅞	9⅛	4⅞	3½ x 7⅛	14.2
	1000	5100	EB	4½	9	5⅝	3½ x 7 9/16	15.5
	1500	5150	EB	4½	10½	5⅝	3½ x 8	23.5
	2000	5200	JB	9⅛	10⅛	7½	8⅛ x 4	32
	3000	5300	JB	9⅛	10⅝	7½	8⅛ x 4½	37
	5000	5500	JB	9⅛	12½	7½	8⅛ x 6½	60
"600" SERIES INPUT RANGE: 145-160-175-190-210-225-245V. OUTPUT: 230V. — 50/60 CYCLE	150	615	EB	3⅞	7	4⅞	3 x 4 15/16	5
	350	635	EB	3⅞	7⅜	4⅞	3 x 5 5/16	6.5
	500	650	EB	3⅞	7⅝	4⅞	3 x 5 9/16	8
	750	675	EB	3⅞	8⅜	4⅞	3 x 6 5/16	13
	1000	6100	EB	3⅞	9⅛	4⅞	3 x 7 1/16	14.5

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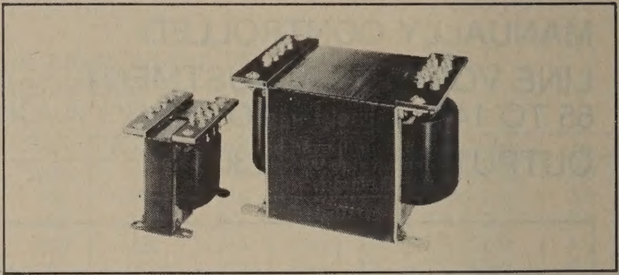
power isolation transformers

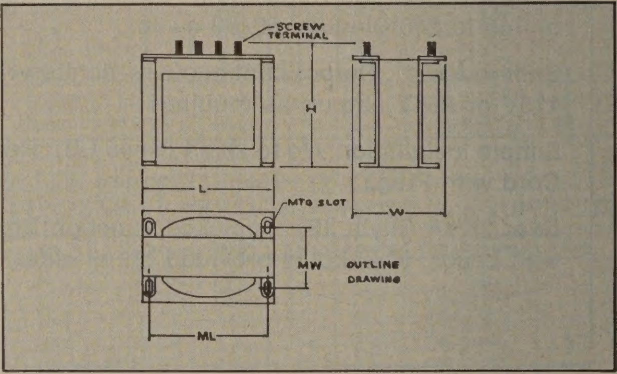
INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



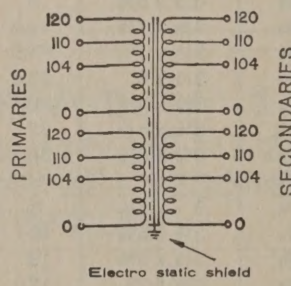
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electro static shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.



DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

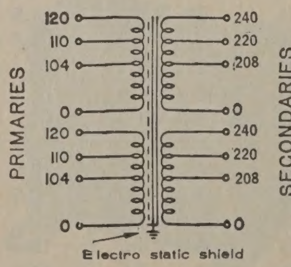


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

		Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. &	
Part No.	KVA	Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡	Term. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5⁵⁄₁₆	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5⁵⁄₁₆	5⁵⁄₁₆	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7⁹⁄₁₆	6¼	7¼	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7⁹⁄₁₆	8¼	7¼	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7⁹⁄₁₆	9¼	7¼	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7⁹⁄₁₆	10¾	7¼	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	9	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	83	9	13	8	7½	9	¼	150

* Maximum. † ±¹⁄₃₂. ‡ ±¹⁄₁₆.

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

		Series Secondaries		Parallel Secondaries		Mechanical Dimensions					Mtg. &	
Part No.	KVA	Volts	Max. Amps	Volts	Max. Amps	L *	W *	H *	ML †	MW ‡	Term. Screw	Appr. Lbs.
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5⁵⁄₁₆	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5⁵⁄₁₆	5⁵⁄₁₆	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7⁹⁄₁₆	6¼	7¼	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7⁹⁄₁₆	8¼	7¼	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7⁹⁄₁₆	9¼	7¼	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7⁹⁄₁₆	10¾	7¼	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	9	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±¹⁄₃₂. ‡ ±¹⁄₁₆.

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price list

JULY 1, 1977

Part No.	Net
10-0.1	$6.80
10-0.25	7.11
10-0.5	7.31
10-1	7.93
10-2	9.68
10-4	12.30
10-6	16.09
10-8	16.65
10-12	18.67
10-25	28.36
10-50	44.88
10-100	76.00
12.8-0.1	6.87
12.8-0.25	7.28
12.8-0.5	7.83
12.8-1	8.47
12.8-2A	9.58
12.8-2	11.54
12.8-4	13.53
12.8-6	15.56
12.8-8	15.81
12.8-12	21.22
12.8-25	31.82
12.8-50	46.92
12.8-100	77.00
16-0.1	7.11
16-0.25	7.40
16-0.5	7.70
16-1	8.58
16-2	9.94
16-4	14.73
16-6	17.43
16-8	18.55
16-12	22.24
16-25	40.09
16-50	69.56
16-100	90.78
24-0.1	7.16
24-0.25	7.73
24-0.5	8.29
24-1A	9.27
24-1	11.33
24-2	12.81
24-4	15.68
24-6	20.86
24-8	25.21
24-12	31.72
24-20	41.82
24-25	47.63
24-50	74.97
24-100	109.14
36-0.1	7.21
36-0.25	7.98
36-0.5	8.94
36-1A	10.35
36-1	11.50
36-2	14.66
36-4	21.12
36-6	26.75
36-8	30.14
36-12	38.13
36-20	66.10
36-25	74.97
36-30	78.13
36-50	85.68
36-100	166.26
56-01	7.52
56-0.25	8.86
56-0.5	9.42
56-1	13.74
56-2	17.17
56-4	27.06
56-6	34.95
56-8	39.57
56-12	63.85
56-25	83.13
56-50	153.00
56-100	229.50
68-0.1	7.78
68-0.25	9.12
68-0.5A	9.63
68-0.5	12.36
68-1	13.84
68-2	19.27
68-4	33.21
68-6	36.08
68-8	40.39
68-12	69.36
68-25	85.68
68-50	157.08
80-0.1	7.88
80-0.25	9.94
80-0.5A	10.40
80-0.5	12.61
80-1	$14.81
80-2	21.63
80-4	36.90
80-6	41.82
80-8	50.59
80-12	78.03
80-25	100.98
80-50	183.60
88-0.1	8.09
88-0.25	10.30
88-0.5	10.71
88-1	15.27
88-2	21.99
88-4	38.34
88-6	42.64
88-8	52.02
88-12	78.30
88-25	104.04
88-50	187.68
120-0.5	14.42
120-1	20.39
120-2	27.06
120-4	42.03
120-6	63.55
120-8	75.48
120-12	84.15
120-20	117.30
160-0.5	15.24
160-1	21.94
160-2	32.39
160-4	48.69
160-8	74.46
160-12	94.86
180-0.5	15.66
180-1	24.31
180-2	35.06
180-4	55.35
180-6	75.48
180-8	79.97
180-12	112.20
230-0.5	20.60
230-1	27.37
230-2	42.84
230-4	74.46
230-6	80.58
300-0.5	20.81
300-1	34.48
300-2	47.74
300-4	78.54
DL 10-0.1	8.25
DL 10-0.25	8.56
DL 10-0.5	8.76
DL 10-1	9.38
DL 10-2	11.13
DL 10-4	13.75
DL 10-6	17.53
DL 10-8	18.10
DL 10-12	20.12
DL 10-25	29.81
DL 10-50	46.33
DL 10-100	77.45
DL 12.8-0.1	8.32
DL 12.8-0.25	8.73
DL 12.8-0.5	9.28
DL 12.8-1	9.92
DL 12.8-2A	11.03
DL 12.8-2	13.00
DL 12.8-4	14.98
DL 12.8-6	17.01
DL 12.8-8	17.26
DL 12.8-12	22.67
DL 12.8-25	33.27
DL 12.8-50	48.37
DL 12.8-100	78.50
DL 16-0.1	8.56
DL 16-0.25	8.85
DL 16-0.5	9.15
DL 16-1	10.03
DL 16-2	11.39
DL 16-4	16.18
DL 16-6	18.88
DL 16-8	20.00
DL 16-12	23.69
DL 16-25	41.54
DL 16-50	71.01
DL 16-100	92.23
DL 24-0.1	8.61
DL 24-0.25	9.18
DL 24-0.5	9.74
DL 24-1A	10.72
DL 24-1	12.78
DL 24-2	14.26
DL 24-4	17.13
DL 24-6	$22.31
DL 24-8	26.66
DL 24-12	33.17
DL 24-20	43.27
DL 24-25	49.08
DL 24-50	76.42
DL 36-0.1	8.66
DL 36-0.25	9.43
DL 36-0.5	10.39
DL 36-1A	11.80
DL 36-1	12.95
DL 36-2	16.11
DL 36-4	22.57
DL 36-6	28.20
DL 36-8	31.59
DL 36-12	39.58
DL 36-20	67.55
DL 36-25	76.42
DL 36-30	79.58
DL 56-0.1	8.97
DL 56-0.25	10.31
DL 56-0.5	10.87
DL 56-1	15.19
DL 56-2	18.62
DL 56-4	28.51
DL 56-6	36.40
DL 56-8	41.02
DL 56-12	65.30
DL 56-25	84.58
DL 68-0.1	9.23
DL 68-0.25	10.57
DL 68-0.5A	11.08
DL 68-0.5	13.81
DL 68-1	15.29
DL 68-2	20.72
DL 68-4	34.66
DL 68-6	37.53
DL 68-8	41.84
DL 68-12	70.81
DL 80-0.1	9.33
DL 80-0.25	11.39
DL 80-0.5A	11.85
DL 80-0.5	14.06
DL 80-1	16.26
DL 80-2	23.08
DL 80-4	38.35
DL 80-6	43.27
DL 80-8	52.04
DL 80-12	79.48
DL 88-0.1	9.54
DL 88-0.25	11.75
DL 88-0.5	12.16
DL 88-1	16.72
DL 88-2	23.44
DL 88-4	39.79
DL 88-6	44.09
DL 88-8	53.47
DL 88-12	79.75
DL 120-0.5	15.87
DL 120-1	21.84
DL 120-2	28.51
DL 120-4	43.48
DL 120-6	65.00
DL 120-8	76.93
DL 120-12	85.60
DL 120-20	118.75
DL 160-0.5	16.69
DL 160-1	23.39
DL 160-2	33.84
DL 160-4	50.14
DL 160-8	75.91
DL 180-0.5	17.11
DL 180-1	25.76
DL 180-2	36.51
DL 180-4	56.80
DL 180-6	76.93
DL 180-8	81.42
DL 180-12	113.70
DL 230-0.5	22.05
DL 230-1	28.82
DL 230-2	44.29
DL 230-4	75.91
DL 230-6	82.03
DL 300-0.5	22.26
DL 300-1	35.93
DL 300-2	49.19
DL 300-4	80.00
CH 0.5	6.50
CH 1	9.06
CH 2	10.30
CH 4	15.40
CH 6	18.77
CH 8	23.77
CH 12	31.01
CH 16	$34.99
CH 20	32.23
CH 25	44.88
CH 30	54.06
CH 50	62.22
CH 100	70.38
CH 200	112.20
CH 250	121.38
CH 500	130.56
CH 1000	145.86
CL 1-2	6.20
CL 2-4	7.52
CL.4-8	12.40
CL 6-12	14.25
CL 12-24	24.00
CL 25-50	22.13
CL 50-100	27.23
6-250	106.50
9-250	137.70
12-250	148.00
24-250	262.00
6-500	145.90
9-500	190.70
12-500	259.00
24-500	425.00
3-1000	155.00
6-1000	252.00
12-1000	420.00
3PH 24-50	148.00
3PH 24-100	212.00
3PH 24-200	338.00
3PH 48-30	148.00
3PH 48-60	212.00
3PH 48-120	338.00
DU ¼	44.10
DU ½	56.10
DU 1	94.35
DU 2	135.65
DU 3	191.70
DU 5	252.90
DU 7.5	325.00
DU 10	397.00
SU ¼	45.30
SU ½	57.85
SU 1	96.20
SU 2	137.70
SU 3	194.80
SU 5	255.00
SU 7.5	328.00
SU 10	400.00
110	11.74
112	14.11
115	15.14
120	16.07
125	17.41
130	19.98
150	24.72
175	32.34
1100	42.44
1150	52.53
1200	64.79
1300	103.00
1400	123.60
1500	133.90
1600	149.35
110-OF	8.87
112-OF	10.71
115-OF	11.42
120-OF	12.34
125-OF	13.87
130-OF	15.91
150-OF	20.81
175-OF	26.93
1100-OF	35.90
1150-OF	48.25
1200-OF	58.34
1300-OF	83.00
1400-OF	101.00
1500-OF	114.25
1600-OF	127.50
315	37.00
335	42.00
350	49.50
375	58.30
3100	64.20
3150	77.40
3200	114.20
3300	131.50
3500	178.00
415	37.80
435	42.80
450	50.00
475	59.00
4100	65.00
515	37.00
535	42.00
550	49.50
575	$58.30
5100	64.20
5150	77.40
5200	114.20
5300	131.50
5500	178.00
615	37.80
635	42.80
650	50.00
675	59.00
6100	65.00
PC 10-90	5.20
PC 10-120	5.10
PC 10-440	5.35
PC 10-1000	5.65
PC 10-2400	7.45
PC 12-70	5.20
PC 12-100	5.10
PC 12-350	5.35
PC 12-800	5.65
PC 12-2000	7.45
PC 16-55	5.20
PC 16-75	5.10
PC 16-260	5.35
PC 16-640	5.65
PC 16-1500	7.45
PC 20-45	5.20
PC 20-60	5.10
PC 20-220	5.35
PC 20-500	5.65
PC 20-1200	7.45
PC 24-35	5.20
PC 24-50	5.10
PC 24-180	5.35
PC 24-450	5.65
PC 24-1000	7.45
PC 28-30	5.20
PC 28-40	5.10
PC 28-160	5.35
PC 28-360	5.65
PC 28-800	7.45
PC 34-25	5.20
PC 34-35	5.10
PC 34-125	5.35
PC 34-300	5.65
PC 34-700	7.45
PC 40-20	5.20
PC 40-30	5.10
PC 40-110	5.35
PC 40-250	5.65
PC 40-600	7.45
PC 56-15	5.20
PC 56-20	5.10
PC 56-80	5.35
PC 56-180	5.65
PC 56-420	7.45
PC 88-10	5.20
PC 88-15	5.10
PC 88-50	5.35
PC 88-120	5.65
PC 88-270	7.45
PC 120-8	5.20
PC 120-10	5.10
PC 120-35	5.35
PC 120-85	5.65
PC 120-200	7.45
PC 180-6	5.65
PC 180-24	5.85
PC 180-55	6.10
PC 180-130	8.15
PC 230-5	5.80
PC 230-20	6.00
PC 230-40	6.25
PC 230-100	8.25
DPC 10-90	6.45
DPC 10-120	6.02
DPC 10-440	6.27
DPC 10-1000	6.63
DPC 10-2400	8.40
DPC 12-70	6.45
DPC 12-100	6.02
DPC 12-350	6.27
DPC 12-800	6.63
DPC 12-2000	8.40
DPC 16-55	6.45
DPC 16-75	6.02
DPC 16-260	6.27
DPC 16-640	6.63
DPC 16-1500	8.40
DPC 20-45	6.45
DPC 20-60	6.02
DPC 20-220	6.27
DPC 20-500	6.63
DPC 20-1200	8.40
DPC 24-35	6.45
DPC 24-50	6.02
DPC 24-180	6.27
DPC 24-450	$6.63
DPC 24-1000	8.40
DPC 28-30	6.45
DPC 28-40	6.02
DPC 28-160	6.27
DPC 28-360	6.63
DPC 28-800	8.40
DPC 34-25	6.45
DPC 34-35	6.02
DPC 34-125	6.27
DPC 34-300	6.63
DPC 34-700	8.40
DPC 40-20	6.45
DPC 40-30	6.02
DPC 40-110	6.27
DPC 40-250	6.63
DPC 40-600	8.40
DPC 56-15	6.45
DPC 56-20	6.02
DPC 56-80	6.27
DPC 56-180	6.63
DPC 56-420	8.40
DPC 88-10	6.45
DPC 88-15	6.02
DPC 88-50	6.27
DPC 88-120	6.63
DPC 88-270	8.40
DPC 120-8	6.45
DPC 120-10	6.02
DPC 120-35	6.27
DPC 120-85	6.63
DPC 120-200	8.40
DPC 180-6	6.60
DPC 180-24	6.90
DPC 180-55	7.25
DPC 180-130	9.15
DPC 230-5	6.75
DPC 230-20	7.00
DPC 230-40	7.40
DPC 230-100	9.30
10-BR	.42
24-BR	.42
LP 10-600	8.40
LP 10-1200	10.20
LP 12-450	8.40
LP 12-900	10.20
LP 16-350	8.40
LP 16-700	10.20
LP 20-300	8.60
LP 20-600	10.45
LP 24-250	8.60
LP 24-500	10.45
LP 34-170	8.60
LP 34-340	10.45
LP 40-150	8.60
LP 40-300	10.70
LP 56-100	8.80
LP 56-200	10.70
LP 88-65	8.80
LP 88-130	10.95
LP 120-50	8.80
LP 120-100	10.95
LP 230-25	8.80
LP 230-50	10.95
ALL 241-3-	4.55
ALL 241-4-	4.85
ALL 241-5-	5.40
ALL 241-6-	6.70
ALL 241-7-	8.30
ALL 241-8-	11.00
ALL DP 241-4-	5.70
ALL DP 241-5-	6.35
ALL DP 241-6-	7.60
ALL DP 241-7-	9.30
ALL DP 241-8-	11.80
ALL ST 3-	4.90
ALL ST 4-	5.00
ALL ST 5-	5.50
ALL ST 6-	6.90
ALL DST 3-	5.80
ALL DST 4-	5.90
ALL DST 5-	6.50
ALL DST 6-	7.90
ST-MS	6.00/C
ST-MN	6.00/C

DISCOUNT SCHEDULE*

Quantity	Discount
1-4	Net
5-9	10%
10-24	25%
25-49	34%
50-99	42%
100-249	50%

*Different part numbers may not be aggregated to obtain quantity discount.
Terms: Net 30 days on approved credit. FOB Factory, Inwood, N.Y.
Prices subject to change without notice!

"Always in Stock"—"THE PRONTO CHALLENGE:—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

"See page 4459 for prices"

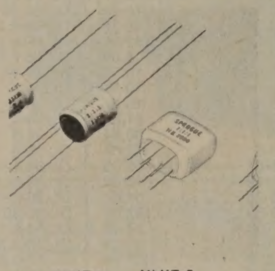
signal
TRANSFORMER

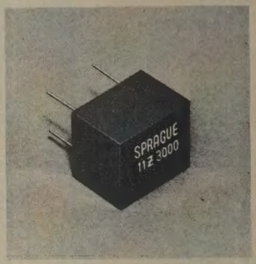
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

SPRAGUE PULSE TRANSFORMERS

TYPE 11Z TRIGATE® PULSE TRANSFORMERS

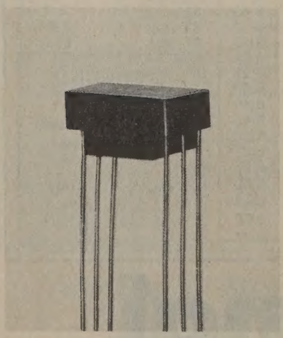
- Specifically designed for commercial and industrial SCR triggering applications where low cost and excellent performance are required.
- Single-ended pulse transformers are designed with leads especially intended for mounting on printed wiring boards; these units are self supporting.
- Balanced pulse characteristics and energy transfer between windings.
- Minimum saturation effect to allow operation where increased pulse widths are required.
- Fast pulse rise time and increased current capability to prevent SCR di dt failure.
- Operating temperature range of —10 C to +70 C.
- For complete technical data, see latest issue of Sprague Engineering Bulletin 40,003.


UNIT 1 UNIT 2


UNIT 3

Turns Ratio	Catalog Number	Size	Min. L_P (μH)	Max. L_L (μH)	Max. C_C (pF)	Max. DCR (Ω)	60 Cycle Dielectric Test (Volts RMS)	Max. 60 Cy A-C Line Voltage (Volts RMS)
			FLEXIBLE LEAD DESIGN (Unit 1 in photo)					
1:1	11Z12	.593″ D. x .828″ L.	200	3	800	1.5-1.5	1600	240
1:1:1	11Z13	.593″ D. x .828″ L.	200	3	800	2-2-2	1600	240
2:1	11Z14	.593″ D. x .828″ L.	1000	10	1300	10-2	1600	240
2:1:1	11Z15	.593″ D. x .828″ L.	1000	15	1300	10-2-2	1600	240
5:1	11Z16	.593″ D. x .828″ L.	5000	1500	400	19-3	1600	240
			PLUG-IN DESIGN with THERMOPLASTIC SHEATH (Unit 2 in photo)					
1:1	11Z2000	.775″ W. x .968″ L. x .800″ H.	200	3.0	800	1.5-1.5	1600	240
1:1	11Z2001	.775″ W. x .968″ L. x .800″ H.	1000	12.0	2000	8-8	1600	240
2:1	11Z2003	.775″ W. x .968″ L. x .800″ H.	1000	10.0	1300	10-2	1600	240
5:1	11Z2004	.775″ W. x .968″ L. x .800″ H.	5000	1500	400	19-3	1600	240
1:1:1	11Z2100	.775″ W. x .968″ L. x .800″ H.	200	3.0	800	2-2-2	1600	240
1:1:1	11Z2101	.775″ W. x .968″ L. x .800″ H.	1000	12.0	2000	10-10-10	1600	240
2:1:1	11Z2103	.775″ W. x .968″ L. x .800″ H.	1000	15.0	1300	10-2-2	1600	240
5:1:1	11Z2104	.775″ W. x .968″ L. x .800″ H.	5000	1500	400	20-4-4	1600	240
			PLUG-IN DESIGN with PRE-MOLDED CASE (Unit 3 in photo)					
1:1	11Z3000	.775″ W. x .950″ L. x .750″ H.	200	3.0	800	1.5-1.5	1600	240
1:1	11Z3001	.775″ W. x .950″ L. x .750″ H.	1000	12.0	2000	8-8	1600	240
1:1	11Z3002	.775″ W. x .950″ L. x .750″ H.	5000	15.0	3500	18-18	1600	240
2:1	11Z3003	.775″ W. x .950″ L. x .750″ H.	1000	10.0	1300	10-2	1600	240
5:1	11Z3004	.775″ W. x .950″ L. x .750″ H.	5000	1500	400	19-3	1600	240
1:1:1	11Z3100	.775″ W. x .950″ L. x .750″ H.	200	3.0	800	2-2-2	1600	240
1:1:1	11Z3101	.775″ W. x .950″ L. x .750″ H.	1000	12.0	2000	10-10-10	1600	240
1:1:1	11Z3102	.775″ W. x .950″ L. x .750″ H.	5000	15.0	3500	27-27-27	1600	240
2:1:1	11Z3103	.775″ W. x .950″ L. x .750″ H.	1000	15.0	1300	10-2-2	1600	240
5:1:1	11Z3104	.775″ W. x .950″ L. x .750″ H.	5000	1500	400	20-4-4	1600	240

TYPE 66Z SCR TRIGGER TRANSFORMERS



- Pre-molded construction permits slightly lower cost than fully-molded units without sacrifice in humidity resistance.
- Small size for use on pc boards and in encapsulated modular packages. Case measures .400″ W. x .785″ L. x .312″ H.
- For complete technical data, refer to latest issue of Sprague Engineering Bulletin 40,004.

Turns Ratio	Catalog Number	Min. L_P (μH)	Max. L_L (μH)	Max. C_C (pF)	Typ. Vμsec Output Winding	60 Cycle Dielectric Test (Volts RMS)	Max. 60 Cy A-C Line Voltage
1:1:1	66Z900	700	300	25	60	1000	240
1:1:1	66Z903	700	300	25	60	2200	550
1:1:1	66Z930	4800	25	50	110	1000	240
1:1:1	66Z932	4800	25	50	110	2200	550

IND-EEM-66-PPAR

All sizes subject to change without notice.

STERLING
TRANSFORMER

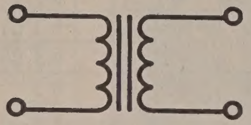
step-up/step-down ISOLATION – AUTO transformers

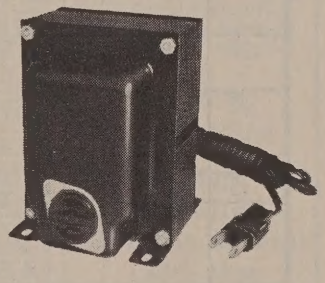
STEP-DOWN ISOLATION TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.	Net Price
S2-50	50	A	2 29/32	3 7/16	3½	2¼	1 13/16	3	$16.29
S2-100	100	A	3 7/32	3⅞	3⅞	2½	2 3/16	5	21.07
S2-150	150	A	3 17/32	4⅜	4¼	2¾	2 13/16	7	23.91
S2-220	220	A	3 27/32	4⅝	4⅝	3	3 1/16	9.5	26.59
S2-330	330	A	4 17/32	5¼	5 7/16	3½	3¼	14.5	38.97
S2-500	500	A	4 17/32	6¼	5 7/16	3½	4¼	21	42.50
S2-700	700	A	5½	5 15/16	6 9/16	4¼	3½	25	50.01
S2-1000	1000	A	5½	6 15/16	6 9/16	4¼	4½	35	84.51
S2-1500	1500	B	9	7¾	6 5/16	8¼	4⅜	42	100.99
S2-2200	2200	B	9	9⅜	6 5/16	8¼	6	65	124.01
S2-3300	3300	B	9	11⅝	6 5/16	8¼	8¼	95	194.88

**Style A Only; Style B — Knockouts for Conduit Connectors.*





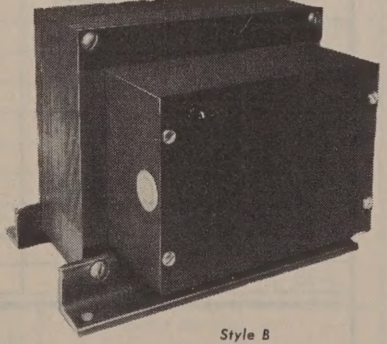
Style A

ISOLATION TRANSFORMERS

PRIMARY: 120 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.	Net Price
S1-50	50	A	2 29/32	3 7/16	3½	2¼	1 13/16	3	$16.29
S1-100	100	A	3 7/32	3⅞	3⅞	2½	2 3/16	5	21.07
S1-150	150	A	3 17/32	4⅜	4¼	2¾	2 13/16	7	23.91
S1-220	220	A	3 27/32	4⅝	4⅝	3	3 1/16	9.5	26.59
S1-330	330	A	4 17/32	5¼	5 7/16	3½	3¼	14.5	38.97
S1-500	500	A	4 17/32	6¼	5 7/16	3½	4¼	21	42.38
S1-700	700	A	5½	5 15/16	6 9/16	4¼	3½	25	50.01
S1-1000	1000	A	5½	6 15/16	6 9/16	4¼	4½	35	84.52
S1-1500	1500	B	9	7¾	6 5/16	8¼	4⅜	42	101.00
S1-2200	2200	B	9	9⅜	6 5/16	8¼	6	65	124.01
S1-3300	3300	B	9	11⅝	6 5/16	8¼	8¼	95	194.88

**Style A Only; Style B — Knockouts for Conduit Connectors.*



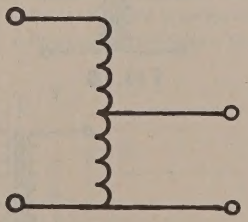
Style B

STEP-DOWN AUTO TRANSFORMERS

PRIMARY: 240 Volts • 50/60 HZ • Line Cord and Plug*
SECONDARY: 120 Volts • Standard Female Receptacle
• UL Approved Cord and Plug.

Cat No.	VA Watts	Style	DIMENSIONS L	W	H	Mounting Centers M1	M2	Appr. Wt.	Net Price
SA-100	100	A	2 29/32	3 7/16	3½	2¼	1 13/16	3	$14.52
SA-150	150	A	2 29/32	3¾	3½	2¼	2⅛	4	16.65
SA-200	200	A	3 7/32	3⅞	3⅞	2¼	2 3/16	5	21.26
SA-300	300	A	3 17/32	4⅜	4¼	2¾	2 13/16	7	27.10
SA-450	450	A	3 27/32	4⅝	4⅝	3	3⅙	9½	30.29
SA-650	650	A	4 17/32	5¼	5 7/16	3½	3¼	14½	35.78
SA-1000	1000	A	4 17/32	6¼	5 7/16	3½	4¼	21	41.62
SA-1500	1500	A	5½	5 15/16	6 9/16	4¼	3½	25	60.23
SA-2000	2000	A	5½	6 15/16	6 9/16	4¼	4½	35	74.58
SA-3000	3000	B	9	7¾	6 5/16	8¼	4⅜	42	102.75
SA-4500	4500	B	9	9⅜	6 5/16	8¼	6	65	132.87
SA-6500	6500	B	9	11⅝	6 5/16	8¼	8¼	95	186.02
SA-8000**	8000	B	10⅝	9⅝	8¼	9⅝	6⅛	90	212.59
SAB-5300†	5300	A	5¾	8 5/16	4	3¾	6½	17.5	95.67

**Style A Only **60 HZ Only Style B — Knockouts for Conduit Connector*
†Step-up/down Auto Transformer. Connections for 208/230 V or 230/208 V, 23 Amp 50/60 HZ



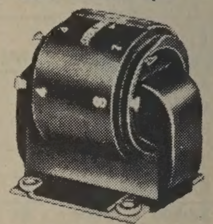
STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

STERLING
TRANSFORMER

ENCAPSULATED 400 cps *transformers*
CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp	Insul. Volts (RMS)	Pri. Volts	Mold Size	Net Price
19	4C1	6.3 CT	0.8	1500	115	SM3	$24.44
19	4C2	6.3 CT	1.2	1500	115	SM2	24.44
19	4C3	6.3 CT	6.8	1500	110/115/120	2	39.24
20	4C4	6.3 6.3	4.9 2.7	1500	115	3	35.08
19	4C5	6.3 CT	7.2	1500	115	35	40.74
21	4C6	6.3 6.3 6.3	7 7 1.5	1500 1500 1500	120	35	39.68
22	4C7	6.3 CT 6.3 CT	7 7	1500 1500	120	4	52.23
21	4C8	6.3 6.3 6.3	13.7 2.9 0.3	1500 1500 1500	115	4	52.23
19	4C9	6.3 CT	12.3	1500	115	5	43.67
21	4C11	6.3 6.3 6.3	2.4 2.5 2.7	1500	115	3	43.67
19	4C26	6.3 CT	2	1500	115	SM1	31.09
19	4C27	6.3 CT	3	1500	115	1A	32.33
19	4C28	6.3 CT	5	1500	115	2	33.48
19	4C29	5 CT	3	2500	115	SM1	31.10
19	4C30	5 CT	6	2500	115	2	33.48
19	4C31	8.5 CT	12	1500	115	5	43.63
19	4C32	8.5 CT	23	1500	115	7	48.36
19	4C33	8.5 CT	35	1500	115	8	52.71
19	4C34	8.5 CT	45	1500	115	9	63.59
18	4C12	14.1	3	1500	115	3	33.28
19	4C35	21 CT	4.5	1500	115	5	43.63
19	4C13	21 CT	9	1500	115	7	37.74
19	4C36	21 CT	18	1500	115	9	63.59
19	4C10	20 CT	0.6	1500	115	SM1	31.10

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C
Specifications

MIL Type
TF5SX01ZZ
85°C Max. Ambient
130°C Max.
Oper. Temp.

HIGH SHOCK
EXTREME
ENVIRONMENT
CONDITIONS
LIGHTWEIGHT FOR
AIRBORNE USE
10,000 HOUR
PLUS-LIFE
SERVO
APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL
CIRCUITS
MISSILE CIRCUITS

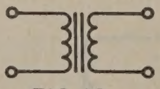


FIG. 18

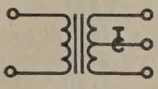


FIG. 19

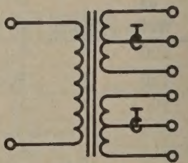


FIG. 22

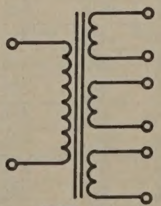


FIG. 21

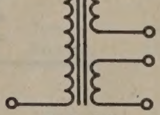


FIG. 20

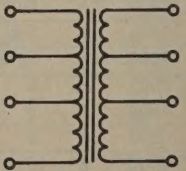


FIG. 23

STERLING TRANSFORMER CORPORATION

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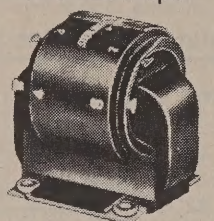
STERLING
TRANSFORMER

ENCAPSULATED 400 cps transformers
CLIPPER SERIES

Fig.	Cat. No.	Sec. Volts	Sec. Amp.	Insul. Volts (RMS)	Pri. Volts	Mold Size	Net Price
19	4C37	21 CT	24	1500	115	10	$76.36
19	4C38	24 CT	4	1500	115	5	43.63
19	4C39	24 CT	8	1500	115	7	48.36
19	4C40	24 CT	16	1500	115	9	63.59
19	4C41	24 CT	21	1500	115	10	76.36
18	4C14	26	0.5	1500	115	SM1	30.33
19	4C15	26 CT	1.5	1500	115	3	31.35
19	4C23	26 CT	3	1500	115	4	37.74
19	4C24	26 CT	5	1500	115	6	44.03
22	4C16	28 CT 6.3 CT	0.8 7	1500	115	3	47.15
19	4C42	41 CT	2.3	1500	115	5	43.63
19	4C43	41 CT	4.5	1500	115	7	48.36
19	4C44	41 CT	9	1500	115	9	63.59
19	4C45	41 CT	12	1500	115	10	76.36
19	4C46	48 CT	2	1500	115	5	43.63
19	4C47	48 CT	4	1500	115	7	48.36
19	4C48	48 CT	8	1500	115	9	63.59
19	4C49	48 CT	10	1500	115	10	76.36
19	4C25	52 CT	2	1500	115	5	43.63
19	4C17	52 CT	0.2	1500	115	SM1	33.84
19	4C18	90 CT	4.5	1500	115	9	63.59
18	4C19	115	.05	1500	115	SM2	24.99
18	4C21	115	2.8	1500	115	8	51.79
23	4C20	105/115/125	0.4	1500	105/115/125	2	35.96
23	4C50	105/115/125	1	1500	105/115/125	6	45.62
23	4C51	105/115/125	2.4	1500	105/115/125	8	53.49
23	4C52	105/115/125	3.2	1500	105/115/125	9	58.63
23	4C53	105/115/125	4	1500	105/115/125	10	77.46
18	4C22	334	025	1500	115	SM1	28.56

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C
Specifications

MIL Type
TF5SX01ZZ
85°C Max. Ambient
130°C Max.
Oper. Temp.

HIGH SHOCK
EXTREME
ENVIRONMENT
CONDITIONS
LIGHTWEIGHT FOR
AIRBORNE USE
10,000 HOUR
PLUS-LIFE
SERVO
APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL
CIRCUITS
MISSILE CIRCUITS

Mold No.	Overall Dimen.			Mtg. Dimen.		App. Wt. (Lbs.)	Mtg. Meth.
	L	W	H	F	G		
SM3	1 1/32	1 5/16	1¼	1	Note 1	0.06	Note 1
SM2	1½	1¼	1 11/16	1	Note 1	0.10	Note 1
SM1	1½	1½	1 11/16	1⅛	Note 1	0.16	Note 1
1	1 13/16	1⅞	1 13/16	1¼	1 7/16	0.25	Note 2
1A	1 11/16	1 17/32	1 13/16	1 5/32	1⅛	0.25	Note 2
2	2	1 15/16	2⅛	1 9/32	1¼	0.40	Note 2
3	2 5/16	1 13/16	2⅛	1 9/32	1 7/16	0.45	Note 2
35	2 1/16	2⅜	2 3/16	1 17/32	1 11/16	0.70	Note 2
4	2 5/16	2⅜	2 9/16	1 17/32	1 11/16	0.90	Note 2
5	2¾	2⅜	2⅞	1 17/32	2 3/16	1.20	Note 2
6	2¾	2⅝	3⅛	1 17/32	2 3/16	1.50	Note 2
7	3	2⅞	3⅜	1 25/32	2½	2.00	Note 2
8	3⅜	2⅞	3⅜	1 25/32	2½	2.50	Note 2
83	3¾	3¼	3⅜	2¼	3	3.25	Note 3
86	3¾	3¾	3⅜	2¾	3⅛	4.25	Note 3
9	4 1/16	3⅜	3⅞	2 3/16	3½	5.00	Note 3
10	4½	3 15/16	3 15/16	2¾	3⅛	6.00	Note 3

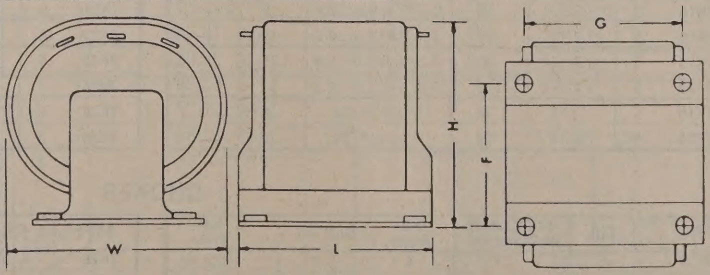
Note 1 —
SM Series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.

Note 2 —
#6-32 Pem nuts on bracket are standard.

Note 3 —
#8-32 Pem nuts on bracket are standard.

- All primaries 380-1000 cps
- Dielectric test voltages:

  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Epoxy resin used as encapsulant
- Prices subject to change without notice



STERLING TRANSFORMER CORPORATION

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transistor transformers

STERLING
TRANSFORMER

UNIVERSAL DC POWER MODULE TRANSFORMERS

High reliability transformers having a tapped primary and single or dual secondary windings which may be connected F.W. bridge or F.W. center tap so as to obtain a wide range of DC voltages and current ratings.

INPUT PRIMARY 115 volts 50-500 cps

TYPE	FIG.		F.W. BRIDGE								F.W. CT			MIL STD'D* HERM SEAL TF 45x02		INDUST. OPEN FRAME	
		AC VOLT	40 5	32.25	28.5	24	20.25	16 5	12	8.25	40.5	24	16.5				
		DC VOLT	53.0	41.0	34	25	24	18	12	6	24	12	6.6	Style	Net Pr.	Style	Net Pr.
7K1	1	DC AMP	.025	.035	.040	.042	.055	.042	.070	.085	.042	.055	.068	H	$22.85	F	$13.99
		INPUT CAP	(.1)	(.1)	(.1)	(.1)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)				
7K2	1	DC AMP	.085	.12	.13	.14	.18	.14	.23	.23	.14	.17	.21	H	25.16	L	16.29
		INPUT CAP	(.1)	(.1)	(.1)	(.1)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)	(.2)				
7K3	1	DC AMP	.48	.60	.60	.64	1.0	.8	1.2	1.52	.8	.883	.92	H	28.08	F	14.44
		INPUT CAP	(.5)	(.5)	(.5)	(.5)	(1.0)	(1.0)	(2.0)	(2.0)	(1.0)	(1.0)	(2.0)				
7K4	1	DC AMP	1.2	1.5	1.5	1.6	2.5	2.0	3.0	3.8	2.0	2.2	2.8	H	38.61	L	23.73
		INPUT CAP	(.5)	(.5)	(.5)	(.5)	(1.0)	(1.0)	(2.0)	(2.0)	(1.0)	(1.0)	(2.0)				
7K5	1	DC AMP	3.0	3.5	3.8	4.0	6.0	4.5	7.5	9.0	4.5	5.5	6.7	H	56.16	L	40.14
		INPUT CAP	(1.0)	(1.0)	(1.0)	(1.0)	(2.0)	(2.0)	(4)	(4)	(2.0)	(2.0)	(2.0)				
7K6	1	DC AMP	7.5	8.5	9.5	10	15	11	19	23	11	13.5	17	H	93.53	L	64.10
		INPUT CAP	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)	(6.0)	(12)	(12)	(6)	(6)	(12)				
TYPE	FIG.	AC VOLTS	81	64.5	57.0	48	40.5	33	24	16 5	81	48	33				
		DC VOLT	106	82	68	50	48	36	24	12	48	24	13				
7K7	2	DC AMP	0.6	0.75	0.75	0.8	1.25	1.0	1.5	1.9	1.0	1.1	1.4	H	39.73	L	24.81
		INPUT CAP	(.125)	(.125)	(.125)	(.125)	(.25)	(.25)	(.5)	(0.5)	(.25)	(.25)	(.5)				

TYPE	FIG.	PRI TAP	SEC.		F.W. BRIDGE CHOKE INPUT		CAP INPUT			F.W. CT CHOKE INPUT		CAP INPUT			MIL STD * HERM SEAL		INDUST. OPEN FRAME	
			AC Volt	AC Amp	DC Volt	DC Amp	DC Volt	DC Amp	Cap	DC Volt	DC Amp	DC Volt	DC Amp	Cap	Style	Net Pr.	Style	Net Pr.
7K8	3	—	20CT	0.3	16.5	0.3	26	0.2	(.2)	8	0.43	12	0.3	(.5)	H	$19.93	F	$10.09
7K9	3	—	20CT	0.6	16.5	0.6	26	0.4	(.4)	9	0.85	13	0.6	(1.0)	H	25.16	F	15.33
					F.W. BRIDGE													
					SEC. in PARALLEL CONN.					SEC. in SERIES CONN.								
7K10	4	L	17	1.5	14	3.0	18.5	2.0	(1.0)	28	1.5	45	1	(.5)	H	$36.31	L	$23.73
		H	21.5	1.5	17.5	3.0	25	2.0	(1.0)	35	1.5	36	1	(.5)				
7K11	4	L	17	4	14	8.0	18.5	5.0	(2.0)	28	4.0	45	2.5	(1.0)	H	58.45	L	41.81
		H	21.5	4	17.5	8.0	25	5.0	(2.0)	35	4.0	36	2.5	(1.0)				
7K12	4	L	17	9	14	18.0	18.5	12.0	(6.0)	28	9.0	45	6	(4.0)	H	89.45	L	65.72
		H	21.5	9	17.5	18.0	25	12.0	(6.0)	35	9.0	36	6	(4.0)				
7K13	4	L	34	4.5	28	9.0	43	6.0	(4.0)	56	4.5	85	3 0	(1.0)	H	89.45	L	65.73
		H	43	4.5	35	9.0	56	6.0	(4.0)	70	4.5	110	3.0	(1.0)				
7K14	4	L H	10	20	8.2	20	10	13	(12)	—	—	—	—	—	H	52.60	L	40.67

*FOR MILITARY USE REDUCE DC AMP 20%. Note Input Cap = (K) 1000 MFD. in Rectifier Circuit.

HIGH CURRENT TRANSFORMERS AND CHOKES

115V. 50-500 CPS

TRANSFORMERS

TYPE	FIG.	SEC. IN PARALLEL AC Volt	SEC. IN PARALLEL AC Amp	SEC. IN SERIES AC Volt	SEC. IN SERIES AC Amp	Net Price
7K15	5	3.2/6.4	16	3.2/6.4/9.6/12.8	8	$15.20
7K16	5	3.2/6.4	24	3.2/6.4/9.6/12.8	12	18.01
7K17	5	3.2/6.4	50	3.2/6.4/9.6/12.8	25	38.06
7K18	5	3.2/6.4	100	3.2/6.4/9.6/12.8	50	52.28
7K19	5	6/12	16	6/12/18/24	8	25.27
7K20	5	6/12	24	6/12/18/24	12	31.61

TYPE	FIG.	SEC. IN PARALLEL AC Volt	SEC. IN PARALLEL AC Amp	SEC. IN SERIES AC Volt	SEC. IN SERIES AC Amp	Net Price
7K21	5	6/12	50	6/12/18/24	25	$50.54
7K22	5	6/12	100	6/12/18/24	50	75.78
7K23	5	9/18	16	9/18/27/36	8	33.31
7K24	5	9/18	24	9/18/27/36	12	32.10
7K25	5	9/18	50	9/18/27/36	25	62.60
7K26	5	9/18	100	9/18/27/36	50	90.60

CHOKES

TYPE	FIG.	INDUCTANCE (Millihenries)	D.C. Amps	DCR (Ω)	Net Price
7K27	9	30	8	0.3	$22.85
7K28	9	15	12	0.1	29.49

TYPE	FIG.	INDUCTANCE (Millihenries)	D.C. Amps	DCR (Ω)	Net Price
7K29	9	5	25	0.025	$46.30
7K30	9	1.4	50	0.01	63.11

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STERLING
TRANSFORMER

transistor transformers

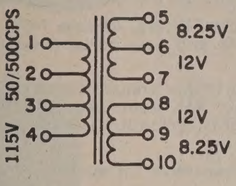
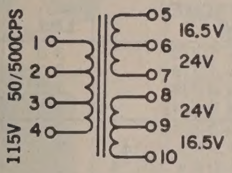

115V 50/500CPS
1
2
3
4
5
6
7
8
9
10
8.25V
12V
12V
8.25V

FIG. 1


115V 50/500CPS
1
2
3
4
5
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7
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9
10
16.5V
24V
24V
16.5V

FIG. 2

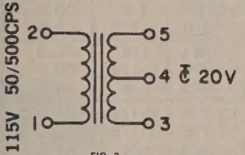
115V 50/500CPS
2
1
5
4 C̄ 20V
3

FIG. 3

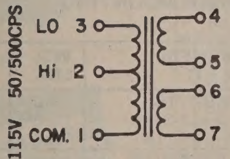
115V 50/500CPS
LO 3
Hi 2
COM. 1
4
5
6
7

FIG. 4

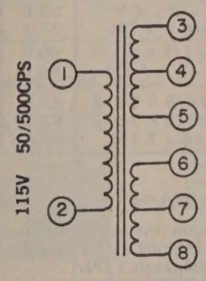
115V 50/500CPS
1
2
3
4
5
6
7
8

FIG. 5

TYPE	STYLE	FIG.	L	W	H	M1	M2	MTG. HOLES	STUDS
7K1	H	8	1 5/16	1 5/16	1¾	1¼	—	—	(2) 6-32
	F	6	2⅛	1¼	1¼	1¾	—	(2) 3/16	—
7K2	H	8	1⅝	1⅝	2⅜	1 3/16	1 3/16	—	(4) 6-32
	L	7	1⅜	1⅝	2⅛	1 1/16	1⅜	(4) 5/32	—
7K3	H	8	2 5/16	2 1/16	3⅛	1 11/16	1 7/16	—	(4) 6-32
	F	6	3¾	2	2 5/16	3⅛	—	(2) 3/16	—
7K4	H	8	3 1/16	2⅝	4¼	2 19/64	1 55/64	—	(4) 8-32
	L	7	2⅞	2⅝	3 7/16	2¼	2⅛	(4) 13/64	—
7K5	H	8	3 15/16	3⅜	5¼	3	2 7/16	—	(4) 10-32
	L	7	3⅞	3½	4⅝	3	2½	(4) 13/64	—
7K6	H	8	5½	4½	6¾	3¾	3	—	(4) ¼-20
	L	7	4 7/16	4½	5⅜	3½	3⅜	(4) 9/32	—
7K7	H	8	3 1/16	2⅝	4¼	2 19/64	1 55/64	—	(4) 8-32
	L	7	2⅞	2⅝	3 7/16	2¼	2⅛	(4) 13/64	—
7K8	H	8	1 15/16	1 13/16	2 7/16	1⅜	1¼	—	(4) 6-32
	F	6	2⅞	1½	1 11/16	2⅜	—	(2) 3/16	—
7K9	H	8	1 15/16	1 13/16	2¾	1⅜	1¼	—	(4) 6-32
	F	6	3 5/16	2¼	2	2 13/16	—	(2) 3/16	—
7K10	H	8	3 1/16	2⅝	4¼	2 19/64	1 55/64	—	(4) 8-32
	L	7	2⅞	2½	3 7/16	2¼	2	(4) 13/64	—
7K11	H	8	4 5/16	3 11/16	5 9/16	3 5/16	2 11/16	—	(4) 10-32
	L	7	3⅞	3⅝	4⅝	3 5/16	2¾	(4) 13/64	—
7K12	H	8	5⅞	4¾	6 11/16	4⅛	3½	—	(4) ¼-20
	L	7	4½	5¼	5⅜	3½	4⅛	(4) 9/32	—
7K13	H	8	5⅞	4¾	6 11/16	4⅛	3½	—	(4) ¼-20
	L	7	4½	5¼	5⅜	3½	4⅛	(4) 9/32	—
7K14	H	8	3 15/16	3⅜	5¼	3	2 7/16	—	(4) 10-32
	L	7	3⅞	3½	4⅝	3	2½	(4) 13/64	—
7K15	L	9	3 13/16	3	3 3/16	3⅛	2¼	(4) 13/64	—
7K16	L	9	4 3/16	3¼	3½	3 7/16	2⅜	(4) 13/64	—
7K17	L	9	5⅜	4¼	4⅝	4⅜	2⅞	(4) 9/32	—
7K18	L	9	5⅜	5¾	4⅝	4⅜	4⅛	(4) 9/32	—
7K19	L	9	4 3/16	3⅞	3½	3 7/16	3	(4) 13/64	—
7K20	L	9	4 9/16	4½	3⅞	3¾	3⅜	(4) 13/64	—
7K21	L	9	5⅜	5¾	4⅝	4⅜	4⅛	(4) 9/32	—
7K22	L	9	6½	6⅜	5⅝	5 5/16	4⅜	(4) 9/32	—
7K23	L	9	4 9/16	4⅜	3⅞	3¾	3⅜	(4) 13/64	—
7K24	L	9	5⅜	4⅞	4⅝	4⅜	3⅜	(4) 9/32	—
K725	L	9	6½	6	5⅝	5 5/16	3¾	(4) 9/32	—
7K26	L	9	6½	7¾	5⅝	5 5/16	5⅛	(4) 9/32	—
7K27	L	9	4 3/16	3⅝	3½	3 7/16	3	(4) 13/64	—
7K28	L	9	5⅜	4¼	4⅝	4⅜	3⅛	(4) 9/32	—
7K29	L	9	5⅜	4¾	4⅝	4⅜	3⅞	(4) 9/32	—
7K30	L	9	6½	5¾	5⅝	5 5/16	4⅛	(4) 9/32	—

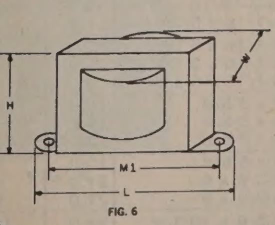

FIG. 6

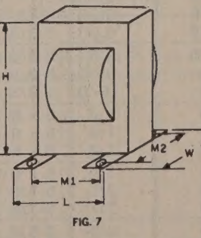

FIG. 7

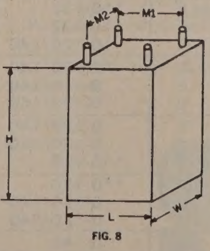

FIG. 8

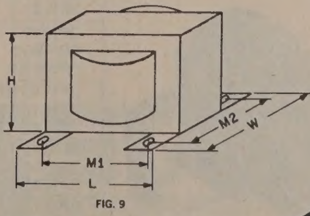

FIG. 9

STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

STACO variable transformers

The most versatile and reliable voltage controls available today are variable transformers. They are widely used as basic components in the control of voltage, current, power, heat, speed, light and electro-mechanical force in many industrial and laboratory applications.

Staco variable transformers deliver continuously adjustable output voltage from AC power lines without introducing any wave form distortion or SCR generated noise. All STACO variables offer precious metal-plated commutators, excellent regulation, high efficiency, conservative ratings and are extremely rugged.

Models are available in various configurations from 1.75 to 600 ampere rating. Choose from panel mounted units, cord and plug types, ganged and/or motor-driven, metered models and fully portable power supplies with or without metering.

Your STACO distributor is capable of assisting you in selecting the particular transformer best suited for your application. Should you require a special or non-standard product for your particular need, STACO's Engineering staff will respond quickly with solutions to your requirements. Often it just requires minor revisions to standard components enabling STACO to keep your costs at a minimum.

Prices shown are List Prices. Contact your STACO distributor or representative for quantity discount schedule.

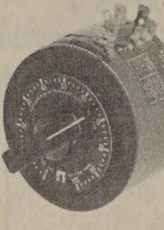
FIG. A

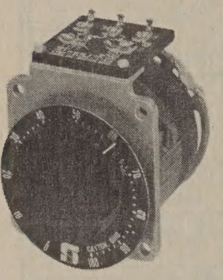
FIG. B

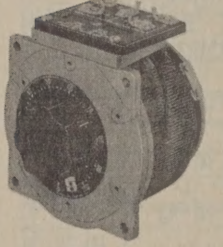
FIG. C

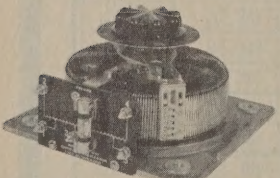
FIG. D

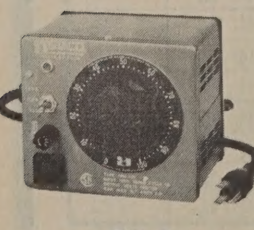
FIG. E

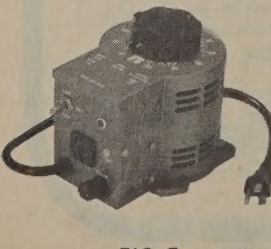
FIG. F

120 VOLT INPUT SINGLE PHASE PANEL OR BENCH MOUNTING

Available in cased or uncased units designed for mounting on panels 1/4" to 5/8" thick. Most units also can be bench mounted.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
171	A	*0-120/132	1.75	0.23	2-13/16 x 1-7/8	3.0	$ 15.90
201	A	*0-120/132	2.0	0.26	2-13/16 x 1-7/8	3.0	16.30
221	A	*0-120/132	2.25	0.30	2-13/16 x 2-1/8	3.2	16.70
251	A	*0-120/132	2.5	0.33	2-13/16 x 2-5/16	3.5	17.55
291	A	*0-120/132	3.0	0.40	2-13/16 x 2-5/16	3.5	18.05
371	B	*0-120/140	3.75	0.53	3-3/4 x 3-3/4 x 3-1/4	5.0	25.90
501	B	0-120/140	5.0	0.70	3-3/4 x 3-3/4 x 3-5/16	6.0	26.00
1010	B	0-120/140	10.0	1.4	5-5/16 x 5 x 4-3/16	12.0	34.50
1010CT	J	0-120/140	10.0	1.4	6-7/8 x 5 x 4-7/16	12.0	48.20
1210	B	**0-120	12.0	1.4	5-5/16 x 5 x 4-3/16	12.0	38.00
1210CT	J	**0-120	12.0	1.4	6-7/8 x 5 x 4-7/16	12.0	49.10
1510	C	0-120/140	15.0	2.1	6-1/8 x 6-5/8 x 4-3/8	20.0	64.80
2510	C	0-120/140	25.0	3.5	8-3/16 x 7-5/8 x 4-1/8	23.0	94.30
2510CT	K	0-120/140	25.0	3.5	9-5/8 x 7-5/8 x 4-1/8	26.0	115.50
5010	D	0-140	50.0	7.0	15-3/8 x 13-7/8 x 5-1/4	60.0	225.90
5010CT	D	0-140	50.0	7.0	17-15/16 x 14 x 7-1/8	66.0	252.50
6010	D	0-120/140	60.0	8.4	15-3/8 x 13-7/8 x 5-1/4	67.0	266.60
6010C	D	0-120/140	60.0	8.4	15-3/8 x 13-7/8 x 7-1/8	67.0	276.70
6010CT	D	0-120/140	60.0	8.4	17-15/16 x 14 x 7-1/8	67.0	303.00

CT refers to enclosed coil and terminals *60 cycle operation only at overvoltage **60 cycle operation only

C refers to enclosed coil only

240 VOLT INPUT SINGLE PHASE PANEL OR BENCH MOUNTING

Designed for mounting on panels 1/4" to 5/8" thick

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
252	A	0-240/264	0.8	0.19	2-13/16 x 2-7/16	3.5	$ 27.60
1020	B	0-240/280	3.5	0.98	5-5/16 x 5 x 4-3/16	12.0	42.50
1020CT	J	0-240/280	3.5	0.98	6-7/8 x 5 x 4-7/16	12.0	53.60
1220	B	**0-240	5.0	1.2	5-5/16 x 5 x 4-3/16	12.0	45.20
1220CT	J	**0-240	5.0	1.2	6-7/8 x 5 x 4-7/16	12.0	55.70
1520	C	0-240/280	9.5	2.7	6-1/8 x 6-5/8 x 4-13/16	20.0	64.80
1520CT	K	0-240/280	9.5	2.7	6-3/8 x 9-1/8 x 5	23.0	82.90
2520	C	0-240/280	10.0	2.8	8-3/16 x 7-5/8 x 4-1/8	23.0	94.30
2520CT	K	0-240/280	10.0	2.8	9-5/8 x 7-5/8 x 4-1/8	26.0	115.50
5020	D	0-240/280	28.0	7.8	15-3/8 x 13-7/8 x 5-1/4	60.0	218.20
5020CT	D	0-240/280	28.0	7.8	17-15/16 x 14 x 7-1/8	66.0	252.50
6020	D	0-240/280	35.0	9.8	15-3/8 x 13-7/8 x 5-1/4	63.0	257.50
6020C	D	0-240/280	35.0	9.8	15-3/8 x 13-7/8 x 7-1/8	63.0	276.70
6020CT	D	0-240/280	35.0	9.8	17-15/16 x 14 x 7-1/8	63.0	303.00

**60 Cycle Operation Only C refers to enclosed coil only.

120 VOLT INPUT SINGLE PHASE PORTABLE TYPES

All models feature a protective housing for coil and terminal board and have line cord, matching receptacle, switch, pilot light, fuse and are connected for clockwise knob rotation. Models available with 2 conductor line cord and receptacle (2PF) or a 3-conductor grounded line cord and receptacle (3PN)

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
2PF171	E	**0-132	1.75	0.23	3-15/16 x 3-15/16 x 3-1/2	3.5	$ 32.80
3PN171	E	**0-132	1.75	0.23	3-15/16 x 3-15/16 x 3-1/2	3.5	39.40
2PF371	E	*0-120/140	3.75	0.53	5-3/8 x 6-1/16 x 5-5/8	7.0	39.40
3PN371	E	*0-120/140	3.75	0.53	5-3/8 x 6-1/16 x 5-5/8	7.0	45.90
2PF501	E	0-120/140	5.0	0.70	5-3/8 x 6-1/16 x 5-5/8	9.0	43.20
3PN501	E	0-120/140	5.0	0.70	5-3/8 x 6-1/16 x 5-5/8	9.0	49.90
2PF1010	F	0-120/140	10.0	1.4	5 x 6-7/8 x 5-5/8	12.0	47.50
3PN1010	F	0-120/140	10.0	1.4	5 x 6-7/8 x 5-5/8	12.0	53.00
2PF1210	F	**0-120	12.0	1.4	5 x 6-7/8 x 5-5/8	12.0	55.80
3PN1210	F	**0-120	12.0	1.4	5 x 6-7/8 x 5-5/8	12.0	62.20
2PF1510	G	0-120/140	15.0	2.1	5-7/8 x 6-3/8 x 9	21.0	90.90
3PN1510	G	0-120/140	15.0	2.1	5-7/8 x 6-3/8 x 9	21.0	90.90
2PF2210	G	0-140	22.0	2.4	5-5/8 x 7-5/8 x 10-3/4	24.0	132.20
3PN2210	G	0-140	22.0	2.4	5-5/8 x 7-5/8 x 10-3/4	24.0	132.20

*60 cycle operation only on overvoltage **60 cycle operation only

STACO variable transformers

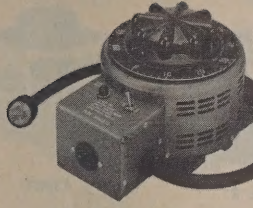

FIG. G

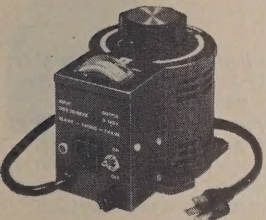

FIG. H

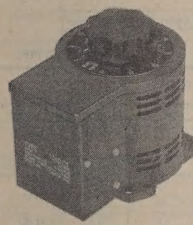

FIG. J

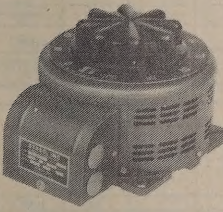

FIG. K

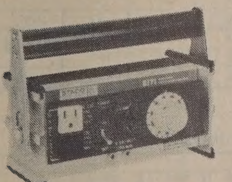

FIG. L

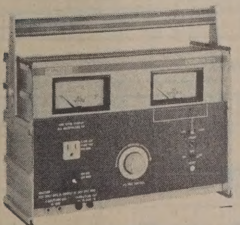

FIG. M

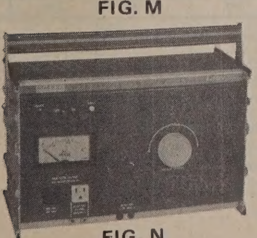

FIG. N

240 VOLT INPUT SINGLE PHASE PORTABLE TYPE

Same physical specifications as 120 volt portable types.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
2PF1020	F	0-240/280	3.5	0.98	5 x 6-7/8 x 5-5/8	12.0	$ 56.90
3PN1020	F	0-240/280	3.5	0.98	5 x 6-7/8 x 5-5/8	12.0	62.50
2PF1220	F	**0-240	5.0	1.2	5 x 6-7/8 x 5-5/8	12.0	62.90
3PN1220	F	**0-240	5.0	1.2	5 x 6-7/8 x 5-5/8	12.0	66.20
2PF1520	G	0-240/280	9.5	2.7	5-7/8 x 6-3/8 x 9	21.0	92.60
3PN1520	G	0-240/280	9.5	2.7	5-7/8 x 6-3/8 x 9	21.0	94.40
2PF2520	G	0-280	10.0	2.8	5-5/8 x 7-5/8 x 10-3/4	24.0	132.20
3PN2520	G	0-280	10.0	2.8	5-5/8 x 7-5/8 x 10-3/4	24.0	132.20

**60 cycle operation only

120 VOLT & 240 VOLT INPUT METERED PORTABLE TYPES

Staco's new series of Metered Cord & Plug type variable transformers eliminate the need for separate metering. Featuring an accurate, high quality pivot and jewel meter conveniently located atop the enclosure for easy, accurate readout. 120V models have 0-150V meter, 240V models have 0-300V meter.

MFG. TYPE NO.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
2PF1010V	H	120	0-140	10.0	1.4	5 x 6-7/8 x 5-5/8	12.0	$ 75.80
3PN1010V	H	120	0-140	10.0	1.4	5 x 6-7/8 x 5-5/8	12.0	78.30
2PF1020V	H	240	0-280	3.5	0.98	5 x 6-7/8 x 5-5/8	12.0	86.60
3PN1020V	H	240	0-280	3.5	0.98	5 x 6-7/8 x 5-5/8	12.0	89.10

120 VOLT INPUT VARIABLE ISOLATION TRANSFORMERS

An exclusive by STACO, for use where the safety of isolation is required. The output voltage is completely isolated from the power line (input voltage). Additional outputs are available on uncased models. These outputs include voltage doubler, series and non-isolated when hooked to the proper terminal supplied.

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
J201	B	0-140	2.0	0.28	5-5/6 x 5 x 4-3/4	13.0	$ 67.80
J401	B	0-140	4.0	0.56	6-1/8 x 6-5/8 x 4-7/16	20.0	121.70
J901	C	0-140	9.0	1.26	8-3/16 x 7-5/8 x 4-3/4	32.0	163.00

AC POWER SUPPLIES

Portable AC Power Supplies, ideal for labs or test bench use. Housed in a ventilated steel and aluminum enclosure with carrying handle. Each model is complete with a three-conductor line cord, plug & matching receptacle, pilot light, switch and circuit breaker. Metered models are available with Voltmeter, Ammeter or a Wattmeter (or a combination of meters).

MFG. TYPE NO.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
E171	L	**120	0-132	1.75	0.23	4-3/8 x 10-13/16 x 3-5/8	13.0	$ 47.70
E371	L	120	0-120/140	3.75	0.52	6-1/8 x 11-1/4 x 5	15.0	57.20
E501	L	120	0-120/140	5.0	0.7	6-1/8 x 11-1/4 x 5	16.0	60.00
E501V	N	120	0-120/140	5.0	0.7	6-1/8 x 17-5/8 x 5-7/8	20.0	109.00
E501VA	M	120	0-120/140	5.0	0.7	10 x 15-1/16 x 5-7/8	25.0	180.50
E501VAW	M	120	0-120/140	5.0	0.7	10 x 15-1/16 x 5-7/8	28.0	284.00
E1010	L	120	0-120/140	10.0	1.4	6-1/8 x 11-15/16 x 5-7/8	20.0	106.20
E1010V	N	120	0-120/140	10.0	1.4	6-3/16 x 17-5/8 x 5-7/8	27.0	136.10
E1010VA	M	120	0-120/140	10.0	1.4	10 x 15-1/16 x 5-7/8	33.0	214.50
E1010VAW	M	120	0-120/140	10.0	1.4	10 x 15-1/16 x 5-7/8	35.0	315.30

V = Voltmeter VA = Voltmeter, Ammeter VAW = Voltmeter, Ammeter, Wattmeter

**60 cycle operation only

ISOLATED AC/DC POWER SUPPLIES

The isolated variable transformer used in these AC/DC Power Supplies have a separate primary winding which is electrically isolated from the secondary or output winding. There is no common connection between the input and output of the transformers; either side of the output can be grounded independently of the supply line. Each unit has all of the features of the AC Power Supplies plus a 0-150V direct rating output voltmeter. EJ201V, EJ401V, EJ901V have 0-140V AC and 0-120V DC isolated outputs at full rated current available from banana jacks.

MFG. TYPE NO.	FIG.	INPUT VOLTS	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	WT. LBS.	PRICE
EJ201V	N	120	0-140	2.0	0.28	6-3/16 x 17-5/8 x 5-7/8	20.0	$130.90
EJ401V	N	120	0-140	4.0	0.56	10 x 15-1/32 x 5-7/8	30.0	169.30
EJ901V	N	120	0-140	9.0	1.26	10 x 16-5/32 x 7-1/2	43.0	239.40

Prices shown are List Prices. Contact your STACO distributor or Representative for quantity discount schedule.

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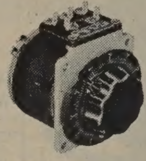
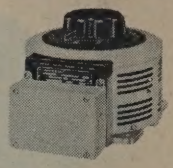
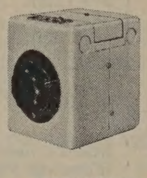
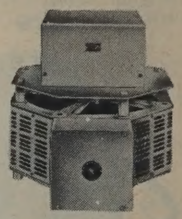
POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 2- or 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.

TYPE 10B


TYPE 21


TYPE 136BT


TYPE EN216B


TYPE 5MB1156DT

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			Ship. Wt. Lbs.
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	
10B-12 SERIES								
Single Phase								
120 120	50/60 60	0-120 0-132	2.25* 2.25*	0.27 0.30	3‡ —	0.36 —	✓ 10B	2½
240 240	50/60 50/60	0-240 0-264	0.7* 0.5**	0.17 0.13	0.9‡ —	0.22 —	✓ 12	2½
240 240	50/60 60	0-240 0-264	2.25* 2.25*	0.54 0.59	3‡ —	0.72 —	10B-2	6
480 480	50/60 50/60	0-480 0-528	0.7* 0.5**	0.34 0.26	0.9‡ —	0.43 —	12-2	6
Three Phase								
120 120	50/60 60	0-120 0-132	2.25* 2.25*	0.47 0.51	3‡ —	0.62 —	10B-2	6
240 240	50/60 50/60	0-240 0-264	0.7* 0.5**	0.29 0.23	0.9‡ —	0.37 —	12-2	6
240	60	0-240	2.25*	0.94	3‡	1.2	10B-3	8½
480 480	50/60 60	0-480 0-528	0.7* 0.5**	0.58 0.46	0.9‡ —	0.75 —	12-3	8½
21-22 SERIES								
Single Phase								
120 120	50/60 50/60	0-120 0-140	4.5 4.5	0.54 0.63	6.5 —	0.78 —	✓ 21	6
240 240	50/60 50/60	0-240 0-280	2.25 2.25	0.54 0.63	3.25 —	0.78 —	✓ 22	6
240 240	50/60 50/60	0-240 0-280	4.5 4.5	1.1 1.3	6.5 —	1.6 —	✓ 21-2	13½
480 480	50/60 50/60	0-480 0-560	2.25 2.25	1.1 1.3	3.25 —	1.6 —	22-2	13½
Three Phase								
120 120	50/60 50/60	0-120 0-140	4.5 4.5	0.94 1.1	6.5 —	1.4 —	21-2	13½
240 240	50/60 50/60	0-240 0-280	2.25 2.25	0.94 1.1	3.25 —	1.4 —	22-2	13½
240 240	50/60 60	0-240 0-280	4.5 4.5	1.9 2.2	6.5 —	2.7 —	21-3	19
480 480	50/60 60	0-480 0-560	2.25 2.25	1.9 2.2	3.25 —	2.7 —	✓ 22-3	19

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			Ship. Wt. Lbs.
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	
116B-216B and 117B-217B SERIES†								
Single Phase								
120 120	50/60 50/60	0-120 0-140	10 10	1.2 1.4	13 —	1.6 —	✓116B	12
120	60	0-120	12	1.4	15	1.8	✓117BT	12
240 240	50/60 50/60	0-240 0-280	3.5 3.5	0.84 0.98	5 —	1.2 —	✓216B	12
240	60	0-240	5	1.2	7	1.7	✓217BT	12
240 240	50/60 50/60	0-240 0-280	10 10	2.4 2.8	13 —	3.1 —	✓116BT-2	24
240	60	0-240	12	2.9	15	3.6	117BT-2	24
480 480	50/60 50/60	0-480 0-560	3.5 3.5	1.7 2.0	5 —	2.4 —	216BT-2	24
480	60	0-480	5	2.4	7	3.4	217BT-2	24
Three Phase								
120 120	50/60 50/60	0-120 0-140	10 10	2.1 2.4	13 —	2.7 —	✓116BT-2	24
120	60	0-120	12	2.5	15	3.1	117BT-2	24
240 240	50/50 50/60	0-240 0-280	3.5 3.5	1.5 1.7	5 —	2.1 —	216BT-2	24
240	60	0-240	5	2.1	7	2.9	217BT-2	24
240 240	50/60 60	0-240 0-280	10 10	4.2 4.8	13 —	5.4 —	✓116BT-3	36
240	60	0-240	12	5.0	15	6.2	117BT-3	36
480 480	50/60 60	0-480 0-560	3.5 3.5	2.9 3.4	5 —	4.2 —	✓216BU-3	36
480	60	0-480	5	4.2	7	5.8	✓217BU-3	36
EN116B-EN216B and EN117B-EN217B SERIES								
Single Phase								
120 120	50 60 50-60	0-120 0-140	8 8	0.96 1.1	13 —	1.6 —	✓EN116B	15
120	60	0-120	10	1.2	14.5	1.7	✓EN117B	15
Three Phase								
480 480	50 60 60	0-480 0-560	3 3	2.5 2.9	4.5 —	3.7 —	✓EN216B-3	39
40-VOLT SERIES								
Single Phase								
40	60	0-40	7	0.28	9	0.36	✓ 10B-40	3½
			18	0.72	22	0.88	✓ 21-40	6

LW136B SERIES

INPUT		OUTPUT‡‡				
Volts	Hertz	Volts	Max. Amps.	Max. KVA	TYPE	Ship. Wt. Lbs.
Single Phase						
120 240	50 60	15-0-15	35	0.52	✓ LW136B	25
120 240	50 60	0-30	25	0.75		

‡‡LW136B Series ratings are for use as low voltage isolated output transformer.

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1.75 amp., 12 Series to 0.5 amp.

‡Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 2.5 amp., 12 Series to 0.75 amp.

**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel.

†Also available with open construction. Suffix U when ordering.

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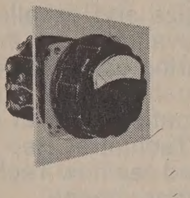
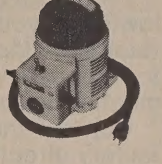
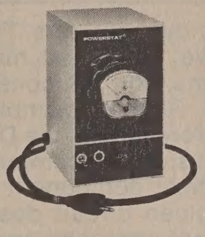




ENCLOSED LABORATORY TYPES

TYPE N116B



TYPE N116BK

Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with metered knobs. Stationary voltmeter does not turn with knob. Voltmeter accurate within ±3% of full scale and insensitive to stray magnetic fields. When ordering, add VS prefix to type number. *Back-of-panel* mounted types in the 21-22 through 146-246 series can be combined with Metered Knob Assemblies. Existing models can be retrofitted also. Assembly type VS150 has a 0-150 volt scale and type VS300 has 0-300. Types VS116B, VS3PN116B and VS3PN136B are available off-the-shelf from distributor stock.

Portable 120 volt, single-phase units having grounded NEMA cord-plug assembly, on-off switch, output receptacle, pilot light and fuse, recessed panel controls and integral handle. Slot at rear for wall hanger brackets. Type N10B rated 0-132 volts, 1.75 amp; type N21 rated 0-140 volts, 4.5 amp; type N116B and N116BK rated 0-140 volts, 10 amp. Type N116BK has knob with nonturning voltmeter to conveniently measure load voltage without necessity of providing separate units. All available off-the-shelf from distributor stock.

INPUT		OUTPUT						Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	
			126-226 SERIES†					
Single Phase								
120	50/60	0-120	15	1.8	20	2.4	✓ 126	17
120	50/60	0-140	15	2.1	—	—		
240	50/60	0-240	7.5	1.8	10	2.4	✓ 226	17
240	50/60	0-280	7.5	2.1	—	—		
240	50/60	0-240	15	3.6	20	4.8	126-2	32
240	50/60	0-280	15	4.2	—	—		
480	50/60	0-480	7.5	3.6	10	4.8	✓ 226U-2	32
480	50/60	0-560	7.5	4.2	—	—		
Three Phase								
120	50/60	0-120	15	3.1	20	4.2	126-2	32
120	50/60	0-140	15	3.6	—	—		
240	50/60	0-240	7.5	3.1	10	4.2	✓ 226U-2	32
240	50/60	0-280	7.5	3.6	—	—		
240	50/60	0-240	15	6.2	20	8.3	126-3	49
240	60	0-280	15	7.3	—	—		
480	50/60	0-480	7.5	6.2	10	8.3	✓ 226T-3	49
480	60	0-560	7.5	7.3	—	—		
			136B-236B SERIES†					
Single Phase								
120	50/60	0-120	22	2.6	28	3.4	✓ 136B	25
120	50/60	0-140	22	3.1	—	—		
120	50/60	0-120	44	5.3	56	6.7	136B-2 §	52
120	50/60	0-140	44	6.2	—	—		
240	50/60	0-240	10	2.4	13	3.1	✓ 236B	25
240	50/60	0-280	10	2.8	—	—		
240	50/60	0-240	22	5.3	28	6.7	✓ 136B-2	52
240	50/60	0-280	22	6.2	—	—		
480	50/60	0-480	20	4.8	26	6.2	✓ 236B-2	52
480	50/60	0-560	20	5.6	—	—		
Three Phase								
120	50/60	0-120	22	4.6	28	5.8	✓ 136B-2	52
120	50/60	0-140	22	5.3	—	—		
240	50/60	0-240	10	4.2	13	5.4	✓ 236B-2	52
240	50/60	0-280	10	4.8	—	—		
240	50/60	0-240	22	9.1	28	11.6	✓ 136B-3	76
240	60	0-280	22	10.7	—	—		
480	50/60	0-480	10	8.3	13	10.8	✓ 236B-3	76
480	60	0-560	10	9.7	—	—		
			146-246 SERIES†					
Single Phase								
120	50/60	0-120	30	3.6	35	4.2	✓ 146	38
120	50/60	0-140	30	4.2	—	—		
120	50/60	0-120	60	7.2	70	8.4	146-2 §§	83
120	50/60	0-140	60	8.4	—	—		
240	50/60	0-240	15	3.6	19	4.6	✓ 246	38
240	50/60	0-280	15	4.2	—	—		
240	50/60	0-240	30	7.2	35	8.4	146-2	83
240	50/60	0-280	30	8.4	—	—		
480	50/60	0-480	15	7.2	19	9.1	246-2	83
480	50/60	0-560	15	8.4	—	—		

INPUT		OUTPUT						Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amps.	Max. KVA	Max. Amps.	Max. KVA	TYPE	
			146-246 SERIES† (contd.)					
Three Phase								
120	50/60	0-120	30	6.2	35	7.3	146-2	83
120	50/60	0-140	30	7.3	—	—		
240	50/60	0-240	15	6.2	19	7.9	246-2	83
240	50/60	0-280	15	7.3	—	—		
240	50/60	0-240	30	12.5	35	14.5	146-3	125
240	60	0-280	30	14.5	—	—		
480	50/60	0-480	15	12.5	19	15.8	246-3	125
480	60	0-560	15	14.5	—	—		
			1156D-1256D SERIES†					
Single Phase								
120	50/60	0-120	50	6.0	55	6.6	✓ 1156D	82
120	50/60	0-140	50	7.0	—	—		
120	50/60	0-120	100	12.0	110	13.2	1156D-2P	169
120	50/60	0-140	100	14.0	—	—		
120	50/60	0-120	150	18.0	165	19.8	1156D-3P	272
120	50/60	0-140	150	21.0	—	—		
240	50/60	0-240	28	6.7	28	6.7	✓ 1256D	82
240	50/60	0-280	28	7.8	—	—		
240	50/60	0-240	50	12.0	55	13.2	1156D-2S	156
240	50/60	0-280	50	14.0	—	—		
240	50/60	0-240	56	13.4	56	13.4	✓ 1256D-2P	169
240	50/60	0-280	56	15.7	—	—		
240	50/60	0-240	84	20.2	84	20.2	1256D-3P	272
240	50/60	0-280	84	23.5	—	—		
240	50/60	0-240	100	24.0	110	26.4	1156D-4PS	361
240	50/60	0-280	100	28.0	—	—		
480	50/60	0-480	28	13.4	28	13.4	✓ 1256D-2S	156
480	50/60	0-560	28	15.7	—	—		
480	50/60	0-480	56	26.9	56	26.9	1256D-4PS	361
480	50/60	0-560	56	31.4	—	—		
Three Phase								
120	50/60	0-120	50	10.4	55	11.4	1156D-2D	155
120	50/60	0-140	50	12.1	—	—		
240	50/60	0-240	28	11.6	28	11.6	✓ 1256D-2D	155
240	50/60	0-280	28	13.6	—	—		
240	50/60	0-240	50	20.8	55	22.9	✓ 1156D-3Y	230
240	60	0-280	50	24.2	—	—		
240	50/60	0-240	100	41.6	110	45.7	1156D-6Y	507
240	50/60	0-280	100	48.5	—	—		
480	50/60	0-480	28	23.3	28	23.3	✓ 1256D-3Y	235
480	60	0-560	28	27.2	—	—		
480	50/60	0-480	56	46.6	56	46.6	1256D-6Y	507
480	60	0-560	56	54.3	—	—		

†Also available with open construction. Suffix U when ordering.

§Requires also one paralleling choke type T5000.

§§Requires also one paralleling choke type T6053.

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Turns Ratio Tolerance ±5%	Part No.	Lm μH ±20%	Leakage Inductance Max. Value in μH		Winding Resistance Max. Value in Ohms			Interwinding Cap. Max. Value in pF		Effective Distributed Capacity Shunting Winding N_1 Max. Value in pF C_D (1, 3, 5 gnd)	ET Rating Volt-μsec Minimum
			L_L (N_1-N_2)	L_L (N_1-N_3)	R(N_1)	R(N_2)	R(N_3)	C_1 (N_1-N_2)	C_1 (N_1-N_3)		
1:1:1	11PHC	2,000	1.2	1.2	2.7	2.7	2.7	47	47	5	20
	11LHA	750	0.7	0.7	1.8	1.8	1.8	26	26	4	14
	11HHB	250	0.5	0.5	1.1	1.1	1.1	16	16	4	9
	11EHA	70	0.7	0.7	1.8	1.8	1.8	23	23	4	9
	11DHB	48	0.5	0.5	1.4	1.4	1.4	21	21	4	8
	11BHC	25	0.4	0.4	1.1	1.1	1.1	15	15	4	5.8
	11AHA	15	0.4	0.4	0.9	0.9	0.9	13	13	4	4.6
	118HA	7.5	0.4	0.4	0.7	0.7	0.7	11	11	4	3.5
2:1:1	21PHA	2,500	7.0	8.4	2.8	1.6	1.6	24	22	6	22
	21LHA	750	4.0	4.2	1.7	1.0	1.0	13	12.8	4.5	14
	21HHA	250	2.5	2.6	1.0	0.7	0.7	10	9.7	4	9
	21EHA	70	2.0	2.1	1.8	1.0	1.0	13.7	12.4	4	9
	21DHA	48	1.9	2.0	1.4	0.8	0.8	13	11	4	8
	21BHA	24	1.5	1.6	1.1	0.7	0.7	9.7	8.9	4	5.8
	21AHA	13.5	1.0	1.1	0.9	0.6	0.6	8.5	7.9	3	4.4
	218HA	6.7	0.8	0.9	0.7	0.5	0.5	7.2	6.5	3	3.4
3:1:1	31PHA	2,500	6.5	7.0	2.8	1.2	1.2	21	17	5	22
	31LHA	750	4.0	4.4	1.7	0.8	0.8	10.5	9.1	4	14
	31HHA	250	1.8	2.0	1.0	0.6	0.6	9	8	4	9
	31EHA	68	2.8	3.3	1.8	0.8	0.8	10.8	10.5	4	9
	31DHA	52	2.5	3.0	1.4	0.7	0.7	10.5	9.5	4	8
	31BHA	25	1.8	1.9	1.1	0.6	0.6	8	7.3	3	5.8
	31AHA	15	1.6	1.7	0.9	0.5	0.5	7.2	6.5	3	4.6
	318HA	7.5	1.3	1.4	0.7	0.4	0.4	6.1	5.9	3	3.5
3:3:1	33PHA	2,500	3.0	8.0	2.8	3.1	1.2	30	17	6	22
	33LHA	750	1.3	5.0	1.7	1.8	0.8	18	9.1	5	14
	33HHA	250	0.9	2.0	1.0	1.1	0.6	12	8	5	9
	33EHA	68	1.2	6.0	1.8	1.8	0.8	18.3	10.5	5	9
	33DHA	52	1.0	3.1	1.4	1.4	0.7	16.8	9.2	5	8
	33BHA	25	0.7	1.9	1.1	1.1	0.6	12.4	7.5	4	5.8
	33AHB	15	0.7	1.7	0.9	0.9	0.5	10.3	6.6	4	4.6
	338HA	7.5	0.6	1.4	0.7	0.7	0.4	8.6	5.9	4	3.5
4:2:1	42PHA	2,500	5.0	6.0	2.8	1.6	0.9	24	13.6	5.5	22
	42LHA	750	2.5	4.0	1.7	1.0	0.7	13	7.9	4.5	14
	42HHA	250	1.5	2.4	1.0	0.7	0.5	10	7.2	4	9
	42EHA	77	3.5	5.7	1.8	1.0	0.7	14.2	9.4	4.5	9
	42DHA	53	2.8	5.0	1.4	0.8	0.6	12	8.1	4	8
	42CHA	28	1.8	2.5	1.1	0.7	0.4	10	6.9	4	6
	42AHA	13.5	1.3	2.3	0.9	0.6	0.4	8.2	6.1	4	4.4
	429HA	8.8	1.0	2.2	0.7	0.5	0.4	7.5	5.6	3	3.7

Case	L	W	H
H	.500	.350	.250
G	.650	.425	.350
A	.790	.495	.3125
F	.365	.235	.400
K	.560	.560	.450
M	.500	.350	.250
Z	.485	.350	.350

- Leads Out Bottom
- Temperature Stable and Special Low Leakage Versions Available
- Many Other Units Available in Other Cases and Combinations of Parameters
- **Contact Factory Direct or Write for Catalog**

BALANCED CENTER TAPPED TRANSFORMERS

Turns Ratio Tolerance ±2%	Part No.	mH ±20%	Leakage Inductance Max. Value in μH L_L (N_1-N_3)	Winding Resistance Max. Value in Ohms		Interwinding Cap. Max. Value in pF C_1 (N_1-N_3)	Effective Distributed Capacity Shunting Winding N_1 Max. Value in pF C_D (1, 6 gnd)	ET Rating Volt-μsec Minimum
				R(N_1)	R(N_3)			
1CT:1CT	1ZSHA	6.0	1.26	5.0	5.0	78	9	32
	1ZPHA	2.2	.78	2.9	2.9	42	7	21
	1ZKHA	.40	.56	1.4	1.4	15	5	10.5
	1ZGHA	.14	.49	0.9	0.9	9.7	4.5	6.8

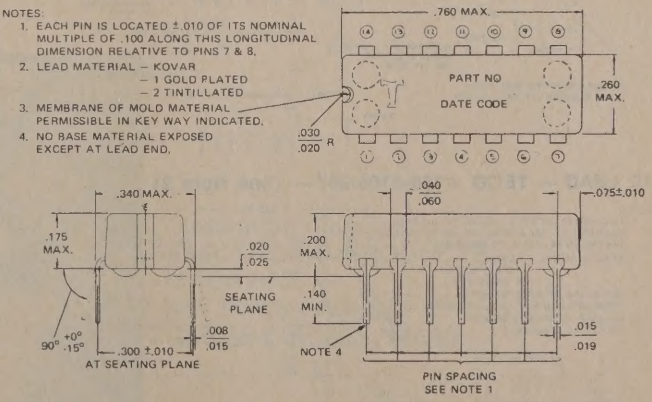
PARYLENE COATING FACILITIES AVAILABLE

DUAL-IN-LINE PACKAGING

Up to four pulse transformers can be mounted on a common lead frame and encapsulated by transfer moulding. This new concept is compatible with the "DIL" packaging of the Integrated Circuit Industry. The lead frame has no exposed base metal. Optimum pin arrangements and elevated seating plane of the case allow maximum clearance above pad area to enhance board cleaning after assembly and to accommodate other circuits without danger of shorting to the case pins. Controlled manufacturing processes and automatic selection and grading of cores provides maximum reliability. Improved features of the new DIL packages include automated handling for test and insertion, increased PC board packing density, uniform and repetitive PC board hole layout, and minimum ultimate cost.

Specialists in pulse transformers and completely transfer molded, welded DIP delay lines under 3/16" high.

14 LEAD — TECO #166-2100-245 — (See Note 2)



NOTES:
1. EACH PIN IS LOCATED ±.010 OF ITS NOMINAL MULTIPLE OF .100 ALONG THIS LONGITUDINAL DIMENSION RELATIVE TO PINS 7 & 8.
2. LEAD MATERIAL – KOVAR
   – 1 GOLD PLATED
   – 2 TINTILLATED
3. MEMBRANE OF MOLD MATERIAL PERMISSIBLE IN KEY WAY INDICATED.
4. NO BASE MATERIAL EXPOSED EXCEPT AT LEAD END.

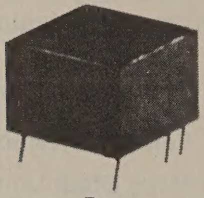
Technitrol, Inc.

DEPT. EM 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 (215) 426-9105 TELEX 834245

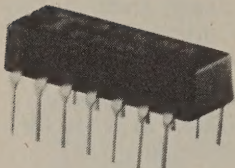
Technitrol, Inc.

LEAD CENTERS (Centered in Case)

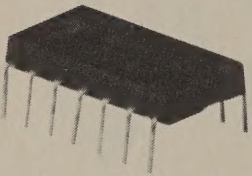
Across Max. Dim.	Across Min. Dim.
.400	.10
.500	.15
.600	.20
.140	.15
.400	.20
.400	.10
.375	.125



Z



DIP



Special

G CASE TRANSFORMERS (Also available in A, K cases)

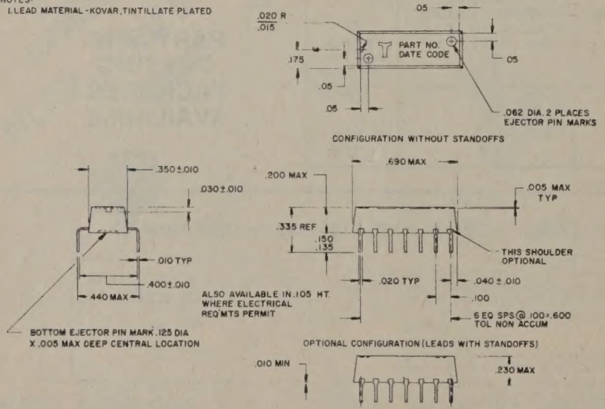
Turns Ratio Tolerance ±5%	Part No.	Lm mH ±20%	Leakage Inductance Max. Value in μH		Winding Resistance Max. Value in Ohms			Interwinding Cap. Max. Value in pF		Effective Distributed Capacity Shunting Winding N_1 Max. value in pF C_D (1, 3, 5 gnd)	ET Rating Volt-μsec Minimum
			L_L (N_1-N_2)	L_L (N_1-N_3)	R(N_1)	R(N_2)	R(N_3)	C_1 (N_1-N_2)	C_1 (N_1-N_3)		
1:1:1	11GGA	0.12	0.5	0.5	1.0	1.0	1.0	13.0	13.0	5	10
	11KGB	0.5	0.7	0.7	1.9	1.9	1.9	24.0	24.0	7	21
	11NGB	1.4	0.9	0.9	2.9	2.9	2.9	36.8	36.8	8	35
	11RGD	5.0	2.2	2.2	5.3	5.3	5.3	77.0	77.0	9	67
	11UGA	12.5	3.0	3.0	8.9	8.9	8.9	127.0	127.0	16	105
2:1:1	21GGA	0.12	1.4	1.5	1.0	0.6	0.6	9.3	7.9	4	10
	21KGA	0.5	2.4	2.5	1.9	1.0	1.0	14.3	12.6	6	21
	21NGB	1.4	2.6	2.7	2.9	1.6	1.6	20.3	17.6	7	35
	21RGA	5.0	7.0	9.1	5.3	2.9	2.9	38.5	33.6	10	67
	21UGA	12.5	12.0	14.5	8.9	4.6	4.6	57.5	39.4	12	105
3:1:1	31GGA	0.12	2.0	2.1	1.0	0.5	0.5	7.9	7.1	4	10
	31KGA	0.5	3.8	3.9	1.9	0.8	0.8	13.8	12.4	6	21
	31NGA	1.3	5.1	5.2	2.9	1.2	1.2	15.9	14.1	8	35
	31RGB	5.0	6.7	7.8	5.3	2.0	2.0	31.6	26.1	12	67
	31UGA	12.5	13.3	15.0	8.9	3.2	3.2	43.5	36.2	15	105
3:3:1	33GGA	0.12	1.3	2.4	1.0	1.0	0.5	11.1	6.9	5	10
	33KGA	0.5	1.4	2.5	1.9	1.9	0.8	19.9	11.4	7	21
	33NGA	1.3	1.5	3.6	2.9	2.9	1.2	28.6	14.8	8	35
	33RGB	5.0	4.5	9.0	5.3	5.3	2.0	49.5	24.7	13	67
	33UGA	12.5	12.5	14.0	8.9	8.9	3.2	75.0	40.0	16	105
4:2:1	42GGB	0.12	1.2	2.8	1.0	0.6	0.5	8.9	6.5	5	10
	42KGA	0.5	2.6	3.4	1.9	1.0	0.6	13.4	9.0	6	21
	42NGA	1.4	3.0	6.5	2.9	1.6	0.9	20.3	12.8	8	35
	42RGA	5.0	6.0	8.0	5.3	2.9	1.4	34.1	20.1	11	67
	42UGA	12.5	12.0	20.0	8.9	4.6	2.4	55.0	30.0	12	105

BALANCED CENTER TAPPED TRANSFORMERS

Turns Ratio Tolerance ±2%	Part No.	Lm mH ±20%	Leakage Inductance Max. Value in μH L_L (N_1-N_3)	Winding Resistance Max. Value in Ohms		Interwinding Cap. Max. Value in pF C_1 (N_1-N_3)	Effective Distributed Capacity Shunting Winding N_1 Max. Value in pF C_D (1, 6 gnd)	ET Rating Volt-μsec Minimum
				R(N_1)	R(N_3)			
1CT:1CT	1ZMGA	1.0	1.5	2.8	2.8	30	9	30
	1ZQGA	3.3	2.0	4.8	4.8	54	11	55
	1ZTGA	11.0	3.0	8.6	8.6	125	14	96
	1ZWGA	33.0	5.0	15.2	15.2	240	21	180

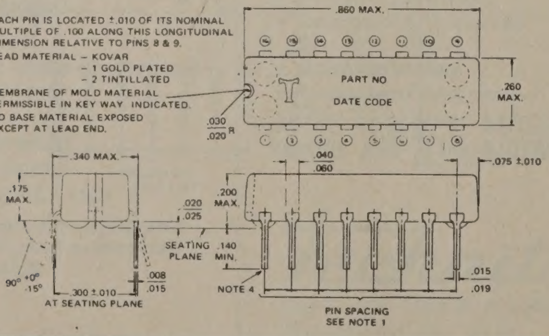
SPECIAL DIP — TECO #166-2100-267

NOTES:
1. LEAD MATERIAL - KOVAR, TINTILLATE PLATED


.020 R
.015
.05
.175
.05
.05
PART NO.
DATE CODE
.05
.062 DIA. 2 PLACES
EJECTOR PIN MARKS
CONFIGURATION WITHOUT STANDOFFS
.350±.010
.030±.010
.010 TYP
.400±.010
.440 MAX
BOTTOM EJECTOR PIN MARK .125 DIA
X .005 MAX DEEP CENTRAL LOCATION
.200 MAX
.690 MAX
.005 MAX
TYP
.335 REF
.150
.135
THIS SHOULDER
OPTIONAL
.020 TYP
.040±.010
.100
6 EQ SPS@.100=.600
TOL NON ACCUM
ALSO AVAILABLE IN .105 HT.
WHERE ELECTRICAL
REQ'MTS PERMIT
OPTIONAL CONFIGURATION (LEADS WITH STANDOFFS)
.010 MIN
.230 MAX

16 LEAD — TECO #166-2100-247 — (See Note 2)

NOTES:
1. EACH PIN IS LOCATED ±.010 OF ITS NOMINAL MULTIPLE OF .100 ALONG THIS LONGITUDINAL DIMENSION RELATIVE TO PINS 8 & 9.
2. LEAD MATERIAL – KOVAR
   – 1 GOLD PLATED
   – 2 TINTILLATED
3. MEMBRANE OF MOLD MATERIAL PERMISSIBLE IN KEY WAY INDICATED.
4. NO BASE MATERIAL EXPOSED EXCEPT AT LEAD END.


.860 MAX.
PART NO
DATE CODE
.260
MAX.
.030
.020 R
.340 MAX.
.175
MAX.
.020
.025
.200
MAX.
SEATING
PLANE
.140
MIN.
.040
.060
.075 ±.010
90° +0°
-15°
.300 ±.010
AT SEATING PLANE
.008
.015
NOTE 4
.015
.019
PIN SPACING
SEE NOTE 1

DUAL-IN-LINE PACKAGING

Contact Local Representative or Factory Direct With Specific Application or Requirements.

ELECTRICAL CHARACTERISTICS

L_m — UP to 2.0 mh maximum for 1:1 turns ratio.
UP to 8.0 mh maximum for inductors.
"Special Dip"
UP to 5.0 mh maximum for 1:1 turns ratio.
UP to 20.0 mh maximum for inductors.

L_L — As low as 0.02% of L_m for the highest permeability cores when C_I is not critical.

C_I — As low as 3.0 pfd for the highest permeability cores when L_L is not critical.

$L_L \times C_I$ — Lowest $L_L \times C_I$ product available in the industry.

POWER

"ET" ratings up to 7.0 volt μsec. for an L_M = 1.0 mh.

"Special Dip" "ET" ratings up to 15 volt μsec. for an L_M = 2.0 mh.

Specialists in pulse transformers and completely transfer molded, welded DIP delay lines under 3/16" high — see our page in Section 2350.

Technitrol, Inc.

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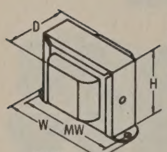
AUDIO TRANSFORMERS

THORDARSON

OUTPUT AND INPUT/INTERSTAGE Listed in Order of Increasing Primary Impedance



BAH
BHH

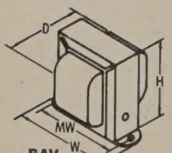
TM Part No.	Application	Impedance in Ohms		Audio Watts	Normal DC Resistance		Overall Turns Ratio	Frequency Response ±3 DB	RMS Test Volts	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
		Pri.	Sec.		Pri. Ohms	Sec. Ohms					Pri.	Sec.	H	W	D	MW	MD	
20A07	Line to Line	50/125/200/ 333/500	50/125/200/ 333/500	30	27	29	1:1	200-15000	500	BHH	Lugs	Lugs	2	3¼	1¾	2¹³⁄₁₆	—	1.0
24S75	Line to Voice Coil	500	3.2/6/8	5	50	0.85	8.1:1	60-20000	1000	BAH	Leads	Lugs	1⅜	2⅜	1¼	2	—	0.45
20A102	Line to Grids	500/600 C.T.	60000 C.T.	1	24	1325	1:10	100-10000	1500	BAH	Leads	Leads	1⅜	2⅜	1⅜	2	—	0.5
24S64	Univ Output	1500 to 10000	.02 to .30	10	230	1.2	18.3:1	—	1600	BHH	Lugs	Lugs	1⅝	2⅞	1½	2⅜	—	0.7
24S50	Output	2000	3.5	5	90	0.4	23.7:1	50-20000	2000	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5
24S53	Output	2000	3.5	3	130	0.42	25:1	200-1000	1000	BAH	Leads	Leads	1³⁄₁₆	2⅛	1⅛	1¾	—	0.2
24S174	Univ Output	3000/ 10000 C.T.	.09 to 65.4	20	160	0.7	18.1:1	—	1000	BHV	Leads	Leads	2¾	3⅛	2⅛	2¹³⁄₁₆	—	1.8
24S48	Univ Output	4000-5000	3.5	5	240	0.42	39.5:1	30-20000	1000	BAH	Leads	Leads	1¼	2⅛	1	1¾	—	0.4
24S60	Univ Output	4000 to 14000 C.T.	0.1 to 30	4	350	0.81	21.9:1	—	500	BHH	Leads	Lugs	1⅜	2⅜	1¼	2	—	0.5
24S06	Univ Output	4000 to 14000 C.T.	0.1 to 50	8	500	2.1	18.1:1	—	1500	BHH	Leads	Lugs	1⅝	2⅞	1½	2⅜	—	0.75
24S04	Univ Output	4000 to 14000 C.T.	0.1 to 50	4	300	1.1	18.3:1	—	1500	BHH	Leads	Lugs	1⅜	2⅜	1¼	2	—	0.5
24S61	Univ Output	4000 to 14000 C.T.	0.1 to 30	8	182	0.835	22:1	—	1500	BHH	Lugs	Lugs	1⅝	2⅞	2	2⅜	—	1.0
24S51	Output	5000	3.5	5	280	0.38	37.8:1	200-20000	1000	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5
24S51A	Output	5000†	3.5	5	260	0.43	39.9:1	200-20000	1100	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5
24S52	Output	7000-10000	3.5	5	350	0.41	44.5:1	200-20000	500	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5
24S49	Output	7000-8000	3.5	3	372	0.44	47.6:1	200-15000	1000	BAH	Leads	Leads	1¼	2¹⁄₁₆	1⅛	1¾	—	0.4
24S98	Output	10000	4	5	290	0.26	57.1:1	200-20000	1000	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5
20A16	Line to Grids	7000-15000	28000- 60000 C.T.	10	431	1158	1:2	100-10000	750	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.4
24S19	Output	10000 C.T.	4/8/16 3.5/8/16	12	575	1.2	24.1:1	100-15000	1500	BAV	Leads	Leads	2⅜	2⅞	1¾	2⅜	—	1.0
24S80	Transceiver Output	10000	2000 and 50	2	670	250 and 5	2.2:1 and 14.1:1	200-20000	500	BAH	Leads	Leads	1⅜	2⅜	1⅜	2	—	0.5
24S99	Output	25000	4	5	1160	0.6	80.3:1	200-25000	1000	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.5

†3% and 6% primary humbucking tap.

25 VOLT LINE TO VOICE COIL (SPEAKER)

TM Part No.	Impedance in Ohms		Audio Watts	Overall Turns Ratio	DC Resistance		Frequency Response ±3 DB	RMS Test Volts	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Pri.	Sec.			Pri. Ohms	Sec. Ohms				Pri.	Sec.	H	W	D	MW	MD	
24S22	39/78/156/312.5/ 625/1250	4/8/16	16/8/4/2/ 1/0.5	8.8:1	70	1.8	100-6000	1500	BHV	Lugs	Lugs	2¾	3¼	2⅛	2¹³⁄₁₆	—	1.75
24S21	78/156/312.5/625/ 1250	4/8/16	8/4/2/1.5	8.8:1	125	1.1	100-10000	1000	BHV	Lugs	Lugs	2	2⅜	1¾	2	—	1.0
24S24	125/250/500/1000/ 2000	4/8	5/2.5/1.25/ 0.62/0.31	15.8:1	85	0.50	30-20000	500	BHH	Lugs	Lugs	1⅜	2⅜	1¼	2	—	0.4
24S169	125/312/625/1250	4/8	5/2/1/0.5	12.8:1	65	0.75	—	900	BAH	Leads	Leads	1⅝	2¹³⁄₁₆	1⅜	2⅜	—	0.7
24S109	312/625/1250	4/8	2/1/0.5	12.4:1	80	0.62	40-15000	1500	BAH	Leads	Leads	1⅜	2⅜	1⅜	2	—	0.45

70.7 VOLT LINE TO VOICE COIL (SPEAKER)



BAV
BHV

TM Part No.	Impedance in Ohms		Audio Watts	Overall Turns Ratio	DC Resistance		Frequency Response ±3 DB	RMS Test Volts	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Pri.	Sec.			Pri. Ohms	Sec. Ohms				Pri.	Sec.	H	W	D	MW	MD	
24S171	166/312/625/1250	8	30/15/7.5/3.8	12.6:1	27	0.5	—	1000	BAH	Leads	Leads	2⅝	4	2¼	3⁵⁄₁₆	—	2.5
24S166	166/250/500/1000	4/8/16	30/20/10/5	7.9:1	36	9.1	40-20000	1500	BAV	Lugs	Lugs	2⅜	2⅞	1¾	2⅜	—	1.2
24S72	312.5/625/1250/ 2500/5000/10000	4/8/16	16/8/4/2/ 1/0.5	25.1:1	480	0.88	100-5000	1000	BHV	Lugs	Lugs	2⅝	3⅛	2¼	2¹³⁄₁₆	—	1.75
24S124	500/555/625/715/833	8/16	10/9/8/7/6	6.9:1	69	1.2	50-20000	1000	BHV	Lugs	Lugs	2	2⅜	1⅝	2	—	0.7
24S170	500/1000/2000/4000	8	10/5/2.5/1.25	22.2:1	200	1.2	—	1000	BAV	Leads	Leads	2¼	3¹⁄₁₆	1¾	2⅜	—	1.0
24S71	625/1250/2500/ 5000/10000	4/8/16	8/4/2/1/0.5	25:1	830	1.4	50-20000	1000	BHV	Lugs	Lugs	2	2½	1⅝	2	—	1.0
24S168	1000/2500/5000/10000	8	5/2/1/0.5	35.1:1	600	0.73	—	900	BAH	Leads	Leads	1⅝	2¹³⁄₁₆	1⅜	2⅜	—	0.7
24S74	1000/2000/4000/ 8000/16000	4/8	5/2.5/1.25/ 0.62/0.31	44.7:1	850	0.54	50-20000	1000	BHH	Lugs	Lugs	1⅜	2⅜	1¼	2	—	0.5
24S125	1000/1250/1667/ 2500/5000	8/16	5/4/3/2/1	79.1:1	265	1.9	50-20000	1000	BHH	Lugs	Lugs	1⅜	2⅜	1⅜	2	—	0.5
24S128	1250/2500/5000/ 10000/20000/40000	8	4/2/1/0.5/ 0.25/0.12	64.6:1	1820	1.1	50-20000	1000	BAH	Leads	Leads	1⅝	2⅞	1½	2⅜	—	0.7
24S176	2500/5000/10000	8	2/1/0.5	34.6:1	650	0.74	50-2000	1000	BAH	Leads	Leads	1⅜	2⅜	1½	2	—	0.4

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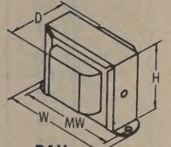
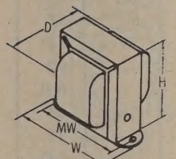
THORDARSON TRANSISTOR TRANSFORMERS THORDARSON

TRANSISTOR TRANSFORMERS — AUDIO/LOW LEVEL GENERAL USE

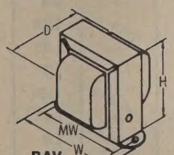
Listed in Order of Increasing Primary Impedance



BAH



BHV



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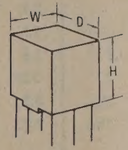
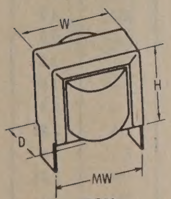


M3



BCH

TM Part No.	Application	Impedance in Ohms		DC Resistance		Overall Turns Ratio	Max. Unbal. Pri. MADC	Audio Watts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
		Primary	Secondary	Pri. Ohms	Sec. Ohms					H	W	D	MW	MD	
TR300	Output	20 C.T.	8	.55	.35	—	500	10	BAH	1⅜	2 7/16	1½	2	—	0.45
TR60	Output†	48 C.T.	3.2/8/16	3.6	1.4	—	550	10	BHV	2 5/16	2⅞	2	2⅜	—	0.90
TR196	Output	48 C.T.	8/16	4.5	1.4	—	275	8	BAH	1 15/16	3⅛	1⅜	2 13/16	—	1.0
TR111	Output	100 C.T.	4/8/16	11	1.5	2.5:1	2	0.3	BAH	¾	1⅝	13/16	1⅜	—	0.07
TR195	Driver	100	100 C.T.	9.1	10	—	100	4	BAH	1⅝	2 13/16	1½	2⅜	—	0.60
TR296	Interstage	100 C.T.	10 C.T.	4.3	0.8	—	100	0.25	BAH	1¼	2⅛	1 1/16	1¾	—	0.25
TR257	Interstage	100	1000 C.T.	5.5	60	—	100	1	BAH	1⅜	2⅜	1½	2	—	0.35
TR63	Output	100 C.T.	3.2/8/16	6.6	1.5	—	500	10	BAV	2 5/16	2⅞	2	2⅜	—	0.95
27S93	TR or Voice Coil	150 C.T.	12	16	3.0	3.4:1	10	0.05	M3‡	—	—	—	—	—	0.01
TR246	Interstage	200 C.T.	2000 C.T.	29	233	—	2	0.2	BAH	¾	1⅝	1	1⅜	—	0.08
TR113	Output	400 C.T.	4/8/16	32	1.5	2.5:1	—	—	BAH	¾	1⅝	13/16	1⅜	—	0.12
TR5	Driver	490 C.T.	150 C.T.	30	16	1.8:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.05
TR102	Output	500 C.T.	4/8/16	75	3.5	5.52:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.06
TR114	Output	500 C.T.	4/8/16	47	0.85	2.78:1	2	0.3	BAH	¾	1⅝	13/16	1⅜	—	0.07
TR240	Output	500 C.T.	125/500*	50	55	1:1.1	5	0.02	BAH	⅝	1 7/32	¾	1	—	0.02
TR66	Driver	500 C.T.	200 C.T.	50	37	—	17	0.5	BAH	1¼	2⅛	1	1¾	—	0.20
TR1	Output	500 C.T.	500 C.T.	40	55	1:1	—	—	BAH	¾	1⅝	13/16	1⅜	—	0.12
27S100	Output or Mixing	500 C.T.	600	60	90	1:1.1	3	0.05	M3‡	—	—	—	—	—	0.01
TR259	Interstage	500 C.T.	5000 C.T.	40	245	—	12‡	1	BAH	1⅜	2⅜	1⅜	2	—	0.35
27S111	TR or Line/Line	600 C.T.	600 C.T.	65	85	1:1	3.0	.05	M3‡	—	—	—	—	—	0.01
27S101	TR to Line	900 C.T.	600	100	90	1.2:1	4.0	0.05	M3‡	—	—	—	—	—	0.01
TR116	Output	1000	4/8/16	10	120	—	1.6	0.3	BAH	¾	1⅝	1	1⅜	—	0.07
TR119	Input	1000 C.T.	200000 C.T.	123	1815	1:14.1	—	—	BAH	¾	1⅝	13/16	1⅜	—	0.12
TR4	Output	1500	500 C.T.	100	45	1.73:1	—	—	BCH	11/16	11/16	⅝	13/16	—	.05
TR106	Interstage	1200	20000 C.T.	142	1860	1:4.1	—	—	BCH	11/16	11/16	⅝	13/16	—	.05
27S102	TR to Line	1500 C.T.	600	150	100	1.6:1	3	0.05	M3‡	—	—	—	—	—	0.01
TR258	Output	2000 C.T.	4/8/16	10	260	—	4	0.2	BAH	¾	1⅝	1	1⅜	—	0.08
TR260	Driver	2000 C.T.	200 C.T.	5.0	748	—	120	0.1	BAH	⅝	1 3/32	11/16	1 1/16	—	0.05
TR249	Interstage	2000	1500 C.T.	165	40	1.15:1	2	0.2	BAH	¾	1⅝	1	1⅜	—	0.07
TR250	Interstage	2000 C.T.	8000 C.T.	200	550	1:2	4	0.2	BAH	¾	1⅝	1	1⅜	—	0.07
TR107	Output	2500	4/16	370	2.3	11.81:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.06
TR3	Interstage	5000 C.T.	10000 C.T.	550	1100	1:1.4	—	—	BCH	11/16	13/16	⅝	13/16	—	.05
TR108	Interstage	5000 C.T.	80000 C.T.	573	5740	1:4	—	—	BCH	11/16	13/16	⅝	13/16	—	.05
TR109	Output	10000 C.T.	4/8/16	1174	2.6	24.54:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.06
27D39	Driver	10000 C.T.	500 C.T.	1100	75	4.5:1	0.5	0.05	M3‡	—	—	—	—	—	0.01
27D37	Driver	10000 C.T.	1200 C.T.	1100	400	2.9:1	1	0.05	M3‡	—	—	—	—	—	0.01
27D38	Driver	10000 C.T.	2000 C.T.	1100	500	2.2:1	1	0.05	M3‡	—	—	—	—	—	0.01
TR23	Output	10000	2000	900	11	7.05:1	—	—	BCH	1 3/16	1 7/16	1	1⅜	—	.05
TR7	Interstage	10000	2000 C.T.	740	300	2.24:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.04
TR6	Interstage	10000	3000 C.T.	820	660	1.8:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.05
27S110	Output or Isolation	10000 C.T.	10000 C.T.	1050	1100	1:1	1	0.5	M3‡	—	—	—	—	—	0.01
TR17	Interstage	20000	800 C.T.	1300	95	5:1	—	—	BCH	11/16	13/16	⅝	13/16	—	.05
27A111	TR Interstage	25000 C.T.	1000 C.T.	1500	100	5:1	0.5	0.04	M3‡	—	—	—	—	—	0.01
27A108	TR Interstage	50000 C.T.	1000 C.T.	3500	70	7.1:1	0	0.025	M3‡	—	—	—	—	—	0.01
TR24	Interstage	100000	1500 C.T.	3000	45	8.6:1	—	—	BAH	¾	1⅝	13/16	1⅜	—	0.12
27A109	Input	200000	1000	4870	90	14.1:1	0	0.01	M3‡	—	—	—	—	—	0.01
27A107	Chopper Input	200000 C.T.	1000 C.T.	4870	90	14.1:1	0	0.01	M3‡	—	—	—	—	—	0.01
27C80	Inductor	1.25 Hys.	—	180	—	—	2	—	M3‡	—	—	—	—	—	0.01
27C79	Inductor	6 Hys.	—	1700	—	—	2	—	M3‡	—	—	—	—	—	0.01

‡M3 Style: H-0.465, W-0.410, D-0.310 mounting is P.C. with 3/32″ grid spacing. *Split center tap winding. †Has lugs on secondary.

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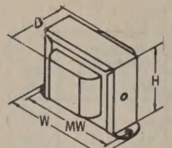
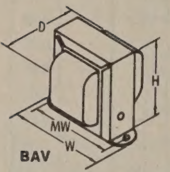
FILAMENT TRANSFORMERS

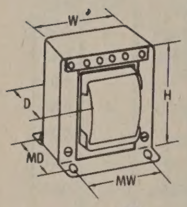
FILAMENT TRANSFORMERS — SINGLE SECONDARY



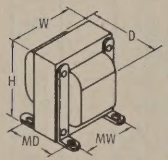
BAH



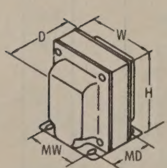
BAV



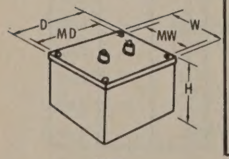
CTV
CAV



LAV
LHV



GGV



KTV

TM Part No.	Secondary		Primary Volts	RMS Test Volts	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps				Primary	Secondary	H	W	D	MW	MD	
21F191	2.5 C.T.	0.3	117	1500	BAH	Leads	Leads	1¼	2⅛	1 5/16	1¾	—	0.3
21F34	2.5	1.5	117	1500	BAH	Leads	Leads	1⅝	2⅞	1½	2⅜	—	0.7
21F120	2.5 C.T.	3.0	117	1500	BAH	Leads	Leads	1⅝	2⅞	1¾	2⅜	—	0.6
21F165	2.5 C.T.	3.0	115/230	1500	BAH	Leads	Leads	1¾	2⅞	1⅝	2⅜	—	0.6
21F31	2.5 C.T.	5.0	117	7500	BAV	Leads	Leads	2 11/16	3 5/16	2¼	2 13/16	—	1.5
21F92	2.5 C.T.	6.0	117	1500	BAH	Leads	Leads	2	3 5/16	1⅞	2 13/16	—	1.0
21F166	2.5 C.T.	6.0	115/230	1500	BAH	Leads	Leads	2	3 5/16	2	2 13/16	—	1.0
21F93	2.5 C.T.	10.0	117	1500	BAH	Leads	Leads	2 5/16	3¾	2⅛	3⅛	—	1.5
21F103	2.5 C.T.	10.0	107/117	7500	BAV	Leads	Leads	3⅛	3⅝	2½	3⅛	—	2.5
21F02	2.5 C.T.	10.0	117	10000	CAV	Leads	Leads	3⅛	2½	2¼	2	1¾	2.75
21F94	5.0 C.T.	3.0	117	1500	BAH	Leads	Leads	2	3 5/16	2	2 13/16	—	1.3
21F13	5.0 C.T.	10.0	117	2500	CAV	Leads	Leads	3⅛	2⅞	2½	2	2⅜	3.0
26F66	5.0 C.T.	15.0	117	2500	CAV	Leads	Leads	3	2½	2⅞	2	2⅛	3.5
21F20	5.0 C.T.	15.0	117	10000	CAV	Leads	Leads	4⅝	3¾	3¼	3	2½	6.75
21F39	5.0 C.T.	22.0	107/117	10000	KTV	Terms.	Terms.	5⅛	4⅝	8½	2¾	6	13.5
21F69	6.3/5.0 Tap†	2.0	117	5000	BAH	Leads	Leads	2	3 5/16	2	2 13/16	—	1.25
26F73	6.3 C.T.	0.3	117	1500	BAH	Leads	Leads	1¼	2⅛	1⅝	1¾	—	0.3
21F21	6.3	0.6	117	1500	BAH	Leads	Leads	1⅜	2⅜	1¼	2	—	0.75
21F162	6.3 C.T.	0.6	117	1500	BAH	Leads	Leads	1⅜	2⅜	1½	2	—	0.4
21F167	6.3	0.6	115/230	1500	BAH	Leads	Leads	1⅜	2⅜	1⅜	2	—	0.6
21F200	6.3 C.T.	0.6	230	1500	BAH	Leads	Leads	1⅜	2⅝	1½	2	—	0.4
21F143	6.3 C.T.	1.0	117	1500	BAH	Leads	Leads	1⅝	2⅞	1½	2⅜	—	0.6
21F08	6.3 C.T.	1.2	117	2500	BAV	Leads	Leads	2	2⅜	1½	2	—	0.7
21F09	6.3 C.T.	1.2	117	2500	BAH	Leads	Leads	1⅝	2⅞	1½	2⅜	—	0.7
21F212	*6.3	1.2	117	2500	BAH	*Leads	Leads	1⅝	2⅞	1½	2⅜	—	0.7
26F60	6.3	1.2	117	7000	BAH	Leads	Leads	2	3¼	2	2 13/16	—	1.25
21F168	6.3 C.T.	1.2	115/230	2500	BAH	Leads	Leads	1⅝	2 13/16	1⅝	2⅜	—	0.5
26F65	6.3	1.2	6.3	5000	BAH	Leads	Leads	2	3¼	2	2 13/16	—	1.25
21F10	6.3 C.T.	3.0	117	2500	BAH	Leads	Leads	2	3¼	2⅛	2 13/16	—	1.25
21F169	6.3 C.T.	3.0	115/230	2500	BAH	Leads	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3
21F71	6.3	4.0	117	1500	BAH	Leads	Leads	2	3 5/16	2	2 13/16	—	1.25
21F70	6.3	4.0	117	5000	BAH	Leads	Leads	2 9/16	4	2¼	3 9/16	—	2.1
21F203	6.3 C.T.	4.0	117	1500	BAH	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.6
21F204	6.3 C.T.	5.0	117	1500	BAH	Leads	Leads	2⅜	3¾	2⅛	3⅛	—	1.8
21F59	6.3 C.T.	6.0	117	2500	LHV	Lugs	Lugs	3⅛	2⅞	2½	2	2	2.75
21F11	6.3 C.T.	6.0	117	1500	CAV	Leads	Leads	3⅛	2½	2½	2	1¾	2.5
21F42	6.3 C.T.	6.0	107/117	2500	GGV	Leads	Leads	3⅝	3	3⅛	2	2¼	3.5
21F72	6.3 C.T.	6.0	107/117	2000	BAH	Leads	Leads	2¼	3⅝	2½	3⅛	—	2.0
21F170	6.3 C.T.	6.0	115/230	1500	BAH	Leads	Leads	2 19/32	4	2¼	3 9/16	—	2.3
21F96	6.3 C.T.	8.0	117	1500	BAH	Leads	Leads	2⅝	4	2½	3 9/16	—	2.5
21F74	6.3 C.T.	10.0	117	1500	GGV	Leads	Leads	3½	3	3⅛	2¼	2	3.8
21F12	6.3 C.T.	10.0	117	2500	CAV	Leads	Leads	3⅛	2½	2½	2	2	3.25
21F43	6.3 C.T.	10.0	107/117	2500	LAV	Leads	Leads	3½	2⅞	2¾	2¼	2 3/16	3.5
21F109	*6.0/6.5 C.T., 7.0 C.T.	13	117	2000	LHV	Lugs	Cu. Tabs	3⅜	2 13/16	3⅜	2¼	2 11/16	4.5
21F76	6.3 C.T.	15.0	117	10000	LAV	Leads	Leads	4¼	3½	3 5/16	2¾	2 13/16	7.5
21F77	6.3 C.T.	20.0	117	2500	GGV	Leads	Leads	3⅞	3 9/32	4¼	2½	2 15/16	7.0
21F25	6.3 C.T.	20.0	107/117	2500	LAV	Leads	Leads	4⅝	3 13/16	3¼	3	2⅜	6.7
21F79	*6.3/7.5 C.T.	25.0	117	3000	LHV	Leads	Lugs	4⅝	3 13/16	3 7/16	3	3 1/16	7.5
21F45	7.5 C.T.	4.0	117	2500	LHV	Lugs	Lugs	3⅛	2⅝	2¾	2	2⅛	2.7
21F62	7.5 C.T.	8.0	117	2500	LAV	Leads	Leads	3⅞	3⅛	2⅞	2½	2⅜	4.7
21F205	10.0 C.T.	1.0	117	1500	BAH	Leads	Leads	2	3¼	1⅝	2 13/16	—	0.9
21F206	10.0 C.T.	2.0	117	1500	BAH	Leads	Leads	2	3¼	2	2 13/16	—	1.3
26F71	10.0 C.T.	3.0	117	1500	BAH	Leads	Leads	2⅜	3¾	2¼	3⅛	—	1.6
21F207	10.0 C.T.	4.0	117	1500	BAH	Leads	Leads	2⅝	4	2⅛	3 9/16	—	2.3
21F61	10.0 C.T.	4.0	117	2500	LHV	Lugs	Lugs	3 7/16	2⅞	2⅝	2¼	2⅛	3.25
21F172	10.0 C.T.	5.0	117	2000	LAV	Leads	Leads	3	2½	2⅝	2 1/16	2	2.5
21F18	10.0 C.T.	5.0	117	2500	CAV	Leads	Leads	3⅛	2 9/16	2½	2	1¾	2.25
21F208	10.0 C.T.	6.0	117	1500	LAV	Leads	Leads	3⅛	2½	2¾	2	2 5/16	3.1
21F209	10.0 C.T.	8.0	117	1500	LAV	Leads	Leads	3 7/16	2 13/16	3	2¼	2½	4.1
21F28	10.0 C.T.	8.0	117	2500	CAV	Leads	Leads	3⅞	3⅛	3⅛	2½	2⅜	4.9

*Secondary voltage varied by means of primary taps. †Fused primary.

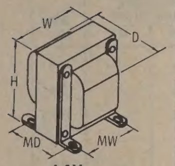
Listing continued on next page

THORDARSON

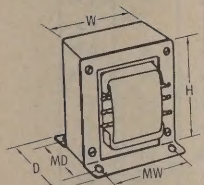
FILAMENT TRANSFORMERS

THORDARSON

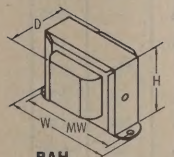
FILAMENT TRANSFORMERS — SINGLE SECONDARY (Cont'd)



LAV



CAV

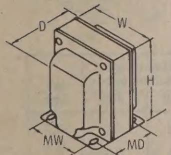


BAH

TM Part No.	Secondary		Primary Volts	RMS Test Volts	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps				Primary	Secondary	H	W	D	MW	MD	
21F173	10.0 C.T.	10.0	117	2000	LAV	Leads	Leads	4 1/8	3 1/2	3 1/4	2 3/4	2 7/16	7.5
21F68	*10.0 C.T./ 11.0 C.T./ 12.0 C.T.	11.0	115	3000	LAV	Leads	Leads	4 3/8	3 1/2	3 1/16	2 3/4	2 9/16	6.5
21F19	*10.0 C.T. or 11.0 C.T.	12.0 10.0	117	2500	CAV	Leads	Leads	3 7/8	3 3/16	2 7/8	2 1/2	2 1/4	6.0
21F174	12.6 C.T.	1.0	117	1500	BAH	Leads	Leads	1 15/16	3 5/16	1 3/4	2 13/16	—	0.9
26F72	12.6 C.T.	1.0	117	1500	BAH	Leads	Leads	2	3 1/4	1 3/4	2 13/16	—	0.9
21F149	12.6 C.T.	1.5	117	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.0
21F175	12.6 C.T.	1.5	115/230	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.0
26F67	12.6 C.T.	2.0	117	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.1
21F176	12.6 C.T.	2.0	115/230	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.1
21F177	12.6 C.T.	2.5	115/230	1500	BAH	Leads	Leads	2 5/16	3 11/16	2	3 3/8	—	1.5
21F81	12.6 C.T.	2.5	117	1500	BAH	Leads	Leads	2 1/4	3 5/8	2 1/8	3 1/8	—	1.6
21F150	12.6 C.T.	3.0	117	1500	BAH	Leads	Leads	2 5/16	3 11/16	2 1/4	3 1/8	—	1.2
21F193	12.6 C.T.	4.0	117	1500	BAH	Leads	Leads	2 5/8	4	2 3/8	3 3/16	—	2.5
21F194	12.6 C.T.	6.0	117	1500	GGV	Leads	Leads	3 1/2	2 13/16	3 3/8	2 1/8	2 1/4	3.5
21F195	12.6 C.T.	8.0	117	1500	GGV	Leads	Leads	3 7/8	3 1/8	3 3/8	2 3/16	2 1/2	4.5
21F196	12.6 C.T.	10.0	117	1500	GGV	Leads	Leads	4 1/4	3 7/16	3 7/8	2 11/16	2 3/4	5.5
21F84	24.0 C.T.	1.0	117	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.5
26F68	24.0	1.0	117	2500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.5
21F181	24.0 C.T.	1.0	115/230	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.5
21F100	*24.5 to 29.0 C.T.	0.04	117	1500	BAH	Leads	Leads	1 1/4	2 1/8	1 3/8	1 3/4	—	0.25
21F101	*24.5 to 29.0 C.T.	0.25	117	1500	BAH	Leads	Leads	1 5/8	2 13/16	1 5/8	—	—	0.6
21F51	25.2	1.0	117	1500	BAH	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.5
21F142	25.2 C.T.	1.0	117	1500	BAH	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.5
21F83	25.2 C.T.	2.0	117	1500	BAH	Leads	Leads	2 9/16	4	2 1/4	3 3/16	—	2.2
21F180	25.2 C.T.	2.0	115/230	1500	BAH	Leads	Leads	2 9/16	4	2 1/4	3 3/16	—	2.2
21F114	25.2 C.T.	3.0	117	1500	BAH	Leads	Leads	2 9/16	4	2 1/4	3 3/16	—	2.2
21F197	25.2 C.T.	5.0	117	1500	GGV	Leads	Leads	4 1/4	3 7/16	3 7/8	2 3/4	2 11/16	5.5
21F198	25.2 C.T.	7.5	117	1500	GGV	Leads	Leads	4 1/4	3 7/16	4 1/4	2 3/4	3 1/16	7.5
21F199	25.2 C.T.	10.0	117	1500	GGV	Leads	Leads	4 9/16	3 3/4	5	3	3 13/16	10.0
21F27	26.5 C.T.	0.6	117	3000	BAH	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.6
21F82	26.8 C.T.	1.0	117	1500	BAH	Leads	Leads	2	3 1/4	2	2 13/16	—	1.6
21F178	26.8 C.T.	1.0	115/230	1500	BAH	Leads	Leads	2	3 1/4	2 1/8	2 13/16	—	1.7
23V270	26.8 C.T.	1.7	115	1500	BAH	Leads	Leads	2 5/8	4	2 1/4	3 3/16	—	3.5
21F190	30.0	3.0	117	1500	GGV	Leads	Leads	3 1/2	2 13/16	3 5/8	2 1/4	2 7/16	4.2
21F187	*45 to 54 C.T.	1.0	117	2500	BAH	Leads	Leads	2 5/8	4	2 3/8	3 3/16	—	2.3

*Secondary voltage varied by means of primary taps.

FILAMENT TRANSFORMERS — WITH MULTIPLE SECONDARIES



GGV

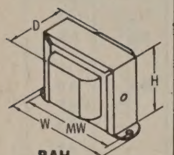
TM Part No.	Secondary		RMS Test Volts	Primary Volts 50/60 Hz	Style	Termination		Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps				Primary	Secondary	H	W	D	MW	MD	
21F56	5.0 C.T. 6.3 C.T.	6.0 6.0	1765 1765	107/117	GGV	Leads	Leads	3 7/8	3 1/4	3 3/8	2 1/2	2 3/16	4.8
21F88	6.3 6.3 6.3 6.3 C.T.	1.75 1.75 1.75 1.75	1500 1500 1500 1500	115	GGV	Leads	Leads	3 1/8	2 5/8	3	2	2 1/4	3.5
21F87	6.3 C.T. 6.3 C.T.	3.0 3.0	1500 1500	117	GGV	Leads	Leads	3 3/32	2 21/32	2 5/8	2	1 7/8	2.5
21F24	6.3 6.3 6.3 6.3	3.0 3.0 3.0 3.0	2500 2500 2500 2500	117	GGV	Leads	Leads	3 7/8	3 1/4	3 3/8	2 1/2	2 1/4	5.0
21F97	24.0 C.T. or 12.0	2.0 4.0	1500 —	117	BAH	Leads	Leads	2 11/16	4	2 5/8	3 3/16	—	2.5
21F90	12.6 12.6 C.T.	2.5 2.5	1500 1500	115	GGV	Leads	Leads	3 1/2	3	3 1/8	2 1/4	2	3.7
21F52	12.6 12.6	3.5 3.5	2500 —	117	GGV	Leads	Leads	3 1/2	2 7/8	3 7/8	2 1/4	2 5/8	5.0
21F91	12.6 C.T. 12.6 C.T.	5.0 5.0	2000 2000	105/115/125	GGV	Leads	Leads	3 7/8	3 7/32	3 1/2	2 1/2	2 5/8	6.0

THORDARSON

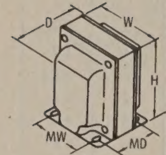
INDUCTORS

THORDARSON

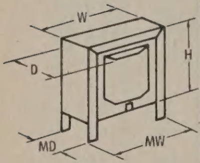
FILTER CHOKES — SMOOTHING



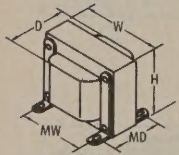
BAH



GGV



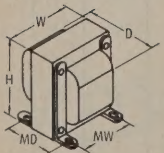
BCH-1



LAH
LHH

TM Part No.	MADC	Nominal Inductance Hz	DC Res. Ohms	RMS Test Volts	Style	Termination	Outline Dimensions H	W	D	Mounting Dimensions MW	MD	Wt. Lbs.
26C40	10	1.5	95	2500	BAH	Leads	1¼	2⅛	1⅛	1¾	—	0.5
20C102	15	2.0	70	1500	BAH	Leads	1 3/16	2 3/16	1¼	1¾	—	0.4
20C43	15	20	900	1500	BAH	Leads	1⅝	2⅞	1½	2⅜	—	0.75
20C51	15	35	1850	1200	BAH	Leads	1⅜	2⅜	1¼	2	—	0.5
20C04	15	50	3500	1500	BAH	Leads	1⅜	2⅜	1½	2	—	0.5
20C05	20	15	1000	1000	BAH	Leads	1⅝	2 13/16	1¾	2⅜	—	0.6
20C185	30	12	400	2000	BAH	Leads	1⅜	2⅜	1 5/16	2	—	0.5
20C52	40	8.0	450	1500	BAH	Leads	1⅜	2⅜	1¼	2	—	0.5
20C47	50	4.5	300	1500	BAH	Leads	1⅜	2⅜	1⅜	2	—	0.5
20C59	55	7.0	200	1600	BAH	Leads	1⅝	2⅞	1⅝	2⅜	—	0.75
20C84	50	7.0	550	1500	BAH	Leads	1⅜	2⅜	1⅜	2	—	0.5
20C81	50	8.5	400	1500	BAH	Leads	1⅝	2⅞	1½	2⅜	—	0.75
20C66	50	9.0	500	2500	BAH	Leads	1⅝	2⅞	1½	2⅜	—	0.75
26C87	50	16	580	1500	BAH	Leads	2	3¼	2⅛	2 13/16	—	1.2
26C86	75	15	400	1500	BAH	Leads	2¼	3¼	2⅝	3⅛	—	1.5
20C53	80	12	375	2000	BAH	Leads	2	3¼	2⅛	2 13/16	—	1.5
20C71	80	16	360	1500	GGV	Leads	3 3/16	2⅝	2⅝	2	1 11/16	2.5
20C48	80	8.0	250	2000	BAH	Leads	2	3¼	2⅛	2 13/16	—	1.5
20C06	90	10	270	1000	BAH	Leads	2	3 5/16	2	2 13/16	—	1.3
20C07	90	4.0	100	1500	BAH	Leads	2	3 5/16	1¾	2 13/16	—	1.0
26C85	110	10.5	225	3000	BAH	Leads	2⅝	4	2½	3 9/16	—	1.75
26C83	125	7.0	300	1500	BAH	Leads	2	3¼	2⅛	2 13/16	—	1.5
26C88	130	2.5	100	2000	BAH	Leads	2	3¼	1¾	2 13/16	—	1.2
26C89	150	2.3	60	1500	BAH	Leads	2	3¼	1¾	2 13/16	—	1.0
20C54	150	8	145	1700	GGV	Leads	3⅛	2 9/16	2¾	2	1 11/16	2.2
26C41	200	1.5	90	1600	BAH	Leads	1⅝	2⅞	1⅝	2⅜	—	0.75
26C43	200	2.0	50	1500	BAH	Leads	2	3⅛	1⅝	2 13/16	—	1.0
20C13	200	6.0	150	1500	GGV	Leads	3 3/32	2 21/32	2⅝	2	1⅞	2.5
20C14	200	6.0	150	1500	BAH	Leads	2⅝	4	2¼	3 9/16	—	2.3
26C45	200	10	140	3000	GGV	Leads	3½	2⅞	4⅛	2⅞	2¼	4.9
26C76	240	1.0	50	1500	BAH	Leads	1⅝	2⅞	1½	2⅜	—	0.75
26C80	300	0.5	30	1500	BAH	Leads	1⅜	2⅜	1½	2	—	0.5
26C77	290	0.7	30	1500	BAH	Leads	1⅝	2 13/16	1½	2⅜	—	0.75
26C79	350	0.6	35	1500	BAH	Leads	1⅝	2 13/16	1½	2⅜	—	0.6
26C78	350	1.0	35	1500	BAH	Leads	2	3 5/16	2	2 13/16	—	1.35
26C92	375	0.8	25	1500	BAH	Leads	2 5/16	3 11/16	2	3⅛	—	1.5
20C21	375	1.5	50	1500	BAH	Leads	2 5/16	3 11/16	2	3⅛	—	1.5
26C81	600	0.32	10	1500	BAH	Leads	2	3¼	2	2 13/16	—	1.3

HIGH CURRENT CHOKES



LAV

TM Part No.	Notes	Amps DC	Induct. M.H.	DC Res. Ohms	RMS Test Volts	Style	Termination	Outline Dimensions H	W	D	Mounting Dimensions MW	MD	Wt. Lbs.
TR153	—	1.0	3	0.25	1000	BCH-1	Leads	1¼	1½	1	1¼	7/16	0.2
TR154	—	1.0	11	0.75	1000	BCH-1	Leads	1¼	1½	1	1¼	7/16	0.2
20C25	Dual Winding*	1.0 2.0	300 75	3.0 0.75	1500	LAV	Leads	3½	2⅞	3 3/16	2¼	2⅝	3.5
20C00	—	2.0	35	0.75	1500	LAH	Leads	2⅜	2⅝	2¾	2 3/16	2	1.9
20C26	Dual Winding*	2.5 5.0	80 20	0.60 0.15	1500	LAV	Leads	3 13/16	3 3/16	3 9/16	2½	3 1/16	6.0
20C01	—	4.0	25	0.425	1500	LHH	Lugs	3	3⅜	2⅞	2 13/16	2⅛	3.4
20C27	Dual Winding*	5.0 10.0	32 8	0.20 0.05	1500	LAV	Leads	4¼	3½	3 9/16	2¾	3 1/16	7.5
20C02	—	8.0	10	0.15	1500	LAH	Leads	3¼	3¾	3 3/16	3⅛	2½	5.3
20C03	—	12.5	10	0.11	1500	LAH	Leads	3½	4⅛	3 1/16	3 7/16	2⅜	5.9

*May be connected in "Series" or "Parallel" for values listed.

THORDARSON

POWER TRANSFORMERS

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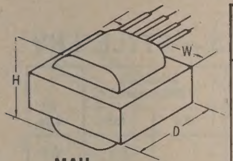
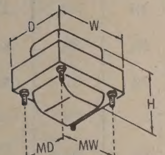
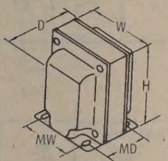
PLATE AND FILAMENT — PRIMARY 117V 50/60 Hz WITH LEADS



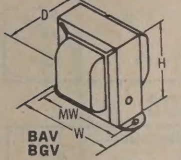
MAH



AGF



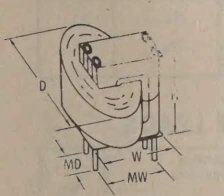
GGV



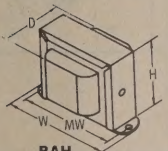
BAV
BGV

TM Part No	Plate Supply		Other Windings		Rectifier Fil.		Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts AC	MADC	Volts	Amps	Volts	Amps		H	W	D	MW	MD	
23V378	54 C.T.	500	6.3	0.5	—	—	GGV	2⅝	2¼	2 9/16	1¾	1⅝	1.7
26R37	125	15	6.3	0.6	—	—	BAV	2	2⅜	1⅝	2	—	0.7
24R165	125	15	—	—	12.6	0.3	BAV	1 15/16	2⅜	1⅝	2	—	0.7
26R38	125	50	6.3	2.0	—	—	BAH	2¼	3 11/16	2⅛	3⅛	—	1.5
24R167	125	50	—	—	12.6	1.0	BAH	2¼	3 11/16	2⅛	3⅛	—	1.5
26R60	150	25	6.3	.5	—	—	BGV	2	2⅜	1 13/16	2	—	0.7
24R168	150	25	—	—	12.6	0.3	GGV	1 15/16	2⅜	1 13/16	2	—	0.8
22R39	125-0-125	25	6.3	1.0	—	—	BAV	2⅜	2⅞	1¾	2⅜	—	1.0
24R166	125-0-125	25	—	—	12.6	0.6	BAV	2 5/16	2 13/16	1¾	2⅜	—	1.0
24R11	230-0-230	50	6.3	2.5	—	—	AGF	2⅝	3	2½	2	1 9/16	2.2
24R11U	230-0-230	50	6.3	2.5	—	—	GGV	3 3/16	2⅝	2⅝	2	2½	2.2
24R19U	240-0-240	55	5.0	2.0	6.3 C.T.	2.0	GGV	3⅛	2⅝	2¾	2	1 11/16	2.5
24R12U	240-0-240	70	6.3	3.0	—	—	GGV	3⅛	2½	2⅞	2	1 13/16	2.6
24R09U	250-0-250	70	5.0	2.0	6.3 C.T.	2.5	GGV	3⅛	2⅝	3⅛	2	2 1/16	3.2
24R13U	260-0-260	90	5.0	2.0	6.3 C.T.	3.0	GGV	3½	2⅞	3⅝	2¼	2¼	4.0
24R20U	270-0-270	120	5.0	3.0	6.3 C.T.	3.5	GGV	3⅞	3⅛	3½	2½	2 3/16	5.0
26R160	270-0-270	260	5.0	3.0	6.3	8.8	GGV	3⅞	3⅛	3½	2½	2¼	5.5
26R51	281-0-281	250	5.0	3.0	6.3	9.5	GGH	3⅝	4⅛	4⅜	1 13/16	2⅜	6.2
24R96	300-0-300	65	—	—	6.3 C.T	2.7	GGV	3⅛	2⅝	2½	2	1¾	2.7
22R05U	300-0-300	120	5.0	3.0	6.3 C.T	5.0	GGV	3⅞	3¼	3⅜	2½	2 9/16	4.2
24R08U	325-0-325	55	5.0	2.0	6.3 C.T.	2.0	GGV	3⅛	2½	3⅛	2	2 1/16	3.2
24R22	360-0-360	120	5.0	3.0	6.3 C.T.	3.5	AGF	3¾	3⅛	3¾	2½	3⅛	5.5
24R07U	400-0-400	200	5.0	3.0	6.3 C.T.	5.0	GGV	4⅝	3¾	4½	3	3⅜	9.2

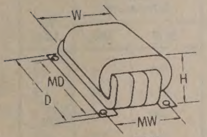
INVERTER/CONVERTER — TRANSISTOR POWER SUPPLY



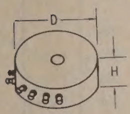
DAH



BAH



TYL

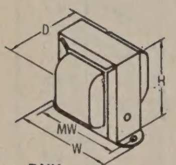


TM1

Part No.	Application	Style	DC Input Volts	Output Volts	Output MADC	Output PWR	Mounting Dimensions		Outline Dimensions			Termi-nation	Wt. Lbs.
							MW	MD	H	W	D		
TR269	Converter	TMI	12.6	250/125	100/200	25	11/64	—	¾	—	1¾	Lug	.4
TR270	Converter	TMI	12.6	300/150	200/400	60	11/64	—	1	—	1¾	Lug	.4
TR271	Converter	TMI	12.6	325/162.5	150/300	49	11/64	—	1	—	1¾	Lug	.4
TR272	Converter	TMI	12.6	375/187.5	200/400	75	11/64	—	1	—	2	Lug	.5
TR273	Converter	TMI	12.6	450/225	150/300	68	11/64	—	1	—	2	Lug	.5
TR274	Converter	TMI	12.6	500/250	250/500	125	3/16	—	1⅜	—	2¾	Lug	.6
TR275	Converter	TMI	12.6	600/300	200/400	120	3/16	—	1⅜	—	2¾	Lug	.6
TR483	Converter	TMI	12.6	600/300	350	105	13/64	—	1⅞	—	2⅞	Lug	1.2
TR484	Converter	TMI	12.6	425/212.5	350	75	3/16	—	1⅜	—	2¾	Lug	.6
TR276	Converter	TMI	28	250/125	80/160	20	7/64	—	9/16	—	1 5/16	Lug	.4
TR277	Converter	TMI	28	300/150	100/200	30	11/64	—	¾	—	1¾	Lug	.4
TR278	Converter	TMI	28	325/162.5	200/400	65	11/64	—	1	—	1¾	Lug	.4
TR279	Converter	TMI	28	375/187.5	200/400	75	11/64	—	1	—	2	Lug	.5
TR280	Converter	TMI	28	450/225	200/400	90	11/64	—	1	—	2	Lug	.5
TR287	Inverter	TYL	28	110/115/125V	400 Hz	60	1⅞	1⅜	1⅞	2¼	2	Leads	.6
TR288	Inverter	TYL	12	110/115/125V	400 Hz	60	1⅞	1⅜	1⅞	2¼	2	Leads	.6
TR355	Inverter	GGV	12	110/115/125V	60 Hz	115	2½	2⅜	3⅞	3 9/32	3¼	Leads	4
TR354	Inverter	GGV	12	110/115/125V	60 Hz	60	2	1⅞	3⅛	2⅝	2⅝	Leads	3
TR78	Converter	DAH	12	250/125	65/130	16.5	1½	—	1¾	1¾	1⅜	Leads	.50
TR95	Converter	DAH	12	600/300	200/400	120	3¾	—	2	4⅛	3	Self	1.1
*TR485	Converter	DAH	12	670/335	180/360	60	3¾	—	2	4⅛	3	Leads	1.1
TR462	Converter	BAH	3	1000 (½ wave)	—	25 ma	1⅜	—	¾	1⅝	13/16	Leads	.13
TR464	Converter	MAH	4	425/500	—	50 µa	—	—	7/16	7/16	½	Leads	.025
TR465	Converter	BAH	3	535 (½ wave)	—	90 µa	1⅜	—	¾	1⅝	13/16	Leads	.13

*Has separate bias winding for SSB transmitter.

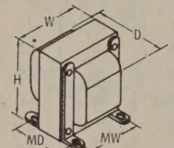
RECTIFIER TRANSFORMERS



BHV

UNIVERSAL RECTIFIER—117V 50/60 Hz PRIMARY-LUG TERMINATIONS—STYLE LHV

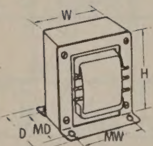
TM Part No.	Fullwave Rectifier Circuits	Secondary AC Volts	Res. or Ind. Load		Capacitive Load		Recom-mended Capacitor	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
			DC Volts	DC Amps	DC Volts	DC Amps		H	W	D	MW	MD	
23V60	C.T. Bridge	11.7 to 29.4 11.1 to 28.5	3.3 to 11.2 7.4 to 23.0	2.0 1.25	3.5 to 12.8 8.7 to 30.0	2.0 1.25	1000 mfd 500 mfd	3⅛	2⅝	2⅞	2	2⅛	2.5
23V61	C.T. Bridge	12.2 to 29.7 12.2 to 29.7	3.7 to 11.1 8.9 to 24.3	4.0 2.0	4.0 to 14.7 10.8 to 33.0	4.0 2.0	2000 mfd 1000 mfd	3⁷⁄₁₆	2¹³⁄₁₆	3⅛	2¼	2⅜	3.75
23V62	C.T. Bridge	11.7 to 29.2 11.8 to 29.2	4.3 to 12.0 8.8 to 24.0	8.0 4.0	4.5 to 14.5 11.4 to 32.4	8.0 4.0	4000 mfd 2000 mfd	3¹³⁄₁₆	3³⁄₁₆	4⅛	2½	3⅜	6.5
23V63	C.T. Bridge	12.0 to 29.8 12.0 to 29.6	3.4 to 11.5 8.4 to 24.0	12.0 6.0	3.9 to 14.4 10.0 to 32.0	12.0 6.0	6000 mfd 3000 mfd	4¼	3⁹⁄₁₆	4¼	2¾	3¼	8.0
23V406	C.T. Bridge	23.5 to 60.0 23.5 to 60.0	9.0 to 25.0 20.5 to 53.0	1.0 0.5	11.0 to 34.0 27.0 to 74.0	1.0 0.5	1500 mfd 600 mfd	3⅛	2½	3⅜	2	2¼	2.7
23V407	C.T. Bridge	24.0 to 59.0 24.0 to 59.0	9.0 to 25.0 20.5 to 52.5	2.0 1.0	11.5 to 34.0 28.5 to 73.5	2.0 1.0	2500 mfd 1500 mfd	3⁷⁄₁₆	2¹³⁄₁₆	3¹¹⁄₁₆	2¼	2½	4.1
23V408	C.T. Bridge	23.0 to 58.0 23.0 to 58.0	9.0 to 25.0 20.0 to 51.5	4.0 2.0	11.0 to 33.5 27.0 to 72.5	4.0 2.0	3000 mfd 1500 mfd	3¹³⁄₁₆	3⅛	4½	2½	3¹⁄₁₆	6.9



LAV
LHV

117V 50/60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V100	17.0/18.0	3.0	1500	LAV	3⅛	2⁹⁄₁₆	2¹³⁄₁₆	2	2⅜	3.2
23V101	17.0/18.0	6.0	1500	LAV	3¹³⁄₁₆	3⁵⁄₁₆	3³⁄₁₆	2½	2¹¹⁄₁₆	5.5
23V383	20.0 C.T.	1.0	1500	BAH	2	3¼	2⅛	2¹³⁄₁₆	—	1.4
23V122	80.0 C.T.	1.2	1500	GGV	3½	2⅞	3½	2½	2⅜	4.5

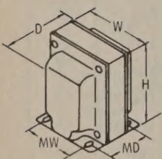


CAV
CHV

115/230V 50/60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V357	17.0/18.0	3.0	1500	CAV	3⅛	2⁹⁄₁₆	2¹³⁄₁₆	1⅝	2⅜	3.2
23V358	6.5/13.0/19.5/ 26.0	3.0	1500	LAV	3½	2⅞	2¹¹⁄₁₆	2¼	2³⁄₁₆	3.5

SIGNALING — 115V 60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS

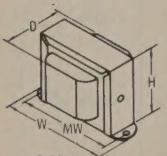


GGV

Part No. TM	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V03	4/8/12/16/20/24	2.0 to 2.8	1500	BAH	2¼	3¹¹⁄₁₆	2½	3⅛	—	1.7
23V04	4/8/12/16/20/24	4.0 to 5.6	1500	LAV	3½	2⅞	2⁵⁄₁₆	2¼	2⁵⁄₁₆	3.1

*Secondary has terminals

DUAL SECONDARIES — 115/230V 50/60 Hz PRIMARY



BAH

TM Part No.	Secondary Outputs						VA Capacity	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Each Winding		Sec. in Series		Sec. in Parallel									
	Volts	Amps	Volts	Amps	Volts	Amps			H	W	D	MW	MD	
23V50	6.0	1.0	12	1.0	6.0	2.0	12	BHV	2⅜	2⅞	1⅞	2⅜	—	1.0
23V51	6.0	2.0	12	2.0	6.0	4.0	24	BHV	2¾	3⅛	2⅛	2¹³⁄₁₆	—	1.5
23V52	12	2.0	24	2.0	12	4.0	48	BHV	3⅛	3⁹⁄₁₆	2⅜	3⅛	—	2.5
23V53	12	4.0	24	4.0	12	8.0	96	CHV	3⁷⁄₁₆	2⅞	3⅛	2¼	2⅜	4.3
23V54	12	8.0	24	8.0	12	16	192	CHV	4³⁄₁₆	3½	3½	2¾	2⅞	8.0
23V388	24	0.25	48	0.25	24	0.5	12	BHV	2⅜	2⅞	1⅞	2⅜	—	1.0
23V389	24	0.50	48	0.50	24	1.0	24	BHV	2¾	3⅛	2⅛	2¹³⁄₁₆	—	1.5
23V390	24	1.0	48	1.0	24	2.0	48	BHV	3⅛	3⁹⁄₁₆	2⅜	3⅛	—	2.5
23V391	24	2.0	48	2.0	24	4.0	96	CHV	3⁷⁄₁₆	2⅞	3⅛	2¼	2⅜	4.3
23V392	24	4.0	48	4.0	24	8.0	192	CHV	4³⁄₁₆	3½	3½	2¾	2⅞	8.0

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RECTIFIER TRANSFORMERS

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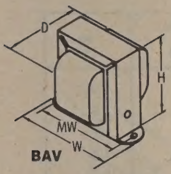
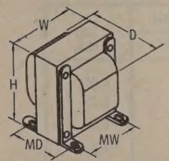


BAV

TRIPLE SECONDARIES — 117V 50/60 Hz PRIMARY — WITH LEADS

TM Part No.	Each Secondary		Secondaries in Series		Secondaries in Parallel		Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps	Volts	Amps	Volts	Amps		H	W	D	MW	MD	
23V236	12	0.10	36	0.10	12	0.30	BAV	1¾	2	1½	1¾	—	0.36
23V237	12	0.15	36	0.15	12	0.45	BAV	2	2⅜	1¾	2	—	0.60
23V238	12	0.25	36	0.25	12	0.75	BAV	2⅜	2⅞	2	2⅜	—	0.85
23V239	12	0.50	36	0.50	12	1.50	BAV	2⅜	2⅞	2¼	2⅜	—	1.25



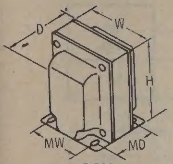
LAV

117V 50/60 Hz PRIMARY — MULTI-TAPPED SECONDARY — WITH LEADS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V103	6.3/13/19.5/26	3.0	1500	LAV	3½	2⅞	2¹¹⁄₁₆	2¼	2³⁄₁₆	3.5
23V107	7/8/9	7.0	1500	LAV	3½	2⅞	2¹¹⁄₁₆	2¼	2³⁄₁₆	3.5
23V396*	18/20/22	2.0	1500	BHV*	3⅛	3⁹⁄₁₆	2¼	3⅛	—	2.5
23V104	24/27/30/33/36	3.0	1500	LAV	3¹³⁄₁₆	3⁵⁄₁₆	3³⁄₁₆	2½	2¹¹⁄₁₆	5.6
23V394	24/26/28/30	15.0	1500	LAH▲	3¹³⁄₁₆	4½	5½	3¾	4⅜	17.0

*Secondary has Solder Lug Terminals.

▲Secondary Leads have Terminals attached.

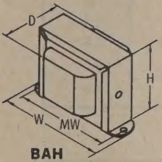


GGV

117V 50/60 Hz PRIMARY — DUAL SECONDARIES — WITH LEADS

TM Part No.	Primary Volts	Secondary 1		Secondary 2		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
		Volts	Amps	Volts	Amps			H	W	D	MW	MD	
23V121*	117	*13/18*	.900	13/18*	.900	1500	GGV	3⅛	3	2½	2	2	2.7
23V102	117	36	3.0	36	3.0	1500	LAV	4⅝	3¾	3¾	3	3¹⁄₁₆	9.7

*Secondary Voltage varied by means of Primary Taps.

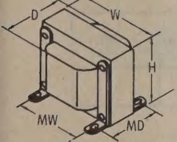


BAH

MULTIPLE PRIMARY AND SECONDARY TAPS — WITH LEADS

TM Part No.	Primary Volts (Blk/Blk/Yel)	Secondary		Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
		Volts*	Amps		H	W	D	MW	MD	
23V115	117	10-20-40*	0.035	BAH	1⅜	2⅜	1⅜	2	—	.5
23V116	117	10-20-40*	0.100	BAH	1⅝	2¹³⁄₁₆	1¾	2⅜	—	.7
23V117	117	10-20-40*	0.300	BAH	2¼	3¹¹⁄₁₆	2	3⅛	—	1.5
23V118	117	10-20-40*	0.750	BAH	2⅝	4	2¼	3⁹⁄₁₆	—	2.4
23V119	117	10-20-40*	1.0	GGV	3¼	2¹¹⁄₁₆	3	2	2⅛	3.2
23V411	117	6 to 42*	1.0	GGV	3⅛	2½	3⅛	2	2⅛	3.2
23V410	117	6 to 42*	0.750	BAH	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3
23V409	117	6 to 42*	0.035	BAH	1⅜	2⅜	1⁷⁄₁₆	2	—	.45

*Additional secondary voltages available in ranges provided by applying primary voltage to other taps.

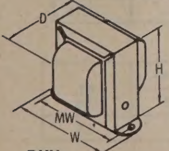


LAH

117V 50/60 Hz PRIMARY — SINGLE SECONDARY — WITH LEADS

12 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V252	12	0.150	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25
23V253	12	0.300	1500	BAH	1⅜	2⅜	1⅜	2	—	0.35
23V254	12	0.700	1500	BAH	1⅝	2⅞	1½	2⅜	—	0.6
23V255	12	1.2	1500	BAH	2	3¼	1⅝	2¹³⁄₁₆	—	0.85
23V415	12	2.0	1500	BAH	2	3¼	2⅛	2¹³⁄₁₆	—	1.3
23V416	12	4.0	1500	BAH	2⅝	4	2¼	3⁹⁄₁₆	—	2.3
23V417	12	6.0	1500	LAV	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4
23V418	12	8.0	1500	LAV	3¹³⁄₁₆	3⅛	2¾	2½	2⅛	4.3



BHV

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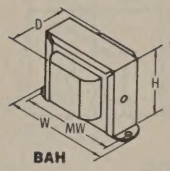
THORDARSON RECTIFIER TRANSFORMERS THORDARSON

117V 50/60 Hz PRIMARY — SINGLE SECONDARY — WITH LEADS (Cont'd)



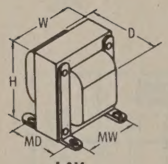
BAH

24 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V257	24 C.T.	0.200	1500	BAH	1⅜	2⅜	1⅜	2	—	0.35
23V258	24 C.T.	0.400	1500	BAH	1⅝	2⅜	1⅜	2	—	0.6
23V259	24 C.T.	0.700	1500	BAH	2	3¼	1¾	2¹³⁄₁₆	—	0.85
23V419	24 C.T.	4.0	1500	LAV	3¹³⁄₁₆	3⅛	2¹³⁄₁₆	2½	2⅛	4.0
23V420	24 C.T.	6.0	1500	LAV	4³⁄₁₆	3⁷⁄₁₆	3.0	2¾	2¼	5.7
23V421	24 C.T.	8.0	1500	LAV	4³⁄₁₆	3⁷⁄₁₆	3⅜	2¾	2¾	7.3
23V422	24 C.T.	12.0	1500	LAV	4⁹⁄₁₆	3¾	4⅝	3.0	3¼	11.5

28 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V379	28 C.T.	0.085	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25
23V380	28 C.T.	0.175	1500	BAH	1⅜	2⅜	1⅜	2	—	0.35
23V381	28 C.T.	0.300	1500	BAH	1⅝	2⅞	1½	2⅜	—	0.6
23V382	28 C.T.	0.800	1500	BAH	2	3¼	2	2¹³⁄₁₆	—	1.0
23V423	28 C.T.	1.0	1500	BAH	2.0	3¼	2⅛	2¹³⁄₁₆	—	1.4
23V424	28 C.T.	2.0	1500	LAV	3⅛	2½	2½	2.0	2³⁄₁₆	2.9
23V425	28 C.T.	4.0	1500	LAV	3¹³⁄₁₆	3⅛	3¼	2½	2½	5.3
23V426	28 C.T.	6.0	1500	LAV	4³⁄₁₆	3⁷⁄₁₆	3½	2¾	2⅝	7.0



LAV

30 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
21F190	30	3.0	1500	GGV	3½	2¹³⁄₁₆	3⅝	2¼	2⁷⁄₁₆	4.2

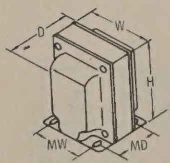
36 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V384	36 C.T.	0.065	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25
23V385	36 C.T.	0.135	1500	BAH	1⅜	2⅜	1⅜	2	—	0.35
23V386	36 C.T.	0.300	1500	BAH	1⅝	2⅞	1½	2⅜	—	0.6
23V387	36 C.T.	0.550	1500	BAH	2	3¼	1⅝	2¹³⁄₁₆	—	1.0
23V427	36 C.T.	1.0	1500	BAH	2⅜	3¾	2¼	3⅛	—	2.0
23V428	36 C.T.	2.0	1500	LAV	3⁷⁄₁₆	2¹³⁄₁₆	2¾	2¼	2⅛	3.5
23V429	36 C.T.	4.0	1500	LAV	4³⁄₁₆	3⁷⁄₁₆	2⅞	2¾	2⅜	6.0
23V430	36 C.T.	6.0	1500	LAV	4⁹⁄₁₆	3¾	3½	3	2⅝	8.3

48 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
21F187	48 C.T.†	1.0	2500	BAH	2⅝	4	2⅜	3⁹⁄₁₆	—	2.3

†Primary tapped to provide secondary voltage of 45 C.T. or 48 C.T. or 51 C.T. or 54 C.T.



GGV

50 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V377	50 C.T.	1.0	1500	GGV	3⅛	2½	2¾	2	1¾	2.3

64 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V215	64 C.T.	0.9	1500	BAH	2⁹⁄₁₆	4	2½	3⁹⁄₁₆	—	1.75

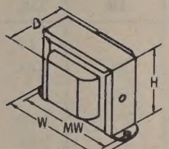
72 VOLTS

TM Part No.	Secondary		RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
	Volts	Amps			H	W	D	MW	MD	
23V89	72 C.T.	0.075	1500	BAH	1⅝	2¹³⁄₁₆	1⅝	2⅜	—	0.6

THORDARSON RECTIFIER TRANSFORMERS THORDARSON

230V 50/60 Hz PRIMARY — SINGLE SECONDARY

24 VOLTS



BAH

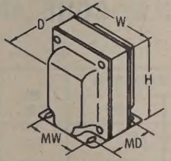
TM Part No.	Secondary Volts	Secondary Amps	RMS Test Volts	Style	Outline Dimensions H	Outline Dimensions W	Outline Dimensions D	Mounting Dimensions MW	Mounting Dimensions MD	Wt. Lbs.
23V401	24 C.T.	0.085	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25
23V402	24 C.T.	0.200	1500	BAH	1⅜	2⅜	1⅜	2	—	0.35
23V403	24 C.T.	0.400	1500	BAH	1⅝	2⅞	1⅝	2⅜	—	0.60
23V404	24 C.T.	0.700	1500	BAH	2	3¼	1¾	2¹³⁄₁₆	—	0.85

36 VOLTS

TM Part No.	Secondary Volts	Secondary Amps	RMS Test Volts	Style	Outline Dimensions H	Outline Dimensions W	Outline Dimensions D	Mounting Dimensions MW	Mounting Dimensions MD	Wt. Lbs.
23V405	36 C.T.	0.065	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25

SILICON RECTIFIER — 117V 50/60 Hz PRIMARY

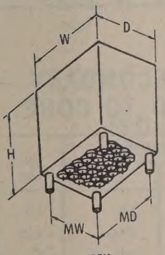
These transformers have been designed to fill the gap between the electronic tube — high voltage, low current — type of transformer and the transistor — low voltage, high current — type unit. The two 6.3 volt windings may be connected in series or in parallel to provide either 6.3 volts or 12.6 volts C.T. They may also be used with suitable rectifiers to supply a low voltage DC source.



GGV

TM Part No.	Secondary No. 1 Volts	Secondary No. 1 Amps RMS	Secondary No. 2 Volts	Secondary No. 2 Amps RMS	Secondary No. 3 Volts	Secondary No. 3 Amps RMS	Termination Pri.	Termination Sec.	Style	Outline Dimensions H	Outline Dimensions W	Outline Dimensions D	Mounting Dimensions MW	Mounting Dimensions MD	Wt. Lbs.
24R100	400 C.T.	400	6.3	3.0	6.3	3.0	Leads	Leads	GGV	4¼	3⁷⁄₁₆	4¼	2¾	3¹⁄₁₆	7.1
24R101	300 C.T.	600	6.3	2.5	6.3	2.5	Leads	Leads	GGV	4¼	3⁷⁄₁₆	4¼	2¾	3¹⁄₁₆	7.1
23V378	54 C.T.	500	6.3	0.5	—	—	Leads	Leads	GGV	2⅝	2¼	2⁹⁄₁₆	1¾	1⅝	1.7
24R102	200 C.T.	800	6.3	2.0	6.3	2.0	Leads	Leads	GGV	4¼	3⁷⁄₁₆	4⅛	2¾	2¹⁵⁄₁₆	6.9
24R103	100 C.T.	1600	6.3	1.5	6.3	1.5	Leads	Leads	GGV	4¼	3⁷⁄₁₆	3⅞	2¾	2¹¹⁄₁₆	6.0
24R104	80 C.T.	2000	6.3	1.5	6.3	1.5	Leads	Leads	GGV	4¼	3⁷⁄₁₆	4	2¾	2¹³⁄₁₆	6.5
24R105	60 C.T.	2500	6.3	1.5	6.3	1.5	Leads	Leads	GGV	4¼	3⁷⁄₁₆	4	2¾	2¹³⁄₁₆	6.5

UNIVERSAL RECTIFIER — ENCASED MILITARY — PRIMARY 115V 50/60 Hz — DUAL SECONDARY — TAPPED PRIMARY



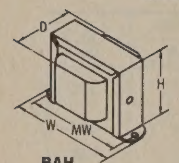
MIL

TM Part No.	MIL-T-27 Classification	Military DC Range	Industrial DC Range	MIL Case	Mounting Dimensions	Case Dimensions H	Case Dimensions W	Case Dimensions D	Wt. Lbs.
27V60	TF4RX02AH	6V—.065A to 53V—.025A	6V—.085A to 53V—.025A	AH	1¼	1¾	1⁵⁄₁₆	1⁵⁄₁₆	.37
27V61	TF4RX02AJ	6V—.22A to 53V—.07A	6V—.028A to 53V—.085A	AJ	1³⁄₁₆ x 1³⁄₁₆	2⅜	1⅝	1⅝	.6
27V62	TF4RX02FA	6V—1.2A to 53V—.4A	6V—1.52A to 53V—.48A	FA	1¹¹⁄₁₆ x 1⁷⁄₁₆	3⅛	2¹⁄₁₆	2⁵⁄₁₆	1.75
27V63	TF4RX02HA	6V—3A to 53V—1A	6V—3.8A to 53V—1.2A	HA	2¹⁹⁄₆₄ x 1⁵⁵⁄₆₄	4¼	2⅝	3¹⁄₁₆	4.5
27V64	TF4RX02KA	6V—7.5A to 53V—2.5A	6V—9A to 53V—2.5A	KA	3 x 2⁷⁄₁₆	5¼	3⅜	3¹⁵⁄₁₆	8.5

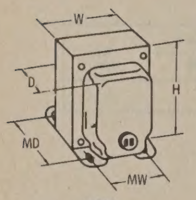
REPLACEMENT PARTS

THORDARSON maintains the most complete line of replacement transformers in the industry. Television flybacks, yokes, vertical output and power transformers are stocked in-depth plus thousands of other hard-to-get transformers and chokes for consumer, commercial, industrial, medical, and military applications. Your THORDARSON distributor has up-to-date TV replacement info.

THORDARSON LINE ADJUSTING TRANSFORMERS THORDARSON



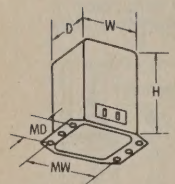
BAH



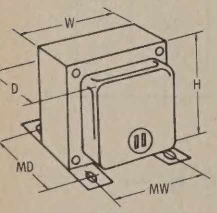
GMV

STEP-DOWN AND STEP-UP AUTOFORMERS — INPUT 50/60 Hz WITH 2 CONDUCTOR LINE CORD AND PLUG. OUTPUT 2 CONDUCTOR FEMALE RECEPTACLE.

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V393	50	230	115	1500	BAH	2 5/16	3 11/1	1 7/8	3 1/8	—	1.5
23V338	85	230	115	1500	GMV	3 1/2	2 5/8	2 3/4	2	1 3/4	2.5
23V397	85	115	230	1500	GMV	3	2 1/2	2 3/4	2	1 3/4	2.5
23V344	125	230	115	1500	GMV	3	2 5/8	3	2	2	3.0
23V398	125	115	230	1500	GMV	3	2 1/2	3	2	2	3.0
23V22	150	230	115	1500	GMV	3 7/8	3 1/4	3 3/8	2 1/2	2 1/16	3.0
23V339	200	230	115	1500	GMV	3 7/8	3 3/16	3 5/16	2 1/2	2	4.2
23V23	250	230	115	1500	GMV	4 5/8	3 7/8	3 1/2	3	2 3/8	6.2
23V343	300	230	115	1500	GMV	3 7/8	3 3/16	3 11/16	2 1/2	2 3/8	5.2
23V399	300	115	230	1500	GMV	3 7/8	3 3/16	3 11/16	2 1/2	2 3/8	5.2
23V340	400	230	115	1500	GMV	3 7/8	3 3/16	4 3/8	2 1/2	3 1/16	7.0
23V342	500	230	115	1500	GMV	4 9/16	3 13/16	4 5/8	3	3 7/16	10.3
23V400	500	115	230	1500	GMV	4 9/16	3 13/16	4 5/8	3	3 7/16	10.3
23V341	1000	230	115	1500	GMV	4 9/16	3 13/16	6 1/8	3	4 15/16	17.0
25V15	1000	230	115	1500	TMV	7 1/16	6 1/8	6 1/2	6	4 1/4	22.0
23V84	1200	230	115	1500	GMV	4 5/8	3 7/8	6 7/8	3	5 1/2	18.0
23V120	2000	230	115	1500	GMV	5 5/16	4 1/2	7 7/8	3 1/2	6 7/8	33.0
23V46	3000	230/208	208/230	1750	GMH	4	4 1/2	6	3 3/4	2 1/2	10.0



TMV

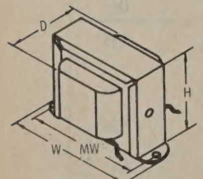


GMH

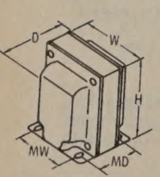
STEP-DOWN AUTOFORMERS — INPUT 230 VOLTS 50/60 Hz WITH LINE CORD AND 3 CONDUCTOR PLUG. OUTPUT 115 VOLTS WITH 3 CONDUCTOR RECEPTACLE. CORE AND FRAME GROUNDED TO THIRD CONDUCTOR OF NEMA STANDARD CORD.

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V290	75	230	115	1500	GMV	3 7/8	3 3/16	2 3/4	2 1/2	1 1/2	3.0
23V413	100	230	115	1500	BMH*	2 1/4	3 11/16	2 3/8	3 1/8	1 1/2	1.75
23V288	100	230	115	1500	GMV	3 7/8	3 3/16	3	2 1/2	1 3/4	3.7
23V291	150	230	115	1500	GMV	3 7/8	3 3/16	3 1/4	2 1/2	2	4.4
23V292	250	230	115	1500	GMV	4 5/8	3 13/16	3 3/4	3	2 5/8	7.6
23V293	350	230	115	1500	GMV	4 5/8	3 13/16	3 3/4	3	2 5/8	7.4
23V289	500	230	115	1500	GMV	4 5/8	3 13/16	4 3/16	3	3 1/16	9.6
23V295	750	230	115	1500	GMV	5 1/2	4 5/8	4 1/2	3 1/2	2 7/8	12.1
23V294	1000	230	115	1500	GMV	5 1/2	4 5/8	5 3/8	3 1/2	3 3/4	16.5
23V296	1500	230	115	1500	GMV	5 1/2	4 5/8	5 7/8	3 1/2	4 1/4	20.1

*These units have 2 conductor line cords, plug and receptacle.



BMH



GGV

ISOLATION—PRIMARY 50/60 Hz WITH 2 CONDUCTOR LINE CORD. SECONDARY—2 CONDUCTOR RECEPTACLE AND ELECTROSTATIC SHIELD GROUNDED TO CORE.

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V86	40	110-120	110-120	1500	GMV	3 1/8	2 5/8	3 1/8	2	1 7/8	4.0
23V45	50	115	115	1500	GMV	3 7/8	3 1/4	3 1/4	2 1/2	1 13/16	4.25
23V25	100	105/115/125	115	1500	GMV	4 1/4	3 1/2	3 7/8	2 3/4	3 1/16	6.2
23V49	150	115	115	1500	GMV	4 3/4	3 7/8	3 3/4	3	2 9/16	7.0
23V74	150	115-230	115	1500	GGV	3 7/8	3 9/32	3 7/8	2 1/2	3	7.0
23V68	250	115	115	1500	GMV	4 3/4	3 7/8	5 3/4	3	3 9/16	12.5
23V126	250	105/115/125*	115	1500	GMV	4 3/4	4	5 3/8	3	4 5/16	14.2
23V129	250	210/230/250*	115	1500	GMV	4 3/4	4	5 3/8	3	4 5/16	14.2
23V19	350	115	105/115/1	1500	GMV	5 3/8	4 1/2	5 3/4	3 1/2	3 7/8	13.0
23V44	600	115	115	1500	GMV	4 5/8	3 7/8	7 3/16	3	6	16.0

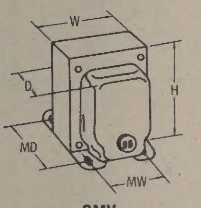
†Has receptacle for voltage adjustment. *Complete with tap switch for voltage adjustment.

FLYBACKS AND YOKES FOR DISPLAY INFORMATION SYSTEMS AND MONITORS

THORDARSON designs and manufactures flybacks and yokes to customer specifications for a broad range of display applications. Our high voltage transformers feature flame retardant construction in all configurations. Contact factory with your display requirements.

THORDARSON LINE ADJUSTING TRANSFORMERS THORDARSON

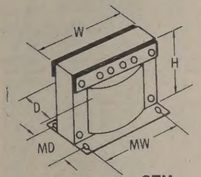
ISOLATION — PRIMARY 50/60 Hz WITH 3 CONDUCTOR LINE CORD. SECONDARY — 3 CONDUCTOR RECEPTACLE. CORE AND FRAME GROUNDED TO THIRD CONDUCTOR OF NEMA STANDARD CORD.



GMV

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V365	150	115	115	1500	GMV	3⅞	3³⁄₁₆	4³⁄₁₆	2½	2¹⁵⁄₁₆	7.0
23V366	250	115	115	1500	GMV	4¹¹⁄₁₆	3¾	4⅜	3	3³⁄₁₆	9.3
23V371	250	230	115	1500	GMV	4¹¹⁄₁₆	3¾	4¼	3	3³⁄₁₆	9.0
23V367	500	115	115	1500	GMV	4¹¹⁄₁₆	3¾	6	3	4¹³⁄₁₆	16.5
23V372	500	230	115	1500	GMV	4¹¹⁄₁₆	3¾	6	3	4¹³⁄₁₆	16.0
23V368	1000	115	115	1500	GMV	5½	4⁹⁄₁₆	8⅛	3½	6½	31.5
23V373	1000	230	115	1500	GMV	5½	4⁹⁄₁₆	8⅛	3½	6½	31.0

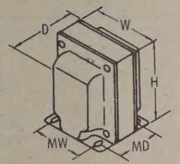
ISOLATION — UNIVERSAL VOLTAGE CONTROL 50/60 Hz WITH 4-115 VOLT WINDINGS AND PRIMARY/SECONDARY LUGS ISOLATION CONNECTIONS 115 TO 115 VOLT, 115 TO 230 VOLT, 230 TO 115 VOLT. AUTOFORMER CONNECTIONS 115 TO 230 VOLT, 115 TO 460 VOLTS, 230 TO 460 VOLTS.



CTH

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V34	50	115/230	115/230	1500	CTH	2⅝	3	3⅝	2½	2⅛	2.75
23V35	100	115/230	115/230	1500	CTH	3¼	3¾	2⅞	3⅛	2⅛	5.0
23V36	200	115/230	115/230	1500	CTH	2⅞	4½	3⅝	3¾	2¾	9.0
23V37	300	115/230	115/230	1500	CTH	4⅛	4⅞	3¾	4⅛	2⅞	11.0
23V38	500	115/230	115/230	1500	CTH	4⅛	4⅞	5	4⅛	4⅛	17.0

ISOLATION — 50/60 Hz WIRE — IN TYPE WITH LEAD WIRES FOR PERMANENT INSTALLATION (SHIELDED).

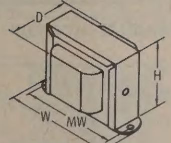


GGV

TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
23V376	0.6	115	115	1500	BAH	1¼	2⅛	1¼	1¾	—	0.25
23V374	15	115	115	1500	BAH	2	3¼	1⅞	2¹³⁄₁₆	—	1.0
23V17	35	115	115	1500	BAH	2¼	3¹³⁄₁₆	2½	3⅛	—	1.75
23V80	50	115	115	1500	BAH	2¼	3¹³⁄₁₆	2½	3⅛	—	1.75
23V18	80	115	115	1500	GGV	3⅞	3³⁄₁₆	3½	2½	2⁵⁄₁₆	5.0
23V395	150	115	115/230	1500	GMV	3⅞	3³⁄₁₆	4	2½	2¾	6.2
23V94	250	115/230	115	1500	GGV	4⅝	3¹⁵⁄₁₆	4¾	3	3⅝	11.0

¶Secondary has two separate windings.

ISOLATION — 50/60 Hz MACHINE TOOL CONTROL TYPE — PRIMARY/SECONDARY SCREW TERMINALS



BAH

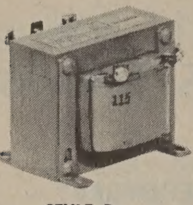
TM Part No.	Output VA	Primary Voltage	Secondary Voltage	RMS Test Volts	Style	Outline Dimensions			Mounting Dimensions		Wt. Lbs.
						H	W	D	MW	MD	
G342	50	230/460	115	2000	CTH	3³⁄₁₆	3¾	3³⁄₁₆	3⅛	1½	3.0
G343	75	230/460	115	2000	CTH	3³⁄₁₆	3¾	3⁷⁄₁₆	3⅛	1¾	4.0
G344	150	230/460	115	2000	CTH	3⅞	4⅝	3¹⁵⁄₁₆	3¾	2⅜	7.5
G345	300	230/460	115	2000	CTH	3⅞	4⅝	5⁹⁄₁₆	3¾	4	13.5
G346	500	230/460	115	2000	CTH	4¹³⁄₁₆	5¼	5	4⅜	3⁹⁄₁₆	13.5
G347	750	230/460	115	2000	CTH	4¹³⁄₁₆	5¼	6⁷⁄₁₆	4⅜	5	21.0
G348	1000	230/460	115	1500	CTH	6⅛	6¾	5⅞	5½	3½	26.5

TODD ENGINEERED

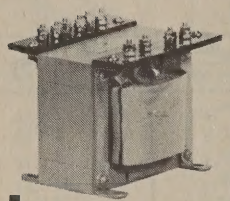
- NAME PLATES
- WIRING DIAGRAMS

HIGH CURRENT TRANSFORMERS

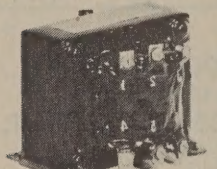
- 45° TEMP. RISE
- MINIMUM REGULATION



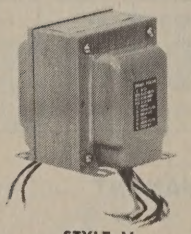
STYLE B



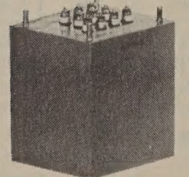
STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

FOUR STYLES STOCKED IN DEPTH

SECONDARY VOLTS TAP VOLTS	PART NO.	PRIMARY VOLTS 50-500 Hz	RATING VA	SECONDARY AMPS (RMS) SERIES HOOKUP	SECONDARY AMPS (RMS) PARALLEL HOOKUP
10 VOLTS Series 2.5 - 5 - 7.5 - 10 Parallel 2.5 - 5	10 02	115	20	2	4
	10 05	115	50	5	10
	10 10	115	100	10	20
	10 20	115	200	20	40
12.6 VOLTS Series 3.1 - 6.3 - 9.4 - 12.6 Parallel 3.1 - 6.3	12 02	115	24	2	4
	12 05	115	60	5	10
	12 10	115	120	10	20
	12 20	115	240	20	40
24 VOLTS Series 6 - 12 - 18 - 24 Parallel 6 - 12	24 01	115	24	1	2
	24 02	115	48	2	4
	24 04	115	96	4	8
	24 06	115	144	6	12
	24 08	115	192	8	16
	24 12	105, 115, 125	288	12	24
	24 20	105, 115, 125	480	20	40
	24 25	105, 115, 125	600	25	50
	24 30	105, 115, 125	720	30	60
	24 50	105, 115, 125	1200	50	100
	24 100	115, 230	2400	100	200
36 VOLTS Series 9 - 18 - 27 - 36 Parallel 9 - 18	36 00	115	18	0.5	1
	36 01	115	36	1	2
	36 02	115	72	2	4
	36 04	115	144	4	8
	36 06	115	216	6	12
	36 08	105, 115, 125	288	8	16
	36 12	105, 115, 125	432	12	24
	36 20	105, 115, 125	720	20	40
	36 25	105, 115, 125	900	25	50
	36 30	105, 115, 125	1080	30	60
	36 50	115, 230	1800	50	100
	36 100	115, 230	3600	100	200
56 VOLTS Series 14 - 28 - 42 - 56 Parallel 14 - 28	56 00	115	28	0.5	1
	56 01	115	56	1	2
	56 02	115	112	2	4
	56 04	115	224	4	8
	56 06	115	336	6	12
	56 08	105, 115, 125	448	8	16
	56 12	105, 115, 125	672	12	24
	56 25	105, 115, 125	1400	25	50
	56 50	115, 230	2800	50	100
	56 100	115, 230	5600	100	200
64 VOLTS Series 16 - 32 - 48 - 64 Parallel 16 - 32	64 00	115	32	0.5	1
	64 01	115	64	1	2
	64 02	115	128	2	4
	64 04	115	256	4	8
	64 06	115	384	6	12
	64 08	105, 115, 125	512	8	16
	64 12	105, 115, 125	768	12	24
	64 25	105, 115, 125	1600	25	50
	64 50	115, 230	3200	50	100
80 VOLTS Series 20 - 40 - 60 - 80 Parallel 20 - 40	80 00	115	40	0.5	1
	80 01	115	80	1	2
	80 02	115	160	2	4
	80 05	115	400	5	10
	80 10	105, 115, 125	800	10	20
	80 25	115, 230	2000	25	50
	80 50	115, 230	4000	50	100
120 VOLTS Series 30 - 60 - 90 - 120 Parallel 30 - 60	120 00	115	60	0.5	1
	120 01	115	120	1	2
	120 02	115	240	2	4
	120 04	115	480	4	8
	120 08	105, 115, 125	960	8	16
	120 12	105, 115, 125	1400	12	24
	120 20	105, 115, 125	2400	20	40
180 VOLTS Series 45 - 90 - 135 - 180 Parallel 45 - 90	180 00	115	90	0.5	1
	180 01	115	180	1	2
	180 02	115	360	2	4
	180 05	115	640	5	10
	180 10	105, 115, 125	1800	10	20
230 VOLTS Series 57.5 - 115 - 172.5 - 230 Parallel 57.5 - 115	230 00	115	115	0.5	1
	230 01	115	230	1	2
	230 02	115	460	2	4
	230 05	105, 115, 125	1150	5	10
	230 08	115, 230	1840	8	16
300 VOLTS Series 75 - 150 - 225 - 300 Parallel 175 - 150	300 00	115	150	0.5	1
	300 01	115	300	1	2
	300 02	115	600	2	4
	300 05	105, 115, 125	1500	5	10

DC TO RMS CONVERSION CHART

SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW

	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

TODD SYSTEMS "HIGH CURRENT TRANSFORMERS & CHOKES" are designed for use in high power rectifier circuits, and high current A.C. applications. "TODD ENGINEERED" designs feature a nominal temperature rise of 45°C., at full load, thus providing outstanding overload capacity. All designs utilize extremely low regulation, varying from 10% in the smallest to 1% in the larger units.

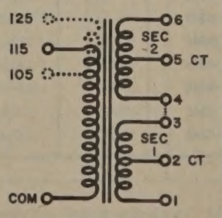
Four styles . . . select the type best suited for your lab, test rigs, OEM or production equipment

ALL PRICES AND DATA SUBJECT TO CHANGE WITHOUT NOTICE

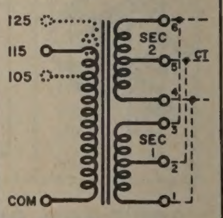
CERTIFIED DATA AVAILABLE

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



QUALITY ENGINEERED • PRECISION BUILT

TODD SYSTEMS INC.

4 RADFORD PLACE
YONKERS, N. Y., U.S.A.
(914) 963-3400

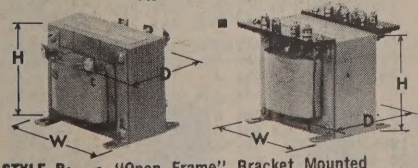
TODD ENGINEERED

HIGH CURRENT TRANSFORMERS

MECHANICAL SPECIFICATIONS • • • • • • • • • • • • • • SPECIFY STYLE REQUIRED

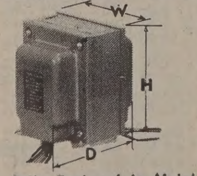
• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE)						STYLE B	STYLE BE	• FULLY MTD. SHELLS (STYLE V)						STYLE V	• HERMETIC SEALED MIL-T (STYLE CM)						STYLE CM	
H	W	D	MW	MD	WGT.	PRICE	PRICE	H	W	D	MW	MD	WGT.	PRICE	H	W	D	MW	MD	WGT.	PRICE	PART NO.
2½	3	2⅛	2½	1½	1¼	10.35	35.20	3	2½	2¼	2	1¼	1¼	10.00	3 13/16	3½	3	2⅝	2⅛	2⅛	60.30	10 02
2½	3	2⅝	2½	2⅛	2½	14.70	43.60	3	2½	2⅞	2	1⅞	2½	13.20	3 13/16	3½	3	2⅝	2⅛	3½	67.50	10 05
3⅛	3¾	3¼	3⅛	2⅜	4¼	25.40	61.55	3⅞	3¼	3⅝	2½	2⅜	4¾	22.15	4 7/16	4½	3⅝	3 5/16	2 11/16	6½	77.90	10 10
3¾	4½	3⅞	3¾	2⅝	8¼	32.30	79.90	4½	3¾	4⅛	3	3	8¾	28.25	5 7/16	5	4¼	4 1/16	3 5/16	12	102.90	10 20
2½	3	2⅛	2½	1⅝	1½	12.40	37.40	3⅛	2½	2⅜	2	1¼	1¾	12.35	3 13/16	3½	3	2⅝	2⅛	2¾	62.65	12 02
2½	3	3	2½	2⅜	3	15.90	45.70	3⅛	2½	3⅛	2	2	3¼	13.80	3 13/16	3½	3	2⅝	2⅛	4¾	69.35	12 05
3¼	3¾	3⅝	3⅛	2⅛	5¼	27.25	66.65	3⅞	3¼	3⅝	2½	2½	5¼	24.35	4 7/16	4¼	3⅝	3 5/16	2 11/16	7½	87.80	12 10
3¾	4½	4⅛	3¾	2¾	9	34.30	87.40	4½	3¾	4¼	3	3⅛	9½	31.20	6¼	5¾	4⅞	4⅜	3½	12½	107.95	12 20
2½	3	2⅛	2½	1¾	1¾	12.35	37.10	3⅛	2½	2⅝	2	1½	2¼	12.15	3 13/16	3½	3	2⅝	2⅛	3⅜	62.20	24 01
2½	3	2½	2½	2	2¼	14.65	43.30	3⅛	2½	2⅞	2	1¾	2½	13.85	3 13/16	3½	3	2⅝	2⅛	3¾	66.65	24 02
3⅛	3¾	3⅜	3⅛	2⅛	4¼	18.65	50.95	3¾	3⅛	3⅜	2½	2⅛	4¼	16.50	4 7/16	4¼	3⅝	3 5/16	2 11/16	6¼	73.05	24 04
3½	4⅛	3⅜	3 7/16	2 5/16	6¼	25.50	65.20	4⅛	3½	3⅝	2¾	2½	6¾	22.50	4⅞	4⅝	3 15/16	3 11/16	3	9½	87.05	24 06
3½	4⅛	4	3 7/16	3	9	28.75	71.30	4¼	3½	4⅜	2¾	3⅜	8½	26.15	4⅞	4⅝	3 15/16	3 11/16	3	11½	95.10	24 08
3¾	4½	4⅞	3¾	3⅜	12	37.55	93.05	4½	3¾	5	3	3¾	12½	33.85	5 7/16	5	4¼	4 1/16	3 5/16	16	111.90	24 12
4⅜	5¼	5	4⅜	3½	16½	48.90	112.30	5¼	4⅜	5½	3½	3⅞	17	44.70	6¼	5¾	4⅞	4⅜	3½	22	127.55	24 20
4⅜	5¼	5⅝	4⅜	3⅞	19½	77.00	159.95	5¼	4⅜	6	3½	4⅜	20	63.50	6¼	5¾	4⅞	4⅜	3½	24½	171.90	24 25
■4⅜	5¼	6	4⅜	4⅜	21¼	80.95	169.10	5¼	4⅜	6⅜	3½	4¾	22	67.00	7½	6⅞	5 13/16	5 5/16	4¼	27½	182.20	24 30
■5⅜	6⅜	6⅜	5 5/16	5⅜	39	104.22	208.00	6½	5½	7⅜	4¼	5 5/16	43	92.20	7½	6⅞	5 13/16	5 5/16	4¼	52	227.40	24 50
■6⅛	7 1/16	8	5⅞	6½	64	150.84	302.95							——	8¾	8	6¾	6¾	5½	74	338.45	24 100
2 3/16	2⅝	1⅜	2 3/16	1½	1	10.10	33.55	2¾	2¼	2¼	1¾	1½	1¼	9.80	3 13/16	3½	3	2⅝	2⅛	2	59.20	36 00
2½	3	2⅛	2½	1⅞	1⅞	13.40	38.65	3⅛	2½	2¾	2	1⅝	2	12.85	3 13/16	3½	3	2⅝	2⅛	3	64.75	36 01
2⅞	3⅜	2¾	2 13/16	2¼	3¼	16.20	46.50	3½	2⅞	3¼	2¼	2 3/16	3⅝	14.45	4¼	3⅞	3 5/16	3	2 7/16	5¼	70.50	36 02
3½	4⅛	3½	3 7/16	2½	6¾	22.40	58.50	4¼	3½	4	2¾	2⅞	6¾	19.45	4⅞	4⅝	3 15/16	3 11/16	3	9½	80.85	36 04
3¾	4½	4¼	3¾	2⅝	8¼	32.85	81.05	4⅝	3⅞	4⅛	3	2⅞	9¼	29.80	5 7/16	5	4¼	4 1/16	3 5/16	13	103.95	36 06
3¾	4½	5⅛	3¾	3½	12½	37.55	93.10	4⅝	3⅞	5	3	3⅞	12¼	33.85	5 7/16	5	4¼	4 1/16	3 5/16	17	111.90	36 08
4 7/16	5¼	5¼	4⅜	3⅝	16¾	46.30	109.40	5½	4½	5¾	3½	4 1/16	17¼	42.25	6¼	5¾	4⅞	4⅜	3½	22	125.45	36 12
■5⅜	6⅜	4⅝	5 5/16	3¾	24	78.70	146.55	6½	5½	5¾	4¼	3¾	25	65.15	7½	6⅞	5 13/16	5 5/16	4¼	31	182.20	36 20
■5⅜	6⅜	5½	5 5/16	4	30	90.15	181.85	6½	5½	6	4¼	4	28	76.35	7½	6⅞	5 13/16	5 5/16	4¼	34	227.55	36 25
■5 5/16	6⅜	6	5 5/16	4¾	33	96.75	197.80	6½	5½	6¾	4¼	4¾	36	84.90	7½	6⅞	5 13/16	5 5/16	4¼	43	245.85	36 30
■6¼	7 1/16	7½	5⅞	6⅛	55	127.30	257.60							——	8¼	7 9/16	6⅝	5 13/16	4¾	61	327.85	36 50
■7½	9	9	7½	7	105	212.35	454.65							——							——	36 100
2 13/16	2⅝	1½	2 13/16	1⅝	1¼	12.71	37.70	2¾	2¼	2⅜	1¾	1¾	1⅝	11.75	3 13/16	3½	3	2⅝	2⅛	2¾	63.10	56 00
2½	3	2⅞	2½	2¼	2⅞	15.00	44.20	3	2⅝	2⅞	2	2	3¼	13.20	3 13/16	3½	3	2⅝	2⅛	4	68.20	56 01
3⅛	3¾	3¼	3⅛	2⅜	4¼	19.45	52.60	3⅞	3¼	3½	2½	2 5/16	4¾	16.95	4 7/16	4¼	3⅝	3 5/16	2 11/16	7½	75.80	56 02
3½	4⅛	4	3 7/16	3	9	29.25	71.85	4¼	3½	4½	2¾	3⅜	8½	24.90	4⅞	4⅝	3 15/16	3 11/16	3	12½	107.75	56 04
4⅜	5¼	4½	4⅜	2⅞	12	40.95	98.90	5 7/16	4½	4¾	3½	3⅛	12½	36.15	6¼	5¾	4⅞	4⅜	3½	16	135.60	56 06
4⅜	5¼	5	4⅜	3⅝	16¾	61.05	110.75	5 7/16	4½	5⅝	3½	4	18	42.55	6¼	5¾	4⅞	4⅜	3½	22½	144.03	56 08
■5 5/16	6⅜	4⅝	5 5/16	3 7/16	24	71.70	142.60	6½	5½	5½	4¼	3½	25	63.85	7½	6⅞	5 13/16	5 5/16	4¼	31	205.65	56 12
■5 5/16	6⅜	6⅜	5 5/16	5 5/16	39	110.00	222.35	6½	5½	7¼	4¼	5¼	39	99.85	7½	6⅞	5 13/16	5 5/16	4¼	45	285.80	56 25
■6¼	7 1/16	8½	5⅞	7¼	78	167.75	351.80							——	8¾	8	6¾	6¾	5½	85	428.34	56 50
■7½	9	11	7½	9	140	262.45	604.95							——							——	56 100
2½	3	2¼	2½	1⅞	2	13.40	41.05	3	2½	2⅝	2	1¾	2	12.35	3 13/16	3½	3	2⅝	2⅛	3¼	64.70	64 00
2½	3	2¾	2½	2⅜	3	16.40	45.85	3⅛	2⅝	3⅛	2	2⅛	2⅛	14.30	4 7/16	4¼	3⅝	3 5/16	2 11/16	3¾	69.50	64 01
3⅛	3¾	3¼	3⅛	2⅜	5	20.80	55.75	3⅞	3⅛	3⅝	2½	2⅜	4¾	20.30	5 15/16	4⅝	3 15/16	3 11/16	4⅞	7¼	78.80	64 02
3¾	4½	4⅜	3¾	3⅛	10	31.85	76.55	4⅝	3¾	4½	3	3⅜	11	28.00	5 7/16	5	4¼	4 1/16	3 5/16	15½	97.80	64 04
3¾	4½	5½	3¾	4⅜	15	43.30	103.70	4⅝	3¾	4⅞	3	3⅝	16	40.15	6¼	5¾	4⅞	4⅜	3½	22	121.10	64 06
4⅜	5¼	5⅛	4⅜	3¾	18	52.70	131.95	5½	4½	5⅞	3½	4¼	19¼	48.85	6¼	5¾	4⅞	4⅜	3½	25	149.90	64 08
■5½	6⅜	4⅞	5 5/16	3¾	27	83.60	172.00	6½	5½	5¾	4¼	3¾	27	70.00	7½	6⅞	5 13/16	5 5/16	4¼	32½	217.50	64 12
■6¼	7 1/16	7¼	5 13/16	5⅜	50	117.25	238.40							——	7½	6⅞	5 13/16	5 5/16	4¼	57	345.47	64 25
■7⅝	9	8¼	7½	6⅜	95	187.35	398.28							——	10⅜	8	6¾	6¾	5½	103	467.80	64 50
2½	3	2⅝	2½	2⅛	2½	14.40	42.10	3	2½	2⅞	2	2	2½	13.70	3 13/16	3½	3	2⅝	2⅛	3¾	65.80	80 00
2 13/16	3⅜	2⅞	2 13/16	2¼	3½	17.05	47.95	3½	2⅞	3¼	2¼	2¼	3⅝	15.25	4¼	3⅞	3 5/16	3	2 7/16	5¼	71.55	80 01
3 7/16	4⅛	3¼	3 7/16	2½	6½	24.10	61.65	4¼	3½	4	2¾	2⅞	6¾	20.75	4⅞	4⅝	3 15/16	3 11/16	3	9	84.35	80 02
4⅜	5¼	5	4⅜	3½	17	44.55	105.40	5 7/16	4½	5½	3½	3¾	17½	40.17	4 7/16	4¼	3⅝	3 5/16	2 11/16	21½	122.05	80 05
■5½	6⅜	5	5⅜	3⅞	30	85.70	178.10	6½	5½	6	4¼	4	31	71.50	7½	6⅞	5 13/16	5 5/16	4¼	36½	222.15	80 10
■6¼	7⅛	5⅞	5 13/16	4½	44	134.31	271.50							——	8¼	7 9/16	6⅝	5 13/16	4¾	48½	344.75	80 25
■7⅝	9	9¼	7½	7⅜	115	232.65	510.10							——							——	80 50
2 13/16	3⅜	2⅝	2 13/16	2⅛	3	15.40	45.10	3 7/16	2⅞	3⅛	2¼	2	3	14.10	4¼	3⅞	3 5/16	3	2 7/16	4¾	68.90	120 00
3⅛	3¾	3⅜	3⅛	2⅜	5	20.20	54.00	3⅞	3¼	3½	2½	2¼	4⅞	18.20	4 7/16	4¼	3⅝	3 5/16	2 11/16	6¾	77.15	120 01
3¾	4½	4⅝	3¾	3⅜	11	30.85	74.80	4⅝	3⅞	4⅝	3	3⅜	10½	27.40	5 7/16	5	4¼	4 1/16	3 5/16	14	97.37	120 02
4⅜	5¼	4⅞	4⅜	3½	16	48.40	111.25	5½	4½	5½	3 7/16	4	17	45.50	6¼	5⅜	4⅞	4⅜	3½	21¼	126.30	120 04
■5⅜	6⅜	6½	5 5/16	4½	35	93.15	180.80	6⅜	5 7/16	6⅜	4¼	4½	34	81.75	7½	6⅞	5 13/16	5 5/16	4¼	40½	238.10	120 08
■5⅜	6⅜	6⅞	5 5/16	5¾	45	112.95	228.27	6⅜	5 7/16	7⅝	4¼	5¾	47	105.25	7½	6⅞	5 13/16	5 5/16	4¼	51½	290.25	120 12
■6¼	7⅛	8¼	5 13/16	6⅜	64	150.85	302.95							——	8¼	7 9/16	6⅝	5 13/16	4¾	70½	390.80	120 20
3⅛	3¾	3⅜	3⅛	2⅛	4¼	18.72	57.25	3⅞	3 3/16	3½	2½	2¼	4¾	16.15	4 7/16	4¼	3⅝	3 5/16	2 11/16	6⅝	84.35	180 00
3 7/16	4⅛	3⅜	3 7/16	2½	5¾	26.35	74.70	4¼	3½	3⅞	2¾	2⅞	6½	22.80	4⅞	4⅝	3 15/16	3 11/16	3	8¾	100.85	180 01
4⅜	5¼	4¾	4⅜	3¼	15	41.85	110.05	5 7/16	4½	5⅜	3½	3⅛	15¾	35.85	6¼	5¾	4⅞	4⅜	3½	19½	132.55	180 02
■5 5/16	6⅜	5¾	5 5/16	4⅜	34	88.60	190.90	6⅜	5 7/16	6⅜	4¼	4⅜	32	76.10	7½	6⅞	5 13/16	5 5/16	4¼	39¼	226.95	180 05
■6¼	7 1/16	7½	5⅞	6⅛	54	171.22	257.60							——	7½	6⅞	5 13/16	5 5/16	4¼	57½	327.85	180 10
3⅛	3¾	3⅜	3⅛	2½	5	20.55	62.05	3⅞	3⅛	3⅝	2½	2½	5¼	17.80	4 7/16	4¼	3⅝	3 5/16	2 11/16	7½	89.20	230 00
3½	4⅛	4	3 7/16	3⅛	9½	30.50	83.35	4¼	3½	4⅝	2¾	3½	8½	26.50	4⅞	4⅝	3 15/16	3 11/16	3	11¼	109.35	230 01
4⅜	5¼	5¼	4⅜	4	18	50.45	127.05	5 7/16	4½	5⅞	3½	3⅝	18	43.65	6¼	5¾	4⅞	4⅜	3½	21¾	154.20	230 02
■5⅜	6⅜	6	5 5/16	4¾	36	99.00	202.35	6⅜	5 7/16	6⅞	4¼	4⅞	36	89.60	7½	6⅞	5 13/16	5 5/16	4¼	41	254.95	230 05
■6¼	7 1/16	7½	5⅞	6⅛	54	130.55	262.10							——	8¼	7 9/16	6½	5 13/16	4¾	59¼	332.52	230 08
3¾	4½	3½	3¾	2¼	6	23.95	69.70	4½	3¾	3¾	3	2⅝	6½	20.65	4⅞	4⅝	3 15/16	3 11/16	3	9	95.70	300 00
4⅜	5¼	4	4⅜	3⅛	12½	35.80	96.50	5½	4½	5	3½	3⅜	13½	30.85	6¼	5¾	4⅞	4⅜	3½	16¾	120.30	300 01
4⅜	5¼	5⅝	4 5/16	4¾	23	57.50	135.40	5½	4½	6⅝	3½	5	24	52.00	6¼	5¾	4⅞	4⅜	3½	27½	107.40	300 02
■5 5/16	6⅜	7⅛	5 5/16	6¼	49	115.80	233.90	6½	5½	8	4¼	6	48	107.95	7½	6⅞	5 13/16	5 5/16	4¼	52½	298.25	300 05

Add 3/16 to H W D for Style BE

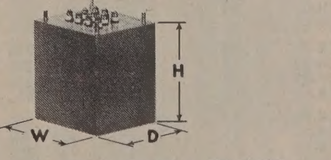


STYLE B:
- "Open Frame" Bracket Mounted
- Double Vacuum Varnish Impregnated

STYLE BE:
- Conforms to MIL-T-27B
- Epoxy Encapsulation added to Style B



STYLE V:
- Fully Enclosed in Metal Shells
- Ease of "Wiring with Leads"
- Attractive Appearance
- Dbl Vacuum Varnish Impregnated



STYLE CM:
- Hermetically Sealed to MIL-T-27B
- Environment Proof
- Attractive Gray Finish
- Permanent Name Plate

QUALITY ENGINEERED • PRECISION BUILT

TODD SYSTEMS INC.

4 RADFORD PLACE
YONKERS, N. Y., U.S.A.
(914) 963-3400

For Manufacturers Sales Offices refer to MANUFACTURERS, SALES OFFICES AND TRADE MARKS DIRECTORY

TODD ENGINEERED

LINE ISOLATION ··············· HIGH CURRENT CHOKES

LINE ISOLATION

OUTPUT 115 VOLTS 50/60 HERTZ *UL* COMPONENTS

STRAIGHT ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

TWO STYLES

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS						STYLE LO PRICE	STYLE LRG PRICE
				H	W	D	MW	MD	WGT.		
LI-25	25	115	1500	3⅛	2⅝	2½	2	1½	1⅝	19.20	24.25
LI-50	50	115	1500	3½	2⅞	3	2¼	1⅞	3	20.80	26.80
LI-100	100	115	1500	3½	2⅞	3½	2¼	2¼	4	27.40	33.00
LI-175	175	115	1500	4⅝	3⅞	3⅞	3	2¾	7	29.80	37.80
LI-250	250	115	1500	4⅝	3⅞	4⅜	3	3¼	10	41.85	49.55
LI-350	350	115	1500	4⅝	3⅞	5¼	3	4⅛	14	56.45	63.50
LI-500	500	115	1500	6	4⅜	5⅛	3⁷⁄₁₆	3⅜	17½	71.45	80.35
LI-750	750	115	1500	6	4⅜	6⅜	3⁷⁄₁₆	4½	24	123.10	132.10
LI-1000	1000	115	1500	6	4⅜	7¼	3⁷⁄₁₆	5½	30	136.70	146.85
LI-1500	1500	115	1500	6½	5½	7½	4¼	5⅜	42	164.40	173.30
LI-2000	2000	115	1500	6½	5½	9	4¼	6⅞	58	199.45	211.35
LI-100-1	100	230	2000	3½	2⅞	3½	2¼	2¼	4	26.80	34.10
LI-250-1	250	230	2000	4⅝	3⅞	4⅜	3	3¼	10	41.40	50.23
LI-500-1	500	230	2000	6	4⅜	5⅛	3⁷⁄₁₆	3⅜	17½	73.55	83.90
LI-1000-1	1000	230	2000	6	4⅜	7¼	3⁷⁄₁₆	5½	30	145.80	158.90
LI-1500-1	1500	230	2000	6½	5½	7½	4¼	5⅜	42	168.10	179.85
LI-2000-1	2000	230	2000	6½	5½	9	4¼	6⅞	58	197.75	212.50

STYLE LO
STYLE LRG
W
H
W
H

LEAD WIRE TERMINALS

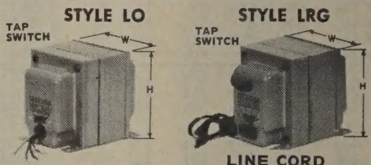
LINE CORD RECEPTACLE (W/GROUND)

ADJUSTABLE ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

- PRIMARY TAPPED
- TWO STYLES

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS						STYLE LO PRICE	STYLE LRG PRICE
				H	W	D	MW	MD	WGT.		
LI-50-2	50	105/115/125	1500	3½	2⅞	3⅞	2¼	2½	3	26.30	31.60
LI-100-2	100	105/115/125	1500	3½	2⅞	4⅜	2¼	3	4½	35.65	42.10
LI-250-2	250	105/115/125	1500	4⅝	3⅞	5⅛	3	4	11½	46.90	54.95
LI-500-2	500	105/115/125	1500	6	4⅜	5⅞	3⁷⁄₁₆	4⅛	19	87.50	96.90
LI-1000-2	1000	105/115/125	1500	6	4⅜	8⅛	3⁷⁄₁₆	6⅜	34	189.30	200.15
LI-50-3	50	210/230/250	2000	3½	2⅞	3⅞	2¼	2½	3	30.55	35.60
LI-100-3	100	210/230/250	2000	3½	2⅞	4⅜	2¼	3	4½	41.20	46.30
LI-250-3	250	210/230/250	2000	4⅝	3⅞	5⅛	3	4	11½	45.85	54.80
LI-500-3	500	210/230/250	2000	6	4⅜	5⅞	3⁷⁄₁₆	4⅛	19	87.15	95.95
LI-1000-3	1000	210/230/250	2000	6	4⅜	8⅛	3⁷⁄₁₆	6⅜	34	187.75	198.05



LEAD WIRE TERMINALS

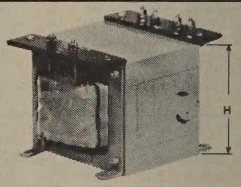
LINE CORD RECEPTACLE (W/GROUND)

HI-POWER ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

BRACKET MOUNTED

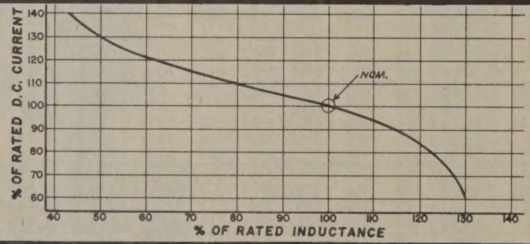
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS						PRICE
				H	W	D	MW	MD	WGT.	
LI-2500-4	2500	115/230	2000	6⅛	7⅛	8¾	5⅞	7	60	221.20
LI-3000-4	3000	115/230	2000	7½	9	7⅞	7½	6½	95	396.25
LI-4000-4	4000	115/230	2000	7½	9	9	7½	7⅝	113	471.55
LI-5000-4	5000	115/230	2000	7½	9	10¼	7½	8⅞	135	502.10
LI-6000-4	6000	115/230	2000	7½	9	11¾	7½	10¼	168	512.95
LI-2500-5	2500	230/460	2500	6⅛	7⅛	8¾	5⅞	7	60	234.10
LI-3000-5	3000	230/460	2500	7½	9	7⅞	7½	6½	95	415.25
LI-4000-5	4000	230/460	2500	7½	9	9	7½	7⅝	113	500.75
LI-5000-5	5000	230/460	2500	7½	9	10¼	7½	8⅞	135	534.70
LI-6000-5	6000	230/460	2500	7½	9	11¾	7½	10¼	168	567.95



SCREW TERMINALS

HIGH CURRENT CHOKES

50/500 HERTZ | DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE)						STYLE B	STYLE BE	• FULLY MTD. SHELLS (STYLE V)						STYLE V	• HERMETICALLY SEALED MIL-T (STYLE CM)						STYLE CM
				H	W	D	MW	MD	WGT.	PRICE	PRICE	H	W	D	MW	MD	WGT.	PRICE	H	W	D	MW	MD	WGT.	PRICE
CH-00	200	.5	3.00	2¼	2⅝	2	2	1¾	1½	8.20	22.40	2⅝	2¼	2¼	1¾	1⅝	1¾	8.50	3⅛	3	2⁹⁄₁₆	2⁵⁄₁₆	1⅞	2⅛	39.90
CH-01	100	1	1.50	2½	2	2⅛	2½	2	2¼	9.00	26.45	3⅛	2½	2⅝	2	1¾	2¼	9.45	3¹³⁄₁₆	3½	3	2⅝	2⅛	3¼	46.60
CH-02	80	2	.95	2½	3	2½	2½	2	2½	9.85	32.65	3⅛	2½	2½	2	1¾	2½	10.50	3¹³⁄₁₆	3½	3	2⅝	2⅛	3½	52.40
CH-04	60	4	.65	3⅛	3¾	3¼	3⅛	2½	5¼	16.65	39.65	3⅞	3⁵⁄₁₆	3¾	2½	2¼	6	17.25	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	7¼	58.15
CH-05	50	5	.40	3⅛	3¾	3⅜	3⅛	2¾	5¾	17.40	43.30	3⅞	3⁵⁄₁₆	4	2½	3	6½	18.00	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	8	65.45
CH-06	40	6	.30	3⅛	3¾	3⅜	3⅛	2¾	6	18.00	44.65	3⅞	3⁵⁄₁₆	4	2½	3	6½	18.55	4⁷⁄₁₆	4¼	3⅝	3⁵⁄₁₆	2¹¹⁄₁₆	8⅝	68.15
CH-08	30	8	.20	3½	4⅛	3⅞	3⅜	3	8	18.75	47.70	4⅛	3½	4⅜	2¾	3⅜	8½	19.60	4⅞	4⅝	4	3¹¹⁄₁₆	3	11⅛	74.90
CH-12	20	12	.10	4⁷⁄₁₆	5¼	4½	4⅜	3⅜	15½	42.85	79.60	5⁷⁄₁₆	4½	5	3½	3½	14	41.85	6¼	5¾	4⅞	4⅜	3½	21	95.35
CH-16	15	16	.08	4⁷⁄₁₆	5¼	4⅝	4⅜	3⅜	14¼	45.90	89.70	5⁷⁄₁₆	4½	5¼	3½	3¾	15	45.25	6¼	5¾	4⅞	4⅜	3½	22½	120.05
CH-20	10	20	.055	4⁷⁄₁₆	5¼	4½	4⅜	3½	15½	49.70	98.80	5⁷⁄₁₆	4½	5⅜	3½	3⅞	16	48.30	6¼	5¾	4⅞	4⅜	3½	24	133.85
CH-25	7	25	.03	4⁷⁄₁₆	5¼	5	4⅜	4	18½	51.90	106.15	5⁷⁄₁₆	4½	5⅞	3½	4⅜	19½	50.45	6¼	5¾	4⅞	4⅜	3½	26½	154.60
CH-30	5	30	.02	5⅜	6⅜	4½	5¼	3¼	21	67.30	140.40	6½	5⁷⁄₁₆	5½	4¼	3¼	24	68.45	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	29½	182.55
CH-40	3½	40	.018	5⅜	6⅜	4⅝	5¼	3½	23	74.80	159.20	6½	5⁷⁄₁₆	5¾	4¼	3½	25	75.20	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	32½	201.85
CH-50	2	50	.010	5⅜	6⅜	4¾	5¼	3⅝	25	76.00	166.00	6½	5⁷⁄₁₆	5¾	4¼	3½	26	76.65	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	34	209.35
CH-100	.7	100	.004	5⅜	6⅜	5	5¼	3⅞	29	83.55	178.20	6½	5⁷⁄₁₆	6⅛	4¼	3⅞	31	85.20	7½	6⅞	5¹³⁄₁₆	5⁵⁄₁₆	4¼	41	223.50
CH-200	.35	200	.0007	6⅛	7⅛	6¾	5⅞	5½	43	102.00	205.60														

QUALITY ENGINEERED ······························ PRECISION BUILT

TODD SYSTEMS INC.

4 RADFORD PLACE YONKERS, N. Y., U.S.A. (914) 963-3400

TODD ENGINEERED

STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

50/60 HERTZ—*UL* COMPONENTS • FOR STEP-UP USE MOST UNITS CAN BE REVERSED OR REWIRED

PORTABLE MODEL

220/240 INPUT
110/120 OUTPUT

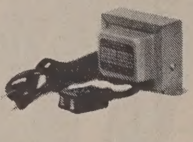
CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-35	20	⅞	1½	2	2⅝	12.60
SD-36	40	1¼	1 7/16	2⅛	3½	14.40
SD-37	60	1 5/16	1 7/16	2⅛	3½	16.60
SD-41	80	1 7/16	1 7/16	2⅛	3½	17.25

LINE CORD • RECEPTACLE

NORMAL DUTY MODEL

220/240 INPUT
110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-24	50	1⅝	2¼	2¾	2¼	11.15
SD-21	65	1⅝	2¼	2¾	2¼	11.60
SD-25	80	1¾	2¼	2¾	2⅜	12.50
SD-23	100	1¾	2¼	2¾	2⅜	13.25
SD-26	125	2⅜	2⅝	3 1/16	2½	14.80
SD-27	150	2⅜	2⅝	3 1/16	2½	15.40

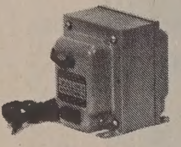


LINE CORD • PIGTAIL

HEAVY DUTY MODEL

220/240 INPUT
110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-15	75	2	3⅛	2⅝	3⅛	——
SD-16	100	2¼	3⅛	2⅝	3¼	16.40
SD-17	150	3½	3⅛	2⅝	3⅞	18.40
SD-38	200	3¾	3⅛	2⅝	4	20.80
SD-12	250	5½	4⅝	3⅞	3⅜	24.95
SD-18	350	6½	4⅝	3⅞	3⅝	28.80
SD-11	500	9¾	4⅝	3⅞	4¼	34.90
SD-19	750	12	4⅝	3⅞	5	42.75
SD-13	1000	13¾	4⅝	3⅞	5¼	56.20
SD-14	1500	19	4⅝	3⅞	6⅝	67.00
SD-20	2000	24½	6	4⅜	6⅜	127.50
SD-39	2500	35½	6½	5½	6⅝	227.50

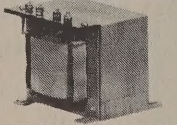


LINE CORD • RECEPTACLE

INDUSTRIAL MODEL

208/220/240 INPUT
110/120 OUTPUT

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-28	3000	47	6⅛	7 7/16	6¼	302.90
SD-29	4000	54	6⅛	7 7/16	7⅛	360.80
SD-22	5000	59	6⅛	7 7/16	7½	422.20
SD-30	6000	70	6⅛	7 7/16	8½	499.00

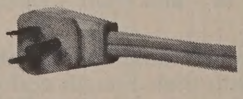


SCREW TERMINALS

ACCESSORIES

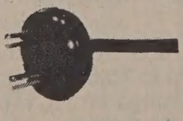
AVAILABLE FOR USE WHERE APPLICABLE

3 WIRE RECEPTACLE



3 WIRE LINE CORD

PLUG ADAPTERS



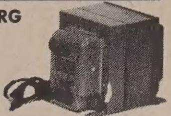
FOREIGN PLUGS

3 TAP REFRIGERATION

188/210
210/236 → 105V-50Hz
236/260 → 115V-60Hz

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-31LRG	350	6½	4⅝	3⅞	4⅜	48.50
SD-32LRG	550	9¼	4⅝	3⅞	5	51.90
SD-33LRG	750	12	4⅝	3⅞	5¾	57.30
SD-34LRG	1000	16¼	4⅝	3⅞	7	74.90
SD-40LRG	1500	23	4⅝	3⅞	8½	99.80

STYLE LRG



TAP SWITCH

LINE CORD • RECEPTACLE (GROUNDED)

CATALOG NUMBER	RATING WATTS	WEIGHT LBS.	DIMENSIONS H	W	D	PRICE
SD-31LO	350	6¼	4⅝	3⅞	4½	46.25
SD-32LO	550	9	4⅝	3⅞	5⅛	50.50
SD-33LO	750	12	4⅝	3⅞	5½	56.50
SD-34LO	1000	16	4⅝	3⅞	6½	73.75
SD-40LO	1500	22	4⅝	3⅞	8	96.50

STYLE LO

JUNCTION BOX

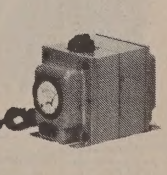
LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR

METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D	PRICE
MVR-17	11 or 22	150	4⅝	4⅝	3⅞	5	71.25
MVR-18	11 or 22	350	6½	4⅝	3⅞	5½	77.50
MVR-11	11 or 22	500	8	4⅝	3⅞	5¾	81.00
MVR-19	11 or 22	750	11	4⅝	3⅞	6⅝	86.50
MVR-13	11 or 22	1000	13¼	4⅝	3⅞	7⅛	116.00
MVR-14	11 or 22	1500	17	6	4⅜	7⅜	165.50
MVR-20	11 or 22	2000	22	6	4⅜	8¼	212.50
MVR-17	12 or 21	150	6	4⅝	3⅞	5⅛	75.00
MVR-18	12 or 21	350	9	4⅝	3⅞	5⅞	83.50
MVR-11	12 or 21	500	12½	4⅝	3⅞	6¾	92.50
MVR-19	12 or 21	750	15	4⅝	3⅞	7¼	100.25
MVR-13	12 or 21	1000	18¾	6	4⅜	7½	139.75
MVR-14	12 or 21	1500	24	6	4⅜	8½	188.75
MVR-20	12 or 21	2000	30½	6	4⅜	9¼	255.75



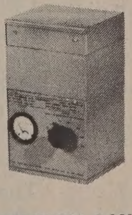
UL LINE CORD & RECEPTACLE

PANEL MOUNTED VOLTAGE REGULATOR

METER • SWITCH
JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	115
12	84	92	100	108	115	122	130	138	208, 230
21	170	185	200	215	230	245	260	275	115
22	170	185	200	215	230	245	260	275	208, 230

CATALOG NUMBER	TYPE	RATING WATTS	WGT. LBS.	DIMENSIONS H	W	D	PRICE
PVR-20	11 or 22	2000	29	5⅜	6⅜	11¼	542.00
PVR-28	11 or 22	3000	40	5⅜	6⅜	12¼	598.00
PVR-29	11 or 22	4000	49	5⅜	6⅜	13⅜	645.00
PVR-22	11 or 22	5000	57	5⅜	6⅜	14⅝	695.00
PVR-30	11 or 22	6000	63	6⅛	7⅛	13¾	760.00
PVR-20	12 or 21	2000	44	6⅛	7⅛	13	625.00
PVR-28	12 or 21	3000	58	6⅛	7⅛	14	695.00
PVR-29	12 or 21	4000	78	6⅛	7⅛	15½	760.00
PVR-22	12 or 21	5000	91	6⅛	7⅛	16½	820.00
PVR-30	12 or 21	6000	105	6⅛	7⅛	18	895.00



- JUNCTION BOX
- LEAD TERMINALS

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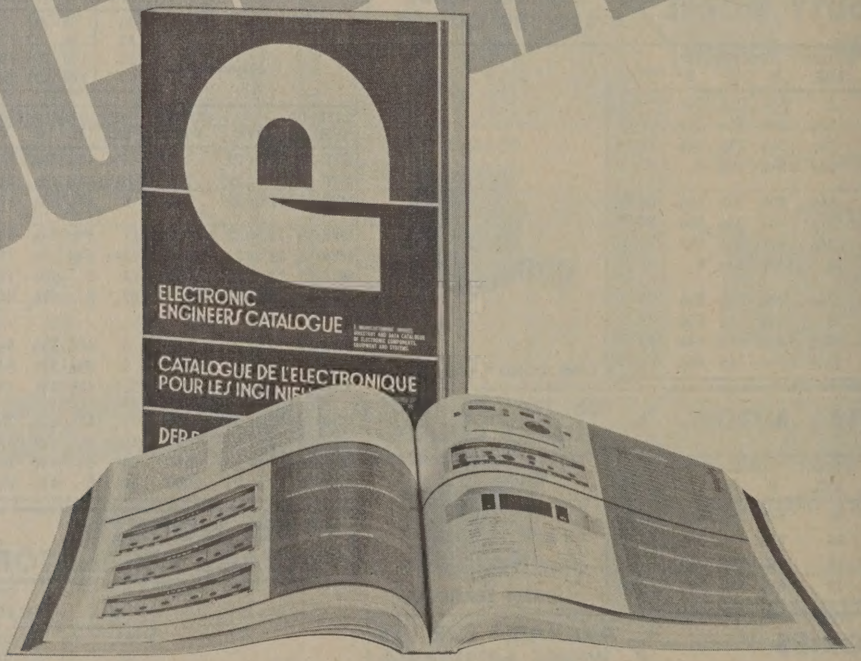
DER PRODUKTKALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

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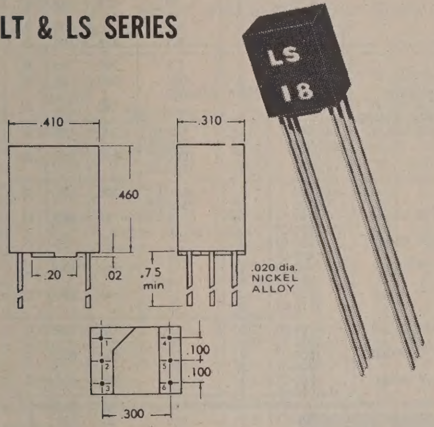
TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030
PHONE: (816) 761-6314   TWX 910-777-7037

SUBMINIATURE AUDIO TRANSFORMERS

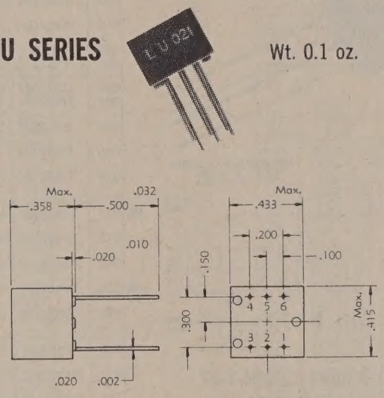
PROTOTYPES IN 48 HOURS UPON REQUEST

LT & LS SERIES



LU SERIES

Wt. 0.1 oz.



The LS Series is electrically and mechanically the same as the LT Series except for phase relationships between terminals.

LS, LT, and LU Series transformers have successfully passed the rigid requirements of MIL-T-27, Class R, Grade 5.

Subminiature in size, weighing less than 0.1 ounce, these transformers have tenth inch grid spacing between terminals and are ideally suited for transistor circuit applications which utilize printed circuit board design. All three series have risers on mounting surfaces to facilitate inspection and board cleaning, and also to prevent moisture traps.

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.

The new LU Series exhibits the same electrical characteristics as the LS and LT Series but has been packaged in a "thin line" configuration to allow for closer board spacing for "card cage" applications or where height dimensions are critical.

MAGNETIC SHIELDING

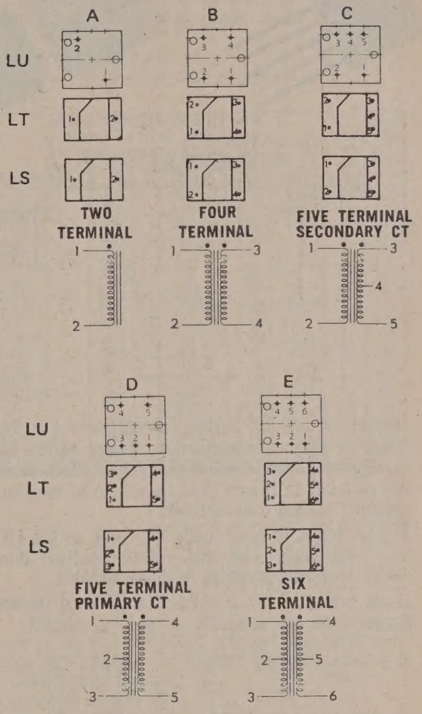
LS and LT Series transformers are available with magnetic shields when required. Overall dimensions of transformers with the magnetic shield added are .365 max. x .465 max. x .531 max.

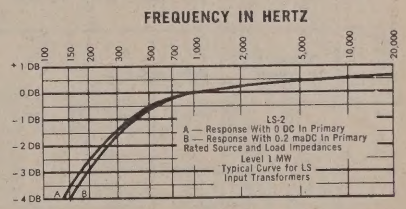
To order transformers with shields installed add 500 to dash numbers shown in the table below. For example: to order an LS-22 with shield, specify LS-522.

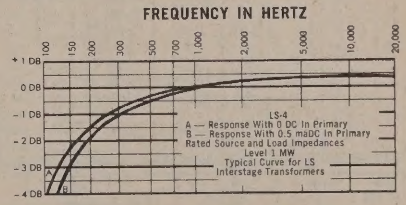
LS, LT or LU No.	MIL-T-27 Designation	Application	Primary Impedance	DC Res. Pri. Ohms	DC ma Pri.	Secondary Impedance	Max. Power MW	Term. Layout
2	TF5S21ZZ	Input	50,000-CT	3800	.2	1000-CT	25	E
4	TF5S21ZZ	Interstage	20,000/30,000	1700	.5	800/1200	40	B
5	TF5S21ZZ	Interstage	20,000/30,000-CT	1700	.5	800/1200-CT	40	E
6	TF5S21ZZ	Interstage	10,000/12,000-CT	1050	1	1500/1800-CT	50	E
7	TF5S21ZZ	Driver	10,000/12,000-CT	1050	1	1200/1500-CT	50	E
(T) 8	TF5S21ZZ	Driver	10,000/12,000-CT	1050	1	2000/2500-CT	50	E
9	TF5S21ZZ	Driver	10,000/12,000-CT	1050	1	500/600-CT	50	E
10	TF5S21ZZ	Output	500/600	60	3	50/60	50	B
11	TF5S21ZZ	Output	1000/1200	145	3	50/60	50	B
12	TF5S21ZZ	Output	600	70	3	3.2	50	B
13	TF5S21ZZ	Output	1200	120	2	3.2	50	B
14	TF5S21ZZ	Output	10,000	1160	1	3.2	50	B
15	TF5S21ZZ	Output	150/200-CT	18	10	12/16	50	D
16	TF5S21ZZ	Output	300/400-CT	38	7	12/16	50	D
17	TF5S21ZZ	Output	600/800-CT	75	4.5	12/16	50	D
18	TF5S21ZZ	Output	1000/1330-CT	120	3.5	12/16	50	D
19	TF5S21ZZ	Output	1500/2000-CT	180	3	12/16	50	D
20	TF5S21ZZ	Output	7500/10,000-CT	820	1	12/16	50	D
21	TF5S21ZZ	Output	300-CT	37	7	600	50	D
22	TF5S21ZZ	Output	500-CT	60	3	600	50	D
23	TF5S21ZZ	Output	900-CT	100	4	600	50	D
24	TF5S21ZZ	Output	1500-CT	170	3	600	50	D
25	TF5S21ZZ	Output	120/150-CT	15	10	3.2/4	50	D
26	TF5S21ZZ	Output	320/400-CT	40	6	3.2/4	50	D
27	TF5S21ZZ	Output	600/750-CT	70	4.5	3.2/4	50	D
28	TF5S21ZZ	Output	800/1000-CT	100	4	3.2/4	50	D
29	TF5S21ZZ	Output	1200/1500-CT	125	3	3.2/4	50	D
30	TF5S21ZZ	Output	1600/2000-CT	190	2.5	3.2/4	50	D
31	TF5S21ZZ	Output	8000/10,000-CT	820	1	3.2/4	50	D
(T) 32	TF5S21ZZ	Output	10,000-CT	1000	1	10,000-CT	50	E
33	TF5S21ZZ	Driver	10,000/12,000	1050	1	500/600-CT	50	C
34	TF5S21ZZ	Driver	20,000	1700	.3	1000	50	B
35	TF5S21ZZ	Output	1000	135	3	50	50	B
36	TF5S21ZZ	Output	400-CT	40	3	11	50	D
(T,U) 37	TF5S21ZZ	Driver	10,000/12,000	1050	1	2000/2500-CT	50	C
38	TF5S21ZZ	Output	600-CT	72	3	600-CT	50	E
(T) 39	TF5S21ZZ	Output	10,000	1000	1	10,000 split	50	*
40	TF5S21ZZ	Output	600	72	3	600 split	50	*
41	TF5S21ZZ	Input	25,000-CT	4300	0.6	1000-CT	30	E
(U) 42	TF5S21ZZ	Isolation	600-CT	90	4	600-CT	30	E
101	TF5S20ZZ	Choke	6 H @ 2 ma	1700				A
102	TF5S20ZZ	Choke	1.25 H @ 2 ma	180				A
103	TF5S20ZZ	Choke	3.5 H @ 2 ma	1100				A
104	TF5S20ZZ	Choke	.3 H @ 4 ma	42				A

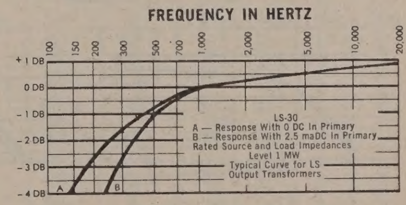
*PRIMARY TERM. 1-2; SECONDARY TERM. 3-4, 5-6

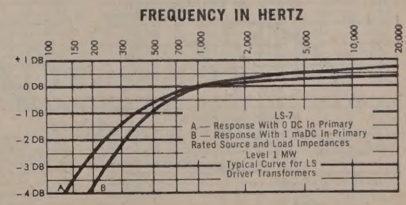
(U) LU
(T) LT } Distributor Item











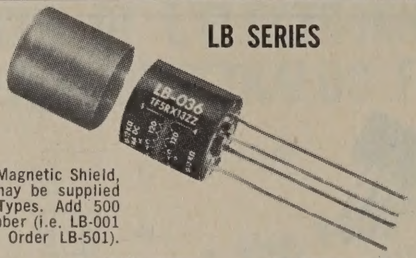
The above are typical response curves up to 20 kHz however many items in this series have useful frequency ranges up to 100 kHz and beyond.

TOROTEL INC.
13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030
PHONE: (816) 761-6314 TWX 910-777-7037

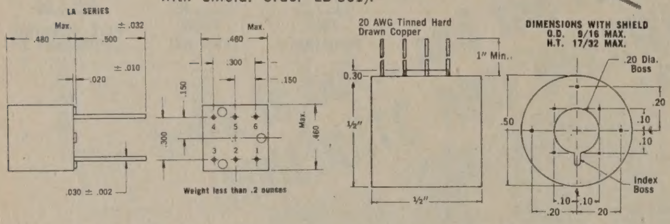
TOROTEL
LA 036
6804

LA SERIES

LB SERIES



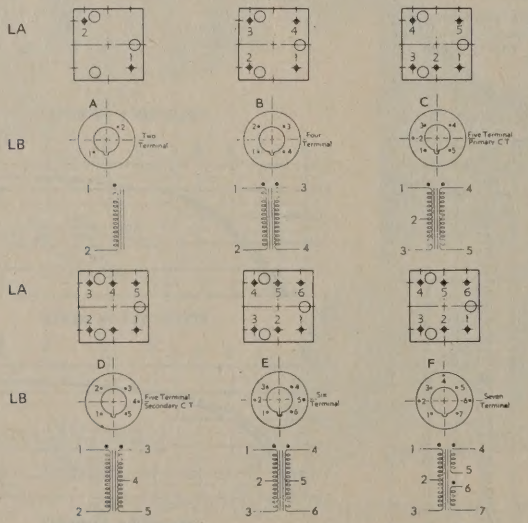
The LB-500 Magnetic Shield, as shown, may be supplied for all LB Types. Add 500 to Dash Number (i.e. LB-001 with Shield. Order LB-501).

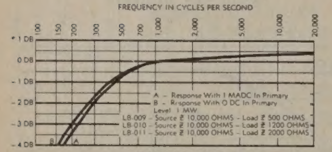


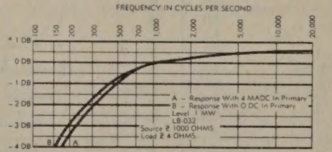
Torotel LA and LB Series Transformers are manufactured to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.

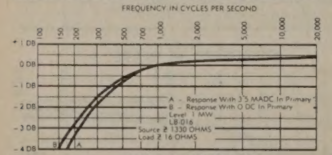
The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.

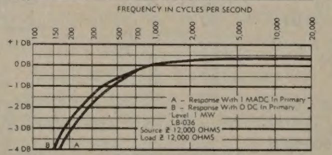
Leads are made of 20 AWG Tinned Hard Drawn Copper. Units utilizing Dumet Wire are available on special request.

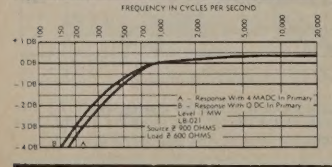


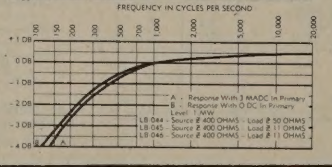










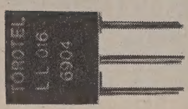


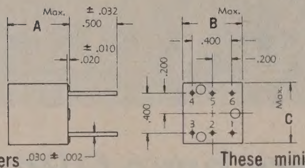
	LA, LB No.	MIL Designation	Application	Primary Impedance	DC mA in Pri.	Secondary Impedance	Nom. Pri. Res.	MW Level @ 1 kHz	Term. Lay-out
	001	TF5S21ZZ	Interstage	20,000 30,000	.5 .5	800 1200	850	50	B
	002	TF5S21ZZ	Output	500 600	3 3	50 60	60	100	B
	003	TF5S21ZZ	Output	1000 1200	3 3	50 60	115	100	B
	004	TF5S21ZZ	Output	600	3	3.2	60	100	B
	005	TF5S21ZZ	Output	1200	2	3.2	115	100	B
	006	TF5S21ZZ	Output	10,000	1	3.2	790	100	B
	007	TF5S21ZZ	Input Other Application	200,000 500	0 0	1000 100,000	8500	25	B
	008	TF5S20ZZ	Reactor 3.5 H @ 2 maDC, 1 H @ 5 maDC				630		A
	009	TF5S21ZZ	Output or Driver	10,000 12,000	1 1	500-CT 600-CT	800	100	D
	010	TF5S21ZZ	Driver	10,000 12,000	1 1	1200-CT 1500-CT	800	100	D
(B)	011	TF5S21ZZ	Driver	10,000 12,000	1 1	2000-CT 2500-CT	800	100	D
	012	TF5S21ZZ	Single or PP Output	150-CT 200-CT	10 10	12 16	11	500	C
	013	TF5S21ZZ	Single or PP Output	300-CT 400-CT	7 7	12 16	20	500	C
(B)	014	TF5S21ZZ	Single or PP Output	600-CT 800-CT	5 5	12 16	43	500	C
	015	TF5S21ZZ	Single or PP Output	800-CT 1070-CT	4 4	12 16	51	500	C
	016	TF5S21ZZ	Single or PP Output	1000-CT 1330-CT	3.5 3.5	12 16	71	500	C
	017	TF5S21ZZ	Single or PP Output	1500-CT 2000-CT	3 3	12 16	108	500	C
	018	TF5S21ZZ	Single or PP Output	7500-CT 10,000-CT	1 1	12 16	505	500	C
(B)	019	TF5S21ZZ	Output to Line	300-CT	7	600	19	500	C
(B)	020	TF5S21ZZ	Output to Line to Line or Mixing	500-CT	5.5	600	31	500	C
(A)	021	TF5S21ZZ	Output to Line	900-CT	4	600	53	500	C
(B)	022	TF5S21ZZ	Output to Line	1500-CT	3	600	86	500	C
	023	TF5S21ZZ	Interstage	20,000-CT 30,000-CT	.5 .5	800-CT 1200-CT	850	100	E
(B)	024	TF5S21ZZ	Input Other Application	200,000-CT 500-CT	0 0	1000-CT 100,000-CT	8500	25	E
(B)	025	TF5S21ZZ	Interstage	10,000-CT 12,000-CT	1 1	1500-CT 1800-CT	800	100	E
	026	TF5S20ZZ	Reactor 6 H @ 2 maDC 1.5 H @ 5 maDC				2100		A
	027	TF5S20ZZ	Reactor 1.2 H @ 2 maDC, .5 H @ 11 maDC				100		A
	028	TF5S20ZZ	Reactor .3 H @ 4 maDC .15 H @ 20 maDC				31		A
	029	TF5S21ZZ	Single or PP Output	120-CT 150-CT	10 10	3.2 4	10	500	C
	030	TF5S21ZZ	Single or PP Output	320-CT 400-CT	7 7	3.2 4	20	500	C
	031	TF5S21ZZ	Single or PP Output	640-CT 800-CT	5 5	3.2 4	43	500	C
	032	TF5S21ZZ	Single or PP Output	800-CT 1000-CT	4 4	3.2 4	51	500	C
	033	TF5S21ZZ	Single or PP Output	1060-CT 1330-CT	3.5 3.5	3.2 4	71	500	C
	034	TF5S21ZZ	Single or PP Output	1600-CT 2000-CT	3 3	3.2 4	109	500	C
	035	TF5S21ZZ	Single or PP Output	8000-CT 10,000-CT	1 1	3.2 4	505	100	C
(A) (B)	036	TF5S21ZZ	Isolation or Interstage	10,000-CT 12,000-CT	1	10,000-CT 12,000-CT	950	100	E
	037	TF5S21ZZ	Driver	10,000-CT 12,000-CT	1 1	1200-CT 1500-CT	800	100	E
	038	TF5S21ZZ	Driver	10,000-CT 12,000-CT	1 1	2000-CT 2500-CT	800	100	E
(B)	039	TF5S21ZZ	Driver	10,000-CT 12,000-CT	1 1	500-CT 600-CT	800	100	E
	040	TF5S21ZZ	Input	100,000	0	1000	1700	70	B
	041	TF5S21ZZ	Driver	20,000	.5	1000	1000	100	B
	042	TF5S21ZZ	Driver	20,000	.5	1200-CT	1000	100	D
	043	TF5S21ZZ	Output	1000	3	50	60	100	B
	044	TF5S21ZZ	Output	400	3	50	30	100	B
	045	TF5S21ZZ	Output	400	3	11	30	100	B
	046	TF5S21ZZ	Single or PP Output	400-CT	3	11	30	500	C
	047	TF5S20ZZ	Reactor 10 H @ 0 maDC, 8 H @ .5 maDC				650		A
	048*	TF5S21ZZ	Isolation or Interstage Ratio 1:1:1	2000-CT 2500-CT	3 3	8000 split 10,000 split	195	100	F
	049*	TF5S21ZZ	Interstage	10,000-CT 12,000-CT	1 1	2000 split 2400 split	560	100	F
	050*	TF5S21ZZ	Interstage	20,000-CT 30,000-CT	.5 .5	1000 split 1500 split	800	100	F
	051*	TF5S21ZZ	Interstage	40,000-CT 50,000-CT	.25 .25	400 split 500 split	1700	50	F
	052*	TF5S21ZZ	Interstage or Output	400-CT 500-CT	8 6	400 split 500 split	46	500	F
	053*	TF5S21ZZ	Interstage	400-CT 500-CT	8 6	120 split 150 split	46	500	F
	054*	TF5S21ZZ	Interstage	400-CT 500-CT	8 6	40 split 50 split	46	500	F
	055*	TF5S21ZZ	Interstage	80-CT 100-CT	12 10	32 split 40 split	9.8	500	F
	056	TF5S21ZZ	Input	50,000-CT	.3	1000-Ct	1900	50	E
	057	TF5S21ZZ	Output	600-CT 750-CT	4.5	3.2 4.0	40	500	C
	058	TF5S21ZZ	Output	1200-CT 1500-CT	3	3.2 4	100	500	C
	059	TF5S21ZZ	Input	100K-CT	0	1000-CT	3300	25	E
	060	TF5S21ZZ	Driver	10K-CT	1	600-CT	1100	100	E
	061	TF5S21ZZ	Interstage	4K-CT	2	10K-CT	440	500	E
	062	TF5S21ZZ	Output to Line	1000-CT	3	600-CT	110	500	E
	063	TF5S21ZZ	Input	600-CT	4	25K-CT	65	100	E
(A)	064	TF5S21ZZ	Isolation	600-CT	4	600-CT	67	100	E
	065	TF5S21ZZ	Output	600-CT	4	60	65	100	C
	066	TF5S21ZZ	Output	600-CT	4	4	65	100	C
(B)	500		Magnetic Shielding Case						

*These LA Types have no Primary C-T

(A) LA
(B) LB } Distributor Item

AUDIO TRANSFORMERS LL & LR SERIES





Series	A	B	C
LL	.600	.590	.590
LR	.925	.800	.710

These tiny, versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.

RESPONSE: ±1 db 200 to 50,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 50,000 HZ
WEIGHT: 0.4 OZ

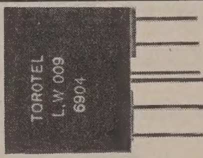
	LL No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri DC (ma)	Max. 200 Hz Pwr* (mw)
				Pri	Sec.	Pri	Sec		
	001	TF5S21ZZ	Input	100K-CT	1000-CT	6000	60	0	150
	002	TF5S21ZZ	Interstage	25K-CT	1000-CT	2800	120	0	150
	003	TF5S21ZZ	Interstage	10K-CT	10K-CT	1100	1200	1	150
	004	TF5S21ZZ	Driver	10K-CT	1500-CT	1100	200	1	150
	005	TF5S21ZZ	Output to Line	10K-CT	600-CT	1100	75	1	150
	006	TF5S21ZZ	Interstage	4000-CT	10K-CT	440	1200	1.5	150
**	007	TF5S21ZZ	Output to Line	1000-CT	600-CT	100	60	3	150
	008	TF5S21ZZ	Output	1000-CT	4	100	0.4	3	150
	009	TF5S21ZZ	Input	600-CT	25K-CT	65	3500	4	150
**	010	TF5S21ZZ	Isolation	600-CT	600-CT	65	75	4	150
	011	TF5S21ZZ	Output	600-CT	60	65	7	4	150
	012	TF5S21ZZ	Output	600-CT	4	65	0.5	4	150
	013	TF5S21ZZ	Driver	10K-CT	2000-CT	1100	240	1	150
	014	TF5S21ZZ	Driver	10K-CT	500-CT	1100	65	1	150
	015	TF5S21ZZ	Line to Line	500-CT	600-CT	55	75	4.5	150
	016	TF5S21ZZ	Output to Line	300-CT	600-CT	33	75	5.5	150

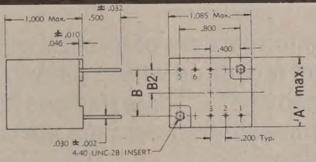
These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.

RESPONSE: ±1 db 200 to 20,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 20,000 Hz
WEIGHT: 1.0 OZ

	LR No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri DC (ma)	Max. 200 Hz Pwr* (mw)
				Pri	Sec.	Pri	Sec		
	001	TF5S21ZZ	Interstage	25K-CT	1000-CT	2600	110	0.5	750
	002	TF5S21ZZ	Interstage	10K-CT	10K-CT	1000	1100	1	750
	003	TF5S21ZZ	Driver	10K-CT	1500-CT	1000	165	1	750
	004	TF5S21ZZ	Output to Line	10K-CT	600-CT	1000	70	1	750
	005	TF5S21ZZ	Output	10K-CT	4	1000	0.5	1	750
	006	TF5S21ZZ	Interstage	4000-CT	10K-CT	400	1100	1.5	750
	007	TF5S21ZZ	Output	1500-CT	15	150	2	2.5	750
	008	TF5S21ZZ	Output to Line	1000-CT	600-CT	100	70	3	750
	009	TF5S21ZZ	Output	1000-CT	4	100	0.5	3	750
	010	TF5S21ZZ	Input	600-CT	25K-CT	60	2900	4	750
	011	TF5S21ZZ	Isolation	600-CT	600-CT	60	70	4	750
**	012	TF5S21ZZ	Output	600-CT	60	60	6.5	4	750
	013	TF5S21ZZ	Output	600-CT	15	60	2	4	750
	014	TF5S21ZZ	Output	600-CT	4	60	0.5	4	750
	015	TF5S21ZZ	Output to Line	250	600-CT	25	70	7	750
	016	TF5S21ZZ	Driver	10K-CT	2000-CT	1000	110	1	750
	017	TF5S21ZZ	Driver	10K-CT	500-CT	1000	110	1	750
	018	TF5S21ZZ	Line to Line	500-CT	600-CT	50	70	4.5	750
	019	TF5S21ZZ	Output to Line	300-CT	600-CT	30	70	5.5	750

AUDIO TRANSFORMERS LW & LY SERIES





Series	A	B	B_2
LW	.900	.600	.300
LY	1.125	.800	.400

"LW" series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.

RESPONSE: ±1 db 100 to 10,000 Hz
DISTORTION: 1.5% Max. at 60 MW, 200 to 10,000 Hz
WEIGHT: 2.0 OZ.

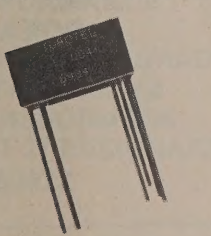
	LW No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri DC (ma)	Max. 200 Hz Pwr* (watt)
				Pri	Sec.	Pri	Sec		
	001	TF5S21ZZ	Interstage	10K-CT	10K-CT	800	1050	1	3.5
	002	TF5S21ZZ	Output to Line	10K-CT	600-CT	800	60	1	3.5
	003	TF5S21ZZ	Output	10K-CT	4	800	0.5	1	3.5
	004	TF5S21ZZ	Output	1500-CT	15	110	1.5	2.5	3.5
**	005	TF5S21ZZ	Output to Line	1000-CT	600-CT	75	60	3	3.5
	006	TF5S21ZZ	Output	1000-CT	4	75	0.5	3	3.5
	007	TF5S21ZZ	Input	600-CT	25K-CT	45	2700	4	2.5
	008	TF5S21ZZ	Isolation	600-CT	600-CT	45	60	4	3.5
	009	TF5S21ZZ	Output	600-CT	60	45	6.5	4	3.5
	010	TF5S21ZZ	Output	600-CT	15	45	1.5	4	3.5
	011	TF5S21ZZ	Output	600-CT	4	45	0.5	4	3.5
	012	TF5S21ZZ	Output to Line	250	600-CT	20	60	7	3.5
	013	TF5S21ZZ	Interstage	25K-CT	1000-CT	2500	85	0.5	2.5
	014	TF5S21ZZ	Driver	10K-CT	2000-CT	800	170	1	3.5
	015	TF5S21ZZ	Driver	10K-CT	500-CT	800	50	1	3.5
	016	TF5S21ZZ	Line to Line	500-CT	600-CT	50	60	4.5	3.5
	017	TF5S21ZZ	Output to Line	300-CT	600-CT	30	60	5.5	3.5
	018	TF5S21ZZ	Interstage	2500-CT	10K-Split	200	900	1.5	3.5

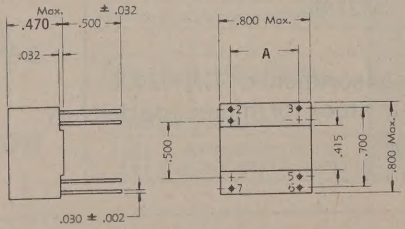
"LY" series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.

RESPONSE: ±1 db 60 to 10,000 Hz
DISTORTION: 1% Max. at 250 MW, 200 to 10,000 Hz
10% Max. at rated power, 200 to 10,000 Hz
WEIGHT: 2.5 OZ.

	LY No.	MIL-T-27 Designation	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri DC (ma)	Max. 200 Hz Pwr* (watt)
				Pri	Sec.	Pri	Sec		
	001	TF5S21ZZ	Interstage	10K-CT	10K-CT	700	900	1	6
	002	TF5S21ZZ	Output to Line	10K-CT	600-CT	700	55	1	6
	003	TF5S21ZZ	Output	10K-CT	4	700	0.4	1	6
	004	TF5S21ZZ	Output	1500-CT	15	100	1.5	2.5	7.5
	005	TF5S21ZZ	Output to Line	1000-CT	600-CT	65	55	3	7.5
	006	TF5S21ZZ	Output	1000-CT	4	65	0.4	3	7.5
**	007	TF5S21ZZ	Isolation	600-CT	600-CT	40	55	4	7.5
	008	TF5S21ZZ	Output	600-CT	60	40	6	4	7.5
	009	TF5S21ZZ	Output	600-CT	15	40	1.5	4	7.5
	010	TF5S21ZZ	Output	600-CT	4	40	0.4	4	7.5
	011	TF5S21ZZ	Output to Line	250	600-CT	16	55	7	7.5
	012	TF5S21ZZ	Driver	10K-CT	2000-CT	700	150	1	6
	013	TF5S21ZZ	Driver	10K-CT	500-CT	700	45	1	6
	014	TF5S21ZZ	Line to Line	500-CT	600-CT	45	55	4.5	7.5
	015	TF5S21ZZ	Output to Line	300-CT	600-CT	27	55	5.5	7.5
	016	TF5S21ZZ	Interstage	2500-CT	10K-Split	170	800	1.5	7.5

AUDIO TRANSFORMERS — LH & LK SERIES





"LK/LH" Series transformers are the ultimate in compactness and their .470 HT and 0.1 grid spacing provide a most efficient .5" board spacing unit. Designed to meet MIL-T-27C, Grade 5, Class S.

RESPONSE: ±1 db 200 to 10,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 10,000 Hz
WEIGHT: 0.75 OZ

Series	A
LK	.700
LH	.600

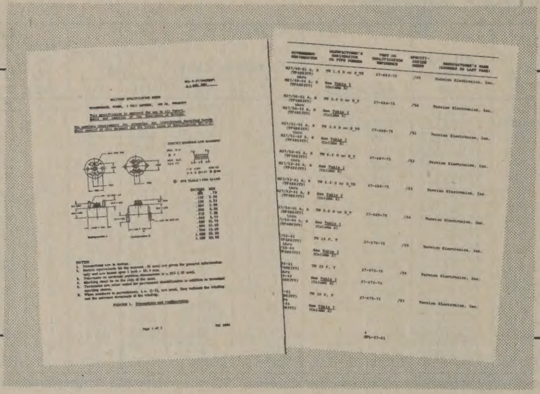
	LJ No.	Application	Impedance Ohms		DC Resistance Ohms		Max. Pri DC (ma)	Max. 200 Hz Pwr* (mw)
			Pri	Sec	Pri	Sec		
	001	Interstage	25K-CT	1000-CT	1325	53	0.5	300
	002	Interstage	10K-CT	10K-CT	510	525	1	325
	003	Driver	10K-CT	1500-CT	510	80	1	325
**	004	Output to Line	10K-CT	600-CT	510	31	1	325
	005	Output	10K-CT	4	510	0.3	1	325
	006	Interstage	4000-CT	10K-CT	200	525	1.5	325
	007	Output	1500-CT	15	75	1	2.5	325
	008	Output to Line	1000-CT	600-CT	50	31	3	325
	009	Output	1000-CT	4	50	0.3	3	325
	010	Input	600-CT	25K-CT	30	1500	4	300
**	011	Isolation	600-CT	600-CT	30	31	4	325
	012	Output	600-CT	60	30	3	4	325
	013	Output	600-CT	15	30	1	4	325
	014	Output	600-CT	4	30	0.3	4	325
	015	Output to Line	250	600-CT	13	31	7	325
	016	Driver	10K-CT	2000-CT	510	106	1	325
	017	Driver	10K-CT	500-CT	510	26	1	325
	018	Line to Line	500-CT	600-CT	25	31	4.5	325
	019	Output to Line	300-CT	600-CT	15	31	5.5	325
	020	Isolation-Ratio 1:1:1	2000-CT	8K Split	100	425	2	300
	021	Isolation	10K-CT	2K Split	510	106	1	300

* These power ratings are based upon lowest frequency operation. Much higher ratings are possible at higher operating frequencies.

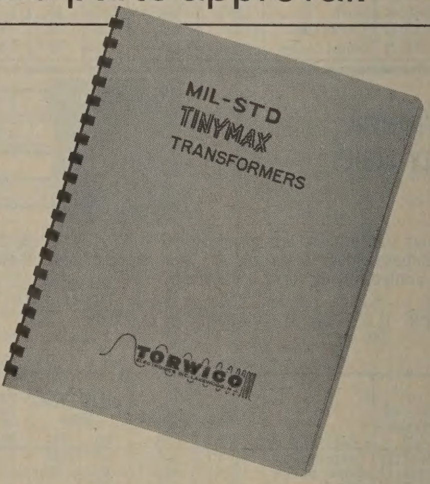
** Distributor Item

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

TINYMAX Transformers have QPL Status on Qualified Product List 27.



Now you can specify Military Standard Transformers without the need for Qualification Testing or requests for non-standard parts approval.



These miniature transformers are of toroidal construction and offer a size and weight reduction when compared to conventional laminated and "C" core designs. Yet, the prices on these custom engineered transformers are competitive with off-the-shelf stock items.

So, when you need a 115V, 400 Hz transformer having a specific secondary voltage don't settle for an off-the-shelf item that may only approximate your requirement. Torwico has over 2,000 MIL/STD units and an almost infinite selection of STD TINYMAX.

What's more, Torwico offers fast delivery and competitive pricing. Selection, delivery and price--Torwico has it all.

STD TINYMAX -- MIL-T-27, Grade 4 and Grade 5, Class S, 115 volt, 400 Hz transformers available in power ratings ranging from 1.5 VA through 250 VA, with an almost infinite combination of secondary voltages of 6V through 300V.

MIL-STD TINYMAX -- Grade 4 and Grade 5, Class S, 115 Volt, 400 Hz transformers. Reference M27/37 through M27/66. Over 2,000 choices of secondary voltages.

EXTENSION OF APPROVAL -- Any design selected directly from, or based, on our MIL/STD TINYMAX transformer may be qualified to MIL-T-27 by similarity.

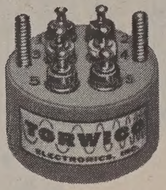
PROCUREMENT NOTE -- Catalog information and cross referenced sheets may be obtained from the factory or for MIL-STD units, refer directly to specification sheets M27/37 through M27/66.

PROTOTYPE DELIVERIES -- A large assortment of TINYMAX transformers is always maintained in stock for immediate delivery. Others can be shipped within 10 days.

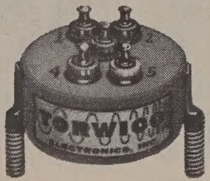
For a copy of Towico's MIL-STD TINYMAX catalog, contact your local Torwico representative. He'll show you why Torwico is the easy way to deal with military standards.

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

TINYMAX 400 HZ Power Transformers



This Case style
available in
1.5 through 250 VA

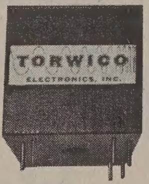


This Case style
available in
1.5 through 9 VA

TINYMAX

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 4 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF4S03YY

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ±3% (from range shown) with 115V PRI.	O.D ±.031"	HT. ±.031"	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.000	.469	1.00 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.000	.594	1.25 oz.	18%	17°C
3	6.0 to 300	1.000	.594	1.25 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.000	.812	1.70 oz.	12%	20°C
6	6.0 to 300	1.000	.812	1.70 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.000	1.062	2.30 oz.	10%	25°C
9	6.0 to 300	1.000	1.062	2.30 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
16 WITH OR WITHOUT ELECTROSTATIC SHIELD	6.0 to 300	1.375	1.125	3.80 oz.	8%	32°C
25	6.0 to 300	1.375	1.375	4.95 oz.	7%	45°C
50	6.0 to 300	2.000	1.500	11.00 oz.	3%	35°C
75	10 to 300	2.000	1.750	13.50 oz.	3%	40°C
100	12 to 300	2.250	2.000	18.70 oz.	2.5%	43°C
250	26 to 300	2.875	2.000	30.00 oz.	2%	55°C



TINYMAX

CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 5 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF5S03ZZ

VA RATING	SELECTED FULL LOAD SEC. V (RMS) ±3% (from range shown) with 115V PRI.	SIZE MAX- INCHES	WEIGHT MAX.	REGULATION MAX.	TEMP. RISE MAX.
1.5	6.0 to 300	1.09 Sq. X .47 ht.	.85 oz.	23%	17°C
1.5 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	17°C
3	6.0 to 300	1.09 Sq. X .59 ht.	1.10 oz.	18%	20°C
3 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	20°C
6	6.0 to 300	1.09 Sq. X .78 ht.	1.65 oz.	12%	25°C
6 (With Electrostatic Shield)	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	25°C
9	6.0 to 300	1.09 Sq. X 1.03 ht.	2.20 oz.	10%	30°C
9 (With Electrostatic Shield)	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
16 WITH OR WITHOUT ELECTROSTATIC SHIELD	6.0 to 300	1.40 Sq. X .97 ht.	3.40 oz.	8%	32°C
25	6.0 to 300	1.40 Sq. X 1.20 ht.	4.40 oz.	7%	45°C

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The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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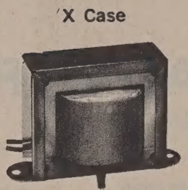
TRIAD-UTRAD

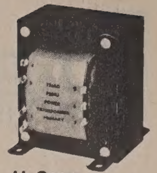
Litton Distributor Services

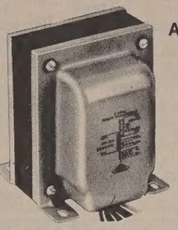
Transformers for Power Supply, Control and Filament Circuits

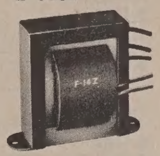
Listed in order of increasing secondary voltages

All units in case type X also available on special order with shields added or with channel frame removed.


X Case


U Case


A Case


Z Case

Single secondary / 50-60 Hz

Type No.	Secondary		Primary Volts	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension			Mounting Dimension	
	Volts	Amps					H	W	D	MW	MD
F-1X#	2.5 CT	3	115	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	
F-301X			115/230								
F-6X#	2.5 CT	6	115	Pri. 1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	
				Sec. 2500							
F-306X			115/230								
F-3X#	2.5 CT	10	115	Pri. 1500	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	
				Sec. 3000							
F-7X	5 CT	3	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-13X	6.3	.6	115	1500	X	Leads	1 3/8	2 3/8-	1 3/8	2	
F-313X			115/230								
F-14X	6.3 CT	1.2	115	Pri. 1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	
				Sec. 2500							
F-314X			115/230								
F-52X	6.3‡	1.2	115	Pri. 1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	
				Sec. 5000							
F-43X#	6.3	4	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-16X	6.3 CT	3	115	Pri. 1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
				Sec. 2500							
F-316X			115/230								
F-18X	6.3 CT	6	115	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-318X			115/230								
F-21A	6.3 CT	10	115	1500	A	1-Leads	3 19/32	2 31/32	3 1/8	2 1/4	2
F-180X	10.0 CT	1	115	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	
F-31X	10 CT	3	115	2000	X	Leads	2 9/32	3 3/4	2 1/8	3 1/8	
F-23U	10 CT	7	115	1500	U	Leads	3 1/2	2 7/8	2 15/16	2 1/4	2 7/16
F-113X	12	0.15	115	1500	X	Leads	1 3/8	2 3/8	1 3/8		2
F-114X	12	0.7	115	1500	X	Leads	1 5/8	2 13/16	1 5/8		2 3/8
F-70X	12.6 CT	1.0	115	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	
F-29U†	12 CT-11 CT	11	115	Pri. 1500	U	Leads	4 3/8	3 1/2	3 3/8	2 3/4	2 9/16
	10 CT			Sec. 3000							
F-25X	12.6 CT	1.5	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-325X			115/230								
F-44X#	12.6 CT	2	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-344X			115/230								
F-26X#	12.6 CT	2.5	115	1500	X	Leads	2 9/32	3 11/16	2	3 1/8	
F-326X			115/230								
F-181U	12.6 CT	4	115	1500	U	Leads	3 1/16	2 9/16	2 3/16	2	2
F-3181U			115/230								
F-182U	12.6 CT	6	115	1500	U	Leads	3 3/8	2 13/16	2 7/16	2 1/4	2 3/8
F-183U	12.6 CT	8	115	1500	U	Leads	3 13/16	3 3/16	2 15/16	2 1/2	2 1/4
F-112X	14 CT	0.25	115	1500	X	Leads	1 3/8	2 3/8	1 3/8		
F-250X	14 CT	1	115	1500	X	Leads	1 15/16	3 1/4	1 3/4	2 13/16	
F-251X	14 CT	2	115	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	
F-252U	14 CT	4	115	1500	U	Leads	3	2 1/2	2 7/16	2	2 1/4
F-253U	14 CT	6	115	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8
F-254X	20 CT	1	115	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	
F-255X	20 CT	2	115	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	
F-256U	20 CT	4	115	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8
F-257U	20 CT	6	115	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8
F-258U	20 CT	8	115	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8
F-259U	20 CT	10	115	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4

‡ Static shield. † Tapped primary to produce lower voltages. # 60 cycle operation

TRIAD-UTRAD

Litton Distributor Services

Single secondary / 50-60 Hz (Continued)

Type No.	Secondary Volts	Secondary Amps	Primary Volts	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-115X	24 CT	0.085	115	1500	X	Leads	1 3/16	2 1/16	1 1/4	1 3/4	
F-116X F-3116X	24 CT	0.2	115 115/230	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	
F-117X	24 CT	0.4	115	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	
F-3117X	24 CT	0.4	115/230	1500	X	Leads	1 5/8	2 13/16	1 1/2	2 3/8	
F-118X	24 CT	0.7	115	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	
F-45X# F-345X	24 CT	1	115 115/230	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-46X#	24	1	115	1500	X	Leads	1 15/16	3 11/16	2 1/8	2 13/16	
F-230X	24.0 CT	1	440	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	
F-192X	24 CT	2	115	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-213X	24.0 CT	2	440	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	
F-193U	24 CT	4	115	1500	U	Leads	3 13/16	3 1/8	2 13/16	2 1/2	2 1/8
F-232U	24.0 CT	4	440	1500	U	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 1/4
F-260U	24 CT	6	115	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8
F-261U	24 CT	8	115	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4
F-57X	25.2 CT	1	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-41X F-341X	25.2 CT	2	115 115/230	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-56X	25.2 CT	2.8	115	1500	X	Leads	2 21/32	4	2 1/4	3 9/16	
F-119X	26.8 CT	0.15	115	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	
F-120X	26.8 CT	0.5	115	1500	X	Leads	1 15/16	3 1/4	2	2 13/16	
F-40X F-340X	26.8 CT	1	115 115/230	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-55X F-355-X	26.8 CT	1.7	115 115/230	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-184X	28.0 CT	1	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-185U F-3185U	28.0 CT	2	115 115/230	1500	U	Leads	3	2 1/2	2 5/8	2	2 1/1
F-187U	28.0 CT	4	115	1500	U	Leads	3 3/4	3 1/8	3 1/4	2 1/2	2 5/8
F-262X	30.0 CT	1	115	1500	X	Leads	2 1/4	3 11/16	1 15/16	3 1/8	
F-210X	30.0 CT	1.7	115	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-263U	30.0 CT	2	115	1500	U	Leads	3	2 1/2	2 9/16	2	2 3/8
F-264U	30.0 CT	4	115	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8
F-265U	30.0 CT	6	115	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4
F-266U	30.0 CT	8	115	1500	U	Leads	4 1/2	3 3/4	4	3	3
F-188X	35.0 CT	.1	115	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	
F-189X	35.0 CT	.5	115	1500	X	Leads	1 15/16	3 5/16	1 3/4	2 13/16	
F-54X F-354X	35 CT	1.5	115 115/230	1500	X	Leads	2 19/32	4	2 1/4	3 9/16	
F-190U	35.0 CT	2	115	1500	U	Leads	3 3/8	2 13/16	2 3/4	2 1/4	2 3/16
F-191U	35.0 CT	4	115	1500	U	Leads	4 1/8	3 7/16	2 7/8	2 3/4	2 3/8
F-267U	35.0 CT	6	115	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4
F-268U	35.0 CT	8	115	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 1/4
F-269U	35.0 CT	10	115	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 3/4
F-270X	40.0 CT	1	115	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	
F-271U	40.0 CT	2	115	1500	U	Leads	3 3/8	2 13/16	2 7/8	2 1/4	2 3/8
F-272U	40.0 CT	4	115	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8
F-273U	40.0 CT	6	115	1500	U	Leads	4 1/2	3 3/4	4	3	3
F-274U	40.0 CT	8	115	1500	U	Leads	4 1/2	3 3/4	4 1/4	3	3 5/8
F-275U	40.0 CT	10	115	1500	U	Leads	5 1/4	4 3/8	4 1/2	3 1/2	3 1/4
F-276X	50.0 CT	1	115	1500	X	Leads	2 9/16	4	2 1/4	3 9/16	
F-277U	50.0 CT	2	115	1500	U	Leads	3 3/4	3 1/8	2 7/8	2 1/2	2 3/8
F-278U	50.0 CT	4	115	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4
F-58A	50 CT	5	115	1500	A	Leads	4 5/8	3 15/16	4 1/2	3	3 3/8
F-59X	60 CT	.4	115	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-279U	60.0 CT	1	115	1500	U	Leads	3	2 1/2	2 5/8	2	2 3/8
F-280U	60.0 CT	2	115	1500	U	Leads	3 3/4	3 1/8	3 1/8	2 1/2	2 5/8
F-281U	60.0 CT	4	115	1500	U	Leads	4 1/2	3 3/4	4	3	3
F-282U	60.0 CT	6	115	1500	U	Leads	5 1/4	4 3/8	4 1/8	3 1/2	2 7/8
F-283U	70.0 CT	1	115	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4
F-284U	70.0 CT	2	115	1500	U	Leads	3 3/4	3 1/8	3 1/2	2 1/2	2 7/8

Multiple secondary / primary 115 volt, 50-60 Hz

Type No.	Secondary Volts	Secondary Amps	RMS Test Voltage	Case Type	Connections or Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-34A	6.3 CT* 6.3* 6.3* 6.3*	1.75 1.75 1.75 1.75	1500	A	2-Leads	3 3/16	2 21/32	3	2	2 1/16
F-42A	12.6 CT* 12.6*	2.5 2.5	1500	A	1-Leads	3 19/32	2 21/32	3 1/8	2 1/4	2
F-83A¶ #	12.6 CT* 12.6 CT*	5 5	Pri. 1500 Sec. 2500	A	2-Leads	3 7/8	3 9/32	3 3/4	2 1/2	2 5/8
F-194X	32.0 CT 15.5 CT	.050 .2	1500	X	Leads	1 3/8	2 3/8	1 1/2	2	
F-195X	32.0 CT 15.5 CT	.250 .750	1500	X	Leads	1 15/16	3 5/16	2	2 13/16	
F-196U	32.0 CT 15.0 CT	1 2	1500	U	Leads	3 3/8	2 13/16	2 5/8	2 1/4	2 1/4
F-197U	32.0 CT 15.0 CT	1 4	1500	U	Leads	3 3/4	3 1/8	2 15/16	2 1/2	2 1/4
F-198U	32.0 CT 15.0 CT	1 6	1500	U	Leads	3 3/4	3 1/8	3 3/16	2 1/2	2 3/4
F-199U	32.0 CT 15.0 CT	1.5 10	1500	U	Leads	4 1/8	3 7/16	3 1/2	2 3/4	2 3/4

CONTROL TRANSFORMERS / 6, 12, 24 volt secondaries

Type No.	Primary	Secondary Parallel	Secondary Series	VA Rating	Case Type	Connections	Height Overall	Base Area	Mtg. Dim.	Shpg. Wt. in Lbs.
F-105Z		6V @ 2A	12V @ 1A	12	Z	Lugs	2 3/8	2 7/8x1 3/4	2 3/8	1
F-106Z	115V/230V	6V @ 4A	12V @ 2A	24	Z	Lugs	2 3/4	3 1/8x2	2 13/16	1 1/2
F-107Z	50/60 CPS	12V @ 4A	24V @ 2A	48	Z	Lugs	3 1/8	3 5/8x2 3/8	3 1/8	2 1/2
F-108U	on all	12V @ 8A	24V @ 4A	96	U	Lugs	3 1/2	2 7/8x3	2 1/4x2 1/4	4 1/4
F-109U		12V @ 16A	24V @ 8A	192	U	Lugs	4 1/8	3 3/4x3 1/2	3 x2 3/4	8
F-211Z		24V @ .5A	48V @ .25A	12	Z	Lugs	2 5/16	2 13/16x1 1/2	2 3/8	.678
F-212Z		24V @ 1.0A	48V @ .50A	24	Z	Lugs	2 3/4	3 1/8x2 1/4	2 13/16	1.05
F-213Z		24V @ 2.0A	48V @ 1.0A	48	Z	Lugs	3 1/16	3 5/8x2 3/8	3 1/8	1.55
F-214U		24V @ 4.0A	48V @ 2.0A	96	U	Lugs	3 31/32	3 3/16x2 3/16	2 1/4x2 5/8	3.24
F-215U		24V @ 8.0A	48V @ 4.0A	192	U	Lugs	4 5/32	3 3/4x3 7/16	2 3/4x3	6.06

LOW VOLTAGE RECTIFIER / transistor drive voltage, 50-60 Hz

Type No.	Primary Volts	Secondary AC Volts	Secondary AC Amps	DC Volts Half Wave	DC Volts Bridge	RMS Test Voltage	Case Type	Connections	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
F-94X	115†	10–20 CT–40 CT	.035	15	30	1500	X	Leads	1 3/8	2 3/8	1 3/8	2	
F-90X	115†	10–20 CT–40 CT	.1	15	30	1500	X	Leads	1 5/8	2 13/16	1 5/8	2 3/8	
F-91X	115†	10–20 CT–40 CT	.3	15	30	1500	X	Leads	2 9/32	3 11/16	2	3 1/8	
F-93X	115†	10–20 CT–40 CT	.75	15	30	1500	X	Leads	2 19/32	4	2 1/4	3 5/16	
F-92A	115†	10–20 CT–40 CT	1	15	30	1500	A	Leads (2 Holes)	3 3/16	2 21/32	3	2	2 1/16

ISOLATION / 50-60 Hz

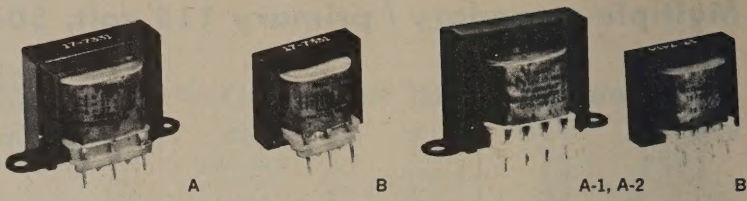
All isolation units have static shields

Type No.	Output Watts (VA)	Primary Volts	Secondary AC Volts ± 5%	Secondary AC Amps	RMS Test Voltage	Case Type	Connections	Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW	Mounting Dimension MD
N-48X	15	115	115	.13	1500	X	Leads	–	1 15/16	3 5/16	2	2 13/16	–
N-51X#	35	115	115	.3	1500	X	Leads	–	2 9/32	3 11/16	2 1/8	3 1/8	–
N-68X	50	115–230§	115	.435	1500	X	Leads	–	2 9/32	3 11/16	2 1/8	3 1/8	–
N-53M	85	115	115	.74	1500	M	6′ Cord, Plug & Socket	–	3 19/32	2 31/32	3 5/8	2 1/4	2 3/8
N-54M	150	115	115	1.3	1500	M	6′ Cord, Plug & Socket	–	3 7/8	3 9/32	4 1/4	2 1/2	3
N-73A	150	115	115–230§	.65	1500	A	Leads	1	3 7/8	3 9/32	3 7/8	2 1/2	2 3/4
N-67A	150	115–230§	115	1.3	1500	A	Leads	2	3 7/8	3 9/32	4 1/8	2 1/2	3
N-55M N-55MG†	250	115 115	115	2.17	1500	M	6′ Cord, Plug & Socket	–	4 5/8	3 15/16	5	3	3 7/8
N-66A	250	115–230§	115	2.17	1500	A	Leads	2	4 5/8	3 15/16	4 5/8	3	3 5/8
N-469A#	50	220–440§	115	.435	1500	A	Leads	1	3 3/16	2 21/32	2 1/2	2	1 9/16
N-471A#	300	220–440§	115	2.6	2000	A	Leads	1	4 5/8	3 15/16	4 3/8	3	3 3/8

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding.

CT for Center Tap. ¶ Tapped primary 105-115-125. § Split winding. # 60 cycle operation. † Tapped primary to produce lower voltages.

TRIAD-UTRAD
Litton Distributor Services



LOW-VOLTAGE, LOW-CURRENT PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS 115 volts, 50/60 Hz Primary/Dual Secondaries

			SECONDARY		Dimensions							
Cat. No.	Fig.	Output Watts	Series Conn.	Parallel Conn.	H.	W.	D.	L.	A.	B.	Mtg. Dim.	Wt. Oz.
F-131P	B	1 1/2	8V CT @ .188A	4V @ .376A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-139P	B	1 1/2	12.6V CT @ .12A	6.3V @ .24A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-132P	B	1 1/2	15V CT @ .100A	7.5V @ .200A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-150P	B	1 1/2	17V CT @ .085A	8.5V @ .170A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-138P	B	1 1/2	25.2V CT @ .06A	12.6V @ .12A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-133P	B	1 1/2	30V CT @ .050A	15V @ .100A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-160P	B	1 1/2	34V CT @ .045A	17V @ .090A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-135P	B	1 1/2	76V CT @ .020A	38V @ .040A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-149XP	A	4 1/2	12.6V CT @ .35A	6.3V @ .70A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-142XP	A	4 1/2	15V CT @ .300A	7.5A @ .600A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-161XP	A	4 1/2	17V CT @ .264A	8.5V @ .528A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-148XP	A	4 1/2	25.2V CT @ .178A	12.6V @ .356A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-143XP	A	4 1/2	30V CT @ .150A	15V @ .300A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-162XP	A	4 1/2	34V CT @ .132A	17V @ .264A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-147XP	A	4 1/2	40V CT @ .112A	20V @ .224A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-144XP	A	4 1/2	54V CT @ .084A	27V @ .168A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-159XP	A	7 1/2	12.6V CT @ .60A	6.3V @ 1.2A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-152XP	A	7 1/2	15V CT @ .500A	7.5V @ 1.000A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-163XP	A	7 1/2	17V CT @ .441A	8.5V @ .882A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-158XP	A	7 1/2	25.2V CT @ .30A	12.6V @ .60A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-153XP	A	7 1/2	30V CT @ .250A	15V @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-164XP	A	7 1/2	34V CT @ .220A	17V @ .440A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-154XP	A	7 1/2	54V CT @ .140A	27V @ .280A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5

115/230 volts, 50/60 Hz Dual Primary /Dual Secondaries

F-333P	B-1	1 1/2	30V CT @ .050A	15V @ .100A	1 1/8	–	1 1/8	1 3/8	13/64	1	–	4.0
F-349XP	A-1	4 1/2	16V CT @ .280A	8V @ .560A	1 3/8	2 3/8	1 1/4	1 5/8	1/4	1 7/64	2	6.5
F-359XP	A-2	10	24V CT @ .450A	12V @ .900A	1 5/8	1 7/16	2 13/16	1 7/8	1/4	1 5/16	2 3/8	11.0
F-362XP	A-2	10	20V CT @ .500A	10V @ 1.0A	1 5/8	1 7/16	2 13/16	1 7/8	1/4	1 5/16	2 3/8	11.0

PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS 115 volts, 50/60 Hz Pri Triple Output Secondaries for ±15V and ±5V DC

			SECONDARY		Dimensions							
Cat. No.	Fig.	Output Watts	Series Conn.	Parallel Conn.	H.	W.	D.	L.	A.	B.	Mtg. Dim.	Wt. Oz.
F-165P	B	1 1/2	24V CT @ .025A	9V CT @ .100A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-167P	B	1 1/2	32V CT @ .020A	15V CT @ .060A	1 1/8	1 25/64	1 5/32	1 25/64	5/16	1		3.5
F-168XP	A	4 1/2	32V CT @ .050A	15V CT @ .195A	1 25/64	2 3/8	1 1/4	1 45/64	13/32	1 3/32	2	7.5
F-166XP	A	7 1/2	24V CT @ .125A	9V CT @ .500A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5
F-169XP	A	7 1/2	32V CT @ .100A	15V CT @ .287A	1 41/64	2 13/16	1 15/32	1 61/64	13/32	1 5/16	2 3/8	10.5

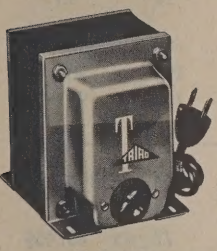
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS

						Dimensions					
Cat. No.	Fig.	Output M.W.	Primary Impedance	Secondary Impedance	Pri. D.C. Unbalance	H.	W.	D.	Pin Dim.		Wt. Oz.
TY-141P	B	100	10,000 CT	10,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-142P	B	100	10,000 CT	2,000 CT	4 ma.	5/8	13/16	19/32	3/16	.042	1
TY-147P	B	10	150 CT	600 CT	15 ma.	5/8	13/16	19/32	3/16	.042	5

TELEPHONE COUPLING TRANSFORMERS

Cat. No.	Fig. No.	Application	Pri. Imp.	Sec. Imp.	Dimensions A	B	C	D	E	F	G	H	I	J	Wt. Oz.
TY-300P	B	Hybrid*	600	600/600**	.63	.75	.55	.421	.187	.375	.25	.203	.020	.041	.5
TY-301P	B	Coupling	600	900	.63	.75	.55	.421		.375	.25	.203	.020	.041	.5
TY-302P	B	Hybrid*	600	600/600	.75	1.0	.94	.781	.200	.400	.26	.203	.020	.041	1.2
TY-303P	B	Bridging	4000	600	.63	.75	.55	.421		.375	.25	.203	.020	.041	.5
TY-304P	B	Coupling	600 CT	600 CT	.63	.75	.55	.421	.187	.375	.25	.188	.018	.041	.5
TY-350P	B	Holding Coil	2.0 hy @ 60 ma, 1.3 hy @ 100 maDC, 180 ohms DCR		1.19	1.44	.98	1.00		.63	.25		.020	.040	3.5

* Two required for hybrid operation. ** Split winding; one wide band, one narrow band.



M Case

STEPDOWN AUTOFORMERS / 50-60 Hz

Type No.	Output Watts (VA)	Primary Volts	Secondary Volts ± 5%	Secondary RMS Amps	RMS Test Voltage	Case Type	Connec-tions	Mounting Dimension MW	MD
N-1X	50	230	115	.435	1500	X	Leads	3⅛	–
N-3M	85	230	115	.74	1500	M	6′ Cord & Plug & Socket	2¼	1⅝
N-4M	150	230	115	1.3	1500	M	"	2¼	2⅜
N-5M	250	230	115	2.17	1500	M	"	2½	3
N-7M	600	230	115	5.22	1500	M	"	3	3⅞

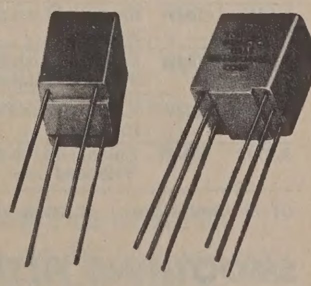
UNIVERSAL RECTIFIER POWER / primary 117 volts, 50-60 Hz

Type No.	Secondary No. 1 AC Volts	Secondary DC Amps Full Wave CT	Bridge	Secondary No. 2 AC Volts	DC Amps	RMS Test Volts	Case Type	Connec-tions	Case Dimensions H	W	D	Mounting Dimension MW	MD
F-202U	11.0 to 29.5	2.0	1.25	–		1000	U	Lugs	3	2½	3	2	2⅛
F-203U	12.0 to 30.0	4.0	2.0	–		1000	U	Lugs	3⅜	2¹³⁄₁₆	3¼	2¼	2⅜
F-204U	11.5 to 29.0	8.0	4.0	–		1000	U	Lugs	3¾	3⅛	4⅛	2½	2⅞
F-205U	12.0 to 29.5	12.0	6.0	–		1000	U	Lugs	4⅛	3⁷⁄₁₆	5⅛	2¾	3¼

Type No.	Primary Volts	Secondary AC Volts	Amps	DC Volts Half Wave	Bridge	RMS Test Voltage	Case Type	Connec-tions	Case Dimension H	W	D	Mounting Dimension MW	MD
F-47U	115	0–17–18	3	6–7	13–14	1500	U	Leads	3	2½	2¾	1⅝	2⅜
F-347U	115/230												
F-48U	115	0–17–18	6	6–7	13–14	1500	U	Leads	3¹³⁄₁₆	3³⁄₁₆	3³⁄₁₆	2½	2¹¹⁄₁₆
F-49U	115	36* 36*	3 3	13 13	26 26	1500	U	Leads	4⅝	3¹³⁄₁₆	3¾	3	3¹⁄₁₆
F-60U	115	0–6.5–13–19.5–26	3	9	18	1500	U	Leads	3⅜	2¹³⁄₁₆	2⅝	2¼	2³⁄₁₆
F-360U	115/230												
F-61U	115	0–24–27–30–33–36	3	13	26	1500	U	Leads	3¾	3⅛	3¼	2½	2⅝
F-361U	115/230												
F-67U #	110–120	0–24–27–30–33–36	8	13	26	1500	U	Leads	4⅝	3¹³⁄₁₆	4⅜	3	3⁵⁄₁₆
F-64U	115	0–7–8–9	7	–	5–6–7	1500	U	Leads	3⅜	2¹³⁄₁₆	2¾	2¼	2³⁄₁₆

RED SPEC TRANSISTOR TRANSFORMERS

All Red Spec transformers are designed and constructed to conform to the rigid requirements of Specification MIL-T-27B. Features are: solid epoxy molded case . . . legible, permanent circuit data on every unit . . . base mounting pad for ready inspection of all solder joints . . . high-strength .020-diameter nickel alloy leads . . . no stripping or tinning required . . . operating voltage: 150 volts DC . . . exceptional operation from 100 to 100,000 cycles . . . base dimensions of only .310 by .410 inch . . . total height of just .465 inch . . . weight: 1/10 ounce . . . lowest possible fatigue factor . . . dry hydrogen-annealed Trialloy, deep-drawn .020-inch case (SP-310) available for providing as much as 20 to 45 db magnetic shielding.



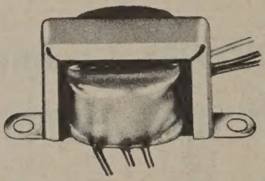
Type No.	Mil Type Number	Power Level In MW	Application	Matching Impedance Primary	Secondary	Max MA DC Unbalanced In Primary	DC Resistance Primary	Secondary
SP-4	TF5SX16ZZ	10	Input	200,000 CT	1,000 CT	0	5300	100
SP-5	TF5SX16ZZ	25	Input	50,000 CT	1,000 CT	0	3800	75
SP-13	TF5SX13ZZ	40	Interstage	25,000 CT/20,000 CT	1,000 CT/800 CT	.5	1700	115
SP-15	TF5SX13ZZ	50	Interstage	10,000 CT	1,500 CT	1	1050	300

TRIAD-UTRAD TRANSFORMERS

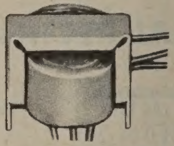
Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	D. C. Resistance Primary	D. C. Resistance Secondary	Overall Turns Ratio	Freq. Resp. ± 3DB	RMS Test Voltage	Case Type	Connections
SP-20	TF5SX13ZZ	50	Driver	10,000 CT		1,200 CT		1	1050		200
SP-21	TF5SX13ZZ	50	Driver	10,000 CT		2,000 CT		1	1050		330
SP-22	TF5SX13ZZ	50	Driver	10,000		2,000 CT/500§		1	1050		146/168§
SP-29	TF5SX13ZZ	50	Driver	10,000 CT		500 CT		1	1050		80
SP-33	TF5SX17ZZ	50	Output	1,000		50		3	145		8
SP-42	TF5SX17ZZ	50	Output	150 CT		12		10	18		2.7
SP-50	TF5SX17ZZ	50	Output	500 CT		600		3	67		98
SP-51	TF5SX17ZZ	50	Output	900 CT		600		4	104		96
SP-52	TF5SX13ZZ	50	Output	1,500 CT		600		3	168		92
SP-66	TF5SX13ZZ	50	Output-Isolation	10,000 CT		10,000 CT		1	1000		1300
SP-67	TF5SX17ZZ	50	Output-Isolation	600 CT		600 CT		3	72		92
SP-69	TF5SX17ZZ	50	Output-Isolation	600		600 CT/150§		3	72		40/45§
SP-70	TF5SX17ZZ	50	Output-Isolation	600		600		3	72		92

CT for Center Tap. § Split Secondary.

MINIATURE AUDIO TRANSFORMERS



X Case



XT Case

Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	DC Resistance Primary	DC Resistance Secondary	Overall Turns Ratio	Frequency Response ± 3DB	RMS Test Volts	Case Type	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimension MW
T-1X‡	1MW.	Line or Mike to Grid	600/250/50	50,000	80	3200	1:9.16	60–15,000	500	X	5/8	1 7/32	3/4	1
T-31X‡	10MW.	Line to Line	600/250/50	600/250/50	55	80	1:1	50–15,000	500	X	5/8	1 7/32	3/4	1
T-34X	20MW.	Transistor or Line to Transistor or Line	500 CT 2 MA. D.C.	500 CT/125§	45	55	1:1.03	50–20,000	500	X	5/8	1 9/32	11/16	1 1/16
T-35X	10MW.	Transistor or Line to Transistor	600 CT 1 MA. D.C.	2000 CT/500§	68	200	1:1.7	50–20,000	500	X	5/8	1 7/32	3/4	1

J SERIES / low level high fidelity

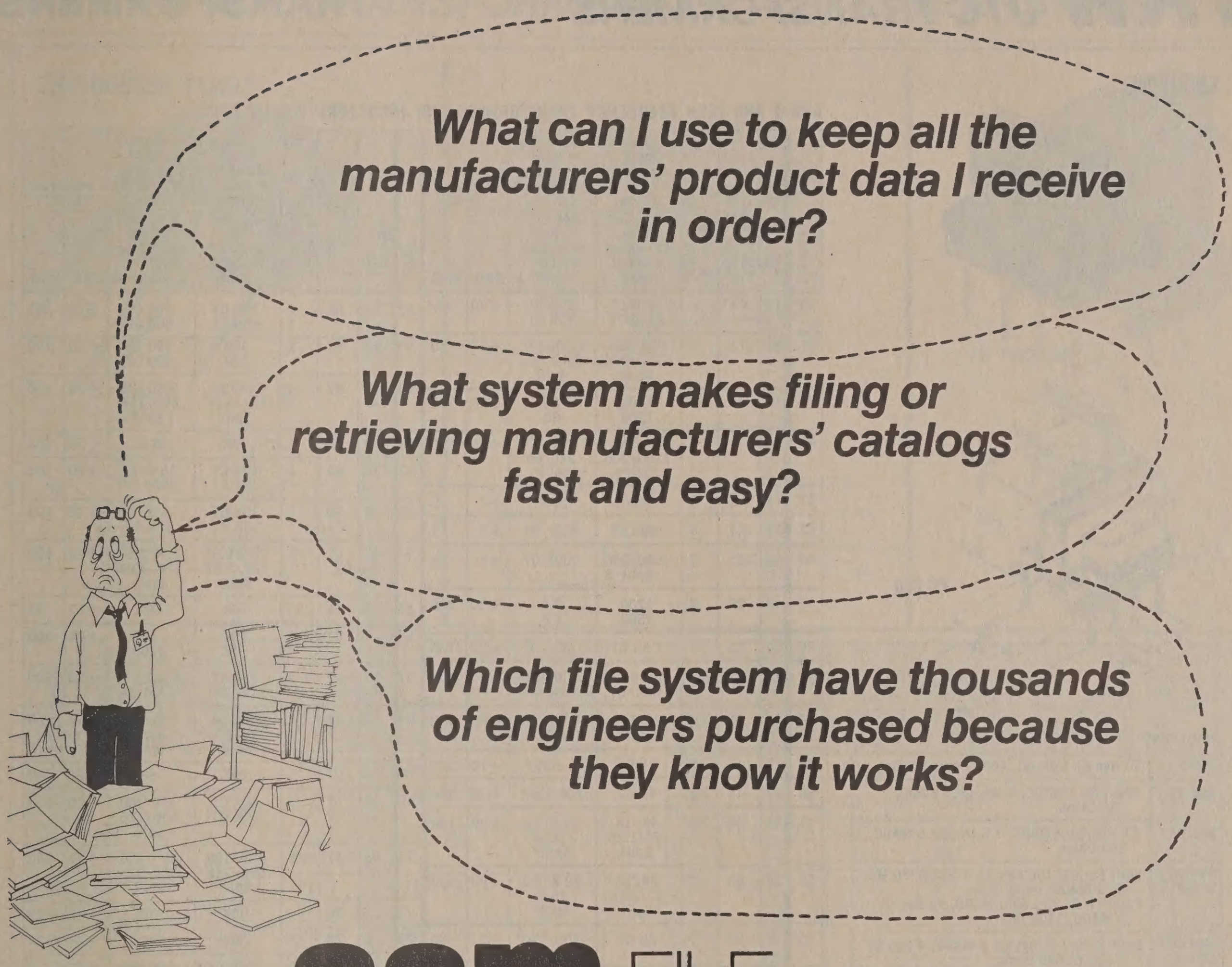
Type No.	Power Output	Application	Matching Impedance Primary	Matching Impedance Secondary	D. C. Resistance Primary	D. C. Resistance Secondary	Overall Turns Ratio	Freq. Resp. ± 3DB	RMS Test Voltage	Case Type	Connections
A-12J‡	10MW	Balanced Line or Mike to Grid	600 CT/150 §§§	60,000	50	4920	1:10	30–15,000	500	J	Leads
A-65J	100MW	Single or Push-Pull Plates to Balanced Line	15,000 CT	600 CT/150 §§§	1630	73	5:1	30–15,000	500	J	Leads
A-57J	50MW	Line or Transistor to Line	600/250/ 50	600/250/ 50	40	44	1:1	30–30,000	500	J	Leads
A-67J‡	50MW	Balanced Line to Balanced Line	600 CT/150 §§§	600 CT/150 §§§	43.8	44.1	1:1	30–15,000	500	J	Leads

CT for Center Tap. ‡ Static shield. §§§ Split winding.

SMOOTHING FILTER REACTORS

Type No.	Current DC MA.	Inductance† Henries	Resistance Ohms	RMS Test Voltage	Case Type	Connections	Lead Holes Used	Case Dimension H	Case Dimension W	Case Dimension D	Mounting Dimensions MW	Mounting Dimensions MD
C-1X	20	15	1000	1000	X	Leads	–	1 3/16	2 1/16	1 1/4	1 3/4	
C-5X	75	12	390	1000	X	Leads	–	1 15/16	3 5/16	1 3/4	2 13/16	
C-36X	300	.5	30	1500	X	Leads	–	1 3/8	2 3/8	1 1/2	2	
C-40X	600	.32	10	1500	X	Leads	–	1 15/16	3 5/16	2	2 13/16	

† Inductance tolerance—20% + 50%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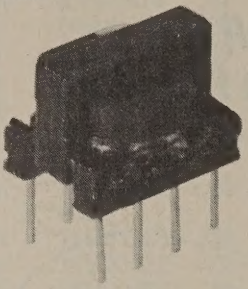
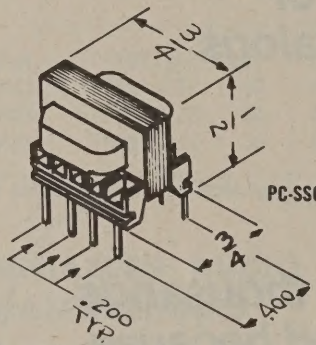
TRW UTC TRANSFORMERS

SSO LINE





PC-SSO

AUDIO AND HIGH FREQUENCY TRANSFORMERS AND INDUCTORS (CONT'D)

Line	Type No. SSO-	E.T. Product Unbal. DC MA	In Winding Millivolt Sec.	Primary Input-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S	Secondary Output-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S	Maximum Level DBM	Maximum Level M.W.
38	15	8.5	5	800 CT 1200 CT	20K CT 30K CT	+20	100
39	42 *	8.5	5	800/200 1200/300 Split	20K/5K 30K/7.5K Split	+17	50
40	12	11	3	1000 1200	50 60	+20	100
41	34 *	—	6	1K/250 1200/300 Split*	200/50 240/60 Split*	+20	100
42	13	3.2	0	1000	200K	+7	5
43	21	3.2	0	1000 CT	200K CT	+7	5
44	45 *	3.25	0	1000/250 Split S	200K CT	+7	5
45	16	22	3	1200 1500	3.2 4.0	+20	100
46	20	23	7	1.5K CT	600 CT	+20	100
47	22	32	7	1500 CT 1800 CT	10K CT 12K CT	+20	100
48	35 *	25	2.5	2K/500 Split*	600/150 Split*	+20	100
49	8	10	2.2	2K CT	10K	+20	100
50	27	16	2.5	4K CT	600 Split	+20	100
51	36 *	44	2.6	4K/1K 5K/1.25 Split	12.8/3.2 16/4 Split*	+20	100
52	38 *	63	2	8K/2K 10/2.5K Split	12.8/3.2 16/4 Split*	+20	100
53	37 *	30	.6	8K CT S	600/150 Split*	+7	50
54	9	82	2	10K	16	+20	100
55	18	79	4	10K CT 12K CT	3.2 4.0	+20	100
56	3	55	3 1.5	10K 25K	200 500	+20	100
57	39 *	55	3 1.5	10K/2.5K 25K/6.25K Split	200/50 500/125 Split*	+20	100

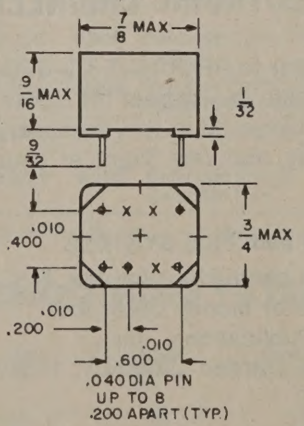
Line	Type No. SSO-	E.T. Product Millivolt Sec.	Unbal. DC MA In Winding	Primary Input-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S	Secondary Output-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S	Maximum Level DBM	Maximum Level M.W.
58	14	33	2 1	10K CT 25K CT	200 CT 500 CT	+20	100
59	17	82	2	10K 12K	500 CT 600 CT	+20	100
60	40 *	82	4	10K/2.5 12K/3.0K Split	500/125 600/150 Split	+20	100
61	8	23	1	10K	2K CT	+20	100
62	22	82	4	10K CT 12K CT	1500 CT 1800 CT	+20	100
63	25	60	1	10K CT 12K CT	10K CT 12K CT	+20	100
64	41 *	60	1	10K/2.5K 12K/3.0K Split	10K/2.5K 12K/3.0K Split	+20	100
65	2	13	.25	10K	90K	+15	30
66	7	42	.5	20K 30K	800 1200	+20	100
67	15	42	1	20K CT 30K CT	800CT 1200 CT	+20	100
68	42 *	42	1	20K/5K 30K/7.5K Split	800/200 1200/300 Split	+17	50
69	4	64	1	30K	50	+20	100
70	26	57	.5	40K CT 50K CT	400/100 500/125 Split	+20	100
71	43 *	57	.5	40K/10K 50K/25K Split	400/100 500/125 Split	+20	100
72	2	38	—	90K	10K	+15	30
73	6	79	.5	100K	60	+20	100
74	44 *	40	0	100K CT S 200K CT	100/25 200/50 Split	+7	5
75	13	48	0	200K	1000	+7	5
76	21	48	0	200K CT	1K CT	+7	5
77	45 *	48	0	200K CT S	1K/250 Split	+7	5
78	1	44	0	250K 62.5K	200 50	+7	5

*Available in PCSSO and SSOP Style only.

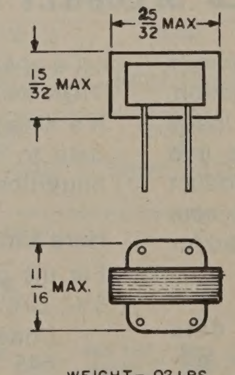
INDUCTORS

SSO-5	50 Hys @ 1 MADC, 4400 Ohms DC Res.
SSO-23	8 Hys @ 2 MADC, 4 Hys @ 5 MADC, 650 Ohms
SSO-24	3.5 Hys @ 2 MADC, 1.5 Hys @ 5 MADC, 160 Ohms
PC-SSO SO-5P	Split Series: 100 Hys @ 0 MADC, 50 Hys @ 1 MADC, 4400 Ohms Parallel: 25 Hys @ 0 MADC, 12 Hys @ 2 MADC, 1100 Ohms
PC-SSO SO-23P	Split Series: 8 Hys @ 2 MADC, 4 Hys @ 5 MADC, 600 Ohms Parallel: 2 Hys @ 4 MADC, 1 Hy @ 10 MADC, 150 Ohms
PC-SSO SO-24P	Split Series: 3.5 Hys @ 2 MADC, 1.5 Hy @ 5 MADC, 160 Ohms Parallel: 0.9 Hy @ 4 MADC, 0.4 Hy @ 10 MADC
PC-SSO SSO-100P	Split Series: 0.3 Hy @ 9 MADC, 0.2 Hy @ 18 MADC, 20 Ohms Parallel: 0.75 Hy @ 18 MADC, .05 Hy @ 36 MADC, 5 Ohms

SSO-P

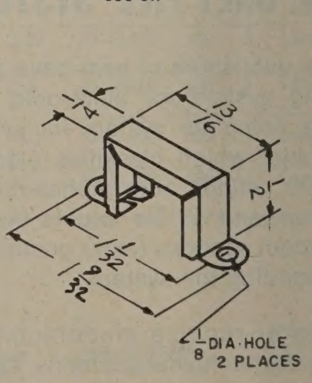


SSO



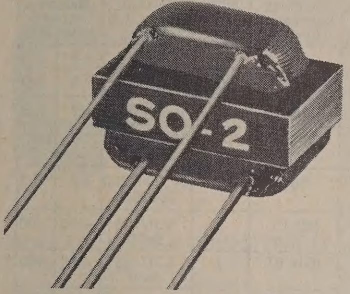
WEIGHT - .02 LBS
LEADS: 4" LONG
FINISH: BLACK

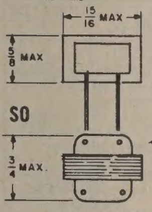
SSO-CH



TRW UTC TRANSFORMERS

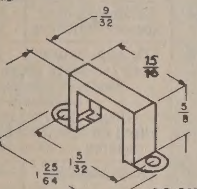
SUB-OUNCER FAMILY





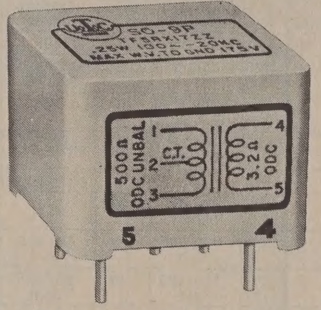
SO

WEIGHT- .03LBS
LEADS: 4" LONG
FINISH BLACK

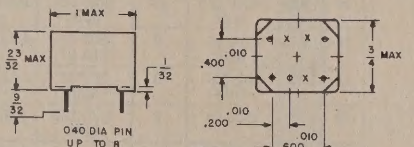


SO-CH

— 1/8 DIA-HOLE
2 PLACES

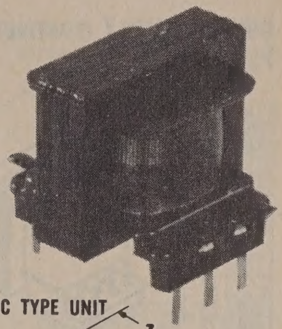


SO-MOLDED(P) UNIT

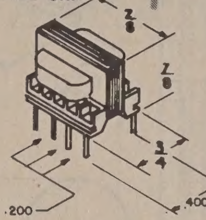


040 DIA PIN
UP TO 8
.200 APART

SO-P



PC TYPE UNIT



.040 DIA. PINS
AS REQUIRED
UP TO 8

Type No. SO SO-P PC-SO	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	Maximum Level DBM	Maximum Level MW	Series Connected DCR ±25% Ohms In Pri.	Series Connected DCR ±25% Ohms Out Sec.
9	1.5	0	3.2	500 CT	+24	250	0.35	15
19	3.3	60	8 split* 16 split*	250 split 500 split	+24	250	7	23
10	4.6	60	8 16	2000 CT 4000 CT	+24	250	2	290
14	5.2	10	32 split 40 split	80 CT 100 CT	+24	250	3.2	4.9
13	5.8	2.5	40 split 50 split	400 CT 500 CT	+24	250	4.5	20
4	3.7	24	50	30K	+23	200	3.8	1850
6	3.2	20	60	100K	+23	200	3.7	3400
14	8.3	16	80 CT 100 CT	32 split 40 split	+24	250	4.9	3.2
12	10	14	120 split 150 split	400 C 500 CT	+24	250	12.6	20
1	1.2	0	200 50	250K 62.5K	+10	10	2500	16
3	10	21 10	200 500	10K 25K	+23	200	30	1225
19	18	10	250 split* 500 split*	8 split* 16 split*	+24	250	23	.7
13	18	8	400 CT 500 CT	40 split 50 split	+24	250	20	4.5
12	18	8	400 CT 500 CT	120 split 150 split	+24	250	20	12.5
11	18	8	400 CT 500 CT	400 split 500 split	+24	250	20	45
9	19	0	500 CT	3.2	+24	250	15	.35
15	23	6	600 CT	600 split	+24	250	35	60

Type No. SO SO-P PC-SO	E.T. Product Millivolt Sec.	Unbal. DC ma In Winding	Input-Matching Impedance Primary (Ohms)	Output-Matching Impedance Secondary (Ohms)	Maximum Level DBM	Maximum Level MW	Series Connected DCR ±25% Ohms In Pri.	Series Connected DCR ±25% Ohms Out Sec.
20	32	9	600 split†	10K CT	+23	200	80	1050
18	23	9	600 split	50K CT	+24	250	63	2400
7	9.2	2.5	800 1200	20K 30K	+23	200	32	450
10	7.4	4 2	2K CT 4K CT	8 16	+24	250	290	2
8	15	2.2	2K CT	10K	+23	200	40	1000
16	46	4	2500 CT	2500 split	+24	250	140	300
3	74	3 1.5	10K 25K	200 500	+23	200	1225	30
20	133	1	10K CT†	600 split	+23	200	1050	80
8	34	1	10K	2000 CT	+23	200	1000	40
21	111	1	10K CT† 12K CT†	10K split 12K split	+23	200	855	1080
2	10	.25	10K	90K	+20	100	215	1850
7	46	.5	20K 30K	800 1200	+23	200	450	32
4	91	1	30K	50	+23	200	1850	3.8
18	100	1	50K CT	600 split	+24	250	2400	63
2	29	0	90K	10K	+20	100	1850	215
6	130	.5	100K	60	+23	200	3400	3.7
1	44	0	250 K 62.5K	200 50	+10	10	2500	16

† Electrostatic Shield *Bifilar

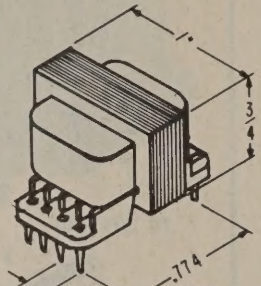
INDUCTORS

35	SO-5	Inductor, 50 Hys @ 1 maDC, 2675 ohms DC res.	
36	SO-5P PC-SO5	Split Inductor	Series: 40 Hys @ 1 maDC, 20 Hys @ 2 maDC, 2675 ohms Parallel: 10 Hys @ 2 maDC, 5 Hys @ 4 maDC, 6700 ohms
37	SO-17P PC-SO17	Split Inductor	Series: 16 Hys @ 2 maDC, 8 Hys @ 4 maDC, 1100 ohms Parallel: 4 Hys @ 4 maDC, 2 Hys @ maDC, 275 ohms

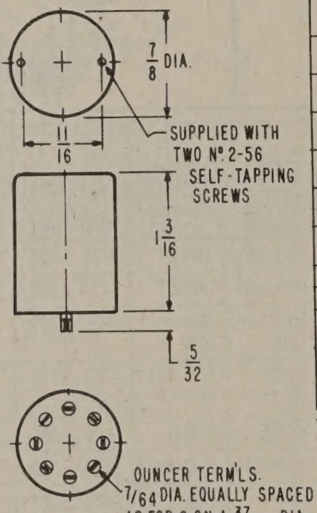
OUNCER FAMILY (CONTINUED) PC-O LINE

Key

O PC-O Type	Line
1	3
2	4
3	1
4	23
5	24
6	25
7	26
8	21
9	22
10	27
11	28
12	2
13	37
14	5
15	20
16	32
17	38
18	17
19	18
20	13
21	14
22	6
23	35
24	36
25	12
26	19
27	16
28	29
29	30
30	10
31	9
32	7
33	8
34	34
35	11
36	33
37	15
38	31



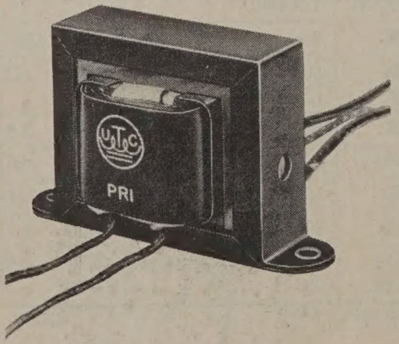
PC-O


7/8 DIA.
11/16
SUPPLIED WITH TWO Nº 2-56 SELF-TAPPING SCREWS
1 3/16
5/32
OUNCER TERM'LS. 7/64 DIA. EQUALLY SPACED AS FOR 8 ON A 37/64 DIA.

STANDARD "O" LINE UNIT

Line	Type O/ PC-O	Primary Matching Impedance (Ohms)	Unbal. DC M.A.	Secondary Matching Impedance (Ohms)	Maximum Level DBM	Maximum Level M.W.
1	3	7.5/30	0	50K	+8	6.3
2	12	50, 200/250	0	50, 200/259 500/600	+8	6.3
3	1	50, 200/250 500/600	0	50K	+8	6.3
4	2	50, 200/250 500/600	0	50K CT	+8	6.3
5	14	200	0	½ Megohm	+8	6.3
6	22	400 CT 500 CT	20	3.2 4	+30	1W
7	32	500/125 Split	20	50/12.5 Split	+30	1W
8	33	500/125 Split	40	50/12.5 Split	+30	1W
9	31	500/125 Split	20	150/37.5 Split	+30	1W
10	30	500/125 Split	20	500/125 Split	+30	1W
11	35	Hybrid 600	0	600 CT 600 CT	+24	250
12	25	600/150 Split	0	2K/500 Split	+15	30
13	20	1500 CT	8	500/125 Split	+20	100
14	21	2000 CT 4000 CT	4	8 16	+20	100
15	37	4K/1K Split	4	600/150 Split	+30	1W
16	27	10K CT	4	500/125 Split	+20	100
17	18	10/2.5K Split	4	2K/500 Split	+20	100
18	19	10/2.5K Split	4	4K/1K Split	+20	100
19	26	10K CT	4	10K CT	+20	100
20	15	10K	0	1 Megohm	+8	6.3
21	8	15K	0	50, 200/250 500/600	+8	6.3
22	9	15K	4	50, 200/250 500/600	+8	6.3
23	4	15K	0	60K	+8	6.3
24	5	15K	4	60K	+8	6.3
25	6	15K	0	95K CT	+8	6.3
26	7	15K	4	95K CT	+8	6.3
27	10	30K CT	0	50, 200/250 500/600	+8	6.3
28	11	50K	0	50, 200/250 500/600	+8	6.3
29	28	50K CT	2	500/125 Split	+20	100
30	29	100K CT	1	500/125 Split	+20	100
31	38	Autotransformer Speaker Matching		0, 4, 8, 16.0 DC	+30	1W
32	16 *	Low Imp. to Grid Uses two heavy gauge hipermalloy shields for very low hum pick-up plus orientable mounting. Primary CT is balanced to 1% can be used for 150, 200, 250, 500 or 600 ohm source — 200:1 imped. ratio, 3 oz.		250 CT	—	1W
33	36	Split Inductor		Series Connection: 1 Hy, 200 MADC, 60 Ohms Parallel Connection: 25 Hy, 40 MADC, 15 Ohms		
34	34	Split Inductor		Series Connection: 60 Mhy, 80 MADC, 4 Ohms Parallel Connection: 15 Mhy, 160 MADC, 1 Ohm		
35	23	Inductor		7 Hys @ 3 MADC, 3.5 Hys @ 10 MADC, 230 Ohms		
36	24	Inductor		1.6 Hys @ 3 MADC, 8 Hys @ 10 MADC, 25 Ohms		
37	13	Inductor		300 Hys @ 0 DC, 50 Hys @ 3 MADC, 600 Ohms		
38	17	Hipermalloy shield, split fit over Ouncer, 1″ O. dia. provides 25 db shielding.				

*Not available in PC Style.



CHANNEL FRAME FILAMENT/TRANSISTOR TRANSFORMERS

Primary 115 V 50/60 Hz — Test Volts RMS: 1500

Type No.	Secondary	W	D	H	M	Lbs.
FT-1	2.5 VCT-3A	2⅞	1⅝	1$\frac{11}{16}$	2⅜	¾
FT-2	6.3 VCT-1.2A	2⅞	1⅝	1$\frac{11}{16}$	2⅜	¾
FT-3	2.5 VCT-6A	3$\frac{5}{16}$	1⅞	2	2$\frac{13}{16}$	1
FT-4	6.3 VCT-3A	3$\frac{5}{16}$	1⅞	2	2$\frac{13}{16}$	1
FT-6	5 VCT-3A	3¾	2⅛	2$\frac{5}{16}$	3⅛	1½
FT-7	7.5 VCT-3A	3¾	2⅛	2$\frac{5}{16}$	3⅛	1½
FT-8	6.3 VCT-8A	4	2½	2⅝	3$\frac{9}{16}$	2½
FT-10	25 VCT-2A or 12 V-4A	4	2⅝	2$\frac{11}{16}$	3$\frac{9}{16}$	2½
FT-11	24 VCT-1A or 12 V-2A	3¾	2⅛	2$\frac{5}{16}$	3⅛	1½
FT-12	36 VCT-1.3A or 18 V-2.6A	4	2⅝	2⅝	3$\frac{9}{16}$	2½

Taps on primary of FT-13, FT-14, FT-15 and FT-16 to modify secondary nominal V, −6%, +6%, +12%

FT-13	26 VCT-.04A	2⅛	1⅜	1¼	1¾	¼
FT-14	26 VCT-.25A	2⅞	1⅝	1$\frac{11}{16}$	2⅜	¾
FT-15	48 VCT-1A	4	2½	2⅝	3$\frac{9}{16}$	2½
FT-16*	11 VCT-2.5A or 5.5 V-5A	3¾	2⅛	2$\frac{5}{16}$	3⅛	1½

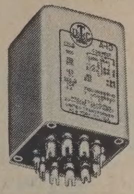
*For 120 V input, use −6% tap.

PACKAGING High lustre black enamel.

APPLICATION Industrial type. Primary 117 V 50/60 Hz.

CONSTRUCTION Designed for low temp. rise. Vacuum sealed against humidity. Special impregnation prevents corrosion and electrolysis.

ULTRA-COMPACT AUDIO UNITS



TYPE A CASE

Length	1½″
Width	1½″
Height	2″
Mounting	1⁵⁄₃₂″ sq.
Screws	4-40
Cutout	1⅜″ dia.
Unit Weight	½ lb.

PACKAGING High quality rugged die cast zinc alloy case with both top and bottom mounting facilities. Asterisked items (see Type No.) have multiple alloy shield.

APPLICATIONS Compact amplifiers and equipments.

APPLICATION NOTE Included in line are filament/transistor supply units.

NOTE All units except those carrying DC in primary employ a true hum bucking coil structure, which provides electrical balance and effects good inductive shielding.

INPUT AND MATCHING TRANSFORMERS

Type No.	Application	Primary Impedance (Ohms)	Unbalanced DC	Secondary Impedance (Ohms)	Response ±2 db (Hz)	Pri. Res. (Ohms)	Max. Level dbm	MW
A-10	Low imp. to grid	50, 125/150, 200/250, 333, 500/600	0	50,000 (split)	20-20,000	59	+15	30
A-11*	Low imp. to 1 or 2 grids	50, 200, 500	0	50,000CT	20-20,000	52	+ 5	3
A-12	Low imp. to PP grids	50, 125/150, 200/250, 333, 500/600	0	80,000 (split)	20-20,000	60	+15	30
A-20†	Mixing, matching	50, 125/150, 200/250, 333, 500/600	0	50, 125/150, 200/250, 333, 500/600	10-50,000	64	+15	30
A-21*†	Mixing, matching	50, 200/250, 500/600	0	50, 200/250, 500/600	30-30,000	28	+15	30
A-27	Xtal/hi. imp. to line	100,000 (split)	0	50, 125/150, 200/250, 333, 500/600	30-20,000 meas. with res. source	3700	+15	30
A-39*	Line to transistor	600/150 (split)	0	2000/500 (split)	20-20,000	70	+10	10
A-43†	Mixing, matching line or transistor to 2 simultaneously loaded lines or transistors	600/150 (split)	0	2 secondaries each 600/150 (split)	20-30,000	45	+15	30

* = Multiple alloy shield for extremely low hum pick-up. † = High electrostatic shielding.

INTERSTAGE AND OUTPUT TRANSFORMERS

Type No.	Application	Primary Impedance (Ohms)	Unbalanced DC	Secondary Impedance (Ohms)	Response ±2 db (Hz)	Pri. Res. (Ohms)	Max. Level dbm	MW
A-15	Transistor interstage	10,000/2500 (split)	8 ma	2000/500 (split)	40-20,000	600	—	1w
A-16	Plate to grid	15,000	0	60,000	20-20,000	800	+15	30
A-18	Single or PP plates to PP grids	15,000 (split)	0	80,000 (split)	20-20,000	1040	+15	30
A-19	Plate to PP grids	15,000	8 ma	80,000 (split)	40-20,000	2900	+15	30
A-22	Tr. interstage or output	500 CT	20 ma	500/125 (split)	40-20,000	36	—	1w
A-23	Tr. interstage or output	500 CT	20 ma	16/4 (split)	40-20,000	36	—	1w
A-24	Single or PP plates to line	15,000 (split)	0	50, 125/150, 200/250, 333, 500/600	20-40,000	1430	+15	30
A-25	Plate to line	15,000	8 ma	50, 125/150, 200/250, 333, 500/600	40-20,000	1580	+15	30
A-26	Single or PP plates to line	30,000 (split)	0	50, 125/150, 200/250, 333, 500/600	20-40,000	2520	+15	30
A-28	Transistor to V.C.	48 CT	750 ma Bal	16 (split) 8, 4	40-20,000	5	—	5w
A-34	Transistor interstage	25,000/6250 (split)	3 ma	500/125 (split)	30-20,000	1620	—	1w
A-35	Transistor interstage	10,000/2500 (split)	8 ma	500/125 (split)	30-20,000	610	—	1w
A-36	Transistor interstage	500/125 (split)	20 ma	150/37.5 (split)	40-20,000	36	—	1w
A-37	Transistor interstage	500/125 (split)	20 ma	50/12.5 (split)	40-20,000	36	—	1w
A-38	Transistor interstage	100/25 (split)	40 ma	40/10 (split)	40-20,000	6.2	—	1w
A-44	Tr. interstage or output	4K/1K (split)	12 ma	600/150 (split)	30-20,000	310	—	1w

SPECIAL APPLICATION TRANSFORMERS

Type No.	Application	Pri. Imp. Ohms	Unbal. DC	±2 db From	Pri. Res. Ohms	Max. Level
A-45	Autotransformer, speaker matching	4, 8, 16	0	40 Hz/20 kHz	1.2	1w @ 40 Hz; 4w @ 80 Hz

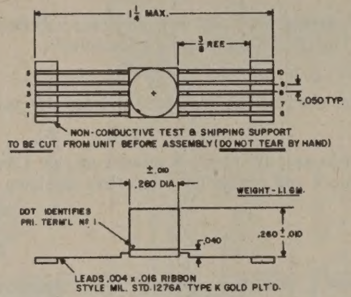
Type No.	Application	Pri. Imp. Ohms	Unbal. DC	Sec. Imp. Ohms	±2 db From	Pri. Res. Ohms	Max. Level
A-47	Hybrid transformer 3 balanced windings CT	500/600 CT	0	500/600 CT 500/600 CT	40 Hz/20 kHz	39	+10 dbm, 10 mw

Type No.	Application	Pri. Imp. Ohms	Unbal. DC	Sec. Imp. Ohms	±2 db From	Max. Level
A-48	"2 wire to 4 wire" hybrid circuit. Two transformers in one case for hybrid circuit use.	500/600	0	500/600 } 2 wdgs. 500/600 } plus winding for balance loading	40 Hz/20 kHz	+10 dbm, 10 mw
	Includes electromagnetic shielding. Hybrid circuit will provide 60 db minimum circuit isolation.					

TRW UTC TRANSFORMERS

THE BIT-250™ LINE-A COMPLETELY NEW DEVELOPMENT IN TRANSFORMER TECHNOLOGY

BIT-250 ACTUAL SIZE


1¼ MAX.
⅜ REF.
1
2
3
4
5
6
7
8
9
10
.050 TYP.
NON-CONDUCTIVE TEST & SHIPPING SUPPORT
TO BE CUT FROM UNIT BEFORE ASSEMBLY (DO NOT TEAR BY HAND)
±.010
.260 DIA.
WEIGHT - 1.1 GM.
DOT IDENTIFIES PRI. TERM'L Nº 1
.260 ±.010
.040
LEADS .004 x .016 RIBBON STYLE MIL. STD 1276A TYPE K GOLD PLT'D.

INDUCTORS

BIT-250 Type No.	MIL Type	Connections	Inductance Hys Min @ 1 kHz 5 V	@ ma DC	DC Res Ω	Ratio of Wdgs.
BIT-250-03 (2 Wdgs)	TF5R20ZZ	Series	8.6 2.5	0 2	2260	1:1
		Parallel	2.4 .63	0 4	565	
BIT-250-05 (1 Wdg)	TF5R20ZZ		5.5 1.5	0 2	1000	
BIT-250-06 (1 Wdg)	TF5R20ZZ		.80 .25	1 6	250	
BIT-250-09 (2 Wdgs)	TF5R20ZZ	Series	.60 .15	0 5	146	1:1
		Parallel	.15 .038	0 10	37	

TRANSFORMERS

BIT-250 Type No.	MIL Type	Pri Imp Ω (CT)	Sec Imp Ω (Split Wdg) Series/Par	Power Level mW for 5% Max Dist @ 1 kHz	Pri DCR Ω	(Series Conn.) Sec DCR Ω	Turns Ratio Pri/Sec/Sec	Turns Ratio Pri/Overall Sec	Typical Application
BIT-250-14	TF5R21ZZ	150	12/3	80	16	1.85	7.1:1:1	3.54:1	Output
BIT-250-18	TF5R21ZZ	300	600/150	80	30	65	1.4:1:1	1:1.4	Output or Matching
BIT-250-20	TF5R21ZZ	400	400/100	80	45	45	2:1:1	1:1	Matching or Interstage
BIT-250-26	TF5R21ZZ	500	50/12.5	80	58	5.5	6.32:1:1	3.16:1:1	Output
BIT-250-30	TF5R21ZZ	600	600/150	80	65	65	2:1:1	1:1	Isolation or Matching
BIT-250-36	TF5R21ZZ	1000	1000/250	80	110	100	2:1:1	1:1	Output or Matching
BIT-250-40	TF5R21ZZ	1500	600/150	75	150	65	3.16:1:1	1.58:1	Output
BIT-250-48	TF5R21ZZ	2000	8000/2000	75	177	745	1:1:1	1:2	Isolation or Interstage
BIT-250-56	TF5R21ZZ	10K	500/125	75	900	45	8.92:1:1	4.46:1	Output or Driver
BIT-250-60	TF5R21ZZ	10K	1200/300	75	900	100	5.78:1:1	2.89:1	Driver
BIT-250-64	TF5R21ZZ	10K	2000/500	75	900	160	4.48:1:1	2.24:1	Interstage
BIT-250-70	TF5R21ZZ	10K	10K/2500	75	900	750	2:1:1	1:1	Isolation or Interstage
BIT-250-90	TF5R21ZZ	25K	1000/250	40	2400	78	10:1:1	5:1	Interstage

TRANSISTOR TRANSFORMERS

DO-T* AND DI-T*

DO T37
UTC
DI-T36

DO-T DI-T
(Actual Size)

Revolutionary transistor transformers hermetically sealed to MIL-T-27C specs. Plastic insulated solderable leads, firmly anchored to withstand 10 pound pull. Ideal for printed circuits. DO-T: 5/16″ dia. x 13/32″ long, wt., 1/10 oz. DI-T: 5/16″ dia. x ¼″ long, wt., 1/15 oz. These compact units provide frequency response, high efficiency and low distortion. U.S. Pat. No. 2,949,591.

DO-T Type	DI-T Type	Application	Primary Impedance (Ohms)	Secondary Impedance (Ohms)
DO-T1	DI-T1	a	20K/30K, 0.5 MA	800/1200
DO-T2	DI-T2	b	500/600, 3 MA	50/60
DO-T3	DI-T3	b	1K/1.2K, 3 MA	50/60
DO-T4	—	b	600, 3 MA	3.2
DO-T5	DI-T5	b	1.2K, 2 MA	3.2
DO-T6	—	b	10K, 1 MA	3.2
DO-T7	—	c	200K	1K
DO-T8	DI-T8	d•	3.5 Hys @ 2 MA	2.5 Hys‡‡
DO-T9	DI-T9	e	10K/12K, 1 MA	500/600 CT
DO-T10	DI-T10	f	10K/12.5K, 1 MA	1.2K/1.5K CT
DO-T11	DI-T11	f	10K/12.5K, 1 MA	2K/2.5K CT
DO-T12	—	b	150/200 CT, 10 MA	12/16
DO-T13	—	b	300/400 CT, 7 MA	12/16
DO-T14	—	b	600/800 CT, 5 MA	12/16
DO-T15	—	b	800/1070 CT, 4 MA	12/16
DO-T16	—	b	1K/1330 CT, 3.5 MA	12/16
DO-T17	—	b	1.5K/2K CT, 3 MA	12/16
DO-T18	—	b	7.5K/10K CT, 1 MA	12/16
DO-T19	DI-T19	b	300 CT, 7 MA	600
DO-T20	DI-T20	b	500 CT, 5.5 MA	600
DO-T21	DI-T21	b	900 CT, 4 MA	600
DO-T22	DI-T22	b	1500 CT, 3 MA	600
DO-T23	DI-T23	a	20K/30K CT, .5 MA	0.8K/1.2K CT
DO-T24	—	c	200K CT	1K CT
DO-T25	DI-T25	a	10K/12K CT, 1 MA	1.5K/1.8K CT
DO-T26	DI-T26	d†	6 Hys @ 2 MA	4.5 Hys‡‡
DO-T27	DI-T27	d‡	1.25 Hys @ 2 MA	0.9 Hy‡‡

DO-T Type	DI-T Type	Application	Primary Impedance (Ohms)	Secondary Impedance (Ohms)
DO-T28	DI-T28	d§	0.3 Hy @ 4 MA	0.1 Hy‡‡
DO-T29	—	b	120/150 CT, 10 MA	3.2/4
DO-T30	—	b	320/400 CT, 7 MA	3.2/4
DO-T31	—	b	640/800 CT, 5 MA	3.2/4
DO-T32	—	b	800/1K CT, 4 MA	3.2/4
DO-T33	—	b	1060/1330 CT, 3.5 MA	3.2/4
DO-T34	—	b	1.6K/2K CT, 3 MA	3.2/4
DO-T35	—	b	8K/10K CT, 1 MA	3.2/4
DO-T36	DI-T36	a	10K/12K CT, 1 MA	10K/12K CT
DO-T37	DI-T37	a	2K/2.5K CT, 3 MA	8K/10K Split
DO-T38	DI-T38	a	10K/12K CT, - MA	2K/2.4K Split
DO-T39	—	a	20K/30K CT, .5 MA	1K/1.5K Split
DO-T40	—	a	40K/50K CT, .25 MA	400/500 Split
DO-T41	DI-T41	a	400/500 CT, 8/6 MA	400/500 Split
DO-T42	—	a	400/500 CT, 8/6 MA	120/150 Split
DO-T43	DI-T43	a	400/500 CT, 8/6 MA	40/50 Split
DO-T44	DI-T44	a	80/100 CT, 12/10 MA	32/40 Split
DO-T45	—	a	1K/1.25K CT, 3.5 MA	16K/20K Split
DO-T46	—	c	100K CT	500 CT
DO-T47	—	a	9K10K, 1 MA	9K/10K CT
DO-T48	—	a	8K/10K, 1 MA	1.2K/1.5K CT
DO-T49	—	d§§	Series: 20 Hys @ 1 MA, 5100Ω Parallel: 5 Hys @ 2 MA, 1275Ω	
DO-T50	—	d§§	Series: .075 Hys @ 10 MA, 10.5Ω Parallel: .018 Hys @ 20 MA, 2.6Ω	
DO-T51	DI-T51	a	2K/2.5K CT, 3 MA	2K/2.5K Split
DO-T52	DI-T52	a	4K/5K CT, 2 MA	8K/10K CT
DO-T53	DI-T53		400/500 CT, 8 MA	4K/5K CT
DO-T54	—		40K/50K CT, .25 MA	4K/5K CT
DO-T55	DI-T55	a	600 CT, 4 MA	600 CT
DO-T400	—	h	28 V, 380-1 kHz	6.3 V, 60 MA
DO-T410	—	h	28 V, 380-1 kHz	Two 6.3 V, 30 MA
DO-T420	—	h	28 V, 380-1 kHz	28 V, 10 MA
DO-TSH	DI-TSH		High MU shield and cover; 25 db	

•630 ohms. † 2100 ohms. ‡100 ohms. §25 ohms.
‡‡DI-T primary impedance. §§2 Wdgs.
a-Interstage; b-Output; c-Input; d-Inductor; e-Driver or Output; f-Driver; g-Matching; h-Power Unit.

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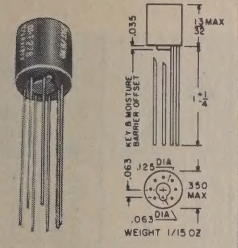
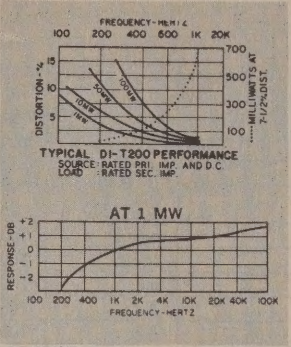
DO-T200 AND DI-T200 SERIES TRANSFORMERS AND INDUCTORS

HEIGHT 9/16 FOR DO-T



WEIGHT: 1/15 OZ. DI-T
1/8 OZ. DO-T



PACKAGING Metal encased. DO-T family unit. See page 10.

MIL SPECS To complete MIL-T-27D Specs. Ruggedized, metal encased to MIL Grade 5, Class R. See pages 80, 81.

FREQUENCY RESPONSE At 1 mw ±3 db, 300 Hz to 20 kHz, DO Type; ±3 db, 400 Hz to 100 kHz, DI Type.

TERMINALS Leads are .016 Dumet wire, gold plated, and may be either welded or soldered. They are uninsulated and are spaced on a .1″ radius circle, conforming to the termination pattern of the "TO-76" cased semiconductors and micrologic elements.

U.S. PAT. NO. 2,949,591: OTHERS PENDING.

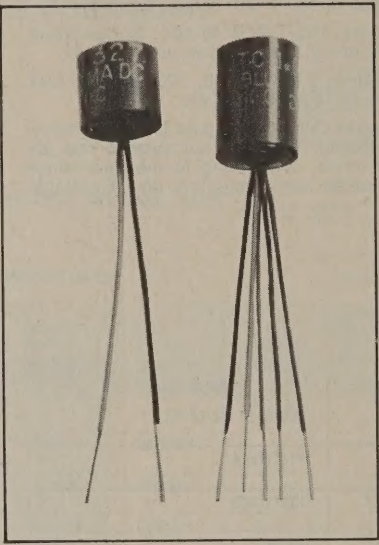
Type No.	MIL Type	Pri. Imp. Ω	ma D.C.‡ In Pri.	Sec. Imp. Ω	Pri. DCR Ω	mw Level*	Application
DO-T255	TF5R21ZZ	1000 CT 1200 CT	3 3	50 60	115	100	Output or matching
DO-T275	TF5R21ZZ	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	780	100	Interstage
DO-T277	TF5R21ZZ	10,000 CT 12,000 CT	1 1	2000 split 2400 split	560	100	Interstage
DO-T278	TF5R21ZZ	10,000 12,500	1 1	2000 CT 2500 CT	780	100	Driver
DO-T283	TF5R21ZZ	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	975	100	Isolation or Interstage (Ratio 1:1) also pulse application
DO-T288	TF5R21ZZ	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	830	50	Interstage
DO-T297	TF5R21ZZ	200,000 CT	0	1000 CT	8500	25	Input and Chopper
DO-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, 37/64 h x 3/8″ dia, no cover						
DI-T225	TF5R21ZZ	80 CT 100 CT	12 10	32 split 40 split	11.5	500	Interstage
DI-T230	TF5R21ZZ	300 CT	7	600 CT	20	500	Output or line to line or matching
DI-T235	TF5R21ZZ	400 CT 500 CT	8 6	40 split 50 split	50	500	Interstage
DI-T240	TF5R21ZZ	400 CT 500 CT	8 6	400 split 500 split	50	500	Interstage or output (Ratio 2:1:1) also wide pulse application
DI-T245	TF5R21ZZ	500 CT 600 CT	3 3	50 CT 60 CT	65	500	Output or matching
DI-T250	TF5R21ZZ	500 CT	5.5	600 CT	32	500	Output or line to line or mixing or matching
DI-T255	TF5R21ZZ	1000 CT 1200 CT	3 3	50 CT 60 CT	110	500	Output or matching
DI-T260	TF5R21ZZ	1500 CT	3	600 CT	87	500	Output to line or matching
DI-T265	TF5R21ZZ	2000 CT 2500 CT	3 3	8000 split 10,000 split	180	100	Isol. or interstage (Ratio 1:1:1) also wide pulse application
DI-T270	TF5R21ZZ	10,000 CT 12,000 CT	1 1	500 CT 600 CT	870	100	Output or driver
DI-T273	TF5R21ZZ	10,000 CT 12,500 CT	1 1	1200 CT 1500 CT	870	100	Output or driver
DI-T276	TF5R21ZZ	10,000 CT 12,000 CT	1 1	2000 CT 2400 CT	870	100	Interstage or driver
DI-T278	TF5R21ZZ	10,000 CT 12,500 CT	1 1	2000 split 2500 split	620	100	Interstage or driver
DI-T283	TF5R21ZZ	10,000 CT 12,000 CT	1 1	10,000 CT 12,000 CT	970	100	Isol. or interstage (Ratio 1:1) also wide pulse application
DI-T288	TF5R21ZZ	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	815	50	Interstage or driver
DI-T290	TF5R21ZZ	600 CT	4	600 CT	47	500	Isol. or interstage (Ratio 1:1) also wide pulse application
DI-T204	TF5R20ZZ	Split Inductor (2 wdgs)	Series connected: .1 Hy @ 4 ma DC, .08 Hy @ 10 ma DC, DCR 25 ohms Parallel connected: .025 Hy @ 8 ma DC, .02 Hy @ 20 ma DC, DCR 6 ohms				
DI-T208	TF5R20ZZ	Split Inductor (2 wdgs)	Series connected: .9 Hy @ 2 ma DC, .5 Hy @ 6 ma DC, DCR 105 ohms Parallel connected: .2 Hy @ 4 ma DC, .1 Hy @ 12 ma DC, DCR 26 ohms				
DI-T212	TF5R20ZZ	Split Inductor (2 wdgs)	Series connected: 2.5 Hys @ 2 ma DC, .9 Hy @ 4 ma DC, DCR 630 ohms Parallel connected: .6 Hy @ 4 ma DC, .2 Hy @ 8 ma DC, DCR 157 ohms				
DI-T216	TF5R20ZZ	Split Inductor (2 wdgs)	Series connected: 4.5 Hys @ 2 ma DC, 1.2 Hys @ 4 ma DC, DCR 2300 ohms Parallel connected: 1.1 Hys @ 4 ma DC, .3 Hy @ 8 ma DC, DCR 575 ohms				
DI-T200SH	Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, 27/64 h x 3/8″ dia, no cover						

* For 5% maximum distortion @ 1 kHz.

‡ ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced value taken by .5W transistors. Where windings are listed as split, 1/4 of the listed impedance is available by paralleling the winding.

TRW UTC TRANSFORMERS

I-DOT™ AND I-DIT™ TRANSFORMERS AND INDUCTORS



PACKAGING TRW/UTC's plastic casing is designed for protection to 85°C. The bobbin is completely rigid and the wire turns are circular to reduce turn corner stress and assure uniform wire lay. External leads are rigidly anchored internally. No tapes are used. Insulated leads are .016" diameter tinned copper. Units mount vertically or on side and can be wave soldered.

I-DO-T and **I-DI-T** transformers are industrial quality counterparts of TRW/UTC's DO-T and DI-T line of MIL-Spec transformers. Environmental specifications, such as hermetic sealing, have been relaxed to reduce the cost. Electrical performance is identical. See pages 11 and 12.

WORKING VOLTAGE All units = 50 V.

FREQUENCY RESPONSE Frequency response is ±3 db, 300 Hz to 20 kHz (I-DO-T). Frequency response is ±3 db, 400 Hz to 100 kHz (I-DI-T).

TEMPERATURE RANGE Maximum operating temperature is +85°C.

SHIELDING Hipermalloy electromagnetic shield is available from stock for all I-DO-T and I-DI-T units.

PERFORMANCE In power handling capability and reliability coupled with small size, I-DO-T and I-DI-T transformers are unprecedented for industrial use. Electrical parameters and areas of application exceed conventional transformer capabilities.

TRANSFORMERS

I-DO-T Type No.	Pri. Pulse Voltage Time-Product Millivolt Sec.	Pri. Imp.	Unbal. DC ma in Pri.	Sec. Imp. (Split*)	P. Max. in mw @ 1 kHz 5% Dist.	DCR ±25% Pri.	DCR ±25% Sec. Ser. Conn.	Turns Ratio ±3% Pri.	Turns Ratio ±3% Sec. Ser. Conn.
101	27.0	20K/30K	.5	800/1200	50	830	115	5	1
102	4.3	500/600	3	50/60	100	60	8	3.16	1
103	6.0	1K/1.2K	3	50/60	100	115	8	4.46	1
104	4.7	600	3	3.2	100	60	.58	13.7	1
105	6.7	1200	2	3.2	100	105	.58	19.35	1
106	19.0	10K	1	3.2	100	790	.68	55.7	1
107	43.0	200K	0	1K	25	8500	100	14.14	1
108	See Inductors								
109	19.0	10K/12K	1	500/600 CT	100	780	50	4.48	1
110	19.0	10K-12.5K	1	1200/1500 CT	100	780	115	2.89	1
111	19.0	10K-12.5K	1	2000/2500 CT	100	780	190	2.24	1
112	2.3	150/200 CT	10	12/16	500	11	1.5	3.54	1
113	3.3	300/400 CT	7	12/16	500	20	1.63	5	1
114	5.1	600/800 CT	5	12/16	500	43	1.5	7.07	1
115	5.4	800/1070 CT	4	12/16	500	51	1.5	8.15	1
116	6.0	1K/1.33K	3.5	12/16	500	71	1.5	9.15	1
117	7.5	1.5K/2K CT	3	12/16	500	108	1.5	11.2	1
118	16.0	7.5K/10K CT	1	12/16	100	505	1.6	25	1
119	3.3	300 CT	7	600	500	19	89	1	1.41
120	4.3	500 CT	5.5	600	500	31	90	1	1.1
121	5.8	900 CT	4	600	500	53	89	1.22	1
122	7.5	1.5K CT	3	600	500	85	89	1.58	1
123	27.0	20K/30K CT	.5	800/1200 CT	50	830	115	5	1
124	43.0	200K CT	0	1K CT	25	8500	100	14.14	1
125	7.5	10K/12K CT	1	1500/1800 CT	100	780	126	2.58	1
126									
127	See Inductors								
128									
129	2.0	120/150 CT	10	3.2/4	500	10	.46	6.12	1
130	3.4	320/400 CT	7	3.2/4	500	20	.46	10	1
131	5.2	640/800 CT	5	3.2/4	500	43	.46	14.1	1
132	5.4	800/1000 CT	4	3.2/4	500	51	.46	15.8	1
133	6.0	1060/1330 CT	3.5	3.2/4	500	71	.46	18.2	1
134	7.5	1.6K/2K	.3	3.2/4	500	109	.46	22.4	1
135	17.0	8K/10K CT	1	3.2/4	100	505	.46	50	1
136	19.0	10K/12K CT	1	10K/12K CT	100	975	1175	1	1
137	8.6	2K/2.5K CT	3	8K/10K*	100	195	455	1	2
138	19.0	10K/12K CT	1	2K/2.4K*	100	560	230	2.24	1
139	27.0	20K/30K CT	.5	1K/1.5K*	50	800	113	4.47	1
140	38.7	40K/50K CT	.25	400/500*	50	1700	60	10	1
141	3.8	400/500 CT	8/6	400/500*	500	46	74	1	1
142	3.8	400/500 CT	8/6	120/150*	500	46	26	1.82	1
143	3.8	400/500 CT	8/6	40/50*	500	46	8	3.16	1

INDUCTORS

I-DO-T Type No.	Connections	Inductance Hys Min @ 1 kHz 5 V	@ DC ma	DCR ±25% Ohms	Ratio of Wdgs.	I-DI-T Type No.	Inductance Hys Min. @ 1 kHz 5 V	@ DC ma	DCR ±25% Ohms	Max. Wkg. Volts Peak
150	Series	.075H	10	10.5	1:1	308	2.5	2	630	49 V
(2 Wdgs)	Parallel	.018	20	2.6			.9	4		
128		.3	4	25		326	4.5	2	2300	49 V
127		1.25	2	100			1.2	4		
108		3.5	2	560		327	.9	2	105	49 V
126		6.0	2	2100			.5	6		
149	Series	20.0	1	5100	1:1	328	.1	4	25	49 V
(2 Wdgs)	Parallel	5.0	2	1275			.08	10		

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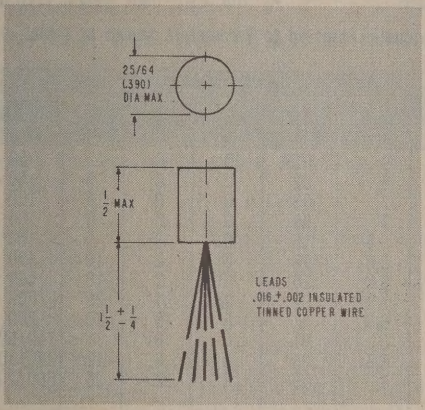
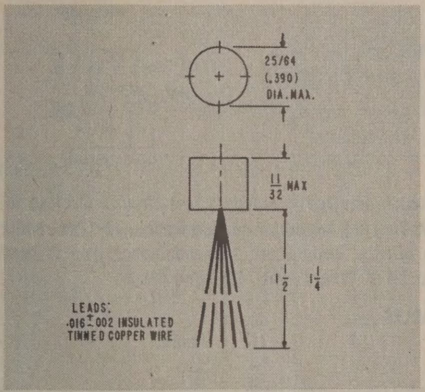
I-DOT™ AND I-DIT™ TRANSFORMERS AND INDUCTORS (continued)

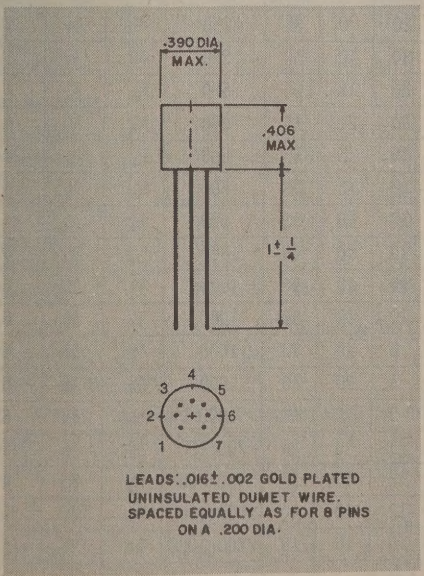
I-DOT



I-DIT



I-DIT-500



Type No.	Pri. Pulse Voltage Time-Product Millivolt Sec.	Pri. Imp. Electrostatic Shield (A)	Unbal. DC ma in Pri.	Sec. Imp. (Split*)	P. Max. in mw @ 1 kHz 5% Dist.	DCR ±25%		Turns Ratio ±3%	
						Pri.	Sec. Ser. Conn.	Pri.	Sec. Ser. Conn.
I-DO-T									
144	1.7	80/100 CT	12/10	32/40*	500	9.8	6	1.58	1
145	6.0	1K/1.25K CT	3.5	16K/20K*	100	120	940	1	4
146	30.6	100K CT(A)	0	500 CT	25	7900	85	14.14	1
147	18.0	9K/10K CT (A)	1	9K/10K CT	100	850	1080	1	1
148	17.0	8K/10K CT (A)	1	1.2K/1.5K CT	100	640	110	2.58	1
149	See Inductors								
150									
151	8.6	2K/2.5K CT	3	2K/2.5K*	100	195	125	1	1
152	12.0	4K/5K CT (A)	2	8K/10K CT	100	316	590	1	1.41
153	3.8	400/500 CT	8/6	4K/5K CT	500	46	550	1	3.33
154	38.7	40K/50K CT	.25	4K/5K CT	50	1800	450	3.33	1
155	6.0	600 CT	4	600 CT	500	47	47	1	1
I-DO-TSH	Drawn Hipermalloy shield and cover for I-DO-T's provides 20 to 30 db shielding, ½h x 13/32″ dia., ⅛″ hole in cover								
I-DI-T									
301	15.0	20K/30K	.5	800/1200	50	815	140	5	1
302	2.4	500/600	3	50/60	100	65	9	3.16	1
303	3.4	1000/1200	3	50/60	100	110	9	4.46	1
305	3.8	1200	2	3.2	100	110	.53	19.35	1
308	See Inductors								
309	10.8	10K/12K	1	500/600	100	870	50	4.48	1
310	10.8	10K/12.5K	1	1.2K/1.5K CT	100	870	130	2.89	1
311	4.9	10K/12.5K	1	2K/2.5K CT	100	870	180	2.24	1
319	1.9	300 CT	7	600	500	20	89	1	1.41
320	2.4	500 CT	5.5	600	500	32	89	1	1.1
321	3.3	900 CT	4	600	500	53	90	1.22	1
322	4.3	1500 CT	3	600	500	87	90	1.58	1
323	15.0	20K/30K CT	.5	800/1.2K CT	50	815	140	5	1
325	10.8	10K/12K CT	1	1.5K/1.8K CT	100	870	105	2.58	1
326									
327	See Inductors								
328									
336	10.8	10K/12K CT	1	10K/12K CT	100	970	1270	1	1
337	4.8	2K/2.5K CT	3	8K/10K*	100	180	440	1	2*
338	10.8	10K/12K CT	1	2K/2.4K*	100	620	220	2.24	1
341	2.1	400/500 CT	8/6	400/500*	500	50	89	1	1
343	2.1	400/500 CT	8/6	40/50*	500	50	6.5	3.12	1
344	.96	80/100 CT	12/10	32/40*	500	11.5	4	1.58	1
351	4.8	2K/2.5K CT	3	2K/2.5K*	100	180	110	1	1
352	6.8	4K/5K CT (A)	2	8K/10K CT	100	300	530	1	1.4

PC I-DI-T LINE — Line Performance Characteristics:

TRANSFORMERS Freq. Resp.: ±3 db, 400 Hz @ 1 mw. Ref. Level 1 kHz

I-DI-T Type No.	Pri. Pulse Voltage Time-Product Millivolt Sec.	Pri. Imp. Electrostatic Shield (A)	Unbal. DC ma in Pri.	Sec. Imp. (Split*)	P. Max. in mw @ 1 kHz 5% Dist.	DCR ±25%		Turns Ratio ±3%	
						Pri.	Sec. Ser. Conn.	Pri.	Sec. Ser. Conn.
525	.96	80/100 CT	12/10	32/40*	500	11.5	4	1.58	1
530	1.9	300 CT	7	600 CT	500	20	89	1	1.41
535	2.1	400/500 CT	8/6	40/50*	500	50	6.5	3.12	1
540	2.1	400/500 CT	8/6	400/500*	500	50	89	1	1
545	2.4	500/600 CT	3	50/60 CT	500	65	9	3.16	1
550	2.4	500 CT	5.5	600 CT	500	32	89	1	1.1
555	3.4	1000/1200 CT	3	50/60 CT	500	110	9	4.46	1
560	4.3	1500 CT	3	600 CT	500	87	90	1.58	1
565	6.8	2K/2.5K CT (A)	3	8K/10K*	100	180	440	1	2
570	10.8	10K/12K CT	1	500/600 CT	100	870	50	4.48	1
573	10.8	10K/12.5K CT	1	1.2K/1.5K CT	100	870	130	2.89	1
578	10.8	10K/12K CT	1	2K/2.5K*	100	620	220	2.24	1
583	10.8	10K/12K CT	1	10K/12K CT	100	970	1270	1	1
588	15.0	20K/30K CT	.5	800/1.2K CT	50	815	140	5	1

INDUCTORS

I-DI-T Type No.	Connection	Inductance Hys Min. @ 1 kHz 5 V	@ DC ma	Lead Code		DCR ±25% Ohms	Ratio of Wdgs.	Peak Wkg. Volts
				Conn. to	Join			
504	Series	.1	4	1-4	2-3	25	1:1	50 V
	Parallel	.025	8	1-4	1-2 & 3-4	6		
508	Series	.9	2	1-4	2-3	105	1:1	50 V
	Parallel	.2	4	1-4	1-2 & 3-4	26		
512	Series	2.5	2	1-4	2-3	630	1:1	50 V
	Parallel	6	4	1-4	1-2 & 3-4	157		
516	Series	4.5	2	1-4	2-3	2300	1:1	50 V
	Parallel	1.1	4	1-4	1-2 & 3-4	575		

PIP* SERIES TRANSISTOR PULSE TRANSFORMERS

UTC's PIP series of subminiature transistor type pulse transformers is designed to give a maximum of component density in equipments, their configuration being especially compatible with transistors. The design is based on the UTC DO-T and DI-T series to impart exceptional reliability. PIP-1 through PIP-9 have a ratio of 4:4:1, PIP-10 through PIP-12 have a ratio of 5:3:1. All units are checked and adjusted in a transistor test circuit to give the required pulse width.

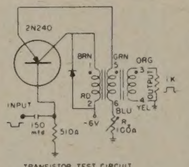
Hermetically sealed, manufactured and guaranteed to MIL-T-20138B by full environmental testing . . . all units, completely METAL CASED, MIL Type TP6RX4410CZ. See UTC page 3015 for other miniature pulse transformers.

U.S. Pat. No. 2,949,591 5/16" Dia. x 3/16" high. Weight 1/20 oz.

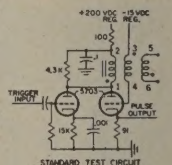
All Units Individually Adjusted to Parameters Shown in Table

	APPROXIMATELY DCR, OHMS			BLOCKING OSCILLATOR PULSE					COUPLING CIRCUIT CHARACTERISTICS						
Type No.	1-Brown 2-Red	3-Orange 4-Yellow	5-Green 6-Blue	Width µSec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P-Width µSec.	Volt Out	Rise Time	% Over Shoot	Droop %	Back Swing	Imp. In, Out Ohms
PIP-1	.18	.20	.07	.05	.02	0	0	37	.05	9	.018	0	0	12	50
PIP-2	.47	.56	.17	.1	.025	0	0	25	.1	8	.02	0	0	5	50
PIP-3	1.01	1.25	.37	.2	.030	2	0	15	.2	7	.035	0	0	5	100
PIP-4	1.5	1.85	.54	.5	.05	0	0	15	.5	7	.06	0	0	0	100
PIP-5	2.45	3.1	.9	1	.08	0	0	14	1	6.8	.15	0	0	5	100
PIP-6	3.0	3.7	1.1	2	.10	0	0	15	2	6.6	.18	0	2	10	100
PIP-7	4.9	6.05	1.8	3	.20	0	0	14	3	6.8	.20	0	2	10	100
PIP-8	8.0	9.7	2.9	5	.30	0	0	3	5	7.9	.22	0	13	25	200
PIP-9	13.1	15.9	4.7	10	.35	0	5	12	10	6.5	.4	0	15	20	200
PIP-10	.55	.41	.15	.1	.01	0	0	20	.1	8	.01	0	0	5	140/50
PIP-11	2.9	2.2	.82	1	.02	4	4	6	1	6.6	.05	0	6	12	280/100
PIP-12	9.4	7.1	2.6	5	.05	0	12	12	5	8	.09	2	12	25	560/200
PIP-SH	Draw Hipermalloy shield and cover for PIP's provides 20 to 30 db shielding.														

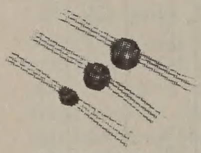
PRECISION MINIATURE WIDE APPLICATION PULSE TRANSFORMERS



TRANSISTOR TEST CIRCUIT



STANDARD TEST CIRCUIT



Size and weight of these units same as H-45.

MANUFACTURED AND GUARANTEED TO COMPLETE MIL-T-21038B

UTC miniature, wound core, pulse transformers are indvidually precision adjusted in standard test circuits to close tolerances. They are high reliability units, hermetically sealed by vacuum molding and suited for service from −70°C to +130°C. Wound core structure provides excellent temperature stability (unlike ferrite). Designs are high inductance type to provide minimum of droop and assure true pulse width. H-45 thru H-57 ratio 1:1:1. Others ratio 4:4:1 and 5:3:1.

ALL UNITS INDIVIDUALLY ADJUSTED TO PARAMETERS SHOWN IN TABLES

SCR AND VACUUM TUBE PULSE TRANSFORMERS

	APPROX. DCR, OHMS			BLOCKING OSCILLATOR PULSE					COUPLING CIRCUIT CHARACTERISTICS							DIMENSIONS		
Type No.	1-2	3-4	5-6	Width µSec.	Rise Time	% Over Shoot	Droop %	% Back Swing	P Width µSec.	Volts -Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp. In, Out Ohms	L In.	W In.	Wt. Grams
H-45	3	3.5	4	.05	.022	0	20	10	.05	17	.01	20	0	35	250	3/8	3/8	1
H-46	5.5	6.5	7	.10	.024	0	25	10	.10	19	.01	30	10	50	250	3/8	3/8	1
H-47	3.7	4.0	4	.20	.026	0	25	8	.20	18	.01	30	15	65	500	9/16	9/16	4
H-48	5.5	5.8	6	.50	.03	0	20	5	.50	20	.01	30	20	65	500	9/16	9/16	4
H-49	8	8.5	9	1	.04	0	20	10	1	24	.02	15	15	65	500	9/16	9/16	4
H-50	20	21	22	2	.05	0	20	10	2	27	.05	10	15	35	500	9/16	9/16	4
H-51	28	31	33	3	.10	1	20	8	3	26	.07	10	10	35	500	9/16	9/16	4
H-52	36	41	44	5	.13	1	25	8	5	23	.15	10	10	45	1000	9/16	9/16	4
H-53	37	44	49	7	.28	0	25	8	7	24	.20	10	10	50	1000	5/8	5/8	6
H-54	50	58	67	10	.30	0	20	8	10	24	.25	10	10	50	1000	5/8	5/8	6
H-55	78	96	112	16	.75	0	20	10	16	23	.40	5	15	20	1000	5/8	5/8	6
H-56	93	116	138	20	1.25	0	25	10	20	23	.6	5	10	10	1000	5/8	5/8	6
H-57	104	135	165	25	2.0	0	30	10	25	24	1.5	5	10	10	1000	5/8	5/8	6
H-461	9.6	6.4	2.5	.1	.025	0	0	8	.1	19	.02	3	5	20	700/250	3/8	3/8	1
H-501	30	20	7	2	.08	0	12	5	2	27	.06	12	15	35	1400/500	9/16	9/16	4
H-531	66	47	17	7	.32	0	12	3	7	24	.23	12	10	40	2800/1000	5/8	5/8	6
H-561	180	142	53	20	1.75	0	13	5	20	23	.7	5	10	10	2800/1000	5/8	5/8	6
H-58	Pulse transformer kit. Consisting of H-45 thru H-57 in a partitioned plastic case.																	

TRW/UTC TRANSFORMERS • 150 VARICK STREET, NEW YORK, N. Y. 10013 • TELEPHONE: (212) 255-3500 • TWX: 710-581-2722

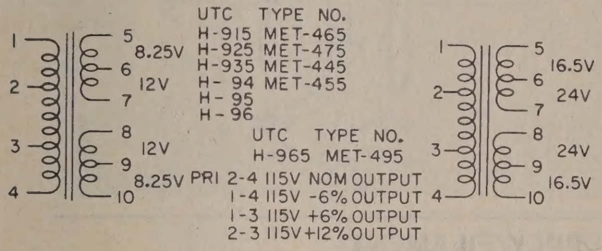
UNIVERSAL TRANSISTOR SUPPLY TRANSFORMERS

PACKAGING Hermetically sealed. Drawn metal case to Mil Grade 4.

MIL SPECS. To complete MIL-T-27 Specs. Mil Type: TF4SX02 plus two letter case code.

NOTES Chart, below, shows the secondary AC voltages available, and the approximate DC voltages resulting, in typical capacitive filter silicon rectifier circuits (at the indicated currents). Since the capacitor following the rectifier affects the DC, voltage values used (in 1000 mfd) are shown in parenthesis ( ) after each current rating.

Primary taps can modify nominal AC voltages by −6%, +6%, and +12%.



INCLUDING MET™ SERIES

Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 8.25 to 40.5

Type No.	MIL DC Range	Industrial DC Range	MIL Case
H-915	6V-.065A to 53V-.02A	6V-.085A to 53V-.025A	AH
H-925	6V-.22A to 53V-.07A	6V-.28A to 53V-.085A	AJ
H-935	6V-1.2A to 53V-.4A	6V-1.52A to 53V-.48A	FA
H-94	6V-3A to 53V-1A	6V-3.8A to 53V-1.2A	HA
H-95	6V-7.5A to 53V-2.5A	6V-9A to 53V-3A	KA
H-96	6V-18A to 53V-6A	6V-23A to 53V-7.5A	OA

Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 16.5 to 81

H-965	12V-1.5A to 106V-.5A	12V-1.9A to 106V-.6A	HA

Primary 115 Volts 400 Hz Nominal Sec. Volts, 8.25 to 40.5

MET-445	6V-.6A to 53V-.2A	6V-.75A to 53V-.24A	AH
MET-455	6V-1.2A to 53V-.4A	6V-1.52A to 53V-.48A	AJ
MET-465	6V-3A to 53V-1A	6V-3.8A to 53V-1.2A	FA
MET-475	6V-7.5A to 53V-2.5A	6V-9A to 53V-3A	HA

Primary 115 Volts, 400 Hz Nominal Sec. Volts, 16.5 to 81

MET-495	12V-.6A to 106V-.2A	12V-.76A to 106V-.24A	AJ

AC AND DC VOLTAGES @ INDUCATED CURRENTS

MIL-T-27 RATINGS IN REGULAR TYPE, **INDUSTRIAL RATINGS IN BOLD TYPE**

	Full Wave Bridge Silicon Rectifier								Full Wave CT		
	Secondary AC Voltages and Approximate DC Voltages										
Nom. AC Volts*	40.5	32.25	28.5	24	20.25	16.5	12	8.25	40.5 CT	24 CT	16.5 CT
Appr. DC Volts*	53	41	34	25	24	18	12	6	24	12	6.6

DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPES

Type No.											
H-915	.02 (.1)	.023(.1)	.025(.1)	.027(.1)	.042(.2)	.035(.2)	.055(.2)	.065(.2)	.035(.2)	.040(.2)	.055(.2)
H-915	**.025(.1)**	**.035(.1)**	**.040(.1)**	**.042(.1)**	**.055(.2)**	**.042(.2)**	**.070(.2)**	**.085(.2)**	**.042(.2)**	**.055(.2)**	**.068(.2)**
H-925	.07 (.1)	.08 (.1)	.085(.1)	.09 (.1)	.14 (.2)	.11 (.2)	.18 (.2)	.22 (.2)	.11 (.2)	.13 (.2)	.17 (.2)
H-925	**.085(.1)**	**.12 (.1)**	**.13 (.1)**	**.14 (.1)**	**.18 (.2)**	**.14 (.2)**	**.23 (.2)**	**.28 (.2)**	**.14 (.2)**	**.17 (.2)**	**.21 (.2)**
H-935	.4 (.5)	.44 (.5)	.48 (.5)	.52 (.5)	.8 (1.0)	.6 (1.0)	1.0 (2.0)	1.2 (2.0)	.6 (1)	.72 (1)	.92 (2)
H-935	**.48 (.5)**	**.6 (.5)**	**.6 (.5)**	**.64 (.5)**	**1.0 (1.0)**	**.8 (1.0)**	**1.2 (2.0)**	**1.52 (2)**	**.8 (1)**	**.88 (1)**	**1.12 (2)**
H-94	1 (.5)	1.1 (.5)	1.2 (.5)	1.3 (.5)	2 (1)	1.5 (1)	2.5 (2)	3 (2)	1.5 (1)	1.8 (1)	2.3 (2)
H-94	**1.2 (.5)**	**1.5 (.5)**	**1.5 (.5)**	**1.6 (.5)**	**2.5 (1)**	**2 (1)**	**3 (2)**	**3.8 (2)**	**2 (1)**	**2.2 (1)**	**2.8 (2)**
H-95	2.5 (1)	3 (1)	3 (1)	3.5 (1)	5 (2)	3.7 (2)	6 (4)	7.5 (4)	3.7 (2)	4.5 (2)	5.5 (4)
H95	**3 (1)**	**3.5 (1)**	**3.8 (1)**	**4 (1)**	**6 (2)**	**4.5 (2)**	**7.5 (4)**	**9 (4)**	**4.5 (2)**	**5.5 (2)**	**6.7 (4)**
H-96	6 (4)	7 (4)	7.5 (4)	8 (4)	12 (6)	9 (6)	15 (12)	18 (12)	9 (6)	11 (6)	13.5 (12)
H-96	**7.5 (4)**	**8.5 (4)**	**9.5 (4)**	**10 (4)**	**15 (6)**	**11 (6)**	**19 (12)**	**23 (12)**	**11 (6)**	**13.5 (6)**	**17 (12)**

400 Hz TYPES

MET-445	.2 (.15)	.22 (.15)	.24 (.15)	.26 (.15)	.4 (.25)	.3 (.25)	.5 (.5)	.6 (.5)	.3 (.25)	.36 (.25)	.46 (.5)
MET-445	**.24 (.15)**	**.3 (.15)**	**.3 (.15)**	**.32 (.15)**	**.5 (.25)**	**.4 (.25)**	**.6 (.5)**	**.75 (.5)**	**.4 (.25)**	**.44 (.25)**	**.56 (.5)**
MET-455	.4 (.15)	.44 (.15)	.48 (.15)	.52 (.15)	.8 (.25)	.6 (.25)	1.0 (.5)	1.2 (.5)	.6 (.25)	.72 (.25)	.92 (.5)
MET-455	**.48 (.15)**	**.6 (.15)**	**.6 (.15)**	**.64 (.15)**	**1.0 (.25)**	**.8 (.25)**	**1.2 (.5)**	**1.52 (.5)**	**.8 (.25)**	**.88 (.25)**	**1.12 (.5)**
MET-465	1 (.15)	1.1 (.15)	1.2 (.15)	1.3 (.15)	2 (.25)	1.5 (.25)	2.5 (.5)	3 (.5)	1.5 (.25)	1.8 (.25)	2.3 (.5)
MET-465	**1.2 (.15)**	**1.5 (.15)**	**1.5 (.15)**	**1.6 (.15)**	**2.5 (.25)**	**2 (.25)**	**3 (.5)**	**3.8 (.5)**	**2 (.25)**	**2.2 (.25)**	**2.8 (.5)**
MET-475	2.5 (.25)	3 (.25)	3 (.25)	3.5 (.25)	5 (.5)	3.7 (.5)	6 (1)	7.5 (1)	3.7 (.5)	4.5 (.5)	5.5 (1)
MET-475	**3 (.25)**	**3.5 (.25)**	**3.8 (.25)**	**4 (.25)**	**6 (.5)**	**4.5 (.5)**	**7.5 (1)**	**9 (1)**	**4.5 (.5)**	**5.5 (.5)**	**6.7 (1)**

SECONDARY AC VOLTAGES AND APPROXIMATE DC VOLTAGES

Nom. AC Volts*	81	64.5	57	48	40.5	33	24	16.5	81 CT	48 CT	33 CT
Appr. DC Volts*	106	82	68	50	48	36	24	12	48	24	13

DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPE

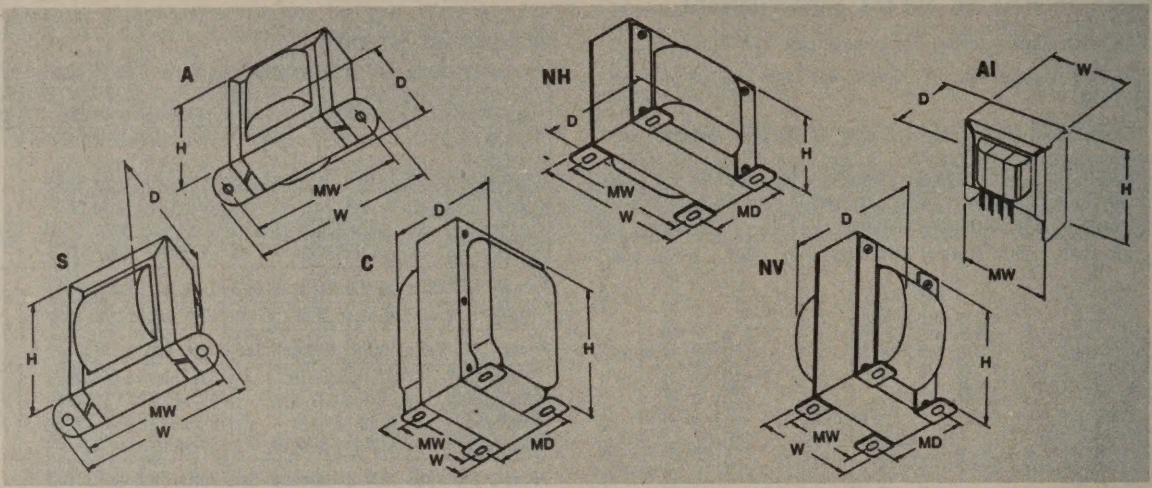
H-965	0.5 (.125)	0.55(.125)	0.6 (.125)	0.65(.125)	1.0 (.25)	0.75 (.25)	1.25 (.5)	1.5 (.5)	0.75 (.25)	0.9 (.25)	1.15 (.5)
H-965	**0.6 (.125)**	**0.75(.125)**	**0.75(.125)**	**0.8 (.125)**	**1.25 (.25)**	**1.0 (.25)**	**1.5 (.5)**	**1.9 (.5)**	**1.0 (.25)**	**1.1 (.25)**	**1.4 (.5)**

400 Hz TYPE

MET-495	.2 (.04)	.22(.04)	.24(.04)	.26 (.04)	.4 (.06)	.3 (.06)	.5 (.06)	.6 (.06)	.3 (.06)	.36 (.06)	.46 (.06)
MET-495	**.24(.04)**	**.3 (.04)**	**.3 (.04)**	**.32 (.04)**	**.5 (.06)**	**.4 (.06)**	**.6 (.06)**	**.76 (.06)**	**.4 (.06)**	**.44 (.06)**	**.56 (.06)**

*Nom. AC and DC volts are at 115 volt input . . . primary taps can modify −6%, +6%, and +12%.

INDUSTRIAL TRANSFORMERS



POWER TRANSFORMERS/TRANSISTOR SUPPLY/FILAMENT

Type No.	SECONDARY VOLTS AC RMS Volts	SECONDARY VOLTS Cap Input DC Volts Bridge Volts / Cap*	SECONDARY VOLTS Cap Input DC Volts Full Wave CT Volts / Cap*	SECONDARY CURRENT RMS AC Amps	SECONDARY CURRENT Bridge DC Amps	SECONDARY CURRENT Full Wave CT Amps	PRIMARY VOLTAGE NOMINAL RMS 50/60 Hz Volts	INSULATION TEST VOLTAGE Volts	TERMINATIONS Leads or Lugs	CASE DIMENSIONS (Inches) H	CASE DIMENSIONS (Inches) W	CASE DIMENSIONS (Inches) D	MOUNTING DIMENSIONS (Inches) MW	MOUNTING DIMENSIONS (Inches) MD	WT. Lbs.	CASE STYLE Fig.
UP8611	36 CT	44 .3	19.5 .1	.135	.10	.175	115	1500	Leads	1⅜	2⅜	1⅜	2	—	.35	A
UP8613	36 CT	46.2 0.3	21.7 1.0	.55	.35	.65	115	1500	Leads	2	3¼	1⅝	2 13/16	—	1.0	A
UF54X	35 CT	42.7 0.6	19.2 2.5	1.5	1.0	2.0	115	1500	Leads	2 19/32	4	2¼	3 9/16	—	2.2	A
UP8600	28 CT	32.0 0.1	14.0 0.1	.085	.065	.110	115	1500	Leads	1¼	2⅛	1¼	1¾	—	.25	A
UP8601	28 CT	32.5 0.1	13.5 0.1	.175	.125	.225	115	1500	Leads	1⅜	2⅜	1⅜	2	—	.35	A
UP8609/F40	26.8 CT	33.8 .6	15.5 2.0	1.0	.67	1.3	115	1500	Leads	2	3¼	2⅛	2 13/16	—	1.3	A
UP8180	25.2 CT	31 .6	14.0 2.0	1.0	.67	1.3	115	1500	Leads	2	3¼	2⅛	2 13/16	—	1.4	A
UP6469	25.2	30 .6	— —	1.0	.67	—	115	1500	Leads	2	3¼	2⅛	2 13/16	—	1.4	A
UP8357/F41	25.2 CT	32 2.0	14.8 5.0	2.0	1.3	2.6	115	1500	Leads	2⅝	4	2¼	3 9/16	—	2.2	A
UP8388	25.2 CT	31.0 2	14.1 7	2.8	1.8	3.7	115	1500	Leads	2⅝	4	2¼	3 9/16	—	2.2	A
UP8394	24 CT	28 .06	10.5 .25	.085	.065	.135	115	1500	Leads	1¼	2⅛	1¼	1¾	—	.25	A
UP8395	24 CT	29 .2	11.7 .5	.2	.135	.275	115	1500	Leads	1⅜	2⅜	1⅜	2	—	.35	A
UP8396	24 CT	24 0.25	13 1.0	.4	.27	.55	115	1500	Leads	1⅝	2⅞	1½	2⅜	—	.6	A
UP8397	24 CT	29 .45	13 2	.7	.45	.925	115	1500	Leads	2	3¼	1⅝	2 13/16	—	.85	A
UF45X	24 CT	29 1.0	13 3.0	1.0	.67	1.3	115	1500	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3	A
UP6377	Split 24 CT Series	27.8 1.2	12 5	2.0	1.3	2.6	115/230	1500	Lugs	3⅛	3⅝	2¼	3⅛	—	2.5	S
	12 Parallel	12.2 5	— —	4.0	2.6	—										
UF47U	18	20.7 2	— —	3.0	1.5	—	115	1500	Leads	3 1/16	2 9/16	2¾	1⅝	2⅜	3.2	NV
	17 Tap	22 2	— —	3.0	1.5	—										

*Capacity in 1,000's of µf.

POWER TRANSFORMERS/TRANSISTOR SUPPLY/FILAMENT (Cont'd)

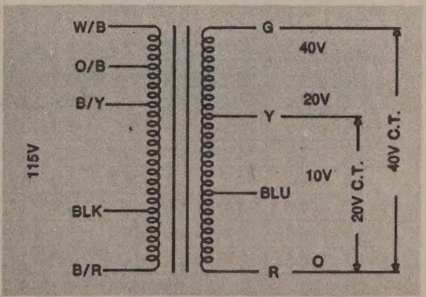
Type No.	SECONDARY VOLTS			SECONDARY CURRENT			PRIMARY VOLTAGE NOMINAL RMS 50/60 Hz	INSULATION TEST VOLTAGE	TERMINATIONS	CASE DIMENSIONS (Inches)			MOUNTING DIMENSIONS (Inches)		WT.	CASE STYLE
	AC RMS	Cap Input DC Volts Bridge	Cap Input DC Volts Full Wave CT	RMS AC	Bridge DC	Full Wave CT										
	Volts	Volts Cap*	Volts Cap*	Amps	Amps	Amps	Volts	Volts	Leads or Lugs	H	W	D	MW	MD	Lbs.	Fig.
UP8384	12.6 CT	14.7 2	6.5 5	1.0	.67	1.33	115	1500	Leads	2	3¼	1¾	2¹³⁄₁₆	—	.9	A
UF25X	12.6 CT	14.0 2	6.0 7	1.5	1.0	2.0	115	1500	Leads	1¹⁵⁄₁₆	3⁵⁄₁₆	2	2¹³⁄₁₆	—	1.3	A
UP8130/F44	12.6 CT	14.3 10	6.2 10	2.0	1.3	2.6	115	1500	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4	A
UF26X	12.6 CT	14.2 3	6.0 10	2.5	1.7	3.3	115	1500	Leads	2⁹⁄₃₂	3¹¹⁄₁₆	2	3⅛	—	1.55	A
UP8358	12.6 CT	14.5 4	6.18 15	3.0	2.0	4.0	115	1500	Leads	2⅜	3¾	2¼	3⅛	—	1.6	A
UP8390	12.0	14 0.3	— —	.15	.1	—	115	1500	Leads	1¼	2⅛	1¼	1¾	—	.25	A
UP8391	12.0	14.2 0.45	— —	.35	.2	—	115	1500	Leads	1⅜	2⅜	1⅜	2	—	.35	A
UP8392	12.0	14.2 1.0	— —	.7	.45	—	115	1500	Leads	1⅝	2⅞	1½	2⅜	—	.6	A
UP6375	Split 12 CT Series	14.1 6	6.2 20	1.0	.67	1.33	115/230	1500	Lugs	2⅜	2⅞	1⅝	2⅜	—	1.0	S
	6 Parallel	— —	— —	2.0	1.33	—										
UP8393	12.0	14.1 1.5	— —	1.2	.75	—	115	1500	Leads	2	3¼	1⅝	2¹³⁄₁₆	—	.85	A
UP6458	10 CT	10.9 7	4.1 20	5.0	3.3	6.6	115/105	2000	Leads	3¹⁄₁₆	2½	2½	2³⁄₃₂	1¹⁵⁄₁₆	3.0	NV
UP8385	6.3 CT	6.5 1.0	2.5 3.0	.3	.2	.4	115	1500	Leads	1¼	2⅛	1⅜	1¾	—	.3	A
UP6465	6.3 CT	6.6 2.0	3.8 6.0	.6	.4	.8	115	1500	Leads	1⅜	2⅜	1½	2	—	.4	A
UF13X	6.3	7 6	— —	.6	.4	—	115	1500	Leads	1⅜	2⅜	1⅜	2	—	.37	A
UP8389	6.3	6.5 3.0	— —	1.0	.67	—	115	1500	Leads	1⅝	2⅞	1½	2⅜	—	.6	A
UP6134/F14	6.3 CT	6.1 10	2.5 20	1.2	.8	1.6	115	3000	Leads	1⅝	2⅞	1⅞	2⅜	—	.8	A
UP8190	6.3	6.5 3	— —	1.2	.8	—	115	5000	Leads	2	3¼	1⅞	2¹³⁄₁₆	—	1.0	A
UP6466/F16	6.3 CT	6.1 7	2.5 30	3.0	2.0	4.0	115	2500	Leads	2	3⁵⁄₁₆	2⅛	2¹³⁄₁₆	—	1.4	A
UP6308	6.3 CT	6.0 20	— —	10.0	6.3	12.6	115/105	2500	Leads	3⁷⁄₁₆	2¹³⁄₁₆	2⅝	2¼	2⅛	3.4	NV†
UP6467	5 CT	4.4 10	1.5 40	3.0	2.0	4.0	115	2500	Leads	2	3¼	2⅛	2¹³⁄₁₆	—	1.4	A
UP6468	5 CT	4.0 120	— —	30.0	20.0	40.0	115/105	2500	Lugs	4¼	3⁷⁄₁₆	3⅞	2¾	2¹¹⁄₁₆	6.3	C†
UF1X	2.5 CT	1.2 20	— —	3.0	2.0	4.0	115	1500	Leads	1⅝	2¹³⁄₁₆	1⅝	2⅜	—	.68	A

*Capacity in 1,000's of μf. †Electro-static shield.

POWER TRANSFORMERS/TRANSISTOR SUPPLY—MULTIPLE OUTPUT VOLTAGE

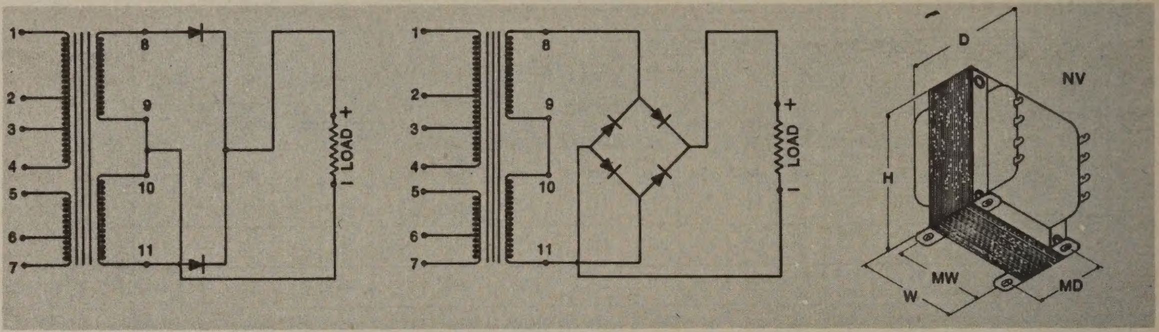
Type No.	PRIMARY VOLTS RMS 50/60 Hz	SECONDARY AC RMS		SECONDARY DC APPROXIMATE						TERMINATIONS	INSULATION TEST VOLTAGE RMS	CASE DIMENSIONS			MOUNTING DIMENSIONS		WT.	CASE STYLE
				BRIDGE			FULL WAVE CT											
		Volts	Amps	Volts	Cap*	Amps	Volts	Cap*	Amps			H	W	D	MW	MD	Lbs.	Fig.
UF94X	115†	10 20 CT 40 CT	.035	12.0 24.4 47.0	0.1	.019	— 10.0 19.2	0.2	.04	Leads	1500	1⅜	2⅜	1⅜	2	—	.5	A
UF90X	115†	10 20 CT 40 CT	.10	12.3 25.5 50.0	0.25	.056	— 11.4 22.4	0.5	.11	Leads	1500	1⅝	2¹³⁄₁₆	1⅝	2⅜	—	.7	A
UF91X	115†	10 20 CT 40 CT	.30	12.3 25.5 51.0	1.0	.17	— 11.3 22.6	2.0	.34	Leads	1500	2⁹⁄₃₂	3¹¹⁄₁₆	2	3⅛	—	1.5	A
UF93X	115†	10 20 CT 40 CT	.75	11.7 24.6 49.0	2.0	.42	— 11.2 22.5	4.0	.84	Leads	1500	2¹⁹⁄₃₂	4	2¼	3⁵⁄₁₆	—	2.4	A
UF92A	115†	10 20 CT 40 CT	1.0	11.7 25.2 51.0	3.0	.56	— 11.5 23.5	5.0	1.1	Leads Two Holes	1500	3⁵⁄₁₆	2²¹⁄₃₂	3	2	2¹⁄₁₆	3.25	C

†Tapped primary to product lower voltages. *Capacity in 1,000's μf.



UNIVERSAL RECTIFIER TRANSFORMERS

PRIMARIES 117 VOLTS 50/60Hz — SOLDER LUG TERMINATION (MAY BE OPERATED TO 400Hz)



Type No.	STYLE	RECTIFIER CIRCUIT	RANGE OF APPLIED AC VOLTS UNDER LOAD (APPROX.)	OUTPUT RESISTIVE OR INDUCTIVE LOAD MAX. DC		OUTPUT CAPACITIVE LOAD* MAX. DC		CASE DIMENSIONS			MTG. DIMENSIONS		WT.
				Volts	Amps	Volts	Amps	H	W	D	MW	MD	Lbs.
URT-201	NV	CT Bridge	11.7 to 29.4 11.1 to 28.5	11.2 23.0	2.0 1.25	13.8[1] 30.0[2]	2.0 1.25	3⅛	2½	2⅜	2	2⅛	2.5
URT-202	NV	CT Bridge	12.0 to 29.8 12.0 to 29.8	11.1 24.3	4.0 2.0	14.7[3] 33.0[1]	4.0 2.0	3 7/16	2 13/16	2¾	2¼	2⅜	3.8
URT-204	NV	CT Bridge	11.7 to 29.2 11.6 to 29.2	12.0 24.0	8.0 4.0	14.5[4] 32.4[3]	8.0 4.0	3 13/16	3⅛	3½	2½	2⅞	6.1
URT-206	NV	CT Bridge	12.0 to 29.7 12.0 to 29.7	11.5 24.0	12.0 6.0	14.4[5] 32.0[6]	12.0 6.0	4 3/16	3 7/16	4	2¾	3¼	9.1

*MFD Filter Capacitor: 1-1000, 2-5000, 3-2000, 4-4000, 5-6000, 6-3000, 7-7500, 8-12000, 9-1500, 10-600, 11-2500.

PRIMARY WINDING ARRANGEMENT

Terminals 1, 2, 3 and 4 are the primary winding. Terminals 5, 6 and 7 are a separate winding that may be used in series bucking or aiding with the primary to raise or lower the secondary output voltage.

SECONDARY WINDING ARRANGEMENT

Terminals 8 & 9 and 10 & 11 represent two identical secondary windings. Table 2 gives the output voltages for specific terminal connections, many other combinations are possible.

RATINGS

URT transformers are designed to operate to 105°C maximum winding temperature. Many factors affect the operating temperature, such as: duty cycle, cooling (natural connection or forced air), input voltage, frequency, type of load (AC, DC capacitor or inductive), etc. These factors must be related in the specific application.

Table 1 relates approximate form factors for rectifier loads to the AC RMS current rating.

TABLE 1

RECTIFIER CIRCUIT	FORM FACTOR	
	Inductor Resistor Input	Capacitor Input
Half Wave	1.25	2.3
Full Wave Center Tap	.7	1.0
Full Wave Bridge	1.0	1.5
Full Wave Doubler	—	≈4.0

UNIVERSAL RECTIFIER TRANSFORMERS — TABLE 2

URT-201		FULL-WAVE CT				FULL-WAVE BRIDGE			
		Output 2.0A DC				Output 1.25A DC			
POWER SUPPLY		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 VAC Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.4	11.2	28.8	13.8	28.5	23.0	27.9	30.0
1-7	2-6	26.0	9.8	25.7	11.7	25.4	20.0	25.1	26.4
1-6	2-5	23.0	8.4	22.7	9.9	22.3	17.3	21.8	22.2
1-7	2-5	20.9	7.4	20.8	8.6	20.2	15.4	19.8	19.7
1-3	—	19.4	6.7	19.1	7.6	18.6	13.9	18.2	17.6
1-7	3-6	17.8	6.1	17.6	6.7	17.2	12.8	16.8	15.7
1-6	3-5	16.3	5.3	16.1	6.0	15.7	11.2	15.2	13.8
1-7	3-5	14.9	4.7	14.8	5.3	14.3	10.3	14.1	12.4
1-4	—	14.2	4.4	14.2	5.0	13.7	9.7	13.5	11.6
1-7	4-6	13.4	4.0	13.3	4.4	12.7	8.8	12.5	10.4
1-6	4-5	12.4	3.6	12.4	3.9	11.7	7.9	11.7	9.5
1-7	4-5	11.7	3.3	11.7	3.5	11.1	7.4	11.1	8.7

*1000 MFD. †500 MFD.

URT-202		FULL-WAVE CT				FULL-WAVE BRIDGE			
		Output 4.0A DC				Output 2.0A DC			
POWER SUPPLY		Resistive Load		Capacitive Load*		Resistive Load			
Input 117 VAC Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.7	11.1	29.3	14.7	29.7	24.3	29.3	33.0
1-7	2-6	26.2	9.8	26.0	12.6	26.2	21.5	26.0	29.0
1-6	2-5	24.4	8.8	24.0	11.3	24.3	19.5	23.9	26.0
1-7	2-5	21.9	7.8	21.7	9.9	21.8	17.6	21.5	23.1
1-3	—	20.9	7.4	20.7	9.3	20.9	16.6	20.6	21.7
1-7	3-6	19.2	6.6	18.9	8.2	19.1	15.1	18.9	19.6
1-6	3-5	18.0	6.1	17.8	7.5	18.0	14.2	17.8	18.2
1-7	3-5	16.6	5.5	16.4	6.6	16.6	12.8	16.4	16.3
1-4	—	14.4	4.4	14.2	5.3	14.4	11.8	14.2	13.7
1-7	4-6	13.5	4.1	13.4	4.9	13.5	10.1	13.4	12.6
1-6	4-5	12.9	3.9	12.7	4.4	12.9	9.5	12.7	11.7
1-7	4-5	12.2	3.7	12.0	4.0	12.2	8.9	12.0	10.8

*2000 MFD. †1000 MFD.

TRW UTC TRANSFORMERS TRANSFORMERS & FILTERS

UNIVERSAL RECTIFIER TRANSFORMERS — TABLE 2 (Cont'd)

URT-204		FULL-WAVE CT Output 8.0A DC				FULL-WAVE BRIDGE Output 4.0A DC				URT-206		FULL-WAVE CT Output 12.0A DC				FULL-WAVE BRIDGE Output 6.0A DC			
POWER SUPPLY		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†		POWER SUPPLY		Resistive Load		Capacitive Load*		Resistive Load		Capacitive Load†	
Input 117 VAC Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Input 117 VAC Term. No.	Connect Term. No.	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC	Sec. Volts AC	Output Volts DC
1-2	—	29.2	12.0	28.8	14.5	29.2	24.0	29.0	32.4	1-2	—	29.8	11.5	29.6	14.4	29.6	24.0	29.2	32.0
1-7	2-6	25.7	10.5	25.7	12.6	25.7	21.1	25.4	29.2	1-7	2-6	26.0	9.9	25.8	12.0	25.8	20.6	25.4	27.3
1-6	2-5	22.8	9.2	22.8	10.9	22.8	18.7	22.7	25.7	1-6	2-5	23.8	8.8	23.6	10.7	23.8	18.6	23.6	24.6
1-7	2-5	20.6	8.3	20.6	9.6	20.7	16.6	20.6	22.8	1-7	2-5	21.2	7.6	21.0	9.0	21.2	16.4	21.0	21.4
1-3	—	19.3	7.7	19.3	8.7	19.4	15.4	19.0	21.0	1-3	—	19.7	7.0	19.7	8.4	19.7	15.2	19.4	19.2
1-7	3-6	17.6	7.0	17.6	7.8	17.8	14.0	17.6	19.0	1-7	3-6	17.9	6.2	17.8	7.2	17.9	13.5	17.8	17.3
1-6	3-5	16.2	6.3	16.2	6.9	16.3	12.7	16.1	17.2	1-6	3-5	16.7	5.7	16.6	6.6	16.8	12.5	16.6	15.8
1-7	3-5	15.0	5.8	15.0	6.3	15.1	11.6	14.9	15.6	1-7	3-5	15.4	5.1	15.4	5.9	15.4	11.4	15.2	14.0
1-4	—	14.2	5.4	14.2	5.8	14.4	11.0	14.2	14.8	1-4	—	14.6	4.7	14.5	5.2	14.6	10.6	14.5	13.4
1-7	4-6	13.3	5.0	13.3	5.3	13.4	10.2	13.3	13.5	1-7	4-6	13.5	4.2	13.4	4.7	13.5	9.8	13.4	12.0
1-6	4-5	12.5	4.6	12.5	4.9	12.6	9.4	12.5	12.4	1-6	4-5	12.9	3.9	12.8	4.3	12.9	9.2	12.8	11.0
1-7	4-5	11.7	4.3	11.7	4.5	11.8	8.8	11.6	11.4	1-7	4-5	12.0	3.4	12.0	3.9	12.0	8.4	12.0	10.0

*4000 MFD. †2000 MFD.

*6000 MFD †3000 MFD.

ISOLATION TRANSFORMERS—50/60 HZ—TERMINATION LEADS

Type No.	OUTPUT WATTS (VA)	PRIMARY VOLTS	SECONDARY		INSULATION TEST VOLTAGE RMS	CASE DIMENSIONS			MOUNTING DIMENSIONS		WT.	CASE STYLE
			Volts	Amps		H	W	D	MW	MD	Lbs.	Fig.
UP6411/N48	15	115	115	.13	1500	2	3¼	1⅞	2 13/16	—	1.35	A†
UN51X	35	115	115	.3	1500	2 9/32	3 11/16	2⅛	3⅛	—	1.7	A†
UN68X	50	115-230 Split Winding	115	.435	1500	2 9/32	3 11/16	2⅛	3⅛	—	1.7	A†

†Electro-static shield.

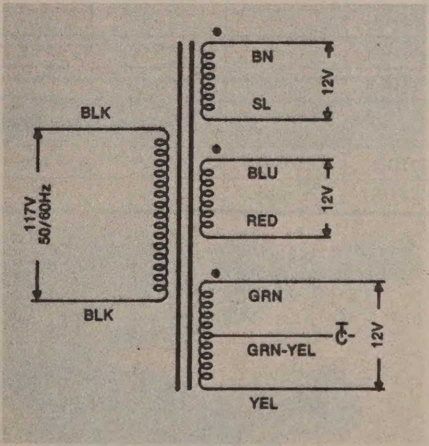
LOW CURRENT CONTROL TRANSFORMERS

PRIMARIES 117 VOLTS 50/60 Hz

LEAD WIRE TERMINATION — MULTIPLE SECONDARIES

Three isolated 12 volt secondaries (one with center tap) provide many combinations of output voltages and current by series or parallel combinations.

Type No.	CURRENT EACH SEC. AMPERES	CASE DIMENSIONS			MTG. DIMENSION	WT.	CASE STYLE
		H	W	D	MW	Lbs.	Fig.
UP8361	.10	1¾	2	1½	1¾	.36	S
UP8363	.25	2⅜	2⅞	1¾	2⅜	.85	S
UP8364	.50	2⅜	2⅞	2⅛	2⅜	1.25	S



FILTER CHOKES

Type No.	INDUCTANCE Hy	DC MA	DC RES. OHM	INSULATION TEST RMS VOLTS	TERMINATIONS	CASE DIMENSIONS			MTG. DIMENSIONS		WT.	CASE STYLE
						H	W	D	MW	MD	Lbs.	Fig.
UC3X	10.0	50	500	1500	Leads	1⅝	2 13/16	1½	2⅜	—	.6	A
UC8X	7.0	75	240	1500	Leads	1 15/16	3 5/16	1¾	2 13/16	—	1.0	A
UC1706	4.5	50	300	1500	Leads	1⅜	2⅜	1 11/32	2	—	.5	A
UC15A	4.0	250	100	1500	Leads	3 3/16	2 21/32	2⅝	2	1 11/16	2.65	C
UC27X	0.7	290	30	1500	Leads	1⅝	2 13/16	1½	2⅜	—	.75	A
UC40X	0.32	600	10	1500	Leads	1 15/16	3 5/16	2	2 13/16	—	1.3	A
UC2685	.035	2000	.75	1500	Leads	2 5/16	2⅝	2⅛	2 3/16	2	1.9	NH

Amperex Instrument Cathode Ray Tubes

MONO-ACCELERATOR TYPES

Flat-faced, mono-accelerator CRT's intended primarily for use in inexpensive oscilloscopes, read-outs, and monitors for industrial and medical instrumentation.

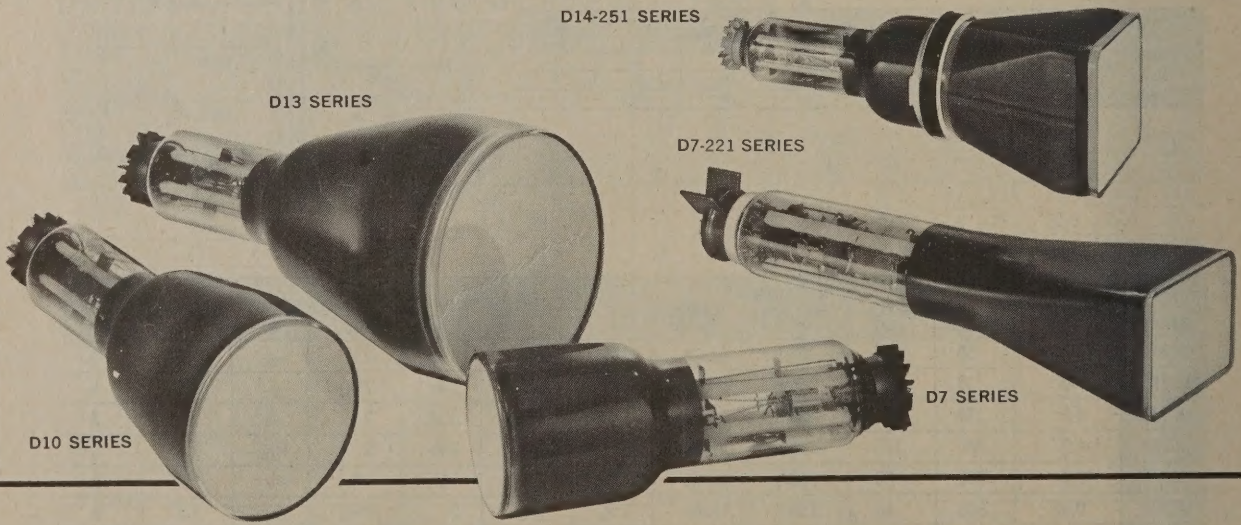
Amperex CRT's are ruggedly constructed and are designed to be mounted in any position; thus they are suitable for use in portable and mobile instruments as well as in fixed equipment. Special low-wattage heaters are available in most types to reduce power consumption of portable equipment.

These are electrostatic deflection tubes, electrostatically focussed and with symmetrical X and Y deflection plates. Orthogonality between X and Y plates is 90° ±1°. Deflection linearity from 25% to 75% of full deflection is better than 1%.

No external astigmatism control is needed for equipment in which these CRT's are used; initial adjustment at the time of manufacture is all that is required if mean X and Y plate potentials are correctly set.

Each tube is supplied with an Amperex 55566 14-pin socket.

TYPE	DIAMETER (in.)	DISPLAY AREA (cm)	PHOSPHOR	DEFLECTION COEFFICIENT (V/cm)		ACCELERATOR VOLTAGE	HEATER CURRENT (mA at 6.3V)	LENGTH (in.)	WEIGHT (oz.)
				HOR.	VERT.				
D7-190GH	2.52	5 x 6	P31	29	11.5	1000	300	8	9
D7-190GM	2.52	5 x 6	P7	29	11.5	1000	300	8	9
D7-191GH	2.52	5 x 6	P31	29	11.5	1000	95	8	9
D7-191GM	2.52	5 x 6	P7	29	11.5	1000	95	8	9
D10-160GH	3.35	6 x 8	P31	32	13.7	1500	300	9¼	14
D10-160GM	3.35	6 x 8	P7	32	13.7	1500	300	9¼	14
D10-161GH	3.35	6 x 8	P31	32	13.7	1500	95	9¼	14
D10-161GM	3.35	6 x 8	P7	32	13.7	1500	95	9¼	14
D13-480GH	4.48	8 x 10	P31	31.3	14.4	2000	300	11¼	23
D13-480GM	4.48	8 x 10	P7	31.3	14.4	2000	300	11¼	23
D13-481GH	4.48	8 x 10	P31	31.3	14.4	2000	95	11¼	23
D13-481GM	4.48	8 x 10	P7	31.3	14.4	2000	95	11¼	23
NEW RECTANGULAR TYPES INTRODUCED IN 1974									
D7-221GH	3.0 (Diag.)	3.6 x 6	P31	13	22	1000	95	8	9
D14-251GH	5.5 (Diag.)	8 x 10	P31	23	13.5	2000	95	13.11	23 (appr.)



AMPEREX ELECTRONIC CORPORATION
Slatersville Division
Slatersville, Rhode Island 02876
Telephone: 401-762-3800 TWX: 710-382-6332

Amperex Instrument Cathode Ray Tubes

POST-DEFLECTION ACCELERATOR TYPES

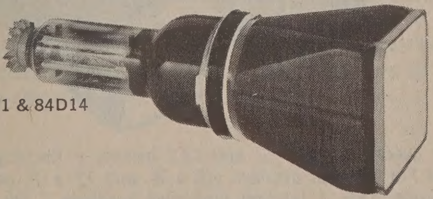
A complete range of flat faced rectangular and round post-deflection accelerator tubes for use in laboratory and portable instrumentations at bandwidths of 25 MHz and higher.

Main Features:
- High deflection sensitivity
- Excellent center to edge resolution
- Short overall length
- State-of-the-art glass techniques
- Availability of low power heaters
- Availability of trace rotation coils
- All tubes are supplied with sockets

Type E14-100GH offers a split-beam display with horizontal axes perfectly parallel and with 100% overlap between both vertical and horizontal systems. Traces strike the screen at nearly 90° to minimize image distortion. A special Amperex circuit is available to completely eliminate the shift that normally occurs when the intensity or focus of a dual trace CRT is adjusted. The circuit also provides automatic focussing of the tube.

TYPE	DIAGONAL (In.)	DISPLAY AREA (cm)	PHOSPHOR	DEFLECTION COEFFICIENT (V/cm)		LINE WIDTH (mm)	ACCELERATOR VOLTAGE	POST-DEFLECTION VOLTAGE	LENGTH (In.)
				HOR.	VERT.				
D14-120GH	5.5	8 x 10	P31	4.2	15.5	0.4	1500	10,000	15.2
D14-120GM	5.5	8 x 10	P7	4.2	15.5	0.4	1500	10,000	15.2
1) D14-121GH	5.5	8 x 10	P31	4.2	15.5	0.4	1500	10,000	15.2
1) D14-121GM	5.5	8 x 10	P7	4.2	15.5	0.4	1500	10,000	15.2
2) D14-162GH/09	5.5	8 x 10	P31	4.1	15.2	0.3	1500	10,000	16.4
2) D14-162GM/09	5.5	8 x 10	P7	4.1	15.2	0.3	1500	10,000	16.4
D18-120GH	7	10 x 12	P31	4.5	15.5	0.35	2000	10,000	17.8
D18-120GM	7	10 x 12	P7	4.5	15.5	0.35	2000	10,000	17.8
3) E14-100GH	5.5	8 x 10	P31	9	13.5	0.35	1500	10,000	16.7
D14-261GH	5.5	8 x 10	P31	19	9.5	0.35	2000	4,000	13.03
84D14GH	5.5	8 x 10	P31	14	7	0.45	2000	10,000	13.03

Notes: 1) Side connections to deflection plates reduce plate capacitance, allow operation up to 50 MHz.
2) Complete with coils for image rotation/orthogonality correction. Suitable for applications to 80 MHz. Edge-lit graticule.
3) Split beam; 100% overlap of the two systems.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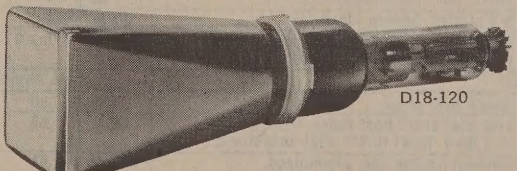
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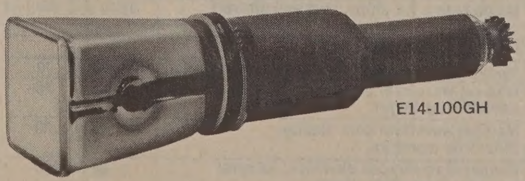
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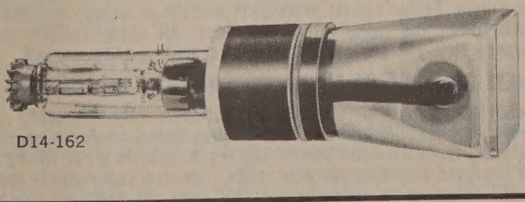
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BRIMAR

high quality MONITOR TUBES/RADAR TUBES/ INSTRUMENT TUBES

NINETEEN DIFFERENT PHOSPHORS / INTERNAL & EXTERNAL GRATICULES / FLASHOVER PROTECTION / IMPLOSION PROTECTION (5 Different Constructions)

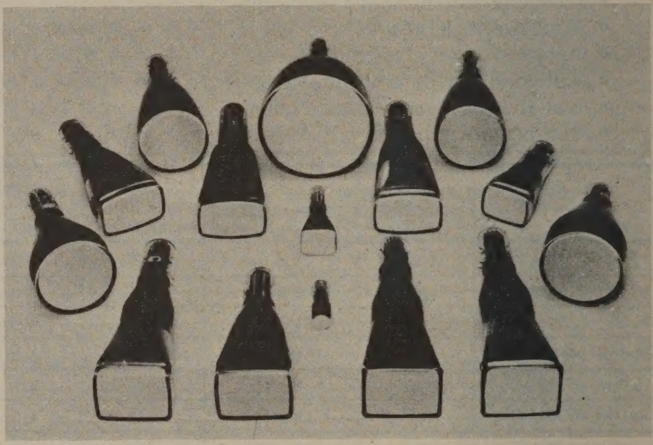
Accessories offered for Brimar cathode ray tubes include sockets, connectors, yokes, focusing coils and twist coils. Substantial savings can be offered when Magnetic Shields and Tubes are purchased as assemblies.

PARTIAL LISTING OF AVAILABLE TYPES

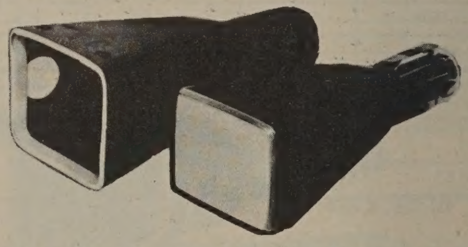
Selected Types	Application and Description	Face Shape & Dia. (Min.)	Useful Min. Screen Area (inch)
FLYING SPOT SCANNER TUBES			
Q7-100GU	Electrostatic focus. High resolution.	3 ●	4.7
Q13-202GS	Electrostatic focus. Document readers or telecine EHT connection by CT8 socket	5 ●	3.5x2.7
SMALL ELECTROSTATIC DISPLAY TUBES			
D3-130	General purpose indicating device	1 ●	1.1
D7-200	Indicators. Oscilloscopes. CCTV. Alpha-numerical readout.	3 ■	2x1.6
D7-201	Low power, 8 to 10 mil spot. Inexpensive. For portable scopes.	3 ■	2x1.6
D9-110	Low power, letter box format	3½ ■	2.6x1.6
INSTRUMENT TUBES—SINGLE GUN			
D10-230	Low cost, high quality, flat face. Short (10.25″), low X deflection voltage requirement.	4 ●	3.15x2.5
D10-240	Low power, short (10.25″), spiral p.d.a., good line width and deflection coefficients, deflection blanking.	4 ■	2.75x2
D10-291	High bandwidth. Portable small compact size	4 ■	2.75x2
D13-47	Medium bandwidth. For transistor scan circuits. Spiral p.d.a.	5 ■	4x2.4
D13-600	General purpose. Short length. Large screen area.	5 ●	4x3.1
D13-610	Medium bandwidth for transistor scan circuits. Spiral p.d.a.	5 ●	4x3.1
D13-630	Short length monoaccelerator.	5 ●	4x3.1
D14-172	General purpose. Short length.	5½ ■	4x3.1
D14-180	Medium bandwidth for transistor scan circuits.	5½ ■	4x3.1
D14-210	75 MHz for very high writing speed. Aluminized mesh p.d.a.	5½ ■	4x3.1
D14-270	Short, low cost monoaccelerator	5½ ■	4x3.1
D16-100	X-Y plotter. Square faced tube.	5½ ■	4x4
D18-130	Short (12.2″), large screen, spiral p.d.a. General purpose applications.	7 ■	4.7x3.9
RADAR TUBES			**Defl. Angle**
F10-100	Small boat radar.	4 ●	30
F15-101	Low cost small boat radar, light weight (0.3 lbs.). Short (9.5″). High brightness.	6 ●	53
F21-10	General marine use. Aluminized.	8½ ●	41
F28-130	Rimguard III 'push-through' protection. Private yacht radar.	11 ■	90
F31-10	General marine use.	12 ●	40
F41-120	Major radars for ships, port and aircraft control.	16 ●	50
DISPLAY AND PICTURE MONITOR TUBES			
M14-100	Medical and camera viewfinder applications.	5½ ■	70
M17-10	Medical waveform display. Television camera view finder.	7 ■	70
M21-13	Medical waveform data display. Industrial monitors.	8½ ■	90
M24-120	Rimguard reinforced envelope, integral mounting lugs. Data display.	9 ■	90
M31-184	Industrial monitor, rimband, integral mounting lugs.	12 ■	90
M38-100	Industrial monitors. Data displays.	15 ■	90
M38-111	High resolution position and write data display, anti-reflection face plate.	15 ■	90
M38-140	High voltage focus, high resolution data display. Fine line width (8 mil—shrinking raster). Short (12.6″).	15 ■	110
M44-120	Data displays. Ind. picture monitors.	17 ■	110
M61-120	Industrial monitors. Data displays.	24 ■	110

Thorn Radio Valves and Tubes Limited is one of Britain's largest manufacturers of industrial cathode ray tubes. Examine a BRIMAR catalog and you will find about the widest range of tubes, one of which is likely to be a perfect fit for your requirement. But if you have something unusual in mind it is probable that BRIMAR can make it.

INSTRUMENT TUBES



D14-172/D18-130 SHORT RECTANGULAR TUBES



Short overall lengths (12 and 12.2 inches) / Rectangular 3.9 x 3.15- and 4.7 x 3.9-inch displays (10 x 8- and 12 x 10-cm / Spiral p.d.a. for bright trace / Internal graticules available / For general purpose applications/Shown above with TELFORM shield.

MAGNETIC SHIELDS UP TO 30″ DIAMETER FOR CATHODE RAY TUBES & TRANSFORMERS by Telcon Metals Ltd.

Telcon Metals, Ltd., has its own in-plant facilities to handle every phase of the magnetic shield manufacturing process from start to finish. This means 100% Telcon supervision all the way — from the melting and rolling of the raw material to the fabrication and annealing of the magnetic shield. Telcon's total production method is based on a century of experience in the manufacture of alloys. All these factors are your assurance that you get a sensibly priced, high quality product.

A NEW CONCEPT IN MAGNETIC SHIELD CONSTRUCTION

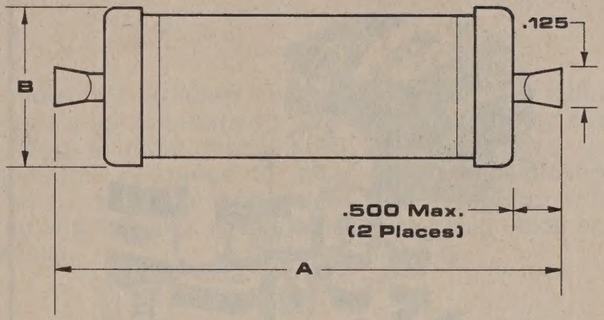
Specially developed for quantity production of high efficiency complex shields, new TELFORM construction utilizes precision drawn segments to drastically reduce welded seams. The result is extra close fitting shields with improved shielding characteristics. This new technique is applicable for CRT tubes up to approximately 20″ long. No premium charge even though dimensions, finish and appearance are far more uniform throughout batches than conventionally fabricated shields. Rapid delivery after initial tooling. Available in 80%, 50% and 36% nickel-iron alloys.

Extremely Competitive Prices on Custom Shields.
Send for Illustrated Catalog and Ask for a Quotation.

VICTOREEN SPARK GAPS

CERAMIC SERIES

VICTOREEN High Energy Ceramic Spark Gaps are designed for applications in the areas of over-voltage protection in high voltage circuits (1000 volts and up), and repetitive energy discharge capability of this type Gap is up to 70% better than a similar glass enclosed Spark Gap, resulting in a significant improvement in operating life. With questions or a specific application contact VICTOREEN Application Engineering Department.



CERAMIC SERIES SPECIFICATIONS

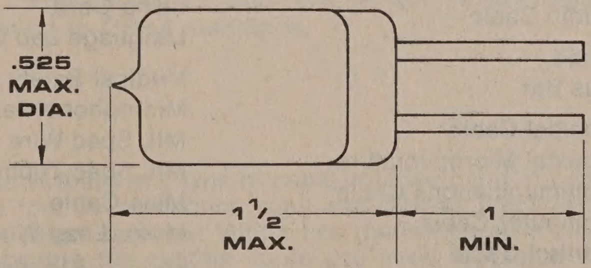
Type	[1]DC Firing Voltage	Tolerance	[2]Max. Energy/Pulse	"A"	"B"
SGCA	1000 - 12,000	±10%	100 Joules	1.930 Ref.	.562 Ref.
SGCB	12,000 - 20,000	±10%	100 Joules	2.180 Ref.	.562 Ref.
SGCC	20,000 - 35,000	±10%	100 Joules	2.680 Ref.	.562 Ref.

[1] DC is defined as a ramp rate less than 5 volts/microsecond. A firing time of typically 1 microsecond or less will result in some overshoot depending on the ramp rate of the pulse.

[2] This is maximum energy in single shot applications. For maximum energies/pulse during various repetition rates contact VICTOREEN Applications Engineering Department.

GLASS SERIES

The SGSP Series of Spark Gaps is a rugged glass encapsulated series of protective devices, capable of handling as much as 10 times the energy of the familiar "button" gaps. Their construction lends them to either circuit board mounting or insertion in a suitable socket. This type Spark Gap is available in any firing voltage from 150 to 5000 volts. Parameters on some of the more common types are listed below.



GLASS SERIES SPECIFICATIONS

Type	Nominal DC Firing Volt. ±10%	Firing Voltage At		Extinguishing Voltage	Energy Dissipation Capability*
		100 v/u Sec. Rise	10 kv/u Sec. Rise		
SGSP - 150	150	360	550	15	60 Joules
SGL	215	470	730	15	60 Joules
SGSP - 350	350	680	1050	15	60 Joules
SGSP - 470	470	920	1400	15	60 Joules
SGSP - 600	600	1150	1750	20	60 Joules
SGSP - 800	800	1530	2350	40	60 Joules

*Maximum energy capable of being dissipated in a single pulse.

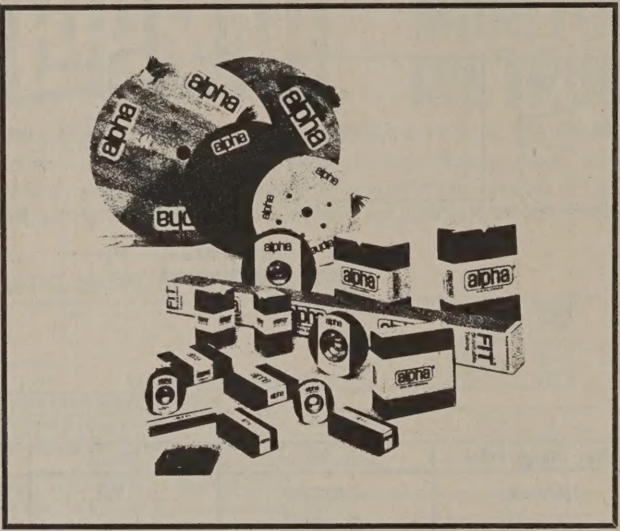
Write: Victoreen Instrument Division

VICTOREEN

10101
Woodland
Avenue,
Cleveland,
Ohio 44104

SG SHELLER-GLOBE CORPORATION

alpha your source for 4,000 products



Alpha is your one-stop source for your requirements in communications, control, military, aerospace, installation, maintenance and repair. The widest selection of wire, cable, tubing and flat cable and connectors in the electronics industry. From audio cables to vinyl hook-up wire, Alpha can fill your requirements. Among the newest Alpha products are two styles of flat cables — both bonded and laminated — and matching connectors for mass termination, in over 60 styles; a new line of over 400 cables that are UL listed, CSA certified, and OSHA acceptable, over 1000 types of instrumentation cables and the revolutionary plastic-blade wire stripper. Alpha has the widest selection of sizes, packages, spools and colors making it easy for you to select not only the exact item to suit your requirement, but the most economical package as well. We have the necessary MIL, UL, CSA and OSHA approvals to meet your most stringent requirements.

A complete line of WIRE-CABLE-TUBING for the electronics industry

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Aircraft Wire
Airport Lighting Cable
Antenna Wire
Appliance Wire
Asbestos Wire
Audio Cable

Braid
Bus Bar

Coaxial Cable
Coaxial Microminiature
Communications Cable
Computer Cable
Control Cable
Cordage
Cord Sets
CSA Certified Cables

Data Cable
Diesel and Car Cable

Extension Cords

Flat Cable
Flat Cable Connectors
Fixture Wire
Foil Shielded Cable

Headset Cable
Hook-up Wire

Instrumentation Cable
Intercom Cable
Irradiated Wire and Cable

Kynar Wire

Lacing Cord
Lamp Cord
Language Lab Cable

Medical Safety Cable
Microphone Cable
MIL Spec Wire and Cable
MIL Spec Tubing
Mine Cable
Motor Lead Wire

Neoprene Cables

OSHA Cables

Phonograph Wire
Power Cable
Power Cords
Polyethylene Cable
PVC Wire, Cable and Tubing

Replacement Cords
Retractile Cords
Ribbon Cable
Rubber Cable

Shielding
Speaker Cable
Spiral Shielded Cable
Stereo Cable
Switchboard Wire

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Tefzel Wire
Telephone Station Cable
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Test Lead Wire
Thermostat Cable

UL Listed Wire, Cable and Tubing
UL/OSHA Cables

Welding Cable
Wire Wrap

Zipper Tubing

TUBING
- Jackets
- Markers
- MIL Spec
- Plastic Impregnated Fiberglass
- PVC
- Shrinkable Tubing (PVC, Polyolefin, Neoprene, Teflon)
- Sleeving
- Spiral Wrap Tubing
- Teflon
- UL Listed
- Zipper Tubing

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

GET FILLED IN!

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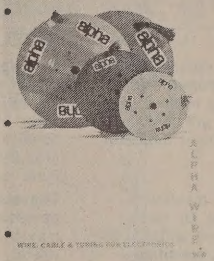
LEARN WHY ALPHA'S PRODUCT LINE IS THE BROADEST IN THE COUNTRY

FULL-LINE CATALOG



The electronic industry's broadest line of wire, cable and tubing is detailed in Alpha's full-line catalog. 128 pages containing over 2500 different items in more than 13,000 sizes, packages and colors. Your complete reference to audio and communication cable, control cable, electrical and power cable, hook-up wire, shrinkable tubing and sleeving. Also featured are design aids and reference materials.

Ask for W-8

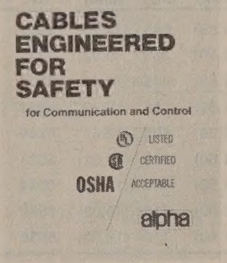
TUBING CATALOG

alpha
TUBING & INSULATION CATALOG
T-2

Alpha can supply you with all your tubing needs. Our catalog contains the industry's largest selection of tubing. You'll find shrinkable and non-shrinkable tubings of polyolefin, PVC, Kynar, Teflon, FEP Teflon and neoprene, as well as caps, boots, seals and markers. Also included is a full range of heating devices to fit all application requirements. An estimator chart for cut tubing pieces lets you determine how many feet you will need of any tubing to produce the required number of tubing pieces.

Ask for T-2

UL/CSA/ OSHA CABLES



CABLES ENGINEERED FOR SAFETY

for Communication and Control

UL / LISTED

CSA / CERTIFIED

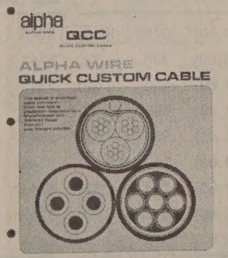
OSHA / ACCEPTABLE

alpha

Cables Engineered for Safety, for Communications and Control. The industry's broadest line of UL listed, CSA certified and OSHA acceptable multiconductor and multipair electronic cables. This catalog is designed to help you select the right cable for manufacturing compliance to UL and CSA, as well as MRO applications conforming to OSHA standards.

Ask for UL-1

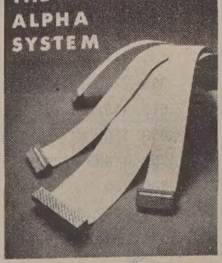
QUICK CUSTOM CABLE



Alpha can make virtually any type of cable you need and in quantities from one foot to production runs and deliver them faster than you ever thought possible. Alpha has thousands of in-stock items to manufacture the custom cable you need. Combine this with our cable engineering, manufacturing and test facilities and you have the answer to all your special prototype and custom cable needs.

Ask for 722

FLAT CABLE AND CONNECTORS



Alpha's flat cable and connector system is described in this catalog with complete information, specifications and design aids. The product line includes flat cable, in 14 to 50 conductor sizes and a full complement of insulation displacement connectors and assembly tools. Make up to 50 connections in seconds. Special designers laboratory kits are also available.

Ask for FC-2

These catalogs may be obtained from your local Alpha distributor or directly from Alpha.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

COMPUTER CABLES

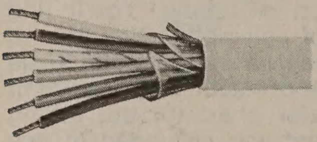
80°C MULTICONDUCTOR COMPUTER CABLES UL2343

UL LISTED
CSA CERTIFIED
OSHA ACCEPTABLE

UNSHIELDED

Description: Each conductor stranded tinned copper, color coded PVC insulation, mylar wrap, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

Characteristics: 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.



24 AWG (7/32)

Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5200	5	.063	(1.60)	.250	(6.35)
5201	7	.063	(1.60)	.265	(6.73)
5202	12	.063	(1.60)	.320	(8.13)
5203	15	.063	(1.60)	.340	(8.64)
5204	19	.063	(1.60)	.360	(9.15)
5205	27	.063	(1.60)	.410	(10.41)
5206	37	.063	(1.60)	.445	(11.30)
5207	48	.063	(1.60)	.495	(12.57)
5208	60	.063	(1.60)	.535	(13.59)

22 AWG (7/30)

Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5210	5	.063	(1.60)	.270	(6.86)
5211	7	.063	(1.60)	.285	(7.24)
5212	12	.063	(1.60)	.345	(8.76)
5213	15	.063	(1.60)	.370	(9.40)
5214	19	.063	(1.60)	.390	(9.91)
5215	27	.063	(1.60)	.440	(11.18)
5216	37	.063	(1.60)	.490	(12.45)
5217	48	.063	(1.60)	.545	(13.84)
5218	60	.063	(1.60)	.580	(14.73)

20 AWG (19/32)

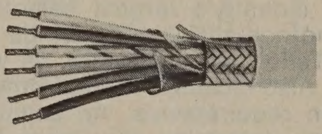
Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5220	5	.063	(1.60)	.295	(7.49)
5221	7	.063	(1.60)	.320	(8.13)
5222	12	.063	(1.60)	.390	(9.91)
5223	15	.063	(1.60)	.415	(10.54)
5224	19	.063	(1.60)	.440	(11.18)
5225	27	.063	(1.60)	.510	(12.95)
5226	37	.063	(1.60)	.560	(14.22)
5227	48	.063	(1.60)	.630	(16.00)
5228	60	.063	(1.60)	.680	(17.27)

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

SHIELDED

Description: Each conductor stranded tinned copper, color coded PVC insulation, shield 85-90% coverage, mylar wrap, nylon rip cord, PVC jacket overall with measurement indicator at 1′ intervals.

Characteristics: 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.



24 AWG (7/32)

Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5300	5	.063	(1.60)	.275	(6.99)
5301	7	.063	(1.60)	.290	(7.37)
5302	12	.063	(1.60)	.345	(8.76)
5303	15	.063	(1.60)	.365	(9.27)
5304	19	.063	(1.60)	.380	(9.65)
5305	27	.063	(1.60)	.430	(10.92)
5306	37	.063	(1.60)	.470	(11.94)
5307	48	.063	(1.60)	.520	(13.21)
5308	60	.063	(1.60)	.555	(14.10)

22 AWG (7/30)

Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5310	5	.063	(1.60)	.290	(7.37)
5311	7	.063	(1.60)	.310	(7.87)
5312	12	.063	(1.60)	.380	(9.65)
5313	15	.063	(1.60)	.390	(9.91)
5314	19	.063	(1.60)	.410	(10.41)
5315	27	.063	(1.60)	.470	(11.94)
5316	37	.063	(1.60)	.510	(12.95)
5317	48	.063	(1.60)	.570	(14.48)
5318	60	.063	(1.60)	.610	(15.49)

20 AWG (19/32)

Alpha No.	No. Conductors	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5320	5	.063	(1.60)	.325	(8.26)
5321	7	.063	(1.60)	.345	(8.76)
5322	12	.063	(1.60)	.410	(10.41)
5323	15	.063	(1.60)	.440	(11.18)
5324	19	.063	(1.60)	.465	(11.81)
5325	27	.063	(1.60)	.530	(13.46)
5326	37	.063	(1.60)	.585	(14.86)
5327	48	.063	(1.60)	.660	(16.76)
5328	60	.063	(1.60)	.715	(18.16)

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

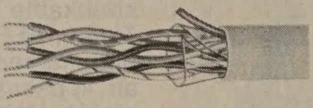
80°C TWISTED PAIRS COMPUTER CABLES UL2343, 2344

UL LISTED
CSA CERTIFIED
OSHA ACCEPTABLE

UNSHIELDED

Description: Each conductor stranded tinned copper, color coded PVC insulation, conductors twisted, mylar wrap, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

Characteristics: 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.



24 AWG (7/32)

Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5230	5	.063	(1.60)	.345	(8.76)
5231	7	.063	(1.60)	.355	(9.02)
5232	12	.063	(1.60)	.445	(11.31)
5233	15	.063	(1.60)	.485	(12.32)
5234	19	.063	(1.60)	.505	(12.83)
5235	27	.063	(1.60)	.575	(14.61)
5236	37	.063	(1.60)	.640	(16.26)
5237	48	.063	(1.60)	.710	(18.03)
5238	60	.063	(1.60)	.760	(19.30)

22 AWG (7/30)

Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5240	5	.063	(1.60)	.370	(9.40)
5241	7	.063	(1.60)	.385	(9.78)
5242	12	.063	(1.60)	.485	(12.32)
5243	15	.063	(1.60)	.535	(13.59)
5244	19	.063	(1.60)	.565	(14.35)
5245	27	.063	(1.60)	.645	(16.38)
5246	37	.063	(1.60)	.735	(18.67)
5247	48	.063	(1.60)	.815	(20.70)
5248	60	.080	(2.03)	.915	(23.24)

20 AWG (19/32)

Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5250	5	.063	(1.60)	.420	(10.67)
5251	7	.063	(1.60)	.435	(11.05)
5252	12	.063	(1.60)	.555	(14.10)
5253	15	.063	(1.60)	.610	(15.49)
5254	19	.063	(1.60)	.650	(16.51)
5255	27	.063	(1.60)	.750	(19.05)
5256	37	.080	(2.03)	.890	(20.61)
5257	48	.080	(2.03)	.990	(25.15)
5258	60	.080	(2.03)	1.065	(27.05)

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

SHIELDED

Description: Each conductor stranded tinned copper, color coded PVC insulation, conductors twisted, mylar wrap, braided tinned copper shield 85-90% coverage, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

Characteristics: 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.

24 AWG (7/32)

Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5330	5	.063	(1.60)	.365	(9.27)
5331	7	.063	(1.60)	.380	(9.66)
5332	12	.063	(1.60)	.465	(11.81)
5333	15	.063	(1.60)	.510	(12.95)
5334	19	.063	(1.60)	.525	(13.34)
5335	27	.063	(1.60)	.595	(15.11)
5336	37	.063	(1.60)	.670	(17.02)
5337	48	.063	(1.60)	.740	(18.80)
5338	60	.063	(1.60)	.815	(20.70)

22 AWG (7/30)

Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5340	5	.063	(1.60)	.395	(10.03)
5341	7	.063	(1.60)	.410	(10.41)
5342	12	.063	(1.60)	.510	(12.95)
5343	15	.063	(1.60)	.555	(14.10)
5344	19	.063	(1.60)	.590	(14.99)
5345	27	.063	(1.60)	.680	(17.27)
5346	37	.063	(1.60)	.770	(19.56)
5347	48	.080	(2.03)	.890	(22.61)
5348	60	.080	(2.03)	.950	(24.13)

20 AWG (19/32)

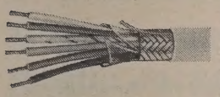
Alpha No.	No. Pairs	Nominal Jacket Thickness Inch	(mm)	Nominal O.D. Inch	(mm)
5350	5	.063	(1.60)	.440	(11.18)
5351	7	.063	(1.60)	.460	(11.68)
5352	12	.063	(1.60)	.580	(14.73)
5353	15	.063	(1.60)	.645	(16.38)
5354	19	.063	(1.60)	.680	(17.27)
5355	27	.063	(1.60)	.785	(19.94)
5356	37	.080	(2.03)	.930	(23.62)
5357	48	.080	(2.03)	1.030	(26.16)
5358	60	.080	(2.03)	1.100	(27.94)

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

UL/CSA/OSHA CABLES

MULTICONDUCTOR SHIELDED CABLE



Wiring cable suitable for industrial control equipment, business machines and many other uses. Conductor is stranded, annealed, tinned copper; insulation is PVC rated at 80°C (105°C for Type 2501) and 300 volts (600V for Type 2501); tape wrap is 0.001″ clear mylar; nylon rip cord; jacket is gray PVC thickness as listed and marked at one foot intervals.

UL STYLE 2464, 300V, 80°C

20 AWG — 10/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5152	2	.032	.235
5153	3	.032	.245
5154	4	.032	.265
5156	6	.032	.315
5158	8	.032	.335
5160	10	.032	.385
5160/15	15	.032	.425
5160/20	20	.032	.470
5160/25	25	.032	.535
5160/30	30	.032	.565
5160/40	40	.050	.665
5160/50	50	.050	.735
5160/60	60	.050	.790
5160/70	70	.080	.925
5160/80	80	.080	.955
5160/90	90	.080	1.000
5160/00	100	.080	1.070

18 AWG — 10/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5162	2	.032	.255
5163	3	.032	.265
5164	4	.032	.290
5166	6	.032	.340
5168	8	.032	.365
5170	10	.032	.420
5170/15	15	.032	.470
5170/20	20	.032	.530
5170/25	25	.050	.625
5170/30	30	.050	.660
5170/40	40	.050	.735
5170/50	50	.050	.805
5170/60	60	.080	.935
5170/70	70	.080	1.015
5170/80	80	.080	1.050
5170/90	90	.080	1.095

16 AWG — 26/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5172	2	.032	.285
5173	3	.032	.300
5174	4	.032	.330
5176	6	.032	.385
5178	8	.032	.415
5180	10	.032	.480
5180/15	15	.032	.545
5180/20	20	.050	.645
5180/25	25	.050	.720
5180/30	30	.050	.760
5180/40	40	.080	.910
5180/50	50	.080	1.000
5180/60	60	.080	1.070

UL STYLE 2501, 600V, 105°C

22 AWG — 7/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5504	4	.063	.390
5505	5	.063	.420
5507	7	.063	.450
5509	9	.063	.510
5509/12	12	.063	.555
5509/15	15	.063	.610
5509/19	19	.063	.650
5509/25	25	.063	.745

20 AWG — 10/30 STRAND

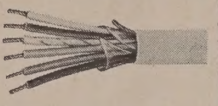
Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5514	4	.063	.410
5515	5	.063	.440
5517	7	.063	.470
5519	9	.063	.535
5519/12	12	.063	.595
5519/15	15	.063	.640
5519/19	19	.063	.685
5519/25	25	.063	.735

18 AWG — 16/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5524	4	.063	.435
5525	5	.063	.465
5527	7	.063	.500
5529	9	.063	.570
5529/12	12	.063	.635
5529/15	15	.063	.685
5529/19	19	.063	.735
5529/25	25	.080	.885

UL STYLE 2501 IS ALSO AVAILABLE IN #16 AND #14 AWG

MULTICONDUCTOR UNSHIELDED CABLE



Appliance wiring cable; suitable for interconnection of business machines, switch gear, intercoms, air conditioners and many other uses. Stranded, annealed, tinned copper conductors. PVC insulation; rated 80°C (105°C for Type 2501); 300V (600V for Type 2501). .001″ thick, clear mylar tape wrap. Gray PVC jacket; thickness as listed. Cable marked at 1′ intervals.

UL STYLE 2464, 300V, 80°C

20 AWG — 10/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5052	2	.032	.220
5053	3	.032	.225
5054	4	.032	.245
5056	6	.032	.285
5058	8	.032	.315
5060	10	.032	.360
5060/15	15	.032	.405
5060/20	20	.032	.450
5060/25	25	.032	.500
5060/30	30	.032	.535
5060/40	40	.050	.635
5060/50	50	.050	.695
5060/60	60	.050	.750
5060/70	70	.080	.885
5060/80	80	.080	.915
5060/90	90	.080	.955
5060/00	100	.080	1.030

18 AWG — 16/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5062	2	.032	.230
5063	3	.032	.245
5064	4	.032	.265
5066	6	.032	.320
5068	8	.032	.345
5070	10	.032	.395
5070/15	15	.032	.445
5070/20	20	.032	.495
5070/25	25	.032	.555
5070/30	30	.050	.625
5070/40	40	.050	.700
5070/50	50	.050	.770
5070/60	60	.080	.895
5070/70	70	.080	.975
5070/80	80	.080	1.010
5070/90	90	.080	1.055
5070/00	100	.080	1.135

16 AWG — 26/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5072	2	.032	.260
5073	3	.032	.275
5074	4	.032	.300
5076	6	.032	.365
5078	8	.032	.395
5080	10	.032	.455
5080/15	15	.032	.515
5080/20	20	.050	.610
5080/25	25	.050	.680
5080/30	30	.050	.725
5080/40	40	.080	.875
5080/50	50	.080	.960
5080/60	60	.080	1.030

UL STYLE 2501, 600V, 105°C

22 AWG — 7/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5404	4	.063	.370
5405	5	.063	.395
5407	7	.063	.425
5409	9	.063	.485
5409/12	12	.063	.535
5409/15	15	.063	.575
5409/19	19	.063	.615
5409/25	25	.063	.710

20 AWG — 10/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5414	4	.063	.385
5415	5	.063	.415
5417	7	.063	.445
5419	9	.063	.510
5419/12	12	.063	.565
5419/15	15	.063	.610
5419/19	19	.063	.650
5419/25	25	.063	.750

18 AWG — 16/30 STRAND

Alpha No.	No. of Conds.	Nominal Jacket Thickness, Inches	Nominal O.D., Inches
5424	4	.063	.410
5425	5	.063	.445
5427	7	.063	.475
5429	9	.063	.555
5429/12	12	.063	.605
5429/15	15	.063	.655
5429/19	19	.063	.700
5429/25	25	.063	.810

UL STYLE 2501 IS ALSO AVAILABLE IN #16 AWG

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha **UNSHIELDED INTERCOM CABLES**

UNSHIELDED INTERCOM CABLE

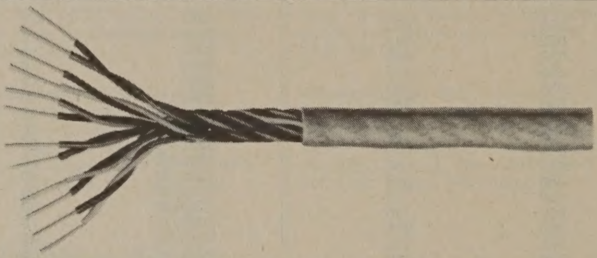
Paired Conductors — Plastic Jacket

Passes FR-1 Vertical Flame Test

DESCRIPTION: Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted into pairs, gray polyvinylchloride jacket overall.

APPLICATIONS: Balanced Intercom Systems, Annunciators, Telephones, Nurses Call Systems, Control Circuit Cable, Electronic Computer Cable, Multiple Speaker Cable, Signal Systems, Alarm Systems.

CHARACTERISTICS: Suggested Operating Temperature:
−20°C to +80°C.



22 GAUGE — SOLID CONDUCTORS — UL 2576, 80°C, 150 VOLTS

Alpha No.	No. of Pairs	No. of Cond.	Cond. Size	Cond. Strand	Nom. Wall Thickness	Nom. Jkt. Thickness	Nom. O.D.
1300©	1	2	22 Solid	1	.010″	.032″	.154″
1302©	2	4	22 Solid	1	.010″	.032″	.222″
1304©	3	6	22 Solid	1	.010″	.032″	.234″
1305	4	8	22 Solid	1	.010″	.032″	.252″
1307	6	12	22 Solid	1	.010″	.032″	.289″
1307/9	9	18	22 Solid	1	.010″	.032″	.334″
1308/11	11	22	22 Solid	1	.010″	.032″	.354″
1309	13	26	22 Solid	1	.010″	.032″	.374″
1309/15	15	30	22 Solid	1	.010″	.032″	.397″
1310	16	32	22 Solid	1	.010″	.032″	.425″
1311	19	38	22 Solid	1	.010″	.032″	.440″
1312	23	46	22 Solid	1	.010″	.032″	.481″
1313	27	54	22 Solid	1	.010″	.040″	.521″

22 GAUGE — STRANDED CONDUCTORS — UL 2576, 80°C, 150 VOLTS

1316	1	2	22	7/30	.010″	.032″	.164″
1317	2	4	22	7/30	.010″	.032″	.239″
1318	3	6	22	7/30	.010″	.032″	.252″
1319	4	8	22	7/30	.010″	.032″	.274″
1320	5	10	22	7/30	.010″	.032″	.304″
1322	6	12	22	7/30	.010″	.035″	.320″
1323	9	18	22	7/30	.010″	.035″	.370″
1324	11	22	22	7/30	.010″	.035″	.400″
1327	15	30	22	7/30	.010″	.040″	.450″
1327/19	19	38	22	7/30	.010″	.040″	.480″
1328	23	46	22	7/30	.010″	.040″	.530″
1329	27	54	22	7/30	.010″	.040″	.708″
1329/41	41	82	22	7/30	.010″	.040″	.710″
1330	51	102	22	7/30	.010″	.045″	.800″

18 GAUGE—STRANDED CONDUCTORS—400 VOLTS, NOT UL LISTED

1133	3	6	18	16/30	.016″	.037″	.356″
1136	6	12	18	16/30	.016″	.045″	.540″
1139	9	18	18	16/30	.016″	.055″	.616″
1142	12	24	18	16/30	.016″	.055″	.654″
1145	15	30	18	16/30	.016″	.060″	.760″
1149	19	38	18	16/30	.016″	.070″	.830″
1151	27	54	18	16/30	.016″	.070″	.965″

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

PAIR NO. **COLOR COMBINATION**

1—Black paired with Red
2—Black paired with White
3—Black paired with Green
4—Black paired with Blue
5—Black paired with Brown
6—Black paired with Yellow
7—Black paired with Orange
8—Red paired with Green
9—Red paired with White
10—Red paired with Blue
11—Red paired with Yellow
12—Red paired with Brown
13—Red paired with Orange
14—Green paired with Blue
15—Green paired with White
16—Green paired with Brown
17—Green paired with Orange
18—Green paired with Yellow
19—White paired with Blue
20—White paired with Brown
21—White paired with Orange
22—White paired with Yellow
23—Blue paired with Brown
24—Blue paired with Orange
25—Blue paired with Yellow
26—Brown paired with Orange
27—Brown paired with Yellow
28—Purple paired with Red
29—Purple paired with White
30—Purple paired with Green
31—Purple paired with Blue
32—Purple paired with Brown
33—Purple paired with Yellow
34—Purple paired with Orange
35—Purple paired with Slate
36—Purple paired with Black
37—Slate paired with Red
38—Slate paired with White
39—Slate paired with Green
40—Slate paired with Blue
41—Slate paired with Brown
42—Slate paired with Yellow
43—Slate paired with Orange
44—Slate paired with Black
45—White/Black paired with Red
46—White/Black paired with Green
47—White/Black paired with Blue
48—White/Black paired with Brown
49—White/Black paired with Yellow
50—White/Black paired with Orange
51—White/Black paired with Purple

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

UNSHIELDED AUDIO CABLE

alpha

UNSHIELDED AUDIO CABLE
Multi-Conductor — Plastic Jacket

Passes FR-1 Vertical Flame Test — 80°C, 300 Volts

DESCRIPTION: Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted, gray polyvinylchloride jacket overall. Suitable for outdoor installations.

APPLICATIONS: Intercoms, Interconnecting Cables, Remote Control Circuits, Telephones, Telemetering Connecting Cable, "Baby Sitter" Intercom.

CHARACTERISTICS: Suggested Operating Temperature: −20°C to +80°C.

SOLID

Alpha No.	No. of Cond.	Conductor Size	Conductor Strand	Nom. Wall Thickness	Nominal Jacket	Nominal O.D.	Sugg. Oper. Voltage
1793*	2	22	1	.010″	.020″	.130″	200V
1794*	3	22	1	.010″	.020″	.140″	200V
1794/4*	4	22	1	.010″	.020″	.160″	200V
1795	2	20	1	.016″	.020″	.170″	300V
1796	3	20	1	.016″	.020″	.180″	300V
1796/4	4	20	1	.016″	.020″	.200″	300V
1797	2	18	1	.016″	.020″	.190″	300V
1798	3	18	1	.016″	.020″	.200″	300V
1798/4	4	18	1	.016″	.020″	.220″	300V
1799	2	16	1	.016″	.020″	.215″	300V
1799/3	3	16	1	.016″	.020″	.230″	300V
1799/4	4	16	1	.016″	.020″	.250″	300V

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

STRANDAD

Alpha No.	No. of Cond.	Conductor Size	Conductor Strand	Nom. Wall Thickness	Nominal Jacket	Nominal O.D.	Sugg. Oper. Voltage
1893*	2	22	7/30	.010″	.020″	.135″	200V
1894*	3	22	7/30	.010″	.020″	.145″	200V
1894/4*	4	22	7/30	.010″	.020″	.170″	200V
1895©	2	20	10/30	.016″	.020″	.180″	300V
1896	3	20	10/30	.016″	.020″	.190″	300V
1896/4	4	20	10/30	.016″	.020″	.215″	300V
1896/6	6	20	10/30	.016″	.020″	.255″	300V
1896/8	8	20	10/30	.016″	.020″	.270″	300V
1896/10	10	20	10/30	.016″	.020″	.335″	300V
1896/12	12	20	10/30	.016″	.020″	.350″	300V
1897©	2	18	16/30	.016″	.020″	.200″	300V
1898	3	18	16/30	.016″	.020″	.210″	300V
1898/6	6	18	16/30	.016″	.020″	.290″	300V
1898/8	8	18	16/30	.016″	.025″	.315″	300V
1898/4	4	18	16/30	.016″	.020″	.240″	300V
1898/10	10	18	16/30	.016″	.025″	.370″	300V
1898/12	12	18	16/30	.016″	.025″	.385″	300V
1898/15	15	18	16/30	.016″	.030″	.445″	300V
1898/19	19	18	16/30	.016″	.030″	.470″	300V
1898/25	25	18	16/30	.016″	.035″	.558″	300V
1899	2	16	26/30	.016″	.020″	.225″	300V
1899/3	3	16	26/30	.016″	.020″	.245″	300V
1899/4	4	16	26/30	.016″	.020″	.270″	300V
1891*	2	14	41/30	.016″	.020″	.260″	350V
1891/3*	3	14	41/30	.016″	.020″	.280″	350V
1892*	2	12	65/30	.016″	.020″	.300″	350V
1892/3*	3	12	65/30	.016″	.020″	.320″	350V

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

*THESE ITEMS NOT LISTED BY UL

COLOR CODE OF CONDUCTORS

1—Black
2—Red
3—White
4—Green
5—Orange
6—Blue
7—Brown
8—Yellow
9—Purple
10—Slate
11—Pink
12—Tan
13—Red/Green
14—Red/Yellow
15—Red/Black
16—White/Black
17—White/Red
18—White/Green
19—White/Yellow
20—White/Blue
21—White/Brown
22—White/Orange
23—White/Gray
24—White/Violet
25—White/Black/Red

alpha

FOIL SHIELDED CABLES

FOIL SHIELDED JACKETED CABLE

UL STYLE 2092, 2093 & 2094*

MYLAR SUPPORTED ALUMINUM FOIL SHIELD

DESCRIPTION: Each conductor stranded tinned copper, color coded polyethylene insulation, conductors cabled, wrapped mylar supported aluminum foil shield, 100% coverage with drain wire laid parallel, aluminum foil facing outward to provide maximum ground, gray PVC jacket overall.

CHARACTERISTICS: Operating Temperature: −20°C to +60°C. Operating Voltage: 300 volts. Lightweight, reduces cable diameter, and provides 100% shield coverage.

Alpha No.	No. of Cond.	Conductor		Nom. Wall Thick. (Inch)	Nom. Jkt. Thick. (Inch)	Nom. O.D. (Inch)	Cond. Color Code
		Size	Strand				
2400	2	24	7/32	.016	.020	.160	1, 3
2401©	2	22	7/30	.016	.020	.170	1, 3
2402©	2	22	7/30	.016	.020	.170	1, 2
2403©	3	22	7/30	.016	.020	.185	1, 2, 3
2404	4	22	7/30	.016	.020	.210	1, 2, 3, 4
2411©	2	20	10/30	.016	.020	.186	1, 3
2412©	2	20	10/30	.016	.020	.186	1, 2
2413	3	20	10/30	.016	.020	.205	1, 2, 3
2414	4	20	10/30	.016	.020	.225	1, 2, 3, 4
2421©	2	18	16/30	.016	.020	.210	1, 3
2422©	2	18	16/30	.016	.020	.210	1, 2
2423	3	18	16/30	.016	.020	.230	1, 2, 3
2424	4	18	16/30	.016	.020	.255	1, 2, 3, 4
2432	2	16	26/30	.016	.020	.245	1, 2
2433	3	16	26/30	.016	.020	.270	1, 2, 3
2442†	2	14	41/30	.020	.030	.310	1, 3
2444†	2	12	65/30	.020	.030	.350	1, 3

Color Code of Conductors: 1—Black, 2—Red, 3—Clear, 4—Green
STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.
*2 Cond.—2092 3 Cond.—2093 4 Cond.—2094
†Not UL Listed

MINIATURE FOIL SHIELDED CABLE

TWO 22 GAUGE CONDUCTORS

DESCRIPTION: Each conductor tinned solid or stranded copper, color coded polypropolene insulation, aluminum/Mylar foil shield, drain wire, gray vinyl jacket overall.

APPLICATIONS: Designed for space-saving in miniature and subminiature instrumentation and audio applications.

200 VOLTS, −55°C, +105°C

Alpha No.	Conductor		Nom. Wall Thickness (Inch)	Nom. Jkt. Thickness (Inch)	Nom. O.D. (Inch)
	Size	Strand			
2460	22	Solid	.008	.018	.118
2461	22	7/30	.008	.020	.135

Color Code of Conductors: Black, Red
STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

FOIL SHIELDED AUDIO AND DATA CABLE

INDIVIDUALLY SHIELDED MULTIPLE PAIRS — PLASTIC JACKET

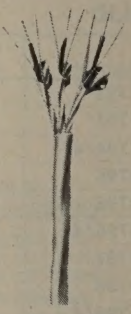
DESCRIPTION: Each conductor, tinned copper, color coded, high density polypropolene conductors twisted into pairs, tinned copper drain wire. Mylar supported aluminum foil shield, aluminum facing inward. Chrome gray PVC jacket overall.

CHARACTERISTICS: Mutual capacitance between conductors of a pair, 25 pf/ft. Capacitance of a single conductor to shield, 45 pf/ft.

APPLICATIONS: For audio, R.F. and pulse applications requiring superior circuit isolation.

#22 — SOLID

Alpha No.	No. of Pairs	No. of Cond.	Cond. Strand	Nom. Wall Thick. (Inch)	Nom. Jkt. Thick. (Inch)	Nom. O.D. (Inch)
6000	3	6	1	.010	.025	.235
6002	6	12	1	.010	.030	.318
6004	9	18	1	.010	.030	.371
6006	11	22	1	.010	.035	.414
6008	15	30	1	.010	.040	.485



#22 — STRANDED

Alpha No.	No. of Pairs	No. of Cond.	Cond. Strand	Nom. Wall Thick. (Inch)	Nom. Jkt. Thick. (Inch)	Nom. O.D. (Inch)
6010	3	6	7/30	.010	.025	.252
6012	6	12	7/30	.010	.030	.342
6014	9	18	7/30	.010	.035	.410
6016	11	22	7/30	.010	.040	.457
6018	15	30	7/30	.010	.040	.523
6020	19	38	7/30	.010	.050	.570
6022	27	54	7/30	.010	.055	.687

#20 — STRANDED

Alpha No.	No. of Pairs	No. of Cond.	Cond. Strand	Nom. Wall Thick. (Inch)	Nom. Jkt. Thick. (Inch)	Nom. O.D. (Inch)
6023	3	6	10/30	.016	.035	.372
6024	6	12	10/30	.016	.045	.555
6025	9	18	10/30	.016	.055	.620
6026	12	24	10/30	.016	.070	.765
6027	15	30	10/30	.016	.070	.830

STANDARD SPOOL PUT-UP:
500 FT., 1000 FT.

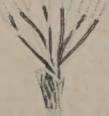
Pair No. **Color Combination of Pairs**
1—Black p.w. Red
2—Black p.w. White
3—Black p.w. Green
4—Black p.w. Blue
5—Black p.w. Brown
6—Black p.w. Yellow
7—Black p.w. Orange
8—Red p.w. Green
9—Red p.w. White
10—Red p.w. Blue
11—Red p.w. Yellow
12—Red p.w. Brown
13—Red p.w. Orange
14—Green p.w. Blue
15—Green p.w. White
16—Green p.w. Brown
17—Green p.w. Orange
18—Green p.w. Yellow
19—White p.w. Blue
20—White p.w. Brown
21—White p.w. Orange
22—White p.w. Yellow
23—Blue p.w. Brown
24—Blue p.w. Orange
25—Blue p.w. Yellow
26—Brown p.w. Orange
27—Brown p.w. Yellow
NOTE: p.w.—paired with

MULTIPLE PAIRS FOIL SHIELDED OVERALL

22 GAUGE, 38, 51 PAIRS

DESCRIPTION: Tinned solid copper conductors, with vinyl or polypropolene color coded insulation, cabled in pairs. Aluminum/Mylar foil shield overall. Stranded copper drain wire, chrome vinyl jacket.

APPLICATIONS: Communications, telephone and sound systems, control and instrumentation cables.



Alpha No.	No. of Pairs	Cond. Size	Insulation		Nom. Jkt. Thickness (Inch)	Nom. O.D. (Inch)
			Type	Thick. (Inch)		
2450	38	22	PP	.008	.045	.605
2451	51	22	Vinyl	.010	.050	.728

Pair No. **Color Combination**
1—Blue p.w. White
2—Orange p.w. White
3—Green p.w. White
4—Brown p.w. White
5—Slate p.w. White
6—Blue-White striped p.w. White
7—Blue-Orange p.w. White
8—Blue-Green striped p.w. White
9—Blue-Brown striped p.w. White
10—Blue-Slate striped p.w. White
11—Orange-White striped p.w. White
12—Orange-Green striped p.w. White
13—Orange-Brown striped p.w. White
14—Orange-Slate striped p.w. White
15—Green-White striped p.w. White
16—Green-Brown striped p.w. White
17—Green-Slate striped p.w. White
18—Brown-White striped p.w. White
19—Brown-Slate striped p.w. White
20—Slate-White striped p.w. White
21—Blue p.w. Red
22—Orange p.w. Red
23—Green p.w. Red
24—Brown p.w. Red
25—Slate p.w. Red
NOTE: p.w. — paired with

Pair No. **Color Combination**
26—Blue-White striped p.w. Red
27—Blue-Orange striped p.w. Red
28—Blue-Green striped p.w. Red
29—Blue-Brown striped p.w. Red
30—Blue-Slate striped p.w. Red
31—Orange-White striped p.w. Red
32—Orange-Green striped p.w. Red
33—Orange-Brown striped p.w. Red
34—Orange-Slate striped p.w. Red
35—Green-White striped p.w. Red
36—Green-Brown striped p.w. Red
37—Green-Slate striped p.w. Red
38—Brown-White striped p.w. Red
39—Brown-Slate striped p.w. Red
40—Slate-White striped p.w. Red
41—Blue p.w. Black
42—Orange p.w. Black
43—Green p.w. Black
44—Brown p.w. Black
45—Slate p.w. Black
46—Blue-White striped p.w. Black
47—Blue-Orange striped p.w. Black
48—Blue-Green striped p.w. Black
49—Blue-Brown striped p.w. Black
50—Blue-Slate striped p.w. Black
51—Orange-White striped p.w. Black

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

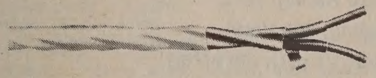
SPIRAL—BRAIDED SHIELDED CABLES

SPIRAL SHIELDED PLASTIC JACKETED CABLE

Passes FR-1 Vertical Flame Test

DESCRIPTION: Each conductor stranded or solid tinned copper, color coded polyvinylchloride insulation, conductors twisted, spiral wrapped copper shield, gray polyvinylchloride jacket. Nominal Jacket Thickness: .020.

CHARACTERISTICS: Use of spiral pigtailing off extremely simple and fast. Excellent for production line work. Provides 95% shielded coverage for audio and RF frequencies. Suggested Operating Temperature: −20°C to +80°C.



Alpha No.	No. of Cond.	Conductor Size	Conductor Strand	Nom. Wall Thickness (Inch)	Nom. O.D. (Inch)	Sugg. Working Voltage
2255	2	22	Solid	.016	.170	350V
2254/1	1	22	7/30	.016	.115	350V
2254©	2	22	7/30	.016	.175	350V
2254/3	3	22	7/30	.016	.190	350V
2254/4	4	22	7/30	.016	.200	350V
2254/6	6	22	7/30	.016	.235	350V
2256/1	1	20	10/30	.016	.130	350V
2256©	2	20	10/30	.016	.195	350V
2256/3	3	20	10/30	.016	.210	350V
2256/4	4	20	10/30	.016	.225	350V
2256/6	6	20	10/30	.016	.265	350V
2258/1	1	18	16/30	.016	.135	350V
2258©	2	18	16/30	.016	.230	350V
2258/3	3	18	16/30	.016	.235	350V
2258/4	4	18	16/30	.016	.245	350V
2260	2	16	26/30	.016	.240	350V
2260/3	3	16	26/30	.016	.245	350V
2265	2	14	41/30	.020	.285	450V
2265/3	3	14	41/30	.020	.290	450V
2268	2	12	65/30	.020	.325	450V
2268/3	3	12	65/30	.020	.330	450V

BRAIDED SHIELDED JACKETED CABLE

Passes FR-1 Vertical Flame Test

DESCRIPTION: Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted, braided copper shield, gray polyvinylchloride jacket overall. Suitable for outdoor installations.

CHARACTERISTICS: A conventional type of braided shield providing approximately 75% coverage is particularly desirable where flexibility is required. The copper shield allows ease of pigtail soldering. Shield construction provides additional cable strength. Operating Temperature: −20°C to +80°C. Nominal Jacket Thickness: .020.

STRANDED

Alpha No.	No. of Cond.	Conductor Size	Conductor Strand	Nom. Wall Thickness (Inch)	Nom. O.D. (Inch)	Sugg. Working Voltage
1735	1	22	7/30	.016	.125	350V
1736©	2	22	7/30	.016	.185	350V
1737	3	22	7/30	.016	.200	350V
1738	4	22	7/30	.016	.210	350V
1740	1	20	10/30	.016	.135	350V
1741©	2	20	10/30	.016	.200	350V
1742	3	20	10/30	.016	.220	350V
1743	4	20	10/30	.016	.230	350V
1745	1	18	16/30	.016	.145	350V
1746©	2	18	16/30	.016	.235	350V
1747	3	18	16/30	.016	.245	350V
1747/4	4	18	16/30	.016	.255	350V
1748	2	16	26/30	.016	.250	350V
1749	3	16	26/30	.016	.255	350V
1750	2	14	41/30	.020	.290	450V
1751	3	14	41/30	.020	.295	450V
1760	2	12	65/30	.020	.335	450V
1761	3	12	65/30	.020	.340	450V

SOLID

Alpha No.	No. of Cond.	Conductor Size	Conductor Strand	Nom. Wall Thickness (Inch)	Nom. O.D. (Inch)	Sugg. Working Voltage
1775*	2	22	1	.016	.175	350V
1779	2	20	1	.016	.210	350V
1783	2	18	1	.016	.220	350V

*With 22 AWG solid tinned copper ground wire under braided copper shield.

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

COLOR CODE OF CONDUCTORS: 1—Black, 2—Red, 3—White, 4—Green, 5—Yellow, 6—Blue

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RIBBON CABLES

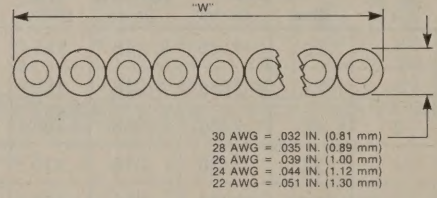
BONDED RIBBON CABLE

DESCRIPTION: 22, 24, 26, 28 and 30 AWG stranded tinned copper conductors insulated with either .010″ or .016″ of PVC, insulated conductors are bonded into a flat configuration to form a ribbon cable. This configuration allows easy termination, ease of location and simplifies routing, while saving space over typical round cable.

- 22 AWG 19/34; 22 AWG 7/30; 24 AWG 19/36; 26 AWG 7/34; 28 AWG 7/36; and 30 AWG 7/38 stranded tinned copper conductors.
- 22 AWG 7/30 insulated with .016″ of PVC.
- 22 AWG 19/34; 24 AWG 19/36; 26 AWG 7/34; 28 AWG 7/36; and 30 AWG 7/38 insulated with .010″ of PVC.
- 10, 15, 20 and 30 conductor size.

CHARACTERISTICS:

- Temperature Rating: −55°C to 105°C
- Voltage Rating: .010 (MIL-W-16878 Type B) 600V
  .016 (MIL-W-16878 Type C) 1000V
- Passes FR-1 Vertical Flame Test
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, Black (repeat)


"W"
30 AWG = .032 IN. (0.81 mm)
28 AWG = .035 IN. (0.89 mm)
26 AWG = .039 IN. (1.00 mm)
24 AWG = .044 IN. (1.12 mm)
22 AWG = .051 IN. (1.30 mm)

Alpha No.	No. Conds.	Gauge (AWG)	Strands	Nominal O.D. Width x Thickness (in Inches)
3530	10	22	19/34	.510 x .051
3531	15	22	19/34	.765 x .051
3532	20	22	19/34	1.020 x .051
3533	30	22	19/34	1.530 x .051
3530/7	10	22	7/30	.510 x .051
3531/7	15	22	7/30	.765 x .051
3532/7	20	22	7/30	1.020 x .051
3533/7	30	22	7/30	1.530 x .051
3540	10	24	19/36	.440 x .044
3541	15	24	19/36	.660 x .044
3542	20	24	19/36	.880 x .044
3543	30	24	19/36	1.320 x .044
3540/7	10	24	7/32	.440 x .044
3541/7	15	24	7/32	.660 x .044
3542/7	20	24	7/32	.880 x .044
3543/7	30	24	7/32	1.320 x .044
3550	10	26	7/34	.392 x .039
3550/14	14	26	7/34	.546 x .039
3551	15	26	7/34	.587 x .039
3551/16	16	26	7/34	.624 x .039
3552	20	26	7/34	.783 x .039
3553	30	26	7/34	1.190 x .039
3560	10	28	7/36	.351 x .035
3561	15	28	7/36	.523 x .035
3562	20	28	7/36	.701 x .035
3563	30	28	7/36	1.060 x .035
3570	10	30	7/38	.311 x .032
3571	15	30	7/38	.482 x .032
3572	20	30	7/38	.625 x .032
3573	30	30	7/38	.965 x .032

TWISTED PAIR LAMINATED RIBBON CABLE

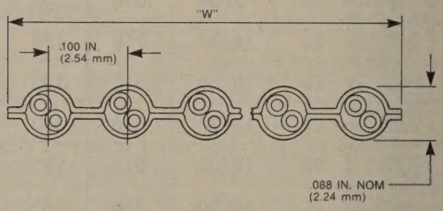
DESCRIPTION: 26 AWG stranded tinned copper conductors insulated with .010″ of PVC, twisted into pairs and intermittently laminated between layers of .005″ clear PVC film. The intermittent laminations allow easy access to the pairs while maintaining the shape and integrity of the cable.

- 26 AWG (7/34) stranded tinned copper conductor
- Conductors insulated with 0.010″ (.13mm) PVC rated FR-1
- Conductors twisted into pairs
- Pairs are laminated between two .005″ strips of clear PVC film
- Laminating interval .750″ (19mm) nominal
- Conductors pairs are .100″ apart (2.54mm)

CHARACTERISTICS:

- Temperature Rating: 80°C
- Voltage Rating: 300 Volts
- Capacitance: 21 pf/ft (69 pf/m)
- Propagation Delay: 1.7 ns/ft (5.6 ns/m)
- Impedance: 95 ohms nominal
- Cross Talk: 10 ft. (30.48cm) with two adjacent lines driven and a 1.3 ns rise time, 12% near end, 13% far end
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black (repeat). First conductor, common conductor is tan.

APPLICATIONS: Used in situations where reduced cross-talk is necessary, such as high speed data transmission in computers and communications equipment, but where easy mass termination is not necessary.



Alpha No.	No. Conds.	No. Pairs	Overall Width		Weight/100A	
			(in.)	(mm)	(lbs.)	(kg)
3586/14	14	7	0.8	20	2.5	1.13
3586/16	16	8	0.9	23	2.9	1.32
3586/20	20	10	1.1	28	3.6	1.63
3586/26	26	13	1.4	36	4.7	2.13
3586/34	34	17	1.8	36	6.2	2.81
3586/40	40	20	2.1	53	7.3	3.31
3586/50	50	25	2.6	66	9.1	4.13
3586/60	60	30	3.1	79	10.9	4.95

FCC* FLAT CABLES

alpha

FCC* COLOR-CODED FLAT CABLE

*Flat Cable and Connectors

Termination flexibility is the unique property of Alpha's FCC Color-Coded Flat Cable. Precise conductor spacing allows you to terminate this cable to any major brand of insulation displacement connectors on .050 in. (1.27mm) centers, including Alpha's. Color-coded insulation and excellent teardown characteristics permit you to terminate it like conventional hookup wire. Or take the best of both worlds and use both techniques on the same cable. Alpha FCC Color-Coded Flat Cable lets you expand your design capabilities.

DESCRIPTION: Alpha Color-Coded Laminated Ribbon Cable consists of PVC insulated round conductors on .050 in. (1.27mm) centers laminated between two sheets of clear PVC film. The lamination process results in controlled electrical characteristics with the advantage of color-coding, ease of separation and mass termination. Cable can be terminated with any major brand of IDC (insulation displacement connectors) on .050 in. (1.27mm) centers.

- 28 AWG (7/36) stranded tinned copper conductor
- .010 in. (.25mm) nom. wall PVC
- Conductors laminated to a sheet of .005 in. (0.13mm) nom. clear PVC film
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black. Color code repeats beyond 10 conductors.
- UL listed
- Passes FR-1 Vertical Flame Test

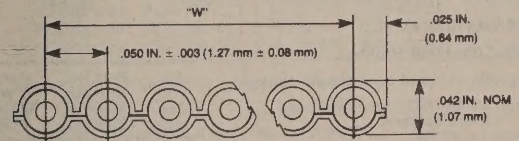
CHARACTERISTICS:

- Temperature Rating: 80°C
- Voltage Rating: 300 volts
- Capacitance: 14 pf/ft. nom.
- Propagation Delay: 1.4 ns/ft.
- Impedance: 103 ohms nom.
- Cross Talk: Nom. between two adjacent signal lines @ 5 ns rise time over 10 ft. (3.05m) length; near end 5.2%, far end 7.3%
- Environmental: Resists acids, alkalis, oils, moisture, solvents, ozone and fungus

APPLICATIONS: Ideal for applications in digital data and signal transmission system where termination speed and termination flexibility are required.

SPECIAL CONSTRUCTIONS:

- Other color combinations available



ALPHA FCC COLOR-CODED FLAT CABLE

Alpha No.	No. of Conductors	Nom. Width "W" (Inch)	Approx. Wt./Roll (Lbs.)
3581/10	10	.45	1.10
3581/14	14	.65	1.50
3581/16	16	.75	1.70
3581/20	20	.95	2.20
3581/26	26	1.25	2.90
3581/34	34	1.65	3.70
3581/40	40	1.95	4.40
3581/50	50	2.45	5.50
3581/60	60	2.95	6.60

STANDARD PACKAGE:
100 foot (30.48m) spools with exclusive footage remaining window

FCC* COLOR-CODED TWISTED PAIR FLAT CABLE

*Flat Cable and Connectors

Alpha has flat cable with a new twist. Take Alpha's FCC Color-Coded Flat Cable, twist the conductors into pairs and you've got Color-Coded Twisted Pair Flat Cable. Putting a twist in the cable gives you reduced cross talk. A flat 2 inch section every 18 inches allows you to terminate it to any major brand of insulation displacement connectors including Alpha's. Or terminate it like any twisted pair wire. Or do both on the same cable. You get the electrical advantages of ground plane flat cable with the added benefits of lower cost and easier termination. FCC Color-Coded Twisted Pair Flat Cable gives you the ultimate in design flexibility and signal response.

DESCRIPTION: Color-Coded Flat Cable consisting of 18 in. (457mm) sections of twisted pairs laminated on .100 in. (2.54mm) centers alternating with 2 in. (50.8mm) straight sections with conductors parallel on .050 in. (1.27mm) centers. Alpha, or any brand of IDC (insulation displacement connectors) on .050 in. (1.27mm) centers, can be used with this cable. The termination is made in the 2 in. (50.8mm) flat section.

- 28 AWG (7/36) stranded tinned copper conductor
- .010 in. (.25mm) nom. wall PVC
- Conductors laminated between layers of PVC film
- Color Code: Pairs have common Tan lead with Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black. Color code repeats beyond 10 pairs.
- UL listed
- Passes FR-1 Vertical Flame Test

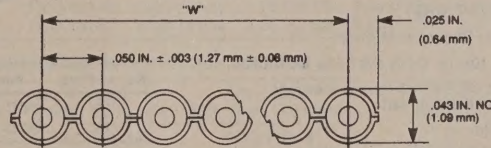
CHARACTERISTICS:

- Temperature Rating: 80°C
- Voltage Rating: 300 volts
- Capacitance: 22.4 pf/ft. nom.
- Impedance: 100 ohms nom.
- Cross Talk: Nom. between two adjacent signal lines @ 5 ns rise time over 10 ft. (3.05m) length; near end 6.0%, far end 5.3%
- Environmental: Resists acids, alkalis, oil, moisture, solvents, ozone and fungus

APPLICATIONS: Exceptionally well-suited for applications in which minimum cross talk and fast termination is required. Well-suited for switching and data transmission by high speed computers and communication equipment.

SPECIAL CONSTRUCTIONS:

- Other color combinations available
- Twisted pair sections other than 18" long available



ALPHA FCC COLOR-CODED TWISTED PAIR FLAT CABLE

Alpha No.	No. of Pairs	No. of Conductors	Nom. Width "W" (Inch)	Approx. Wt./Roll (Lbs.)
3582/10	5	10	.45	1.5
3582/14	7	14	.65	2.1
3582/16	8	16	.75	2.4
3582/20	10	20	.95	3.0
3582/26	13	26	1.25	3.9
3582/34	17	34	1.65	5.1
3582/40	20	40	1.95	6.0
3582/50	25	50	2.45	7.5
3582/60	30	60	2.95	9.0

STANDARD PACKAGE:
100 foot (30.48m) spools with exclusive footage remaining window

FCC* GRAY LAMINATED FLAT CABLE

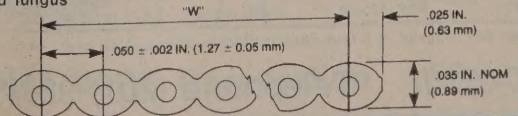
*Flat Cable and Connectors

DESCRIPTION: Laminated Gray Flat Cable consisting of stranded conductors laminated between layers of gray PVC film to form a flat ribbon. The laminate is formed precisely around the conductors so that wires, each surrounded by insulation film, may be easily and quickly separated or terminated with any major brand of IDC (insulation displacement connectors) on .050 in. (1.27mm) centers.

- 28 AWG (7/36) stranded tinned copper conductor
- Conductors laminated between layers of PVC film
- Gray PVC with Red stripe on leading edge
- UL listed
- Passes FR-1 Vertical Flame Test

CHARACTERISTICS:

- Temperature Rating: 105°C
- Voltage Rating: 300 volts
- Capacitance: 14 pf/ft. nom.
- Propagation Delay: 1.4 ns/ft.
- Impedance: 105 ohms nom.
- Cross Talk: Nom. between two adjacent signal lines @ 5 ns rise time over 10 ft. (3.05mm) length; near end 5.2%, far end 6.5%
- Environmental: Resists acids, alkalis, oil, moisture, solvents, ozone and fungus



APPLICATIONS: A general purpose flat cable designed for use in electronic products such as computers and business machines where speed of termination and economy is required.

SPECIAL CONSTRUCTIONS:

- 30 AWG solid tinnd copper available

Here's the cable that started the whole system of flat cable design for mass termination. Alpha's Gray Laminated Flat Cable is designed for general purpose interconnections. It combines low-cost with consistently reliable performance. It features excellent tear-down characteristics with high flexibility for applications requiring intricate cable routing. Mirror image profile permits reverse plane termination ability on same cable length. Alpha's Gray Laminated Flat Cable fits your all-around design requirements.

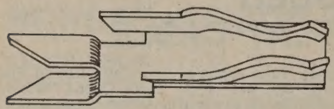
ALPHA FCC GRAY LAMINATED FLAT CABLE

Alpha No.	No. of Conductors	Nom. Width "W" (Inch)	Approx. Wt./Roll (Lbs.)
3580/10	10	.45	1.2
3580/14	14	.65	1.7
3580/16	16	.75	2.0
3580/20	20	.95	2.4
3580/26	26	1.25	3.2
3580/34	34	1.65	4.2
3580/40	40	1.95	4.9
3580/50	50	2.45	6.1
3580/60	60	2.95	7.3

STANDARD PACKAGING:
100 foot (30.48m) spools with exclusive footage remaining window

alpha

FLAT CABLE CONNECTORS



OFF-SET TINES
Patented off-set tines place forces on the conductor in opposite directions in two different planes, keeping the conductor under constant tension, ensuring a gas-tight connection.

DUAL CANTILEVERED CONTACTS
The Female Socket Connectors feature dual cantilevered contacts insuring good electrical contact when inserted into a header. The design provides two surfaces for wiping action which will remove any oxides or dirt that may have built up on the contacts.

FAST Alpha Connectors simultaneously terminate up to 50 conductors in seconds.

LOW COST Simultaneous termination reduces labor cost and error by eliminating the need for individual crimping and stripping conductors.

RELIABLE Alpha's patented off-set tine design pieces, separates, strips the insulation from the conductor and holds it under tension, assuring a gas-tight connection. Each tine is micro-etched to remove any burrs or rough edges which could sever strands of the conductors.

UNIQUE PACKAGING Alpha DIP, PCB and Female Socket Connectors are packaged in specially designed clear plastic tubes to protect them in transit and storage. Your connector inventory is easy to check and always in perfect condition. Four connectors are packed in each tube. Header connectors and Card Edge connectors are individually protected in extra-thick airtight clear polyethylene. All connector tubes and bags are then packed in shipping containers for added protection.

DIP CONNECTORS

DIP (Dual-In Line-Package) Connectors are compatible with standard IC component spacing and will mate with standard 14 and 16 pin IC sockets. A low cost hand tool or bench press can be used for assembly. DIP Connectors will accept 28-30 AWG stranded or solid conductors.

SPECIFICATIONS:

Contacts: Phosphor Bronze

Plating: 10μ in. Gold over 50μ in. Nickel

Material: UL 94 V-O flame retardant thermoplastic

Color: Blue

Temperature: −55°C to +105°C

Current Rating: 1 Amp (maximum)

Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level

Insulation Resistance: 5 x 10⁶ Ohms

No. of Pins	Part No.
14	FCC-130-14
16	FCC-130-16

Put-Up: 20 connectors per box, packed in 5 four-pack protective tubes. Also available in bulk pack.

PCB CONNECTORS

The PCB (Printed Circuit Board) Connector is designed to make a permanent connection. It is used where the application calls for the cable to be directly terminated to the Printed Circuit Board. After the cable is crimped onto the connector, the connector is soldered to the PC Board. A detailed hole pattern is shown on the following page. The PCB Connectors will accept 28-30 AWG stranded or solid conductors.

SPECIFICATIONS:

Contacts: 725 Nickel Silver alloy

Material: UL 94 V-O flame retardant plastic

Color: Blue

Temperature: −55°C to +105°C

Current Rating: 1 Amp (maximum)

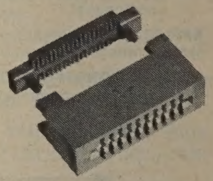
Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level

Insulation Resistance: 5 x 10⁶ Ohms

No. of Pins	Part No.
10	FCC-140-10
20	FCC-140-20
26	FCC-140-26
34	FCC-140-34
40	FCC-140-40
50	FCC-140-50

Put-Up: 20 conductors per box, packed in 5 four-pack protective tubes.
Also available in bulk pack.

CARD EDGE CONNECTORS



Alpha card edge connectors are mateable with stranded .062″ (1.57mm) printed circuit boards and will mate with boards ranging in thickness from .032″ (.81mm) to .075″ (1.91mm). The connectors will accept 28 or 30 AWG solid or stranded conductors on .050″ (1.27mm) centers providing a direct, reliable access to PCB pads on .100″ (2.54mm) centers. Alpha card edge connectors are available with and without mounting flanges.

SPECIFICATIONS:

Contacts: Phosphor Bronze

Plating: 20μ in. Gold over 50μ in. Nickel

Material: UL 94 V-O flame retardant thermoplastic

Color: Blue

Temperature: −55°C to +105°C

Current Rating: 1 Amp (maximum)

Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level

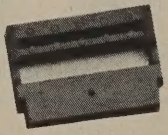
Insulation Resistance: 5 x 10⁶ Ohms

No. of Contacts	Part No. Without Mounting Flanges	Part No. With Mounting Flanges
10	FCC-170-10	FCC-171-10
20	FCC-170-20	FCC-171-20
26	FCC-170-26	FCC-171-26
34	FCC-170-34	FCC-171-34
40	FCC-170-40	FCC-171-40
50	FCC-170-50	FCC-171-50

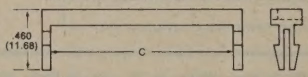
FEMALE SOCKET CONNECTORS

FEATURES:

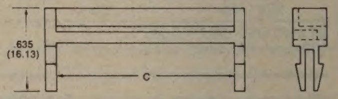
- 10, 20, 26, 34, 50 pin versions
- Mates with all standard headers and 0.025″ wire wrap posts
- Available with or without integral strain relief
- Recessed cover design allows cable to remain within connector profile
- Self-locking removable cover
- Patented off-set tine design insures reliable gas tight termination
- Gold plated phosphor bronze contacts
- Terminations can be inspected before cover is put on



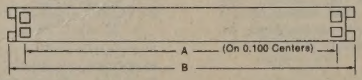
COVER WITHOUT STRAIN RELIEF



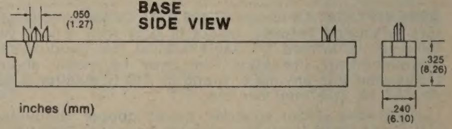
COVER WITH STRAIN RELIEF



BASE TOP VIEW



BASE SIDE VIEW



inches (mm)

SPECIFICATIONS:

Contacts: Phosphor Bronze

Plating: 20μ in. Gold over 50μ in. Nickel

Insertion Force: 0.50 lbs. (.23kg) per contact

Withdrawal Force: 0.50 lbs. (.23kg) per contact

Material: UL 94 V-O flame retardant thermoplastic

Color: Blue

Temperature: −55°C to +105°C

Current Rating: 1 Amp (maximum)

Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level

Insulation Resistance: 5 x 10⁶ Ohms

FEMALE SOCKET CONNECTORS

No. of Pins	Part No. With Strain Relief	Part No. Without Strain Relief	A Inches (mm)	B Inches (mm)	C Inches (mm)
10	FCC-110-10	FCC-120-10	.400 (10.16)	.575 (17.15)	.520 (13.21)
20	FCC-110-20	FCC-120-20	.900 (22.86)	1.175 (29.85)	1.020 (25.91)
26	FCC-110-26	FCC-120-26	1.200 (30.48)	1.475 (37.47)	1.320 (33.53)
34	FCC-110-34	FCC-120-34	1.600 (40.64)	1.875 (47.63)	1.720 (43.59)
40	FCC-110-40	FCC-120-40	1.900 (48.26)	2.175 (55.25)	2.020 (51.31)
50	FCC-110-50	FCC-120-50	2.400 (60.96)	2.675 (67.95)	2.520 (64.01)

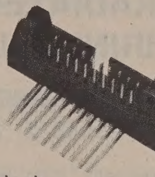
Put-Up: 20 connectors per box, packed in 5 four-pack protective tubes. Also avail. in bulk pack.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

FLAT CABLE CONNECTORS

alpha

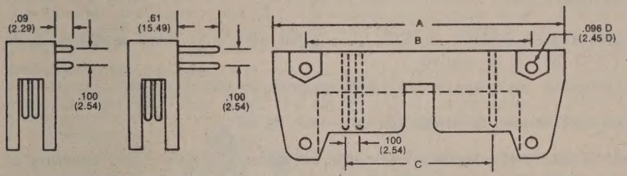
HEADER CONNECTOR
RIGHT ANGLE STYLE



FEATURES:

- Mates with all standard female socket connectors
- Available with solder or wire wrap terminals
- Available in 10, 20, 26, 34, 40, 50 pin versions
- Available with or without locking tabs
- Gold plated phosphor bronze contacts (20μ inches over 50μ inches nickel)
- UL 94 V-O flame retardant thermoplastic body

Solder and Wire Wrap Termination



RIGHT ANGLE HEADERS

No. of Pins	Part No. Solder Terminals	Part No. Wire Wrap Terminals	A Inches (mm)	B Inches (mm)	C Inches (mm)
10	FCC-151-10	FCC-152-10	1.26 (32.00)	.86 (21.84)	.40 (10.16)
20	FCC-151-20	FCC-152-20	1.76 (44.70)	1.36 (34.54)	.90 (22.86)
26	FCC-151-26	FCC-152-26	2.06 (52.32)	1.66 (42.16)	1.20 (30.48)
34	FCC-151-34	FCC-152-34	2.46 (62.48)	2.06 (52.32)	1.60 (40.64)
40	FCC-151-40	FCC-152-40	2.76 (70.10)	2.36 (59.94)	1.90 (48.26)
50	FCC-151-50	FCC-152-50	3.26 (82.80)	2.86 (72.64)	2.40 (60.96)

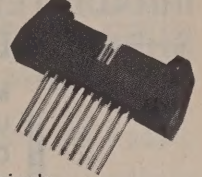
RIGHT ANGLE HEADERS WITH LOCKING TABS

No. of Pins	Part No. Solder Terminals	Part No. Wire Wrap Terminals
10	FCC-153-10	FCC-154-10
20	FCC-153-20	FCC-154-20
26	FCC-153-26	FCC-154-26
34	FCC-153-34	FCC-154-34
40	FCC-153-40	FCC-154-40
50	FCC-153-50	FCC-154-50

Designed for use with female socket connectors with strain relief. (F.C.C. — 110 Series)

Put-Up: 10 per box, individually packaged. Also available in bulk pack.

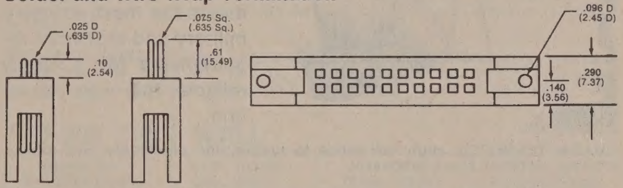
HEADER CONNECTOR
STRAIGHT STYLE



FEATURES:

- Mates with all standard female socket connectors
- Available with solder or wire wrap terminals
- Available in 10, 20, 26, 34, 40, 50 pin versions
- Available with or without locking tabs
- Gold plated phosphor bronze contacts (20μ inches over 50μ inches nickel)
- UL 94 V-O flame retardant thermoplastic body

Solder and Wire Wrap Termination



STRAIGHT HEADERS

No. of Pins	Part No. Solder Terminals	Part No. Wire Wrap Terminals	A Inches (mm)	B Inches (mm)	C Inches (mm)
10	FCC-161-10	FCC-162-10	1.26 (32.00)	.86 (21.84)	.40 (10.16)
20	FCC-161-20	FCC-162-20	1.76 (44.70)	1.36 (34.54)	.90 (22.86)
26	FCC-161-26	FCC-162-26	2.06 (52.32)	1.66 (42.16)	1.20 (30.48)
34	FCC-161-34	FCC-162-34	2.46 (62.48)	2.06 (52.32)	1.60 (40.64)
40	FCC-161-40	FCC-162-40	2.76 (70.10)	2.36 (59.94)	1.90 (48.26)
50	FCC-161-50	FCC-162-50	3.26 (82.80)	2.86 (72.64)	2.40 (60.96)

STRAIGHT HEADERS WITH LOCKING TABS

No. of Pins	Part No. Solder Terminals	Part No. Wire Wrap Terminals
10	FCC-163-10	FCC-164-10
20	FCC-163-20	FCC-164-20
26	FCC-163-26	FCC-164-26
34	FCC-163-34	FCC-164-34
40	FCC-163-40	FCC-164-40
50	FCC-163-50	FCC-164-50

Designed for use with female socket connectors with strain relief. (F.C.C. — 110 Series)

Put-Up: 10 per box, individually packaged. Also available in bulk pack.

ASSEMBLY TOOLS

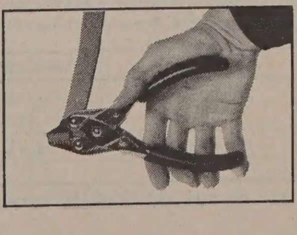
Alpha has designed the easiest to use assembly system available. One universal adaptor accepts **all** connectors without additional components or adjustments. Any Alpha connector of any size can be inserted and crimped in seconds. The Alpha flat cable system offers you this feature. It will save valuable time, particularly in the operations where a variety of short run or complex harnesses are used.

A low cost hand tool designed to accept DIP Connectors is also available. Ideal for field replacement.

FCT-10 Bench Press complete with Universal Adapter, designed to accept all Alpha Connectors.

Part No. FCT-60 Universal Adapter adapts other bench presses to the Alpha System without modification.

Part No. FCT-30 designed to accept Alpha 14 and 16 pin DIP Connectors.



DESIGNER KIT

The designer kits make it easy to have available all the components needed to make a wide range of flat cable assemblies. It is ideal for use in schools, research labs and design groups for prototype applications.

alpha
FLAT CABLE

The Alpha System Designer Kit, FCT-80, includes an assortment of 57 styles of connectors, flat cable and a bench press with universal adapter. You get 248 connectors, representing Alpha's complete line of DIP, PCB, Card Edge, Female Socket and Header Connectors; 100 feet of 50 conductor flat cable; and a bench press with Alpha's exclusive universal adapter. The Designer Kit is packaged in its own storage cabinet, made with a gray baked enamel finish and heavy-duty welded steel frame. The molded styrene drawers are virtually unbreakable and will not crack, break or dent.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha SHRINKABLE TUBING

IRRADIATED POLYOLEFIN SHRINKABLE TUBING

MIL-I-23053/5
UL RECOGNIZED COMPONENT*
AMS-3636B, 3637B

The single most widely used type of FIT Shrinkable Tubing, FIT-221 is manufactured from irradiated cross-linked polyolefin. FIT-221 is an all-purpose tubing with excellent physical, chemical and electrical properties. It meets the most stringent military and industrial requirements for a highly reliable, thin wall insulation.

CHARACTERISTICS: High resistance to fungus and chemicals. Self-extinguishing. Will not crack or peel.

APPLICATIONS: General purpose insulation, strain relief, jacketing material and as component insulation. Material is easily and permanently marked.

SPECIFICATIONS: Operating Temperature: −55°C to +135°C. Shrinkage Temperature: 135°C. Tensile Strength: 2500 psi. Ultimate Elongation: 400%. Longitudinal Shrinkage: 5% maximum. Dielectric Strength: 1300 volts/mil. Non-flammable — self-extinguishing. Specific Gravity: 1.3 maximum.

Alpha No. and Size (Inch)	Min. I.D. Before Shrink. (Inch)	Recovered I.D. After Shrink. (Inch)	Recovered Nom. Wall Thick. (Inch)	Standard Package			Bulk Pkg. 4′Lgth. Total Ftg.
				4′ Lgths. Total Ftg.	2′ Lgths. Total Ftg.	6″ Lgths. Total Ftg.	
FIT-221-3/64	.046	.023	.016	100	100	20	1,000
FIT-221-1/16	.063	.031	.017	100	100	18	1,000
FIT-221-3/32	.093	.046	.020	100	100	16	1,000
FIT-221-⅛	.125	.062	.020	100	100	14	1,000
FIT-221-3/16	.187	.093	.020	100	100	12	1,000
FIT-221-¼	.250	.125	.025	100	100	10	1,000
FIT-221-⅜	.375	.187	.025	100	100	8	1,000
FIT-221-½	.500	.250	.025	20	20	7	200
FIT-221-¾	.750	.375	.030	20	20	6	200
FIT-221-1	1.000	.500	.035	20	20	4	200
FIT-221-1½	1.500	.750	.040	20	20	2.5	200
FIT-221-2	2.000	1.000	.045	20	20	1.5	200
FIT-221-3	3.000	1.500	.050	8	8	1	100
FIT-221-4	4.000	2.000	.055	8	8	5	100

STOCK COLORS: Black, White, Red, Yellow, Blue, Clear

STANDARD PACKAGE FIT-221. Tubing is available ONLY in specified pkgs. When ordering, indicate package desired.

*UL marked tubing available on request.

MAY BE CUT AND MARKED TO YOUR SPECIFICATIONS

PACKAGED ASSORTMENTS

FIT-221 — Assorted sizes and colors per box — contains an assortment of 6″ lengths in various sizes and colors. Every length identified as to size and supplied in Black, White, Red, Yellow, Blue and clear.

Alpha No.	Tubing Size Range	Lengths Per Box
FIT-221 MS-1	3/64″ thru 3/16″	30
FIT-221 MS-2	¼″ thru ¾″	16
FIT-221 MS-3	1″ thru #4	10

Pre-cut lengths of FIT-221 in the two most popular cut sizes. Packaged in poly bags and boxes. Specify size.

Alpha No. and Size (Inch)	No. Cut Pcs. ½″ or 1″	Alpha No. and Size (Inch)	No. Cut Pcs. ½″ or 1″
FIT-221-3/64	1000	FIT-221-⅜	1000
FIT-221-1/16	1000	FIT-221-½	100
FIT-221-3/32	1000	FIT-221-¾	100
FIT-221-⅛	1000	FIT-221-1	100
FIT-221-3/16	1000	FIT-221-1½	100
FIT-221-¼	1000	FIT-221-2	100

IRRADIATED VINYL SHRINKABLE TUBING

MINIMAL LONGITUDINAL SHRINKAGE
MIL-I-23053/2, AMS-3582

A specially formulated polyvinylchloride tubing, that is mechanically strong, extremely flexible and significantly different from non-irradiated heat shrinkable tubing. Unlike non-irradiated PVC tubing, FIT-105 shrinks evenly and will not split when shrunk. Non-irradiated tubing has a much greater waste factor, with longitudinal shrinkage approximately 20%. FIT-105 will shrink less than 10% of its original length.

CHARACTERISTICS: Extremely flexible. Will not cold flow or melt. Easily marked.

SHRINKAGE RATIO: To 50% of original size (2:1) when temperature of 175°C (347°F) is applied.

Controlled shrinkage within seven seconds at 166°C (325°F).

LONGITUDINAL SHRINKAGE: Less than 10%.

APPLICATIONS: Jacketing of cable harnesses, insulation and covering of components, bus bar insulation, tab disconnects, jacketing of cable cores with many of the qualities of the finest extruded plastic jackets.

SPECIFICATIONS: Temperature Operating Range: −35°C to +105°C. Minimum Shrink Temperature: 175°C. Tensile Strength: 2600 PSI. Elongation: 250%. Dielectric Strength: 750 volts/mil. Flame Resistance: Non-burning. Fungus Resistant; Fluid Resistant To: Hydrocarbons, solvents, aqueous solutions, acids, bases.

DIMENSIONS CHART

Alpha No. and Size (Inch)	Minimum I.D. Before Shrinking (Inch)	Recovered I.D. After Shrinking (Inch)	Nominal Wall Thickness (Inches)	Standard Put-up (Feet)
FIT-105-3/64	.046	.023	.020	25, 100, 500
FIT-105-1/16	.062	.031	.020	25, 100, 500
FIT-105-3/32	.093	.046	.020	25, 100, 200
FIT-105-⅛	.125	.062	.025	25, 100, 200
FIT-105-3/16	.187	.093	.025	25, 100, 200
FIT-105-¼	.250	.125	.025	25, 100, 200
FIT-105-⅜	.375	.187	.030	25, 100, 200
FIT-105-½	.500	.250	.030	25, 100
FIT-105-¾	.775	.375	.035	25, 100
FIT-105-1	1.000	.500	.040	25, 100
FIT-105-1½	1.500	.750	.045	25, 100
FIT-105-2	2.000	1.000	.050	10, 25, 50

STOCK COLOR: Black

LONG LENGTHS — PACKAGING: Maximum Three Lengths Per Put-up

PACKAGED ASSORTMENTS

FIT-105-MS—Assorted sizes per box—contains an assortment of 6″ lengths in various sizes. Every length identified as to size and supplied in Black only.

Alpha No.	Tubing Size Range	Lengths Per Box
FIT-105-MS-1	3/64″ thru ¼″ (6 sizes)	10 lengths per size (60 lengths)
FIT-105-MS-2	⅜″ thru 1″ (4 sizes)	10 lengths per size (40 lengths)

MAY BE CUT AND MARKED TO YOUR SPECIFICATIONS.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

PVC AND TFE TUBING

alpha

PVC-105 POLYVINYLCHLORIDE PLASTIC TUBING

UL LISTED, ASTMD-876, D-9222
MIL-I-6310 TYPE F, FORM U, GRADE C, CLASS 1, CATEGORY 1

DESCRIPTION: The superior mechanical, thermal, and electrical properties of Alpha PVC-105, coupled with its economical cost have led to an ever increasing use of this all-purpose insulating material. Another major advantage of Alpha PVC-105 is its high degree of flexibility, which is maintained even under severe environmental conditions.

Rated for temperatures as high as 105°C, PVC-105 has a high dielectric strength that remains unaffected by increasing temperature throughout its range. PVC-105 maintains a high resistance to the agents of heat, oil, chemical corrosion and fungi with no loss in tensile strength, or flexibility. Other features include an exceptional resistance to abrasion and indefinite shelf life.

Alpha PVC-105 is compounded with first quality, non-migratory resinous type plasticizers. Carefully selected stabilizers and modifiers added in the manufacturing process, counteract chemical and environmental degradation. Under adverse conditions Alpha PVC-105 retains its flexibility which permits it to cling to and protect irregular shapes. An unusually simple to handle insulating material, PVC-105 "snakes" well under all environmental conditions.

APPLICATIONS: Designed and manufactured for general electronic, aircraft and electrical applications involving temperatures as high as 105°C. Especially useful to protect wires and cables subject to abrasion or where a flexible tubing with a high degree of resistivity to oil, chemicals or solvents is necessary.

CUT-PIECES

Pre-cut, ready to use tubing pieces in ½″ and 1″ lengths are available from stock. Cut pieces are available from stock in packages of 100, 500, 1000 pieces. When ordering specify Alpha No., add suffix CP, lgth. of cut piece, ½″ or 1″ and quantity (100, 500, 1000).

DIMENSIONS CHART

Alpha No. and Size (Inch)	Nom. Inside Dia. (Inch)	Nom. Wall Thickness (Inch)	Stock Colors	Standard Put-ups (Feet)
PVC-105-24	.022	.013	1-6	100, 1000 Spools
PVC-105-22	.027	.012	1-6	100, 1000 Spools
PVC-105-20	.034	.016	1-6	100, 1000 Spools
PVC-105-19	.038	.016	1-6	100, 1000 Spools
PVC-105-18	.042	.016	1-6	100, 1000 Spools
PVC-105-17	.047	.016	1-6	100, 1000 Spools
PVC-105-16	.053	.016	1-6	100, 1000 Spools
PVC-105-15	.059	.016	1-6	100, 1000 Spools
PVC-105-14	.066	.016	1-6	100, 500 Spools
PVC-105-13	.076	.016	1-6	100, 500 Spools
PVC-105-12	.085	.016	1-6	100, 500 Spools
PVC-105-11	.095	.016	1-6	100, 500 Spools
PVC-105-10	.106	.016	1-6	100, 500 Spools
PVC-105-9	.118	.020	1-6	100, 500 Spools
PVC-105-8	.133	.020	1-6	100, 500 Spools
PVC-105-7	.148	.020	1-6	100, 500 Spools
PVC-105-6	.166	.020	1-6	100, 500 Spools
PVC-105-5	.186	.020	1-6	100, 500 Spools
PVC-105-4	.208	.020	1-6	100, 250 Coils
PVC-105-3	.234	.020	1-6	100, 250 Coils
PVC-105-2	.263	.020	1-6	100, 250 Coils
PVC-105-1	.294	.020	1, 2, 3	100, 250 Coils
PVC-105-0	.330	.020	1, 2, 3	100, 250 Coils
PVC-105-5⁄16	.312	.025	1, 2, 3	100, 250 Coils
PVC-105-⅜	.375	.025	1, 2, 3	100, 250 Coils
PVC-105-7⁄16	.438	.025	1, 2, 3	100 Coils
PVC-105-½ A	.500	.025	1, 2, 3	100 Coils
PVC-105-9⁄16	.562	.030	1, 2, 3	100 Coils
PVC-105-⅝	.625	.030	1, 2, 3	100 Coils
PVC-105-¾	.750	.035	1, 2, 3	50 Coils
PVC-105-⅞	.875	.035	1, 2, 3	50 Coils
PVC-105-1	1.000	.035	1, 2, 3	50 Coils
PVC-105-1⅛	1.125	.035	1, 2	50 Coils
PVC-105-1¼	1.250	.040	1, 2	50 Coils
PVC-105-1⅜	1.375	.040	1, 2	50 Coils
PVC-105-1½	1.500	.045	1, 2	50 Coils
PVC-105-1¾	1.750	.055	1, 2	50 Coils
PVC-105-2	2.000	.060	1, 2	50 Coils
PVC-105-2¼	2.250	.065	1, 2	50 Coils
PVC-105-2½	2.500	.070	1, 2	50 Coils

***STOCK COLORS:**
1—Clear, **2**—Black, **3**—White, **4**—Yellow, **5**—Red, **6**—Green
NOTE: UL FILE NO. ON REQUEST

TFT 200-250-300-400 EXTRUDED TEFLON TUBING (TFE)

MIL-I-22129C, AMS-3651B, 3655, 3653 — FED. SPEC. P-403A
OPERATING TEMPERATURE: −65°C TO +260°C

Alpha Teflon Tubing offers all the unique thermal, electrical and mechanical properties of Teflon. Teflon Tubing is rated for continuous operation at 260°C and retains an exceptional toughness and flexibility throughout its range. At high frequencies, the dielectric strength of Teflon is many times that of other insulating materials. Teflon Tubing is completely inert and has zero moisture absorbtion. Standard wall Teflon (TFT-250) has the same characteristics as thin wall tubing (TFT-200) but is used where higher dielectric values and additional mechanical strength is required.

CHARACTERISTICS: Operating Temperature: −65°C to +260°C. High dielectric strength. Chemically inert. Zero moisture absorbtion.

APPLICATIONS: Insulation of components, connectors, all electrical and electronic apparatus requiring high thermal insulation and superior dielectric qualities.

SPECIFICATIONS: Tensile Strength: 5000-75000 PSI. Completely non-flammable. Min. Vol. Res.: 10^{17} Ohm-cm. Ultimate Elongation: 300-500%. Dielectric Strength: 1400V/Mil. Dielectric Constant: 2.2. Abrasion Resistance: Fair.

TFT-200 THIN WALL

Alpha No. and Size (Inch)	Nom. Inside Dia. (Inch)	Nom. Wall Thick. (Inch)	Standard Put-ups (Feet)
†TFT-200-30	.012	.009	100, 1000
†TFT-200-28	.015	.009	100, 1000
†TFT-200-26	.018	.010	100, 1000
†TFT-200-24	.022	.010	100, 1000
†TFT-200-22	.027	.010	100, 1000
†TFT-200-20	.034	.012	100, 1000
†TFT-200-19	.038	.012	100, 1000
†TFT-200-18	.042	.012	100, 1000
†TFT-200-17	.047	.012	100, 1000
†TFT-200-16	.053	.012	100, 1000
†TFT-200-15	.059	.012	100, 1000
†TFT-200-14	.066	.012	100, 500
†TFT-200-13	.076	.012	100, 500
†TFT-201-12	.085	.012	100, 500
†TFT-200-11	.095	.012	100, 500
†TFT-200-10	.106	.012	100, 500
†TFT-200-9	.118	.015	100, 500
‡TFT-200-8	.133	.015	100 Coils*
‡TFT-200-7	.148	.015	100 Coils*
‡TFT-200-6	.166	.015	100 Coils*
‡TFT-200-5	.186	.015	100 Coils*
‡TFT-200-4	.208	.015	100 Coils*
‡TFT-200-3	.234	.015	100 Coils*
‡TFT-200-2	.263	.015	100 Coils*
‡TFT-200-1	.294	.015	100 Coils*
‡TFT-200-0	.330	.015	100 Coils*

STOCK COLORS: †Natural, Black ‡Natural Only
***RANDOM LENGTHS PACKED IN 100′ COILS**

TFT-250 STANDARD WALL

Alpha No. and Size (Inch)	Nom. Inside Dia. (Inch)	Nom. Wall Thick. (Inch)	Standard Put-ups (Feet)
TFT-250-24	.022	.012	100, 1000
TFT-250-22	.027	.012	100, 1000
TFT-250-20	.034	.016	100, 1000
TFT-250-19	.038	.016	100, 1000
TFT-250-18	.042	.016	100, 1000
TFT-250-17	.047	.016	100, 1000
TFT-250-16	.053	.016	100, 1000
TFT-250-15	.059	.016	100, 1000
TFT-250-14	.066	.016	100, 500
TFT-250-13	.076	.016	100, 500
TFT-250-12	.085	.016	100, 500
TFT-250-11	.095	.016	100, 500
TFT-250-10	.106	.016	100, 500
TFT-250-9	.118	.020	100, 500
TFT-250-8	.133	.020	100 Coils*
TFT-250-7	.148	.020	100 Coils*
TFT-250-6	.166	.020	100 Coils*
TFT-250-5	.186	.020	100 Coils*
TFT-250-4	.208	.020	100 Coils*
TFT-250-3	.234	.020	100 Coils*
TFT-250-2	.263	.020	100 Coils*
TFT-250-1	.294	.020	100 Coils*
TFT-250-0	.330	.020	100 Coils*

STOCK COLORS: Natural
***RANDOM LENGTHS PACKED IN 100′ COILS**

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha ZIPPER TUBING

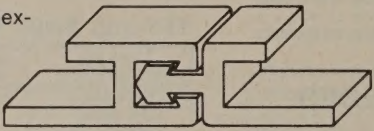
ALPHA ZIPPER TUBING

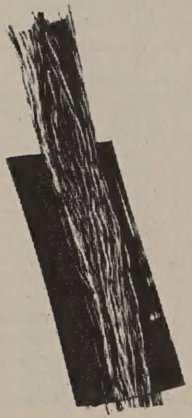
UL Recognized Component — Easy to Use
Ideal for Prototypes — Short Run Cables
Adds Extra Mechanical Protection
Eliminates Tape-Wrapping or Other "Make-Do" Jacketing Material

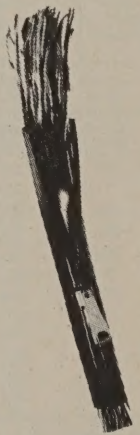
Alpha Zipper Tubing allows you to jacket any group of wires or cables in just seconds. It is the ideal jacketing material for all short run and prototype cable applications. Zipper tubing is ideal for use in the plant, on the job, in the field or anywhere extra protection or a short run or prototype cable jacket is needed. needed.

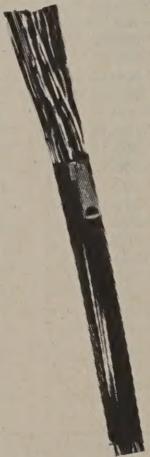
Zipper Tubing is supplied on a spool and consists of a plastic jacket with matching tracks on each side. When the zipper tubing is formed into a circular shape, the two tracks at each end interlock to form a continuous and circling cable jacket. Closure of zipper tubing is simplified by use of a slide that matches the track and will lock continuously as it is pulled. The end result is a permanent jacket or protective cover.

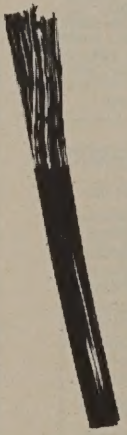
Alpha Loc-Trac® provides a permanent, flex-resistant seal. This track will not pop open even when the jacketed material is bent in a U-shape. It requires no sealant or any adhesive to hold together.




Place wire to be covered as flat tubing.


Wrap tubing around wires.


Zip up with slider provided.


Wires are now jacketed.

Specifications for Alpha Zipper Tubing

Material:	Polyvinylchloride
Track Thickness (when closed):	Std. .095" Loc-Trac® .150
Dielectric Strength V/mil:	759
Tensile Strength P.S.I.:	3810
Ultimate Elongation:	255%
Operating Temperature Upper Limit:	106°C
Cold Brittleness:	−86°C
Fungus-proof:	Will Not Support Fungus
Flammability:	Self-extinguishing
Lateral Pull Strength:	42.7 pounds/inch

Loc-Trac® ZIP-41 All Purpose

MIL-I-631 D/C PVC TUBING, −20°C to +105°C, .020 WALL THICKNESS.

Alpha No. and Size (Inch)	Diameter (Inch)	Approx. Flat Width (Inch)
ZIP-41-½	½	2
ZIP-41-⅝	⅝	2⅜
ZIP-41-¾	¾	2¾
ZIP-41-⅞	⅞	3⅛
ZIP-41-1	1	3⁹⁄₁₆
ZIP-41-1⅛	1⅛	3¹⁵⁄₁₆
ZIP-41-1¼	1¼	4⅛
ZIP-41-1½	1½	4⅞
ZIP-41-1¾	1¾	5⅝
ZIP-41-2	2	6⅜
ZIP-41-2¼	2¼	7½
ZIP-41-2½	2½	8¼
ZIP-41-2¾	2¾	9⅛
ZIP-41-3	3	10
ZIP-41-3¼	3¼	10¾
ZIP-41-3½	3½	11½
ZIP-41-3¾	3¾	12¼
ZIP-41-4	4	13

STOCK COLORS: Clear, Black
STANDARD PUT-UP: 100 FT., 50 FT., 25 FT.

Loc-Trac® ZIP-41M Heavy Duty

MIL-I-631 D/C PVC TUBING, −20°C to +105°C, .040 WALL THICKNESS.

Alpha No. and Size (Inch)	Diameter (Inch)	Approx. Flat Width (Inch)
ZIP-41M-½	½	2
ZIP-41M-⅝	⅝	2⅜
ZIP-41M-¾	¾	2¾
ZIP-41M-⅞	⅞	3⅛
ZIP-41M-1	1	3⁹⁄₁₆
ZIP-41M-1⅛	1⅛	3¹⁵⁄₁₆
ZIP-41M-1¼	1¼	4⅛
ZIP-41M-1½	1½	4⅞
ZIP-41M-1¾	1¾	5⅝
ZIP-41M-2	2	6⅜
ZIP-41M-2¼	2¼	7½
ZIP-41M-2½	2½	8¼
ZIP-41M-2¾	2¾	9⅛
ZIP-41M-3	3	10
ZIP-41M-3¼	3¼	10¾
ZIP-41M-3½	3½	11½
ZIP-41M-3¾	3¾	12¼
ZIP-41M-4	4	13

STOCK COLORS: Clear, Black
STANDARD PUT-UP: 100 FT.

Loc-Trac® ZIP-60 Foil Shielded

ALUMINUM FOIL LAMINATED BETWEEN PVC JACKETS
MIL-I-631 D/C PVC TUBING, −20°C to +105°C, .020 WALL THICKNESS.

Alpha No. and Size (Inch)	Diameter (Inch)	Approx. Flat Width (Inch)
ZIP-60-½	½	2
ZIP-60-⅝	⅝	2⅜
ZIP-60-¾	¾	2¾
ZIP-60-⅞	⅞	3⅛
ZIP-60-1	1	3⁹⁄₁₆
ZIP-60-1⅛	1⅛	3¹⁵⁄₁₆
ZIP-60-1¼	1¼	4⅛
ZIP-60-1½	1½	4⅞
ZIP-60-1¾	1¾	5⅝
ZIP-60-2	2	6⅜
ZIP-60-2¼	2¼	7½
ZIP-60-2½	2½	8¼
ZIP-60-2¾	2¾	9⅛
ZIP-60-3	3	10
ZIP-60-3¼	3¼	10¾
ZIP-60-3½	3½	11½
ZIP-60-3¾	3¾	12¼
ZIP-60-4	4	13

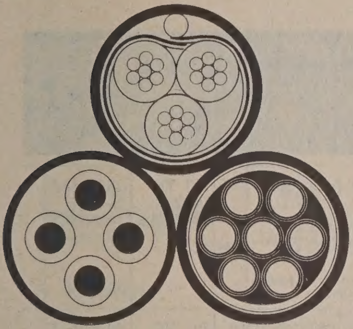
STOCK COLOR: Gray
STANDARD PUT-UP: 100 FT.

ALPHA WIRE Corporation Elizabeth, N.J. 07207 Telephone (201) 925-8000

QUICK CUSTOM CABLE

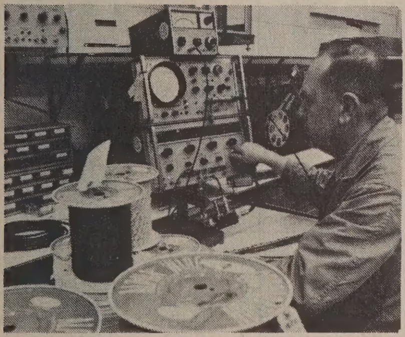
alpha

The special or prototype cable you need — From one foot to production requirements — Manufactured and delivered faster than you ever thought possible.



QCC IS

- THE AVAILABILITY OF THE THOUSANDS OF IN-STOCK ITEMS IN THIS CATALOG TO CONSTRUCT THE CABLE YOU NEED.
- THE KNOW-HOW THAT COMES FROM 51 YEARS IN MANUFACTURING
- THE ESSENTIAL MILITARY, COMMERCIAL AND UL APPROVALS.
- THE SPECIALIZED EQUIPMENT TO MANUFACTURE CUSTOM CABLE OF THE HIGHEST QUALITY.
- THE EXPERIENCED PERSONNEL TO HELP YOU IN DESIGNING YOUR CABLE.



A specially prepared customer cable specification sheet may be obtained from Alpha. We can also work from your sketch or blueprint.

Our QCC design department is anxious to work with you in designing cable for maximum efficiency at minimum cost.

QUICK — Alpha can manufacture and deliver special cable constructions faster than you ever thought possible — overnight in some instances. CUSTOM — we can make virtually any type of cable you need — and in quantities from one foot to thousands of feet. And the QC part of QCC means just what it says — **QUALITY.** All cable is thoroughly tested for all electrical, mechanical and appearance parameters by our fully equipped quality control laboratory.

Alpha offers you more in-stock military specification and UL wire and cable conductors than any other source in the world. Combine this with our cable engineering manufacturing and test facilities, and you have the answer to all your special, prototype and custom cable needs.

ALPHA WIRE CORPORATION

711 Lidgerwood Ave., Elizabeth, New Jersey 07207 Tel: (201) 925-8000 TWX: 710-996-5895

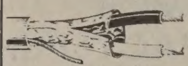
alpha
ALPHA WIRE

QCC
QUICK CUSTOM CABLE

BELDEN

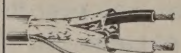
shielded sound and broadcast audio cables

TWO CONDUCTOR SHIELDED CABLES

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per-cent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m		ft.	m
BELDFOIL®	**8640†**	28 (Solid) [.32]	.0025	.064	.020	.51	.090	2.29	Blk, Red	100	55	180	105	344	100	250, 500 U-500, (UNREEL)	76.2, 152.4 U-152.4, (UNREEL)®
		Solid copper, GEOSOL™ insulated (solderable—no stripping required), twisted pair, BELDFOIL aluminum-polyester shield, 30 AWG solid tinned copper covered steel drain wire, WHITE vinyl jacket. Maximum operating temperature 105°C. *Ideal for Instrumentation and Audio Console Work where Subminiaturization is Required. The BELDFOIL shield combines high cable reliability with ease of termination.*															
 **BELDFOIL**	**★9462†** UL LISTED **2464**	22 (7x30) [.76]	.012	.30	.031	.79	.174	4.42	Blk, Red	100	45	148	80	262	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) *Tinned copper, vinyl insulated, twisted pair, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket.*															
BELDFOIL	**8450•†**	22 (Solid) [.64]	.006	.15	.018	.46	.118	3.00	Blk, Red	100	40	131	76	249	200	100, 250, 500 T-1000 (Convert-a-pak) U-500, U-1000 (UNREEL)	30.5, 76.2, 152.4 T-304.8 (Convert-a-pak)™ U-152.4, U-304 8 (UNREEL)
		Solid tinned copper drain wire															
	8451•†	22 (7x30) [.76]	.008	.20	.020	.51	.135	3.43	Blk, Red	100	34	111	67	220	200	100, 250, 500 T-1000 (Convert-a-pak) U-500, U-1000 (UNREEL)	30.5, 76.2, 152.4 T-304.8 (Convert-a-pak) U-152.4, U-304.8 (UNREEL)
	9451•	22 (7x30) [.76]	.008	.20	.020	.51	.135	3.43	Blk, Red	100	34	111	67	220	200	500 T-1000 (Convert-a-pak) U-500 (UNREEL)	152.4 T-304.8 (Convert-a-pak) U-152.4 (UNREEL)
		The jacket and shield on 9451 are bonded so both can be removed on automatic stripping equipment.															

Tinned copper, polypropylene insulated, twisted pair, stranded tinned copper drain wire (8450 has solid copper drain wire). BELDFOIL aluminum-polyester shield, paper wrap, 8450 and 8451 BLACK or GRAY vinyl jacket, 9451 GRAY vinyl jacket.

Belden's Miniature Type Broadcast Audio and Instrumentation Cables occupy ½ to ⅔ less space than standard cables. The BELDFOIL shield combines high cable reliability with ease of termination.

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per-cent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m		ft.	m
BELDFOIL	**9452**	24 (19x36) [.64]	.008	.20	.020	.51	.135	3.43	Blk, Red	100	30	98	58	190	200	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Tinned copper, polypropylene insulated, twisted pair, noise reducing tape, 24 AWG stranded tinned copper drain wire, BELDFOIL aluminum-polyester shield, BLACK vinyl jacket. *Balanced pair instrumentation cable featuring short lay cabling to minimize pick-up of electro-magnetic interference and special conductive textile tape to minimize microphonic noise.*															
 **BELDFOIL**	**8641•** UL LISTED **2092**	24 (7x32) [.61]	.015	.38	.025	.64	.164	4.17	Blk, Clear	100	22	72	42	138	350	100, 500, 1000, 2000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2092) 300 Volts															
	8761• UL LISTED **2092**	22 (7x30) [.76]	.015	.38	.025	.54	.171	4.17	Blk, Clear	100	24	79	47	154	350	500, 1000, 2000 U-500, U-1000 (UNREEL)	152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2092) 300 Volts															

Tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire (24 AWG for 8641 and 22 AWG for 8671), chrome vinyl jacket.
The BELDFOIL shield combines high cable reliability with ease of termination.

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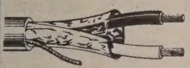
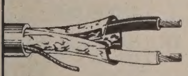
*★New Item. *Capacitance between conductors.*
***Capacitance between 1 conductor and other conductor connected to shield.*
•Belden U.S. Patent 3,032,604. †Passes the FR-1 vertical flame test.

ELECTRONIC DIVISION/BELDEN CORPORATION, P.O. BOX 1331, RICHMOND, IN 47374 (317) 966-6661

© 1967, 1970, 1973, 1976 BELDEN CORPORATION

shielded sound and broadcast audio cables | BELDEN

TWO CONDUCTOR SHIELDED CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Percent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m		ft.	m
 **BELDFOIL®**	**8762•** UL LISTED **2092**	20 (7x28) [.97]	.015	.38	.028	.71	.200	5.08	Blk, Clear	100	27	89	49	161	350	100, 250, 500, 1000, 2000 U-500, U-1000 (UNREEL)	30.5, 76.2 152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2092) 300 Volts															
	8760• UL LISTED **2092**	18 (16x30) [1.17]	.018	.46	.028	.71	.222	2.64	Blk, Clear	100	24	79	44	144	450	250, 500, 1000, 2000, U-500 U-1000 (UNREEL)	76.2, 152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2092) 300 Volts															
	8719 UL LISTED **2106**	16 (19x29) [1.42]	.030	.76	.030	.76	.292	7.42	Blk, Clear	100	24	79	47	154	600	500, 1000, 2000 U-500, U-1000 (UNREEL)	152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2106)															
	8720• UL LISTED **2106**	14 (19x27) [1.80]	.032	.81	.035	.89	.340	4.64	Blk, Clear	100	24	79	47	154	750	500, 1000, 2000 U-500 (UNREEL)	152.4, 304.8, 609.6 U-152.4 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2106) 600 Volts															
	8718• UL LISTED **2106**	12 (19x25) [2.29]	.037	.94	.040	1.02	.400	10.16	Blk, Clear	100	25	82	49	161	1000	500, 1000, 2000 U-500 (UNREEL)	152.4, 304.8, 609.6 U-152.4 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2106) 600 Volts															
		Tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire (20 AWG for 8760 and 8762, 18 AWG for 8719, 16 AWG for 8720, and 14 AWG for 8718), chrome vinyl jacket. *The BELDFOIL shield combines high cable reliability with ease of termination.*															
 **BELDFOIL**	**9154•** UL LISTED **2464**	20 (7x28) [.97]	.012	.30	.031	.79	.194	4.93	Blk, Red	100	60	197	100	328	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) *Tinned Copper, vinyl insulated, twisted pair, BELDFOIL aluminum-polyester shield, 22 AWG stranded tinned copper drain wire, beige vinyl jacket.*															
 BELDFOIL High Temperature△	**83394†** **TEFLON**	22 (7x30) [.76]	.015	.38	.030	.76	.204	5.18	Blk, Wht	100	22	72	42	138	1000 DC	25, 100, 500	7.6, 30.5, 152.4
		Tinned copper, insulated with FEP TEFLON■, twisted pair, noise reducing tape, 22 AWG (7x30) nickel coated copper drain wire, special BELDFOIL shield, red Silicone rubber jacket. +150°C maximum, −70°C minimum operating temperature. *Jacket working voltage: 1000V DC, shield to ground.*															
	83393 **TEFLON**	20 (7x28) [.97]	.020	.51	.030	.76	.245	6.22	Blk, Red	100	22	72	42	138	1000 DC	25, 100, 500	7.6, 30.5, 152.4
		Tinned copper, insulated with FEP TEFLON, twisted pair, noise reducing tape, 20 AWG (10x30) nickel coated copper drain wire, special BELDFOIL shield, yellow Silicone rubber jacket. +150°C maximum, −70°C minimum operating temperature. *Jacket working voltage: 1000V DC, shield to ground.*															

**Capacitance between conductors*
***Capacitance between 1 conductor and other conductor connected to shield.*
•Belden U.S. Patent 3,032,604
†Passes the FR-1 vertical flame test
■Trademark of DuPont
△ For additional high temperature shielded cables see pages 9, 10 & 11.

BELDEN | shielded instrumentation cables

INSTRUMENTATION CABLES

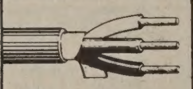
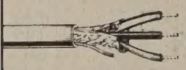
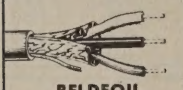
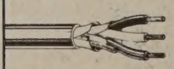
Instrumentation cable provides the vital communications link between sensing devices and read-out equipment. Because of the many and diverse conditions of environment and stress under which instrumentation cables must transmit information—in usable form, without distortion or change—cable characteristics should always be carefully matched with the specific requirements of the particular application.

The scientific medical and industrial uses of instrumentation cable are vast and ever growing. Some of the common uses for instrumentation cable are in the measurement of pressure, speed, resistance and temperature.

Belden manufactures a wide variety of precision instrumentation wire using several types of insulating materials, conductors and shields to meet a wide variety of electrical, physical and thermal requirements.

Many Belden Instrumentation Cables are unique in the field and have been engineered for specific application problems.

THREE CONDUCTOR SHIELDED CABLES

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Percent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m		ft.	m
	8791†	18 (7x26) [1.27]	.020	.51	.028	.71	.236	5.99	Blk, Red, Wht	78.2	47	149	84	267	450	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Tinned copper, vinyl insulated, conductors cabled, tinned copper spiral wrapped shield, chrome vinyl jacket.															
 BELDFOIL®	9770•†	22 (7x30) [.79]	.008	.20	.020	.51	.145	3.68	Blk, Red, Wht	100	32	102	60	191	200	250, 500, 1000 U-500, U-1000 (UNREEL)	76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Tinned copper, polypropylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 22 AWG stranded tinned copper drain wire, brown vinyl jacket.															
 BELDFOIL	8771• UL LISTED 2093	22 (7x30) [.79]	.015	.38	.025	.64	.179	4.55	Blk, Red, Clear	100	23	75	41	134	350	250, 500, 1000 U-500, U-1000 (UNREEL)	76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2093) 300 Volts															
	8772• UL LISTED 2093	20 (7x28) [.97]	.015	.38	.028	.71	.204	5.18	Blk, Red, Clear	100	27	89	51	167	350	500, 1000 U-500, U-1000	152.4, 304.8 U-152.4, U-304.8
		Underwriters Laboratories Inc. Listed (Style 2093) 300 Volts															
	8770• UL LISTED 2093	18 (16x30) [1.19]	.018	.46	.018	.46	.236	5.99	Blk, Red, Clear	100	24	79	48	157	450	500, 1000 U-500, U-1000	152.4, 304.8 U-152.4, U-304.8
		Underwriters Laboratories Inc. Listed (Style 2093) 300 Volts															
	8618• UL LISTED 2107	16 (19x29) [1.42]	.030	.76	.030	.76	.310	7.87	Blk, Red, Clear	100	26	85	50	164	600	500, 1000 U-500 (UNREEL)	152.4, 304.8 U-152.4 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2107)															
		Tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire (22 AWG for 8771, 20 AWG for 8770 and 8772, and 18 AWG for 8618), CHROME vinyl jacket. (8772 BEIGE or CHROME).															
 High Temperature TEFLON and Silicone△	83395†	22 (7x30) [.79]	.015	.38	.030	.76	.213	5.41	Blk, Red, Wht	100	20	66	35	115	1000 DC	25, 100, 500	7.6, 30.5, 152.4
		Tinned copper, insulated with FEP TEFLON, conductors cabled, noise reducing tape, 22 AWG (7x30) nickel coated copper drain wire, special BELDFOIL shield, red Silicone rubber jacket. + 150°C maximum, −70°C minimum operating temperature. Jacket working voltage: 1000V DC, shield to ground.															

For underground burial recommendations of all types of vinyl, polyethylene, Hypalon and neoprene jacketed cables, please write for Technical Data Bulletin T/8-6.

**Capacitance between conductors.*

***Capacitance between 1 conductor and other conductors connected to shield*

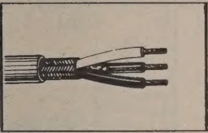
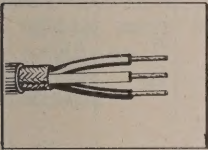
†Passes the FR-1 vertical flame test.

•Belden U.S. Patent 3,032,604.

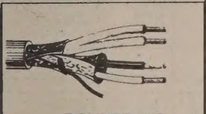
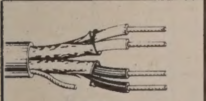
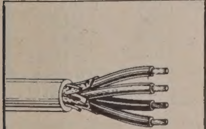
△ For additional high temperature shielded cables see pages 9, 10 & 11.

shielded instrumentation cables | BELDEN

THREE CONDUCTOR SHIELDED CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per-cent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m		ft.	m
 Tinned copper, polypropylene insulated, conductors cabled around textile strength member, tinned copper braid shield, chrome vinyl jacket. For other multi-conductor braid shielded cables see Belden pages 9 and 10.	**8643**	30 (7x38) [.30]	.005	.13	.010	.25	.086	2.18	Blk, Red, Wht	.95	25	82	43	141	200	100, 250	30.5, 76.2
 Underwriters Laboratories Inc. Listed (Style 2096) 300 Volts Tinned copper, vinyl insulated, conductors cabled, tinned copper braid shield, chrome vinyl jacket.	**8735†** UL LISTED **2096**	22 (7x30) [.79]	.015	.38	.025	.064	.199	5.15	Blk, Red, Wht	70	34	111	60	200	350	15, 50, 100, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 15.2, 30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®

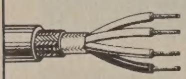
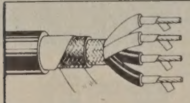
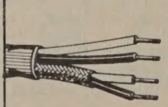
FOUR CONDUCTOR SHIELDED CABLES

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		°Nominal O.D.		Cond. Color Coding	Per cent Shield Coverage	Nominal* Capacitance				Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m		ft.	m
 **BELDFOIL®** Tinned conductor, polyethylene insulated, black and red conductors under BELDFOIL aluminum-polyester shield, stranded drain wire, green and clear conductors under over-all BELDFOIL aluminum-polyester shield, chrome vinyl jacket. Pairs cabled on common axis to reduce diameter. θ	**8434•**	4	25 (7x33) 3 copper 4 copper coated steel [.34]	.013	.33	.020	.51	.165	4.19	Red, Blk, Grn, Clear	100	25	82	40	131	400	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
 **BELDFOIL** Tinned copper, polypropylene insulated, black and red under a BELDFOIL aluminum-polyester shield, green and white under a BELDFOIL aluminum-polyester shield, 24 AWG stranded tinned copper common drain wire, chrome vinyl jacket. Pairs cabled on common axis to reduce diameter. θ	**8723•**	4 2 pair	22 (7x30) [.79]	.008	.20	.019	.48	.165	4.19	Red, Blk, Grn, Wht	100	35	115	62	203	400	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
 BELDFOIL Underwriters Laboratories Inc. Listed (Style 2717) Tinned copper, polypropylene inslulated, conductors cabled in pairs, each pair BELDFOIL aluminum-polyester shielded with 24 AWG stranded tinned copper drain wire, polyester film over each shield, overall BELDFOIL aluminum-polyester shield and 24 AWG stranded tinned copper drain wire; chrome vinyl jacket. Pairs cabled on common axis to reduce diameter. θ	**8728** UL LISTED **2717**	4 2 pair	22 (7x30) [.79]	.008	.20	.030	.76	.198	5.03	Red, Blk, Grn, Wht	100	35	115	62	203	400	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
 **BELDFOIL** Underwriters Laboratories Inc. Listed (Style 2493) Tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 3—23 AWG solid tinned copper coated steel and 1—25 AWG stranded tinned copper coated steel drain wires, white vinyl jacket. Belden U.S. Patent 3,673,315 and Belden Canadian Patent 875,187.	**8729•** UL LISTED **2493**	4	22 (19x34) [.76]	.015	.38	.050	1.27	.265	6.73	Red, Blk, Grn, Clear	100	22	72	42	138	600	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductors connected to shield.
†Passes the FR-1 vertical flame test.
•Belden U.S. Patent 3,032,604.
θRequest Technical Data Bulletin T/8-21 before planning high and low level circuits in the same cable.

BELDEN | shielded instrumentation, strain gauge and communication cable

FOUR CONDUCTOR SHIELDED CABLES (Cont'd)

Description	Trade & UL Style Number	No. of Cond.	(AWG Stranding) (Dia. in mm)	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per cent Shield Coverage	Nominal Capacitance				Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m		ft.	m
BELDFOIL® High Temperature TEFLON and Silicone △	**83396†**	4	22 (7x30) [.79]	.015	.38	.030	.76	.222	5.64	Red, Blk, Grn, Wht	100	20	66	35	115	1000 DC	25, 100, 500	7.6, 30.5, 152.4
		Tinned copper, insulated with FEP TEFLON, conductors cabled, noise reducing tape, 22 AWG (7 x 30) nickel coated copper drain wire, special BELDFOIL shield, red Silicone rubber jacket. +150°C maximum, −70°C minimum operating temperature. Jacket working voltage: 1000V DC, shield to ground.																
	**8404†** ⓊL LISTED **2094**	4	20 (26x34) [.94]	.015	.38	.033	.84	.248	6.30	Red, Blk, Grn, Clear	87	25	82	45	147	600	15, 100, 250, 500, 1000	4.6, 30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2094) 300 Volts *Tinned copper, polyethylene insulated, conductors cabled, rayon braid, tinned copper braid shield, chrome vinyl jacket.* *For other multi-conductor braid shielded cables see pages 9 & 10.*																
	8407†	4	16 (65x34) [1.47]	.032	.81	.043	1.09	.416	10.57	Red, Blk, Grn, Wht	85	30	98	55	180	600	100, 250	30.5, 76.2
		Tinned copper, separator, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black neoprene jacket. *For other multi-conductor braid shielded cables see pages 9 & 10.*																
	**8424**	4	20 (26x34) [.94]	.020	.51	.040	1.02	.290	7.37	Red, Blk, Grn, Wht	85	35	115	60	197	600	50, 100, 250, 500, 1000	15.2, 30.5, 76.2, 152.4, 304.8
		Tinned copper, cotton wrap, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black rubber jacket. *For other multi-conductor braid shielded cables see pages 9 & 10.*																
BELDFOIL	**9155•** ⓊL LISTED **2094**	2 shielded	20 (7x28) [.97]	.018	.46	.031	.79	.256	6.50	Blk, Red, Grn, Wht	100	22	72	40	131	300	500, 1000	152.4, 304.8
		2 unshielded	18 (16x30) [1.19]	.018	.46													
		Underwriters Laboratories Inc. Listed (Style 2094) *Tinned copper, polyethylene insulated, BELDFOIL aluminum-polyester shield over 20 AWG twisted pair, 22 AWG stranded tinned copper drain wire, beige vinyl jacket.*																
	8724•†()	2 shielded	22 (7x30) [.79]	.008	.20	.019	.48	.165	4.19	Red, Blk, Grn, Wht	100	34	111	67	220	200	250, 500, 1000 U-500, U-1000 (UNREEL)	76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		2 unshielded	22 (7x30) [.79]	.008	.20													
	8722•†	2 shielded	20 (7x28) [.97]	.015	.38	.028	.71	.230	5.84	Red, Blk, Grn, Wht	100	60	197	99	324	350	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		2 unshielded	20 (7x28) [.97]	.015	.38													
		Tinned copper, 8722 vinyl insulated 8724 polypropylene insulated, BELDFOIL aluminum-polyester shield over 2 conductors, stranded tinned copper drain wire (22 AWG for 8722 and 24 AWG for 8724), 8724 CHROME, 8722 CHROME or WHITE vinyl jacket. Pairs cabled on common axis to reduce diameter. ().																
	**8732** ⓊL LISTED **2094**	2 shielded	22 (7x30) [.76]	.015	.38	.030	.76	.188 x .296	4.78 x 7.52	Blk, Clear	62	21	69	37	121	350	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		2 unshielded	22 (7x30) [.76]	.015	.38					Blk, Clear								
		Underwriters Laboratories Inc. Listed (Style 2094) 300 Volts *Tinned copper, polyethylene insulated, conductors cabled, tinned copper braid shield over 1 pair, chrome vinyl jacket.*																

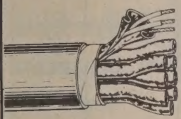
**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductor connected to shield.*
†Passes the FR-1 vertical flame test.
•Belden U.S. Patent 3,032,604.

△ For additional high temperature shielded cables see pages 9, 10 & 11.
()Request Technical Data Bulletin T/8-21 before planning high and low level circuits in same cable.

shielded paired audio, sound and data cables | BELDEN

MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND SOUND CABLES

22 GAGE

Description	Trade & UL Style Number	No. of Pairs	AWG (stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance *pF/ft.	Nominal Capacitance *pF/m	Nominal Capacitance **pF/ft.	Nominal Capacitance **pF/m	Standard Lengths ft.	Standard Lengths m
 **22 GAGE VINYL INSULATION** **BELDFOIL®**	**8767•†** UL LISTED **2464**	3	22 (Solid) [.64]	.013	.33	.037	.94	.279	7.09	40	131	77	252	100, 500, 1000	30.5 152.4 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)													
	8768•† UL LISTED **2464**	6	22 (Solid) [.64]	.013	.33	.037	.94	.394	10.01	40	131	77	252	100, 500, 1000	30.5, 152.4 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)													
	8764•† UL LISTED **2464**	9	22 (Solid) [.64]	.013	.33	.040	1.02	.440	11.18	40	131	77	252	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)													
	8765•† UL LISTED **2464**	11	22 (Solid) [.64]	.013	.33	.040	1.02	.485	12.32	40	131	77	252	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)													
	8766•† UL LISTED **2464**	15	22 (Solid) [.64]	.013	.33	.045	1.14	.540	13.72	40	131	77	252	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)													

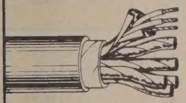
22 AWG Tinned copper, vinyl insulated, twisted pairs, each pair and its drain wire under BELDFOIL aluminum-polyester shield, overall chrome vinyl jacket. 300 Volts suggested working voltage.

Insulation resistance between shields. 100 megohms/M'nom. Capacitance between adjacent shields. 115 pF/ft. nom. Voltage breakdown between adjacent shields. 1500 volts nom. Working voltage between adjacent shields. 50 volts max.

Vinyl insulation is used for ease of stripping and soldering. Recommended for audio frequency applications requiring excellent circuit isolation.

MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND DATA CABLES

22 GAGE

Description	Trade & UL Style Number	No. of Pairs	AWG (stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance *pF/ft.	Nominal Capacitance *pF/m	Nominal Capacitance **pF/ft.	Nominal Capacitance **pF/m	Standard Lengths ft.	Standard Lengths m
 **22 GAGE POLYPROPYLENE INSULATION** **BELDFOIL**	**8777•†** UL LISTED **2493**	3	22 (7x30) [.76]	.010	.25	.045	1.14	.295	7.49	30	78	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	8778•† UL LISTED **2493**	6	22 (7x30) [.76]	.010	.25	.045	1.14	.410	10.41	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	8774•† UL LISTED **2493**	9	22 (7x30) [.76]	.010	.25	.045	1.14	.450	11.43	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													

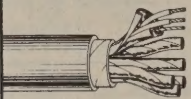
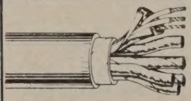
See construction data on Belden page 8.

Recommended for audio, pulse and radio frequency applications requiring superior circuit isolation. Polypropylene insulation is used for excellent high frequency properties and mechanical toughness.

**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductor connected to shield.*
†Passes the FR-1 vertical flame test.
•Belden U.S. Patent 3,032,604.

BELDEN | shielded paired audio, sound and data cables

MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND DATA CABLES (Cont'd)

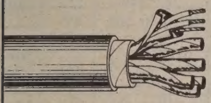
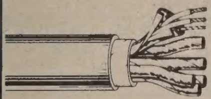
Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding), [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm	*pF/ ft.	*pF/ m	**pF/ ft.	**pF/ m	ft.	m
			22 GAGE (Cont'd.)												
 **22 GAGE POLYPROPYLENE INSULATION** **BELDFOIL®**	**8775•†** UL LISTED **2493**	11	22 (7x30) [.76]	.010	.25	.045	1.14	.495	12.57	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	9768•† UL LISTED **2493**	12	22 (7x30) [.76]	.010	.25	.045	1.14	.495	12.57	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	8776•† UL LISTED **2493**	15	22 (7x30) [.76]	.010	.25	.060	1.52	.570	14.48	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	9769•† UL LISTED **2493**	17	22 (7x30) [.76]	.010	.25	.060	1.52	.620	15.75	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	8769•† UL LISTED **2493**	19	22 (7x30) [.76]	.010	.25	.060	1.52	.630	16.00	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	8773•† UL LISTED **2493**	27	22 (7x30) [.76]	.010	.25	.070	1.78	.760	19.30	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriter Laboratories Inc. Listed (Style 2493) *250, 500 & 1000 ft. lengths +20% −0 length tolerance.*												
			20 GAGE												
 **20 GAGE POLYPROPYLENE INSULATION** **BELDFOIL**	**9873•†** UL LISTED **2493**	3	20 (10x30) [.94]	.013	.33	.045	1.14	.350	8.89	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	9874•† UL LISTED **2493**	6	20 (10x30) [.94]	.013	.33	.045	1.14	.480	12.19	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	9875•† UL LISTED **2493**	9	20 (10x30) [.94]	.013	.33	.060	1.52	.560	14.22	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												
	9876•† UL LISTED **2493**	11	20 (10x30) [.94]	.013	.33	.060	1.52	.585	14.86	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 512.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2493)												

See construction data on Belden page 8.

**Capacitance between conductors. **Capacitance between 1 conductor and other conductor connected to shield. †Passes the FR-1 vertical flame test.*
•Belden U.S. Patent 3,032,604.

shielded paired audio, sound and data cables | BELDEN

MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND DATA CABLES (Cont'd)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance *pF/ft.	Nominal Capacitance *pF/m	Nominal Capacitance **pF/ft.	Nominal Capacitance **pF/m	Standard Lengths ft.	Standard Lengths m
			20 GAGE (Cont'd)												
	9877•† UL LISTED 2493	12	20 (10x30) [.94]	.013	.33	.060	1.52	.605	15.40	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
20 GAGE POLYPROPYLENE INSULATION BELDFOIL®	9878•† UL LISTED 2493	13	20 (10x30) [.94]	.013	.33	.060	1.52	.620	15.75	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	9879•† UL LISTED 2493	15	20 (10x30) [.94]	.013	.33	.060	1.52	.660	16.76	30	98	55	180	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
			18 GAGE												
	9773•† UL LISTED 2493	3	18 (16x30) [1.19]	.016	.41	.045	1.14	.392	9.96	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
18 GAGE POLYPROPYLENE INSULATION BELDFOIL	9774•† UL LISTED 2493	6	18 (16x30) [1.19]	.016	.41	.060	1.52	.575	14.61	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	9775•† UL LISTED 2493	9	18 (16x30) [1.19]	.016	.41	.060	1.52	.630	16.00	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	9776•† UL LISTED 2493	12	18 (16x30) [1.19]	.016	.41	.070	1.78	.765	19.43	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													
	9777•† UL LISTED 2493	15	18 (16x30) [1.19]	.016	.41	.070	1.78	.830	21.08	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2493)													

Tinned copper, polypropylene insulated, twisted pairs, each pair and its stranded tinned copper drain wire (22 AWG on 22 AWG and 20 AWG series, 20 AWG on 18 AWG series) under BELDFOIL aluminum-polyester shield, overall chrome vinyl jacket. 300 volts suggested working voltage for 22 AWG; 350 volts for 20 AWG, 400 volts for 18 AWG; Color code chart on page 39.

Insulation resistance between shields. 100 megohms/M' nom. Capacitance between adjacent shields. 115 pF/ft. nom. Voltage breakdown between adjacent shields. 1500 volts nom. Working voltage between adjacent shields. 50 volts max. UL voltage rating not specified.

Recommended for audio, pulse and radio frequency applications requiring superior circuit isolation. Polypropylene insulation is used for excellent high frequency properties and mechanical toughness.

†Passes the FR-1 vertical flame test. *•Belden U.S. Patent 3,032,604.*

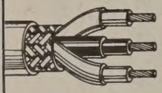
**Capacitance between conductors.* ***Capacitance between 1 conductor and other conductor connected to shield.*

BELDEN

multi-conductor shielded cables and high temperature shielded cables

MULTI-CONDUCTOR SHIELDED CABLES

MIL-W-16878-TYPE B SHIELDED CABLES

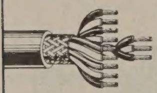
Description	Trade & UL Style Number	No. of Cond.	AWG (Strand-ing) [Dia. in mm]	Insulation Thickness		Nominal Nylon Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Cod-ing	Per cent Shield Cover-age	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m	ft.	m
	★9966†	2	22 (19x34) [.79]	.010	.25	.003	.08	.020	.51	.176	4.47	Wht, Blk	91	49	161	87	285	100, 500, 1000	30.5, 152.4, 304.8
	9962†	2	20 (19x32) [.94]	.010	.25	.003	.08	.020	.51	.192	4.88	Wht, Blk	92	55	180	95	312	100, 500, 1000	30.5, 152.4, 304.8
	9952†	2	16 (19x29) [1.42]	.010	.25	.003	.08	.025	.64	.238	6.05	Wht, Blk	92	70	230	120	394	100, 500, 1000	30.5, 152.4, 304.8
	★9967†	3	22 (19x34) [.79]	.010	.25	.003	.08	.020	.51	.184	4.67	Wht, Blk, Rd	91	49	161	817	285	100, 500, 1000	30.5, 152.4, 304.8
	9963†	3	20 (19x32) [.94]	.010	.25	.003	.08	.020	.51	.202	5.13	Wht, Blk, Red	91	55	180	95	312	100, 500, 1000	30.5, 152.4, 304.8
	9953†	3	16 (19x29) [1.42]	.010	.25	.003	.08	.025	.64	.250	6.35	Wht, Blk, Red	91	70	230	120	394	100, 500, 1000	30.5, 152.4, 304.8
	★9968†	4	22 (19x34) [.79]	.010	.25	.003	.08	.020	.51	.200	5.08	Wht, Blk, Rd, Grn	90	49	161	817	285	100, 500, 1000	30.5, 152.4, 304.8
	9964†	4	20 (19x32) [.94]	.010	.25	.003	.08	.020	.51	.212	5.38	Wht, Blk, Red, Grn	92	55	80	95	312	100, 500, 1000	30.48, 152.40, 304.80
	9954†	4	16 (19x29) [1.42]	.010	.25	.003	.08	.023	.58	.270	6.86	Wht, Blk, Red, Grn	91	70	230	120	394	100, 500, 1000	30.5, 152.4, 304.8

Stranded tinned copper, vinyl insulated, clear nylon jacket, conductors cabled, tinned copper braid shield, white vinyl jacket.

Suggested working voltage—600 volts

SHIELDED CONTROL CABLE

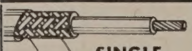
Recommended for applications where remote switching of video camera function is required.

	9260† UL LISTED 2464	6	6-20 (7x28) [.96]	.016	.41	—	—	.032	.81	.305	7.75	Grey	83	35	115	—	—	50, 100, 500, 1000	15.2, 30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts																	
	9261† UL LISTED 2464	12	12-20 (7x28) [.96]	.016	.41	—	—	.040	1.02	.410	10.44	Grey	81	35	115	—	—	50, 100, 500, 1000	15.2, 30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts																	

Tinned copper conductors, vinyl insulated, color coded, overall tinned copper braid shield, gray vinyl jacket.

SINGLE AND MULTIPLE CONDUCTOR CABLE INSULATED WITH TEFLON

MIL-W-16878 TYPE E SHIELDED CABLES

Description	Trade & UL Style Number	AWG (Strand-ing) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Cod-ing	Per cent Shield Cover-age	Nominal Capacitance				Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m	ft.	m
 **SINGLE CONDUCTOR**	83301†	30 (7x38) [.30]	.010	.25	.010	.25	.070	1.78	Wht	90	—	—	30	98	100, 500, 1000	30.5, 152.4, 304.8
	83302†	28 (7x36) [.38]	.010	.25	.010	.25	.073	1.85	Wht	90	—	—	35	115	100, 500, 1000	30.5, 152.4, 304.8

Stranded silver coated copper conductors. insulated with Type E extruded TFE TEFLON. color coded, cabled. braided silver plated copper shield. white TFE TEFLON tape wrapped jacket. MIL-SPEC: MIL-W-16878 Type E. TEMPERATURE RATING:—65°C to 200°C. VOLTAGE: 600 Volts (RMS). Manufactured to Current Specifications and Subsequent Revisions.

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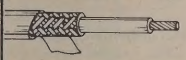
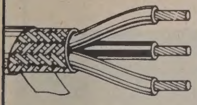
*★New Item *Capacitance between conductors. **Capacitance between 1 conductor and other conductor connected to shield. †Passes the FR-1 vertical flame test.*

ELECTRONIC DIVISION/BELDEN CORPORATION, P.O. BOX 1331, RICHMOND, IN 47374 (317) 966-6661

MULTIPLE CONDUCTOR CABLE INSULATED WITH TEFLON (Cont'd.)

MIL-W-16878 TYPE E SHIELDED CABLES

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per cent Shield Coverage	Nominal Capacitance				Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ ft.	* pF/ m	** pF/ ft.	** pF/ m	ft.	m
 **SINGLE CONDUCTOR**	**83303†**	26 (7x34) [.48]	.010	.25	.010	.25	.077	1.96	Wht	90	—	—	40	131	100, 500, 1000	30.5, 152.4, 304.8
	83304†	24 (19x36) [.64]	.010	.25	.010	.25	.082	2.04	Wht	90	—	—	51	167	100, 500, 1000	30.5, 152.4, 304.8
	83305†	22 (19x34) [.79]	.010	.25	.010	.25	.089	2.26	Wht	90	—	—	60	197	100, 500, 1000	30.5, 152.4, 304.8
	83306†	20 (19x32) [.94]	.010	.25	.010	.25	.100	2.54	Wht	90	—	—	67	220	100, 500, 1000	30.5, 152.4, 304.8
	83307†	18 (19x30) [1.17]	.010	.25	.010	.25	.113	2.87	Wht	90	—	—	75	246	100, 500, 1000	30.5, 152.4, 304.8
	83308†	16 (19x29) [1.42]	.011	.28	.012	.30	.123	3.12	Wht	90	—	—	89	292	100, 500, 1000	30.5, 152.4, 304.8
TWO CONDUCTOR	**83315†**	30 (7x38) [.30]	.010	.25	.010	.25	.106	2.69	Wht, Blk	90	15	49	27	89	100, 500, 1000	30.5, 152.4, 304.8
	83316†	28 (7x36) [.38]	.010	.25	.010	.25	.112	2.84	Wht, Blk	90	18	59	32	105	100, 500, 1000	30.5, 152.4, 304.8
	83317†	26 (7x34) [.48]	.010	.25	.010	.25	.120	3.05	Wht, Blk	90	20	66	36	118	100, 500, 1000	30.5, 152.4, 304.8
	83318†	24 (19x36) [.64]	.010	.25	.010	.25	.132	3.35	Wht, Blk	90	22	72	40	131	100, 500, 1000	30.5, 152.4, 304.8
	83319†	22 (19x34) [.79]	.010	.25	.010	.25	.144	3.66	Wht, Blk	90	26	85	46	151	100, 500, 1000	30.5, 152.4, 304.8
	83320†	20 (19x32) [.94]	.010	.25	.012	.30	.162	4.11	Wht, Blk	90	28	92	52	170	100, 500, 1000	30.5, 152.4, 304.8
	83321†	18 (19x30) [1.17]	.010	.25	.012	.30	.188	4.78	Wht, Blk	90	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
	83322†	16 (19x29) [1.42]	.011	.28	.012	.30	.200	5.08	Wht, Blk	90	33	128	59	193	100, 500, 1000	30.5, 152.4, 304.8
 **THREE CONDUCTOR**	**83330†**	30 (7x38) [.30]	.010	.25	.010	.25	.111	2.82	Wht, Blk, Red	90	14	46	25	82	100, 500, 1000	30.5, 152.4, 304.8
	83331†	28 (7x36) [.38]	.010	.25	.010	.25	.117	2.97	Wht, Blk, Red	90	17	56	30	98	100, 500, 1000	30.5, 152.4, 304.8
	83332†	26 (7x34) [.48]	.010	.25	.010	.25	.126	3.20	Wht, Blk, Red	90	19	62	33	108	100, 500, 1000	30.5, 152.4, 304.8
	83333†	24 (19x36) [.64]	.010	.25	.010	.25	.136	3.45	Wht, Blk, Red	90	22	72	38	124	100, 500, 1000	30.5, 152.4, 304.8
	83334†	22 (19x34) [.79]	.010	.25	.012	.30	.156	3.96	Wht, Blk, Red	90	24	79	41	134	100, 500, 1000	30.5, 152.4, 304.8

Stranded silver coated copper conductors, insulated with Type E extruded TFE TEFLON, color coded, cabled, braided silver plated copper shield, white TFE TEFLON tape wrapped jacket. MIL-SPEC: MIL-W-16878 Type E. TEMPERATURE RATING:—65°C to 200°C. VOLTAGE: 600 Volts (RMS). Manufactured to Current Specifications and Subsequent Revisions.

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*Capacitance between conductors.

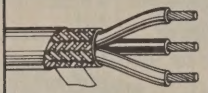
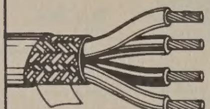
**Capacitance between 1 conductor and other conductor connected to shield. †Passes the FR-1 vertical flame test.

BELDEN

high temperature shielded cables, shielded and unshielded paired sound and control cables

MULTIPLE CONDUCTOR CABLE INSULATED WITH TEFLON (Cont'd.)

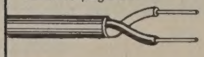
MIL-W-16878 TYPE E SHIELDED CABLES

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per cent Shield Coverage	Nominal Capacitance				Standard Lengths	
			Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **THREE CONDUCTOR**	**83335†**	20 (19x32) [.94]	.010	.25	.012	.30	.175	4.45	Wht, Blk, Red	90	27	89	45	147	100, 500, 1000	30.5, 152.4, 304.8
	83336†	18 (19x30) [1.17]	.010	.25	.012	.30	.196	4.98	Wht, Blk, Red	90	28	92	52	170	100, 500, 1000	30.5, 152.4, 304.8
	83337†	16 (19x29) [1.42]	.011	.28	.012	.30	.218	5.54	Wht, Blk, Red	90	30	98	56	184	100, 500, 1000	30.5, 152.4, 304.8
 **FOUR CONDUCTOR**	**83345†**	30 (7x38) [.30]	.010	.25	.010	.25	.119	3.02	Wht, Blk, Red, Grn	90	13	43	24	79	100, 500, 1000	30.5, 152.4, 304.8
	83346†	28 (7x36) [.38]	.010	.25	.010	.25	.126	3.20	Wht, Blk, Red, Grn	90	16	53	28	92	100, 500, 1000	30.5, 152.4, 304.8
	83347†	26 (7x34) [.48]	.010	.25	.010	.25	.135	3.43	Wht, Blk, Red, Grn	90	18	59	32	105	100, 500, 1000	30.5, 152.4, 304.8
	83348†	24 (19x36) [.64]	.010	.25	.012	.30	.151	3.84	Wht, Blk, Red, Grn	90	20	66	36	118	100, 500, 1000	30.5, 152.4, 304.8
	83349†	22 (19x34) [.79]	.010	.25	.012	.30	.166	4.22	Wht, Blk, Red, Grn	90	23	75	40	131	100, 500, 1000	30, 48, 152.40, 304.80
	83350†	20 (19x32) [.94]	.010	.25	.012	.30	.185	4.70	Wht, Blk, Red, Grn	90	25	82	44	144	100, 500, 1000	30.5, 152.4, 304.8
	83351†	18 (19x30) [1.17]	.010	.25	.012	.30	.215	5.46	Wht, Blk, Red, Grn	90	27	89	50	164	100, 500, 1000	30.5, 152.4, 304.8
	83352†	16 (19x29) [1.42]	.011	.28	.014	.36	.235	5.97	Wht, Blk, Red, Grn	90	29	95	54	117	100, 500, 1000	30.5, 152.4, 304.8

Stranded silver coated copper conductors, insulated with Type E extruded TFE TEFLON, color coded, cabled, braided silver plated copper shield, white TFE TEFLON tape wrapped jacket. MIL-SPEC: MIL-W-16878 Type E. TEMPERATURE RATING:—65°C to 200°C. VOLTAGE: 600 Volts (RMS). Manufactured to Current Specifications and Subsequent Revisions.

MULTIPLE PAIR UNSHIELDED SOUND AND CONTROL CABLES

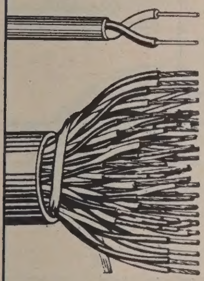
TYPICAL APPLICATION: Balanced line sound systems. Made with 80°C vinyl plastic compounds for high dielectric strength and the best physical properties, such as free stripping, small diameter and tear resistance. It also resists the effects of water, sun, oil, grease and ozone. The conductors are paired with a short-lay twist for conductor balance, providing a quiet circuit, minimizing cross talk

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm		ft.	m
		22 SOLID										
ALL CONSTRUCTIONS: *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket. For color coding please refer to page 39.* 	**8740†** UL LISTED **Wires, Misc.**	1	22 (Solid) [.64]	.015	.38	.025	.64	.150	.381	300	100, T-500, and T-1000 (Convert-a-pak) U-500, U-1000 (UNREEL)	30.5, T-152.4, and T-304.8 (Convert-a-pak) U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Wires misc.) 90 V max.										
	8741† UL LISTED **2464**	2	22 (Solid) [.64]	.015	.38	.030	.76	.205	5.21	300	100, 1000, T-500 (Convert-a-pak) U-500, U-1000 (UNREEL)	30.5, 304.8, T-152.4 (Convert-a-pak) U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)										

*For color coding please refer to page 39. *Capacitance between 1 conductor and other conductors connected to shield. *Capacitance between conductors. †Passes the FR-1 vertical flame test.*

MULTIPLE PAIR UNSHIELDED SOUND AND CONTROL CABLES (Cont'd.)

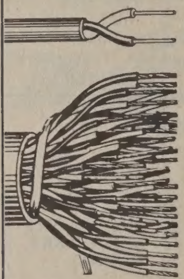
22 SOLID (Cont'd.)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm		ft.	m
ALL CONSTRUCTIONS: *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket.* *For color coding please refer to page 39.* 	**8742**† UL LISTED **2464**	3	22 (Solid) [.64]	.015	.38	.030	.76	.240	6.10	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)										
	8757† UL LISTED **2464**	4	22 (Solid) [.64]	.015	.38	.030	.76	.255	6.48	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)										
	9158† UL LISTED **2464**	5	22 (Solid) [.64]	.012	.30	.040	1.02	.298	7.57	300	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)										
	8743† UL LISTED **Wires, Misc.**	6	22 (Solid) [.64]	.010	.25	.035	.89	.305	7.75	200	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	9160† UL LISTED **2464**	8	22 (Solid) [.64]	.012	.30	.040	1.02	.336	8.53	300	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)										
	8744† UL LISTED **Wires, Misc.**	9	22 (Solid) [.64]	.010	.25	.037	.94	.354	8.99	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	8753† UL LISTED **Wires, Misc.**	11	22 (Solid) [.64]	.010	.25	.037	.94	.384	9.75	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	8754† UL LISTED **Wires, Misc.**	13	22 (Solid) [.64]	.010	.25	.037	.94	.409	10.39	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	8745† UL LISTED **Wires, Misc.**	15	22 (Solid) [.64]	.010	.25	.040	1.02	.420	10.67	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	8755† UL LISTED **Wires, Misc.**	19	22 (Solid) [.64]	.010	.25	.040	1.02	.445	11.30	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										

†Passes the FR-1 vertical flame test.

BELDEN | unshielded paired sound and control cables

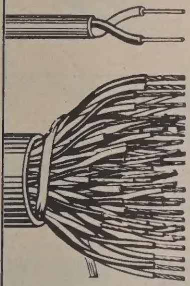
MULTIPLE PAIR UNSHIELDED SOUND AND CONTROL CABLES (Cont'd.)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Sugg. Working Voltage	Standard Lengths ft.	Standard Lengths m
		22 SOLID (Cont'd.)										
ALL CONSTRUCTIONS: *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket.* *For color coding please refer to page 39.*	**8756†** UL LISTED **Wires, Misc.**	23	22 (Solid) [.64]	.010	.25	.040	1.02	.510	12.95	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max.										
	**8746†** UL LISTED **Wires, Misc.**	27	22 (Solid) [.64]	.010	.25	.045	1.14	.550	13.97	200	250, 500, 1000, 2000	76.2, 152.4, 304.8, 609.6
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90 V Max. All lengths +20% −0 Length Tolerance										
		22 STRANDED										
	9744† UL LISTED **2464**	2	22 (7x30) [.76]	.015	.38	.030	.76	.234	5.94	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)										
	9745† UL LISTED **2464**	3	22 (7x30) [.76]	.015	.38	.030	.76	.280	7.11	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)										
	9746† UL LISTED **2464**	4	22 (7x30) [.76]	.015	.38	.030	.76	.295	7.49	300	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)										
	8747† UL LISTED **2576**	6	22 (7x30) [.76]	.010	.25	.035	.89	.320	8.13	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										
	8748† UL LISTED **2576**	9	22 (7x30) [.76]	.010	.25	.037	.94	.389	9.88	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										
	9747† UL LISTED **2576**	12	22 (7x30) [.76]	.010	.25	.040	1.02	.440	11.18	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										
	8749† UL LISTED **2576**	15	22 (7x30) [.76]	.010	.25	.040	1.02	.455	11.56	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										
	9748† UL LISTED **2576**	19	22 (7x30) [.76]	.010	.25	.040	1.02	.520	13.21	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										

†Passes the FR-1 vertical flame test.

unshielded paired sound and control cables | BELDEN

MULTIPLE PAIR UNSHIELDED SOUND AND CONTROL CABLES (Cont'd.)

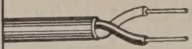
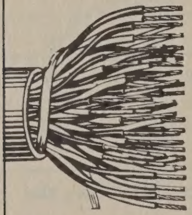
Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm		ft.	m
		22 STRANDED (Cont'd.)										
ALL CONSTRUCTIONS: *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. For color coding please refer to page 39.* 	**9749†**	23	22 (7x30) [.76]	.010	.25	.045	1.14	.570	14.48	200	500, 1000	152.4, 304.8
	UL LISTED 2576	Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts										
	8750†	27	22 (7x30) [.76]	.010	.25	.045	1.14	.595	15.11	200	250, 500, 1000, 2000	76.2, 152.4, 304.8, 609.6
	UL LISTED 2576	Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts All lengths +20% −0 Length Tolerance										
		20 STRANDED										
	9750	3	20 (10x30) [.94]	.012	.30	.040	1.02	.301	7.65	300	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										
	9751	6	20 (10x30) [.94]	.012	.30	.040	1.02	.370	9.40	300	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										
	9752	9	20 (10x30) [.94]	.012	.30	.040	1.02	.447	11.35	300	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										
	9755	15	20 (10x30) [.94]	.012	.30	.040	1.02	.535	13.59	300	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										
		18 STRANDED										
	9740†	1	18 (16x30) [1.19]	.018	.46	.030	.76	.220	5.59	400	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9156	2	18 (16x30) [1.19]	.012	.30	.035	.89	.282	7.16	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										
	8690†	3	18 (16x30) [1.19]	.018	.46	.037	.94	.362	9.19	400	100, 500, 1000 U-500 (UNREEL)	30.5, 152.4, 304.8 U-152.4 (UNREEL)
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9157	4	18 (16x30) [1.19]	.012	.30	.040	1.02	.353	8.97	300	500, 1000	152.4, 304.8
	UL LISTED 2464	Underwriters Laboratories Inc. Listed (Style 2464)										

†Passes the FR-1 vertical flame test.

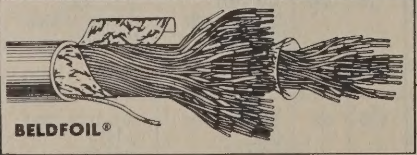
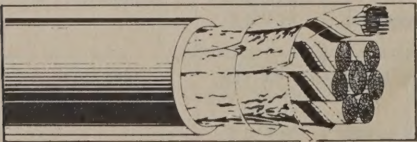
BELDEN | shielded and unshielded paired sound and control cables

MULTIPLE PAIR UNSHIELDED SOUND AND CONTROL CABLES (Cont'd.)

18 STRANDED (Cont'd.)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm		ft.	m
ALL CONSTRUCTIONS *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. For color coding please refer to page 39.*  	**9159†**	5	18 (16x30) [1.19]	.012	.30	.050	1.27	.409	10.38	300	500, 1000	152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464)										
	8691†	6	18 (16x30) [1.19]	.018	.46	.045	1.14	.550	13.97	400	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9161	8	18 (16x30) [1.19]	.012	.30	.050	1.27	.469	11.91	300	500, 1000	152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464)										
	8692†	9	18 (16x30) [1.19]	.018	.46	.055	1.40	.590	14.99	400	100, 500, 1000	30.5, 152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9741†	12	18 (16x30) [1.19]	.018	.46	.055	1.40	.690	17.53	400	500, 1000	152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9742†	15	18 (16x30) [1.19]	.018	.46	.060	1.52	.800	20.32	400	500, 1000	152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										
	9743†	19	18 (16x30) [1.19]	.018	.46	.070	1.78	.880	22.35	400	500, 1000	152.4, 304.8
	UL LISTED **2464**	Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts										

38, 51 AND 102 PAIR CABLES

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm	ft.	m
 	**8752•†**	38	22 (Solid)	.008	.20	.045	1.14	.600	15.24	250, 500, 1000	76.2, 152.4, 304.8
		All lengths +20% −0 Length Tolerance									
	8751•†	51	22 (Solid)	.010	.25	.050	1.27	.700	17.78	250, 500, 1000, 1500	76.2, 152.4, 304.8, 457.2
		All lengths +20% −0 Length Tolerance									
	**9753**	102	22 (Solid)	.010	.25	.085	2.16	1.100	27.95	250, 500, 1000, 1500	76.2, 152.4, 304.8, 457.2
		All lengths +20% −0 Length Tolerance									

Tinned copper, 8751 and 9753 vinyl insulated, 8752 polypropylene insulated, twisted pairs, BELDFOIL aluminum-polyester shield overall, 22 AWG (7x30) stranded drain wire, chrome vinyl jacket. 200 Volts suggested working voltage.

For color coding information on 8751 and 8752 write for Technical Data Bulletin T/8-4.

For color coding information on 9753 write for Technical Data Bulletin T/8-22.

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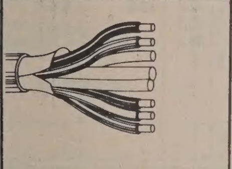
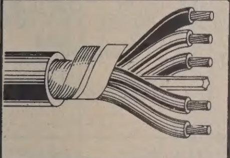
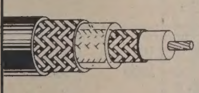
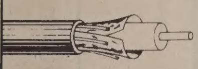
†Passes the FR-1 vertical flame test. *•Belden U.S. Patent 3,032,604.*

SPECIAL DATA, INSTRUMENTATION, P.O.S. AND COMPUTER CABLES

These cables are intended for those applications with special requirements such as miniature size, low capacitance for minimum signal distortion or good electrical characteristics. They are recommended for both analog and digital systems. Special cable designs are available to satisfy unique physical and electrical requirements.

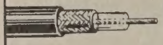
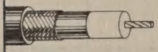
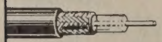
Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Cond. Color Coding	Per cent Shield Coverage	Nominal Capacitance				Suggested Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			* pF/ft.	* pF/m	** pF/ft.	** pF/m		ft.	m
	**9640**	5 3 Shielded 2 Shielded	28 (Solid) [.33]	.0025	.064	.015	.38	.087	2.21	 Blk, Red, Blue Grn, Wht	100	60	197	110	361	100	25, 50	7.6, 15.2
		Solid copper, GEOSOL™ insulated (solderable no stripping required), conductors cabled, 3 conductor group shielded from 2 conductor group (Patent No. 3,291,891), overall BELDFOIL aluminum-polyester shield for low level signal, white vinyl jacket, 105°C maximum operating temperature.																
	**★9895**	5	25 (7x33) [.53] 3 copper 4 copper covered steel	.0085	.22	.025	.64	.195	4.95	Red, Black, White, Green, Brown	100	39	128	72	236	100	500, 1000	152.4, 304.8
		Stranded conductor, vinyl insulated, noise reducing tape shield to minimize microphonic signals resulting from flexing plus a spiral tinned copper shield to produce a very flexible cable, gray vinyl jacket, 105°C maximum operating temperature.																

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Nom. Core O.D.		Number of Shields and Material	Jacket	Nominal O.D.		Nom. Imp. (ohms)	Nom. Vel. of Prop.	Nominal Capacitance		Nominal Attenuation			Standard Lengths	
			Inch	mm			Inch	mm			pF/ft.	pF/m	MHz	db/100 ft.	db/100 m	ft.	m
	8700	28 (Solid) [.33] tinned copper	Polypropylene .023	.58	1 bare copper braid	Black vinyl	.054	1.37	32	66%	48	157	400	55.0	180	25, 50, 100, 250	7.6, 15.2, 30.5, 76.2
	**★9888 8/U Type**	11 (7x19) [2.74] bare copper	Foam Polyethylene .285	7.2	2 bare copper	Black Polyethylene	.480	12.19	50	78%	26	85	50 100 200 300 400	1.2 1.8 2.6 3.3 3.8	3.9 5.9 8.5 10.8 12.4	500, 1000	152.4, 304.8
	**★9889 UL LISTED 1354**	18 (Solid) [1.02] bare copper	Foam Polyethylene .116	2.9	1 Duofoil with 4 24 AWG bare copper drain wires	Black vinyl	.216	5.49	50	78%	26	85	50 100 200 400 500 900	3.3 4.9 7.4 11.0 14.0 17.8	10.8 16.1 24.3 36.1 45.9 58.4	500, 1000, 2000	152.4, 304.8, 609.6
		Underwriters Laboratories Inc. Listed (Style 1354)															
	9269 UL LISTED 1381 62A/U	22 (Solid) [.64] bare copper covered steel	Semi-Solid Polyethylene .146	3.71	1 bare copper	Black Non-Contaminating vinyl	.242	6.15	93	84%	13.5	44	100 200 400 900	3.1 4.4 6.3 11.0	10.2 14.4 20.7 36.1	500, 1000, 2000	152.4, 304.8, 609.6
		Underwriters Laboratories Inc. Listed (Style 1381)															
	9268 UL LISTED 1381 62A/U Type	22 (Solid) [.64] bare copper covered steel	Semi-solid Flame Retardant Polyethylene .146	3.71	1 bare copper	Black vinyl	.260	6.0	93	80%	14.5	47.6	100 200 400 900	3.1 4.4 6.3 11.0	10.2 14.4 20.7 36.1	500, 1000, 2000	152.4, 304.8, 609.6
		Underwriters Laboratories Inc. Listed (Style 1381)															

★New Item.
**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductors connected to shield.*

BELDEN | RG/U transmission line cables

COAXIAL CABLES

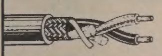
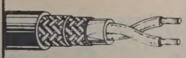
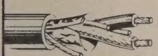
Description	Trade & UL Style Number	RG No.	AWG (Stranding) [Dia. in mm] Nom. D.C.R.	Insulation Nominal Core O.D.		No. of Shields and Material Nom. D.C.R.	Nominal O.D.		Nom. Imp. (ohms)	Nom. Vel. of Prop.	Nominal Capacitance		Nominal Attenuation			Standard Lengths	
				Inch	mm		Inch	mm			pF/ft.	pF/m	MHz	db/100 ft.	db/100 m	ft.	m
	★9310 UL LISTED 1354	58/U Type	20 (Solid) [.81] bare copper 10.1Ω/M' 33.1Ω/km Underwriters Laboratories, Inc. Listed (Style 1354)	.116	2.95	2 Duobond & 56% tinned copper braid 14.0Ω/M' 45.9Ω/km	.206 Jacket: Black vinyl	5.23	53.5	66%	28.5	92.4	100 200 400 900	4.9 6.6 9.2 13.4	16.1 21.7 30.2 44.2	100, 500, 1000	30.5, 152.4, 304.8
	8259	58A/U JAN-C-17A	20 (19x.0071) [.89] tinned copper 10.8Ω/M' 35.4Ω/km	.116	2.95	1 tinned copper 4.1Ω/M' 13.5Ω/km	.195 Jacket: Black vinyl	4.95	50	66%	30.8	101.1	100 200 400 900	5.3 8.2 12.6 20.0	17.4 26.9 41.3 65.6	25, 50, 100, 500, 1000 U-500, U-1000 (UNREEL)	7.6, 15.2, 30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
	8262	58C/U MIL-C-17D	20 (19x.0071) [.89] tinned copper 10.8Ω/M' 35.4Ω/km	.116	2.95	1 tinned copper 4.1Ω/M' 13.5Ω/km	.195 Jacket: Black non-contaminating vinyl	4.95	50	66%	30.8	101.1	100 200 400 900	5.3 8.2 12.6 20.0	17.4 26.9 41.3 65.6	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8219 UL LISTED 1354	58A/U Type	20 (19x32) [.94] tinned copper 8.8Ω/M' 28.9Ω/km Underwriters Laboratories, Inc. Listed (Style 1354)	Cellular Polyethylene .116	2.95	1 tinned copper 4.1Ω/M' 13.5Ω/km	.195 Jacket: White, Black vinyl	4.95	50	78%	26.0	85.3	100 200 400 900	4.8 6.9 10.1 15.5	15.8 22.6 33.1 50.9	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	★9311 UL LISTED 1354	58A/U Type	20 (19x32) [.94] tinned copper 8.5Ω/M' 27.9Ω/km Underwriters Laboratories, Inc. Listed (Style 1354)	Cellular Polyethylene .114	2.90	2 Duobond & 56% tinned copper braid 17Ω/M' 55.8Ω/km	.205 Jacket: Black vinyl	5.21	50	78%	26.0	85.3	100 200 400 900	4.8 6.9 10.1 15.5	15.8 22.6 33.4 50.9	100, 500, 1000	30.5, 152.4, 304.8
	8241* UL LISTED 1354	59/U JAN-C-17A	22 (Solid) [.64] bare copper covered steel 55Ω/M' 180.5 Ω/km Underwriters Laboratories, Inc. Listed (Style 1354)	Polyethylene .146	3.71	1 bare copper 2.7Ω/M' 8.9Ω/km	.242 Jacket: Black vinyl	6.15	73	66%	21.0	68.9	100 200 400	3.4 4.9 7.1	11.2 16.1 23.3	25, 50, 100, 500, 1000, 2000 U-500, U-1000 (UNREEL)	7.6, 15.2, 30.5, 152.4, 304.8, 609.6 U-152.4, U-304.8 (UNREEL)
	8263	59B/U MIL-C-17D	.023 (Solid) [.57] bare copper covered steel 65Ω/M' 213.3 Ω/km	Polyethylene .146	3.71	1 bare copper 2.57Ω/M' 8.4Ω/km	.242 Jacket: Black non-contaminating vinyl	6.15	75	66%	20.5	67.3	100 200 400 900	3.4 4.9 7.1 11.1	11.2 16.1 23.3 36.4	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)

★New Item

**Sweep tested 8241 is available on special order.*

REQUEST QUOTATIONS ON PRODUCTION QUANTITIES OF RG/U CABLES NOT LISTED.

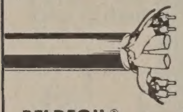
SPECIAL DATA, INSTRUMENTATION, P.O.S. AND COMPUTER CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Nom. Core O.D. Inch	Insulation Nom. Core O.D. mm	Number of Shields and Material	Jacket	Nominal O.D. Inch	Nominal O.D. mm	Nom. Imp. (ohms)	Nom. Vel. of Prop.	Nominal Capacitance pF/ft.	Nominal Capacitance pF/m	Nominal Attenuation MHz	Nominal Attenuation db/100 ft.	Nominal Attenuation db/100 m	Standard Lengths ft.	Standard Lengths m
 **Twinaxial**	**9272** † UL LISTED **2092**	2 Cond. 20 (7x28) [.97] tinned copper	Polyethylene color coded —	—	1 tinned copper braid	Blue vinyl	.242	6.15	78	66%	19.7	64.6	100 200 400 900	7.5 11.0 16.0 25.0	24.6 36.1 52.5 82.0	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2092)															
 Twinaxial	**8227** † UL LISTED **2498**	2 cond. 20 (7x28) [.97] 1 tinned copper 1 bare copper	Polyethylene .240 —	6.10 —	1 tinned copper	Black vinyl	.325	8.26	100	66%	15.5	50.9	100 200 300 400	4.1 6.4 8.4 10.2	13.5 21.0 27.6 33.5	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2498)															
	**9250** †	2 Cond. 18 (7x.0152) [1.16] bare copper, one conductor has tinned center strand	Polyethylene .285 —	7.24 —	2 tinned copper	Black non-contaminating vinyl	.420	10.67	95	66%	16.0	52.5	100 200 400 900	3.0 4.5 6.8 11.0	9.8 14.8 22.3 36.1	100, 500, 1000	30.5, 152.4, 304.8
	**9271** † UL LISTED **2092**	2 Cond. 25 (7x33) [.53] tinned copper	Polyethylene color coded —	—	BELDFOIL® with stranded tinned copper drain wire	Blue vinyl	.242	6.15	124	66%	12.2	40.0	1 10 20 50	0.6 1.7 2.3 3.6	2.0 5.6 7.6 11.8	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2092)															
	★9863 UL LISTED **2094**	Same as above except 6 Cond. (3 pair version of 9271)	Same as above —	—	BELDFOIL with stranded tinned copper drain wire over each pair	Blue vinyl	.450	11.43	124	66%	12.2	40.0	1 10 20 50	0.6 1.7 2.3 3.6	2.0 5.6 7.6 11.8	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2094)															
	★9860	2 Cond. 16 (Solid) [1.29] bare copper	Foam Polyethylene color coded —	—	1 Duofoil tape 1 tinned copper braid	Black vinyl	.440	11.18	124	78.8%	Between Cond. 10.9 Shield un-grn'd	35.8	5 10 20 50 100	0.4 0.7 1.0 1.7 2.4	1.3 2.3 3.3 5.6 7.9	500, 1000, 2000	152.4, 304.8, 609.6
	★9855 UL LISTED **2582**	4 Cond. 22 (Solid) [.64] tinned copper (2 pair)	Polyethylene color coded —	—	BELDFOIL with solid tinned copper drain wire and tinned copper braid	Black vinyl	.290	7.37	100	66%	15.5	50.9	.3 .6 1.0 1.5	0.40 0.53 0.65 0.78	1.3 2.0 2.3 2.6	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2582)															

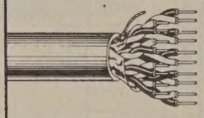
★New Item.
†Passes the FR-1 vertical flame test.

BELDEN | data, instrumentation, p.o.s. and computer cables

SPECIAL DATA INSTRUMENTATION, P.O.S. AND COMPUTER CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Nom. Core O.D. Inch	Insulation Nom. Core O.D. mm	Number of Shields and Material	Jacket	Nominal O.D. Inch	Nominal O.D. mm	Nom. Imp. (ohms)	Nom. Vel. of Prop.	Nominal Capacitance pF/ft.	Nominal Capacitance pF/m	Nominal Attenuation MHz	Nominal Attenuation db/100 ft.	Nominal Attenuation db/100 m	Standard Lengths ft.	Standard Lengths m
200 OHM VIDEO TWINAX  **BELDFOIL®**	**9851** UL LISTED **2606**	(1 pair) 29 (Solid) [.29] Silver-plated Copper-coated steel	Cellular Flame Retardant Polyethylene —	—	BELDFOIL overall	Chrome vinyl	.245	6.22	200	76%	6.7	22.0	1 10 20 50 100	1.5 2.0 2.5 3.5 5.0	4.9 6.6 8.2 11.5 16.4	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2606)															
DUAL—200 OHM VIDEO TWINAX	**9852** UL LISTED **2606**	Same as above except 2 pair	Same as above —	—	BELDFOIL over pairs and overall	Black vinyl	.490	12.45	200	78%	6.5	21.0	—	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2606)															

PAIRED INSTRUMENTATION, COMPUTER AND POS CABLES

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance * pF/ft.	Nominal Capacitance * pF/m	Nominal Capacitance ** pF/ft.	Nominal Capacitance ** pF/m	Standard ft.	Lengths m
 **BELDFOIL**	**9302†** UL LISTED **2464**	2	22 (Solid) [.64]	.012	.30	.030	.76	.215	5.46	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9305† UL LISTED **2464**	4	22 (Solid) [.64]	.012	.30	.030	.76	.253	6.43	35	115	—	—	100, 500, 1000	30.5, 152.4 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	9306† UL LISTED **2464**	6	22 (Solid) [.64]	.012	.30	.035	.89	.310	7.87	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	9309† UL LISTED **2464**	9	22 (Solid) [.64]	.012	.30	.037	.94	.360	9.14	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	9315† UL LISTED **2464**	15	22 (Solid) [.64]	.012	.30	.040	1.02	.435	11.05	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	9319† UL LISTED **2464**	19	22 (Solid) [.64]	.012	.30	.040	1.02	.470	11.94	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	9327† UL LISTED **2464**	27	22 (Solid) [.64]	.012	.30	.045	1.14	.563	14.30	35	115	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													

Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. *For color coding please refer to page 39.*

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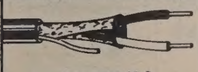
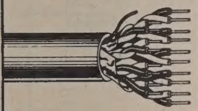
†Passes the FR-1 vertical flame test. **Capacitance between conductors.* ***Capacitance between 1 conductor and other conductors connected to shield.*

PAIRED INSTRUMENTATION, COMPUTER AND POS CABLES (Cont'd)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Capacitance				Standard	Lengths
				Inch	mm	Inch	mm	Inch	mm	* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **BELDFOIL®**	★9462• UL LISTED 2464	1	22 (7x30) [.76]	.012	.30	.031	.79	.174	4.42	45	148	80	262	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
 **BELDFOIL**	★9501 UL LISTED 2464	1	24 (7x32) [.61]	.009	.23	.030	.76	.148	3.76	41	135	75	246	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8, U-152.4, U-304.8, (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9502 UL LISTED 2464	2	24 (7x32) [.61]	.009	.23	.030	.76	.210	5.33	30	98	—	—	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9503 UL LISTED 2464	3	24 (7x32) [.61]	.009	.23	.030	.76	.220	5.59	30	98	—	—	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9504 UL LISTED 2464	4	24 (7x32) [.61]	.009	.23	.030	.76	.240	5.72	30	98	—	—	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9505 UL LISTED 2464	5	24 (7x32) [.61]	.009	.23	.035	.89	.285	7.24	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9506 UL LISTED 2464	6	24 (7x32) [.61]	.009	.23	.035	.89	.285	7.24	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9507 UL LISTED 2464	7	24 (7x32) [.61]	.009	.23	.035	.89	.290	7.37	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9508 UL LISTED 2464	8	24 (7x32) [.61]	.009	.23	.035	.89	.320	7.87	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9509 UL LISTED 2464	9	24 (7x32) [.61]	.009	.23	.035	.89	.330	8.38	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9510 UL LISTED 2464	10	24 (7x32) [.61]	.009	.23	.040	1.02	.365	9.27	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													

Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 39.

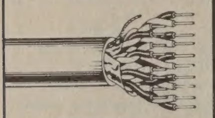
★*New Item.*
•*Belden U.S. Patent 3,032,604*

**Capacitance between conductors.*
***Capacitance between one conductor and other conductor connected to shield.*

BELDEN

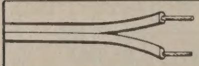
instrumentation, computer and p.o.s. cables
two conductor unshielded

PAIRED INSTRUMENTATION, COMPUTER AND P.O.S. CABLES (Cont'd)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm	* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **BELDFOIL®**	★9515 UL LISTED 2464	15	24 (7x32) [.61]	.009	.23	.040	1.02	.410	10.4	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9525 UL LISTED 2464	25	24 (7x32) [.61]	.009	.23	.045	1.14	.510	12.9	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													
	★9550 UL LISTED 2464	50	24 (7x32) [.61]	.009	.23	.050	1.27	.685	16.6	30	98	—	—	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts													

Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket.
For color coding please refer to page 39.

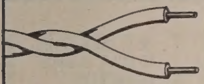
TWO CONDUCTOR UNSHIELDED CABLES

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Cond. Color Coding	Available Jacket Colors	Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm			Inch	mm		ft.	m
 **Copper, vinyl insulated PARALLEL**	8782	24 (7x32) [.61]	.017	.43	—	—	1 cond. tinned	Chrome, Brown, White, Clear	.058 x .115	1.47 x 2.92	300	25, 50, 100, 500, 1000 U-500, U-1000 (UNREEL)	7.6, 15.2, 30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
	★9712	22 (7x30) [.76]	.017	.43	—	—	1 cond. tinned	Clear	.065 x .130	1.65 x 3.30	300	50, 100, 500, 1000 U-500, U-1000 (UNREEL)	15.2, 30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8781†	22 (Solid) [.64]	.016	.41	—	—	1 cond. tinned	Chrome	.060 x .120	1.32 x 3.04	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8649†	20 (7x28) [.97]	.020	.51	—	—	1 cond. tinned	Chrome, Clear	.073 x .146	1.95 x 3.74	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	★9708	18 (16x30) [1.19]	.030	.76	—	—	1 cond. tinned	Clear	.110 x .225	2.79 x 5.71	300	50, 100, 500, 1000 U-500, U-1000 (UNREEL)	15.2, 30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)

†Passes the FR-1 vertical flame test.
★New Item.

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductors connected to shield.

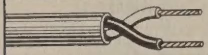
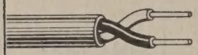
TWO CONDUCTOR UNSHIELDED CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Cond. Color Coding	Available Jacket Colors	Nominal O.D. Inch	Nominal O.D. mm	Sugg. Working Voltage	Standard Lengths ft.	Standard Lengths m
Without JACKET  **Copper, vinyl insulated, CABLED**	**8481†** UL LISTED **1007**	22 (Solid) bare [.64]	.016	.41	—	—	Brn, Tan	—	.114	2.90	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters' Laboratories Inc. Listed (Style 1007)											
	9151 UL LISTED **Wires, Misc.**	22 (7x30) [.76]	.012	.32	—	—	Brn paired or Wht paired 1 cond. tinned	—	.108	2.74	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Wires, Misc.) 90V Max.											
	9152 UL LISTED **Wires, Misc.**	20 (10x30) [.94]	.012	.32	—	—	Brn paired or Wht paired 1 cond. tinned	—	.125	3.17	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Wires, Misc.) 90V Max.											
	8482†	19 (Solid) bare [.91]	.015	.38	—	—	Brn, Tan	—	.130	3.30	350	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8492†	19 (Solid) [.91]	.025	.64	—	—	Brn, paired or Wht paired 1 cond. tinned 1 cond. Bare	—	.170	4.32	600	1000 U-1000 (UNREEL)	304.8 U-304.8 (UNREEL)
	9153 UL LISTED **Wires, Misc.**	18 (16x30) [1.19]	.012	.30	—	—	Brn, paired or Wht paired 1 cond. tinned 1 cond. Bare	—	.142	3.61	300	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Wires, Misc.) 90V Max.											
	8460† UL LISTED **1007**	18 (7x26) [1.22] tinned	.020	.51	—	—	Blk, Wht	—	.175	4.45	450	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Style 1007)											
	8470† UL LISTED **1007**	16 (19x29) [1.42] tinned	.023	.58	—	—	Blk, Wht	—	.206	5.23	600	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Style 1007)											
	★9497 UL LISTED **1007**	16 (19x29) [1.42] tinned	.023	.58	—	—	Org, Blk	—	.206	5.23	600	500, 1000	152.4, 304.8
		Underwriters' Laboratories Inc. Listed (Style 1007)											
With JACKET **SOLID**	**8740†** UL LISTED **Wires, Misc.**	22 (Solid) [.64] tinned	.015	.38	.025	.64	Blk, Red	Chrome	.150	3.81	300	100, T-500 and T-1000 (Convert-a-pak) U-500, U-1000 (UNREEL)	30.5, T-152.4 and T-304.8 (Convert-a-pak) U-152.4, U-304.8 (UNREEL)
		Underwriters' Laboratories Inc. Listed (Wires, Misc.) 90V Max.											

†Passes the FR-1 vertical flame test.
★New Item.

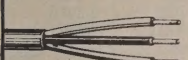
BELDEN | two conductor unshielded cables

TWO CONDUCTOR UNSHIELDED CABLES (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Cond. Color Coding	Available Jacket Colors	Nominal O.D.		Sugg. Working Voltage	Standard Lengths	
			Inch	mm	Inch	mm			Inch	mm		ft.	m
 **STRANDED**	**8442†** UL LISTED **2508**	22 (7x30) [.76] tinned	.015	.38	.025	.64	Blk, Red	Chrome, Lt. Beige	.165	4.19	350	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2508)										8442-100 Chrome only	
 **SOLID**	**8205†** UL LISTED **Wires, Misc.**	20 (10x30) [.94] tinned	.018	.46	.025	.64	Blk, Red	Chrome	.190	4.83	350	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
								Lt. Beige				500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Wires, Misc.) 90V Max.											
Copper, vinyl insulated, twisted pair, vinyl jacket.	**8486†**	19 (Solid) [.91] bare	.015	.38	.025	.64	Brn, Tan	Chrome	.162	4.11	350	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8461† UL LISTED **Wires, Misc.**	18 (7x26) [1.22] tinned	.020	.51	.028	.71	Blk, Wht	Chrome	.226	5.74	450	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
								Lt. Beige				500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. (Wires, Misc.) 90V Max.											
	9740† UL LISTED **2464**	18 (16x30) [1.19] tinned	.018	.46	.030	.76	Blk, Red	Chrome	.220	5.59	400	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464) 300 Volts											
	8471†	16 (19x29) [1.42] tinned	.023	.58	.030	.76	Blk, Wht	Chrome	.256	6.50	600	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8473†	14 (19x27) [1.80] tinned	.031	.79	.035	.89	Blk, Wht	Chrome	.332	8.43	600	500, 1000 U-500 (UNREEL)	152.4, 304.8 U-152.4 (UNREEL)
	8477†	12 (19x25) [2.29] tinned	.031	.79	.040	1.02	Blk, Wht	Chrome	.384	9.75	600	500, 1000 U-500 (UNREEL)	152.4, 304.8 U-152.4 (UNREEL)

†*Passes the FR-1 vertical flame test.*

VINYL MULTIPLE CONDUCTOR CONTROL AND AUDIO CABLES (NOT PAIRED)

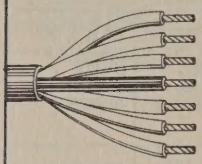
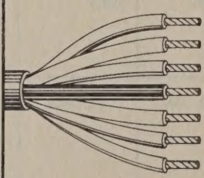
Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Color Code Chart No.	Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			ft.	m
		22 GAGE (Cont'd)											
 *Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.*	**8445†** UL LISTED **2576**	5	22 (7x30) [.76]	.010	.25	.030	.76	.190	4.83	1	200	25, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	7.6, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	9430† UL LISTED **2576**	7	22 (7x30) [.76]	.010	.25	.030	.76	.210	5.33	1	200	500, 1000 U-500, U-1000 (UNREEL)	152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8456† UL LISTED **2576**	10	22 (7x30) [.76]	.010	.25	.030	.76	.260	6.60	1	200	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8457† UL LISTED **2576**	12	22 (7x30) [.76]	.010	.25	.030	.76	.260	6.60	1	200	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8458† UL LISTED **2576**	15	22 (7x30) [.76]	.010	.25	.040	1.02	.320	8.13	2R	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	9431† UL LISTED **2576**	20	22 (7x30) [.76]	.010	.25	.040	1.02	.345	8.76	2R	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8459† UL LISTED **2576**	25	22 (7x30) [.76]	.010	.25	.040	1.02	.370	9.39	2R	200	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	9432† UL LISTED **2576**	30	22 (7x30) [.76]	.010	.25	.040	1.02	.400	10.16	2R	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	9433† UL LISTED **2576**	40	22 (7x30) [.76]	.010	.25	.040	1.02	.455	11.56	2R	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	9434† UL LISTED **2576**	50	22 (7x30) [.76]	.010	.25	.045	1.14	.500	12.70	2R	200	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											

†Passes the FR-1 vertical flame test.

For color coding refer to page 27.

BELDEN | multiple conductor unshielded cables

VINYL MULTIPLE CONDUCTOR CONTROL AND AUDIO CABLES (NOT PAIRED) (Cont'd)

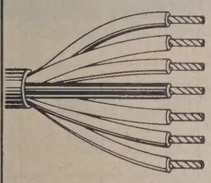
Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Color Code Chart No.	Sugg. Working Voltage	Standard Lengths ft.	Standard Lengths m
20 GAGE													
 *Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.*	**9444†** UL LISTED **2464**	4	20 (10x30) [.91]	.012	.30	.030	.76	.208	5.28	1	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)											
	9445† UL LISTED **2464**	5	20 (10x30) [.91]	.012	.30	.030	.76	.230	5.84	1	300	100, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2464)											
	9439† UL LISTED **2464**	7	20 (10x30) [.91]	.012	.30	.030	.76	.250	6.35	1	300	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)											
	9455† UL LISTED **2464**	9	20 (10x30) [.91]	.012	.30	.035	.89	.310	7.87	1	300	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)											
	9457† UL LISTED **2464**	12	20 (10x30) [.91]	.012	.30	.035	.89	.330	8.38	1	300	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)											
	9458† UL LISTED **2464**	15	20 (10x30) [.91]	.012	.30	.040	1.02	.380	9.65	2	300	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2464)											
18 GAGE													
 *Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.*	**8489†** UL LISTED **2273**	4	18 (16x30) [1.19]	.018	.46	.030	.76	.250	6.35	1	400	100, 250, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2273) 300 Volts											
	8465† UL LISTED **2274**	5	18 (16x30) [1.19]	.018	.46	.037	.94	.286	7.26	1	400	100, 250, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2274) 300 Volts											
	8467† UL LISTED **2276**	7	18 (16x30) [1.19]	.018	.46	.037	.94	.324	8.23	1	400	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2276) 300 Volts											
	8469† UL LISTED **2278**	9	18 (16x30) [1.19]	.018	.46	.037	.94	.379	9.63	1	400	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2278) 300 Volts											

†Passes the FR-1 vertical flame test. *For color coding refer to page 27.*

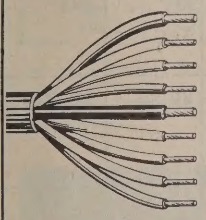
multiple conductor unshielded cables | BELDEN

VINYL MULTIPLE CONDUCTOR CONTROL AND AUDIO CABLES (NOT PAIRED) (Cont'd)

18 GAGE (Cont'd)

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Color Code Chart No.	Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			ft.	m
 Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.	**8466†** UL LISTED **2281**	12	18 (16x30) [1.19]	.018	.46	.040	1.02	.412	10.46	2R	400	100, 250, 500, 1000	30.5, 76.2, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2281) 300 Volts											
	8468† UL LISTED **2284**	15	18 (16x30) [1.19]	.018	.46	.045	1.14	.490	12.45	2R	400	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2284) 300 Volts											
	8619† UL LISTED **2288**	19	18 (16x30) [1.19]	.018	.46	.045	1.14	.505	12.83	2R	400	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2288) 300 Volts											
	9626† UL LISTED **2598**	25	18 (16x30) [1.19]	.018	.46	.060	1.52	.600	15.24	2R	400	500, 1000	152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2598) 300 Volts											

COMBINATION GAGES

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Color Code Chart No.	Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			ft.	m
 Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.	**8446†** UL LISTED **2576**	6	4-22 (7x30) [.76] 2-18 (16x30) [1.19]	.010 .018	.25 .46	.030	.76	.232	5.89	1	200 400	15, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8447† UL LISTED **2576**	7	5-22 (7x30) [.76] 2-18 (16x30) [1.19]	.010 .018	.25 .46	.030	.76	.250	6.35	1	200 400	100, 250, 500, 1000 U-500, U-1000 (UNREEL)	30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8448† UL LISTED **2576**	8	6-22 (7x30) [.76] 2-18 (16x30) [1.19]	.010 .018	.25 .46	.030	.76	.254	6.45	1	200 400	15, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											
	8449† UL LISTED **2576**	9	7-22 (7x30) [.76] 2-18 (16x30) [1.19]	.010 .018	.25 .46	.030	.76	.265	6.73	1	200 400	15, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
		Underwriters Laboratories Inc. Listed (Style 2576) 150 Volts											

2R Same as IPCEA except ring band striping.
†Passes the FR-1 vertical flame test.

For color coding refer to page 27.

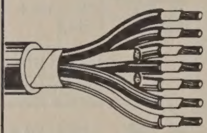
BELDEN PAGE 26

ELECTRONIC DIVISION/BELDEN CORPORATION, P.O. BOX 1331, RICHMOND, IN 47374 (317) 966-6661

BELDEN | multiple conductor unshielded cables

TYPE SO NEOPRENE MULTIPLE CONDUCTOR CONTROL CABLES (NOT PAIRED)

General purpose industrial and utility control applications, remote control of automatic electric equipment and motor control. Heavy duty neoprene jacket offers excellent resistance to oils, acids, oxidation, weathering, ozone, abrasion and impact.

Description	Trade Number & UL Type	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Color Code Chart No.	Sugg. Working Voltage	Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm			ft.	m
		16 GAGE											
 *Bare copper, rubber insulated, conductors cabled with fillers, black neoprene jacket.*	**9420†** UL LISTED **SO**	5	16 (65x34) [1.65]	.032	.81	.078	1.98	.520	13.21	2R	600	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Type SO)											
	9422† UL LISTED **SO**	7	16 (65x34) [1.65]	.032	.81	.078	1.98	.560	14.22	2R	600	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Type SO)											
	9424† UL LISTED **SO**	9	16 (65x34) [1.65]	.032	.81	.078	1.98	.610	15.49	2R	600	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Type SO)											
	9425† UL LISTED **SO**	12	16 (65x34) [1.65]	.032	.81	.094	2.38	.720	18.29	2R	600	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Type SO)											
	9427† UL LISTED **SO**	16	16 (65x34) [1.65]	.032	.81	.094	2.38	.800	20.32	2R	600	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Type SO)											
	9429† UL LISTED **SO**	20	16 (65x34) [1.65]	.032	.81	.094	2.38	.880	22.35	2R	600	100, 500	30.5, 152.4
		Underwriters Laboratories Inc. Listed (Type SO)											

COLOR CODE Chart No. 1

Conductor	Color
1st	Black
2nd	White
3rd	Red
4th	Green
5th	Brown
6th	Blue
7th	Orange
8th	Yellow
9th	Purple
10th	Gray
11th	Pink
12th	Tan

18 Gage conductors in cables 8446 through 8449 are Black and White.

IPCEA COLOR CODE Chart No. 2 & 2R

(Insulated Power Cable Engineers Association)
2R—These Cables feature a ring band striping.

Conductor	Color	Conductor	Color	Conductor	Color
1st	Black	18th	Orange/Red	35th	Wht/Red/Org
2nd	White	19th	Blue/Red	36th	Org/Wht/Blue
3rd	Red	20th	Red/Green	37th	Wht/Red/Blue
4th	Green	21st	Orange/Green	38th	Blk/Wht/Grn
5th	Orange	22nd	Blk/Wht/Red	39th	Wht/Blk/Grn
6th	Blue	23rd	Wht/Blk/Red	40th	Red/Wht/Grn
7th	White/Black	24th	Red/Blk/Wht	41st	Grn/Wht/Blue
8th	Red/Black	25th	Grn/Blk/Wht	42nd	Org/Red/Grn
9th	Green/Black	26th	Org/Blk/Wht	43rd	Blue/Red/Grn
10th	Orange/Black	27th	Blue/Blk/Wht	44th	Blk/Wht/Blue
11th	Blue/Black	28th	Blk/Red/Grn	45th	Wht/Blk/Blue
12th	Black/White	29th	Wht/Red/Grn	46th	Red/Wht/Blue
13th	Red/White	30th	Red/Blk/Grn	47th	Grn/Org/Red
14th	Green/White	31st	Grn/Blk/Org	48th	Org/Red/Blue
15th	Blue/White	32nd	Org/Blk/Grn	49th	Blue/Red/Org
16th	Black/Red	33rd	Blue/Wht/Org	50th	Blk/Org/Red
17th	White/Red	34th	Blk/Wht/Org		

†Passes the FR-1 vertical flame test.

telephone cables,
direct burial, audio and data cables

BELDEN

TELEPHONE CABLES (PAIRED)

Description	Trade & UL Style Number	No. of Pairs	AWG (Stranding) Dia. in mm	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Sugg. Working Voltage	Standard Lengths ft.	Standard Lengths m
	★9561 UL LISTED 2576	1	24 (Solid) [.51]	.010	.25	.030	.76	.150	3.81	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576)										
	★9562 UL LISTED 2576	2	24 (Solid) [.51]	.010	.25	.030	.76	.195	4.95	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576)										
	★9566 UL LISTED 2576	6	24 (Solid) [.51]	.010	.25	.030	.76	.285	7.24	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576)										
	★9568 UL LISTED 2576	8	24 (Solid) [.51]	.010	.25	.035	.89	.300	7.62	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576)										
	★9570 UL LISTED 2576	10	24 (Solid) [.51]	.010	.25	.035	.89	.350	8.89	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters Laboratories Inc. Listed (Style 2576)										
	★9585 UL LISTED 2576	25	24 (Solid) [.51]	.010	.25	.040	1.02	.495	12.57	150	100, 500, 1000	30.5, 152.4, 304.8
		Underwriters' Laboratories Inc. Listed (Style 2576)										

COLOR CODE CHART
for paired telephone cables

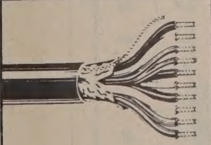
Pair	Color
1st	White/Blue
2nd	White/Orange
3rd	White/Green
4th	White/Brown
5th	White/Slate
6th	Red/Blue
7th	Red/Orange
8th	Red/Green
9th	Red/Brown
10th	Red/Slate
11th	Black/Blue
12th	Black/Orange
13th	Black/Green
14th	Black/Brown
15th	Black/Slate
16th	Yellow/Blue
17th	Yellow/Orange
18th	Yellow/Green
19th	Yellow/Brown
20th	Yellow/Slate
21st	Violet/Blue
22nd	Violet/Orange
23rd	Violet/Green
24th	Violet/Brown
25th	Violet/Slate

Tinned copper, vinyl insulated, conductors cabled, silver gray vinyl jacket.

MULTI-CONDUCTOR AND MULTIPLE PAIR INDIVIDUALLY SHIELDED DIRECT BURIAL, AUDIO AND DATA CABLE

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) Dia. in mm	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance *pF/ft.	Nominal Capacitance *pF/m	Nominal Capacitance **pF/ft.	Nominal Capacitance **pF/m	Standard Lengths ft.	Standard Lengths m
 BELDFOIL®	9883•	6 (3 pair)	20 (10x30) [.94]	.013	.33	.040	1.02	.340	8.64	30	98	55	180	500, 1000	152.4, 304.8
	9886•	12 (6 pair)	20 (10x30) [.94]	.013	.33	.045	1.14	.480	12.19	30	98	55	180	500, 1000	152.4, 304.8

Tinned copper, polypropylene insulated, BELDFOIL aluminum-polyester shield over individually twisted pairs with 22 AWG stranded tinned copper drain wire, black High Density Polyethylene jacket.

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) Dia. in mm	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Nominal Capacitance *pF/ft.	Nominal Capacitance *pF/m	Nominal Capacitance **pF/ft.	Nominal Capacitance **pF/m	Standard Lengths ft.	Standard Lengths m
	★9890	10	20 (Solid) [.81]	.013	.33	.040	1.02	.310	7.87	—	—	—	—	500, 1000	152.4, 304.8
	★9894	15	20 (Solid) [.81]	.013	.33	.045	1.14	.390	9.91	—	—	—	—	500, 1000	152.4, 304.8

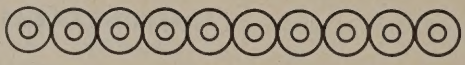
Tinned copper, polypropylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield overall, 22 AWG stranded tinned copper drain wire, black High Density Polyethylene jacket.

★*New Item.*
Manufactured to current Government specifications and subsequent revisions.

**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductor connected to shield.*
•Belden U.S. Patent 3,032,604.

BELDEN | flat cable

BELDEN BONDED FLAT CABLE



UL LISTED 2697

Belden Bonded Flat Cable meets Underwriter Laboratories, Inc. Listed Style No. 2697.
Passes FR-1 Vertical Flame Test.

Conductors:
Available in stranded tinned copper conductors. 10 to 30 conductors per cable.
22 AWG STRANDED
24 AWG STRANDED
26 AWG STRANDED

Temperature Rating: 80°C.

Voltage Rating: 300V.

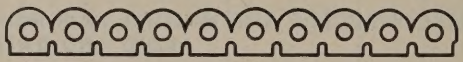
Conductor Insulation:
.010" (.25mm).

Color Code:
Brown / Red / Orange / Yellow / Green / Blue / Violet / Grey / White / Black. Colors repeat.

Lengths:
Standard 100' put-ups. Other lengths available on a special order basis.

Trade No.	AWG (Stranding) [Dia. in mm]	No. of Cond.	Nom. Width		Nom. Thickness	
			In.	mm	In.	mm
7 STRAND CONSTRUCTIONS UL LISTED STYLE NO. 2697						
9A22010	22 (7x30) [.76]	10	.51	12.94	.051	1.3
9A22015	22 (7x30) [.76]	15	.77	19.43	.051	1.3
9A22020	22 (7x30) [.76]	20	1.01	25.91	.051	1.3
9A22030	22 (7x30) [.76]	30	1.53	38.86	.051	1.3
9A24010	24 (7x32) [.61]	10	.44	11.18	.044	1.12
9A24015	24 (7x32) [.61]	15	.66	16.76	.044	1.12
9A24020	24 (7x32) [.61]	20	.88	22.35	.044	1.12
9A24030	24 (7x32) [.61]	30	1.32	33.53	.044	1.12
9A26010	26 (7x34) [.48]	10	.39	9.91	.039	1.00
9A26015	26 (7x34) [.48]	15	.59	14.99	.039	1.00
9A26020	26 (7x34) [.48]	20	.78	19.81	.039	1.00
9A26030	26 (7x34) [.48]	30	1.17	29.72	.039	1.00
19 STRAND CONSTRUCTIONS UL LISTED STYLE NO. 2697						
9B22010	22 (19x34) [.80]	10	.51	12.94	.051	1.3
9B22015	22 (19x34) [.80]	15	.77	19.43	.051	1.3
9B22020	22 (19x34) [.80]	20	1.02	25.91	.051	1.3
9B22030	22 (19x34) [.80]	30	1.53	38.86	.051	1.3
9B24010	24 (19x36) [.64]	10	.45	11.43	.045	1.14
9B24015	24 (19x36) [.64]	15	.68	17.15	.045	1.14
9B24020	24 (19x36) [.64]	20	.90	22.86	.045	1.14
9B24030	24 (19x36) [.64]	30	1.35	34.29	.045	1.14

BELDEN LAMINATED FLAT CABLE



UL LISTED 2651

Vinyl jacket 300V-105°C. Underwriters Laboratories Inc. Listed Style No. 2651. Passes FR-1 Vertical Flame Test.

Conductors:
Available in tinned copper stranded conductors. 10 to 60 conductors per cable.
28 AWG STRANDED

Temperature Rating: 105°C

Voltage Rating: 300V

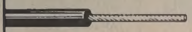
Color Code:
Blue line on edge of cable indicates "polarity."

Lengths:
Standard 100' put-ups. Other lengths available on a special order basis.

Trade No.	AWG (Stranding) [Dia. in mm]	No. of Cond.	Nom. Width		Nom. Thickness	
			In.	mm	In.	mm
9L28010	28 (7x36) [.38]	10	.50	12.70	.034	.86
9L28014	28 (7x36) [.38]	14	.70	17.78	.034	.86
9L28016	28 (7x36) [.38]	16	.80	20.32	.034	.86
9L28020	28 (7x36) [.38]	20	1.00	25.40	.034	.86
9L28024	28 (7x36) [.38]	24	1.20	30.48	.034	.86
9L28025	28 (7x36) [.38]	25	1.25	31.75	.034	.86
9L28026	28 (7x36) [.38]	26	1.30	33.02	.034	.86
9L28034	28 (7x36) [.38]	34	1.70	43.18	.034	.86
9L28037	28 (7x36) [.38]	37	1.85	46.99	.034	.86
9L28040	28 (7x36) [.38]	40	2.00	50.80	.034	.86
9L28050	28 (7x36) [.38]	50	2.50	63.50	.034	.86
9L28060	28 (7x36) [.38]	60	3.00	76.20	.034	.86

hook-up and lead wire | **BELDEN**

STYLE 1007 300V—80°C HOOK-UP WIRE—(CSA TYPE TR-64)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Nominal O.D.		Stock Colors	Standard Lengths	
			Inch	mm	Inch	mm		ft.	m
	★9922† UL LISTED 1007	22 (7x30) [.76] Uni-strand® Underwriters Laboratories, Inc. Listed (Style 1007)	.016	.41	.064	1.63	2,4, 5, 9, 10, 13	5000	1524.0
	★9920† UL LISTED 1007	20 (7x28) [.91] Uni-strand Underwriters Laboratories, Inc. Listed (Style 1007)	.016	.41	.070	1.78	9, 10	5000	1524.0
	★9918† UL LISTED 1007	18 (16x30) [1.17] Underwriters Laboratories, Inc. Listed (Style 1007)	.016	.41	.080	2.03	10	5000	1524.0

Tinned copper, vinyl insulated.
Rated −10°C to +80°C, 300V rated 600V peak for electronic circuits.
Internal wiring of electronic and electrical equipment.

STYLE 1015 600V—105°C HOOK-UP WIRE—(CSA TYPE TEW)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Nominal O.D.		Stock Colors	Standard Lengths	
			Inch	mm	Inch	mm		ft.	m
	★9924† UL LISTED 1015	24 (7x32) [.61] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.088	2.24	1, 2, 3, 4, 5, 8, 9, 10, 13	100, 1000	30.5, 304.8
	★9720† UL LISTED 1015	24 (Solid) [.51] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.085	2.16	2, 4, 5, 8, 9, 10, 13	5000	1524.0
	8920† UL LISTED 1015	22 (7x30) [.76] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.094	2.39	1, 2, 3, 4, 5, 9, 10, 13	100, 1000, 5000	30.5, 304.8, 1524.0
	★9822† UL LISTED 1015	22 (7x30) [.76] Uni-strand Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.094	2.39	2, 4, 5, 9, 10, 13	5000	1524.0
	★9722† UL LISTED 1015	22 (Solid) [.64] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.090	2.29	2, 4, 5, 8, 9, 10, 13	5000	1524.0
	8919† UL LISTED 1015	20 (10x30) [.91] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.100	2.54	1, 2, 3, 4, 5, 9, 10, 13	100, 1000, 4000	30.5, 304.8, 1219.2
	★9820† UL LISTED 1015	20 (7x28) [.91] Uni-strand Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.100	2.54	2, 5, 9, 10, 13	4000	1219.2
	8918† UL LISTED 1015	18 (16x30) [1.17] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.110	2.79	1, 2, 3, 4, 5, 9, 10, 13	100, 1000, 4000	30.5, 304.8, 1219.2
	★9818† UL LISTED 1015	18 (16x30) [1.14] Uni-strand Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.110	2.79	2, 4, 9, 10	4000	1219.2

Tinned copper, vinyl insulated.

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†Passes the FR-1 vertical flame test. *UNI-STRAND—bunch stranded, tinned overall to unify.*

★New Item

STOCK COLORS: 1 Brown; 2 Red; 3 Orange; 4 Yellow; 5 Green; 6 Light Blue; 7 Violet (purple); 8 Gray (slate); 9 White; 10 Black; 13 Dark Blue.

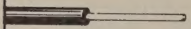
BELDEN hook-up and lead wire

STYLE 1015 600V—105°C HOOK-UP WIRE—(CSA TYPE TEW) (Cont'd)

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Nominal O.D.		Stock Colors	Standard Lengths	
			Inch	mm	Inch	mm		ft.	m
	8917† UL LISTED 1015	16 (26x30) [1.52] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.126	3.20	1, 2, 3, 4, 5, 9, 10, 13	100, 500, 1000, 4000	30.5, 152.4, 304.8, 1219.2
	8916† UL LISTED 1015	14 (41x30) [1.91] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.141	3.58	1, 2, 3, 4, 5, 9, 10, 13	100, 500	30.5, 152.4
	★9912† UL LISTED 1015	12 (65x30) [2.41] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.162	4.11	10	100, 250	30.5, 76.2
	★9910† UL LISTED 1015	10 (65x28) [3.05] Underwriters Laboratories, Inc. Listed (Style 1015)	.031	.79	.185	4.70	10	100, 250	30.5, 76.2
	★9908† UL LISTED 1015	8 (84x27) [3.94] Underwriters Laboratories, Inc. Listed (Style 1015)	.045	1.14	.253	6.43	10	100, 250	30.5, 76.2

Tinned copper, vinyl insulated. *Rated —40°C to +105°C, 600V 2500V peak for electronic circuits.*
Internal wiring of electronic and electrical equipment.

STYLE 1061 300V—80°C HOOK-UP WIRE

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Nominal O.D.		Stock Colors	Standard Lengths	
			Inch	mm	Inch	mm		ft.	m
	★9978† UL LISTED 1061	30 (Solid) [.25] Underwriters Laboratories, Inc. Listed (Style 1061)	.009	.23	.028	.71	1, 2, 3, 4, 5, 7, 8, 9, 10, 13	1000	304.8
	9977† UL LISTED 1061	28 (Solid) [.32] Underwriters Laboratories, Inc. Listed (Style 1061)	.009	.23	.031	.79	1, 2, 3, 4, 5, 7, 8, 9, 10, 13	1000	304.8
	9976† UL LISTED 1061	26 (Solid) [.41] Underwriters Laboratories, Inc. Listed (Style 1061)	.009	.23	.034	.86	1, 2, 3, 4, 5, 7, 8, 9, 10, 13	1000	304.8
	9975† UL LISTED 1061	24 (Solid) [.51] Underwriters Laboratories, Inc. Listed (Style 1061)	.009	.23	.038	.97	1, 2, 3, 4, 5, 7, 8, 9, 10, 13	1000	304.8

Suitable for wire wrap applications. *Tinned copper, semi-rigid vinyl insulation.*

STYLE 1095 300V—80°C HOOK-UP WIRE

Description	Trade & UL Style Number	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Nominal O.D.		Stock Colors	Standard Lengths	
			Inch	mm	Inch	mm		ft.	m
	★9828† UL LISTED 1095	28 (7x36) [.38] Uni-strand® Underwriters Laboratories, Inc. Listed (Style 1095)	.012	.30	.041	1.04	2, 4, 5, 8, 9, 10, 13	100, 1000, 5000	30.5, 304.8, 1524.0
	★9826† UL LISTED 1095	26 (7x34) [.48] Uni-strand Underwriters Laboratories, Inc. Listed (Style 1095)	.012	.30	.045	1.14	2, 4, 5, 8, 9, 10, 13	100, 1000, 5000	30.5, 304.8, 1524.0
	★9824† UL LISTED 1095	24 (7x32) [.61] Uni-strand Underwriters' Laboratories, Inc. Listed (Style 1095)	.012	.30	.051	1.30	2, 4, 5, 8, 9, 10, 13	100, 1000, 5000	30.5, 304.8, 1524.0

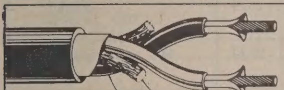
Tinned bonded copper, vinyl insulation. *Rated —10°C to +80°C, 300V.*
Internal wiring in electric bookkeeping, accounting, time-recording machines, electronic, medical or dental equipment, if within a chassis or protected from mechanical injury.

★New Item.
†Passes the FR-1 Vertical Flame Test.
UNI-STRAND—bunch stranded, tinned overall to unify.

PORTABLE CORDAGE

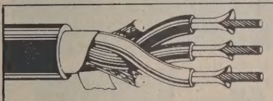
S-2 CONDUCTOR—RUBBER JACKET 600V-60°C

Color Code—Black, White

Description	Trade Number	Standard Package ft. S—250 = 1—250 ft. Spl. 2S—250 = 2—250 ft. Spls. C = Coil	Standard Package m S—76.2 = 1—76.2 m Spl. 2S—76.2 = 2—76.2 m Spls. C = Coil	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	**19104**	S-250	S-76.2	18 (41x34) [1.19]	.386	9.81	22	Black
	19103	S-250	S-76.2	16 (65x34) [1.47]	.401	10.19	25	Black
	19102	C-250	C-76.2	14 (41x30) [1.91]	.528	13.41	36	Black
	19101	C-250	C-76.2	12 (65x30) [2.41]	.599	15.21	46	Black

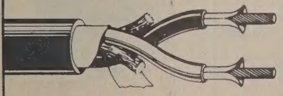
S-3 CONDUCTOR—RUBBER JACKET 600V-60°C

Color Code—Black, White, Green

Description	Trade Number	Standard Package ft. S—250 = 1—250 ft. Spl. 2S—250 = 2—250 ft. Spls. C = Coil	Standard Package m S—76.2 = 1—76.2 m Spl. 2S—76.2 = 2—76.2 m Spls. C = Coil	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 *19107—Lateral separator wrap under jacket* UL LISTED Certified to C.S.A. Standards	**19109**	C-250	C-76.2	18 (41x34) [1.19]	.401	10.19	22	Black
	19108	C-250	C-76.2	16 (65x34) [1.47]	.426	10.82	27	Black
	19107	C-250	C-76.2	14 (41x30) [1.91]	.558	14.17	45	Black, Nickel Gray
	19106	C-250	C-76.2	12 (65x30) [2.41]	.634	16.10	57	Black
	19105	C-250	C-76.2	10 (105x30) [3.00]	.689	17.50	74	Black

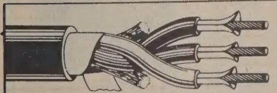
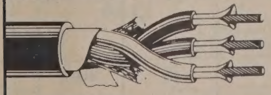
SO-2 CONDUCTOR—NEOPRENE JACKET 600V-60°C

Color Code—Black, White

Description	Trade Number	Standard Package ft. S—250 = 1—250 ft. Spl. 2S—250 = 2—250 ft. Spls. C = Coil	Standard Package m S—76.2 = 1—76.2 m Spl. 2S—76.2 = 2—76.2 m Spls. C = Coil	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	**19204**	S-250	S-76.2	18 (41x34) [1.19]	.386	9.81	24	Black
	19203	S-250	S-76.2	16 (65x34) [1.47]	.401	10.19	26	Black
	19202	C-250	C-76.2	14 (41x30) [1.91]	.528	13.41	39	Black
	19201	C-250	C-76.2	12 (65x30) [2.41]	.599	15.21	50	Black
	19200	C-250	C-76.2	10 (105x30) [3.00]	.643	16.33	60	Black

SO-3 CONDUCTOR—NEOPRENE JACKET 600V-60°C

Color Code—Black, White, Green

Description	Trade Number	Standard Package ft. S—250 = 1—250 ft. Spl. 2S—250 = 2—250 ft. Spls. C = Coil	Standard Package m S—76.2 = 1—76.2 m Spl. 2S—76.2 = 2—76.2 m Spls. C = Coil	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 *19207—Lateral separator wrap under jacket* UL LISTED Certified to C.S.A. Standards	**19209**	C-250	C-76.2	18 (41x34) [1.19]	.401	10.19	23	Black
	19208	C-250	C-76.2	16 (65x34) [1.47]	.426	10.82	28	Black
	19207	C-250	C-76.2	14 (41x30) [1.91]	.558	14.17	48	Black
	19206	C-250	C-76.2	12 (65x30) [2.41]	.634	16.10	60	Black
	19205	C-250	C-76.2	10 (105x30) [3.00]	.689	17.50	77	Black
 UL LISTED	**19210**	C-50	C-15.2	8 (132x29) [4.11]	.872	22.15	22	Black
	19210	C-200	C-60.9	8 (132x29) [4.11]	.872	22.15	89	Black
	19211	C-50	C-15.2	6 (133x27) [5.21]	.961	24.41	30	Black
	19211	C-200	C-60.9	6 (133x27) [5.21]	.961	24.41	120	Black

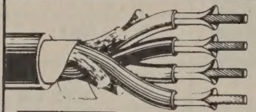
Continuous lengths will be supplied on at least 85% of each shipment.
When 2 lengths are supplied, 50 ft. will be minimum.
Shipped only in standard packages as listed above.

BELDEN portable cordage

PORTABLE CORDAGE (Cont'd)

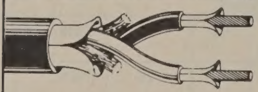
SO-4 CONDUCTOR—NEOPRENE JACKET 600V-60°C

Color Code—Black, White, Green, Red

Description	Trade Number	Standard Package ft. S—250=1—250 ft. Spl. 2S—250=2—250 ft. Spls. C=Coil	Standard Package m S—76.2=1—76.2 m Spl. 2S—76.2=2—76.2 m Spls. C=Coil	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	19217	C-50	C-15.2	14 (41x30) [1.91]	.603	15.32	11	Black
	19217	C-200	C-60.9	14 (41x30) [1.91]	.603	15.32	44	Black
	19216	C-50	C-15.2	12 (65x30) [2.41]	.690	17.53	15	Black
	19216	C-200	C-60.9	12 (65x30) [2.41]	.690	17.53	60	Black
	19215	C-50	C-15.2	10 (105x30) [3.00]	.770	19.56	19	Black
	19215	C-200	C-60.9	10 (105x30) [3.00]	.770	19.56	76	Black
 UL LISTED	19214	C-25	C-7.6	8 (132x29) [4.11]	.970	24.64	14	Black
	19214	C-100	C-30.5	8 (132x29) [4.11]	.970	24.64	56	Black
	19213	C-25	C-7.6	6 (133x27) [5.21]	1.090	27.69	20	Black
	19213	C-100	C-30.5	6 (133x27) [5.21]	1.090	27.69	80	Black

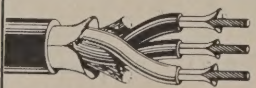
SJ-2 CONDUCTOR—RUBBER JACKET 300V-60°C

Color Code—Black, White

Description	Trade Number	Standard Package ft.	Standard Package m	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	19127	2S-250	2S-76.2	18 (16x30) Flex [1.19]	.298	7.57	26	Black
	19111	2S-250	2S-76.2	18 (41x34) X flex. [1.19]	.298	7.57	26	Black
	19128	2S-250	2S-76.2	16 (26x30) Flex [1.52]	.323	8.20	32	Black
	19110	2S-250	2S-76.2	16 (65x34) X flex. [1.47]	.323	8.20	33	Black

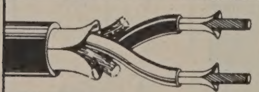
SJ-3 CONDUCTOR—RUBBER JACKET 300V-60°C

Color Code—Black, White, Green

Description	Trade Number	Standard Package ft.	Standard Package m	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	19129	2S-250	2S-76.2	18 (16x30) Flex [1.19]	.328	8.33	35	Black
	19125	2S-250	2S-76.2	18 (41x34) X flex. [1.19]	.328	8.33	35	Black
	19130	2S-250	2S-76.2	16 (26x30) Flex [1.52]	.353	8.97	42	Black
	19124	2S-250	2S-76.2	16 (65x34) X flex. [1.47]	.353	8.97	43	Black

SJO-2 CONDUCTOR—NEOPRENE JACKET 300V-60°C

Color Code—Black, White

Description	Trade Number	Standard Package ft.	Standard Package m	AWG (Stranding) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Weight Std. Pkg. in lbs.	Jacket Colors
 UL LISTED Certified to C.S.A. Standards	19227	2S-250	2S-76.2	18 (16x30) Flex [1.19]	.298	7.57	27	Black
	19228	2S-250	2S-76.2	16 (26x30) Flex [1.52]	.323	8.20	35	Black

Continuous lengths will be supplied on at least 85% of each shipment.
When 2 lengths are supplied, 50 ft. will be minimum.
Shipped only in standard packages as listed above.

retractile cables and cords | BELDEN

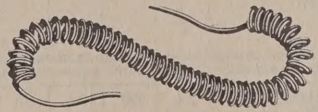
RETRACTILE CORDS

Retractile cords keep telephone and microphone cables from tangling and cluttering desk tops, communications consoles and the front seats of motor vehicles. Belden manufactures a full line of high quality retractile coiled cord products for a wide number of applications.

Belden retractile cables and cords are used for telephone equipment; ham and citizen band radios; hand and desktop microphones; language lab equipment; musical instruments; mobile controls and mobile communications equipment and for a variety of assorted industrial applications.

The specially designed conductors and shields of Belden retractile cords are constructed to withstand rugged use and to minimize replacement frequency.

Belden's full line of retractile cords shown in this catalog will meet most of your requirements. For any custom or unusual cord and cable application contact Belden's Special Custom Design Center (317) 966-6681.



RETRACTILE AND MICROPHONE CABLES

Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Coil O.D.		Percent Shield Coverage	Nominal ***Cap. (pF/Cord)	Retracted Length		Practical Extended Length		Standard Put-up
			Inch	mm	Inch	mm	Inch	mm	Inch	mm			Inch	cm	ft.	m	
★9470	2 unshielded	33 (tinsel) [.61]	—	—	.020	.51	.105	2.67	½	12.7	No shield	—	10½	26.7	5	1.5	1
			Solderable tinsel conductors, parallel, 2.2 ohms/cord, each conductor, black vinyl jacket. 6" straight portion at each end cut blunt. Long flex-life.														
★9468	3 1 shielded 2 unshielded	31 (tinsel) [.71]	.007	.18	.040	1.02	.150	3.80	½	12.7	100	900	20	50.8	10	3.1	1
			Solderable tinsel conductors, 3.9 ohms/cord, each conductor, polypropylene insulation, spiral tinsel and Beldfoil aluminum-polyester shield, black vinyl jacket. 6" straight portion at each end cut blunt. Long flex-life.														
★9469	4 unshielded	31 (tinsel) [.71]	.007	.18	.040	1.02	.150	3.81	½	12.70	No shield	—	20	50.8	10	3.1	1
			Solderable tinsel conductors, 3.9 ohms/cord, each conductor, polypropylene insulation, black vinyl jacket. 6" straight portion at each end cut blunt. Long flex-life.														
★9466	3 1 shielded 2 unshielded	28 (7x36) [.38]	.005	.13	.050	1.27	.160	4.10	⅝	15.89	90	1000	12	30.5	6	1.8	1
			Tinned copper, nylon insulated, spiral tinned copper shield, black neoprene jacket. 6" straight portion at each end cut blunt.														
8409	4 unshielded	28 (7x36) [.38]	.005	.13	.050	1.27	.165	4.19	9/16	14.29	No shield	—	12	30.5	6	1.8	1
			Tinned copper, nylon insulated, neoprene jacket. 6" straight portion at each end cut blunt.														
★9467	5 1 shielded 4 unshielded	28 (7x36) [.38]	.005	.13	.045	1.14	.175	4.45	11/16	17.46	90	1000	12	30.5	6	1.8	1
			Tinned copper, nylon insulated, spiral tinned copper shield, black neoprene jacket. 6" straight portion at each end cut blunt.														
8499	1 shielded	24 (45x40) [.61]	.019	.48	.043	1.09	.170	4.32	11/16	17.46	80	285	7½	19.1	4	1.2	1
			Tinned cadmium bronze, rubber insulated, spiral tinned copper shield, cotton wrap, black neoprene jacket. 6" straight portion at each end cut blunt.														
★9499	1 shielded	24 (45x40) [.61]	.019	.48	.043	1.09	.170	4.32	11/16	17.46	80	910	24	61.0	12	3.7	1, 10
			Tinned cadmium bronze, rubber insulated, spiral tinned copper shield, cotton wrap, black neoprene jacket. 6" straight portion at each end cut blunt.														
8605	1 shielded	24 (19x36) [.61]	.021	.53	.042	1.07	.160	4.06	11/16	17.46	87	680	21½	54.6	12	3.7	1
			Tinned copper, polypropylene insulated, spiral tinned copper shield, Gray vinyl jacket. 6" straight portion at each end cut blunt.														
8497	3 1 shielded 2 unshielded	23 (21x36) [.66]	.020	.51	.046	1.17	.250	6.35	⅞	22.23	100	510	11½	29.2	6	1.8	1, 50
			5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, conductive textile wrap shield plus BELDFOIL aluminum-polyester shield with drain wire same as conductors, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.														
9417	3 1 shielded 2 unshielded	23 (21x36) [.66]	.020	.51	.046	1.17	.250	6.35	⅞	22.23	100	1200	30	76.2	15	4.6	1, 15
			5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, conductive textile wrap shield plus BELDFOIL aluminum-polyester shield with drain wire same as conductors, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.														

CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue.

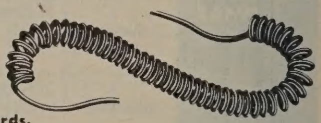
★*New Item.*
****Capacitance of shielded conductor.*

BELDEN | retractile cables and cords

RETRACTILE AND MICROPHONE CABLES (Cont'd)

Trade & UL Style Number	No. of Cond.	AWG (Standing) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Coil O.D.		Percent Shield Coverage	Nominal ***Cap. (pF/Cord)	Retracted Length		Practical Extended Length		Standard Put-up
			Inch	mm	Inch	mm	Inch	mm	Inch	mm			Inch	cm	ft.	m	
8415	4 unshielded	23 (21x36) [.66]	.020	.51	.055	1.40	.250	6.35	⅞	22.23	No shield	—	11½	29.2	6	1.8	1, 50
	5 strands tinned copper covered steel. 16 strands tinned copper, rubber insulated, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.																
9415	4 unshielded	23 (21x36) [.66]	.020	.51	.055	1.40	.250	6.35	⅞	22.23	No shield	—	30	76.2	15	4.6	1, 15
	5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.																
8491	4 2 individually shielded 2 unshielded	23 (21x36) [.66]	.020	.51	.050	1.27	.275	6.99	1¹⁄₁₆	26.99	100	510	12	30.5	6	1.8	1
	5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, conductive textile wrap shield plus BELDFOIL® aluminum-polyester shield with drain wire same as conductors, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.																
9416	4 2 individually shielded 2 unshielded	23 (21x36) [.66]	.020	.51	.050	1.27	.275	6.99	¹⁵⁄₁₆	23.81	100	1200	30	76.2	15	4.6	1, 15
	5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, conductive textile wrap shield plus BELDFOIL® aluminum-polyester shield with drain wire same as conductors, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.																
8490	5 unshielded	23 (21x36) [.66]	.020	.51	.045	1.14	.265	6.73	⅞	22.23	No shield	—	11½	29.2	6	1.8	1
	5 strands tinned copper covered steel, 16 strands tinned copper, rubber insulated, paper tape, black neoprene jacket. 6" straight portion at each end cut blunt.																

CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue.



NEOPRENE RETRACTILE POWER CONTROL CABLES

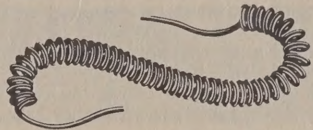
Underwriters Laboratories Inc. Listed. Certified to C.S.A. Standards.

Trade Number & UL Type	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Coil O.D.		Retracted Length		Practical Extended Length		Standard Put-up
			Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	cm	ft.	m	
8601 UL LISTED **SVO**	2	18 (41x34) [1.19]	.016	.41	.045	1.14	.270	6.86	¹⁵⁄₁₆	23.81	12	30.5	6	1.8	1
	Underwriters Laboratories Inc. Listed (Type SVO)														
9476 UL LISTED **SVO**	2	18 (41x34) [1.19]	.016	.41	.045	1.14	.270	6.86	¹⁵⁄₁₆	23.81	24	61.0	12	3.7	1, 15
	Underwriters Laboratories Inc. Listed (Type SVO)														
9477 UL LISTED **SVO**	2	18 (41x34) [1.19]	.016	.41	.045	1.14	.270	6.86	¹⁵⁄₁₆	23.81	48	121.9	25	7.6	1, 15
	Underwriters Laboratories Inc. Listed (Type SVO)														
9478 UL LISTED **SVO**	3	18 (41x34) [1.19]	.016	.41	.045	1.14	.275	6.99	¹⁵⁄₁₆	23.81	24	61.0	12	3.7	1, 15
	Underwriters Laboratories Inc. Listed (Type SVO)														
9479 UL LISTED **SVO**	3	18 (41x34) [1.19]	.016	.41	.045	1.14	.275	6.99	¹⁵⁄₁₆	23.81	48	121.9	25	7.6	1, 15
	Underwriters Laboratories Inc. Listed (Type SVO)														
8602 UL LISTED **SJO**	3	18 (41x34) [1.19]	.031	.79	.045	1.14	.360	9.14	1⅜	34.93	12	30.5	6	1.8	1
	Underwriters Laboratories Inc. Listed (Type SJO)														

Bare copper, paper wrap, rubber insulated, cabled with fillers, paper tape wrap black neoprene jacket. 12" straight portion each end (except 6" straight portion on 8601, 8602). Jacket removed 1½" each end. Conductor Color Coding: (1) White, (2) Black, (3) Green.

****Capacitance of shielded conductor.*

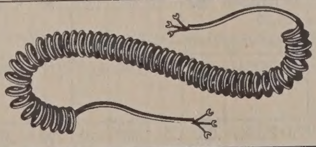
NEOPRENE RETRACTILE POWER CONTROL CABLES (Cont'd)



Trade Number & UL Type	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Coil O.D.		Retracted Length		Practical Extended Length		Standard Put-up
			Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	cm	ft.	m	
9480 UL LISTED **SJO**	3	18 (41x34) [1.19]	.031	.79	.045	1.14	.360	9.14	1⅜	34.93	24	60.9	12	3.7	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
9481 UL LISTED **SJO**	3	18 (14x34) [1.19]	.031	.79	.045	1.14	.360	9.14	1⅜	34.93	48	121.9	25	7.6	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
8603 UL LISTED **SJO**	3	16 (65x34) [1.47]	.031	.79	.045	1.14	.370	9.40	1⁷⁄₁₆	36.51	12	30.5	6	1.8	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
9484 UL LISTED **SJO**	3	16 (65x34) [1.47]	.031	.79	.045	1.14	.370	9.40	1⁷⁄₁₆	36.51	24	60.9	12	3.7	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
9485 UL LISTED **SJO**	3	16 (65x34) [1.47]	.031	.79	.045	1.14	.370	9.40	1⁷⁄₁₆	36.51	48	121.9	25	7.6	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
9482 UL LISTED **SJO**	4	18 (41x34) [1.19]	.031	.79	.045	1.14	.385	9.78	1⁷⁄₁₆	36.51	24	60.9	12	3.7	1
		Underwriters Laboratories Inc. Listed (Type SJO)													
9483 UL LISTED **SJO**	4	18 (41x34) [1.19]	.031	.79	.045	1.14	.385	9.78	1⁷⁄₁₆	36.51	48	121.9	25	7.6	1
		Underwriters Laboratories Inc. Listed (Type SJO)													

Bare copper, paper wrap, rubber insulated, cabled with fillers, paper tape wrap, black neoprene jacket. 12" straight portion each end (except 6" straight portion on 8603). Jacket removed 1½" each end. Conductor Color Coding: (1) White, (2) Black, (3) Green, (4) Red.

VINYL RETRACTILE TELEPHONE CORDS



Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Nominal Coil O.D.		Retracted Length		Practical Extended Length		Standard Put-up
			Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	cm	ft.	m	
8495	3	23 (21x36) [.66]	.020	.51	.041	1.04	.220	5.59	⅞	22.23	10	25.4	4½	1.4	1
			Bare cadmium bronze, vinyl insulated, conductors cabled, paper tape wrap, black vinyl jacket. One end stripped 2¾", spade terminals attached and hook strain relief clamped over jacket. Other end stripped 3⁷⁄₁₆" and spade terminals attached. *Conductor Color Coding: (1) White, (2) Black, (3) Red. Black Jacket only.*												

BELDEN | microphone and shielded power supply cables

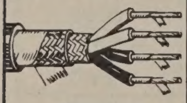
MICROPHONE CABLES

Belden Microphone Cables are designed for flexible service at audio frequencies. They are used not only for microphones, but also for home entertainment equipment, instruments, tape recorders and shielded power supplies.

Shielded single conductor cables are used in high impedance systems, while multiple conductor cables are used in low impedance applications.

All cables are precision-engineered and manufactured to transmit clear signals and to cancel out hum pick-up and cross-talk interference. They are designed to withstand the flexing and normal abuse of studio, laboratory and home usage.

RUBBER, HYPALON■ AND NEOPRENE MICROPHONE AND SHIELDED POWER SUPPLY CABLES

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D		Percent Shield Coverage	Sugg. Working Voltage	Impedance (Ohms)	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm				* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
SINGLE CONDUCTOR	**8410**	1	25 (7x33) [.53]	.063	1.60	.025	.64	.245	6.22	80	3000 DC	52	—	—	33	108	25, 50, 100, 250, 500 U-500 (UNREEL)	7.6, 15.2, 30.5, 76.2, 152.4 U-152.4 (UNREEL)®
		3 strands copper, 4 strands copper covered steel tinned, cellulose yarn braid, rubber insulated, rayon braid, tinned copper braid shield, cellulose yarn wrap, black rubber jacket.																
MINIATURE CONDUCTOR	**8413**	2	24 (45x40) [.61]	.019	.48	.025	.64	.190	4.83	100	300	—	30	98	55	180	15, 25, 50, 100, 250, 500 U-500 (UNREEL)	4.6, 7.6, 15.2, 30.5, 76.2, 152.4 U-152.4 (UNREEL)
	8406	3	24 (45x40) [.61]	.019	.48	.025	.64	.223	5.66	100	300	—	35	114	60	197	100, 500 U-500 (UNREEL)	30.5, 152.4 U-152.4 (UNREEL)
		Tinned cadmium bronze, cotton serve, rubber insulated, cabled with fillers, 100% coverage conductive textile wrap shield, tinned copper braid shield, cotton serve, black rubber jacket.																
	★9399	2	24 (45x40) [.61]	.017	.43	.030	.76	.195	4.95	100	300	—	30	98	55	180	100, 500, 1000	30.5, 152.4, 304.8
		Bare cadmium copper conductor, cotton serve, rubber insulated, cable with fillers, 100% coverage conductive textile wrap shield, tinned copper braid shield, cotton serve, brown rubber jacket.																
 **MULTIPLE CONDUCTOR**	**8412**	2	20 (26x34) [.94]	.020	.51	.043	1.09	.263	6.68	85	600	—	30	98	55	180	25, 50, 100, 250, 500, 1000	7.6, 15.2, 30.5, 76.2, 152.4, 304.8
	8402†	2	20 (26x34) [.94]	.020	.51	.040	1.02	.263	6.68	85	600	—	30	98	55	180	100, 250, 500	30.5, 76.2, 152.4
		Brown Hypalon jacket.																
	8428	2	18 (41x34) [1.19]	.022	.56	.038	.97	.290	7.37	85	600	—	35	115	60	197	100, 500, 1000	30.5, 152.4, 304.8
		Black neoprene jacket.																
	8408†	2	16 (65x34) [1.65]	.032	.81	.040	1.02	.385	9.78	85	600	—	30	98	55	180	100, 500	30.5, 152.4
		Brown Hypalon jacket—Heavy Duty.																
	8423	3	20 (26x34) [.94]	.020	.51	.040	1.02	.272	6.91	85	600	—	35	115	60	197	50, 100, 250, 500, 1000	15.2, 30.5, 76.2, 152.4, 304.8
	8424	4	20 (26x34) [.94]	.020	.51	.040	1.02	.290	7.37	85	600	—	35	115	60	197	50, 100, 250, 500, 1000	15.2, 30.5, 76.2, 152.4, 304.8
	8407†	4	16 (65x34) [1.47]	.032	.81	.043	1.09	.416	10.57	85	600	—	30	98	55	180	100, 250	30.5, 76.2
		Black neoprene jacket—Heavy Duty.																
	8425	5	20 (26x34) [.94]	.020	.51	.040	1.02	.318	8.08	85	600	—	35	115	60	197	100, 250	30.5, 76.2
		Tinned copper, cotton wrap, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black rubber jacket.																

CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue, (6) Brown, (7) Yellow, (8) Orange.

★New Item.

■Trademark of DuPont.

†Passes the FR-1 vertical flame test.

**Capacitance between conductors.*

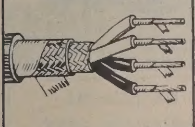
***Capacitance between 1 conductor and remaining conductors (if any) connected to shield.*

microphone and shielded power supply cables

BELDEN

RUBBER, HYPALON AND NEOPRENE MICROPHONE AND SHIELDED POWER SUPPLY CABLES (Cont'd)

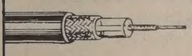
MULTIPLE CONDUCTOR (Cont'd)

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Percent Shield Coverage	Sugg. Working Voltage	Impedance (Ohms)	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm				* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
	**8426**	6	20 (26x34) [.94]	.020	.51	.040	1.02	.344	8.74	85	600	—	35	115	60	197	100, 250	30.5, 76.2
	8427	7	20 (26x34) [.94]	.020	.51	.043	1.09	.355	9.02	85	600	—	35	115	60	197	100, 250	30.5, 76.2
	8418	8	20 (26x34) [.94]	.020	.51	.043	1.09	.381	9.68	85	600	—	35	115	60	197	100, 250	30.5, 76.2

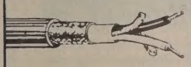
CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue, (6) Brown, (7) Yellow, (8) Orange.

Tinned copper, cotton wrap, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black rubber jacket.

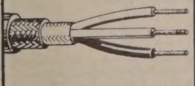
VINYL MICROPHONE AND SHIELDED POWER SUPPLY CABLES

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Percent Shield Coverage	Sugg. Working Voltage	Impedance (Ohms)	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm				* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **SINGLE CONDUCTOR**	**8411**	1	25 (7x33) [.53]	.020	.51	.020	.51	.144	3.66	72	3500 DC	52	—	—	40	129.7	15, 25, 50, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 7.6, 15.2, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)®
	8401	1	25 (7x33) [.53]	.043	1.09	.025	.64	.200	5.08	74	5000 DC	57	—	—	25	81.1	15, 25, 50, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 7.6, 15.2, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)

3 strands copper, 4 strands copper covered steel tinned, braided textile, polyethylene insulated, tinned copper braid shield, chrome vinyl jacket.

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Percent Shield Coverage	Sugg. Working Voltage	Impedance (Ohms)	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm				* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **MINIATURE**	**8420**†	2	24 (45x40) [.61]	.015	.38	.020	.51	.185	4.70	77	500	—	22	71.3	40	129.7	15, 25, 50, 100, 250 500 U-500 (UNREEL)	4.6, 7.6, 15.2, 30.5, 76.2, 152.4, 304.8 U-152.4 (UNREEL)

Tinned cadmium bronze, cotton wrap, polyethylene insulated, cabled with fillers, rayon braid, tinned copper braid shield, chrome vinyl jacket.

Description	Trade & UL Style Number	No. of Cond.	AWG (Stranding) [Dia. in mm]	Insulation Thickness		Jacket Thickness		Nominal O.D.		Percent Shield Coverage	Sugg. Working Voltage	Impedance (Ohms)	Nominal Capacitance				Standard Lengths	
				Inch	mm	Inch	mm	Inch	mm				* pF/ft.	* pF/m	** pF/ft.	** pF/m	ft.	m
 **MULTIPLE CONDUCTOR**	**8422**	2	22 (16x34) [.79]	.023	.58	.023	.58	.231	5.87	87	1000	—	18	58.4	32	103.8	15, 25, 50, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 7.6, 15.2, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8403†	3	20 (26x34) [.94]	.015	.38	.033	.84	.244	6.20	89	600	—	25	81.1	45	145.9	15, 50, 100, 250, 500, 1000 U-500, U-1000 (UNREEL)	4.6, 15.2, 30.5, 76.2, 152.4, 304.8 U-152.4, U-304.8 (UNREEL)
	8404† UL LISTED **2094**	4	20 (26x34) [.94]	.015	.38	.033	.84	.248	6.30	87	600	—	23	75.5	40	131.2	15, 100, 250, 500, 1000	4.6, 30.5, 76.2, 152.4, 304.8
			Underwriters Laboratories Inc. Listed (Style 2094) 300 Volts															
	8405†	5	20 (26x34) [.94]	.015	.38	.035	.89	.275	6.99	83	600	—	23	75.5	40	131.2	250, 500, 1000	76.2, 152.4, 304.8

CONDUCTOR COLOR CODING: (1) Clear, (2) Black, (3) Red, (4) Green, (5) Blue.

Tinned copper, polyethylene insulated, conductors cabled, rayon braid, tinned copper braid shield, chrome vinyl jacket.

PLASTIC CABLES RECOMMENDED FOR: Lower capacitance, lower loss, greater ozone and oil resistance, lighter weight, smaller diameter.
RUBBER CABLES RECOMMENDED FOR: Greater abrasion and impact resistance and extra limpness so cable will lie flat on stage or studio floor.
NEOPRENE AND HYPALON CABLES RECOMMENDED FOR: Outside use, cold weather applications. Resistant to effects of sun, oil and ozone.

**Capacitance between conductors. **Capacitance between 1 conductor and remaining conductors (if any) connected to shield.*

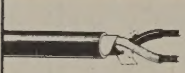
†Passes the FR-1 vertical flame test.

BELDEN

multiple conductor unshielded cables and fire alarm cables

ELECTRICAL POWER AND CONTROL CABLES—MIL-C-3432

Electrical power and control cables intended for use in electrical and electronic applications. These cables are intended for military applications to transmit power and control signals. These medium duty cables are suitable for small portable tools, sound equipment, radio receivers and motor leads. The tough flexible jacket is resistant to the mechanical abuse and extreme humidity and temperature conditions normally encountered in the intended applications.

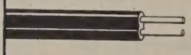
Description	Trade & UL Style Number	Type Designation	No. of Cond.	AWG (Stranding) Dia. in. mm	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Suggested Working Voltage	Standard Lengths ft	Standard Lengths m
	**9215**	CO-02 MGF (2/18) 0310	2	18 (41x34) [1.19]	.033	.84	.039	.99	.310	7.87	600	500, 1000	152.4, 304.8
	9216	CO-02 MGF (2/16) 0335	2	16 (65x34) [.147]	.033	.84	.047	1.19	.335	8.51	600	500, 1000	152.4, 304.8
	9217	CO-02 MGF (2/14) 0400	2	14 (41x30) [1.91]	.036	.91	.047	1.19	.400	10.16	600	500, 1000	152.4, 304.8
	9218	CO-03 MGF (3/18) 0340	3	18 (41x34) [1.19]	.033	.84	.047	1.19	.345	8.76	600	500, 1000	152.4, 304.8
	9219	CO-03 MGF (3/16) 0365	3	16 (65x34) [.147]	.033	.84	.047	1.19	.365	9.27	600	500, 1000	152.4, 304.8

Tinned copper conductors, rubber insulated, cabled with fillers, cotton serve, black rubber jacket.
Conductor color coding: (1) White, (2) Black, (3) Green.
Manufactured to current Government specifications and subsequent revisions.
For Underwriters Laboratories Inc. Listed power cables see pages 32-33.

FIRE ALARM CABLES

These cables meet the physical and dimensional requirements of UL subject 13, low energy circuit cable. These designs are rated at 105°C and marked as "Limited Energy Circuit Cables" in the **low energy circuit cable category.** They are suitable for fire protection alarm circuit wiring.

19 AWG

Description	Trade & UL File Number	No. of Cond.	AWG (Stranding) Dia. in. mm	Insulation Thickness Inch	Insulation Thickness mm	Jacket Thickness Inch	Jacket Thickness mm	Nominal O.D. Inch	Nominal O.D. mm	Cond. Color Coding	Working Voltage	Standard Lengths ft	Standard Lengths m
	**★9596** UL LISTED **E 34972**	2	19 (Solid) [.91]	.030	.76	—	—	.100 x .190	2.54 x 4.83	Red	300	500, 1000	152.4, 304.8
			Bare copper, red vinyl, parallel.										
			Underwriters Laboratories Inc. Listed (File No. E34972) 250 Volts										
	★9597 UL LISTED **E 34972**	4	19 (Solid) [.91]	.015	.38	.035	.89	.230	5.84	Black Red Yellow Blue	300	500, 1000	152.4, 304.8
			Underwriters Laboratories Inc. Listed (File No. E34972) 250 Volts										
	★9598 UL LISTED **E 34972**	6	19 (Solid) [.91]	.015	.38	.040	1.02	.278	7.06	Black Red Yellow Blue Brown Orange	300	500, 1000	152.4, 304.8
			Underwriters Laboratories Inc. Listed (File No. E34972) 250 Volts										

Bare copper, vinyl insulated, conductors cabled, red vinyl jacket.

★New Item.

COLOR CODING FOR PAIRED CABLES

Pair Number	Color Combination	Pair Number	Color Combination	Pair Number	Color Combination
1	Black paired with Red	10	Red paired with Blue	19	White paired with Blue
2	Black paired with White	11	Red paired with Yellow	20	White paired with Yellow
3	Black paired with Green	12	Red paired with Brown	21	White paired with Brown
4	Black paired with Blue	13	Red paired with Orange	22	White paired with Orange
5	Black paired with Yellow	14	Green paired with White	23	Blue paired with Yellow
6	Black paired with Brown	15	Green paired with Blue	24	Blue paired with Brown
7	Black paired with Orange	16	Green paired with Yellow	25	Blue paired with Orange
8	Red paired with White	17	Green paired with Brown	26	Brown paired with Yellow
9	Red paired with Green	18	Green paired with Orange	27	Brown paired with Orange

power cords | **BELDEN**

Power Cords Meet Applicable O.S.H.A. Requirements

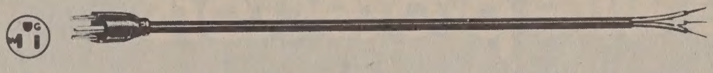
Belden Power Cords are designed to meet the special electrical needs and environmental requirements of a broad range of specific light and heavy duty applications in home and industry. All cords are built to withstand rugged everyday wear under predictable conditions of use.

TYPE SV RUBBER AND SVT VINYL

Three conductor SV and SVT cords may now be used on some small tools, business machines and instruments.

UL LISTED

Tan Flag Label
Certified to C.S.A. Standards


NEMA 5-15P
MOLDED VINYL GROUNDING PLUG PH-290B
OUTER JACKET STRIPPED 1½", CONDUCTORS STRIPPED AND TWISTED ⅝"

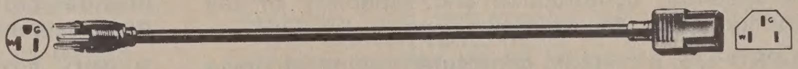
Trade Number	Length of Cord Ft.	Length of Cord m	AWG (Stranding) Dia. in mm	Nominal O.D. Inch	Nominal O.D. mm	Rating	Type of Cordage	Color
17236	6	1.83	18 (41x34) [1.19]	.265	6.74	1250 Watts 10A-125V	SV Rubber	Black
17238	8	2.44	18 (41x34) [1.19]	.265	6.74	1250 Watts 10A-125V	SV Rubber	Black
17237	6	1.83	18 (41x34) [1.19]	.253	6.43	1250 Watts 10A-125V	SVT Vinyl	Gray
17239	8	2.44	18 (41x34) [1.19]	.253	6.43	1250 Watts 10A-125V	SVT Vinyl	Gray

TYPE SVT VINYL

For use on U.S. and Canadian electronic instruments, business machines, test equipment, desk top computers and appliances. National Stock No. NSN-6150-00-351-3405. Connector mates with 17252 or Switchcraft EAC-301.

UL LISTED

Blue Flag Label
Certified to C.S.A. Standards


NEMA 5-15P
MOLDED VINYL GROUNDING PLUG PH-290B
MOLDED VINYL GROUNDING CONNECTOR SPH-386

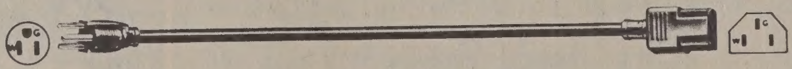
Trade Number	Length of Cord Ft.	Length of Cord m	AWG (Stranding) Dia. in mm	Nominal O.D. Inch	Nominal O.D. mm	Rating	Type of Cordage	Color
17250	7½	2.29	18 (41x34) [1.19]	.253	6.43	1250 Watts 10A-125V	SVT Vinyl	Black
★17255	7½	2.29	16 (65x34) [1.47]	.353	8.96	1625 Watts 13A-125V	SJT Vinyl	Black

TYPE SVT VINYL

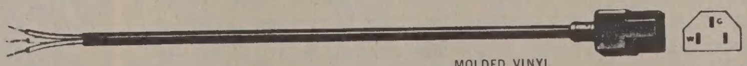
For use on U.S. electronic instruments, business machines, test equipment, desk top computers and appliances. Connector mates with 17252 or Switchcraft EAC-301.

UL LISTED

Blue Flag Label
Conductor employs I.E.C. color code—Brown, Lt. Blue, and Green with a Yellow stripe.


NEMA 5-15P
MOLDED VINYL GROUNDING PLUG PH-290B
MOLDED VINYL GROUNDING CONNECTOR SPH-386

Trade Number	Length of Cord Ft.	Length of Cord m	AWG (Stranding) Dia. in mm	Nominal O.D. Inch	Nominal O.D. mm	Rating	Type of Cordage	Color
★17251	7½	2.29	18 (41x34) [1.19]	.253	6.43	1250 Watts 10A-125V	SVT Vinyl	Black


OUTER JACKET STRIPPED 2"
CONDUCTORS STRIPPED AND TWISTED ⅝"
MOLDED VINYL GROUNDING CONNECTOR SPH-386

Trade Number	Length of Cord Ft.	Length of Cord m	AWG (Stranding) Dia. in mm	Nominal O.D. Inch	Nominal O.D. mm	Rating	Type of Cordage	Color
★17254	7½	2.29	18 (41x34) [1.19]	.253	6.43	1250 Watts 10A-125V	SVT Vinyl	Black

★*New Item.*

BREEZE
ILLINOIS INC.

the wire protectors

BREEZE-ILLINOIS, INCORPORATED
Designs and Manufactures
Interconnector assemblies
that are Shielded Against
EMI, EMP, RFI, Nuclear
Radiation, Compromising
Eminations (TEMPEST),
Mechanical Stressing,
Chemical Environments,
Weather and Temperature

Breeze-Illinois has developed a complete line of shielded interconnectors that assure wiring integrity in every situation. Trade marked **BI-PRO** (for **B**reeze-**I**llinois **PRO**tected) our products meet and exceed all applicable Government, Military and NASA specifications. Some are super tough to withstand the punishment of continuous flexing and heavy work. Others are light weight to be compatible with aerospace requirements. High temperature Bi-Pro cable withstands hostile environments of over 1000°. And, all Bi-Pro interconnectors feature superior shielding against the complete spectrum of electromagnetic interference, radiation and Tempest.

The numbered suffix to the Bi-Pro name indicates the material, construction and capability of the interconnector, for example:

Bi-PRO 175, a metallic convoluted tubing of Brass with a Bronze braid provides EMI protection for electrical wiring on communication and navigation systems. Bi-Pro 175 is also used as a protected interconnection between computers and machine tools. Bi-Pro 175 and 223 shields ignition systems on jet and industrial engines against interference and for fire protection.

Bi-PRO 223 consists of a 50/50 nickel-iron inner core and a stainless steel braid. It provides TEMPEST and EMI protection against low frequency fields.

Bi-PRO 237, manufactured of 80/20 nickel-iron alloy is used on submarines to prevent interference between the power system and super-sensitive gyros and/or sonar detection equipment.

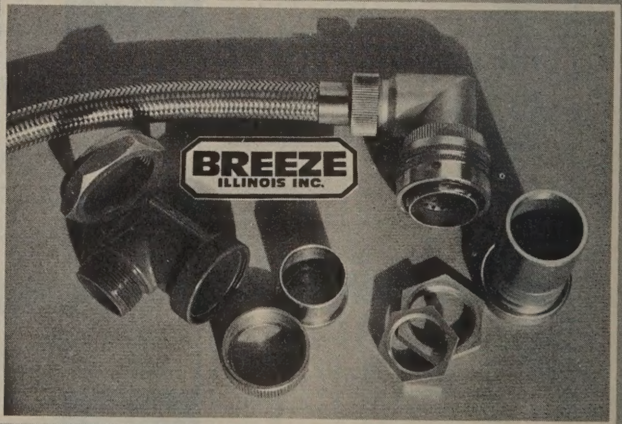
Bi-PRO 811 is a non-metallic Teflon, helically convoluted tubing with stainless steel over-braid. It provides protection for wiring systems on landing gear assemblies for commercial and military aircraft.

Bi-PRO 827 is a non-metallic Teflon annular corrugated tubing with tinned copper braid to provide an ultra-flexible EMI protected interconnection or umbilical between moving devices.

The name Breeze-Illinois is synonymous with wiring protection.

Our 40 years experience in manufacturing our own hardware such as coupling nuts, backshell assemblies, junction boxes, branches and connectors has established the name Breeze as the standard in the protected cable assembly field. We are highly competitive and best qualified to construct custom designed assemblies for our customers - from one assembly to thousands of copies. If you wish to assemble your own interconnectors, we manufacture individual components and can supply many off-the-shelf items for your interconnector needs. We also braid textiles such as Nylon and Dacron to wire bundles from your simplest design to your most complicated system.

We have a nationwide network of sales representatives anxious to serve you - Call or write us today.



BREEZE
ILLINOIS

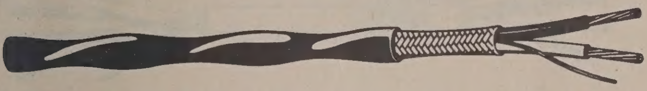
Need more information? Call or write for our product and facilities brochures.
Breeze-Illinois, Incorporated, Main and Agard Sts. Wyoming, Illinois 61491
Phone, (309) 695-2511 TWX, 510 390 3691

FOR PROTECTED *INTERCONNECTOR ASSEMBLIES*

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411

SHIELDED AUDIO CABLE

BRAID SHIELD, PVC JACKET, DRAIN WIRE



Stock Color: Black jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper braid shield, tinned copper drain wire, PVC jacket overall.

Specifications: −20°C to +60°C. Entire cable passes FR-1 vertical flame test.

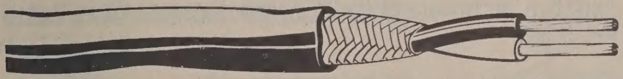
Color Code: Black, Red.

Applications: Shielded cable for recording studios, radio transmitters, sound systems, broadcast use.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	Size AWG	Stranding	Nom. Insul. Thck.	Nom. Jkt. Thck.	Nom. O.D. In.
02676	2	22	Solid	.015	.025	.200
02677	2	22	16/34	.015	.025	.210

BRAID SHIELD, PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper braid shield, PVC jacket overall.

Specifications: −20°C to +60°C. Entire cable passes FR-1 vertical flame test.

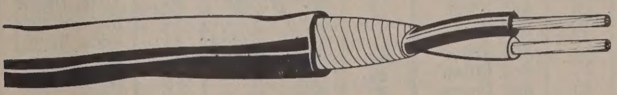
Color Code: Black, Red, White, Green.

Applications: Shielded cable for recording studios, radio transmitters, sound systems and electronic circuits where shielding is required.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	Size AWG	Stranding	Nom. Insul. Thck.	Nom. Jkt. Thck.	Nom. O.D. In.
02695	2	20	Solid	.015	.025	.205
02696	2	18	Solid	.015	.025	.220
02679	2	22	7/30	.015	.025	.200
02678	3	22	7/30	.015	.025	.210
02680	4	22	7/30	.015	.025	.225
02681	2	20	10/30	.015	.025	.215
01332	3	20	10/30	.015	.025	.225
02683	4	20	10/30	.015	.025	.245
02686	2	18	16/30	.018	.025	.245
02687	3	18	16/30	.018	.025	.260
02688	4	18	16/30	.018	.025	.280
02689	2	16	26/30	.018	.025	.270
02690	3	16	26/30	.018	.025	.285
02691	2	14	41/30	.020	.030	.320
02692	3	14	41/30	.020	.030	.335
02693	2	12	65/30	.020	.030	.360
02694	3	12	65/30	.020	.030	.380

SPIRAL SHIELD, PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper spiral wrapped shield, PVC jacket overall.

SPIRAL SHIELD, PVC JACKET (CONT'D)

Specifications: −20°C to +60°C. Entire cable passes FR-1 vertical flame test.

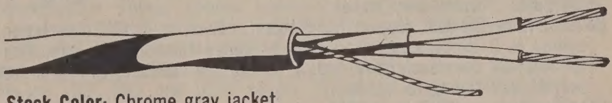
Color Code: Black, Red, White, Green, Yellow, Blue.

Applications: Cable for recording studios, radio transmitters, sound systems and electronic circuits where shielding is required. Spiral shield allows ease of pigtail soldering.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	Size AWG	Stranding	Nom. Insul. Thck.	Nom. Jkt. Thck.	Nom. O.D. In.
02884	2	22	Solid	.015	.025	.175
02885	3	22	Solid	.015	.025	.180
02882	2	22	7/30	.015	.025	.185
01335	3	22	7/30	.015	.025	.190
01337	4	22	7/30	.015	.025	.210
01341	6	22	7/30	.015	.025	.245
02888	2	20	10/30	.015	.025	.200
02893	3	20	10/30	.015	.025	.210
02769	4	20	10/30	.015	.025	.225
02770	6	20	10/30	.015	.025	.265
02892	2	18	16/30	.020	.025	.240
02768	3	18	16/30	.020	.025	.250
02894	4	18	16/30	.020	.025	.275
02895	2	16	26/30	.020	.025	.265
02896	3	16	26/30	.020	.025	.280
02897	2	14	41/30	.020	.025	.290
02898	3	14	41/30	.020	.030	.320
02899	2	12	65/30	.020	.030	.345
02900	3	12	65/30	.020	.030	.365

MYLAR/ALUMINUM FOIL SHIELDED AUDIO CABLE



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded polyethylene insulation, conductors cabled, wrapped with Flexfoil® mylar supported aluminum foil shield with foil facing to outside, stranded tinned copper drain wire, PVC jacket overall.

Specifications: −20°C to +60°C. Jacket only passes FR-1 vertical flame test.

Color Code: Black, Clear, Red, Green.

Applications: 100% shielded cable for recording studios, broadcast sound systems and electronic circuits where RF shielding is required.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	AWG (Stranding)	Jacket Thck. In.	Nom. Insul. In.	Nom. O.D. In.
02513	2	24 (7/32)	.025	.015	.160
02514	2	22 (7/30)	.025	.015	.170
02526	3	22 (7/30)	.025	.015	.180
02523	4	22 (7/30)	.025	.015	.195
02524	2	20 (10/30)	.025	.015	.190
02525	3	20 (10/30)	.028	.015	.205
02534	2	18 (16/30)	.028	.018	.225
02535	3	18 (16/30)	.028	.018	.240
02536	2	16 (26/30)	.030	.025	.285
02537	3	16 (26/30)	.030	.025	.300
02538	2	14(41/30)	.035	.032	.350
02539	2	12(65/30)	.037	.040	.420

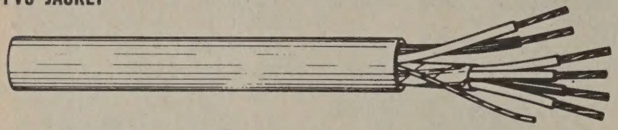
MINIATURE SIZE

Requires ½ to ⅔ less space than standard broadcast cables. Same construction as above, but with color-coded polypropylene insulation, .011″ thick. Color Code: 1, Black; 2, Red; 3, White.

Columbia No.	No. of Cond.	AWG (Stranding)	Jacket Thck. In.	Nom. Insul. In.	Nom. O.D. In.
02515	2	22 (Solid)	.018	.011	.135
02516	2	22 (7/70)	.020	.011	.145
02517	3	22 (7/30)	.020	.011	.155

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411

SPECIAL SHIELDED AUDIO & COMMUNICATION CABLE
PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, 4 conductors cabled, Flexfoil® aluminum/polyester shield over 4 cabled conductors, 22 gauge TC drain wire, 2 conductors unshielded, PVC jacket overall.

Specifications: −20°C to +60°C.

Color Code: Shielded — Black, Green, Red, Yellow.
Unshielded — Blue, White.

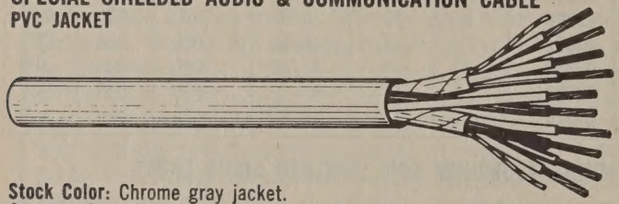
Applications: Special cable for audio and communications use.

Put-up: 100′, 500′ and 1000′ spools. (Other put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	% Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.)
01345	6	4-24 shielded	7/32	.015	.025	100	350V	.230
		2-22 unshielded	7/30					

■ PASSES THE FR-1 VERTICAL FLAME TEST.

SPECIAL SHIELDED AUDIO & COMMUNICATION CABLE
PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, cabled in 2 quads, each quad with 24 gauge tinned drain wire, Flexfoil® shield over each quad, plus 2 unshielded conductors, PVC jacket overall. Foil facing to inside.

Specifications: −20°C to +60°C.

Color Code: 1st Quad — Gray, White, Blue, Green.
2nd Quad — Red, Brown, Yellow, Orange.
Unshielded — White, Blue.

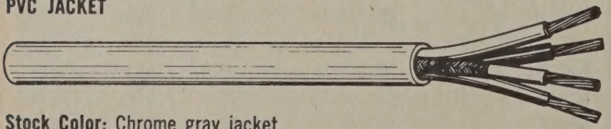
Applications: Special cable for audio and communications use.

Put-up: 100′ and 500′ spools. (Other put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	% Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.)
04086	10	4-24 shielded	7/32	.012	.030	100	350V	.310
		4-24 shielded	7/32	.012		100		
		2-22 unshielded	7/30	.015				

■ PASSES THE FR-1 VERTICAL FLAME TEST.

SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, tinned copper braid shield over one conductor, conductors cabled, PVC jacket overall.

Specifications: −20°C to +60°C.

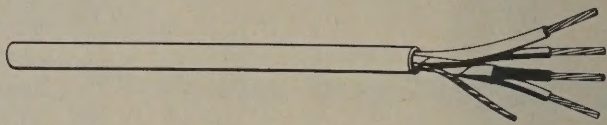
Color Code: Shielded — White.
Unshielded — Black, Red, Green.

Applications: Special cable for audio, communications and instrumentation use.

Put-up: 100′, 250′ and 500′ spools. (Other put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	App. % Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.)
01336	4	1-20 shielded 3-20 unshielded	10/30	.015	.025	82	300V	.220

SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded polypropylene insulation, each pair shielded with Flexfoil® aluminum polyester shield, stranded tinned copper drain wire, cables paired on common axis to reduce O.D., PVC jacket overall. Foil facing to outside. Drain wire 24 gauge, 7/32.

Specifications: −20°C to +60°C.

Color Code: No. 1 Pair — Black, Red.
No. 2 pair — Green, White.

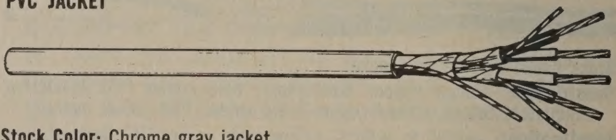
Applications: Special cable for audio, communications and instrumentation use.

Put-up: 100′, 500′ and 1000′ spools. (Other put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	% Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.)	Nom. Cap.* PF/ Ft.	Nom. Cap.** PF/ Ft.
01352	4	22	7/30	.011	.025	100	400V	.185	28	51

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded polypropylene insulation, cabled in pairs, each pair Flexfoil® alumuminum/polyester shielded, with stranded tinned copper drain wire, overall Flexfoil® aluminum fail/polyester shields and stranded, 24 gauge, 7/32, tinned copper drain wire, cabled on common axis to reduce O.D., PVC jacket overall.

Specifications: −20°C to +60°C.

Color Code: No. 1 Pair — Black, Red.
No. 2 pair — Green, White.

Applications: Special cable for audio, communications and instrumentation use.

Put-up: 500′ and 1000′ spools. (Available put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	% Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.)	Nom. Cap.* PF/ Ft.	Nom. Cap.** PF/ Ft.
01353	4	22	7/30	.011	.025	100	400V	.200	28	51

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

CONDUCTOR COLOR CODE CHART I

No. Prs.	Paired Colors	No. Prs.	Paired Colors	No. Prs.	Paired Colors
1	Black, Red	18	Green, Orange	35	Purple, Slate
2	Black, White	19	White, Blue	36	Purple, Black
3	Black, Green	20	White, Yellow	37	Slate, Red
4	Black, Blue	21	White, Brown	38	Slate, White
5	Black, Yellow	22	White, Orange	39	Slate, Green
6	Black, Brown	23	Blue, Yellow	40	Slate, Blue
7	Black, Orange	24	Blue, Brown	41	Slate, Brown
8	Red, White	25	Blue, Orange	42	Slate, Yellow
9	Red, Green	26	Brown, Yellow	43	Slate, Orange
10	Red, Blue	27	Brown, Orange	44	Slate, Black
11	Red, Yellow	28	Purple, Red	45	W/B*, Red
12	Red, Brown	29	Purple, White	46	W/B*, Green
13	Red, Orange	30	Purple, Green	47	W/B*, Blue
14	Green, White	31	Purple, Blue	48	W/B*, Brown
15	Green, Blue	32	Purple, Brown	49	W/B*, Yellow
16	Green, Yellow	33	Purple, Yellow	50	W/B*, Orange
17	Green, Brown	34	Purple, Orange	51	W/B*, Purple

* White body with black stripe.

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SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
PVC JACKET

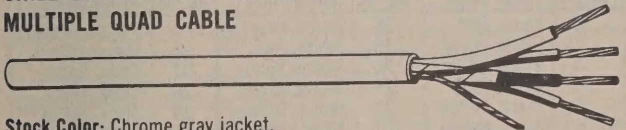
Stock Color: Chrome gray jacket.
Construction: Tinned copper conductors, color-coded polyethylene insulation, cabled, filled where required, clear mylar wrap, tinned copper braid shield, PVC jacket overall.
Specifications: −20°C to +60°C. Suggested working voltage 600V.
Applications: Special cable for audio, communications and instrumentation use.
Put-up: 100′, 500′ and 1000′ spools. (Other put-ups also available.)

Cat. No.	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	App. % Shld. Cov.	Sugg. Work. Volt.	Nom. O.D. (In.	Nom. Cap. * PF/FT.	Nom. Cap. ** PF/FT.
01644	4	20	26/34	.015	.045	87	600V	.290	26	48

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

Color Code: Black, white, red, green.

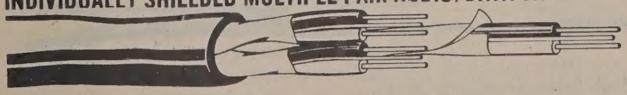
SHIELDED INSTRUMENTATION/COMMUNICATION MULTIPLE QUAD CABLE



Stock Color: Chrome gray jacket.
Construction: Tinned copper conductors. Cat. No. 1340 color-coded polypropylene insulation. Cat. No. 1331 color coded PVC insulation. Cat. No. 1343 color coded polyethylene insulation. Flexfoil® aluminum foil/polyester shield (foil facing to outside) over 2 conductors, stranded tinned copper drain wire (Cat. No. 1340 - 24 gauge, Cat. No. 1331 and 1343 - 22 gauge), one shielded pair and 2 singles cabled on common axis to reduce O.D., PVC jacket overall.
Specifications: −20°C to +60°C. Suggested working voltage: Cat. No. 1340 — 200V, Cat. No. 1331 and 1343 — 350V, Cat. No. 1331 entire cable passes FR-1, Cat. Nos. 1340 and 1343 jacket only passes FR-1.
Color Code: Shielded – Black Red; Unshielded – Green White.
Applications: Special cable for audio, communications and instrumentation use.
Put-up: 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	AWG (Stranding)	Nom. Insul. In.	Jacket Thck. In.	Nom. O.D. In.
01340	4	22 (7/30)	.011	.025	.185
01331	4	20 (10/30)	.015	.025	.215
01343	4	2-20 (10/30) Shld 2-18 (16/30) Unshld	.018 .018	.030	.255

INDIVIDUALLY SHIELDED MULTIPLE PAIR AUDIO/DATA CABLE

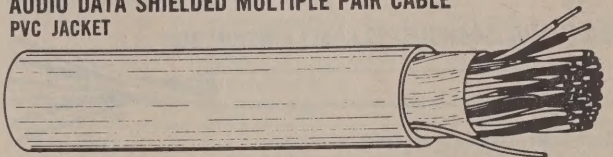


Stock Color: Chrome gray jacket.
Construction: Tinned copper conductors, color-coded polypropylene insulation, cabled in pairs, each pair and its drain wire under Flexfoil® aluminum foil/polyester shield, PVC jacket overall.
Jacket: +60°C. Conductors: +105°C. Suggested working voltage: 22 gauge — 300V; 20 gauge — 350V: 18 gauge — 400V. 100 Megohms/M insulation resistance between shields. 115PF/FT. capacitance between adjacent shields. 1500V voltage breakdowns between adjacent shields. 50V working voltage between adjacent shields. 22 gauge and 20 gauge series — 22 gauge drain wire; 18 gauge series — 20 gauge drain wire. JACKET ONLY PASSES FR-1 VERTICAL FLAME TEST.
Color Code: Chart I, Page 197.
Applications: For audio RF and pulse applications requiring superior circuit isolation. The use of polypropylene insulation results in excellent high frequency properties and mechanical durability.
Put-up: 100′, 500′ and 1000′ spools.**

INDIVIDUALLY SHIELDED MULTIPLE PAIR AUDIO/DATA CABLE (CONT'D)

Columbia No.	No. of		AWG (Stranding)	Nom. Insul. Thick.	Jacket Thick. In.	Nom. O.D. In.
	Pairs	Cond.				
06040	3	6	22 (7/30)	.011	.030	.260
06041	6	12	22 (7/30)	.011	.030	.340
06042	9	18	22 (7/30)	.011	.035	.405
06043	11	22	22 (7/30)	.011	.035	.440
06059	12	24	22 (7/30)	.011	.035	.455
06044	15	30	22 (7/30)	.011	.040	.520
06060	17	34	22 (7/30)	.011	.040	.545
06045	19	38	22 (7/30)	.011	.040	.575
06046	27	54	22 (7/30)	.011	.050	.675
06052	3	6	20 (10/30)	.013	.035	.315
06053	6	12	20 (10/30)	.013	.040	.420
06054	9	18	20 (10/30)	.013	.045	.500
06055	11	22	20 (10/30)	.013	.045	.545
06056	12	24	20 (10/30)	.013	.045	.560
06057	13	26	20 (10/30)	.013	.055	.610
06058	15	30	20 (10/30)	.013	.055	.640
06047	3	6	18 (16/30)	.016	.035	.375
06048	6	12	18 (16/30)	.016	.045	.495
06049	9	18	18 (16/30)	.016	.055	.575
06050	12	24	18 (16/30)	.016	.070	.705
06051	15	30	18 (16/30)	.016	.070	.785

AUDIO DATA SHIELDED MULTIPLE PAIR CABLE
PVC JACKET

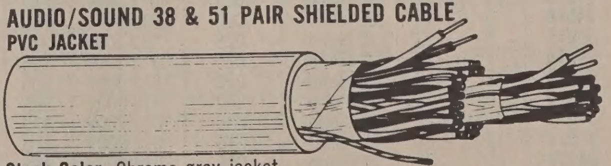


Stock Color: Chrome gray jacket.
Construction: Tinned copper conductors, color-coded PVC insulation, cabled in pairs, overall Flexfoil® aluminum foil/polyester shield, stranded tinned copper drain wire, PVC jacket overall.
Specifications: −20°C to +60°C. UL listed (Wires Misc.). 90V max.
Put-up: 100′, 500′ and 1000′ spools. (Other put-ups also available.)

Cat. No.	No. of Pairs	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	Nom. O.D. (In.)	Nom. Cap.* PF/FT.
01670	2	4	22	Solid	.012	.025	.210	35
01671	6	12	22	Solid	.012	.025	.285	35
01672	9	18	22	Solid	.012	.030	.340	35
01673	15	30	22	Solid	.012	.035	.435	35
01674	19	38	22	Solid	.012	.035	.465	35
01675	27	54	22	Solid	.012	.040	.570	35

*Capacitance between conductors.
Color Code: Chart I, Page 197.

AUDIO/SOUND 38 & 51 PAIR SHIELDED CABLE
PVC JACKET



Stock Color: Chrome gray jacket.
Construction: Tinned copper conductors, color-coded polypropylene insulation (Cat. No. 06438) or PVC insulation (Cat. No. 06451) conductors cabled in pairs, Flexfoil® aluminum foil/polyester shield provides 100% coverage with foil facing to outside, 22 gauge 7/30 tinned copper drain wire laid parallel, PVC jacket overall.
Jacket: +60°C. Conductors: +105°C. Cat. No. 06438: JACKET ONLY PASSES FR-1 VERTICAL FLAME TEST. Cat. No. 06451: ENTIRE CABLE PASSES FR-1 VERTICAL FLAME TEST. Suggested working voltage 200V.
Applications: Multiple pair cable for audio and sound use with overall shield.
Put-up: Cut to specified length. Minimum 25′, maximum 1500′.

Cat. No.	No. of Pairs	No. of Cond.	Cond. Size	Cond. Strand.	Nom. Insul. Thck. (In.)	Nom. Jkt. Thck. (In.)	Nom. O.D. (In.)
06438	38	76	22	Solid	.008	.045	.565
06451	51	102	22	Solid	.010	.050	.685

Color Code Top Next Page.

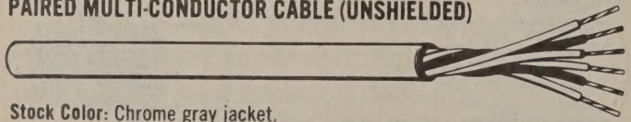
AUDIO/SOUND 38 & 51 PAIR SHIELDED CABLE (CONT'D)

PVC JACKET

No. of Pairs	Color Coding ☐
1	Blue p/w White
2	Orange p/w White
3	Green p/w White
4	Brown p/w White
5	Slate (Gray) p/w White
6	Blue/White striped p/w White
7	Blue/Orange striped p/w White
8	Blue/Green striped p/w White
9	Blue/Brown striped p/w White
10	Blue/Slate (Gray) striped p/w White
11	Orange/White striped p/w White
12	Orange/Green striped p/w White
13	Orange/Brown striped p/w White
14	Orange/Slate (Gray) striped p/w White
15	Green/White striped p/w White
16	Green/Brown striped p/w White
17	Green/Slate (Gray) striped p/w White
18	Brown/White striped p/w White
19	Brown/Slate (Gray) striped p/w White
20	Slate (Gray)/White striped p/w White
21	Blue p/w Red
22	Orange p/w Red
23	Green p/w Red
24	Brown p/w Red
25	Slate (Gray) p/w Red
26	Blue/White striped p/w Red
27	Blue/Orange striped p/w Red
28	Blue/Green striped p/w Red
29	Blue/Brown striped p/w Red
30	Blue/Slate (Gray) striped p/w Red
31	Orange/White striped p/w Red
32	Orange/Green striped p/w Red
33	Orange/Brown striped p/w Red
34	Orange/Slate (Gray) striped p/w Red
35	Green/White striped p/w Red
36	Green/Brown striped p/w Red
37	Green/Slate (Gray) striped p/w Red
38	Brown/White striped p/w Red
39	Brown/Slate (Gray) striped p/w Red
40	Slate (Gray)/White striped p/w Red
41	Blue p/w Black
42	Orange p/w Black
43	Green p/w Black
44	Brown p/w Black
45	Slate (Gray) p/w Black
46	Blue/White striped p/w Black
47	Blue/Orange striped p/w Black
48	Blue/Green striped p/w Black
49	Blue/Brown striped p/w Black
50	Blue/Slate (Gray) striped p/w Black
51	Orange/White striped p/w Black

☐ First color in stripe combination is body color. Second or third colors are stripes. Example: White/Black/Red. Other striped combinations available to order.

PAIRED MULTI-CONDUCTOR CABLE (UNSHIELDED)



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, conductors paired with a short lay twist for conductor balance providing a circuit free from cross talk, pairs cabled, PVC jacket overall.

Specifications: −20°C to +60°C. Entire cable passes FR-1 vertical flame test.

Color Code: See Chart II, this page.

Applications: Heavy-duty intercom and audio cable for intercom systems, signal systems, annunciators, nurse's call systems, multiple speaker systems, control circuit cables.

Put-up: 100′, 500′ and 1000′ spools.**

Columbia No.	No. of Pairs	No. of Cond.	AWG (Stranding)	Jacket Thick. In.	Nom. Insul. Thick.	Nom. O.D. In.
SOLID CONDUCTORS UL listed (Wires, Misc.) 90V max.						
04008	1	2	22 (Solid)	.025	.012 200V	.150
04010	2	4	22 (Solid)	.025	.012 300V	.210
04014	3	6	22 (Solid)	.025	.012 300V	.225
04015	4	8	22 (Solid)	.025	.012 300V	.240
04016	5	10	22 (Solid)	.025	.012 300V	.260
04017	6	12	22 (Solid)	.025	.012 200V	.280
04018	7	14	22 (Solid)	.025	.012 200V	.295
04019	8	16	22 (Solid)	.025	.012 300V	.305
04020	9	18	22 (Solid)	.030	.012 200V	.335
04022	11	22	22 (Solid)	.030	.012 200V	.370
04024	13	26	22 (Solid)	.035	.012 200V	.410
04026	15	30	22 (Solid)	.035	.012 200V	.430
04028	16	32	22 (Solid)	.035	.012 200V	.440
04029	19	38	22 (Solid)	.035	.012 200V	.460
04031	23	46	22 (Solid)	.040	.012 200V	.525
04030	27	54	22 (Solid)	.040	.012 200V	.565
04032	41	82	22 (Solid)	.045	.012 200V	.685
04038	51	102	22 (Solid)	.060	.012 200V	.765
STRANDED CONDUCTORS						
06010	2	4	22 (7/30)	.025	.010 300V	.210
06014	3	6	22 (7/30)	.025	.010 300V	.230
06015	4	8	22 (7/30)	.025	.010 300V	.250
06017	6	12	22 (7/30)	.025	.010 200V	.275
06019	9	18	22 (7/30)	.030	.010 200V	.340
06023	12	24	22 (7/30)	.030	.010 200V	.385
06026	15	30	22 (7/30)	.035	.010 200V	.435
06027	19	38	22 (7/30)	.035	.010 200V	.470
06028	23	46	22 (7/30)	.040	.010 200V	.530
06030	27	54	22 (7/30)	.040	.010 200V	.570

PAIRED MULTI-CONDUCTOR CABLE (Cont'd)

Columbia No.	No. of Pairs	No. of Cond.	AWG (Stranding)	Jacket Thick. In.	Nom. Insul. Thick.	Nom. O.D. In.
STRANDED CONDUCTORS (CONT'D)						
06032	31	62	22 (7/30)	.050	.010 200V	.635
06033	41	82	22 (7/30)	.060	.010 200V	.730
06025	51	102	22 (7/30)	.060	.010 200V	.780
UL listed (Wires, Misc.) 90V max.						
06113	3	6	20 (10/30)	.025	.015 300V	.260
06114	6	12	20 (10/30)	.030	.015 300V	.350
06115	9	18	20 (10/30)	.035	.015 300V	.445
06116	15	30	20 (10/30)	.040	.015 300V	.585
06101	1	2	18 (16/30)	.025	.018 400V	.220
06118	2	4	18 (16/30)	.035	.018 400V	.310
06103	3	6	18 (16/30)	.035	.018 400V	.330
06119	4	8	18 (16/30)	.035	.018 400V	.370
06120	5	10	18 (16/30)	.035	.018 400V	.400
06106	6	12	18 (16/30)	.035	.018 400V	.440
06121	8	16	18 (16/30)	.040	.018 400V	.500
06109	9	18	18 (16/30)	.040	.018 400V	.545
06110	12	24	18 (16/30)	.050	.018 400V	.640
06111	15	30	18 (16/30)	.060	.018 400V	.750
06112	19	38	18 (16/30)	.060	.018 400V	.795

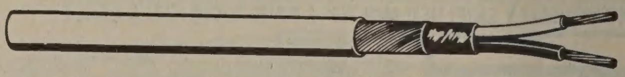
CONDUCTOR COLOR CODE CHART II

No. Prs.	Paired Colors	No. Prs.	Paired Colors	No. Prs.	Paired Colors
1	Black, Red	18	Green, Orange	35	Purple, Slate
2	Black, White	19	White, Blue	36	Purple, Black
3	Black, Green	20	White, Yellow	37	Slate, Red
4	Black, Blue	21	White, Brown	38	Slate, White
5	Black, Yellow	22	White, Orange	39	Slate, Green
6	Black, Brown	23	Blue, Yellow	40	Slate, Blue
7	Black, Orange	24	Blue, Brown	41	Slate, Brown
8	Red, White	25	Blue, Orange	42	Slate, Yellow
9	Red, Green	26	Brown, Yellow	43	Slate, Orange
10	Red, Blue	27	Brown, Orange	44	Slate, Black
11	Red, Yellow	28	Purple, Red	45	W/B*, Red
12	Red, Brown	29	Purple, White	46	W/B*, Green
13	Red, Orange	30	Purple, Green	47	W/B*, Blue
14	Green, White	31	Purple, Blue	48	W/B*, Brown
15	Green, Blue	32	Purple, Brown	49	W/B*, Yellow
16	Green, Yellow	33	Purple, Yellow	50	W/B*, Orange
17	Green, Brown	34	Purple, Orange	51	W/B*, Purple

* White body with black stripe.

TWO-CONDUCTOR MICROPHONE CABLE

SPIRAL SHIELD



Stock Color: Silver gray jacket.

Construction: Tinned copper conductors, color-coded polyethylene insulation, cabled with fillers, textile wrap, spiral tinned copper shield, high gloss Flexlife® jacket.

Specifications: −20°C to +60°C.

Color Code: White, Black.

Applications: For use with low impedance microphones. Flexlife jacket provides extreme flexibility, high abrasion resistance and outstanding appearance.

Put-up: 100′, 250′, 500′ and 1000′spools (other Put-ups also available).

Columbia No.	Impedance	AWG (Stranding)	Nom. Insul. Thick. In.	Jkt. Thick. In.	Nom. O.D. In.
01323	Low	22 (16/34)	.025	.025	.225
01328	Min. Low	24 (10/34)	.016	.030	.190

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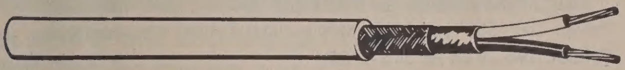
BRAIDED SHIELD



Stock Color: Silver gray jacket.

Construction: Tinned copper conductors, color-coded polyethylene insulation, cabled with fillers, textile wrap, braided tinned copper shield, high gloss Flexlife jacket.

Specifications: −20°C to +60°C.

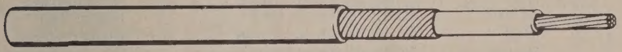
Color Code: White, Black.

Applications: For use with low impedance microphones. Flexlife jacket provides extreme flexibility, high abrasion resistance and outstanding appearance.

Put-up: 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	Impedance	AWG (Stranding)	Nom. Insul. Thick. In.	Jkt. Thick. In.	Nom. O.D. In.
01322	Low	22 (16/34)	.025	.025	.235

ONE-CONDUCTOR MICROPHONE CABLE
SPIRAL SHIELD



Stock Color: Silver gray jacket. (Cat. No. 01359 available in black jacket.)

Construction: Single conductor 3/33 strands tinned copper, 4/33 strands tinned copperweld, white foam polyethylene dielectric, spiral tinned copper shield, high gloss Flexlife® jacket.

Specifications: −20°C to +60°C.

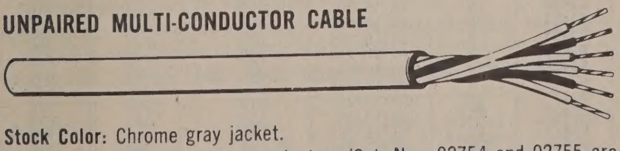
Applications: For use with high impedance microphones and hi-fi interconnecting cables. Flexfoam dielectric (foam polyethylene) provides as much as 35% lower capacitance than the best standard solid polyethylene dielectric microphone cables. Flexfoam cables are the most flexible plastic microphone cable available, with limpness almost equal to rubber and with better abrasion resistance.

Put-up: 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	Microphone Type	Thick. In.		Nom. Cap. MMF/Ft.	Nom. O.D. In.
		Insulation	Jacket		
01359	Min.	.016	.012	29	.085
01369	Lapel	.030	.020	19	.130
01389	Crystal	.050	.025	15	.185
01395	Crystal	.075	.030	13	.245
01314*	Crystal	.040	.020	25	.155

* Solid polyethylene dielectric.

UNPAIRED MULTI-CONDUCTOR CABLE



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors (Cat. Nos. 02754 and 02755 are bare copper), color-coded PVC insulation, PVC jacket overall, conductors cabled.

Specifications: −20°C to +60°C. All items pass FR-1 vertical flame test.

Color Code: Chart III.

Applications: PA systems, unbalanced intercom systems, interconnecting cables, remote control circuits, telephones, low-voltage relay control cables.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

SOLID CONDUCTORS UL listed (Wires, Misc.) 90V max.

Columbia No.	No. of Cond.	AWG (Stranding)	Nom. Insul. Thick. In.	Nom. Jacket Thick. In.	Nom. O.D. In.
04008	2	22 (1)	.012	.025	.150
04310	3	22 (1)	.012	.025	.160
04311	2	20 (1)	.015	.025	.175
02754	2	19 (1)	.015	.025	.180
02755	3	19 (1)	.015	.025	.190

STRANDED CONDUCTORS UL listed (Wires, Misc.) 90V max.

06348	2	22 (7/30)	.012	.025	.160
04062	3	22 (7/30)	.012	.025	.165
04063	4	22 (7/30)	.012	.025	.180
04064	5	22 (7/30)	.012	.025	.195
04066	6	22 (7/30)	.012	.025	.210
04088	7	22 (7/30)	.012	.025	210
04065	8	22 (7/30)	.012	.025	.230
04070	9	22 (7/30)	.012	.025	.245
04071	10	22 (7/30)	.012	.025	.265
04067	12	22 (7/30)	.012	.025	.275
04073	15	22 (7/30)	.012	.025	.295
04069	18	22 (7/30)	.012	.030	.330
04075	20	22 (7/30)	.012	.030	.345
04076	25	22 (7/30)	.012	.030	.385
04077	30	22 (7/30)	.012	.035	.415
04078	40	22 (7/30)	.012	.035	.465
04079	50	22 (7/30)	.012	.040	.535
04087	60	22 (7/30)	.012	.040	.570
06351	2	20 (10/30)	.015	.025	.190
06352	3	20 (10/30)	.015	.025	.200
06353	4	20 (10/30)	.015	.025	.215
06355	5	20 (10/30)	.015	.030	.240
06356	7	20 (10/30)	.015	.030	.265
06357	9	20 (10/30)	.015	.035	.310
06358	15	20 (10/30)	.015	.040	.395
02830	2	18 (16/30)	.018	.025	.220
02831	3	18 (16/30)	.018	.025	.230
02404	4	18 (16/30)	.018	.025	.255
02405	2	16 (26/30)	.023	.025	.250
02406	3	16 (26/30)	.023	.025	.265
02409	2	14 (41/30)	.030	.030	.332
02410	2	12 (65/30)	.030	.030	.370

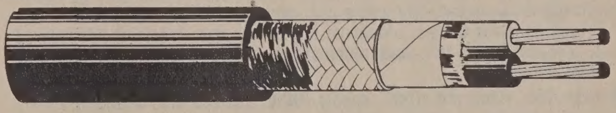
*Not UL Listed

CONDUCTOR COLOR CODE CHART III.

No. 2754 has red and white conductors; No. 2755 has red, white and green; Nos. 2830, 2405, 2409 and 2410 have black and white. All other cables above have conductors as indicated in this table. First color is body; second or third colors are stripes.

No.	Color	No.	Color	No.	Color
1	Black	10	Gray	19	White/Yellow
2	Red	11	Pink	20	White/Blue
3	White	12	Tan	21	White/Brown
4	Green	13	Red/Green	22	White/Orange
5	Orange	14	Red/Yellow	23	White/Gray
6	Blue	15	Red/Black	24	White/Violet
7	Brown	16	White/Black	25	White/Black/Red
8	Yellow	17	White/Red		
9	Purple	18	White/Green		

SHIELDED CONTROL CABLE



Stock Color: Black jacket.

Construction: Tinned copper conductors, color-coded rubber insulation, cabled, filled where required, clear mylar wrap, tinned copper braided shield, cotton wrap, neoprene jacket or rubber jacket.

Specifications: −20°C to +60°C. Suggested working voltage 350V.

Color Code: Chart IV.

Applications: Control circuits, video and audio interconnecting cables, broadcast and studio use. Precision engineered to prevent cross-talk and eliminate hum pick-up. Neoprene and rubber jackets are resistant to impact and abrasion and have extra limpness. For outside installations, neoprene is recommended being resistant to oil, ozone, moisture and sunlight.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

RUBBER JACKET — HEAVY DUTY

Columbia No.	No. of Cond.	AWG (Stranding)	Nom. Insul. Thick. In.	Nom. Jacket Thick. In.	Nom. O.D. In.
01303	2	18 (41/34)	.020	.035	.295
01300	1	20 (26/34)	.040	.035	.230
01302	2	20 (26/34)	.020	.035	.270
01304	3	20 (26/34)	.020	.035	.285
01305	4	20 (26/34)	.020	.035	.305
01308	5	20 (26/34)	.020	.035	.330
01310	6	20 (26/34)	.020	.035	.345
01312	7	20 (26/34)	.020	.035	.360
01313	8	20 (26/34)	.020	.035	.385
01315	10	20 (26/34)	.020	.035	.440
01316	12	20 (26/34)	.020	.065	.525
01317	15	20 (26/34)	.020	.065	.595
01325	20	20 (26/34)	.020	.065	.660

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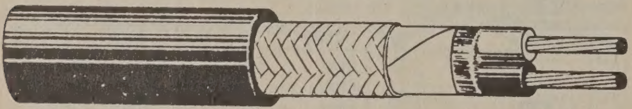
NEOPRENE JACKET — HEAVY DUTY

01201	1	18 (41/34)	.040	.035	.240
01202	2	18 (41/34)	.020	.035	.295
01203	3	18 (41/34)	.020	.035	.305
01204	4	18 (41/34)	.020	.035	.330
01206	6	18 (41/34)	.020	.035	.370
01208	8	18 (41/34)	.020	.035	.420
01210	10	18 (41/34)	.020	.035	.480
01212	12	18 (41/34)	.020	.065	.555
01215	15	18 (41/34)	.020	.065	.640
01220	20	18 (41/34)	.020	.065	.730
01602	2	16 (65/34)	.025	.035	.335
01603	3	16 (65/34)	.025	.035	.355
01604	4	16 (65/34)	.025	.035	.385
01606	6	16 (65/34)	.025	.040	.445
01608	8	16 (65/34)	.025	.040	.510
01610	10	16 (65/34)	.025	.040	.575
01612	2	14 (41/30)	.030	.040	.395
01613	3	14 (41/30)	.030	.040	.425
01614	4	14 (41/30)	.030	.040	.455
01616	6	14 (41/30)	.030	.040	.515
01622	2	12 (65/30)	.030	.040	.440
01623	3	12 (65/30)	.030	.040	.465
01624	4	12 (65/30)	.030	.040	.505
01632	2	10 (105/30)	.030	.040	.495
01633	3	10 (105/30)	.030	.040	.520

POLYETHYLENE INSULATION AND PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded polyethylene insulation, cabled, filled where required, clear mylar wrap, tinned copper braid shield, PVC jacket overall.

Specifications: −20°C to +60°C. Suggested working voltage 600V. Jacket only passes FR-1 vertical flame test.

Color Code: Chart IV.

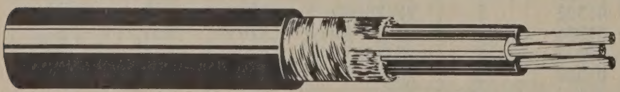
Applications: Low capacity cable for control circuits, video and audio interconnecting cables, broadcast and studio use. Precision engineered to prevent cross-talk and eliminate hum pick-up. Low capacitance, light weight.

Put-up: 100′, 500′ and 1000′ spools. (Other put-ups also available.)

CONDUCTORS 20 GA 26/34 STR T.C.

Columbia No.	No. of Cond.	Nom. Insul. Thick. In.	Nom. Jacket Thick. In.	Nom. O.D. In.
01642	2	.015	.040	.250
01643	3	.015	.045	.270
01644	4	.015	.045	.290
01645	5	.015	.045	.310
01646	6	.015	.045	.325
01648	8	.015	.045	.350
01650	10	.015	.045	.390
01652	12	.015	.045	.405
01655	15	.015	.045	.440
01660	20	.015	.045	.480

UNSHIELDED CONTROL CABLE
RUBBER INSULATION AND RUBBER JACKET



Stock Color: Black jacket.

Construction: Tinned copper conductors, color-coded rubber insulation, cabled, filled where required, cotton wrap, rubber jacket.

Specifications: −20°C to +60°C. Suggested working voltage 350V.

Color Code: Chart IV.

Applications: Control circuits, broadcast and studio use, traffic and fire alarm control, temperature control systems, other multiple control applications. Resistant to impact and abrasion. Extra limpness.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

CONDUCTORS 20 GA 26/34 STR T.C.

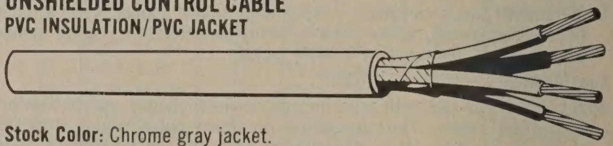
Columbia No.	No. of Cond.	Nom. Insul. Thick. In.	Nom. Jacket Thick. In.	Nom. O.D. In.
03602	2	.020	.035	.240
03603	3	.020	.035	.255
03604	4	.020	.035	.275
03605	5	.020	.035	.300
03606	6	.020	.035	.315
03607	7	.020	.035	.325
03608	8	.020	.035	.360
03610	10	.020	.035	.410
03612	12	.020	.035	.435
03615	15	.020	.035	.505
03620	20	.020	.035	.570

CONDUCTOR COLOR CODE CHART IV.

First color is body color; second color is stripe.

No.	Color	No.	Color	No.	Color
1	Black	8	Orange	15	White/Blue
2	White	9	Gray (Slate)	16	White/Brown
3	Red	10	Purple	17	White/Purple
4	Green	11	White/Black	18	White/Gray
5	Yellow	12	White/Red	19	Black/Red
6	Blue	13	White/Green	20	Black/Yellow
7	Brown	14	White/Yellow		

UNSHIELDED CONTROL CABLE
PVC INSULATION/PVC JACKET



Stock Color: Chrome gray jacket.

Construction: Tinned copper conductors, color-coded PVC insulation, mylar binder overall (no mylar binder on Cat. Nos. 02404, 02420, 02421, 02422), PVC jacket, conductors cabled.

Specifications: −20°C to +60°C. Suggested working voltage: 18GA — 400V, 16GA - 12GA — 600V. Pass FR-1 vertical flame test.

Color Code: Chart V (Page 2•1918) 18GA cables UL listed (Wires, misc.).

Applications: Interconnecting cables for electronic equipment, control circuits, broadcast and studio use, temperature control systems.

Put-up: 100′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	No. of Cond.	AWG (Stranding)	Nom. Insul. In.	Jacket Thck. In.	Nom. O.D. In.
02404	4	18 (16/30)	.018	.025	.255
02420	5	18 (16/30)	.018	.037	.300
02421	7	18 (16/30)	.018	.037	.325
02422	9	18 (16/30)	.018	.037	.375
02412	12	18 (16/30)	.018	.040	.430
02423	15	18 (16/30)	.018	.045	.485
02424	19	18 (16/30)	.018	.045	.510
02433	25	18 (16/30)	.018	.060	.625
02425	4	16 (19/29)	.030	.045	.380
02434	5	16 (19/29)	.030	.045	.410
02426	7	16 (19/29)	.030	.045	.445
02435	9	16 (19/29)	.030	.045	.510
02427	12	16 (19/29)	.030	.060	.610
02428	15	16 (19/29)	.030	.060	.675
02429	19	16 (19/29)	.030	.065	.725
02436	25	16 (19/29)	.030	.065	.830
02430	4	14 (19/27)	.045	.045	.480
02437	5	14 (19/27)	.045	.060	.555
02431	7	14 (19/27)	.045	.060	.605
02438	9	14 (19/27)	.045	.065	.715
02432	12	14 (19/27)	.045	.065	.800
02439	15	14 (19/27)	.045	.080	.920
02440	4	12 (65/30)	.045	.045	.540
02442	7	12 (65/30)	.045	.060	.675
02444	10	12 (65/30)	.045	.080	.900

CONDUCTOR COLOR CODE CHART V

No.	Color	No.	Color	No.	Color
1	Black	10	Orange/Black	19	Blue/Red
2	White	11	Blue/Black	20	Red/Green
3	Red	12	Black/White	21	Orange/Green
4	Green	13	Red/White	22	Black/White/Red
5	Orange	14	Green/White	23	White/Black/Red
6	Blue	15	Blue/White	24	Red/Black/White
7	White/Black	16	Black/Red	25	Green/Black/White
8	Red/Black	17	White/Red		
9	Green/Black	18	Orange/Red		

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UL HOOK UP WIRE STYLE 1015, CSA TYPE TEW

Stock Colors: See table below.
Construction: Tinned copper conductor, color-coded PVC insulation.
Specifications: —40°C to +105°C, 600V. Resistant to acids, oil, alkalis, flame, moisture and fungus. Entire cable passes FR-1 vertical flame test.
Color Code: Chart VI.
Applications: Internal wiring of electronic and electrical equipment.
Put-up: 100′ and 1000′ spools (other Put-ups also available).

Columbia No.	AWG (Stranding)	Nom. Insul. Thick. In.	Voltage Rating	Nom. O.D. In.
02117	22 (1)	.031	600	.088
02118	20 (1)	.031	600	.094
02119	18 (1)	.031	600	.102
02100	24 (7/32)	.031	600	.086
02101	22 (7/30)	.031	600	.092
02102	20 (10/30)	.031	600	.100
02103	18 (16/30)	.031	600	.110
02104	16 (26/30)	.031	600	.122
02105	14 (41/30)	.031	600	.136

UL HOOK UP WIRE UL STYLE 1007 CSA TR-64

Stock Colors: See table below.
Construction: Tinned copper conductor, color-coded PVC insulation.
Specifications: —40°C to +80°C, 300V. Resistant to acids, oil, alkalis, flame, moisture and fungus.
Applications: Internal wiring of electronic and electrical equipment.
Color Code: Chart VI.
Put-up: 100′ and 1000′ spools (other Put-ups also available).

Columbia No.	AWG (Stranding)	Nom. Insul. Thick. In.	Voltage Rating	Nom. O.D. In.
02003	24 (1)	.016	300	.054
02004	22 (1)	.016	300	.060
02028	20 (1)	.016	300	.066
02052	18 (1)	.016	300	.072
02053	16 (1)	.016	300	.085
02015	24 (7 32)	.016	300	.056
02016	22 (7/30)	.016	300	.064
02040	20 (10 30)	.016	300	.072
02064	18 (16 30)	.016	300	.082
02065	16 (26 30)	.016	300	.094

STOCK COLORS CHART VI.

1	White	3	Red	5	Yellow	7	Brown	9	Gray (slate)
2	Black	4	Green	6	Light Blue	8	Orange	10	Violet (purple)

Stripe combinations also available — consult factory.

RUBBER TEST LEAD WIRE

Stock Colors: See table below.
Stock Color: Black or Red. (Other colors available on special order.)
Construction: Extra flexible stranded tinned soft annealed copper conductor, color-coded rubber insulation.
Specifications: —20°C to +60°C. All breakdown voltages and suggested working voltages are AC RMS values.
Applications: Test lead wire for use in multimeters, analyzers, oscillators and other applications requiring extra flexible insulated wire.
Put-up: 250′, 500′ and 1000′ spools (other Put-ups also available).

Columbia No.	Color*	AWG (Stranding)	Nom. Insul. Thick. In.	Sug. Working Voltage	Nom. O.D. In.
01326	*	20 (41 36)	.040	1,500V	.125
01319	*	20 (41/36)	.047	3,000V	.140
01321	*	18 (65/36)	.045	5,000V	.140
01318	*	18 (65 36)	.088	10,000V	.230

* Available in red or black; please specify.

PLASTIC TEST LEAD WIRE

Stock Color: Black or red. (Other colors available on special order.)
Construction: Extra flexible stranded tinned soft annealed copper conductor, color-coded extra flexible, high gloss Flexlife® plastic insulation.
Specifications: —20°C to +60°C, 5000V. Insulation resistant to acids, oil, alkalis, flame, moisture and fungus. All breakdown voltages and suggested working are AC RMS values.

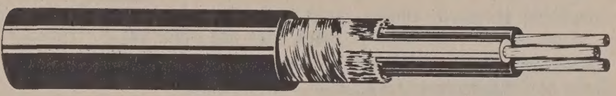
Applications: Test lead wire for use in multimeters, analyzers, oscillators, and other applications requiring extra flexible insulated wire. Flexlife plastic insulation is durable and has a high-gloss finish.

PLASTIC TEST LEAD WIRE (CONT'D)

Put-up: 250′ and 500′ spools (other Put-ups also available).

Columbia No.	Color*	AWG (Stranding)	Nom. Insul. Thick. In.	Sug. Working Voltage	Nom. O.D. In.
01320	Black or Red	18 (65/36)	.045	5,000V	.140

PORTABLE SERVICE AND POWER CORD



Copper: Bare soft annealed. Stranding per ASTM-B-174 and ASTM-B-173.
Insulation of inner conductors: Synthetic Rubber (SBR) per IPCEA Pub. No. S-19-81 (4th Edition) Part 3.7.1 (SBR); N.E.M.A. Publication No. WC-3-1964; and UL Subject 62, Class 3.
Temperature Range: 60°C (140°F) to —37°C (—35°F).
Color Code Conductors: 2 conductor — Black, White; 3 conductor — Black, White, Green; 4 conductor — Black, White, Green, Red.
Foundation: Conductors twisted together with fillers to make a round core: separator over core.
Neoprene Jacket: Black Neoprene: 60°C (140°F to —37°C (—35°F) per IPCEA Pub. No. S-19-81 (4th Edition) Part 7.7.5.1; NEMA Pub. No. WC-3-1964; ASTM D-752; and UL Subject 62, Class 15.
Rubber Jacket: Black Synthetic Rubber (SBR) 60°C (140°F) to —37°C (—35°F) per IPCEA Pub. No. S-19-81 (4th Edition) Part 7.7.5.1; NEMA Pub. No. WC-3-1964; and UL Subject 62, Class 6.
Jacket Marking: All sizes surface printed* showing gauge, number of conductors, voltage and type.
Neoprene Use: For heavy (SO) and light (SJO) service such as tools, power extensions, motor and welding leads, portable machinery, floor polishers and sanders, battery chargers, portable stage light, garage portable lights, sound equipment, washing machines, refrigerators, sewing machines, and other electrical equipment. Type SVO — for vacuum cleaners, home food mixers, office equipment, and other light duty requirements.
Rubber Use: For heavy (S) and light (SJ) service such as tools, power extensions, motor and welding leads, portable machinery, floor polishers and sanders, battery chargers, portable stage lights, garage portable lights, sound equipment, washing machines, refrigerators, sewing machines, and other electrical equipment. Type SV — For vacuum cleaners, home food mixers, office equipment, and other light duty requirements.
Neoprene Environment: For use in areas where exposed to oil, ozone, grease, chemicals or solvents.
Rubber Environment: Useful cord life is reduced where exposed to oil, ozone, grease, chemicals or solvents. Cords to be used in such environments are Neoprene SO.

NEOPRENE JACKET

Columbia No.	No. of Cond.	Size AWG	Type	Volt Rating	Nom. Insul.	Current Amps	Nom. O.D. In.
01477	2	18	SVO	300V	1/64	10	.250
01478	2	18	SJO	300V	2/64	10	.305
01479	3	18	SJO	300V	2/64	10	.330
01481	2	16	SJO	300V	2/64	13	.330
01482	3	16	SJO	300V	2/64	13	.360
01484	2	18	SO	600V	2/64	10	.385
01485	3	18	SO	600V	2/64	10	.400
01487	2	16	SO	600V	2/64	13	.400
01488	3	16	SO	600V	2/64	13	.425

RUBBER JACKET

Columbia No.	No. of Cond.	Size AWG	Type	Volt Rating	Nom. Insul.	Current Amps	Nom. O.D. In.
01420	2	18	SV	300V	1/64	10	.250
01425	2	18	SJ	300V	2/64	10	.305
01435	3	18	SJ	300V	2/64	10	.330
01438	4	18	SJ	300V	2/64	7	.370
01445	2	16	SJ	300V	2/64	13	.330
01450	3	16	SJ	300V	2/64	13	.360
01446	4	16	SJ	300V	2/64	10	.400
01500	2	14	S	600V	3/64	18	.527
01505	3	14	S	600V	3/64	18	.557
01509	4	14	S	600V	3/64	15	.602
01510	2	12	S	600V	3/64	25	.597
01515	3	12	S	600V	3/64	25	.632

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RUBBER JACKET (CONT'D)

Columbia No.	No. of Cond.	Size AWG	Type	Volt Rating	Nom. Insul.	Current Amps	Nom. O.D. In.
01517	2	10	S	600V	3/64	30	.637
01519	3	10	S	600V	3/64	30	.687

PLASTIC JACKET CONSTRUCTION

Copper: Bare soft drawn annealed, Class K stranding per ASTM-B-174 and ASTM-B-173.

Insulation: Polyvinyl chloride, resistant to oils, water, acids, alkalies and ozone. 60°C — UL Class II. Black, gray and white SVT.

Temperature Range: 60°C (140°F) to −20°C (−4°F).

Color Code Conductors: 2 conductor — black, white.
3 conductor — black, white, green.

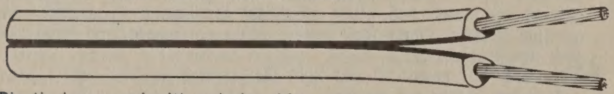
Foundation: Conductors twisted together with fillers to make a round core; separator over core.

Jacket: 60°C. Black, gray or white (SVT) or black (SJT) UL Class II, non marking 60°C (140°F) to −20°C (−4°F) polyvinyl chloride, resistant to oil, water, acid, alkali, ozone and abrasion. Jacket meets specifications per ASTM-D-1047. SVT jacket ribbed to help cord remain clean.

Columbia No.	No. of Cond.	Size AWG	Type	Voltage Ra. ng	Nom. Insul.	Current Amps	Nom. O.D. In.
01554	2	18	SVT	300V	1/64	10	.250
01556	3*	18	SVT	300V	1/64	10	.264
01496	2	18	SJT	300V	2/64	10	.305
01497	3	18	SJT	300V	2/64	10	.330
01498	2	16	SJT	300V	2/64	13	.325
01499	3	16	SJT	300V	2/64	13	.355

*Two Conductor W/3rd Conductor for Grounding Only.

TYPE SPT LAMP AND POWER CORD

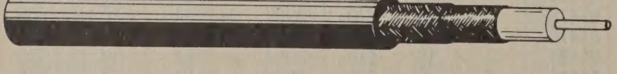


Plastic lamp cord with polarity ridge over one conductor. Rip type construction. UL Listed. For fans, lamps, radios, TV, stereo speakers, signs, etc. Specify Brown, White, Gray or Black.

Columbia No.	No. of Cond.	AWG (Strand)	Type	Current Amps	Nom. O.D. In.
01415	2	18 (41/34)	SPT-1	10	.105 x .205
01402	2	16 (65/34)	SPT-2	13	.155 x .296

RG TYPE COAXIAL CABLES

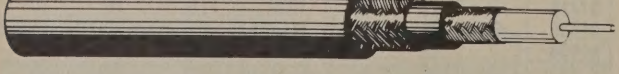
DOUBLE BRAIDED SHIELD



RG/U No.	Cat. No.	Jkt.	Shld.	Di-elec. Matl.	Cond. Ea.	Nom. O.D. (In.)	Nom. % of Vel.	Nom. Cap.	Features
6A	01168	PVC	Double Brd BC	PE	21 BCW	.336	66	20.5	Flexlife®

• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

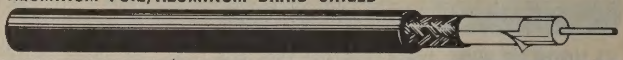
DOUBLE BRAIDED SHIELD WITH INNER PE JACKET



RG/U No.	Cat. No.	Jkt.	Shld.	Di-elec. Matl.	Cond. Ea.	Nom. O.D. (In.)	Nom. % of Vel.	Nom. Cap.	Features
11	05027	PE	Double Brd BC	FPE	14 BC	.475	78	17.3	Permaline®

• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

ALUMINUM FOIL/ALUMINUM BRAID SHIELD

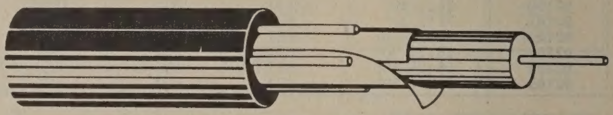


RG/U No.	Cat. No.	Jkt.	Shld.	Di-elec. Matl.	Cond. Ea.	Nom. O.D. (In.)	Nom. % of Vel.	Nom. Cap.	Features
6	05775	PVC	—	FPE	18 BC	.270	78	17.5	UL 1594 100% Swept
59	05776	PVC	—	FPE	20 BCW	.242	78	17.3	
59	05780	PVC	—	FPE	20 BCW	.242	78	17.3	
59	05770	PVC	—	FPE	22 BCW	.242	78	16.3	

• Max. Shield Coverage • Nom. Impedance 75 ohms •

RG TYPE COAXIAL CABLES (CONT'D)

ALUMINUM FOIL WITH SOLID TINNED COPPERWELD DRAIN WIRES



RG/U No.	Cat. No.	Jkt.	Shld.	Di-elec. Matl.	Cond. Ea.	Nom. O.D. (In.)	Nom. % of Vel.	Nom. Cap.*	Features
11	05026	PVC	—	FPE	14 BC	.380	78	17.3	UL 1594
59	05750	PVC	—	PE	22 BCW	.242	66	21.0	Dura Color®
59	05755	PVC	—	FPE	22 BCW	.242	78	16.3	Foam Dura Color®
59/6	05760	PVC	—	FPE	18 BC	.242	78	17.3	Super Dura Color®

• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

BRAID SHIELD

RG/U No.	Catalog No.	Shield Coverage	Jkt.	Shld.	Dielectric Mat'l.	Condr. Ga.	Nom. O.D. (Ins.)	Nom. Imp. (Ω)	Nom. % Vel. of Prop.	Nom. Cap. mmf/ft.	Features	Tested
8	01154	MIL	PVC	BC	PE	13(7x21)BC	.405	52	66	29.5	JANC17A	—
8	01198	Max.	PVC	BC	FPE	11(7x19)BC	.405	50	78	26	Super flex®	—
8	05015	Max.	PE	BC	FPE	11(7x19)BC	.405	50	78	26	Perma-foam®	—
8	01113	Comm'l	PVC	BC	PE	13(7x21)BC	.405	50	66	29.5	—	—
8	01109	Comm'l	PVC	BC	FPE	13(7x21)BC	.405	50	78	26	—	—
8	05013	Comm'l	PE	BC	FPE	13(7x21)BC	.405	50	78	26	—	—
11	01160	MIL	PVC	BC	PE	18(7x26)TC	.405	75	66	20.5	—	—
11	05025	Max.	PE	BC	FPE	14BC	.405	75	78	17.3	Perma-line	100% Sweep
58	01166	MIL	PVC	TC	PE	20BC	.195	53.5	66	28.5	UL1594	—
58	05045	Max.	PE	TC	FPE	20BC	.195	53	78	22	Perma-line®	—
58A	01178	MIL	PVC	TC	PE	20(19str)TC	.195	50	66	30.8	JANC17A	—
58A	01188	Max.	PVC	TC	FPE	20(19str)TC	.195	50	78	26	Super-flex®	—
58	01117	Comm'l	PVC	TC	PE	20BC	.195	50	66	28.5	—	—
58	01116	Comm'l	PVC	TC	FPE	20BC	.195	50	78	22	—	—
59	01104	MIL	PVC	BC	PE	22BCW	.242	73	66	21	UL1594	100% Sweep
59	01102	Max.	PE	BC	FPE	20BCW	.242	75	78	17.3	—	—
59	01103	Max.	PVC	BC	FPE	22strBC	.242	75	78	17.3	UL1594	100% Sweep
59	01105	Max.	PVC	BC	FPE	22BCW	.242	75	78	16.3	UL1594	100% Sweep
59	01135	Max.	PVC	BC	FPE	22BCW	.242	75	78	16.3	Super-flex®	100% Sweep
59	05035	Max.	PE	BC	FPE	22BCW	.242	75	78	16.3	Perma-foam®	100% Sweep
59	01110	Comm'l	PVC	BC	PE	22BCW	.242	75	66	21	—	—
59	01112	Comm'l	PVC	BC	FPE	22BCW	.242	75	78	16.3	—	—
59	05135	Comm'l	PE	BC	FPE	22BCW	.242	75	78	16.3	—	—
62A/U	01162	MIL	NCV	BC	SPE	22BCW	.242	93	84	13.5	—	—
174	01156	Max.	PVC	TC	PE	26(7x34) BCW	.100	50	66	30.8	—	—

Max. = Maximum Coverage
Mil. = Military
Comm'l. = Commercial
PE = Polyethylene
FPE = Foam Polyethylene
PVC = Polyvinyl Chloride
NCV = Non-Contaminating Vinyl
SPE = Semi-Solid Polyethylene

BRD = Braid
BC = Bare Copper
BCW = Bare Copperweld
TC = Tinned Copper
STR = Stranded

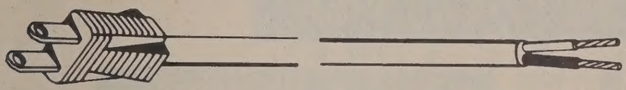
COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411

POWER SUPPLY AND REPLACEMENT CORDS

Molded plastic male cap on one end. Other end has outer jacket removed, conductors stripped; all cords hanked. UL Listed. Rated for 125 VAC. For portable tools, appliances, etc.

TWO-CONDUCTOR

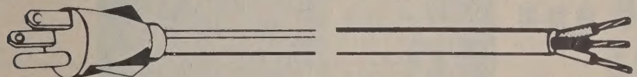
Outer Jacket Stripped 1½″, Conductors Stripped ⅝″ — UL Listed.



Columbia No.	AWG Size	Type	Length Ft.	Rating Amps	Color
20250	18	SV	6	10	Black
20254	18	SV	12	10	Black
20327	18	SVT	6	10	Black
24516	18	SJ	6	10	Black
20258	18	SJ	10	10	Black
24546	18	SJT	6	10	Gray
24549	18	SJT	9	10	Gray
20260	16	SJ	8	13	Black
20262	16	SJ	10	13	Black

THREE-CONDUCTOR

SV and SVT Cords — Outer Jacket Stripped 1½″, Conductors Stripped ⅝″. SJ and SJT Cords — Outer Jacket Stripped 2″. Conductors Stripped ⅝″. S Cords — Outer Jacket Stripped 2″. Conductors Stripped ¾″. UL Listed and Meet OSHA Requirements.

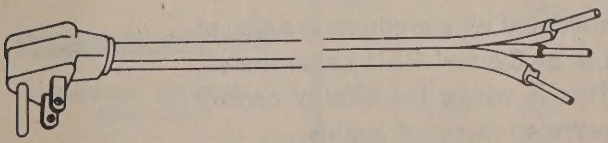


Columbia No.	AWG Size	Type	Length Ft.	Rating Amps	Color
20330*	18	SVT	6	10	Gray
20331*	18	SVT	8	10	Gray
20264	18	SJ	6	10	Black
20314	18	SJ	8	10	Black
20317	18	SJ	12	10	Black
24936	18	SJT	6	10	Gray
24939	18	SJT	9	10	Gray
24926	16	SJ	6	13	Black
20324	16	SJ	8	13	Black
24929	16	SJ	9	13	Black
24932	16	SJ	12	13	Black
24946	16	SJT	6	13	Gray
24949	16	SJT	9	13	Gray
20332	14	S	9	15	Black

*Also available in rubber (Type SV).

POWER SUPPLY CORDS — GENERAL PURPOSE

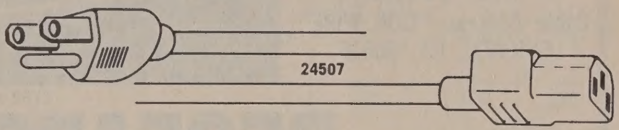
Right angle cap, free end split 1¼″, Stripped ⅝″, Grounding Conductor — UL Listed.

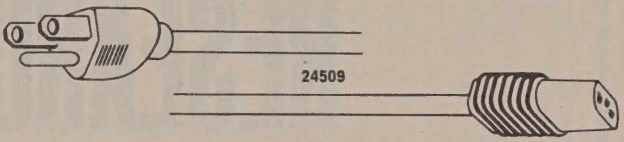


Columbia No.	Cord Type	Length Ft.	Color	Type Package	Rating
24108	16/3 SPT	8	Gray	Bulk	13A-125V

BUSINESS MACHINE POWER SUPPLY CORDS

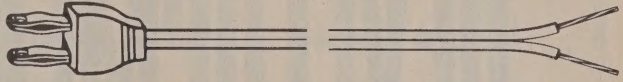
UL Listed.





Columbia No.	Cord Type	Length Ft.	Color	Type Package	Rating
24507	18/3 SVT	8	Gray	Hanked	7A-125V
24509	18/3 SVT	8	Gray	Hanked	7A-125V

SMALL APPLIANCE CORDS

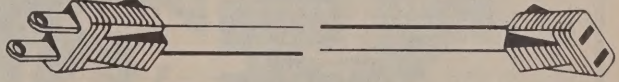


Columbia No.	AWG Size	Type	Length Ft.	Rating Amps	Color
24586	18/2	SPT-1	6	10	Brown or White
24589	18/2	SPT-1	9	10	
24597	18/3	SPT-1	8	10	

EXTENSION CORDS

Molded plastic cap and connector. UL Listed. For portable cord appliances, business machines, etc. Rated at 125 VAC. All cords hanked.

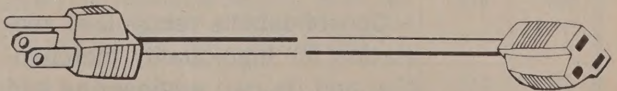
TWO-CONDUCTOR



Columbia No.	AWG Size	Type	Length Ft.	Rating Amps	Color
20272	18	SV	6	10	Black
26010	18	SJ	10	10	Black
26025	18	SJ	25	10	Black
26110	16	SJ	10	13	Black

THREE-CONDUCTOR

Rubber — UL Listed — Meets OSHA Requirements. For Indoor Use.



Columbia No.	AWG Size	Type	Length Ft.	Rating Amps	Color
20288	18	SJ	10	10	Black
26525	18	SJ	25	10	Black
20294	16	SJ	15	13	Black
26625	16	SJ	25	13	Black

MORE THAN 2000 WIRE AND CABLE PRODUCTS IN STOCK

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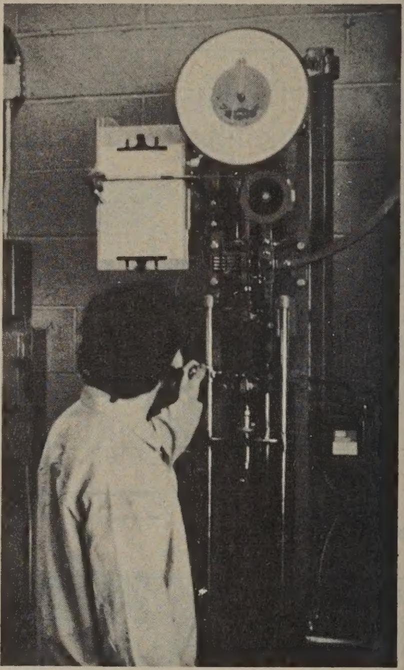
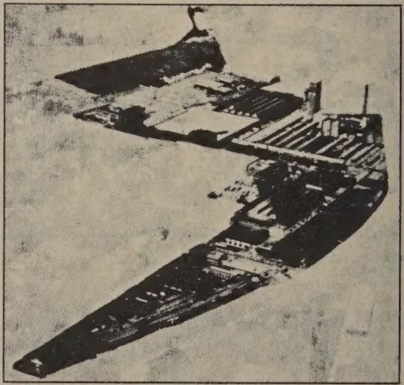
(312) 421-4441
Cable Address: "CON WIRE"
CHICAGO, ILL. 60616

CONSOLIDATED

MORE THAN 11,000 DIFFERENT SIZES, PACKAGES AND COLORS IN STOCK

RESEARCH AND DEVELOPMENT... PRODUCTION...





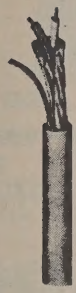
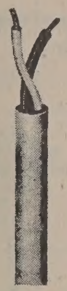
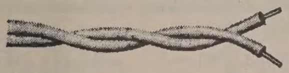
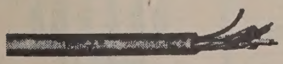
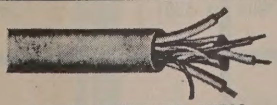
Consolidated's recognized reputation for high-quality merchandise and its own engineering and testing facilities are supported by the modern research and development laboratories at Cyprus' R&D Center. Here metallurgists, electrical engineers, chemists and scientists of many disciplines combine their talents to develop better products for you.

The never-ending search for new and better materials for Consolidated Wire products is a way of life at Cyprus' R&D Laboratories. This is where the quality control we're so proud of begins.

Supporting this program of research and development at the laboratory level, every foot of wire that leaves the plant must pass rigid inspections. These products meet or exceed all relevant Underwriters Laboratories, IPCEA, NEMA and other standards.

UL LISTED INTERCOMMUNICATION AND SOUND SYSTEM CABLES

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

	Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Jkt. Thickness (Inches)	Nom. Dia. (Inches)
 **SHIELDED 2 AND 3 CONDUCTOR**	5572	2 Condr.	22 7x30	Tinned copper conductors. .016″ Polyethylene insulation color coded black and red. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. UL Style 2552	.025	.170
	5573	2 Condr.	20 10x30	Same as 5572 color coded black and white. UL Style 2552	.025	.200
	5574	2 Condr.	18 16x30	Same as 5573 UL Style 2092	.030	.225
	5575	2 Condr.	16 26x30	Same as 5573 UL Style 2092	.030	.250
	5589	2 Condr.	14 41x30	Same as 5573 UL Style 2106	.030	.320
	5596	2 Condr.	12 19x25	Same as 5573 UL Style 2106	.040	.400
	5576	3 Condr.	22 7x30	Same as 5572 color coded black, white and red. UL Style 2093	.025	.210
	5577	3 Condr.	20 10x30	Same as 5576 UL Style 2093	.025	.235
	5578	3 Condr.	18 16x30	Same as 5576 UL Style 2093	.025	.240
	5590	3 Condr.	16 26x30	Same as 5576 UL Style 2093	.030	.255
	5591	3 Condr.	14 41x30	Same as 5576 UL Style 2107	.030	.285
 **UNSHIELDED WITH JACKET**	5579	2 Condr.	22 7x30	Tinned copper conductors. .015″ Vinyl insulation. Color coded black and red. UL Style 2335	.020	.165
	5580	2 Condr.	20 10x30	Same as 5579 color coded black and white. UL Style 2508	.025	.190
	5581	2 Condr.	18 16x30	Same as 5580 UL Style 2092	.030	.225
	5582	2 Condr.	16 26x30	Same as 5580 UL Style 2508	.030	.245
	5583	2 Condr.	14 41x30	Same as 5580 UL Style 2508	.030	.310
	5597	2 Condr.	12 19x25	Same as 5580 UL Style 2463	.040	.380
 **WITHOUT JACKET**	5584	2 Condr.	22 Solid	Tinned copper conductors. .015″ Vinyl insulation twisted. Color coded brown and tan. UL Style 1007		.115
	5585	2 Condr.	18 16x30	.018″ insulation. Same as 5584. Color coded black and white. UL Style 1007		.175
	5586	2 Condr.	16 26x30	.020″ insulation. Same as 5585. UL Style 1007		.195
 **MINIATURE BROADCAST AUDIO CABLE**	5570	2 Condr.	22 7x30	Tinned copper .010″ Polyethylene insulation color coded black and red. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. UL Style 2552	.016	.140
	5588	2 Condr.	22 Solid	Same as 5570 UL Style 2552	.016	.120
 **2 PAIR MINIATURE AUDIO AND SOUND CABLE**	5594	2 Pair	22 7x30	Tinned copper polypropylene insulation. Each pair shielded. Mylar aluminum shield and drain wire. Color coded same as 5571. UL Style 2725	.019	.165
	5571	2 Pair	22 7x30	Tinned copper .009″ Polyethylene insulation 1 pair black and red with Mylar aluminum shield. I pair white and green both pairs twisted with stranded tinned copper ground wire gray vinyl jacket. UL Style 2552	.019	.165

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

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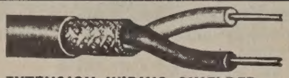
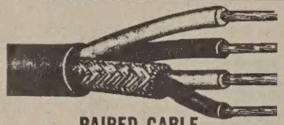
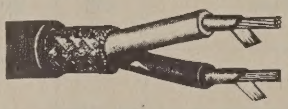
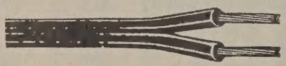
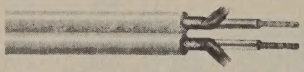
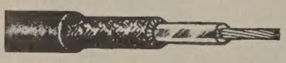
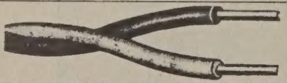
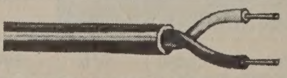
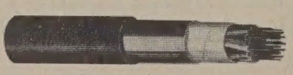
WRITE FOR COMPLETE CONSOLIDATED CATALOG

UL LISTED DATA, INSTRUMENTATION AND SOUND SYSTEM CABLES

STANDARD SPOOL PUT-UP: 100 FT., 250 FT., 500 FT. and 1000 FT.

	Catalog Number	Type	Size & Stranding	Specifications and General Applications	Insul. Thickness (Inches)	Nom. Dia. (Inches)
 EXTENSION WIRING SHIELDED — PLASTIC JACKET	5511	2 Condr.	22 Solid	Tinned copper vinyl plastic insulation, wires twisted together — 1 condr. red — 1 condr. black — and a spiral tinned copper shield with .020″ tubed gray vinyl plastic jacket. UL Style 2095	.015	.170
 PAIRED CABLE SHIELDED — PLASTIC JACKET	5516	2 Pair 4 Condr.	22 7x30	Stranded tinned copper vinyl plastic insulation. 2 pair cabled (4 conductors — 1 pair black & white with braided tinned copper shield mylar tape — 1 pair black & brown unshielded — both pair bunched and .020″ gray vinyl plastic jacket overall. UL Style 2095	.015	.168x .276
 EXTENSION SPEAKERS SHIELDED — PLASTIC JACKET	5568	2 Condr.	22 7x30	Tinned copper vinyl plastic insulation, 2 condrs. — cabled black and red — tinned copper spiral wrapped shield .023″ chrome vinyl plastic jacket. UL Style 2552	.015	.166
	5569	3 Condr.	22 7x30	Tinned copper vinyl plastic insulation, 3 condrs. — cabled black, red, white — tinned copper spiral shield — chrome vinyl plastic jacket. UL Style 2096	.015	.193
	5538	2 Condr.	18 16x30	Stranded tinned copper vinyl plastic insulation, wires twisted together, 1 condr. red, 1 condr. white. Spiral tinned copper shield and .020″ gray vinyl plastic jacket overall. UL Style 2552	.020	.225
	5543	2 Condr.	20 10x30	Same as 5538 1 condr. red — 1 condr. black. UL Style 2552	.020	.185
	5541	2 Condr.	18 16x30	Stranded tinned copper vinyl plastic insulation, wires twisted together. 1 condr. red — 1 condr. white, closely woven braided tinned copper shield and .020″ gray vinyl plastic jacket overall. UL Style 2095	.020	.225
 JUKE BOX SPEAKER CABLE	5547	2 Condr.	24 7x32	Stranded 1 condr. bare copper — 1 condr. tinned copper. 2 condrs. parallel vinyl plastic insulation. Colors: gray, white, brown, clear.	.015	.058x .115
 DUAL CHANNEL AUDIO CABLE FOR STEREO & LANGUAGE LABORATORIES	5587	2 Condr.	24 7x32	Tinned copper conductor. Spiral tinned copper individual shield, .020″ gray vinyl jacket.	.018	.130x .260
 ELECTRIC GUITARS — HIGH IMPEDANCE LAPEL MICROPHONES	5551	1 Condr.	22 16x34	Stranded tinned copper polyethylene insulation closely spiral tinned copper shield with .020″ gray vinyl jacket. UL Style 1107	.020	.135
 INTERCOMMUNICATING SOUND SYSTEM	5556	2 Condr.	19 Solid	Bare copper vinyl plastic insulation, wires twisted together — 1 condr. brown — 1 condr. tan.	.015	.115
	5561	3 Condr.	19 Solid	Same as 5556 — 1 condr. brown — 1 condr. tan — 1 condr. gray.	.015	.132
 INTERCOMMUNICATING SOUND SYSTEM	5557	2 Condr.	19 Solid	Same as 5556 except .025″ outer gray PVC jacket. UL Style 1095	.015	.162
 SHIELDED PAIRED CONTROL CABLE	5901	38 Pair	22 Solid	Tin copper polypropylene insulation. Color coded twisted pairs. Overall mylar aluminum foil shield. 22 AWG (7x30) T.C. drain. .045″ gray plastic jacket.	.008	.600
	5902	51 Pair	22 Solid	Tin copper vinyl insulation. Color coded. Same as 5901 except .050″ gray plastic jacket.	.010	.700

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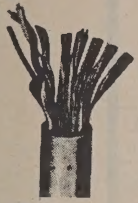
WRITE FOR COMPLETE CONSOLIDATED CATALOG

UL LISTED MULTIPLE PAIR SHIELDED AND UNSHIELDED CABLE
MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND DATA CABLE

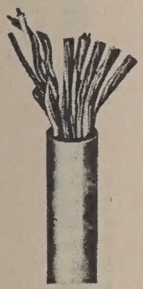
22 AWG SOLID



SHIELDED PAIRS

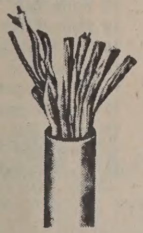
Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Jkt. Thickness (Inches)	Nom. Dia. (Inches)
5303	3 Pair	22 Solid	Tinned copper conductor .010″. Polypropylene insulation. Mylar aluminum shield and tinned copper drain wire, each pair. Overall gray vinyl jacket. UL Style 2725	.028	.250
5306	6 Pair	22 Solid	Same as 5303 UL Style 2725	.037	.330
5309	9 Pair	22 Solid	Same as 5303 UL Style 2725	.040	.390
5311	11 Pair	22 Solid	Same as 5303 UL Style 2725	.040	.420
5315	15 Pair	22 Solid	Same as 5303 UL Style 2725	.045	.485

22 AWG STRANDED



Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Jkt. Thickness (Inches)	Nom. Dia. (Inches)
5323	3 Pair	22 7x30 Overall	Tinned copper .010″ polypropylene insulation. Mylar aluminum shield and tinned copper drain wire each pair. Overall gray vinyl jacket. UL Style 2725	.030	.265
5326	6 Pair	22 7x30	Same as 5323 UL Style 2725	.037	.355
5329	9 Pair	22 7x30	Same as 5323 UL Style 2725	.040	.425
5331	11 Pair	22 7x30	Same as 5323 UL Style 2725	.040	.455
5335	15 Pair	22 7x30	Same as 5323 UL Style 2725	.045	.525
5339	19 Pair	22 7x30	Same as 5323 UL Style 2725	.055	.575
5347	27 Pair	22 7x30	Same as 5323 UL Style 2725	.070	.705

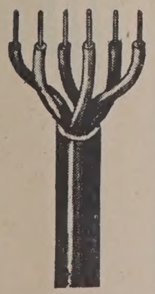
18 AWG STRANDED



Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Jkt. Thickness (Inches)	Nom. Dia. (Inches)
5353	3 Pair	18 16x30	Tin copper .016″ polypropylene insulation. Mylar aluminum shield and tinned copper drain wire each pair. Overall gray vinyl jacket. UL Style 2493	.035	.372
5356	6 Pair	18 16x30	Same as 5353 UL Style 2493	.045	.555
5359	9 Pair	18 16x30	Same as 5353 UL Style 2493	.055	.620
5362	12 Pair	18 16x30	Same as 5353 UL Style 2493	.070	.765
5365	15 Pair	18 16x30	Same as 5353 UL Style 2493	.070	.830

MULTIPLE PAIR UNSHIELDED AUDIO CABLE

18 AWG STRANDED



Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Jkt. Thickness (Inches)	Nom. Dia. (Inches)
5601	1 Pair	18 16x30	Tin copper .016″ vinyl insulation cabled into pairs. Overall gray vinyl jacket.	.020	.220
5603	3 Pair	18 16x30	Same as 5601	.035	.362
5606	6 Pair	18 16x30	Same as 5601	.045	.540
5609	9 Pair	18 16x30	Same as 5601	.055	.615
5612	12 Pair	18 16x30	Same as 5601	.055	.650
5615	15 Pair	18 16x30	Same as 5601	.060	.760
5619	19 Pair	18 16x30	Same as 5601	.070	.830
5627	27 Pair	18 16x30	Same as 5601	.070	.965

Color Coding For Paired Intercom Cables

PAIRED INTERCOMMUNICATING CABLES COLOR CODING
Identification is simple with Consolidated Intercom Cables because they are all color coded. See chart below.

1. Black paired with Red
2. Black paired with White
3. Black paired with Green
4. Black paired with Blue
5. Black paired with Yellow
6. Black paired with Brown
7. Black paired with Orange
8. Red paired with White
9. Red paired with Green
10. Red paired with Blue
11. Red paired with Yellow
12. Red paired with Brown
13. Red paired with Orange
14. Green paired with White
15. Green paired with Blue
16. Green paired with Yellow
17. Green paired with Brown
18. Green paired with Orange
19. White paired with Blue
20. White paired with Yellow
21. White paired with Brown
22. White paired with Orange
23. Blue paired with Yellow
24. Blue paired with Brown
25. Blue paired with Orange
26. Brown paired with Yellow
27. Brown paired with Orange

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

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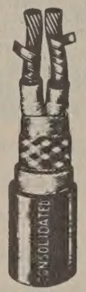
SHIELDED AND JACKETED CABLES CONTROL AND MICROPHONE TYPE

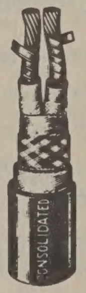
SHIELDED RUBBER JACKET



SHIELDED AND JACKETED CABLES CONTROL AND MICROPHONE TYPE MULTI-CONDUCTOR CABLES

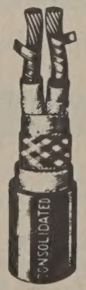
Catalog Number	No. of Condr.	Size & (Stranding)	Special Use	Specifications	Finished O.D. (Inches)	Nom. Capac. per ft. (mmf)
1460	1	20(26x34)	Crystal microphone	Tinned copper, wall of live rubber; cotton fillers and wrap; tinned copper braid shield; cotton wrap rubber jacket overall.	.240	33.
1462	2	20(26x34)	Low impedance microphones	Same as 1460; color coded	.268	68.
1456	2	18(41x34)	Heavy duty studio cable	Same as 1460; color coded	.295	80.
1463	3	20(26x34)	Low impedance microphones	Same as 1460; color coded	.277	85.
1464	4	20(26x34)	Low impedance microphones	Same as 1460; color coded	.295	95.
1465	5	20(26x34)	Interconnecting power cable for all electronic uses	Same as 1460; color coded	.323	
1466	6	20(26x34)	Same as 1465	Same as 1460; color coded	.349	
1467	7	20(26x34)	Same as 1465	Same as 1460; color coded	.360	
1455	8	20(26x34)	Same as 1465	Same as 1460; color coded	.386	

SHIELDED NEOPRENE JACKET



Catalog Number	No. of Condr.	Size & (Stranding)	Specifications	Finished O.D. (Inches)
1701	1	18(41x34)	Tinned copper, yarn serve; wall of live rubber; cotton fillers and wrap; tinned copper braid shield; cotton wrap neoprene jacket overall.	.235
1702	2	18(41x34)	Same as 1701, color coded	.295
1703	3	18(41x34)	Same as 1701, color coded	.305
1704	4	18(41x34)	Same as 1701, color coded	.330
1708	6	18(41x34)	Same as 1701, color coded	.430
1709	8	18(41x34)	Same as 1701, color coded	.465
1710	10	18(41x34)	Same as 1701, color coded	.480
1711	12	18(41x34)	Same as 1701, color coded	.550
1712	15	18(41x34)	Same as 1701, color coded	.630
1713	20	18(41x34)	Same as 1701, color coded	.725

SHIELDED NEOPRENE JACKET



1705	2	16(65x34)	Same as 1701, color coded	.320
1706	3	16(65x34)	Same as 1701, color coded	.340
1707	4	16(65x34)	Same as 1701, color coded	.355
1714	2	14(41x30)	Same as 1701, color coded	.395
1715	3	14(41x30)	Same as 1701, color coded	.425
1716	4	14(41x30)	Same as 1701, color coded	.450
1717	2	12(65x30)	Same as 1701, color coded	.440
1718	3	12(65x30)	Same as 1701, color coded	.465
1719	4	12(65x30)	Same as 1701, color coded	.500

Stock Colors

1	Black
2	White
3	Red
4	Green
5	Yellow
6	Blue
7	Brown
8	Orange
9	Gray (slate)
10	Purple
11	White/Black
12	White/Red
13	White/Green
14	White/Yellow
15	White/Blue
16	White/Brown
17	White/Purple
18	White/Gray (slate)
19	Black/Red
20	Black/Yellow

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

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CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

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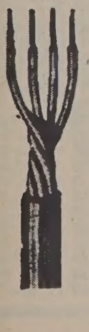
CONTROL CABLES SHIELDED AND UNSHIELDED

SHIELDED PLASTIC JACKET

SHIELDED AND JACKETED CABLES CONTROL AND MICROPHONE TYPE MULTI-CONDUCTOR CABLES

Catalog Number	No. of Cond.	Size & (Stranding)	Special Use	Specifications	Finished O.D. (Inches)	Nom. Capac. per ft. (mmf)	Stock Colors
1721	1	24(7x32)	Low Capacitance	Tinned copper polyethylene insulation with a close spiral tinned copper shield. Gray vinyl plastic jacket.	.132	29.	1 Black 2 White 3 Red 4 Green 5 Yellow 6 Blue 7 Brown 8 Orange 9 Gray (slate) 10 Purple 11 White/Black 12 White/Red 13 White/Green 14 White/Yellow 15 White/Blue 16 White/Brown 17 White/Purple 18 White/Gray 19 Black/Red 20 Black/Yellow
1461	1	22(16x34)	Lapel microphone	Same as 1721 UL Style 1107	.125	36.	
1457	1	22(16x34)	Crystal, Ribbon and other high impedance microphones	Same as 1721 except heavier polyethylene insulation on conductor.	.200	25.	
1458	2	22(16x34)	Low impedance microphones and control cable	Tinned copper conductors polyethylene insulation conductors; black and clear. Cabled with fillers rayon serve, spiral tinned copper shield. Gray vinyl plastic jacket.	.231	32.	
1459	1	20(26x34)	Lapel microphone	Tinned copper wire, with polyethylene to .087″ O.D. with a closely tinned copper shielded braid, and a heavy black plastic jacket overall.	.175	40.	
1722	2	20(26x34)	Same as 1458	Same as 1458 except braided tin copper shield.	.245	32.	
1723	3	20(26x34)	Same as 1458	Same as 1722	.250	45.	
1724	4	20(26x34)	Same as 1458	Same as 1722 UL Style 2725	.255	45.	
1725	5	20(26x34)	Same as 1458	Same as 1722	.275	45.	
1726	6	20(26x34)	Same as 1458	Same as 1722	.300		
1727	7	20(26x34)	Same as 1458	Same as 1722	.330		
1728	8	20(26x34)	Same as 1458	Same as 1722	.375		
1740	10	20(26x34)	Same as 1458	Same as 1722	.380		
1741	12	20(26x34)	Same as 1458	Same as 1722	.385		
1742	15	20(26x34)	Same as 1458	Same as 1722	.415		
1743	20	20(26x34)	Same as 1458	Same as 1722	.455		

UNSHIELDED RUBBER JACKET



Catalog Number	No. of Cond.	Size & (Stranding)	Insulation Thickness (Inches)	Jacket Thickness (Inches)	Finished O.D. (Inches)
1733	3	20(26x34)	.020	.035	.255
1734	4	20(26x34)	.020	.035	.275
1735	5	20(26x34)	.020	.035	.300
1736	6	20(26x34)	.020	.035	.315
1737	7	20(26x34)	.020	.035	.325
1738	8	20(26x34)	.020	.035	.360

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS CONSOLIDATED

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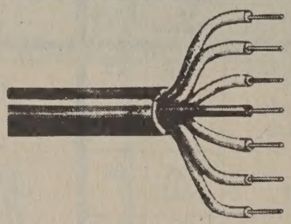
WRITE FOR COMPLETE CONSOLIDATED CATALOG

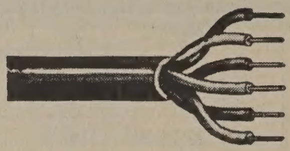
UL LISTED UNSHIELDED AUDIO CABLE MULTICONDUCTOR - PLASTIC JACKET



STRANDED CONDUCTORS — 300 VOLTS

22 AWG — UL Style 2335

Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)
5400	2 Cond.	22 7x30	Tinned copper conductor .010″ vinyl cabled gray vinyl jacket UL Style 2335	.140
5401	3 Cond.	22 7x30	Same as 5400 UL Style 2335	.145
5406	4 Cond.	22 7x30	Same as 5400 UL Style 2335	.160
5411	5 Cond.	22 7x30	Same as 5400 UL Style 2335	.180
5416	6 Cond.	22 7x30	Same as 5400 UL Style 2335	.200
5421	7 Cond.	22 7x30	Same as 5400 UL Style 2335	.205
5426	8 Cond.	22 7x30	Same as 5400 UL Style 2335	.205
5431	9 Cond.	22 7x30	Same as 5400 UL Style 2335	.220
5432	10 Cond.	22 7x30	Same as 5400 UL Style 2335	.230
5434	12 Cond.	22 7x30	Same as 5400 UL Style 2335	.245
5438	15 Cond.	22 7x30	Same as 5400 UL Style 2335	.268
5440	20 Cond.	22 7x30	Same as 5400 UL Style 2335	.300
5442	25 Cond.	22 7x30	Same as 5400 UL Style 2335	.330
5446	30 Cond.	22 7x30	Same as 5400 UL Style 2335	.375
5448	40 Cond.	22 7x30	Same as 5400 UL Style 2335	.435
5450	50 Cond.	22 7x30	Same as 5400 UL Style 2335	.500
5460	60 Cond.	22 7x30	Same as 5400 UL Style 2335	.530



STRANDED CONDUCTORS — 600 VOLTS

16 AWG — UL Style 2570

Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)
5480	4 Condr.	16 19x29	Tin Copper .030″ PVC cables .045″ Gray outer PVC Jkt.	.375
5488	5 Condr.	16 19x29	Same as 5480	.405
5481	7 Condr.	16 19x29	Same as 5480	.455
5489	9 Condr.	16 19x29	Same as 5480	.510
5482	12 Condr.	16 19x29	Same as 5480 Except .060″ Jacket	.600
5483	15 Condr.	16 19x29	Same as 5480 Except .060″ Jacket	.650
5484	19 Condr.	16 19x29	Same as 5480 Except .065″ Jacket	.715
5490	25 Condr.	16 19x29	Same as 5480 Except .065″ Jacket	.820

14 AWG — UL Style 2463

Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)
5485	4 Condr.	14 19x27	Tin copper .045″ PVC cabled .045″ Gray outer PVC Jkt.	.495
5491	5 Condr.	14 19x27	Same as 5485 Except .060″ Jacket	.560
5486	7 Condr.	14 19x27	Same as 5485 Except .060″ Jacket	.630
5492	9 Condr.	14 19x27	Same as 5485 Except .065″ Jacket	.750
5487	12 Condr.	14 19x27	Same as 5485 Except .065″ Jacket	.770
5493	15 Condr.	14 19x27	Same as 5485 Except .080″ Jacket	.900

Color Coding For Multiple Intercom Cables

CHART 1*

1 Black
2 Red
3 Green
4 White
5 Brown
6 Blue
7 Orange
8 Yellow
9 Purple
10 Slate
11 Pink
12 Tan

CHART 2**

1 Black
2 White
3 Red
4 Green
5 Orange
6 Blue
7 White/Black
8 Red/Black
9 Green/Black
10 Orange/Black
11 Blue/Black
12 Black/White
13 Red/White
14 Green/White
15 Blue/White
16 Black/Red
17 White/Red
18 Orange/Red
19 Blue/Red
20 Red/Green
21 Orange/Green
22 Black/White/Red
23 White/Black/Red
24 Red/Black/White
25 Green/Black/White
26 Orange/Black/White
27 Blue/Black/White
28 Black/Red/Green
29 White/Red/Green
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43 Blue/Red/Green
44 Black/White/Blue
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46 Red/White/Blue
47 Green/Orange/Red
48 Orange/Red/Blue
49 Blue/Red/Orange
50 Black/Orange/Red
51 White/Black/Orange
52 Red/Orange/Black
53 Green/Red/Blue
54 Orange/Black/Blue
55 Blue/Black/Orange
56 Black/Orange/Green
57 White/Orange/Green
58 Red/Orange/Green
59 Green/Black/Blue
60 Orange/Green/Blue

STRANDED CONDUCTORS — 400 VOLTS

18 AWG — UL Style 2464

Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)
5470	4 Condr.	18 16x30	Tin copper .018″ PVC cabled .030″ Gray outer PVC Jkt.	.250
5471	5 Condr.	18 16x30	Same as 5470 Except .037″ Jacket	.295
5472	7 Condr.	18 16x30	Same as 5470 Except .037″ Jacket	.324
5473	9 Condr.	18 16x30	Same as 5470 Except .037″ Jacket	.379

18 AWG — UL Style 2464

Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)
5474	12 Condr.	18 16x30	Same as 5470 Except .040″ Jacket	.412
5475	15 Condr.	18 16x30	Same as 5470 Except .065″ Jacket	.475
5476	19 Condr.	18 16x30	Same as 5470 Except .045″ Jacket	.505
5477	25 Condr.	18 16x30	Same as 5470 Except .060″ Jacket	.600

* Catalog No.'s 5400 thru 5434 and 5470 thru 5473 Color Coding Chart 1
** Catalog No.'s 5438 thru 5460 and 5474 thru 5493 Color Coding Chart 2

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

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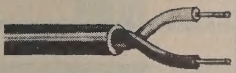
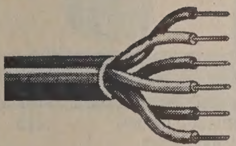
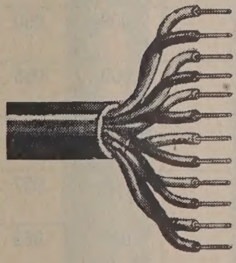
UL LISTED UNSHIELDED INTERCOM CABLE

PAIRED CONDUCTORS SOLID AND STRANDED PLASTIC JACKET







Catalog Number	Type	Size & (Stranding)	Specications and General Applications	Nominal Diameter (Inches)
SOLID — UL STYLE 2508				
5201	1 Pr. 2 Condr.	22 Solid	Tinned copper conductor .010″ vinyl plastic insulation. Cabled, gray vinyl plastic jacket overall	.130
5205	2 Pr. 4 Condr.	22 Solid	Same as 5201	.190
5211	3 Pr. 6 Condr.	22 Solid	Same as 5201	.220
5221	5 Pr. 10 Condr.	22 Solid	Same as 5201	.250
5226	6 Pr. 12 Condr.	22 Solid	Same as 5201	.275
5231	7 Pr. 14 Condr.	22 Solid	Same as 5201	.280
5236	8 Pr. 16 Condr.	22 Solid	Same as 5201	.300
5241	9 Pr. 18 Condr.	22 Solid	Same as 5201	.320
5251	11 Pr. 22 Condr.	22 Solid	Same as 5201	.340
5271	15 Pr. 30 Condr.	22 Solid	Same as 5201	.400
5286	27 Pr. 54 Condr.	22 Solid	Same as 5201	.510
5289	31 Pr. 62 Condr.	22 Solid	Same as 5201	.555
5292	41 Pr. 82 Condr.	22 Solid	Same as 5201	.630
5297	51 Pr. 102 Condr.	22 Solid	Same as 5201	.735
STRANDED — UL Style 2508				
5151	1 Pr. 2 Condr.	22(7x30)	Tinned copper conductor .010″ vinyl plastic insulation. Cabled, gray vinyl plastic jacket overall	.145
5152	2 Pr. 4 Condr.	22(7x30)	Same as 5151	.210
5153	3 Pr. 6 Condr.	22(7x30)	Same as 5151	.230
5155	5 Pr. 10 Condr.	22(7x30)	Same as 5151	.265
5156	6 Pr. 12 Condr.	22(7x30)	Same as 5151	.290
5157	7 Pr. 14 Condr.	22(7x30)	Same as 5151	.300
5158	8 Pr. 16 Condr.	22(7x30)	Same as 5151	.320
5159	9 Pr. 18 Condr.	22(7x30)	Same as 5151	.355
5161	11 Pr. 22 Condr.	22(7x30)	Same as 5151	.370
5165	15 Pr. 30 Condr.	22(7x30)	Same as 5151	.450
5167	27 Pr. 54 Condr.	22(7x30)	Same as 5151	.570
5171	31 Pr. 62 Condr.	22(7x30)	Same as 5151	.635
5181	41 Pr. 82 Condr.	22(7x30)	Same as 5151	.710
5191	51 Pr. 102 Condr.	22(7x30)	Same as 5151	.800

Color Coding For Paired Intercom Cables

PAIRED INTERCOMMUNICATING CABLES COLOR CODING

Identification is simple with Consolidated Intercom Cables because they are all color coded. See chart below.

1 Black prd. w. Red
2 Black prd. w. White
3 Black prd. w. Green
4 Black prd. w. Blue
5 Black prd. w. Brown
6 Black prd. w. Yellow
7 Black prd. w. Orange
8 Red prd. w. Green
9 Red prd. w. White
10 Red prd. w. Blue
11 Red prd. w. Yellow
12 Red prd. w. Brown
13 Red prd. w. Orange
14 Green prd. w. Blue
15 Green prd. w. White
16 Green prd. w. Brown
17 Green prd. w. Orange
18 Green prd. w. Yellow
19 White prd. w. Blue
20 White prd. w. Brown
21 White prd. w. Orange
22 White prd. w. Yellow
23 Blue prd. w. Brown
24 Blue prd. w. Orange
25 Blue prd. w. Yellow
26 Brown prd. w. Orange
27 Brown prd. w. Yellow
28 Purple prd. w. Red
29 Purple prd. w. White
30 Purple prd. w. Green
31 Purple prd. w. Blue
32 Purple prd. w. Brown
33 Purple prd. w. Yellow
34 Purple prd. w. Orange
35 Purple prd. w. Slate
36 Purple prd. w. Black
37 Slate prd. w. Red
38 Slate prd. w. White
39 Slate prd. w. Green
40 Slate prd. w. Blue
41 Slate prd. w. Brown
42 Slate prd. w. Yellow
43 Slate prd. w. Orange
44 Slate prd. w. Black
45 White/Black prd. w. Red
46 White/Black prd. w. Green
47 White/Black prd. w. Blue
48 White/Black prd. w. Brown
49 White/Black prd. w. Yellow
50 White/Black prd. w.
51 White/Black prd. w. Purple

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT. ALL ITEMS.

CONSOLIDATED

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

WRITE FOR COMPLETE CONSOLIDATED CATALOG

STEREO, PHONO, AND SPEAKER CABLES

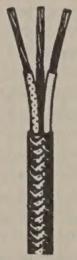
SPEAKER CABLE

Catalog Number	Type	Size & Stranding	Special Use	Specifications	Finished O.D. (Inches)
5137	2 Condr.	24 7x32	Juke box speaker cable.	Stranded 1 conductor bare copper — 1 conductor tinned copper — 2 conductors parallel .015 vinyl plastic insulation. Colors: gray, brown, white clear.	.058 x .115
5142	2 Condr.	22 7x30	Speaker Cable "PLT"	Same as 5148. Colors: clear, gray, brown, black, white.	.060 x .120
5140	2 Condr.	20 10x30	Lamp Cord "PLT"	Two conductors bare copper parallel .015 vinyl insulation. Colors: black, gray, brown, white clear. 1 conductor ribbed for identification.	.080 x .165
5144	2 Condr.	20 26x34	Lamp Cord "XT"	Same as 5140 except .032 vinyl insulation.	.100 x .190
5148	2 Condr.	18 16x30	Speaker Cable "PLT"	Stranded 1 conductor bare copper — 1 conductor tinned copper — 2 conductors parallel .016 vinyl insulation. Color: clear.	.090 x .185

Catalog Number	Type	Size & Stranding	U.L. Type	Nom. Insulation Thickness (Inches)	Nom. O.D. (Inches)
RUBBER PARALLEL PORTABLE CORDAGE					
4072	2 Condr.	18(41x34)	SP-1	1/32	.220 x .120
4074	2 Condr.	16(65x34)	SP-2	3/64	.300 x .160
PLASTIC PARALLEL PORTABLE CORDAGE					
4077	2 Condr.	18(41x34)	SPT-1	1/32	.215 x .115
4079	2 Condr.	16(65x34)	SPT-2	3/64	.300 x .160

Colors: Black, Brown, White, Gray.

STANDARD SPOOL PUT-UP: 25 FT., 50 FT., 100 FT., 250 FT., 500 FT., 1000 FT.



MULTI-CONDUCTOR PHONO CABLE

Catalog Number	Type	Size & Stranding	Special Use	Specifications	Finished O.D. (Inches)
5123	3 Condr.	Two 16 26x30 One 18 10x30	Phono and Juke box cable.	2 conductors No. 16 - 1/64″ thermoplastic insulation, 1 conductor No. 20 - 1/64″ thermoplastic insulation, all individually color coded. All conductors grouped into cable form with gray vinyl plastic jacket.	.215
5124	4 Condr.	18 Solid	Phono and Juke box cable.	Same as 5123	.225

STEREO CABLE — HI-FI, STEREO

Catalog Number	Type	Size & Stranding	Specifications	Insul. Thick. (Inches)	Finished O.D. (Inches)
1470	1 Condr.	24 16x.005	Bare copper; flexible stranding; vinylite plastic insulation; tinned copper braid — SHIELDED.	.010	.070
1478	2 Condr.	32 7x40	Tinned copper: flexible stranding. Vinyl Plastic insulation; Black and Red.	.009	.050
1401	3 Condr.	32 7x40	Same as 1478. Black, Red, White.	.009	.055
1402	4 Condr.	32 7x40	Same as 1478. Black, Red, Green, White.	.009	.070
1479	2 Condr.	32 7x40	Same as 1478 and tinned copper braid — SHIELDED.	.009	.057
1406	3 Condr.	32 7x40	Same as 1401 and tinned copper braid — SHIELDED.	.009	.063
1407	4 Condr.	32 7x40	Same as 1402 and tinned copper braid — SHIELDED.	.009	.070
1410	2 Condr.	32 7x40	Individually SHIELDED and twisted conductors.	.009	.055 x .055

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

TELEMETERING AND DATA SHIELDED CONTROL CABLE

DESCRIPTION: Each conductor bare solid copper, high molecular weight polyethylene insulation, color coded, twisted into pairs, cabled with a non-hygroscopic binder tape .008″ aluminum shield, black polyethylene jacket overall. Operating voltage 300 volts.

Double jacketed types (8306-8420 below), same except for additional inner black polyethylene jacket over binder, and .005″ copper shield, or .010″ aluminum shield.

APPLICATIONS: Remote control of rocket recording data and test-firing control, transmission of signals which telemeter temperature, voltage pressure, etc. control of multiple circuits, measuring devices, quality control equipment, radar antenna. For aerial, duct and conduit installations.

Double jacketed types have higher dielectric strength and suited for direct burial installations.

Catalog Number	No. of Pairs	Nom. Insul. Thick. (Inches)	Nom. Jkt. Thick. (Inches)	Nom. O.D. (Inches)	Approx. Lbs. M/Ft.
#22 AWG — SOLID					
8006	6	.012	.060	.420	95
8012	12	.012	.060	.490	137
8018	18	.012	.060	.560	201
8025	25	.012	.060	.630	245
8050	50	.012	.060	.800	420
8100	100	.012	.060	1.120	807
8200	200	.012	.060	1.500	1,485
#19 AWG — SOLID					
8016	6	.015	.060	.500	136
8112	12	.015	.060	.630	235
8118	18	.015	.060	.730	318
8125	25	.015	.060	.820	419
8150	50	.015	.060	1.120	753
8110	100	.015	.060	1.520	1,455
8220	200	.015	.060	2.090	2,657

DOUBLE JACKET — HEAVY DUTY

Catalog Number	No. of Pairs	Nom. Insul. Thick. (Inches)	Nom. Jkt. Thick. (Inches)		Nom. O.D. (Inches)	Approx. Lbs. M/Ft.
			Inner	Outer		
#22 AWG — SOLID						
8306	6	.012	.047	.040	.480	150
8312	12	.012	.047	.040	.550	170
8318	18	.012	.047	.040	.620	241
8325	25	.012	.047	.040	.690	302
8350	50	.012	.047	.040	.860	478
8310	100	.012	.047	.050	1.180	886
8320	200	.012	.047	.050	1.560	1,597
#19 AWG — SOLID						
8406	6	.015	.047	.040	.560	168
8412	12	.015	.047	.040	.690	290
8418	18	.015	.047	.040	.790	367
8425	25	.015	.047	.040	.880	480
8450	50	.015	.047	.040	1.180	871
8410	100	.015	.047	.050	1.580	1,568
8420	200	.015	.047	.050	2.220	2,986

STANDARD PUT-UP: CUT TO SPECIFICATION — MIN. 25 FT.

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CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS
1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

TELEPHONE AND COMMUNICATION CABLE

AERIAL AND DUCT INSTALLATION — MEETS REA-PE-22

DESCRIPTION: Each conductor bare solid copper, color coded polyethylene insulation, insulated conductors paired, pairs cabled with non-hygroscopic tape wrap, .008″ corrugated aluminum shield, black polyethylene jacket overall.

CHARACTERISTICS: Average mutual capacitance — .083 microfarads/mile. Minimal cross talk.

APPLICATIONS: A tough, long lasting communication cable that can withstand moisture, ultra-violet and weathering.

Catalog Number	No. of Pairs	Nom. Jkt. Thick. (Inches)	Nom. O.D. (Inches)	Ship. Wt. Lbs. M/Ft.
#22 AWG — SOLID				
6606	6	.060	.420	95
6612	12	.060	.490	137
6618	18	.060	.560	201
6625	25	.060	.630	245
6650	50	.060	.800	420
6675	75	.060	.980	596
6610	100	.070	1.120	807
6615	150	.070	1.320	1,083
6620	200	.070	1.500	1,485
6630	300	.080	1.810	2,160
6640	400	.090	2.050	2,705
#19 AWG — SOLID				
6706	6	.060	.500	136
6712	12	.060	.630	235
6718	18	.060	.730	318
6725	25	.060	.820	419
6750	50	.070	1.120	753
6775	75	.070	1.320	1,070
6710	100	.080	1.520	1,455
6715	150	.080	1.790	2,051
6720	200	.090	2.090	2,657

DIRECT BURIAL INSTALLATION — MEETS REA-PE-23

DESCRIPTION: Each conductor bare solid copper, color coded polyethylene insulation, insulated conductors paired, pairs cabled with non-tygroscopic tape wrap, polyethylene inner jacket, .005″ corrugated copper, or .010″ corrugated aluminum shield, black polyethylene jacket overall.

CHARACTERISTICS: Average mutual capacitance .166 microfarads/mile. Minimal cross talk.

APPLICATIONS: Impervious to moisture, abrasion resistant, suitable for direct burial.

#22 AWG — SOLID				
6006	6	.040	.480	150
6012	12	.040	.550	170
6018	18	.040	.620	241
6025	25	.040	.690	302
6050	50	.040	.860	478
6075	75	.040	1.040	680
6100	100	.040	1.180	886
6150	150	.050	1.400	1,258
6200	200	.050	1.560	1,557
6300	300	.060	1.890	2,173
6400	400	.060	2.130	2,853
#19 AWG — SOLID				
6106	6	.040	.560	168
6112	12	.040	.690	290
6118	18	.040	.790	367
6125	25	.040	.880	480
6170	50	.050	1.180	871
6175	75	.050	1.400	1,246
6110	100	.050	1.580	1,568
6250	150	.060	1.890	2,236
6220	200	.060	2.170	2,986

STANDARD PUT-UP: CUT TO SPECIFICATION — MIN. 25 FT. — COLOR CODE — per IPCEA.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

UNSHIELDED STATION CONTROL CABLE

HEAVY DUTY MULTI-CONDUCTOR PLASTIC JACKET — TYPE CT-B CONTROL CABLE — 600 VOLTS

Catalog Number	No. of Cond.	Nom. Jkt. Thick. (Inches)	Nom. O.D. (Inches)	Catalog Number	No. of Cond.	Nom. Jkt. Thick. (Inches)	Nom. O.D. (Inches)
16 GAUGE — 26/30 BARE COPPER							
7502	2	.045	.330	**7519**	19	.060	.690
7503	3	.045	.350	**7521**	21	.060	.730
7505	5	.045	.410	**7522**	22	.060	.760
7506	6	.045	.440	**7524**	24	.060	.810
7507	7	.045	.440	**7526**	26	.060	.820
7508	8	.045	.480	**7530**	30	.060	.900
7510	10	.045	.580	**7537**	37	.060	.960
7512	12	.045	.600	**7540**	40	.060	1.00
7514	14	.045	.630	**7550**	50	.080	1.10
7516	16	.045	.660	**7560**	60	.080	1.19
14 GAUGE — 7/22 BARE COPPER							
7602	2 Twin	.045	*	**7614**	14	.060	.744
7603	3 Rd.	.045	.419	**7616**	16	.060	.798
7604	4	.045	.425	**7619**	19	.060	.808
7605	5	.045	.462	**7624**	24	.080	.947
7606	6	.045	.481	**7627**	27	.080	1.002
7607	7	.045	.502	**7630**	30	.080	1.110
7608	8	.060	.556	**7634**	34	.080	1.118
7609	9	.060	.622	**7637**	37	.080	1.124
7610	10	.060	.657	**7640**	40	.080	1.290
7612	12	.060	.696				
12 GAUGE — 7/20 BARE COPPER							
7702	2 Twin	.045	**	**7715**	15	.060	.832
7703	3 Rd.	.045	.460	**7716**	16	.060	.901
7704	4	.045	.471	**7718**	18	.080	.928
7705	5	.045	.523	**7719**	19	.080	.943
7706	6	.045	.564	**7720**	20	.080	.966
7707	7	.060	.599	**7722**	22	.080	1.01
7708	8	.060	.644	**7725**	25	.080	1.09
7709	9	.060	.690	**7727**	27	.080	1.129
7710	10	.060	.727	**7730**	30	.080	1.168
7712	12	.060	.775	**7734**	34	.080	1.201
7714	14	.060	.807	**7737**	37	.080	1.257
10 GAUGE — 7/18 BARE COPPER							
7802	2	.045	.27x.45	**7809**	9	.060	.777
7803	3	.045	.483	**7810**	10	.060	.830
7804	4	.060	.569	**7812**	12	.080	.915
7805	5	.060	.618	**7815**	15	.080	.93
7806	6	.060	.640	**7816**	16	.080	.99
7807	7	.060	.671	**7820**	20	.080	1.11
7808	8	.060	.700				
9 GAUGE — 19/22 BARE COPPER							
7902	2	.045	.29x.48	**7909**	9	.060	.831
7903	3	.045	.526	**7910**	10	.060	.900
7904	4	.060	.604	**7912**	12	.080	.978
7905	5	.060	.659	**7915**	15	.080	.99
7906	6	.060	.670	**7916**	16	.080	1.10
7907	7	.060	.716	**7920**	20	.080	1.70
7908	8	.060	.760				

* Flat Dimension .233″ x .366″

** Flat Dimension .252″ x .404″

DESCRIPTION: Each conductor, stranded bare copper, .020″ polyethylene insulation, .010″ polyvinylchloride jacket, over each conductor, color coded, cabled with fillers where necessary, moisture resistant tape, black polyvinylchloride jacket overall. 600 volt operating voltage. Approved per IPCEA-NEMA standards.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

RG TYPE COAXIAL CABLES

Non-Contaminating Low Temp. Black Jkt.		Vinyl & Poly. Jackets					Shields							
Number RG/U	Catalog Number	Number RG/U	Catalog Number	Armor O.D.	Jacket O.D.	Vinyl Jacket	Outer	Inner	Dielectric O.D.	Center Conductor	V.P. %	Cap. Mmfd./ Ft.	Max. Oper. Volts Rms.	Nom. Imp. Ohms
5B	4432				.332	Black	S	S	.185	.053S	65.9	29.5	3000	50
6A	4433				.332	Black	C	C	.185	21CW	65.9	20	2700	75
		8	4415		.405	Black		C	.285	7/21	65.9	29.5	4000	52
8A	4435				.405	Black		C	.285	7/.0296	65.9	30.5	4000	52
		9	4436		.420	Gray	C	S	.280	7/21S	65.9	30	4000	51
9A	4437				.420	Gray	S	S	.280	7/21S	65.9	30	4000	51
9B	4438				.425	Black	S	S	.285	7/.0296S	65.9	30.5	4000	50
10A	4439			.475	.405	Black		C	.285	7/.0296	65.9	30.5	4000	50
		11	4419		.405	Black		C	.285	7/26T	65.9	20.5	4000	75
11A	4440				.405	Black		C	.285	7/26T	65.9	20.5	4000	75
12A	4441			.475	.405	Black		C	.285	7/26T	65.9	20.5	4000	75
13A	4443				.425	Black	C	C	.285	7/26T	65.9	20.5	4000	75
14A	4468				.545	Black	C	C	.370	.106	65.9	30	5500	52
17A	4482				.870	Black		C	.680	.188C	65.9	29.5	11000	52
18A	4483			.945	.870	Black		C	.680	.188C	65.9	29.5	11000	52
		21	4444		.322	Gray	S	S	.185	16N	65.9	29	2700	53
21A	4445				.332	Black	S	S	.185	.053N	65.9	30	2700	50
		22	4471		.405	Black		T	.285	Two 7/.0152	65.9	16	1000	95
22B	4475				.420	Black	T	T	.285	Two 7/.0152	65.9	16	1000	95
		29	4446		.184	Poly		T	.116	20	65.9	28.5	1900	53.5
		54A	4469		.250	Poly		T	.178	7/.0152	65.9	26.5	3000	58
		55	4447		.206	Poly	T	T	.116	20	65.9	28.5	1900	53.5
55A	4448				.216	Black	S	S	.116	.035S	65.9	29.5	1900	50
55B	4484				.206	Black	T	T	.116	20S	65.9	28.5	1900	53.5
		58	4405		.195	Black		T	.116	20	65.9	28.5	1900	53.5
58A	4449				.195	Black		T	.116	19/.0071T	65.9	29.5	1900	50
58B	4474				.195	Black		T	.116	20	65.9	28.5	1900	53.5
58C	4450				.195	Black		T	.116	19/.0071T	65.9	29.5	1900	50
		59	4401		.242	Black		C	.146	22CW	65.9	21	2300	73
		59	4402		.242	Gray		C	.146	22CW	65.9	21	2300	73
59	4403				.242	White		C	.146	22CW	65.9	21	2300	73
59A	4451				.242	Black		C	.146	.023CW	65.9	20.5	2300	75
59B	4470				.242	Black		C	.146	.023CW	65.9	20.5	2300	75
		62	4452		.242	Black		C	.146**	22CW	84	13.5	750	93
62A	4453				.242	Black		C	.146**	22CW	84	13.5	750	93
62B	4472				.242	Black		C	.146	7x32CW	84	13.5	750	93
		63	4454		.405	Black		C	.285**	22CW	84	10	1000	125
63B	4455				.405	Black		C	.285**	22CW	84	10	1000	125
71A	4466				.245	Black	T	T or C	.146**	22CW	84	13.5	750	93
71B	4485				.250	Black	T	C	.146	22CW	84	13.5	750	93
74A	4486			.615	.545	Black	C	C	.370	10C	65.9	29.5	7000	52
79B	4487			.475	.405	Black		C	.285	22CW	84	10	1000	125
		83	4410		.405	Black		C	.240	10C	65.9	44	2000	35
		100	4412		.242	Black		C	.146	19/.0147C	65.9	44	2000	35

** Semi-Solid Dielectric N—Nichrome C—Copper S—Silvered Copper CW—Copperweld T—Tinned Copper F—Formvar

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CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS
1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

RG TYPE COAXIAL CABLES

Non-Contaminating Low Temp. Black Jkt. Number RG/U	Non-Contaminating Low Temp. Black Jkt. Catalog Number	Vinyl & Poly. Jackets Number RG/U	Vinyl & Poly. Jackets Catalog Number	Armor O.D.	Jacket O.D.	Vinyl Jacket	Shields Outer	Shields Inner	Dielectric O.D.	Center Conductor	V.P. %	Cap. Mmfd./Ft.	Max. Oper. Volts Rms.	Nom. Imp. Ohms
		108	**4464**		.235	Black		T	.079 ea.	Two 7/28T	68	23.5	1000	78
108A	**4465**				.235	Black		T	.079 ea.	Two 7/28T	65.9	23.5	1000	78
		111	**4422**	.480	.420	Gray	T	T	.285	Two 7/.152T	65.9	16	1000	95
111A	**4423**			.490	.420	Gray	T	T	.285	Two 7/.152T	65.9	16	1000	95
		114	**4426**		.405	Black		C	.285	.007CW		6.8	1000	185
114A	**4427**				.405	Black		C	.285	.007CW		6.8	1000	185
122	**4457**				.160	Black		T	.096	27/36T	65.9	29.5	1900	50
130	**4428**				.625	Black		T	.472	Two 7/21C	65.9	17	3000	95
131	**4429**			.710	.625	Black		T	.472	Two 7/21C	65.9	17	3000	95
133A	**4430**				.405	Black		C	.285	21C	65.9	16.2	1000	95
		164	**4404**		.870	Black		C	.680	.1045C			10000	75
		177	**4406**		.895	Black	S	S	.680	.195C			11000	50
		181	**4407**		.640	Black		C	.210	Two 7/26C		12	3500	125
212	**4488**				.332	Black	S	S	.185	.0556S	65.9	29.5	3000	50
213	**4489**				.405	Black		C	.285	7X.0296C	65.9	29.5	5000	50
214	**4490**				.425	Black	S	S	.285	7X.0296C	65.9	29.5	5000	50
215	**4497**				.475	Black		C	.285	7/.029C	65.9	29.5	4000	50
216	**4491**				.425	Black	C	C	.285	7X26TC	65.9	20.5	5000	75
217	**4492**				.545	Black	C	C	.370	.106C	65.9	29.5	7000	50
218	**4493**				.870	Black		C	.680	.195C	65.9	29.5	11000	50
219	**4494**			.945	.870	Black		C	.680	.195C	65.9	29.5	11000	50
		220	**4408**		1.120	Black		C	.910	.260C	65.9	29.5	14000	50
		221	**4409**	1.195	1.120	Black		C	.910	.260C	65.9	29.5	14000	50
222	**4495**				.332	Black	S	S	.185	.0556N	65.9	29.0	2700	50
223	**4496**				.216	Black	S	S	.116	.035S	65.9	29.5	1900	50
		224	**4411**	.615	.545	Gray	C	C	.370	.106C	65.9	29.5	5500	52

MINIATURE COAXIAL CABLE

Non-Contaminating Low Temp. Black Jkt. Number RG/U	Non-Contaminating Low Temp. Black Jkt. Catalog Number	Vinyl & Poly. Jackets Number RG/U	Vinyl & Poly. Jackets Catalog Number	Armor O.D.	Jacket O.D.	Vinyl Jacket	Shields Outer	Shields Inner	Dielectric O.D.	Center Conductor	V.P. %	Cap. Mmfd./Ft.	Max. Oper. Volts Rms.	Nom. Imp. Ohms
		174	**4459**		.105	Black		T	.060**	7/.0063CW		30		50

FOAM POLYETHYLENE COAXIAL CABLE

Non-Contaminating Low Temp. Black Jkt. Number RG/U	Non-Contaminating Low Temp. Black Jkt. Catalog Number	Vinyl & Poly. Jackets Number RG/U	Vinyl & Poly. Jackets Catalog Number	Armor O.D.	Jacket O.D.	Vinyl Jacket	Shields Outer	Shields Inner	Dielectric O.D.	Center Conductor	V.P. %	Cap. Mmfd./Ft.	Max. Oper. Volts Rms.	Nom. Imp. Ohms
		8	**4477**		.405	Black		C	.285	7/21C	80	24.5	1500	50
11	**4476**				.405	Black		C	.285	14C	80	16.5	3000	75
		58	**4498**		.195	Black		C	.116	20C	80	28.5	1900	53.5
		59	**4478**		.242	Black		C	.107	22CW	80	17	500	72
62	**4479**				.242	Black		C	.146	.023CW	80	14.5	700	93

FOAM POLYETHYLENE TRIAXIAL CABLE DOUBLE SHIELD DOUBLE JACKET

Non-Contaminating Low Temp. Black Jkt. Number RG/U	Non-Contaminating Low Temp. Black Jkt. Catalog Number	Vinyl & Poly. Jackets Number RG/U	Vinyl & Poly. Jackets Catalog Number	Armor O.D.	Jacket O.D.	Vinyl Jacket	Shields Outer	Shields Inner	Dielectric O.D.	Center Conductor	V.P. %	Cap. Mmfd./Ft.	Max. Oper. Volts Rms.	Nom. Imp. Ohms
11	**4480**				.460	Black	C	C	.285	14C	80	16.5	3000	75
59	**4481**				.315	Black	C	C	.107	.032CW	80	17	500	72

TRIAXIAL CABLE DOUBLE SHIELD DOUBLE JACKET

RG/U Type	Catalog Number	Impedance In Ohms	Jacket Diameter	Vinyl Jacket	Shields 1st	Shields 2nd	O.D. Dielectric	Inner Conductor	V.P. %	Cap. Mmfd./Ft.	Max. Oper. Volts Rms.
Triaxial 58A	**4463**	50	.285	Black	T	T	.116	19 .0071T	65.9	28.5	1900
Triaxial 59	**4460**	73	.325	Black	C	C	.146	22CW	65.9	21.0	2300
Triaxial 11	**4461**	75	.460	Black	C	C	.285	14C	65.9	20.5	4000
Triaxial 8	**4462**	52	.490	Black	C	C	.285	7/21C	65.9	29.5	4000

** Semi-Solid Dielectric N—Nichrome C—Copper S—Silvered Copper CW—Copperweld T—Tinned Copper F—Formvar

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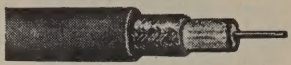
TEFLON COAXIAL CABLE



Number RG/U	Catalog Number	Inner Conductor	Dielectric Material	Nominal Diameter of Dielectric (Inch)	Type of Shielding Braids	Protective Covering	Nominal Over-all Diameter (Inch)	Nominal Capacitance (Mmfd/Ft.)	Maximum Operating Voltage (Volts Rms)	Nominal Imped. (Ohms)
62C	4700	.0253 Silver Covered Copper Steel	F-3	.146	Silver Covered Copper Single Braid	V	.242	14.5	750	93
87A	4701	7/.032 Silver Covered Copper	F-1	.280	Silver Coated Copper Double Braid	V	.425	29.5	5000	50
94	4702	19/.0025 Silver Covered Copper	F-2	.292	Copper Double Braid	V	.445	29.0	7000	50
94A	4703	19/.0254 Silver Plated Copper	F-2	.370	Copper Double Braid	V	.500	27.0	7000	50
115	4704	7/.028 Silver Covered Copper	F-2	.250	Silver Coated Copper Double Braid	V	.375	29.5	5000	50
115A	4705	7/.028 Silver Covered Copper	F-2	.255	Silver Coated Copper Double Braid	V	.415	29.5	5000	50
116	4706	7/.032 Silver Covered Copper	F-1	.280	Silver Coated Copper Double Braid	V with armor	.490	29.5	5000	50
117	4707	.188 Copper	F-1	.620	Copper Single Braid	V	.730	29.0	7000	50
117A	4708	.188 Copper	F-1	.620	Copper Single Braid	V	.730		7000	50
118	4709	.188 Copper	F-1	.620	Copper Single Braid	V with armor	.795	29.0	7000	50
118A	4710	.188 Copper	F-1	.620	Copper Single Braid	V with armor	.780		7000	50
119	4711	.102 Copper	F-1	.332	Copper Double Braid	V	.465	29.0	6000	50
120	4712	.102 Copper	F-1	.332	Copper Double Braid	V with armor	.525	29.0	6000	50
126	4713	7/.0203 Karma or Equal	F-1	.185	Karma or Equal Single Braid	V	.280	29.0	3000	50
140	4714	.025 Silver Coated Copper Steel	F-1	.146	Silver Coated Copper Single Braid	V	.233	21.0	2300	75
141	4715	.0359 Silver Plated Copper Weld	F-1	.116	Silver Coated Copper Single Braid	V	.190	28.5	1900	50
141A	4716	.039 Silver Covered Copper Steel	F-1	.116	Silver Coated Copper Single Braid	V	.190	28.5	1900	50
142	4717	.0359 Silver Covered Copper Steel	F-1	.116	Silver Coated Copper Double Braid	V	.206	28.5	1900	50
142A	4718	.039 Silver Covered Copper Steel	F-1	.116	Silver Coated Copper Double Braid	V	.206	28.5	1900	50
142B	4719	.039 Silver Covered Copper Steel	F-1	.116	Silver Coated Copper Double Braid	FEP	.195	28.5	1900	50
143	4720	.057 Silver Plated Copper Weld	F-1	.185	Silver Coated Copper Double Braid	V	.325	28.5	3000	50
143A	4721	.059 Silver Covered Copper Steel	F-1	.185	Silver Coated Copper Double Braid	V	.325	28.5	3000	50
144	4722	7/.0179 Silver Covered Copper Steel	F-1	.285	Silver Coated Copper Single Braid	V	.410	20.5	5000	75
146	4723	.007 Copper Covered Steel	F-3	.285	Copper Single Braid	V	.375	6.0	1000	190
161	4724	7/38 Silver Plated Cadmium Bronze	F-1	.057	Single Silver Copper	Extruded Black Nylon	.090	20.0	1000	70
165	4725	7/.032 Silver Covered Copper	F-1	.285	Silver Covered Copper Single Braid	V	.410		5000	50
166	4726	7/.032 Silver Covered Copper	F-1	.285	Silver Covered Copper Single Braid	V with armor	.460		5000	50
178	4727	7/.0039 Silver Plated Copper Weld	F-1	.036	Silver Plated Copper Single Braid	KEL-F	.079	27.9	1000	50
178A	4728	7/.004 Silver Covered Copper Steel	F-1	.034	Silver Plated Copper Single Braid	KEL-F	.075	27.9	1000	50
178B	4729	7/.004 Silver Covered Copper Steel	F-1	.034	Silver Covered Copper Single Braid	FEP	.075		1000	50
179	4761	7/.004 Silver Covered Copper Steel	F-1	.063	Silver Covered Copper Single Briad	KEL-F	.100		1200	75

Continued on following page

F-1 — Solid Teflon F-2 — Taped Teflon F-3 — Air Spaced Teflon

V — High Temperature Lacquer Impregnated Fiberglass Braid with Teflon Tape Between Shield and Jacket.

VI — Polyester Fiber Impregnated with High Temperature Lacquer over Wrapped or Extruded Silicone Impregnated Fiberglass

IIA — Low Temperature Black Polyvinylchloride Non-Contaminating

FEP — Fluorinated Ethylene Propylene Copolymar, 200° Teflon

TFE — Tertafluoride Ethylene Propylene Copolymar, 250°C Teflon

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TEFLON COAXIAL CABLE

Number RG/U	Catalog Number	Inner Conductor	Dielectric Material	Nominal Diameter of Dielectric (Inch)	Type of Shielding Braids	Protective Covering	Nominal Over-all Diameter (Inch)	Nominal Capacitance (Mmfd/Ft.)	Maximum Operating Voltage (Volts Rms)	Nominal Imped. (Ohms)
179A	4730	7/.004 Silver Covered Copper Steel	F-1	.063	Silver Plated Copper Single Briad	KEL-F	.105	20.0	1200	75
179B	4731	7/.004 Silver Covered Copper Steel	F-1	.063	Silver Covered Copper Single Braid	FEP	.105		1200	75
180	4732	7/.0039 Silver Covered Copper Steel	F-1	.103	Silver Plated Copper Single Braid	KEL-F	.141	15.3	1500	93
180A	4733	7/.004 Silver Covered Copper Steel	F-1	.102	Silver Plated Copper Single Braid	KEL-F	.145	14.5	1500	95
180B	4734	7/.004 Silver Covered Copper Steel	F-1	.102	Silver Covered Copper Single Braid	FEP	.145		1500	95
187	4735	7/.004 Silver Covered Copper Steel	F-1	.060	Silver Covered Copper Single Braid	Teflon	.110		1200	75
187A	4736	7/.004 Silver Covered Copper Steel	F-1	.060	Silver Covered Copper Single Braid	TFE	.110		1200	75
188	4737	7/.0067 Silver Covered Copper Steel	F-1	.060	Silver Covered Copper Single Braid	Teflon	.110		1200	50
188A	4738	7/.0067 Silver Covered Copper Steel	F-1	.060	Silver Covered Copper Single Braid	TFE	.110		1200	50
195	4739	7/.004 Silver Covered Copper Steel	F-1	.102	Silver Covered Copper Single Braid	Teflon	.155		1500	95
195A	4740	7/.004 Silver Covered Copper Steel	F-1	.102	Silver Covered Copper Single Braid	TFE	.155		1500	95
196	4741	7/.004 Silver Covered Copper Steel	F-1	.034	Silver Covered Copper Single Braid	Teflon	.080		1000	50
196A	4742	7/.004 Silver Covered Copper Steel	F-1	.034	Silver Covered Copper Single Braid	TFE	.080		1000	50
209	4743	19/.037 Silver Covered Copper	F-3	.500	Silver Covered Copper Double Braid	VI	.750		3200	50
210	4744	.0253 Silver Covered Copper Steel	F-3	.146	Silver Covered Copper Single Braid	V	.242	14.5	750	93
211	4745	.190 Copper	F-1	.620	Copper Single Braid	V	.730		7000	50
211A	4746	.190 Copper	F-1	.620	Copper Single Braid	V	.730		7000	50
225	4747	7/.0312 Silver Covered Copper	F-1	.285	Silver Covered Copper Double Braid	V	.430		5000	50
226	4748	19/.0254 Silver Covered Copper	F-2	.370	Copper Double Braid	V	.500		7000	50
227	4749	7/.0312 Silver Covered Copper	F-1	.285	Silver Covered Copper Double Braid	V with armor	.490		5000	50
228	4750	.190 Copper	F-1	.620	Copper Single Braid	V with armor	.795		7000	50
228A	4751	.190 Copper	F-1	.620	Copper Single Braid	V with armor	.795		7000	50
235	4752	7/.028 Copper	F-2	.255	Silver Covered Copper Double Braid	VI	.490		5000	50
279	4762	19/.005 Silver Covered Copper Steel	F-1	.110	Silver Covered Copper Single Braid	V	.145	17.3	1500	75
280	4753	.1144 Copper	F-2	.327	Silver Covered Copper Double Braid	IIA	.480	27.5	4000	50
281	4754	19/.0378 Silver Covered Copper	F-2	.500	Silver Covered Copper Double Braid	VI	.750	29.5	4000	50
301	4755	7/.0203 Karma	F-1	.185	Karma Single Braid	FEP	.245	29.0	3000	50
302	4756	.025 Silver Covered Copper Steel	F-1	.146	Silver Covered Copper Single Braid	FEP	.206	21.0	2300	75
303	4757	.039 Silver Covered Copper Steel	F-1	.116	Silver Covered Copper Single Braid	FEP	.170	28.5	1900	50
304	4758	.059 Silver Covered Copper Steel	F-1	.185	Silver Covered Copper Double Braid	FEP	.280	28.5	3000	50
316	4759	7/.0067 Silver Covered Copper Steel	F-1	.060	Silver Covered Copper Single Braid	FEP	.102		1200	50

F-1 — Solid Teflon F-2 — Taped Teflon F-3 — Air Spaced Teflon

V — High Temperature Lacquer Impregnated Fiberglass Braid with Teflon Between Shield and Jacket.

VI — Polyester Fiber Impregnated with High Temperature Lacquer over Wrapped or Extruded Silicone Impregnated Fiberglass

IIA — Low Temperature Black Polyvinylchloride Non-Contaminating

FEP — Fluorinated Ethylene Propylene Copolymar, 200° Teflon

TFE — Tertafluoride Ethylene Propylene Copolymar, 250°C Teflon

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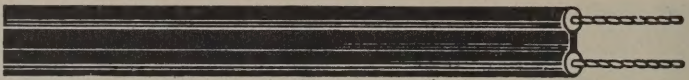
SHIELDED AND UNSHIELDED—"CONCO-FOAM" (Low Loss Foam Polyethylene All Channel Color TV Cable)

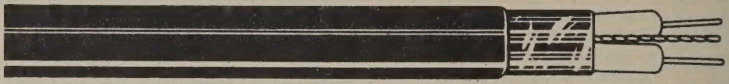


Conco-Foam assures excellent VHF, UHF, Color and B/W TV reception in uncongested and fringe regions. Will provide far greater signal than any other unshielded twin lead cable. Assures highest efficiency even when exposed to weathering and atmospheric conditions.

Conco-Foam assures excellent VHF, UHF, Color and B/W TV reception in crowded areas where reception is critical. Mylar-aluminum shielding provides strong and clean signals, eliminating electrical noise and ghost signals. Conco-Foam can be attached to mast, installed in gutters, conduit, or underground.

AWG and Stranding	Color	Nom. O.D. (Inches)	Nom. Velocity of Propagation	Nom. Cap. (Mmf/Ft.)	Nom. Attenuation Per 100′	Spool Put-Up*
4530 "CONCO-FOAM"						
20 - 7 Strands	Black	.150 x .410	80.3%	4.9	100MC/1.04 DB 500MC/3.5 DB 900MC/4.5 DB	**50′, 100′ **75′ 500′, 1000′
4532 "CONCO-FOAM"						
22 - 7 Strands	Black	.160 x .400	80%	5.3	100MC/1.4 DB 500MC/3.8 DB 900MC/5.6 DB	500′, 1000′

Bare Copper, 2 conductors parallel, white Conco-Foam insulation, overall Black polyethylene jacket with web.
** Furnished individually packed coils.



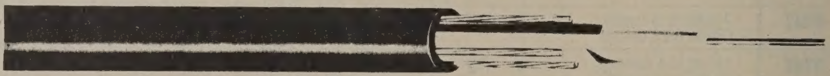
AWG and Stranding	Color	Nom. O.D. (Inches)	Nom. Velocity of Propagation	Nom. Cap. (Mmf/Ft.)	Nom. Attenuation Per 100′	Spool Put-Up*
4535 SHIELDED "CONCO-FOAM"						
22 - 7 Strands	Black	.275 x .455	76.5%	6.8	50MC/2.0 DB 100MC/2.8 DB 200MC/4.1 DB 400MC/5.9 DB 675MC/7.5 DB	**50′, 100′ **75′ 500′, 1000′

Copperweld, 2 conductors, white Conco-Foam insulation, mylar aluminum foil shield, stranded tin copper drain wire, outer Black polyethylene jacket.

* Spade terminals available with Catalog 4535.

** Furnished individually packed coils.

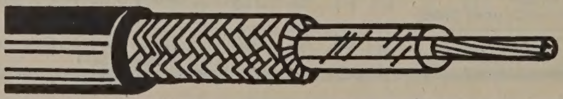
MATV - CATV COAXIAL CABLE — 75 ohm 82 channel



100% Sweep Tested to provide quality free operation.

Conco-Color—AX is manufactured for distribution systems carrying both UHF and VHF. Cable loss is about half of ordinary RG59/U coax and less than twin lead. Ideal for homes and stores.

AWG and Stranding	Primary Insulation	Shield and Material	Jacket	Nom. O.D. (Inches)	Nom. Imp. Ohms	Nom. Vel. of Prop.	Nom. Cap.
4575 82 CHANNEL COLOR COAX 75 OHMS							
18 Solid Bare Copper	Cellular Polyethylene	Mylar Aluminum Foil Shield & 4 Drain Wires	White, Black Gray, PVC	.242	75	78%	17.3
4585 82 CHANNEL COLOR COAX 75 OHMS							
18 Solid Bare Copper	Cellular Polyethylene	Mylar Aluminum Foil Shield & Aluminum Braid	Black PVC	.242	75	78%	17.3
4559 82 CHANNEL COLOR COAX 75 OHMS							
22 Solid Bare Copperweld	Cellular Polyethylene	Mylar Aluminum Foil Shield & 4 Drain Wires	White, Black PVC	.242	75	78%	16.8
4569 82 CHANNEL COLOR COAX 75 OHMS							
22 Solid Bare Copperweld	Cellular Polyethylene	Mylar Aluminum Foil Shield & Aluminum Braid	Black PVC	.242	75	78%	16.3



AWG and Stranding	Primary Insulation	Dielectric O.D. (Inches)	Shield	Jacket	Nominal O.D. (Inches)	Spool Put-Up
4582 CONCO-COLOR — AX 82 CHANNEL CABLE						
18 Solid Bare Copper	Foam Polyethylene	.184	34 AWG Braid Bare Copper	Black PVC	.270	500′, 1000′

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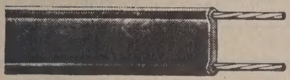
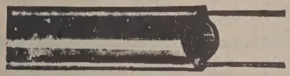
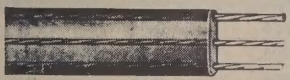
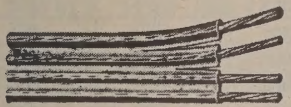
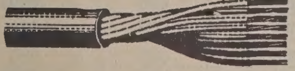
TELEVISION AND ROTOR CABLE











Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)	Fre-quency (mc)	Atten-uation Per 100 Ft.	Imped-ance (Ohms)	Velocity of Propa-gation (%)	Capaci-tance Per Ft. (Mmf)
				Nominal Electrical Properties					
4500	2 Condr.	22 7x30	Both conductors bare copper; flexible stranding; conductors parallel; insulated with brown polyethylene.	.055 x .365	50	.72	300	85	4.6
4503	2 Condr.	20 7x28	Same as 4500	.072 x .400	50	.72	300	85	4.6
4504	2 Condr.	20 7x28	Same as 4500	.080 x .400	50	.72	300	85	4.6
4506	2 Condr.	20 7x28	Same as 4500	.100 x .400	50	.72	300	85	4.6
4527	2 Condr. Round	20 7x28	Copper conductors; tubular design protects against exterior hazards. USE: For UHF and VHF.	.350	30	.63	300	84	5.6
4507	3 Condr.	20 7x28	Two bare, one tinned copper conductor; flexible stranding; conductors parallel; clear polyethylene insulation. USE: Same as 4503.	.072 x .365	50	.72	300	85	4.6
4509	4 Condr.	20 7x28	Same as 4503 except three conductors bare copper, one conductor tinned. Brown polyethylene insulation overall. USE: Rotor Aerials.	.072 x .400	50	.72	300	85	4.6
4510	4 Condr.	20 7x28	Same as 4509	.072 x .400	50	.72	300	85	4.6
4517	5 Condr.	20 7x28	Same as 4509	.072 x .400	50	.72	300	85	4.6
4515	4 Condr.	22 7x30	Copper conductors. .010 thermoplastic insulation over each conductor color coded with gray jacket overall. USE: Rotor Aerials.	.160					
4518	5 Condr.	22 7x30	Same as 4515	.170					
4521	8 Condr.	22 7x30	Same as 4515	.205					
4524	4 Condr.	20 7x28	Same as 4515	.180					
4525	5 Condr.	20 7x28	Same as 4515	.190					
4538	8 Condr.	6x22 7x30 2x18 16x30	Same as 4515 For heavy duty rotors.	.250					

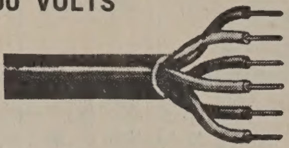
STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS CONSOLIDATED

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

UNSHIELDED MULTICONDUCTOR CABLE — PLASTIC JACKET

STRANDED CONDUCTORS 300 VOLTS



Catalog Number	Type	Size & Stranding	Specifications and General Applications	Nom. Diam. (Inches)	Color Coding For Multiple Intercom Cables
5640	2 Condr.	20(10x30)	Tin copper .012 PVC ins. minimum .020 gray PVC jacket.	.180	CHART 1* 1 Black 2 Red 3 Green 4 White 5 Brown 6 Blue 7 Orange 8 Yellow 9 Purple 10 Slate 11 Pink 12 Tan
5641	3 Condr.	20(10x30)	Same as 5640	.190	
5642	4 Condr.	20(10x30)	Same as 5640	.208	
5643	5 Condr.	20(10x30)	Same as 5640	.225	
5644	7 Condr.	20(10x30)	Same as 5640	.240	
5645	9 Condr.	20(10x30)	Same as 5640	.300	
5646	12 Condr.	20(10x30)	Same as 5640	.320	

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

ELECTRICAL CORDAGES — UNDERWRITERS APPROVED

RUBBER SHEATHED SERVICE CORD
UNDERWRITERS APPROVED

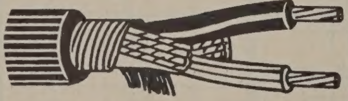
SPECIFICATIONS AND APPLICATION

Extra flexible bare copper cotton served. 1/32″ rubber insulation color coded conductors cable with fillers, cotton wrap and black, tough rubber jacket.

For all electronic equipment, household appliances, garden and power tools.

Catalog Number	Type	AWG Size	U.L. Type	Current Carrying Capacity	Voltage Rating	Nom. O.D. (Inches)
4202	2 Condr.	18	SV	5 Amps.	300	.250
4207	2 Condr.	18	SJ	5 Amps.	300	.310
4212	3 Condr.	18	SJ	5 Amps.	300	.345
4214	4 Condr.	18	SJ	5 Amps.	300	.360
4217	2 Condr.	16	SJ	7 Amps.	300	.340
4222	3 Condr.	16	SJ	7 Amps.	300	.375
4224	4 Condr.	16	SJ	7 Amps.	600	.395
4227	2 Condr.	18	S	5 Amps.	600	.390
4232	3 Condr.	18	S	5 Amps.	600	.405
4234	4 Condr.	18	S	5 Amps.	600	.435
4237	2 Condr.	16	S	7 Amps.	600	.410
4242	3 Condr.	16	S	7 Amps.	600	.430
4244	4 Condr.	16	S	7 Amps.	600	.485
4247	2 Condr.	14	S	15 Amps.	600	.540
4252	3 Condr.	14	S	15 Amps.	600	.560
4254	4 Condr.	14	S	15 Amps.	600	.605
4257	2 Condr.	12	S	20 Amps.	600	.605
4262	3 Condr.	12	S	20 Amps.	600	.635
4264	4 Condr.	12	S	20 Amps.	600	.665
4267	2 Condr.	10	S	25 Amps.	600	.640
4272	3 Condr.	10	S	25 Amps.	600	.690
4274	4 Condr.	10	S	25 Amps.	600	.745

NEOPRENE SHEATHED SERVICE CORD
UNDERWRITERS APPROVED



SPECIFICATIONS AND APPLICATION

Same specifications as 4200 Series except black Neoprene jacket.

For all types of equipment exposed to oils, acid and excessive moisture.

Catalog Number	Type	AWG Size	U.L. Type	Current Carrying Capacity	Voltage Rating	Nom. O.D. (Inches)
4307	2 Condr.	18	SJO	5 Amps.	300	.310
4312	3 Condr.	18	SJO	5 Amps.	300	.345
4314	4 Condr.	18	SJO	5 Amps.	300	.360
4317	2 Condr.	16	SJO	7 Amps.	300	.340
4322	3 Condr.	16	SJO	7 Amps.	300	.375
4324	4 Condr.	16	SJO	7 Amps.	600	.395
4327	2 Condr.	18	SO	5 Amps.	600	.390
4332	3 Condr.	18	SO	5 Amps.	600	.405
4334	4 Condr.	18	SO	5 Amps.	600	.435
4337	2 Condr.	16	SO	7 Amps.	600	.410
4342	3 Condr.	16	SO	7 Amps.	600	.430
4344	4 Condr.	16	SO	7 Amps.	600	.485
4347	2 Condr.	14	SO	15 Amps.	600	.540
4352	3 Condr.	14	SO	15 Amps.	600	.560
4354	4 Condr.	14	SO	15 Amps.	600	.605
4357	2 Condr.	12	SO	20 Amps.	600	.605
4362	3 Condr.	12	SO	20 Amps.	600	.635
4364	4 Condr.	12	SO	20 Amps.	600	.665
4367	2 Condr.	10	SO	25 Amps.	600	.640
4372	3 Condr.	10	SO	25 Amps.	600	.690
4374	4 Condr.	10	SO	25 Amps.	600	.745

STANDARD PUT-UP: 25 FT., 50 FT., 100 FT., 250 FT.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

CONSOLIDATED

TEST PROD WIRE

CONSOLIDATED

Single conductor, extra flexible stranded tinned soft annealed copper, wrap, color coded rubber insulation.

STANDARD SPOOL PUT-UP: 10 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

Catalog Number	Size	Stranding	Nom. Wall Thickness (Inches)	Voltage Breakdown	Nom. O.D. (Inches)
1001	20	41x36	.043	10,000	.140
1002	18	65x36	.045	12,000	.140
1006	18	65x36	.088	25,000	.230

MILITARY TYPE MIL-W-131169B

Catalog Number	Size	Stranding	Nom. Wall Thickness (Inches)	Voltage Breakdown	Nom. O.D. (Inches)
1007	18	65x36	.047	12,000	.150

HIGH VOLTAGE AND ANODE LEAD CABLE

Flame Retardant Polyethylene Plastic Insulation for high voltage leads to cathode-ray tubes in television receivers, oscilloscopes, power supplies and other uses, requiring a high-voltage cable. Special features: minimum surface leakage, corona resistance and high dielectric strength.

STANDARD SPOOL PUT-UP: 25 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

U.L. STYLE 3239 (FR-1)

Catalog Number	Size	Stranding	Description	Ins.	Working Volts	Nom. O.D. (Inches)
4601	20	7x28	Extra flexible tinned copper wire; Flame retardant Polyethylene Plastic Insulation; red cellulose acetate yarn braid with 2 white tracers; lacquer coating.	.035	10,000	.136
4611	20	7x28	Same as No. 4601 except heavier insulation; solid red braid.	.065	20,000	.198
4616	20	10x30	Extra flexible tinned copper flame retardant polyethylene insulation, white.	.035	10,000	.108
4621	20	10x30	Same as No. 4616 except heavier insulation, white and red.	.065	20,000	.168
4622	18	41x34	Same as No. 4621 except .015″ red PVC outer jacket.	.057	40,000	.195
4623	22	7x30	Same as No. 4622 except outer .020″ PVC jacket. Colors: black, red and blue.	.030	17,000	.130
4624*	22	7x30	Tin copper rulan insulation PVC jacket UL style 3239 "FR—1".	.025	20,000	.120
4625*	22	7x30	Same as 4624	.038	30,000	.146
4626*	22	7x30	Same as 4624	.045	40,000	.160

* Can also furnish pre-bond overcoat and topcoat conductor on catalog numbers 4624, 4625, and 4626.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

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UL LISTED HOOK-UP WIRE

ROME SYNTHINOL — UL TYPE HOOK-UP AND LEAD WIRES

TINNED COPPER

UL-300V-80C (CSA — TR-64) FR-1 Flame Test **Style 1007**

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
803	24	Solid	1/64	300	.055
801	22	Solid	1/64	300	.065
811	20	Solid	1/64	300	.071
841	18	Solid	1/64	300	.080
817	16	Solid	1/64	300	.094
819	24	7 x No. 32	1/64	300	.059
821	22	7 x No. 30	1/64	300	.069
831	20	10 x No. 30	1/64	300	.078
846	18	16 x No.30	1/64	300	.085
816	16	26 x No. 30	1/64	300	.095
881	20 2/Condr.	10 x No. 30	.025	300	.170

UL-600V-105C (CSA-TEW) FR-1 Flame Test **Style 1015**

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
851	22	Solid	1/32	600	.097
856	20	Solid	1/32	600	.104
861	18	Solid	1/32	600	.112
866	22	7 x No. 30	1/32	600	.102
871	20	10 x No. 30	1/32	600	.110
876	18	16 x No. 30	1/32	600	.119
890	16	26 x No. 30	1/32	600	.127
891	14	41 x No. 30	1/32	600	.141
892	12	65 x No. 30	1/32	600	.160
893	10	105 x No. 30	1/32	600	.194
894	8	133 x No. 29	3/64	600	.255

*"TOPCOAT" COPPER CONDUCTOR

UL-300V-80C (CSA — TR-64) FR-1 Flame Test **Style 1007**

UL-600V-105C (CSA-TEW) FR-1 Flame Test **Style 1015**

*Stranded copper conductor passed through molten tin bath bonding individual strands together.

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
813	24	7 x No. 32	1/64	300	.059
823	22	7 x No. 30	1/64	300	.069
833	20	10 x No. 30	1/64	300	.078
843	18	16 x No. 30	1/64	300	.085

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
865	22	7 x No. 30	1/32	600	.102
875	20	10 x No. 30	1/32	600	.110
885	18	16 x No. 30	1/32	600	.119

*"HEAVY TIN" COPPER CONDUCTOR

*Stranded "Double" Tin Copper Conductor — Tinning sufficiently thick to allow fusing of strands during induction heating.

UL-300V-80C (CSA — TR-64) FR-1 Flame Test **Style 1007**

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
827	22	7 x No. 30	1/64	300	.069
837	20	10 x No. 30	1/64	300	.078
847	18	16 x No. 30	1/64	300	.085

UL-600V-105C (CSA-TEW) FR-1 Flame Test **Style 1015**

Catalog Number	Size AWG	Stranding	Nom. Ins. Thickness	Volts	Max. Dia. (Inches)
869	22	7 x No. 30	1/32	600	.102
879	20	10 x No. 30	1/32	600	.110
889	18	16 x No. 30	1/32	600	.119

Stock Colors: Black, Blue, Brown, Green, Orange, Pink, Red, Gray, Violet, White, Yellow.
Standard spool size available subject to manufacturing put-up.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS
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CONSOLIDATED

MIL-W-16878

TYPE B—VINYL — 600V — 105C

Tinned copper, polyvinylchloride insulated.

Catalog Number	Type Designation	Size & (Stranding)	Insulation Thickness (Inch)	Nom. O.D. (Inch)	Stock Colors on Standard Spools 100′	Stock Colors on Standard Spools 500′	Stock Colors on Standard Spools 1000′
9300	B-32	32(7x40)	.010	.029	0 thru 9	0 thru 9	0 thru 9
9301	B-30	30(7x38)	.010	.032	0 thru 9	0 thru 9	0 thru 9
9302	B-28	28(7x36)	.010	.035	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98
9303	B-26	26(7x34)	.010	.039	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98
9304	B-24	24(19x36)	,010	.045	9,90thru98	9,90thru98	9,90thru98
9305	B-24	24(7x32)	.010	.044	As Listed	As Listed	As Listed
9306	B-22	22(19x34)	.010	.051	9,90thru98	9,90thru98	9,90thru98
9307	B-22	22(7x30)	.010	.050	As Listed	As Listed	As Listed
9308	B-20	20(19x32)	.010	.059	As Listed	As Listed	As Listed
9309	B-20	20(7x28)	.010	.058	As Listed	As Listed	As Listed
9310	B-18	18(19x30)	.010	.069	As Listed	As Listed	As Listed
9311	B-18	18(7x26)	.010	.068	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98
9312	B-16	16(19x29)	.010	.077	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98	0 thru 9, 90 thru 98

Stock Colors*	
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Dark Blue
7	Violet (Purple)
8	Gray (Slate)
9	White
11	Tan
12	Pink
13	Light Blue
90	White/Black
91	White/Brown
92	White/Red
93	White/Orange
94	White/Yellow
95	White/Green
96	White/Blue
97	White/Violet
98	White/Gray

TYPE B—VINYL-NYLON JACKET — 600V — 115C

Tinned copper, polyvinylchloride insulated, nylon jacket overall.

Catalog Number	Type Designation	Size & (Stranding)	Insulation Thickness (Inch)	Nom. O.D. (Inch)	Stock Colors on Standard Spools 100′	Stock Colors on Standard Spools 500′	Stock Colors on Standard Spools 1000′
9313	B-32	32(7x40)	.010	.035	0 thru 9	0 thru 9	0 thru 9
9314	B-30	30(7x38)	.010	.038	0 thru 9	0 thru 9	0 thru 9
9315	B-28	28(7x36)	.010	.041	As Listed	As Listed	As Listed
9316	B-26	26(7x34)	.010	.045	As Listed	As Listed	As Listed
9317	B-24	24(19x36)	.010	.051	As Listed	As Listed	As Listed
9318	B-24	24(7x32)	.010	.050	As Listed	As Listed	As Listed
9319	B-22	22(19x34)	.010	.057	As Listed	As Listed	As Listed
9320	B-22	22(7x30)	.010	.056	As Listed	As Listed	As Listed
9321	B-20	20(19x32)	.010	.065	As Listed	As Listed	As Listed
9322	B-20	20(7x28)	.010	.064	As Listed	As Listed	As Listed
9323	B-18	18(19x30)	.010	.075	9,90thru98	9,90thru98	9,90thru98
9324	B-18	18(7x26)	.010	.074	As Listed	As Listed	As Listed
9325	B-16	16(19x29)	.010	.083	As Listed	As Listed	As Listed

Stock Colors*	
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Dark Blue
7	Violet (Purple)
8	Gray (Slate)
9	White
90	White/Black
91	White/Brown
92	White/Red
93	White/Orange
94	White/Yellow
95	White/Green
96	White/Blue
97	White/Violet
98	White/Gray

* Stock Color Numbers in Accordance to Military Type Designation and EIA Color Coding.

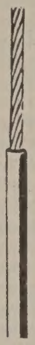
CONSOLIDATED

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

MIL-W-16878

TYPE C — VINYL — 1000V — 105C



Tinned copper, polyvinylchloride insulated.

Catalog Number	Type Designation	Size & (Stranding)	Insulation Thickness (Inch)	Nom. O.D. (Inch)	Stock Colors on Standard Spools 100′	500′	1000′
9400	C-24	24(7x23)	.018	.060	9,90thru98	9,90thru98	9,90thru98
9401	C-22	22(7x30)	.018	.066	As Listed	As Listed	As Listed
9402	C-20	20(7x28)	.018	.074	As Listed	As Listed	As Listed
9403	C-18	18(7x26)	.018	.084	As Listed	As Listed	As Listed
9404	C-16	16(19x29)	.018	.093	9,90thru98	9,90thru98	9,90thru98
9405	C-14	14(19x27)	.018	.107	9,90thru98	9,90thru98	9,90thru98

TYPE C — VINYL-NYLON JACKET — 1000V — 115C

Tinned copper, polyvinylchloride insulated, nylon jacket overall.

Catalog Number	Type Designation	Size & (Stranding)	Insulation Thickness (Inch)	Nom. O.D. (Inch)	Stock Colors on Standard Spools 100′	500′	1000′
9410	C-24	24(7x32)	.018	.066	9,90thru98	9,90thru98	9,90thru98
9411	C-22	22(7x30)	.018	.072	As Listed	As Listed	As Listed
9412	C-20	20(7x28)	.018	.080	As Listed	As Listed	As Listed
9413	C-18	18(7x26)	.018	.091	As Listed	As Listed	As Listed
9414	C-16	16(19x29)	.018	.100	9,90thru98	9,90thru98	9,90thru98
9415	C-14	14(19x27)	.018	.114	9,90thru98	9,90thru98	9,90thru98

TYPE D — VINYL — 3000V — 105C

Tinned copper, polyvinylchloride insulated.

Catalog Number	Type Designation	Size & (Stranding)	Insulation Thickness (Inch)	Nom. O.D. (Inch)	Stock Colors on Standard Spools 100′	500′	1000′
9500	D-24	24(7x23)	.030	.084	9,90thru98	9,90thru98	9,90thru98
9501	D-22	22(7x30)	.030	.090	As Listed	As Listed	As Listed
9502	D-20	20(7x28)	.030	.098	As Listed	As Listed	As Listed
9503	D-18	18(7x26)	.030	.108	As Listed	As Listed	As Listed
9504	D-16	16(19x29)	.030	.117	9,90thru98	9,90thru98	9,90thru98
9505	D-14	14(19x27)	.030	.131	9,90thru98	9,90thru98	9,90thru98
9506	D-12	12(19x25)	.035	.160	9,90thru98	9,90thru98	9,90thru98
9507	D-10	10(37x26)	.035	.181	9,90thru98	9,90thru98	9,90thru98
9508	D-8	8(133x29)	.040	.245	9,90thru98	9,90thru98	9,90thru98
9509	D-6	6(133x27)	.040	.290	9,90thru98	9,90thru98	9,90thru98

Stock Colors*

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Dark Blue
7	Violet (Purple)
8	Gray (Slate)
9	White
90	White/Black
91	White/Brown
92	White/Red
93	White/Orange
94	White/Yellow
95	White/Green
96	White/Blue
97	White/Violet
98	White/Gray

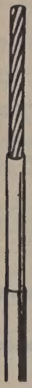
* Stock Color Numbers in Accordance to Military Type Designation and EIA Color Coding.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

MIL-W-5086 AIRCRAFT WIRE & CABLE TYPES 1 & 2 — 600 VOLT

UNSHIELDED



Additional Description — MIL-W-5086 Type I — AN-22 thru AN-12
Stranded tinned copper, white polyvinylchloride, clear nylon jacket insulation.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)	Spec. Type	Stock Colors on Standard Spools 100′	500′	1000′	Stock Color*
9700	AN-22	22(19x34)	.068	No. 1	9	9	9	White only (9)
9701	AN-20	20(19x32)	.078	No. 1	9	9	9	
9702	AN-18	18(19x30)	.088	No. 1	9	9	9	
9703	AN-16	16(19x29)	.098	No. 1	9	9	9	
9704	AN-14	14(19x27)	.117	No. 1	9	9	9	
9705	AN-12	12(37x28)	.137	No. 1	9	9	9	

Additional Description — MIL-W-5086 Type II — AN-22 thru AN-12
Stranded tinned copper, white polyvinylchloride insulation, saturated glass braid, clear nylon jacket.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)	Spec. Type	100′	500′	1000′
9706	AN-22	22(19x34)	.075	No. 2	9	9	9
9707	AN-20	20(19x32)	.085	No. 2	9	9	9
9708	AN-18	18(19x30)	.095	No. 2	9	9	9
9709	AN-16	16(19x29)	.105	No. 2	9	9	9
9710	AN-14	14(19x27)	.125	No. 2	9	9	9
9711	AN-12	12(37x28)	.143	No. 2	9	9	9

Additional Description — MIL-W-5086 Type II — AN-10 thru AN-00
Stranded tinned copper, white polyvinylchloride insulation, saturated glass braid, nylon braid, nylon lacquer.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)	Spec. Type	100′	500′	1000′
9713	AN-10	10(37x26)	.189	No. 2	9	9	9
9714	AN-8	8(133x29)	.240	No. 2	9	9	9
9715	AN-6	6(133x27)	.293	No. 2	9	9	9
9716	AN-4	4(133x25)	.355	No. 2	9	9	9
9717	AN-2	2(665x30)	.425	No. 2	9	9	9
9718	AN-0	0(1045x30)	.525	No. 2	9	9	9
9719	AN-00	00(1330x30)	.590	No. 2	9	9	9

MIL-C-7078 — TYPE II — 600 VOLT

SHIELDED

Additional Description — MIL-W-5086 Type I — AN-22 thru AN-12
Stranded tinned copper, white polyvinylchloride insulation, nylon jacket, braided tinned copper shield. Nylon outer jacket.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)	Spec. Type	100′	500′	1000′
9720	AN-22	22(19x34)	.092	No. II	9	9	9
9721	AN-20	20(19x32)	.102	No. II	9	9	9
9722	AN-18	18(19x30)	.112	No. II	9	9	9
9723	AN-16	16(19x29)	.122	No. II	9	9	9
9724	AN-14	14(19x27)	.141	No. II	9	9	9
9725	AN-12	12(19x25)	.161	No. II	9	9	9

* Stock Color Numbers in Accordance to Military Type Designation and EIA Color Coding.

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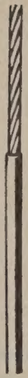
TEFLON



TYPE E MIL-W-16878 — 600 VOLTS

Concentrically stranded silver coated copper conductor, extruded TFE Teflon insulated.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)
9600	E-32	32(7x40)	.032
9601	E-30	30(7x38)	.032
9602	E-28	28(7x36)	.035
9603	E-26	26(19x38)	.039
9604	E-26	26(7x34)	.039
9605	E-24	24(19x36)	.044
9606	E-24	24(7x32)	.044
9607	E-22	22(19x34)	.050
9608	E-22	22(7x30)	.050
9609	E-20	20(19x32)	.058
9610	E-20	20(7x28)	.058
9611	E-18	18(19x30)	.069
9612	E-18	18(7x26)	.069
9613	E-16	16(19x29)	.080
9614	E-14	14(19x27)	.095
9615	E-12	12(19x25)	.115
9616	E-10	10(37x26)	.131

TYPE EE MIL-W-16878 — 1000 VOLTS

Concentrically stranded silver coated copper conductor, extruded TFE Teflon insulated.

Catalog Number	Type Designation	Size & (Stranding)	Nom. O.D. (Inch)
9620	EE-32	32(7x40)	.042
9621	EE-30	30(7x38)	.042
9622	EE-28	28(7x36)	.045
9623	EE-26	26(19x38)	.049
9624	EE-26	26(7x34)	.049
9625	EE-24	24(19x36)	.054
9626	EE-24	24(7x32)	.054
9627	EE-22	22(19x34)	.060
9628	EE-22	22(7x30)	.060
9629	EE-20	20(19x32)	.068
9630	EE-20	20(7x28)	.068
9631	EE-18	18(19x30)	.079
9632	EE-18	18(7x26)	.079
9633	EE-16	16(19x29)	.089
9634	EE-14	14(19x27)	.110
9635	EE-12	12(19x25)	.129
9636	EE-10	10(37x26)	.149

IRRADIATED PVC

U.L. STYLE 1429 AND 1534 — FLAME RETARDANT

Catalog Number	AWG Size	Stranding	Style	Insul. Thick. (Inch)	Nom. O.D. (Inch)
920	26	7x34T.C.	1429	.010	.039
921	24	7x32T.C.	1429	.010	.044
922	22	7x30T.C.	1429	.010	.050
923	20	7x28T.C.	1429	.010	.058
924	18	7x26T.C.	1429	.010	.068
925	16	19x29T.C.	1429	.010	.077
926	14	19x27T.C.	1534	.016	.091

Underwriter's Laboratories, Inc. Listed — Equal to MIL-W-16878 Type "B".

KYNAR INSULATED HOOKUP WIRE FOR WIRE WRAP APPLICATIONS

Especially suited for computer, business machine usage and other areas where space is limited. (For automatic point to point application.)

The conductor is OFHC (Oxygen Free High Conductivity) Annealed Copper, Silver Plated.

The insulation is Kynar, a Vinylidene Fluoride Plastic with unique characteristics.

Mechanically Tough; Operating Temperature Up to 125°C Continuous, Assigned U.L. Rating 105°C.

Catalog Number	AWG Size	Stranding	Insul. Thick. (Inch)	Nom. O.D. (Inch)	U.L. Style
901	30	Solid	.005	.020	1422 & 1426
902	28	Solid	.005	.023	1422 & 1426
903	26	Solid	.005	.026	1422 & 1426
904	24	Solid	.005	.030	1422 & 1426

HIGH VOLTAGE AND ANODE LEAD CABLE

U.L. STYLE 3239 — FLAME RETARDANT

Catalog Number	AWG Size	Stranding*	Rulan Insul. (Inch)	PVC Jacket (Inch)	Nom. O.D. (Inch)
4624	22	7x30T.C.	.025	.020	.120
4625	22	7x30T.C.	.030	.020	.130
4626	22	7x30T.C.	.045	.020	.160

* Can also furnish pre-bond overcoat and topcoat conductor.

NOTE: Minimum purchase per item 1000 ft.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

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SHIELDED TEFLON CABLES — MIL-W-16878

Each conductor stranded silver plated copper Type E extruded Teflon .010″ insulation — 90% braided silver copper shield, also supplied with either a Teflon impregnated Fiberglass braid or Teflon fused tape overall jacket.

Temperature rating −65°C to +260°C. Voltage rating 600 volts.

NO OUTER COVERING OVER SHIELD

Catalog Number	Number of Conductors	Size & (Stranding)	Nom. O.D. (Inch)	Catalog Number	Number of Conductors	Size & (Stranding)	Nom. O.D. (Inch)
9800	1	24(19x36)	.069	9808	1	20(19x32)	.083
9801	2	24(19x36)	.112	9809	2	20(19x32)	.142
9802	3	24(19x36)	.120	9810	3	20(19x32)	.151
9803	4	24(19x36)	.132	9811	4	20(19x32)	.168
9804	1	22(19x34)	.075	9812	1	18(19x30)	.093
9805	2	22(19x34)	.124	9813	2	18(19x30)	.162
9806	3	22(19x34)	.132	9814	3	18(19x30)	.172
9807	4	22(19x34)	.146	9815	4	18(19x30)	.192

Stock Colors: 1 — Black; 2 — White; 3 — Red; 4 — Green.

Catalog Numbers 9800 thru 9859. Specify color coding when ordering. Standard spool put up Catalog Numbers 9800 thru 9859: 100 ft., 500 ft., 1000 ft.

TEFLON TAPE WRAP JACKET OVER SHIELD

9820	1	24(19x36)	.084	9830	3	20(19x32)	.167
9821	2	24(19x36)	.128	9831	4	20(19x32)	.184
9822	3	24(19x36)	.135	9832	1	18(19x30)	.109
9823	4	24(19x36)	.148	9833	2	18(19x30)	.178
9824	1	22(19x34)	.090	9834	3	18(19x30)	.189
9825	2	22(19x34)	.140	9835	4	18(19x30)	.208
9826	3	22(19x34)	.148	9836	1	16(19x29)	.123
9827	4	22(19x34)	.162	9837	2	16(29x29)	.200
9828	1	20(19x32)	.099	9838	3	16(19x29)	.218
9829	2	20(19x32)	.158	9839	4	16(19x29)	.235

TEFLON IMPREGNATED BRAID OVER SHIELD

9840	1	24(19x36)	.081	9850	3	20(19x32)	.163
9841	2	24(19x36)	.126	9851	4	20(19x32)	.180
9842	3	24(19x36)	.133	9852	1	18(19x30)	.106
9843	4	24(19x36)	.144	9853	2	18(19x30)	.174
9844	1	22(19x34)	.088	9854	3	18(19x30)	.185
9845	2	22(19x34)	.137	9855	4	18(19x30)	.205
9846	3	22(19x34)	.144	9856	1	16(19x29)	.120
9847	4	22(19x34)	.158	9857	2	16(19x29)	.195
9848	1	20(19x32)	.097	9858	3	16(19x29)	.213
9849	2	20(19x32)	.154	9859	4	16(19x29)	.228

Color Numbers in accordance to Military Type Designation and EIA Color Coding.
NOTE: Minimum purchase per item 1000 ft.

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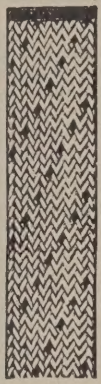
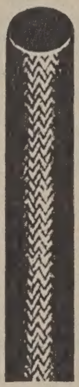
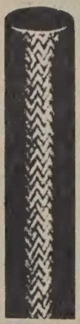
TINNED COPPER SHIELDING

SHIELDING AND BONDING TYPE CABLE

	Catalog Number	Approx. I.D. (Inches)	Size & Number of Wires	Approx. AWG	Carrying Capacity in Amperes
FLAT BRAID 	1386	1/32	16x36	24	7
	1387	3/64	24x36	23	7
	1388	3/32	48x36	19	12
	1389	7/64	72x36	18	14
	1390	1/8	96x36	18	15
	1391	3/16	120x36	15	23
	1392	1/4	168x36	14	30
	1393	3/8	288x36	11	50
	1394	1/2	386x36	10	55
	1395	5/8	528x36	10	61
	1396	3/4	832x36	7	80
	1397	25/32	832x36	7	80
	1398	1	912x36	7	84
	1399	1 3/8	336x30	7	105
TUBULAR BRAID PER QQ-B-575 	1310	1/32	24x36	22	7
	1311	1/16	48x36	19	11
	1312	5/64	72x36	18	16
	1314	7/64	96x36	16	19
	1315	1/8	120x36	15	25
	1316	5/32	240x36	12	40
	1317	11/64	168x36	14	32
	1318	13/64	192x34	11	46
	1319	1/4	384x36	10	53
	1320	9/32	120x30	9	60
	1321	3/8	384x36	10	53
	1322	7/16	240x30	6	90
	1323	1/2	528x36	9	62
	1324	9/16	480x30	3	145
	1325	21/32	768x30	1	190
	1326	25/32	864x36	7	88
OVAL COMMERCIAL BRAID 	1340	1/32	24x34	20	9
	1341	1/16	32x34	19	11
	1342	7/64	64x34	16	20
	1343	1/8	72x34	15	25
	1344	11/64	120x34	14	32
	1345	3/16	144x34	13	38
	1346	1/4	168x34	12	41
	1347	3/8	192x34	11	46
	1348	1/2	336x34	9	62
	1349	5/8	384x34	8	64
	1350	11/16	480x34	7	81
	1351	25/32	528x34	7	85

STANDARD SPOOL PUT-UP: 50 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

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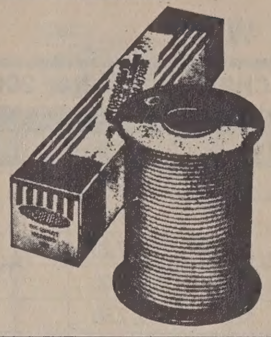
PROTECTA-METAL SPOOLS



Popular, profitable specialty wire packaged for easy selling in radio-electrical, scientific, specialty and hardware.

Wide variety of sizes and insulations.

Keeps stock in perfect order, always saleable.

Supplied on spools as shown and in heavier weights.

Here is a handy and convenient way to stock small quantities of wire. It prevents wire from matting or tangling.

MAGNET WIRE No. 2000

The correct wire for practically any application. Magnet wire is indispensible in the manufacture and repair of both radio and audio frequency coils, transformers, chokes, speaker field coils, short wave coils, tuners, transmitters, etc. Also widely used in the construction and repair of motors, generators, dynamos, etc.

Larger Quantities At Same Per Pound List

SPECIAL MAGNET WIRES

In addition to the standard listing shown here, we maintain an extensive stock of all other sizes in round rectangular and square magnet wire.

	Plain Enamel			Single Formvar			Heavy Formvar			
Size	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**Size**
14	$0.85	$1.40	$ 2.51	$1.10	$ 1.90	$ 3.40	$1.20	$ 2.00	$ 3.65	14
15	$0.86	$1.45	$ 2.55	$1.15	$ 2.00	$ 3.40	$1.20	$ 2.10	$ 3.70	15
16	$0.90	$1.50	$ 2.60	$1.20	$ 2.10	$ 3.50	$1.30	$ 2.10	$ 3.75	16
17	$0.92	$1.55	$ 2.60	$1.22	$ 2.15	$ 3.50	$1.30	$ 2.25	$ 3.80	17
18	$0.95	$1.60	$ 2.60	$1.30	$ 2.20	$ 3.60	$1.35	$ 2.30	$ 3.85	18
19	$0.97	$1.62	$ 2.65	$1.35	$ 2.25	$ 3.60	$1.40	$ 2.35	$ 3.90	19
20	$0.98	$1.65	$ 2.70	$1.38	$ 2.30	$ 3.74	$1.40	$ 2.40	$ 3.90	20
21	$1.00	$1.70	$ 2.80	$1.40	$ 2.30	$ 3.75	$1.45	$ 2.40	$ 4.00	21
22	$1.02	$1.71	$ 2.85	$1.40	$ 2.35	$ 4.00	$1.48	$ 2.50	$ 4.10	22
23	$1.04	$1.72	$ 3.00	$1.42	$ 2.40	$ 4.10	$1.50	$ 2.50	$ 4.15	23
24	$1.06	$1.74	$ 3.15	$1.45	$ 2.45	$ 4.20	$1.55	$ 2.55	$ 4.75	24
25	$1.08	$1.85	$ 3.30	$1.50	$ 2.55	$ 4.40	$1.70	$ 2.75	$ 5.00	25
26	$1.10	$1.90	$ 3.40	$1.55	$ 2.60	$ 4.65	$1.80	$ 2.85	$ 5.50	26
27	$1.12	$1.94	$ 3.50	$1.60	$ 2.70	$ 4.85	$1.90	$ 3.00	$ 5.60	27
28	$1.15	$2.00	$ 3.70	$1.70	$ 2.80	$ 5.00	$2.00	$ 3.05	$ 5.80	28
29	$1.17	$2.07	$ 3.80	$1.75	$ 2.85	$ 5.20	$2.02	$ 3.20	$ 5.90	29
30	$1.26	$2.14	$ 3.85	$1.80	$ 3.00	$ 5.25	$2.04	$ 3.40	$ 6.00	30
31	$1.38	$2.20	$ 4.00	$2.00	$ 3.10	$ 5.50	$2.40	$ 3.60	$ 6.60	31
32	$1.39	$2.26	$ 4.02	$2.00	$ 3.20	$ 5.65	$2.40	$ 3.75	$ 6.75	32
33	$1.43	$2.40	$ 4.20	$2.05	$ 3.40	$ 5.85	$2.50	$ 3.95	$ 7.00	33
34	$1.46	$2.70	$ 4.35	$2.20	$ 3.80	$ 6.05	$2.60	$ 4.25	$ 7.25	34
35	$1.66	$2.90	$ 4.85	$2.40	$ 4.00	$ 6.75	$2.80	$ 4.55	$ 8.00	35
36	$2.45	$3.95	$ 7.00	$3.60	$ 5.65	$ 9.75	$4.25	$ 6.75	$10.00	36
37	$2.61	$4.40	$ 7.80	$4.00	$ 6.00	$10.25	$4.75	$ 7.25	$12.00	37
38	$2.81	$4.75	$ 8.70	$4.65	$ 6.90	$11.75	$5.60	$ 7.50	$14.00	38
39	$3.16	$5.65	$ 9.50	$5.00	$ 8.00	$13.00	$6.00	$ 9.50	$16.00	39
40	$4.01	$8.00	$13.00	$7.60	$11.75	$17.50	$8.50	$13.10	$22.00	40

VARIOUS OTHER INSULATIONS

Film	**Technical Classification**
ENAMEL	— oleoresinous
FORMVAR	— poly vinyl acetal
POLY THERMALEZE	
SODEREZE	— polyurethane
THERMALEZE	— epoxide polyester
NYFORM	— formvar, nylon sheath
NYLEZE	— polyurethane nylon sheath
NYLON	....
BONDEZE	....
GRIPEZE	....
LECTRON	— acrylic
ISONSEL	— terephthalic polyester
ALKANVAR	— terephthalic polyester
SYLKYD ENAMELED	
COTTON AND COMBINATIONS	
SILK AND COMBINATIONS	
CELANESE AND COMBINATIONS	
GLASS AND COMBINATIONS	
PAPER AND COMBINATIONS	

	Double Cotton Covered			Single Nyleze			Heavy Nyleze			
Size	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**¼ Lb.**	**½ Lb.**	**1 Lb.**	**Size**
14	$1.25	$2.40	$ 4.35	$1.20	$ 2.00	$ 3.60	$1.20	$ 2.00	$ 3.75	14
15	$1.30	$2.65	$ 4.40	$1.24	$ 2.15	$ 3.75	$1.25	$ 2.10	$ 3.80	15
16	$1.35	$2.70	$ 4.75	$1.30	$ 2.25	$ 3.85	$1.30	$ 2.20	$ 4.00	16
17	$1.38	$2.75	$ 4.80	$1.35	$ 2.30	$ 3.95	$1.35	$ 2.30	$ 4.10	17
18	$1.40	$2.80	$ 4.95	$1.37	$ 2.35	$ 4.00	$1.40	$ 2.40	$ 4.15	18
19	$1.44	$2.85	$ 5.25	$1.40	$ 2.40	$ 4.00	$1.45	$ 2.50	$ 4.20	19
20	$1.46	$2.95	$ 5.50	$1.45	$ 2.45	$ 4.05	$1.50	$ 2.60	$ 4.30	20
21	$1.64	$3.15	$ 5.75	$1.48	$ 2.50	$ 4.10	$1.55	$ 2.65	$ 4.40	21
22	$1.72	$3.25	$ 6.00	$1.50	$ 2.51	$ 4.20	$1.60	$ 2.70	$ 4.50	22
23	$1.84	$3.45	$ 6.25	$1.54	$ 2.58	$ 4.40	$1.62	$ 2.75	$ 4.60	23
24	$1.92	$3.65	$ 6.70	$1.58	$ 2.60	$ 4.60	$1.65	$ 2.80	$ 5.00	24
25	....	....	....	$1.65	$ 2.70	$ 4.75	$1.75	$ 3.00	$ 5.50	25
26	....	....	....	$1.67	$ 2.75	$ 5.10	$1.85	$ 3.10	$ 5.60	26
27	....	....	....	$1.70	$ 2.85	$ 5.25	$1.90	$ 3.20	$ 5.80	27
28	....	....	....	$1.75	$ 2.90	$ 5.50	$1.95	$ 3.30	$ 6.10	28
29	....	....	....	$1.80	$ 3.00	$ 5.70	$2.00	$ 3.50	$ 6.30	29
30	....	....	....	$1.88	$ 3.15	$ 5.80	$2.10	$ 3.60	$ 6.50	30
31	....	....	....	$2.00	$ 3.25	$ 5.95	$2.40	$ 3.75	$ 7.00	31
32	....	....	....	$2.15	$ 3.35	$ 6.00	$2.45	$ 4.00	$ 7.30	32
33	....	....	....	$2.20	$ 3.60	$ 6.25	$2.60	$ 4.10	$ 7.50	33
34	....	....	....	$2.30	$ 3.80	$ 6.75	$2.70	$ 4.50	$ 7.75	34
35	....	....	....	$2.40	$ 4.15	$ 7.25	$2.90	$ 5.00	$ 8.25	35
36	....	....	....	$2.80	$ 5.75	$ 8.00	$4.00	$ 6.50	$11.75	36
37	....	....	....	$3.40	$ 6.50	$ 9.75	$4.50	$ 7.50	$12.50	37
38	....	....	....	$4.00	$ 7.25	$11.25	$5.50	$ 8.25	$14.00	38
39	....	....	....	$4.75	$ 8.25	$12.50	$6.10	$ 9.75	$14.50	39
40	....	....	....	$9.00	$17.40	$31.75	$8.75	$11.00	$16.00	40

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RESISTANCE WIRE

BARE NICKEL CHROMIUM — No. 2000

Size	1 Oz.	¼ Lb.	1 Lb.		Size	1 Oz.	¼ Lb.	1 Lb.
14	....	$1.85	$ 6.95		28	$1.38	$ 3.30	$13.10
15	....	$1.90	$ 7.05		29	$1.50	$ 3.73	$13.95
16	....	$1.95	$ 7.15		30	$1.65	$ 3.95	$14.75
17	....	$2.00	$ 7.25		31	$1.70	$ 4.10	$15.30
18	....	$2.05	$ 7.30		32	$1.75	$ 4.25	$15.91
19	....	$2.10	$ 7.50		33	$1.95	$ 4.60	$18.30
20	$1.00	$2.20	$ 7.65		34	$2.10	$ 5.20	$20.90
21	$1.05	$2.25	$ 8.10		35	$2.25	$ 5.69	$21.95
22	$1.08	$2.35	$ 8.49		36	$2.50	$ 6.15	$22.84
23	$1.12	$2.60	$ 9.30		37	$3.30	$ 8.00	$29.80
24	$1.14	$2.75	$10.10		38	$4.10	$10.05	$36.28
25	$1.25	$2.90	$10.90		39	$4.25	$10.40	$39.50
26	$1.30	$3.15	$11.65		40	$4.50	$11.20	$42.15
27	$1.35	$3.20	$12.50					

BUS BAR WIRE — No. 2000

BARE COPPER WIRE					TINNED COPPER WIRE			
Size	¼ Lb.	½ Lb.	1 Lb.		Size	¼ Lb.	½ Lb.	1 Lb.
14	$0.90	$1.68	$2.70		14	$1.05	$1.85	$2.90
15	$0.95	$1.70	$2.76		15	$1.15	$1.90	$3.00
16	$1.00	$1.80	$3.10		16	$1.20	$2.10	$3.20
17	$1.01	$1.88	$3.15		17	$1.25	$2.15	$3.30
18	$1.02	$1.90	$3.16		18	$1.30	$2.25	$3.35
19	$1.05	$1.92	$3.20		19	$1.35	$2.30	$3.45
20	$1.06	$1.94	$3.25		20	$1.40	$2.35	$3.55
21	$1.06	$1.96	$3.35		21	$1.44	$2.40	$3.60
22	$1.07	$1.98	$3.45		22	$1.46	$2.45	$3.65
23	$1.10	$2.00	$3.50		23	$1.48	$2.47	$3.70
24	$1.12	$2.04	$3.56		24	$1.50	$2.48	$3.80
25	$1.12	$2.04	$3.58		25	$1.55	$2.50	$3.82
26	$1.14	$2.10	$3.62		26	$1.57	$2.52	$3.85
27	$1.20	$2.18	$3.66		27	$1.59	$2.54	$4.00
28	$1.24	$2.20	$3.75		28	$1.60	$2.65	$4.40
29	$1.26	$2.22	$3.85		29	$1.65	$2.75	$4.50
30	$1.28	$2.26	$3.90		30	$1.68	$2.80	$4.55
31	$1.30	$2.30	$3.94		31	$1.75	$2.90	$4.65
32	$1.32	$2.32	$3.96		32	$1.77	$3.00	$4.70
33	$1.34	$2.34	$4.06		33	$1.80	$3.50	$4.84
34	$1.36	$2.35	$4.25		34	$1.85	$3.55	$4.86
35	$1.37	$2.40	$4.40		35	$1.90	$3.60	$5.00
36	$1.38	$3.00	$5.75		36	$2.40	$4.20	$6.75
37	$1.90	$3.40	$6.00		37	$2.50	$4.50	$7.00
38	$1.92	$3.60	$6.25		38	$2.55	$4.70	$7.40
39	$1.94	$3.75	$6.50		39	$2.60	$4.80	$7.50
40	$2.00	$4.25	$6.60		40	$2.65	$4.90	$7.75

MAGNET WIRE — No. 2010

Size Wire	Plain Enameled	Size Wire	Plain Enameled		Size Wire	Plain Enameled	Size Wire	Plain Enameled
14	25 Ft.	22	133 Ft.		30	590 Ft.	38	1980 Ft.
16	40 Ft.	24	200 Ft.		32	805 Ft.	40	2430 Ft.
18	48 Ft.	26	292 Ft.		34	1150 Ft.		
20	85 Ft.	28	420 Ft.		36	1560 Ft.		

BARE NICKEL CHROMIUM RESISTANCE CHART

B & S Gauge	Ohms Per Ft. 68°F	B & S Gauge	Ohms Per Ft. 68°F
14	.1648	28	4.251
15	.2078	29	5.286
16	.2595	30	6.750
17	.3333	31	8.523
18	.4219	32	10.55
19	.5208	33	13.39
20	.6592	34	17.00
21	.8310	35	21.52
22	1.055	36	27.00
23	1.322	37	33.33
24	1.671	38	42.19
25	2.107	39	55.10
26	2.670	40	70.24
27	3.348		

ANNUNCIATOR (BELL) WIRE

Consolidated Corporation

SUPPLIED IN ASSORTED COLORS

An all around utility wire consisting of a single and two conductors of No. 18 wire, plastic insulation.

Catalog Number	Type
1450	Single Conductor
1445	Two Conductor Twisted

STANDARD SPOOL PUT-UP:
¼ LB., ½ LB., 1 LB., 7 LB.

PHOSPHOR BRONZE DIAL CABLE

BRAIDED phosphor bronze over a pure black linen, lubricated core for exceptional strength and wearing qualities.

Cat. No.	Size (Ins.)	Stranding	Dia. (Ins.)
1436	⅛	16x36	.125

STRANDED phosphor bronze over a concealed white nylon core for exceptional flexibility. Manufactured to highest precision standards, insuring utmost accuracy.

Cat. No.	Size (Ins.)	Stranding	Dia. (Ins.)
1440	⅛	42x35	.125

STANDARD SPOOL PUT-UP:
25 FT., 100 FT., 500 FT., 1000 FT.

CONSOLIDATED

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

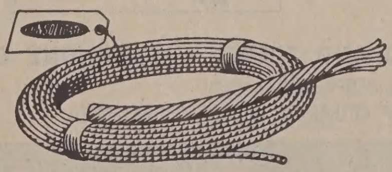
AERIAL WIRE

COPPER

	Catalog Number	Size	Stranding	Breaking Strength Pounds	Type	Nom. Dia. (Inches)
STRANDED BARE	3501	18	7x26	67 Lbs.	Bare Copper	.046
	3521	16	7x24	106 Lbs.	Bare Copper	.057
	3551	14	7x22	167 Lbs.	Bare Copper	.072
	3561	12	7x20	262 Lbs.	Bare Copper	.092
STRANDED TINNED	3601	18	7x26	67 Lbs.	Tinned Copper	.046
	3621	16	7x24	106 Lbs.	Tinned Copper	.057
	3651	14	7x22	167 Lbs.	Tinned Copper	.072
	3661	12	7x20	262 Lbs.	Tinned Copper	.092
SOLID BARE	3801	15	Solid	98 Lbs.	Bare Copper	.057
	3811	14	Solid	124 Lbs.	Bare Copper	.064
	3786	12	Solid	197 Lbs.	Bare Copper	.080
	3791	10	Solid	314 Lbs.	Bare Copper	.102
	3796	8	Solid	480 Lbs.	Bare Copper	.128
AERIAL AND BUS BAR SOLID TINNED	3848	30	Solid	....	Tinned Copper	.010
	3847	28	Solid	....	Tinned Copper	.013
	3846	26	Solid	....	Tinned Copper	.016
	3819	24	Solid	12 Lbs.	Tinned Copper	.020
	3818	22	Solid	20 Lbs.	Tinned Copper	.025
	3817	20	Solid	31 Lbs.	Tinned Copper	.032
	3816	18	Solid	49 Lbs.	Tinned Copper	.040
	3815	16	Solid	73 Lbs.	Tinned Copper	.051
	3821	14	Solid	124 Lbs.	Tinned Copper	.064
	3831	12	Solid	197 Lbs.	Tinned Copper	.081
	3841	10	Solid	314 Lbs.	Tinned Copper	.102
	3845	8	Solid	480 Lbs.	Tinned Copper	.128
SOLID ENAMELED	3851	14	Solid	124 Lbs.	Enameled	.064
	3861	12	Solid	197 Lbs.	Enameled	.082
	3871	10	Solid	314 Lbs.	Enameled	.102

STANDARD PUT-UP: 50 FT., 75 FT., 100 FT., 1000 FT.

PHOSPHOR BRONZE



Recommended for short wave and transmitting aerials.

Tested and used by Army and Navy.

Amazing improvement for reception and transmission.

Phosphor bronze is recognized as the most efficient, practical wire obtainable for short wave and transmitting aerials. It will not stretch or sag and is superinductive.

	Catalog Number	Size	Stranding	Breaking Strength Pounds	Type	Nom. Dia. (Inches)
PHOSPHOR BRONZE	3421	16	7x24	230 Lbs.	Bronze	.058
	3451	14	7x22	360 Lbs.	Bronze	.073
	3461	12	7x20	570 Lbs.	Bronze	.092
	3465	10	7x18	895 Lbs.	Bronze	.116
	3466	8	7x16	1400 Lbs.	Bronze	.146
	3467	6	7x14	2200 Lbs.	Bronze	.184
	3468	4	7x12	3400 Lbs.	Bronze	.232

STANDARD PUT-UP: 500 FT., 1000 FT.

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

RETRACTILE COIL CORDS

POWER CORDS (Underwriters' Approved)

ALL JACKETING NEOPRENE — ALL CORDS 48″ RETRACTED, APPROX. 25′ EXTENDED

Catalog Number	Condr. AWG	Stranding	U.L. Type	Cordage O.D. (Inches)	Coil O.D. (Inches)	Amp Rating	Max. Working Voltage
2801	2/18	41x34	SVO	.250	1	7	300
2802	2/18	41x34	SJO	.310	1¼	7	300
2803	3/18	41x34	SJO	.330	1½	7	300
2804	4/18	41x34	SJO	.360	1½	5.6	300
2805	2/16	65x34	SJO	.330	1½	10	300
2806	3/16	65x34	SJO	.365	1½	10	300
2807	3/16	65x34	SO	.470	1⅞	10	600
2808	4/16	65x34	SJO	.395	1⅝	8	300
2809	4/16	65x34	SO	.500	1⅞	8	600
2810	5/16	65x34	SO	.550	1⅞	8	600
2811	2/14	41x30	SO	.535	2	15	600
2812	3/14	41x30	SO	.560	2⅛	15	600
2813	4/14	41x30	SO	.605	2¼	12	600
2814	2/12	65x30	SO	.605	2¼	20	600
2815	3/12	65x30	SO	.635	2⅜	20	600
2816	4/12	65x30	SO	.665	2½	16	600

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Green, **4**—Red, **5**—Blue

POWER CORDS

ALL JACKETING NEOPRENE — ALL CORDS 48″ RETRACTED, APPROX. 25′ EXTENDED

Catalog Number	Condr. AWG	Stranding	Cordage O.D. (Inches)	Coil O.D. (Inches)	Amp Rating	Max. Working Voltage
2820	5/18	41x34	.440	1¾	5.6	300
2821	7/18	41x34	.500	1⅞	5.6	300
2822	2/12 4/18	65x30 41x34	.610	2¼	17 6	600 600
2824	6/16	65x34	.545	2	8	600
2825	6/16 1/14	65x34 41x30	.575	2⅛	8	600
2827	7/12	65x30	.775	2¾	16	300

TEST LEADS (Red or Black)

24″ RETRACTED, APPROX. 12′ EXTENDED

Catalog Number	Condr. AWG	Cordage O.D. (Inches)	Coil O.D. (Inches)	Amp Rating	Max. Working Voltage
2830	1/20 Black	.165	¾	4	1000
2831	1/20 Red	.165	¾	4	1000

SHIELDED AND TINSEL MICROPHONE CORDS

ALL JACKETING NEOPRENE

ALL CORDS 48″ RETRACTED, APPROX. 25′ EXTENDED

Catalog Number	Condr. AWG	Cordage O.D. (Inches)	Coil O.D. (Inches)
2850	1/24 (S)	.160	⅝
2852	1/23 1/24 (S)	.200	13/16
2854	2/23 1/24 (S)	.240	⅞
2856	2/23 1/24 (S)	.270	1¼
2857	3 Tinsel	.201	13/16
2858	4 Tinsel	.220	⅞
2859	5 Tinsel	.285	1

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Red, **4**—Green, **5**—Blue
(S) SHIELDED

COMMUNICATION AND ELECTRONIC CONTROL CORDS

ALL JACKETING NEOPRENE

ALL CORDS 48″ RETRACTED, APPROX. 25′ EXTENDED

Multi-conductors stranded communication cord No. 23 AWG, tinned copper wire. Lengths can be cut to exact requirement. Maximum working voltage 120 volts. Current carrying capacity 1 ampere Nom. cond. resistance .022 ohms per linear foot.

Catalog Number	Condr. AWG	Stranding	Cordage O.D. (Inches)	Coil O.D. (Inches)
2870	2/23	21x36	.200	¾
2871	3/23	21x36	.210	¾
2872	4/23	21x36	.240	⅞
2873	5/23	21x36	.285	1
2874	6/23	21x36	.305	1⅛
2875	7/23	21x36	.320	1¼

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Red, **4**—Green,
5—Blue, **6**—Yellow, **7**—Brown

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS CONSOLIDATED

1633 S. CLINTON ST. • (312) 421-4441 • Cable Address: "CON WIRE" • CHICAGO, ILL. 60616

MILITARY AND GOVERNMENT SPECIFICATIONS WIRES AND CABLES

WE WELCOME YOUR INQUIRIES FOR THE FOLLOWING, SPECIFY TYPE DESIGNATION

SPECIFICATION

MIL-C-17C
MIL-W-76B
MIL-C-442B
MIL-W-583B
MIL-I-631D
MIL-C-915A
MIL-C-1892
MIL-C-1907
MIL-C-2194D
MIL-C-2486C
MIL-C-2681
MIL-C-3078
MIL-W-3093
MIL-W-3104
MIL-C-3162A
MIL-C-3432B
MIL-C-3458A
MIL-C-3849
MIL-W-3861
MIL-C-3883
MIL-C-3884
MIL-L-3930B
MIL-C-4921
MIL-W-5086A
MIL-C-5136B
MIL-C-5186
MIL-C-5252B
MIL-W-5274A
MIL-C-5756B
MIL-C-5898A
MIL-L-6477B
MIL-C-7072A
MIL-C-7078A
MIL-W-7139A
MIL-W-8777A
MIL-C-8817
MIL-E-9085A
MIL-E-9088A
MIL-C-9660
MIL-C-10065A
MIL-C-10255
MIL-P-10255
MIL-C-10392B
MIL-C-10581B
MIL-P-10582
MIL-C-10769
MIL-C-10820B
MIL-C-10993A
MIL-C-11060

SPECIFICATION

MIL-C-11097A
MIL-C-11311
MIL-C-11440
MIL-C-11540
MIL-C-12349
MIL-C-12432B
MIL-C-12881
MIL-W-12995
MIL-C-13017
MIL-C-13021
MIL-W-13074
MIL-W-13075
MIL-C-13077
MIL-W-13169B
MIL-C-13268
MIL-C-13273
MIL-W-13276
MIL-C-13294B
MIL-C-13486A
MIL-C-13745
MIL-C-13770
MIL-C-13777C
MIL-C-13892
MIL-C-15479C
MIL-C-16839C
MIL-W-16878D
MIL-C-17235
MIL-C-17621
MIL-C-17818
MIL-C-18266
MIL-C-18869A
MIL-C-18913
MIL-C-18959A
MIL-C-18961A
MIL-C-18962A
MIL-W-19150A
MIL-W-19381A
MIL-C-19547
MIL-W-19583
MIL-C-19654
MIL-C-19787B
MIL-C-19883A
MIL-C-21609
MIL-C-22759
MIL-C-23206
MIL-C-25038
MIL-C-25326
MIL-C-25622
MIL-C-27072

SPECIFICATION

MIL-C-27212A
MIL-C-27300A
MIL-C-27500
MIL-C-55036
MIL-C-55040

BUR. YARDS & DOCKS
SPEC. 9YG

AIR FORCE MANUAL
AFM-88-15

J-C-90a
J-C-94
J-C-98
J-C-103b
J-C-129a
J-C-138

INTERIM
J-C-129b
J-C-0094a
J-C-00103c
J-C-00115

CORPS. of ENGRS.
GUIDE SPEC. 303-01
1404.04

QQ-W-343
QQ-A-351d
QQ-A-365b
QQ-B-575

CAA-701c
CAA-893b

L-824

CONSOLIDATED WIRE & ASSOCIATED CORPORATIONS
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DABURN

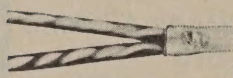
DABURN electronics & cable corp.

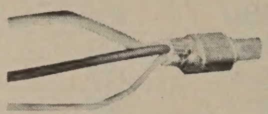
WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

HEAT SHRINKABLE TEFLON* TUBING • FEP • TFE • DUAL WALL

DUAL-WALL TEFLON* ENCAPSULATING SHRINKABLE TUBING

NEW DAFLON SM-450 is a new dual wall shrink and melt Teflon tubing which gives a tight, moisture-proof seal. It is made from two types of Teflon. The outer wall is TFE Teflon and the inner lining is FEP Teflon. When heated to 400°F the FEP melts and at 621°F the TFE shrinks tightly. The FEP is squeezed into a solid or near solid mechanical encapsulation. DAFLEX SM-450 tubing protects against most environmental hazards involving pull, vibration, moisture, chemicals, etc. It may be used over wires, terminals, splices, connectors and as a strain relief and end cap.
Operating Temperature: 450°F.





DAFLON Cat. No.	Nom. I.D. Size	Nom. Expanded I.D.	Nom. Expanded Wall	Recovered I.D.
SM-450-1	1/32″	.036″ .92mm	.022″	.000″**
SM-450-2	1/16″	.060″ 1.52mm	.028″	.000″**
SM-450-3	⅛″	.130″ 3.30mm	.031″	.000″**
SM-450-4	5/32″	.160″ 4.06mm	.032″	.000″**
SM-450-5	3/16″	.190″ 4.83mm	.035″	.062″
SM-450-7	¼″	.250″ 6.35mm	.036″	.125″
SM-450-9	11/32″	.350″ 8.89mm	.036″	.190″
SM-450-11	7/16″	.450″ 11.43mm	.055″	.312″
SM-450-13	11/16″	.700″ 17.78mm	.055″	.440″
SM-450-16	1″	.950″ 24.13mm	.065″	.680″

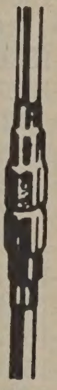
Standard Package: 100′ in 1 to 3 ft. lengths. Special lengths available to order.
**Will fully close off.

DAFLON SH-400 (FEP)

Made with Modified TEFLON‡ FEP will shrink over inserted objects upon exposure to moderate heat. Heretofore, many joints, parts, components, devices could not be protected because of hi temperature required for shrinkage. FEP TEFLON‡, which has a continuous service temperature of 400°F., will shrink at 300°F. Supplied in natural (transparent) color. Complete shrinkage at 350°F. Now, many heat sensitive products can use the permanent protection of TEFLON.* Will not burn or support flame, long lengths available. Will not split or melt. Extruded. Meets MIL-I-23053/11.

DABURN Cat. No.	Size	I.D.	Min. Exp. I.D.	Recovered Max. I.D.	Recovered Wall Thickness*
SH-400-24	24	.023″	.031″	.027″	.008″
SH-400-22	22	.028″	.036″	.032″	.008″
SH-400-20	20	.034″	.045″	.039″	.008″
SH-400-18	18	.042″	.060″	.049″	.008″
SH-400-16	16	.053″	.075″	.061″	.009″
SH-400-14	14	.066″	.092″	.072″	.009″
SH-400-12	12	.085″	.115″	.089″	.009″
SH-400-10	10	.108″	.141″	.114″	.010″
SH-400-9	9	.118″	.158″	.124″	.010″
SH-400-8	8	.136″	.180″	.143″	.010″
SH-400-7	7	.148″	.197″	.158″	.011″
SH-400-6	6	.170″	.225″	.180″	.011″
SH-400-5	5	.186″	.248″	.198″	.011″

*All items on this page are available cut to length or cut and marked.



DABURN Cat. No.	Size	I.D.	Min. Exp. I.D.	Recovered Max. I.D.*	Recovered Wall Thickness*
SH-400-4	4	.214″	.290″	.226″	.011″
SH-400-3	3	.234″	.310″	.249″	.011″
SH-400-2	2	.268″	.365″	.280″	.012″
SH-400-1	1	.294″	.400″	.311″	.012″
SH-400-0	0	.336″	.440″	.349″	.012″
SH-400-⅜	⅜″	.375″	.500″	.383″	.015″
SH-400-7/16	7/16″	.437″	.580″	.448″	.020″
SH-400-½	½″	.500″	.666″	.510″	.020″
SH-400-⅝	⅝″	.625″	.830″	.637″	.025″
SH-400-¾	¾″	.750″	1.000″	.764″	.030″
SH-400-⅞	⅞″	.875″	1.170″	.891″	.035″
SH-400-1″	1″	1.000″	1.330″	1.020″	.035″

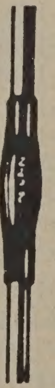
STANDARD PACKAGE: 100 Ft., 4 Ft. Min. Length. ‡ DUPONT
*When full recovery permitted.

DAFLON SHRINK SERIES SH-621

TFE TUBING MIL-I-23053/12

Made of modified TEFLON‡ polytetrafluorethylene will shrink when heated to 621°F. Suitable where hi temp protection is required. Extruded. Will not support combustion, dielectric strength (20 Mil Wall) 850 V/M, low temp. brittle point −66°F, superior chemical resistance.

DAFLON Cat. No.	Nominal Tubing Size	Minimum Expanded I.D.	Recovered Dimensions Maximum I.D.	Recovered Dimensions Wall Thickness
SH-621-26	26	.046″	.022″	.009″
SH-621-24	24	.050″	.027″	.010″
SH-621-22	22	.055″	.032″	.010″
SH-621-20	20	.060″	.039″	.012″
SH-621-19	19	.065″	.043″	.012″
SH-621-18	18	.076″	.049″	.012″
SH-621-17	17	.085″	.054″	.012″
SH-621-16	16	.093″	.061″	.012″
SH-621-15	15	.110″	.067″	.012″
SH-621-14	14	.120″	.072″	.012″
SH-621-13	13	.140″	.080″	.012″
SH-621-12	12	.150″	.089″	.012″
SH-621-11	11	.170″	.101″	.012″
SH-621-10	10	.191″	.112″	.012″



DAFLON Cat. No.	Nominal Tubing Size	Minimum Expanded I.D.	Recovered Dimensions Maximum I.D.	Recovered Dimensions Wall Thickness
SH-621-9	9	.205″	.124″	.015″
SH-621-8	8	.240″	.141″	.015″
SH-621-7	7	.270″	.158″	.015″
SH-621-6	6	.302″	.178″	.015″
SH-621-5	5	.320″	.198″	.015″
SH-621-4	4	.370″	.224″	.015″
SH-621-3	3	.390″	.249″	.015″
SH-621-2	2	.430″	.278″	.015″
SH-621-1	1	.450″	.311″	.015″
SH-621-0	0	.470″	.347″	.015″
SH-621-⅜	⅜″	.560″	.399″	.020″
SH-621-7/16	7/16″	.655″	.462″	.020″
SH-621-½	½″	.750″	.524″	.020″

STANDARD PACKAGE: 100 Feet. Additional Sizes and Colors to Order.
STANDARD PUT-UP: 36″ Straight Lengths — One Foot Minimums Size 13 thru ½″; Size 26-14 3′ Min. Length.
WALL TOLERANCES: 26 thru 22 ± .002; 20 thru 10 ± .003; 9 thru 0 ± .004.

DAFLEX 4:1 SHRINKABLE PTFE TUBING

DAFLON SH-421 Shrinkable Teflon Tubing recovers to approximately 25% of its expanded size when heated to the gel point (621°F). Thus it is now possible to use shrinkable Teflon tubing, with its excellent chemical and physical properties, over objects which require more than the standard 2:1 shrinkdown ratio (see SH-621).

NOTE: Tubing should be allowed to recover **at least 50%.**
Conforms to MIL-I-23053/12 and AMS-3584. **Operating Temp.:** −85°F to +500°F.

DAFLON Cat. No.	Nom. Size	Expanded Min. I.D.	Recovered Max. I.D.	Recovered Nom. Wall
SH-421-5/64	5/64″	.078″	.025″	.009″
SH-421-⅛	⅛″	.125″	.038″	.010″
SH-421-3/16	3/16″	.187″	.050″	.012″

DAFLON Cat. No.	Nom. Size	Expanded Min. I.D.	Recovered Max. I.D.	Recovered Nom.* Wall
SH-421-¼	¼″	.250″	.063″	.012″
SH-421-5/16	5/16″	.312″	.079″	.012″
SH-421-⅜	⅜″	.375″	.096″	.012″
SH-421-½	½″	.500″	.144″	.015″
SH-421-⅝	⅝″	.625″	.178″	.015″
SH-421-¾	¾″	.750″	.225″	.015″
SH-421-⅞	⅞″	.875″	.244″	.015″
SH-421-1	1″	1.000″	.278″	.015″
SH-421-1¼	1¼″	1.250″	.347″	.015″

Standard Package: 100′ in 4 ft. lengths. Tubing may be ordered cut to length.
STANDARD COLOR: Natural (Clear). *When full recovery is allowed.

DABURN No. HG1 — Heat Gun for SH-162, SH-265, SH-267, SH-275, SH-290, ST-275, SH-300 Series.
DABURN No. HG2 — Heat Gun for SH-400, SH-421, SH-621, SH-450, SH-350 Series. SEND FOR OUR COMPLETE CATALOG

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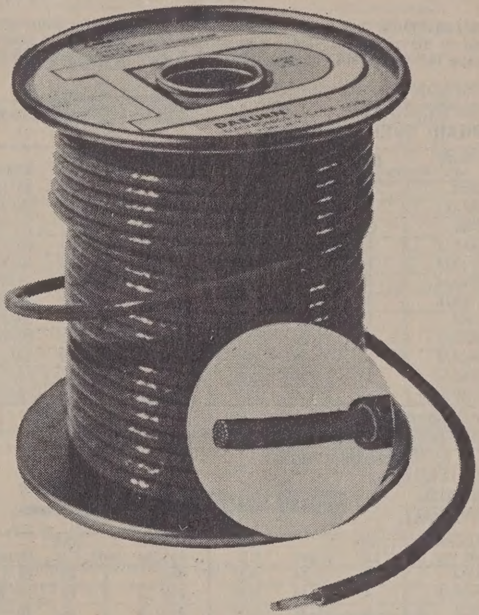
WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

HI-VOLT CORONA RESISTANT TEFLON* CABLE©

Voltage Rating at Sea Level • Voltage Rating at 80,000 feet, approximately 1/3 lower

• Minimum life expectancy: 10,000 hours.

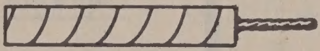


SMALL SIZE:
You do not need bulky, thick, insulation jacketing as used with silicone rubber and polyethylene insulations to get your hi-voltage requirements. Wire used is MIL-SPEC QQ-W-343 and MIL-W-16878D. Insulation used conforms to and surpasses MIL-SPEC-W-16878D

AVOID CORONA PROBLEMS:
Corona Resistant Teflon construction is specifically designed to retard and prevent corona penetration.
Temperature variations from −60° to +300°C have no life effect on the corona resistant Teflon. In addition, there is no stress or crack failure under severe, adverse conditions including mechanical strain, moisture, corona or chemical conditions.

DESCRIPTION:
Single Conductor, Stranded Silver Plated Copper, Corona Resistant Teflon* Insulation.

TEMPERATURE RATING:
−90°C to +250°C.



VOLTAGE RATING:
Based on insulation thickness.

AVAILABLE COLORS:
White, Black, Red, Green, Yellow, Lt. Blue, Brown, Orange, Gray, Violet. (Also available in tracer colors)

PUT-UP: 250′, 500′, 1000′

* DUPONT

ADDITIONAL SIZES AND VOLTAGES AVAILABLE

DABURN No.	AWG Size	Strand	Voltage Rating AC	Voltage Rating DC	Max. O.D.
CRT-12-2	12	19/25	2500	10,000	.142″
CRT-12-2.5	12	19/25	3750	12,500	.152″
CRT-12-3	12	19/25	4500	15,000	.162″
CRT-12-3.5	12	19/25	5300	17,500	.172″
CRT-12-4	12	19/25	6000	20,000	.182″
CRT-12-5	12	19/25	7500	25,000	.202″
CRT-12-6.5	12	19/25	10,000	32,500	.232″
CRT-12-8	12	19/25	12,000	40,000	.262″
CRT-12-10	12	19/25	15,000	50,000	.302″
CRT-14-2	14	19/27	2500	10,000	.124″
CRT-14-2.5	14	19/27	3750	12,500	.134″
CRT-14-3	14	19/27	4500	15,000	.144″
CRT-14-3.5	14	19/27	5300	17,500	.154″
CRT-14-4	14	19/27	6000	20,000	.164″
CRT-14-5	14	19/27	7500	25,000	.184″
CRT-14-6.5	14	19/27	10,000	32,500	.214″
CRT-14-8	14	19/27	12,000	40,000	.244″
CRT-14-10	14	19/27	15,000	50,000	.284″
CRT-16-2	16	19/29	2500	10,000	.109″
CRT-16-2.5	16	19/29	3750	12,500	.119″
CRT-16-3	16	19/29	4500	15,000	.129″
CRT-16-3.5	16	19/29	5300	17,500	.139″
CRT-16-4	16	19/29	6000	20,000	.149″
CRT-16-5	16	19/29	7500	25,000	.169″
CRT-16-6.5	16	19/29	10,000	32,500	.199″
CRT-16-8	16	19/29	12,000	40,000	.229″
CRT-16-10	16	19/29	15,000	50,000	.269″
CRT-18-2	18	19/30	2500	10,000	.102″
CRT-18-2.5	18	19/30	3750	12,500	.112″
CRT-18-3	18	19/30	4500	15,000	.122″
CRT-18-3.5	18	19/30	5300	17,500	.132″
CRT-18-4	18	19/30	6000	20,000	.142″
CRT-18-5	18	19/30	7500	25,000	.162″
CRT-18-6.5	18	19/30	10,000	32,500	.192″
CRT-18-8	18	19/30	12,000	40,000	.222″
CRT-18-10	18	19/30	15,000	50,000	.262″
CRT-20-2	20	19/32	2500	10,000	.092″
CRT-20-2.5	20	19/32	3750	12,500	.102″
CRT-20-3	20	19/32	4500	15,000	.112″
CRT-20-3.5	20	19/32	5300	17,500	.122″
CRT-20-4	20	19/32	6000	20,000	.132″
CRT-20-5	20	19/32	7500	25,000	.152″
CRT-20-6.5	20	19/32	10,000	32,500	.192″
CRT-20-8	20	19/32	12,000	40,000	.212″
CRT-20-10	20	19/32	15,000	50,000	.252″
CRT-22-2	22	19/34	2500	10,000	.084″
CRT-22-2.5	22	19/34	3750	12,500	.094″
CRT-22-3	22	19/34	4500	15,000	.104″
CRT-22-3.5	22	19/34	5300	17,500	.114″
CRT-22-4	22	19/34	6000	20,000	.124″
CRT-22-5	22	19/34	7500	25,000	.144″
CRT-22-6.5	22	19/34	10,000	32,500	.174″
CRT-22-8	22	19/34	12,000	40,000	.204″
CRT-22-10	22	19/34	15,000	50,000	.244″
CRT-24-2	24	19/36	2500	10,000	.077″
CRT-24-2.5	24	19/36	2750	12,500	.087″
CRT-24-3	24	19/36	4500	15,000	.097″
CRT-24-3.5	24	19/36	5300	17,500	.107″
CRT-24-4	24	19/36	6000	20,000	.117″
CRT-24-5	24	19/36	7500	25,000	.137″
CRT-24-6.5	24	19/36	10,000	32,500	.167″
CRT-24-8	24	19/36	12,000	40,000	.197″
CRT-24-10	24	19/36	15,000	50,000	.237″
CRT-26-2	26	7/34	2500	10,000	.071″
CRT-26-2.5	26	7/34	3750	12,500	.081″
CRT-26-3	26	7/34	4500	15,000	.091″
CRT-26-3.5	26	7/34	5300	17,500	.101″
CRT-26-4	26	7/34	6000	20,000	.111″
CRT-26-5	26	7/34	7500	25,000	.131″
CRT-26-6.5	26	7/34	10,000	32,500	.161″
CRT-26-8	26	7/34	12,000	40,000	.191″
CRT-26-10	26	7/34	15,000	50,000	.231″
CRT-28-2	28	7/36	2500	10,000	.067″
CRT-28-2.5	28	7/36	3750	12,500	.077″
CRT-28-3	28	7/36	4500	15,000	.087″
CRT-28-3.5	28	7/36	5300	17,500	.097″
CRT-28-4	28	7/36	6000	20,000	.117″
CRT-28-5	28	7/36	7500	25,000	.127″
CRT-28-6.5	28	7/36	10,000	32,500	.157″
CRT-28-8	28	7/36	12,000	40,000	.187″
CRT-28-10	28	7/36	15,000	50,000	.227″

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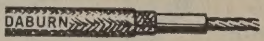
TFE • FEP TEFLON* CABLES • H FILM KAPTON* WIRE

MIL-W-16878D INSTRUMENTATION — SHIELDED • UNSHIELDED

DESCRIPTION: One or more conductors, each conductor silver plated concentrically stranded copper wire, Type E Extruded TFE .010″ insulation. When shielded, braided silver plated copper shield over conductor(s), 90% shield coverage. When covered, either a TEFLON* impregnated fiberglass braid or a .010″ TEFLON* fused, double tape jacket overall. Fungus, solvent, moisture, flame, acid, alkali and oil resistant. Multiconductors are twisted. **TEMP. RATING:** −65°C to +260°C. **VOLT. RATING:** 600V.

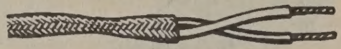
TEFLON* IMPREGNATED BRAID OVER SHIELD



Daburn No.	Conds.	AWG Size	Strand	Nom. O.D.	Daburn No.	Conds.	AWG Size	Strand	Nom. O.D.
2444	1	26	7/34	.075″	2447	1	20	19/32	.093″
2444/2	2	26	7/34	.119″	2447/2	2	20	19/32	.154·
2445	1	24	19/36	.081″	2447/3	3	20	19/32	.163″
2445/2	2	24	19/36	.126″	2447/4	4	20	19/32	.180″
2445/3	3	24	19/36	.133″	2447/5	5	20	19/32	.195″
2445/4	4	24	19/36	.144″	2448	1	18	19/30	.097″
2445/5	5	24	19/36	.156″	2448/2	2	18	19/30	.162″
2446	1	22	19/34	.088″	2448/3	3	18	19/30	.172″
2446/2	2	22	19/34	.137″	2448/4	4	18	19/30	.192″
2446/3	3	22	19/34	.144″	2448/5	5	18	19/30	.207″
2446/4	4	22	19/34	.158″	2449	1	16	19/29	.117″
2446/5	5	22	19/34	.172″	2449/2	2	16	19/29	.196″

STANDARD SPOOL PUT-UPS: 250 Ft., 500 Ft., 1000 Ft.
CONDUCTOR COLOR CODE: 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

SHIELDED BRAID OVERALL



Daburn Cat. No.	Conds.	AWG Size	Strand	Nom. O.D.	Daburn Cat. No.	Conds.	AWG Size	Strand	Nom. O.D.
2434	1	26	7/34	.066″	2437	1	20	19/32	.082″
2434/2	2	26	7/34	.104″	2437/2	2	20	19/32	.142″
2435	1	24	19/36	.068″	2437/3	3	20	19/32	.151″
2435/2	2	24	19/36	.112″	2437/4	4	20	19/32	.168″
2435/3	3	24	19/36	.120″	2437/5	5	20	19/32	.180″
2435/4	4	24	19/36	.132″	2438	1	18	19/30	.093″
2435/5	5	24	19/36	.140″	2438/2	2	18	19/30	.162″
2436	1	22	19/34	.075″	2438/3	3	18	19/30	.172″
2436/2	2	22	19/34	.124″	2438/4	4	18	19/30	.191″
2436/3	3	22	19/34	.132″	2438/5	5	18	19/30	.210″
2436/4	4	22	19/34	.146″	2439	1	16	19/29	.103″
2436/5	5	22	19/34	.154″	2439/2	2	16	19/29	.184″

STANDARD SPOOL PUT-UPS: 250 Ft., 500 Ft., 1000 Ft.
CONDUCTOR COLOR CODE: 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

H FILM KAPTON* WIRE — DALITE™

HIGH TEMPERATURE HOOK-UP AND AIRFRAME WIRE 200°C CONTINUOUS TEMPERATURE RATING (a)

INSULATED WITH DUPONT KAPTON* POLYIMIDE FILM WITH TEFLON* — FEP HEAT SEALED COATING CONFORMS TO MIL-W-60904 & MIL-W-81381.
CHARACTERISTICS: Dalite™ insulated wire provides high temperature stability, low temperature flexibility, high radiation resistance, resistance to cold flow, impervious to most chemicals, high dielectric strength, low dielectric constant, smaller diameters and lighter weight than any other comparable wire used for continuous operation up to 200°C. This hook-up wire meets the test requirements of MIL-W-16878 for 300 V, 600 V and 1000 V with **smaller wall thicknesses, weight and dimensions.**
(a) Temperature based on lowest temperature rating of materials in the insulation — FEP 200°C. Will pass 96 hour heat age tests at 250°C per MIL-W-16878.
DESCRIPTION: Single conductor, silver plated annealed copper conductors, Type H* Polyimide film with Teflon* FEP coating tape wrapped.

DABURN No.	Type Designation	Size AWG	Strand	Voltage Rating (rms)	Nom. Wall	Nom. O.D.	Weight Per 1000′ (lbs.)
2490/30	HF 30	30	7/38	600	.0045″	.021″	0.52
2495/30	HHF 30	30	7/38	1000	.006″	.024″	0.57
2490/28	HF 28	28	7/36	600	.0045″	.024″	0.75
2495/28	HHF 28	28	7/36	1000	.006″	.027″	0.83
2490/26	HF 26	26	7/34	600	.0045″	.028″	1.11
2495/26	HHF 26	26	7/34	1000	.006″	.031″	1.21
2490/24	HF 24	24	19/36	600	.0045″	.034″	1.78
2495/24	HHF 24	24	19/36	1000	.006″	.037″	1.90
2490/22	HF 22	22	19/34	600	.0045″	.041″	2.71
2495/22	HHF 22	22	19/34	1000	.006″	.044″	2.86
2490/20	HF 20	20	19/32	600	.0045″	.049″	4.18
2495/20	HHF 20	20	19/32	1000	.006″	.052″	4.35
2490/18	HF 18	18	19/30	600	.0045″	.059″	6.46
2495/18	HHF 18	18	19/30	1000	.006″	.062″	6.67
2490/16	HF 16	16	19/29	600	.0045″	.066″	8.16
2495/16	HHF 16	16	19/29	1000	.006″	.069″	8.39

STD. COLOR: Natural Gold.
STD. PUT-UP: 1000 Ft.
*DUPONT

Striping and solid colors available. Variations of conductor material—to special order.

TEFLON* TAPE WRAP JACKET OVER SHIELD

Daburn No.	Conds.	AWG Size	Strand	Nom. O.D.	Daburn No.	Conds.	AWG Size	Strand	Nom. O.D.
2454	1	26	7/34	.078″	2457	1	20	19/32	.099″
2454/2	2	26	7/34	.125″	2457/2	2	20	19/32	.158″
2455	1	24	19/36	.084″	2457/3	3	20	19/32	.167″
2455/2	2	24	19/36	.128″	2457/4	4	20	19/32	.184″
2455/3	3	24	19/36	.135″	2457/5	5	20	19/32	.204″
2455/4	4	24	19/36	.148″	2458	1	18	19/30	.109″
2455/5	5	24	19/36	.162″	2458/2	2	18	19/30	.178″
2456	1	22	19/34	.090″	2458/3	3	18	19/30	.189″
2456/2	2	22	19/34	.140″	2458/4	4	18	19/30	.208″
2456/3	3	22	19/34	.148″	2458/5	5	18	19/30	.230″
2456/4	4	22	19/34	.162″	2459	1	16	19/29	.130″
2456/5	5	22	19/34	.183″	2459/2	2	16	19/29	.230″

STANDARD SPOOL PUT-UPS: 250 Ft., 500 Ft., 1000 Ft.
CONDUCTOR COLOR CODE: 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

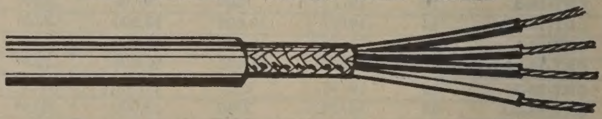
NO SHIELD—TEFLON* IMPREGNATED FIBERGLASS OVERALL

Daburn Cat. No.	Conds.	AWG Size	Strand	Nom. O.D.	Daburn Cat. No.	Conds.	AWG Size	Strand	Nom. O.D.
2464	1	26	7/34	.040″	2467	1	20	19/32	.058″
2464/2	2	26	7/34	.080″	2467/2	2	20	19/32	.118″
2465	1	24	19/36	.044″	2467/3	3	20	19/32	.127″
2465/2	2	24	19/36	.088″	2467/4	4	20	19/32	.144″
2465/3	3	24	19/36	.096″	2467/5	5	20	19/32	.156″
2465/4	4	24	19/36	.108″	2468	1	18	19/30	.069″
2465/5	5	24	19/36	.116″	2468/2	2	18	19/30	.138″
2466	1	22	19/34	.051″	2468/3	3	18	19/30	.148″
2466/2	2	22	19/34	.100″	2468/4	4	18	19/30	.167″
2466/3	3	22	19/34	.108″	2468/5	5	18	19/30	.186″
2466/4	4	22	19/34	.122″	2469	1	16	19/29	.086″
2466/5	5	22	19/34	.131″	2469/2	2	16	19/29	.172″

STANDARD SPOOL PUT-UPS: 250 Ft., 500 Ft., 1000 Ft.
CONDUCTOR COLOR CODE: 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.
Special cable constructions and colors available.

FEP TEFLON* CABLE

FEP EXTRUDED JACKET OVER SHIELD



DESCRIPTION: Each conductor silver plated stranded copper wire, Type E extruded TFE .010″ insulation. Color coded, cabled, braided silver plated copper shield — 90% coverage, FEP white teflon jacket overall.
TEMPERATURE RATING: —65°C to +200°C.

TEMPERATURE RATING: −65°C to +200°C. **VOLTAGE RATING:** 600 V.

DABURN No.	Conds.	AWG Size	Strand	Nom. O.D.
2480	1	24	19/36	.085″
2480/2	2	24	19/36	.130″
2480/3	3	24	19/36	.135″
2480/4	4	24	19/36	.148″
2481	1	22	19/34	.091″
2481/2	2	22	19/34	.150″
2481/3	3	22	19/34	.158″
2481/4	4	22	19/34	.172″
2482	1	20	19/32	.100″
2482/2	2	20	19/32	.168″
2482/3	3	20	19/32	.178″
2482/4	4	20	19/32	.193″
2483	1	18	19/30	.110″
2483/2	2	18	19/30	.188″
2483/3	3	18	19/30	.207″
2483/4	4	18	19/30	.222″
2484	1	16	19/29	.123″
2484/2	2	16	19/29	.220″

CONDUCTOR COLOR CODE: 1—White, 2—Black, 3—Red, 4—Green
STD. PUT-UP: 500 Ft., 1000 Ft.
*Dupont

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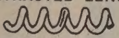
WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

RETRACTILE POWER & COMMUNICATION CORDS — UL & CSA

Long Lasting Service — useful wherever cords must change length or position. Extend to approximately six times its retracted length. Returns to its original shape or length when released. Eliminates tangling, twisting or knots. Cords are UL and CSA approved.

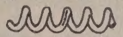
POWER CORDS

RETRACTED LENGTHS: 1, 2, 3 & 4 FT. EXTENDED LENGTHS: 6, 12, 18 & 25 FT.



UL APPROVED — NEOPRENE JACKETED CORD

Operating Temperature: −20°C to +60°C



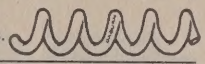
DABURN No. & Retracted Lengths													
4 Ft.* Length	3 Ft. Length	2 Ft. Length	1 Ft. Length	No. Cond.	Size	Strand	UL‡ & CSA Type	Amps	Volt Rating	Coil Nom. O.D. in.	Coil Nom. O.D. mm	Cord Nom. O.D. in.	Cord Nom. O.D. mm
986-4	986-3	986-2	986-1	2	18	41/34	SVO	7	300	⅞	22	.250	7
986/3-4	986/3-3	986/3-2	986/3-1	3	18	41/34	SVO	7	300	1	25	.275	7
989-4	989-3	989-2	989-1	2	18	41/34	SJO	7	300	1³⁄₁₆	30	.310	8
989/3-4	989/3-3	989/3-2	989/3-1	3	18	41/34	SJO	7	300	1⅜	35	.330	9
989/4-4	989/4-3	989/4-2	989/4-1	4	18	41/34	SJO	5.6	300	1⁷⁄₁₆	37	.360	10
989/5-4	—	989/5-2	—	5	18	41/34	—	5.6	300	1¾	41	.440	11
989/7-4	—	989/7-2	—	7	18	41/34	—	5.6	300	1⅞	48	.500	13
990/3-4	—	990/3-2	—	3	18	41/34	SO	7	600	1⁹⁄₁₆	40	.405	10
990/4-4	—	990/4-2	—	4	18	41/34	SO	5.6	600	1⅝	41	.435	11
991-4	991-3	991-2	991-1	2	16	65/34	SJO	10	300	1⅜	35	.330	9
991/3-4	991/3-3	991/3-2	991/3-1	3	16	65/34	SJO	10	300	1⁷⁄₁₆	37	.365	10
991/4-4	991/4-3	991/4-2	—	4	16	65/34	SJO	8	300	1⅝	38	.395	11
991/5-4	—	991/5-2	—	5	16	65/34	SO	8	600	2	54	.540	14
991/6-4	—	991/6-2	—	6	16	65/34	—	8	600	2⅛	51	.550	14
991/7-4	—	991/7-2	—	7	6/16 1/14	#16-65/34 #14-41/30	— SJO	#16-8 #14-2	600	2¼	57	.600	15
992/3-4	—	992/3-2	—	3	16	65/34	SO	10	600	1¹³⁄₁₆	46	.470	12
992/4-4	—	992/4-2	—	4	16	65/34	SO	8	600	1⅞	48	.500	13
993-4	993-3	993-2	—	2	14	41/30	SO	15	600	2	54	.535	14
993/3-4	993/3-3	993/3-2	—	3	14	41/30	SO	15	600	2⅛	54	.560	14
993/4-4	993/4-3	993/4-2	—	4	14	41/30	SO	12	600	2¼	57	.605	15
994-4	994-3	994-2	—	2	12	65/30	SO	20	600	2¼	57	.605	15
994/3-4	994/3-3	994/3-2	—	3	12	65/30	SO	20	600	2⅜	60	.635	16
994/4-4	994/4-3	994/4-2	—	4	12	65/30	SO	16	600	2½	60	.665	17
994/6-4	—	994/6-2	—	6	2/12 4/18	#12-65/30 #18-41/34	— —	#12-17 #18-6	600	2¼	57	.605	15
994/7-4	—	994/7-2	—	7	12	65/30	—	16	600	2⅝	67	.775	20

‡Wherever UL Type is shown, approved by CSA Testing Laboratories.
*Preferred Put-up.
Standard Package: 5

Conductor Color Code:
1-Black, 2-White, 3-Green, 4-Red, 5-Blue, 6-Brown, 7-Yellow.

RETRACTILE TEST LEAD WIRE

Stretch coiled kinkless test lead wire description. 12″ coil — stretches to approximately 6 feet. One conductor #20 stranded copper rubber insulation .165 O.D. Colors: Red, Black.
Coil O.D. ¾″.
Working Voltage: 1000V, 4 Amps.



DABURN No.	Length in.	Size	Strand	Coil O.D. in.	Coil O.D. mm	Cord O.D. in.	Cord O.D. mm
984A	12	20	41/36	¾	19	.165	4.2
984	24	20	41/36	¾	19	.165	4.2

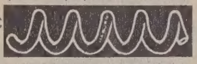
12″ Extends Approx. 6 Ft.
24″ Extends Approx. 12 Ft.

Specify Color, Red or Black.
Standard Package: 6

DABURN MINIATURE RETRACTILE COMMUNICATION CORDS

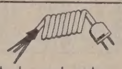
1, 2 Ft. Retracted — 5, 10 Ft. Extended

Miniature size. Suitable for compact equipment. Black plastic jacket overall.
Operating Tem.: −20°C to +60°C
Std. Pkg.: 10



DABURN No. 2 Ft.	DABURN No. 1 Ft.	Cond.	Size	Strand	Coil O.D. in.	Coil O.D. mm	Cond. O.D. in.	Cond. O.D. mm
975/28	975/28A	2	28	19/40TC	½	13	.135	3.4
977/28	977/28A	4	28	19/40TC	½	13	.150	3.8

UL APPROVED RETRACTILE POWER CORD SETS



18″ Retracted — Approx. 9 Ft. Extended — 300V — UL Approved

For portable use. Mobile and office equipment. Neoprene jacketed cord sets with molded male plug on one end. Operating Voltage: 300 Volts.

DABURN No.	Cond.	AWG Size	Strand	Type UL	Coil O.D. in.	Coil O.D. mm	Cord O.D. in.	Cord O.D. mm
980	2	18	41/34	SVO	⅞	22	.250	7
980/3	3	18	41/34	SVO	1	25	.275	7
981	2	18	41/34	SJO	1³⁄₁₆	30	.310	8
981/3	3	18	41/34	SJO	1⅜	35	.330	9
982	2	16	65/34	SJO	1⅜	35	.330	9
982/3	3	16	65/34	SJO	1⁷⁄₁₆	37	.365	10

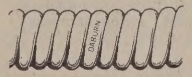
Conductor Color Code: 1-Black, 2-White, 3-Green.

Standard Package: 10

RETRACTILE COMMUNICATION CORDS

Retracted Lengths 2, 3 & 4 Ft. — Extended Lengths 12, 18 & 25 Ft.

Multi-conductors stranded extra flexible #23 AWG 21/36 tinned soft copper for long flex life. Neoprene or "Danyon" plastic jacketed cable for long life. 120 volt working, current carrying capacity 1 amp. Nom. cond. resist. .022 ohms per linear foot, .185 ohms per retracted foot. For communication equipment such as ham operations, telephone car carriers, radio equipment, head sets, etc.
Operating Temp: −20°C to +60°C
Maximum Voltage: 100V



DANYON PLASTIC JACKETED

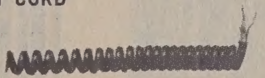
DABURN No. - Retracted Lengths 4 Ft.†	3 Ft.	2 Ft.	No. Cond.	Size	Strand	Nom. Coil O.D. in.	Nom. Coil O.D. mm	Nom. Cord O.D. in.	Nom. Cord O.D. mm
975D-4**	975D-3	975D-2	2	23	21/36	⅝	16	.220	5.6
976D-4**	976D-3	976D-2	3	23	21/36	¾	19	.230	5.8
977D-4**	977D-3	977D-2	4	23	21/36	⅞	22	.255	6.5
978D-4**	978D-3	978D-2	5	23	21/36	1	25	.265	6.7
978D/6-4**	978D/6-3	978D/6-2	6	23	21/36	1⅛	29	.305	7.7
978D/7-4**	978D/7-3	978D/7-2	7	23	21/36	1³⁄₁₆	30	.325	8.3
978D/8-4	978D/8-3	978D/8-2	8	23	21/36	1¼	32	.360	9.1
978D/10-4	978D/10-3	978D/10-2	10	23	21/36	1⅜	35	.380	9.7
978D/12-4	978D/12-3	—	12	23	21/36	1½	38	.390	9.9
978D/15-4**	978D/15-3	978D/15-2	15	23	21/36	1⅝	41	.400	10.2

Conductor Color Code: 1-Black, 2-White, 3-Red, 4-Green, 5-Blue, 6-Yellow, 7-Brown, 8-Orange, 9-White/Black Tracer, 10-White/Red Tracer, 11-White/Green Tracer, 12-White/Blue Tracer, 13-White/Yellow Tracer, 14-White/Brown Tracer, 15-White/Orange Tracer.
†Preferred Put-up
Standard Package: 5
**Stocked in Neoprene Jacket; O.D.'s slightly different; Cat. No. omits "D" i.e. 975-4

RETRACTILE COMMUNICATION CORD

Prepared — Retracted Length 12″ — Extended Length 6 Ft.

Same as our regular communication cord but each end is prepared, stripped and tinned as indicated.



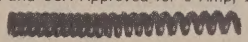
DABURN No.	No. Cond.	Size & Strand	Coil O.D. in.	Coil O.D. mm	Cord O.D. in.	Cord O.D. mm	Prepaired
966	3	#23-21/36	¹³⁄₁₆	21	.220	5.6	**I END:** Length 1½″. Conductor stripped and tinned. Other end: Total L'gth 1½″ jacket removed.
967	4	#23-21/36	¹⁵⁄₁₆	24	.250	6.4	**I END:** Total length 1″. Conductors stripped and tinned. Other end: Total Length 1½″ jacket removed.
968	5	#23-21/36	1¹⁄₁₆	27	.285	7.2	**I END:** Total length 4½″. Conductors stripped and tinned. Other end: Total length 4½″ conds. stripped and tinned.

Conductor Color Code: 1-Black, 2-White, 3-Red, 4-Green, 5-Blue. Standard Package:10

UL APP'D RETRACTILE COMMUNICATION CORDS

Retracted Lengths 2, 3, & 4 Ft. — Extended Lengths 10, 15 & 20 Ft.

Multi-conductor stranded, flexible #22AWG 26/36 tinned soft copper, "Danyon" plastic jacketed cords UL and CSA Approved for 1 Amp, 120V. For use on movable communications equipment where cords must change position for lengths.



DABURN No. & Retracted Lengths 4 Ft.**	3 Ft.	2 Ft.	No. Cond.	Nom. Area Cond. mm²	Nom. O.D. Cable in.	Nom. O.D. Cable mm	Nom. O.D. Coil in.	Nom. O.D. Coil mm
875D-4	875D-3	875D-2	2	.325	.242	6.1	⅞	22
876D-4	876D-3	876D-2	3	.325	.237	6.0	¾	19
877D-4	877D-3	877D-2	4	.325	.255	6.5	¹⁵⁄₁₆	24
878D-4	878D-3	878D-2	5	.325	.275	7.0	1	25
878D/6-4	878D/6-3	878D/6-2	6	.325	.295	7.5	1¹⁄₁₆	27
878D 7-4	878D/7-3	878D/7-2	7	.325	.315	8.0	1³⁄₁₆	30
878D/8-4	878D/8-3	878D/8-2	8	.325	.335	8.5	1¼	32
878D/10-4	878D/10-3	878D/10-2	10	.325	.360	9.1	1⅜	35
878D/12-4	878D/12-3	878D/12-2	12	.325	.370	9.4	1½	38
878D/15-4	878D/15-3	878D/15-2	15	.325	.408	10.4	1⅝	41

Conductor Color Code: 1-Black, 2-White, 3-Red, 4-Green, 5-Orange, 6-Blue, 7-Yellow, 8-Brown, 9-White/Black, 10-Red/Black, 11-Green/Black, 12-Orange/Black, 13-Blue/Black, 14-Yellow/Black, 15-Red/White.

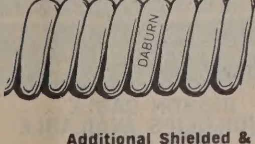
*1 ft. available to order **Preferred Put-up

Standard Package: 5

SHIELDED RETRACTILE COMMUNICATION CORDS

Retracted Lengths 1, 2 & 4 Ft.— Extended Lengths 6, 12 & 25 Ft.

Single and multi-conductors. Shielded mike cables. Neoprene or "Danyon" plastic jacketed shielded conductors are individually shielded. Shield can be pigtailed for soldering. Safe — Reliable.



DANYON PLASTIC JACKETED

DABURN No. & Retracted Lengths 4 Ft.†	2 Ft.	1 Ft.	No. Cond.	Size	Strand	Nom. Coil O.D. in.	Nom. Coil O.D. mm	Nom. Cord O.D. in.	Nom. Cord O.D. mm	Volt Rating	Capacitance MMF Lin. Ft.	Capacitance MMF Retr. Ft.
995D-4	995D-2	995D-1	1	24(S)	41/40	⅝	16	.160	4.1	75	56	440
999D-4	999D-2	999D-1	2	2-23 (Ind. S & J)	21/36	⅞	22	.225	5.7	100	56	450
997D-4	997D-2	997D-1	3	2-23 1-23(S)	21/36	1⅛	29	.250	6.4	100	56	450
998D-4	998D-2	998D-1	4	2-23 2-23 (Ind. S & J)	21/36	1⅛	29	.290	7.4	100	56	450

NEOPRENE

NEOPRENE JACKETED

DABURN No. & Retracted Lengths 4 Ft.	No. Cond.	Size	Strand	Nom. Coil O.D. in.	Nom. Coil O.D. mm	Nom. Cord O.D. in.	Nom. Cord O.D. mm	Volt Rating	Capacitance Lin. Ft. MMF	Capacitance Retr. Ft. MMF
995-4	1	24(S)	41/40	⅝	16	.160	4.1	75	56	440
996-4	2	1-23 1-24(S)	21/36 41/40	¾	19	.210	5.1	100 75	56	450
997-4	3	2-23 1-24(S)	21/36 41/40	⅞	22	.240	6.1	100 75	56	450
998-4	4	2-23 2-24(S**)	21/36 41/40	1	25	.270	6.9	100 75	56	450

Individually shielded †Preferred Put-up Standard Package: 10 **Conductors Are Color Coded.

Additional Shielded & Unshielded Retractile Communication Cables Stocked. Send for Your Own Copy of Our Full Catalog.

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

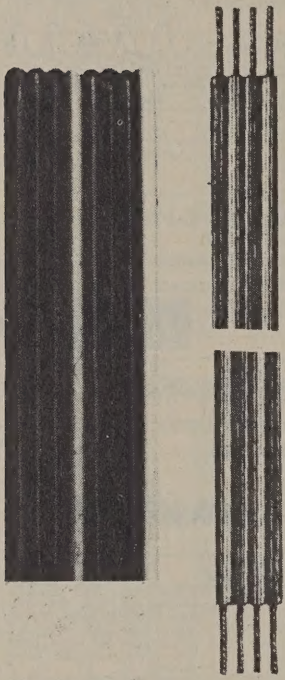
DABURN

DABURN electronics & cable corp.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

NEW FLAT RIBBON CABLE • TYPES B & C PER MIL-W-16878D•UL FR-1

SOLID COLORS



DESCRIPTION: Each conductor is stranded T.C. with extruded PVC insulation, bonded together to form a flat ribbon cable. Conductors separate easily for clean terminations with standard wire connectors, jacks and pins. Ribbon cable saves space and time on circuit interconnecting assemblies, wiring harnesses, sliding drawers and drop assemblies and simplifies identification. Resists acid, alkalis, flame, moisture, oil, solvents and fungus.

TEMPERATURE RATING: −55°C to +105°C. Insulation meets or exceeds UL FR1 vertical flame test.

Per MIL-W-16878D — TYPE B — 600 V

DABURN No.	Cond.	Size	Strand	Nom. Wall	Nom. O.D.
1805/10	10	22	19/34	.010″	.510″ x .051″
1805/15	15	22	19/34	.010″	.765″ x .051″
1805/20	20	22	19/34	.010″	1.02″ x .051″
1805/30	30	22	19/34	.010″	1.53″ x .051″
1806/10	10	24	19/36	.010″	.430″ x .043″
1806/15	15	24	19/36	.010″	.645″ x .043″
1806/20	20	24	19/36	.010″	.860″ x .043″
1806/30	30	24	19/36	.010″	1.30″ x .043″
1807/10	10	26	7/34	.010″	.370″ x .037″
1807/15	15	26	7/34	.010″	.555″ x .037″
1807/20	20	26	7/34	.010″	.740″ x .037″
1807/30	30	26	7/34	.010″	1.11″ x .037″
1808/10	10	28	7/36	.010″	.340″ x .034″
1808/15	15	28	7/36	.010″	.510″ x .034″
1808/20	20	28	7/36	.010″	.680″ x .034″
1808/30	30	28	7/36	.010″	1.020″ x .034″
1809/10	10	30	7/38	.010″	.310″ x .031″
1809/15	15	30	7/38	.010″	.465″ x .031″
1809/20	20	30	7/38	.010″	.620″ x .031″
1809/30	30	30	7/38	.010″	.930″ x .031″

Per MIL-W-16878D — TYPE C — UL2444

DABURN No.	Cond.	Size	Strand	Nom. Wall	Nom. O.D.
1823/5	5	22	7/30	.016″	.065″ x .325″
1823/10	10	22	7/30	.016″	.065″ x .650″
1823/15	15	22	7/30	.016″	.065″ x .975″
1823/20	20	22	7/30	.016″	.065″ x 1.300″

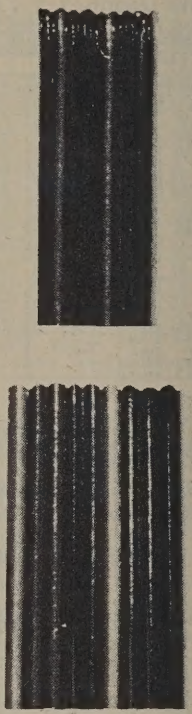
STANDARD PUT-UP: 100 Ft., 1000 Ft.

COLOR CODE: Solid Colors.

COLOR CODE: 1—Brown, 2—Red, 3—Orange, 4—Yellow, 5—Green, 6—Blue, 7—Violet, 8—Gray, 9—White 10†—Black.

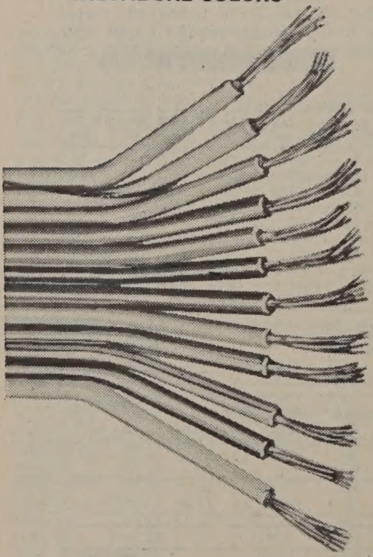
†Beyond 10 conductors, code is repeated.

SOLID COLORS



INDIVIDUALLY COLOR CODED WITH STRIPES

INDIVIDUAL COLORS



ADDITIONAL SIZES & TYPES AVAILABLE TO ORDER

SEND FOR OUR COMPLETE CATALOG

Per MIL-W-16878D — TYPE B — 600 V

DESCRIPTION: Each conductor stranded tinned copper, polyvinyl-chloride insulation, bonded to form flat ribbon cable. Conductors are color coded and separate easily for clean terminations. Saves space, time on circuit and interconnecting assemblies, wiring harnesses, sliding drawers and drop assemblies.
Rated: −55°C to +105°C
INSULATION PASSES U/L FR-1 FLAME TEST

DABURN No.	Cond.	Size	Strand	Nom. Wall	Nom. O.D.
1804/4	4	24	7/32	.010″	.043″ x .172″
1804/8	8	24	7/32	.010″	.043″ x .344″
1804/12	12	24	7/32	.010″	.043″ x .516″
1804/16	16	24	7/32	.010″	.043″ x .688″
1804/20	20	24	7/32	.010″	.043″ x .860″

STD. PUT-UP: 250 Ft., 500 Ft., 1000 Ft.

CONDUCTOR COLOR CODE: Same as noted below for C-22 Series.

Per MIL-W-16878D TYPE C

VOLTAGE RATING: 1000 VOLTS

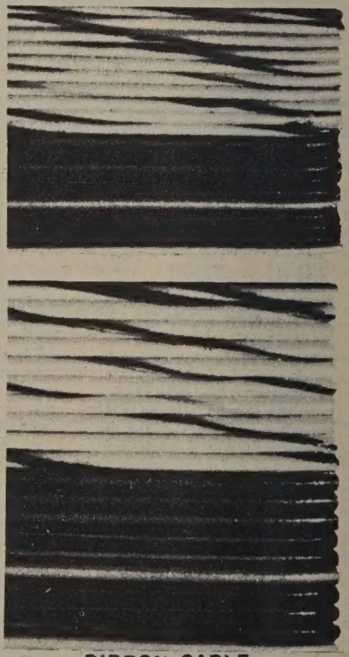
DABURN No.	Cond.	Size	Strand	Nom. Wall	Nom. O.D.
1822/4	4	22	7/30	.016″	.065″ x .260″
1822/8	8	22	7/30	.016″	.065″ x .520″
1822/12	12	22	7/30	.016″	.065″ x .780″
1822/16	16	22	7/30	.016″	.065″ x 1.040″
1822/20	20	22	7/30	.016″	.065″ x 1.300″

STD. PUT-UP: 250 Ft., 500 Ft., 1000 Ft.

CONDUCTOR COLOR CODE — INDIVIDUALLY CODED:

1—White
2— Black
3—Red
4—Green
5—Yellow
6—Lt. Blue
7—Brown
8—Orange
9—Gray
10—Violet
11—Wh/Black
12—Wh/Red
13—Wh/Green
14—Wh/Yellow
15—Wh/Blue
16—Wh/Brown
17—Wh/Orange
18—Wh/Gray
19—Wh/Violet
20—Wh/Blk/Red

INDIVIDUAL COLORS



RIBBON CABLE STICK-CLIPS AVAILABLE FROM STOCK

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

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We Stock one of the most comprehensive inventories of wire, cable and insulation in the United States. In most cases we can ship your needs within 24 hours.

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- Control Cable
- Foil Shielded Cable
- Hookup Wire
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- Kynar Hookup Wire
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DEARBORN WIRE AND CABLE CO. DEPT. EM, 9299 EVENHOUSE AVE., ROSEMONT, ILLINOIS 60018

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DEARBORN WIRE AND CABLE COMPANY

Multi-conductor Shielded and Unshielded Control Cables

• RUBBER • NEOPRENE • PLASTIC

RUBBER — UNSHIELDED

Stranded tinned copper conductors, color coded rubber insulation. Cabled with fillers; cotton wrapped; tough rubber jacket overall. These cables are extremely flexible and are suitable for heavy duty usage. **Temperature rating:** −20°C to +60°C. Insulation thickness on individual conductors is .020″.

RUBBER — SHIELDED

RUBBER JACKETED. Conductors of stranded tinned copper, with color coded .020″ rubber insulation*. Cabled with fillers; cotton wrapped; braided tinned copper shield. Cotton wrap and tough black rubber jacket overall. Used for control circuit, studios, audio circuits, etc., where shielded cable is necessary. **Temperature rating:** −20° to +60°C.

* .040 on single conductor.

PLASTIC SHIELDED

PLASTIC JACKETED. Conductors of stranded tinned copper, with color coded .014″ thick Polythylene insulation. Cabled with fillers; wrapped with rayon; shielded with braided tinned copper shield. Covered with chrome grey Polyvinylchloride jacket overall. **Temperature rating:** −20°C to +60°C. **Operating voltage:** 600 volts.

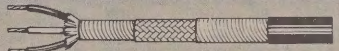
NEOPRENE — SHIELDED

NEOPRENE JACKETED. Stranded tinned copper conductors, with color coded .020″ rubber insulation*. Cabled with fillers; cotton wrapped; braided tinned copper shield. Cotton wrap and tough black neoprene jacket overall. Used for control circuits, studios, audio circuits, etc., where shielded cable is necessary. **Temperature rating:** −20°C to +60°C

* .040 on single conductor.

UNSHIELDED CONTROL CABLES (RUBBER)

DEARBORN NO.	NO. COND.	SIZE OF COND. AWG	STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
652002	2	20	26/34	.035	.240	100, 500 & 1000
652003	3	20	26/34	.035	.255	100, 500 & 1000
652004	4	20	26/34	.035	.275	100, 500 & 1000
652005	5	20	26/34	.035	.300	100, 500 & 1000
652006	6	20	26/34	.035	.315	100, 500 & 1000
652007	7	20	26/34	.035	.325	100, 500 & 1000
652008	8	20	26/34	.035	.360	100, 500 & 1000
652010	10	20	26/34	.035	.410	100, 500 & 1000
652012	12	20	26/34	.035	.435	100, 500 & 1000
652015	15	20	26/34	.035	.505	100, 500 & 1000
652020	20	20	26/34	.035	.570	100, 500 & 1000

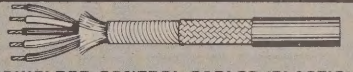


SHIELDED CONTROL CABLES (RUBBER)

DEARBORN NO.	NO. COND.	SIZE OF COND. AWG	STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
661801	1	18	41/34	.035	.240	100, 500 & 1000
661802	2	18	41/34	.035	.295	100, 500 & 1000
662001	1	20	26/34	.035	.230	100, 500 & 1000
662002	2	20	26/34	.035	.270	100, 500 & 1000
662003	3	20	26/34	.035	.285	100, 500, & 1000
662004	4	20	26/34	.035	.305	100, 500 & 1000
662005	5	20	26/34	.035	.330	100, 500 & 1000
662006	6	20	26/34	.035	.345	100, 500 & 1000
662007	7	20	26/34	.035	.355	100, 500 & 1000
662008	8	20	26/34	.035	.385	100, 500 & 1000
662010	10	20	26/34	.035	.440	100, 500 & 1000
662012	12	20	26/34	.065	.525	100, 500 & 1000
662015	15	20	26/34	.065	.595	100, 500 & 1000
662020	20	20	26/34	.065	.660	100, 500 & 1000

SHIELDED CONTROL CABLES (NEOPRENE)

DEARBORN NO.	NO. COND.	SIZE OF COND. AWG	STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
601801	1	18	41/34	.035	.240	100, 500 & 1000
601802	2	18	41/34	.035	.295	100, 500 & 1000
601803	3	18	41/34	.035	.305	100, 500 & 1000
601804	4	18	41/34	.035	.330	100, 500 & 1000
601806	6	18	41/34	.035	.370	100, 500 & 1000
601808	8	18	41/34	.035	.420	100, 500 & 1000
601810	10	18	41/34	.035	.480	100, 500 & 1000
601812	12	18	41/34	.065	.555	100, 500 & 1000
601815	15	18	41/34	.065	.640	100, 500 & 1000
601820	20	18	41/34	.065	.730	100, 500 & 1000



SHIELDED CONTROL CABLES (PLASTIC)

DEARBORN NO.	NO. COND.	SIZE OF COND. AWG	STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
682002	2	20	26/34	.030	.245	100, 500 & 1000
682003	3	20	26/34	.035	.250	100, 500 & 1000
682004	4	20	26/34	.035	.260	100, 500 & 1000
682005	5	20	26/34	.035	.275	100, 500 & 1000
682006	6	20	26/34	.035	.300	100, 500 & 1000
682008	8	20	26/34	.035	.330	100, 500 & 1000
682010	10	20	26/34	.035	.375	100, 500 & 1000
682012	12	20	26/34	.035	.380	100, 500 & 1000
682015	15	20	26/34	.035	.410	100, 500 & 1000
682020	20	20	26/34	.035	.455	100,500 & 1000

COLOR CODE: 1—Black • 2—White • 3—Red • 4—Green • 5—Yellow • 6—Blue • 7—Brown • 8—Orange • 9—Slate • 10—Purple • 11—White/Black 12—White/Red • 13—White/Green • 14—White/Yellow • 15—White/Blue • 16—White/Brown • 17—White/Purple • 18—White/Slate • 19—Black/Red •.20—Black/Yellow

Computer Type Control Cables Miniature Styles 2343 and 2344

The cables listed below, either cabled pairs or multiconductor (not paired), with or without shield are suited for computer use.

The individual conductors are stranded tinned copper. Numbers 22, 24 are 7 strand, No. 20 is 19 strand. Insulated with .010″ wall of PVC to MIL-W-16878D Type B. On this usage, conductors are rated 105°C and 600 V. working voltage. The conductors also meet UL Style 1061, rated 80°C, 300 V. working voltage.

Conductors are cabled by the planetary method and laid contrahelically for best flexibility, with a Mylar tape barrier placed under shields. All shielded cables are of tinned copper braid overall of 85% - 90% coverage per MIL-C-7078.

The jacket over the shield is black 105°C Vinyl per MIL-I-631 Type F. All materials are fungus resistant and self extinguishing.

All items approved under UL STYLE 2343 or 2344* for computer usage: +80°C, 300 volts. On non-UL service can be used at 40°C to +105°C, 600 volts.

MULTI-CONDUCTOR UNSHIELDED CABLES

DEARBORN NO.	NO. OF COND.	COND. SIZE	COND. O.D.	JACKET WALL	NOM. O.D.	PUT UP (FT.)
562405	5	24	.044	.062	.220	500, 1000
562407	7	24	.044	.062	.250	500, 1000
562412	12	24	.044	.062	.300	500, 1000
562415	15	24	.044	.062	.330	500, 1000
562419	19	24	.044	.062	.340	500, 1000
562427	27	24	.044	.062	.390	500, 1000
562437	37	24	.044	.062	.420	500, 1000
562448	48	24	.044	.062	.470	500, 1000
562460	60	24	.044	.062	.510	500, 1000
562205	5	22	.050	.062	.200	500, 1000
562207	7	22	.050	.062	.270	500, 1000
562212	12	22	.050	.062	.330	500, 1000
562215	15	22	.050	.062	.350	500, 1000
562219	19	22	.050	.062	.370	500, 1000
562227	27	22	.050	.062	.430	500, 1000
562237	37	22	.050	.062	.480	500, 1000
562248	48	22	.050	.062	.530	500, 1000
562260	60	22	.050	.062	.570	500, 1000
562005	5	20	.058	.062	.275	500, 1000
562007	7	20	.058	.062	.290	500, 1000
562012	12	20	.058	.062	.360	500, 1000
562015	15	20	.058	.062	.390	500, 1000
562019	19	20	.058	.062	.410	500, 1000
562027	27	20	.058	.062	.490	500, 1000
562037	37	20	.058	.062	.520	500, 1000
562048	48	20	.058	.062	.580	500, 1000
562060	60	20	.058	.062	.640	500, 1000

PAIRED CABLES, UNSHIELDED

DEARBORN NO.	NO. OF PAIRS	COND. SIZE	COND. O.D.	JACKET WALL	NOM. O.D.	PUT UP (FT.)
582405	5	24	.044	.062	.330	500, 1000
582407	7	24	.044	.062	.350	500, 1000
582412	12	24	.044	.062	.435	500, 1000
582415	15	24	.044	.062	.485	500, 1000
582419	19	24	.044	.062	.505	500, 1000
582427	27	24	.044	.062	.590	500, 1000
582437	37	24	.044	.062	.660	500, 1000
582448	48	24	.044	.062	.745	500, 1000
582460	60	24	.044	.062	.815	500, 1000
582205	5	22	.050	.062	.365	500, 1000
582207	7	22	.050	.062	.390	500, 1000
582212	12	22	.050	.062	.470	500, 1000
582215	15	22	.050	.062	.545	500, 1000
582219	19	22	.050	.062	.560	500, 1000
582227	27	22	.050	.062	.600	500, 1000
582237	37	22	.050	.062	.750	500, 1000
*582248	48	22	.050	.062	.850	500, 1000
*582260	60	22	.050	.062	.980	500, 1000
582005	5	20	.058	.062	.395	500, 1000
582007	7	20	.058	.062	.440	500, 1000
582012	12	20	.058	.062	.540	500, 1000
582015	15	20	.058	.062	.600	500, 1000
582019	19	20	.058	.062	.630	500, 1000
582027	27	20	.058	.062	.745	500, 1000
582037	37	20	.058	.062	.820	500, 1000
*582048	48	20	.058	.080	.950	500, 1000
*582060	60	20	.058	.080	1.040	500, 1000

MULTI-CONDUCTOR, OVERALL SHIELDED CABLES

DEARBORN NO.	NO. OF COND.	COND. SIZE	COND. O.D.	JACKET WALL	NOM. O.D.	PUT UP (FT.)
572405	5	24	.044	.062	.245	500, 1000
572407	7	24	.044	.062	.275	500, 1000
572412	12	24	.044	.062	.325	500, 1000
572415	15	24	.044	.062	.350	500, 1000
572419	19	24	.044	.062	.365	500, 1000
572427	27	24	.044	.062	.415	500, 1000
572437	37	24	.044	.062	.445	500, 1000
572448	48	24	.044	.062	.495	500, 1000
572460	60	24	.044	.062	.535	500, 1000
572205	5	22	.050	.062	.285	500, 1000
572207	7	22	.050	.062	.295	500, 1000
572212	12	22	.050	.062	.355	500, 1000
572215	15	22	.050	.062	.380	500, 1000
572219	19	22	.050	.062	.395	500, 1000
572227	27	22	.050	.062	.455	500, 1000
572237	37	22	.050	.062	.510	500, 1000
572248	48	22	.050	.062	.560	500, 1000
572260	60	22	.050	.062	.600	500, 1000
572005	5	20	.058	.062	.300	500, 1000
572007	7	20	.058	.062	.315	500, 1000
572012	12	20	.058	.062	.385	500. 1000
572015	15	20	.058	.062	.415	500, 1000
572019	19	20	.058	.062	.435	500, 1000
572027	27	20	.058	.062	.515	500, 1000
572037	37	20	.058	.062	.550	500, 1000
572048	48	20	.058	.062	.610	500, 1000
572060	60	20	.058	.062	.670	500, 1000

PAIRED CABLES WITH OVERALL SHIELD

DEARBORN NO.	NO. OF PAIRS	COND. SIZE	COND. O.D.	JACKET WALL	NOM. O.D.	PUT UP (FT.)
592405	5	24	.044	.062	.355	500, 1000
592407	7	24	.044	.062	.375	500, 1000
592412	12	24	.044	.062	.460	500, 1000
592415	15	24	.044	.062	.510	500, 1000
592419	19	24	.044	.062	.530	500, 1000
592427	27	24	.044	.062	.620	500, 1000
592437	37	24	.044	.062	.690	500, 1000
592448	48	24	.044	.062	.775	500, 1000
*592460	60	24	.044	.062	.845	500, 1000
592205	5	22	.050	.062	.390	500, 1000
592207	7	22	.050	.062	.415	500, 1000
592212	12	22	.050	.062	.495	500, 1000
592215	15	22	.050	.062	.575	500, 1000
592219	19	22	.050	.062	.580	500, 1000
592227	27	22	.050	.062	.670	500, 1000
592237	37	22	.050	.062	.780	500, 1000
*592248	48	22	.050	.062	.880	500, 1000
*592260	60	22	.050	.062	.960	500, 1000
592005	5	20	.058	.062	.420	500, 1000
592007	7	20	.058	.062	.465	500, 1000
592012	12	20	.058	.062	.570	500, 1000
592015	15	20	.058	.062	.630	500, 1000
592019	19	20	.058	.062	.660	500, 1000
592027	27	20	.058	.062	.775	500, 1000
*592037	37	20	.058	.080	.850	500, 1000
*592048	48	20	.058	.080	.980	500, 1000
*592060	60	20	.058	.080	1.070	500, 1000

Color Code: Ten solid colors and white with stripes per MIL-STD-681

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DEARBORN WIRE AND CABLE COMPANY

105°C TYPE B, 600 VOLT

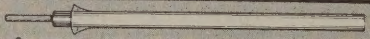
DEARBORN NO.	MIL TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
173207	B-32	32	7/40	.028	.010	0-9
173007	B-30	30	7/38	.032	.010	0-9
172807	B-28	28	7/36	.034	.010	0-9 & 90-98
172607	B-26	26	7/34	.038	.010	0-9 & 90-98
172619	B-26	26	19/38	.038	.010	0-9 & 90-98
172407	B-24	24	7/32	.044	.010	0-9 & 90-98
172419	B-24	24	19/36	.044	.010	0-9 & 90-98
172207	B-22	22	7/30	.051	.010	0-9 & 90-98
172219	B-22	22	19/34	.051	.010	0-9 & 90-98
172007	B-20	20	7/28	.058	.010	0-9 & 90-98
172019	B-20	20	19/32	.058	.010	0-9 & 90-98
171807	B-18	18	7/26	.068	.010	0-9 & 90-98
171819	B-18	18	19/30	.068	.010	0-9 & 90-98
171619	B-16	16	19/29	.077	.010	0-9 & 90-98
171419	B-14	14	19/27	.091	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

105°C TYPE B, BONDED CONDUCTOR, 600V.

DEARBORN NO.	MIL TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
192407	B-24	24	7/32	.043	.010	0-9 & 90-98
192207	B-22	22	7/30	.050	.010	0-9 & 90-98
192007	B-20	20	7/28	.058	.010	0-9 & 90-98
191807	B-18	18	7/26	.068	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK



115°C TYPE B, NYLON JACKET (.003"), 600 V.

DEARBORN NO.	MIL TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
183207	B-32	32	7/40	.035	.010	0-9 & 90-98
183007	B-30	30	7/38	.039	.010	0-9 & 90-98
182807	B-28	28	7/36	.041	.010	0-9 & 90-98
182607	B-26	26	7/34	.044	.010	0-9 & 90-98
182619	B-26	26	19/38	.044	.010	0-9 & 90-98
182407	B-24	24	7/32	.050	.010	0-9 & 90-98
182419	B-24	24	19/36	.050	.010	0-9 & 90-98
182207	B-22	22	7/30	.057	.010	0-9 & 90-98
182219	B-22	22	19/34	.057	.010	0-9 & 90-98
182007	B-20	20	7/28	.064	.010	0-9 & 90-98
182019	B-20	20	19/32	.064	.010	0-9 & 90-98
181807	B-18	18	7/26	.074	.010	0-9 & 90-98
181819	B-18	18	19/30	.074	.010	0-9 & 90-98
181619	B-16	16	19/29	.085	.010	0-9 & 90-98
181419	B-14	14	19/27	.099	.010	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

MIL-SPEC MIL-W-16878D Hookup Wire Types B & C

Single conductor, stranded tinned copper

TYPE B
Insulation PVC .010″ wall thickness, color coded. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

TYPE B — NYLON
Same as above but with clear nylon jacket (.003″ wall) over PVC insulation increasing temperature rating to +115°C.

TYPE B — PREBONDED
Double tinned strands are heated which fuses the individual strands together in order to prevent fraying. Allows easy stripping and insertion in holes in lugs, circuit boards, etc. Color coded .010″ PVC insulation to MIL-W-16878D. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

TYPE C
Insulation PVC .017″ wall thickness. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 1000 volts.

TYPE C — NYLON
Same as above but with clear nylon jacket which increases temperature rating to +115°C.

TYPE C — SHIELD AND NYLON JACKET
Basic type C with 90% coverage braided tinned copper shield and clear nylon .005″ jacket overall.

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White • 90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray

OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

105°C TYPE C, 1000 VOLT

DEARBORN NO.	MIL TYPE	SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
202407	C-24	24	7/32	.058	.017	0-9 & 90-98
202419	C-24	24	19/36	.058	.017	0-9 & 90-98
202207	C-22	22	7/30	.065	.017	0-9 & 90-98
202219	C-22	22	19/34	.065	.017	0-9 & 90-98
202007	C-20	20	7/28	.072	.017	0-9 & 90-98
202019	C-20	20	19/32	.072	.017	0-9 & 90-98
201807	C-18	18	7/26	.082	.017	0-9 & 90-98
201819	C-18	18	19/30	.082	.017	0-9 & 90-98
201619	C-16	16	19/29	.092	.017	0-9 & 90-98
201419	C-14	14	19/27	.105	.017	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE C, NYLON JACKET (.003"), 1000 V.

DEARBORN NO.	MIL TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
212407	C-24	24	7/32	.064	.017	0-9 & 90-98
212419	C-24	24	19/36	.064	.017	0-9 & 90-98
212207	C-22	22	7/30	.071	.017	0-9 & 90-98
212219	C-22	22	19/34	.071	.017	0-9 & 90-98
212007	C-20	20	7/28	.079	.017	0-9 & 90-98
212019	C-20	20	19/32	.079	.017	0-9 & 90-98
211807	C-18	18	7/26	.090	.017	0-9 & 90-98
211819	C-18	18	19/30	.090	.017	0-9 & 90-98
211619	C-16	16	19/29	.100	.017	0-9 & 90-98
211419	C-14	14	19/27	.113	.017	0-9 & 90-98

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

115°C TYPE C, SHIELDED, NYLON JACKET, 1000 V.

DEARBORN NO.	MIL TYPE	GAUGE SIZE	STRANDING	NOM. O.D.	WALL THICKNESS	STOCK COLORS
222407	C-24	24	7/32	.086	.017	9 Only
222207	C-22	22	7/30	.093	.017	9 Only
222007	C-20	20	7/28	.102	.017	9 Only
221819	C-18	18	19/30	.112	.017	9 Only
221619	C-16	16	19/29	.122	.017	9 Only
221419	C-14	14	19/27	.138	.017	9 Only

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

THE XLV IS ESPECIALLY SUITABLE FOR AEROSPACE, MILITARY AND INDUSTRIAL ELECTRONIC EQUIPMENT

Dual service hook-up wire insulated with a polyvinyl chloride which has been cross-linked by an irradiation process. This process changes the linear molecular configuration of the PVC and connects molecules through a network of chemical bonds. This specially processed insulation "XLV" becomes extremely burn-thru and heat resistant. The shrinkback or heat flow normally encountered when applying a hot soldering iron does not occur when using "XLV" hook-up wire.

This resistance to heat also prevents distortion of the insulation when the wire is subjected to temporary overloads and high temperatures.

Cross linking the PVC by irradiation also increases the abrasion resistance and makes it much superior to regular vinyl insulations.

The table below lists both the UL and military specifications to which "XLV" wire is manufactured.

Note that since the military and U.L. specifications vary, the temperature and voltage ratings assigned differ for the same wire as per the chart.

SPECIFICATIONS	MAX. OPER. TEMPS.	MAXIMUM VOLTAGE
MIL-W-16878/1 TYPE B	105°C	600 V. RMS
U.L. AWM STYLE 1429	80°C	Voltage not specified for general appliance hook-up usage. 300 volt peak for electronic use only.
MIL-W-16878/2 TYPE C	105°C	1000 V. RMS.
U.L. AWM STYLE 1430	105°C	300 VOLT RMS 600 VOLT PEAK For electronic use only.

See other U.L. & CSA products starting with page 13

Cross-Linked Irradiated Hookup Wire

XLV Dual Service Hookup Wire

UL and MIL-SPEC Hookup and Lead Wire

Cross-Linked Polyvinyl Chloride Insulation

MIL-W-16878/2 — TYPE C

XLV U.L. STYLE 1430

DEARBORN NO.	MIL TYPE	U.L. STYLE	AWG SIZE STRANDING	NOM. INSUL. THICK'S	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT)
272407	C-24	1430	24 (7/32)	.016	.058	0-9	1000
272407F	C-24	1430	24 (7/32)	.016	.058	0-9	1000
272207	C-22	1430	22 (7/30)	.016	.064	0-9	1000
272207F	C-22	1430	22 (7/30)	.016	.064	0-9	1000
272007	C-20	1430	20 (7/28)	.016	.072	0-9	1000
272007F	C-20	1430	20 (7/28)	.016	.072	9 only	1000
271819	C-18	1430	18 (19/30)	.016	.082	9 only	1000
271807F	C-18	1430	18 (7/26)	.016	.082	9 only	1000
271619	C-16	1430	16 (19/29)	.016	.092	9 only	1000
271419	C-14		14 (19/27)	.016	.105	9 only	1000
271219	C-12		12 (19/25)	.016	.124	9 only	1000

F — SUFFIX INDICATES FUSED OR PREBONDED STRANDS

MIL-W-16878/1 — TYPE B

XLV U.L. STYLE 1429

DEARBORN NO.	MIL TYPE	U.L. STYLE	AWG SIZE STRANDING	NOM. INSUL. THICK'S	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT)
252807	B-28	1429	28 (7/36)	.010	.035	0-9	1000
252607	B-26	1429	26 (7/34)	.010	.039	0-9	1000
252607F	B-26	1429	26 (7/34)	.010	.039	0-9	1000
252407	B-24	1429	24 (7/32)	.010	.044	0-9	1000
252407F	B-24	1429	24 (7/32)	.010	.044	0-9	1000
252419	B-24	1429	24 (19/36)	.010	.045	0-9	1000
252207	B-22	1429	22 (7/30)	.010	.050	0-9	1000
252207F	B-22	1429	22 (7/30)	.010	.050	0-9	1000
252219	B-22	1429	22 (19/34)	.010	.051	0-9	1000
252007	B-20	1429	20 (7/28)	.010	.058	0-9	1000
252007F	B-20	1429	20 (7/28)	.010	.058	0-9	1000
252019	B-20	1429	20 (19/32)	.010	.059	0-9	1000
251819	B-18	1429	18 (19/30)	.010	.068	9 only	1000
251807	B-18	1429	18 (7/26)	.010	.068	9 only	1000
251807F	B-18	1429	18 (7/26)	.010	.068	9 only	1000
251619	B-16	1429	16 (19/29)	.010	.078	9 only	1000
252601	NOT MIL SPEC TYPE	1429	26 (1)	.010	.039	0-9	1000
252401		1429	24 (1)	.010	.044	0-9	1000
252201		1429	22 (1)	.010	.050	0-9	1000

F — SUFFIX INDICATES FUSED OR PREBONDED STRANDS

All above can be supplied in multi-conductor, with shield and XLV jacket or multi-conductor, and XLV jacket.

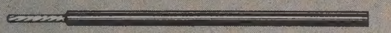
COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

DEARBORN WIRE AND CABLE CO. Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

MIL-W-16878D Teflon* Hookup Wire



TYPE E, 600 VOLT

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE	STRAND'G	NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
13207	E-32	7/40	.010	.029	0-9	0-9
13007	E-30	7/38	.010	.032	0-9	0-9
12807	E-28	7/36	.010	.036	0-9	0-9
12619	E-26	19/38	.010	.040	0-9	0-9 & 90-98
12607	E-26	7/34	.010	.039	0-9	0-9 & 90-98
12419	E-24	19/36	.010	.045	0-9	0-9 & 90-98
12407	E-24	7/32	.010	.044	0-9	0-9 & 90-98
12219	E-22	19/34	.010	.052	0-9	0-9 & 90-98
12207	E-22	7/30	.010	.050	0-9	0-9 & 90-98
12019	E-20	19/32	.010	.060	0-9	0-9 & 90-98
12007	E-20	7/28	.010	.058	0-9	0-9 & 90-98
11819	E-18	19/30	.010	.070	0-9	0-9 & 90-98
11807	E-18	7/26	.010	.068	0-9	0-9 & 90-98
11619	E-16	19/29	.011	.077	0-9	0-9 & 90-98
11419	E-14	19/27	.011	.094	0-9	0-9 & 90-98
11219	E-12	19/25	.012	.113	0-9	0-9 & 90-98
11037	E-10	37/26	.012	.135	0-9	0-9 & 90-98
**SOLID CONDUCTOR						
13201	E-32	1/32	.010	.029	0-9	0-9
13001	E-30	1/30	.010	.032	0-9	0-9
12801	E-28	1/28	.010	.035	0-9	0-9
12601	E-26	1/26	.010	.039	0-9	0-9
12401	E-24	1/24	.010	.044	0-9	0-9
12201	E-22	1/22	.010	.050	0-9	0-9
12001	E-20	1/20	.010	.058	0-9	0-9

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

**Not MIL Spec.

TYPE E, 600 VOLT
Single conductor, stranded or solid silver plated copper, extruded TFE Teflon insulation. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C.

TYPE EE, 1000 VOLT
Same as Type E, except for insulation thickness and voltage rating of 1000 volts.

TYPE EE, 1000 VOLT

DEARBORN NO.	TYPE & CONDUCTOR AWG SIZE	STRAND'G	NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS 100′	STOCK COLORS 1000′
23207	EE-32	7/40	.015	.039	0-9	0-9
23007	EE-30	7/38	.015	.042	0-9	0-9
22807	EE-28	7/36	.015	.045	0-9	0-9
22607	EE-26	7/34	.015	.049	0-9	0-9 & 90-98
22619	EE-26	19/38	.015	.050	0-9	0-9 & 90-98
22407	EE-24	7/32	.015	.054	0-9	0-9 & 90-98
22419	EE-24	19/36	.015	.055	0-9	0-9 & 90-98
22207	EE-22	7/30	.015	.060	0-9	0-9 & 90-98
22219	EE-22	19/34	.015	.062	0-9	0-9 & 90-98
22007	EE-20	7/28	.015	.068	0-9	0-9 & 90-98
22019	EE-20	19/32	.015	.070	0-9	0-9 & 90-98
21819	EE-18	19/30	.015	.079	0-9	0-9 & 90-98
21619	EE-16	19/29	.016	.089	0-9	0-9 & 90-98
21419	EE-14	19/27	.017	.105	0-9	0-9 & 90-98
21219	EE-12	19/25	.017	.124	0-9	0-9 & 90-98
21037	EE-10	37/26	.017	.145	0-9	0-9 & 90-98
28133	EE-8	133/29	.020	.207	0,2,9	0,2,9

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

TYPE E, SPIRAL WRAPPED FUSED TEFLON
Same as Type E — 600 volt but with spiral wrapped fused Teflon insulation.

TYPE EE, SPIRAL WRAPPED FUSED TEFLON
Same as Type EE, but with spiral wrapped fused Teflon insulation.

ALSO AVAILABLE:

TYPE ET, 250 VOLT
Same as Type E except for insulation thickness of .006 and voltage rating of 250 volts.

CORONA RESISTANT HIGH VOLTAGE WIRE

- High Dielectric Strength
- Flame Retardant
- Abrasion Resistant
- Easy to Strip

CONSTRUCTION

Conductors: All conductors are tinned copper, flexible stranding. Also available on special order with: silver plated copper conductors, nickel plated copper conductors and pure nickel conductors. Pure nickel increases rating to 260°C (500°F). **Insulation:** High temperature, high voltage silicone rubber for easy stripping. High dielectric strength, flame retardant.

APPLICATIONS

Recommended for stoves, heaters, furnaces, dryers, motors, therapeutic devices, signs, lighting fixtures and special electronic devices where high temperatures are incurred. Military applications include use on jet aircraft, atomic submarines and related equipment.

COLOR: Natural.

200°C SILICONE HIGH TEMPERATURE, HIGH VOLTAGE WIRE

DEARBORN NO.	AWG SIZE	WALL THICKNESS	NOM. O.D.	D.C. VOLTAGE LISTING
392245	22 (STR'D)	.045″	.120	10 KV.
392250	22 (STR'D)	.050″	.130	12 KV.
392260	22 (STR'D)	.060″	.150	15 KV.
392275	22 (STR'D)	.075″	.180	20 KV.
392045	20 (STR'D)	.045″	.126	10 KV.
392060	20 (STR'D)	.060″	.156	15 KV.
392075	20 (STR'D)	.075″	.186	20 KV.
391845	18 (STR'D)	.045″	.137	10 KV.
391875	18 (STR'D)	.075″	.197	20 KV.
391890	18 (STR'D)	.090″	.227	30 KV.
391645	16 (STR'D)	.045″	.149	10 KV.
391660	16 (STR'D)	.060″	.179	15 KV.
391675	16 (STR'D)	.075″	.209	20 KV.
391690	16 (STR'D)	.090″	.239	30 KV.
391445	14 (STR'D)	.045″	.163	10 KV.
391460	14 (STR'D)	.060″	.193	15 KV.
391475	14 (STR'D)	.075″	.223	20 KV.
391490	14 (STR'D)	.090″	.253	30 KV.
391245	12 (STR'D)	.045″	.185	10 KV.
391290	12 (STR'D)	.090″	.275	30 KV.
391045	10 (STR'D)	.045″	.206	10 KV.
391090	10 (STR'D)	.090″	.296	30 KV.
390860	8 (STR'D)	.060″	.267	15 KV.
390660	6 (STR'D)	.060″	.304	15 KV.
390460	4 (STR'D)	.060″	.352	15 KV.
390260	2 (STR'D)	.060″	.412	15 KV.

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White • 90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray

* Du Pont T.M.

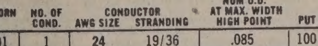
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

MIL-W-16878D Shielded Teflon* Cables

- **TEFLON IMPREGNATED BRAID OVER SHIELD**
  Braided natural or white Teflon impregnated fiberglass braid overall.
- **FEP EXTRUDED JACKET OVER SHIELD**
  Tough abrasion resistant extruded white FEP Teflon jacket overall.
- **TEFLON TAPE WRAP JACKET OVER SHIELD**
  Sintered wrapped white Teflon tape jacketed overall.

Each conductor stranded silver plated copper, Type E extruded TFE Teflon .010″ color coded insulation. **Braided silver plated copper** shield, 90% coverage. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

*Dupont T.M.



EXTRUDED JACKET OVER SHIELD

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
72401	1	24	19/36	.085	100 & 1000
72402	2	24	19/36	.130	100 & 1000
72403	3	24	19/36	.135	100 & 1000
72201	1	22	19/34	.091	100 & 1000
72202	2	22	19/34	.150	100 & 1000
72203	3	22	19/34	.158	100 & 1000
72001	1	20	19/32	.100	100 & 1000
72002	2	20	19/32	.168	100 & 1000
72003	3	20	19/32	.178	100 & 1000
71801	1	18	19/30	.110	100 & 1000
71802	2	18	19/30	.188	100 & 1000
71803	3	18	19/30	.207	100 & 1000
71601	1	16	19/29	.123	100 & 1000
71602	2	16	19/29	.220	100 & 1000
71603	3	16	19/29	.235	100 & 1000

TEFLON TAPE WRAP OVERALL

DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
62401	1	24	19/36	.095	100 & 1000
62402	2	24	19/36	.140	100 & 1000
62403	3	24	19/36	.147	100 & 1000
62404	4	24	19/36	.159	100 & 1000
62201	1	22	19/34	.102	100 & 1000
62202	2	22	19/34	.154	100 & 1000
62203	3	22	19/34	.162	100 & 1000
62204	4	22	19/34	.176	100 & 1000
62001	1	20	19/32	.110	100 & 1000
62002	2	20	19/32	.170	100 & 1000
62003	3	20	19/32	.175	100 & 1000
62004	4	20	19/32	.213	100 & 1000
61801	1	18	19/30	.120	100 & 1000
61802	2	18	19/30	.190	100 & 1000
61803	3	18	19/30	.219	100 & 1000
61804	4	18	19/30	.237	100 & 1000
61601	1	16	19/29	.130	100 & 1000
61602	2	16	19/29	.230	100 & 1000
61603	3	16	19/29	.240	100 & 1000
61604	4	16	19/29	.270	100 & 1000

TEFLON IMPREGNATED BRAID OVERALL

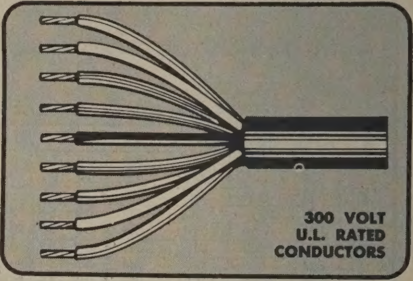
DEARBORN NO.	NO. OF COND.	CONDUCTOR AWG SIZE	CONDUCTOR STRANDING	NOM O.D. AT MAX. WIDTH HIGH POINT	PUT UP (FT.)
52401	1	24	19/36	.081	100 & 1000
52402	2	24	19/36	.126	100 & 1000
52403	3	24	19/36	.133	100 & 1000
52404	4	24	19/36	.144	100 & 1000
52201	1	22	19/34	.088	100 & 1000
52202	2	22	19/34	.137	100 & 1000
52203	3	22	19/34	.144	100 & 1000
52204	4	22	19/34	.158	100 & 1000
52001	1	20	19/32	.097	100 & 1000
52002	2	20	19/32	.154	100 & 1000
52003	3	20	19/32	.163	100 & 1000
52004	4	20	19/32	.180	100 & 1000
51801	1	18	19/30	.106	100 & 1000
51802	2	18	19/30	.174	100 & 1000
51803	3	18	19/30	.185	100 & 1000
51804	4	18	19/30	.205	100 & 1000
51601	1	16	19/29	.117	100 & 1000
51602	2	16	19/29	.196	100 & 1000
51603	3	16	19/29	.225	100 & 1000
51604	4	16	19/29	.255	100 & 1000

COLOR CODE OF CONDUCTORS: 1st Conductor—White • 2nd Conductor—Black • 3rd Conductor—Red • 4th Conductor—Green

DEARBORN WIRE AND CABLE CO. Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

Unshielded Audio Cable



MULTICONDUCTOR PLASTIC JACKETED

Stranded or solid tinned copper conductors. Color coded polyvinylchloride insulation. Conductors cabled and covered with a gray PVC jacket overall. Suitable for outdoor usage. Recommended for P.A. systems, intercom connecting cables, remote control circuits, relay circuits, telephones, and telemetering circuits.

All inner conductors are U.L. styles as follows: No. 22 - Style 1061, Nos. 20, 18 and 16 are Style 1007, No. 14 and No. 12 are Styles 1335 and 1336.

Temperature ratings
On Style 1061 and 1007 are −10°C to +80°C; on Styles 1335 and 1336 ratings are −10°C to +90°C.

NO. 22 AWG MULTI-CONDUCTOR

DEARBORN NO.	NO. OF COND.	SIZE	STRANDING	NOM. WALL THICK.	NOM. JKT. THICK.	NOM. O.D.	COLOR CODE CHART
832202	2	22	7/30	.010	.020	.140	1
832203	3	22	7/30	.010	.020	.145	1
832204	4	22	7/30	.010	.020	.170	1
832205	5	22	7/30	.010	.020	.175	1
832206	6	22	7/30	.010	.020	.185	1
832207	7	22	7/30	.010	.020	.190	1
832208	8	22	7/30	.010	.020	.200	1
832209	9	22	7/30	.010	.020	.225	1
832210	10	22	7/30	.010	.020	.235	1
832212	12	22	7/30	.010	.020	.255	1
832215	15	22	7/30	.010	.020	.280	2
832220	20	22	7/30	.010	.020	.310	2
832224	24	22	7/30	.010	.020	.325	2
832225	25	22	7/30	.010	.020	.330	2
832230	30	22	7/30	.010	.020	.365	2
832240	40	22	7/30	.010	.025	.452	2
832250	50	22	7/30	.010	.035	.500	2
832260	60	22	7/30	.010	.035	.530	2
NO. 20 AWG MULTI-CONDUCTOR							
832002	2	20	10/30	.016	.020	.180	1
832003	3	20	10/30	.016	.020	.190	1

NO. 18 AWG MULTI-CONDUCTOR

DEARBORN NO.	NO. OF COND.	SIZE	STRANDING	NOM. WALL THICK.	NOM. JKT. THICK.	NOM. O.D.	COLOR CODE CHART
831802	2	18	16/30	.018	.020	.200	2
831803	3	18	16/30	.018	.025	.210	2
831804	4	18	16/30	.018	.030	.250	1
831805	5	18	16/30	.018	.037	.286	1
831806	6	18	16/30	.018	.037	.310	1
831807	7	18	16/30	.018	.037	.325	1
831808	8	18	16/30	.018	.037	.350	1
831809	9	18	16/30	.018	.037	.379	1
831812	12	18	16/30	.018	.040	.417	2
831815	15	18	16/30	.018	.045	.490	2
831819	19	18	16/30	.018	.045	.505	2
NO. 16 AWG MULTI-CONDUCTOR							
831602	2	16	19/29	.030	.025	.256	2
831603	3	16	19/29	.030	.030	.300	2
831604	4	16	19/29	.030	.045	.375	2
NO. 14 AWG MULTI-CONDUCTOR							
831402	2	14	19/27	.031	.035	.332	2
831403	3	14	19/27	.031	.035	.400	2
831404	4	14	19/27	.045	.045	.495	2
NO. 12 AWG MULTI-CONDUCTOR							
831202	2	12	19/25	.031	.040	.384	2
831203	3	12	19/25	.031	.040	.425	2

COLOR CODE CHART NO. 1

1—Black
2—Red
3—Green
4—White
5—Brown
6—Blue
7—Orange
8—Yellow
9—Purple
10—Slate
11—Pink
12—Tan
13—Red/Green
14—Red/Yellow
15—Red/Black
16—White/Black
17—White/Red
18—White/Green
19—White/Yellow
20—White/Blue
21—White/Brown
22—White/Orange
23—White/Gray
24—White/Violet
25—White/Black/Red
26—White/Black/Green
27—White/Black/Yellow
28—White/Black/Blue
29—White/Black/Brown
30—White/Black/Orange

COLOR CODE CHART NO. 2 (IPCEA)

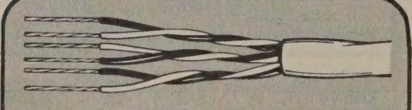
1—Black
2—White
3—Red
4—Green
5—Orange
6—Blue
7—White/Black
8—Red/Black
9—Green/Black
10—Orange/Black
11—Blue/Black
12—Black/White
13—Red/White
14—Green/White
15—Blue/White
16—Black/Red
17—White/Red
18—Orange/Red
19—Blue/Red
20—Red/Green
21—Orange/Green
22—Black/White/Red
23—White/Black/Red
24—Red/Black/White
25—Green/Black/White
26—Orange/Black/White
27—Blue/Black/White
28—Black/Red/Green
29—White/Red/Green
30—Red/Black/Green
31—Green/Black/Orange
32—Orange/Black/Green
33—Blue/White/Orange
34—Black/White/Orange
35—White/Red/Orange
36—Orange/White/Blue
37—White/Red/Blue
38—Black/White/Green
39—White/Black/Green
40—Red/White/Green
41—Green/White/Blue
42—Orange/Red/Green
43—Blue/Red/Green
44—Black/White/Blue
45—White/Black/Blue
46—Red/White/Blue
47—Green/Orange/Red
48—Orange/Red/Blue
49—Blue/Red/Orange
50—Black/Orange/Red
51—White/Black/Orange
52—Red/Orange/Black
53—Green/Red/Blue
54—Orange/Black/Blue
55—Blue/Black/Orange
56—Black/Orange/Green
57—White/Orange/Green
58—Red/Orange/Green
59—Green/Black/Blue
60—Orange/Green/Blue

STANDARD PUT UP FOR ALL ABOVE — 100′, 500′, 1000′

Unshielded Paired Conductors Intercom Cables

PAIRED CONDUCTOR, PLASTIC JACKETED CABLES

Stranded or solid tinned copper conductors. Color coded polyvinylchloride .010″ insulation. Conductors are twisted into pairs, cabled and jacketed overall with a gray PVC jacket. Temperature rating: −20°C to +80°C. Conductors are **U.L. Style 1061.**
Suitable for outdoor usage. Recommended for remote control circuits, relay circuits, balanced intercom systems, multiple speaker cable, telephones, call systems, etc. **Suggested operating voltage:** 300 volts maximum.

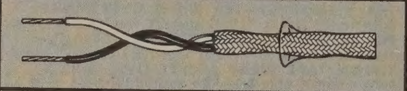


**STRANDED CONDUCTOR
MULTIPLE TWISTED PAIRS
U.L. INNER CONDUCTORS**

DEARBORN NO.	NO. OF PAIRS	NO. OF COND.	COND. SIZE	STRANDING	NOM. JKT. THICK.	NOM. O.D.
862201	1	2	22	7/30	.020	.145
862202	2	4	22	7/30	.020	.210
862203	3	6	22	7/30	.020	.225
862204	4	8	22	7/30	.020	.240
862205	5	10	22	7/30	.020	.265
862206	6	12	22	7/30	.020	.290
862209	9	18	22	7/30	.020	.355
862211	11	22	22	7/30	.020	.365
862215	15	30	22	7/30	.025	.450
862219	19	38	22	7/30	.025	.480
862223	23	46	22	7/30	.030	.530
862227	27	54	22	7/30	.035	.570
862231	31	62	22	7/30	.040	.635
862241	41	82	22	7/30	.040	.710
862251	51	102	22	7/30	.045	.800

MINIATURE CABLE/Shielded Clear Plastic Jacket

Tinned copper conductors, insulated with color coded polyvinylchloride. Conductors are twisted and shielded with a fine braided tinned copper shield. Clear, .010″ polyvinylchloride jacket overall. **Suggested maximum operating voltage:** 200 V. **Temperature rating:** −20°C to +60°C.



DEARBORN NO.	NO. OF COND.	COND. SIZE	STRANDING	NOM. WALL THICK.	NOM. O.D.	STOCK PUT UP (FT.)
942802	2	28	7/36	.010	.105	100, 500 & 1000
942803	3	28	7/36	.010	.115	100, 500 & 1000
942804	4	28	7/36	.010	.120	100, 500 & 1000

COLOR CODE OF CONDUCTORS: 1—Black • 2—Red • 3—White • 4—Green.

COLOR CODING OF PAIRS

PAIR NO. — COLOR COMBINATION

1—Black paired with Red
2—Black paired with White
3—Black paired with Green
4—Black paired with Blue
5—Black paired with Yellow
6—Black paired with Brown
7—Black paired with Orange
8—Red paired with White
9—Red paired with Green
10—Red paired with Blue
11—Red paired with Yellow
12—Red paired with Brown
13—Red paired with Orange
14—Green paired with White
15—Green paired with Blue
16—Green paired with Yellow
17—Green paired with Brown
18—Green paired with Orange
19—White paired with Blue
20—White paired with Yellow
21—White paired with Brown
22—White paired with Orange
23—Blue paired with Yellow
24—Blue paired with Brown
25—Blue paired with Orange
26—Brown paired with Yellow

PAIR NO. — COLOR COMBINATION

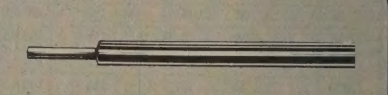
27—Brown paired with Orange
28—Purple paired with Red
29—Purple paired with White
30—Purple paired with Green
31—Purple paired with Blue
32—Purple paired with Brown
33—Purple paired with Yellow
34—Purple paired with Orange
35—Purple paired with Slate
36—Purple paired with Black
37—Slate paired with Red
38—Slate paired with White
39—Slate paired with Green
40—Slate paired with Blue
41—Slate paired with Brown
42—Slate paired with Yellow
43—Slate paired with Orange
44—Slate paired with Black
45—White/Black paired with Red
46—White/Black paired with Green
47—White/Black paired with Blue
48—White/Black paired with Brown
49—White/Black paired with Yellow
50—White/Black paired with Orange
51—White/Black paired with Purple

KYNAR

Insulated Hookup Wire for Wire Wrap Applications

Especially suited for computer, business machine usage and other areas where space is limited. (For automatic point to point application.)

The miniaturization of computers and business machines has created special problems in the wiring of components and associated programming equipment. Essentially there is a need for wire with a tough insulation that is resistant to abrasion and cold flow. It should function at operating temperatures up to 125°C. The Wire-Wrap type of termination requires a high conductivity low corrosive surface on the conductor. Dearborn Kynar insulated wire fulfills these needs.



KYNAR HOOK-UP WIRE

DEARBORN NO.	AWG SIZE	INSUL. THICK.	NOM. O.D.	U.L. STYLE	STOCK COLORS AVAILABLE
773001	30(1)	.005″	.0195″	1422	0, 1, 2, 3, 4, 5, 6, 8, 9
772801	28(1)	.0035″	.020″	1432	0, 1, 2, 5, 6, 9
772601	26(1)	.005″	.027″	1422	2, 4, 5, 6, 8, 9
772401	24(1)	.010″	.042″	1327	2, 4, 5, 6, 9

ALL SUPPLIED ON SPECIALLY DESIGNED LARGE HUB REELS, 1,000′ MINIMUM
CODE COLORING: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Gray • 9—White

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

Service, Power and Replacement Cords and Cordage

U.L. PARALLEL LAMP CORD

Stranded extra-flexible bare copper, parallel conductors, insulated with Rubber, (SP-1), or Polyvinyl (SPT-1 -SPT-2) or Neoprene (HPN). JACKET OVERALL. Slit in jacket between conductors for ease in separation. Applications: Small appliances, radios, clocks; the HPN is suitable for coffeemakers, fry pans, soldering irons, etc. **Temperature Rating:** 20°C to +60°C. **Suggested Operating Voltage:** 300 V.

EXTENSION CORD SETS

Flexible, 2 or 3 conductor, high quality black rubber cords. Black molded plastic male plug on one end, molded plastic female plug on other end. Will fit conventional sockets and plugs. **Voltage rating:** 300 volts. The 3 conductor cord is used where 1 conductor requires grounding, such as for hand tools, garden edgers, etc.

* This item supplied in grey.

REPLACEMENT CORDS

Flexible high quality black Rubber, Plastic and Neoprene Cords. Types SV and SJ are rubber insulated and jacketed. Types SVT and SJT are plastic insulated and jacketed. Type SJO is rubber insulated and neoprene jacketed. One end has molded black plastic straight plug (either 2 prong or 3 prong depending on 2 or 3 conductor cable). The other end of the jacket is stripped back 1½" with ⅝" of the conductors stripped. **Voltage rating:** 300 volts. The 3 conductor cord is used where 1 conductor is required for grounding.

* This item supplied in grey.

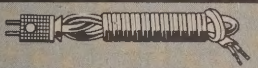
AIR CONDITIONER EXTENSION CORDS

Flat, parallel 3 conductor SPT-3, grey plastic cord with a molded 3 blade right angle plug on one end and a female 3 wire U ground connector molded on the other end. **Rating:** 125 volts, 15 Amps.

U.L. PARALLEL LAMP CORD

DEARBORN NO.	SIZE & NO. OF COND.	STRANDING	TYPE OF INSUL.	NOM. WALL	U.L. TYPE	NOM. O.D.
1182S	18/2	41/34	Rubber	.032	SP-1	.220 x .120
1182T	18/2	41/34	Plastic	.032	SPT-1	.215 x .115
1182T2	18/2	41/34	Plastic	.048	SPT-2	.255 x .143
3182N	18/2	41/34	Neoprene	.048	HPN	.272 x .142
3162N	16/2	65/34	Neoprene	.048	HPN	.295 x .150

Stock Colors: 1182S — Available Brown, Black, White. 1182T — Available Brown, Black, White, Gray, Tan, Clear. 1182T2 — Available Brown, Black. 3182N & 3162N —Black only. 1182T2 3182N 3162N — Stock Putups 250 - 1000. 1182S - 1182T — Stock Putups: 25, 100, 500, 1000.



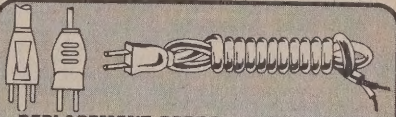
PARALLEL CORD WITH PLUG

DEARBORN NO.	SIZE & NO. OF COND.	STRANDING	TYPE OF INSUL.	NOM. O.D.	U.L. TYPE	CORD LENGTH
9650	18/2	41/34	Plastic, Brn.	.110x.207	SPT-1	6 ft.
9651	18/2	41/34	Plastic, Brn.	.110x.207	SPT-1	9 ft.
9652	18/2	41/34	Neoprene	.140x.276	HPN	6 ft.

Construction: 18/2 SPT-1 or HPN cord with a molded plastic plug on one end and other end conductor split 1" stripped; twisted ⅝".

EXTENSION CORDS—2 CONDUCTOR

DEARBORN NO.	COND. SIZE	COND. STRANDING	RATING (AMPS.)	U.L. STYLE	NOM. O.D.	CORD LENGTH FT.
9620	18/2	41/34	7	SV	.245	6
9622	18/2	41/34	7	*SV	.245	9
9624	18/2	16/30	7	SJ	.300	10
9626	18/2	16/30	7	SJ	.300	25
9628	16/2	26/30	10	SJ	.325	10
9630	16/2	26/30	10	SJ	.325	25
9632	16/2	26/30	10	SJ	.325	50
9634	16/2	26/30	10	SJ	.325	100
3 CONDUCTOR						
9636	18/3	16/30	7	SJ	.330	10
9638	18/3	16/30	7	SJ	.330	25
9639	18/3	16/30	7	SJ	.330	50
9640	16/3	26/30	10	SJ	.365	15
9641	16/3	26/30	10	SJ	.365	10
9642	16/3	26/30	10	SJ	.365	25
9644	16/3	26/30	10	SJ	.365	50



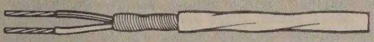
REPLACEMENT CORDS—2 CONDUCTOR

DEARBORN NO.	COND. SIZE	COND. STRANDING	RATING (AMPS.)	U.L. STYLE	NOM. O.D.	CORD LENGTH FT.
9600	18/2	41/34	7	*SV	.245	6
9602	18/2	41/34	7	*SVT	.245	6
9604	18/2	41/34	7	SVT	.245	6
9606	18/2	16/30	7	SJ	.300	8
9608	18/2	16/30	7	SJ	.300	10
9610	16/2	26/30	10	SJ	.325	8
9612	16/2	26/30	10	SVT	.325	10
3 CONDUCTOR						
9601	18/3	41/34	7	SV	.255	6
9603	18/3	41/34	7	SV	.255	8
9609	18/3	41/34	7	*SVT	.255	6
9615	18/3	16/30	7	SJ	.330	6
9617	18/3	16/30	7	SJ	.330	8
9637	18/3	16/30	7	*SJT	.330	8
9643	18/3	16/30	7	SJO	.330	8
9619	16/3	26/30	10	SJ	.365	9

Shielded Microphone, Sound and Intercom Cables

SOUND AND INTERCOM CABLES

Each conductor is solid or stranded tinned copper (See Chart), insulated with color coded polyvinylchloride. Conductors are twisted and shielded with either a spiral wrapped tinned copper shield or a tinned copper braided shield −20°C to +60°C. Ideal for all types of public address or sound work, recording studios, and other types of audio circuits requiring shielding. Sizes 16 thru 22 rated at 350 V working voltage. Sizes 14 and 12 are rated at 450 Volts working voltage. **.020" nom. jacket,** thk. of chrome PVC.



SPIRAL SHIELDED INTERCOM CABLE

DEARBORN NO.	NO. OF COND.	COND. SIZE	STRANDING	NOM. WALL THICK.	NOM. O.D.
692202	2	22	7/30	.016	.175
692203	3	22	7/30	.016	.190
692204	4	22	7/30	.016	.200
692206	6	22	7/30	.016	.235
692001	1	20	10/30	.016	.130
692002	2	20	10/30	.016	.195
692003	3	20	10/30	.016	.210
692004	4	20	10/30	.016	.225
692006	6	20	10/30	.016	.265
691801	1	18	16/30	.016	.135
691802	2	18	16/30	.016	.230
691803	3	18	16/30	.016	.235
691804	4	18	16/30	.016	.245
691602	2	16	26/30	.016	.240
691603	3	16	26/30	.016	.245
691402	2	14	41/30	.020	.285
691403	3	14	41/30	.020	.290
691202	2	12	65/30	.020	.325
691203	3	12	65/30	.020	.330

STANDARD PUT UPS: 100 Ft., 500 Ft., 1000 Ft.

BRAIDED SHIELD INTERCOM CABLE

DEARBORN NO.	NO. OF COND.	COND SIZE	STRANDING	NOM. WALL THICK.	NOM. O.D.
812202	2	22	Solid	.016	.175
742202	2	22	7/30	.016	.185
742203	3	22	7/30	.016	.200
742204	4	22	7/30	.016	.210
742001	1	20	10/30	.016	.135
812002	2	20	Solid	.016	.210
742002	2	20	10/30	.016	.210
742003	3	20	10/30	.016	.220
742004	4	20	10/30	.016	.230
741801	1	18	16/30	.016	.145
811802	2	18	Solid	.016	.220
741802	2	18	16/30	.016	.235
741803	3	18	16/30	.016	.245
741804	4	18	16/30	.016	.255
741602	2	16	26/30	.016	.250
741603	3	16	26/30	.016	.255
741402	2	14	41/30	.020	.290
741403	3	14	41/30	.020	.295
741202	2	12	65/30	.020	.335
741203	3	12	65/30	.020	.340

STANDARD PUT UP: 100 Ft., 500 Ft., 1000 Ft.

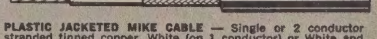
MICROPHONE CABLE

RUBBER OR NEOPRENE JACKETED MIKE CABLE—Stranded tinned copper conductor with color coded rubber insulation. Cotton wrap, braided tinned copper shield; cotton wrap, tough black neoprene or rubber jacket overall.

RUBBER JACKETED MIKE CABLE

DEARBORN NO.	NO. OF COND. & SIZE	STRANDING	WALL THICK.	NOM. CAP. PER FT.	NOM. JKT. THICK.	NOM. O.D.
662001	1-20	26/34	.040	60 MMF	.035	.230
662002	2-20	26/34	.020	68 MMF	.035	.270
661801	1-18	41/34	.040	69 MMF	.035	.240
661802	2-18	41/34	.020	78 MMF	.035	.295
NEOPRENE JACKETED MIKE CABLE						
601801	1-18	41/34	.040	69 MMF	.035	.240
601802	2-18	41/34	.020	78 MMF	.035	.295
601602	2-16	65/34	.025	82 MMF	.035	.335

STANDARD PUT UP: 100 Ft., 500 Ft., 1000 Ft.
CAPACITY MEASURED BETWEEN 1 CONDUCTOR AND SHIELD AND ANY OTHER REMAINING CONDUCTORS.



PLASTIC JACKETED MIKE CABLE — Single or 2 conductor stranded tinned copper. White (on 1 conductor) or White and Black (on 2 conductor) polyethylene insulation. Braided or spiral wrapped tinned copper shield, with gray chrome PVC jacket overall.

BRAIDED SHIELD MIKE CABLE

DEARBORN NO.	NO. OF COND. & SIZE	STRANDING	WALL THICK.	NOM. CAP. PER FT.	NOM. JKT. THICK.	NOM. O.D.
732001	1-20	26/34	.030	36 MMF	.030	.175
682002	2-20	26/34	.014	45 MMF	.030	.245
SPIRAL SHIELD MIKE CABLE						
722201	1-22	16/34	.016	36 MMF	.020	.125
722401	1-24	7/32	.020	29 MMF	.020	.132
722202	2-22	16/34	.016	32 MMF	.030	.231

STOCK PUT UP: 100 Ft., 500 Ft., 1000 Ft.
CAPACITY MEASURED BETWEEN ONE CONDUCTOR AND REMAINING CONDUCTOR AND SHIELD CONNECTED TOGETHER.

COLOR CODE OF CONDUCTORS: 1—Black • 2—Red • 3—White • 4—Green • 5—Yellow • 6—Blue

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

Multi-Conductor Unshielded Control Cable

Neoprene or Plastic

PLASTIC JACKETED 15/5 CONTROL CABLES, 600 VOLT, VN20, 90°C

Stranded bare copper conductors, insulated with .015″* PVC color coded insulation and .005″ Nylon jacket over each conductor; cabled with fillers. Moisture resistant tape, and a black Polyvinyl-chloride jacket overall. Used for controlling temperature, voltage, pressure and relay circuits and many other electronic and electrical circuits. **All conductors color coded to IPCEA Standards (see bottom, this page).**

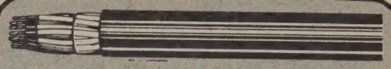
* .020″ on sizes 14 and 12; .015″ on size 16.

RUBBER INSULATED CONDUCTORS, NEOPRENE JACKETED

Stranded bare copper conductors, with color coded rubber insulation; cabled with fillers; cotton wrapped; tough Neoprene jacket overall. Used for remote control circuits. Flexible stranding and heavy duty Neoprene jacket combined, make this cable suitable for outdoor usage under extreme conditions. Neoprene jacket resists sunlight, oil, moisture, ozone, abrasion and impact.

NEC COLOR CODE FOR CONTROL CABLES: 1—Black • 2—White • 3—Red • 4—Green • 5—Orange • 6—Blue • 7—Yellow • 8—Brown • 9—Slate • 10—Purple • 11—Black/White • 12—Red/White • 13—Orange/White • 14—Blue/White • 15—Yellow/White • 16—Brown/White • 17—Slate/White • 18—Purple/White • 19—Red/Black • 20 Orange/Black • 21—Blue/Black • 22—Yellow/Black • 23—Brown/Black • 24—Slate/Black • 25—Purple/Black • 26—Black/Red • 27—Blue/Red • 28—Yellow/Red • 29—Brown/Red • 30—Slate/Red • 31—Purple/Red • 32—Black/Orange • 33—Blue/Orange • 34—Yellow/Orange • 35—Brown/Orange • 36—Slate/Orange • 37—Purple/Orange • 38—Black/Blue • 39—Red/Blue • 40—Orange/Blue

IPCEA COLOR CODING: 1—Black • 2—White • 3—Red • 4—Green • 5—Orange • 6—Blue • 7—White/Black • 8—Red/Black • 9—Green/Black • 10—Orange/Black • 11—Blue/Black • 12—Black/White • 13—Red/White • 14—Green/White • 15—Blue/White • 16—Black/Red • 17—White/Red • 18—Orange/Red • 19—Blue/Red • 20—Red/Green



UNSHIELDED CONTROL CABLE (PLASTIC)

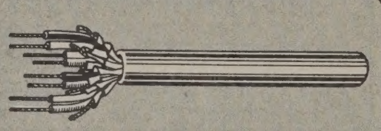
DEARBORN NO.	NO. CONDUCTOR	AWG SIZE	JKT. THICKNESS	NOM. O.D.
701602	2	16	.045	.295
701603	3	16	.045	.310
701604	4	16	.045	.335
701605	5	16	.045	.360
701606	6	16	.045	.395
701607	7	16	.045	.395
701608	8	16	.045	.420
701609	9	16	.045	.455
701610	10	16	.045	.490
701611	11	16	.045	.505
701612	12	16	.045	.505
701614	14	16	.060	.560
701616	16	16	.060	.595
701620	20	16	.060	.650
701402	2	14	.045	.325
701403	3	14	.045	.345
701404	4	14	.045	.375
701405	5	14	.045	.405
701406	6	14	.045	.440
701407	7	14	.045	.440
701408	8	14	.045	.475
701409	9	14	.045	.510
701410	10	14	.060	.585
701411	11	14	.060	.605
701412	12	14	.060	.605
701414	14	14	.060	.630
701416	16	14	.060	.665
701420	20	14	.060	.735
701202	2	12	.045	.365
701203	3	12	.045	.385
701204	4	12	.045	.420
701205	5	12	.045	.460
701206	6	12	.060	.500
701207	7	12	.060	.500
701208	8	12	.060	.570
701209	9	12	.060	.615
701210	10	12	.060	.665
701211	11	12	.060	.685
701212	12	12	.060	.685
701214	14	12	.060	.720
701216	16	12	.080	.760
701220	20	12	.080	.880

25 Ft. MINIMUM ORDER — CUT TO LENGTH — NO RETURNS

UNSHIELDED CONTROL CABLES (NEOPRENE)

DEARBORN NO.	NO. COND.	SIZE AWG	INSULATION THICKNESS	JACKET THICKNESS	NOMINAL O.D.
711805	5	18	1/32	5/64	.490
711806	6	18	1/32	5/64	.525
711808	8	18	1/32	5/64	.570
711809	9	18	1/32	5/64	.620
711810	10	18	1/32	5/64	.630
711814	14	18	1/32	6/64	.710
711605	5	16	1/32	5/64	.530
711606	6	16	1/32	5/64	.570
711607	7	16	1/32	5/64	.570
711608	8	16	1/32	5/64	.605
711610	10	16	1/32	6/64	.740
711612	12	16	1/32	6/64	.760
711614	14	16	1/32	6/64	.785
711616	16	16	1/32	6/64	.820
711620	20	16	1/32	6/64	.920
711622	22	16	1/32	6/64	.930
711624	24	16	1/32	7/64	1.010
711626	26	16	1/32	7/64	1.030
711630	30	16	1/32	7/64	1.050
711637	37	16	1/32	7/64	1.140
711640	40	16	1/32	7/64	1.175
711650	50	16	1/32	7/64	1.520
711660	60	16	1/32	7/64	1.610
711405	5	14	3/64	6/64	.695
711406	6	14	3/64	6/64	.750
711407	7	14	3/64	6/64	.760
711408	8	14	3/64	6/64	.820
711409	9	14	3/64	6/64	.925
711410	10	14	3/64	6/64	.930
711412	12	14	3/64	6/64	.935
711205	5	12	3/64	6/64	.750
711206	6	12	3/64	6/64	.810
711207	7	12	3/64	6/64	.870
711208	8	12	3/64	6/64	.920
711209	9	12	3/64	7/64	1.000
711210	10	12	3/64	7/64	1.000
711212	12	12	3/64	7/64	1.050
711216	16	12	3/64	7/64	1.160
711005	5	10	3/64	6/64	.830
711006	6	10	3/64	6/64	.890
711008	8	10	3/64	7/64	1.060
711010	10	10	3/64	7/64	1.160

25 FT. MINIMUM ORDER — CUT TO LENGTH — NO RETURNS



INDIVIDUALLY SHIELDED PAIRS

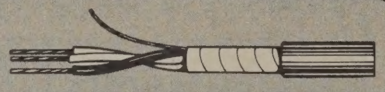
STRANDED CONDUCTORS

DEARBORN NO.	NO. OF PAIRS	NO. COND.	SIZE & STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
962201	1	2	22-7/30 ‡	.020	.135	100, 500 & 1000
962203	3	6	22-7/30	.025	.252	100, 500 & 1000
962206	6	12	22-7/30	.030	.342	100, 500 & 1000
962209	9	18	22-7/30	.035	.410	100, 500 & 1000
962211	11	22	22-7/30	.040	.457	100, 500 & 1000
962215	15	30	22-7/30	.040	.523	100, 500 & 1000
962219	19	38	22-7/30	.050	.570	100, 500 & 1000
962227	27	54	22-7/30	.055	.687	100, 500 & 1000
961803	3	6	18-16/30	.035	.372	1000
961806	6	12	18-16/30	.045	.555	1000
961809	9	18	18-16/30	.055	.620	1000
961812	12	24	18-16/30	.070	.765	1000
961815	15	30	18-16/30	.070	.830	1000

COLOR COMBINATION OF PAIRS

Pair No.	Pair No.	Pair No.
1—Black and Red	10—Red and Blue	19—White and Blue
2—Black and White	11—Red and Yellow	20—White and Yellow
3—Black and Green	12—Red and Brown	21—White and Brown
4—Black and Blue	13—Red and Orange	22—White and Orange
5—Black and Yellow	14—Green and White	23—Blue and Yellow
6—Black and Brown	15—Green and Blue	24—Blue and Brown
7—Black and Orange	16—Green and Yellow	25—Blue and Orange
8—Red and White	17—Green and Brown	26—Brown and Yellow
9—Red and Green	18—Green and Orange	27—Brown and Orange

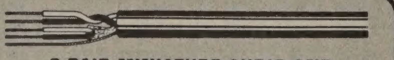
‡ .008″ Polypropylene insulation ▲ Grey or Black Jacket - Specify Color



FOIL SHIELDED, MULTI-CONDUCTOR CABLE

DEARBORN NO.	NO. COND.	AWG SIZE	STRANDING	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
972202	2	22	7/30	.025	.167	100, 500 & 1000
972203	3	22	7/30	.025	.175	100, 500 & 1000
972204	4	22	7/30	.025	.190	100, 500 & 1000
972002	2	20	10/30	.025	.195	100, 500 & 1000
972003	3	20	10/30	.025	.200	100, 500 & 1000
972004	4	20	10/30	.028	.215	100, 500 & 1000
971802	2	18	16/30	.028	.223	100, 500 & 1000
971803	3	18	16/30	.028	.236	100, 500 & 1000
971804	4	18	16/30	.028	.250	100, 500 & 1000
971602	2	16	26/30	.030	.275	100, 500 & 1000
971603	3	16	26/30	.030	.300	100, 500 & 1000
971402	2	14	41/30	.035	.340	100, 500 & 1000
971403	3	14	41/30	.035	.400	100, 500 & 1000

Color Code: 1—Black • 2—Clear • 3—Red • 4—Green



2 PAIR MINIATURE AUDIO AND SOUND CABLE
1 - Shielded — 1 - Unshielded

DEARBORN NO.	NO. OF PAIRS	NO. COND.	SIZE & STRANDING	NOM. JKT. O.D.	PUT UP (FT.)
970001	2	4	22-7/30	.165	100, 500 & 1000
970002	2	4	20-10/30	.230	100, 500 & 1000

Data and Audio Cable Miniature Sound Cable

INDIVIDUALLY SHIELDED MULTIPLE PAIRS

Tinned copper conductors, either stranded or solid (see tables), insulated with high density color coded *.010″ Polyethylene, conductors twisted into pairs. Along with a †22 gauge stranded tinned copper drain wire, each pair is shielded with a Mylar supported aluminum foil shield. Covered with a Grey PVC jacket overall. Used for all circuits requiring isolation between pairs. Especially suitable for multiple audio and data control circuits. Mylar Wrap between shields and jacket.

* .016″ on #18 gauge † #20 on #18 gauge

FOIL SHIELDED, PLASTIC JACKETED, MULTI-CONDUCTOR CABLE

Stranded tinned copper conductors, insulated with .015″‡ thick color coded Polyethylene insulation. Conductors are cabled and, along a No. 22§ tinned copper stranded drain wire laid parallel, are shielded with aluminum foil Mylar backed shield. Gray PVC jacket overall. This type of shielding provides 100% effective shielding and is suitable for audio and data work where cross talk must be reduced to a minimum. **Temperature rating:** −20°C to +60°C. **Operating voltage rating:** 400 volts.

§ No. 20 on No. 18, No. 16, No. 14.
‡.025″ on No. 16, .032″ on No. 14.

2 PAIR MINIATURE AUDIO AND SOUND CABLE

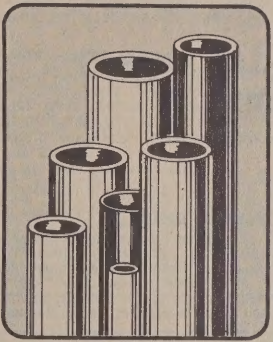
Tinned copper, .009″¶ Polypropylene insulation on 970001. 1 pair of black and red shielded with Mylar aluminum shield. Other pair of white and green twisted, not shielded. Both pairs twisted with #22 stranded T.C. drain wire and chrome vinyl jacket overall.

¶ .015″ PVC on 970002

DEARBORN WIRE AND CABLE COMPANY

Extruded Tubing

- Plastic
- Polyvinyl Chloride
- High and Low Temperature
- MIL-Spec and U.L.
- TFE Teflon* (MIL-I-22129B)
- Lightwall
- Thinwall
- Standard Wall



"PVC" U.L./MIL 105°C

Dearborn No.	Size	Nom. I.D. Inches	Nom. Wall Thickness	Stock Put Up (Ft.)
SM24	24	.022	.012	100 & 1000
SM22	22	.027	.012	100 & 1000
SM20	20	.034	.016	100 & 1000
SM19	19	.038	.016	100 & 1000
SM18	18	.042	.016	100 & 1000
SM17	17	.047	.016	100 & 1000
SM16	16	.053	.016	100 & 1000
SM15	15	.059	.016	100 & 1000
SM14	14	.066	.016	100 & 500
SM13	13	.076	.016	100 & 500
SM12	12	.085	.016	100 & 500
SM11	11	.095	.016	100 & 500
SM10	10	.106	.016	100 & 500
SM9	9	.118	.020	100 & 500
SM8	8	.133	.020	100 & 500
SM7	7	.148	.020	100 & 500
SM6	6	.166	.020	100 & 500
SM5	5	.186	.020	100 & 200
SM4	4	.208	.020	100 & 200
SM3	3	.234	.020	100 & 200
SM2	2	.263	.020	100 & 200
SM1	1	.294	.020	100 & 200
SM0	0	.330	.020	100 & 200
SM516	5/16	.312	.025	100 & 200
SM380	3/8	.375	.025	50 & 100
SM716	7/16	.438	.025	50 & 100
SM120	1/2	.500	.025	50 & 100
SM916	9/16	.562	.030	50
SM580	5/8	.625	.030	50
SM340	3/4	.750	.035	50
SM780	7/8	.875	.035	50
SM100	1	1.000	.035	50
SM114	1-1/4	1.250	.040	25
SM138	1-3/8	1.375	.040	25
SM112	1-1/2	1.500	.045	25
SM134	1-3/4	1.750	.055	25
SM200	2	2.000	.060	25
SM214	2-1/4	2.250	.065	25
SM212	2-1/2	2.500	.070	25

STOCK COLORS: Black, White, Red, Yellow, Blue, Green and Clear.

THINWALL / TEFLON

Dearborn No.	Size	Nom. I.D. Inches	Nom. Wall Thickness	Stock Put Up (Ft.)
				Spools
TW30	30	.013	.009	100 & 1000
TW28	28	.015	.009	100 & 1000
TW26	26	.018	.009	100 & 1000
TW24	24	.022	.009	100 & 1000
TW22	22	.027	.009	100 & 1000
TW20	20	.034	.012	100 & 1000
TW19	19	.038	.012	100 & 1000
TW18	18	.042	.012	100 & 1000
TW17	17	.047	.012	100 & 1000
TW16	16	.053	.012	100 & 1000
TW15	15	.059	.012	100 & 1000
TW14	14	.066	.012	100 & 500
TW13	13	.076	.012	100 & 500
TW12	12	.085	.012	100 & 500
TW11	11	.095	.012	100 & 500
TW10	10	.106	.012	100 & 500
TW9	9	.118	.015	100 & 500
TW180	1/8	.125	.015	100 & 500
Items below on Coils				
TW8	8	.138	.015	100
TW7	7	.148	.015	100
TW6	6	.166	.015	100
TW5	5	.188	.015	100
TW4	4	.208	.015	100
TW3	3	.234	.015	50
TW140	1/4	.250	.015	50
TW2	2	.263	.015	50
TW1	1	.294	.015	50
TW516	5/16	.312	.015	50
TW0	0	.330	.015	50

■ **POLYVINYL CHLORIDE "SM" 105°C U.L./MIL** This is a high temperature tubing meeting both U.L. and MIL-I-631C, Type F, Form U, Grade C, Class 1, (FUNGUS RESISTANT), Category 1 requirements. **Temperature rating:** −20°C to +105°C. **Specs:** MIL-I-631C, ASTM D-922 Grade C. U.L. File number on request.

■ **TFE TEFLON TUBING** Extruded TFE Teflon in three Wall Thicknesses. Lightwall: (.006″ to .012″), Thinwall: (.009″ to .015″), Standard: (.010″ to .020″).
Operating Temperature Range: −65°C to +250°C. Unaffected by soldering iron temperatures. Dearborn extruded Teflon tubing is chemically inert, has zero moisture absorption and its dielectric strength at high frequencies surpasses other types of insulation even at maximum operating temperatures.
These three wall thicknesses offer an excellent choice for use in miniaturization and compactness of design, especially where high heat, and a chemical solvent and corrosion resistant material is desired.
Meets requirements of— MIL-I-22129B, MIL-P-14077, MIL-P-14078, AMS-3651, AMS-3653.
COLOR CODE: 1—Clear or Natural • 2—Black • 3—Red • Other colors available on Special Order.

* Du Pont Trademark.

Heat Shrinkable Tubing

Style ST-301

STYLE ST-301

100′ — 25 x 4′ LENGTHS PER BOX					6″ LENGTHS
DEARBORN NO.	EXP. SIZE	MIN. I.D.	REC. I.D.	WALL THICK.	NO. OFL ENGTHS PER BOX
ST-301-3/64	3/64″	.046″	.023″	.016″	40
ST-301-1/16	1/16″	.063″	.031″	.017″	36
ST-301-3/32	3/32″	.093″	.046″	.020″	32
ST-301-1/8	1/8″	.125″	.062″	.020″	28
ST-301-3/16	3/16″	.187″	.093″	.020″	24
ST-301-1/4	1/4″	.250″	.125″	.025″	20
ST-301-3/8	3/8″	.375″	.187″	.025″	16
20′ — 5 x 4′ LENGTHS PER BOX					6″ LENGTHS
ST-301-1/2	1/2″	.500″	.250″	.025″	14
ST-301-3/4	3/4″	.750″	.375″	.030″	12
ST-301-1	1″	1.00″	.500″	.035″	8
ST-301-1½	1½″	1.50″	.750″	.040″	5
ST-301-2	2″	2.00″	1.00″	.045″	3
8′ — 2 x 4′ LENGTHS PER BOX					6″ LENGTHS
ST-301-3	3″	3.00″	1.50″	.050″	2
ST-301-4	4″	4.00″	2.00″	.055″	1

Specify 4′ or 6″ Box When Ordering.
Stock Colors: Clear, Black, Red and White — Specify Color.

STYLE ST-301 POLYOLEFIN HEAT SHRINKABLE TUBING TO MIL-I-23053B/5, U.L. APPROVED

Dearborn Style ST-301 Heat Shrinkable Tubing is an irradiated, thermally stabilized, polyolefin product which meets or exceeds MIL-I-23053B/5, AMS 3636B and AMS 3637B. ST-301 shrinks to 50% of diameter at 121°C (250°F) in 7 seconds, and has an operating temperature range of −55°C (−67°F) to +135°C (+275°F).
MIL-I-23053/5 — CLASS I (COLORED INSULATION)
MIL-I-23053/5 — CLASS II (CLEAR INSULATION)

All sizes are shown and supplied in expanded inside diameters. Stock Colors: Black, Red, White and Clear. Clear is Non-Flame Retardant. All other colors are Flame Retardant under MIL-I-23053B/5. Additional colors available on special order. Supplied in either 4 Ft. or 6 Inch lengths, and 6 Inch Assortments. Suitable for all military applications as well as industrial and commercial uses.

ST-301 Kit Assortments Available in 6″ lengths, Assorted colors AST-301-1-6 — 3/64″ thru 3/16″ (30) Lengths. AST-301-2-6 — 1/4″ thru 3/4″ (16) Lengths.

Detects Faulty Circuits Instantly!

CIRCUIT MONITOR

HELPS PREVENT FIRE DAMAGE, AND LOSS!

The Circuit Monitor detects whether or not proper ground and AC polarity are available from 115 Volt 3 wire power outlets for safe operation of power tools, appliances, office machines, lab and other electrical equipment. It does the job instantly anc accurately without the inconvenience of handling probes and meters.

Dearborn No.	Description
5102B	Circuit Monitor in Box.
5012C	Circuit Monitor on Card for Display Rack.

EASY TO USE. Simply plug into 3 wire receptacle and lights on Circuit Monitor will indicate the following:

▲	**O & K**	Circuit Okay
▲	**O only**	Improper Ground
▲	**K only**	Improper Neutral
▲	**O & X**	Reversed Polarity
▲	**K & X**	Reversed Ground
▲	**None**	Power is OFF

DEARBORN WIRE AND CABLE COMPANY

MIL-W-3861 Type S, QQ-W-343 Type S, ASTM B-33 Uninsulated Tinned or Silver Plated Copper Wire

FLAT BRAID

Tinned copper strands, woven and rolled flat to specific width depending on construction, number of strands, etc.
Used for bonding, straps, grounding, or connecting moving parts. Recommended for high current usage.

***FLAT TINNED COPPER BRAID**

DEARBORN NO.	NOM. FLAT WIDTH (INCHES)	TOT. NO. INDIV. STRANDS	SIZE EACH STRAND AWG	NOM. CIRCULAR MIL AREA	STOCK (PUT UPS (FT.)
91221	.025	8	36	200	100, 500 & 1000
91222	1/32	16	36	400	100, 500 & 1000
91223	3/64	24	36	600	100, 500 & 1000
91224	3/32	48	36	1200	100, 500 & 1000
91229	1/8	72	36	1800	100, 500 & 1000
91230	3/16	120	36	3000	100, 500 & 1000
91231	1/4	168	36	4200	100, 500 & 1000
91232	3/8	288	36	7200	100, 500 & 1000
91233	1/2	384	36	9600	100, 500 & 1000
91234	3/4	832	36	20,800	100, 500 & 1000
91235	1	832	36	20,800	100, 500 & 1000
91239	1-3/8	336	30	33,700	100, 500 & 1000
91240	1-1/2	528	30	53,064	100, 500 & 1000
91241	1-3/4	1248	30	125,424	100, 500 & 1000
91242	2	1536	30	154,368	100, 500 & 1000

*Commercial Type.

TUBULAR BRAID

Tinned copper braid woven in completely round configuration as outlined in MIL-SPEC QQ-B-575. All strands soft drawn tinned copper. Shielding is 95% or more when placed over equivalent diameter mandrel to the inside diameter of the tubular braid. Used as both shielding and protective covering.

TINNED COPPER TUBULAR BRAID

DEARBORN P/N	SIZE I.D. INCHES	TOTAL NO. INDIVDUAL STRANDS	SIZE EACH STRAND AWG	NOM. CIRCULAR MIL AREA	STOCK PUT UPS (FT.)
92160	1/32	24	36	600	100
92162	1/16	48	36	1200	100
92164	7/64	96	36	2400	100
92166	1/8	120	36	3000	100
92168	11/64	168	36	4200	100
92170	13/64	192	34	7630	100
92171	1/4	384	36	9600	100
92172	3/8	384	36	9600	100
92174	1/2	528	36	13,200	100
92175	9/16	480	30	48,240	100
92176	25/32	864	36	21,600	100
92177	* 7/8	336	30	33,700	50 & 100
92178	*1	384	30	38,600	50 & 100
92179	*1-1/8	432	30	43,330	50 & 100
92180	*1-1/4	480	30	48,150	50 & 100
92181	*1-3/8	528	30	53,000	50 & 100
92182	*1-1/2	576	30	57,775	50 & 100

SOFT DRAWN SOLID WIRE

Properly annealed, pure electrolytic soft, drawn, solid, tinned or silver plated copper wire used for applications such as point to point wiring, component leads, and ground wire.

UNINSULATED TINNED COPPER WIRE

DEARBORN NO.	CONDUCTOR SIZS	NOM. CIRCULAR MIL AREA	NOM. O.D.	STOCK PUT UPS (FT.)
938	38	16.0	.004	100 & 1000
936	36	25.0	.005	100 & 1000
934	34	39.7	.006	100 & 1000
932	32	64.0	.008	100 & 1000
930	30	100.5	.010	100 & 1000
928	28	159.8	.013	100 & 1000
926	26	254.1	.016	100 & 1000
924	24	404.0	.020	100 & 1000
922	22	642.4	.025	100 & 1000
920	20	1,022.0	.033	100 & 1000
918	18	1,642.0	.040	100 & 1000
916	16	2,583.0	.051	100 & 1000
914	14	4,107.0	.065	100 & 1000
912	12	6,530.0	.082	100 & 1000
910	10	10,380.0	.103	100 & 1000
908	8	16,510.0	.129	100 & 1000
906	6	26,250.0	.162	100 & 1000

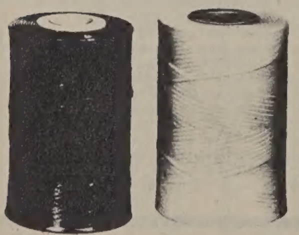
UNINSULATED SILVER PLATED WIRE

DEARBORN NO.	CONDUCTOR SIZS	NOM. CIRCULAR MIL AREA	NOM. O.D.	STOCK PUT UPS (FT.)
922SPC	22	642.4	.025	100 & 1000
920SPC	20	1,022.0	.033	100 & 1000
918SPC	18	1,642.0	.040	100 & 1000
916SPC	16	2,583.0	.051	100 & 1000
914SPC	14	4,107.0	.065	100 & 1000

Suffix SPC denotes Silver Plated Copper

Lacing Tapes and Twine Meeting and Exceeding Military and Commercial Specifications

NYLON LACING TAPE
MIL-T-43435 TYPE I



- **INDUSTRIAL PRICING!**
- **SAME DAY SHIPMENT!**

Designed to Meet and Exceed MIL-T-713D, Type P, and MIL-T-43435 Types I, II, and IV, also AMS 3815, AMS 3816, AMS 3817.

FINISHES AND COATINGS

- **W — WAX, MIL SPEC "B"**

A microcrystalline fungicidal wax which exceeds military specifications, provides excellent knot retention and is suitable for either lacing or spot ties.

- **G — SYNTHETIC RUBBER, MIL SPEC "C"**

A special continuous coating of fungicidal synthetic elastomer (rubber) which exceeds Mil Spec requirements, ties easily and exhibits outstanding knot holding characteristics.

- **A — SYNTHETIC RESIN, MIL SPEC "E"**

A synthetic rubber-like resin formulated with fungicidal ingredients. Handling characteristics are excellent, knot retention is outstanding; meets or exceeds Mil Spec requirements. Operational Temperature Ranges: −67°F to +250°F on all items.

NYLON LACING TWINE MIL-T-713D TYPE P

Round twisted nylon fiber impregnated with microcrystalline fungicidal wax.

POLYESTER LACING TAPE MIL-T-43335 TYPE II

Flat braided polyester yarn impregnated with special finishes to military specifications. **Available in 500-yard spools.**

NYLON LACING TAPE MIL-T-43435 TYPE I

Flat braided high-tenacity nylon yarn impregnated with microcrystalline fungicidal wax or impregnations to meet military specifications. **Available in 500-yard spools.**

NYLON LACING TAPE MIL-T-43435 TYPE I

Flat braided high-tenacity nylon yarn impregnated with microcrystalline fungicidal wax or impregnations to meet military specifications. Available in 500-yard spools.

MIL SPEC SIZE	DEARBORN PART NO.	TEST TENSILE STRENGTH	WIDTH	COLOR	FINISH	MIL SPEC FINISH
3	805032W	50 lbs.	.090″	Natural	A	E
3	805032B	50 lbs.	.090″	Black	A	E
4	802534W	25 lbs.	.062″	Natural	W	B
4	802534B	25 lbs.	.062″	Black	W	B
3	805036W	50 lbs.	.090″	Natural	W	B
3	805036B	50 lbs.	.090″	Black	W	B
3	805040W	50 lbs.	.090″	Natural	G	C
3	805040B	50 lbs.	.090″	Black	G	C

POLYESTER LACING TAPE MIL-T-43335 TYPE II

Flat braided polyester yarn impregnated with special finishes to military specifications. Available in 500-yard spools.

MIL SPEC SIZE	DEARBORN PART NO.	TEST TENSILE STRENGTH	WIDTH	COLOR	FINISH	MIL SPEC FINISH
3	805058W	50 lbs.	.090″	Natural	A	E
3	805058B	50 lbs.	.090″	Black	A	E
3	805062W	50 lbs.	.090″	Natural	W	B
3	805062B	50 lbs.	.090″	Black	W	B

NYLON LACING TWINE MIL-T-713D TYPE P

Round twisted nylon fiber impregnated with microcrystalline fungicidal wax.

MIL SPEC CLASS	DEARBORN PART NO.	TEST TENSILE STRENGTH	NOM. DIAM.	PUT-UP 1 LB. SPOOL (LENGTH)	COLOR	FINISH	MILSPEC FINISH
1	807013W	70 lbs.	.039″	550 yds.	Natural	W	B
1	807013B	70 lbs.	.039″	550 yds.	Black	W	B
2	804814W	48 lbs.	.029″	750 yds.	Natural	W	B
2	804814B	48 lbs.	.029″	750 yds.	Black	W	B
3	803215W	32 lbs.	.025″	1100 yds.	Natural	W	B
3	803215B	32 lbs.	.025″	1100 yds.	Black	W	B

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

Teflon* Insulated Aircraft, Missile and Electronic Wire and Cable

MIL-W-16878D, TYPE ET
Voltage Rating: 250 volts. **Temperature Rating:** −65°C to +200°C. Single conductor stranded silver plated copper, extruded TFE Teflon insulation.

MIL-W-7139B, CLASS I WIRE
Voltage Rating: 600 volts. **Temperature Rating:** −65°C to +200°C. Silver plated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with blue tracer. Teflon impregnated fiberglass braid overall.

MIL-W-7139B, CLASS II WIRE
Voltage Rating: 600 volts. **Temperature Rating:** −65°C to +260°C. Nickel coated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with orange tracer. Teflon impregnated fiberglass braid overall.

MIL-W-16878D, TYPE ET, TEFLON

DEARBORN P/N	TYPE & CONDUCTOR AWG SIZE & STRAND.		NOM. WALL THICKNESS	NOM. O.D.	STOCK P.U. (FT.)	STOCK COLORS
33207	ET-32	7/40	.006	.021	500 & 1000	0-9
33219	ET-32	19/44	.006	.023	500 & 1000	0-9
33007	ET-30	7/38	.006	.024	500 & 1000	0-9
33019	ET-30	19/42	.006	.024	500 & 1000	0-9
32807	ET-28	7/36	.006	.027	500 & 1000	0-9
32819	ET-28	19/40	.006	.027	500 & 1000	0-9
32607	ET-26	7/34	.006	.031	500 & 1000	0-9
32619	ET-26	19/38	.006	.031	500 & 1000	0-9
32407	ET-24	7/32	.006	.036	500 & 1000	0-9
32419	ET-24	19/36	.006	.036	500 & 1000	0-9
32207	ET-22	7/30	.006	.042	500 & 1000	0-9
32219	ET-22	19/34	.006	.042	500 & 1000	0-9
32007	ET-20	7/28	.006	.050	500 & 1000	0-9
32019	ET-20	19/32	.006	.050	500 & 1000	0-9

MIL-W-7139B, CLASS I WIRE

DEARBORN P/N	CONDUCTOR AWG SIZE & STRANDING		NOMINAL O.D. FINISHED WIRE	STOCK PUT UP (FT.)
82219	22	19/34	.087	500 & 1000
82019	20	19/32	.097	500 & 1000
81819	18	19/30	.112	500 & 1000
81619	16	19/29	.132	500 & 1000
81419	14	19/27	.147	500 & 1000
81219	12	19/25	.167	500 & 1000
81037	10	37/26	.197	500 & 1000
88133	8	133/29	.250	500 & 1000
86133	6	133/27	.293	500 & 1000
84133	4	133/25	.350	500 & 1000
82665	2	665/30	.435	500 & 1000
81817	1	817/30	.480	500 & 1000
80001	0	1045/30	.540	500 & 1000
80002	00	1330/30	.590	500 & 1000
80003	000	1665/30	.654	500 & 1000
80004	0000	2109/30	.743	500 & 1000

MIL-W-7139B, CLASS II WIRE

DEARBORN P/N	CONDUCTOR AWG SIZE & STRANDING		NOMINAL O.D. FINISHED WIRE	STOCK PUT UP (FT.)
82219N	22	19/34	.087	500 & 1000
82019N	20	19/32	.097	500 & 1000
81819N	18	19/30	.112	500 & 1000
81619N	16	19/29	.132	500 & 1000
81419N	14	19/27	.147	500 & 1000
81219N	12	19/25	.167	500 & 1000
81037N	10	37/26	.197	500 & 1000
88133N	8	133/29	.250	500 & 1000
86133N	6	133/27	.293	500 & 1000
84133N	4	133/25	.350	500 & 1000
82665N	2	665/30	.435	500 & 1000
81817N	1	817/30	.480	500 & 1000
80001N	0	1045/30	.540	500 & 1000
80002N	00	1330/30	.590	500 & 1000
80003N	000	1665/30	.654	500 & 1000
80004N	0000	2109/30	.743	500 & 1000

COLOR CODE ON HOOKUP WIRE: 0—Black, 1—Brown, 2—Red, 3—Orange, 4—Yellow, 5—Green, 6—Blue, 7—Violet, 8—Grey, 9—White. Other Colors and Stripe Combinations Available Upon Request.

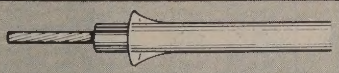
MIL-W-5086A Unshielded Aircraft Wire

For use as airframe wire at temperatures within the range of −55°C to +105°C. Voltage rating is 600 volts. Both types are resistant to water, aircraft fuels, hydraulic fluid, oils, skydral, ethyleneglycol, dilute acids, alcohol, alkalis, fungus and abrasion.

TYPE I — AN-22 THRU AN-12
Single conductor stranded tinned copper with white PVC insulation and a clear (polyamide) nylon jacket overall.

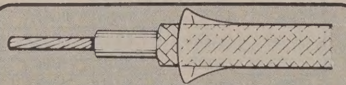
TYPE II — AN-22 THRU AN-12
Single conductor stranded tinned copper with white PVC insulation, white glass braid and a clear nylon jacket overall.

TYPE II — AN-10 THRU AN-0000
Single conductor stranded tinned copper with white PVC insulation, white glass braid, flame retardant nylon lacquered nylon braid overall.



MIL-W-5086A TYPE I

DEARBORN P/N	MIL P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
102219	AN-22	22	19/34	.068	100 & 1000
102019	AN-20	20	19/32	.078	100 & 1000
101819	AN-18	18	19/30	.088	100 & 1000
101619	AN-16	16	19/29	.098	100 & 1000
101419	AN-14	14	19/27	.117	100 & 1000
101219	AN-12	12	19/25	.137	100 & 1000

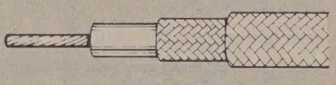


MIL-W-5086A TYPE II

DEARBORN P/N	MIL P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
AN-22 THROUGH AN-12					
112219	AN-22	22	19/34	.075	100 & 1000
112019	AN-20	20	19/32	.085	100 & 1000
111819	AN-18	18	19/30	.095	100 & 1000
111619	AN-16	16	19/29	.105	100 & 1000
111419	AN-14	14	19/27	.125	100 & 1000
111219	AN-12	12	19/25	.143	100 & 1000
AN-10 THROUGH AN-0000					
111049	AN-10	10	49/27	.189	100 & 1000
118133	AN-8	8	133/29	.240	100 & 1000
116133	AN-6	6	133/27	.293	100 & 1000
114133	AN-4	4	133/25	.355	100 & 1000
112665	AN-2	2	665/30	.425	100 & 1000
111817	AN-1	1	817/30	.470	100 & 1000
110001	AN-0	0	1045/30	.525	100 & 1000
110002	AN-00	00	1330/30	.590	100 & 1000
110003	AN-000	000	1661/30	.645	100 & 1000
110004	AN-0000	0000	2104/30	.715	100 & 1000

MIL-W-8777B - MS 25471
SILICONE AIRCRAFT WIRE

These wires are intended for installation in aircraft electrical systems where potential does not exceed 600 volts (RMS). Temperature limits are −55°C to +200°C. Single conductor silver plated copper, silicone rubber insulation, glass and dacron braid impregnated with high temperature lacquer and a white dacron braid and high temperature lacquer overall. Resistant to aircraft fuels, hydraulic fluid, oils, water, skydral, ethyleneglycol, dilute acids, alcohol, alkalis, fungus and abrasion.



MIL-W-8777B - MS 25471
SILICONE AIRCRAFT WIRE

DEARBORN P/N	MIL P/N	AWG SIZE	STRANDING	NOM. O.D.	PUT UP (FT.)
162219	MS 25471-22	22	19/34	.085	100 & 1000
162019	MS 25471-20	20	19/32	.095	100 & 1000
161819	MS 25471-18	18	19/30	.110	100 & 1000
161619	MS 25471-16	16	19/29	.125	100 & 1000
161419	MS 25471-14	14	19/27	.143	100 & 1000
161219	MS 25471-12	12	19/25	.163	100 & 1000
161049	MS 25471-10	10	49/27	.193	100 & 1000
168133	MS 25471-8	8	133/29	.248	100 & 1000
166133	MS 25471-6	6	133/27	.303	100 & 1000
164133	MS 25471-4	4	133/25	.360	100 & 1000

ALSO AVAILABLE
MIL-W-5086A — TYPE III
MIL-W-5274A — TYPE I, CLASS A
MIL-W-5274A — TYPE II, CLASS A
MIL-W-22759 — TYPE I
MS — 21985
MS — 21986
NAS 702, TYPES U AND S, CLASSES A, B, C
NAS 703, TYPES U, S, SJ, CLASSES A AND C
CALL DEARBORN ON ALL YOUR WIRE REQUIREMENTS

Consult Us for MIL-W-5086A - MIL-C-7078A Shielded Aircraft Wire for Electrical Systems

BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE I
Stranded tinned copper conductors, with color coded Polyvinylchloride insulation and a clear Nylon jacket on each conductor; cabled, with a braided tinned copper shield (85% coverage) overall.

BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE I
Stranded tinned copper conductors, insulated with white PVC, color coded glass braid on each conductor. Each conductor has clear Nylon jacket over glass braid insulation. Conductors are cabled and have braided tinned copper shield (85% coverage) overall.

BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE II
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type I, with addition of a clear Nylon jacket over the shield.

BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE II
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type II, with addition of clear Nylon jacket over the shield.

GENERAL CHARACTERISTICS — Temperature rating: −55°C to +105°C. **Voltage rating:** 600 Volts. Resistant to effects of oil, water, hydraulic fuel, skydrol, aircraft fuels, ethyleneglycol, alcohol, dilute acids, alkalis, fungus, and abrasion.

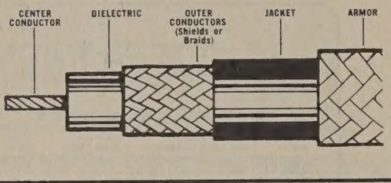
DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

RG Coaxial Cable

Dearborn has the most complete selection of RG Coaxial Cable in the nation, manufactured to meet the needs of government and industry . . . backed by America's most dependable quality warranty.

Nomenclature



Operating Temperature Limits for Cable Jackets

MILITARY DESIGNATION	JACKET TYPE	TEMPERATURE LIMITS
TYPE I	Black Polyvinylchloride	−40°C to +80°C
TYPE II	Grey Polyvinylchloride	−25°C to +80°C
TYPE IIa	Black or Grey Polyvinylchloride	Under ¼" O.D. −55°C to +90°C Over ¼" O.D. −40°C to +90°C
TYPE IIIa	Black Polyethylene	−55°C to +85°C
TYPE IV	Black Synthetic Rubber	Under ½" −55°C to +80°C Over ½" −40°C to +80°C
TYPE V	Fiberglas Braid	−55°C to +250°C
TYPE VI	Silicon-Rubber Dacron Braid	−55°C to +175°C
TYPE VII	Teflon (PTFE)	−55°C to +250°C
TYPE VIII	Synthetic Rubber	−55°C to +75°C
TYPE IX	Teflon (FEP)	−55°C to +200°C

EXPLANATION OF NOMENCLATURE

CENTER CABLE CONDUCTORS

Center cable conductors may be solid or stranded wires, or in some cases, a tube. Selection is made on the mechanical and electrical properties desired. Solid wires result in lowest cable attentuation. Stranding permits increased cable flexibility but also increases attenuation. Bare, tinned, or silver plated copper wire is usually used for center conductors. Other materials are Copperweld, Cadmium Bronze, Aluminum, Nichrome and Karma.

DIELECTRICS (CABLE)

EXTRUDED POLYETHYLENE

Low cost, flexibility, ease of application, high dielectric strength and low dielectric constant make it well suited for RF applications. It is the most commonly used low temperature cable dielectric.

FOAM CORE (CELLULAR POLYETHYLENE)

An excellent low temperature dielectric formed by expanding polyethylene with millions of bubbles of an inert gas. Its low dielectric constant of 1.5 for Foam Core compared to 2.26 for solid polyethylene permits the design of lower attenuation and low capacity cables.

TEFLON

Teflon will withstand high temperature applications. It has high dielectric strength and a very low dielectric constant. Its ability to withstand exposure to gases and liquids makes it the dielectric selected where other materials would be inadequate.

CABLE OUTER CONDUCTORS

SHIELDS† OR BRAID

The outer conductor is usually made of a metal braid but it can be a solid tube. The braid is used where flexibility is a vital factor; the tubular construction is used where a high degree of shielding is required. Tubular construction also provides lower cable attenuation. Two adjacent braids offer better shielding action than one braid. Generally speaking braids are either copper, tinned copper or silver plated copper.

† Armor

CONSULT FACTORY FOR PHYSICAL AND ELECTRICAL PROPERTIES

RG/U No.	Dearborn No.	RG/U No.	Dearborn No.	RG/U No.	Dearborn No.	RG/U No.	Dearborn No.	RG/U No.	Dearborn No.
5	6005	35B	6035B	116	6116	188A	6188A	324	6324
5A	6005A	54	6054	117	6117	195	6195	325	6325
5B	6005B	54A	6054A	117A	6117A	195A	6195A	326	6326
6	6006	55	6055	118	6118	196	6196	327	6327
6A	6006A	55A	6055A	118A	6118A	196A	6196A	328	6328
7	6007	55B	6055B	119	6119	209	6209	329	6329
8	6008	57	6057	120	6120	210	6210	330	6330
8A	6008A	57A	6057A	122	6122	211	6211	331	6331
9	6009	58	6058	126	6126	211A	6211A	332	6332
9A	6009A	58A	6058A	130	6130	212	6212	333	6333
9B	6009B	58B	6058B	131	6131	213	6213	334	6334
10	6010	58C	6058C	133	6133	214	6214	335	6335
10A	6010A	59	6059	133A	6133A	215	6215	336	6336
11	6011	59A	6059A	140	6140	216	6216	337	—
11A	6011A	59B	6059B	141	6141	217	6217	359	—
12	6012	62	6062	141A	6141A	218	6218	360	6360
12A	6012A	62A	6062A	142	6142	219	6219	366	6366
13	6013	62B	6062B	142A	6142A	220	6220	367	6367
13A	6013A	62C	6062C	142B	6142B	221	6221	369	6369
14	6014	63	6063	143	6143	222	6222	370	6370
14A	6014A	63B	6063B	143A	6143A	223	6223	372	—
15	6015	71	6071	144	6144	224	6224	373	—
17	6017	71A	6071A	146	6146	225	6225	374	6374
17A	6017A	71B	6071B	149	6149	226	6226	375	—
18	6018	74	6074	150	6150	227	6227	376	6376
18A	6018A	74A	6074A	161	6161	228	6228	377	6377
19	6019	—	6075sm	164	6164	228A	6228A	378	6378
19A	6019A	79	7679	165	6165	235	6235	379	—
20	6020	79A	6079A	166	6166	264	6264	381	—
20A	6020A	79B	6079B	174	6174	264A	6264A	382	—
21	6021	83	6083	174A	6174A	280	6280	383	6383
21A	6021A	85A	6085A	177	6177	281	6281	384	6384
22	6022	87A	6087A	178	6178	298	6298	385	6385
22A	6022A	88A/u	6088A	178A	6178A	301	6301	386	6386
22B	6022B	94	6094	178B	6178B	302	6302	388	6388
23	6023	94A	6094A	179	6179	303	6303	389	6389
23A	6023A	100	6100	179A	6179A	304	6304	391	6391
24	6024	108	6108	179B	6179B	307A	6307A	392	6392
24A	6024A	108A	6108A	180	6180	316	6316	393	6393
29	6029	111	6111	180A	6180A	317	6317	397	6397
34	6034	111A	6111A	180B	6180B	318	6318	400	6400
34A	6034A	114	6114	181	6181	319	6319	401	6401
34B	6034B	114A	6114A	187	6187	321	6321	402	6402
35	6035	115	6115	187A	6187A	322	6322	403	6403
35A	6035A	115A	6115A	188	6188	323	6323	404	6404

Cable Jacket Types

TYPE I (MIL-C-17)—Description: Black Polyvinylchloride. **Characteristics:** Excellent weathering and abrasion properties, but is of the contaminating type and will cause cable attenuation to increase with age. Can be used for direct burial.

TYPE II (JAN-C-17A)—Description: Grey Polyvinylchloride. **Characteristics:** A semi-noncontaminating jacket.

TYPE IIA (MIL-C-17)—Description: Black or Grey Polyvinylchloride. **Characteristics:** Noncontaminating. Good weathering and abrasion resistant properties. Can be used for direct burial.

TYPE IIIA (MIL-C-17)—Description: Black Polyethylene. **Characteristics:** Moisture resistant, abrasion resistant, defies ultra violet damage. Noncontaminating; recommended for direct burial.

TYPE IV (MIL-C-17)—Description: Black Synthetic Rubber. **Characteristics:** This jacket material is used only on high voltage pulse cables. The basic material is polymerized chloroprene.

TYPE V (MIL-C-17)—Description: Fiberglas Braid. **Characteristics:** Impregnated with silicone varnish to provide abrasion resistance and a moisture seal.

TYPE VI (MIL-C-17—Description: Silicone Rubber Dacron Braid. **Characteristics:** Two wraps of silicone rubber impregnated fiberglass tape which is fused into a homogeneous layer. A dacron braid is applied, followed by a high temperature fluorocarbon lacquer.

TYPE VII (MIL-C-17)—Description: Teflon (Polytetrafluordethyene). **Characteristics:** Either extruded or tape wrapped. Withstands high temperatures; chemically inert; insoluble in liquids and gases.

TYPE VIII (MIL-C-17)—Description:: Synthetic Rubber. **Characteristics:** This material is a polychloroprene compound and is used with only a few pulse cables. Its primary use is as a jacket material for multiconductor cables.

TYPE IX (MIL-C-17)—Description: Teflon (Fluorinated Ethylene Propylene). **Characteristics:** Excellent weathering properties and chemically inert. Maximum operating temperature of 200°C.

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

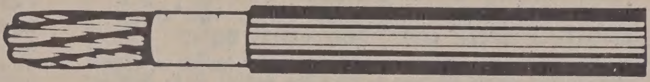
Automotive Wire

TYPE G.P.T. — SAE, TYPE I, PRIMARY WIRE
Single conductor, stranded bare copper. Color coded polyvinylchloride insulation. Resistant to grease, oil, gasoline, acid and ageing.

G.P.T. SAE TYPE 1 AUTOMOTIVE WIRE

DEARBORN NO.	AWG SIZE	STRANDING	NOM. WALL THICKNESS	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT.)
992007	20	7/28	.023	.084	2, 0	100 & 1000
991816	18	16/30	.023	.093	2, 0	100 & 1000
991619	16	19/29	.023	.102	0, 1, 2, 4, 5, 6, 9	100 & 1000
991419	14	19/27	.023	.117.	0, 1, 2, 4, 5, 6, 9	100 & 1000
991219	12	19/25	.026	.142	0, 1, 2, 4, 5, 6, 9	100 & 1000
991019	10	19/23	.031	.175	2, 9, 0	100 & 500
990865	8	65/26	.040	.230	2, 0	100 & 500
990649	6	49/23	.049	.282	2, 0	100 & 500

Welding Cable



INDUSTRO-FLEX NEOPRENE WELDING CABLE
The Industro-Flex Neoprene Series is a new development which utilizes No. 30 stranding. It has a smaller O.D. and still retains flexibility at lower prices than the standard Neoprene welding cable.

NEOPRENE AND RUBBER WELDING CABLES
These cables are constructed of stranded bare copper conductors, with a tape wrap and either a neoprene or rubber jacket overall as specified in tables at right. All have extra fine stranding, are extremely flexible and have high resistance to abrasion, impact, flexing and twisting.

INDUSTRO-FLEX NEOPRENE WELDING CABLE

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D.	CURRENT CARRYING CAP. (AMPS)	PUT UP SOLD PER FT.
820600	6	259/30	.376	75	25′ Min.
820400	4	413/30	.420	100	25′ Min.
820300	3	532/30	.455	150	25′ Min.
820200	2	665/30	.495	200	25′ Min.
820100	1	840/30	.550	250	25′ Min.
820001	1/0	1050/30	.615	300	25′ Min.
820002	2/0	1323/30	.690	375	25′ Min.
820003	3/0	1680/30	.740	450	25′ Min.
820004	4/0	2121/30	.835	500	25′ Min.

NEOPRENE WELDING CABLE

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D.	CURRENT CARRYING CAP. (AMPS)	PUT UP SOLD PER FT.
500600	6	1050/36	.400	75	25′ Min.
500400	4	1057/34	.450	100	25′ Min.
500300	3	1344/34	.490	150	25′ Min.
500200	2	1680/34	.560	200	25′ Min.
500100	1	2142/34	.610	250	25′ Min.
500001	1/0	2667/34	.680	300	25′ Min.
500002	2/0	3360/34	.730	375	25′ Min.
500003	3/0	4270/34	.810	450	25′ Min.
500004	4/0	5355/34	.900	500	25′ Min.

RUBBER WELDING CABLE

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D.	CURRENT CARRYING CAP. (AMPS)	PUT UP SOLD PER FT.
510600	6	1050/36	.400	75	25′ Min.
510400	4	1057/34	.450	100	25′ Min.
510300	3	1344/34	.490	150	25′ Min.
510200	2	1680/34	.560	200	25′ Min.
510100	1	2142/34	.610	250	25′ Min.
510010	1/0	2667/34	.680	300	25′ Min.
510002	2/0	3360/34	.730	375	25′ Min.
510003	3/0	4270/34	.810	450	25′ Min.
510004	4/0	5355/34	.900	550	25′ Min.

COLOR CODE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Gray • 9—White.

Service and Power Cords — Rubber Neoprene and Plastic

GENERAL CHARACTERISTICS

Temperature Rating: −20°C to +60°C.

Voltage Rating: Types SV, SVT, SJ, SJT, and SJO are 300 V rated; Type S and SO are 600 V rated. On SJO two types are listed: Stationary and Constant Service. Constant Service has more flexible stranding.

TYPES SV, SJ AND S/RUBBER CORD CONSTRUCTION
Conductors are stranded bare copper. Separator, color coded rubber insulation, cabled with fillers. Separator and tough rubber jacket overall.

TYPES SVT AND SJT PLASTIC CORDS
Types SVT and SJT are plastic insulated and plastic jacketed. Construction is same as SV and SJ. Jacket is black.

TYPES SJO AND SO/NEOPRENE CORD CONSTRUCTION
Conductors are stranded bare copper. Separator, color coded rubber insulation cabled with fillers. Separator and black neoprene jacket overall. Resistant to oil, grease, ozone, acid and moisture.

300 VOLT, RUBBER & NEOPRENE CORDS

DEARBORN NO.	U.L. TYPE	SIZE & NO. OF COND.	NOM. INSUL. THICK.	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
SV & SJ RUBBER (STATIONARY SERVICE)						
1182V	SV	18/2	.016	.032	.245	50, 100, 250 & 1000
1183V	SV	18/3	.016	.032	.255	50, 100, 250 & 1000
1182	SJ	18/2	.032	.032	.305	50, 100, 250 & 1000
1183	SJ	18/3	.032	.032	.330	50, 100, 250 & 1000
1184	SJ	18/4	.032	.032	.370	50, 100, 250 & 1000
1162	SJ	16/2	.032	.032	.330	50, 100, 250 & 1000
1163	SJ	16/3	.032	.032	.360	50, 100, 250 & 1000
1164	SJ	16/4	.032	.032	.400	50, 100, 250 & 1000
1142	SJ	14/2	.032	.032	.370	50, 100, 250 & 1000
1143	SJ	14/3	.032	.032	.390	50, 100, 250 & 1000
1144	SJ	14/4	.032	.032	.420	50, 100, 250 & 1000
SVT & SJT PLASTIC CORDS						
8182	SVT	18/2	.016	.032	.245	50, 100, 250 & 1000
8183	SVT	18/3	.016	.032	.255	50, 100, 250 & 1000
*8184	SVT	18/4	.016	.032	.265	50, 100, 250 & 1000
7183	SJT	18/3	.032	.032	.330	50, 100, 250 & 1000
7163	SJT	16/3	.032	.032	.360	500 & 1000
SJO, SVO NEOPRENE (STATIONARY SERVICE)						
3182	SJO	18/2	.032	.032	.305	50, 100, 250 & 1000
3182V	SVO	18/2	.032	.032	.305	50, 100, 250 & 1000
3183	SJO	18/3	.032	.032	.330	50, 100, 250 & 1000
3184	SJO	18/4	.032	.032	.370	50, 100, 250 & 1000
3162	SJO	16/2	.032	.032	.330	50, 100, 250 & 1000
3163	SJO	16/3	.032	.032	.360	50, 100, 250 & 1000
3164	SJO	16/4	.032	.032	.400	50, 100, 250 & 1000
3142	SJO	14/2	.032	.032	.370	50, 100, 250 & 1000
3143	SJO	14/3	.032	.032	.390	50, 100, 250 & 1000
3144	SJO	14/4	.032	.032	.420	50, 100, 250 & 1000
SJO NEOPRENE (CONSTANT SERVICE)						
3182C	SJO	18/2	.032	.032	.305	50, 100, 250 & 1000
3183C	SJO	18/3	.032	.032	.330	50, 100, 250 & 1000
3184C	SJO	18/4	.032	.032	.370	50, 100, 250 & 1000
3162C	SJO	16/2	.032	.032	.330	50, 100, 250 & 1000
3163C	SJO	16/3	.032	.032	.360	50, 100, 250 & 1000
3164C	SJO	16/4	.032	.032	.400	50, 100, 250 & 1000

*NOT UL LISTED.

600 VOLT RUBBER & NEOPRENE HEAVY DUTY CORDS

DEARBORN NO.	U.L. TYPE	SIZE & NO. OF COND.	NOM. INSUL. THICK.	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
TYPE S, RUBBER						
2182	S	18/2	.030	.060	.390	50, 100, 250 & 1000
2183	S	18/3	.030	.060	.405	50, 100, 250 & 1000
2184	S	18/4	.030	.060	.435	50, 100, 250 & 1000
2162	S	16/2	.030	.060	.405	50, 100, 250 & 1000
2163	S	16/3	.030	.060	.430	50, 100, 250 & 1000
2164	S	16/4	.030	.060	.485	50, 100, 250 & 1000
2142	S	14/2	.045	.075	.530	50, 100, 250 & 1000
2143	S	14/3	.045	.075	.560	50, 100, 250 & 1000
2144	S	14/4	.045	.075	.605	50, 100, 250 & 1000
2122	S	12/2	.045	.090	.600	50, 100 & 250
2123	S	12/3	.045	.090	.635	50, 100 & 250
2124	S	12/4	.045	.090	.665	50, 100 & 250
2102	S	10/2	.045	.090	.640	50, 100 & 250
2103	S	10/3	.045	.090	.690	50, 100 & 250
2104	S	10/4	.045	.090	.745	50, 100 & 250
2082	S*	8/2	.050	.090	.700	50 & 100
2083	S*	8/3	.050	.090	.750	50 & 100
2084	S*	8/4	.050	.090	.820	50 & 100
2062	S*	6/2	.050	.100	.820	50 & 100
2063	S*	6/3	.050	.100	.885	50 & 100
2064	S*	6/4	.050	.100	.975	50 & 100
DEARBORN NO.	U.L. TYPE	SIZE & NO. OF COND.	NOM. INSUL. THICK.	NOM. JKT. THICK.	NOM. O.D.	STOCK PUT UP (FT.)
TYPE SO, NEOPRENE						
4182	SO	18/2	.030	.060	.390	50, 100, 250 & 1000
4183	SO	18/3	.030	.060	.405	50, 100, 250 & 1000
4184	SO	18/4	.030	.060	.435	50, 100, 250 & 1000
4162	SO	16/2	.030	.060	.405	50, 100, 250 & 1000
4163	SO	16/3	.030	.060	.430	50, 100, 250 & 1000
4164	SO	16/4	.030	.060	.485	50, 100, 250 & 1000
4142	SO	14/2	.045	.075	.530	50, 100, 250 & 1000
4143	SO	14/3	.045	.075	.560	50, 100, 250 & 1000
4144	SO	14/4	.045	.075	.605	50, 100, 250 & 1000
4122	SO	12/2	.045	.090	.600	50, 100 & 250
4123	SO	12/3	.045	.090	.635	50, 100 & 250
4124	SO	12/4	.045	.090	.665	50, 100 & 250
4102	SO	10/2	.045	.090	.640	50, 100 & 250
4103	SO	10/3	.045	.090	.690	50, 100 & 250
4104	SO	10/4	.045	.090	.745	50, 100 & 250
4082	SO	8/2	.050	.090	.700	50 & 100
4083	SO	8/3	.050	.090	.750	50 & 100
4084	SO	8/4	.050	.090	.820	50 & 100
4062	SO	6/2	.050	.090	.820	50 & 100
4063	SO	6/3	.050	.090	.885	50 & 100
4064	SO	6/4	.050	.090	.975	50 & 100

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

STYLE 1007, U.L. HOOK-UP WIRE

Voltage rating: 300 Volts. **Temperature rating:** −10°C to +80°C. 1/64" Polyvinylchloride insulation over stranded tinned copper.

STYLE 1061, U.L. SEMI-RIGID BUSINESS MACHINE WIRE

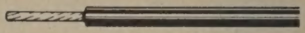
Voltage rating: 300 Volts. **Temperature rating:** −10°C to +80°C. .009" Polyvinylchloride insulation over solid or stranded tinned copper.

"TEW" FLAME RETARDANT, FR-1 STYLES 1015, 1028, 1283, 1284 600 VOLT, 105°C AND FR-1 STYLE 1007, 300 VOLT, 80°C

The polyvinylchloride insulation used on this series has the necessary additives that enable the wire to pass the Vertical Flame Test as prescribed by the Underwriter Laboratories for this UL style. All this wire is imprinted with the symbol FR-1 indicating it is covered by the above specifications. See page 22 for high voltage Flame Resistant wire.

Thermoplastic Insulated Hookup Wire

U.L. AND C.S.A. APPROVED



X-L POLYETHYLENE, U.L. STYLES 3173, 3199, 125°C — 600 VOLT, 105°C — 300 VOLT

The Polyethylene insulation used on this series of lead wire is chemically cross-linked, which increases the moisture resistance, solvent resistance and aging characteristics. When momentary high temperatures caused by overloads or shorts occur, the insulation does not deform as quickly as if not cross-linked. Typical applications include small motors, control panels, dry transformers, etc. **Recommended maximum baking cycles:** 300°F for 24 hrs. — 325°F for 12 hrs. — 350°F for 8 hours.

300 VOLT, 80°C,U.L. STYLE 1007

DEARBORN PART NO.	AWG SIZE	STRANDING	NOM. O.D.	NOM. WALL THICK.
402801	28	1/28	.047	1/64
402807	28	7/36	.049	1/64
402601	26	1/26	.050	1/64
402607	26	7/34	.052	1/64
402607F	26	7/34	.052	1/64
402401	24	1/24	.055	1/64
402407	24	7/32	.058	1/64
402407F	24	7/32	.058	1/64
402201	22	1/22	.059	1/64
402207	22	7/30	.065	1/64
402207F	22	7/30	.065	1/64
402001	20	1/20	.066	1/64
402010	20	10/30	.070	1/64
402010F	20	10/30	.070	1/64
401801	18	1/18	.074	1/64
401816	18	16/30	.080	1/64
401816F	18	16/30	.080	1/64
401601	16	1/16	.085	1/64
401626	16	26/30	.094	1/64

PUT UP: 500 FT., 1000 FT., AND BULK
STOCK COLORS: 0-9

U.L. SEMIRIGID STYLE 1061

DEARBORN NO.	AWG SIZE	STRANDING	NOM. WALL	NOM. O.D.	STANDARD PUT UP (FT.)	STOCK COLORS
422601	26	1/26	.009	.036	500, 1000 & 5000	0-9
422607	26	7/34	.009	.037	500, 1000 & 5000	0-9
422401	24	1/24	.009	.041	500, 1000 & 5000	0-9
422407	24	7/32	.009	.042	500, 1000 & 5000	0-9
422201	22	1/22	.009	.046	500, 1000 & 5000	0-9
422207	22	7/30	.009	.049	500, 1000 & 5000	0-9
422001	20	1/20	.009	.052	500, 1000 & 5000	0-9
422007	20	7/28	.009	.057	500, 1000 & 5000	0-9
422010	20	10/30	.009	.057	500, 1000 & 5000	0-9
421801	18	1/18	.009	.060	500, 1000 & 5000	0-9
421807	18	7/26	.009	.067	500, 1000 & 5000	0-9
421816	18	16/30	.009	.067	500, 1000 & 5000	0-9
421626	16	26/30	.009	.076	500, 1000 & 5000	0-9

XL - 125° C - 600 VOLT U.L. STYLE 3173

DEARBORN NO.	AWG SIZE	STRANDING	NOM. WALL	NOM. O.D.	STANDARD PUT UP (FT.)	STOCK COLORS
752207	22	7/30	1/32	.094	1000 & 5000	0 only
752010	20	10/30	1/32	.102	1000 & 5000	0 only
751816	18	16/30	1/32	.112	1000 & 5000	0 only
751626	16	26/30	1/32	.125	1000 & 5000	0 only
751441	14	41/30	1/32	.143	1000 & 5000	0 only
751265	12	65/30	1/32	.164	1000 & 3000	0 only
751065	10	65/28	1/32	.187	1000 & 2000	0 only

XL - 105° C - 300 VOLTS U.L. STYLE 3199

DEARBORN NO.	AWG SIZE	STRANDING	NOM. WALL	NOM. O.D.	STANDARD PUT UP (FT.)	STOCK COLORS
762207	22	7/30	1/64	.066	1000 & 5000	0, 2, 4, 5, 9
762010	20	10/30	1/64	.072	1000 & 5000	0, 2, 4, 5, 9
761816	18	16/30	1/64	.082	1000 & 5000	0, 2, 4, 5, 9
761626	16	26/30	1/64	.109	1000 & 5000	0, 2, 4, 5, 9

FR-1 105° C — 600 VOLT, U.L. STYLES 1015, 1028, 1283, 1284

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D.	NOM. WALL THICK.	UL TYPE
782601	26	1/26	.080	1/32	1015
782607	26	7/34	.083	1/32	1015
782607F	26	7/34	.083	1/32	1015
782401	24	1/24	.085	1/32	1015
782407	24	7/32	.088	1/32	1015
782407F	24	7/32	.088	1/32	1015
782201	22	1/22	.093	1/32	1015
782207	22	7/30	.095	1/32	1015
782207F	22	7/30	.095	1/32	1015
782001	20	1/20	.098	1/32	1015
782010	20	10/30	.100	1/32	1015
782010F	20	10/30	.100	1/32	1015
781801	18	1/18	.104	1/32	1015
781816	18	16/30	.110	1/32	1015
781816F	18	16/30	.110	1/32	1015
781601	16	1/16	.115	1/32	1015
781626	16	26/30	.124	1/32	1015
781401	14	1/14	.130	1/32	1015
781441	14	41/30	.141	1/32	1015
781201	12	1/12	.145	1/32	1015
781265	12	65/30	.160	1/32	1015
781001	10	1/10	.166	1/32	1015
781000	10	105/30	.194	1/32	1015
788133	8	133/29	.255	3/64	1028
786133	6	133/27	.335	4/64	1283
784133	4	133/25	.390	4/64	1283
782133	2	133/23	.460	4/64	1283
782665	2	665/30	.470	4/64	1283
781259	1	259/25	.525	5/64	1284
781836	1	836/30	.535	5/64	1284
780001	1/0	1045/30	.580	5/64	1284
780002	2/0	1330/30	.640	5/64	1284
780003	3/0	1661/30	.680	5/64	1284
780004	4/0	2107/30	.785	5/64	1284

FR-1 80° C — 300 VOLT, STYLE 1007

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D.	NOM. WALL THICK.	UL TYPE
792407	24	7/32	.057	1/64	1007
792207	22	7/30	.065	1/64	1007
792010	20	10/30	.071	1/64	1007
791816	18	16/30	.080	1/64	1007
791626	16	26/30	.095	1/64	1007

(F) After number indicates fused or prebonded.

PUT UP: STYLES 1015 AND 1028: 500 FT., 1000 FT., AND BULK; STYLES 1283 AND 1284: 100 FT. AND 1000 FT.; STYLE 1007: 1000 FT. AND 5000 FT.
STOCK COLORS: STYLES 1015 AND 1028: 0-9; STYLES 1283 AND 1284: 0, 2, 9; STYLE 1007: 0-9.

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

Consult Factory for Further Details on Striped Colors

DEARBORN WIRE AND CABLE CO. Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

U.L. Listed
High Temperature Teflon* Wire

Dearborn supplies a variety of high temperature insulated wires that are listed by the Underwriters Laboratories. The types shown here fall into the category of appliance wiring material (AWM) and are covered by the Flexible Cord and Fixture Wire Standard and UL Standard 758.1 for insulated single conductor appliance wiring material. Among a variety of requirements, the latter document assigns ratings regarding the duty group, flame retardance, temperature rating, voltage rating, service flexibility, resistance to abnormal temperature, oil resistance, water resistance and gasoline resistance where applicable. All of the following Underwriters styles are flame retardant and will satisfy the FR-1 designation of UL.

This section lists only the most commonly used conductors. In many instances, the Underwriter's Laboratories allow the use of other materials. Consult factory for further details.

*DuPont TM

U.L.
LISTED

U.L. STYLES 1164 & 1180

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
22801UL3	28	Solid	.042(1.07)
22807UL3	28	7/36	.045(1.14)
22819UL3	28	19/40	.045(1.14)
22601UL3	26	Solid	.045(1.14)
22607UL3	26	7/34	.048(1.22)
22619UL3	26	19/38	.048(1.22)
22401UL3	24	Solid	.049(1.24)
22407UL3	24	7/32	.053(1.35)
22419UL3	24	19/36	.053(1.35)
22201UL3	22	Solid	.054(1.37)
22207UL3	22	7/30	.060(1.52)
22219UL3	22	19/34	.060(1.52)
22001UL3	20	Solid	.061(1.55)
22007UL3	20	7/28	.068(1.73)
22019UL3	20	19/32	.068(1.73)
21807UL3	18	7/26	.079(2.00)
21819UL3	18	19/30	.079(2.00)
21619UL3	16	19/29	.086(2.18)
21419UL3	14	19/27	.102(2.59)
21219UL3	12	19/25	.120(3.05)

STOCK COLORS: 0-9

UL STYLES 1164 AND 1180

CONDUCTOR: Silver plated copper. On special order nickel plated copper conductors are available. **INSULATION:** Extruded "Teflon" TFE, .013″ min. (average) wall. **TEMPERATURE RATING:** UL 1180-200°C. **VOLTAGE RATING:** 300 volts rms. **USE:** For internal wiring of appliances, also suitable for immersion in gasoline, gasoline vapor and 80°C oil. **TEMPERATURE IDENTIFICATION MARKER:** UL 1164-Brown, UL 1180-Black. Dearborn standard temperature identification is a longitudinally applied stripe in size 18 AWG and larger. Sizes 20 AWG and smaller do not require temperature identification. Upon request and at an additional charge, surface printing can be provided.

U.L. STYLES 1198 & 1199

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
22601UL6	26	Solid	.060(1.52)
22607UL6	26	7/34	.063(1.60)
22619UL6	26	19/38	.063(1.60)
22401UL6	24	Solid	.064(1.63)
22407UL6	24	7/32	.068(1.73)
22419UL6	24	19/36	.068(1.73)
22201UL6	22	Solid	.069(1.75)
22207UL6	22	7/30	.077(1.96)
22219UL6	22	19/34	.077(1.96)
22001UL6	20	Solid	.079(2.00)
22007UL6	20	7/28	.083(2.11)
22019UL6	20	19/32	.083(2.11)
21807UL6	18	7/26	.093(2.36)
21819UL6	18	19/30	.093(2.36)
21619UL6	16	19/29	.101(2.57)
21419UL6	14	19/27	.116(2.95)
21219UL6	12	19/25	.136(3.45)
21037UL6	10	37/26	.157(3.99)
28133UL6	8	133/29	.237(5.94)
26133UL6	6	133/27	.268(6.81)
24133UL6	4	133/25	.321(8.15)
22665UL6	2	665/30	.401(10.2)
21836UL6	1	836/30	.474(12.1)

STOCK COLORS: 0-2-9

UL STYLES 1198 AND 1199

CONDUCTOR: Silver plated copper. On special order nickel plated copper conductors are available under series 3XTN-UL. **INSULATION:** Extruded "Teflon" TFE, .020″ min. (average) wall. **TEMPERATURE RATING:** UL 1198-150°C. UL 1199-200°C. **VOLTAGE RATING:** 600 volts rms, 2500 volts peak for electronic use. **USE:** Internal wiring of appliances, also suitable for immersion in gasoline, gasoline vapor and 80°C oil. **TEMPERATURE IDENTIFICATION MARKER:** UL 1198-Brown, UL 1199-Black. Dearborn standard temperature identification is a longitudinally applied stripe in size 18 AWG and larger. Sizes 20 AWG and smaller do not require temperature identification. Upon request and at an additional charge, surface printing can be provided. Consult factory for availability of sizes 1/0 thru 4/0.

OTHER U.L. STYLES AVAILABLE UPON REQUEST

UL STYLE	VOLTAGE	TEMP. (C)	INSULATION	UL STYLE	VOLTAGE	TEMP. (C)	INSULATION
1609	125	105°	Tetzel	1516		105°	Tetzel
1332	300	200°	FEP	1517		105°	Tetzel
1333	300	150°	FEP	1523		105°	Tetzel
1335		200°	FEP-H	1538	90	105°	FEP
1371		105°	TFE	1558		125°	Tetzel
1394		200°	TFE-H	1570	600	250°	TFE
1508	30	105°	Tetzel	1586		105°	Tetzel
1512		105°	TFE	1609	125	105°	Tetzel
1513		105°	Tetzel				

U.L. STYLES 1212 & 1213

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
13201UL	32	Solid	.027(.686)
13207UL	32	7/40	.029(.734)
13219UL	32	19/44	.029(.734)
13001UL	30	Solid	.029(.734)
13007UL	30	7/38	.032(.813)
13019UL	30	19/42	.032(.813)
12801UL	28	Solid	.032(.813)
12807UL	28	7/36	.035(.889)
12819UL	28	19/40	.035(.889)
12601UL	26	Solid	.035(.889)
12607UL	26	7/34	.038(.965)
12619UL	26	19/38	.038(.965)
12401UL	24	Solid	.040(1.02)
12407UL	24	7/32	.043(1.09)
12419UL	24	19/36	.043(1.09)
12201UL	22	Solid	.046(1.17)
12207UL	22	7/30	.050(1.27)
12219UL	22	19/34	.050(1.27)
12001UL	20	Solid	.054(1.37)
12007UL	20	7/28	.058(1.47)
12019UL	20	19/32	.058(1.47)

STOCK COLORS: 0-9

UL STYLES 1212 AND 1213

CONDUCTOR: Silver plated copper. On special order, nickel plated copper or silver plated high strength high conductivity copper alloy conductors are available. **INSULATION:** Extruded "Teflon" TFE, .008″ min. (average) wall. **TEMPERATURE RATING:** UL 1212 and UL 1213-105°C. **VOLTAGE RATING:** Not specified. **USE:** In office appliances where exposed to temperatures not exceeding 80°C or 105°C or to oil at temperatures not exceeding 60°C, and where not subjected to undue mechanical abuse. Temperature identification on the wire is not required on these styles. Consult factory for tracer or stripe on special.

U.L. STYLES 1226 & 1227

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
13201AUL	32	Solid	.027(.686)
13207AUL	32	7/40	.029(.734)
13001AUL	30	Solid	.029(.734)
13007AUL	30	7/38	.032(.813)
12801AUL	28	Solid	.032(.813)
12807AUL	28	7/36	.035(.889)
12601AUL	26	Solid	.035(.889)
12607AUL	26	7/34	.038(.965)
12619AUL	26	19/38	.038(.965)
12401AUL	24	Solid	.040(1.02)
12407AUL	24	7/32	.043(1.09)
12419AUL	24	19/36	.043(1.09)
12201AUL	22	Solid	.046(1.17)
12207AUL	22	7/30	.050(1.27)
12219AUL	22	19/34	.050(1.27)
12001AUL	20	Solid	.054(1.37)
12007AUL	20	7/28	.058(1.47)
12019AUL	20	19/32	.058(1.47)

STOCK COLORS: 0-9

UL STYLES 1226 AND 1227

CONDUCTOR: Tin plated copper. Constructions with silver plated copper or silver plated high strength high conductivity copper alloy are available on request. **INSULATION:** Extruded "Teflon" FEP, .008″ min. (average) wall. **TEMPERATURE RATING:** UL 1226-80°C. UL 1227-105°C. **VOLTAGE RATING:** Not specified. **USE:** In office appliances where exposed to temperatures not exceeding 80°C and 105°C or oil at temperatures not exceeding 60°C, and where not subjected to undue mechanical abuse. Temperature identification of the wire is not required for these styles.

U.L. STYLES 1330 & 1331

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
22601AUL6	26	Solid	.060(1.52)
22607AUL6	26	7/34	.063(1.60)
22619AUL6	26	19/38	.063(1.60)
22401AUL6	24	Solid	.064(1.63)
22407AUL6	24	7/32	.068(1.73)
22419AUL6	24	19/36	.068(1.73)
22201AUL6	22	Solid	.069(1.75)
22207AUL6	22	7/30	.077(1.96)
22219AUL6	22	19/34	.077(1.96)
22001AUL6	20	Solid	.079(2.00)
22007AUL6	20	7/28	.083(2.11)
22019AUL6	20	19/32	.083(2.11)
21807AUL6	18	7/26	.093(2.36)
21819AUL6	18	19/30	.093(2.36)
21619AUL6	16	19/29	.101(2.57)
21419AUL6	14	19/27	.116(2.95)
21219AUL6	12	19/25	.136(3.45)
21037AUL6	10	37/26	.157(3.99)
28133AUL6	8	133/29	.237(5.94)
26133AUL6	6	133/27	.268(6.81)
24133AUL6	4	133/25	.321(8.15)
22665AUL6	2	665/30	.401(10.2)
21836AUL6	1	836/30	.474(12.1)

STOCK COLORS: 0-9

UL STYLES 1330 AND 1331

CONDUCTOR: Tin plated copper. **INSULATION:** Extruded "Teflon" FEP, .020″ min. (average) wall, sizes 26-10 AWG, .030″ min. (average) wall, sizes 8-2 AWG. **TEMPERATURE RATING:** UL 1330-200°C, may be used with tin plated copper conductors only where the individual strand diameter is .015″ (26 AWG) or larger. UL 1331-150°C. **VOLTAGE RATING:** 600 volts rms. **USE:** For general appliance wiring where not subjected to temperatures exceeding 200°C for style 1330 (see above limiting note), or 150°C for style 1331. Suitable for immersion in gasoline, gasoline vapor and 80°C oil. Constructions with silver plated copper are available on request; this version has an unrestricted 200°C temperature rating for style 1330. For sizes 18 AWG and larger, temperature identification is indicated by a black marker thread for style 1330 and a brown marker thread for style 1331, located under the insulation. Sizes 20 AWG and smaller do not require temperature identification.

DEARBORN WIRE AND CABLE CO. Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

DEARBORN WIRE AND CABLE COMPANY

Approved High Temperature Teflon Appliance Wire

THIN WALL

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
13201CSA	32	Solid	.031(.787)
13207CSA	32	7/40	.032(.813)
13219CSA	32	19/44	.033(.838)
13001CSA	30	Solid	.033(.838)
13007CSA	30	7/38	.035(.889)
13019CSA	30	19/42	.035(.889)
12801CSA	28	Solid	.036(.914)
12807CSA	28	7/36	.038(.965)
12819CSA	28	19/40	.038(.965)
12601CSA	26	Solid	.039(.991)
12607CSA	26	7/34	.042(1.06)
12619CSA	26	19/38	.042(1.06)
12407CSA	24	7/32	.047(1.19)
12419CSA	24	19/36	.047(1.19)
12207CSA	22	7/30	.053(1.34)
12219CSA	22	19/34	.053(1.34)
12007CSA	20	7/28	.061(1.54)
12019CSA	20	19/32	.061(1.54)
11819CSA	18	19/30	.070(1.77)
11619CSA	16	19/0117	.079(2.01)

THIN WALL INSULATION RATED AT 150 VOLTS AND 150°C

CONDUCTOR: Silver plated copper. Constructions with nickel plated copper or nickel conductor can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon "TFE, .010" (0.25mm) min. average wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of process control and computer equipment.

STOCK COLORS: AWG SIZES 16 THROUGH 24 = 0-2-9.
AWG SIZES 26 THROUGH 32 = 0-9.

* For availability of other color and stripe combinations, consult factory.

STANDARD WALL

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
22801CSA	28	Solid	.048(1.29)
22807CSA	28	7/36	.050(1.34)
22819CSA	28	19/40	.050(1.34)
22601CSA	26	Solid	.051(1.37)
22607CSA	26	7/34	.054(1.45)
22619CSA	26	19/38	.054(1.45)
22401CSA	24	Solid	.055(1.40)
22407CSA	24	7/32	.059(1.59)
22419CSA	24	19/36	.059(1.59)
22201CSA	22	Solid	.060(1.52)
22207CSA	22	7/30	.065(1.75)
22219CSA	22	19/34	.065(1.75)
22001CSA	20	Solid	.068(1.73)
22007CSA	20	7/28	.073(1.96)
22019CSA	20	19/32	.073(1.96)
21819CSA	18	19/30	.082(2.21)
21619CSA	16	19/.0117	.089(2.26)
21419CSA	14	19/.0147	.103(2.62)
21219CSA	12	19/.0185	.122(3.10)

STANDARD WALL INSULATION RATED AT 300 VOLTS AND 200°C

CONDUCTOR: Silver plated copper; constructions with nickel plated copper or nickel conductors can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon" TFE, 1/64" (0.4mm) minimum wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of electronic, photographic, refrigeration and air conditioning equipment, ballast and incandescent lampholder leads, ovens, flood lights, business machines, clothes dryers and electric stoves.

STOCK COLORS: AWG SIZES 12 THROUGH 24 = 0-2-9.
AWG SIZES 26 THROUGH 28 = 0-9.

HEAVY WALL

DEARBORN NO.	AWG SIZE	STRANDING	NOM. O.D. OVER INSULATION INCH (MM)
22801CSA6	28	Solid	.078(2.10)
22807CSA6	28	7/36	.080(2.15)
22819CSAC	28	19/40	.080(2.15)
22601CSA6	26	Solid	.081(2.18)
22607CSA6	26	7/34	.084(2.26)
22619CSA6	26	19/38	.084(2.26)
22401CSA6	24	Solid	.085(2.16)
22407CSA6	24	7/32	.089(2.39)
22419CSA6	24	19/36	.089(2.39)
22201CSA6	22	Solid	.090(2.28)
22207CSA6	22	7/30	.095(2.55)
22219CSA6	22	19/34	.095(2.55)
22001CSA6	20	Solid	.097(2.46)
22007CSA6	20	7/28	.103(2.77)
22019CSA6	20	19/32	.103(2.77)
21819CSA6	18	19/30	.112(3.01)
21619CSA6	16	19/0117	.120(3.05)
21419CSA6	14	19/0147	.134(3.40)
21219CSA6	12	19/0185	.153(3.88)

HEAVY WALL INSULATION RATED AT 600 VOLTS AND 200°C

CONDUCTOR: Silver plated copper. Constructions with nickel plated copper or nickel conductor can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon" TFE, 1/32" (0.79mm) min. wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of electronic, photographic, refrigeration and air conditioning equipment, ballast and incandescent lampholder leads, infrared ovens, flood lights, business machines, clothes dryers and electric stoves.

STOCK COLORS: 0-2-9.

COLOR CODE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

Appliance and Fixture Wire

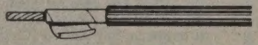
U.L. LISTED

200°C, SILICONE, GLASS BRAID. 600 VOLT

DEARBORN NO.	AWG SIZE	STRANDING	WALL THICKNESS	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT.)
431816	18	16 x 30	1/32	.131	0, 9	500
431626	16	26 x 30	1/32	.144	0, 9	500
431441	14	41 x 30	1/32	.159	0, 9	500
431241	12	41 x 28	1/32	.180	0, 9	500
431065	10	65 x 28	3/64	.236	0, 9	500

150°C TYPE AA, ASBESTOS, 300 VOLT

DEARBORN NO.	AWG SIZE	STRANDING	WALL THICKNESS	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT.)
451665	16	65/34	.075	.210	White	250
451400	14	104/34	.075	.230	White	250
451200	12	168/34	.075	.250	White	250
451000	10	261/34	.085	.285	White	250
450800	8	471/34	.085	.335	White	250
450600	6	665/34	.090	.390	White	250
450400	4	1057/34	.090	.425	White	250
450200	2	1680/34	.090	.500	White	250



150°C TYPE AF, 300 VOLT

DEARBORN NO.	AWG SIZE	STRANDING	WALL THICKNESS	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT.)
481816	18	16/30	1/32	.111	0, 2, 9	500
481626	16	26/30	1/32	.123	0, 2, 9	500
481441	14	41/30	1/32	.141	0, 2, 9	500
481265	12	65/30	3/64	.191	0, 2, 9	500
481000	10	105/30	3/64	.217	0, 2, 9	250

COLOR CODE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Gray • 9—White.

OTHER COLORS AVAILABLE ON SPECIAL ORDER

SILICONE RUBBER TYPES

HIGH TEMPERATURE BRAIDLESS SILICONE RUBBER WIRE

Braidless silicone is easy stripping, and has excellent physical strength and mechanical properties. Recommended for stoves, dryers, motors and electronic devices where high temperatures are incurred. All conductors are of stranded tinned copper. U.L. Style 3212 — Sizes 10 thru 22; U.L. Style 3213 — Sizes 2 thru 8; Style 3214 — Sizes 00 thru 1.

HIGH TEMPERATURE SILICONE RUBBER WIRE WITH GLASS BRAID

High temperature silicone rubber insulation for easy stripping. Lacquered glass braid overall gives additional abrasion resistance. Lacquer prevents fraying of braid. Used for appliance and hookup wire. U.L. Style 3071 on AWG Sizes: Nos. 18, 16, 14, and 12. U.L. Style 3075 on AWG Size No. 10.

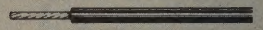
ASBESTOS INSULATED TYPES

TYPE AA

U.L. Style C-2130, 150°C; 300 Volts. Designed for wiring of electric ranges, grills, space heaters and other types of electrical heating devices where heat but not moisture is present. Maximum copper temperature is 200°C (392°F).

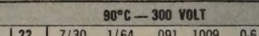
TYPE AF

U.L. Style AF 3200, 150°C; 300 Volts. Stranded copper conductor; tape, felted asbestos insulation — flame, heat and moisture resistant. Approved for all types of interior illumination, particularly fluorescent devices, and all high wattage units, especially where socket temperatures exceed 90°C (194°F).



150°C, BRAIDLESS SILICONE, 600 VOLT

DEARBORN NO.	AWG SIZE	STRANDING	WALL THICKNESS	NOM. O.D.	STOCK COLORS	STOCK PUT UP (FT.)
392207	22	7/30	3/64	.129	9	500
392010	20	10/30	3/64	.135	0, 9	500
391816	18	16/30	3/64	.143	0, 2, 9	500
391626	16	26/30	3/64	.156	0, 2, 9	500
391441	14	41/30	3/64	.173	0, 2, 9	100 & 500
391265	12	65/30	3/64	.194	0, 2, 9	100 & 500
391065	10	65/28	3/64	.228	0, 9	100 & 500
390854	8	54/25	4/64	.295	0, 9	100 & 500
390684	6	84/25	4/64	.338	0, 9	100 & 500
394133	4	133/25	4/64	.397	0, 9	100 & 250
392259	2	259/26	4/64	.467	0, 9	100 & 250
391259	1	259/25	5/64	.542	0, 9	100 & 250
390001	0	259/24	5/64	.594	0, 9	100 & 250
390002	00	259/23	5/64	.674	0, 9	100 & 250



VINYL, LACQ'D COTTON BRAID

DEARBORN NO.	SIZE AWG	STRANDING	PVC INSUL. THK.	NOM. O.D.	UL STYLE	STOCK COLOR	STOCK PUT UP (FT.)
90°C — 300 VOLT							
472207F	22	7/30	1/64	.091	1009	0-6, 9	250 & 1000
472207	22	7/30*	1/64	.091	1009	0-6, 9	250 & 1000
472010F	20	10/30	1/64	.098	1009	0-6, 9	250 & 1000
472010	20	10/30*	1/64	.098	1009	0-6, 9	250 & 1000
471816	18	16/30	1/64	.113	1009	0-6, 9	250 & 1000
471626	16	26/30	1/64	.126	1009	0-6, 9	250 & 1000
90°C — 600 VOLT							
471441	14	41/30	1/32	.177	1014	0,2,4,5,9	250 & 1000
471265	12	65/30	1/32	.199	1014	0, 2	250
471065	10	65/28	1/32	.222	1014	0 Only	250
470884	8	84/27	3/64	.293	1025	0 Only	250
470684	6	84/25	4/64	.369	1265	0 Only	250

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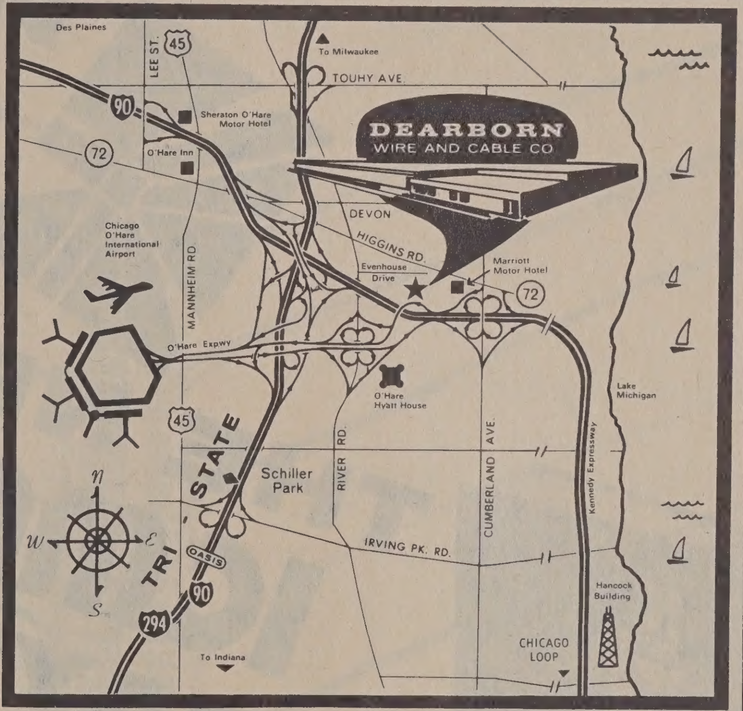
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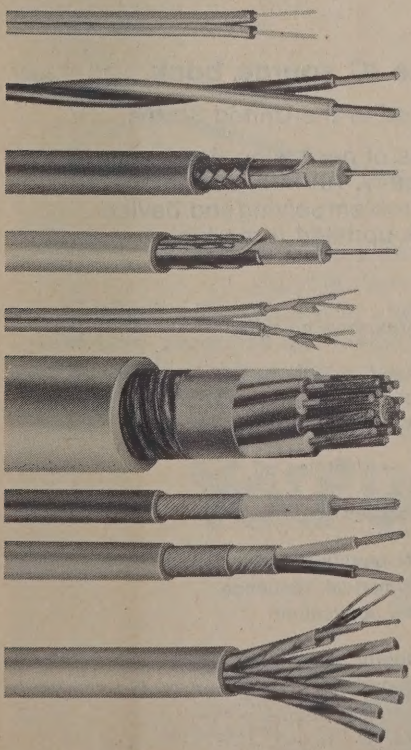

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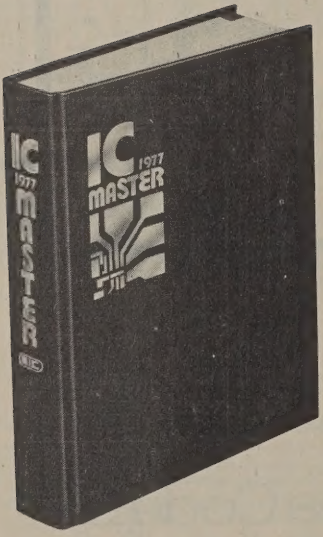

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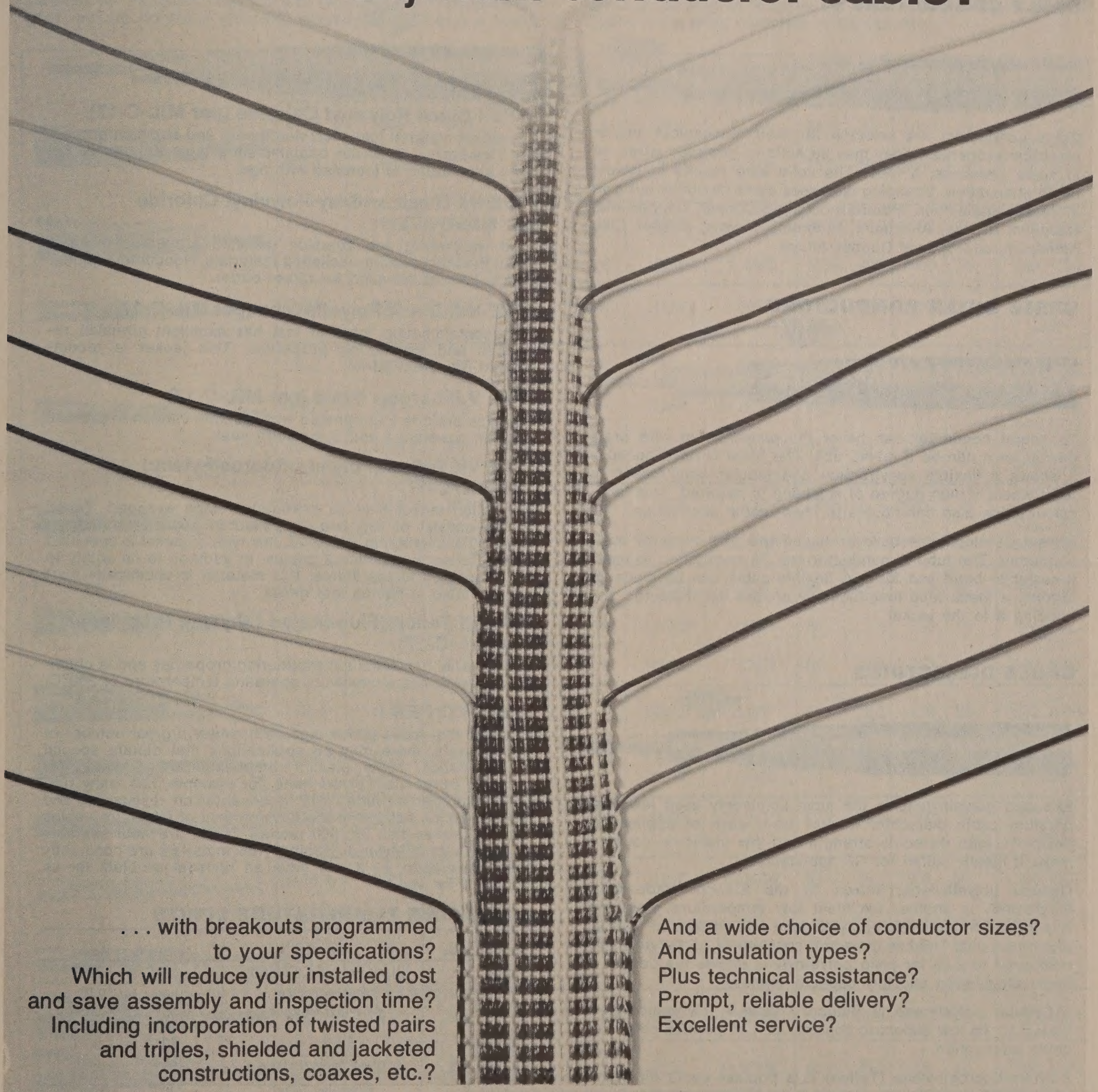

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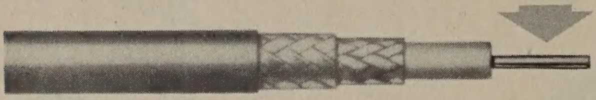
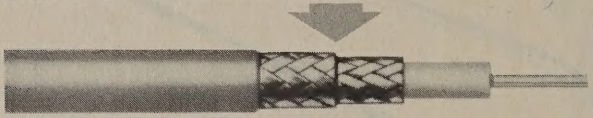
CABLE CONDUCTORS



Cable conductors are selected for their mechanical and/or electrical properties. They may be solid or stranded wires, or in some instances, a tube. The solid wire results in lowest cable attenuation. Stranding increases cable flexibility but also increases attenuation. Materials used are Copper, Copperweld, Cadmium Bronze, Aluminum, Nichrome, Karma, Copper Clad Aluminum, and Special Copper Alloys.

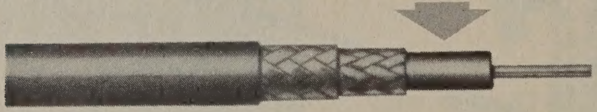
CABLE OUTER CONDUCTORS



The outer conductor can be of the conventional wire braid design, or it can be a metal tube. The braid is used because it allows a flexible construction and tubular construction is used where a high degree of shielding is required. This latter construction also contributes to lower cable attenuation.

Recent developments have produced two new types of outer conductor. The tubular conductor can be corrugated to make it easier to bend and form. A flexible cable can be made by forming a metal tape longitudinally around the dielectric and bonding it to the jacket.

CABLE DIELECTRICS



Extruded polyethylene is the most commonly used low temperature cable dielectric. Its low cost, ease of application, flexibility, high dielectric strength and low dielectric constant make it ideally suited for RF applications.

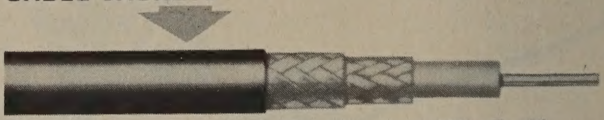
Cellular polyethylene, known by the Stancor trade mark Polyfoam®, is another excellent low temperature dielectric. It is formed by expanding polyethylene with millions of bubbles of an inert gas. The low dielectric constant of 1.5 for polyfoam compared to 2.26 for solid polyethylene allows the design of lower attenuation and low capacity cables.

Cellular polystyrene is Stancor's newest low temperature dielectric. Its low dielectric constant of 1.18 permits still lower cable attenuation.

Polytetrafluoroethylene (Teflon) is a popular cable dielectric, because of its ability to withstand high temperatures. It too has high dielectric strength and a very low dielectric constant. In addition, its ability to withstand exposure to gases and liquids makes it the dielectric choice where other materials would be inadequate.

Micro-porous Teflon is Stancor's newest high temperature dielectric. In addition to the standard Teflon properties, its 1.3 dielectric constant means lower cable attenuation.

CABLE JACKETS



TYPE I Black Polyvinyl Chloride (per MIL-C-17)

This jacket material has good weathering and abrasion properties. However, it is of the contaminating type and will cause cable attenuation to increase with age.

TYPE IIA Black or Grey Polyvinyl Chloride (per MIL-C-17)

Good weathering and abrasion resistant properties make it one of the most popular jacketing materials. Noncontaminating. This jacket can be used for direct burial.

TYPE IIIA Black Polyethylene (per MIL-C-17)

A noncontaminating material that has excellent abrasion resistance and weathering properties. This jacket is recommended for direct burial.

TYPE V Fiberglas Braid (per MIL-C-17)

Fiberglas braid is impregnated with silicone varnish to provide abrasion resistance and a moisture seal.

TYPE VII Teflon (Polytetrafluoroethylene) (per MIL-C-17)

The Teflon jacket may be extruded or tape wrapped. Taped jackets consist of two wraps applied in opposite directions with a 50% overlap. In MIL-C-17, this type of jacket is specified for the Teflon subminiature cables. In addition to its ability to withstand high temperatures, this material is chemically inert and insoluble in liquids and gases.

TYPE IX Teflon (Fluorinated Ethylene Propylene) (per MIL-C-17)

This material has excellent weathering properties and is chemically inert. It has a maximum operating temperature of 200°C.

OTHER TYPES

Although the above jacket types will satisfy a great number of requirements, there may be applications that dictate special characteristics. Many plastic compounds are available for jacketing purposes. Polyurethane, for example, has many rubber like properties along with good abrasion resistance, and miniaturization has led to the development of miniature cables with jackets as thin as .003 inches. These are heat sealable taped jackets of Mylar or Kapton. New materials are constantly being developed — if you have an unusual problem let us resolve it for you.

OPERATING TEMPERATURE LIMITS

Military Designation	Jacket Type	Temperature Limits
TYPE I	Black Polyvinyl Chloride	−40°C to +80°C
TYPE IIa	Black or Grey Polyvinyl Chloride	Under ¼″ O.D. −55°C to +90°C Over ¼″ O.D. −40°C to +90°C
TYPE IIIa	Black Polyethylene	−55°C to +85°C
TYPE V	Fiberglas Braid	−55°C to +250°C
TYPE VII	Teflon (PTFE)	−55°C to +250°C
TYPE IX	Teflon (FEP)	−55°C to +200°C

NOTE: C-Copper; S-Silvered Copper; CW-Copperweld; TC-Tinned Copper; P-Polyethylene; CCP-Conductive Coated Polyethylene; T-Teflon; TT-Teflon Tape; SCW-Silvered Copperweld; SST-Semi-Solid Teflon; SSP-Semi-Solid Polyethylene; CAL-Corrugated Aluminum.

Type I, Black Polyvinyl Chloride; Type IIa, Black or Grey Polyvinyl Chloride; Type IIIa, Black Polyethylene; Type V, Fiberglas Braid; Type VII, Teflon (PTFE); Type IX, Teflon (FEP).

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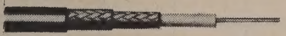
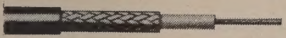
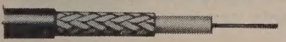
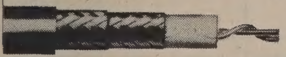
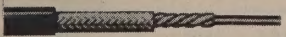
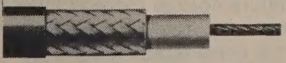
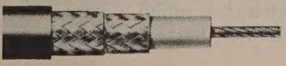
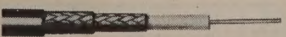
CABLE AND WIRE PRODUCTS
RG/U COAXIAL CABLE

ESSEX STANCOR

Stancor RG/U Coaxial Cables are designed to provide superior low capacitance and low attenuation. The various insulations available assure you of constant electrical characteristics regardless of changes in frequency or temperature. These insulations include polyvinyl chloride, polyethylene, fiberglas braid and teflon (FEP). Operating temperatures for this cable range from −40°C to +250°C and the shieldings available are copper, tinned copper or silvered copper. With these features, plus versatile packaging lengths, the Stancor line of RG/U Coaxial Cable is the most complete in the industry.

	RG/U	STANCOR Cat. No.	Jacket O.D.	Jacket Type	Shields		Dielectric O.D. & Type	Center Conductor	V.P. %	Cap. Mmfd./ft.	Max. Oper. V RMS	Nom. Imp. Ohms	Std. Spool Lengths in Feet
					Out.	In.							
	8/U	1000	.405	I	—	C	.285P	7/21C	65.9	29.5	5000	52	50, 100, 500, 1000
	8A/U	1001	.405	IIa	—	C	.285P	7/21C	65.9	29.5	5000	52	100, 500, 1000
	11/U	1002	.405	I	—	C	.285P	7/26TC	65.9	20.5	5000	75	100, 500, 1000
	11A/U	1003	.405	IIa	—	C	.285P	7/26TC	65.9	20.5	5000	75	500, 1000
	55B/U	1005	.206	IIIa	TC	TC	.116P	20S	65.9	28.5	1900	53.5	100, 500, 1000
	58/U	1006	.195	I	—	TC	.116P	20C	65.9	28.5	1900	53.5	25, 50, 100, 500, 1000
	58A/U	1007	.195	I	—	TC	.116P	19/.0071TC	65.9	30	1900	50	25, 50, 100, 500, 1000
	58C/U	1009	.195	IIa	—	TC	.116P	19/.0071TC	65.9	30	1900	50	25, 50, 100, 500, 1000
	59/U	1010	.242	I	—	C	.146P	22CW	65.9	21.5	2300	73	25, 50, 100, 500, 1000
	59B/U	1011	.242	IIa	—	C	.146P	.023CW	65.9	21	2300	75	500, 1000
	62/U	1012	.242	I	—	C	.146SSP	22CW	84	13.5	750	93	100, 500, 1000
	62A/U	1022	.242	IIa	—	C	.146SSP	22CW	84	13.5	750	93	100, 500, 1000
	62B/U	1013	.242	IIa	—	C	.146SSP	7/32CW	84	13.5	750	93	500, 1000
	71B/U	1014	.250	IIIa	TC	C	.146SSP	22CW	84	13.5	750	93	500, 1000
	108A/U	1015	.235	IIa	—	TC	.079 (ea. P)	Two 7/28TC	68	23.5	1000	78	100, 500, 1000
	122/U	1020	.160	IIa	—	TC	.096P	27/36TC	69.5	29.5	1900	50	100, 500, 1000
	141A/U	1501	.190	V	—	S	.116T	.039SCW	69.5	28.5	1900	50	100, 500, 1000
	142B/U	1502	.195	IX	S	S	.116T	.039SCW	69.5	28.5	1900	50	100, 500, 1000
	213/U	1017	.405	IIa	—	C	.285P	7/.0296C	65.9	29.5	5000	50	500, 1000
	214/U	1018	.425	IIa	S	S	.285P	7/.0296C	65.9	29.5	5000	50	500, 1000
	223/U	1019	.216	IIa	S	S	.116P	.035S	65.9	29.5	1900	50	100, 500, 1000

NOTE: C-Copper; S-Silvered Copper; CW-Copperweld; TC-Tinned Copper; P-Polyethylene; CCP-Conductive Coated Polyethylene; T-Teflon; TT-Teflon Tape; SCW-Silvered Copperweld; SST-Semi-Solid Teflon; SSP-Semi-Solid Polyethylene; CAL-Corrogated Alum.
Type I, Black Polyvinyl Chloride; Type IIa, Black or Grey Polyvinyl Chloride; Type IIIa, Black Polyethylene; Type V, Fiberglas Braid; Type VII, Teflon (PTFE); Type IX, Teflon (FEP).

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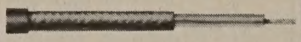
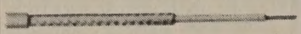
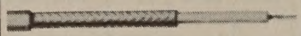
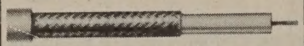
ESSEX STANCOR

RG SUBMINIATURE

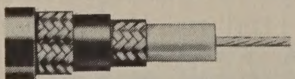
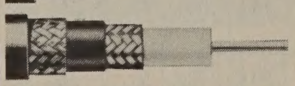
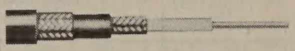
Stancor's line of subminiature coaxial cable was created for use in any miniaturized electronic application where high temperature and extreme flexibility is a consideration. This Teflon dielectric subminiature cable is able to withstand continuous operating temperatures up to 250°C. Teflon jacket is weatherproof, chemically inert, insoluble in liquids and gases — provides the greatest flexibility and lowest attenuation. Stancor subminiature cables have been laboratory tested at −55°C and retained all their flexible properties.

The polyethylene dielectric miniature coaxial cable is intended for use in any miniaturized electronic application where extremely high temperature is not a consideration.

	RG/U	STANCOR Cat. No.	Jacket O.D.	Jacket Type	Shield	Dielectric O.D. & Type	Center Conductor	V.P. %	Cap. Mmfd. /ft.	Max. Oper. V RMS	Nom. Imp. Ohms	Std. Spool Lengths in Feet
	174A/U	1016	.100	I	TC	.060P	7/34CW	65.9	30.0	1500	50	100, 500, 1000
	178B/U	1503	.075 Max.	IX	S	.034T	7/38SCW	69.5	28.5	1000	50	100, 500, 1000
	179B/U	1504	.105 Max.	IX	S	.063T	7/38SCW	69.5	19.5	1200	75	100, 500, 1000
	180B/U	1505	.145 Max.	IX	S	.102T	7/38SCW	69.5	15.0	1500	95	100, 500, 1000

TRIAXIAL CABLE

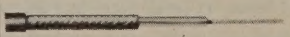
Stancor Triaxial Cables are especially designed to satisfy the need for a high degree of shielding in a flexible transmission line. This is achieved by adding a high coverage braid over the cable jacket and then applying a second or outer jacket. This type of construction provides more effective shielding action than two adjacent braids. Aside from applications requiring maximum attenuation of radiated signals or minimum pickup of external interference, this cable can also be used to carry two separate signals.

	RG/U	STANCOR Cat. No.	Outer Jacket O.D. and Type	Inner/ Outer Shields	Inner Jacket O.D. and Type	Dielectric O.D. and Type	Center Conductor	V.P. %	Cap. Mmfd. /ft.	Max. Oper. V RMS	Nom. Imp. Ohms	Std. Spool Lengths in Feet
	58/U	2037	.285 I	TC	.195 I	.116P	19/.0071TC	65.9	29.5	1900	50	100, 500, 1000
	11/U	2038	.460 I	C	.370 CP	.285P	7/26TC	65.9	20.5	5000	75	500, 1000
	11/U	2002	.460 P	C	.370 P	.285FP	14C	80.0	16.5	3000	75	500, 1000
	59/U	2001	.242 P	C	.170 CP	.107FP	22CW	80.0	17.0	500	72	100, 500, 1000

SUBMINAX® CABLE

A combination of trends toward both miniaturization and high temperature applications in the electronics industry has created the need for the Stancor line of SUBMINAX® Cable. These high temperature, miniaturized cables with Teflon extruded jackets are weatherproof, chemically inert, insoluble in liquids and gasses, and are extremely flexible. SUBMINAX® cables will withstand continuous operating temperatures up to 200°C. The polyethylene dielectric miniature coaxial cable is intended for use in any miniaturized electronic application where extremely high temperature is not a consideration.

Intended for use in airborne instrumentation, computers, circuitry controls, monitoring equipment are a few applications.

	RG/U	STANCOR Cat. No.	Jacket O.D.	Jacket Type	Shield	Dielectric O.D. & Type	Center Conductor	V.P. %	Cap. Mmfd. /ft.	Max. Oper. V RMS	Nom. Imp. Ohms	Std. Spool Lengths in Feet
	—	2003	.150	I	TC	.100P	7/.0056CW	65.9	20	2500	75	100, 500, 1000

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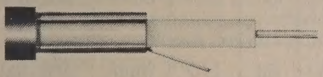
RG TYPE COAXIAL CABLE

APPLICATIONS: CATV, MATV, CCTV, C.B., AMATEUR

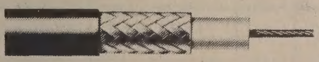
ESSEX STANCOR

RG 6/U TYPE



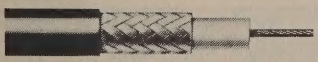
STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D.″	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2015	18 CW	Polyfoam® .185	Alum. Foil + Drain	Polyethylene	.247	75	80	17.2	Black	100, 500, 1000
2029	18 CW	Polyfoam® .185	Foil w/55% Alum. Braid	PVC	.275	75	80	17.2	Black	500, 1000
2030	18 CW	Polyfoam® .185	Foil w/55% Alum. Braid	PVC	.275	75	80	17.2	Beige	500, 1000
2032	18 CW	Polyfoam® .185	Foil w/90% Alum. Braid	PVC	.275	75	80	17.2	Black	500, 1000
2034	18 CW	Polyfoam® .185	Foil w/90% Al. Braid	PVC	.275	75	80	17.2	White	500, 1000
2041	18 CW	Polyfoam® .185	Alum. Foil + Drain	PVC	.247	75	78	17.2	Black	100, 500, 1000

RG 8/U TYPE



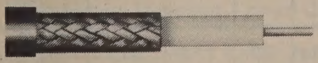
STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D.″	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2004	7/19 C	Polyfoam® .285	90% Copper Braid	PVC	.405	50	80	26.0	Black	50, 100, 500, 1000
2042	7/19 C	Polyfoam® .285	70% Copper Braid	PVC	.405	50	80	26.0	Black	50, 100, 500, 1000
2044	19/24 C	Polyfoam® .285	96% Copper Braid	PVC	.405	50	78	26.0	Black	50, 100, 500, 1000
2045	19/24 C	Polyfoam® .285	70% Copper Braid	PVC	.405	50	78	26.0	Black	50, 100, 500, 1000
2047	7/19 C	Polyfoam® .285	80% Copper Braid	PVC	.405	50	80	26.0	Black	50, 100, 500, 1000

RG 11/U TYPE



STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D.″	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2007	14 CW	Polyfoam®	90% Copper Braid	PVC	.405	75	80	17.2	Black	100, 500, 1000

RG 58/U TYPE



STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D.″	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2005	20 BC	Polyfoam® .146	88% Copper Braid	PVC	.195	65	80	19.5	Black	25, 50, 100, 500, 1000
2043	19/33 TC	Polyfoam® .116	96% Copper Braid	PVC	.195	50	78	26.0	Black	25, 50, 100, 500, 1000
2046	20 C	Polyethylene .116	70% Copper Braid	PVC	.195	53.5	65.9	28.5	Black	25, 50, 100, 500, 1000

®Registered Trademark, Cellular Polyethylene.

NOTE: C-Copper; S-Silvered Copper; CF-Copperweld; TC-Tinned Copper; P-Polyethylene; CCP-Conductive Coated Polyethylene; T-Teflon; TT-Teflon Tape; SCW-Silvered Copperweld; SST-Semi-Solid Teflon; SSP-Semi-Solid Polyethylene; CAL-Corrugated Alum.

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ESSEX STANCOR

RG TYPE COAXIAL CABLE

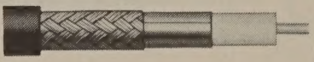
RG 59/U TYPE

STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D."	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2006	22 CW	Polyethylene .146	90% + Copper Braid	Polyethylene	.242	75	80	20.5	Black	500, 1000
2010	20 CW	Polyfoam® .146	85% Copper Braid	PVC	.242	75	80	17.2	White	500, 1000

CHROMAFOIL 100% SHIELDED CABLE

Stancor Chromafoil cables are especially designed, high quality cables which meet or exceed all electrical, environmental and performance specifications of RG/59U. Stancor Chromafoil cables offer the advantages of lower attenuation than Mil. Spec. RG 59/U. In addition, they are extremely flexible, provide easy termination, offer superior shielding effectiveness and have a temperature range of −40°C to 80°C. Chromafoil cables are designed for CATV, closed circuit TV or pay TV applications.

RG 59/U TYPE



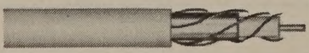
STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D."	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2018	20 CW	Polyfoam® .146	Foil w/90% Alum. Braid	PVC	.242	75	80	17.2	Beige	500, 1000
2020	20 CW	Polyfoam®	Foil w/90% Alum. Braid	PVC	.242	75	80	17.2	White	500, 1000
2023	20 CW	Polyfoam®	Foil w/55% Alum. Braid	PVC	.242	75	80	17.2	Black	1000, 2000
2025	20 CW	Polyfoam®	Foil w/55% Alum. Braid	PVC	.242	75	80	17.2	White	100, 1000
2031	20 CW	Polyfoam® .146	Foil w/55% Alum. Braid	PVC	.242	75	80	17.2	Beige	100, 500, 1000

COLORFOIL 100% SHIELDED CABLE

Stancor Colorfoil® is a high reliability, low loss, 100% shielded cable especially designed for inside use. Mechanically fough — yet flexible. Colorfoil also offers superior electrical performance providing you 82 UHF/VHF channels of perfect color or black and white TV reception. Colorfoil's 80 db isolation is approximately 30 db higher than braided coaxial cables. Colorfoil's 4 drain wires provide mechanical strength and shielding continuity.

Once installed, Stancor Colorfoil will provide years of maintenance-free performance.

RG 59 /U TYPE



STANCOR Cat. No.	Conductor Size & Material	Insulation & O.D.	Shield Type & Material	Jacket	Nom. O.D."	Nom. Imped.	Vel. of Prop.	Nom. Cap. Pf/ft.	Jacket Color	Standard Length in Feet
2026	22 CW	Polyfoam® .146	Foil + 4 Drain Wires	PVC	.220	75	80	16.2	Black	500, 1000, 2000
2039	22 CW	Polyfoam® .146	Foil + 4 Drain Wires	PVC	.220	75	80	16.2	White	500, 1000, 2000
2027	20 CW	Polyfoam® .146	Foil + 4 Drain Wires	PVC	.225	75	80	17.2	Black	500, 1000, 2000
2040	20 CW	Polyfoam® .146	Foil + 4 Drain Wires	PVC	.225	75	80	17.2	White	500, 1000, 2000

®Registered Trademark, Cellular Polyethylene.

NOTE: C-Copper; S-Silvered Copper; CF-Copperweld; TC-Tinned Copper; P-Polyethylene; CCP-Conductive Coated Polyethylene; T-Teflon; TT-Teflon Tape; SCW-Silvered Copperweld; SST-Semi-Solid Teflon; SSP-Semi-Solid Polyethylene; CAL-Corrugated Alum.

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ELECTRONIC HOOKUP WIRE

ESSEX STANCOR

MIL-W-76B

TYPE-MW/ PVC INSULATION

Description: Medium wall electronic hookup wire, PVC insulation, unaffected by water, oil, acids, solvents, fungus and passes FR-1 vertical flame test.
Mil. Spec. No.: Mil-W-76B
Conductor: Stranded or Solid Tinned Copper
Insulation: PVC
Temperature: −40°C to +80°C
Rating: 1000 Volts R.M.S.

STANCOR Cat. No.	Mil. Type Designations	Conductor		Nom. Wall Thick. (inches)	Nom. O.D. (inches)	Stock Colors	
		AWG Size	Strand			100′	1000′
STRANDED							
3061	MW-C24(7)U	24	7x32	.016	.056	1-22	1-22
3062	MW-C22(7)U	22	7x30	.016	.062	1-30	1-30
3063	MW-C20(10)U	20	10x30	.016	.071	1-30	1-30
3064	MW-C18(16)U	18	16x30	.016	.081	1-30	1-30
3065	MW-C16(26)U	16	26x30	.016	.092	1-22	1-22
3066	MW-C14(41)U	14	41x30	.018	.107	1-22	1-22
3067	MW-C12(65)U	12	65x30	.018	.127	1-10	1-10
SOLID							
3070	MW-C20(1)U	20	1	.016	.066	1-22	1-22
3071	MW-C18(1)U	18	1	.016	.074	1-13	1-13

U.L. FILE E-19046

STYLE NO. 1007
CSA STYLE NO. TR-64
PVC INSULATION — 80°C. 300V.

Specifications: Passes the FR-1 vertical flame test. U.L. File E-19046. Style #1007. C.S.A. File LR-25765-2. Style #TR-64.
Conductor: Stranded Tinned Copper
Insulation: PVC
Temperature: 80°C
Rating: 300 Volts

STANCOR Cat. No.	AWG Size	Conductor Strand	Insulation Thick. (inch.)	Approx. Dia. (inch.)	Stock Colors	Standard Spool Length in Feet
3100	24	7/32	1/64	.058	1-30 Inclusive	100, 1000, 5000
3101	22	7/30	1/64	.064		100, 1000, 5000
3102	20	10/30	1/64	.072		100, 1000, 4000
3103	18	16/30	1/64	.080		100, 1000, 4000
3104	16	26/30	1/64	.096		100, 500, 1000

U.L. Style No. 1007 with Overcoated TCW available with Standard Stranding in A.W.G. sizes and colors listed below.

STANCOR Cat. No.	AWG Size	Conductor Strand	Insulation Thick. (inch.)	Approx. Dia. (inch.)	Stock Colors	Standard Spool Length in Feet
3109	24	7/32	1/64	.058	2, 4, 5, 6, 9, 10	100, 1000, 5000
3110	22	7/30	1/64	.064		100, 1000, 5000
3111	20	10/30	1/64	.072		100, 1000, 4000
3112	18	16/30	1/64	.080		100, 1000, 4000

U.L. FILE E-12586

STYLE NO. 1015
PVC INSULATION—105°C., 600V.

Specifications: Passes the FR-1 vertical flame test. U.L. File E-12586. Style #1015. C.S.A. File 15540 TEW.
Conductor: Stranded Tinned Copper
Insulation: PVC
Temperature: 105°C
Rating: 600 Volts

STANCOR Cat. No.	AWG Size	Conductor Strand	Insulation Thick. (inch.)	Approx. Dia. (inch.)	Stock Colors	Standard Spool Length in Feet
3099	24	7/32	1/32	.089	1, 2, 3, 4, 5, 9, 10, 13	100, 1000, 5000
3074	22	7/30	1/32	.096		100, 1000, 5000
3076	20	10/30	1/32	.103		100, 1000, 4000
3078	18	16/30	1/32	.113		100, 1000, 4000
3080	16	26/30	1/32	.125		100, 500, 1000
3081	14	41/30	1/32	.140		100, 500

U.L. Style No. 1015 with Overcoated TCW available with Standard Stranding in A.W.G. sizes and colors listed below.

STANCOR Cat. No.	AWG Size	Conductor Strand	Insulation Thick. (inch.)	Approx. Dia. (inch.)	Stock Colors	Standard Spool Length in Feet
3105	24	7/32	1/32	.088	2, 4, 5, 6, 9, 10	100, 1000, 5000
3106	22	7/30	1/32	.096		100, 1000, 5000
3107	20	10/30	1/32	.103		100, 1000, 4000
3108	18	16/30	1/32	.113		100, 1000, 4000

AUTOMOTIVE PRIMARY WIRE
S.A.E. THERMOPLASTIC (PVC) GENERAL PURPOSE TYPE

Specifications: Resistant to flame, oil, gasoline, grease, acid and most solvents S.A.E.-GPT J558A.
Conductor: Stranded Tinned Copper
Insulation: PVC
Temperature: Meets S.A.E. requirements or 120°C for 120 hours and −40°C for three hours.
Rating: 600 Volts.

STANCOR Cat. No.	AWG Size	Conductor Strand	Insulation Thick. (inch.)	Approx. Dia. (inch.)	Stock Colors	Standard Spool Length in Feet
3089	18	16/30	.023	.093	Blue	100, 250
3090	16	19/29	.023	.103	Black	100, 250
3091	14	19/27	.023	.117	Green	100, 250
3092	12	19/25	.026	.143	Red	100, 250
3093	10	19/23	.031	.175	White	100, 250

Manufactured to current government specifications and latest revisions. Other put ups and/or colors available on special order.

COLOR CODE

1. Brown
2. Red
3. Orange
4. Yellow
5. Green
6. Light Blue
7. Violet (purple)
8. Gray (slate)
9. White
10. Black
11. Tan
12. Pink
13. Dark Blue
14. White/Black
15. White/Red
16. White/Green
17. White/Yellow
18. White/Blue
19. White/Brown
20. White/Orange
21. White/Gray
22. White/Violet
23. White/Black/Red
24. White/Black/Green
25. White/Black/Yellow
26. White/Black/Blue
27. White/Black/Brown
28. White/Black/Orange
29. White/Black/Gray
30. White/Black/Violet

First color in stripe combination is body color and second and third colors are stripes. EXAMPLE: White/Black/Red.

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ESSEX STANCOR

TEFLON INSULATED WIRE

MIL-W-16878D

Teflon has been solving critical electronic wire insulation problems for over 25 years.

Capable of withstanding severe temperature extremes, Stancor Teflon wires and cables are also unaffected by oil, heat, water, solvents, acids or alkalies, have excellent solder iron resistance and have passed the FR-1 vertical flame test.

Stancor Teflon-insulated electronic wires and cables are produced in the largest, most modern electronic wire plant in the country, with the latest in wire processing equipment, including extruding machines to handle both Teflon T.F.P. (temp. rating −100°C to +260°C) and Teflon T.E.P. (temp. rating −100°C to +200°C). Silver or nickel plated conductors can be supplied with either fuse-wrapped or extruded Teflon insulation.

Because of their excellent thermal and electrical characteristics, Stancor Teflon-insulated wires and cables are recommended for critical high temperature and electronic applications where space and weight factors are paramount.

TYPE-E
TEFLON INSULATION

Description: Thin wall hookup wire has high temperature insulation, is light weight, provides space savings, has excellent solder iron resistance and is unaffected by most chemicals.

Mil. Spec. No.: Mil-W-16878D

Conductor: Solid or Stranded Silver Plated Copper. Solid conductors are not covered by Mil-W-16878D

Insulation: Extruded Teflon

Temperature: Silver Plated +200°C

Rating: 600 Volts R.M.S.

STANCOR Cat. No.	Mil. Type Designation	Conductor		O.D. (inches)		Stock Colors	Std. Spool Length in Feet
		AWG Size	Strand	Min.	Max.		
STRANDED							
3544	E-30	30	7x38	.028	.036	1-10	100, 500, 1000
3545	E-28	28	7x36	.028	.036	1-10	100, 500, 1000
3546	E-26	26	7x34	.035	.043	1-10	100, 500, 1000
3547	E-26	26	19x38	.035	.043	1-10	100, 500, 1000
3548	E-24	24	7x32	.040	.048	1-10	100, 500, 1000
3549	E-24	24	19x36	.040	.048	1-10	100, 500, 1000
3550	E-22	22	7x30	.046	.054	1-10	100, 500, 1000
3551	E-22	22	19x34	.046	.054	1-10	100, 500, 1000
3552	E-20	20	7x28	.054	.062	1-10	100, 500, 1000
3553	E-20	20	19x32	.054	.062	1-10	100, 500, 1000
3554	E-18	18	7x26	.064	.074	1-10	100, 500, 1000
3555	E-18	18	19x30	.064	.074	1-10	100, 500, 1000
3556	E-16	16	19x29	.073	.086	1-10	100, 500, 1000
3557	E-14	14	19x27	.087	.101	1-10	100, 500, 1000
SOLID							
3558	E-26	26	Solid	.035	.043	1-10	100, 500, 1000
3559	E-24	24	Solid	.040	.048	1-10	100, 500, 1000
3560	E-22	22	Solid	.046	.054	1-10	100, 500, 1000
3561	E-20	20	Solid	.054	.062	1-10	100, 500, 1000

Manufactured to current government specifications and latest revisions. Other put ups and/or colors available on special order.

COLOR CODE

1. Brown
2. Red
3. Orange
4. Yellow
5. Green
6. Light Blue
7. Violet (purple)
8. Gray (slate)
9. White
10. Black

INSULATION COLORS

Wire and nylon jacket supplied in the ten basic EIA colors in accordance with Mil. Std. 681, also with one, two or three stripes on special order.

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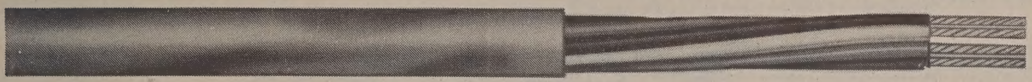
UNSHIELDED AUDIO & CONTROL CABLES

ESSEX STANCOR



Conductor: Tinned copper except*

Insulation: 80°C PVC

Shield: Conductors twisted together (not paired)

Jacket: Overall gray PVC

CONDUCTOR COLOR CODE:

1. Black
2. White
3. Red
4. Green
5. Orange
6. Blue
7. White/Black
8. Red/Black
9. Green/Black
10. Orange/Black
11. Blue/Black
12. Black/White
13. Red/White
14. Green/White
15. Blue/White
16. Black/Red
17. White/Red
18. Orange/Red
19. Blue/Red
20. Red/Green
21. Orange/Green
22. Black/White/Red
23. White/Black/Red
24. Red/Black/White
25. Green/Black/White

Manufactured to current government specifications and latest revisions.
Other put ups available on special order.
Passes FR-1 vertical flame test.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Wall Thickness (Inches)	Jacket Thickness (Inches)	Nom. O.D. (Inches)	Working Voltage	Standard Spool Lengths in Feet
4000	2	22(7/30)	.010	.020	.140	200V	25, 100, 250, 500, 1000
4001	3	22(7/30)	.010	.020	.148	200V	25, 100, 250, 500, 1000
4002	4	22(7/30)	.010	.020	.170	200V	25, 100, 250, 500, 1000
4003	5	22(7/30)	.010	.020	.175	200V	25, 100, 250, 500, 1000
4004	7	22(7/30)	.010	.020	.190	200V	100, 500, 1000
4190	8	22(7/30)*	.010	.020	.205	200V	100, 500, 1000
4005	10	22(7/30)	.010	.020	.240	200V	100, 500, 1000
4006	12	22(7/30)	.010	.020	.250	200V	100, 500, 1000
4007	15	22(7/30)	.010	.025	.285	200V	100, 500, 1000
4009	25	22(7/30)	.010	.030	.360	200V	100, 500, 1000
4010	2	20(10/30)	.016	.020	.180	350V	100, 500, 1000
4011	3	20(10/30)	.016	.020	.190	350V	100, 500, 1000
4012	4	20(10/30)	.016	.020	.215	350V	100, 500, 1000
4154	4	20(7/28)*	.010	.020	.180	200V	100, 500, 1000
4189	5	20(7/28)*	.010	.020	.190	200V	100, 500, 1000
4017	2	18(16/30)	.016	.020	.200	350V	100, 500, 1000
4018	3	18(16/30)	.016	.020	.215	350V	100, 500, 1000
4019	4	18(16/30)	.016	.020	.235	350V	100, 250, 500, 1000
4020	5	18(16/30)	.016	.020	.250	350V	100, 250, 500, 1000
4021	7	18(16/30)	.016	.025	.292	350V	100, 250, 500, 1000
4022	9	18(16/30)	.016	.025	.320	350V	100, 250, 500, 1000
4023	12	18(16/30)	.016	.030	.395	350V	100, 250, 500, 1000
4026	25	18(16/30)	.016	.040	.565	350V	500, 1000
4027	4	16(19/29)	.030	.045	.375	600V	100, 500, 1000
4028	5	16(19/29)	.030	.045	.405	600V	100, 500, 1000
4029	7	16(19/29)	.030	.045	.455	600V	100, 500, 1000
4030	9	16(19/29)	.030	.045	.510	600V	100, 500, 1000
4031	12	16(19/29)	.030	.060	.600	600V	100, 500, 1000
4032	15	16(19/29)	.030	.060	.650	600V	100, 500, 1000
4033	19	16(19/29)	.030	.065	.715	600V	100, 500, 1000
4035	4	14(19/27)	.045	.045	.495	600V	100, 500, 1000
4036	5	14(19/27)	.045	.060	.560	600V	100, 500, 1000
4037	7	14(19/27)	.045	.060	.630	600V	100, 500, 1000
4038	9	14(19/27)	.045	.065	.750	600V	500, 1000
4039	12	14(19/27)	.045	.065	.770	600V	100, 500, 1000

*Bare copper wire

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ESSEX STANCOR

MULTI CONDUCTOR CABLE/ MULTIPLE PAIR UNSHIELDED INTERCOM & CONTROL CABLES

Conductor: Tinned copper

Insulation: 80°C PVC

Shield: Conductors twisted into pairs

Jacket: Overall gray PVC

Rating: 200 volt suggested working voltage for 22 AWG conductors, 400 volts for 18 AWG conductors

CONDUCTOR COLOR CODE:

1. Black paired with Red
2. Black paired with White
3. Black paired with Green
4. Black paired with Blue
5. Black paired with Brown
6. Black paired with Yellow
7. Black paired with Orange
8. Red paired with Green
9. Red paired with White
10. Red paired with Blue
11. Red paired with Yellow
12. Red paired with Brown
13. Red paired with Orange
14. Green paired with Blue
15. Green paired with White
16. Green paired with Brown
17. Green paired with Orange
18. Green paired with Yellow
19. White paired with Blue
20. White paired with Brown
21. White paired with Orange
22. White paired with Yellow
23. Blue paired with Brown

Manufactured to current government specifications and latest revisions.

Other put ups available on special order.

Passes FR-1 vertical flame test.

STANCOR Part No.	No. of Pairs	No. of Cond.	AWG & Stranding	Wall Thickness (Inches)	Jacket Thickness (Inches)	Nom. O.D. (Inches)	Standard Spool Lengths in Feet
4040	1	2	22 Solid	.010	.020	.130	100, 500, 1000
4041	2	4	22 Solid	.010	.025	.208	100, 500, 1000
4042	3	6	22 Solid	.010	.025	.220	100, 500, 1000
4043	4	8	22 Solid	.010	.025	.240	100, 500, 1000
4044	5	10	22 Solid	.010	.025	.257	100, 500, 1000
4046	8	16	22 Solid	.010	.025	.300	100, 500, 1000
4047	9	18	22 Solid	.010	.025	.320	100, 500, 1000
4048	11	22	22 Solid	.010	.025	.345	100, 500, 1000
4049	13	26	22 Solid	.010	.030	.370	100, 500, 1000
4050	15	30	22 Solid	.010	.030	.393	100, 500, 1000
4052	19	38	22 Solid	.010	.030	.420	100, 500, 1000
4053	23	46	22 Solid	.010	.035	.475	100, 500, 1000
4054	1	2	22(7/30)	.010	.025	.150	100, 500, 1000
4056	3	6	22(7/30)	.010	.025	.233	100, 500, 1000
4057	4	8	22(7/30)	.010	.025	.260	100, 500, 1000
4058	6	12	22(7/30)	.010	.025	.300	100, 500, 1000
4059	9	18	22(7/30)	.010	.035	.370	100, 500, 1000
4060	11	22	22(7/30)	.010	.035	.400	100, 500, 1000
4061	12	24	22(7/30)	.010	.035	.407	100, 500, 1000
4063	15	30	22(7/30)	.010	.040	.450	100, 500, 1000
4064	16	32	22(7/30)	.010	.040	.470	100, 500, 1000
4065	19	38	22(7/30)	.010	.040	.480	100, 500, 1000
4066	23	46	22(7/30)	.010	.040	.530	100, 500, 1000
4071	1	2	18(16/30)	.016	.030	.220	100, 500, 1000
4072	2	4	18(16/30)	.016	.035	.350	100, 500, 1000
4074	3	6	18(16/30)	.016	.037	.377	100, 500, 1000
4076	6	12	18(16/30)	.016	.045	.490	100, 500, 1000
4078	9	18	18(16/30)	.016	.055	.590	100, 500, 1000
4079	12	24	18(16/30)	.016	.055	.652	100, 500, 1000
4080	15	30	18(16/30)	.016	.060	.712	100, 500, 1000
4081	19	38	18(16/30)	.016	.070	.780	100, 500, 1000

*4045 — 6 Pair (See Listing Elsewhere)

**4051 — 16 Pair (See Listing Elsewhere)

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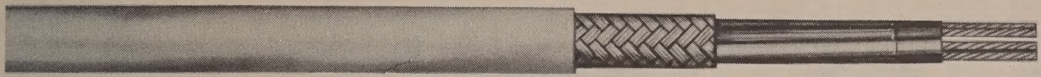
MULTI CONDUCTOR CABLES

ESSEX STANCOR

SHIELDED CONTROL CABLES



Mil. Spec. No.: MIL-W-16878/B
Conductor: Tinned copper
Insulation: 105°C PVC
Jacket: Clear nylon over each conductor — overall white PVC
Shield: Tinned copper braided with 90% coverage
Rating: 400 volts working voltage

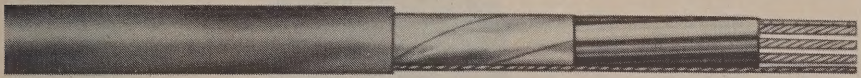
CONDUCTOR COLOR CODE:

1. White
2. Black
3. Red
4. Green

Manufactured to current government specifications and latest revisions.
Other put ups available on special order.
Passes FR-1 vertical flame test.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Wall Thickness (Inches)	Nylon Thickness (Inches)	Jacket Thickness (Inches)	Nom. O.D. (Inches)	Standard Spool Lengths in Feet
4097	2	24(19/36)	.010	.003	.016	.154	100, 500, 1000
4101	3	24(19/36)	.010	.003	.016	.163	100, 500, 1000
4105	4	24(19/36)	.010	.003	.017	.177	100, 500, 1000
4094	1	20(19/32)	.010	.003	.010	.106	100, 500, 1000
4098	2	20(19/32)	.010	.003	.019	.188	100, 500, 1000
4102	3	20(19/32)	.010	.003	.019	.199	100, 500, 1000
4106	4	20(19/32)	.010	.003	.021	.219	100, 500, 1000
4095	1	18(19/30)	.010	.003	.012	.120	100, 500, 1000
4099	2	18(19/30)	.010	.003	.021	.214	100, 500, 1000
4103	3	18(19/30)	.010	.003	.022	.226	100, 500, 1000
4107	4	18(19/30)	.010	.003	.023	.248	100, 500, 1000
4100	2	16(19/29)	.010	.003	.023	.230	100, 500, 1000
4104	3	16(19/29)	.010	.003	.023	.244	100, 500, 1000
4108	4	16(19/29)	.010	.003	.025	.270	100, 500, 1000

SHIELDED AUDIO & COMMUNICATIONS CABLE



Conductor: Tinned copper
Insulation: Polyethylene
Shield: Aluminum/Mylar wrap, 100% coverage, aluminum surface facing out Longitudinal drain wire, 7/30 22 AWG
Jacket: Gray PVC
Rating: 400 volts working voltage

CONDUCTOR COLOR CODE:

1. Black 2. Red 3. Clear

Manufactured to current government specifications and latest revisions.
Other put ups available on special order.
Passes FR-1 vertical flame test.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Wall Thickness (Inches)	Jacket Thickness (Inches)	Nom. O.D. (Inches)	Standard Spool Lengths in Feet
4083	2	22(7/30)	.016	.020	.190	100, 500, 1000
4084	3	22(7/30)	.016	.020	.205	100, 500, 1000
4085	2	20(10/30)	.016	.020	.210	100, 500, 1000
4087	2	18(16/30)	.016	.020	.230	100, 500, 1000
4091	2	14(41/30)	.030	.030	.362	100, 500, 1000

Conductor: Tinned copper
Insulation: 80°C PVC
Shield: Flexible 75% coverage bare copper braided
Jacket: Gray PVC
Rating: 350 volts working voltage

CONDUCTOR COLOR CODE:

1. Black
2. Red
3. White
4. Green

Manufactured to current government specifications and latest revisions.
Other put ups available on special order.
Passes FR-1 vertical flame test.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Wall Thickness (Inches)	Jacket Thickness (Inches)	Nom. O.D. (inches)	Standard Spool Lengths in Feet
4130	2	24(7/32)	.016	.020	.180	100, 500, 1000
4131	2	22(7/30)	.016	.020	.190	100, 500, 1000
4132	3	22(7/30)	.016	.020	.205	100, 500, 1000
4137	2	18(16/30)	.016	.020	.230	100, 500, 1000

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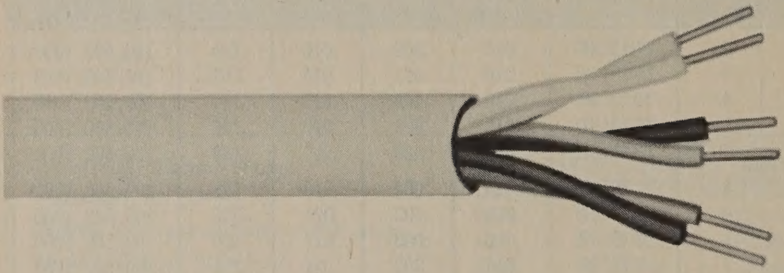
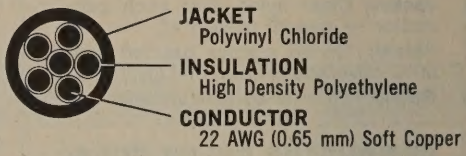
ESSEX STANCOR

MULTI-PAIR INSIDE-OUTSIDE STATION AND INTERCOM WIRE





APPLICATION

For outside use or inside runs from station protectors to telephone terminal blocks, intercoms and for distribution of low-voltage power when up to four pairs are required.

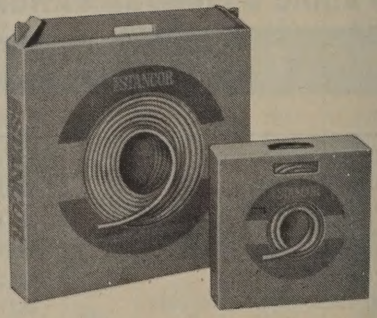
CONSTRUCTION

Conductor: 22 AWG (0.65 mm) bare, soft copper, solid.

Insulation: High density polyethylene.

Wire Assembly: Available in two, three and four pairs. Conductors are twisted into pairs with all different lengths of pair twist, cabled together, then jacketed.

Jacket: Special weather-resistant compound of polyvinyl chloride to resist the deteriorating effects of sunlight and extremes of temperature. Available in beige.



250, 500 and 1000 Foot
Put Ups In S-Pak

STANCOR Part No.	No. of Pairs	No. of Cond.	AWG & Stranding	Nom. O.D.	Conductor Color Coding	Jacket Color	Std. Length in Feet
4143	2	4	22 (Solid)	.185	White/Blue & Blue White/Orange & Orange	Beige	250, 500
4144	3	6	22 (Solid)	.220	White/Blue & Blue White/Orange & Orange White/Green & Green	Beige	250, 500
4145	4	8	22 (Solid)	.240	White/Blue & Blue White/Orange & Orange White/Green & Green White/Brown & Brown	Beige	250, 500

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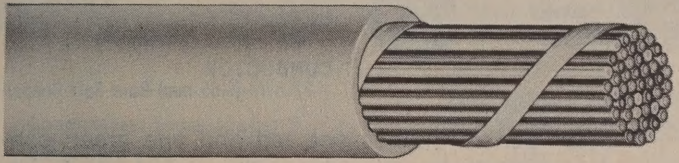
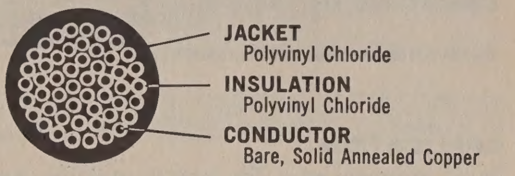
TELEPHONE/INTERCOM/ CONTROL CABLES-UNSHIELDED

ESSEX STANCOR





All cable dimensions and weights are subject to manufacturing tolerances.

APPLICATION

Designed for use with interior communications systems, such as sound systems and inside telephone PBX systems, where flexibility, crush resistance and Positive Identification are essential to obtain quick, easy and economical installations.

CONSTRUCTION

Conductor: Solid bare copper, 24 and 22 AWG (0.5 and 0.65 mm).

Insulation: Semi-rigid polyvinyl chloride colored to the standard telephone industry color code with Positive Identification bands at 1″ intervals on each conductor. Positive Identification bands match the insulation color of the mating conductor of a pair.

Core Assembly: Individual conductors are paired and pairs are cabled into a cylindrical core.

Jacket: Tough flame and abrasion resistant polyvinyl chloride. For ease of jacket removal a nylon slitting cord is placed under the jacket. Jacket available in beige.

STANCOR Part No.	AWG & Stranding	No. of Pairs	Cable Diameter		Jacket Thickness		Ap. Cable Weight		Standard Spool Length in Feet
			(Inches)	(mm)	(Inches)	(mm)	(lbs./kf)	(kg/km)	
4045	24 Solid	6	.24	6.1	.040	1.02	40	59	250, 500, 1000, 2000
4092	24 Solid	12	.31	7.9	.040	1.02	60	90	250, 500, 1000, 2000
4051	24 Solid	16	.34	8.6	.040	1.02	80	118	250, 500, 1000, 2000
4146	24 Solid	25	.41	10.4	.040	1.02	110	164	250, 500, 1000, 2000
4147	24 Solid	50	.56	14.2	.050	1.27	215	320	250, 500, 1000, 2000
4173	24 Solid	75	.66	16.8	.050	1.27	310	461	250, 500, 1000, 2000
4174	24 Solid	100	.74	18.8	.050	1.27	400	595	250, 500, 1000, 2000
4175	22 Solid	6	.29	7.4	.040	1.02	50	74	250, 500, 1000, 2000
4176	22 Solid	12	.38	9.7	.040	1.02	90	134	250, 500, 1000, 2000
4177	22 Solid	16	.43	10.9	.040	1.02	115	171	250, 500, 1000, 2000
4178	22 Solid	25	.52	13.2	.040	1.02	170	253	250, 500, 1000, 2000
4180	22 Solid	50	.71	18.0	.050	1.27	330	491	250, 500, 1000, 2000
4181	22 Solid	75	.84	21.3	.050	1.27	480	714	250, 500, 1000, 2000
4182	22 Solid	100	.96	24.4	.050	1.52	620	923	250, 500, 1000, 2000

COLOR CODE

FIRST CONDUCTOR OF PAIR									SECOND CONDUCTOR OF PAIR								
Pr.	Color of Insulation	Color of Band Mark	Pr.	Color of Insulation	Color of Band Mark	Pr.	Color of Insulation	Color of Band Mark	Pr.	Color of Insulation	Color of Band Mark	Pr.	Color of Insulation	Color of Band Mark	Pr.	Color of Insulation	Color of Band Mark
1	White	Blue	10	Red	Slate	19	Yellow	Brown	1	Blue	White	10	Slate	Red	19	Brown	Yellow
2	White	Orange	11	Black	Blue	20	Yellow	Slate	2	Orange	White	11	Blue	Black	20	Slate	Yellow
3	White	Green	12	Black	Orange	21	Violet	Blue	3	Green	White	12	Orange	Black	21	Blue	Violet
4	White	Brown	13	Black	Green	22	Violet	Orange	4	Brown	White	13	Green	Black	22	Orange	Violet
5	White	Slate	14	Black	Brown	23	Violet	Green	5	Slate	White	14	Brown	Black	23	Green	Violet
6	Red	Blue	15	Black	Slate	24	Violet	Brown	6	Blue	Red	15	Slate	Black	24	Brown	Violet
7	Red	Orange	16	Yellow	Blue	25	Violet	Slate	7	Orange	Red	16	Blue	Yellow	25	Slate	Violet
8	Red	Green	17	Yellow	Orange				8	Green	Red	17	Orange	Yellow			
9	Red	Brown	18	Yellow	Green				9	Brown	Red	18	Green	Yellow			

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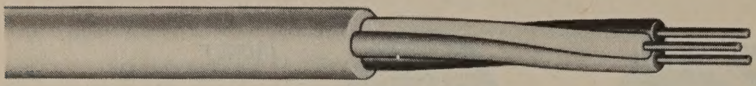
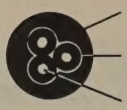
ESSEX STANCOR

INSIDE-OUTSIDE STATION AND INTERCOM WIRE





APPLICATION

Dual purpose wire for use in outside exposed or inside protected conditions, as are encountered from the station protector to the telephone terminal block. Installation can be accomplished by the use of a standard stapling gun.

CONSTRUCTION

Conductor: 22 AWG (0.65 mm) soft copper, solid.

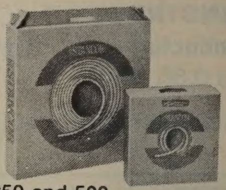
Insulation: Heat and color stabilized high density virgin polyethylene.

Color Code: Pair has one red and one green conductor, triple has third leg yellow, quad has fourth conductor black.

Wire Assembly: Insulated conductors are twisted together in 2, 3 or 4 conductor configuration and then jacketed.

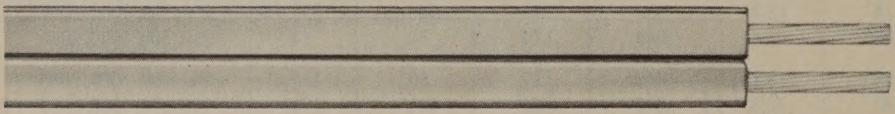
Jacket: Tough weather and flame resistant polyvinyl chloride jacket provides protection against exposure to outside weather conditions and inside house cleaning detergents, waxes, moisture, oil and most solvents.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Nom. O.D.	Conductor Color Coding	Jacket Color	Standard Spool Length in Feet
4140	2	22 Solid	.130	Red, Green	Beige	100, 250, 500
4141	3	22 Solid	.140	Red, Green, Yellow	Beige	100, 250, 500
4142	4	22 Solid	.150	Red, Green, Yellow, Black	Beige	100, 250, 500



250 and 500 Feet Put Ups in S-Pak

SPEAKER CABLE



Popular sizes of speaker cables are available per this listing. Conductors are coded (one bare copper and the other tinned copper) for polarity purposes. Insulation permits blending with decorator colors in indoor installations.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Standard Color	Nom. O.D. (Inches)	Wall Thick. (Inches)	Standard Spool Lengths in Feet
4183	2	16(26/30)	.031	.129 x .249	Clear	100, 250, 500, 1000
4184	2	18(41/34)	.031	.117 x .205	Clear	100, 250, 500, 1000
4185	2	20(7/28)	.016	.079 x .152	Clear	100, 250, 500, 1000
4186	2	22(7/30)	.016	.072 x .133	Clear	100, 250, 500, 1000
4187	2	24(7/32)	.016	.064 x .121	Clear	100, 250, 500, 1000
4188	2	22 Solid	.016	.070 x .130	Gray	100, 250, 500, 1000

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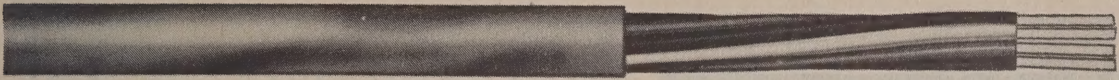
THERMOSTAT CONTROL CABLES FOR LOW VOLTAGE APPLICATIONS

ESSEX STANCOR



Conductors: Bare Copper

Insulation: PVC

Jacket: PVC

*All Conductors Twisted, Except in 2 Conductor Cable, Conductors are in Parallel.

STANCOR Part No.	No. of Cond.	AWG & Stranding	Nom. Wall Thickness (Inches)	Nom. O.D. (Inches)
4191	2	18 Solid	.016	.100 x .170*
4192	3	18 Solid	.016	.179
4193	4	18 Solid	.016	.196
4194	5	18 Solid	.016	.216
4195	6	18 Solid	.016	.236
4196	7	18 Solid	.016	.240
4197	8	18 Solid	.016	.257

CONDUCTOR COLOR CODE:

2. White, Red
3. White, Red, Green
4. White, Red, Green, Blue
5. White, Red, Green, Blue, Yellow
6. White, Red, Green, Blue, Yellow, Brown
7. White, Red, Green, Blue, Yellow, Brown, Orange
8. White, Red, Green, Blue, Yellow, Brown, Orange, Black

BUS BAR WIRE

Made in Accordance with Federal Spec. QQ-W-343.

Solid Tinned Copper Wire.

STANCOR Part No.	AWG	Nom. O.D. (Inches)	Area Cir. Mils	Standard Spool Lengths in Feet
5030	30	.010	100	100, 500, 1000
5028	28	.012	159	100, 500, 1000
5026	26	.016	253	100, 500, 1000
5024	24	.020	404	100, 500, 1000
5022	22	.025	640	100, 500, 1000
5020	20	.032	1020	100, 500, 1000
5018	18	.040	1620	100, 500, 1000
5016	16	.050	2580	100, 500, 1000
5014	14	.064	4110	100, 500, 1000
5012	12	.080	6530	100, 500, 1000

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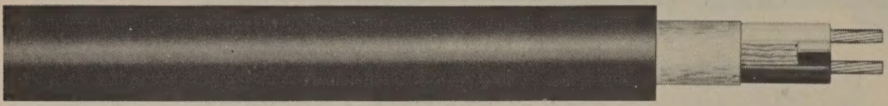
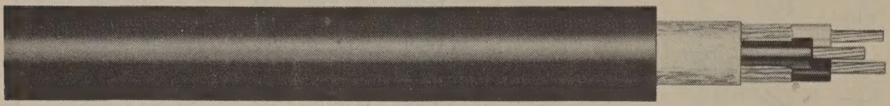
ESSEX STANCOR

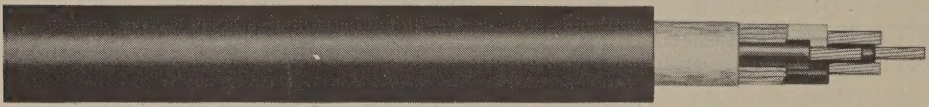
FLEXIBLE POWER SUPPLY CORDS



2-CONDUCTOR CORDS



3-CONDUCTOR CORDS



4-CONDUCTOR CORDS

These 60°C Stancor cords are covered by U.L. File reference E-6112 and C.S.A. File reference LR-12817. Cords can be made available for higher temperature ratings when required.

Cords are generally classified under one of the following service requirements, and the common types of cord according to U.L. type designation are shown opposite them:

1. **APPLIANCE CORD** — Types SV, SVO, SVT, SP, SPT, HPD, HSJ and HPN
2. **LIGHT DUTY** — Types SJ, SJO and SJT
3. **HEAVY DUTY** — Types S, SO and ST

All types except SP, SPT and HPN have separately insulated conductors, twisted, with an overall jacket. SP, SPT and HPN are parallel types with integral insulation.

The type designations further indicate the kind of insulation and jacket:

S, SJ, SV, SP — RUBBER — Recommended where cords will not be exposed to any appreciable amount of oils, grease, acids, alkalies or sunlight.

SO, SJO, SVO, HPN — NEOPRENE — Recommended where cords are repeatedly exposed to oils, grease, acids, alkalies or sunlight.

ST, SJT, SVT, SPT — POLYVINYLCHLORIDE (PVC) — Recommended where cords will be exposed to oils, grease, acids, alkalies or sunlight, and where a glossy finish with bright colors is desired. These types are also highly flame-resistant.

COLOR CODE OF CONDUCTORS: 1 - White, 2 - Black, 3 - Green, 4 - Red. (Doesn't apply to parallel appliance cords.)

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APPLIANCE CORD

ESSEX STANCOR

A lightweight round cord for use on vacuum cleaners, sewing machines, electric mixers, office machines, electronic equipment, and other light duty applications. This cord features an extra-flexible copper conductor, bare, paper serve (omitted with PVC), rubber or PVC insulation, conductors cabled with filler, paper binder, rubber, neoprene or PVC jacket.

	STANCOR Part No.	AWG Size	Conductor Stranding	Type	Insulation & Jacket	Approx. Dia. (In.)	Colors	Standard Spool Length in Feet
2-CONDUCTOR, ROUND, 300 VOLTS	**7000**	18	41/34	SV	Rubber	.245	Black, Gray	50, 100, 250
	7001	18	41/34	SVO	Neoprene	.245	Black	50, 100, 250
	7002	18	41/34	SVT	PVC	.245	Black, Gray	50, 100, 250
3-CONDUCTOR, ROUND, 300 VOLTS	**7003**	18	41/34	SV	Rubber	.255	Black	50, 100, 250
	7004	18	41/34	SVO	Neoprene	.255	Black	50, 100, 250

FLEXIBLE LIGHT DUTY CORD

This type of cord is used with refrigerators, freezers, washing machines, and other appliances, plus portable lighting and motion picture equipment, sound equipment, small motors, blowers, fans, electronic equipment and hand tools. The cord itself features a flexible or an extra-flexible copper conductor, bare, paper serve (omitted with PVC), rubber or PVC insulation, conductors cabled with filler, paper binder, rubber, neoprene or PVC jacket.

	STANCOR Part No.	AWG Size	Conductor Stranding	Type	Insulation & Jacket	Approx. Dia. (In.)	Colors	Standard Spool Length in Feet
2-CONDUCTOR, ROUND, 300 VOLTS	**7005**	18	16/30	SJ	Rubber	.300	Black	50, 100, 250
	7006	18	41/34	SJ	Rubber	.300	Black	50, 100, 250
	7007	18	16/30	SJO	Neoprene	.300	Black	50, 100, 250
	7008	18	41/34	SJT	PVC	.300	Black	50, 100, 250
	7010	16	65/34	SJ	Rubber	.325	Black	50, 100, 250
	7011	16	26/30	SJO	Neoprene	.325	Black	50, 100, 250
	7012	16	65/34	SJT	PVC	.325	Black	50, 100, 250
3-CONDUCTOR, ROUND, 300 VOLTS	7013	18	16/30	SJ	Rubber	.330	Black	50, 100, 250

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ESSEX STANCOR

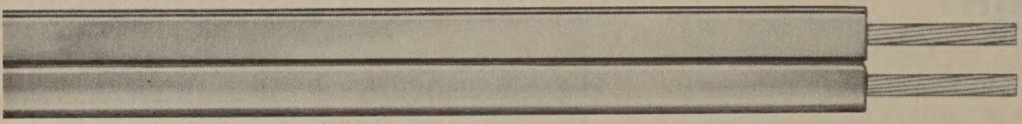
FLEXIBLE HEAVY DUTY CORD

This type of cord, with its heavier and more rugged jacket, is best qualified for use on floor sanders, grinders, vending machines, battery chargers, shop equipment, and other heavy duty tools and equipment which will be subjected to hard usage. The cord itself features a flexible or an extra-flexible copper conductor, bare, paper serve (omitted with PVC), rubber or PVC insulation, conductors cabled with filler, paper binder, rubber, neoprene or PVC jacket.

2-CONDUCTOR, ROUND, 600 VOLTS

STANCOR Part No.	AWG Size	Conductor Stranding	Type	Insulation & Jacket	Approx. Dia. (In.)	Color	Standard Spool Length in Feet
7019	18	41/34	S	Rubber	.385	Black	50, 100, 250
7021	16	65/34	S	Rubber	.400	Black	50, 100, 250
7022	16	65/34	SO	Neoprene	.400	Black	50, 100, 250
7023	14	41/30	S	Rubber	.527	Black	50, 100, 250

PARALLEL APPLIANCE CORD



These parallel flat cords provide easy slitting and stripping. SP-1 and SPT-1 are used for items such as lamps, clocks, radios, speaker hook-up, household fans, display signs and innumerable low power applications not subject to hard usage. SP-2 and SPT-2 are recommended where heavier insulation is desired. HPN is a heater cord for use where higher temperatures are required as on toasters, waffle irons, grills, coffeemakers, roasters, heat lamps, radiant heaters, soldering irons, industrial heating pots, etc. SP and SPT cords are normally rated for 60°C. HPN cord is rated at 90°C.

The cord itself features a flexible conductor, #34 AWG bare copper strands for SP and SPT, #34 AWG tinned copper strands for HPN, and rubber, PVC or neoprene integral insulation.

2-CONDUCTOR, PARALLEL, 300 VOLTS

STANCOR Part No.	AWG Size	Conductor Stranding	Type	Insulation & Jacket	Approx. Dia. (In.)	Colors	Standard Spool Length in Feet
7044	18	41/34	SP-1	Rubber	.108x.195	Black, Brown	250, 500, 1000
7045	18	41/34	SPT-1	PVC	.108x.195	Black, Brown White, Clear	250, 500, 1000
7056	18	41/34	SPT-1	PVC*	.108x.195	Black, Brown	250, 500, 1000
7046	18	41/34	SP-2	Rubber	.143x.259	Black, Brown	250, 500, 1000
7048	16	65/34	SPT-2	PVC	.150x.282	Black, Brown	250, 500, 1000

*105°C Parallel Appliance Cord.

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ESSEX CORD SET SELECTION GUIDE

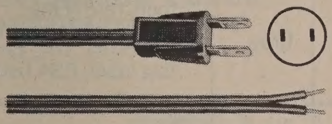
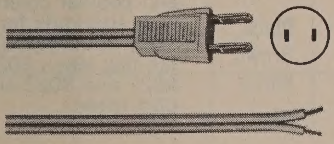
ESSEX STANCOR

Various types of electrical products use different types of cord construction. To help guide you, here is a listing of typical appliances and the types of cords used on them.

	Wire Type
Air Conditioners	SPT-3, SP-3, SJT, SJ
Blankets	SPT-1, SP-1, SPT-3
Calculators (Desk Type)	SPT-2, SP-2, SVT, SV, SJT, SJ
Can Openers	SP-2, SPT-2
Cash Registers	SJT, SJ
Clothes Dryers	SRD, HPN, HSJ
Dehumidifiers	SJ, SJT
Dictating Machines	SP-2, SPT-2, SV, SVT, SJ, SJT
Dishwashers	SJ, SJT
Fans	SP-1, SPT-1, SP-2, SPT-2, SJT, SJ
Floor Sanders, Scrubbers	SV, SVT, S, ST
Food Mixers and Slicers	SP-2, SPT-2, SV, SVT, SJ, SJO, SJT, S, SO, ST
Hair Dryers and Curlers	SP-2, SPT-2, HPN, HPD, SJ, SJT, HSJ

	Wire Type
Household Appliances	HPN, HPD, HSJ, HS
Lamps — Indoor/Outdoor	SPT-1, SP-1, SJ, SJT, SJO
Medical and Dental Equipment	SJ, SJT, S, SO, ST
Phonographs	SP-1, SPT-1, SJ, SJT
Photographic Viewers and Projectors	SP-2, SPT-2, SJ, SJT
Radios	SPT-1, SP-1, SPT-2, SP-2
Ranges	SRD, SRDT
Refrigerators	SPT-3, SP-3, SJT, SJ
Sewing Machines	SP-1, SPT-1, SP-2, SPT-2, SJ, SJT
Tape Recorders	SP-2, SPT-2, SJ, SJT
Television Receivers	SPT-1, SP-1
Tools — Portable Drills, Grinders, Lawn Mowers	SJ, SJT, S, ST
Vacuum Cleaners	SV, SVT, SJ, SJT, SPT-3, SJ, SJO, SJT
Washing Machines	S, SO, ST

SMALL APPLIANCE CORDS

	STANCOR Part No.	Cord Length (ft.)	AWG (Stranding)	Nom. O.D. (In.)	Rating	Type of Cord	Color	APPLICATIONS:
HEATING APPLIANCE, TOASTER & SPACE HEATER CORDS  Type HPN, Neoprene, 2 Conductor, Flat	8000	6	18 (41 x 34)	.143 x .269	1250 Watts 10A-125V	HPN	Black	**TYPE HPN, NEOPRENE, FLAT** For appliances that generate heat such as irons, toasters, bottle warmers, counter-top ovens, and have permanently attached cords. U/L tan flag label.
MIXER & FAN CORDS  Type SPT-2, Vinyl, 2 Conductor, Flat	8001	6	18 (41 x 34)	.143 x .259	1250 Watts 10A-125V	SPT-2 Vinyl	White	**TYPE SPT-2, VINYL, FLAT** For non heat generating appliances with permanently attached cords such as food mixers, blenders, juicers, knife sharpeners, fans, business machines, etc. U/L tan flag label, CSA listed.
	8002	9	18 (41 x 34)	.143 x .259	1250 Watts 10A-125V	SPT-2 Vinyl	Brown, White	

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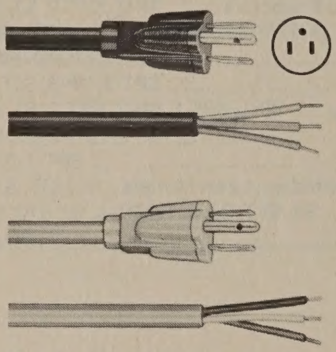
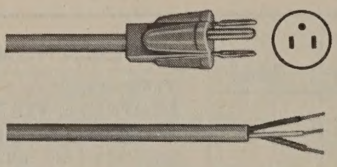
ESSEX STANCOR

POWER SUPPLY CORDS

3 CONDUCTOR POWER SUPPLY CORDS



Type SJ, SJT and SJO, Round



Type SVT, Vinyl, Round

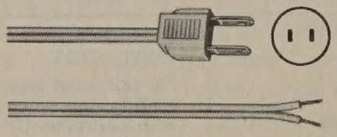
STANCOR Part No.	Cord Length (ft.)	AWG (Stranding)	Nom. O.D. (In.)	Rating	Type of Cord	Color
8006	6	18 (16 x 30)	.330	1250 Watts 10A-125V	SJ Rubber	Black
8007	6	18 (16 x 30)	.330	1250 Watts 10A-125V	SJT Vinyl	Gray
8008	8	18 (16 x 30)	.330	1250 Watts 10A-125V	SJ Rubber	Black
8009	8	18 (16 x 30)	.330	1250 Watts 10A-125V	SJT Vinyl	Gray
8010	8	18 (16 x 30)	.330	1250 Watts 10A-125V	SJO Neoprene	Black
8017	6	18 (41 x 34)	.255	1250 Watts 10A-125V	SVT Vinyl	Gray
8018	8	18 (41 x 34)	.255	1250 Watts 10A-125V	SVT Vinyl	Gray

APPLICATIONS:

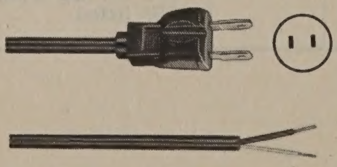
TYPE SJ, SJT and SJO, ROUND
For all electrical equipment requiring a three conductor grounded cord. Select the type of jacket material in accordance with probable environmental conditions. U/L tan flag label, CSA listed.

TYPE SVT, VINYL, ROUND
Smaller diameter power cord for business machines, instruments, small tools, etc. Fine stranding for extra flexibility. U/L tan flag label, CSA listed.

2 CONDUCTOR POWER SUPPLY CORDS



Type SPT-1, Vinyl, and SP-1, Rubber, Flat, Parallel Conductor Lamp Cords



Type SVT, Vinyl, Round

STANCOR Part No.	Cord Length (ft.)	AWG (Stranding)	Nom. O.D. (In.)	Rating	Type of Cord	Color
8021	6	18 (41 x 34)	.108x .195	1250 Watts 10A-125V	SPT-1 Vinyl	Black, Brown, Gray, White
8022	9	18 (41 x 34)	.108x .195	1250 Watts 10A-125V	SPT-1 Vinyl	Brown, Black, White
8023	12	18 (41 x 34)	.108x .195	1250 Watts 10A-125V	SPT-1 Vinyl	Black, Brown, White
8024	6	18 (41 x 34)	.108x .195	1250 Watts 10A-125V	SP-1 Rubber	Brown
8025	9	18 (41 x 34)	.108x .195	1250 Watts 10A-125V	SP-1 Rubber	Brown
8026	6	18 (41 x 34)	.245	1250 Watts 10A-125V	SVT Vinyl	Black, Gray

TYPE SPT-1, VINYL, and SP-1, RUBBER, FLAT
For small appliances, clocks, radios, fans, etc. In a variety of convenient lengths and popular colors. Fine stranding for extra flexibility. U/L tan flag label, 8021, 8022 and 8023 are CSA listed.

TYPE SVT, VINYL, ROUND
For kitchen appliances subjected to oils, greases, condiments, etc. Fine stranding for extra flexibility. U/L tan flag label, CSA listed.

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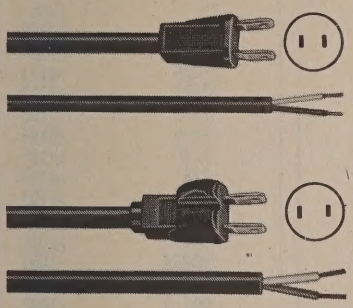
CONTROLS DIVISION / STANCOR PRODUCTS / 3501 W. Addison St., Chicago, IL 60618 / (312) 463-7400 / TWX: 910-221-5466

POWER SUPPLY CORDS
CONT.

ESSEX STANCOR

2 CONDUCTOR POWER SUPPLY CORDS

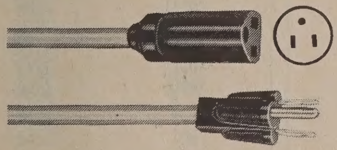


Type SJ, Rubber, Round

STANCOR Part No.	Cord Length (Ft.)	AWG Stranding	Nom. O.D. (In.)	Rating	Type of Cord	Color	APPLICATIONS:
8042	8	18 (16x30)	.30	1250 Watts 10A-125V	SJ Rubber	Black	**TYPE SJ, RUBBER, ROUND** For small appliances using fractional horsepower motors not requiring a three conductor grounding cord. U/L tan flag label, CSA listed.
8028	8	16 (26x30)	.325	1625 Watts 13A-125V	SJ Rubber	Black	

*105°C Parallel Appliance Cord

3-CONDUCTOR LONG EXTENSION CORDS
OUTDOOR/INDOOR USE



Type SJT, Vinyl, Round

STANCOR Part No.	Cord Length (Ft.)	AWG Stranding	Nom. O.D. (In.)	Rating	Type of Cord	Color	
8200	25	18 (16x30)	.330	1250 Watts 10A-125V	SJT Vinyl	Orange	**TYPE SJT, VINYL, ROUND** For outdoor use to power lawn mowers, hedge clippers, electric saws, etc. The bright orange jacket provides high visibility to minimize cutting the cord. U/L blue flag label.
8201	50	18 (16x30)	.330	1250 Watts 10A-125V	SJT Vinyl	Orange	
8202	25	16 (26x30)	.355	1625 Watts 13A-125V	SJT Vinyl	Orange	
8203	50	16 (26x30)	.355	1625 Watts 13A-125V	SJT Vinyl	Orange	
8204	100	16 (26x30)	.355	1250 Watts 10A-125V	SJT Vinyl	Orange	

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ESSEX STANCOR

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ALPHA / STANCOR

Alpha	Stancor
286	5014
289	5012
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296	5018
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298	5022
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299/3	5030
777	8017
778	8008
779	8009
1064	4027
1065	4028
1067	4029
1069	4030
1072	4031
1075	4032
1079	4033
1133	4074
1136	4076
1139	4078
1142	4079
1145	4080
1149	4081
1173	4001
1174	4002
1175	4003
1177	4004
1180	4005
1181	4006
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1181/25	4009
1202	4140
1203	4141
1204	4142
1243	4157
1243/3	4158
1243/4	4156
1274	4035
1275	4036
1277	4037
1279	4038
1282	4039
1300	4040
1302	4041
1304	4042
1305	4043
1307	4045
1307/9	4047
1308/11	4048
1309	4049
1309/15	4050
1311	4052
1312	4053
1318	4056
1319	4057
1322	4058
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1328	4066
1550	3061
1551	3062
1553	3063
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1560	3067
1563	3070
1565	3071
1704	4168
1710	4169
1713	4170
1715	4171
1716	4172
1737	4132
1826	4163
1827	4164
1828	4165
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1897	4071
1898/4	4019
1898/12	4023
1898/25	4026
1931	7001
1932	7007
1933	7011
1935	7022
1945	4187
1948	4188
1949	4185
1951	7000
1951/3	7003
1952	7005, 7006
1952/3	7013
1953	7010
1977	7045
2256	4152
2258	4151
2258/3	4153
2401	4083
2403	4084
2411	4085
2422	4087
2460	4149
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2464	4155
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3051	3101
3053	3102
3055	3103
3057	3104
3071	3074
3073	3076
3075	3078
3077	3080
3079	3081
3211	4097
3212	4101
3213	4105
3230	4094
3231	4098
3232	4102
3233	4106
3246	4100
3247	4104
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5858	3556
6022	4159
7276	4191
7277	4192
7278	4193
7279	4194
7280	4195
7281	4196
7282	4197
9008	1000
9008A	1001
9011	1002
9011A	1003
9058	1006
9058A	1007
9058C	1009
9059	1010
9059B	1011
9062	1012
9062A	1022
9062B	1013
9071B	1014
9174	1016
9178B	1503
9179B	1504
9180B	1505
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9214	1018
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9844	2026
9846	2004
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ESSEX STANCOR

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8021	5022
8022	5024
8023	5026
8024	5028
8025	5030
8213	2007
8214	2004
8216	1016
8228	2041
8237	1000
8238	1002
8240	1006
8241	1010
8254	1012
8255	1013
8258	1014
8259	1007
8261	1003
8262	1009
8263	1011
8267	1017
8268	1018
8401	4168
8403	4170
8404	4171
8405	4172
8411	4167
8422	4169
8443	4001
8444	4002
8445	4003
8446	4163
8447	4164
8448	4165
8449	4166
8450	4149
8451	4150
8452	7000
8456	4005
8457	4006
8458	4007
8459	4009
8460	4115
8465	4020
8466	4023
8467	4021
8469	4022
8472	7010
8473	7006
8482	4161
8483	4162
8484	4154
8485	4189
8488	4190
8489	4019
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8521	3065
8522	3064
8523	3063
8524	3062
8525	3061
8527	3067
8528	3071
8529	3070
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8622	4031
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8732	4156
8734	4157
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8749	4063
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8754	4049
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8757	4043
8759	4152
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8762	4085
8763	4158
8771	4084
8773	4159
8781	4188
8782	4187
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8791	4153
8794	4141
8795	4140
8916	3081
8917	3080
8918	3078
8919	3076
8920	3074
9156	4072
9158	4044
9160	4046
9233	2026
9233	2039
9234	2027
9234	2040
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9252	1020
9269	1022
9273	1019
9301	2023
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9623	4036
9624	4038
9626	4026
9712	4186
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9742	4080
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9749	4066
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9964	4106
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9973	4101
9974	4105
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17109	8022
17112	8023
17116	8001
17126	8024
17129	8025
17139	8002
17205	8026
17237	8017
17239	8018
17308	8042
17328	8028
17405	8007
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17408	8008
17409	8010
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17492	8201
17494	8202
17495	8203
17497	8204
17806	8000
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19103	7021
19104	7019
19110	7010
19111	7006
19115	7044
19120	7000
19121	7046
19122	7045
19126	7048
19127	7005
19129	7013
19140	7002
19141	7008
19142	7012
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19227	7007
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83001	3545
83002	3546
83003	3549
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83008	3552
83009	3555
83010	3556
83241	1501
83242	1502
83264	1504
83265	1503
83266	1505

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01360	4185
01362	4186
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01401	7046
01402	7048
01415	7045
01418	4184
01420	7000
01421	7003
01425	7005
01426	7010
01432	7019
01434	7021
01435	7013
01477	7001
01478	7007
01481	7011
01487	7022
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02103	3078
02104	3080
02105	3081
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02911	4191
02912	4194
02913	4192
02914	4195
02915	4196
02916	4197
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03223	5018
03224	5024
03226	5026
03228	5028
03230	5030
03233	5016
03243	5014
03253	5012
04010	4041
04014	4042
04015	4043
04408	4140
04410	4141
04412	4142
05015	2004
05025	2007
05755	2026
05760	2041
05775	2029
05780	2023
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07014	3545
07015	3547
07018	3546
07019	3549
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07032	3552
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07038	3555
07042	3556
07046	3557
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07602	3062
07604	3063
07605	3070
07606	3064
07607	3071
07608	3065
07610	3066
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24589	8022
24596	8021
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ESSEX STANCOR

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18-0216-18	3103
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18-5216-18	3064
18-5226-16	3065
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18-5265-12	3067
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21-316	1009
21-318	1022
21-327	1015
21-441	1020
21-598	1016
21-771	1013
21-779	1017
21-780	1018
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22-03804	4081
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22-04602	4066
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421-098	1505
421-139	1501
421-176	1502
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621-189	2005
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621-242-1	2032
621-246-1	2034
621-248-1	2040
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621-276-1	2025
621-277-1	2020
621-284-1	2029
621-285-1	2030
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621-314	2010
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02513-00	4197
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02517-00	4193
02518-00	4194
02519-00	4195
02574-00	4191
04352-22	4188
41511-14	7023
42400-6	3095
42400-8	3094
42400-10	3093
42400-12	3092
42400-14	3091
42400-16	3090
42400-18	3089
42536-16	7012
42536-18	7008
46409-16	7048
46470-18	7045
46472-18	7056
48576-18	7003
48584-18	7004
51386-18	7044
51388-18	7046
51503-18	7013
51504-16	7021
51504-18	7019
51506-16	7022
51512-16	7011
51512-18	7007
51515-18	7001
51516-18	7000
51593-16	7010
51593-18	7006
51594-18	7005
52331-14	3081
52331-16	3080
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52331-20	3076
52331-22	3074
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52352-20	4185
52352-22	4186
52352-24	4187
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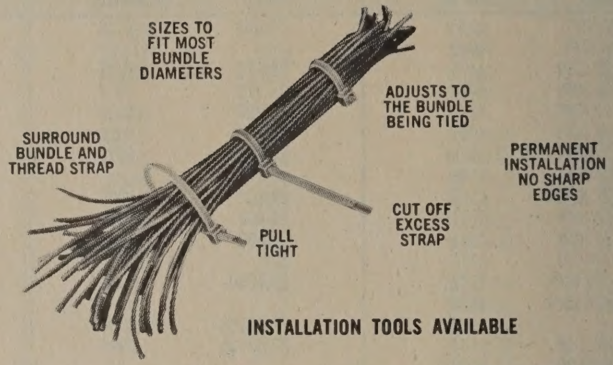
CONTROLS DIVISION / STANCOR PRODUCTS / 3501 W. Addison St., Chicago, IL 60618 / (312) 463-7400 / TWX: 910-221-5466

Grayhill®

FASTRAPS™ CABLE TIES AND CLAMPS

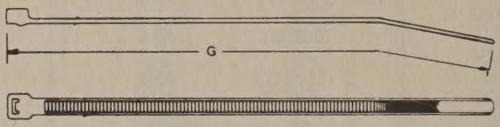
PERMANENT WIRE AND CABLE TIES A QPL TIE AT A LOWER COST

- HIGH DIELECTRIC STRENGTH, HIGH TENSILE STRENGTH AND OUTSTANDING RESILIENCE
- RESISTANCE TO ABSORPTION AND ABRASION, AND CHEMICAL DETERIORATION FROM SOLVENTS, OIL, GREASE
- MOLDED FROM NYLON — WHITE (NATURAL) IS STANDARD COLOR — OTHER COLORS AVAILABLE
- MEETS MS-3367 AND MIL-S-23190

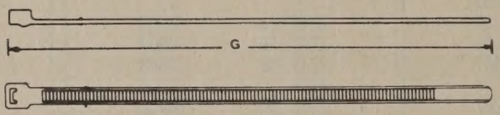

SIZES TO FIT MOST BUNDLE DIAMETERS
ADJUSTS TO THE BUNDLE BEING TIED
SURROUND BUNDLE AND THREAD STRAP
PERMANENT INSTALLATION NO SHARP EDGES
CUT OFF EXCESS STRAP
PULL TIGHT

INSTALLATION TOOLS AVAILABLE

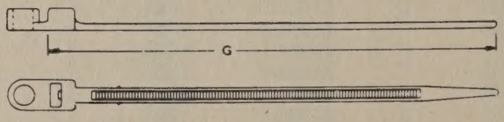
FASTRAPS Bent Tip Cable Tie Designed for Easy Threading
Standard Duty (Model 6005)



FASTRAPS Straight Tip Cable Tie . . . Provides Maximum Strength
Heavy Duty (Model 6006)



FASTRAPS Cable Tie with Mounting Hole
Heavy Duty, Straight Tip (Model 6007) .250″ mounting hole
Standard Duty, Bent Tip (Model 6008) .205″ mounting hole



Part No.	Prices In packages of 100 or 1000, except 11 and 14″ lengths, which are packages of 100 or 500	
Stem Length Color	PRICE/100 1C	1M To 10M
6005 — 0350 NAT	$1.58	$10.50
6005 — 0400 NAT	2.10	14.00
6005 — 0550 NAT	2.78	18.50
6005 — 0675 NAT	3.24	21.60
6005 — 0800 NAT	3.16	21.10
6005 — 1100 NAT	6.82	45.50
6005 — 1400 NAT	8.02	53.50
6006 — 1400 NAT	13.10	87.30
6006 — 2100 NAT	24.56	163.70
6006 — 2800 NAT	26.97	179.75
6007 — 1400 NAT	19.68	131.15
6007 — 2100 NAT	26.40	176.00
6007 — 2800 NAT	29.97	199.75
6008 — 0550 NAT	5.07	33.85
6008 — 0675 NAT	5.16	34.40

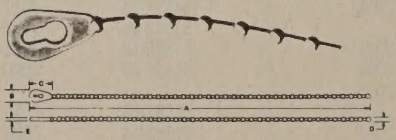
ORDERING INFORMATION:

Color: NAT = White (Natural) Nylon. Other colors available (50,000 pc. min. order)

Length: 0350 = 3½″, 0400 = 4″, 0550 = 5½″, 0675 = 6¾″, 1100 = 11″, 1400 = 14″, 2100 = 21″, 2800 = 28″

Basic Stem Number for FASTRAPS Type

REUSABLE, ECONOMICAL WIRE AND CABLE TIES



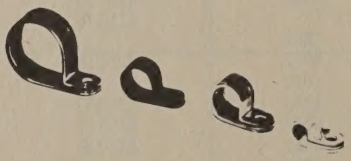
NYLON — Natural (NAT) only Model 6002
POLYETHYLENE — Model 6003

LENGTH:
4″ (400), 5″ (500), 6″ (600) 8″ (800), 10″ (1000)

Part No.	Prices In packages of 100 or 1000	
Stem Length Color	PRICE/100 1C	1M To 10M
6002 — 0400 NAT	$1.16	$5.75
6002 — 0500 NAT	1.22	6.12
6002 — 0600 NAT	2.36	11.76
6002 — 0800 NAT	3.00	14.95
6002 — 1000 NAT	3.52	17.65
6003 — 0400 *	.92	4.60
6003 — 0500 *	.99	4.94
6003 — 0600 *	2.12	10.59
6003 — 0800 *	2.34	11.66
6003 — 1000 *	2.42	12.13

*COLORS: Natural (NAT), Red (RED), Blue (BLU), Yellow (YEL), in 4″ only.

SCREW-DOWN CABLE CLAMPS



HOW TO ORDER:

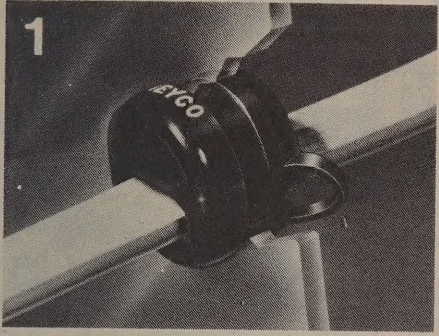
Stem # — From Chart Determines Material, Width, Thickness, Hole Size.
Bundle Dia. Dash No. — From Nom. Bundle Dia. Dash No. Chart. (Note Limitations by Stem #.)
Color — (Note Limitations In Stem # Chart.) Nat. = Natural, Blk. = Black, Amb. = Amber.

Example: 6021-08-NAT Orders A Natural Color Nylon Clamp, ⅜″ Wide, With A .203″ Hole Size Which Will Accommodate A Bundle of Wires ½″ In Diameter.

Bundle Dia. (Inch.)	Width of Clamp (Inch.)	Nom. Thick. (Inch.)	Screw Hole Size (Inch.)	Part No.	Price/100 1C	1M To 10M
⅛	⅜	.050	.203	6021-02 NAT or BLK	$1.72	$8.00
3/16	⅜	.050	.203	6021-03 NAT or BLK	1.73	8.63
¼	⅜	.050	.203	6021-04 NAT or BLK	1.80	9.02
5/16	⅜	.050	.203	6021-05 NAT or BLK	1.88	9.41
⅜	⅜	.050	.203	6021-06 NAT or BLK	2.00	10.00
7/16	⅜	.050	.203	6021-07 NAT or BLK	2.05	10.25
½	⅜	.050	.203	6021-08 NAT or BLK	2.12	10.59
½	½	.060	.203	6022-08 NAT or BLK	3.20	15.95
9/16	½	.060	.203	6022-09 NAT or BLK	3.24	16.20
⅝	½	.060	.203	6022-10 NAT or BLK	3.42	17.12
11/16	½	.060	.203	6022-11 NAT or BLK	3.76	18.82
¾	½	.060	.203	6022-12 NAT or BLK	4.00	20.00
13/16	½	.060	.203	6022-13 NAT or BLK	4.16	20.78
⅞	½	.060	.203	6022-14 NAT or BLK	4.32	21.57
1	½	.060	.203	6022-16 NAT or BLK	4.52	22.61
1⅛	½	.060	.203	6022-18 NAT or BLK	6.67	33.33
1 3/16	½	.060	.203	6022-19 NAT or BLK	6.98	34.90
1¼	½	.060	.203	6022-20 NAT or BLK	7.24	36.21
1⅜	½	.060	.203	6022-22 NAT or BLK	7.48	37.39
1½	½	.060	.203	6022-24 NAT of BLK	7.74	38.69

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

Heyco® nylon bushings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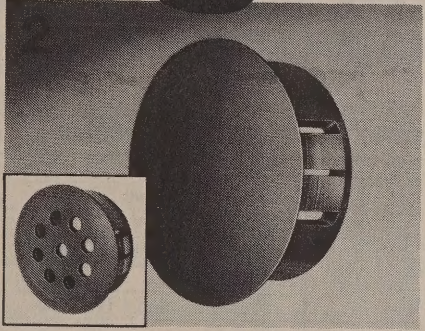
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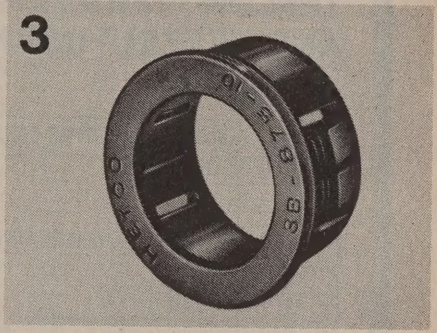
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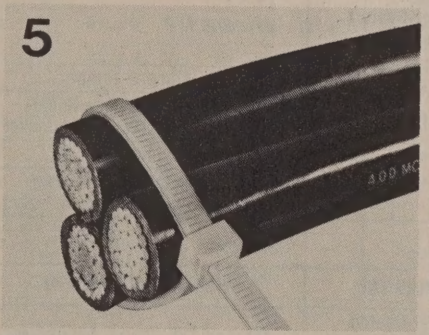
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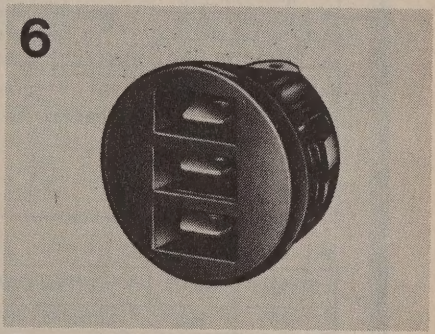
6

1. STRAIN RELIEF BUSHINGS
Inexpensive way to securely anchor, insulate and protect cable at point of entry into chassis. Completely absorb push, pull and twist on wire. Approved for use in elevated temperatures. 52 sizes—for chassis holes from 3/8″ through 1-3/16″. Available for straight through, right angle or spring applications.

4. CABLE CLAMPS
Anchor, insulate and direct cable, wiring, tubing and piping. Open ended for easy assembly. Fully radiused edges. 26 sizes—available in both standard and heavy duty types with inside diameters ranging from 1/8″ to 1-1/2″.

2. HOLE PLUGS
For neat, low-cost closures of factory adjustment holes, wiring outlets and unnecessary openings. Snap-lock installation by finger pressure provides the quickest hole-closing method for assembly lines. Unaffected by elevated temperatures. 20 sizes—for panels up to 1/8″ thickness, holes from 3/16″ through 2″ diameter. Also 2 sizes available with perforated head for ventilation.

5. WIRE TIES
Nytye® self-locking wire ties for standard and heavy duty, regular and mountable applications. 19 sizes for bundling and holding cables, wires, hoses, etc. of 1/16″ to 8-1/8″ in diameter. Mounting platforms also available.

3. INSULATING BUSHINGS
Convert sharp-edged metal holes to smooth, neat insulated holes. Quick, snap assembly with finger-tip pressure. Will withstand 35 pound pushback test. Meets specifications for insulation and mechanical protection of tubing, cables, etc.

Available in 58 sizes for 3/16″ to 2-1/2″ diameter holes with various I.D.'s. 5 sizes also available with split side.

6. TERMINAL BUSHINGS***
Provide low cost, fully insulated, quick connecting and disconnecting of wires through panels or housing. Six sizes with 1, 2 or 3 terminals, in 8 colors for color coding. Choice of solder, double-male or crimp terminals which mate with 3/16″ or 1/4″ standard female quick-connect terminals.

NYLON INSULATING BUSHINGS, STRAIN RELIEFS & PLUGS
HEYCO
LABKIT NO. 4

Order 4 for $30.00! All 5 for $37.00!

Heyco Labkits®

LABKIT No. 1	LABKIT No. 2	LABKIT No. 3	LABKIT No. 4	LABKIT No. 5
Strain Relief Bushings 185 piece working assortment for prototype and lab use. **$10.00** **Assembly Plier $12.50**	**Insulating Bushings** 258 Snap and Shorty Bushings in 18 popular sizes. **$10.00**	**Hole Plug Assortment** 255 of the 18 most popular sizes instantly available for product design use. **$10.00**	**Assortment for K. O.'s** 125 Insulating Bushings, Plugs and Strain Relief Bushings for 1/2 KO (7/8″) and 3/4 KO (1-3/32″) holes. **$10.00** **Strain Relief Assembly Plier $12.50**	**Cable Clamps** 285 clamps of 18 different sizes, both standard and heavy duty for 1/8″ to 1-1/2″ diameter applications. **$10.00**

Heyman Manufacturing Company

Box 160B, Kenilworth, N.J. 07033 • (201) 245-2345 • TWX: 710-996-5986
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Call Toll-Free (800) 558-0917 Except From Wisconsin • If Calling From Wisconsin Use (800) 242-0985
In Europe: Heyman Mfg. GmbH, Zu den Mühlen 17, D-63 Giessen, Germany

255B

MARKEL CORPORATION

High Temperature Wire and Cable —Insulating Tubings and Sleevings

TEFLON* TFE & FEP, PFA, SILICONE RUBBER, AND TEFZEL* INSULATED LEADWIRES

FLEXLEAD®

*TM of DuPont

MIL-W-16878

TYPE	VOLTS	COPPER CONDUCTOR	INSULATION MATERIAL
E	600	Stranded, Silver-Coated	Extruded TFE
E	600		Wrapped Sintered TFE Tape
EE	1000		Extruded TFE
EE	1000		Wrapped Sintered TFE Tape
ET	300		Extruded TFE
ET	300		Wrapped Sintered TFE Tape
K	600	Stranded, Silver-Coated or Tin-Coated	Extruded FEP
KK	1000		
KT	300		
F	600	Stranded, Tin-Coated	Extruded Silicone Rubber
F	600		Extr. S.R. with Silicone Resin-Impregnated Glass Braid Jacket
FF	1000		Extruded Silicone Rubber
FF	1000		Extr. S.R. with Silicone Resin-Impregnated Glass Braid Jacket

MIL-W-22759

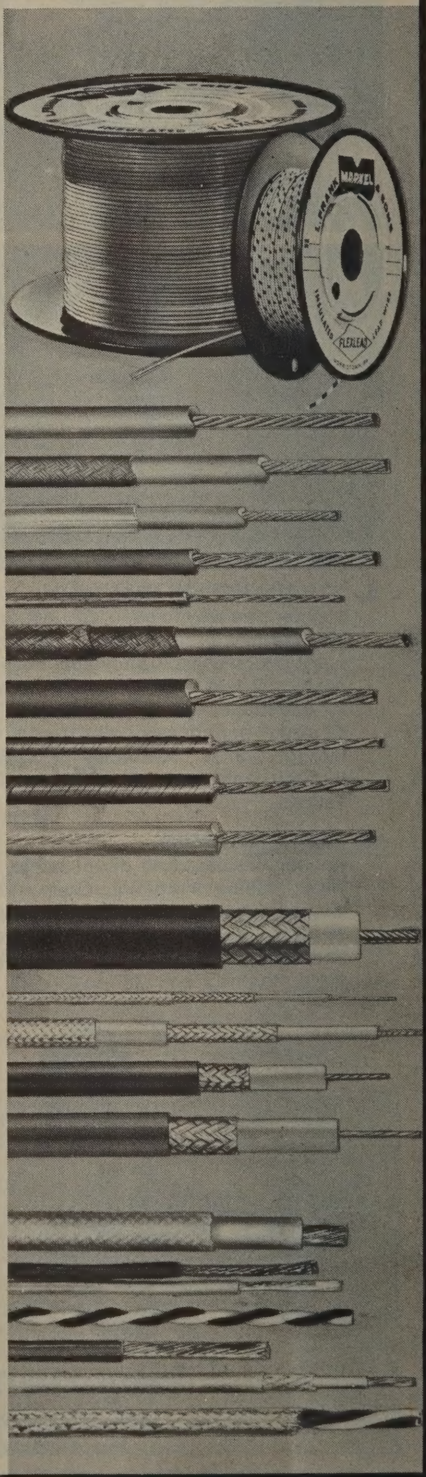
TYPE	VOLTS	COPPER CONDUCTOR		INSULATION MATERIAL
/1	600	Stranded, Silver-Coated		TFE and TFE-Coated Fiberglass
/2	600	Stranded, Nickel-Coated		
/3	600	Stranded, Nickel-Coated		TFE-glass-TFE medium weight
/4	600	Stranded, Silver-Coated		TFE-glass-FEP medium weight
/5	600			Abrasion-resistant Extruded TFE
/6	600	Stranded, Nickel-Coated		
/7	600	Stranded, Silver-Coated		Abrasion-resistant Extruded TFE medium weight
/8	600	Stranded, Nickel-Coated		
/9	1000	Stranded, Silver-Coated		Extruded TFE
/10	1000	Stranded, Nickel-Coated		
/11	600	Stranded, Silver-Coated		
/12	600	Stranded, Nickel-Coated		
/16	600	Stranded, Tin-Coated		ETFE, medium weight
/17	600	Stranded, High-Strength Copper Alloy	Silver-Coated	
/18	600		Tin-Coated	ETFE
/19	600		Silver-Coated	Extruded TFE
/20	1000			
/21	1000		Nickel-Coated	
/22	600		Silver-Coated	
/23	600		Nickel-Coated	

NOTE: While PFA is not specifically called out in MIL-W-16878 or MIL-W-22759, it will meet all the requirements of the specification where TFE is indicated. In addition, melt-extrudable PFA can be extruded in long, continuous fault-free lengths.

FLEXLEAD Fused Twisted Pair. This unique Teflon-insulated twisted pair construction finds wide application in computers and similar circuitry. The fusing, which will withstand predetermined pulls to separate the individual wires, keeps the wires evenly twisted for easier assembly and uniform capacitance and inductance. Ask for a test sample and prices.

FLEXLEAD Wire for Wire-Wrap Applications. Markel stocks Tefzel-insulated, silver-coated, solid copper conductor wire in these sizes:

#24	AWG	0.0305	± .0015
#26	AWG	0.027	± .0015
#30	AWG	0.0195	± .001



MARKEL CORPORATION

High Temperature Wire and Cable —Insulating Tubings and Sleevings

UL STYLE	TYPE INSULA-TION	SIZE RANGE	WALL THICK-NESS	RATING	JACKET
1164	TFE	#28-#10	.013″	150°C 300V	—
1180	TFE	#32-#10	.013″	200°C 300V	—
1198	FEP	#26-#10 #8-#2 #1-4/0	.020″ .030″ .045″	150°C 600V	—
1199	FEP	#26-#10 #8-#2 #1-4/0	.020″ .030″ .045″	200°C 600V	—
1212	TFE	#32-#20	.008″	80°C	—
1213	TFE	#32-#20	.008″	105°C	—
1226	FEP	#32-#20	.008″	80°C	—
1227	FEP	#32-#20 #18-#14	.008″ .013″	105°C	—
1292	FEP	#26-#20	.006″	105°C	Nylon
1330	FEP	#26-#10 #8-#2 #1-4/0	.020″ .030″ .045″	200°C 600V	—
1331	FEP	#26-#10 #8-#2 #1-4/0	.020″ .030″ .045″	150°C 600V	—
1332	FEP	#30-#10	.013″	200°C 300V	—
1333	FEP	#30-#10	.013″	150°C 300V	—
1354	TFE FEP	#40 Min.	various	150°C 30V	Coax.Cable
1371	TFE FEP	#32-#20 #18-#16 #14-#10 #8-#6	.0055″ .008″ .013″ .020″	105°C	—
1419	TFE FEP	#30-#16	.024″	105°C	Coax Cable
1508	TEFZEL	#32-#20	.0055″	105°C 30V	—
1513	TEFZEL	#32-#20	.005″	105°C	—
1516	TEFZEL	#32-#20	.004″	105°C	—
1517	TEFZEL	#32-#20	.006″	105°C	—
1523	TEFZEL	#32-#20	.005″	105°C	—
1538	TFE FEP	#32-#20 #18-#16 #14-#10 #8-#6	.0055″ .008″ .013″ .020″	105°C 125V	—
1577	TFE FEP	#32-#16	.012″	200°C	—
1586	TEFZEL	#32-#20 #18-#16 #14-#10 #8-#6	.0055″ .008″ .013″ .020″	105°C	—
1609	TEFZEL	#32-#20 #18-#16 #14-#10 #8-#6	.0055″ .008″ .013″ .020″	105°C 125V	—
1659	TFE	#26-#10 #8-#2 #1-4/0	.020″ .030″ .045″	250°C 600V	—
3066	Silicone Rubber	#28-#20	1/32″	200°C 600V	—
3067	Silicone Rubber	#28-#20	1/32″	200°C 600V	Fiberglass

UL STYLE	TYPE INSULA-TION	SIZE RANGE	WALL THICK-NESS	RATING	JACKET
3068	Silicone Rubber	#26-#20	1/64″	150°C 300V	Fiberglass
3069	Silicone Rubber	#26-#20	1/32″	150°C 600V	Fiberglass
3070	Silicone Rubber	#18-#12	1/32″	150°C 600V	Fiberglass
3071	Silicone Rubber	#18-#14	1/32″	200°C 600V	Fiberglass
3074	Silicone Rubber	#12	1/32″	200°C 600V	Fiberglass
3075	Silicone Rubber	#10	3/64″	200°C 600V	Fiberglass
3099	Silicone Rubber	#20-#16	1/32″	150°C 300V	—
3100	Silicone Rubber	#12	1/32″	150°C 300V	Fiberglass
3101	Silicone Rubber	#10	3/64″	150°C 600V	Fiberglass
3113	Silicone Rubber	#18	1/16″	150°C 600V	—
3115	Silicone Rubber	#20	1/32″	150°C 300V	—
3122	Silicone Rubber	#26-#20	1/64″	200°C 300V	Fiberglass
3123	Silicone Rubber	#30-#16	1/32″	150°C 600V	—
3125	Silicone Rubber	#8-#2	1/16″	200°C 600V	Fiberglass
3126	Silicone Rubber	#1-4/0	5/64″	200°C 600V	Fiberglass
3127	Silicone Rubber	#8-#2	1/16″	150°C 600V	Fiberglass
3128	Silicone Rubber	#1-4/0	5/64″	150°C 600V	Fiberglass
3129	Silicone Rubber	Special	3/64″	150°C 300V	—
3130	Silicone Rubber	#28 Min.	3/64″	150°C 300V	—
3132	Silicone Rubber	#30-#16	1/64″	150°C 300V	—
3133	Silicone Rubber	#30-#16	1/32″	150°C 600V	—
3134	Silicone Rubber	#18-#12	1/32″	150°C 600V	—
3135	Silicone Rubber	#18-#12	1/32″	200°C 600V	—
3136	Silicone Rubber	#26-#20	3/64″	150°C 300V	—
3137	Silicone Rubber	#26-#20	3/64″	150°C 600V	—
3138	Silicone Rubber	#18-#12	3/64″	150°C 600V	—
3139	Silicone Rubber	#18-#12	3/64″	200°C 600V	—
3140	Silicone Rubber	#26-#20	1/16″	150°C 300V	—
3141	Silicone Rubber	#26-#20	1/16″	150°C 600V	—
3142	Silicone Rubber	#18-#12	1/16″	150°C 600V	—
3143	Silicone Rubber	#18-#12	1/16″	200°C 600V	—
3144	Silicone Rubber	#12	3/64″	200°C 600V	Fiberglass
3145	Silicone Rubber	#12	1/16″	200°C 600V	Fiberglass

UL STYLE	TYPE INSULA-TION	SIZE RANGE	WALL THICK-NESS	RATING	JACKET
3177	Silicone Rubber	#28 Min.	1/32″	150°C 300V	—
3178	Silicone Rubber	#28 Min.	4/64″	150°C 300V	—
3179	Silicone Rubber	#28 Min.	3/64″	150°C 300V	—
3180	Silicone Rubber	#32 Min.	.023″	150°C 300V	—
3210	Silicone Rubber	#18-#12	1/16″	150°C 600V	Fiberglass
3211	Silicone Rubber	#26-#14	1/32″	150°C 300V	—
3212	Silicone Rubber	#26-#10	3/64″	150°C 600V	—
3213	Silicone Rubber	#8-#2	1/16″	150°C 600V	—
3214	Silicone Rubber	#1-4/0	5/64″	150°C 600V	—
3215	Silicone Rubber	#18-#16	1/16″	150°C 600V	—
3216	Silicone Rubber	#14-#10	5/64″	150°C 600V	—
3239	Silicone Rubber	#24-#10	10KV-.040″ 20KV-.050″ 25KV-.062″ 30KV-.075″ 40KV-.097″—All 150°C		
3262	Silicone Rubber	#26-#20	1/32″	200°C 600V	—
SF-1	Silicone Rubber	#18	1/64″	200°C 300V	Fiberglass
SF-2	Silicone Rubber	#18-#14	1/32″	200°C 600V	Fiberglass
SFF-1	Silicone Rubber	#18	1/64″	150°C 300V	Fiberglass
SFF-2	Silicone Rubber	#18-#14	1/32″	150°C 600V	Fiberglass

CANADIAN STANDARDS ASSOCIATION

CSA	TEFZEL	#32-#20	.005″	105°C 150V	—
CSA	TEFZEL	#30-#16	.010″	105°C 300V	—
CSA	TFE	#32-#16	.011″	150°C 150V	—
CSA	TFE	#28-#10	.016″	200°C 300V	—
CSA	TFE	#28-#8	.031″	200°C 600V	—
CSA	TFE	#28-#8	.047″	200°C 600V	—
CSA	TFE	#28-#8	.047″	200°C 1000V	—
CSA **SEW-1**	Silicone Rubber	Solid # 22-# 16 Stranded # 18-# 16	.016″	200° C 300V	Fiberglass
CSA **SEWF-1**	Silicone Rubber	Stranded # 22-# 16	.016″	150°C Copper 200°C Nickel 300V	Fiberglass
CSA **SEW-2**	Silicone Rubber	# 22-# 12 # 10	.031″ .047″	200°C 600V	Fiberglass
CSA **SEWF-2**	Silicone Rubber	# 22-# 12 # 10 # 8-# 2 # 1-4/0	.031″ .047″ .062″ .078″	150°C Copper 200°C Nickel 600V	Fiberglass

NOTE: Sizes #18 and larger must be temperature and/or manufacturer marked. Some UL styles and all CSA types require marking of all sizes.

FLEXLEAD MB Bondable Teflon. The Markel MB process can be factory-applied to any of the FLEXLEAD Teflon wires, extruded or tape-wrapped, and renders the surface bondable with commonly used elastomeric and epoxy-base potting and encapsulating compounds. Without affecting the color or electrical properties of the insulation, the MB treatment provides a bond with up to 150 psi pull-out strength, and a surface that is receptive to marking and printing. For more data, request MB brochure.

FLEXLEAD Coaxial Cables. Markel manufactures a complete line of both standard and special RG/U coaxial cables. In accordance with specifications, types are available with silver-plated copper, plated or unplated copper-covered steel, or bare copper-center conductor; one or two braided shields; tape-wrapped Teflon shield guards; and outer jacketing of impregnated fiberglass braid or Teflon (extruded or tape-wrapped). For complete data, ask for a FLEXLEAD Coaxial Cable Specifications folder.

FLEXLEAD Special Constructions. Because wiring problems cannot always be solved with standard materials, Markel's capacity for engineering high-temperature wire and cable construction to meet particular needs has grown steadily with the demand. We can combine insulations—Teflon, silicone rubber, fiberglass, nylon-shielding, fillers, liners, and jacket materials—with single, twisted-pair or multiple conductors—to provide a special cable construction for any temperature range from —90° to 260°C. For more data ask for a FLEXLEAD Wire and Cable Selector.

Ask for data sheets, prices, and samples of FLEXLEAD wire constructions

MARKEL CORPORATION
SCHOOL LANE, NORRISTOWN, PENNSYLVANIA 19401
Telephone: 215-272-8960 ■ TWX: 510-660-0929

NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-045699

NATIONAL WIRE AND CABLE CORP.

As a manufacturer of wire and cable products . . . with warehouses on both East and West coasts, National Wire & Cable is ready to fill your immediate needs. Choose from our standard lines of wire or cable . . . OR let us design and custom manufacture exactly what you require for your application.

Our wire inventory is now over 160 million feet, and our 500 different standard multi-conductor cables total in excess of 1.3 million feet!

When you call National Wire, you'll find we are especially well equipped to handle your large as well as minimal requirements. If our "standard" items won't meet your application, we have the wire inventory, the machinery, the expertise to come up with exactly what you need. 86,000 square feet of manufacturing area and our expert engineering staff are at your disposal!!! All cable components are produced within our own facility in order to assure complete quality control.

Review the following catalog pages. If you need some assistance with your specific requirement, call our factory direct, or call our representative nearest you. See Manufacturers and Sales Office Directory Yellow Pages,

NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

U/L Listed Wire

CSA Listed Wire

- Wires listed by the Underwriter's Laboratories, Inc. for operation in an air or an oil environment. U.L. File #E35793.
- Wires listed by the Canadian Standards Association for radio or electronic uses. CSA File #LR-20482 & LR-32511.

U/L Style 1061

Appliance wiring material available as FR-1 rated 80-degree C Service. .009″ semi-rigid vinyl insulation U/L rated: 300-volt service. Meets Mil-W-16878D Type B, and CSA S-R PVC. Also available with solid conductors.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
28	N304-736U	7	36	.015	.034	69.0	1.0
26	N304-1938U	19*	38	.019	.038	42.9	1.5
24†	N304-1936U	19*	36	.024	.043	26.8	2.0
22†	N304-1934U	19*	34	.030	.050	16.7	3.0
20	N304-1932U	19*	32	.038	.057	10.5	4.75
18	N304-1930U	19	30	.048	.068	6.57	6.5
16	N304-1929U	19	29	.057	.077	4.85	9.0

U/L Style 1007

Appliance wiring available as FR-1 rated 80-degree C Service. 1/64″ vinyl insulation U/L rated: 300 volt appliance, use 600 volt electronic use. Meets Mil-W-16878D Type C. Also approved by CSA as Type TR-64 radio wiring for 90-degree C Service. Colors: 10 standard colors plus tracers on solid colors. Also available with solid conductors.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24†	N303-732U	7	32	.024	.058	26.8	2.75
22†	N303-1934U	19*	34	.030	.063	16.7	3.75
20	N303-1932U	19*	32	.038	.072	10.5	5.50
18	N303-1930U	19	30	.048	.082	6.57	8.0
16	N303-1929U	19	29	.057	.090	4.85	10.0

U/L Style 1015

Appliance wiring material available as FR-1 rated 105-degree C Service 1/32″ vinyl insulation U/L rated, 2500 volts electronic use, 600 volt appliance use. Meets Mil-W-16878D Type D. Colors: 10 standard colors plus tracers on solid colors.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24†	N600-732U	7	32	.024	.082	26.8	4.0
22†	N600-730U	7	30	.030	.090	16.7	5.2
20†	N600-728U	7	28	.038	.098	10.5	7.3
18	N600-1930U	19	30	.048	.108	6.57	10.0
16	N600-1929U	19	29	.057	.117	4.85	12.0
14	N600-1927U	19	27	.071	.130	3.05	17.1
12	N600-1925U	19	25	.090	.162	1.92	27.4
10	N600-4927U	49	27	.111	.181	1.24	38.6

CSA/Type TR-32 Radio Wire

Rated: 90-degree C 600 volt, 1/32″ vinyl insulation. Also listed as CSA Appliance Wiring Material 90-degree 600 V. Meets U/L Style 1015 & Mil-W-16878D Type D.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24†	N307-732U	7	32	.024	.082	26.8	4.0
22†	N307-730U	7	30	.030	.090	16.7	5.2
20†	N307-728U	7	28	.038	.098	10.5	7.3
18	N307-1930U	19	30	.048	.108	6.57	10.0
16	N307-1929U	19	29	.057	.117	4.85	12.0
14	N307-1927U	19	27	.071	.130	3.05	17.1
12	N307-1925U	19	25	.090	.162	1.92	27.4
10	N307-4927U	49	27	.111	.181	1.24	38.6

*Also available in 7 strands

CSA Listed Type TR-64 Radio Wire

Rated 90-degree C 300 volt, 1/64″ vinyl insulation. Meets U/L Style 1007 & Mil-W-16878D Type C.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24†	N308-732U	7	32	.024	.058	28.4	2.75
22†	N308-1934U	19*	34	.030	.063	19.0	3.50
20	N308-1932U	19*	32	.038	.072	13.12	5.25
18	N308-1930U	19	30	.048	.082	7.89	6.75
16	N308-1929U	19	29	.057	.090	4.97	10.0

†Also available as NABOND

Also available with Nylon Jacket

NATIONAL WIRE
AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Military Electronic Hookup Wire

MIL-W-16878/1
Type BU

For internal wiring of electronic equipment.

.010″ wall vinyl primary insulation. No outer covering.

—54-degree C to +105-degree C, 600 V, R.M.S. (working). Also available as NABOND. Meets U/L Style 1061, and CSA S-R PVC.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
32	NB740U	7	40	.009	.028	179.0	0.70
30	NB738U	7	38	.012	.031	111.0	0.75
28	NB736U	7	36	.015	.034	69.0	1.0
26	NB1938U	19*	38	.019	.038	42.9	1.5
24	NB1936U	19*	36	.024	.043	26.8	2.0
22	NB1934U	19*	34	.030	.050	16.7	3.0
20	NB1932U	19*	32	.038	.057	10.5	4.5
18	NB1930U	19	30	.048	.068	6.57	6.5
16	NB1929U	19	29	.057	.077	4.85	9.0
14	NB1927U	19	27	.071	.091	3.05	14.0

*Also available in 7 strands

MIL-W-16878/1
Type BN

For internal wiring of electronic equipment.

Vinyl primary insulation with Nylon jacket overall.

—54-degree C to +115-degree C, 600 V, R.M.S. (working). Meets U/L Style 1006.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
32	NB740N	7	40	.009	.032	179.0	0.75
30	NB738N	7	38	.012	.036	111.0	1.0
28	NB736N	7	36	.015	.039	69.0	1.25
26	NB1938N	19*	38	.019	.044	42.9	1.75
24	NB1936N	19*	36	.024	.049	26.8	2.25
22	NB1934N	19*	34	.030	.056	16.7	3.25
20	NB1932N	19*	32	.038	.063	10.5	4.75
18	NB1930N	19	30	.048	.074	6.57	7.0
16	NB1929N	19	29	.057	.083	4.85	9.0
14	NB1927N	19	27	.071	.098	3.05	14.7

*Also available in 7 strands

MIL-W-16878/2
Type CU

For internal wiring of meters, panels & electronic equipment, .015″ Wall Vinyl primary insulation (no outer covering). −54° C to +105° C, 1000 Volts, R.M.S. (working). Also available as NABOND. Meets U/L Style 1007 and CSA TR-64.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24	NC732U	7	32	.024	.058	26.8	2.75
22	NC1934U	19*	34	.030	.063	16.7	3.75
20	NC1932U	19*	32	.038	.072	10.5	5.50
18	NC1930U	19	30	.048	.082	6.57	8.0
16	NC1929U	19	29	.057	.090	4.85	10.0
14	NC1927U	19	27	.071	.104	3.05	15.0
12	NC1925U	19	25	.090	.124	1.92	24.0

*Also available in 7 strands

MIL-W-16878/3
Type DU

Resists the effect of salt water, aviation fuel, motor oil, ethylene glycol and alcohols (methyl or ethyl). .031″ Wall Vinyl primary insulation. No outer covering. —54-degree C to +105-degree, 3000 V, R.M.S. (working). Meets U/L Style 1015 and CSA TR-32.

GAUGE (AWG)	NATIONAL CATALOG NUMBER	NO. OF STRANDS	GA. OF STRANDS (AWG)	NOM. DIAM. OF STRANDED CONDUCTOR (INCHES)	NOM. FIN. WIRE DIAM. (INCHES)	MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT.	NOM. WT. PER 1000 FT. (LBS.)
24	ND732U	7	32	.024	.082	26.8	4.0
22	ND730U	7	30	.030	.090	16.7	5.2
20	ND728U	7	28	.038	.098	10.5	7.3
18	ND1930U	19	30	.048	.108	6.57	10.0
16	ND1929U	19	29	.057	.117	4.85	12.0
14	ND1927U	19	27	.071	.130	3.05	17.1
12	ND1925U	19	25	.090	.162	1.92	27.4
10	ND4927U	49	27	.111	.181	1.24	38.6
8	ND13329U	133	29	.167	.246	0.726	70.5
6	ND13327U	133	27	.210	.290	0.444	104.0

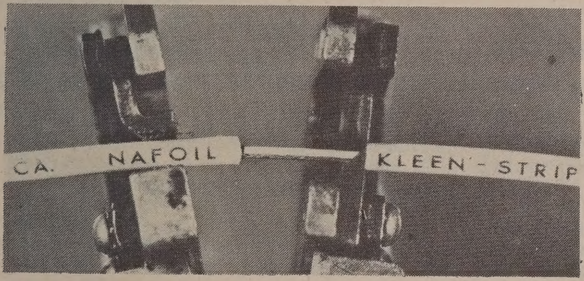
*Also available in 7 strands.

NOTE: THE ABOVE WIRES COME IN 10 STANDARD COLORS PLUS TRACERS ON SOLID COLORS.

Nafoil Kleen-Strip® Foil-Shielded Audio & Instrumentation Cables (NKS Series)

NATIONAL WIRE
AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569



National Wire and Cable Corporation manufactures a full line of small shielded instrumentation cables using our "NAFOIL KLEEN-STRIP" self stripping foil shield construction, plus non-fraying NABOND bonded stranded conductors.

Since the foil shield of "NAFOIL KLEEN-STRIP" is integrally fusion-bonded to the cable jacket, stripping the jacket from the end of the cable automatically removes the foil shield in the same operation.

This eliminates hand untwisting and trimming of foil shields. Excellent for automatic machine stripping.

Insulated conductor and "drain" wire use National's "NABOND" bonded stranded wire which eliminates frayed wire ends. The "NABOND" process lightly bonds the tinning of all strands. "NABOND" wire acts like a solid wire during stripping and wiring operations. Subsequent flexure breaks the bonding and the wire returns to its flexible condition. Offers the convenience of solid wire during manufacture, with the reliability of stranded wire for normal use.

All wires are stranded, bonded, tinned copper with .010" vinyl insulation for use up to +80.C @ 300 volts (U.L. Style 1061). Also rated 105.C @ 600 volts per MIL-W-16878/1.

Foil shield is ½ MIL Mylar with .00035" Aluminum, 50% overlap. Bare drain wire is the same as used in insulated conductors.

Overall jacket is 105 C. polyvinyl chloride thermoplastic per MIL-I-631 Class B and exceeds U.L. requirements. Jacket wall thickness .031". For extra flexible applications, these cables are also available with .022" jacket wall.

COMPUTER GRADE U.L. LISTED SELF-STRIPPING FOIL SHIELD

Self stripping feature saves preparation time . . . increases production.

TECHNICAL DATA

U.L. Voltage Rating:	300. Volts RMS AC (U.L. Style 1061)
Military Rating:	600. Volts RMS AC (Mil-W-16878/1)
Breakdown Voltage:	Greater than 3000. Volts RMS AC
Insulation Leakage Resistance:	Higher than 200. Megohms per 1000 ft at 500. V.D.C. from any conductor to all else.
Jacket Leakage Resistance:	Higher than 10 Megohms per 1000 ft at 500. V.D.C. from shield through Jacket to water bath.
Capacitance:	See Table Below.
Shield Leakage Capacitance:	Nominal "Look-Through" capacitance from conductor group through the shield to water bath is less than 2.pf/1000 ft. Reinforcing action of bonded jacket reduces "Window" effects caused by flexure.
Usable Temp. Range:	U.L. +80° Military: −40° to +105°C
Cold Bend:	All cables are suitable for flexing to a circle diameter of approx. 6 cable diameters from +80°C to −40°C.

STANDARD "KLEEN-STRIP" SHIELDED CABLES

	CONDUCTOR AWG & STRANDING	NATIONAL PART NO.	INSULATION DIAMETER	DRAIN WIRE AWG & STRANDING	JACKET THICKNESS	DIAMETER OVER JKT.	CAPACITANCE PF/FT		RESISTANCE OHMS/MFT
							W-S	W-W	
SINGLE CONDUCTOR SHIELDED & JACKETED	26 (7)	NKS-261	.038	26 (7)	.031	.125	97.8	—	42.9
	24 (7)	NKS-241	.043	24 (7)	.031	.135	170.9	—	26.8
	22 (7)	NKS-221	.050	22 (7)	.031	.148	131.5	—	16.7
	20 (7)	NKS-201	.057	20 (7)	.031	.163	167.2	—	10.5

	CONDUCTOR AWG & STRANDING	NATIONAL PART NO.	INSULATION DIAMETER	DRAIN WIRE AWG & STRANDING	JACKET THICKNESS	DIAMETER OVER JKT.	CAPACITANCE PF/FT		RESISTANCE OHMS/MFT
							W-S	W-W	
2-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)	26 (7)	NKS-262	.038	26 (7)	.031	.144	85.6	46.9	42.9
	24 (7)	NKS-242	.043	24 (7)	.031	.154	94.4	51.8	26.8
	22 (7)	NKS-222	.050	22 (7)	.031	.168	115.1	63.1	16.7
	20 (7)	NKS-202	.057	20 (7)	.031	.182	146.29	46.9	10.5

	CONDUCTOR AWG & STRANDING	NATIONAL PART NO.	INSULATION DIAMETER	DRAIN WIRE AWG & STRANDING	JACKET THICKNESS	DIAMETER OVER JKT.	CAPACITANCE PF/FT		RESISTANCE OHMS/MFT
							W-S	W-W	
3-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)	26 (7)	NKS-263	.038	26 (7)	.031	.150	80.8	44.0	42.9
	24 (7)	NKS-243	.043	24 (7)	.031	.165	89.2	48.6	26.8
	22 (7)	NKS-223	.050	22 (7)	.031	.176	108.7	59.2	16.7
	20 (7)	NKS-203	.057	20 (7)	.031	.191	138.3	75.2	10.5

	CONDUCTOR AWG & STRANDING	NATIONAL PART NO.	INSULATION DIAMETER	DRAIN WIRE AWG & STRANDING	JACKET THICKNESS	DIAMETER OVER JKT.	CAPACITANCE PF/FT		RESISTANCE OHMS/MFT
							W-S	W-W	
4-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)	26 (7)	NKS-264	.038	26 (7)	.031	.159	79.	42.	42.9
	24 (7)	NKS-244	.043	24 (7)	.031	.176	88.	46.	26.8
	22 (7)	NKS-224	.050	22 (7)	.031	.188	107.	57.	16.7
	20 (7)	NKS-204	.057	20 (7)	.031	.205	136.	73.	10.5

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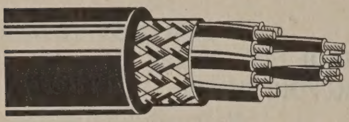
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Miniature Signal & Control Cables Single Conductors (NX Series)



(NX1922SJ shown)

National Wire & Cable Corporation manufactures a complete line of MINIATURE low voltage signal and control cable. Available as cabled pairs or cabled singles, with optional overall shield. Conductors are stranded tinned copper with .010″ wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type B. Insulated for 600 volts working voltage. (Also meets U.L. AWM Type 1061; 300 volt, 80°C.) All are coded using 10 standard colors plus stripes on white per MIL-STD-681.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape barrier under shields. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078; and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C. vinyl meeting MIL-I-631 Type F. All materials are self-extinguishing and fungus resistant. All items are U.L. LISTED STYLE 2343 COMPUTER CABLE; rated 80°C. (Higher temp. ratings apply for any non-U.L. service.)

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

IN STOCK

MIL-SPEC U.L. LISTED COMPUTER GRADE STYLE 2343

For light duty, gray jacketed version of these cables in the U.L. Style 2464, see Pages 4680-4683 NQ Series.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage:	Greater than 5000 volts AC RMS, 60 cps.
Capacitance:	Nominal capacitance from a wire to all else in a cable ranges from 45. to 70. pf/ft. at 1. kc, depending on gauge and position.
Insulation Leakage:	200. megohms/1000 ft. min. @ 500. VDC from any conductor to all else in cable.
Sheath Leakage:	10. megohms/1000 ft. min. @ 500 VDC from shield or conductor group through sheath to ground.
Temperature Range:	Suitable for continuous use from −40°C. to +105°C. (U.L. Service limited to +80°C.)
Bending Characteristics:	All cables are suitable for flexing to a circle diameter of 6. cable diameters from +105°C. to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°C.

MULTICONDUCTOR STOCK CABLED SINGLES

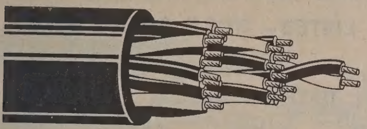
Cond: 22, 24 are 7 strand; 20 AWG is 19 strand

UNSHIELDED							OVERALL SHIELDED							
PART NO.	NO. COND.	COND. AWG	COND. O.D.	JKT. WALL	CABLE O.D.	WEIGHT LB/M′	PART NO.	NO. COND.	COND. AWG	COND. O.D.	JKT. WALL	SHIELD AWG	CABLE O.D.	WEIGHT LB/M′
NX-524 J	5	24	.045	.062	.220	32 Lbs.	NX-524 SJ	5	24	.045	.062	36	.245	44 Lbs.
NX-724 J	7	24	.045	.062	.250	40 Lbs.	NX-724 SJ	7	24	.045	.062	36	.275	55 Lbs.
NX-1224J	12	24	.045	.062	.300	53 Lbs.	NX-1224SJ	12	24	.045	.062	36	.325	68 Lbs.
NX-1524J	15	24	.045	.062	.330	65 Lbs.	NX-1524SJ	15	24	.045	.062	36	.350	80 Lbs.
NX-1924J	19	24	.045	.062	.340	73 Lbs.	NX-1924SJ	19	24	.045	.062	36	.365	88 Lbs.
NX-2724J	27	24	.045	.062	.390	85 Lbs.	NX-2724SJ	27	24	.045	.062	36	.415	102 Lbs.
NX-3724J	37	24	.045	.062	.420	120 Lbs.	NX-3724SJ	37	24	.045	.062	36	.445	140 Lbs.
NX-4824J	48	24	.045	.062	.470	142 Lbs.	NX-4824SJ	48	24	.045	.062	36	.495	172 Lbs.
NX-6024J	60	24	.045	.062	.510	170 Lbs.	NX-6024SJ	60	24	.045	.062	36	.535	205 Lbs.
NX-522 J	5	22	.050	.062	.265	40 Lbs.	NX-522 SJ	5	22	.050	.062	36	.285	50 Lbs.
NX-722 J	7	22	.050	.062	.270	48 Lbs.	NX-722 SJ	7	22	.050	.062	36	.295	58 Lbs.
NX-1222J	12	22	.050	.062	.330	72 Lbs.	NX-1222SJ	12	22	.050	.062	36	.355	87 Lbs.
NX-1522J	15	22	.050	.062	.350	85 Lbs.	NX-1522SJ	15	22	.050	.062	36	.380	101 Lbs.
NX-1922J	19	22	.050	.062	.370	96 Lbs.	NX-1922SJ	19	22	.050	.062	36	.395	111 Lbs.
NX-2722J	27	22	.050	.062	.430	130 Lbs.	NX-2722SJ	27	22	.050	.062	36	.455	150 Lbs.
NX-3722J	37	22	.050	.062	.480	163 Lbs.	NX-3722SJ	37	22	.050	.062	34	.510	193 Lbs.
NX4822J	48	22	.050	.062	.530	210 Lbs.	NX-4822SJ	48	22	.050	.062	34	.560	245 Lbs.
NX-6022J	60	22	.050	.062	.570	255 Lbs.	NX-6022SJ	60	22	.050	.062	34	.600	295 Lbs.
NX-520 J	5	20	.057	.062	.275	49 Lbs.	NX-520 SJ	5	20	.057	.062	36	.300	59 Lbs.
NX-720 J	7	20	.057	.062	.290	59 Lbs.	NX-720 SJ	7	20	.057	.062	36	.315	69 Lbs.
NX-1220J	12	20	.057	.062	.360	90 Lbs.	NX-1220SJ	12	20	.057	.062	36	.385	105 Lbs.
NX-1520J	15	20	.057	.062	.390	110 Lbs.	NX-1520SJ	15	20	.057	.062	36	.415	137 Lbs.
NX-1920J	19	20	.057	.062	.410	128 Lbs.	NX-1920SJ	19	20	.057	.062	36	.435	158 Lbs.
NX-2720J	27	20	.057	.062	.490	166 Lbs.	NX-2720SJ	27	20	.057	.062	36	.515	196 Lbs.
NX-3720J	37	20	.057	.062	.520	220 Lbs.	NX-3720SJ	37	20	.057	.062	34	.550	255 Lbs.
NX-4820J	48	20	.057	.062	.580	275 Lbs.	NX-4820SJ	48	20	.057	.062	34	.610	320 Lbs.
NX-6020J	60	20	.057	.062	.640	335 Lbs.	NX-6020SJ	60	20	.057	.062	34	.670	385 Lbs.

NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Miniature Signal & Control Cables Twisted Pairs (NXP Series)



(NXP1924J shown)

National Wire & Cable Corporation manufactures a complete line of MINIATURE low voltage signal and control cable. Available as cabled pairs or cabled singles, with optional overall shield. Conductors are stranded tinned copper with .010″ wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type B. Insulated for 600 volts working voltage. (Also meets U.L. AWM Type 1061; 300 volt, 80°C.) All are coded using 10 standard colors plus stripes on white per table below.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape barrier under shields. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078; and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C. vinyl meeting MIL-I-631 Type F. All materials are self-extinguishing and fungus resistant. All items are U.L. LISTED STYLE 2343 COMPUTER CABLE; rated 80°C. (Higher temp. ratings apply for any non-U.L. service.)

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.
* Denotes U.L. Style 2344.

IN STOCK MIL-SPEC

U.L. LISTED COMPUTER GRADE STYLE 2343 & 2344

For light duty, gray jacketed version of these cables in the U.L. Style 2464, see Pages 4680-4683 NQ Series.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage:	Greater than 5000 volts AC RMS, 60 cps.
Capacitance:	Nominal capacitance from a wire to all else in a cable ranges from 45. to 70. pf/ft. at 1. kc, depending on gauge and position.
Insulation Leakage:	200. megohms/1000 ft. min. @ 500. VDC from any conductor to all else in cable.
Sheath Leakage:	10. megohms/1000 ft. min. @ 500 VDC from shield or conductor group through sheath to ground.
Temperature Range:	Suitable for continuous use from −40°C. to +105°C. (U.L. Service limited to +80°C.)
Bending Characteristics:	All cables are suitable for flexing to a circle diameter of 6. cable diameters from +105°C. to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°C.

Impedance: **(24. AWG pairs)**	**Balanced:**	**87. ohms ±5%**
	Unbalanced:	**52. ohms ±5%**

MULTI-CONDUCTOR STOCK CABLED PAIRS

Cond: 22, 24 are 7 strand; 20 AWG is 19 strand

UNSHIELDED							OVERALL SHIELDED							
PART NO.	NO. PAIRS	COND. AWG	COND. O.D.	JKT. WALL	CABLE O.D.	WEIGHT LB/M′	PART NO.	NO. PAIRS	COND. AWG	COND. O.D.	JKT. WALL	SHLD. AWG	CABLE O.D.	WEIGHT LB/M′
NXP-524 J	5	24	.045	.062	.330	52 Lbs.	NXP-524 SJ	5	24	.045	.062	36	.355	67 Lbs.
NXP-724 J	7	24	.045	.062	.350	60 Lbs.	NXP-724 SJ	7	24	.045	.062	36	.375	75 Lbs.
NXP-1224J	12	24	.045	.062	.435	90 Lbs.	NXP-1224SJ	12	24	.045	.062	36	.460	115 Lbs.
NXP-1524J	15	24	.045	.062	.485	110 Lbs.	NXP-1524SJ	15	24	.045	.062	36	.510	140 Lbs.
NXP-1924J	19	24	.045	.062	.505	126 Lbs.	NXP-1924SJ	19	24	.045	.062	36	.530	161 Lbs.
NXP-2724J	27	24	.045	.062	.590	167 Lbs.	NXP-2724SJ	27	24	.045	.062	34	.620	211 Lbs.
NXP-3724J	37	24	.045	.062	.660	216 Lbs.	NXP-3724SJ	37	24	.045	.062	34	.690	266 Lbs.
NXP-4824J	48	24	.045	.062	.745	270 Lbs.	NXP-4824SJ	48	24	.045	.062	34	.775	330 Lbs.
NXP-6024J	60	24	.045	.062	.815	325 Lbs.	NXP-6024SJ*	60	24	.045	.062	34	.845	390 Lbs.
NXP-522 J	5	22	.050	.062	.365	56 Lbs.	NXP-522 SJ	5	22	.050	.062	36	.390	77 Lbs.
NXP-722 J	7	22	.050	.062	.390	82 Lbs.	NXP-722 SJ	7	22	.050	.062	36	.415	100 Lbs.
NXP-1222J	12	22	.050	.062	.470	120 Lbs.	NXP-1222SJ	12	22	.050	.062	36	.495	150 Lbs.
NXP-1522J	15	22	.050	.062	.545	145 Lbs.	NXP-1522SJ	15	22	.050	.062	34	.575	185 Lbs.
NXP-1922J	19	22	.050	.062	.550	170 Lbs.	NXP-1922SJ	19	22	.050	.062	34	.580	210 Lbs.
NXP-2722J	27	22	.050	.062	.640	230 Lbs.	NXP-2722SJ	27	22	.050	.062	34	.670	280 Lbs.
NXP-3722J	37	22	.050	.062	.750	300 Lbs.	NXP-3722SJ	37	22	.050	.062	34	.780	357 Lbs.
NXP-4822J*	48	22	.050	.080	.850	375 Lbs.	NXP-4822SJ*	48	22	.050	.080	34	.880	445 Lbs.
NXP-6022J*	60	22	.050	.080	.930	460 Lbs.	NXP-6022SJ*	60	22	.050	.080	34	.960	535 Lbs.
NXP-520 J	5	20	.057	.062	.395	82 Lbs.	NXP-520 SJ	5	20	.057	.062	36	.420	102 Lbs.
NXP-720 J	7	20	.057	.062	.440	108 Lbs.	NXP-720 SJ	7	20	.057	.062	36	.465	123 Lbs.
NXP-1220J	12	20	.057	.062	.540	163 Lbs.	NXP-1220SJ	12	20	.057	.062	34	.570	203 Lbs.
NXP-1520J	15	20	.057	.062	.600	196 Lbs.	NXP-1520SJ	15	20	.057	.062	34	.630	241 Lbs.
NXP-1920J	19	20	.057	.062	.630	235 Lbs.	NXP-1920SJ	19	20	.057	.062	34	.660	280 Lbs.
NXP-2720J	27	20	.057	.062	.745	320 Lbs.	NXP-2720SJ	27	20	.057	.062	34	.775	380 Lbs.
NXP-3720J	37	20	.057	.062	.820	420 Lbs.	NXP-3720SJ*	37	20	.057	.080	34	.850	490 Lbs.
NXP-4820J*	48	20	.057	.080	.950	530 Lbs.	NXP-4820SJ*	48	20	.057	.080	34	.980	605 Lbs.
NXP-6020J*	60	20	.057	.080	1.040	650 Lbs.	NXP-6020SJ*	60	20	.057	.080	34	1.070	735 Lbs.

COLOR CODING USED IN TWISTED PAIRS

PR#	PAIR COLORS	PR#	PAIR COLORS	PR#	PAIR COLORS	PR#	PAIR COLORS	PR#	PAIR COLORS	PR#	PAIR COLORS
1	White with Black	11	Black with Red	21	Brown with Green	31	Orange with Yellow	41	Green with Violet	51	Wht/Blk with Green
2	White with Brown	12	Black with Orange	22	Brown with Blue	32	Orange with Green	42	Green with Gray	52	Wht/Blk with Blue
3	White with Red	13	Black with Yellow	23	Brown with Violet	33	Orange with Blue	43	Blue with Violet	53	Wht/Blk with Violet
4	White with Orange	14	Black with Green	24	Brown with Gray	34	Orange with Violet	44	Blue with Grey	54	Wht/Ik with Gray
5	White with Yellow	15	Black with Blue	25	Red with Orange	35	Orange with Gray	45	Violet with Gray	55	Wht/Brn with Black
6	White with Green	16	Black with Violet	26	Red with Yellow	36	Yellow with Green	46	Wht/Blk with Black	56	Wht/Brn with Brown
7	White with Blue	17	Black with Gray	27	Red with Green	37	Yellow with Blue	47	Wht/Blk with Brown	57	Wht/Brn with Red
8	White with Violet	18	Brown with Red	28	Red with Blue	38	Yellow with Violet	48	Wht/Blk with Red	58	Wht/Brn with Orange
9	White with Gray	19	Brown with Orange	29	Red with Violet	39	Yellow with Gray	49	Wht/Blk with Orange	59	Wht/Brn with Yellow
10	Black with Brown	20	Brown with Yellow	30	Red with Gray	40	Green with Blue	50	Wht/Blk with Yellow	60	Wht/Brn with Green

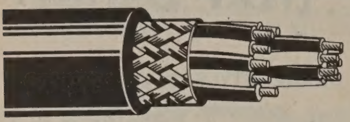
NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Heavy Duty Signal & Control Cables Single Conductors (NW Series)

IN STOCK

MIL-SPEC U.L. LISTED — STYLE 2343 & 2344



(NW1918SJ shown)

National Wire & Cable Corporation manufactures a complete line of multiple conductor control cable. Conductors are stranded tinned copper with 1/64″ wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type C.* Insulated for 1000 volts working voltage. Color coded using 10 standard colors plus stripes on white per MIL-STD-681.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape serve over cable bundle. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078, and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C vinyl meeting MIL-I-631 Class F. All materials are self-extinguishing and fungus resistant. All cables are U. L. LISTED STYLE 2343; rated 80°C. (Higher temp. ratings apply to any non-U.L. service.) Specify polyurethane sheath for extreme rough usage or low-temp. service. Standard Putups: 100, 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

* Insulated wires also meet U.L. style 1007 and CSA type TR-64.
† Denotes U.L. Style 2344.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage:	Greater than 8000 volts AC RMS, 60 cps.
U.L. Voltage Rating:	300 volts RMS AC (appliance use). 600 volts RMS AC (electronic use).
Military Voltage Rating:	1000 volts RMS.
Capacitance:	Nominal capacitance from a wire to all else in the cable ranges from 40 to 65 mmfd per ft., @ 1000 cps; dependent on gauge and position.
Insulation Leakage Res.:	200. megohms/1000 ft. min. at 500 VDC from any conductor to all else in cable.
Sheath Leakage Res.:	10. megohms/1000 ft. min. at 500 VDC from overall shield through sheath to outside world.
Usable Temp. Range:	Suitable for continuous use from +105°C to −55°C.
Cold Bending Capability:	All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C. For continuous flexing applications consult factory.

Conductor sizes 22, 20, 18, 16, 14 & 12 gauge. 22 AWG is 7 strand. All others 19 strand.

UNSHIELDED						OVERALL SHIELDED						
PART NO.	NO. COND.	COND. AWG	JKT. THICK	CABLE O.D.	WEIGHT PER M′	PART NO.	NO. COND	COND AWG	T.C. SHIELD	JKT. THICK	CABLE O.D.	WEIGHT PER M′
NW-722 J	7	22	.060	.315	40 Lbs.	NW-722 SJ	7	22	No. 36	.060	.340	55 Lbs.
NW-1222J	12	22	.060	.385	70 Lbs.	NW-1222SJ	12	22	No. 34	.060	.410	90 Lbs.
NW-1922J	19	22	.060	.440	110 Lbs.	NW-1922SJ	19	22	No. 34	.060	.465	145 Lbs.
NW-2722J	27	22	.060	.510	160 Lbs.	NW-2722SJ	27	22	No. 34	.060	.535	200 Lbs.
NW-3722J	37	22	.060	.565	200 Lbs.	NW-3722SJ	37	22	No. 34	.060	.590	245 Lbs.
NW-4822J	48	22	.060	.635	245 Lbs.	NW-4822SJ	48	22	No. 34	.060	.660	300 Lbs.
NW-6022J	60	22	.060	.695	300 Lbs.	NW-6022SJ	60	22	No. 34	.060	.720	355 Lbs.
NW-7222J	72	22	.060	.755	360 Lbs.	NW-7222SJ	72	22	No. 34	.060	.780	425 Lbs.
NW-8822J	88	22	.060	.820	425 Lbs.	NW-8822SJ	88	22	No. 34	.080	.895†	500 Lbs.
NW-10222J	102	22	.080	.920†	485 Lbs.	NW-10222SJ	102	22	No. 34	.080	.945†	560 Lbs.
NW-720 J	7	20	.060	.340	50 Lbs.	NW-720 SJ	7	20	No. 34	.060	.365	68 Lbs.
NW-1220J	12	20	.060	.420	105 Lbs.	NW-1220SJ	12	20	No. 34	.060	.445	125 Lbs.
NW-1920J	19	20	.060	.485	160 Lbs.	NW-1920SJ	19	20	No. 34	.060	.510	195 Lbs.
NW-2720J	27	20	.060	.565	210 Lbs.	NW-2720SJ	27	20	No. 34	.060	.590	250 Lbs
NW-3720J	37	20	.060	.630	280 Lbs.	NW-3720SJ	37	20	No. 34	.060	.655	325 Lbs
NW-4820J	48	20	.060	.710	360 Lbs.	NW-4820SJ	48	20	No. 34	.060	.735	415 Lbs
NW-6020J	60	20	.060	.775	435 Lbs.	NW-6020SJ	60	20	No. 34	.060	.800	500 Lbs
NW-7220J	72	20	.080	.885†	485 Lbs.	NW-7220SJ	72	20	No. 34	.080	.910†	555 Lbs
NW-8820J	88	20	.080	.960†	580 Lbs.	NW-8820SJ	88	20	No. 34	.080	1.035†	660 Lbs
NW-10220J	102	20	.080	1.030†	670 Lbs.	NW-10220SJ	102	20	No. 34	.080	1.055†	750 Lbs
NW-718 J	7	18	.060	.370	75 Lbs.	NW-718 SJ	7	18	No. 34	.060	.395	95 Lbs
NW-1218J	12	18	.060	.460	135 Lbs.	NW-1218SJ	12	18	No. 34	.060	.485	170 Lbs.
NW-1918J	19	18	.060	.535	225 Lbs.	NW-1918SJ	19	18	No. 34	.060	.560	265 Lbs.
NW-2718J	27	18	.060	.625	300 Lbs.	NW-2718SJ	27	18	No. 34	.060	.650	350 Lbs.
NW-3718J	37	18	.060	.700	390 Lbs.	NW-3718SJ	37	18	No. 34	.060	.725	445 Lbs.
NW-4818J	48	18	.060	.790	510 Lbs.	NW-4818SJ	48	18	No. 34	.060	.815	575 Lbs.
NW-6018J	60	18	.080	.905†	600 Lbs.	NW-6018SJ	60	18	No. 34	.080	.930†	680 Lbs.
NW-7218J	72	18	.080	.985†	720 Lbs.	NW-7218SJ	72	18	No. 34	.080	1.010†	820 Lbs.
NW-716 J	7	16	.060	.395	95 Lbs.	NW-716 SJ	7	16	No. 34	.060	.420	125 Lbs.
NW-1216J	12	16	.060	.495	155 Lbs.	NW-1216SJ	12	16	No. 34	.060	.520	195 Lbs.
NW-1916J	19	16	.060	.575	230 Lbs.	NW-1916SJ	19	16	No. 34	.060	.600	275 Lbs.
NW-2716J	27	16	.060	.615	320 Lbs.	NW-2716SJ	27	16	No. 34	.060	.640	375 Lbs.
NW-3716J	37	16	.060	.755	430 Lbs.	NW-3716SJ	37	16	No. 34	.060	.780	500 Lbs.
NW-4816J	48	16	.080	.895†	625 Lbs.	NW-4816SJ	48	16	No. 34	.080	.920†	700 Lbs.
NW-6016J	60	16	.080	.975†	750 Lbs.	NW-6016SJ	60	16	No. 34	.080	1.000†	830 Lbs.
NW-714 J **	7	14	.060	.435	150 Lbs.	NW-714 SJ	7	14	No. 34	.060	.465	180 Lbs.
NW-1214J **	12	14	.060	.555	240 Lbs.	NW-1214SJ	12	14	No. 34	.060	.580	280 Lbs.
NW-1914J **	19	14	.060	.645	370 Lbs.	NW-1914SJ	19	14	No. 34	.060	.670	420 Lbs.
NW-2714J **	27	14	.060	.760	515 Lbs.	NW-2714SJ	27	14	No. 34	.060	.785	575 Lbs.
NW-512 J **	5	12	.060	.460	175 Lbs.	NW-512 SJ	5	12	No. 34	.060	.485	210 Lbs.
NW-712 J **	7	12	.060	.500	225 Lbs.	NW-712 SJ	7	12	No. 34	.060	.525	265 Lbs.
NW-1212J **	12	12	.060	.680	375 Lbs.	NW-1212SJ	12	12	No. 34	.060	.705	430 Lbs.
NW-1912J **	19	12	.060	.745	560 Lbs.	NW-1912SJ	19	12	No. 34	.060	.770	625 Lbs.

**Not listed under UL styles 2343 or 2344 in these gauges.

NATIONAL WIRE
AND CABLE CORPORATION

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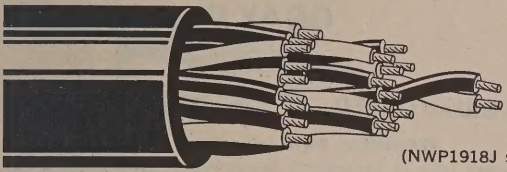
Heavy Duty Signal & Control Cables Twisted Pairs (NWP Series)



(NWP1918J shown)

IN STOCK MIL-SPEC

U.L. LISTED

Identical to National's NW-Series Cables except offered as twisted pairs.

National Wire & Cable Corporation manufactures a complete line of multiple pair control cables. Conductors are of tinned copper strand with $\frac{1}{64}''$ vinyl primary insulation for use up to 105°C per MIL-W-16878D Type C. Insulated for **1000** volts working voltage. Conductors are color coded using 10 standard basic colors, plus spiral tracers on white per table below.

All pairs are planetary cabled and contra-helically laid with a Mylar tape serve over the cable bundle. The overall jacket is a 105°C black vinyl plastic per MIL-I-631; or may be Neoprene to MIL-R-6855 Class 2 Grade 60 specification. (Neoprene at added cost).

SHIELDED CABLES

National Multiple Conductor SHIELDED CABLES are to the same specifications as above with addition of tinned copper braided shield over cable complex with 85-90% coverage to MIL-C-7078A.

TECHNICAL DATA (all cables)

Insulation Breakdown Voltage:	Greater than 8,000 volts AC RMS, 60 cps.
Capacitance:	Nominal capacitance wire to wire for a pair ranges from 27. to 40. mmfd/ft. Capacitance from both wires tied together measured to all else in common ranges from 35. to 60. mmfd/ft. dependent on gauge and position. Overall shield has negligible effect on W-W capacitance.
Insulation Leakage Res.:	200. megohms / 1000 ft. min. at 500 VDC from any conductor to all else in cable.
Sheath Leakage Res.:	10. megohms / 1000 ft. min. at 500 VDC from overall shield through sheath to outside world.
Usable Temp. Range:	Suitable for continuous use from +105°C to −55°C.
Cold Bending Capability:	All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C. For continuous flexing applications consult factory.

UNSHIELDED OVERALL						OVERALL SHIELDED					
PART NO.	NO. OF PAIRS	COND. GA.	JKT. THICK	O. D.	WEIGHT	PART NO.	NO. OF PAIRS	COND. GA.	JKT. THICK	O. D.	WEIGHT
NWP-722 J	7	22	.045	.470	90 Lbs.	NWP-722 SJ	7	22	.045	.495	135 Lbs.
NWP-1222J	12	22	.050	.600	150 Lbs.	NWP-1222SJ	12	22	.050	.630	206 Lbs.
NWP-1922J	19	22	.050	.700	200 Lbs.	NWP-1922SJ	19	22	.050	.730	260 Lbs.
NWP-2722J	27	22	.055	.830	280 Lbs.	NWP-2722SJ	27	22	.055	.860	358 Lbs.
NWP-3722J	37	22	.060	.960	370 Lbs.	NWP-3722SJ	37	22	.060	.990	460 Lbs.
NWP-4822J	48	22	.060	1.080	470 Lbs.	NWP-4822SJ	48	22	.060	1.110	570 Lbs.
NWP-6022J	60	22	.060	1.200	560 Lbs.	NWP-6022SJ	60	22	.060	1.230	675 Lbs.
NWP-720 J	7	20	.050	.520	120 Lbs.	NWP-720 SJ	7	20	.050	.550	170 Lbs.
NWP-1220J	12	20	.050	.660	200 Lbs.	NWP-1220SJ	12	20	.050	.690	260 Lbs.
NWP-1920J	19	20	.050	.800	290 Lbs.	NWP-1920SJ	19	20	.050	.830	355 Lbs.
NWP-2720J	27	20	.060	.960	420 Lbs.	NWP-2720SJ	27	20	.060	.990	510 Lbs.
NWP-3720J	37	20	.060	1.100	500 Lbs.	NWP-3720SJ	37	20	.060	1.130	603 Lbs.
NWP-4820J	48	20	.060	1.240	620 Lbs.	NWP-4820SJ	48	20	.060	1.270	735 Lbs.
NWP-6020J	60	20	.060	1.380	750 Lbs.	NWP-6020SJ	60	20	.060	1.410	880 Lbs.
NWP-718 J	7	18	.050	.580	150 Lbs.	NWP-718 SJ	7	18	.050	.610	205 Lbs.
NWP-1218J	12	18	.050	.740	290 Lbs.	NWP-1218SJ	12	18	.050	.770	360 Lbs.
NWP-1918J	19	18	.060	.920	400 Lbs.	NWP-1918SJ	19	18	.060	.950	487 Lbs.
NWP-2718J	27	18	.060	1.080	560 Lbs.	NWP-2718SJ	27	18	.060	1.110	660 Lbs.
NWP-3718J	37	18	.060	1.240	750 Lbs.	NWP-3718SJ	37	18	.060	1.270	865 Lbs.
NWP-4818J	48	18	.060	1.400	900 Lbs.	NWP-4818SJ	48	18	.060	1.430	1030 Lbs.
NWP-716 J	7	16	.050	.640	180 Lbs.	NWP-716 SJ	7	16	.050	.670	240 Lbs.
NWP-1216J	12	16	.060	.840	300 Lbs.	NWP-1216SJ	12	16	.060	.870	377 Lbs.
NWP-1916J	19	16	.060	1.020	430 Lbs.	NWP-1916SJ	19	16	.060	1.050	520 Lbs.
NWP-2716J	27	16	.060	1.200	720 Lbs.	NWP-2716SJ	27	16	.060	1.230	830 Lbs.
NWP-3716J	37	16	.060	1.380	1000 Lbs.	NWP-3716SJ	37	16	.060	1.410	1330 Lbs.

COLOR CODING USED ON TWISTED PAIRS

PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS	PR #	PAIR COLORS
1.	WHITE WITH BLACK	11.	BLACK WITH RED	21.	BROWN WITH GREEN	31.	ORANGE WITH YELLOW	41.	GREEN WITH VIOLET	51.	WHT/BLK WITH GREEN
2.	WHITE WITH BROWN	12.	BLACK WITH ORANGE	22.	BROWN WITH BLUE	32.	ORANGE WITH GREEN	42.	GREEN WITH GRAY	52.	WHT/BLK WITH BLUE
3.	WHITE WITH RED	13.	BLACK WITH YELLOW	23.	BROWN WITH VIOLET	33.	ORANGE WITH BLUE	43.	BLUE WITH VIOLET	53.	WHT/BLK WITH VIOLET
4.	WHITE WITH ORANGE	14.	BLACK WITH GREEN	24.	BROWN WITH GRAY	34.	ORANGE WITH VIOLET	44.	BLUE WITH GREY	54.	WHT/BLK WITH GRAY
5.	WHITE WITH YELLOW	15.	BLACK WITH BLUE	25.	RED WITH ORANGE	35.	ORANGE WITH GRAY	45.	VIOLET WITH GRAY	55.	WHT/BRN WITH BLACK
6.	WHITE WITH GREEN	16.	BLACK WITH VIOLET	26.	RED WITH YELLOW	36.	YELLOW WITH GREEN	46.	WHT/BLK WITH BLACK	56.	WHT/BRN WITH BROWN
7.	WHITE WITH BLUE	17.	BLACK WITH GRAY	27.	RED WITH GREEN	37.	YELLOW WITH BLUE	47.	WHT/BLK WITH BROWN	57.	WHT/BRN WITH RED
8.	WHITE WITH VIOLET	18.	BROWN WITH RED	28.	RED WITH BLUE	38.	YELLOW WITH VIOLET	48.	WHT/BLK WITH RED	58.	WHT/BRN WITH ORANGE
9.	WHITE WITH GRAY	19.	BROWN WITH ORANGE	29.	RED WITH VIOLET	39.	YELLOW WITH GRAY	49.	WHT/BLK WITH ORANGE	59.	WHT/BRN WITH YELLOW
10.	BLACK WITH BROWN	20.	BROWN WITH YELLOW	30.	RED WITH GRAY	40.	GREEN WITH BLUE	50.	WHT/BLK WITH YELLOW	60.	WHT/BRN WITH GREEN

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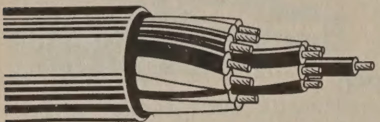
Miniature Signal & Control Cables Single Conductors (NQ Series)

EXTRA FLEXIBLE — GRAY PVC JACKET



(NQ1928J shown)

GRAY PVC JACKET

National Wire & Cable Corporation manufactures a complete line of highly flexible micro-miniature low-voltage instrument control cable. These are available as cabled pairs or singles, with optional overall shield of either foil with drain or a braided shield. Stocked with braided shields.

Conductors are stranded tinned copper with .010″ wall of tough extruded polyvinyl chloride primary insulation, rated for 300 volt use at +80°C under U. L. listed style 1061.* All are color coded using ten standard colors plus white with stripes per MIL-STD-681. Coded pairs use the same sequence as type NXP and NWP.

Conductors are planetary cabled and helically laid for optimum flexibility, with a barrier under braids. Shielded cables have a tinned copper braid of 90% coverage per MIL-C-7078, with braid angles below 40° for easy pushback; or have a 100% coverage foil shield in intimate contact with a drain wire for easy termination. See Section 3 of our master catalog for relative shield effectiveness.

Outer jacket is highly flexible abrasion-resistant gray polyvinyl chloride thermoplastic, meeting the requirements of U.L. listed style 2464.**

All materials are flame retardant and fungus resistant.

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

* Wire also meets MIL-W-16878 type B, rated 600 volts, +105°C.

** Jacket material is military rated for +105°C; meets MIL-I-631, Class F.

MIL-SPEC & U.L. LISTED STYLE 2464

TECHNICAL DATA (all cables)

Insulation breakdown voltage:	Greater than 3000 volts AC RMS, 60cps.
Capacitance:	Nominal capacitance from a wire to all else in a cable ranges from 25 to 45 pf/ft at 1kc, depending on gauge and position.
Insulation Leakage:	200 megohms/1000 feet minimum @ 500VDC from conductor to all else in cable.
Sheath Leakage:	10 megohms/1000 feet minimum @ 500VDC from shield or conductor group through sheath to ground.
Temperature Range:	U.L. rating: +80°C per U.L. style 2464. Military: Continuous use from −40°C to +105°C.
Bending Characteristics:	All cables are suitable for flexing to a circle diameter of 6 cable diameters from +105°C to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°. For continuous flexing applications consult the factory.
Foil Shielded Cables:	The nominal overall diameter of foil shielded cables will be .006″ greater than the non-shielded cables of the same conductor count and wire size.
Characteristic Impedance: (NQP Paired Cables)	Ranges from 150 ohms to 45 ohms, dependent on wire size (AWG), geometry and drive method. Consult our technical staff for data on specific cable types.

MULTI-CONDUCTOR STOCK CABLED SINGLES

Conductor sizes 28, 26, 24, 22 are 7 strand. All others 19 strand.

UNSHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQ-228 J	2	28	.034	.031	.135	8
NQ-328 J	3	28	.034	.031	.142	9
NQ-428 J	4	28	.034	.031	.150	11
NQ-528 J	5	28	.034	.031	.161	12
NQ-628 J	6	28	.034	.031	.171	13
NQ-728 J	7	28	.034	.031	.171	14
NQ-828 J	8	28	.034	.031	.196	19
NQ-928 J	9	28	.034	.031	.206	22
NQ-1028 J	10	28	.034	.031	.206	23
NQ-1228 J	12	28	.034	.031	.212	25
NQ-1528 J	15	28	.034	.031	.231	28
NQ-1928 J	19	28	.034	.031	.241	33
NQ-2728 J	27	28	.034	.031	.282	42
NQ-3728 J	37	28	.034	.031	.311	55
NQ-226 J	2	26	.038	.031	.144	9
NQ-326 J	3	26	.038	.031	.150	11
NQ-426 J	4	26	.038	.031	.160	13
NQ-526 J	5	26	.038	.031	.171	15
NQ-626 J	6	26	.038	.031	.183	17
NQ-726 J	7	26	.038	.031	.183	18
NQ-826 J	8	26	.038	.031	.210	23
NQ-926 J	9	26	.038	.031	.222	25
NQ-1026 J	10	26	.038	.031	.222	26
NQ-1226 J	12	26	.038	.031	.228	30
NQ-1526 J	15	26	.038	.031	.249	35
NQ-1926 J	19	26	.038	.031	.261	42
NQ-2726 J	27	26	.038	.031	.306	55
NQ-3726 J	37	26	.038	.031	.339	70
NQ-4826 J	48	26	.038	.031	.384	92

OVERALL SHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQ-228 SJ	2	28	.034	.031	.159	16
NQ-328 SJ	3	28	.034	.031	.165	17
NQ-428 SJ	4	28	.034	.031	.173	20
NQ-528 SJ	5	28	.034	.031	.184	21
NQ-628 SJ	6	28	.034	.031	.194	23
NQ-728 SJ	7	28	.034	.031	.194	24
NQ-828 SJ	8	28	.034	.031	.219	31
NQ-928 SJ	9	28	.034	.031	.229	35
NQ-1028SJ	10	28	.034	.031	.229	36
NQ-1228SJ	12	28	.034	.031	.235	38
NQ-1528SJ	15	28	.034	.031	.254	42
NQ-1928SJ	19	28	.034	.031	.264	48
NQ-2728SJ	27	28	.034	.031	.305	60
NQ-3728SJ	37	28	.034	.031	.333	75
NQ-226 SJ	2	26	.038	.031	.167	17
NQ-326 SJ	3	26	.038	.031	.173	20
NQ-426 SJ	4	26	.038	.031	.183	22
NQ-526 SJ	5	26	.038	.031	.194	25
NQ-626 SJ	6	26	.038	.031	.205	28
NQ-726 SJ	7	26	.038	.031	.205	29
NQ-826 SJ	8	26	.038	.031	.233	36
NQ-926 SJ	9	26	.038	.031	.245	39
NO-1026SJ	10	26	.038	.031	.245	40
NQ-1226SJ	12	26	.038	.031	.251	44
NQ-1526SJ	15	26	.038	.031	.272	51
NQ-1926SJ	19	26	.038	.031	.284	58
NQ-2726SJ	27	26	.038	.031	.329	75
NQ-3726SJ	37	26	.038	.031	.362	92
NQ-4826SJ	48	26	.038	.031	.407	117

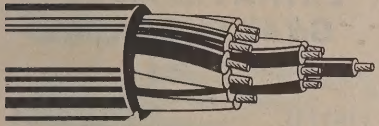
(continued on following page)

NATIONAL WIRE
AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Miniature Signal & Control Cables Single Conductors (NQ Series)

EXTRA FLEXIBLE — GRAY PVC JACKET



(NQ1928J shown)

MIL-SPEC & U.L. LISTED

STYLE 2464

MULTI-CONDUCTOR STOCK CABLED SINGLES continued from previous page.

UNSHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQ-224 J	2	24	.043	.031	.154	11
NQ-324 J	3	24	.043	.031	.161	13
NQ-424 J	4	24	.043	.031	.172	15
NQ-524 J	5	24	.043	.031	.185	18
NQ-624 J	6	24	.043	.031	.198	21
NQ-724 J	7	24	.043	.031	.198	23
NQ-824 J	8	24	.043	.031	.229	27
NQ-924 J	9	24	.043	.031	.242	30
NQ-1024 J	10	24	.043	.031	.242	32
NQ-1224 J	12	24	.043	.031	.249	37
NQ-1524 J	15	24	.043	.031	.273	44
NQ-1924 J	19	24	.043	.031	.286	53
NQ-2724 J	27	24	.043	.031	.337	70
NQ-3724 J	37	24	.043	.031	.374	93
NQ-4824 J	48	24	.043	.031	.425	120
NQ-6024 J	60	24	.043	.031	.462	145
NQ-222 J	2	22	.050	.031	.166	13
NQ-322 J	3	22	.050	.031	.174	17
NQ-422 J	4	22	.050	.031	.186	20
NQ-522 J	5	22	.050	.031	.201	25
NQ-622 J	6	22	.050	.031	.216	28
NQ-722 J	7	22	.050	.031	.216	31
NQ-822 J	8	22	.050	.031	.251	36
NQ-922 J	9	22	.050	.031	.266	40
NQ-1022 J	10	22	.050	.031	.266	43
NQ-1222 J	12	22	.050	.031	.274	50
NQ-1522 J	15	22	.050	.031	.301	60
NQ-1922 J	19	22	.050	.031	.316	73
NQ-2722 J	27	22	.050	.031	.374	100
NQ-3722 J	37	22	.050	.031	.416	142
NQ-4822 J	48	22	.050	.031	.474	169
NQ-6022 J	60	22	.050	.031	.590	210
NQ-220 J	2	20	.057	.031	.182	17
NQ-320 J	3	20	.057	.031	.191	23
NQ-420 J	4	20	.057	.031	.205	28
NQ-520 J	5	20	.057	.031	.223	33
NQ-620 J	6	20	.057	.031	.240	39
NQ-720 J	7	20	.057	.031	.240	43
NQ-820 J	8	20	.057	.031	.281	51
NQ-920 J	9	20	.057	.031	.298	55
NQ-1020 J	10	20	.057	.031	.298	60
NQ-1220 J	12	20	.057	.031	.307	70
NQ-1520 J	15	20	.057	.031	.339	85
NQ-1920 J	19	20	.057	.031	.356	103
NQ-2720 J	27	20	.057	.031	.423	143
NQ-3720 J	37	20	.057	.031	.472	190
NQ-218 J	2	18	.068	.031	.202	23
NQ-318 J	3	18	.068	.031	.213	29
NQ-418 J	4	18	.068	.031	.229	37
NQ-518 J	5	18	.068	.031	.250	44
NQ-618 J	6	18	.068	.031	.270	52
NQ-718 J	7	18	.068	.031	.270	59
NQ-818 J	8	18	.068	.031	.318	68
NQ-918 J	9	18	.068	.031	.338	75
NQ-1018 J	10	18	.068	.031	.338	82
NQ-1218 J	12	18	.068	.031	.349	96
NQ-1518 J	15	18	.068	.031	.386	117
NQ-1918 J	19	18	.068	.031	.406	144
NQ-2718 J	27	18	.068	.031	.484	206

OVERALL SHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQ-224 SJ	2	24	.043	.031	.177	20
NQ-324 SJ	3	24	.043	.031	.184	22
NQ-424 SJ	4	24	.043	.031	.195	25
NQ-524 SJ	5	24	.043	.031	.208	29
NQ-624 SJ	6	24	.043	.031	.221	33
NQ-724 SJ	7	24	.043	.031	.221	35
NQ-824 SJ	8	24	.043	.031	.252	41
NQ-924 SJ	9	24	.043	.031	.265	45
NQ-1024SJ	10	24	.043	.031	.265	47
NQ-1224SJ	12	24	.043	.031	.272	53
NQ-1524SJ	15	24	.043	.031	.296	61
NQ-1924SJ	19	24	.043	.031	.309	71
NQ-2724SJ	27	24	.043	.031	.360	92
NQ-3724SJ	37	24	.043	.031	.397	118
NQ-4824SJ	48	24	.043	.031	.453	148
NQ-6024SJ	60	24	.043	.031	.490	176
NQ-222 SJ	2	22	.050	.031	.189	23
NQ-322 SJ	3	22	.050	.031	.197	27
NQ-422 SJ	4	22	.050	.031	.209	31
NQ-522 SJ	5	22	.050	.031	.224	37
NQ-622 SJ	6	22	.050	.031	.239	41
NQ-722 SJ	7	22	.050	.031	.239	44
NQ-822 SJ	8	22	.050	.031	.274	52
NQ-922 SJ	9	22	.050	.031	.289	57
NQ-1022SJ	10	22	.050	.031	.289	60
NQ-1222SJ	12	22	.050	.031	.297	67
NQ-1522SJ	15	22	.050	.031	.324	79
NQ-1922SJ	19	22	.050	.031	.339	93
NQ-2722SJ	27	22	.050	.031	.397	125
NQ-3722SJ	37	22	.050	.031	.434	169
NQ-4822SJ	48	22	.050	.031	.502	201
NQ-6022SJ	60	22	.050	.031	.618	245
NQ-220 SJ	2	20	.057	.031	.205	28
NQ-320 SJ	3	20	.057	.031	.214	35
NQ-420 SJ	4	20	.057	.031	.228	41
NQ-520 SJ	5	20	.057	.031	.246	47
NQ-620 SJ	6	20	.057	.031	.263	54
NQ-720 SJ	7	20	.057	.031	.263	58
NQ-820 SJ	8	20	.057	.031	.304	69
NQ-920 SJ	9	20	.057	.031	.321	74
NQ-1020SJ	10	20	.057	.031	.321	79
NQ-1220SJ	12	20	.057	.031	.330	90
NQ-1520SJ	15	20	.057	.031	.362	107
NQ-1920SJ	19	20	.057	.031	.379	126
NQ-2720SJ	27	20	.057	.031	.451	171
NQ-3720SJ	37	20	.057	.031	.500	221
NQ-218 SJ	2	18	.068	.031	.225	35
NQ-318 SJ	3	18	.068	.031	.236	42
NQ-418 SJ	4	18	.068	.031	.252	51
NQ-518 SJ	5	18	.068	.031	.273	60
NQ-618 SJ	6	18	.068	.031	.293	69
NQ-718 SJ	7	18	.068	.031	.293	76
NQ-818 SJ	8	18	.068	.031	.341	88
NQ-918 SJ	9	18	.068	.031	.361	97
NQ-1018SJ	10	18	.068	.031	.361	104
NQ-1218SJ	12	18	.068	.031	.372	119
NQ-1518SJ	15	18	.068	.031	.409	142
NQ-1918SJ	19	18	.068	.031	.434	171
NQ-2718SJ	27	18	.068	.031	.513	238

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Miniature Signal & Control Cables Twisted Pairs (NQP Series)

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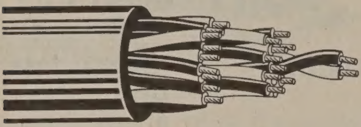

(NQP1928J shown)

MIL-SPEC & U.L. LISTED **STYLE 2464**

GRAY PVC JACKET

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* Wire also meets MIL-W-16878 type B, rated 600 volts, +105°C.

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Insulation Leakage:	200 megohms/1000 feet minimum @ 500VDC from conductor to all else in cable.
Sheath Leakage:	10 megohms/1000 feet minimum @ 500VDC from shield or conductor group through sheath to ground.
Temperature Range:	U.L. rating: +80°C per U.L. style 2464. Military: Continuous use from −40°C to +105°C.
Bending Characteristics:	All cables are suitable for flexing to a circle diameter of 6 cable diameters from +105°C to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°. For continuous flexing applications consult the factory.
Foil Shielded Cables:	The nominal overall diameter of foil shielded cables will be .006″ greater than the non-shielded cables of the same conductor count and wire size.
Characteristic Impedance: (NQP Paired Cables)	Ranges from 150 ohms to 45 ohms, dependent on wire size (AWG), geometry and drive method. Consult our technical staff for data on specific cable types.

MULTI-CONDUCTOR STOCK CABLED PAIRS

UNSHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M′
NQP- 228J	2	28	.034	.031	.185	15
NQP- 328J	3	28	.034	.031	.202	16
NQP- 428J	4	28	.034	.031	.217	20
NQP- 528J	5	28	.034	.031	.236	23
NQP- 628J	6	28	.034	.031	.262	29
NQP- 728J	7	28	.034	.031	.262	28
NQP- 828J	8	28	.034	.031	.304	34
NQP- 928J	9	28	.034	.031	.318	41
NQP-1028J	10	28	.034	.031	.318	39
NQP-1228J	12	28	.034	.031	.328	43
NQP-1528J	15	28	.034	.031	.367	55
NQP-1928J	19	28	.034	.031	.381	61
NQP- 226J	2	26	.038	.031	.199	20
NQP- 326J	3	26	.038	.031	.218	21
NQP- 426J	4	26	.038	.031	.234	26
NQP- 526J	5	26	.038	.031	.256	34
NQP- 626J	6	26	.038	.031	.284	37
NQP- 726J	7	26	.038	.031	.284	38
NQP- 826J	8	26	.038	.031	.331	52
NQP- 926J	9	26	.038	.031	.347	60
NQP-1026J	10	26	.038	.031	.347	51
NQP-1226J	12	26	.038	.031	.358	59
NQP-1526J	15	26	.038	.031	.401	75
NQP-1926J	19	26	.038	.031	.417	85
NQP-2726J	27	26	.038	.031	.498	115

OVERALL SHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M′
NQP- 228SJ	2	28	.034	.031	.208	28
NQP- 328SJ	3	28	.034	.031	.225	29
NQP- 428SJ	4	28	.034	.031	.240	35
NQP- 528SJ	5	28	.034	.031	.259	37
NQP- 628SJ	6	28	.034	.031	.285	46
NQP- 728SJ	7	28	.034	.031	.285	45
NQP- 828SJ	8	28	.034	.031	.327	55
NQP- 928SJ	9	28	.034	.031	.341	63
NQP-1028SJ	10	28	.034	.031	.341	61
NQP-1228SJ	12	28	.034	.031	.351	66
NQP-1528SJ	15	28	.034	.031	.390	81
NQP-1928SJ	19	28	.034	.031	.404	88
NQP- 226SJ	2	26	.038	.031	.222	34
NQP- 326SJ	3	26	.038	.031	.241	36
NQP- 426SJ	4	26	.038	.031	.257	42
NQP- 526SJ	5	26	.038	.031	.279	52
NQP- 626SJ	6	26	.038	.031	.307	56
NQP- 726SJ	7	26	.038	.031	.307	57
NQP- 826SJ	8	26	.038	.031	.355	75
NQP- 926SJ	9	26	.038	.031	.370	85
NQP-1026SJ	10	26	.038	.031	.370	76
NQP-1226SJ	12	26	.038	.031	.381	84
NQP-1526SJ	15	26	.038	.031	.424	103
NQP-1926SJ	19	26	.038	.031	.440	115
NQP-2726SJ	27	26	.038	.031	.521	152

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AND CABLE CORPORATION

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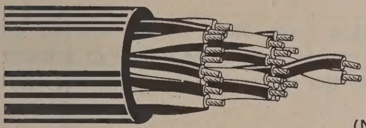
Miniature Signal & Control Cables Twisted Pairs (NQP Series)

EXTRA FLEXIBLE — GRAY PVC JACKET


(NQP1928J shown)

MIL-SPEC & U.L. LISTED

STYLE 2464

MULTI-CONDUCTOR STOCK CABLED PAIRS

continued from previous page.

UNSHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQP- 224J	2	24	.043	.031	.216	24
NQP- 324J	3	24	.043	.031	.237	26
NQP- 424J	4	24	.043	.031	.256	32
NQP- 524J	5	24	.043	.031	.280	40
NQP- 624J	6	24	.043	.031	.312	46
NQP- 724J	7	24	.043	.031	.312	47
NQP- 824J	8	24	.043	.031	.365	65
NQP- 924J	9	24	.043	.031	.383	75
NQP-1024J	10	24	.043	.031	.383	65
NQP-1224J	12	24	.043	.031	.395	74
NQP-1524J	15	24	.043	.031	.444	95
NQP-1924J	19	24	.043	.031	.462	108
NQP-2724J	27	24	.043	.031	.554	141
NQP- 222J	2	22	.050	.031	.236	30
NQP- 322J	3	22	.050	.031	.260	33
NQP- 422J	4	22	.050	.031	.282	42
NQP- 522J	5	22	.050	.031	.309	51
NQP- 622J	6	22	.050	.031	.346	62
NQP- 722J	7	22	.050	.031	.346	64
NQP- 822J	8	22	.050	.031	.406	87
NQP- 922J	9	22	.050	.031	.426	100
NQP-1022J	10	22	.050	.031	.426	88
NQP-1222J	12	22	.050	.031	.440	102
NQP-1522J	15	22	.050	.031	.496	131
NQP-1922J	19	22	.050	.031	.516	143
NQP-2722J	27	22	.050	.031	.620	198
NQP- 220J	2	20	.057	.031	.263	39
NQP- 320J	3	20	.057	.031	.292	45
NQP- 420J	4	20	.057	.031	.312	57
NQP- 520J	5	20	.057	.031	.348	70
NQP- 620J	6	20	.057	.031	.391	85
NQP- 720J	7	20	.057	.031	.391	89
NQP- 820J	8	20	.057	.031	.460	121
NQP- 920J	9	20	.057	.031	.484	139
NQP-1020J	10	20	.057	.031	.484	124
NQP-1220J	12	20	.057	.031	.500	144
NQP-1520J	15	20	.057	.031	.565	176
NQP-1920J	19	20	.057	.031	.588	205
NQP- 218J	2	18	.068	.031	.297	52
NQP- 318J	3	18	.068	.031	.330	60
NQP- 418J	4	18	.068	.031	.360	77
NQP- 518J	5	18	.068	.031	.396	96
NQP- 618J	6	18	.068	.031	.447	117
NQP- 718J	7	18	.068	.031	.447	122
NQP-1218J	12	18	.068	.031	.575	188

OVERALL SHIELDED CABLES

Part No.	No. Cond.	Cond. AWG	Cond. Diam.	Jkt. Wall	Nom. O/A Diam.	Wght. LB/M'
NQP- 224SJ	2	24	.043	.031	.239	39
NQP- 324SJ	3	24	.043	.031	.260	42
NQP- 424SJ	4	24	.043	.031	.279	50
NQP- 524SJ	5	24	.043	.031	.303	59
NQP- 624SJ	6	24	.043	.031	.335	67
NQP- 724SJ	7	24	.043	.031	.335	68
NQP- 824SJ	8	24	.043	.031	.390	91
NQP- 924SJ	9	24	.043	.031	.406	102
NQP-1024SJ	10	24	.043	.031	.406	92
NQP-1224SJ	12	24	.043	.031	.418	102
NQP-1524SJ	15	24	.043	.031	.467	127
NQP-1924SJ	19	24	.043	.031	.485	142
NQP-2724SJ	27	24	.043	.031	.577	185
NQP- 222SJ	2	22	.050	.031	.259	47
NQP- 322SJ	3	22	.050	.031	.283	51
NQP- 422SJ	4	22	.050	.031	.305	62
NQP- 522SJ	5	22	.050	.031	.332	73
NQP- 622SJ	6	22	.050	.031	.369	86
NQP- 722SJ	7	22	.050	.031	.369	88
NQP- 822SJ	8	22	.050	.031	.430	116
NQP- 922SJ	9	22	.050	.031	.449	131
NQP-1022SJ	10	22	.050	.031	.449	119
NQP-1222SJ	12	22	.050	.031	.463	134
NQP-1522SJ	15	22	.050	.031	.519	167
NQP-1922SJ	19	22	.050	.031	.539	180
NQP-2722SJ	27	22	.050	.031	.645	245
NQP- 220SJ	2	20	.057	.031	.286	58
NQP- 320SJ	3	20	.057	.031	.315	65
NQP- 420SJ	4	20	.057	.031	.335	79
NQP- 520SJ	5	20	.057	.031	.371	95
NQP- 620SJ	6	20	.057	.031	.414	112
NQP- 720SJ	7	20	.057	.031	.414	116
NQP- 820SJ	8	20	.057	.031	.483	154
NQP- 920SJ	9	20	.057	.031	.507	174
NQP-1020SJ	10	20	.057	.031	.507	159
NQP-1220SJ	12	20	.057	.031	.525	181
NQP-1520SJ	15	20	.057	.031	.588	216
NQP-1920SJ	19	20	.057	.031	.615	248
NQP- 218SJ	2	18	.068	.031	.320	74
NQP- 318SJ	3	18	.068	.031	.353	83
NQP- 418SJ	4	18	.068	.031	.383	103
NQP- 518SJ	5	18	.068	.031	.420	124
NQP- 618SJ	6	18	.068	.031	.475	148
NQP- 718SJ	7	18	.068	.031	.475	153
NQP-1218SJ	12	18	.068	.031	.600	230

These pages are only a partial reproduction of our master catalog. If our "standard" items won't meet your application, let us **CUSTOM DESIGN** and manufacture exactly what you need. Write or call our customer services dept. for technical assistance.

NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Digital Data Transmission Cables (D-200 Series)

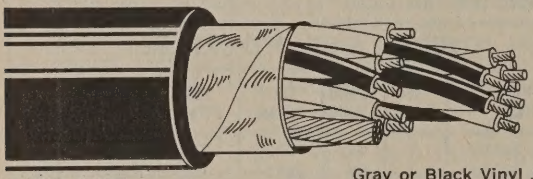
Low Voltage Computer Cable

Manufactured by our affiliate,
Dynatronic Cable Engineering Corp.

THE D-200 SERIES CABLES ARE MULTIPLE-PAIR FLEXIBLE CABLES DESIGNED FOR TRANSMISSION OF DIGITAL PULSE SIGNALS BETWEEN A COMPUTER AND ITS PERIPHERAL EQUIPMENT.

UL LISTED
U.S. Pat. No. 3489844

D-200 XX (XX designates number of pairs)



Gray or Black Vinyl Jackets

D-200 XXRF (RF designates braided shield)*

DESIGN FEATURES OF THE D-200 SERIES DIGITAL DATA CABLE

Unlike conventional flexible cable construction, the primary features offered by the D-200 series data cable are the high and accurately controlled characteristic impedance of every pair, regardless of its position in the cable and special geometry chosen to reduce crosstalk.

ADVANTAGES

1. Less crosstalk and noise from mismatched loads, due to proper matching.
2. Uniform light loading on drivers allows direct I.C. drive, accurate prediction of current demands from power supply, and driver power dissipation.
3. Proper load match reduces re-flection and inversion noise where driver end is not matched to line. (Typical of TTL.)
4. Special geometry and pair construction provides exceptionally close capacitance balance between pair wires, reducing differential crosstalk.

USAGE

We recommend use of balanced drive and differential-input line receivers for lowest crosstalk and best pulse-reduction, utilizing the 110 ohm balanced impedance of the pairs. With such a system, TTL and MECL speeds have been used on D-200 cable at 1 mc data rates over 1000 ft.

Where the system is single-ended drive and receive, all pairs exhibit the 78 ohm impedance. Since these line receivers cannot discriminate between noise and the desired signal, crosstalk limits the cable distance over which transmission is reliable. Typical runs for DTL having 50 ns risetimes are 200 ft. Where risetimes can be slowed to longer than 100 ns, run lengths are practical to 500 ft. Without differential line reception, runs over 500 ft are not recommended for D-200 cable due to external noise aspects.

The D-210 series cable are recommended for high noise or long-run application. (Utilizing individual shields.)

Although use of balanced drive and differential line reception will avoid most noise problems, there are some installations where the expected external noise is unknown but assumed to be very great. Here, the use of data cables having individually-shielded pairs may be considered as conservative engineering practice. The assurance of a lower received noise may justify the increased size, cost and risetime.

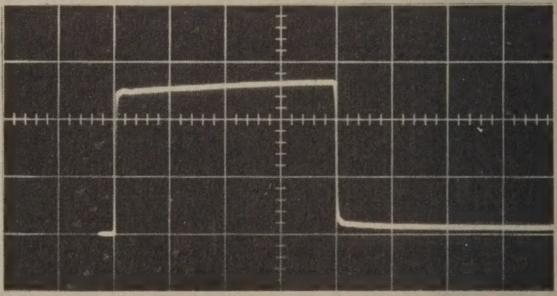
For these high noise-long run applications, Dynatronic Cable Engineering Corp has developed the D-210 series data cables. Electrical performance is essentially the same as the D-200 series cables, which use only an overall shield. *An overall tinned-copper shield braid may be specified on either series by the suffix -RF on the part number. Standard D-200 shield is aluminum-mylar foil.

For runs of 1000-5000 ft. or where extra-fast output pulse risetime is required, we offer the D-220 series cable: a larger version of the D-200 series having improved transmission properties with sufficient mechanical strength for long pulls in conduit. Consult factory for technical data.

PULSE TRANSMISSION LOSS in D-series data cables causes a moderate amplitude loss, with definite rounding of the leading and trailing edges from 50% to 90% amplitude. The photos below (for a 1.25 megabit clock rate) show typical waveforms. The D-220 and D-222 series cables offer even lower losses than the D-200 or D-210 cables for long-run or fast-clocked applications.

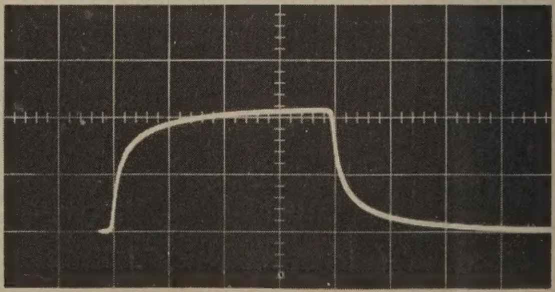
Contact our factory engineering staff for detailed pulse-shape versus distance information, or for special applications.

INPUT PULSE



Horizontal: 200. ns/cm
Vertical : 2. volts/cm

OUTPUT PULSE at 500.FT.



Horizontal: 200. ns/cm
Vertical : 2. volts/cm

NATIONAL WIRE
AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569
Manufactured by our affiliate, Dynatronic Cable Engineering Corp.

Digital Data Transmission Cables (D-200 Series continued)

Low Voltage Computer Cable

Part No.						
Black Jacket	Extra Flexible Gray Jacket	No. of Pairs	Cond. AWG.	Delay NS/FT	Cable Diam.	Weight (Lbs. per M ft.)
D-200-4	D-200-4G	4	24	1.61	.315″	41.
D-200-7	D-200-7G	7	24	1.61	.410″	73.
D-200-12	D-200-12G	12	24	1.61	.455″	96.
D-200-15	D-200-15G	15	24	1.61	.510″	120.
D-200-20	D-200-20G	20	24	1.61	.635″	160.
D-200-24	D-200-24G	24	24	1.61	.660″	180.
D-200-27	D-200-27G	27	24	1.61	.690″	210.
D-200-30	D-200-30G	30	24	1.61	.710″	230.
D-200-33	D-200-33G	33	24	1.61	.750″	250.
D-200-42	D-200-42G	42	24	1.61	.840″	280.
D-200-50	D-200-50G	50	24	1.61	.910″	320.

TECHNICAL DATA

Characteristic	Balanced**	Single-ended*
Characteristic Impedance	110. ohms ±5%	78. ohms ±4%
Capacitance	14. pf/ft.	21. pf/ft.
Signal Delay	1.61 ns/ft.	1.61 ns/ft.
DC Resistance/100 ft.	5.6 ohms loop	2.8 ohms
Insulation Breakdown	6. KV min. DC	6. KV min. DC
Insulation Resistance	> 1000. megohms/M′	> 1000. megohms/M′
Temperature Range	−20. C up to +80. C (60. C for U.L.)	
Min. Bend Radius	6 x cable diameter	

*One conductor of each pair tied to common.

STANDARD DATA CABLE CONSTRUCTIONS — D-210 SERIES INDIVIDUALLY SHIELDED DATA PAIRS

Part. No.	No. of Pairs	Z_o	Delay NS/FT	Cond. AWG.	Cable Diam.	Sheath
D-210-1	1	110.	1.61	24	.220	PVC
D-210-12	12	110.	1.61	24	.980	PVC
D-210-15	15	110.	1.61	24	1.06	PVC
D-210-20	20	110.	1.61	24	1.20	PVC
D-210-30	30	110.	1.61	24	1.42	PVC
D-210-40	40	110.	1.61	24	1.69	PVC
D-210-48	48	110.	1.61	24	1.76	PVC

All items available in 50 ft. multiples.

TECHNICAL DATA

Characteristic	Balanced**	Single-ended*
Characteristic Impedance	110. ohms ±5%	63. ohms ±4%
Capacitance	14. pf/ft.	23.5 pf/ft.
Signal Delay	1.61 ns/ft.	1.61 ns/ft.
DC Resistance/100 ft.	5.6 ohms loop	2.8 ohms
Insulation Breakdown	6. KV min. DC	6. KV min. DC
Insulation Resistance	> 1000. megohms/M′	> 1000. megohms/M′
Temperature Range	−20. C up to +80. C (60. C for U.L.)	
Min. Bend Radius	9 x cable diameter	

**Both driven, one inverted. *One conductor of each pair tied to common.

We invite your telephone inquiries for technical information on data cables. Contact Mr. Frank Motley or Mr. Ralph Wells in our Engineering Dept.

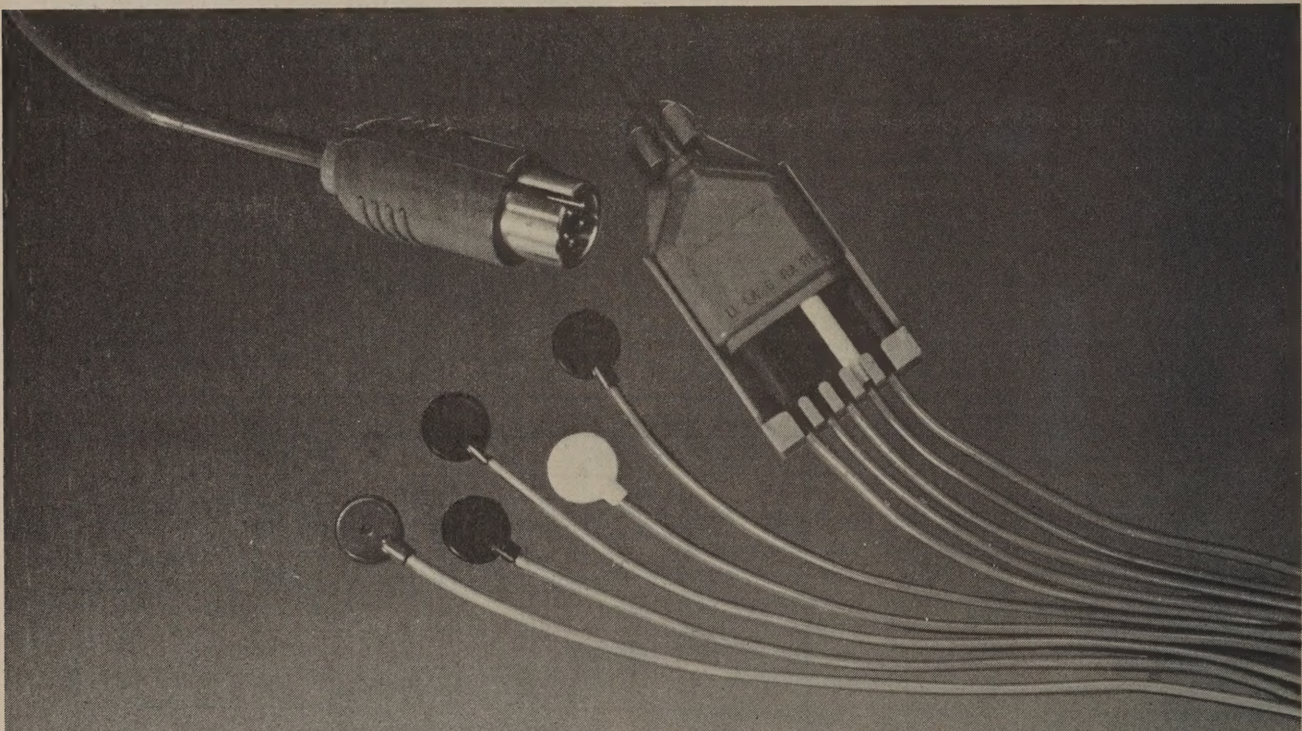
NATIONAL CABLE
MOLDING CORPORATION

AN AFFILIATE OF NATIONAL WIRE & CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Molded Instrumentation Cables for all Types of Medical & Electronic Applications

AN AFFILIATE OF NATIONAL WIRE & CABLE CORPORATION



SPECIALISTS IN INJECTION-MOLDING OF CONNECTORS DIRECTLY ONTO CABLE!

INTEGRAL-MOLDED ELECTRONIC CABLE/CONNECTOR ASSEMBLIES

Utilizing integral cable molding techniques, National Cable Molding Corporation (NCM) manufactures all components "in-house" from wire insulation to cable manufacture, connector assembly, tooling and molding the entire unit ready for use!

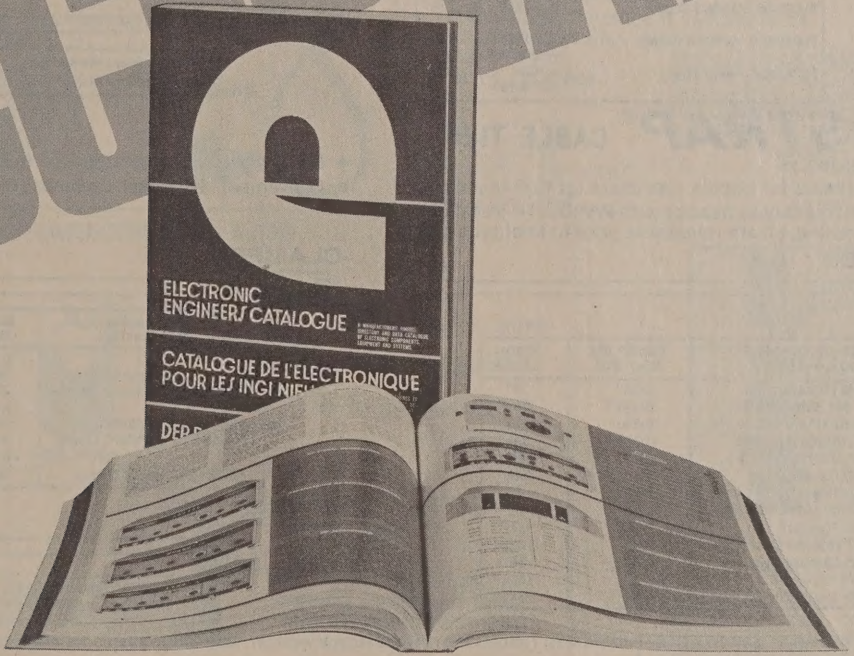
Write or call Mr. Frank W. Motley today for technical information or assistance. Phone: (213) 225-5611.

ELECTRONIC ENGINEERS CATALOGUE
CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
DER PRODUKTKATALOG FÜR ELEKTRONIKER

The book is out...and the response is in...

IMMEDIATE AND OVERWHELMING

ACCEPTANCE



The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to - and from - Western Europe and the United Kingdom.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 products alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe and the United Kingdom. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

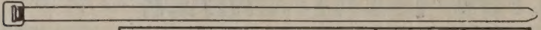
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

PANDUIT® wiring components

PAN-TY® CABLE TIES

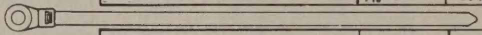
- Strong, one-piece, all nylon. Minimum loop tensile strength up to 250 lbs.
- 39 sizes available including lashing ties. For bundle diameters up to 12 inches

CABLE TIES



Cat. No. & Cross-section	Bundle Dia. Min./Max.	Approx. Length
PLT1M Miniature Tie	1⁄16″-¾″	3⅞″
PLT1.5M Miniature Tie	1⁄16″-1¼″	5½″
PLT1.5I Intermediate Tie	1⁄16″-1¼″	5½″
PLT1.5S Standard Tie	1⁄16″-1½″	6⅜″
PLT2M Miniature Tie	1⁄16″-2″	8″
PLT2I Intermediate Tie	1⁄16″-2″	8″
PLT2S Standard Tie	1⁄16″-1¾″	7⅜″
PLT3I Intermediate Tie	1⁄16″-3″	11½″
PLT3S Standard Tie	1⁄16″-3″	11½″
PLT3H Heavy Tie	1⁄16″-3″	11½″
PLT4I Intermediate Tie	1⁄16″-4″	14½″
PLT4S Standard Tie	1⁄16″-4″	14½″
PLT4H Heavy Tie	3⁄16″-4″	14½″
PLT8H Heavy Tie	3⁄16″-9″	30⅝″

CLAMPS

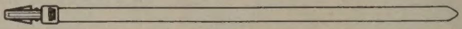


PLC1M-S4 Miniature Clamp	1⁄16″-¾″ #4 Screw	4⅜″
PLC1.5I-S8 Intermediate Clamp	1⁄16″-1¼″ #8 Screw	6⅛″
PLC2S-S6 Standard Clamp	1⁄16″-1¾″ #6 Screw	7⅞″
PLC2S-S10 Standard Clamp	1⁄16″-1¾″ #10 Screw	7⅞″
PLC4H-S25 Heavy Clamp	3⁄16″-4″ ¼″ Screw	15¼″

Applicable sizes of PAN-TY and STA-STRAP cable ties are Recognized under Components Program of Underwriters' Laboratories, Inc. and meet applicable Mil Specs.

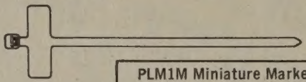
- Fast—install quickly by hand or with PANDUIT® installation tools. Self-locking and releasable types available
- Economical and versatile. Use to secure wires, cables, hoses
- Convenient dispenser cartons

PUSH MOUNT TIES

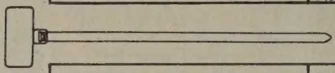


Cat. No. & Cross-section	Bundle Dia. Min./Max.	Approx. Length
PLP1.5I Intermediate Push Mount Tie	1⁄16″-1¼″	6⅛″
PLP2S Standard Push Mount Tie	1⁄16″-1¾″	7⅞″

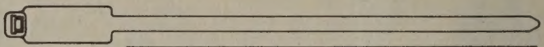
MARKER TIES



PLM1M Miniature Marker Tie	3⁄16″-¾″	4″
PLM2M Miniature Marker Tie	3⁄16″-2″	8″



PLF1M Miniature Flag Marker Tie	1⁄16″-¾″	4⅜″

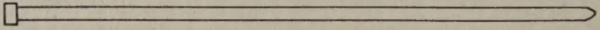


PLM2S Standard Marker Tie	⅜″-1¾″	7¼″
PLM4S Standard Marker Tie	¾″-4″	14½″

STA-STRAP® CABLE TIES

- Strong, all nylon
- 21 sizes available for bundle diameters up to 8 inches
- Fast — install quickly by hand or with PANDUIT® installation tools. Self-locking, all are releasable prior to final tensioning

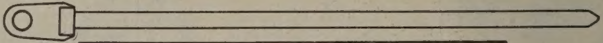
CABLE TIES



Catalog Number and Cross-section	Bundle Dia. Min./Max.	Approx. Length
SST1M Miniature Tie	0-¾″	4″
SST1.5M Miniature Tie	0-1¼″	5½″
SST1.5I Intermediate Tie	0-1¼″	5½″
SST1.5S Standard Tie	0-1¼″	5¾″
SST2I Intermediate Tie	0-2″	8 3⁄16
SST2S Standard Tie	0-1¾″	6¾″
SST2H Heavy Tie	0-2″	8″
SST3I Intermediate Tie	0-3″	11″
SST3S Standard Tie	0-3″	11″
SST4I Intermediate Tie	0-4″	14¾″
SST4S Standard Tie	0-4″	15″
SST4H Heavy Tie	0-4″	14¾″
SST8H Heavy Tie	0-8″	27½″

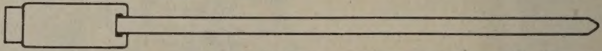
- Economical and versatile. Use to secure wires, cables, hoses
- Convenient dispenser cartons.

CLAMPS



Catalog Number and Cross-section	Bundle Dia. Min./Max.	Approx. Length
SSC2S-S6 Standard Clamp SSC2S-S10 Standard Clamp	0-1¾″ #6 Screw #10 Screw	7 7⁄16″
SSC4S-S6 Standard Clamp SSC4S-S10 Standard Clamp	0-4″ #6 Screw #10 Screw	15 7⁄16″
SSC4H-S25 Heavy Clamp	0-4″ ¼″ Screw	15 7⁄16″

MARKER TIES



SSM2S Standard Marker Tie	0-1¾″	6¾″
SSM4S Standard Marker Tie	0-4″	14¾″

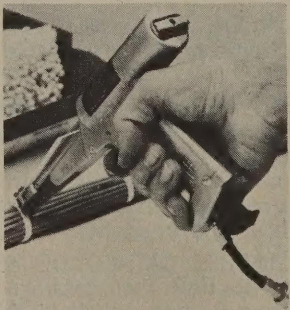
Standard colors of PAN-TY and STA-STRAP cable ties: Natural nylon white. Black weather resistant available for outdoor use. 10 other colors available.

PANDUIT®

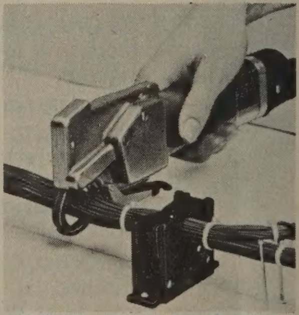
CABLE TIE INSTALLATION TOOLS

A complete tooling program to meet all production requirements for fast, neat harnessing.

GS2B Installation manual tool provides uniform tensioning and cutoff of all PANDUIT® miniature, intermediate and standard cross-section cable ties, clamps and markers; meets MIL-T-81306(AS), MS90387-1. Also available is GS4H manual installation tool for all standard and heavy ties; meets MIL-T-81306(AS), MS-90387-2.



PPTS hand-operated pneumatic cable tie installation tool. Installs all PANDUIT miniature, intermediate and standard cross-section cable ties, clamps and markers. Uses standard 70-80 psi air.



PATIM fully automatic cable tie installation tool. Automatically feeds cable tie around bundle, tensions the tie, and cuts off flush in less than 1 second. Weighs just 1¾ lbs. Accommodates bundles up to ¾″ dia.

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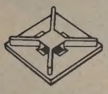
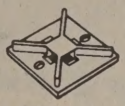
PANDUIT® wiring components

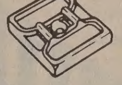
PANDUIT® MOUNTING & HARNESSING ACCESSORIES (Part of a Complete Selection)

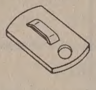
ADHESIVE BACKED MOUNTS

- Convenient mounting method. Many types for different applications.


ABMM-A

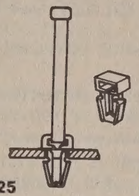

ABM2S-A

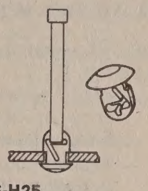

ABMS-A


MABMS-A

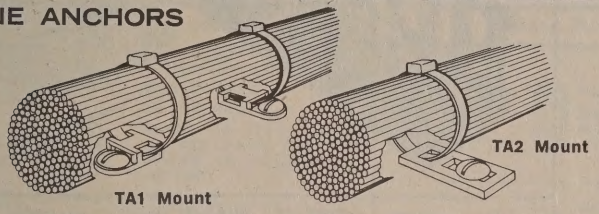
PUSH MOUNTS

- For panel thickness ⅛″ max. Hole diam. nom. ¼″.


PM2H25

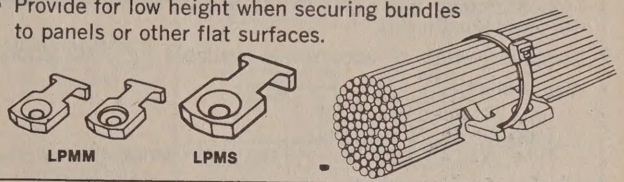

PBMS-H25

TIE ANCHORS



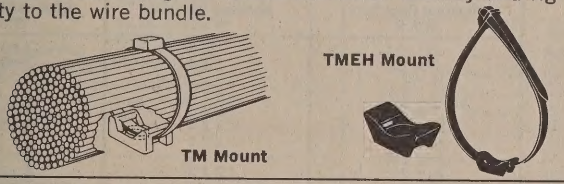
LOW PROFILE MOUNTS

- Provide for low height when securing bundles to panels or other flat surfaces.



TIE MOUNTS

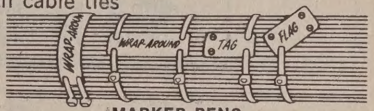
- Unique cradle design. Provides maximum stability and rigidity to the wire bundle.



MARKER PLATES

- Provide clear, permanent identification
- Secured to bundles with cable ties
- Made of nylon
- 6 sizes available

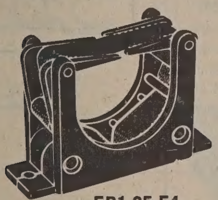
MP150 — ¾″ x 1½″
MP175 — ¾″ x 1¾″
MP200 — ¾″ x 2″
MP250W175 — 1¾″ x 2½″
MP250 — ¾″ x 2½″
MP350 — ¾″ x 3½″

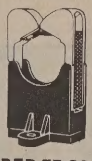


MARKER PENS
PX-0 Black **PX-2 Red**

- Used to mark nylon marker plates

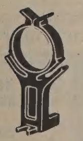
HARNESSING AIDS


ER1.25-E4

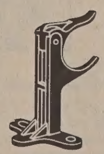

RER.75-S6

Elastic Retainers

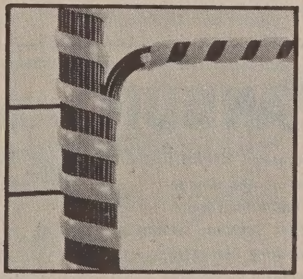
Automatically form bundles as wires are inserted.
RER.75-S6 — up to ¾″ bundle diameter.
ER1.25-E4 — up to 1¼″ bundle diameter.



Bundle Retainer
BR.75-E6
Maintains bundle above harness board at uniform height.



Corner Post
CPH.75-S8
Used to route wires around corners on the harness board. Maintains uniform height.

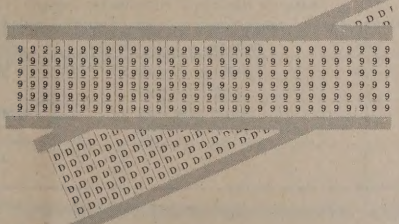


PANDUIT® SPIRAL WRAPPING

- Choose from three standard materials and three sizes covering a bundle range of ⅟₁₆″ up to 4″
- Easily installed with tool supplied in each package

PANDUIT® INSTA-CODE™

WIRE AND IDENTIFICATION MARKERS



FAST AND EASY WIRE IDENTIFICATION

- Self adhesive
- Permanent
- Meet industry standards
- Wide selection

CONVENIENT DISPENSER CARDS

Solid numbers: 0-100

Consecutive numbers: 1-33, 34-66, 67-99, 100-124, 125-149, 150-174, 175-199

Solid letters: A-Z

Consecutive letters: A-Z and A-J

Solid symbols: T1, T2, T3, L1, L2, L3, +, −, GRD, GND, SPARE

Voltage markers: 100V thru 13,800V

Self-laminating wire and cable markers.

Safety signs.

Plus handy books — with terminal markers. 16 assortments

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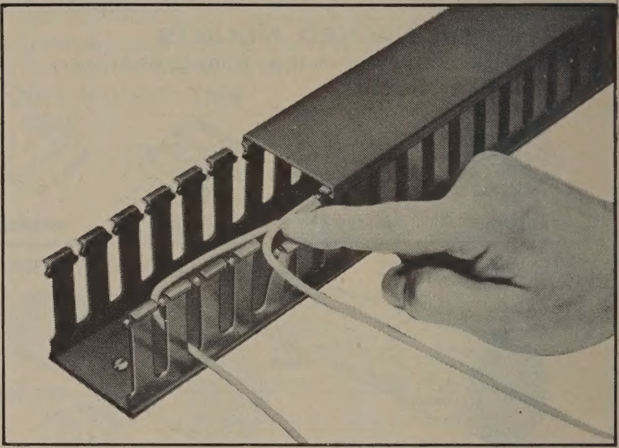
PANDUIT® wiring components

PANDUCT®

PLASTIC WIRING DUCT — TYPE "E"

- Reduce your total installed costs with patented snap-in slot design:
  - Holds breakout wires captive while providing complete accessibility for adding or removing wires — even with terminations attached.
  - Result: your total cost is reduced during initial installation, wire tracing, trouble shooting and circuit revisions.
- Non-slip cover prevents vibration slippage, yet easy to install or remove.
- Standard color: Light gray. White and dark gray available. Standard length: 6 ft.
- Complete variety of accessories available for installation.
- Also available:
  - Type "S" Solid Wall Duct
  - Type "D" Round Hole Duct
  - Type "NE" & "NS" Chlorine-Free, High-Temperature Duct



TYPE "E" SNAP-IN SLOT

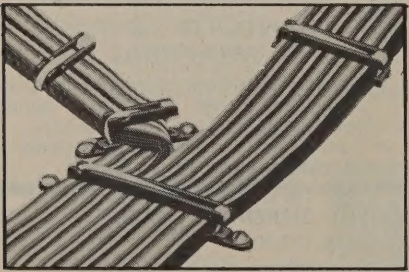
Applicable sizes are recognized under Components Program of Underwriters' Laboratories, Inc.

MEETS J.I.C. REQUIREMENTS

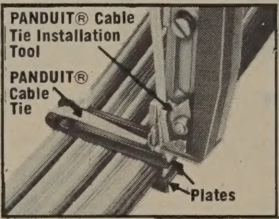
Nominal Duct Size W x H	Nominal Duct Size W x H	Nominal Duct Size W x H
.5 x .5	1 x 3	3 x 1
.5 x .62	1 x 4	3 x 1.25
.5 x 1	1.5 x 1.5	3 x 2
.5 x 1.25	1.5 x 2	3 x 3
.5 x 1.75	1.5 x 3	3 x 4
.75 x .75	1.5 x 4	3 x 5
.75 x 1	2 x 1	4 x 1.5
.75 x 1.5	2 x 2	4 x 2
.75 x 2	2 x 3	4 x 3
1 x 1	2 x 4	4 x 4
1 x 1.5	2.5 x 3	4 x 5
1 x 2		

PANDUIT® FLAT CABLE MOUNT

Combination of PANDUIT® Cable Tie and unique Flat Cable Accessory provides . . . secure method of mounting or bundling flat cable

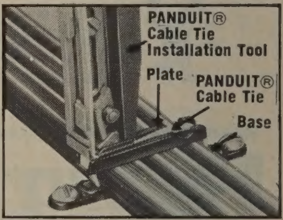


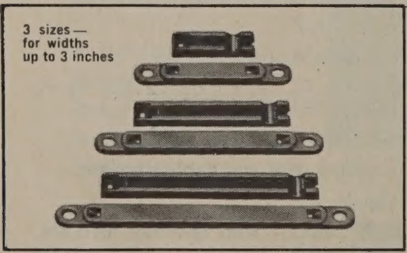
BUNDLING APPLICATION



- Secures stacked cables, folds, and breakouts
- Secures laminated and molded bus bars
- Available in 1", 2" and 3" widths — accommodates flat cable widths of 0-3"
- Secure location of flat cables reduces variations in transmission characteristics such as crosstalk, impedance and capacitance
- Can be used in applications where vibration and strain is a factor
- Strong, 100% nylon — safe, will not damage the flat cable
- Removable and reusable
- Can be used with any type of flat cable

MOUNTING APPLICATION





SELECTION CHART FOR PANDUIT® FLAT CABLE MOUNTS and PAN-TY® CABLE TIES

For Flat Cable Width (up to)	FOR MOUNTING† Use one (1) each of the following and one (1) cable tie	FOR BUNDLING Use two (2) each of the following and one (1) cable tie	MAXIMUM FLAT CABLE STACK HEIGHT (inches)			
			PANDUIT PAN-TY PLT1.5I Cable Tie	PANDUIT PAN-TY PLT2I Cable Tie	PANDUIT PAN-TY PLT3I Cable Tie	PANDUIT PAN-TY PLT4I Cable Tie
1"	FCPI1 FCBI1(-S10 or -A)	FCPI1	.8	2.0	3.7	5.2
2"	FCPI2 FCBI2(-S10 or -A)	FCPI2	—	1.0	2.7	4.2
3"	FCPI3 FCBI3(-S10 or -A)	FCPI3	—	—	1.7	3.2

† For base with #10 screw hole use suffix -S10. For base to be mounted with commercial adhesive (supplied by user) use suffix -A.

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PANDUIT® wiring components

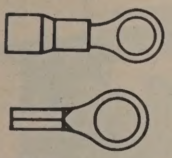
PAN-TERM® TERMINALS, SPLICES, DISCONNECTS, WIRE JOINTS and INSTALLATION TOOLS

For specific details on the wide range of PAN-TERM terminal products to meet your requirements, contact your local Panduit Distributor or Sales Office.

Listed by Underwriters' Laboratories, Inc. and approved by Canadian Standards Association. PAN-TERM terminating devices have successfully passed the test requirements of U.L. specification 486 and CSA specification C22.2 No. 65 where indicated in Bulletin T-2 which lists the complete line.

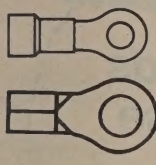
TERMINALS

Wire sizes from #22 through #10 AWG and stud sizes through ⅜″

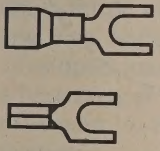


RING TONGUE
Nylon Insulated
TEFZEL* Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #4, #6, #8, #10, ¼″, 5⁄16″ and ⅜″

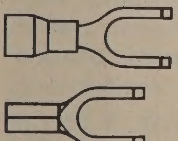
* TEFZEL Fluoropolymer Reg. TM, E. I. Dupont De Nemours Co.



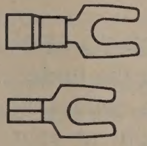
HEAVY DUTY RING TONGUE — .050″ stock
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #16-12 wire. Stud sizes #6, #8, #10, ¼″, 5⁄16″ and ⅜″



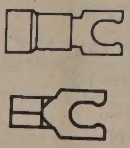
FORK TONGUE
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #6, #8, #10 and ¼″



FLANGED FORK
Nylon Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #6, #8 and #10



LOCKING FORK
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #6, #8 and #10. Wide Locking Forks available.

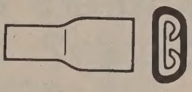


SHORT LOCKING FORK
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #5, #6, #8, #10, ¼″.

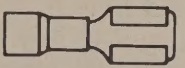
DISCONNECTS

Wire sizes from #22 through #10 AWG and tab sizes .250, .187, .145, and .110 by .032 or .020

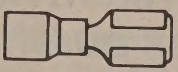
FEMALE DISCONNECTS



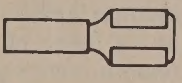
Vinyl Fully Pre-insulated
Available for #22-18, #16-14 and #12-10 wire. Tab sizes .250 x .032 and .187 x .020



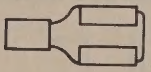
Vinyl Insulated — Funnel Entry Insulation Grip Sleeve
Available for #22-18 and #16-14 wire. Tab sizes .250 x .032 and .187 x .020



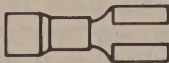
Nylon Insulated Funnel Entry
For #22-18 wire. Tab sizes .250 x .032 and .187 x .020
Insulation Grip Sleeve
For #16-14 wire. Tab sizes .250 x .032 and .187 x .020



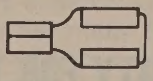
Sleeved Barrel Vinyl Insulated
Available for #22-18, #16-14 and #12-10 wire. Tab sizes .250 x .032, .187 x .020, .110 x .032, .110 x .020



Sleeved Barrel Non-insulated
Available in all same sizes as above.

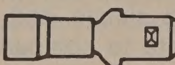


Butted Seam Vinyl Insulated
Available for #22-18 and #16-14 wire. Tab sizes .250 x .032 and .187 x .020

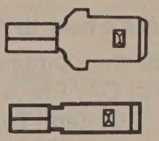


Butted Seam Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Tab sizes .250 x .032, .187 x .020, .110 x .032 and .110 x .020

MALE DISCONNECTS



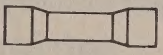
Vinyl Insulated Brazed Seam
Available for #22-18 and #16-14 wire. Tab sizes .250 x .032 and .145 x .032



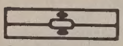
Non-insulated Brazed Seam
Available for #22-18 wire. Tab sizes .250 x .032 and .145 x .032

SPLICES

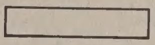
Wire sizes from #22 through #10 AWG



Butt Type
Nylon Insulated
Vinyl Insulated



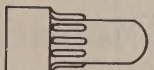
Butt Type
Non-insulated



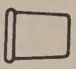
Parallel Type
Nylon Insulated
Non-insulated

WIRE JOINTS

Capacities from (2) #24 to (4) #10 AWG wires

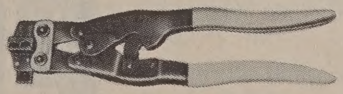


Nylon Insulated
Three sizes. Range from minimum of (2) #24 to maximum of (4) #12 wires



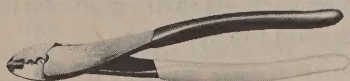
Non-insulated
Three sizes. Range from minimum of (2) #14 to maximum of (4) #10 wires

Installation Tools



Controlled Cycle Tools CT-500; CT-510; CT-520; CT-550; CT-570
Precision made tools to provide TOOL-CONTROLLED crimps for PAN-TERM insulated and non-insulated terminals, splices, disconnects and wire joints on wire ranging from #10 to #22. Color coded handles readily identify the tool needed for parts being crimped.

CT-100 Tool crimps PAN-TERM insulated and non-insulated terminals, splices, disconnects and wire joints on wire ranging from #10 to #22. Also cuts and strips wire, and cuts popular screws.



CT-200 Tool installs non-insulated PAN-TERM terminals, disconnects and splices on wire ranging from #10 to #22.

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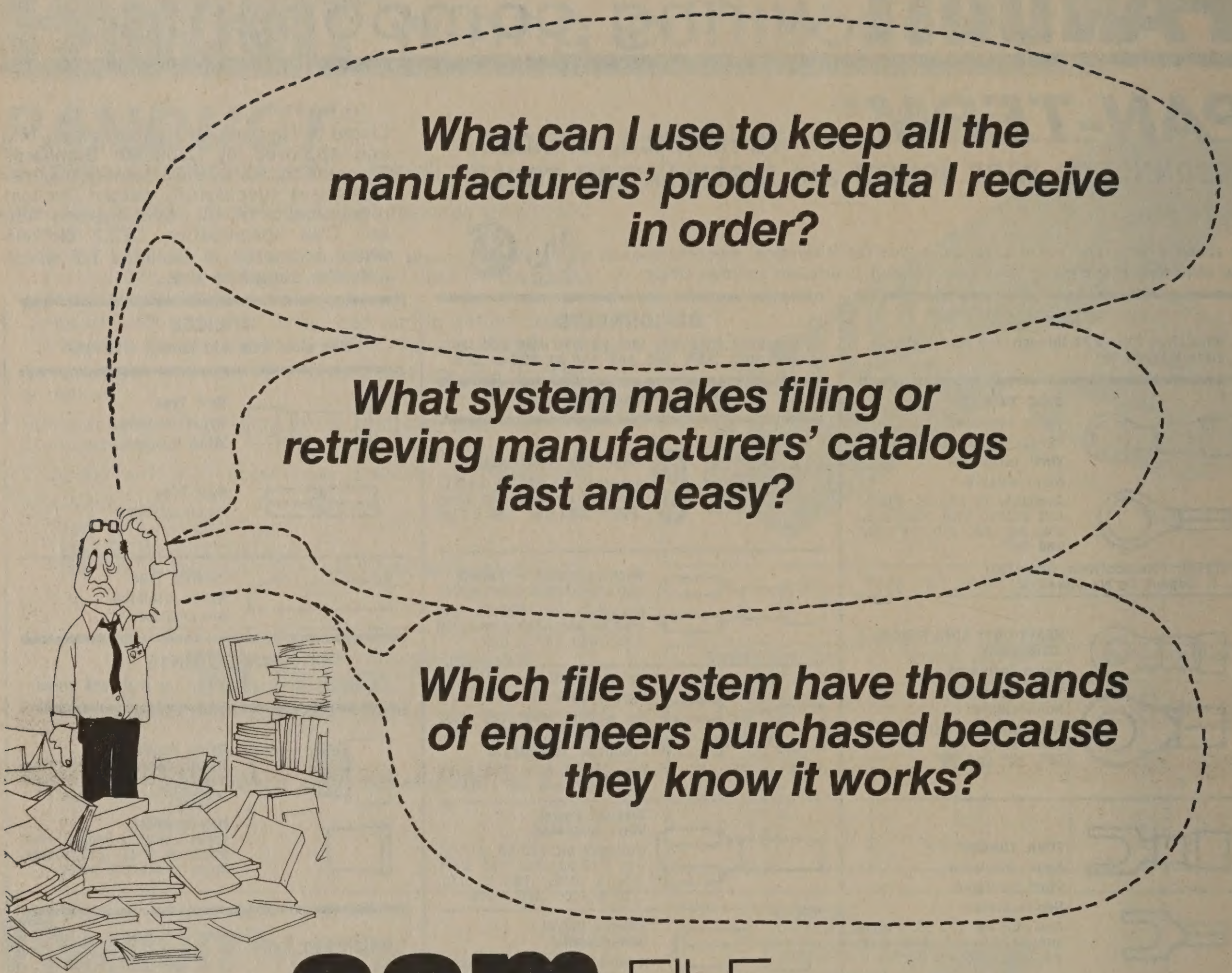
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What system makes filing or retrieving manufacturers' catalogs fast and easy?
Which file system have thousands of engineers purchased because they know it works?

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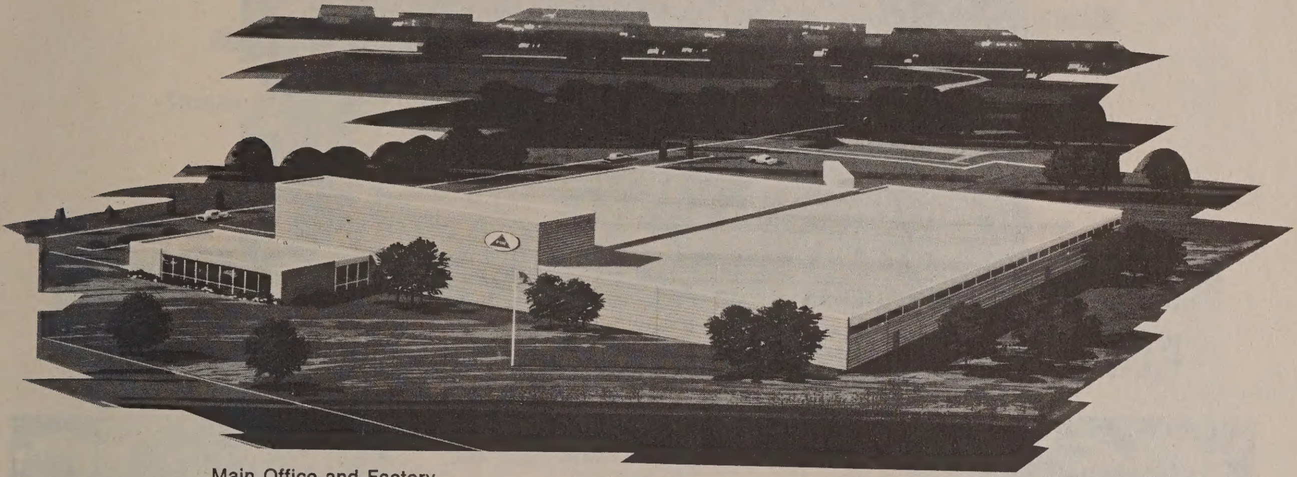
PIW®

PHILADELPHIA INSULATED WIRE CO., INC.



Main Office and Factory

333 NEW ALBANY ROAD / MOORESTOWN, N. J. 08057
(609) 235-6700 TOLL FREE 800-257-8357 TWX NO. 710-897-0187

When P.I.W. was founded in 1820, the original product line was hoop-skirts for the ladies. In 1842, P.I.W. developed insulated wire by wrapping cotton around a bare copper conductor. This first insulated wire was produced for Samuel F. B. Morse, the inventor of the telegraph.

Originally located in Philadelphia, Pennsylvania, P.I.W. produced annunciator wire, litz wire, organ cables, connecting wire, polyvinylchloride hookup wire and cables, and various braided glass and cotton constructions.

In 1959, P.I.W. moved to new facilities in Moorestown, New Jersey, when it was purchased by the Wilbur B. Driver Company of Newark, New Jersey. This move served to establish P.I.W. as a greatly respected producer of high temperature insulated wire for the computer, aerospace and electronics industries.

From the beginning, the goal of P.I.W. has been to surpass the exacting standards required in the manufacture of high temperature insulated wire. Despite a change of ownership in recent years, P.I.W. continues to maintain the skill and proficiency which established a reputation for quality and service that has endured for over a century and a half. Quality products and efficient service remain top priorities at Philadelphia Insulated Wire Company, Inc.

P.I.W. has the capability of producing the following insulations: TFE and FEP Teflon, Kynar, Polyethylene, Tefzel and Halar. PVC hookup wire and PVC control cables are also produced.

Complete information in P.I.W.'s outstanding line of insulated wire and cable is presented in this catalog, as well as technical descriptions denoting electrical characteristics, applications, packaging, etc. It has been impossible, however, within the confines of a catalog such as this, to set forth all the possible combinations of cable available. For more detailed information, please contact the nearest P.I.W. sales office.

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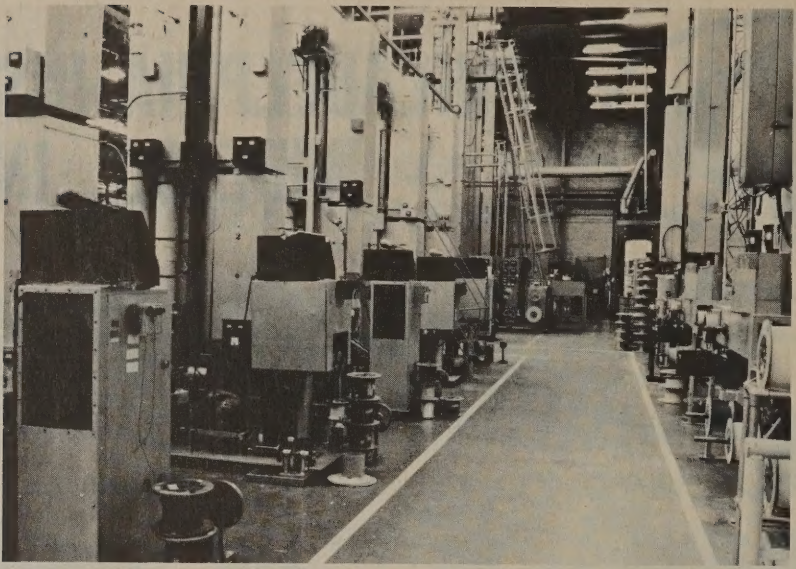
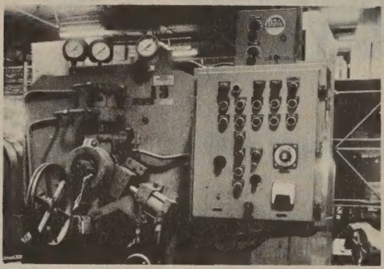
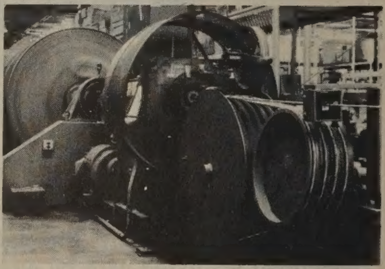


P.I.W.'s Production Department consists of the following operations:

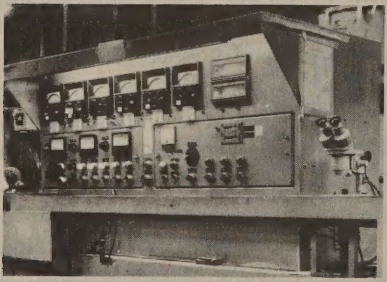




Paste Extrusion	— (PTFE compounds)
Melt Extrusion	— (FEP, Polyethylene, Tefzel, Halar, PVC, Nylon, etc.)
Tape Wrap	— (PTFE, Polyester, etc.)
Shielding	— (Silver Plated Copper, Tin Plated Copper, Nickel Plated Copper, Stainless Steel, etc.)
Braiding	— (Cotton, Nylon, Glass, etc.)

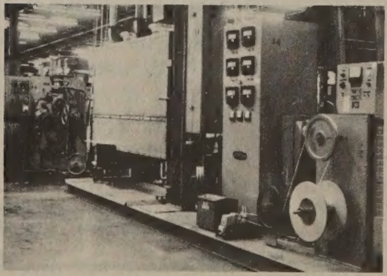
Each department can produce a finished product or can function as an integral operation for more complex insulations.

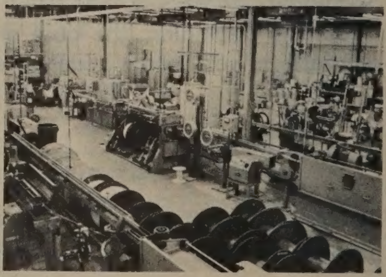
Secondary operations include cabling, bonding, shielding, impregnating, striping, jacketing, etc., as well as developing insulated conductors for every application.



P.I.W serves as a prime source for the following types of wire and cable:

Air Frame Wire	— (MIL-W-22759/9, 10, 11 & 12, Teflon)
Appliance Wire	— (Teflon, Thermoplastic)
Business Machine Wire	— (Teflon, Thermoplastic)
Building Wire	— (Thermoplastic)
Cathodic Protection Cables	— (High Molecular Weight Polyethylene, Teflon, Tefzel and Halar)
Coaxial Cables	— (MIL-C-17D, Teflon Types)
Computer Wire	— (Teflon, Kynar,Tefzel, Halar, etc.)
Control Cables	— (Multiconductor Cables, TFE and FEP Teflon, Tefzel, Halar, etc.)
Fire Alarm Cables	— (New York City Local Law No. 5, Approved Source, Teflon)
Heating Cables and Electric Heating Wire	— (Teflon, Thermoplastic)
Inter-communication Cables	— (Thermoplastic)
Motor Lead Wire	— (Teflon, Thermoplastic)
Organ Cables	— (Thermoplastic)





P.I.W. has the ability to insulate a wide range of conductors from 32 gauge to 750 MCM depending upon type of insulation. Flexibility allows P.I.W. to make long high speed production runs, and incorporates design changes to meet rapid technological advances.

Our specialized equipment results in minimum time loss with maximum reliability; a significant factor in holding down costs, and providing optimum deliveries.

The extent of P.I.W.'s manufacturing facilities and equipment are shown in the illustrations on this page.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW® LEADWIRE-TEFLON** MILITARY

Stranded or Solid Silver Plated Copper Conductor Insulated with Extruded Tetrafluoroethylene (TFE)

MIL-W-16878**

+260°C Nickel Plated

TYPE E*

600 VOLTS

+200°C Silver Plated

Size	PIW Part Number	Conductor No. of Strands	Conductor AWG-Size of Strands	Conductor Diameter	Diameter Over Insulation Minimum	Diameter Over Insulation Nominal	Diameter Over Insulation Maximum	Nominal Weight Lb/M'
32	100-010-00	*7	40(.0031)	.009	.025	.029	.033	0.80
30	100-012-10	1	—	.010	.026	.030	.034	1.10
30	100-012-00	*7	38(.0040)	.012	.028	.032	.036	1.00
28	100-014-10	1	—	.013	.029	.033	.037	1.30
28	100-014-00	*7	36(.0050)	.015	.031	.035	.039	1.40
28	100-014-01	19	40(.0031)	.016	.032	.036	.039	1.55
26	100-017-12	1	—	.016	.032	.036	.040	1.60
26	100-016-00	*7	34(.0063)	.019	.035	.039	.043	1.80
26	100-017-00	19	38(.0040)	.020	.036	.040	.043	1.80
24	100-018-10	1	—	.020	.036	.040	.044	2.15
24	100-018-00	*7	32(.0080)	.024	.040	.044	.048	2.50
24	100-019-00	19	36(.0050)	.025	.041	.045	.048	2.70
22	100-020-10	1	—	.025	.041	.045	.049	3.00
22	100-020-00	*7	30(.0100)	.030	.046	.050	.054	3.40
22	100-021-00	19	34(.0063)	.032	.048	.052	.054	3.50
20	100-022-10	1	—	.032	.048	.052	.056	4.40
20	100-022-00	*7	28(.0126)	.038	.054	.058	.062	4.95
20	100-023-00	19	32(.0080)	.040	.056	.060	.062	5.20
18	100-024-02	1	—	.040	.056	.060	.065	6.50
18	100-024-00	*7	26(.0159)	.048	.064	.068	.074	7.30
18	100-025-00	19	30(.0100)	.050	.066	.070	.074	7.50
16	100-026-00	*19	29(.0113)	.057	.073	.080	.087	10.10
14	100-028-00	*19	27(.0142)	.071	.087	.094	.101	15.00
12	100-030-00	*19	25(.0179)	.090	.106	.113	.120	23.00
10	100-032-00	*37	26(.0159)	.111	.127	.134	.141	34.00

*Minimum number of strands permitted by MIL-W-16878D, Type E.

Standard Put Up 1000 Ft. Reels

Solid Colors in Stock

Striping — 1000 Ft. minimum per item

Voltage Rating 600V
Temperature Rating 200°C
Sparktest 3400V
Dielectric Test 2000V
Impulse Test 13.5KV Peak
Insulation Resistance 5000 Megohms/1000 Ft.
Coldbend 2 turns @ −65°C
Shrinkage 0.03" max. in 12" @ 290°C

** Also available in wrapped TFE tape providing long continuous lengths with no loss in properties.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW® LEADWIRE-TEFLON** MILITARY

P.I.W. Teflon hook-up wire is fabricated utilizing the most advanced techniques in extrusion and process control. The properties of Teflon, when combined with P.I.W. skill result in a product that can be used in severe temperature and environmental conditions. It has proven especially applicable to those situations requiring superior di-electric characteristics.

MIL-W-16878** TYPE ET* 250 VOLTS

+260°C Nickel Plated +200°C Silver Plated

Stranded Silver Plated Copper Conductor Insulated With Extruded Tetrafluoroethylene (TFE)

AWG	Stranding	PIW Part No.	Nominal Conductor Diameter (inch)	Maximum Conductor Resistance ohms/M' 25°C	Finished Wire Diameter (inch)	Nominal Weight Lb/M'
32	7/40	050-010-00	.009	179.00	.021 ±.002	0.60
30	7/38	050-012-00	.012	111.00	.024 ±.002	0.75
28	7/36	050-014-00	.015	69.00	.027 ±.002	0.95
26	7/34	050-016-00	.019	42.90	.031 ±.002	1.35
26	19/38	050-017-00	.021	42.90	.031 ±.002	1.50
24	7/32	050-018-00	.024	26.80	.036 ±.002	2.10
24	19/36	050-019-00	.025	26.80	.036 ±.002	2.20
22	7/30	050-020-00	.030	16.70	.042 ±.002	3.00
22	19/34	050-021-00	.032	16.70	.042 ±.002	3.20

* Also available in wrapped TFE tape.

MIL-W-16878** TYPE EE* 1000 VOLTS

+260°C Nickel Plated +200°C Silver Plated

Stranded Silver Plated Copper Conductor Insulated With Extruded Tetrafluoroethylene (TFE)

AWG	Stranding	PIW Part No.	Nominal Conductor Diameter (inch)	Maximum Conductor Resistance ohms/M' 25°C	Finished Wire Diameter (inch)	Nominal Weight Lb/M'
32	7/40	120-010-00	.009	179.00	.039 ±.004	1.50
30	7/38	120-012-00	.012	111.00	.042 ±.004	1.80
28	7/36	120-014-00	.015	69.00	.045 ±.004	2.10
26	7/34	120-016-00	.019	42.90	.049 ±.004	2.60
26	19/38	120-017-00	.019	42.90	.049 ±.004	2.75
24	7/32	120-018-00	.024	26.80	.054 ±.004	3.40
24	19/36	120-019-00	.025	26.80	.054 ±.004	3.50
22	7/30	120-020-00	.030	16.70	.060 ±.004	4.25
22	19/34	120-021-00	.032	16.70	.060 ±.004	4.50
20	7/28	120-022-00	.038	10.50	.068 ±.004	6.10
20	19/32	120-023-00	.040	10.50	.068 ±.004	6.50
18	7/26	120-024-00	.048	6.57	.079 ±.005	8.75
18	19/30	120-025-00	.050	6.57	.079 ±.005	9.25
16	19/29	120-026-00	.057	4.85	.089 ±.006	11.50
14	19/27	120-028-00	.071	3.05	.105 ±.008	16.50
12	19/25	120-030-00	.090	1.92	.124 ±.008	25.25
10	37/26	120-032-00	.111	1.24	.145 ±.008	36.50
8*	133/29	120-034-00	.167	0.68	.207 ±.010	65.00

* Also available in wrapped TFE tape.

** Also available in wrapped TFE tape providing long continuous lengths with no loss in properties.

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PIW TEFLON 80°C — 105°C UL STYLES 1212, 1213* UL

UL 1212 80°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
170-010-00	32	7/40	.010	.029
170-012-06	30	7/38	.010	.032
170-014-06	28	7/36	.010	.036
170-016-00	26	7/34	.010	.040
170-017-99	26	19/38	.010	.041
170-019-99	24	19/36	.010	.045
170-018-00	24	7/32	.010	.044
170-021-99	22	19/34	.010	.051
170-020-00	22	7/30	.010	.050
170-023-99	20	19/32	.010	.059
170-022-00	20	7/28	.010	.058

UL 1213 105°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
170-010-00	32	7/40	.010	.029
170-012-06	30	7/38	.010	.032
170-014-00	28	7/36	.010	.036
170-016-00	26	7/34	.010	.040
170-017-99	26	19/38	.010	.041
170-019-99	24	19/36	.010	.045
170-018-00	24	7/32	.010	.044
170-021-99	22	19/34	.010	.051
170-020-00	22	7/30	.010	.050
170-023-99	20	19/32	.010	.059
170-022-00	20	7/28	.010	.058

PIW TEFLON 300 VOLTS UL

UL 1164 150°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
176-014-00	28	7/36	.014	.045
176-016-00	26	7/34	.014	.049
176-017-99	26	19/38	.014	.048
176-018-00	24	7/32	.014	.054
176-019-00	24	19/36	.014	.055
176-020-00	22	7/30	.014	.060
176-021-99	22	19/34	.014	.062
176-022-00	20	7/28	.014	.063
176-023-99	20	19/32	.014	.070
176-024-00	18	7/26	.014	.079
176-025-99	18	19/30	.014	.080
176-026-99	16	19/29	.014	.089
176-028-99	14	19/27	.014	.078
176-030-99	12	19/25	.014	.084

UL 1180 200°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
176-014-00	28	7/36	.014	.045
176-016-00	26	7/34	.014	.049
176-017-99	26	19/38	.014	.048
176-018-00	24	7/32	.014	.054
176-019-00	24	19/36	.014	.055
176-020-00	22	7/30	.014	.060
176-021-99	22	19/34	.014	.062
176-022-00	20	7/28	.014	.068
176-023-99	20	19/32	.014	.070
176-024-00	18	7/26	.014	.079
176-025-99	18	19/30	.014	.080
176-026-99	16	19/29	.014	.089
176-028-99	14	19/27	.014	.078
176-030-99	12	19/25	.014	.084

PIW TEFLON 600 VOLTS UL

UL 1198 150°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
177-014-01	28	Solid	.018	.025
177-014-00	28	7/36	.018	.027
177-015-99	28	19/40	.018	.027
177-016-04	26	Solid	.018	.028
177-016-00	26	7/34	.018	.029
177-017-99	26	19/38	.018	.033
177-018-04	24	Solid	.018	.034
177-018-00	24	7/32	.018	.034
177-019-99	24	19/36	.018	.036
177-020-00	22	7/30	.018	.030
177-021-99	22	19/34	.018	.044

UL 1199 200°C

Part No.	Size	Strand	Wall Thick.	Nom. O.D.
177-014-01	28	Solid	.018	.025
177-014-00	28	7/36	.018	.027
177-015-99	28	19/40	.018	.027
177-016-04	26	Solid	.018	.028
177-016-00	26	7/34	.018	.029
177-017-99	26	19/38	.018	.033
177-018-04	24	Solid	.018	.034
177-018-00	24	7/32	.018	.034
177-019-99	24	19/36	.018	.036
177-020-00	22	7/30	.018	.030
177-021-99	22	19/34	.018	.044

* Available CSA Approved

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW® KYNAR® WIRE COMPUTER BACK PANEL WIRING

APPLICATION: Designed for use in automatic wire wrapping equipment for applications in the computer industry.

DESCRIPTION: Solid, Silver Plated, Oxygen-free, high conductivity (OFHC) Copper conductor, extruded Kynar® (Polyvinylidene fluoride) insulation.

UL 1422** — 105°C

PIW Part No.	Size (AWG)	Nom. Wall Thickness	Nom. O.D.
485-012-00	30	.005	.020
485-014-00	28	.005	.023
485-016-00	26	.005	.026

UL 1423**

PIW Part No.	Size (AWG)	Nom. Wall Thickness	Nom. O.D.
482-012-00	30	.0045	.019
482-014-00	28	.0045	.022
482-016-00	26	.0045	.026
482-018-00	24	.0045	.031

UL 1426**

PIW Part No.	Size (AWG)	Nom. Wall Thickness	Nom. O.D.
483-012-00	30	.006	.020
483-014-00	28	.006	.023
483-016-00	26	.006	.026
483-018-00	24	.006	.032

UL 1327**

PIW Part No.	Size (AWG)	Nom. Wall Thickness	Nom. O.D.
480-012-00	30	.010	.030
480-014-00	28	.010	.033
480-016-00	26	.010	.036
480-018-00	24	.010	.041

® Registered Trademark of PENNWALT
** Available CSA Approved

BACK PANEL WIRE TEFLON TFE INSULATION U.L. STYLE — 1371 — 105°C

AWG	Conductor Strand	Nom. Wall Thick.	O.D. Nom.	Min. O.D.	Max. O.D.	Part No.
30	Solid SPC*	.0055	.021	.020	.023	070-012
28	Solid SPC	.0055	.024	.023	.026	070-014
26	Solid SPC	.0055	.027	.026	.029	070-016
24	Solid SPC	.0055	.031	.030	.033	070-018

* Conductor May Be Tin Coated Copper

BACK PANEL WIRE TEFLON FEP/NYLON JACKET U.L. STYLE — 1292 — 105°C

AWG	Conductor Strand	Nom. Wall Thick.	Nom. Jacket Thick.	Nom. O.D.	Min. O.D.	Max. O.D.	Part No.
26	Solid SPC*	.006	.003	.034	.030	.036	475-216
24	Solid SPC	.006	.003	.038	.034	.040	475-218

* Conductor May Be Tin Coated Copper

BACK PANEL WIRE TEFZEL INSULATION

AWG	Conductor Strand	Nom. Wall Thick.	Nom. O.D.	Min. O.D.	Max. O.D.	Part No.
30	Solid SPC*	.005	.020	.018	.022	380-012
28	Solid SPC*	.005	.023	.021	.025	380-014
26	Solid SPC*	.005	.026	.024	.028	380-016
24	Solid SPC*	.010	.040	.038	.042	380-018
22	Solid SPC*	.010	.046	.044	.048	380-020

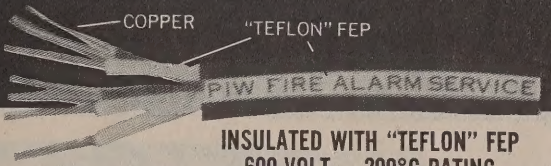
* Conductor May Be Tin Coated Copper

BACK PANEL WIRE HALAR INSULATION

AWG	Conductor Strand	Nom. Wall Thick.	Nom. O.D.	Min. O.D.	Max. O.D.	Part No.
30	Solid SPC	.005	.020	.018	.022	381-012
28	Solid SPC	.005	.023	.021	.025	381-014
26	Solid SPC	.005	.026	.024	.028	381-016
24	Solid SPC	.010	.040	.038	.042	381-018
22	Solid SPC	.010	.046	.044	.048	381-020

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW FIRE ALARM CONTROL CABLES



INSULATED WITH "TEFLON" FEP
600 VOLT — 200°C RATING

APPLICATION:

These control cables have been designed for fire alarm and associated control circuits or control apparatus where maximum reliability is required. Typical application of these cables would be, floor warden and fire command control stations, smoke detection, voice communication, supervisory, and all associated systems.

SPECIFICATIONS

I CONDUCTORS: Solid soft bare copper per ASTM B3. Also available in tin plated copper solid or stranded.

II PRIMARY INSULATION: Extruded Teflon F.E.P. per ASTMD-2116. Minimum insulation wall thickness .018″ rated for 600 volt service at 200°C continuous operating temperature and conforming to U.L. approved wire.

CODING

Individual pairs shall be color coded for easy identification. Coding can also be furnished in accordance with I.P.C.E.A. methods, if desired.

CABLE LAY-UP

Individual pairs and cable lay are in accordance with standard commercial practice.

JACKET

The jacket is Teflon F.E.P. .025″ minimum wall thickness colored fire department red and is marked Fire Alarm Service at regular intervals for entire length.

SHIELDING

To meet shielding requirements on individual pairs for voice communication and other applications, a shield consisting of aluminized/mylar plus a solid tin plated copper drain wire shall be applied. A conventional braided shield is also available if desired.

NOTE:

Additional cable constructions conforming to Class "E" are available upon request.

NON-SHIELDED CONSTRUCTION

	PIW Part Number	No. of Pairs	Nom. O.D. Inches	Nom. Weight Lbs./M Ft.
AWG 22	450-220-01	1	.206	28
	450-220-02	2	.315	39
	450-220-03	3	.335	63
	450-220-04	4	.365	78
	450-220-05	5	.410	90
	450-220-06	6	.425	110
AWG 18	450-224-01	1	.242	40
	450-224-02	2	.377	71
	450-224-03	3	.400	93
	450-224-04	4	.440	117
	450-224-05	5	.494	142
	450-224-06	6	.512	164
AWG 16	450-226-01	1	.255	48
	450-226-02	2	.400	91
	450-226-03	3	.425	120
	450-226-04	4	.465	152
	450-226-05	5	.525	185
	450-226-06	6	.545	215
AWG 14	450-228-01	1	.286	63
	450-228-02	2	.454	128
	450-228-03	3	.483	165
	450-228-04	4	.533	220
	450-228-05	5	.600	288
	450-228-06	6	.622	310

PIW CATHODIC PROTECTION CABLE

HIGH MOLECULAR WEIGHT POLYETHYLENE — Application — Industrial and Utility Plants

Construction — Single conductor, uncoated Copper conductor, Black Polyethylene Uni-Insulation and Jacket 600 Volts IPCEA Specification.

Halar and High Molecular Weight Polyethylene

The cable is available in #8 AWG copper conductor with 20 mils of Halar primary insulation and a 40, 50, 60, 70, 80 or 90 mils of H.M.W.P.

Application — Deep well ground beds where chlorine gas from brakish water attacks and deteriorates cable.

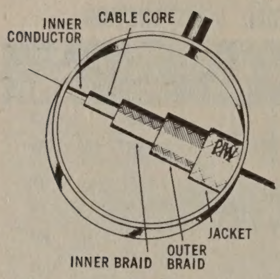
PIW Product Number	Size AWG	Stranding	Insulation Thickness Inches	Approx. O.D. Inches	Approx. Shipping Weight Lbs./M Ft.
370-034-00P	8	7	7/64	.37	98
370-036-00P	6	7	7/64	.41	134
370-038-00P	4	7	7/64	.46	200
370-040-00P	2	7	7/64	.52	287

PIW's high temperature insulations provide a unique combination of toughness, abrasion and resistance to the chemical reaction of soil corrosives. Whether your system utilizes deep wells or parallel ground beds; no matter what the condition or chemical composition of the soil — PIW's cable is designed to outlast all the other components of your system. These cables are available in 6 and 8 AWG; 7 strand Bare or Tinned Copper, various wall thicknesses. Other sizes available on special request.

* Cathodic Protection Cable also available in various insulations including Tefzel, FEP Teflon and Kynar. Consult PIW technical staff for further information.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW RG/U TYPE COAXIAL CABLES



Impedance Group	PIW Part No.	RG/U Type	MIL-C-17 Spec. Sheet	Inner Conductor	Cable Core	Outer Conductor	Moisture Seal
a	160-312-16	142B/U	60B	Type 1 .039 ±.001 In.	Type F-1 .116 ±.005 In.	Double Braid AWG 36 Type 3	—
b	160-512-12	178B/U	93C	Type 2 7 x .004 In. .012 In. Nom.	Type F-1 .034 ±.002 In.	Single Braid AWG 38 Type 3	—
c	160-312-11	188A/U	69B	Type 2 7 x .0067 In. .020 In. Nom.	Type F-1 .060 ±.003 In.	Single Braid AWG 38 Type 3	—
d	160-312-12	196A/U	71B	Type 2 7 x .004 In. .012 In. Nom.	Type F-1 .034 ±.002 In.	Single Braid AWG 38 Type 3	—
e	160-512-10	179B/U	94D	Type 2 7 x .004 In. .012 In. Nom.	Type F-1 .063 ±.003 In.	Single Braid AWG 38 Type 3	Two Wraps .005 x .5 In. Type F-2
f	160-312-10	187A/U	68C	Type 2 7 x .004 In. .012 In. Nom.	Type F-1 .063 ±.003 In.	Single Braid AWG 38 Type 3	—

REQUIREMENTS

1. Dielectric strength
   5,000 volts, rms, minimum.
2. Corona
   1,900 volts, rms, minimum.
3. Attenuation
   9.0 db/100-ft. maximum at 400 mc.
4. Impedance
   50 ±2 ohms.

CONSTRUCTION DETAILS

Inner conductor

Silver-covered copper-covered steel wire. Overall diameter, 0.039 ±0.001 inch.

Cable core

Type F-1 Teflon®. Overall diameter, 0.116 ±0.005 inch.

Outer conductor

Double braid, AWG size 36 silver-covered copper wire. Overall diameter, 0.171 inch maximum.

Inner braid

Carriers 16
Ends 7
Picks/Inch .... 11.5, ±10 percent

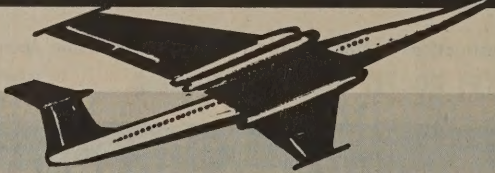
Outer braid

Carriers 16
Ends 7
Picks/Inch .... 14.5, ±10 percent

Jacket

Type IX, Extruded Fluorinated Ethylene Propylene. Overall diameter, 0.195 ±0.005 inch. Minimum wall thickness, 0.012 inch.

PIW AIRCRAFT TEFLON, TFE INSULATION



In keeping with the PIW policy of upgrading our product lines, we have QPL listing on the following products.

Government Designation	Manufacturer's Designation	Government Designation	Manufacturer's Designation
MIL-W-22759/9-28	PIW 197-015-99	MIL-W-22759/10-18	PIW 197-025-98
-26	017	-16	027
-24	019	-14	029
-22	021	-12	031
-20	023	-10	032
-18	025	MIL-W-22759/20-28	PIW 197-015-01
-16	027	-26	017
-14	029	-24	019
-12	031	-22	021
-10	032	-20	023
MIL-W-22759/10-28	PIW 197-015-98	MIL-W-22759/21-28	PIW 197-015-02
-26	017	-26	017
-24	019	-24	019
-22	021	-22	021
-20	023	-20	023

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PIW RG/U TYPE COAXIAL CABLES

Impedance Group	Jacket	Weight Lb/M′	Dielectric Strength Volts (RMS) Min.	Corona Ignition Volts (RMS) Min.	Attenuation db/ 100′ @ 400 Mc. Max.	Capacitance PF/FT Nom.	Velocity % Nom.	Impedance OHMS	Cross Reference
a	Type IX .195 ±.005 In. .012 In. Min. Wall	40.0 Nom.	5000	1900	9.0	29	70	50 ±2	—
b	Type IX .075 In. Max. .007 In. Min. Wall	6.25 Max.	2000	1000	29.0	30	68	50 ±2	Same as RG-196A/U Except Jacket
c	Type VII .110 In. Max. .010 In. Min. Wall	10.5 Nom.	2000	1200	20.0	30	68	50 ±2	Same as RG-316/U Except Jacket
d	Type VII .080 In. Max. .010 In. Min. Wall	6.0 Nom.	2000	1000	29.0	30	68	50 ±2	Same as RG-178B/U Except Jacket
e	Type IX .100 ±.005 In. .007 In. Min. Wall	10.8 Max.	2000	1200	21.0	20	68	75 ±2	Same as RG-187A/U Except Jacket
f	Type VII .110 In. Max. .010 In. Min. Wall	10.5 Nom.	2000	1200	21.0	20	68	75 ±3	Same as RG-179B/U Except Jacket

CONDUCTOR TYPE

Type 1 — Silver Covered, Copper Covered, Steel Wire
Type 2 — Silver Covered, Annealed Copper Covered, Steel Wire
Type 3 — Silver Covered, Copper Wire

INSULATION TYPE

Type F-1 — Solid Polytetrafluoroethylene
Type F-2 — Taped Polytetrafluoroethylene

JACKET TYPE

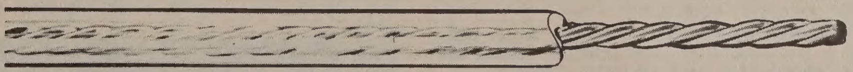
Type V — Silicone Impregnated Fiberglass
Type VII — Taped Polytetrafluoroethylene
Type IX — Extruded Fluorinated Ethylene Propylene

POLYTETRAFLUOROETHYLENE DATA

Dielectric Constant* — 2.1 Maximum
Power Factor* — .0005 Maximum
Temperature Range — −70°C to +250°C

* When measured between 50 mc and 100 mc

PIW AIRCRAFT TEFLON, TFE INSULATION



Wire indicated is normally white that meets all requirements of MIL-STD-104. Other colors must be specified on the purchase order, and when supplied will meet all requirements of MIL-STD-681.

MIL-W-22759/11** MS-21985**

600 Volts +200°C (SPC)

AWG	Stranding	Max. Cond. Diam. (inch)	Max. Cond. Resist. ohms/M′ 20°C	Finished Wire Diameter (inch)	Nom. Weight Lb/M′	PIW Part No.
28	7/36	.016	63.60	.033 ±.002	1.36	196-014
26	19/38	.021	37.30	.038 ±.002	1.90	196-016
24	19/36	.026	23.60	.043 ±.002	2.58	196-018
22	19/34	.033	14.80	.049 ±.002	3.72	196-020
20	19/32	.041	9.09	.058 ±.002	5.43	196-022
18	19/30	.051	5.80	.068 ±.002	8.14	196-024
16	19/29	.058	4.54	.075 ±.002	10.04	196-026

MIL-W-22759/12** MS-21986**

600 Volts +260°C (NPC)

AWG	Stranding	Max. Cond. Diam. (inch)	Max. Cond. Resist. ohms/M′ 20°C	Finished Wire Diameter (inch)	Max. Weight Lb/M′	PIW Part No.
28	7/36	.016	67.60	.033 ±.002	1.36	197-014
26	19/38	.021	41.00	.038 ±.002	1.90	197-016
24	19/36	.026	25.10	.043 ±.002	2.58	197-018
22	19/34	.033	15.70	.049 ±.002	3.72	197-020
20	19/32	.041	9.67	.058 ±.002	5.43	197-022
18	19/30	.051	6.03	.068 ±.002	8.14	197-024
16	19/29	.058	4.73	.075 ±.002	10.04	197-026

** Latest revision

PIW® SHIELDED TEFLON* CABLES

TEFLON Impregnated Braid/Over Shield

DESCRIPTION: Each conductor stranded silver plated copper, Type E extruded .010″ TFE Teflon insulation, color coded, cabled braided silver plated copper shield, 90% coverage, braided white fused Teflon impregnated, fiberglass braid overall.

CHARACTERISTICS: Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

PIW Part No.	No. of Cond.	Conductor		Nom. O.D. (inch)	Nom. Cap. in MMF	
		Size	Strand		Shield to Cond.	Cond. to Cond.
101-419-01	1	24	19/36	.081	45	—
102-419-01	2	24	19/36	.126	35	25
103-419-01	3	24	19/36	.133	35	20
104-419-01	4	24	19/36	.144	35	20
101-421-01	1	22	19/34	.088	55	—
102-421-01	2	22	19/34	.137	45	25
103-421-01	3	22	19/34	.144	35	25
104-421-01	4	22	19/34	.158	35	25
101-423-01	1	20	19/32	.097	55	—
102-423-01	2	20	19/32	.154	95	25
103-423-01	3	20	19/32	.163	85	25
104-423-01	4	20	19/32	.180	140	30
101-425-01	1	18	19/30	.106	70	—
102-425-01	2	18	19/30	.174	60	35
103-425-01	3	18	19/30	.185	60	35
104-425-01	4	18	19/30	.205	55	35
101-426-01	1	16	19/29	.117	107	—
102-426-01	2	16	19/29	.196	67	35

STANDARD PUT UP: 1000 FT. SPOOLS
Color Code of Conductors: 1—White 2—Black 3—Red 4—Green

TEFLON FEP Extruded Jacket/Over Shield

DESCRIPTION: Each conductor stranded silver plated copper, Type E extruded TFE insulation color coded, cabled, braided silver plated copper shield 90% coverage, extruded FEP white Teflon jacket overall.

CHARACTERISTICS: Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus. Extruded FEP Teflon jacket is tough and abrasion resistant.

PIW Part No.	No. of Cond.	Conductor		Nom. Wall Thick. (inch)	Nom. Jacket Thick. (inch)	Nom. O.D. (inch)	Nom. Cap. in MMF	
		Size	Strand				Shield to Cond.	Cond. to Cond.
101-219-15	1	24	19/36	.010	.010	.085	45	—
102-219-10	2	24	19/36	.010	.010	.130	35	25
103-219-08	3	24	19/36	.010	.010	.135	35	20
101-221-01	1	22	19/34	.010	.010	.098	55	—
102-221-03	2	22	19/34	.010	.014	.150	45	25
103-221-03	3	22	19/34	.010	.014	.158	35	25
101-223-02	1	20	19/32	.010	.014	.102	55	—
102-223-02	2	20	19/32	.010	.014	.162	95	25
103-221-09	3	20	19/32	.010	.014	.178	85	25
101-225-03	1	18	19/30	.010	.014	.120	70	—
102-225-03	2	18	19/30	.010	.014	.188	60	35
103-225-03	3	18	19/30	.010	.014	.200	60	35
101-226-07	1	16	19/29	.012	.014	.130	107	—
102-226-07	2	16	19/29	.012	.014	.210	67	25
101-228-07	1	14	19/27	.012	.014	.145	—	—
102-228-07	2	14	19/27	.012	.014	.240	—	—

STANDARD PUT UP: 1000 FT. SPOOLS
Color Code of Conductors: 1—White 2—Black 3—Red

No Outer Covering Over Shield
UL Style 1212, 1213 or Type E, MIL-W-16878

DESCRIPTION: Each conductor stranded silver plated copper, Type E extruded TFE .010″ insulation, braided silver plated copper shield over conductor(s), 90% coverage.

CHARACTERISTICS: Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

PIW Part No.	No. of Cond.	Conductor		Nom. O.D. (inch)	Nom. Cap. in MMF	
		Size	Strand		Shield to Cond.	Cond. to Cond.
101-019-00S	1	24	19/36	.069	45	—
102-019-00S	2	24	19/36	.112	35	25
103-019-00S	3	24	19/36	.120	35	20
104-019-00S	4	24	19/36	.132	35	20
101-021-00S	1	22	19/34	.075	55	—
102-021-00S	2	22	19/34	.124	45	25
103-021-00S	3	22	19/34	.132	35	25
104-021-00S	4	22	19/34	.146	35	25
101-023-00S	1	20	19/32	.083	55	—
102-023-00S	2	20	19/32	.142	95	25
103-023-00S	3	20	19/32	.151	85	25
104-023-00S	4	20	19/32	.168	140	30
101-025-00S	1	18	19/30	.093	70	—
102-025-00S	2	18	19/30	.162	60	35
103-025-00S	3	18	19/30	.172	60	35
104-025-00S	4	18	19/30	.192	55	35
101-026-00S	1	16	19/29	.103	107	—
102-026-00S	2	16	19/29	.184	67	35

STANDARD PUT UP: 1000 FT. SPOOLS
Color Code of Conductors: 1—White 2—Black 3—Red 4—Green

TEFLON TFE Tape Wrapped Jacket/Over Shield

DESCRIPTION: Each conductor stranded silver plated copper, Type E extruded TFE Teflon insulation, color coded, cabled, braided silver plated copper shield, 90% coverage, sintered wrapped white Teflon tape jacketed overall.

CHARACTERISTICS: Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

PIW Part No.	No. of Cond.	Conductor		Nom. Jacket Thick. (inch)	Nom. O.D. (inch)	Nom. Cap. in MMF	
		Size	Strand			Shield to Cond.	Cond. to Cond.
101-219-14	1	24	19/36	.010	.095	45	—
102-219-09	2	24	19/36	.010	.140	35	25
103-219-07	3	24	19/36	.010	.147	35	20
104-219-02	4	24	19/36	.010	.159	35	20
101-221-00	1	22	19/34	.014	.102	55	—
102-221-06	2	22	19/34	.014	.154	45	25
103-221-07	3	22	19/34	.014	.162	35	25
104-221-02	4	22	19/34	.014	.176	35	25
101-223-09	1	20	19/32	.014	.110	55	—
102-223-01	2	20	19/32	.014	.170	95	25
103-223-04	3	20	19/32	.014	.180	85	25
104-223-04	4	20	19/32	.014	.195	140	30
101-225-04	1	18	19/30	.014	.120	70	—
102-225-04	2	18	19/30	.014	.190	60	35
103-225-04	3	18	19/30	.014	.203	60	35
104-225-04	4	18	19/30	.014	.220	55	35
101-226-09	1	16	19/29	.014	.130	107	—
102-226-09	2	16	19/29	.014	.210	67	25
101-228-09	1	14	19/27	.014	.145	—	—
102-228-09	2	14	19/27	.014	.240	—	—

STANDARD PUT UP: 1000 FT. SPOOLS
Color Code of Conductors: 1—White 2—Black 3—Red

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* DuPont Registered Trademark

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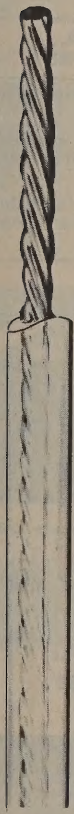
PIW® TEFLON-FEP MILITARY

P.I.W. can furnish FEP Insulated wires in multiconductor cables. Shielding and Jacket materials can be selected which will best meet your particular requirements.



MIL-W-16878** TYPE K 600 VOLTS +200°C Silver Plated

AWG	Stranding	Nominal Conductor Diameter (inch)	Max. Conductor Resist. ohms/M' 25°C	Finished Wire Diameter (inch)	Nominal Weight Lb/M'	PIW Part No.
32	7/40	.009	179.00	.029 ±.004	0.80	400-010
30	7/38	.012	111.00	.032 ±.004	1.00	400-012
28	7/36	.015	69.00	.035 ±.004	1.40	400-014
26	7/34	.019	42.90	.039 ±.004	1.90	400-016
26	19/38	.021	42.90	.039 ±.004	2.05	400-017
24	7/32	.024	26.80	.044 ±.004	2.50	400-018
24	19/36	.025	26.80	.044 ±.004	2.70	400-019
22	7/30	.030	16.70	.050 ±.004	3.60	400-020
22	19/34	.032	16.70	.050 ±.004	3.80	400-021
20	7/28	.038	10.50	.058 ±.004	5.10	400-022
20	19/32	.040	10.50	.058 ±.004	5.40	400-023
18	7/26	.048	6.57	.069 ±.005	7.50	400-024
18	19/30	.050	6.57	.069 ±.005	7.90	400-025
16	19/29	.057	4.85	.080 ±.007	9.80	400-026
14	19/27	.071	3.05	.094 ±.007	15.50	400-028
12	19/25	.090	1.92	.113 ±.007	23.50	400-030
10	37/26	.111	1.24	.134 ±.007	34.25	400-032

MIL-W-16878** TYPE KK 1000 VOLTS +200°C Silver Plated

AWG	Stranding	Nominal Conductor Diameter (inch)	Max. Conductor Resist. ohms/M' 25°C	Finished Wire Diameter (inch)	Nominal Weight Lb/M'	PIW Part No.
32	7/40	.009	179.00	.039 ±.004	1.50	420-010
30	7/38	.012	111.00	.042 ±.004	1.80	420-012
28	7/36	.015	69.00	.045 ±.004	2.10	420-014
26	7/34	.019	42.90	.049 ±.004	2.60	420-016
26	19/38	.021	42.90	.049 ±.004	2.75	420-017
24	7/32	.024	26.80	.054 ±.004	3.40	420-018
24	19/36	.025	26.80	.054 ±.004	3.50	420-019
22	7/30	.030	16.70	.060 ±.004	4.25	420-020
22	19/34	.032	16.70	.060 ±.004	4.50	420-021
20	7/28	.038	10.50	.068 ±.004	6.10	420-022
20	19/32	.040	10.50	.068 ±.004	6.50	420-023
18	7/26	.048	6.57	.079 ±.005	8.75	420-024
18	19/30	.050	6.57	.079 ±.005	9.25	420-025
16	19/29	.057	4.85	.089 ±.006	11.50	420-026
14	19/27	.071	3.05	.105 ±.008	16.50	420-028
12	19/25	.090	1.92	.124 ±.008	25.25	420-030
10	37/26	.111	1.24	.145 ±.008	36.50	420-032
8	133/29	.167	0.68	.207 ±.010	65.00	420-034

** Latest revision
All items also available with Tin Plated Conductors

PIW® QUALITY CONTROL

Each product manufactured by P.I.W. will meet or exceed all customers' specification, standards of reliability, and quality.

To insure this pledge our quality control system is equipped with the latest test equipment. P.I.W.'s Quality Control Department monitors our production process from raw material to finished product. The Philadelphia Insulated Wire Company, Inc., guarantees its product.

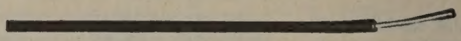
The heart of our production operation is the Quality Control Department. The test and measuring equipment throughout P.I.W. facilities is calibrated to comply with Military Specifications.

Standards and production processes are checked and inspected at every key stage of manufacture.

Together with production control, our laboratory engages in advanced product development and government QPL testing. Every procedure is supervised by carefully trained and experienced technicians and inspectors.

PIW® TEFLON GLASS HOOK-UP WIRE MIL-W-16878 — LATEST REVISION

AWG	Stranding	Nom. O.D.	600 V, Type E 200°C Overall	600 V, Type E 260°C Diameter	1000 V, Type EE 200°C Overall	1000 V, Type EE 260°C Diameter
			Min.	Max.	Min.	Max.
28	7/36	.015	.043	.054	.053	.064
26	7/34 19/38	.019 .019	.047	.058	.057	.068
24	7/32 19/36	.024 .025	.052	.063	.062	.073
22	7/30 19/36	.030 .032	.058	.069	.066	.079
20	7/28 19/32	.038 .040	.066	.077	.076	.087
18	7/26 19/30	.048 .050	.076	.089	.086	.099
16	19/29 61/34	.057 .055	.085	.102	.095	.110
14	19/27 37/29	.071 .076	.103	.116	.113	.128
12	19/25 65/30	.090 .093	.122	.135	.132	.152
10	37/26 105/30	.111 .126	.143	.161	.153	.173



Fused, spiral tape wrapped wire with a Teflon impregnated glass yarn braid. The glass braid offers additional protection where cut through and added abrasion resistance are particularly important.

Government Spec	MIL-W-16878D — Latest Revision
Operating Temperature	+200°C
Operating Voltage	Type E — 600 volts RMS Type EE — 1000 volts RMS
Construction	Conductors - Silver coated copper conductor Insulation - Fused tape wrapped, with Teflon impregnated glass yarn braid. Colors - Standard colors available to MIL-STD 104. Other colors available on request.
Special Constructions	Available on request.

PIW® TEFLON (FEP) CONTROL CABLE

Teflon (FEP) insulated control cables can be used in steel mills, chemical plants, oil refineries and in other industries where control and signal circuits are exposed to high ambient temperature and corrosive chemical environments.

The ability of FEP to operate continuously at temperatures up to 400°F and its resistance to water, oil, grease and most chemicals make this an ideal insulation for applications where severe environmental conditions are encountered.

TEMPERATURE: Continuous service up to 400°F and for short periods up to 550°F.

ELECTRICAL: Excellent electrical properties, low dielectric constant (2.1), exceptionally high insulation resistance.

CHEMICAL: FEP is resistant to all known chemicals and solvents other than molten alkali metals and fluorine at elevated temperatures. Water absorption — .01%.

NYLON JACKET: Either an extruded nylon jacket or a nylon braid and lacquer can be furnished for abrasion protection. The protection afforded by the nylon is effective up to 300°F for a limited time.

CONSTRUCTION: Conductors: #18.

AWG 19/30 Silver-plated or Tin-plated Copper.

Insulation: Teflon 100 FEP.

Cabling: Individual conductors are concentrically cabled with glass fillers to give a uniformly smooth appearance. A glass tape is applied over the cable core when necessary.

Inner Jacket: Teflon 100 FEP.

Outer Jacket: Will be designed to fit the particular application of this cable. Jackets of extruded nylon or braided nylon and lacquer impregnation can be furnished where abrasion is unusually severe and temperatures encountered are below 300°F. Double glass braids can be furnished where abrasion is not severe and continuous service up to 400°F is needed.

FEP Control Cables #18 AWG 19/30 S.P. Copper - 1/64″ FEP FEP — Cabled with Glass Fillers — Glass Tape — FEP Inner Jacket — Outer Jacket

No. Cond.	PIW Part No.	Nom. Fin. O.D.
2	425-224-2	.250
3	425-224-3	.275
4	425-224-4	.290
5	425-224-5	.320
6	425-224-6	.335
7	425-224-7	.335
8	425-224-8	.375
9	425-224-9	.400
10	425-224-10	.430
12	425-224-12	.450

Other gauges or constructions can be manufactured to customer specifications or to fit specialized applications. We invite you to call on our technical sales staff for help with your control cable problems.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW® FIXTURE WIRE "TEFLON" FEP

Applications: Designed for installation in lighting fixtures and in similar equipment where they are enclosed or protected and not subject to bending or twisting in use. They can also be used for connecting lighting fixtures to the conductors of the circuit that supplies the fixtures but are not intended for use as branch circuit conductors.

Type PF 200°C, 600 Volt, Single Conductor

AWG	Insulation Thickness (inches)	Nominal Wire O.D. (inches)		Approximate Weight Lb/M′		PIW Part No.
		Solid	7 Strand	Solid	7 Strand	
18	.020	.080	.086	8.50	8.80	400-024-00
16	.020	.091	.098	12.00	12.70	400-026-00
14	.020	.104	.113	17.45	18.25	400-028-00

Type PFF 150°C, 600 Volt, Single Conductor

AWG	Insulation Thickness (inches)	Nominal Wire O.D. (inches) 19 Stranded	Approximate Weight Lb/M′ 19 Stranded	PIW Part No.
18	.020	.086	8.85	430-024-02
16	.020	.098	12.75	430-026-02
14	.020	.113	18.25	430-028-02

Conductor — Tin Coated Copper

Type PGF 200°C, 600 Volt, Single Conductor

AWG	Ins. Thickness (inches)		Nominal Wire O.D. (inches)		Approximate Weight Lb/M′		PIW Part No.
	FEP	Braid	Solid	7 Strand	Solid	7 Strand	
18	.014	.006	.080	.086	8.00	8.40	420-425-00
16	.014	.006	.091	.098	11.50	12.25	420-426-00
14	.014	.006	.104	.113	17.00	17.75	420-428-00

Type PGFF 150°C, 600 Volt, Single Conductor

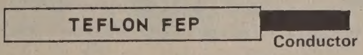
AWG	Ins. Thickness (inches)		Nominal Wire O.D. (inches) 19 Stranded	Approximate Weight Lb/M′ 19 Stranded	PIW Part No.
	FEP	Braid			
18	.014	.006	.086	8.35	410-424-00
16	.014	.006	.098	12.25	410-426-00
14	.014	.006	.113	17.75	410-428-00

Insulation — "Teflon" FEP

PIW® GENERAL PURPOSE WIRE "TEFLON" FEP

Applications: Designed for such industrial applications as infrared ovens, industrial ovens, high-wattage lighting fixtures, motor lead wire, rheostat wire, signal and control wire, locomotive headlight and control wiring around boilers, heaters, drying rooms—and scores of other industrial applications in the 200°C range.

NATIONAL ELECTRICAL CODE LISTED WIRE
Type FEP
200°C, 600 Volt, Single Conductor



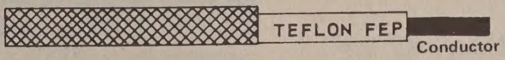
Wire Size (AWG)	Insulation Thickness (inches)	Nominal Wire O.D. (inches)		Approx. Weight Lb/M′	PIW Part No.
		Solid	Stranded		
14	.020	.105	.113	18.0	420-028-00A
12	.020	.121	.132	26.6	420-030-00A
10	.020	.142	.156	39.8	420-032-00A
8	.030	.189	.206	66.1	420-034-00A
6	.030	—	.244	99.3	420-036-00A
4	.030	—	.292	151.4	420-038-00A
2	.030	—	.352	232.6	420-040-00A

Typical Dimensional Comparisons — 1965 National Electrical Code

Wire Size (AWG)	Type FEP	Type FEPB	Type SA	Type AIA	RHH
14	.105	.105	.243	.214	.204
12	.121	.121	.260	.231	.221
10	.142	.142	.281	.252	.242
8	.189	.169	.340	.278	.311
6	.244	.302	.399	.394	.397
4	.292	.350	.447	.442	.452
2	.352	.410	.507	.502	.513

Note: #14 - #8 solids; #6 - #2 stranded. Approximate Diameter - Inches.

NATIONAL ELECTRICAL CODE LISTED WIRE
Type FEPB
200°C, 600 Volt, Single Conductor



Braided glass #14 - #8; Asbestos #6 - #2

Wire Size (AWG)	Insulation Thickness (inches)	Braid Thickness (inches)	Nominal Wire O.D. (inches)		Approx. Weight Lb/M′	PIW Part No.
			Solid	Stranded		
14	.014	.006	.104	.113	19.2	430-428-00
12	.014	.006	.121	.132	27.5	430-430-00
10	.014	.006	.142	.156	40.2	430-432-00
8	.014	.006	.169	.186	61.0	430-434-00

Typical Comparisons for Number of Wires in Trade-Size Conduit or Tubing

Size (AWG)	½″ Conduit			1″ Conduit					2″ Conduit				
	14	12	10	14	12	10	8	6	14	10	8	6	2
FEP	13	10	7	39	29	21	12	7	154	84	47	29	13
FEPB	13	10	7	39	29	21	15	4	154	84	59	18	10
AIA	3	2	2	9	8	6	5	2	37	26	22	11	6
SA	2	2	1	7	6	5	3	1	29	21	14	10	6
RHH	3	3	2	10	8	7	4	2	41	29	17	10	6

Note: FEPB and FEP from 1965 National Electrical Code rewiring tables. Other numbers calculated per 1965 National Electrical Code rewiring requirements.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW HOOK-UP WIRE-TEFZEL

STRANDED or SOLID SILVER PLATED COPPER CONDUCTOR

Size	PIW Part No.	Conductor		Conductor Diameter	Diameter Over Insulation Nominal
		No. of Strands	AWG-Size of Strands		
30	488-012-00	1	—	.010	.030
30	488-012-01	7	38(.0040)	.012	.032
28	488-014-00	1	—	.013	.033
28	488-014-01	7	36(.0050)	.015	.035
28	488-015-99	19	40(.0031)	.016	.036
26	488-016-00	1	—	.016	.036
26	488-016-01	7	34(.0063)	.019	.039
26	488-017-99	19	38(.0040)	.020	.040
24	488-018-00	1	—	.020	.040
24	488-018-01	7	32(.0080)	.024	.044
24	488-019-99	19	36(.0050)	.025	.045
22	488-020-00	1	—	.025	.045
22	488-020-01	7	30(.0100)	.030	.050
22	488-021-99	19	34(.0063)	.032	.052
20	488-022-00	1	—	.032	.052
20	488-022-01	7	28(.0126)	.038	.058
20	488-023-99	19	32(.0080)	.040	.060
18	488-021-01	7	26(.0159)	.048	.068
18	488-025-99	19	30(.0100)	.050	.070
16	488-026-99	19	29(.0113)	.057	.080
14	488-028-99	19	27(.0142)	.071	.094
12	488-030-99	19	25(.0179)	.090	.113
10	488-032-99	37	26(.0159)	.111	.134

Sizes larger than 10 AWG available upon request. Also available in Tin Copper Conductor.
* DuPont's Registered Trademark.

Insulated with Extruded ETFE*. (Ethylene Tetrafluoroethylene)

ALSO AVAILABLE IN CONTROL CABLES

PIW HOOK-UP WIRE-HALAR*

STRANDED or SOLID SILVER PLATED COPPER CONDUCTOR

Insulated with Extruded E-CTFE* (Ethylene-chlorotri-Fluorethylene Copolymer)

ALSO AVAILABLE IN CONTROL CABLES

Size	PIW Part No.	Conductor		Conductor Diameter	Diameter Over Insulation Nominal
		No. of Strands	AWG-Size of Strands		
30	488-012-02	1	—	.010	.030
30	488-012-03	7	38(.0040)	.012	.032
28	488-014-02	1	—	.013	.033
28	488-014-03	7	36(.0050)	.015	.035
28	488-014-04	19	40(.0031)	.016	.036
26	488-016-02	1	—	.016	.036
26	488-016-03	7	34(.0063)	.019	.039
26	488-016-04	19	38(.0040)	.020	.040
24	488-018-02	1	—	.020	.040
24	488-018-03	7	32(.0080)	.024	.044
24	488-018-04	19	36(.0050)	.025	.045
22	488-020-02	1	—	.025	.045
22	488-020-03	7	30(.0100)	.030	.050
22	488-020-04	19	34(.0063)	.032	.052
20	488-022-02	1	—	.032	.052
20	488-022-03	7	28(.0126)	.038	.058
20	488-022-04	19	32(.0080)	.040	.060
18	488-024-03	7	26(.0159)	.048	.068
18	488-024-04	19	30(.0100)	.050	.070
16	488-026-01	19	29(.0113)	.057	.080
14	488-028-01	19	27(.0142)	.071	.094
12	488-030-01	19	25(.0179)	.090	.113
10	488-032-01	37	26(.0159)	.111	.134

Sizes larger than 10 AWG available upon request. Also available in Tin Copper Conductor.
* Allied Chemical's Registered Trademark.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW MILITARY—PVC HOOK-UP WIRE

*Military — PVC MIL-W-16878

	Conductor				Type B Insulation		Type BN Insulation	
	AWG	Minimum Stranding*	Nominal Diameter (inch)	Maximum D.C. Res. ohms/M' at 25°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-16878** TYPE B (PVC) 600 Volts - 105°C and TYPE BN (PVC/Nylon Jacket)	32	7/40	.009	179.00	.028 ±.003	200-010-00	.006 ±.002	200-210-00N
	30	7/38	.012	111.00	.031 ±.003	200-012-00	.006 ±.002	200-212-00N
	28	7/36	.015	69.00	.034 ±.003	200-014-00	.006 ±.002	200-214-00N
	26	7/34	.019	42.90	.038 ±.003	200-016-00	.006 ±.002	200-216-00N
	24	7/32	.024	26.80	$.043 {}^{+.004}_{-.003}$	200-018-00	.006 ±.002	200-218-00N
	22	7/30	.030	16.70	$.049 {}^{+.004}_{-.003}$	200-020-00	.006 ±.002	200-220-00N
	20	7/28	.038	10.50	$.057 {}^{+.004}_{-.003}$	200-022-00	.006 ±.002	200-222-00N
	18	7/26	.048	6.57	$.067 {}^{+.004}_{-.003}$	200-024-00	.006 ±.002	200-224-00N
	16	19/29	.057	4.85	.077 ±.004	200-026-00	.006 ±.002	200-226-00N
	14	19/27	.071	3.05	.091 ±.004	200-028-00	.007 ±.002	200-228-00N

	Conductor				Type C Insulation		Type CN Insulation	
	AWG	Minimum Stranding*	Nominal Diameter (inch)	Maximum D.C. Res. ohms/M' at 25°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-16878** TYPE C (PVC) 1000 Volts - 105°C and TYPE CN (PVC/Nylon Jacket)	26	7/34	.019	42.90	.053 ±.004	210-016-00	.006 ±.002	210-216-00N
	24	7/32	.024	26.80	.058 ±.004	210-018-00	.006 ±.002	210-218-00N
	22	7/30	.030	16.70	.064 ±.004	210-220-00	.006 ±.002	210-220-00N
	20	7/28	.038	10.50	.072 ±.004	210-222-00	.006 ±.002	210-222-00N
	18	7/26	.048	6.57	.082 ±.004	210-224-00	.007 ±.002	210-224-00N
	16	19/29	.057	4.85	.091 ±.004	210-226-00	.007 ±.002	210-226-00N
	14	19/27	.071	3.05	.105 ±.004	210-228-00	.007 ±.002	210-228-00N
	12	19/25	.090	1.92	.124 ±.004	210-230-00	.009 ±.003	210-230-00N

	Conductor				Type D Insulation		Type DN Insulation	
	AWG	Minimum Stranding*	Nominal Diameter (inch)	Maximum D.C. Res. ohms/M' at 25°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-16878** TYPE D (PVC) 3000 Volts - 105°C and TYPE DN (PVC/Nylon Jacket)	24	7/32	.024	26.80	$.082 {}^{+.008}_{-.007}$	220-018-00	.007 ±.002	220-218-00N
	22	7/30	.030	16.70	$.088 {}^{+.008}_{-.007}$	220-020-00	.007 ±.002	220-220-00N
	20	7/28	.038	10.50	$.096 {}^{+.008}_{-.007}$	220-022-00	.007 ±.002	220-222-00N
	18	7/26	.048	6.57	$.106 {}^{+.008}_{-.007}$	220-024-00	.007 ±.002	220-224-00N
	16	19/29	.057	4.85	$.115 {}^{+.008}_{-.007}$	220-026-00	.007 ±.002	220-226-00N
	14	19/27	.071	3.05	$.129 {}^{+.008}_{-.007}$	220-028-00	.009 ±.003	220-228-00N
	12	19/25	.090	1.92	$.161 {}^{+.008}_{-.007}$	220-030-00	.012 ±.004	220-230-00N
	10	37/26	.111	1.24	$.181 {}^{+.008}_{-.007}$	220-032-00	.012 ±.004	220-232-00N
	8	133/29	.187	0.73	$.246 {}^{+.008}_{-.007}$	220-034-00	.018 ±.006	220-234-00N

** Latest revision

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW MILITARY—PVC HOOK-UP WIRE

MIL-W-76

	Conductor				Type MW Insulation		Type MWN Insulation	
	AWG	Minimum Stranding*	Maximum Diameter (inch)	Maximum D.C. Res.† ohms/M' at 20°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-76** TYPE MW (PVC) 1000 Volts - 80°C and TYPE MWN (PVC/Nylon Jacket)	24	7/32	.025	28.40	.062 MAX	270-018-00	.004 +.002 −.001	270-218-00N
	22	7/30	.033	19.00	.070 MAX	270-020-00	.005 +.002 −.001	270-220-00N
	20	7/28	.041	13.12	.078 MAX	270-022-00	.006 ±.002	270-222-00N
	18	16/30	.052	7.89	.089 MAX	270-024-00	.007 ±.002	270-224-00N
	16	19/29	.065	4.97	.102 MAX	270-026-00	.007 +.003 −.002	270-226-00N
	14	19/27	.078	3.13	.115 MAX	270-028-00	.009 ±.003	270-228-00N
	12	19/25	.098	1.92	.135 MAX	270-030-00	.010 +.004 −.003	270-230-00N
	10	37/26	.122	1.27	.159 MAX	270-032-00	.012 ±.004	270-232-00N
	8	127/29	.175	0.73	.242 MAX	270-034-00	.018 ±.006	270-234-00N

	Conductor				Type LW Insulation		Type LWN Insulation	
	AWG	Minimum Stranding*	Maximum Diameter (inch)	Maximum D.C. Res.† ohms/M' at 20°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-76** TYPE LW (PVC) 300 Volts - 80°C and TYPE LWN (PVC/Nylon Jacket)	30	7/38	.014	73.60	.037 MAX	260-012-00	.004 +.002 −.001	260-212-00N
	28	7/36	.016	70.00	.039 MAX	260-014-00	.004 +.002 −.001	260-214-00N
	26	7/34	.020	49.00	.043 MAX	260-016-00	.004 +.002 −.001	260-216-00N
	24	7/32	.025	28.40	.049 MAX	260-018-00	.004 +.002 −.001	260-218-00N
	22	7/30	.033	19.00	.057 MAX	260-020-00	.004 +.002 −.001	260-220-00N
	20	7/28	.041	13.12	.065 MAX	260-022-00	.004 +.002 −.001	260-222-00N

	Conductor				Type HW Insulation		Type HWN Insulation	
	AWG	Minimum Stranding*	Maximum Diameter (inch)	Maximum D.C. Res.† ohms/M' at 20°C	Insulation Diameter (inch)	PIW Part No.	Nylon Jacket Diameter Increase (inch)	PIW Part No.
MIL-W-76** TYPE HW (PVC) 2500 Volts - 80°C (AWG 14 to AWG 8) and TYPE HWN (PVC/Nylon Jacket)	22	7/30	.033	19.00	.106 MAX	280-020-00	.007 +.003 −.002	280-220-00N
	20	7/28	.041	13.12	.114 MAX	280-022-00	.008 +.003 −.002	280-222-00N
	18	16/30	.052	7.89	.125 MAX	280-024-00	.009 ±.003	280-224-00N
	16	19/29	.065	4.97	.138 MAX	280-026-00	.010 +.004 −.003	280-226-00N
	14	19/27	.078	3.13	.180 MAX	280-028-00	.013 +.005 −.004	280-228-00N
	12	19/25	.098	1.92	.200 MAX	280-030-00	.015 ±.005	280-230-00N
	10	37/26	.122	1.27	.224 MAX	280-032-00	.016 +.006 −.005	280-232-00N
	8	127/29	.175	0.73	.277 MAX	280-034-00	.021 ±.007	280-234-00N

* Also available with solid conductor ** Latest revision † Copper conductor

PIW UL LISTINGS

BELOW ARE LISTED THE UL APPROVALS MANUFACTURED BY PIW

ALL PVC ELECTRONIC HOOK-UP WIRE ALSO AVAILABLE IN CSA STYLE TEW 600V OR 300V TR32 OR TR64

TEFLON TFE UL STYLES

STYLE	DESCRIPTION	SIZE
1164	150°C 300 Volts 13 Mils Min Avg TFE 12 Mils Any Point	28-12
1180	200°C 300 Volts 13 Mils Min Avg TFE 12 Mils Any Point	28-12
1198	150°C 600 Volts 20 Mils Min Avg TFE 18 Mils Min Any Point	26-10
1199	200°C 600 Volts 20 Mils Min Avg TFE 18 Mils Min Any Point	26-10
1212	80°C No Voltage 8 Mils Min Avg TFE 7 Mils Min Any Point	32-20
1213	105°C No Voltage 8 Mils Min Avg TFE 7 Mils Min Any Point	32-20
1371	105°C No Voltage 5.5 Mils Min Avg 5 Mils Min	32-20
1525	200°C 150 Volts 8 Mils Min Avg 2 Mils Min Avg ML	32-16
1538	105°C 125 Volts 5.5 Mils Min Avg 5 Mils Min Any Point	32-16

TEFLON FEP UL STYLES

STYLE	DESCRIPTION	SIZE
1226	80°C No Voltage 8 Mils Min Avg FEP 7 Mils Min Any Point	32-20
1292	105°C No Voltage 6 Mils Min Avg FEP 4.3 Mils Min Avg. Nyl	30-20
1293	105°C No Voltage 10 Mils Min Avg FEP 2 Mils Min Avg Nyl	30-20
1294	80°C No Voltage 10 Mils Min Avg FEP 2 Mils Min Any Point	26-20
1330	150°C 600 Volts 20 Mils Min Avg FEP 18 Mils Min Any Point	28-10
1331	200°C 600 Volts 20 Mils Min Avg FEP 18 Mils Min Any Point	28-10
1332	200°C 300 Volts 13 Mils Min Avg FEP 12 Mils Min Any Point	28-10
1333	150°C 300 Volts 13 Mils Min Avg FEP 12 Mils Any Point	28-10
1371	105°C No Voltage 5.5 Mils Min Avg FEP	32-20
1419	105°C No Voltage 24 Mils Min Avg 21 Mils Shield FEP JKT	30-16
1538	105°C 125 Volts TFE or FEP 5.5 Mils Min Avg	32-20

KYNAR UL STYLES

STYLE	DESCRIPTION	SIZE
1422	105°C No Voltage 5 Mils Min Avg 4 Mils Min Any Point	32-20
1423	105°C No Voltage 4 Mils Min Avg 3 Mils Min Any Point	32-20
1327	105°C No Voltage 10 Mils Min Avg 8 Mils Min Any Point	30-16
1426	105°C No Voltage 6 Mils Min Avg 5 Mils Min Any Point	32-20

PVC UL STYLES

STYLE	DESCRIPTION	SIZE
1001	80°C 300 Volts 9 Mils Min Avg PVC 7 Mils Any Point	30-16
1004	80°C No Volts 8 Mils Min Avg PVC 2 Mils Nyl or Lac Braid	26-16
1005	90°C No Voltage 8 Mils Min Avg PVC 2 Mils Min Nyl or L. B	26-16
1006	105°C No Voltage 8 Mils Min Avg PVC 2 Mils Min Nyl or L. B	26-16
1007	80°C 300 Volts 16 Mils Min Avg PVC	32-16
1008	80°C 300 Volts 16 Mils Min Avg PVC 2 Mils Min Nyl or L. B	28-16
1009	90°C 300 Volts 16 Mils Min Avg PVC 2 Mils Min Nyl or L. B	28-16
1010	105°C 300 Volts 16 Mils Min Avg PVC 2 Mils Min Nyl or L. B	28-16
1011	80°C 600 Volts 31 Mils Min Avg PVC	26-9
1012	80°C 600 Volts 31 Mils Min Avg PVC 2 Mils Min Nyl or L. B	28-9
1013	90°C 600 Volts 31 Mils Min Avg PVC	26-9
1014	90°C 600 Volts 31 mils Min Avg PVC 2 Mils Min Nyl or L. B	26-9
1015	105°C 600 Volts 31 Mils Min Avg PVC	28-9
1016	105°C 600 Volts 31 Mils Min Avg PVC 2 Mils Min Nyl or L. B	26-9
1017	80°C 600 Volts 47 Mils Min Avg PVC 2 Mils Min Nyl or L. B	22-8
1018	80°C 600 Volts 47 Mils Min Avg PVC 2 Mils Nylon	8-6
1024	90°C 600 Volts 47 Mils Min Avg PVC 43 Mils Any Point	22-8
1025	90°C 600 Volts 47 Mils Min Avg PVC 2 Mils Nylon	8-6
1030	80°C 1,000 VAC & 1,200 VDC Nom 31 Mils PVC No Cover	26-10
1031	80°C 1,000 VAC & 1,200 VDC Nom 31 Mils PVC 2 Mils Nyl	26-10
1061	80°C 300 Volts Nom 9 Mils PVC No Covering	30-16

PVC UL STYLES (Cont.)

STYLE	DESCRIPTION	SIZE
1083	90°C 600 Volts Nom 31 Mils PVC 3 Mils Nylon	26-10
1095	80°C 300 Volts Nom 12 Mils PVC 9.5 Mils Any Point	26-16
1096	80°C 300 Volts Nom 12 Mils PVC 2 Mils Nylon	26-16
1108	80°C 300 Volts Nom 15.6 Mils Tin Copper Braid PVC Jacket	26-16
1116	80°C 600 Volts 47 Mils Min Avg PVC 2 Mils Min Nyl or L. B	22-8
1194	90°C 250 Volts Nom 31 Mils PVC 3 Mils Min	30-16
1195	80°C 300 Volts Nom 15 Mils PVC	26-14
1208	80°C 300 Volts 13 Mils PVC 12 Mils Min Any Point	26-16
1216	90°C 250 Volts 31 Mils PVC 28 Mils Min Any Point	Size on wattage
1219	90°C 250 Volts 31 Mils PVC 28 Mils Min Any Point	Size on wattage
2095	80°C 300 Volts 2 Cond's 15 Mils PVC Shield PVC JKT	30-16
2096	80°C 300 Volts 3 Cond's 15 Mils PVC Shield PVC JKT	30-16
2097	80°C 300 Volts 4 Cond's 15 Mils PVC Shield PVC JKT	30-16
2115	80°C 600 Volts 26-16 2 Cond's 31 Mils PVC Sh 31 Mils PVC J	26-16
2116	80°C 600 Volts 26-16 3 Cond's 31 Mils PVC Sh 31 Mils PVC J	26-16
2117	80°C 600 Volts 4 Cond's 31 Mils PVC Shld 31 Mils PVC JKT	26-16
2343	80°C No Voltage Computer Cable PVC Jacket 60 Mils	30 Min
2344	80°C No Voltage Computer Cable PVC Jacket 80 Mils	30 Min
2345	80°C No Voltage Computer Cable PVC Jacket 110 Mils	30 Min
2346	80°C No Voltage Computer Cable PVC Jacket 140 Mils	30 Min
2384	60°C 30 Volts Computer Cable PVC Jacket 35 Mils	30 Min
2385	60°C 30 Volts Computer Cable PVC Jacket 60 Mils	30 Min
2386	60°C 30 Volts Computer Cable PVC Jacket 80 Mils	30 Min
2387	60°C 30 Volts Computer Cable PVC Jacket 110 Mils	30 Min
2448	60°C 30 Volts Computer Cable PVC Jacket 110 Mils	30 Min
2461	80°C 300 Volts 2 to 61 Conds PVC Jacket	26-16
2462	60°C 300 Volts 2 to 61 Conds PVC Jacket	24-16
2463	80°C 600 Volts 2 to 19 Conds PVC Jacket	26-16
2464	80°C 300 Volts Multi Conds Braided PVC Jacket	30-16
2490	60°C No Voltage Multi Conds Braided PVC Jacket	30-16
2493	60°C No Voltage Multi Conds Braided PVC Jacket	30-16
2507	105°C No Voltage 3 to 100 Conds 7 Mils FEP Teflon	32-26

POLYETHYLENE UL STYLES

STYLE	DESCRIPTION	SIZE
1113	60°C 600 Volts 31 Mils Poly Shield 31 Mil PVC Jacket	26-16
1354	60°C 30 Volts Coaxial Cable	
2106	60°C 600 Volts 2 Cond's 31 Mils Poly Shield 31 Mils PVC SKT	26-16
2107	60°C 600 Volts 3 Cond's 31 Mils Poly Shield 31 Mils PVC SKT	26-16
2108	60°C 600 Volts 4 Cond's 31 Mils Poly Shield 31 Mils PVC SKT	26-16

TEFZEL UL STYLE

STYLE	DESCRIPTION	SIZE
1587	125°C No Voltage 4 Mils Min Avg CTFE	32-20

BRAIDED GLASS HOOK-UP UL STYLES

STYLE	DESCRIPTION	SIZE
5002	90°C 300 Volts 2 Wraps Butyrate Tape with 7 Mils Min Glass Braid Lac.	26-14
5003	90°C 300 Volts 3 Wraps Butyrate Tape with 11 Mils Min Wall 2 Glass Braids Lac.	26-14
5004	90°C 300 Volts 2 Wraps Butyrate Tape with 7 Mils Min Wall Soft Cotton Braid Lac.	26-14
5048	105°C 600 Volts Lead Wire for Hermetic Motors 0.5 Mylar Tape between Dacron Braids	20-8
5058	105°C 600 Volts Same as style 5048 except added 2.0 Teflon Tape	20-8

PIW®

BUSINESS MACHINE WIRE

Rating	Conductor	Insulation	Jacket
80°C, 300V	#30 — #16, Solid or Stranded, Tinned or Bare Copper	Nom. .009 PVC	None

UL STYLE 1061
PVC Insulation
STRANDED CONDUCTOR

Size AWG	Conductor Stranding	Nominal Conductor O.D.	Nominal Finished O.D.	Nominal Weight Lb/M'
30	7/38	.012	.030	.70
28	7/36	.015	.034	1.00
26	7/34	.019	.038	1.35
24	7/32	.024	.044	2.00
22	7/30	.030	.048	2.85
20	7/28	.038	.056	4.20
18	7/26	.048	.066	6.50
16	19/29	.056	.074	8.65

Rating	Conductor	Insulation	Jacket
80°C, 300V	#30 — #16, Solid or Stranded, Tinned or Bare Copper	Nom. .009 PVC	None

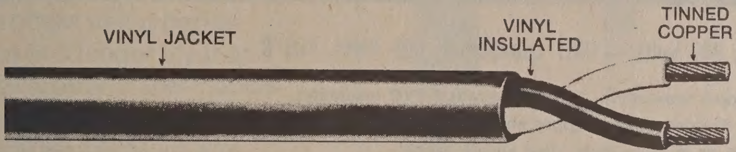
SOLID CONDUCTOR

Size AWG	Conductor Stranding	Nominal Conductor O.D.	Nominal Finished O.D.	Nominal Weight Lb/M'
30	Solid	.010	.028	.60
28	Solid	.0126	.031	.85
26	Solid	.0159	.034	1.20
24	Solid	.0201	.038	1.70
22	Solid	.0253	.044	2.50
20	Solid	.032	.050	3.80
18	Solid	.0408	.060	5.85
16	Solid	.0508	.070	8.90

All PVC Electronic hook-up wire also available in CSA style TEW-300V, 600V or TR 32 and TR 64.

PHILADELPHIA INSULATED WIRE CO., INC. • 333 NEW ALBANY RD. • MOORESTOWN, NJ 08057 • (609) 235-6700 • TOLL FREE 800-257-8357

PIW® COMPUTER AND CONTROL CABLE UNSHIELDED



Cable Rated at 80°C, 300 Volts
1061 Conductors, 600 Volts, 80°C

Stranded tinned copper conductor, .010″ color-coded PVC insulation. Cabled singly or in pairs, gray vinyl jacket overall.

UNSHIELDED MULTI-CONDUCTOR CABLES

24 GAUGE

NOM. O.D. CONDUCTOR — .045″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

PIW Part No.	No. of Conductors	Nom. O.D.
300-218-05	5	.218
300-218-07	7	.251
300-218-12	12	.301
300-218-15	15	.328
300-218-19	19	.341
300-218-27	27	.394
300-218-37	37	.418
300-218-48	48	.470
300-218-60	60	.508

22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

PIW Part No.	No. of Conductors	Nom. O.D.
300-220-05	5	.202
300-220-07	7	.272
300-220-12	12	.332
300-220-15	15	.352
300-220-19	19	.372
300-220-27	27	.432
300-220-37	37	.481
300-220-48	48	.533
300-220-60	60	.574

20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

PIW Part No.	No. of Conductors	Nom. O.D.
300-222-05	5	.277
300-222-07	7	.293
300-222-12	12	.363
300-222-15	15	.393
300-222-19	19	.412
300-222-27	27	.494
300-222-37	37	.521
300-222-48	48	.584
300-222-60	60	.644

UNSHIELDED PAIRED CABLES

24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

PIW Part No.	No. of Pairs	Nom. O.D.
302-218-05	5	.332
302-218-07	7	.352
302-218-12	12	.438
302-218-15	15	.488
302-218-19	19	.507
302-218-27	27	.595
302-218-37	37	.665
302-218-48	48	.747
302-218-60	60	.819

22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

PIW Part No.	No. of Pairs	Nom. O.D.
302-220-05	5	.368
302-220-07	7	.393
302-220-12	12	.475
302-220-15	15	.551
302-220-19	19	.563
302-220-27	27	.604
302-220-37	37	.755
302-220-48	48	.856
302-220-60	60	.984

20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

PIW Part No.	No. of Pairs	Nom. O.D.
302-222-05	5	.398
302-222-07	7	.445
302-222-12	12	.545
302-222-15	15	.607
302-222-19	19	.634
302-222-27	27	.749
302-222-37	37	.826
302-222-48	48	.955
302-222-60	60	1.045

APPLICATION: Control and signal application in computers, industrial equipment and instrumentation.

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PIW COMPUTER AND CONTROL CABLE SHIELDED

Cable Rated at 80°C, 300 Volts — 1061 Conductors, 600 Volts, 105°C

Stranded tinned copper conductor, .010″ color-coded PVC insulation.
Braided tinned copper shield.
Cabled singles or in pairs, gray vinyl jacket overall.

SHIELDED MULTI-CONDUCTOR CABLES

24 GAUGE

NOM. O.D. CONDUCTOR — .045″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

PIW Part No.	No. of Conductors	Nom. O.D.
300-218-05	5	.247
300-218-07	7	.277
300-218-12	12	.328
300-218-15	15	.353
300-218-19	19	.367
300-218-27	27	.418
300-218-37	37	.447
300-218-48	48	.497
300-218-60	60	.538

22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

PIW Part No.	No. of Conductors	Nom. O.D.
300-220-05	5	.287
300-220-07	7	.298
300-220-12	12	.357
300-220-15	15	.382
300-220-19	19	.397
300-220-27	27	.458
300-220-37	37	.513
300-220-48	48	.563
300-220-60	60	.603

20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

PIW Part No.	No. of Conductors	Nom. O.D.
300-222-05	5	.302
300-222-07	7	.318
300-222-12	12	.387
300-222-15	15	.417
300-222-19	19	.437
300-222-27	27	.518
300-222-37	37	.552
300-222-48	48	.612
300-222-60	60	.673

SHIELDED PAIRED CABLES

24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

PIW Part No.	No. of Pairs	Nom. O.D.
302-218-05	5	.357
302-218-07	7	.378
302-218-12	12	.478
302-218-15	15	.513
302-218-19	19	.533
302-218-27	27	.622
302-218-37	37	.693
302-218-48	48	.778
302-218-60	60	.847

22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

PIW Part No.	No. of Pairs	Nom. O.D.
302-220-05	5	.392
302-220-07	7	.418
302-220-12	12	.497
302-220-15	15	.578
302-220-19	19	.584
302-220-27	27	.672
302-220-37	37	.784
302-220-48	48	.883
302-220-60	60	.960

20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

PIW Part No.	No. of Pairs	Nom. O.D.
302-222-05	5	.422
302-222-07	7	.468
302-222-12	12	.572
302-222-15	15	.633
302-222-19	19	.665
302-222-27	27	.778
302-222-37	37	.854
302-222-48	48	.983
302-222-60	60	1.074

APPLICATION: Control and signal application in computers, industrial equipment and instrumentation.

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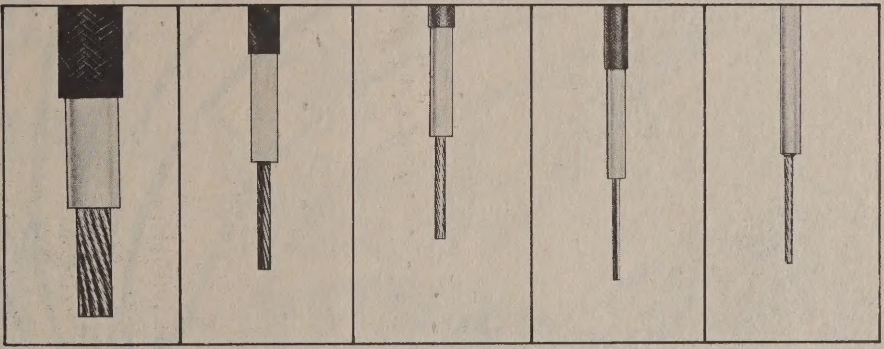
ROWE KNOWS WIRE AND CABLE

High Temperature silicone rubber wire and cable.

Rowe's silicone rubber insulation offers better performance and longer life than natural rubber or thermoplastic insulation. For example, our high temperature wire and cable is: heat stable to 200°C and flexible to −90°C, unaffected by severe thermal cycling, ultraviolet radiation, ozone or corona, resistant to ageing, moisture and chemicals, highly flame retardant and tough enough for unbraided lead wire.

Choose from a variety of UL listed styles or ask us to design one that meets your special requirements.



Power cable for 600 volts +.

Appliance & fixture wire for 300 volts +.

Apparatus & motor lead wire for 600 volts +.

Lighting wire for 600 volt transmission with solid tinned copper conductor, silicone rubber insulation and fiberglass braided covering.

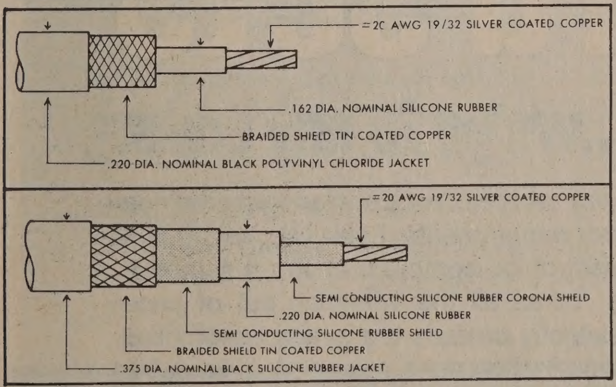
High Temp NB especially suited for motor lead wire. No braided covering necessary. Tinned copper, stranded or solid tinned copper conductor. Silicone rubber insulation in 10 colors.

All the above wire and cable feature tinned copper, stranded conductors, silicone rubber insulation, with fiberglass braided covering.

Hi-V cable, wire, and interconnections.

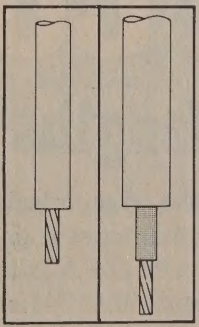
Well suited for a variety of industrial and military applications including accelerators, radar, x-ray, ECM and others. Hi-V combines semi-conducting, corona-suppressing layers with thermosetting materials for noise-free, corona-free cable and wire. It is available in single conductor, coaxial and triaxial configurations.

COAXIAL.


#20 AWG 19/32 SILVER COATED COPPER
.162 DIA. NOMINAL SILICONE RUBBER
BRAIDED SHIELD TIN COATED COPPER
.220 DIA. NOMINAL BLACK POLYVINYL CHLORIDE JACKET
#20 AWG 19/32 SILVER COATED COPPER
SEMI CONDUCTING SILICONE RUBBER CORONA SHIELD
.220 DIA. NOMINAL SILICONE RUBBER
SEMI CONDUCTING SILICONE RUBBER SHIELD
BRAIDED SHIELD TIN COATED COPPER
.375 DIA. NOMINAL BLACK SILICONE RUBBER JACKET

Features: 5-100KV minimum voltage ratings, 8-22 AWG corona-free and ozone resistant, 80°C to 200°C operating temperature range. Excellent for high pulse applications and for use with Rowe high voltage miniature coaxial connector series, G series connectors, Hi-pulse 40KV series and Rowe R75 connector series. All exhibit good corona-free RFI-EMI capabilities and have excellent flexibility properties.

SINGLE CONDUCTOR, UNSHIELDED.



Features: 5-60 KVDC minimum voltage ratings, 10-20 AWG corona-free, ozone-resistant material, 200°C operating temperature, excellent flexibility at high and low temperatures.

ROWE

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That's why Shigoto can help make your ends meet. From hundreds of standard combinations to unusual characteristics that meet your own requirements. Even U.L. and C.S.A. approved. Our volume production for O.E.M.'s in electronics, communications, automotive, appliances, and practically every other industry, takes all the variables out of price-performance differences. Shigoto's ability to consistently produce top quality assemblies, when combined with large quantities, always brings in the prices you need. Unmatched quality has become our standard, our reliability and delivery schedules will become yours. Call, write, or wire your specs. At Shigoto, you'll find we'll go to any ends, to any lengths, to satisfy you.

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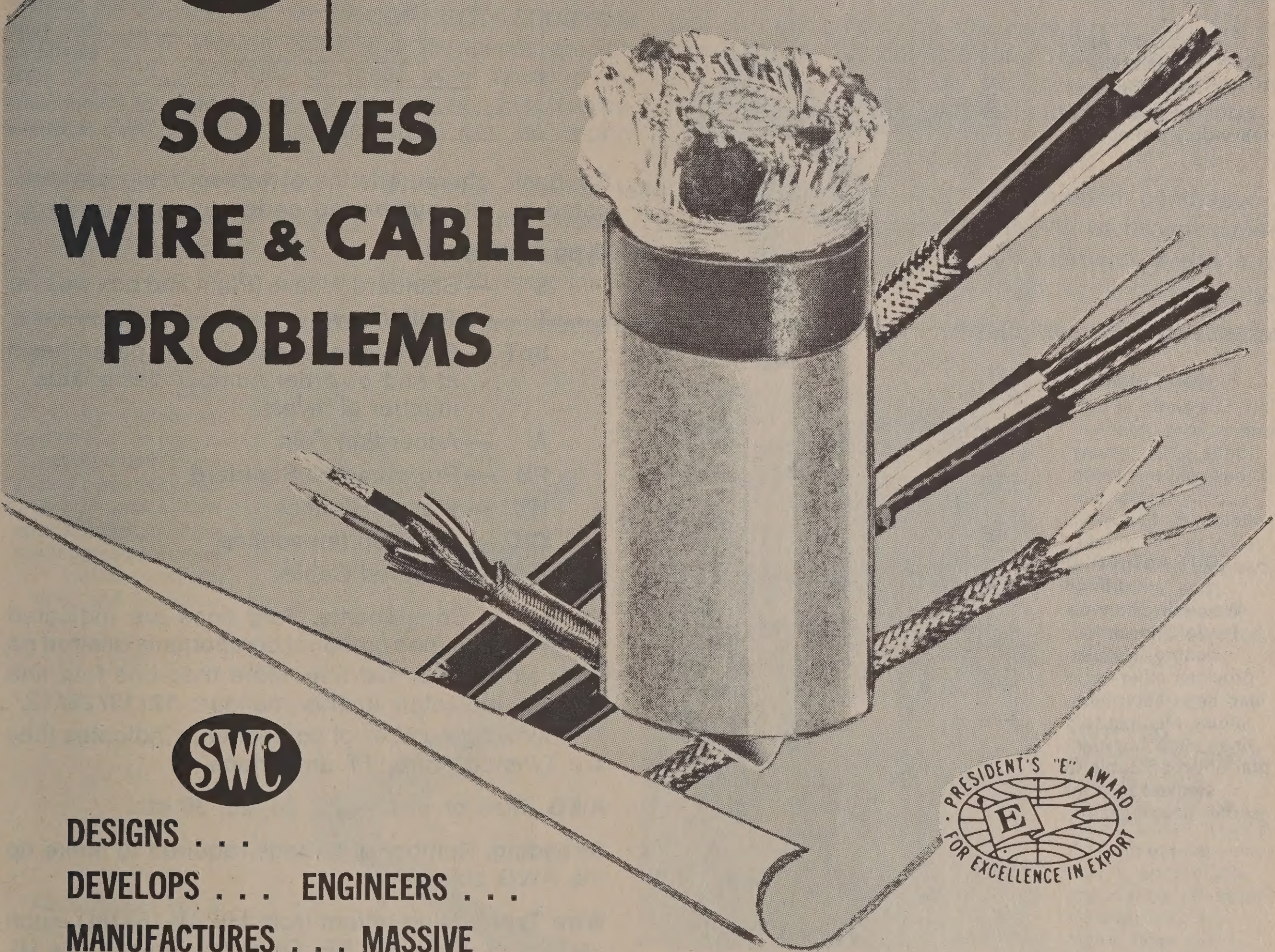
STANDARD WIRE & CABLE CO.

SOLVES WIRE & CABLE PROBLEMS



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CONFIGURATIONS TO MICROMINIATURE
TO YOUR SPECIFIC NEEDS

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FOR EXCELLENCE IN EXPORT

For immediate information call SWC Wire & Cable experts to answer your technical questions that will help you to meet your requirements.

FOR QUOTES, send for **SWC's** specially prepared **"CABLE DESIGN CHECKLIST"** that will assist you to specify details of your custom cable needs quickly and accurately.

FOR QUALITY AND SERVICE RELY ON SWC'S 30-YEAR HISTORY OF ABILITY TO DELIVER.

Wire, Cable & Cord is available for IMMEDIATE DELIVERY from distribution centers noted below. Sales offices and representatives in all Metropolitan areas.

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40 Townsend Road, Attleboro, Ma. 02703
Phone: (617) 226-1500, Telex 92-7795

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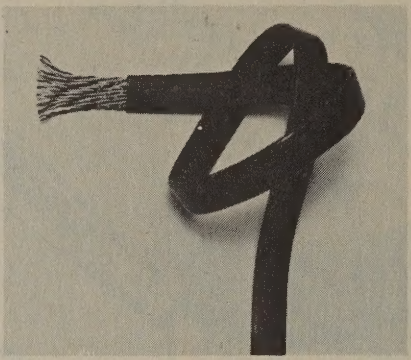
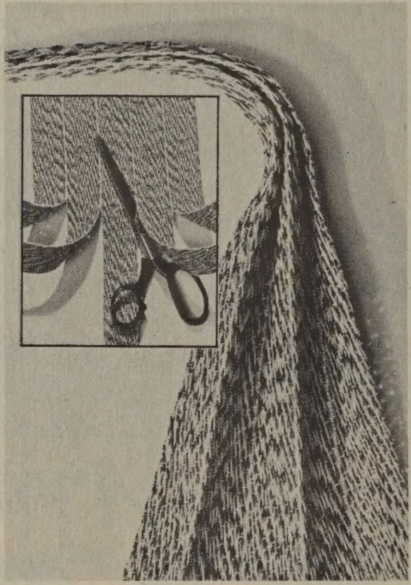
WOVEN CABLE

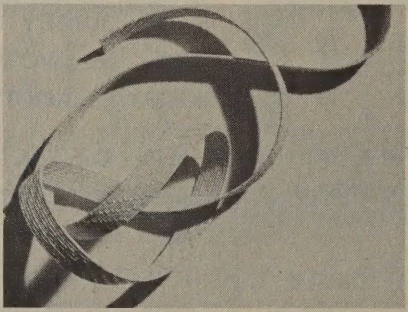
JACKETS AND SHIELDING
Shielding and extruded jackets for heavy-duty protection.



CUT AND FOLD LINES
Woven-in channels for folding and/or cutting. Cut line provides most rapid lead separation technique. Multiple fold lines allow compaction of broad cable to stacked fold for smaller openings, etc.



ULTRA-FLEXIBLE CABLES
Withstand continuous flexing without delamination while retaining insulation continuity.



WOVEN ELECTRONICS®

Telephone (803) 963-5131
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P.O. Box 189, Mauldin, SC 29662
Plant Location: Old Stage Road
Simpsonville, SC 29681

ORDERING WOVEN CABLE

T 12/13 26 07 B N (1) (50")

- (50") — **Length of Cable**
- (1) — **Number of Layers**
- N — **Weave Material**
- B — **Wire Type**
- 07 — **Stranding**
- 26 — **AWG**
- 12/13 — **Number of Components**
- T — **Type of Weave**

Six basic characteristics of woven cable are indicated by this numbering code.

Type of Weave

S — Standard Weave (Plain and box weave)
T — Twill Weave
SpT — Stack Weave. Number in parenthesis at end of order number designates number of layers.
A — Accordion Fold
PS — Programmed Standard
HS — Woven Harness
CIC — Matched Impedance
C — Covered Cable

Number of Components. Fold lines are indicated by /, between the number of components desired on each side of the fold line. More than one fold line may be indicated in this manner: 12/13/26/12. TP following number of components indicates they are Twisted Pairs. TT are Triads.

AWG. Size of wire — 22, 24, 26, 30 etc.

Stranding. Number of strands required to make up the AWG size.

Wire Type. Using letters from MIL-W-16878D, such as Type B, C, E, ET, EE. Or at this point show UL style of wire required — UL-1007, UL-1061, etc.

Weave Material. Most commonly specified: N-Nylon NX-Nomex D-Dacron Pp-Polypropylene G-Glass.

Number of Layers. When ordering stack-weave cable, number of layers into which designated components are to be formed should be shown in parentheses at the end of the numbering code.

Length of Cable. When ordering programmed cable (PS, HS, CIC), show length in inches, in parentheses, at end of numbering code.

Special Requirements. For special requirements, drawings and detailed notes may be used. Dimensional drawings are necessary for all harnesses, accordion fold units and programmed lead units, as well as wire run list and bill of materials.

If a special array of conductors is needed, list and number each conductor. Indicate colors required. If using standard NEMA color code and repeat, simply note — "NEMA and repeat."

WORLD LEADERS IN THE DESIGN, DEVELOPMENT AND PRODUCTION OF WOVEN INTERCONNECT SYSTEMS.

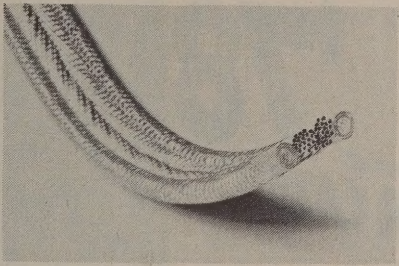
WOVEN ELECTRONICS®

RIBBON CABLE/IC INTERCONNECTS/CUSTOM HARNESSES. Woven cable and harnesses are designed and produced to meet your specific requirements. Assistance from Woven Electronics' design and engineering specialists can be important in fully employing the exceptional benefits of woven assembly forms. Total testing capabilities and stringent production monitoring assure you of the highest standards of technical reliability.

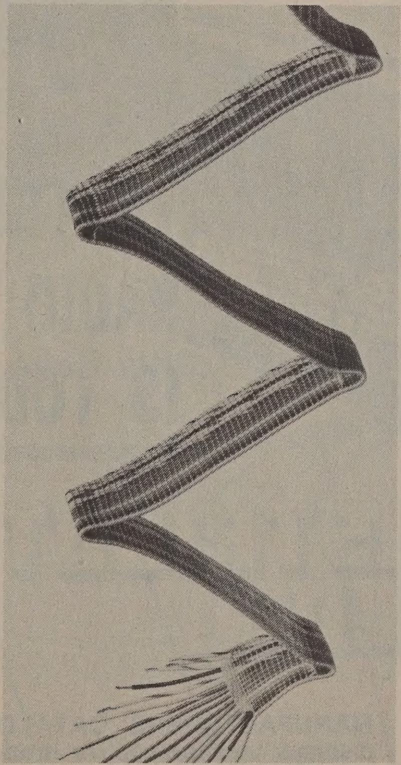
THE MOST VERSATILE, MOST RELIABLE OF ALL FLAT CABLE FORMS.

■ Fastest, easiest lead exposure ■ Independently insulated conductors. Tighter signal control. Sure protection. Longer life. ■ Widest design capabilities. Combine diverse conductor sizes, function, insulations. ■ Use any UL or MIL spec insulation. ■ Conductors are easily freed for discrete wiring.

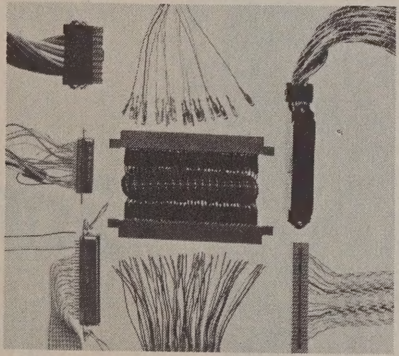
MULTI-FUNCTION CABLES
Air, Liquid, gas carrying tubes may be packed with signal and power conductors. Organize fibre-optic bundles, multiple diode arrays. Combine varied conductor sizes and functions.



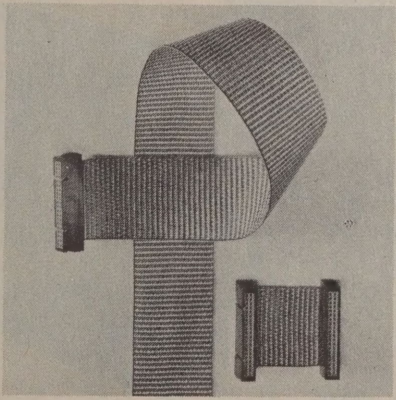
ACCORDION FOLD
Strain-relief threads at each fold prevent flexing fatigue. Optional reinforced cable edges prevent wear from movement.



CUSTOM HARNESSES AND JUMPERS
Expertly woven or hand tied, complete with branches, breakouts, terminations. Small jumpers or massive harness assemblies.

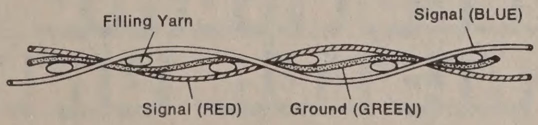


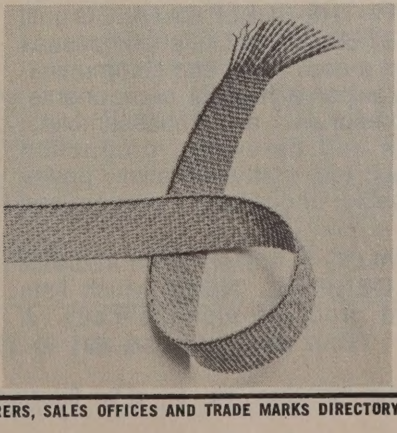
TERMINATION
Use of standard insulated wire in most woven cable eliminates need for special connectors or dies. Strip with automatic equipment, or order pre-cut with stripped and tinned ends. Complete interconnects supplied, ready to plug in.



MATCHED IMPEDANCE CABLE
Less than 10% deviation. Can be folded, rolled, twisted, tied without delamination or appreciable impedance alteration. Configuration of signal lines and ground planes minimizes crosstalk. Provided with or without termination, to your specs. Available in 80 ohm and 100 ohm standard.

Cross Sectional View, Wrap Direction





TWISTED SETS
Twisted pairs, triads and quads woven as flat ribbon cable. Rugged durability. Remarkable convenience in lead exposure and separation, without danger to adjacent insulation. Ideal method of ribbonizing PVC, TFE, Polyimid, FEP, Tefzel, Asbestos, 81044 Airframe — any insulation.

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MASTER CATALOG

Known as O-T-S, OFF-THE-SHELF CATALOG until this edition, the MASTER CATALOG encompasses the following product areas: audio and communications equipment; electromechanical components; electronic circuit components and subassemblies; panel components and hardware; production equipment and tools; test instrumentation; power sources; wire and cable; and related materials and chemicals.

The MASTER CATALOG is broken down into four basic sections. **A GENERAL INDEX** which lists manufacturers and products alphabetically. **A MANUFACTURERS' CATALOG SECTION** which displays their respective product pages and lists their addresses and phone numbers. **A MANUFACTURERS' DIRECTORY,** where participating manufacturers, again listed alphabetically with addresses and phone numbers, highlight their distributors. And a **GEOGRAPHIC DISTRIBUTORS' DIRECTORY** which includes the names, addresses and phone numbers of the local distributors nationwide which stock the products of manufacturers whose data appears in the "Manufacturers' Catalog Section."

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TRW HOLYOKE WIRE & CABLE

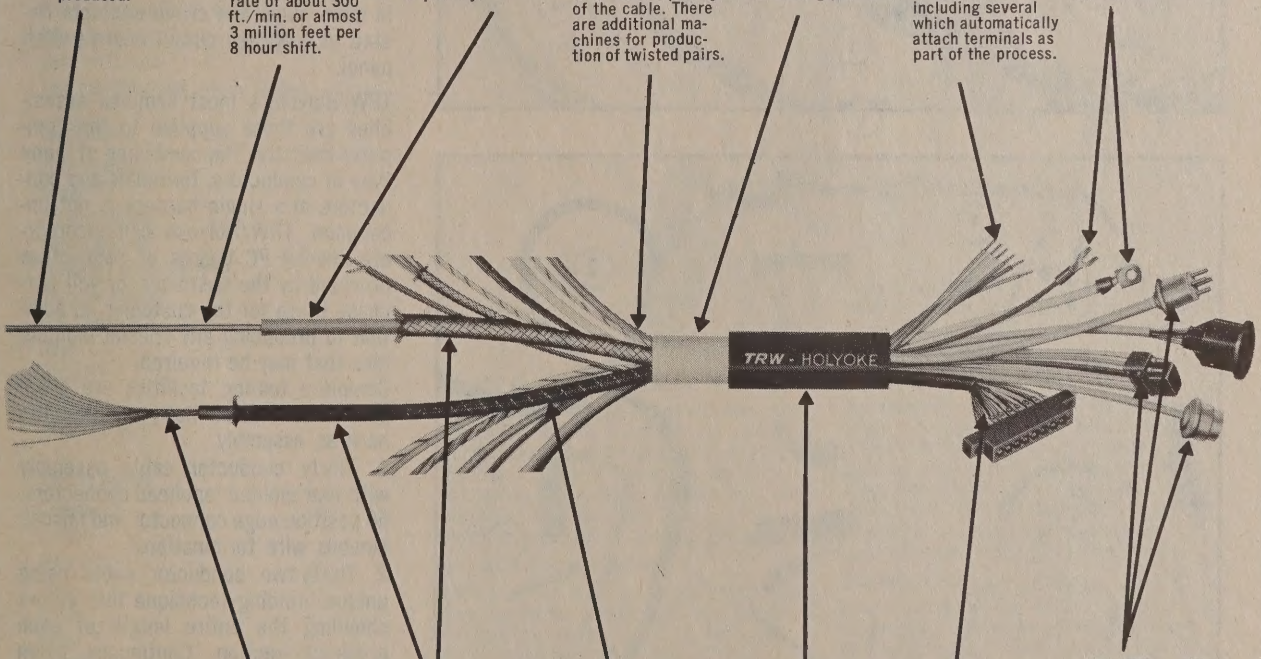
TOTAL CAPABILITY IN PRECISION CABLE ASSEMBLIES

At TRW/Holyoke Wire and Cable, "total capability" in the manufacture of precision cable assemblies and harnesses is a blend of complete facilities, advanced technology, and wide experience.

Every manufacturing step — from the drawing of individual copper wires to the attaching of hardware and molding of the connector — is performed internally to achieve maximum cost effectiveness and control of product quality.

Through its complete in-house wire and cable manufacturing facilities, TRW/Holyoke is equipped to fabricate any cable assembly or harness, regardless of its complexity.

Laced or textile braided assemblies, with shielded breakouts and solder or crimp attachment of any single or multiple termination can be supplied. Dies for molded connector assemblies are designed and built internally for a wide range of molding materials.



DRAWING — Copper wire is drawn to a specific diameter on seven machines, each with an average production rate of 6,000 ft./min. Wires as small as 36 AWG (.005") can be produced.

TINNING — Three tinning lines deposit 40 microinches of tin on the copper wire as it moves through the tinning baths. Each spool picks up wire at a rate of about 300 ft./min. or almost 3 million feet per 8 hour shift.

EXTRUDING — By changing the extruding die, insulated wire with insulation thicknesses up to 0.155" can be produced. The 12 extruding machines at TRW/Holyoke have a combined capacity in excess of 7,000,000 ft. per day.

CABLING — The cabling department has an average capacity of 100,000 ft. of cable per day. This varies greatly with the complexity of the cable. There are additional machines for production of twisted pairs.

WRAPPING — When required, special equipment like this is available for wrapping the cable with mylar shielding or textile binding. Usually, these operations are carried out as part of the cabling process.

CUTTING/STRIPPING — There are numerous machines, capable of preparing lengths of wire from 2 inches to 40 ft. including several which automatically attach terminals as part of the process.

CRIMPING — The assembly department has scores of crimping machines capable of handling the terminals of all major manufacturers. Critical parameters are held to a high degree of precision.

STRANDING — Depending upon the length of the twist or "lay" as well as the diameter of the wire, these 36 machines each produce stranded wire at a rate of 50-100 ft./min., utilizing the total output of the tinning lines.

BRAIDING — The braiding room contains over 400 machines, including "butt" braiders which produce "breakout" textile cables of the type shown on cable assembly page. Capacity is in excess of 2,000,000 ft. per day.

LACQUERING — This department can easily match the total capacity of the braiding room. A number of lacquer and saturant formulations are used to impart anti-fray, flame-retardant, moisture and fungus resistant properties.

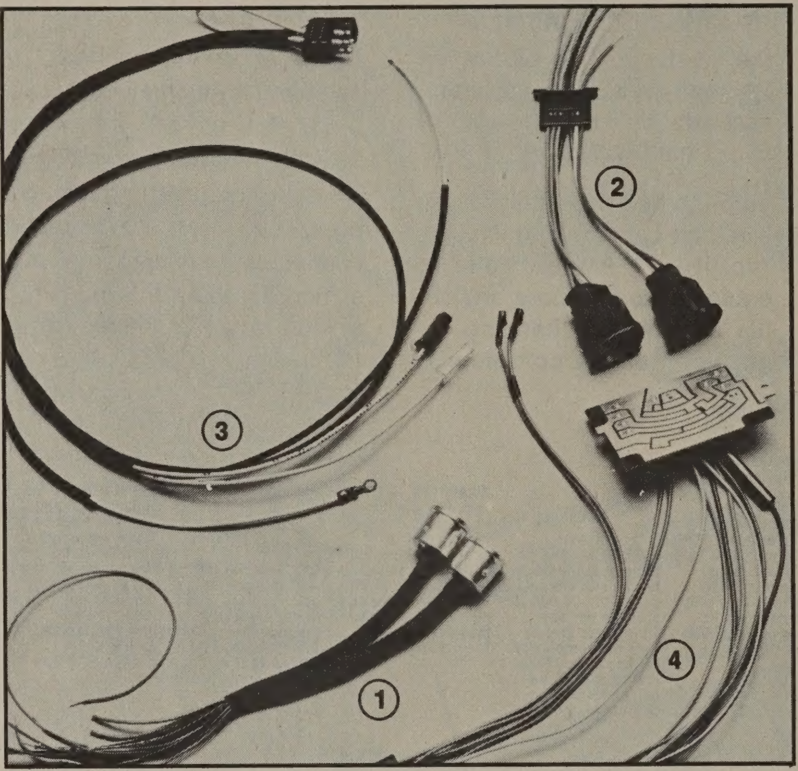
JACKETING — Jacketing of cables is accomplished on the extruding machines with the use of appropriately designed extruding dies and adjustment of temperatures, cooling profile, line speed, etc.

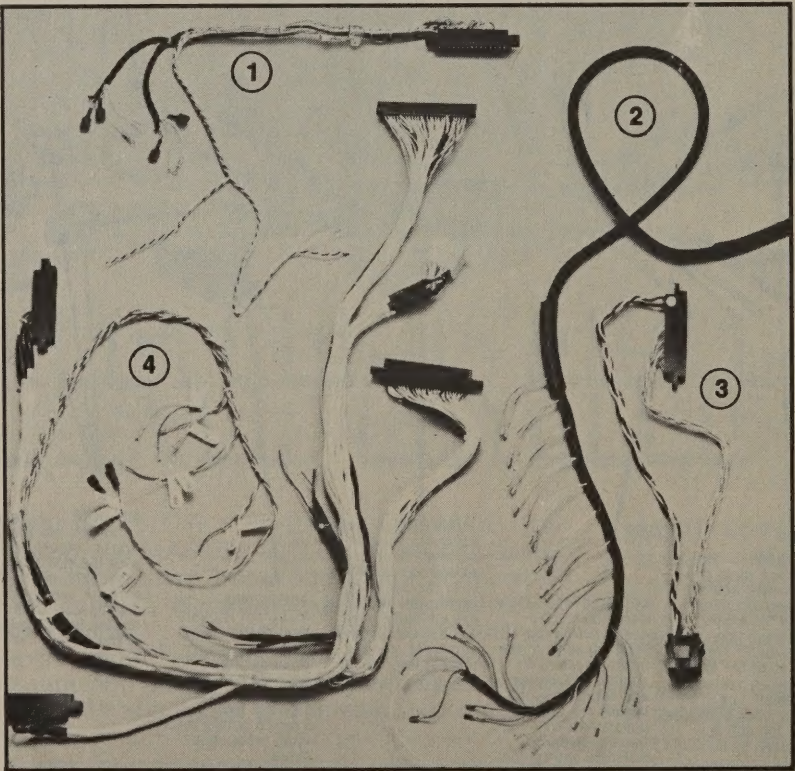
SOLDERING — Over 4,000 sq. ft., with numerous production lines is devoted to soldering in the assembly area. Internally designed jigs and tools are used to obtain maximum production rates.

MOLDING — Fifteen automatic machines, whose output varies with the size and complexity of the part are now in operation. Electrical testing is conducted at the machine as the part is completed.

TRW/HOLYOKE WIRE & CABLE, AN ELECTRONIC COMPONENTS DIV. OF TRW INC. / 720 MAIN STREET / HOLYOKE, MASS. 01040

TRW HOLYOKE WIRE & CABLE





CABLE ASSEMBLIES

Automotive cable assemblies produced by TRW/Holyoke cover the range from low voltage, low current semiconductor circuit devices to high power, high reliability types — all with the appropriate environmental terminations and connectors.

1. Passenger car rear seat control cable assembly incorporating Y-shaped "break-put" nylon braiding to two solder-terminated female connectors.

2. Dual connector electronic ignition cable assembly with molded grommet and molded-in blade contacts in pull-apart insulator shells.

3. Semi-trailer refrigeration system nylon braided cable assembly, for high reliability control application. Coded aircraft type connectors, terminated with pre-insulated crimped terminals and molded automotive type plug.

4. Automobile climate control cable assembly with crimp insertable contacts in male plugs and crimp contacts riveted to a printed circuit board switch panel.

TRW/Holyoke's most complex assemblies are those supplied to the computer industry. The combining of many type of conductors, terminals and connectors in a single harness is not uncommon. TRW/Holyoke can incorporate special PC boards or connectors provided by the customer, or will purchase these for the customer, in addition to producing any special molding dies that may be required.

Complete testing facilities are available — no matter how complex the harness assembly.

1. Thirty conductor cable assembly with four molded tapehead connectors, 50 position edge connector and miscellaneous wire terminations.

2. Thirty-two conductor cable using unique braiding technique that allows shielding the entire length of each breakout section. Continuous nylon braid to end of breakout combines minimum cable diameter with high flexibility.

3. Fifteen crimp-insertable terminations (4 twisted pairs, 7 single) in nylon plug and PC connector assembly.

4. Sixty-six conductor harness assembly with four crimp insertable terminal edge connectors, crimp plug and miscellaneous terminals.

TRW/HOLYOKE WIRE & CABLE, AN ELECTRONIC COMPONENTS DIV. OF TRW INC. / 720 MAIN STREET / HOLYOKE, MASS. 01040

TRW HOLYOKE WIRE & CABLE

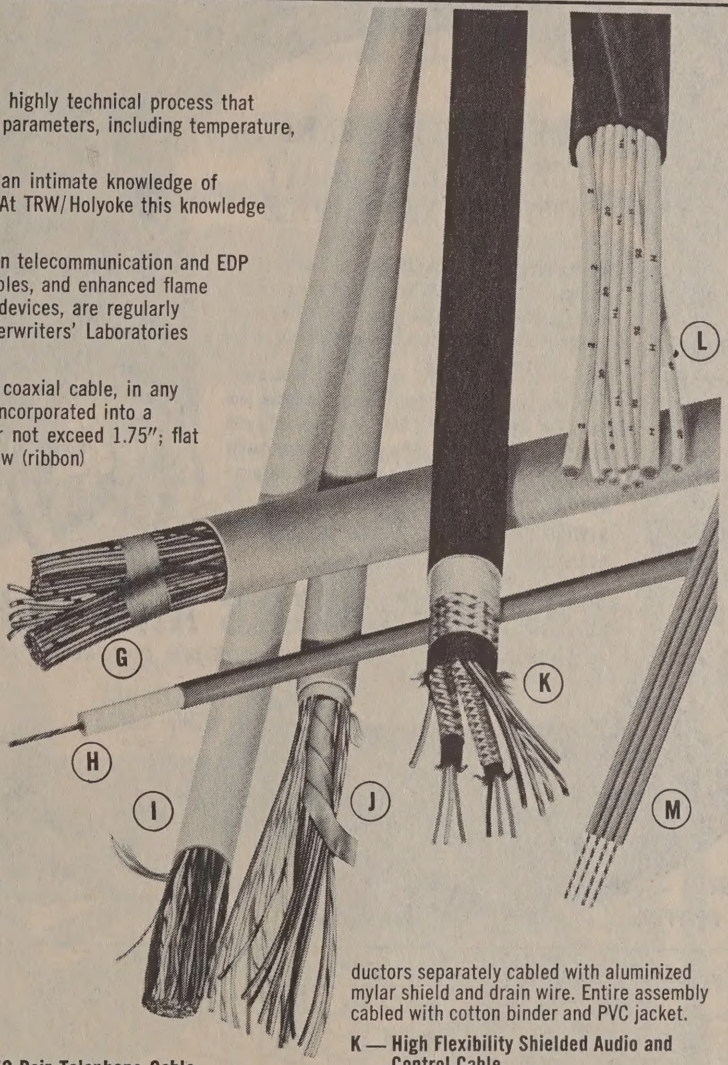
WIRE & CABLE

The manufacture of single-insulated conductors is a highly technical process that requires precision control of a variety of production parameters, including temperature, wire diameter, die size, and production rate.

Establishment of these parameters is the result of an intimate knowledge of equipment capabilities and material characteristics. At TRW/Holyoke this knowledge is based on over sixty years of experience.

Critical requirements, such as low cross talk levels in telecommunication and EDP cables, minimum impedance discontinuities in RF cables, and enhanced flame retardancy in home entertainment wires and wiring devices, are regularly engineered into products. The requirements of Underwriters' Laboratories fulfilled through design engineering.

Any combination of single wires, twisted pairs, and coaxial cable, in any number, with necessary fillers and bindings can be incorporated into a cable. The only limitation is that the cable diameter not exceed 1.75″; flat braided (woven) cable, up to 0.5″ width. Flat rainbow (ribbon) cable is available with 2 to 43 parallel conductors.



Manufacturing Options

Conductors

Copper, copper covered steel, cadmium bronze, phosphor bronze, precious metal alloys.
10 through 30 AWG
Solid or Stranded or Tinsel
Stranding from 7 to 500 strands
Bare or Tinned
Topcoat, Overcoat, Heavy Tinned — fused

Insulations

Polyethylene
Kynar***
Polypropylene
Polyurethane
Polyvinyl Chloride (PVC)
Silicone Rubber
FEP Teflon**
Nylon
Tefzel**

Insulation wall thickness from .002″ to .155″

Textile Braids

Celanese*
Cotton
Dacron**
Glass
Nylon
Orlon**
Rayon

. . . with or without lacquer

Shieldings

Conductive Vinyl
Aluminized Mylar**
Spiral Wrapped and Braided Copper

***Pennwalt Corp. T.M.
**DuPont T.M.
*Celanese Corp. T.M.

G — 52 Pair Telephone Cable

Semi-rigid thin wall insulated #24AWG solid conductors with band marked color coding. Conductors paired with programmed lay for minimum cross-talk. Assembled into 25 pair units with coding binders and four spare conductors, with flexible PVC sheath overall. Overall diameter .625″. Rated at 80°C.

H — High Voltage Lead Wire

Tinned copper conductors, solid or stranded, covered with flame retardant high dielectric strength insulation with 105°C. PVC jacket. Construction is designated as UL style #3239 and can be provided in a variety of conductors and voltage ratings to 40 KV.

I — Telephone Distribution Cable

25 pairs #24AWG solid conductors with thin wall semi-rigid insulation, spiral stripe coded. Pairs cabled with flexible bunch lay. PVC sheath extruded overall with nylon rip-cord under sheath. O.C. is 0.375″.

J — Mini Computer Memory Bank Cable

36 conductors with flexible stranding, PVC insulation and spiral stripe coding. 12 conductors separately cabled with aluminized mylar shield and drain wire. Entire assembly cabled with cotton binder and PVC jacket.

K — High Flexibility Shielded Audio and Control Cable

Cable core of seven #24AWG PVC insulated single conductors and two triple conductor cables of #24AWG stranded conductors PVC insulated with color coded textile braiding. These three conductors are then nylon braided as a unit and copper-braid shielded. The entire cable core is nylon braided and copper shielded with a PVC jacket overall.

L — Power and Control Cable

Nine #18AWG and two #12AWG stranded conductors insulated with 105°C. thermoplastic, then covered with lacquered glass braid and extruded nylon. Cabled with extruded thermoplastic jacket overall. Rated 600 volts, −55°C to +105°C. For on-the-road tractor-trailer interconnection.

M — Environmental Resistant Flat Cable

Four stranded conductors simultaneously insulated with high performance extruded silicone rubber compound to form an extremely flexible high reliability cable for military applications. Rated at 300V., −100°C. to +200°C., moisture, fungus and radiation resistant.

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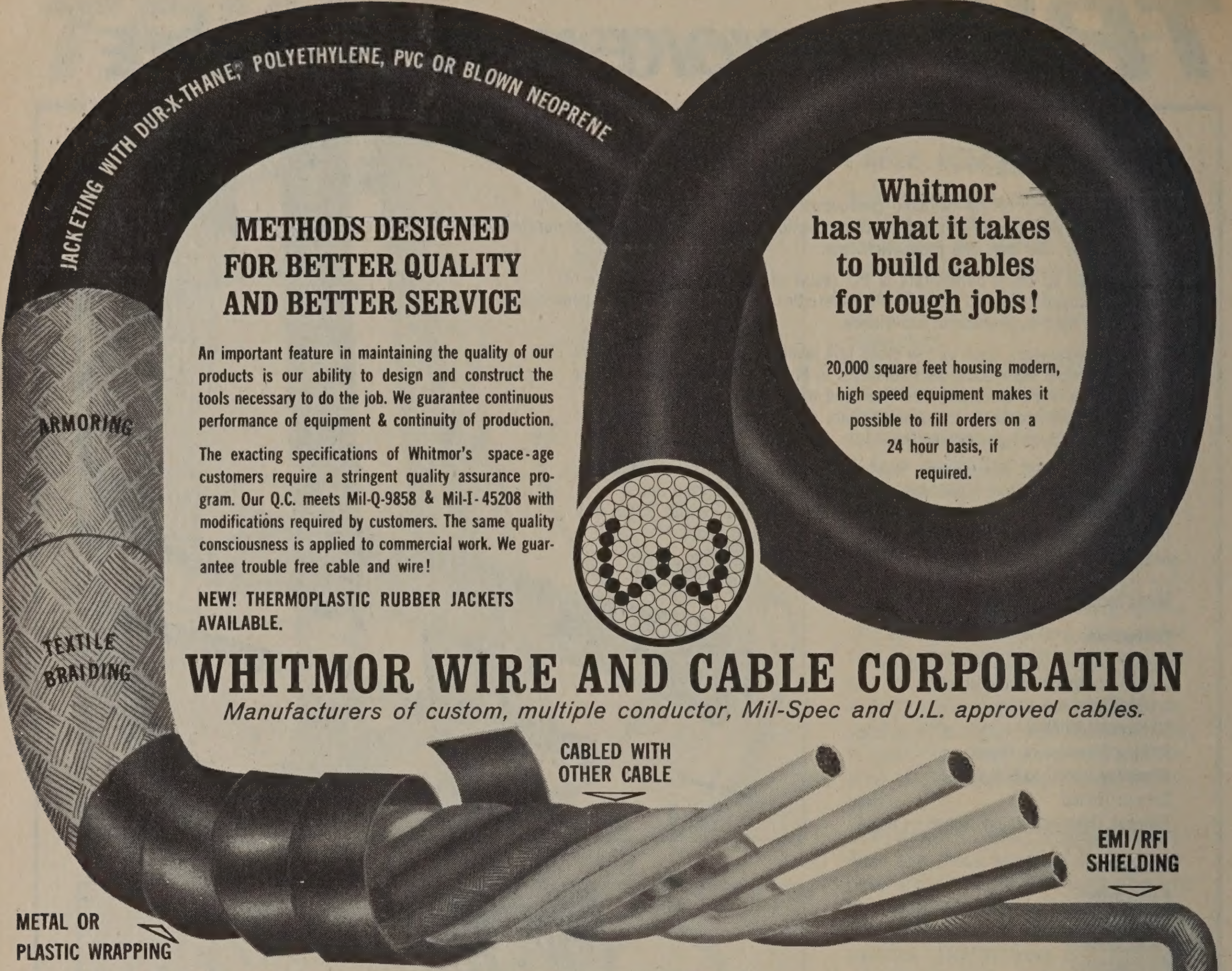
JACKETING WITH DUR-X-THANE® POLYETHYLENE, PVC OR BLOWN NEOPRENE
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TEXTILE BRAIDING
CABLED WITH OTHER CABLE
EMI/RFI SHIELDING
METAL OR PLASTIC WRAPPING

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An important feature in maintaining the quality of our products is our ability to design and construct the tools necessary to do the job. We guarantee continuous performance of equipment & continuity of production.

The exacting specifications of Whitmor's space-age customers require a stringent quality assurance program. Our Q.C. meets Mil-Q-9858 & Mil-I-45208 with modifications required by customers. The same quality consciousness is applied to commercial work. We guarantee trouble free cable and wire!

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MULTI-CONDUCTOR STOCK CABLES / All wire 19 strand					DUR-X-THANE®		STOCK		DUR-X-THANE®	
PART NO.	COND. AWG	NO. COND.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.	JKT. THICK.	CABLE O.D.
W-227*	22	7	.040	.280	.030	.260	.040	.305	.030	.285
W-2212*	22	12	.050	.380	.030	.340	.050	.405	.030	.365
W-2219*	22	19	.060	.450	.040	.410	.060	.475	.040	.435
W-2227*	22	27	.060	.530	.040	.490	.060	.555	.040	.515
W-2237*	22	37	.060	.580	.040	.540	.060	.605	.040	.565
W-2248*	22	48	.060	.660	.050	.640	.060	.685	.050	.665
W-2261*	22	61	.060	.710	.050	.690	.060	.735	.050	.715
W-2272*	22	72	.060	.775	.060	.775	.060	.800	.060	.800
W-207*	20	7	.040	.300	.030	.280	.040	.325	.030	.305
W-2012*	20	12	.050	.400	.030	.360	.050	.425	.030	.385
W-2019*	20	19	.060	.475	.040	.435	.060	.500	.040	.460
W-2027*	20	27	.060	.560	.040	.520	.060	.585	.040	.545
W-2037*	20	37	.060	.610	.040	.570	.050	.640	.040	.595
W-2048*	20	48	.060	.700	.050	.680	.060	.725	.050	.705
W-2061*	20	61	.060	.750	.060	.750	.060	.775	.060	.775
W-2072*	20	72	.060	.840	.060	.840	.060	.865	.060	.865
W-187*	18	7	.040	.335	.030	.315	.040	.360	.030	.340
W-1812*	18	12	.050	.450	.040	.430	.050	.475	.040	.455
W-1819*	18	19	.060	.550	.040	.510	.060	.575	.040	.535
W-1827*	18	27	.060	.650	.050	.630	.060	.675	.050	.655
W-1837*	18	37	.060	.720	.050	.700	.060	.745	.050	.725
W-1848*	18	48	.060	.820	.060	.820	.060	.845	.060	.845
W-1861*	18	61	.060	.890	.060	.890	.060	.915	.060	.915
W-1872*	18	72	.060	.995	.060	.995	.060	1.020	.060	1.020
W-167*	16	7	.040	.370	.030	.350	.040	.395	.030	.375
W-1612*	16	12	.050	.500	.040	.480	.050	.525	.040	.505
W-1619*	16	19	.060	.600	.040	.560	.060	.625	.040	.585
W-1627*	16	27	.060	.685	.050	.665	.060	.710	.050	.590
W-1637*	16	37	.060	.755	.060	.755	.060	.780	.060	.780
W-1648*	16	48	.060	.865	.060	.865	.060	.890	.060	.890
W-1661*	16	61	.060	.935	.060	.935	.060	.960	.060	.960
W-147*	14	7	.050	.420	.040	.400	.050	.445	.040	.425
W-1412*	14	12	.050	.550	.040	.530	.050	.575	.040	.555
W-1419*	14	19	.060	.645	.050	.625	.060	.670	.050	.650
W-1427*	14	27	.060	.775	.060	.775	.060	.800	.060	.800
W-125*	12	5	.050	.445	.040	.400	.050	.470	.040	.425
W-127*	12	7	.050	.480	.040	.460	.050	.505	.040	.485
W-1212*	12	12	.060	.650	.050	.650	.060	.675	.050	.675
W-1219*	12	19	.060	.820	.060	.820	.060	.845	.060	.845

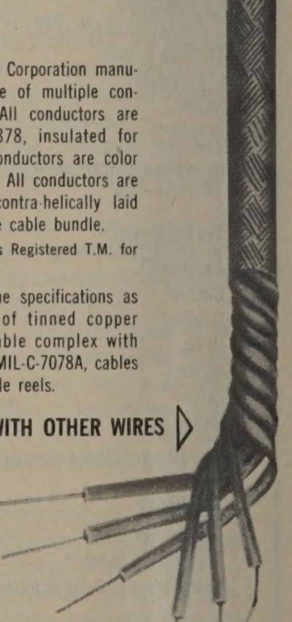
*Designate jacketing desired as follows: V=vinyl X=Dur-X-thane P=polyethylene N=neoprene - Mil-S-6855 - Class 2 - Grade 60
EXAMPLE: W-1827P=Cable w/27 conductors, 18 gauge wire, w/polyethylene jacketing. **Add "S" to PART NO. for Shielded cable.
Other constructions available on request using 1/32" PVC insulation (3000 V, Military Type D); (600 V, Style 1015 U.L. Commercial)

TECHNICAL DATA

Whitmor Wire and Cable Corporation manufactures a complete line of multiple conductor control cables. All conductors are Type C per MIL-W-16878, insulated for 1000 V and 105° C. Conductors are color coded per MIL-STD 681. All conductors are planetary cabled and contra-helically laid with Mylar tape over the cable bundle.

® Dur-X-thane is Whitmor's Registered T.M. for extruded Polyurethane.

SHIELDED CABLES: Same specifications as above with additions of tinned copper braided shield over cable complex with 85%-95% coverage to MIL-C-7078A, cables shipped on non-returnable reels.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INDIVIDUAL WIRES
INSULATED, COLOR CODED, LETTERED AND IDENTIFIED.

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It's what you've come to expect from ITT Cannon. For your convenience, we've placed more than 265 pages of data at your fingertips in the 1977-78 edition of EEM.
Look:

CANNON® CONNECTORS, pages 1849 to 2026

Full range of standard connectors covering circular, PC packaging, RF (SMA), rectangular rack and panel connectors, microminiature, and the new Mas/Ter system of insulation displacement connectors.

CANNON DISTRIBUTION

All Cannon standard connector products are available through distribution. CAPS® distributors (Cannon Authorized Plug Specialists) and their branches are located in every key market throughout the country and stock at the local level. CAPS distributors assemble most Cannon standard connector series. This assures quick delivery of a wide range of thousands of items within the product lines. No matter where your facility is located, there is a Cannon distributor near you. Refer to Manufacturers EEM Directory Volume for a complete list of Cannon distributors. Cannon offers you many more products not shown in this edition of EEM. These products include SURE-SEAL™ Environmental Connectors, Rack and Panel, and many other specialized interconnect devices for transportation, telecommunications, energy and fiber optics applications. A full line of customer tooling is also available.

CANNON/ETC TERMINAL PRODUCTS, pages 2027 to 2038

Full-range, including loose-piece terminals; continuous strip terminals; barrier-type terminal blocks (closed and open back); cable ties; low-cost commercial connectors; hand-crimp semi-automatic tape and continuous strip automatic tooling.

CANNON/ETC DISTRIBUTION

All Cannon/ETC products are available through a nationwide distribution network. For the distributor nearest you, refer to Manufacturers EEM Directory Volume.

POMONA TEST ACCESSORIES, pages 2039 to 2113

ITT Pomona Electronics, part of ITT Cannon's total product offering, has a broad and versatile line of patch cords, cable assemblies, socket adapters, ¾" spaced molded test leads and other connector leads to suit virtually every need.

POMONA ELECTRONICS SALES OFFICES

Sales offices are located in all key areas of the U.S. For the sales office nearest you refer to Manufacturers EEM Directory Volume.

PRODUCT OFFERING: STANDARD CONNECTORS, TERMINAL PRODUCTS, AND ELECTRONIC TEST ACCESSORIES

Welcome to the ITT Cannon Electric store. A storehouse of components and systems that can solve your every need. What's more, in our store you'll discover we place high value on reliability and quality. And value means a lower total installed cost. One of the ways we help you keep your total installed costs down is by maintaining standard stocks of millions of connectors, terminals and test accessories in hundreds of distribution centers, one most likely near you.

CANNON CIRCULAR CONNECTORS are high performance, low-cost units, and include the new KJL-Series I connectors designed to MIL-C-38999, quick disconnect K Series (standard size down to subminiature and environmental), MS Series with the widest range of styles, and the MC Series for severe environments.

PC PACKAGING CONNECTORS are designed for data processing applications, from backplanes to fabrication. Included are Mas/Ter-UND insulation displacement connectors, DL Zero Insertion Force, rectangular connectors, Adapta-Con post and receptacle I/O connector system, Press-T-Mate™ press-fit connector system, ECS edgecard connectors for metal backplane applications.

RECTANGULAR RACK AND PANEL CONNECTORS, often the most economical solution, designed for minimum-volume use. Types include D Subminiature (standard and double density), DPX environment and non-environment resistant, DPK high reliability, environment resistant.

MICROMINIATURE CONNECTORS, where custom solutions are needed for size, weight, density problems. Available in rectangular, circular, strip, and special configurations. PC board component insertion, flat cable termination, and termination of connectors to your specification. Can reduce installation costs by 50%, weight and space by 80%.

ENVIRONMENTAL CONNECTORS, like Sure-Seal,™ the first proven truly water-resistant low-cost connector, meets most electrical and environmental requirements for automotive, marine, and appliance applications.

SPECIALIZED CONNECTOR CAPABILITIES include complete line of RF connectors, from SMA's to special-reliability designs; IC sockets for board-mounting DIP's; CATV connectors; and many more.

CUSTOMER TOOLING that speeds production and lowers total installed cost. Full range, from simple hand tools through crimp machines to semiautomatic strip-and-crimp machines, and tooling to meet MIL specs.

Cannon/ETC can!

ETC TERMINAL PRODUCTS, in any configuration, to meet any specification. Available in numerous tongue types, barrel styles, insulated and uninsulated barrels. Also splices, quick-disconnect terminals, cable ties, terminal blocks, and insulation displacement connectors, and, of course, manual and automatic crimping equipment.

POMONA ELECTRONICS TEST ACCESSORIES, ITT Pomona Electronics offers a broad and versatile line of patch cords, cable assemblies, socket adapters, ¾" spaced molded test leads and other connector leads to suit virtually every need. Extensive engineering and manufacturing facilities assure fast delivery of stock and custom designs.

Don't forget...This 1977-78 EEM Directory is your single source for the complete line of ITT Cannon standard connectors, ETC terminal products and ITT Pomona Electronics test accessories. ITT Cannon Electric, 666 East Dyer Road, Santa Ana, CA 92702, (714) 557-4700.

For immediate action, call the Cannon Hot Line: Toll-free, 24 hr. (800) 854-3573; in Calif. (800) 432-7063. Terminal Products Unit (800) 321-9184; In Ohio (800) 362-9122. Pomona Electronics (714) 623-3463.

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